Instruction Manual
D104782X012
May 2024

Fisher™ FIELDVUE™ L2t

Liquid Level Controller

This manual applies to

Device Type	0x1314
Device Revision	1
Firmware Revision	3
DD Revision	1

FISHER™

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Table of Contents

Section 1: Introduction

1.1 Scope of the Manual

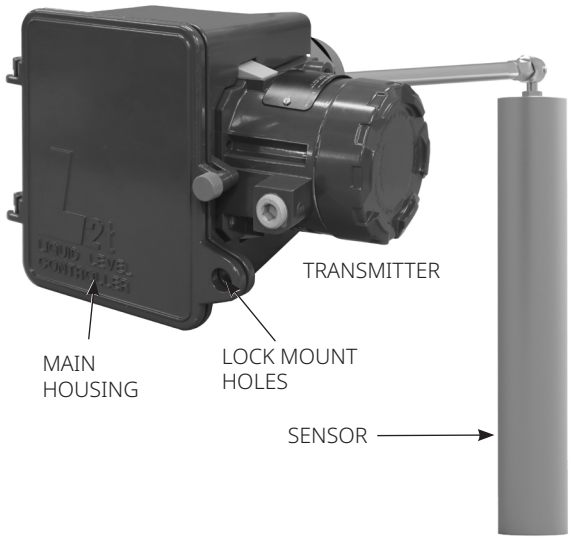
This instruction manual includes specifications, installation, basic setup and configuration and maintenance and troubleshooting information for the Fisher™ FIELDVUE™ L2t liquid level controller.

This manual describes using the local interface or an Emerson handheld communicator, such as the AMS Trex Device Communicator, to setup and calibrate the instrument.

⚠ WARNING

Do not install, operate or maintain a FIELDVUE L2t 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 of 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. FIELDVUE L2t Liquid Level Controller



X1988

Scan or click code for Installation Documents and Field Support.

1.2 Description

The FIELDVUE L2t liquid level controller comes as a package that includes sensor, main housing and transmitter. The package is pre-calibrated and can be mounted onto a vessel using the 2 NPT connection.

The rugged L2t liquid level controller use a displacer type sensor (see Figure 1) to detect liquid or the interface of two liquids of different specific gravities.

These controllers use an electrical 4 to 20 mA signal to provide applicable control and action. The device delivers an electrical signal to a control/dump valve.

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

1.3 Specifications

Specifications for the L2t are shown in Table 1 and 2.

⚠ WARNING

This product is intended for a specific current range, temperature range and other application specifications. Applying different current, temperature and other service conditions may result in personal injury, property damage or malfunction of the product.

1.4 Educational Services

Emerson Educational Services
Phone: +1-800-338-8158
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emerson.com/mytraining

Table 1. Specifications - Housing and Sensor

Available Configuration	Maximum Displacer Insertion Length[4]
Sensor: Displacer-type liquid level sensor for mounting to side of tank. Displacer travel is transmitted to controller by pivotal movement of displacer rod.	Standard lever arm length plus one 6-in. extension, horizontal or vertical
Input Signal	**Displacer Material and Maximum Sensor Working Pressure[5]**
Type: Liquid level or liquid-to-liquid interface Level change required for full change in output signal in a 1.0 specific gravity liquid with either vertical displacer with standard lever arm length Default: 71 mm / 2.8 in., user configurable if other range desired Minimum Span Level Change 102 mm / 4 in.[1] Maximum Span Level Change 305 mm / 12 in.[1]	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 S31603 SST Displacer: CL600 pressure temperature ratings per ASME B16.34 up to maximum pressure of 99.3 bar / 1440 psig Note: For slip-on flange connection, maximum sensor working pressure must be consistent with the flange ratings
Minimum Specific Gravity[2]	**Displacer Material and Sensor Temperature Limits[5]**
0.4	PVC Displacer: -18 to 71 °C / 0 to 160 °F S31603 SST Displacer: -40 to 204 °C / -40 to 400 °F
Output Signal	**Operating Ambient Temperature Limits[5]**
4 to 20 mA and two discrete switches Reverse acting via configuration or calibration	-29 to 71 °C / -20 to 160 °F
Sensor to Vessel Connection	**Declaration of SEP**
■ 2 NPT threaded or ■ NPS 2 CL150 through 1500 slip-on flange connection[3]	Fisher Controls International LLC declares this product to be in compliance with Article 4 paragraph 3 of the PED Directive 2014/68/EU and Part 1, Requirement 8 of the PESR Regulation. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance or the UKCA mark related to the PESR Regulation. However, the product *may* bear the CE or UKCA marking to indicate compliance with other applicable European Community Directives or UK Regulations (Statutory Instruments).
Controller Connection	
Case Vent: 1/4 NPT internal with vent screen assembly located on the back of the case	
Displacer Size	
■ 48 x 305 mm, 541 cm^3 / 1-7/8 x 12 in., 33 $in.^3$ (Standard) or ■ 70 x 203 mm, 778 cm^3 / 2-3/4 x 8 in., 47.5 $in.^3$ (Optional)	

NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.

1. Any deviation from the standard construction described in the input signal specification above requires special displacer sizing considerations. Contact your Emerson sales office for information.
2. Minimum specific gravity values apply to both horizontal and vertical displacers with standard lever arm length .
3. 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 Emerson.com or from your Emerson sales office.
4. Standard lever arm length.
5. The temperature limits in this document and any applicable code limitations should not be exceeded.

Table 2. Specifications - Transmitter

Input Signal Source	Reference Accuracy
Hall Effect Sensor and magnet array	± 1% of output span. Includes combined effects of hysteresis, linearity and deadband Limit Switch: 2% of travel span
Transmitter Output Signal	**Sensor Refresh Rate**
Analog 4 to 20 mA DC High saturation: 20.5 mA Low saturation: 3.8 mA High alarm(1): > 21.0 mA Low Alarm(1): < 3.6 mA **Digital** HART 1200 Baud Frequency Shift Keyed (FSK) HART Version 7 HART impedance requirements must be met to enable communication. Total shunt impedance across the master device connections (excluding the master and transmitter impedance) must be between 230 and 600 ohms. HART receive impedance: Rx: 28.06k ohms Cx: 5.84 nF **Output Current Limit** 30 mA DC maximum	100 ms / 10 Hz
	Repeatability
	± 0.25% of span
	Electromagnetic Compatibility
	Meets EN61326-1:2013 Performance is shown in Table 3 and EN61326-3-2:2008 Performance is shown in Table 4
	General Electrical Safety - Environmental Conditions
	Use: Indoor and Outdoor Altitude: up to 2000 m Relative Humidity: 9.2 - 90% Supply Voltage Fluctuations: N/A, not connected to Mains Transient Overvoltage: Category I Pollution Degree: 4 Wet Locations: Yes
Recommended Power Supply	**Hazardous Area Approvals**
24 to 30 V DC; 25 mA Instrument has reverse polarity protection. A minimum compliance voltage of 17.75 V DC (due to HART impedance requirement) is required to guarantee HART communication	cCSAus - Flameproof (Ex d), Explosion-proof, Class I Div. 1, Class I Div. 2, Dust Ignition-proof (Canada and United States) ATEX - Flameproof IECEx - Flameproof
Integral Limit Switch	**Hazardous Area Approvals - PENDING**
Two isolated solid state limit switches, configurable throughout the calibrated travel range or actuated from a device alert Off State: 0 mA (nominal) On State: up to 1 A Supply Voltage: 8 to 30 V DC	cCSAus - Intrinsically Safe ATEX - Intrinsically Safe, Type n, Dust by intrinsic safety or by enclosure IECEx - Intrinsically Safe, Type n, Dust by intrinsic safety or by enclosure
Travel Limit Trip Points	**Electrical Housing**
Two	cCSAus - Type 4X, IP66 ATEX - IP66 IECEx - IP66

NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.

1. Only one high/low alarm available in a given configuration alarms are NAMUR NE43 compliant.

Table 3. EMC Summary Results—Immunity per EN61326-1

Port	Phenomenon	Basic Standard	Test Level	Test Results[1][2]
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz at 10 V/m with 1 kHz AM at 80% 1400 to 6000 MHz at 3 V/m with 1 kHz AM at 80%	A
	Radiated power frequency magnetic field	IEC 61000-4-8	30 A/m at 50 and 60 Hz	A
I/O signal/ control	Burst	IEC 61000-4-4	1 kV	A
	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	A
Protective earth	Burst	IEC 61000-4-4	2 kV	A
	Surge	IEC 61000-4-5	2 kV (line to ground only)	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	A

1. A = No degradation during testing.
   B = Temporary degradation during testing, but is self-recovering.
   Specification Limit = +/- 1% of span.
2. HART communication was considered as "not relevant to the process" and is used primarily for configuration, calibration and diagnostic purposes.

Table 4. EMC Summary Results—Immunity per EN61326-3-2

Port	Phenomenon	Basic Standard	Test Level	Test Results[1][2]
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	6 kV contact 8 kV air	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz at 10 V/m with 1 kHz AM at 80% 1400 to 2000 MHz at 10 V/m with 1 kHz AM at 80% 2000 to 2700 MHz at 3 V/m with 1 kHz AM at 80%	A
	Radiated power frequency magnetic field	IEC 61000-4-8	100 A/m at 50 and 60 Hz	A
I/O signal/ control	Burst	IEC 61000-4-4	1 kV	A
	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	FS
	Conducted RF	IEC 61000-4-6	10 kHz to 80 MHz at 3 Vrms	A
Protective earth	Burst	IEC 61000-4-4	2 kV	A
	Surge	IEC 61000-4-5	1 kV (line to ground only)	A
	Conducted RF	IEC 61000-4-6	10 kHz to 80 MHz at 10 Vrms	A

1. A = No degradation during testing.
   B = Temporary degradation during testing, but is self-recovering.
   FS = Fail Safe.
   Specification Limit = +/- 1% of span.
2. HART communication was considered as "not relevant to the process" and is used primarily for configuration, calibration and diagnostic purposes.

Section 2: Security

NOTICE

Physical security is an important part of any security program and is fundamental to protecting your system. Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users equipment. This could be intentional or unintentional and must be protected against by restricting access of unauthorized personnel in your facility.

- The L2t controller cover can be padlocked to the controller base, using the lock mount holes, to protect against zero adjustment changes, see Figure 1.
- The L2t has several features to help protect against unintentional configuration changes:
  - System stores configuration and log data
  - Signed Firmware
  - Configuration lock switch
  - Cannot be connected directly to a network and cannot access the worldwide internet
- If unsecured, any device in the field is vulnerable to a physical attack; safety and security procedures must include mitigation by physical security controls.
- The following are unsecured, unencrypted inputs and outputs used by the L2t controller:
  - AO - position feedback
  - DO - two solid state position limit switches
  - HART - used for digital communication
  - Zero pushbutton, Span pushbutton and LED indicator – used for local calibration
- The configuration lock switch, located under the terminal cover, will prohibit configuration and calibration changes over all interfaces. Refer to the Calibration section (page 13) for additional information on the lock switch.
- The L2t has optional applications for configuration and data viewing. When such applications are used, they must run on devices that are configured according to local security policies.
- The device has been developed using secure coding principals and procedures, including threat modeling and security specific testing. It has several interfaces for configuration, with each of them having an option to disable write options.
- There are multiple ways to configure the device, including:
  - The Zero pushbutton and the Span pushbutton, located under the cover.
  - The FDI (Field Device Integration) or DD (Device Description) used with asset manager software such as AMS Device Manager or a handheld communicator such as Emerson Trex.

- Product Operation Best Practices:
  - Ensure that operation personnel are trained both on local security policies and the secure operation of the L2t.
  - It is recommended that you set the configuration lock switch in the enabled position after configuration is complete.
  - Operate the device within a controlled and secured physical environment.
  - Operate the L2t and the FDI/DD host within a controlled and secured network environment.
  - Configure the FDI/DD host to allow users to have least privilege access to the L2t, providing access to only what is absolutely required to perform their job function.
  - Apply security patches and updates as they are released.

NOTE

Work with your Emerson sales office to stay informed and obtain access to security patches and updates.

- Report security incidents and potential product vulnerabilities at: https://go.emersonautomation.com/reportvulnerability_en
- Password Management Best Practices:
  - Manage FDI/DD host user passwords per local security policy.
- Product Disposal

When the device needs to be disposed of, consider the following aspects of device removal:

Identify whether the device can be reused in another part of the process or for testing or training purposes.

Identify what data is stored on the device and sanitize this data with the latest industry recommended methods. To restore the device back to factory defaults:

1. Set *Restore Configuration Defaults on Power Cycle* to *Reset Configuration*.
2. Save the variable setting by hitting Send.
3. Select *Reset Device*.
4. If using an FDI/DD host wait approximately 30 seconds for logs, variables, cycle counter and configuration change alert to update. The LED indicator, located under the cover, will turn off during the reset and come back on green when the reset is complete.

If the device will not be reused, follow local disposal policy.

Section 3: 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.

3.1 Attaching a Vertical Displacer

Refer to Figure 2 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.

3.2 Attaching a Horizontal Displacer

Refer to Figure 2for part locations.

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

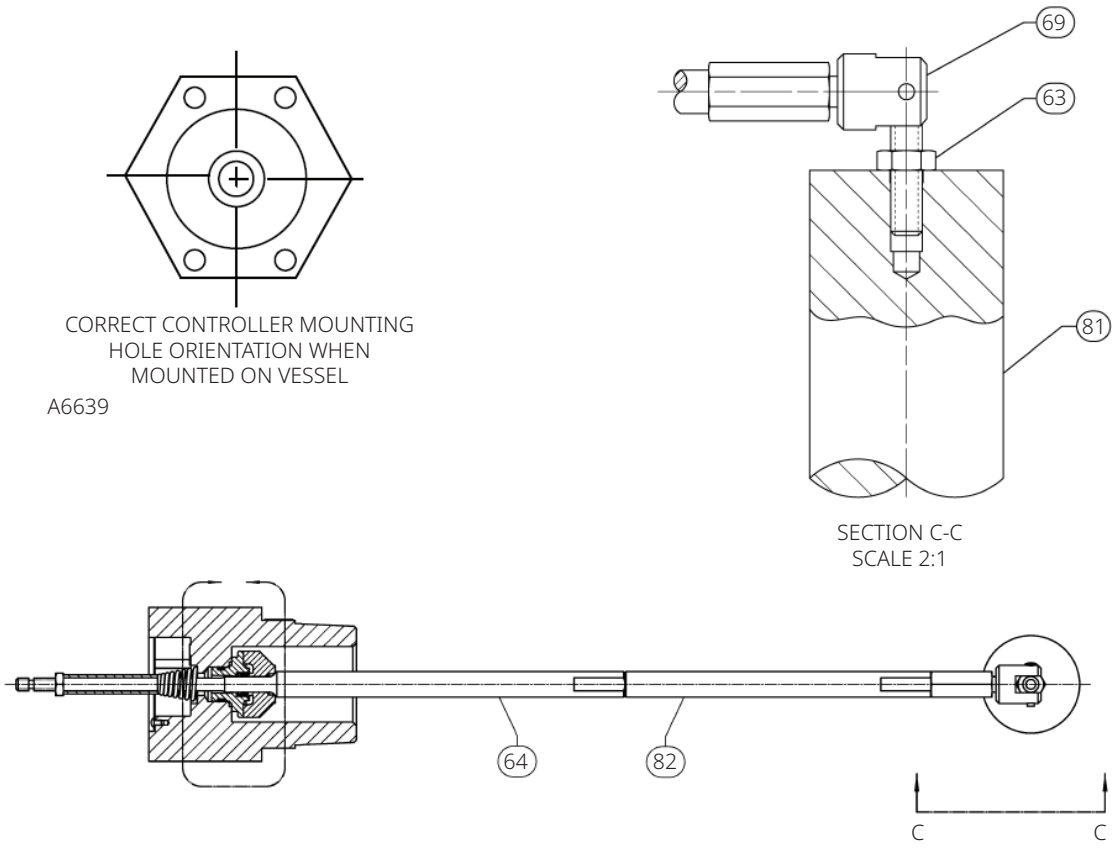
3.3 Attaching the Sensor to the Vessel

Insert the displacer end of the L2t 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 and Parts



3.4 Electrical Connections

⚠ WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated 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.

To avoid personal injury resulting from electrical shock, do not exceed maximum input voltage specified on the product nameplate. If the input voltage specified differs, do not exceed the lowest specified maximum input voltage.

Personal injury or property damage caused by fire or explosion may occur if electrical connections are attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cover before proceeding.

1. Remove the terminal box cover.
2. Route the field wiring into the terminal box through the conduit connection, see Figure 3.

NOTE

Install conduit using local and national electrical codes relevant to the connection.

3. Connect the control system input channel positive wire to the LOOP + terminal (see Figure 4 for wiring diagram.)
4. Connect the control system input channel negative wire to the LOOP - terminal (see Figure 4).
5. Install a 250 ohm resistor to provide correct impedance for HART communication on the LOOP - terminal.
6. Replace and hand tighten the cover on the terminal box.

Figure 3. Transmitter without Cover

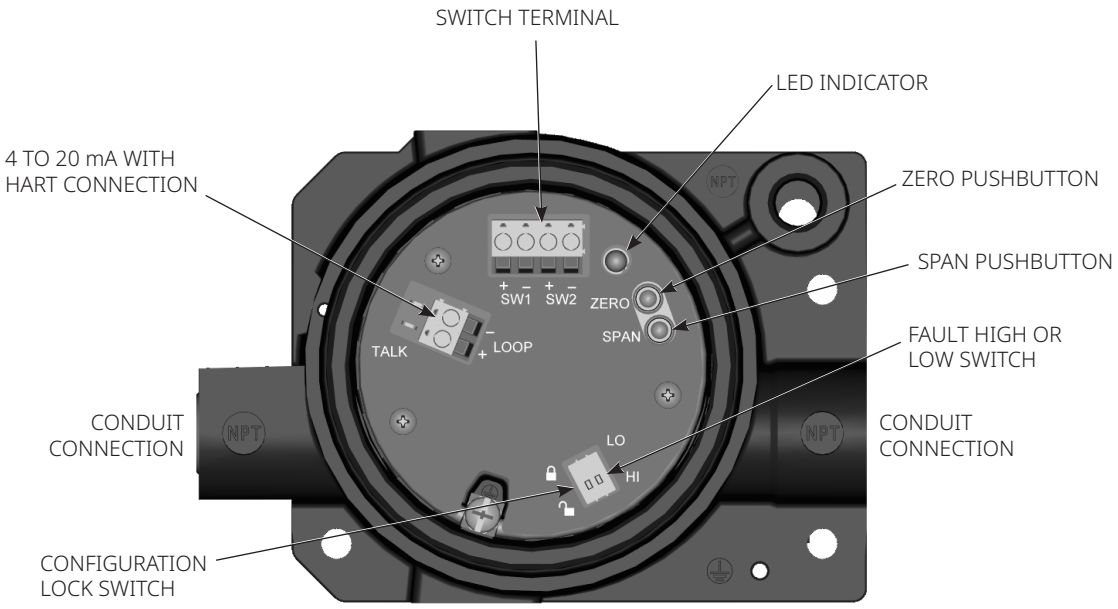
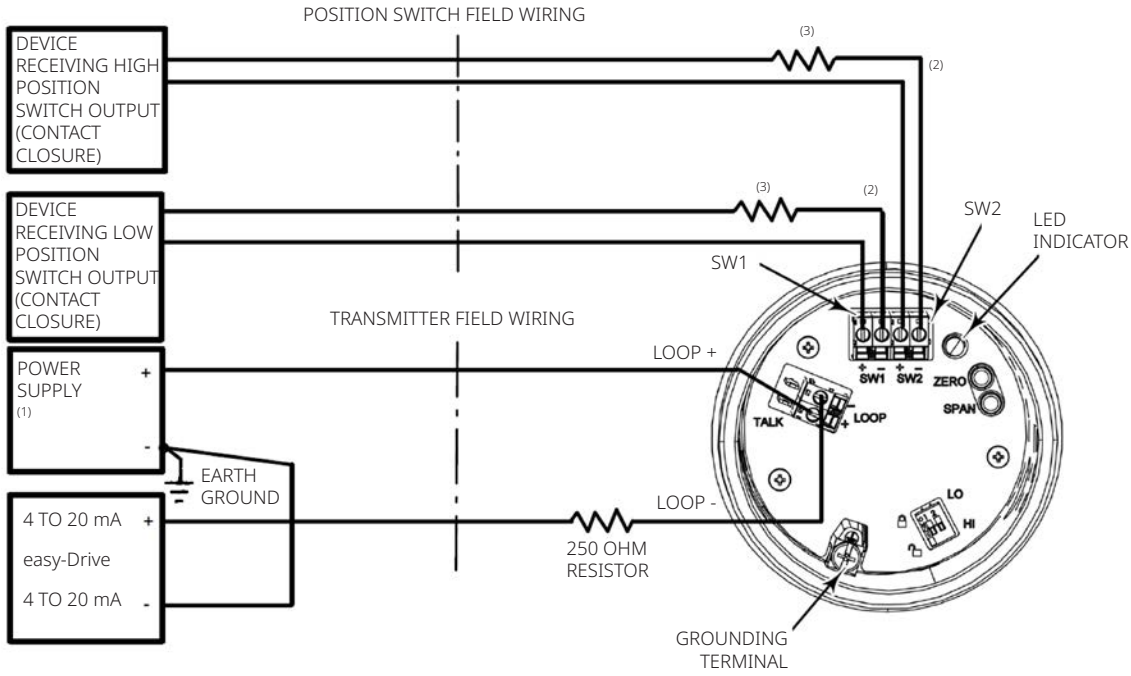


Figure 4. Wiring Diagram with easy-Drive Actuator



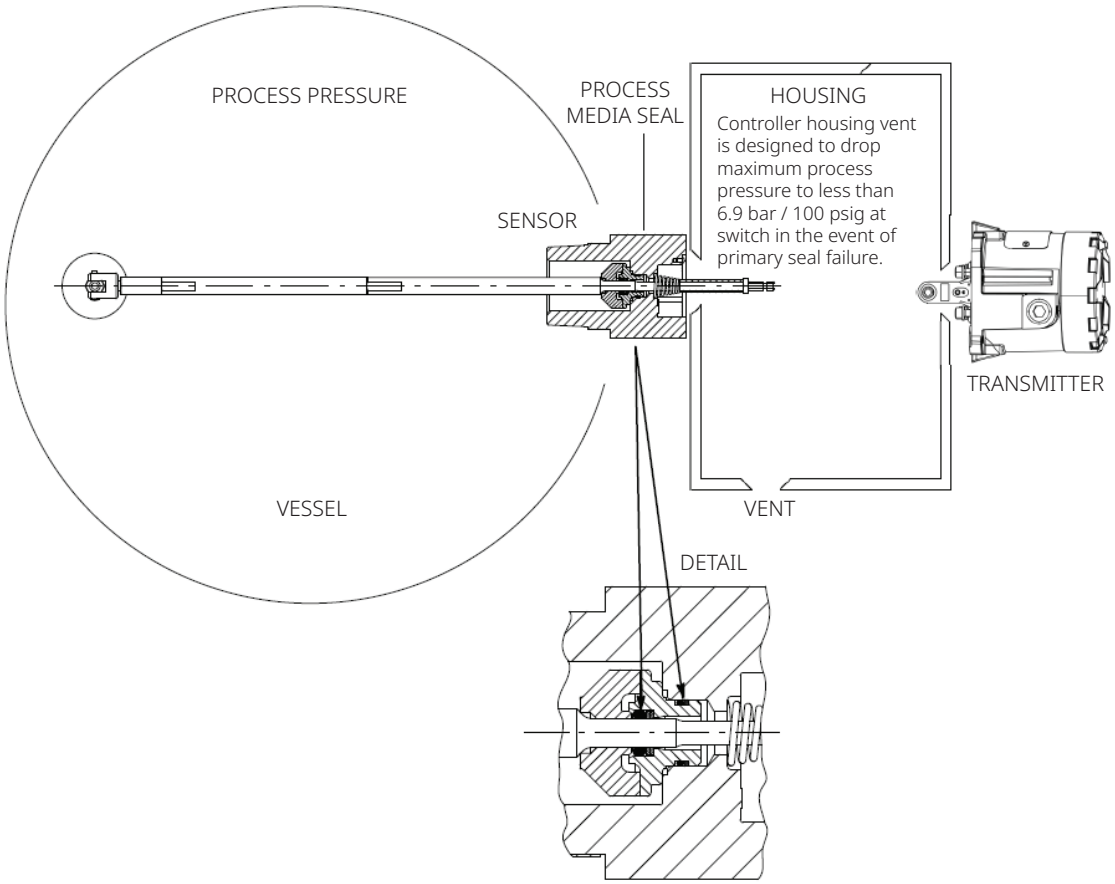
NOTES:

1. RECEIVING DEVICE MAY BE ANALOG CURRENT INPUT TO DISTRIBUTED CONTROL SYSTEM, PROGRAMMABLE LOGIC CONTROLLER OR INDICATING DEVICE. INDICATING DEVICE CAN BE A VOLTMETER ACROSS A 250 OHM RESISTOR OR A CURRENT METER.
2. CONFIGURABLE SWITCH. DEFAULT SETTING: DURING NORMAL OPERATIONS, SW1 AND SW2 ARE ENERGIZED. SW1 AND SW2 ARE USER CONFIGURABLE AS TO WHETHER THEY ARE NORMALLY OPEN (NO) OR NORMALLY CLOSED (NC). AS SHIPPED FOR BOTH SWITCHES IS DEFINED AS NORMALLY OPEN, DISABLED. A TRIPPED (OR ALARM) CONDITION IS WITH THE SWITCH(ES) DE-ENERGIZED, WHICH CONNECTS THE COMMON (C) TERMINAL TO THE NORMALLY CLOSED (NC) TERMINAL.
   * WHEN THE SWITCH IS DEFINED AS NORMALLY OPEN, THE SWITCH WILL ALLOW THE CURRENT TO FLOW THROUGH ONCE IT IS ACTUATED (HIGH OR LOW LIMIT BEING TRUE). IN ZERO POWER STATE, NO CURRENT WILL FLOW THROUGH THE SWITCH.
   * WHEN THE SWITCH IS DEFINED AS NORMALLY CLOSED, THE SWITCH WILL NORMALLY ALLOW CURRENT FLOW. THE SWITCH WILL STOP THE CURRENT ONCE IT IS ACTUATED (HIGH OR LOW LIMIT BEING TRUE). IN ZERO POWER STATE, NO CURRENT WILL FLOW THROUGH THE SWITCH.
3. RESISTOR REQUIREMENTS: NOMINAL 1K OHM RECOMMENDED.

Seal Certification

The L2t transmitter is not dual-seal certified. However, the enclosure is not exposed to process pressure during normal operation, and is vented, as shown in Figure 5. The process seal is contained in the separate mechanical sensor which can be separated from the L2t housing without disturbing the process connection. A process seal failure will result in process fluids being exhausted through the L2t housing vent, with an accompanying decrease in enclosure pressure from the operating process pressure. Thus, annunciation of a process seal failure is provided. The transmitter component, which is separately sealed from the L2t main enclosure volume, is never exposed to full process pressure even in the event of process seal failure.

Figure 5. Schematic



Section 4: Calibration

The L2t is pre-calibrated when ordered from the factory; recalibration is generally unnecessary. However, if calibration is required for any reason, refer to the following calibration procedure.

NOTICE

When accessing the pushbuttons or terminals, proper means of electrostatic discharge protection is required. Failure to provide appropriate protection can cause the device to malfunction.

The primary function of the local user interface is for calibration. However, the LED on the local user interface can provide information for checking the status of the device, as well as connected equipment or valve, as follows:

Green - Normal, no issues

Green blink - Indicates an alert is active

Red solid Failure - replace device, solid red during calibration for 2 seconds only

Red blink Function Check, calibration error, Calibration in Progress and/or Out of Service.

NOTE

The cover must be removed for the LED on the local user interface to be visible, as well as to access the zero and span buttons.

Ensure the LED is solid green prior to calibrating the instrument. If the LED is not solid green, check the magnet assembly position and adjust as needed to change to solid green. If performing the calibration procedure after a failed calibration, the LED will be blinking red. Cycle instrument power before attempting another calibration.

NOTE

The level must move from empty to full (or 100), or vice versa, in order for the level transmitter to be calibrated. The Zero and Span buttons and LED (shown in Figure 3) are used during calibration. Press both for 3 to 8 seconds until the LED flashes red, see Calibration section. Attempting to calibrate the device without moving the process will result in the action being discarded; the operation of the device will be unchanged. The calibration function of the local user interface can be locked out from the HART master for security purposes.

NOTE

In order to perform calibration and/or configuration procedures, the configuration lock switch (shown in Figure 3) must be in the unprotected position (🔓) and the instrument must be In Service.

Once calibration and configuration is complete, set the configuration lock switch to the protected position (🔒) to prevent configuration and calibration changes to the instrument.

4.1 Calibration Using the LUI

1. Verify the level is at the point you want the dump valve to be fully closed.
2. Press both zero and span buttons for 3 to 8 seconds, then release. The LED will blink red after the buttons are released.
3. Press and release the zero button. The red LED will remain solid for 2 seconds then resume blinking.
4. Move the level to the point where you want the dump valve to be fully open.
5. Press and release the span button. The red LED will remain solid for 2 seconds then resume blinking.
6. Calibration is complete when the LED turns solid green.

NOTE

The LED will blink red if calibration is not successful.

A too narrow or too wide span may cause calibration to fail. Restart the calibration procedure and adjust the fully closed and/or fully open points.

NOTE

The limit switches do not require an independent calibration; they are calibrated as part of the Zero and Span calibration.

4.2 Calibration using an Emerson Handheld Communicator

1. Install the latest version of the communication software on the user interface tool.

NOTE

This may include an FDI package or DD. Contact your Emerson sales office to ensure you have the latest software version, or for information on locating the necessary files.

NOTE

The TALK terminals are located under the transmitter cover.

2. Connect to device using TREX or other handheld communicator.
3. Open the device and go to Process Variables to take out of service.
4. Once out of service, go to Configure > Guided setup.
5. Start calibration and follow instructions to move to and select the Zero position. The red LED will remain solid for 2 seconds then resume blinking.
   You will then be instructed to set the Zero again or press next to set span.
6. Move the actuator or other device to the other end of travel and select span. The red LED will remain solid for 2 seconds. The handheld will ask to set again or continue.
7. Follow the prompts to fill in Calibration details.
8. Calibration is complete when the LED turns solid green.
9. Return the instrument to In Service.

4.3 Zero Adjustment

If the entire control band needs to be adjusted, for example, to work in a sight glass range, refer to the following procedure.

1. Loosen the Zero Adjustment hex nut (key 5) (shown in Figure 12).
2 Move the Zero Adjustment as needed to attain the desired range.
3. Tighten the Zero Adjustment hex nut (key 5) to lock the Zero setting.

Section 5: Configuration

NOTE

An Emerson handheld communicator can provide access to configuration and setup information, as well as various service tools.

NOTE

Trip Recovery Mode should be set to Auto. If set to Manual and the device trips on sensor out of range it will lock and remain locked until reset via DD or cycle power.

Smart Instruments are considered universal; they can be used with any final control element from any manufacturer. The default factory configuration of universal instruments may not fit or suit the application, therefore the ability to change or alter the device configuration is necessary. This section describes the transmitters advanced features and parameters that can be accessed with a handheld communicator. See Figure 6, 7, 8, and 9 for the menu structure.

NOTE

Various menu items/parameters within the menu structure are defined alphabetically on the following pages.

Calibrate Time Delay
The transmitter captures the first end point and stores it indefinitely until the second end point is captured. This is used to provide baseline time for open/closed diagnostics/alerts.

Close State Dwell Time is the length of time, in seconds, the position remained in the closed state.

Cycle Counter
The capability of the instrument to record the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it can be counted as a cycle.

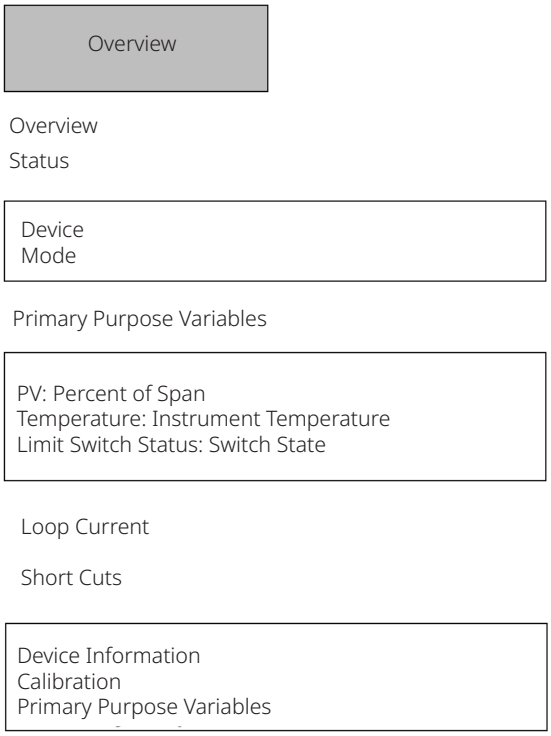
Deadband (Limit Switch): The difference between the trip and reset points of a relay, set in percent (%).

Descriptor
Enter a descriptor for the application with up to 16 characters. The descriptor provides a longer user-defined electronic label to assist with more specific instrument identification than is available with the Tag.

Device includes important information regarding the connected instrument such as device type, firmware and hardware revisions, functional options and the HART ID identifier.

Dynamic Variables:
Input Voltage, Instrument Temperature, Cycle Counter, Switch One State, Switch Two State, Last Time Closed, Last Time Open, Closed State Dwell Time, Open State Dwell Time, Percent of Span, Travel Accumulator

Figure 6. Overview



Instrument Date
Allows you to set the date on the instrument clock for use in stamping logged events. The order of year, month and day depends on the setting of the operating system. For example, enter the date in the form MM/DD/YYYY, where MM is two digits for the month (1 through 12), DD is two digits for the day (1 through 31) and YYYY is four digits for the year (1980 through 2040).

Instrument Time
Allows you to set the time. The instrument clock uses a 24-hour format. Enter the time in the form HH:MM:SS, where HH is two digits for the hour (00 to 23), MM is two digits for the minutes (00 to 59) and SS is two digits for the seconds (00 through 59).

When alerts are stored in the alert record, the date and time (obtained from the instrument clock) that they were stored is also stored in the record.

Instrument Serial Number
Enter the serial number on the instrument nameplate, up to 12 characters.

Limit Switch One/Limit Switch Two
Set the Normal Position (Open or Close), Action (Disable, Trip Above or Trip Below), the Trigger Point (equipment position desired for the switch to change state) and the Deadband (percent [%] of ranged travel around the trigger point, where the switch will not change state; default is 1%).

If the transmitter experiences a power interruption, the switch will go to the open state. Upon loss of power, the switches will default to the open state. Default is normally open.

Figure 7. Configure

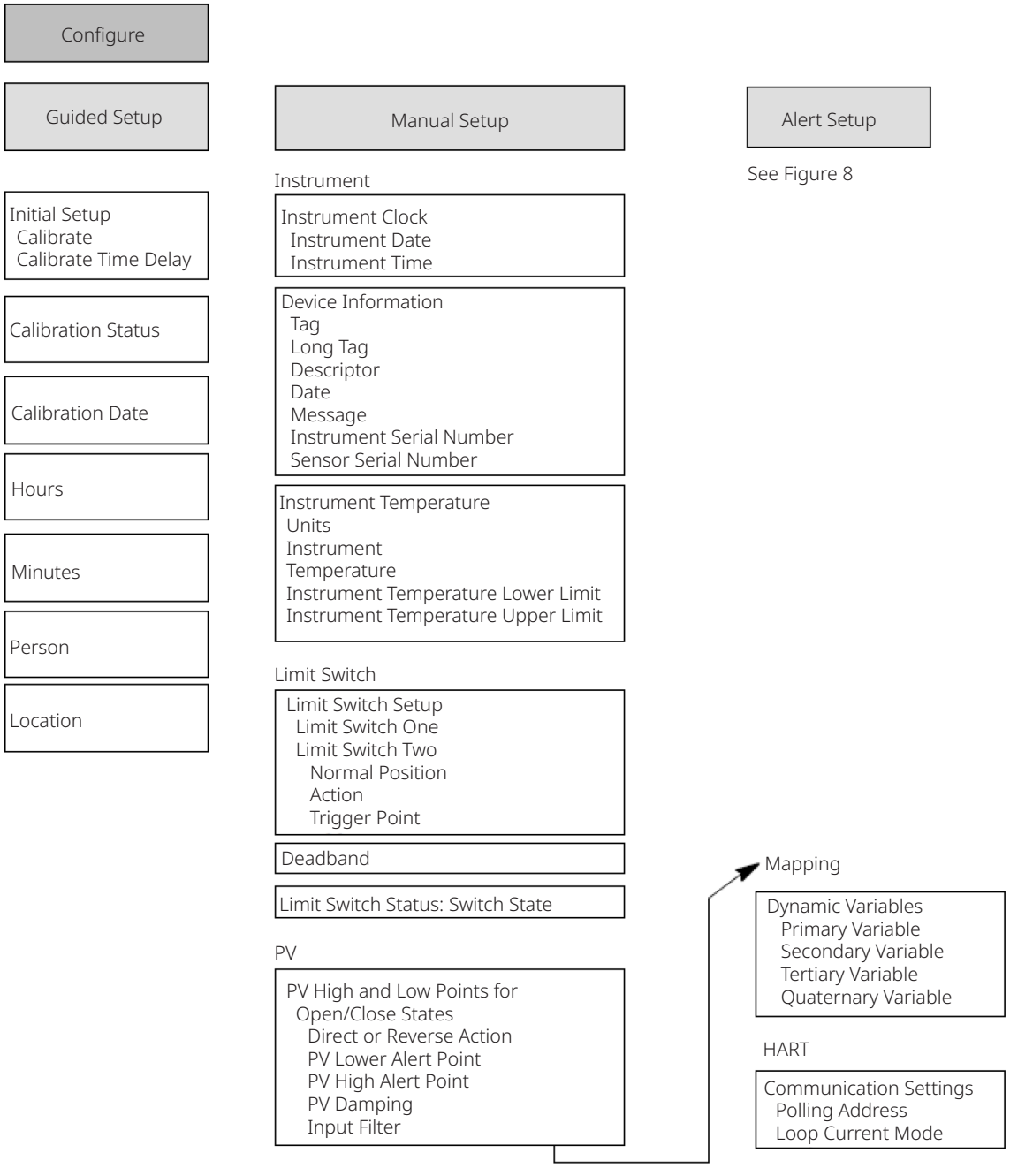


Figure 8. Configure: Alert Setup

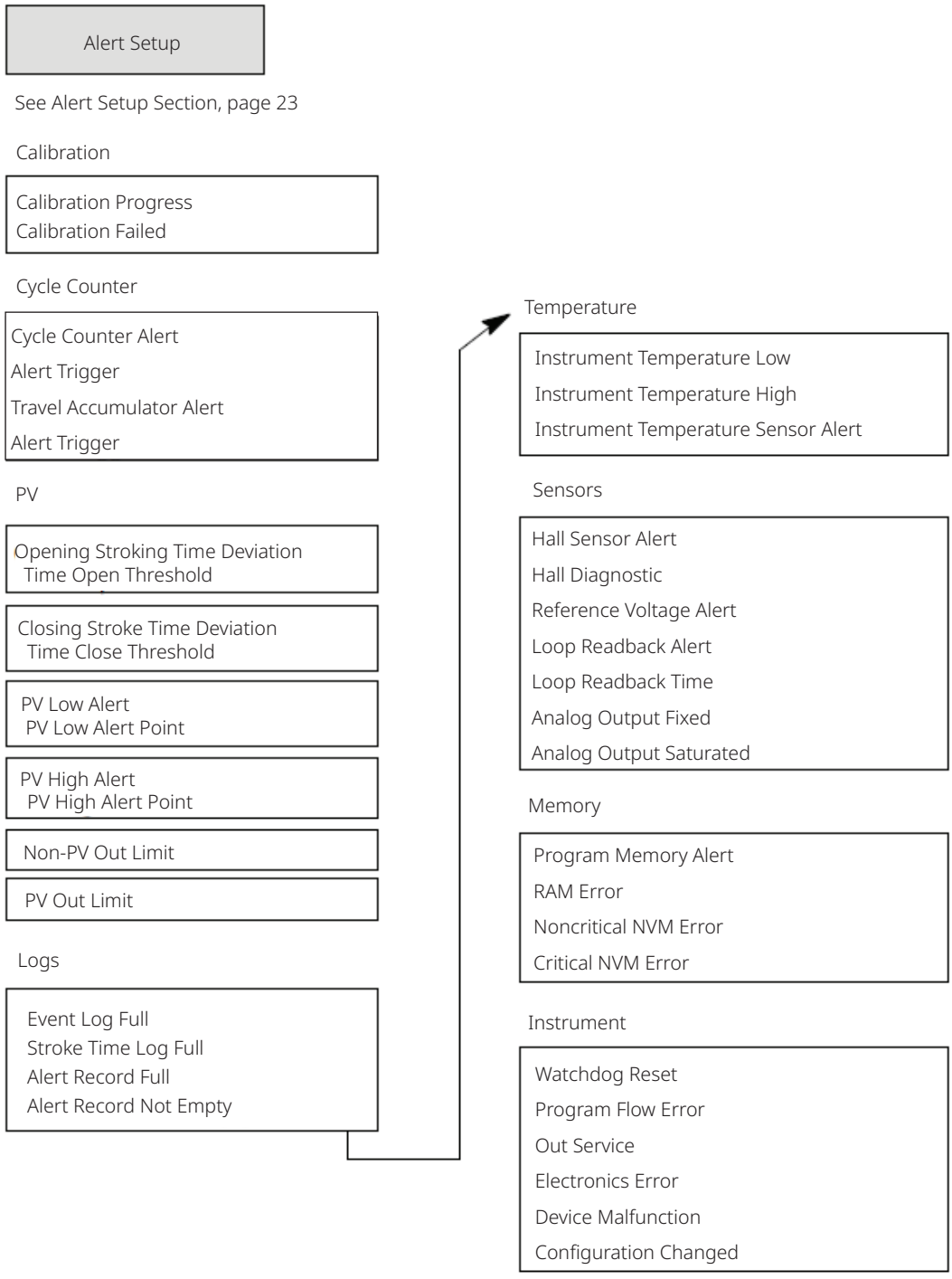


Figure 9. Service Tools

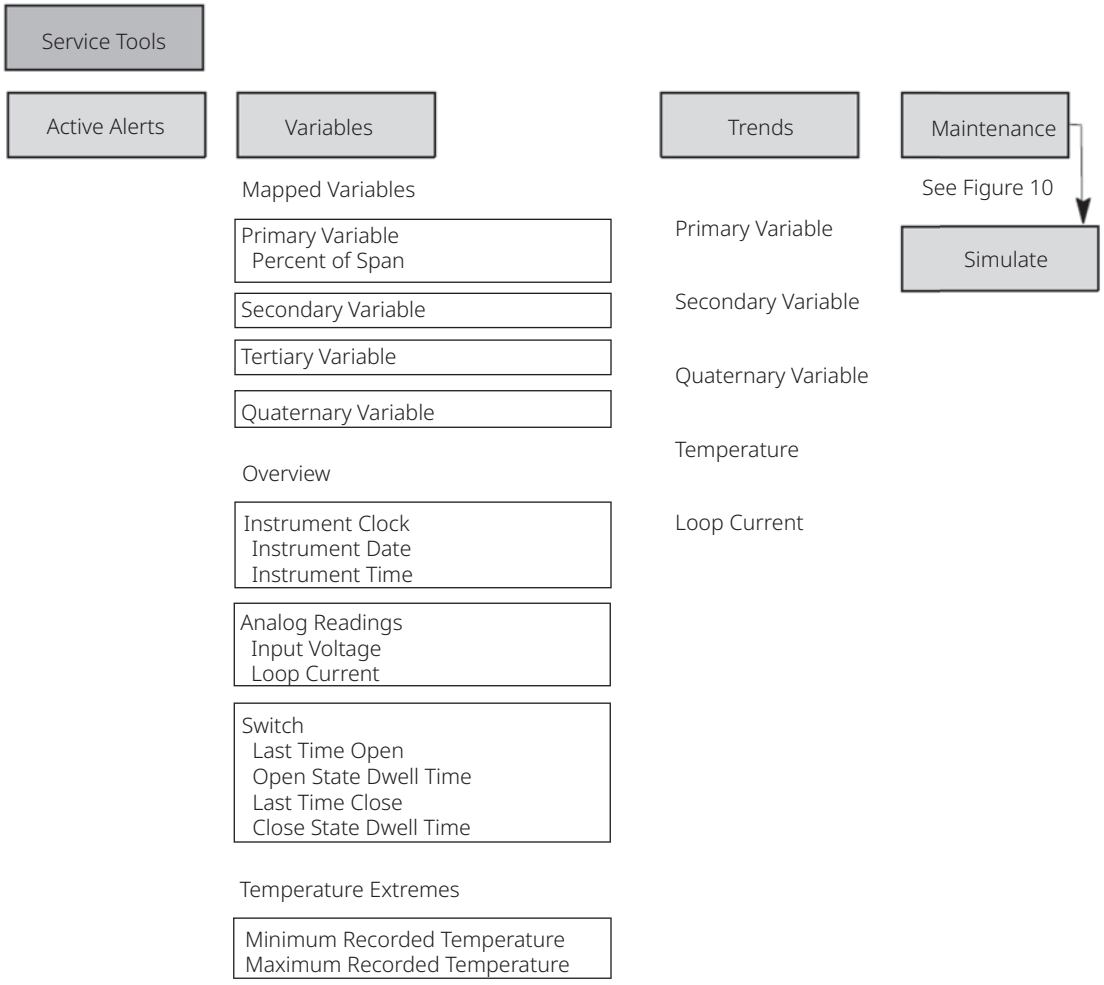
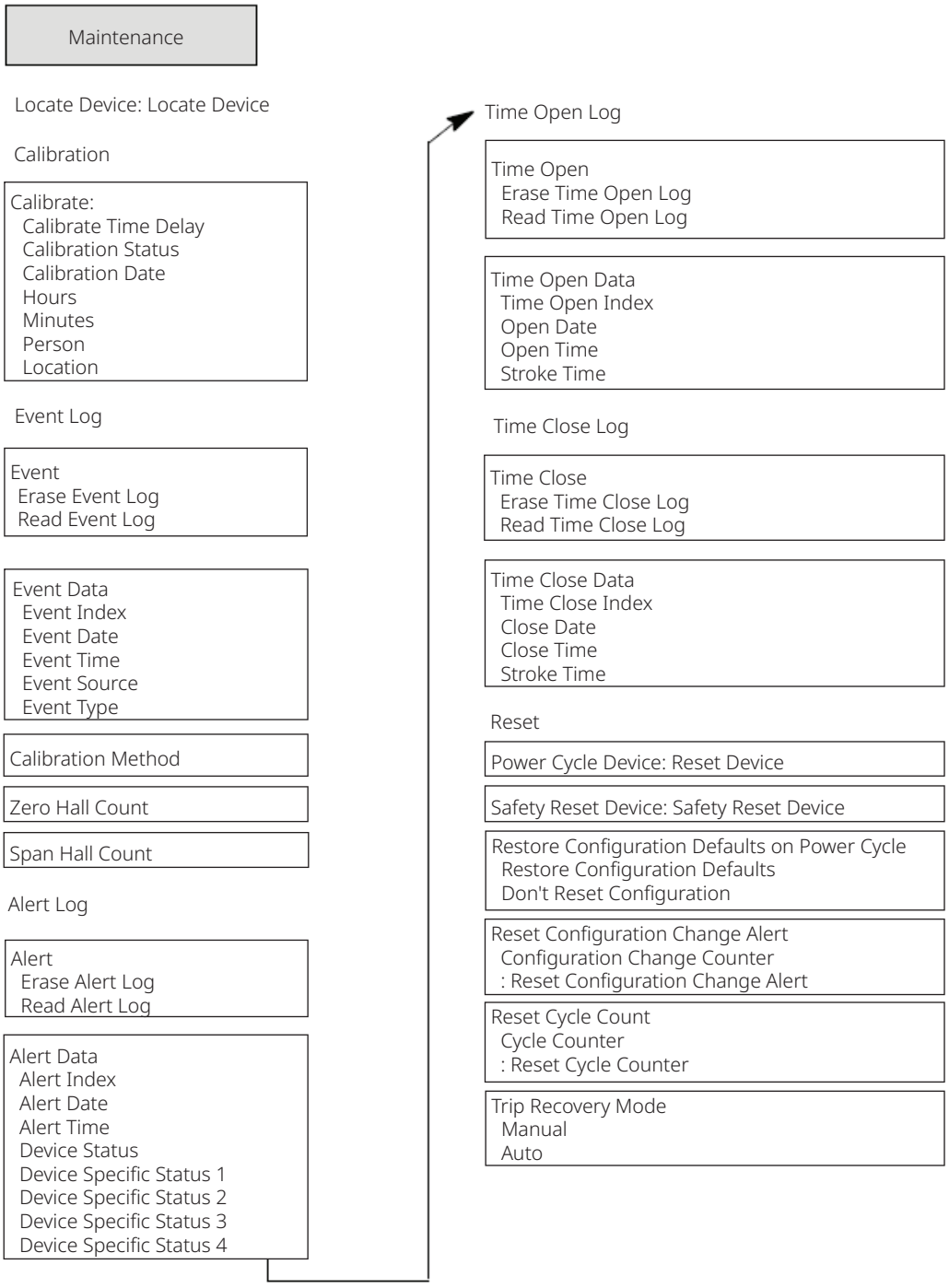


Figure 10. Service Tools: Maintenance



Loop Current refers to the instrument's output current of 4.0 mA to 20.0 mA for normal operation based on array position and calibration. Alert state outputs of High (21.5 mA) and Low (3.6 mA) are displayed when the device's travel sensor is out of range. Alert points of High or Low are configurable parameters.

Long Tag is a tag name of up to 32 characters used to help distinguish the instrument from other instruments.

Mapping
Allows configuration of the dynamic variables. The secondary, tertiary and quaternary variables can be mapped in any order from the drop down menu of the available variables (see Dynamic Variables on page 17).

Message
Enter any message with up to 32 characters. The Message field provides the most specific user-defined means for identifying individual instruments in multi-instrument environments.

Mode
Instrument Mode allows you to place the device in-service for operational function or out-of-service for installation and maintenance task.

Open State Dwell Time is the length of time, in seconds, the position remained in the open state.

Polling Address is used by the Host to identify a field device on the wired maintenance port. It has no significance on the wireless network and can only be edited at the maintenance port. Default is 0, addressable range is 0 through 63.

Primary Variables
PV, SV, TV and QV are selectable variables that are broadcasted in HART from the device. PV (Primary Variable) is locked in for Percent (%) of Span and cannot be changed. Variable SV (Secondary Variable), TV (Tertiary Variable) and QV (Quaternary Variable) are selectable from the available dynamic variables (see page 17). Factory default settings are as follows:

PV: Percent of Span (locked, cannot be changed)
SV: Temperature: Instrument's internal temperature in degrees, selectable for °F or °C
TV: Limit Switch 1 Status: Current #1 switch state
QV: Limit Switch 2 Status: Current #2 switch state

Reset

Power Cycle Device resets the device and has the same effect as removing power from the instrument. It should only be used if the instrument has become unresponsive.

Safety Reset Device will restore the loop current if all safety critical alerts are resolved.

Restore Configuration Defaults on Power Cycle will restore the instrument to factory default configuration if enabled. This should be used as a last resort as it will reset all settings, including calibration.

Reset Configuration Change Alert will clear the configuration changed alert.

Reset Cycle Count will set the cycle counter value to zero.

Trip Recovery Mode determines the action to release the device from the safe state.

NOTE

Trip Recovery Mode should be set to Auto. If set to Manual and the device trips on sensor out of range, it will lock and remain locked until reset via DD or cycle power.

Sensor Serial Number
Enter the serial number on the sensor nameplate, up to 12 characters.

Simulate
Provides enable/disable feature for simulation of alerts. Any alert can be simulated and viewed.

Status
Instrument alerts, when enabled, detect many operational and performance issues that may be of interest. If there are no alerts currently active, Status is shown as GOOD on a green background. When the Status is BAD, it will be seen on a red background and the menu item may be expanded to display a list of active alerts, together with their PlantWeb Alert categories, description, recommended actions and, where applicable, helpful troubleshooting procedures, images or variable values.

Last Close Time is the value, in seconds, of when the position moved from the open state to the closed state.

Last Open Time is the value, in seconds, of when the position moved from the closed state to the open state.

NOTE

Closed state default is 10% of span. Open state default is 90% of span.

Tag
Enter the Tag for the instrument (up to 8 characters). The Tag is the easiest way to distinguish between instruments in a multi-instrument environment. Use the Tag to label instruments electronically according to the requirements of your application.

Trends
Trend charts of the Primary, Secondary, Tertiary and Quaternary Variables, plus Instrument Temperature and Loop Current.

Alert Setup

Alerts, when enabled, detect many operational and performance issues that may be of interest. To view these alerts, you must open the appropriate status screen on a host system.

User configured alerts are grouped into four categories consistent with NAMUR NE 107:

Failure: Transmitter output signal is invalid due to due to malfunction in the field device or its sensors.

Function Check: Output signal temporarily invalid (e.g., frozen) due to ongoing work on the device.

Maintenance Required: Although the output signal is valid, a function will soon be restricted due to operational conditions.

Out of Specification: The device is operating outside its specified range or an internal diagnostic indicates deviations from measured or set values due to internal problems in the device or process characteristics.

NOTE

Various alerts are defined alphabetically below.

Analog Output Fixed indicates that the output is in fixed current mode, not tracking process.

Analog Output Saturated indicates that the analog output is saturated at 3.6 mA or 21.5 mA.

Closing Stroke Time Deviation is active when the time it takes for the valve to move from the open state to the closed state exceeds the defined Time Open Threshold. Disabled by default.

Critical NVM Error indicates that configuration data affecting the critical parameters in the memory is corrupted.

Cycle Counter Alert is set when the value exceeds the set Alert Trigger [expressed in percent (%)]. Reset the Cycle Counter to a value less than the alert trigger to clear the alert.

Hall Diagnostic indicates that the internal hall diagnostics has possible failure in the Hall circuitry.

Hall Sensor Alert indicates that the hall sensor reading has not been changing for ten consecutive samples or has violated one of the hard-coded limits.

Instrument Temperature High is active if the temperature is greater than the Instrument Temperature Upper Limit.

Instrument Temperature Low is active if the temperature is below than the Instrument Temperature Lower Limit.

Instrument Temperature Sensor Alert is active if the Temperature Sensor reading is outside the functional range.

Noncritical NVM Error indicates that non-critical configuration data in the memory is corrupted.

Non-PV Out Limit indicates that the process applied to the non-primary variable is outside the operating limits of the field device.

Opening Stroke Time Deviation is active when the time it takes for the valve to move from the closed state to the open state exceeds the defined Time Open Threshold. Disabled by default.

Out Service indicates the instrument is Out of Service, indicated by a red blinking light.

NOTE

The cover must be removed for the LED on the local user interface to be visible.

Program Flow Error indicates that the instrument is not performing the expected series of calculations.

Program Memory Alert is active if a pending Flash or NVM failure is present.

PV High Alert indicates that the primary variable has violated the user-specified PV High Alert Point [expressed in percent (%)].

PV Low Alert indicates that the primary variable has violated the user-specified PV Low Alert Point [expressed in percent (%)].

PV Out Limit indicates that the process applied to the primary variable is outside the operating limits of the field device.

RAM Error indicates an error in the RAM test.

Reference Voltage Failure is active if there is a failure associated with the internal voltage reference. If this alert is active, replace the printed wiring board assembly.

Travel Accumulator Alert is active when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It clears after you reset the Travel Accumulator to a value less than the alert point.

Watchdog Reset indicates the watchdog timer has timed out, triggering a hardware reset.

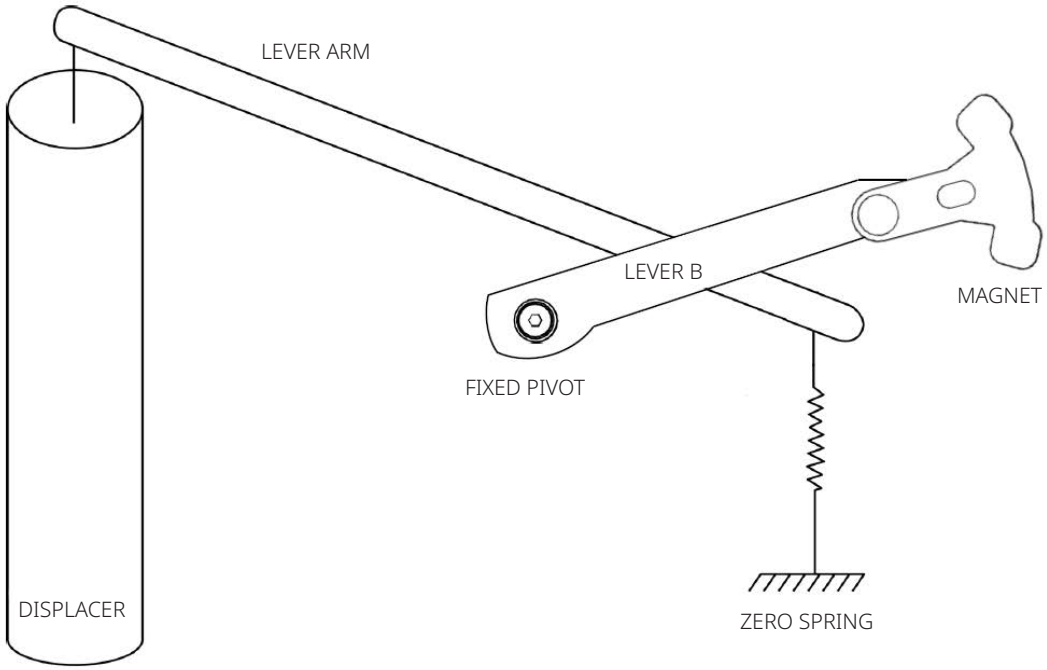
Section 6: Principle of Operation

The operation of the L2t'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 lever B to move the magnet (refer to Figure 11). 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.

The magnet is attached to lever B, which has a fixed return spring bringing lever B down toward the zero spring. Lever B is adjusted at the factory so that when it is on one travel stop, it is connected with a fixed pivot. The movement of the magnet is defined during factory calibration.

Figure 11. Principle of Operation Schematic



Section 7: Maintenance

There are no repairable or replaceable parts on the L2t liquid level controller, however the entire controller assembly can be replaced per the directions below. Contact your Emerson sales office if a replacement L2t controller is needed.

⚠ 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:

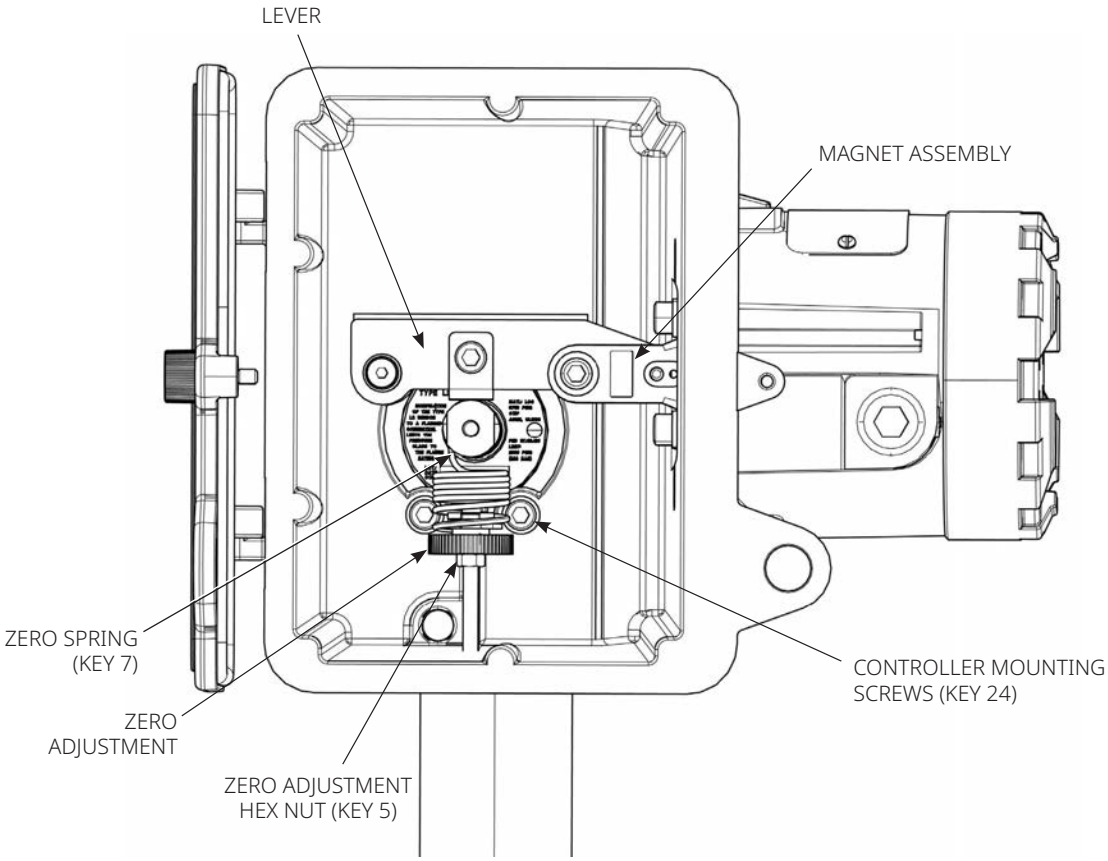
- **Completely shut off the process to isolate the controller/sensor from process pressure or if the application allows, provide some temporary means of control for the process before taking the controller out of service.**
- **Provide a means of containing the process fluid before removing any measurement 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.**

7.1 Replacing the Complete Controller Assembly

Refer to Figure 12 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) (Figure 2).
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.
8. Perform the Calibration procedures found on page 13.

Figure 12. Fisher L2t Controller



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