Operating instructions

Compact Terminal SCTSi (PROFINET, EtherNet/IP, EtherCAT)

WWW.SCHMALZ.COM

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Translation of the original operating instructions

Note

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

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1 Important Information

1.1 Note on Using this Document

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

These Operating instructions contain important notes and information about the different operating phases of the product:

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

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

The displayed figures are only examples. Depending on the particular design, they can differ from the product.

1.2 The technical documentation is part of the product

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

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

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

If you still have questions after reading the technical documentation, contact Schmalz Service at:

www.schmalz.com/services

1.3 Type Plate

The type plates (1) and (2) are permanently attached to the Terminal and must always be clearly legible.

The type plate (1) contains the following data:

- Name
- Part number
- QR code
- Product key
- MAC address

Please specify all the information above when ordering replacement parts, making warranty claims or for any other inquiries.

The type plate (2) contains the following data:

- Manufacturer's address
- CE label
- ETL mark with control number [1)]
- Applied UL and CSA standards
- Voltage range
- Permitted pressure range
- Manufacturing date
- Serial number

[1)] Not for the version with an IO-Link master module

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.

1.5 Trademark

EtherCAT® is a registered trademark and patented technology licensed by Beckhoff Automation GmbH, Germany.

PROFINET® is a registered trademark of PROFIBUS and PROFINET International (PI).

EtherNet/IP is a brand owned by ODVA, Inc.

IO-Link is the standard IEC 61131-9:2013 and provides the specifications for digital single-drop communication interface technology for SDCI small sensors and actuators (commonly known as IO-Link).

2 Fundamental Safety Instructions

2.1 Intended Use

The Compact terminal SCTSi is designed to generate a vacuum for gripping and transporting objects when used in conjunction with suction cups.

Neutral gases are approved as evacuation media. Neutral gases include air, nitrogen and inert gases (e.g. argon, xenon and neon). For further information, see (> See ch. Technical Data).

Two different additional modules can also be connected:

- The corresponding IO-Link class B and class A devices can be connected and controlled via the IO-Link class B master.
- Digital input signals are recorded via digital input modules (DI module).

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

The product is intended for industrial and commercial applications.

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

Any other use is considered improper by the manufacturer and is deemed as contrary to the designated use.

2.2 Non-Intended Use

Schmalz accepts no liability for damages caused by non-intended usage of the Terminal.

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

- Use in potentially explosive atmospheres
- Use in medical applications
- Lifting people or animals
- Evacuation of objects that are in danger of imploding

2.3 Personnel Qualifications

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

1. Task only qualified personnel to perform the tasks described in these Operating instructions.
2. The product must be operated only by persons who have undergone appropriate training.

These Operating instructions are intended for fitters who are trained in handling the product and who can operate and install it.

2.4 Warnings in This Document

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

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

2.5 Residual Risks

The system integrator must carry out a risk assessment of the entire system for all operating modes and define the danger zone precisely. In doing so, country-specific provisions and regulations must be observed.

⚠ 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.

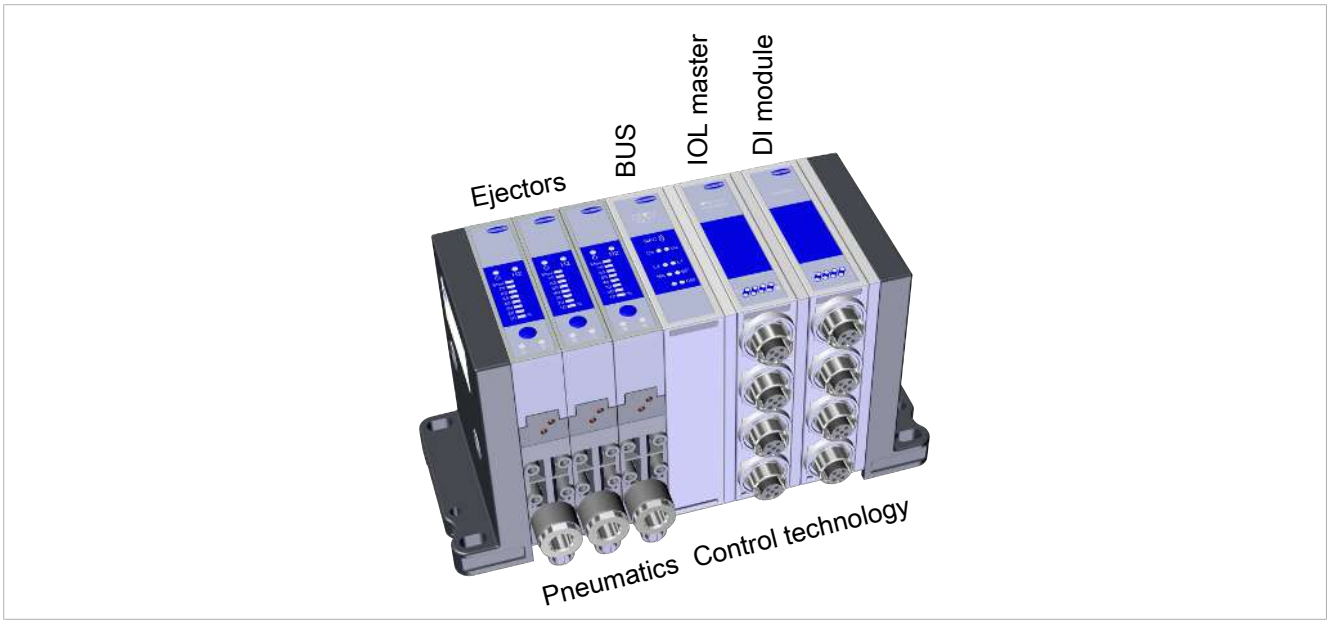
2.6 Modifications to the Product

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 Compact Terminal Description



The Schmalz Compact terminal SCTSi, SCTSi for short, is a compact unit consisting of individual discs that links several vacuum generators, ejectors, IO-Link class B masters and digital input modules (DI modules).

Thanks to its modular design, up to 16 individual ejectors can be controlled and configured independently. It can be used to handle different parts simultaneously and independently using just one vacuum system.

Up to 8 corresponding IO-Link class B or class A devices can be connected via the IO-Link masters (2 maximum).

Digital input signals (up to 48) from peripheral devices are recorded via the DI modules (maximum 6).

The Compact terminal SCTSi has an industrial Ethernet interface. The compressed air supply can be connected centrally for all ejectors. As an alternative, it can also be connected separately for each ejector. Each ejector has an autonomous energy and process control for monitoring the vacuum circuit.

All settings, parameters and measurement and analysis data are made available centrally via the interface. Additionally, much of the information and status reports for the Compact terminal SCTSi can be accessed using wireless communication with NFC (Near Field Communication).

3.1.1 Variants and Product Keys

The item designation of the Compact terminal SCTSi is composed of a product key that indicates the number of ejectors installed and their exact properties. Additional modules such as the IO-Link master and DI module can also be provided.

Compact Terminal Designation

The breakdown of the item designation (SCTSi-ECT-E16-ABC00234C) is as follows:

Property	Variants	Examples
Type	SCTSi (compact terminal)	—
Bus module	**EIP** = EtherNetIP **ECT** = EtherCat **PNT** = ProfiNet	—
Number of ejectors	**EX** = X ejectors	**E16** = 16 ejectors
Individual configuration code	Unique 9-digit code	SCTSi-EIP-E16-**ABC00235M**

Important notes:

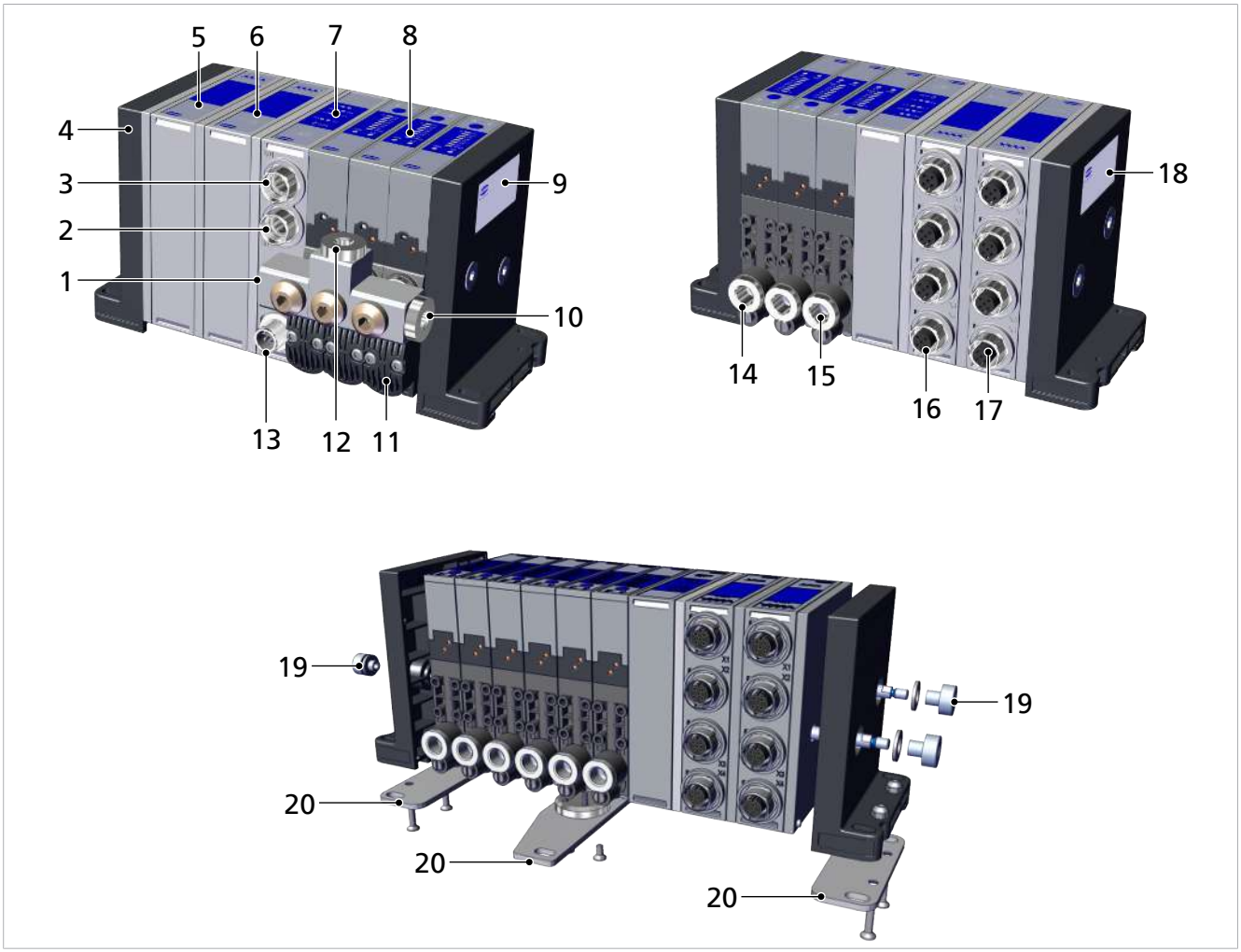
- A terminal always consists of a bus module and individual discs (ejectors).
- A maximum of four individual ejector discs can be used.
- Identical individual discs must be installed grouped together as blocks.
- The ejectors differ with regard to nozzle size, vacuum connection and the NO, NC or IMP variant.

Ejector Designation

The breakdown of the item designation (e.g. SCPSt 10 G02 NC C7D) is as follows:

Property	Variants
Type	SCPSt
Nozzle size	0.7, 1.0, 2-07, etc.
Additional functions	**M**; Power blow off **EA**; Exhaust duct **LS**; High suction flow rate / Low max. vacuum value **M-EA**; Power blow off and exhaust duct
Fluid connectors	Coding of the fluid connectors
Suction valve control	**NO** (normally open), sucks when no voltage is applied **NC** (normally closed), does not suck when no voltage is applied **IMP** (pulse variant)
Individual configuration code (parameter 254 / 0x00FE)	3-digit code "**AAA**" It clearly describes an ejector disc.

3.1.2 Components of the Compact Terminal SCTSi



1	Pressure distributor with 1/4"-thread compressed air connection	2	Electrical connection socket M12-D for Ethernet (port X02)
3	Electrical connection socket M12-D for Ethernet (port X01)	4	End plate with mounting possibility for M5 screws
5	Digital input module (max. 6)	6	IO-Link master module (max. 2)
7	Bus module with display	8	Ejector SCPSt with display/operator handle (1 to 16)
9	Type plate 1	10	Pressure distributor with additional 1/4"-thread compressed air connection
11	Silencer cover and exhaust outlet Version with exhaust duct is not shown	12	Pressure distributor with additional 1/4"-thread compressed air connection
13	Electrical connection plug M12-L for voltage supply (port X03)	14	Blow off valve screw
15	Vacuum connection	16	Electrical connection socket M12-A, 4x/module
17	Electrical connection socket M12-A, 4x/module	18	Type plate 2
19	Connectors	20	Stabilization components, for 6 ejectors or more

3.2 Bus Module Description

3.2.1 Description

The bus module ensures communication with the controller.

3.2.2 Bus Module Displays

Bus module section	Symbol	Meaning	Description
	**NFC**	Position of the NFC antenna	Optimum position for connection to an NFC transponder

Bus module PROFINET	LED	Meaning	State	Description
	**U_S**	Sensor voltage	Off	No sensor voltage
			Green	Sensor voltage OK
			Flashing green	Sensor voltage not OK
	U_A	Actuator voltage	Off	No actuator voltage
			Green	Actuator voltage OK
			Flashing green	Actuator voltage not OK
	L1 and **L2**	Link Port X01 and Port X02	Off	No PROFINET connection
			Green	PROFINET connection established
			Flashing green	PROFINET connection with data transfer
	NS	Network status	Off	No connection to PROFINET IO controller
			Green	Online (RUN)
			Green, 1 flash	Online (STOP) I/O controller stopped or faulty I/O data
			Red	Severe internal error
			Red, 1 flash	Station name error
			Red, 2 flashes	IP address error
			Red, 3 flashes	Configuration error
	SF	System error	Off	No error in system design
			Red	Error in system design
	CM	Condition monitoring	Off	No CM information available
			Yellow	CM information available

Bus module EtherNet/IP	LED	Meaning	State	Description
	**U_S**	Sensor voltage	Off	No sensor voltage
			Green	Sensor voltage OK
			Flashing green	Sensor voltage not OK
	U_A	Actuator voltage	Off	No actuator voltage
			Green	Actuator voltage OK
			Flashing green	Actuator voltage not OK
	L1 and **L2**	Link Port X01 and Port X02	Off	No EtherNet/IP connection
			Green	EtherNet/IP connection established
			Flashing green	EtherNet/IP connection with data transfer
	NS	Network status	Off	No voltage or no IP address
			Green	Online, one or more connections established (CIP class 1 or 3)
			Flashing green	Online, no connections established
			Red	Duplicate IP address, severe error
			Flashing red	One or more connections interrupted due to timeout (CIP class 1 or 3)
	SF	System error	Off	No error in system design
			Red	Error in system design
	MS	Network status	Off	No voltage
			Green	Connected to a scanner in run state
			Flashing green	Not configured or scanner in idle state
			Red	Major error (e.g. EXCEPTION state)
			Flashing red	Parameter deviation
	CM	Condition monitoring	Off	No CM information available
			Yellow	CM information available

Bus module EtherCAT	LED	Meaning	State	Description
	U_S	Sensor voltage	Off	No sensor voltage
			Green	Sensor voltage OK
			Flashing green	Sensor voltage not OK
	U_A	Actuator voltage	Off	No actuator voltage
			Green	Actuator voltage OK
			Flashing green	Actuator voltage not OK
	L1 and **L2**	Link Port X01 and Port X02	Off	No EtherCAT connection
			Green	EtherCAT connection established
			Flashing green	EtherCAT connection with data transfer
	RUN	Network status	Off	EtherCAT device is in “INIT” state (or no voltage)
			Green	EtherCAT device is in “OPERATIONAL” state
			Flashing green	EtherCAT device is in “PRE-OPERATIONAL” state
			Green, 1 flash	EtherCAT device is in “SAFE-OPERATIONAL” state
			Flickering green	EtherCAT device is in “BOOT” state
	SF	System error	Off	No error in system design
			Red	Error in system design
	ERR	Error	Off	No errors in EtherCAT communication (or no voltage)
			Flashing red	Incorrect EtherCAT configuration
			Red, 1 flash	Slave changed EtherCAT status independently
			Red, 2 flashes	Watchdog timeout for the application
			Red	Application controller failed
			Flickering red	Boot error detected
	CM	Condition monitoring	Off	No CM information available
			Yellow	CM information available

3.3 Description of the Ejector

The compact ejectors of the terminal are supplied with electrical voltage by internal transmission. The same bus interface is used for communication with the control unit of the higher-level machine. The electrical connection is made centrally via the bus module.

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 or exhaust air channel.

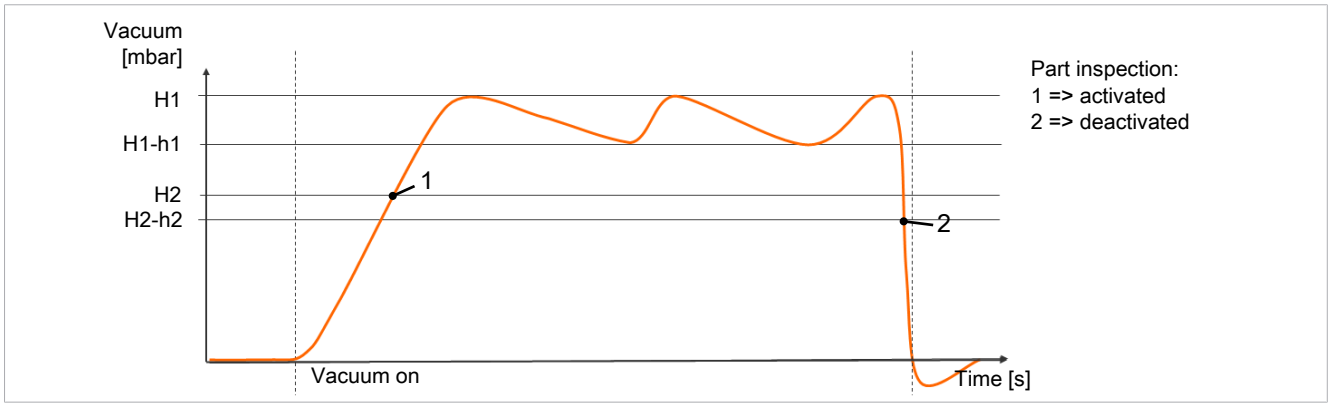
The compressed air supply can be connected centrally for all ejectors. As an alternative, there can also be a compressed air supply for each ejector.

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 there is a power failure or if there is no control signal, 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.)

An integrated sensor records the vacuum generated by the venturi nozzle. The vacuum value is displayed via the LED bar and can be read out via the process data.

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



The ejector also has a button that can be used for manual operation.

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

- The electronics switch the venturi nozzle off (“Venturi nozzle inactive“) 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.

3.3.1 Ejector Variants

Information Relating to Switching Logic

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

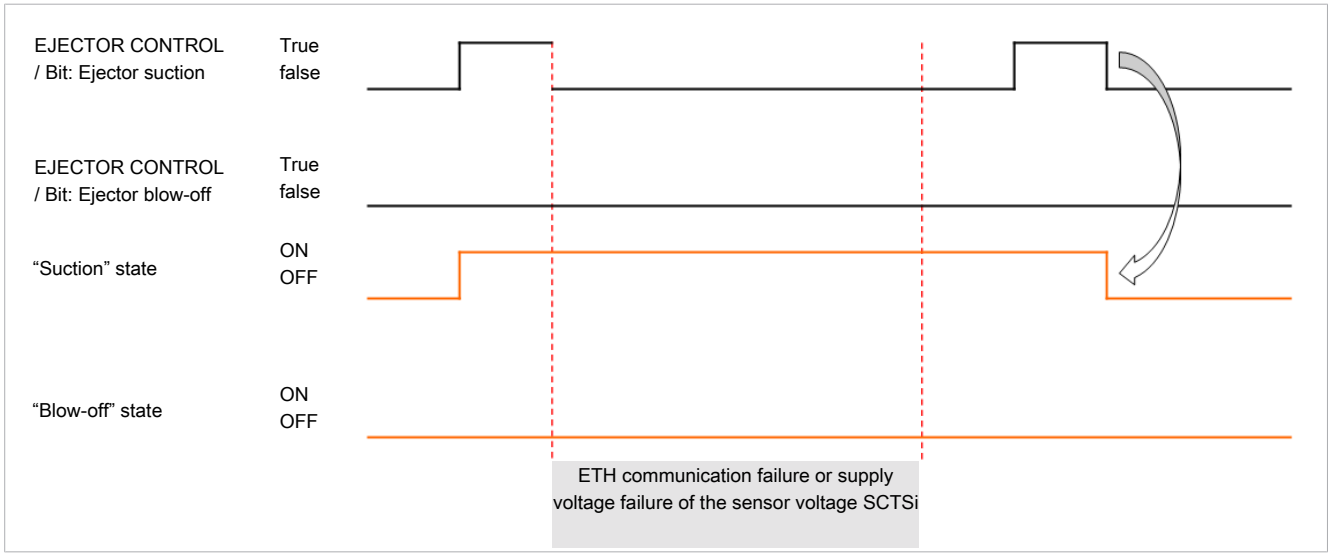
- In the (normally open) variant NO, the venturi nozzle is deactivated when the suction signal is received.
- In the (normally closed) variant NC, the venturi nozzle is activated.
- In the variant IMP, the venturi nozzle is controlled in the same way as in the variant NC. It is therefore not necessary to trigger pulses using the Suction command. Transmission in pulses is carried out internally in the ejector depending on the requested Suction command.

Power failure or communication failure with the ejector variant IMP

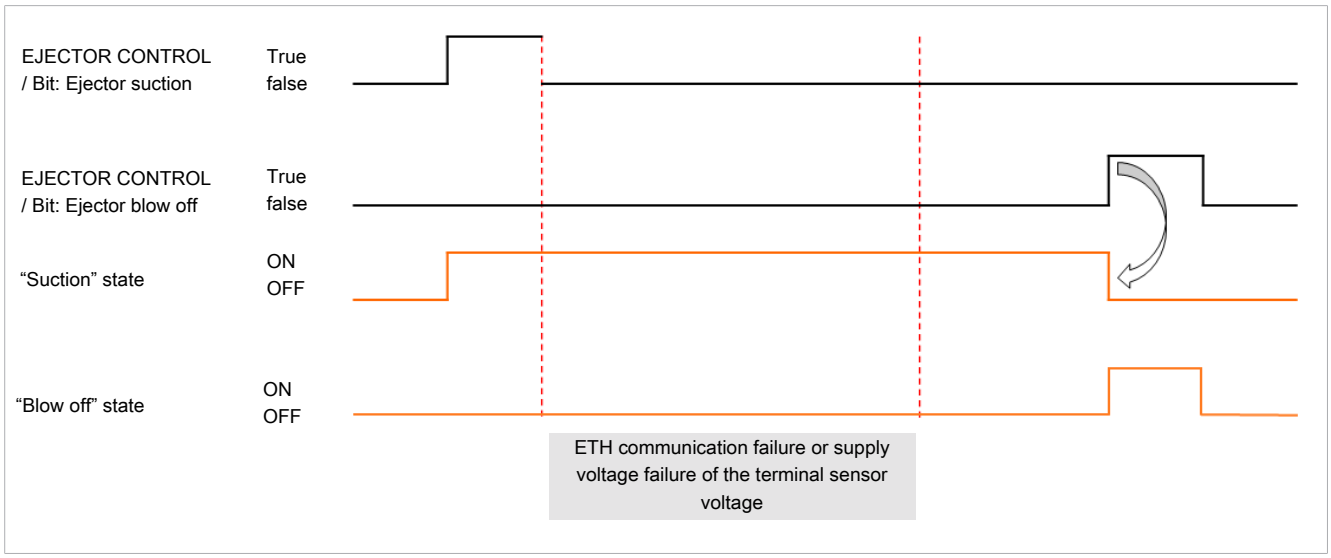
In the ejector variant IMP, the ejector remains in “Suction” mode if the power supply fails during automatic operation. This prevents the object being gripped from falling from the suction cup in the event of a power failure (or failure of the control unit or its communication). This also applies when 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 actuator supply voltage returns, the ejector remains in automatic mode with the air saving function activated.

If the pulse ejector is in the “Suction” operating state when the terminal is restarted or communication is re-established (after a communication interruption with the control unit), it can only be reset to the “No suction” operating state either by a falling edge of the suction command (option 1) or by a rising edge of the blow off command (option 2).

Option 1: SUCTION = OFF after a communication failure or restart of the SCTSi via falling edge at bit: Ejector suction

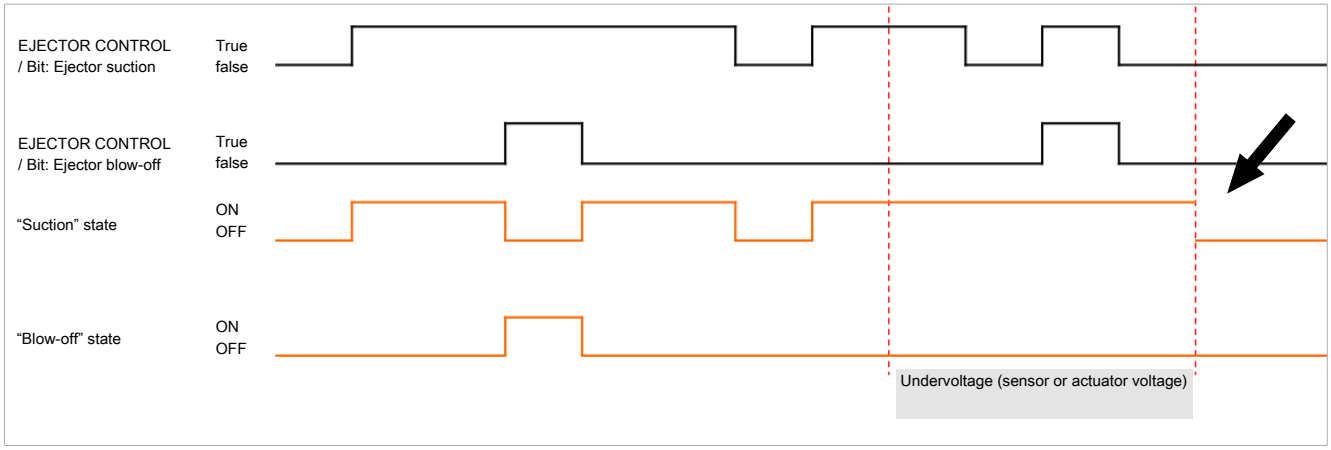


Option 2: SUCTION = OFF after a communication failure or restart of the SCTSi via rising edge at bit: Ejector blow off



Undervoltage for ejector variant IMP

In contrast to a power failure or communication interruption, the suction command is reset in the event of undervoltage (without restarting the terminal) as soon as the supply voltage is in the permissible range again and Bit = false is present on the suction ejector.



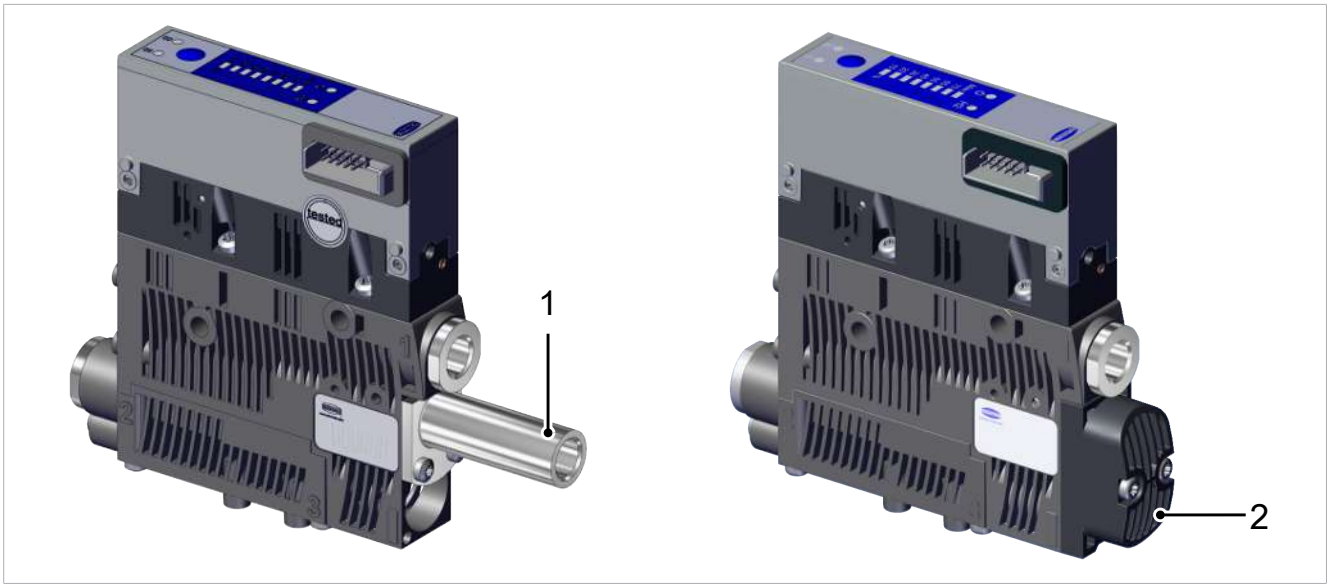
The blow off valve on the ejector is activated and deactivated using the blow off command. The valve is always designed as an NC (normally closed) variant and switches the air pressure channel to the vacuum connection for the duration of activation. If both suction and blow off are activated, blow off is given higher priority and the venturi nozzle is not 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.

If communication of the higher-level bus system (Profinet, Ethernet/IP, EtherCAT) is interrupted, the ejectors retain their last activated state of suction, the neutral position or blow-off.

Information Relating to the Exhaust Duct

The exhaust duct is marked with the number 3 on the ejector.



1	Variant with exhaust outlet with **exhaust duct**	2	Variant with exhaust outlet with **integrated silencer**

CAUTION! Hearing damage caused by the operation of the ejector without silencer or without exhaust air hose! In the variant with exhaust duct (1), one of the following system expansions must be added to ensure the safe operation of the ejector by the operator:

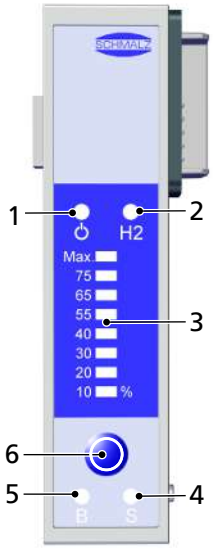
- Mounting of a silencer
- Mounting of an exhaust air hose

on all ejectors via the thread G... (1/8" internal thread).

3.3.2 Ejector Displays and Operating Elements

The **MANUAL MODE** button (6) switches the ejector to manual mode.

An LED bar and 4 LEDs are used to indicate the following information:

Ejector	Item	Meaning	State	Description
	1	Operating mode LED	Green	In operation
			Flashing green	1 Hz: Connection error 2 Hz: local firmware update
	2	Limit value H2 LED	Yellow	Switching point H2 reached
			Off	Switching point H2 not reached
	3	LED bar	Off	Vacuum < 10%
			Yellow	Current vacuum level
			Flashing yellow	Vacuum outside of measurement range (10% blow-off, for example)
	4*)	Suction LED S	Off	No suction from ejector
			Yellow	Suction from ejector
	5*)	Blow-off LED B	Off	Ejector not blowing off
			Yellow	Ejector blowing off
	6	**MANUAL MODE** button	Manual control of the suction and blow-off ejector functions (both the suction and blow-off LEDs flash). Refer to the “Manual Operation of the Ejectors” chapter.	

*) The suction and blow-off LEDs are activated only when there is actuator supply voltage.

3.4 IO-Link Class B Master

NOTE

The actuator power supply of each IO-Link master port is protected against short circuit, but not against overload.

Damage to the device

- Ensure that the maximum permissible current values are observed.

NOTE

The actuator power supply of each IO-Link master port is switched on after a power-up. This must be observed when connecting class A devices.

Damage to a connected device

- Ensure that the actuator voltage is deactivated if the voltage at this pin can cause damage to the connected device (actuator voltage U_A can be deactivated via the corresponding parameters).
- Or use a 3-pin M12 cable to connect Class A devices with a 3-pin connector. Switching off the actuator voltage can then be omitted.

NOTE

Power load greater than 16 A

Damage to the device

- Ensure that the maximum permissible total current (for the whole terminal) of 16 A is not exceeded.
- In addition, suitable fuse protection of the supply line is necessary.
- The supply line must be designed in accordance with the planned power consumption and the length of the line. A cable cross-section of 2.5 mm² is recommended.

If communication of the higher-level bus system (Profinet, Ethernet/IP, EtherCAT) is interrupted, the output process data of the IO-Link masters (IO-Link output) are reset to 0 (zero) for safety reasons.

3.4.1 Description

The IOL master is a decentralized IO-Link, input and output module. It enables the connection of up to four IO-Link devices. These can be actuators, sensors, or a combination of both.

Two LEDs are assigned to each IO-Link master port. The LEDs indicate the communication status and the actuator supply voltage.

Up to four IO-Link devices (with the possible transmission speeds COM1, COM2, COM3) can be connected to each IO-Link master. All communication takes place via the industrial Ethernet interface. All master ports are designed as Class B ports and marked accordingly. This allows sensor-actuator systems to be operated while taking electrical isolation into account. IO-Link class A devices can also be connected using a 3-pole sensor connection line. Up to 2 A per port from the actuator supply voltage are available for the actuators. If the actuator current is exceeded, the corresponding port is switched off.

The maximum permissible total current of 16 A (of the whole terminal) must not be exceeded. The power consumption of other components within the whole terminal must also be taken into account --> see 4.2 “Electrical and Technical Parameters”.

The pin assignment corresponds to the IO-Link specification for class B ports. See also chapter 8.4.3.

The IO-Link ports of the device satisfy the requirements of the IO-Link specification 1.1.

Max. line length per IO-Link port: 20 m.

3.4.2 Display

IO-Link Communication Status

The LEDs indicate the following information:

IO-Link master	Item	Meaning	State	Description
	1	LED assignment for the ports	—	1: Port X1 2: Port X2 3: Port X3 4: Port X4
	2	LED supply voltage for actuator U_A	Off	Supply voltage for the actuator is deactivated
			Yellow	Supply voltage for the actuator is activated and connected to the corresponding port (Pin 2)
	3	LED – IO-Link communication	Off	No IO-Link communication
			Flashing yellow slowly	Ready to establish IO-Link communication
			Flashing yellow quickly	IO-Link communication is being established with a device
			Permanently yellow	IO-Link communication is established

3.5 DI module

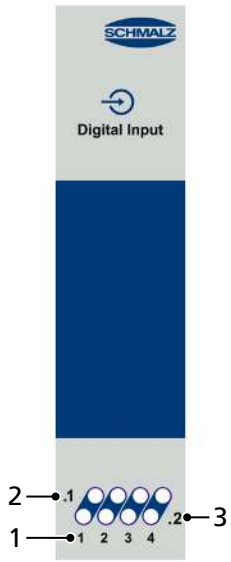
3.5.1 Description

Up to eight (two per M12 socket) digital signals can be read via the digital input module. Port status information is output via the process data of the industrial Ethernet interface. The 24 V sensor supply voltage is available at each M12 socket in accordance with the standard pin assignment for sensors. The inputs are 24 V PNP inputs in accordance with IEC 61131-2 type 1, 3.

3.5.2 Display

An LED for displaying the status is assigned to each input.

The LEDs indicate the following information:

DI module	Item	Meaning	State	Description
	1	LED assignment for the ports	—	1: Port X1 2: Port X2 3: Port X3 4: Port X4
	2	LED – status 1	Off	No valid signal (0 V) at input 1 (Pin 2) of the corresponding port
			Yellow	Valid signal (24 V) at input 1 (Pin 2) of the corresponding port
	3	LED – status 2	Off	No valid signal (0 V) at input 2 (Pin 4) of the corresponding port
			Yellow	Valid signal (24 V) at input 2 (Pin 4) of the corresponding port

4 Technical Data

4.1 Operation and Storage Conditions

Operating medium	Air or neutral gas, filtered to 5 µm, oiled or not oiled Class 3-3-3 compressed air quality acc. to ISO 8573-1
Max. dynamic pressure	6.8 bar
Working temperature	0 to 50° C
Storage temperature	-10 to 60° C
Permitted air humidity	10 to 85% RH (free from condensation)
Environmental conditions	Do not use outdoors and do not permanently expose to direct sunlight
Precision of vacuum sensor	± 3% FS (full scale)

4.2 Electrical and Technical Parameters

Supply voltage for sensor	24 V -20 to +10% VDC (PELV[1)])	—	
Max. permitted power consumption for sensor supply voltage	24 V	5 A	
Supply voltage for actuator	24 V -20 to +10% VDC (PELV[1)])	—	
Max. permitted power consumption for actuator supply voltage	24 V	16 A	
		typ.	max. every 500 ms for 25 ms or when switching on and off (valves)
Power consumption [2)] for sensor supply voltage (at 24 V)	Bus module	100 mA	—
	1 x NC ejector	10 mA	—
	1 x NO ejector	10 mA	—
	1 x IMP ejector	10 mA	—
	1 x DI module	12 mA	—
	1 x IO-Link master	30 mA	—
Power consumption [2)] for actuator supply voltage (at 24 V)	Bus module	10 mA	—
	1 x NC ejector (suction and release)	20 mA	30 mA
	1 x NO ejector (no suction / release)	20 mA / 30 mA	40 mA / 60 mA
	1 x IMP ejector (suction or no suction / release)	20 mA / 30 mA	120 mA @24 V 180 mA @19.2 V [1)]
	1 x IO-Link master	25 mA	—
Polarity reversal protection	Yes, all M12 connector connections		
Degree of protection	IP 65		
NFC	NFC Forum Tag type 4		

IO-Link master		
Maximum permitted output current I_L+ (Pin 1)	400 mA	
Actuator supply voltage U_A (Pin 2)	Typ. 24 V	
Sensor supply voltage L+ (Pin 1)	Typ. 24 V	
Supported baud rates	COM 1 (4.8 k bauds) COM 2 (38.4 k bauds) COM 3 (230.4 k bauds – max. 4 devices per terminal)	
IO-Link specification	The IO-Link ports of the device satisfy the requirements of the IO-Link specification 1.1.	
Max. permitted line length	20 m	
Max. permitted output current I_U_A (PIN 2)	2 A per port	
Max. permitted output current I_C/Q (Pin 4)	100 mA per port 500 mA (per port for WURQ)	
Switching threshold (1) C/Q (Pin 4)	C/Q as digital input	Min. 11 V
Switching threshold (0) C/Q (Pin 4)	C/Q as digital input	Max. 11 V
Input current C/Q (Pin 4)	C/Q as digital input	6.2 mA[2)]
DI module		
Max. permitted supply current U_S (Pin 1)	Protected against short-circuits; not overload-proof	200 mA
Specification	IEC 61131-2 type 1, 3 (3 conductors)	
Signal voltage (0) DIn (Pin 2 and 4)	–3 V ... 7 V	
Signal voltage (1) DIn (Pin 2 and 4)	11 V ... 36 V	
Max. permitted digital input voltage (Pin 2 and 4)	36 V	
Input current I_DIn (Pin 2 and 4)	Max. 2.7 mA	
Input filter (Pin 2 and 4)	Typ. 3 ms / max. 4.5 ms	

[1)] At an actuator supply voltage < 21.4 V, a cascaded activation or deactivation of suction or blow-off occurs as of an IMP ejector number >= 8. The ejectors are switched on or off in blocks of 4 (starting from ejector #1) at intervals of approx. 40 ms. This reduces the maximum current consumption when several IMP ejectors are switched on simultaneously. This results in a maximum delay of 160 ms when expanding with 13-16 IMP ejectors.

[2)] The power supply must correspond to the regulations in accordance with EN60204 (protected extra-low voltage). In addition, the voltage must be electrically isolated from the sensor supply voltage while taking the basic insulation into account (in accordance with IEC 61010-1, secondary circuit with maximum 30 V DC derived from the mains circuit up to 300 V of overvoltage category II).

4.3 Mechanical Data

4.3.1 Performance Data

All data is based on the ejector SCPSt:

Type	Nozzle size mm	Max. vacuum[1] %	Suction rate[1] l/min	Blow-off air consumption[1] l/min	Air consumption[1] l/min
SCPS-07	0.7	85	16	120	22
SCPS-10	1.0	85	36	120	46
SCPS-15	1.5	85	65.5	120	98
SCPS-2-07	0.7	85	37	120	22
SCPS-2-09	0.9	85	49.5	120	40.5
SCPS-2-14	1.4	85	71.5	120	82

[1] at 4 bar

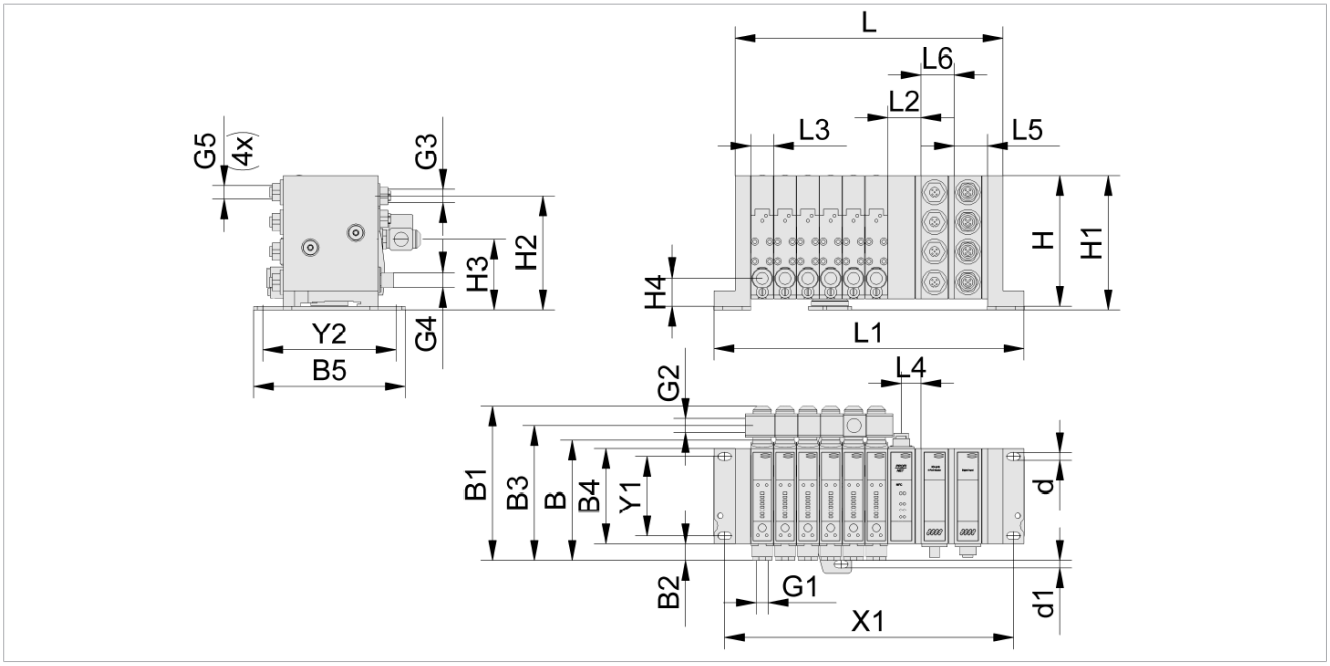
Type		Sound level[1], unobstructed suction dBA	Sound level[1] with workpiece picked up dBA
SCTSi with 2 ejectors	(07 … 15)	75 … 82	66 … 77
SCTSi with 4 ejectors	(07 … 15)	77 … 84	68 … 79
SCTSi with 8 ejectors	(07 … 15)	78 … 85	70 … 81
SCTSi with 16 ejectors	(07 … 15)	81 … 83	70 … 78
Individual ejector SCPS-07		63	58
Individual ejector SCPS-10		73	60
Individual ejector SCPS-15		73	65
Individual ejector SCPS-2-07		63	58
Individual ejector SCPS-2-09		73	60
Individual ejector SCPS-2-14		75	65

[1] at 4 bar

4.3.2 Dimensions

Table of dimensions with formulas

When using terminal variants with power blow off or an exhaust air pipe, see the parameter drawings for the ejector disc further below for differing dimensions.



B	B1	B2	B3	B4	B5 [1)]	G1	G2	G3	G4	G5
97.3	124.7	13.5	109	77	123	1/8" internal thread	1/4" internal thread	M12x1 external thread		M12x1 internal thread

H	H1 [1)]	H2	H3	H4	L	L1
105	108	88.5	53.5	22.5	26+(n*18.5)+(a*27)+(b*27)	60+(n*18.5)+(a*27)+(b*27)

L2	L3	L4	L5	X1	Y1	Y2 [1)]	d	d1 [1)]
27	18.5	16	27	43+(n*18.5)+(a*27)+(b*27)	64	108	6	6

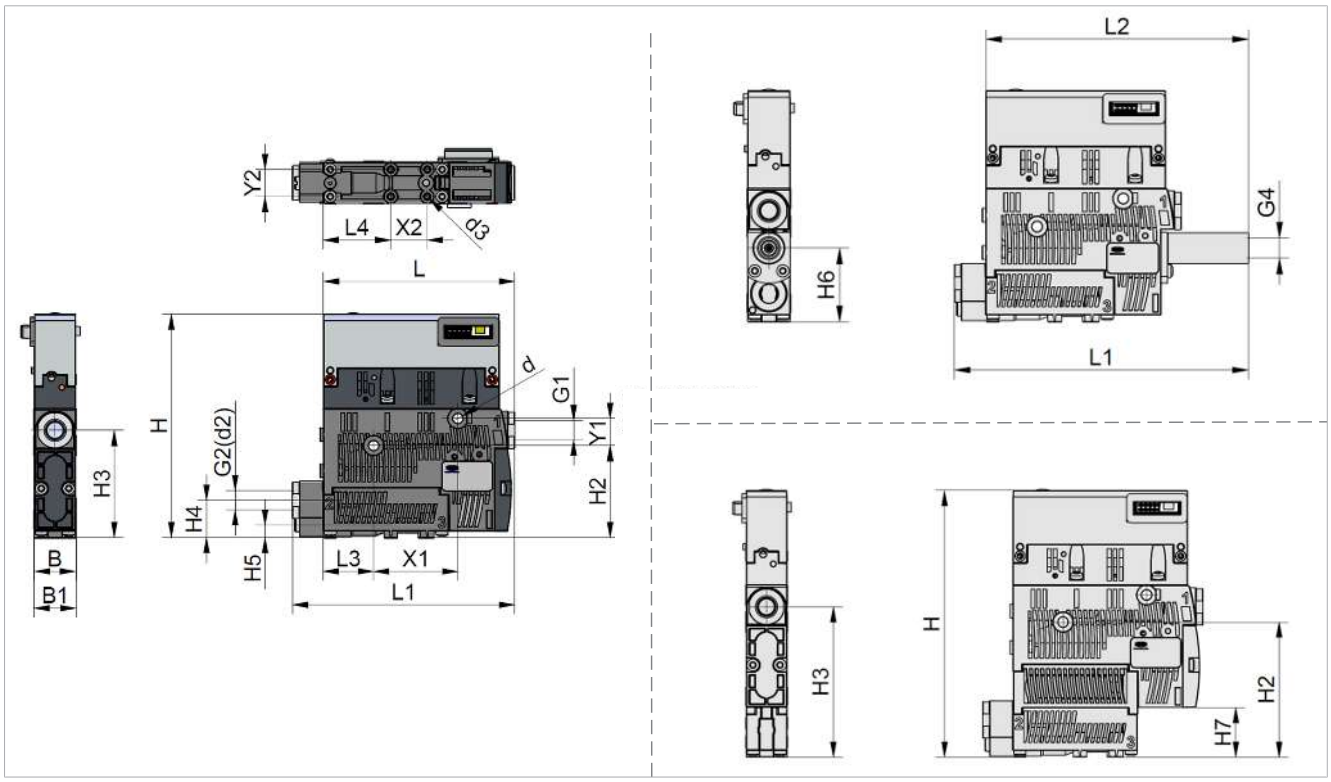
The letter “n” stands for the number of ejector discs installed in the terminal.

The letter “a” stands for the number of IO-Link modules installed in the terminal.

The letter “b” stands for the number of DI modules installed in the terminal.

[1)] The dimensions B5, H1, Y2 and d1 are relevant only for variants with six or more ejector discs.

Ejector Dimensions



B	B1	H	H2	H3	H4	H5	G1	G2
18	18.6	99	40.8	47.5	16.5	5.5	1/8" internal thread	1/8" internal thread

L	L1	L2	L3	L4	X1	X2	Y1	Y2	d	d3
83.8	107	92.5	22	29.5	36.9	16	12	12	4.4	2.6

Different dimensions for the variant with power blow off module

H	H2	H3	H7
118	59.8	66.5	22

Different dimensions for the variant with exhaust air pipe

H6	L1	L2	G4
31.5	126	112.5	1/8" internal thread

All dimensions given in millimeters [mm].

4.3.3 Terminal Mass

The mass of a terminal is determined by the masses of the individual components:

Individual components	Mass [g]
ProfiNet-D bus system	150
IO-Link class B bus system	150
EtherNet/IP bus system	150
EtherCAT bus system	150
IO-Link master	160
DI module for Ethernet	130
Ejector disc	240
Cover and clamping elements for 1 to 9 ejector discs	Approx. 230
Cover and clamping elements for 10 to 16 ejector discs	Approx. 350

The approximate mass of one terminal amounts to:

- with up to 9 ejector discs
  m = approx. 230 g + 150 g + (n*240) g + (a*160) g + (b*130) g
- with 10 to 16 ejector discs
  m = approx. 350 g + 150 g + (n*240) g + (a*160) g + (b*130) g

The letter “n” stands for the number of ejector discs installed in the terminal.

The letter “a” stands for the number of IO-Link modules installed in the terminal.

The letter “b” stands for the number of DI modules installed in the terminal.

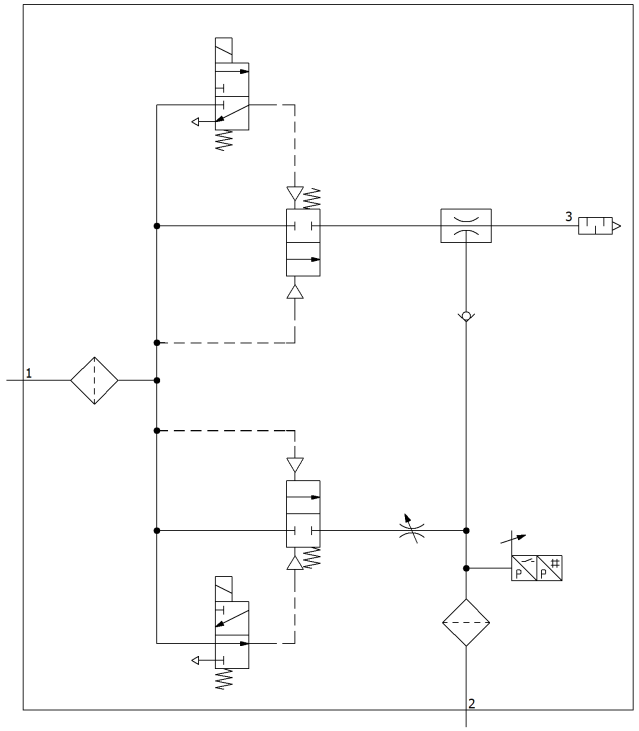
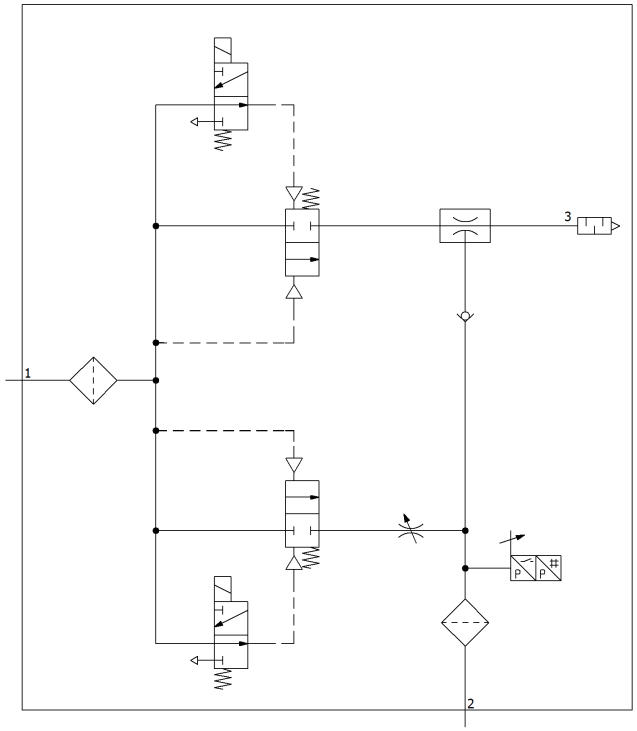
The order confirmation indicates the exact mass of the respective terminal.

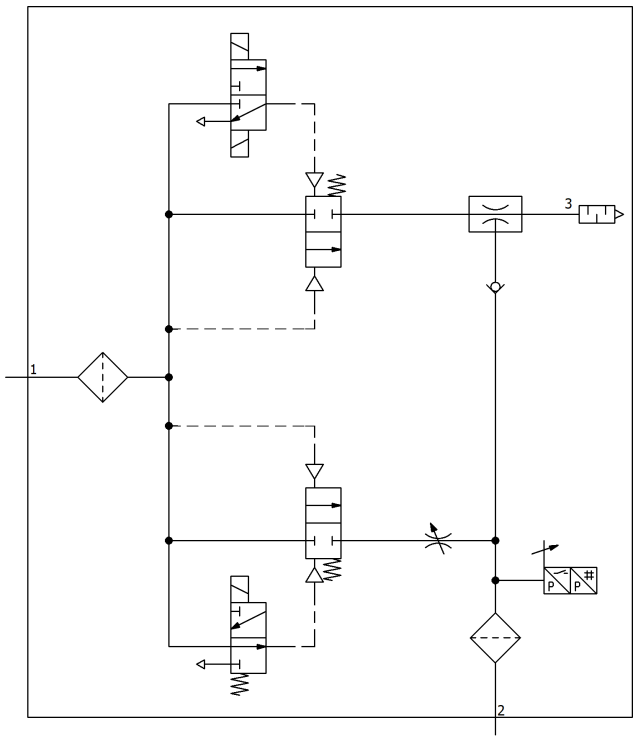
4.3.4 Pneumatic circuit plans

The illustrated pneumatic circuit diagrams show the product in an unpressurized state in accordance with the standard DIN ISO 1219-1.

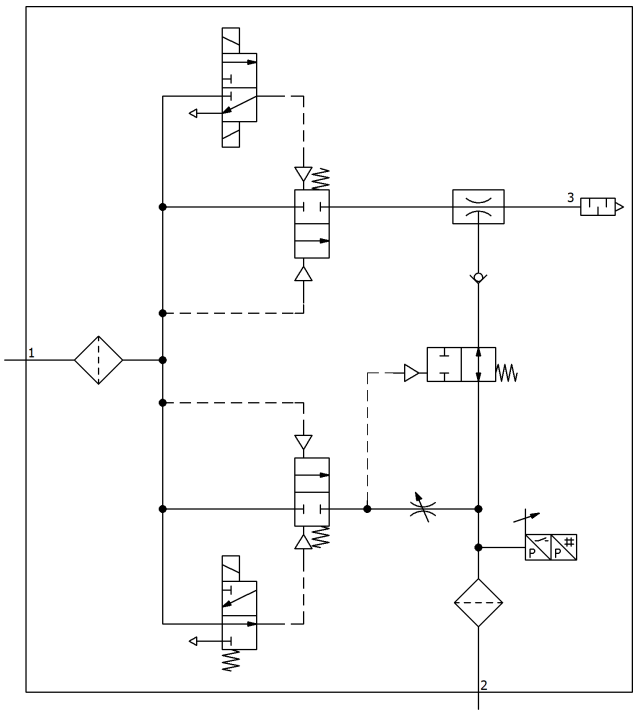
Key:	
NC	Normally closed
NO	Normally open
IMP	Bistable, pulse-controlled
M	Power blow off
1	Compressed air connection
2	Vacuum connection
3	Exhaust outlet

Pneumatic circuit diagrams for the standard single-stage version

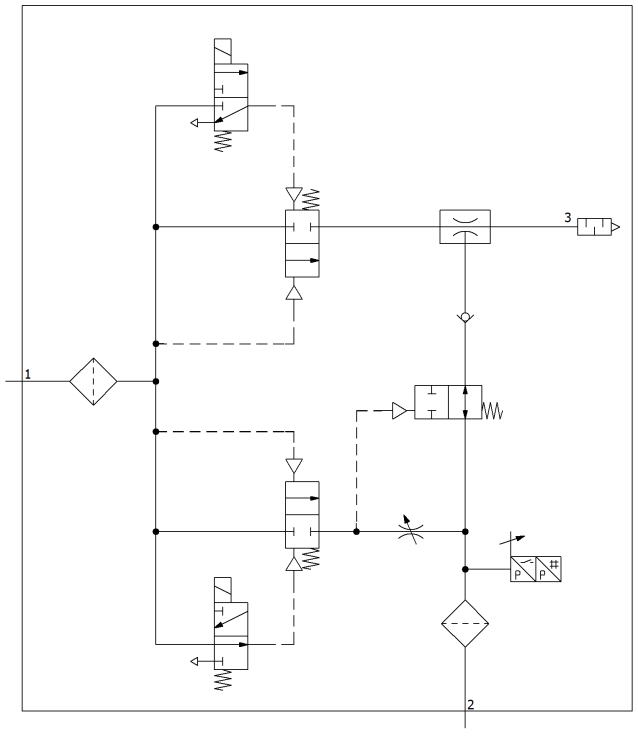
...NO...	**...NC...**
	
...IMP	**...IMP_M**

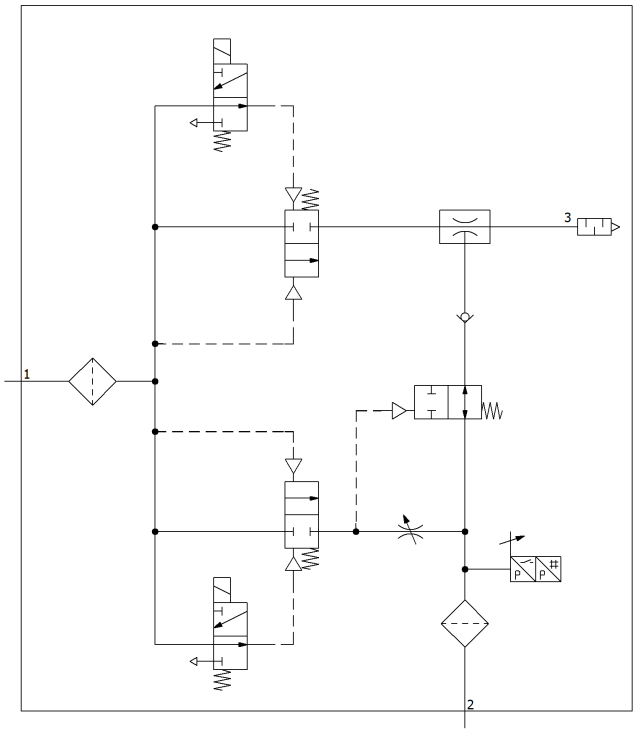


...NO... M

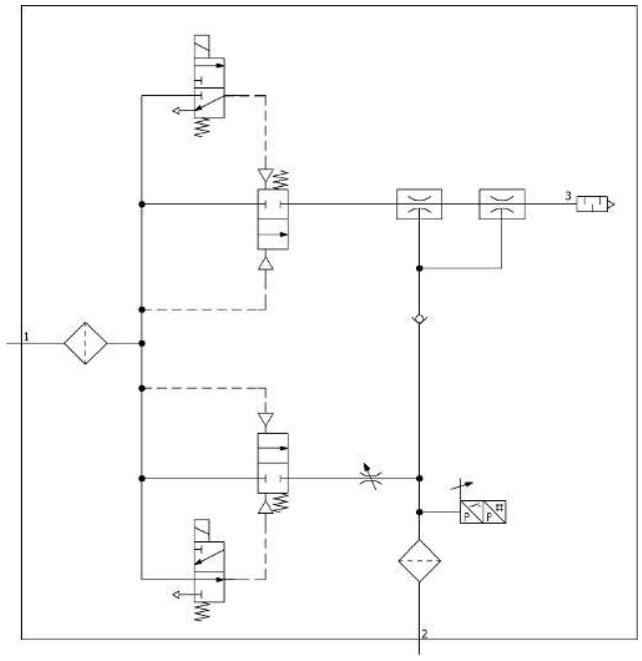
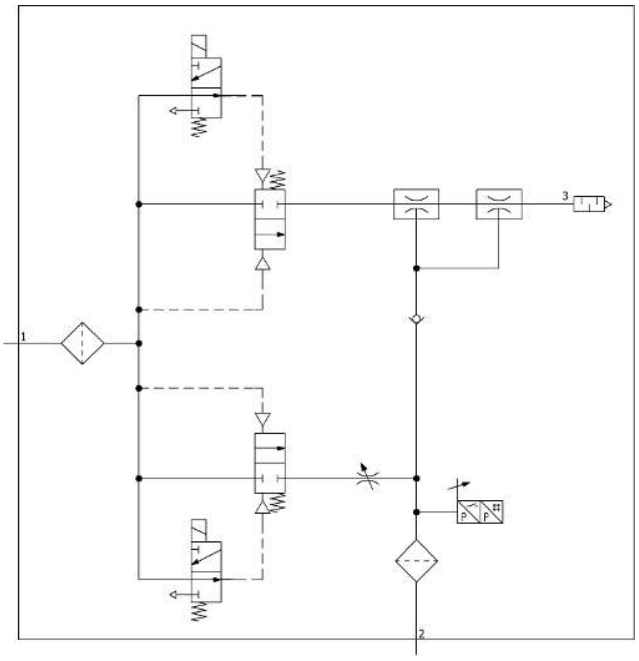
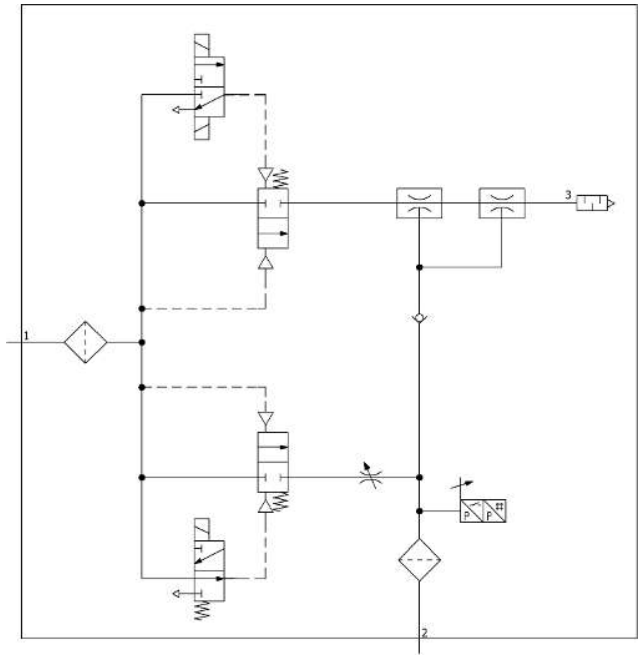
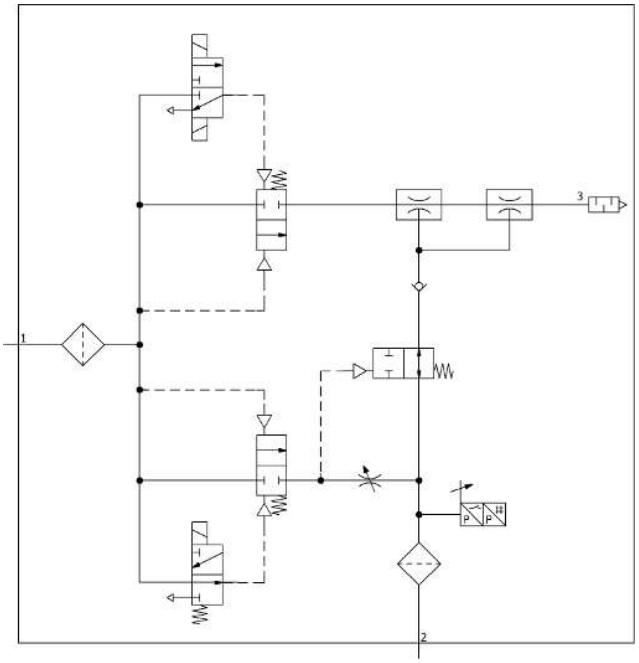


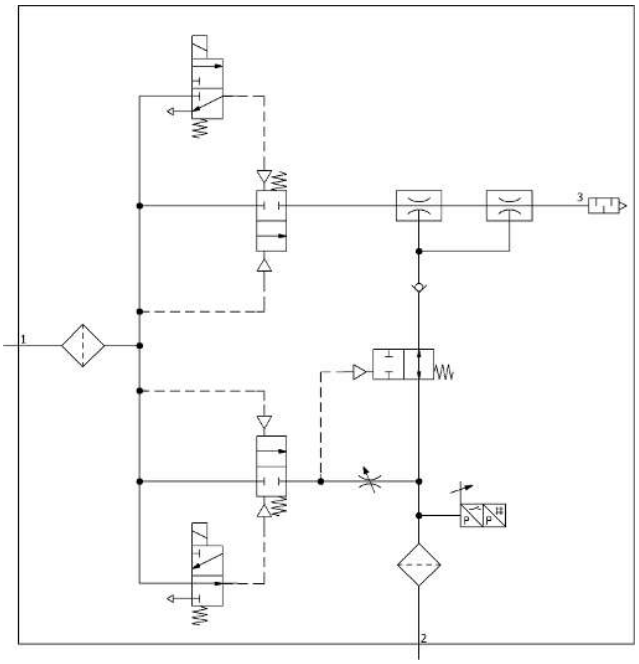
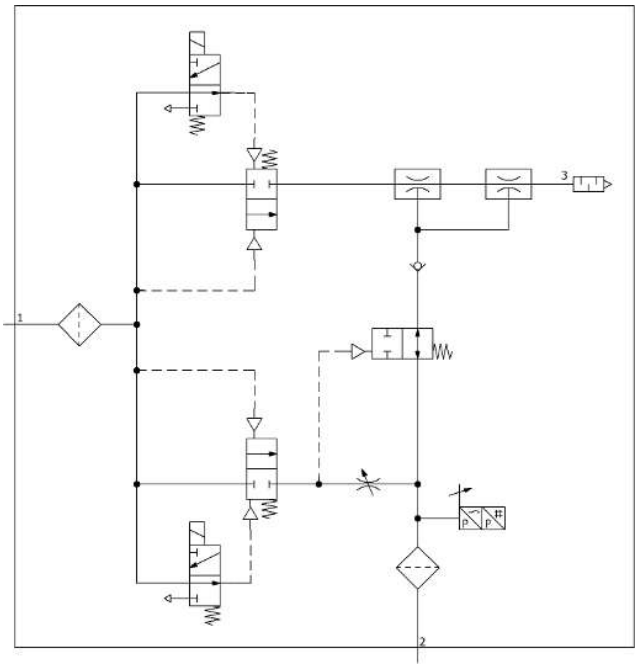
...NC...M





Pneumatic circuit diagrams for the two-stage version

... NO...	...NC...
	
...IMP...	**...IMP_M**
	

... NO...M	... NC...M
	

4.4 Factory Settings

The factory settings relate to the particular ejector of the Terminal.

Parameter	(dec)	(hex)	Value	Description
Limit value switching point H1	100	0x0064	-750 mbar	—
Hysteresis h1	101	0x0065	150 mbar	—
Limit value for switching point H2	102	0x0066	-550 mbar	—
Hysteresis h2	103	0x0067	10 mbar	—
Blow-off pulse duration	106	0x006A	200 ms	—
Permissible evacuation time	107	0x006B	2000 ms	—
Permissible leakage	108	0x006C	250 mbar/s	—
Air saving function	109	0x006D	0x02	Control active
Blow-off mode	110	0x006E	0x00	Externally controlled

5 Control Interfaces

5.1 Industrial Ethernet

The industrial Ethernet interface is used to control the entire Terminal, set all of the parameters and provide a wide variety of measurement and analysis data.

The PROFINET, EtherNet/IP or EtherCAT protocol is supported, depending on the design.

5.1.1 TCP/IP Configuration

For the EtherCAT variant, the TCP/IP setting and any changes to it using the tools listed below only become effective with "Ethernet-over-EtherCAT (EoE)."

The preset TCP/IP configuration can optionally be changed with the following example tools/programs (selection):

J. Schmalz GmbH assumes no responsibility for the download/use of the following programs.

- BootP-DHCP server or any other DHCP server
- HMS Ipconfig
- With Profinet via the controller

5.2 Process Data

The cyclical process data is used to control the ejectors/valves and receive current information reported from Compact terminal SCTSi. From the perspective of the higher-level PLC, there is a difference between input process data (data from the Compact terminal SCTSi) and output process data (data to the Compact terminal SCTSi):

Device description files are available for integration into a higher-level controller.

The process data width is dependent on the actual number of compact terminal ejectors.

5.2.1 Protocol-Specific Settings and Information

Profinet:

The process data can be configured in Profinet. Various configuration modules (module and submodules), which are predefined in the corresponding GSDML (device description file), are available for this purpose. These have a designated area for placement in the slots and subslots. Since the user determines exact placement during project planning, it is not possible to specify a generally valid division of the process data. In addition, input and output process data are not strictly separated. Rather, the submodules can have both, for example.

Modules (*=fixed, all others can be optionally configured):

Designation	Slot	Direction	Length in bytes
Device status	1*	Input	1
Supply pressure	2*	Output	1
Total air consumption	3*	Input	4
Module central unit Fixed submodule: CU condition monitoring CU active errors	4 Subslot 1 Subslot 2	Input	 1 1
IO-Link master Fixed submodule: Control	5-6 Subslot 1	Input/output Output	Variable 1

Designation	Slot	Direction	Length in bytes
DI module	5-10	Input	6
Vacuum ejector Fixed submodule: Ejector status & control	11-26 Subslot 1	Input/output Input/output	Variable 1+1

Optional Submodules:

Designation	Module assignment	Direction	Length in bytes
Ejector extended values	Vacuum ejector	Input	10
IOL-E-xx byte 01/02/04/06/08/10/16/24/32	IO-Link master	Input	1 - 32
IOL-A-xx byte 01/02/04/06/08/10/16/24/32	IO-Link master	Output	1 - 32
IOL-E/A-xx/xx byte 01/01 02/02 02/04 02/08 04/02 04/04 04/08 08/08 16/16 24/24 32/04 32/32	IO-Link master	Input/output	1 - 32 + 1 - 32

The process data width of each IO-Link master port can, for example, be adapted to the process data width of the connected device by configuring it with a module with a suitable data length. If no suitable configuration module is available, the next larger data length should be selected.

It is also possible to configure each IO-Link master port either as a digital input or digital output (C/Q: Pin 4) instead of configuring IO-Link and reading or writing the status via process data.

The configuration is carried out by assigning the appropriate configuration module to the corresponding port in the controller.

Special Features for Programming Profinet with Beckhoff TwinCAT

Here the slot number for the modules mentioned in the table above is shifted by +1. You must observe gaps when placing the modules. If there are free slots between slots 5 and 11 (IOLM or DI modules) because these modules are not available in the device, then you must place empty slots in order to be able to place ejector modules from slot 11 onwards.

EtherNet/IP™

The process data width is fixed and is 445 bytes for input process data and 273 bytes for output process data, regardless of the actual number of ejectors, DI modules or IO-Link masters of the compact terminal.

For EtherNet/IP, one of the available connection points (identification label or assembly instances) must be selected. If necessary, the corresponding target address (output/input assembly) must also be specified.

The resulting total process data width depends on the selected connection.

The connection points and associated target addresses are predefined in the EDS file (device description file).

CIP connection name / assembly instances	Input assembly (target address of input process data)	Resulting input process data width [bytes]	Output assembly (target address of output process data)	Resulting output process data width [bytes]
“Exclusive owner”	100	445	150	273
“Listen only”			4	0
“Input only”			3	
“Listen only extended”			7	
“Input only extended”			6	

EtherCAT

As with EtherNet/IP, the process data width is fixed and is 445 bytes for input process data and 273 bytes for output process data, regardless of the actual number of ejectors, DI modules or IO-Link masters of the compact terminal.

IO-Link Process Data

The IO-Link process data of an IO-Link master port is forwarded to the Ethernet bus system unchanged, i.e. the endianness (byte order) and structure remain unchanged. The start byte in the overall Ethernet process data for the respective IO-Link master port is listed in table 5.2.1 as “Master x Port x Input” and 5.2.2 as “Master x Port x Output”.

5.2.2 Input Process Data

The input data provides cyclical reporting of a range of information relating to the SCTSi, the individual ejectors and the additional modules:

- Device status of the SCTSi in the form of a status traffic light (refer to the “Device status” parameter)
- The switching values H1 and H2 of the connected ejectors and their hysteresis h1 and h2
- Error messages of the bus module
- Condition monitoring events from the bus module and the individual ejectors
- Total air consumption
- Process data of IO-Link devices connected to the IO-Link master ports or the status of the inputs if the IO-Link master ports are defined as inputs
- Status of the DI modules

The length of the input process data depends on the design of the compact terminal with respect to the protocol and number of actual components of the compact terminal (see 5.2 “Process Data”).

Possible Access Types of the Parameters

Access type	Abbreviation
Read only	ro
Write only	wo
Read and write	rw

INPUT PROCESS DATA for EtherCAT AND EtherNet/IP

Byte no.	Designation
0	Device status
1	CU active errors
2	CU condition monitoring
3 ... 18	Ejector status
19 ... 22	Total air consumption
23 ... 54	Master 1 Port 1 Input
55 ... 86	Master 1 Port 2 Input
87 ... 118	Master 1 Port 3 Input
119 ... 150	Master 1 Port 4 Input
151 ... 182	Master 2 Port 1 Input
183 ... 214	Master 2 Port 2 Input
215 ... 246	Master 2 Port 3 Input
247 ... 278	Master 2 Port 4 Input
279 ... 288	Extended Values Ejector 1
289 ... 298	Extended Values Ejector 2
299 ... 308	Extended Values Ejector 3
309 ... 318	Extended Values Ejector 4
319 ... 328	Extended Values Ejector 5
329 ... 338	Extended Values Ejector 6
339 ... 348	Extended Values Ejector 7
349 ... 358	Extended Values Ejector 8
359 ... 368	Extended Values Ejector 9
369 ... 378	Extended Values Ejector 10
379 ... 388	Extended Values Ejector 11
389 ... 398	Extended Values Ejector 12
399 ... 408	Extended Values Ejector 13
409 ... 418	Extended Values Ejector 14
419 ... 428	Extended Values Ejector 15
429 ... 438	Extended Values Ejector 16
439	DI Modules 1 Input
440	DI Modules 2 Input
441	DI Modules 3 Input
442	DI Modules 4 Input
443	DI Modules 5 Input
444	DI Modules 6 Input

DEVICE STATUS [ro]

DS		**res**					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 5:0	**res:**	Reserved
Bit 7:6	**DS:**	Device status 00 [green] Device is working optimally 01 [yellow] Device is working, maintenance necessary 10 [orange] Device is working, but there are warnings in the control unit 11 [orange] Device is working, but there are warnings in the control unit

CU ACTIVE ERRORS (Control Unit Active Errors) [ro]

CU active errors							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0	Internal error: data corruption
Bit 1	Internal error: bus fault
Bit 2	Primary voltage too low
Bit 3	Primary voltage too high
Bit 4	Secondary voltage too low
Bit 5	Secondary voltage too high
Bit 6	Supply pressure too low (< 1.9 bar) or too high (> 6.3 bar)
Bit 7	Error in one or more ejectors

CU CONDITION MONITORING

(Control Unit Condition Monitoring)

res				**CU condition monitoring**			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0:3	**CU condition monitoring**	Condition monitoring of control unit [ro] Bit 0 = Primary voltage limit Bit 1 = Secondary voltage limit Bit 2 = Input pressure limit (3.5 to 5 bar) (hysteresis = 0.2 bar) Bit 3 = Warning in one or more ejectors
Bit 4:7	**res:**	Reserved

EJECTOR (1–16) STATUS [ro]

(ejectors 1 – 16)

Ejector CM						Status	
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0:1	**Status**	Bit 0: H1 level reached (air saving function) in ejector Bit 1: H2 level reached (part present) in ejector
Bit 2:7	**Ejector CM**	Condition monitoring of ejectors Bit 2 = Valve protection active Bit 3 = Evacuation time greater than limit Bit 4 = Leakage rate greater than limit Bit 5 = H1 not reached in suction cycle Bit 6 = Free flow vacuum too high Bit 7 = Manual mode active

TOTAL AIR CONSUMPTION [ro]

Total air consumption in l/min

IO-LINK MASTER 1 PORT INPUT [ro]

Master 1 Port 1 (IO-Link input)	IO-Link Master 1 Port X1 process data (IO-Link device process data at Master 1 Port X1)
Master 1 Port 2 (IO-Link input)	IO-Link Master 1 Port X2 process data (IO-Link device process data at Master 1 Port X2)
Master 1 Port 3 (IO-Link input)	IO-Link Master 1 Port X3 process data (IO-Link device process data at Master 1 Port X3)
Master 1 Port 4 (IO-Link input)	IO-Link Master 1 Port X4 process data (IO-Link device process data at Master 1 Port X4)
Master 1 Port 1 (digital input)	IO-Link Master 1 Port X1 process data (digital input (24 V) at Master 1 Port X1 – Pin 4)
Master 1 Port 2 (digital input)	IO-Link Master 1 Port X2 process data (digital input (24 V) at Master 1 Port X2 – Pin 4)
Master 1 Port 3 (digital input)	IO-Link Master 1 Port X3 process data (digital input (24 V) at Master 1 Port X3 – Pin 4)
Master 1 Port 4 (digital input)	IO-Link Master 1 Port X4 process data (digital input (24 V) at Master 1 Port X4 – Pin 4)

IO-LINK MASTER 2 PORT INPUT [ro]

Master 2 Port 1 (IO-Link input)	IO-Link Master 2 Port X1 process data (IO-Link device process data at Master 2 Port X1)
Master 2 Port 2 (IO-Link input)	IO-Link Master 2 Port X2 process data (IO-Link device process data at Master 2 Port X2)
Master 2 Port 3 (IO-Link input)	IO-Link Master 2 Port X3 process data (IO-Link device process data at Master 2 Port X3)
Master 2 Port 4 (IO-Link input)	IO-Link Master 2 Port X4 process data (IO-Link device process data at Master 2 Port X4)
Master 2 Port 1 (digital input)	IO-Link Master 2 Port X1 process data (digital input (24 V) at Master 2 Port X1 – Pin 4)
Master 2 Port 2 (digital input)	IO-Link Master 2 Port X2 process data (digital input (24 V) at Master 2 Port X2 – Pin 4)
Master 2 Port 3 (digital input)	IO-Link Master 2 Port X3 process data (digital input (24 V) at Master 2 Port X3 – Pin 4)
Master 2 Port 4 (digital input)	IO-Link Master 2 Port X4 process data (digital input (24 V) at Master 2 Port X4 – Pin 4)

EJECTOR (1–16) EXTENDED VALUES [ro]

(ejectors 1 – 16)

Ejector Extended Values

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0:7		Byte 0:1: System vacuum (in mbar) Byte 2:3: Air consumption (in l/min) Byte 4:5: Leakage of last cycle (in mbar/s) Byte 6:7: Evacuation time T1 (in ms) Byte 8:9: Last free flow vacuum (in mbar)

DI MODULES (INPUT)

(DI module 1–6)

DI Module Input

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0:7	DI modules status Bit 0 = DI module status; Port X1, Pin (2) Bit 1 = DI module status; Port X1, Pin (4) Bit 2 = DI module status; Port X2, Pin (2) Bit 3 = DI module status; Port X2, Pin (4) Bit 4 = DI module status; Port X3, Pin (2) Bit 5 = DI module status; Port X3, Pin (4) Bit 6 = DI module status; Port X4, Pin (2) Bit 7 = DI module status; Port X4, Pin (4)

5.2.3 Output Process Data

The output process data is used to control the SCTSi, the IO-Link class B master and the individual ejectors cyclically:

- To determine the air consumption, the system pressure (> 0 bar) must be preset.
- All ejectors are controlled via the suction and blow-off commands.

The length of the output process data depends on the design of the compact terminal with respect to the protocol and number of actual components of the compact terminal. See 5.2 “Process Data”.

Overview:

PDOut byte	Designation		PDOut byte	Designation
0	Device supply pressure		13	Ejector 13 Control
1	Ejector 1 Control		14	Ejector 14 Control
2	Ejector 2 Control		15	Ejector 15 Control
3	Ejector 3 Control		16	Ejector 16 Control
4	Ejector 4 Control		17 ... 48	Master 1 Port X1 Output
5	Ejector 5 Control		49 ... 80	Master 1 Port X2 Output
6	Ejector 6 Control		81 ... 112	Master 1 Port X3 Output
7	Ejector 7 Control		113 ... 144	Master 1 Port X4 Output
8	Ejector 8 Control		145 ... 176	Master 2 Port X1 Output
9	Ejector 9 Control		177 ... 208	Master 2 Port X2 Output
10	Ejector 10 Control		209 ... 240	Master 2 Port X3 Output
11	Ejector 11 Control		241 ... 272	Master 2 Port X4 Output
12	Ejector 12 Control		—	—

DEVICE SUPPLY PRESSURE [rw]

Device Supply Pressure

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 7:0	**Device Supply Pressure:**	Specify the supply pressure value in 0.1 bar steps

EJECTOR (1–16) CONTROL [rw]

(ejectors 1 – 16)

res	res	res	res	res	res	B01	S01
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0	**S01:**	Ejector suction
Bit 1	**B01:**	Ejector blow-off
Bit 2	**res:**	Reserved
Bit 3	**res:**	
Bit 4	**res:**	
Bit 5	**res:**	
Bit 6	**res:**	
Bit 7	**res:**	

IO-LINK MASTER 1 PORT OUTPUT [ro]

Master 1 Port 1 (IO-Link output)	IO-Link Master 1 Port X1 process data (IO-Link device process data at Master 1 Port X1)
Master 1 Port 2 (IO-Link output)	IO-Link Master 1 Port X2 process data (IO-Link device process data at Master 1 Port X2)
Master 1 Port 3 (IO-Link output)	IO-Link Master 1 Port X3 process data (IO-Link device process data at Master 1 Port X3)
Master 1 Port 4 (IO-Link output)	IO-Link Master 1 Port X4 process data (IO-Link device process data at Master 1 Port X4)
Master 1 Port 1 (digital output)	IO-Link Master 1 Port X1 process data (digital output (24 V) at Master 1 Port X1 – Pin 4)
Master 1 Port 2 (digital output)	IO-Link Master 1 Port X2 process data (digital output (24 V) at Master 1 Port X2 – Pin 4)
Master 1 Port 3 (digital output)	IO-Link Master 1 Port X3 process data (digital output (24 V) at Master 1 Port X3 – Pin 4)
Master 1 Port 4 (digital output)	IO-Link Master 1 Port X4 process data (digital output (24 V) at Master 1 Port X4 – Pin 4)

IO-LINK MASTER 2 PORT OUTPUT [ro]

Master 2 Port 1 (IO-Link output)	IO-Link Master 2 Port X1 process data (IO-Link device process data at Master 2 Port X1)
Master 2 Port 2 (IO-Link output)	IO-Link Master 2 Port X2 process data (IO-Link device process data at Master 2 Port X2)
Master 2 Port 3 (IO-Link output)	IO-Link Master 2 Port X3 process data (IO-Link device process data at Master 2 Port X3)
Master 2 Port 4 (IO-Link output)	IO-Link Master 2 Port X4 process data (IO-Link device process data at Master 2 Port X4)
Master 2 Port 1 (digital output)	IO-Link Master 2 Port X1 process data (digital output (24 V) at Master 2 Port X1 – Pin 4)
Master 2 Port 2 (digital output)	IO-Link Master 2 Port X2 process data (digital output (24 V) at Master 2 Port X2 – Pin 4)
Master 2 Port 3 (digital output)	IO-Link Master 2 Port X3 process data (digital output (24 V) at Master 2 Port X3 – Pin 4)

Master 2 Port 4 (digital output)	IO-Link Master 2 Port X4 process data (digital output (24 V) at Master 2 Port X4 – Pin 4)

5.3 Parameter data

All parameters of the device can be read and partially written via acyclic communication. This includes set values such as ejector H1-H2 thresholds, hysteresis and permitted leakage, device information (HW-FW version, designations, current voltage values), status values and condition monitoring, error evaluation as well as control of all ejectors, IO-Link devices and reading of DI modules.

The precise meanings of the data and functions are further explained in the section “Functions of the Compact Terminal and the Ejectors.”

Special Features of PROFINET:

The following PROFINET query parameters are available for querying the device parameters via PROFINET:

- API = 0 (constant)
- Slot = 0 (constant)
- Subslot = 1 (constant)
- Index: This is the index of the parameters as listed below
- Data length = length of the parameter in bytes

Special Features of EtherCAT:

For EtherCAT, the parameters are transferred via the “CANopen over EtherCAT” (CoE) service. All parameters are located in the “Manufacturer” object range from 0x2000 – 0x5FFF.

This means that all index values in the parameter data tables must be added with an offset of 0x2000 in order to read or write the respective object.

According to the CANopen specification, the subindex 0 of a parameter of the array returns the length of the array. It is possible to tell whether a parameter is an array in the “Length” column of the following table (if length > 1).

Special Features of Ethernet/IP:

To access the parameter data via Ethernet/IP, an object (also known as a class), an instance and an attribute must be specified in the object-based “Common Industrial Protocol” (CIP).

The 0xA2 object can be used to read—and write, depending on access rights—all parameter data with the following services:

- 0x0E: Get_Attribute_Single
- 0x10: Set_Attribute_Single

The instance corresponds to the offset from the parameter data table.

Attribute 5 causes the values of the parameter data to be read or, if permission is granted, written as well.

In addition to attribute 5, the following additional attributes can be queried in object A2h per instance (= parameter index):

#	Name	Access	Type	Description
1	Name	Get	SHORT_STRING	Parameter name
2	Data type	Get	Array of USINT	BOOL (0), SINT8 (1), SINT16 (2), SINT32 (3), UINT8 (4), UINT16 (5), UINT32 (6), CHAR (7), ENUM (8), BITS8 (9), BITS16 (10), BITS32 (11), OCTET (12)
3	Number of elements	Get	USINT	Number of elements of the specified data type
4	Access rights of the instance	Get	Array of USINT	Specifies the access rights for the instance: Bit 0: 1=read rights Bit 1: 1=write rights
5	Value	Get/ Set	Determined by attributes #2, #3 and #9	Instance value
6	Max. value	Get	Determined by attributes #2, #3 and #9	Maximum value permitted
7	Min. value	Get	Determined by attributes #2, #3 and #9	Minimum value permitted
8	Default value	Get	Determined by attributes #2, #3 and #9	Default parameter value
9	Number of sub-elements	Get	Array of UINT8	Number of sub-elements, default value is 1

Application Process Data Parameters

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
10	0x000A	0	Device status [*part of processdata*]	uint8	1	ro
11	0x000B	0	Ejectors status [*part of processdata*]	unit8	16	ro
12	0x000C	0	Supply pressure [*part of processdata*]	uint8	1	rw
13	0x000D	0	Ejectors control [*part of processdata*]	uint8	16	rw
130	0x0082	16	Error in control unit [*part of processdata*]	uint8	1	ro
146	0x0092	16	Condition monitoring of control unit [*part of processdata*]	uint8	1	ro
146	0x0092	0 to 15	Condition monitoring of ejectors [*part of processdata*]	uint8	16	ro

Device Data Parameters

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
16	0x0010	0	Device vendor name	char	32	ro
17	0x0011	0	Vendor text	char	32	ro
18	0x0012	0	Product name	char	32	ro
20	0x0014	0	Product text	char	32	ro
21	0x0015	0	Device serial number	char	9	ro
22	0x0016	0	HW revision	char	3	ro
23	0x0017	0	FW revision	char	5	ro

24	0x0018	0	Application-specific tag	char	1 … 32	rw
240	0x00F0	0	Unique device ID	uint8	20	ro
241	0x00F1	0	Device features	uint8	11	ro
242	0x00F2	0	Equipment identification	char	1 to 64	rw
246	0x00F6	0	Geolocation	char	1 to 64	rw
247	0x00F7	0	GSD web link	char	1 to 64	rw
248	0x00F8	0	NFC web link	char	1 to 64	rw
249	0x00F9	0	Storage location	char	1 to 32	rw
250	0x00FA	0	Article number	char	14	ro
251	0x00FB	0	Article revision	char	2	ro
252	0x00FC	0	Production date	char	10	ro
253	0x00FD	0	Installation Date	char	1 to 16	rw
254	0x00FE	0	System configuration	uint8	64	ro
354	0x062	0	Current system configuration	char	128	ro

Device Settings

Offset		***Index***	***Description***	***Type***	***Length [bytes]***	***R/W***
(Dec)	***(Hex)***					
2	0x0002	0	System command	uint8	1	wo
90	0x005A	0	Extended device locks	uint8	1	wr
91	0x005B	0	PIN code	uint16	1	rw
100	0x0064	0 … 15	Setpoint H1 for ejectors #1 to #16	uint16	16 x 2	rw
101	0x0065	0 … 15	Hysteresis h1 for ejectors #1 to #16	uint16	16 x 2	rw
102	0x0066	0 … 15	Setpoint H2 for ejectors #1 to #16	uint16	16 x 2	rw
103	0x0067	0 … 15	Hysteresis h2 for ejectors #1 to #16	uint16	16 x 2	rw
106	0x006A	0 … 15	Duration automatic blow for ejectors #1 to #16	uint16	16 x 2	rw
107	0x006B	0 … 15	Permissible evacuation time for ejectors #1 to #16	uint16	16 x 2	rw
108	0x006C	0 … 15	Permissible leakage rate for ejectors #1 to #16	uint16	16 x 2	rw
109	0x006D	0 … 15	Control mode for ejectors #1 to #16	uint8	16 x 1	rw
110	0x006E	0 … 15	Blow mode for ejectors #1 to #16	uint8	16 x 1	rw
111	0x006F	0 ... 3	Master 0 actuator current	uint16	4 x 2	ro
112	0x0070	0 _ 3	Master 1 actuator current	uint16	4 x 2	ro

Device Monitoring Parameters

Offset		***Index***	***Description***	***Type***	***Length [bytes]***	***R/W***
(Dec)	***(Hex)***					
66	0x0042	0	Primary supply voltage	uint16	2	ro
66	0x0042	1	Primary supply voltage, min.	uint16	2	ro
66	0x0042	2	Primary supply voltage, max.	uint16	2	ro
67	0x0043	0	Auxiliary supply voltage	uint16	2	ro
67	0x0043	1	Auxiliary supply voltage, min.	uint16	2	ro
67	0x0043	2	Auxiliary supply voltage, max.	uint16	2	ro
148	0x0094	0 … 15	Evacuation time t0 for ejectors #1 to #16	uint16	16 x 2	ro

149	0x0095	0 … 15	Evacuation time t1 for ejectors #1 to #16	uint16	16 x 2	ro
156	0x009C	0 … 15	Air consumption per cycle for ejectors #1 to #16	uint32	16 x 4	ro
156	0x009C	16	Air consumption per cycle of all ejectors	uint32	4	ro
160	0x00A0	0 … 15	Leakage rate for ejectors #1 to #16	uint16	16 x 2	ro
161	0x00A1	0 … 15	Free-flow vacuum for ejectors #1 to #16	uint16	16 x 2	ro
164	0x00A4	0 … 15	Max. vacuum reached in cycle for ejectors #1 to #16	uint16	16 x 2	ro
515	0x0203	0 … 15	System vacuum for ejectors #1 to #16	uint16	16 x 2	ro
11000 … 11015	0x2AF8 … 0x2B07	0	Ejector extended values #1 to #16	uint16	16 x 5	ro

Device Diagnostics Parameters

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
10	0x000A	0	Device status [part of processdata]	uint8	1	ro
130	0x0082	0 … 15	Errors in ejectors #1 to #16	uint8	16 x 1	ro
130	0x0082	16	CU active errors [part of processdata] (active errors of control unit)	uint8	1	ro
138	0x008A	0	Extended device status – event category	uint16	1	ro
138	0x008A	1	Extended device status – event code	uint16	1	ro
139	0x008B	0	NFC Status	uint8	1	ro
32	0x0020	0	IO-Link communication status	uint8	2	ro
140	0x008C	0 … 15	Vacuum-on counter for ejectors #1 to #16	uint32	16 x 4	ro
141	0x008D	0 … 15	Valve operating counter for ejectors #1 to #16	uint32	16 x 4	ro
143	0x008F	0 … 15	Erasable vacuum-on counter for ejectors #1 to #16	uint32	16 x 4	ro
144	0x0090	0 … 15	Erasable valve operating counter for ejectors #1 to #16	uint32	16 x 4	ro
146	0x0092	0 … 15	Condition monitoring of ejectors #1 to #16	uint8	16 x 1	ro
146	0x0092	16	CU condition monitoring [part of processdata] (condition monitoring of control unit)	uint8	1	ro

The information in the table below refers to the IO-Link master 1 Port X1. For additional IO-Link masters or ports, the following offset addresses must be added:

Offset for Additional Ports (Dec)

	Port X1	Port X2	Port X3	Port X4
IO-Link master 1	+ 0	+ 10	+ 20	+ 30
IO-Link master 2	+ 50	+ 60	+ 70	+ 80

Example: “Event Instance” has the following addresses at the corresponding ports (Dec)

	Port X1	Port X2	Port X3	Port X4
IO-Link master 1	10700	10710	10720	10730
IO-Link master 2	10750	10760	10770	10780

“Parameters – IO-Link Master: Events”

Offset		*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*				
10700	0x296D	Event-Instance	uint8	1	ro
10701	0x296E	Event-Mode	uint8	1	ro
10702	0x296F	Event-Type	uint8	1	ro
10703	0x2970	Event-Origin	uint8	1	ro
10704	0x2971	Event-Code	uint8	1	ro
10705	0x2972	Event-Number	uint8	1	ro

Parameters – IO-Link Master: Device Process Data

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
10600	0x2968	—	Master 1 process data input	uint8	128	R
10601	0x2969	—	Master 2 process data input	uint8	128	R
10602	0x296A	—	Master 1 process data output	uint8	128	RW
10603	0x296B	—	Master 2 process data output	uint8	128	RW

Parameters – IO-Link Master: ISDU Parameter Management

The information in the table below refers to the IO-Link master 1 Port X1. For additional IO-Link masters or ports, the following offset addresses must be added:

Offset for Additional Ports (Dec)

	Port X1	**Port X2**	**Port X3**	**Port X4**
IO-Link master 1	+ 0	+ 20	+ 40	+ 60
IO-Link master 2	+ 100	+ 120	+ 140	+ 160

Example: “Request: Index” has the following addresses at the corresponding ports (Dec)

	Port X1	**Port X2**	**Port X3**	**Port X4**
IO-Link master 1	10200	10220	10240	10260
IO-Link master 2	10300	10320	10340	10360

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
10200	0x27D8		Request: Index	uint16	2	wo
10201	0x27D9		Request: Subindex	uint8	1	wo
10202	0x27DA		Request: RW	bool	1	wo
10203	0x27DB		Request: Length	uint8	1	wo
10204	0x27DC		Request: Data	uint8	232	wo
10205	0x27DD		Request: Trigger	bool	1	wo
10206	0x27DE		Request: Error	uint8	1	ro
10207	0x27DF		Response Result	bool	1	ro
10208	0x27E0		Response: Error Code	uint8	1	ro
10209	0x27E1		Response: Additional Error Code	uint8	1	ro
10210	0x27E2		Response: Error	uint8	1	ro

10211	0x27E3		Response: Trigger	uint8	1	wo
10212	0x27E4		Response: Length	uint8	1	ro
10213	0x27E5		Response: Data	uint8	232	ro

Parameters – IO-Link Master: Port Configuration

The information in the table below refers to the IO-Link master 1 Port X1. For additional IO-Link masters or ports, the following offset addresses must be added:

Offset for Additional Ports (Dec)

	Port X1	Port X2	Port X3	Port X4
IO-Link master 1	+ 0	+ 20	+ 40	+ 60
IO-Link master 2	+ 100	+ 120	+ 140	+ 160

Example: "Process Data Input Length" has the following addresses at the corresponding ports (Dec)

	Port X1	Port X2	Port X3	Port X4
IO-Link master 1	10400	10420	10440	10460
IO-Link master 2	10500	10520	10540	10560

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
10400	0x28A0		Process data input length	uint8	1	R/W
10401	0x28A1		Process data input offset	uint8	1	R/W
10402	0x28A2		Process data output length	uint8	1	R/W
10403	0x28A3		Process data output offset	uint8	1	R/W
10404	0x28A4		Operating mode	uint8	1	R/W
10405	0x28A5		Port cycle	uint8	1	R/W
10406	0x28A6		Cycle time	uint8	1	R/W
10407	0x28A7		Vendor ID	uint16	2	R/W
10408	0x28A8		Device ID	uint32	4	R/W
10409	0x28A9		Serial number	uint8	16	R/W
10410	0x28AA		Inspection level	uint8	1	R/W
10411	0x28AB		Data storage activation	uint8	1	R/W
10412	0x28AC		Data storage download enable	uint8	1	R/W
10413	0x28AD		Data storage upload enable	uint8	1	R/W
10414	0x28AE		Power on/off (switch L+ (Pin 1))	bool	1	R/W
10415	0x28AF		Auxiliary power on/off (switch UA (Pin 2))	bool	1	R/W

Parameters – DI Module:

Offset		*Index*	*Description*	*Type*	*Length [bytes]*	*R/W*
(Dec)	*(Hex)*					
34	0x0022	0	Digital input status	uint8	8	ro

See also

Parameter data [▶ 44]

5.4 Interface NFC

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

The device functions as a passive NFC tag that can be read or written to by a reading device such as a smartphone or tablet with NFC activated. Read access to the device via NFC is also possible when the supply voltage is not connected.

Web link **https://myproduct.schmalz.com/#/**

There are two options for communicating via NFC:

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

6 Component Functions

6.1 Overview of Functions

The SCTSi primarily consists of the bus module, the IO-Link class B master and between 1 and 16 ejectors. Depending on the function, it refers to the whole terminal, the bus module or the additional modules (IO-Link master, DI module or ejector).

Device Status of the Whole Terminal SCTSi

Many parameters and values are measured with monitoring and diagnostic functions of the compact terminal SCTSi (bus module and additional modules). These values are made available via the process data and parameter data and are used for further diagnostics.

Device Monitoring (Determination of the Required System Parameters)

- Current terminal operating voltages
- Ejector evacuation times
- Ejector air consumption data
- Ejector leakage data
- Ejector dynamic pressure data (free-flow vacuum)
- Ejector vacuum data (maximum or current)

Device Diagnostics:

- Terminal status via status traffic light (device status)
- Terminal status via extended status signals (extended device status)
- Condition diagnostics of the bus module and ejectors (condition monitoring control unit / condition monitoring ejector)
- Error status of the bus module and ejectors (CU active errors / ejector errors)
- Display of IO-Link events (IO-Link events from the IO-Link master and connected IO-Link devices on the master)

Bus Module Functions (Control Unit)

The SCTSi bus module has the following general functions, independent of the additional modules:

Device data:

- Device identification
- System commands
- Access rights
- User-specific localization

Ejector SCPSt Functions

- Switching points for control and component checks
- Air saving functions
- Blow-off functions
- Setting for the permitted evacuation time t1
- Setting for the permitted leakage
- Permanent and erasable counters for the suction cycles and switching frequency of the valves
- Manual operation
- Ejector control (suction and release)

- Display of the ejector status (status of the vacuum level)

The functions relate to an ejector SCTSi and apply to each individual ejector, regardless of the number of installed ejectors.

IO-Link Master Functions

- Process data management (IO-Link device process data is copied to the Ethernet process data)
- Port configuration
- IO-Link ISDU – data management (read/write parameter data of IO-Link devices)
- IO-Link event handling

DI Module Functions

- Process data management (input status is copied to the Ethernet process data)

Note about replacing the device: All modifiable parameter data (e.g. switching point settings) is saved in the bus module. When replacing an ejector, the previous data is loaded to the new ejector.

6.2 Bus Module Functions

6.2.1 System Commands

System commands are predefined processes for triggering specific functions and are described below. They are controlled by writing parameter "System command" 0x0002 with a predefined value.

Offset parameter	**2 (0x0002)**
Description	System command – triggers special features of the device
Index	-
Data type	uint8
Length	1 bytes
Access	Write only
Value range	0x82: Reset device parameters to factory defaults 0xA5: Calibrate vacuum sensors of all ejectors 0xA7: Reset erasable counters in all ejectors 0xA8: Reset voltage min./max.
Default value	-
Unit	-
EEPROM	No

Reset to Factory Settings

The system command "Reset device parameters to factory defaults" 0x82 is used to reset all the setting parameters to their factory settings.

Counter statuses, the zero-point adjustment of the sensor and the maximum and minimum values of the measurements are not affected by this function.

Calibrating the Vacuum Sensor

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

Via IO-Link, the sensor zero-point adjustment command is executed using the parameter "System command" 0x0002 with the value 0xA5 for Calibrate vacuum sensor.

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

The violation of the upper permissible limits are reported by the relevant parameter (see the data dictionary).

Resetting Counters (Reset Erasable Counters)

System command 0xA7 is used to delete the two erasable counters in each ejector.

Reset Maximum and Minimum Values for Supply Voltage

System command 0xA8 (reset voltages min/max) is used to delete the minimum and maximum values of the two supply voltages for the sensor and actuator.

6.2.2 Device Identification

The Industrial Ethernet protocol provides a range of identification data that can be used to uniquely identify a specific device. All of these parameters are ASCII character strings that adapt their length to the relevant content.

The following parameters can be called up:

- Manufacturer's name and website (Device Vendor Name)
- Supplier text (Vendor Text)
- Product name and product text (Product Name / Product Text)
- Serial number (Serial Number)
- Version status of the hardware and firmware (Hardware Revision)
- Unique device ID and device characteristics (Unique Device ID)
- Part number and development status (Article number, Article revision)
- Date of manufacture (Production date)
- System configuration (System Configuration)
- Device ID
- User ID (Equipment identification)
- Web link for NFC app and device description file (GSD Web Link, NFC Web Link)

Parameter offset	**16 (0x0010)**	**17 (0x0011)**	**18 (0x0012)**
Description	Device vendor name	Vendor text	Product name
Index	-	-	-
Data type	char		
Length	32 byte		

Access	Read only
Value range	-
Default value	-
Unit	-
EEPROM	Yes

Parameter offset	**20 (0x0014)**	**21 (0x0015)**	**22 (0x0016)**
Description	Product text	Device serial number	HW revision
Index	-		
Data type	char		
Length	32 bytes	9 bytes	3 bytes
Access	Read only		
Value range	-		
Default value	-		
Unit	-		
EEPROM	Yes		

Parameter offset	**250 (0x00FA)**	**251 (0x00FB)**	**252 (0x00FC)**
Description	Article number	Article revision	Production date
Index	-		
Data type	char		
Length	14 bytes	2 bytes	10 bytes
Access	Read only		
Value range	-		
Default value	-		
Unit	-		
EEPROM	Yes		

Parameter offset	**23 (0x0017)**	**24 (0x0018)**	**240 (0x00F0)**
Description	FW revision	Application-specific tag	Unique device ID
Index	-		
Data type	char	char	uint8
Length	5 bytes	32 bytes	20 bytes
Access	Read only	Read/write	Read only
Value range	-		
Default value	-	***	-
Unit	-		
EEPROM	Yes		

Parameter offset	**241 (0x00F1)**	**242 (0x00F2)**	**354 (0x0162)**
Description	Device features	Equipment identification	Current system configuration
Index	-		
Data type	uint8	char	
Length	11 bytes	64 bytes	128 bytes
Access	Read only	Read/write	Read only
Value range	-		String #1: Bus module; Strings #2 – #17: Ejectors; Strings #18 – #23: IOL master and DI module
Default value	-	***	-
Unit	-		
EEPROM	Yes		-

Parameter offset	**247 (0x00F7)**	**248 (0x00F8)**	**254 (0x00FE)**
Description	GSD web link	NFC web link	System configuration (at delivery)
Index	-		
Data type	char		uint8
Length	64 bytes		
Access	Read/write		Read only
Value range	-		See 3.1.1 “Ejector Designation”
Default value	***	https://myproduct.schmalz.com/#/	-
Unit	-		
EEPROM	Yes		

6.2.3 User-Specific Localization

The following parameters are available when saving user-specific information:

- Identification of the installation location
- Identification of the storage location
- Equipment labeling from the circuit diagram
- Installation date
- Geo-location

The parameters are ASCII character strings with the maximum length given in section 5.3. Parameter data. They can also be used for other purposes if necessary.

The NFC web link parameter is a special feature. This parameter must include a valid web address beginning with http:// or https:// and is automatically used as a web address for NFC read accesses. As a result, read accesses from smart phones or tablets are rerouted e.g. to an address in the company's own intranet or a local server.

Offset parameter	**249 (0x00F9)**	**253 (0x00FD)**	**247 (0x00F7)**
Description	Storage location	Installation date	GSD web link
Index	-		
Data type	char		
Length	32 bytes	16 bytes	64 bytes
Access	Read/write		
Value range	-		
Default value	***		
Unit	-		
EEPROM	Yes		

Offset parameter	**246 (0x00F6)**	**241 (0x00F1)**	**242 (0x00F2)**
Description	Geo-location	Device Features	Equipment identification
Index	-		
Data type	char	uint8	char
Length	64 bytes	11 bytes	64 bytes
Access	Read/write	Read only	Read/write
Value range	-		
Default value	***	-	***
Unit	-		
EEPROM	Yes		

6.2.4 Preventing NFC Access

In the parameter “Extended device access locks” 0x005A, there is an option to completely prevent NFC access or limit it to read-only function.

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

The firmware of the ejectors at the time of delivery is stored on the bus module. When the device is switched on, the existing ejector firmware is updated by the bus module if the ejector firmware corresponds to an older version (local firmware update). This update can be disabled via the extended device access locks parameter.

Offset parameter	**90 (0x005A)**
Description	Extended device locks
Index	-
Data type	uint8

Length	1 bytes
Access	Read/write
Value range	Bit 0: NFC write lock Bit 1: NFC disable Bit 2: local ejector firmware update locked Bit 3: local user interface locked (manual mode in ejectors locked)
Default value	-
Unit	-
EEPROM	Yes

6.2.5 Access Rights: PIN Code for NFC Write Protection

The writing of changed parameters via NFC can be controlled using a separate "PIN code NFC" 0x005B. When delivered, the PIN code is **000** and a lock is therefore not active.

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

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

6.3 Compact Terminal Device Status

Many parameters and values are measured with the monitoring and diagnostic functions of the compact terminal (bus module and additional modules). These values are made available via the process data and parameter data and are used for further diagnostics.

Device monitoring (determination of the required system parameters):

- Current terminal operating voltages
- Ejector evacuation times
- Ejector air consumption data
- Ejector leakage data
- Ejector dynamic pressure data (free-flow vacuum)
- Ejector vacuum data (maximum or current)

Device Diagnostics:

- Terminal status via status traffic light (device status)
- Terminal status via extended status signals (extended device status)
- Condition diagnostics of the bus module and ejectors (condition monitoring control unit / condition monitoring ejector)
- Error status of the bus module and ejectors (CU active errors / ejector errors)
- Display of IO-Link events (IO-Link events of connected IO-Link devices on the master)

The data collected using this function can be used for energy and process control (EPC) of the system. Energy and process control (EPC) is divided into three process-oriented 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

6.3.1 Device Monitoring (Determination of the Required System Parameters)

The following system parameters are used for the system monitoring functions and are made available to the user.

The values for the individual ejectors are constantly redetermined for each suction cycle.

Current Operating Voltage

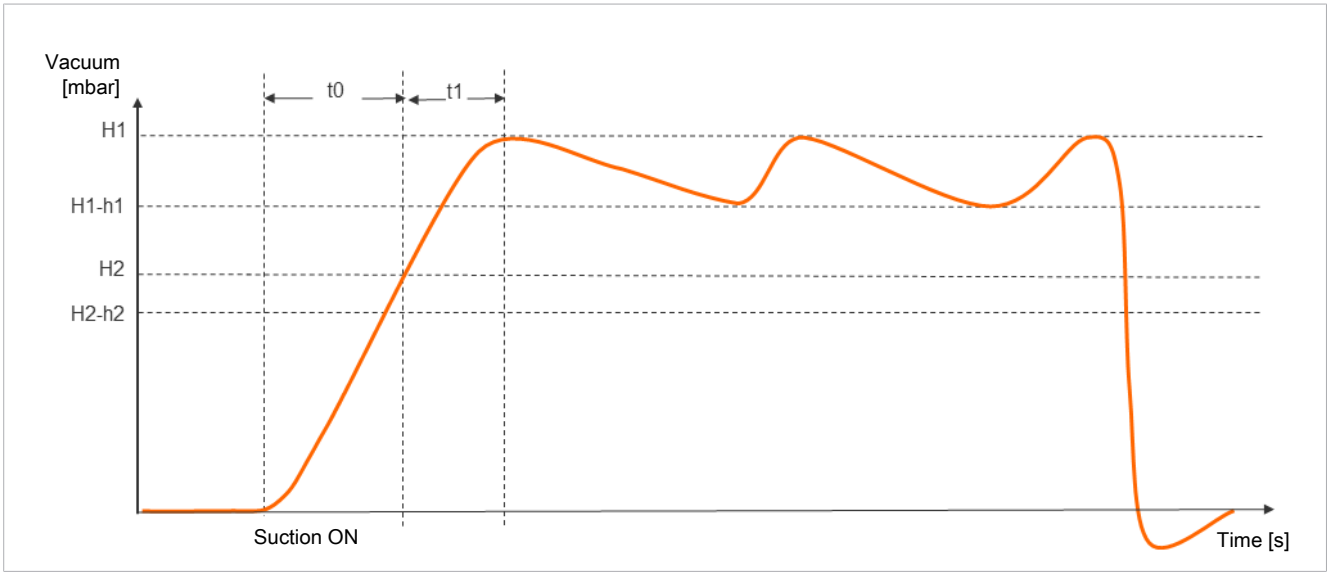
The operating voltages U_S and U_A that are currently applied on the device are measured.

Parameter offset	**66 (0x0042)**	**67 (0x0043)**
Description	Primary supply voltage (supply voltage for sensor)	Auxiliary supply voltage (supply voltage for actuator)
Index	0: actual value as measured by the device 1: min. value since last power-up 2: max. value since last power-up	
Data type	uint16	
Length	6 byte	
Access	read only	
Default value	-	
Unit	0.1 V	
EEPROM	no	

In addition, the maximum and minimum values for the U_S and U_A operating voltages that were measured since the last activation are logged.

The maximum and minimum values can be reset during operation using the appropriate system command.

Measuring the Evacuation Time t0 and t1



The evacuation time t0 is defined as the time (in ms) from the start of a suction cycle, which is started by the “Suction ON” command, until switching threshold H2 is reached.

The evacuation time t1 is defined as the time (in ms) from when switching threshold H2 is reached until switching threshold H1 is reached.

Offset parameter	**148 (0x0094)**	**149 (0x0095)**
Description	Evacuation time t0 for ejectors	Evacuation time t1 for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16	
Data type	uint16	
Length	32 bytes	
Access	Read only	
Value range	0 … 65535	
Default value	-	
Unit	ms	
EEPROM	No	

Measuring the Air Consumption

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

The supply pressure process data can be used to notify the ejector of the actual system pressure. If it is not explicitly defined (values > 0 mbar), a measurement result is not provided.

Offset parameter	**156 (0x009C)**
Description	Air consumption per cycle for ejectors
Index	0 to 15: Air consumption per cycle for ejectors #1 to #16 16: Air consumption per cycle of all ejectors
Data type	uint32
Length	68 bytes
Access	Read only
Value range	0 to 15: 0 to 65535 16: 0 to 1048560
Default value	-
Unit	0.1 Nl
EEPROM	No

Measuring Leakage

This function measures the leakage “Leakage rate for ejectors” 0x00A0 (represented as the vacuum drop per time unit in mbar/s) after the air saving function interrupts the suction because switching point H1 was reached.

Offset parameter	**160 (0x00A0)**
Description	Leakage rate for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint16

Length	32 bytes
Access	Read only
Value range	0 … 8000
Default value	-
Unit	mbar/s
EEPROM	No

Measuring Dynamic Pressure

The system vacuum achieved during unobstructed suction is measured using parameter “Free-flow vacuum” 0x00A1. The duration of the measurement is approx. 1 second. Thus evaluation of a valid dynamic pressure value requires at least one second of unobstructed suction after the suction cycle has commenced. The suction point must not be occupied by a component at this time.

Measured values below 5 mbar or above the switching point H1 are not regarded as valid dynamic pressure measurements and are rejected. The result of the last valid measurement is retained.

Measured values above the switching point (H2 - h2) but simultaneously lower than switching point H1 result in a condition monitoring event.

Offset parameter	**161 (0x00A1)**
Description	Free-flow vacuum for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint16
Length	32 bytes
Access	Read only
Value range	0 … 999
Default value	-
Unit	mbar
EEPROM	No

Maximum Vacuum Reached

In each suction cycle, the maximum system vacuum level reached is determined and made available as the parameter “Max. reached vacuum in cycle for ejector” 0x00A4.

Offset parameter	**164 (0x00A4)**
Description	Max. vacuum reached in cycle for ejector
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint16
Length	32 bytes
Access	Read only
Value range	0 … 999
Default value	-
Unit	mbar
EEPROM	No

Vacuum Value of the Ejectors

The parameter "System vacuum for ejectors" 0x0203 is used to display the vacuum currently applied for the individual ejectors.

Offset parameter	**515 (0x0203)**
Description	System vacuum for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint16
Length	32 bytes
Access	Read only
Value range	0 … 999
Default value	-
Unit	mbar
EEPROM	No

Extended Ejector Data

In these parameters 0x2AF8 to 0x2B07, aggregated device data for each ejector can be displayed. The individual values can each be read separately via separate parameters (see above).

Offset parameter	**11000 (0x2AF8) to 11015 (0x2B07)**
Description	Ejector extended values #1 … #16
Byte	1 to 10
Data type	uint16
Length	10 bytes
Access	Read only
Value range	Byte 0:1: System vacuum (in mbar) Byte 2:3: Air consumption (in l/min) Byte 4:5: Leakage of last cycle (in mbar/s) Byte 6:7: Evacuation time T1 (in ms) Byte 8:9: Last free flow vacuum (in mbar)
Default value	-
Unit	
EEPROM	No

6.3.2 Device Diagnostics

Device Status (Process Data)

The overall status of the system is displayed as a traffic light in the ISDU parameters. All warnings and errors are used to determine the status shown here. The status of the device is displayed in 4 levels.

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

Parameter 0x000A	Status	Description
Device status	00 (green)	Device is operating without any errors (Device is operating properly)
	01 (yellow)	Maintenance or adaptation of settings required (Maintenance required)
	10 (orange)	Device is operating outside the permissible specification (Out of Spec)
	11 (red)	Error – safe operation within the operating limits is no longer ensured (Error)

Extended System Status

The category of the pending event code and the current event code itself is displayed.

Extended device status 0x008A, event category

Parameter	138 (0x008A)
Description	Extended device status – event category
Byte	1+2: Event category of current device status
Access	Read only
Value range	0x10: Device is operating properly 0x21: Warning, low 0x22: Warning, high 0x41: Critical condition, low 0x42: Critical condition, high 0x81: Defect/fault, low 0x82: Defect/fault, high

Extended device status 0x008A, event code

Parameter	138 ()		
Description	Extended Device Status – Event code		
Byte	3+4: Event category of current device status		
Data type	uint16		
Length	2 bytes		
Access	Read only		
Value range	**Event Code** 0x5100 0x5110 0x5112	**Event Name** Primary supply voltage (US) too low Primary supply voltage (US) too high Secondary supply voltage (UA) too low	**Status Category** Critical condition, high Critical condition, high Critical condition, high

	0x1812	Secondary supply voltage (UA) too high	Critical condition, high
	0x1802	Input pressure too high (> 6.3 bar) or too low (< 1.9 bar)	Critical condition, high
	0x1811	Internal error, user data corrupted	Defect/fault, high
	0x1000	Internal error, bus fault	Defect/fault, high
	0x8C01	Manual mode is active in at least one ejector	Warning, low
	0x180C	Condition monitoring: primary supply voltage US outside of operating range	Warning, high
	0x180D	Condition monitoring: secondary supply voltage outside of operating range	Warning, high
	0x180E	Condition Monitoring: supply pressure outside of operating range (3.5 to 5 bar)	Warning, high
	0x8C20 to 8C2F	Calibration fail, ejectors #1 to #16	Defect/fault, low
	0x8D00 to 8D0F	Measurement range overrun, ejectors #1 to #16	Defect/fault, low Warning, high
	0x8D10 to 8D1F	Valve protection active, ejectors #1 to #16	Warning, low
	0x8D20 to 8D2F	Evacuation time t1 is greater than limit, ejectors #1 to #16	Warning, low
	0x8D30 to 8D3F	Leakage rate is greater than limit, ejectors #1 to #16	Warning, high
	0x8D40 to 8D4F	H1 was not reached, ejector #1 to #16	Warning, low
	0x8D50 to 8D5F	Free-flow vacuum level too high, ejector #1 to #16	
Default value	-		
Unit	-		
EEPROM	No		

More detailed error code descriptions, causes and remedies can be found in chapter 11.2.

Error Codes

The active error codes for the SCTSi are displayed using individual bits in the parameter “CU Active Errors” 0x0082.

Parameter	**130 (0x0082) + process data**
Description	Active errors of the control unit
Index	16
Data type	uint8
Length	1 bytes
Access	Read only
Value range	Bit 0 = internal error: data corruption Bit 1 = Internal error: bus fault Bit 2 = Primary voltage too low Bit 3 = Primary voltage too high Bit 4 = Secondary voltage too low Bit 5 = Secondary voltage too high Bit 6 = Supply pressure too low (< 1.9 bar) or too high (> 6.3 bar) Bit 7 = Error in one or more ejectors

Default value	0
Unit	-
EEPROM	No

Ejector Error Codes

The active error codes for the compact terminal and ejectors are displayed using individual bits in the parameter "Errors of ejector" 0x0082.

Parameter	**130 (0x0082)**
Description	Errors of ejector
Index	Index 0…15 corresponds to ejector #1…#16
Data type	uint8
Length	16 bytes
Access	Read only
Value range	Bit 0 = Measurement range overrun Bit 1 = Vacuum calibration failed Bit 2 = Configuration Error
Default value	0
Unit	-
EEPROM	No

More detailed error code descriptions, causes and remedies can be found in chapter 11.2.

Condition Monitoring [CM] (0x0092)

Offset parameter	**146 (0x0092)**
Description	Condition monitoring of ejectors #1 to #16
Index	Index 0 ...15 corresponds to ejector #1…#16
Data type	uint8
Length	16 bytes
Access	Read only
Value range	Byte 1 ...16: Bit 0 = Valve protection active Bit 1 = Evacuation time greater than limit Bit 2 = Leakage rate greater than limit Bit 3 = H1 not reached in suction cycle Bit 4 = Free flow vacuum too high Bit 5 = Manual mode active
Default value	0
Unit	–
EEPROM	no

Offset parameter	**146 (0x0092)**
Description	CU condition monitoring [part of processdata] (condition monitoring of control unit)

Index	16
Data type	uint8
Length	1 bytes
Access	Read only
Value range	Bit 0 = Primary voltage limit Bit 1 = Secondary voltage limit Bit 2 = Input pressure limit (3.5 ... 5 bar) Bit 3 = Warning in one or more ejectors
Default value	0
Unit	–
EEPROM	no

IO-Link communication status

This parameter is used to determine the current status of the IO-Link communication at the IO-Link master port.

Offset parameter	**32 (0x001F)**
Description	IO-Link communication status
Index	Index 0 ...1 corresponds to IO-Link master #1 ... #2
Data type	uint8
Length	2 bytes
Access	Read only
Value range	Bit 0 = IO-Link master status – Port X1 (0 = no IO-Link connection / 1 = IO-Link connection) Bit 1 = IO-Link master status – Port X2 (0 = no IO-Link connection / 1 = IO-Link connection) Bit 2 = IO-Link master status – Port X3 (0 = no IO-Link connection / 1 = IO-Link connection) Bit 3 = IO-Link master status – Port X4 (0 = no IO-Link connection / 1 = IO-Link connection)
Default value	–
Unit	–
EEPROM	no

IO-Link Master Events:

The following parameters can be used to detect, read and evaluate IO-Link events in accordance with the IO-Link specification of the IO-Link master(s) or IO-Link devices connected to them.

Note:

It is possible to display events of the IO-Link master in the Profinet variant directly via the diagnostic status within the integration in a SIEMENS controller via TIA portal without having to call up the following parameters individually.

Offset parameter	**10700 (0x29CC)** Refers to IO-Link master 1 – Port X1	**10701 (0x29CD)** Refers to IO-Link master 1 – Port X1
Description	**Event instance** Event trigger (particular source)	**Event mode** Event mode

Index	–	
Data type	uint8	
Length	1 bytes	
Access	Read only	
Value range	0x00 unknown 0x01 – 0x03 / 0x05 – 0x07 reserved 0x04 application	0x00 reserved 0x01 single-shot event 0x02 event disappears 0x03 event appears
Default value	0x00	
Unit	–	
EEPROM	–	

Offset parameter	**10702 (0x29CE)** Refers to IO-Link master 1 – Port X1	**10703 (0x29CF)** Refers to IO-Link master 1 – Port X1
Description	**Event type** Event category	**Event origin** Event source
Index	–	
Data type	uint8	
Length	1 bytes	
Access	Read only	
Value range	0x00 reserved 0x01 notification 0x02 warning 0x03 error	0x00 device (remote) 0x01 master (local)
Default value	0x00	
Unit	–	
EEPROM	–	

Offset parameter	**10704 (0x29D0)** Refers to IO-Link master 1 – Port X1	**10705 (0x29D1)** Refers to IO-Link master 1 – Port X1
Description	**Event code** Event source	**Event number** Evacuation time t1 for ejectors
Index	–	
Data type	uint16	uint8
Length	2 bytes	2 bytes
Access	Read only	
Value range	See “Extended Device Status – Event Code” --> 6.3.1 “Device Diagnostics”	0 … 65535
Default value	0x00	
Unit	–	
EEPROM	–	

NFC Status

This parameter is used to determine the current status of the NFC data transfer.

Offset parameter	**139 (0x008B)**
Description	NFC status
Index	-
Data type	uint8
Length	1 bytes
Access	Read only
Value range	0x00: data valid, write finished successfully 0x23: write failed: write access locked 0x30: write failed: parameter(s) out of range 0x41: write failed: parameter set inconsistent 0xA1: write failed: invalid authorization 0xA2: NFC not available 0xA3: write failed: invalid data structure 0xA5: write pending 0xA6: NFC internal error
Default value	-
Unit	-
EEPROM	no

Transferring Device Data with NFC

The reading distance is very short for NFC applications. If necessary, find the position of the NFC antenna in the reading device used.

✓ Use a suitable read/write device with activated NFC, such as a smartphone or tablet.

1. Align the read device as parallel to the top of the SCTSi as possible.
2. Position the antenna of the read device in the center of the SCTSi's antenna.

After setting a parameter, the power supply of the SCTSi must remain stable for at least 3 seconds, otherwise there may be a loss of data.

Access to the SCTSi parameters via NFC also works when the supply voltage is not connected.

6.3.3 Condition Monitoring [CM] (0x0092)

Condition monitoring events that occur during the suction cycle cause the system status indicator light to immediately switch from green to yellow. The specific event that caused this switch can be seen in the Condition Monitoring parameter.

Condition monitoring for the ejectors describes events that 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 excessive dynamic pressure, is initially deleted when the device is switched on and is updated when a dynamic pressure value is detected again.

The condition monitoring events for the bus module are constantly updated independently of the suction cycle and reflect the current values for the supply voltages and system pressure.

The measurement values for condition monitoring – the evacuation times t0 and t1 as well as the leakage range – are reset at the start of the suction cycle and updated at the point in time when they can be measured.

CM of the Control Unit

Parameter	**146 (0x0092)**
Description	Condition monitoring of control unit
Index	16
Data type	uint8
Length	1 bytes
Access	Read only
Value range	Bit 0 = Primary voltage limit Bit 1 = Secondary voltage limit Bit 2 = Input pressure limit (3.5 to 5 bar) Bit 3 = Warning in one or more ejectors
Default value	0
Unit	–
EEPROM	no

CM of the Ejectors

Parameter	**146 (0x0092)**
Description	Condition monitoring of ejector
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint8
Length	16 bytes
Access	Read only
Value range	Bit 0 = Valve protection active Bit 1 = Evacuation time greater than limit Bit 2 = Leakage rate greater than limit Bit 3 = H1 not reached in suction cycle Bit 4 = Free flow vacuum too high Bit 5 = Manual mode active
Default value	0
Unit	–
EEPROM	no

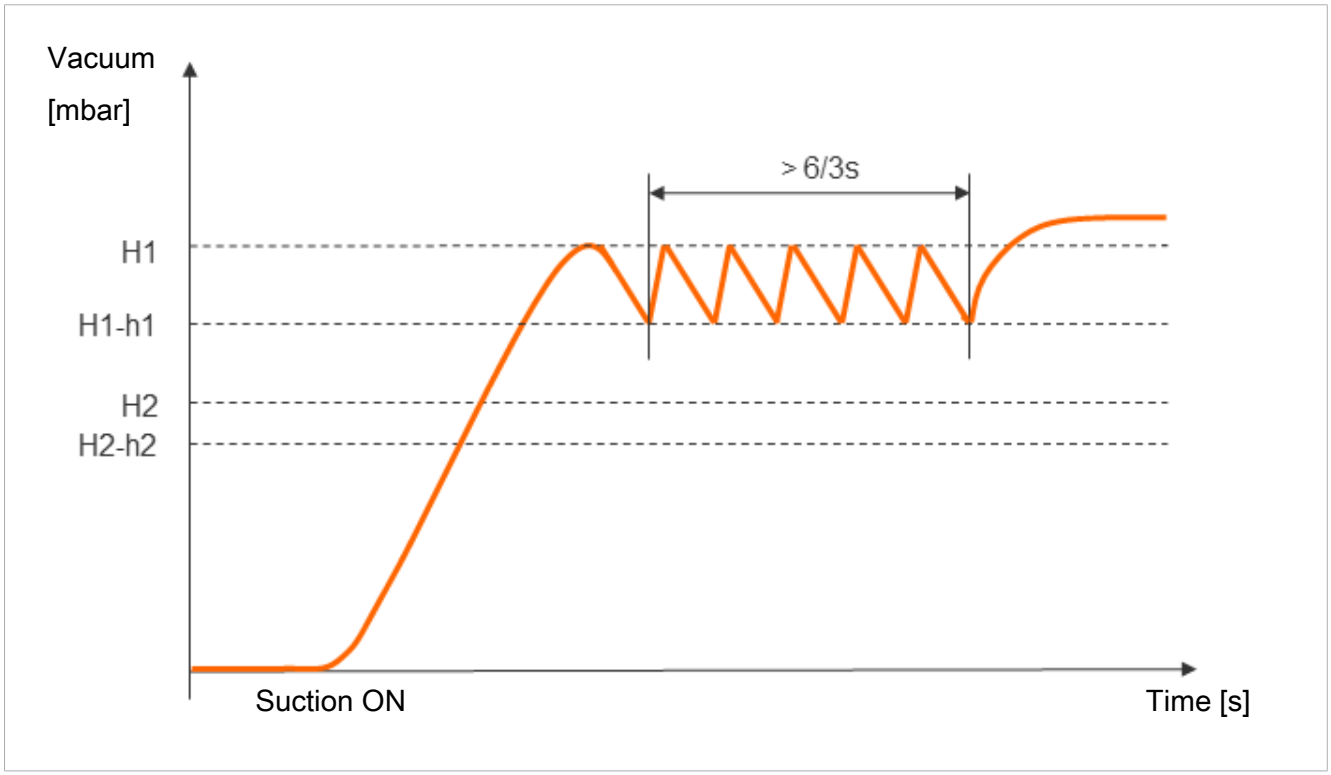
The CM data is displayed by EPC events in the process data.

Monitor 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 automatically deactivates the air saving function and switches to continuous suction if the switching frequency > 6/3 s (more than 6 switching operations within 3 seconds). In this case the ejector remains in the Suction state.

It also issues and warning and sets the corresponding condition monitoring bit.



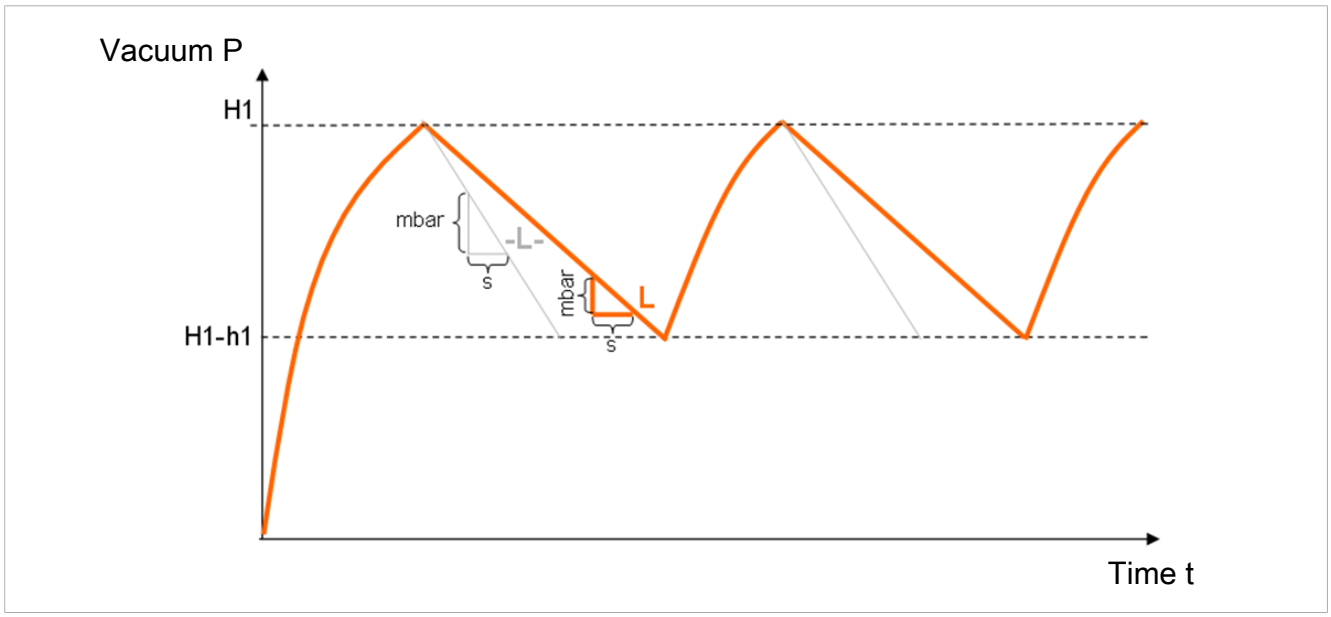
Monitor Evacuation Time

If the measured evacuation time t1 (from H2 to H1) exceeds the specified value, the Evacuation time longer than t-1 condition monitoring warning is triggered and the system status light switches to yellow.

Monitor Leakage

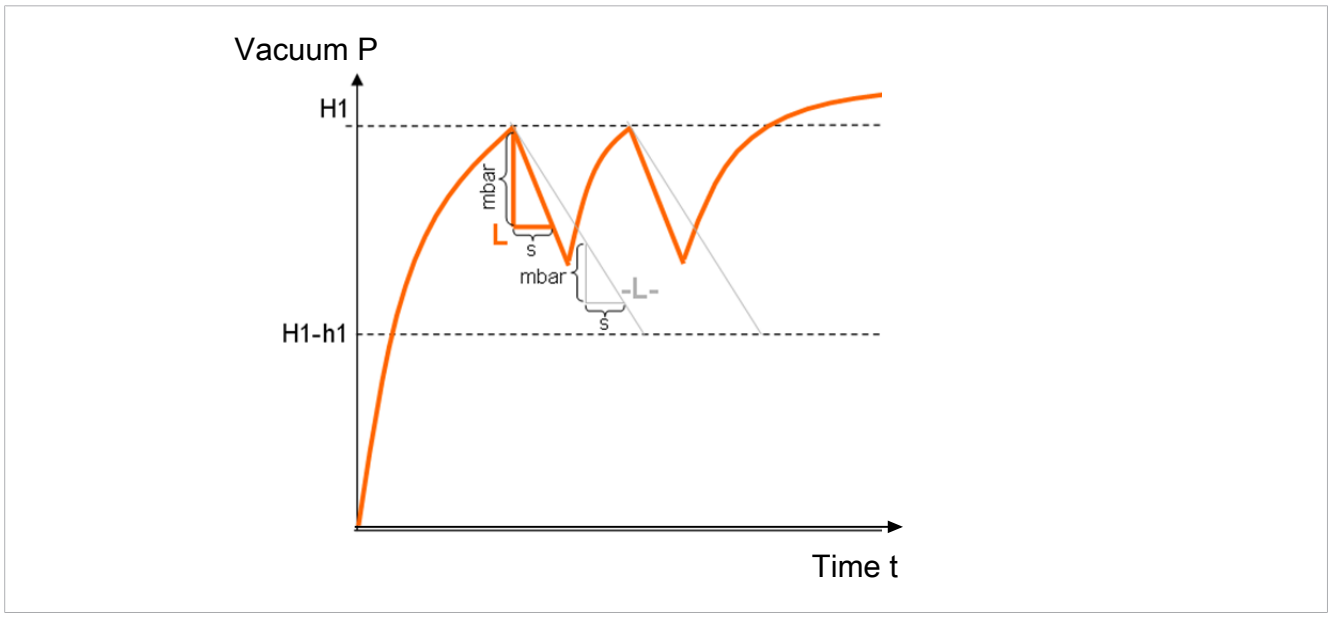
In control mode, the loss of vacuum within a certain period is monitored (mbar/s). There are two possible statuses.

Leakage L < Permitted Value



If the leakage is lower than the set value, the vacuum continues to fall until it reaches the switching point H1-h1. The ejector begins to suck 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



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.

Monitor Control Threshold

If the switching point 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.

Monitor Dynamic Pressure

If possible, a dynamic pressure measurement is taken at the start of every suction cycle (vacuum during unobstructed suction). The result of this measurement is compared to the 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 is triggered and the status light switches to yellow.

Monitor Supply Voltages

The device 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 device measures the level of the U_S and U_A supply voltages. The measured value can be read from the parameter data.

If the voltages are outside the valid range, the following status messages change:

- Device status
- Condition monitoring parameter
- Bus module LED flashes

If there are undervoltages, the valves are no longer activated and the ejectors return to their basic setting:

- NO ejectors switch to Suction mode.
- NC ejectors switch to Pneumatically OFF mode.

If the ejector is in manual mode, it exits manual mode.

A condition monitoring event is also generated If there is an overvoltage.

Evaluate System Pressure

The internal analysis functions on the device sometimes require the system pressure with which the components are operated. To make the results more precise, the actual pressure level can be communicated to the compact terminal via the process data. If no level is specified, the optimum operating pressure is assumed for the calculations.

6.4 Ejector/Vacuum Valve Functions

- Switching points for control and “parts present” checks
- Air saving functions
- Blow off Functions
- Setting for the permitted evacuation time t1
- Setting for the permitted leakage
- Permanent and erasable counters for the suction cycles and switching frequency of the pilot valves
- Control (suction and release)
- Display of the status (status of the vacuum level)

The functions relate to a mini compact terminal component and apply to each individual component, regardless of the number of installed components.

6.4.1 Switching Points (0x0064 to 0x0067)

Two separate switching points can be set for the ejector. Each switching point has an activation point and a corresponding hysteresis. The system vacuum is constantly compared to the set values for the switching points during operation.

An LED displays when the switching point for H2 is reached.

The set values for H2 must be lower than the values for H1. The exact configuration conditions can be found in the parameter descriptions.

Parameter	Description
H1 for ejector 1 ... 16	Control switching point
h1 for ejector 1 ... 16	Hysteresis of control switching point
H2 for ejector 1 ... 16	Switching point for component check
h2 for ejector 1 ... 16	Hysteresis of switching point for component check

Offset parameter	**100 (0x0064)**	**101 (0x0065)**
Description	Setpoint H1 for ejectors	Hysteresis h1 for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16	
Data type	uint16	
Length	32 bytes	
Access	Read/write	
Value range	998 >= H1 >= (H2+h1)	(H1-H2) >= h1 > 10
Default value	750	150
Unit	mbar	
EEPROM	Yes	

Offset parameter	**102 (0x0066)**	**103 (0x0067)**
Description	Setpoint H2 for ejectors	Hysteresis h2 for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16	
Data type	uint16	
Length	32 bytes	
Access	Read/write	
Value range	(H1-h1) >= H2 >= (h2+2)	(H2-2) >= h2 >= 10
Default value	550	10
Unit	mbar	
EEPROM	Yes	

System vacuum evaluation:

Once the system vacuum reaches the value for H2, the following responses are triggered:

- The process data bit for H2 is set.
- The H2 LED on the ejector’s display illuminates.

Once the system vacuum reaches the value for H1, the following responses are triggered:

- Depending on whether the air saving function is selected, vacuum generation is interrupted.
- The process data bit for H1 is set.

6.4.2 Control Functions (0x006D)

The ejector allows you to conserve compressed air or prevent a too powerful vacuum from being generated. Vacuum generation is interrupted once the configured switching point H1 is reached. If leakage causes the vacuum to fall below the hysteresis switching point (H1-h1), vacuum generation resumes.

Offset parameter	**109 (0x006D)**
Description	Control mode for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint8
Length	16 bytes
Access	Read/write
Value range	0x00 = control is not active, H1 in hysteresis mode 0x01 = control is not active, H1 in comparator mode 0x02 = control is active 0x03 = control is active with monitoring of leakage 0x04 = control is active, continuous sucking disabled 0x05 = control is active with monitoring of leakage, continuous sucking disabled
Default value	0x02 = control is active
Unit	-
EEPROM	Yes

The following control function operating modes can be chosen:

No Control (Continuous Suction), H1 in Hysteresis Mode

The ejector produces continuous suction with maximum power.

The switch point evaluation for H1 is operated in hysteresis mode (two-point mode).

The hysteresis mode is a threshold switch with hysteresis. When the measurement value increases, the switching point will be active when the switch-on threshold H1 is reached and remains on until it falls below the reset threshold H1 – h1. The following must always apply for switching thresholds and reset thresholds: H1 > h1. The hysteresis is therefore defined by the difference |H1 – h1|.

No Control (Continuous Suction), H1 in Comparator Mode

The ejector produces continuous suction with maximum power.

The switch point evaluation for H1 is operated in comparator mode (window mode).

In comparator mode, the switching point is active when the measurement value is between the upper window point H1 and the lower window point h1. Outside this window, the switching point is inactive. If necessary, a common switching hysteresis Hyx can be set, which symmetrically applies to both window points. For the parameters “Upper window point H1” and “Lower window point h1”, the following must always apply: H1 > h1.

Control

The ejector switches off vacuum generation when the switching point H1 is reached and switches it back on when the vacuum falls below the hysteresis point (H1-h1). The switch point 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 with Leak Monitoring

This operating mode is the same as the previous mode, with the addition that the leakage rate within the system is measured and compared to the configurable limit value.

If the actual leakage rate exceeds the limit value more than twice in succession, the control function is then deactivated and the ejector switches to continuous suction.

Control without Continuous Suction

This operating mode is the same as the "Control" operating mode but it does not switch to continuous suction when the valve switching frequency is exceeded (parameter value 0x04).

When the control shutoff is deactivated, the suction valve makes frequent adjustments. The component can be destroyed.

Control with Leakage Monitoring, without Continuous Suction

This operating mode is the same as the "Control function with leakage monitoring" operating mode, but the device does not switch to continuous suction when the permitted leakage is exceeded or when the valve switching frequency is exceeded (parameter value 0x05).

When the control shutoff is deactivated, the suction valve makes frequent adjustments. The component can be destroyed.

6.4.3 Blow-off Function

Parameter offset	**110 (0x006E)**
Description	Blow mode for ejectors
Index	Ejectors 1 to 16
Data type	uint8
Length	16 byte
Access	Read/write
Value range	0x00 = externally controlled blow-off 0x01 = internally controlled blow-off – time-dependent 0x02 = externally controlled blow-off – time-dependent
Default value	0
Unit	—
EEPROM	Yes

The following three blow-off modes are available:

Externally Controlled Blow-Off

The ejector switches to blow-off mode for as long as the signal for "Blow-off" mode is present.

Internally Time-Controlled Blow-Off

After the suction signal is switched off, the ejector switches to blow-off mode automatically for the set time. With this function, the blow off signal does not also have to be activated.

The internal time-controlled blow-off should not be used in conjunction with pulse ejectors (IMP variant).
This variant cannot blow off with pulse control. Therefore the suction state can no longer be left after it has been activated.

Externally Time-Controlled Blow-Off

The blow-off starts with the blow-off signal and is performed for the set time period. Applying the blow-off signal for a longer time does not lead to a longer blow-off period.

Setting the Blow-off Time (P-0: 0x006A)

If the blow-off function of the ejector is set to internally time-controlled or externally time-controlled "Blow-off", then the blow-off time may be specified. The default value for the blow-off time is 200 ms.

The time can range from 0.10 to 9.99 seconds.

6.4.4 Set Permitted Evacuation Time t1 (0x006B)

The permitted evacuation time t1 is specified in milliseconds. The measurement starts when the switching threshold H2 is reached and ends when the switching threshold H1 is fallen below.

Parameter	Description
Permitted evacuation time	Time from H2 to H1

Offset parameter	**107 (0x006B)**
Description	Permissible evacuation time t1 for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint16
Length	32 bytes
Access	Read/write
Value range	0 … 9999
Default value	2000
Unit	ms
EEPROM	Yes

6.4.5 Set Permitted Leakage (0x006C)

The permitted leakage is set in mbar/s. The leakage is measured after the air saving function has interrupted suction once switching point H1 is reached.

Parameter	Description
Permitted leakage	Leakage after reaching H1

Offset parameter	**108 (0x006C)**
Description	Permissible leakage rate for ejectors
Index	Index 0 to 15 corresponds to ejector #1 to #16
Data type	uint16
Length	32 bytes
Access	Read/write
Value range	0 … 999
Default value	250
Unit	mbar/s
EEPROM	Yes

6.4.6 Counters

Each ejector has two internal non-erasable counters and two erasable counters.

Parameter address	Description
0x008C	Counter for suction cycles (Suction signal)
0x008D	Counter for suction valve switching frequency
0x008F	Counter for suction cycles (Suction signal) – erasable
0x0090	Counter for suction valve switching frequency – erasable

The erasable counters can be reset to 0 using the appropriate system commands.

The non-volatile storage of the counter statuses only occurs every 256 steps. When the operating voltage is switched off, up to 255 steps of the counter are lost.

Offset parameter	**140 (0x008C)**	**141 (0x008D)**
Description	Vacuum-on counter for ejector	Valve operating counter for ejector
Index	Index 0 to 15 corresponds to ejector #1 to #16	
Data type	uint32	
Length	64 bytes	
Access	Read only	
Value range	0 … 999,999,999	
Default value	-	
Unit	-	
EEPROM	Yes	

Offset parameter	**143 (0x008F)**	**144 (0x0090)**
Description	Erasable vacuum-on counter for ejector	Erasable valve operating counter for ejector
Index	Index 0 to 15 corresponds to ejector #1 to #16	
Data type	uint32	
Length	64 bytes	
Access	Read only	
Value range	0 … 999,999,999	
Default value	-	
Unit	-	
EEPROM	Yes	

6.4.7 Manual Operation of the Ejectors

⚠ CAUTION

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

Personal injury or damage to property!

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

⚠ CAUTION

External signals may change manual mode

Personal injury or property damage due to unforeseen work steps!

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

In manual mode, the suction and blow-off ejector functions can be controlled independently of the higher-level controller using the **MANUAL MODE** button on the operating panel.

Because the valve protection function is deactivated in manual mode, this function can be used to locate and rectify leaks in the vacuum circuit.

Activating Manual Mode:

✓ The ejector is in the Pneumatically OFF state.

- Press the **MANUAL MODE** button on the ejector for at least 3 seconds.

⇨ The Suction and Blow-off LEDs flash.

⇨ The ejector is in the Pneumatically OFF position.

Activating suction in manual mode:

✓ The Suction and Blow-off LEDs flash.

▸ Press the **MANUAL MODE** button on the ejector.

⇨ The ejector begins to suck.

⇨ The Suction LED is on and the Blow-Off LED flashes.

Activating blow-off in manual mode:

✓ The Suction LED is on and the Blow-Off LED flashes.

1. Press and hold the **MANUAL MODE** button on the ejector.
   ⇨ The Suction LED flashes and the Blow-off LED is on.
   ⇨ The ejector blows off as long as the button is held.
2. Release the **MANUAL MODE** button on the ejector to end the blow-off.
   ⇨ The ejector is in Pneumatically OFF mode.
3. Press the **MANUAL MODE** button again to reactivate suction.

Exiting manual mode:

✓ The ejector is in manual mode.

▸ Press the **MANUAL MODE** button on the ejector for at least 3 seconds.

⇨ The Suction and Blow-off LEDs cease to flash.

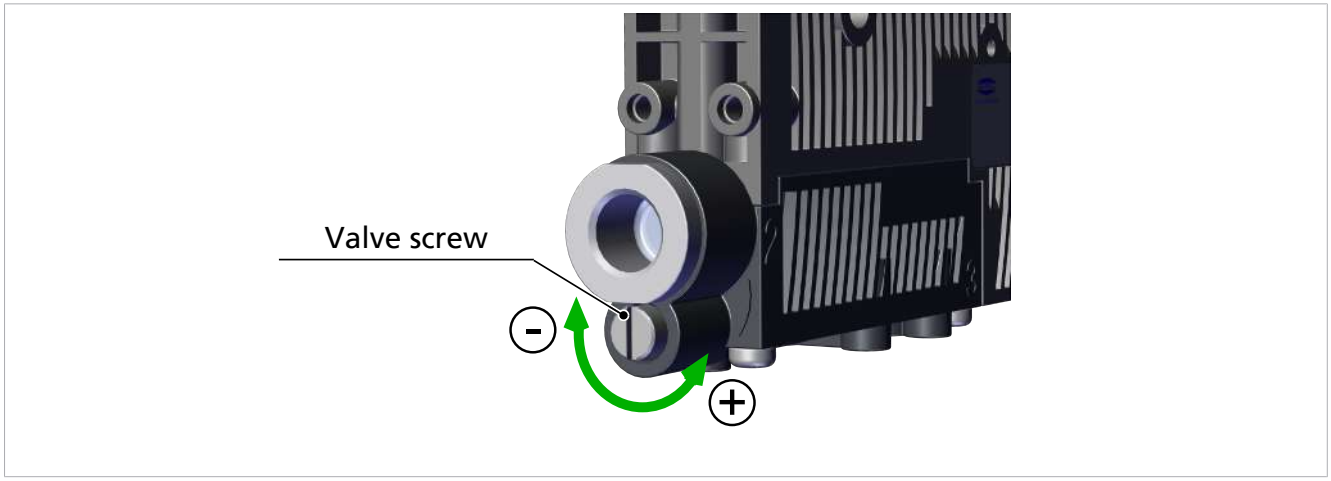
⇨ The ejector is in the Pneumatically OFF position.

A signal change (suction, blow-off) also ends manual mode.

6.4.8 Changing the Blow-Off Flow Rate on the Ejector

Do not overwind past the stop on the valve screw. The blow off flow rate can be adjusted within the range between 0% and 100%.

There is a valve screw below the vacuum connection that can be used to adjust the blow-off flow rate. The valve screw is equipped with a stop on both sides.



1. Turn the valve screw clockwise to reduce the flow rate.
2. Turn the valve screw counterclockwise to increase the flow rate.

6.5 IO-Link Master Functions

Functions of the IO-Link class B master:

- Process data management (IO-Link device process data is copied to the Ethernet process data)
- Port configuration
- IO-Link ISDU – data management (read/write parameter data of IO-Link devices)
- IO-Link master event handling

6.5.1 Process Data Management

The maximum process data width (input or output process data) per IO-Link master port is defined as 32 bytes. In the Profinet variant, the process data width actually used can be adapted to the process data width of the connected IO-Link device (e.g. Profinet). This is ensured by configuring the port in the controller using corresponding modules/submodules that are predefined in the device description file. For other Ethernet variants, the size is fixed at 32 bytes.

--> See 5.2 “Process Data”.

Furthermore, the byte order (endianness) for the corresponding Ethernet variant must be observed.

--> See 5.2 “Process Data”.

Process Data via Parameter Data

Alternatively, the process data can also be read/written via parameter data:

Offset parameter	**10600 (0x2968)**	**10601 (0x2969)**	**10602 (0x296A)**	**10603 (0x296B)**
Description	Master 1 process data input	Master 2 process data input	Master 1 process data output	Master 2 process data output
Index	-			
Data type	uint8			
Length	128 bytes			
Access	Read		Read/write	
Value range	Byte 0–31: Port X1 Byte 32-63: Port X2 Byte 64-95: Port X3 Byte 96-127: Port X4			
Default value	***			
Unit	-			
EEPROM	no			

6.5.2 IO-Link Port Configuration

Each port on the IO-Link master can be configured individually.

The configuration is usually carried out using parameter data.

The following port configurations are available:

- IO-Link device validation
- Operating mode port
- Additional port settings (port cycle / cycle time)
- IO-Link device data storage
- Switch on/off sensor voltage L+
- Switch on/off actuator voltage UA
- Summary: IO-Link master as digital input or digital output module

All addresses listed below refer to IO-Link master 1 – Port X1. All additional offset addresses for additional ports are listed in the corresponding tables in 5.3 “Parameter Data”.

Note:

It is possible to conveniently set most port configuration functions in the Profinet variant both within the module parameters via a user interface by integrating the IO-Link_CALL function module and through integration into a SIEMENS controller via TIA portal.

Operating mode port

Offset parameter	10404 (0x28A4) Refers to IO-Link master 1 – Port X1
Description	Operating mode
Index	—
Data type	uint8
Length	1 bytes
Access	Read/write
Value range	0x00 INACTIVE 0x01: DO (digital output) 0x02: DI (digital input) 0x03: FIXEDMODE (IO-Link communication) 0x04: SCANMODE (IO-Link communication)
Default value	0x04 (SCANMODE)
Unit	—
EEPROM	no

The listed operating modes each refer to Pin 4 (C/Q):

- INACTIVE: The port is inactive, i.e. all input process data is ZERO. There is no activity on the port. The IO-Link LED on the corresponding master/port goes out.
- DO (digital output): The port is configured as a digital output (24 V). The output is activated or deactivated depending on the lowest bit of the lowest output process data byte of the port. The corresponding maximum power load of the pin must be observed.
- DI (digital input): The port is configured as a digital input (24 V). Depending on the voltage potential applied to Pin 4, the lowest bit of the lowest input process data byte of the port is either set or deleted.

- FIXEDMODE (IO-Link communication): The port is configured for continuous IO-Link communication.
  Device-specific data is read in this mode. Depending on the type of validation required (see “IO-Link Device Validation” below), IO-Link communication to the device is either started or not started.
- SCANMODE (IO-Link communication): The port is configured for continuous IO-Link communication. In this mode, device-specific data is read and can be saved as new “identification data”.

Additional port settings (port cycle / cycle time)

The IO-Link cycle time of a port (port cycle time) can be set via the following modes:

Offset parameter	10405 (0x28A5) Refers to IO-Link master 1 – Port X1
Description	Port cycle
Index	—
Data type	uint8
Length	1 bytes
Access	Read/write
Value range	0x00 FreeRunning: No restriction to port cycle 0x01: FixedValue: The port cycle timing is fixed to a specific value (see parameter: Cycle time) 0x02: MessageSync: The port cycle timing is restricted to the synchronous start of all messages on all IO-Link ports of this master
Default value	0x00
Unit	–
EEPROM	no

- Free Running: No limitation of the port cycle time, i.e. the master communicates with the cycle time that was communicated to it by the device via the “MinCycleTime” communication parameter.
- The port cycle time is specified by the cycle time parameter (see below).
- MessageSync: The port cycle time is adjusted so that all IO-Link messages on ports X1 to X4 start synchronously on a master, i.e. all communicate using the same cycle time. The maximum “MinCycleTime” of all connected devices (on one master) is the decisive factor here. This is used for all devices.

IO-Link Device Validation

Offset parameter	10406 (0x28A6) Refers to IO-Link master 1 – Port X1
Description	Cycle time
Index	—
Data type	uint8
Length	1 bytes
Access	Read/write
Value range	0-65535
Default value	0x14

Unit	–
EEPROM	no

This parameter contains the requested or current value of the cycle time. If this value is to be binding as the master cycle time for communication with a device at the port, the “Port cycle” parameter (see above) must also be configured using “FixedValue”.

IO-Link Device Validation

The following four parameters (inspection level / vendor ID / device ID / serial number) can be used to validate a connected IO-Link device. IO-Link communication is only started if the data match. The “Inspection level” parameter can be used to determine whether or not validation should take place and which data should be validated. IO-Link device validation functions only in the operating mode port FIXEDMODE.

Offset parameter	**10410 (0x28AA)** Refers to IO-Link master 1 – Port X1	**10407 (0x28A7)** Refers to IO-Link master 1 – Port X1
Description	Inspection level	Vendor ID
Index	—	
Data type	uint8	uint16
Length	1 bytes	2 bytes
Access	Read/write	
Value range	0x00 NO_CHECK (no device validation) 0x01: TYPE_COMP (device validation: device ID + vendor ID) 0x02: IDENTICAL (device validation: device ID + vendor ID + serial number)	0 – 65535
Default value	0x00	
Unit	—	
EEPROM	no	

Offset parameter	**10408 (0x28A8)** Refers to IO-Link master 1 – Port X1	**10409 (0x28A9)** Refers to IO-Link master 1 – Port X1
Description	Device ID	Serial number
Index	—	
Data type	uint32	uint8
Length	4 bytes	16 bytes
Access	Read/write	
Value range	0 – 4294967295	0 – 255 for each byte
Default value	0x00	
Unit	—	
EEPROM	no	

For “Serial number,” enter each character of the serial number as an ASCII character in the corresponding byte. For example: Serial number “001389549” results in 0x71 = ASCII 9 in the first byte, 0x64 = ASCII 4 in the second byte, etc.

Data Storage

This function allows parameter data to be uploaded from the IO-Link device to the IO-Link master (upload = backup) and saved, and if necessary, when the device is replaced, this data can be downloaded to a new device (download = restore) and copied. The modes of the “Data Storage Activation State” parameter can be used to configure data storage with respect to backup and restore.

Prerequisite: To use data storage, the “Inspection Level” parameter must be configured with at least TYPE_COMP.

You can define which of the two functionalities (backup = upload) or (restore = download) are activated or deactivated within the “Data Storage Activation state = DS_ENABLED” via the two parameters “Data Storage Download Enable” and “Data Storage Upload Enable”.

	DS Activation state = DS_ENABLED (Backup + Restore)	**DS Activation state = DS_ENABLED (Restore)**	**DS Activation state = DS_ENABLED (Backup)**
DS Download Enable	true	true	false
DS Upload Enable	true	false	true

Note:

It is possible to set most port configuration functions in the Profinet variant within the module parameters via a user interface through integration into a SIEMENS controller via TIA portal. When the corresponding “Data backup” mode is selected, the remaining necessary parameters are automatically preconfigured according to the table above.

Offset parameter	10411 (0x28AB) Refers to IO-Link master 1 – Port X1
Description	Data storage activation
Index	—
Data type	uint8
Length	1 bytes
Access	Read/write
Value range	0x00 DS_DISABLED: DS mechanism is inactive and the complete parameter set of this port remains stored. 0x01: DS_ENABLED: DS mechanism is active and provides the full data storage functionality (backup and/or restore). 0x02: DS_CLEARED: DS mechanism is disabled and the stored parameter set of this port is cleared. (no backup + no restore)
Default value	0x00
Unit	—
EEPROM	no

- DS_ENABLED:
  Restore (= download) and backup (= upload) – functionality (dependent on the status of the “Data Storage Download Enable” + “Data Storage Upload Enable” parameters):
  Activates the function for downloading parameter data from the master to the IO-Link device (= download), as well as for uploading data from the IO-Link device to the master (= upload).
  Backup (= upload):

Prerequisites:

– "Data Storage Upload Enable" = true;

– Any existing "Data storage lock" or "Parameter storage lock" in the IO-Link device must not be activated.

An upload is performed if an IO-Link device is connected, but there is no valid data in the master. The read parameters are permanently stored in the master. The parameter data in the master can be overwritten by executing the "Force upload of parameter data into the master" command (ISDU index 0x0002, value 0x05) in the device. This allows device parameter data changed at runtime to be manually updated in the master.

Restore (= download):

Prerequisites:

– "Data Storage Download Enable" = true;

– Any existing "Data storage lock" or "Parameter storage lock" in the IO-Link device must not be activated.

If a new connection to an IO-Link device is established, the master compares the stored parameter data with the data from the device. The master downloads the stored data to the device if there are any discrepancies.

- DS_DISABLED:
  Data storage is deactivated. Stored parameter data in the master remains available.
- DS_CLEARED:
  Data storage is deactivated. Stored parameter data in the master is deleted.

Offset parameter	**10412 (0x28AC)** Refers to IO-Link master 1 – Port X1	**10413 (0x28AD)** Refers to IO-Link master 1 – Port X1
Description	Data storage download enable	Data storage upload enable
Index	—	
Data type	uint8	bool
Length	1 bytes	1 bytes
Access	Read/write	
Value range	0x00 The data storage mechanism is not permitted to write data to the connected device. 0x01: The data storage mechanism is permitted to write data to the connected device.	0x00 The DS mechanism is not permitted to read data from the connected device. 0x01: The DS mechanism is permitted to read data from the connected device.
Default value	0x00	
Unit	—	
EEPROM	no	

Switch on/off sensor voltage L+

The sensor voltage L+ (Pin 1) can be switched on or off with the following parameter. By default, the voltage L+ is switched on after power-up, so that an IO-Link device can be automatically supplied with voltage when it is plugged in. With this parameter it is possible, for example, to use Pin 1 of the port as a digital output (refers to GND_S = pin 3).

Offset parameter	10414 (0x28AE) Refers to IO-Link master 1 – Port X1
Description	Power on/off (switch L+ (pin 1))
Index	—
Data type	bool
Length	1 bytes
Access	Read/write
Value range	False: L+ power off True: L+ power on
Default value	True: L+ power on
Unit	—
EEPROM	no

Switch on/off actuator voltage UA

The actuator voltage U_A (Pin 2) can be switched on or off with the following parameter. By default, the voltage U_A is already switched on after power-up. In this case, ensure that 24 V is applied to this pin for class A devices.

With this parameter it is possible, for example, to use Pin 2 of the port as a digital output (refers to GND-A = Pin 5).

Offset parameter	10415 (0x28AF) Refers to IO-Link master 1 – Port X1
Description	Auxiliary power on/off (switch UA (Pin 2))
Index	
Data type	bool
Length	1 bytes
Access	Read/write
Value range	False: Auxiliary power off True: Auxiliary power on
Default value	True: Auxiliary power on
Unit	–
EEPROM	no

IO-Link master as digital input or digital output module

If configured accordingly, each IO-Link master port can be used as a digital input or digital output.

Each port has up to the following number of available inputs/outputs:

– 3 digital outputs or

– 2 digital outputs and 1 digital input

Port X digital output	Ground reference	Max. current	Required configuration / prerequisites
Pin 1 (L+)	Pin 3 (GND_S)	400 mA	Activate/deactivate the output: Power on/off = true/false Please note: The output is initially switched on after power-up!
Pin 2 (UA)	Pin 5 (GND_A)	2 A	Activate/deactivate the output: Auxiliary power on/off = true/false Please note: The output is initially switched on after power-up!
Pin 4 (C/Q)	Pin 3 (GND_S)	100 mA	Operating mode = 0x01: DO (digital output); Activate/deactivate the output: IO-Link master process data (lowest bit / lowest byte)

Port X digital input	Ground reference	Max. current	Required configuration / prerequisites
Pin 4 (C/Q)	Pin 3 (GND_S)	—	Operating mode = 0x02: DI (digital input); Input status: Status of the IO-Link master process data (lowest bit / lowest byte)

6.5.3 IO-Link ISDU – Data Management (Reading/Writing Parameter Data)

IO-Link ISDU data management describes the possibility of reading or changing acyclic data (i.e. on-request data or ISDU data) of an IO-Link device (connected to an IO-Link master port) via Ethernet.

PROFINET:

For PROFINET, “IOL_CALL” function modules are available from various controller manufacturers. These are specified in accordance with “IO-Link Integration for Profinet”. With the appropriate integration into the controller, this provides a convenient option for both ISDU data exchange of connected devices and port configuration of the master ports.

The IO-Link master supports the use of the IOL_Call module (IO-Link device).

The following settings and specifications are necessary to use the module:

- A **CAP-ID** (Client Access Point) as transfer parameter. The value is **16#FFFF.**
- ID = HW-ID of the corresponding IO-Link head module (e.g. SCTSi-PNT~IO-Link_Master_1)
- Port = Port number of the port used by the IO-Link master, starting with 1

For further information about this module, please refer to the official module description of the controller/library supplier.

EtherCAT:

For EtherCAT and EthernetIP, Schmalz offers its own function module, which, based on the IOL-CALL function module for Profinet, allows convenient ISDU read and write access. The function module can be downloaded from the Schmalz homepage. You can find more detailed information in the function module documentation.

Independent of the above mentioned function modules, read/write accesses are possible via the following sequences of Ethernet parameter read/write accesses.

All specifications listed below refer to the IO-Link master 1 Port X1. For additional IO-Link masters or ports, the following offset addresses must be added.

Offset for Additional Ports:

	Port X1	Port X2	Port X3	Port X4
IO-Link master 1	+ 0	+ 20	+ 40	+ 60
IO-Link master 2	+ 100	+ 120	+ 140	+ 160

Example: “Request: Index” has the following addresses at the corresponding ports

	Port X1	Port X2	Port X3	Port X4
IO-Link master 1	10200	10220	10240	10260
IO-Link master 2	10300	10320	10340	10360

Read the ISDU parameter sequence:

R/W	*Offset*		*Parameter*	*Data*	*Bytes*	*Example*
	(Dec)	*(Hex)*				
W	10205	0x27DD	Request: Trigger	Initially reset the 0 trigger	1	0
W	10200	0x27D8	Request: Index	ISDU index of the device	2	0x0002
W	10201	0x27D9	Request: Subindex	ISDU subindex of the device	1	0x00
W	10202	0x27DA	Request: RW	0 = Read	1	1
W	10205	0x27DD	Request: Trigger	1 = Start inquiry	1	1
R	10206	0x27DE	Request: Error	0 = Request was successfully sent 1 = Request was aborted because of “Service busy” or “State conflict”	1	0
R	10211	0x27E3	Response: Trigger	1: PDESTATUS==1 or (PDESTATUS==1 && DSUPLOADED==1) 0: Else	1	1
R	10207	0x27DF	Response: Result	1= Positive response for the ISDU read/write request 0 = Negative response	1	1

1. Wait until “Response: Result” = 1. (This usually takes at least 500 ms, possibly even several seconds.)
2. The following data can then be read:

R	10210	0x27E2	Response: Error	1 = Error in response, e.g. “BUFFERBUSY”,	1	0

				“STATE-CONFLICT”, “PARAMETER-ERROR”, “FINISHEDWITHERROR” 0 = No error		
R	10208	0x27E0	Response: Error Code	Error code of the IO-Link device	1	0
R	10209	0x27E1	Response: Additional Error Code	Additional error code of the IO-Link device	1	0
R	10212	0x27E4	Response: Length	Length in bytes of the IO-Link device	1	15
R	10213	0x27E5	Response: Data	Read data	232	01... 02... 03 ...

Write the ISDU parameter sequence:

R/W	***Offset***		***Parameter***	***Data***	***Bytes***	***Example***
	(Dec)	***(Hex)***				
W	10205	0x27DD	Request: Trigger	Initially reset the 0 trigger	1	0
W	10200	0x27D8	Request: Index	ISDU index of the device	2	0x0002
W	10201	0x27D9	Request: Subindex	ISDU subindex of the device	1	0x00
W	10202	0x27DA	Request: RW	1 = Write	1	1
W	10203	0x27DB	Request: Length	Specification for the number of bytes for parameter 10204	1	10
W	10204	0x27DC	Request: Data	Data to be written (always transmit 232 bytes, regardless of the data width actually used)	232	01 ..02 .. 03...
W	10205	0x27DD	Request: Trigger	1 = Start inquiry	1	1
R	10206	0x27DE	Request: Error	0 = Request was successfully sent 1 = Request was aborted because of “Service busy” or “State conflict”	1	0
R	10211	0x27E3	Response: Trigger	1: PDESTATUS==1 or (PDESTATUS==1 && DSUPLOADED==1) 0: Else	1	1
R	10207	0x27DF	Response: Result	1 = Positive response for the ISDU read/write request 0 = Negative response	1	1

1. Wait until “Response: Result” = 1. (This usually takes at least 500 ms, possibly even several seconds.)
2. The following data can then be read:

R	10210	0x27E2	Response: Error	1 = Error in response, e.g. “BUFFERBUSY”, “STATE-CONFLICT”, “PARAMETER-ERROR”, “FINISHEDWITHERROR” 0 = No error	1	0

R	10208	0x27E0	Response: Error Code	Error code of the IO-Link device	1	0
R	10209	0x27E1	Response: Additional Error Code	Additional error code of the IO-Link device	1	0

Offset parameter	**10206 (0x27DE)**	**10208 (0x27E0)**
Description	Request: Error Code	Response: Error Code
Index	—	
Data type	bool	uint8
Length	1 bytes	1 bytes
Access	Read only	
Value range	0 = No error in the connection to the IO-Link master 1 = Timeout during establishing the connection to the IO-Link master	Error code in accordance with the IO-Link interface specification
Default value	—	
Unit	—	
EEPROM	No	

Offset parameter	10209 (0x27E1)
Description	Response: Additional Error Code
Index	—
Data type	uint8
Length	1 bytes
Access	Read only
Value range	Additional error code in accordance with the IO-Link interface specification
Default value	—
Unit	—
EEPROM	No

EtherNetIP:

To access the ISDU parameters of an IO-Link device connected to the IO-Link master, an object, an instance and an attribute must be specified in the object-based “Common Industrial Protocol” (CIP). The object 0x10B must be selected for this purpose. The instance represents the IO-Link index number. The attribute represents the IO-Link subindex number. Refer to the IO-Link device description for the index and subindex. The service code is used to select the IO-Link master and port on which the service is to be executed.

The service codes are assigned as follows:

Master # Port #	Service code
Master 1 Port 1	0x11
Master 1 Port 2	0x12
Master 1 Port 3	0x13
Master 1 Port 4	0x14
Master 2 Port 1	0x21
Master 2 Port 2	0x22
Master 2 Port 3	0x23
Master 2 Port 4	0x24

If a length is specified in the CIP object, write access takes place. If length 0 is specified, read access takes place. In case of an error, an error code and an extended error code are returned. The error code can be found in the system information. The extended error code describes the error in accordance with the IO-Link interface specification.

The CIP object must be provided with the following parameters:

Message type	CIP generic
Service type	Custom
Service code	See above table for master and port
Instance	Index
Class/object	0x10B
Attribute	Subindex
Source length	0 for read access; parameter length for write access

6.6 DI Module Functions

Status of the Input Ports via Process Data

The status of each input (valid signal on/valid signal off) can be read via process data or parameter data. Each DI module has 8 digital inputs: 2 inputs per port.

A maximum of 6 DI modules can be installed on one terminal. Thus, up to 48 digital inputs are possible on the compact terminal.

Status via Input Process Data:

EtherNet/IP + EtherCAT:

An input process data byte is fixed for each DI module in both variants.

--> See 5.2 “Process Data”.

PROFINET:

By selecting appropriate modules/submodules (predefined in the device description file), the DI modules can be specifically defined in the process data that is actually present.

--> See 5.2 “Process Data”.

For a detailed description of the corresponding process data --> see 5.2 “Process Data”.

Status via Parameter Data:

Digital input status

This parameter is used to determine the current status of each input.

Parameter	34 (0x0022)
Description	Digital input status
Subindex	Index 0..5 corresponds to DI module #1…#6
Data type Subindex	uint8
Length	8 bytes
Access	Read only
Value range	Bit 0 = DI module status; Port X1, Pin (2) Bit 1 = DI module status; Port X1, Pin (4) Bit 2 = DI module status; Port X2, Pin (2) Bit 3 = DI module status; Port X2, Pin (4) Bit 4 = DI module status; Port X3, Pin (2) Bit 5 = DI module status; Port X3, Pin (4) Bit 6 = DI module status; Port X4, Pin (2) Bit 7 = DI module status; Port X4, Pin (4)
Default value	-
Unit	-
EEPROM	no

7 Transportation and Storage

7.1 Checking the Delivery

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

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

7.2 Removing the Packaging

The device is delivered packaged in a cardboard box.

NOTE

Sharp knives or blades

Damage to components!

- Ensure that no components are damaged while opening the packaging.

1. Carefully open the packaging.
2. Dispose of the packaging material in accordance with the national laws and guidelines.

7.3 Reusing the Packaging

The product is delivered in cardboard packaging. The packaging should be reused to safely transport the product at a later stage.

Keep the packaging for future transport or storage.

8 Installation

8.1 Installation Instructions

⚠ CAUTION

Improper installation or maintenance

Personal injury or damage to property

- Prior to installation and before maintenance work, the product must be disconnected from the power supply and secured against unauthorized restart.

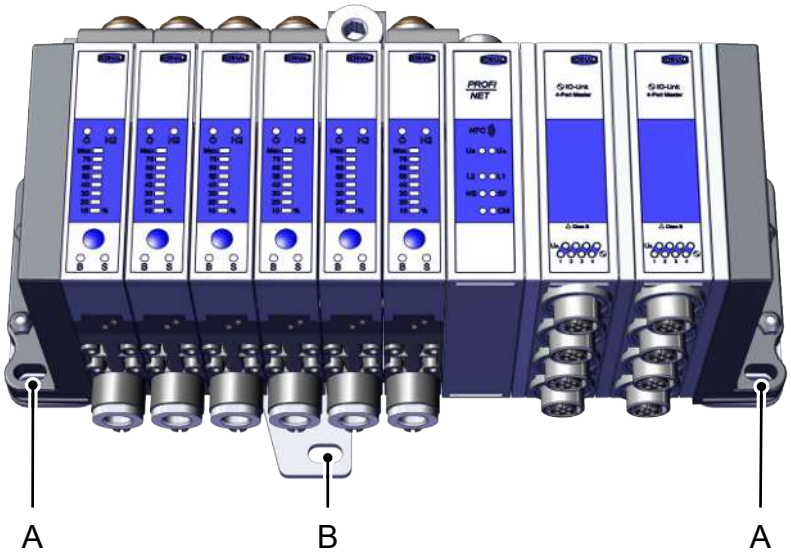
For safe installation, the following instructions must be observed:

1. Use only the connectors, mounting holes and attachment materials that have been provided.
2. Firmly connect and secure pneumatic and electrical line connections to the compact terminal.
3. Ensure that there is adequate installation space in the area where the product will be installed.

8.2 Mounting

The compact terminal may be installed in any position.

The way in which the compact terminal is attached depends on the number of ejector discs mounted:

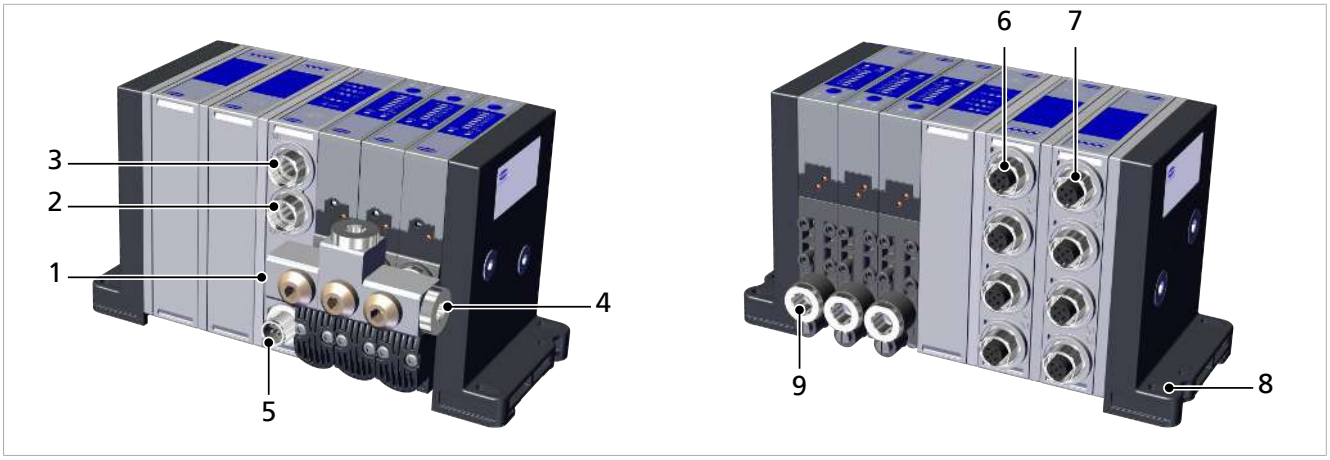


Up to five mounted ejector discs

- Attach the compact terminal at the end plates (A) using two M5 screws and washers each. The maximum recommended tightening torque is 4 Nm.

With six or more ejector discs, additional reinforcing plates are mounted on the compact terminal

- Attach the compact terminal at the end plates (A) as well as at the center reinforcing plates (B) using two M5 screws and washers each. The maximum recommended tightening torque is 4 Nm.



1	Compressed air connection, 1/4" thread	2	M12-D electrical connection for Ethernet Port X02 (straight [1:1])
3	M12-D electrical connection for Ethernet Port X01 (crossover [x])	4	Alternative compressed air connection 1/4" thread (2 Nm)
5	M12-L electrical connection for voltage supply. Labeled with X03 on bus module.	6	Electrical connection socket M12-A Port X01 to X04 for IO-Link devices
7	Electrical connection socket M12-A Port X01 to X04 for digital sensors	8	End plate with two mounting holes (4 Nm)
9	Vacuum connection, 1/8" thread (2 Nm)		

8.3 Connecting the Compressed Air and Vacuum

⚠ CAUTION

Compressed air or vacuum in direct contact with the eye

Severe eye injury

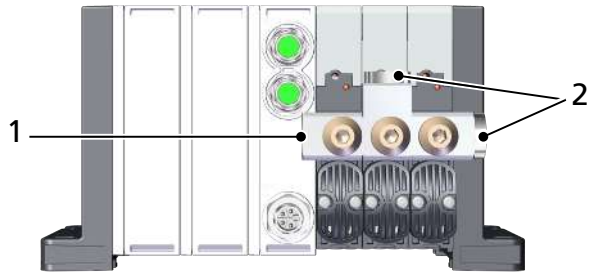
- Wear eye protection
- Do not look into compressed air openings
- Do not look into the silencer air stream
- Do not look into vacuum openings such as suction cups, suction lines and hoses.

⚠ CAUTION

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

Hearing damage!

- Correct installation.
- Wear ear protectors.



1	1x compressed air connection per 16 ejector discs	2	Optional: Compressed air connection
3	1x vacuum air connection per ejector disc (marking 2)		

The compressed air connector with the plug connector 8/6 or 1/8" thread is marked with the number 1 on the ejector disc.

- Connect compressed air hose. For threaded connectors, the maximum tightening torque is 1 Nm.

The vacuum connector with the plug connector 8/2 or 6/4 or M5 or M7 thread is marked with the number 2 on the ejector disc.

- Connect the vacuum hose. For threaded connectors, the maximum tightening torque is 1 Nm.

8.3.1 Recommended Line Cross Sections (Internal Diameters) in mm

SCPS performance class	Cross section, compressed air-side For 2 to 8 ejectors[1)]	Cross section, compressed air-side For 9 to 16 ejectors[1)]	Cross section, vacuum side[1)]
07	7	9	4
10	7	9	4
15	7	9	6
2-07	7	9	4
2-09	7	9	4
2-14	7	9	6

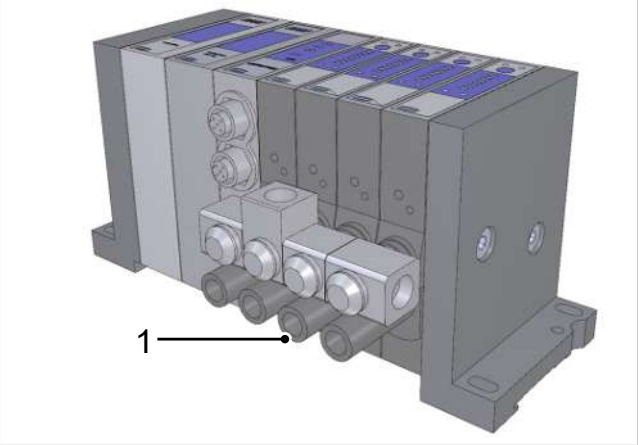
[1)] Specifications based on a maximum hose length of 2 m.

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

If the recommended line cross section is too large due to how the line is routed (e.g. an energy chain or robot flange), the alternative compressed air connections can be used to provide additional compressed air.

8.4 Connecting Variant with Exhaust Duct, Silencer or Hose

For ejectors without a silencer, the variant with exhaust duct is supplied with pipe extensions (1) for the removal of the exhaust air.

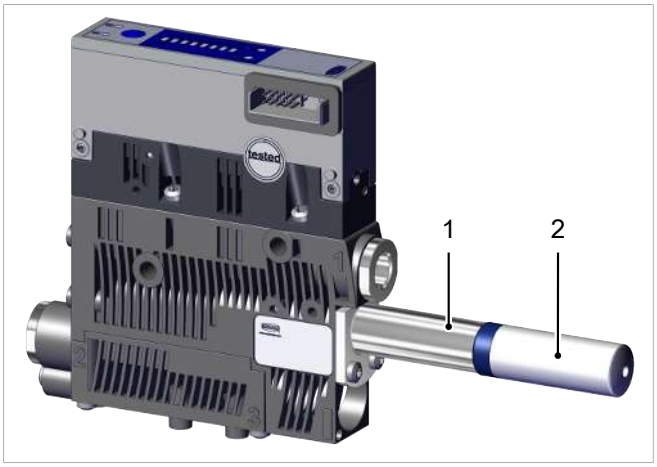


CAUTION! Hearing damage caused by the operation of the ejector without silencer or without exhaust air hose! In the variant with exhaust duct, one of the following system expansions must be added to ensure the safe operation of the ejector by the operator:

- Mounting of a silencer
- Mounting of an exhaust air hose

This must be done on each ejector, via thread G4 (1/8" internal thread).

✓ A suitable silencer (> See ch. 12.2 Accessories, p. 110) or the attachment parts for the solution with exhaust hose are provided by the customer.



▸ To remove the exhaust air, connect a silencer (2) or a hose to the thread (1/8" internal thread) of the pipe extension (1).
Max. tightening torque for the mounting of the silencer = hand tight.
The maximum tightening torque for mounting a hose connection depends on the selected hose connection.

8.5 Electrical Connection

⚠ WARNING

Electric shock

Risk of injury

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

NOTE

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

Personal injury or damage to property

- Electrical connection may be performed only by specialists who can evaluate the effects of signal changes on the overall system.

NOTE

Power load greater than 16 A

Damage to the device

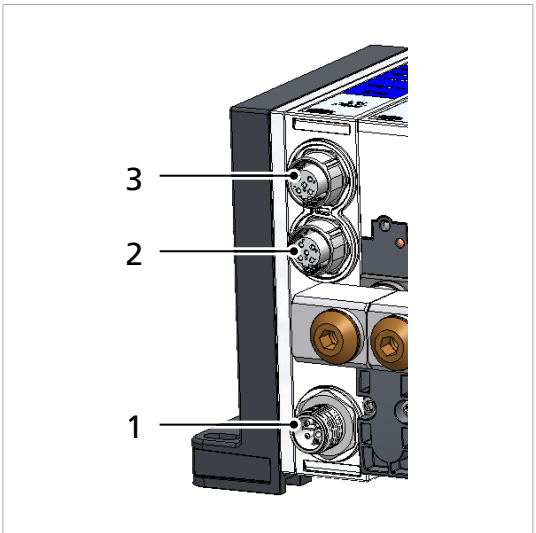
- Ensure that the maximum permissible total current (for the whole terminal) of 16 A is not exceeded.
- In addition, suitable fuse protection of the supply line is necessary.
- The supply line must be designed in accordance with the planned power consumption and the length of the line. A cable cross-section of 2.5 mm² is recommended.

8.5.1 Instructions for Start of Operations

To operate the terminal, the supply voltage and at least one communication line must be connected.

The supply voltage for the sensors (U_S) and the supply voltage for the actuators (U_A) are electrically isolated and can come from different sources.

8.5.2 Bus module



1	M12-L electrical connection plug for voltage supply Labeled with X03 on bus module	2	M12-D electrical connection socket for Ethernet port X02 (straight [1:1]) Labeled with X02 on bus module [EtherCAT: OUT port]
3	M12-D electrical connection socket for Ethernet port X01 (crossover [x]) Labeled with X01 on bus module [EtherCAT: IN port]		

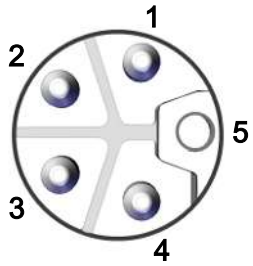
✓ Prepare the connection cable.

1. Fasten the connection cable to the electrical connection (1) with 5-pin M12 connector in L-coded design; max. tightening torque = hand-tight.
2. At least one Ethernet cable also needs to be connected to the D-coded M12 sockets at connection (2) or (3).

Observe the following connection instructions:

- The device can be operated only via Ethernet communication. This requires corresponding hardware components (master).
- The data cable must be shielded. The cable shield must be equipotentially bonded.
- The functional ground of the voltage supply cable must be equipotentially bonded.
- The device is designed to supply sensors and actuators with potential separation.

Pin Assignments, L-coded M12 Connector for Voltage Supply

M12-L plug	PIN	Symbol	Wire color [1]	Function
	1	U_s	Brown	Supply voltage for sensor
	2	GND_A	White	Actuator ground
	3	GND_s	Blue	Sensor ground
	4	U_A	Black	Supply voltage for actuator
	5	FE	Pink	Functional ground (earth)

[1] When using a Schmalz connection cable (see accessories)

Pin Assignments, D-coded M12 Socket for Industrial Ethernet

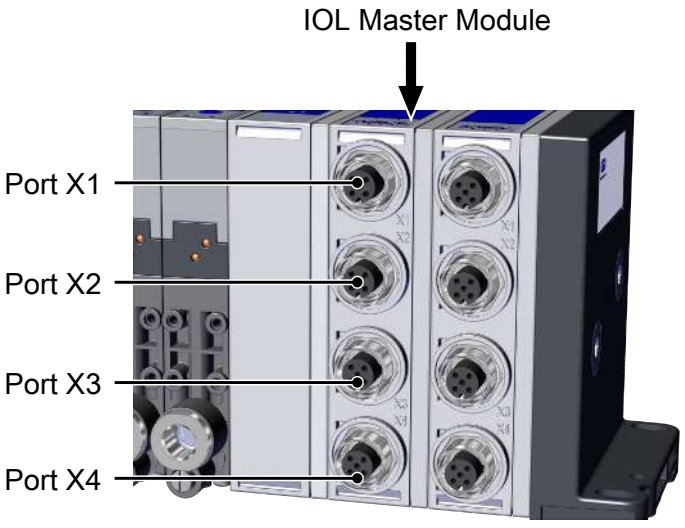
M12-D socket	PIN	Symbol
	1	TX+
	2	RX+
	3	TX-
	4	RX-
	Thread	FE

8.5.3 IOL Master Module

Mounting the Connection Cable

Mount the connection cable to the IOL master module.

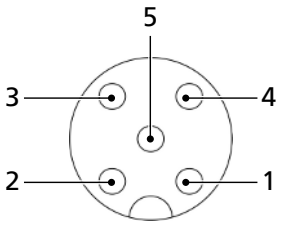
The figure shown here is an example. Depending on the design of the terminal, one or two IOL master modules are installed.



✓ Prepare the connection cable (maximum length = 20 m).

▸ Connect the connection cable to one of the four 5-pin M12 sockets (Port X1 to X4) on the IOL master module and tighten the union nut with the max. tightening torque (hand-tight).

PIN Assignment, M12 Socket, A-Coded

M12-A socket	PIN	Symbol	Wire color [1)]	Function
	1	L+	Brown	Supply voltage for sensor
	2	UA / DO	White	Supply voltage for actuator and digital output
	3	GND_s	Blue	Sensor ground
	4	IO-Link / DI / DO	Black	IO-Link and digital input/output
	5	GND_A	Gray	Actuator ground

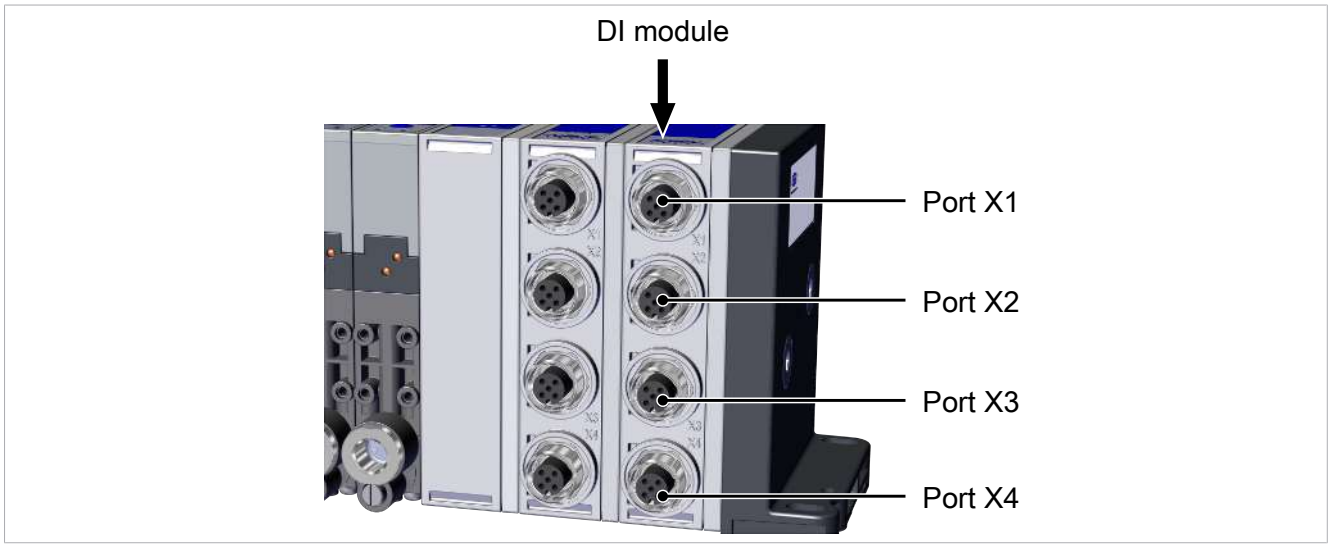
[1)] When using a Schmalz connection cable (see accessories)

8.5.4 DI module

Mounting the Connection Cable

Connect the connection cable to the DI module.

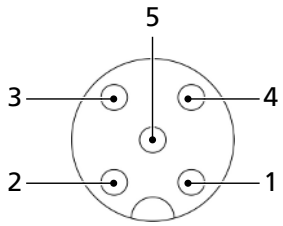
The figure shown here is an example. Depending on the design of the terminal, one to six DI modules are installed.



✓ Prepare the connection cable.

▸ Connect the connection cable to one of the four 5-pin M12 sockets (Port X1 to X4) on the DI module and tighten the union nut with the max. tightening torque (hand-tight).

PIN Assignment, M12 Socket, A-Coded

M12-A socket	PIN	Symbol	Wire color [1)]	Function
	1	U_S	Brown	Supply voltage for sensor
	2	DI 2	White	Digital input 2
	3	GND_s	Blue	Sensor ground
	4	DI 1	Black	Digital input 1
	5	n.c.	Gray	Not connected

[1)] When using a Schmalz connection cable (see accessories)

9 Operation

9.1 Safety Instructions for Operation

⚠ WARNING

Suspended load

Risk of serious injury

- Do not walk, stand or work under suspended loads.

⚠ 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 (for example, protective barriers or sensor systems).

9.2 Checking for Correct Installation and Function

Before starting the handling process, check for proper installation and function.

10 Maintenance

10.1 Safety Instructions

Maintenance work may only be carried out by qualified personnel.

⚠ WARNING

Risk of injury due to incorrect maintenance or troubleshooting

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

⚠ CAUTION

Damage due to flying parts

Risk of injury or damage to property!

- Wear eye protection
- Before performing maintenance, make sure that the vacuum and compressed air system is at atmospheric pressure.

NOTE

Improper maintenance

Damage to the compact terminal and the ejectors!

- Switch off the supply voltage before any maintenance.
- Secure it so that it cannot be switched back on.
- The compact terminal must only be operated with a silencer and press-in screens.

Maintenance work or repairs that go beyond the activities described here may not be carried out by the operator of the product without consulting Schmalz.

10.2 Replacing the Silencer

When the silencer is open, a heavy infiltration of dust, oil, and so on, may contaminate it and reduce the suction capacity. We do not recommend cleaning the silencer because of capillary action in the porous material.

- If the suction capacity decreases, replace the silencer.

10.3 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.

10.4 Cleaning the Compact Terminal

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 compact terminal is not soaked in soapy water.
3. Ensure that no moisture gets into the electrical connection.

11 Troubleshooting

11.1 Help with Malfunctions

Malfunction	Possible cause	Solution
No communication	Incorrect electrical connection	▸ Check electrical connection and pin assignment
	Higher-level controller not correctly configured	▸ Check the controller configuration
	GSD connection does not work	▸ Check for appropriate GSD
No NFC communication	NFC connection between SCTSi and reader (e.g. smartphone) not correct	▸ Hold the reader at the intended position on the SCTSi
	NFC function on reader (e.g. smartphone) not activated	▸ Activate NFC function on reader
	NFC deactivated in SCTSi	▸ Activate NFC function in SCTSi
	Write operation canceled	▸ Hold the reader at the intended position on the SCTSi
No parameters can be changed using NFC	PIN code for NFC write protection activated	▸ Enable NFC write permissions
Ejectors are not responding	No actuator supply voltage	▸ Check electrical connection and pin assignment
	No compressed air supply	▸ Check the compressed air supply
Vacuum level is not reached or vacuum is created too slowly	Press-in screen in contaminated	▸ Replace screen
	Silencer is dirty	▸ Replace the silencer
	Leakage in hose line	▸ Check hose connections
	Leakage at suction cup	▸ Check suction cup
	Operating pressure too low	▸ Increase operating pressure. Note the maximum limits!
	Internal diameter of hose line too small	▸ Observe recommendations for hose diameter
Load cannot be held	Vacuum level too low	▸ Increase the control range for the air saving function
	Suction cup too small	▸ Select a larger suction cup
IO-Link communication to the device is not established	No voltage	▸ Activate sensor and actuator voltage if deactivated
	Incorrect port configuration	▸ Switch the operating mode to IO-Link mode (fixed mode or scan mode)
	Incorrect port cycle time	▸ Adjust the port cycle time supported by the device.
	Incorrect device validation (connected device does not meet the specifications)	▸ Check and adjust the validation parameters (inspection level / vendor ID / device ID / serial number)
Data storage is not running correctly	Incorrect data storage configuration	1. Check and adjust the required parameters (e.g. data storage activation, data storage download enable, data storage upload enable) 2. Wrong device connected; see “Incorrect device validation” above

11.2 Error Codes, Causes and Solutions (0x0082)

If a known error occurs, it is transmitted via parameter 0x0082 in the form of an error number.

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

Control unit error code:

Error code	Malfunction	Possible cause	Solution
Bit 0	Internal EEPROM error	Operating voltage was disconnected too quickly after a parameter change, saving process was not complete.	1. Reset to factory settings. 2. Use engineering tool to import a valid dataset.
Bit 1	Internal bus error	Internal bus was interrupted.	▸ Perform Power On again.
Bit 2	Undervoltage U_S	Sensor supply voltage too low and outside the permitted range	1. Check power supply unit and power load 2. Increase supply voltage
Bit 3	Overvoltage U_S	Sensor supply voltage too high and outside the permitted range	1. Check power supply unit. 2. Reduce supply voltage
Bit 4	Undervoltage U_A	Actuator supply voltage is too low. (Outside the permitted range.)	1. Check power supply unit and power load. 2. Increase supply voltage
Bit 5	Overvoltage U_A	Actuator supply voltage is too high. (Outside the permitted range.)	1. Check power supply unit. 2. Reduce supply voltage
Bit 6	Supply pressure	System pressure outside the permitted range.	▸ Check and adjust supply pressure.

Ejector error code:

Error code	Malfunction	Possible cause	Solution
Bit 0	Measurement range exceeded	The measurement range of at least one ejector was exceeded.	▸ Check the pressure and vacuum sections of the system.
Bit 1	Calibration error	Calibration was canceled when measurement value was too high or too low.	1. Ventilate the vacuum circuit. 2. Perform calibration.

You can find more detailed information in the **Device Status** section.

12 Spare and Wearing Parts, Accessories

12.1 Spare and Wearing Parts

Maintenance work may only be carried out by qualified personnel.

⚠ WARNING

Risk of injury due to incorrect maintenance or troubleshooting

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

NOTE

Improper maintenance

Damage to the compact terminal and the ejectors!

- Switch off the supply voltage before any maintenance.
- Secure it so that it cannot be switched back on.
- The compact terminal must only be operated with a silencer and press-in screens.

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

Part no.	Designation	Type
10.02.02.04141	Silencer insert	Wearing part
10.02.02.03376	Screen	Spare part
10.02.02.04152	Insulating plate	Wearing part
10.02.01.00540	Silencer (round) for variant with exhaust duct, SD 1/8" external thread 14x40	Wearing part
10.02.02.04737	Ejector wear part set SCPS **single stage** SD, contains: filters/silencers/non-return valves, piston/springs/O-rings	Wearing part
10.02.02.04738	Ejector wear parts set SCPS-**two-stage** SD, contains: filters/silencers/non-return valves, piston/springs/O-rings	Wearing part

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

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

12.2 Accessories

Part no.	Designation	Note
21.04.05.00351	Power connection cable	M12 5-pin socket [L] with open cable end | 1.5 m
21.04.05.00352	Power connection cable	M12 5-pin socket [L] with open cable end | 5 m
21.04.05.00353	Network connection cable	M12 4-pin plug [D] to M12 4-pin plug [D] | 1 m
21.04.05.00354	Network connection cable	M12 4-pin plug [D] to M12 4-pin plug [D] | 5 m
21.04.05.00355	Network connection cable	M12 4-pin plug [D] to RJ45 plug | 1 m
21.04.05.00356	Network connection cable	M12 4-pin plug [D] to RJ45 plug | 5 m
21.04.05.00252	M12 protective cap	Sealing cap for unused M12 socket | IP67 4 protective caps are included in delivery for each the IO-Link class B master and DI module
21.04.05.00158	M12 connection cable	M12 5-pin plug to M12 5-pin plug | 1 m
21.04.05.00383	Y-distributor	Y-VER-M12 S-M12-5 2xB-M12-5 A
10.02.01.00540	SD 1/8" external thread 14x40	Silencer (round) for variant with exhaust duct

13 Decommissioning and Disposal

13.1 Disposing of the Compact Terminal

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

13.2 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
Sealing	Nitrile rubber (NBR)
Lubrication	Silicone-free

14 Declarations of Conformity

14.1 EU Declaration of Conformity

The manufacturer Schmalz confirms that the product described in these 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 61000-6-4+A1	Electromagnetic compatibility - Part 6-4: Generic standards - Emission standard for industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

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

14.2 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 50581	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.

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