

Displacer Type Transmitter

EN



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Prior to starting any work, read the operating instructions!
Keep for later use!

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1. Product description and scope of application

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The displacer type level transmitter consists of an intelligent liquid level transmitter and a set of displacer sensors. Intelligent transmitter is imported from Fisher company, Advanced technology, reliable performance, with HART communications and LCD local display. The displacer sensor is made in China. It has a simple and reliable structure, flexible installation, high temperature and high-pressure resistance, and corrosion resistance. The MTBF of the product is over 80 thousand hours. Measure liquid level, interface, or liquid specific gravity. Widely used in refining, chemical, metallurgical, power generation, pharmaceutical, and other industries. The transmitter is suitable for various inflammable and explosive occasions. The output of the 4 ~ 20mA DC standard signal remote transmission system using DCS distributed control network, Automatic detection and automatic control of process flow.

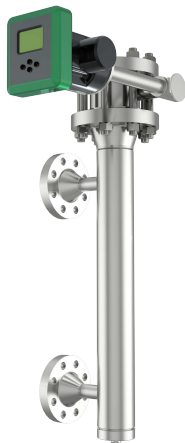


Fig. 1 Outline

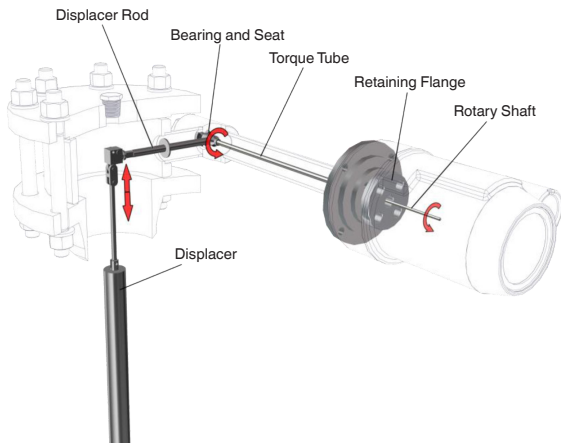
2. Working Principle

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The displacer type level gauge consists of two parts: a sensor and a transmitter. The sensor is composed of chamber, displacer, rod and torque tube assembly. The displacer is immersed in the liquid medium in the tank or chamber and is rigidly connected to the torque tube assembly. The rod moves in a circle around the support point.

The change of the density, level or the interface of the liquid medium in the chamber cause the buoyancy change of the displacer immersed in the tank or the chamber, which lead to a certain angle change (about 4 degree) of the torque tube. The rotary shaft transferred this angle change to the transmitter, and after processing the transmitter outputs the corresponding electrical signals.



3. Specifications

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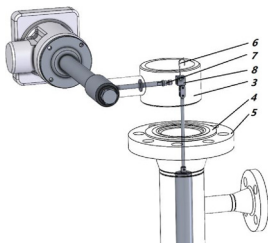
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■ Accuracy:	±0.5% FS
■ Hysteresis:	±0.25% FS
■ Output:	4-20 mA DC; Direct/Reverse action
■ Impedance:	250~520 ohms
■ Supply:	12 to 30 volts DC; 25 mA; reverse polarity protection
■ Media temperature:	-40°C~+450°C
■ Ambient Temperature:	-40°C~+80°C
■ Humidity:	10~95%
■ Measurement range:	300~3000mm
■ Medium specific gravity:	0.1-1.5g/cm ³
■ Interface measure Min. S.G.:	0.1 g/cm ³
■ Operation pressure:	up to 32Mpa
■ Cable gland:	1/2" NPT
■ Electrical explosion protection:	Ex ia IIC T6 (intrinsic safety); Ex d IIC T6 (explosion-proof)
■ Dust explosion prevention:	DIP A21 T6
■ Ingress Protection:	IP66

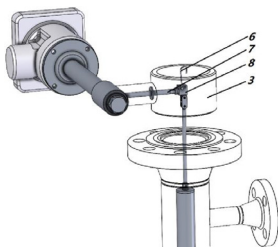
4. Mounting the Sensor

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1) Place the seal 4 on the connecting flange 5. Insert displacer in displacer chamber or vessel. Hold wafer body 3 above connecting flange.



2) Lift up the displacer lock rod 6, insert the torque rod 7 into the hole of displacer joint 8.

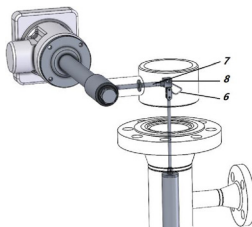


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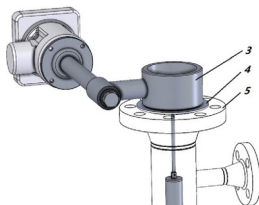
4. Mounting the Sensor

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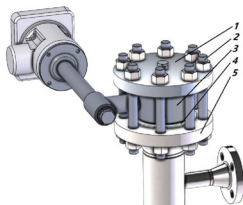
3) Release the displacer lock rod 6 to the place indicated in the right figure, in which place the displacer will lock to the torque rod 7.



4) Place and hold the wafer body 3 on the connecting flange 5 and seal 4.



5) Place seal on wafer body. Place blind flange 1 on wafer body so that holes in blind flange and connecting flange 5 are aligned. Tighten nuts of all eight studs 2 crosswise in several steps to recommended tightening torque.



Recommended tightening torque

(Prestressed to 70% of minimum yield point at 20°C)

Studs	M16	M20	M24	M27	M30	M36
Tightening torque [Nm]	95	185	310	450	630	1080

5. Protecting the Coupling and Flexures

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CAUTION

The transmitter is mounted on the sensor and calibrated before shipment. Do not move the lever lock unless you want to re-calibrate it.

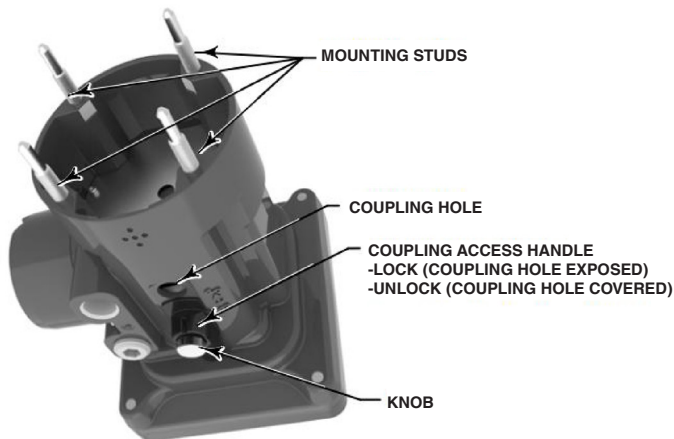
Damage to flexures and other parts can cause measurement errors. Observe the following steps before moving the sensor and controller.

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Lever Lock

The lever lock is built into the coupling access handle. When the handle is locked (exposing the coupling hole), it positions the lever assembly in the neutral travel position for coupling. In some cases, this function is used to protect the lever assembly from violent motion during shipment.

Figure 1. Sensor Connection Compartment



5. Mounting the Sensor

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1. Press the knob and slide the coupling access handle to the locked position to lock the lever assembly in place and to expose the access hole.
2. Using a 10 mm deep well socket inserted through the access hole, loosen the shaft clamp. This clamp will be re-tightened during the Coupling procedure.
3. Remove the four hex nuts from the mounting studs.
4. Position the digital level controller so the access hole is at the bottom of the instrument.
5. Carefully slide the mounting studs into the sensor mounting holes until the digital level controller is snug against the sensor.
6. Reinstall the four hex nuts on the mounting studs and tighten to 10 Nm.
7. Follow the Coupling procedure to couple the DLC3100 digital level controller to the sensor.

Coupling

If the digital level controller is not already coupled to the sensor, perform the following procedure.

1. Press the knob on the coupling access handle, shown in figure 1, then slide the handle towards the front of the DLC3100 to expose the access hole and lock the lever assembly in place. Be sure the locking handle drops into the detent; the DLC3100 LCD will display "Lever Locked".
2. If in the actual process condition, set the displacer to the lowest possible process condition (lowest fluid level for level application, or fill with fluid with minimum specific gravity for interface application). If on the bench, ensure the displacer is dry and the displacer rod lever arm is not hitting a travel stop. Alternatively, the heaviest calibration weight can be used to replace the displacer to simulate the dry displacer condition.
3. Insert a 10 mm deep well socket through the access hole and onto the torque tube shaft clamp nut. Tighten the clamp nut to a maximum torque of 2.1 Nm.
4. Press the knob on the coupling access handle, shown in figure 1, then slide the handle towards the rear of the unit to unlock the lever assembly. Be sure the locking handle drops into the detent; "Lever Locked" on the DLC3100 LCD will be cleared.

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6. Electrical Connections



WARNING!

Select wiring with temperature rating of $> 85^{\circ}\text{C}$ 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.

Proper electrical installation is necessary to prevent errors due to electrical noise. A resistance between 230 and 600 ohms must be present in the loop for communication with a Device Communicator. Refer to figure 2 for current loop connections.

Power Supply

To communicate with the digital level controller, minimum 17.75 VDC power supply is required. The power supplied to the transmitter terminal is determined by the available supply voltage minus the product of the total loop resistance and the loop current. The available supply voltage should not drop below the lift-off voltage. The lift-off voltage is the minimum available supply voltage required for a given total loop resistance. Refer to figure 3 to determine the required lift-off voltage.

6. Electrical Connections

Figure 2. Connecting a Device Communicator to the Digital Level Controller Loop

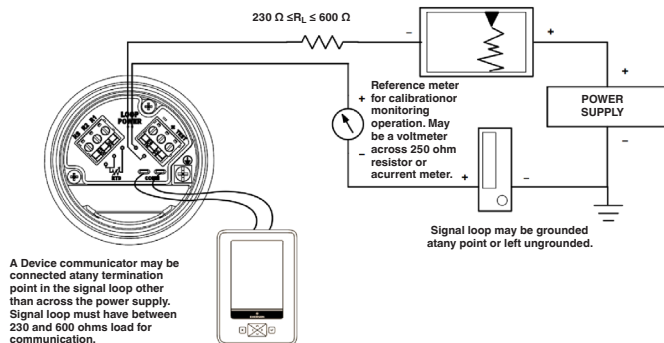
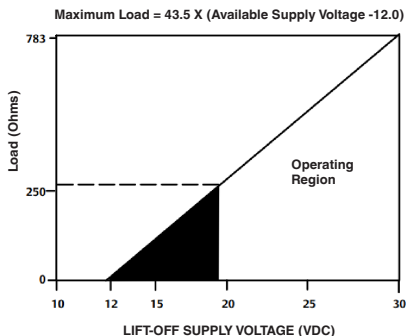


Figure 3. Power Supply Requirements and Load Resistance



6. Electrical Connections

If the power supply voltage drops below the lift-off voltage while the transmitter is being configured, the transmitter may output incorrect information.

The DC power supply should provide power with less than 2% ripple. The total resistance load is the sum of the resistance of the signal leads and the load resistance of any controller, indicator, or related pieces of equipment in the loop. Note that the resistance of intrinsic safety barriers, if used, must be included.

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Field Wiring



WARNING

To avoid personal injury or property damage caused by fire or explosion, remove power to the instrument before removing the digital level controller cover in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

All power to the digital level controller is supplied over the signal wiring. The conductor size shall be of the range 16-24 AWG. Signal wiring need not be shielded but use twisted pairs for best results. Do not run unshielded signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. If the digital controller is in an explosive atmosphere, do not remove the digital level controller covers when the circuit is alive, unless in an intrinsically safe installation. Avoid contact with leads and terminals. To power the digital level controller, connect the positive power lead to the + terminal and the negative power lead to the - terminal (see figure 4).

6. Electrical Connections

Grounding

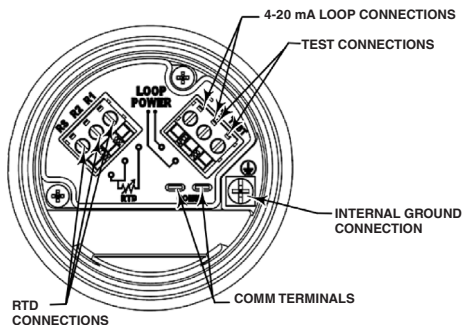
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WARNING

Personal injury or property damage can result from fire or explosion caused by the discharge of static electricity when flammable or hazardous gases are present. Connect a 14 AWG (2.1 mm²) ground strap between the digital level controller and earth ground when flammable or hazardous gases are present. Refer to national and local codes and standards for grounding requirements.

Figure 4. Digital Level Controller Terminal Box



The digital level controller operates with the current signal loop either floating or grounded. However, the extra noise in floating systems affects many types of readout devices. If the signal appears noisy or erratic, grounding the current signal loop at a single point may solve the problem. The best place to ground the loop is at the negative terminal of the power supply. As an alternative, ground either side of the readout device. Do not ground the current signal loop at more than one point.

6. Electrical Connections

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Shielded Wire

To achieve EMC immunity, the recommended grounding techniques for shielded wire usually call for dual grounding points for the shield. The shield can be connected at the power supply and the grounding terminals (internal or external at the instrument terminal box, shown in figure 4).

Power/Current Loop Connections

Use ordinary copper wire of sufficient size to ensure that the voltage across the digital level controller terminals does not go below 12.0 volts DC. Connect the current signal leads as shown in figure 2. After making connections, recheck the polarity and correctness of connections, then turn the power on.

RTD Connections

An RTD that senses process temperatures may be connected to the digital level controller. This permits the instrument to automatically make density corrections for temperature changes. For best results, locate the RTD as close to the displacer as practical. For optimum EMC performance, use shielded wire no longer than 3 meters (9.8 feet) to connect the RTD. Connect only one end of the shield. Connect the shield to either the internal ground connection in the instrument terminal box or to the RTD thermowell. Wire the RTD to the digital level controller as follows (refer to figure 4):

Two - Wire RTD Connections

1. Connect a jumper wire between the RS and R2 terminals in the terminal box.
2. Connect the RTD to the R1 and R2 terminals.

Three - Wire RTD Connections

1. Connect the 2 wires which are connected to the same end of the RTD to the RS and R1 terminals in the terminal box. Usually, these wires are the same color.
2. Connect the third wire to terminal R2. The resistance measured between this wire and either wire connected to terminal RS or R1 should read an equivalent resistance for the existing ambient temperature. Refer to the RTD manufacturer's temperature to resistance conversion table. Usually, this wire is a different color from the wires connected to the RS and R1 terminals.

6. Electrical Connections

Communication Connections

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WARNING

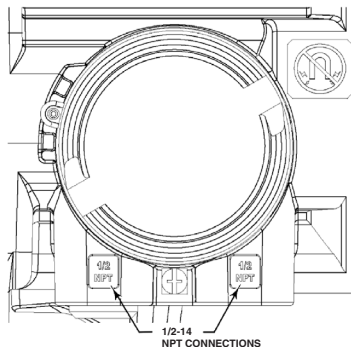
Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in an area which contains a potentially explosive atmosphere or has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal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

The Device Communicator interfaces with the DLC3100 directly via the COMM terminals inside the terminal box, as shown in figure 4.

Entries

Two 1/2-14 NPT entries are available for conduit connections, as shown in figure 5.

Figure 5. Internal Conduit Connections



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