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

ULTRAFINE CONDENSATION PARTICLE COUNTER MODEL 3776



The Ultrafine Condensation Particle Counter (UCPC) Model 3776 is designed primarily for researchers interested in airborne particles smaller than 20 nm. With sensitivity to particles down to 2.5 nm, 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.

Applications

TSI offers the most comprehensive line of CPCs available. Building on a tradition of 30 years experience, TSI CPCs have become the standard to which all others are compared.

General applications include:

+ Basic aerosol research
+ Filter and air cleaner testing
+ Atmospheric and climate studies
+ Particle formation and growth studies
+ Combustion and engine exhaust studies
+ Inhalation or exposure chamber studies
+ Health effects studies

Features and Benefits

+ Fast response to rapid changes in aerosol concentration
+ Extended single particle counting up to 300,000 particles/cm^3 with continuous, live-time coincidence correction
+ 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
+ Built-in SMPS™ spectrometer compatibility
+ Auto recovery from power failure

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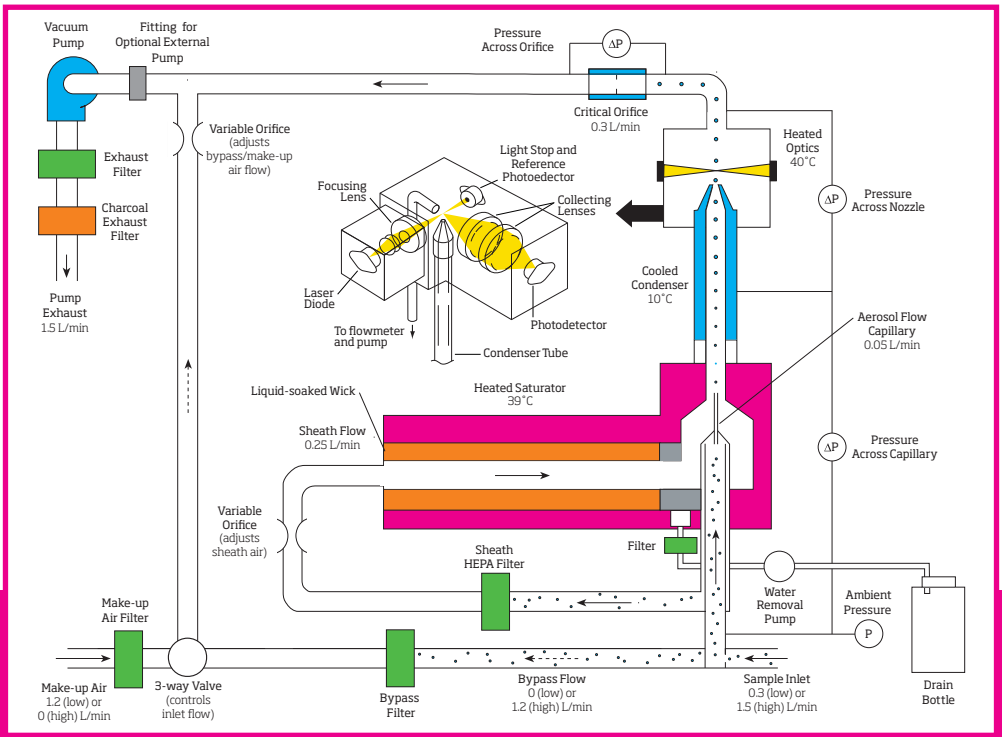
Operation

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 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.



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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 Scanning Mobility Particle Sizer (SMPS) 3936 spectrometers. Collectively, SMPS spectrometers configured with a UCPC Model 3776 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 on SMPS spectrometers.

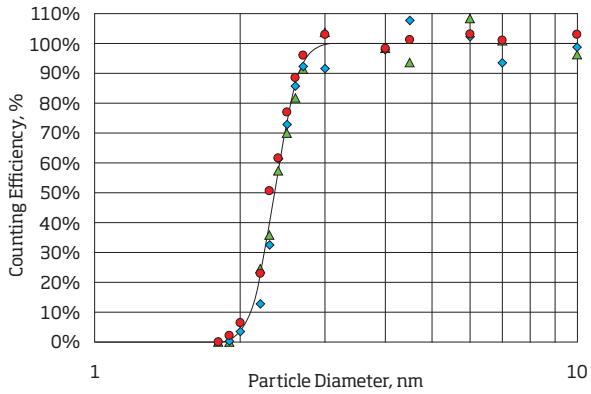
Selectable Size Limits

The optional Particle Size Selector (PSS) Model 376060 lets you choose any of eleven cutoff sizes between 0.032 and 0.267 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) lets you select cutoff diameters up to 0.6 micrometer.

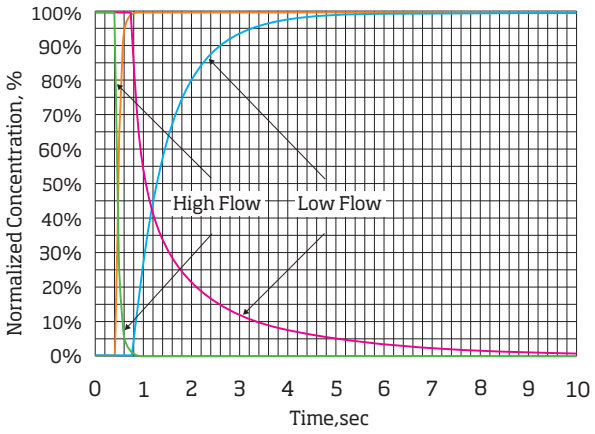
Diffusion Screens	Particle size cut, µm (50%)*	
	Flow 0.3 L/min	Flow 1.5 L/min
0	0.003	0.003
1	0.032	0.014
2	0.056	0.024
3	0.079	0.033
5	0.123	0.050
6	0.147	0.058
7	0.170	0.066
8	0.192	0.074
9	0.216	0.081
10	0.240	0.089
11	0.267	0.096

*Calculated using efficiencies for 3776 UCPC and diffusion screen

TSI Model 3776 Efficiency, Sucrose Particles



TSI Model 3776 Response Time



TO ORDER

Condensation Particle Counter

Specify	Description
3776	Ultrafine Condensation Particle Counter with TSI Aerosol Instrument Manager software

ACCESSORIES

Specify	Description
376060	Particle Size Selector with 11 screens
376061	Additional screens for Particle Sizer Selector, set of 12
1031558	Inlet Cyclone (calculated cut-points: 5.90 µm @ 0.3 L/min; 1.53 µm @ 1.5 L/min)
1031498	Maintenance Kit for 3776 UCPC (includes 1 reservoir cover, 3 O-rings, screws, ten 0.50" diameter plugs, ten 0.75" diameter plugs, 3 aerosol flow control orifices, 5 small charcoal filters, 2 micropump filters, 2 makeup air/butanol fill filters, 2 exhaust/bypass air filters, and 2 sheath air HEPA filters, and 2 saturator wicks)
1031495	Replacement Saturator Wick Kit for 3776 CPC (includes 2 saturator wicks)

Accessories must be ordered separately

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SPECIFICATIONS

ULTRAFINE CONDENSATION PARTICLE COUNTER
MODEL 3776

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

Single Particle Counting	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

Particle Concentration Accuracy
±10% at <3 × 10^5 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 (50 to 95°F)
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)
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-sub connector
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
Supplied with TSI Aerosol Instrument Manager® software

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 (H x W x D)
25 × 32 × 37 cm (10 × 13 × 15 in.), not including fill bottle and bracket

Weight
9.9 kg (22 lbs)

Specifications are subject to change without notice.

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.

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France	**Tel:** +33 4 91 11 87 64	**Singapore**	**Tel:** +65 6595 6388
Germany	**Tel:** +49 241 523030		

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