

## Single Particle Optical Sizing



### Preparation Checklist

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## LPC 500 Liquid Particle Counter: *Particle Counting/Sizing for Coupling with ICP-OES*

CETAC Particle Xpress sample introduction system comprise a complete set of accessories for particle analysis of lubricating oils. This is used in conjunction with wear metals analysis by ICP-OES, coupling to a PerkinElmer Avio® 500 Oils system. A suitable working area, a computer table, and an instrument bench are still needed and must be provided by the analyst.

The LPC 500 liquid particle counter consists of an optical sensor and multi-channel pulse analyzer, while the Particle Xpress system includes the syringe pump module, sampling valve, and electronic module – the dimensions of which are provided in Table 1 (Page 4), along with that of the Oils 7400 autosampler.

### Introduction

The LPC 500™ liquid particle counter, Teledyne CETAC Oils 7400 autosampler and Teledyne

## Suitable Working Area

An instrument's environment is an important consideration. The instrument will operate with a laboratory temperature between 15 °C and 35 °C (59-95 °F).

The relative humidity should be between 20% and 80%, noncondensing.

In order to minimize contamination problems, a relatively dust-free environment is necessary. Maximum dust levels should not exceed 36 million particles (0.5 µm or larger) per cubic meter of air. Failure to operate the instrument in a relatively dust-free environment will necessitate more frequent maintenance and could, eventually, damage the instrument. As a reference, a normal, clean office environment would be 18 to 36 million particles per cubic meter. Areas of the lab near doors, vents, and windows should be avoided when selecting a location for the liquid particle counting system.

Another important consideration is to locate the instrument in an area free of corrosive fumes and excessive vibration.

The LPC 500 liquid particle counter, when attached to an ICP-OES instrument, is bench-mounted and may need to be moved for service and preventative maintenance. Allow at least 5 cm behind the autosampler and particle counter for cable egress, ventilation, and access to the power switch. Always position the equipment so that it is easy to disconnect the power cord.

## Location

A bench for the LPC 500 particle counter, when attached to an Avio 500 ICP-OES, is available (Part No. N0811905).

The Avio 500 instrument should be placed to the far-left edge of the bench to accommodate the autosampler, Teledyne CETAC Particle Xpress syringe pump module, and valve to the right of the instrument.

The LPC 500 particle counter and Particle Xpress electronics module should be placed on the shelf below the autosampler to save space on the bench top.

Another option for the bench is available (Part No. N0782060, the dimensions of which are listed in Figure 1), for which a separate replacement shelf top (Part No. N0777930) must be ordered to accommodate the size of the Oils 7400 autosampler.

## Electrical Services

**NOTE: Grounding the instrument is necessary.**

The LPC 500 particle counter, Particle Xpress sample introduction system, and Oils 7400 autosampler are equipped with four power cords in total. The Particle Xpress syringe pump module, Particle Xpress controller, Oils 7400 autosampler, and the LPC 500 particle counter each have a power cord. For all of these cords, the power supply must be connected to an AC power source that will not apply more than 240 VAC between the supply conductors and ground. A protective ground connection, by way of the grounding connector in the power cord, is required for safe operation.

## Rinse and Dilution Solution Requirements

The sample matrix and analytical method will determine the rinse and dilution agent that should be used.

For in-service lubricants analysis, V-Solv™ is often used as the rinse and dilution agent. The rinse agent source should be placed within two meters of the autosampler. The autosampler rinse solution should be relatively clean of particulates and metals so that the probe and stir paddle are properly rinsed between sample runs.

Concentrations of metals below 1.0 µg/g for Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, La, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Sc, Se, Si, Sn, Sr, Ti, Tl, V, Y, Zn, and Zr is recommended. We carry the Ultra Low Particulate (ULP) V-Solv™ for use as the autosampler rinse (Part No. N9308749 for 5 gallons). It has verified particle count limits for the >4 µm, >6 µm and >14 µm particle sizes. This solution is also recommended for use as the rinse solution when back-flushing the syringe, loop, tubing, and particle counter optical sensor before each sample analysis for the most reproducible particle counting results.

As with ICP-OES analysis without the liquid particle counter, samples are diluted with V-Solv™, containing Co as the internal standard. To provide the lowest level of background contamination, we carry ULP V-Solv™ with Co added to be used for dilution (Part No. N9308750 for 5 gallons). All solutions should remain capped when not in use to prevent particle contamination.

## Drain Vessels

A drain vessel (Part No. 09200486) and end cap (Part No. N0690271) are supplied with the Avio 500 ICP-OES system.

If the LPC 500 liquid particle counter is being attached to an existing Avio 500 ICP-OES, these may already be on site. The vessel is made of plastic and is used to gather the effluent from the ICP torch and the rinse station on the autosampler.

The drain vessel should be placed on the floor in front of the ICP-OES and within two meters of the autosampler. The waste receptacle inlet should be 30 to 60 centimeters lower than the autosampler rinse station outlet and set up so that the rinse station drain tubing drops directly into the waste receptacle with no coiling and without being submerged below the liquid level of the waste receptacle.

The drain vessel should not be stored in an enclosed storage area. It should be checked regularly and emptied when necessary. Should it become necessary to replace the drain vessel, it should be made from a material not likely to be impacted by samples being analyzed. Glass or other brittle materials are not recommended due to the higher possibility of breakage.

Separate drain vessels must be used for acid-containing aqueous and organic samples.

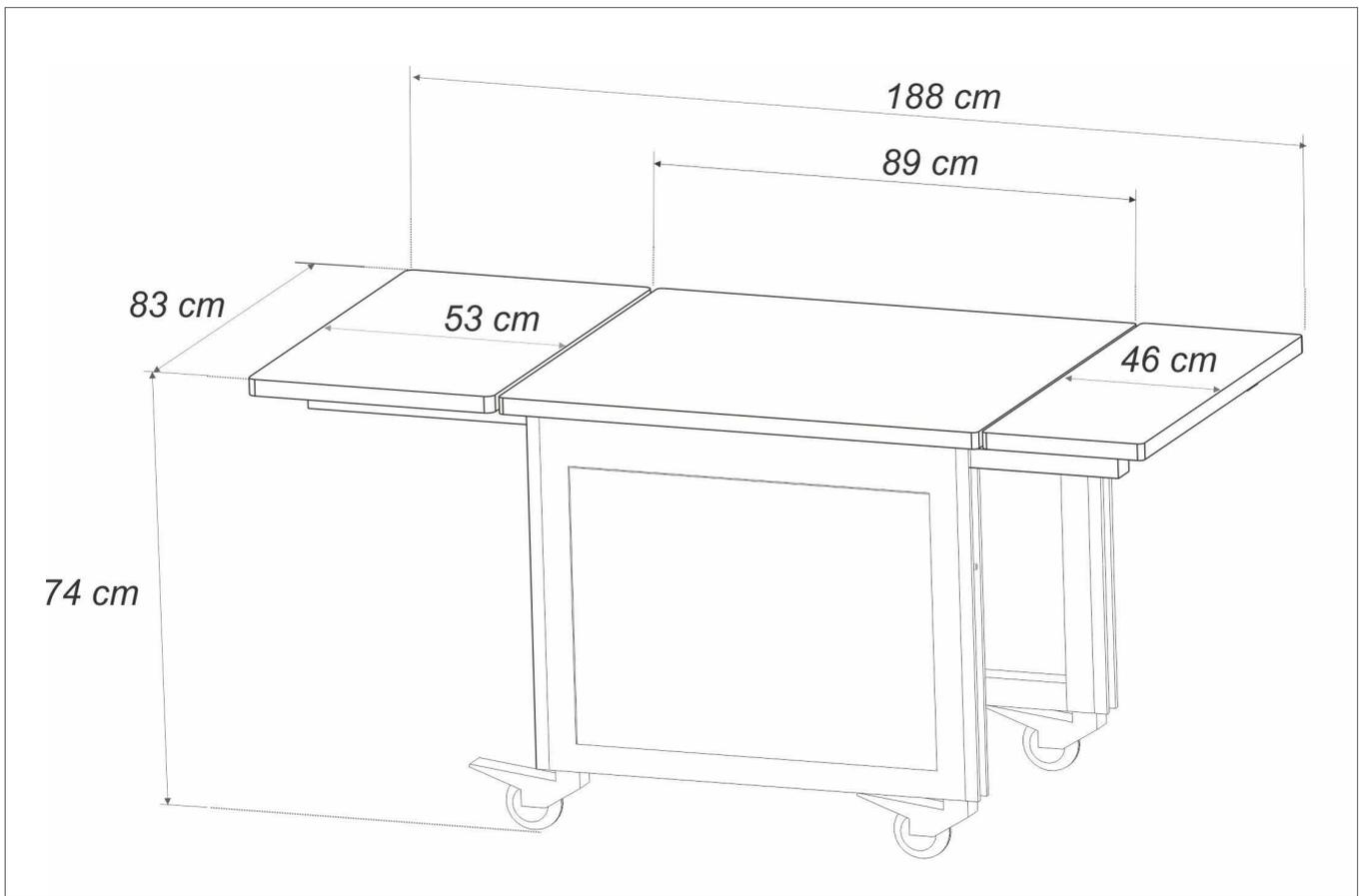


Figure 1. Bench for LPC 500 particle counter (Part No. N0782060), for which a separate replacement shelf top is available (Part No. N0777930).

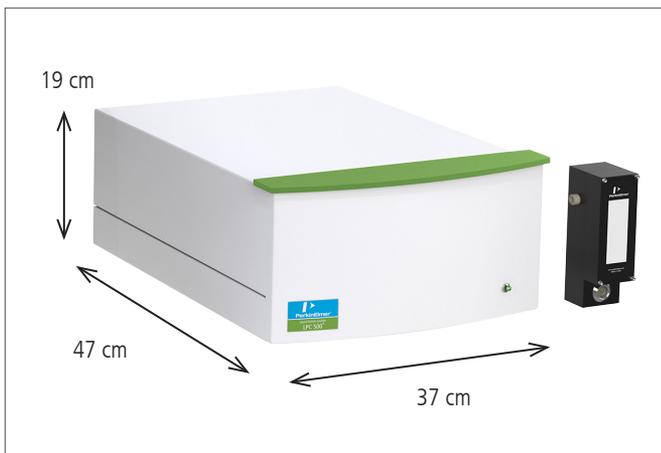


Figure 2. LPC 500 multi-channel pulse analyzer dimensions.

### Summary: Facilities Required

Tables 1 and 2 provide the dimensions and power requirements, respectively, for the liquid particle counter and its major accessories.

The ANSI-IEEE C62.41\* recommends the noise level to be <10 volts normal mode (signal to ground) and <1/2 volt common mode\*\* (neutral to ground) for the AC power input. This can be verified by an oscilloscope or power meter.

\* American National Standards Institute (ANSI) is a private, non-profit organization that administers and coordinates the U.S. voluntary standards.

\*\* Institute of Electrical and Electronics Engineers (IEEE) is a professional association with its corporate office in New York City.

\*\* Excessive common mode (neutral to ground) noise can be caused by a poor building ground. The NEC (National Electrical Code) requires that the building ground resistance does not exceed 25 ohms. This can be verified with an earth ground test.

**Table 1. Dimensions of LPC 500 particle counter components and peripherals**

Dimensions	Width	Height	Depth	Weight
LPC 500 Optical Sensor	16.0 cm (6.5 in.)	5.0 cm (2.0 in.)	6.0 cm (2.5 in.)	0.7 kg (1.6 lb)
LPC 500 Multi-Channel Pulse Analyzer	37.0 cm (14.5 in.)	19.0 cm (7.5 in.)	47.0 cm (18.5 in.)	8.5 kg (18.8 lb)
Oils 7400 Autosampler	57.0 cm (22.0 in.)	49.0 cm (19.3 in.)	54.0 cm (21.0 in.)	23.0 kg (50.0 lb)
Particle Xpress Electronics Module	9.0 cm (3.5 in.)	26.0 cm (10.0 in.)	14.0 cm (5.5 in.)	1.2 kg (2.7 lb)
Particle Xpress Switching Valve	7.0 cm (2.5 in.)	7.0 cm (2.5 in.)	14.0 cm (5.5 in.)	1.0 kg (2.2 lb)
Particle Xpress Syringe Pump Module	7.5 cm (3.0 in.)	30.0 cm (11.8 in.)	17.0 cm (6.7 in.)	3.0 kg (6.6 lb)
Computer Keyboard	48.3 cm (19.0 in.)	4.3 cm (1.7 in.)	21.6 cm (8.5 in.)	2.0 kg (4.0 lb)
Computer CPU (minitower)*	18.0 cm (7.1 in.)	42.6 cm (16.8 in.)	44.7 cm (17.6 in.)	10.0 kg (22.0 lb)
Computer Monitor 24" Flat Panel	56.0 cm (22.0 in.)	43.6 cm (17.2 in.)	17.2 cm (6.8 in.)	6.8 kg (15.0 lb)

**Table 2. Power specifications for LPC 500 particle counter components and peripherals**

Power	Volts	Hz	Ampere
LPC 500 Optical Sensor	+/-15 V, +5 V	Power provided by the LPC 500 Multi-Channel Pulse Analyzer	
LPC 500 Multi-Channel Pulse Analyzer	115-240 VAC	50-60 Hz	750 VA
Oils 7400 Autosampler	100-240 VAC	47-63 Hz	1.07 amp
Particle Xpress Electronics Module	100-240 VAC	47-63 Hz	1.07 amp
Particle Xpress Switching Valve	Included in the Particle Xpress Electronics Module values		
Particle Xpress Syringe Pump Module	100-240 VAC	47-63 Hz	1.07 amp
Computer	115 V	60 Hz	-

For information on preparing your laboratory for the Avio 500 ICP-OES, refer to the Avio 500 ICP-OES Preparing Your Laboratory.