PRODUCT

INFORMATION

Model 3010
Condensation Particle Counter

The Model 3010 Condensation Particle Counter (CPC) is a compact, rugged instrument that detects airborne* particles down to 10 nanometers in diameter. Due to a high signal-to-noise ratio that limits its false background counts to nearly zero, it detects these small particles with remarkable accuracy.

The Model 3010 CPC samples and counts submicrometer particles on a continuous basis, enlarging them to a size that can be detected easily. It offers an upper concentration limit of 10,000 particles per cubic centimeter and responds quickly to concentration changes, showing accurate readings in a matter of seconds. It operates quietly and does not introduce contaminants into the surrounding area.

Additionally, the Model 3010 includes a front-panel display for viewing particle counts and concentration data. An internal microprocesser and built-in serial communications port facilitate sending data directly to a computer for storage and display.

A compact, full-featured Condensation Particle Counter from the leader in CPC technology

A leader in CPC technology, TSI manufactures a complete family of Condensation Particle Counters. A comparison chart is included on the back of this document. Contact your TSI representative for additional information.

APPLICATIONS

- Basic aerosol research
- Outdoor and indoor air monitoring
- Filter and air-cleaner testing
- Particle shedding and component tests
- 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 3010 is available in either a standard or a scanning configuration. The scanning version, Model 3010-S, is required for use in TSI Scanning Mobility Particle Sizer (SMPS) systems. Collectively, SMPS systems configured with a 3010-S provide size-distribution measurements from 0.01 to 1.0 micrometer. Specific size ranges vary depending on the Differential Mobility Analyzer used.

*Also safe for use with inert gases such as nitrogen, argon, and helium.

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OPERATION

During operation, alcohol condenses onto particles in the sample flow, creating aerosol droplets large enough to be detected efficiently using a light-scattering technique. Upon entering the CPC, the sample passes through a saturator block, where alcohol evaporates into the sample stream. The flow becomes saturated with alcohol vapor. The sample then passes into a vertical condenser tube cooled by a thermoelectric heat pump. Here, the alcohol vapor supersaturates and condenses onto virtually all particles larger than 10 nanometers, regardless of chemical composition.

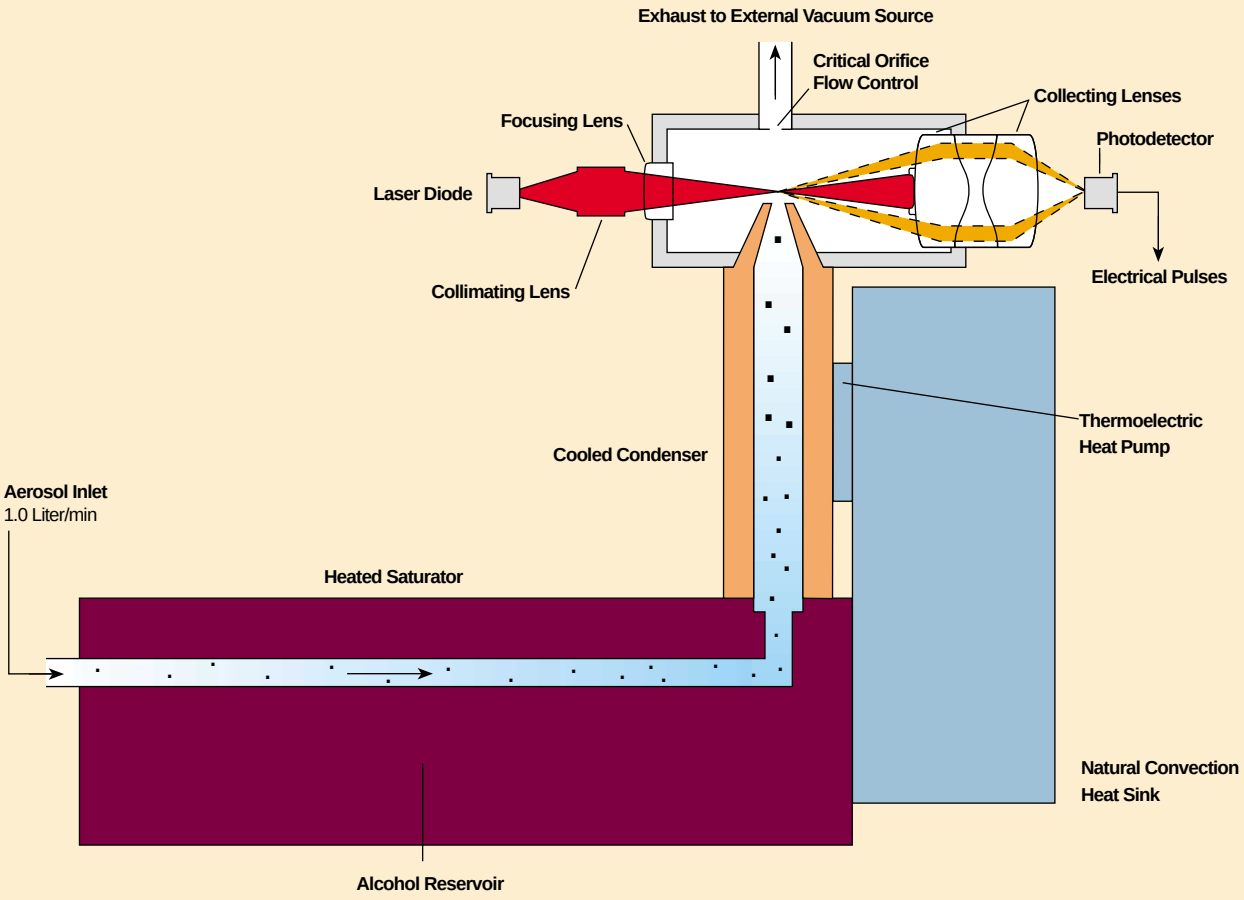
As droplets exit the condenser, they pass through a thin ribbon of laser light. Light scattered by these droplets is collected by optics and focused onto a photodetector. The photodetector converts the light signal to an electrical pulse, which is recorded as a particle count.

SELECTABLE SIZE LIMITS

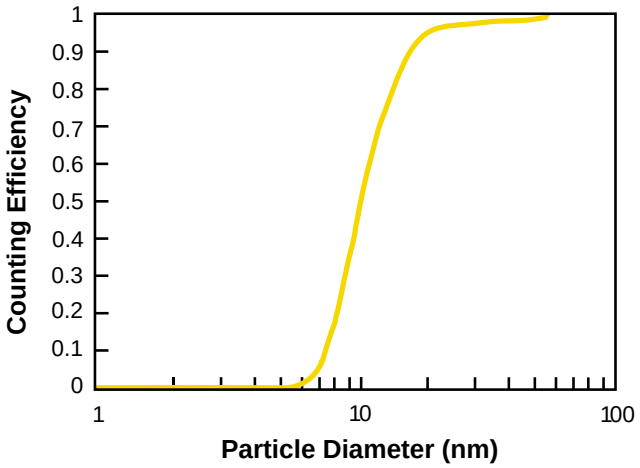
An optional Model 376060 Particle Size Selector (PSS) lets you select any of eleven cutoff points between 0.01 and 0.12 micrometer. The PSS uses a series of fine-mesh screens to remove small particles by diffusional capture.

An additional set of diffusion screens (available separately) allows you to select cutoff diameters up to 0.25 micrometer.

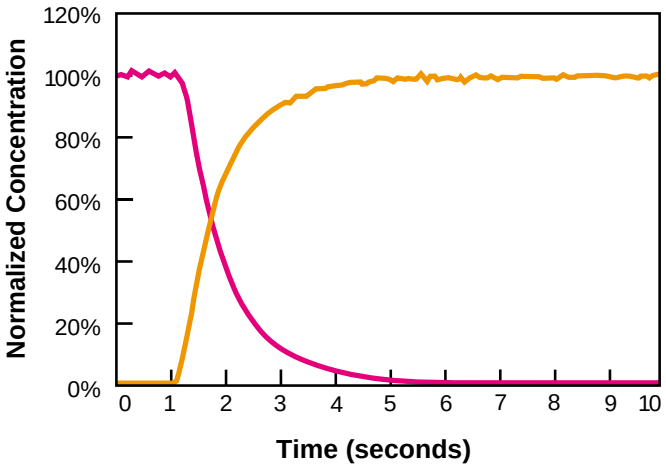
Diffusion screens	Particle size cut, µm (50%)
0	0.010
1	0.017
2	0.030
3	0.041
4	0.052
5	0.062
6	0.072
7	0.083
8	0.092
9	0.102
10	0.112
11	0.122



Particle-detection efficiency, silver particles in nitrogen at 50% R.H. (Caldow et al. 1992)



Response-time for a concentration step-change at time = 0



SPECIFICATIONS

Particle size range
Minimum detectable particle: 50% of 10-nm particles
Maximum detectable particle: >3 µm
Particle concentration range: 0 to 10,000 particles/cm^3 with <10% coincidence at 10,000 particles/cm^3
Concentration accuracy: ±10% compared to standard
False background counts: <0.00001 particle/cm^3
Response time: <5 sec for 95% response to concentration step change
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: 20:1 minimum
Light source: Stable, 50-mW, 780-nm laser diode
Flow
Aerosol flow rate: 1.0 L/min (0.035 cfm) ±10%
Purge flow rate: 1.0 L/min (0.035 cfm)
Outlet (total) flow rate: 2.0 L/min (0.07 cfm)
Flow sensor: Internal sensing by measuring differential pressure across critical orifice
Flow control: External vacuum with critical orifice

For long-term operation, our CPCs require the use of an external fill bottle (provided with the instrument).

Condensing liquid
Working fluid: Reagent-grade n-butyl alcohol (not included)
Internal reservoir capacity: 350 ml
Mean time between fills: 7 days at 22 °C
Filling system: Manually initiated electronic liquid fill or autofill once per day, requires connection to fill bottle (provided with instrument)
Operating temperatures: A temperature differential of 17 °C is maintained between the saturator and condenser
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
Voltage output (selectable using DIP switch)
Square pulse: 5 V, 500 ± 100 ns
16-bit analog output: 0 to 10 V full scale (0 to 11 V under HOST control)
Software: Supplied with CPCount™ Software
Calibration check: Recommended annually
Required utilities
Power: 100/120/230/240 VAC, 50/60 Hz, 25 W maximum
Vacuum source: 450 mm Hg (18 in. Hg) minimum gauge
Physical features
Front panel: Aerosol sample inlet, liquid-level window, indicator lights (particle, laser, flow, temperature, liquid status), 5-digit LCD display, operating buttons
Rear panel: Power connector, fuse, 9-pin serial connector, BNC connector, DIP switches to select operating conditions, liquid-fill and drain connectors, vacuum port
Dimensions (LWH): 19 cm × 22 cm × 19 cm (7.5 in. × 8.5 in. × 7.5 in.), not including fill bottle
Weight: 5.5 kg (12 lbs)
Environmental operating conditions
Ambient temperature range: 5 to 40 °C
Ambient humidity range: 0 to 90% RH, noncondensing

Specifications are subject to change without notice.

TO ORDER

Specify	*Description*
3010	Condensation Particle Counter with CPCount™ Software
3010-S	Condensation Particle Counter with Fast-Scanning EPROM and CPCount™ Software
EP3010-S	Fast-Scanning EPROM only (for upgrading Model 3010)

The Model 3010-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*
3032	Vacuum Pump
3033	Vacuum Pump
376060	Particle Size Selector
376061	Additional screens for Particle Size Selector (set of 12)

Accessories must be ordered separately. Design specifications for the Model 3010 are covered in U.S. patent number 4,790,650. The technique of using a condensation particle counter with diffusion screens to select specific size ranges is covered in U.S. patent number 5,072,626. TSI, the TSI logo, and CPCount are trademarks of TSI Incorporated. IBM is a trademark of IBM Corporation.

BIBLIOGRAPHY

Caldow RC, MR Palmer, and FR Quant; Performance of the TSI Model 3010 Condensation Particle Counter; paper presented at the American Association for Aerosol Research Eleventh Annual Meeting; San Francisco, California, USA; October 1992. *(TSI paper A83)*

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 Model 3760A.) The comparison chart, above, lists the major differences between our CPCs. Contact your TSI representative for more information.

TSI Incorporated
Particle Instruments
P.O. Box 64394
St. Paul, MN 55164-0394
USA

Shipping address:
500 Cardigan Road
Shoreview, MN 55126-3996
USA

Toll Free: 1 800 677 2708
Tel: 651 490 2833
Fax: 651 490 3860
E-mail: particle@tsi.com
Web: www.tsi.com

Europe:
TSI GmbH
Zieglerstrasse 1
D-52078 Aachen
Germany
Tel: +49 241 523030
Fax: +49 241 5230349
E-mail: Particle-Europe@tsi.com