

VRDLC3010 Series
Smart Displacer Liquid Level (Interface) Transmitter
Equipped with FISHER FIELDVUE DLC3010
AND FISHER 249 CONSTRUCTION

Catalogue and Manual



DANDONG VIRTUE RIVER TECHNOLOGY CO., LTD

<http://www.v-river.com>

Tel.: +86-415-6199871, E-mail: davidsong@v-river.com



Content

1. Introduction	2
2. Features	3
3. Technique Parameters	3
4. Operating Principal	6
5. Model Selection Table	7
6. Construction Schematics	8
7. Explosion Protection Wiring	10
8. Installation Methods	11
9. DLC-3010 Controller Mechanical Schematics	12
10. Troubleshooting	12
11. Calibration	13
12. Setup Procedure Menu	15

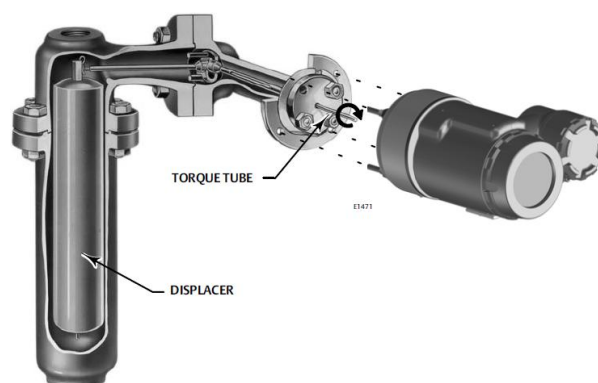
1. Introduction

VRDLC3010 series smart displacer level (interface) transmitters use the original Fisher FIELDVUE DLC3010 digital controller which is the updated version of the 2390 series controller. Other parts are manufactured by V-river locally. The transmitter is suitable to measure liquid level, interface level, or liquid specific gravity (density). The buoyancy force from the liquid, which changes with the liquid level's change, is exerted on the displacer, which rotates the torque tube shaft. This rotary motion is transferred to the digital level controller, then the liquid level change finally is changed into current signals 4-20mA, which is sent out from the digital level controller. (Please refer to the picture lower right)



DLC3000 series smart level transmitters are communicating, microprocessor-based level, interface or density sensing instruments. In addition to the normal function of providing 4~20mA current signal, DLC3000 series smart level transmitter, using HART communications protocol, give easy access to information critical to process operation. You can gain information from the process, the instrument, or sensor, using a communicator 275 or 375 with HART protocol, being compatible with DLC3010. The HART Communicator may be connected at the digital level controller or at a field junction box. By using the HART communicator, the user can perform several operations with the transmitter. The user can interrogate, configure, calibrate, or test the smart level transmitter. Using the HART protocol, information from the field can be integrated into control systems or be received on a single loop basis. In addition, the transmitter has platinum RTD for sensing process temperature to permit compensating for changes in specific gravity to improve the measurement accuracy, linearity and repeatability of the transmitter.

DLC3000 Series smart level transmitters can be widely used in many industrial areas, such as oil and gas, petrochemical, refinery, chemical, metallurgy, medicine and food industries, etc.



2. Features

a. Convenience of configuration and calibration

Using the Setup Wizard, the transmitter can be quickly activated, carrying out the configuration and calibration on liquid level, interface level, density, temperature, and alarm with field display mode. By using the HART Communicator or computer with related software it can re-calibrate the measure range of the transmitter without reference liquid.

b. High amplification and wide damping adjustment

High amplification and high reliability measurement device can detect very little changes of liquid level, interface, and density, as little as 0.05g/cm^3 in density changes. 0.1~16 seconds output signal damping adjustment can meet various requirements in applications where the liquid level is fluctuated frequently and widely.

c. Temperature compensation

The transmitter integrates PTC temperature sensor to protect measure accuracy from changes in environment and processing temperature; With 100 ohm platinum RTD for sensing process temperature to self-compensate changes in specific gravity.

d. Explosion proof architecture

The transmitter is designed with approved explosion proof housing, and anti-vibrating and anti-corrosion architecture.

3. Technique parameters

Mounting types: outer displacer type, top-bottom type, side-side type, top-side type, bottom-side type, internal displacer type, top-placed type, and side placed type

Mounting positions: right- or left-of-displacer, see figure 1.

Operating pressure (MPa): 4.0, 6.3, 16.0, 20.0, and 32.0. or higher on request.

Operating temperature: $-190\sim 29^\circ\text{C}$ for Low-temp type; $-19\sim 150$ for normal type; $150\sim 350$ for high-temp type, and $350\sim 427$ for ultra-high temp type, see table 1 and figure 2.

Flange connections: JB/TB82.2-94, HGJ, GB, ANSI, JIS etc

Materials: Displacer: 1Cr18Ni9Ti, 316L

Displacer cage: carbon Steel, 1Cr18Ni9Ti, 316L

Explosion proof: Ex d IICT6 and Ex ia IICT6

Differential density: $0.4\sim 1.5\text{g/cm}^3$ (liquid level) and $0.05\sim 0.5\text{g/cm}^3$ (liquid interface)

Electrical connections: G1/2" and M20*1.5 adaptor available

Input voltage: 24VDC (standard), 12VDC (Min.), 30VDC (Max.)

Dandong Virtue River Technology Co., Ltd

www.v-river.com, Tel.: +86 – 415 – 6199871, E-mail: davidsong@v-river.com

VRDLC3010 Series Smart Displacer Level (Interface) Transmitters

Load resistance: 250ohm (standard), 600ohm (max. when input voltage is 24VDC)

Output signal: two-wire, 4~20 mA, HART

Output damping: 0.1~16S

Accuracy: $\pm 0.2\%$ for Level, $\pm 0.5\%$ for interface

Ambient Temp: $-40 \sim 80^{\circ}\text{C}$

Temp Affect: $< 0.03\% / ^{\circ}\text{C}$ (within environment temperature)

Relative humidity: 0~95%

Material	Processing Temperature	
	Minimal	Maximal
Cast Iron	$-29^{\circ}\text{C} (-20^{\circ}\text{F})$	$232^{\circ}\text{C} (450^{\circ}\text{F})$
Carbon Steel	$-29^{\circ}\text{C} (-20^{\circ}\text{F})$	$427^{\circ}\text{C} (800^{\circ}\text{F})$
Stainless Steel	$-198^{\circ}\text{C} (-325^{\circ}\text{F})$	$427^{\circ}\text{C} (800^{\circ}\text{F})$
NO5500	$-198^{\circ}\text{C} (-325^{\circ}\text{F})$	$371^{\circ}\text{C} (500^{\circ}\text{F})$
Graphite/SS	$-198^{\circ}\text{C} (-325^{\circ}\text{F})$	$427^{\circ}\text{C} (800^{\circ}\text{F})$
Monel/FPA	$-73^{\circ}\text{C} (-73^{\circ}\text{F})$	$204^{\circ}\text{C} (400^{\circ}\text{F})$

Table 1: Processing Temperature for Different Material



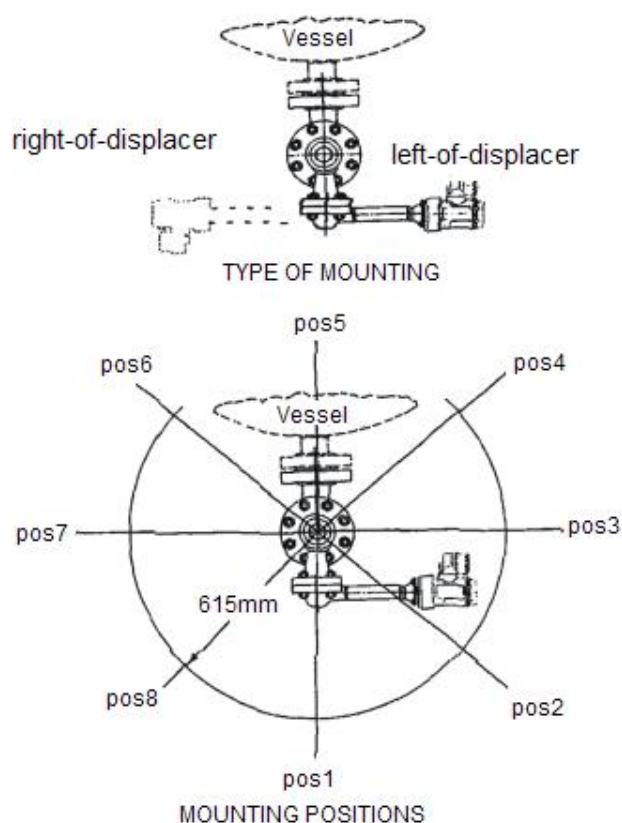
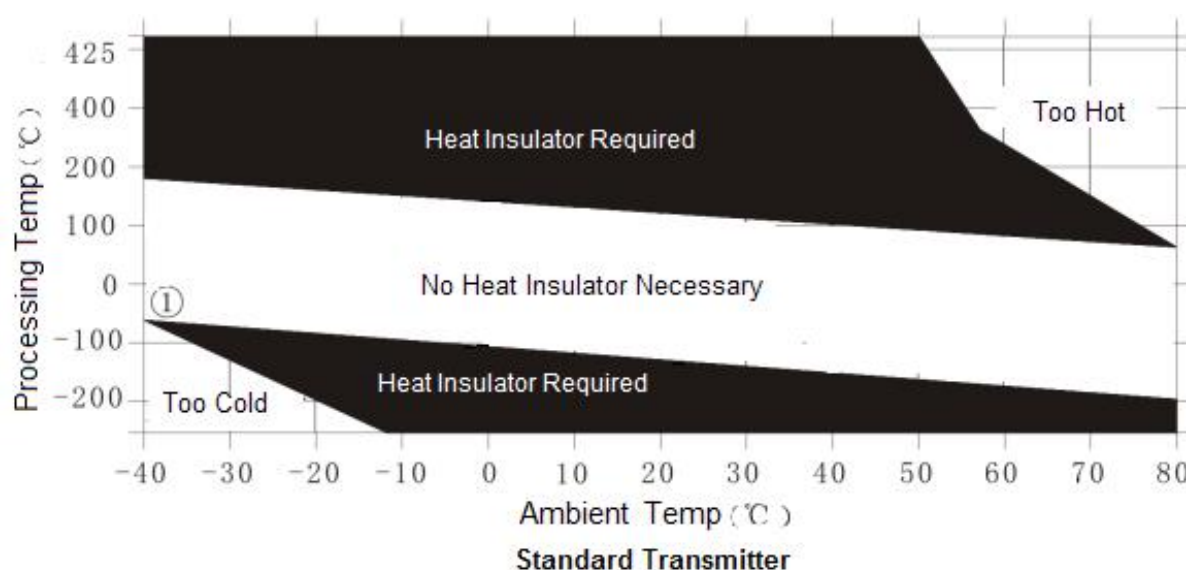


Figure 1: Typical Mounting Positions for DLC3000 Smart Level Transmitter



Note:

- ① For process temperatures below 29 °C and above 204 °C sensor materials must be appropriate for the process, see table 1
2. If Ambient dew point is above process temperature, ICE formation may cause instrument malfunction and reduce insulator effectiveness

Figure 2: Guidelines for Use of Optional Heat Insulator Assembly

4. Operating Principal

VRDLC3010 Smart Displacer Type Level (Interface) Transmitter, as shown in Figure 3, consists of three parts: detecting part, processing part, and transmission part. The detecting part is built with displacer, its housing and lever; the processing part includes torque tube, magnet, and sensor; the transmission part includes A/D and D/A converter, CPU, HART modem and LCD display.

Changes in the level of liquid, the interface of two liquids or specific gravity exert a buoyant force on a displacer which rotates the torque tube shaft. This rotary motion is applied to the sensor producing a differential voltage. This differential voltage is amplified, converted, and processed. The resulting current is indicated on the LCD display or sent to a final control element along with the HART communication signal.

Linear adjustment, measurement range, unit change, temperature compensation and damping calculation are processed by the CPU. The HART modem modulates and de-modulates the resulting information into HART signal, which is loaded on the standard 4~20mA current signal.

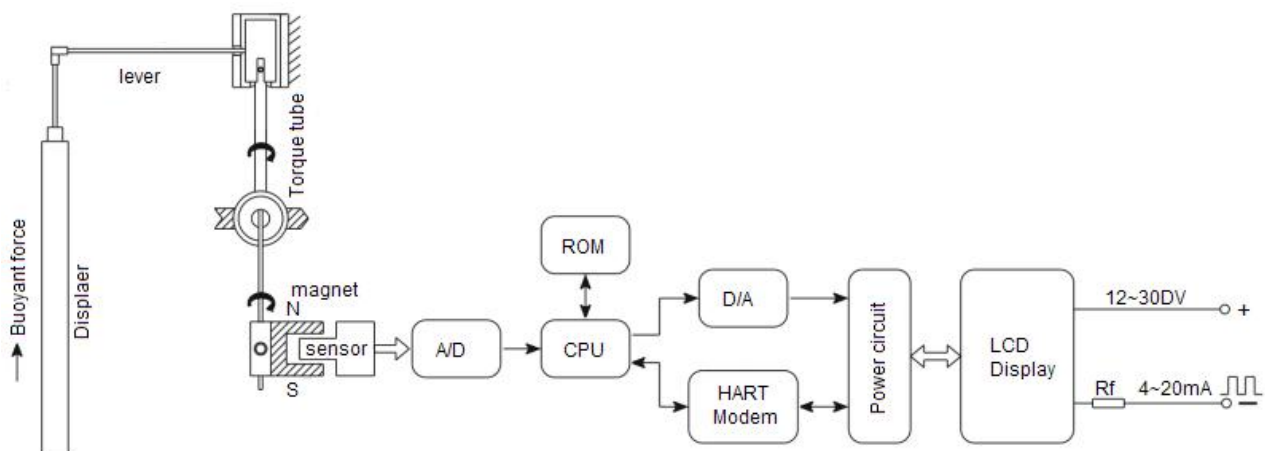


Figure 3: Operating Principal





VRDLC3010 Series Smart Displacer Level (Interface) Transmitters

5. Model Selection Table

VRDLC3010	Smart Displacer Liquid Level (Interface)Transmitter							Model Number		
	1	Level measurement							Measurement Type	
	2	Interface level measurement								
	3	Density measurement								
	A	Top-side mounted							Mounting Type	
		B	Top-bottom mounted							
			Side-side mounted							
			Bottom-side mounted							
			Top mounted							
			Side mounted							
	3	2.5 MPa							Pressure Grade	
		4.0 MPa								
		6.3 MPa								
		10.0 MPa								
		16.0MPa								
	C	Carbon steel							Material of Measuring range	
		Stainless steel 304								
		Stainless steel 316								
		Stainless steel 316L								
		Other material								
	L	Normal temperature, lower than 100℃							Medium Temperature	
		High temperature, ≥ 100℃								
	N	No explosion-proof							Ex-proof Type	
		Intrinsically safe: Ex ia IIC T6								
		Flameproof: Ex d IIC T6								
		With heating jacket								
	- R	Measuring range							Measuring range	

Model selection sample:

Model: VRDLC3010-1C6SLI-800

Transmitting head: Fisher FIELDVUE DLC3010 digital level controller, output signals are analogue, 4-20mA, the communication is HART, measuring cage is side - side mounted type, working pressure: 6.3MPa, measuring cage material is stainless steel 304, working temperature is less than 100 degree Celsius, the explosion proof is intrinsically safe, Ex ia IICT6, the measuring range is 800mm. The flanges sizes and grades will be on request. The material of torque tube will be on request.

Dandong Virtue River Technology Co., Ltd

www.v-river.com, Tel.: +86 - 415 - 6199871, E-mail: davidsong@v-river.com

6. Construction schematic drawing

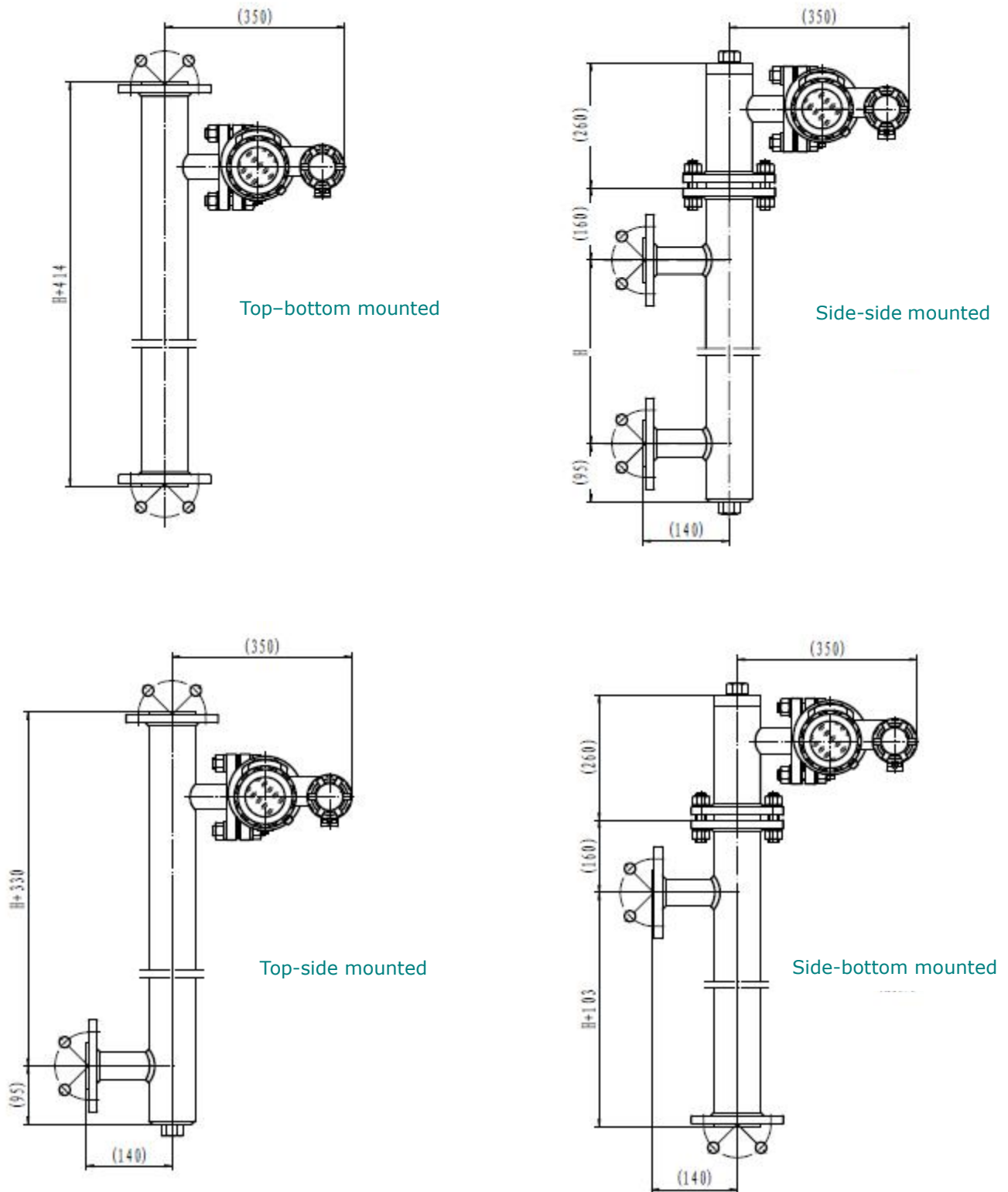


Figure 4

VRDLC3010 Series Smart Displacer Level (Interface) Transmitters

Model	High Temp VRDLC3010 Transmitters Side - side mounted (Refer to figure 4)						Normal Temp VRDLC3010 Transmitters Side - side mounted (Refer to figure 4)					
Operating Pressure	6.3 MPa						16.0 MPa					
H	300	500	800	1200	1600	2000	300	500	800	1200	2600	2000
Total Height	815	1015	1315	1715	2115	2515	815	1015	1315	1715	2115	2515
Flange size and standard	JB/T82.2-94 DN40 PN6.3 RF Other standard is available on request						JB/T82.2-94 DN40 PN16 RF Other standard is available on request					

Note: The table above shows some examples for your reference. The dimensions, flanges rate and size may vary, depending on practical working conditions and constructions.

Model	VRDLC3010 Transmitter Top mounted					VRDLC3010 Transmitter Side mounted					
Operating Pressure	6.3/16 MPa					4.0 MPa					
H	500	800	1200	1600	2000	300	500	800	1200	1600	2000
Z	224										
G	860										
L	1000					1000					
Flange size and standard	JB/T82.2-94 DN40 PN6.3/PN16 RF Other standard is available on request					Different standard is available on request					

Table 3: VRDLC3010 Transmitter Structure Dimensions

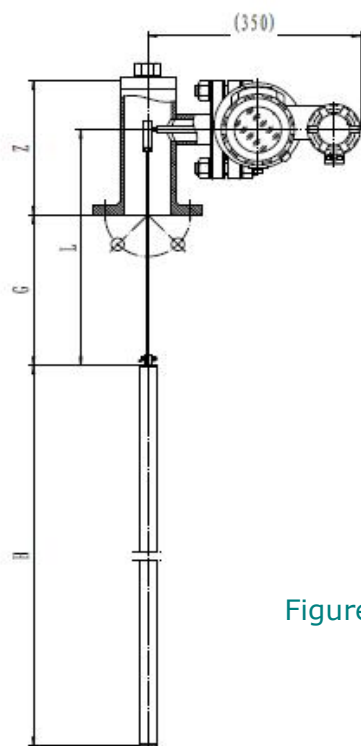


Figure 5

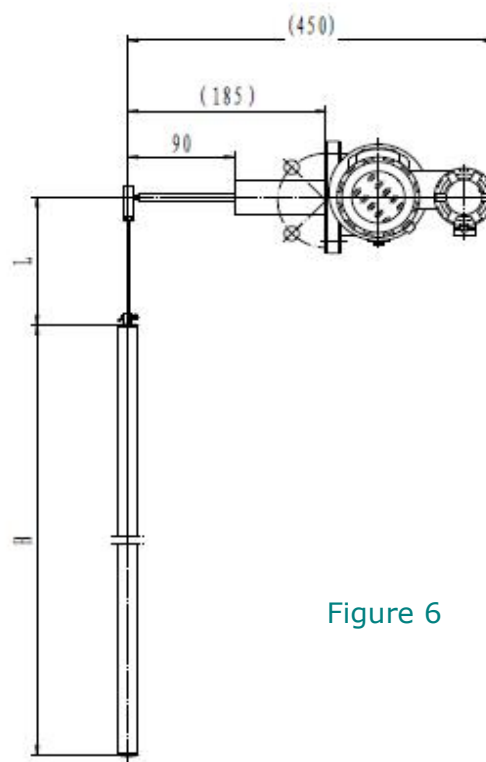


Figure 6

7. Explosion Proof Wiring

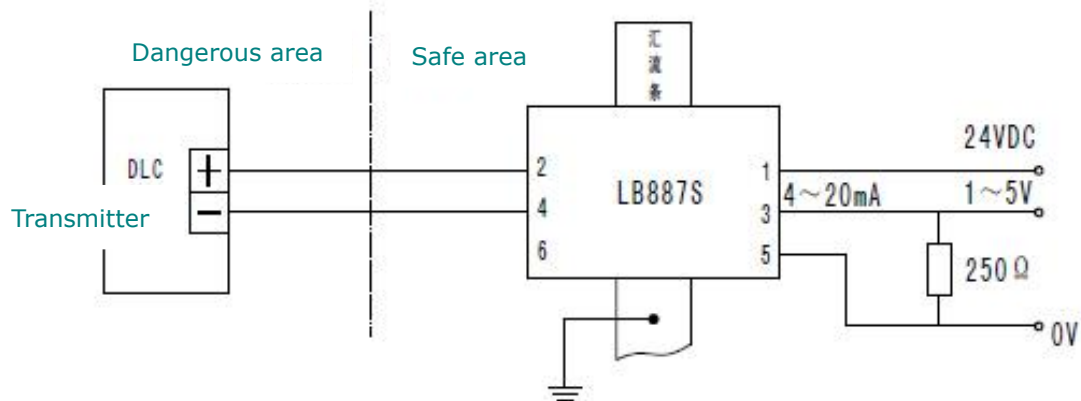


Figure 7

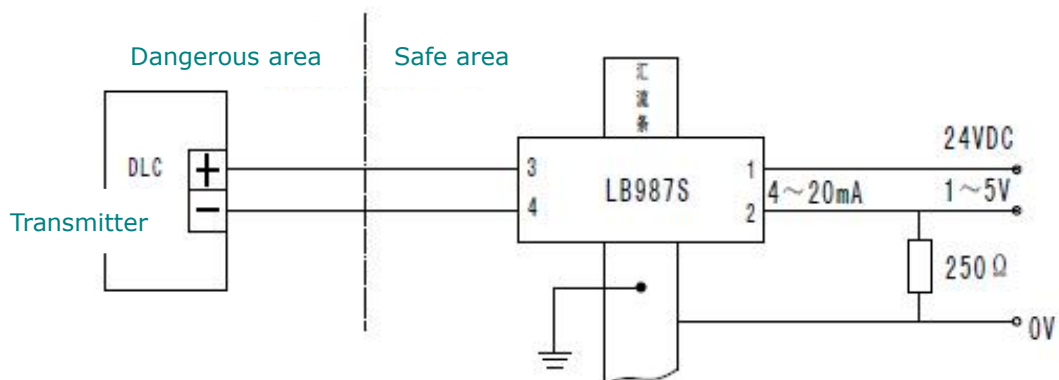
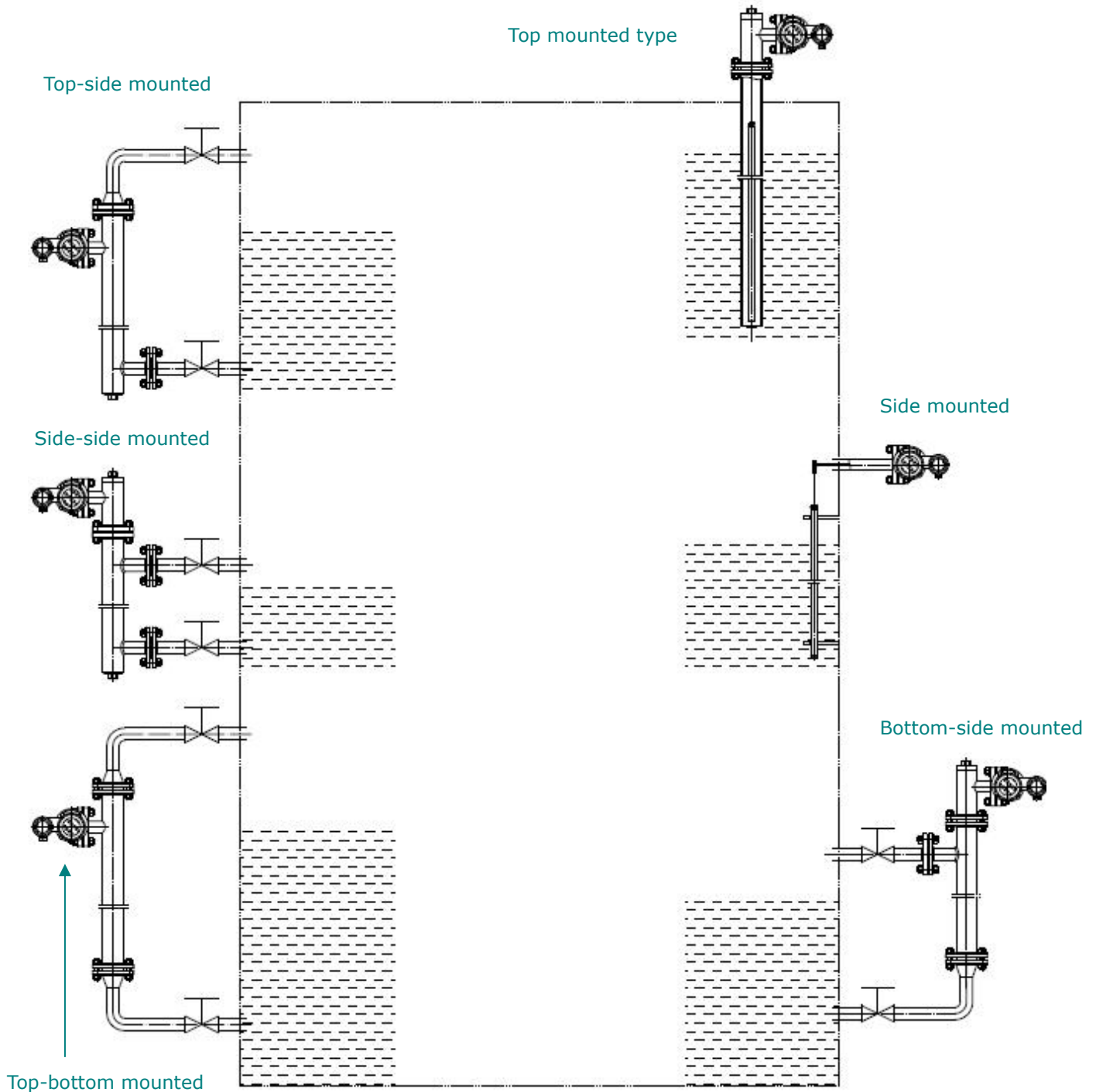


Figure 8



8. Installation Methods



9. FISHER FIELDVUE DLC-3010 Controller Mechanical Schematics

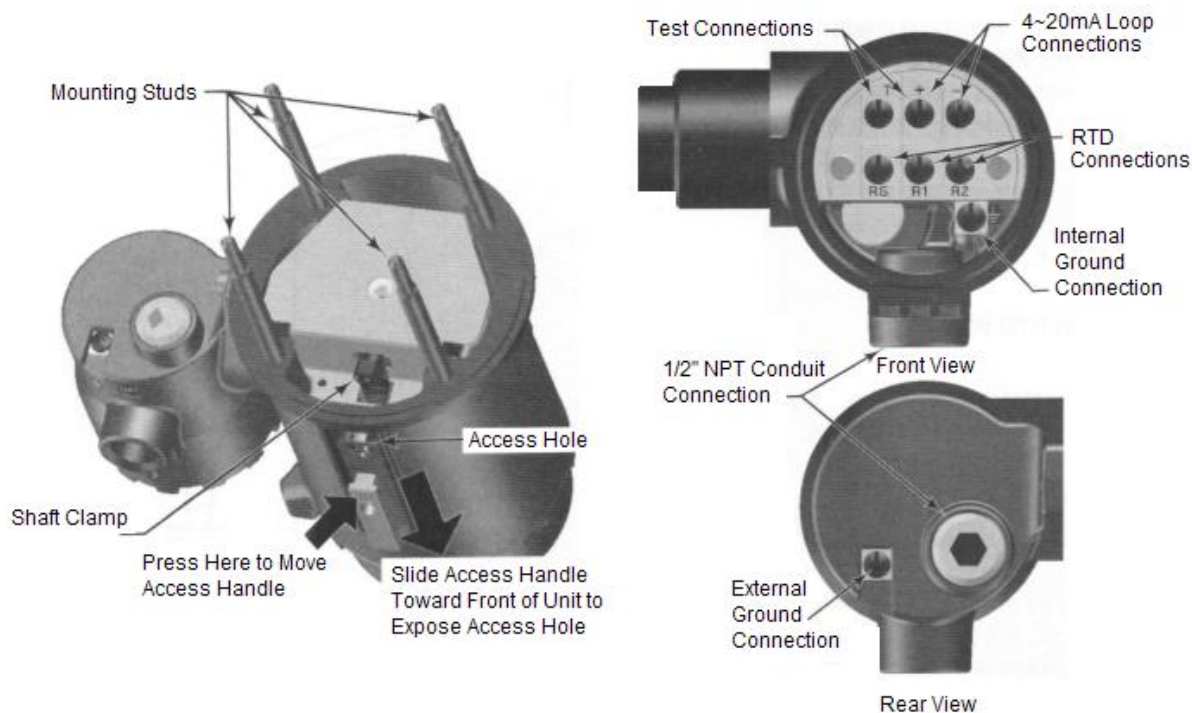


Figure 7: Sensor Connection Compartment and DLC3000 Controller Terminal Box

10. Troubleshooting

Problems	Solutions
No display after power on	<ol style="list-style-type: none"> 1. Check whether power supply is correctly wired 2. Check whether power supply is within right range
Display maximal level after power on	<ol style="list-style-type: none"> 1. Check if internal float is dropped during transportation 2. Check if the access handle is slide out
Poor Linearization	<ol style="list-style-type: none"> 1. Check if measure range and zeroing are changed during transportation, may require recalibration 2. Check if all input parameters are correct 3. Check if the internal displacer is touched with its housing



11. Calibration

When coupling is complete, you must calibrate the digital level controller to match the sensor if you want the engineering units to be properly scaled. If you simply want the 4~20mA output to indicate 0 to 100% of spans, calibration is not necessary. You only need to set the upper and lower range values as described below.

a. Mark Dry Coupling Point

This procedure marks the dry coupling point. It prompts you to hang the displacer to be completely dry or submerged in the lightest density liquid for density or interface applications. The dry coupling point value is used for internal calculations and can be read back as the reference coupling point.

b. Two Liquid Level Calibration

This procedure is the most accurate method for calibrating the instrument and sensor. It uses two liquid levels that can be externally measured. Perform the "Mark Dry Coupling Point" procedure before performing two liquid level calibration.

From the Online menu, select Basic Setup, Sensor Calibrate, and Two Liquid Lvl Cal. Follow the prompts on the HART Communicator to calibrate the instrument and sensor.

- 1) Set the control loop for manual control
- 2) Adjust the liquid level to a position near the top or bottom of the displacer
- 3) Enter the externally measured liquid level in the current PV units.
- 4) Adjust the liquid level to a position near the bottom or top of the displacer, but at a position that is at the opposite end of the displacer from step 2.
- 5) Enter the externally measured liquid level in the current PV units.

The instrument and sensor are calibrated. Proceed to Setting the Range Values.

C. Wet/Dry Calibration

The following procedure can be used to calibrate the instrument and sensor if the liquid level can



VRDLC3010 Series Smart Displacer Level (Interface) Transmitters

be changed so that the displacer is completely dry and completely submerged, but the actual liquid level is not known. This procedure is not quite as accurate as the two liquid level calibration procedure but is more accurate than the one liquid level calibration procedure. Displacer information must be entered before performing this procedure.

From the online menu, select Basic Setup, Sensor Calibrate, and Wet/Dry Cal. Follow the prompts on the HART Communicator to calibrate the instrument and sensor.

- 1) Set the control loop for manual control
- 2) Enter the specific gravity for the liquid in the system
- 3) Adjust the liquid level until the displacer is dry, displacer is completely out of the liquid.
- 4) Adjust the liquid level until the displacer is completely submerged in the liquid.

The instrument and sensor are calibrated. Proceed to Setting the Range Values.

D. One Liquid Level Calibration

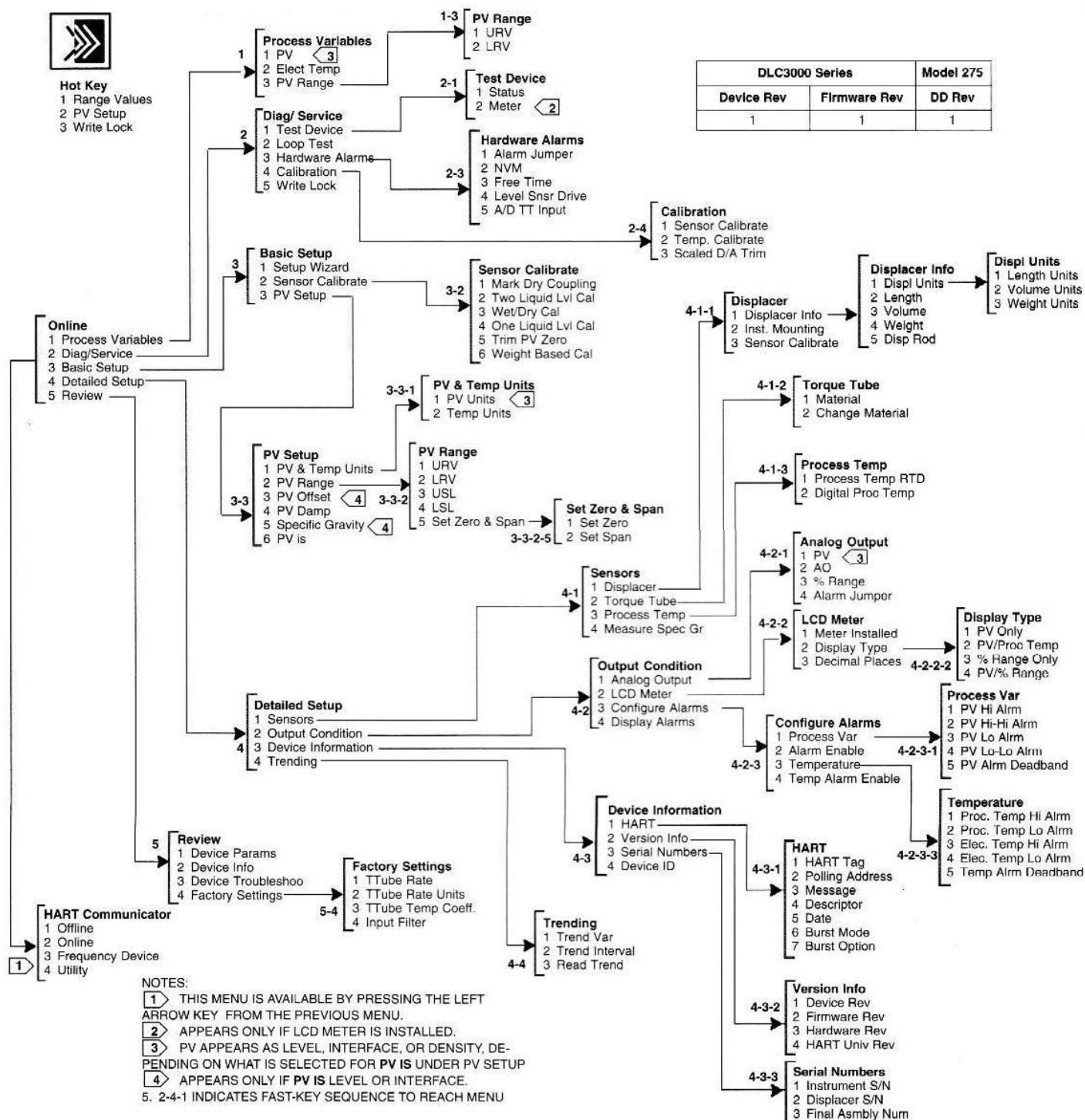
This procedure uses a single reference point to calibrate the instrument and sensor. An external method of measuring the liquid level is required. This procedure is less accurate than the two liquid level calibration and wet/dry calibration procedures. However the one liquid level calibration procedure can be used if it is not possible to lower the liquid level so the displacer is completely dry to raise the level so the displacer is completely submerged. A means of externally measuring the liquid level is required. The dry coupling point must already be marked.

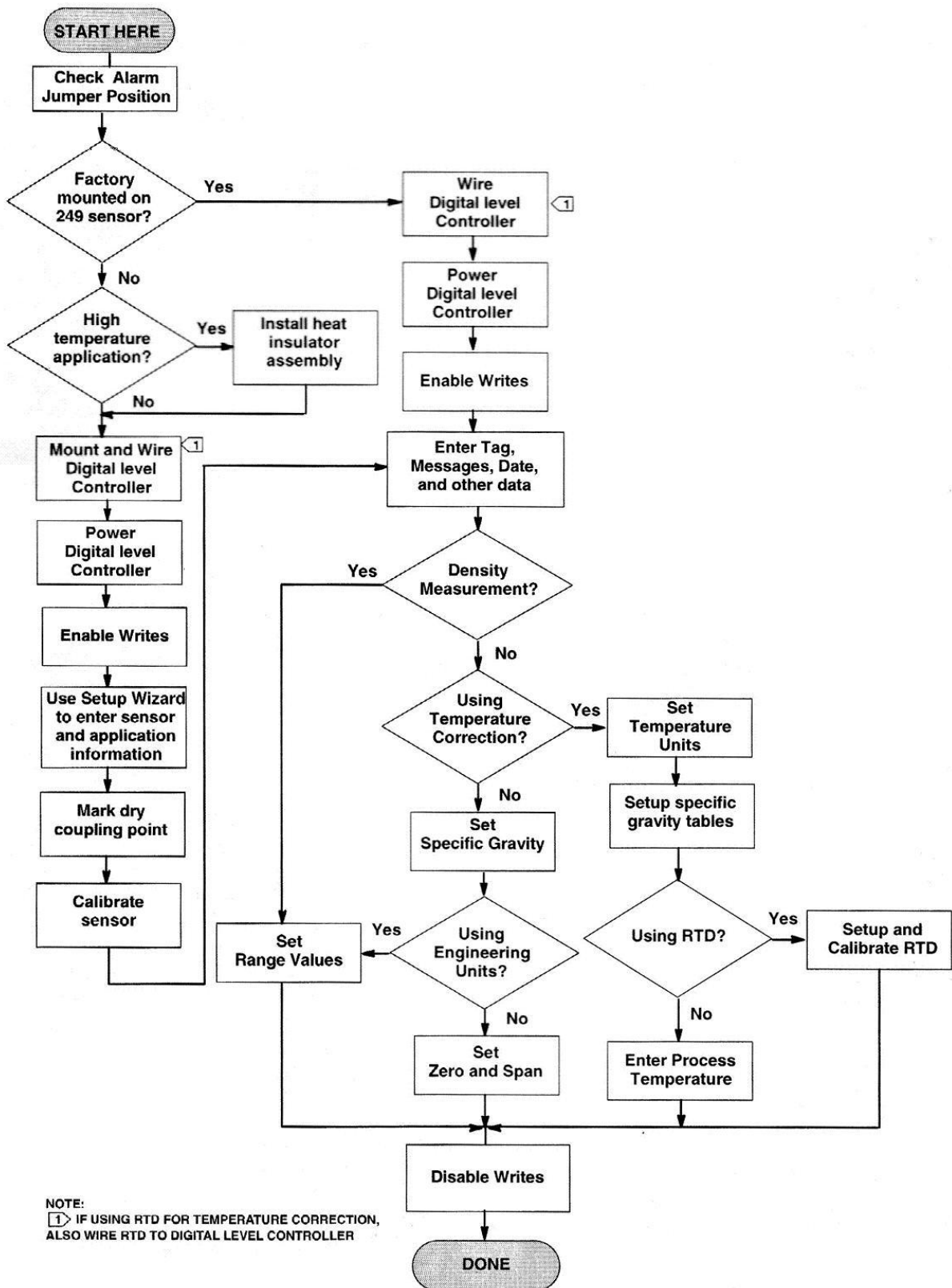
From the Online menu, select Basic Setup, Sensor Calibrate, and One Liquid Lvl Cal. Follow the prompts on the HART Communicator to calibrate the displacer and torque tube.

- 1) Adjust the liquid level to a known position, preferably with the displacer partially submerged.
- 2) Enter the externally measured liquid level in the current PV units.

The instrument and sensor are calibrated. Proceed to Setting the Range Values. For detailed setup procedure, please refer to "Instruction Manual to DLC3010 Digital Level Controller".

12. Setup Procedure Menu







德行天下 泽润四方

SHARE WIN-WIN WITH VIRTUE

丹东德泽科技有限公司

Dandong Virtue River Technology Co., Ltd

<http://www.v-river.com>

辽宁省丹东市沿江开发区滨江中路 132 号太阳世纪广场 B 栋 1801 室

R.M.1801, Building B, Solar Century Plaza, No. 132, Binjiang Road (M.S.),

Riverside Development Zone, Dandong City, 118002, Liaoning Province, P. R. China

Tel.: +86-415-6199 871, Fax: +86-415-3118 579, davidsong@v-river.com

Dandong Virtue River Technology Co., Ltd

www.v-river.com, Tel.: +86 - 415 - 6199871, E-mail: davidsong@v-river.com