# Explosion-proof Spring Return Fail-safe Electric Valve Actuator

2020.01
SY08-B001C/EN

## CAUTION！

**The applicable place of the product should be based on the nameplate and followed our safety instructions, explosion-proof standards and local relevant specifications. The explosion-proof standards and important notices are not universal.**

II2GD Ex db IIB T4 Gb, Ex tb IIIC T130℃ Db

SE series Explosion-proof Spring Return Fail-safe Electric Valve Actuator (referred as "actuator") is a control device for valves and can be used in the places, where is classified as Zone 1 or Zone 2, contained Group Ⅱ A and Group Ⅱ B gases, Zone 21 or Zone 22, contained the combustible dust atmosphere or the mixture circumstance with the explosive gas atmospheres and the combustible dust atmospheres. Temperature group T1 - T4.

This product is certified to be used in the following locations：
Atmospheric pressure：80 - 110 kPa.
Ambient temperature：- 30 ℃ to + 70 ℃ ( - 22 ℉ to + 158 ℉).
Relative humidity：Not more than 95 % (+ 25 ℃ / 77 ℉).
The actuator can operate normally within tolerated variation of ±10 % of rated supply voltage or 1 % of rated frequency.

TD0404XY

II2GD Ex db IIB T4 Gb, Ex tb IIIC T130℃ Db

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C US

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**Division System** where is classified as North American Division 1 or Division 2 of hazardous location, contains Group C and Group D gases and temperature group T1 - T4 ; or contains one or several flammable dusts with minimum flaming point over 130 ℃ ; or include both above flammable gases and dusts.

**Zone System** where is classified as North American Zone 1 or Zone 2 of hazardous location, contains Group Ⅱ A and Group Ⅱ B gases and temperature group T1 - T4 ; or in Zone 21 or Zone 22, contained one or several flammable dusts with the minimum flaming point over 130 ℃; or include both above flammable gases and dusts.

This product is certified to be used in the following locations：
**Class I, Division 1, Groups C, D T4**
**Class II, Division 1, Groups E, F, G T130℃**
**Type 4X**
**Ex db IIB T4 Gb (For Canada)**
**Class I, Zone 1, AEx db IIB T4 Gb (For US)**
**Ex tb IIIC T130˚C Db (For Canada)**
**Zone 21, AEx tb IIIC T130˚C Db (For US)**
**IP68 (72h, 7m)**

## Installation Notices

a. The spring return actuator is shipped in spring return position (spring unloaded) with the configuration of spring clockwise and fully-closed when power outage unless specified.
b. DO NOT install in ambient temperatures that exceed 70 ℃ (158 ℉).
c. DO NOT, under any circumstances, remove the cover of the actuator while in a hazardous location when the power is still live inside the actuator. This could cause ignition of a hazardous atmosphere.
d. DO NOT, under any circumstances, use an explosion-proof electric actuator in a hazardous location that does not meet the specification which the actuator was designed for.
e. Mount, test, and calibrate actuators in non-hazardous location.
f. When removing the actuator, care must be taken not to scratch, scar or deform the flame path of the cover or base of the actuator. That will negate the protection rating of the encosure in a hazardous location.
g. The explosion-proof electric actuator is shipped with mating surfces of the cover and base. When assembling them, pay attention to the mating number (QA code) to assure the protection rating in a hazardous location.
h. Please read operation manual and wiring diagram carefully before installation.
i. Verify that supply voltage is in accordance with the data on nameplate to prevent short circuit or electrical/electronic parts damage caused by incorrect power input.
j. Turn power off before wiring or maintenance.
k. There are grounding devices both inside and outside of the actuator and the ground wires should be connected properly.
l. The metal plugs in conduit entries are for transit only. For long term protection fit suitable flameproof cable gland and power cable should be with a minimum withstand temperature105 ℃ (221℉). Please refer to operation manual section 1.2.3 (P.3).
m. To avoid functional failure caused by static, do not touch any components on the PCB with metal tools or bare hands.
n. Do not parallel wire multiple actuators together without using an extra relay.
o. Use proper techniques when installing conduit and properly seal the connection. Do not mount the actuator with conduit entries in upright position to prevent condensation from entering the unit.
p. After manual operation, the actuator shall be returned to its unloaded position by handwheel before electrical operation of the actuator.
q. Actuator should be installed in an upright or horizontal position. Do not mount upside down or below a horizontal position.
r. Periodically inspect actuator enclosure to prevent dust from accumulating.
s. Perform below inspections prior to installation. Not allowed to adopt if any item is unqualified.
   - ✓ Check the marking and certificate number to see if it conforms to the indicated application.
   - ✓ All the parts of the housing are assembled in the right manner and fastened.
     ⚠ **USE FASTENERS WITH YIELD STRESS ≥ 700MPa.**
   - ✓ All the explosion-proof parts should be made without cracks or functional defects.
t. KEEP COVER TIGHT WHILE CIRCUITS ARE ALIVE.
   ⚠ **AFTER DE-ENERGIZING, DELAY 10 MINUTES BEFORE OPENING THE COVER.**
u. SEAL REQUIRED WITHIN 18 INCHES (450 mm) OF ENCLOSURE (for Divisions only).
v. SEAL REQUIRED WITHIN 2 INCHES (50 mm) OF ENCLOSURE (for Zones only).

**CAUTION !**

- **Please ensure that the O-ring seal is in good condition prior to cover installation.**
- **Installation, maintenance and repair works must be performed by trained personnel.**
- **Do not use any tools to increase force on handwheel for operating as this can damage the actuator or valve.**

## Manual Device Installation

a . Slide fixing screw through washers and handwheel and secure them to override shaft as shown in the figure below (figure 1).

⚠ **Turn off power when installing handwheel.**

b . Assembly completed as shown in the figure below (figure 2).

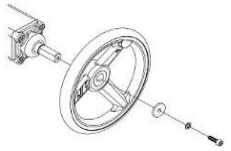
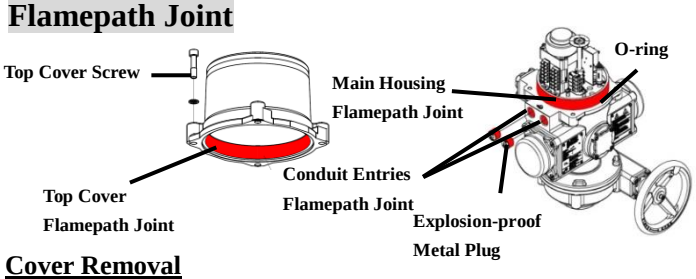


Figure 1

Figure 2

## Flamepath Joint




### Cover Removal

Remove the conduit entry metal plugs to relieve the pressure inside the actuator for the ease of the top cover removal and gently remove the cover. DO NOT attempt to remove the top cover with a screwdriver as it will damage the surfaces.

### Cover Installation

⚠ **Please ensure that the O-ring seal is in good condition prior to cover installation. Slowly re-install the cover while being careful not to pinch the O-ring seal.**

⚠ **The explosion-proof enclosures are labeled with a QA code on both of the middle plate and the cover, please verify the QA code inside the cover is the same as the one on middle plate when installation. The cover is not interchangeable.**

Please follow below table to tighten the cover screws：

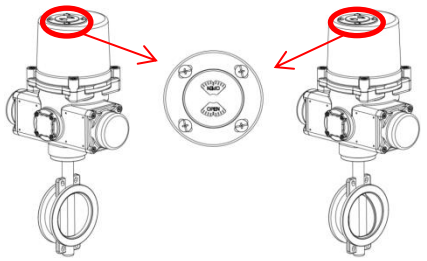
| Model | Screw | Allen Key | Torque |
|---|---|---|---|
| | | mm | N·m |
| SE-500 | M10 | 8 | 43 |
| SE-1300 | M14 | 12 | 120 |
| SE-2000 to SE-2600 | M16 | 14 | 185 |

## Valve Mounting Instructions

⚠ **For safety reasons, do not remove or inspect the SPRING STRUCTURE. Proper tools must be used, or serious injury will occur.**

a. The actuator shall be sized to ensure that its torque output meets the load requirements of valve and its ability to overcome the required duty cycle of application (As a MINIMUM, a 30% safety factor is suggested for the calculation of torque requirement).

- If the maximum torque of 5” valve is 80 N·m
  → 80 × 1.3 (safety factor) = 104 N·m
  **104 N·m < 130 N·m (SE-1300) →OK!**
  104 N·m > 50 N·m (SE-500) →Not OK!



b. The spring return actuator is shipped in spring return position (spring unloaded) with the configuration of spring clockwise and fully-closed when power outage unless specified. Refer to operation manual section 7 to ensure actuator selected meets the application.

c. Make sure the valve is in correct FAIL POSITION before mounting the actuator to it. Refer to illustration above.

d. Remove all of valve handle parts, for example, the handle or open/close mechanical stops so as to not interfere with the actuator.

⚠ **Do not remove packing gland or other parts necessary for operation from valve.**

e. Check again that the valve and actuator are in the same position (fully-open or closed).

f. Once mounted together, either directly or with a mounting kit, ensure that they are properly secured together and all fasteners are tightened.

g. Remove the conduit entry metal plugs to relieve the pressure inside the actuator for the ease of the top cover removal and gently remove the cover. Please refer to Flamepath Joint section for cover installation.

⚠ **The power must be off before removing the cover.**

⚠ **AFTER DE-ENERGIZING, DELAY 10 MINUTES BEFORE OPENING THE COVER.**

h. Refer to operation manual section 4.3 for wiring notices and connect the wires according to the wiring diagram labeled inside the cover of actuator.

i. Supply power to actuator.

⚠ **Care must be taken at all times as there are live circuits present that may cause electrical shock.**

j. Re-calibration may be required for the end positions, refer to Actuator Set-up section for further instructions.

k. Assemble the cover and secure cover screws firmly after setting.

- **Refer to Flamepath Joint section for installation and check if there is any foreign object between top cover flamepath joint and base.**
- **Please ensure that the O-ring seal is in good condition prior to cover installation.**

⚠ **The explosion-proof enclosures are labeled with a QA code on both of the middle plate and the cover, please verify the QA code inside the cover is the same as the one on middle plate when installation. The cover is not interchangeable.**

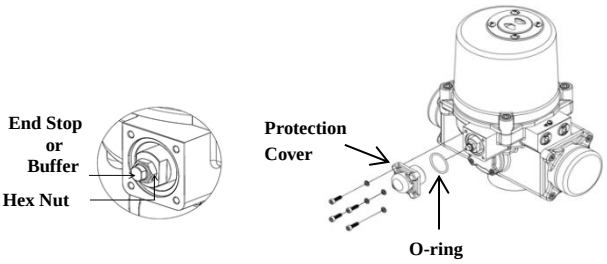
## Actuator Set-up

⚠ **If the actuator is equipped with a manual override, rotate the handwheel to return the actuator to its spring fully unloaded position before the power is supplied.**

⚠ **Use proper cable glands with IP rating when installing and securely tighten the conduit fittings to ensure the enclosure protection rating.**

The spring return actuator provides fail-safe positioning and the end stop position of spring return is determined by either buffer or end stop (On/Off by the buffer, floating or modulating limited by end stop). When the actuator is motorized, the end position is determined by limit switches.

The actuator has been set and calibrated at the factory. Most of products will not require recalibration of these settings. However these are general settings. After valve and actuator are bolted together, apply power to drive the actuator to its fully-open (spring compressed). Then remove power to let the rack and pinion spring mechanism drive back to its fully-closed position. If the OPEN or CLOSE stop point are not aligned with valve or damper correctly, its end positions must be adjusted. Please follow steps below：

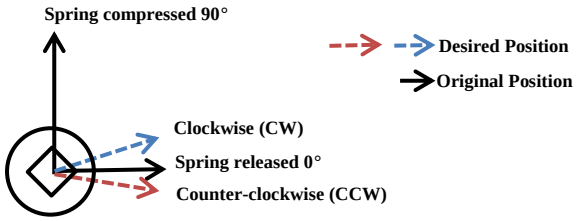



⚠ **For modulating unit, ensure to loosen the sector gear of potentiometer first before adjusting the following settings.**

- **Adjustment procedure for spring-return actuator in the fail-closed position upon loss of supply voltage.**

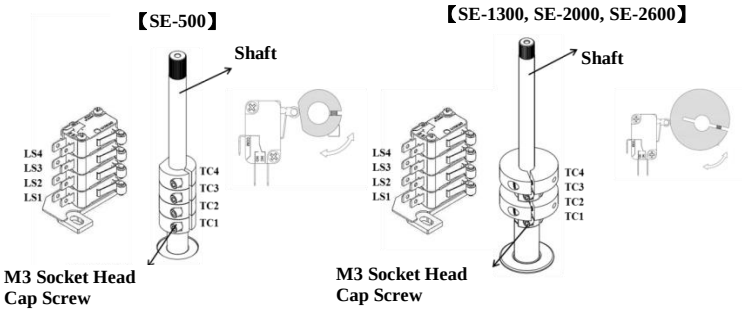
**Adjust FULLY-CLOSED (spring released) stop point as steps below:**

a. Turn power off and loosen the protection cover using a 5 mm hex key.
b. Loosen the hex nut of the end stop or buffer using a 17 mm hex wrench. Hold the hex nut and turn the end stop or buffer using a 10 mm hex wrench to adjust end position.
c. Turn the buffer or end stop to adjust the fully-closed stop point.



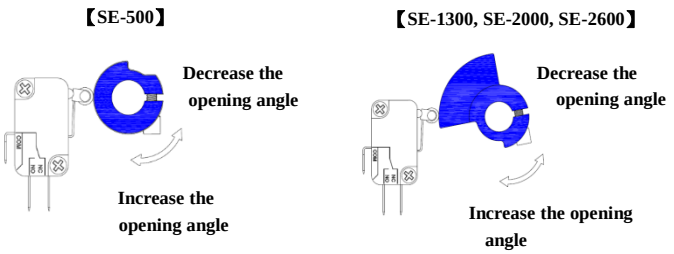

- SE-500: One turn = 2.3 degrees.
- SE-1300 to SE-2600: One turn = 1.4 degrees.

d. Once completed, tighten the hex nut, replace the protection cover and tighten all screws.
⚠ **If the buffer or end stop is adjusted, TC2 must be reset in accordance with the buffer or the end stop.**
e. Loosen the M3 cap screw of cam TC2 with a 2.5 mm hex key.
f. Rotate the cam TC2 counter-clockwise until a light click is heard, and then slowly rotate the cam TC2 clockwise until a light click is heard.
g. Tighten the cap screw of cam TC2.



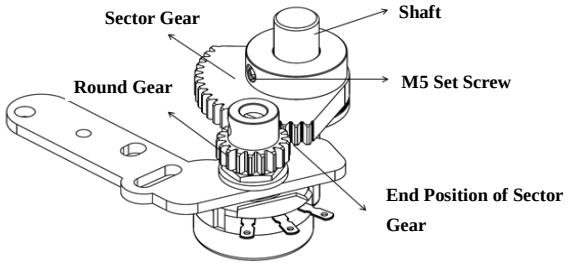

**Adjust FULLY-OPEN (spring compressed) stop point as steps below:**

a. Apply power to drive the actuator to its fully-open (spring compressed) position. If the open stop point is not aligned with the valve or damper properly, then it must be adjusted.
b. Remove power to let spring system to drive back to its fully-closed (spring released) position.
c. If it is required to adjust, loosen the cap screw of cam TC1 with a 2.5 mm hex key.
   - To increase the opening angle, turn the cam clockwise.
   - To decrease the opening angle, turn the cam counter-clockwise.




d. After adjusting the cam, apply power to drive the actuator to the fully-open position.
e. Verify that it is in the correct fully-open position.
   - ✓ If it is in correct position, remove power and lock the cap screw of cam TC1.
   - ✓ If it is not in correct position, repeat step C until the correct position is reached.
f. If auxiliary switches will be used for feedback, cams TC3 and TC4 need to be calibrated.
   - ✓ Adjust cam TC3 so it trips just before cam TC1 does.
   - ✓ Adjust cam TC4 so it trips just before cam TC2 does.

- For modulating actuators, after completing the calibration, turn the actuator to fully-closed position and follow the procedure below：
  a. Loosen M5 set screw.
  b. Rotate sector gear clockwise to the position shown in figure below.
  ⚠ **Ensure that round gear and sector gear are engaged properly.**
  c. Tighten M5 set screw.



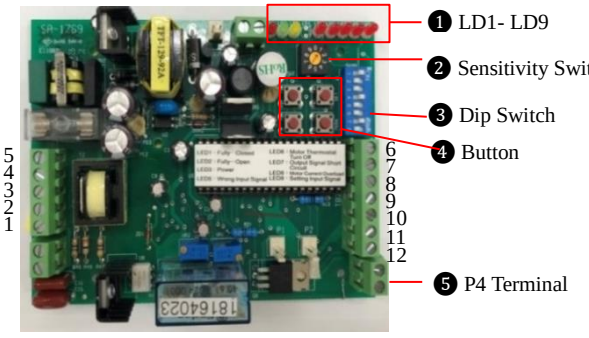

**TC2 is utilized for sensing fully-closed stop point. Once the spring mechanism has been released when power outage, the actuator will not drive under power again until it has reached its fail stop position and TC2 trips.**

**TC1 "OPEN"** ⟲ **Clockwise：increase opening degree.**
**Counter-clockwise：decrease opening degree.**

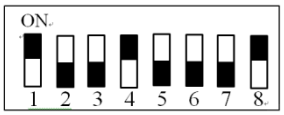
**Note:**
- **LS2 shall trip while TC2 reaches the end stop point.**
- **TC3 &TC4 are optional; refer to operation manual P.19 & P.21 section 4.4.1 (f.) and 4.4.2 (f.) for calibration.**

## Modulating Control Board Adjustment

**▲The layout is based on 110 / 220V voltage.**



## Dip-Switch Setting (Original Factory Setting：1, 4, 8 ON)




ON

OFF

* S1, S2：Input Signal Setting

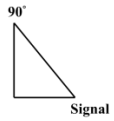
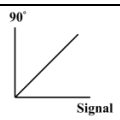
| Input Signal | S1 | S2 |
|---|---|---|
| 4 - 20 mA | ON | OFF |
| 1 - 5 V | OFF | OFF |
| 2 - 10 V | OFF | ON |

* S3, S4 & S5：Output Signal Setting

| Output Signal | S3 | S4 | S5 |
|---|---|---|---|
| 4 - 20 mA | OFF | ON | OFF |
| 2 - 10 V | ON | OFF | ON |

* S6, S7 & S8：Setting of fail position when input signal fails.

⚠ **The input signal type is set by switches 1 and 2. And switch 6 is used to set the corresponding relationship between value of input signal and operation direction of actuator.**

| Symbol | S6 | S7 | S8 | Signal Failed Position |
|---|---|---|---|---|
|   | ON | OFF | ON | Fully-Open ( 90°) |
| | | ON | OFF | Fully-Closed ( 0°) |
| | | ON | ON | The Last Position |
|   | OFF | ON | OFF | Fully- Open ( 90°) |
| | | OFF | ON | Fully- Closed ( 0°) |
| | | ON | ON | The Last Position |

## P4 Terminal

- P4 is a contact for alarm conduction. If the microprocessor detects that the actuator has not reached the preset end of travel stop within 15 seconds, then the microprocessor conducts P4. It can connect with an alarm or similar devices for warning.

## Sensitivity Switch Setting (SW2)

a. When switched to “1”: The Highest Sensitivity.
When switched to “0”: The Lowest Sensitivity.
b. Original factory setting
- SE-500, SE-1300, SE-2000 to SE-2600: 3.

## Signal Setting for Open and Close Position

UP SET

DN MODE

⚠ **These settings are set and calibrated at the factory. Mostly, they do not need to be recalibrated. Please follow steps below to set when required.**

⚠ **Use a multimeter to measure the output signal in accordance with the selected signal type.**

| | | | |
|---|---|---|---|
| LD1 | Fully-closed | LD6 | Motor thermal protector activated |
| LD2 | Fully-open | LD7 | Output signal short circuit |
| LD3 | Power | LD8 | Overcurrent in motor |
| LD5 | Wrong input signal | LD9 | Local setting mode |

Press and hold ”SET” switch for 2 seconds until LD 9 lights to enter local setting mode.

**Signal setting for Fully-OPEN position**

a. Press and hold “UP” switch to operate the actuator to open until it has reached the fully-open position and LD2 lights and then input a signal 5 V or 10 V or 20 mA.
b. Press ”MODE” switch for 2 seconds to complete the setting of fully-open position.

**Signal setting for Fully-CLOSED position**

a. Press and hold “DOWN” switch to operate the actuator to close until it has reached fully-closed position and LD1 lights, and then input a signal 1V or 2V or 4 mA.
b. Press “MODE” switch for 2 seconds to complete the setting of fully-closed position.

**After completing the above settings, press “SET” switch to quit local setting.**