CONDENSATION PARTICLE COUNTER MODEL 3775



The Condensation Particle Counter (CPC) Model 3775 is a general-purpose counter that can detect airborne particles down to 4 nm in diameter. It provides highly accurate measurements over a wide concentration range from 0 to 10^7 particles/cm^3. As a result, this CPC is versatile and well-suited for a broad range of applications, including basic aerosol research, filter and air-cleaner testing, combustion and engine exhaust research, health effects studies, inhalation and exposure studies, atmospheric and climate studies, and nanotechnology research. Additionally, it can be used as part of a TSI Scanning Mobility Particle Sizer™ (SMPS™) spectrometer.

Applications

TSI offers the most comprehensive line of CPCs available. Building on a CPC 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 with continuous, live-time coincidence correction up to 5×10^4 particles/cm^3
+ 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 compatibility
+ Auto recovery from power failure

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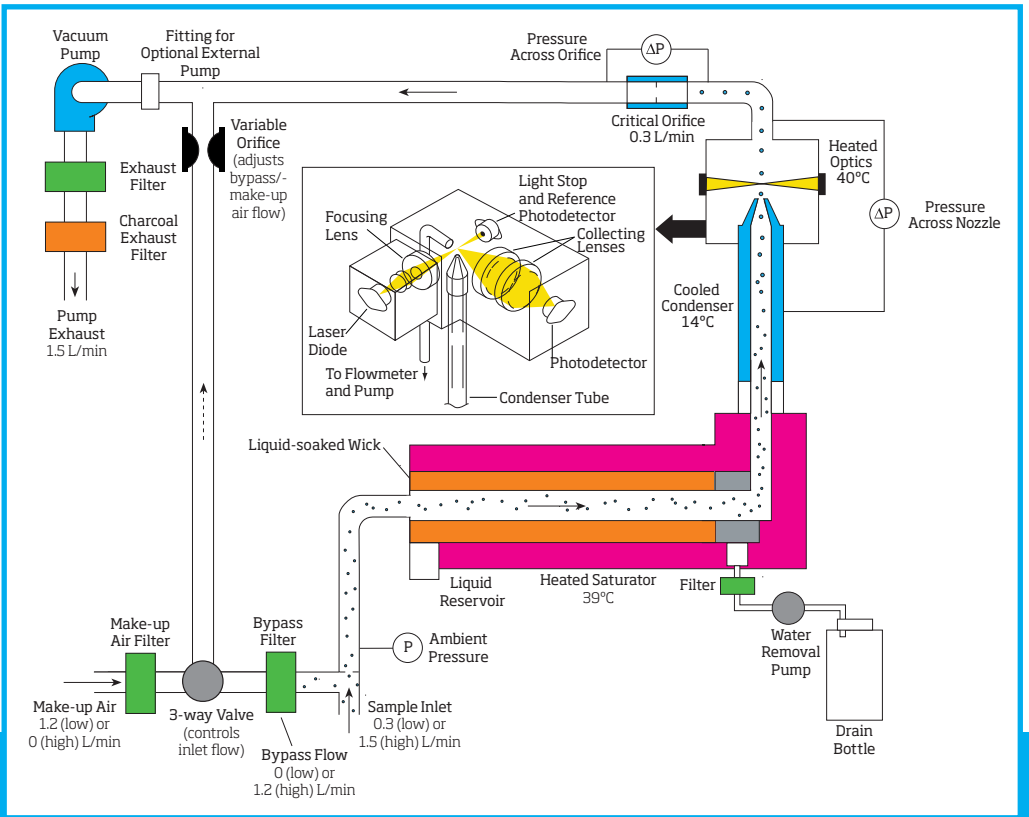
Operation

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.

The Model 3775 is able to measure a wide concentration range because it employs both single particle counting and photometric modes of operation. In single particle counting mode, the detector counts individual pulses produced as each particle (droplet) passes through the sensing zone. Continuous, live-time coincidence correction is provided in this single count mode to maximize measurement accuracy. Higher concentrations up to 10^7 particles/cm^3 are measured by detecting total light scattered by all particles in the sensing zone at any one time and comparing the intensity of the scattered light with calibration levels (photometric mode).

An internal pump draws the aerosol sample into the Model 3775. 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. The volumetric flow rate of this 0.3 L/min aerosol flow is controlled accurately using a critical orifice, which also allows the use of an external vacuum source without change in flow control.

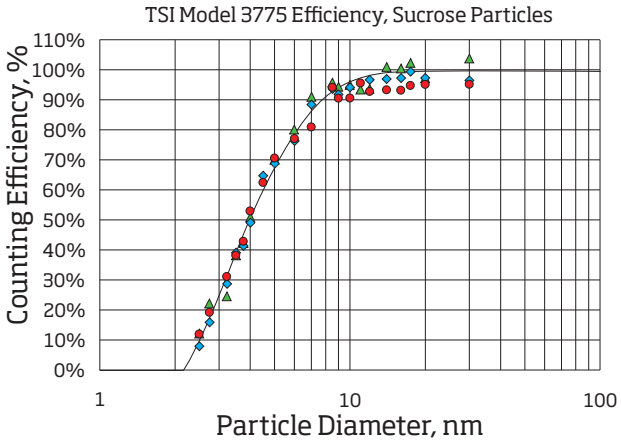
Real-time graphs of particle concentration versus time, concentration, totalizer function, and operating parameters are all viewable on the front-panel color display. Data are directly accessible via standard serial and USB interfaces at a maximum time resolution of 0.1 second. Instrument reading and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

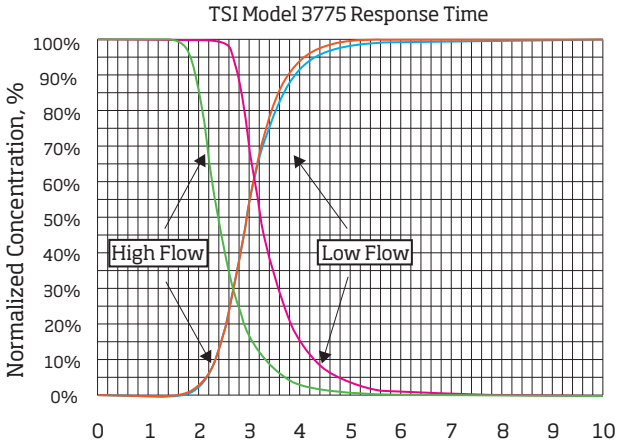


Software and Built-in SMPS Compatibility

Every Model 3775 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 3775 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 3775 CPC provide size-distribution measurements from 0.004 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 µm. 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 µm.

Diffusion Screens	Particle Size Cut, µm (50%)*	
	Flow 0.3 L/min	Flow 1.5 L/min
0	0.004	0.004
1	0.032	0.014
2	0.056	0.024
3	0.079	0.033
4	0.102	0.042
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 3775 CPC and diffusion screen

TO ORDER

Condensation Particle Counter

Specify	Description
3775	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)
1031497	Maintenance Kit for 3775 CPC (includes 1 reservoir cover, 3 O-rings, screws, ten 0.50" diameter plugs, ten 0.7" 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 saturator wicks)
1031494	Replacement Saturator Wick Kit for 3775 CPC (includes 2 saturator wicks)

Accessories must be ordered separately

SPECIFICATIONS

CONDENSATION PARTICLE COUNTER
MODEL 3775

Particle Size Range

Min. Detectable Particle (D_{50})	4 nm, verified with DMA-classified sucrose particles
Max. Detectable Particle	>3 µm

Particle Concentration Range

Single Particle Counting	0 to 5 × 10^4 particles/cm^3 with continuous, live-time coincidence correction
Photometric	5 × 10^4 to 10^7 particles/cm^3

Particle Concentration Accuracy

±10% at <5 × 10^4 particles/cm^3, ±20% at <10^7 particles/cm^3

Response Time

High-flow Mode	About 4 sec to 95% in response to concentration step change
Low-flow Mode	About 5 sec to 95% in response to concentration step change

Flow

Aerosol Inlet Flow Rate	0.3 ± 0.015 L/min
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 aerosol flow by internal critical orifice; differential pressure across critical orifice is monitored

Operating Temperatures

Saturator	39 ± 0.2°C
Condenser	14 ± 0.2°C
Optics	40 ± 0.2°C

False Background Counts

<0.01 particle/cm^3, based on 12-hour 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 2.5 microsec 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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