



PS7000 系列 · 西安派声 · PISONICS

超声波声阻抗密度计

Ultrasonic Acoustic Impedance Density Meter

技术规格书 · Technical Specification

告别核源隐患 · 重新定义浆液密度在线测量 *Precision beyond limits*



▲ PS7000 主机（分体式）与法兰测量管段 PS7000 transmitter and flanged measuring spool

一、产品概述 Product Overview

PS7000 系列超声波声阻抗密度计是西安派声（PISONICS）自主研发的新一代非核源浆体密度在线监测仪表，彻底摒弃传统 γ 射线密度计的辐射安全隐患与繁琐的环保审批维护成本，专为有色金属、火力发电、煤炭洗选、化工冶金、钾肥盐化等行业的浆体密度精准控制而打造。仪表搭载创新的线性调频（Chirp）声阻抗解析算法，于 0~80% 质量浓度（0~3000 kg/m³）全量程实现 $\pm 1\%$ FS 的高精度连续计量。

The PS7000 series is a new-generation non-nuclear online slurry density meter independently developed by PISONICS. It eliminates the radiation risk and licensing/maintenance burden of conventional gamma-ray density meters, and is purpose-built for accurate slurry density control in non-ferrous metallurgy, thermal power, coal washing, chemical & metallurgical processing, and potash/salt industries. Its innovative chirp acoustic-impedance algorithm delivers $\pm 1\%$ FS continuous measurement across the full 0–80% mass-concentration (0–3000 kg/m³) range.

二、测量原理 Measuring Principle

声阻抗法基于一个核心物理现象：超声波在介质中传播遇到固液界面时，回波强度由界面两侧的声阻抗差异决定，而声阻抗 $Z = \text{介质密度 } \rho \times \text{声速 } c$ ，与浆体密度直接相关。PS7000 采用单探头自发自收设计，持续发射线性调频（Chirp）超声脉冲并实时采集回波；Chirp 信号的宽频带特性可穿透气泡层、消除多重反射干扰，主机通过算法解析回波的声阻抗特征，准确还原浆体的真实密度。

The acoustic-impedance method relies on a core principle: when ultrasound meets a solid-liquid interface, the echo strength is governed by the impedance contrast across it, where acoustic impedance $Z = \text{density } \rho \times \text{sound speed } c$ — directly linked to slurry density. The PS7000 uses a single self-transmit/self-receive probe that emits chirp (linear-frequency-modulated) pulses and captures echoes in real time. The chirp's wideband nature penetrates bubble layers and suppresses multiple-reflection interference, so the host can resolve the impedance signature and reconstruct true slurry density.

三、技术参数 Technical Specifications

项目 Item	规格参数 Specification
产品型号 Model	PS7000 系列（声阻抗序列） / PS7000 Series (Acoustic Impedance)
测量原理 Measuring principle	超声波线性调频（Chirp）声阻抗法 / Ultrasonic chirp acoustic-impedance method
测量对象 Measured medium	固液两相浆体（矿浆、灰浆、煤浆、石灰石浆、盐溶液等） / Solid-liquid two-phase slurry
测量范围 Measuring range	0 ~ 80%（质量浓度） / 0 ~ 3000 kg/m ³
测量精度 Accuracy	±1% FS
分辨率 Resolution	0.001 g/cm ³ 或 0.1% / 0.001 g/cm ³ or 0.1%
输出模式 Output modes	质量浓度 / 体积浓度 / 密度 / 波美度 — Mass conc. / Volume conc. / Density / Baumé
供电电源 Power supply	DC 24V 或 AC 220V ±20% (50/60Hz) , 四线制 / DC 24V or AC 220V ±20%, 4-wire
整机功耗 Power consumption	≤ 1 W
环境温度 Ambient temperature	-30°C ~ +60°C
介质温度 Medium temperature	0°C ~ 80°C（高温型可达 120°C） / 0-80°C (high-temp up to 120°C)
环境湿度 Humidity	≤ 98%RH（无凝露） / ≤ 98%RH, non-condensing
适用管径 Pipe diameter	DN50 ~ DN1000（更大口径可定制） / DN50-DN1000 (larger customizable)

项目 Item	规格参数 Specification
安装方式 Mounting	法兰直插式 / 焊接式 / 分体式 (兼容 ANSI / DIN / JIS)
探头材质 Probe material	316L / 2205 双相钢 + 蓝宝石, Ra ≤ 0.4 μm / duplex steel + sapphire, Ra ≤ 0.4 μm
可选衬里 Optional liner	PTFE / 橡胶 / 陶瓷 — PTFE / rubber / ceramic
温度传感 Temperature sensor	PT1000 (探头温度) / PT1000 (probe temperature)
模拟输出 Analog output	4-20mA × 2 (负载 ≤ 500Ω) / 4-20 mA × 2 (load ≤ 500 Ω)
数字通讯 Digital communication	RS485 MODBUS-RTU (波特率 300–57600, 地址 1–247) / RS485 Modbus-RTU
远程传输 Remote transmission	支持 4G 无线模块 (选配) / Optional 4G wireless module
分体传输距离 Remote signal cable	信号最远 500 m / Up to 500 m
数据存储 Data logging	实时 2000 条 + 日志 400 条 / 2,000 real-time + 400 log records
输出修正 Output correction	$Y = aX + b$
显示屏 Display	128 × 64 OLED (中/英双语, 可选远端显示) / 128×64 OLED, CN/EN, optional remote
防护等级 Ingress protection	管段 IP68 / 主机 IP65 / Pipe section IP68, host IP65
防爆等级 Ex rating	Exd II CT6Gb (可选) / Exd II CT6Gb (optional)
认证 Certification	欧盟 CE / EU CE
外形尺寸 Dimensions	400 × 400 × 180 mm (主机 / host)
主机重量 Weight	约 2.5 kg / approx. 2.5 kg

四、核心技术优势 Key Advantages

关键技术 / 特性 Feature	客户价值 Customer Value
线性调频 (Chirp) 声阻抗算法 Chirp acoustic-impedance algorithm	穿透气泡层、消除多重反射, 精准还原固液两相真实密度 Penetrates bubbles, removes multiple reflections, accurate two-phase density

关键技术 / 特性 Feature	客户价值 Customer Value
非核源、零辐射 Non-nuclear, zero radiation	告别 γ 射线辐射隐患与繁琐的环保审批 No gamma-ray hazard or environmental licensing
非接触式探头设计 Non-contact probe	零磨损、零堵塞、免维护, 寿命 ≥ 5 年 Zero wear/clog, maintenance-free, life ≥ 5 years
定制化耐磨探头 Custom wear-resistant probe	316L / 2205 + 蓝宝石, $Ra \leq 0.4\mu m$, 光洁抗结垢 316L/2205 + sapphire, $Ra \leq 0.4\mu m$, anti-scaling
法兰直插式安装 Flange-insertion mounting	直管段仅需 5D+2D, 无满管要求 Only 5D+2D straight run, no full-pipe requirement
多种衬里可选 Multiple liners	PTFE / 橡胶 / 陶瓷, 应对强酸碱、高磨蚀 PTFE / rubber / ceramic for acid, alkali, abrasion
一体 / 分体灵活安装 Integral or remote mounting	壁挂 / 面板 / 管道安装, 分体信号最远 500 m Wall / panel / pipe; remote signal up to 500 m
中英双语 OLED 交互 Bilingual OLED interface	图形化菜单提示, 操作直观 Graphical menu, intuitive operation
双模信号输出 Dual-mode output	4-20mA (双路) + MODBUS-RTU, 接入 PLC / DCS 4-20mA $\times 2$ + Modbus-RTU, PLC/DCS ready
支持 4G 远程传输 4G remote (optional)	实时数据云端可视, 远程运维便捷 Cloud visualization, easy remote O&M
海量数据存储 Mass data logging	2000 条实时 + 400 条日志, 断电不丢 2,000 + 400 records, non-volatile
防爆 / CE 认证 Ex & CE certified	可选 Exd II CT6Gb, 已通过欧盟 CE 认证 Optional Exd II CT6Gb, EU CE certified

五、产品组成与安装 Composition & Installation

产品由密度计仪器（超声波探头 + OLED 视窗 + 线缆接口）、定制测试管道、远端显示屏与红外遥控器组成。支持一体式与分体式两种安装：一体式便于观察、推荐常规使用；测试管道周边空间受限或非满管工况时，宜采用分体式安装（水平安装时探头应位于管道下方）。安装于直管段，无满管要求。

The system comprises the meter instrument (ultrasonic probe + OLED window + cable interface), a custom test pipe spool, a remote display, and an infrared remote control. Both integral and remote mounting are supported: integral is recommended for general use and easy reading; remote mounting suits congested or non-full-pipe locations (in horizontal pipes the probe should sit at the bottom). Install on a straight run; no full-pipe condition is required.

电气连接 / Wiring:

- DC 24V 电源：+ 端接 24V，- 端接电源地。
- DC 24V power: + to 24V, - to ground.
- 模拟输出：两路 4-20mA 接 lo_1 / lo_2 端子，+/- 对应正负极。
- Analog output: dual 4-20mA on lo_1 / lo_2 terminals, observe +/- polarity.
- RS485: A 为正、B 为负、G 为地，最远 500 m。

- RS485: A (+), B (-), G (GND), up to 500 m.
- 探头信号接 MEA, 探头温度接 PT1000 (红 +, 白 -)。
- Probe signal to MEA; probe temperature to PT1000 (red +, white -).

安装注意事项 / Installation Notes:

- 安装场所应无强烈震动、环境温度变化小, 便于安装与维护。
- Site free of strong vibration, with stable ambient temperature; easy to service.
- 推荐垂直安装, 流体自下而上, 流速正常 (>1 m/s; 矿料密度越大, 流速需越高); 避免低流速或静止, 防止颗粒沉降扰动影响精度与稳定。
- Vertical mounting recommended — flow bottom-to-top at >1 m/s (higher for denser slurry); avoid low or static flow to prevent particle settling.
- 特殊情况水平安装时, 须保证测点浆液具代表性、无分层、均匀稳定, 且流速 >1 m/s。
- For horizontal mounting, ensure the slurry at the sensor point is representative, unstratified and uniform, with flow >1 m/s.
- 安装位置应远离泵及局部阻力件 (阀门、弯头等); 水平安装须保证前 10D、后 5D 直管段 (最少前 5D、后 3D)。
- Locate away from pumps and fittings (valves, elbows); horizontal mounting requires 10D upstream / 5D downstream straight run (min 5D / 3D).
- 现场标定采用取样称重法。
- On-site calibration is performed by sampling and weighing.

六、典型应用 Typical Applications

行业 Industry	典型测点 Typical Applications
有色冶金 Non-ferrous metallurgy	选矿给料 / 排料浓度、浮选浓度、浓密机与旋流器出口 Feed/discharge, flotation, thickener & cyclone outlet
火力发电 Thermal power	石灰石浆液制备、FGD 脱硫浓度、循环浆液密度 Limestone prep, FGD desulfurization, recirculation
煤炭洗选 Coal washing	重介质悬浮液密度、精/中/尾煤分选浓度 Heavy-medium density, product separation
钢铁冶金 Steel & coking	石灰石脱硫浆液、转炉除尘浆液浓度 Desulfurization slurry, dedusting slurry
化工 / 钾肥 Chemical & potash	盐湖卤水、饱和结晶溶液、含固两相流计量 Brine, saturated crystal solution, two-phase flow
矿山尾矿 Mine tailings	充填站出口料浆、磨矿循环密度控制 Backfill discharge, grinding circuit density

七、选型与定制 Model Selection & Customization

PS7000 支持非标量程、特殊衬里 (PTFE / 橡胶 / 陶瓷)、高温型 (介质温度可达 120°C)、防爆型 (Exd II CT6Gb)、远端显示及 4G 远程传输等定制选项。各项参数已根据具体固相与介质特性预先标定, 现场可通过遥控器菜单完成设备地址、波特率、输出类型、4/20mA 对应值、修正系数 a/b、阻尼与量程上下限等设置。

Customization options include non-standard ranges, special liners (PTFE/rubber/ceramic), high-temperature type (medium up to 120°C), explosion-proof type (Exd II CT6Gb), remote display, and 4G transmission. Parameters are pre-calibrated to the specific solid and medium; on site, device address, baud rate, output type, 4/20mA endpoints, correction coefficients a/b, damping, and range limits are set via the IR remote menu.

八、质保与服务 Warranty & Service

自发货之日起，仪表主机保修期为一年，修理及维护保修期为半年。保修仅限原厂购买者或指定经销商的用户，不适用于人为错误使用、改造、疏忽或事故及非正常条件下使用导致的损坏。保修期内的故障仪表提供免费维修，请联系售后服务部并附故障说明。

From the shipping date, the host carries a one-year warranty and repair/maintenance a six-month warranty. Coverage is limited to the original purchaser or authorized distributor's users and excludes damage from misuse, modification, negligence, accident, or abnormal operating conditions. In-warranty faulty units are repaired free of charge — please contact after-sales service with a fault description.

联系方式 Contact

西安派声信息科技有限公司 PISONICS

电话 Tel: +86 159 0293 2017

邮箱 Email: info@pisonics.com

网址 Web: pisonics.com / pisonics.cn

地址 Add: 西安市碑林区长安北路 14 号 / No.14 Chang'an North Rd, Beilin District, Xi'an, China

注：本规格书参数如有变更，恕不另行通知，最终解释权归西安派声所有。

Note: Specifications are subject to change without notice.