

# Control Valve Actuators

## EA-C / EA-B

For the Type Series BOA-CVE C/CS/W/IMS/EKB/IMS EKB

## Installation/Operating Manual



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Installation/Operating Manual EA-C / EA-B

Original operating manual

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## 1 General

### 1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number uniquely identify the valve and actuator and serve as identification for all further business processes.

In the event of damage, immediately contact your nearest service facility to maintain the right to claim under warranty.

### 1.2 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

### 1.3 Symbols

Table 1: Symbols used in this manual

| Symbol  | Description  |
|---|--|
| ✓   | Conditions which need to be fulfilled before proceeding with the step-by-step instructions |
| ▷   | Safety instructions  |
| ⇒   | Result of an action  |
| ⇔   | Cross-references   |
| 1.<br>2.  | Step-by-step instructions  |
|  | Note<br>Recommendations and important information on how to handle the product             |

### 1.4 Key to safety symbols/markings

Table 2: Definition of safety symbols/markings

| Symbol   | Description   |
|--|---|
|  <b>DANGER</b>  | <b>DANGER</b><br>This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.   |
|  <b>WARNING</b> | <b>WARNING</b><br>This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.   |
|  <b>CAUTION</b> | <b>CAUTION</b><br>This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.   |
|                 | <b>Explosion protection</b><br>This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX). |
|                 | <b>General hazard</b><br>In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.                          |

| Symbol  | Description   |
|---|---|
|  | <p><b>Electrical hazard</b><br/>In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.</p> |
|  | <p><b>Machine damage</b><br/>In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.</p>  |



## 2 Safety

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

### 2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
  - Markings for connections
  - Name plate
- The operator is responsible for ensuring compliance with all local regulations not taken into account.
- The motor has been designed and constructed in accordance with the requirements of Directive 2014/35/EU (“Low-voltage Directive”). The motor is intended for use in industrial plants.
- If the motor is used in countries outside the European Community, adhere to the regulations applicable to the relevant country. Also observe any local and industry-specific regulations governing installation and safety.

### 2.2 Intended use

- Only operate actuators which are in perfect technical condition.
- Do not operate partially assembled actuators.
- Generally observe the operating limits given.
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

#### 2.2.1 Prevention of foreseeable misuse

- Never exceed the permissible application and operating limits specified in the data sheet or product literature regarding temperature, etc.
- Observe all safety information and instructions in this manual.

### 2.3 Personnel qualification and training

- All personnel involved must be fully qualified to install, operate, maintain and inspect the product this manual refers to.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Training on the product must always be supervised by specialist technical personnel.

### 2.4 Consequences and risks caused by non-compliance with this operating manual

- Non-compliance with this operating manual will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices

### 2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

### 2.6 Safety information for the user/operator

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)

### 2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the actuator are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Any work on the product shall only be performed when it has been disconnected from the power supply (de-energised).
- Carry out work on the product during standstill only.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.2, Page 28)

### 2.8 Unauthorised modes of operation

Never operate the product outside the limits stated in the data sheet and in this manual.

The warranty relating to the operating reliability and safety of the product supplied is only valid if the product is used in accordance with its intended use.

### 3 Transport/Storage/Disposal

#### 3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify or the supplying dealer and the insurer about the damage in writing immediately.

#### 3.2 Transport

|   |   |
|---|---|
|  | <b>CAUTION</b>  |
|   | <p><b>Impacts against the coupling when placing it in a horizontal or vertical position</b><br/>                 Damage to the coupling!</p> <p>▷ Place a suitable support underneath the coupling half when placing it in a horizontal or vertical position.</p> |

Transport the actuator carefully and in its original packaging. Avoid damaging the coating.

#### 3.3 Storage/preservation

If commissioning is to take place some time after delivery, we recommend that the following measures be taken:

**Table 3:** Ambient conditions for storage

| Ambient condition        | Value            |
|--------------------------|------------------|
| Storage temperature EA-B | -40 °C to +80 °C |
| Storage temperature EA-C | -20 °C to +80 °C |
| Humidity                 | 5 % to 95 % rH   |

- Well-ventilated
- Dry
- Dust-free
- Shock-free
- Vibration-free

#### 3.4 Disposal/recycling

Due to some components, the product is classified as special waste.

1. Dismantle the product.
2. Separate and sort the materials, e.g. by:
  - Metals
  - Plastics
  - Electronic waste
  - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner. PCBs, power electronics, capacitors and electronic components are all hazardous waste.

## 4 Description

### 4.1 General description

- Electric actuator for the automation of a control valve

The electric actuators are installed in industrial plants and power plants for actuating control valves and shut-off valves. They provide high actuating forces at short actuating times.

#### Versions

##### Continuous-action actuator versions 24 V AC/DC, 230 V AC including actuator version 24 V AC 3-point

**Variable speed actuator control**

- 24 V DC motor, controlled by pulse-width modulation (PWM)
- Absolute-coded feedback via precision potentiometer
- Positioning function
- Active feedback function
- Automatic commissioning
- Comprehensive diagnosis options

**Parameterisation by software**

- Actuator functions can be adapted to a wide variety of process conditions by means of current and voltage monitoring.
- Setting of valve-specific details
- Setting of actuating force and actuating moment
- Setting of stroke and actuating speed
- Configuration of messages
- Freely programmable characteristic curve corrections

##### 3-point actuators 230 V AC

- The actuator can be set by limit switches in opening direction and closing direction.
- Torque transmission via soft-seated valve disc/plug in closing direction.
- 2 limit switches for visualising the limit positions included as standard

### 4.2 Designation

**Example: EA-C 80**

**Table 4:** Designation key

| Code | Description                                       |
|------|---|
| EA-C | Type series                                       |
| 80   | Actuator size and maximum actuating force of 8 kN |

### 4.3 Name plate

The main control valve data is given on the name plate fitted on the actuator housing.

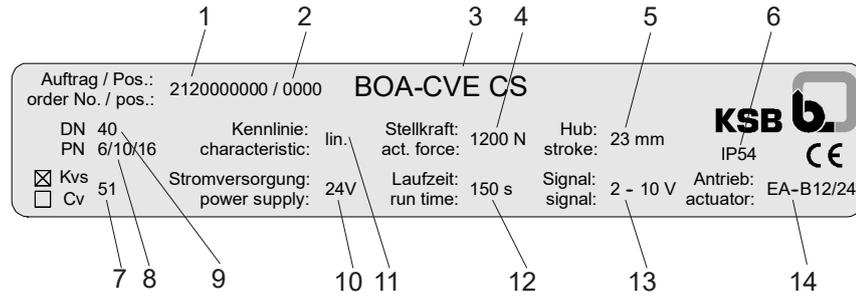


Fig. 1: Name plate example for BOA-CVE CS

|    |                      |    |                        |
|----|----------------------|----|------------------------|
| 1  | Order number         | 2  | Order item number      |
| 3  | Product name         | 4  | Actuating force [N]    |
| 5  | Actuator stroke      | 6  | Enclosure              |
| 7  | Kvs value            | 8  | Nominal pressure class |
| 9  | Nominal size (DN)    | 10 | Power supply           |
| 11 | Characteristic curve | 12 | Runtime                |
| 13 | Actuating signal     | 14 | Actuator size          |

#### 4.4 Design details

##### Operating modes

- IEC 34-1, 8: S2 for short-time duty
- IEC 34-1, 8: S4 for control duty

##### Actuating force

1 kN to 140 kN

##### Actuating speed<sup>1)</sup>

- Continuous-action actuation: 0.2 mm/s to 1.3 mm/s
- 3-point actuation: 0.45 mm/s to 1.4 mm/s

##### Enclosure

- EA-B 10: IP54 to EN 60529
- EA-C 20: IP65 to EN 60529
- EA-C 40: IP65 to EN 60529
- EA-C 80: IP65 to EN 60529
- EA-C 140: IP67 to EN 60529

<sup>1</sup> Depending on the actuator type

## Design

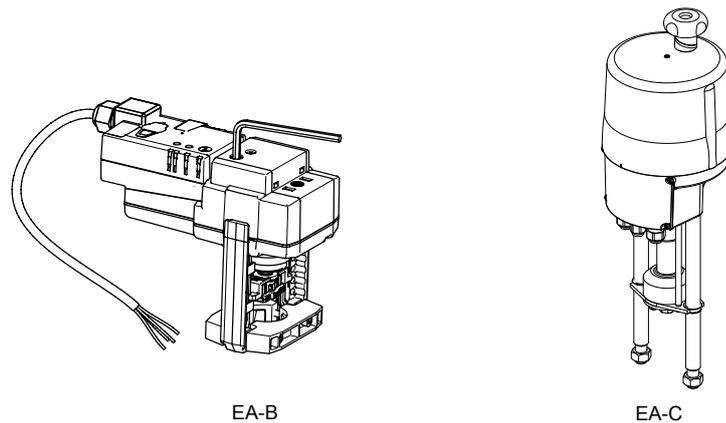


Fig. 2: Design types EA-B and EA-C

- Configurable, microprocessor-controlled actuators
  - Supply voltage: 24 V AC/DC, 230 V AC
  - Position setpoint: 4 - 20 mA, 0/2 - 10 V
  - Actual-position feedback: 4 - 20 mA, 0/2 - 10 V
  - Limit switching is torque-dependent in closing direction and stroke-dependent in opening direction.
- 3-point actuators
  - Supply voltage: 230 V AC
  - Actual-position feedback value: 2 limit switches
  - Stopping via limit switches in closing direction and opening direction
- Actuating time between 23 and 150 seconds, depending on the stroke
- Operating data stored in permanent memory
- After a power failure, operation is resumed in accordance with the operating data.

## Variants for type EA-C

- Actuator configured to match the order specification
- Integrated process controller
- Power back-up unit
- Heating of the motor space
- Local control unit
- Additional limit switch for continuous-action actuator
- Optional potentiometer for 3-point actuators
- PSPT<sup>2)</sup> for 3-point actuators

## 4.5 Function

**Function** The actuator pillars serve to mount the actuator on the valve. The motor torque is transmitted via a multistage spur gear to a spindle with trapezoidal thread. The spindle translates the torque received into axial thrust via a self-locking spindle nut. The resulting linear movement of the spindle nut is transferred to the valve stem via a coupling.

<sup>2)</sup> Optional potentiometer with printed circuit board for converting the resistance into a 4 - 20 mA output current signal (additional 24 V DC power supply required)

#### 4.6 Noise characteristics

The sound pressure level depends on the local conditions and the duty point. The value is  $\leq 35$  dB(A) for EA-B and  $\leq 70$  dB(A) for EA-C.

## 5 Installation

### 5.1 General information/Safety regulations

|   |  |
|---|--|
|    | <p><b>⚠ DANGER</b></p> <p><b>Electrical connection work by unqualified personnel</b><br/>         Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Always have the electrical connections installed by a trained and qualified electrician.</li> <li>▷ Observe regulations IEC 60364.</li> </ul>  |
|    | <p><b>⚠ DANGER</b></p> <p><b>Work performed on an energised terminal box</b><br/>         Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Switch off the power supply at least 5 minutes prior to commencing work and ensure that it cannot be switched on again unintentionally.</li> </ul>   |
|   | <p><b>⚠ WARNING</b></p> <p><b>Incorrect connection to the mains</b><br/>         Damage to the mains network, short circuit!</p> <ul style="list-style-type: none"> <li>▷ Observe the technical specifications of the local energy supply companies.</li> <li>▷ Inspect the power cable for visible damage.</li> <li>▷ Never connect damaged power cables.</li> </ul>      |
|  | <p><b>NOTE</b></p> <p>The power cables must be designed for the maximum power input of the equipment and comply with the IEC 227 and IEC 245 standards.</p>  |
|  | <p><b>NOTE</b></p> <p>Yellow/green conductors must be connected to earth terminals only.</p>   |
|  | <p><b>NOTE</b></p> <p>When running the cables through the actuator cable glands make sure to observe the minimum bending radius for the cables.</p>  |
|  | <p><b>NOTE</b></p> <p>The building circuitry and the overcurrent protection devices must comply with standard IEC 364-4-41, Safety Class I.</p>  |
|  | <p><b>NOTE</b></p> <p>The actuators are not provided with an internal means of electrical isolation. The building circuitry must therefore be equipped with a switch or circuit breaker. This switch must be fitted close to the equipment and must be readily accessible to users. The switch must be clearly marked as being the isolating switch for the equipment.</p> |

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### 5.2 Checking prior to installation

Before beginning with the installation check the following:

- The actuator and valve are compatible.
- The valve has been prepared for the actuator to be mounted.
- The actuator cover has been removed if necessary.
  - The actuator cover has to be removed on 3-point actuators. (⇒ Section 5.6.2, Page 21)
  - The minimum wall clearance for removing the actuator cover has been ensured.

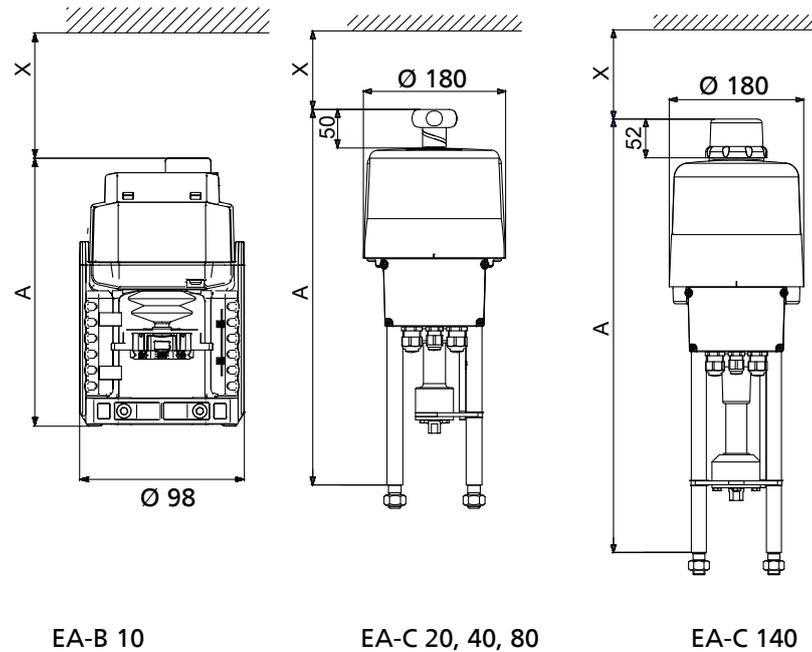


Fig. 3: Actuator with minimum wall clearance X

Table 5: Dimensions [mm]

| Type     | A     | Minimum wall clearance X |
|----------|-------|--------------------------|
| EA-B 10  | 160   | 100                      |
| EA-C 20  | 478,2 | 100                      |
| EA-C 40  | 481   | 100                      |
| EA-C 80  | 510,3 | 100                      |
| EA-C 140 | 579   | 120                      |

### 5.3 Installation position

|  |  |
|--|--|
|  | <b>CAUTION</b>   |
|  | <p><b>Incorrect installation position</b><br/>Valve function impaired!</p> <p>▷ Always observe the valve's operating manual and the permissible installation position.</p> |

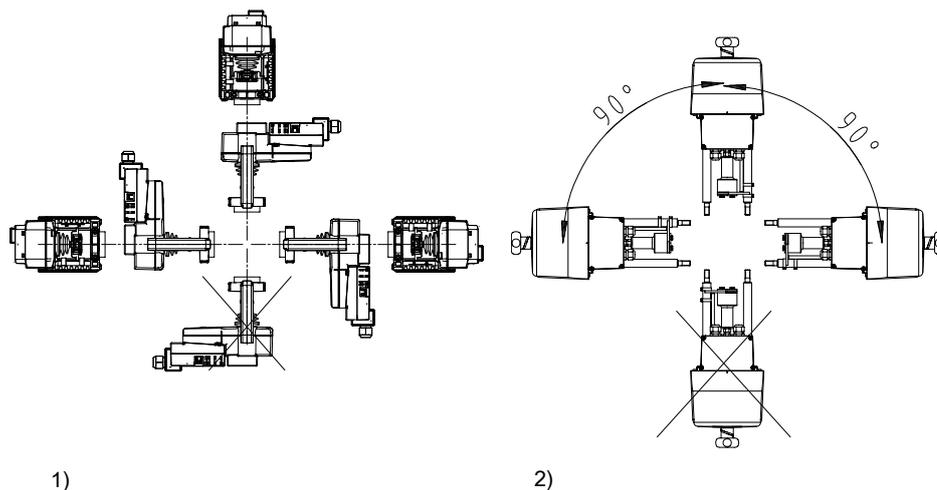


Fig. 4: Installation position depending on actuator type

|    |   |
|----|---|
| 1) | Actuator type EA-B 10 <sup>3)</sup>                               |
| 2) | Actuator types EA-C 20 to EA-C 140 and EA-C 3-point <sup>3)</sup> |

Install the actuator with sufficient clearance for removal. (⇒ Section 5.2, Page 15)

#### 5.4 Manual override

A handwheel (actuator type EA-C) or hexagon socket (actuator type EA-B) is provided for operating the actuator in the event of a power failure or for making settings when mounting the actuator on the valve. Optionally available power back-up units, if fitted, must be disconnected to allow manual operation via the handwheel.

Proceed as follows:

1. Open the terminal box cover (⇒ Section 9.3.1, Page 39) .
2. Disconnect the cable from the minus terminal (⇒ Section 5.5.2, Page 18) .
3. The actuator is supplied with 230 V AC or 24 V AC/DC.

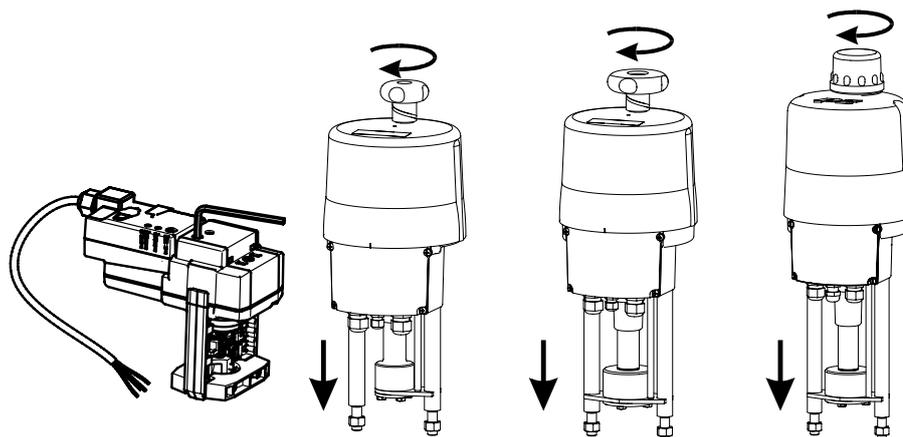


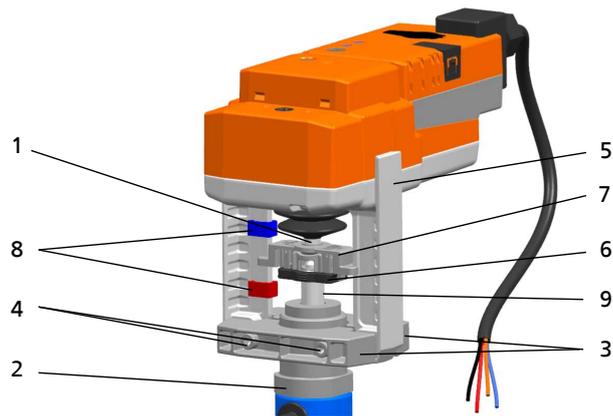
Fig. 5: Manual override for types EA-B and EA-C

<sup>3</sup> Installation of BOA-CVE IMS and BOA-CVE IMS EKB with the valve stem in a horizontal position is not allowed.

|  |   |
|--|---|
|  | <b>CAUTION</b>  |
|  | <p><b>Manual operation of actuator</b><br/>                 Damage to the actuator and the valve!</p> <p>▷ Do not operate the actuator manually when the motor is in the electric actuation mode. The actuator will try to compensate for the deviation in position, depending on the actuation mode.</p> |
|  | <b>CAUTION</b>  |
|  | <p><b>Incorrect manual operation</b><br/>                 Damage to the actuator!</p> <p>▷ Do not exceed the valve travel set at the limit switches when operating the actuator manually.</p>   |

### 5.5 Mounting actuator type EA-B 10

#### 5.5.1 Mounting the actuator



|   |                 |   |                                |
|---|-----------------|---|--------------------------------|
| 1 | Actuator stem   | 2 | Actuating bush                 |
| 3 | Clamping halves | 4 | Hexagon socket head cap screws |
| 5 | Bracket         | 6 | Locking device                 |
| 7 | Coupling        | 8 | Position indicator             |
| 9 | Valve stem      |   |                                |

Mount actuator type EA-B 10 as follows:

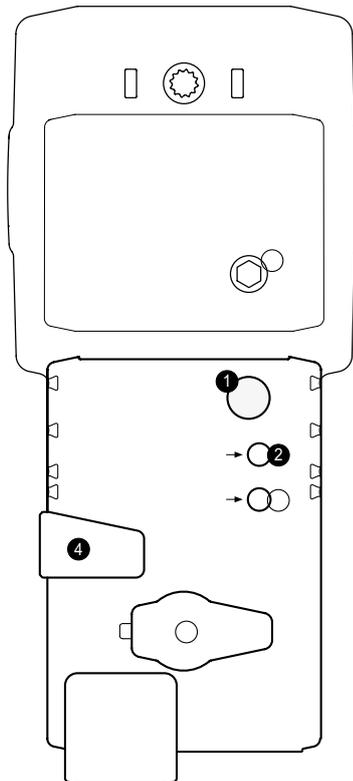
- ✓ The actuator has been de-energised.
- ✓ Retract the actuator stem (1) sufficiently.
  1. Undo the hexagon socket head cap screws (4) at the bracket (5) and slide the clamping halves (3) with the bracket screws (4) to the bracket (5) and slide the clamping halves (3) with the bracket screws (4) to the bracket (5) until the bracket is firmly seated.
  2. The actuator can be rotated on the actuating bush (2) and fastened in any position.
  3. Evenly tighten both hexagon socket head cap screws (4) to a torque of 10 Nm.
  4. Slide the locking device (6) upwards until it will not go any further, unlocking the coupling (7).

5. Using the manual override, run the actuator stem (1) in closing direction until the valve stem (9) engages in the coupling (7).
6. Slide the locking device (6) down again until it will not go any further, locking the connection between the coupling (7) and the valve stem (9).
7. Position the tabs of the position indicator (8) such that they abut the coupling (7). The position indicator (8) tabs will be moved automatically to the programmed stroke limits during the commissioning procedure.

⇒ The actuator mounting procedure is now complete.

**5.5.2 Electrical connection**

1. Use a suitable Phillips screwdriver to remove the actuator cover.
2. Below the actuator cover you will find the terminals for connecting the cables as well as the control elements S1, S2, S3 and the LED display H1.
3. By means of the S3 slide switches or the S1 and S2 pushbuttons the actuator can easily be adjusted to the requirements at the site. (S3.1 Direction of valve travel S3.2 Closing point of the valve)
4. The terminals have to be connected as shown in the connection diagram. (⇒ Section 5.6.2, Page 21)



**Fig. 6:** Display/indicator and operating elements

**Table 6:** Control elements for connection

| Control elements | Status         | Description  |
|------------------|----------------|--|
| H1 LED           | Steady green   | Actuator is working properly                                   |
|                  | Flashing green | <b>Test run</b> or adjustment with synchronisation in progress |
|                  | Steady red     | <b>Fault</b> , adjustment must be repeated                     |

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| Control elements | Status                         | Description  |
|------------------|--------------------------------|--|
| H1 LED           | Flashing red                   | <b>Power loss (&gt; 2 seconds); the next time the valve closes</b> synchronisation will automatically be effected for the closing point found and the LED will change from flashing red to steady green. |
| S1 pushbutton    |                                | The control valve covers its programmed travel; it is checked whether both travel limits (H = 0 % and H = 100 %) are reached.  |
| S2 pushbutton    |                                | The programmed valve travel is recorded as 100 % travel and stored in the microcontroller. The actuating signal and the runtime are matched to this 100 % travel.  |
| S3.1 switch      | Position OFF (factory setting) | 0 % actuating signal means 0 % travel.   |
|                  | Position ON                    | 100 % actuating signal means 0 % travel.   |
| S3.2 switch      | Position OFF (factory setting) | Linear characteristic  |
|                  | Position ON                    | Equal-percentage characteristic  |

### 5.6 Mounting actuator type EA-C 20 to 140

#### 5.6.1 Fitting the actuator

- ✓ The actuator has been de-energised.
  - ✓ The actuator is in the middle position.
1. Unscrew the four hexagon head bolts (8) from the actuator coupling (1).
  2. Slide the coupling disc (6) over the end of the stem (7).
  3. Screw the torque-transmitting element (4) onto the stem (7) and secure with the grub screw (5).
  4. Place the spacer (3) onto the torque-transmitting element (4).
  5. Insert the actuator into the actuator flange (9) holes via the actuator pillars (2) in such a way that the pre-assembled stem (7) components are guided into the actuator coupling (1).
  6. Tighten the four hexagon head bolts (8) and the hexagon nuts (10) of the actuator.

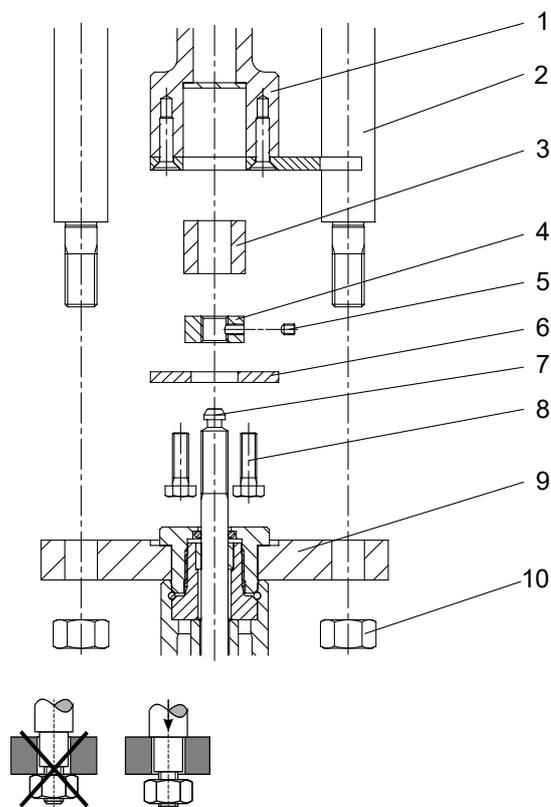


Fig. 7: Removing actuator type EA-C 20 to 140

|   |                          |    |                             |
|---|--------------------------|----|-----------------------------|
| 1 | Actuator coupling        | 2  | Actuator pillars            |
| 3 | Spacer                   | 4  | Torque-transmitting element |
| 5 | Grub screw               | 6  | Coupling disc               |
| 7 | Stem                     | 8  | Hexagon head bolts          |
| 9 | Top flange <sup>4)</sup> | 10 | Hexagon nut                 |

<sup>4</sup> Control valve flange for mounting the actuator

|  |  |
|--|--|
|  | <b>CAUTION</b>   |
|  | <p><b>Incorrect installation of actuator pillars</b><br/>Damage to the actuator!</p> <ul style="list-style-type: none"> <li>▷ Before tightening the hexagon head bolts (7) and the hexagon nuts (9) make sure that both actuator pillars are fully engaged in the holes of the valve's top flange (8).</li> <li>▷ If required, correct the actuator position using the handwheel.</li> </ul> |

**5.6.2 Electrical connection**

|  |   |
|--|---|
|  | <b>⚠ DANGER</b>   |
|  | <p><b>Electrical connection work by unqualified personnel</b><br/>Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Always have the electrical connections installed by a trained and qualified electrician.</li> <li>▷ Observe regulations IEC 60364.</li> </ul> |

|  |  |
|--|--|
|  | <b>⚠ DANGER</b>  |
|  | <p><b>Work performed on an energised terminal box</b><br/>Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Switch off the power supply at least 5 minutes prior to commencing work and ensure that it cannot be switched on again unintentionally.</li> </ul> |

|  |   |
|--|---|
|  | <b>⚠ WARNING</b>  |
|  | <p><b>Sudden start-up of the continuous-action actuator with power back-up unit after disconnection from the mains.</b><br/>Crushing of hands!</p> <ul style="list-style-type: none"> <li>▷ Disconnect the equipment from the power supply.</li> <li>▷ Secure against unauthorised start-up.</li> </ul> |

|  |   |
|--|---|
|  | <b>CAUTION</b>  |
|  | <p><b>Pressing down the actuator cover with force</b><br/>Damage to components!</p> <ul style="list-style-type: none"> <li>▷ Turn the actuator cover gently to and fro until you can feel it lock in position.</li> </ul> |

|  |   |
|--|---|
|  | <b>NOTE</b>   |
|  | <p>The terminal box has terminals for connecting solid and flexible electric cables with cross-sections from 0.14 mm<sup>2</sup> to 2.5 mm<sup>2</sup> as well as a PE terminal on the housing.</p> |

Depending on the actuator, the terminal box is located behind the terminal box cover or under the actuator cover.

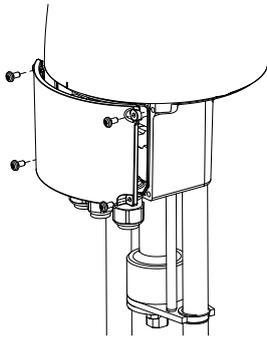


Fig. 8: Undo the screws.

**Terminal box behind the terminal box cover (on continuous-action actuators and 24 V 3-point actuators)**

- ✓ The actuator has been de-energised.
- 1. Undo and store the screws of the terminal box cover.
- 2. Remove the terminal box cover.
- 3. Unscrew the cable gland.
- 4. Choose the supply voltage and control signals in accordance with the data on the name plate.
- 5. Connect the power cable and control cable to the terminals as shown in the wiring diagram. (⇒ Section 9.3, Page 39)
- ⇒ Use separate cables for this purpose.

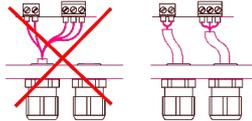


Fig. 9: Illustration of power cable and control cable

- 6. Mechanically secure the power cable and control cable before the terminals to prevent loosening.
- 7. Tighten the cable gland.
- 8. Mount the terminal box cover and fasten it with screws.
- ⇒ Only tighten the screws until resistance can be felt.

**Terminal box under the actuator cover (handwheel on top - on 230 V and 400 V 3-point actuators)**

- ✓ The actuator has been de-energised.
- 1. For EA-C 140 actuators, unscrew the protective cap.
- 2. Loosen and store the fastening screw of the handwheel.
- 3. Remove the handwheel.
- 4. For EA-C 140 actuators, loosen and store the hexagon socket head cap screws of the actuator cover.
- 5. Use both hands to gently lift off the actuator cover.
- 6. Unscrew the cable gland.
- 7. Choose the supply voltage and control signals in accordance with the data on the name plate.
- 8. Connect the power cable and control cable to the terminals as shown in the wiring diagram. (⇒ Section 9.3, Page 39)
- ⇒ Use separate cables for this purpose.



Fig. 10: Removing the protective cap of EA-C 140

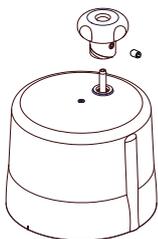


Fig. 11: Removing the fastening screw of EA-C 20 - 80

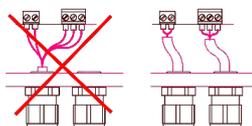


Fig. 12: Illustration of power cable and control cable

- 9. Mechanically secure the power cable and control cable before the terminals to prevent loosening.
- 10. Tighten the cable gland up to one full turn.
- 11. A thin coat of grease may be applied to the joint ring to facilitate fitting of the actuator cover.
- 12. Properly place the joint ring in the groove of the housing.

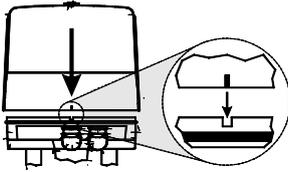


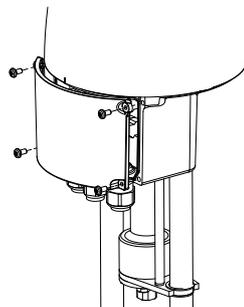
Fig. 13: Markings on actuator cover / housing

13. Slip the actuator cover over the handwheel shaft.
14. Observe the marking.
15. Do not press down the actuator cover by force. Turn the actuator cover gently to and fro until you can feel it lock in position.
16. Slide the actuator cover over the joint ring as far as it will go. When properly seated, the actuator cover cannot be turned any more, and its lower edge is flush with the housing edge.
17. Mount the handwheel on the handwheel shaft until it has seated. Secure the handwheel with the fastening screw onto the flattened area of the shaft.
18. Fasten the actuator cover with the screws.
19. For EA-C 140 actuators, tighten the protective cap.
20. Tighten the cable gland.

5.6.3 Mains connection

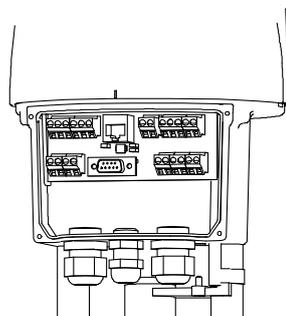
|  |   |
|--|---|
|  | <p><b>⚠ DANGER</b></p>  |
|  | <p><b>Unintentional contact with live parts</b><br/>                 Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ De-energise the mains connection.</li> <li>▷ Take steps to ensure that the mains connection cannot be re-energised unintentionally.</li> </ul> |
|  | <p><b>CAUTION</b></p>   |
|  | <p><b>Improper electrical connection</b><br/>                 Damage to the actuator!</p> <ul style="list-style-type: none"> <li>▷ Check the type of current and voltage of the mains.</li> <li>▷ Observe the wiring diagrams.</li> </ul>   |

Table 7:



Open the terminal box.

The terminal box has terminals for connecting solid and flexible electric cables with cross-sections from 0.14 mm<sup>2</sup> to 2.5 mm<sup>2</sup> as well as a PE terminal on the housing.



Connect the power cable and control cable to the appropriate terminals as shown in the wiring diagram.

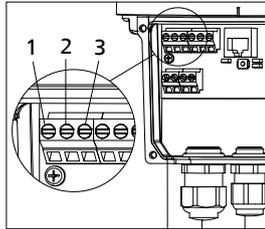
### 5.6.4 Interfaces

The EA-C actuator is provided with several interfaces in the terminal box which can be configured using the parameterisation software.

**Communication and parameterisation**

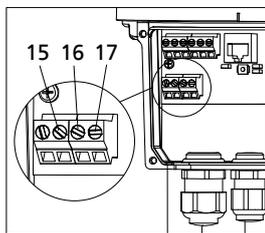
For communication with and parameterisation by a PC, the communication cable must be plugged into the RJ45 socket. The actuator parameters can be set using the parameterisation software.

**Inputs Galvanically isolated setpoint input**



The parameterisable setpoint for closed-loop control is supplied to terminals 1 to 3 via 4-20 mA or 0/2-10 V signals.

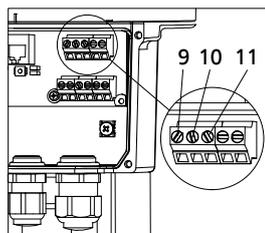
**Actual process value for process controller (optional)**



Terminals 15 to 17 serve to connect the parameterisable actual process value via 4-20 mA or 0/2-10 V signals supplied by the process sensor, if the optional process controller in the actuator is used.

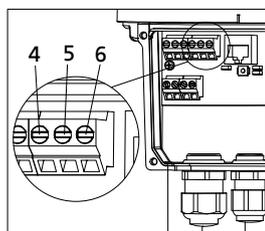
|   |             |
|---|-------------|
|   | <b>NOTE</b> |
| <p>The binary inputs described below take priority over the setpoint supplied: If the actuator parameters are set for closed-loop control, the actuator will not follow the setpoint supplied as long as binary signals are received. Only after the signal has been removed will the actuator return to the position stipulated by the setpoint.</p> |             |

**Galvanically isolated binary inputs**



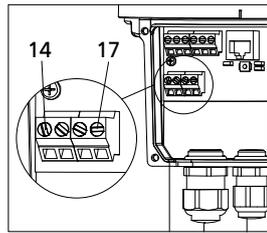
The binary Open/Close signals are connected to terminals 9 to 11. These inputs are supplied with 24 V AC/DC as standard (see wiring diagram). The actuator is operated in open-loop control mode in this configuration.

**Outputs Continuous actual-position feedback**



Terminals 4 to 6 can be used for transmitting the parameterisable actual-position value as a 4-20 mA or 0/2-10 V signal.

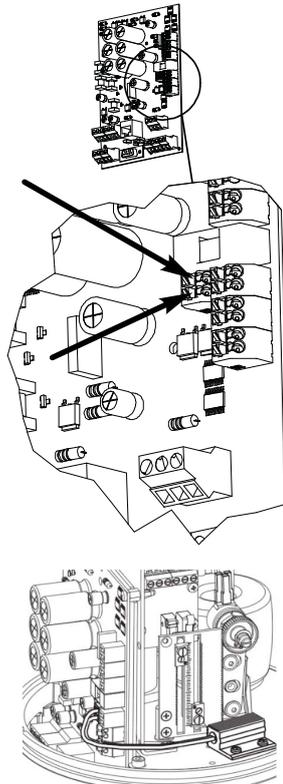
**Power supply for process sensor (optional)**



Terminals 14 and 17 supply 24-30 V DC unregulated voltage, 100 mA max., for powering an optional process controller.

**5.6.5 Heating resistor (optional)**

On option, a heating resistor can be installed to heat the actuator's terminal compartment. If actuators are used outdoors, in environments with highly fluctuating ambient temperatures or high atmospheric humidity, condensation will form inside the actuators. A heating resistor helps to prevent condensation.



The heating resistor inside the actuator is powered by the actuator's power supply, i.e. separate mains connection is not required. When retrofitting the heating resistor, connect it to the terminals on the mainboard as shown.

Mount the heating resistor on the mounting plate in the position shown, using the screws supplied. The internal cable must be routed in such a way that it can neither be crushed by the actuator cover seal nor come into contact with moving components.

**5.6.6 Limit switching**

**5.6.6.1 Continuous-action actuators**

Limit switching of the EA-C actuator is software-controlled and optimally adapted to the valve characteristic.

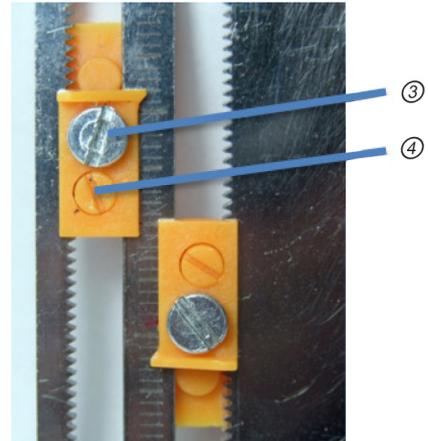
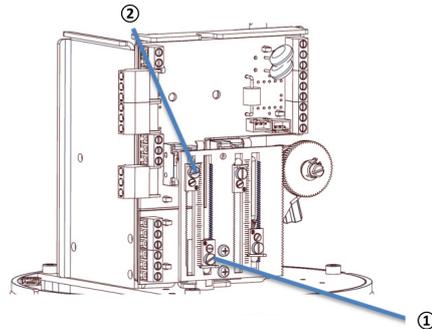
The actuator generates the set maximum torque every time it is actuated to its limit position. If the limit position inside the valve has shifted (due to temperature change), the actuator - within its stroke range - will adjust the closing point accordingly.

Additional limit switches are designed and fitted as volt-free changeover contacts. They are used for signalling valve disc positions.

### 5.6.6.2 230 V, 3-point actuators

The standard limit switches of the actuator serve to stop the motor when the limit positions have been reached.

1. Loosen the locking screw of the corresponding switching cam.
2. Turn the gear screw to move the switching cam towards the limit switch until you hear the switch click.
3. Tighten the locking screw again.
4. Verify the setting by running the actuator to the limit position again. Re-adjust the switching cam if necessary.

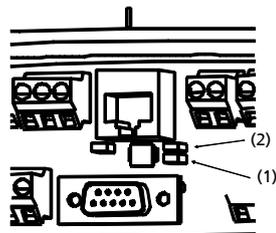


|   |                            |   |                            |
|---|----------------------------|---|----------------------------|
| ① | Stem nut retracting (Open) | ② | Stem nut extending (Close) |
| ③ | Locking screw              | ④ | Gear screw                 |

### 5.6.7 Operation

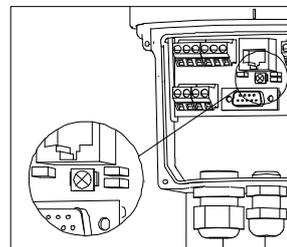
Operation status indication/  
Operating elements

Status LEDs inside the terminal box



Inside the terminal box, a red (1) and a green (2) LED indicate the operation and fault status, respectively.

Commissioning button



A commissioning button is provided inside the terminal box for starting the automatic procedure adjusting the actuator to the straight-way valve.

|  |  |
|--|--|
|  | <b>CAUTION</b>   |
|  | <p><b>Incorrect operation of commissioning button</b><br/>Failure of button function!</p> <p>▷ Light pressure on the pushbutton is sufficient to operate it. Do not apply excessive pressure with sharp-edged objects.</p> |

All internal parameters such as the motor torque required, the actual position and the actuator's operating status are monitored continuously during operation so that the actuator is positioned with maximum accuracy and the valve closed correctly at all times.

## 6 Commissioning/Start-up/Shutdown

### 6.1 Prerequisites for commissioning/start-up

|   |   |
|---|---|
|  | <p><b>NOTE</b></p> <p>Never operate the actuator electrically or pneumatically before it has been mounted onto a valve.</p> |
|---|---|

Before commissioning/starting up the actuator, make sure the following conditions are met:

- The actuator has been properly mounted and positioned
- Make sure that the operating conditions correspond to the data specified and those provided on the name plate.
- All fastening bolts, connecting elements, and electrical connections have been properly tightened to the specified tightening torques.
- Implement all measures preventing accidental contact with moving and live parts.
- For the preconditions to be met prior to commissioning optional add-on parts refer to the operating manuals of the corresponding accessories.

### 6.2 Commissioning/Start-up

#### 6.2.1 Automatic commissioning of EA-B actuators

At first power-up, the actuator will operate in line with the default operating data configured prior to delivery.

No additional settings are required to be made for putting an actuator into service that has been mounted to the straight-way valve at the factory. After power-up, LED H1 will initially be flashing red until synchronisation has been completed.

Synchronisation serves to match actuator operation to minor installation-induced variations. It is effected automatically once the actuator, following its actuating signal, reaches the Closed position (background synchronisation). If required, synchronisation can also be started manually after power-up by using the T2 pushbutton.

For this purpose, undo the two cross recessed head screws and remove the actuator cover, exposing the actuator's PCB with the LED H1, two pushbuttons and two slide switches, which allow simple checking of the actuator's functions.

#### 6.2.2 Automatic commissioning of EA-C actuators (continuous-action and 24 V AC/DC 3-point actuators)

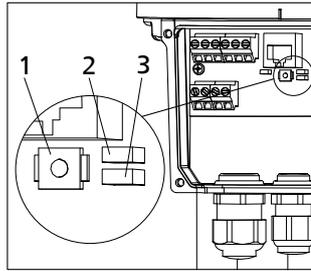
The actuator is delivered in "initialised" mode and the green LED is lit. In this mode the actuator responds to the setpoint supplied or to other operating commands.

If the actuator has been replaced, automatic commissioning must be performed.

Power supply must not be interrupted during commissioning.

If the actuator stroke is blocked during commissioning before the actuator has reached a set stroke-dependent limit position, the value reached will be saved.

If no torque limit is found during commissioning, or the stroke determined is below the permissible minimum stroke of 5 mm, commissioning is aborted. The actuator returns to the "non-initialised" state, which is indicated by the green LED flashing slowly. This will also happen if the actuator has not been initialised correctly.



**Fig. 14:** Commissioning button and LEDs

|   |                      |   |           |
|---|----------------------|---|-----------|
| 1 | Commissioning button | 2 | Green LED |
| 3 | Red LED              |   |           |

- ✓ Check whether the terminal box cover or the actuator cover needs to be removed, see the selection table.
- 1. Remove the terminal box cover or the actuator cover, depending on the design. (⇒ Section 5.6.2, Page 21)
- 2. Press and hold the commissioning button (1) inside the terminal box for 3 seconds.
- 3. The initialisation process starts, the green LED (2) flashes and the actuator completes a full cycle between the set limit positions.
- 4. The green LED (2) lights up continuously.
  - ⇒ The actuator has now been commissioned and is ready for operation.
- 5. Close the actuator cover or the terminal box cover, depending on the design. (⇒ Section 5.6.2, Page 21)

**6.2.3 Mechanical commissioning of 3-point actuators**

- ✓ Check whether the terminal box cover or the actuator cover needs to be removed, see the selection table.
- 1. Remove the terminal box cover or the actuator cover, depending on the design. (⇒ Section 5.6.2, Page 21)
- 2. Use the handwheel to move the actuator to the middle of the valve travel.
- 3. Operate the actuator in both directions using the actuating signals until the respective limit switches stop the actuator.
- 4. If limit switching is not correct, re-adjust the limit switches.
- 5. The green LED (2) is lit.
- 6. Close the actuator cover or the terminal box cover, depending on the design. (⇒ Section 5.6.2, Page 21)

**6.3 Operating limits**

**6.3.1 Ambient temperature**

Observe the following parameters and values during operation:

**Table 8:** Permissible ambient temperatures

| Ambient condition            | Value            |
|------------------------------|------------------|
| Ambient temperature for EA-B | 0 °C to +50 °C   |
| Ambient temperature for EA-C | -10 °C to +60 °C |
| Humidity                     | 5 % to 95 % rH   |

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## 6.4 Shutdown

### 6.4.1 Measures to be taken for shutdown

1. Disconnect the equipment from the power supply.
  - ⇒ If a power back-up unit is fitted, the stem moves into the set limit position.
2. Secure against unauthorised start-up.
  - ⇒ If a power back-up unit is fitted, allow the capacitors to fully discharge before further work is done. The discharge time is 3 hours.

### 6.5 Returning to service

After maintenance work has been carried out on the actuator and/or valve during which the stem coupling and disc spring stack were dismantled, the following must be observed after proper reassembly.

- An initialisation run must always be performed for continuous-action actuators. (⇒ Section 6.2.2, Page 28)
- The limit switches of 3-point actuators must be checked.

## 7 Servicing/Maintenance

### 7.1 Safety regulations

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

|   |  |
|---|--|
|  |  <b>WARNING</b>   |
|   | <p><b>Unintentional starting of the actuator</b><br/>Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Always make sure the electrical connections are de-energised before carrying out work on the actuator. Ensure that the main circuits as well as the supplementary and auxiliary circuits are de-energised.</li> <li>▷ Mind the capacitor discharge time. After switching off the frequency inverter, wait 10 minutes until dangerous voltages have discharged.</li> <li>▷ Ensure that the actuator cannot be switched on unintentionally.</li> </ul> |

|   |  |
|---|--|
|  |  <b>WARNING</b>   |
|   | <p><b>Insufficient stability</b><br/>Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> <li>▷ Secure the actuator against tilting or tipping over during installation/dismantling.</li> </ul> |

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the actuator with a minimum of maintenance expenditure and work.

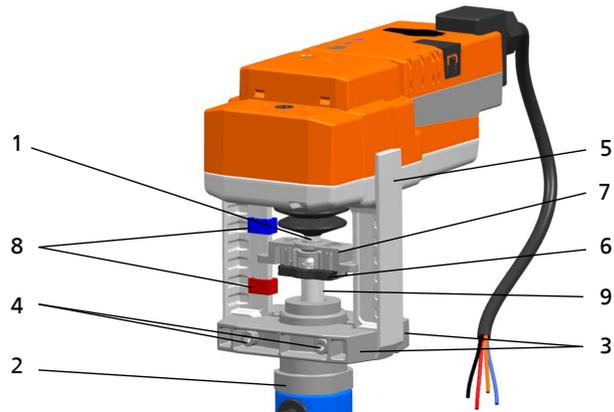
|   |  |
|---|--|
|  | <b>NOTE</b>  |
|   | <p>All maintenance work, service work and installation work can be carried out by Service or authorised workshops.</p> |

Never use force when dismantling and reassembling the actuator.

### 7.2 Removing the actuator

#### 7.2.1 Removing type EA-B 10

- ✓ The actuator has been de-energised.
1. Slide the locking device (6) up until it will not go any further, unlocking the connection between the coupling (7) and the valve stem (9).
  2. Undo the fastening nuts (4) from the clamping hoop (6).
  3. Pull the actuator off towards the top.



|   |                 |   |                                |
|---|-----------------|---|--------------------------------|
| 1 | Actuator stem   | 2 | Actuating bush                 |
| 3 | Clamping halves | 4 | Hexagon socket head cap screws |
| 5 | Bracket         | 6 | Locking device                 |
| 7 | Coupling        | 8 | Position indicator             |
| 9 | Valve stem      |   |                                |

7.2.2 Removing type EA-C 20 to 140

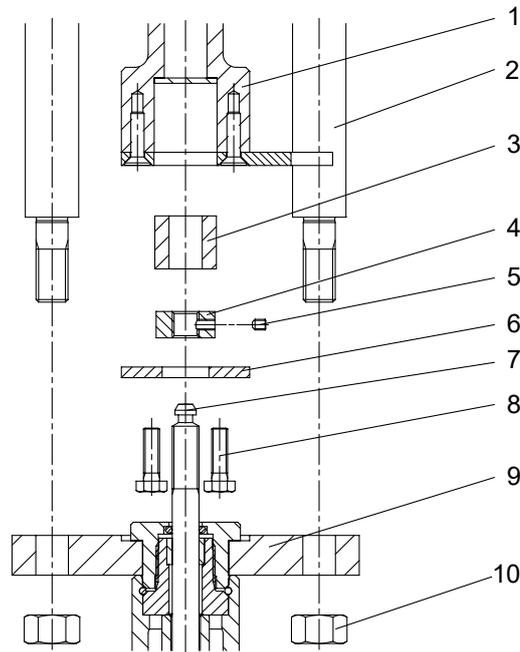


Fig. 15: Removing actuator type EA-C 20 to 140

|   |                   |   |                             |
|---|-------------------|---|-----------------------------|
| 1 | Actuator coupling | 2 | Actuator pillars            |
| 3 | Spacer            | 4 | Torque-transmitting element |
| 5 | Grub screw        | 6 | Coupling disc               |

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|   |                          |    |                    |
|---|--------------------------|----|--------------------|
| 7 | Stem                     | 8  | Hexagon head bolts |
| 9 | Top flange <sup>5)</sup> | 10 | Hexagon nut        |

- ✓ The actuator has been de-energised.
- ✓ The power back-up unit of continuous-action actuators has been disconnected separately.
- 1. Depending on the actuator, remove the actuator cover or terminal box cover. (⇒ Section 5.6.2, Page 21)
- 2. Disconnect the power cable and the control cable from the terminals.
- 3. Undo the hexagon nuts (10).
- 4. Fully undo the hexagon head bolts (8).
- 5. Use the handwheel to move the actuator coupling (1) into its top starting position.
- 6. Fully undo the hexagon nuts (10). Pull the actuator pillars (2) out of the actuator flange holes<sup>5)</sup> (9).

### 7.3 Maintenance/inspection

The actuators are maintenance-free.

### 7.4 Lubrication

The gearing is lubricated for life and does not need to be relubricated.

The moving parts such as the stem and the coupling nut must be lubricated using standardised lubricants to DIN 51825.

### 7.5 Cleaning

|   |   |
|---|---|
|  | <b>CAUTION</b>  |
|   | <p><b>Improper cleaning of actuators</b></p> <p>Damage to the actuator covers!</p> <ul style="list-style-type: none"> <li>▷ Clean the actuators in dry condition only.</li> <li>▷ Do not use solvents.</li> <li>▷ Use a soft cloth.</li> <li>▷ Do not use abrasive substances.</li> </ul> |

### 7.6 Mounting the actuator

After maintenance / inspection, the actuator must be mounted back onto the valve. Connect the power cable and the control cable. Mechanically secure them before the terminals to prevent loosening. (⇒ Section 5.6.2, Page 21) For returning the actuator to service after maintenance and mounting, see (⇒ Section 6.5, Page 30) .

### 7.7 Spare parts stock

In the case of damage and malfunction, a full replacement is recommended.

<sup>5)</sup> Control valve flange for mounting the actuator

## 8 Trouble-shooting

### 8.1 Display of EA-B actuators

The LED display shows the current status of the actuator using two colours (red/green).

Table 9: LED display H1

| Display | Status                               | Possible cause  | Remedy  |
|---------|--------------------------------------|---|---|
| H1 LED  | Steady green                         | The actuator is working properly.   |   |
|         | Flashing green                       | Test or adjustment in progress.   |   |
|         | Steady red                           | A fault has occurred.   | Possible causes: <ul style="list-style-type: none"> <li>▪ Actuator mounted incorrectly</li> <li>▪ Valve stem blocked</li> <li>▪ No valve mounted</li> </ul> After the fault has been remedied, adjustment has to be repeated using switch S2. |
|         | Flashing red                         | Every time a voltage interruption (> 2 seconds) has occurred. The next time the valve closes synchronisation is automatically effected for the selected closing point. The LED will change from flashing red to steady green. |   |
|         | Alternating red/green flashing light | Addressing via process control system and activation via adjustment pushbutton S2 in progress.  |   |

### 8.2 Display of EA-C actuators

|  |  |
|--|--|
|  | <b>WARNING</b>   |
|  | <p><b>Improper work to remedy faults</b></p> <p>Risk of injury!</p> <p>▸ For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.</p> |

If problems occur that are not described in the following table, consultation with the service is required.

Faults are indicated by a green and a red LED inside the terminal box. To see the display, the terminal box cover or actuator cover must be removed, depending on the design. (⇒ Section 5.6.2, Page 21)

- A The red LED lights up continuously.
- B The red LED flashes rapidly.
- C The red LED flashes slowly.
- D The red LED is not lit.
- E The green LED lights up continuously.
- F The green LED flashes rapidly.
- G The green LED flashes slowly.
- H The green LED is not lit.

Table 10: Trouble-shooting statuses

| A | B | C | D | E | F | G | H | Status   | Possible cause  | Remedy                  |
|---|---|---|---|---|---|---|---|--|-----------------|-------------------------|
| - | - | - | X | - | - | - | X | Actuator does not respond; both status LEDs are off. | No power supply | Check mains connection. |

| A | B | C | D | E | F | G | H | Status   | Possible cause  | Remedy                                 |
|---|---|---|---|---|---|---|---|--|---|--|
| - | - | - | X | - | - | - | X | Actuator does not respond; both status LEDs are off.                                 | Voltage supplied does not match the supply voltage indicated on the name plate. | Apply correct supply voltage.          |
| - | - | - | X | X | - | - | - | Actuator does not cover the full valve travel.                                       | Initialisation has not been performed correctly.                                | Repeat initialisation procedure.       |
| - | - | - | X | X | - | - | - |  | Insufficient stroke has been set for stroke-dependent limit position.           | Check valve travel parameter settings. |
| - | - | - | X | X | - | - | - | Actuator does not provide correct valve shut-off.                                    | Initialisation has not been performed correctly.                                | Repeat initialisation procedure.       |
| - | - | - | X | X | - | - | - |  | Actuator's closing force / closing torque is insufficient.                      | Verify actuator selection.             |
| - | - | - | X | X | - | - | - | Actuator is in normal operating mode but does not respond to setpoint modifications. | Actuator has been configured as process controller.                             | Connect the process sensor.            |
| - | - | - | X | X | - | - | - | Actuator position does not match the setpoint supplied.                              | A non-linear characteristic has been parameterised.                             | Check parameters of characteristic.    |

Table 11: Trouble-shooting operating modes

| A | B | C | D | E | F | G | H | Operating modes                     | Possible cause | Remedy   |
|---|---|---|---|---|---|---|---|-------------------------------------|----------------|--|
| - | - | - | X | X | - | - | - | Normal operating mode               | -              | -  |
| - | - | - | X | - | X | - | - | Actuator is in initialisation mode. | -              | Initialisation mode is exited automatically upon completion. |
| - | - | - | X | - | - | X | - | Actuator has not been initialised.  | -              | Run automatic initialisation.                                |

Table 12: Trouble-shooting faults in the actuator's environment

| A | B | C | D | E | F | G | H | Faults in the actuator's environment   | Possible cause  | Remedy  |
|---|---|---|---|---|---|---|---|--|---|---|
| - | - | X | - | X | - | - | - | An excessive torque has been measured when the actuator is run to its limit positions. | Actuator has not been initialised correctly for the valve actuated.                 | Repeat initialisation procedure.  |
| - | - | X | - | X | - | - | - |  | Actuator stroke is blocked mechanically.  | Verify smooth operation of valve and actuator.  |
| - | - | X | - | X | - | - | - |  | Incorrect actuator selection  | Verify actuator selection.  |
| - | - | X | - | - | X | - | - | No or incorrect actual process value signal<br>Maximum control range is exceeded.      | No or incorrect actual process value signal   | Apply correct actual process value signal, check polarity of actual process value signal. |
| - | - | X | - | - | X | - | - |  | Actual process value not within set range   | Ensure correct actual process value.  |
| - | - | X | - | - | X | - | - |  | No signal provided by process sensor.   | Check process sensor or power supply.   |
| - | - | X | - | - | - | X | - | Actuator moves to a pre-set position.  | A signal has been applied to the fail-safe binary input.                            | Disconnect signal.  |
| - | - | X | - | - | - | X | - |  | Power supply failure on actuator with optional "accupack" rechargeable battery pack | Check power supply.   |
| - | - | X | - | - | - | - | X | Setpoint signal not applied or not within set range                                    | Setpoint signal not applied   | Apply setpoint signal.  |
| - | - | X | - | - | - | - | X |  | Incorrect polarity of setpoint signal   | Check polarity of setpoint signal.  |
| - | - | X | - | - | - | - | X |  | Setpoint signal not within the set range  | Check setpoint range.   |

7520.85/02-EN

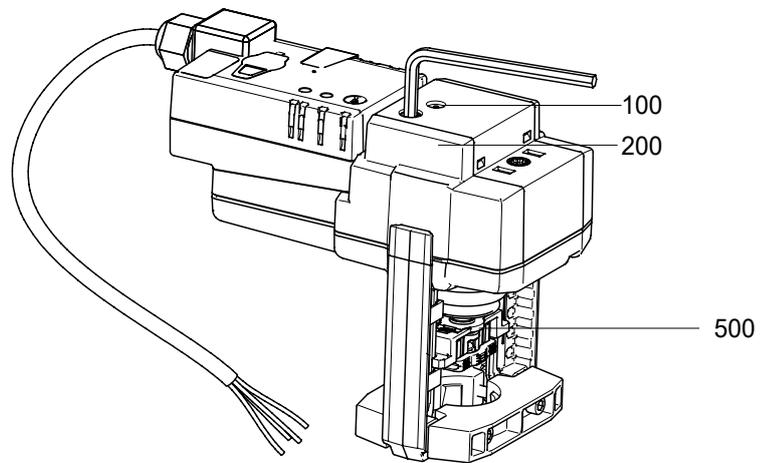
| A | B | C | D | E | F | G | H | Faults in the actuator's environment                                  | Possible cause  | Remedy                             |
|---|---|---|---|---|---|---|---|---|---|------------------------------------|
| - | X | - | - | X | - | - | - | The limit position stored during initialisation has not been reached. | Dirt deposits on valve seat or loosened valve seat  | Check valve seat.                  |
| - | X | - | - | - | X | - | - | The limit position stored during initialisation has been exceeded.    | Worn or defective valve seat  | Check valve seat.                  |
| - | X | - | - | - | - | X | - | Insufficient supply voltage in the actuator                           | Incorrect mains connection  | Check mains connection.            |
|   |   |   |   |   |   |   |   |   | Supply voltage fluctuations   | Check power supply. See data sheet |
|   |   |   |   |   |   |   |   |   | Insufficient voltage supplied by rechargeable battery (on actuator options with "accupack" rechargeable battery pack) | Contact KSB Service.               |

Table 13: Trouble-shooting actuator faults

| A | B | C | D | E | F | G | H | Actuator fault   | Possible cause   | Remedy   |
|---|---|---|---|---|---|---|---|--|--|--|
| X | - | - | - | X | - | - | - | Actuator has reached service limit.                        | Wear and/or operating hours                              | Contact KSB Service.   |
| X | - | - | - | - | X | - | - | Electronics fault / Invalid parameter data                 | Power supply has been interrupted during initialisation. | Contact KSB Service.   |
|   |   |   |   |   |   |   |   |  | Damaged electronic component                             |  |
| X | - | - | - | - | - | X | - | Critical or maximum actuator temperature has been reached. | Excessive frequency of starts                            | Check control settings.  |
|   |   |   |   |   |   |   |   |  | Ambient temperature too high                             | Check ambient temperature and reduce if possible. See data sheet |
| X | - | - | - | - | - | - | X | Mechanical actuator fault                                  | Damaged mechanical component                             | Contact KSB Service.   |

## 9 Related Documents

### 9.1 General assembly drawing of manual override EA-B 10



**Fig. 16:** General assembly drawing of manual override EA-B 10

**Table 14:** List of components

| Part No. | Description                        | Material |
|----------|------------------------------------|----------|
| 100      | Hexagon socket for manual override | Metal    |
| 200      | Actuator cover                     | Plastic  |
| 500      | Coupling                           | Plastic  |

9.2 General assembly drawing, handwheel on top (EA-C 20 to 140)

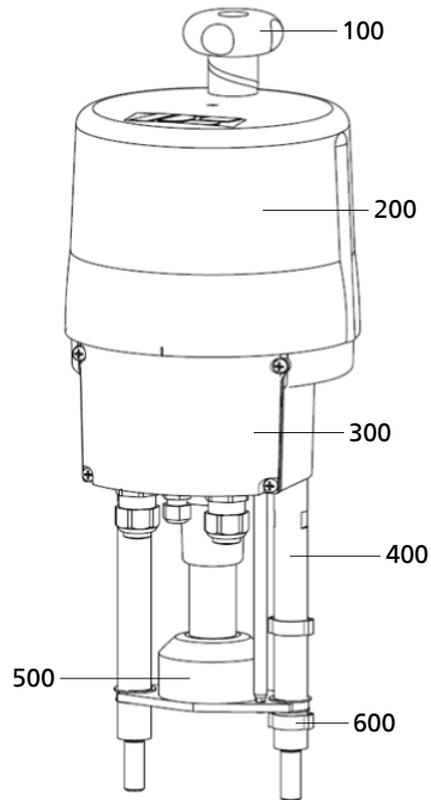


Fig. 17: General assembly drawing, handwheel on top (EA-C 20 to 140)

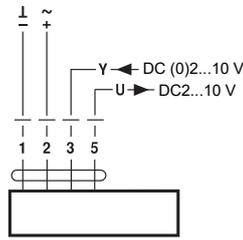
Table 15: List of components

| Part No. | Description        | Material          |
|----------|--------------------|-------------------|
| 100      | Handwheel          | Plastic           |
| 200      | Actuator cover     | Plastic/Aluminium |
| 300      | Terminal box cover | Plastic           |
| 400      | Pillars            | Steel             |
| 500      | Coupling           | Brass/PA          |
| 600      | Double-ear clamps  | Steel             |

### 9.3 Wiring diagrams

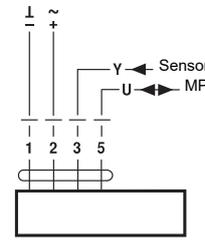
#### 9.3.1 Terminal configuration EA-B 10/24

AC/DC 24 V, continuous-action



Cable colours:  
1 = black  
2 = red  
3 = white  
5 = orange

Operation on MP bus



Cable colours:  
1 = black  
2 = red  
3 = white  
5 = orange

Fig. 18: Continuous-action actuation

#### Wiring diagram EA-B 10/24

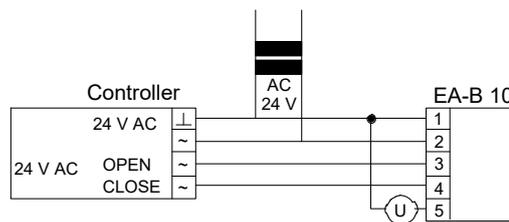


Fig. 19: 3-point actuation

#### 9.3.2 Terminal configuration EA-C 20 to 140

Table 16: Continuous-action and 3-point actuation 24 V AC/DC

| 1            | 2             | 3   | 4            | 5             | 6   | 7                             | 8  | 9      | 10 | 11      | 12                               | 13 | 14         | 15       | 16       | 17  | 18         | 19         | 20         | 21         | 22                 | 23                 |    | RJ-45 TTL  | Push button |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |
|--------------|---------------|-----|--------------|---------------|-----|-------------------------------|----|--------|----|---------|----------------------------------|----|------------|----------|----------|-----|------------|------------|------------|------------|--------------------|--------------------|----|------------|-------------|--|---|--|--|--|--|--|---|--|--|--|--|--|---|--|--|--|--|--|---|--|--|--|--|--|---|--|--|--|--|--|---|--|--|--|--|--|---|--|--|--|--|--|--|--|--|--|--|--|
| ↑            | ↑             | ↑   | ↓            | ↓             | ↓   | ↑↓                            | ↑↓ | ↑      | ↑  | ↑       | ↑                                | ↑  | ↓          | ↑        | ↑        | ↑   | ↑↓         | ↑↓         | ↑↓         | ↑↓         | ↑                  | ↑                  |    |            |             |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |
| +0(2) - 10 V | +0(4) - 20 mA | GND | +0(2) - 10 V | +0(4) - 20 mA | GND | Max. load<br>100 mA at 24 VDC |    | L OPEN | N  | L CLOSE | L (24 V AC/DC)<br>N (24 V AC/DC) |    | 24 V AC/DC | 115 V AC | 230 V AC | GND | (Optional) | (Optional) | (Optional) | (Optional) | L (see name plate) | N (see name plate) | PE | (Optional) |             |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |
| Ⓐ            |               |     | Ⓑ            |               |     |                               |    |        |    |         |                                  |    |            |          |          |     |            |            |            |            |                    |                    |    |            |             |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |
| Ⓩ            |               |     |              |               |     |                               |    | ⓓ      |    |         |                                  |    |            | ⓔ        |          |     |            |            |            |            |                    |                    |    |            |             |  | ⓕ |  |  |  |  |  | ⓖ |  |  |  |  |  | ⓗ |  |  |  |  |  | ⓙ |  |  |  |  |  | ⓚ |  |  |  |  |  | ⓛ |  |  |  |  |  | ⓜ |  |  |  |  |  |  |  |  |  |  |  |
| Ⓩ            |               |     |              |               |     |                               |    | ⓓ      |    |         |                                  |    |            | ⓔ        |          |     |            |            |            |            |                    |                    |    |            |             |  | ⓕ |  |  |  |  |  | ⓖ |  |  |  |  |  | ⓗ |  |  |  |  |  | ⓙ |  |  |  |  |  | ⓚ |  |  |  |  |  | ⓛ |  |  |  |  |  | ⓜ |  |  |  |  |  |  |  |  |  |  |  |

**i** In 3-point configuration, only the terminals in columns Ⓑ, ⓓ and ⓙ are active. ⓓ is set to 24 V AC/DC by default.

Table 17: Key

|  |  |
|--|--|
| Ⓐ Setpoint input                       | ⓙ Supply voltage: single-phase alternating current or direct current |
| Ⓑ Active actual-position feedback      | ⓚ Field bus connection (optional)                                    |
| ⓐ Volt-free fault message (optional)   | ⓛ Communication with PC  |
| ⓓ Binary control (standard 24 V AC/DC) | ⓜ Commissioning  |
| ⓔ Power failure signal <sup>6</sup>    | ⓝ Galvanically isolated 1 kV   |
| ⓕ Supply                               | ⓞ Process sensor (optional)  |
| ⓖ Actual value                         | ⓟ Limit switch, volt-free contact                                    |
| ⓗ Closed                               | ⓠ Supply voltage: three-phase current                                |
| ⓙ Open                                 |  |

<sup>6</sup> Optional connections for external power back-up unit

9.3.3 Terminal configuration EA-C 20 to 140, 230 V AC

Table 18: Continuous-action actuation, 230 V AC

|              |               |     |              |               |     |                  |           |        |    |         |                |                |                  |              |               |     |            |            |            |            |                    |                    |    |            |              |                     |   |
|--------------|---------------|-----|--------------|---------------|-----|------------------|-----------|--------|----|---------|----------------|----------------|------------------|--------------|---------------|-----|------------|------------|------------|------------|--------------------|--------------------|----|------------|--------------|---------------------|---|
| 1            | 2             | 3   | 4            | 5             | 6   | 7                | 8         | 9      | 10 | 11      | 12             | 13             | 14               | 15           | 16            | 17  | 18         | 19         | 20         | 21         | 22                 | 23                 |    |            | RJ-45<br>TTL | Push-<br>butto<br>n |   |
| ↑            | ↑             | ↑   | ↓            | ↓             | ↓   | ↑↓               | ↑↓        | ↑      | ↑  | ↑       | ↑              | ↑              | ↓                | ↑            | ↑             | ↑   | ↑↓         | ↑↓         | ↑↓         | ↑↓         | ↑                  | ↑                  |    |            |              |                     |   |
| +0(2) - 10 V | +0(4) - 20 mA | GND | +0(2) - 10 V | +0(4) - 20 mA | GND | 100 mA at 24 VDC | Max. load | L OPEN | N  | L CLOSE | L (24 V AC/DC) | N (24 V AC/DC) | 24 V DC / 100 mA | +0(2) - 10 V | +0(4) - 20 mA | GND | (Optional) | (Optional) | (Optional) | (Optional) | L (see name plate) | N (see name plate) | PE | (Optional) |              |                     |   |
| Ⓐ            |               |     |              | Ⓑ             |     | Ⓒ                |           |        | Ⓓ  |         | Ⓔ              |                | Ⓕ                |              | Ⓖ             |     |            | Ⓗ          |            | Ⓙ          |                    | Ⓚ                  |    | Ⓛ          | Ⓚ            | Ⓛ                   | Ⓜ |
| Ⓝ            |               |     |              |               |     | Ⓞ                |           |        |    |         |                | Ⓟ              |                  |              |               |     |            |            |            |            |                    |                    |    |            |              |                     |   |

**i** In continuous-action configuration, only the terminals in columns Ⓐ, Ⓑ and Ⓚ are active.

Table 19: Key

|   |                                      |   |                                 |
|---|--------------------------------------|---|---------------------------------|
| Ⓐ | Setpoint input                       | Ⓚ | Open                            |
| Ⓑ | Active actual-position feedback      | Ⓛ | Power supply                    |
| Ⓒ | Volt-free fault message (optional)   | Ⓜ | Field bus connection (optional) |
| Ⓓ | Binary control (standard 24 V AC/DC) | Ⓛ | Communication with PC           |
| Ⓔ | Power failure signal                 | Ⓜ | Commissioning                   |
| Ⓚ | Supply                               | Ⓝ | Galvanically isolated 1 kV      |
| Ⓛ | Actual value                         | Ⓞ | Process sensor (optional)       |
| Ⓜ | Closed                               | Ⓟ | Limit switch, volt-free contact |

3-point actuation, 230 V AC

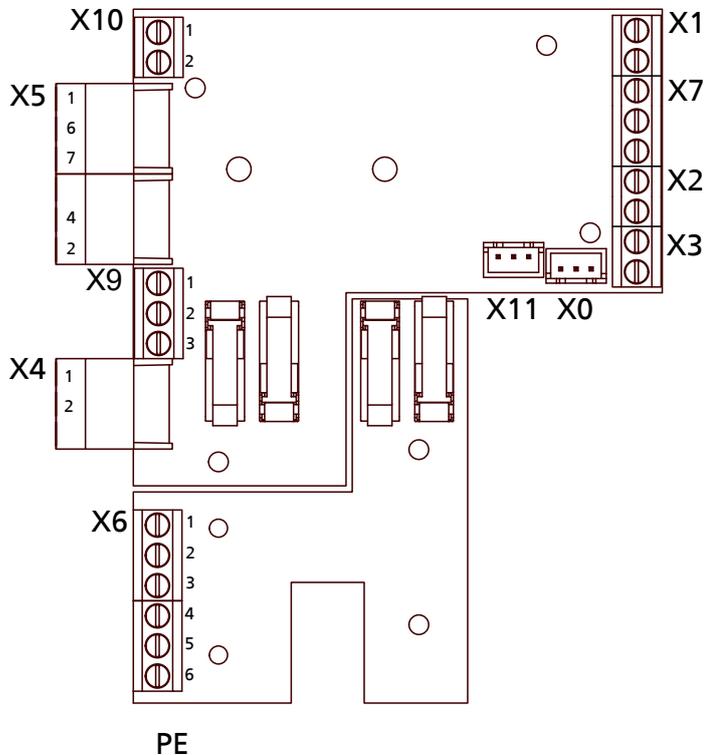
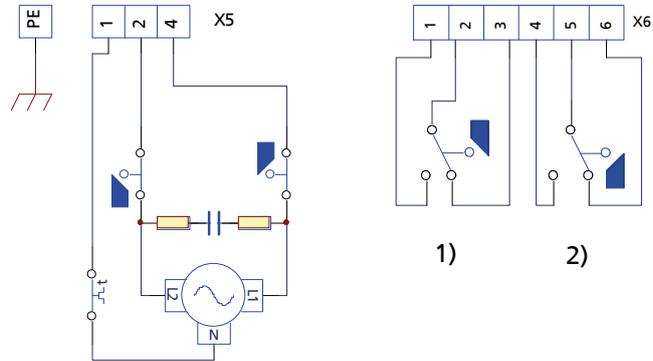


Fig. 20: Terminal configuration on printed circuit board

|    |                 |
|----|-----------------|
| X1 | Internal wiring |
| X2 | Internal wiring |
| X3 | Internal wiring |
| X4 | Potentiometer 1 |

|               |                                     |
|---------------|-------------------------------------|
| X5/1          | Neutral                             |
| X5/2          | Motor phase to open                 |
| X5/4          | Motor phase to close                |
| X5/6 and X5/7 | Thermal switch as volt-free contact |
| X6            | Additional limit switches           |
| X7            | Not used                            |
| X8            | Heating resistor                    |
| X9            | Potentiometer 2                     |
| PE            | Earth connection on housing         |



Terminal configuration of power supply

Terminal configuration of additional limit switches

|    |        |    |      |
|----|--------|----|------|
| 1) | Closed | 2) | Open |
|----|--------|----|------|

## 9.4 Technical data

### 9.4.1 Operating data of EA-B 10

**Table 20:** Operating data of EA-B 10 (24 V AC)

|                                 |        |                           |
|---------------------------------|--------|---------------------------|
| Actuating force                 | [N]    | 1000                      |
| Stroke                          | [mm]   | 20                        |
| Manual actuation                | -      | With pushbutton, lockable |
| Actuating speed                 | s/mm]  | 150 / 20                  |
| Power supply                    | [V]    | AC/DC 24 V                |
| Frequency                       | [Hz]   | 50/60                     |
| Max. power input                | [W]    | 1,5                       |
| Duty type                       |        |                           |
| Enclosure                       | IEC/EN | IP 54                     |
| Permissible ambient temperature | [°C]   | 0 to +50                  |
| Weight (without accessories)    | [kg]   | 1,2                       |

### 9.4.2 Operating data: EA-C 20 to 140 actuators, 24 V AC/DC

**Table 21:** Operating data: continuous-action and 3-point

|                                 |                 | EA-C 20                          | EA-C 40              | EA-C 40              | EA-C 140              |
|---------------------------------|-----------------|----------------------------------|----------------------|----------------------|-----------------------|
| Actuating force                 | [N]             | 2000                             | 4500                 | 8000                 | 14000                 |
| Stroke                          | [mm]            | 50                               | 50                   | 50                   | 65                    |
| Handwheel turns                 | [/10 mm stroke] | 12                               | 12                   | 12                   | 40                    |
| Actuating speed                 | [mm/s]          | 0,45 - 0,9                       | 0,45 - 0,9           | 0,3 - 0,7            | 0,65 - 1,3            |
| Power supply                    | [V]             | 24 V AC/DC                       | 24 V AC/DC           | 24 V AC/DC           | 24 V AC/DC            |
| Frequency                       | [Hz]            | 50                               | 50                   | 50                   | 50                    |
| Nominal current <sup>7)</sup>   | [A]             | 0,7 (AC)/<br>0,4 (DC)            | 1,1 (AC)/<br>0,7(DC) | 2,1 (AC)/<br>1,3(DC) | 4,6 (AC)/<br>2,9 (DC) |
| Max. power input <sup>8)</sup>  | [W]             | 12 (AC)/<br>11 (DC)              | 18 (AC)/<br>16 (DC)  | 35 (AC)/<br>32 (DC)  | 82 (AC)/<br>69 (DC)   |
| Mode of operation <sup>9)</sup> | IEC 60034-1,8   | S2 30 min, S4 50 % ED - 1200 c/h |                      |                      |                       |
| Enclosure                       | EN 60529        | IP 65                            | IP 65                | IP 65                | IP 67                 |

<sup>7)</sup> Power input at nominal load

<sup>8)</sup> Maximum rated power during starting

<sup>9)</sup> At an ambient temperature of +25 °C

|                                 |      | EA-C 20                                    | EA-C 40 | EA-C 40 | EA-C 140 |
|---------------------------------|------|--|---------|---------|----------|
| Permissible ambient temperature | [°C] | -20 to +60                                 |         |         |          |
| Motor protection                |      | Thermal monitoring and overload protection |         |         |          |
| Weight (without accessories)    | [kg] | 8  | 8       | 10      | 12       |

#### 9.4.3 Operating data: EA-C 20 to 140 actuators, 230 V AC

**Table 22:** Operating data: 230 V AC, continuous-action

|                                  |                 | EA-C 20                                    | EA-C 40     | EA-C 40     | EA-C 140    |
|----------------------------------|-----------------|--|-------------|-------------|-------------|
| Actuating force                  | [N]             | 2000                                       | 4500        | 8000        | 14000       |
| Stroke                           | [mm]            | 50   | 50          | 50          | 65          |
| Handwheel turns                  | [/10 mm stroke] | 12   | 12          | 12          | 40          |
| Actuating speed                  | [mm/s]          | 0,45 - 0,9                                 | 0,45 - 0,9  | 0,3 - 0,6   | 0,65 - 1,3  |
| Power supply                     | [V]             | 230 V AC 1~                                | 230 V AC 1~ | 230 V AC 1~ | 230 V AC 1~ |
| Frequency                        | [Hz]            | 50   | 50          | 50          | 50          |
| Nominal current <sup>10)</sup>   | [A]             | 0,07                                       | 0,11        | 0,22        | 0,48        |
| Max. power input <sup>11)</sup>  | [W]             | 13   | 19          | 38          | 88          |
| Mode of operation <sup>12)</sup> | IEC 60034-1,8   | S2 30 min, S4 50 % ED - 1200 c/h           |             |             |             |
| Enclosure                        | EN 60529        | IP 65                                      | IP 65       | IP 65       | IP 67       |
| Permissible ambient temperature  | [°C]            | -20 to +60                                 |             |             |             |
| Motor protection                 |                 | Thermal monitoring and overload protection |             |             |             |
| Weight (without accessories)     | [kg]            | 8  | 8           | 10          | 12          |

**Table 23:** Operating data: 230 V AC, 3-point

|                                |                 | EA-C 20     | EA-C 40     | EA-C 40     | EA-C 140    |
|--------------------------------|-----------------|-------------|-------------|-------------|-------------|
| Actuating force                | [N]             | 2000        | 4500        | 8000        | 14000       |
| Stroke                         | [mm]            | 50          | 50          | 50          | 65          |
| Handwheel turns                | [/10 mm stroke] | 12          | 12          | 31          | 28          |
| Actuating speed                | [mm/s]          | 0,5         | 0,5         | 0,65        | 0,45        |
| Power supply                   | [V]             | 230 V AC 1~ |
| Frequency                      | [Hz]            | 50          | 50          | 50          | 50          |
| Nominal current <sup>13)</sup> | [A]             | 0,05        | 0,08        | 0,23        | 0,23        |

<sup>10)</sup> Power input at nominal load

<sup>11)</sup> Maximum rated power during starting

<sup>12)</sup> At an ambient temperature of +25 °C

<sup>13)</sup> Power input at nominal load, without accessories

|  |               | EA-C 20                           | EA-C 40                 | EA-C 40                          | EA-C 140 |
|--|---------------|-----------------------------------|-------------------------|----------------------------------|----------|
| Max. power input <sup>14)</sup>                  | [W]           | 12                                | 18                      | 52                               | 52       |
| Mode of operation <sup>15)</sup>                 | IEC 60034-1,8 | S2 30 min, S4 80 % ED - 1200 c/h  |                         | S2 30 min, S4 50 % ED - 1200 c/h |          |
| Enclosure  | EN 60529      | IP 65                             | IP 65                   | IP 65                            | IP 67    |
| Permissible ambient temperature                  | [°C]          | -20 to +80 (S2) / -20 to +60 (S4) |                         |                                  |          |
| Motor protection                                 |               | Anti-jam design                   | Thermal circuit breaker |                                  |          |
| Actual-position feedback with two limit switches |               | ✓                                 | ✓                       | ✓                                | ✓        |
| Weight (without accessories)                     | [kg]          | 4,5                               | 4,5                     | 7,2                              | 8,0      |

<sup>14)</sup> Maximum rated power incl. accessories

<sup>15)</sup> At an ambient temperature of +25 °C

## 10 EU Declaration of Conformity

Manufacturer: **KSB SE & Co. KGaA**  
**Johann-Klein-Straße 9**  
**67227 Frankenthal (Germany)**

The manufacturer herewith declares that the product:

### **KSB EA-B 10, KSB EA-C 20, KSB EA-C 40, KSB EA-C 80, KSB EA-C 140**

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - 2011/65/EU: Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)
  - 2014/30/EU: Electromagnetic Compatibility (EMC)
  - 2014/35/EU: Electrical Equipment Designed for Use within Specific Voltage Limits (Low Voltage)

The manufacturer also declares that

- the following harmonised international standards have been applied:
  - EN 61000-6-2:2005
  - EN 61000-6-3:2007+A1:2011
  - EN 61010-1:2010

The EU Declaration of Conformity was issued in/on:

Frankenthal, 17 November 2020



Rainer Michalik  
Head of Integrated Management Systems



Dieter Hanewald  
Product Management and Product Development II  
Frankenthal

## 11 Declaration of Incorporation of Partly Completed Machinery

Manufacturer: **KSB SE & Co. KGaA**  
**Johann-Klein-Straße 9**  
**67227 Frankenthal (Germany)**

The manufacturer herewith declares for the partly completed machinery:

### **KSB EA-B 10, KSB EA-C 20, KSB EA-C 40, KSB EA-C 80, KSB EA-C 140**

- The following essential requirements of the Machinery Directive 2006/42/EC, Annex I, have been applied and fulfilled:
  - 1.1.2, 1.1.3, 1.1.5
  - 1.2.1, 1.2.2, 1.2.6
  - 1.3.2, 1.3.4, 1.3.7, 1.3.9
  - 1.5.1, 1.5.4, 1.5.5, 1.5.6
  - 1.7.1, 1.7.3, 1.7.4
- The relevant technical documentation has been compiled in accordance with Part B of Annex VII. This documentation or parts hereof will be transmitted by post or electronically in response to a reasoned request by the national authorities.

The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Machinery Directive 2006/42/EC, where appropriate.

Person authorised to compile the technical file:

Dieter Hanewald  
Product Management and Product Development II Frankenthal  
KSB SE & Co. KGaA  
Johann-Klein-Str. 9  
67227 Frankenthal (Germany)

The Declaration of Incorporation was issued in/on:

Frankenthal, 17 November 2020



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Dieter Hanewald  
Product Management and Product Development II Frankenthal  
KSB SE & Co. KGaA  
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