Motorized Rotary Actuator baelz 375-E42

BA_375-E42_02_DEF_MJ_3721

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1. SAFETY

Read these operating instructions, in particular the following safety instructions, carefully before installation and operation.

Beware
Potentially hazardous situation that could result in minor injury.
Also indicates a hazard that may result in property damage.

Caution
Potentially harmful situation in which the product or an object in its vicinity may be damaged.

Danger
Imminent danger of death or serious injury.

Warning
Potentially hazardous situation that may result in death or serious injury.

Tip: Application instructions and other useful information.

1.1 Intended use

Baelz 375-E42 motorized rotary actuators are controlled by three-point control or constant control in combination the digital positioner baelz 7020A. The rotary actuators of the series described in this document are intended for the rotary adjustment of valves.
To ensure their intended use, make sure that the above type identification complies with the identification label of the rotary actuators before starting any activities. The actual technical data of the rotary actuators and the power supply requirements are the specifications indicated on the identification label.
Any use other than the intended use mentioned above, different tasks, and operation with other power sources than those permitted, is considered to be improper use. In case of improper use, the operator shall be solely liable for the risk presented to persons and the device as well as other property!
Intended use also includes compliance with accident prevention and DIN VDE regulations as well as safe working practices for all measures described in these operating instructions, taking into account the usual technical regulations.

1.2 Instructions for the operator

Always keep the operating instructions available at the place where the actuator is used!
During installation, operation and maintenance, observe the applicable occupational safety, accident prevention and DIN VDE regulations. If necessary, observe additional regional, local or internal safety regulations.
Make sure that every person entrusted with one of the measures described in these operating instructions has read and understood these instructions.

1.3 Personnel

Only qualified personnel may work on this rotary actuator or in its vicinity. Qualified persons are deemed to be persons who are familiar with the installation, assembly, commissioning and operation or maintenance of the actuators and have the appropriate qualifications for their job. Necessary or prescribed qualifications include, but are not limited to:

- Training / instruction and the authorization to switch electric circuits and devices / systems on and off in accordance with EN 60204 (DIN VDE 0100 / 0113) and the technical safety standards
- Training or instruction in the care and use of appropriate safety and work protection equipment in accordance with safety technology standards.
- First aid training.

Work in a safe manner and avoid any operation that would endanger the safety of persons or damage the rotary actuator or other property in any way.

1.4 Before starting work

Before carrying out any work, check whether the types specified here correspond to the information on the name plate of the actuator:

baelz 375-E42

1.5 During operation

Safe operation is only possible if transport, storage, assembly, operation and maintenance is carried out in a safe, proper and professional manner.

1.5.1 Transport, installation and assembly

Observe the general installation and safety regulations for heating, ventilation, air conditioning and piping systems. Use tools only for their intended purpose. Wear the required personal and other protective equipment.

1.5.2 Maintenance and repair

Prior to maintenance or repair, make sure that the rotary actuator is disconnected from power by qualified personnel in accordance with DIN VDE standards. The rotary actuator requires little or no maintenance.

1.6 Working environment

Note the information on working environment in the technical specifications.

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2. PRODUCT DESCRIPTION

2.1 Identification

Each actuator has a nameplate showing specifications regarding the maximum operating conditions of the device and a unique, order-related serial number (F no.).

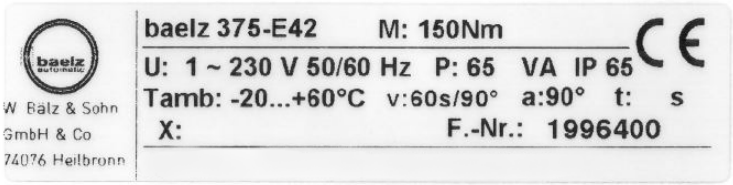

Fig. 1: Baelz nameplate for motorized actuators

2.2 Motorized rotary actuator

The baelz 373-E42 is a motorized rotary actuator for flow control applications requiring a 90° rotation, such as those using drive butterfly valves or ball valves. The actuators are designed for highly accurate positioning in an industrial environment. Manual adjustment can be carried one-handed and without use of a clutch. The travel-dependent and/or torque-dependent limit switches can be individually configured.

2.3 Technical Specifications

Table 1. Technical Specifications, baelz 375-E42		
Torque	**Nm**	150
Postioning time for 90°	**s**	60 (at 60 Hz the positioning speed and power consumption both increase by 20 %)
Power consumption (230 V)	**VA**	65
Nominal current (230 V)	**A**	0.28
Type of motor		synchronous motor (syn)
Motor protection		thermoswitch
Max. angle of rotation	**°**	90
Supply voltage		230 V 50/60 Hz ± 10 % (other supply voltages available upon request)
Operating mode acc. to IEC 34-1		S3 - 50 % duty cycle 1200 c/h
Cable glands		1 x M20 x 1.5; 2 x blind plug M20 x 1.5
Electrical connection		internal terminal block, see wiring diagram for terminal allocation
Limit switches		2 torque dependent and 2 travel dependent switches, max. 250 V AC, ohmic load: max. 10 A, inductive load: max. 5 A
End positions		Mechanical stops, adjustable from the outside
Fitting position		as required, but not "head down" with the actuator below the valve
Ambient temperature	**°C**	0 to +50
Position indicator		Position indicator in the actuator cover
Manual adjustment		crank wheel
IP-rating according to EN 60529		IP 65
Connection type		DIN 5211, (F04), F05, F07, F10
Weight, approx.	**kg**	7.5

2.4 Accessories and options

Table 2. Options for Actuators	
2EZ	Two additional limit switches for signalling end positions or intermediate positions, freely adjustable, max. 250 V AC, rating for resistive load max. 10 A, for inductive load max. 5 A
Fg5k	5 kΩ potentiometer, linearity error ≤ 0.5%, max. 1.5 W, contact current 30 mA
7020A	Digital positioner for actuator control, self adapting 1 input signal: 0(2)…10 V, 0(4)…20 mA or (3-point) 2 output signals: 0(2)…10 V and 0(4)…20 mA 1 digital input, 2 relays for feedback on end or intermediate positions, Interface RS485 Modbus RTU, incl. 5 kΩ potentiometer
Hzg	Heating resistor with thermoswitch against moisture with automatic temperature regulation, max. 15 Watts

2.5 Type name

baelz 375	**-**	**E42**	**-**	**150Nm**	**-**	**60s**	**-**	**230V**
motorized rotary actuator		actuator type		torque		positioning time for 90°		supply

2.6 Operating conditions

In case of extreme variations in ambient temperature and high humidity levels, installation of a heating resistor is recommended to minimise condensation in the actuator.
Actuator covers with suppression of thermal bridges (dual covers) are recommended.

- Connect the heater (HZG) as shown in the wiring diagram.
- Put the device into service as soon as it is installed.

The actuators are suitable for installation in industrial plants and in waterworks and power plants with a low pollutant concentration.
For use outdoors or in an environment with a high pollutant concentration, such as heavy traffic areas, industrial areas (chemical plants, sewage plants, etc.), coastal areas and the open sea, the actuators must have external parts made of non-corrosive material and must be provided with a special coating.
When used outdoors, the actuator must be protected with an additional cover against

- rain
- direct sunlight
- strong draughts
- dust

3. TRANSPORT AND STORAGE

Caution

Risk of injury caused by failure to observe safety regulations!

- Wear the required personal and other protective equipment.
- Protect the rotary actuator from impact, shock, vibration and similar influences.
- Store the rotary actuator (or the complete actuator/valve assembly) in a dry place.
- Observe the transport and storage temperature limits of -20 to +60°C.

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4. ASSEMBLY

Attention **Make sure that the specifications on the nameplate correspond to those in the order documents!**

4.1 Fitting position

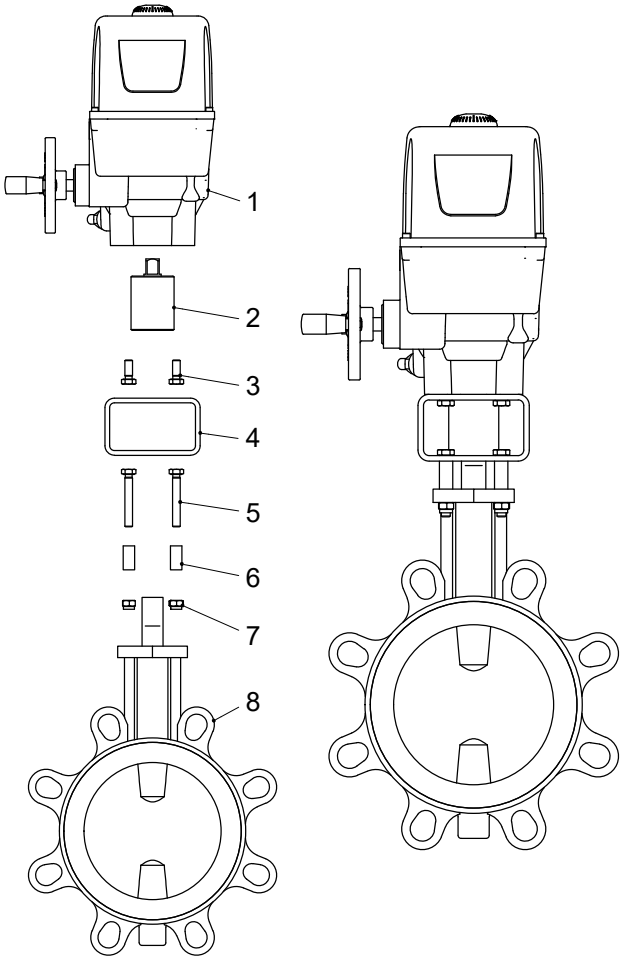
Do not mount rotary actuators "head down" below the valve. Allow for about 200 mm space above the cover at the site of installation.

4.2 Assembly with the valve

Before assembly, check the rotary actuator for damage. Damaged parts should be replaced with original spare parts. After assembly, check the rotary actuator for damage to the paint. Touch up the paint if necessary in order to prevent corrosion.

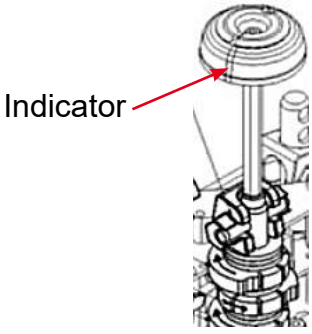
For gate valves the recommended assembly position is the SHUT end position. For this, turn the crank wheel on the rotary actuator clockwise until the mechanical stop of the SHUT position is reached before assembling.

For ball valves the recommended assembly position is the OPEN end position. For this, turn the crank wheel on the rotary actuator anticlockwise until the mechanical stop of the OPEN position is reached before assembling.



Caution Important note: If the actuator needs to be rotated on site to change the position of the handwheel, first loosen the screws (3) and remove the actuator from the yoke.

If the actuator is rotated by 90°, the indicator under the cover, which shows the position of the valve, must also be rotated by 90°.



Thorougly degrease the contact surfaces of the connecting flanges of the rotary actuator and the valve. Lightly grease the valve shaft. Fit the coupling to the valve shaft and secure it, keeping to the dimensions X and Y (see Fig. 2 and Table 3, below).

Lubricate gear teeth on the coupling thoroughly with acid-free grease. Fit the actuator so that the connection holes in the actuator and the valve flange are aligned, possibly turning the actuator on the coupling by one tooth. If necessary, turn the crank wheel slightly towards OPEN or SHUT until the holes are aligned. Ensure correct alignment (if applicable) and complete contact of the mounting faces. Fix actuator with screws (at least quality 8.8) and spring washers; Tighten screws alternately and gradually up to the torque given in Table 3, below.

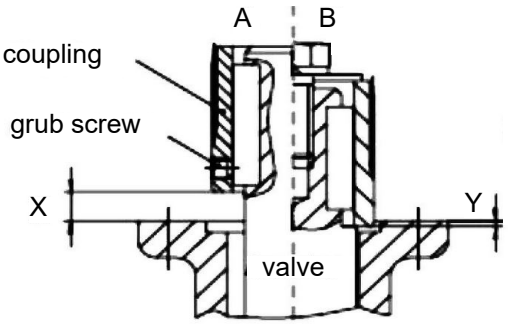


Table 3. Dimensions for coupling and tightening torques for screws

Connection	X max. (mm)	Y max. (mm)	size	T_A (Nm)
F05	0,5	3	4 x M6	10
F07	0,5	3	4 x M8	25
F10	0,5	3	4 x M10	50

Fig. 2: Coupling / Assembly of actuator and valve

4.3 Principle of operation

4.3.1 Manual adjustment

By turning the crank wheel the position of the actuator can be adjusted. This also turns the motor.
Only carry out manual adjustment when the motor is not in motion. If a positioner is used, the actuator will automatically move back to the original position. Therefore only carry out manual adjustment when the actuator is disconnected from the power supply.
It is not necessary to use an extension for a greater mechanical advantage during manual operation. Use of excessive force can damage the equipment.

4.3.2 Removing the cover

Disconnect the device from the power supply before starting any maintenance or adjustment work.

- Loosen the four socket-head screws at the corners of the cover
- Grip the cover and lift to remove

4.4 Electrical connection

Risk of electric shock!

Danger

Use an appropriate power supply to ensure that no hazardous voltage can enter the device during normal operation or in the event of a system failure or defective system components.
Failure to heed this warning may result in death, serious injury or substantial material damage.
For short-circuit protection and disconnection of the actuator from the power supply, fuses and switch disconnectors must be provided on site. The current values for the rating depend on the operating current of the motor (refer to the nameplate).
The electrical connection should only be carried out by trained, qualified personnel.

- Prior to connection, observe the instructions in this chapter.
- After connection, but before applying voltage, observe the instructions in the chapter "Commissioning" (page 11).
- When making the electrical connection, be sure that the power supply is turned OFF! Ensure protection against unintentional reconnection to the power supply!
- For wiring and connection, observe the regulations for the construction of electric power installations and the regulations of the local energy supplier!
- Check compliance of the supply voltage and frequency with the specifications on the nameplate of the actuator and on the nameplate of the actuator motor.
- Always select the cable cross section so as to match the actuator's power consumption and the required cable length. Minimum cross section of the cable for this rotary actuator: 1-2.5 mm²

In case of malfunction:
Dangerous voltage if protective earth conductor is NOT connected! Risk of electric shock!
→ Do not operate the device if the protective earth conductor is not connected!
Trapped wires can lead to short circuiting! Risk of electric shock and malfunction.

4.5 Carrying out the electrical connection

Risk of electric shock!

Danger

→ Disconnect the device from the power supply before removing cover.
Always use the wiring diagram on the inside of the cover or supplied with the actuator.
Replace the dummy plugs with cable glands.

1. Strip the cable as necessary.
2. Strip the ends of the individual wires.
3. For flexible wires: Use wire end ferrules as specified in DIN 46228.
4. Connect the wires as shown in the job-specific wiring diagram.

The IP-rating shown on the nameplate is only valid if suitable cable glands are used.

5. COMMISSIONING

Compare the actuator torque and the set travel with the technical specifications of the valve. Overloading can lead to serious damage to the valve. Watch out for moving parts during assembly and adjustment. Risk of injury and substantial material damage.

Caution

The rotary actuator is factory set to a rotational travel of 90°. Actuators with positioners are supplied with a control input signal of 0-10 unless otherwise stipulated upon ordering.

5.1 Setting the mechanical end stops

Move the actuator out of the end position, tighten the stop screw to the dimension shown in Fig. 3 and counter-tighten the nut. The stop screw should not be turned out of the specified range. If the range is exceeded, rotate the coupling by one tooth relative to the output shaft.

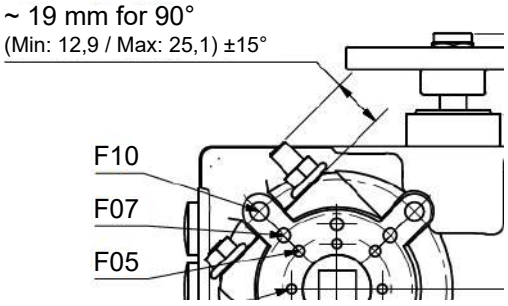


Fig. 3: Setting the mechanical end stops

5.2 Setting the limit switches

Move actuator into chosen end position. Open the eccentric tappet (1) using a 10 mm wrench and adjust the switch cam with a screwdriver (7). Close the eccentric tappet again using the wrench (Fig. 4).

Use of the limit switches to switch off the actuator will prolong its lifespan.

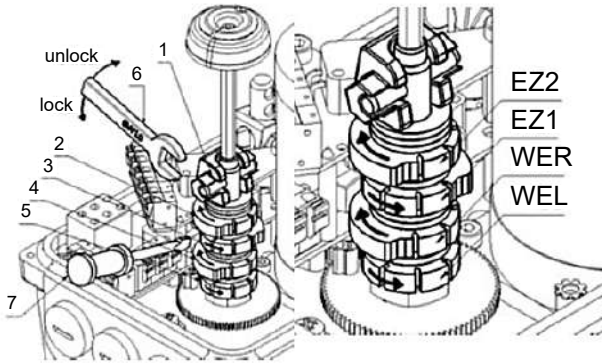


Fig. 4: Setting the limit switches

5.3 Test run

5.3.1 Checking the direction of rotation

- Adjust the actuator manually to roughly the middle position.
- In direction of travel CLOSE, switch the actuator on and watch the direction of rotation.
- If the direction of rotation is wrong, switch off immediately.
- Check wiring (jumpers).
- Repeat the test run.

Attention

If the direction of travel is set incorrectly, damage to actuator and valve is imminent as the limit switches will not function with the wrong direction of rotation!

5.3.2 Switching off in end positions

Danger

Risk of electric shock!

If the switches in the actuator are not factory-wired, check proper switching off in end positions:
With the cover removed, the rotary actuator may only be operated briefly for test runs or when performing absolutely essential adjustments on electrical components, such as potentiometer, limit switches or positioning electronics.
While performing this activity, there is unobstructed access to hazardous, live, exposed, moving and rotating parts. Adjustments performed incorrectly or without exercising the necessary caution may result in death, serious injury or substantial material damage.
Any operation of the rotary actuator with the cover removed for a purpose other than that described above is prohibited.

Use an insulated screwdriver to actuate the switching rollers of the DE switches as shown in the wiring diagram, Fig. 9, page 19, and check that the each switch actually switches off the motor. If necessary, change the motor supply jumpers.

6. RETROFITTING OF ADDITIONAL COMPONENTS

6.1 Retrofitting of potentiometer

Danger

Disconnect actuator from power supply before starting work!

1. Remove capacitor bracket.
2. If the actuator is equipped with a heating element, the potentiometer retaining plate [5] is already fitted and can be used for potentiometer assembly. Put potentiometer R1 [1] into retaining plate [5] and fasten with a lock washer and nut. Place two locking rings on the pinion [8] and fit the pinion to the potentiometer shaft. Solder the potentiometer wiring to the potentiometer, insert downwards through the Ø8 mm hole and connect to the lower part of the plug connector [2] red-28, gray-29, yellow-30. Fix the lower part of the plug connector [2] to the potentiometer retaining plate [5] using allen screws M2.5x6 [4].
3. If no heating element is fitted, clip the spacer [9] to the potentiometer retaining plate [5]. Replace the allen screw on the gear cover with the spacer bolt M4x22 [7]. Fit the potentiometer retaining plate [5] into the actuator, clip the spacer [9] into the gear cover and fix to spacer bolt M4x22 [7] using allen screw M4x6. To eliminate backlash, gently push the potentiometer assembly in the direction of the camshaft whilst tightening the screw. Insert the capacitor bracket into the retaining plate [5] and fix with allen screw M4x6.

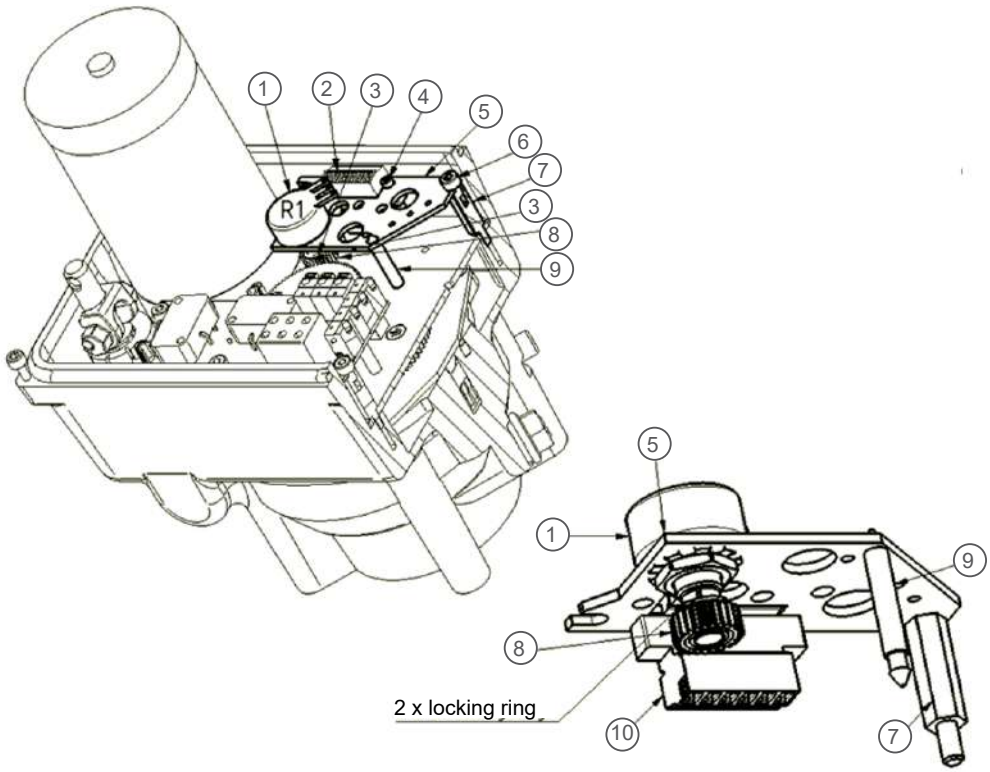


Fig. 5: Fitting the potentiometer

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6.2 Retrofitting of two additional travel switches (2EZ)

Danger

Disconnect actuator from power supply before starting work!

1. Remove the two allen screws [1] on the main switch board. Replace them with two spacer bolts [3].
2. Clip the spacer [2] into the main switch board.
3. Clip the additional switch board [4] onto the spacer [2] and fix with the allen screws [1].
4. Adjust the cams according to the instructions in section 5.2

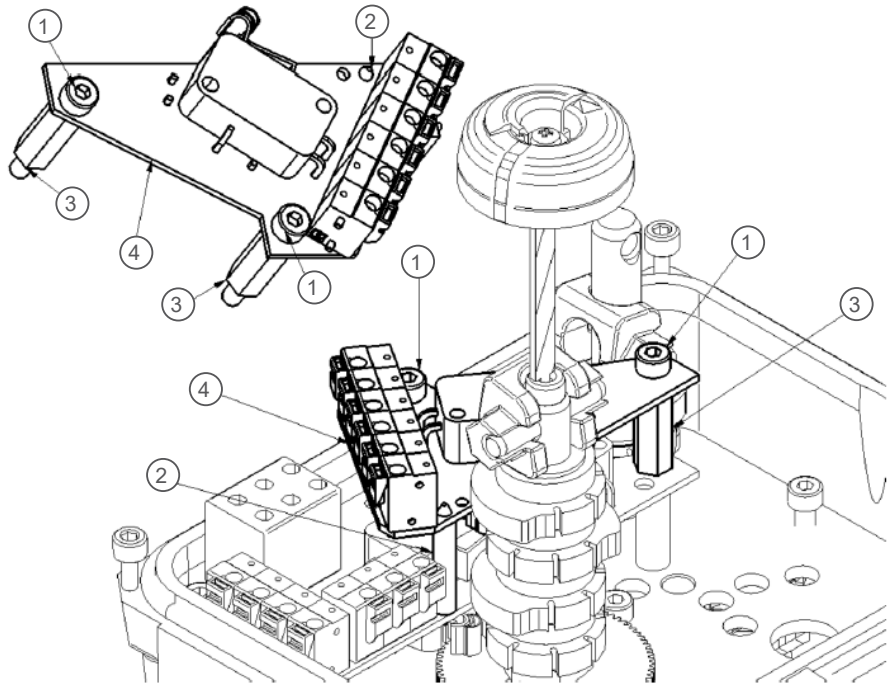


Fig. 6: Retrofitting of two additional travel switches (2EZ)

6.3 Fitting the 7020A digital postioner

Danger

Disconnect actuator from power supply before starting work!

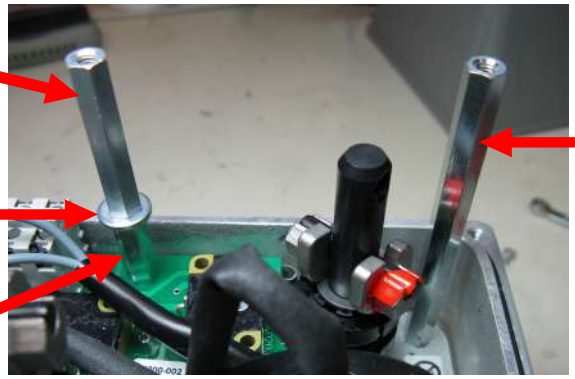
1. Remove the two screws indicated below.

2. Replace the screws with the spacer bolts

spacer bolt
M4 x 38 mm

washer 1.6mm
(only without
additional travel
switches)

spacer bolt
M4 x 22 mm
(only without
additional travel
switches)

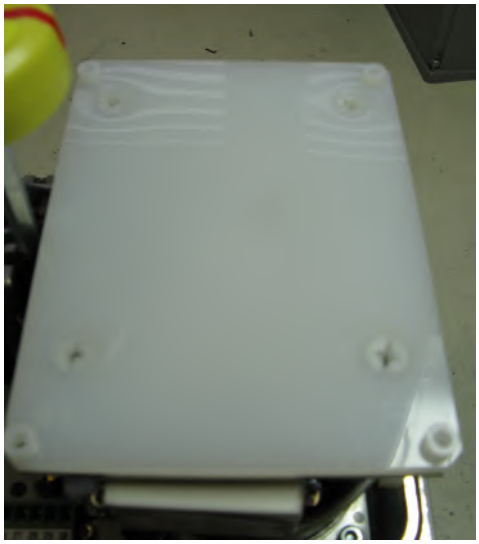


spacer bolt
M4 x 85 mm

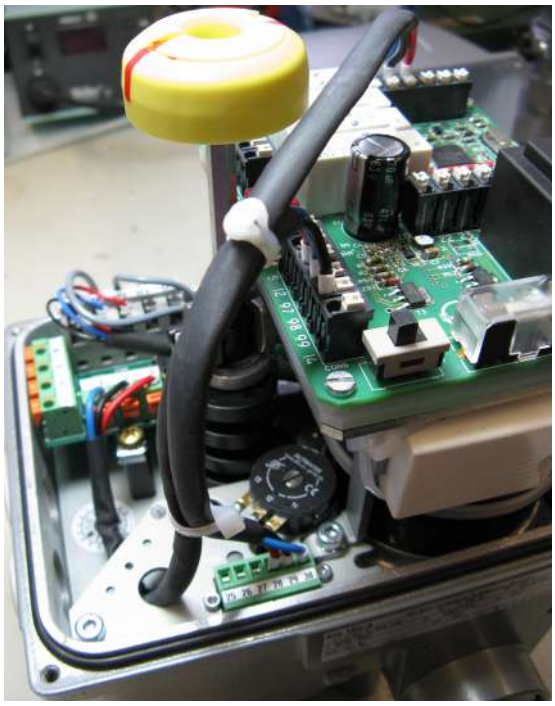
3. Place the adaptor panel onto the spacer bolts and the capacitor bracket and fix with the metal countersunk screws. IMPORTANT NOTE: The holes in the adaptor panel are not symmetrical; the outermost hole is at the top left (see right-hand photo below). The bottom right-hand hole remains unused.

1. Fix the isolation panel with the 4 plastic countersunk screws. Tighten gently, so as not to damage the screw thread.

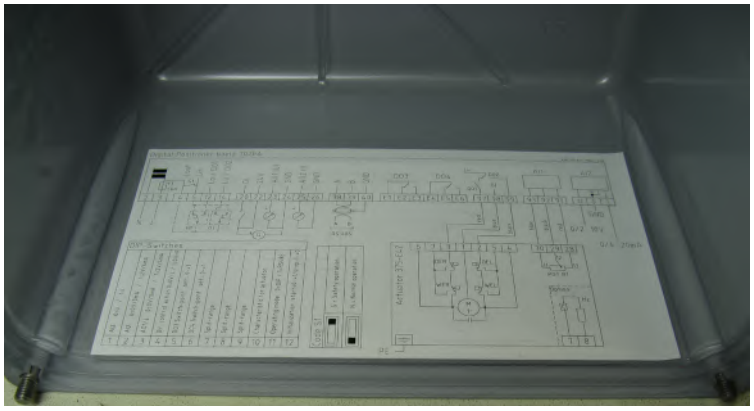
2. Fit the 7020A digital positioner circuit board. To do this, place the plastic spacer sleeves over the four threaded holes in the corners of the isolation panel. Insert the slotted cheese-head screws (M3) into the holes in the circuit board, then place the circuit board onto the isolation panel. Tighten all four screws. Make sure that the spacer sleeves remain between the isolation panel and the circuit board.



3. Wire up the circuit board and the actuator using the wiring provided and according to the wiring diagram provided.



4. After fitting the digital positioner, stick the wiring diagram onto the inside of the actuator cover as shown.



7. DIGITAL POSITIONER 7020A

7.1 Intended use

The digital positioner **baelz 7020A** controls the actuator according to the value of the control signal: 0(2)-10 V, 0(4)-20 mA

To ensure use for the purpose intended, check that the above type identification corresponds to the nameplate on the positioner before starting any activities. The technical specifications of the positioner and the power supply requirements are the indicated on the name plate.
Any use other than the intended use stated above, use for different tasks, and operation with other power sources than those permitted, is considered to be improper use. In case of improper use, the operator shall be solely liable for the risk presented to persons and to the device as well as to other property!

The intended use also comprises compliance with the accident prevention regulations and the DIN VDE standards of the German Institute for Standardization and the Association for Electrical, Electronic & Information Technologies. It also implies working in accordance with the safety requirements when performing all activities described in these operating instructions, under consideration of general technical rules and regulations.

7.2 Operational modes and operating options

Tip: ***For further information and additional functions, see baelz 7020 operating instructions.***

7.2.1 Standard operation using DIP switches

The DIP switches can be used to carry out standard configurations and operations (see section 7.4).
When DIP switch 11 is set to 0, the 7020A is in the standard operational mode.
In standard mode, all DIP switches are active and the functions of the Baelz 7020A can be individually adapted. Functions which are predefined and unalterable in standard mode are described in section 6.1 of the baelz 7020 operating instructions.

7.2.2 Standard operation using Modbus VT100 or direct addressing

In standard mode, the Baelz 7020A can be operated using Modbus VT100. For this, a virtual 7020A display and a virtual 7020A keypad are transmitted to a user interface. Modbus direct addressing, e.g. from a building automation system, enables access to status information and allows operation and configuration. (See baelz 7020 operating instructions, Appendix A). The settings given by the DIP switches remain active. Values which are only relevant in Modbus mode can be adjusted in standard mode, but only take effect in Modbus mode.

7.2.3 Modbus mode

When DIP switch 11 is set to 1, the Baelz 7020A is in Modbus mode. In Modbus mode, the 7020A is at its most flexible and can be configured and operated using either a Modbus VT100 or Modbus direct addressing, for example in a building automation system. See separate operating instructions "Baelz 7020 Digital Positioner - Operating Instructions for Modbus mode"

7.2.4 Normal and safety modes

In normal mode the position of the valve is controlled by the set value at analogue input AI2. The N↔S switch shown in the picture on the right is set to normal mode (N). In normal mode, no external control systems can be connected to terminals 12 and 14.

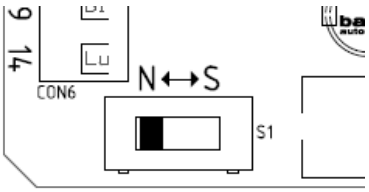


Fig. 7: N↔S-switch

7.2.5 Safety mode: freeze protection and excessive temperature

In safety mode the actuator can be sent to a safe position (extended / retracted, depending on the direction of action of the valve) in case of failure or malfunctioning of the microcontroller.
To operate the Baelz 7020 in connection with an external freeze protection and/or excessive temperature thermostat, set the N↔S switch to safety mode (S).
Connect the freeze protection and/or excessive temperature thermostat according to desired function and priority. Be sure to take the direction of action into account! See wiring diagrams in the baelz 7020 operating instructions.

7.2.6 3-point control with a continuous output signal

1. Set the positioner up and wire to power supply as described previously and initialize as described in section 7.5.2.
2. To deactivate the error signal, if desired, set the DIP-switch 11 to 1 ("ON") and change the following values in the menu item "CA" using WinBas Tools (on PC, see baelz 7020 operating instructions):
   - AD to 0
   - EFP to 0.0%
   - LA to 1

(If you don't mind the red LED error signal, step 2 can be left out completely. This has no effect on the function of the positioner.)

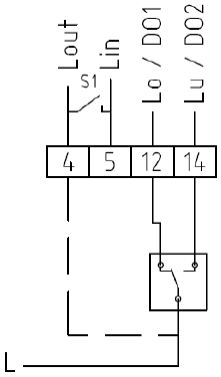


Fig. 8: Wiring diagram 3-point-signal

3. Set the N↔S switch (Fig. 7) to "S" and wire as shown in Fig. 8 (the positioner must remain connected to the power supply throughout).
4. The required signal can now be picked up on AO1 and AO2.

IMPORTANT NOTE: Before any further re-initialization of the device, disconnect terminals 12 and 14 and set the N↔S switch to normal operation (N).

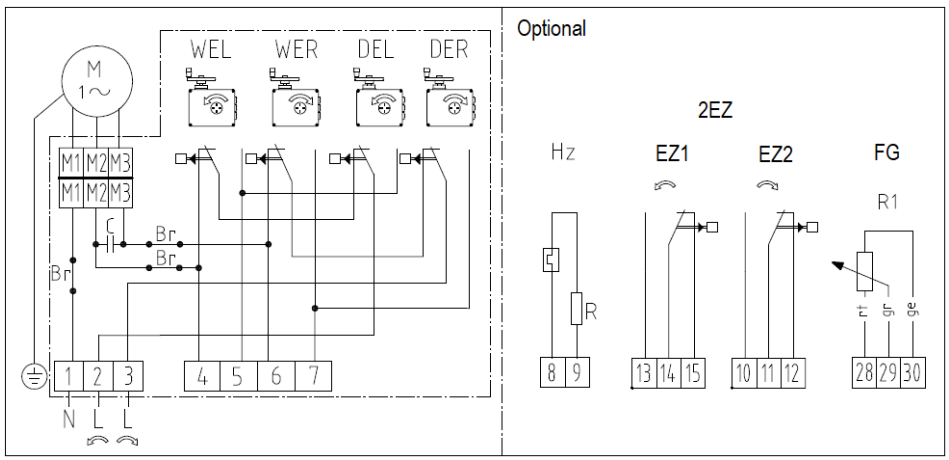
7.3 Wiring diagrams and allocation of connection terminals

Danger

Disconnect actuator from power supply before starting work
See also section 4.4.

7.3.1 Wiring diagram

Fig. 9: Wiring diagram basic actuator



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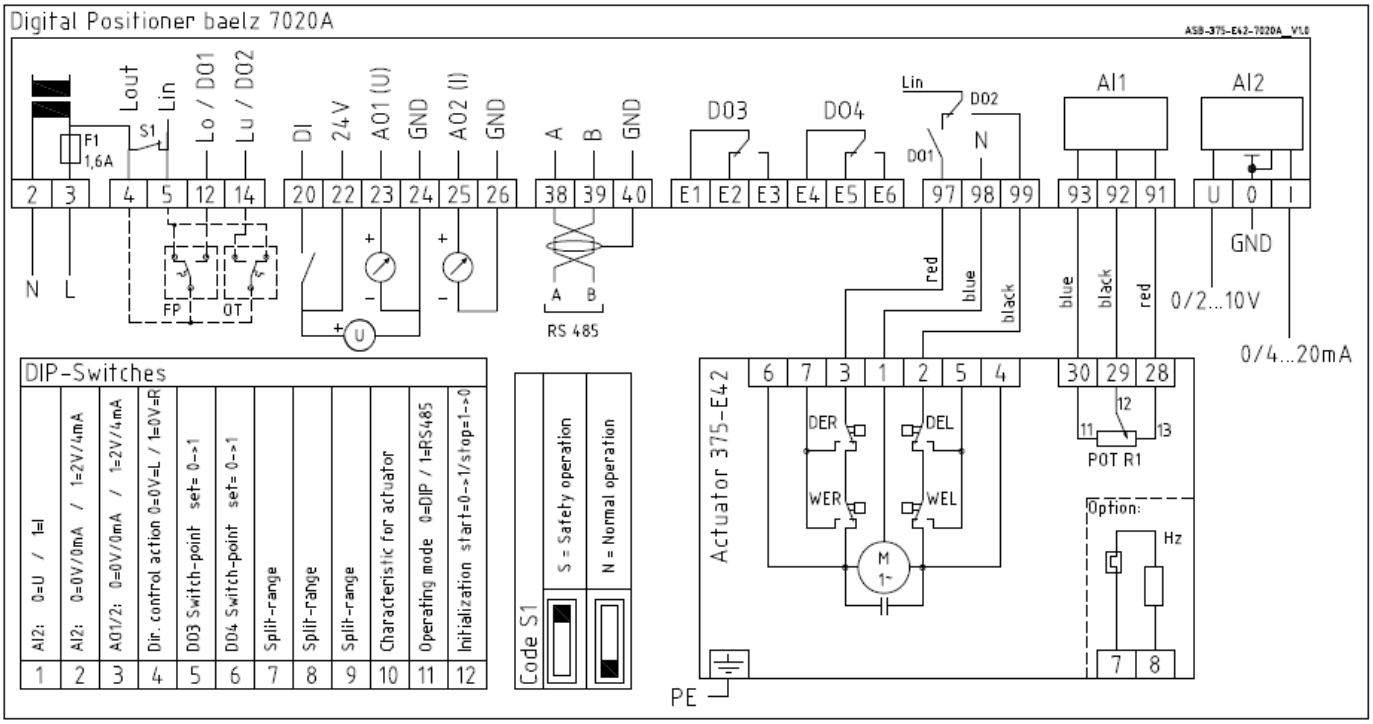
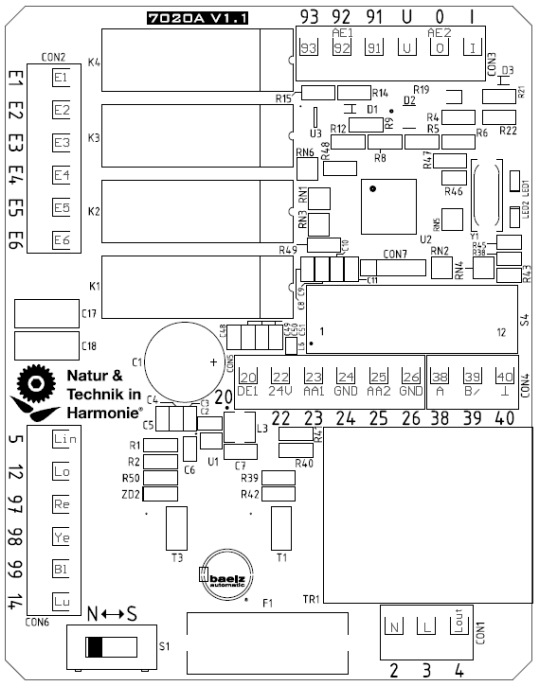


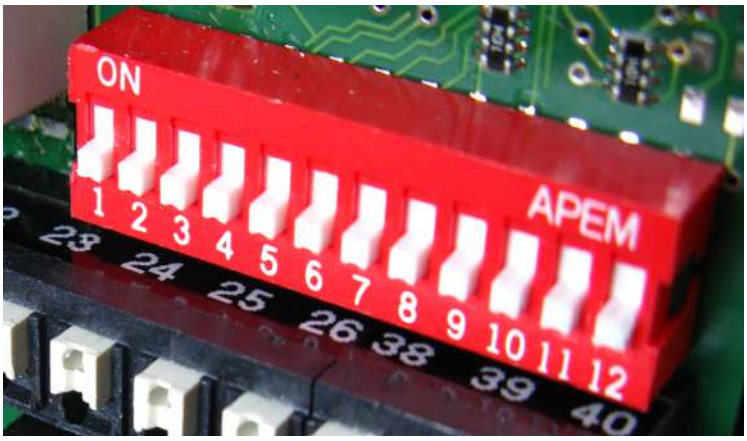
Fig. 10: Wiring diagram with digital positioner baelz 7020A

7.3.2 Allocation of connection terminals



Terminal	Allocation	Notes
2, 3	supply terminals	See wiring diagram for correct allocation.
4, 5, 12, 14	Can be allocated to an overriding external control system (freeze protection, excessive temperatures).	For external control, the N↔S switch must be set to „S“ (safety mode).
20, 22	Digital input for a switch used to select between two conditions, e.g. „open / closed“ or „summer / winter“.	
23, 24, 25, 26	Analogue output position indicater using voltage and / or current.	Analogue outputs can be connected simultaneously.
38, 39, 40	Connection terminals for Modbus	
91, 92, 93	Connection terminals for potentiometer	
U, 0, I	Input setpoint value for valve position	IMPORTANT! Position of DIP switch 1, see section 7.4
E1, E2, E3, E4, E5, E6	Terminals for 2 digital outputs	IMPORTANT! Position of DIP switches 5 & 6, see section 7.4
97, 98, 99	Connection terminals for motor	Ex-works wiring varies according to type of actuator

7.4 Configuration of the DIP switches



The factory setting of the DIP switches is position 0, as shown.

Switch	Function	Position 1 "ON"	Position 0
DIP 1	Set value input: voltage, V or current, mA?	current, mA	voltage, V
DIP 2	Set value input starting at 0 V / 0 mA or 2 V / 4 mA?	2-10 V / 4-20 mA	0-10 V / 0-20 mA
DIP 3	Analogue output starting at 0 V / 0mA or 2 V / 4 mA?	2-10 V and / or 4-20 mA	0-10 V and / or 0-20 mA
DIP 4	Direction of control action: does valve close when actuator turns clockwise or anticlockwise? (position indicator in cover)	Actuator turns clockwise → valve closed	Actuator turns anticlockwise → valve closed
DIP 5	Current position of the actuator is saved as additional switching position "2EZ-1". See wiring diagram, page 20.		from 0 to 1 → save "2EZ-1" = 2%
DIP 6	Current position of the actuator is saved as second additional switching position "2EZ-1". See wiring diagram, page 20.		from 0 to 1 → save "2EZ-2" = 98%
DIP 7, 8, 9	These 3 DIP switches define the function: linear / split range / 11-point / inverted		s. , page 24 = linear
DIP 10	Defines valve characteristic using actuator characteristic, see page 23.	Actuator characteristic inverse equal percentage, valve action linear	Actuator characteristic linear, valve action equal percentage
DIP 11	Selects standard or Modbus mode.	Modbus mode	standard mode
DIP 12	Starts initialization run. Set back to 0 after initialization (s. section 7.5.2)		from 0 to 1 → starts initialization run
N↔S	Selects normal or safety mode	position "S" = safety mode	position "N" = normal mode

Fig. 11: Setting the DIP switches

factory setting

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7.4.1 Details on DIP switches

DIP1 and DIP2:
are interpreted together:
DIP1: 0 = voltage → DIP2: 0 = 0-10 V or 1 = 2-10 V.
DIP1: 1 = current → DIP2: 0 = 0-20 mA or 1 = 4-20 mA.

Attention **Either a voltage source can be connected to the U-terminal or a current source to the I-terminal. Never connect both at the same time.**

DIP3:
DIP switch 3 configures the analogue outputs AO1 and AO2 (see wiring diagram, Fig. 10, page 20). DIP switch 3 defines the scaling of the two analogue outputs. When DIP 3 = 0, AO1 is set to 0-10 V and AO2 to 0-20 mA (factory setting), when DIP 3 = 1, AO1 is set to 2-10 V and AO2 to 4-20 mA. In Modbus mode AO1 and AO2 can be configured separately.

Tip: *Using 2-10 V / 4-20 mA enables clear identification of a loss of signal (= 0 V / 0 mA).*

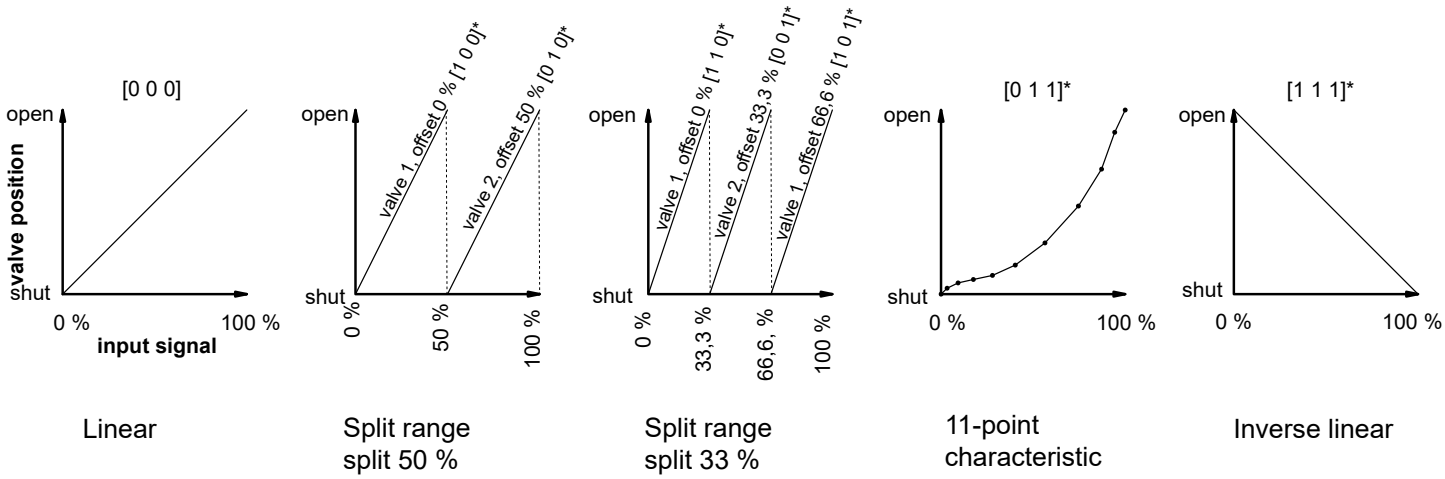
DIP4:
DIP switch 4 changes the direction of operation of the actuator.
The direction of operation can only be changed if the unit has been initialized. Until the unit has been initialized, the following setting applies: Valve closes when actuator turns anticlockwise. There can also be no change in the direction of operation during an initialization run, whether or not the unit was already initialized before starting the current initialization run.
The direction of operation must not be confused with heating/cooling! Heating in standard mode is carried out with DIP switches 7, 8 and 9 set to "0". Cooling in standard mode is carried out with DIP switches 7, 8 and 9 set to "1". Split-range can be combined with heating in standard mode, but not with cooling. In Modbus mode, split-range can be combined with both heating and cooling.

DIP5:
Saves the current position as switching position "2EZ-1" when switched from 0 to 1. No function is assigned to switching from 1 to 0. Even if DIP 5 is left in position 1 when the 7020A positioner is switched on, the current position will not be saved.

DIP6:
Saves the current position as switching position "2EZ-2" when switched from 0 to 1. No function is assigned to switching from 1 to 0. Even if DIP 6 is left in position 1 when the 7020A positioner is switched on, the current position will not be saved.

DIP7, DIP8 and DIP9:
These three DIP switches work together to define the split range function at analogue input 2 (AI2).

FUNCTION	DIP7	DIP8	DIP 9
Linear, 1:1	0	0	0
Split Range: split 50 %, offset 0 %	1	0	0
Split Range: split 50 %, offset 50 %	0	1	0
Split Range: split 33.3 %, offset 0 %	1	1	0
Split Range: split 33.3 %, offset 33.3 %	0	0	1
Split Range: split 33.3 %, offset 66.6 %	1	0	1
11-point characteristic	0	1	1
Inverted: 0 becomes 100 and 100 becomes 0 %	1	1	1



Linear | Split range split 50 % | Split range split 33 % | 11-point characteristic | Inverse linear

Fig. 12: Graphical illustration of selection of functions by DIP switches 7, 8 & 9

DIP10:

An actuator characteristic can be used indirectly to change a valve characteristic. If, for example, the valve has an equal percentage characteristic, an inverse equal percentage actuator characteristic can be used to generate a resulting linear characteristic, see illustration below.

The actuator characteristic (DIP 10) can also be combined with the characteristics which can be selected using DIPs 7, 8 and 9 (e.g. split range). The microcontroller first processes the characteristic defined by DIPs 7, 8 and 9 and subsequently the characteristic defined by DIP 10.

In Modbus mode, two further actuator characteristics can be selected: equal percentage and quadratic inverse equal percentage.

Desired characteristic	DIP-switch 10	Characteristic of the valve	Characteristic of the actuator	Effective at valve
Equal percentage	1 / 0 / 10			
Quadratic	actuator characteristic only selectable in Modbus mode			
Linear	1 / 0 / 10			
Equal percentage	actuator characteristic only selectable in Modbus mode			
Linear	1 / 0 / 10			

= factory setting

DIP11:

DIP switch 11 defines the mode of operation: 1 = Modbus mode, 0 = standard mode. Standard mode is used to apply predefined normal settings.

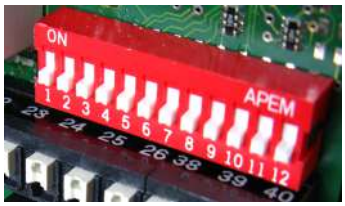
DIP12:

Starts an initialization run when switched from 0 to 1. If DIP 12 is left in position 1 when the 7020A positioner is switched on, an initialization run will not be startet.

As long as DIP 12 is set to 1, errors and alarms occurring during normal positioner operation will not be shown. This enables errors occurring during initialization to be distinguished from errors during normal positioner operation. Switch DIP 12 back to 0 after the initialization run (after having analysed possible error codes) to show any errors occurring in normal positioner operation on the red LED. See also section 7.5.2 "Initialization run".

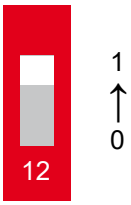
7.5 Commissioning

7.5.1 Quick start guide



1. Set DIP switches

2. Connect to supply



3. Start initialization run

7.5.2 Initialization run

If the unit is not initialized, the green LED flashes. The red LED is lit when the position of the potentiometer is not ideal for an initialization run. (See section 7.5.3 for meaning of LED signals.) An initialization run can still be carried out, but it will take approx. 1x valve travel time longer. During a successful initialization run, the actuator is moved to both of its end positions. The potentiometer and the position of the actuator are synchronized and values for actuator travel time and switching hysteresis are determined.

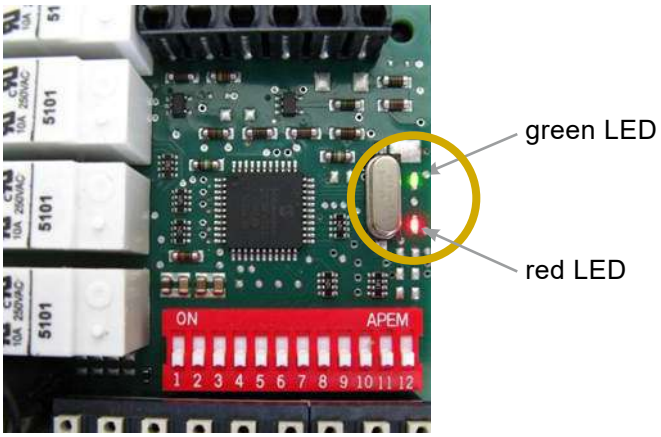
Switch DIP switch 12 from 0 to 1 to start an initialization run. The red LED is lit during initialization.

When initialization has been successfully completed, only the green LED is lit. For error signals see table in section "Errors after an initilization run", page 26

As long as DIP switch 12 is set to 1, errors and alarms occurring during normal positioner operation will not be shown. This enables errors occurring during initialization to be distinguished from errors during normal positioner operation.

Switch DIP 12 back to 0 after the initialization run to show any errors occurring in normal positioner operation on the red LED.
(After the first initialization run (unit not previously initialized), the unit moves to the 50% position upon completion of initialization. As soon as DIP 12 is set to 0, the baelz 7020A will follow the set value signal at analogue input 2.)

7.5.3 Meaning of LED signals



	LED signal	LED signal	Meaning
1	● ●	green off red off	Unit is switched off.
2	● ●	green off red on	Initialization run in progress.
3	✸ ●	green flashing red off	Unit is not initialized. Potentiometer in ideal position for initialization run (between 7.5 and 17.5%).
4	✸ ●	green flashing red on	Unit is not initialized. Potentiometer not in ideal position for initialization run. Initialization still possible. (If the red LED is flickering, the position of the potentiometer is at the edge of the optimal range and therefore OK.)
5	✸ ✸	green and red flashing	Error during initialization. Unit is not initialized. The flashing red LED shows the number of the error code: 3 flashes, interval, 3 flashes, interval → error code 3. See also section 7.6.1.
6	● ●	green on red off	Unit is initialized. No errors.
7	● ●	green on red on	Immediately after the unit is switched on, both LEDs are lit for 2 seconds to show that they are in working order.
8	● ✸	green on red flashing	Unit is initialized. DIP 12 set to 1 → error after initialization run, see section 7.6.1 DIP 12 set to 0 → error or alarm during normal positioner operation, see section 7.5.2.

7.6 Errors

7.6.1 Errors after an initialization run

Following a successful initialization run, only the green LED is lit.
If the red LED is flashing, this indicates an error following an unsuccessful initialization run.
The first error to occur during initialization is shown. If the green LED is lit, the unit had already been initialized before the current initialization run. If the green LED is flashing, the unit had not been successfully initialized previously.

The red LED shows errors occuring during initialization as follows:

Error code 1: ✸ interval ✸ interval ✸ etc.

Error code 2: ✸✸ interval ✸✸ interval ✸✸ etc.

etc. up to ...

Error code 8: ✸✸✸✸✸✸✸✸ interval ✸✸✸✸✸✸✸✸ interval ✸✸✸✸✸✸✸✸ etc..

Error code	Error	Corrective action
1 → 1 x ✸	Invalid status of initialization run. Possible cause: EMI (electromagnetic interference).	Remove source of interference.
2 → 2 x ✸	Sensor malfunction at analogue input AI1: No signal from potentiometer.	Check connection terminals 91, 92, 93 (see wiring diagram, Fig. 10, page 20). Replace potentiometer if necessary.
3 → 3 x ✸	Potentiometer value at AI1 too small. Possible cause: EMI.	Remove source of interference. Replace potentiometer if necessary.
4 → 4 x ✸	Potentiometer value at AI1 too large. Possible cause: EMI.	Remove source of interference. Replace potentiometer if necessary.
5 → 5 x ✸	Wrong direction of travel	Check motor (97, 98, 99) and potentiometer (91, 92, 93) connections (see wiring diagram, Fig. 10, page 20). Remove source of interference.
6 → 6 x ✸	Obstruction: potentiometer or motor not moving.	Check connections, set N↔S switch to "N", remove any obstructions.
7 → 7 x ✸	Actuator turns too far.	Set a smaller angle of rotation for the actuator (< 110°).
8 → 8 x ✸	Actuator doesn't turn far enough.	Set a larger angle of rotation for the actuator (> 25°).

Following an initialization run, the red LED shows only initialization errors as long as DIP switch 12 is set to 1. This enables a clear differentiation between errors occuring during initialization and those occuring during normal positioner operation. Setting DIP switch 12 from 1 back to 0 permits the red LED to show any normal operational errors instead of initialization errors which may have occured.

7.6.2 Errors during normal positioner operation

The green LED is lit during normal positioner operation.
A flashing red LED shows an error during normal positioner operation. For this, DIP switch 12 must be set to 0.

The red LED indicates errors during normal positioner operation as follows:
( = long flash,  = short flash)

Error code 1:  interval  interval etc.

Error code 2:  interval  interval etc.

etc. up to ...

Error code 6:  interval  interval etc.

Multiple error codes can be displayed simultaneously:

Error codes 3 & 5:  interval  interval

The red LED flashes 10 times between intervals (1.6 s), as a maximum of 10 error codes can be allocated.
The error codes 7 to 10 are not allocated and are reserved for additional alarms.

Error code	Error	Corrective action
1	Sensor malfunction at analogue input AI1: No signal from potentiometer.	Check connection terminals 91, 92, 93 See wiring diagram, Fig. 10, page 20.
2	Sensor malfunction at analogue input AI2: No setpoint signal.	Check connection terminals U, 0, I See wiring diagram, Fig. 10, page 20.
3	Alarm 1: additional switching position (2EZ-1) or other threshold value reached.	Informational alarm: 2EZ-1 is set using DIP 5.
4	Alarm 2: additional switching position (2EZ-2) or other threshold value reached.	Informational alarm: 2EZ-2 is set using DIP 6.
5	Alarm 3: control deviation too large.	Deactivate antifreeze / excessive temp. Re-initialize Baelz 7020A.
6	Alarm 4: potentiometer end stops too imprecise or obstruction.	Deactivate antifreeze / excessive temp. Re-initialize Baelz 7020A.
7-10	Reserved for as yet undefined alarms 5-8	No error possible.

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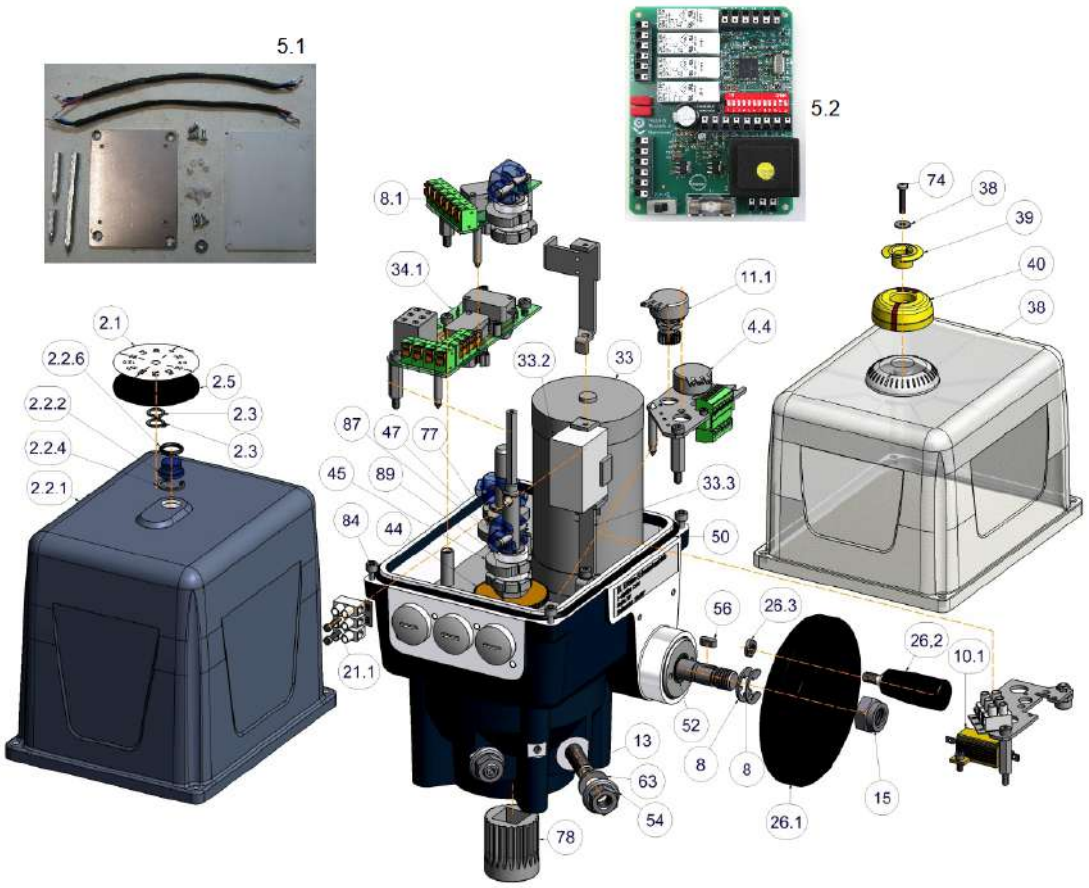
7.7 Technical Specifications

Table 4. Technical Specifications, baelz 7020A	
Supply voltage	230 VAC -15 % / +10 %, 50 / 60 Hz, option: 115 VAC 50 / 60 Hz, 24 VAC 50 / 60 Hz
Fuse	internal 1,6 A/T (slow-blow)
Power consumption	approx. 5 VA
IP rating	IP 42
Ambient temperature	0 to 50 °C
Transport / storage temp.	- 25 to +65 °C
Ambient humidity	5 to 90 % relative humidity. (non-condensing)
Dimensions WxHxD	approx. 105 x 82 x 32 mm
DI suppy voltage	24 V DC, Imax = 5 mA
Digital input	1 configurable using software, Imax 5mA, low=0...5VDC, high=9...38VDC, Re=5.5kΩ
Digital outputs	2 potential free auxiliary chageover switches, configurable, max. 250 VAC, 4A min. contact load: 10 V / 100 mA
2 output signals	Output 1: 0/2...10 V / min. ohmic resistance 5kΩ Output 2: 0/4...20 mA / max. ohmic resistance 300Ω Factory setting: 0...10 V and 0...20 mA
Input signal	0/2...10V / Re 63kΩ, 0/4...20mA / Re 200Ω, measurement accuracy 0.1%
Connection	PUSH IN spring terminals, stripping length 8 mm
Wiring	Wire size AWG: min. AWG 24; max. AWG 16 solid wire / stranded wire: min. 0.2 mm²; max. 1.5 mm² with wire ferrule according to DIN 46 228/1: min. 0.25 mm²; max. 1.5 mm² with insulated wire ferrule DIN 46 228/4: min. 0.25 mm²; max. 0.75 mm²
Operation	12 DIP switches / optional: advanced operation using RS485 and software
Interface	RS485 Modbus RTU, Baud rate 2400...19200, 1 start, 8 pieces of data, 1 stop-bit, no parity
Memory	non-volatile semiconductor
Weight	approx. 0.2 kg

7.8 Accessories and options

- Free parameterisation software (Modbus RTU) - Interface RS 485 required!
- For laptops with USB we recommend our interface convertor (Order No. 5280-051).

8. SPARE PARTS



Pos.	Bezeichnung	Spare Part
2.1	Drehwinkelskala	turn gauge
2.2.1	Aluminiumhaube	aluminium cover
2.2.2	Sichtfenster	inspection glass
2.2.4	Sicherungsring	circlip
2.2.6	O-Ring	O-seal
2.3	Sicherungsring	circlip
2.5	Stellungsanzeiger	position indicator
4.4	Potentiometer	potentiometer
5.1	Einbauteile 7020A	fitting kit
5.2	Stellungsregler 7020A	positioner 7020A
8	Sicherungsscheibe	circlip
8.1	Zusatzschalter	additional switches
10.1	Heizung	heater
11.1	Zusatzpotentiometer	additional potentiometer
13	Gewindestift	setscrew
15	Sechskantmutter	hex-nut
21.1	Motorklemme 3~	motor terminal 3~
26.1	Handrad	handwheel
26.2	Zylindergriff	cylindrical handle
26.3	Sechskantmutter	hex-nut
33	Motor	motor

Pos.	Bezeichnung	Spare Part
33.2	Kondensator	capacitor
33.3	Winkel	capacitor bracket
34.1	Schalterplatine	switch board
38	Kunststoffhaube	plastic cover
39	Schleppzeiger	drag indicator
40	Anzeige	indicator
44	Zahnrad	gear wheel
45	Schaltnocke	cam
47	Bolzen	bolt
50	O-Ring	O-seal
52	Dichtring	seal ring
54	Sechskantmutter	hex-nut
56	Passfeder	feather key
63	Federring	split washer
74	Linsenschraube	pan head screw
77	Exzenter	eccentric
78	Kupplung	coupling
83	Scheibe	washer
84	Zylinderschraube	socket head screw
87	Passscheibe	shim ring
89	Scheibe	ring

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9. DECOMMISIONING AND DISPOSAL

Dispose of the digital positioner in accordance with the relevant, country-specific regulations and laws..

10. TROUBLESHOOTING

If the actuator does not work properly, proceed as follows to correct the problem:

1. Check that the actuator is correctly installed.
2. Check the actuator settings and the specifications on the nameplate.
3. Correct the problems as specified in the checklist (page 31).
4. If the problem cannot be corrected, contact the Baelz service department.
5. If, despite consultation, the issue still cannot be resolved, the device can be returned to Baelz for repair / replacement by arrangement with the service department.

Please give the following information when contacting the manufacturer or sending the device in for repair:

- F number (order-related serial number)
- Type name
- Supply voltage and frequency
- Extras fitted
- Error report

10.1 Checklist for operational malfunctions

Malfunction	Cause	Action required
Actuator not working	Power failure	Determine the cause and correct the problem.
	Defective fuse (in control cabinet)	Determine the cause and correct the problem, replace the fuse.
	Rotary actuator incorrectly connected	Re-connect as specified on circuit diagram (inside cover).
	Short circuit caused by humidity	Determine the cause, dry the rotary actuator; if necessary, replace cover seal and screws and/or fit protective cover.
	Short circuit caused by incorrect connection	Connect correctly.
	Motor winding damage caused, for example, by high voltage or defective electronics	Determine cause, measure current data, compare with nameplate and specifications, dismantle rotary actuator and return for repair.
	Voltage drop due to connecting cables being too long and / or having insufficient cross-section	Measure current data with rotary actuator, recalculate connecting cables and replace as necessary.
Actuator running erratically, constantly opening and closing	Power fluctuations exceed permissible tolerance	Improve power supply conditions.
	Loose contact in supply line	Check and tighten connections (terminal blocks).
Actuator stops intermittently	Valve jamming	Enable smooth valve movement.
Actuator does not move to end position. Valve fails to open / close	System pressure too high	Adjust system pressure.
	Poor input signal - interfering signals - signal fluctuation	Check input signal at rotary actuator, correct the problem causing the malfunction.
Rotary actuator fails to move or does not move correctly to the position defined by the input signal.	Circuit board defective	Replace circuit board, if necessary dismantle actuator and return for repair.

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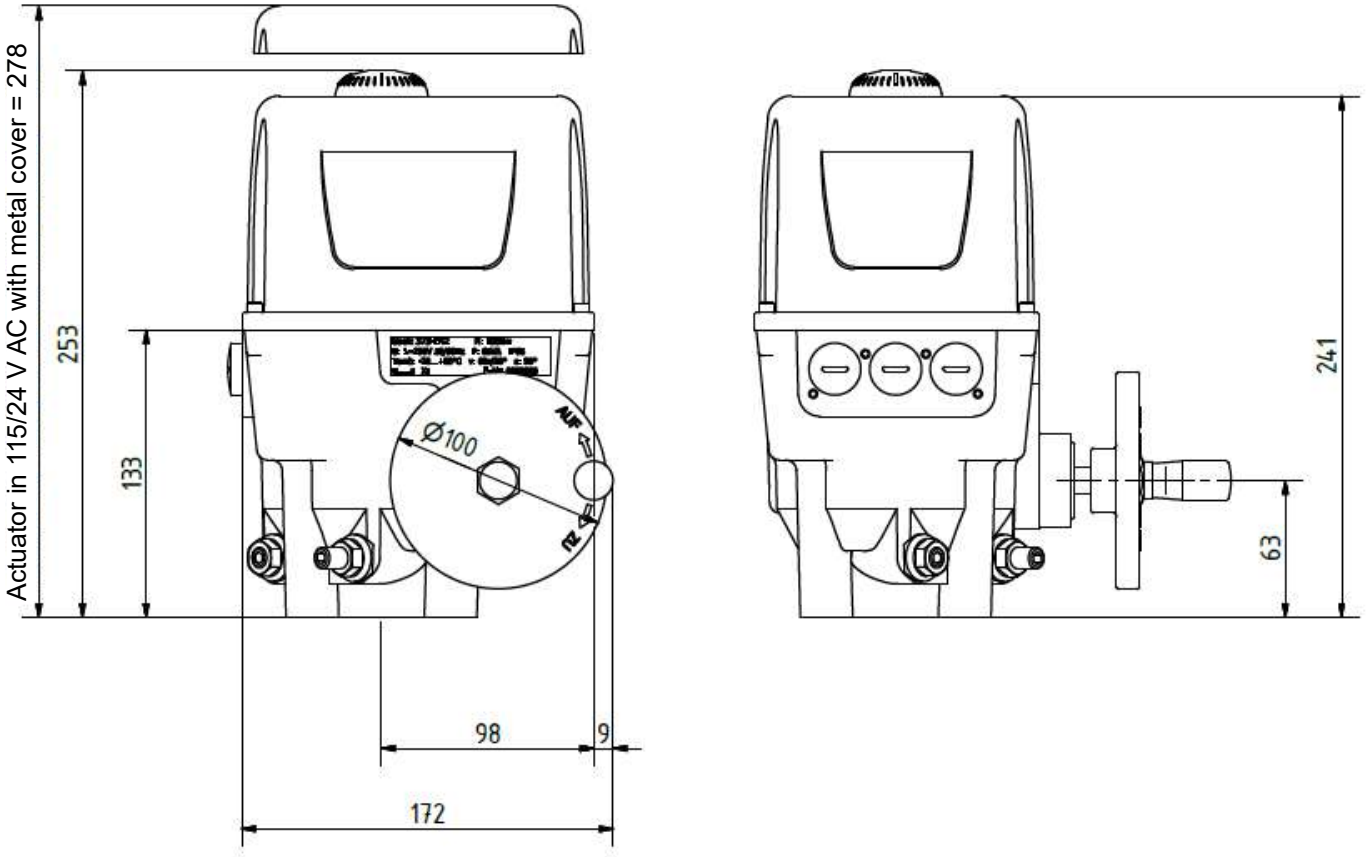
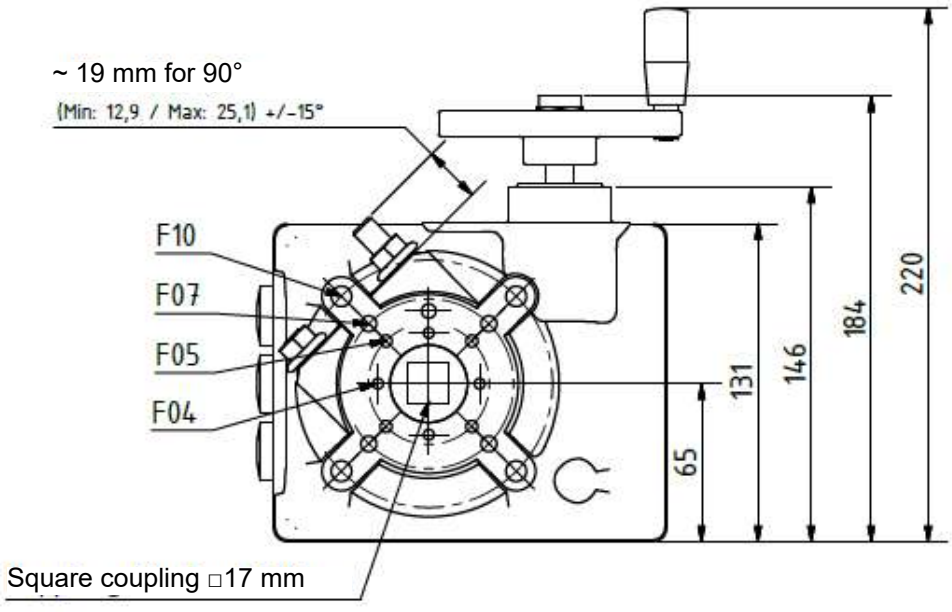
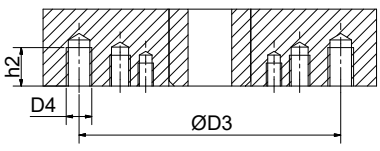
11. DIMENSIONAL DRAWINGS

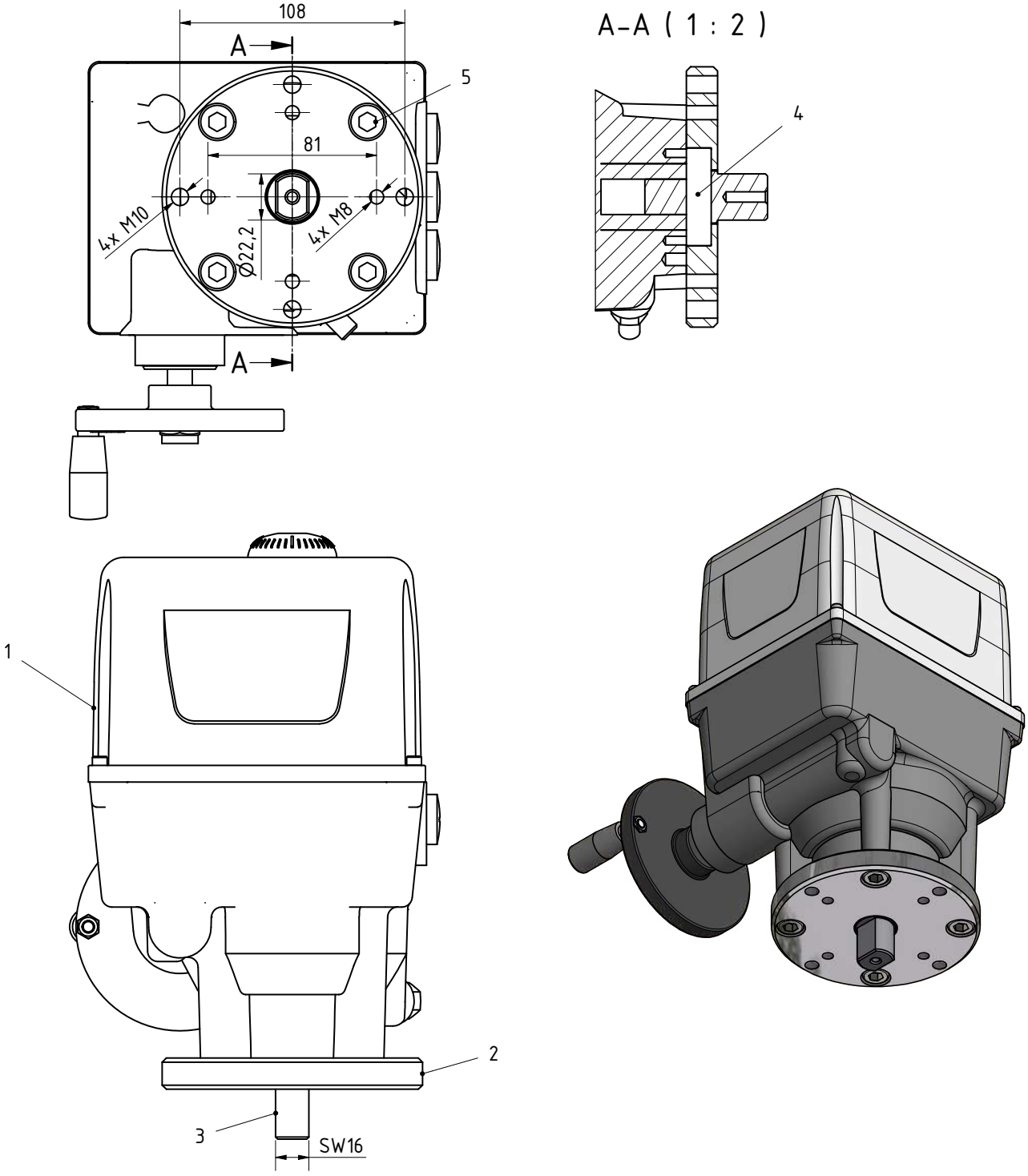






	ØD3 (mm)	D4	h2 (mm)	Mmax (Nm)
F 04	42	M5	8	63
F 05	50	M6	9	125
F 07	70	M8	12	250
F 10	102	M10	15	500

Fig. 13: Dimensional drawing baelz 375-E42



Item	Quantity	Part number	Description	Article number
1	1	MZN 375-E42-001	Electrical rotary actuator 375-E42	K30003029
2	1	KT 30978	Adapter plate	F20002914
3	1	KT 30979	Actuator shaft	F20002915
4	1	SKF 6005-2Z	Ball bearing	K30003204
5	4	M10x16mm DIN 7984	Socket head cap screw	K30002097

Fig. 14: baelz 375-E42 with adapter fittings as a replacement for baelz 375-E41