



## Model 3781 Water-based Condensation Particle Counter

*Our lowest-cost-per-point WCPC for indoor and outdoor monitoring applications.*

The Model 3781 Water-based Condensation Particle Counter (WCPC) can detect airborne particles down to 6 nm in diameter. Using single particle detection with live-time coincidence correction, the Model 3781 covers a wide particle concentration range up to  $5 \times 10^5$  particles/cm<sup>3</sup>. This WCPC features small size and light weight and is an ideal choice for monitoring spatial variations of various environments with multiple units. It is well-suited for a wide range of applications, including indoor air-quality measurements, environmental monitoring, atmospheric and climate-change studies, and mobile aerosol studies.

The Model 3781 WCPC offers these additional features:

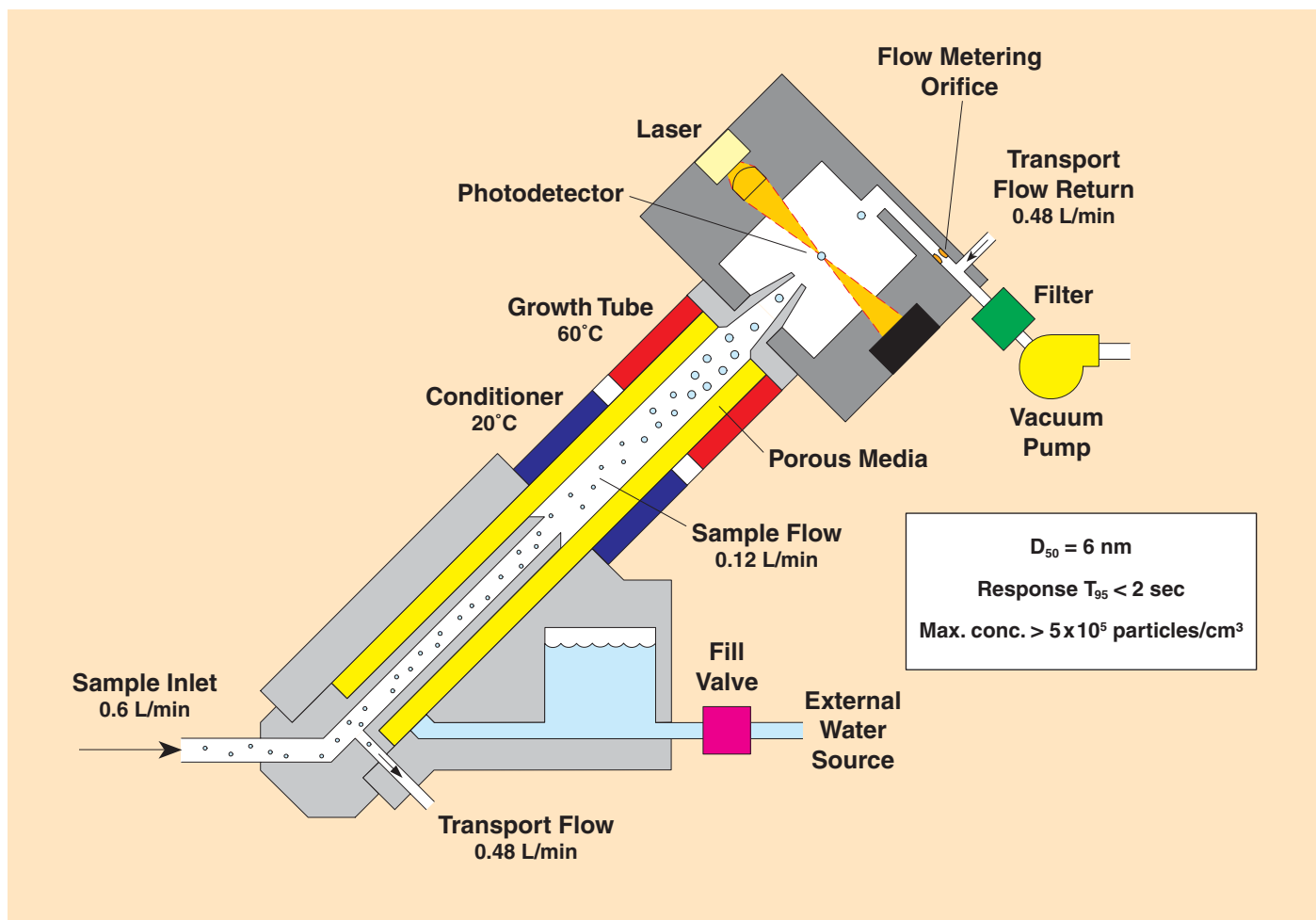
- Fast response to rapid changes in aerosol concentration ( $T_{95} < 2$  seconds)
- One week of unattended operation
- Internal data logging with user-selectable data averaging from 1 second to 1 hour
- Feedback-controlled, pressure-corrected aerosol flow rate of 0.12 L/min
- Ease of use

### Operation

In general, TSI CPCs operate on the principle of enlarging small particles using a condensation technique to a size that is large enough to be detected optically. The Model 3781 brings the convenience of using water to measurements of submicrometer aerosol particles. Using a patented technique,\* an aerosol sample is drawn continuously through a cooled saturator and then into a heated condenser where water vapor diffuses into the sample stream. Effectively, water diffuses to the centerline of the condenser faster than heat is transferred from the warm walls, producing supersaturated conditions. Particles that are present in the sample stream (and larger than the minimum activation size) serve as condensation sites for the water vapor. Once condensation begins, particles grow quickly into larger water droplets and pass through an optical detector, where they are counted easily.

\*Technology from Aerosol Dynamics, Inc., United States Patent Number 6,712,881





The Model 3781 WCPC uses single-particle-detection with continuous, live-time coincidence correction to provide accurate concentration measurements up to  $5 \times 10^5$  particle/cm<sup>3</sup>. The single-path sample flow design allows for precise, pressure-corrected flow control. It has fast response to changes in aerosol concentration. An additional 0.48 L/min transport flow reduces particle diffusion losses at the sample inlet. A transport bypass lever allows measurement of aerosol flow rate directly at the sample inlet.

Data can be logged internally and can be downloaded via standard interfaces. Records include time stamp, particle concentration, and instrument status. These records can be reported at an interval ranging from 1 to 3600 seconds.

## Software

Every Model 3781 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, download, and export capabilities, as well as several choices for data display.

## Applications

TSI offers the most comprehensive line of CPCs available anywhere. Building on a tradition of more than 25 years experience, TSI CPCs have become the standard to which all others are compared. General applications for our family of CPCs 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

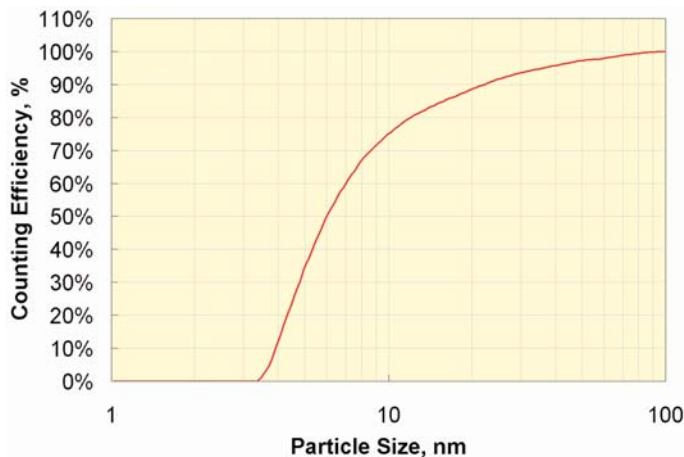
## Model 3781 Water-based Condensation Particle Counter

<b>Particle Size Range</b>	
Min. Detectable Particle ( $D_{50}$ )	6 nm, verified with DMA-classified sucrose particles
Max. Detectable Particle	>3 $\mu\text{m}$
Particle Concentration Range	0 to $5 \times 10^5$ particles/cm <sup>3</sup> , single particle counting with continuous live-time coincidence correction
Particle Concentration Accuracy	$\pm 10\%$ at $5 \times 10^5$ particles/cm <sup>3</sup>
Response Time	<2 sec to 95% in response to concentration step change
<b>Flow</b>	
Aerosol Flow Rate	0.12 $\pm$ 0.012 L/min
Flow Source	Internal vacuum pump; option to use an external vacuum source
Flow Control	Sensor feedback controlled with absolute pressure correction, transport bypass lever allows direct measure of aerosol flow rate
Inlet Flow Rate	0.6 $\pm$ 0.12 L/min
False Background Counts	<0.001 particle/cm <sup>3</sup> , 1-hr average
Aerosol Medium	Air only, 10 to 35°C
<b>Environmental Operating Conditions</b>	
Ambient Temperature Range	10 to 35°C
Ambient Humidity Range	0 to 90% RH, noncondensing
Inlet Pressure Operation (Absolute)	50 to 110 kPa (0.5 to 1.1 atm)
Inlet Pressure (Gauge)	0 to -2.5 kPa (0 to -10 in. water)
Condensing Liquid	Water (distilled water recommended)
Water System	Internal reservoir for up to 2-hour operation, external 250-ml bottle for up to 1-week operation

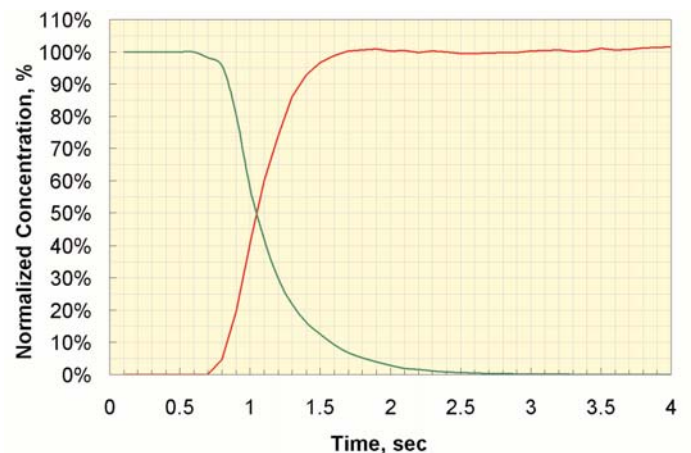
Filling Method	Reservoir fed by gravity from external bottle via fill valve, controlled by float switch
Water Consumption	250 ml/week
Unattended Operation	One week between water refills or other attention
<b>Communications</b>	
Data Logging	Internal 4-Megabit data memory; data averaging interval of 1 to 3600 sec; capable of storing two weeks of one-minute data samples with date/time stamp provided by the internal, battery-sustained, real-time clock
Analog Output	Particle concentration
Digital Output	Data download using USB or RS-232 serial interfaces
<b>Front Panel</b>	
Display	6-digit, 7-segment LCD, provides output of particle concentration
LEDs	Particle, Status, Flow
Button	Pump
Inlet	0.64 cm (0.25 in.) OD SS tube
Side Panel	Transport bypass lever, serial RS-232, USB, power, fan
Rear Panel Connections	Water fill, exhaust
Software	Supplied with TSI Aerosol Instrument Manager software
Calibration Check	Recommended annually
Power Requirements	12 VDC, <30 W; external table-top power supply, 100 to 240 VAC, 50/60 Hz, 100 W max.
Dimensions (HWD)	18 x 13 x 18 cm (7 x 5 x 7 in.), not including fill bottle or bracket
Weight	2.3 kg (5 lbs)

Specifications are subject to change without notice.

TSI Model 3781 Efficiency, Sucrose Particles



TSI Model 3781 Response Time



## Bibliography

Hering, S.V. and M.R. Stolzenburg, Continuous, Laminar Flow Water-based Particle Condensation Device and Method; U.S. Patent 6,712,881, issued March 30, 2004.

Biswas, S., P.M. Fine, M.D. Geller, S.V. Hering, and C. Sioutas, Performance Evaluation of a Recently Developed Water-Based Condensation Particle Counter, *Aerosol Science and Technology* 39(5): 419-427 (2005).

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Liu, W., S.L. Kaufman, F.R. Quant, D.R. Oberreit, B.L. Osmondson, and G.J. Sem, Water-based Condensation Particle Counters for Environmental Monitoring of Ultrafine Particles, *Journal of Air and Waste Management Association*, April 2006.

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## To Order

### Water-based Condensation Particle Counter

Specify	Description
3781	Water-based Condensation Particle Counter with Aerosol Instrument Manager software

### Optional Accessories

Specify	Description
376060	Particle Size Selector and 11 diffusion screens
376061	Set of 12 additional diffusion screens for above

## Selectable Size Limits

The optional Model 376060 Particle Size Selector (PSS) lets you choose any of twelve cutoff sizes between 0.006 and 0.167  $\mu\text{m}$ . 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 0.365  $\mu\text{m}$ .

\*Calculated using efficiencies for 3781 WCPC and diffusion screen

Diffusion screens	Particle size cut, $\mu\text{m}$ (50%)*
0	0.006
1	0.026
2	0.041
3	0.056
4	0.070
5	0.083
6	0.097
7	0.113
8	0.127
9	0.140
10	0.153
11	0.167



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