SPX504 TUNING FORK RESONANT DENSITY METER

MAIN FEATURES

- The use of industrial-grade high-performance micro-controller integrated circuit, high accuracy, good stability, strong anti-jamming ability.
- Power supply using isolation circuit design, wide-format precision power supply, impact resistance, anti-jamming.
- "Plug and use, maintenance-free" measurements for monitoring and controlling continuous measurements
- Sensor signal with photoelectric compartment design with 4-20 mA output, connectivity PLC control system
- Long rod type is suitable for use in open and sealed tanks and cans up to 2m in length
- Explosion-proof certification

OVERVIEW

SPX504 tuning fork densitometer is installed by plug-in type, which is widely applicable to the detection of medium density in pipeline, open tank container and closed tank container. The fluid density directly depends on the vibration frequency received by the tuning fork when the sensor is inserted into the medium. The built-in temperature sensor provides temperature compensation for the sensor.

Application: petrochemical industry, brewing industry, food industry, pharmaceutical industry and mineral processing (such as clay, carbonate, silicate, etc.), specifically applied to the interface detection of multi product pipeline in the above industries, density detection of mixing mixture, end point monitoring of reactor, interface detection of separator.

WORKING PRINCIPLE

The sensor of tuning fork densitometer is designed according to the vibration principle of components. This vibrating element is similar to a tuning fork with two teeth. The fork body vibrates because of a piezoelectric crystal located at the root of the teeth. The frequency of vibration is detected by another piezoelectric crystal. Through phase-shifting and amplification circuit, the fork body is stabilized on the natural resonance frequency. When the medium flows through the fork, the change of resonance frequency is caused by the change of medium quality.

The density and vibration frequency of the medium conform to the following mathematical formula:

$D = K_0 + K_1 T + K_2 T_2$

In the formula: D = density of measured medium, T = natural frequency of the fork, T_2 = frequency of the measured medium passing through the fork

K_0, K_1, K_2 = constant

According to this formula, the accurate density of the medium can be calculated by the electronic processing unit.

PRESSURE AND TEMPERATURE LIMITS FOR PROCESS CONNECTIONS

You must ensure that the pressure and temperature limits of the instrument are not exceeded (if necessary), using suitable safety accessories. The pressure and temperature ratings of the instrument connections are in accordance with the relevant flange standards. Check the latest standards for process connections.

See table for pressure and temperature limits for zirconium process connections.

Process flange type	Process and Temperature Ratings			
	100°F (37.8°C)	199.9°F (93.3°C)	299.8°F (148.8°C)	392°F (200°C)
2" ANSI 150	226.3pis(15.6bar)	197.3pis(13.6bar)	159.5pis(11.0bar)	110.2pis(7.6bar)
2" ANSI 300	588.9pis(40.6bar)	513.4pis(35.4bar)	417.7pis(28.8bar)	336.5pis(23.2bar)
DN50 PN16	229.2pis(15.8bar)	175.5pis(12.1bar)	137.8pis(9.5bar)	107.3pis(7.4bar)
DN50 PN40	571.5pis(39.4bar)	439.5pis(30.3bar)	342.3pis(23.6bar)	266.9pis(18.4bar)

SPECIFICATION

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Density range	0.5 – 2.5 g /cc (0 – 2500 kg/m3), 0~100%
Calibration range	0.5 – 2.5 g /cc (0 – 2500 kg/m3), 0~100%
Accuracy	± 0.001 g /cc (± 1 kg/m3)/± 0.002 g /cc (± 2 kg/m3)
Repeatability	± 0.0001 g /cc (± 0.1 kg/m3)
Sensitivity level	0.0001 cm3 / g
Temperature range	-40°C ~ +150°C
Max. working pressure	0.1～4Mpa(customized 20MPa)
Fluid viscosity range	0 – 600 cP
Temperature coefficient	＜0.1 kg / m3 / °C(±0.5%)（after correction）
Pressure effect	Negligible
Built in temperature sensor	PT100
Wetting material	316L, 2205 Stainless steel, Hacalloy, Titanium alloy
Fork coating	Standard, PTFE or PFA
Power supply	24VDC，≥500mA
Signal output	4 -20 mA, 0-1000Hz, RS232, RS485 Modbus RTU
Output accuracy (20 °C)	± 0.1% of reading or ± 0.05% FS
Output repeatability (- 40 ~ + 85 °C)	+ 0.05% FS
Process connection	Flange, thread, hygienic chuck
Protection level	IP67
Shell material	Aluminium alloy

• Guide for liquid and material compatibility of tuning fork densitometers

Liquid type	Name	Molecular formula	Concentration (%)	Zirconium	Ha C	Stainless steel
acid	hydrochloric acid	HCl	0-40	☆	○	×
	sulphuric acid	H2SO4	0-50	☆	○	○
		H2SO4	50-75	○	○	×
		H2SO4	75-98	○	○	○
	nitric acid	HNO3	0-100	☆	○	○
	phosphoric acid	H3PO4	0-98	×	☆	○
alkali	sodium hydroxide	NaOH	0-100	×	☆	○
	Potassium hydroxide	KOH	0-50	☆	☆	○
	calcium hydroxide	Ca(OH)2	0-50	○	☆	○
others	Urea (urea)	(NH2)2　CO	0-100	☆	☆	×
	sodium hypochlorite	NaOCl	0-16	×	○	×
	hydrogen peroxide	H2O2	0-90	×	☆	☆
☆Recommended ○ use under specific concentration and temperature limit × not use						

DIMENSION

Umit:mm
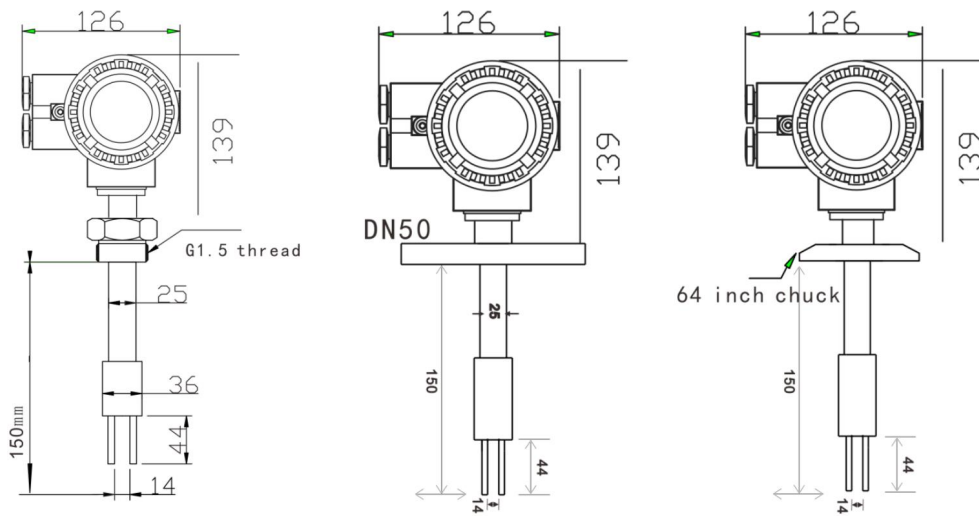
INSTALLATION

Installation	T-type side opening plug-in installation	T-type side opening and retracting installation
Description	Fork part goes directly into the mainstream	Fork body shrinks into the open part of the line side
Velocity	Supervisor Road Flow Rate 0-1m/s	Supervisor Road Flow Rate 1-5m/s
Viscosity range	Up to 20000CP	Up to 100CP
Temperature	-50-150°C	-50-150°C
Main pipe size	≥Horizontal pipe 100mm (4") ≥Vertical pipe 150mm (6")	≥50mm (2")
Advantages	Easy to install and high measurement accuracy	Reduces the wear of the grey paste fluid on the meter
Not available for	unstable flow rate	floc solution (e.g. pulp, etc.)
		unstable flow rate
	the supervisor caliber is less than DN100	viscosity has a progressive solution
		the supervisor caliber is less than DN50
		the temperature effect of significant situation

Calculation of velocity: V = Q / (1/4 *п*d2)
Example: flow 20m3 / h, pipe diameter 100mm
V = 20 / 3600 / (1 / 4 * 3.14 * 0.1 * 0.1) = 0.7 m / S

● Installation of open pool or open tank

Note: during the installation of open pool or open tank, support shall be used for fixing, and fork body of tuning fork can only be measured below the minimum liquid level. When there is mixing in open pool or open tank, protective cover shall be provided, and the inserting rod of tuning fork in this installation method is long, and the maximum length can be 2 meters.

Minimum liquid level

Oil mixing with protective cover
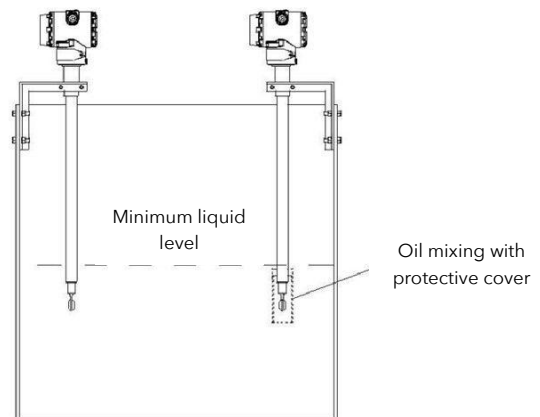
● Seal tank installation

A. When the tank is installed at the top, it is similar to the open tank. The tuning fork should be below the liquid level. When mixing, it needs to be equipped with a protective cover. Generally, it is only for the tank with the top opening or the buried tank. To change the insertion depth, use a section of the support with a flange.

B. The fork part of the tuning fork densitometer is not totally closed. The boundary effect of the tube wall or container wall on the fluid plus the viscosity effect of the measurement medium itself will have a certain impact on the measurement and calibration of the sensor. In order to overcome these problems, according to different environments, we have summarized and set up the installation mode and pipe diameter to facilitate the selection under the same conditions. When the tank is installed at the side, the tuning fork can be directly extended into the tank without stirring; when there is stirring and no sedimentation, it can be installed with protective cover or T-shaped casing, and the tuning fork is in the protective cover or T-shaped casing; when there is stirring and sedimentation, it can be installed with bell mouth
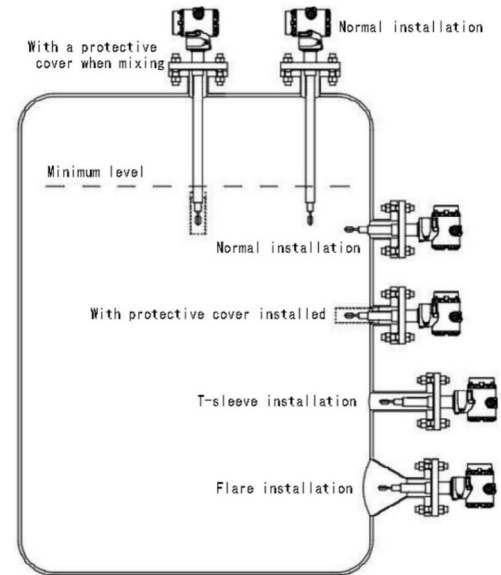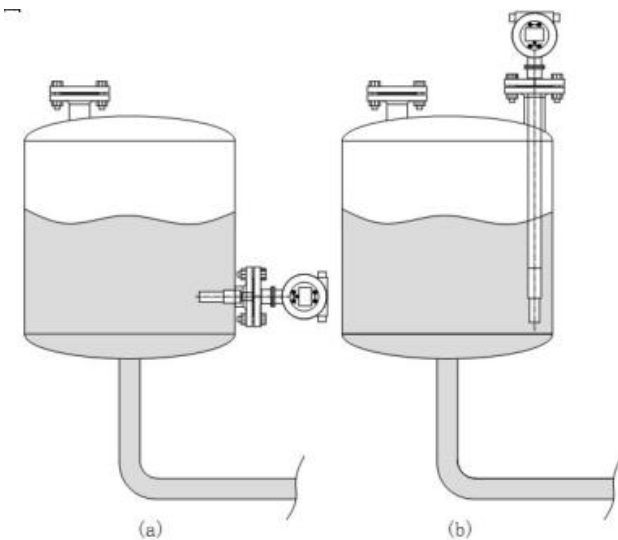
● Pipe installation

Note: the fork part of the tuning fork densitometer is not totally closed. The boundary effect of the tube wall or container wall on the fluid plus the viscosity effect of the measuring medium itself will have a certain impact on the measurement and calibration of the sensor. In order to overcome these problems, according to different environments, we have summarized and set up the installation mode and pipe diameter to facilitate the selection under the same conditions. For pipeline installation, when the flow rate is less than 0.5m/s, the tuning fork can be directly extended into the pipeline; when the flow rate is more than 0.5m/s and there is no precipitation, the tuning fork can be installed with a protective cover or T-shaped casing, and the tuning fork can be installed in the protective cover or T-shaped casing; when there is precipitation, it can be installed with a bell mouth. At any time, the opening direction of the fork body should be in the vertical direction to avoid the accumulation of sediment or bubbles in the fork body Up.
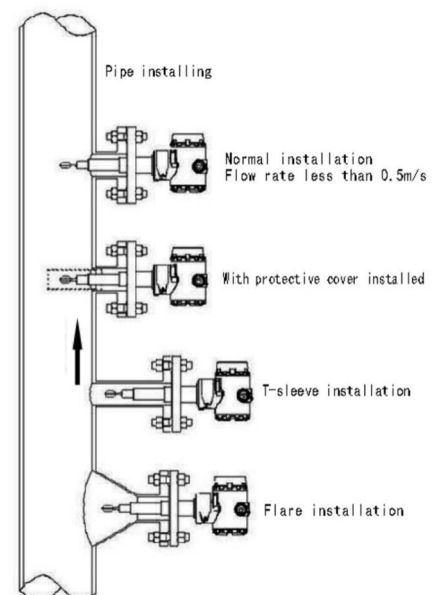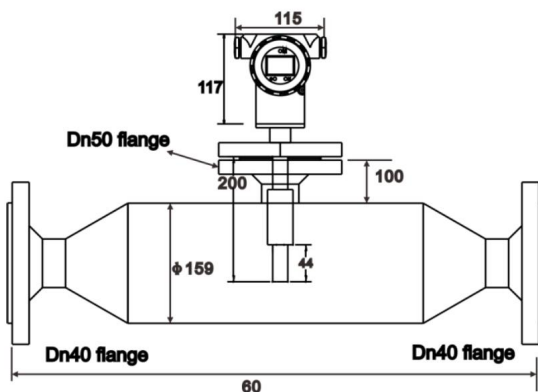
ORDER CODE

SPX504	tuning fork densitometer									
	CODE	Type								
	I	industrial type								
	H	hygienic type								
		CODE	Range							
		S	0.5– 2.5 g /cc (500 – 2500 kg/m3)							
			CODE	Wetted part material						
			S	316L stainless steel						
			H	Hastelloy alloy						
			C	More customized						
				CODE	Process connection					
				A	ANSI 150 ~1500 RF					
				DP1	DIN 50 PN16 flange					
				DP4	DIN 50 PN40 flange					
				S	IDF and RJT sanitary					
				O	More customized					
					CODE	Insertion length				
					1	150mm				
					2	More customized				
						CODE	Fork coating			
						S	Standard type			
						P	PTFE			
						E	Electrolytic polishing			
						C	More customized			
							CODE	Working pressure		
							S	207 bar (3000psi)		
							C	More customized		
								CODE	Working temperature	
								S	-50°C~ +200°C	
								C	More customized	
									CODE	Signal output
									A1	4 -20 mA
									R2	RS485
									C	More customized
SPX504	I	S	S	DP1	1	S	S	S	A1	-