PRODUCT

INFORMATION

Model 3025A Ultrafine Condensation Particle Counter

TSI manufactures an Ultrafine Condensation Particle Counter (CPC) for use in particle research applications. Model 3025A is a continuous-flow particle counter capable of detecting airborne particles as small as 3 nanometers in diameter—smaller than any other particle counter can detect!

The Model 3025A measures the number concentration of small particles with high efficiency. Due to a vapor sheath that confines the aerosol flowpath near the centerline of the condenser, all particles experience nearly identical supersaturation conditions. The result is a sharply defined lower size-detection limit. This unique flow design minimizes response time and diffusion losses of ultrafine particles. Therefore, you can measure rapid changes in aerosol concentration with utmost accuracy.

TSI is the world's leading manufacturer of high-performance CPCs. We offer a variety of models to accommodate specific needs. A comparison chart listing the differences between our CPCs appears on the back of this document. Contact your TSI representative for more information.

An extremely sensitive particle counter that detects particles down to 3 nm

APPLICATIONS

- Basic aerosol research
- Outdoor and indoor air-quality research
- Filter and air-cleaner testing
- Particle shedding and component tests
- Particle formation and growth studies
- Atmospheric and climate studies
- Particle counter calibration (when used as the reference standard)
- Combustion and engine-exhaust studies
- Inhalation or exposure-chamber studies

The Model 3025A is designed primarily for researchers interested in particles smaller than 20 nanometers. Sensitivity to 3-nanometer particles is important for nucleation, combustion, condensation, and growth studies. The Model 3025A is available in either a standard or a scanning configuration. The scanning version, Model 3025A-S, is required for use in TSI Scanning Mobility Particle Sizer (SMPS) systems. Collectively, SMPS systems configured with a Model 3025A-S provide size-distribution measure-

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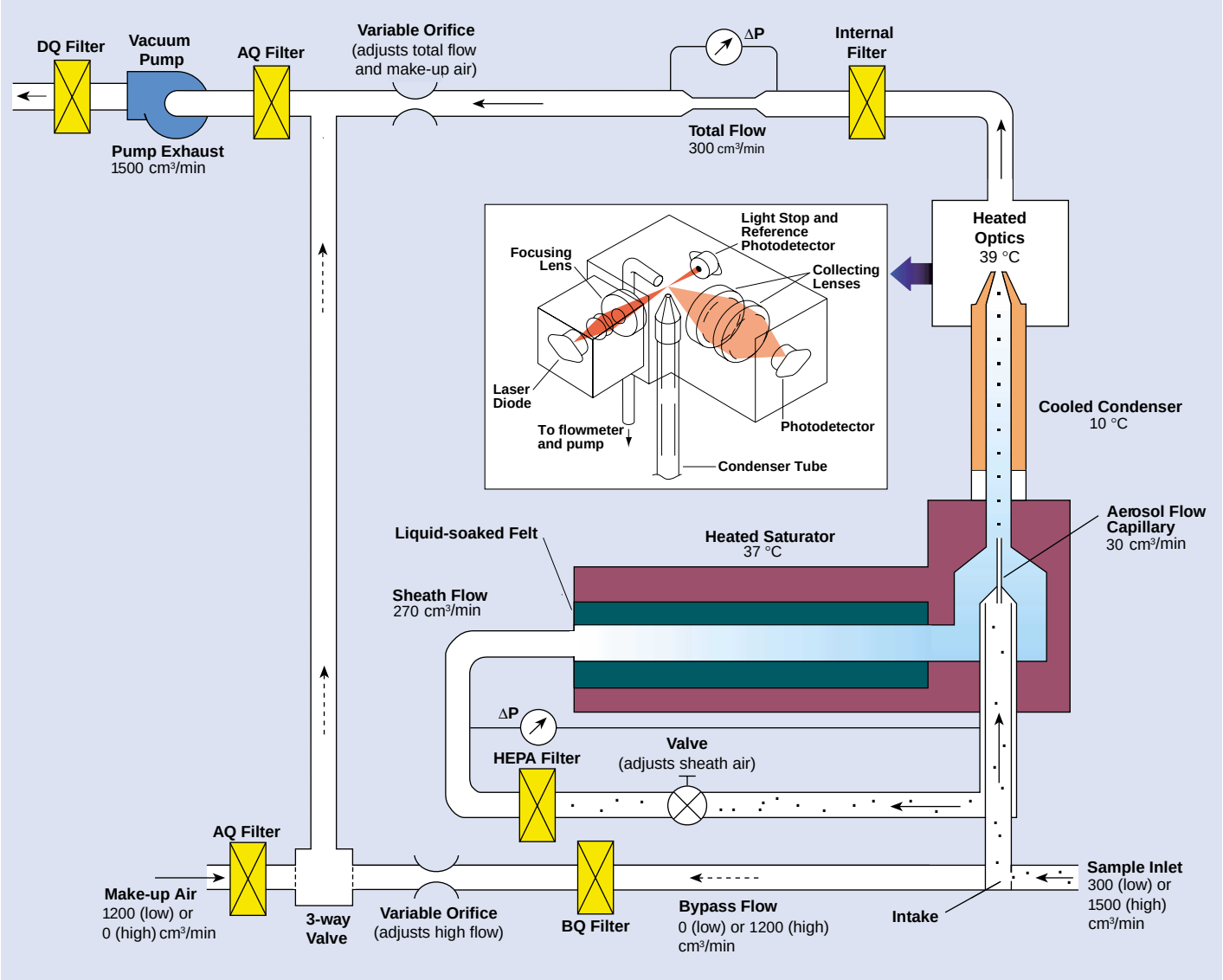


ments from 0.003 to 1.0 micrometer. Specific size ranges vary depending on the Differential Mobility Analyzer used.

OPERATION

The inlet flow of the Ultrafine CPC can be configured for high-flow operation (1.5 liters per minute) to speed response time and minimize transport loss, or for low-flow operation (0.3 liters per minute) to provide flexibility when used as part of an SMPS system. In high-flow mode, 1.2 L/min of the inlet flow is diverted as a bypass-transport flow. In both high- and low-flow modes, 0.3 L/min of the total flow passes through the saturator, condenser, and optics regions of the instrument. Just prior to the aerosol flow capillary, the total flow splits into a 0.27 L/min sheath flow and a 0.03 L/min aerosol sample flow. The sheath flow is cleaned by a HEPA filter and drawn through a heated, liquid-soaked, felt tube where it becomes saturated with vapor. The aerosol sample enters the cleaned vapor-sheath flow near the inlet of the condenser. A short, heated section at this juncture allows vapor to diffuse into the aerosol before entering the cooled condenser.

Because the aerosol sample is confined near the centerline of the condenser, it encounters uniformly high supersaturation levels and negligible losses to the wall. The continuous flow is controlled volumetrically using linear-element flowmeters. Internal optics focus laser light to a thin ribbon just above the aerosol focusing nozzle. Droplets are counted individually (in concentrations up to 10^5 particles per cubic centimeter) as they scatter light onto a photodetector.

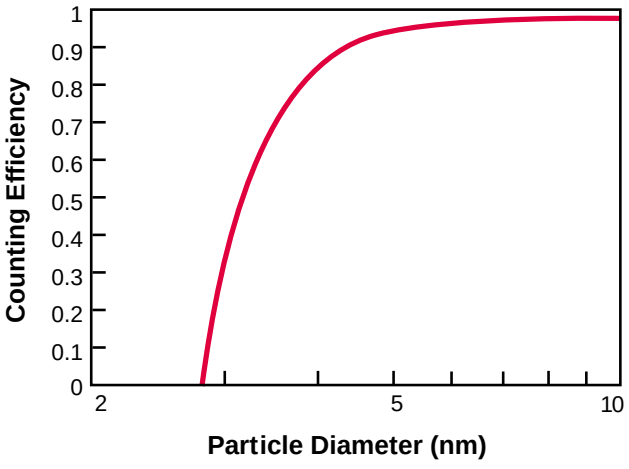
SPECIFICATIONS

Particle size range
Minimum detectable particle: 50% of 3-nm particles
Maximum detectable particle: >3 µm
Particle concentration range: Counts single particles in concentrations from 0 to 9.99×10^4 particles/cm^3; provides running-average over 1, 2, 20, and 200 seconds depending on concentration range; display updated every second
Concentration accuracy: ±10% up to 10^5 particles/cm^3, coincidence less than 2% at 10^4 particles/cm^3, live-time particle counting from 10^4 to 10^5 particles/cm^3 provides automatic correction for coincidence
False background counts: < 0.01 particle/cm^3
Response time: 1 sec for 95% response to concentration step change when sampling in high-flow mode, <5 sec for low-flow mode
Aerosol medium: Recommended for use with air; safe for use with inert gases such as nitrogen, argon, and helium (Performance specifications are for air.)
Signal-to-noise ratio: 25:1 nominal
Light source: Stable, 5-mW, 780-nm laser diode
Flow
Aerosol flow rate: 30 ± 3 cm^3/min
Total flow rate: 300 ± 15 cm^3/min
High-flow inlet: 1500 ± 150 cm^3/min
Low-flow inlet: 300 ± 15 cm^3/min
Flow control: Automatic volumetric flow control of total flow calibrated using pressure drop across capillary to control internal carbon-vane pump
Condensing liquid
Working fluid: Reagent-grade n-butyl alcohol (not included)
Filling system: Electronic liquid-level sensor initiates automatic filling as needed, requires connection to fill bottle (provided with instrument)

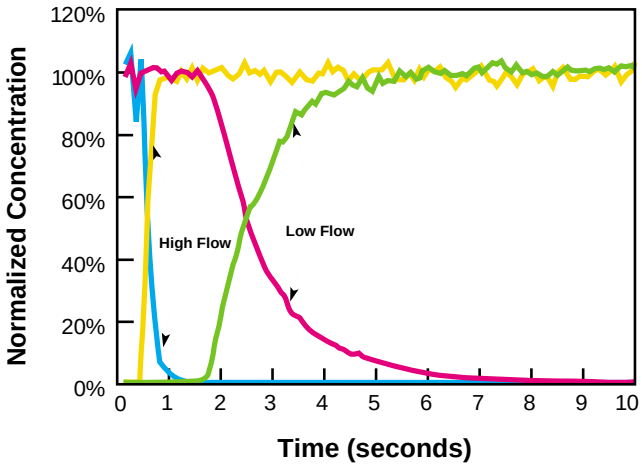
Operating temperatures
Saturator: 37 ± 0.3 °C
Condenser: 10 ± 0.3 °C
Optics: 39 ± 2.0 °C
Communications
Protocol: Command set based on ASCII characters
Interface: RS-232, 9-pin, "D" subminiature connector, pinouts compatible with standard IBM-style serial cables and interfaces
Outputs
Digital display: Concentration, total counts, status (temperatures, aerosol flow, condenser flow, photodetector voltage)
Analog: BNC connection, 0 to 10 volts, user-selectable function output (linearized concentration, log concentration, condenser flow, aerosol flow, pump control, photodetector voltage) (For use in TSI SMPS systems, a Host mode allows output to 11 volts.)
Pulse: BNC connection, 13V square pulse, typically 3.3 µsec wide
Software: Supplied with CPCount™ Software
Calibration: Recommended annually
Power requirements: 100/120/230/240 VAC, 50/60 Hz, 200 W maximum
Physical features
Front panel: 12-digit LED-pixel display, sample inlet, indicator lights (particle, laser, flow, temperature, liquid status), operating buttons
Rear panel: Power connector, fuse, 9-pin serial connector, three BNC connectors, fan, liquid-fill connector, makeup-air port, pump-exhaust port, fill bottle with bracket
Dimensions (LWH): 24 cm × 38 cm × 25 cm (9.5 in. × 15 in. × 10 in.), not including fill bottle and bracket
Weight: 12.5 kg (27 lb)
Environmental operating conditions
Ambient temperature range: 10 to 37 °C
Ambient humidity range: 0 to 90% RH, noncondensing

Specifications are subject to change without notice.

Particle-detection efficiency, NaCl particles in nitrogen at 1500 cm^3/min inlet flow (Keston et al. 1991)



Response-time for a concentration step-change at time = 0 (Quant et al. 1992)



TO ORDER

Specify	*Description*
3025A	Ultrafine Condensation Particle Counter with CPCount™ Software
3025A-S	Ultrafine Condensation Particle Counter with Fast-scanning EPROM and CPCount™ Software
EP3025A-S	Fast-scanning EPROM only (for upgrading Model 3025 or 3025A)

The Model 3025A-S is a standard component in selected Scanning Mobility Particle Sizer (SMPS) systems. Ask your TSI representative for additional information on SMPS systems.

Accessories

Specify	*Description*
376060	Particle Size Selector
376061	Additional screens for Particle Size Selector (set of 12)

Accessories must be ordered separately. The TSI Model 3025 Condensation Particle Counter, the predecessor of our Model 3025A, was developed in cooperation with the University of Minnesota Particle Technology Laboratory. TSI, the TSI logo, and CPCount are trademarks of TSI Incorporated. IBM is a trademark of IBM Corporation.

BIBLIOGRAPHY

Stolzenburg MR and PH McMurry, An Ultrafine Aerosol Condensation Nucleus Counter, *Aerosol Science and Technology* 14:48-65 (1991). *(TSI paper A82)*

Kesten J, A Reineking, and J Porstendörfer, Calibration of a TSI Model 3025 Ultrafine Condensation Particle Counter, *Aerosol Science and Technology* 15:107-111 (1991). *(TSI paper A77)*

Quant FR, R Caldow, GJ Sem, and TJ Addison, Performance of Condensation Particle Counters with Three Continuous-Flow Designs, *J. Aerosol Sci.* 23:S405-S408 (1992). *(TSI paper A79)*

For the most current information available on this instrument, go to www.tsi.com and select "Particle Instruments."

COMPARISON CHART

TSI CONDENSATION PARTICLE COUNTERS	3010	3022A	3025A	3760A	3762
Minimum particle size (50% efficiency, nm)	10	7	3	11	11
Aerosol flow rate (cm^3/min)	1000	300	30	1500	3000
Upper concentration limit (particles/cm^3)	10^4	10^7	10^5	10^4	5×10^3
Lower concentration sensitivity (particles/cm^3)	0	0	0	0	0
False background counts (particles/cm^3)	<0.00001	<0.01	<0.01	<0.00005	<0.00005
Response time (sec for 95% response)	<5	<13	1	<3	<1.5
Vacuum source	External	Internal pump	Internal pump	External	External
SMPS compatibility	Yes	Yes	Yes	No	No

TSI offers the most complete set of scientific CPCs available anywhere. (Model 3762 is not pictured. It has the same appearance and dimensions as the Model 3760A.) The comparison chart, above, lists the major differences between our CPCs. Contact your TSI representative for more information.

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