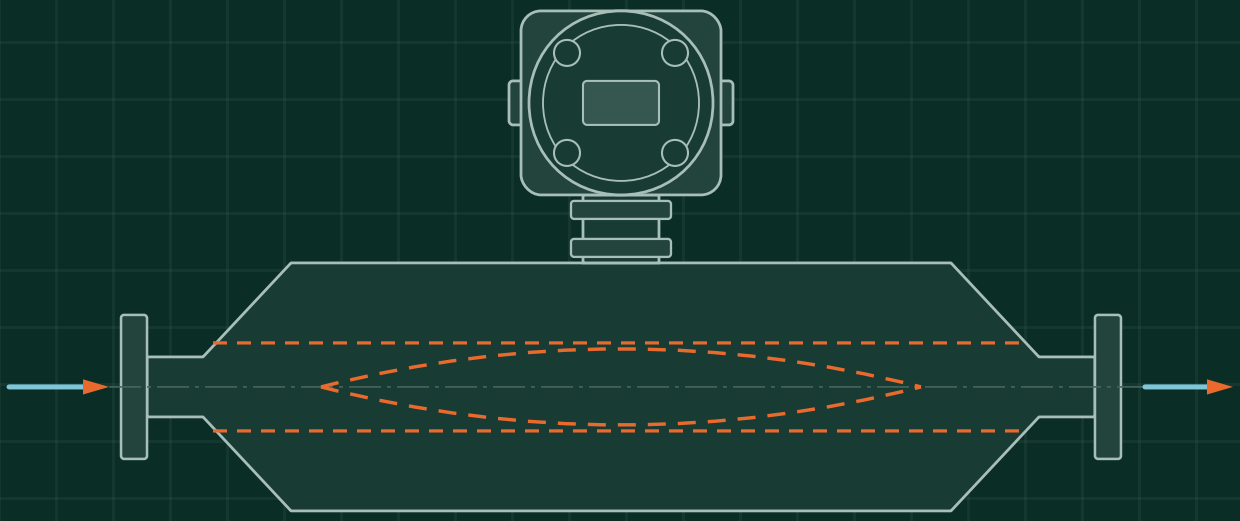
PS7220 · Vibrating straight tube · Inline liquid density and concentration

Straight-Tube Inline Density Meter

TECHNICAL SPECIFICATION

Vibrating straight-tube resonant frequency · No flow-obstructing elements · Absolute density error from ±0.5 kg/m³

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▲ The measuring tube is a single straight tube installed in the line; the orange dashed lines indicate the tube wall and the mode envelope

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The PS7220 is the straight-tube model of the PS7200 series and measures liquid density by the vibrating-tube resonant-frequency principle. The measuring tube is a single straight tube with no flow-obstructing elements and no moving parts, and its bore matches the line. Chapter 03 explains the accuracy basis and the influencing factors — please read it before selection; chapters 05 and 06 cover dimensions and installation requirements, chapter 09 the conversion to concentration and standard-condition density, and chapter 12 the ordering code.

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01 Scope and Key Data

The PS7220 is the straight-tube inline density meter of the PS7200 series from Xi'an Pisonics (PISONICS). It works on the vibrating-tube resonant-frequency principle: the measuring tube is a single straight tube that a driver keeps oscillating at its natural frequency. A change in the density of the medium in the tube changes the vibrating mass and, with it, the resonant frequency, from which the density is calculated.

The measuring tube has no flow-obstructing elements and no moving parts, and its bore matches the line — pressure loss is low, the tube is easy to flush and can pass pigging tools. The meter is suitable for viscous or non-Newtonian fluids, low-velocity media, inhomogeneous mixtures, media carrying solids or gas, slurries and highly corrosive fluids, as well as very high- and very low-temperature service. It is calibrated before delivery; no on-site calibration is needed at commissioning.

KEY DATA AT A GLANCE

0–5 g/cm³ density measuring range (range end points adjustable)	**±0.5 kg/m³** accuracy (highest class; ±1 and ±2 also available)	**±1 kg/m³** repeatability	**400 °C** max. medium temperature (by temperature class)
4.0 MPa nominal pressure (also 1.6 MPa; higher on request)	**DN15–DN80** nominal size	**4–20 mA** 4-wire, active output; also 0–1 kHz and RS-485	**IP67** ingress protection (IP66 optional)

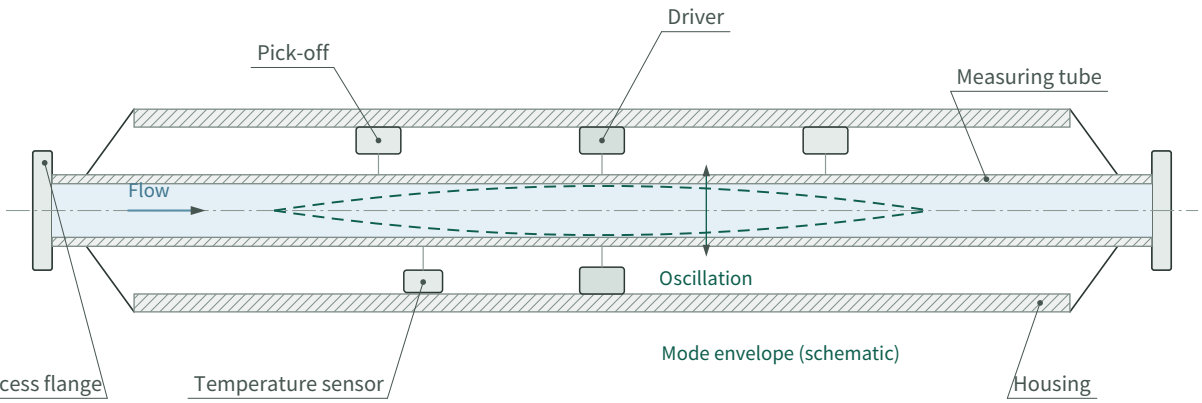
Before reading the data: The accuracy of this meter is an absolute error in density, in kg/m³, independent of the set range — for example, ±1 kg/m³ is ±0.001 g/cm³, which on a 1.0 g/cm³ medium corresponds to 0.1 % of reading. This is not the same basis as an error referred to full scale (%FS); convert both to the same basis before comparing products. The conversion table and the other influencing factors are in chapter 03.

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02 Measuring Principle

The vibrating-tube method measures the resonant frequency of the tube oscillating together with the medium inside it. The heavier the medium, the greater the vibrating mass and the lower the resonant frequency. Frequency can be measured very precisely — this is where the high accuracy and long-term stability of the method come from.

A driver and a pick-off are mounted on the outside of the measuring tube. The driver continuously excites the tube at its natural frequency and the pick-off senses the vibration signal. The transmitter measures the resonant period and converts it to density with the fitted equation obtained in factory calibration; at the same time the built-in temperature sensor compensates the change of the elastic modulus of the tube material with temperature.



Section view; driver and pick-off are outside the tube, not wetted

▲ Operating principle. The driver excites the measuring tube at its natural frequency and the pick-off senses the vibration signal; the dashed lines indicate the mode envelope

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

ρ
density of the medium

τ
resonant period of the measuring tube

A, B
set by the mass, stiffness and volume of the measuring tube; determined in factory calibration

Internally the meter converts to density with a fitted relation of this kind, with a temperature compensation term added. Calibration is done at the factory and stored in the chip; it is retained when power is removed.

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2.1 Key design points

- The measuring tube is a single straight tube with no flow-obstructing elements and no moving parts inside. Its bore matches the line; pressure loss is low, flushing is easy, and viscous media or media carrying solids do not readily remain in the tube.
- A floating support structure decouples the measuring tube from the housing and flanges and suppresses the coupling of external pipeline vibration into the measurement. Pump discharges, water hammer and sources of severe vibration should still be avoided at installation (see chapter 06).
- What is measured is the vibrating mass, independent of flow velocity — low-velocity and even stationary media can also be measured, unlike measuring methods that work only while there is flow.
- The driver and pick-off are mounted outside the measuring tube and do not contact the medium; the only wetted parts are the measuring tube and the two end flanges, whose material is selected for the corrosiveness of the medium (see chapter 04).

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03 Accuracy and Influencing Factors

This chapter explains what the three accuracy classes mean and how they convert to the %FS basis, and in which direction temperature, gas content, scaling and installation conditions affect the reading.

3.1 Three accuracy classes

The accuracy class is determined with the order. All three classes are absolute errors in density; they apply over the entire measuring range and do not change with the set range.

Class code	Accuracy	Equivalent g/cm³	% of reading at 1.0 g/cm³
M	±0.5 kg/m³	±0.0005	0.05 %
N (standard)	±1 kg/m³	±0.001	0.1 %
S	±2 kg/m³	±0.002	0.2 %

Note: The last column is an example converted at 1.0 g/cm³; for media of other densities the result differs — the absolute error stays the same, while the percentage of reading varies inversely with density.
The applicable conditions for class M and the corresponding repeatability are confirmed with the order.

3.2 Temperature effect and compensation

The elastic modulus of the tube material varies with temperature, which directly changes the stiffness of the measuring tube and hence its resonant frequency. The built-in temperature sensor measures and compensates this effect in real time; the temperature coefficient after compensation is established in factory calibration. In service the medium temperature must stay within the range covered by the selected temperature class; where the temperature fluctuates sharply, the stability of the reading is limited by how fast the compensation can follow.

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3.3 Effect of the condition of the medium

Condition	Effect on the reading	Action
Tube not completely full, trapped gas, or gas bubbles in the medium	Vibrating mass too low: density reading low, with larger fluctuation	Choose the installation position per chapter 06; if necessary, fit a gas–liquid separator upstream of the meter
Scaling or build-up on the tube wall	Deposits vibrate with the tube: vibrating mass too high, density reading high	Inspect and flush regularly; for viscous or crystallising media, prefer vertical installation
Settling of solids, stratification of the medium	Uneven density distribution in the tube: reading not representative	Maintain flow velocity; do not take readings at low velocity or with the flow stopped
Medium temperature outside the selected temperature class	Outside the effective range of compensation: error not under control	Select the temperature class for the actual conditions, with a margin

3.4 Effect of installation conditions

- External pipeline vibration: the floating support suppresses coupling, but strong vibration sources (pump discharges, downstream of control valves, water hammer) should still be avoided, and the process line must have its own supports — the measuring section must not carry the weight or thrust of the line.
- Pipeline misalignment: forcing misaligned pipework into line with the meter puts permanent stress on the measuring tube and changes its stiffness. The pipes upstream and downstream must be coaxial, with parallel flange faces.
- Orientation: in horizontal installations the meter must sit at a low point of the line so that the tube stays full; viscous media and media prone to settling should be installed vertically, with flow from bottom to top.

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04 Technical Data

Measurement

Measuring principle	Vibrating-tube (straight tube) resonant-frequency method
Density measuring range	0 to 5 g/cm³ (0 to 5000 kg/m³); output range end points adjustable
Accuracy	±0.5 / ±1 / ±2 kg/m³ (class M / N / S, determined with the order); absolute error in density, see 3.1
Repeatability	±1 kg/m³ (0.001 g/cm³)
Resolution (liquids)	±0.5 kg/m³ (0.0005 g/cm³)
Temperature measurement	Built-in temperature sensor, used for temperature compensation of density; also available as an output variable
Density units	g/cm³, kg/m³, lb/gal, lb/ft³, selectable in the menu
Temperature units	°C, °F, selectable in the menu
Component concentration	Calculated from the set densities of two components; output as volume fraction (V/V) or mass fraction (m/m), see chapter 09
Standard-condition density	Gasoline, alcohol, hydrochloric acid, aqueous ammonia, sulfuric acid, caustic soda, urea and “Other”, converted from the operating density, see chapter 09

Process conditions

Suitable media	Cement slurries, mineral slurries, sand slurries, viscous and crystallising liquids, gas-containing liquids, as well as viscous or non-Newtonian fluids, inhomogeneous mixtures and highly corrosive fluids
Medium temperature	Temperature class A 150 °C / B 250 °C / C 350 °C / D 400 °C, determined with the order; low-temperature and cryogenic service to be stated and confirmed when ordering
Nominal pressure	1.6 MPa or 4.0 MPa (rating 16 / 40); higher pressures on request
Nominal size	DN15 / DN25 / DN50 / DN80
Ambient temperature	As confirmed with the order

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Materials

Measuring tube	316L stainless steel (standard); optional: Hastelloy C-276, C4 steel (ASTM A600Ti2004), titanium Ti (ASTM B265), tantalum Ta (ASTM B708), zirconium, high-nickel, copper-nickel and nickel-base alloys; other materials customised
Flanges, other wetted parts	304 (standard) or 316L
Sensor housing	304 (standard), 304L, 316L; other materials and finishes customised
Transmitter housing	Powder-coated cast aluminium (standard), 316, 316L
Process connection	HG/T 20592-2009 flanges; other standards customised

Electrical

Power supply	DC 24 V (⩾ 500 mA) or AC 220 V; DC supply polarity detected automatically
Wiring	4-wire
Analogue output	4–20 mA, active; output variable density / temperature / volume fraction / mass fraction, selectable in the menu
Frequency output	0–1 kHz, active; variable as above, selected independently of the current output
Digital communication	By output code: RS-485 Modbus-RTU; HART + RS-485 Modbus-RTU; FF; Profibus PA (see chapter 12)
Cable entry	1/2″NPT (female) × 2; others customised
Transmitter mounting	Integral; remote (connecting cable length stated with the order)

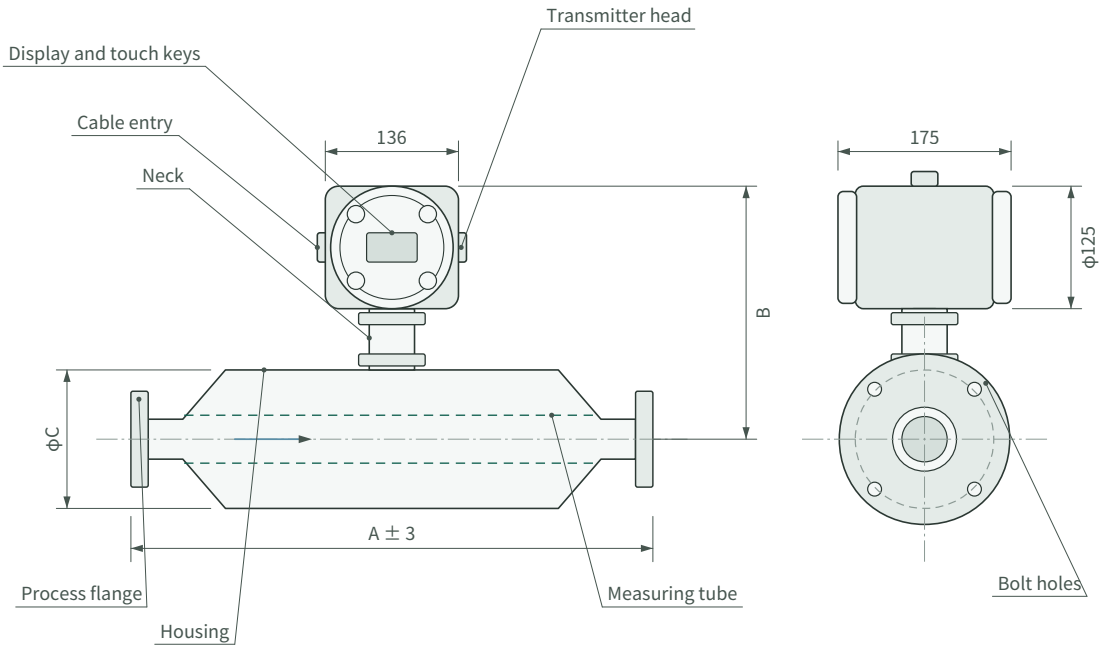
Display, protection and certification

Display and operation	LCD; touch keys, no need to open the cover; backlight on/off
Menu languages	Chinese / English / Russian / German / Spanish
Parameter storage	Settings retained on power loss
Explosion protection	Ex db mb IIC T6 Gb
Ingress protection	IP67 (standard) or IP66
Test certificate	Factory test certificate to company standard, or national-level calibration certificate to national standard (selected with the order)

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05 Dimensions

The meter is of integral design: the measuring tube and housing form the sensor body, and the transmitter head sits directly above it on a neck. For remote mounting the head is mounted separately; the connecting cable length is determined with the order.



Dimensions in mm · Left: front view · Right: side view and flange end view · Not to scale

▲ Dimension codes: A is the face-to-face distance between the two flange sealing faces, B is from the measuring-tube axis to the top of the head, φC is the outside diameter of the housing. Values in the table below

Model	Nominal size	A ± 3	B	φC
PS7220-15	DN15	438	285	95
PS7220-25	DN25	570	296	120
PS7220-50	DN50	700	307	139
PS7220-80	DN80	1022	315	155

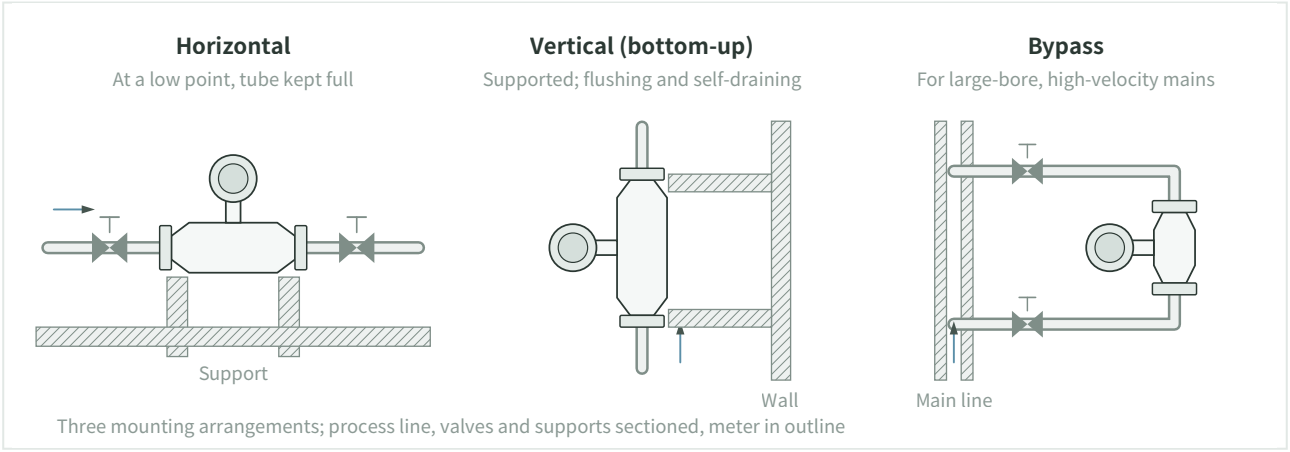
Note: Dimensions in mm. Head: width 136 in front view, length 175 in side view, cover φ125.
Flange outside diameter, number and diameter of bolt holes per HG/T 20592-2009 and the selected nominal pressure; the order drawing governs. B does not apply to remote mounting.

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06 Installation

Installation has three aims: keep the measuring tube full of medium at all times, keep forces from the pipeline off the measuring tube, and keep the meter away from strong vibration sources. The three mounting arrangements suit different media and line conditions.

> The measuring tube must be full of medium and free of gas bubbles — this is the precondition for every accuracy figure. Mounting at a low point in horizontal lines, bottom-to-top flow in vertical lines, and valves at both ends of a bypass all serve this purpose.



▲ Three mounting arrangements. Selection criteria in the table below, installation requirements in 6.1

Mounting	Conditions of use	Key points
Horizontal	Free-flowing media that do not settle and are not viscous	Preferably at a low point of the line, so that the measuring tube stays full of medium
Vertical	Viscous media and media prone to settling	Flow from bottom to top; provide supports; easy flushing and self-draining
Bypass	Large-bore main line, high flow velocity	Shut-off valves at both ends of the bypass for isolation, removal and flushing in operation

6.1 Installation requirements

- Before start-up, vent the air from the measuring tube and raise the pressure slowly. Gas in the tube makes the density reading low and increases its fluctuation.
- The process line must have its own supports, placed on the line; the measuring section must not be clamped in a support. The meter must not carry the weight, thrust or thermal-expansion stress of the line.

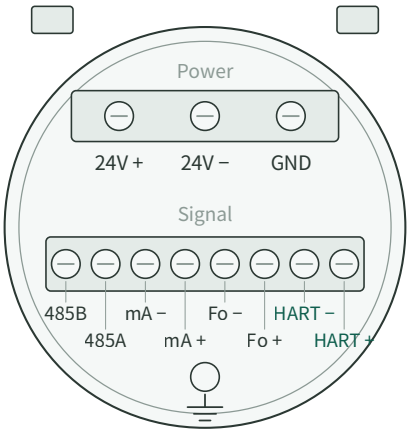
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- The pipes upstream and downstream must be coaxial with parallel flange faces; the meter must not be used to pull misaligned pipework into line.
- Avoid pump discharges, locations downstream of control valves, water hammer and sources of severe vibration; where several pumps share one line, place the measuring point on the side with weaker vibration transmission.
- Where the medium tends to carry gas, fit a gas–liquid separator or degassing section upstream of the meter.
- Outdoors, fit a sun shade so that the head is not exposed to strong direct sunlight.
- In hazardous areas, cable entry, sealing and earthing follow the local explosion-protection rules; the meter is normally not earthed separately but through the connected pipework.

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07 Electrical Connection and Outputs

The meter is 4-wire; supply and signals are on two rows of terminals in the terminal compartment. The current output and the frequency output are both active outputs, and the output variable of each is selected independently.



Terminal layout (top view); HART terminals with the HART output option

▲ Terminal layout in the terminal compartment (top view). Terminal functions in the table below

Terminal	Name	Description
24V +/–	**DC 24 V supply**	Current not less than 500 mA; polarity detected automatically. For AC 220 V supply the same terminals are used, switched over automatically
GND	**Signal shield earth**	Shield earthed at one end only
mA +/–	**Current output**	4–20 mA, active; variable selectable in the menu
Fo +/–	**Frequency output**	0–1 kHz, active; variable selectable in the menu
485A / 485B	**RS-485**	Modbus-RTU, see chapter 08
HART +/–	**HART**	Provided with the HART output option
⊥	**Housing earth**	Connect per local earthing rules

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7.1 Cable requirements

Circuit	Cable	Nominal cross-section	Distance
DC 24 V supply	Two-core sheathed	0.75 mm²	⩽ 20 m
RS-485 communication	Twisted pair	0.35 mm²	⩽ 20 m
4–20 mA / HART	Two-core sheathed	0.5 mm²	⩽ 20 m
Frequency output	Two-core shielded	0.5 mm²	⩽ 20 m

Note: Beyond the distances in the table, cross-section and shielding must be calculated for the actual voltage drop and interference conditions. Several meters in one area may share one power supply; where meters are widely spread and cables are long, a small local power supply is advisable.

7.2 Fixed-output test

The fixed-output test in the menu is used to check the loops during commissioning: the meter outputs the frequency and current for the selected percentage point at the same time; leaving the menu ends the test.

Test point	Frequency output	Current output
0 %	0 Hz	4 mA
25 %	250 Hz	8 mA
50 %	500 Hz	12 mA
75 %	750 Hz	16 mA
100 %	1000 Hz	20 mA

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08 Communication and Configuration

8.1 Modbus-RTU communication parameters

Item	Factory default
Protocol	Modbus-RTU (RS-485)
Baud rate	9600, changeable in the menu
Data bits / stop bits / parity	8 / 1 / none (N), parity changeable in the menu
Station address	1, changeable in the menu
Register data type	Floating point

8.2 Open holding registers

Holding register	Address (hex / decimal)	Definition
41001	0x03E8 / 1000	Density
41003	0x03EA / 1002	Temperature
41009	0x03F0 / 1008	Content of component A

Note: The other registers hold factory calibration parameters; they are not open and must not be written by the user. If further variables need to be transmitted, raise this with the order or during commissioning.

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8.3 Configuration items

The transmitter is operated with touch keys, without opening the cover. A password is required to enter the user settings main menu; each setting is stored as soon as it is confirmed and is retained on power loss.

Group	Configuration items
Display	Density unit, temperature unit, display response time (refresh rate), backlight on/off, menu language
Output	Current output variable, frequency output variable, lower range value, upper range value, low-signal cut-off, output filter coefficient
Communication	Station address, baud rate, parity, communication mode
Components and standard conditions	Component display (V/V or m/m), density of component A, density of component B, medium type, K factor
Maintenance	View records (operating frequency, model, serial number, version), fixed-output test, read fault codes, automatic on-site calibration, meter reset, restore factory settings

Note: The lower and upper range values are the end points of the output: a measured value below the lower value is displayed as 0, a value above the upper value is held at the upper value. The low-signal cut-off suppresses small floating values around zero; the output filter coefficient reduces the effect of interference — a heavier filter also slows the response.

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09 Concentration and Standard-Condition Density

The meter measures density. Concentration and standard-condition density are both calculated from it — how accurately the parameters of the conversion are known directly determines how far these two values can be trusted.

9.1 Two-component concentration

The medium is treated as a mixture of two known components. With the densities of component A and component B set, the meter calculates the component ratio from the measured density and outputs, as selected in the menu, the volume fraction (V/V) or the mass fraction (m/m). The result can be assigned to the current output, the frequency output and Modbus.

Precondition	Explanation
The medium really has two components	Any change in the content of a third component goes straight into the result
The two component densities differ enough	The smaller the density difference, the more a given density error is amplified into concentration error
Component densities taken at the operating temperature	Where a component density varies with temperature, confirm the value for the process temperature range; set it in segments if necessary
Tube full, no gas bubbles	Gas makes the density reading low, and the calculated concentration deviates with it

9.2 Standard-condition density

For gasoline, alcohol, hydrochloric acid, aqueous ammonia, sulfuric acid, caustic soda, urea and similar media, the meter converts the measured operating density and temperature to the density at standard conditions according to the selected medium type. When “Other” is selected, the conversion is corrected with the K factor (concentration ratio factor).

Note: With the medium type set to “Off”, the standard-condition density screen is closed; once a medium is selected, the screen opens and the component content page is reset to zero — standard-condition density and two-component concentration are not used at the same time, so decide which one is needed when ordering and configuring.

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10 Diagnostics and Maintenance

10.1 Common symptoms and remedies

Symptom	Cause	Remedy
No display	Power supply fault	Check supply voltage and wiring; current not less than 500 mA
Measuring screen not reached after power-on	Sensor not working	Check the resistance at the sensor connector
Density displayed as zero	No medium in the sensor	Make sure the measuring tube is full of liquid; vent the air
Large fluctuation of the reading	Too much gas in the medium	Fit a gas–liquid separator upstream of the meter; check installation position and flow velocity
Reading high overall and rising slowly	Scaling or build-up on the tube wall	Flush the measuring tube during a shutdown; change to vertical installation for viscous or crystallising media

Note: “Read fault codes” in the menu reads the fault codes recorded by the self-test and during operation; when reporting a fault, please give the fault code, model and serial number of the meter.

10.2 Automatic on-site calibration

The meter is calibrated before delivery, and on-site calibration is normally not needed. If a newly installed meter is to be matched to the installation conditions on site, an automatic on-site calibration can be performed: enter the known density of the medium currently in the tube; the meter acquires the current state and stores it in the chip, where it is retained on power loss until replaced by the next calibration.

> Before an automatic on-site calibration, confirm three things: the measuring tube is full of this medium, there are no gas bubbles, and conditions are stable; the density entered comes from a laboratory analysis of a sample taken at the same time and the same place, or from a reference liquid. Calibrating with an inaccurate density value locks the deviation into the meter.

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10.3 Routine maintenance

- Check the reading periodically: take samples for laboratory analysis at the process interval and compare them with the meter reading; the sampling point should be close to the meter so that transport delay is not mistaken for meter error.
- Watch the long-term trend of the reading: a slow rise in one direction usually means scaling; a sudden increase in fluctuation usually means gas in the medium or insufficient flow velocity.
- During shutdowns, drain and flush the measuring tube, especially with crystallising media and media prone to settling.
- The head is operated without opening the cover, so routine checks do not require opening the housing; in hazardous areas the cover must never be opened while energised.

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11 Typical Applications

The PS7220 is used in process control where density is the basic parameter, and in quality control based on concentration or solids content. Typical industries and measuring points are listed below.

Chemicals and fine chemicals

Acid and alkali concentration, reactor feed and discharge density, density of concentrated solutions, interfaces in solvent separation

Metallurgy and mining

Density and solids content of mineral, sand and tailings slurries

Building materials

Cement slurry density, slurry proportioning

Sugar, brewing and food

Sugar solution concentration, alcohol concentration, proportioning of liquids

Oil and gas

Density of crude oil and refined products, conversion to standard-condition density, interface detection in multi-product pipelines

Power and environment

Desulfurisation slurry, sludge, concentration of wastewater-treatment chemicals

Lithium batteries and new materials

Density and proportioning of electrolytes and slurries

Refrigeration and cryogenics

Density of low-temperature media (temperature class confirmed with the order)

11.1 Suitable media conditions

The straight-tube design is advantageous for

- viscous or non-Newtonian fluids
- low-velocity media
- inhomogeneous mixtures
- media carrying solids or gas
- slurries
- highly corrosive fluids
- very high-temperature media
- very low-temperature media

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11.2 PS7220 and other Pisonics inline density meters

Model	Measuring principle	Application
PS7000	ultrasonic acoustic impedance	non-intrusive, nothing in the flow path; high-solids slurries and aerated service
PS7220	**vibrating straight-tube resonance**	installed in line, full bore; small and medium sizes, high accuracy, high-temperature or highly corrosive media
PS7300	hydrostatic differential pressure	vertical sections of large-bore main lines; tanks of all kinds
PS7400	vibrating tuning fork	insertion type, compact; general-purpose measuring points on pipes and tanks

Note: Select by medium, line size, accuracy requirement and installation conditions. For larger line sizes, or where installing a measuring section in the line is not permitted, consider non-intrusive and insertion-type solutions first.

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12 Ordering Code

The order code is made up of the codes of the items below, in sequence, for example: PS7220-15-B-A-A-16-A-N-F-F-A-K-A-A-M-A-A (DN15; 4–20 mA + HART + 0–1 kHz + Modbus-RTU; powder-coated cast aluminium housing; DC 24 V; 1.6 MPa; 150 °C; ±1 kg/m³; HG/T 20592 flanges; factory test certificate; measuring tube 316L / flanges 304; sensor housing 304; Chinese menu; integral mounting; 1/2″NPT cable entry; Ex db mb IIC T6 Gb; IP67).

Item	Code	Description
Model	PS7220-	Straight-tube inline density meter
Nominal size	15 / 25	DN15 / DN25
	50 / 80	DN50 / DN80
Transmitter output	A	4–20 mA + 0–1 kHz + Modbus-RTU
	B	4–20 mA (HART) + 0–1 kHz + Modbus-RTU
	C	4–20 mA + 0–1 kHz + FF
	D	4–20 mA + 0–1 kHz + Profibus PA
Transmitter housing material	A / B / C	Powder-coated cast aluminium / 316 / 316L
Power supply	A / B	DC 24 V (⩾ 500 mA) / AC 220 V
Pressure rating	16 / 40	1.6 MPa / 4.0 MPa
	XXX	Special; state the pressure rating when ordering
Temperature class	A / B	150 °C / 250 °C
	C / D	350 °C / 400 °C
Accuracy class	M / N / S	±0.5 / ±1 / ±2 kg/m³ [1]
Process connection	F / G	HG/T 20592-2009 / special
Test certificate	F / I	Factory test certificate (company standard) / national-level calibration certificate (national standard)
Sensor material	A	Measuring tube 316L, flanges 304 (standard)
	B	Measuring tube 316L, flanges 316L

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Item	Code	Description
	C / D	Wetted parts Hastelloy / high-nickel alloy
	E / F	Wetted parts titanium Ti (ASTM B265) / tantalum Ta (ASTM B708)
	G / H	Wetted parts C4 steel (ASTM A600Ti2004) / copper-nickel alloy
	I / J	Wetted parts nickel-base alloy / other material on request [2]
Sensor housing material	K / L / M	304 (standard) / 304L / 316L
	N	Other material and finish on request [2]
Menu language	A / B / C	Chinese / English / Russian
	D / E	German / Spanish
Transmitter mounting	A	Integral
	B (xxx)	Remote; xxx is the connecting cable length
Cable entry	M / N	1/2″NPT (F) × 2 / other [2]
Explosion protection	A	Ex db mb IIC T6 Gb
Ingress protection	A / B	IP67 / IP66

Note: [1] Accuracy is an absolute error in density, applies over the entire measuring range and is independent of the set range (see 3.1); the applicable conditions for class M are confirmed with the order.

[2] Special materials and non-standard cable entries must be raised when ordering and agreed by both parties.

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13 Ordering Information and Scope of Supply

13.1 Information required with the order

Item	Used to
Medium and its composition	Select wetted materials; check whether two-component conversion applies
Working density range	Set the output range end points and select the accuracy class
Medium temperature and operating pressure	Select the temperature class and pressure rating
Line size, flange standard and pressure rating	Select the nominal size and process connection
Normal flow velocity and flow direction	Check whether bypass mounting is needed (see chapter 06)
Solids or gas in the medium	Assess the effect of gas and settling (see 3.3)
Mounting arrangement and space available	Horizontal / vertical / bypass; integral or remote, and connecting cable length
Output and communication requirements	Select the transmitter output code and output variables
Site conditions	Hazardous-area classification, corrosive media, outdoor sun shading and similar requirements

13.2 Scope of supply (per meter)

Item	Quantity
PS7220 straight-tube inline density meter (sensor body + transmitter)	1
Certificate of conformity	1
Factory test report and factory calibration report	1 each
Operating manual	1
Explosion-protection certificate (for explosion-protected versions)	1

Note: For remote mounting, the connecting cable is supplied cut to length; it must not be shortened or extended on site. Mounting flanges, gaskets and fasteners are as agreed in the contract and are not included in the scope of supply by default.

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14 Warranty and Service

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

Item	Content
On-site service	Installation guidance, commissioning and automatic on-site calibration; training of operating and maintenance staff
Remote support	Selection calculations, configuration and troubleshooting
Delivery time	Depends on the ordered 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 meter shall prevail.

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