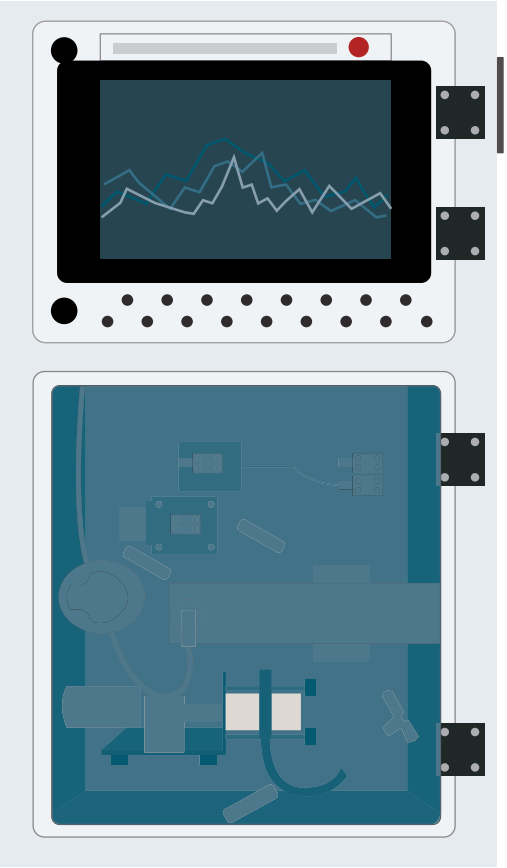
AccuSizer Mini FLEX

Online Liquid Particle Counter

The Entegris AccuSizer Mini is the most sensitive, accurate, and widely used (600+ installations) online liquid particle size and counter. The Mini FLEX is the next generation with unique capabilities for monitoring suspensions ranging from clean water to high concentration CMP slurries.



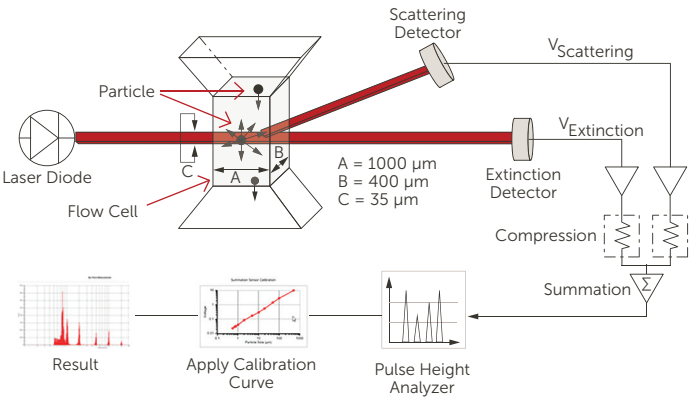
COMPONENTS

All AccuSizer Mini systems consist of a sensor, dilution fluidics, counter, and computer/software. The sensors all operate on some combination of light obscuration and/or light scattering. Each sensor has a specific mode of operation, size range, and concentration limit. The Mini FLEX can be used for both the LE400 and FX sensors with changeover between sensors performed in under 10 minutes. The fluidics systems dilute the sample (if required), provide mixing, and flush the system between measurements. Sample dilution in the Mini FLEX is easily controlled with a single factor in the protocol. The counter acts as a pulse height analyzer, converting sensor pulses into particle size using a calibration curve. The counter also controls the system operations along with the AccuSizer software.

SENSORS – FLEXIBLE, THE MINI FLEX CAN OPERATE WITH BOTH THE LE400 AND FX SENSORS

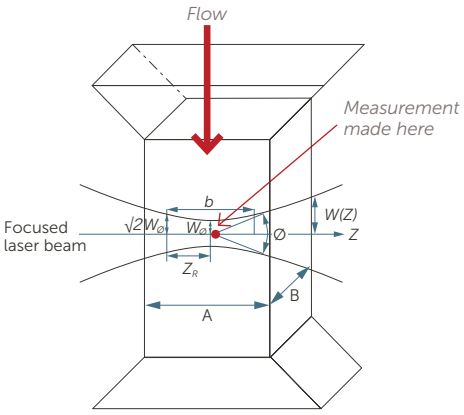
LE400 Sensor

The LE400 sensor counts 100% of the particles passing through the sensor. The wide dynamic range of 0.5-400 µm is accomplished by including both extinction and scattering detectors as shown in the figure below. This is the most sensitive sensor for detecting a few particles > 0.5 µm since it operates with 100% counting efficiency. Most silica CMP slurries and all clean fluids are measured using the LE400 sensor.



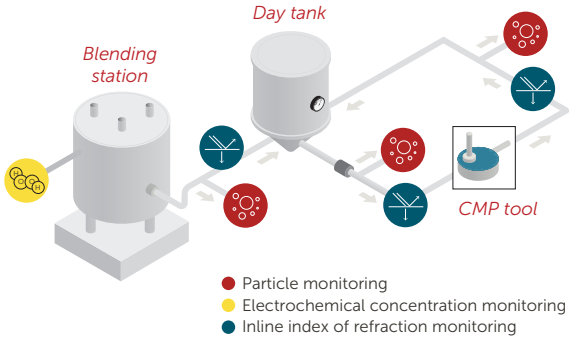
FX Sensor

The FX sensor uses a focused laser beam to inspect the particles only passing through the center of the flow cell as shown below. The dynamic range is 0.7 – 20 µm using only an extinction detector. The FX sensor can operate at much higher concentrations (~10^6 particles/mL) since only the particles at the very center of the cell are measured. This sensor is typically used for high concentration ceria CMP slurries or other high concentration samples.



CMP Slurry Monitoring

Large particle counts in CMP slurries can cause scratches and defects on IC chips. Continuous LPC monitoring safeguards against yield loss due to these scratches. Slurry delivery systems can be optimized and controlled when the AccuSizer Mini FLEX provides insight into the relationship between process conditions and LPCs. When measuring CMP slurries, the Mini FLEX is often positioned downstream of the blending station and day tank as shown below.



Note: Entegris also supplies chemical concentration monitors based on electrochemical titration and refractive index.

APPLICATIONS

Most Mini Flex systems monitor large particle counts (LPCs) in CMP slurries.

Other possible applications include:

- Suspensions
- Emulsions
- Clean water

BENEFITS

- Continuous particle size and count monitoring
- Automated sampling and measurement to eliminate operator and lab resources
- Flexible operation of both the LE400 and FX sensors
- Dilution factor easily controlled with a single input
- Fast total measurement time including cleanup
- Easy result transfer into data acquisition systems

OPERATION

The Mini FLEX is typically used for continuous online measurements but can also be used for batch sampling from bottles.

The sample dilution is controlled through the Initial 2nd Stage Dilution Factor, or DF2, in the Line Control Menu. A higher DF2 means more dilution = lower counts over a period of time. This relationship is non-linear and typically determined experimentally.

After choosing a DF2 value, the operator sets the measurement and flush times to optimize the measurement sequence for a given sample.

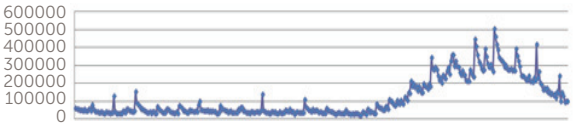
RESULTS

Results are displayed for either individual measurements or as a trend line vs. time. Results for a single measurement include the following values:

- Particle concentration/mL at specified size ranges
- Total number of particles sized
- Sample time and fluid volume
- Sensor details and DF2 value

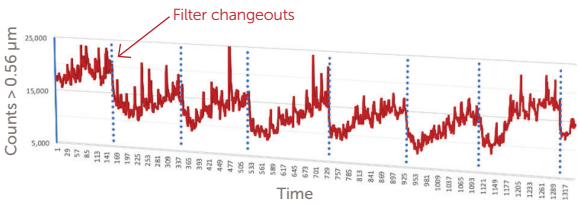
Results from online continuous measurement typically plot particle concentration/mL vs. time for one or more size ranges. The first plot on the next page shows the LPC count > 1 micron over a period of about one month. The increase in LPC count seen to the right side of the graph was later connected to an increase in count scratches on the wafers processed during this period and a related decrease in yield.

LPCs > 1 Micron



The second plot below shows a periodic rise in LPC count followed by a dramatic drop after filter replacement. This kind of LPC data can be used to optimize other process parameters such as blending station and tank operations.

Example of LPC Growth During CMP Filter Loading



CONNECTIONS AND REQUIREMENTS

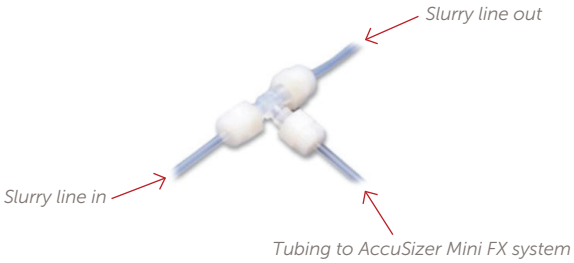
The utility requirements for installing the Mini FLEX are shown below.

Installation Utilities for Mini FLEX

Power	3 prong power receptacle (IEC C14 socket)	100 to 240 VAC 5 amps max power
Compressed air or gas	¼" push on	3.5 to 5.6 kg/cm^2 50 to 80 psi
Water	¼" flare	1.8 to 2.5 kg/cm^2 25 to 35 psi
Sample	¼" flare	0.2 to 2.1 kg/cm^2 3 to 30 psi
Drain	¼" flare	Zero pressure drain
Serial port (for ASCII serial output)	RS232	
Remote start		Contact closure

All fluid and gas tubes are passed through on bottom of system (connections are internal).
All electrical (including power) are made on top panel.

The sample should be brought to the Mini FLEX through either ⅛ or ¼ inch tubing as shown below. Customers are responsible for this part of the installation and are encouraged to follow their own internal procedures.



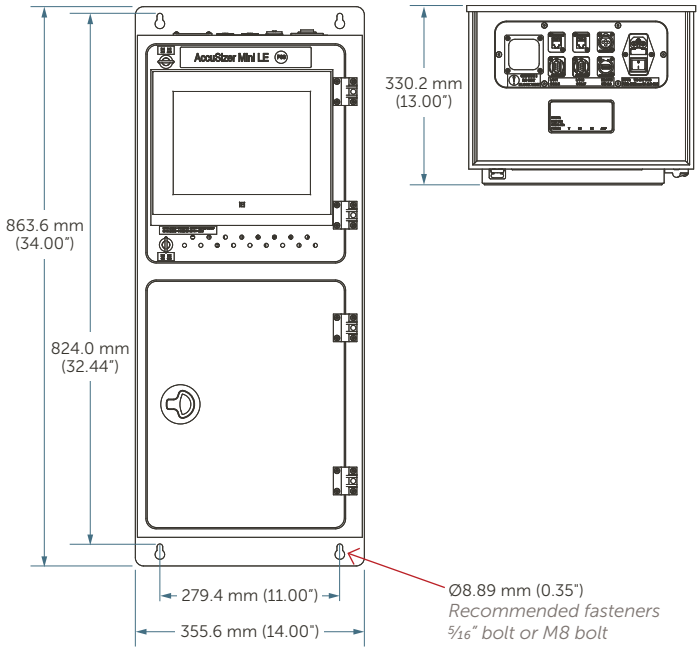
SPECIFICATIONS

Size range	0.5 – 400 µm for LE400 sensor 0.7 – 20 µm for FX sensor
Concentration	PPB to 10 wt%
Principle	Single particle optical sizing (SPOS)
Sample volume	10 mL minimum
Accuracy	±10% of certified mean for 1 µm PSL
Dimensions	863.6 mm x 355.6 mm x 279.4 mm (34" x 14" x 11")
Weight	60 lb (33 kg)
Case	Polypropylene
Control	Touchscreen computer
Safety	Leak detector

DIMENSIONS

Front View

Top View



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Entegris

Corporate Headquarters
129 Concord Road
Billerica, MA 01821
USA

Customer Service
Tel +1 952 556 4181
Fax +1 952 556 8022
Toll Free 800 394 4083