

Adaptive shape grippers DHEF

FESTO



Key features

At a glance

Several gripping benefits are combined in a single model:

- Gripping parts with undefined positions and shapes
- Form-fitting gripping of products with different geometries

- Form-fitting gripping with suction cup effect
- Gentle gripping of delicate products of varying sizes

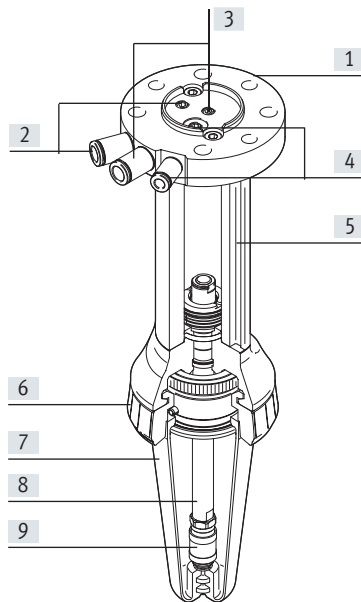
Sensor technology:

- Position sensing possible with position transmitters and proximity sensors

Applications:

- Human-robot collaboration thanks to gripper without edges
- Unpacking of boxes as well as separation and positioning of parts
- Picking parts and magazining

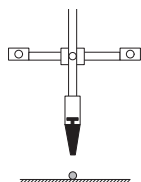
The technology in detail



- [1] Direct mounting via through-hole suitable for DIN ISO 9409-1-50-4-M6 (industrial robots – mechanical interfaces)
- [2] Compressed air supply port for retracting
- [3] Compressed air supply port for advancing
- [4] Compressed air supply port for inverting cap
- [5] T-slot for mounting the sensors (both sides)
- [6] Bayonet lock
- [7] Inverting cap
- [8] Piston rod
- [9] Releasing ring for replacing the inverting cap

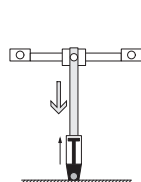
Control variant

Positioning



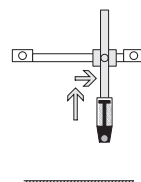
- Move the tip of the inverting cap to the object to be gripped
- The inverting cap is supplied with 0.07 ... 0.1 bar via a pressure regulator
- The drive is exhausted

Gripping



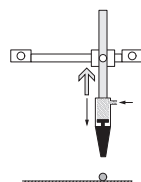
- Press the shape gripper on the object to be gripped until the inverting cap is retracted
- Pressurise the compressed air supply port for retracting in order to hold the object in place

Moving



- Move to the placement position

Placing



- Exhaust the compressed air supply port for retracting
- The object to be gripped is released
- Move the shape gripper away from the object
- If the shape gripper does not release the object it has gripped, the compressed air supply port for advancing will have to be pressurised

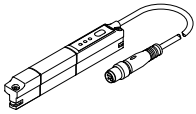
- Note

The gripper variant with robot connection DHEF...-RA1 makes it possible to integrate the gripper into the robot control system directly and easily. A software plug-in is provided for this purpose.

Key features

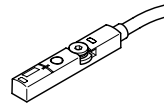
Position sensing

With position transmitter SDAT-MHS



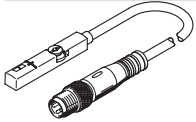
- Analogue position feedback possible
- Analogue output
– 4 ... 20 mA

With position transmitter SDAS-MHS



- Choice of two operating modes:
- Two adjustable switching outputs
 - IO-Link

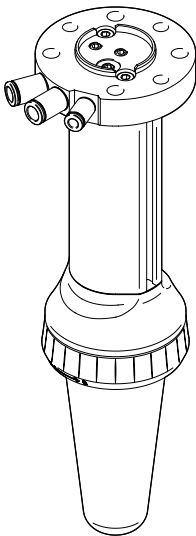
With position transmitter SMAT-8M



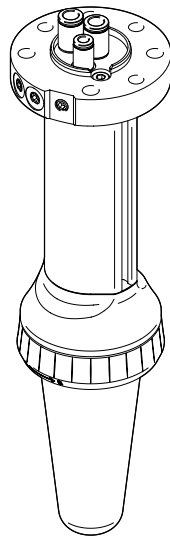
- Analogue position feedback possible
- Analogue output
– 0 ... 10 V

Compressed air supply ports

From the side

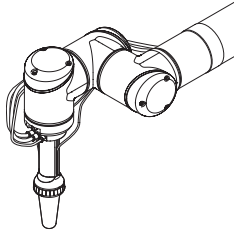


From above



Key features

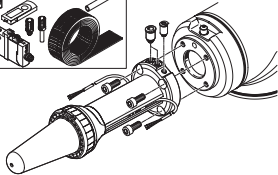
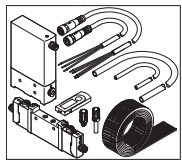
Fast and intuitive integration on a robot arm



The gripper with robot connection DHEF-...-RA1 enables fast integration on a light-weight robot.

In order to mount the gripper on the robot arm, the necessary accessories are included in the kit, in addition to the gripper itself.

The plug-in is a simple means for integrating the gripper directly into the program sequence of the robot control system (→ page 6).



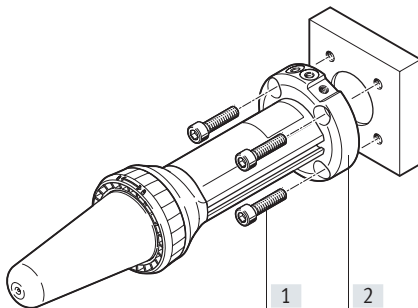
- - **Note**

The gripper with robot connection DHEF-...-RA1 is only compatible with the following robots:

- Universal Robots UR3/UR5/UR10:
from software version PolyScope CB 3.8.0
- Universal Robots UR3e/UR5e/UR10e/UR16e:
from software version PolyScope SW 5.2.0

For additional information → www.festo.com/sp

Mounting options

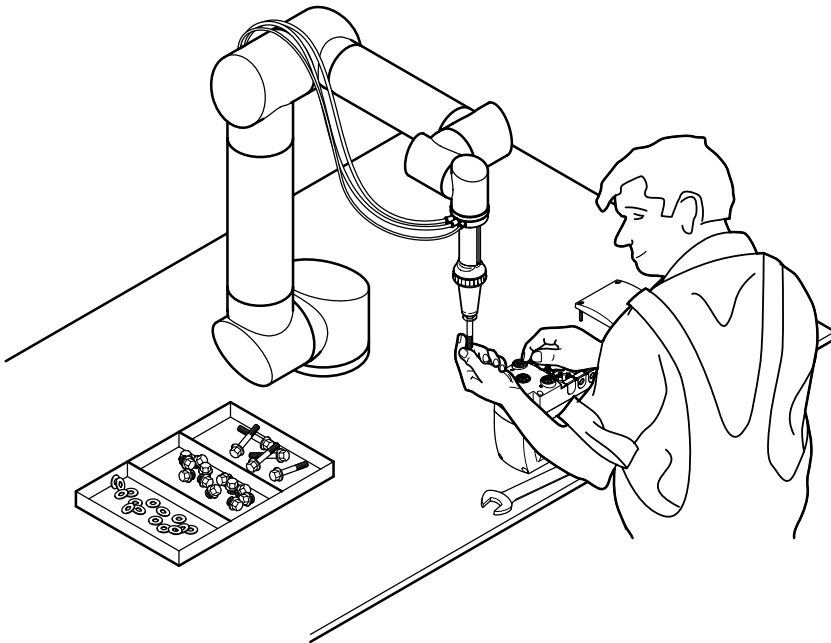


- [1] Retaining screws
- [2] Direct mounting via through-hole suitable for DIN ISO 9409-1 - 50-4-M6 (industrial robots – mechanical interfaces)

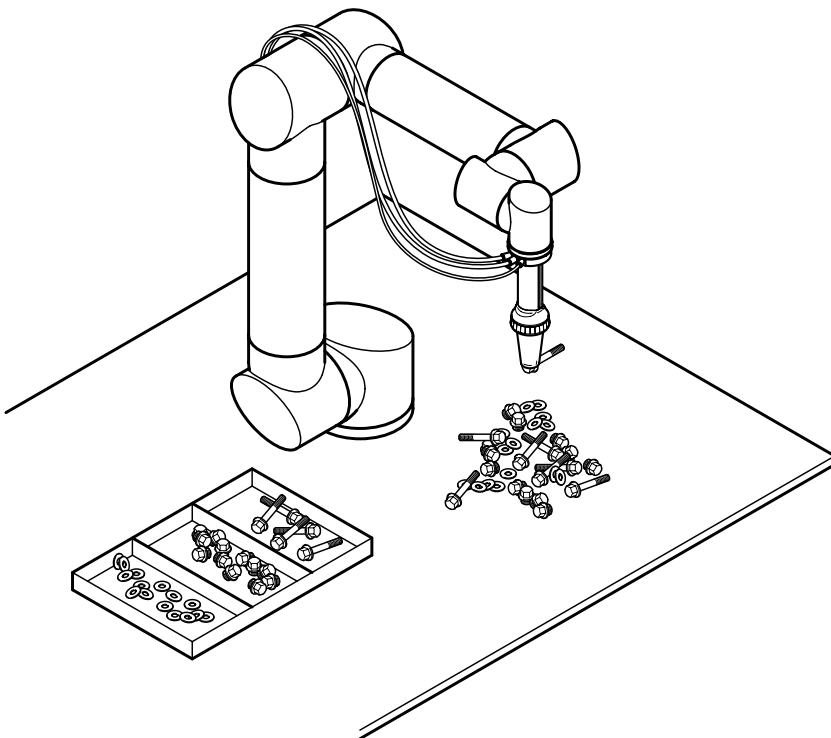
Key features

Application examples

Human-robot collaboration

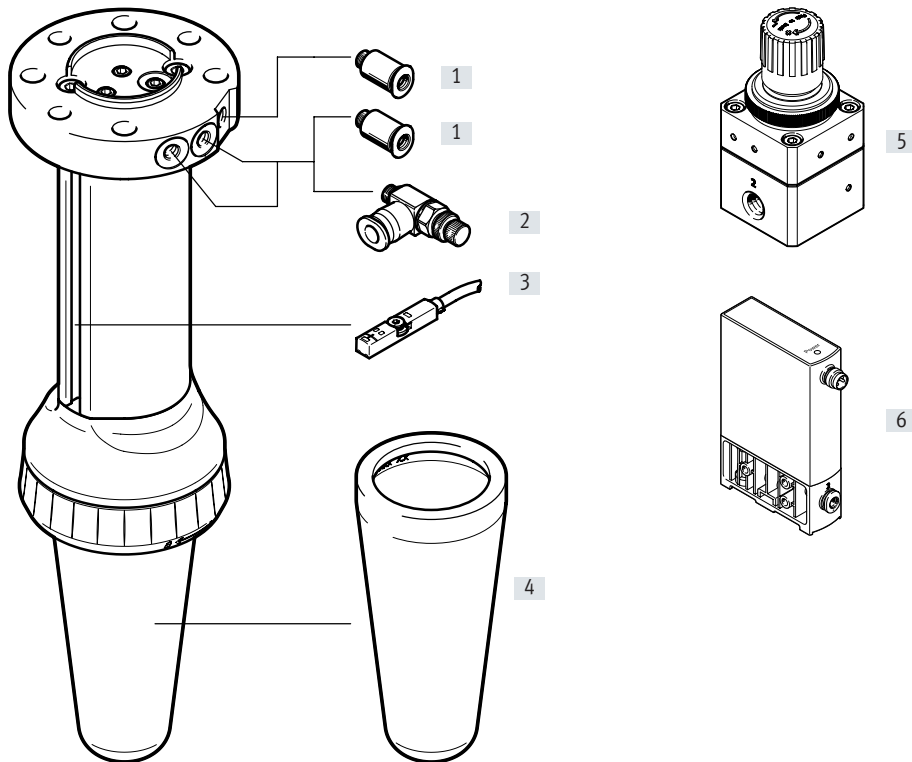


Picking parts



Peripherals overview

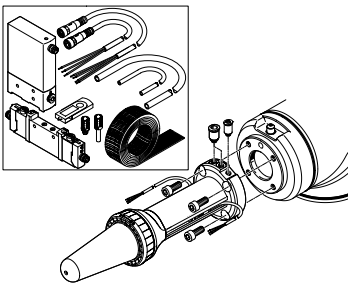
Peripherals overview



Accessories

| Type | Description | → Page/Internet |
|---|--|-----------------|
| [1] Push-in fitting QSM, QSMLV | For connecting compressed air tubing with standard O.D. | 13 |
| [2] One-way flow control valve GRLA | For regulating speed | 12 |
| [3] Proximity sensor SMT-8 | For position sensing | 12 |
| Position transmitter SDAT, SMAT, SDAS | For detecting the current position | 13 |
| [4] Inverting cap DHAS | Included in the scope of delivery of the shape gripper; can be reordered as an accessory | 12 |
| [5] Precision pressure regulator LRP | For manually regulating the operating pressure of the inverting cap | 12 |
| [6] Proportional-pressure regulator VEAB | For electronically regulating the operating pressure of the inverting cap | 12 |

System product for robot connection



If the feature DHEF-...-RA1 is used, the delivery includes all the connection components in addition to the gripper:

- Proximity sensors
- Valve and pressure regulator
- Connecting cables
- Tubing for connecting the gripper
- QS fittings and silencers
- Velcro strip for fixing the connecting cables and tubing in place
- Mounting screws
- USB memory stick for software plug-in

Ordering data → page 11

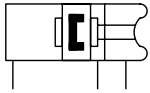
Type codes

| | | |
|------|------------------------|--|
| 001 | Series | |
| DHEF | Adaptive shape gripper | |

| | | |
|-----|----------------------|--|
| 003 | Position sensing | |
| A | For proximity sensor | |

| | | |
|-----|------|--|
| 002 | Size | |
| 20 | 20 | |

Data sheet



The technical data is valid for the following conditions:

- Object to be gripped: steel ball
- Diameter: 30 mm
- Weight: 390 g
- Smooth, lathed surface

The values may differ if another type of object needs to be gripped.

Sharp-edged objects can affect the service life of the inverting cap.



General technical data

| | |
|--|---|
| Design | Inverting cap |
| | Force-guided motion sequence |
| Inverting cap version | Standard |
| Mode of operation | Double-acting |
| Gripper function | Adaptive |
| Guide | Basic guide |
| Stroke | [mm] 66 |
| Pneumatic connection | M5 |
| Max. operating frequency | [Hz] 1 |
| Position sensing | Via proximity sensor and position transmitter |
| Type of mounting | To ISO 9409 |
| Mounting position | Any |
| Diameter to be gripped | [mm] 12 ... 38 |
| Permissible dynamic transverse load with max. cantilever | [N] 2.3 |
| Mass moment of inertia | [kgcm ²] 1.29 |
| Guide value for payload | [kg] 1 |

Operating and environmental conditions

| | |
|---|--|
| Operating pressure of drive | [bar] 1 ... 8 |
| Operating medium | Compressed air to ISO 8573-1:2010 [7:4:4] |
| Note on operating/pilot medium | Operation with lubricated medium not possible |
| Ambient temperature ¹⁾ | [°C] 0 ... +60 |
| Corrosion resistance class CRC ²⁾ | 2 |
| Operating pressure of cap | [bar] 0.07 ... 0.1 |
| Nominal pressure of cap | [bar] 0.08 |
| Burst pressure of cap | [bar] 0.3 |
| Recommended min. flow rate for pressure regulator ³⁾ | [l/min] 10 |
| Robot compatibility with variant DHEF-...-RA1 | Universal Robots UR3/UR5/UR10: from software version PolyScope CB 3.8.0 |
| | Universal Robots UR3e/UR5e/UR10e/UR16e: from software version PolyScope SW 5.2.0 |

1) Note operating range of proximity sensors

2) Corrosion resistance class CRC 2 to Festo standard FN 940070

Moderate corrosion stress. Indoor applications in which condensation can occur. External visible parts with primarily decorative surface requirements which are in direct contact with a normal industrial environment.

3) Theoretical guide value during operation of the drive at nominal pressure (6 bar) without an object being gripped.

The inverting cap must not be overstretched during gripping and has to be checked for every gripping application.

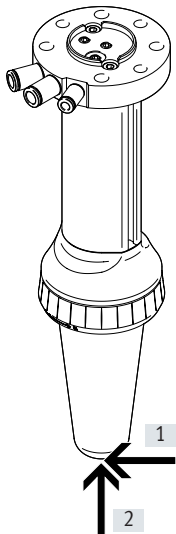
It may be necessary to restrict the speeds.

Data sheet

| Weight [g] | | |
|---|--|-----|
| Product weight | | 475 |
| Inverting cap | | 18 |
| Moving mass without inverting cap | | 60 |
| Materials | | |
| Housing | Anodised aluminium | |
| Inverting cap | VMQ (silicone) | |
| Locking cover | Polyamide | |
| Note on materials | Contains paint-wetting impairment substances RoHS-compliant | |
| Suitability for use in the food industry | See supplementary material information | |
| Forces and impact energy | | |
| Drive force at 6 bar | | |
| Retracting | [N] | 158 |
| Advancing | [N] | 189 |
| Contact force on object to be gripped ¹⁾ | [N] | 20 |
| Max. holding forces | | |
| Parallel to the gripper axis | [N] | 26 |
| Perpendicular to the gripper axis | [N] | 45 |
| Max. impact energy at the end positions | [J] | 0.1 |

1) In unpressurised state

Holding force



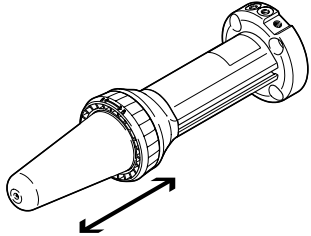
- [1] Holding force perpendicular to the gripper axis
 [2] Holding force parallel to the gripper axis

Data sheet

| Max. speeds [mm/s] | |
|-----------------------|-------------------|
| Without object | 290 |
| For picking up object | 120 ¹⁾ |

1) The shape gripper must be throttled

Retracting and advancing times [ms]

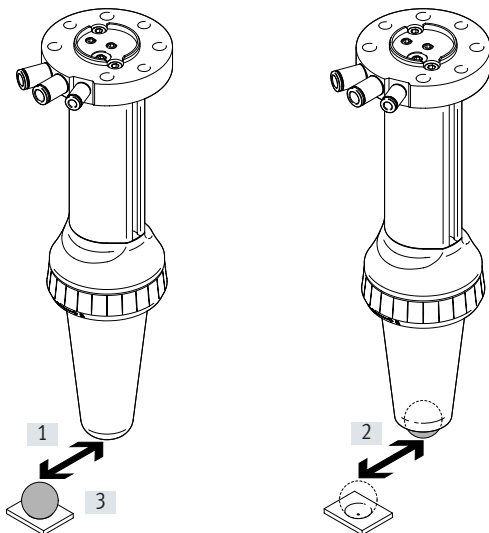


The specified retracting and advancing times [ms] are valid for the following conditions:

- Operating pressure of 6 bar
- Horizontal mounting position
- Without gripped object

| | |
|------------|-----|
| Retracting | 290 |
| Advancing | 270 |

Pick-up and placement tolerances [mm]



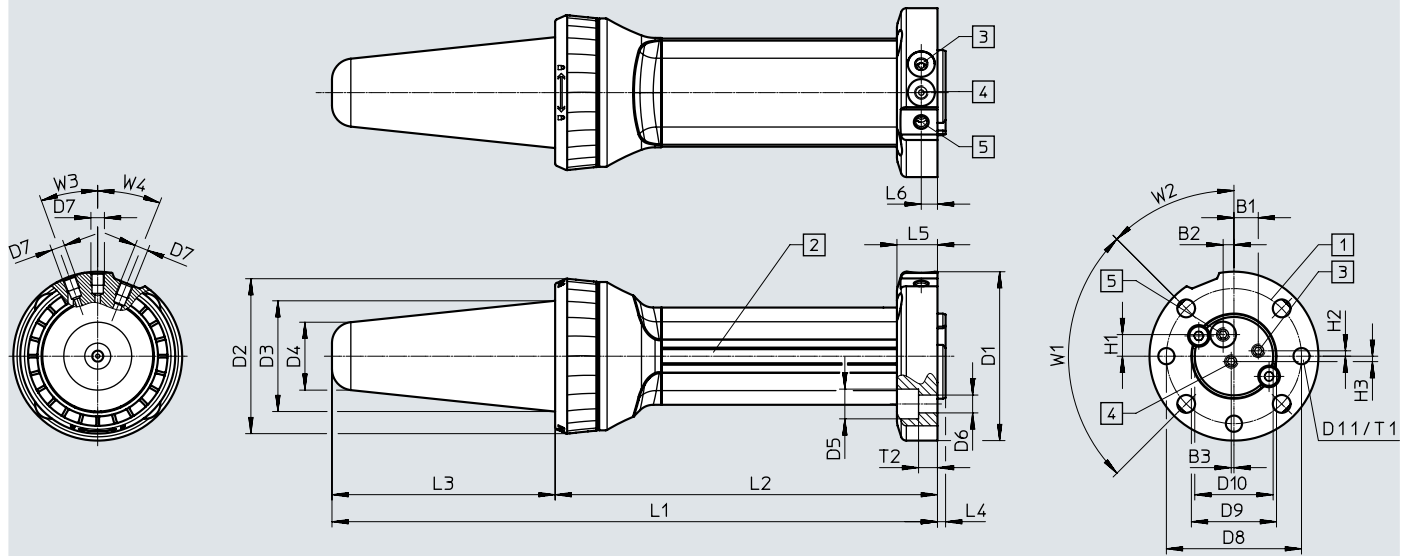
- [1] Pick-up tolerance
- [2] Placement tolerance
- [3] Object to be gripped

| | |
|---------------------|----|
| Pick-up tolerance | ±4 |
| Placement tolerance | ±2 |

Data sheet

Dimensions

Download CAD data → www.festo.com



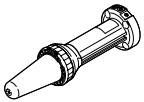
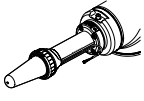
- [1] Mechanical interface/mounting flange suitable for DIN ISO 9409-1-50-4-M6 (industrial robots – mechanical interfaces)
- [2] T-slot for mounting the sensors (both sides)
- [3] Compressed air supply port for retracting
- [4] Compressed air supply port for advancing
- [5] Compressed air supply port for inverting cap

| Size | B1 | B2 | B3 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|------|----|----|----|------|------|----|----|----|-----|----|
| [mm] | | | | ∅ | ∅ | ∅ | ∅ | ∅ | ∅ | ∅ |
| 20 | 9 | 4 | 1 | 62.5 | 57.5 | 41 | 25 | 11 | 6.6 | M5 |

| Size | D8 | D9 | D10 | D11 | H1 | H2 | H3 | L1 | L2 | L3 |
|------|----|------|-----|-----|----|----|----|-----|-------|------|
| [mm] | ∅ | ∅ | ∅ | ∅ | | | | | | |
| 20 | 50 | 31.5 | 29 | 6 | 8 | 2 | 2 | 224 | 141.5 | 82.5 |

| Size | L4 | L5 | L6 | T1 | T2 | W1 | W2 | W3 | W4 |
|------|----|----|----|-----|----|-----|-----|-----|-----|
| [mm] | | | | | | | | | |
| 20 | 3 | 15 | 6 | 8.5 | 7 | 90° | 45° | 20° | 22° |


Ordering data

| | Part no. | Type |
|---|---|----------------------|
|  | Gripper | |
| | 8092533 | DHEF-20-A |
|  | Gripper with robot connection ¹⁾ | |
| | 8119114 | DHEF-20-A-RA1 |

1) Only the gripper and the necessary accessories are included in the scope of delivery → p. 6
Compatible robots → p. 4


Accessories

Ordering data – Inverting caps

| | Description | Weight [g] | Material | Part no. | Type |
|--|---|------------|----------------|----------------|----------------------|
|  | Spare part for the adaptive shape gripper | 18 | VMQ (silicone) | 8097634 | DHAS-GA-B22-S |

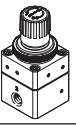
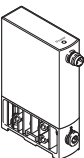
Ordering data – One-way flow control valves

Data sheets → Internet: grla

| | Connection thread | For tubing O.D. | Material | Part no. | Type |
|--|-------------------|-----------------|----------|---------------|-----------------------|
|  | M5 | 3 | Metal | 193137 | GRLA-M5-QS-3-D |
| | | 4 | | 193138 | GRLA-M5-QS-4-D |


Ordering data – Pressure regulators

Data sheets → Internet: pressure regulators

| | | Pressure regulation range [bar] | Part no. | Type |
|---|--|---------------------------------|---------------|---|
| Precision pressure regulator | | | | |
|  | <ul style="list-style-type: none"> For regulating the operating pressure of the inverting cap Manual | 0.05 ... 0.7 | 159500 | LRP-1/4-0.7 |
| Proportional-pressure regulator | | | | |
|  | <ul style="list-style-type: none"> For regulating the operating pressure of the inverting cap Electronic | Voltage type, 0 ... 10 V | 0.001 ... 0.2 | 8046301 VEAB-L-26-D12-Q4-V1-1R1 |
| | | Current type, 4 ... 20 mA | 0.001 ... 0.2 | 8046302 VEAB-L-26-D12-Q4-A4-1R1 |



Ordering data – Proximity sensor for T-slot, magneto-resistive

Data sheets → Internet: smt

| | Type of mounting | Switching output | Electrical connection | Cable length [m] | Part no. | Type |
|--|--|------------------|-----------------------|------------------|---------------|----------------------------------|
| N/O contact | | | | | | |
|  | Insertable in the slot from above, flush with the cylinder profile, short design | PNP | Cable, 3-wire | 2.5 | 574335 | SMT-8M-A-PS-24V-E-2.5-OE |
| | | | Plug M8x1, 3-pin | 0.3 | 574334 | SMT-8M-A-PS-24V-E-0.3-M8D |
| | | NPN | Cable, 3-wire | 2.5 | 574338 | SMT-8M-A-NS-24V-E-2.5-OE |
| | | | Plug M8x1, 3-pin | 0.3 | 574339 | SMT-8M-A-NS-24V-E-0.3-M8D |

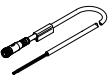
Ordering data – Connecting cables

Data sheets → Internet: nebu



| | Electrical connection, left | Electrical connection, right | Cable length [m] | Part no. | Type |
|--|------------------------------|------------------------------|------------------|---------------|----------------------------|
|  | Straight socket, M8x1, 3-pin | Cable, open end, 3-wire | 2.5 | 541333 | NEBU-M8G3-K-2.5-LE3 |
| | | | 5 | 541334 | NEBU-M8G3-K-5-LE3 |
|  | Angled socket, M8x1, 3-pin | Cable, open end, 3-wire | 2.5 | 541338 | NEBU-M8W3-K-2.5-LE3 |
| | | | 5 | 541341 | NEBU-M8W3-K-5-LE3 |

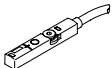
Ordering data – Connecting cables for the gripper's connector plugs



Data sheets → Internet: nebu



| | Electrical connection, left | Electrical connection, right | Cable length [m] | Part no. | Type |
|--|------------------------------|------------------------------|------------------|---------------|--------------------------|
|  | Straight socket, M8x1, 3-pin | Cable, open end, 3-wire | 5 | 569846 | NEBU-M8G3-R-5-LE3 |

Accessories

| Ordering data – Position transmitters for T-slot | | | | | | | | Data sheets → Internet: position transmitters |
|---|--------------------------|-----------------|----------|-----------------------------------|---------------------------|------------------|----------|---|
| | Position measuring range | Analogue output | | Type of mounting | Electrical connection | Cable length [m] | Part no. | Type |
| | | [V] | [mA] | | | | | |
|  | 0 ... 50 | – | 4 ... 20 | Insertable in the slot from above | Plug M8x1, 4-pin, in-line | 0.3 | 1531265 | SDAT-MHS-M50-1L-SA-E-0.3-M8 |
|  | 0 ... 40 | 0 ... 10 | – | Insertable in the slot from above | Plug M8x1, 4-pin, in-line | 0.3 | 553744 | SMAT-8M-U-E-0.3-M8D |

| Ordering data – Position transmitters for T-slot | | | | | | | | Data sheets → Internet: sdas |
|---|--------------------------|---|-----------------------------------|---------------------------|------------------|----------|----------------------------------|------------------------------|
| | Position measuring range | Description | Type of mounting | Electrical connection | Cable length [m] | Part no. | Type | |
|  | ≤ 33 | Choice of two operating modes: • Two adjustable switching outputs • IO-Link | Insertable in the slot from above | Plug M8x1, 4-pin, in-line | 0.3 | 8063974 | SDAS-MHS-M40-1L-PNLK-PN-E-0.3-M8 | |
| | | | | Cable, open end | 2.5 | 8063975 | SDAS-MHS-M40-1L-PNLK-PN-E-2.5-LE | |

| Ordering data – Connecting cables | | | | | | Data sheets → Internet: nebu |
|---|------------------------------|------------------------------|------------------|----------|---------------------|------------------------------|
| | Electrical connection, left | Electrical connection, right | Cable length [m] | Part no. | Type | |
|  | Straight socket, M8x1, 4-pin | Cable, open end, 4-wire | 2.5 | 541342 | NEBU-M8G4-K-2.5-LE4 | |
| | | | 5 | 541343 | NEBU-M8G4-K-5-LE4 | |
|  | Angled socket, M8x1, 4-pin | Cable, open end, 4-wire | 2.5 | 541344 | NEBU-M8W4-K-2.5-LE4 | |
| | | | 5 | 541345 | NEBU-M8W4-K-5-LE4 | |

| Ordering data – Push-in fittings | | | | | | | Data sheets → Internet: push-in fittings |
|---|------------|--------------------|------------------|------------------|----------|--------------|--|
| | Connection | Nominal width [mm] | Tubing O.D. [mm] | Weight/piece [g] | Part no. | Type | PU ¹⁾ |
| Male thread with internal hexagon | | | | | | | |
|  | M5 | 1.9 | 3 | 3.2 | 153313 | QSM-M5-3-I | 10 |
| | | 2.5 | 4 | 3 | 153315 | QSM-M5-4-I | |
| | | 2.6 | 6 | 4.4 | 153317 | QSM-M5-6-I | |
| Male thread with internal hexagon, rotatable | | | | | | | |
|  | M5 | 1.7 | 3 | 5.1 | 130830 | QSMLV-M5-3-I | 10 |
| | | 1.8 | 4 | 5.0 | 130831 | QSMLV-M5-4-I | |

1) Packaging unit

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