

Fisher™ L2e Electric Level Controller



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Section 1: Introduction

1.1 Scope of the Manual

This instruction manual includes installation, adjustment, maintenance and parts ordering information for the Fisher L2e electric liquid level controller.

WARNING


 Do not install, operate or maintain an L2e electric 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 the 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.

Figure 1. Fisher L2e Electric Level Controller



X0660

1.2 Description

The L2e electric liquid level differential gap on-off controller uses a displacement type sensor to detect liquid level or the interface between two liquids of different specific gravities.

The L2e controls the lower trip point (zero) that closes the dump valve, allowing the vessel to fill to the upper trip point. Once the upper trip point is reached, the dump valve opens to drain the fluid down to the zero or lower trip point. The difference between the upper trip point and the zero or lower trip point is called differential gap or DG. The L2e operates as a two position (on-off) controller.

The instrument uses an electronic switch (solid state relay) that provides one Normally Closed (NC) and one Normally Open (NO) contact. The electronic switch can be used to provide liquid monitoring or to provide differential gap (DG) control by operating an electrically-actuated valve.

Unless otherwise noted, all NACE references are to NACE MR0175-2002.

1.3 Specifications

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

1.4 Educational Services


Emerson Educational Services
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emerson.com/mytraining

Table 1. Specifications

Available Configurations	Controller Connection
<p>Controller: Differential gap (DG) electric control action with intuitive Zero and Span Adjustments (refer to page 2 for differential gap description)</p> <p>Sensor: Displacer-type liquid level sensor for mounting to side of vessel</p>	<p>Electrical 1/2-14 NPT external conduit connection with 0.5 m (greater than 18 in.) of 18 AWG lead wires, located at the bottom of the case</p>
Input Signal	Displacer Sizes
<p>Type: Liquid level or liquid-to-liquid interface</p> <p>Level Change Required for Full Change in State of Output: 5.0 to 305 mm / 0.2 to 12 in.</p> <p>Dynamic differential gap for the level in the vessel depends on factors such as valve sizing, actuator speed, molecular weight, pressure and temperature of process fluids, input flow rate and vessel size.</p>	<ul style="list-style-type: none"> ■ 48 X 305 mm, 541 cm³ / 1-7/8 X 12 in., 33 in.³ ■ 76 X 152 mm, 688 cm³ / 3 X 6 in., 42 in.³
Specific Gravity Limits	Maximum Displacer Insertion Length ⁽²⁾ , Horizontal or Vertical
<p>Minimum SG: 0.15</p> <p>Maximum SG</p> <p>PVC Displacer: 1.3</p> <p>SST Displacer: 1.1</p>	<p>1-7/8 x 12 Displacer with one 6-in. extension (optional use)</p> <p>3 x 6 Displacer with one 3-in. extension (optional use)</p>
Switch Contact Electrical Rating	Displacer Material and Maximum Mechanical Sensor Working Pressure ⁽³⁾
<p>1 Amp resistive, 0.5 Amp inductive/28 V DC; contacts are not polarity sensitive</p> <p>Note: The easy-Drive™ actuator application draws 7 mA through the L2e contacts at 5 V DC.</p>	<p>PVC Displacer: Consistent with CL1500 pressure temperature ratings per ASME B16.34 up to maximum pressure of 258.5 bar / 3750 psig.</p> <p>For PED (2014/68/EU) maximum pressure limited to 200 bar / 2900 psig.</p>
Power Requirements	<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>Voltage: 9 to 30 V DC</p> <p>Maximum Input Voltage Ripple: 400 mV</p> <p>Current draw:</p> <p>Less than 15 mA steady state</p> <p>Less than 500 mA peak startup or switching transient</p>	
Sensor to Vessel Connection	Operative Ambient Temperature Limits ⁽³⁾
<p>■ 2 NPT threaded or ■ NPS 2 CL150 through 1500 slip-on flange connection⁽¹⁾</p>	<p>Controller: -40 to 85 °C / -40 to 185 °F</p>

- continued -

Table 1. Specifications (continued)

Operative Process Temperature Limits ⁽³⁾	Hazardous Area Classifications Available
Sensor: ■ PVC Displacer: -18 to 71 °C / 0 to 160 °F ■ S31603 SST Displacer: -40 to 204 °C / -40 to 400 °F	Switch Only Refer to GH04148 instruction manual (D104234X012) for switch information cCSAus Explosion-proof Class I Division 1, Groups ABCD Dust Ignition-proof Class II Division 1 2, Groups EFG Single Seal ⁽⁴⁾ ATEX  II 2 GD Flameproof Ex d IIC T5 (Ta ≤ at 85 °C) / T6 (Ta ≤ at 78 °C) Dust Ex tb IIIC T92°C / T85°C Db IP6X 1 A Max IECEx Flameproof Ex d IIC T5 (Ta ≤ at 85 °C) / T6 (Ta ≤ at 78 °C) Dust Ex tb IIIC T92°C / T85°C Db IP6X 1 A Max Ingress Protection Rating per IEC 60529: IP66 Refer to D104234X012 for Special Conditions of Safe Use
Construction Materials	Canadian Registration (CRN)
Controller Case and Cover: Marine grade aluminum Switch: Aluminum 6061T Switch Body Internal O-ring: Fluorosilicone Rubber Span Levers: Stainless steel Springs: Stainless steel Sensor Sensor Body: LCC O-rings: Fluorocarbon Pivot Assembly: Stainless steel Displacer: ■ Polyvinylchloride (PVC) or ■ S31603 SST Sensor Spring: Stainless steel	Refer to the L2 CRN which is deemed applicable to the L2e.
<p>NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 Process Instrument Terminology.</p> <ol style="list-style-type: none"> 1. Converting from a threaded NPT connection to a flange connection is to be done by the end-user. Refer to Converting a Threaded NPT Connection to a Flange Connection Instruction Manual Supplement (D103277X012), available at Fisher.com or from your Emerson sales office. 2. Maximum span setting with 1-7/8 x 12 in. horizontal displacer plus 6 in. extension is not recommended due to potentially insufficient zero adjustment. 3. The pressure and temperature limits in this document and any applicable code limitations should not be exceeded. 4. Electronic switch pressure rating is based on maximum pressure at sensor. Controller housing vent is designed to drop maximum process pressure to less than 6.9 bar / 100 psig at switch. 	

Section 2: Installation

⚠ WARNING

Always wear protective clothing, gloves and eyewear when performing any installation operations to avoid personal injury.

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.

Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

If installing this into an existing application, also refer to the WARNING at the beginning of the Maintenance section of this instruction manual.

NOTICE

If the L2e electric 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 instrument and or 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 wall connection such that the displacer will be at the desired control level.

2.1 Attaching a Vertical Displacer

Refer to Figure 12 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 against the displacer.

2.2 Attaching a Horizontal Displacer

Refer to Figure 12 for part locations.

1. Thread the displacer (key 81) all the way onto the displacer rod (key 64) or extension (key 82) and tighten.

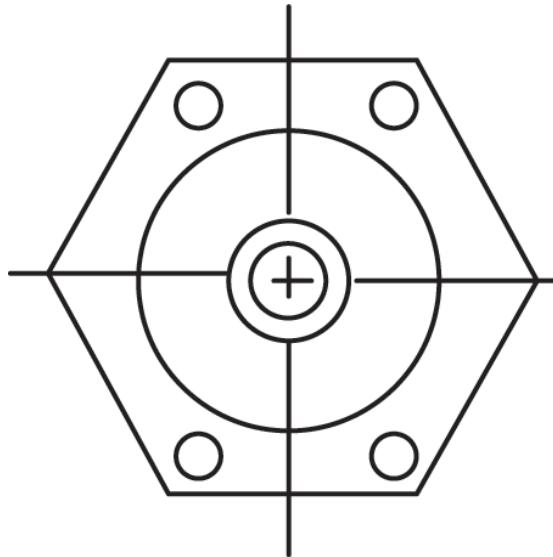
2.3 Attaching the Sensor to the Vessel

Insert the displacer end of the L2e sensor into the vessel connection and tighten enough to seal the threads. If necessary, loosen or tighten slightly to obtain the horizontal orientation shown in Figure 2. Make sure that the controller case is level.

NOTICE

The displacer rod (key 64) is not a handle. Grasp sensor body or controller housing to lift and carry to avoid internal component damage.

Figure 2. Sensor Orientation



CORRECT CONTROLLER MOUNTING
HOLE ORIENTATION WHEN MOUNTED ON VESSEL

A6639

2.4 Electrical Connections

WARNING

For explosion-proof applications, disconnect power before installing, servicing or removing electrical components. Personal injury or property damage from fire or explosion may result if power is not disconnected.

Select junction boxes, wiring and/or cable glands that are rated for the environment of use (such as hazardous location, ingress protection and temperature). Failure to use properly rated electrical hardware wiring and/or cable glands can result in personal injury or property damage from fire or explosion. Wiring connections must be in accordance with local, regional and national codes for any given hazardous area approval. Failure to follow the local, regional and national codes could result in personal injury or property damage from fire or explosion.

An electrical 1/2-14 NPT conduit connection with 0.5 meters (greater than 18 in.) of 18 AWG lead wires is located at the bottom of the case. The conduit connection is integral to the body of the switch.

The Electronic Switch has Normally Closed (NC) and Normally Open (NO) outputs. The Switch electronics is housed in Explosion/Flame proof and dust explosion proof enclosure.

The action of the controller is such that the switch contacts activate a dump valve when the fluid level exceeds the high trip point and remain in that state until the level falls below the low trip point. At the low trip point, the switch contacts de-activate or close the dump valve. The contacts remain in that state until the level builds up to the high trip point again.

Connect L2e electrical wires as shown in Table 2. To reverse the action refer to Table 2 and reverse wiring for normally open and normally closed.

Table 2. L2e Electrical Wire Color Code

Wire Color	Description
White/Red	DC Supply +
White/Black	DC Supply -
Red	Normally Closed Contact
Brown	Common Contact
Blue	Normally Open Contact
Green	Ground (Housing, Safety)

2.5 Wiring Configurations

There are two recommended wiring configurations depending on the preferred site solution and approach to electric level control; a direct connection to the easy-Drive actuator, shown in Figure 3 or a direct connection to the easy-Drive actuator and a remote monitor (Figures 4 and 5). In these examples, the L2e is wired using a common and separate N/O or N/C contact. When implemented as suggested, these wiring configurations provide definitive level switch points and help reduce issues associated with single pole single throw contact switches, such as “bouncing” due to vibration or sloshing liquids in a vessel.

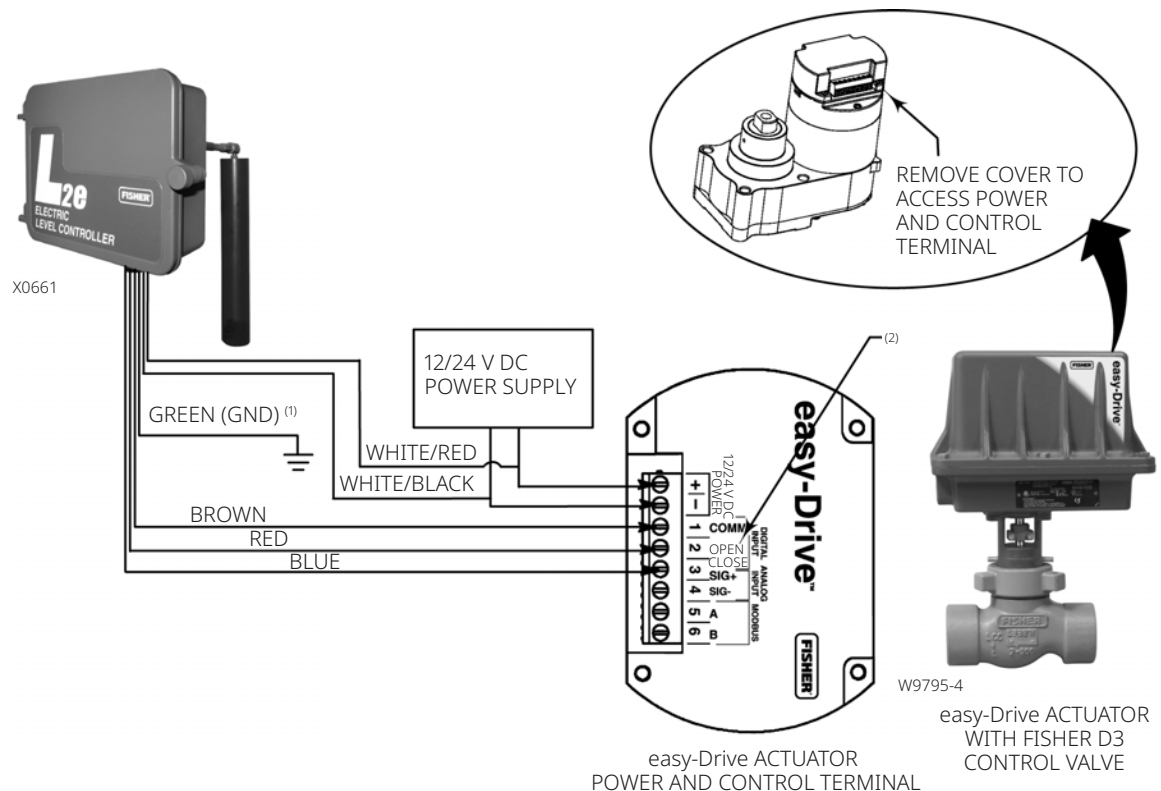
NOTE

The wiring diagrams shown are for “sourcing”-type digital input cards.

“Sinking”-type digital input cards should not be wired to the L2e switch terminals in parallel with the easy-Drive input terminals as they will be unintentionally and constantly activated by the easy-Drive “sourcing”-type input circuits.

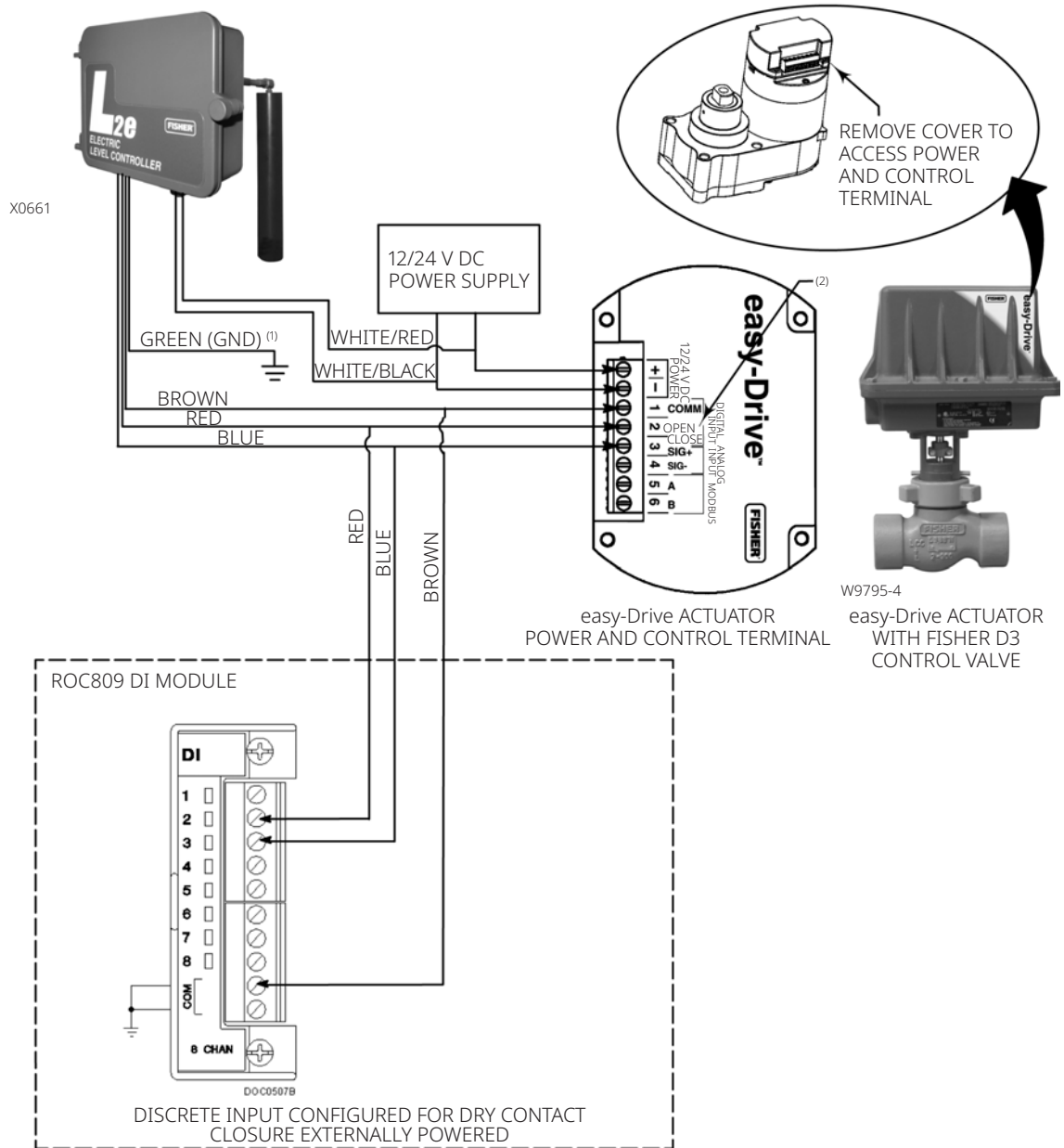
If a PLC with sinking digital input cards is used, the easy-Drive input terminals need to be driven by a digital output card on that PLC and the PLC must control those digital outputs by its logic program after reading its digital inputs. This will introduce additional delay into the response to the input, modifying the dynamic differential gap achieved by the controller.

Figure 3. Local Level Control with Direct Connection to easy-Drive Actuator Without Remote Monitor



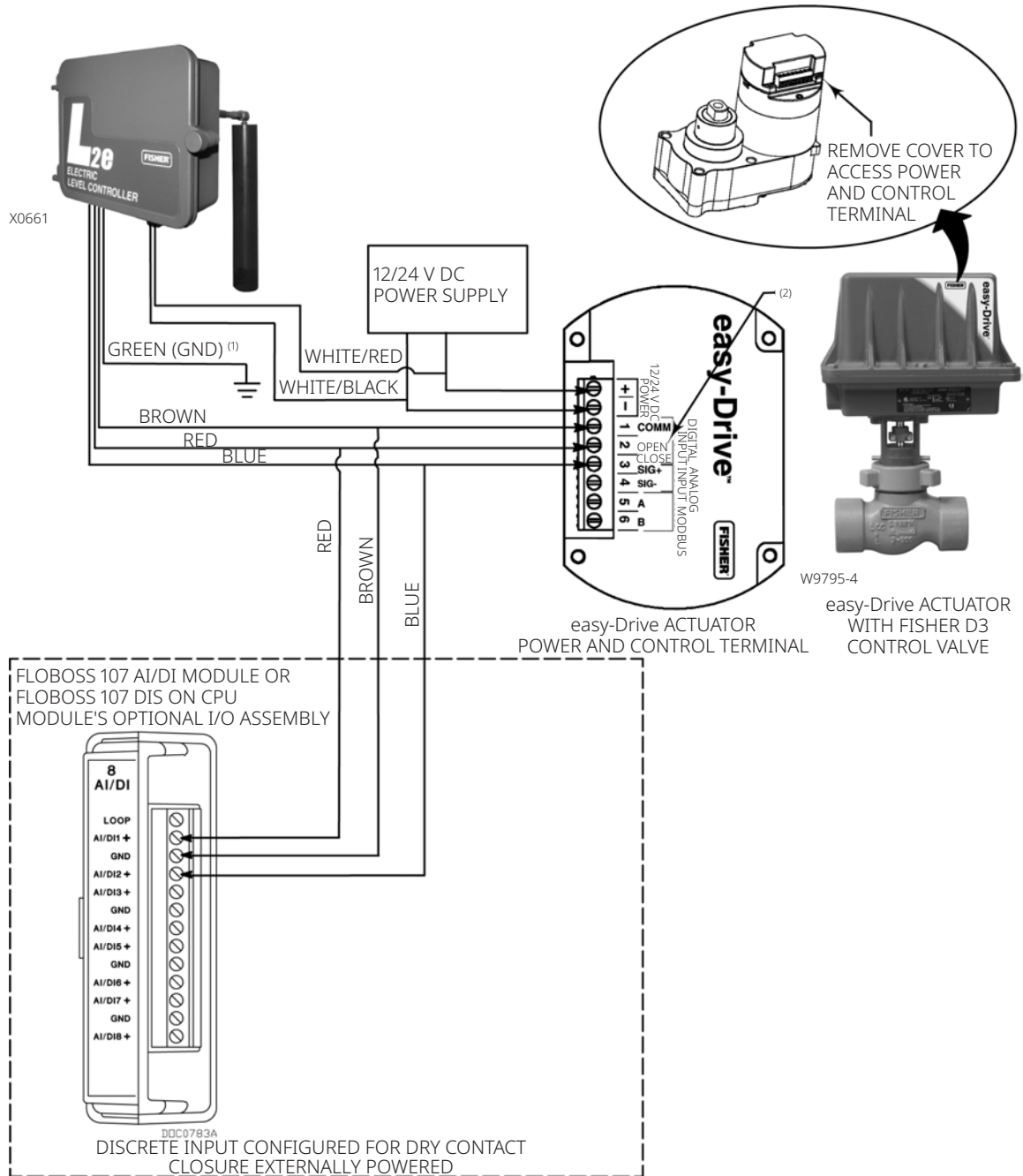
1. CONNECT GREEN WIRE TO ACTUATOR GROUND (NOT SHOWN).
2. OPEN CONTACT (2) MAY BE LABELED N.O. AND CLOSE CONTACT (3) MAY BE LABELED N.C.

Figure 4. Local Level Loop Control with Direct Connect to easy-Drive Actuator with ROC809 Remote Monitor



1. CONNECT GREEN WIRE TO ACTUATOR GROUND (NOT SHOWN).
2. OPEN CONTACT (2) MAY BE LABELED N.O. AND CLOSE CONTACT (3) MAY BE LABELED N.C.

Figure 5. Local Level Loop Control with Direct Connect to easy-Drive Actuator with FloBoss 107 Remote Monitor

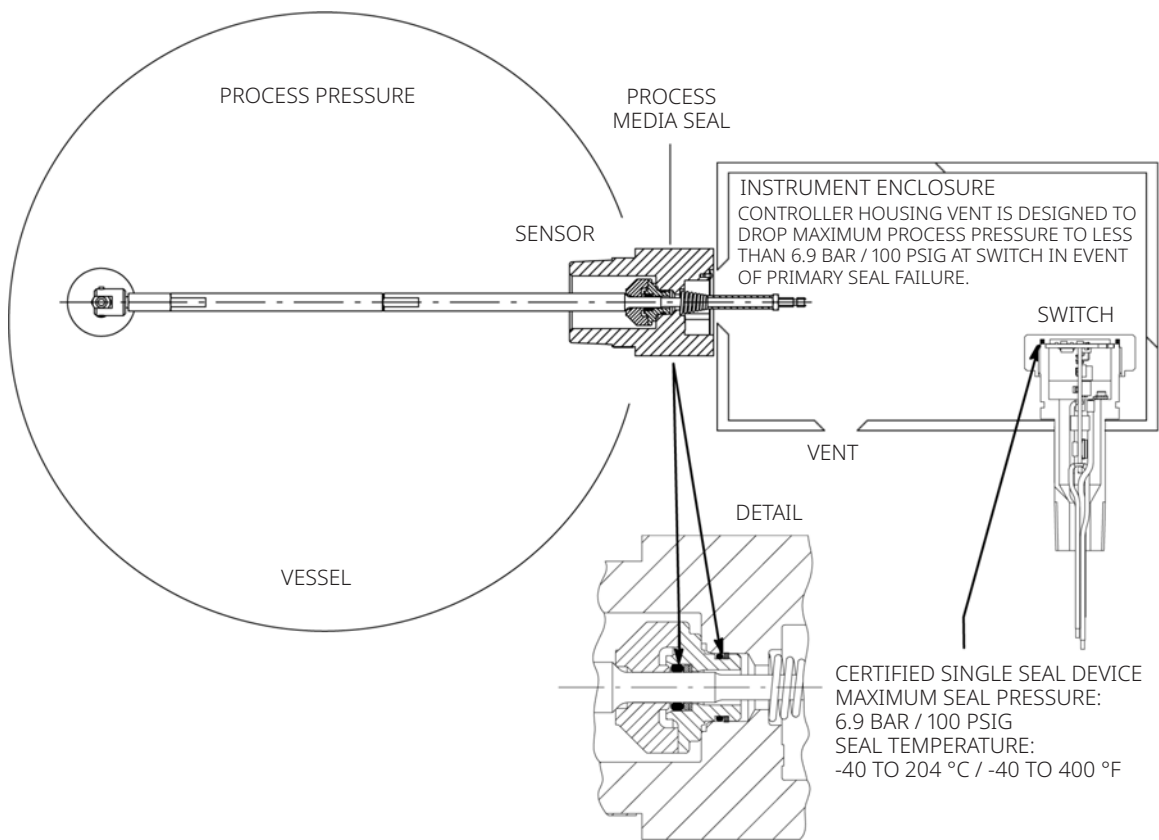


1. CONNECT GREEN WIRE TO ACTUATOR GROUND (NOT SHOWN).
2. OPEN CONTACT (2) MAY BE LABELED N.O. AND CLOSE CONTACT (3) MAY BE LABELED N.C.

Seal Certification

The L2e instrument is not dual-seal certified. However, the enclosure is not exposed to process pressure during normal operation and is vented, as shown in Figure 6. The process seal is contained in the separate mechanical sensor which can be separated from the L2e enclosure without disturbing the process connection. A process seal failure will result in process fluids being exhausted through the L2e enclosure vent, with an accompanying decrease in enclosure pressure from the operating process pressure. Thus, annunciation of a process seal failure is provided. The switch component, which is separately sealed from the L2e main enclosure volume by a metal cap, is never exposed to full process pressure even in the event of process seal failure.

Figure 6. Schematic



2.6 L2e Initial Setup (Dry Displacer)

Refer to Figure 7.

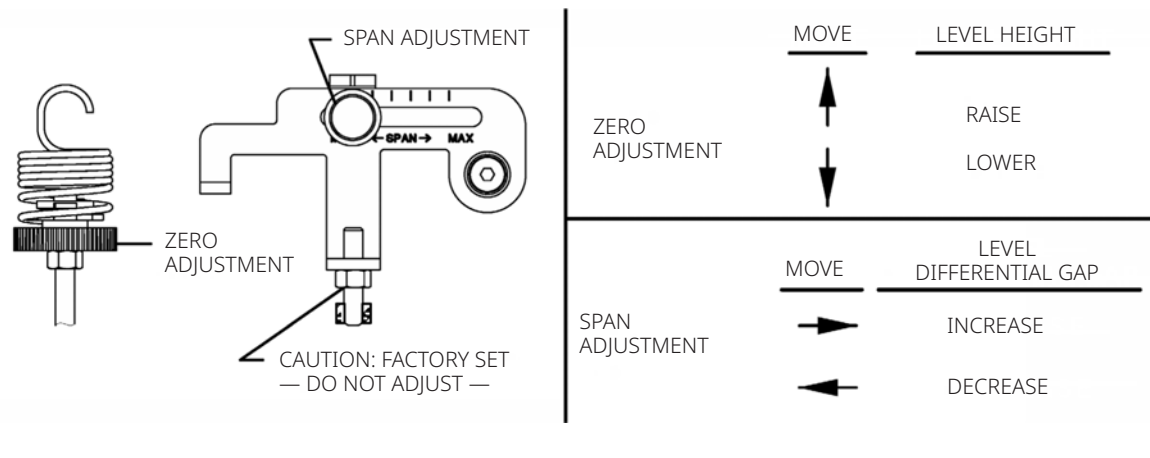
1. Apply power to the L2e Switch assembly.
2. Move Span to minimum setting.
3. If the switch is already in the state that opens the dump valve, skip to step 4. Otherwise, (e.g., lever B is resting on its travel stop), first move the plunger away from the switch by moving the Zero adjustment until the switch just changes to the state required to open the dump valve.
4. Slowly bring the plunger towards the switch by moving the Zero adjustment until the switch changes to the state required to close the dump valve.

2.7 L2e Zero and Span Adjustment (Wet Displacer)

After initial setup (dry displacer) is complete,

1. Enable process flow into the vessel.
2. Move Zero and Span Adjustment for desired liquid zero position and level DG.
3. Tighten the Zero Adjustment hex nut (key 5), shown in Figure 10, to lock the Zero setting.

Figure 7. Initial Setup

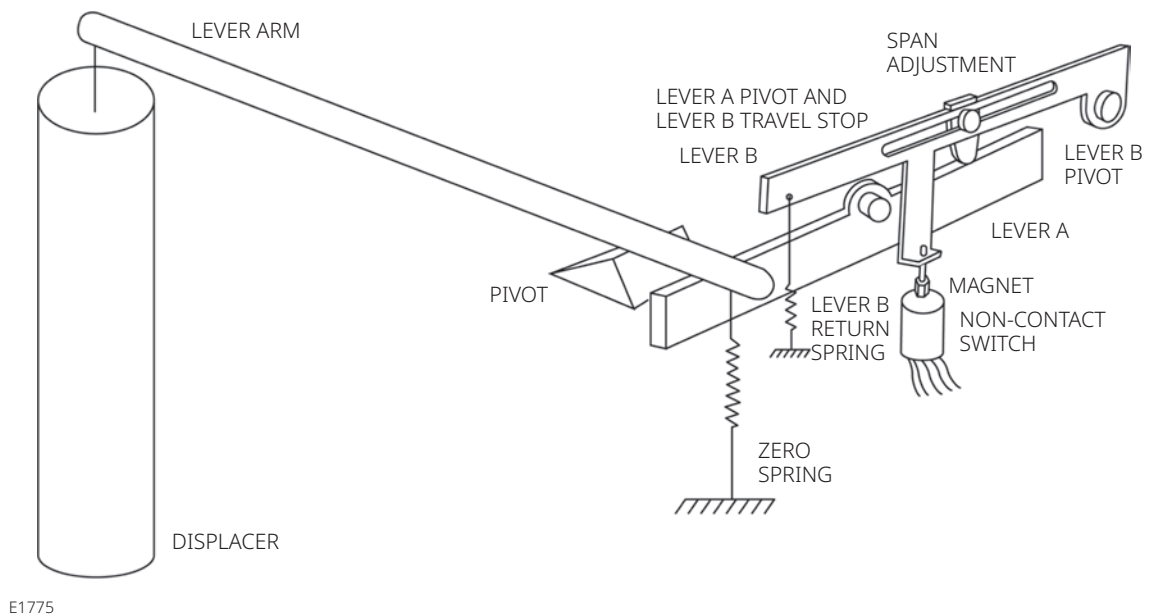


Section 3: Principle of Operation

The operation of the L2e's mechanical sensor is based on Archimedes' Principle, which states that a body immersed in a liquid will be buoyed up by a force equal to the weight of the fluid being displaced. The net weight of the displacer in the liquid is transmitted to the controller and amplified by the lever arm ratio. The amount of force amplification is increased by adding extensions in the arm and/or by mounting the displacer horizontally, since the effective length of the vessel side of the lever arm is the radial distance from the pivot to a vertical line through the center of gravity of the displacer. (Mounting the displacer horizontally distributes the total buoyancy change over a much smaller vertical level change. It also introduces non-linearity, because the change in submerged volume of a horizontal cylinder is much higher for small level changes around the 50% point than it is near the top and bottom limits.)

Changes in the resultant force are transmitted through levers A and B to move the magnet (refer to Figures 8 and 9). As fluid level rises, the magnet moves away from the switch and vice versa. The lower switch point (at which the dump valve is to close) is set by balancing out the net force at that position with the zero-spring setting.

Figure 8. Principle of Operation Schematic



The magnet is attached to a plunger on lever B, which has a fixed return spring forcing the plunger toward the electronic switch. The hysteresis between magnet positions that cause the electronic switch to change states is fixed. The magnet plunger is adjusted at the factory so that when lever B is on its travel stop, the switch contacts are in the state required to close the dump valve and the full hysteresis required to change to the state that will open the dump valve is available for utilization. Levers A and B are connected by a movable pivot so that the change in buoyant force required to produce a given amount of movement between the magnet and the switch can be adjusted. This span adjustment controls the amount of buoyancy change required to change the switch state, thus setting upper switch point and the static value of the differential gap.

Figure 9. Fisher L2e Controller Operation

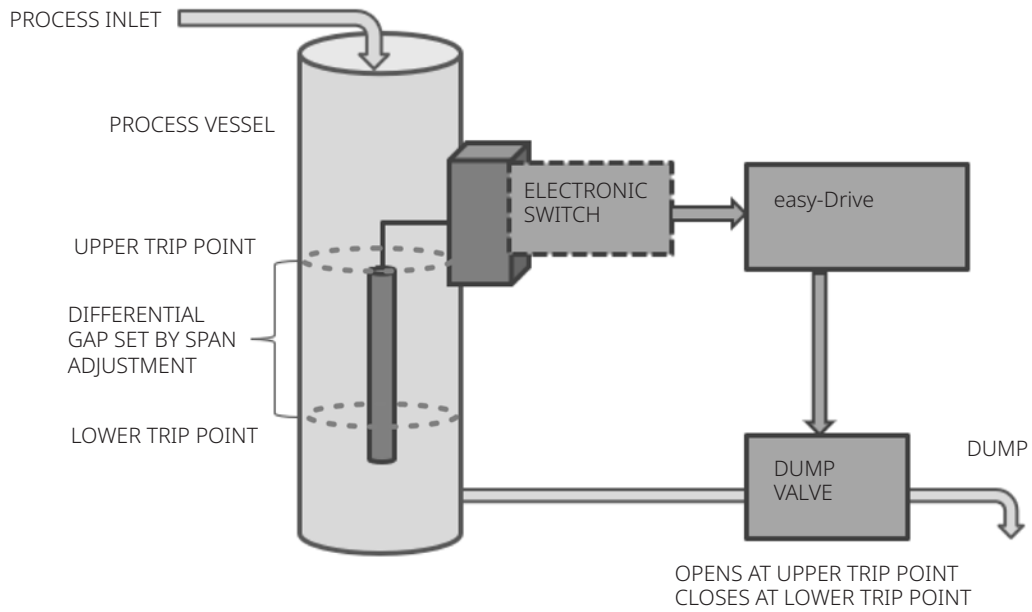
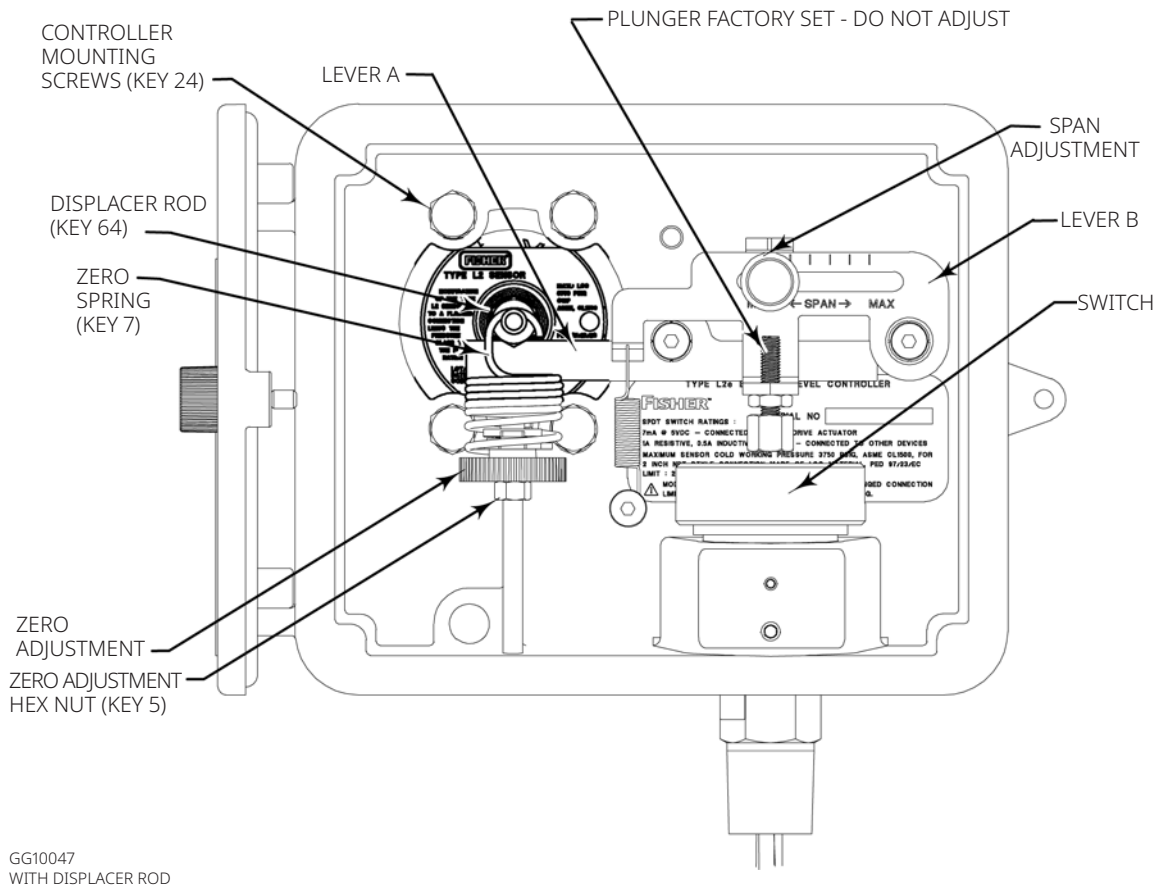


Figure 10. Fisher L2e Controller



Section 4: 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 when performing any maintenance operations to avoid personal injury. To avoid personal injury or property damage caused by the release of pressure or process fluid, observe the following before starting maintenance:

- **Provide some temporary means of control for the process before taking the controller out of service.**
- **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.**

4.1 Removing the Controller From the Sensor

Refer to Figure 9 for key number locations unless otherwise indicated.

1. Disconnect power from any electrical source.
2. Slide the hook end of the zero spring (key 7) over and off the controller end of the displacer rod (key 64).
3. Remove the four controller mounting screws (key 24) and pull the controller straight away from the sensor.

4.2 Installing Sensor Repair Kit (RL2SENSX012)

Refer to Figure 12 for key number locations unless otherwise indicated.

Disassembly

1. Remove the controller from the sensor by following the procedure outlined in the previous section.

WARNING

To avoid personal injury or property damage from leaking process fluid relieve process pressure and drain the vessel before removing the sensor from the vessel.

2. Remove the sensor from the vessel.
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 12.

1. Place the pivot body (key 72) on the displacer rod (key 64) so that it is positioned as shown in Figure 12.
2. Apply silicone sealant (key 79) to the O-ring (key 74) and slide onto the displacer rod assembly (key 64) with the anti-extrusion ring (key 75) and retaining ring (key 76). Be sure the O-ring, anti-extrusion ring and retaining ring are in the order shown in Figure 12. Slide the pivot base onto the displacer rod so that the knife edges of the pivot body (key 72) engage the slots in the pivot base (key 73).
3. Apply silicone sealant (key 79) to the O-ring (key 77) and install with the backup ring (key 78) into the groove on the pivot base (key 73). Be sure the backup ring is on the process pressure side of the O-ring as shown in Figure 12.
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 2.

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. Examine the sensor to ensure that the two pivot knife edges are seated in the pivot base slots.
9. Install the sensor on the vessel.

4.3 Replacing the Complete Controller Assembly (RL2E0X00C22)

Refer to Figure 10 for key number locations unless otherwise indicated.

1. Disconnect power from any electrical source.
2. Slide the hook end of the zero spring (key 7) over and off the controller end of the displacer rod (key 64).
3. Remove the four controller mounting screws (key 24) and pull the controller straight away from the sensor.
4. Install the new controller assembly on the sensor.
5. Mount with the four screws (key 24).
6. Slide the hook end of the zero spring (key 7) on the controller end of the displacer rod (key 64).
7. Complete signal wiring hookup to easy-Drive electric actuator.
8. Perform the Initial Setup (Dry Displacer) and Zero and Span Adjustment procedures found on page 12.

Section 5: Related Documents

- Fisher L2e Electric Level Controller Bulletin ([D103532X012](#))
- Changing easy-Drive Electric Actuator On/Off Input Configuration from Single Dry Contact Control to Dual Dry Contact Control ([D103987X012](#))
- Converting a Threaded NPT Connection to a Flange Connection ([D103277X012](#))
- Dimensions for NPS 2 CL150 through 1500 Slip On Flange Connections ([D103405X012](#))
- Fisher D3 Control Valve Bulletin ([D103269X012](#))
- Fisher D3 Control Valve with easy-Drive Electric Actuator Instruction Manual ([D103460X012](#))
- Fisher D4 Control Valve Assembly Bulletin ([D103039X012](#))
- Fisher D4 Control Valve with easy-Drive Electric Actuator Instruction Manual ([D103597X012](#))

All documents are available from your [Emerson sales office](#) or Fisher.com.

Section 6: Parts

6.1 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.

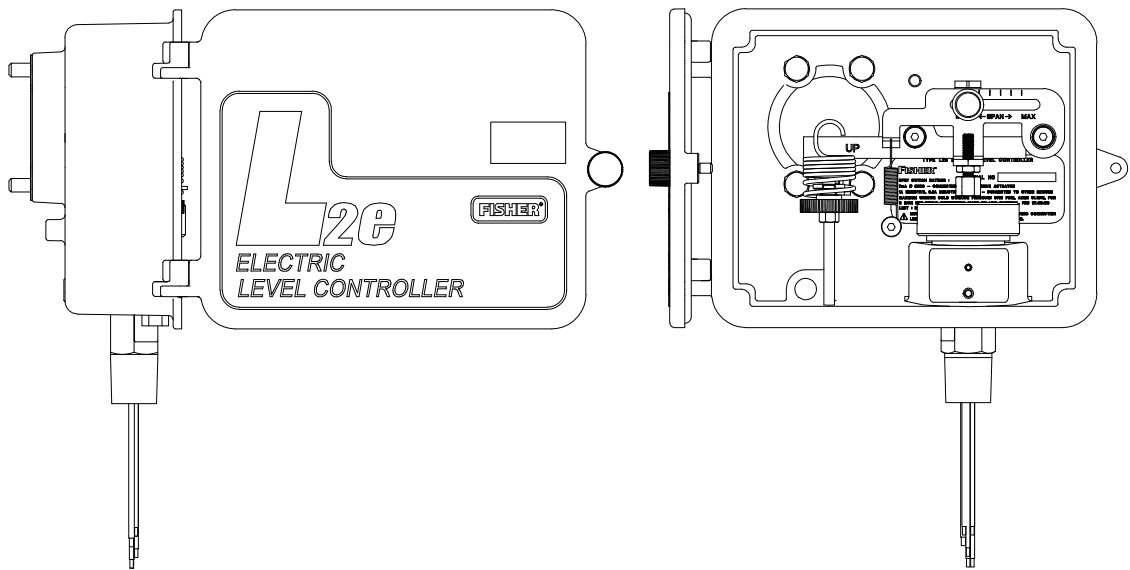
WARNING

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.

6.2 Parts Kits

Description	Part Number
Sensor Repair Kit Repair kit includes keys 74, 75, 76, 77 and 78 (fluorocarbon O-rings, anti-extrusion ring, retaining ring and fluorocarbon backup ring)	RL2SENSX012
Controller Assembly Replacement Replacement kit includes complete controller assembly (Figure 11) with mounting screws and gasket	RL2E0X00C22

Figure 11. Fisher L2e Electric Level Controller Assembly



GG10047-K

6.3 Parts List

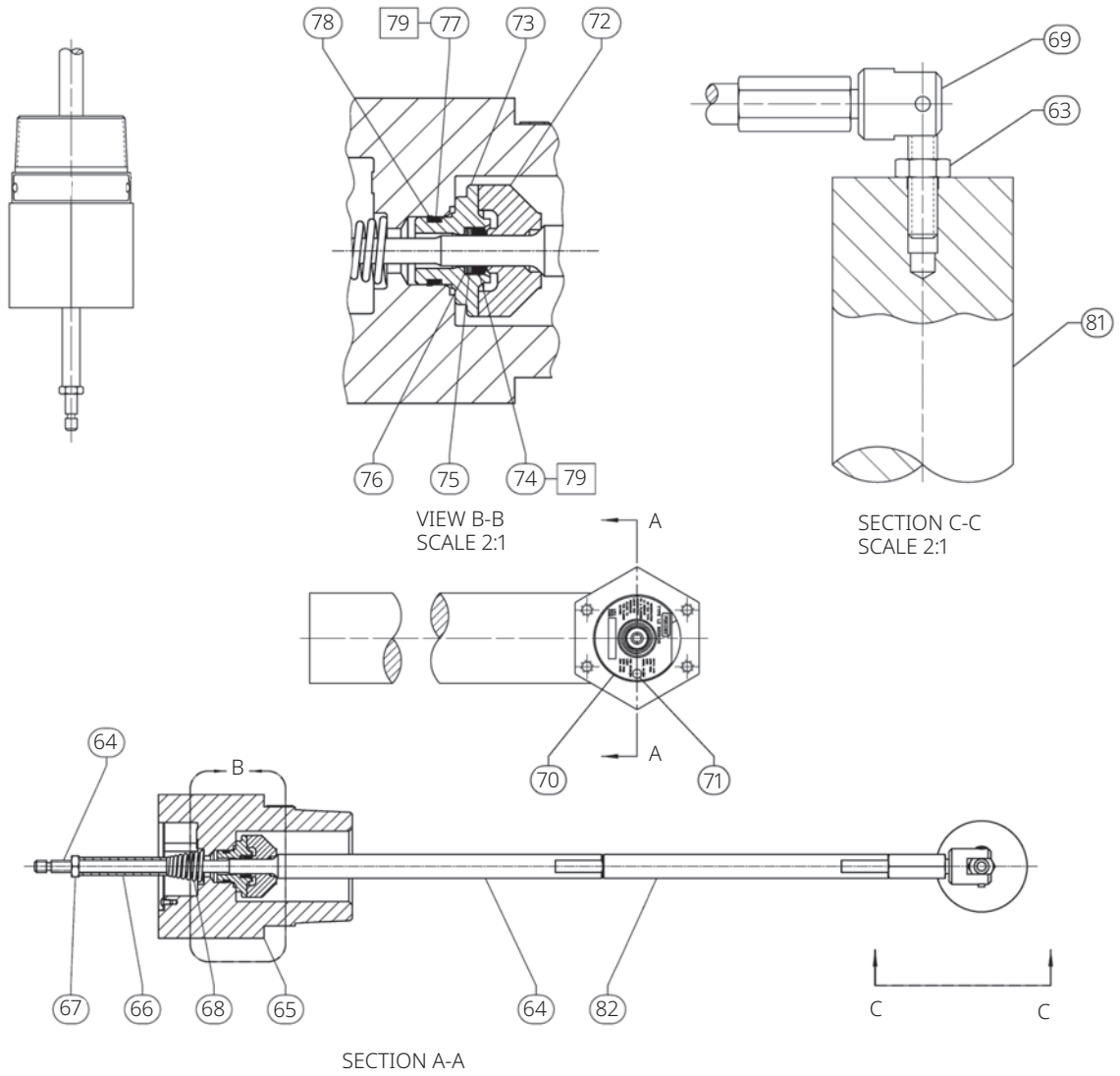
NOTE

Contact your [Emerson sales office](#) for Part Ordering information.

Sensor (See Figure 12)



Key No.	Description
63	Hex jam nut
64	Displacer rod
65	Sensor connection
66	Spacer
67	Hex jam nut
68	Conical spring
69	Universal Joint (vertical displacer only)
70	Nameplate
71	Drive screw
72	Knife pivot body
73	Knife pivot base
74 ⁽¹⁾	O-ring
75 ⁽¹⁾	Anti-extrusion ring
76 ⁽¹⁾	Retaining ring
77 ⁽¹⁾	O-ring
78 ⁽¹⁾	Backup ring
79	Sealant, silicone (not furnished with sensor)
81	Displacer, 1-7/8 x 12-in. 3 x 6-in.
82	Extension 3 in. 6 in.
1. Keys 74, 75, 76, 77 and 78 are included in the Sensor Repair Kit.	

Figure 12. Sensor



GG12263-C

□ APPLY LUB/SEALANT

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