

NANOTRAC

Nanotechnology Particle Size Measurement Solutions

Microtrac has been a pioneer in particle sizing technology for over 30 years! In 1990 Microtrac released the Ultrafine Particle Analyzer (UPA) which incorporated the Controlled Reference Method (CRM) in a dynamic light scattering instrument. The Nanotracs are the latest generation of sub-micron particle size analyzers from Microtrac! The enhanced design on the Nanotracs features faster measurements (up to 20 times faster), smaller particle size capability (to 0.8 nm), higher precision, higher accuracy and advanced software capabilities in a small, robust dynamic light scattering instrument with no moving components.

Nanotracs comply with the ISO 13320 standard for Dynamic Light Scattering.

The main features of the Nanotracs are

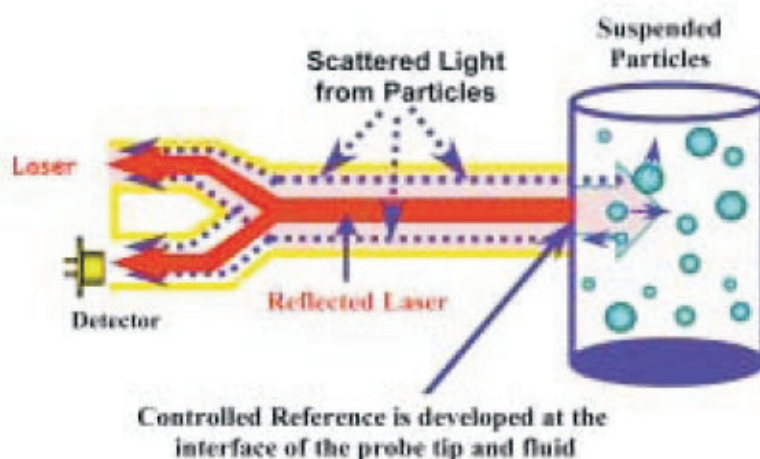
- **Technology:** Dynamic Light Scattering incorporating the patented Controlled Reference Method for advanced power spectrum analysis of Doppler shifts under Brownian Motion.
- **Range: Measurement** capability from 0.8 to 6500 nanometers.
- **Sample Size:** Typically less than 3ml in **standard** cell, or 0.2ml with small cell option.
- **Rapid Analysis:** 15 to 30 second analysis times in most cases.
- **Analysis Simplicity:** No "A Priori" or advance knowledge of the sample is required. Nanotracs will accurately report monomodal, multimodal, broad and narrow distributions without the need to select special calculation algorithms.
- **Accuracy:** Measures using Mie scattering calculations for spherical particles and proprietary modified Mie calculations for non-spherical particles. This feature is unique to Microtracs.
- **Repeatability:** Better than 1% from instrument to instrument for 100nm polystyrene.
- **Traceability:** Particle Size measurements traceable to NIST standards.
- **Concentration:** Capable to measure up to 40% by solids in some cases. This feature reduces the need to dilute samples which may affect particle size or colloid stability. Low concentration measurements can be as low as 0.1ppm for 200nm polystyrene.
- **Temperature Control:** Precise temperature monitoring and compensation eliminates the need for temperature controlled baths or devices.
- **Versatility:** Nanotracs probe **can** be external in NPA250 for use in autosamplers (NAS), Dip-N-Run configuration or in-line applications.
- **Security/Validation:** Nanotracs **FLEX** software complies with FDA 21 CFR Part 11 protocols. Full IQ/OQ/PQ validation documentation is available for Nanotracs.

Nanotracs : How it works

THE CONTROLLED REFERENCE METHOD

Particles suspended in a dispersing fluid are subject to random collisions with the thermally excited molecules of the dispersing fluid resulting in Brownian motion. The velocity and direction of the resulting motion are random but the velocity distribution of a large number of mono-sized particles averaged over a long period will approach a known functional form, in this case the size distribution of the particles.

In the Nanotracs, light from a laser diode is coupled to the sample through an optical beam splitter in the Nanotracs probe assembly. The interface between the sample and the probe is a sapphire window at the probe tip. The sapphire window has two functions! Firstly, it reflects the original laser back through the beam splitter to a photodetector. This signal which has the same frequency as the original laser acts as a reference signal for detection, offering heterodyne detection. Secondly, the laser passes through the sapphire window and is scattered by the particles which are in suspension but moving under Brownian motion. The laser is frequency shifted according to the Doppler effect relative to the velocity of the particle. Light is scattered in all directions including 180 degrees backwards. This scattered, frequency shifted light is transmitted through the sapphire window to the optical splitter in the probe to the photodetector. These signals of various frequencies combine with the reflected signal of un-shifted frequency (Controlled Reference) to generate a wide spectrum of heterodyne difference frequencies. The power spectrum of the interference signal is calculated with dedicated highspeed FFT (Fast Fourier Transform) digital signal processor hardware. The power spectrum is then inverted to give the particle size distribution.



As particle size is determined from the velocity distribution of the particles moving under Brownian motion it is necessary to compensate for the physical parameters that directly affect the particle velocity. If the dispersing fluid molecules have a higher average thermal energy they will impart higher velocities to the particles with which they collide. Median particle velocity is directly proportional to the absolute temperature of the fluid. A viscous fluid slows the energized particles. Particle velocity is inversely proportional to fluid viscosity. The Nanotracs incorporates a highly accurate temperature sensor in the sample cell. By describing the fluid temperature and viscosity characteristics in the Nanotracs algorithm, these parameters can be included in determining accurate particle size distributions. Also, because the laser light needs only to penetrate approximately 100 microns into the sample to generate a power spectrum, the Nanotracs can accurately determine particle size distributions at significantly higher concentrations than other methods.

NANOTRAC: THE OPTIONS

NANOTRAC NPA150

The Nanotrac 150 features an internal probe embedded in a stainless steel sample cuvette. The standard cuvette has a sample volume of 3mls but is also available in a 0.2ml version. Temperature and viscosity compensation is achieved through the use of a highly accurate temperature sensor embedded in the sample block. The sample chamber can be maintained at a constant temperature by connecting it to an external constant temperature water bath. Nanotrac is controlled by the Microtrac FLEX operating software package. Data can be stored, retrieved, exported and trended.



NANOTRAC NPA151 - NANOTRAC ULTRA

A feature of Nanotrac is its ability to measure samples at significantly higher concentrations than conventional Photon Correlation Spectroscopy. However, there are many applications where materials are produced in very low concentrations and typically in sizes less than 50nm. The Nanotrac ULTRA has been designed to measure such samples. The unique Nanotrac Probe design has been optimized to detect particle size distributions in low concentration suspensions and is particularly sensitive to size ranges below 50 nm.

NANOTRAC NPA252 COMBINATION

Nanotrac NPA252 offers the flexibility of having an external probe with the ability to insert it in a fixed sample chamber if desired.



NANOTRAC NPA250 - NAS35 AUTOSAMPLER

The Nanotrac NPA250 features an external probe. This allows the user to immerse the probe in a sample vessel or process bypass. The probe cable is available in various lengths. Temperature compensation is facilitated through a sensor embedded in the probe tip. While incorporated with the NAS35 Autosampler, a robot arm moves to probe to up to 35 sample vials mounted on a carousel.

NANOTRAC SPECIFICATIONS

Models	Nanotracs NPA 150	Internal sample cell and probe.
	Nanotracs NPA 151	ULTRA, optimized for low concentration measurements
	Nanotracs NPA 250	External probe option.
	Nanotracs NPA 252	Combination unit with both internal and external probe capabilities.
External probe options	1.5 meter cable is standard. Also available at 0.75, 1.5, 3.5, 5.5, 10, 15, 20 Meters.	
Internal Sample Cell Volumes	3 ml (Standard), 0.2 ml	
Measurement Range	0.8 to 6500 nanometers (0.0008 to 6.5 microns)	
Measurement Angle	180 Degrees.	
Repeatability	1% for 100nm Polystyrene	
Concentration limits	High up to 40% by solids in some cases Low 0.1ppm for 200 nm polystyrene ppb range in Nanotracs ULTRA	
Optical Components	Laser Diode - 780 nm wavelength, 3 mW nominal, Class IIIB Laser and detector fixed in place- no alignment required.	
Solvent Compatibility	Wetted surfaces are stainless steel and sapphire. Compatible with most organic and inorganic solvents	
Power Requirements	Instrument powered via PCI bus. 90 to 240 VAC 47 to 63 Hz 5 Amps	
Water circulator fittings	5/16" OD Swagelock Tube Fittings.	
Temperature	10 to 50 Degrees C	
Humidity	up to 90% non condensing	
Sample Temperature	10 to 82 Degrees C	
Temperature Measurement	Accurate to +/- 0.1 Degree C.	
Dimensions	Width 10.2 cms (4 inches) Depth 38.1 cms (15 inches) Height 15.2 cms (6 inches) Weight 3.2 kgs (7 pounds)	