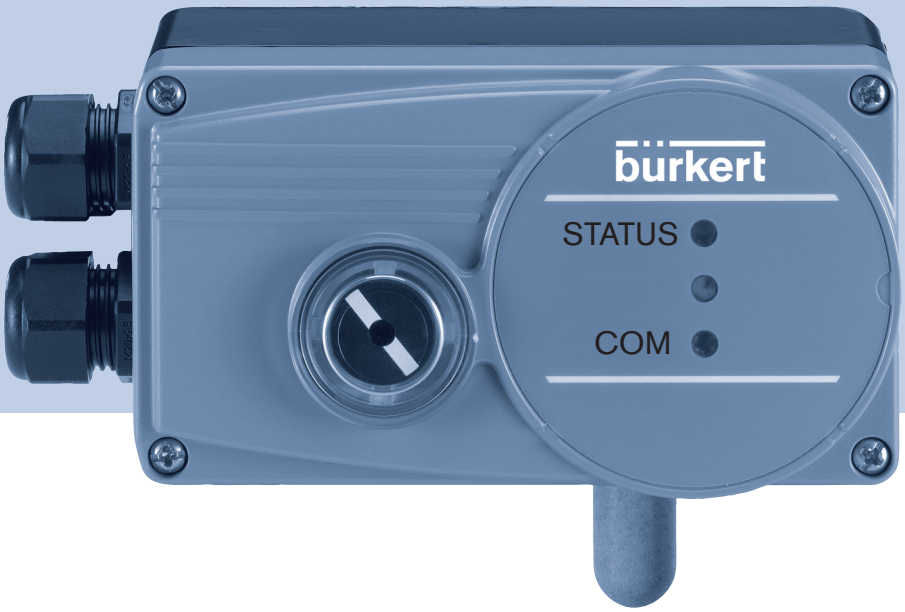
bürkert
FLUID CONTROL SYSTEMS

Type 8791 REV.2

Positioner SideControl BASIC

Electropneumatic positioner



Operating Instructions

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Operating Instructions 2002/02_EU-EN_00815310 / Original DE

Electropneumatic positioner Type 8791 REV.2

Contents

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1 ABOUT THESE INSTRUCTIONS

The operating instructions describe the entire life cycle of the device.

→ Keep these instructions ready to hand at the operation site.

Important safety information.

- ▸ Carefully read these instructions.
- ▸ Observe in particular the safety instructions, intended use and operating conditions.
- ▸ Persons, who work on the device, must read and understand these instructions.

1.1 Symbols

DANGER

Warns of an immediate danger.

- ▸ Failure to observe the warning will result in a fatal or serious injury.

WARNING

Warns of a potentially dangerous situation.

- ▸ Failure to observe the warning may result a fatal or serious injury.

CAUTION

Warns of a possible danger.

- ▸ Failure to observe the warning may result in moderate or minor injuries.

ATTENTION

Warns of damage to property.

- ▸ Failure to observe the warning may result in damage to device or system.

Indicates important additional information, tips and recommendations.

Refers to information in these operating instructions or in other documentation.

▸ Indicates an instruction for risk prevention.

→ Indicates a procedure which you must carry out.

Indicates a result.

Menu Indicates a interface text.

1.2 Definition of terms

In these instructions the term “device” denotes the following device types:

Positioner Type 8791 REV.2

The term “büS” (Bürkert system bus) used in this instruction stands for the communication bus developed by Bürkert and based on the CANopen protocol.

In these instructions, the abbreviation “Ex” always refers to “potentially explosive area”.

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2 INTENDED USE

The Positoner Type 8791 REV.2 is designed to be mounted on pneumatic actuators of process valves for the control of media. The permitted fluid media are listed in the technical data.

- Use the device for its intended purpose only. Non-intended use of the device may be dangerous to people, nearby equipment and the environment.
- Correct transportation, correct storage as well as correct installation, commissioning, operation and maintenance are essential for reliable and problem-free operation.
- When using the device, observe the permitted data, operating conditions and application conditions. This information can be found in the contractual documents, the operating instructions and on the type label.
- Use the device only in conjunction with third-party devices and components recommended and authorized by Bürkert.
- Do not use the device outdoors without protection from the weather.
- In areas at risk of explosion, only use devices approved for use in those areas. These devices are labeled with a separate Ex type label. For such use, note the information provided on the separate Ex type label and the additional explosion-related information or separate explosion-related operating instructions.
- Pulsating direct voltage (rectified alternating voltage without smoothing) must not be used as power supply.

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3 BASIC SAFETY INSTRUCTIONS

These safety instructions do not consider any contingencies or incidents which occur during installation, operation and maintenance.

The operator is responsible for observing the location-specific safety regulations, also with reference to the personnel.

DANGER

Risk of injury from high pressure and discharge of medium.

- Before working on the device or system, switch off the pressure. Vent or drain lines.

DANGER

Risk of injury from electric shock.

- Before working on the device or system, switch off the power supply. Secure against reactivation.
- Observe applicable accident prevention and safety regulations for electrical equipment.

To prevent injury, ensure the following:

- Secure device or system to prevent unintentional activation.
- Only trained technicians may perform installation and maintenance work.
- Perform installation and maintenance with suitable tools only.
- Do not make any changes to the device and do not subject it to mechanical stress.
- Operate the device only in perfect state and in consideration of the operating instructions.
- Observe the general rules of technology.
- Install the device according to the regulations applicable in the respective country.
- Do not feed corrosive or flammable media into the device connections.
- Do not feed any fluids into the connections of the device.
- After the process is interrupted, restart in a controlled manner. Observe sequence:
  1. Connect electrical or pneumatic power supply.
  2. Charge the device with medium.
- Observe intended use.

ATTENTION!

Electrostatic sensitive components or modules.

The device contains electronic components which react sensitively to electrostatic discharge (ESD). Contact with electrostatically charged persons or objects is hazardous to these components. In the worst case scenario, they will be destroyed immediately or will fail after start-up.

- Observe the requirements in accordance with EN 61340-5-1 to minimise or avoid the possibility of damage caused by sudden electrostatic discharge.
- Also ensure that you do not touch electronic components when the power supply voltage is present.

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4 GENERAL INFORMATION

4.1 Contact addresses

Germany

Bürkert Fluid Control Systems
Sales Center
Christian-Bürkert-Str. 13-17
D-74653 Ingelfingen
Tel. + 49 (0) 7940 - 10 91 111
Fax + 49 (0) 7940 - 10 91 448
E-mail: info@buerkert.com

International

Contact addresses can be found on the final pages of these printed operating instructions.

And also on the internet at:

www.burkert.com

4.2 Warranty

The warranty is only valid if the positioner Type 8791 are used as intended in accordance with the specified application conditions.

4.3 Information on the Internet

The operating instructions and data sheets for Type 8791 can be found on the internet at:

www.burkert.com

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5 DESCRIPTION OF SYSTEM

5.1 General description

The positioner Type 8791 is a digital, electropneumatic positioner for pneumatically actuated continuous valves. The device incorporates the main function groups

- Position sensor
- Pilot valve system (electropneumatic control system)
- Microprocessor electronics

The position sensor measures the current positions of the continuous valve.
The microprocessor electronics continuously compare the current position (actual value) with a set-point position value specified via the standard signal input and supplies the result to the positioner.
If there is a control difference, the electropneumatic control system corrects the actual position accordingly.

5.1.1 Features

- **Version**
  Positioner:
  The position of the actuator is regulated according to the position set-point value. The position set-point value is specified by an external standard signal (or via field bus).
- **Position sensor**
  - internal high resolution conductive potentiometer or
  - external non-contact, non-wearing position sensor (remote).
- **Microprocessor-controlled electronics**
  for signal processing, control and valve control.
- **Control module**
  The device is operated via 2 buttons and 4 DIP switches.
  2 LEDs (1 RGB LED for device status and 1 green LED for communication interface status) indicate different statuses of the device.
- **Pilot valve system**
  The control system consists of 2 solenoid valves and 4 diaphragm reinforcers. In single-acting actuators the working connection 2 must be sealed with a threaded plug.
- **Position feedback**
  The feedback is implemented either via 2 proximity switches or via an 4 – 20 mA output (variant, without fieldbus communication) or digitally via a fieldbus communication (e.g. büS, IO-Link).
  The operator can change the proximity switches or limit positions via control lugs.
- **Pneumatic interfaces**
  Internal thread G1/4“
- **Electrical interfaces**
  Circular plug-in connector or cable gland
- **Communications interface**
  For exchanging process data and for configuration and parameterization
- **Housing**
  Plastic-coated aluminium housing with hinged cover and captive screws.
  The housing of the positioner is protected from excessively high internal pressure, e.g. due to leaks, by a pressure limiting valve.

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- **Mounting**
  on linear actuator according to NAMUR recommendation (DIN IEC 534-6) or on rotary actuator according to VDI/VDE 3845.
- **Optional**
  Remote version for standard rail mounting or for mounting bracket

5.1.2 Combination with valve types and mounting versions

The positioner Types 8791 can be mounted on different continuous valves. For example on valves with linear (piston), membrane or rotary actuator. The actuators can be single-acting or double-acting.

- For single-acting actuators, only one chamber is aerated and deaerated during actuation. The generated pressure works against a spring. The piston moves until there is an equilibrium of forces between compressive force and spring force. To do this, one of the two air connections must be sealed with a threaded plug.
- For double-acting actuators the chambers on both sides of the piston are pressurised. In this case, one chamber is aerated when the other one is deaerated and vice versa. In this design, no spring is installed in the actuator.

Two basic device versions are offered for the positioner Type 8791; they differ in the attachment option and in the position sensor.

Device version NAMUR:
An internal position sensor is used which is designed as a rotary potentiometer. The positioner is attached directly to the actuator.

Device version Remote:
An external position sensor (linear or rotative) via a digital interface. The positioner is attached to a wall either with a standard rail or with a mounting bracket (remote design).

5.1.3 Optionally external position feedback with inductive proximity switch

The positioner type 8791 can be fitted with an external position feedback (see data sheet / accessories).

The installation and the setting are described in the installation instructions which are enclosed with the external position feedback.

The installation instructions can also be found on the Internet.

www.burkert.com → Type 8791

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5.1.4 Overview of the mounting options

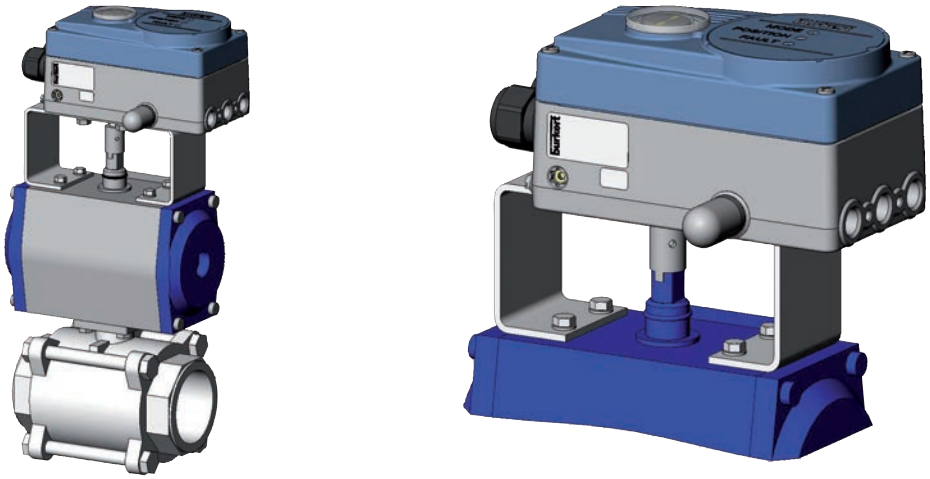
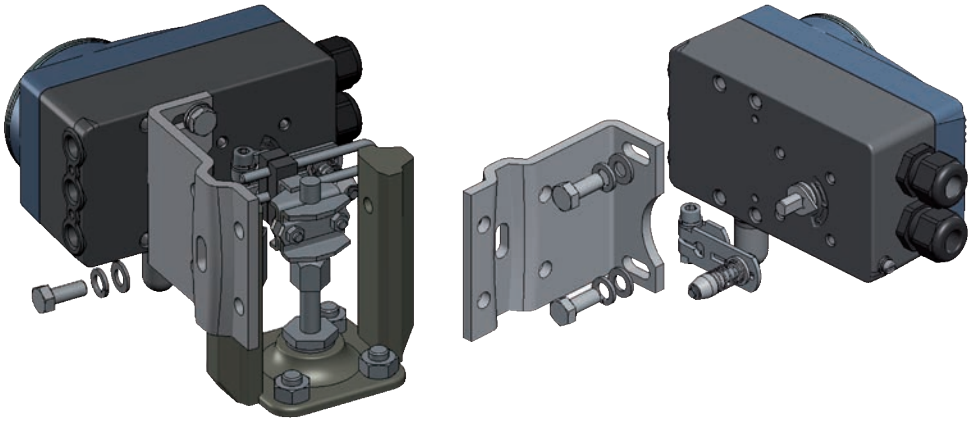
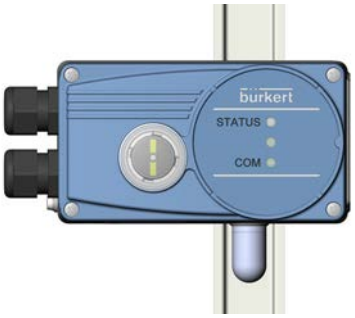
Mounting NAMUR on rotary actuator	
Mounting NAMUR with mounting bracket on a linear actuator	
Remote mounting with mounting bracket	
Remote mounting with standard rail	

Table 1: Overview of the mounting options

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6 STRUCTURE

The positioner Type 8791 consist of the micro-processor controlled electronics, the position sensor and the pilot valve system.

The unit is operated via 2 buttons and 4 DIP switches.
2 LEDs (1 RGB LED for device status and 1 green LED for communication interface status) indicate the different statuses of the unit.

The pilot valve system for single-acting and double-acting actuators consists of 2 solenoid valves.

6.1 Representation

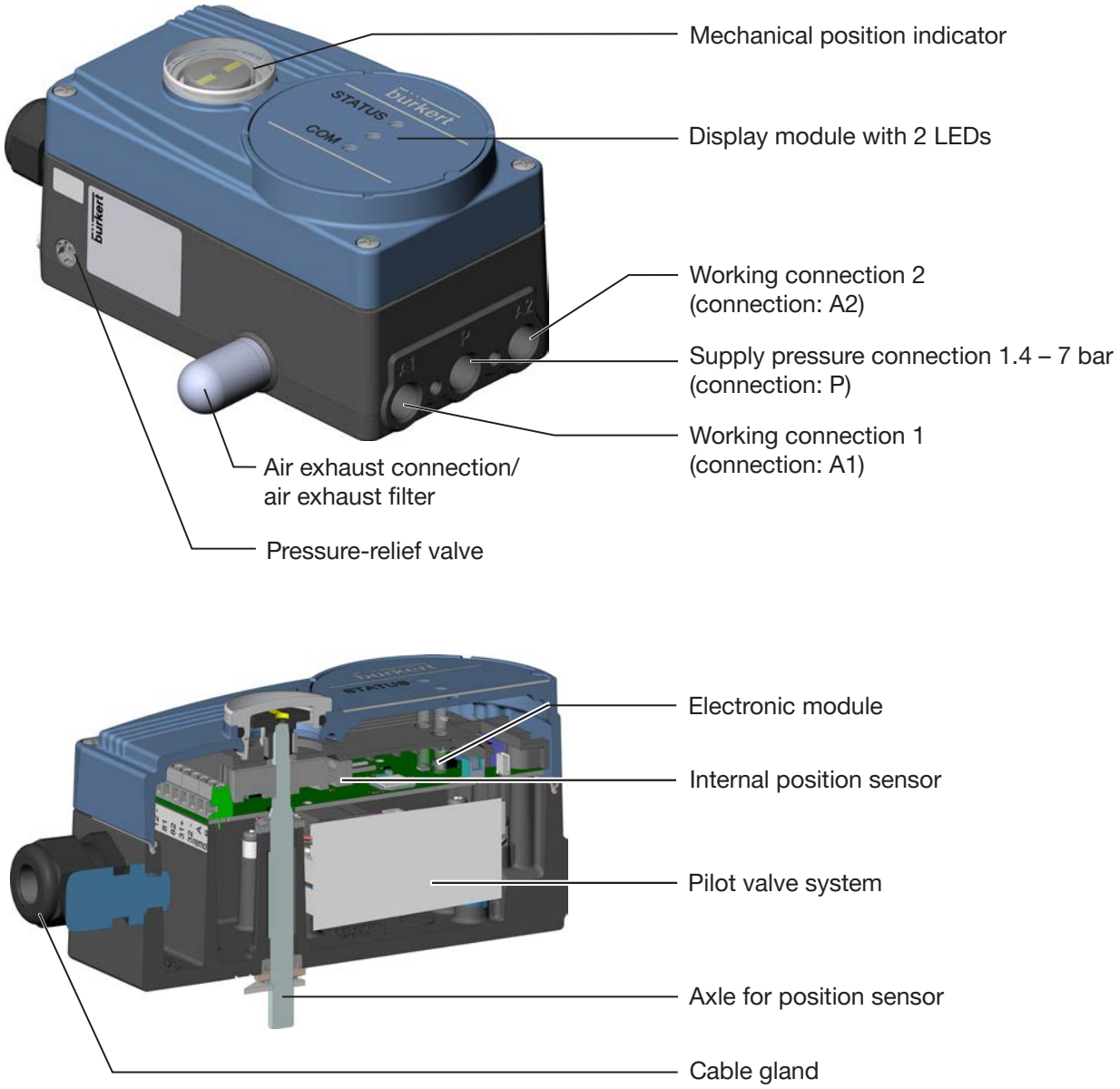

Figure 1: Structure, positioner type 8791

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7 FUNCTION

7.1 Function diagram

Diagram illustrating single-acting actuator

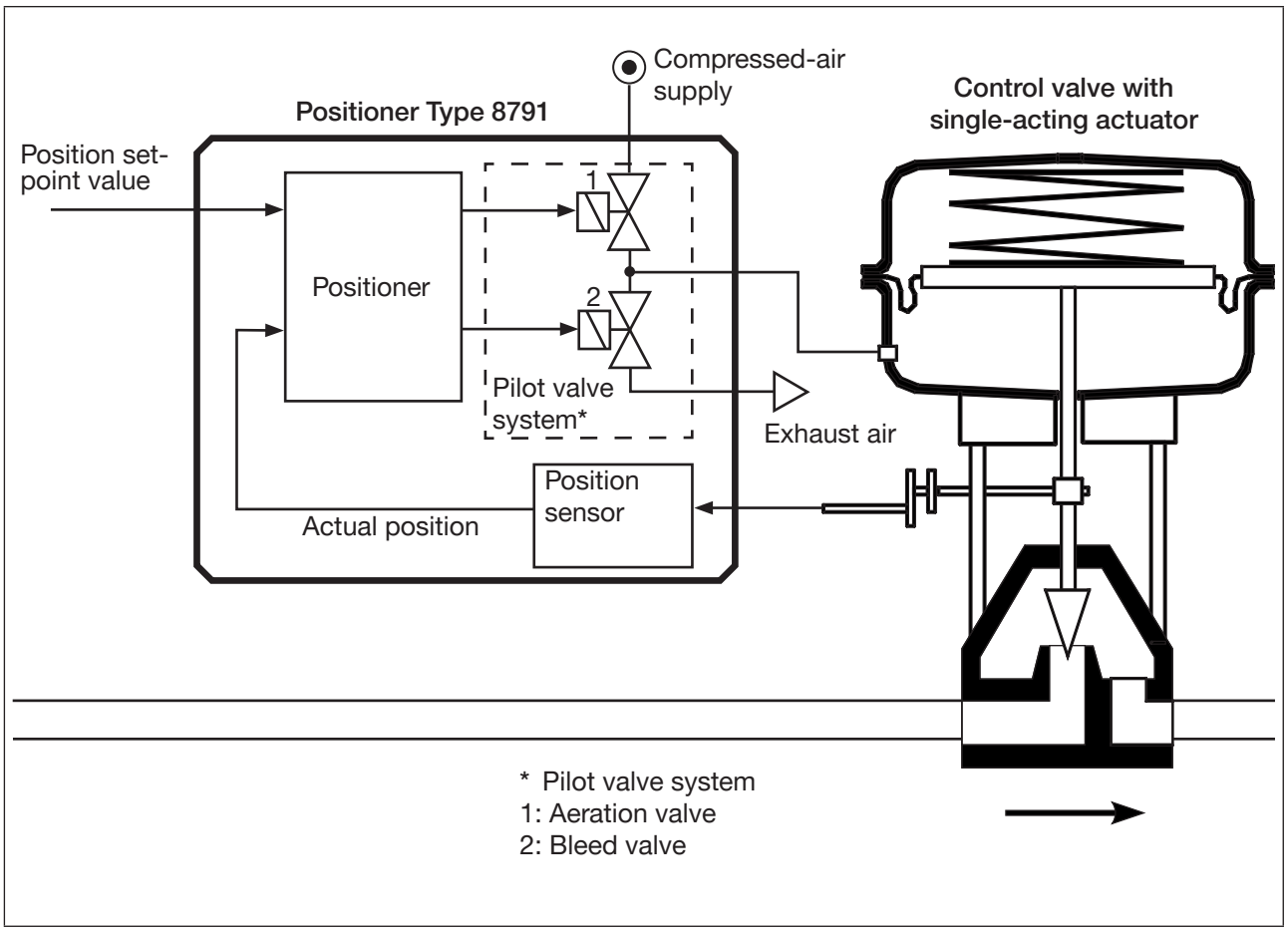

Figure 2: Function diagram, positioner type 8791

The remote design has the position sensor situated outside the positioner directly on the valve and is connected to the latter by a cable.

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7.2 Function of the position control

The position sensor records the current position (*POS*) of the pneumatic actuator. The positioner compares this actual position value with the set-point value (*CMD*) which is a standard signal. If there is a control difference (Xd1), the actuator is aerated and deaerated via the control system. In this way the position of the actuator is changed until control difference is 0. Z1 represents a disturbance variable.

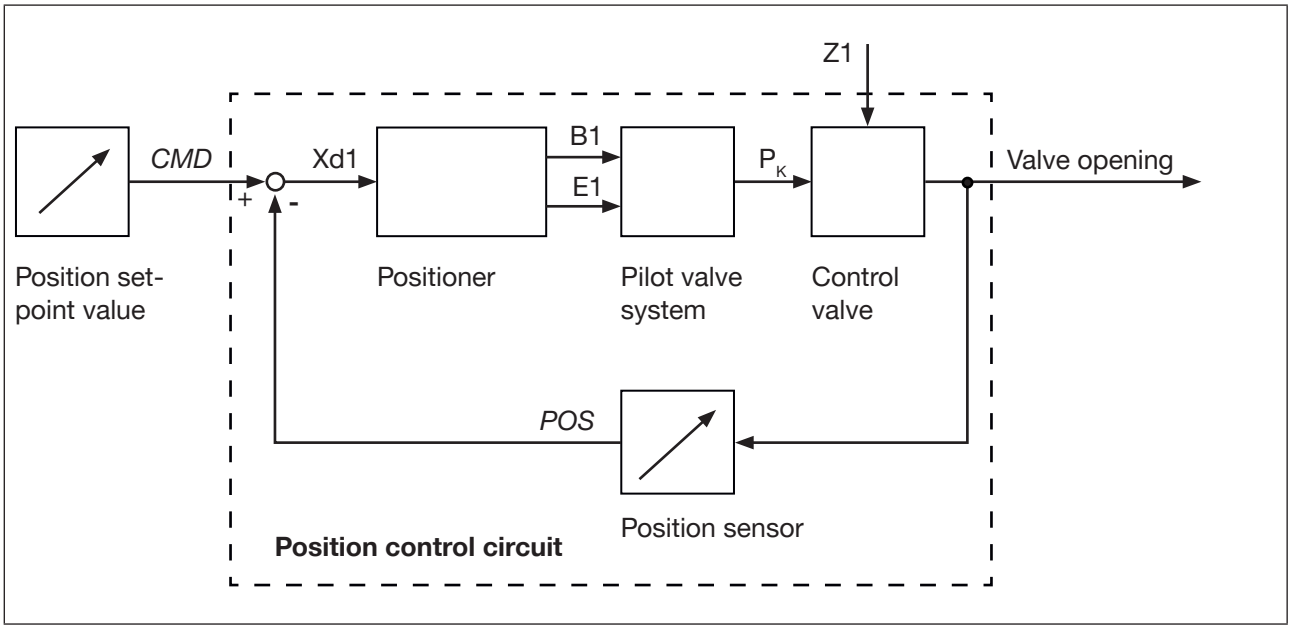

Figure 3: Signal flow plan of positioner

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7.2.1 Schematic representation of the position control

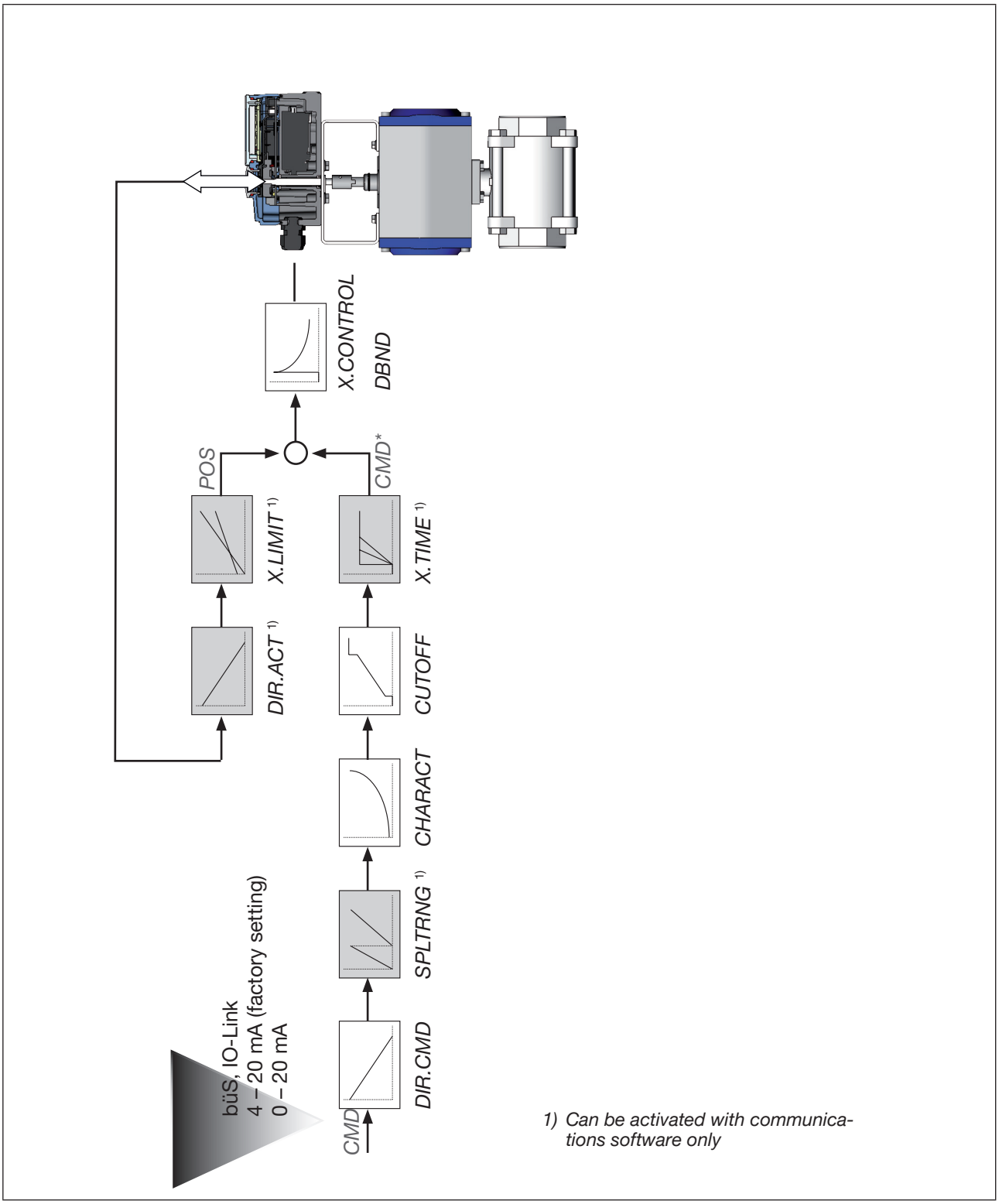

Figure 4: Schematic representation of position control

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7.2.2 Functions of the position controller software

Basic functions

- Activation via DIP switches
- Parameter setting via communications software

Function	Effect
Sealing function *CUTOFF*	Valve closes tight outside the control range. Specification of the value (as %) from which the actuator is completely deaerated (when 0%) or aerated (when 100%) (see chapter entitled "9.3.2 Function of the DIP switches").
Characteristic correction *CHARACT*	Linearization of the operating characteristic can be implemented (see chapter entitled "9.3.2 Function of the DIP switches").
Reversal of the effective direction set-point value *DIR.CMD*	Reversal of the effective direction of the set-point value (see chapter entitled "9.3.2 Function of the DIP switches").

Table 2: Basic functions

Basic functions

- Activation with buttons or communications software

Function	Effect
Standard signal[2)] *INPUT*	Select set-point value standard signal.
Automatic calibration of the position controller *X.TUNE*	
Reset to factory settings *RESET*	Reset to factory settings.

Table 3: Basic functions

2) Only adjustable with communications software
Only for variant without fieldbus communication.

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Auxiliary functions

- Activation and parameter setting with communications software

Function	Effect
Reversal of the effective direction of the actuator *DIR.ACT*	Assignment of the aeration status of the actuator chamber to the actual position.
Signal split range *SPLTRNG*	Standard signal as % for which the valve runs through the entire mechanical stroke range.
Stroke limit *X.LIMIT*	Limit the mechanical stroke range
Limit actuating time *X.TIME*	Limit the control speed
Control parameters *X.CONTROL*	Parameterize the position controller
Safety position *SAFEPOS*	Definition of the safety position
Cable break detection[3)] *SIG.ERROR*	Configuration of signal level fault detection
Digital input[3)] *BINARY.IN*	Configuration of the digital input
Analog output[3)] *OUTPUT*	Configuration of the analog output (variant)

Table 4: Auxiliary functions

3) Only for variant without fieldbus communication.

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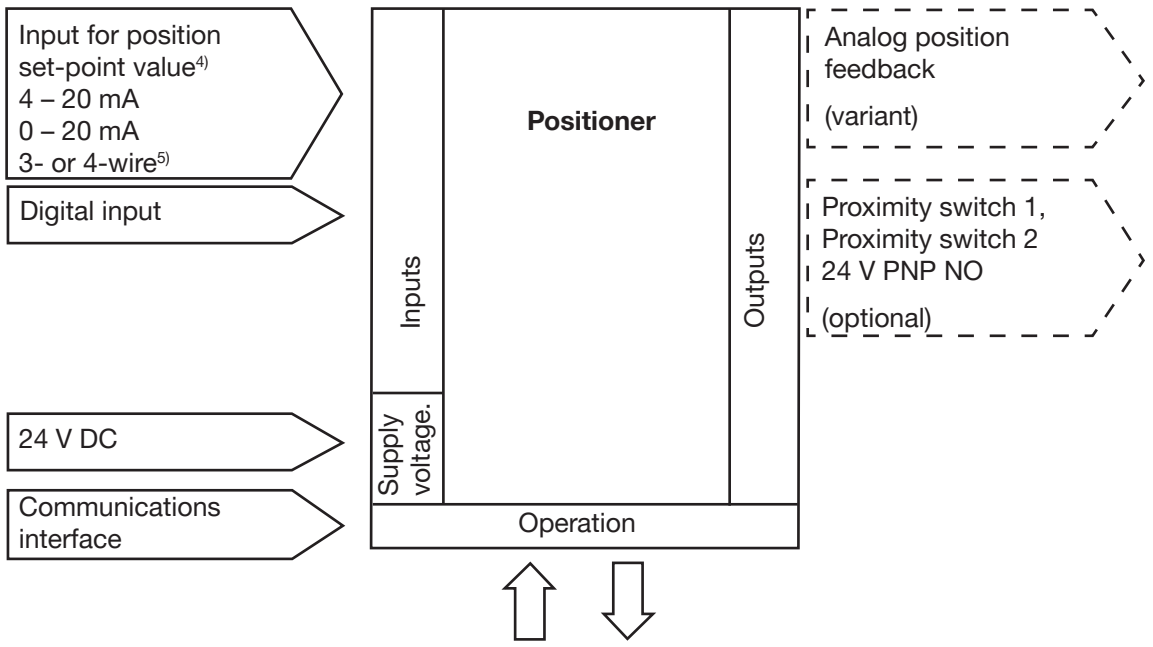
7.3 Interfaces of the positioner



4) Or via fieldbus communication (büS/CANopen or IO-Link)

5) Factory setting is 4 – 20 mA, 4-wire

Figure 5: Interfaces of the positioner

The positioner Type 8791 must be operated in 3-wire or 4-wire connection, i.e. the power (24 V DC) is supplied separately from the set-point value signal.

- Input for nominal position value[6] (4 – 20 mA corresponds to 0 – 100%) (depends on the position of DIP switch 1).
- Digital input[6]
  When applying voltage of > 10 V, safety position (*SAFEPOS)* will be activated, i.e. the valve is moved into the safety position.
- Analog position feedback[6] (variant)
  The position of the valve can be relayed to the PLC via an analog 4 – 20 mA output (4 – 20 mA corresponds to 0 – 100%).

6) Only for variant without fieldbus communication.

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8 TECHNICAL DATA

8.1 Conformity

In accordance with the EU Declaration of conformity, the positioner Type 8791 is compliant with the EU Directives (if applicable).

8.2 Standards

The applied standards on the basis of which compliance with the EU Directives is confirmed are listed in the EU type examination certificate and/or the EU Declaration of Conformity (if applicable).

8.3 Operating conditions

WARNING!

Solar radiation and temperature fluctuations may cause malfunctions or leaks.

- If the device is used outdoors, do not expose it unprotected to the weather conditions.
- Ensure that the permitted ambient temperature does not exceed the maximum value or drop below the minimum value.

Ambient temperature	see type label
Protection class	IP65 / IP67[7] according to EN 60529 (only if cables, plugs and sockets have been connected correctly)

7) If the positioner is used under IP67 conditions, the ventilation filter (see "Figure 1: Structure, positioner type 8791") must be removed and the exhaust air conducted into the dry area.

Altitude	up to 2000 m above sea level

8.4 Mechanical data

Dimensions	See data sheet
Material	
Housing material	Plastic-coated aluminium
Other external parts	Stainless steel (V4A), PC, PE, POM, PTFE
Sealing material	EPDM, NBR, FKM
Weight	approx. 1.0 kg

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8.5 Type label

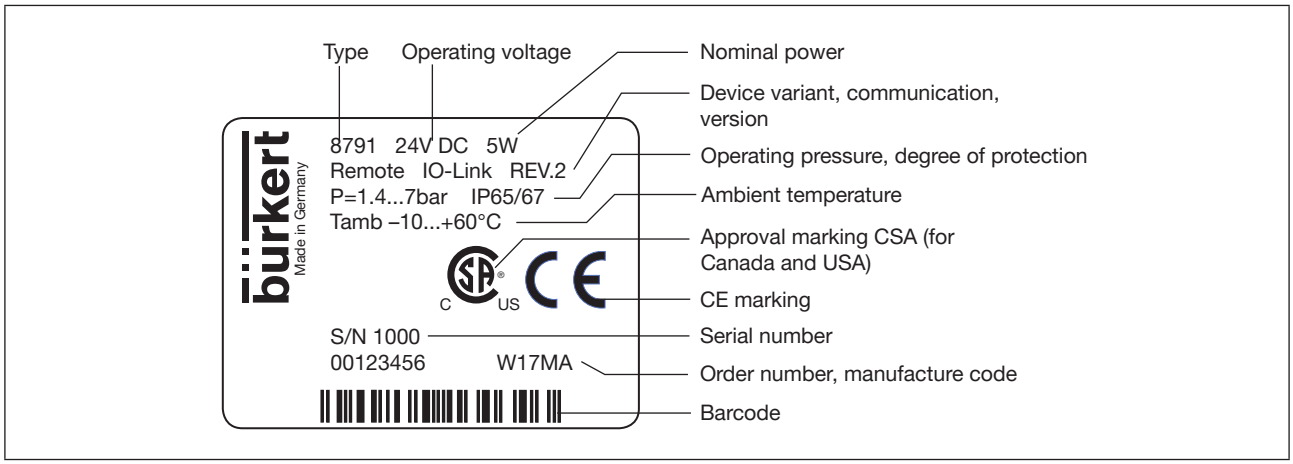

Figure 6: Type label (example)

8.6 Electrical data

8.6.1 Electrical data, without fieldbus communication

Protection class	III in accordance with DIN EN 61140 (VDE 0140-1)
Connections	2 cable glands (M20 x 1.5) with screw-type terminals 0.14 – 1.5 mm² or circular plug-in connector (M12, 8-pin plug)
Operating voltage	24 V DC ± 25%, max. residual ripple 10%
Current consumption	max. 190 mA
Power consumption	max. 3.5 W
Input resistance for set-point value signal	75 Ω in 0/4 – 20 mA / Resolution 12 bit
Analog position feedback max. Burden (load) for current output 0/4 – 20 mA)	560 Ω
Inductive proximity switches	100 mA current limit
Digital input	0 – 5 V = log “0”, 10 – 30 V = log “1” inverted input in reverse order (input current < 6 mA)
Communications interface	Connection to PC via USB bus interface set
Communication software	Bürkert Communicator

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8.6.2 Electrical data, IO-Link

Protection class	III as per DIN EN 61140 (VDE 0140-1)
Connection	Circular plug-in connector M12 x 1, 5-pin, A-coded, Port Class B
Operating voltage	
System supply (Pin 1+3)	24 V DC ±25 % (according to specification)
Actuator supply (Pin 2+5)[8)]	24 V DC ±25 % (according to specification)
Current consumption	
System supply (Pin 1+3)	max. 50 mA
Actuator supply (Pin 2+5)	max. 100 mA
Total power consumption	max. 3.5 W

8) Actuator supply is galvanically isolated from system supply in accordance with IEC 60664 and for electrical safety in accordance with SELV from IEC 61010-2-201

8.6.3 Electrical data, büS

Protection class	III as per DIN EN 61140 (VDE 0140-1)
Connection	Circular plug-in connector M12 x 1, 5-pin, A-coded
Operating voltage	24 V DC ±25 %
Current consumption	max. 150 mA
Total power consumption	max. 3.5 W

8.7 Pneumatic data

Control medium		Neutral gases, air Quality classes in accordance with ISO 8573-1
Dust content	Quality class 7	max. particle size 40 µm, max. particle density 10 mg/m^3
Water content	Quality class 3	max. pressure dew point - 20 °C or min. 10 degrees below the lowest operating temperature
Oil content	Quality class X	max. 25 mg/m^3
Temperature range		0 – +60 °C
Pressure range		1.4 – 7 bar
Air flow rate		50 l_N / min (at 1.4 bar[9)]) for aeration and deaeration 150 l_N / min (at 6 bar[9)]) for aeration and deaeration (Q_{Nn} = 100 l_N / min (according to definition for pressure drop from 7 to 6 bar absolute)).
Connections		Internal thread G1/4“

9) Pressure specifications: Overpressure with respect to atmospheric pressure

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8.8 Safety end positions after failure of the electrical or pneumatic auxiliary power

The safety end position depends on the fluid connection of the actuator to the working connections A1 or A2.

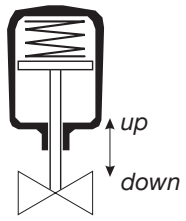
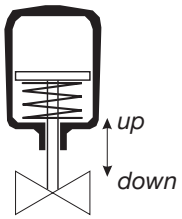
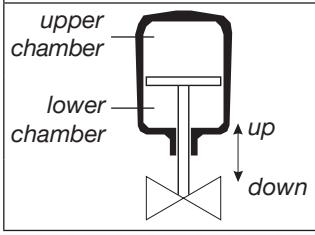
Actuator system	Designation	Safety end positions after failure of the	
		electrical auxiliary power	pneumatic auxiliary power
	single-acting Control function A	down → Connection according to "Figure 7"	down
		up → Connection according to "Figure 8"	
	single-acting control function B	up → Connection according to "Figure 7"	up
		down → Connection according to "Figure 8"	
	double-acting Control function I	→ Fluid connection see "Figure 9"	not defined
		up = lower chamber of the actuator to A2	
		down = upper chamber of the actuator to A2	

Table 5: Safety end positions

Fluid connection: Description for "Table 5"

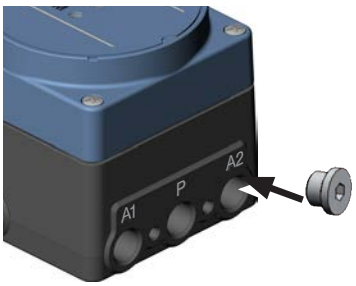
Single-acting actuators Control function A and B		Double-acting actuators Control function I
		
Connection: working connection A1 to actuator A2 sealing	Connection: working connection A2 to actuator A1 sealing	Connection: Working connection A1 and A2 to actuator Safety end position: up = lower chamber to A2 down = upper chamber to A2

Figure 7: Connection A1 *Figure 8: Connection A2* *Figure 9: Connection with CFI*

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8.9 Factory settings of the positioner

8.9.1 Functions can be activated via DIP switches

Function	Parameter	Value
CUTOFF	Sealing function below Sealing function above	2 % 98 %
CHARACT	Characteristic correction	FREE[10)]
DIR.CMD	Reversal of the effective direction set-point value	Off

Table 6: Factory settings

8.9.2 Functions can be activated via communications software

Function	Parameter	Value
INPUT	Set-point value input	4 – 20 mA, 4-wire
DIR.ACT	Reversal of the effective direction of the actuator	Off
SPLTRNG Function deactivated	Signal split range below Signal split range above	0 % 100 %
X.LIMIT Function deactivated	Stroke limit below Stroke limit above	0 % 100 %
X.TIME Function deactivated	Actuating time Open Actuating time Closed	(1 s) values determined by *X.TUNE* (1 s) values determined by *X.TUNE* After implementation of *RESET*: 1 s
X.CONTROL	Deadband Open amplification factor Close amplification factor	1,0 % (1) values determined by *X.TUNE* (1) values determined by *X.TUNE* After implementation of *RESET*: 1
SAFEPOS	Safety position	0 %
SIG.ERROR[11)] Function deactivated	Cable break detection set-point value	Deactivated
BINARY.IN[11)]	Digital input function Operating principle of digital input	Safety position Normally open
OUTPUT[11)] (variant)	Norm signal output: Parameter Norm signal output: Type	Position (POS) 4 – 20 mA

Table 7: Factory settings

10) Without change to the settings via the communications software a linear characteristic is stored in FREE.

11) Only for variant without fieldbus communication.

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9 OPERATING

9.1 Safety instructions

WARNING!

Risk of injury from improper operation!

Improper operation may result in injuries as well as damage to the unit and the area around it.

- The operating personnel must know and have understood the contents of the operating instructions.
- Observe the safety instructions and intended use.
- Only adequately trained personnel may operate this equipment.

9.2 Operating state

To operate the DIP switches and buttons, make sure that the local control lock is deactivated/ unlocked (factory setting): with communication software or fieldbus communication.

AUTOMATIC (AUTO)

Normal controller mode is implemented and monitored in AUTOMATIC operating state.

MANUAL

In MANUAL operating state the valve can be opened and closed manually via the buttons.

DIP switch 4 can be used to switch between the two operating states AUTOMATIC and MANUAL (see chapter “9.3.2 Function of the DIP switches”).

9.3 Control and display elements of the positioner

To operate the DIP switches and buttons, make sure that the local control lock is deactivated/ unlocked (factory setting): with communication software or fieldbus communication.

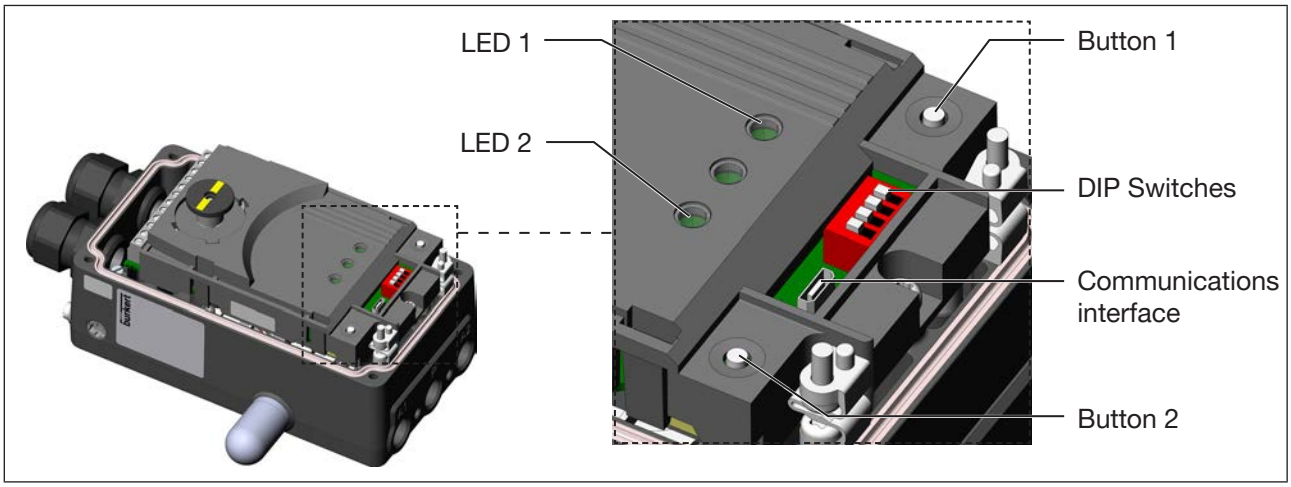

Figure 10: Description of control elements

The positioner features 2 buttons, 4 DIP switches and 2 LEDs as a display element.

→ To operate the buttons and DIP switches, unscrew the 4 screws on the housing cover and remove the housing cover.

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9.3.1 Configuration of the buttons

To operate the DIP switches and buttons, make sure that the local control lock is deactivated/ unlocked (factory setting): with communication software or fieldbus communication.

The configuration of the 2 buttons inside the housing varies depending on the operating state (AUTOMATIC/ MANUAL).

The description of the operating state (AUTOMATIC/MANUAL) can be found in the chapter entitled “9.2 Operating state”.

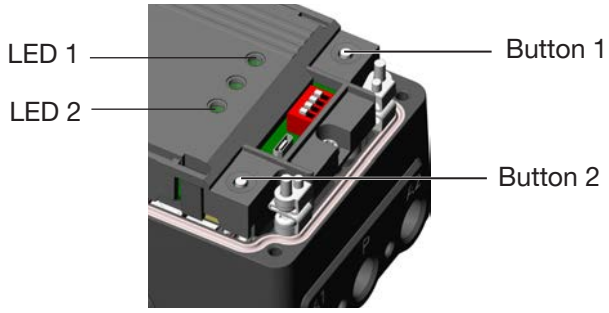

Figure 11: Description of the buttons

→ To operate the buttons and DIP switches, unscrew the 4 screws on the housing cover and remove the housing cover.

MANUAL operating state (DIP switch 4 set to ON):

Button	Function
1	Aerate (manually open / close the actuator)[12)]
2	Deaerate (manually open / close the actuator)[12)]
1 and 2 simultaneously	Longer than 10 s (< 30 s, LED 2 flashes at 5 Hz): Device restart
	Longer than 30 s (LED 2 flashes at 10 Hz): Reset device to factory setting
12) Depending on the control function of the actuator.	

Table 8: Configuration of the buttons for MANUAL operating state

AUTOMATIC operating state (DIP switch 4 set to OFF):

Button	Function
1	Start the *X.TUNE* function: press button for 5 seconds until LED 2 (green) flashes
2	-
1 and 2 simultane-ously	Longer than 10 s (< 30 s, LED 2 flashes at 5 Hz): Device restart
	Longer than 30 s (LED 2 flashes at 10 Hz): Reset device to factory setting

Table 9: Configuration of the buttons for AUTOMATIC operating state

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9.3.2 Function of the DIP switches

To operate the DIP switches and buttons, make sure that the local control lock is deactivated/ unlocked (factory setting): with communication software or fieldbus communication.

→ To operate the buttons and DIP switches, unscrew the 4 screws on the housing cover and remove the housing cover.

DIP Switches	Position	Function
1	ON	Reversal of the effective direction of the set-point value (*DIR.CMD*) (set-point value 20 – 4 mA corresponds to position 0 – 100%)
	OFF	Normal effective direction of the set-point value (set-point value 4 – 20 mA corresponds to position 0 – 100%)
2	ON	Sealing function active. The valve completely closes below 2%[13)] and opens above 98% of the set-point value (*CUTOFF*)
	OFF	No sealing function
3	ON	Characteristic correction for adjustment of the operating characteristic (Linearization of the operating characteristic *CHARACT*)[14)]
	OFF	Linear characteristic
4	ON	MANUAL operating status manual
	OFF	AUTO AUTOMATIC operating status

13) Factory setting can be changed via communications software.

14) Characteristic type can be changed via communications software.

Table 10: Function of the DIP switches

Information about the communications software:

The switching position of the DIP switch has priority over the communications software.

If the values of the sealing function (CUTOFF) or the correction characteristic (CHARACT) are changed via the communication software, the corresponding function must be active (DIP switch set to ON).

The effective direction of the set-point value (*DIR.CMD*) can be changed via the Dip switches.

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9.3.3 Display of the LEDs

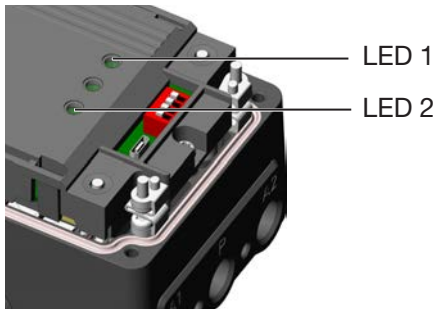

Figure 12: LED display

LED 1 (RGB)	Display of the device status and valve position
LED 2 (green)	Display of the bus status Display during functions • X.TUNE • Device restart • Reset to factory settings

9.3.4 Device status display

The device status LED 1 (RGB) show the device status.

The user can set the following LED modes for the display of device status and valve position.

- Valve mode
- Valve mode with error messages
- Valve mode with error messages and warnings (factory setting)
- NAMUR mode
- LED off

The LED mode and the colors of the valve position can be set with the Bürkert Communicator.

IO-Link:
The LED mode and the colors of the valve position can be also set with an acyclic parameter (see parameter list).

The description for setting the LED mode can be found in the section "10.2.10 Setting the LED mode, device status" in the operating manual.

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9.3.4.1 Valve mode

Displays in valve mode:

- Valve position: open, half-way, closed
- Device status: Error

Valve position	Valve position status, color	Device status: Error status, color	
Open	is lit yellow*	flashes red	alternately with yellow*
Half-way	LED off*	flashes red	alternately with LED off*
Closed	is lit green*	flashes red	alternately with green*

Table 11: Valve mode

9.3.4.2 Valve mode + warnings

Displays in valve mode + warnings:

- Valve position: open, half-way, closed
- Device status: failure, function check, out of specification, maintenance required (according to NAMUR)

Valve position		Device status
	Status, color	Normal operation
Open	is lit yellow*	--
Half-way	LED off*	--
Closed	is lit green*	--

Table 12: Valve mode + warnings, normal operation

If several device statuses exist simultaneously, the device status with the highest priority is displayed.

Valve position	Device status				
	Failure	Function check	Out of specification	Maintenance required	
	Status, color	Status, color	Status, color	Status, color	
Open	flashes red	flashes orange	flashes yellow	flashes blue	alternately with yellow*
Half-way	flashes red	flashes orange	flashes yellow	flashes blue	alternately with LED off*
Closed	flashes red	flashes orange	flashes yellow	flashes blue	alternately with green*

Table 13: Valve mode + warnings, device status

For warning messages, the LEDs are briefly switched off between the change of the colors.

For localizations, the colors are only shown momentarily.

** Factory setting, selectable colors for the valve position: Off, white, green, blue, yellow, orange, red*

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9.3.4.3 NAMUR mode

The device status LEDs (top LED) show the device status.

The display elements change color in accordance with NAMUR NE 107.

If several device statuses exist simultaneously, the device status with the highest priority is displayed. The priority is determined by the severity of the deviation from controlled operation (red LED = failure = highest priority).

Status display in accordance with NE 107, edition 2006-06-12			
Color	**Color code**	**Status**	**Description**
Red	5	Outage, error or malfunction	Normal operation is not possible due to a malfunction in the device or on its peripheral equipment.
Orange	4	Function check	Work is being carried out on the device; normal operation is therefore temporarily not possible
Yellow	3	Out of specification	Ambient conditions or process conditions for the device are outside the specified area.
Blue	2	Maintenance required	The device is in normal operation, although a function is briefly restricted. →Service device.
Green	1	Diagnostics active	Device is operating perfectly. Status changes are indicated in different colors. Messages are transmitted via a fieldbus if connected.

Table 14: Description of the colors

9.3.5 Status LED, green

LED 2 (green) indicates the following:

Color	Status	Description
green	is lit	
	is not lit	IO-Link communication inactive
	flashes	IO-Link communication active
	flashes with 5 Hz	X.TUNE is running or device is restarted
	flashes with 10 Hz	Device is reset to factory settings

Table 15: LED 2, green

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9.4 Error messages

9.4.1 Messages for device status „Out of specification“

Message	Description	Procedure
Temperature limit exceeded	Ambient temperature is too high	Reduce ambient temperature. If problems continue, contact your Bürkert Service Center
Temperature limit not achieved	Ambient temperature is too low	Increase ambient temperature
Voltage limit exceeded	Supply voltage is too high	Check supply voltage
Voltage limit not achieved	Supply voltage is too low	Check supply voltage
CMD sensor break	Cable break of the set-point value signal.. The message can be parameterized (see)	Check the signal line of the set-point value

Table 16: Messages

9.4.2 Messages: Actuator moves to safety position

Message	Description	Procedure
Excess temperature detected	Device temperature is too high for operation	Reduce ambient temperature. If problems continue, contact your Bürkert Service Center
Insufficient temperature detected	Device temperature is too low for operation	Increase ambient temperature
Excess voltage detected	Supply voltage is too high for operation	Check supply voltage
Insufficient voltage detected	Failure of the supply voltage or supply voltage is too low for operation	Check supply voltage. If problems continue, contact your Bürkert Service Center
Persistent memory cannot be used: Defective or not available	Writing or reading error of the internal data storage EEPROM	Restart device. If problems continue, contact your Bürkert Service Center
BueS event: Producer(s) not found	Assigned external büS producer cannot be found	Check signal to büS partner
BueS event: Bus connection lost / not available	büS network cannot be found	Check büS network
BueS event: Producer is not operational	Producer is not operational in the status	Check büS producer
BueS event: A device is using the same address	Another büS participant is using the same address	Assign device and büS participant a unique address

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IO-Link error	No valid process data is received	- Check connection to the IO-Link master - Check whether valid setpoints are sent to the device via the IO-Link interface
X.TUNE error occurred	The last X.TUNE was not successful.	-Check compressed air supply -Run X.TUNE again
Actuator supply is down	The actuator supply voltage is too low. Only with IO-Link	Check actuator supply voltage
POS.Monitor	The set-point position is not reached	-Run X.TUNE -Check compressed air supply.
CMD sensor break	Cable break of the set-point value signal.. The message can be parameterized	Check the signal line of the set-point value

Table 17: Messages

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10 FUNCTIONS

The positioner type 8791 has different basic and additional functions which can be configured and parameterized via the DIP switches or the communications software.

10.1 Basic functions

The following basic functions can be activated via the DIP switches (*CUTOFF* and *CHARACT*) or changed (*DIR.CMD*).

The parameters for the sealing function (*CUTOFF*) and characteristic correction (*CHARACT*) are set using the communication software.

Function	Description	DIP Switches	OFF	ON
Reversal of the effective direction set-point value *DIR.CMD*	Effective direction between input signal and set-point position	1	rise	fall
Sealing function *CUTOFF*	Sealing function for position controller	2	Sealing function off	Sealing function on
Characteristic correction *CHARACT*	Selection of the Transfer Characteristic between Input Signal and Stroke (Correction Characteristic)	3	Linear characteristic	Correction characteristic

Table 18: Basic functions of DIP switches

The following basic functions can be activated or changed with the buttons or the communications software.

Function	Description	Factory setting
Standard signal[15)] *INPUT*	Entry of the standard signal input for the set-point value	4 – 20 mA, 4-wire
Reset to factory settings *RESET*	Reset to factory settings	
Automatic calibration of the position controller *X.TUNE*	Automatic adjustment of the positioner to the relevant operating conditions	

Table 19: Basic functions

15) Only with communications software

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10.1.1 *DIR.CMD* - Reversal of the effective direction of the positioner set-point value

Use this function to set the effective sense of direction between the input signal (INPUT) and the set-point position of the actuator.

Factory settings: DIP switch set to OFF (ascending)

DIP switches	Position	Function
1	ON	Reversal of the effective sense of direction of the set-point value (*DIR.CMD*) (Set-point value 20 – 4 mA corresponds to position 0 – 100 %), descending
	OFF	Normal effective sense of direction of the set-point value (Set-point value 4 – 20 mA corresponds to position 0 – 100 %), ascending

Table 20: DIP switches 1

The effective sense of direction (*DIR.CMD*) can be changed only via DIP switch 1 in the positioner.

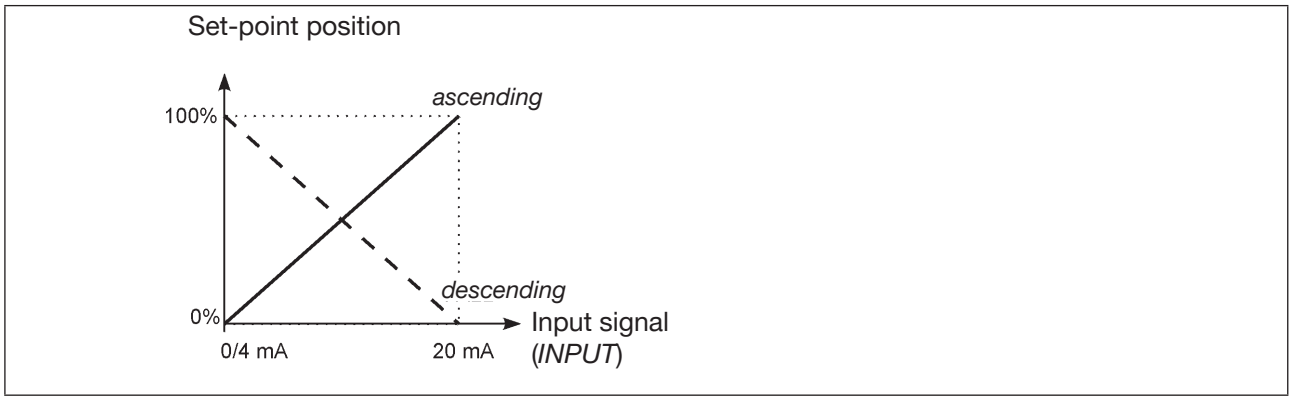

Figure 13: DIR.CMD graph

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10.1.2 *CUTOFF* - Sealing function for the positioner

This function causes the valve to be sealed outside the control range.

Controlled operation is resumed with a hysteresis of 1 %.

Factory settings: DIP switch 2 set to OFF (no sealing function)

DIP switches	Position	Function
2	ON	Sealing function active. The valve completely closes below 2 %[16] and opens above 98 % of the set-point value (*CUTOFF*)
	OFF	No sealing function

Table 21: DIP-switch 2

The communications software can be used to change the limits for the position set-point value as a percentage.

The switching position of the DIP switches in the positioner has priority over the communications software, i.e. settings of the sealing function (*CUTOFF*) which are changed via the communications software are not active unless DIP switch 2 in the positioner is set to ON.

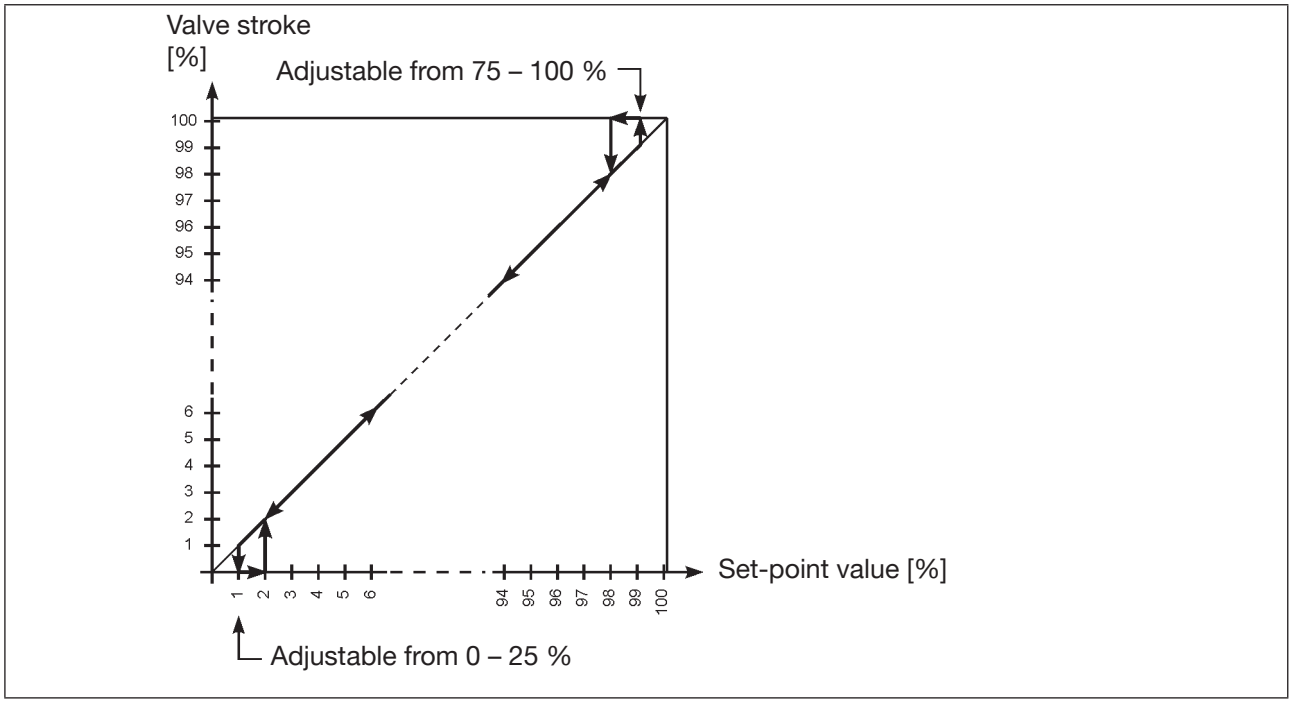

Figure 14: CUTOFF graph

16) *Factory settings can be changed via communications software.*

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10.1.3 *CHARACT* - Characteristic correction between input signal (position set-point value) and stroke

Characteristic (customer-specific characteristic)

This function can be used to activate a transfer characteristic with respect to set-point value (set-point position) and valve stroke for correction of the flow or operating characteristic.

The transfer characteristic can be changed via the communications software only.

Factory settings: DIP switch 3 set to OFF (linear)

DIP switches	Position	Function
3	ON	Characteristic correction for adjustment of the operating characteristic (linearization of the process characteristic *CHARACT*)[17]
	OFF	Linear characteristic

Table 22: DIP switch 3

The switching position of the DIP switches in the positioner has priority over the communications software, i.e. settings of the correction characteristic (*CHARACT*) which are changed via the communications software are not active unless DIP switch 3 in the positioner is set to ON.

Characteristics which can be selected via the communications software:

Characteristic	Description
Linear	Linear characteristic
1 : 25	Equal percentage characteristic 1 : 25
1 : 33	Equal percentage characteristic 1 : 33
1 : 50	Equal percentage characteristic 1 : 50
25 : 1	Inversely equal percentage characteristic 25 : 1
33 : 1	Inversely equal percentage characteristic 33 : 1
55 : 1	Inversely equal percentage characteristic 55 : 1
FREE	User-defined characteristic, freely programmable via nodes

Table 23: Selection of characteristics

17) The characteristic type can be changed via the communications software only.

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The flow characteristic $k_V = f(s)$ indicates the flow-rate of a valve, expressed by the value k_V as a function of the stroke s of the actuator spindle. It is determined by the design of the valve seat and the seat seal. In general two types of flow characteristics are implemented, the linear and the equal percentage.

In the case of linear characteristics, equal k_V value changes dk_V are assigned to equal stroke changes ds.

$$(dk_V = n_{lin} \cdot ds).$$

In the case of an equal percentage characteristic, an equal percentage change of the k_V value corresponds to a stroke change ds.

$$(dk_V/k_V = n_{eqlprct} \cdot ds).$$

The operating characteristic Q = f(s) specifies the correlation between the volumetric flow Q in the installed valve and the stroke s. This characteristic has the properties of the pipelines, pumps and consumers. It therefore exhibits a form which differs from the flow characteristic.

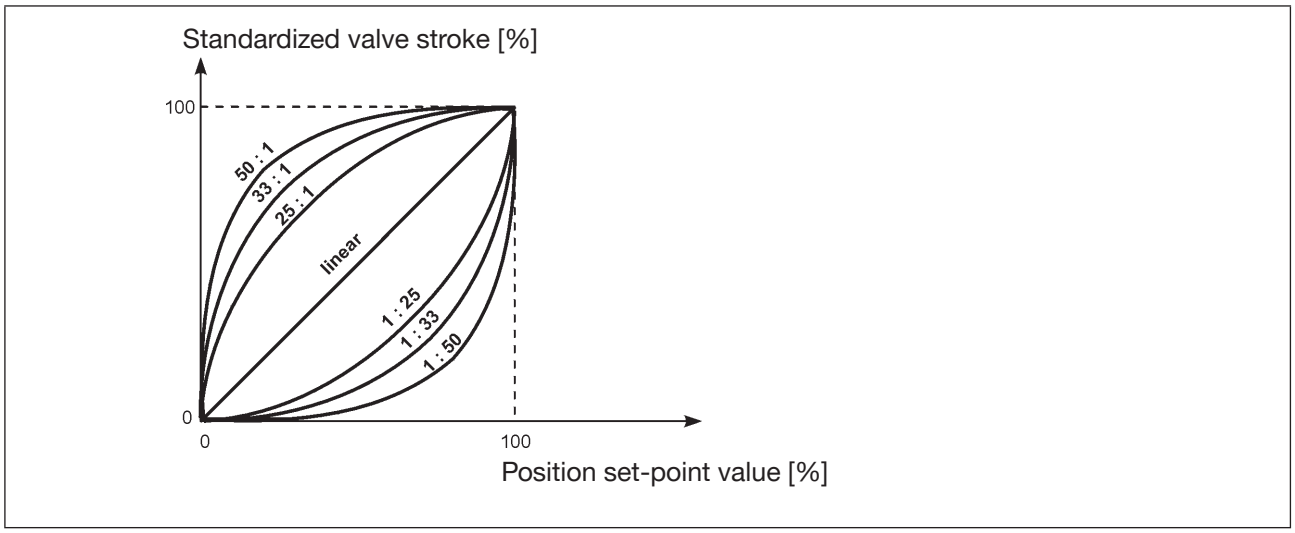

Figure 15: Characteristic

In the case of control tasks for closed-loop control systems it is usually particular demands which are placed on the course of the operating characteristic, e.g. linearity. For this reason it is occasionally necessary to correct the course of the operating characteristic in a suitable way. For this purpose the positioner features a transfer element which implements different characteristics. These are used to correct the operating characteristic.

Equal percentage characteristics 1:25, 1:33, 1:50, 25:1, 33:1, and 50:1 as well as a linear characteristic can be set. A characteristic can be freely programmed using nodes.

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Entering the freely programmable characteristic

The characteristic is defined by 21 nodes distributed uniformly over the position set-point values ranging from 0 – 100%. They are spaced at intervals of 5%. A freely selectable stroke (adjustment range 0 – 100%) is assigned to each node. The difference between the stroke values of two adjacent nodes must not be greater than 20%.

Example of a programmed characteristic

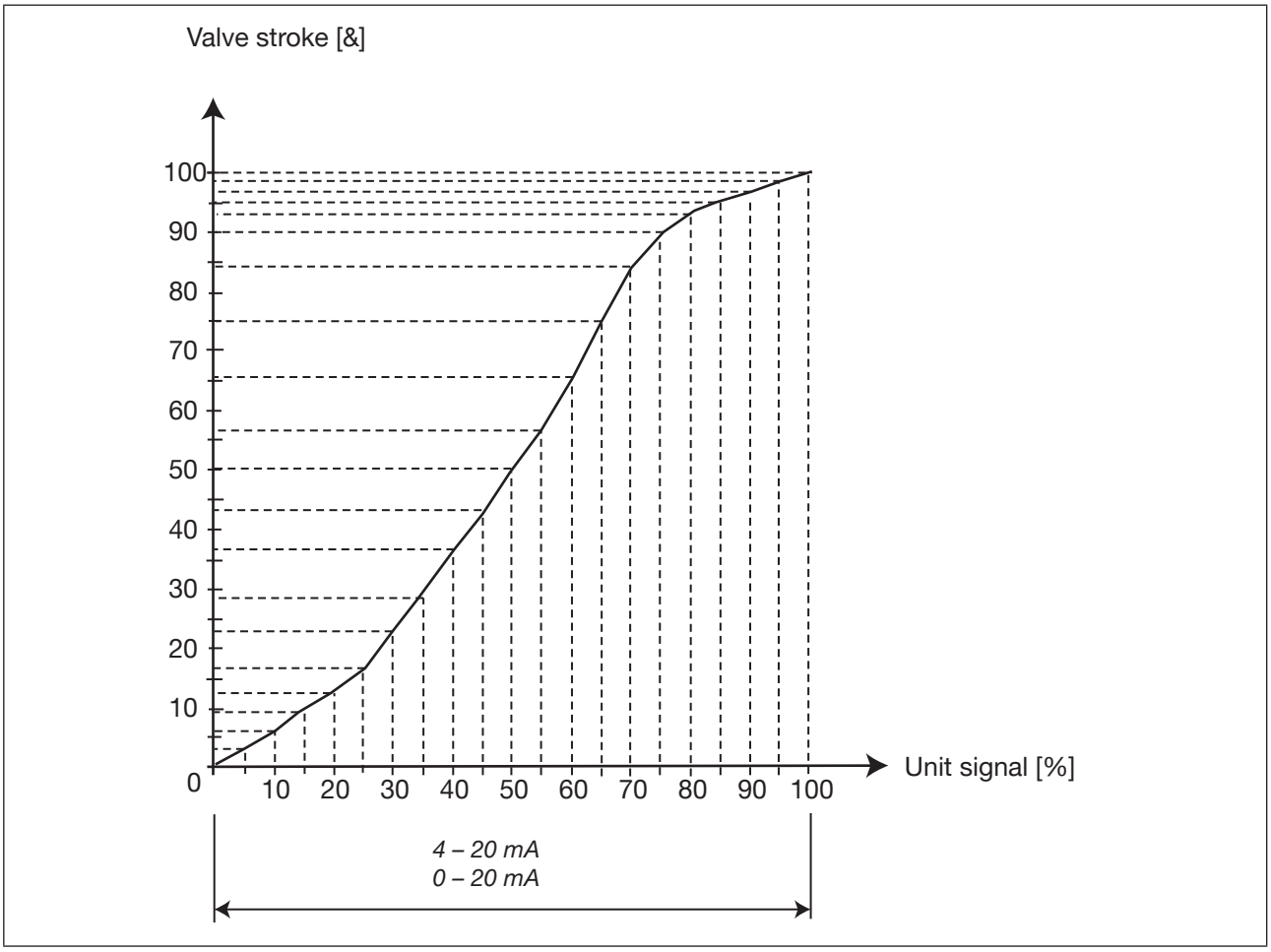

Figure 16: Example of a programmed characteristic

10.1.4 *INPUT* - Enter the standard signal (only variant without fieldbus communication)

Under this menu option, enter the input signal used for the set-point value.

Factory setting: 4 – 20 mA, 4-wire

Further settings: 4 - 20 mA, 3-wire
0 - 20 mA, 4-wire
0 - 20 mA, 3-wire

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10.1.5 *RESET* - Reset to factory settings

This function can be used to reset the positioner to the factory settings.

10.1.6 *X.TUNE* - Automatic calibration of the position controller to the relevant operating conditions

The *X.TUNE* function must be run for a function check of the positioner to adjust to specific local features.

WARNING!

While the *X.TUNE* function is running, the valve automatically moves from its current position.

- Never run *X.TUNE* while a process is running.
- Take appropriate measures to prevent the system / positioner from being unintentionally actuated.

NOTE!

Avoid maladjustment of the controller due to an incorrect compressed air supply or applied operating medium pressure.

- Run *X.TUNE* **whenever** the compressed air supply (= pneumatic auxiliary energy) is available during subsequent operation.
- Run the *X.TUNE* function preferably **without** operating medium pressure to exclude interference caused by flow forces.

To run *X.TUNE*, the positioner must be in the AUTOMATIC operating state (DIP switch 4 = OFF).

→ SSelect Automatic calibration of the position controller.

→ Start *X.TUNE*. To do this, click **Next**.

The progress of *X.TUNE* is shown in the communication software:

When the automatic adjustment completes, a message appears.

The changes are automatically transferred to the positioner‘s memory (EEPROM) after the *X.TUNE* function is successful.

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10.2 Additional functions

The following additional functions can be configured and parameterized via the communications software:

Function	Description
Reversal of the effective direction of the actuator *DIR.ACT*	Assignment of the aeration status of the actuator chamber to the actual position
Signal split range *SPLTRNG*	Signal split range; input signal as a % for which the valve runs through the entire stroke range.
Stroke limit *X.LIMIT*	Limit the mechanical stroke range
Limit actuating time *X.TIME*	Limit the control speed
Control parameters *X.CONTROL*	Parameterize the position controller
Safety position *SAFEPOS*	Input the safety position
Cable break detection[18)] *SIG.ERROR*	Configuration of signal level fault detection
Digital input[18)] *BINARY.IN*	Activation of the digital input
Analog output[18)] *OUTPUT*	Configuration of the outputs (only with auxiliary board for analogue feedback signal or digital outputs)

Table 24: Auxiliary functions

18) Only for variant without fieldbus communication.

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10.2.1 *DIR.ACT* - Reversal of the effective direction of the actuator

Use this function to set the effective direction between the aeration state of the actuator and the actual position.

Factory setting: Off (rise)

Rise: Direct effective direction (deaerated → 0 %; aerated 100 %)
Case: Inverse effective direction (deaerated → 100 %; aerated 0 %)

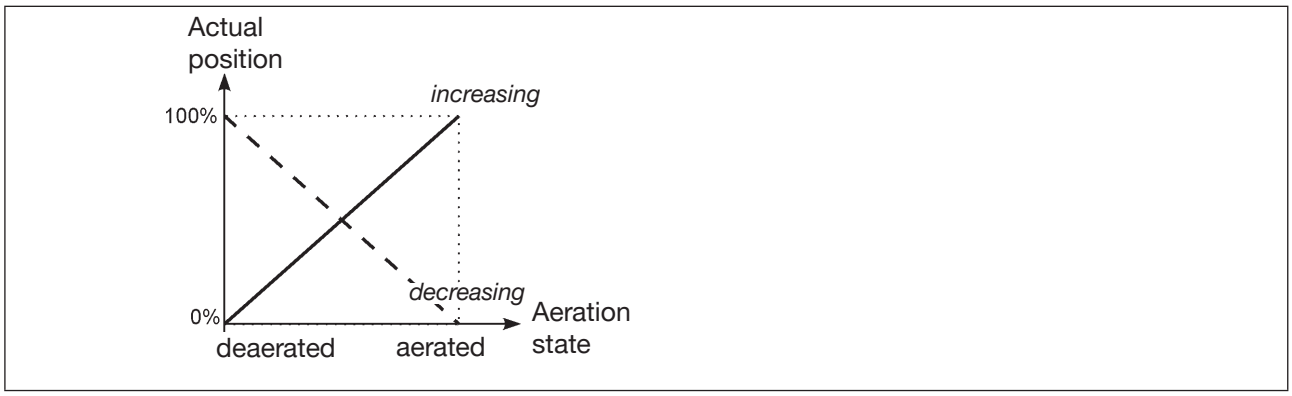

Figure 17: DIR.ACT graph

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10.2.2 *SPLTRNG* - Signal split range

Minimum and maximum values of the input signal as a % for which the valve runs through the entire stroke range.

Factory setting: Lower signal range split = 0 %; Upper signal range split = 100 %

Lower value split range: Input the minimum value of the input signal as a %
Adjustment range: 0 – 75 %

Upper value split range: Input the maximum value of the input signal as a %
Adjustment range: 25 – 100 %

Use this function to limit the position set-point value range of the positioner by specifying a minimum and a maximum value. This makes it possible to divide a unit signal range that is used (4 – 20 mA, 0 – 20 mA) into several positioners (without or with overlapping). This allows several valves to be used alternately or, in the case of overlapping set-point value ranges, simultaneously as actuators.

To split a unit signal range into two set-point value ranges:

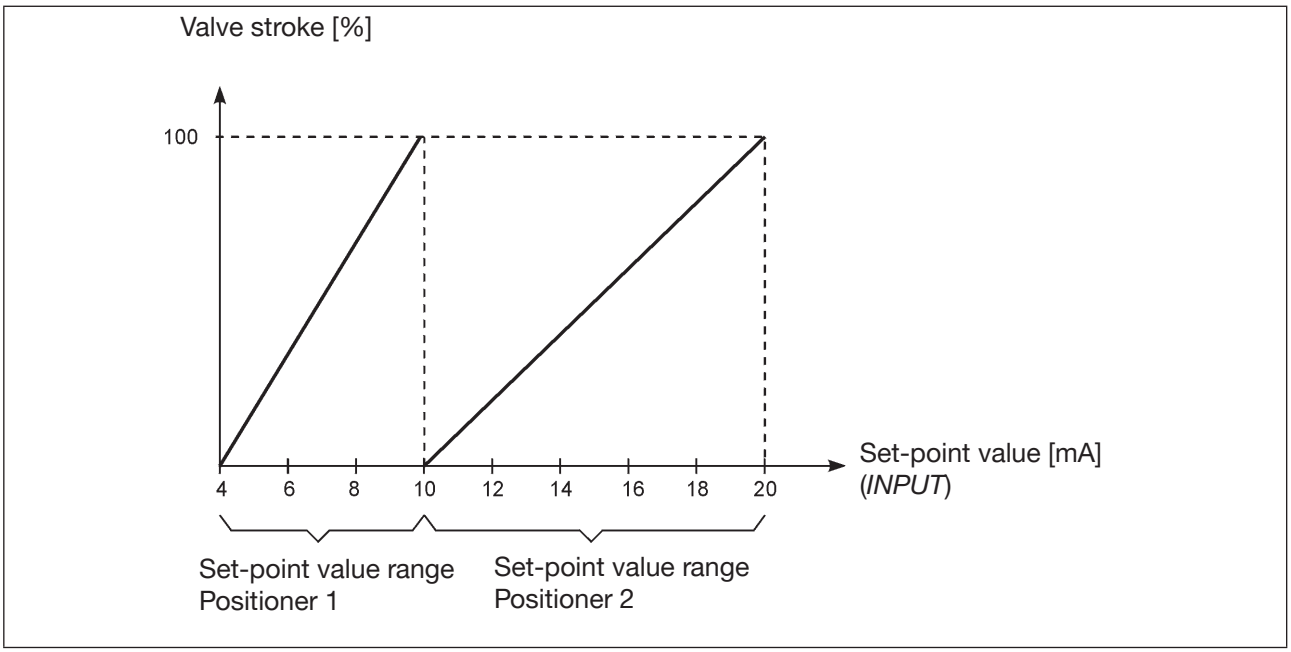

Figure 18: SPLTRNG graph

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10.2.3 *X.LIMIT* - Stroke limit

This function limits the (physical) stroke to specified % values (lower and upper). In doing so, the stroke range of the limited stroke is set equal to 100 %. If the limited stroke range is left during operation, negative actual positions or actual positions greater than 100 % are shown.

Factory setting: Lower position limit = 0 %, upper position limit = 100 %

Adjustment ranges:

Lower position limit: 0 – 50 % of the entire stroke

Upper position limit: 50 – 100 % of the entire stroke

The minimum distance between the upper and lower stroke limit is 50 %. Therefore if one value is entered with a minimum distance of < 50 % the other value is adjusted automatically.

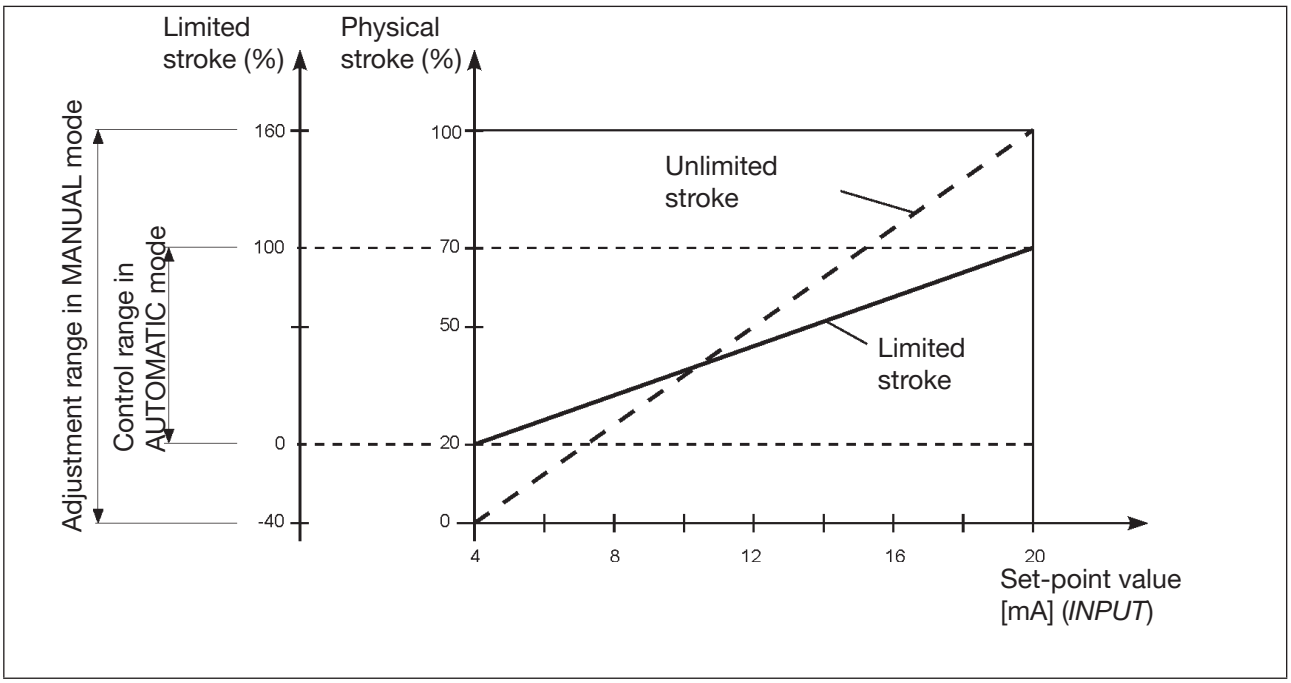

Figure 19: X.LIMIT graph

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10.2.4 *X.TIME* - Limit actuating time

Use this function to specify the opening and closing times for the entire stroke and thereby limit control speeds.

When the *X.TUNE* function is running, the minimum opening and closing time for the entire stroke is automatically entered for Open and Close. Therefore, movement can be at maximum speed.

Factory setting: values determined at the factory by the *X.TUNE* function

If the control speed will be limited, values can be input for Open and Close which are between the minimum values determined by the *X.TUNE* and 60 seconds.

Valve timeopen: Opening time for entire stroke (in seconds)
Adjustment range: 1 – 60 seconds

Valve timeclose: Closing time for entire stroke (in seconds)
Adjustment range: 1 – 60 seconds

Effect of limiting the opening speed when there is a jump in the set-point value

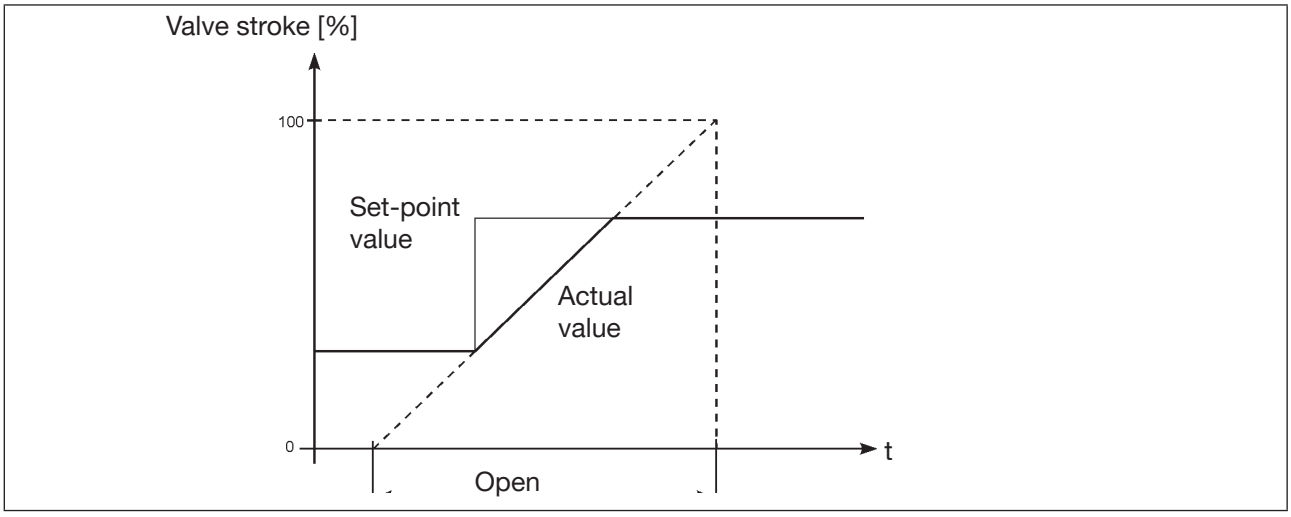

Figure 20: X.TIME graph

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10.2.5 *X.CONTROL* - Parameterization of the positioner

Use this function to set the parameters for the positioner (dead band and amplification factors (kp)).

Deadband: Insensitivity range of the positioner

Entry for the deadband as a % in reference to the scaled stroke range;
i.e. X.LIMIT upper stroke limit - X.LIMIT lower stroke (see auxiliary function *X.LIMIT*).

This function causes the controller to respond only beginning at a specific control difference. This function saves wear on the solenoid valves in the positioner and the pneumatic actuator.

If the auxiliary function control parameters (*X.CONTROL)* is in the main menu while *X.TUNE* (Autotune of the positioner) is running, the deadband is determined automatically depending on the friction behavior of the actuator drive. The value determined in this way is an approximate value. You can re-adjust it manually.

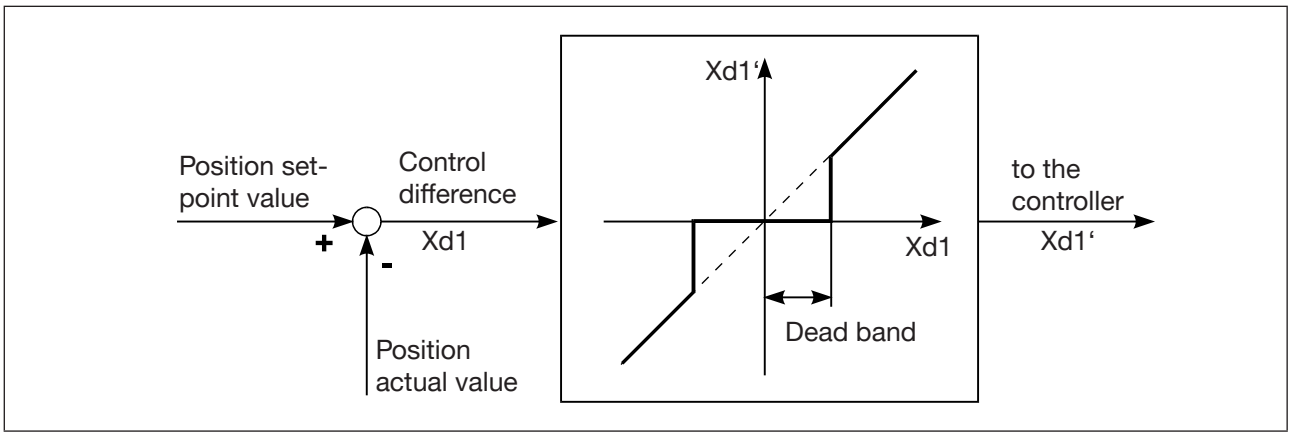

Figure 21: X.CONTROL graph

Open/close amplification factor: Parameters for the positioner

Open amplification factor: Amplification factor of the positioner (for closing the valve)

Close amplification factor: Amplification factor of the positioner (for opening the valve)

10.2.6 *SAFEPOS* - Definition of the safe position

This function specifies the actuator safety position which is approached at defined signals.

**The set safety position is only approached if there is a corresponding signal at the digital input (for configuration see digital input (*BINARY.IN)*) or if a error occurs.
If the mechanical stroke range is limited with the stroke limit function (*X.LIMIT)*, only safety positions within these limits can be approached.
This function is executed in AUTOMATIC mode only.**

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10.2.7 *SIG.ERROR* - Configuration of cable break detection (only for variant without fieldbus communication)

The cable break detection function (*SIG.ERROR)* is used to detect a fault on the input signal.

Cable break detection can be selected for a 4 – 20 mA signal only:
Fault if input signal ≤ 3.5 mA (± 0.5 % of final value, hysteresis 0.5 % of final value)

If 0 – 20 mA is selected, cable break detection cannot be selected.

A signal error is indicated on the device by the LED 1 for activated cable break detection (error or out of spezification).

Safety position for activated cable break detection**:**

Active safe position function (*SAFEPOS)*
If a fault is detected, the actuator moves to the position set under safe position function.

Inactive safe position function (*SAFEPOS)*
If a fault is detected, the actuator moves to the end position which it would assume in the isolated state.

10.2.8 *BINARY.IN* (variant) - Configuration of the digital input (only for variant without fieldbus communication)

The following settings can be implemented:

- Approach the safety position
- Starting the function *X.TUNE*

Safety position

Digital input = 1 → Approach the safety position.

Active safety position function (*SAFEPOS)*
The actuator moves to the position set under safe position function.

Inactive safety position function (*SAFEPOS)*
The actuator moves to the end position which it would assume in the isolated state.

Starting the function *X.TUNE*

Digital input = 1 → Starting *X.TUNE*.

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10.2.9 *OUTPUT* (variant) - Configuration of the analog output (only for variant without fieldbus communication)

The function analog output (OUTPUT) only appears in the selection of functions if the positioner has an analog output (variant) or if no parameters have been read in yet.

The analog output can be used for feedback of the current position or of the set-point value to the control center.

Function	Position (POS) Set-point value (CMD)	Output of the current position Output of the set-point value
Standard signal	4 – 20 mA 0 – 20 mA	Selection of the standard signal

10.2.10 Setting the LED mode, device status

User level: installer

Factory setting: valve mode + warnings

Menu or function	Values or description	
Device		
> General settings		
> Parameter		
> Status LED		
Mode	⦿ NAMUR mode ○ Valve mode ○ Valve mode + Warnings ○ Fixed color ○ LED off	

Setting the LED mode, device status:

→ Status LED

→ Mode

Possible selection:

⦿ NAMUR mode
○ Valve mode
○ Valve mode + Warnings
○ Fixed color
○ LED off

→ Select mode.

✔ The mode is set.

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11 ATTACHMENT AND ASSEMBLY

The dimensions of the positioner and the different device versions can be found on the data sheet.

11.1 Safety instructions

WARNING!

Risk of injury from improper installation.

- Installation may be carried out by authorised technicians only and with the appropriate tools.

Risk of injury from unintentional activation of the system and an uncontrolled restart.

- Secure system from unintentional activation.
- Following assembly, ensure a controlled restart.

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11.2 Attachment to a continuous valve with linear actuators according to NAMUR

The valve position is transferred to the position sensor installed in the positioner via a lever (according to NAMUR).

11.2.1 Attachment kit (IEC 534-6) for linear actuators (order no. 787215)

(Can be purchased as an accessory from Bürkert).

Part no.	Quantity	Name
1	1	NAMUR mounting bracket IEC 534
2	1	Hoop
3	2	Clamping piece
4	1	Driver pin
5	1	Conical roller
6a	1	NAMUR lever for stroke range 3 – 35 mm
6b	1	NAMUR lever for stroke range 35 – 130 mm
7	2	U-bolt
8	4	Hexagon bolt DIN 933 M8 x 20
9	2	Hexagon bolt DIN 933 M8 x 16
10	6	Circlip DIN 127 A8
11	6	Washer DIN 125 B8.4
12	2	Washer DIN 125 B6.4
13	1	Spring VD-115E 0.70 x 11.3 x 32.7 x 3.5
14	1	Spring washer DIN 137 A6
15	1	Locking washer DIN 6799 - 3.2
16	3	Circlip DIN 127 A6
17	3	Hexagon bolt DIN 933 M6 x 25
18	1	Hexagon nut DIN 934 M6
19	1	Square nut DIN 557 M6
21	4	Hexagon nut DIN 934 M8
22	1	Guide washer 6.2 x 9.9 x 15 x 3.5

Table 25: Attachment kit for linear actuators

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11.2.2 Installation

WARNING!

Risk of injury from improper installation.

- Installation may be carried out by authorised technicians only and with the appropriate tools.

Risk of injury from unintentional activation of the system and an uncontrolled restart.

- Secure system from unintentional activation.
- Following assembly, ensure a controlled restart.

Procedure:

→ Using the bracket ② the clamping pieces ③, hexagon bolts ⑰ and circlips ⑯ attach the hoop to the actuator spindle.

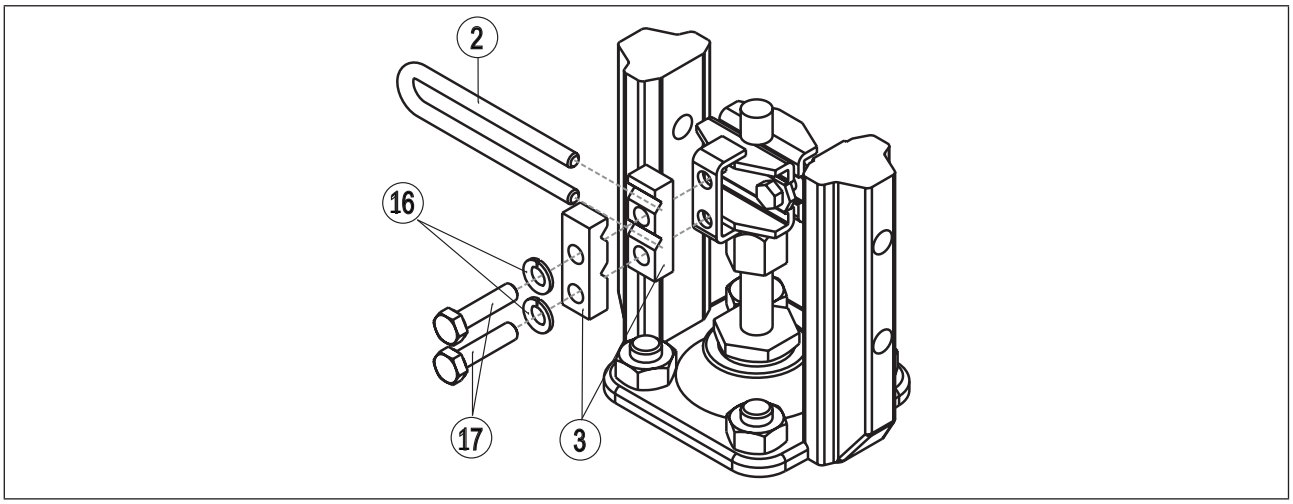

Figure 22: Attaching the hoop

→ Select short or long lever according to the stroke of the actuator (see "Table 25: Attachment kit for linear actuators" part no. 6a/6b).

→ Assemble lever (if not pre-assembled) "Figure 23".

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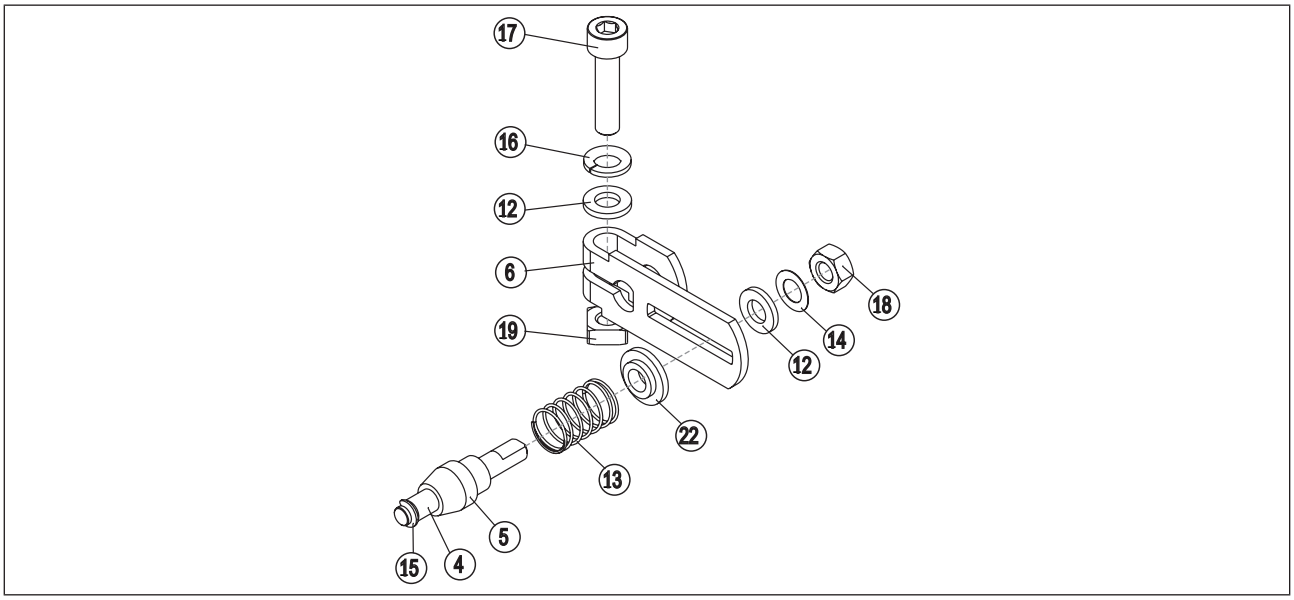

Figure 23: Assembling the lever

The gap between the driver pin and the axle should be the same as the drive stroke. This results in the ideal angular range of the lever of 60° (see "Figure 24").

Angular range of the position sensor:
The maximum angular range of the position sensor is 150°.

Rotational range of the lever:
To ensure that the position sensor operates at a good resolution, the rotational range of the lever must be at least 30°.

The rotational movement of the lever must be within the position sensor angular range of 150°.

The scale printed on the lever is not relevant.

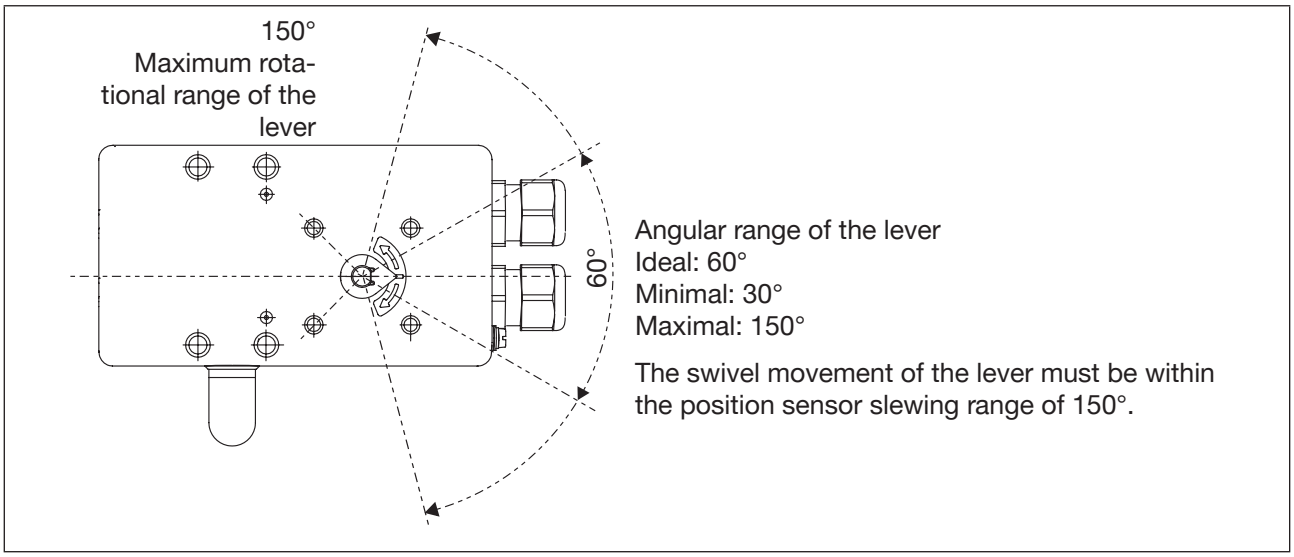

Figure 24: Rotational range of the lever

→ Attach lever to the axle of the positioner and screw tight (⑰ and ⑲).

11.2.3 Attaching mounting bracket

→ Attach mounting bracket ① to the back of the positioner with hexagon bolts ⑨, circlip ⑩ and washers ⑪ (see "Figure 25").

The selection of the M8 thread used on the positioner depends on the size of the actuator.

→ To determine the correct position, hold the positioner with mounting bracket on the actuator.

The conical roller on the lever of the position sensor in the hoop must be able to run freely on the drive over the entire stroke range.
At 50% stroke the lever position should be approximately horizontal (see chapter "11.2.4 Aligning lever mechanism").

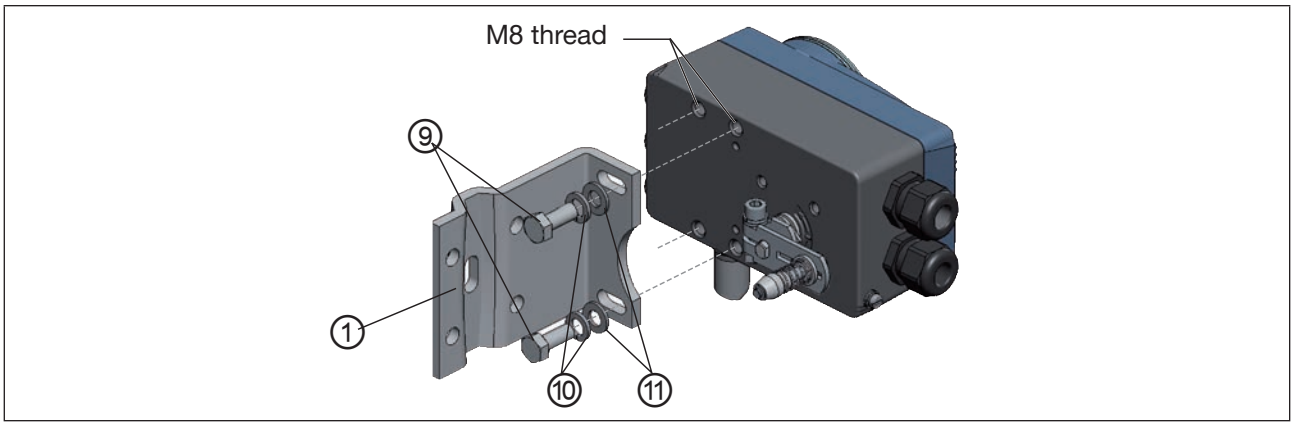

Figure 25: Attaching mounting bracket

Attaching the positioner with mounting bracket for actuators with cast frame:

→ Attach mounting bracket to the cast frame with one or more hexagon bolts ⑧, washers ⑪ and circlips ⑩ (see "Figure 26").

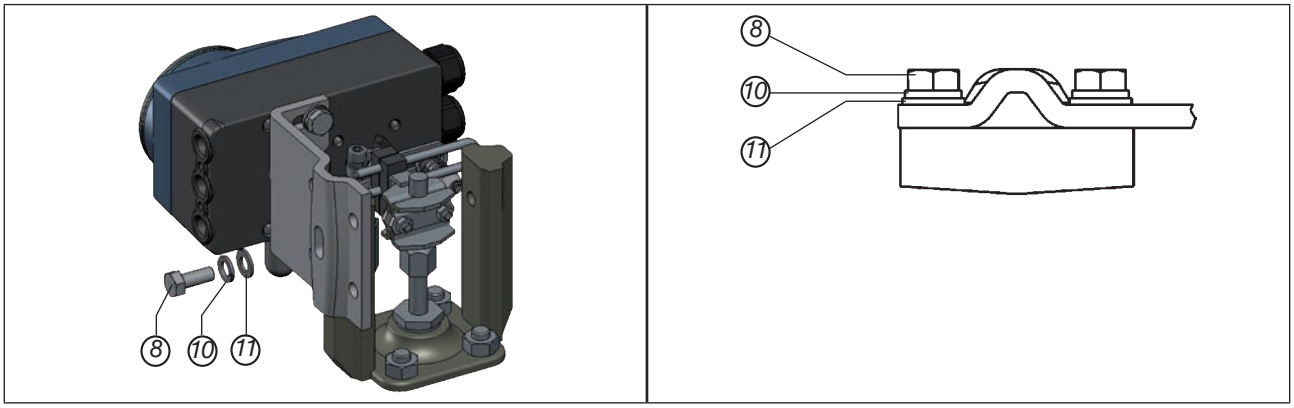

Figure 26: Attach positioner with mounting bracket; for actuators with cast frame

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Attaching the positioner with mounting bracket for actuators with columnar yoke:

→ Attach mounting bracket to the columnar yoke with the U-bolt ⑦, washers ⑪, circlips ⑩ and hexagon nuts ㉑ (see "Figure 27").

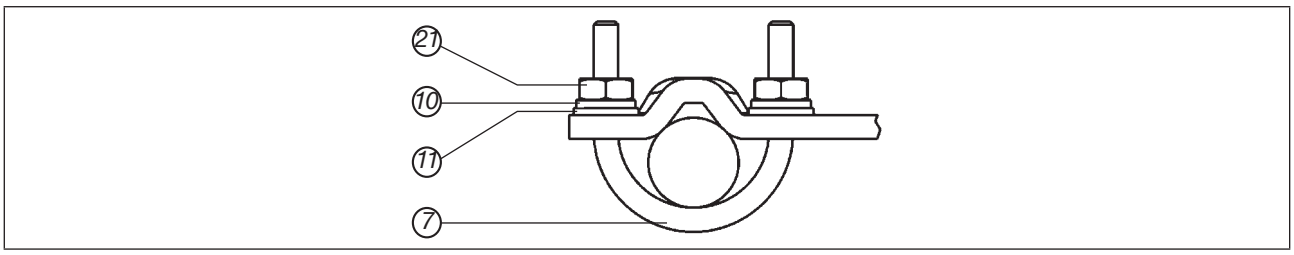

Figure 27: Attach positioner with mounting bracket; for actuators with columnar yoke

11.2.4 Aligning lever mechanism

The lever mechanism cannot be correctly aligned until the device has been connected electrically and pneumatically.

→ Move the actuator in manual mode to half stroke (according to the scale on the actuator).

→ Adjust the height of the positioner until the lever is horizontal.

→ Fix the positioner in this position on the actuator.

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11.3 Attachment to a continuous valve with rotary actuator

The axle of the position sensor integrated in the positioner is connected directly to the axle of the rotary actuator.

11.3.1 Attachment kit (VDI/VDE 3845) on rotary actuator (order no. 787338)

(Can be purchased as an accessory from Bürkert).

Part no.	Quantity	Name
1	1	Adapter
2	2	Setscrew DIN 913 M4 x 10
3	4	Cheese-head screw DIN 933 M6 x 12
4	4	Circlip B6
5	2	Hexagon nut DIN 985, M4

Table 26: Attachment kit on rotary actuator

Other accessories:

The assembly bridge with fastening screws (according to VDI/VDE 3845) can be purchased from Bürkert as an accessory by quoting the identification number 770294.

11.3.2 Installation

WARNING!

Risk of injury from improper installation.

- Installation may be carried out by authorised technicians only and with the appropriate tools.

Risk of injury from unintentional activation of the system and an uncontrolled restart.

- Secure system from unintentional activation.
- Following assembly, ensure a controlled restart.

Procedure:

→ Specify the attachment position of the positioner:
- parallel to the actuator or
- rotated by 90° to the actuator.

→ Determine home position and direction of rotation of the actuator.

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Anti-twist safeguard:

Note the flat side of the axle.
One of the setscrews must be situated on the flat side of the axle as an anti-twist safeguard (see "Figure 28").

Angular range of the position sensor:

The maximum angular range of the position sensor is 150°.
The axle of the positioner may be moved within this range only.

→ Connect adapter ① to the axle of the positioner and secure with 2 setscrews.

→ Secure setscrews with self-locking nuts to prevent them from working loose.

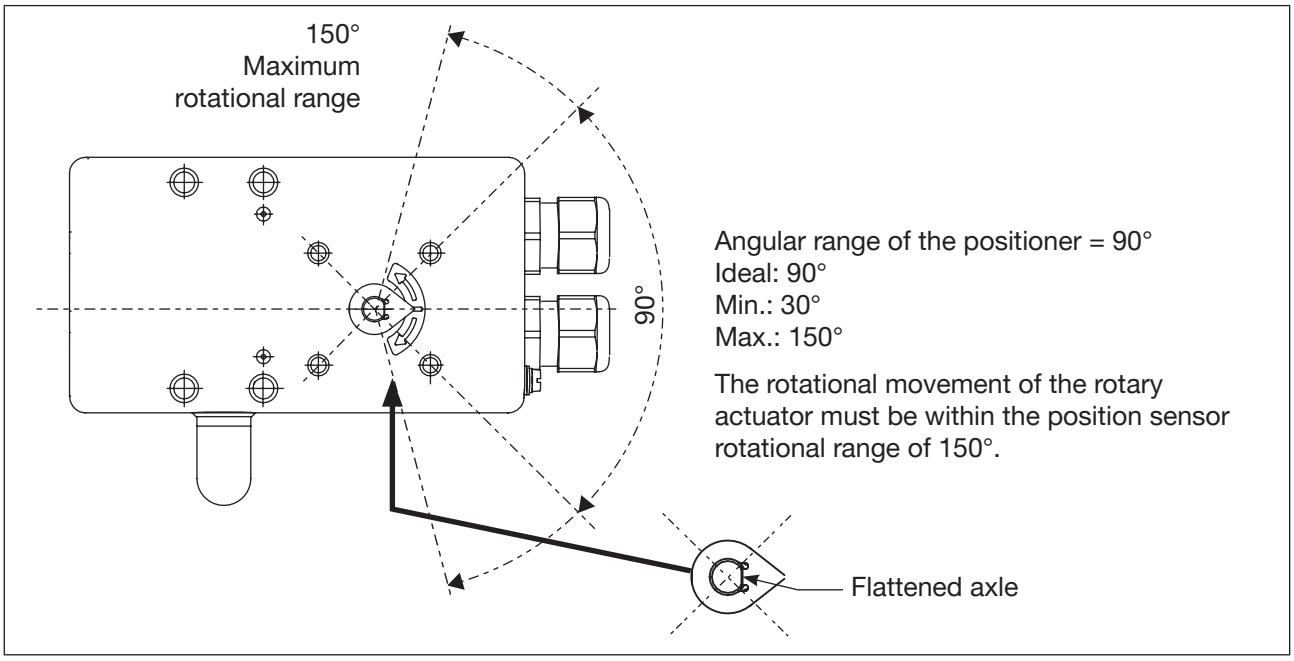

Figure 28: Angular range / anti-twist safeguard

→ Assemble the multi-part assembly bridge[19] suitable for the actuator.

→ Attach the assembly bridge to the positioner using 4 cheese-head screws ③ and circlips ④.
(see "Figure 29").

19) The assembly bridge consists of 4 parts which can be adjusted to the actuator by varying the arrangement.

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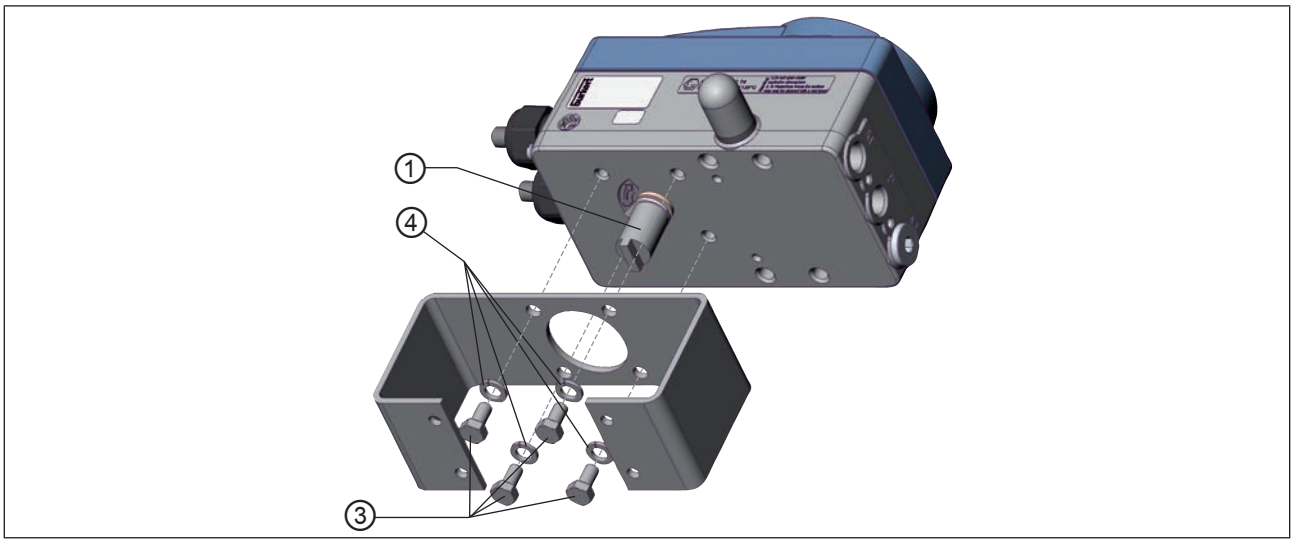

Figure 29: Attach assembly bridge (schematic representation)

→ Place positioner with assembly bridge on the rotary actuator and attach (see “Figure 30”).

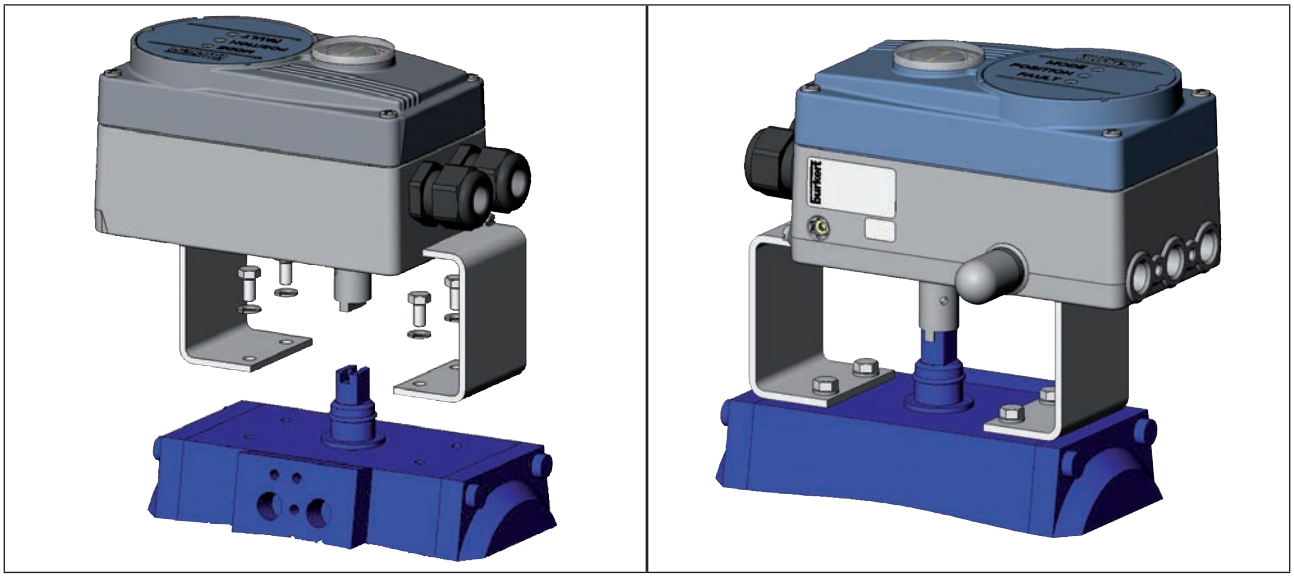

Figure 30: Rotary actuator attachment

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11.4 Remote operation with external position sensor

In the case of this model the positioner has no position sensor in the form of a rotary position sensor, but an external remote sensor.

The Remote-Sensor Type 8798 is connected via a serial, digital interface.

11.4.1 Mounting accessories

There are two options of attaching the positioner in remote operation (see “Figure 31”).

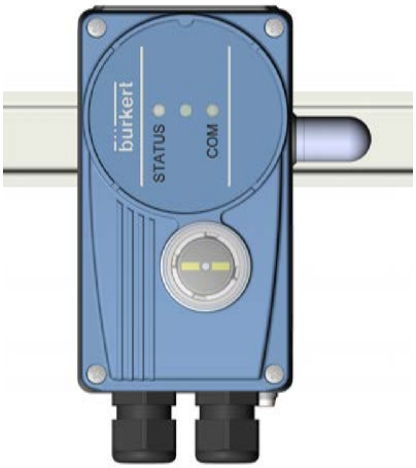
Installation on a standard rail with accessory kit, order no. 675702	Installation on a wall with accessory kit, order no. 675715
	

Figure 31: Attachment types in remote operation

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11.4.2 Connection and start-up of the Remote-Sensor Type 8798

WARNING!

Risk of injury from improper start-up.

- Start-up may be carried out by authorised technicians only and with the appropriate tools.

Risk of injury from unintentional activation of the system and an uncontrolled restart.

- Secure system from unintentional activation.
- Following assembly, ensure a controlled restart.

→ Connect the 4 wires of the sensor cable to the designated screw-type terminals of the positioner (see chapter "13.3.5 Terminal assignment for external position sensor (for remote model only)").

→ Attach Remote Sensor on the actuator.
The correct procedure is described in the brief instructions for the Remote Sensor Type 8798.

→ Connect positioner pneumatically to the actuator.

→ Connect compressed air to positioner.

→ Switch on supply voltage to the positioner.

→ Run the *X.TUNE* function.

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12 FLUID CONNECTION

12.1 Safety instructions

DANGER!

Risk of injury from high pressure in the equipment/device.

▸ Before working on equipment or device, switch off the pressure and deaerate/drain lines.

WARNING!

Risk of injury from improper installation.

▸ Installation may be carried out by authorized technicians only and with the appropriate tools.

Risk of injury from unintentional activation of the system and an uncontrolled restart.

▸ Secure system from unintentional activation.

▸ Following installation, ensure a controlled restart.

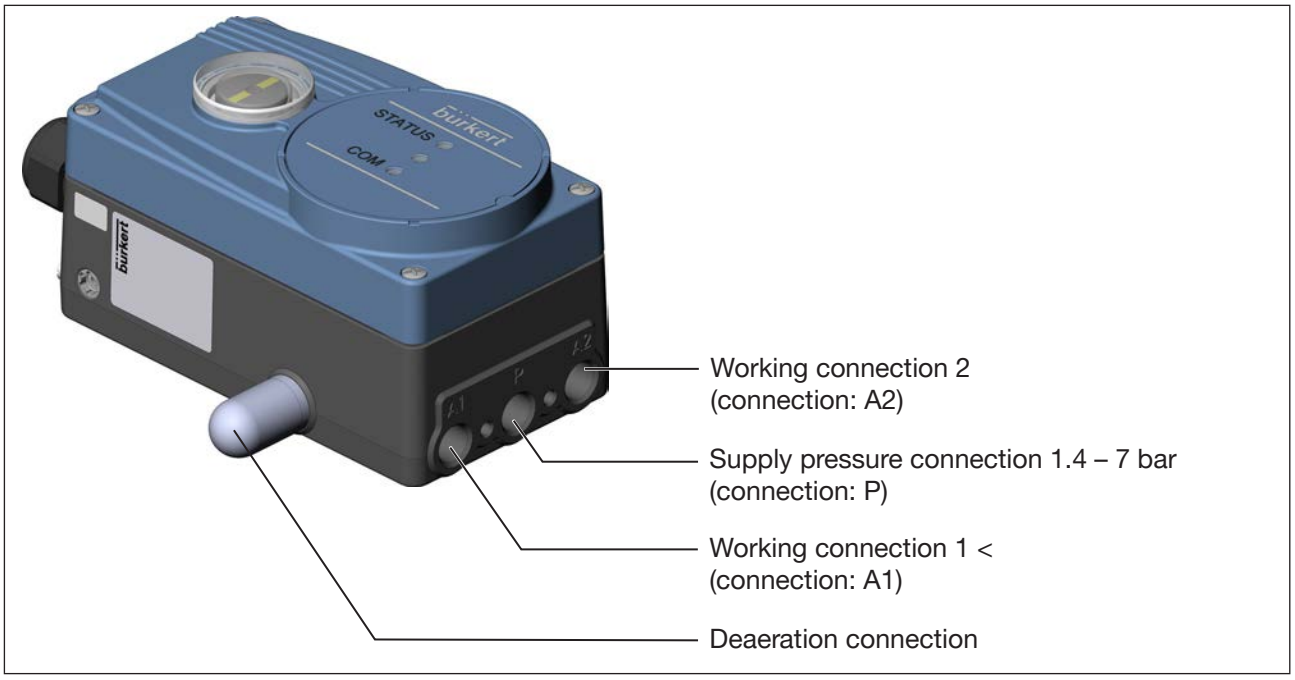

Figure 32: Fluid installation / Location of the connections

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Procedure:

→ Apply supply pressure (1.4 – 7 bar) to the supply pressure connection P.

For single-acting actuators (Control function A and B):

→ Connect one working connection (A1 or A2, depending on required safety end position) to the chamber of the single-acting actuator.
Safety end positions see chapter “8.8 Safety end positions after failure of the electrical or pneumatic auxiliary power”.

→ Seal a working connection which is not required with a plug.

For double-acting actuators (Control function I):

→ Connect working connections A1 and A2 to the respective chambers of the double-acting actuator.
Safety end positions see chapter “8.8 Safety end positions after failure of the electrical or pneumatic auxiliary power”.

Important information for perfect control behavior!

This ensures that the control behavior is not extremely negatively affected in the upper stroke range on account of too little pressure difference.

→ keep the applied supply pressure at least 0.5 – 1 bar above the pressure which is required to move the pneumatic actuator to its end position.

If fluctuations are greater, the control parameters measured with the *X.TUNE* function are not optimum.

→ during operation keep the fluctuations of the supply pressure as low as possible (max. ±10%).

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13 ELECTRICAL INSTALLATION, WITHOUT FIELDBUS COMMUNICATION

All electrical inputs and outputs of the device are not galvanically isolated from the supply voltage.

13.1 Safety instructions

DANGER!

Risk of electric shock.

- Before working on equipment or device, switch off the power supply and secure to prevent reactivation.
- Observe applicable accident prevention and safety regulations for electrical equipment.

WARNING!

Risk of injury from improper installation.

- Installation may be carried out by authorized technicians only and with the appropriate tools.

Risk of injury from unintentional activation of the system and an uncontrolled restart.

- Secure system from unintentional activation.
- Following installation, ensure a controlled restart.

13.2 Electrical installation with circular plug-in connector

13.2.1 Designation of the circular plug-in connector

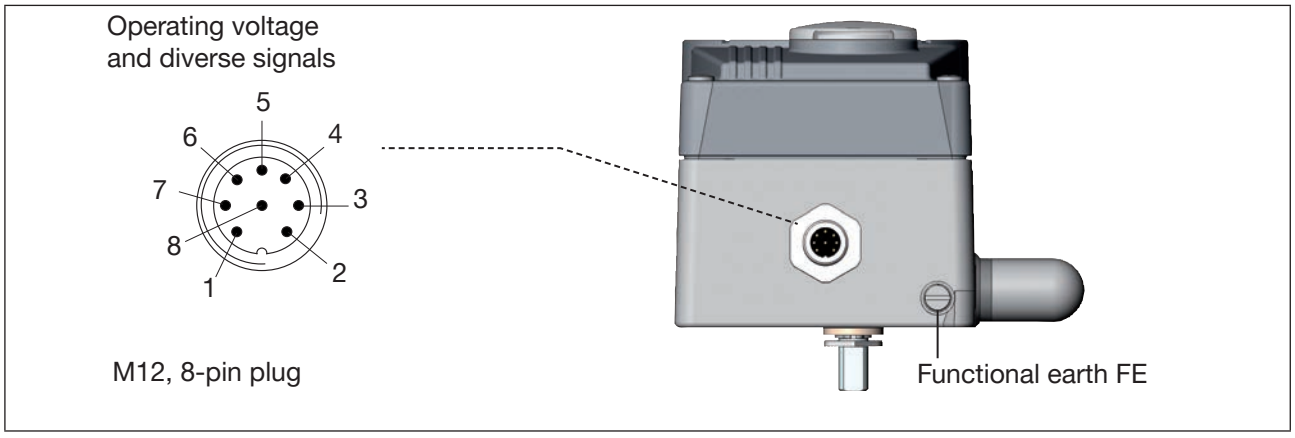

Figure 33: Designation of the circular plug-in connector and contacts

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13.2.2 Pin assignment for input signals from the control centre (e.g. PLC)

Pin	Wire color*	Configuration	On the device side	External circuit / Signal level
1	white	Set-point value + (0/4 – 20 mA)	1	+ (0/4 – 20 mA)
2	brown	Set-point value GND	2	GND see table connection type 3-wire or 4-wire
5	grey	Digital input	5	+ 0 – 5 V (log. 0) 10 – 30 V (log. 1) with reference to Pin 3 (GND)
* The indicated wire colors refer to the connection cable, part no. 919061, available as an accessory.				

Table 27: Pin assignment, input signals of the control centre, M12, 8-pole plug

Connection type 3-wire or 4-wire (setting via communication software):

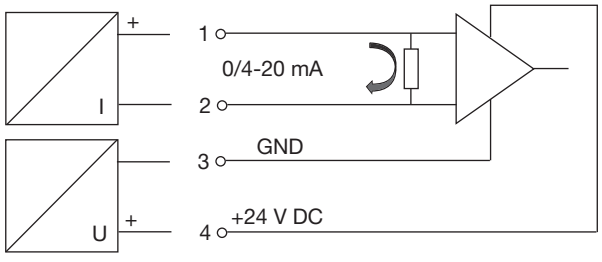
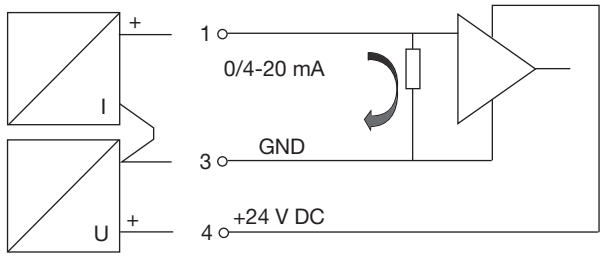
Connection type 4-wire (factory setting)	Connection type 3-wire
The set-point value input is designed as a differential input, i.e. the GND lines of the set-point value input and the supply voltage are not identical. Note: If the GND signals of the set-point value input and the supply voltage are connected, the 3-wire connection type must be set in the software.	The set-point value input is related to the GND line of the supply voltage, i.e. setpoint input and supply voltage have a common GND line.
	

Table 28: Connection type

13.2.3 Pin assignment for output signals to the control centre (e.g. PLC), required for analogue output variant only

Pin	Wire color*	Configuration	On the device side	External circuit / Signal level
8	red	Analogue feedback +	8	+ (0/4 – 20 mA)
7	blue	Analogue feedback GND	7	GND (identical with the GND operating voltage)
* The indicated wire colors refer to the connection cable, part no. 919061, available as an accessory.				

Table 29: Pin assignment, output signals to the control centre, M12, 8-pole plug

13.2.4 Pin assignment for operating voltage

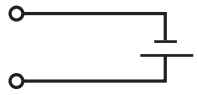
Pin	Wire color*	Configuration	External circuit / Signal level
3	green	GND	3  24 V DC ± 25% max. residual ripple 10%
4	yellow	+24 V	4
* The indicated wire colors refer to the connection cable, part no. 919061, available as an accessory.			

Table 30: Pin assignment, operating voltage, M12, 8-pole circular plug-in connector

13.3 Electrical connection with cable gland

13.3.1 Designation of the screw-type terminals

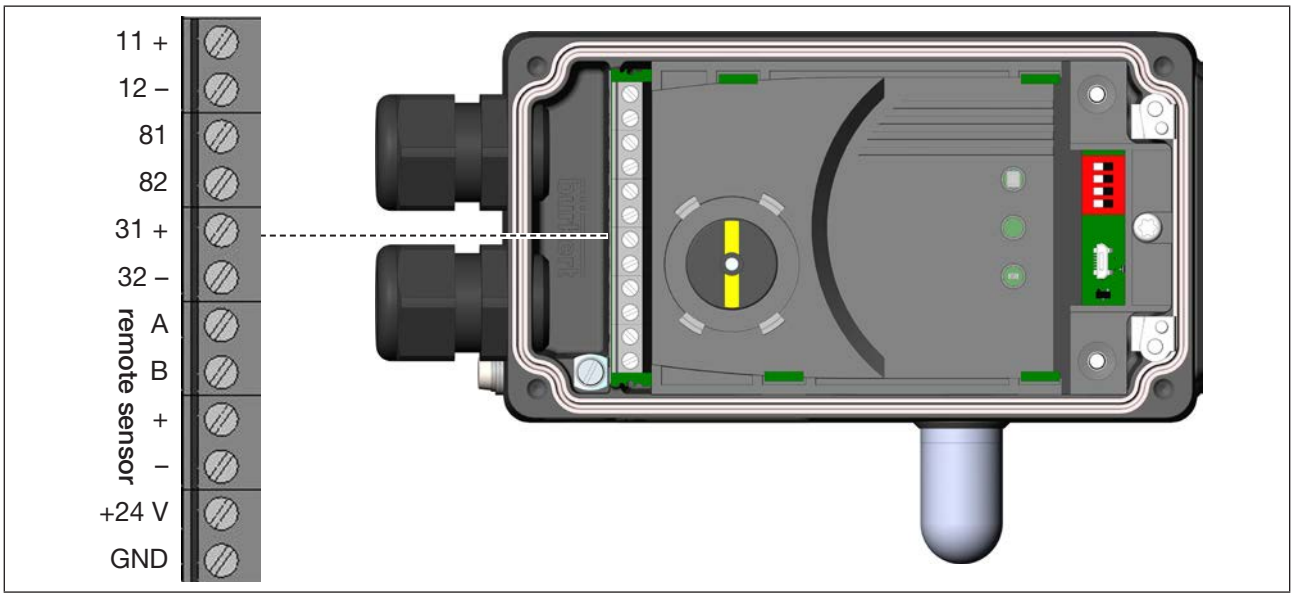


Figure 34: Designation of the screw-type terminals

13.3.2 Connection of the screw-type terminals

→ Unscrew the 4 screws on the housing cover and remove the cover.
The screw-type terminals are now accessible.

→ Connect terminals according to the configuration.

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13.3.3 Terminal assignment for input signals from the control centre (e.g. PLC)

Terminal	Configuration	On the device side	External circuit / Signal level
11 +	Set-point value +	11 +	+ (0/4 – 20 mA)
12 –	Set-point value GND	12 –	GND see table connection type 3-wire or 4-wire
81 +	Digital input +	81 +	+ 0 – 5 V (log. 0) 10 – 30 V (log. 1)
82 –	Digital input –	82 –	GND (identical with the GND operating voltage)

Table 31: Terminal assignment, input signals of the control centre

Connection type 3-wire or 4-wire (setting via communication software):

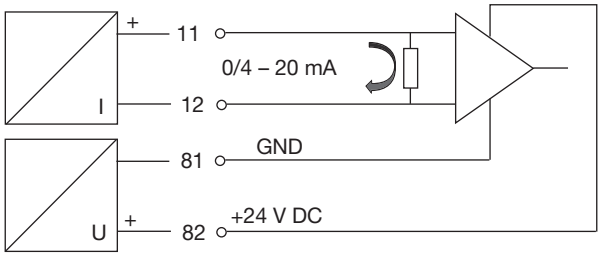
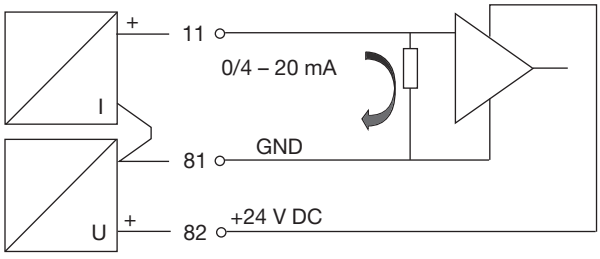
Connection type 4-wire (factory setting)	Connection type 3-wire
The set-point value input is designed as a differential input, i.e. the GND lines of the set-point value input and the supply voltage are not identical. Note: If the GND signals of the set-point value input and the supply voltage are connected, the 3-wire connection type must be set in the software.	The set-point value input is related to the GND line of the supply voltage, i.e. setpoint input and supply voltage have a common GND line.
	

Table 32: Connection type

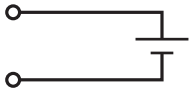
13.3.4 Terminal assignment for output signals to the control centre (e.g. PLC), for analogue output variant only

Terminal	Configuration	On the device side	External circuit / Signal level
31 +	Analogue feedback +	31 +	+ (0/4 – 20 mA)
32 –	Analogue feedback GND	32 –	GND (identical with the GND operating voltage)

Table 33: Terminal assignment, output signals to the control centre

Terminal assignment for operating voltage

Terminal	Configuration	External circuit / Signal level
+24 V	Operating voltage +	+24 V
GND	Operating voltage GND	GND



24 V DC ± 25%
max. residual ripple 10%

Table 34: Terminal assignment, operating voltage

13.3.5 Terminal assignment for external position sensor (for remote model only)

Terminal	Configuration	On the device side	External circuit / Signal level
S +	Supply sensor +	S +	+
S -	Supply sensor –	S –	–
A	Serial interface, A cable	A	A line
B	Serial interface, B-cable	B	B line

Remote-Sensor Type 8798[20)]

20) *Assignment of the wire color see "Table 36"*

Table 35: Terminal assignment, external position sensor

Positioner Terminal	Wire color Remote-Sensor with cable type 1	Wire color Remote-Sensor with cable type 2
S +	brown	brown
S –	white	black
A	green	red
B	yellow	orange

Table 36: Assignment of the wire color (Remote-Sensor)

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14 ELECTRICAL INSTALLATION, IO-LINK

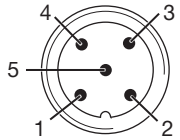
	Pin	Designation	Configuration	
	1	L +	24 V DC	System supply
	2	P24	24 V DC	Actuator supply
	3	L –	0 V (GND)	System supply
	4	C/Q	IO-Link	
	5	M24	0 V (GND)	Actuator supply

Table 37: Pin assignment

14.1 Pin assignment for external position sensor (for remote model only)

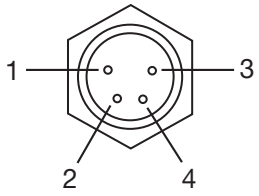


Figure 35: Pin assignment

Pin	Configuration	On the device side	External circuit / Signal level
1	Supply sensor +	S +	+
2	Supply sensor –	S –	–
3	Serial interface, A cable	A	A line
4	Serial interface, B-cable	B	B line
			Remote-Sensor Type 8798[21)]

21) Assignment of the wire color see "Table 39"

Table 38: Pin assignment; external position sensor

Positioner Pin	Wire color Remote-Sensor with cable type 1	Wire color Remote-Sensor with cable type 2
1	brown	brown
2	white	black
3	green	red
4	yellow	orange

Table 39: Assignment of the wire color (Remote-Sensor)

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15 ELECTRICAL INSTALLATION, BÜS

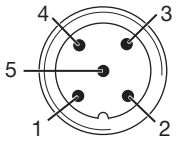
	Pin	Wire color	Configuration
	1	CAN plate/shielding	CAN plate/shielding
	2	red	+24 V DC ±25%, max. residual ripple 10%
	3	black	GND / CAN_GND
	4	white	CAN_H
	5	blue	CAN_L

Table 40: Pin assignment

For electrical installation with büS network, note:

Use a 5-pin round plug and shielded 5-core cable.

The shielding is capacitively connected to the functional earth via the device.

15.1 Pin assignment for external position sensor (for remote model only)

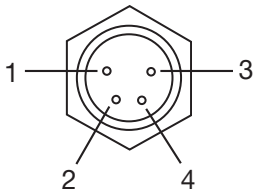


Figure 36: Pin assignment

Pin	Configuration	On the device side	External circuit / Signal level
1	Supply sensor +	S +	+
2	Supply sensor –	S –	–
3	Serial interface, A cable	A	A line
4	Serial interface, B-cable	B	B line

Remote-Sensor Type 8798[22)]

22) *Assignment of the wire color see "Table 42"*

Table 41: Pin assignment; external position sensor

Positioner Pin	Wire color Remote-Sensor with cable type 1	Wire color Remote-Sensor with cable type 2
1	brown	brown
2	white	black
3	green	red
4	yellow	orange

Table 42: Assignment of the wire color (Remote-Sensor)

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16 START-UP

16.1 Safety instructions

WARNING!

Risk of injury from improper operation.

Improper operation may result in injuries as well as damage to the device and the area around it.

- Before start-up, ensure that the operating personnel are familiar with and completely understand the contents of the operating instructions.
- Observe the safety instructions and intended use.
- Only adequately trained personnel may operate the equipment/the device.

16.2 Specifying the standard settings

The basic settings of the positioner are implemented at the factory.

To adjust the positioner to local conditions, the *X.TUNE* function must be run following installation.

16.2.1 Running the automatic adjustment *X.TUNE*

WARNING!

Danger due to the valve position changing when the *X.TUNE* function is running.

When the *X.TUNE* is running under operating pressure, there is an acute risk of injury.

- Never run *X.TUNE* while a process is running.
- Take appropriate measures to prevent the equipment from being accidentally actuated.

NOTE!

Avoid maladjustment of the controller due to an incorrect supply pressure or applied operating medium pressure.

- Run *X.TUNE* **whenever** the supply pressure (= pneumatic auxiliary energy) is available during subsequent operation.
- Run the *X.TUNE* function preferably **without** operating medium pressure to exclude interference caused by flow forces.

→ Unscrew the 4 screws on the housing cover and remove the housing cover.

To run *X.TUNE*, the positioner must be in the AUTOMATIC operating state (DIP switch 4 = OFF).

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→ Start *X.TUNE* by pressing button 1 for 5 sec [23].

LED 2 flashes at 5 Hz. The device is in the NAMUR state function check, LED 1 lights orange.

If the X.TUNE is successfully completed, the NAMUR state is reset again. The changes are automatically transferred to the memory (EEPROM) provided the *X.TUNE* function is successful.

When LED 1 lights red after X.TUNE:

→ Execute X.TUNE again.

→ Perform a device restart if necessary.

16.3 Setting with Bürkert Communicator

The Bürkert Communicator can be used to make all settings on the device.

The settings in the Bürkert Communicator can be found in the operating manual.

16.3.1 Connecting IO-Link device with Bürkert Communicator

Required components:

- Communications software: Bürkert Communicator for PC
- USB-büS interface set (see accessories)
- büS adapter for communications interface (see accessories)
- If necessary, a büS cable extension (see accessories)

→ To connect the IO-Link device to the Bürkert Communicator, unscrew the housing cover.

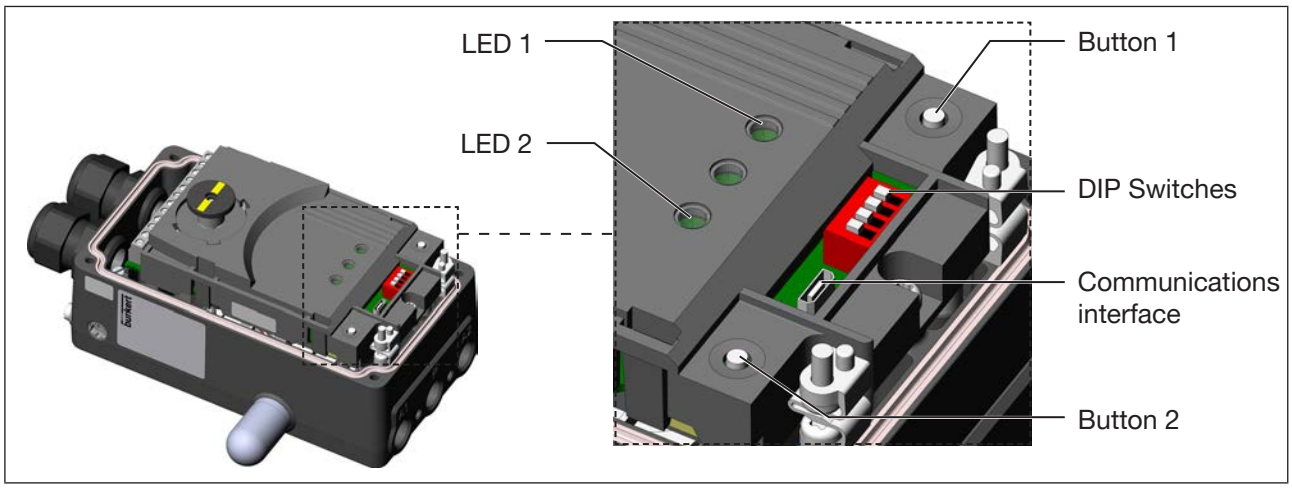

Figure 37: Description of control elements

23) *The X.TUNE can also be started via communications software.*

→ Insert micro USB plug in communications interface.

→ Establish connection to PC with USB-büS interface set.

→ Starting Bürkert Communicator.

→ Implementing settings.

16.3.2 Connecting büS device with Bürkert Communicator

Required components:

- Communications software: Bürkert Communicator for PC
- USB-büS interface set (see accessories)

→ Establish connection to PC with USB-büS interface set.

→ Starting Bürkert Communicator.

→ Implementing settings.

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17 IO-LINK

17.1 Information, IO-Link

IO-Link is an internationally standardized IO technology (IEC 61131-9) to enable sensors and actuators to communicate.

IO-Link is a point-to-point communication with 3-wire connection technology for sensors and actuators and unshielded standard sensor cables.

To ensure clear communication, the IO-Link devices should not be parameterised simultaneously by the higher-level controller (PLC) via the IO-Link master and with the Bürkert Communicator (via the service interface).

17.2 Technical specifications, IO-Link

IO-Link specifications	V1.1.2
Supply	via IO-Link (M12 x 1, 5-pin, A-coded)
Port Class	B
SIO mode	no
IODD file	see Internet
VendorID	0x0078, 120
DeviceID	see IODD file
ProductID	8791
Transmission speed	COM3 (230.4 kbit/s)
PD Input Bits	80
PD Output Bits	40
M-sequence Cap.	0x0D
Min. cycle time	5 ms
Data storage	Yes
Max. cable length	20 m

17.2.1 Configuration of the fieldbus

The required start-up files and the description of the process data and acyclic parameters are available on the Internet.

Download from:
www.burkert.com **/ Type 8694 / Software**

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18 BÜS

18.1 Information, büS

büS is a system bus developed by Bürkert with a communication protocol based on CANopen.

18.2 Configuration of the fieldbus

The required start-up files and the description of objects are available on the Internet.

Download from:
www.burkert.com / Type 8791 / Software

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19 SERVICE

If the positioner type 8791 is operated according to the instructions in this manual, it is maintenance-free.

20 ACCESSORIES

CAUTION!

Risk of injury and/or damage by the use of incorrect parts.

Incorrect accessories and unsuitable replacement parts may cause injuries and damage the device and the surrounding area.

▸ Use only original accessories and original replacement parts from Bürkert.

The order numbers of the attachment kits for linear or rotary actuators as well as for the matching cable plugs of the multi-pole version of the positioner can be found in the data sheet for type 8791.

Designation	Order no.
M12 connection cable, 8-pole	919061
Communication software Bürkert Communicator	Information at www.burkert.com

USB-büS interface set:	
USB-büS interface set 2 (büS stick + 0.7 m cable with M12 plug)	772551
büS adapter for büS service interface (M12 on büS service interface Micro-USB)	773254
büS cable extension (M12 pin to M12 socket), length 1 m	772404
büS cable extension (M12 pin to M12 socket), length 3 m	772405
büS cable extension (M12 pin to M12 socket), length 5 m	772406
büS cable extension (M12 pin to M12 socket), length 10 m	772407

Table 43: Accessories

20.1 Communications software

The PC operating program “Communicator” is designed for communication with the devices from the Bürkert positioner family. If you have any questions regarding compatibility, please contact the Bürkert Sales Center.

A detailed description and precise schedule of the procedure for the installation and operation of the software can be found in the associated documentation.

Download the software: www.burkert.com

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21 TRANSPORTATION, STORAGE, DISPOSAL

NOTE

Damage in transit due to inadequately protected devices.

- ▸ Protect the device against moisture and dirt in shock-resistant packaging during transportation.
- ▸ Observe permitted storage temperature.

NOTE

Incorrect storage may damage the device.

- ▸ Store the device in a dry and dust-free location.
- ▸ Storage temperature: -20 to +65 °C

NOTE

Damage to the environment caused by device components contaminated with media.

- ▸ Dispose of the device and packaging in an environmentally friendly manner.
- ▸ Observe applicable disposal and environmental regulations.

Observe national regulations on the disposal of waste.

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