Operating Manual for the Bettis RTS FL Fail-Safe Linear Electric

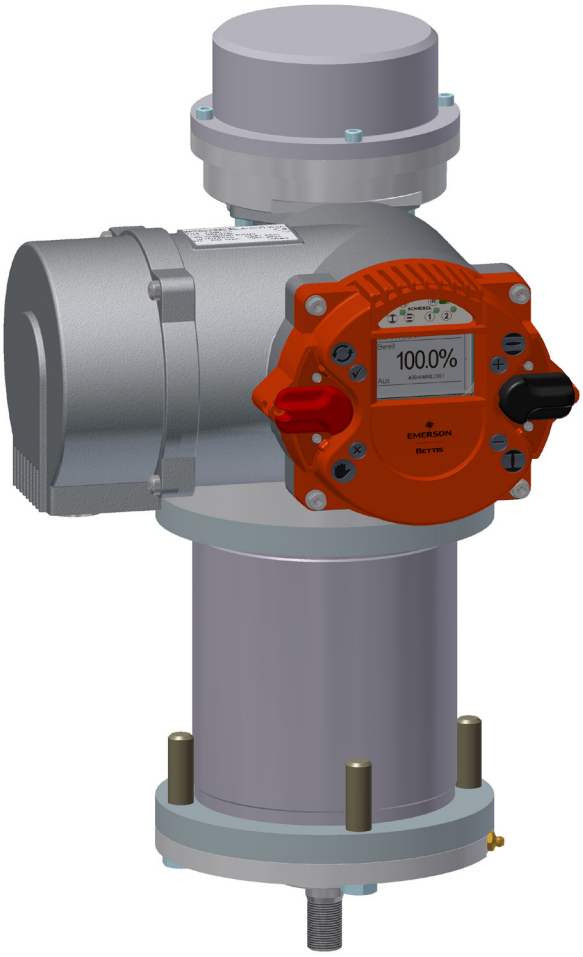

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Table of Contents

Section 1: Introduction

Bettis RTS FL Fail-Safe Linear actuators are designed to operate appropriate valves when a fail-safe functionality is required.

Appropriate valves are all kind of valves that require a linear movement to operate (valves, gate valves, etc.).

In the event of a power failure or if the fail-safe function is triggered deliberately, the linear Actusafe actuator shifts the valve to the fail-safe position, using the built-in energy storage device to do so.

Figure 1 Bettis RTS FL Fail-Safe Electric Actuator

Section 2: Functional Description of the Bettis RTS FL Fail-Safe Linear Actuator

See figure 1 below. Under normal operating conditions, the Bettis RTS FL Fail-Safe Linear actuator is operated by a 1) brushless DC 2) thru a worm gear stage and a 3) planetary gear train. The motor drives the spindle nut of a ball screw (4). The sun gear shaft of the planetary gear train is fixed in place by an operating current brake (5).

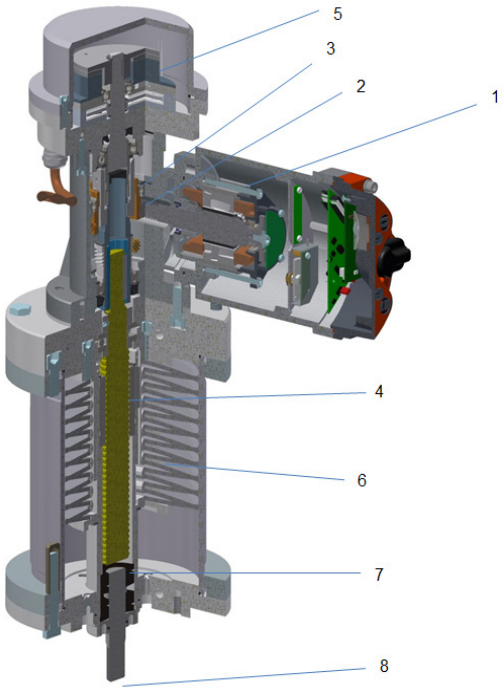
The ball screw converts the rotational movement of the gear unit into linear motion, which, on the other hand, charges the spring packet (6), which acts as an energy storage device. On the other hand, the linear motion is transmitted to the valve stem (8) via a spring-loaded spindle pin (7).

There are no engaging or disengaging elements between the motor, the energy storage device and the fitting shaft in the actuator. All the gear unit components are permanently engaged.

While moving against the fail-safe direction, the electric motor has to move both the valve and the energy storage device (disk spring assembly) for the fail-safe stroke.

If the supply for the operating current brake is interrupted (by a power failure, or intentionally to trigger a fail-safe stroke, the actuator will no longer be held, and the energy stored in the disk spring packet will be converted into kinetic energy so as to move the actuator and thus the valve to the fail-safe position. In this situation, the entire gear chain of the actuator with the exception of the worm gear stage will be moved until the end stop of the valve is reached. The spring-loaded spindle pin (7) dampens the stop and thus protects the valves seat. Owing to this operating principle, neither an initializing stroke nor resetting of the drive is required after a fail-safe stroke. As soon as the power supply is restored, the actuator is immediately ready for operation.

Figure 2 Cutaway View of RTS FL Fail-Safe Actuator



Parts Overview:

1. Motor
2. Worm Gear Stage
3. Planetary Gear Train
4. Ball Screw
5. Operating Current Brake
6. Spring Packet
7. Spring Loaded Spindle Pin
8. Valve Stem

2.1 Fail-Safe Direction

This type of fail-safe actuator can be built in two versions for "Fail-Safe Close" (extend actuator stem) or "Fail-Safe Open" (retract actuator stem).

2.2 Option Manual Override

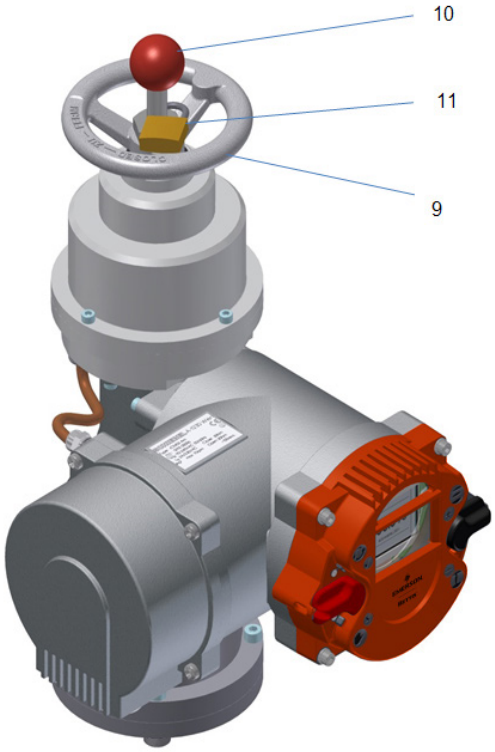
RTS FL Fail-Safe Linear actuator can additionally be equipped with a manual mode. This additional option allows an adjustment of the valve in powered down.

⚠ CAUTION: MANUAL MODE OPERATION

- By activating the manual drive the fail-safe function is disabled.
- By activating the manual drive the electrical function of the drive is disabled.

In normal operation, the hand wheel (9) is not engaged. By pushing the coupling rod (10), the hand wheel is engaged and at the same time, disables the actuator electrically (switched to malfunction) and the fail-safe function. Using a padlock, the actuator can be protected against unintended manual operation or inadvertent activation of manual operation.

Figure 3 RTS FL Fail-Safe Actuator with Padlock



Parts Overview:

9. Hand wheel
10. Coupling Rod
11. Padlock

Section 3: General Information

3.1 Safety Instructions

⚠ CAUTION: WORK UNDER GUIDANCE AND SUPERVISION

When operating electrical devices, certain parts are inevitably under dangerous voltage. Work on the electrical systems or components may only be carried out by electricians or by individuals who have been instructed how to do so. Working under the guidance and supervision of an electrician in accordance with electro-technical regulations.

⚠ WARNING: ALWAYS REFER TO STANDARDS

When working in potentially explosive areas, pay attention to European Standards EN 60079-14 “Installing Electrical Systems in Explosion Endangered Areas” and EN 60079-17 “Inspection and Maintenance of Electrical Installations in Explosion Endangered Areas”.

Working in potentially explosive areas is subject to special regulations (European Standard EN 60079-17), which must be complied with. Any additional national regulations must be heeded.

3.2 Direction of Rotation

⚠ CAUTION: STANDARD DIRECTION OF ROTATION

The standard direction of rotation for the actuator is:

- Clockwise = Actuator stem to be retracted
- Counter clockwise = Actuator stem to be extended

All the information in this operating manual refers to the standard direction of rotation.

Section 4: Packaging, Transport and Storage

Depending on the order, actuators may be delivered packed or unpacked. Special packaging requirements must be specified when ordering. Please use extreme care when removing or repackaging equipment.

⚠ CAUTION: USE APPROPRIATE LIFTING EQUIPMENT

Use soft straps to hoist the equipment; do not attach straps to the hand wheel. If the actuator is mounted on a valve, attach the hoist to the valve and not to the actuator.

4.1 General

The connection compartment of RTS FQ Fail-Safe Quarter-Turn actuators contains 5g of factory supplied silica gel.

⚠ CAUTION: REMOVE SILICA GEL

Please remove the silica gel before commissioning the actuator (see Section 16).

4.2 Storage

⚠ CAUTION: OBSERVE PROPER STORAGE

Please observe the following measures to avoid damage during the storage of actuators:

- Store actuators in well-ventilated, dry premises.
- Protect against floor dampness by storing actuators on wooden grating, pallets, mesh boxes or shelves.
- Protect the actuators against dust and dirt with plastic foil.

- Actuators must be protected against mechanical damage.
- Storage temperature must be between -20°C to +40°C.

It is not necessary to open the controller of the actuator for servicing batteries or similar operations.

4.3 Long-term Storage

⚠ CAUTION: FOLLOW PROPER STORAGE

If you intend to store the actuator for over 6 months, follow additional instructions below:

- The silica gel in the connection compartment must be replaced after 6 months of storage (from date of delivery).
- After replacing the silica gel, brush with glycerine the connection cover seal. Then, carefully close again the connection compartment.
- Coat screw heads and bare spots with neutral grease or long-term corrosion protection.
- Renovate damaged paint work arising from transport, improper storage, or mechanical influences.
- Every 6 months, all measures and precautions for long term storage must be checked for effectiveness and corrosion protection and silica gel renewed.
- Failure to follow the above instructions may lead to condensation which can damage to the actuator.

Section 5: Installation Instructions

Installation of the actuator may only be performed by qualified personnel.

5.1 Mechanical Connection

Check:

- Whether valve flange and actuator base match-up.
- If the bore of the coupling piece coincides with the spindle pin and sufficient thread engagement is available.

Make sure the fitting is in the same position as the actuator:

- For a “fail-safe opener” actuator, the valve has to be completely open.
- For a “fail-safe closer” actuator, the valve has to be completely closed.

In general, refer to the following instructions:

- Clean the bare parts on the actuator coated with rust protectant.
- Clean the mounting surface for the fitting thoroughly.
- Lightly grease the valve stem.
- Set the actuator in place.

- Make sure of centered positioning and that the contact surface of the flange is full.
- Fasten the actuator with suitable bolts:
  - Minimum strength grade: 8.8 or A2-70
  - Ensure sufficient thread engagement (min. 1xd)

⚠ CAUTION: AVOID USING TOO LONG SCREWS

Screws that are too long may go against the thread root, creating the risk of the actuator moving radially in relation to the fitting. This may lead to the bolts shearing off.

NOTE:
Unsuitable bolts may result in the actuator falling off.

- Tighten bolts to the correct torque, alternating between bolts on opposite sides.

Table 1. Torque Thread Table (1)

Thread	Tightening Torque [Nm] for Bolts with Strength Grade	
	8.8	A2-70/A4-70
M6	11	8
M8	25	18
M10	51	36
M12	87	61
M16	214	150
M20	431	294
M30	1489	564

⚠ CAUTION: PREVENT ACTUATOR OVERSPEEDING

Valve or piping may be damaged due to high actuating speed.

5.2 Setting Procedure

⚠ CAUTION: NO POWERING UP DURING MAINTENANCE

All adjustment work may only be performed with the actuator disconnected from the power supply. Due to this requirement, the actuator has to be in the fail-safe position. Any powering up must be ruled out during maintenance.

⚠ WARNING: ALWAYS REFER TO STANDARDS

When working in potentially explosive areas, pay attention to European Standards EN 60079-14 “Installing Electrical Systems in Explosion Endangered Areas” and EN 60079-17 “Inspection and

Maintenance of Electrical Installations in Explosion Endangered Areas".

Section 6: Commissioning

It is assumed that the actuator has been installed and electrically connected correctly. (See Section 5).

NOTE:
Remove silica gel from the alarm cover.

6.1 General information

NOTE:
When commissioning and each time after dismounting the actuator, the electrical end positions have to be reset (see Section 16.4).

6.2 Manual Operation

6.2.1 Standard Version of Actuator

Actuators cannot be manually operated.

6.2.2 Actuator with Additional Option Manual Mode

The manual operation of the linear actuator allows an adjustment of the valve when powered-off.

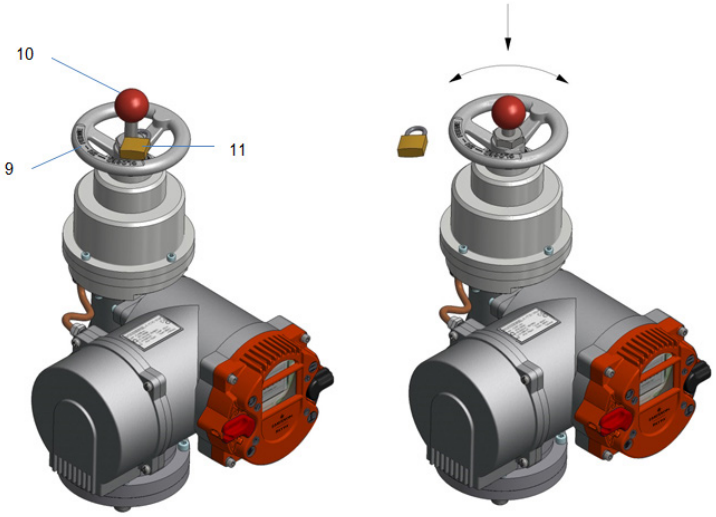
⚠ CAUTION: MANUAL DRIVE OPERATION

- By activating the manual drive is the fail-safe function is disabled.
- By activating the manual drive the electrical function of the drive is disabled. In normal operation, the hand wheel (9) has no effect, it rotates idly by.

NOTE:
The manual mode can be activated only when the drive is in the fail-safe position. To activate manual mode, the padlock has to be removed, and the coupling rod can be pushed all the way into the drive. For easier clutch engagement move the hand wheel easily back and forth. Through the engagement of the actuator is automatically electrically disabled:

- Display "manual operation'.

Figure 4 RTS FL Fail-Safe Actuator Hand wheel Rotation



Parts Overview:

- Hand wheel
- Coupling Rod
- Padlock

Hand wheel Rotation:

- Hand wheel clockwise rotation = Retract the actuator stem
- Hand wheel counterclockwise rotation = Extend actuator stem

To exit the manual mode and enable the actuator again for the automatic mode must:

- The actuator be driven in the fail-safe position by hand wheel.
- The coupling rod be pulled up to the stop of the actuator.
- The coupling rod again secured with the padlock.

6.3 Final Step

Following commissioning, check for proper sealing the covers to be closed and cable inlets (see Section 13.4). Check actuator for paint damage (by transport or installation) and repair if necessary.

Section 7: Maintenance

All maintenance work may only be performed with the actuator powered-off. Due to this requirement, the actuator has to be in the fail-safe position. If this is not the case, it may be because of a fault in the fitting (stuck fitting shaft).

⚠ CAUTION: OBSERVE SAFETY MEASURES

The actuator has a preloaded disk spring assembly. When loosen the flange mounting bolts, the spring force against the valve can cause the actuator to come loose from the valve. Adequate safety measures must be taken.

Any powering up must be ruled out during maintenance. Work on the electrical systems or components may only be carried out by electricians or by individuals who have been instructed how to do so. Working under the guidance and supervision of an electrician in accordance with electro-technical regulations. After completing their commissioning, the actuators are ready for use. The actuator is filled with oil as standard when shipped.

Routine checks:

- Be mindful of increased running noises. In cases of long downtimes, operate the actuator at least every three months.
- Check the fail-safe function (check the operating time and smoothness of running in fail-safe operation). Lengthening in the running time may also be caused by an increased torque requirement for the fitting after long down times.

⚠ CAUTION: ALWAYS REFER TO INSTRUCTIONS

The actuator has a prestressed disk spring assembly. Improper dismounting may lead to both damage to the actuator as well as serious injuries. If maintenance work is needed requiring the actuator to be dismounted, contact Emerson regarding detailed instructions and/or any special purpose tools for relaxing the spring assembly.

The actuators are designed for any mounting position (see Section 13.5), which is why there is neither a filling level indicator nor a drain plug on the main casing.

Depending on the stressing subjected to, do the following approximately every 10,000 to 20,000 hours (about 5 years; see Section 10):

- Oil change
- Replace seals
- Check all the roller bearings and the worm gear assembly and replace if necessary.

Take the types of oils and greases to be used from our Lubricant Table (see Section 10).

Section 8: Lubricant Recommendation and Requirements

8.1 Main Casing

Gear oil: DIN 51 517 - CLP - HC

Fully synthetic high performance industrial gear oils based on poly-alpha-olefins (PAO)

Temperature -25°C to +60°C

Viscosity grade: 320 ISO VG

Lubricant requirements: 0.25 Lt

8.2 90° Gear Unit and Spindle Actuator

Lubricating grease: DIN 51862 - G1 - G

Temperature: -40°C to +85°C

Water repellent, Al-soap-based complex grease with high resistance to acids and alkalis

Worked penetration of 0.1mm: by 265

Dropping point: approx. 260°C

NLGI grade: 1

Acid-free, non or only slightly water reactive

8.3 Basic Lubricant Service Interval

⚠ CAUTION: CONSIDER REDUCTION FACTORS

The service interval for RTS FL actuators is ten years from the shipping date, Emerson. However, the functionality and service life of the lubricants depends on the operating conditions. Reduction factors have to be taken into consideration if applicable.

Table 2. Lubrication Utilization (1)

Operating Condition(s)	Definition	Reduction Factor (Multiplier)
Duty cycle DC	(Total motor running time)	
Extremely high DC	Over 1,250 hours/year	0.5
High DC	Over 500 hours/year	0.7
Extremely low DC	Less than 0.5 hours/year	0.8
Ambient temperature	(permanent or long term)	
Extremely changeable	Between -10°C and +50°C	0.5
Extremely high	Over +50°C	0.7
Extremely low	Below -25°C	0.9
Output speed	(on main shaft of actuator)	
High speed	Over 80 rpm	0.8
Degree of utilization	(based on nominal capacity)	
Very high	Over 90%	0.8
High	Between 80 to 90%	0.9

Example of application:

Extremely low DC + extremely low ambient temperature + high speed + 87% degree of utilization:
0.8 x 0.9 x 0.8 x 0.9 = 0.51
Reduction factor lubricant maintenance interval:
10 years x 0.51= 5.1 years (62 months)

NOTE:
A maintenance interval calculated this way does not apply to the maintenance of output type A (threaded bush) or to the maintenance of linear actuator or spindle actuator units. These have to be relubricated at regular intervals (at least every six months) at the grease nipples. (Section 26.2).

When servicing our actuators, the old lubricant must always be removed and replaced with new lubricant. No mixing of different makes of lubricant is allowed.

The quantities needed for lubricant servicing are set out in Section 26.

Section 9: Training

⚠ CAUTION: CONTACT FOR SUPPORT

If you experience any problems during installation or in doing the adjustment work on site, please contact Emerson at phone +1 281 477 4100 to avoid any possible faulty operation or damage to the actuator. Emerson recommends only using qualified personnel to do the installation. Please contact Emerson to request product training.

Section 10: Operating Manual - Introduction

These operating instructions for the RTS FL Fail-Safe Actuator.

The scope of application covers the operation of industrial valves, e.g., globe valves, gate valves, butterfly valves and ball valves. For other applications please consult with the factory. The manufacturer shall not be liable for incorrect use and possible damage arising thereof. The risk shall be borne solely by the user.

Using the unit as intended also entails the observance of these operating instructions.

⚠ CAUTION: OBSERVE HAZARDOUS VOLTAGE LEVEL

When operating electrical equipment, certain parts inevitably carry hazardous voltage levels. Work on the electrical system or equipment must be carried out only in accordance with electrical regulations by a qualified electrician himself or by specially instructed personnel under the control and supervision of a qualified electrician.

Maintenance instructions must be observed as otherwise the safe operation of the actuator cannot be guaranteed. Failure to follow the warning information may result in serious bodily injury or property damage. Qualified personnel must be thoroughly familiar with all warnings contained in this operating manual. Proper transport, storage, installation, assembly and careful commissioning are essential to proper and safe operation.

⚠ WARNING: ALWAYS REFER TO STANDARDS

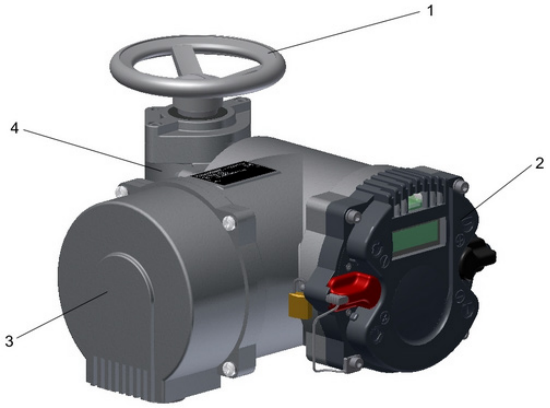
When working in potentially explosive areas, observe the European Standards EN 60079-14 "Electrical Installations in Hazardous Areas" and EN 60079-17 "Inspection and Maintenance of Electrical Installations in Hazardous Areas". Maintenance work on open actuators may only be conducted if powered-off. Reconnection during maintenance is strictly prohibited.

Section 11: General

The actuator of the RTS FL series is a compact, rotary actuator with integrated controller for valve operation. The integral multi-turn sensor allows setting the travel up to 105 revolutions without opening the housing.

11.1 Overview

Figure 5 RTS FL Fail-Safe Actuator



Parts Overview:

1. Hand wheel
2. Control Unit (Operating Unit)
3. Connection Compartment
4. Gear Component

11.2 Serial Number and Name Plate

Each actuator has a serial number. The serial number is a 10-digit number that begins with the year and that can be read from the nameplate (see Figure 6) of the actuator (the nameplate is located next to the hand wheel – see Figure 7). Using this serial number, Emerson can uniquely identify the actuator (type, size, design, options, technical data and test report).

Figure 6 Name Plate

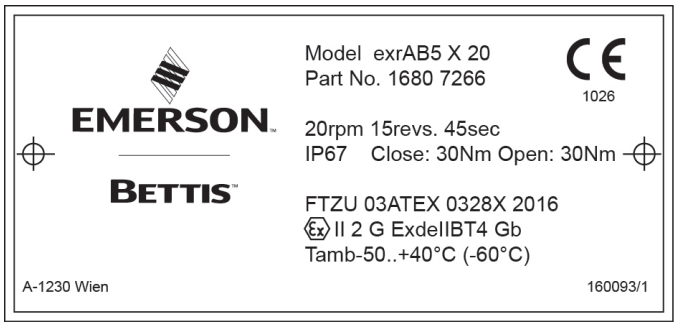
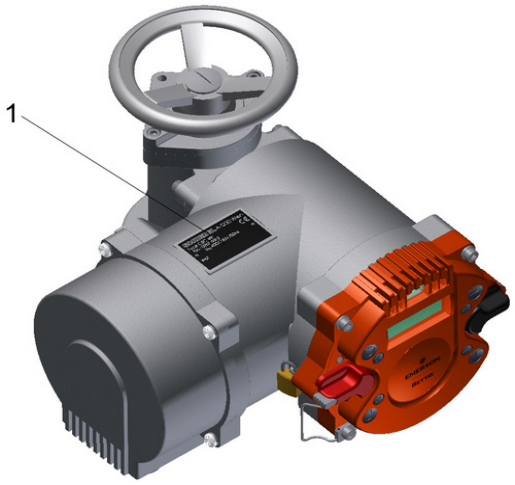


Figure 7 Name Plate Position



11.3 Operating Mode

RTS FL actuators are suitable for open-loop control (S2 operating mode - on/off duty) and closed-loop control (S4 operating mode - modulating duty).

11.4 Protection Class

RTS FL actuators come by default with IP67 (EN 50629) protection.

⚠ CAUTION: PROTECTION CLASS AND CABLE GLANDS

The protection class specified on the nameplate is only effective when cable glands also provide the required protection class, the cover of the connection compartment is carefully screwed and the mounting position (see Section 13.5) is observed.

We recommend metallic screwed cable glands with a metrical thread. Furthermore, cable inlets not be needed must be closed with screw plugs. On explosion Proof actuators cable glands with

protection class EExe according EN60079-7 must be used. After removing covers for assembly purposes or adjustment work, take special care upon reassembly so that seals are not damaged and remain properly fastened. Improper assembly may lead to water entrances and to failures of the actuator.

NOTE:
The cover of the control unit - the operating unit (see Figure 5) must not be opened.

Allow a certain sag in the connector cables before reaching the screwed cable glands so that water can drip off from the connector cables without running to the screwed cable glands. As a result, forces acting on the screwed cable glands are also reduced (see Section 13.5).

11.5 Mounting Position

In principle, the installation position is irrelevant. It is advisable to consider the following for outdoors use or in splash zones:

- Mount actuators with cable inlet facing downwards.
- Ensure that sufficient cable slack is available.

11.6 Direction of Rotation

Unless specifically ordered otherwise, the standard direction is (see Figure 9 and Figure 10):

- Right turning (clockwise) = CLOSED
- Left turning (counter clockwise) = OPEN

Clockwise rotation of the actuator is given when the output shaft turns counter clockwise when looking on the output shaft.

Figure 8 Clockwise = Close

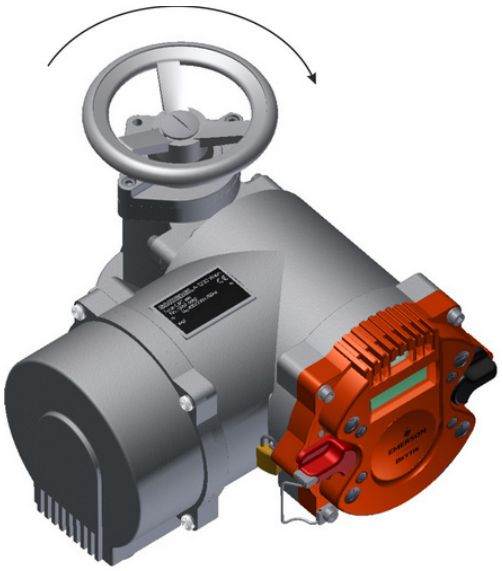
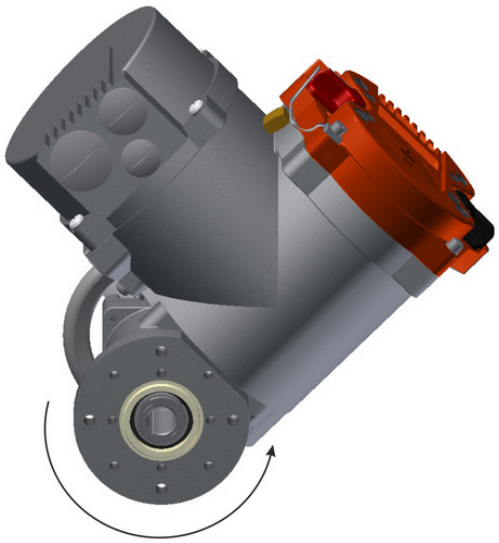


Figure 9 Counter Clockwise = Open



⚠ CAUTION: REFER TO DIRECTION OF ROTATION

All specifications in this operating manual refer to the standard direction of rotation.

11.7 Protection Devices

11.7.1 Torque

RTS FL actuators provide a electronic torque monitoring. Switch off torque can be modified in the menu of the controller for each direction separately. By default, switch off torque is set to the ordered value. If no torque was specified with the order, the actuator is supplied from the factory with the maximum configurable torque.

For more information, see Section 18.2.

11.7.2 Motor Temperature

RTS FL actuators are normally equipped with motor winding temperature sensors, which protect the motor against excessive winding temperature. The display will show the corresponding error upon exceeding the permissible motor temperature (see Section 23.1).

11.7.3 Input Fuse and Thermal Fuse

The frequency inverter is protected by an input fuse and the explosion Proof version also has a thermal fuse. If one of these fuses release a serious defect occurs and the frequency inverter will be disconnected permanent from the power supply. Then the frequency inverter must be changed.

11.8 Ambient Temperature

Unless otherwise specified upon ordering, the following operating temperatures apply:

- On/off duty (open-loop control): -40°C to +60°C
- Modulating duty (closed-loop control): -40°C to +60 °C
- Explosion proof version: -20°C to +40°C (according to EN60079-0)

- Explosion proof version with extended temperature range: -40°C to +60°C

⚠ CAUTION: OBSERVE OPERATING TEMPERATURE

The maximum operating temperature can also depend on further order-specific components. Please refer to the technical data sheets to confirm the as-delivered product specifications.

11.9 Delivery of the Actuators

For each actuator, an inspection report is generated upon final inspection. In particular, this comprises a full visual inspection, calibration of the torque measurement in connection with an extensive run examination and a functional test of the microcontrollers. These inspections are conducted and documented according to the quality system and can be made available if necessary. The basic setting of the end position must be performed after assembly on the actuator.

⚠ CAUTION: OBSERVE COMMISSIONING INSTRUCTIONS

Commissioning instructions (see Section 16) must be strictly observed. During assembly of the supplied valves at the factory, end positions are set and documented by attaching a label (see Figure 11). During commissioning at the plant, these settings must be verified.

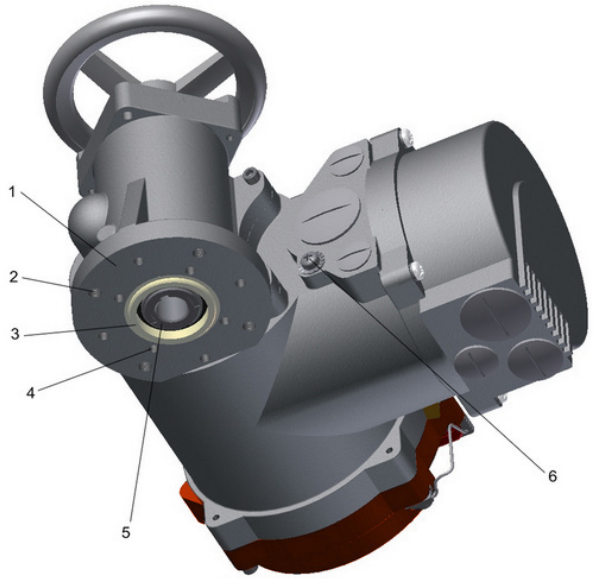
11.10 Information Tag

Each actuator is provided with a bilingual tag containing key information, which is attached to the hand wheel after final inspection. This tag also shows the internal commission registration number (see Figure 12).

Figure 10 Tag

Section 12: Installation Instructions

Figure 11 RTS FL Fail-Safe Actuator



Parts Overview:

1. Mounting Flange
2. Bore Pattern G0/F10
3. Centring Ring
4. Bore Pattern F07
5. Shaft Connection
6. Ground Connection

Installation of actuators may only be performed by qualified personnel.

12.1 Mechanical Connection

See Figure 13.

Check whether the valve flange, actuator flange and valve shaft coincide with the shaft connector of the actuator. For output type A (threaded bushing with bore), check whether the thread of the valve matches the thread of the actuator.

In general, proceed as follows:

- Clean the bare parts of the actuator uncoated with corrosion protection.
- Thoroughly clean the screw mounting surfaces of the valve.
- In the actuator, lubricate appropriately the output shaft and the valve of the driven shaft.
- In the A version, ensure that the valve bushing is amply lubricated.

- Attach the actuator to the valve or gearbox.
- Tighten fastening screws (torque according to table below).
- By means of the hand wheel, check the ease of movement of the actuator-valve connection.

Table 3. Torque Thread Table (2)

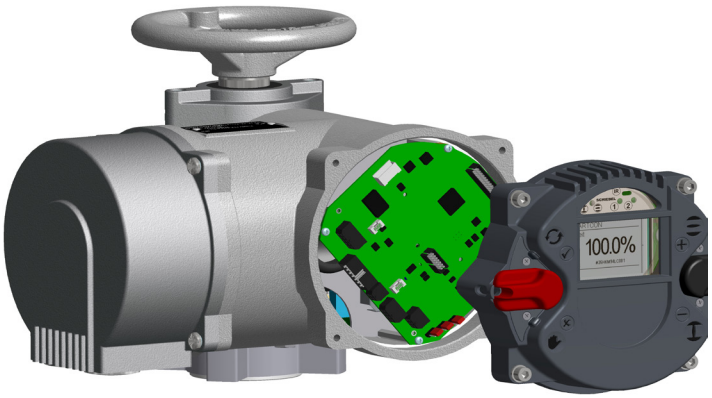
Thread	Tightening Torque [Nm] for Bolts with Strength Grade	
	8.8	A2-70/A4-70
M6	11	8
M8	25	18
M10	51	36
M12	87	61
M16	214	150
M20	431	294
M30	1489	564

For output type A (unbored threaded bushing), you must sufficiently lubricate both needle bearings in the output form after processing and cleaning the spindle nut. For this purpose, use the optional grease lubricant or a grease lubricant according to our grease or lubricant recommendation (see Section 26.2).

12.2 Mounting Position of the Operating Unit

The mounting position of the operating unit can be rotated in 90° steps.

Figure 12 RTS FL Fail-Safe Control Unit



- Disconnect the actuator and control system from the power supply.
- To prevent damage to the electronic components, both the control system and the person have to be grounded.
- Undo the bolts for the interface surface and carefully remove the service cover.
- Turn service cover to new position and put back on.
  - Ensure correct position of the O-ring.
  - Turn service cover by maximum of 180°.

— Put service cover on carefully so that no cables get wedged in.

- The bolts evenly in a crosswise sequence.

NOTE:
Maximum torque of 5 Nm.

12.3 Electrical Connection

Electrical connections may only be carried out by qualified personnel. Please observe all relevant national security requirements, guidelines and regulations. The equipment should be powered-down before working on electrical connections. Furthermore, confirm the absence of electrostatic discharges during the connection. First of all, connect the ground screw.

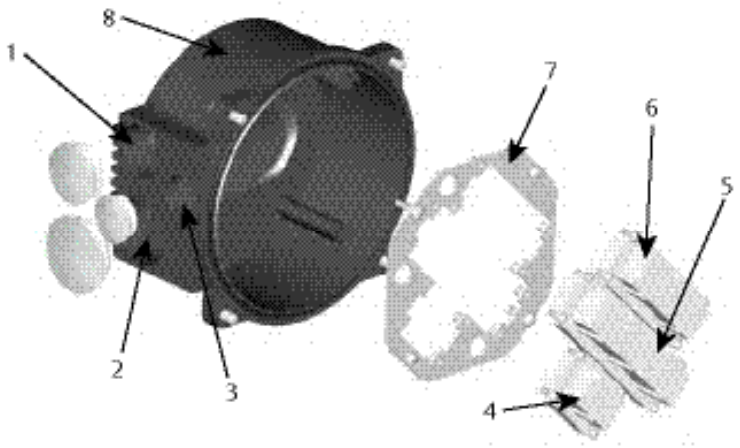
The line and short circuit protection must be done on the system side. The ability to unlock the actuator is to be provided for maintenance purposes. For the dimensioning the rated current is to be used (see Technical Data).

Check whether the power supply (voltage, frequency) is consistent with the connection data (see nameplate - Figure 6). The connection of electrical wiring must follow the circuit diagram. This can be found in the appendix of the documentation. The circuit diagram can be ordered from Emerson by specifying the serial number. When using options, such as a Profibus connection, the relevant guidelines must be followed.

12.3.1 Power Supply Connection

RTS FL actuators feature an integrated motor controller, i.e., it only requires a connection to the power supply. By non-explosion proof actuators the wiring uses a connector independent from control signals (see Figure 15).

Figure 13 Power Supply Connections



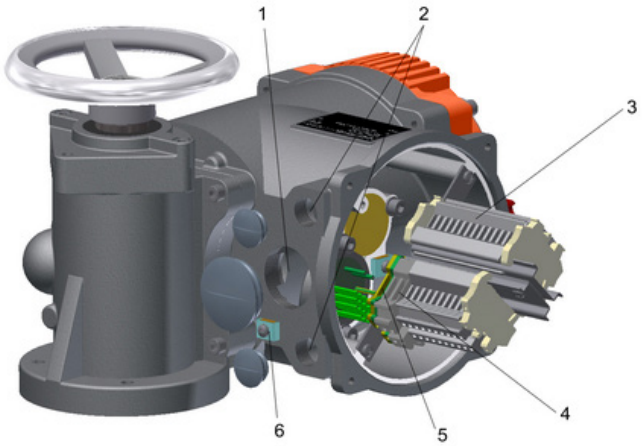
Parts Overview:

1. Metric Screw M32x1.5
2. M40x1.5
3. M25x1.5
4. Plug Insert Han6E (for power supply)
5. Plug Insert Han24E (for control cables)

6. Connector for Options
7. Connector Plate
8. Connecting Housing

Explosion proof actuators or on special request the connection will be made via terminals (see Figure 16).

Figure 14 Terminal Box



Parts Overview:

1. Metric Screw M40x1.5
2. 2xM20x1.5
3. Terminals for the Control Signals
4. Terminals for the Power Supply
5. Terminal for Ground Connection
6. Outside Ground Connection

If, during outdoor installation, commissioning is not carried out immediately after electrical connection. The power supply must be connected at a minimum to achieve a heating effect. In this case, the silica gel may remain in the connection compartment until commissioning.

⚠ CAUTION: OBSERVE CORRECT PROCEDURE

See Section 14.3.

Section 13: Adjustment of Fail-Safe Speed

13.1 General

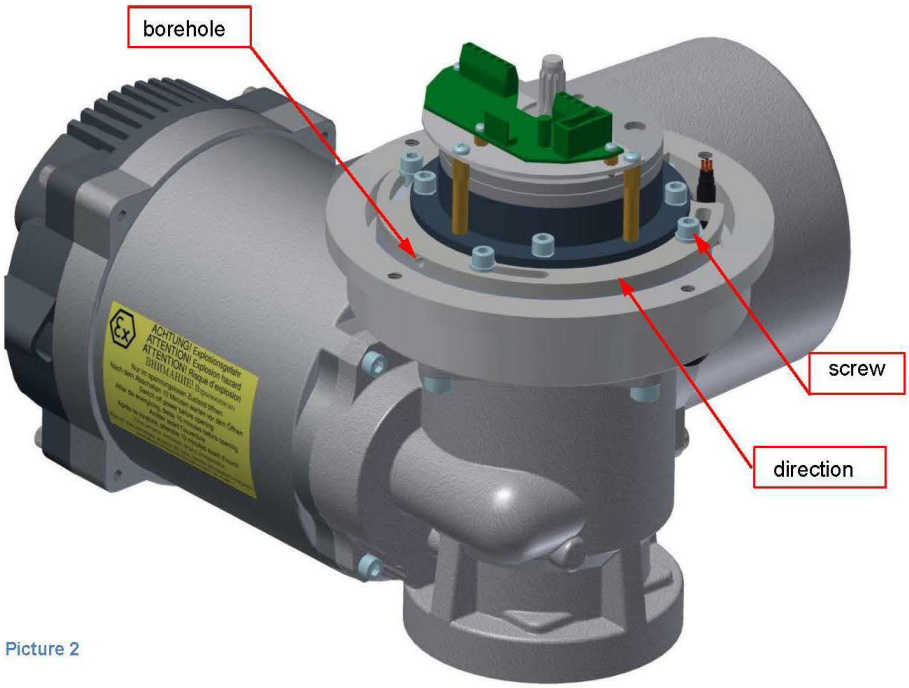
Bettis FL and FQ Fail-Safe actuators are equipped with an adjustable passive eddy current brake, by which it is possible to change the fail-safe speed. When delivered the fail-safe speed is set to minimum.

After mounting the actuator to valve and test run, fail-safe speed can be increased if necessary.

1. Remove cover according Picture 1

Attention: In the version with hand wheel there is a cable connection which has to be unplugged.

2. Loosen but do not remove 4pcs of screws according Picture 2
3. Insert 3mm allen key into radial borehole of flange
4. Turn flange by use of allen key in direction according Picture 2
5. Half of possible rotating angle will approximately double fail-safe speed of actuator While holding flange with key in desired position retighten screws
6. In the version with hand wheel reconnect the cable to the cover



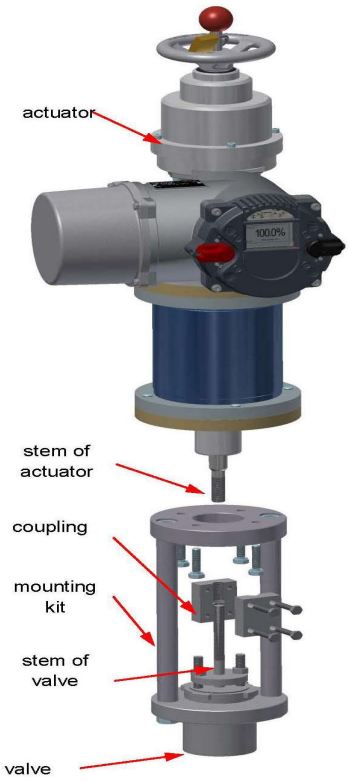
Picture 2

7. Remount the cover while be aware of correct position of O-ring sealing
8. Retest actuator to check for correct fail-safe speed

Section 14: Mounting of the Linear Adaptor (optional)

RTS CM CL Compact actuators move the stem of valve to the fail-safe position in case of fail-safe event. In general stem of actuator is at fail-safe position at delivery!

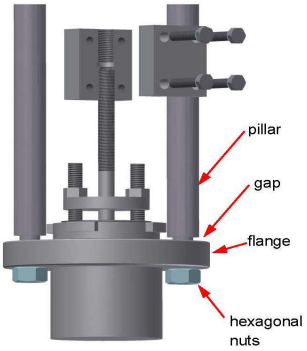
Depending on valve has to be closed or opened by force (sealing force is required in fail- safe position) or by travel (actuator shall stop before touching the seat), mounting procedure has to be done different:



Mounting procedure for valve without required sealing force:

- Connect mounting kit to valve and fix according valve producer specification
- Be sure stem of valve is exact in desired fail-safe end position
- Be sure stem of actuator is in fail-safe position. Actuator must not be electrically connected! Hand wheel must not be engaged. (if applicable, refer to 6.2 manual operation)!
- Mount actuator to mounting kit and fix with 4 screws
- Check distance between end of stem of actuator and end of stem of valve. Allowed range of distance is 2 – 25mm
- Connect both stems with coupling and note symmetrical engagement of both threads!
- Fix coupling with four screws and note both halves of coupling have to be parallel after tightening the screws

Mounting procedure for valve with required sealing force:



- Connect mounting kit to valve and fix according valve producer specification
- Be sure stem of valve is exact in desired fail-safe end position
- Stem of actuator has to be moved 2 – 5 mm away from fail-safe position by using hand wheel (if applicable, refer to 6.2 manual operation)!

If actuator is not equipped with hand wheel switch to alternative procedure:

- Mount actuator to mounting kit and fix with 4 screws

Check distance between end of stem of actuator and end of stem of valve:

- Allowed range of distance is 2 - 25mm
- Connect both stems with coupling and note symmetrical engagement of both threads!
- Fix coupling with for screws and note both halves of coupling have to be parallel after tightening the screws

Alternative procedure for valve with required sealing force:

- Connect mounting kit to valve and fix according valve producer specification
- Be sure stem of valve is exact in desired fail-safe end position
- Loosen hexagonal nuts of mounting kit and generate a gap of 3 - 5 mm between flange and pillar
- Mount actuator to mounting kit and fix with 4 screws
- Check distance between end of stem of actuator and end of stem of valve. Allowed range of distance is 2 - 25mm
- Connect both stems with coupling and note symmetrical engagement of both threads!
- Fix coupling with for screws and note both halves of coupling have to be parallel after tightening the screws
- Finally retighten hexagonal nuts symmetrical until gap disappears

Attention: actuator must not be electrically connected! Hand wheel must not be engaged (if applicable, refer to 6.2 Manual Operation)!

Section 15: Setting Limits

Before commissioning, please ensure the actuator is correctly assembled and powered-on. (See Section 15).

⚠ CAUTION: REMOVE SILICA GEL

Remove silica gel from the connection compartment.

15.1 General

⚠ CAUTION: SET ELECTRIC END POSITIONS CORRECTLY

During commissioning and after every disassembly of the actuator, the electric end positions (see Section 16.4) must be reset.

15.2 Manual Operation

The use of a differential gearbox in the hand wheel assembly makes mechanical switching unnecessary during manual operation.

⚠ CAUTION: OBSERVE PROPER MANUAL OPERATION

Manual operation with mechanical or electromechanical equipment (such as lever, drilling machine, etc.) is not allowed, as this may damage the product.

15.3 Mechanical Default Settings and Preparation

The use of multi-turn sensors makes mechanical settings unnecessary.

⚠ CAUTION: CHECK IF TORQUE SETTINGS IS CORRECT

Before the motorized operation of the valve, check and adjust torque settings.

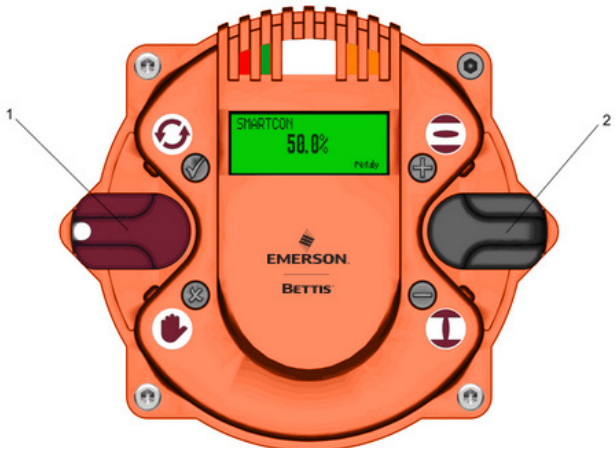
15.4 End Limit Setting

A detailed description of the operation of the RTS FL controller can be found in Section 17.3.

15.4.1 End Limit OPEN

Set the selector switch and control switch to the center position.

Figure 15 Selector/Control Switch (1)



Parts Overview:

1. Selector Switch (red)
2. Control Switch (black)

Scroll through the menu with the control switch. Move the control switch towards the first menu item ⊖ P1.1 End limit – Open.

Figure 16 Control Switch Flipped Down (1)

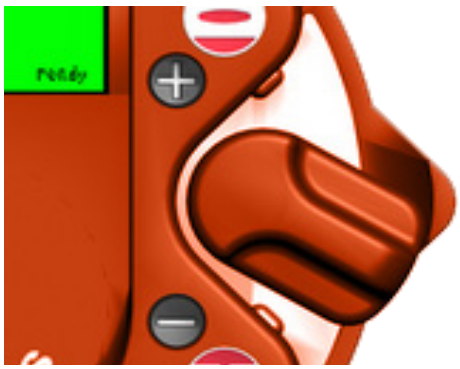


Figure 17 Display (1)

Afterwards, flip up the selector switch slightly and let it snap back to its neutral position .

Figure 18 Selector Switch in Neutral Position (1)

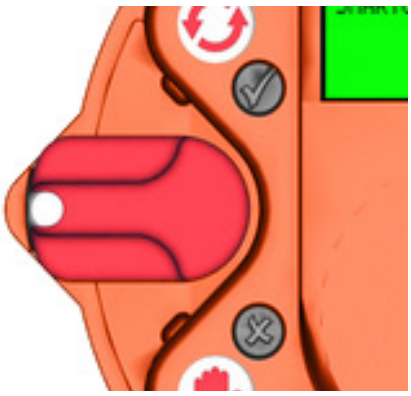


Figure 19 Selector Switch Flipped Up (1)

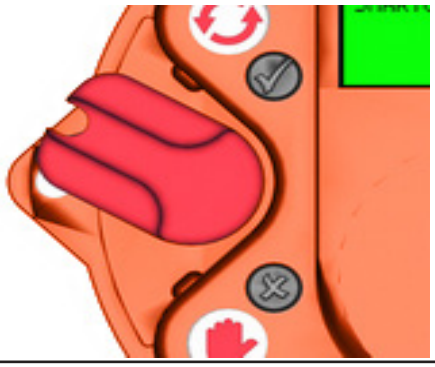
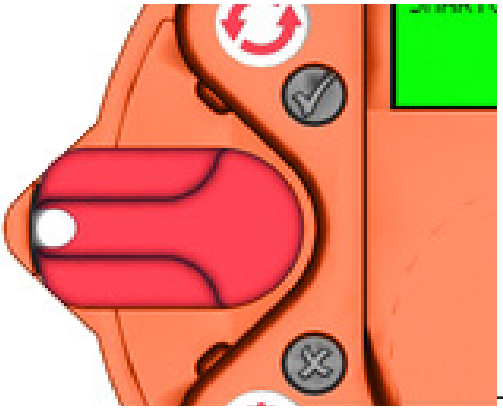


Figure 20 Selector Switch in Neutral Position (2)



This changes the bottom line of the display from "EDIT?" to "SAVE?".

Figure 21 Display (2)

Figure 22 Display (3)

Then, push down the selector switch until it snaps into place. In doing so, the bottom right now on the display will show "TEACHIN" ⊗.

⚠ CAUTION: PROPER OPERATION ON "TEACHIN"

Once the display shows "TEACHIN", use the operating switch (black switch) to start the motorized operation of the actuator. In this mode, no travel-dependent switch off occurs in the end position.

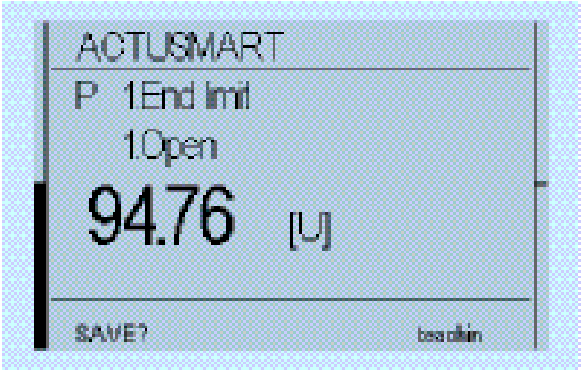
⚠ CAUTION: CHECK IF MAX. TORQUE IS PARAMETERIZED

Please note that during motor operation, only torque monitoring remains active as travel adjustment will happen subsequently. Therefore, please check beforehand whether the maximum torque has been already parameterized.

Absolute and relative values on the display will change continuously along with position changes.

Figure 23 Selector Switch Flipped Down (1)

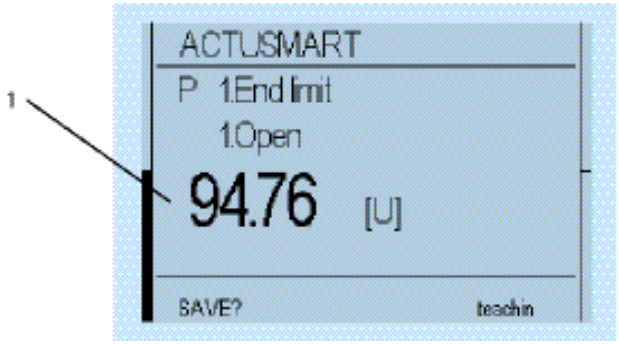
Figure 24 Display (4)



Manually move the actuator with the hand wheel (see Section 13.1 or Section 13.6) or by motor via the operating switch (black button) to the end position OPEN of the valve.

- Absolute value: Absolute value of the position feedback.
- Relative value: The value to the other end position.

Figure 25 Display (5)



Parts Overview:

1. Absolute value

When the desired end position OPEN of the valve is reached, move the selector switch back to the middle position. Thus, the line "TEACHIN" disappears.

Figure 26 Selector Switch in Neutral Position (3)

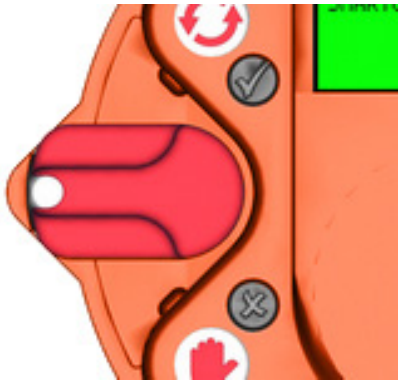


Figure 27 Display (6)

In order to confirm the end position (save), slightly flip up the selector switch and let it snap back to its neutral position ✓.

Figure 28 Selector Switch in Neutral Position (4)

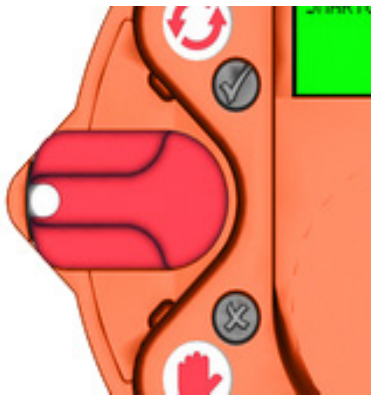


Figure 29 Selector Switch Flipped Up (2)

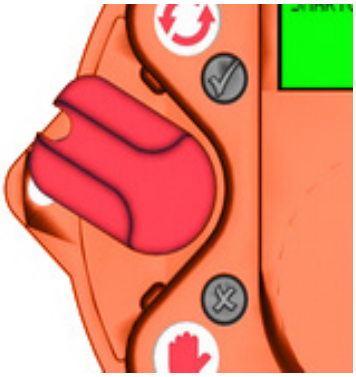
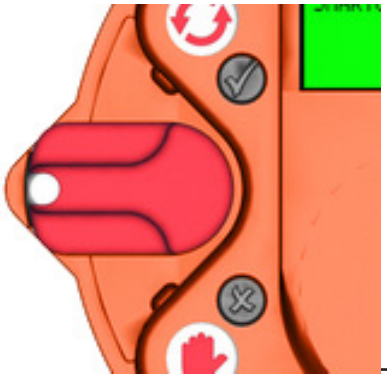


Figure 30 Selector Switch in Neutral Position (5)



This changes the bottom line of the display for "SAVE?" to "EDIT?" and the end position is stored.

Figure 31 Display (7)

Figure 32 Display (8)

15.4.2 End Limit CLOSE

Use menu item P1.2 End limit - End limit CLOSE as for End limit OPEN.

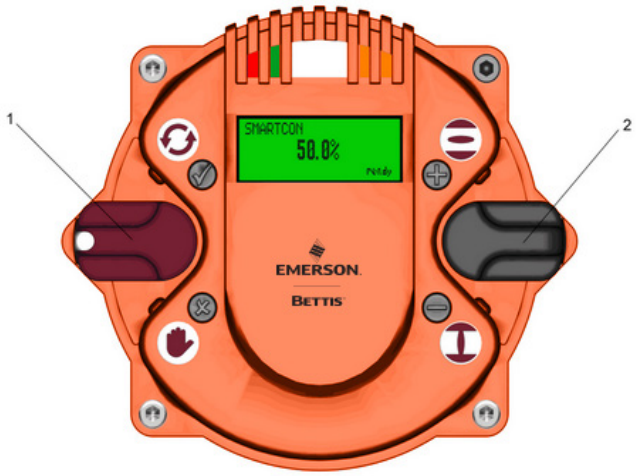
Section 16: Control Unit

The control unit monitors and controls the actuator and provides the interface between the operator, control system and actuator.

16.1 Operating Unit

Operation relies on two switches: the control switch and a padlock-protected selector switch. Information visualization is provided by 4 integrated indicator lights as well as the graphic display. For better visibility, switch symbols (✓, ✕, +, −) are on the cover.

Figure 33 Selector/Control Switch Operating Unit



Parts Overview:

1. Selector Switch
2. Control Switch
3. Graphic Display
4. LED Display

The controller switches serve on the one hand for electric motor operation of the actuator and, on the other hand, to configure and view various menu items.

The controller cover may be wiped clean with a damp cloth. The mounting position of the control unit can be turned in 90° steps (see Section 15.2).

16.2 Display Elements

16.2.1 Graphic Display

The graphic display used in the controller allows text display in different languages.

Figure 34 Display (9)

During operation, the displays shows the position of the actuator as a percentage, operation mode and status. When using the option "identification", a customer-specific label is shown at the bottom of the display (e.g., PPS Number).

Figure 35 Display (10)

Parts Overview:

1. Status
2. Operation Mode
3. Position

16.2.2 LED Display

To provide users with better status information, basic status data is displayed using 4-color LEDs. As the device powers up, it self-tests and 4 LEDs briefly light up simultaneously.

Figure 36 LED Display

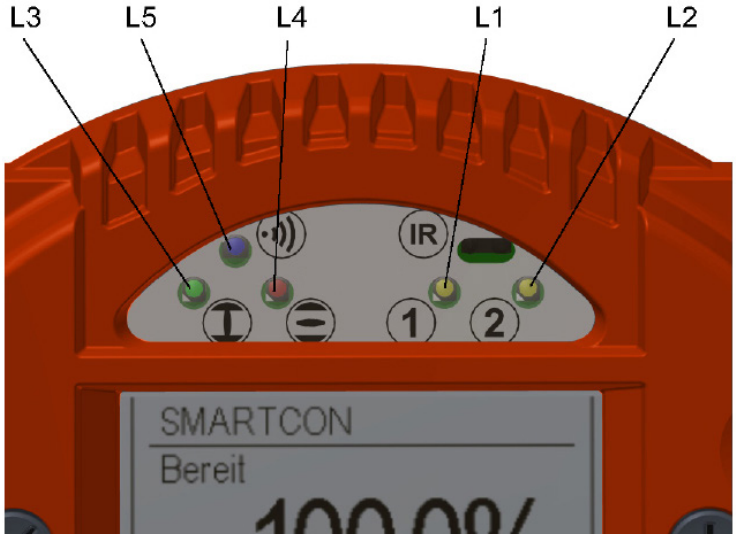


Table 4. LED Function Table

Description	Color	Lights Up up	Flashes quickly	Flashes slowly	Does not light up
L1	Yellow	No torque error	Torque fault	—	—
L2	Yellow	Ready (operational readiness)	Path error (no operational readiness)	—	Error (no operational readiness) motor temperature, supply voltage absent, internal error
L3	Red	OPEN	Moving to OPEN position	Applies upon torque-dependent opening: Occurs when the end position OPEN is reached but the cut-out torque has not yet been reached.	Actuator is not in the open position.
L4	Green	CLOSED	Moving to CLOSED position	Applies upon torque-dependent closing: Occurs when the end position CLOSED is reached but the cut-out torque has not yet been reached.	Actuator is not in the closed position.
L5	Blue	Bluetooth enabled	Bluetooth data transmission	Bluetooth ON, no data transmission	Bluetooth/ Infrared OFF
	Red	Infrared ON	Infrared data transmission	Infrared ON	

16.3 Operation

The actuator is operated via the switches located on the controller (selection and control switch). All actuator settings can be entered with these switches. Furthermore, configuration is also possible via the IR interface or the Bluetooth Interface (see Section 20). Flip the switch up or down to regulate the parameter menu scrolling speed.

Figure 37 Neutral Position

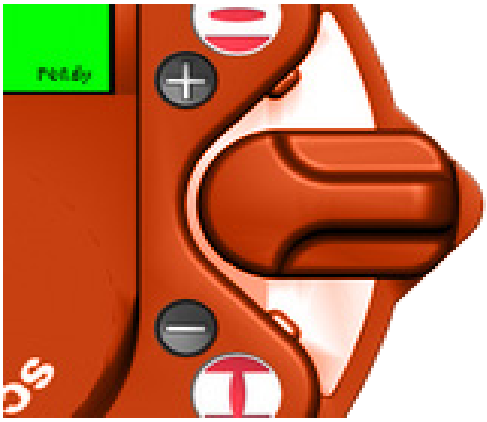
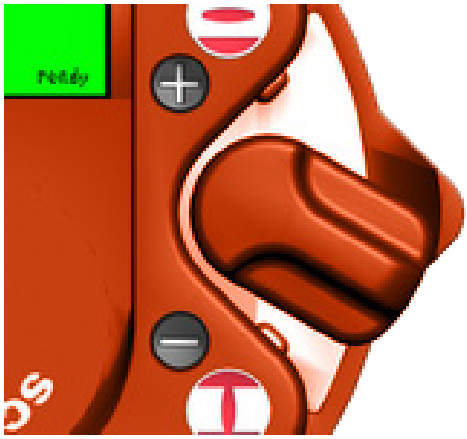


Figure 38 Slight Switch Flip (it will move to the next parameter)



LED L1 and L2 can be changed by parameter P1.7 - see Section 18.1.

Figure 39 Halfway Switch Flip (it will jump to the next parameter category)

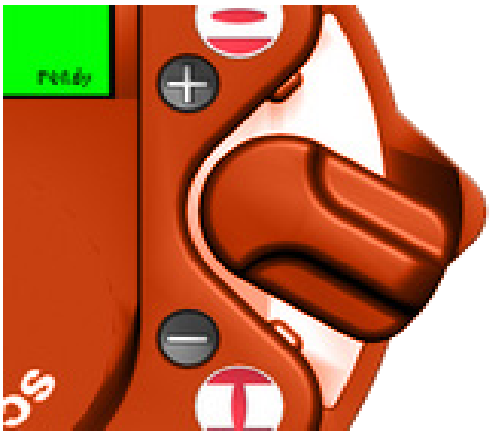
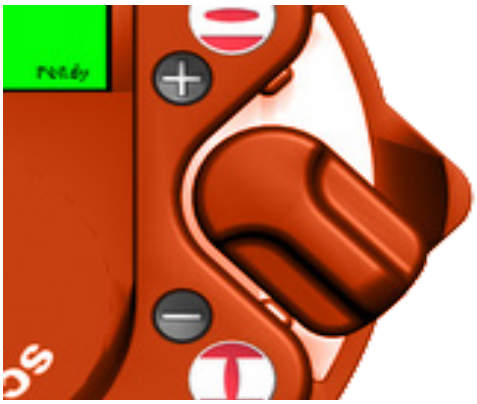


Figure 40 Full Switch Flip (it will jump to the end of the menu)



16.3.1 Operation Mode

Use the selector switch (red) to determine the various operating states of the actuator. In each of these positions, it is possible to block the switch by means of a padlock and thus protect the actuator against unauthorized access.

The selector switch has the following positions:

Table 5. Operating Mode Table

OFF	The actuator can be neither operated via the remote control nor via the control switches of the controller.
Local	It is possible to operate the actuator by motor via the control switch. Control via the remote inputs may be possible with appropriate configuration (superimposed control commands, emergency commands).
Remote	The actuator is ready to process control commands via input signals. The control switch for the motor operation of the actuator is not enabled.

Besides defining the operational status, the selector switch is used in configuration mode to confirm or cancel parameter inputs.

Depending on the selector switch position, the control switch performs different functions:

Table 6. Selector Switch Position Table

Selector switch in the OFF position:	The control switch is used to scroll up or down the menu according to internal symbolism. From the neutral position towards you reach the status and history data areas. Towards the symbols you reach the parameter menu. Here, the selection switch either confirms or rejects the current input according to associated symbolism.
Selector switch in the REMOTE position :	The control switch gives you access to status, history data and parameter area.
Selector switch in the LOCAL position :	With the control switch, the actuator can be operated by motor. You may also operate the actuator in inching and self-hold mode. Switches are spring-loaded to snap back automatically into their neutral position. (To confirm a control command, the control switch must be pushed all the way into its mechanical locking position.)

16.3.2 Configuration

In principle, all parameters are shown as numbers in the corresponding parameter point. From the actuator menu, use the control switch to access different menu points. The lower left corner of the display shows the "EDIT?" option.

Figure 41 Display (11)

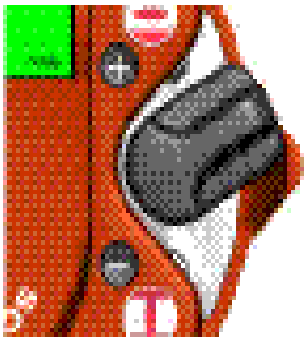
Confirm the selector switch with a slight flip towards ✓, (see Figure 30 to Figure 32) to change the selected parameter. To confirm this input readiness, the display changes from "EDIT?" to "SAVE?".

Figure 42 Display (12)

Use the control switc neter ⊕ or ⊖ (see Figure 39 to figure 42 onfirm the value with the selector switch again ure 32).

16.3.3 Configuratio

By way of example, w) (wireless off) to 2 (Bluetooth communi tivated for a short time and then deactivated switch must be in the neutral position.



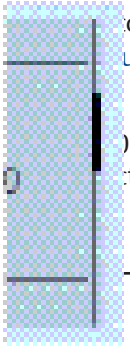
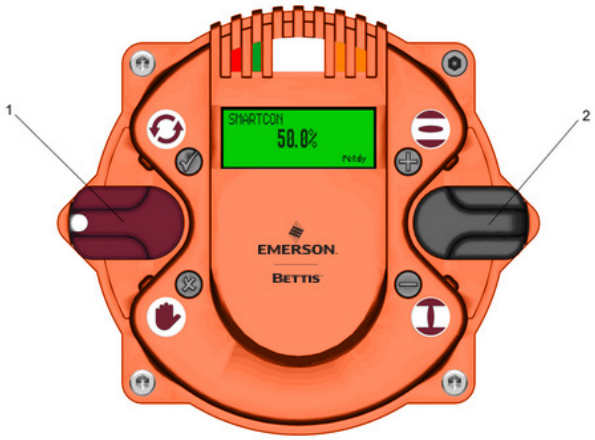


Figure 43 Select



Parts Overview:

4. Selector Switch (red)
5. Control Switch (black)

Now, move the control switch down towards until the menu item P20.6 Miscellaneous Wireless is displayed.

Figure 44 Control Switch Flipped Down (2)

Figure 45 Display (13)

Afterwards, flip up slightly the selector switch towards and let it snap back to its neutral position.

Figure 46 Selector Switch in Neutral Position (6)

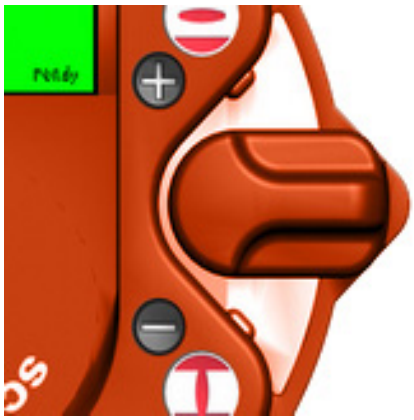


Figure 47 Selector Switch Flipped Up (3)

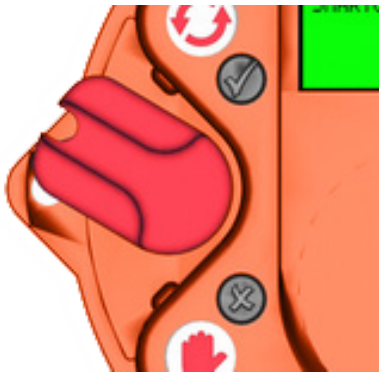
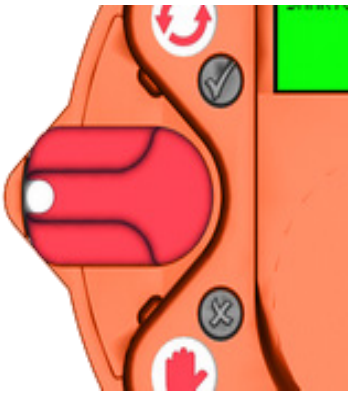


Figure 48 Selector Switch in Neutral Position (7)



This changes the bottom line of the display from "EDIT?" to "SAVE?".

Figure 49 Display (14)

Figure 50 Display (15)

Thereafter, flip up the control switch toward to change the value from 0 (off) to 2 (Bluetooth).

Figure 51 Control Switch Flipped Up

Figure 52 Display (16)

If the value changes to 1, confirm the selection by flipping halfway up the selector switch towards and letting it snap back to its neutral position (see Figure 48 to Figure 50).

Figure 53 Selector Switch Flipped Up (4)

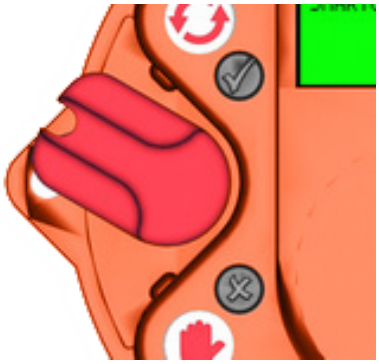


Figure 54 Display (17)

This changes the bottom line of the display from "SAVE?" to "EDIT?" and the parameter is stored.

16.3.4 "TEACHIN"

Furthermore, certain parameters (end positions, intermediate positions) can be set using "TEACHIN". Thus, their configuration is greatly simplified.

After selecting the appropriate menu item (for example: end position) and changing the input type from "EDIT?" to "SAVE?", move the selector switch (red) to manual mode and lock it into place. As you do so, the display will show the message "TEACHIN" and the current position value will be applied continuously to the parameter value. In this mode, further to manual operation by hand wheel, the actuator can be motor-driven with the control switch to the desired position (see Section 16.4.1, Figure 17).

Figure 55 Display (18)

⚠ CAUTION: SET MAXIMUM TORQUE

Please note that during motor operation, only torque monitoring remains active as travel adjustment will happen subsequently. Therefore, please check beforehand whether the maximum torque has been already set.

After reaching the desired, to-be-defined position, move the selector switch back to the neutral position. Finally, the parameter value must still be saved by flipping the selector switch halfway up and letting it snap back to the neutral position (see Figure 48 to Figure 50).

Section 17: Parameter Menu

For each parameter group, you can find a description, tabular overview of the menu items and possible configurations. The parameter list below also includes all possible options per menu item. Please note that some of the menu items listed and described may not be delivered with your configuration.

17.1 Parameter Group: End Limit

These parameters are used to configure the end position and switch off behavior of the actuator. In this regards, it is important to ensure that the basic mechanical configuration described in Section 16.4 has already been made.

NOTE:

Ensure that these parameters are set during commissioning before operating the actuator. In addition, the settings in the "Torque" menu (see Section 18.2) must be compared with the permissible values of the valve and corrected as appropriate.

⚠ CAUTION: PROPER ACTUATOR POSITION

100% stands for fully open and 0% for fully closed. Please note that these values cannot be changed.

Table 7. End Limit Table

	Menu Item	Sub Menu Item	Position Setting	Notes /Comments
P1.1	End limit	Open	TEACHIN; 0-100U	The parameter value can be set using "TEACHIN". With a known travel, the second end position can be entered after setting the first end position.
P1.2	End limit	Close	TEACHIN; 0-100U	The parameter value can be set using "TEACHIN". With a known travel, the second end position can be entered after setting the first end position.
P1.3	End limit	Switch off Open	by travel (0)	The actuator uses end position signals to switch off and report the end position.
			by torque (1)	The actuator signals the end position or stops the motor only after reaching the specified torque with the provision that it has reached the end position. If the end position signal is not reached, the actuator reports an error.
P1.4	End limit	Switch off Close	by travel (0)	The actuator uses end position signals to switch off and report the end position.
			by torque (1)	The actuator signals the end position or stops the motor only after reaching the specified torque with the provision that it has reached the end position. If the end position signal is not reached, the actuator reports an error.
P1.5	End limit	Closing directing	right (0)	Actuator is designed for clockwise = closing
			left (1)	Reverse direction of rotation. Counter clockwise = closing. The crossing of all signals and commands is performed by the controller.
P1.6	End limit	Rotate sense position	0	No function at RTS FL.
			1	

	Menu Item	Sub Menu Item	Position Setting	Notes /Comments
P1.7	End limit	LED function	Close = green (0)	Definition of the LED color of the CLOSED or OPEN end position signalization.
			Close = red (1)	
P1.8	End limit	End limit hysteresis	0.1 - 10.0%	Hysteresis range for end position signals, Example: End position hysteresis 1% means, that the end position OFF is reached when closing 0%, and will leave it when opening only at 1%, i.e., a reclosing can only take place after leaving this hysteresis.

⚠ CAUTION: OBSERVE LIMITS AND FACTORS OF GEAR

When installing the actuator on an gear or a thrust unit, please take into account the limits and factors of the gear/thrust unit at parameterization.

When using end limit switch off by torque, the end position limit must be set before reaching the torque limit. Accordingly, the actuator will only signal the final end position if the configured torque and the associated end position are reached. If the end position is not reached, a torque error is reported (see Section 17.2.2).

17.2 Parameter Group: Torque

If no torque was specified with the order, the actuator is supplied from the factory with the maximum configurable torque.

Table 8. Torque Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P2.1	Torque	Open	8 - 32Nm²	Switch off torque in OPEN direction CAUTION: The range can be restricted via the menu item P2.3
P2.2	Torque	Close	8 - 32Nm²	As P2.1 but in CLOSED direction
P2.3	Torque	Torque limit	8 - 32Nm²	Torque to protect the valve, the transmission or the thrust unit. This value limits the setting of the Parameters P2.1 and P2.2 and to prevent an erroneous increase above the allowed value of these two parameters.
P2.4	Torque	Latching	{Off (0)}	Unassigned in RTS FL
P2.5	Torque	Boost Open	{0%}	Unassigned in RTS FL
P2.6	Torque	Boost Close	{0%}	Unassigned in RTS FL
P2.7	Torque	Hysteresis	{0: 50%}	Unassigned in RTS FL

⚠ CAUTION: OBSERVE CORRECT VALUE OF GEAR

When installing the actuator on an additional gear, please take into account the corresponding values of the gear/thrust unit as you enter the actuator parameters. To achieve

an effective output torque (including gear)/output power (including thrust unit) ratio, the factor gear/thrust unit must be considered.

17.3 Parameter Group: Speed

Table 9. Speed Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P4.1	Speed	Local Open	2.5 - 72.2 mi^{n-1}	Output speed for local operation in direction OPEN
P4.2	Speed	Local Close	2.5 - 72.2 mi^{n-1}	As P4.1 but in direction CLOSE
P4.3	Speed	Remote Open	2.5 - 72.2 mi^{n-1}	Output speed for remote operation in direction OPEN
P4.4	Speed	Remote Close	2.5 - 72.2 mi^{n-1}	As P4.3 but in direction CLOSE
P4.5	Speed	Emergency Open AUF	2.5 - 72.2 mi^{n-1}	Output speed for emergency operation in direction OPEN
P4.6	Speed	Emergency Close	2.5 - 72.2 mi^{n-1}	As P4.5 but in direction CLOSE
P4.7	Speed	Torque-dependent	2.5 - 72.2 mi^{n-1}	Seal-tight speed. Speed at which the actuator runs near the end position at torque-dependent switch off (see P1.3 and P1.4)
P4.8	Speed	Minimum	2.5 - 72.2 mi^{n-1}	Minimum speed

⚠ CAUTION: OBSERVE MAXIMUM SPEED

The maximum speed for the 24VDC actuator version is reduced to $20min^{-1}$.

17.4 Parameter Group: Ramp (option)

The start ramp can be set separately for each operation mode. Thus, a 100% start ramp means that the motor attains its maximum speed in about a second. Higher speeds (see Section 18.3) lead to shorter run times. If the ramp is set below 100%, the starting time increases in an inversely proportional fashion.

Table 10. Ramp Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P5.1	Ramp	Local	5 - 100%	Start ramp for local operation
P5.2	Ramp	Remote	5 - 100%	Start ramp for remote operation
P5.3	Ramp	Emergency	5 - 100%	Start ramp for emergency operation

17.5 Parameter Group: Control

Table 11. Control Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P6.2	Control	Ready delay	0-10s	Drop-out delay for the ready signal (Binary outputs)
P6.5	Control	24V output	0	24V auxiliary output is deactivated (see Section 33.5). The function of the auxiliary input is still activated.
			{1}	24V auxiliary output is activated (see Section 33.5).

17.6 Parameter Group: Password

The actuator control can be password-protected to prevent access at different levels. It is possible to prevent entry by unauthorized personnel or to entirely lock motor operation. Default password is set to "000". You can use both numbers and capital letters in your password. After entering a password, password protection is activated. To remove password protection, enter an empty password (000).

When accessing a password-protected parameter, the user is automatically prompted for its introduction. Only after correctly entering the password, it is possible to change the corresponding parameters.

Table 12. Password Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P7.1	Password	Reading PWD	3- digit	Status display and history data are still viewable; access to the parameter menu is locked until this password is introduced. Parameter menu scrolling is only enabled after entering the password. Electric motor operation is unlocked.
P7.2	Password	Writing PWD	3- digit	Status display, history data and parameter menu can be viewed. However, parameters become read-only.

17.7 Parameter Group: Position

In addition to OPEN and CLOSED end positions, you can define intermediate positions. These can be used as feedback signals for the binary outputs or as target value for fix position approach.

⚠ CAUTION: END POSITIONS MUST BE OBSERVED

If you change the end positions (see Section 18.1) intermediate positions are retained percentage-wise, i.e., the absolute positions of the intermediate positions change.

Table 13. Position Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P8.1	Position	Intermediate position 1	TEACHIN 0 - 100%	Position value of intermediate position 1
P8.2	Position	Intermediate position 2	TEACHIN 0 - 100%	See above
P8.3	Position	Intermediate position 3	TEACHIN 0 - 100%"	See above
P8.4	Position	Intermediate position 4	TEACHIN 0 - 100%	See above
P8.5	Position	Emerge position	TEACHIN 0 - 100%"	Position value of the emergency position.
P8.6	Position	Hysteresis	0.1 - 10.0%	Hysteresis range of intermediate positions. Within this hysteresis, no repositioning occurs upon reaching the intermediate positions (option: fix position approach). Furthermore, the output functions for position = intermediate position are active within this range (see P10.1).

17.8 Parameter Group: Binary Inputs (Discrete Input)

The controller is equipped with 5 freely configurable binary inputs. Please find further information on technical data of the binary inputs in Section 33.1. Binary inputs are also effective during actuator control via Profibus (option).

Default binary inputs are as follows:

Input 1: OPEN

Input 2: CLOSED

Input 3: STOP

Input 4: EMERGENCY OPEN

Input 5: EMERGENCY CLOSED

Table 14. Binary Inputs Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P9.1	Binary Input	Input 1	0: No Function	This input has no function.
			1: Open	OPEN command in REMOTE mode (selector switch in position REMOTE).
			2: Closed	CLOSED command in REMOTE mode (selector switch in position REMOTE).
			3: Stop	STOP command in REMOTE mode (selector switch in position REMOTE).
			4: Open Self-hold	Self-hold for OPEN, i.e., a short pulse is sufficient and the actuator moves then into the end position. Use the STOP command to stop the actuator.
			5: Closed Self-hold	Self-hold for CLOSED, see OPEN SELF-HOLD
			6: Emergency Open	Superimposed run command; run the actuator in direction OPEN regardless of whether the selection switch is set to REMOTE or LOCAL operation.
			7: Emergency Closed	Superimposed run command; run the actuator in direction CLOSED regardless of whether the selection switch is set to REMOTE or LOCAL operation.
			8: Release	The actuator may be operated only with a switched. Both in LOCAL and REMOTE operation.
			9: Open/ Closed	The actuator moves towards OPEN if input is active and towards CLOSED otherwise.
			10: Close Open	The actuator moves towards CLOSED if input is active and towards OPEN otherwise.
			11: Positioner	Release of the positioner
			12: Open inv.	As OPEN but active low
			13: Close inv.	As CLOSED but active low

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments

			14: Stop inv.	As STOP but active low
			15: Open Self-Hold inv.	As Open Self-Hold but active low
			16: Closed Self-Hold inv.	As Closed Self-Hold but active low
			17: Emergency-Open inv.	As Emergency-Open but active low
			18: Emergency-Closed inv.	As Emergency-Closed but active low
			19: Block	With activated (switched) signal, the actuator is locked for operation also in local mode.
			20: Controller lock	Positioner lock
			21: Release Local	The actuator may be operated only with a switched signal.
			22: Block Local	As Release Local but active low
			23: Lock Open	Trigger lock OPEN (in LOCAL and REMOTE mode). Actuator moves with the highest priority to OPEN; command continues internally active after reaching the end position OPEN. Dropping only with LOCK OFF, Supply OFF or operating mode OFF.
			24: Lock Closed	Trigger lock CLOSED (in LOCAL and REMOTE mode). Actuator moves with the highest priority to CLOSED; command continues internally active after reaching the end position CLOSED. Dropping only with LOCK OFF, Supply OFF or operating mode OFF.
			25: Lock Off	Drop the lock
			26: Fail-safe	Trigger the Fail-safe function in all operating modes (only functional in fail-safe actuators).
			27: Fail-safe inv.	As Fail-safe but active low
			28: Lock Open inv.	As Lock Open but active low
			29: Lock Closed inv.	As Lock Open but active low
			30: Lock Off inv.	As Lock Off but active low
			31: Intermediate position 1	Approach intermediate position 1 (P8.1) in REMOTE mode (fix position approach). There is no repositioning upon reaching the intermediate position within the hysteresis (see P8.6) Higher priority than intermediate position 2, 3 and 4.

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
			32: Intermediate position 2	As intermediate position 1 but with higher priority than intermediate positions 3 and 4.
			33: Intermediate position 3	As intermediate position 1 but with higher priority than intermediate position 4.
			34: Intermediate position 4	As intermediate position 1 but with lowest priority.
			35: Emergency position	Approach emergency position (P 8.5). As intermediate position 1 but with higher priority than intermediate positions 1, 2.
			36: Intermediate position 1 inv.	As Intermediate position 1 but active low
			37: Intermediate position 2 inv.	As Intermediate position 2 but active low
			38: Intermediate position 3 inv.	As Intermediate position 3 but active low
			39: Intermediate position 4 inv.	As Intermediate position 4 but active low
			40: Emergency position inv.	As Emergency position but active low
P9.2	Binary Input	Input 2	See Input 1	
P9.3	Binary Input	Input 3	See Input 1	
P9.4	Binary Input	Input 4	See Input 1	
P9.5	Binary Input	Input 5	See Input 1	

17.9 Parameter Group: Binary Outputs (Relay Output)

The controller is equipped with 8 freely configurable binary outputs. Please find further information on technical data of the binary outputs in Section 33.2. Provided with external supply, binary outputs are optically isolated from the rest of the controller.

Default binary outputs are as follows:

Output 1: Ready

Output 2: End position OPEN

Output 3: End position CLOSED

Output 4: Run OPEN

Output 5: Run CLOSED

Output 6: Torque

Output 7: LOCAL

Output 8: REMOTE

Table 15. Binary Outputs Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P10.1	Binary Output	Output 1	0: User Defined	Optional
			1: Ready	Actuator is ready
			2: Fault	General fault; actuator is not ready
			3: Open	Actuator is in open position
			4: Closed	Actuator is in closed position
			5: Running Open	Actuators runs in direction Closed
			6: Running Closed	Actuators runs in direction Closed
			7: Running	Actuator is running in either Open or Closed
			8: Torque Open	Switch off torque was reached in Open direction-actuator has been switched off
			9: Torque Closed	Switch off torque was reached in Closed direction-actuator has been switched off
			10: Torque	Switch off torque was reached in either Closed or Open direction
			11: Travel Open	The Open end position has been reached
			12: Travel Closed	The Closed end position has been reached
			13: Position > Int.1	Position > Intermediate position 1
			14: Position < Int.1	Position < Intermediate position 1
			15: Position > Int.2	Position > Intermediate position 2

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments

			16: Position < Int.2	Position < Intermediate position 2
			17: Position < Int.3	Position > Intermediate position 3
			18: Position < Int.3	Position < Intermediate position 3
			19: Position < Int.4	Position > Intermediate position 4
			20: Position < Int.4	Position < Intermediate position 4
			21: Local	Local operating mode (selector switch in position)
			22: Remote	Remote operating mode (selector switch in position Remote)
			23: Off	Off operating mode (selector switch in the Off position)
			24: No Function	No function
			25: Motor Error	The motor temperature sensor has reported an error
			26: Always	Signal is always on
			27: Never	Signal is always off
			28: Binary Input 1	Forwarding of binary input to output
			29: Binary Input 2	Forwarding of binary input to output
			30: Binary Input 3	Forwarding of binary input to output
			31: Binary Input 4	Forwarding of binary input to output
			32: Binary Input 5	Forwarding of binary input to output
			33: Torque Open ma.	As Torque OPEN although it will suppress (mask) this signal in the end position upon torque-dependent switch off.
			34: Torque Closed ma.	As Torque CLOSED although it will suppress (mask) this signal in the end position upon torque-dependent switch off.
			35:Ready Remote	Ready and Remote operating mode
			36: Ready Local	Ready and Local operating mode
			37: Ready Local/Remote	Ready and Local or Remote mode
			38: Lock Open	Lock OPEN is enabled. OPEN command is internally queued with the highest priority and will not be dropped even in the end position.
			39: Lock Closed	Lock CLOSED is enabled. CLOSED command is internally queued with the highest priority and will not be dropped even in the end position.

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments

			40: Fail-safe OK 1	Fail-safe OK (only for fail-safe actuators)
			41: Fail-safe OK 2	Fail-safe OK and Ready (only for fail-safe actuators)
			42: Fail-safe OK 3	Fail-safe OK, Ready and Remote (only for fail-safe actuators)
			43: Lock	Lock Open or Lock Closed is enabled.
			44: Ready/Torque OK	Actuator is ready and no torque switch off
			45: Ready/ Remote/ Torque OK	Actuator is ready for operation in REMOTE mode and no torque switch off
			46: Position=Int1	Position = Intermediate position 1. The width of the interval is set with the parameter P8.6.
			47: Position=Int2	Position = Intermediate position 2. The width of the interval is set with the parameter P8.6.
			48: Position=Int3	Position = Intermediate position 3. The width of the interval is set with the parameter P8.6.
			49: Position=Int4	Position = Intermediate position 4. The width of the interval is set with the parameter P8.6.
			50: Position = Emergency Position	Position = emergency position. The width of the interval is set with the parameter P8.6.
			51: Bus Bit 1	In existing bus interface (hardware option) the output is set according to the selected bit bus.
			52: Bus Bit 2	
			53: Bus Bit 3	
			54: Bus Bit 4	
			55: Bus Bit 5	
			56: Bus Bit 6	
			57: Bus Bit 7	
			58: Bus Bit 8	
P10.2	Binary Output	Output Configuration 1	Normal	Output 1 is set to normal, i.e., if the condition in point P10.1 is met, Output 1 is set to HIGH (active HIGH).
			Inverted	If the condition in point P10.1 is met, Output 1 is set to LOW (active LOW).
			Normal Flashing	If the condition in point P10.1 is met, Output 1 starts blinking (active HIGH).
			Inv. Flashing	If the condition in point P10.1 is not met, Output 1 starts blinking (otherwise it is set to HIGH).
P10.3	Binary Output	Output 2	See Output 1	
P10.4	Binary Output	Output 2 Configuration	See Output 1 Configuration	
P10.5	Binary Output	Output 3	See Output 1	

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P10.6	Binary Output	Output 3 Configuration	See Output 1 Configuration	
P10.7	Binary Output	Output 4	See Output 1	
P10.8	Binary Output	Output Configuration 4	See Output 1 Configuration	
P10.9	Binary Output	Output 5	See Output 1	
P10.10	Binary Output	Output Configuration 5	See Output 1 Configuration	
P10.11	Binary Output	Output 6	See Output 1	
P10.12	Binary Output	Output Configuration 6	See Output 1 Configuration	
P10.13	Binary Output	Output 7	See Output 1	
P10.14	Binary Output	Output Configuration 7	See Output 1 Configuration	
P10.15	Binary Output	Output 8	See Output 1	
P10.16	Binary Output	Output Configuration 8	See Output 1 Configuration	

⚠ CAUTION: OBSERVE IF END POSITION IS REACHED

When using the point torque-dependent OPEN or torque-dependent CLOSED (see Section

18.1, Menu P1.3 and P1.4) the actuator will only be open or closed when the set torque and the associated end position is reached. If the end position is not reached, a torque error is reported (see Section 17.2.2).

17.10 Parameter Group: Position Output (Option)

Position output is used to indicate the current position of the actuator using 0/4-20 mA; it can retrofitted using software code. If this option is not enabled, the menu point shows the message "inactive". No adjustment to the end positions or the travel is required. Adjustment is automatically performed during the configuration of travel limit positions (see Section 18.1). No further settings are necessary for torque-dependent switch off, because the controller exclusively uses travel limit positions for the calculation. Regardless of whether this is defined by the torque or the travel limit positions.

The factory default settings are:

- 4mA at 0% position
- 20mA at 100% position

Table 16. Position Output Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P11.1	Position-Output	Function	Disabled	Position Output disabled
			Enabled	Position Output enabled
P11.2	Position-Output	Start (at 0%)	0 - 20.5 mA {4 mA}	mA value for the Closed (0%) position
P11.3	Position-Output	End (at 100%)"	0 - 20.5 mA {20 mA }	mA-value for the On (100%) position
P11.4	Position-Output	Calibration 20mA	-10% - +10%	Calibrating the output position during the setting of this parameter will output a 20mA (100%) signal. Use this parameter to calibrate accurately the 20mA output signal. (e.g., if you measure 19.8mA at the output, just add 1% (0.2mA is 1% of 20mA) to the displayed value.

17.11 Parameter Group: Step Mode

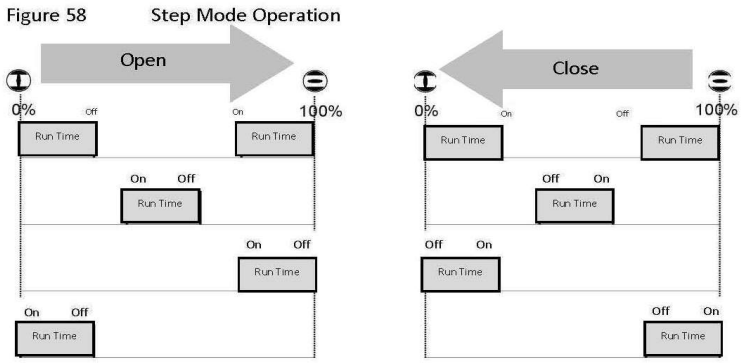
Step mode operation can be used to extend the operating time in certain ranges or for the whole travel; it is available in local, remote and emergency mode. Step mode operation can be activated individually for the directions OPEN and CLOSED. Cycle start, cycle end, cycle duration and interval time can be set separately for both directions. (see Figure 58).

Table 17. Step Mode Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P12.1	Step Mode Function	Mode	Disabled	Step mode operation is disabled
			Enabled	Step mode operation is enabled in LOCAL, REMOTE and EMERGENCY operation.
			Local only	Step mode is only enabled in LOCAL mode
			Remote only	Step mode is only enabled in REMOTE mode
			Local + Remote only	Step mode is enabled in REMOTE and LOCAL mode
P12.2	Step Mode Function	Start Open	0 - 100%	In OPEN direction, position in % from which the step mode operation should start.
P12.3	Step mode Function	End Open	0 - 100%	In OPEN direction, position in % of which the step mode operation should end.
P12.4	Step Mode Function	Runtime Open	0.1 - 60	Runtime in OPEN direction
P12.5	Step Mode Function	Pause Time Open	0.2 - 60	Pause time in OPEN direction
P12.6	Step Mode Function	Start Closed	0 - 100%	In CLOSED direction, position in % from which the step mode operation should start.

P12.7	Step Mode Function	End Closed	0 - 100%	In CLOSED direction, position in % of which the step mode operation should end.
P12.8	Step Mode Function	Runtime Closed	0.1 - 60	Runtime in Closed direction
P12.9	Step Mode Function	Pause Time	02 - 60	Pause time in Closed direction
P12.10	Step Mode Function	Time base	0: Seconds 1: Minutes	Time basis for run and pause times

Figure 56 Step Mode Operation



NOTE:

It is important to ensure that the mode of operation is not exceeded. The running info on the actuator (see Section 17.2.2) only flashes while the drive is running, i.e., during the break, no flash.

17.12 Parameter Group: Positioner (Option)

The positioner SR option is used to control the electric actuator by means of a set point input 0/4-20 mA signal. The SR helps control the position of the actuator, i.e., the positioner ensures that the actual value and thus the position of the actuator matches the desired set point.

Table 18. Positioner Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P13.1	Positioner	Function	Off	Positioner disabled
			On	Positioner enabled

P13.2	Positioner	Begin (at 0%)	0 – 20.5 mA {4, 0 mA}	mA value of the setpoint for the CLOSED (0%) position
P13.3	Positioner	End (at 100%)	0 – 20.5 mA {20, 0 mA}	mA value of the setpoint for the OPEN (100%) position
P13.4	Positioner	Dead band	0,1 – 10,0% {1,0%}	Tolerance range for the control deviation (set point position - actual position) where no adjustment occurs. The deadband should not be set too low to prevent actuator oscillation.
P13.5	Positioner	Gain	1 – 100% {100%}	The gain (gradient) affects the positioning close to the target position. The smaller the gain selected (for example, 20%), the earlier the actuator starts reducing its speed in case of speed variable actuators on approaching the target position. In case of actuators with fixed speed (reversing starters) the speed reduction is done by pulsing (also see parameters P13.9 and P13.10). This provided a better positioning (smaller reachable deadband). A 100% setting disables this gradient.

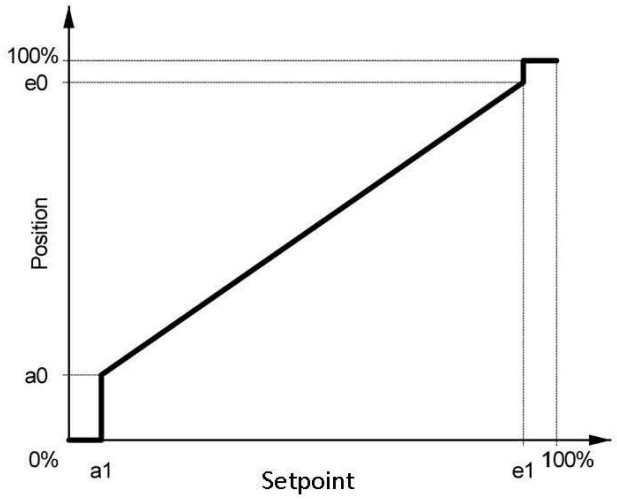
	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P13.6	Positioner	Live zero detect	Ignore	The setpoint monitoring (monitors the setpoint to below approximately 2mA = loss of signal) is disabled.
			Stop	Actuator stops on signal failure.
			Open	On signal failure, actuator moves the OPEN position.
			Close	Actuator moves on signal failure to the CLOSED position.
			Emergency Position	On signal failure, the actuator moves the defined emergency position (see parameter P13.7).
P13.7	Positioner	Emergency position	0 – 100% {50.%}	Determination of the emergency position. (it can also be set in the menu P8.5)
P13.8	Positioner	Calibration setpoint	-10% - +10%	Calibration value for the mA setpoint. Calibration process: By applying 20mA on the setpoint input, this parameter is corrected until the readout matches 20mA.
P13.9	Positioner	Minimum Impulse	{0.2 s}	Variable speed actuators: Without function fixed speed actuators: Minimum activation time of the reversing contactors. For very small activation times (<0.3 to 0.5s), the motor will be switched off during start-up process, which increases significantly reversing contactors mechanical wear. With frequent periods of very small activation times (restless loop, small dead zone, clocking near to the target value), we therefore recommend electronic reversing contactor.

P13.10	Positioner	Period	{2.0 s}	Variable speed actuators: Without function fixed speed actuators: This parameter is only relevant when step mode is enabled and when approaching the target position (parameter gain smaller than 100 %) and determines the period of a run/pause cycle.
P13.11	Positioner	Begin position (a0)	0.0 – 25.0% {2.0%}	Smallest controllable position other than the end position CLOSED. The range 0% to a0 will be just passed through. Use the parameter a0 to define the beginning of the allowable control range of the valve (e.g., blind spot for ball segment valves, etc.).
P13.12	Positioner	End Position (e0)	75.0 – 100.0% {98.0%}	Largest controllable position other than the end position OPEN. The area e0 to 100% is just passed through. Use the parameter e0 to define the end of the allowable control range of the valve.
P13.13	Positioner	Begin Setpoint (a1)	0.0 – 25.0% {2.0%}	Below this value, the end position CLOSED is controlled. In the range 0% to a1 cannot be controlled (end position tolerance). The initial setpoint a1 is associated with a small hysteresis (1/4 of the deadband).

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P13.14	Positioner	End Setpoint (e1)	75.0 – 100.0% {98.0%}	Above this value, the end position OPEN is controlled. The range e1 to 100% cannot be controlled (end position tolerance). The final setpoint e1 is associated with a small hysteresis (1/4 of the deadband).

Figure 57 Assigning the Position to the Setpoint

Figure 59 Assigning the Position to the Setpoint



17.13 Parameter Group: Controller (Optional)

The optional PID controller is used for controlling an external actual value (process variable) to a setpoint using 0/4-20 mA signal by readjusting the actuator.

Table 19. Controller Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P14.1	PID controller	Function	0: disabled	PID controller disabled
			1: Position	The output of the PID controller corresponds to the position setpoint of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see Section 18.12).
			2: Speed	The output of the PID controller corresponds to the change of the position setpoint (speed) of the actuator. The positioning (tracking of the actual position to the setpoint) is done by the positioner (see Section 18.12).

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P14.2	PID controller	External Setpoint	0: Fixed	The PID controller uses an internal, fixed setpoint (see parameter P14.3) .
			1: External	The PID controller uses the external setpoint. The adjustment of this setpoint is done with the parameters P13.2 and P13.3 (see Section 18.12).
P14.3	PID controller	Fixed setpoint	0 – 100%	Specification of the internal fixed setpoint

P14.4	PID controller	Start (at 0%)	0 - 20.5 mA	mA value at 0% of the external actual value
P14.5	PID controller	End (at 100%)	0 - 20.5 mA	mA value at 100% of the external actual value
P14.6	PID controller	Gain (P)	+50.0 - 50.0	Gain (proportional value) of the PID-controller
P14.7	PID controller	Reset time (I)	0 – 100.0s	The shorter the reset time (integral time, integral value), the stronger is the effect of the integral component of the PID-controller. Values below 1,0 will disable the integral component.
P14.8	PID controller	Lead Time (D)	0 – 100.0s	The larger the lead time (differential/derivative value), the stronger is the effect of the derivative component of the PID-controller. To reduce the influence of noise a first-order lag element with 1sec. time constant is added (DT1) .
P14.9	PID controller	Offset	-200 – 200%	The offset value will be added to the output value of the PID controller.
P14.10	PID controller	Dead Band	0.1 – 10.0% {1.0%}	Tolerance range for the control deviation (setpoint external actual value) where no adjustment occurs.
P14.10	PID controller	Period	2.0 – 20.0s	Equal to parameter P13.10 (see Section 18.12).
P14.12	PID controller	Actual Value Monitoring	Ignore	The monitoring of the external actual value is disabled.
			Stop	Actuator stops on signal failure of external actual value.
			Open	Actuator moves on signal failure of external actual values to the OPEN position.
			Closed	Actuator moves on signal failure of external actual values to the CLOSED position.
			Emergency position	Actuator moves on signal failure of external actual values to the EMERGENCY position. (see parameter P13.7).
P14.13	PID controller	Calibration of External Actual Value	-10.0 – 10.0%	Calibration process: By applying 20 mA to the external actual value input, this parameter is corrected until the readout matches to 20 mA.

17.14 Parameter Group: Characteristic Curves (Optional)

With this option, customers can enable travel-dependent torque characteristic curves.

With these characteristic curves, torque limits already set under menu item P2 (torque), can be further reduced depending on travel. Characteristics can be configured via the infrared interface with the SMARTTOOL software. (see Figure 63).

Figure 58 Torque Characteristics

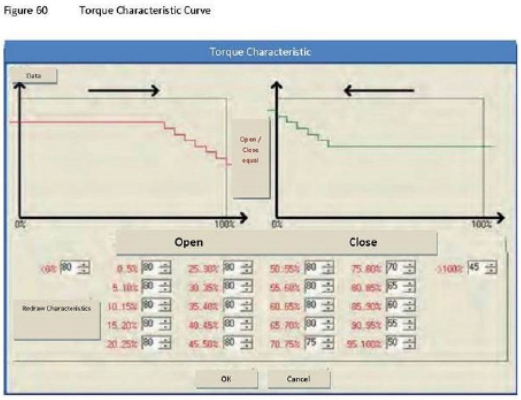


Table 20. Characteristic Table

	Menu Item	Sub Menu Item	Position Setting	Notes/Comments
P17.1	Characteristic	Torque Open	Off	The torque characteristic curve is disabled for the OPEN direction.
			On	The torque characteristic curve is enabled for the OPEN direction.
			Local + Remote only	The torque characteristic curve is enabled for the OPEN direction only in LOCAL and REMOTE mode (while disabled in the EMERGENCY mode).

RTS FL TYPE		FL-05	FL-15	FL-25
Max Force	kN (max. lbs.)	5 (1124)	15 (3372)	25 (5620)
Max Modulating Force	kN (max. lbs.)	3 (674)	8 (1798)	12 (2697)
Remaining Fails-safe Force	kN (max. lbs.)	5 (1124)	8 (1798)	12 (2697)
Fail-safe Function		Selectable opening and closing (stem extending/retracting)		
Fail-safe Trigger		Loss of 24 V DC Fail-safe signal or main power supply (selectable)		
Adjustable Operating Time (Electric)	mm/sec	0.21 - 5.8 mm/s		
Adjustable Operating Time (Fail-Safe)	sec	1 - 3	1 - 5	2 - 10
Max Travel	mm (inch)	30 (1.18)	50 (1.96)	100 (3.93)
Mode of Operation	On/off Duty	S2–15 min		
	Modulating Duty	S4 – 1200 c/h – 40% ED (Operating S9)		
Manual Override		Optional		
VALVE-MOUNTING				
Flange	ISO 5210/ DIN 3358	F07/ F10	F10/ F12	F10/ F14
Stem		M 16x1.5	M 16x1.5	M 16x1.5
ENVIRONMENTAL CONDITIONS				
Weather Protection		IP66, IP67, IP68		
Ambient Temperature		- 40° C (-40°F) to +60°C (140°F)		
Corrosion Protection		K2 for aggressive atmospheres		
Painting/Color		Two component painting / RAL 7024		
Weight approx.	lb. (kg)	85 (39)	105 (48)	187 (85)
MOTOR - BRUSHLESS TECHNOLOGY				
Isolation Class		Insulation class F, max. 155° C (311°F) permanent temperature		
Power Supply	V	24 VDC, 1x 115-230 VAC, 50-60Hz, 3x 380-480 VAc, 50-60 Hz		
	Nominal Current	2.5 A		
Power Consumption Idle with Fail-Safe Brake		36 W	40 W	40 W
ACTUATOR CONTROL				
Technology	Integrated processor control unit with frequency technology for variable speed control			
Control Elements	· With additional language independent symbols · Selector switch LOCAL - OFF- REMOTE (lockable) · Control switch OPEN - STOP - CLOSE contact less sensor technology			
Local Display	Backlit LCD display, can be rotated in 90 degree steps			
LEDs	4 programmable red, green, blue LEDs for operation - readiness - warning - and error messages			
Communication	Infrared communication interface and bluetooth technology including ANDROID APP for simple configuration			
Inputs	· 5 configurable binary (discrete inputs) control inputs: OPEN - STOP - CLOSE - EMERGENCY OPEN - EMERGENCY CLOSE · Nominal voltage 24VDC			
Outputs	· 8 configurable binary (relay) outputs: READY - OPEN - CLOSE - RUNNING OPEN - RUNNING CLOSE - TORQUE - LOCAL - REMOTE · Power supply 24 VDC +/– 6V (selectable internal or external)			
FUNCTIONS				
Standard	· Switch-off mode adjustable, travel or torque dependent · Torque adjustable: 25-100% of max. torque · Adjustable speed for process optimization and emergency speeds · Password protection (reading and/or writing) · Multi-language display · Status indication for binary inputs/outputs and analog signals on LCD Display · Data logging for analysis and service · Motor protection by Positive Temperature Coefficient sensors			
ELECTRICAL CONNECTION				
Cable Entry	3 metric threaded boreholes for cable grands: M40x1.5 / M32x1.5 / M25x1.5 (Optional: 2x NPT1/2“ + 1xNPT1“)			

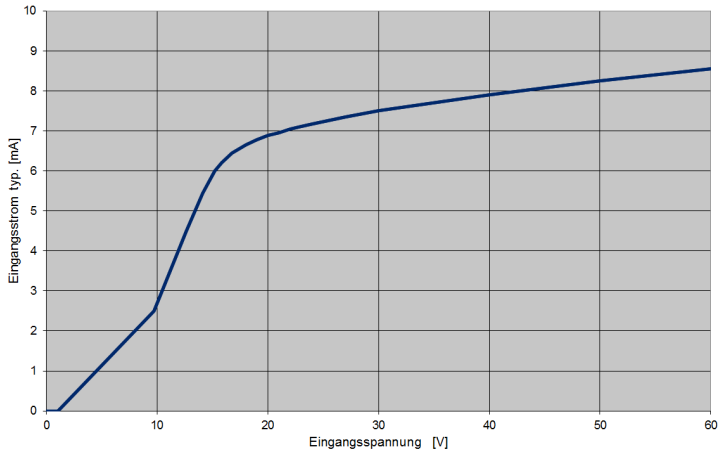
Section 25: Technical Data General

25.1 Binary Inputs Data Table

Parameter	Value
Count:	5
Nominal voltage:	24VDC/48VDC
	towards common ground
Threshold voltage for input set:	>15V
Threshold voltage for input not set:	<10V
Maximum voltage:	60VDC
Current consumption at 24V:	typ. 5mA

Binary inputs are separated from other controllers via optocouplers.

Figure 67 Current/Voltage Relation



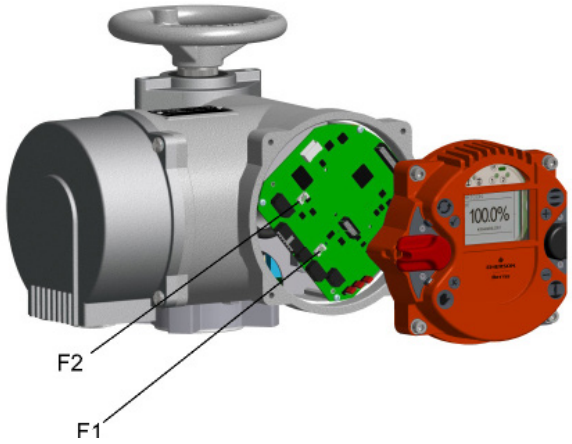
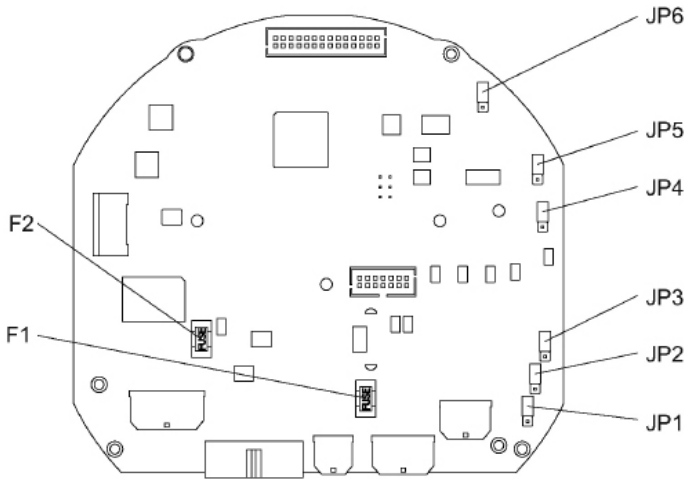
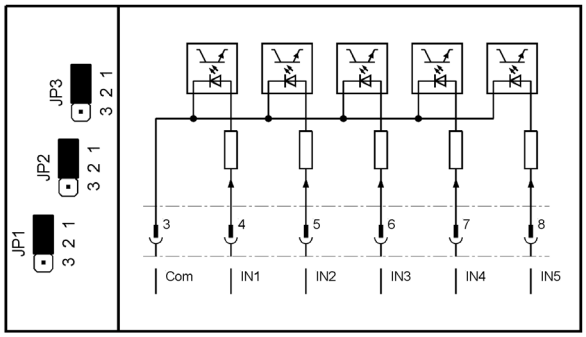


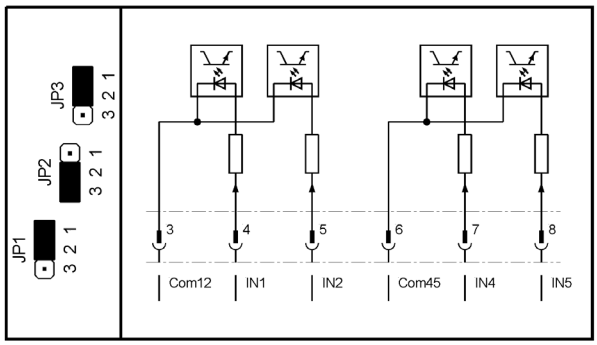
Figure 69 Logic Board



Jumpers JP1 to JP3 can be used to interconnect the binary inputs to groups with separate earths:

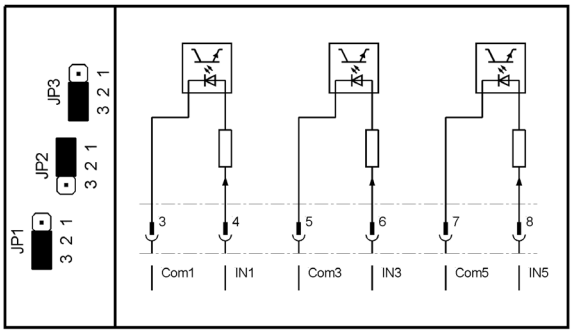
Figure 70 5 Inputs with Same Common





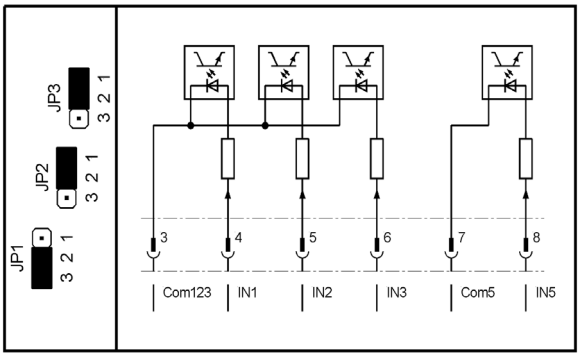
Input In3 is disabled.

Figure 72 3 Separated Inputs



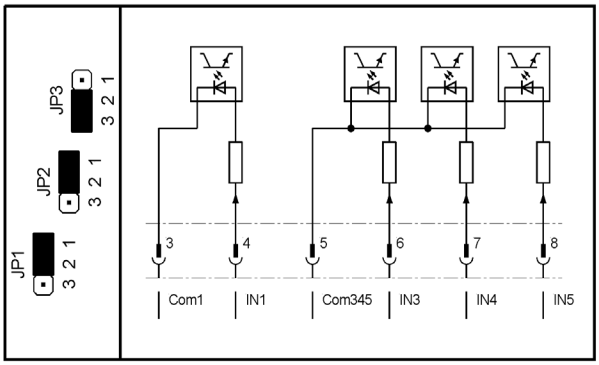
Inputs In2 and In4 are disabled.

Figure 73 3 Inputs with Same Common Ground and 1 Separated Input



Input In4 disabled.

Figure 74 1 Separated Input and 3 Inputs with Same Common



Input In2 is disabled.

25.2 Binary Outputs

Table 26. Output Data Table

Parameter	Value
Count:	8
Power supply:	24VDC nominal
	range: 11 to 35VDC
	(either from internal or external)
Max voltage drop at set output:	1V
Output voltage at non-set output:	<1V
Maximum current per output:	500mA (short circuit proof)
Maximum permissible total current for all outputs:	4A
Fuse (Fuse F2, see Figure 68):	4A time-lag
	(Littelfuse 454 NANO² Slo-BloQ®)

Binary outputs with external supply are separated from other controllers via optocouplers.

25.3 Analog Inputs

Input 1: Reference value

Table 27. Analog Input 1 Table

Parameter	Value
Current range:	0-25mA
Resolution:	14Bit
Accuracy:	0.5%
Input resistance:	60 Ohm

Analog Input 1 is electrically isolated from the rest of the control system.

Input 2: External actual value

Only in conjunction with the PID controller.

Table 28. Analog Input 2 Table

Parameter	Value
Current range:	0-20mA, 8mA
Resolution:	10Bit
Accuracy:	0.5%
Input resistance:	120 Ohm

Jumper JP6 can be used to switch Analog Input 2 from a passive input (default) to an input with 24V power supply (for 4-20 mA, two-wire transmitters).

NOTE:

The earth potential from Analog Input 2 is the common earth of the Control System and the auxiliary power supply (see Section 33.5).

25.4 Analog Outputs

Table 29. Analog Outputs Table

Parameter	Value
Count:	1
Current range:	0-20,8mA
Resolution:	14Bit
Accuracy:	0.5%
Max load:	600 Ohm

Reference ground is the common ground of the controller and the auxiliary voltage (see Section 33.5).

25.5 Auxiliary Voltage Input and Output

Table 30. Auxiliary Voltage Input and Output Table

Parameter	Value
Input voltage range (auxiliary voltage input):	20-30VDC
Maximum current consumption (auxiliary voltage input):	500mA
Maximum current consumption in power-save mode (auxiliary voltage input):	120mA
Output voltage (auxiliary voltage output):	typ. 23VMax
Output current (auxiliary voltage output):	200mA Resistance
Of ground potential vs. body:	typ. 500kOhm
Capacitance of ground potential vs. body:	typ. 100nF
Voltage of ground potential vs. body:	max. 40Vs
Fuse:	1A time-lag
	(Littelfuse 454 NANO² Slo-BloQ®)

Ground potential is the common ground of the controller and the analogue inputs and outputs. The auxiliary voltage output can be set by the menu P6.5 (see Section 18.5).

The power-save mode is defined as follows:

- No power supply (the controller is powered exclusively through the 24V auxiliary voltage input).
- The lighting of the LCD display switches off automatically.
- Binary outputs and the mA output are not enables; when activating, the respective currents must be added to the total current.

25.6 Connections for Non-Explosion Proof Version

Table 31. Connections for Non-Explosion proof Version Table

Parameter	Value
Power/motor:	Industrial plug with 6 pins screw connection
	16A, max. 2.5mm², AWG14
Control signals:	Industrial plug with 24 pins Screw connection
	16A, max. 2.5mm² , AWG14

25.7 Connections for Explosion Proof Version

Table 32. Connections for Explosion proof Version Table

Parameter	Value
Power/motor:	Terminals with screw connection
	16A, 0.5 to 4mm², AWG20 and AWG12
Control signals:	Terminals with screw connection
	4A, 0.5 to 2.5mm², AWG20 and AWG14

Appendix A: List of Figures

Appendix B: List of Tables

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