Operating instructions

Needle Gripper SNGi-AE

Note

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

Published by

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Contents

1 Important Information

1.1 Note on Using this Document

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

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

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

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

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

1.2 The technical documentation is part of the product

1. For problem-free and safe operation, follow the instructions in the documents.
2. Keep the technical documentation in close proximity to the product. The documentation must be accessible to personnel at all times.
3. Pass on the technical documentation to subsequent users.
   ⇨ Failure to follow the instructions in these Operating instructions may result in injuries!
   ⇨ Schmalz is not liable for damage or malfunctions that result from failure to heed these instructions.

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

www.schmalz.com/services

1.3 Type Plate

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

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

1.4 Symbols

ⓘ   This symbol indicates useful and important information.

- ✓ This symbol represents a prerequisite that must be met before an action is performed.
- ▸ This symbol represents an action to be performed.
- ⇨ This symbol represents the result of an action.

Actions that consist of more than one step are numbered:

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

2 Fundamental Safety Instructions

2.1 Intended Use

The needle gripper is used to handle (grip and transport) non-rigid, porous workpieces (e.g. fabrics, CFRP mats, foams, and so on).

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

The product is intended for industrial use.

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

2.2 Non-Intended Use

Schmalz accepts no liability for damages resulting from use other than as intended. In particular, the following are considered non-intended use:

- Use in potentially explosive atmospheres
- Use in medical applications
- Use in food product applications

2.3 Personnel Qualifications

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

The operating company must ensure the following points:

- The personnel must be commissioned for the activities described in these operating instructions.
- The operating staff are physically and mentally capable and can be expected to reliably perform the tasks assigned.
- The operating staff have been instructed in the operation of the product and have read and understood the operating instructions.
- Installation, maintenance, and repairs must be carried out only by specialists or by persons who have undergone appropriate training.

Applicable for Germany:

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

2.4 Warnings in This Document

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

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

2.5 Residual Risks

⚠ CAUTION

Pricks, cuts and scratches caused by exposed needles!
- ‣ If possible, push in the needles manually before troubleshooting or before maintenance and repair work.
- ‣ Wear suitable work gloves.

⚠ CAUTION

Risk of injury due to open compressed air lines
- ‣ Do not place eyes, ears or hands into compressed air lines.
- ‣ Keep eyes and body orifices away from open compressed air lines.

NOTE

Placing the needle gripper firmly on the load under mechanical pressure!
Damage to the needle gripper
- ‣ Ensure that the needles are retracted before fitting.
- ‣ Place the needle gripper gently on the load without mechanical pressure.

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 Variants

The breakdown of the item designation (e.g. SNGi-AE 10 0.8 V 3 IOL) is as follows:

Type	Supply energy	Number of needles	Needle diameter	Additional function	Stroke range	Communication
SNGi	AE Electrically operated AP Pneumatically operated	10 10 pieces	0.8 0.8 mm 1.2 1.2 mm	V Infinitely variable stroke	3 3 mm 10 10 mm 20 20 mm	IOL I/O-Link

The needle grippers are differentiated based on their energy supply, either as AP (pneumatically operated) or AE (electrically operated).
This documentation describes only the AE version!

3.2 Product Design
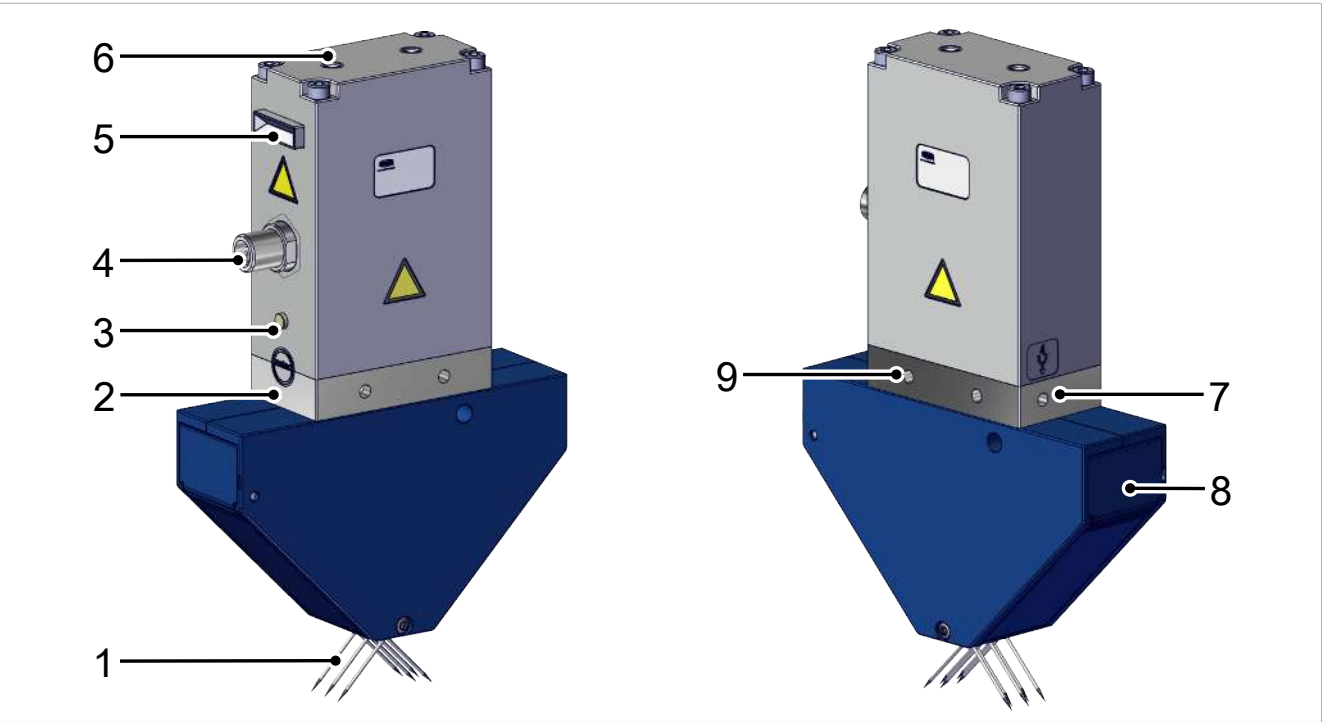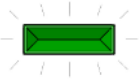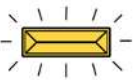
1	Needles (extended position)	6	2x mounting thread, M5
2	Cooling surface for the drive	7	M5 "blow-off" compressed air connection (marking 4)
3	Power LED	8	Maintenance port cover
4	Electrical connection, M12 plug, A-coded	9	Mounting thread, M5
5	Status display	—	—

3.3   Display Elements

The display elements indicate the operating state of the needle gripper for the operator.
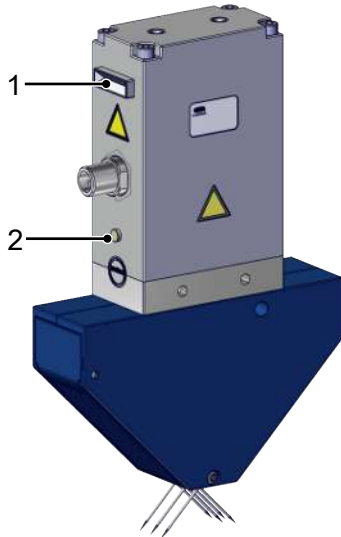
Status display			
1		Flashing green = needles are moving but "target position" is not reached yet
		Green = the "actual position" of needles is the same as the "target position"
		Red = maintenance required (see error code)
		Yellow = advance maintenance warning
		Flashing yellow = warning was issued but needles are moving
		GREEN = system is okay
Power LED			
2		Flashing green = sensor voltage present
		Green = sensor and actuator voltage present

3.4   Functional Description

The needle grippers are designed to handle parts by interlocking with the shape of the workpiece.

In the case of the electrical needle gripper, the needles are moved by an electric drive.

Communication is possible only via the IO-Link interface.

3.5   Basic Principles of IO-Link Communication

Abbreviation:

ISDU: Indexed service data unit, parameter data acyclically queried between the controller and the IO-Link device

IODD: (IO Device Description)

The component is operated via IO-Link to enable intelligent communication with a controller.

IO-Link is a communication system for connecting intelligent sensors and actuators to an automation system and is described in the standard IEC 61131-9. The standard contains both the electrical connection data as well as a digital communication protocol via which sensors and actuators exchange data with the automation system.

An IO-Link system consists of an IO-Link master and one or more IO-Link enabled sensors or actuators. The IO-Link master provides the interface to the higher level controller (PLC) and controls the communication with the connected IO-Link devices. An IO-Link master can have one or more IO-Link ports, however only one IO-Link device can be connected to each port.

IO-Link devices have parameters which are readable or writable via the IO-Link protocol. Parameters can therefore be changed during operation via the higher level controller. Since the sensor and actuator parameters are device-specific, parameter information is available for each device in the form of an IODD (IO Device Description).

The IO-Link communication takes place using cyclical process data and acyclical ISDU parameters.

The product's parameters can be set remotely using IO-Link mode.

4 Technical Data

4.1 Technical Data/General Parameters

Type	Number of nee-dles	Needle Ø	Max. stroke	Needle angle	Weight
SNGi-AE 10 0.8 V 3 IOL	10	0.8 mm	3 mm	30°	500 g
SNGi-AE 10 1.2 V 3 IOL	10	1.2 mm	3 mm	30°	500 g
SNGi-AE 10 0.8 V 10 IOL	10	0.8 mm	10 mm	45°	515 g
SNGi-AE 10 1.2 V 10 IOL	10	1.2 mm	10 mm	45°	515 g
SNGi-AE 10 1.2 V 20 IOL	10	1.2 mm	20 mm	45°	600 g

Total force	50 N
Operating/working temperature	5 to +50° C
Storage temperature	-10 to 60° C
Humidity	10 to 90% r.h., free from condensation
Operating pressure	2 to 6 bar
Sound level[1] during blow-off	78 dBA
Mounting position	Any
Degree of protection	IP53
Duty cycle	45%
Needle retraction/extension time per 1 mm stroke[2]	0.06 to 0.6 s
Stroke resolution	0.1 mm
Repeatability	±0.05 mm (at constant temperature)
Operating medium	Air or neutral gas, 5 µm filtered, with or without oil, class 3-3-3 compressed air quality acc. to ISO 8573-1

[1] At 5 bar and a distance of 1 meter

[2] Retraction/extension time:
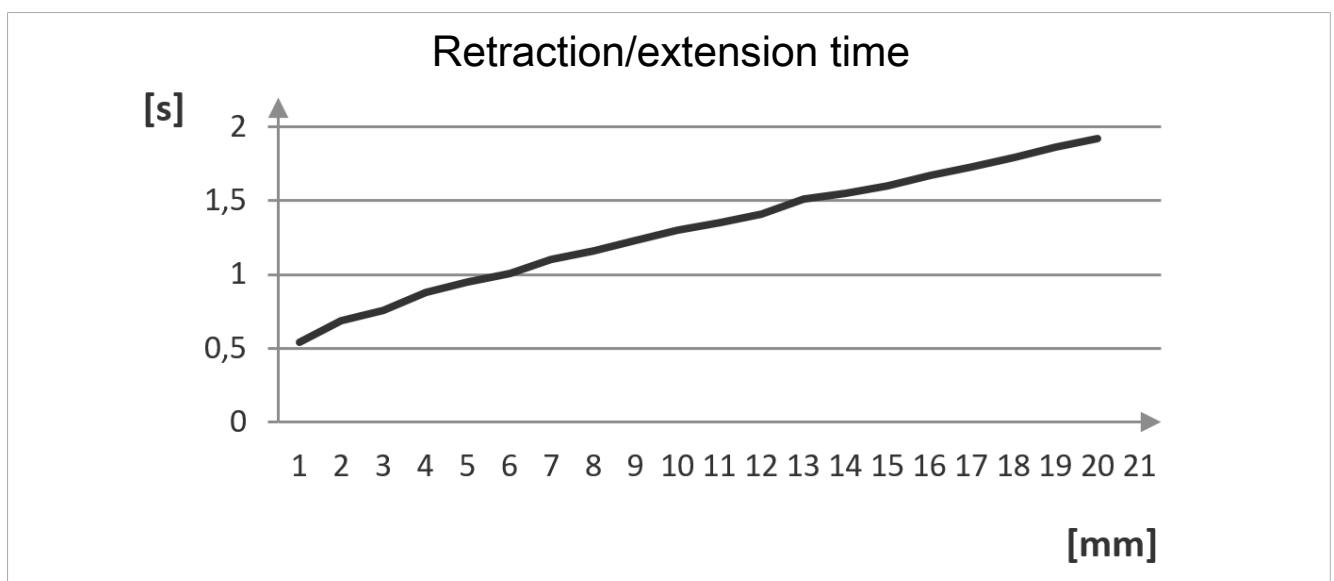
4.2 Dimensions
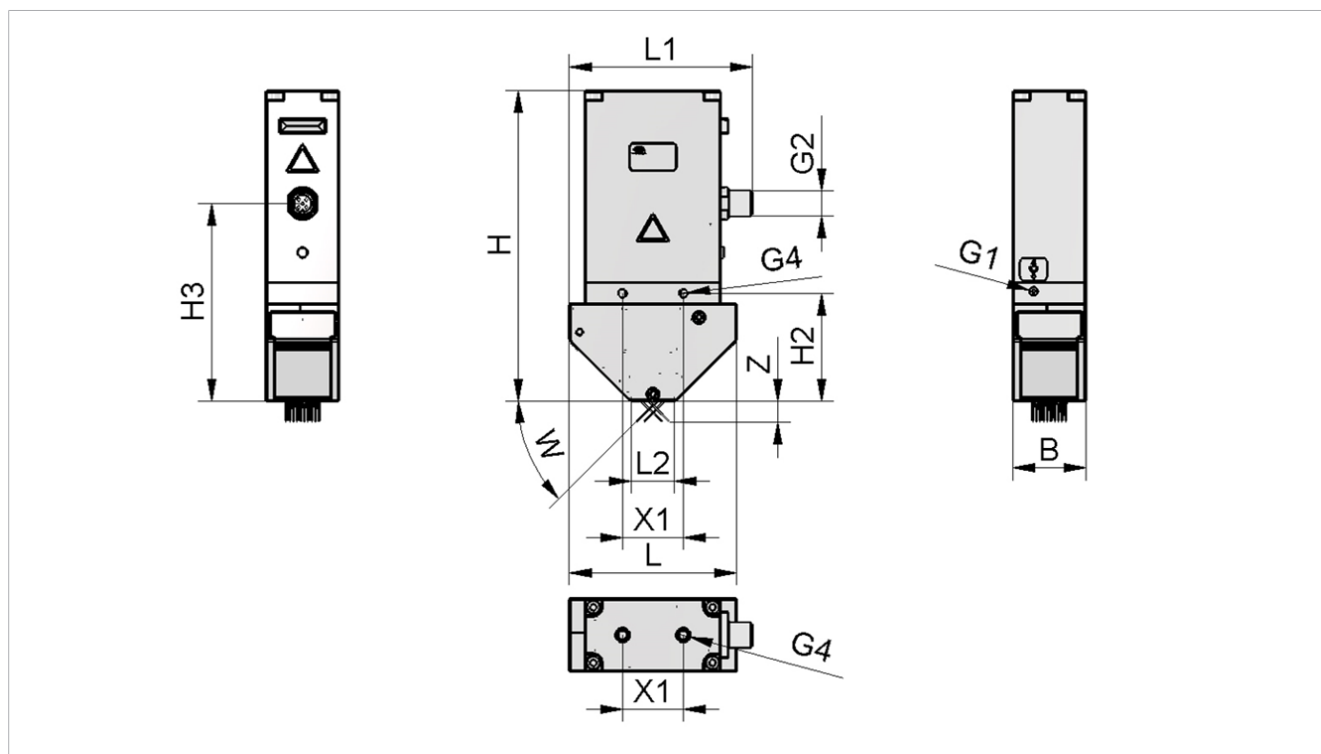
B	G1	G2	G4	Lg4	X1
35	M5 internal thread	M12 external thread	M5 internal thread	7	29

Part no.	Z	W	L	H	L1	L2	H2	H3
SNGi-AE 10 0.8 V 3 IOL	3	30	65	140.2	80	28	41.7	86.2
SNGi-AE 10 1.2 V 3 IOL	3	30	65	140.2	80	28	41.7	86.2
SNGi-AE 10 0.8 V 10 IOL	10	45	80	152	88	22	52	95
SNGi-AE 10 1.2 V 10 IOL	10	45	80	152	88	22	52	95
SNGi-AE 10 1.2 V 20 IOL	20	45	120	178	108	22	78	121

All specifications are in mm.

4.3 Electrical Parameters

Parameter	Symbol	Limit values			Comment
		min.	typ.	max.	
Supply voltage for sensor	U_S	19.2 V	24 V	26.4 V	PELV [1]
Supply voltage for actuator	U_A	19.2 V	24 V	26.4 V	PELV [1]
Rated current for sensor	I_S	—	—	80 mA	
Rated current for actuator	I_A	—	550 mA	900 mA [2]	

[1] The power supply must correspond to the regulations in accordance with EN60204 (protected extra-low voltage). The supply voltages and the IO-Link pin are protected against reverse polarity.
[2] The maximum current is measured only in boost mode.

5 Transportation and Storage

5.1 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.

5.2 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.

5.3 Transport

⚠ **CAUTION**

Pricks, cuts and scratches caused by exposed needles!
‣ If possible, push in the needles manually before troubleshooting or before mainte-
  nance and repair work.
‣ Wear suitable work gloves.

The needle gripper is permitted to be transported only with **retracted** needles.

6 Installation

6.1 Installation Instructions

> ⚠ **CAUTION**
>
> **Pricks, cuts and scratches caused by exposed needles!**
> - ‣ If possible, push in the needles manually before troubleshooting or before maintenance and repair work.
> - ‣ Wear suitable work gloves.

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

1. Check the product for visible damage. Correct any faults or report them to the supervising personnel.
2. Use only the connectors, mounting holes and attachment materials that have been provided.
3. The product must be mounted only when de-energized and depressurized.
4. Firmly connect and secure pneumatic and electrical line connections to the device.
5. Ensure that only authorized persons are present in the working area of the machine or system in order to prevent any hazard from switching on the machine.

6.2 Mounting

The product can be mounted in any position.

To mount the needle gripper, there are two M5 tapped holes each on the front, back and top.

‣ Attach the product to a handling system using one of the mounting options:
(1) Top, 2x M5 thread
(2) Side, 4x M5 thread
Use washers! Max. tightening torque = 2 Nm
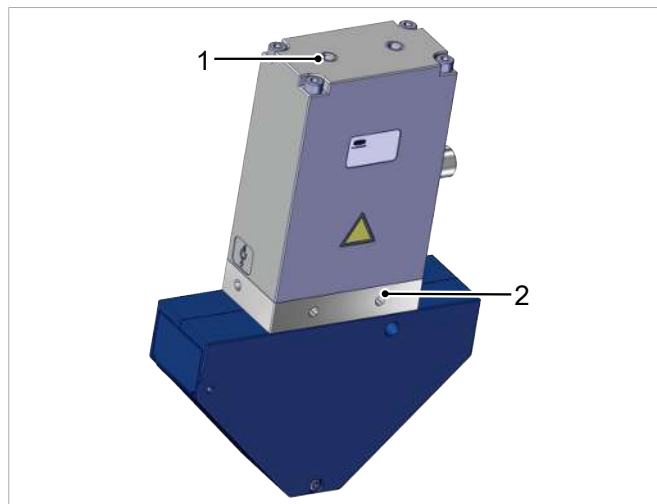
Appropriate holders for incorporating the needle gripper into a tooling system are listed in the accessories (> See ch. 14 Accessories, p. 36).

6.3 Pneumatic Connection

⚠ **CAUTION**

Uncontrolled movement (whipping) of the compressed air hose when the compressed air supply is activated

Risk of injury

- ‣ Deactivate the compressed air supply when working on the product.
- ‣ Cut hoses as short as possible and fix in place.
- ‣ Wear eye protection.

- ‣ Connect the M5 "blow-off" compressed air connection (marking 4) with a max. tightening torque of 4 Nm.
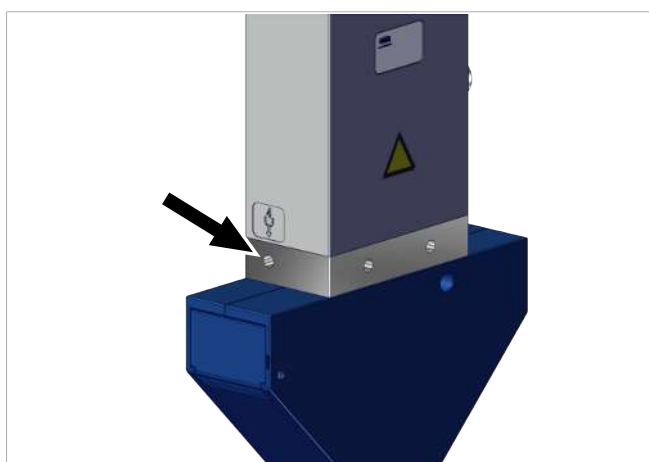
Select a hose with an internal diameter ≥ 4 mm for the compressed air connection.

At the position shown, you can connect a plug-in screw union or a hose sleeve using the M5 thread.

6.4 Electrical Connection

⚠ **WARNING**

Electric shock

Risk of injury

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

⚠ **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, depressurized (vented to the atmosphere) and secured against unauthorized restart.

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

The system is electrically connected through a 5-pin, A-coded M12 connector with the IO-Link class B pin assignment. The sensor and actuator voltage for the device and the IO-Link signal (pin 4) are supplied via this connector. The sensor supply voltage and the IO-Link signal are galvanically isolated from the actuator voltage.

The maximum cable length between an IO-Link master and the needle gripper is 20 m.

‣ Attach the connection cable to the electrical connection (1) and secure it (maximum tightening torque = hand-tight).
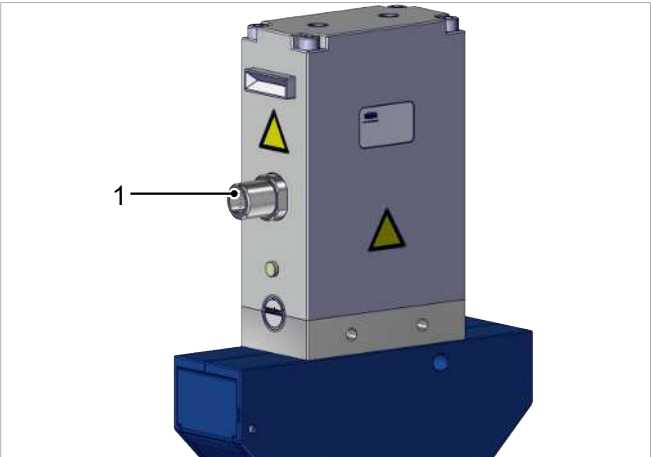
Pin assignment

M12 plug	PIN	Wire color[1]	Symbol	Function
	1	Brown	U_S	Supply voltage for sensor
	2	White	U_A	Supply voltage for actuator
	3	Blue	GND_S	Sensor ground
	4	Black	C/Q	IO-Link
	5	Gray	GND_A	Actuator ground

[1] When using Schmalz connection line part no. 21.04.05.00080
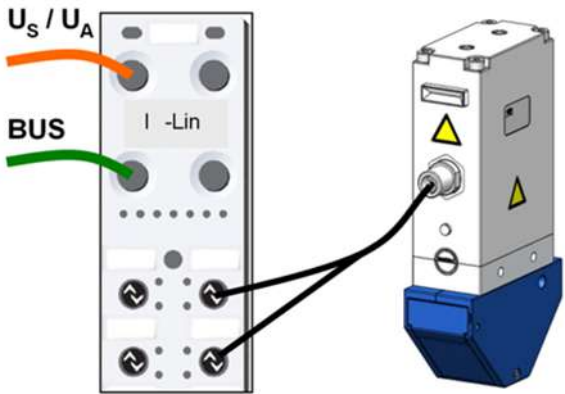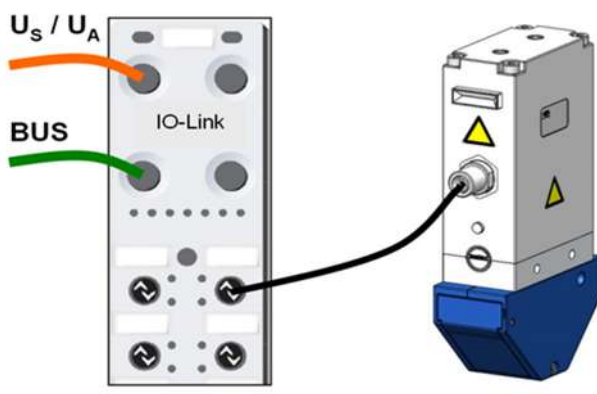
The communication line for IO-Link must always be connected to an IO-Link master port (point-to-point connection). It is not possible to connect multiple C/Q lines to a single IO-Link master port.

Direct connection to a controller

A Schmalz connection line can be used to connect the device to the controller directly:
M12-5 with open end, 5 m, part no. 21.04.05.00080

Connection via IO box

To connect the device to IO boxes, you can use Schmalz connection lines and Schmalz connection distributors, for example.

Class A	Class B
M12-5 to 2xM12, 1 m part no. 10.02.02.04336	M12-5 to M12-5, 1 m part no. 21.04.05.00158 or M12-5 to M12-5, 2 m part no. 21.04.05.00211

7 Start of Operations

Operations are permitted to begin only following successful assembly/installation (> See ch. 6 Installation, p. 14).

For safety reasons, the needle gripper is delivered with a needle stroke of zero millimeters.

> ## NOTE
>
> **Needles of the needle gripper penetrating hard surfaces!**
>
> Damage to the needles
>
> ‣ Ensure that the needles are retracted before fitting.
>
> ‣ Set up the needle gripper on soft surfaces. The thickness of the material must be greater than the maximum stroke of the gripper.

✓ The sensor supply voltage, actuator supply voltage and IO-Link communication line are connected.

‣ Any time that the sensor voltage is interrupted, move to the "home position" afterwards!

⇨ Set the "Needles in home position bit".

With IO-Link, all the variable parameters can be read and changed by the higher-level controller and written back to the device; see the separate data dictionary (> See ch. 17 IO-Link Data Dictionary, p. 39) (This separate PDF file contains a table listing the process data and parameters available via IO-Link).

The device supports both IO-Link standard 1.1 and IO-Link standard 1.0 with four input data bytes and two output data bytes.

The exchange of process data between the IO-Link master and the device is cyclical. Parameter data (acyclical data) is exchanged by the user program in the controller.

You can use an IODD file to integrate the device into a controller or PC tool. This file is available for download in two different versions at www.schmalz.com:

• IODD based on standard 1.1, for use with IO-Link masters in accordance with standard V1.1.

• IODD based on standard 1.0, for use with IO-Link masters in accordance with standard V1.0 (legacy mode).

The parameters are divided into cyclic and acyclic parameters.

The acyclic parameters are further divided into:

• Commands
• Identification parameters
• Initial setup
• Calibration
• Observation
• Diagnosis

8 Troubleshooting

Fault	Possible cause	Solution
Needles do not extend	No movement enabled	▸ Set the Move-enable bit in PD out byte 0 to 0 and then to 1
	Max. insertion force exceeded	▸ Begin the movement to the home position
	Sensor supply voltage undershot	▸ Check the supply voltage
	Actuator supply voltage undershot	▸ Check the supply voltage and connect it if necessary
	Sensor supply voltage exceeded	▸ Check the supply voltage and reduce it if necessary
	Actuator supply voltage exceeded	▸ Check the supply voltage and reduce it if necessary
	Heavy contamination inside the product	▸ Perform maintenance – ([> See ch. 12.3 Dirt inside the Device, p. 32](#))
The workpiece cannot be held	Needle stroke too low	▸ Increase needle stroke
	Needle bends	▸ Select a needle gripper with a larger needle diameter
	Needle broken	▸ Replace needle module
Needle modules have different strokes	Between the insertion of the first and second needle modules, the position of the gear wheels was changed	1. Remove both needle modules 2. Insert both needle modules 3. Move to the home position
The whole stroke range is no longer available	Heavy contamination inside the product	▸ Perform maintenance - ([> See ch. 12.3 Dirt inside the Device, p. 32](#))
The preset stroke is not reached after changing the needles	Before the needle modules were inserted, the position of the gear wheels was changed	▸ Perform homing
No IO-Link communication	Electrical connection faulty	▸ Check electrical connection and PIN assignment
	Master not correctly configured	▸ Check configuration of the master Configure IO-Link port
	IODD connection does not work	▸ Check for the appropriate IODD.

9 Operation

9.1 Safety Instructions for Operation

⚠ **CAUTION**

Pricks, cuts and scratches caused by exposed needles!

▸ If possible, push in the needles manually before troubleshooting or before mainte-
nance and repair work.

▸ Wear suitable work gloves.

⚠ **CAUTION**

Moving parts on the product (e.g. exposed spring, driven components)

Hand injuries

▸ Grip the product only when it is deactivated and de-energized.

⚠ **CAUTION**

Touching hot surfaces

Touching hot surfaces may cause injury from burns.

▸ Wear work gloves.

▸ Do not touch components during operation.

▸ Allow the components to cool down before commencing work on the product.

9.2 Needles Moving (Picking up/Depositing the Workpiece)

The target position of the needles is sent to the gripper via the IO-Link interface. A drive extends and re-
tracts the needles at the given angle (depending on the version).

The actual position can be read out at any time. If unplanned deviations occur, warnings and, where nec-
essary, error messages are displayed.

The needles are moved as shown in the sequence diagram below:
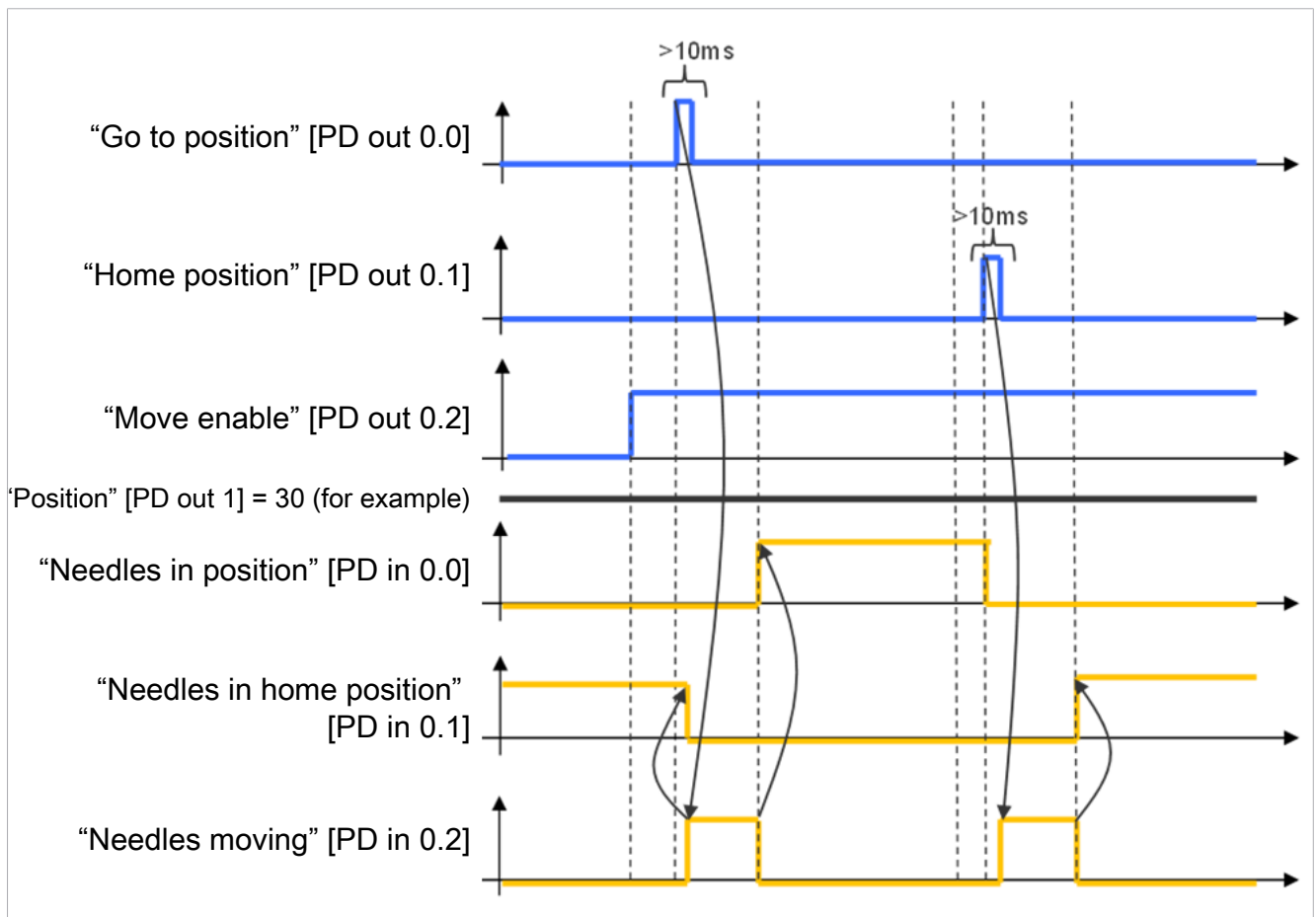
- ✓ The sensor supply voltage, actuator supply voltage and IO-Link communication line are connected.
- ▸ Any time that the sensor supply voltage is interrupted, move to the "home position" afterwards!
- ⇨ The "Needles in home position bit" is set.

9.3 Selecting Predefined Production Profiles

The product can store up to four different production setup profiles (P-0 to P-3). The speed and position data is stored here. The profiles are selected using the PDO byte 0 process data byte. This provides the user with a quick and convenient way to adapt the parameters to different workpiece properties.

The following parameters can be set as "production setup profiles":

- Needle position length (mm)
- Speed at which the needles are withdrawn (%)
- Energy-saving mode (ECO mode)

Bit 0   Bit 7

[PD out byte 0] | 1 | 0 | 1 | | | | 0 | 0 | →   Profile 0 is selected

Bit 0 must be set to 0 again after each movement of the needles.

Bit 0   Bit 7

[PD out byte 0] | 1 | 0 | 1 | | | | 0 | 1 | →   Profile 1 is selected

Bit 0 must be set to 0 again after each movement of the needles.

Bit 0   Bit 7

[PD out byte 0] | 1 | 0 | 1 | | | | 1 | 0 | →   Profile 2 is selected

Bit 0 must be set to 0 again after each movement of the needles.

Bit 0   Bit 7

[PD out byte 0] | 1 | 0 | 1 | | | | 1 | 1 | →   Profile 3 is selected

Bit 0 must be set to 0 again after each movement of the needles.

To ensure that the actual position of the needles corresponds to the selected target position, the lowest bit of byte 0 in the "Process data in" range can be read during or after the movement time. When the target position is reached, this bit is set to 0.

To read out the current position of the needles, the value in the parameter "Current position" (index 0x0040) can be read (e.g.: 10 corresponds to 1 mm, 200 corresponds to 20 mm).

> ℹ️ The needles do not move if the "Go to position bit" is not set in byte 0.

If the needle retraction force is not sufficient to drive the needle out of the material being gripped, boost mode is activated. This increases the retraction force of the needles. A corresponding warning is issued.

> ℹ️ Boost mode makes the device heat up more; for this reason, it is automatically deactivated immediately after the cycle.

9.4 EPC Values in the Process Data

Abbreviations:

EPC: Energy and process control

EPC-ACK: EPC acknowledge bit; bit for acknowledging that the needle gripper received the change.

The current content of this data supplied by the needle gripper can be changed via the process output data using the 2 "EPC-Select" bits. The four possible ways in which this data is configured are listed in the table below:

	PD out byte 0 (bit 4 and bit 5) EPC-Select	PD in bytes 1, 2 and 3 EPC-Value 1 (8 bit)	EPC value 2 (16 bit)	PD in byte 0 (bit 4) EPC-ACK
Online	00	Speed of movement of the needles %	Current position of the needles 0.1 mm (parameter index 0x0040)	0
[CM]	01	CM warnings (for codes, see parameter index 0x0092)	Temperature (unit °C)	1
[PM]	10	[PM]	Movement time (unit s)	1
[EM]	11	Supply voltage (parameter index 0x0042) (unit 0.1 V)	Energy consumed in the last cycle (parameter index 0x0091)	1

Depending on the automation system design, the switchover is performed with a certain time delay. To ensure that the different pairs of values can be read efficiently through a controller program, the EPC-Select-Acknowledge bit (PD in byte 0 bit 4) is provided in the process input data. The bit always accepts the values shown in the table.

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

1. Start with EPC-Select = 00.

2. Create the selection for the next value pair you require (e.g. EPC-Select = 01)

3. Wait until the EPC-Select-Acknowledge bit changes from 0 to 1.
   ⇨ The transmitted values correspond to the selection you have created, and can be adopted by the controller.

4. Switch back to EPC-Select = 00.

5. Wait until the EPC-Select-Acknowledge bit is reset to 0 by the device.

6. Proceed in the same way for the next value pair (e.g. EPC-Select = 10).

The following diagram shows the procedure for querying all EPC values via process data:
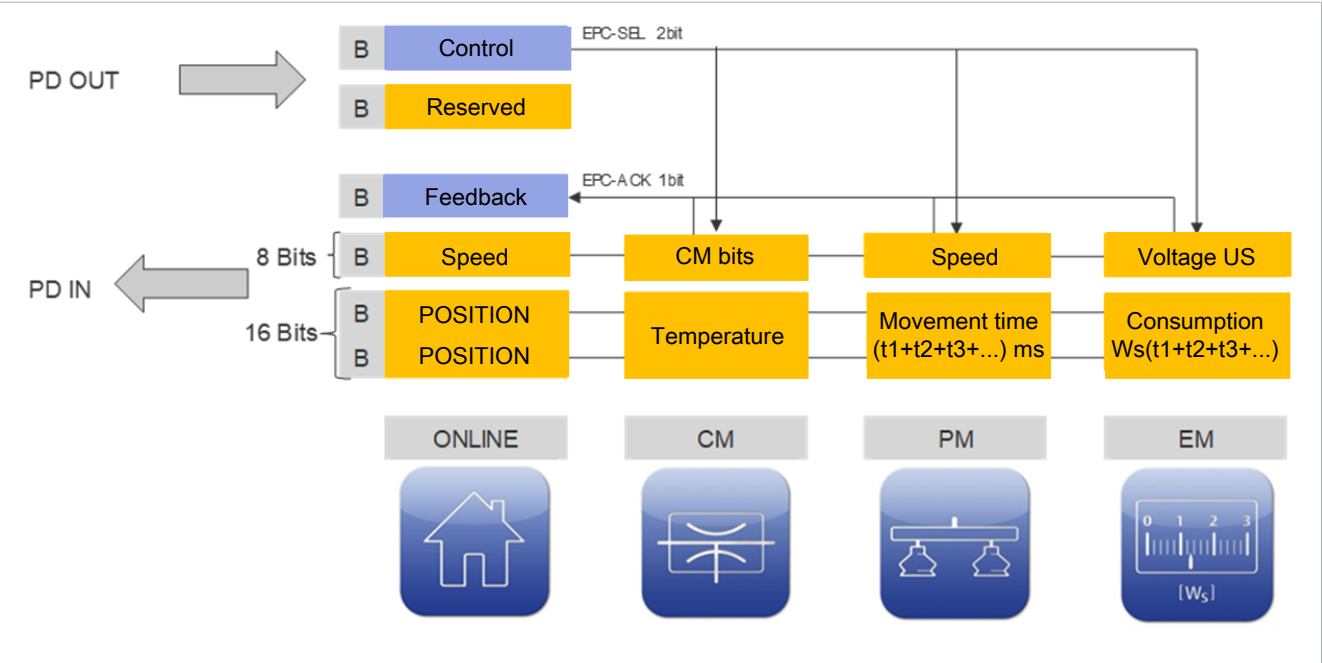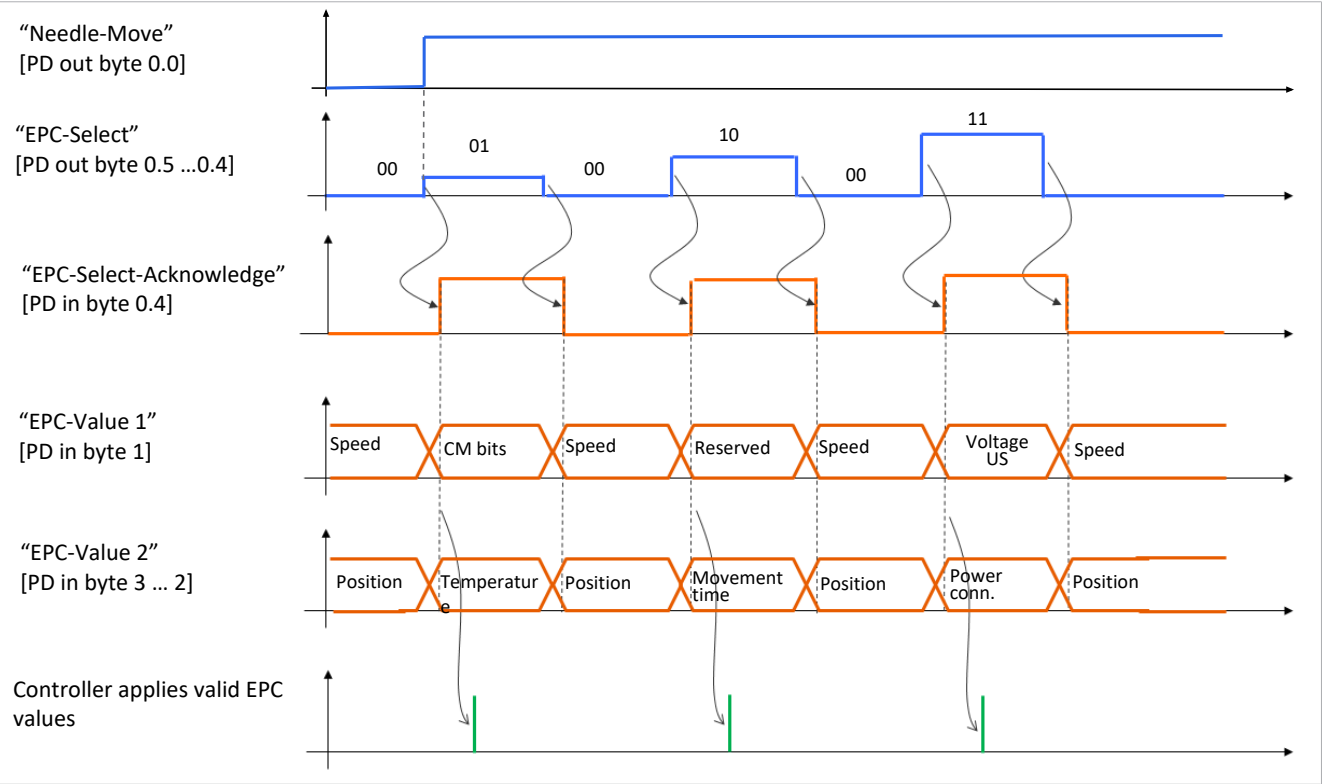
9.5 Movement Time

Under the PD in byte 3 process data, you can find the total needle movement time (10 [PM] Total movement time) following each movement of the needles.
The total movement remains the same until the beginning of the next cycle.
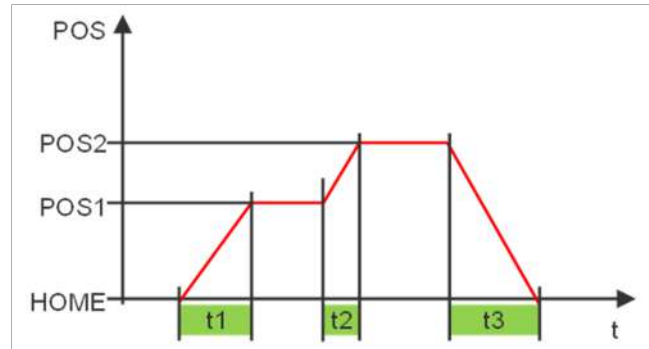
9.6 Assisted Deposit (Blow-off)

⚠ **CAUTION**

Noise pollution due to gripper operation with compressed air during blow-off

Hearing impairments may occur in the long term

▸ Wear suitable hearing protection (PPE)

To assist with the deposit of sticky workpieces, for example, it is possible to generate a compressed air flow from an external source through the needle outlet openings.
Input 4 on the gripper is controlled with compressed air for this purpose.
When using the blow-off function, the workpiece comes into contact with compressed air.

The gripper must be used only with appropriately maintained compressed air (air or neutral gas in accordance with EN 983, filtered to 5 µm, oiled or unoiled).

10 General Description of Functions

10.1 IO-Link Operating Mode

This chapter describes only some of the device functions and parameters. To learn about all the parameters, see the data dictionary(> See ch. 17 IO-Link Data Dictionary, p. 39) or www.schmalz.com.

You can use the following parameters and functions (and more) via IO-Link:

- Displaying the software version
- Displaying the serial number
- Displaying the part number
- Zero-point adjustment of the needles (calibration)
- Setting the offset value for the needles
- ECO mode
- Resetting the device to the factory settings
- Counters
- Condition monitoring [CM]
- Error code
- Monitoring the supply voltage
- Energy monitoring [EM]
- Production setup profiles
- Restricting access using device access locks

10.2 Displaying the Serial Number

The serial number indicates the production period of the device.

This is available in identification parameter 0x0015.

10.3 Displaying the Part Number

The part number is both displayed on the label on the device and stored electronically.

This is available in identification parameter 0x0014.

10.4 Zero-point Adjustment of the Needles (Calibration)

Perform the calibration function to carry out the zero-point adjustment of the needles. This function is available as both a bit in the process data and an ISDU parameter.

If bit 3 is set in PD out or the value "1" is set in the index 0x0078, special homing is carried out, which includes the calibration of the position of the needles.

10.5 Offset Value for the Needles

To compensate for any tolerances when using several grippers in one system, you can change the offset value of the needles (between the end stop and home position).

This value is in the parameter index 0x0050 and is permitted in a range from 0.0 to 0.4 mm.

The default value is 0.1 mm.

10.6 ECO Mode

To save energy and extend the service life of the device, you can use ECO mode to reduce the power consumed by the system. Activating ECO mode reduces the needle insertion force by 20%.

ECO mode is activated and deactivated via index 76 in the ISDU parameters.

ℹ️   If activating ECO mode results in the "Overload" error, then you must deactivate ECO mode. Otherwise, the use of ECO mode is always recommended.

10.7 Resetting the Device to the Factory Settings

This function restores the device configuration from the initial setup and the settings of the active production setup profile to the factory settings.

The following parameters are not affected by this function:

- Counter readings
- Zero-point adjustment of the needle position
- The IO-Link parameter "Application specific tag"
- The production setup profiles, which are currently deactivated

10.8 Counters

Each device has two counters that cannot be cleared and two that can be cleared.

Counters 1 and 2 increase with each valid "Needle Extend/Retract" command, meaning that they count all the gripping cycles during the service life of the device.

Counters 3 and 4 increase each time that a warning or error occurs in the device.

Function	Description	Parameter index
Counter 1	Counter for gripping cycles (can be cleared) ("Needle-Retract/Extend" or "Needle-Move" command)	0x008C
Counter 2	Counter for gripping cycles (cannot be cleared) ("Needle-Retract/Extend" or "Needle-Move" command)	0x008E
Counter 3	Counter for the number of errors and warnings (can be cleared)	0x008F
Counter 4	Counter for the number of errors and warnings (cannot be cleared)	0x0091

10.9 Condition Monitoring Warnings

Condition monitoring to increase system availability:

If a warning occurs, this is sent via an IO-Link parameter in the form of a warning code.

The needle gripper retains its functionality when a warning occurs.

The table below lists the possible warnings and their codes:

Index 0x0092	Description of the warning	Possible measure
Bit 0	Booster mode was triggered due to an overload on the needles. In booster mode, the needles are moved to the home position with maximum force. This causes the needle gripper to heat up more, so it is automatically deactivated again during the next movement to the home position.	It is okay if this only happens once or twice; if it happens more, you should check whether there is a material that is too hard in the movement path of the needles.
Bit 5	Actuator supply voltage is slightly out of the permitted range (yellow area)	Check the actuator supply voltage and adjust it if necessary.
Bit 6	Sensor supply voltage is slightly out of the permitted range (yellow area)	Check the sensor supply voltage and adjust it if necessary.
Bit 7	Overheating	Check whether there is a material that is too hard in the travel path of the needles. Check the ambient temperature

10.10   Error Code

If an error occurs, this is sent via an IO-Link parameter in the form of an error code. The functionality of the device is not guaranteed in the event of a fault. The device drive stops.

The following table lists the possible errors and their codes:

Error code 0x0082	Description	Possible measure
01	Electronics error – EEPROM	Restart the overall supply voltage on the device
02	Electronics error – internal communication	Restart the overall supply voltage on the device
03	Calibration is required/the device is overloaded	Perform the calibration function
05	Actuator supply undervoltage	Check the actuator supply voltage and connect it if necessary
07	Sensor supply undervoltage	Check the sensor supply voltage and connect it if necessary
12	Short circuit on pin 4 (IO-Link)	This error can be read in the error counter following the next successful communication
15	Actuator supply voltage is too high	Check the actuator supply voltage and reduce it if necessary
17	Sensor supply voltage is too high	Check the sensor supply voltage and reduce it if necessary
18	Insertion force exceeds max. permissible insertion force	Check the needles for wear and replace them if necessary
19	Overheating	Check whether there is a material that is too hard in the travel path of the needles. Check the ambient temperature Restart the overall supply voltage on the device

10.11   Monitoring the Supply Voltage

The device has two internal voltage monitors for the actuator and sensor voltages.

Actuator Voltage

If the detected actuator supply voltage is too <u>low</u>, the device sends error message 05 via IO-Link and stops any movement of the needles.

The status indicator turns red and the green power LED also starts to flash.

If the detected actuator supply voltage is too <u>high</u>, the device sends error message 15 via IO-Link and stops any movement of the needles.

Sensor Voltage

If the detected sensor supply voltage is too <u>low</u>, the device sends error message 07 via IO-Link and stops any movement of the needles.

The green power LED goes off.

If the detected sensor supply voltage is too <u>high</u>, the device sends error message 17 via IO-Link and stops any movement of the needles.

ℹ Every time the sensor voltage is interrupted, the controller "loses" the needle position.

▸ Move to the home position ([> See ch. 9.2 Needles Moving (Picking up/Depositing the Workpiece), p. 20](#))

10.12 Energy Monitoring

To enable the optimization of the vacuum gripping systems' energy efficiency, the device provides a function for measuring and displaying the energy consumption.

The system constantly monitors the voltage and current values. The measured values serve as the basis for the various energy monitoring analysis functions.

The energy monitoring values measured for a gripping cycle are available via IO-Link from the beginning of the next respective gripping cycle.

ℹ The values are determined using comparison tables based on the current process parameters. The device is not a calibrated measuring device, but the values can be used as references and for comparative measurements.

10.13 Production Setup Profiles

The device can store up to four different production setup profiles (P-0 to P-3). The speed and position data is stored in these profiles. The profiles are selected using the PD out byte 0 process data byte. This gives users a quick and convenient option for adjusting the parameters to different workpiece conditions.

ℹ The production setup profile P-0 is selected as the default setting.

10.14 Restricting Access Using Device Access Locks

In IO-Link, the "Device access locks" default parameter 0x000C is available to prevent changes to parameter values via IO-Link.

You can also prevent the use of the Data storage mechanism described in IO-Link standard V1.1.

The table below shows the codes for the device access locks:

Bit	Meaning
0	lock IO-Link write accesses (Parameters cannot be changed via IO-Link)
1	lock data storage feature (Data storage mechanism is not triggered)

11 Warranty

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

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

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

Wearing parts are not covered by the warranty.

12 Maintenance

12.1 Safety Instructions for Maintenance

> ⚠ **CAUTION**
>
> **Pricks, cuts and scratches caused by exposed needles!**
> ‣ If possible, push in the needles manually before troubleshooting or before mainte-
>   nance and repair work.
> ‣ Wear suitable work gloves.

> ⚠ **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, depressurized (vented to the atmosphere) and secured against
>   unauthorized restart.

> ⚠ **CAUTION**
>
> **Touching hot surfaces**
>
> Touching hot surfaces may cause injury from burns.
> ‣ Wear work gloves.
> ‣ Do not touch components during operation.
> ‣ Allow the components to cool down before commencing work on the product.

The product must be installed, maintained, and disassembled only by qualified specialist mechanics.

Personnel must have read and understood the instructions.

The maintenance intervals are highly dependent on the specific operating conditions and therefore have to be determined for each respective process.

In particular, operation under difficult conditions such as:

- high levels of dust in the environment or from detached particulates from workpieces
- severe wear on the needles (for instance, due to hard or abrasive work-pieces)

may require a significant reduction in the maintenance intervals.

12.2 Cleaning the Product

1. For cleaning, do not use aggressive cleaning agents such as industrial alcohol, white spirit or thin-ners. Only use cleaning agents with a pH between 7 and 12.

2. Remove dirt on the exterior of the device with a soft cloth and soap suds at a maximum tempera-ture of 60° C.

3. Ensure that no moisture can reach the electrical connection or other electrical components.

12.3 Dirt inside the Device

⚠ **CAUTION**

During machining, dust is released into the environment and can enter the respiratory tract.

Danger to health

▸ Use suction equipment or cover the machining area to ensure that no dust is released into the environment.

▸ If necessary, wear a breathing mask in accordance with class FFP1 or higher.

If there is dirt inside the device, open the maintenance openings on the gripping module as described below, remove the needle modules and remove the dirt using a compressed air gun.

⚠ **CAUTION**

The force of the air flow causes the needle modules to come loose

Risk of injury

▸ Remove the needle modules before cleaning

▸ Wear personal protective equipment (PPE)

NOTE

The "Needles in" position was moved during maintenance

The device may malfunction or become damaged

▸ The "Needle retracted" position of the gripper must be reached before changing the needle modules.

▸ Do not change the position of the gear wheels unless both needle modules are inserted correctly.

Unlocking and Removing the Cover

▸ Use a pointed object (e.g. ballpoint pen, screwdriver) to press in the ball (1) of the spring-loaded pressure piece ❶. While pressing down the ball, slide the cover (2) out of the housing ❷.
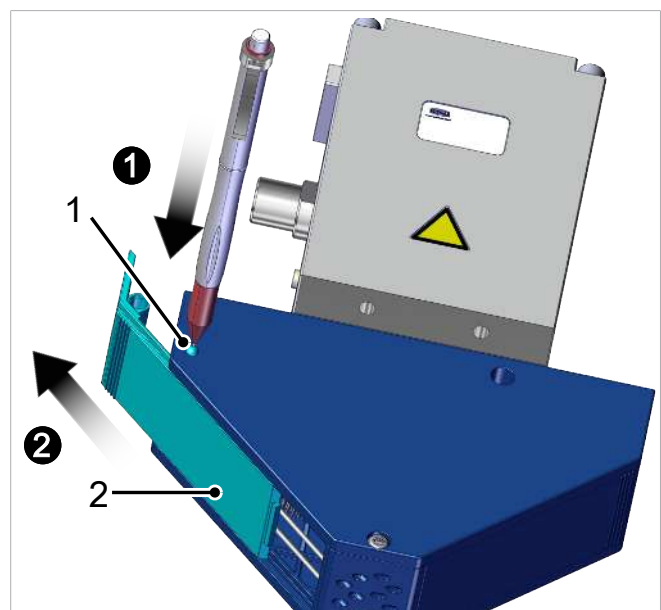
Removing the Needle Module

1. Basic position of the needle module (1).
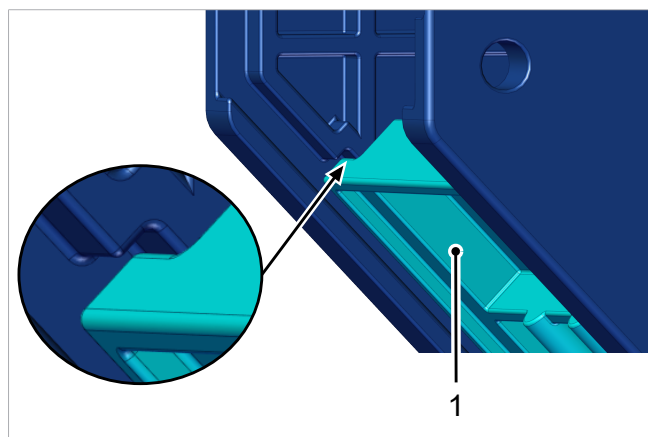
2. Slide the needle module (1) to the lower position.
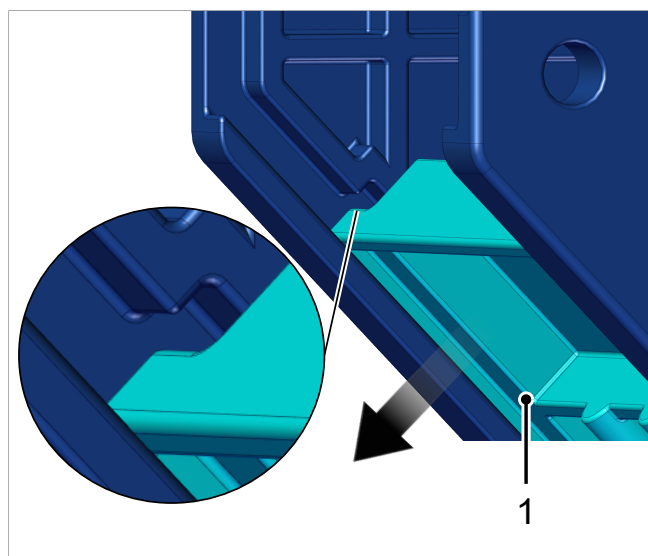
    ⇨ This disengages the needle module from the gearwheel.

3. Pull the needle module (1) out of the housing.
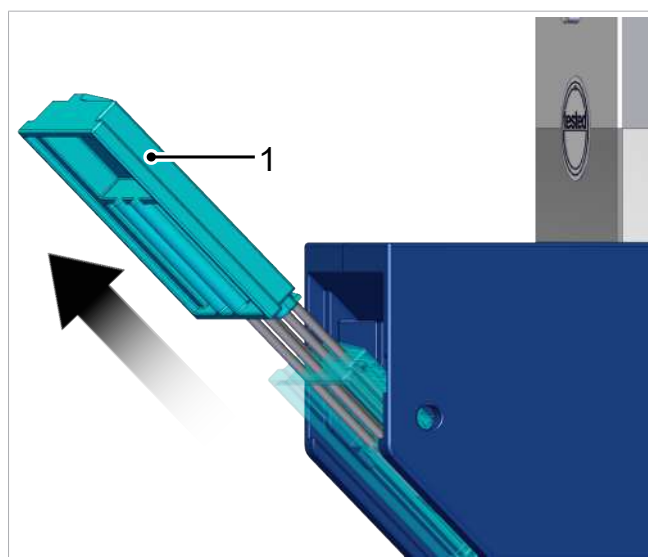
4. Insert the new or cleaned needle module (1) in the opposite order to the removal.

5. After inserting the needle module, move to the **home position**([> See ch. 9.2 Needles Moving (Picking up/Depositing the Workpiece), p. 20](#)).

Installing the Cover

▸ Install the cover in the reverse order of its removal.

⇨ When the covers are installed correctly, the ball of the spring-loaded pressure piece audibly clicks into place.

Checking the Gripper after Cleaning or Changing the Needle Module

▸ Check that the assembly steps above have been carried out correctly:

⇨ 1.) Do the needles <u>not</u> protrude from the gripping surface of the housing?

⇨ 2.) Do both needle modules have the same stroke?

If one of these points is not met, perform the following steps:

1. Remove both needle modules.

2. Insert both needle modules again.

3. Move back to the **home position** again.

Performing a Test Run

▸ Perform a test run before putting the gripper into operation.

13 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.

Part no.	Included in delivery	For needle gripper	Type
10.01.29.00405	ERS SNG-AP/AE 10 0.8 3 2 needle modules, mounted	SNGi-AE 10 0.8 V 3 10.01.29.00390	Wearing part
10.01.29.00406	ERS SNG-AP/AE 10 1.2 3 2 needle modules, mounted	SNGi-AE 10 1.2 V 3 10.01.29.00394	Wearing part
10.01.29.00407	ERS SNG-AP/AE 10 0.8 10 2 needle modules, mounted	SNGi-AE 10 0.8 V 10 10.01.29.00392	Wearing part
10.01.29.00408	ERS SNG-AP/AE 10 1.2 10 2 needle modules, mounted	SNGi-AE 10 1.2 V 10 10.01.29.00396	Wearing part
10.01.29.00409	ERS SNG-AP/AE 10 1.2 10 2 needle modules, mounted	SNGi-AE 10 1.2 V 20 10.01.29.00393	Wearing part
10.01.29.00419	ERS SNG-AP/AE 3 2 covers	SNGi-AE 10 0.8 V 3 10.01.29.00390 SNGi-AE 10 1.2 V 3 10.01.29.00394	Spare part
10.01.29.00420	ERS SNG-AP/AE 10 2 covers	SNGi-AE 10 0.8 V 10 10.01.29.00392 SNGi-AE 10 1.2 V 10 10.01.29.00396	Spare part
10.01.29.00421	ERS SNG-AP/AE 20 2 covers	SNGi-AE 10 1.2 V 20 10.01.29.00393	Spare part

14 Accessories

Part no.	Designation	Note
10.01.29.00403	BEF-PL 38x15x11.5 G1/4-IG SNG	Mounting plate
10.01.29.00622	HTS-A2 SNG AP/AE OP	Holder system, cylindrical shape
10.01.29.00619	HTS-A3 SNG AP/AE OP	Holder system, spherical shape
21.04.05.00158	ASK B-M12-5 1000 S-M12-5	Connection cable
21.04.05.00211	ASK B-M12-5 2000 S-M12-5	Connection cable
21.04.05.00080	ASK B-M12-5 5000 K-5P	Connection cable
10.02.02.04336	ASV IO-L-A B-M12-5 2xS-M12-4	Connection distributor

15 Decommissioning and Disposal

15.1 Taking the Product out of Operation

⚠ **CAUTION**

Improper decommissioning or disassembly of the product

Injury to persons or damage to property

▸ The product must be disassembled only by qualified specialist electricians and mechanics.

▸ The device must be disassembled only when it is unpressurized and disconnected from the mains.

1. Disconnect the product from all supply lines.

2. Remove the product from the higher-level machine.

15.2 Disposing of the Product

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

✓ The product is out of operation.

▸ Disassemble the components of the product and dispose of the materials appropriately.

ℹ For proper disposal, please contact a company specializing in the disposal of technical goods and instruct the company to observe the applicable disposal and environmental regulations. Schmalz is happy to assist you in finding a suitable company.

The table below shows the materials used:

Component	Material
Main body	Fiberglass-reinforced plastics
Inner components	Aluminum alloy, anodized aluminum alloy, brass, gunmetal, stainless steel, PA, PU, POM, steel
Sealing	Nitrile rubber (NBR)
Lubrication	Silicone-free
Screws	Galvanized steel

16 Declarations of Conformity

16.1 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	Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The following harmonized standards were applied:

EN ISO 12100	Safety of machinery — General principles for design — Risk assessment and risk reduction
EN 60204-1+A1+AC	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61000-6-2+AC	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-3+A1+AC	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

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

16.2 UKCA Conformity

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

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

The following designated standards were applied:

EN ISO 12100	Safety of machinery — General principles for design — Risk assessment and risk reduction
EN 61000-6-2+AC	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-3+A1+AC	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

> **ℹ** 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.

17 IO-Link Data Dictionary

See also

SNGi-AE_Data Dictionary_2014-05-19.pdf [▶ 40]

17 IO-Link Data Dictionary

⊘ IO-Link

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SCHMALZ

⊞ IO-Link Implementation

	IO-Link Version 1.1	IO-Link Version 1.0 (legacy mode)
Vendor ID	234 (0x00EA)	234 (0x00EA)
Device ID	100131 (0x018723)	100130 (0x018722)
SIO-Mode	No	No
Baudrate	38.4 kBd (COM2)	38.4 kBd (COM2)
Minimum cycle time	3.3 ms	16.0 ms (Interleave)
Processdata input	4 byte	4 byte
Processdata output	2 byte	2 byte

⊞ Process Data

Process Data In	Name	Bit		Access	Remark
PD In Byte 0	Needles in Position	0		ro	Needles are in selected position
	Needles in home position	1		ro	Needles in Base (home position)
	Neddles moving	2		ro	This bit will be high during the movement of needles
	Calibration	3		ro	This bit will be high during the calibration
	EPC-ACK	4		ro	Acknowledge that EPC values 1 and 2 have been switched according to EPC-Select: 0 - EPC-Select = 00 1 - otherwise
	Device status - green	5		ro	Device is working optimally
	Device status - yellow	6		ro	Device is working but there are warnings
	Device status - red	7		ro	Device is not working properly, there are errors
PD In Byte 1	EPC value 1	7…0		ro	EPC value 1 (byte) Holds 8bit value as selected by EPC-Select 0/1 00 [Online] Speed of Needles in % 01 [CM] Warnings (copy of ISDU parameter 146) 10 [PM] 11 [EM] Supply voltage (ISDU 66)
PD In Byte 2	EPC value 2 high-byte	7…0		ro	EPC value 2 (byte) Holds 16bit value as selected by EPC-Select 0/1 00 [Online] Current position of Needles in 0,1mm (ISDU 64)
PD In Byte 3	EPC value 2 low-byte	7…0		ro	01 [CM] Temperature °C 10 [PM] Total movement time 11 [EM] Energy consumption per cycle (ISDU 157)

Process Data Out	Name	Bit		Access	Remark
PD Out Byte 0	Go to Position	0		wo	Needles move to Position PD OUT Byte 1
	Home position	1		wo	Needles move to Base (home position) (rising edge)
	Move enable	2		wo	Signal has to be true to move the needles (rising edge)
	Calibration	3		wo	perform refrencing then go to home position See feedback in PD In Byte 0 Bit 3
	EPC-Sel0	4		wo	Select Value of PD In Byte 2 and 3
	EPC-Sel1	5		wo	
	Pset0	6		wo	Select Production Profile (2-bit binary coded) (see ISDU parameters from 202)
	Pset1	7		wo	
PD Out Byte 1	Position in 0,1mm	7…0		wo	1 = 0,1mm bis 200 = 20mm

⊞ ISDU Parameters

ISDU Index dec	hex	Parameter	Data width	Value range	Access	Default value	Remark
⊞ Commands							
2	0x02	System command	1 byte		wo	0x82	0x05 (dec 5): Force upload of parameter data into the master 0x82 (dec 130): Restore device parameters to factory defaults 0xA4 (dec 164): Clear diagnostic buffer 0xA5 (dec 165): Perform calibration 0xA7 (dec 167): Reset erasable counters
⊞ Identification							
16	0x0010	Vendor name	15 bytes		ro	J. Schmalz GmbH	Manufacturer designation
17	0x0011	Vendor text	15 bytes		ro	www.schmalz.com	Internet address
18	0x0012	Product name	32 bytes		ro	SNG-AE	General product name
20	0x0014	Product text	30 bytes		ro	SNG-AE 10 0,0 V 00 IOL	Order-Code
250	0x00FA	Article number	14 bytes		ro	10.02.02.*	Order-Nr.
251	0x00FB	Article revision	2 bytes		ro	00	Article revision
21	0x0015	Serial number	9 bytes		ro	000000001	Serial number
22	0x0016	Hardware revision	3 bytes		ro	0.7	Hardware revison
23	0x0017	Firmware revision	3 bytes		ro	1.0	Firmware revision
24	0x0018	Application specific tag	32 bytes		rw	***	User string to store location or tooling information
⊞ Initial Setup							
12	0x000C	Device access locks	2 bytes	0 - 3	rw	0	Bit 0: lock IO-Link write accesses Bit 1: lock data storage feature
76	0x0046	ECO-Mode	1 byte	0-1	rw	0	20% reduction of system current
80	0x0050	Offset value for Needles between perform refrencing and home position	1 byte	0 - 7	rw	0	1 = 0,1mm
⊞ Calibration							
120	0x0078	Calibration	1 byte	1	wo	-	perform refrencing then go to home position (Parameter 80)

⊘ IO-Link

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Index	Hex		Name	Size	Range	Access	Default	Description
122	0x007A		Reset erasable counters	1 byte	1	wo	-	
123	0x007B		Restore factory defaults	1 byte	1	wo	-	1 = Restore to factory defaults
		⊕	Observation					
40	0x0028		Process Data In Copy	4 bytes		ro	-	Copy of currently active process data input
41	0x0029		Process Data Out Copy	2 bytes		ro	-	Copy of currently active process data output
64	0x0040		Current position	2 bytes	0 - 200	ro	-	Current position of needles
65	0x0041		System current	2 byte	0 - 2000	ro	0	Current in mA
66	0x0042		Supply voltage US	2 bytes	0 - 285	ro	-	Supply voltage as measured by the device (unit: 0.1 Volt)
67	0x0043		Supply voltage UA	2 byte	0 - 285	ro	0	Actor voltage as measured by the device (unit: 0.1 Volt)
68	0x0044		Current temperature	2 byte	0 - 285	ro	0	Current system temperature in °C
⊕	Diagnosis							
		⊕	Error					
130	0x0082		Error code	1 byte	0-255	ro	0	Currently active highest priority error code
		⊕	Counter					
140	0x008C		Cycle counter	4 bytes	0 - 999 mio	ro	0	Total number of cycles (Not erasble)
142	0x008E		Condition monitoring counter	4 bytes	0 - 999 mio	ro	0	Total number of warnings and errors (Not erasble)
143	0x008F		Erasable cycle counter	4 bytes	0 - 999 mio	rw	0	Total number of cycles (erasble)
145	0x0091		Erasable condition monitoring counter	4 bytes	0 - 999 mio	rw	0	Total number of warnings and errors (erasble)
		⊕	Condition Monitoring [CM]					
146.0	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	1= Boost mode active
146.1	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	
146.2	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	
146.3	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	
146.4	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	
146.5	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	1 = Sensor voltage outside of operating range
146.6	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	1 = Actor voltage outside of operating range
146.7	0x0092		Condition monitoring	1 Bit	0 - 1	ro	0	1 = Over temperature
		⊕	Energy Monitoring [EM]					
157	0x009D		Energy consumption per cycle	1 byte	0 - 255	ro	0	Energy consumption of last cycle (unit: 1 Ws)
		⊕	Production Setup Profiles					
200	0x00C8		ECO-Mode	1 byte		rw	0	Profile P-0 (selected in PD Out 0: Pset0 = 0, Pset1 = 0)
202	0x00CA		Speed of needles movement	2 bytes		rw	100	
204	0x00CC		Position of needles in 0,1mm	2 bytes		rw	0	
210	0x00D2		ECO-Mode	1 byte		rw	0	Profile P-1 (selected in PD Out 0: Pset0 = 1, Pset1 = 0)
212	0x00D4		Speed of needles movement	2 bytes		rw	100	
214	0x00D6		Position of needles in 0,1mm	2 bytes		rw	30	
220	0x00DC		ECO-Mode	1 byte		rw	0	Profile P-2 (selected in PD Out 0: Pset0 = 0, Pset1 = 1)
222	0x00DE		Speed of needles movement	2 bytes		rw	100	
224	0x00E0		Position of needles in 0,1mm	2 bytes		rw	50	
230	0x00E6		ECO-Mode	1 byte		rw	0	Profile P-3 (selected in PD Out 0: Pset0 = 1, Pset1 = 1)
232	0x00E8		Speed of needles movement	2 bytes		rw	100	
234	0x00EA		Position of needles in 0,1mm	2 bytes		rw	100	

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