

FSE Series Spring Return Electric Actuator

Installation and Maintenance Manual



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OVERVIEW

Triac electric spring return actuators are designed to provide fail-safe positioning of valves and dampers upon loss of supply voltage, and include on/off control and modulating control. A mechanical spring set is used to position the controlled device to either the fully counterclockwise (OPEN) or fully clockwise (CLOSED) position without any external power source. For ON-OFF type, a mechanical BUFFER employed at the end of the spring stroke in order to reduce the dynamic effects of the spring return system. A clutch-less and lever-less manual override is available to provide manual positioning of the controlled device.

General Information

Safety Instructions

- Installation, maintenance and repair works must be performed by trained personnel.
- Handling shall follow the safety and warning instruction contained in this manual.
- The user should read and follow instructions contained in this operation manual. Failure to do so may result in damages and void warranty.
- Local health and safety legislation shall be complied with.
- In some cases, the surface temperature may exceed 140°F (60°C). Please check surface temperature before operation.

Installation Notices



CAUTION: For safety reasons, do not remove or inspect the SPRING STRUCTURE. Serious injury of damage may occur unless proper tools are used.



Operating by handwheel: Do not use any tools to increase force on handwheel for operating as this can damage the actuator or valve. Actuator **MUST** be returned to its spring release position before operating electrically.

- The standard spring return actuator rotates counterclockwise with power (spring compressed) and rotates clockwise with spring released (fully closed or fully open) on loss of power.
- Please read operation manual and wiring diagram before installation.
- Verify that supply voltage is in accordance with the data on nameplate to prevent short circuit or electrical/electronic parts damage.
- Turn off power before wiring or maintenance.
- Connect ground wire to PE point inside the actuator.
- Do not parallel wire multiple actuators together without using extra relays.
- Actuator should be installed in upright or horizontal position. Do not mount upside down or below horizontal.
- These units are not designed to operate in vacuum spaces or where an explosive atmosphere is present.
- Periodically inspect actuator enclosure to prevent dust accumulation.

Inspection, Storage, Transport

Receiving/Inspection

- Carefully inspect the package for any damage resulting from shipping and report all damages to freight carrier and seller.
- After unpacking, please keep cartons and packing materials in case of product return or replacement. Verify the items listed in packing slip or in bill of landing are the same as what were ordered, If there is any discrepancy, please contact the seller.
- Verify the technical data on nameplate and labels is in accordance with what was ordered.

Storage

- The actuator should be stored in a dry area with relative humidity less than 90% (68±9°F / 20±5°C) and at temperatures between -4°F to 104°F (-20°C to 40°C).
- The product shall be stored with suitable protection from weather, extreme vibration and corrosive substances that can damage the actuator.
- Conduit plugs should not be removed until the actuator is ready to be cabled. Use suitable connections to ensure enclosure rating is maintained when installing.

Transport

- Attach ropes or hooks for the purpose of lifting by hoist only to housing and not to handwheel.
- Packaged actuators shall avoid violent impact and strong vibrations and be protected from precipitation.

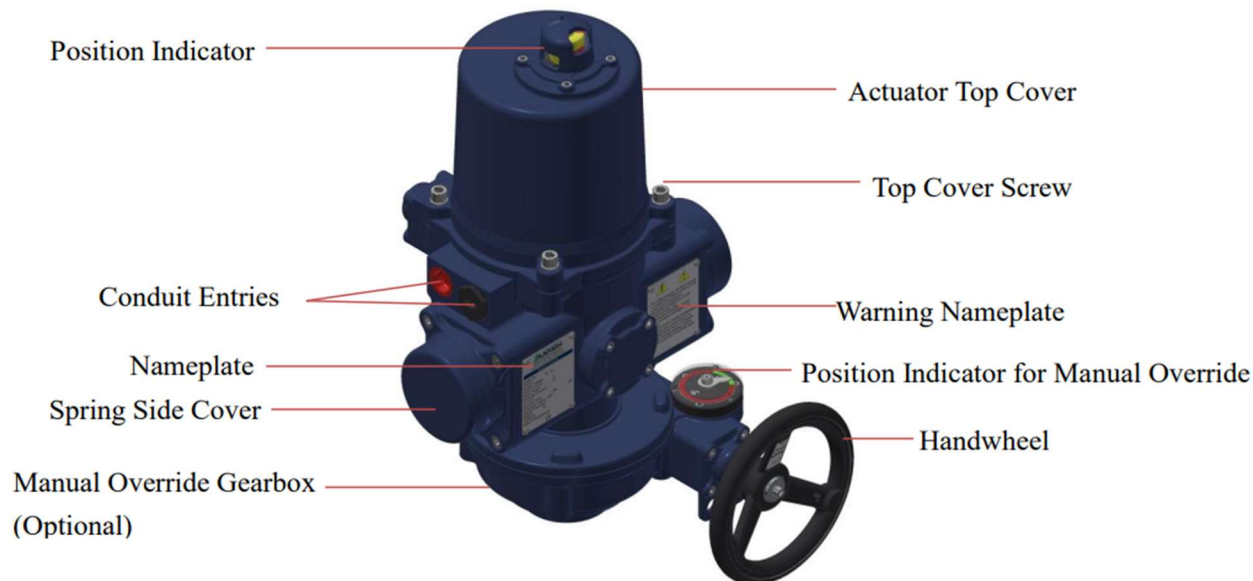
Lubrication

The gear train has been sufficiently lubricated at the factory and requires no additional lubrication.

SPECIFICATION

For purposes of this manual, Close = clockwise, Open = counterclockwise

Identification



Technical Information

Model No.	Max Torque (N.m.)	Weight (Kg.)	Drive Size Inch (mm)	Drive Depth Inch (mm)	Mounting Flange (ISO 5211)	Manual Override
FSE-440	50	27	.669 (17)	1.181 (30)	F07	No
FSE-1150	130	57	.866 (22)	1.614 (41)	F10	No
FSE-1770	200	95	1.063 (27)	1.772 (45)	F12	No
FSE-2300	260	95	1.063 (27)	1.772 (45)	F12	No
FSE-440MO	50	37	.669 (17)	1.181 (30)	F07	Yes
FSE-1150MO	130	74	.866 (22)	1.614 (41)	F10	Yes
FSE-1770MO	200	135	1.063 (27)	1.772 (45)	F12	Yes
FSE-2300MO	260	135	1.063 (27)	1.772 (45)	F12	Yes

► **MO : With Manual Override Gearbox**

Electrical Data

110/120VAC 1 PHASE

Model No. FSE	Max. Torque		Motor Power	Operation Time (Sec./90°)		Current Ratings	
	Nm	In-lb		Motor 60Hz / 50Hz	Spring	Run 60Hz / 50Hz	Lock 60Hz / 50Hz
440	50	440	50W	8 / 9	3	1.3 / 1.7	3.1 / 3.4
1150	130	1150	130W	8 / 9	10	4.0 / 2.5	4.9 / 4.9
1770	200	1700	130W	13 / 15	15	3.7 / 2.5	4.9 / 4.9
2300	260	2300	130W	15 / 18	19	3.7 / 2.5	4.9 / 4.9

220/240VAC 1 PHASE

Model No. FSE	Max. Torque		Motor Power	Operation Time (Sec./90°)		Current Ratings 220VAC/1 Phase	
	Nm	In-lb		Motor 60Hz / 50Hz	Spring	Run 60Hz / 50Hz	Lock 60Hz / 50Hz
440	50	440	50W	8 / 9	3	0.7 / 0.6	1.1 / 1.2
1150	130	1150	130W	8 / 9	10	2.0 / 1.4	2.4 / 2.4
1770	200	1700	130W	13 / 15	15	2.0 / 1.4	2.4 / 2.4
2300	260	2300	130W	15 / 18	19	2.0 / 1.4	2.4 / 2.4

24V AC/DC 1 PHASE

Model No. FSE	Max. Torque		Motor Power	Operation Time (Sec./90°)		Current Ratings 24VAC/DC 1 Phase	
	Nm	In-lb		Motor	Spring	Run DC / 60Hz / 50Hz	Lock DC / 60Hz / 50Hz
440	50	440	50W	8	5	3.5 / 4.2 / 4.3	25.6
1150	130	1150	130W	8	4	6.9 / 8.2 / 8.4	85.0
1770	200	1700	130W	13	4	8.6 / 10.0 / 10.0	85.0
2300	260	2300	130W	16	4	8.6 / 10.0 / 10.0	85.0


* Run : Full Load Ampere

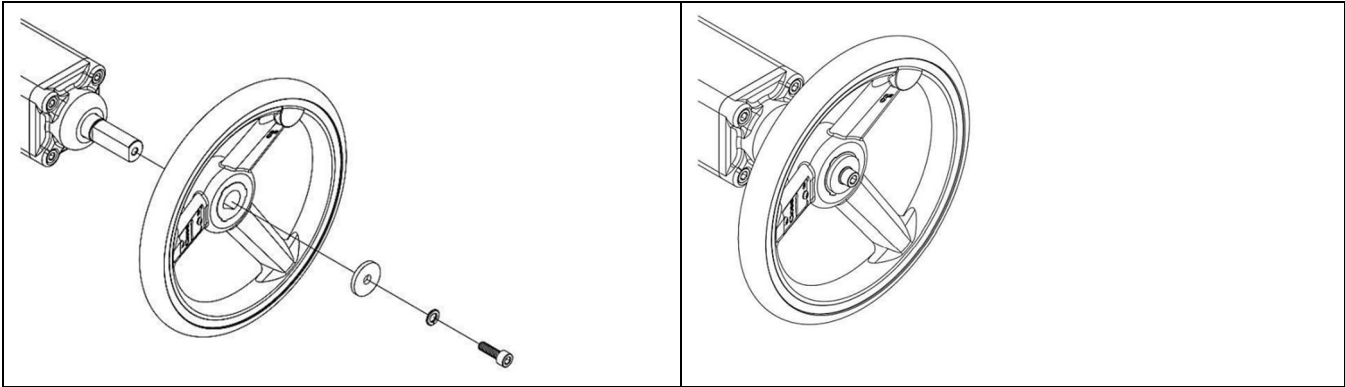
* Lock : Locked Rotor Ampere

INSTALLATION

Manual Handwheel

1. Insert screw through washers and handwheel before securing them to the override shaft as shown.

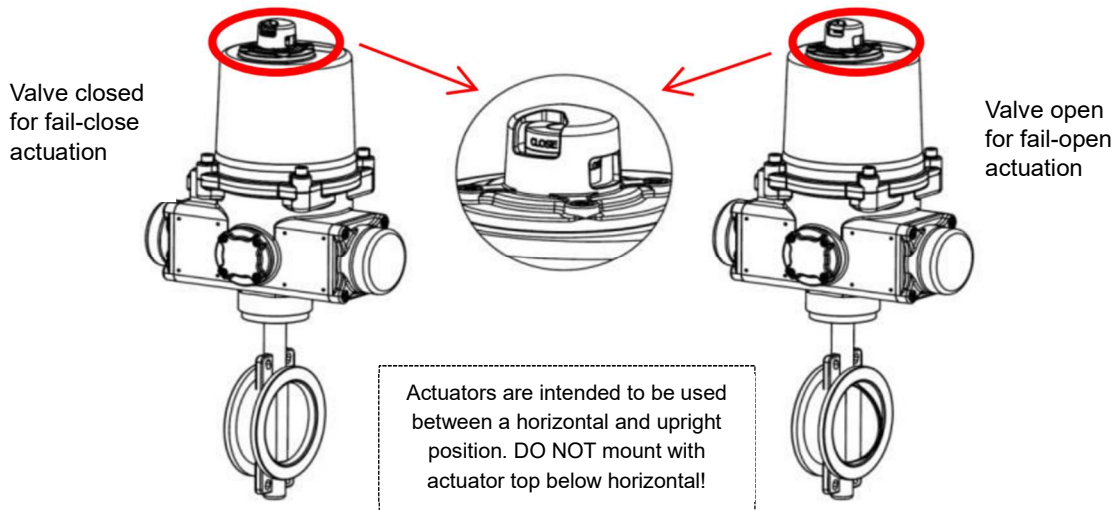
	Turn off power to actuator when installing handwheel.
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Mounting

The actuator is shipped in the designated fail position from the factory. Make sure the valve and actuator are in the same position before mounting.

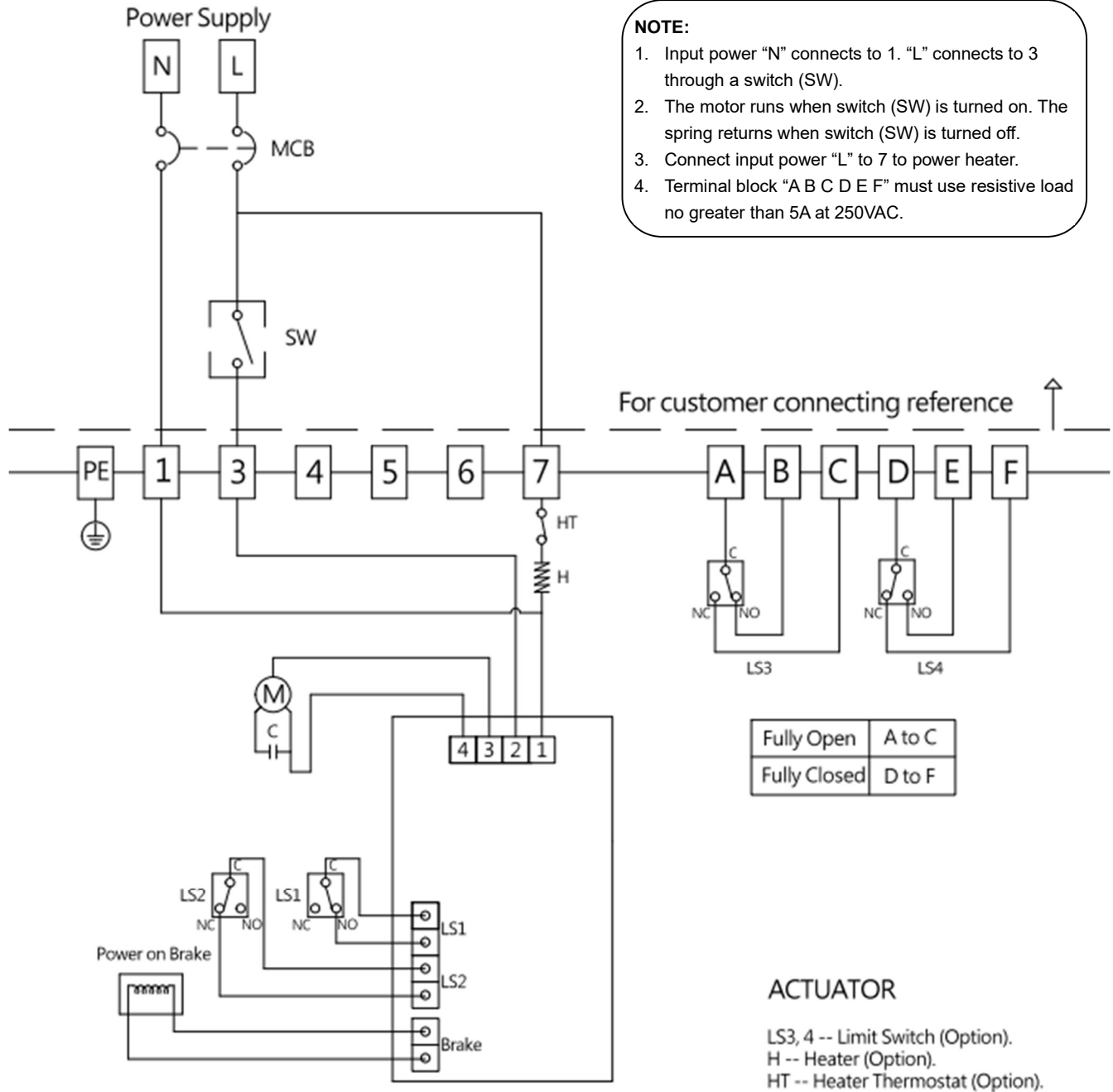
1. If the actuator is to fail close on loss of power, the valve must be in the closed position when mounting the actuator. On the other hand, if the actuator is to fail open on loss of power, the valve must be in the open position when mounting the actuator.



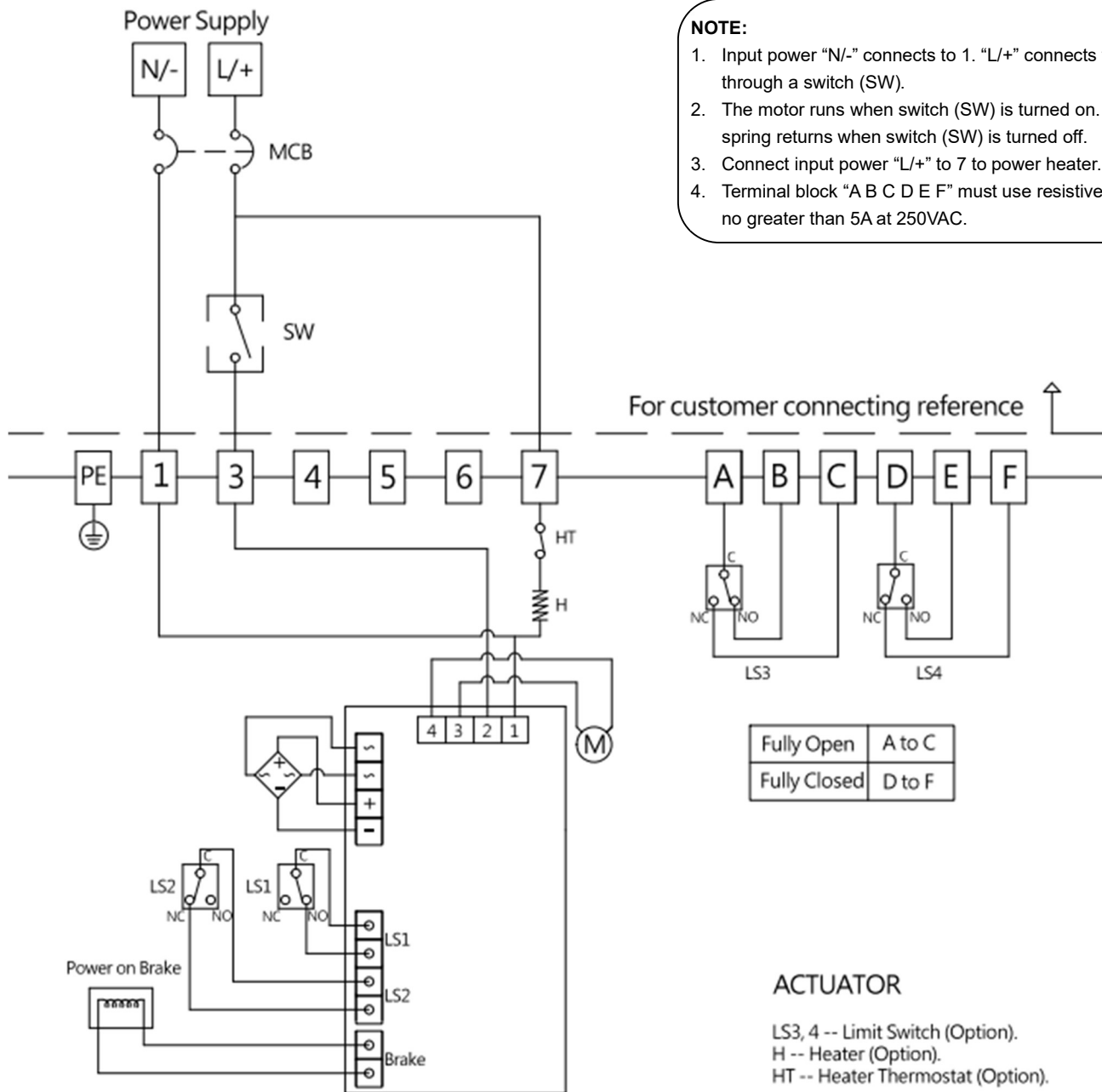
2. Remove valve mechanical stops and mount on the proper connection.
CAUTION: Don't remove any parts necessary for the proper operation of the valve.
3. Check again that the valve and actuator are in the same position.
4. Install mounting hardware on the valve or mount on the valve directly, mount actuator to valve. Securely tighten all bolts and screws once actuator screws have been started.
5. Remove actuator cover. **CAUTION: Be sure power is off at the main power box.**
6. Wire actuator using the wiring diagram inside cover.
7. Turn on power to actuator. **CAUTION: Use extreme caution as there are live circuits that could cause electrical shock or death.**
8. Make sure if it is needed to calibrate the fully-open or fully-closed position of the actuator. Refer to to set the fully -open or fully-closed position.
9. Replace cover and secure cover screws.

WIRING DIAGRAM

110V, 220V AC 1-Phase / On-Off Controller (two-position)



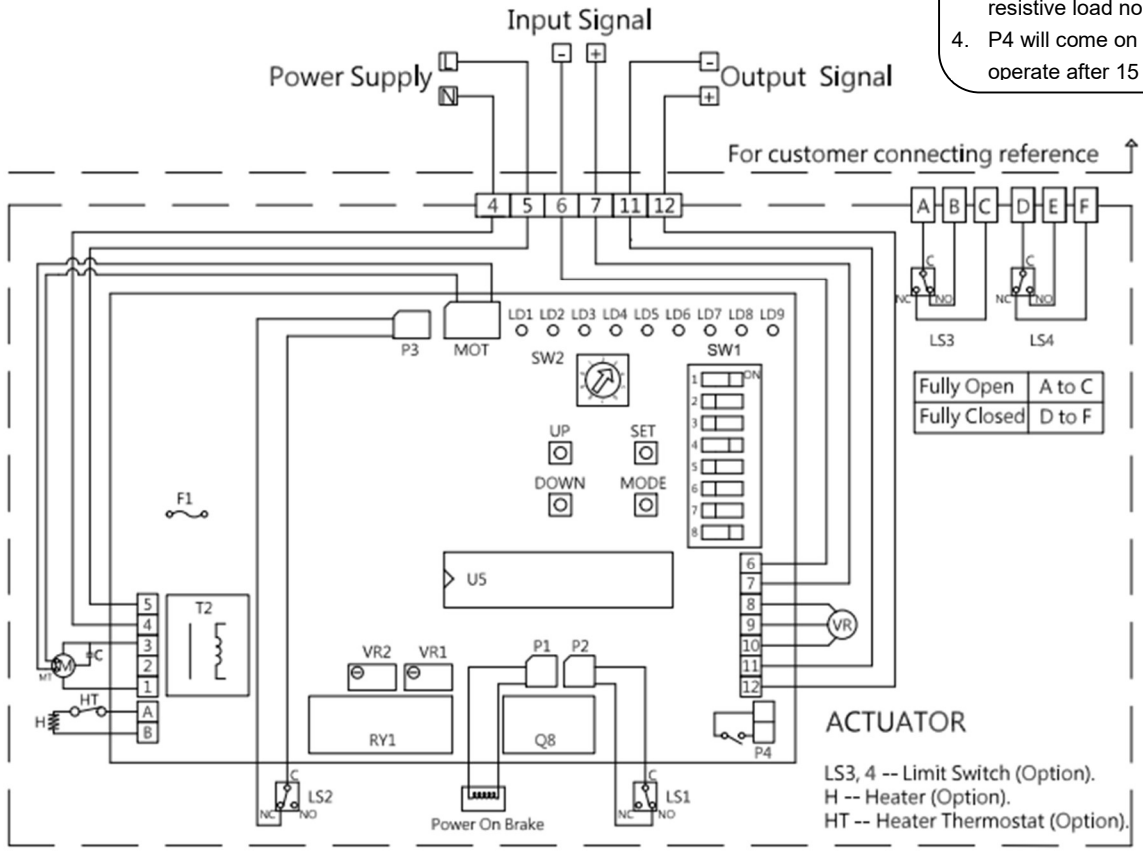
24V AC/DC On-Off Controller (two-position)



110V, 220V AC 1-Phase / Modulating Controller

NOTE:

1. Input signal: 4-20mA, 2-10V, 1-5V
2. Output signal: 4-20mA, 2-10V
3. Terminal block "A B C D E F" must use resistive load no greater than 5A at 250VAC.
4. P4 will come on when actuator does not operate after 15 seconds.



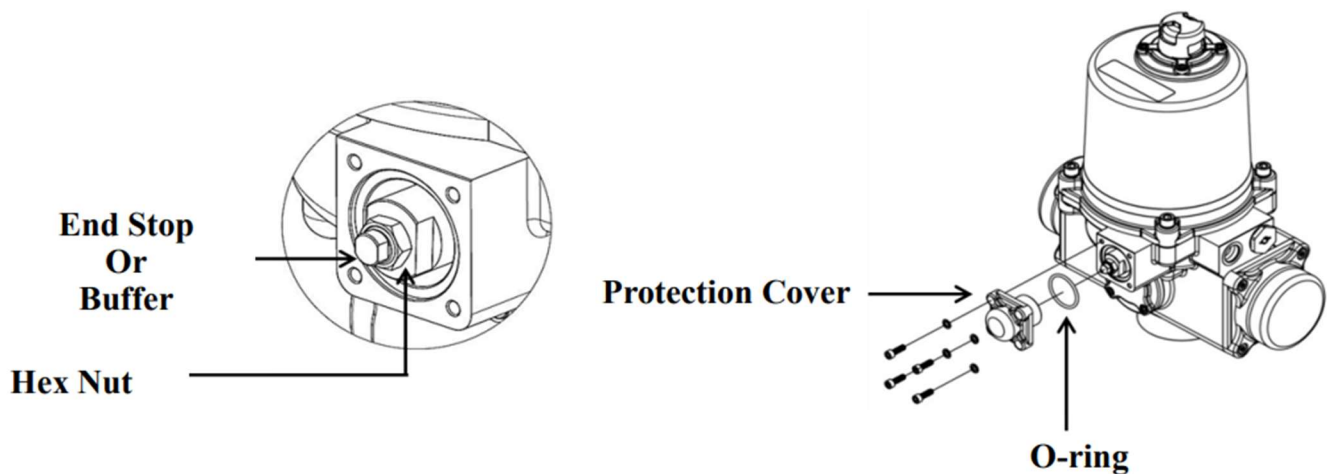
CALIBRATION**Actuator Setup**

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

Securely tighten the conduit fittings to ensure the enclosure protection rating.

Triac Spring return actuator provided fail-safe positioning which is controlled by buffer or mechanical stops. (ON-OFF Type controlled by buffer. / Floating and Modulating Type controlled by mechanical stops). When the actuator is powered, the end position is determined by limit switches.

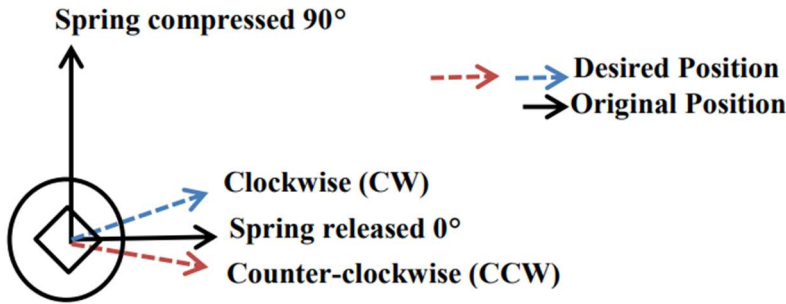
The actuator has been set and calibrated at the factory. Most products will not require recalibration of these settings. However these are general settings. After valve and actuator are bolted together, apply power to drive the actuator to its end (spring compressed) position. Then remove power to let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



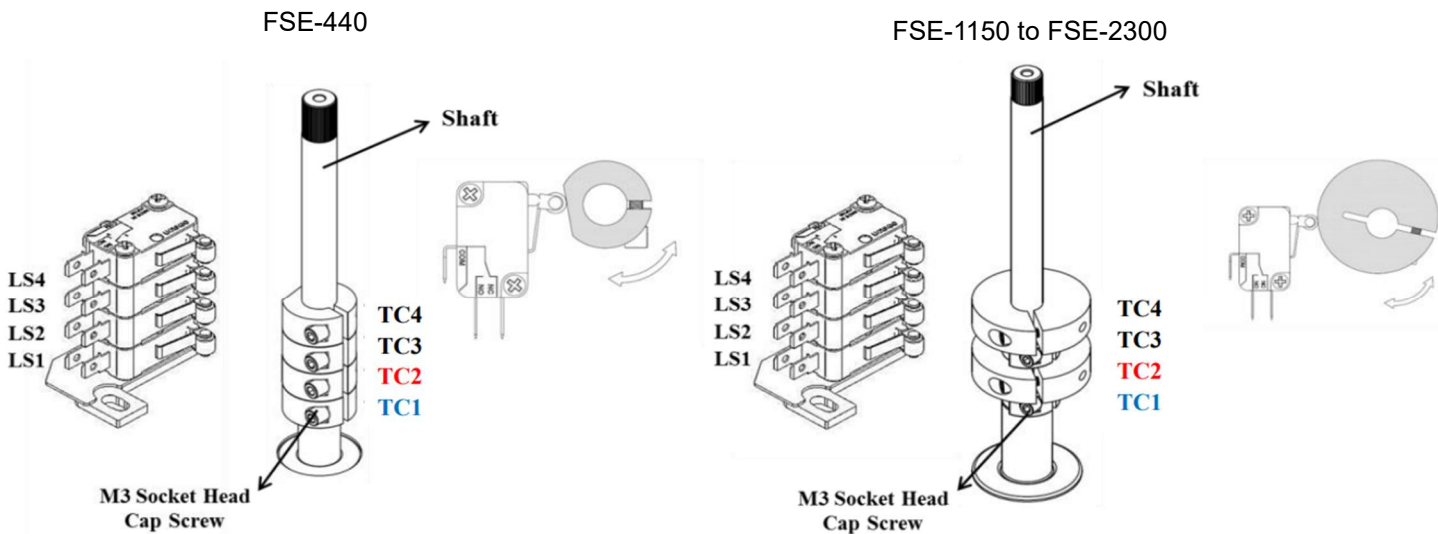
For modulating unit, be sure to loosen the sector gear of the potentiometer before adjusting the following settings.

Setting the fail (spring released) position:

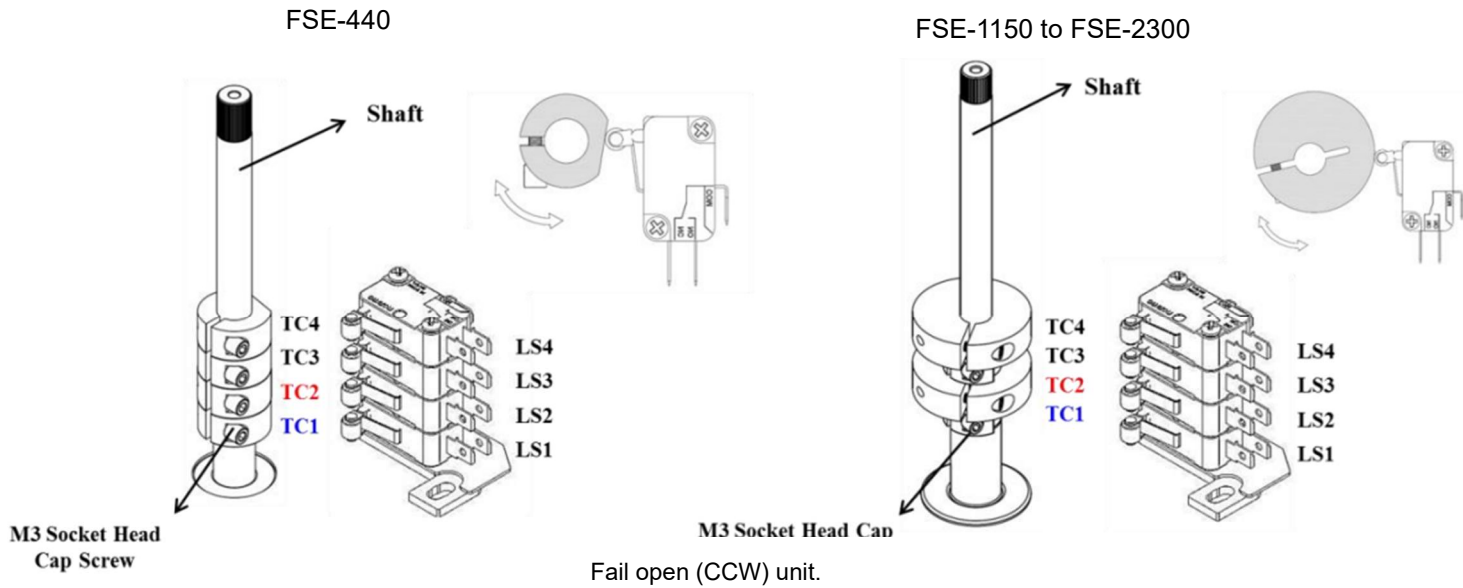
- a. Remove power from actuator and take off **protection cover** with 5mm hex key.
- b. Loosen the hex nut on the buffer or end stop using 17mm hex wrench. Hold the hex nut and turn the buffer or end stop using a 10mm hex wrench to adjust the fail position.
- c. Turn the buffer or end stop to adjust the stop point.



- (i) FSE-440: one turn – 2.3 degrees
- (ii) FSE-1150 to 2300: one turn = 1.4 degrees
- d. After the adjustment is completed, tighten the hex nut, replace the protection cover and securely tighten all cover screws.
If the buffer or end stop is adjusted, LS2 limit switch must be reset accordingly with the following steps.
- e. Loosen the M3 cap screw of cam TC2 with a 2.5mm hex key.
- f. Rotate cam TC2 until LS2 switch lever activates and then rotate TC2 back just until the switch lever releases and then tighten cam TC2 in place.

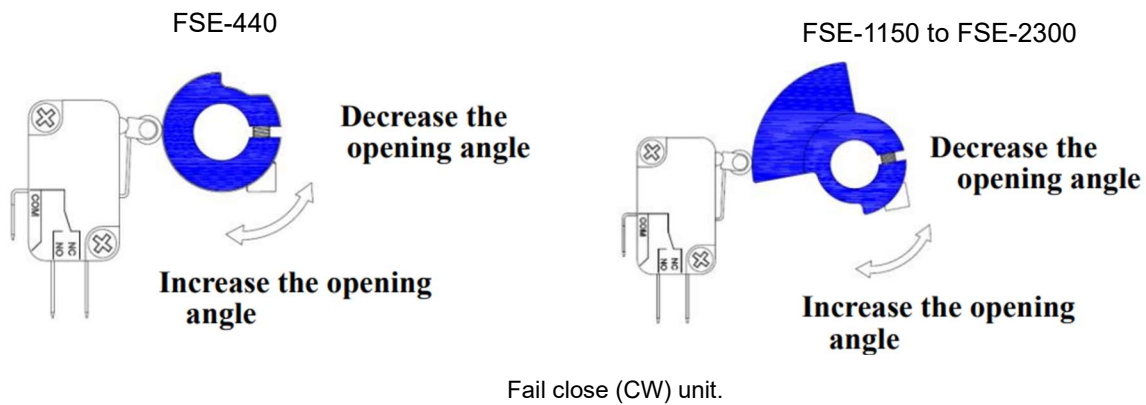


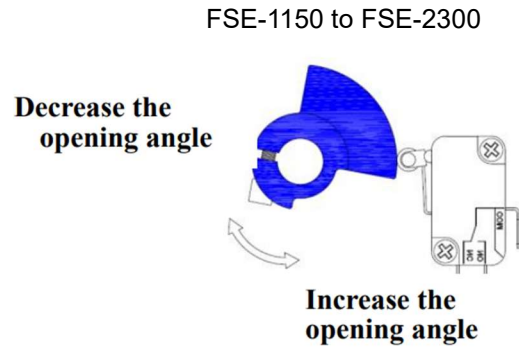
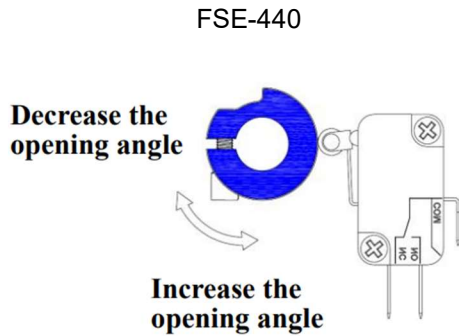
Fail close (CW) unit.



Setting the end (spring compressed) position:

- Apply power to operate actuator to fully open (spring compressed) position. If the open stop point is not aligned with the valve or damper properly, then it must be adjusted.
- Remove power so that the actuator returns to its fully closed (spring released) position.
- Loosen the M3 screw of cam TC1 with a 2.5mm hex key and adjust to increase or decrease the actuation angle.





Fail open (CCW) unit.

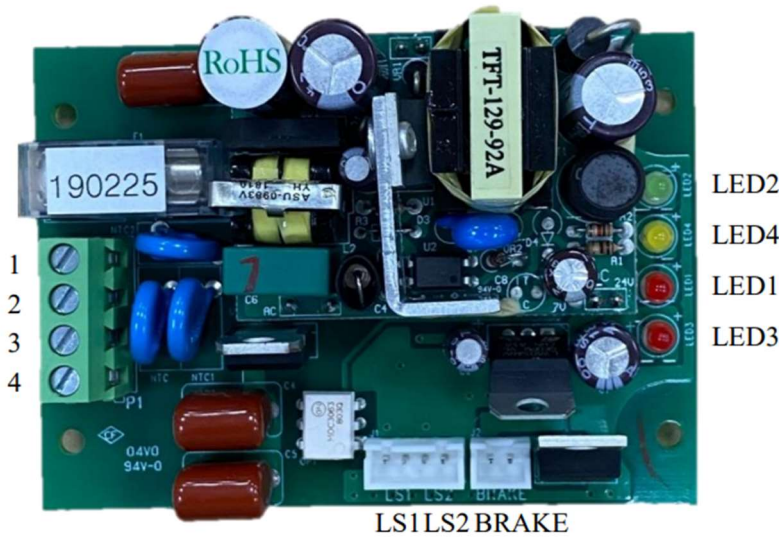
- d. After
adjusting the cam, apply power to drive actuator to the fully open (spring compressed) position.
- e. Verify that the position it stops is correct. If it is correct, ensure the cam TC1 is fully tightened. If it is not correct, remove power and readjust cam again.
- f. If auxiliary switches LS3 and LS4 will be used for feedback, cams TC3 and TC4 need to be adjusted. Full limit switch function is listed in table below.

Limit Switch Truth Table

Switch	Position		
	Fail / 0% (Spring Released)	Intermediate	End / 100% (Spring Compressed)
LS4	1	0	0
LS3	0	0	1
LS2	0	1	1
LS1	1	1	0

On-Off Control Board Adjustment

Displayed board layout is for 110/220V.

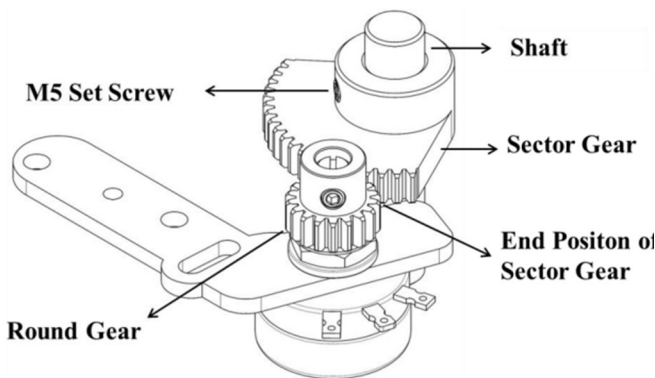


Lamp No.	Status
LED1	Power
LED2	Operating
LED3	Motor Brake
LED4	Fault Status

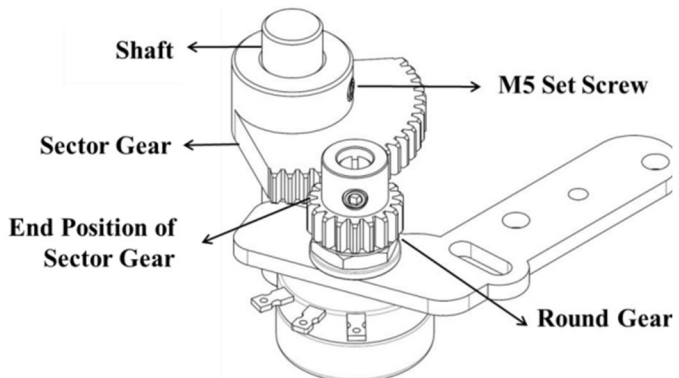
Modulating Control Actuators Potentiometer Setting

For modulating actuators, after completing the position calibration, turn the actuator to the spring released position and follow the procedure below.

- Loosen the M5 set screw on the shaft sector gear.
- Rotate the sector gear clockwise or counterclockwise, depending on the actuator fail direction, to the position in the figures below.
- Tighten M5 set screw.
- If installing new potentiometer, loosen potentiometer round gear set screw and with small screwdriver, rotate potentiometer to its end position while the actuator is in its fail position (CCW for fail CW actuator, or CW for fail CCW actuator). Retighten set screw.



Fail clockwise (CW) rotation

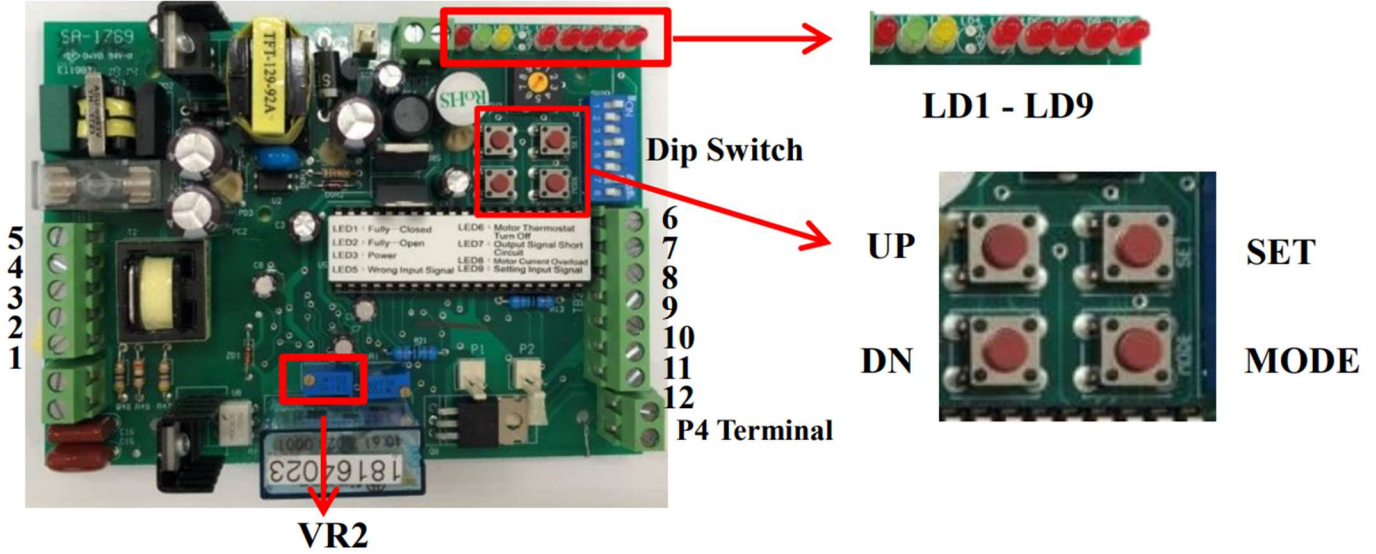


Fail counterclockwise (CCW) rotation

Modulating Control Board Adjustment

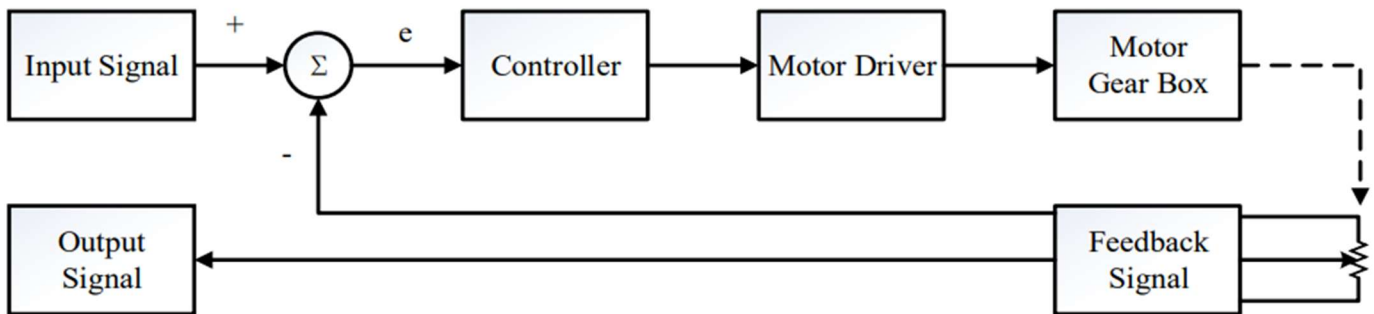
1. Layout

Displayed board layout is for 110/220V.



Lamp	Status	Lamp	Status
LD1	Fully closed (spring released)	LD6	Motor thermal protector active
LD2	Fully open (spring compressed)	LD7	Output signal short circuit
LD3	Power	LD8	Overcurrent in motor
LD5	Wrong input signal	LD9	Local setting mode

2. Programming

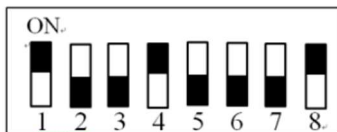


3. DIP Switch Setting (SW1)

The DIP Switch SW1 is a combination of 8 switches. It is utilized to select signal type of input and output as well as positioning when the input signal is lost. Factory setting use with switches, 1, 4, 8 in the ON state (up) and switches 2, 3, 5, 6, 7 in the OFF state (down).

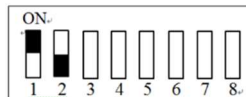


Actuator power must be cycled following any adjustment.



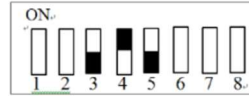
	1	2	3	4	5	6	7	8
Factory Setting	ON	OFF	OFF	ON	OFF	OFF	OFF	ON
4 – 20 mA Input	ON	OFF						
1 – 5V Input	OFF	OFF						
2 – 10V Input	OFF	ON						
4 – 20mA Output			OFF	ON	OFF			
2 – 10V Output			ON	OFF	ON			
Input 20mA / 5V / 10V to operate to fully open (CCW) position								
Input 20mA / 5V / 10V to operate to fully closed (CW) position						ON		
Loss of signal, drive to fully open (CCW).						ON	OFF	ON
Loss of signal, drive to fully closed (CW).						ON	ON	OFF
Loss of signal, drive to fully closed (CW).						OFF	OFF	ON
Loss of signal, drive to fully open (CCW).						OFF	ON	OFF
Loss of signal, stay in place.						n/a	ON	ON

a. Input Signal Setting (switches 1 – 2)



Input Signal	Switch State
4 – 20 mA	1 = ON, 2 = OFF
1 – 5 V	1 = OFF, 2 = OFF
2 – 10 V	1 = OFF, 2 = ON

b. Output Signal Setting (switches 3 – 5)



Output Signal	Switch State
4 – 20 mA	3 = OFF, 4 = ON, 5 = OFF
2 – 10 V	3 = ON, 4 = OFF, 5 = ON

c. Fail Position Setting (switches 6 – 8)

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

Switch S6 ON

20mA / 5V / 10V command is for fully closed (CW) position

Fully-Closed Fully-Open

Switch S6 OFF

20mA / 5V / 10V command is for fully open (CCW) position

Fully-Closed Fully-Open

Input Signal	Fully Open (90°)	Fully Closed (0°)
4 – 20 mA	4 mA	20 mA
1 – 5 V	1 V	5 V
2 – 10 V	2 V	10 V

Input Signal	Fully Open (90°)	Fully Closed (0°)
4 – 20 mA	20 mA	4 mA
1 – 5 V	5 V	1 V
2 – 10 V	10 V	2 V

Lost Signal Position	Switch State
Fully Open (90°)	7 = OFF, 8 = ON
Fully Closed (0°)	7 = ON, 8 = OFF
In Place	7 = ON, 8 = ON

Lost Signal Position	Switch State
Fully Open (90°)	7 = ON, 8 = OFF
Fully Closed (0°)	7 = OFF, 8 = ON
In Place	7 = ON, 8 = ON

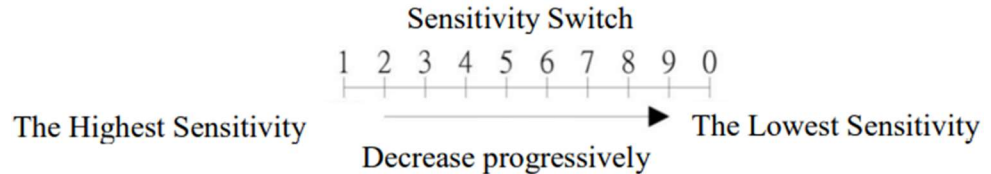
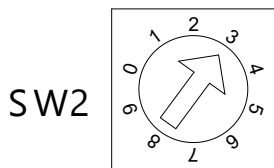
4. P4 Terminal

Contact Rating: 3A / 250V

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

5. Sensitivity Switch (SW2)

Switch SW2 is to adjust the sensitivity of the actuator. When the sensitivity setting is higher, the resolution of the input signal will be higher, and the deadband will be smaller. Excessively high sensitivity may cause the actuator to continuously hunt for position and eventually lead to the motor overheating, which may cause the internal thermostat to trip, thus disabling movement. If the actuator has trouble settling to position, the sensitivity setting should be reduced.



- 1 = Highest Sensitivity
- 0 = Lowest Sensitivity
- 3 = Factory Default

6. Settings for OPEN and CLOSE



These settings are set and calibrated at the factory. Recalibration is typically not required, but if necessary, follow the below steps.

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

Press and hold “SET” button for 2 seconds until LD9 lights to enter local setting mode.

OPEN setting

- a. Press and hold “**UP**” button to operate actuator open until it has reached the fully open (spring compressed) position and LD2 lights. Supply the input signal (5V or 10V or 20mA) and check if the output signal is correct. If output signal is incorrect, adjust VR2 until correct output signal is achieved.
- b. Press “**MODE**” once. The OPEN setting is completed.

CLOSE setting

- a. Press and hold “**DOWN**” button to operate actuator close until it has reached the fully closed (spring released) position and LD1 lights. Supply the input signal (1V or 2V or 4mA).
- b. Press “**MODE**” once. The CLOSE setting is completed.

After completing the above settings, press “**SET**” once to exit local setting mode.

TROUBLE SHOOTING

ON-OFF Controller

General

Issue	Possible Problem	Solution
Motor does not operate or overheats	<ul style="list-style-type: none"> a. Seating torque of valve is too high, possibly from incorrect specification or wear to valve seats from use. b. Jammed valve or stuck seat. c. Motor shaft or bearings are stuck. d. Limit switch for spring released position not tripping (with manual override). e. Limit switch for spring released position not tripping (without manual override). 	<ul style="list-style-type: none"> a. Manually operate or check/replace the valve. b. Check for blockage or obstruction in pipe/valve and remove. c. Replace motor. d. Operate actuator manually to spring release position and adjust switches per instructions if necessary. e. Check for torque overload caused by the valve.
Actuator functions normally but motor is hot.	<ul style="list-style-type: none"> a. Actuator operates too frequently and is exceeding duty cycle rating. b. Torque overload caused by valve. c. Wrong power supply. 	<ul style="list-style-type: none"> a. Adjust the system to reduce frequency of operation. b. If new, check valve specifications. If after in service, check valve seats and replace if worn or damaged. c. Check the power supply.
Valve does not operate electrically or manually.	<ul style="list-style-type: none"> a. Actuator is not properly installed onto the valve. b. Torque of the valve is larger than the torque of the actuator. c. Cap screw on the cam is loose and caused misaligned travel end positions. d. OPEN and CLOSE end stop points of actuator are not aligned with valve. 	<ul style="list-style-type: none"> a. Refer to installation instructions. b. Replace with new valve, or larger size actuator. c. Readjust the mechanical end stops and limit switches per instructions. d. Remove the actuator from the valve and reassemble ensuring the OPEN and CLOSE stop points are aligned. Fail direction must be accounted for.
Capacitor is failed	<ul style="list-style-type: none"> a. PCB failed. 	<ul style="list-style-type: none"> a. Replace

PCB

LED Status	Possible Problem	Solution
Fault Status LED4 goes on	<ul style="list-style-type: none"> a. LS1 and LS2 terminals loose or have poor contact. b. Incorrect connection of LS1 or LS2 terminals. c. Input power failure time is greater than 150ms. d. Abnormal setting of limit switches and cams. e. Power is supplied again during the spring release. f. LS1 or LS2 failed. g. Actuator overload is preventing it from fully returning to the calibrated spring release position. h. Incorrect setting of cam TC2 is preventing LS2 switch from releasing. 	<ul style="list-style-type: none"> a. Refer to wiring diagram and check connections. Replace terminal if necessary. b. Verify correct wiring. c. Provide independent power supply to actuator to avoid unstable supply power. d. Refer to actuator setup instructions. e. Remove power until the actuator fully returns to the spring release position and then resupply power. f. Replace with new limit switches. g. Check sizing is correct. Verify there is no obstruction preventing actuator from returning to full spring release position. Check valve seats are not damaged. h. Refer to actuator setup instructions.
Power LED1 does not go on	<ul style="list-style-type: none"> a. Wrong Supply Voltage. b. Blown fuse. c. PCB failed. 	<ul style="list-style-type: none"> a. Confirm power supply is according to the actuator rated voltage. b. Replace with new fuse. c. Replace with new PCB.
Operating LED2 does not go on	<ul style="list-style-type: none"> a. Incorrect setting for LS1 or LS2. b. PCB failed. 	<ul style="list-style-type: none"> a. Check Fault LED4. If LED4 lights, check troubleshooting for LED4. b. Replace with new PCB.
Motor brake LED3 does not go on	PCB failed.	Replace with new PCB.

Modulating Controller

General

Issue	Possible Problem	Solution
LED indicators (LD5-LD9) flash.		Refer to PCB troubleshooting for Modulating controller below.
Not controlling to position correctly.	<ul style="list-style-type: none"> a. Potentiometer failure causing actuator to not control to setpoint position or is providing abnormal feedback. b. Wrong input signal type. c. Modulating board failed and causing actuator to not operate, or only operating in single direction. 	<ul style="list-style-type: none"> a. Replace with new potentiometer b. Check DIP switch setting matches input signal type. c. Replace with new modulating board.

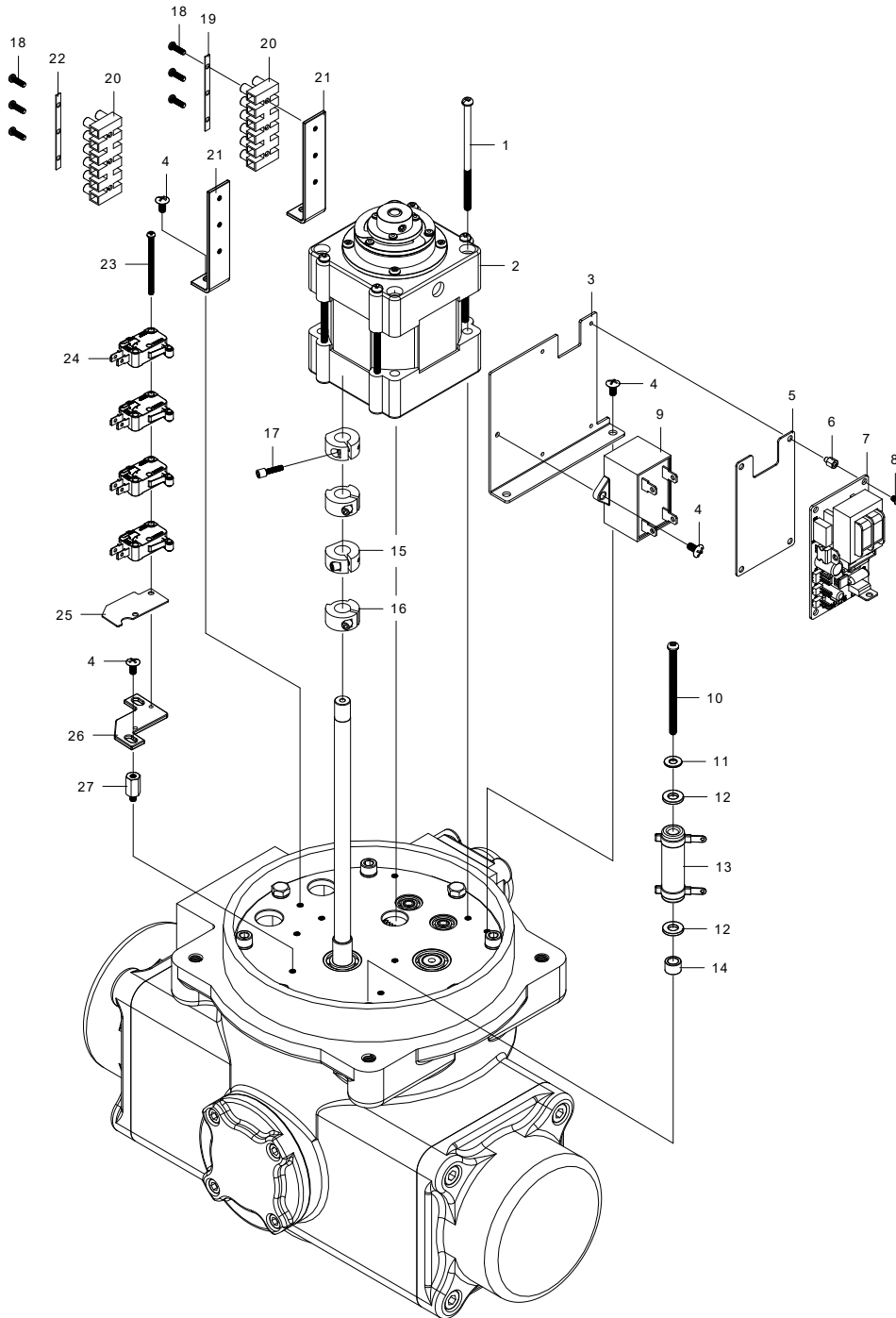
PCB

LED Status	Possible Problem	Solution
LD3 does not go on	<ul style="list-style-type: none"> a. No power supplied. b. Incorrect connection of #8, #9 of potentiometer. c. Modulating controller failed. 	<ul style="list-style-type: none"> a. Check the power supply as well as wires connected to #4, #5. b. Verify actuator is wired properly according to wiring diagram. c. Replace controller or return for evaluation.
LD5 goes on	<ul style="list-style-type: none"> a. Incorrect signal type input. For example, set for 2-10V input, but 4-20mA signal is present. b. Input signal exceeds the input range. For example, set for 2-10V input, but 13.5V present. 	Verify DIP switches set properly for the required input signal.
LD6 goes on	Motor thermal protector active.	<ul style="list-style-type: none"> a. Duty cycle is excessive. b. Contact of motor thermal protector (MOT) is disconnected.
LD7 goes on	<ul style="list-style-type: none"> a. Signal output short circuit. b. Output signal reversed. c. Input signal is reversed. 	<ul style="list-style-type: none"> a. Disconnect output signal wires to check LD7 turns off. b. Check output signal wiring. c. Check input signal wiring.
LD8 goes on	Motor over-current.	<ul style="list-style-type: none"> a. Duty cycle is exceeded. Reduce frequency of operation to actuator's specified duty rating. b. Check actuator load. c. Check if motor rotor is locked, such as from valve obstruction.
LD9 goes on	Local setting mode – setting position for open & close.	Press "SET" button to exit local setting mode when finished setting positions.

Exploded Views & Parts Lists

Model FSE-440

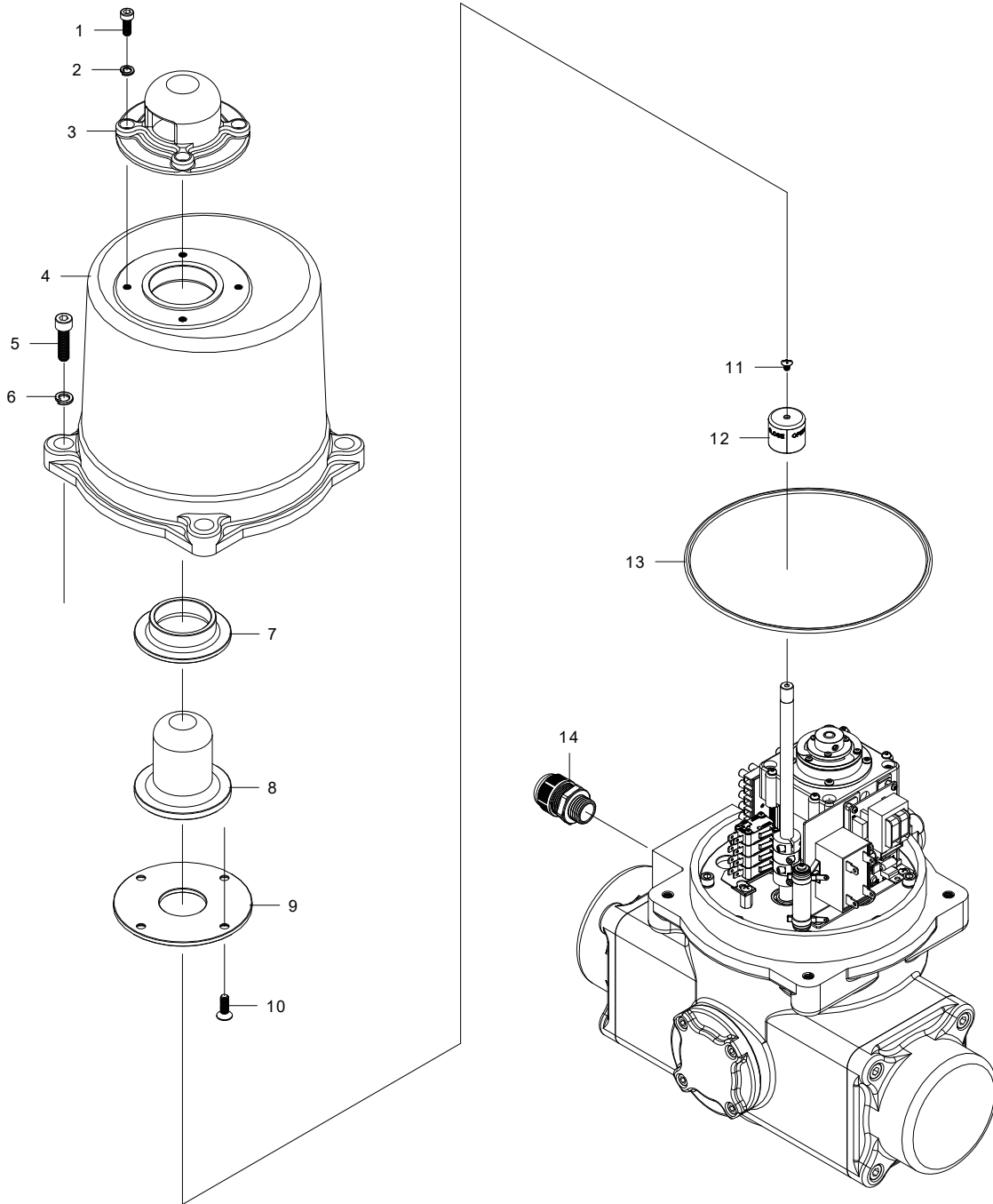
FSE-440 Internal Exploded View



FSE-440 Internal Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Motor Mount Screw	ADC491	M4*90L	4
2	Drive Motor	S05051-220V	220V	1
3	PCB Bracket	S05046		1
4	Bracket Mount Screw	ADE48	M4*8L	7
5	Insulator Sheet	S05047		1
6	Hex Fixed Stud	OMS119		4
7	PCB	S05050	SA-176	1
8	PCB Mount Screw	ADC34	M3*4L	4
9	Capacitor	S05057-220	4.5uf / 350V(220V)	1
10	Heater Mount Screw	ADC465	M4*65L	1
11	Flat Washer	CDZ4111	Ø4	1
12	Bakelite Slice	OMA011		2
13	Heater	OMS040	220V	1
14	Spacer	OMS069	Ø6.5*Ø10*7L	1
15	Cam	OMS196	Close	2
16	Cam	S05044	Open	2
17	Set Screw	S05052	M3*12L	4
18	Round Heads Phillips Screw	ADC310	M3*10L	6
19	Label	ABCDEF	ABCDEF	1
20	Terminal Block	OMS010	6P	2
21	Terminal Fixed Plate	S05043	77L	2
22	Label	134567	134567	1
23	Round Heads Phillips Screw	AKC344	M3*44L	2
24	Limit Switch	OMS007	V-155-1A6	4
25	Bakelite Slice	OMS116	A0007-005(0.8mm)	1
26	Switch Fixed Plate	OMS009		1
27	Hex Stand-Off	S05048		2

FSE-440 External Exploded View

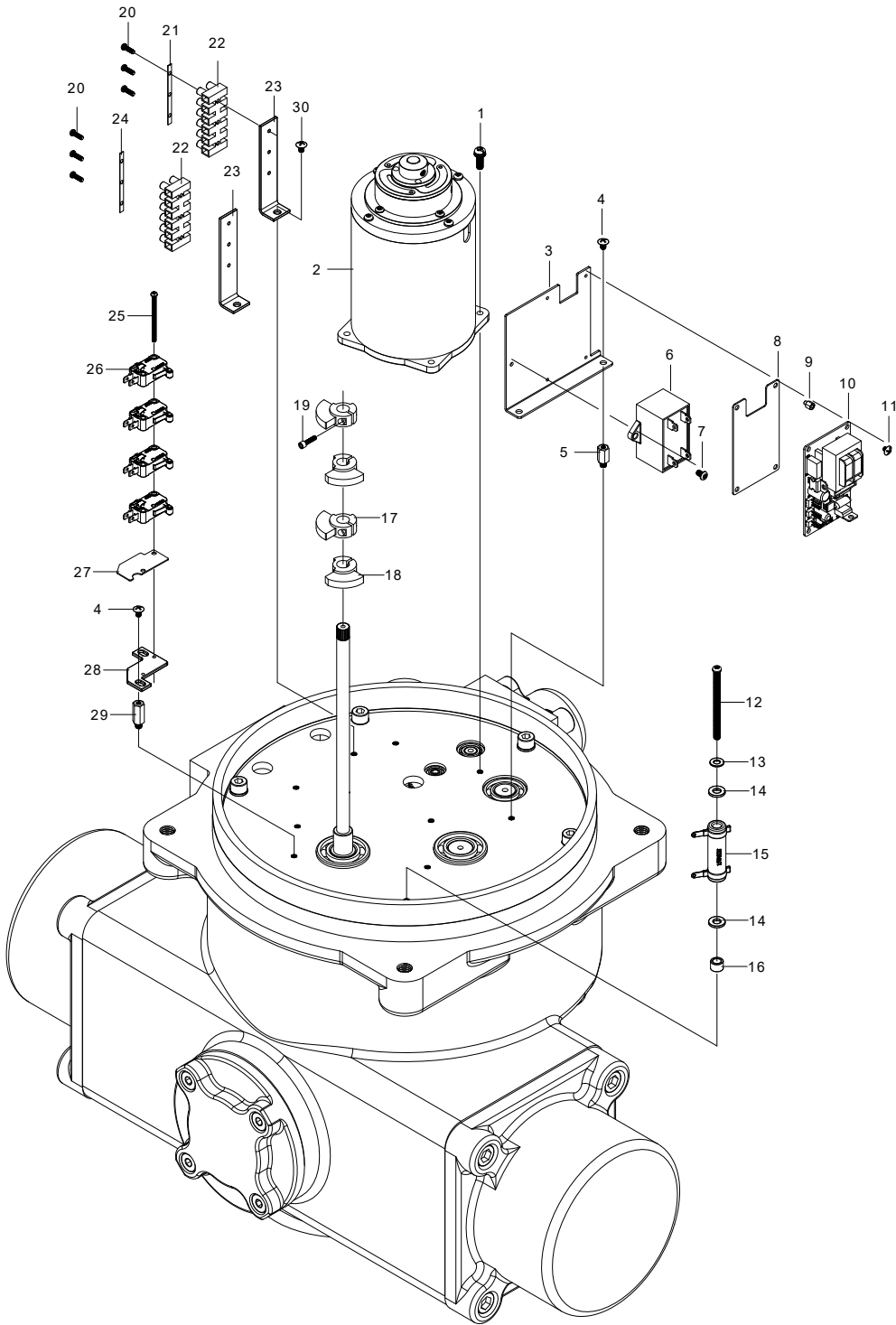


FSE-440 External Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Hex Socket Head Screw	ADB616	M6*16L	4
2	Spring Washer	DDZ6	Ø6	4
3	Window Protection Cover	S05009B	Blue	1
4	Top Cover	S05005B	Blue	1
5	Cover Mount Screw	ADB830	M8*25L	4
6	Spring Washer	DDZ8	Ø8	4
7	Plastics Gasket	S05042		1
8	Indicator Window	S05041	PC	1
9	Window Bracket	SE05040		1
10	Flush Head Screw	ADD615	M6*15L	4
11	Indicator Mount Screw	ADE48	M4*8L	1
12	Position Indicator	OMS088		1
13	O-Ring	JZZAS262	AS262	1
14	Liquid-Tight Stopper	BM1P43	1 / 2 PS	2

Model FSE-1150, FSE-1770, FSE-2300

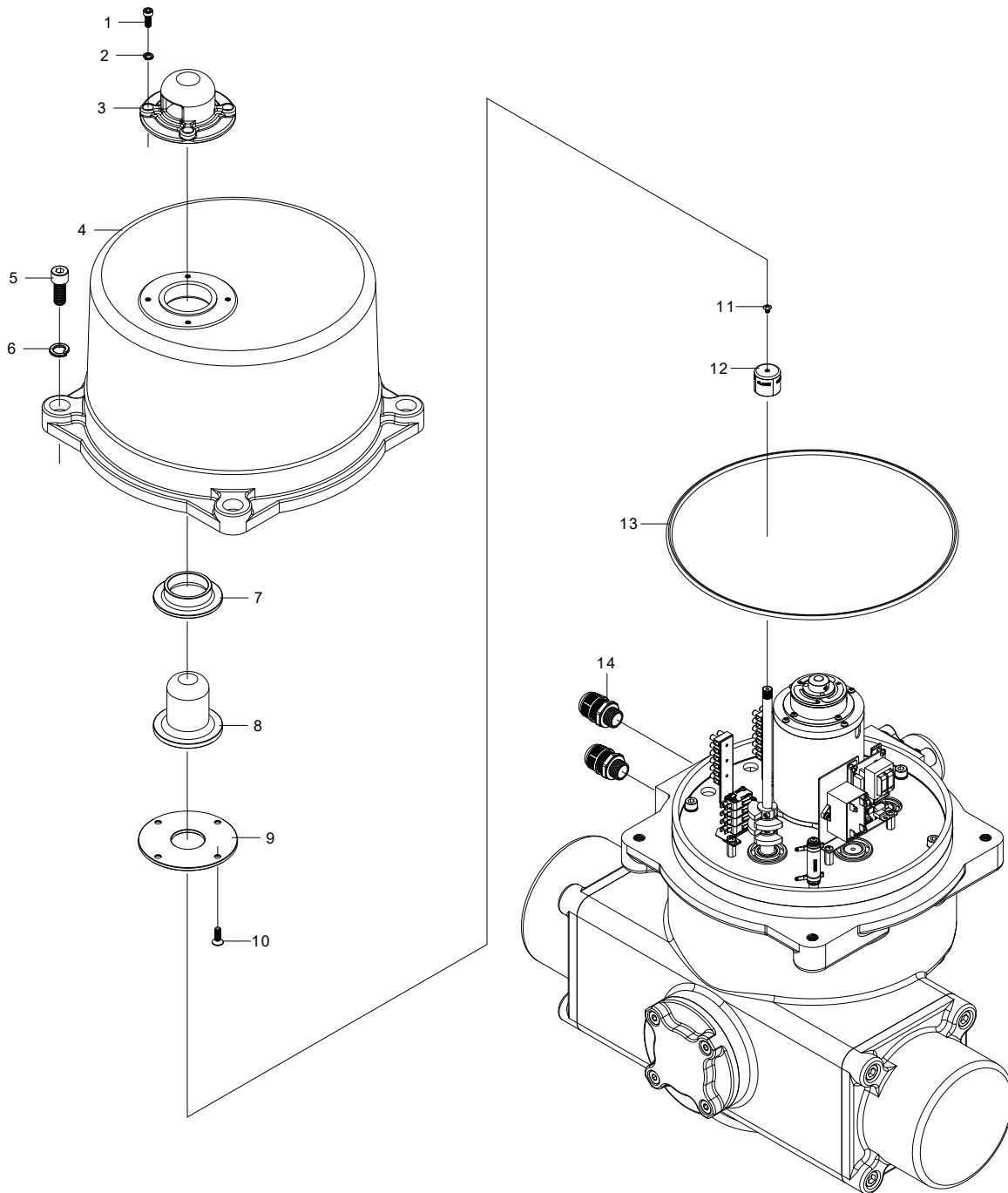
FSE-1150, FSE-1770, FSE-2300 Internal Exploded View



FSE-1150, FSE-1770, FSE-2300 Internal Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Motor Mount Screw	ADC512	M5*15L	4
2	Drive Motor (FSE-1150,1770, 2300)	SE13047-220 SE20052-220	220V	1
3	PCB Bracket	S05046		1
4	Bracket Mount Screw	ADE46	M4*6L	4
5	Hex Fixed Stud	SE13046		2
6	Capacitor	OMB093	6uf/350V	1
7	Capacitor Mount Screw	ADC46	M4*6L	1
8	Insulator Sheet	S05047		1
9	Hex Stand-Off	OMS119		4
10	PCB	S05050	SA-176	1
11	PCB Mount Screw	ADC34	M3*4L	4
12	Heater Mount Screw	ADC565	M5*65L	1
13	Flat Washer	CDZ5111	Ø5	1
14	Bakelite Slice	OMA011		2
15	Heater	OMS040	220V	1
16	Spacer	OMS069	Ø6.5*Ø10*7L	1
17	Cam	SE13043		2
18	Cam	SE13044		2
19	Set Screw	S05052	M3*12L	4
20	Round Heads Phillips Screw	ADC310	M3*10L	6
21	Label	ABCDEF	ABCDEF	1
22	Terminal Block	OMS010	6P	2
23	Terminal Fixed Plate (FSE-1150, 1770, 2300)	S05043 SE20043	77L 83L	2
24	Label	134567	134567	1
25	Round Heads Phillips Screw	AKC344	M3*44L	2
26	Limit Switch	OMS007	V-155-1A6	4
27	Bakelite Slice	OMS116	A0007-005(0.8mm)	1
28	Switch Fixed Plate	OMS009		1
29	Hex Stand-Off (FSE-1150, 1770, 2300)	SE13046 SE20048		2
30	Bracket Mount Screw	ADE56	M5*6L	2

FSE-1150, FSE-1770, FSE-2300 External Exploded View

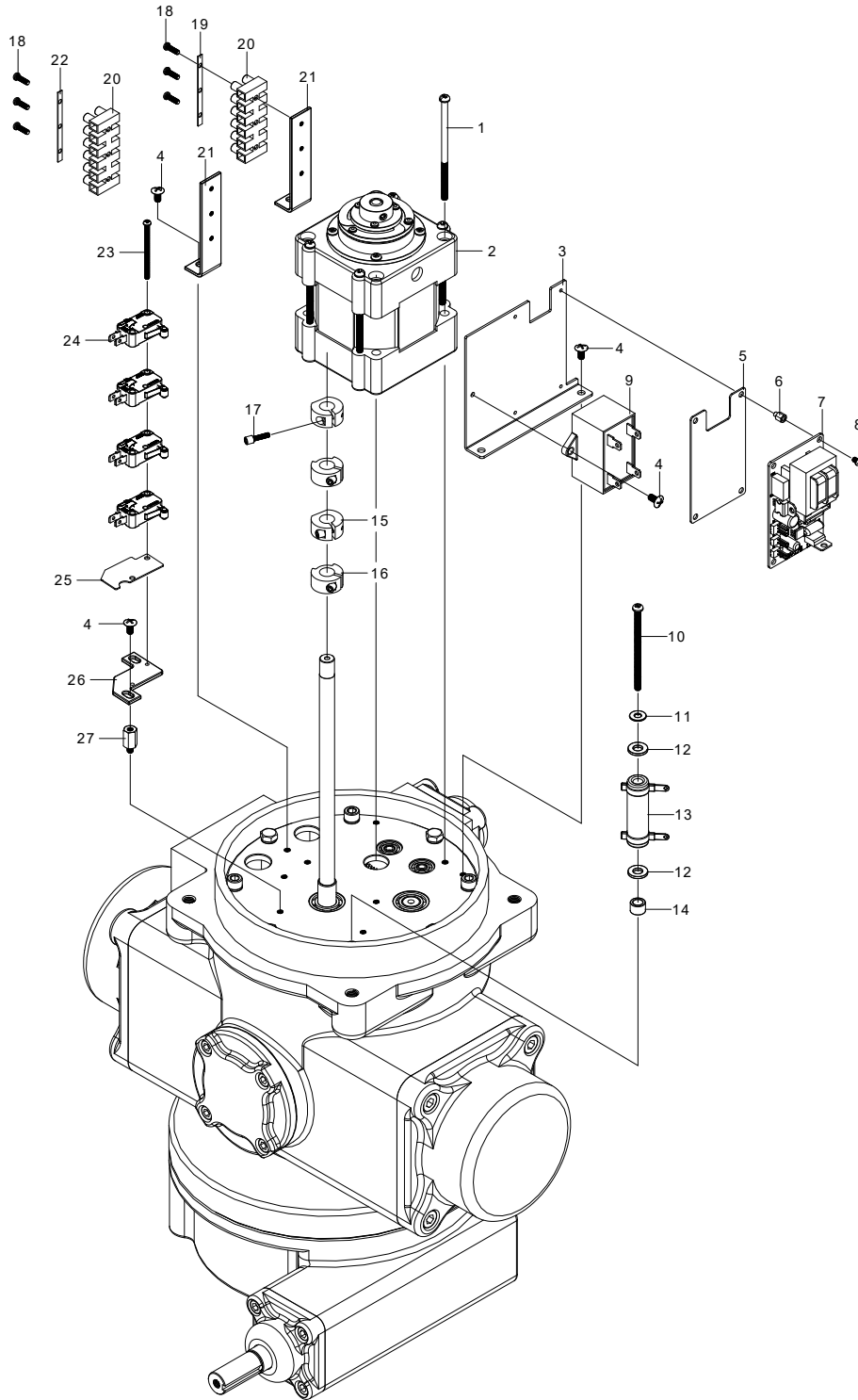


FSE-1150, FSE-1770, FSE-2300 External Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Hex Socket Head Screw	ADB616	M6*16L	4
2	Spring Washer	DDZ6	Ø6	4
3	Window Protection Cover	SE13009B	Blue	1
4	Top Cover	FSE-11505B	Blue	1
5	Cover Mount Screw (FSE-1150, 1770, 2300)	ADB1030 ADB1235	M10*30L M12*35L	4
6	Spring Washer (FSE-1150, 1770, 2300)	DDZ10 DDZ12	Ø10 Ø12	4
7	Plastics Gasket	S05042		1
8	Indicator Window	S05041	PC	1
9	Window Bracket	SE05040		1
10	Flush Head Screw	ADD615	M6*15L	4
11	Indicator Mount Screw (FSE-1150 / FSE-1770~FSE-2300)	ADE48	M4*8L	1
12	Position Indicator	OMS088		1
13	O-Ring (FSE-1150, 1770, 2300)	JZZG260 JZZG300	G260 G300	1
14	Liquid-Tight Stopper	BM1P43	1 / 2 PS	2

Model FSE-440MO

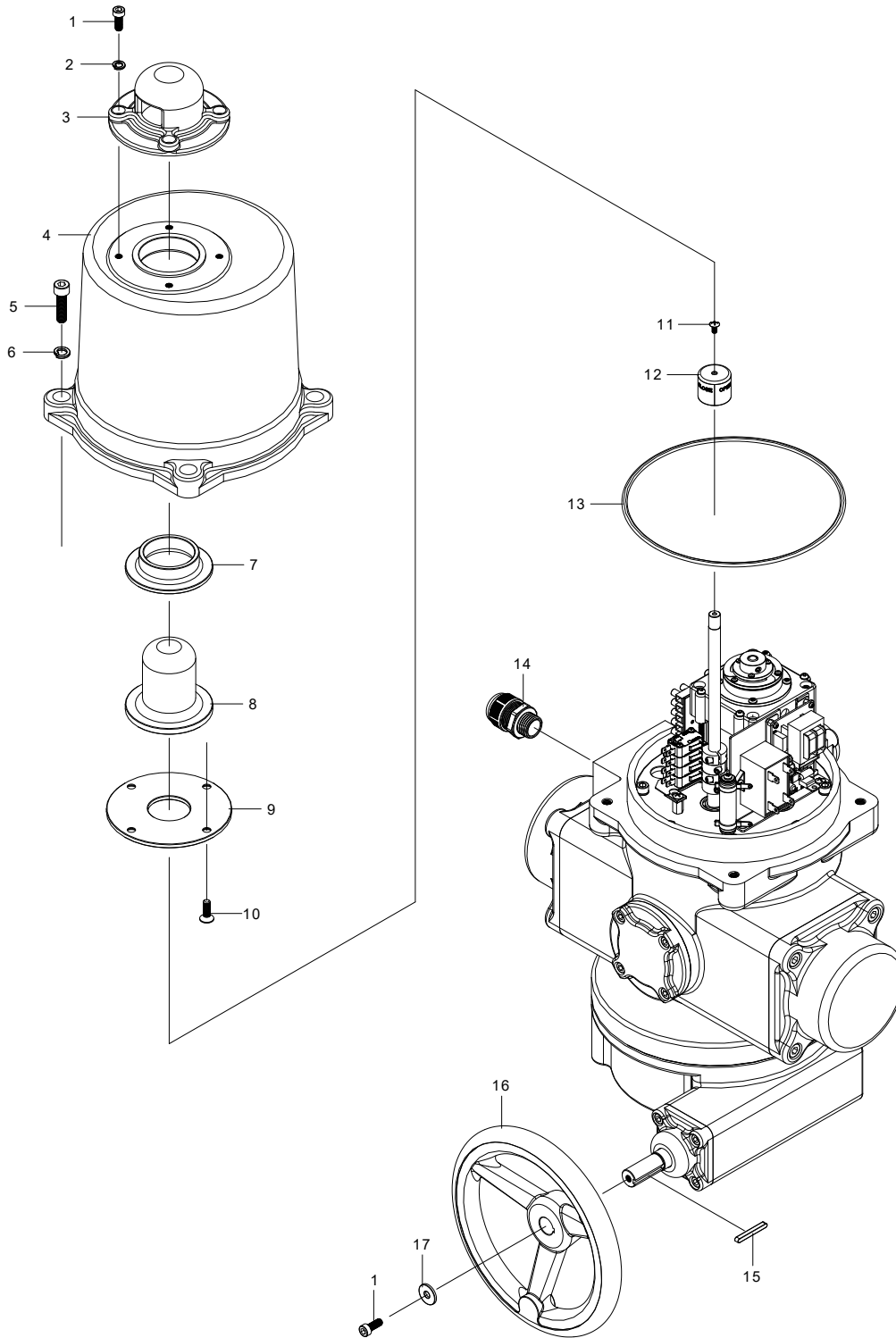
FSE-440MO Internal Exploded View



FSE-440MO Internal Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Motor Mount Screw	ADC491	M4*90L	4
2	Drive Motor	S05051-220V	220V	1
3	PCB Bracket	S05046		1
4	Bracket Mount Screw	ADE48	M4*8L	7
5	Insulator Sheet	S05047		1
6	Hex Fixed Stud	OMS119		4
7	PCB	S05050	SA-176	1
8	PCB Mount Screw	ADC34	M3*4L	4
9	Capacitor	S05057-220	4.5uf / 350V(220V)	1
10	Heater Mount Screw	ADC465	M4*65L	1
11	Flat Washer	CDZ4111	Ø4	1
12	Bakelite Slice	OMA011		2
13	Heater	OMS040	220V	1
14	Spacer	OMS069	Ø6.5*Ø10*7L	1
15	Cam	OMS196	Close	2
16	Cam	S05044	Open	2
17	Set Screw	S05052	M3*12L	4
18	Round Head Philips Screw	ADC310	M3*10L	6
19	Label	ABCDEF	ABCDEF	1
20	Terminal Block	OMS010	6P	2
21	Terminal Fixed Plate	S05043	77L	2
22	Label	134567	134567	1
23	Round Head Philips Screw	AKC344	M3*44L	2
24	Limit Switch	OMS007	V-155-1A6	4
25	Bakelite Slice	OMS116	A0007-005(0.8mm)	1
26	Switch Fixed Plate	OMS009		1
27	Hex Stand-Off	S05048		2

FSE-440MO External Exploded View

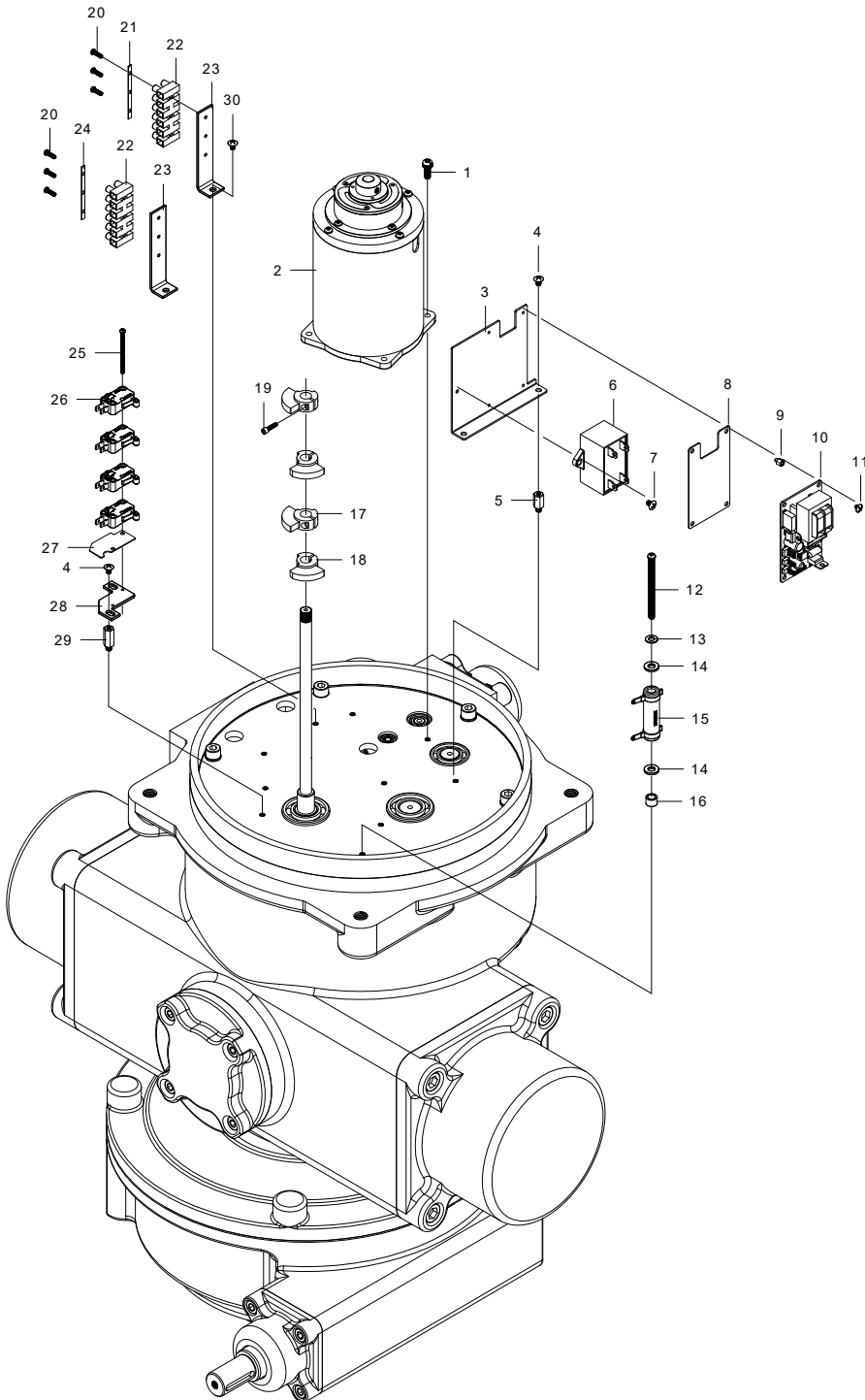


FSE-440MO External Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Hex Socket Head Screw	ADB616	M6*16L	4
2	Spring Washer	DDZ6	Ø6	4
3	Window Protection Cover	S05009B	Blue	1
4	Top Cover	S05005B	Blue	1
5	Cover Mount Screw	ADB830	M8*25L	4
6	Spring Washer	DDZ8	Ø8	4
7	Plastics Gasket	S05042		1
8	Indicator Window	S05041	PC	1
9	Window Bracket	SE05040		1
10	Flush Head Screw	ADD615	M6*15L	4
11	Indicator Mount Screw	ADE48	M4*8L	1
12	Position Indicator	OMS088		1
13	O-Ring	JZZAS262	AS262	1
14	Liquid-Tight Stopper	BM1P43	1 / 2 PS	2
15	Key Way	FZZ4435	4*4*35L	1
16	Hand Wheel	SHE05056	8"	1
17	Flat Washer	CDZ6253	Ø6.8* Ø2.5 *3t	1

Model FSE-1150MO, FSE-1770MO, FSE-2300MO

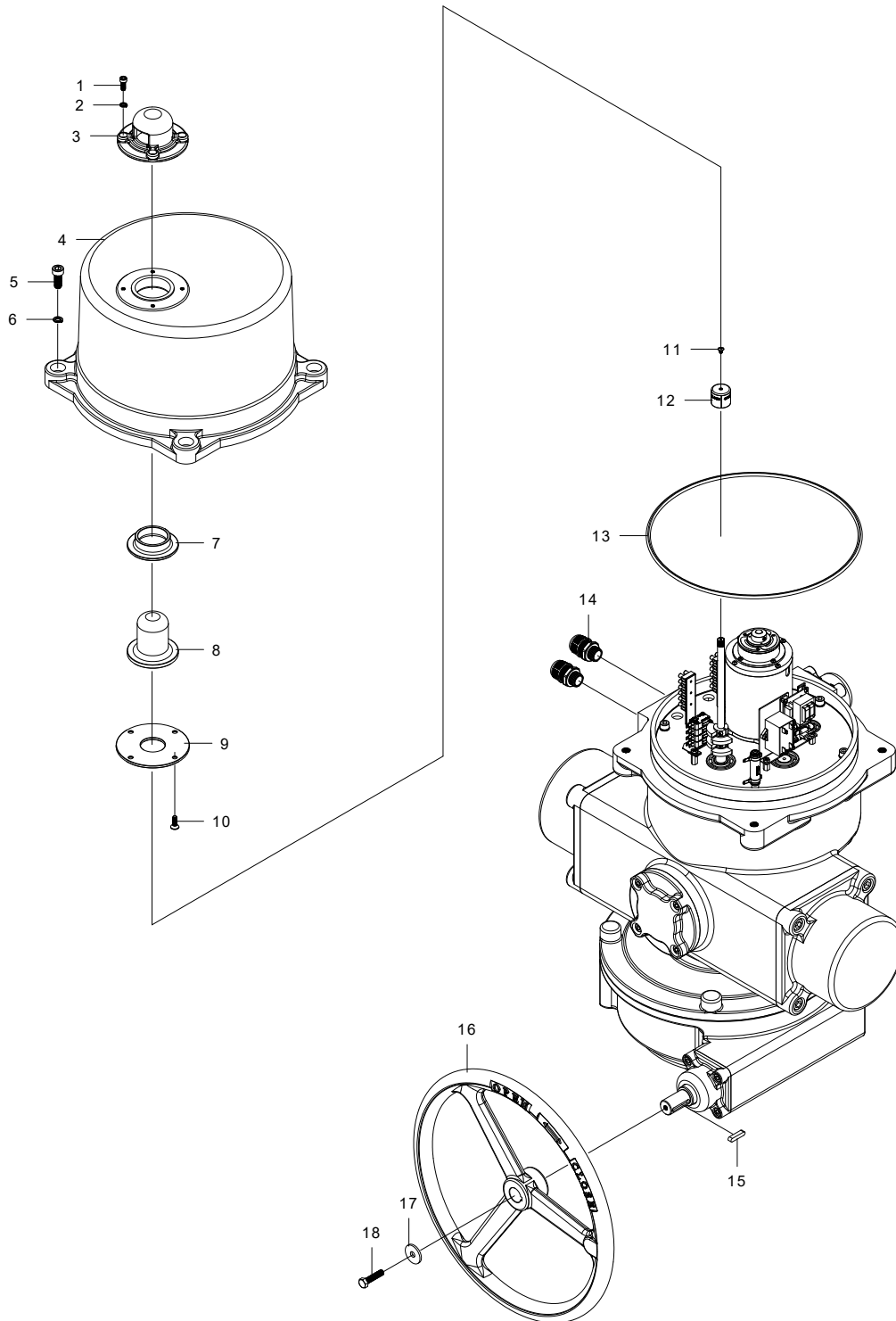
FSE-1150MO, FSE-1770MO, FSE-2300MO Internal Exploded View



FSE-1150MO, FSE-1770MO, FSE-2300MO Internal Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Motor Mount Screw	ADC512	M5*15L	4
2	Drive Motor (FSE-1150, 1770, 2300)	SE13047-220 SE20052-220	220V	1
3	PCB Bracket	S05046		1
4	Bracket Mount Screw	ADE46	M4*6L	4
5	Hex Fixed Stud	SE13046		2
6	Capacitor	OMB093	6uf/350V	1
7	Capacitor Mount Screw	ADC46	M4*6L	1
8	Insulator Sheet	S05047		1
9	Hex Stand-Off	OMS119		4
10	PCB	S05050	SA-176	1
11	PCB Mount Screw	ADC34	M3*4L	4
12	Heater Mount Screw	ADC565	M5*65L	1
13	Flat Washer	CDZ5111	Ø5	1
14	Bakelite Slice	OMA011		2
15	Heater	OMS040	220V	1
16	Spacer	OMS069	Ø6.5*Ø10*7L	1
17	Cam	SE13043		2
18	Cam	SE13044		2
19	Set Screw	S05052	M3*12L	4
20	Round Head Philips Screw	ADC310	M3*10L	6
21	Label	ABCDEF	ABCDEF	1
22	Terminal Block	OMS010	6P	2
23	Terminal Fixed Plate (FSE-1150, 1770, 2300)	S05043 SE20043	77L 83L	2
24	Label	134567	134567	1
25	Round Head Philips Screw	AKC344	M3*44L	2
26	Limit Switch	OMS007	V-155-1A6	4
27	Bakelite Slice	OMS116	A0007- 005(0.8mm)	1
28	Switch Fixed Plate	OMS009		1
29	Hex Stand-Off (FSE-1150, 1770, 2300)	SE13046 SE20048		2
30	Bracket Mount Screw	ADE56	M5*6L	2

FSE-1150MO, FSE-1770MO, FSE-2300MO External Exploded View



[FSE-1150MO, FSE-1770MO, FSE-2300MO External Parts List

No.	Part Name	Part No.	Size	Q'ty
1	Hex Socket Head Screw	ADB616	M6*16L	4
2	Spring Washer	DDZ6	Ø6	4
3	Window Protection Cover	SE13009B	Blue	1
4	Top Cover	FSE-11505B	Blue	1
5	Cover Mount Screw (FSE-1150, 1770, 2300)	ADB1030 ADB1235	M10*30L M12*35L	4
6	Spring Washer (FSE-1150, 1770, 2300)	DDZ10 DDZ12	Ø10 Ø12	4
7	Plastics Gasket	S05042		1
8	Indicator Window	S05041	PC	1
9	Window Bracket	SE05040		1
10	Flush Head Screw	ADD615	M6*15L	4
11	Indicator Mount Screw	ADE48	M4*8L	1
12	Position Indicator	OMS088		1
13	O-Ring (FSE-1150, 1770, 2300)	JZZG260 JZZG300	G260 G300	1
14	Liquid-Tight Stopper	BM1P43	1 / 2 PS	2
15	Key Way	FZZ4435	4*4*35L	1
16	Hand Wheel	SHE05056	8"	1
17	Flat Washer	CDZ6253	Ø6.8* Ø2.5 *3t	1
18	Hex Socket Head Screw	ADB825	M8*25L	1

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