



Verification Procedure for Model 2100 Level Sensor Accuracy

Introduction:

The Electrolab Model 2100 Digital Level Sensor (DLS 2100) is designed to provide consistently accurate measurements of fluids in both hazardous and non-hazardous environments.

The DLS 2100 is offered in both 316L stainless steel encasing and rugged UHMW flexible hose (RU Flex 2100), both options providing a precise measurement of 1/8" resolution and an accuracy of 3/16". One temperature sensor is included in all DLS 2100 models with the option to add up to a total of eight temperature measurements with an accuracy of 1.5° C. Unlike other level sensing technologies, Electrolab's patented controls do not require any complex calibration procedures: the DLS 2100 sensor utilizes direct level measurement from the bottom of the tank to the top of the fluid providing true fluid level measurement.

For the purpose of verifying accuracy in the field, a verification process is accomplished with the DLS 2100 installed in the tank being verified. This verification procedure of the DLS 2100 gives the most accurate results in representing real world operation of fluid level measurement.

Level Offset Procedure:

Prior to initial level offset or initial verification of a DLS 2100 sensor, the tank for installment should stand at a constant level long enough for air and vapor to be released from the liquid and for the tank bottom to reach a stable position. New tanks should also be filled and allowed to stand to minimize error by initial bottom settlement.

When the DLS 2100 is initially installed, it is necessary to calculate the level offset and enter the value into the sensor. If the tanks are empty at the time of the installation, the offset cannot be calculated until the fluid level is at least 12-inches. Once there is enough fluid to perform the level offset and the tank is isolated as to not create fluid movement, the level offset can be calculated and entered into the sensor.

The process to calculate the level offset is as follows:

1. Isolate the tank and leave the fluid level to settle.
2. When there is no movement or waves in the tank, perform a manual measurement using NIST certified and calibrated level tape.
3. At the same time of performing Step 2, take a reading from the DLS 2100 using a hand held programmer, a terminal emulator, or a reading from a PLC or flow computer.
4. The level reading from the DLS 2100 is subtracted from the manual gauge reading to determine



the level offset:

- a. A typical level offset for the stainless steel DLS2100 is 1 to 2 inches, while the level offset on the RU Flex is typically 7-1/2 to 9-1/2 inches. The RU flex requires a larger offset due to the weight at the bottom.
- b. When using a dual float sensor (Product Float and Water-interface Float), an offset can be set for each individual float.
- c. There must be at least 3-inches of oil/condensate to separate the two floats to receive a valid level reading for each fluid.
- d. An offset cannot be acquired on a water-interface float if there is no water in the tank.

Example:

Stainless Steel DLS 2100

Manual Gauge reading is 137.25"

DLS 2100 reading is 135.75

Level Offset will be 1.50"

RU Flex DLS 2100

Manual Gauge reading is 137.25"

DLS 2100 reading is 129.00

Level Offset will be 8.25"

5. Once the level offsets are determined, enter the offset in the sensor using the hand held device or the terminal emulator.
 - a. There should be no change in the offset unless there was a need to remove the sensor from the tank for maintenance.
 - b. If the sensor has been removed and reinstalled, the level offset needs to be recalculated and a new value entered into the sensor.
 - c. The level offset is always added to the raw value of the level reading. To accurately recalculate a new offset, the level offset in the sensor will need to be set to zero before calculating a new level offset.

Accuracy Verification Process:

To perform a full verification at multiple levels, the best practice is to transfer oil/condensate from one tank into the tank being verified. This method will take longer to verify the accuracy, but will provide the user with confidence that the DLS 2100 is maintaining its accuracy over the entire length of the sensor. In lieu of a full verification, a manual gauge can be done periodically to verify the DLS is still accurate to a manual reading.

The process to perform a full verification is as follows:

1. Isolate the tank and let fluid settle.



2. Take manual level gauge using a NIST certified and calibrated manual gauge tape.
3. Verify and record the DLS and manual readings.
 - a. If readings do not match, verify the level offset and recalculate if necessary.
4. Move fluid into the tank of about 40 to 80 bbls.
5. Isolate tank and let fluid settle.
6. Use another manual gauge to verify the DLS 2100 level reading.
7. Move additional fluid 40 to 80 bbls into the tank and repeat level readings.
8. Continue the process with multiple level reading verifications until adequate verification is acquired.
9. For additional verification, more level readings can be compared by removing fluid from the tank in the same method as moving fluid into the tank.

Example:

The readings below were documented from a full verification on a well site in North Dakota in May of 2017. The customer used a vacuum truck to move fluid from one tank to the verification tank.

Product Float:

Reading	RU Flex	Manual Gauge		Difference	Temperatures		Notes
	IN	FT	IN	IN	1 FT	9 FT	Temps compared to temp gauges on tank
1	43.50	4	2 1/2	7.5"			Set level offset on Top Float to 7.50"
2	88.25	7	4 1/4	0	58	70	Moved 44.75 inches of oil into tank
3	127.00	10	7	0	58	58	Moved 38.75 inches of oil into tank
4	159.62	13	3 3/4	-0.125	58	58	Moved 32.75 inches of oil into tank
5	191.87	15	11 7/8	0	59	59	Moved 32.125 inches of oil into tank
6	158.00	13	2	0	59	59	Moved 33.875 inches of oil out of tank
7	124.50	10	4 1/2	0	59	59	Moved 33.50 inches of oil out of tank
8	90.50	7	6 5/8	-0.125	59	68	Moved 33.875 inches of oil out of tank
9	56.62	4	8 5/8	0	60	71	Moved 34.00 inches of oil out of tank
10	46.50	3	10 1/2	0	60	74	Moved 10.125 inches of oil out of tank

Water Float:

Reading	RU Flex	Manual Gauge		Difference	Notes
	IN	FT	IN	IN	Moved 9" of water into tank to get valid interface level
1	3.50	0	10 1/4	6.75	Set level offset for interface float to 6.75"
2	10.25	0	10 1/4	0	minimal water reading will be 8.50 inches or 0.71 feet

Full records should be kept of the initial setting, initial verification, and subsequent verifications. Records of maintenance work should be kept.