



Operating manual
Electro-pneumatic positioners
Series 824

Original instructions

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1 General data

This operating manual contains instructions that enable the product to be safely and properly installed, put into operation and maintained.

The target group for this operating manual is exclusively specially trained and authorised technical personnel.

Please contact the manufacturer if you encounter problems that cannot be solved with the aid of this operating manual.

The product is subject to technical changes at any time.

1.1 Validity of the manual

This operating manual applies to the product in the version described in the device pass.

1.2 Contact details

Further information about the product can be obtained from:

Manufacturer's address

ARCA Regler GmbH
Kempener Str. 18
D-47918 Tönisvorst
Tel.: +49 (0) 2156-7709-0
Fax: +49 (0) 2156-7709-55
E-mail: sale@arca-valve.com
www.arca-valve.com

1.3 Other applicable documents

The product can be delivered as part of an actuator and equipped with additional components that are described in their own operating manuals. The instructions as well as the warning and safety information contained therein must also be observed.

Furthermore, the following documents apply in addition to this operating manual.

- Device pass
- Installation drawing

1.4 Place of storage of the manual

The operating manual and all other applicable documents are part of the product. They must be kept in the immediate vicinity of the product and must be accessible to the personnel at all times.

2 Safety

2.1 Introduction

This manual contains all the information you need for the connection and commissioning of the device.

It is addressed to people who mechanically mount, electrically connect and commission the device, as well as service and maintenance technicians.

We expressly state that the contents of this device manual do not form part of or modify a former or existing agreement, assurance or of a legal relationship. All obligations are specified in the particular purchase contract which also contains all the applicable warranty regulations. These contractual warranty conditions are neither extended nor restricted by any statements in this document.

The contents reflect the technical state at the time of printing.

We reserve the right to make technical changes in the course of further development.



WARNING

Use of a damaged or incomplete device

Risk of explosion!

- ▶ Do not use damaged or incomplete devices.

2.2 General safety information

Requirement for safe use

This equipment has been supplied from the factory in a totally safe condition. To maintain this condition and to ensure safe operation of the device, follow these instructions and observe all safety-relevant information.

Pay attention to the notices and symbols on the device. Do not remove any notices or symbols from the device. Keep the notices and symbols in a fully legible condition at all times.

2.3 Explanation of symbols and notices

This documentation contains notes that you must observe for your own personal safety and for the avoidance of damage to property. Notes concerning personal safety are highlighted by a warning triangle; notes concerning only damage to property are not marked by a warning triangle. Depending on the danger level, the warning notes are shown in decreasing order of severity as follows:



DANGER

means that death or serious injuries will occur if the corresponding preventive measures are not taken.



⚠ WARNING

means that death or serious injuries can occur if the corresponding preventive measures are not taken.



⚠ CAUTION

with a warning triangle means that slight injury and/or damage to property can occur if the corresponding preventive measures are not taken.



NOTICE

indicates an important item of information about the product itself or how the product should be handled, to which special attention should be paid.

CAUTION

without a warning triangle means that damage to property can occur if the corresponding preventive measures are not taken.

ATTENTION

indicates that an undesirable event or condition can occur if the corresponding instructions are not observed.

If several danger levels occur, the warning note for the respectively highest level will always be used. If a warning note with a warning triangle warns against personal injury, a warning against damage to property may be included in the same warning note.

2.4 Warning symbols on the device

| Symbol | Explanation of the warning symbols on the device |
|--------|--|
| | Observe the operating manual |

2.5 Intended use

Observe the following:



⚠ WARNING

ARCA positioners may be used only for the applications specified in the associated technical documentation. Proper transport, storage, erection, assembly, installation, commissioning, operation and maintenance are required for trouble-free and safe operation. The permissible environmental conditions must be maintained. Notices in the associated documentation must be observed.



2.6 Improper modifications to the device

WARNING

Modification to the device

Modifications and repairs to the device can result in danger to the personnel, plant and environment!

- ▶ Modify or repair the device only as described in the instructions delivered with the device. The manufacturer's warranty and the product approvals are rendered null and void if this is ignored.

2.7 Qualified Personnel

The device may be set up and operated only in conjunction with this documentation. Commissioning and operation may be performed only by **qualified personnel**. Qualified personnel within the meaning of the safety instructions in this documentation are persons authorised to commission, earth and mark devices, systems and circuits according to the safety standards.

Qualified persons are those who are familiar with the erection, assembly, commissioning and operation of the product. These persons have the following qualifications:

- They are authorised and have been trained or instructed to operate and maintain devices and systems in accordance with the safety standards for electrical circuits, high pressures and aggressive and/or hazardous media.
- They have been trained or instructed in the care and use of appropriate safety equipment in accordance with safety standards.

2.8 Laws and regulations

The test certificates, regulations and laws applicable to your country must be observed for the connection, assembly and operation.

These are, for example:

- The Work Health and Safety Regulations

2.9 Liability disclaimer

We have checked the contents of this instruction for correspondence to the device described. Nevertheless, deviations cannot be ruled out; therefore we cannot give any guarantee for full correspondence. The specifications are checked regularly and any necessary corrections will be included in subsequent editions.

2.10 Conformity to European directives

The CE mark on the device indicates its conformity to the following European directives:

| | |
|-------------------|--|
| 2014/30/EU EMC | Directive of the European Parliament and of the Council on the approximation of the Laws of the Member States regarding electromagnetic compatibility. |
|-------------------|--|

| | |
|------------|--|
| 2006/42/EC | Directive of the European Parliament and of the Council on Machinery (Machinery Directive for short) |
|------------|--|

The applied standards can be found in the EC Declaration of Conformity for the device.

3 Transport, storage and packaging

3.1 Transport

Transport at a temperature lower than -40 °C or higher than $+80\text{ °C}$ is not permissible.

3.2 Storage



NOTICE

Improper storage!

There is a danger of the product no longer functioning if it is stored improperly.

- ▶ Storage at a temperature lower than -40 °C or higher than $+80\text{ °C}$ is not permissible.
- ▶ It must be stored in roofed-over storage places and that are weather-proof.

Openings are sealed with suitable means to prevent the ingress of dirt. These should be removed by technical personnel at the place of installation.



CAUTION

Inadequate protection during storage

The packaging offers only limited protection against moisture and infiltration!

- ▶ Provide additional packaging if necessary.

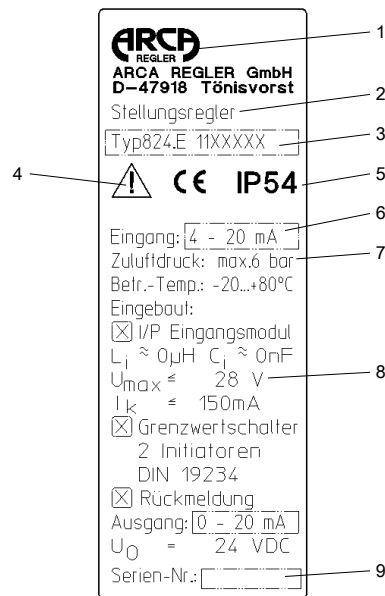
3.3 Packaging

The product is packed in a PE film inside the outer packaging (cardboard box, wooden crate, pallet, lattice box).

If the packaging, in particular the PE film, has been opened, the product must be stored immediately in a heated room.

The product must be packed in weatherproof or seaworthy packaging for transport by ship, rail or truck.

4 Nameplate



| | |
|---|-------------------------------|
| 1 | Manufacturer |
| 2 | Device name |
| 3 | Type |
| 4 | Observe the operating manual |
| 5 | Protection class |
| 6 | Nominal signal range |
| 7 | Auxiliary energy (supply air) |
| 8 | Auxiliary energy (voltage) |
| 9 | Fabrication number |

Illustration 1: Nameplate

5 Type key

| | | | | | | | | |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|
| 824. | P | 0 | 0 | 0 | - | 0 | 0 | 0 |
| [1] | [2] | [3] | [4] | [5] | | [6] | [7] | [8] |

1 Series

824.

2 Operating mode

| | |
|---|--|
| P | pneumatic |
| E | electro-pneumatic, not explosion-proof |

3 Output signal

| | |
|---|---------------|
| 1 | single-acting |
| 2 | double-acting |

4 Input signal

| | |
|---|---------------|
| 0 | 0.2 - 1.0 bar |
| 1 | 4 - 20 mA |
| 2 | 0 - 20 mA |
| 3 | 0.2 - 0.6 bar |
| 4 | 0.6 - 1.0 bar |
| 5 | 4 - 12 mA |
| 6 | 12 - 20 mA |
| 7 | 0 - 10 mA |
| 8 | 10 - 20 mA |

5 For lifting / turning movement

| | |
|---|-----------------------|
| 0 | Stroke \geq 20 mm |
| 1 | Stroke $<$ 20 mm |
| 3 | Angle of rotation 90° |
| 4 | Angle of rotation 60° |

6 Auxiliary pneumatic equipment

| | |
|---|-----------------|
| 0 | without |
| 1 | Manometer block |

7 Limit switches

| | |
|---|-------------------------------------|
| 0 | without |
| 1 | inductive, standard design SJ3.5N |
| 2 | inductive, safety circuit SJ3.5SN |
| 3 | inductive, direct-switching SJ3.5E2 |

8 Feedback

| | |
|---|----------------------------|
| 0 | none |
| 1 | ./. |
| 2 | Potentiometer |
| 3 | Position transducer 3-wire |
| 4 | Position transducer 2-wire |

Example of type designation 824.E110-100

Positioner 824 – electro-pneumatic, not explosion-proof – single-action –
input signal 4 - 20 mA – for stroke \geq 20 mm – with manometer block –
without limit value switch – without feedback

6 Exploded view

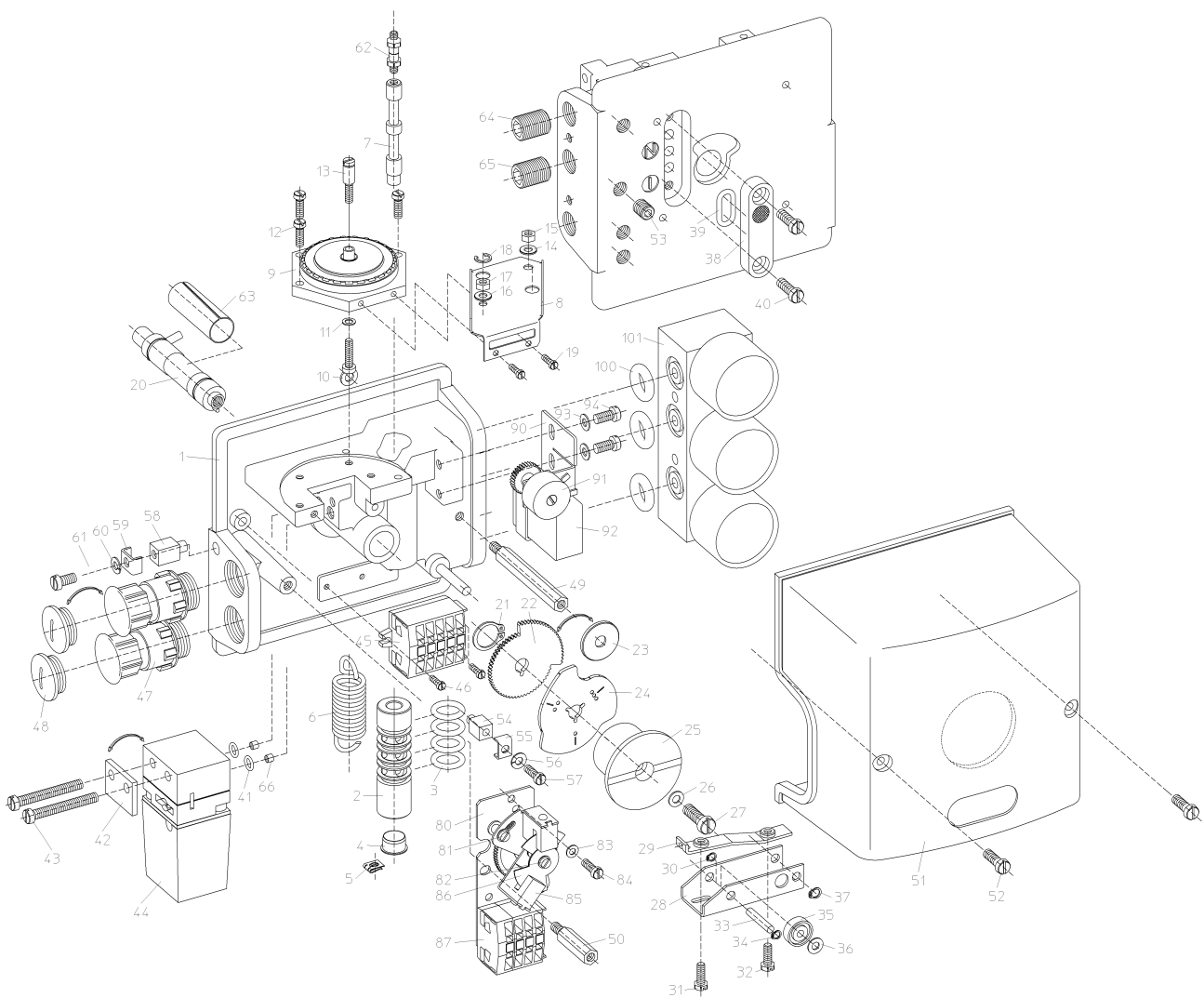


Illustration 2: Detail drawing

7 Parts list

7.1 Positioner

| Item | Name |
|------|--------------------------|
| 1 | Mounting block |
| 2 | Control bushing |
| 3 | O-ring |
| 4 | Plug |
| 5 | Bayonet clips |
| 6 | Spring |
| 7 | Control piston |
| 8 | Piston lever |
| 9 | Diaphragm chamber |
| 10 | Spring suspension |
| 11 | Washer |
| 12 | Cylinder head bolt |
| 13 | Stop screw |
| 14 | Washer |
| 15 | Hex nut |
| 16 | Washer |
| 17 | Hex nut |
| 18 | Grip ring |
| 19 | Cylinder head bolt |
| 20 | Shaft |
| 21 | Circlip |
| 22 | Gear segment |
| 23 | Washer |
| 24 | Cam plate |
| 25 | Position indicator |
| 26 | Washer |
| 27 | Cylinder head bolt |
| 28 | Return plate |
| 29 | Return lever |
| 30 | Circlip |
| 31 | Zero point setting screw |
| 32 | Range setting screw |
| 33 | Shaft |
| 34 | Circlip |
| 35 | Ball bearing |
| 36 | Washer |
| 37 | Circlip |
| 38 | Changeover switch |
| 39 | O-ring |
| 40 | Cylinder head bolt |
| 41 | O-ring |
| 42 | Sealing plate |
| 43 | Cylinder head bolt |
| 44 | I/P module (standard) |
| 45 | Terminal set |
| 46 | Cylinder head bolts |
| 47 | Cable gland |
| 48 | Cover |
| 49 | Spacer screw |
| 50 | Spacer screw |
| 51 | Cover |

| | |
|-----|---------------------------------|
| 52 | Cylinder head bolt |
| 53 | Screw plug |
| 54 | Earthing block |
| 55 | Lug |
| 56 | Spring lock washer |
| 57 | Cylinder head bolt |
| 58 | Earthing block |
| 59 | Lug |
| 60 | Spring lock washer |
| 61 | Cylinder head bolt |
| 62 | Control wire |
| 63 | Plain bearing |
| 64 | Screw plug |
| 65 | Screw plug |
| 66 | Dirt strainer |
| 80 | Limit value transmitter module |
| 81 | Cylinder head bolt |
| 82 | Cylinder head bolt |
| 83 | Washer |
| 84 | Cylinder head bolt |
| 85 | Limit value transmitter |
| 86 | Vane |
| 87 | Terminal set |
| 90 | Feedback module |
| 91 | Potentiometer |
| 92 | Position transducer |
| 93 | Washer |
| 94 | Cylinder head bolt |
| 100 | O-ring |
| 101 | Manometer block |
| 103 | Cylinder head bolt |
| 105 | O-ring |
| 106 | Mounting block |
| 107 | O-ring |
| 108 | I/P module (pressure-resistant) |
| 109 | Cylinder head bolt |
| 110 | O-ring |

8 Description

8.1 Function and structure

- The positioner operates in accordance with the force comparison principle and controls the position of actuators proportionally. The signal air pressure at the input is converted into force by a diaphragm in the diaphragm chamber (9) and compared with the return force of the spring (6). At force equilibrium the positioner is in the steady state. If the input pressure increases, the piston lever (8) is deflected upwards so that the piston (7) is also raised. Supply air now flows via the output into the pneumatic actuator, as a result of which it is moved (downwards in the case shown). The pretension of the return spring (6) is thereby increased via the lifting or rotary lever, the cam plate (24) and the return lever (204). This takes place until the spring force and the diaphragm are in equilibrium (steady state). Actuator stroke and input signal pressure are thus correlated in accordance with the cam plate contour. If the input signal falls, this has the reverse effect on the valve stroke. The piston moves downwards, shuts off the supply air and vents the pneumatic actuator via the vent hole in the piston bushing of the positioner. As a result of this the actuator changes its position towards the original position.
- The functional sequence is the same with the double-action positioners, however the piston now controls two outputs. If the piston is deflected upwards it vents the output y_2 , while supply air flows in through the output y_1 . The relationships at the outputs y_1 and y_2 are the opposite when the piston lever moves downwards.
- The actuation speed of the cylinder can be regulated in both directions by additionally adjustable throttle check valves in the actuation signal lines Y_1 and Y_2 to be provided by the customer. As a result of this a more or less strong fixation of the cylinder actuator is also achieved asymmetrically.
- In the case of the I/P module the impressed DC current I flows through a fixed coil (44.1) as the input signal. This magnetises a magnetically soft yoke (44.2). The field lines of this system exposed at an air gap (44.3) exert a force proportional to the input current on a small magnet (44.4) that is made of a highly coercive alloy. Together with a baffle plate (44.5) the small magnet forms the rotary system of the device. The impact plate covers a nozzle (44.6) to a greater or lesser extent, the air from the nozzle exerting a resetting force that is in equilibrium with the force at the magnet. The nozzle is provided via a throttle (44.7) with air from the output of the control part (44.8), which is influenced by the change in pressure in front of the nozzle. Thus a linear correlation between the electrical input signal and the pneumatic output signal exists.
- Split ranges are used if, for example, two actuators with positioners in different control ranges are to be controlled by one controller. One valve would operate with the input signal range 0.2 – 0.6 bar and the other with the split range 0.6 – 1.0 bar. The split ranges differ by different springs, which are marked in colour.

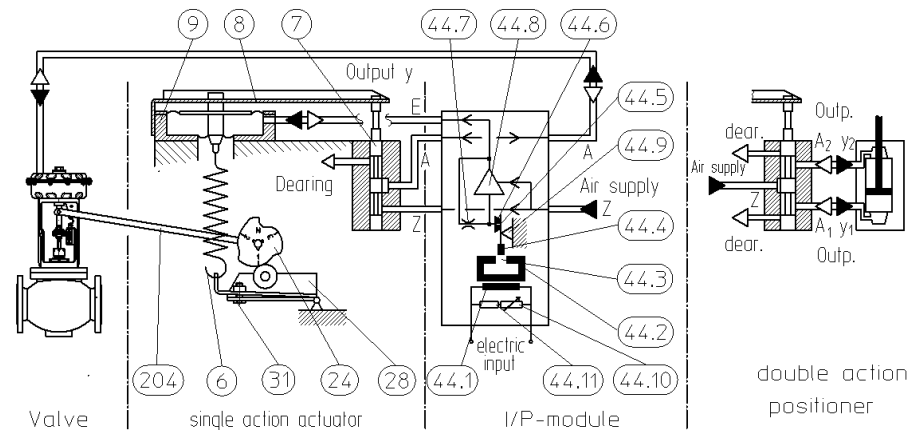
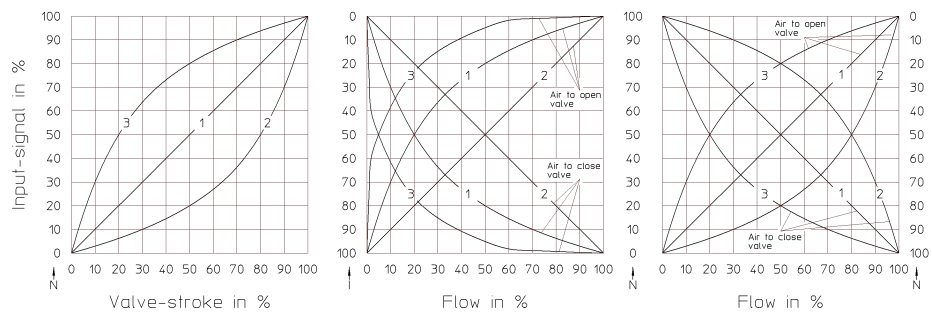


Illustration 3: Functional description

8.1.1 Cam plate

The cam plate (24) of the positioner has three characteristics, which are designed for a 60° angle of rotation equivalent to a 100% stroke or a 90° angle of rotation for a 90° opening angle with rotary valves. For the basic version, the linear curve (no. 1 in fig. 1) is provided normally. The on/off curve (no. 2) and the equal percentage curve (no. 3) are also shown in this diagram.

Figs. 1 and 2 show how these curves affect the flow rate of valves with different opening characteristics. The linear curve (no. 1) linearly assigns the valve stroke to the input signal, i.e. the input signal is mapped directly to the valve stroke so that the effect of the valve's own opening characteristic is retained. The use of the curves (nos. 2 & 3) offers the possibility to change the effect of valve characteristics.



| Fig. 1 | Fig. 2 | Fig. 3 |
|---|---|---|
| Valve characteristics | Flow characteristics | Flow characteristics |
| depending on the input signal with various cam plates | with various cam plates and equal-percentage valve cone depending on the input signal | with various cam plates and linear valve cone depending on the input signal |

9 Installation

Check whether the desired principle of operation - "normal" or "inverted" - is set correctly. To do this, look at the rear side of the positioner and check the setting. If it should be necessary to change the setting, refer to the chapter [12.1] *Normal / Inversion* "Configuration".

9.1 Safety instructions for assembly

CAUTION

Improper installation

Improper installation can result in damage to the device, its destruction or the impairment of its function.

Ascertain that the device shows no visible signs of damage each time before installing it.

Ascertain that the process connections are clean and that suitable seals and cable glands are used.

Install the device using suitable tools.



⚠ CAUTION

Mechanical impact

It is essential that the following sequence is observed during installation in order to avoid injury or mechanical damage to the positioner/mounting kit:

- ▶ Mechanically mount the positioner
- ▶ Connect the pneumatic auxiliary energy
- ▶ Connect the auxiliary electrical energy supply
- ▶ Carry out the commissioning procedure

ATTENTION

The device protection class becoming null and void

Damage to the device due to open or improperly closed housing. The protection class specified on the nameplate is no longer guaranteed.



⚠ CAUTION

Humid environment/dry compressed air

If the environment is humid, mount the positioner in such a way that there is no chance of the control axis freezing (getting stuck) at low ambient temperatures.

Make sure that water does not enter an open housing or threaded joint. If the positioner cannot be immediately and permanently mounted and connected on site, it is possible for water to enter.

In general, only dry compressed air may be used to operate the positioner. Also refer to the chapter [16.2] *Data for the basic device*. You should therefore make use of the usual water separators. In extreme cases it may be necessary to use an additional dryer. The use of dryers is particularly important if you operate the positioner at low ambient temperatures. When mounting on the valve block, set the purging air switch above the pneumatic connections to the "OUT" position.

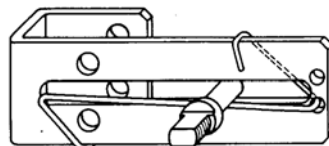
9.2 Mounting a linear actuator

9.2.1 Installation according to DIN/IEC 534 T6 (NAMUR)

Refer also to fig. 5 "Installation 824/Namur":

- Seal the actuation pressure output A_{36} (M8 thread) on the rear side of the positioner with the blanking plug (53).
 - Also refer to the chapter [10] *Pneumatic connection*.
- Mount the spring wire (201) on the drive lever (200) in accordance with fig. 4.
 - **NOTICE!** The version ("N" or "I") is visible on the cam plate (24).
- Mount the drive lever (200) on the stroke indicator using cylinder head bolts (203).
- Mount the stroke setting screw (205) with the washer (206) on the pivot lever (204) using nut (207).
 - **NOTICE!** Observe the stroke scale on the pivot lever (204)!
- Mount the pivot lever (204) on the positioner using the nut, bolt and spring lock washers (208-210).
- Bolt the mounting plate (231) to the positioner with the spring lock washers (234) and bolts (235).
- Position the positioner against the actuator such that the stroke setting screw (205) protrudes into the slot of the drive lever (200).
 - Refer here to fig. 4.
- Mount the complete positioner with mounting plate (231) on the cast iron or pillar yoke according to fig. 5.

Cam plate N (normal)



Cam plate I (inverted)

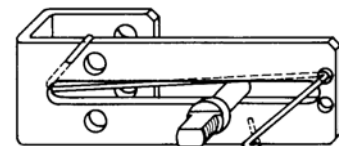


Illustration 4: Drive lever

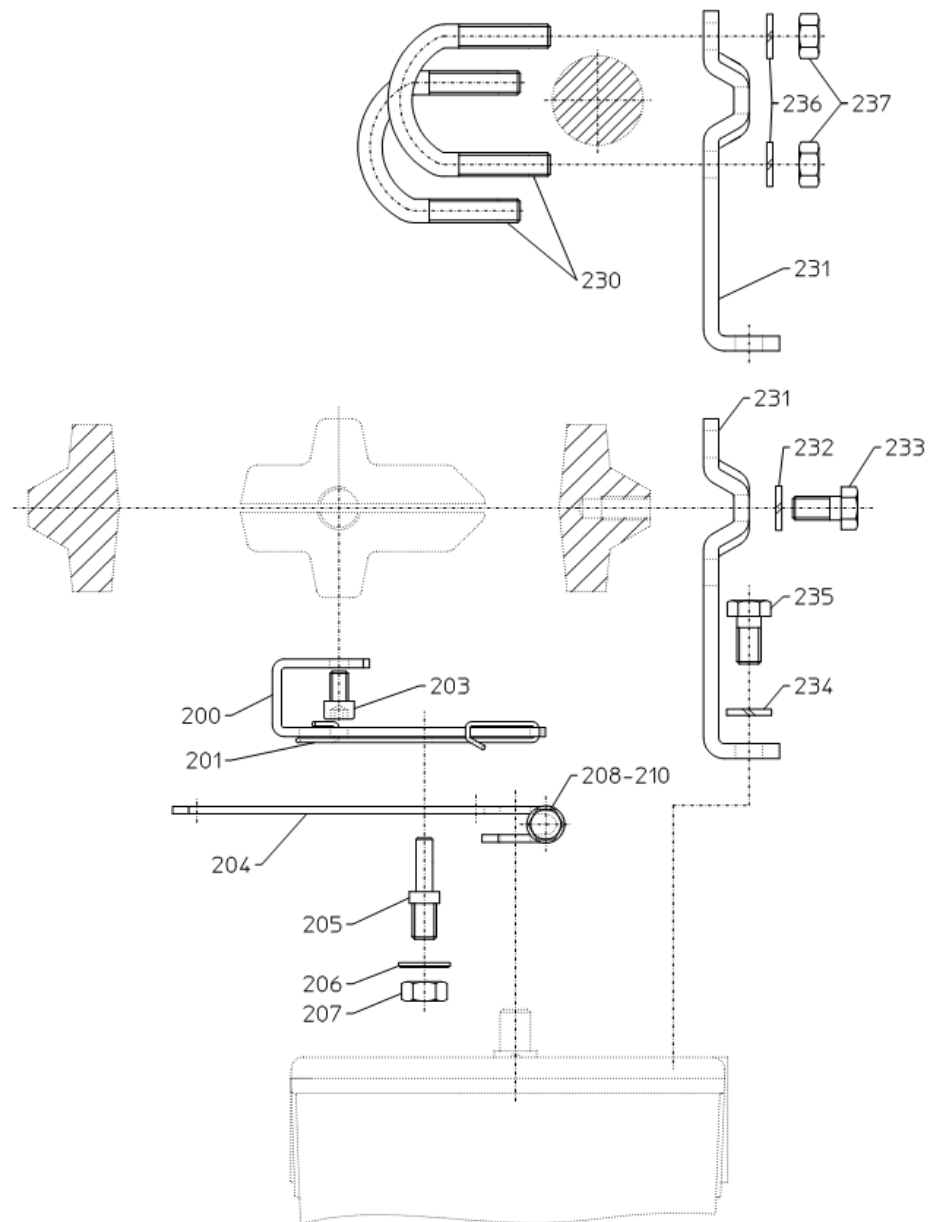


Illustration 5: Installation 824/Namur

| | |
|-----|----------------------|
| 200 | Drive lever |
| 201 | Spring wire |
| 203 | Cylinder head bolts |
| 204 | Pivot lever |
| 205 | Stroke setting screw |
| 206 | Washer |
| 207 | Hex nut |
| 208 | Hex screw |
| 209 | Hex nut |
| 210 | Washer |
| 230 | Stirrup bolts |
| 231 | Mounting plate |
| 232 | Spring lock washer |
| 233 | Hex screw |
| 234 | Spring lock washer |

| | |
|-----|--------------------|
| 235 | Hex screw |
| 236 | Spring lock washer |
| 237 | Hex nut |

9.2.2 Integrated mounting on actuators series 812

Mounting procedure (see illustrations below)

- Mount the stroke driving pin (225) on the actuator stem and secure with Loctite 601.
- Seal the actuation pressure output A_{36} on the positioner with the blanking plug (65).
 - Remove the blanking plug (53) from the rear side of the device (if fitted).
 - Also refer to the chapter [10] *Pneumatic connection*.
- Mount the stroke adjustment screw (222) on the pivot lever (211) with the washer (217), nut (216), sliding washer (218), conical roller (220) and circlip (221).
 - **NOTICE!** Observe the stroke scale on the pivot lever (211)!
- Mount the pivot lever (211) on the positioner using the nut, bolt and spring lock washers (214-212).
- Place the O-ring (224) in the groove in the adapter plate (250).
- Position the positioner against the actuator such that the conical roller (220) engages between the stroke drive pins (225) on the actuator stem.
- Bolt the positioner to the actuator yoke with the bolts (223) and spring lock washers (226).

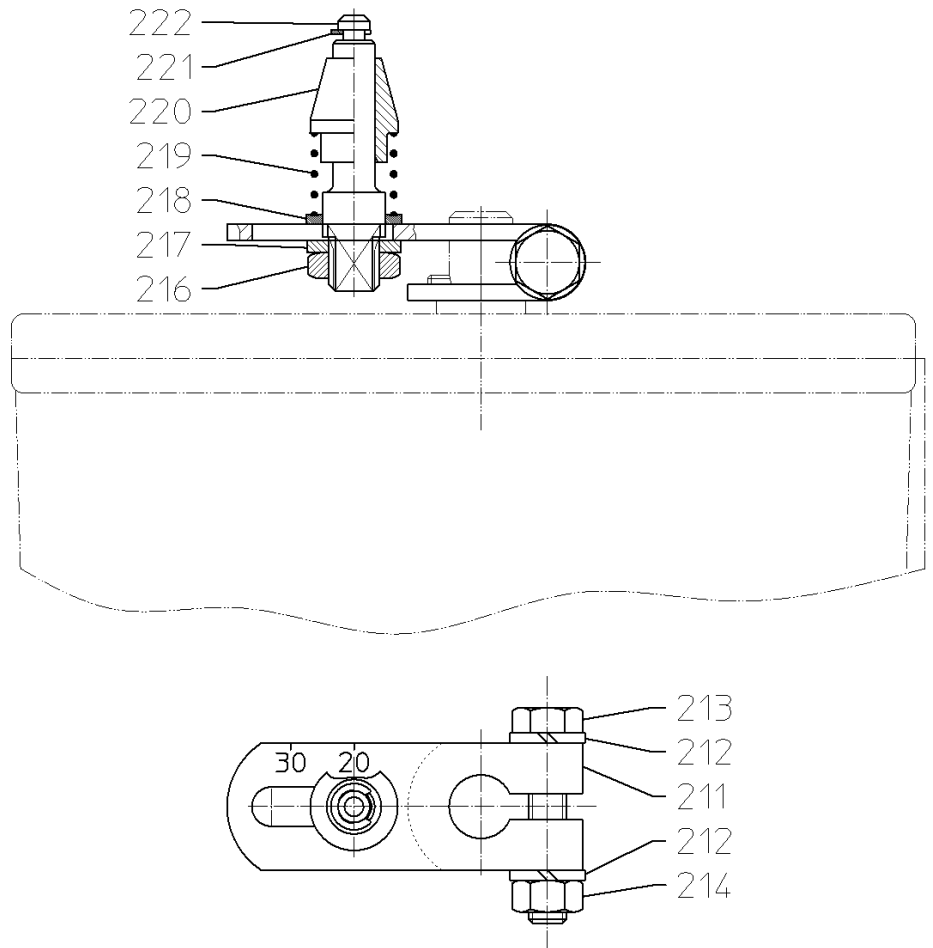


Illustration 6: Pivot lever

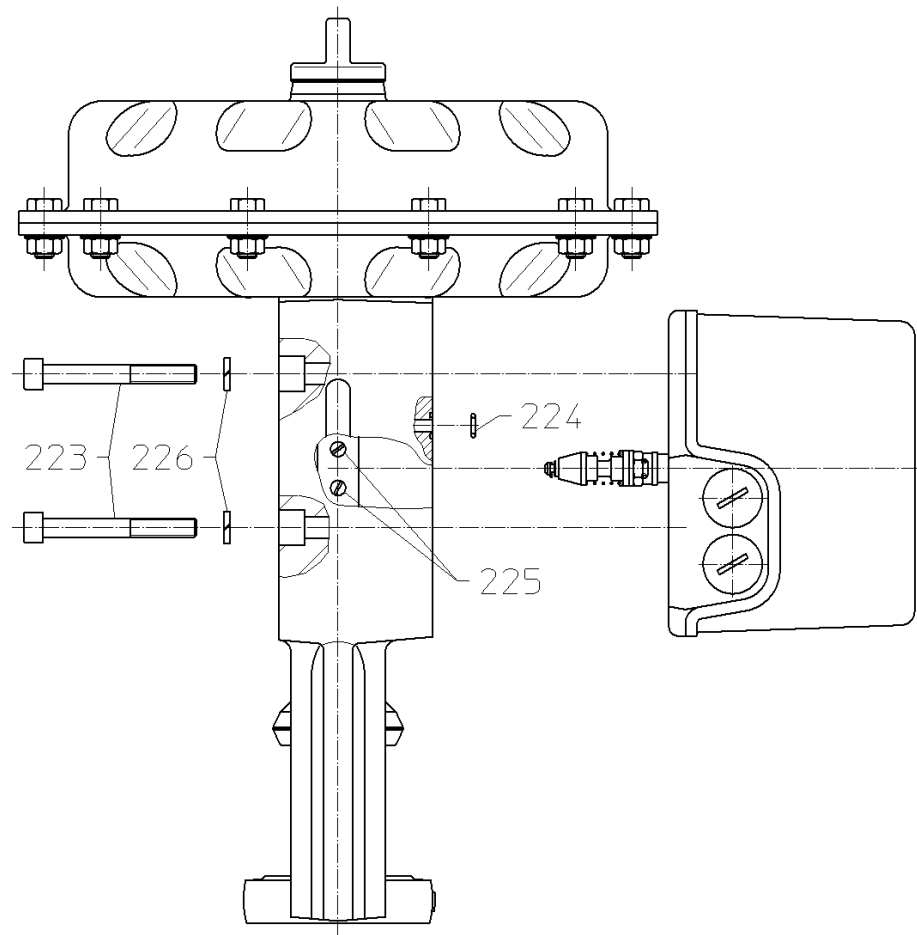
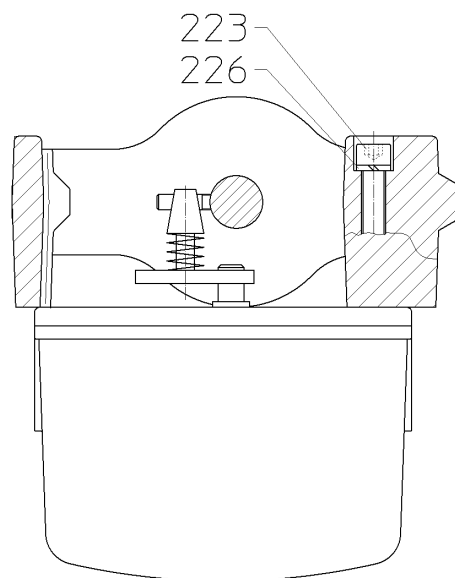


Illustration 7: Assembly 824/812 side view



| | |
|-----|----------------------|
| 211 | Pivot lever |
| 212 | Spring lock washer |
| 213 | Hex screw |
| 214 | Hex nut |
| 216 | Hex nut |
| 217 | Washer |
| 218 | Sliding washer |
| 219 | Spring |
| 220 | Conical roller |
| 221 | Circlip |
| 222 | Stroke setting screw |
| 223 | Cylinder head bolt |
| 224 | O-ring |
| 225 | Stroke driving pin |
| 226 | Spring lock washer |

Illustration 8: Assembly 824/812 standard top view

9.2.3 Integrated mounting on actuators series 813

Mounting procedure (see illustrations below)

- Mount the stroke driving pins (258) on the bracket (257) and secure with Loctite 601.
- Mount the bracket (257) on the actuator stem with the nut (259).

- Seal the actuation pressure output A_{36} on the positioner with the blanking plug (65).
 - Remove the blanking plug (53) from the rear side of the device (if fitted).
 - Also refer to the chapter [10] *Pneumatic connection*.
- Mount the adapter (252) on the positioner with the grub screw (253).
- Mount the adapter plate (250) and O-ring (254) on the positioner with the screws (251).
- Mount the stroke adjustment screw (222) on the pivot lever (211) with the washer (217), nut (216), sliding washer (218), conical roller (220) and circlip (221).
 - **NOTICE!** Observe the stroke scale on the pivot lever (211)!
- Mount the pivot lever (211) on the positioner using the nut, bolt and spring lock washers (214-212).
- Place the O-ring (255) in the nut in the actuator yoke.
- Position the positioner against the actuator such that the conical roller (220) engages between the stroke drive pins (258) on the actuator stem.
- Bolt the positioner to the actuator yoke with the bolts (256).

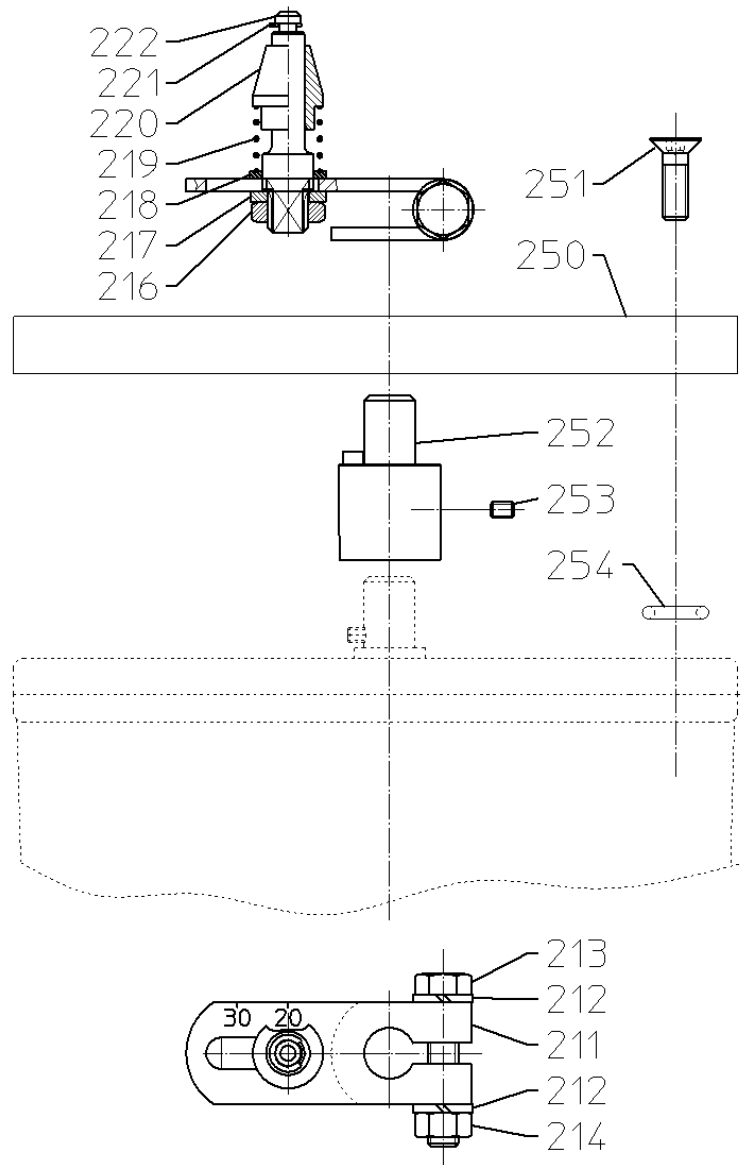


Illustration 9: Adapter plate / pivot lever

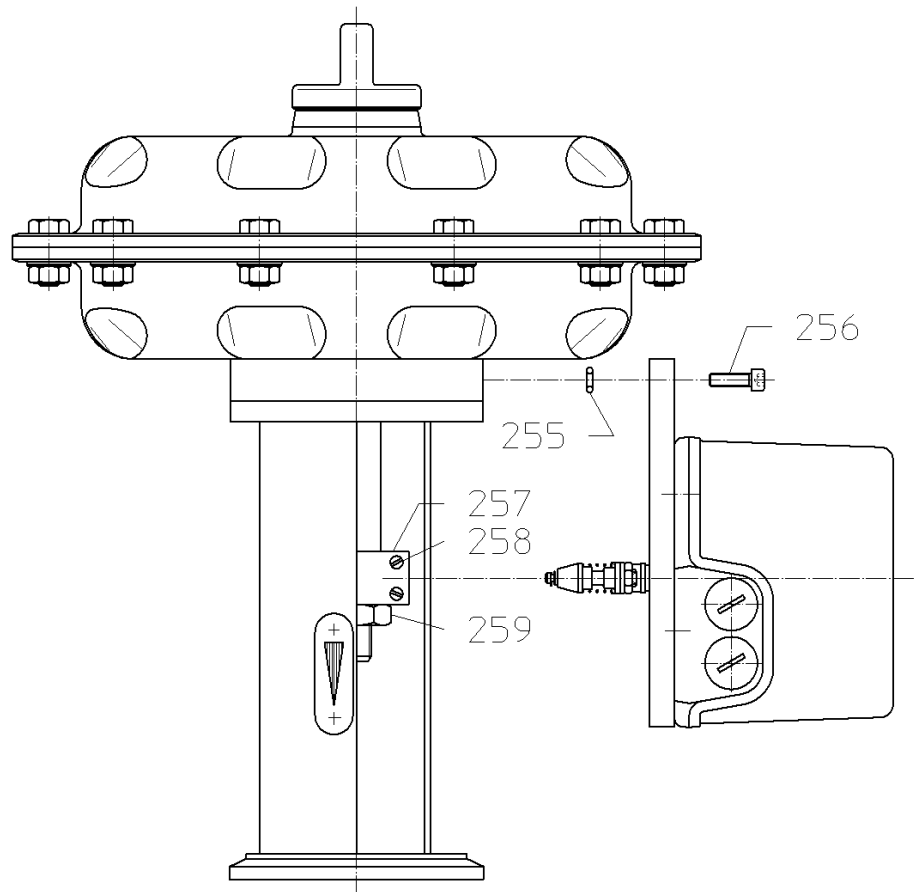
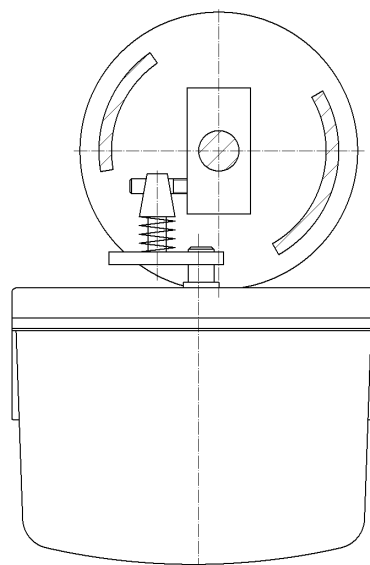


Illustration 10: Assembly 824/813 side view



| | |
|-----|----------------------|
| 211 | Pivot lever |
| 212 | Spring lock washer |
| 213 | Hex screw |
| 214 | Hex nut |
| 216 | Hex nut |
| 217 | Washer |
| 218 | Sliding washer |
| 219 | Spring |
| 220 | Conical roller |
| 221 | Circlip |
| 222 | Stroke setting screw |
| 250 | Adapter plate |
| 251 | Cylinder head bolt |
| 252 | Adapter |
| 253 | Grub screw |
| 254 | O-ring |
| 255 | O-ring |
| 256 | Cylinder head bolt |
| 257 | Bracket |
| 258 | Stroke driving pin |
| 259 | Hex nut |

Illustration 11: Installation 824/813 top view



Illustration 12: Photo - assembly 824/813

9.3 Installation of the swivel actuator

9.3.1 Installation according to VDI/VDE 3845

- Insert the coupling (265) into the actuator adapter (264) (not included in the scope of delivery) and secure with the screw (266).
 - Secure the screw (266) with Loctite 601!
- Mount the yoke (260) (not included in the scope of delivery) on the actuator with the screws (261).
- Mount the adapter plate (268) on the positioner with the screws (267).
 - Secure the screw (267) with Loctite 601!
- Mount the positioner on the yoke (260) with the screws (263) and spring lock washers (262).

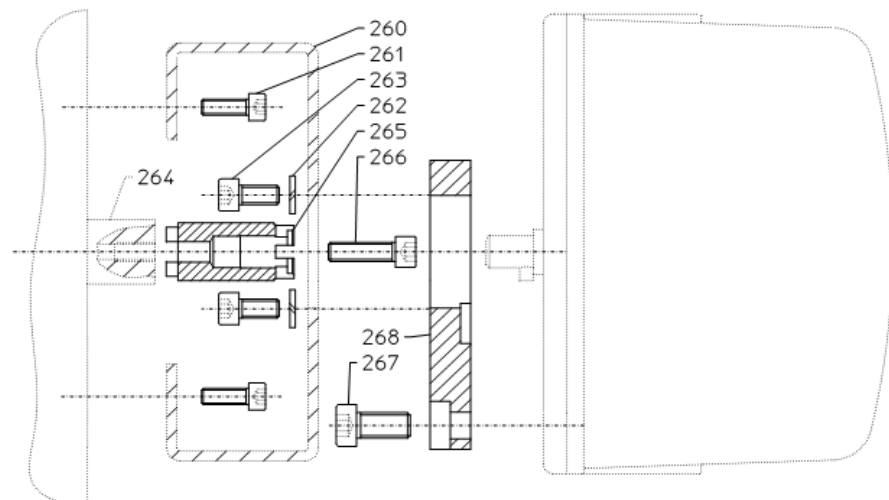


Illustration 13: Installation 824/VDI-VDE 3845 top view

| | |
|-----|--------------------|
| 261 | Cylinder head bolt |
| 262 | Spring lock washer |

| | |
|-----|--------------------|
| 263 | Cylinder head bolt |
| 265 | Coupling |
| 266 | Cylinder head bolt |
| 267 | Cylinder head bolt |
| 268 | Adapter plate |

| | |
|-----|------------------|
| 260 | Yoke |
| 264 | Actuator adapter |

Items 260 and 264 are part of the scope of delivery only when mounting on an ARCA actuator from the series 840. In the case of third-party actuators the yoke (260) can be supplied on request!

9.3.2 ARCA mounting on swivel actuator series 840 (external piping)

- Insert the coupling (271) into the actuator hub.
 - **NOTICE!** Observe the positioning of the groove for the positioner, danger of destruction!
- Mount the yoke (272) on the actuator with the bolts (273).
- In the case of the 844 actuator, additionally place the adapter plate (270) between the yoke (272) and the actuator.
- Mount the positioner on the yoke (272) with the screws (274).

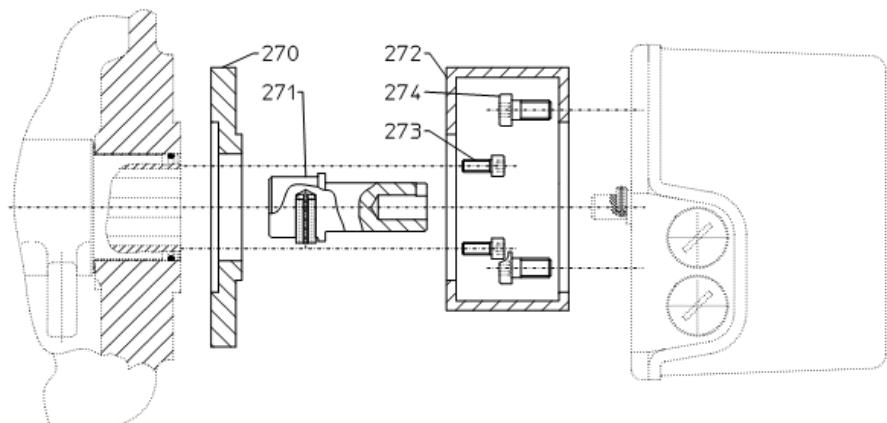


Illustration 14: Assembly 824/840 side view

| | |
|-----|--------------------|
| 270 | Adapter plate |
| 271 | Coupling |
| 272 | Yoke |
| 273 | Cylinder head bolt |
| 274 | Cylinder head bolt |

9.3.3 Integrated mounting on actuators series 840

- Insert the coupling (282) into the actuator hub.
 - **NOTICE!** Observe the positioning of the groove!
- Mount the mounting plate (280) and O-ring (281) on the actuator with the screws (283).
 - Omitted with actuator sizes 841 and 842.
- Mount the transfer plate (285) and O-ring (284) on the actuator or on the mounting plate (280) with the screws (286).

- Seal the actuation pressure output A_{36} on the positioner with the blanking plug (63).
 - Remove the blanking plug (53) from the rear side of the device (if fitted).
 - Also refer to the chapter [10] *Pneumatic connection*.
- Mount the mounting strip (298) and O-ring (288) on the positioner with the screws (299).
- Mount the positioner with the mounting strip (298) installed on the transfer plate (285) with the O-ring (287) and screws (300).

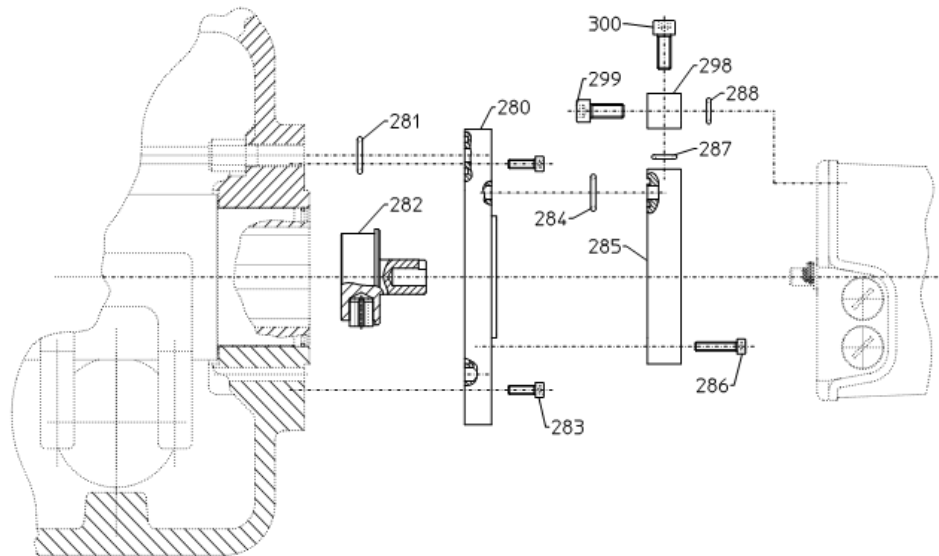


Illustration 15: Assembly 824/840, pipeless, side view

| | |
|-----|--------------------|
| 280 | Mounting plate |
| 281 | O-ring |
| 282 | Coupling |
| 283 | Cylinder head bolt |
| 284 | O-ring |
| 285 | Transfer plate |
| 286 | Cylinder head bolt |
| 287 | O-ring |
| 288 | O-ring |
| 298 | Mounting strip |
| 299 | Cylinder head bolt |
| 300 | Cylinder head bolt |

10 Pneumatic connection

The assignment of the pneumatic connections is done in accordance with the designation of the connection sign affixed to the side or affixed inside the cover (51). Commercially available screw connections for copper and stainless steel pipe or plastic hoses can be used.

In the case of versions with manometer block, the connections are located on the manometer block.

- With all electro-pneumatic versions the input **E₂₆** is to be sealed with the blanking plug (64).
- In the case of integrated positioner mounting (refer also to the chapters [9.2.2] *Integrated mounting on actuators series 812*, [9.2.3] *Integrated mounting on actuators series 813* and [9.3.3] *Integrated mounting on actuators series 840*) the output **A₃₆** is to be sealed with a plug. The blanking plug (53) on the rear side of the positioner (illustration: Rear side) is to be unscrewed and removed.

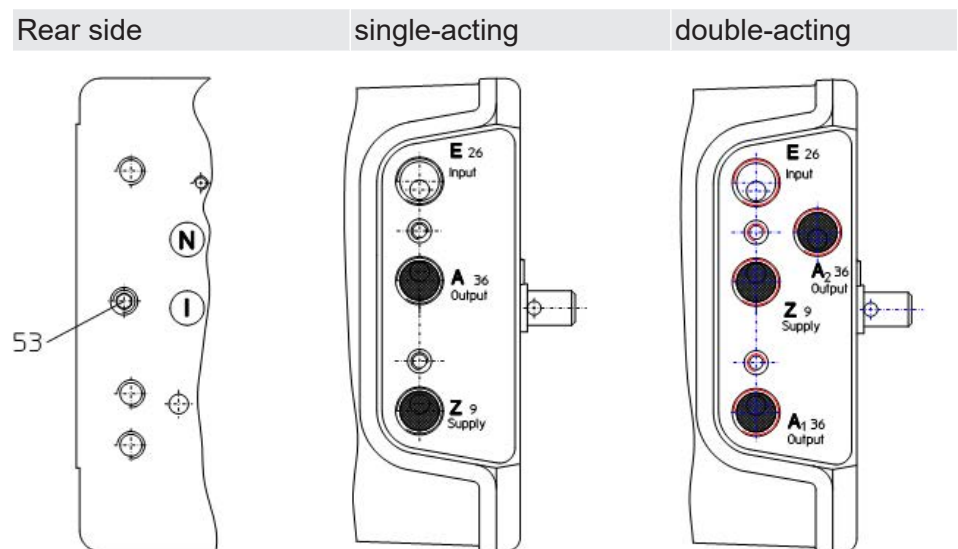


Illustration 16: Pneumatic connection

11 Electrical connection

The electrical work is to be carried out under careful observation of the safety instructions in the chapter [2] *Safety*.

Refer to the chapter [16] *Technical Data* for the individual electrical options!

- Undo the screws (52) and remove the cover (51).
- Feed the cable through the cable gland.
- Connect in accordance with the terminal diagram or the details inside the cover (51).
 - **NOTICE!** Make sure the polarity is correct.
- Activate the strain relief by tightening the cable glands (47).
- The max. permissible connection data for the individual electrical components are shown on the nameplate and must be observed!

11.1 I/P transducer

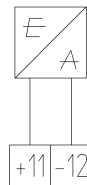


Illustration 17: IP transducer

11.2 Limit value transmitter

The limit value transmitter is equipped with two inductive proximity switches (slot-type proximity switches), which are actuated by the infinitely adjustable vanes. The proximity switches can be supplied in three different basic versions.

11.2.1 Normal version (2-wire, N)

The proximity switches according to EN 60947-5-6 (NAMUR) are 2-wire inductive sensors whose signals only need to be amplified by downstream switching amplifiers (provided by the customer). Normally closed (N) types are generally used.

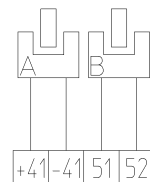


Illustration 18: Limit value transmitter 2-wire N+SN

11.2.2 Safe design (2-wire, SN)

These proximity switches correspond to the normal version, but with an additional function:

In the event of an error message for the proximity switch, the switching amplifier or the connecting cable, the output automatically enters the safe "off" state (= logic 0). Normally closed (SN) types are generally used.

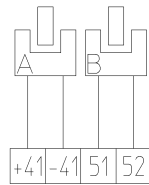


Illustration 19: Limit value transmitter 2-wire N+SN

11.2.3 Direct switching version (3-wire, E2)

These proximity switches already contain an output amplifier and have separate connections for the power supply and for the load. Plus-switching (E2) normally-open types are generally used.

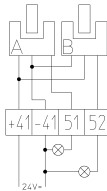
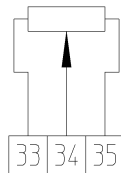


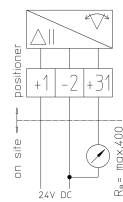
Illustration 20: Limit value transmitter 3-wire E2

11.3 Position feedback

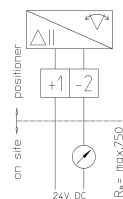
11.3.1 Feedback potentiometer



11.3.2 Position transducer 3-wire



11.3.3 Position transducer 2-wire



12 Configuration

12.1 Normal / Inversion

- Determine the required switch position and cam plate characteristic from fig. 20.
- Refer also to the chapter [8.1.1] *Cam plate*.

| Scheibe cam | Kurve 1 curve 1 | | Kurve 2 curve 2 | | Kurve 3 curve 3 | | einfach wirkend single acting | | doppelt wirkend double acting | | |
|--|--------------------|---------------------|---------------------|---------------------|---------------------|------------------------|-------------------------------------|------------------------|----------------------------------|------|------|
| | | linear | gleich-% equal-% | linear | gleich-% equal-% | linear | gleich-% equal-% | fallend falling | steigend rising | | |
| Kegelkennlinie plug characteristic | linear | gleich-% equal-% | linear | gleich-% equal-% | linear | gleich-% equal-% | ← | → | ← | → | |
| Öffnungskennlinie flow characteristic | linear | gleich-% equal-% | auf/zu on/off | linear | gleich-% equal-% | progressiv gleich-% | → | → | → | → | |
| | | | | | | | Schalterstellung switch-position | I | N | I | N |
| | | | | | | | Kurvenscheibe cam disc | N | I | I | N |
| | | | | | | | | Anschlüsse/connections | | ← | → |
| | | | | | | | | | | A2/A | A1/B |
| | | | | | | | | | | A2/B | A1/A |

Illustration 21: Table: Mode of operation

Check the configuration of the positioner and if necessary perform the steps listed in the chapters [12.1.1] *Changeover switch* and [12.1.2] *Select cam plate*.

- **Depressurise** the positioner and **switch it off!**

12.1.1 Changeover switch

- Loosen the screws (40) and remove the changeover switch (38) with the O-ring (39).
- Mount the changeover switch (38) in the desired position.

| | |
|-------------------------------------|---------------------------------------|
| Changeover switch position "normal" | Changeover switch position "inverted" |
| (Rear side of device) | (Rear side of device) |

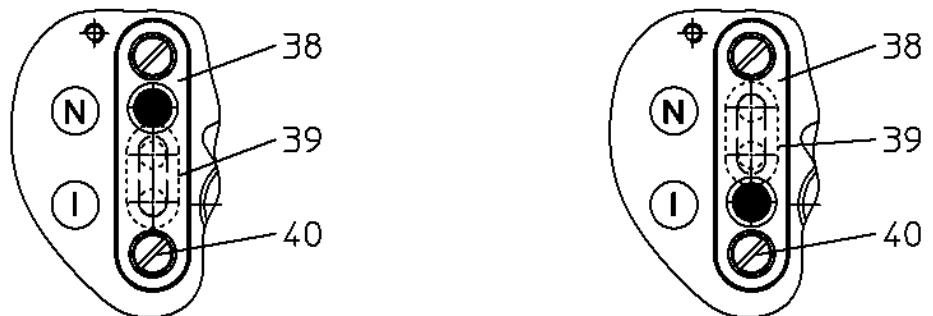


Illustration 22: Changeover switch

12.1.2 Select cam plate

- Unhook the spring (6) from the return lever (29).
- Loosen the screw (27).
- Remove the position indicator (25) (versions for swivel actuators only) and the cam plate (24) and mount in the desired position.
- Hook the spring (6) into the return lever (29).

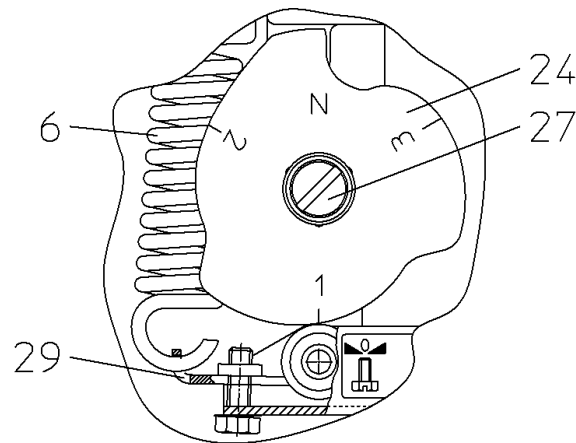


Illustration 23: Curve "1" normal

13 Commissioning

13.1 Adjustment of zero point and stroke/angle of rotation

- The adjustment is done in accordance with the flow chart below.
- Measure the stroke or angle of rotation with a dial gauge or angle of rotation measuring instrument respectively!
- The equations produce the recommended values of the input variables E1 and E2.
 - $E1 = E_{(0\%)} \pm (E_{(0\%)} \times 1.05)$, max. 5% of control range
 - $E2 = E_{(100\%)} \pm (E_{(100\%)} \times 1.05)$, max. 5% of control range

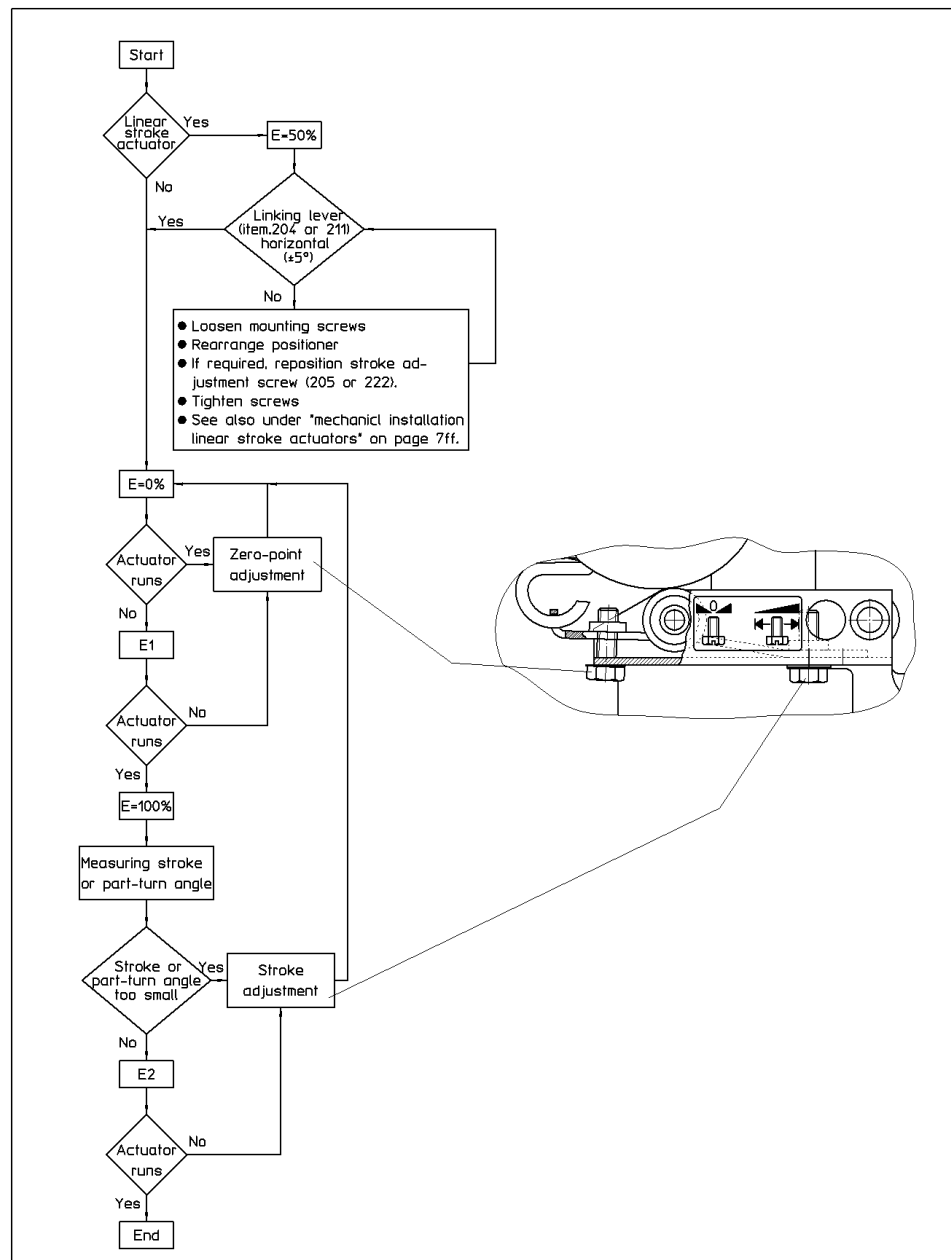


Illustration 24: Zero point and stroke/angle of rotation adjustment chart

13.2 Limit value transmitter

The limit contacts are normally adjusted so that a signal is present in each of the end positions (open/closed). Both vanes can be infinitely rotated so that intermediate positions can also be signalled. To ensure reliable switching, the switching point should be set approx. 2% before the mechanical stop (open/closed). We recommend the valve position "closed" for the limit value transmitter "A" and the valve position "open" for the limit value transmitter "B", whose setting is described below for a normally closed valve.

- Loosen the screws (81).
- Position the limit value transmitter (85) in the centre of the slots.
- Tighten the screws (81).
- Loosen the screw (82).
- Coarse adjustment of the two vanes (86) with input signal at 0% and 100%.
- Tighten the screws (82).
- Apply a 2% input signal.
- Loosen the screw (81) on the limit value transmitter "A".
- Adjust vane "A" so that a signal is present at the limit value transmitter "A".
- Tighten the screws (81).
- Apply a 98% input signal.
- Loosen the screw (81) on the limit value transmitter "B".
- Adjust the vane so that a signal is present at the limit value transmitter "B".
- Tighten the screws (81).

13.3 Position feedback

13.3.1 Feedback potentiometer

The rotary movement of the positioner shaft is transmitted to the potentiometer (91) via a gear unit. The zero point and range setting must be done on the downstream devices (not included in the scope of delivery).

13.3.2 Position transducer

The built-in position transducer (R/I) measures the change in resistance of the feedback potentiometer and converts the input signal into the output signal (0/4 - 20 mA). The zero point and range setting is done using the screws provided for this purpose on the position transducer (92).

14 Service and maintenance

Basic safety instructions



WARNING

Impermissible repair of the device

Repairs may be carried out only by authorised personnel.



WARNING

Impermissible accessories and impermissible spare parts

Damage to the device

- ▶ Use exclusively original accessories and original spare parts.
- ▶ Observe all relevant installation and safety instructions described in the manuals for the device, accessories and spare parts.



WARNING

Improper connection following maintenance

Damage to the device

- ▶ Connect the device correctly following maintenance.
- ▶ Close the device after maintenance.

CAUTION

Penetration of moisture into the device

Damage to the device

- Make sure that no moisture gets into the device during cleaning and maintenance work.

15 Retrofit / exchange / repair

A new nameplate must be requested following any modifications. Some modules cannot be installed together in the positioner. Therefore it is essential that you read the chapter [16] *Technical Data* for the individual modules.

15.1 I/P module

15.1.1 Standard

- Release the cables of the I/P module (44) from the terminals (45).
 - if existent.
- Loosen the screws (53).
- Remove the I/P module (44) or sealing plate (41).
- Insert the dirt strainers (66).
 - if not existent.
- Attach new I/P module (44).
- The cable must be routed between the base plate (1) and the I/P module (44)!
- Tighten the screws (43).
- Mount the terminal set (45).
 - if not existent.
- Insert the blanking plug (64).
 - if not existent.
- For the electrical connection see [11] *Electrical connection*.
- For commissioning see [13] *Commissioning*.

15.2 Limit value switch

- Release the cable of the limit value switch (85) from the terminals (87).
 - if existent.
- Mount the gear segment wheel (22) if not already existing.
 - Dismount the cam plate (24) in accordance with the chapter [12.1.2] *Select cam plate*.
 - Remove the disc (23).
 - Attach the gear segment (22).
 - Mount the cam plate (24) in accordance with the chapter [12.1.2] *Select cam plate*.
- Unscrew the spacer screw (50).
- Attach the limit value module (80).
- Tighten the spacer screw (50) and screw (84) with washer (83).
 - **NOTICE!** The gear wheels must intermesh without play afterwards!
- For the electrical connection see [11] *Electrical connection*.

- For commissioning see [13] *Commissioning*.

15.3 Feedback potentiometer and measuring transducer

- Release the cables of the feedback potentiometer (91) and the measuring transducer (92) from the terminals (45).
 - if existent.
- Mount the gear segment wheel (22) if not already existing.
 - Dismount the cam plate (24) in accordance with the section [12.1.2] *Select cam plate*.
 - Remove the disc (23).
 - Attach the gear segment (22).
 - Mount the cam plate (24) in accordance with the section [12.1.2] *Select cam plate*.
 - Attach the feedback potentiometer and measuring transducer module (90).
- Tighten the screws (94) with washers (93).
 - **NOTICE!** The gear wheels must intermesh without play afterwards!
- Mount the terminal set (45).
 - if not existent.
- For the electrical connection see [11] *Electrical connection*.
- For commissioning see [13] *Commissioning*.

15.4 Manometer block

- Loosen the pneumatic connections.
 - if already mounted.
- Unscrew the manometer block (101) if existent.
- Mount the new manometer block (101).
- Tighten the screws (103).
- For pneumatic connection see [10] *Pneumatic connection*.
- For the electrical connection see [11] *Electrical connection*.
- For commissioning see [13] *Commissioning*.

15.5 Spring

- Unhook the spring (6) from the return lever (29).
- Unhook the spring (6) from the spring suspension (10).
- Hook in the new spring (6).
- For commissioning see [13] *Commissioning*.

15.6 Piston lever

- Dismount the spring (6) in accordance with the chapter [15.5] *Spring*.
- Loosen the nuts (16 & 17).

- Remove the circlip (18).
- Loosen the screws (19).
- Remove the piston lever (8).
- Mount the new piston lever (8).
- Further installation in the reverse order.
- For commissioning see [13] *Commissioning*.

15.7 Complete diaphragm chamber

- Dismount the piston lever (8) in accordance with the chapter [15.6] *Piston lever*.
- Loosen the screws (12).
- Remove the diaphragm chamber (9).
- Mount the new diaphragm chamber (9).
- Further installation in the reverse order.
- For commissioning see [13] *Commissioning*.

15.8 Control piston bushing and wire

- Dismount the diaphragm chamber (9) in accordance with the chapter [15.7] *Complete diaphragm chamber*.
- Pull out the control piston (7).
- Remove the bayonet clip (5) and protective cap (4).
- Pull the control bushing downwards (2).
- Mount the new control bushing (2) and new control piston (7) with a new control wire (62).
- Further installation in the reverse order.
- For commissioning see [13] *Commissioning*.

16 Technical Data

16.1 General data

| | | |
|-----------------------------|--------------------------------|--|
| Installation | on thrust actuators | ARCA-integrated or according to IEC 534-6 (NAMUR) Stroke range 10 to 120 mm |
| | on swivel actuators | ARCA-integrated or according to VDI/VDE 3845 Angle of rotation 90° |
| Housing material | | Cast aluminium / plastic |
| Protection class | | IP 54 |
| Mounting position | | arbitrary |
| Climate class | Operation | 4K3, but -20 to +80 °C, Low temperature version -40 to +80 °C |
| | Storage | 1K5, but -40 to +80 °C |
| | Transport | 2K4, but -40 to +80 °C |
| Vibration resistance | | < 10g according to DIN 89011, recommended continuous operation range of the complete valve ≤ 3 g |
| CE mark | | Conformity according to EU EMC directive 2014/30-EU and Machinery Directive 2006/42/EC |
| Controller data | Gain | max. 100 |
| | Hysteresis | < 0.7 % of the control range |
| | Response threshold | < 0.5 % of the control range |
| | Linearity error | < 2 % of the control range |
| | Draught dependence | < 0.2 % / 0.1 bar, type 824.P < 0.1 % / 0.1 bar |
| Dimensions | | see data sheet |
| Weight | Type 824.P | approx. 1.8 kg |
| | Type 824.E | approx. 2.0 kg |
| | Manometer block | approx. 0.5 kg |
| Connections | electrical | 0 to 2 cable glands M20 x 1.5 depending on the version |
| | pneumatically externally piped | Y and Z: laterally G ¼ DIN 45141, Special version ¼" NPT |
| | pneumatically internally piped | Z: laterally G ¼ DIN 45141, Y: at rear G 1/8 |

16.2 Data for the basic device

Pneumatic data

| | | |
|----------------------------|-------------|--|
| Supply air pressure | | 1.4 to 6 barg |
| Air quality | Solids | Class 2 ISO 8573-1 (particle size ≤ 1 µm, particle density ≤ 10 mg/m ³ in the normal state) |
| | Dew point | Class 2 ISO 8573-1 (-40 °C, at least 20 K below ambient temperature, low temperature version < -50 °C) |
| | Oil content | Class 2 ISO 8573-1 (≤ 0.1 mg/m ³ at standard atmospheric conditions) |

| | | |
|------------------------|--|---|
| Air consumption | | < 0.6 m ³ /h in the normal state, type 824.P < 0.5 m ³ /h in the normal state in stationary operation |
| Flow rate | | 6 m ³ /h in the normal state at 1.4 barg |

Electrical / pneumatic data for the base device

| | | |
|------------------------------|---------------------|------------------------------|
| | pneumatic | not explosion proof |
| Electrical connection | | [11.1] <i>I/P transducer</i> |
| Input signal | 0.2 to 1 bar | 0/4 to 20 mA |
| Split ranges | 0.2 to 0.6 to 1 bar | 0/4 to 10 / 12 to 20 mA |
| Load resistor | | 170 Ω |
| Required load voltage | | 3.4 V |

16.3 Electrical data for options – inductive limit value transmitter

| | |
|-----------------------------------|---|
| Limit value transmitter N | 824.P/Exxx-x1x |
| Normal version | 2-wire technology in accordance with DIN 19234 (NAMUR), for downstream switching amplifiers |
| 2 slot-type initiators | Type SJ 3.5 N |
| Function | NC, normally closed |
| Switching difference | ≤ 1 % |
| Control circuit | see downstream switching amplifier |
| EMC according to | EN 60947-5-2 and DIN 19234 |
| Electrical connection | [11.2.1] <i>Normal version (2-wire, N)</i> |
| Limit value transmitter SN | 824.P/Exxx-x2x |
| Safe design | 2-wire technology according to DIN 19234 (NAMUR) for customer provided switching amplifier in safe design |
| 2 slot-type initiators | Type SJ 3.5 SN |
| Function | NC, normally closed |
| Switching difference | ≤ 1 % |
| Control circuit | see downstream switching amplifier |
| EMC according to | EN 60947-5-2 and DIN 19234 |
| Electrical connection | [11.2.2] <i>Safe design (2-wire, SN)</i> |
| Limit value transmitter E2 | 824.P/Exxx-x3x |
| Direct-switching | 3-wire technology with integrated switching amplifier for direct switching |
| 2 slot-type initiators | Type SB 3.5 E2 |
| Function | NO, normally open |
| Switching difference | ≤ 1 % |
| Operating voltage | 10 to 30 V DC |
| perm. load current | 100 mA |
| Electrical connection | [11.2.3] <i>Direct switching version (3-wire, E2)</i> |

16.4 Electrical data for options – potentiometer and position feedback

| | |
|---------------------------------|--|
| Potentiometer | 824.P/Exxx-xx2 |
| Resistance | 200, 500 or 1000 Ohm ⁴⁾ |
| Characteristic deviation | $\leq 2\%$ ⁵⁾ |
| Internal capacitance Ci | 3.5 pF |
| Internal inductance Li | 10 mH |
| Electrical connection | [11.3.1] <i>Feedback potentiometer</i> |
| Position transducer 3L | 824.P/Exxx-xx3 |
| 3-wire circuit | RWG, type 4522 |
| Operating voltage | 15 to 24 V DC |
| Output | 4(0) - 20 mA, short-circuit proof |
| Current limitation | at approx. 28 mA |
| Load Ri | 0 - 400 Ohm |
| Characteristic deviation | $\leq 2\%$ ⁵⁾ |
| Electrical connection | [11.3.2] <i>Position transducer 3-wire</i> |
| Position transducer 2L | 824.P/Exxx-xx4 |
| 2-wire circuit | RWG, type TMT 136R |
| Supply voltage | DC 8.5 ... 36 V |
| Output | 4 - 20 mA, short-circuit proof |
| Current limitation | at approx. 36 mA |
| Load Ri | 1300 Ohm at 36 V DC |
| Characteristic deviation | $\leq 2\%$ ⁵⁾ |
| Electrical connection | [11.3.3] <i>Position transducer 2-wire</i> |

1) Permissible ambient temperature for other circuits on enquiry.

2) Special version down to -40 °C (pressure dew point < -50 °C).

3) Special version NPT ¼".

4) Zero point and range setting must be done on the receiving device.

5) A deviation of up to 5% is possible, depending on the method of mounting the positioner or the stroke range.

17 Disposal and recycling



WARNING

Operating media and auxiliary materials that are hazardous to health

Danger to people and the environment!

- ▶ Wear suitable protective equipment
- ▶ If applicable, collect and dispose of rinsing medium or residual medium. Particular attention is to be paid to dead spaces (pressure compensation, bellows, etc.)
- ▶ Observe the legal regulations for the disposal of media that are hazardous to health

ARCA products are modularly constructed and can be sorted by material into the following components.

- Electronic components
- Metals
- Plastics
- Greases and oils
- Packaging material

The general rules are:

- greases and oils are usually water pollutants and must not be allowed to escape into the environment
- Dispose of dismantled materials properly or recycle the separate materials
- Observe national disposal regulations



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