Model 3772
Condensation Particle Counter

A compact, full-featured CPC that detects particles down to 10 nm

The Model 3772 Condensation Particle Counter (CPC) is a compact, rugged, and full-featured instrument. It detects airborne particles down to 10 nanometers in diameter at an aerosol flow rate of 1.0 L/min, over a concentration range from 0 to 10^4 particles/cm^3. This CPC is ideally suited for applications that do not require measurement of high concentrations, such as basic aerosol research, filter and air cleaner testing, particle counter calibration, environmental monitoring, mobile aerosol studies, particle shedding and component testing, and atmospheric and climate studies. Additionally, it can be used as part of a TSI Scanning Mobility Particle Sizer™ (SMPS™) spectrometer.

The successor to our Model 3010 CPC, the Model 3772 offers many new features and improvements:

- Fast response to rapid changes in aerosol concentration ($T_{95} \cong 3$ seconds)
- Butanol-friendly features, including anti-spill design, water-removal system, 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, total counts, instrument status, or user settings shown on front panel LCD display

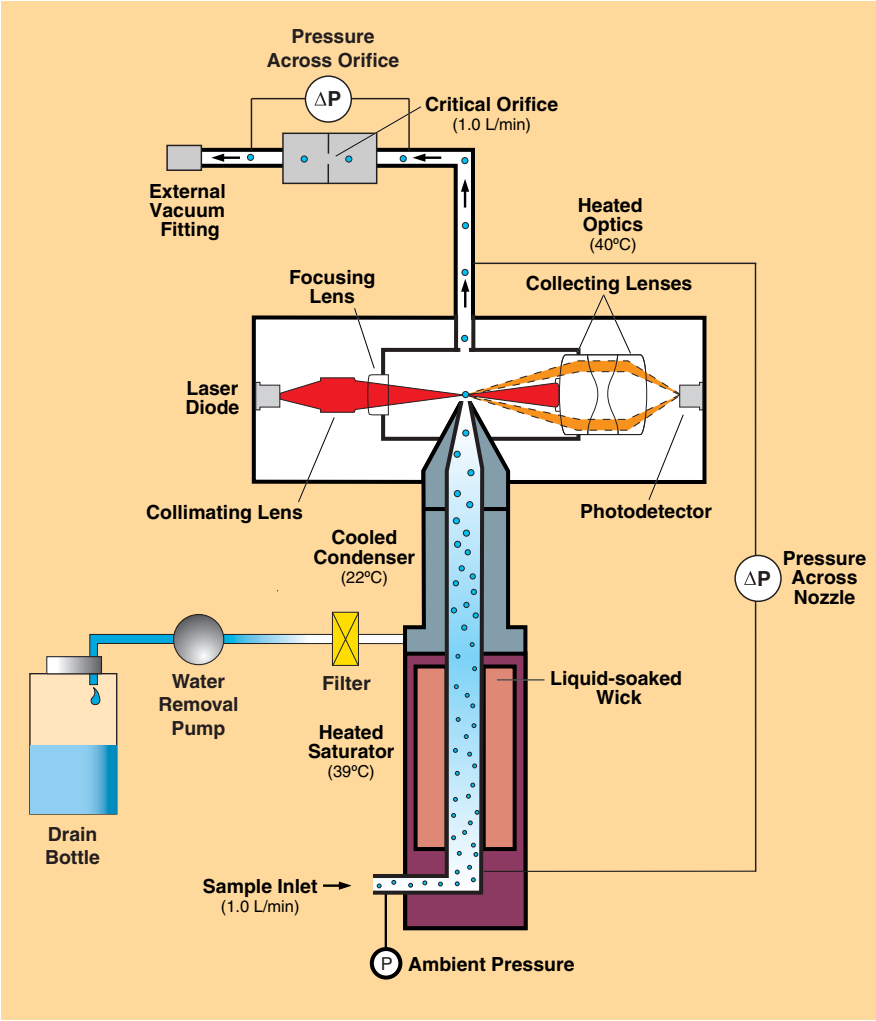
Operation

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.

The Model 3772 employs single-particle-count mode operation to measure concentrations up to 10^4 particles/cm^3. The detector counts individual pulses produced as each particle (droplet) passes through the sensing zone. A high signal-to-noise ratio and continuous, live-time coincidence correction provide great measurement accuracy, even at very low

concentrations. An external vacuum pump is required to draw the aerosol sample through the Model 3772. The volumetric flow rate is controlled accurately and reliably using an internal critical orifice.

Real-time concentration, totalizer function, operating parameters, and user settings are all viewable via the front panel LCD display. Data are directly accessible via standard USB and RS-232 serial 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 3772 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 3772 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 3772 CPC provide size-distribution measurements from 0.01 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.

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 3772 Condensation Particle Counter

Particle Size Range	
Min. Detectable Particle (D_{50})	10 nm, verified with DMA-classified sucrose particles
Max. Detectable Particle	>3 µm
Particle Concentration Range	0 to 10^4 particles/cm^3, single particle counting with continuous, live-time coincidence correction
Particle Concentration Accuracy	±10% at <10^4 particles/cm^3
Response Time	About 3 sec to 95% in response to concentration step change
Flow	
Aerosol Inlet Flow Rate	1.0 ± 0.05 L/min
Flow Source	External vacuum
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	22 ± 0.2°C
Optics	40 ± 0.2°C
False Background Counts	<0.001 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)

Selectable Size Limits

The optional Model 376060 Particle Size Selector (PSS) lets you choose any of eleven cutoff sizes between 0.010 and 0.122 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 0.25 micrometer.

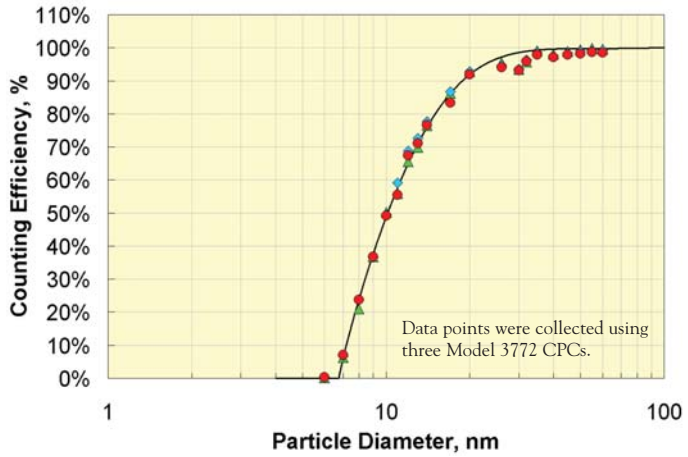
Diffusion screens	Particle size cut, µm (50%)*
0	0.010
1	0.020
2	0.031
3	0.041
4	0.052
5	0.062
6	0.072
7	0.083
8	0.092
9	0.102
10	0.112
11	0.122

*Calculated using efficiencies for 3772 CPC and diffusion screen

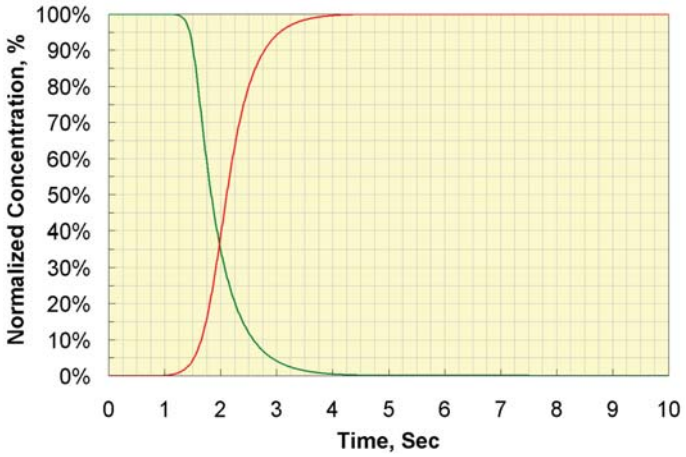
Condensing Liquid (continued)	
Water Removal	All condensate is collected and removed automatically by a constant-flow-rate micropump, may be switched on for use in humid environments
Communications	
Protocol	Command set based on ASCII characters
Interfaces	
RS-232	9-pin, D-sub connector, pinouts compatible 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

Specifications continued on back page

TSI Model 3772 Efficiency, Sucrose Particles (Fink *et al.* 2005)



TSI Model 3772 Response Time (Fink *et al.* 2005)



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	Concentration, time and total counts, status (temperatures, pressures, laser power, *etc.*) and user settings
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 350 nanosec wide
Software	Aerosol Instrument Manager software supplied with instrument (RS-232 and USB compatible)
Calibration	Recommended annually
Required Utilities	
Power	100 to 240 VAC, 50/60 Hz, 210 W maximum
Vacuum Source	60 kPa (18 in. Hg) minimum gauge
Physical features	
Front Panel	Aerosol sample inlet, LED indicator lights (status, particle), 2-line LCD display, 6 operating buttons, 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, external vacuum port, fill bottle and bracket
Dimensions (HWD)	26 × 18 × 25 cm (10 × 7 × 10 in.), not including fill bottle and bracket
Weight	5.5 kg (12 lbs)

To Order

Condensation Particle Counter

Specify	*Description*
3772	CPC with Aerosol Instrument Manager software

The Model 3772 is a standard component in select TSI Scanning Mobility Particle Sizer (SMPS) spectrometers. Ask your TSI representative for additional information on SMPS spectrometers.

Accessories

Specify	*Description*
3032	Vacuum Pump, 115 V
3032-1	Vacuum Pump, 230V/50Hz
3032-EC	Vacuum Pump, 230V (Europe only)
3033	Vacuum Pump, 115 V, recommended when using multiple CPCs that require an external vacuum source (North America only, customers in other parts of the world must contact TSI for model number and power ratings.)
376060	Particle Size Selector with 11 screens
376061	Additional screens for Particle Size Selector, set of 12

Accessories must be ordered separately.

Bibliography

Fink MA, RC Caldow, HS Han, EM Johnson, SJ Olson, and MA Woessner, Characterization of New Butanol-based Condensation Particle Counters, poster #8PC1, American Association for Aerosol Research Conference, Austin, Texas, October 2005.

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

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 Conference, San Francisco, California, October 1992. (TSI paper A83)*

* Paper refers to TSI Model 3010 CPC, a predecessor of the Model 3772.

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