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Find the *TSI 3776* at our website: *Click HERE*

Model 3776
Ultrafine Condensation Particle Counter

A UCPC that detects particles down to 2.5 nm with extended single particle counting up to 300,000 particles/cm³!



The Model 3776 Ultrafine Condensation Particle Counter (UCPC) is designed primarily for researchers interested in airborne particles smaller than 20 nanometers. With sensitivity to particles down to 2.5 nanometers, this UCPC is ideally suited for atmospheric and climate research, particle formation and growth studies, combustion and engine exhaust research, and nanotechnology research. It is compatible with TSI Scanning Mobility Particle Sizer™ (SMPS™) spectrometers.

The successor to our Model 3025A UCPC, the Model 3776 offers many new features and improvements:

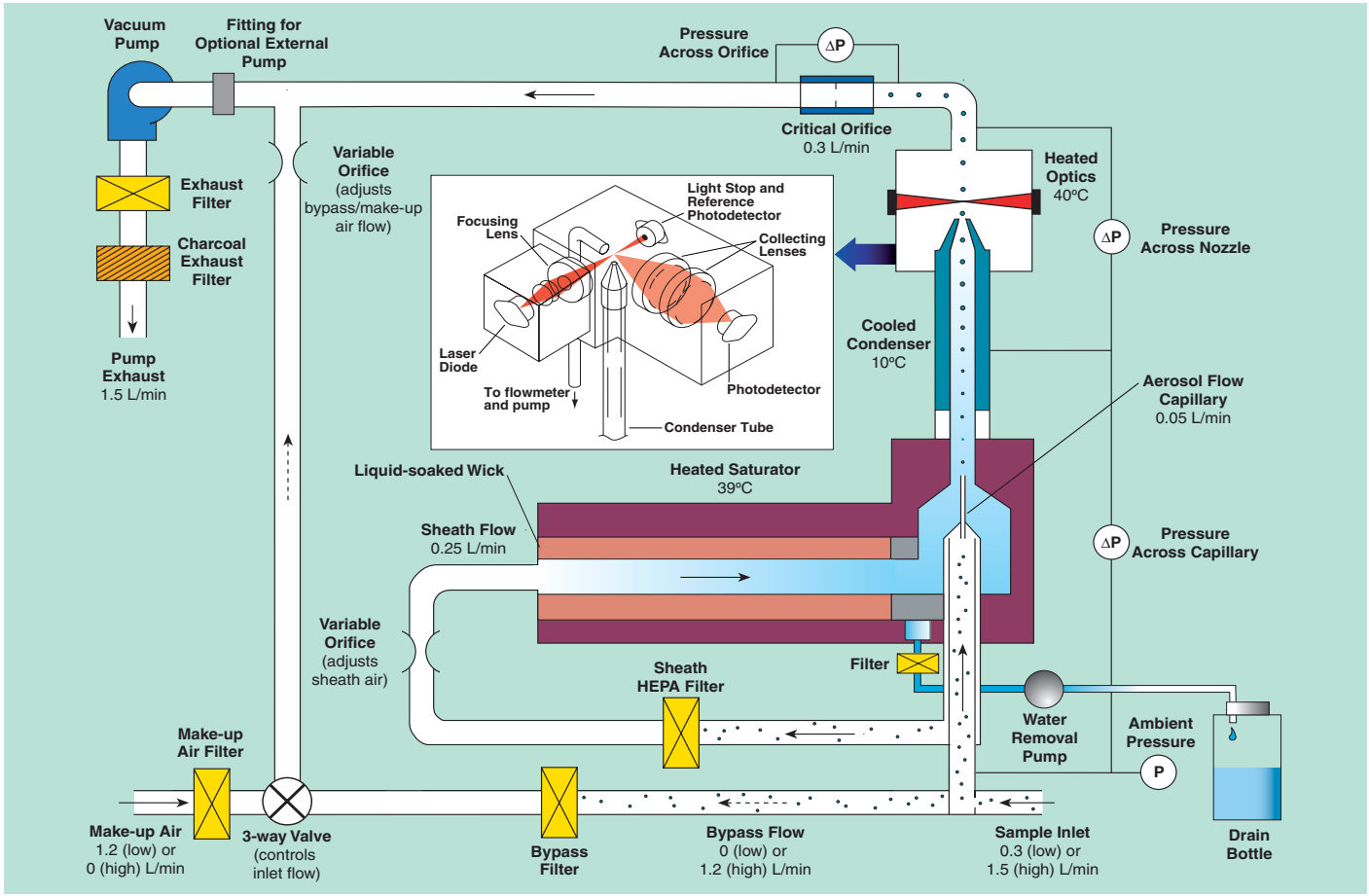
- Detects particles down to 2.5 nm
- Fast response to rapid changes in aerosol concentration (T_{95} <0.8 sec)
- Higher aerosol flow rate of 50 cm³/min for improved counting statistics
- Extended single particle counting up to 300,000 particles/cm³ with continuous, live-time coincidence correction for maximum accuracy
- Butanol-friendly features, including anti-spill design, water-removal system, butanol odor absorber, and improved resistance to optics flooding
- Removable saturator wick for easy transport and maintenance
- Built-in data logging and storage capability with removable memory card
- USB and Ethernet availability
- Built-in SMPS compatibility (Now standard!)
- Auto recovery from power failure
- Particle concentration, plots of concentration versus time, total counts, or instrument status shown on front-panel color LCD display

Operation

In a laminar-flow, alcohol-based CPC, an aerosol sample is drawn continuously through a heated saturator in which alcohol is vaporized and diffuses into the sample stream. Together, the aerosol sample and alcohol vapor pass into a cooled condenser where the alcohol vapor becomes supersaturated and ready to condense. Particles present in the sample stream serve as condensation nuclei. Once condensation begins, particles that are larger than a threshold diameter grow quickly into larger droplets and pass through an optical detector where they are counted easily.

Using a unique sheath-air-flow design that confines the aerosol flow path near the centerline of the condenser, the Model 3776 detects particles as small as 2.5 nanometers in diameter. This design exposes particles to the region of highest supersaturation and uniformity of alcohol vapor. As a result, even the smallest particles can be activated and grown to large droplets for easy optical detection. This unique design greatly enhances measurement response time, produces a sharply

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defined lower-size-detection limit (counting efficiency curve) and minimizes diffusion losses of ultrafine and nanoparticles.

An internal pump draws the aerosol sample into the Model 3776. The inlet flow can be configured for either high-flow mode operation (1.5 L/min) to improve response time and minimize particle transport loss, or low-flow mode operation (0.3 L/min) to provide flexibility when used as part of an SMPS spectrometer. In high-flow mode, 1.2 L/min of the inlet flow is diverted as a bypass flow. In both high- and low-flow modes, 0.3 L/min of the inlet flow passes through the saturator, condenser, and optics regions of the instrument. Just prior to the aerosol flow capillary, the 0.3-L/min sensor flow splits into a 0.25-L/min sheath flow and a 0.05-L/min aerosol flow. The sheath flow is cleaned by a HEPA filter and drawn through a heated, liquid-soaked, porous tube where it becomes saturated with alcohol vapor. The aerosol sample joins the filtered vapor-saturated sheath flow right before the inlet of the condenser. A short, heated section at this juncture allows vapor to diffuse into the aerosol before entering the cooled condenser. The volumetric flow rate of the 0.3-L/min sensor flow is controlled accurately using a critical orifice, which also allows the use of an external vacuum source without change in flow control.

Real-time graphs of particle concentration versus time, concentration, totalizer function, and operating parameters are all viewable on the front-panel color display. Data are directly accessible via standard serial and USB interfaces at a maximum time resolution of 0.1 second. Instrument reading and status can be monitored through Ethernet in real time.

Aerosol Instrument Manager® Software and Built-in SMPS Compatibility

Every Model 3776 is supplied with Aerosol Instrument Manager software designed for use with Microsoft® Windows® operating systems. The software is used for instrument control and provides data collection, management, and export capabilities, as well as several choices for data display.

The Model 3776 comes standard with built-in compatibility for use in TSI Series 3936 Scanning Mobility Particle Sizer (SMPS) spectrometers. Collectively, SMPS spectrometers configured with a Model 3776 UCPC provide size-distribution measurements from 0.0025 to 1.0 micrometer. Specific size ranges vary depending on the Differential Mobility Analyzer (DMA) used and DMA/CPC flow rate settings. Ask your TSI representative for additional information.

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Applications

TSI is proud to offer the most comprehensive offering of scientific CPCs available anywhere. Building on a CPC tradition of more than 25 years experience, TSI CPCs have become the standard to which all others are compared. General applications include:

- Basic aerosol research
- Indoor-air-quality measurements
- Filter and air cleaner testing
- Particle shedding and component tests
- Atmospheric and climate studies
- Particle formation and growth studies
- Particle counter calibration
- Combustion and engine exhaust studies
- Inhalation or exposure chamber studies
- Health effects studies
- Environmental monitoring
- Nanotechnology research
- Mobile aerosol studies

Ask your TSI representative for information on our other CPCs and recommended applications.

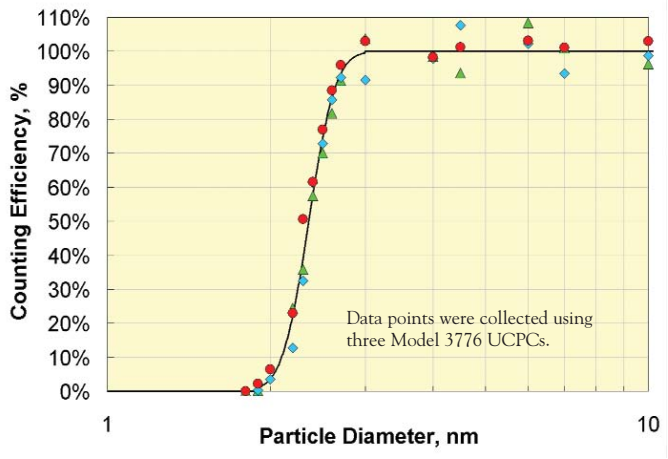
Specifications

Model 3776 Ultrafine Condensation Particle Counter

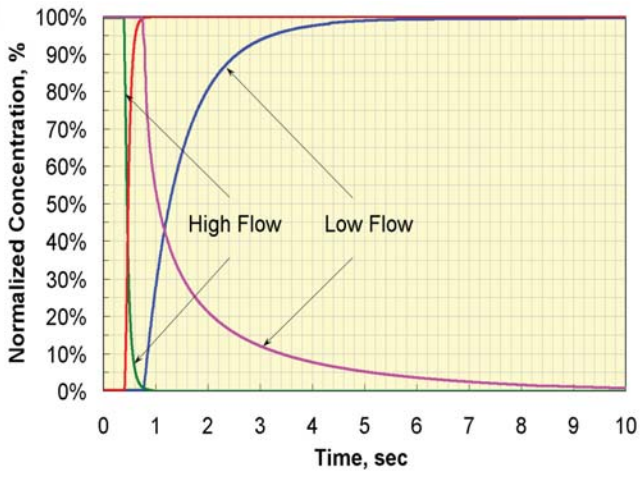
Particle Size Range	
Min. Detectable Particle (D_{50})	2.5 nm, verified with DMA-classified sucrose particles
Max. Detectable Particle	>3 µm
Particle Concentration Range	0 to 3×10^5 particles/cm^3, single particle counting with continuous, live-time coincidence correction; display concentrations up to 10^6 particles/cm^3 (custom calibration versus aerosol electrometer needed for concentrations higher than 3×10^5 particles/cm^3)
Particle Concentration Accuracy	±10% at $<3\times10^5$ particles/cm^3
Response Time	
High-flow Mode	<0.8 sec to 95% in response to concentration step change
Low-flow Mode	<5 sec to 95% in response to concentration step change
Flow	
Aerosol Flow Rate	0.05 ±0.005 L/min
Sensor Flow Rate	0.3 ±0.015 L/min (sheath + aerosol)
High-flow Inlet	1.5 ±0.05 L/min
Low-flow Inlet	0.3 ±0.015 L/min
Flow Source	Internal high-vacuum diaphragm pump with brushless DC motor (15,000-hr rated lifetime); option to use external vacuum source, but this requires change to internal plumbing
Flow Control	Volumetric flow control of sensor flow by critical orifice, aerosol flow is monitored through differential pressure across capillary
Operating Temperatures	
Saturator	39 ±0.2°C
Condenser	10 ±0.2°C
Optics	40 ±0.2°C
False Background Counts	<0.01 particle/cm^3, based on 12-hr average
Aerosol Medium	Recommended for use with air; safe for use with inert gases such as nitrogen, argon, and helium (performance specifications are for air)
Environmental Operating Conditions	
Ambient Temperature	10 to 35°C
Ambient Humidity	0 to 90% RH, noncondensing
Ambient Pressure	75 to 105 kPa (0.75 to 1.05 atm)
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 (included with instrument)

Specifications continued on back page

TSI Model 3776 Efficiency, Sucrose Particles (Shi *et al.* 2005)



TSI Model 3776 Response Time (Shi *et al.* 2005)



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Condensing Liquid (continued)	
Water Removal	All condensate is collected and removed automatically by a constant-flow-rate micropump, may be switched on for use in humid environments
Communications	
Protocol	Command set based on ASCII characters
Interfaces	
RS-232	9-pin, "D" subminiature connector, pinouts compatible with standard IBM-style serial cables and interfaces
USB	Type B connector, USB 2.0 compatible at 12 Mb
Ethernet	8-wire RJ-45 jack, 10/100 BASE-T, TCP/IP
Data Logging and Storage	SD/MMC flash memory card
Averaging Interval	1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60 seconds (set from front panel), software provides more averaging options
Analog Inputs	Two BNC connectors, 0 to 10 V (data recording for external sensors)
Outputs	
Digital Display	Graph of concentration vs. time, concentration, time and total counts, status (temperatures, pressures, laser power, aerosol flow, *etc*.)
Analog	BNC connector, 0 to 10 V, user-selectable function output (linear/log concentration or DMA voltage control)
Pulse	BNC connector, TTL level pulse, nominally 400 nanosec wide
Software	Aerosol Instrument Manager software supplied with instrument (RS-232 and USB compatible)
Calibration	Recommended annually
Power Requirements	100 to 240 VAC, 50/60 Hz, 335 W maximum
Physical Features	
Front Panel	LCD TFT QVGA (320×240 pixel) 5.7-in. color display, sample inlet, LED particle indicator light, rotate/select control knob, flash memory card slot
Rear Panel	Power connector, USB, Ethernet, two 9-pin D-sub serial connectors, two BNC inputs, two BNC outputs, fan, butanol-fill connector, butanol-drain connector, makeup-air port, pump-exhaust port, fill bottle and bracket
Side Panel	Butanol-level viewing window
Dimensions (HWD)	25 × 32 × 37 cm (10 × 13 × 15 in.), not including fill bottle and bracket
Weight	9.9 kg (22 lb)

Specifications are subject to change without notice. TSI, the TSI logo, Scanning Mobility Particle Sizer, SMPS, and Aerosol Instrument Manager are trademarks of TSI Incorporated. Microsoft and Windows are trademarks of Microsoft Corporation. IBM is a trademark of IBM Corporation.

To Order

Ultrafine Condensation Particle Counter

Specify	*Description*
3776	UCPC with Aerosol Instrument Manager software

The Model 3776 is a standard component in select TSI Scanning Mobility Particle Sizer (SMPS) spectrometers. Ask your TSI representative for additional information on SMPS spectrometers.

Bibliography

Shi Q, HS Han, SW Kerrigan, and EM Johnson, Characterization of Two New Butanol-based Condensation Particle Counters, poster #1PC17, American Association for Aerosol Research Conference, Austin, Texas, October 2005.

Shi Q, HS Han, SW Kerrigan, and EM Johnson, Characterization of A New Butanol-based Ultrafine Condensation Particle Counter, oral presentation #086, European Aerosol Conference, Ghent, Belgium, August 2005.

Sem GJ, Design and Performance Characteristics of Three Continuous-Flow Condensation Particle Counters: a Summary, *Atmospheric Research* **62**:267-294, 2002*.

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

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)*

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

*Paper refers to TSI Model 3025 UCPC, a predecessor of the Model 3776.

TSI Incorporated
Corporate Headquarters—Tel: *651 490 2811* ***Toll Free:*** *1 800 874 2811* ***Fax:*** *651 490 3824* ***E-mail:*** *particle@tsi.com*
TSI China—Tel: *+86 10 8260 1595* ***Fax:*** *+86 10 8260 1597* ***E-mail:*** *tsichina@tsi.com*
Contact TSI or visit www.tsi.com for information on specific office locations worldwide.
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