Type *L2* Liquid Level Controllers

Contents

Introduction 1
Scope of Manual 1
Description 3
Specifications 3
Education Services 3
Installation 4
Attaching Vertical Displacer 4
Attaching Horizontal Displacer 4
Screwed Connections 4
Pressure Connections 5
Vent 5
Changing Controller Action or Mode 5
Throttling and On/Off Controllers 5
Snap-Acting Controller 5
Proportional Band Adjustment 7
Preliminary Checks 7
Direct-Acting Throttling Controllers 7
Reverse-Acting Throttling Controllers 8
Direct-Acting On/Off and Snap-Acting Controllers 8
Reverse-Acting On/Off and Snap-Acting Controllers 8
Principle of Operation 8
Maintenance 8
Removing the Controller From the Sensor 9
Replacing the Sensor O-Rings 9
Disassembly 9
Assembly 10
Replacing the Controller Relay 11
Replacing the Controller Supply Filter 11
Parts Ordering 12
Parts Kits 12
Parts List 12
Controller 12
Sensor 14

Figure 1. Type L2 Liquid Level Controller

No person may install, operate or maintain a Type *L2* Liquid Level Controller without first ● being fully trained and qualified in valve, actuator and accessory installation, operation and maintenance, and ● carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your Fisher sales office.

Note

Neither Emerson, Emerson Process Management, nor Fisher assume responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any Fisher product remains with the purchaser and end-user.

Introduction

Scope of Manual

This instruction manual includes installation, adjustment, maintenance, and parts ordering information for Type *L2* liquid level controllers.

Table 1. Specifications

Available Configurations

Controllers: Snap-acting or throttling
Sensor: Displacer-type liquid level sensor for mounting to side of tank. Displacer travel is transmitted to controller by pivotal movement of displacer rod

Input Signal(1)

Type: Liquid level or liquid-to-liquid interface

Level Change Required for Full Change in Output Signal in 1.0 Specific Gravity Liquid, with 1.4 Bar (20 Psig) Supply, Direct Action, and Standard 48 x 305 mm (1-7/8 X 12-Inch) Vertical Displacer with Standard Lever Arm Length:

Control Mode	Maximum Proportional Band Level Change, mm (Inches)	Minimum Proportional Band Level Change, mm (Inches)
Throttling	102 (4)	305 (12)
On/Off	127 (5)	305 (12)
Snap-acting	13 (0.5)	20 (0.8)

Minimum Specific Gravity(2)

Throttling and On/Off Controllers: Minimum specific gravity, or specific gravity differential for interface applications, is 0.1 (see note 3)
Snap-Acting Controllers: Minimum specific gravity, or specific gravity differential for interface applications, is 0.1

Declaration of SEP

Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the product *may* bear the CE marking to indicate compliance with *other* applicable EC Directives.

Output Signal(1)

Pneumatic ■ on-off or ■ proportional pressure signal
Ranges:
Throttling: ■ 0.2 to 1.0 bar (3 to 15 psig) or ■ 0.4 to 2.0 bar (6 to 30 psig)
On/Off: 0 (off) or full supply pressure (on)
Action: Field-reversible between direct (increasing level increases output signal) and reverse (increasing level decreases output signal)

Supply Pressure Requirements

Throttling and On/Off Controller
Throttling: 1.4 bar for 0.2 to 1.0 bar output signal (20 psig for 3 to 15 psig output signal) and 2.4 bar for 0.4 to 2.0 bar output signal (35 psig for 6 to 30 psig output signal)
On/Off: Any desired pressure between 1.4 and 3.4 bar (20 and 50 psig).
Snap-Acting Controller: Any desired pressure between 1.4 and 5.2 bar (20 and 50 psig) direct, and 1.4 bar and 2.4 bar (20 and 35 psig) reverse

Do not use supply pressure below 1.4 bar (20 psig)

Steady-State Air Consumption(5)

Throttling Controller: ≤0.03 normal m^3/hr (1.0 scfh) at 1.4 bar (20 psig) supply pressure
Snap-Acting Controller: ≤0.03 normal m^3/hr (1.0 scfh) at 1.4 bar (20 psig) supply pressure or ≤0.04 normal m^3/hr (1.5 scfh) at 2.4 bar (35 psig) supply pressure in tripped condition; air consumption increases during trip

Standard Displacer Size

48 x 305 mm, 541 cm^3 (1-7/8 x 12 inches, 33 in^3)

Maximum Displacer Working Pressure(4)

258 bar (3750 psig)

Maximum Displacer Insertion Length

Standard lever arm length plus one 6-inch extension, horizontal or vertical

Sensor to Vessel Connection

51 mm (2-inch) screwed (NPT)

Maximum Sensor Working Pressure(4)

Consistent with Class 1500 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)

- Continued -

Table 1. Specifications (continued)

Operative Ambient Temperature Limits(1,4)

Controller: -29 to 71°C (-20 to 160°F)

Sensor Temperature Limits(1,4)

Displacer -29 to 79°C (-20 to 175°F**)**
O-Rings: -40 to 204°C (-40 to 400°F)

Hazardous Area Classification

Complies with the requirements of ATEX Group II Category 2 Gas and Dust

CE ⟨Ex⟩ II 2 G D

Standard Supply, and Output Pressure Gauge Indications

Triple scale gauges in 0 to 60 psig/0 to 0.4 MPa/0 to 4.0 bar

Controller Connections

Supply: 1/4 inch NPT female located on the bottom of the case
Output: 1/4 inch NPT female located on the top of the case
Case Vent: 1/4 inch NPT female with vent screen assembly located on the back of the case

1. This term is defined in ISA Standard S51.1.
2. Depends on float rod/displacer orientation and length. Contact your Fisher sales office for further information.
3. Minimum specific gravity differential with standard displacer is 0.4. Minimum specific gravity differential of 0.1 is possible with special displacer, consult your Fisher sales office for displacer sizing information.
4. The pressure and temperature limits in this document and any applicable code limitations should not be exceeded.
5. Normal m^3/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).

Description

The rugged Type *L2* liquid level controllers use a displacer type sensor (see figure 1) to detect liquid level or the interface of two liquids of different specific gravities.

These low-bleed controllers use a single four-mode relay to provide the applicable control and action. The device delivers a pneumatic output signal to a control valve.

Specifications

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

Educational Services

For information on available courses for Type *L2* Liquid Level Controllers, as well as a variety of other products, contact:

Emerson Process Management
Educational Services, Registration
P.O. Box 190; 301 S. 1st Ave.
Marshalltown, IA 50158-2823
Phone: 800-338-8158 or
Phone: 641-754-3771
FAX: 641-754-3431
e-mail: education@emersonprocess.com

Installation

WARNING

- **Always wear protective clothing 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.**

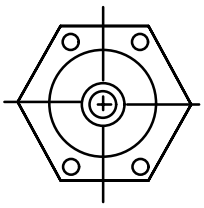
- **If installing this into an existing application, also refer to the WARNING at the beginning of the Maintenance section of this instruction manual.**

CAUTION

If the Type *L2* 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 tank that will interfere with displacer installation or operation.

2. Provide the appropriate connection in the tank wall to match the sensor connection. Locate the tank wall connection such that the displacer will be at the desired control level.



CORRECT CONTROLLER MOUNTING HOLE ORIENTATION WHEN MOUNTED ON VESSEL

A6639 / IL

Figure 2. Sensor Orientation

Attaching a Vertical Displacer

Refer to figure 7 for part locations.

1. Thread jam nut (key 68) 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 7 for part locations.

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

2. Tighten the jam nut (key 63) against the displacer (key 81).

Attaching the Sensor to the Vessel

Insert the displacer end of the controller-sensor assembly into the tank connection, and screw the sensor threads into the tank connection. Tighten sufficiently to seal the threads. If necessary, loosen or tighten slightly to obtain the orientation shown in figure 2. Make sure that the controller case is level.

CAUTION

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.

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 microns in diameter will suffice in most applications, check with a Fisher 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.

1. Provide a source of clean, dry air that meets the requirements of ISA Standard S7.3 as the operating medium. Refer to table 1 to determine supply pressure.

2. Connect the supply pressure to the 1/4-inch NPT female connection on the bottom of the controller case.

3. Connect the output signal line to the equipment being operated and to the 1/4-inch 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.

Changing Controller Action or Mode

WARNING

To avoid personal injury caused by a sudden release of pressure, shut off the supply pressure and bleed pressure from the supply lines before performing any procedure in this section.

Throttling and On/Off Controller

The action of a throttling and on/off controller may be changed between either direct or reverse, and the control mode may be changed between either on/off or throttling.

Refer to figure 3. Loosen the four switch retention screws on the relay. Move the switches to the control action and control mode required by the application. Tighten the four switch retention screws.

Snap-Acting Controller

The action of a snap-acting controller may be changed between either direct or reverse. The control mode is always snap acting.

Refer to figure 4. Loosen the four switch retention screws on the relay. Move the switches to the control action required by the application. Tighten the four switch retention screws.

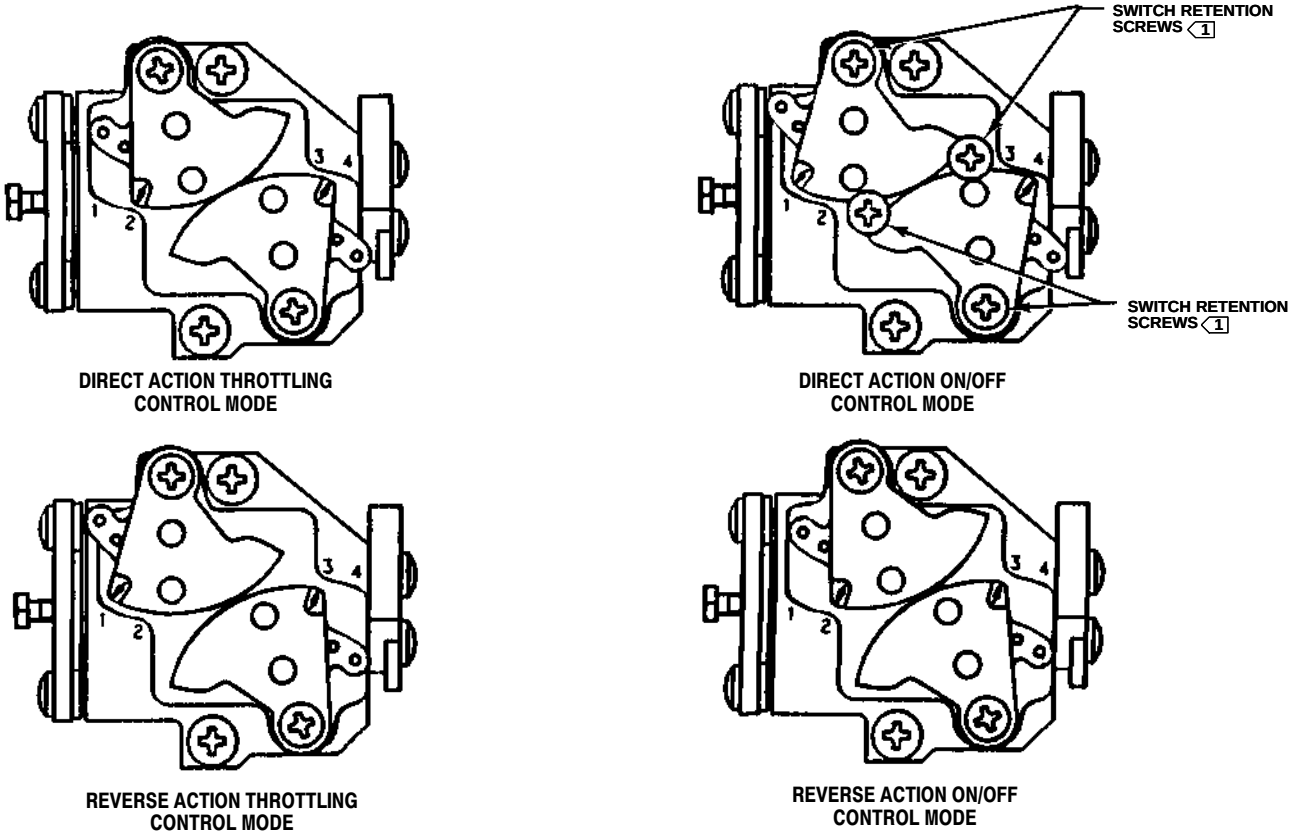


Figure 3. Type L2 Throttling and On/Off Controller Switch Positions for Changing Action and Control Mode

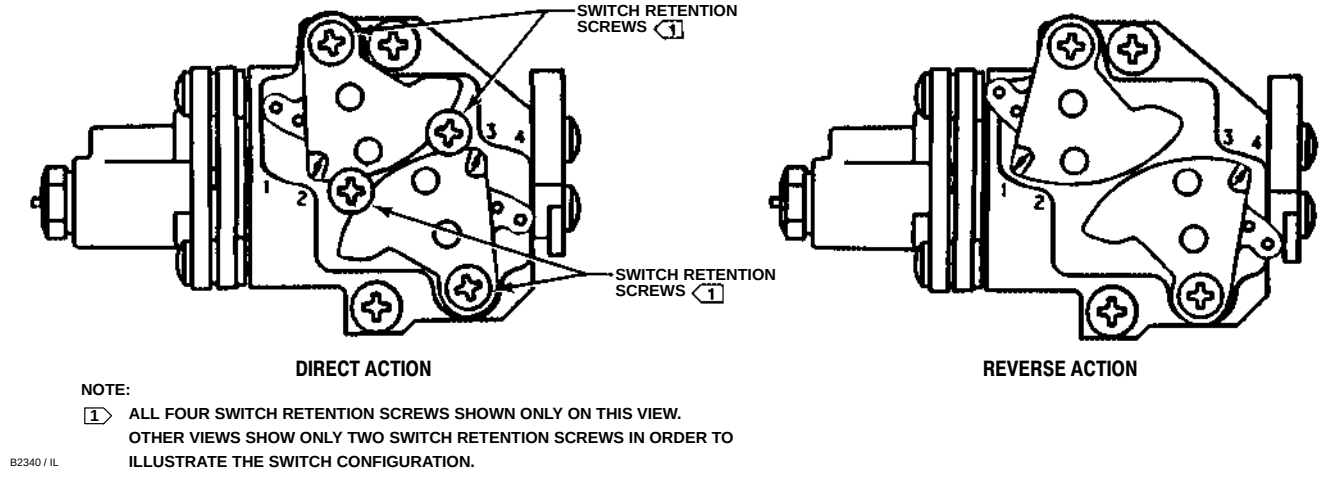


Figure 4. Type L2 Snap-Acting Controller Switch Positions for Changing Action

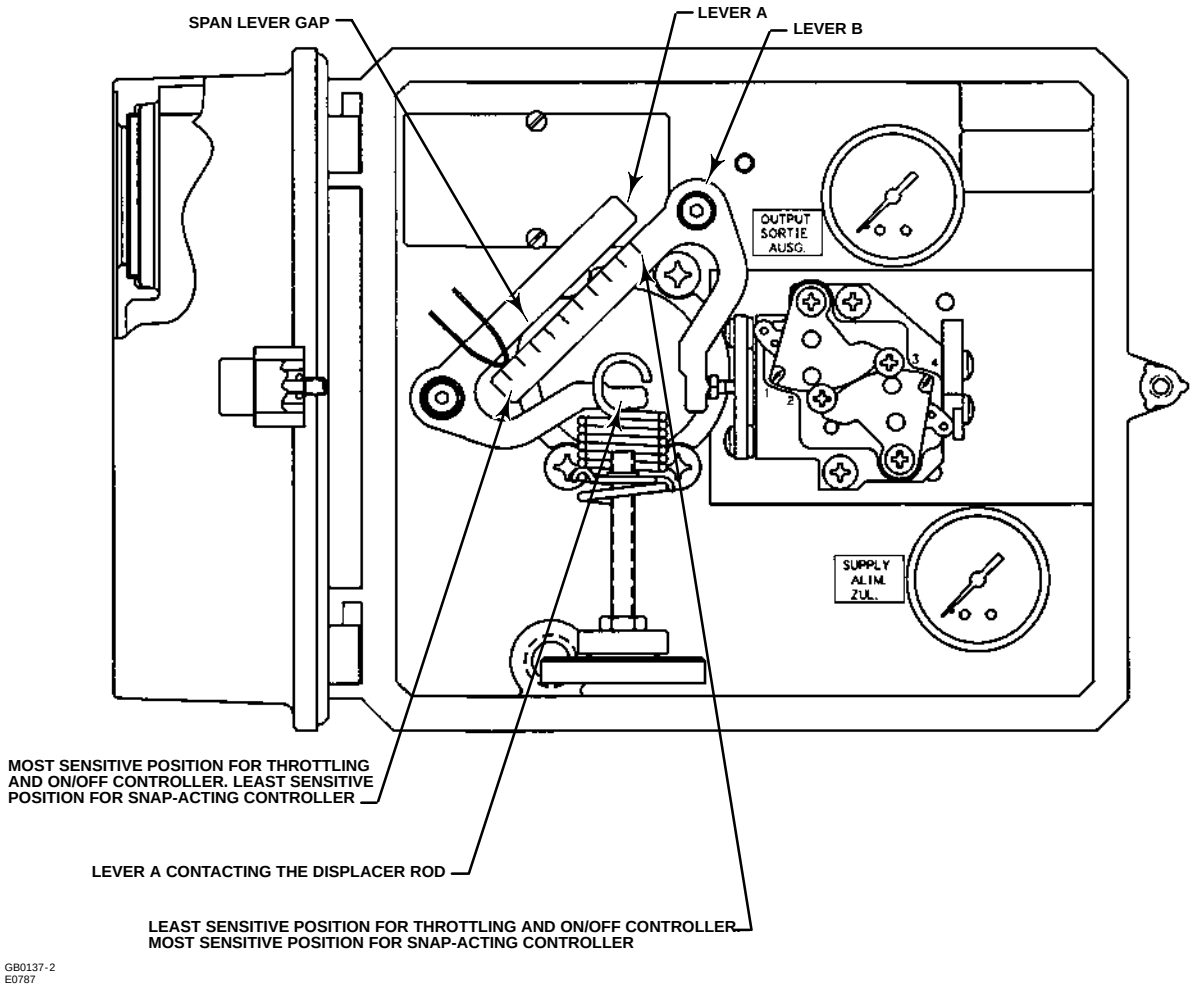


Figure 5. Proportional Band Adjustments

Proportional Band Adjustment

Except where indicated, key numbers referenced in the following procedures are shown in figure 8. The span levers and other proportional band information are shown in figure 5.

Preliminary Checks

1. Check the supply pressure gauge (key 10) to be certain that the supply pressure is at the desired value. Adjust the supply pressure as required.

2. Adjust the displacer rod to the horizontal position with the spring adjustment (key 4).

3. Bounce the end of the displacer rod (key 64, figure 7) up and down to check that the sensor is operating freely.

4. Place the span adjuster (key 9) at the desired position (see figure 5).

5. Check figures 3 and 4 for correct control action and control mode.

6. Adjust the relay adjustment screw (key 49, throttling controller) or the valve assembly (key 51, snap-acting controller) so that the gap between the span levers (see figure 5) is equal when lever A is contacting the displacer rod.

Direct-Acting Throttling Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.

2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the fluid with the lower specific gravity. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.

3. Adjust the spring adjustment (key 4) until the output pressure is 1 to 2 psig for a 3 to 15 psig output range, or 2 to 4 psig for a 6 to 30 psig output range.

Reverse-Acting Throttling Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.

2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the fluid with the lower specific gravity. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.

3. Adjust the spring adjustment (key 4) until the output is 16 to 17 psig for a 3 to 15 psig output range, or 31 to 34 psig for a 6 to 30 psig output range.

Direct-Acting On/Off and Snap-Acting Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.

2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the fluid with the lower specific gravity. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.

3. Adjust the spring adjustment (key 4) until the output pressure is at full supply pressure.

4. Readjust the spring adjustment (key 4) until the output pressure goes to zero psig.

Reverse-Acting On/Off and Snap-Acting Controllers

1. Make certain the Preliminary Checks procedure at the start of this section has been completed.

2. Lower the liquid level so that it is below the bottom of the displacer or at the lowest desired operating point on the displacer. For interface applications, completely cover the displacer with the fluid with the lower specific gravity. The heavier fluid should be below the bottom of the displacer or at the lowest desired operating point on the displacer.

3. Adjust the spring adjustment (key 4) until the output pressure goes to zero psig.

4. Readjust the spring adjustment (key 4) until the output pressure goes to full supply pressure.

Principle of Operation

The operation of Type *L2* controllers in combination with the 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 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 6 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 clockwise zero spring moment and the counterclockwise relay zero 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 valve and bringing the forces back into equilibrium.

For throttling control, the relay pressure output will be proportional to the buoyant force. For on/off control, the relay pressure output will be either zero or equal to the supply pressure over the range of liquid level change. The liquid level change required to fully operate the relay is adjusted by sliding the proportional band adjustment along lever A to vary the lever ratio between levers A and B.

With reverse-acting proportional control, the principle of operation remains the same as that for direct action; however, the controller delivers an increasing pneumatic signal to the control valve when the liquid level falls.

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.

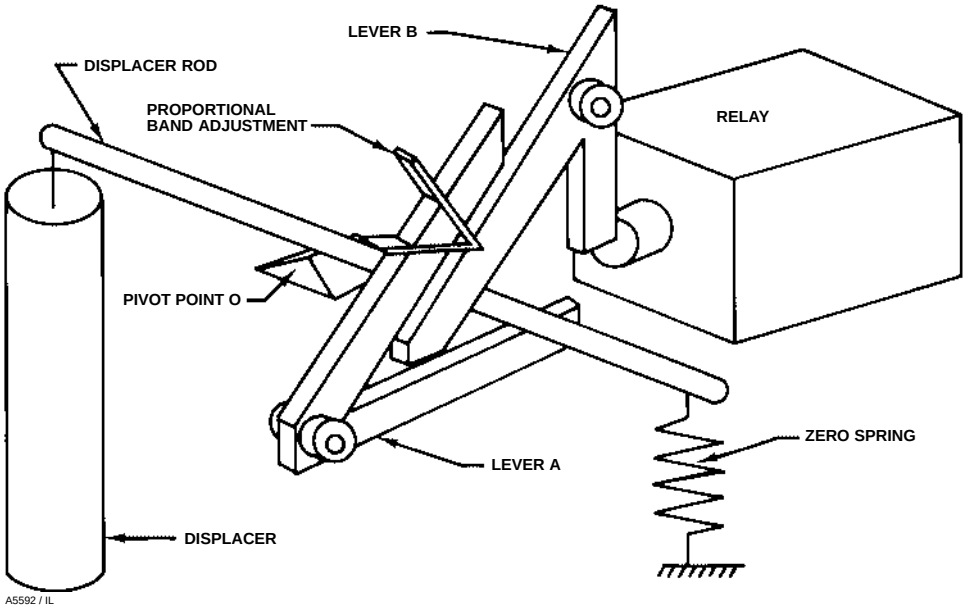


Figure 6. Operational Schematic

When inspection or repairs are required, disassemble only those parts necessary to accomplish the task.

WARNING

Always wear protective clothing 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.**

Removing the Controller From the Sensor

WARNING

Refer to the WARNING at the beginning of this section.

1. Disconnect the supply and output pressure lines.
2. Slide the hook end of the zero spring (key 5, figure 8) over and off the controller end of the displacer rod (key 64, figure 7).
3. Remove the four controller mounting screws (key 11, figure 8), and pull the controller straight away from the sensor.

Replacing the Sensor O-Rings

WARNING

Refer to the WARNING at the beginning of this section.

Refer to figure 7 for key number locations unless otherwise indicated.

Disassembly

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

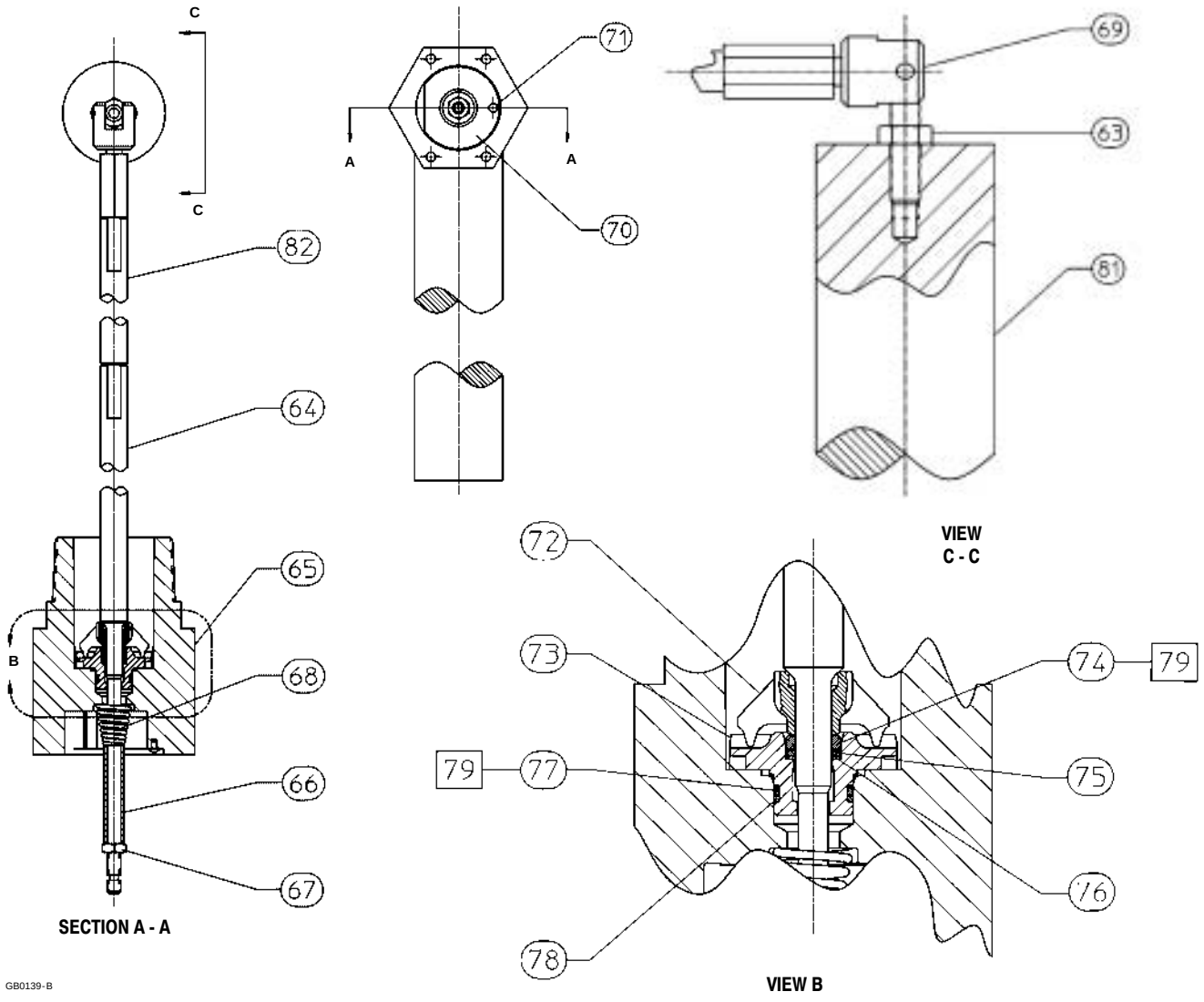


Figure 7. Sensor

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 7.

1. Place the pivot body (key 72) on the displacer rod (key 64) so that it is positioned as shown in figure 7.

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 7. 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 7.

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. 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 on the tank.

Replacing the Controller Relay

WARNING

Refer to the WARNING at the beginning of this section.

Refer to figure 8 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 away from the controller base (key 1).

3. Install the new relay using two relay mounting screws (key 33). Make certain that the relay mounting O-rings (keys 43 and 44, not shown) are completely in their mounting bosses before installing the relay. Make certain span lever B (see figure 5) is in line with and pushing in on the end of either the relay adjustment screw (key 49, throttling controller) or the pilot valve plug of the valve assembly (key 51, snap-acting controller).

Replacing the Controller Supply Filter

WARNING

Refer to the WARNING at the beginning of this section.

Refer to figure 8 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 old filter (key 15), and remove any debris from the filter boss.

4. Install a new supply filter. Reinstall the filter cap (key 14), and tighten the filter cap screws (key 17).

Parts Ordering

When corresponding with your Fisher 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 8). When ordering replacement parts, also specify the complete 11-character part number of each part required as found in the following parts list.

Note

Use only genuine Fisher replacement parts. Components that are not supplied by Fisher should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Fisher will void your warranty, might adversely affect the performance of the valve, and might jeopardize worker and workplace safety.

Note

Neither Emerson, Emerson Process Management, nor Fisher assume responsibility for the selection, use, or maintenance of any product. Responsibility for proper selection, use, and maintenance of any Fisher product remains solely with the purchaser.

Parts Kits

Key	Description	Part Number
	Controller	
	Repair kit includes O-rings (keys 13 and 16) and gaskets (keys 18, 21, and 23)	RL2CNTRX012
	Relay	
	Repair kits include relay assembly, relay mounting screws (key 33), and O-rings (keys 33, 43, and 44)	
	Throttling and On/Off Controller	GB0138X0012
	Snap-Acting Controller	GB0138X0022
	Sensor	
	Repair kit includes keys 74, 75, 77, and 78 (fluoroelastomer O-rings, anti-extrusion ring, and fluoroelastomer backup ring)	RL2SENSX012

Parts List

Note

For part numbers not shown, contact your Fisher sales office.

Controller

Key	Description	Part Number
1	Controller Base, marine grade aluminum	
2	Zero Spring Seat, 316 SST	
3	Zero Adjustment Bolt, stainless steel	
4	Spring Adjustment, 316 SST	
5	Zero Spring, 17-7PH SST	
6	Span Lever Assembly, stainless steel	
7	Shoulder Screw, stainless steel (2 req'd)	
8	Flanged Bearing, nylon (4 req'd)	
9	Span Adjustor, stainless steel	
10	Pressure Gauge (2 req'd)	
11	Mounting Screw, stainless steel (4 req'd)	
12	Cover Screw, stainless steel	
13*	O-Ring, nitrile	
14	Filter Cap, reinforced plexiglass	
15	Filter	11B2307X012
16*	O-Ring, nitrile	
17	Machine Screw, stainless steel (2 req'd)	
18*	Sensor Gasket, composition	
19	Cover, marine grade aluminum	
20	Cover Lens, plexiglass (2 req'd)	
21*	Gasket, neoprene (2 req'd)	
22	Retaining Ring, steel (2 req'd)	
23*	Cover Gasket, nitrile	
33	Relay Mounting Screw, stainless steel (2 req'd)	
43*	Relay Mounting O-Ring, nitrile (not shown)	
44*	Relay Mounting O-Ring, nitrile (not shown)	
49	Relay Adjustment Screw	
51	Valve Assembly	
52	Valve Assembly O-Ring	
53	Label, setup and calibration	
54	Self-Tapping Screw, stainless steel (2 req'd)	
55	Nameplate	
56	Screen, stainless steel	
57	Hex Nut, stainless steel	
60	Sealant Zinc-plate No. 770 (not furnished with controller)	
61	Lubricant, Dow Corning 111 (not furnished with controller)	
62	Sealant, Loctite No. 222 (not furnished with controller)	
84	Adhesive, Loctite 416	

*Recommended spare parts

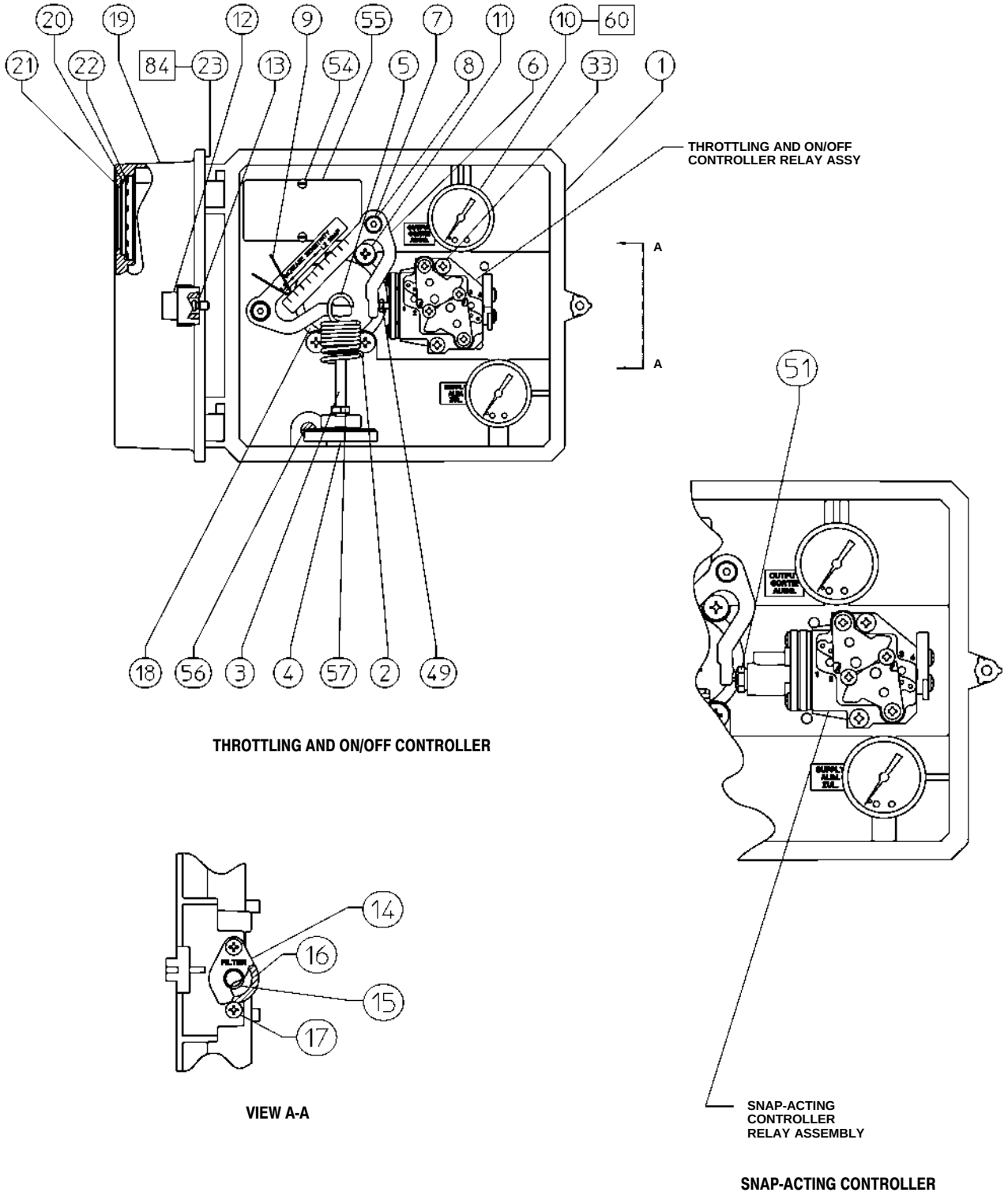


Figure 8. Type L2 Liquid Level Controllers

Sensor

Key	Description	Part Number
81	Displacer, PVC 1-7/8x12-inches	12B2936X032
63	Hex Nut, 316 SST	
64	Displacer Rod, 17-4 SST (17-4PH SST)	
65	Sensor Connection	
66	Spacer, 304 SST (304 SST)	
67	Hex Nut, 316 SST	
68	Conical Spring, 316 SST	
69	Universal Joint, 316 SST (vert displ only)	
70	Nameplate	
71	Drive Screw, stainless steel	
72	Pivot Body, CB7CU-1 (17-4PH SST)	
73	Pivot Base, CF8M (316 SST)	
74*	O-Ring, fluoroelastomer	
75*	Anti-Extrusion Ring, PTFE	
76	Retaining Ring, 304 SST	
77*	O-Ring, fluoroelastomer	
78*	Backup Ring, fluoroelastomer	
79	Lubricant, Lubriplate Mag-1 (not furnished with sensor)	
80	Instruction Tag	
82	Extension, S31600	12B2953X022

*Recommended spare parts

L2 Controllers

Instruction Manual
Form 5732
April 2005

Emerson Process Management

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