

LONN 600-4 Series Tuning Fork Densimeter

Product sample

January 2018

The smart on-line density and concentration measuring meter is a solid instrument that provides a fully integrated plug-and-play and maintenance-free density measurement.

High-performance universal densimeter

High-precision hygienic densimeter

Plug-and-play densimeter

Liquid concentration measuring meter

- ◆ Petroleum industry
- ◆ Chemical industry
- ◆ Pharmaceutical industry
- ◆ Food and beverage industry
- ◆ Battery, electrolyte industry



Lonn 600-4 Density and Concentration Meter

Introduction

The Lonn 600-4 tuning fork densimeter is used to measure the density of liquid media in tanks and pipes. Density measurement is an important process control in the product manufacturing process. Tuning fork densimeter can be used as an indicator of other quality control parameters such as solids content or concentration values. It can meet a variety of measurement requirements on the density, concentration, and solid content.

Working principle

Lonn 600-4 series of on-line density, concentration meter uses a sonic frequency signal source to excite the metal tuning fork, making the tuning fork vibrate freely at the center frequency. As the frequency has an associated corresponding relationship with the density of the liquid contacted, it is possible to obtain the density of liquid by the analysis of frequency and eliminate the temperature drift of the system by temperature compensation. The concentration value can be calculated according to the relational expression of corresponding liquid density and concentration at 20°C.

Liquid densimeter	Granule limit		Air content	Max liquid viscosity
	Diameter of granule	Suspended granule %		
Lonn 600-4	< 10 um 10-50 um	<=40% <=20%	Normally unused	2000cP

Advantages

- Fully integrated plug-and-play and maintenance-free digital meter can be used for monitor and control
- Continuous measurement
- Free of movable parts and less maintenance
- Provide 316L, heusler alloy C and zirconium materials
- Density, standard density or special value (solid percentage, °API, proportion), 4-20mA output
- Provide temperature sensor
- Ex-Proof Equipment Certification
- Long-rod type is applicable to use in open tank and sealed tank
- The maximum length of long rod is up to 4m
- A small amount of solid and bubble is allowed
- Not subjected to temperature and pressure
- Plug type densimeter is applicable to use under high pipe pressure

Typical applications

Interface detection in the multi-product pipeline
Petroleum retail channels
Combined with volume flow meter for mass flow
Malt wort proportion (wine-making)
Serous fluid
Acid / alkali concentration control
Evaporator control
Product mixture
End-point detection in batch reactions
Solvent separation

Typical industries

Petroleum and petrochemical industry	– Interface detection — multi-oil pipeline
Wine-making industry	– Quality control — continuous on-line
Organic and inorganic chemical materials	–Leakage detection—buried tank of using salt water
Pharmaceutical	–Alcohol blending
Mineral processing (clay, carbonate, silicate)	–Traditional Chinese medicine concentrated liquid
	–Density of lithium hydroxide, electrolyte, sulfuric acid solution
Battery industry	

Attentions

Due to the needs of the process, Lonn 600-4 tuning fork densimeter is often installed in the site with harsh working conditions. In order to reduce the effect of working conditions on density sensor as much as possible, the following matters need to be noted:

- ★ The tuning fork densimeter should be installed in a place with less temperature change and without impact and vibration.
- ★ The measured medium should not freeze, otherwise it will damage the sensor components, resulting in damage to the tuning fork densimeter.
- ★ Prevent the densimeter from contacting corrosive or overheating medium.
- ★ Prevent sediment deposition in the tank.
- ★ The tuning fork densimeter should be handled carefully.
- ★ Do not drop the instrument directly.
- ★ Do not measure highly corrosive liquids.
- ★ Do not make the instrument work above the rated pressure.
- ★ Pressure test should not be over the specified test pressure.
- ★ The instrument is suitable for all explosion-proof occasions.

★ Do not weld the pipe when the tuning fork densimeter is being installed.

Density performance

Accuracy ⁽¹⁾	$\pm 0.001\text{g/cc}$	$\pm 1.0\text{kg/m}^3$
Working range ⁽²⁾	0 - 3g/cc	0 - 3000kg/m ³
Repeatability	$\pm 0.0005\text{g/cc}$	$\pm 0.5\text{kg/m}^3$
Process temperature effect (calibrated) ⁽³⁾	$\pm 0.0001\text{g/cc}$	$\pm 0.1\text{kg/m}^3$
Process pressure effect (calibrated) ⁽⁴⁾	Negligible	

(1) The above accuracy applies to the calibration range 0.6-1.25g/cc (600-1250 kg/m³).

(2) When the long rod is used, the viscosity of the liquid up to 500cP.

(3) The temperature effect refers to the maximum measurement deviation caused by the deviation of the process fluid temperature from the factory calibration temperature.

(4) The pressure effect is defined as the change in sensor flow and density sensitivity due to the deviation of the process pressure from the calibration pressure.

Temperature specification

Process temperature	-10°C - 120°C
Ambient temperature	-10°C - 85°C
Temperature coefficient	0.1kg/m ³ /°C (calibrated)
Built-in temperature sensor	PT100

Structure material

Component contacting liquid	Stainless steel 316L, heusler alloy C, zirconium
Fork polishing	Standard, PFA coating or electropolishing
Shell	IP65, aluminium alloy

Weight

Short rod	Stainless steel 3.5KG
-----------	-----------------------

Long rod	Determined by the length of rod
----------	---------------------------------

Rated pressure value

Maximum working pressure ⁽¹⁾	Short rod	200 bar
Testing pressure	Long rod	100 bar

(1) The actual maximum working pressure is subject to process connection rating.

Process connection

Process connection type	Flange
	Clamping band
	Thread

Classification of dangerous areas

Explosion proof

Explosion-proof certification	
Lonn 600-4	Ex d IIB T6 Gb

Electrical characteristics

Power source requirement	24VDC, 100mA
Output	4-wire system, 4-20mA
Electrical interface	M20 * 1.5

Range of fluid viscosity

Viscosity requirement	0-2000 cP
-----------------------	-----------

Compatibility of liquid and material

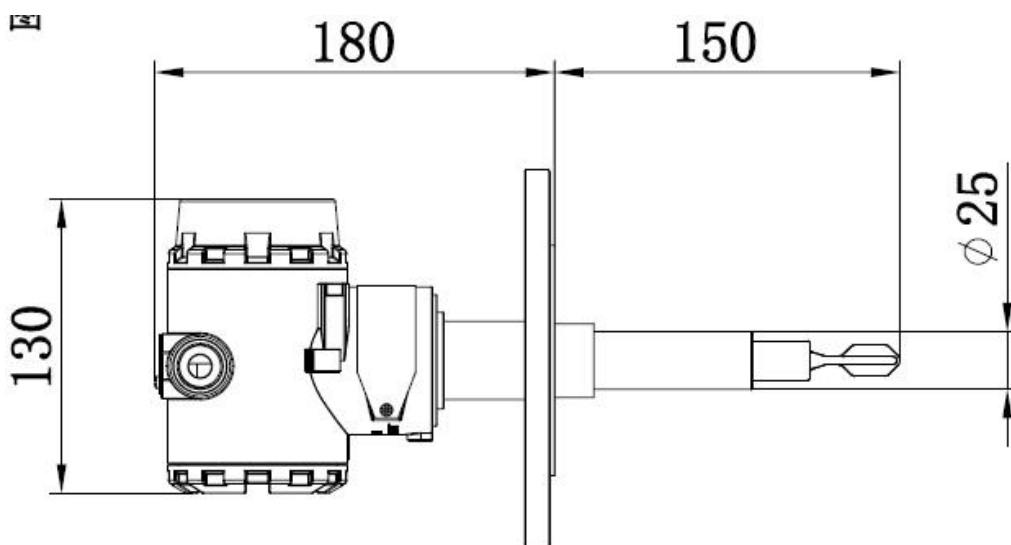
The following table gives the instructions to the compatibility of liquid and material for Lonn 600-4 tuning fork densimeter.

Liquid	Type	Molecular formula	Concentration (%)	Zr	Heusler alloy C	Stainless steel
Acid	Hydrochloric acid	HCl	0-40	☆	○	×
	Sulphuric acid	H ₂ SO ₄	0-50	☆	○	○
			50-75	○	○	×
			75-98	○	○	○
	Hydrogen nitrate	HNO ₃	0-100	☆	○	○
	Phosphoric acid	H ₃ PO ₄	0-98	×	☆	○
Alkali	Sodium hydrate	NaOH	0-100	×	☆	○
	Potassium hydrate	KOH	0-50	☆	☆	○
	Calcium hydroxide	Ca(OH) ₂	0-50	○	☆	○
Others	Carbamide Sodium	(NH ₂) ₂ CO	0-100	☆	☆	☆
	Hypochlorite	NaOCl	0-16	×	○	×
	Perhydrol	H ₂ O ₂	0-90	×	☆	×

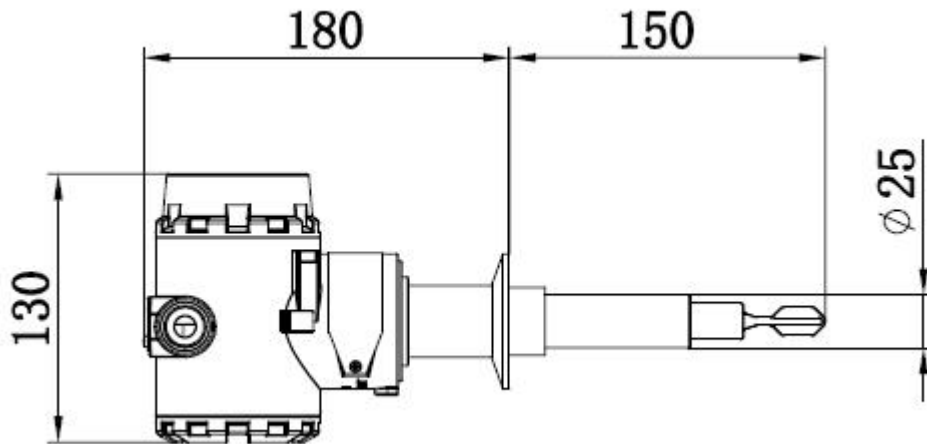
☆ Recommended ○ Use in specific concentration and temperature × Inapplicable

Size diagram

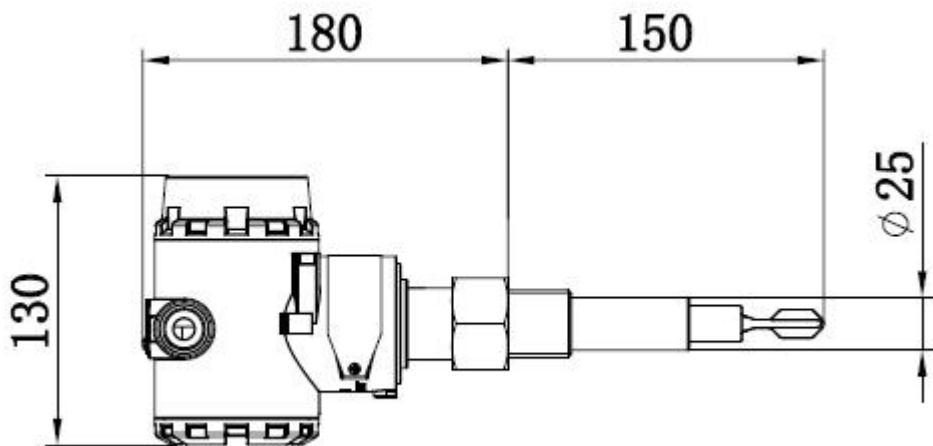
Flange connection



Connection with clamping band

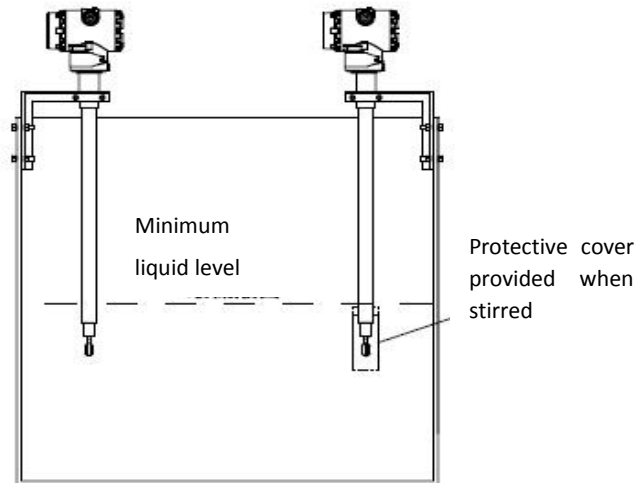


Threaded connection



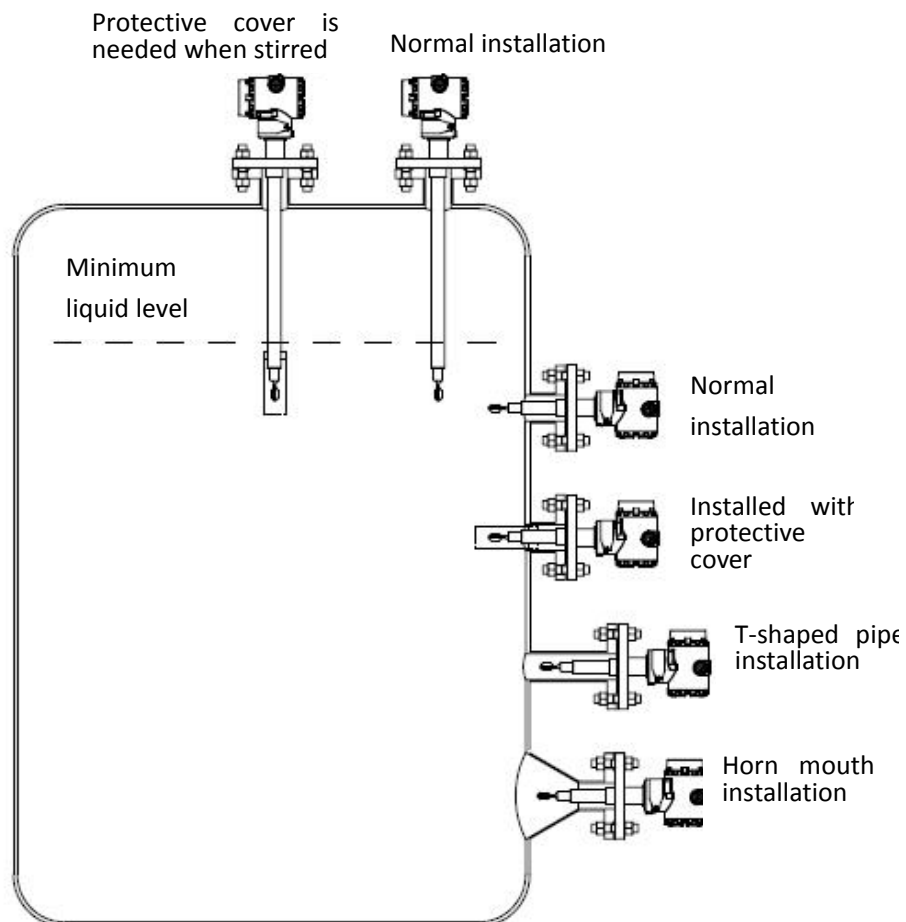
Note: The above insertion length is up to 4m.

Installation**Installation in open pool or tank**



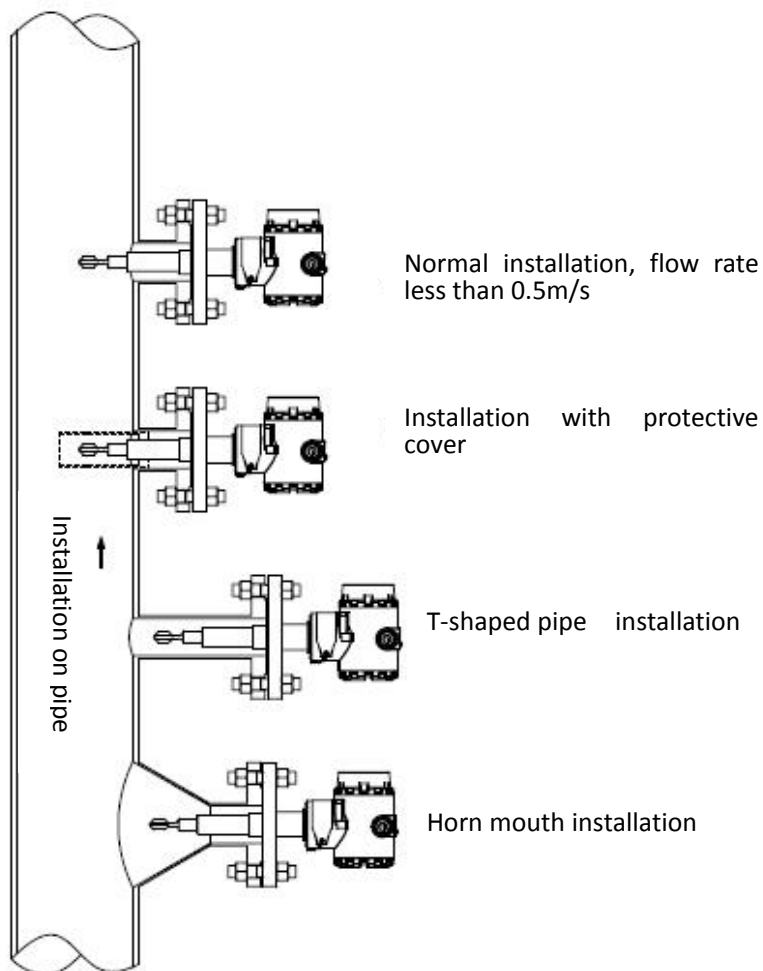
Important: When installed in an open pool or tank, a bracket shall be used for fixing. Note that the tuning fork will not work unless it is below the minimum liquid level. When the open pool or the open tank is stirred, a protective cover is needed. For this type of installation, the insertion rod is long up to 4 meters.

Installation in sealed pool or tank



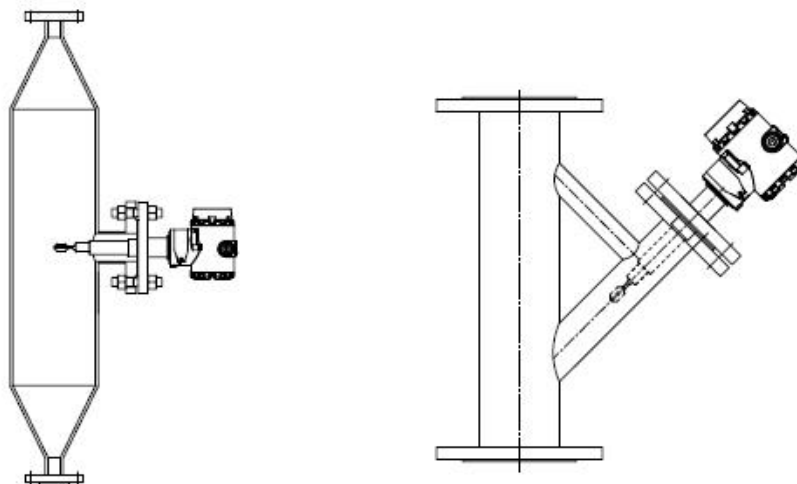
Important: A. The installation is the same as that of open pool or tank when it is installed atop the sealed tank. The tuning fork should be below the liquid level. A protective cover is needed when stirred, which is usually applicable to top-open tank or buried tank. To change the insertion depth, a flanged mount can be used. B. The fork of tuning fork densimeter is not fully sealed. The boundary effect produced to fluidity by pipe wall and tank wall and viscosity effect of medium to be measured will bring about a certain effect to measurement and calibration of the sensor. To overcome these effects, we designed different installation types and pipe diameters for different environments. When the tuning fork densimeter is installed by the side of the tank without stirring, the tuning fork should directly inserted into the tank; where there is stirring without sedimentation, a protective cover or a T-shaped bushing is advised to be installed with the fork in the protective cover or the T-shaped bushing; when there is stirring together with sedimentation, the bell mouth type installation shall be adopted.

Installation on pipe



Important: The fork of tuning fork densimeter is not fully sealed. The boundary effect produced to fluidity by pipe wall and tank wall and viscosity effect of medium to be measured will bring about a certain effect to measurement and calibration of the sensor. To overcome these

effects, we designed different installation types and pipe diameters for different environments. For pipe installation, when the flow rate is within 0.5m/s, the fork can be directly inserted into the pipe; when the flow rate exceeds 0.5m/s and no sedimentation, it can be installed with a protective cover or T-shaped bushing with the fork in the protective cover or the T-shaped bushing. When there is sedimentation, the bell mouth type installation shall be adopted. At any time, the opening of the fork should be vertical to prevent deposits or bubbles from accumulating on the fork body.



Important: When the main pipe’s diameter is smaller, the variable-diameter installation can be adopted, as shown on the left. When the pipe flow rate is high, with sedimentation and bubbles, the installation on the right is adopted. The right part can be provided as an accessory, the typical application is for desulfurization mortar density measurement.

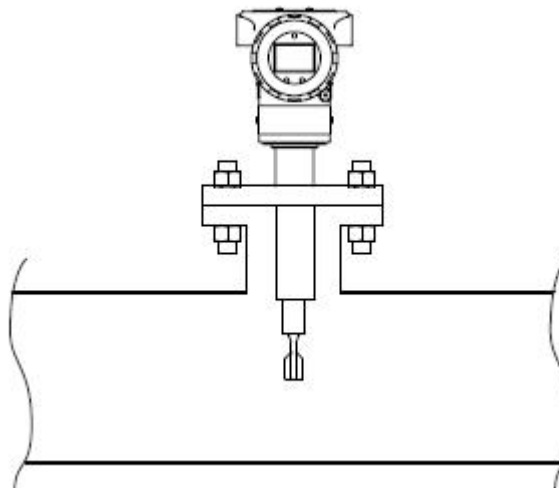
Instructions to installation in pipe

In order to ensure the densimeter can accurately measure and display steadily, the measured medium’s flow rate must be not more than 1m/s and the densimeter should be installed as far as possible away from the pump with the distance better greater than 5m; when the flow rate is greater than 1m/s, diameter-expansion installation shall be adopted. For each additional 1m of flow rate, the diameter of the pipe for installing densimeter should be expanded by 1.5 times. There should be a straight pipe section ≥ 600 mm in front of the instrument. There should be a straight pipe section ≥ 300 mm at the back of the instrument to ensure that the fluid is in a laminar flow state when flowing through the fork.

Installation standard	Straight flow	T-shaped side opening (pipe dia. 2" or 3" or welded pipe)	Fluid goes through vessel
Description	The fork directly enters the fluidity	The fork retracted into the side-opening part of pipe by 25.4mm to keep away from	The fork is placed in a straight-flow vessel making fluid form a

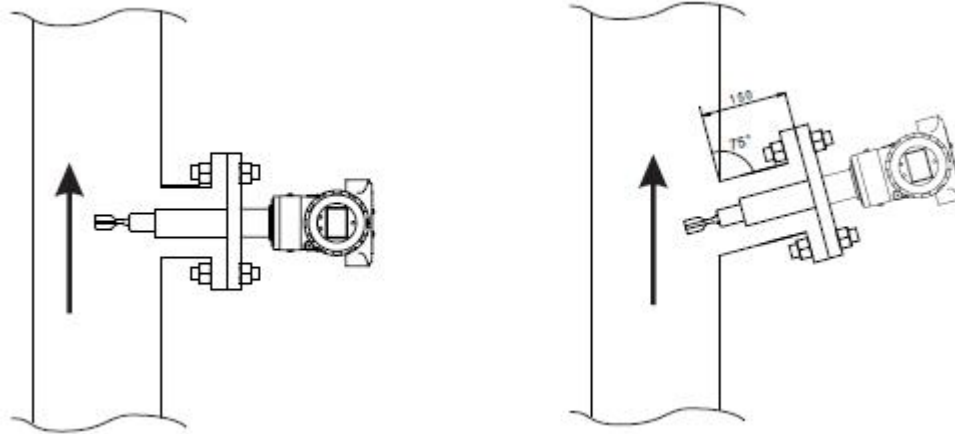
		fluid	inverse flow
Velocity of flow	The flow rate through the fork 0.3-0.5m/s	The flow rate of major pipe 0.3-0.5m/s	10-30L/min
Range of viscosity	Max 2000cP	Max 500cP	Max 2000cP
Medium temperature	-10~120°C	-10~120°C	-10~120°C
Size of major pipe	≥ horizontal pipe 100mm(4") ≥ vertical pipe 150mm(6")	≥50mm(2")	No limit
Advantages	1. Easy for installation in pipe of large diameter; 2. Good effect for purification solution or unwaxed oils	1. Easy for installation in pipe of large diameter; 2. Good effect for purification solution or unwaxed oils	1. Applicable to installation in pipes of different diameters or tanks 2. Good effect for circulating solution and temperature regulation 3. Fast response
Disadvantage	1. Low flow rate or unstable flow rate; 2. Small pipe diameter	Inapplicable to: 1. Turbid solution or mud 2. Low flow rate or unstable flow rate 3. The solution having a gradual change of flow rate 4. Pipe with a small diameter 5. Significant temperature effect	System design needs to be done for special measurements. Rinse the tubing frequently

Typical installation and precautions



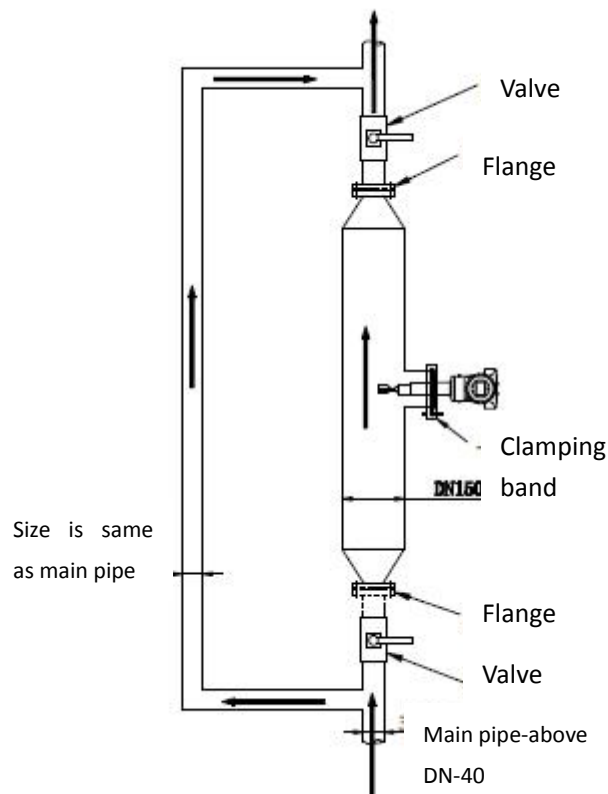
For installation on horizontal pipe, the flange opening is recommended to be made on the side

of the pipe. If the flange opening cannot be made on the side of the pipe due to installation space, and can only be made at the top of the pipe, the fork should be ensured to be completely immersed below the liquid level (the pipe under the flange is easy to). When installing, note that the opening direction of the fork should be parallel to the flow direction.

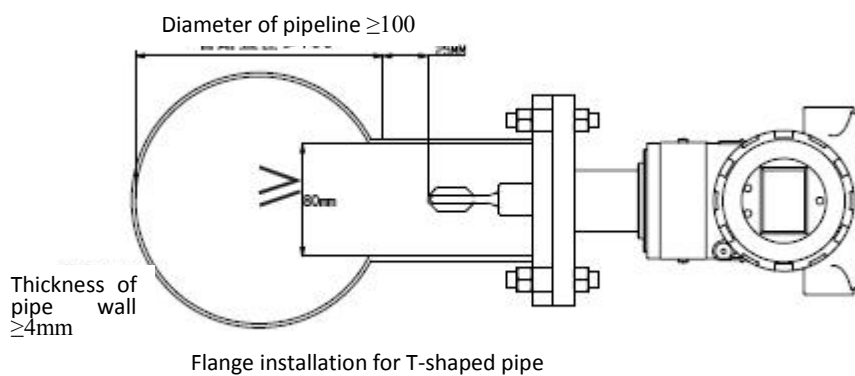


For vertical installation, when the densimeter is mounted on the pipe with the fluid flowing vertically upward and the flow rate $\leq 0.5\text{m/s}$, the above picture on the left will be referred for installation.

For vertical installation, when the densimeter is mounted on the pipe with the fluid flowing vertically upward and the flow rate is $0.5\text{-}3\text{m/s}$ or the medium is viscous, the above picture on the right will be referred for installation.



The above bypass installation method is suggested when pipeline ≥ 150 .



Flange installation for T-shaped pipe

Applicable conditions:

Velocity of flow: 0.5 – 3/ms (main pipeline)

Range of viscosity: ≤ 250 cP

Range of temperature: -10 – 120°C

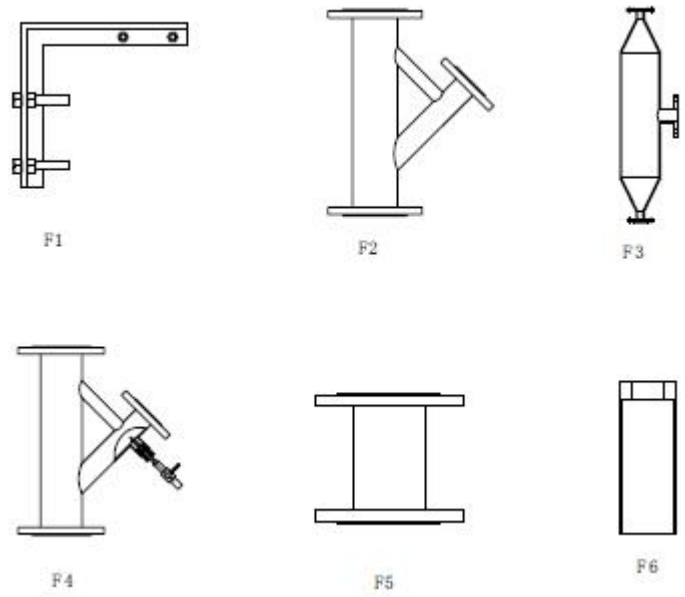
Flange's heat may affect the sensor's temperature, which may bring about certain impact on response time. Main pipe's flow rate and medium viscosity must meet the conditions of use, the medium in T-shaped pipe area must be ensured to flow continuously. At higher viscosities, this

type of installation is less rapid than straight-flow installation in response time.

Select model and ordering

Lonon 600-4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Tuning fork densimeter
Measuring range	1						0 –1.2g/cm ³
	2						0 –2g/cm ³
	X						Others
Process interface		D1					2" 150LB flange
		D2					2" 300LB flange
		D3					Dn50 PN25 flange
		D4					Dn50 PN40 flange
		K1					2" clamping band
		K2					3" clamping band
		M1					G3/4 thread
		M2					G1 thread
		XX					Others
Material contacting liquid			J1				316
			J2				Titanium
			J3				Zirconium
			J4				Heusler alloy C
			JX				Others
Surface treatment				A			Standard polishing
				B			Electropolishing
				C			PFA coating
Insertion length					0		Standard length
					1		100mm
					2		200mm
					3		300mm
					5		500mm
					X		Others
Accessories					F0		None
					F1		Installation bracket
					F2		Bypass pipe
					F3		Circulation room
					F4		Flush port
					F5		Flange mount
					F6		Protective cover
					FX		Others

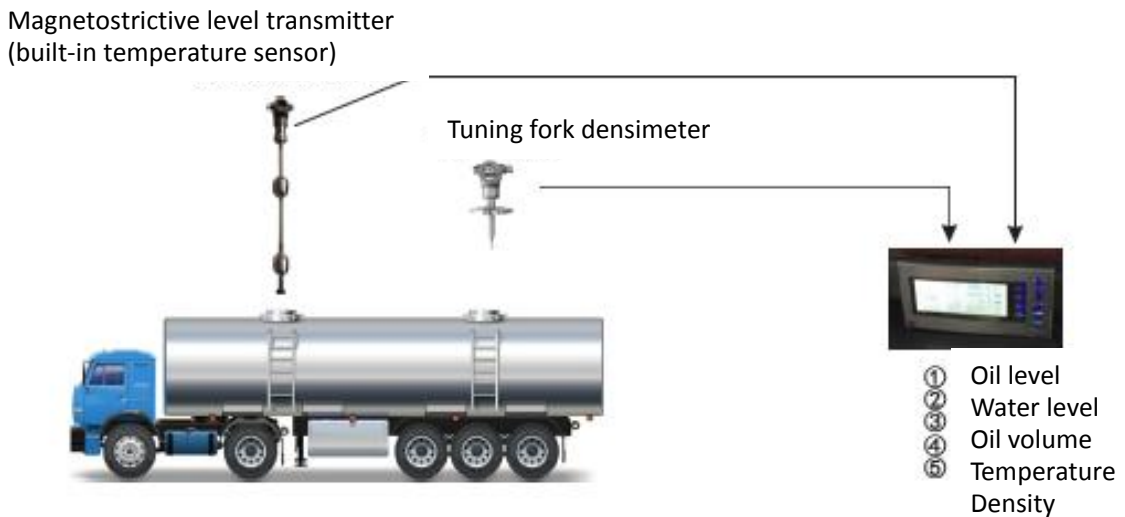
Pictures of accessories



Note: The above accessories are optional parts and only provide 316 stainless steel. The specific size is related to the selected tuning fork densimeter.

Application

Oil tanker's density and liquid level detection system



Gas station and oil tanker monitoring and management system is designed for the automated management of tanks. The system can realize the automatic monitoring of the oil in the oil tank under the condition that the oil tank is sealed. Through the automatic real-time monitoring of the oil parameters in the oil storage tank, the operation of the oil storage tank can be directly reflected, such as the oil reserve in oil tank, oil temperature, density, oil's dynamic changes and other parameters. Our tuning fork densimeter, level meter and thermometer mounted on the tank can achieve the automatic real-time online detection of oil density, level, water level, temperature,

volume and other parameters.

Crude oil and fuel oil are transported from refineries to end users through complex distribution systems. Determining the type of oil is very necessary because different types of oil will be transported through different distribution systems. Oil is directed to the appropriate product tank at the system's discharge end. Accurate and reliable interface testing is required to ensure that each product is eventually stored correctly because product contamination will cost much. In operation, the basic measurement of pipe oil density is divided into static measurement and dynamic (online) measurement. Static measurement is generally conducted by analyzing the collected samples to obtain the density, this method has the advantages of low cost, simple, and high measurement accuracy, but it cannot reflect the changes in density in real time, and there are human factors and the shortcomings of low efficiency, which no longer meets the needs of modern measurement.

The use of tuning fork densimeter to achieve dynamic measurement has the following advantages: 1) high efficiency and easy to achieve automatic control; 2) small human factors; 3) real-time; 4) easy to install. With the above advantages, this tuning fork densimeter is the preferred one for on-line detection of density.

The Global Prospect to Embrace A Win-win Future



Xi'an Lonn M&E Equipment Co.,Ltd

12th South of Chang'an road, Yan ta Dist. Xi'an City, Shaanxi Province , China

 +86-29-8866-1865  +86-29-8866-0964

 xalonn@aliyun.com

 www.xalonn.com

 www.facebook.com/xianlonn

 www.linkedin.com/company/13385899