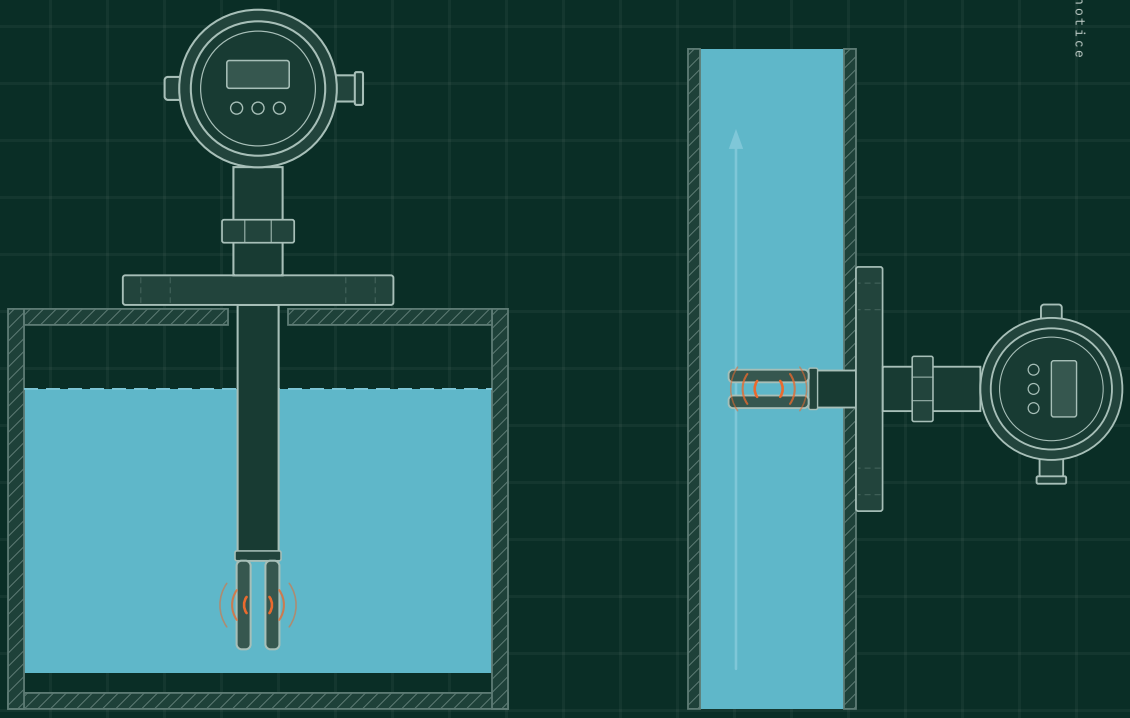
PS7400 · Tuning fork resonance · Online liquid density and concentration

Online Tuning Fork Density Meter

TECHNICAL SPECIFICATION

Resonant frequency method · Insertion mounting ·
Density ±0.001 g/cm³ · Direct concentration output

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▲ Left: flange mounting on a tank roof; right: side entry on a vertical pipe. The fork must always be immersed in the medium

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The PS7400 is an insertion-type online density meter. It measures liquid density by the tuning fork resonant frequency principle and outputs concentration directly, using the density–concentration relation of the selected medium; it can be installed on pipes and in open basins, storage tanks and reactors. Chapter 03 explains the conditions for the accuracy and the influencing factors — please read it before selection. Chapter 06 covers installation, where flow velocity, fork immersion and fork gap orientation decide whether the measurement is valid; chapter 12 is the ordering code.

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01 Scope and Key Data

The PS7400 is the online tuning fork density meter from Xi'an Pisonics (PISONICS). It continuously measures the density of liquids in pipes and tanks, converts it into concentration using the density–concentration relation of the selected medium, and displays and outputs the result via 4–20 mA, RS-485 or HART for process control and quality control.

The meter is of the insertion type: the fork at the end of the probe is inserted into the pipe or tank through a flange, clamp or thread connection, so no measuring spool is installed and the pipe bore is unchanged. In the remote version, the probe is suspended on a cable in open basins or storage tanks. The meter is intended for homogeneous liquids — solutions of acids, alkalis and salts, alcohols and organic solvents, sugar and pharmaceutical solutions; the medium should not contain large amounts of gas bubbles or solids.

Key data at a glance

0–2 g/cm³
density range (also 0–1.5; concentration 0–50 % or 0–100 %)

±1 kg/m³
density accuracy, i.e. ±0.001 g/cm³ (conditions: see 3.1)

0.1 kg/m³
repeatability ±0.1 kg/m³, i.e. ±0.0001 g/cm³

±0.5 %
concentration accuracy (to be verified for the medium, see 3.2)

120 °C
max. medium temperature (standard; 150 °C as special version)

0.4 MPa
max. working pressure (standard; 2 MPa as special version)

4–20 mA
4-wire active output; RS-485 or HART optional

IP67
ingress protection; flameproof Ex d IIC T6 Gb optional

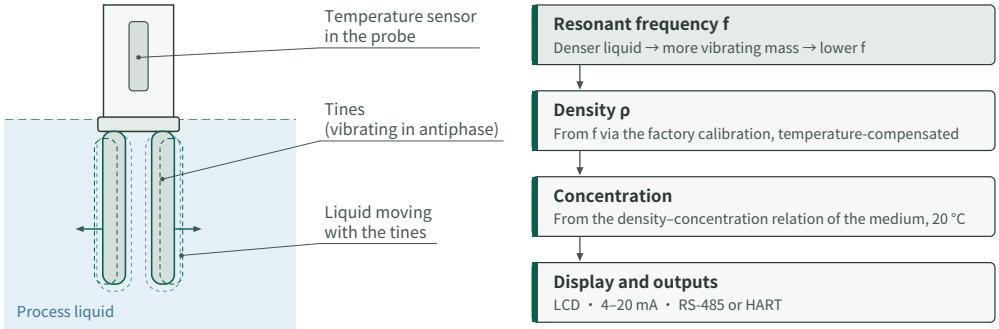
Before reading the data: The density accuracy of ±0.001 g/cm³ applies within the calibration range of 0.8 to 1.5 g/cm³ and under reference conditions, with the medium at the calibration temperature. Concentration is derived from density, so its error depends on how steeply the density of the medium changes with concentration; the conversion is valid only for solutions of a single solute, and multi-component mixtures give larger errors. See chapter 03.

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02 Measuring Principle

The meter measures the resonant frequency of the fork in the medium. The tines carry part of the liquid with them: the denser the liquid, the larger the vibrating mass and the lower the frequency.

The transmitter excites the metal fork at the probe tip with an audio-frequency signal, keeps it vibrating freely at resonance, detects the frequency and converts it to density using the factory calibration; a built-in temperature sensor compensates for temperature effects on the fork and its vibration.



▲ Working principle (dashed: co-vibrating liquid layer); right: from frequency to output

$$\rho \approx A \cdot \tau^2 + B$$

ρ density of the medium

τ resonant period of the fork, τ = 1 / f

A, B fork constants (mass, stiffness, geometry) from factory calibration; the co-vibrating mass rises linearly with ρ, so τ² is almost linear in ρ

2.1 How concentration is obtained

Concentration is not measured directly: the instrument converts density and temperature into concentration at 20 °C with the density–concentration–temperature relation stored for the selected medium (built-in media: chapter 09; for code “X Other”, the relation confirmed with the order is set at the factory).

2.2 Design features

- No moving parts; only fork, probe and process connection are wetted, material to suit the medium (chapter 04).
- Integral version: head, neck, probe and fork in one unit (flange, clamp or thread). Remote version: probe on a cable, suspended in open basins and storage tanks.
- The tines are separated by an open gap, not an enclosed cavity; the gap orientation decides whether bubbles and deposits can leave the fork (see chapter 06).

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03 Accuracy and Influencing Factors

This chapter gives the conditions for the density accuracy, the conversion of density error into concentration error, and the effects of temperature, bubbles, deposits, flow velocity and mounting position on the reading.

3.1 Conditions for the density accuracy

The density accuracy of ±0.001 g/cm³ (±1 kg/m³) and the repeatability of ±0.0001 g/cm³ apply under the following reference conditions:

Condition	Description
Density within the calibration range	0.8 to 1.5 g/cm³ (800 to 1500 kg/m³); for ranges beyond this band, the accuracy is confirmed with the order
Medium at the calibration temperature	additional error caused by a temperature deviation: see 3.3
Homogeneous liquid	no gas bubbles, no solids; fork fully immersed and clean
Installation and flow as in chapter 06	fork-to-wall distance, flow velocity and fork gap orientation as required; on-site calibration done (see 10.2)

3.2 Concentration accuracy depends on the medium

Concentration is derived from density: the same density error of ±0.001 g/cm³ gives a smaller concentration error the faster the density changes with concentration. Examples for common media at 20 °C:

Medium	Range (mass fraction)	Density change per 1 %	±0.001 g/cm³ equals
Sodium hydroxide NaOH	0 to 50 %	approx. +9.5 to +11 kg/m³	approx. ±0.1 %
Sulfuric acid H_2SO_4	0 to 50 %	approx. +7 to +9 kg/m³	approx. ±0.11 to ±0.15 %
Hydrochloric acid HCl	0 to 36 %	approx. +5 kg/m³	approx. ±0.2 %
Ammonia solution NH_3	0 to 30 %	approx. −3 to −4 kg/m³	approx. ±0.25 to ±0.33 %
Ethanol	0 to 100 %	approx. −1.3 to −2.9 kg/m³	approx. ±0.35 to ±0.75 %

Note: Rounded estimates from 20 °C density data in common handbooks, to show the order of magnitude only. The specified concentration accuracy is ±0.5 %; where density changes only slowly with concentration (e.g. ethanol at low concentrations), the error resulting from the density error alone can exceed ±0.5 % — verify for the medium and concentration range when ordering.
The density of sulfuric acid has a maximum at approx. 97 %: near it, one density corresponds to two concentrations, and above 90 % the density changes only slowly, so density alone cannot determine the concentration.

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3.3 Effect of temperature

The fork material and its vibration change with temperature; the built-in temperature sensor compensates for this in real time. After compensation, each 1 °C by which the medium temperature deviates from the factory calibration temperature adds at most ±0.0001 g/cm³ (concentration ±0.1 %) — at a deviation of 10 °C, up to ±0.001 g/cm³. If the operating temperature differs considerably from the calibration temperature, calibrate on site at operating temperature (see 10.2). The temperature measurement accuracy is ±0.5 °C; when the temperature changes rapidly, the stability of the reading is limited by how fast the compensation can follow.

3.4 Effect of medium condition and installation

Situation	Effect on reading	Remedy
Gas bubbles in the medium or on the fork	too low, unstable	avoid points where gas enters or is released; orient the fork gap as in chapter 06; more damping smooths the fluctuation but does not remove the bias
Scale, build-up or adhering material on the fork	too high, drifting slowly with the build-up	inspect and clean regularly; for crystallising or scaling media, fit a flush port (F4) and shorten the inspection interval
Solids settling in the fork gap	too high, unstable	orient the fork gap as in chapter 06; prevent sediment from accumulating in the tank; media with solids: see 11.2
Flow velocity above 1 m/s	unstable, less accurate	protective shield, enlarged section or bypass (see 6.3)
Fork too close to the pipe wall (wall effect)	offset from the factory calibration	more than 10 mm between fork and opposite pipe wall; on-site calibration after commissioning
High viscosity of the medium	thicker co-vibrating layer, too high	max. 2000 cP (to be confirmed for the medium); on-site calibration under operating conditions
Multi-component mixture	concentration conversion distorted	the conversion is valid for single-solute solutions only; a change in a third component goes directly into the concentration
External vibration, strong electromagnetic interference	unstable	keep away from pumps and other vibration sources, frequency converters and large motors; earth the housing reliably

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04 Technical Data

Measurement

Measuring principle	Tuning fork resonant frequency method; built-in temperature sensor compensates for temperature effects
Measured variables	Density, concentration (converted for the selected medium, referred to 20 °C), medium temperature
Density range	0 to 1.5 g/cm³ or 0 to 2 g/cm³ (codes R1 / R2); other ranges on request
Concentration range	0 to 50 % or 0 to 100 % (codes R3 / R4), depending on the medium
Density accuracy	±0.001 g/cm³ (reference conditions, calibration range 0.8 to 1.5 g/cm³, see 3.1)
Concentration accuracy	±0.5 % (volume or mass fraction; to be verified for the medium, see 3.2)
Repeatability	±0.0001 g/cm³; concentration ±0.1 %
Temperature effect (compensated)	±0.0001 g/cm³ per °C; concentration ±0.1 % per °C (relative to the factory calibration temperature, see 3.3)
Pressure effect (compensated)	Negligible within the rated working pressure
Temperature measurement	Built-in temperature sensor chip, accuracy ±0.5 °C
Display	LCD: measured value and unit; station address and medium temperature. Density displayed to 0.0001 g/cm³
Head type	Single display (density or concentration; standard) or dual display (density and concentration on one screen), to be specified with the order

Operating conditions

Suitable media	Homogeneous liquids: solutions of acids, alkalis and salts, alcohols and organic solvents, sugar and pharmaceutical solutions and similar; should not contain large amounts of gas bubbles or solids
Medium temperature	−20 to +120 °C (standard); up to +150 °C (special version); the medium must not freeze
Medium viscosity	0 to 2000 cP, to be confirmed for the medium

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Max. working pressure	0.4 MPa (standard); 2 MPa (special version); also limited by the rating of the process connection
Test pressure	1.5 times the maximum working pressure
Flow velocity	Not above 1 m/s; above this, use a protective shield, an enlarged section or a bypass (see 6.3)
Ambient temperature	−25 to +85 °C

Construction and materials

Wetted materials	316L (standard); 316L with PTFE lining, titanium, Hastelloy, ceramic optional; other materials on request
Fork surface finish	Standard polish; PTFE coating or electropolishing optional
Head housing	Aluminium alloy, ingress protection IP67
Process connection	Flange: DN50 PN16 (standard), DN50 PN25, 2″ 150LB, 2″ 300LB; clamp: 2″, 3″; thread: G¾, G1; others on request
Insertion length	150 mm (standard); 100 / 200 / 300 / 400 mm optional; integral version up to 4 m as special version
Design	Integral (standard); remote: probe connected to the head by cable, cable length specified with the order (recommended below 20 m)

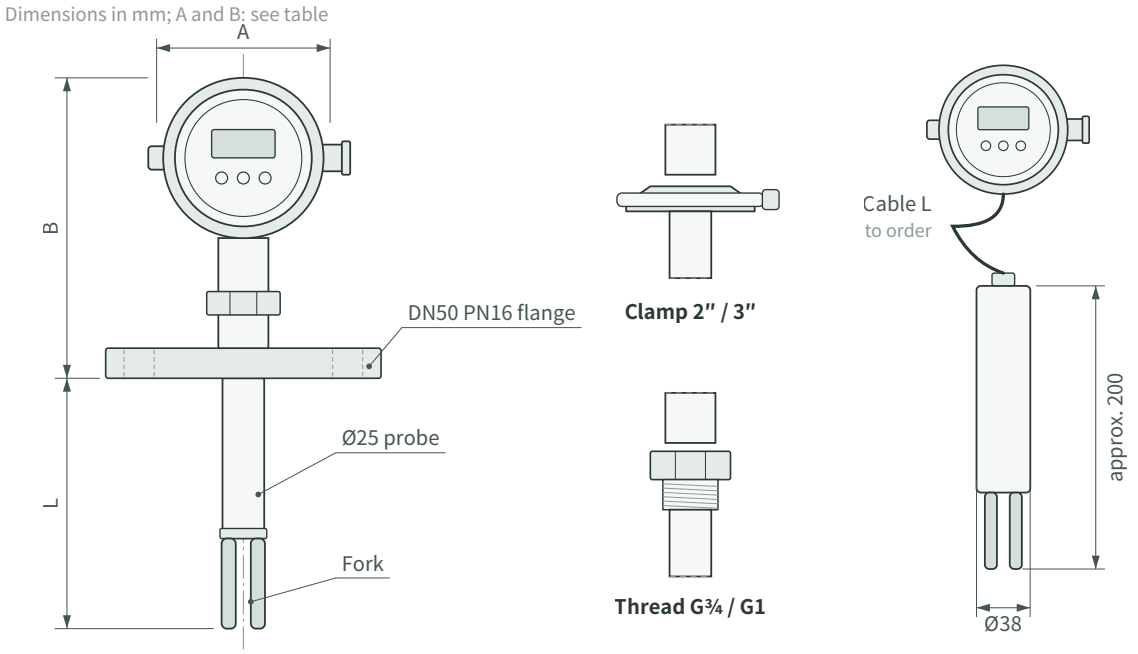
Electrical and explosion protection

Power supply	24 V DC, 100 mA; for a 220 V AC supply, an optional power converter is used
Wiring	4-wire
Analogue output	4 to 20 mA, active
Digital communication	RS-485 Modbus-RTU or HART (codes W2 / W3, see chapter 08)
Cable entry	M20 × 1.5
Explosion protection	Flameproof Ex d IIC T6 Gb (code D)

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05 Dimensions

The integral instrument consists of the head, the neck and the probe, with the fork at the end of the probe. The single-display and dual-display heads differ slightly in size; the process connection is a flange, clamp or thread, and the insertion length is selected with the order code. In the remote version, the probe is connected to the head by a cable.



▲ Dimension symbols: A head width; B top of the head to the sealing face of the process connection; L insertion length (sealing face to fork tip). Values in the table below

Version	A	B	L (insertion length)	Probe diameter
Single-display head	104	180	150 (standard); 100 to 400 optional	Ø25
Dual-display head	107	200	as above	Ø25
Remote probe	—	—	probe length approx. 200	Ø38

Note: Dimensions in mm, for reference only; the order drawing is binding.
Clamp and thread versions have the same A, B and L as the flange version; the probe of the integral version can be made up to 4 m long; for the remote version, the cable length is specified with the order and should be below 20 m.

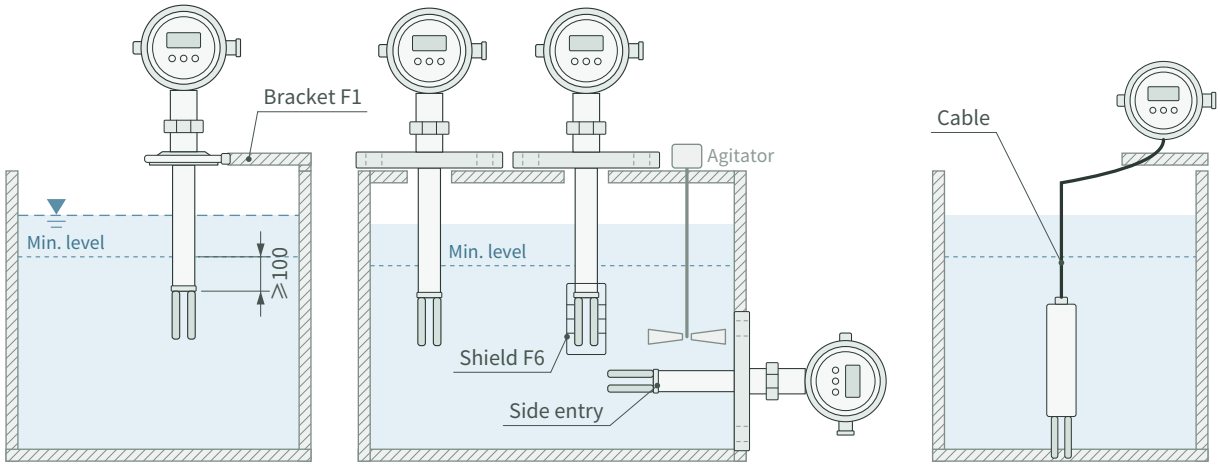
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06 Installation

Tuning fork density meters are sensitive to the mounting position: the fork must always be immersed, bubbles and deposits must not collect around the tines, and the flow past the fork must be steady. Mounting options and requirements for tanks and pipes:

> Fork gap (the slot between the tines): parallel to the flow in pipes, vertical for side entry on tanks, so that the medium flows through the gap and bubbles and deposits do not stay on the fork. This applies to every mounting option.

6.1 Tank installation

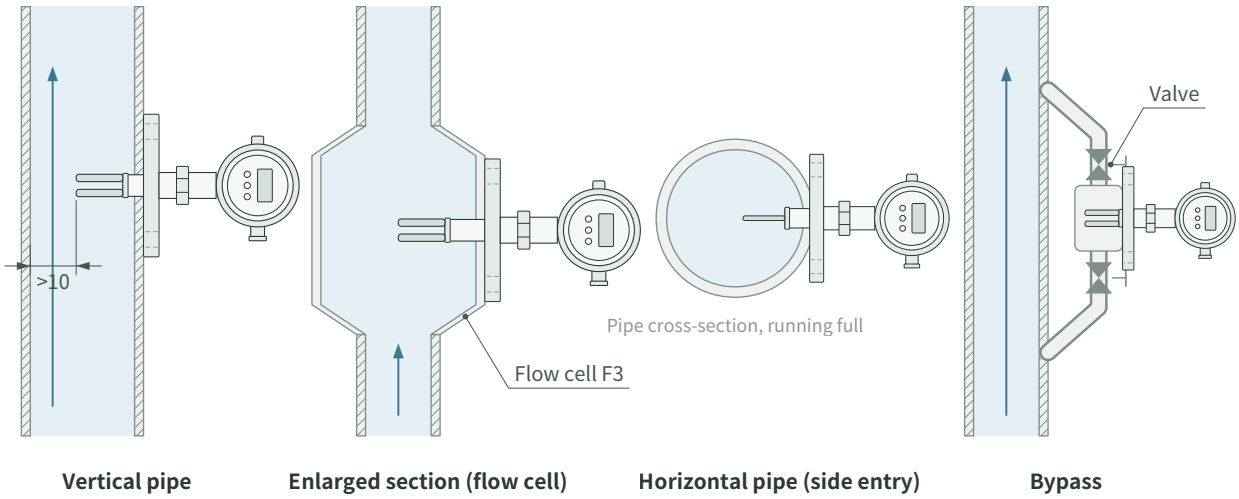


▲ Tank installation. Left: open basin, bracket; centre: closed tank, top mounting (also with shield) and side entry; right: remote probe on its cable

- The fork must be at least 100 mm below the minimum liquid level.
- Open basins and tanks: mounting bracket (F1). Closed tanks: flange on the roof or wall; for top mounting, choose the insertion length by liquid depth (integral version up to 4 m) or suspend a remote probe on its cable.
- Agitated tanks: protective shield (F6) against surges; keep the probe away from the impeller. Tanks agitated by aeration are not suitable.
- Side entry: fork fully inside the tank, fork gap vertical, against adhering sediment and bubbles.
- Prevent sediment in the tank; in crystallising or scaling media, inspect and clean the probe regularly.
- Some media release bubbles when standing, and bubbles on the fork falsify the reading; do not measure such media at standstill.

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6.2 Pipe installation



▲ Pipe installation. Left to right: side entry on a vertical pipe, enlarged section (flow cell), side entry on a horizontal pipe (cross-section), bypass

Mounting	Conditions	Key points
Vertical pipe	pipe wide enough for the fork; velocity max. 1 m/s	flow upwards; fork fully inside the pipe, more than 10 mm from the opposite wall; fork gap parallel to the flow
Enlarged section (flow cell F3)	pipe too narrow for the fork, or velocity too high	enlarged tee or flow cell; requirements as for a vertical pipe
Horizontal pipe	horizontal lines	side entry; pipe kept full — if it may run partly full, the fork must be below the minimum level; if top entry is unavoidable, ensure full immersion, as gas collects below the flange
Bypass	velocity above 1 m/s and the main line cannot be slowed down	valves at both ends; on a horizontal main line the bypass may not run full; if its flow is poor, a control valve in the main line raises the pressure difference

Note: The fork is not fully enclosed, so wall effects and the viscosity of the medium both influence the measurement; carry out an on-site calibration after installing the instrument in a pipe (see 10.2).

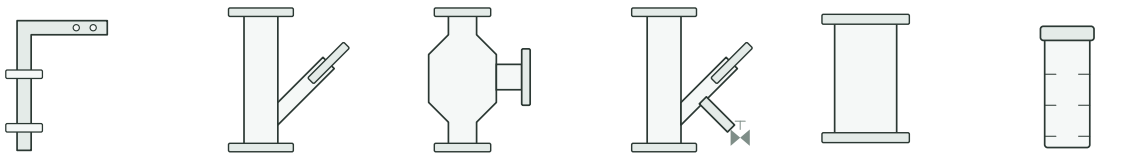
6.3 Flow velocity and enlarged sections

- Flow velocity past the fork: max. 1 m/s. Above this, fit a protective shield (F6) if there are no deposits; otherwise use an enlarged section or a bypass.
- Pipes below DN80, or velocities above 1 m/s: enlarged tee; DN80 and larger with more than 1 m/s: bypass.

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- Enlargement: for every 1 m/s above 1 m/s, enlarge the diameter at the measuring point 1.5 times.
- Straight runs: min. 600 mm upstream and 300 mm downstream; preferably over 1.5 m from pumps.

6.4 Mounting accessories



▲ Mounting accessories F1 to F6 (schematic)

Code	Accessory	Purpose
F1	Mounting bracket	fixing the instrument on open basins and open tanks
F2	Bypass loop	pipe section with branch, for bypass installation (see 6.2)
F3	Flow cell	enlarged section: keeps the fork in a full, slow flow where the pipe is too narrow or the flow too fast
F4	Flush port	mounting section with flushing connection, for periodic flushing of crystallising or scaling media
F5	Flange support	spool with flanges at both ends, used as a mounting adapter
F6	Protective shield	protects the fork and steadies the flow in agitated tanks, or above 1 m/s without deposits

Note: Accessories are normally made of 304 or 316 stainless steel; dimensions, specifications and materials as per order.

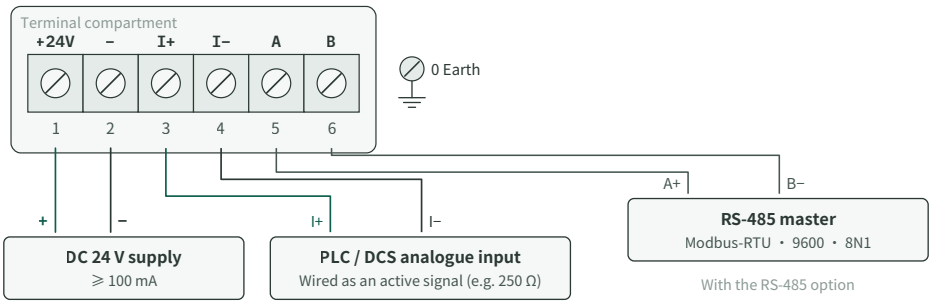
6.5 Other installation requirements

- Mounting point: small temperature gradients and changes, no shock or vibration, low velocity.
- The medium must not freeze, as this damages the fork.
- Do not exceed the rated pressure in operation or the specified test pressure in pressure tests.
- Do not weld on the pipe once the instrument is installed.
- Handle with care: a fork deformed by impact changes its vibration and must be repaired at the factory.
- In hazardous areas, cable entry, sealing and earthing follow the explosion-protection rules on site; never open the cover while energised.

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07 Electrical Connection and Outputs

The instrument is 4-wire: the 24 V DC supply and the active 4–20 mA output are wired separately. The terminals are in a separate compartment of the electronics housing, behind the cover on the terminal side.



▲ Terminals and wiring example; the 4–20 mA output is active

Terminal	Name	Description
0	**Earth**	housing earth terminal, next to the terminal block
1	**+24V**	24 V DC supply, positive (≥ 100 mA)
2	**–**	24 V DC supply, negative
3	**I+**	4 to 20 mA output, positive (active)
4	**I–**	4 to 20 mA output, negative
5	**A**	RS-485 A (+), used with the RS-485 option
6	**B**	RS-485 B (–), used with the RS-485 option

Note: With the HART option, the HART signal is superimposed on the 4 to 20 mA loop.

7.1 Wiring requirements

- Do not run the signal cable with power cables or past equipment with strong electric fields.
- Earth the housing reliably. Keep away from frequency converters and large motors; where necessary, isolate, using shielded power cables and galvanic isolators.
- The 4 to 20 mA output is active: wire the PLC / DCS input for an active signal, with no extra power source in the loop and no load in the supply circuit. After wiring, tighten the cover onto the O-ring to keep moisture out.
- Insulation test voltage max. 45 V; output current of the instrument max. 30 mA DC.
- Where only 220 V AC is available, use the optional power converter (220 V AC to 24 V DC).

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08 Communication and Configuration

8.1 RS-485 communication parameters

Item	Description
Protocol	Modbus-RTU, read function codes 03H (floating point) and 04H (fixed point)
Baud rate	9600 bps
Data format	8 data bits, no parity, 1 stop bit
Station address	01 to 99, default 01; 01 to 255 as special version
Variables	density, concentration (or degrees Baumé), temperature

8.2 Function code 03H: floating-point data

Start address	Registers	Data
0x0002	2	density
0x0004	2	concentration or degrees Baumé
0x0006	2	temperature

Note: IEEE 754 single precision, 2 registers (4 bytes) per value, low word first; read one value, or two or three from 0x0002 on. Suitable for SCADA software and touch panels.

8.3 Function code 04H: fixed-point data

Reading 5 words from address 0x0000 returns 10 bytes: density, concentration (or degrees Baumé) and temperature, 3 bytes each — 2 bytes integer value (high byte first), then 1 byte number of decimal places, whose top bit is the sign (0 positive, 1 negative); byte 10 is reserved.

Byte	Content
1 to 3	density: integer value 2 bytes + decimal places 1 byte
4 to 6	concentration or degrees Baumé: as above
7 to 9	temperature: as above
10	reserved

Note: Example: density bytes 30 39 04 — 0x3039 = 12345 with 4 decimal places, i.e. 1.2345 g/cm³.

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8.4 Local configuration

The head has three keys, Z, M and S; in normal display mode they have no function. Press and hold M for 5 s to enter the menu: Z and S scroll, M opens an item; within an item, S moves the cursor, Z changes the digit (0 to 9, cyclic) and M confirms.

Menu item	Function	User
1 Range	lower and upper range values for 4 mA and 20 mA; they must not be equal	user
2 Unit	displayed and output variable: density, or the concentration of a built-in medium (see chapter 09)	user (set at the factory as ordered)
7 PV Trim	single-point calibration against the laboratory value of a sample or a standard liquid (see 10.2)	user
8 CAL.H2O	calibration in still pure water (see 10.2)	user
9 Damping	0 to 99, default 05; the higher the value, the steadier the reading and the slower the response	user
12 RS485-ID	station address	user (RS-485 option)
10 ADC Value	view the sampled value	read only
3, 4, 5, 6, 11	current output calibration, formatting, temperature calibration, temperature compensation and its switch	factory setting only
13 EXIT	exit the menu	—

Note: After saving settings, go to item 13 EXIT and press M to return to the measuring display.

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09 Concentration Conversion

The instrument measures density. Concentration is converted using the density–concentration–temperature relation stored for the selected medium and is output at 20 °C. The conversion is valid only for solutions of a single solute (two-component systems).

9.1 Built-in media and units

Unit	Meaning	Unit	Meaning
g/cm³	density	**%H_2SO_4**	sulfuric acid concentration
°Bé	degrees Baumé	**%HCl**	hydrochloric acid concentration
%Alcohol	ethanol concentration	**%NaOH**	sodium hydroxide concentration
%$NH_3 \cdot H_2O$	ammonia solution concentration	**%Glycol**	ethylene glycol concentration
%Urea	urea concentration	**Brix**	sugar content
%Methanol	methanol concentration	**%H_2O_2**	hydrogen peroxide concentration

Note: The available units depend on the actual configuration and are set at the factory as ordered. For media outside the “Medium” item of the ordering code (code X), the density–concentration relation confirmed with the order is set at the factory.

9.2 Prerequisites for the conversion

Prerequisite	Explanation
Single-solute solution	a change in the content of a third component goes directly into the concentration; mixtures give larger errors
Medium matches the selected unit	the instrument converts only for the set medium; for a different medium the result is meaningless
Density monotonic over the concentration range	e.g. sulfuric acid has a density maximum at approx. 97 %, where one density corresponds to two concentrations
Temperature within the compensation range	the density–concentration relation changes with temperature and is compensated by the built-in temperature relation; outside the range the error increases
No gas bubbles, no solids	bubbles lower the density and deposits raise it; the converted concentration deviates accordingly

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10 Commissioning, Diagnostics and Maintenance

10.1 Checks before commissioning

Switch on the instrument and check that it starts normally. The fork can be placed, fully immersed, in the centre of a container of pure water at 25 °C; once fork and water are at the same temperature, the density reading should be between 0.997 and 1.000 g/cm³ (concentration display 0 %). Otherwise, the deviation is usually drift from transport vibration or long storage; perform a pure-water calibration as described in 10.2.

10.2 On-site calibration

Pipes, mounting arrangements and installation space differ from site to site, and wall effects may offset the fork reading, so an in-line calibration should be carried out after installation. Two methods are available:

Method	Conditions	Procedure
Pure-water calibration CAL.H2O	water can be let in; still pure water at constant temperature, no bubbles on the fork, fork not touching the wall	set the unit to g/cm³, run the pure-water calibration, then set the unit back to concentration; never run it with the process medium
PV Trim	water cannot be let in; the medium is in a stable measuring state	single-point entry of the laboratory value (or standard liquid value) of a sample taken at the same time right next to the instrument; the value must not be 0 and may not exceed the upper range value

> Before calibrating, make sure the fork is fully immersed and free of bubbles and the medium is stable; the PV Trim value must come from a laboratory analysis of a sample taken at the same time right next to the instrument. Calibrating with an inaccurate value builds the error into the instrument.

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10.3 Symptoms and remedies

Symptom	Possible cause	Remedy
No display	unsuitable power supply, loose connection or reversed polarity; short circuit in the loop; load in the supply circuit	check the 24 V DC supply and the connection of the four wires; check the loop and the voltage
Large error	material adhering to the fork; long-term drift; medium is a mixture or does not match the setting; gas bubbles; fork corroded or deformed	flush the fork or wipe it with a cotton swab moistened with alcohol; pure-water calibration or PV Trim; check the medium and unit settings; remove bubbles; a damaged fork must be returned to the factory for repair
Unstable reading	material adhering to the fork; strong vibration, interference from frequency converters or motors; many bubbles or excessive flow velocity; fork not fully immersed; poor earthing	clean; change the mounting position; increase the damping moderately, and if this does not help, limit the velocity or relocate; ensure immersion; check the earthing
Differs from the secondary instrument or DCS	different range settings at the two ends; excessive losses in the transmission line	check the ranges at both ends; replace the cable

10.4 Routine maintenance

- Take samples for laboratory analysis at intervals set by the process and compare them with the reading; sample right next to the instrument so that transport delay is not mistaken for instrument error.
- Watch the trend: a slow one-directional change usually means scale or build-up on the fork; a sudden increase in fluctuation usually means gas bubbles or a change in flow velocity.
- For crystallising or scaling media, inspect and clean the fork regularly; during shutdowns, do not let the medium dry on the fork.
- If drift occurs after long use, perform a pure-water calibration or PV Trim.

10.5 Transport and storage

Suitable for land and water transport and for freight handling. Store the product and accessories indoors in the original factory packaging, at −10 to +55 °C and a relative humidity not above 85 %.

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11 Typical Applications

The PS7400 serves process control with density as the primary variable and quality control with concentration as the variable. Typical industries and measuring points:

Oil and petrochemicals

density of diesel, petrol, ethylene and similar; interface detection in multi-product pipelines

Chemicals

concentration of H_2SO_4, HCl, HNO_3, chloroacetic acid, ammonia, methanol, ethanol, brine, NaOH, Na_2CO_3, glycerol, H_2O_2 and other solutions

Pharmaceuticals

drug and biological solutions, alcohol extraction; herbal extract concentration; acetone and alcohol recovery

Food and beverages

sugar solutions, fruit juices, brewing, cream

Batteries and electrolytes

sulfuric acid, lithium hydroxide and electrolyte concentration

Environmental

ammonia and urea solutions for DeNOx; recovery of acids, alkalis and salts in MVR wastewater treatment

Salt and brine

salt water and brine concentration; underground storage tanks operated with brine

HVAC and cooling

concentration of antifreeze and ethylene glycol coolants

11.1 Suitable media conditions

	Media conditions
Suitable	homogeneous liquids: acid, alkali and salt solutions, alcohols and organic solvents, sugar and drug solutions; up to 2000 cP; concentration of single-solute solutions
Use with caution or unsuitable	many gas bubbles or aeration; high-solids slurries; crystallising or scaling media (flushing and regular cleaning needed); concentration of multi-component mixtures

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11.2 Other Pisonics online density meters

Model	Measuring principle	Application
PS7000	ultrasonic acoustic impedance	non-invasive, nothing in the flow; high-solids slurries, gas-laden service
PS7220	vibrating straight tube	in-line, full bore; small and medium sizes, high accuracy, high temperature or corrosive media
PS7300	hydrostatic differential pressure	vertical sections of large-bore main lines; tanks of all kinds
PS7400	**vibrating tuning fork**	insertion type, compact; pipe and tank points in homogeneous liquids

Note: For slurries, media with large amounts of gas bubbles or high-viscosity media, consider the PS7000 or PS7220 first. The selection depends on the medium, pipe size, accuracy requirement and installation conditions.

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12 Ordering Code

The order code is formed from the codes of the items below in sequence, for example PS7400-A-R2-W2-A3-L0-A-1-N-F0 (density, 0 to 2 g/cm³, 4–20 mA + RS-485, DN50 PN16 flange, insertion length 150 mm, wetted parts 316L, standard polish, non-Ex, no mounting accessories).

Item	Code	Description
Model	PS7400-	Online tuning fork density meter
Medium	A / B / C / D	density / HCl / H_2SO_4 / ammonia concentration
	E / F / X	alcohol / NaOH concentration / other (state medium, range)
Range	R1 / R2	0 to 1.5 g/cm³ / 0 to 2 g/cm³
	R3 / R4 / RX	0 to 50 % / 0 to 100 % / other
Output	W1 / W2 / W3	4–20 mA / 4–20 mA + RS-485 / 4–20 mA + HART
Process connection [1]	A1 / A2	2″ 150LB flange / 2″ 300LB flange
	A3 / A4	DN50 PN16 flange (standard) / DN50 PN25 flange
	B1 / B2 / C1 / C2 / X	2″ clamp / 3″ clamp / G¾ thread / G1 thread / other
Insertion length	L0 / L1 / L2	150 mm (standard) / 100 mm / 200 mm
	L3 / L4 / LX	300 mm / 400 mm / other (integral version up to 4 m)
Wetted material	A / B / C	316L / 316L with PTFE lining / titanium
	D / E / X	Hastelloy / ceramic / other
Surface finish	1 / 2	standard polish / other (PTFE coating, electropolishing)
Explosion protection	N / D	none / flameproof Ex d IIC T6 Gb
Mounting accessories	F0 / F1 / F2	none / mounting bracket / bypass loop
	F3 / F4 / F5	flow cell / flush port / flange support
	F6 / X	protective shield / other

Note: [1] The pressure rating of the flange is not the working pressure of the instrument: the maximum working pressure is 0.4 MPa for the standard version and 2 MPa for the special version (see chapter 04).
Head type (single / dual display), design (integral / remote, with cable length) and power supply (24 V DC / 220 V AC with power converter) are not part of the code; specify them with the order.

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13 Ordering Information and Scope of Supply

13.1 Information required with the order

Item	Purpose
Medium and composition	medium code and wetted material; confirms a single-solute solution
Density or concentration range	range and concentration conversion
Medium temperature and pressure	standard version (120 °C, 0.4 MPa) or special version
Viscosity; gas bubbles or solids	suitability assessment (see chapter 03)
Measuring point: pipe or tank	pipe: size, flow direction, velocity; tank: level range, agitator
Process connection, insertion length	selected by pipe size or liquid depth
Output and communication	4–20 mA, RS-485 or HART
Head, design, power supply	single / dual display; integral / remote (cable length); 24 V DC / 220 V AC
Site conditions	hazardous area classification, corrosive atmosphere, etc.

13.2 Scope of supply (per instrument)

Item	Quantity
PS7400 Online Tuning Fork Density Meter	1 set
Gasket	1
Quality certificate	1
Operating manual	1
Ex certificate (flameproof version)	1
Mounting accessories (F1 to F6, if ordered)	as ordered
Power converter (for 220 V AC supply)	1

Note: Mating flanges, fasteners and site piping for installation are not included unless agreed in the contract.

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14 Warranty and Service

The instrument is warranted for twelve months from the date of acceptance on delivery. The warranty applies only to the original purchaser or to users supplied by an authorised distributor, and does not cover damage from incorrect use, modification, negligence or accident, or from operation outside the design conditions (excess temperature, excess pressure, frozen medium, corrosion beyond the range of the selected material). Faulty instruments within the warranty period are repaired free of charge; please contact the after-sales department with a description of the fault.

Item	Description
On-site service	installation guidance, commissioning and on-site calibration; training of operating and maintenance staff
Remote support	selection calculations, configuration and troubleshooting
Delivery time	depends on configuration and quantity; agreed in the contract

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Note: Specifications in this document are subject to change without notice. For detailed installation, wiring and operating instructions, the operating manual supplied with the instrument shall prevail.

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