

# Fisher™ L2sj Low Emission Liquid Level Controller

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Figure 1. Fisher L2sj Liquid Level Controller



W9331

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## Introduction

### Scope of Manual

This instruction manual includes installation, adjustment, maintenance, and parts ordering information for the Fisher L2sj low emission liquid level controller.



Do not install, operate or maintain a L2sj low emission liquid level controller without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all contents of this manual, including all safety cautions and warnings. If you have any questions about these instructions, contact your [Emerson sales office](#) before proceeding.

Table 1. Specifications

<p><b>Available Configuration</b></p> <p>Controller: On-Off / Direct Acting Sensor: Displacer-type liquid level sensor for mounting to side of vessel.</p> <p><b>Input Signal</b></p> <p>Liquid Level (gas over liquid)</p> <p><b>Liquid Level Span<sup>(1)</sup></b></p> <p>See table 2</p> <p><b>Minimum Specific Gravity</b></p> <p>3 x 6 inch displacer: 0.6 1-7/8 x 12 inch displacer: 0.75</p> <p><b>Output Signal</b></p> <p>Control: Pneumatic On-Off Range: 0 psi (off) or full supply pressure (on) Action: Direct acting (increasing level increases output signal)</p> <p><b>Supply Pressure Requirements</b></p> <p>Any desired pressure between 0.34 and 2.4 bar (5 and 35 psig).</p> <p><b>Supply Medium</b></p> <p>Air or natural gas<sup>(2)</sup></p> <p><b>Steady-State Air Consumption<sup>(3)</sup></b></p> <p>&lt; 0.01 normal m<sup>3</sup>/hr (&lt; 0.3 scfh) at 1.4 bar (20 psig) supply pressure</p> <p><b>Sensor to Vessel Connection</b></p> <p>■ 2 NPT threaded or ■ NPS 2 CL150 through 1500 slip-on flange connection</p> <p><b>Controller Connections</b></p> <p>Supply: 1/4 NPT internal located on the bottom of the case Output: 1/4 NPT internal located on the top of the case Case Vent: 1/4 NPT internal with vent screen assembly located on the back of the case</p>	<p><b>Displacer Size</b></p> <p>■ 48 x 305 mm, 541 cm<sup>3</sup> (1-7/8 x 12 inches, 33 in<sup>3</sup>)<sup>(4)</sup> or ■ 76 x 152 mm, 688 cm<sup>3</sup> (3 x 6 inches, 42 in<sup>3</sup>)<sup>(5)</sup></p> <p><b>Maximum Sensor Working Pressure<sup>(6)</sup></b></p> <p>PVC Displacer: Consistent with CL1500 pressure temperature ratings per ASME B16.34 up to maximum pressure of 258 bar (3750 psig) For PED (97/23/EC) maximum pressure limited to 200 bar (2900 psig)</p> <p>S31603 SST Displacer: CL600 pressure temperature ratings per ASME B16.34 up to maximum pressure of 99.3 bar (1440 psig)</p> <p>Note: For slip-on flange connection, maximum sensor working pressure must be consistent with the flange ratings</p> <p><b>Sensor Temperature Limits<sup>(6)</sup></b></p> <p>PVC Displacer: -18 to 71°C (0 to 160°F) S31603 SST Displacer: -40 to 204°C (-40 to 400°F)</p> <p><b>Operative Ambient Temperature Limits<sup>(6)</sup></b></p> <p>Controller: -29 to 71°C (-20 to 160°F)</p> <p><b>Standard Supply, and Output Pressure Gauge Indications</b></p> <p>Triple scale gauges in 0 to 60 psig / 0 to 0.4 MPa / 0 to 4.0 bar</p> <p><b>Hazardous Area Classification</b></p> <p>Complies with the requirements of ATEX Group II Category 2 Gas and Dust</p> <p></p> <p>Maximum surface temperature (Tx) depends on operating conditions</p> <p>Gas: T6 Dust: T71</p> <p>Meets Customs Union technical regulation TP TC 012/2011 for Groups II/III Category 2 equipment</p> <p></p>
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-continued-

Table 1. Specifications (continued)

<p><b>Canadian Registration</b> The L2sj utilizes the same sensor unit pressure component as the L2 pneumatic controller version. Refer to the L2 CRN which is deemed applicable to the L2sj.</p> <p><b>Declaration of SEP</b> Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph</p>	<p>product to be in compliance with Article 4 paragraph 3 of the PED Directive 2014/68/EU. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.</p> <p>However, the product <i>may</i> bear the CE marking to indicate compliance with <i>other</i> applicable European Community Directives.</p>
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NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.  
 1. Level change required for full change in output signal.  
 2. This product can be used with natural gas as the supply medium.  
 3. Normal m<sup>3</sup>/hr—Normal cubic meters per hour (0°C and 1.01325 bar, absolute) Scfh—Standard cubic feet per hour (60°F and 14.7 psia).  
 4. Supplied with 6 inch extension.  
 5. Supplied with 3 inch extension.  
 6. The pressure and temperature limits in this document and any applicable standard or code limitation should not be exceeded.

Table 2. Liquid Level Span

SENSOR	SPECIFIC GRAVITY OF LIQUID		
	0.6	0.75	1
<b>Vertical Displacer</b>	<b>Span, mm (inch)</b>		
1-7/8 x 12 inch Displacer with 6 inch extension	n/a	135 (5.3)	102 (4.0)
3 x 6 inch Displacer 3 inch extension	57 (2.25)	46 (1.8)	34 (1.35)
<b>Horizontal Displacer</b>	<b>Span, mm (inch)</b>		
3 x 6 inch Displacer with 3 inch extension	22 (0.85)	17 (0.67)	13 (0.5)
<p>Notes</p> <p>1. Level change required for full change in output signal.                      2. Span adjuster set for maximum sensitivity.                      3. 1.4 bar (20 psig) supply pressure.                      4. For vessels with fast dump cycles, actual liquid span will be larger</p>			

## Description

The rugged L2sj low emission liquid level controller uses a displacer type sensor (see figure 1) to detect liquid level.

The controller features a rugged, metal-seated relay with proportional and integral action. The device delivers a pneumatic output signal to a control/dump valve.

## Specifications

Specifications for the controller and sensor are listed in table 1.

## Educational Services

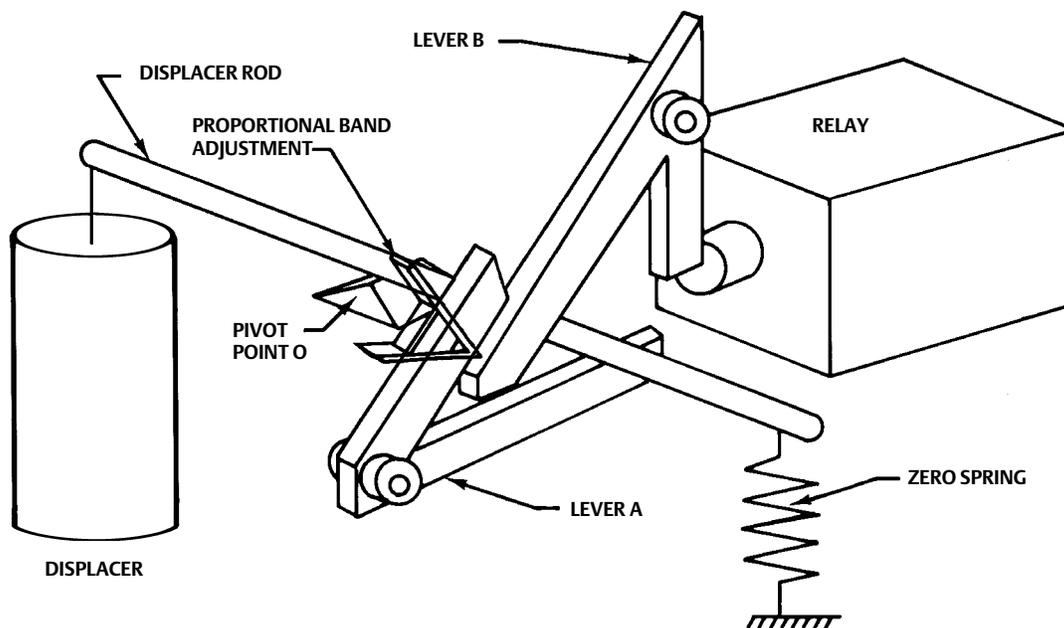
Emerson Automation Solutions  
 Educational Services - Registration  
 Phone: +1-800-338-8158  
 E-mail: education@emerson.com  
 emerson.com/mytraining

## Principle of Operation

The operation of the *L2sj* controller in combination with the sensor is based on the Archimedes Principle, which states that a body immersed in a liquid will be buoyed up by a force equal to the weight of the liquid displaced. The buoyant force and resultant movement of the displacer in the liquid is transmitted to the controller which delivers a pneumatic signal to a control valve.

Figure 2 shows a simple schematic of the controller and sensor. In its normal position, the counterclockwise moment due to the weight of the displacer about pivot point O is balanced by the sum of the clockwise zero spring moment and the counterclockwise relay force moment applied through lever A to the displacer rod. The weight of the displacer decreases when the liquid level increases and the subsequent buoyant force increases causing a force imbalance between the zero spring, relay, and displacer forces. This force imbalance is transmitted to the relay by levers A and B. The relay compensates for the force imbalance by converting it to a pressure output to a control/dump valve and bringing the forces back into equilibrium.

Figure 2. Operational Schematic



## Installation

### **⚠ WARNING**

- Wear protective clothing, gloves, and eyewear whenever possible when performing any installation operations to avoid personal injury or property damage.
- To avoid personal injury or property damage caused by the sudden release of process fluid, be certain the service conditions do not exceed the sensor pressure limits. Use pressure-limiting or pressure-relieving devices to prevent service conditions from exceeding these limits.
- Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 7.
- If installing this into an existing application, also refer to the WARNING at the beginning of the Maintenance section of this instruction manual.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

### **NOTICE**

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

### **NOTICE**

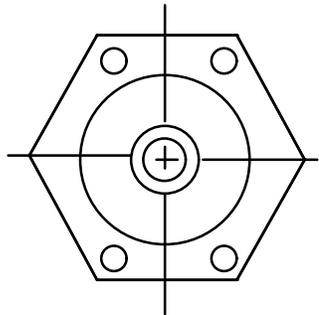
If the L2sj low emission liquid level controller is installed on a vessel that is to be shipped to a different location (e.g. skid mounted units), remove the displacer and displacer rod extensions before shipment. Failure to do so could result in damage to the displacer rod due to vibration and impact loading during shipment. After the vessel is installed at its final location, reassemble the displacer and displacer rod extension.

1. Be sure there are no obstructions inside the vessel that will interfere with displacer installation or operation.
2. Provide the appropriate connection in the vessel wall to match the sensor connection. Locate the vessel connection so that the displacer will be at the desired control level.

## Mounting the Controller to the Vessel

Insert the displacer end of the controller-sensor assembly into the vessel connection, and screw the sensor threads into the vessel connection. Tighten sufficiently to seal the threads. If necessary, loosen or tighten slightly to obtain the orientation shown in figure 3. Make sure that the controller case is level.

Figure 3. Sensor Orientation



**CORRECT CONTROLLER MOUNTING  
HOLE ORIENTATION WHEN  
MOUNTED ON VESSEL**

A6639

### **NOTICE**

**Do not pick up the controller/sensor by lifting the displacer rod (key 64). This action could place excessive stress on the displacer rod and cause the unit to malfunction.**

## Attaching a Vertical Displacer

Refer to figure 5 for part locations.

1. Thread jam nut (key 63) all the way onto the threaded portion of the universal joint assembly (key 69).
2. Thread the displacer (key 81) all the way onto the threaded portion of the universal joint assembly.
3. Tighten the jam nut (key 63) against the displacer (key 81).

## Attaching a Horizontal Displacer

Refer to figure 5 for part locations.

1. Thread jam nut (key 63) all the way onto the displacer rod (key 64) or extension (key 82).
2. Thread the displacer (key 81) all the way onto the displacer rod (key 64) or extension (key 82).
3. Tighten the jam nut (key 63) against the displacer (key 81).

## Supply Pressure Connections

### **⚠ WARNING**

Personal injury or property damage may occur from an uncontrolled process if the supply medium is not clean, dry, oil-free air, or non-corrosive gas. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, check with an Emerson field office and industry instrument air quality standards for use with corrosive air or if you are unsure about the proper amount or method of air filtration or filter maintenance.

### **NOTICE**

Do not use sealing tape on pneumatic connections. This instrument contains small passages that may become obstructed by detached sealing tape. Thread sealant paste should be used to seal and lubricate pneumatic threaded connections.

Provide a source of clean, dry air that meets the requirements of ISA Standard 7.0.01 or noncorrosive gas as the operating medium. Refer to table 1 to determine supply pressure.

1. Connect the supply pressure to the 1/4 NPT internal connection on the bottom of the controller case.
2. Connect the output signal line to the equipment being operated and to the 1/4 NPT output connection on the top of the controller case.

## Vent

### **⚠ WARNING**

If a flammable or hazardous gas is to be used as the supply pressure medium, personal injury or property damage could result from fire or explosion of accumulated gas or from contact with hazardous gas. The controller/actuator assembly does not form a gas-tight seal, and when the assembly is enclosed, a remote vent line, adequate ventilation, and necessary safety measures should be used. A remote vent pipe alone cannot be relied upon to remove all hazardous gas. Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

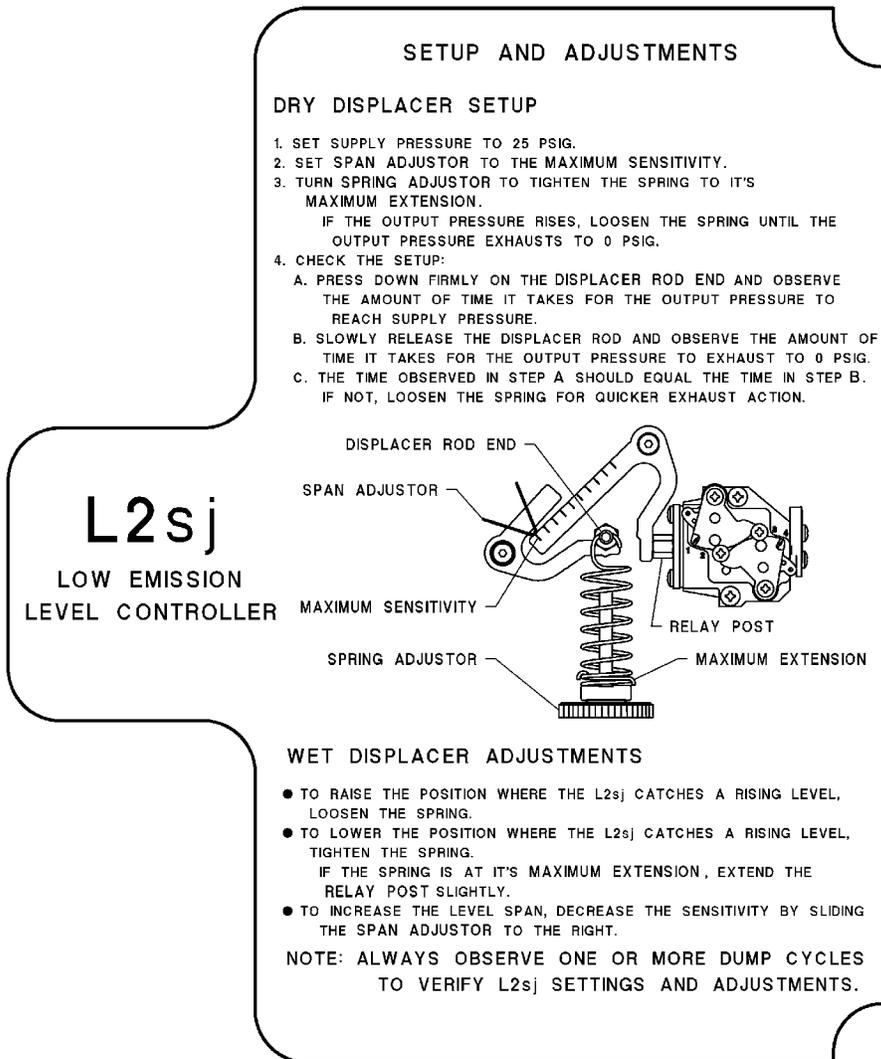
The vent opening or the end of the remote vent pipe, if one is required, must be protected against the entrance of all foreign matter that could plug the vent. Use 13 mm (1/2-inch) diameter pipe for the remote vent pipe. Check the vent periodically to be certain it is free of any obstructions.

## Setup and Adjustments

### Dry Displacer Setup

Refer to the setup and adjustments label shown in figure 4 for the following adjustments.

Figure 4. Setup and Adjustments Label (Inside Fisher L2sj Cover)



CE16844

1. Set the supply pressure to 25 psig.

**Note**

Supply pressure can be set between 0.34 and 2.4 bar (5 and 35 psig).

2. Set the span adjuster to the maximum sensitivity.
3. Turn the spring adjustor to tighten the spring to it's maximum extension. If the output pressure rises, loosen the spring until the output pressure exhausts to 0 psig.

4. Check the setup, as follows:
    - a. Press down firmly on the displacer rod end and observe the amount of time it takes for the output pressure to reach supply pressure.
    - b. Slowly release the displacer and observe the amount of time it takes for the output pressure to exhaust to 0 psig.
    - c. The time observed in step a should equal the time observed in step b. If these times are not equal, loosen the spring for quicker exhaust action, and repeat step 4.
- 

**Note**

Always observe one or more dump cycles to verify the *L2sj* controller settings and adjustments.

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## Wet Displacer Adjustments

Refer to the setup and adjustments label shown in figure 4 for the following adjustments.

- To raise the position where the *L2sj* catches a rising level, loosen the spring.
  - To lower the position where the *L2sj* catches a rising lever, tighten the spring. If the spring is at its maximum extension, extend the relay post slightly.
  - To increase the level span, decrease the sensitivity by sliding the span adjustor to the right.
- 

**Note**

Always observe one or more dump cycles to verify the *L2sj* controller settings and adjustments.

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## Maintenance

Parts are subject to normal wear and must be inspected periodically and replaced as necessary. The frequency of parts inspection and replacement depends upon the severity of service conditions. When inspection or repairs are required, disassemble only those parts necessary to accomplish the task.

**⚠ WARNING**

Always wear protective clothing, gloves, and eyewear whenever possible when performing any maintenance operations to avoid personal injury or property damage.

To avoid personal injury or property damage caused by the release of pressure or process fluid, observe the following before starting maintenance:

- Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 7.

- Completely shut off the process to isolate the controller/sensor from process pressure.
  - Provide a means of containing the process fluid before removing any measurement devices from the process.
  - Vent any trapped process pressure.
  - Check with your process or safety engineer for any additional measures that must be taken to protect against process media.
- 

## Removing the Controller From the Sensor

1. Disconnect the supply and output pressure lines.
2. Slide the hook end of the zero spring (key 5, figure 6) over and off the controller end of the displacer rod (key 64, figure 5).
3. Remove the four controller mounting screws (key 11, figure 6), and pull the controller straight away from the sensor.

## Replacing the Sensor O-Rings

Refer to figure 5 for key number locations unless otherwise indicated.

### Disassembly

1. Remove the controller from the sensor by following the procedure outlined in the previous section.
2. Remove the sensor from the tank.
3. Unscrew the hex nut (key 67) and remove the spacer (key 66) and spring (key 68). After removing the spring, replace the spacer (key 66) and hex nut (key 67) on the displacer rod.

From the displacer end, pull the displacer rod away from the sensor connection (key 65) to pull the pivot base (key 73) loose from the sensor connection. Remove the hex nut (key 67) to permit removing the displacer rod, pivot base, pivot body, and spacer from the sensor connection.

4. Slide the pivot base (key 73), retaining ring (key 76), anti-extrusion ring (key 75), and O-ring (key 74) off the displacer rod. Remove the O-ring (key 77) and backup ring (key 78) from the pivot base.

### Assembly

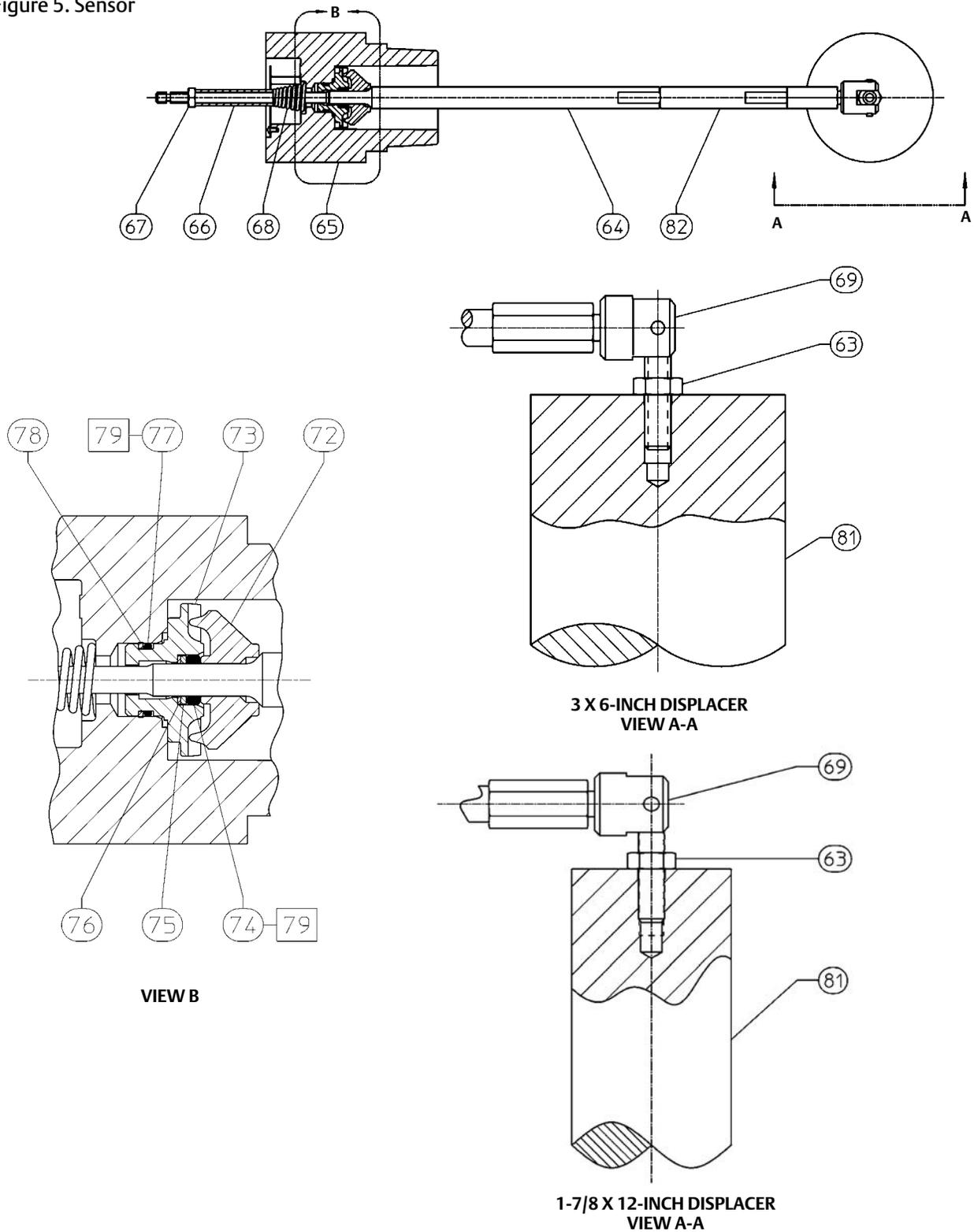
#### **⚠ WARNING**

**Improper assembly of the O-rings, anti-extrusion ring, and backup ring could result in O-ring extrusion and permit leakage of process fluids. To avoid personal injury or property damage from leaking process fluid, be sure the O-rings, anti-extrusion ring and backup ring are assembled in the order shown in figure 5.**

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1. Place the pivot body (key 72) on the displacer rod (key 64) so that it is positioned as shown in figure 5.
2. Slide the O-ring (key 74), anti-extrusion ring (key 75) and retaining ring (key 76) onto the displacer rod assembly (key 64). Be sure the O-ring, anti-extrusion ring, and retaining ring are in the order shown in figure 5. Slide the pivot base onto the displacer rod so that the points of the pivot body (key 72) will engage the slots in the pivot base (key 73).
3. Install the O-ring (key 77) and backup ring (key 78) into the groove on the pivot base (key 73). Be sure the backup ring is on the downstream pressure side of the O-ring as shown in figure 5.

Figure 5. Sensor



4. Insert the displacer rod (key 64) into the vessel side of the sensor connection (key 65).
5. The pivot base must seat in the slots cast in the sensor connection. These slots will be horizontal when the sensor connection (key 65) is oriented as shown in figure 3.
6. To reduce the possibility of nicking the O-ring (key 77) on the pivot base, keep the displacer rod centered in the sensor connection as much as possible while pushing the pivot base into the sensor connection. Be sure the pivot base seats in the slots cast in the sensor connection.
7. Slide the spring (key 68) and spacer (key 66) onto the displacer rod and secure with the hex nut (key 67). Fully tighten the hex nut (key 67).
8. View the sensor connection from the vessel side. Ensure that the pivot body arms remain aligned with the pivot base arms (the two pivot body points are seated in the pivot base slots).
9. Install the sensor in the vessel.

## Replacing the Controller Relay

Refer to figure 6 for key number locations unless otherwise indicated.

1. Disconnect the supply and output pressure lines.
2. Remove the two relay mounting screws (key 33), and pull the relay, including the relay mounting O-rings (keys 43 and 44, not shown), away from the controller base (key 1).
3. Install the new relay using two relay mounting screws (key 33). To install it properly, you will need to shift it to the right. Make certain that the relay mounting O-rings (keys 43 and 44, not shown) are lubricated and completely in their mounting bosses before installing the relay. Make certain the span lever assembly (key 6) is in line with and pushing in on the end of the relay post (key 87).

## Replacing the Controller Supply Filter

Refer to figure 6 for key number locations unless otherwise indicated.

1. Disconnect the supply and output pressure lines.
2. Loosen the filter cap screws (key 17), and rotate the filter cap (key 14) to the side to uncover the supply filter (key 15).
3. Remove the O-ring (key 16) and the old filter (key 15), and remove any debris from the filter boss.
4. Install a new supply filter, and O-ring (key 16). Reinstall the filter cap (key 14), and tighten the filter cap screws (key 17).

## Parts Ordering

When corresponding with your [Emerson sales office](#) about this equipment, always mention the serial number of the controller. The serial number can be found on the nameplate (key 55, figure 6).

### **⚠ WARNING**

**Use only genuine Fisher replacement parts. Components that are not supplied by Emerson should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson may void your warranty, might adversely affect the performance of the valve, and could cause personal injury or property damage.**

## Parts Kits

Description	Part Number
<b>Controller Repair Kit</b> Kit includes O-rings (keys 13 and 16) and gaskets (keys 18, 21, and 23)	RL2CNTRX012
<b>Relay Repair Kit</b> Kit includes relay assembly, relay mounting screws (key 33), and O-rings (key 43, and 44) On/Off Control	GE16507X012
<b>Sensor Repair Kit</b> Kit includes keys 74, 75, 76, 77, and 78 (fluorocarbon O-rings, anti-extrusion ring, retaining ring, and fluorocarbon backup ring)	RL2SENSX012

Key	Description
6	Span Lever Assembly
7	Shoulder Screw (2 req'd)
8	Flanged Bearing (4 req'd)
9	Span Adjustor
10*	Pressure Gauge (2 req'd)
11	Mounting Screw (4 req'd)
12	Cover Screw
13*	O-Ring <sup>(1)</sup>
14	Filter Cap
15*	Filter
16*	O-Ring <sup>(1)</sup>
17	Machine Screw (2 req'd)
18*	Sensor Gasket <sup>(1)</sup>
19	Cover
20	Cover Lens (2 req'd)
21*	Gasket (2 req'd) <sup>(1)</sup>
22	Retaining Ring (2 req'd)
23*	Cover Gasket <sup>(1)</sup>
33	Relay Mounting Screw (2 req'd) <sup>(2)</sup>
43*	Relay Mounting O-Ring (not shown) <sup>(2)</sup>
44*	Relay Mounting O-Ring (not shown) <sup>(2)</sup>
53	Label, setup and calibration
54	Self-Tapping Screw (2 req'd)
55	Nameplate
56	Screen
60	Anti-seize sealant (not furnished with controller)
61	Lubricant, silicone sealant (not furnished with controller)
62	Thread locking adhesive, mild strength (not furnished with controller)
84	Adhesive
85	Nameplate (ATEX)
86	Span Lever Assy, min adj
87	Relay Post

## Parts List

Key Description

### Controller (figure 6)

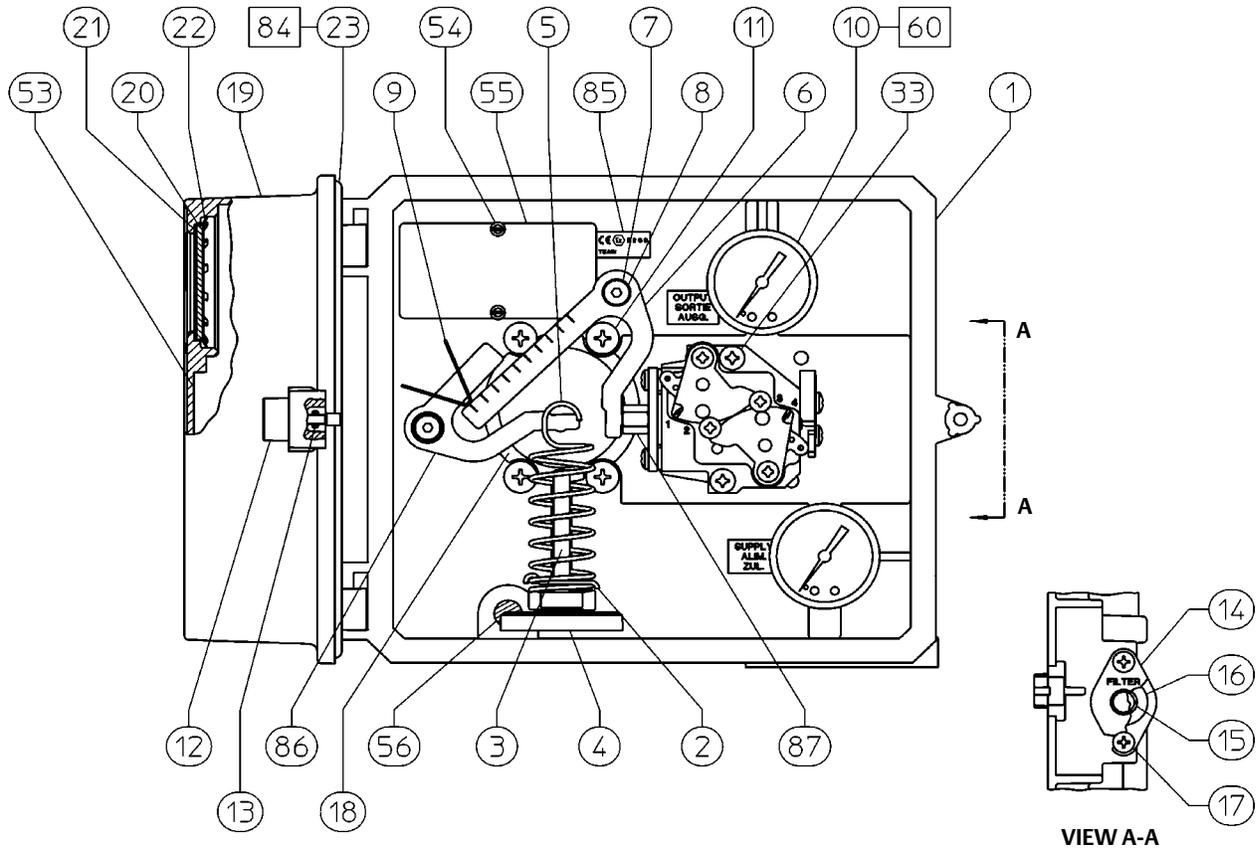
1	Controller Base
2	Zero Spring Seat
3	Zero Adjustment Bolt
4	Spring Adjustment
5	Zero Spring

\*Recommended spare parts

1. Included in the Controller Repair Kit

2. Included in the Relay Repair Kit

Figure 6. Fisher L2sj Low Emission Liquid Level Controller



APPLY LUB/SEALANT  
GB16509-A

Key Description

### Sensor (figure 5)

- 63 Hex Nut
- 64 Displacer Rod
- 65 Sensor Connection
- 66 Spacer
- 67 Hex Nut
- 68 Conical Spring
- 69 Universal Joint (vertical displacer only)
- 70 Nameplate (not shown)
- 71 Drive Screw (not shown)
- 72 Pivot Body

Key Description

- 73 Pivot Base
- 74\* O-Ring<sup>(3)</sup>
- 75\* Anti-Extrusion Ring<sup>(3)</sup>
- 76 Retaining Ring<sup>(3)</sup>
- 77\* O-Ring<sup>(3)</sup>
- 78\* Backup Ring<sup>(3)</sup>
- 79 Lubricant, silicone sealant  
(not furnished with sensor)
- 80 Instruction Tag
- 81 Displacer  
1-7/8x12-inches  
3x6-inches
- 82 Extension  
3-inch  
6-inch

\*Recommended spare parts  
3. Included in the Sensor Repair Kit



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