

S1000 series

Sensors for online monitoring of density,
viscosity and temperature



Small, robust and precise

Products

The S1000 Density and Viscosity online monitoring sensor uses the world's most advanced piezoelectric resonance MEMS components, through the internal integration of high-precision signal sampling and processing unit, combined with advanced algorithms, can be real-time and automatic detection of three indicators of the density, viscosity and temperature of the liquid.

The S1000 is simple to use and operates without personnel involvement, all testing is done automatically by the sensor, users only need to install it in the pipeline to achieve the process of density, viscosity and temperature measurement in the production process, or through the offline kit to achieve laboratory analysis.

The S1000 is a compact, intelligent, reliable and feature-rich online monitoring sensor that greatly increases your return on investment and provides you with a reliable basis for quality control in your production process.



Measuring principle

S1000 adopts the piezoelectric resonance mode to obtain the relevant parameters by controlling the vibrator parts to work in the resonance state.

Its vibration period T is related to the density of the liquid:

$$\rho = K_0 + K_1 * T + K_2 * T^2 \quad (K_0 \ K_1 \ K_2 \text{ are the instrument calibration parameter})$$

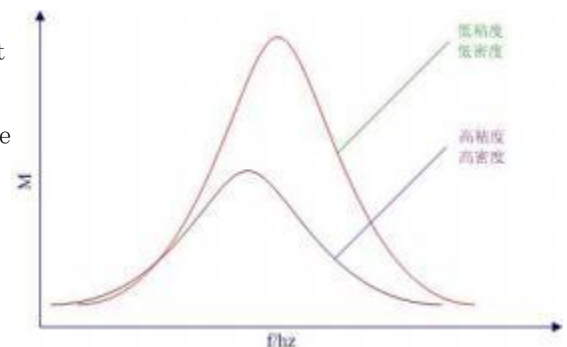
The vibration quality factor Q is viscosity dependent:

$$\eta = C_0 + C_1 * Q + C_2 * Q^2 \quad (C_0 \ C_1 \ C_2 \text{ are the instrument calibration parameter})$$

Kinematic viscosity can also be converted according to the following formula:

$$\mu = \eta / \rho \quad (\rho - \text{kinematic viscosity } \text{mm}^2/\text{s} = \text{cSt}, \eta - \text{dynamic viscosity } \text{mPa}\cdot\text{s} = \text{cP},$$

$$\rho - \text{density } \text{g}\cdot\text{cm}^{-3} = 1000\text{kg}\cdot\text{m}^{-3})$$



Key features

- Imported probe, high accuracy measurement of density, viscosity and temperature
- Density accuracy up to $\pm 5\text{kg}\cdot\text{m}^{-3}$
- Viscosity range 1~1000cP, accuracy up to 5%.
- Wide range of permissible fluid temperatures, from 0°C to 100°C.
- Fast response, data refresh per second
- Measurements are unaffected by external vibration
- All stainless steel for on-line monitoring robustness requirements
- Excellent chemical and pressure resistance
- No moving parts, no consumables, 10 year life span
- Multiple approvals and test reports
- Compact size for easy system integration
- Convenient integrated module for on-site calibration



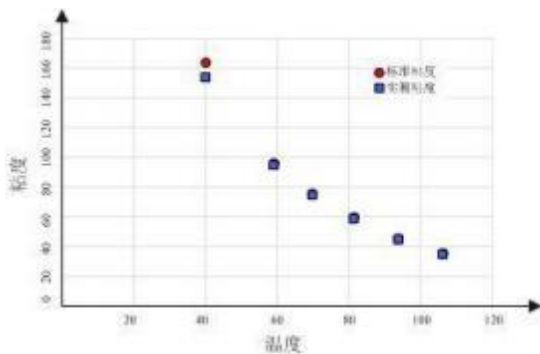
Applicable samples

- Lubricating Oil
- Hydraulic oil
- Gearbox oil
- Petrol, diesel
- Aviation fuel
- Paraffin
- Biodiesel
- Ethanol
- Chemical Reagents
- Coatings and Inks
- Food Processing
- Laboratory Analysis

Applications

- Fuel Storage & Transportation Segment
- Refining, oil industry
- Wind power
- Thermal power generation and other power generation industries
- Aviation, marine, railway and other transport industries
- Offshore engineering such as drilling rigs
- Large construction machinery and equipment
- Transport vehicles
- Seawater treatment and testing equipment
- Oil treatment equipment
- Chemical laboratory analysis
- Process Quality Management
- Oil treatment and filtration systems
- Coatings, inks and printing industry
- Medical equipment

Accurate detection

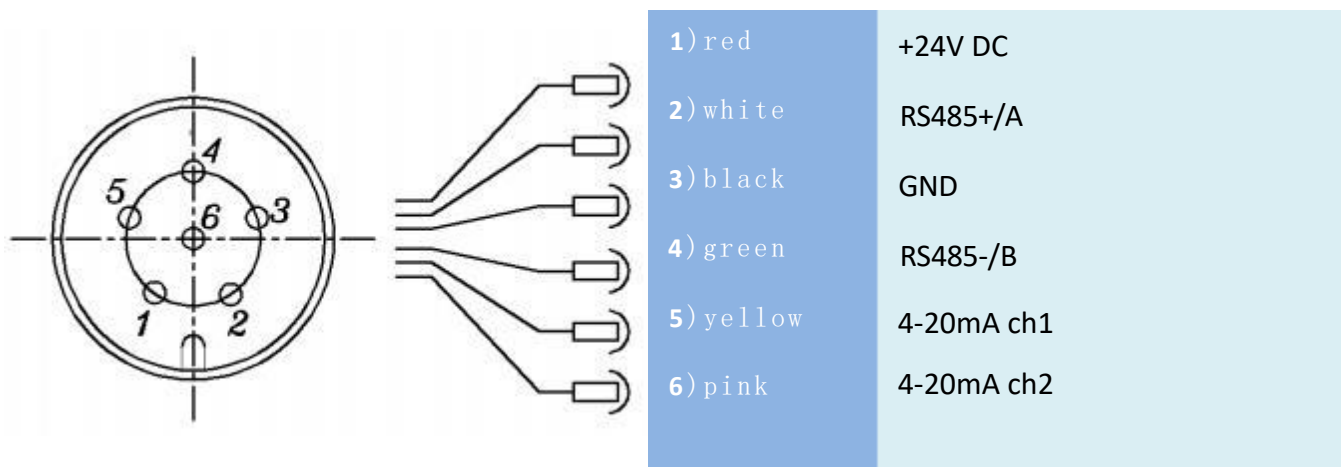


The full range of S1000 density, viscosity and temperature monitoring products are calibrated in the laboratory using National Institute of Standards and Technology (NIST) accredited standard solutions.

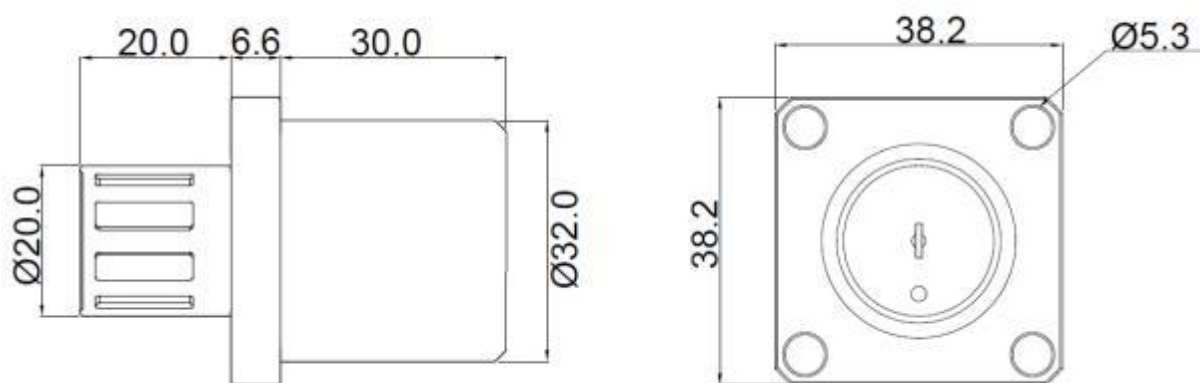
Technical parameters

Measurement indicators	density (kg.m ⁻³), dynamic viscosity (cP), temp (°C)
Measurement range	density 600 kg.m ⁻³ ...1250 kg.m ⁻³ *
	viscosity 1cP...1000cP (Please consult us for a larger range)*
	temp 0°C...100°C *
Accuracy @25°C typical	density 2% or 5kg.m ⁻³ whichever is the greater
	viscosity 5% or 1cP whichever is the greater
	temp 0.5°C
resolution	density 0.1 kg.m ⁻³
	viscosity 0.1cP
	temp 0.1°C
response time	Less than 30 seconds (first time), data refresh 1 time/second
digital output	RS485 MODBUS RTU
analogue output	2-way 3-wire 4-20mA, RL=500Ω (optional)
alarm node	2 way 250VAC/3A or 30VDC/3A
Supply Voltage	DC 9V-32V@RS485, DC20V-32V@4-20mA
Power Consumption	< 20mA@24Vdc RS485
Probe pressure resistance	max 10bar(Please consult us for a larger range)
fluid temperature	0°C... 100°C
environmental temperature	-40°C... 85°C
Storage temperature	-40°C... 80°C
Shell material	316/304 Stainless steel Hastelloy
Structural dimension	φ32×90 mm
mechanical interface	NESSI
weight	360g
protection class	IP66
Seal Material	FKM fluoroelastomer Inner Diameter 21.8 Outer Diameter 25.8 Wire Diameter 1.78
connection cable	2 metres M8 6-core
Maximum flow rate	<0.1 metres/second
standards-compliant	CE, ASTM1657, National Metrology and Testing Agency reports
Explosion-proof grade	EXia IIB T6 Ga (optional)
electromagnetic compatibility	EN 61326-1 EN 61326-2-3 ICES-003 Level B

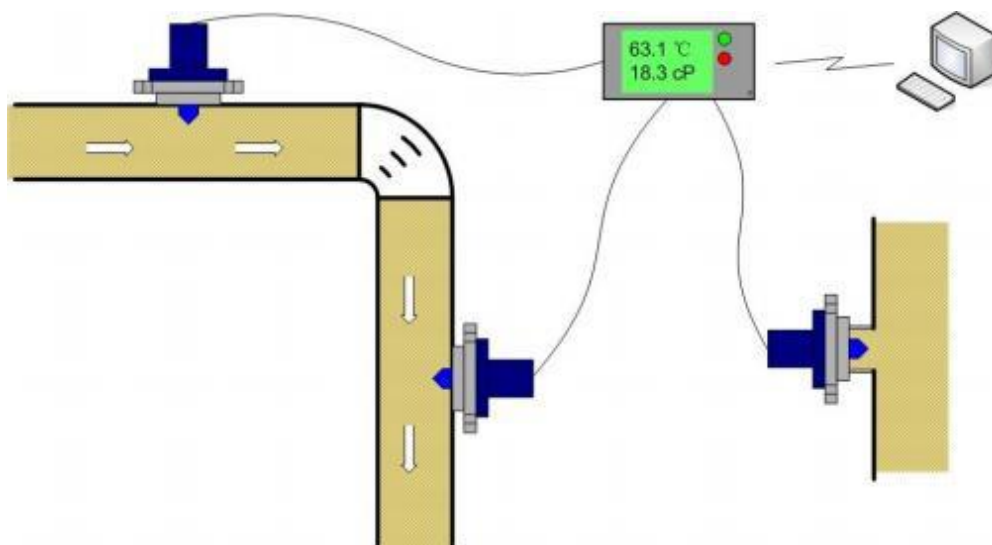
Interface Definition (M12 Female Flange Mount)



Structural dimensions (mm)



In-line installation (pipework, box)



Options and Accessories

Name of annex	Order Number
USB to RS485 Data Debugging Cable	LW-UR001
sealing gasket	LW -SO001
Offline Measurement Module	LW -OT001
Connection cable 2 metres, M8 threaded, 90° elbow	LW -CB001
Upper computer software OV600	LW -OV600
Display and Control Unit DDU400	LW -DP001

Offline Kits

The S1000 can be used in conjunction with the off-line measurement module LW-OT001 and the commissioning cable LW-UR001 to measure the density, viscosity and temperature of oil, ethanol or other reagents and liquids in the laboratory or in the field. With the PC or the LW-DP001 display and control unit, the user can obtain the exact density, viscosity and temperature of up to 5ml of sample in just 1 minute.



ShangHai LUWATECH Industrial Co.,Ltd.

Address: 2F, South Gate, Building 5, No. 333 Kangqiao East Road, Pudong New Area, Shanghai

TEL: 139173371469 (VX) 021-58073569

E-mail: maorong.long@luowansy.com

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