

# The Thermo Scientific iCAP PRO Series ICP-OES

## Enabling ease of use through an intuitive design

Keywords: POP window, POP/ceramic cones, Inner torch box, Cleaning of the iCAP PRO, New ergonomic design, Improved safety with drain sensor, Sliding door, LED, MFC, Additional gas box

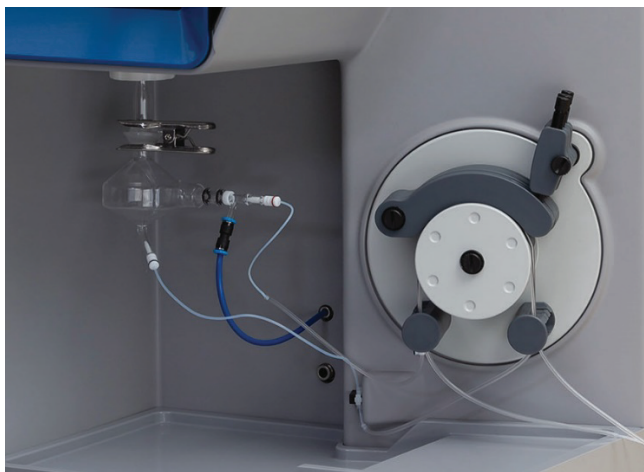
### Introduction

Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) is a technique widely recognized for its ability to determine the concentration of major, minor and trace elements in almost any matrix. Regardless of whether the sample analyzed is a clean water or heavily used lubricating oil, an ICP-OES will determine concentrations of a wide variety of trace elements in the sample. A key factor for many laboratories is the ease of use of an instrument, due to the potentially high number of different instruments a user may have to interact with. Therefore, instruments need to be as intuitive as possible to use and deliver outstanding and consistent results without extensive maintenance. An intuitive instrument makes operation simple so multiple users can work on the system without being experts in ICP-OES. The Thermo Scientific™ iCAP™ PRO Series ICP-OES system is an intuitive and an easy-to-use instrument.

### Ensuring simplicity with the iCAP PRO Series ICP-OES

#### Sample introduction area

The sample introduction area of an ICP-OES instrument (Figure 1) is where the user interacts with the instrument the most, typically on a daily basis. Within this area, the sample introduction system is installed and accessories, such as valve-based sample introduction systems and autosamplers, are connected to the iCAP PRO Series ICP-OES. The sample introduction area of the iCAP PRO Series ICP-OES is designed to fulfil two requirements. First, it is optimized for user ergonomics, allowing the user easy access and to perform functions (e.g., optimization pump tubing tension) in an intuitive manner. Second, the iCAP PRO Series ICP-OES provides ample space in the sample introduction area, which makes it simple for the users to install various accessories and the different sample introduction kits that are available.



**Figure 1. The sample introduction area of the iCAP PRO Series ICP-OES**

### Drain sensor

All iCAP PRO Series ICP-OES systems are supplied with an installed drain sensor. The sensor tracks the air bubbles that are in the spray chamber drain tubing and stops the instrument peristaltic pump automatically if no bubble flow is detected, therefore avoiding spillages in the laboratory or wastage of valuable samples. The analysis is halted and the instrument set to standby mode awaiting action from the user. In case of non liquid sample introduction, the drain sensor can be disabled to allow for uninterrupted measurement.

### LED information system

The two LEDs above the door on the front panel of the instrument indicate the status of the instrument (left LED) and the active analysis (right LED). These LEDs make it easy for the user to identify the instrument and analysis status from a distance, such as across a laboratory without having to interact directly with the software, saving valuable time for the user.

**Table 1. Description of the LED status and meaning**

Instrument status LED	
LED color	Information
Green	Instrument is in standby
Green (flashing)	Instrument is starting up, warming up, or performing Get Ready
Blue	Plasma is on and instrument is ready
Red blinking	Hardware interlock is active

### Analysis status LED

LED color	Information
Blue (flashing)	Analysis is running
Green	Analysis is successfully completed
Red	Analysis has finished with error
Off	No Analysis was run since the instrument startup

### Torch box door

The torch box door on the front of the iCAP PRO Series ICP-OES offers easy access to the torch box. This sliding door can be opened and closed with a single movement making it simple to check the condition of the sample introduction components within the torch box without the need to remove them. The door is equipped with a safety interlock, which means the plasma switches off when the user opens the door. The window in the door allows viewing the plasma when it is ignited. To further aid plasma viewing, the iCAP PRO XP and iCAP PRO XPS ICP-OES have a camera within the torch box and a live stream can be viewed using Plasma TV within the Thermo Scientific™ Qtegra™ Intelligent Scientific Data Solution™ (ISDS) Software, which controls the instrument.

### Torch box to optics interface

The iCAP PRO Series ICP-OES has unique optics which are located in a sealed housing. The interface between the torch box and the optical housing comprises a series of purged optical pathways (POP) (Figure 3). These POPs protect the optical system from contamination.

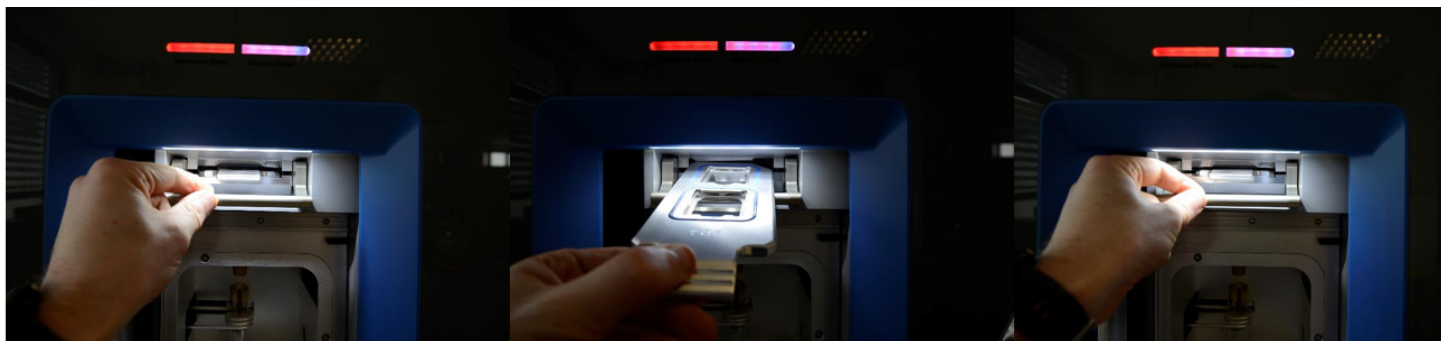
The components of the POP that directly interfaces with the plasma are corrosion-resistant ceramic cones (one for the dedicated radial instrument and two for the dual view instrument). Light emitted from the plasma will enter the optical system of the iCAP PRO ICP-OES through the cones. As the cones interface with the plasma they therefore need to withstand the high temperatures and acidic gases without corrosion in the long term. The cones are purged, so typically they will not become contaminated by sample deposits. However, if the cones get contaminated (by very complex or heavy organic matrices), they can be easily removed, cleaned and reinstalled.



**Figure 2. The iCAP PRO Series ICP-OES Radial torch box**

The windows are located between the POP cones and the fore optics in a unique holder. The holder for a dual view instrument contains two quartz glass windows—one for the axial view and one for the radial view, whereas the holder for a radial only instrument contains one window. The holder containing the window is purged from both sides so that no matrix from the analyzed samples can enter the fore

optics. These windows can be cleaned or replaced easily, if required. The user only needs to open the iCAP PRO Series ICP-OES torch box door and remove the holder. To aid inspection of the torch box and removal of the windows, there is an integrated light that turns on when the torch box door is open, improving visibility.



**Figure 3. Three easy steps to remove the POP window holder: (1) pull lever to release window holder from compartment (2) pull window holder out (3) push lever to close window holder compartment again**

## The inner torch box

Unique to the iCAP PRO Series ICP-OES is an inner torch box. This inner torch box has multiple benefits for the system.

First, the inner torch box provides a high level of plasma stability by optimizing the air flow inside the system. Second, the inner torch box protects against corrosion, often observed in laboratories running samples such as high salt containing aqueous solutions. The air flow is designed in a way that plasma gases are efficiently transported to the exhaust chimney. In the unlikely event of contamination of the inner torch box, it can be removed and cleaned easily.

## Gas control system

The iCAP PRO Series ICP-OES main gas control system comprises three mass flow controllers (MFCs). The MFCs ensure that the flows of the nebulizer gas, auxiliary gas and coolant gas are consistent for excellent long-term stability. The gas flows are either fixed or tunable, depending on the instrument configuration.

An additional MFC is supplied with the gas control system of the Thermo Scientific iCAP PRO XP ICP-OES and the Thermo Scientific iCAP PRO XPS ICP-OES instruments. This additional gas MFC has a flow tunable between 0 and 0.25 L/min. The additional gas can be used as a sheath gas to enable the analysis of high-salt samples (up to 30% TDS) or to remove interferences arising from organic solvents. The user can choose which gas is connected to this MFC depending on the application. With the iCAP PRO Series ICP-OES the following gases can be used: argon, compressed air and oxygen. This enables several applications such as high TDS and long-term organic analysis.

## Conclusion

The iCAP PRO Series ICP-OES has been designed with simplicity and ease of use in mind. The features described above make the iCAP PRO Series ICP-OES an intuitive instrument that is easy to learn, use and maintain. The design increases instrument performance, enhances safety and improves the user experience, so that all laboratories can benefit from reduced running costs, higher uptime and faster results.

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