

# Operating Instructions

## Compact Ejector SCPSi, SCPSi-2

**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](http://www.schmalz.com/services)

## 1.3 Type Plate

The type plate is permanently attached to the product and must always be clearly legible. It contains product identification data and important technical information.

The QR code on the nameplate enables access to the digital technical documentation for the product.

- ▶ For spare parts orders, warranty claims or other inquiries, have the information on the type plate to hand.

## 1.4 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 ejector is designed to generate a vacuum for gripping and transporting objects when used in conjunction with suction cups. It is operated by a controller with discrete signals or via IO-Link.

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

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 use.

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 non-intended usage of the ejector.

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

- Use in potentially explosive atmospheres
- Use for medical applications
- Evacuation of objects that are in danger of imploding
- Filling pressurized containers, driving cylinders, valves or other pressure-operated functional elements

### 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
 <b>WARNING</b>	Indicates a medium-risk hazard that could result in death or serious injury if not avoided.
 <b>CAUTION</b>	Indicates a low-risk hazard that could result in minor or moderate injury if not avoided.
<b>NOTE</b>	Indicates a danger that leads to property damage.

## 2.5 Residual Risks



### **CAUTION**

#### **Falling product**

Risk of injury

- ▶ Securely attach the product at the site of operation.
- ▶ Wear safety shoes (S1) and safety glasses when handling and mounting/dismounting the product.



### **CAUTION**

#### **Unexpected movement of the handling system or dropping the lifted payload when the device is active**

Risk of injury (trapping or impact) due to collision or the release of a payload

- ▶ Do not sit or stand in the transport area of the lifted payload.
- ▶ Wear protective work shoes and gloves.



### **WARNING**

#### **Noise pollution due to the escape of compressed air**

Hearing damage!

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



### **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.



### **⚠ WARNING**

**Uncontrolled movements of system components or falling objects caused by incorrect activation and switching of the device 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**

**Depending on the purity of the ambient air, the exhaust air can contain particles, which escape from the exhaust air outlet at high speed.**

Eye injuries!

- ▶ Do not look into the exhaust air flow.
  - ▶ Wear eye protection.
- 



### **⚠ CAUTION**

**Vacuum close to the eye**

Severe eye injury!

- ▶ Wear eye protection.
  - ▶ Do not look into vacuum openings such as suction lines and hoses.
- 

## **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.

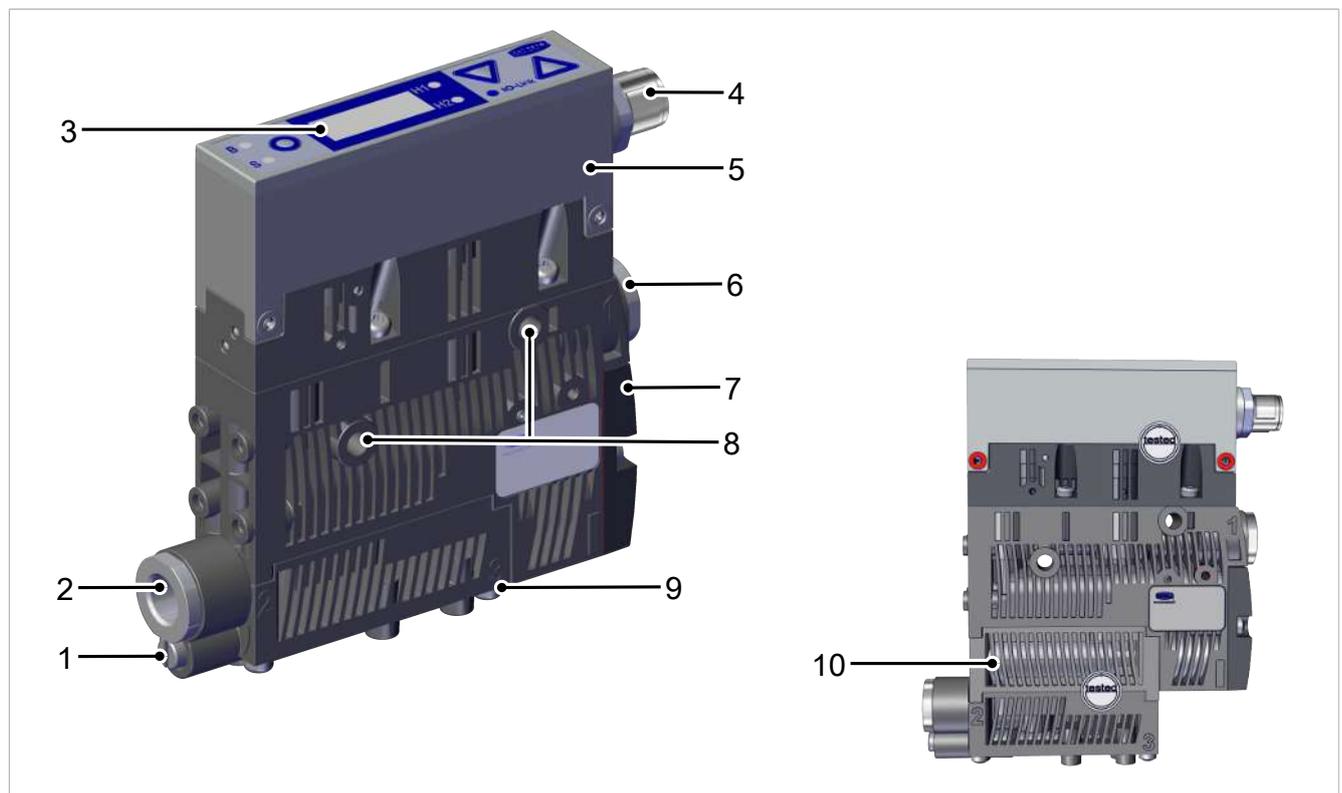
## 3 Product Description

### 3.1 Ejector Designation

The breakdown of the item designation (e.g. SCPSi 10 M G2 NO M12-5) is as follows:

Property	Variants
Type of ejector	SCPSi
Performance class	07, 10, 15, 2-07, 2-09, 2-14
Power blow off function	M
Pneumatic connection	G02 (1/8" internal thread) S02 (8/6 mm) S04 (6/4 mm)
Control unit	<b>NO</b> , normally open <b>NC</b> , normally closed <b>IMP</b> , bistable, switched with pulse
Electrical connection	M12-5 (1 x M12, 5-pin)

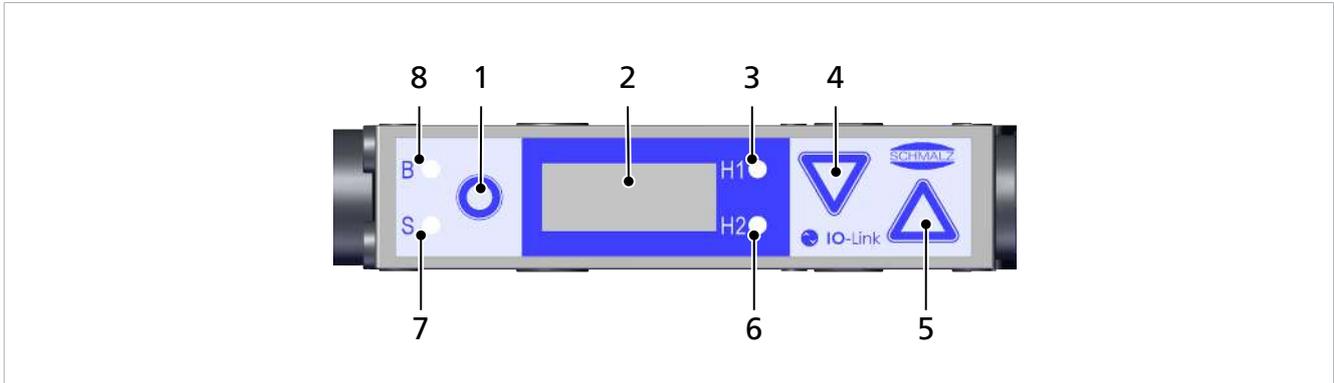
### 3.2 Ejector Structure



1	Blow off valve screw	6	1/8" compressed air connection (marking 1 [P])
2	1/8" vacuum connection; marking 2 [V]	7	Silencer cover
3	Display and operating element	8	Mounting hole (2x)
4	M12 electrical connection	9	Exhaust outlet (marking 3)
5	Control unit	10	Power blow-off module for variant M

### 3.3 Display and Operating Element in Detail

The ejector is fitted with 3 buttons, the 3-digit display and 4 LEDs for status information to ensure simple operation.



1	<b>MENU BUTTON</b>	5	<b>UP BUTTON</b>
2	Display	6	LED vacuum limit value H2
3	LED vacuum limit value H1	7	LED process state "suction"
4	<b>DOWN BUTTON</b>	8	LED process state "blow off"

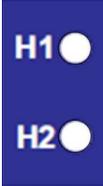
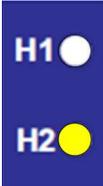
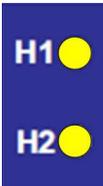
#### Definition of the LED indicators

The "suction" and "blow off" process states are each assigned an LED.

Display		Ejector state
	LEDs are both off	No suction from ejector
	LED for the suction function is constantly lit	Ejector sucks or is under control
	LED for the blow off function is constantly lit	Ejector blowing off

### Meaning of the Vacuum Limit Value LEDs

The LEDs for the vacuum limit values H1 and H2 indicate the current level of the system vacuum relative to the configured limit values. Their display is independent of the switching function and assignment of the output, and independent of whether the condition monitoring function is active.

Display		Ejector state
	LEDs are both off	Rising vacuum: $\text{Vacuum} < \text{H2}$ Falling vacuum: $\text{Vacuum} < (\text{H2}-\text{h2})$
	H2 LED lit steadily	Rising vacuum: $\text{Vacuum} > \text{H2}$ and $< \text{H1}$ Falling vacuum: $\text{Vacuum} > (\text{H2}-\text{h2})$ and $< (\text{H1}-\text{h1})$
	Both LEDs continuously lit	Rising vacuum: $\text{Vacuum} > \text{H1}$ Falling vacuum: $\text{Vacuum} > (\text{H1}-\text{h1})$

## 4 Technical Data

### 4.1 Display Parameters

Parameter	Value	Unit	Comment
Display	3	digit	Red 7-segment LED display
Solution	$\pm 1$	mbar	—
Accuracy	$\pm 3$	% FS	$T_{amb} = 25^\circ \text{C}$ , based on FS (full-scale) final value
Linearity error	$\pm 1$	%	—
Offset error	$\pm 2$	mbar	After zero-point adjustment, without vacuum
Temperature influence	$\pm 3$	%	$0^\circ \text{C} < T_{amb} < 50^\circ \text{C}$
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 General Parameters

Parameter	Symbol	Limit value			Unit	Comment	
		min.	typ.	max.			
Working temperature	$T_{amb}$	0	---	50	$^\circ \text{C}$	---	
Storage temperature	$T_{sto}$	-10	---	60	$^\circ \text{C}$	---	
Humidity	$H_{rel}$	10	---	90	% r.h.	Free from condensation	
Degree of protection	---	---	---	IP65	---	---	
Operating pressure (flow pressure)	P	3	4.2	6	bar	---	
Max. vacuum	p	---	---	-850	mbar	---	
Precision of vacuum sensor	---						$\pm 3\%$ FS (full scale)
Operating medium	Air or neutral gas, 5 $\mu\text{m}$ filtered, with or without oil, class 3-3-3 compressed air quality in acc. with ISO 8573-1						

### 4.3 Electrical Parameters

Parameter	Symbol	Limit values			Unit	Comment
		min.	typ.	max.		
Supply voltage	$U_{SA}$	19.2	24	26.4	V DC	PELV <sup>1)</sup>
Power consumption from $U_{S/A}$ 2) with NO variant	$I_{S/A}$	---	50 <sup>4)</sup>	120	mA	$U_{S/A} = 24.0 \text{ V}$
Power consumption from $U_{S/A}$ 2) with NC variant	$I_{S/A}$	---	40 <sup>4)</sup>	70	mA	$U_{S/A} = 24.0 \text{ V}$
Power consumption from $U_S$ with IMP variant	$I_S$	---	40 <sup>5)</sup>	70	mA	$U_S = 24.0 \text{ V}$
Voltage of signal output (PNP)	$U_{OH}$	$U_{S/A} - 2$	---	$V_{S/A}$	$V_{DC}$	$I_{OH} < 140 \text{ mA}$
Voltage of signal output (NPN)	$U_{OL}$	0	---	2	$V_{DC}$	$I_{OL} < 140 \text{ mA}$
Power consumption of signal output (PNP)	$I_{OH}$	---	---	140	mA	Short-circuit-proof <sup>3)</sup>
Power consumption of signal output (NPN)	$I_{OL}$	---	---	-140	mA	Short-circuit-proof <sup>3)</sup>

Parameter	Symbol	Limit values			Unit	Comment
Voltage of signal input (PNP)	$U_{IH}$	15	—	$U_{A/SA}$	$V_{DC}$	In reference to $Gnd_{A/SA}$
Voltage of signal input (NPN)	$U_{IL}$	0	—	9	$V_{DC}$	In reference to $U_{A/SA}$
Current of signal input (PNP)	$I_{IH}$	—	5	—	mA	—
Current of signal input (NPN)	$I_{IL}$	—	-5	—	mA	—
Response time of signal inputs	$t_i$	—	3	—	ms	—
Response 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 inputs and outputs are all protected against reverse polarity.

2) Plus the output currents

3) The signal output is protected against short circuits. However, the signal output is not protected against overloading. Constant load currents > 0.15 A may lead to impermissible heating and therefore the destruction of the ejector.

4) Mean value

5) Average value; pulse currents of 140 mA and 30 milliseconds possible when switching the valves.

#### 4.4 Factory Settings

The following table shows the factory settings of the ejector:

Code	Parameter	Value of the factory setting
H-1	Limit value H1	750 mbar
h-1	Hysteresis value h1	150 mbar
H-2	Limit value H2	550 mbar
h-2	Hysteresis value h2	10 mbar
tBL	Blow off time	0.2 s
cEr	Control	Activated = ON
dcS	Permanent suction	Deactivated = OFF
t-1	Evacuation time	2 s
-L-	Leakage value	250 mbar/s
bLo	Blow off function	Externally controlled blow off = -E-
un1	Vacuum unit	Vacuum unit in mbar = -bA
tYP	Signal type	PNP switching = PnP
dLY	Switch-off delay	10 ms
dPY	Display rotation	Standard = Std
Eco	Eco mode	Deactivated = OFF
P in	PIN	User-defined 000
o-2	Signal output	"Normally open" contact = no

The production setup profiles P-1 to P-3 are factory-set to have the exact same data set as the default data set P-0.

## 4.5 Performance Data

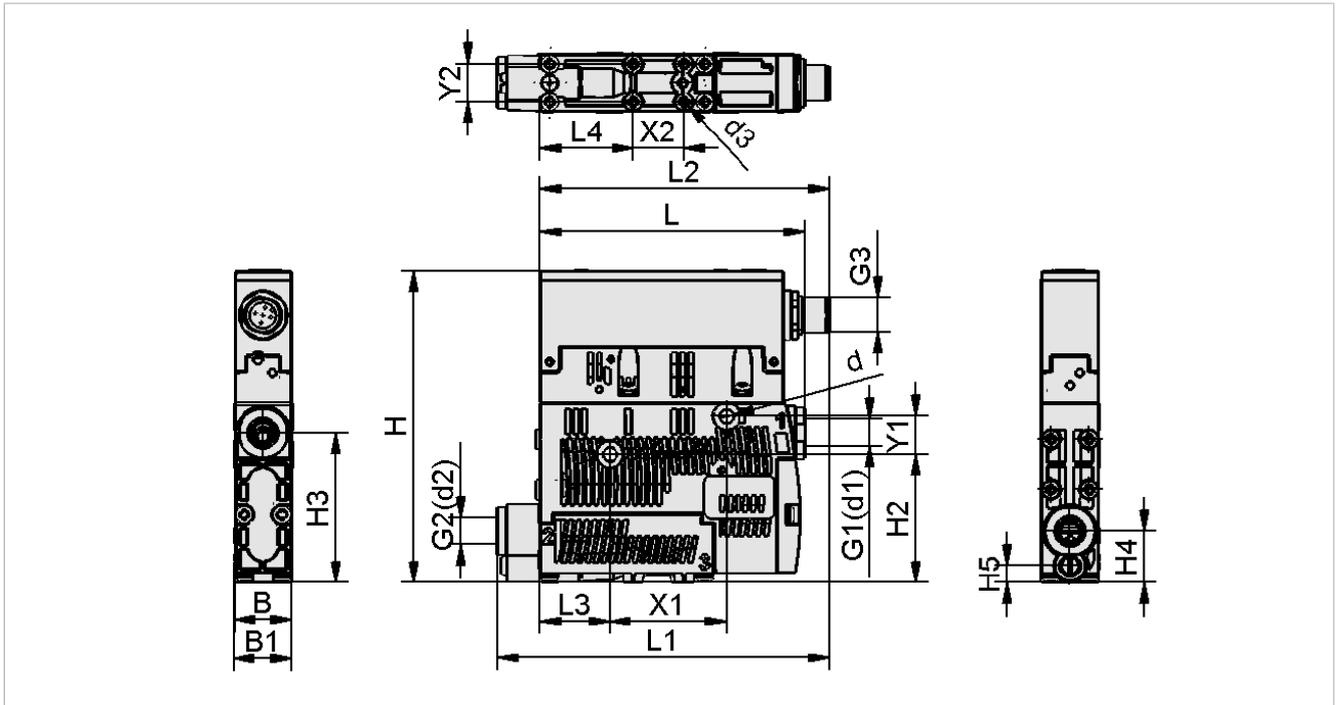
Type	SCPSi-07	SCPSi-10	SCPSi-15
Nozzle size [mm]	0.7	1.0	1.5
Max. vacuum <sup>1</sup> [mbar]	850		
Suction rate <sup>1</sup> [l/min]	16	34	63
Max. blow off capacity <sup>1</sup> [l/min]	120		
Air consumption <sup>1</sup> (suction) [l/min]	25	42	95
Sound level <sup>1</sup> , unobstructed suction [dB(A)]	63	75	77
Sound level <sup>1</sup> , suction [dB(A)]	58	61	65
Weight [kg]	0.195		
Weight of variant with power blow off module [kg]	0.213		

Type	SCPSi-2-07	SCPSi-2-9	SCPSi-2-14
Nozzle size [mm]	0.7	0.9	1.4
Max. vacuum <sup>1</sup> [mbar]	850		
Suction rate <sup>1</sup> [l/min]	37	49	71
Max. blow off capacity <sup>1</sup> [l/min]	120		
Air consumption <sup>1</sup> (suction) [l/min]	22	40.5	82
Sound level <sup>1</sup> , unobstructed suction [dB(A)]	63	73	75
Sound level <sup>1</sup> , suction [dB(A)]	58	62	70
Weight [kg]	0.195		

<sup>1)</sup> At 4.0 bar

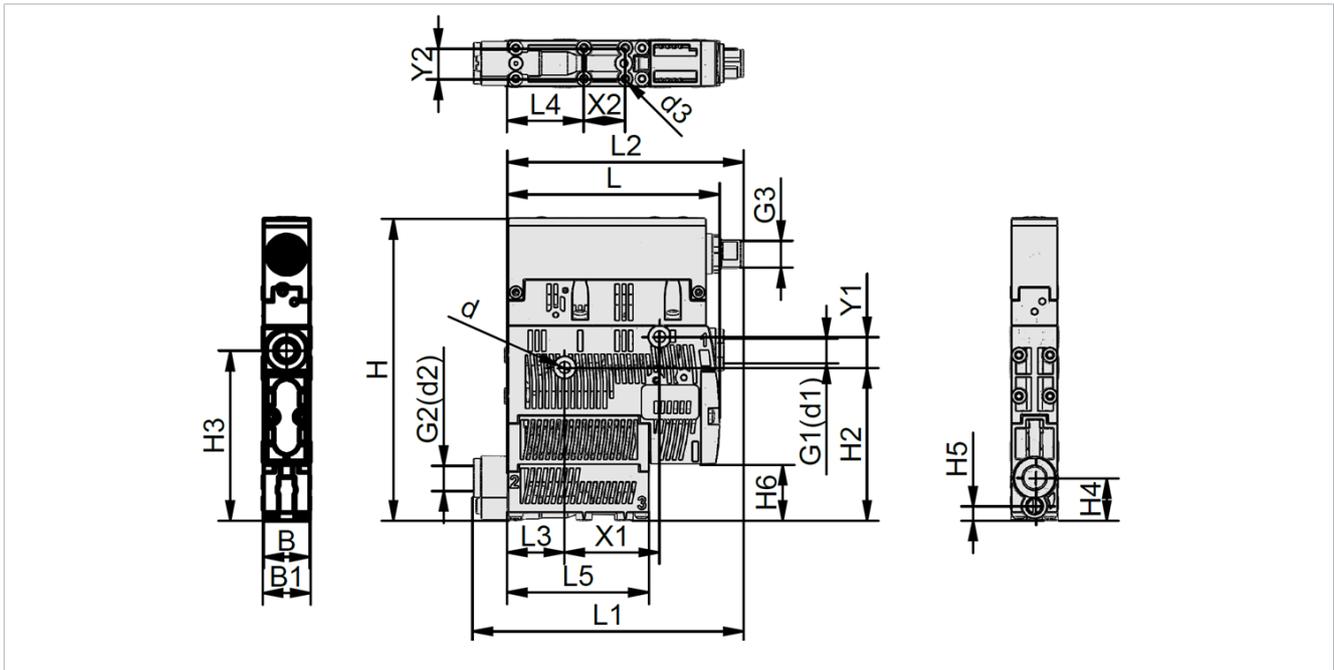
## 4.6 Dimensions

Version without power blow-off



B	B1	d	(d1) <sup>1</sup>	(d2) <sup>1</sup>	d3	G1	G2	G3	H	H2	H3
18	18.6	4.4	6 / 8	6 / 8	2.6	1/8" internal thread	1/8" internal thread	M12x 1 ex- ternal thread	99	40.8	47.5
H4	H5	L	L1	L2	L3	L4	L5	X1	X2	Y1	Y2
16.5	5.5	83.8	105	91.5	22	29.5	83.8	36.9	16	12	12

Version with power blow-off (M)



B	B1	d	(d1) <sup>1</sup>	(d2) <sup>1</sup>	d3	G1	G2	G3	H	H2	H3	
18	18.6	4.4	6 / 8	6 / 8	2.6	1/8" internal thread	1/8" internal thread	M12x1 external thread	117.8	59.6	66.35	
H4	H5	H6	L	L1	L2	L3	L4	L5	X1	X2	Y1	Y2
16.5	5.5	21.8	83.8	105	91.5	22	29.5	54.8	36.9	16	12	12

<sup>1)</sup> Depending on the design of the push-in connection.

All specifications are in mm

### 4.7 Pneumatic Circuit Plans

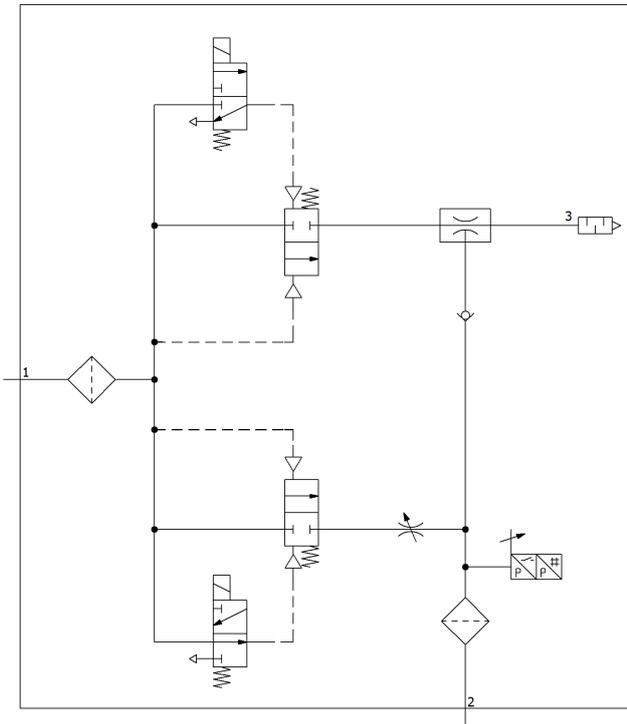
The pneumatic circuit diagrams are shown in simplified form.

**Key:**

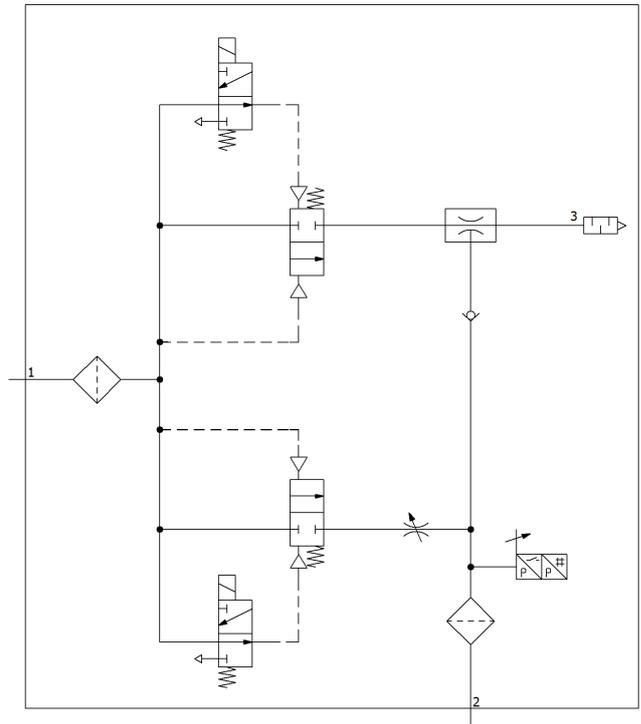
NC	Normally closed
NO	Normally open
IMP	Bistable, pulse-controlled
M	Power blow off
1	Compressed air connection
2	Vacuum connection
3	Exhaust outlet

Pneumatic circuit diagrams for the standard single-stage version

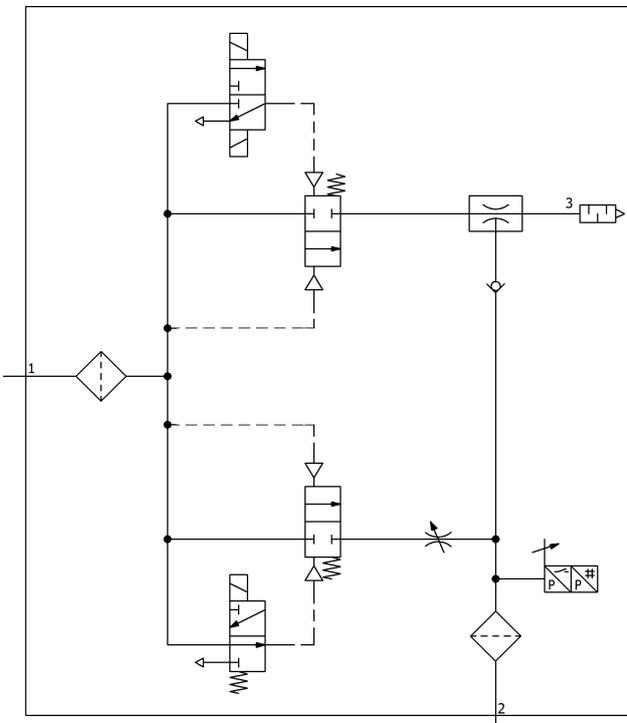
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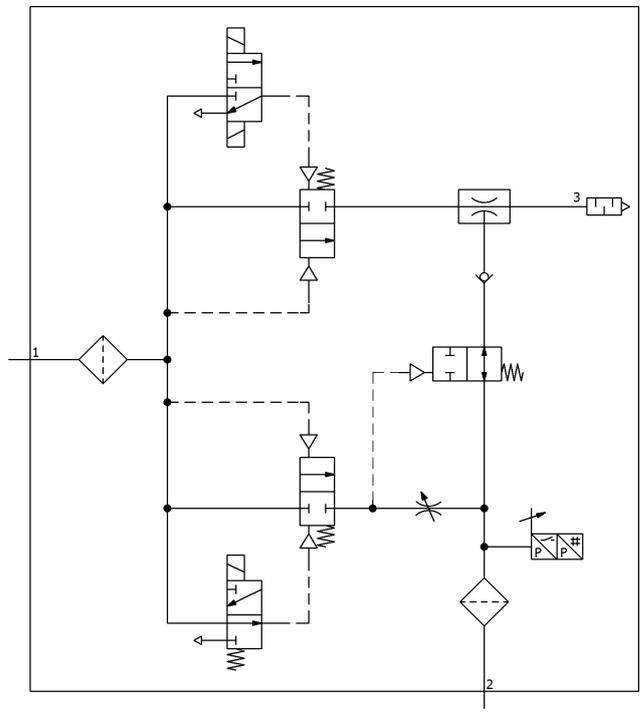
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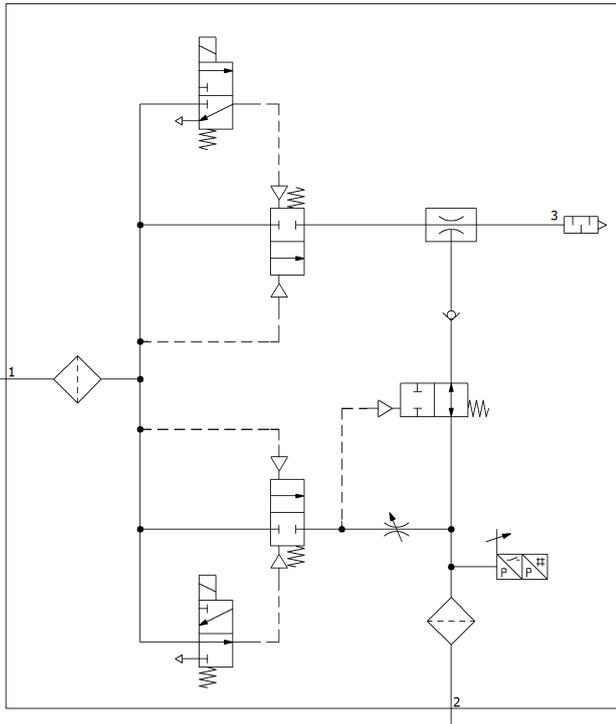
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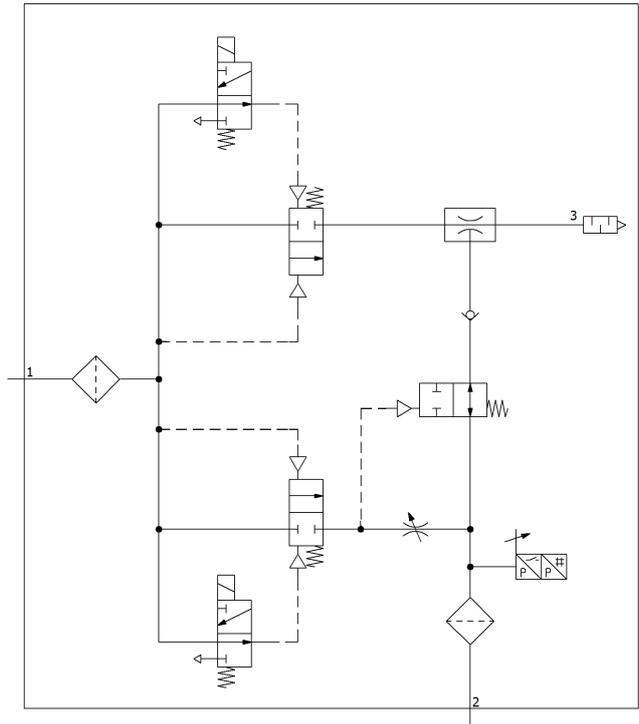
...IMP\_M



**...NO... M**

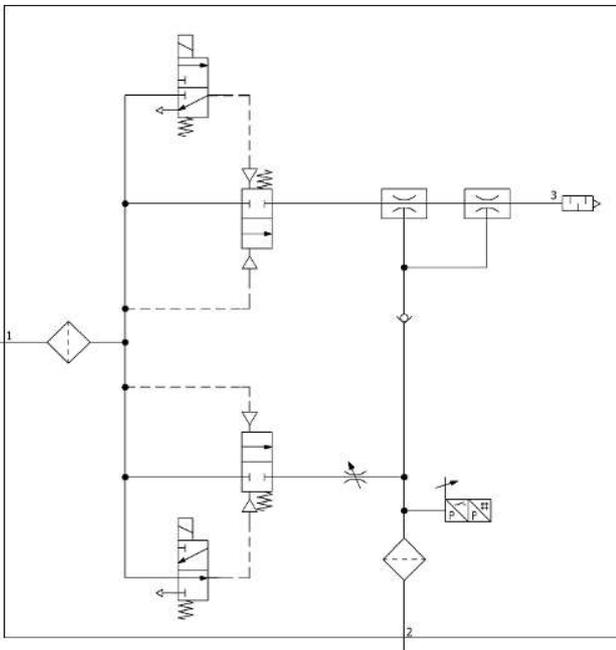


**...NC...M**

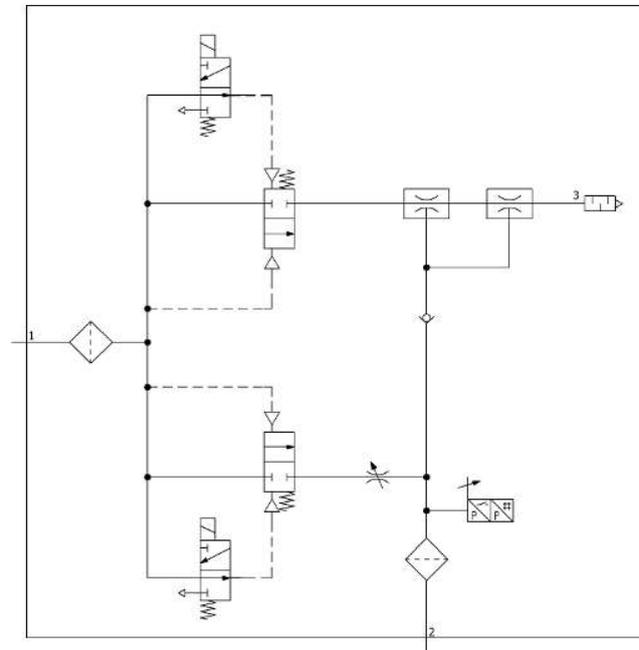


**Pneumatic circuit diagrams for the two-stage version**

**... NO...**

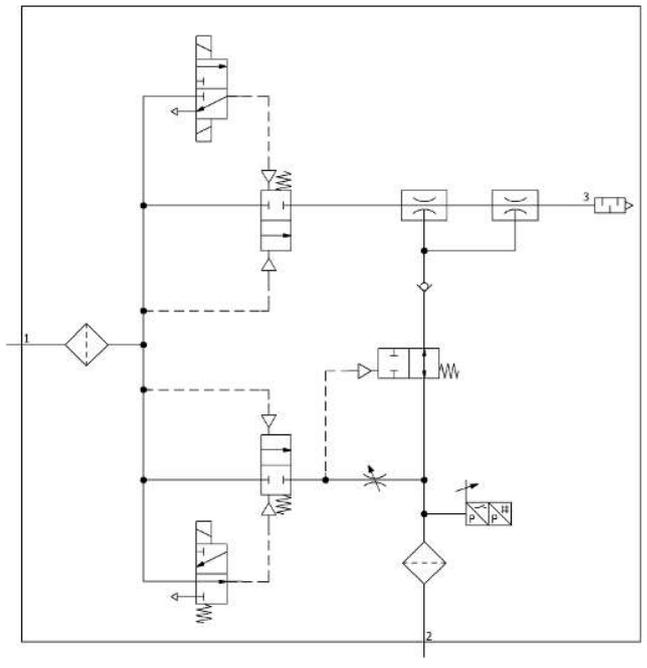
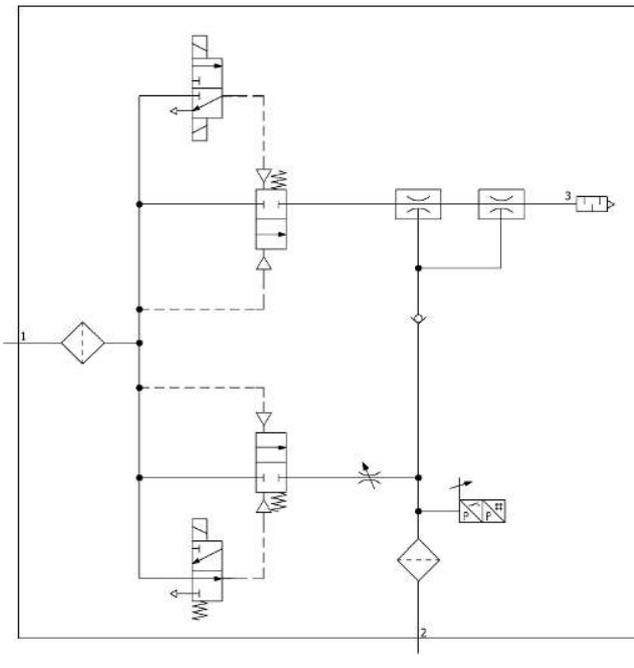


**...NC...**



**...IMP...**

**...IMP\_M**





## 5 Operating and Menu Concept

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.

Navigation is divided into three menus:

- The basic menu
- The configuration menu
- The system menu

Setting the device in the basic menu is sufficient for standard applications. The configuration menu is available for applications with special requirements.

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

### 5.1 Enabling the Menu

Menus can be protected against unauthorized access by defining a PIN [ $\overline{P}$  10] in the configuration menu. When the lock is active, [ $\overline{L}$  00] flashes on the display or the PIN is requested.

The menus are accessed as follows:

1. Press the **MENU** button  
⇒ The display changes to input
2. Use the **UP** or **DOWN** button to enter the first digit of the PIN
3. Confirm with the **MENU** button
4. Enter the remaining digits in the same way
5. To enable the device using the menu, press the **MENU** button

The lock is activated again automatically after you leave the selected menu or close the function.

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



#### Tips and tricks for parameter setting

- Pressing the **UP** or **DOWN** button for approx. 3 seconds scrolls quickly through the value to be changed.
- If you exit the changed value using the **MENU** button, the change will not be applied.

### 5.2 Main Menu

All the settings for standard ejector applications can be configured and read through the main menu.

#### 5.2.1 Functions in the Main Menu

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

Display code	Parameter	Explanation
H-1	Vacuum limit value H1	Deactivation value of control function (only if $\overline{c} \overline{t} \overline{r} = 00$ and $005$ are active)
h-1	Hysteresis value h-1	Hysteresis value for the control function
H-2	Vacuum limit value H2	"Part Present" check switching value
h-2	Hysteresis value h-2	"Part Present" check hysteresis value
$\overline{t} \overline{b} \overline{L}$	Blow off time	Only activated for $\overline{E} - \overline{t}$ or $\overline{L} - \overline{t}$
$\overline{c} \overline{A} \overline{L}$	Calibration	Calibrate the vacuum sensor

## 5.2.2 Changing the Parameters of the Main Menu

1. Open the main menu by pressing the **MENU** button.
  2. Use the **UP** or **DOWN** button to select the desired adjustable parameter.
  3. Confirm the selection with the **MENU** button.
  4. Use the **UP** or **DOWN** button to set the value of the parameter.
  5. To save and exit the menu, press and hold the **MENU** button for at least 2 seconds.
- ⇒ The displayed value flashes to confirm.

The factory settings for the parameters are listed in the Technical Data section.

## 5.3 Configuration Menu

An extended configuration menu is available for applications with special requirements.

### 5.3.1 Functions in the Configuration Menu

The following table shows an overview of the display codes in the configuration menu:

Display code	Parameter	Possible settings	Explanation
cEr	Air saving function	oN oFF oNS	Control active Control inactive Valve protection function active (max. permissible leakage is monitored)
dCS	Deactivate auto. control shutoff	oN oFF	Suppresses the automatic valve protection function when set to YES. Cannot be activated when cEr = oFF.
t- l	Max. permissible evacuation time	Configurable between 0.01 and 9.99 s in 0.01 increments oFF	Permissible evacuation time; evaluation in IO-Link only  No monitoring
-L-	Max. permissible leakage	Values from 0 to 999 mbar/s can be configured in 1 mbar/s increments	Menu item only displayed when cEr = oNS Unit: millibar per second This value is used for oNS and CM warnings. The adjustable leakage value can be used to judge the quality of the suction process. Evaluation in IO-Link only.
bLo	Blow off function	-E- l-t  E-t	Externally controlled Internally controlled (triggered internally, time can be set) Externally controlled (triggered externally, time can be set)
o-2	Signal output 2	no nc	Configure output 2, "Part Present" check for normally open for normally closed
tYP	Signal type	PnP nPN	Define signal type for inputs and outputs Signal type PNP, input/output on = 24 V Signal type NPN, input/output on = 0V
dLY	H2 switching signal delay	Values: 10, 50, 200 and oFF	Delays the switching signals H 1 and H2 Unit: milliseconds

Display code	Parameter	Possible settings	Explanation
UN I	Vacuum unit	-bA -iH -PA	Define the displayed vacuum unit Vacuum level in mbar Vacuum level in inHg Vacuum level in kPa
dPY	Display rotation	Std rEd	Display configuration Standard Rotated 180°
Eco	Display in Eco mode	oFF on	Configure the display Eco mode is deactivated – the display remains on ECO mode is activated – the display switches off
P in	PIN	Value from 00 1 to 999	Specify the PIN, lock the menus If the PIN is 000, then the device is not locked.
rES	Reset	YES	Set all parameter values to factory settings.

### 5.3.2 Changing the Parameters of the Configuration Menu

1. Open the configuration menu by pressing the **MENU** button for more than 3 seconds.  
⇒ During activation, [ - C - ] appears.
2. Use the **UP** or **DOWN** button to select the desired adjustable parameter.
3. Confirm the selection with the **MENU** button.
4. Use the **UP** or **DOWN** button to set the value of the parameter.
5. To save and exit the menu, press and hold the **MENU** button for at least 2 seconds.  
⇒ The displayed value flashes to confirm.

The factory settings for the parameters are listed in the Technical Data section.

## 5.4 System Menu

A special menu is available for reading out system data such as counters, the software version, part numbers and serial numbers.

### 5.4.1 Functions in the System Menu

Display code	Parameter	Explanation
CC 1	Counter 1	Suction cycles
CC 2	Counter 2	Number of valve switches
SoC	Software function	Software on the internal controller
ArE	Part number	Format of the part no., example: 10.02.02.00383
Snr	Serial number	Provides information about the production period

## 5.4.2 Displaying Data in the System Menu

1. Open the system menu by simultaneously pressing the **MENU** and **UP** buttons for more than 3 seconds.
  - ⇒ During activation,  appears.
2. Use the **UP** or **DOWN** button to select the value to be displayed.
3. Confirm the selection with the **MENU** button.
  - ⇒ The value is displayed.
4. To save and exit the menu, press and hold the **MENU** button for at least 2 seconds.

## 5.5 Individual Functions

### Displaying the vacuum level:

Outside of the menu, the ejector is in display mode and the current vacuum level is displayed. In display mode, a specific function is assigned to each button.

### Displaying the supply voltage:

- ▶ Press the **UP** button
- ⇒ The supply voltage that is currently applied to the ejector is displayed in volts.

After 3 seconds, the screen returns to the vacuum display.

The displayed voltage is a guideline value and is used for comparative measurements.

### Displaying the operating mode:

- ▶ Press the **DOWN** button
- ⇒ The current operating mode is displayed.

It is either standard I/O (SIO) mode  or IO-Link mode .

In IO-Link mode, you can also press the **DOWN** button again to view the IO-Link Standard (1.0, 1.1) that is currently in use.

After 3 seconds, the screen returns to the vacuum display.

## 6 Operating Modes

All the ejectors in this series can be operated in two operating modes:

- Via direct connection to inputs and outputs (standard I/O = SIO) or
- Connection via a communication line (IO-Link)

By default, the ejector always runs in SIO mode, but it can be switched in and out of IO-Link mode by an IO-Link master at any time.

### 6.1 SIO Operating Mode

In SIO mode, all input and output signals are connected to a controller, either directly or using intelligent terminal boxes. For this purpose, in addition to the supply voltage, two input signals and one output signal should be connected to allow the ejector to communicate with the controller.

The following basic ejector functions are used:

- Inputs
  - Suction ON/OFF
  - Blow off ON/OFF
- Output
  - H2 (Part Present) feedback

The “Blow off” signal does not have to be used if the ejector is operated with internal time control in blow off mode. This allows operation on a single port in a configurable terminal box (using 1xDO and 1xDI).

The parameters are set and the internal counters are read out using the operating and display elements. The energy and process control functions are unavailable in SIO mode.

### 6.2 IO-Link Operating Mode

By default (after the supply voltage has been applied), the product always runs in digital I/O mode or SIO mode, but can be switched to IO-Link mode at any time by an IO-Link master.

When operating the product in IO-Link mode (digital communication), the supply voltage, the ground and the communication line are connected to a controller, either directly or using intelligent terminal boxes. The communication line for IO-Link (C/Q line) is always connected with an IO-Link master port (point-to-point connection). It is not possible to connect multiple C/Q lines to a single IO-Link master port.

Connecting the Ejector via IO-Link provides access to a number of additional functions alongside the basic functions of the Ejector, such as suction, blow-off and feedback.

They include:

- The current vacuum level
- Choice of four production profiles (production setup profiles)
- Errors and warnings
- System status indicator
- Access to all parameters
- Energy and process control (EPC) functions

This allows all modifiable parameters to be read, modified and written back to the Ejector directly via the higher-level controller.

Evaluation of the condition monitoring and energy monitoring results allows you to draw direct conclusions regarding the current handling cycle and perform trend analyses.

The product supports IO-Link revision 1.1 with four bytes of input data and two bytes of output data. It is also compatible with IO-Link masters that use revision 1.0 and above. In this case, one byte of input data and one byte of output data are supported.

The process data is exchanged cyclically between the IO-Link master and the product (data transmission rate with COM2 = 38.4 kBit/sec.).

ISDU parameter data (acyclical data) is exchanged only on request. It is exchanged by the user program in the control unit (e.g. using communication modules).

### 6.2.1 Process Data

The cyclical process data is used to control the ejectors and receive current information reported from the ejector. There is a difference between the input data (Process Data In) and the controlling output data (Process Data Out).

The input data Process Data In is used to report the following information cyclically:

- Vacuum limit values H1 and H2
- CM-Autoset acknowledgment
- EPC-Select acknowledgment
- The ejector device status in the form of a status traffic light
- Multifunctional EPC values

The output data Process Data Out is used to control the ejector cyclically:

- Vacuum on/off
- Blow off active
- Setup mode
- CM Autoset
- EPC-Select: switching the multifunctional EPC values
- Switching production setup profiles P0–P3
- Inlet pressure in 0.1 bar (measured value from external pressure sensor, 0 = function inactive)

A detailed description of the process data can be found in the data dictionary.

The corresponding device description file (IODD) is available for integration into a higher-level control unit.

### 6.2.2 Parameter Data

In addition to the process data that is exchanged automatically, the IO-Link protocol provides an acyclical data channel for identification data, setting parameters or general feedback from the device. The available data objects are referred to as ISDU with IO-Link and are to be uniquely addressed within a device through their index and subindex.

Controller manufacturers usually provide a specialized function module – e.g. the “IOL\_CALL” module for Siemens controllers – to enable these parameters to be accessed from a control program.

Information about which parameter data the device provides and how this data is displayed as ISDU objects can be found in the “Data Dictionary”.

### 6.2.3 IO-Link

The ejector can be operated in IO-Link mode to enable intelligent communication with a controller. The ejector's parameters can be set remotely using IO-Link mode. The energy and process control (EPC) function is also available in IO-Link mode. It is divided into 3 modules:

- Condition monitoring (CM): Condition monitoring to increase system availability
- Energy monitoring (EM): Energy monitoring to optimize the vacuum system's energy consumption
- Predictive maintenance (PM): Predictive maintenance to increase the performance and quality of the gripping systems

## 7 General Description of Functions

### 7.1 Applying Suction to the Workpiece/Part



#### **WARNING**

**The compressed air supply of the vacuum generator fails during operation.**

Danger of falling parts because the vacuum for the vacuum gripper collapses quickly.

- ▶ Ensure that the compressed air supply does not fail during operation.
- ▶ Carry out a risk assessment for each application.

The ejector is designed for handling and holding workpieces by means of a vacuum in combination with suction systems. The vacuum is generated in a nozzle according to the venturi principle, using suction generated by the flow of accelerated compressed air. Compressed air is channeled into the ejector and flows through the nozzle. A vacuum is generated immediately downstream of the motive nozzle; this causes the air to be sucked through the vacuum connection. The air and compressed air that have been removed by the suction exit together via the silencer.

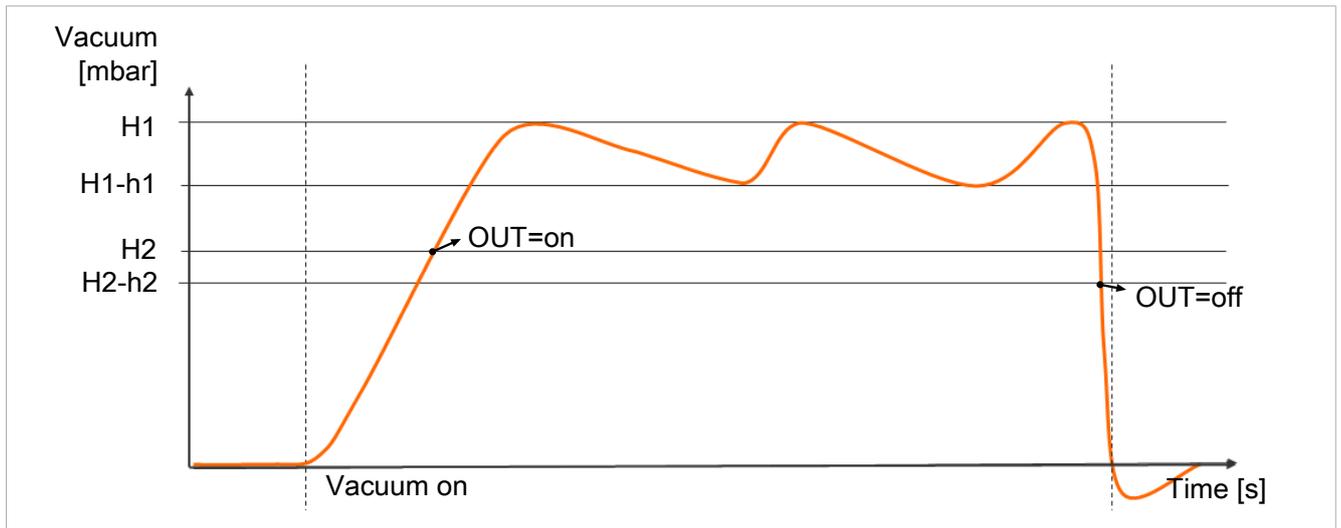
The venturi nozzle on the ejector is activated and deactivated using the suction command:

- In the NO (normally open) version, vacuum generation is deactivated when the suction signal is received.  
(This means that if the power fails or if no control signal is present, vacuum is constantly generated (continuous suction).)
- In the NC (normally closed) version, vacuum generation is activated when the suction signal is received.  
(This means that if the power fails or if no control signal is present, no vacuum is generated.)
- In the variant IMP, the venturi nozzle is controlled in the same way as in the variant NC. That is, the ejector switches to "suction" operating mode when the "suction" signal is present.  
In the event of a power failure, the last state is retained. (If the suction signal is present when the power fails but the ejector is currently in control mode, the ejector is switched to continuous suction.)

In the ejector variant IMP, the ejector remains in "Suction" mode if the power supply fails during automatic operation. This prevents objects that have been picked up from falling off the suction cup in the event of a power supply failure. This also applies when the ejector is in "venturi nozzle inactive" status with the air saving function activated. In this case, the ejector switches to "venturi nozzle active," i.e., to continuous suction. When the power supply returns, the ejector remains in automatic operation with the air saving function activated. If the ejector is in "blow off" mode when the power supply fails, the blow off is stopped and the ejector is set to "pneumatically OFF" status. This prevents unnecessary consumption of compressed air, thus saving energy and additional costs. When the power supply returns, the ejector remains in "pneumatically OFF" status.

An integrated sensor records the vacuum generated by the venturi nozzle. The exact vacuum level is shown on the display and can be read from the IO-Link process data.

The diagram below shows the vacuum curve for when the air saving function is activated:



The ejector has an integrated air saving function and automatically regulates the vacuum in suction mode:

- The electronics switch the venturi nozzle off as soon as the set vacuum limit value (switching point H1) is reached.
- When objects with airtight surfaces are picked up, the integrated non-return valve prevents the vacuum from dropping.
- If the system vacuum drops below the limit value switching point H1-h1 due to leaks, the venturi nozzle is switched back on.
- Depending on the vacuum, the H2 process data bit is set once a workpiece is picked up safely. This enables the further handling process.



If small volumes are to be evacuated, the set switching point H1 may be exceeded considerably before the vacuum is switched off. This system behavior does not constitute an error.

## 7.2 Depositing the Workpiece/Part (Blowing Off)

In blow off mode, the vacuum circuit of the ejector is supplied with compressed air. This ensures that the vacuum drops quickly, allowing the workpiece/part to be deposited quickly.

The ejector provides three blow off modes for selection:

- Externally controlled blow off
- Internal time-controlled blow off (not applicable for pulse variant)
- External time-controlled blow off

The current process state is indicated by the LED status indicators.

If the "Suction" signal input is still present in the pulse-controlled ejector variant (IMP) after "blow off", it is not evaluated. The ejector does not switch to "suction" status until another pulse is activated.

During blow off, [-FF] is shown on the display.

## 7.3 Operating Modes

The ejector can be operated in four operating modes:

- Direct connection to inputs and outputs (standard I/O = SIO)
- Connection via the communication line (IO-Link)
- "Manual mode," operation using the ejector buttons
- Setup mode

By default, the ejector always runs in SIO mode, but it can be switched in and out of IO-Link mode by an IO-Link master at any time.

In addition to automatic operation, you can also use the keys on the ejector to change the operating state and switch to manual mode.

The ejector is always parameterized in automatic mode.

### 7.3.1 Automatic Operation

Once the product is connected to the power supply, it is ready for operation and enters automatic mode. This is the normal operating mode, in which the product is operated by the system control unit.

A differentiation is made between SIO mode and IO-Link mode.

The operating mode may be changed from automatic operation to manual operation using the buttons.

The ejector is always parameterized in automatic mode.

### 7.3.2 Manual Operating Mode



#### **WARNING**

**Through an external signal, manual operation is exited, external signals are evaluated and system parts move.**

Personal injury or damage to property due to collisions

- ▶ Ensure that the danger zone of the system is clear of people during operation.
- ▶ Wear the required personal protective equipment (PPE) when working in the danger zone.



#### **WARNING**

**Falling objects due to incorrect operation in manual mode**

Risk of injury

- ▶ Higher level of attention
- ▶ Ensure that there are no persons within the danger zones of the machine/system

In manual mode, a higher level of attention is advisable because incorrect operation may cause gripped parts to fall, resulting in injuries.

In manual mode, the "suction" and "blow off" ejector functions can be controlled independently of the higher-level controller using the buttons on the operating panel. In this operating mode, the "H1" and "H2" LEDs both flash.

#### **Activating the operating mode**

- ▶ Press and hold the **DOWN** and **UP** button for more than 3 seconds.

### Manual suction

1. Press the **UP** button to activate "suction" on the ejector.
2. The **DOWN** or **UP** button exits "suction" mode again.

When the air saving function is switched on, it is also active in the "Manual Operation" operating mode.

### Manual blow off

- ▶ Press the **DOWN** button to activate "blow off" on the ejector for as long as the button is pressed.
- ⇒ The H1 and H2 LEDs light up simultaneously.

### Deactivating the operating mode

- ▶ By pressing the **MENU** button or through an external state change by signal inputs.

### 7.3.3 Setup Mode

Setting mode is used for locating and eliminating leakages in the vacuum circuit. Since the valve protection function is deactivated and the control is not deactivated, even at increased control frequencies.

In this operating mode, the "H1" and "H2" LEDs both flash.

#### Setting Mode Activated and Deactivated

- ▶ Set the corresponding value using bit 2 in the output process data byte (PDO).

A change to bit 0 or bit 1 (suction or blow off) in the PDO also causes the ejector to exit setting mode.

This function is only available in IO-Link mode.

## 7.4 Vacuum Monitoring

The ejector has an integrated sensor for monitoring the current system vacuum. The vacuum level provides information about the process and has an effect on the following signals and parameters:

- The limit value H1
- The limit value H2
- The signal output H2
- The process data bit H1
- The process data bit H2

The limit values and associated hysteresis values are adjusted in the menu items  $H-1$ ,  $h-1$ ,  $H-2$  and  $h-2$  in the main menu or via IO-Link.

## 7.5 Control Function

The ejector allows you to conserve compressed air or prevent an excessive vacuum from being generated. Vacuum generation is interrupted when the set vacuum limit value H1 is reached. If leakage causes the vacuum to fall below the hysteresis limit value (H1-h1), vacuum generation resumes.

The operating modes for the control function can be set under the  $\square \square \square$  menu item in the configuration menu or via IO-Link.

Operating mode	Explanation
No control/continuous suction, H1 in hysteresis mode [cbr] => [oFF]	The ejector produces continuous suction with maximum power. This setting is recommended for very porous workpieces, which would otherwise cause vacuum generation to switch on and off continuously due to the high rate of leakage. The limit value evaluation for H1 is operated in hysteresis mode. Can be adjusted only if the control shutoff is deactivated ([dcS] => [oFF])
Control function activated [cbr] => [on]	The ejector switches off vacuum generation when the vacuum limit value H1 is reached. It switches it back on when the vacuum falls below the hysteresis limit value (H1-h1). The limit value evaluation for H1 follows the control function. To protect the ejector, valve switching frequency monitoring is activated in this operating mode. If the readjustment is too fast, the control function is deactivated and the device switches to continuous suction.
Control function activated, leakage measurement activated [cbr] => [onS]	Like the "Control function activated" operating mode; in addition, the system leakage rate is measured and compared to the adjustable leakage limit value [-L-]. If the actual leakage rate exceeds the limit value more than twice in succession, the control function is deactivated and the ejector switches to continuous suction.

Available control function operating modes

The control shutoff function can deactivate the automatic control shutoff.

The function can be set under the [dcS] menu item in the configuration menu or via IO-Link. If the [dcS = oFF] function is selected, the ejector switches to the "Continuous suction" operating mode when there is excessively high leakage and the valve switches too frequently. With the [dcS = on] setting, continuous suction is deactivated, and the ejector continues in control mode despite a high leakage rate or control frequency greater than 6 times per 3 s. The setting [dcS = on] can only be adjusted if the control function [cbr □ on] or [cbr] => [onS] is activated.



When the control shutoff is deactivated, the suction valve makes frequent adjustments. This can destroy the ejector.

In the event of undervoltage or a power failure, the NO ejector version reacts with continuous suction even though continuous suction is deactivated with [dcS = on].

## 7.6 Blow off Functions

The ejector has three blow off functions in three different modes. The function is set under the [bL o] menu item in the configuration menu or via IO-Link.

Explanations of the blow off modes:

Description	Explanation
Externally controlled blow off [bL o] => [-E -]	The ejector switches to blow off mode for as long as the blow off signal is present. The blow off signal is given priority over the suction signal.
Internally time-controlled blow off [bL o] => [L -t]	After the suction signal is switched off, the ejector switches to blow off mode automatically for the set time (which can be adjusted using [t bL]). With this function, the blow off signal does not have to be additionally controlled. "Blow off" mode can still be activated in this mode using the "Blow off" signal input. The blow off signal overrides the suction signal, even if the specified blow off time is very long. The [L -t] function is not available for ejector variant IMP.
External time-controlled blow off [bL o] => [E -t]	The blow off starts with the blow off signal and is performed for the set time period [t bL]. Applying the blow off signal for a longer time does not lead to a longer blow off period. The blow off signal overrides the suction signal, even if the specified blow off time is very long.

The length of the blow off time [t bL] is set in the main menu. This menu item is suppressed in operating mode [-E -].

The number displayed indicates the blow off time in seconds. Blow off times from 0.10 seconds to 9.99 seconds can be set.

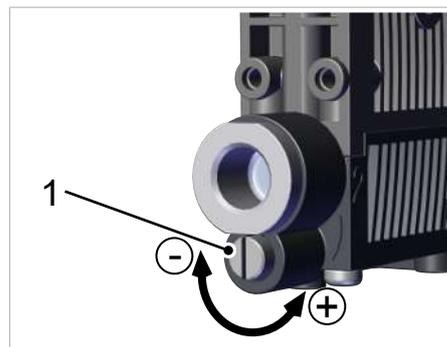
## 7.7 Changing the Blow-Off Flow Rate on the Ejector



Do not overwind past the stop on the valve screw. A minimum flow rate of approx. 10% is always necessary for technical reasons. The blow off volume flow can be set between 10% and 100%.

The figure shows the position of the valve screw (1) for adjusting the blow off flow rate. The valve screw is equipped with a stop on both sides.

- Rotate the valve screw (1) clockwise to reduce the flow rate.
- Rotate the valve screw (1) counterclockwise to increase the flow rate.



## 7.8 Monitoring the Supply Voltages



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

The ejector measures the supply voltages  $U_s$ . The measured value can be read from the parameter data. If the voltages are outside the valid range (min. 19.2 V and max. 26.4 V), the following status messages change:

- Device status
- Condition monitoring parameter
- An IO-Link event is generated

There is no guarantee that the ejector will operate as intended below a supply voltage of 19.2 V:

- The reaction to signal inputs is disabled.
- The "Part Present" check output retains its normal functionality.
- The current supply voltage can still be viewed using the **UP** button.
- The pneumatic state of the ejector changes as follows:
  - For the NO-type ejector, the ejector switches to the "suction" operating state
  - For the NC-type ejector, the ejector switches to the "pneumatically OFF" operating state

## 7.9 Evaluating the Inlet Pressure

The available supply pressure level in the system cannot be measured by the ejector itself. However, the current measured value for the inlet pressure can be transmitted to the ejector from the system controller via IO-Link. In this case, the ejector evaluates the pressure level and activates a condition monitoring warning if the pressure level is not optimal. If there is a significant deviation, an error message is also generated.

A pressure level must also be transferred to enable the volume of compressed air consumed in the suction cycle to be estimated in the area of energy monitoring.

## 7.10 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  $\square RL$  or using IO-Link.

1. Press the **MENU** button
  - ⇒ The menu changes to input
2. Press the **UP** or **DOWN** button until  $\square RL$  appears on the display
3. Confirm with the **MENU** button
4. When  $\surd ES$  appears, press the **MENU** button to confirm.
  - ⇒ The vacuum sensor is now calibrated.

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

When the permissible limit is exceeded by  $\pm 3\%$ , error code  $\square \square \square$  will appear on the display.

## 7.11 Signal Output

### 7.11.1 Setting the Output Function

The ejector has a signal output. The signal output can be configured using the corresponding menu item.

The signal output OUT can be switched between [NO] (normally open) and [NC] (normally closed) contact. You can switch it in the configuration menu using the [0-2] menu item or set it via IO-Link. The function of the limit value H2/h2 ("Part Present" check) is assigned to the signal output OUT.

The signal output is switched on or off when the system vacuum is higher or lower than the relevant threshold value.

### 7.11.2 Setting the Signal Type

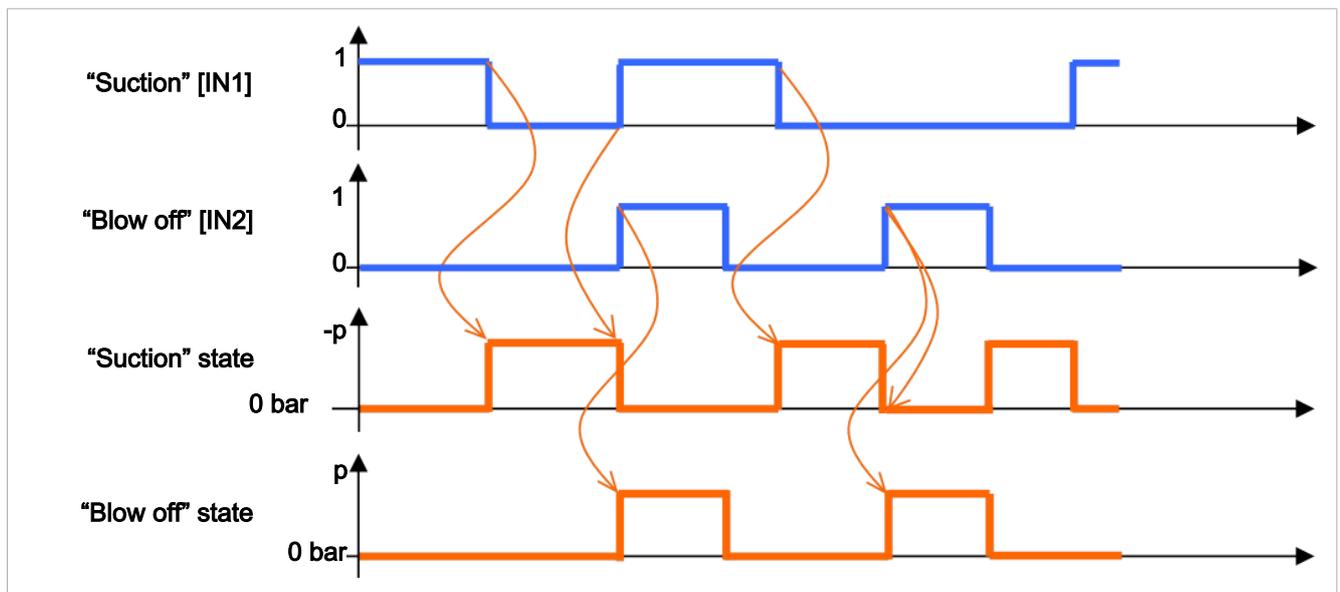
The signal type, or the switching behavior (PNP or NPN) of the electrical signal inputs and the signal output, can be set on the device and therefore does not depend on the version.

You can switch this setting using the [EYP] menu item in the configuration menu or via IO-Link.

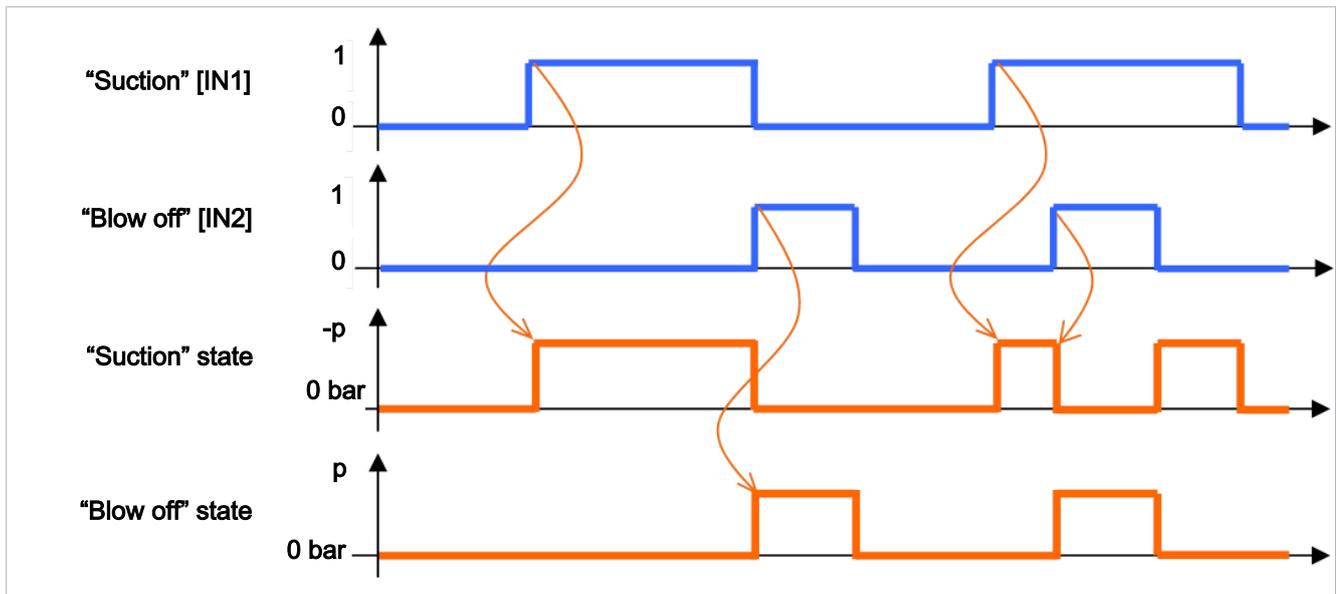
The ejector is factory set to PNP.

## 7.12 Control of the Ejector Variants

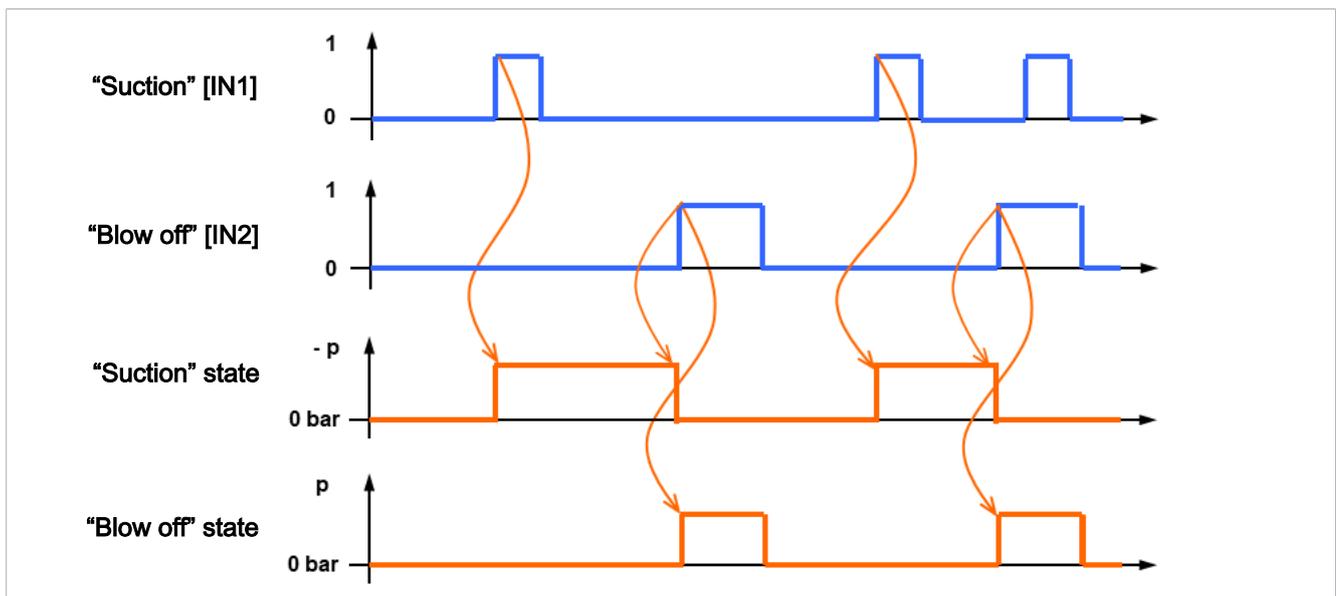
### 7.12.1 Control Concept for NO Ejectors



### 7.12.2 Control Concept for NC Ejectors



### 7.12.3 Control Concept for IMP Ejector Variant



On delivery, the ejector variant IMP is set to "pneumatically OFF." The ejector only produces suction after a valid pulse has been applied at the "suction" signal input.

## 7.13 Vacuum unit

You can choose between the following three units for the unit of the displayed vacuum level under the [Vac] menu item in the configuration menu or via IO-Link.

Unit	Setting parameter	Display unit
Bar	[-bA]	mbar
Pascal	[-PA]	kPa
InchHg	[-iH]	inHg

The selection of the vacuum unit only affects the display. The units of the parameters that can be accessed via IO-Link are not affected by this setting.

## 7.14 Switch-off Delay

You can use this function to set a switch-off delay for the H2 "Part Present" check signal. This can be used to mask short-term fluctuations in the vacuum level of the vacuum system. The duration of the switch-off delay can be set with the parameter [dL4] in the configuration menu or via IO-Link. The value can be set to 10, 50 or 200 ms. To deactivate this function, enter the value [000] (= off).

The switch-off delay affects the OUT<sub>2</sub> discrete output, the process data bit in IO-Link and the H2 status display



If the output OUT2 is configured as a normally open contact [NO], there will be an electrical switch-off delay. On the other hand, if it is configured as a normally closed contact [NC], there will be an equivalent switch-on delay.

## 7.15 ECO Mode

The ejector offers the option to switch off the display to save energy. If ECO mode is activated, the display is switched off and the system power consumption is reduced after 2 minutes if no buttons are pressed.

ECO mode can be activated and deactivated using the [E□□] parameter in the configuration menu or via IO-Link.

A red dot in the lower right corner of the display indicates that the display has been switched off.

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.

## 7.16 Write Protection

### 7.16.1 PIN

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.

Full access to the ejector 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.

You enter the PIN using the P□□ parameter in the configuration menu or via IO-Link.

### 7.16.2 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.

### 7.17 Resetting to Factory Settings

This function restores the ejector configuration of the initial setup and the settings of the active production setup profile to the 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.

The function is executed using the  $rES$  menu item in the configuration menu or via IO-Link:

1. Press the **MENU** button for more than 3 seconds.
  - ⇒ When the menu is locked, enter the valid PIN.
2. Use the **UP** or **DOWN** button to select the menu item  $rES$ .
3. Confirm using the **MENU** button.
  - ⇒  $rES$  appears on the display.
4. Press the **MENU** button for more than 3 seconds.
  - ⇒ The ejector is reset to the factory settings.
  - ⇒ The display flashes for a number of seconds and then returns to display mode.

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 production setup profiles, which are currently deactivated

The factory settings for the ejector are listed in the Technical Data section.

## 7.18 Counters

The ejector has two internal counters, [cc 1] and [cc 2], which cannot be erased:

Counter 1 increases with each valid pulse at the "suction" signal input, meaning that it counts all the suction cycles during the ejector's service life. Counter 2 increases each time the "suction" valve is switched on. As a result, the average switching frequency of the air saving function can be determined using the difference between counters 1 and 2.

Designation	Display parameter	Description
Counter 1	[cc 1]	Counter for suction cycles ("suction" signal input)
Counter 2	[cc 2]	Counter for the "suction valve" switching frequency

### Displaying a counter on the operating panel of the ejector:

- ✓ Select the counter you wish to see in the system menu.
- ▶ Confirm the counter by pressing the **MENU** button.
- ⇒ The last three decimal places of the counter total are displayed (the digits  $\times 10^0$ ). This corresponds to the least significant three digits. The decimal point at the far right lights up. This corresponds to the least significant three digits.

Use the **UP** or **DOWN** button to display the remaining decimal places of the counter total. The decimal points show which three-digit block of the complete counter value is shown on the display.

The counter total is comprised of the 3 number blocks together:

Displayed section	$10^6$	$10^3$	$10^0$
Digit block	0.48	6 18	593.

The current counter total in this example is 48 618 593.

## 7.19 Displaying the Software Version

The software version indicates the software currently running on the internal controller.

1. If the menu is locked: Enter a valid PIN.
  2. Use the **UP** or **DOWN** button to select the [50c] parameter.
  3. Confirm using the **MENU** button.
    - ⇒ The value is displayed.
- ▶ To exit the function, press the **MENU** button.

## 7.20 Displaying the Part Number

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

- ✓ In the system menu, select the parameter **Part**.
1. Confirm using the **MENU** button.
    - ⇒ The first two digits of the part number are displayed.
  2. You can press the **DOWN** or **UP** button to display the remaining digits of the part number. The decimal points shown are part of the part number.

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

Displayed section	1	2	3	4
Digit block	10.	020	200	383

The part number in this example is 10.02.02.00383.

- ▶ To exit the function, press the **MENU** button.

## 7.21 Displaying the serial number

The serial number indicates the production period of the ejector.

- ✓ In the system menu, select the [500] parameter.
1. Confirm using the **MENU** button.
    - ⇒ The last three decimal places of the serial number are displayed (the digits x 10<sup>0</sup>). The decimal point at the far right flashes. This corresponds to the least significant three digits.
  2. You can press the **DOWN** or **UP** button to display the remaining decimal places in the serial number. The decimal points show which three-digit block of the serial number is shown on the display.

The serial number consists of 3 number blocks:

Displayed section	10 <sup>6</sup>	10 <sup>3</sup>	10 <sup>0</sup>
Digit block	0.48	6 18	593.

The serial number in this example is 48 618 593.

- ▶ To exit the function, press the **MENU** button.

## 7.22 Production Setup Profiles

The ejector can store up to four different production setup profiles (P-0 to P-3) via IO-Link. All the important parameter data for handling the workpiece is stored in this case. The profiles are selected using the PDO byte 0 process data byte. This gives users a quick and convenient option for adjusting the parameters to different workpieces.

The data set that is currently selected is displayed in the parameter data under "Production Setup." This data is also the current parameters with which the ejector is working. They can be viewed using the menu.

In IO-Link mode, display the parameter data set (P-0 to P-3) currently in use:

1. Select the main menu
2. Press the **MENU** button.
  - ⇒ The parameter data set (P-0 to P-3) currently in use is briefly shown on the display.

In the default setting and in SIO mode, the P-0 production setup profile is selected.

## 7.23 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.

## 7.24 Energy and Process Control (EPC)

In IO-Link mode, the energy and process control (EPC) function is available. It is subdivided into three modules:

- Condition monitoring (CM): Condition monitoring to increase system availability
- Energy monitoring (EM): Energy monitoring to optimize the vacuum system's energy consumption
- Predictive maintenance (PM): Predictive maintenance to increase the performance and quality of the gripping systems.

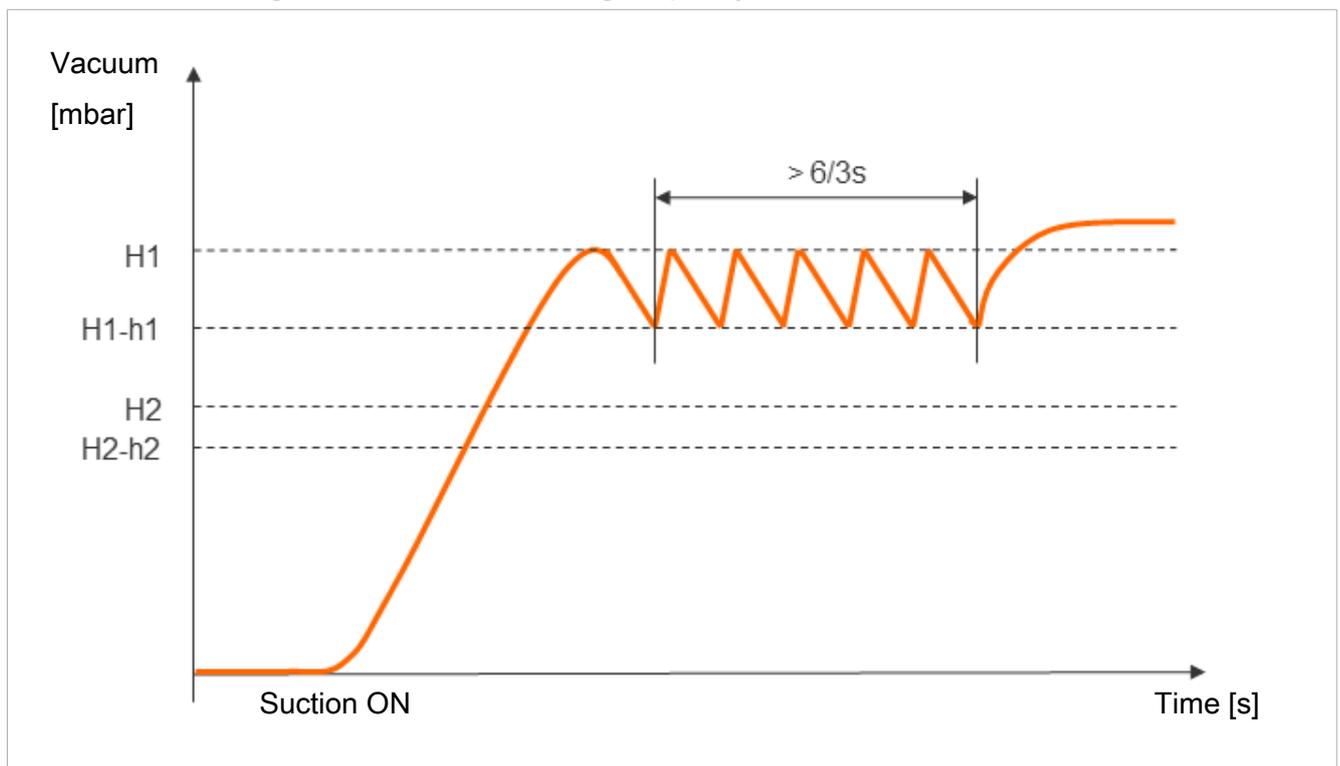
### 7.24.1 Condition Monitoring (CM)

#### Monitoring the valve switching frequency:

When the air saving function is activated and there is a high leakage level in the gripping system, the ejector switches between the suction and suction-off states very frequently. The number of valve switching procedures thus increases rapidly within a short time. To protect the ejector and increase its service life, the ejector switches the air saving function off automatically at a switching frequency of more than 6 times every 3 seconds and activates continuous suction; the ejector then remains in the suction state. In IO-Link mode, the appropriate condition monitoring warning is also set. In addition, the system status light switches to yellow.

The basic monitoring for the valve protection function is also active in SIO mode.

Schematic diagram of the valve switching frequency



With the  $[d5 = 0]$  setting, continuous suction is deactivated, and the ejector continues in control mode despite a high leakage rate or control frequency greater than 6 times per 3 s.

**Monitoring the Control:**

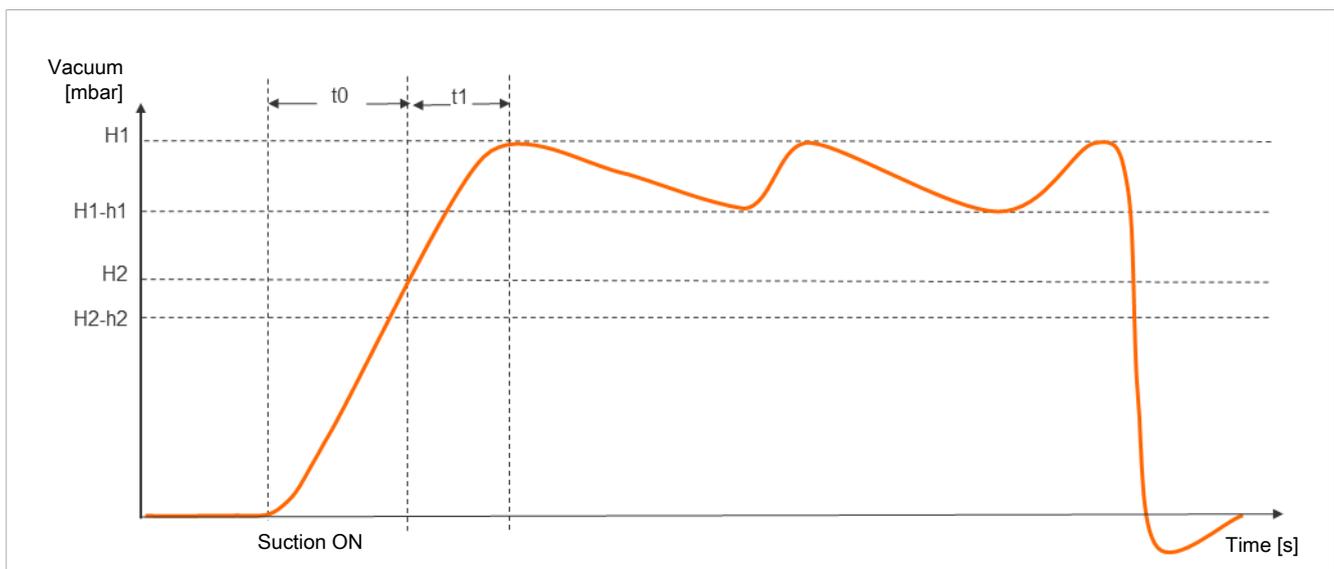
If the vacuum limit value H1 is never reached during the suction cycle, the "H1 not reached" condition monitoring warning is triggered and the system status light switches to yellow.

This warning is available at the end of the current suction phase and remains active until the next suction cycle.

**Measuring and monitoring the evacuation times:**

$t_0$  is the time from the beginning of a suction cycle to when the vacuum limit value H2 is reached (in ms).

$t_1$  is the time from when the vacuum limit value H2 is reached to when the vacuum limit value H1 is reached (in ms).

Evacuation times  $t_0$  and  $t_1$ 

If the measured evacuation time  $t_1$  (from H2 to H1) exceeds the specified value  $[t-1]$ , the "Evacuation time longer than  $t-1$ " condition monitoring warning is triggered and the system status light switches to yellow.

The specified value for the max. permitted evacuation time can be set under the  $[t-1]$  menu item in the configuration menu or via IO-Link. Setting the value to "0" deactivates monitoring. The maximum permitted evacuation time setting is 9.99 seconds.

**Leakage monitoring:**

In control mode ( $[L-1] = [L-2]$ ), the loss of vacuum within a certain period is monitored (mbar/s). There are two possible statuses.

**Leakage  $L <$  permitted value -L-**

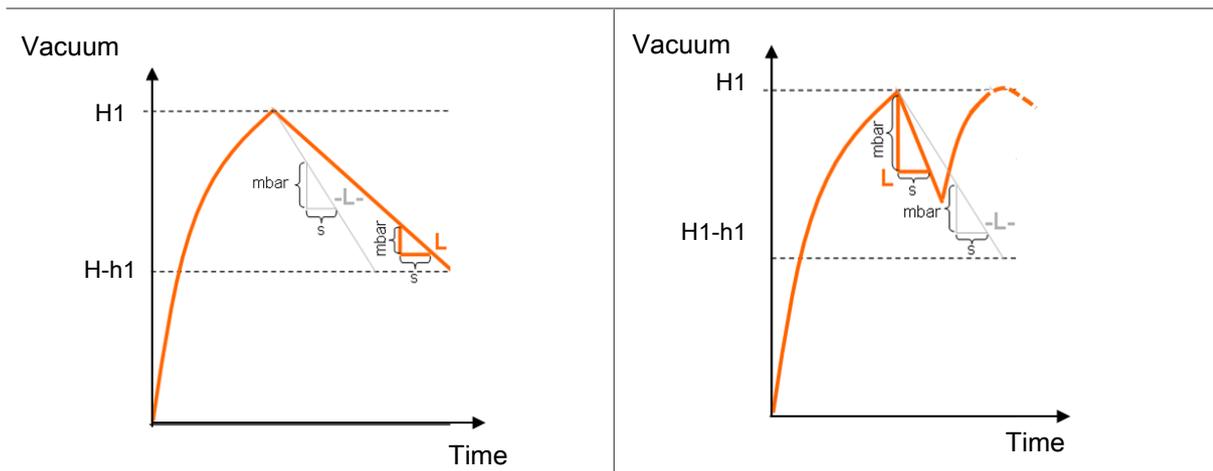
If the leakage is lower than the set value, the vacuum continues to fall until it reaches the vacuum limit value H1-h1, and the ejector begins with suction again (normal control mode).

The condition monitoring warning is not activated and there is no effect on the system status light.

**Leakage  $L >$  permitted value -L-**

If the leakage is higher than the value, the ejector readjusts immediately.

If the permitted leakage is exceeded twice, the ejector switches to continuous suction. The condition monitoring warning is activated and the system status light switches to yellow.



#### Dynamic pressure monitoring:

If possible, a dynamic pressure measurement is taken at the start of every suction cycle. The result of this measurement is compared to the vacuum limit values set for H1 and H2.

If the dynamic pressure is greater than (H2 - h2) but less than H1, the corresponding condition monitoring warning will be set and the system status light will switch to yellow.

#### Leakage level evaluation:

This function determines the average leakage during the last suction cycle, divides it into subareas and makes it available as a parameter via IO-Link.

#### Autoset

The CM Autoset IO-Link function in the process output data allows the condition monitoring parameters for maximum permitted leakage [ $-L-$ ] and the evacuation time [ $t - l$ ] to be set automatically. The actual values from the last suction cycle are combined with additional tolerance and stored.

### 7.24.2 Energy Monitoring (EM)

To optimize the energy efficiency of the vacuum gripping systems, the ejector provides functions for measuring and displaying energy consumption.



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

#### Percentage-based air consumption measurement:

The ejector calculates the air consumption from the last suction cycle as a percentage. This value corresponds to the ratio for the full duration of the suction cycle and the active suction and blow-off times.

#### Absolute air consumption volume:

The actual air consumption in a suction cycle is calculated taking the system pressure and nozzle size into account.



An absolute air consumption measurement can be made only using a pressure value supplied externally via IO-Link.

The measured value for the absolute air consumption (air consumption per cycle) is reset at the start of the suction cycle and then continuously updated during the cycle. It can continue to change until after the end of blow-off.

**Energy consumption measurement:**

The ejector determines the electrical energy consumed during a suction cycle, including the energy it consumes itself and the energy consumed by the valve coils.

To determine the values for the air consumption as a percentage and the electrical energy consumption, the neutral phase of the suction cycle must also be taken into account. Therefore, the measured values can only ever be updated when the next suction cycle begins. Throughout the cycle, the measured values displayed then represent the results from the previous cycle.

**7.24.3 Predictive Maintenance (PM)**

For early detection of wear and other impairments to the vacuum gripper system, the ejector features functions for detecting trends in the quality and performance of the system. The leakage and dynamic pressure are measured for this purpose.

**Measurement of leakage:**

The leakage (represented as the vacuum drop per time unit in mbar/s) after the control function interrupts suction because the vacuum limit value H1 has been reached is measured.

The measured value for the leakage rate and the related quality assessment in percent are reset at the start of every suction cycle and constantly updated during the cycle as moving averages. The values therefore remain stable until after the suction cycle is complete.

**Measurement of dynamic pressure:**

This measures the system vacuum achieved during unobstructed suction. The duration of the measurement is approx. 1 second. Therefore, to evaluate a valid dynamic pressure, uninterrupted suction is required for at least 1 second after starting the suction, i.e. the suction point must not be covered by a part. Measured values below 5 mbar or above the vacuum limit value H1 are not regarded as valid dynamic pressure measurements and are rejected. The result of the last valid measurement is retained. Measured values that are higher than the vacuum limit value (H2-h2) and simultaneously lower than vacuum limit value H1 result in a condition monitoring event.

The dynamic pressure (vacuum during unobstructed suction) and the related performance assessment in percent are initially unknown when the ejector is switched on. As soon as a dynamic pressure measurement can be performed, they are updated and retain their values until the next dynamic pressure measurement.

**Quality assessment:**

To evaluate the overall gripping system, the ejector calculates a quality rating based on the measured system leakage. The greater the leakage in the system, the worse the quality rating of the gripping system. Conversely, low leakage results in a high quality rating.

**Performance calculation:**

Similar to the quality assessment, the performance calculation is used to evaluate the system status. The performance of the gripping system can be assessed based on the determined dynamic pressure. Optimally configured gripping systems lead to low dynamic pressure and thus to high performance. Conversely, poorly configured systems result in low performance. Dynamic pressure events that exceed the vacuum limit value (H2-h2) always result in a performance rating of 0%. A dynamic pressure value of 0 mbar (indicator that a valid measurement was not obtained) also results in a performance rating of 0%.

**7.24.4 Diagnostic Buffer**

The condition monitoring warnings described above and the general error messages from the device are saved in an integrated diagnostic buffer. The content of this memory is made up of the last 38 events, starting with the most recent, and can be read out via an IO-Link parameter. For each event, the current reading of the suction cycle counter cc1 is also saved to allow subsequent temporal assignment of the events to other processes in the system. See the associated IO-Link Data Dictionary for the actual data display of the diagnostic buffer. The recording of these events is also active in SIO mode and the contents of the memory is retained after a power failure.

The memory is deleted manually using the IO-Link system command "Clear diagnostic buffer" or also by restoring the factory settings on the device.

### 7.24.5 EPC Data Buffer

The ejector provides a ten-stage data buffer to enable long-term monitoring and trend analysis of the most important key figures in a handling process. The current measured values for the evacuation time  $t_1$ , leakage rate and dynamic pressure (vacuum during unobstructed intake), which are determined during the suction cycle, can be saved in this buffer. The values are saved automatically, always together with the execution of the autosest function in the condition monitoring area described above. For each data record, the current reading of the suction cycle counter  $cc_1$  is also saved to allow subsequent temporal assignment to other processes in the system. The contents of the EPC data buffer can be read out via an IO-Link parameter. See the associated IO-Link Data Dictionary for the actual data display of this buffer. The contents of the memory remains intact after a power failure.

### 7.24.6 EPC Values in the Process Data

To quickly and easily capture the most important results from the condition monitoring [CM], energy monitoring and predictive maintenance functions, these are also made available via the process input data of the device. The top 3 bytes of the process output data are also configured as a multifunctional data range, consisting of an 8 bit value ("EPC Value 1") and a 16 bit value ("EPC Value 2").

The contents of this data that are currently supplied can be switched via the Process Data Out using the 2 "EPC-Select" bits.

The four possible ways in which this data is configured are listed in the table below:

#### EPC Values 1

PD Out EPC-Select	PD In Byte 1 EPC Value 1	EPC-Select Ac- knowledge
00	Current inlet pressure (unit 0.1 mbar)	0
01	Condition monitoring	1
10	Leakage rate (unit 1 mbar/s)	1
11	Supply voltage (unit 0.1 V)	1

#### EPC value 2

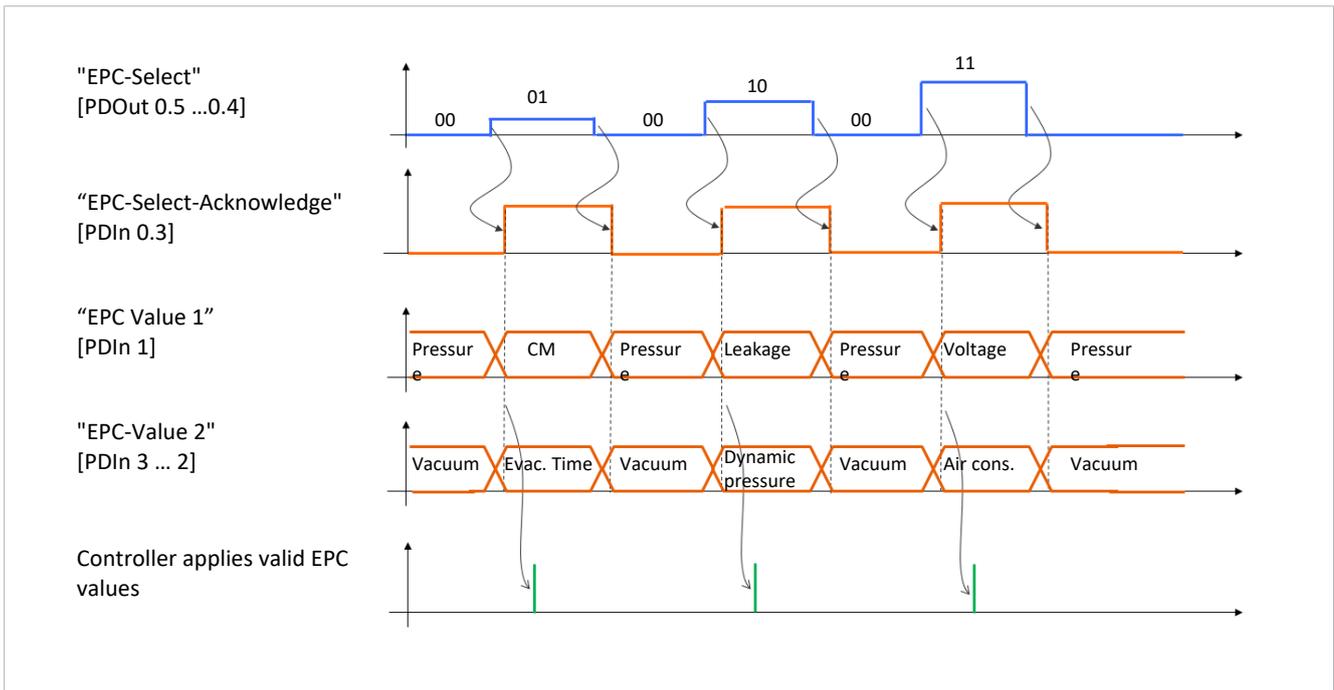
PD Out EPC-Select	PD In Byte 2 EPC Value 2	EPC-Select Ac- knowledge
00	Current vacuum value (unit 1 mbar)	0
01	Evacuation time $t_1$ (unit 1 ms)	1
10	Last measured dynamic pressure (unit 1 mbar)	1
11	Air consumption in the last cycle (unit 0.1 NL)	1

The switch is made depending on the structure of the automation system with some time delay. However, to ensure that the different pairs of values can be read efficiently through a controller program, the bit EPC-Select-Acknowledge is provided in the process input data. The bit always accepts the values shown in the table.

To read out all EPC values, the procedure illustrated in the following diagram is recommended:

1. Start with EPC-Select = 00.
2. Create the selection for the next value pair you require (e.g. EPC-Select = 01)
3. Wait until the EPC-Select-Acknowledge bit changes from 0 to 1.
  - ⇒ The transmitted values correspond to the selection you have created, and can be adopted by the control system.
4. Switch back to EPC-Select = 00.
5. Wait until the EPC-Select-Acknowledge bit from the device is reset to 0.
6. Proceed in the same way for the next value pair (e.g. EPC-Select = 10).

The following diagram illustrates the sequence for the EPC system query.



## 8 Transportation and Storage

### 8.1 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.

## 9 Installation

### 9.1 Installation Instructions



#### ⚠ CAUTION

##### Improper installation or maintenance

Injury to persons 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.

To ensure safe installation, the following instructions must be observed:

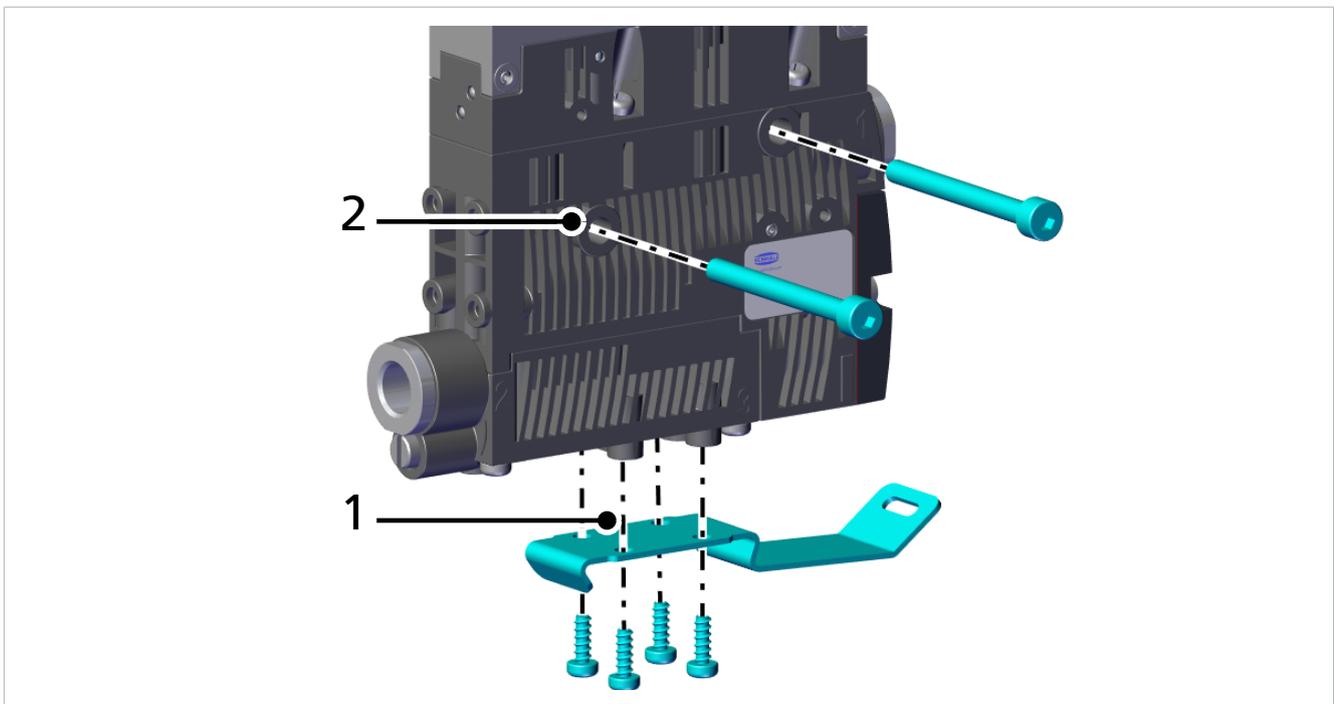
- Use only the connectors, mounting holes and attachment materials that have been provided.
- Mounting and removal must be performed only when the device is unpressurized and disconnected from the mains.
- Pneumatic and electrical line connections must be securely connected and attached to the product.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

### 9.2 Mounting

The ejector can be installed in any position.

There are two 4.4 mm mounting holes for mounting the ejector.

A DIN rail mount for DIN rail TS35 can be used as a mounting option.



1 DIN rail mount for TS35 DIN rail, incl. plastic tapping screws  
Max. tightening torque 0.5 Nm

2 2x M4 fastening screws with washers

When mounting with fastening screws, use M4 washers (2 Nm max. tightening torque).

For the 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 is connected via the compressed air connection. The compressed air supply must be supplied by the higher-level machine.

The vacuum circuit is connected to the vacuum connection.

The installation process is described and explained in detail below.

### 9.3 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 such as suction cups, suction lines and hoses.



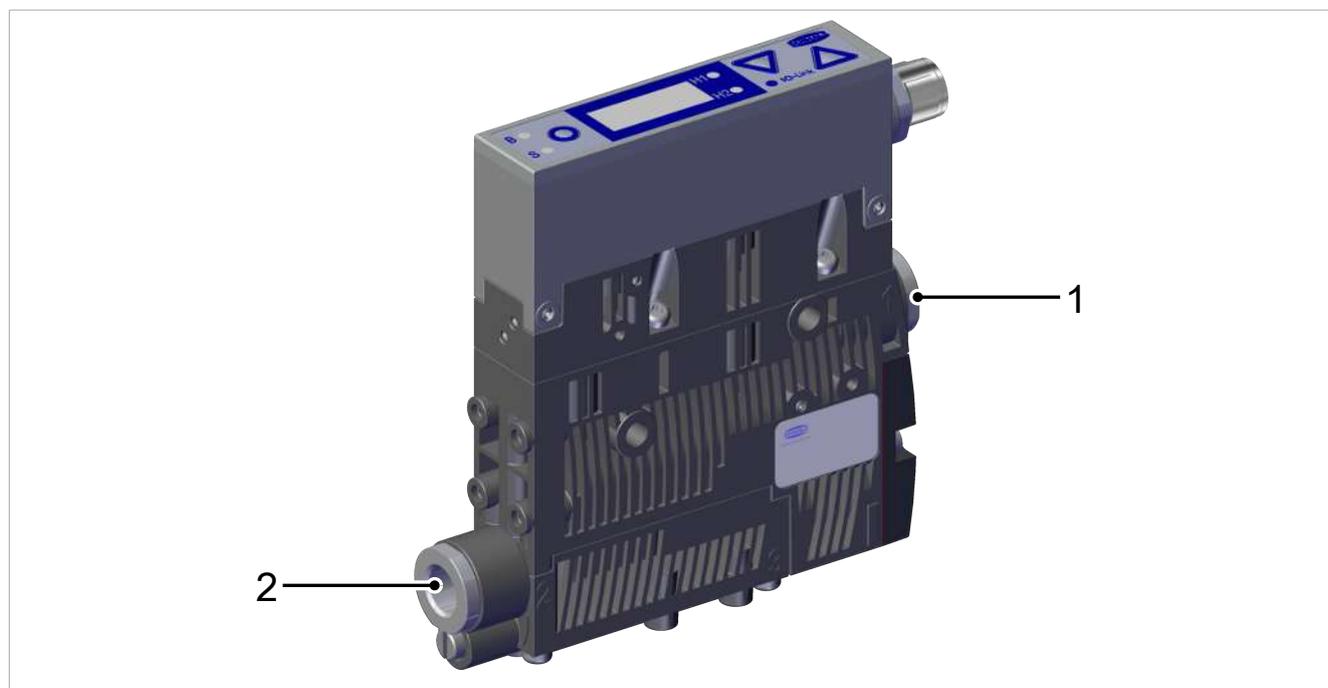
#### ⚠ CAUTION

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

Hearing damage!

- ▶ Correct installation.
- ▶ Wear ear protectors.

#### 9.3.1 Connecting the Compressed Air and Vacuum



1 Compressed air connection

2 Vacuum connection

The compressed air connection G1/8" is marked with the number 1 on the ejector.

- ▶ Connect compressed air hose. The max. tightening torque is 3 Nm.

The 1/8" vacuum connection is marked with the number 2 on the ejector.

- ▶ Connect the vacuum hose. The max. tightening torque is 3 Nm.

### 9.3.2 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 for the product, only use adequately maintained compressed air and take the following requirements into account:

- Use of air or neutral gas in accordance with EN 983, filtered 5 µm, oiled or unoiled.
  - Dirt particles or foreign bodies in the product connections, hoses or pipelines can lead to partial or complete 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 product; otherwise, use the next largest diameter.
    - On the compressed air side, ensure that the internal diameter has the dimensions required for the product to achieve its performance data.
    - On the vacuum side, ensure that the internal diameters have the necessary dimensions for preventing high flow resistance. If the selected internal diameter is too small, the flow restrictor 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 <sup>1)</sup>	
	Pressure side	Vacuum side
07	4	4
10	4	4
15	4	6
2-07	4	4
2-09	4	4
2-14	4	6

<sup>1)</sup> Based on a maximum hose length of 2 m.

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

## 9.4 Electrical connection



### **⚠ WARNING**

#### **Electric shock**

Risk of injury

- ▶ Operate the product using a power supply unit with protected extra-low voltage (PELV).



### **⚠ 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 device with voltage, and contains the two input signals and the output signal. The inputs and outputs are not electrically isolated from one another.

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

Establish the ejector's electrical connection using plug connector 1 as shown in the figure.



1 Electrical connection plug, M12, 5-pin

- ✓ Prepare a connection cable with an M12 5-pin connector (supplied by the customer).
- ▶ Attach the connection cable to the electrical connection (1) on the ejector (max. tightening torque = hand-tight).

### 9.4.1 PIN Assignment of M12, 5-Pin Connection Plug

Plug	PIN	Wire color <sup>1)</sup>	Symbol	Function
	1	Brown	$U_{S/A}$	Supply voltage for sensors/actuators
	2	White	IN1	"Suction" signal input <sup>2</sup>
	3	Blue	$Gnd_{S/A}$	Ground for sensors/actuators
	4	Black	OUT	"Part present" signal output (H2/h2)
	5	Gray	IN2	"Blow off" signal input <sup>3)</sup>

<sup>1)</sup> When using a Schmalz connection cable, part no. 21.04.05.00080  
<sup>2)</sup> NO version: Suction OFF, NC version: Suck ON, IMP version: suction ON only  
<sup>3)</sup> NO/NC version: Blow off ON/OFF, IMP version: Suction OFF and blow off ON/OFF

### PIN Assignment in IO-Link Mode

#### PIN assignment, M12 5-pin connector

M12 plug	PIN	Wire color <sup>1)</sup>	Symbol	Function
	1	Brown	$U_{S/A}$	Supply voltage for sensors/actuators
	2	White	—	—
	3	Blue	$GND_{S/A}$	Ground for sensors/actuators
	4	Black	C/Q	IO-Link Communication
	5	Gray	—	—

<sup>1)</sup> When using Schmalz connection cable part no. 21.04.05.00080

## 9.5 Configuring (IO-Link)

To operate the ejector in IO-Link mode, it is sufficient to connect one IO-Link communication line (C/Q) in addition to the supply voltage. This means that only one line is required for all process and parameter data per ejector.

The ports on an IO-Link master typically have to be switched to IO-Link mode first. This is done using the configuration tool supplied by the manufacturer of the master or controller. The port can be configured generically for IO-Link by entering the correct process data length for the IO-Link device and possibly also storing standard settings for the required manufacturer ID and device ID in the master.

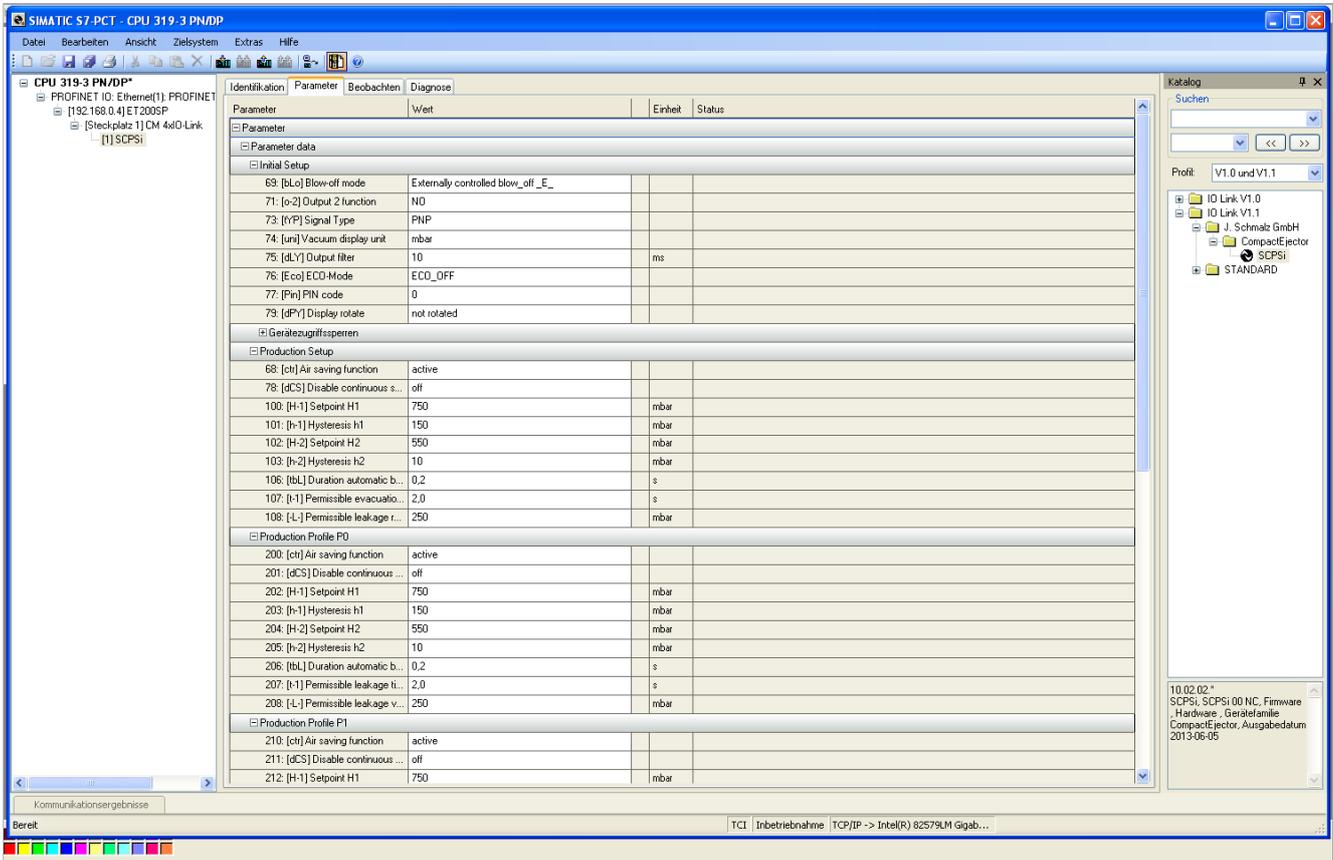
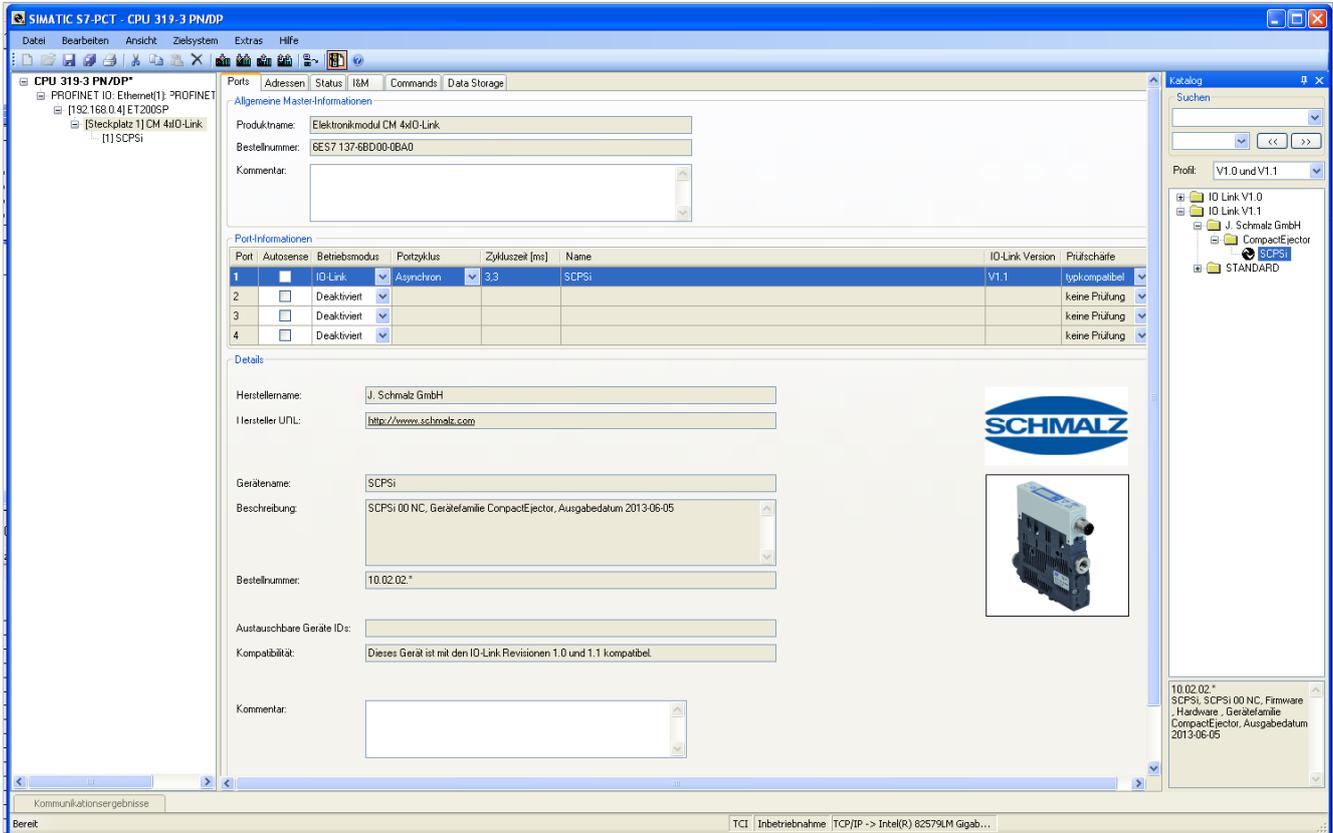
Alternatively, the electronic device description file, or IODD, can be used. To do this, an IO-Link configuration tool from the master manufacturer must be available into which the IODD is imported. This kind of tool displays all process and parameter data for the device in a meaningful format and enables convenient offline parameterization or also observation during operation.

For the devices in the SCPSi series (NO and NC variants), the IODD is available to download in two versions from [www.schmalz.com](http://www.schmalz.com):

- IODD revision 1.1 and above, for use with current IO-Link masters. The full range of functions is available with four bytes of input data and two bytes of output data.
- IODD revision 1.0 and above, for use with older IO-Link masters (legacy mode). The range of functions is slightly restricted, the process data is limited to one byte of input data and one byte of output data.

For the devices in the SCPSi series with **IMP valves**, the IODD is available to download from [www.schmalz.com](http://www.schmalz.com) in the version IODD revision 1.1 and above for use with current IO-Link masters.

For example, when using Siemens components, the IODD for the ejector is displayed as follows in the program S7-PCT:



### 9.5.1 Process Data

Once communication with an IO-Link master has been established, the master begins the automatic cyclic exchange of process data. The master receives new process output data (PDO) from the controller or field bus level and passes this on to the ejector for control. The feedback and measured values from the ejector are collected from the master as process input data (PDI) and forwarded to the system controller. In the two possible IO-Link revisions 1.1 and 1.0, the process data from the ejector is as follows:

#### Process Input Data (PDI)

PDI bytes	Bit	Parameter	IO-Link 1.1	IO-Link 1.0
0	0	Part Present (H2)	X	X
	1	Air saving function (H1)		
	3	CM-Autoset acknowledgment		
	4	EPC-Select acknowledgment		
	5	Device status – green		
	6	Device status – yellow		
	7	Device status – red		
1	7...0	Multifunctional EPC value 1	X	-
2	7...0	Multifunctional EPC value 2.....(high-byte)	X	-
3	7...0	Multifunctional EPC value 2.....(low-byte)	X	-

#### Process Output Data (PDO)

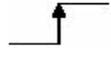
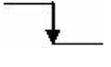
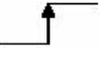
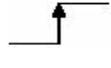
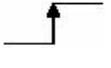
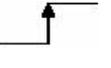
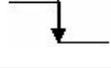
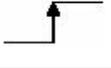
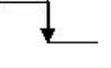
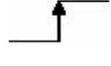
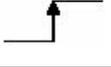
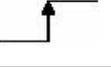
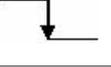
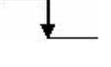
PDI bytes	Bit	Parameter	IO-Link 1.1	IO-Link 1.0
0	0	Vacuum on/off	X	X
	1	Blow off active		
	2	Setup mode		
	3	CM Autoset		
	5...4	EPC-Select: switching the multifunctional EPC values		
	7...6	Switching production setup profiles P0–P3		X
1	7...0	Inlet pressure in 0.1 bar (measured value from external pressure sensor, 0 = function inactive)	X	-

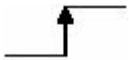
### 9.6 Start of Operations

A typical handling cycle is divided into the following three phases:

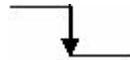
- Phase 1: Suction, switching steps 1 and 2
- Phase 2: Deposit, switching steps 3 and 4
- Phase 3: Idle state, switching steps 5 and 6

To check whether sufficient vacuum has built up, the limit value H2 is monitored by an integrated vacuum sensor during suction and output to the higher-level controller via OUT.

Switching step	NC variant		NO variant		IMP variant				
	Signal	Status	Signal	Status	Signal	Status			
1		IN1	Suction ON		IN1	Suction ON		IN1	Suction ON
2		OUT	Vacuum > H2		OUT	Vacuum > H2		OUT	Vacuum > H2
3		IN1	Suction OFF		IN1	Suction OFF		-	— <sup>1)</sup>
4		IN2	Blow off ON		IN2	Blow off ON		IN2	Blow off ON / suction OFF <sup>1)</sup>
5		IN2	Blow off OFF		IN2	Blow off OFF		IN2	Blow off OFF
6		OUT	Vacuum < (H2-h2)		OUT	Vacuum < (H2-h2)		OUT	Vacuum < (H2-h2)



Signal status changes from inactive to active



Signal status changes from active to inactive

<sup>1)</sup>With the IMP variant, the "suction OFF" state can only be reached by activating "blow off ON".

## 10 Operation

### 10.1 Safety Instructions for Operation



#### **⚠ WARNING**

##### **Change of output signals when product is switched on or plug is connected**

Risk of injury to persons and damage to property due to uncontrolled movements of the higher-level machine/system!

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



#### **⚠ 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.



#### **⚠ CAUTION**

##### **Depending on the purity of the ambient air, the exhaust air can contain particles, which escape from the exhaust air outlet at high speed.**

Eye injuries!

- ▶ Do not look into the exhaust air flow.
- ▶ Wear eye protection.



#### **⚠ CAUTION**

##### **Vacuum close to the eye**

Severe eye injury!

- ▶ Wear eye protection.
- ▶ Do not look into vacuum openings such as suction lines and hoses.



#### **⚠ CAUTION**

##### **When the system is started in automatic operation, components move without advanced warning.**

Risk of injury!

- ▶ Ensure that the danger zone of the machine or system is free of persons during automatic operation.

## 10.2 General Preparations

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 ejector for visible damage and deal with any problems immediately (or notify your 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.

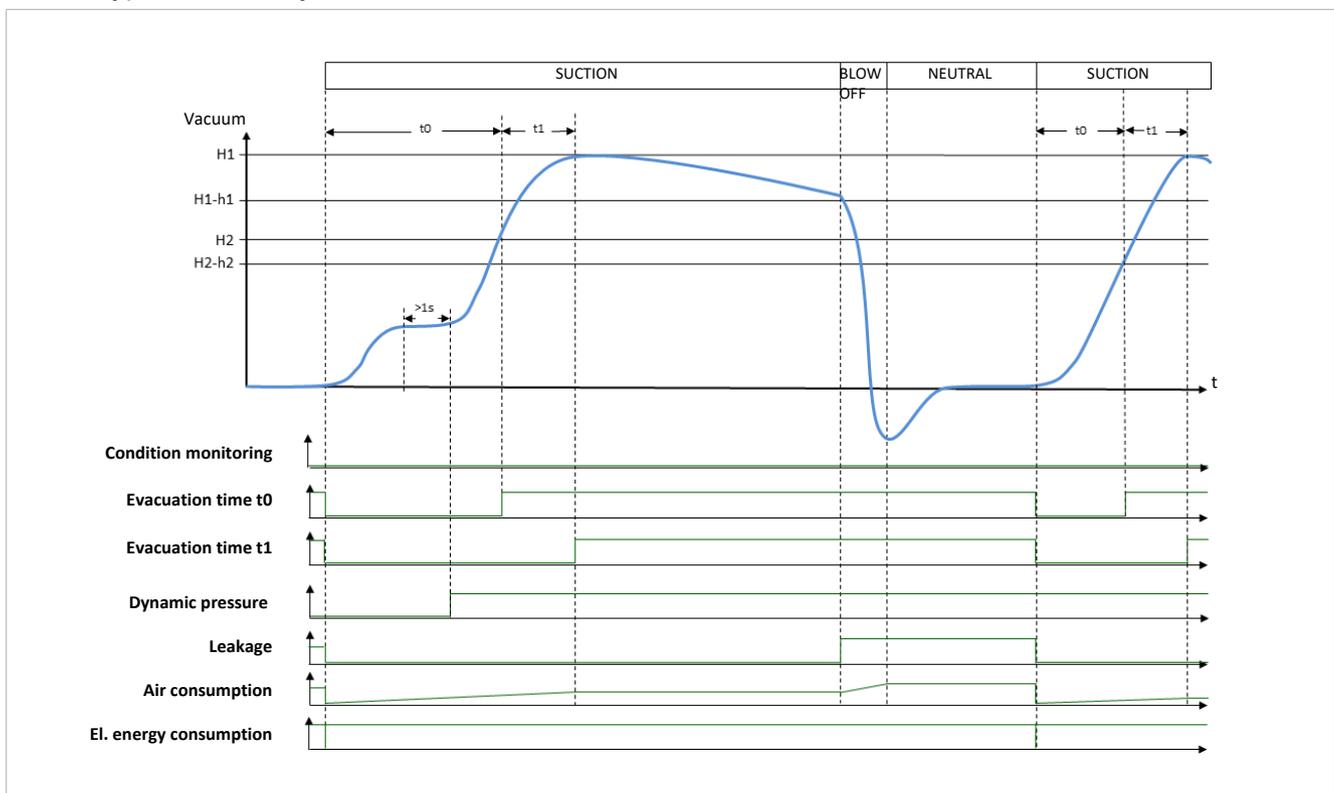
There must be no people in the system danger area while it is in operation.

## 10.3 Typical Suction Cycles

The diagrams below show some typical vacuum processes during a suction cycle. The diagrams also indicate the times at which EPC measured values are updated.

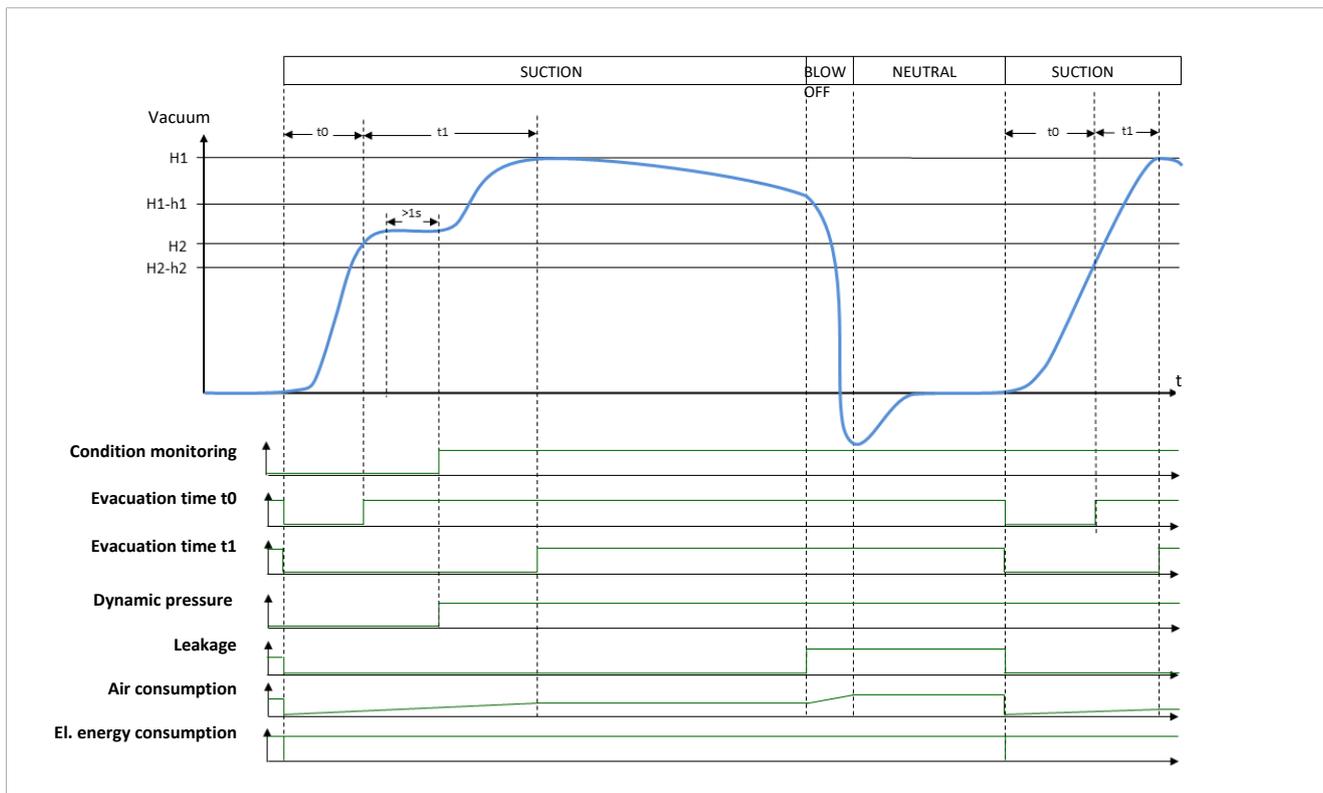
Handling cycle with dynamic pressure measurement and average leakage:

Typical suction cycle



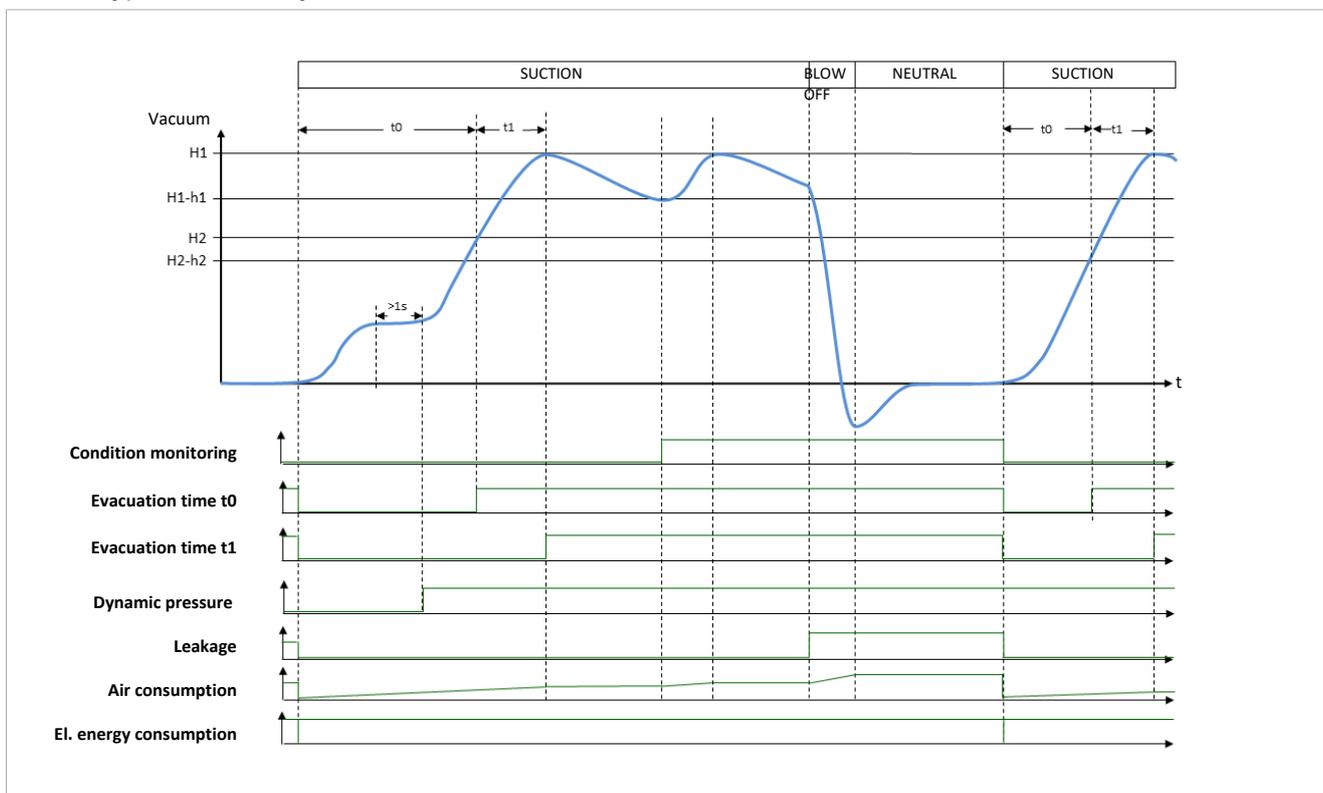
Handling cycle with dynamic pressure measurement and excessive leakage:

Typical suction cycle



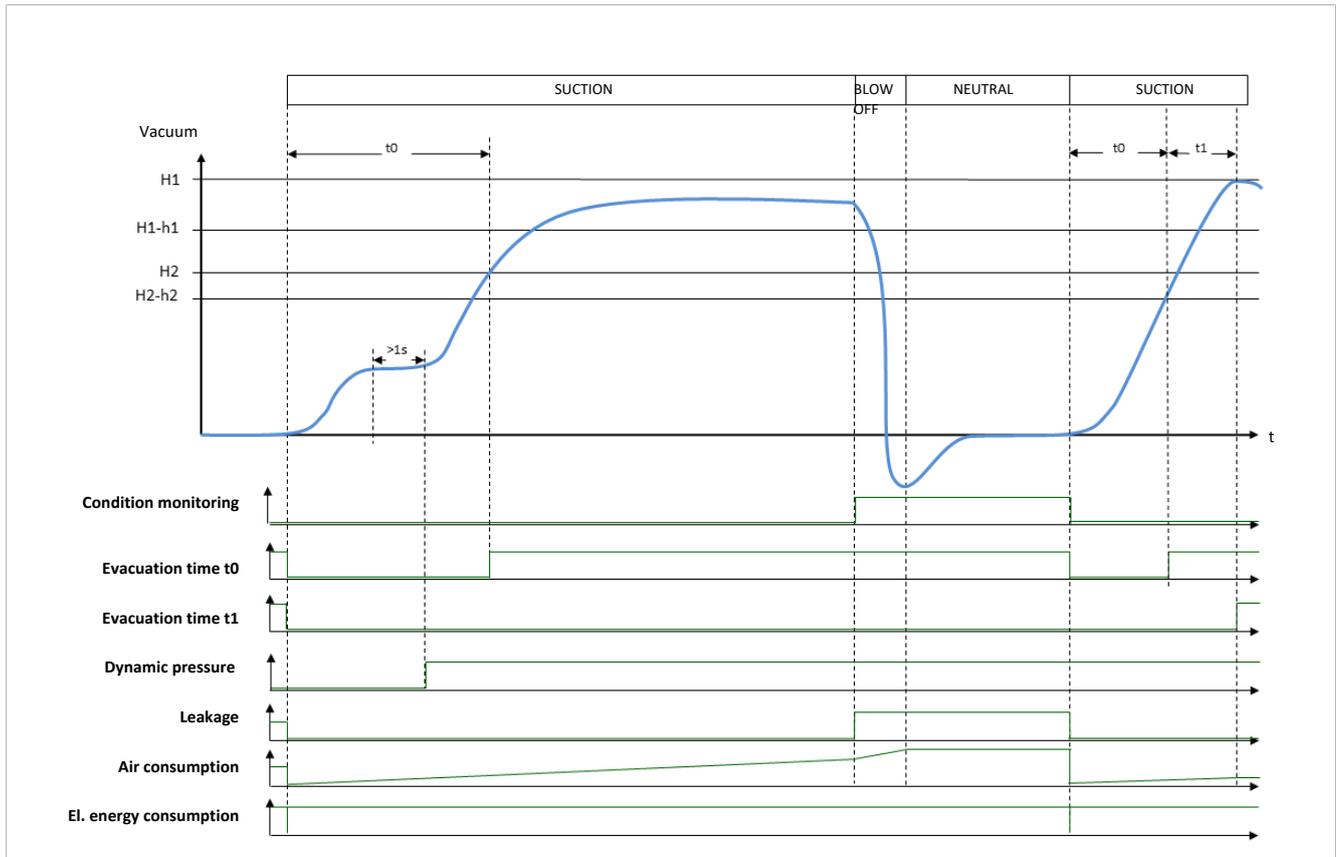
Handling cycle with leakage > L and readjustment:

Typical suction cycle



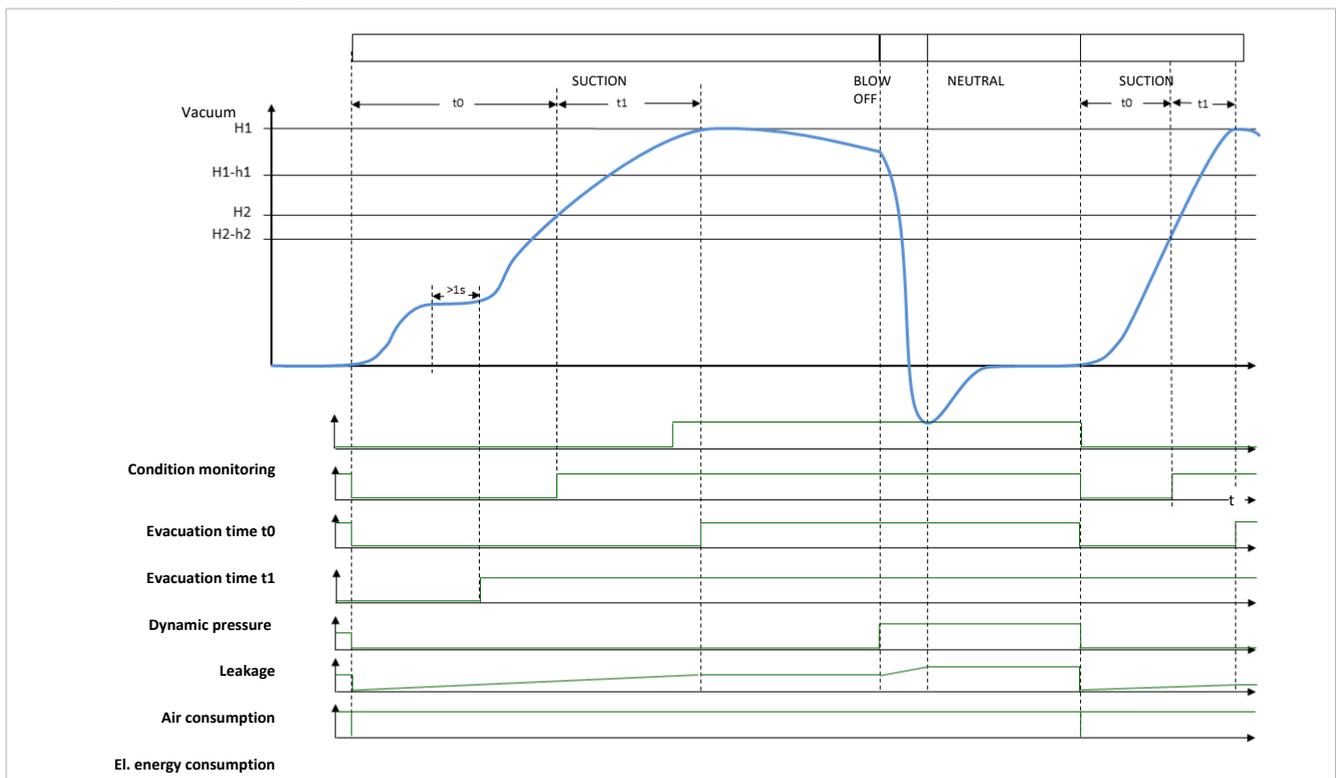
Handling cycle with very high leakage (H1 is not reached):

Typical suction cycle



Handling cycle with excessive evacuation time t1:

Typical suction cycle



## 11 Help with Faults

Fault	Cause	Solution
No IO-Link communication	Incorrect electrical connection	▶ Check electrical connection and pin assignment
	Master not correctly configured	▶ Check the master configuration 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 actuator supply voltage	▶ Check electrical connection and pin assignment
	No compressed air supply	▶ Check the compressed air supply.
	Ejector is faulty.	▶ Check the ejector and contact Schmalz Service if necessary.
Vacuum level is not reached or vacuum is created too slowly	Dirty screen	▶ Clean or replace the screen
	Silencer is dirty	▶ Replace the silencer insert
	Hose or screw unions are leaking	▶ Replace or seal components
	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 too low	<ol style="list-style-type: none"> <li>1. Increase the control range for the air saving function</li> <li>2. Increase operating pressure, observe maximum limits</li> </ol>
	Suction cup too small	▶ Select a larger suction cup

## 12 Warnings and Errors

### 12.1 Error Messages in SIO Operation

When a known error occurs, this is reported in the form of an error number. In SIO mode, error messages are shown on the display. An “E” followed by the error number appears on the display.

The following table shows all the error codes:

Code displayed	Explanation
E01	Electronics error – internal data management, EEPROM
E02	Electronics error – internal communication
E03	Zero-point adjustment of the vacuum sensor outside $\pm 3\%$ FS
E07	Supply voltage is too low
E12	Short circuit on output 2
E17	Supply voltage is too high
FFF	Present vacuum exceeds the measurement range
-FF	Overpressure in vacuum circuit; this normally happens exclusively in Blow off mode.

The error [E01] remains on 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.

### 12.2 System Status Light in IO-Link Mode

The overall status of the ejector system is displayed as a traffic light using 3 bits in process data input byte 0. All warnings and errors are taken into account when defining the status of the traffic lights.

This basic display provides immediate information about the status of the ejector with all its input and output parameters.

System status displayed	Description of the status
Green	System is working perfectly with optimal operating parameters
Yellow	Warning – Condition monitoring warnings in place; ejector system not functioning perfectly Check operating parameters
Red	Error – Error code provided in parameter error; safe operation of the ejector within the operating limits is no longer ensured <ul style="list-style-type: none"> <li>• Cease operation</li> <li>• Check the system</li> </ul>

### 12.3 Warnings and Error Messages in IO-Link Mode

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

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.

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

The table below explains the coding of the condition monitoring warnings:

Bit	Event	Update
0	Valve protection function activated	Cyclic
1	Set limit value $t-1$ for evacuation time exceeded	Cyclic
2	Set leakage limit value -L- exceeded	Cyclic
3	Limit value H1 was not reached	Cyclic
4	Dynamic pressure $> (H2 - h2)$ and $< H1$	As soon as a corresponding dynamic pressure value has been determined
5	Supply voltage $U_s$ outside the operating range	Constant
7	Input pressure outside operating range	Constant

The four bits with the lowest values describe events that can only occur once per suction cycle. They are reset at the start of every suction cycle and remain stable until after suctioning has finished.

Bit number 4, which describes dynamic overpressure, is initially deleted when the device is switched on and is updated when a dynamic pressure value is detected.

Bits 5 and 7 are regularly updated independently of the suction cycle, and reflect the current values for the supply voltage and system pressure.

The values measured by the condition monitoring system, namely the evacuation times  $t_0$  and  $t_1$  and the leakage value  $L$ , are reset at the beginning of the suction process and updated once they have been measured.

## 12.4 Error Messages in IO-Link Mode

When a known error occurs, this is reported in the form of an error number. In SIO mode, error messages are shown on the display. An "E" followed by the error number appears on the display.

The following table shows all the error codes:

Code displayed	Explanation
E01	Electronics error – internal data management, EEPROM
E02	Electronics error – internal communication
E03	Zero-point adjustment of the vacuum sensor outside $\pm 3\%$ FS
E07	Supply voltage is too low
E08	IO-Link communication is interrupted
E17	Supply voltage is too high
E18	Input pressure outside operating range
FFF	Present vacuum exceeds the measurement range
-FF	Overpressure in vacuum circuit; this normally happens exclusively in Blow off mode.

The error [E01] remains on 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.

## 13 Maintenance

### 13.1 Safety Instructions

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**

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

- ▶ Read the Operating instructions carefully and observe the contents.



#### **⚠ 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 the supply voltage before carrying out maintenance work.
- ▶ Secure it so that it cannot be switched back on.
- ▶ The ejector must be operated only with a silencer and press-in screen(s).

### 13.2 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 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.

### 13.3 Replacing the Silencer Insert

Heavy infiltration of dust, oil, and so on, may contaminate the silencer insert and reduce the suction capacity. Cleaning the silencer insert is not recommended due to the capillary effect of the porous material.

### 13.4 Replacing the Press-In Screens

The vacuum and compressed air connections of the ejectors contain press-in screens. Dust, chippings and other solid materials may be deposited in the screens over time.

- ▶ If you notice that the performance of the ejectors has declined, replace the screens.

### 13.5 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 version 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 in the user menu on the device or via NFC are 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 [0x0002] using the command "Force upload of parameter data into the master" (numerical value 0x05) (see Data Dictionary).



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

## 14 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.

## Spare and Wearing Parts

Maintenance work may only be carried out by qualified personnel.

- ▶ **WARNING! Risk of injury due to improper maintenance!** After performing any maintenance or repair work, check that the system is functioning correctly, particularly the safety features.



### NOTE

#### Incorrect maintenance work

Damage to the ejector!

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

The following list contains the most important spare and wearing parts.

Part no.	Designation	Legend
10.02.02.04141	Silencer insert	Wearing part
10.02.02.04404	Screen	Spare part
10.02.02.04152	Insulating plate	Wearing part
10.02.02.04737	Ejector wear part set for 1-stage variant	Wearing part
10.02.02.04738	Ejector wear part set for 2-stage variant	Wearing part

When tightening the fastening screws on the silencer module, observe a maximum tightening torque of 0.5 Nm.



When you replace the silencer insert, we recommend that you also replace the insulating plate.

## 15 Accessories

Part no.	Designation	Note
21.04.05.00080	Connection cable	M12, 5-pin, with open end, 5 m
10.02.02.00158	Connection cable	M12, 5-pin, to M12 5-pin connector, 1 m
10.02.02.03490	Connection distributor	M12, 5-pin, to 2xM12, 4-pin
10.02.02.04149	HUT-SN-KL SCPS	Complete DIN rail mount

## 16 Decommissioning and Disposal

### 16.1 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.

### 16.2 Materials Used

Component	Material
Housing	PA6-GF, PC-ABS
Inner components	Aluminum alloy, anodized aluminum alloy, brass, galvanized steel, stainless-steel, PU, POM
Silencer insert	Porous PE
Screws	Galvanized steel
Seals	Nitrile rubber (NBR)
Lubrication	Silicone-free

## 17 Declarations of Conformity

### 17.1 EC Conformity

#### EU Declaration of Conformity

The manufacturer Schmalz confirms that the product Ejector described in these Operating instructions fulfills the following applicable EU directives:

2014/30/EU	Electromagnetic Compatibility
2011/65/EU	RoHS Directive

The following harmonized standards were applied:

EN ISO 12100	Safety of machinery — General principles for design — Risk assessment and risk reduction
EN 61000-6-2+AC	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-3+A1+AC	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-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.

### 17.2 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 61000-6-2+AC	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-3+A1+AC	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-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.

## 18 Attachment

### See also

📄 Schmalz SCPSi\_V2 Data Dictionary 21.10.01.00065\_03 2024.01.16\_TF.pdf [▶ 75]

### 18.1 Overview of the Display Codes

Code	Parameter	Comment
H-1	Limit value H1	Switch-off value for air-saving function/control
h-1	Hysteresis value h1	Hysteresis of control
H-2	Limit value H2	Switch-on value of the "Part Present" signal output (when the NO output is configured)
h-2	Hysteresis value h2	Hysteresis of "Part Present" check signal output
tBL	Blow off time	Set the blow off time for time-controlled blow off
cAL	Zero-point adjustment	Calibrating the vacuum sensor
cc1	Total counter 1	Counter for suction cycles ("suction" signal input)
cc2	Total counter 2	Counter for valve switching frequency
SoC	Software function	Displays the current software version
Art	Part number	Displays the part number of the ejector
Snr	Serial number	Displays the serial number of the ejector
cEr	Energy-saving function (control)	Setting the control function
onS	Control function on with leakage monitoring	Control with leak monitoring active
dcS	Deactivate auto. control shutoff	Suppresses the automatic valve protection function when set to YES. Cannot be activated when cEr = OFF.
t-1	Evacuation time	Set the maximum permitted evacuation time
-L-	Leakage value	Set the maximum permitted leakage
bLo	Blow off function	Menu for configuring the blow off function
-E-	"External" blow off	Selection of externally controlled blow off
U-t	"Internal" blow off	Select internally controlled blow off (triggered internally, time-adjustable)
E-t	"External time-controlled" blow off	Selection of externally controlled blow off (triggered externally; time-adjustable)
o-2	Signal output	Menu for configuring the signal output
no	Normally open contact	Setting of the signal output as a normally open contact
nc	Normally closed contact	Setting of the signal output as a normally closed contact
tYP	Signal type	Menu for configuration of the signal type (NPN/PNP)
PnP	PNP signal type	All input and output signals switch according to PNP (input / output on = 24 V)
nPn	NPN signal type	All input and output signals switch according to NPN (input / output on = 0V)
un1	Vacuum unit	Setting the vacuum unit
-bA	Vacuum level in mbar	The displayed vacuum level is shown in mbar.
-PA	Vacuum level in kPa	The displayed vacuum level is shown in kPa.

Code	Parameter	Comment
- ih	Vacuum level in inHg	The displayed vacuum is shown in inches of Hg.
dLY	Switch-off delay	Setting the switch-off delay for OUT2 (delay)
dPY	Display rotation	Setting the display position (rotation)
Std	Default display	Display is not rotated
rEd	Rotated display	Display is rotated by 180°
Eco	Eco mode	Setting Eco mode
P in	PIN	Entry of the PIN for unlocking the menu
Loc	Menu locked	Parameter modification locked.
unc	Menu unlocked	The buttons and menus are unlocked.
rES	Reset	All adjustable values are reset to the factory settings.
FFF	Vacuum measurement range	Present vacuum exceeds the measurement range.
-FF	Vacuum circuit over-pressure	Overpressure in vacuum circuit; this normally happens exclusively in Blow off mode.



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IO-Link Implementation		
	IO-Link Version 1.1	IO-Link Version 1.0 (legacy mode)
Vendor ID	234 (0x00EA)	234 (0x00EA)
Device ID	100243 (0x018793)	100242 (0x018792)
Device ID (IMP)	100247 (0x018797)	-
SIO-Mode	Yes	Yes
Baudrate	38.4 kBd (COM2)	38.4 kBd (COM2)
Minimum cycle time	3.5 ms	3.0 ms
Processdata input	4 byte	1 byte
Processdata output	2 byte	1 byte

Process Data						
Process Data In	Name	Bits		Access	Availability	Remark
PD In Byte 0	Signal H2 (part present)	0		ro	IO-Link V1.1, V1.0	Vacuum is over H2 & not yet under H2-h2
	Signal H1 (automatic air saving function)	1		ro	IO-Link V1.1, V1.0	Vacuum is over H1 & not yet under H1-h1
	-	2		ro	-	unused
	CM-Autoset acknowledged	3		ro	IO-Link V1.1, V1.0	Acknowledge that the Autoset function has been completed
	EPC-Select acknowledged	4		ro	IO-Link V1.1 only	Acknowledge that EPC values 1 and 2 have been switched according to EPC-Select: 0 - EPC-Select = 00 1 - otherwise
	Device status - green	5		ro	IO-Link V1.1, V1.0	Device is working optimally
	Device status - yellow	6		ro	IO-Link V1.1, V1.0	Device is working but there are warnings
	Device status - red	7		ro	IO-Link V1.1, V1.0	Device is not working properly, there are errors
PD In Byte 1	EPC value 1	7..0		ro	IO-Link V1.1 only	EPC value 1 (byte) Holds 8bit value as selected by EPC-Select (see PD Out Byte 0)
PD In Byte 2	EPC value 2, high-byte	7..0		ro	IO-Link V1.1 only	EPC value 2 (word) Holds 16bit value as selected by EPC-Select (see PD Out Byte 0)
PD In Byte 3	EPC value 2, low-byte	7..0		ro	IO-Link V1.1 only	EPC value 2 (word) Holds 16bit value as selected by EPC-Select (see PD Out Byte 0)
Process Data Out	Name	Bits		Access	Availability	Remark
PD Out Byte 0	Vacuum	0		wo	IO-Link V1.1, V1.0	Vacuum on/off
	Blow-off	1		wo	IO-Link V1.1, V1.0	Activate Blow-off
	Vacuum with forced control	2		wo	IO-Link V1.1, V1.0	Vacuum on/off with continuous suction disabled (regardless of dCS parameter)
	CM Autoset	3		wo	IO-Link V1.1, V1.0	Perform CM Autoset function and save EPC data in buffer
	EPC-Select	5..4		wo	IO-Link V1.1 only	Select the function of EPC values 1 and 2 in PD In (content is 2 bit binary coded integer) 0: EPC value 1 = Input pressure (0.1 bar) EPC value 2 = System vacuum (1 mbar) 1: EPC value 1 = CM-Warnings (see ISDU 146 for bit definitions) EPC value 2 = Evacuation time t1 (1 msec) 2: EPC value 1 = Leakage of last suction cycle (1 mbar/sec) EPC value 2 = Last measured free-flow vacuum (1 mbar) 3: EPC value 1 = Primary supply voltage (0.1 Volt) EPC value 2 = Air consumption of last suction cycle (0.1 NL)
	Profile-Set	7..6		wo	IO-Link V1.1, V1.0	Select Production Profile (content is 2-bit binary coded integer) 0: Activate Production Setup Profile P0 1: Activate Production Setup Profile P1 2: Activate Production Setup Profile P2 3: Activate Production Setup Profile P3
PD Out Byte 1	Input pressure	7..0		wo	IO-Link V1.1 only	Pressure value from external sensor (unit: 0.1 bar)

ISDU Parameters								
(all ISDUs use subindex 0 only)								
ISDU Index	Display	Parameter	Data width	Value range	Access	Default value	Remark	
dec	hex	Appearance						
<b>Identification</b>								
16	0x0010		Vendor name	15 bytes		ro	J. Schmalz GmbH	Manufacturer designation
17	0x0011		Vendor text	15 bytes		ro	www.schmalz.com	Internet address
18	0x0012		Product name	8 bytes		ro	SCPSi_V2	General product name
20	0x0014		Product text	30 bytes		ro	SCPSi 00 G2 NC M12-5	Order-Code
250	0x00FA	Art	Article number	14 bytes		ro	10.02.02.*	Order-Nr.
251	0x00FB		Article revision	2 bytes		ro	00	Article revision
22	0x0016		Hardware revision	2 bytes		ro	03	Hardware revision
23	0x0017	SoC	Firmware revision	4 bytes		ro	2.01	Firmware revision
21	0x0015	Snr	Serial number	9 bytes		ro	000000001	Serial number
24	0x0018		Application specific tag	0...32 bytes		rw	***	User string to store location or tooling information
<b>Parameter</b>								
<b>Access Locks</b>								
12	0x000C		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	Pin	PIN code	2 bytes	0 - 999	rw	0	0 = menu editing unlocked >0 = menu editing locked with pin-code



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Initial Setup								
69	0x0045	bLo	Blow-off mode	1 byte	0 - 2	rw	0	0 = Externally controlled blow-off (-E) 1 = Internally controlled blow-off – time-dependent (I-I) 2 = Externally controlled blow-off – time-dependent (E-I)
71	0x0047	o-2	OUT2 function	1 byte	0 - 1	rw	0	0 = NO 1 = NC
73	0x0049	tyP	Signal type	1 byte	0 - 1	rw	0	0 = PNP 1 = NPN
75	0x004B	dLY	Output filter	1 byte	0 - 3	rw	1	0 = Off 1 = 10ms 2 = 50ms 3 =200ms
74	0x004A	uni	Vacuum display unit	1 byte	0 - 2	rw	0	0 = mbar 1 = kPa 2 = inHg
79	0x004F	dpy	Display rotation	1 byte	0 - 1	rw	0	0 = standard 1 = rotated
76	0x004C	Eco	Eco-Mode	1 byte	0 - 1	rw	0	0 = off 1 = on
Production Setup - Profile P0								
68	0x0044	ctr	Air saving function	1 byte	0 - 2	rw	1	0 = not active (off) 1 = active (on) 2 = active with supervision (onS)
78	0x004E	dCS	Disable continuous suction	1 byte	0 - 1	rw	0	0 = off 1 = on
100	0x0064	H-1	Setpoint H1	2 bytes	998 >= H1 >= (H2+h1)	rw	750	Unit: 1 mbar
101	0x0065	h-1	Hysteresis h1	2 bytes	(H1-H2) >= h1 >= 10	rw	150	Unit: 1 mbar
102	0x0066	H-2	Setpoint H2	2 bytes	(H1-h1) >= H2 >= (h2+2)	rw	550	Unit: 1 mbar
103	0x0067	h-2	Hysteresis h2	2 bytes	(H1-H2) >= h1 >= 10	rw	10	Unit: 1 mbar
106	0x006A	tBL	Duration automatic blow	2 bytes	10-9999	rw	200	Unit: 1 ms
107	0x006B	t-1	Permissible evacuation time	2 bytes	0, 10 - 9999	rw	2000	Unit: 1 ms
108	0x006C	-L-	Permissible leakage rate	2 bytes	1 - 999	rw	250	Unit: 1 mbar/sec
Production Setup - Profile P1								
180	0x00B4		Air saving function	1 byte	0 - 2	rw	1	Profile P-1 (selected by PD Out 0 - Profile-Set = 1)
181	0x00B5		Disable continuous suction	1 byte	0 - 1	rw	0	
182	0x00B6		Setpoint H1	2 bytes	998 >= H1 >= (H2+h1)	rw	750	
183	0x00B7		Hysteresis h1	2 bytes	(H1-H2) >= h1 >= 10	rw	150	
184	0x00B8		Setpoint H2	2 bytes	(H1-h1) >= H2 >= (h2+2)	rw	550	
185	0x00B9		Hysteresis h2	2 bytes	(H1-H2) >= h1 >= 10	rw	10	
186	0x00BA		Duration automatic blow	2 bytes	10-9999	rw	200	
187	0x00BB		Permissible evacuation time	2 bytes	0, 10 - 9999	rw	2000	
188	0x00BC		Permissible leakage rate	2 bytes	1 - 999	rw	250	
Production Setup - Profile P2								
200	0x00C8		Air saving function	1 byte	0 - 2	rw	1	Profile P-2 (selected by PD Out 0 - Profile-Set = 2)
201	0x00C9		Disable continuous suction	1 byte	0 - 1	rw	0	
202	0x00CA		Setpoint H1	2 bytes	998 >= H1 >= (H2+h1)	rw	750	
203	0x00CB		Hysteresis h1	2 bytes	(H1-H2) >= h1 >= 10	rw	150	
204	0x00CC		Setpoint H2	2 bytes	(H1-h1) >= H2 >= (h2+2)	rw	550	
205	0x00CD		Hysteresis h2	2 bytes	(H1-H2) >= h1 >= 10	rw	10	
206	0x00CE		Duration automatic blow	2 bytes	10-9999	rw	200	
207	0x00CF		Permissible evacuation time	2 bytes	0, 10 - 9999	rw	2000	
208	0x00D0		Permissible leakage rate	2 bytes	1 - 999	rw	250	
Production Setup - Profile P3								
220	0x00DC		Air saving function	1 byte	0 - 2	rw	1	Profile P-3 (selected by PD Out 0 - Profile-Set = 3)
221	0x00DD		Disable continuous suction	1 byte	0 - 1	rw	0	
222	0x00DE		Setpoint H1	2 bytes	998 >= H1 >= (H2+h1)	rw	750	
223	0x00DF		Hysteresis h1	2 bytes	(H1-H2) >= h1 >= 10	rw	150	
224	0x00E0		Setpoint H2	2 bytes	(H1-h1) >= H2 >= (h2+2)	rw	550	
225	0x00E1		Hysteresis h2	2 bytes	(H1-H2) >= h2 >= 10	rw	10	
226	0x00E2		Duration automatic blow	2 bytes	10-9999	rw	200	
227	0x00E3		Permissible evacuation time	2 bytes	0, 10 - 9999	rw	2000	
228	0x00E4		Permissible leakage rate	2 bytes	1 - 999	rw	250	
Commands								
2	0x0002		System command	1 byte		wo		0x05 (dec 5): Force upload of parameter data into the master 0x81 (dec 129): Reset application 0x82 (dec 130): Restore to factory defaults 0x83 (dec 131): Back-To-Box 0xA4 (dec 164): Clear diagnostic buffer 0xA5 (dec 165): Calibrate vacuum sensor
120	0x0078	CAL	Calibrate vacuum sensor	1 byte	1	wo		1 = Calibrate vacuum sensor (can also be executed by switching PD Out 0 Bits 2 and 3 simultaneously from 0 to 1)
123	0x007B	rES	Restore to factory defaults	1 byte	1	wo		1 = Restore to factory defaults
Observation								
40	0x0028		Process Data In Copy	1 byte (V1.0) 4 bytes (V1.1)		ro		Copy of currently active process data input
41	0x0029		Process Data Out Copy	1 byte (V1.0) 2 bytes (V1.1)		ro		Copy of currently active process data output
64	0x0040		System vacuum	2 bytes		ro		Current vacuum level (unit: 1 mbar)
66	0x0042		Supply voltage	2 bytes		ro		Supply voltage as measured by the device (unit: 0.1 Volt)
65	0x0041		Input pressure	2 bytes	0 - 255	ro		Pressure value from external pressure sensor (unit: 0.1 bar)

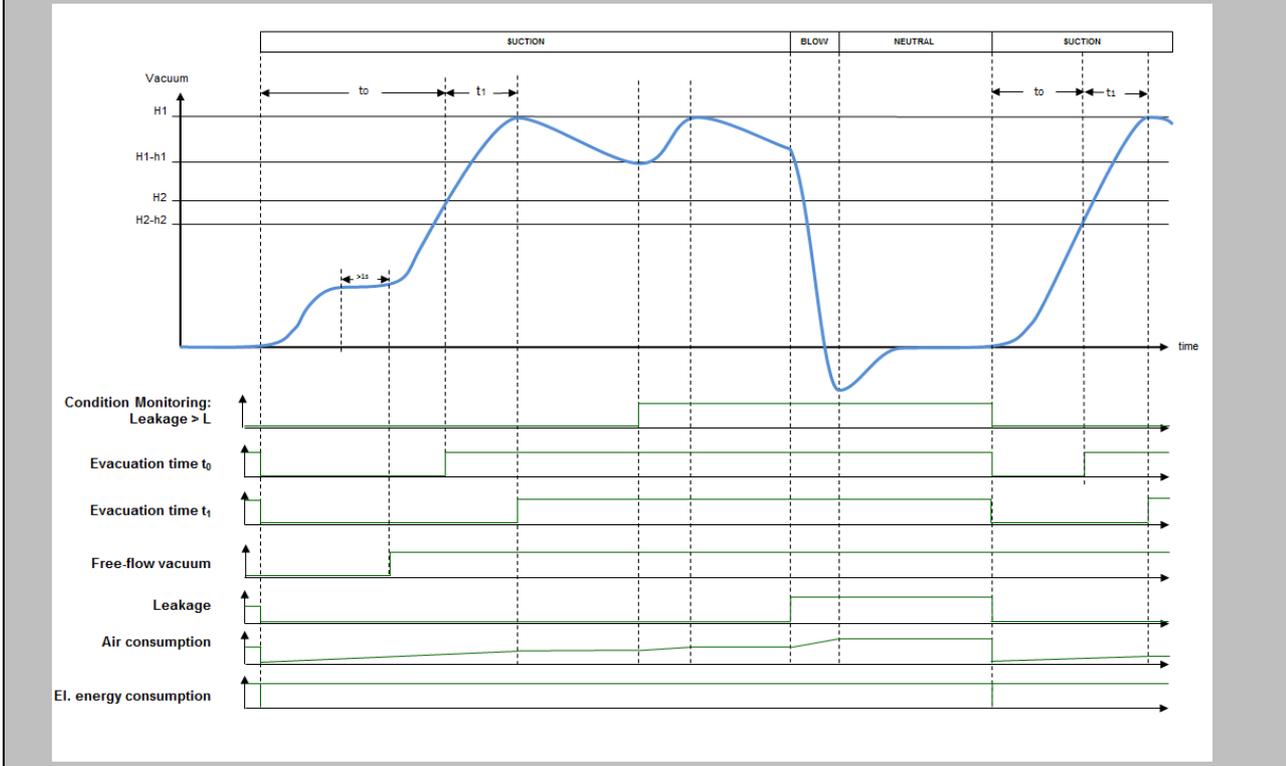


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☒ Diagnosis							
☒ Error							
130	0x0082	Exx	Active error code	1 byte		ro	1-99 = Error code displayed by the device
☒ Counter							
140	0x008C	cc1	Vacuum-on counter	4 bytes		ro	Total number of suction cycles
141	0x008D	cc2	Valve operating counter	4 bytes		ro	Total number of times the suction valve has been switched on
☒ Condition Monitoring [CM]							
146.0	0x0092		Condition monitoring	1 Bit		ro	1 = Valve protection active
146.1	0x0092		Condition monitoring	1 Bit		ro	1 = Evacuation time t1 above limit [t-1]
146.2	0x0092		Condition monitoring	1 Bit		ro	1 = Leakage rate above limit [-L-]
146.3	0x0092		Condition monitoring	1 Bit		ro	1 = H1 not reached in suction cycle
146.4	0x0092		Condition monitoring	1 Bit		ro	1 = Free-flow vacuum > (H2-h2) but < H1
146.5	0x0092		Condition monitoring	1 Bit		ro	1 = Primary voltage US outside of optimal range
146.6	0x0092		Condition monitoring	1 Bit		ro	unused
146.7	0x0092		Condition monitoring	1 Bit		ro	1 = Input pressure outside of operating range
147	0x0093		Leakage area	1 byte		ro	0 = no actual value 1 = Leakage of last suction cycle is >200mbar/s 2 = Leakage of last suction cycle is between 133 ... 200mbar/s 4 = Leakage of last suction cycle is between 67 ... 133mbar/s 8 = Leakage of last suction cycle is <67mbar/s
148	0x0094		Evacuation time t <sub>0</sub>	2 bytes		ro	Time from start of suction to H2 (unit: 1 ms)
149	0x0095		Evacuation time t <sub>1</sub>	2 bytes		ro	Time from H2 to H1 (unit: 1 ms)
☒ Energy Monitoring [EM]							
155	0x009B		Air consumption per cycle in percent	1 byte		ro	Air consumption of last suction cycle (unit: 1 %)
156	0x009C		Air consumption per cycle	2 bytes		ro	Air consumption of last suction cycle (unit: 0.1 NI)
157	0x009D		Energy consumption per cycle	2 bytes		ro	Energy consumption of last suction cycle (unit: 1 Ws)
☒ Predictive Maintenance [PM]							
160	0x00A0		Leakage rate	2 bytes		ro	Leakage of last suction cycle (unit: 1 mbar/sec)
161	0x00A1		Free-flow vacuum	2 bytes		ro	Last measured free-flow vacuum (unit: 1 mbar)
162	0x00A2		Quality	1 byte		ro	Quality of last suction cycle (unit: 1 %)
163	0x00A3		Performance	1 byte		ro	Last measured performance level (unit: 1 %)
☒ Diagnostic Buffer							
131	0x0083		Diagnostic buffer (all entries)	228 bytes		ro	Newest 38 entries in the diagnostic buffer (encoding see table below)
132	0x0084		Diagnostic buffer (newest)	6 bytes		ro	Newest entry in the diagnostic buffer (encoding see table below)
☒ EPC Data Buffer							
133	0x0085		EPC data buffer (all entries)	100 bytes		ro	Newest 10 entries in the EPC data buffer (encoding see table below)
134	0x0086		EPC data buffer (newest)	10 bytes		ro	Newest entry in the EPC data buffer (saved at last autoset) (encoding see table below)

Availability of EPC data during suction cycle





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**Diagnostic Buffer - Details**

**Data Format of Single Entry (ISDU 132)**

Bytes 0...1	Bytes 2...5	Remark
Diagnostic-Type (MSB first)	Counter cc1 (MSB first)	Counter value cc1 of when the entry was recorded

**Data Format of Diagnostic Buffer (ISDU 131)**

Bytes 0...5	Bytes 6...11	Bytes 12...17	...	Bytes 223...228	Remark
Entry 1 (newest)	Entry 2	Entry 3	...	Entry 38 (oldest)	Buffer of 38 entries (newest to oldest) with encoding as in ISDU 131

**Encoding of Diagnostic-Type**

Diagnostic-Type	Description	Remark
<b>☰ Notifications</b>		
0x1401	Notification: Device powered on	
0x1402	Notification: Diagnostic buffer cleared	
0x1403	Notification: Parameters restored to factory defaults	
0x1404	Notification: Vacuum sensor calibrated successfully	
0x1405	Notification: Manual mode entered	
0x0405	Notification: Manual mode exited	
0x14AA	Notification: Corrupted entry	Single entry was written incorrectly - do not evaluate
<b>☰ Errors</b>		
0x1201	Error E01: Internal Error	Remains until next power-on
0x1202	Error E02: Internal Error	Remains until next power-on
0x1203	Error E03: Vacuum sensor calibration failed	
0x1207	Error E07 appeared: Primary voltage US too low	
0x0207	Error E07 disappeared: Primary voltage US too low	
0x1208	Error E08 appeared: IO-Link communication interrupted	
0x0208	Error E08 disappeared: IO-Link communication interrupted	
0x120C	Error E12 appeared: Short-circuit at OUT2	
0x020C	Error E12 disappeared: Short-circuit at OUT2	
0x1211	Error E17 appeared: Primary voltage US too high	
0x0211	Error E17 disappeared: Primary voltage US too high	
0x1212	Error E18 appeared: Input pressure outside operating range	
0x0212	Error E18 disappeared: Input pressure outside operating range	
<b>☰ Condition Monitoring Warnings</b>		
0x1101	CM-Warning: Valve protection activated	Remains until next suction cycle
0x1102	CM-Warning: Evacuation time t1 above limit [t-1]	Remains until next suction cycle
0x1104	CM-Warning: Leakage rate above limit [-L-]	Remains until next suction cycle
0x1108	CM-Warning: H1 not reached in suction cycle	Remains until next suction cycle
0x1110	CM-Warning appeared: Free-flow vacuum > (H2-h2) but < H1	
0x0110	CM-Warning disappeared: Free-flow vacuum > (H2-h2) but < H1	
0x1120	CM-Warning appeared: Primary voltage US outside of optimal range	
0x0120	CM-Warning disappeared: Primary voltage US outside of optimal range	
0x1180	CM-Warning appeared: Input pressure outside of operating range	
0x0180	CM-Warning disappeared: Input pressure outside of operating range	

**EPC Data Buffer - Details**

**Data Format of Single Entry (ISDU 134)**

Bytes 0...1	Bytes 2...3	Bytes 4...5	Bytes 6...9	Remark
Evacuation time t1 (MSB first)	Leakage rate (MSB first)	Free-flow vacuum (MSB first)	Counter cc1 (MSB first)	Counter value cc1 of when the data was recorded

**Data Format of EPC Data Buffer (ISDU 133)**

Bytes 0...9	Bytes 10...19	Bytes 20...29	...	Bytes 90...99	Remark
Entry 1 (newest)	Entry 2	Entry 3	...	Entry 10 (oldest)	Buffer of 10 entries (newest to oldest) with encoding as in ISDU 133

**Implemented IO-Link Events**

Event code	Event name	Event type	Remark
0x1000	General malfunction	Error	Internal error e.g. E01 / E02
0x5100	General power supply fault	Error	Primary supply voltage US too low
0x5110	Primary supply voltage over-run	Warning	Primary supply voltage US too high
0x8C01	Simulation active	Warning	Manual mode active
0x1800	Vacuum calibration OK	Notification	
0x1801	Vacuum calibration failed	Notification	
0x1802	System pressure fault	Warning	System pressure outside of operating range



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