



Optical Emission Spectrometry

iCAP PRO Series ICP-OES

Installation Procedure

BRE0024126

Revision B

October 2022

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Tel: +49(0)421 5493 0, Fax: +49(0)421 5493 396

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General Lab Equipment. Not for Clinical, Patient or Diagnostic Use.

History

The following table lists the changes within this document.

Rev.	Section/Link	Title
A	entire manual	initial version
B	Special Instructions	Added special instructions.
B	entire manual	Removal of typographical mismatches. Updated screenshots according to current software version. Renaming of particular chapters and sections.
B	Figure 1-1	Updated flow diagram.
B	Table 3-1	Updated P/Ns.
B	below Table 3-1	Enhanced precision in naming instruments. Modified the P/N for Kits.
B	Connecting Exhaust	More detailed description for the exhaust.
B	Connecting Gases	More detailed description for the gases.
B	Activating Engineering Purge	Additions to purge.
B	Table 3-3	Enhanced precision for temperature range.
B	Table 11-1	Updated information to become more precise.
B	Auto Tuning of Fore Optics Alignment	Added section for Auto tuning of Fore Optics alignment.
B	Auto Peak	Added section for Auto Peak.
B	Table 15-1	Correction of P/N.

History

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General Installation Procedure

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- [Installation Flow Diagram](#) on page 1-2
- [Required Special Tools \(Engineer Tool Kit\)](#) on page 1-3
- [Reference Documentation](#) on page 1-3

This document *iCAP PRO Series ICP-OES Installation Procedure* provides the guidelines for installing Thermo Scientific iCAP PRO Series ICP-OES systems. The procedures described in this guide may only be carried out by Thermo Fisher Scientific field service engineer and other trained, certified personnel acting on behalf of Thermo Fisher Scientific.

Procedures that may be carried out by the customer are described in the *iCAP PRO Series ICP-OES Operating Manual*.

The *IFC iCAP PRO Master Control Checklist (iCAP PRO Master Control Installation and Customer Familiarization Checklist)* is a mandatory controlled document to be used for the tracking of the installation process of any iCAP PRO Series ICP-OES system. This Installation Procedure document at your hand is the “cookbook” describing the process from the start to the end. The *IFC iCAP PRO Master Control Checklist* must still be filled in and filed.

All warnings, precautions and safety considerations for handling and operating the instrument as shown in the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide* and the *iCAP PRO Series ICP-OES Operating Manual* must always be followed.

Special Instructions



Items to remember while carrying out the installation procedure:

- Wear safety boots or shoes, which are penetration-resistant and feature protective toecaps, when installing the iCAP PRO Series ICP-OES.
- Wear gloves and goggles at all times when handling liquids and parts that may have been in contact with samples.
- Exercise caution when handling hot parts.
- Observe appropriate chemical disposal requirements specified by the customer.

Installation Flow Diagram

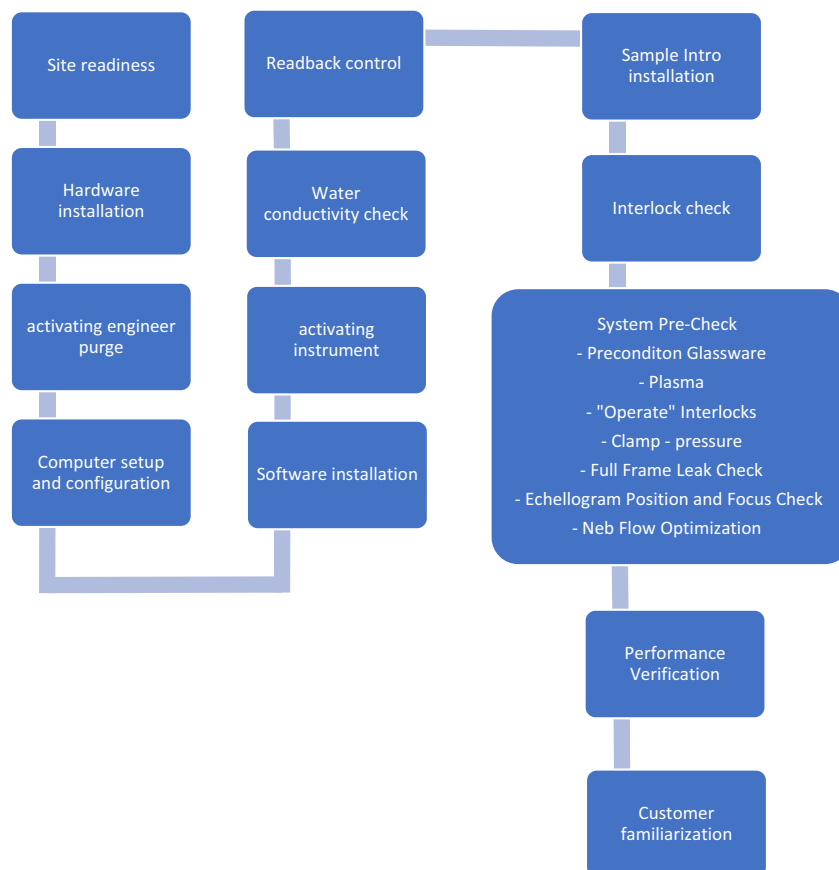


Figure 1-1. Installation Flow Diagram – rough overview

Required Special Tools (Engineer Tool Kit)

Alongside a standard tool set, a

- torch dummy and a
- long 3 mm Allen key

are part of the iCAP PRO Eng. Tool Kit (BRE0019654).

The torch dummy will be needed to align the coil. See [“Positioning of the Coil”](#) on [page 10-3](#).

The long Allen key may be required to optimize 193C position and image quality (focus). See [“Test Set Echellogram Position Detection”](#) on [page 12-6](#).

Reference Documentation

iCAP PRO Series ICP-OES Operating Manual

iCAP PRO Series ICP-OES Pre-Installation Requirements Guide

iCAP PRO Series ICP-OES Customer Familiarization Guide

Qtegra ISDS Software for iCAP PRO Series ICP-OES Installation Guide

PC Specifications for Qtegra ISDS Software

General Installation Procedure

Reference Documentation

Pre-Installation

On the day of installation, the conditions of the laboratory and installation location must be in accordance with the factory specifications as described in the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide*.

Site Readiness Checklist

The table “Technical Data of the iCAP PRO Series ICP-OES Systems” of the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide* can be used as a reference for technical details of the checklist (Table 2-1; N/A means not applicable).

Table 2-1. Site readiness checklist

		Yes	No	N/A	Notes
Safety	Local safety regulations met?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Installation of equipment will not affect compliance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Functional telephone close to the instrument's location?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Provisions have been made for collecting waste solvents?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Installation	Instrument was delivered and stored as received (packed) in “good conditions” before the day of installation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Key operator available during the period of installation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	The person authorized to accept the instrument after installation and sign required documentation will be available during and towards the end of the period of installation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Location	The floor capacity as well as the dimensions of the laboratory hallways and doors are within specification?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	The workbench for the instrument is free of vibration, can support the dimensions and weights of the instrument as well as accessories and peripherals?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Table 2-1. Site readiness checklist, continued

		Yes	No	N/A	Notes
Environment	Air quality and stability of lab atmosphere is adequate (temperature, humidity, particulate matter, non-corrosive)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Electrical Power	Main power installed and in compliance with electrical codes and regulations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Enough power outlets for the instrument, data station and accessories – all of the correct configuration – is located in the proximity of the installation site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Country Kit received?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Electrical power for the instrument within specified range and stable?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exhaust and Gas	A dedicated suitable exhaust system is present for the instrument? It is separate from solvent waste?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Instrument exhaust extraction system is stable, adjustable and within specification?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	All gases required (plasma, purge) are on site at the required purity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Stainless steel or refrigerator grade copper gas lines and 2-stage wall regulators (no needle valves) are in the proximity of the instrument?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Cooling Water	The required minimum volume of cooling water can be supplied to the instrument free of suspended matter at the desired flow rate and temperature?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	In-house water supply only: connectors and water tubing at the desired lengths and diameters are on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Data Station	PC not bought with the instrument: minimum requirements as specified in <i>PC Specifications for Qtegra ISDS Software</i> met?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Readiness	Installation can start on the expected day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Installation of Hardware

Contents

- [Receiving the Delivery](#) on page 3-1
- [Moving the Instrument to the Location of Installation](#) on page 3-2
- [Connecting Supplies](#) on page 3-10

Receiving the Delivery

At arrival after shipping, the iCAP PRO Series ICP-OES instrument must be stored as packed by Thermo Fisher Scientific for at least 24 hours at an environmental condition of 15–35 °C and a relative humidity of 20–80% (< 30 °C ambient) or 20–60% (≥ 30 °C ambient) before connecting it to the power supply.

Check the sales order against goods received. Confirm that all goods ordered with the instrument have been received by the customer. If anything is reported to you as missing before you have even started unpacking, take notes and report this to your local Thermo Fisher Scientific representative.

The iCAP PRO Series ICP-OES instrument part number as per sales order will include:

- iCAP PRO Kit instrument (Duo or Radial only)
- iCAP PRO Installation Kit (Duo or Radial only Kit)
 - connections and filters for gas, water, exhaust, network
 - Qtegra ISDS Software
 - test solutions
 - earthquake security clamps
 - standard sample introduction kit incl. the standard aqueous peristaltic pump tubing

The power cable will come separate from the instrumental part number as part of the Country Kit.

A data station must be on site to accomplish the installation. If a data station was not ordered with the instrument, the customer must provide a suitable substitute meeting the minimum requirements (as per *PC Specifications for Qtegra ISDS Software*).

Installation of Hardware

Moving the Instrument to the Location of Installation

Moving the Instrument to the Location of Installation

The packed instrument on its shipping crate and accompanying boxes from the same sales order will have to be moved to be location of installation.

Because of heavy weight, the factory guidelines for safe handling and transportation must always be followed:

Handling and Safety

The packed instrument has a weight of approximately 115 kg. A means of transport (a pallet jack, for example) will be required for in-house transportation of the instrument in its shipping container and additional components.

Inspection for Damage

Before opening of the shipping crate and unpacking the iCAP PRO Series ICP-OES instrument, check the packaging for any signs of external damage.

If the instrument's shipping containers or any attached shock or tilt indicators (Shock Watch™, Tilt Watch™, for example), show any evidence of damage or mishandling during shipment, do not open the container. See [Figure 3-1](#).

Call your Thermo Fisher Scientific representative for instructions on what to do. If the system arrives safely, proceed with the following instructions.



Figure 3-1. Shock and tilt indicators (green ball at 60° is the acceptable maximum tilt)

Unpacking the Instrument

Several metal clamps hold the walls of the wooden shipping crate together. These clamps can easily be removed using the tool which is attached to it. See [Figure 3-2](#).



Figure 3-2. Shipping container of instrument (left) and clamp-release tool (right)

Installation Kit, Test Solutions, Country Kit, Data Station

The Installation Kit of the iCAP PRO Series will be delivered inside the instrument's shipping crate. Again, inspect the kit for completeness (packing list included) and visual damage. Report missing parts or damage to your local Thermo Fisher Scientific representative. See [Table 3-1](#).

Table 3-1. Content of Installation Kit

Part Number	Description	Quantity
BRE0020132	External PE water tubing, 12 mm outer and 9 mm inner diameter, blue	3 m
BRE0020131	External PE water tubing, 9 mm inner diameter, 12 mm outer and 9 mm inner diameter, black	3 m
BRE0014936	Elbow coupling to instrument for water tubing	2 pieces
BRE0020020	Hose clips for water tubing	2 pieces
BRE0020528	External water filter (including connector)	1 piece

Table 3-1. Content of Installation Kit, continued

Part Number	Description	Quantity
BRE0020130	External PE plasma and purge gas tubing 6 mm outer and 4 mm inner diameter, black	2×3 m
BRE0020134	Kitchen nebulizer PE gas tubing, black	1×18 cm
BRE0014927	Y-connector to bridge external gas lines purge and plasma	1 piece
842312052121	External gas filter kit (including connector)	2 pieces
BRE0019657	iCAP PRO Extraction Hose	1 piece
430122823191	Hose clip for extraction hose	1 piece
401320772479	External network cable (RJ45, Cat5e)	1 piece
BRE0015494	Earthquake security holders (to fasten instrument on workbench)	2 pieces
BRE0016445	Screws to attach earthquake security holders (M10×30 hex cap)	2 pieces
BRE0020564	Qtetra ISDS for iCAP PRO	
	Dependent on instrument type	
BRE0019681	iCAP PRO Duo Aqueous sample introduction Kit	1 piece
BRE0019956	iCAP PRO Radial Aqueous sample introduction Kit	1 piece
BRE0019665	iCAP PRO Duo Installation Kit	
BRE0020126	iCAP PRO Radial Installation Kit	

Only the four high-end models (iCAP PRO XP Duo or Radial and iCAP PRO XPS Duo or Radial) will come with:

BRE0021099	Additional Gas Installation Kit (external gas tubing from wall regulator to the instrument and from the kitchen area to the sample intro)
842312052201	Radial Ceramic D Torch Kit iCAP 7000/iCAP PRO

NOTICE

The connections to the iCAP PRO system for network, electrical power, exhaust, gas and water must be made only with the cables and tubing of the ratings, dimensions and materials which are supplied with the iCAP PRO Installation Kits.

By no means is polyurethane an acceptable material. Any deviation from these factory specifications may result in malfunction of the iCAP PRO system.

The Test Solutions are shipped separate from the installation kit and instrument. Confirm that each bottle comes with a Safety Data Sheet (SDS) and the Certificate of Authenticity (CoA).

If the sealing of one of the bottle caps is damaged or either SDS or CoA are missing, report this to your local Thermo Fisher Scientific representative.

- P/N 430122821401 iCAP Series Multi Element Test Solution
- P/N 430122821411 iCAP Series Setup Solution (Loaded Blank)

The Country Kit including the power cable for the instrument will have to be ordered separately and is shipped separate from the instrument and the installation kit. Verify that the right power cable for your region was delivered and is not damaged. If damaged, report to your local Thermo Fisher Scientific representative. See [Table 3-2](#).

The Country Kit for North America will come with two additional French user labels which will have to be used in Canada only.

Table 3-2. List of available Country Kits^a

Part number	Name of Country Kit
BRE0020411	iCAP PRO Country Kit Continental Europe _Type A
BRE0020412	iCAP PRO Country Kit ANZ_Type C = Australia, New Zealand
BRE0020413	iCAP PRO Country Kit UK/IE _Type D = United Kingdom
BRE0020414	iCAP PRO Country Kit DK _Type E = Denmark
BRE0020415	iCAP PRO Country Kit FR/BE _Type F = France, Belgium
BRE0020416	iCAP PRO Country Kit IN/ZA _Type G = India, South Africa
BRE0020417	iCAP PRO Country Kit IL _Type H = Israel
BRE0020418	iCAP PRO Country Kit IT _Type I = Italy, Chile
BRE0020419	iCAP PRO Country Kit JP _Type J = Japan

Installation of Hardware

Moving the Instrument to the Location of Installation

Table 3-2. List of available Country Kits^a, continued

Part number	Name of Country Kit
BRE0020420	iCAP PRO Country Kit NA_Type K = North America (USA and Canada)
BRE0020421	iCAP PRO Country Kit CH_Type L = Switzerland
BRE0020422	iCAP PRO Country Kit BR_Type O = Brazil
BRE0020423	iCAP PRO Country Kit AR_Type T = Argentina
BRE0020424	iCAP PRO Country Kit TH_Type O_TH1 = Thailand
BRE0020425	iCAP PRO Country Kit CN_Type X = China

^a Images of instrument socket plugs for all kits can be found in the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide*.

The typical minimum Data Station setup consists of a computer with keyboard, mouse and a monitor. Confirm that one of each of these is on site and the packages show no signs of damage. Again, report any damage of the packaging or missing parts to your local Thermo Fisher Scientific representative.

Canada Only: Attach French Warning Labels

Place the French warning labels to the designated locations: one onto the top cover plate and two onto the connection plate on the rear side of the instrument. See [Figure 3-3](#).

Place the labels parallel to the existing label (top) and flush with the sheet metal, central in between the screw heads (rear).

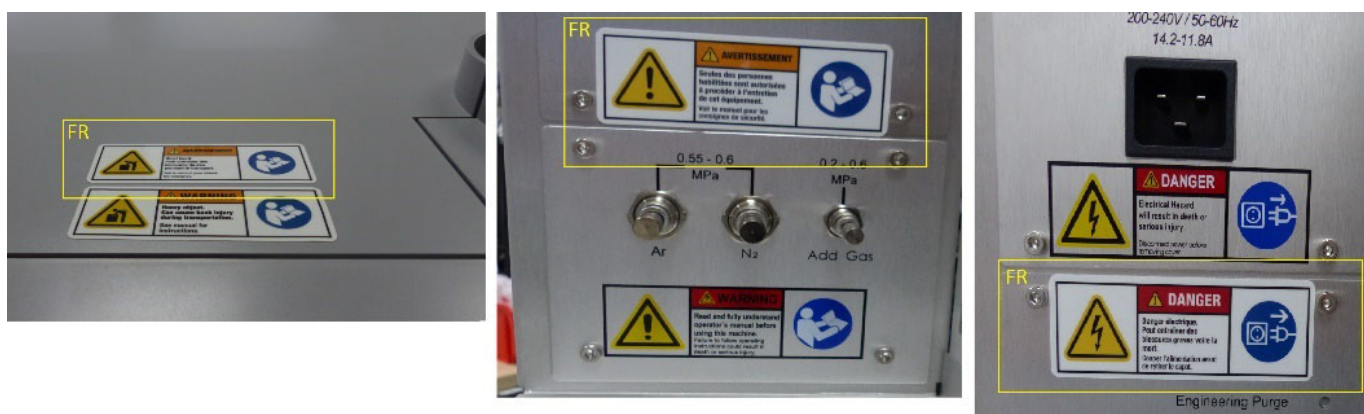


Figure 3-3. Location of French warning labels (Canada only)^a

^a top cover, connection plate bottom, connection plate top (from left to right)

Placing the Instrument on the Workbench

When the instrument is at the location of installation and has been unpacked, it is ready to be placed on the workbench.

The installation site must be in accordance with the factory specifications. See “[Site Readiness Checklist](#)” on [page 2-1](#).

The iCAP PRO Series instrument is designed to be placed on a dry and clean bench with its rear panel facing a wall. The bench surface should ideally be 80–85 cm above the floor. See [Figure 3-4](#).

To allow shutting off the instrument in an emergency, free access must be possible to the power connections at the right-hand rear side of the instrument at any time.

Two spacers at the rear side of the iCAP PRO Series instrument allow clearance for the gas and water lines and electrical connections, as well as for the connections to the computer and peripheral devices. Owing to these spacers, the instrument can be pushed all the way towards the wall until it makes contact.

Before lifting to the bench, read the guidelines in this section to ensure safe handling and reduce the risk of injury. The properties of the bench must be in accordance with the factory specifications. [Figure 3-4](#) shows an example for the typical space requirement of the iCAP PRO system including data station and autosampler.

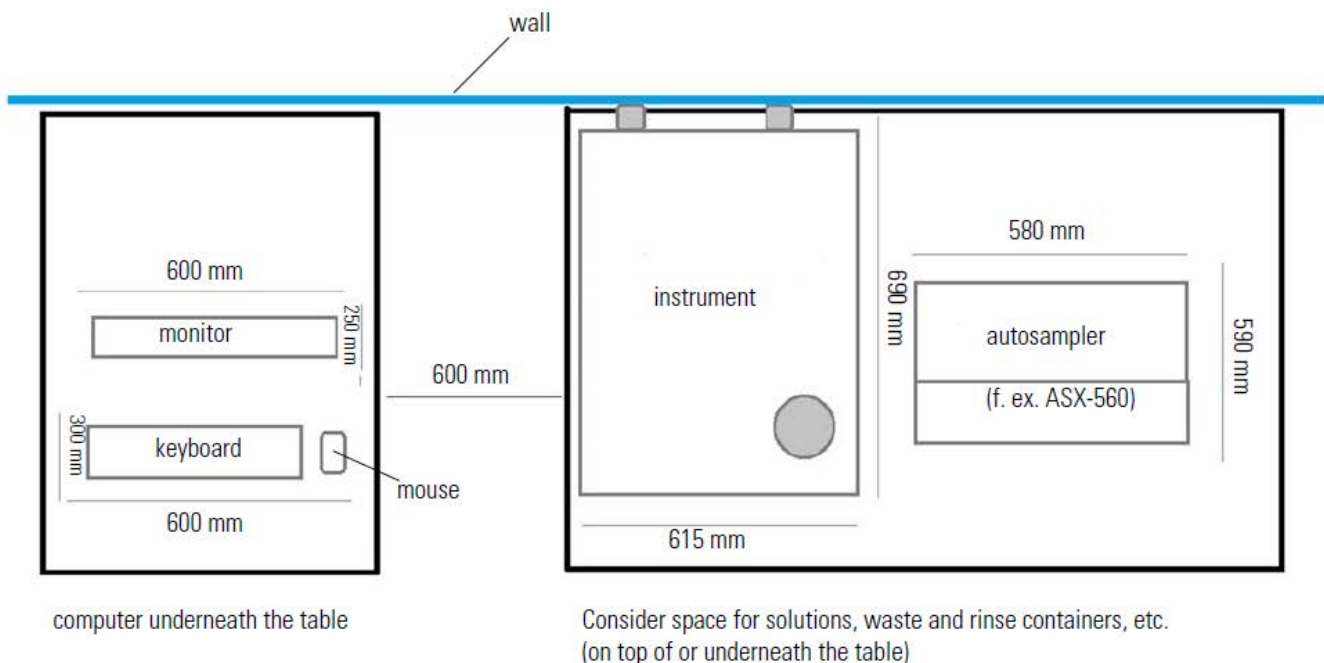


Figure 3-4. Typical floor space requirement for iCAP PRO Series instrument, autosampler and data station

Installation of Hardware

Moving the Instrument to the Location of Installation

The total weight of the unpacked instrument is approximately 80 kg. The iCAP PRO instrument is equipped with four shell-type handles within its base plate: two long handles on the right side and two on the left side of the base plate allow four persons to lift and lower the unpacked instrument safely. See [Figure 3-5](#).

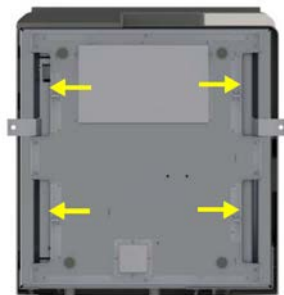


Figure 3-5. Position of shell-type handles – bottom view

CAUTION

Heavy Load. Carriers must always consider and identify mechanical lifting aids first, before deciding to lift the unpacked instrument. If carriers have assessed the risk and manual lifting cannot be avoided, they must be trained on how to assess loads safely and how injuries can occur when lifting and lowering the instrument's weight safely.

For example, teams of more than four members are unlikely to work successfully unless they are managed very carefully. During the handling operation, the proportion of the load that is supported by each member of the team will inevitably vary to some extent.

CAUTION

Top Heavy Load. Carriers must also be informed about the instrument's tendency to tilt. Due to the position of its center of gravity, the instrument tends to tilt forward. This has the potential for the instrument to tip over while being moved which may result in injury or instrument damage. See [Figure 3-6](#).

When lifting the instrument try to keep the tilt angle below 5°. By no means exceed 10°. If the four carriers are not able to do this, a fifth person is strongly advised to support the top of the instrument.

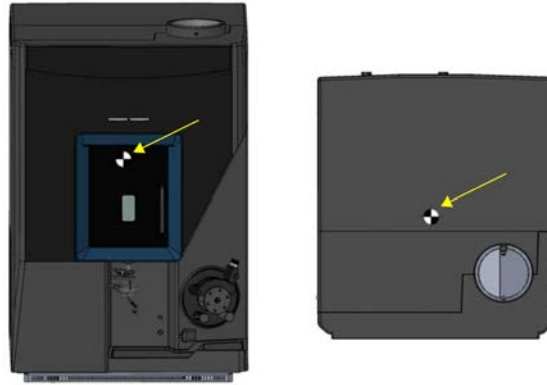


Figure 3-6. Center of gravity – front view and top view

Installation of the Drip Tray

Slide in the drip tray as shown in [Figure 3-7](#). It is connected to the chassis by a clip underneath and one extra screw on its right side.

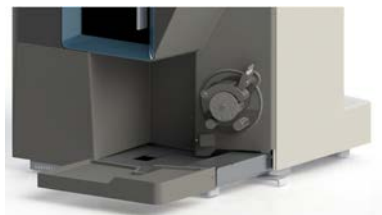


Figure 3-7. Drip tray

Removal of Protective Plastic Film

Carefully remove the protective plastic film on the high gloss frame on the front cover (black or gray, model dependent). Detach the foil on one edge and pull off slowly.

Connecting Supplies

Once the instrument is located on the workbench, you will connect it to electrical power, exhaust and gas supplies. Instructions are given in this section.

This will allow you to turn on the instrument and enable the Engineering Purge on the connection panel. A timer for two hours of maximum purge through the camera and the polychromator tank will be triggered.

All supplies to the instrument (power, exhaust, gas and cooling water) must be in accordance with the factory specifications. See “[Site Readiness Checklist](#)” on page 2-1.

While the camera and tank are purging, you will continue with the installation of the data station.

Connecting Power

The power cable is included in the respective Country Kit. See [Table 3-2](#). Verify the quality of power to agree with the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide* (that is 200–240 V, 50/60 Hz and stable).

If your local area is susceptible to corrupted power or power disruptions, an uninterruptible power supply (UPS) should be installed in your laboratory.

The main function of an UPS is to back up power. If the input power fails or is below the tolerance of the UPS, it switches to battery power.

A voltage stabilizer assures that fluctuations of the output voltage are regulated to a certain range (1%, for example). If the input power is lost by total failure or deep drops, the stabilizer cannot work.

For compliance and safety, ensure that your uninterruptible power supply (UPS) devices are certified by recognized domestic and international organizations (UL, CSA, TÜV, and VDE, for example).

Connect the instrument via its power cable to the wall socket (see [Figure 3-8](#)), or to the UPS or voltage stabilizer if applicable.

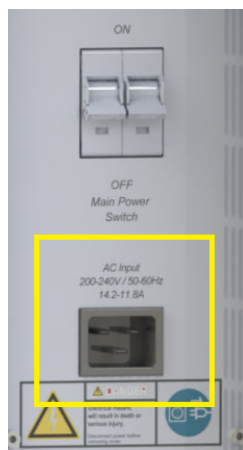


Figure 3-8. Power connector on the instrument

Switch on the instrument.

Connecting Exhaust

CAUTION

Before connecting the gas supply to the instrument and activating Engineering Purge, you must ensure the proper installation of the exhaust system. Nitrogen and argon might cause suffocation if they accumulate in the laboratory.

The extraction hose assembly as supplied with the Installation Kit has a length of 2 m. The exhaust tube can be attached to the exhaust system with the metal clamp provided in the Installation Kit. The exhaust system should be equipped with a throttle valve to allow regulation of the flow. The flexible hose is connected to the instrument via an adapter piece and attached with a screw. Do not tighten the screw yet, as the exhaust is used for venting the gas hoses (see [“Connecting Gases”](#) on [page 3-13](#)).

The range of the required exhaust volume flow rate for a “green” interlock corresponds to a flow velocity of approximately 5.5–6 m/s measured in the gap between the exhaust port and the exhaust tube, perpendicular to the flow and a static pressure of 220 Pa (refer to corresponding Service Note) as shown in [Figure 3-9](#).

NOTICE

Pay attention to the correct direction of flow through the anemometer when measuring.

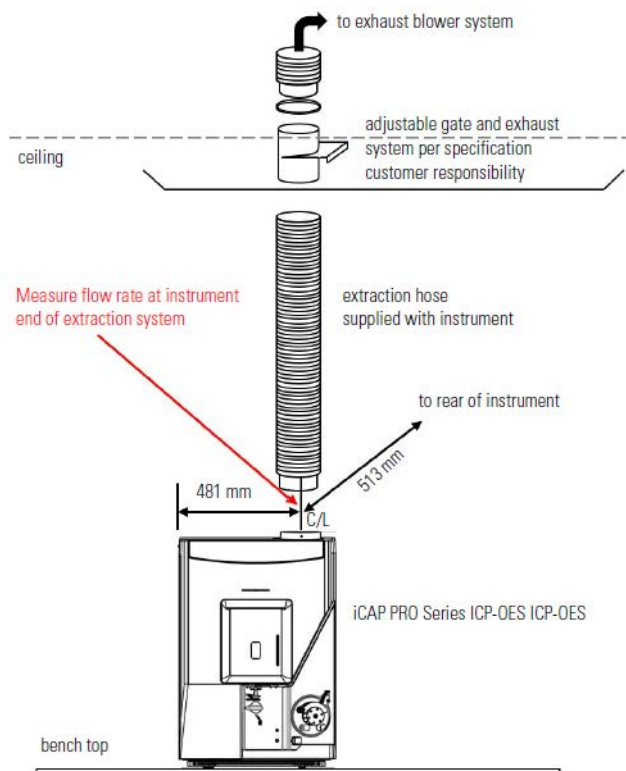


Figure 3-9. iCAP PRO Series ICP-OES extraction system

Connect the extraction hose assembly as shown in [Figure 3-10](#). Set the velocity of the extraction flow. When connected to the instrument via Service Software, verify the setting using the readback in mbar from Hardware Control. See [“Service Software Readback Control”](#) on [page 8-1](#).



Figure 3-10. Connection from exhaust port of instrument to exhaust supply^a

^a Lower left: to instrument port (attachment screw not shown). Lower right: to exhaust supply with throttle valve

Connecting Gases

The external gas tubing (2×3 m) and gas filters for connecting the instrument to the supply regulators for plasma gas (argon) and purge gas (argon or nitrogen) are included in the Installation Kit.

The gas (particle) filters must be installed in the incoming line from the regulators to the instrument, one for plasma gas and one for purge gas.

Argon and nitrogen gas purity must be 99.995% or better. To ensure that the gas supplied to the instrument is not contaminated by the gas lines, refrigerator grade copper or stainless steel must be used.

The gas pressure regulators must be qualified for the purity specification. Regulators should be 2-stage regulators with stainless steel diaphragm. Shut-off valves should be ball valves.

NOTICE

Do not use needle valves.

The argon supply to the iCAP PRO Series instrument must be stabilized.

NOTICE

Cut off tubing flush and do not scratch open ends of tubing to avoid leakage on connections.

Option 1: Purge and Plasma Gas is Argon

1. Connect one piece of the black 6 mm outer diameter tubing to the 2-stage pressure regulator for argon.
2. Flush the gas lines with argon at approximately 1–2 bar for about three minutes by opening the supply.

WARNING

The open end of the tubing must be oriented towards the exhaust. Do not let the gas flow freely into the room.

3. Close the argon supply. Cut the tubing at about 50 cm distance from the open end. Install one of the gas filters (P/N 842312052121) in between the two pieces of tubing.
4. Cut the tubing at about 30 cm distance from the open end. Install the Y-bridge (P/N BRE0014927) from the Installation Kit.
5. Cut the short tubing of about 30 cm length in two pieces. Connect both to the Y-bridge.
6. Connect the remaining open ends of tubing to the instrument (“Plasma Gas” and “Purge Gas”). See [Figure 3-12](#).
7. Open the argon supply. Set the pressure to 5.5–6 bar (approximately 80–87 psi).

8. Leak check: Close the argon supply and monitor the pressure on the wall regulator for three minutes. The gas pressure must remain stable to proof leak tightness. If a loss of pressure occurs, check all connections and repeat [step 7](#) and [step 8](#) until leak tightness is guaranteed.

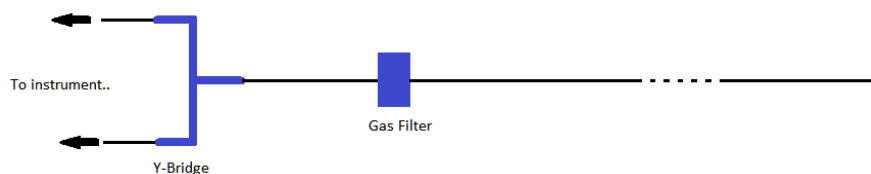


Figure 3-11. Connection of argon for plasma and purge supply

Option 2: Purge Gas is Nitrogen, Plasma Gas is Argon

1. Connect one piece of the black 6 mm outer diameter tubing to the 2-stage pressure regulator for nitrogen, and the other piece to the 2-stage pressure regulator for argon.
2. Flush each gas line with the respective gas at approximately 1–2 bar for about three minutes by opening the supply.

⚠ WARNING

The open end of the tubing must be oriented towards the exhaust. Do not let the gas flow freely into the room.

3. Close the respective gas supply after flushing.
4. Cut both pieces of tubing at about 30 cm distance from the open end. Install the gas filters (P/N 842312052121) from the Installation Kit in between the two pieces of tubing.
5. Connect the open ends of tubing to the instrument: argon to “Plasma Gas” and nitrogen to “Purge Gas”. See [Figure 3-12](#).
6. Open the nitrogen and argon supply. Set the pressure to 5.5–6 bar (approximately 80–87 psi).
7. Leak check: Close the argon supply and monitor the pressure on the wall regulators for three minutes. The gas pressure must remain stable to proof leak tightness. If a loss of pressure occurs, check all connections and repeat [step 6](#) and [step 7](#) until leak tightness is guaranteed.

For option 1 and 2: The leak tightness [step 8](#) (option 1) and [step 7](#) (option 2) can be performed for the external purge line at this point because the instrument is powered on, but not yet connected to the data station, that means that no purge gas flow is induced through the instrument.

As soon as either the Engineering Purge was activated by an operator or the instrument has connected to the Qtegra ISDS Software, purge gas will flow and exit into the torch box.



Figure 3-12. Connections on the instrument for gas supply

The installation of the Additional Gas Option, a feature of the XP and XPS models, is described at [“Additional Gas”](#) on [page 14-2](#).

Activating Engineering Purge

Now that the instrument is switched on, the exhaust system installed and activated, and the gases can be supplied to the instrument, the purging of the optical tank needs to be initiated.

The Engineering Purge push-button can be accessed via the Connection panel on the rear of the instrument. See [Figure 3-13](#).

Use a suitable tool with a pen-like end piece to gently press down the push-button, for example using a 2.5 mm or a 3/32 in. socket wrench.

After activation, the left LED on the LED panel flashes white.



Figure 3-13. Engineering Purge push-button on Connection panel

The Engineering Purge will be active for two hours from now on. You deactivate it after about two hours before you will light plasma for the first time.

The Engineering Purge will purge the polychromator tank at 9.2 L/min and the camera at 1 L/min. A new camera on installation or after replacement will require this maximum purge for a minimum time of three hours before plasma should be lit to prevent icing on the chip. The Boost Purge which can be activated on the Qtegra Dashboard does only boost purge the optical tank, not the camera.

While the optical tank is being purged, you continue to connect the cooling water supply, install the data station, software, make the network connection and verify the connection to the instrument.

Connecting Cooling Water

The external water tubing (2×3 m) and a filter unit for connecting the instrument to the water supply are included in the Installation Kit (blue tubing for inflow and black tubing for outflow of cooling water).

To connect to the instrument, the push fit elbow couplings must be fitted to the open ends of the tubing. The couplings and hose clips for fastening are included in the Installation Kit.

NOTICE

Cut off tubing flush and do not scratch open ends of tubing to avoid leakage on connections.

The water (particle) filters must be installed in the incoming line from the chiller or in-house supply to the instrument.

Cooling water quality and temperature must be in accordance with the specifications in the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide*. See [Table 3-3](#).

Table 3-3. Cooling water quality and temperature

Parameter	Value
Conductivity	< 1000 $\mu\text{S}/\text{cm}$
Solid residual	< 50 μm particle size
Pressure when instrument connected (main valve open)	2–6 bar
Temperature	max. 5 °C below ambient temperature (21 °C \pm 2.5 °C per hour)

Option 1: Cooling Water Supplied by Recirculating Chiller¹

The water to be used in the ThermoFlex chiller is filtered/single distilled water. Refer to the respective chiller manual.

The conductivity of the cooling water remains the primary factory specification. The ThermoFlex water reservoir has a volume of 7.2 L. This minimum volume of water of the required quality must be available on the day of installation.

For a previously used chiller, that is not new on the day of installation, clean or replace water and air filters, flush the system several times with distilled water until it appears to be clean.

1. While the chiller is turned off, fill the reservoir of the ThermoFlex chiller with about 6.7 L of distilled water (DI).
2. Bridge in- and outflow of the chiller with suitable tubing.
3. Switch on the chiller. Adjust the pressure to about 4 bar (58 psi) only.

Tip Fine adjustment will be performed later by matching the software readback for desired flow.

4. Disconnect bridging tubing. Connect external tubing to the chiller (blue line “to instrument” and black line “back to chiller”).
5. Install couplings with hose clips to the open ends.
6. Cut the blue tubing at about 25 cm distance from its open end. Install the water filter in-line.

¹ here: ThermoFlex 900/1400. For instruments operated at an altitude above 1500 m, the ThermoFlex 1400 is recommended as per the *iCAP PRO Series ICP-OES Pre-Installation Requirements Guide*.

7. Connect push fit couplings to the instrument.

Option 2: Cooling Water Supplied by Central In-House Supply

1. Flush the external water lines for about three minutes.
2. Collect some water into a suitable container, preferably a glass beaker which allows you to visually inspect the water, for example for particles.
3. Measure the conductivity of the cooling water using a conductivity meter.
4. Connect external tubing to the in-house supply (blue line “to instrument” and black line “back to chiller”).
5. Install couplings with hose clips to the open ends.
6. Cut the blue tubing at about 25 cm distance from its open end and install the water filter in-line.
7. Connect push fit couplings to the instrument.
8. Open the in-house water supply for the black line (outflow).
9. Open the in-house water supply for the blue line (inflow) gradually if possible and do not fully open - to not exceed maximum pressure. You will fine adjust later using the Service Software readback value.

Computer setup and Configuration

Contents

- [Introduction](#) on page 4-1
- [Warranty Transfer](#) on page 4-2

Introduction

If the computer was not bought from Thermo Fisher Scientific with the instrument, ensure that the minimum requirements for the data station – as included in the *Installation Request Form* of the *PC Specifications for Qtegra ISDS Software* are met.

1. Connect monitor, keyboard and mouse to the computer. Connect the computer to main power and switch it on.
2. Connect the network cable from the Installation Kit to the instrument.

The preferred option is to use the additional network card for the instrument connection and the onboard connection for the local network connection. Either one Ethernet port on the connection panel can be used. See [Figure 4-1](#).



Figure 4-1. Network connections to local network onboard (left) and instrument to network card (right)

Warranty Transfer

If the iCAP PRO system was supplied with a PC purchased through Thermo Fisher Scientific, the warranty must be transferred to the customer to be able to make a claim for warranty services through DELL.

Log on to the DELL warranty transfer website (www.dell.com/globaltagtransfer) and enter the requested information starting with the PC's Service Tag.

Installation of Software

Contents

- [Installation of Qtegra \(Qtegra-iCAP PRO\) on page 5-2](#)
- [Making Connection to the Instrument on page 5-3](#)
- [Network Setup on page 5-3](#)
- [Verifying Connection and Engineering Purge on page 5-4](#)

Installation of Qtegra (Qtegra-iCAP PRO)

For instructions on how to install Qtegra and on how to activate it, refer to the *Qtegra ISDS Software for iCAP PRO Series ICP-OES Installation Guide*.

Qtegra Configurator

1. Open the **Configurator**.
2. Navigate to **Experiment Configurator**.
3. Right-click **iCAP PRO Series**.
4. Choose **Settings**.
5. Click the **Drain Sensor Settings** tab.
6. To be able to verify the correct display of Drain Sensor interlock, do not disable by default. Choose **Drain Sensor Interlock Options** and set the value to **Stop peripump and nebulizer gas flow**. See [Figure 5-1](#).

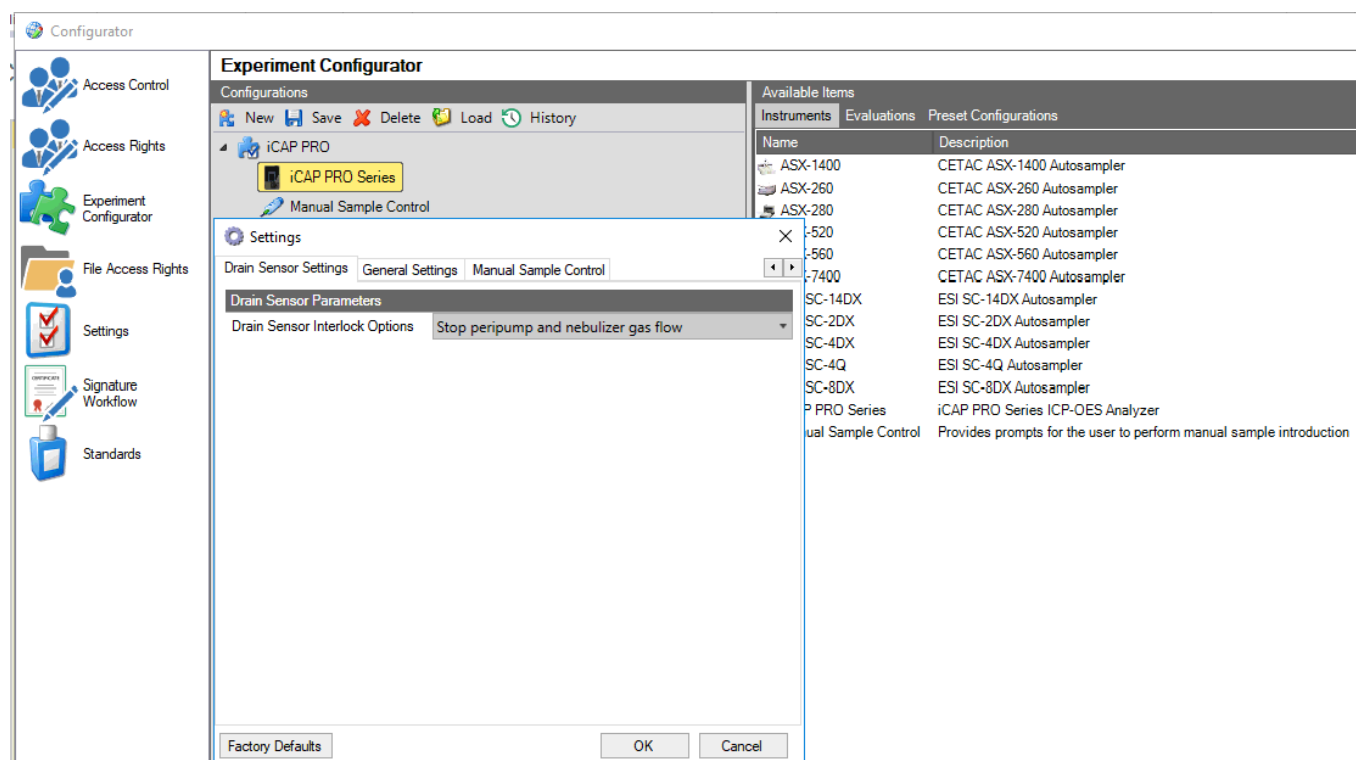


Figure 5-1. Drain Sensor Interlock options – Default on installation

Restart the computer after installation to activate the customer license.

Making Connection to the Instrument

Now that the software for instrument control has been installed, you will establish the LAN connection to the instrument, activate the instrument capabilities, use the Service Software read backs to fine tune the water flow and the exhaust flow and perform minor changes to the PC settings.

Network Setup

1. Connect the ethernet cable of the Installation Kit to either of the Ethernet ports on the connection panel of the instrument. See [Figure 4-1](#).
2. Navigate to **Network and Sharing Center**.
3. Rename the network connection for the instrument to **iCAP PRO** (external network card preferred).
4. Choose **Internet Protocol Version 4 (ICP/IPv4)** only.
5. Click the **General** tab.

At **IP address**, enter 192.168.1.100.

At **Subnet mask**, enter 255.255.254.0. See [Figure 5-2](#).

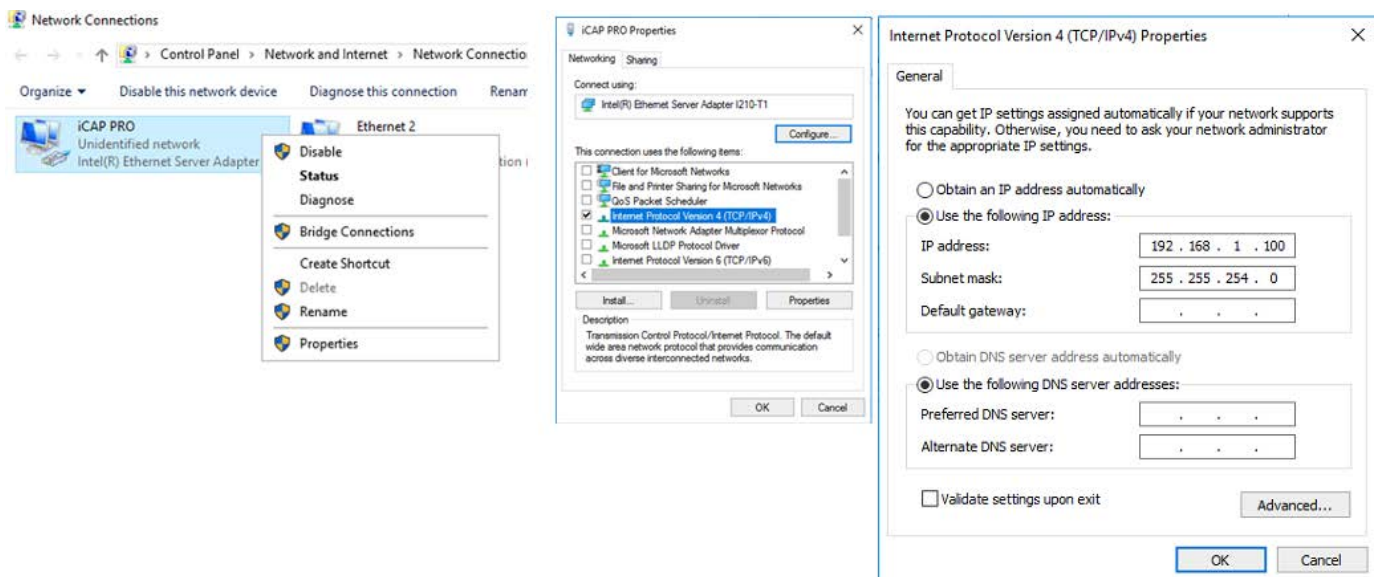


Figure 5-2. Ethernet setup for instrument connection

Verifying Connection and Engineering Purge

Open Qtegra ISDS. It may take about 20–30 s until the instrument makes connection. You hear a “click” when the main water valve opens.

Navigate to **Qtegra > Dashboard > Home**. Check the Interlocks. At this step of the installation procedure, you should see red interlocks only for Torch Holder and Detector Temperature. The Drain Sensor only shows red when no bubbles are detected during plasma ignition.

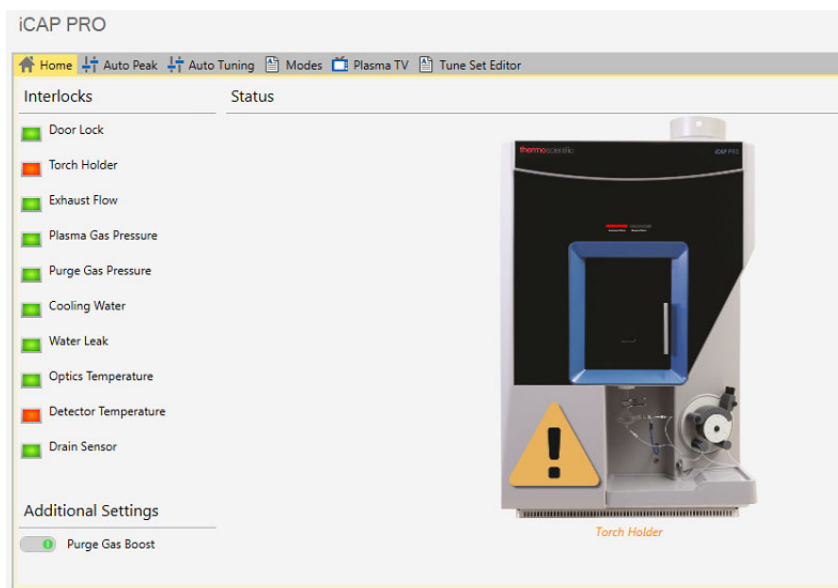


Figure 5-3. Display of Qtegra Dashboard Interlocks at this step of installation procedure

If the optical tank has not reached 30 °C, the Optics temperature interlock will be red, the Cooling water Interlock may still be red if the actual flow is not yet as specified (see “[Service Software Readback Control](#)” on [page 8-1](#)) or the chiller was turned off. See [Table 11-1](#).

Check that the Purge Gas Boost is still active. It should deactivate when you connect the instrument with the PC and the Qtegra Services establish the instrument connection. If the minimum time of 3 hours purge time has not finished yet, push the engineer purge button again to ensure a good purge. You can check the purge valve settings in the Service Software or via the front LED panel (blue with a green flashing).

Even though only the Engineering Purge will “boost purge” the camera, the “Purge Gas Boost” will appear activated if the Engineering Purge is still on.

Make sure to reactivate the Engineering Purge by gently pressing the push-button on the Connection panel. See [Figure 3-13](#).

Confirm that the Purge Gas Boost on the Qtegra Dashboard Home is active after this step.

If you cannot make a connection, turn off the firewall/Windows Defender. Disconnect the instrument PC from the local network such that the only remaining network connection on the PC is to the instrument.

Installation of Software

Verifying Connection and Engineering Purge

Activating Instrument Capabilities

Contents

- [Installation of the Qtegra Service Software \(Qtegra-iCAP PRO-Service-Software\) on page 6-2](#)
- [Field Service Portal on page 6-2](#)
- [Connecting to the Service Software on page 6-3](#)
- [Activation of the Instrument Capabilities on page 6-4](#)

Activating Instrument Capabilities

Installation of the Qtegra Service Software (Qtegra-iCAP PRO-Service-Software)

Installation of the Qtegra Service Software (Qtegra-iCAP PRO-Service-Software)

Install the Qtegra Service Software.

Qtegra and the Qtegra Service Software must be of the same release/version to be able to run on the same PC without conflict.

Field Service Portal

Service Software Activation Key

According to [Figure 6-1](#), download an Activation Key for the Service Software from the Field Service Portal.

You need to enter a date and the serial number of the instrument.

You can create Service Software Keys ahead of the visit. In case of a 2-days visit, you can create two 1-day keys, and so forth.

Field Service Portal 2.14.5122.158

Field Service Portal

Service Token

Instrument Preparation

SERVICE TOKEN

Generate a temporary activation key for the Qtegra Service App. This key depends on the instrument serial number and is valid for one day. Internet connection is required.

Instrument: iCAPPRO

Serial number: 10007
Please enter only the numeric part of the iCAP PRO serial number (5 digits)

Date: 8/11/2022
The Service Token generated is only valid for the day specified under Date.

Generate Service Token

Figure 6-1. Downloading an Activation Key

Requesting Intermediate File

According to [Figure 6-2](#), download the license file for the activation of the instrumental capabilities (so called Intermediate File) from the Field Service Portal. The serial number of the instrument will be requested.

You can download the Intermediate File already ahead of the visit if you have the serial number available (in case the customer site does not have a good Internet connection).

You need to enter a date and the serial number of the instrument.

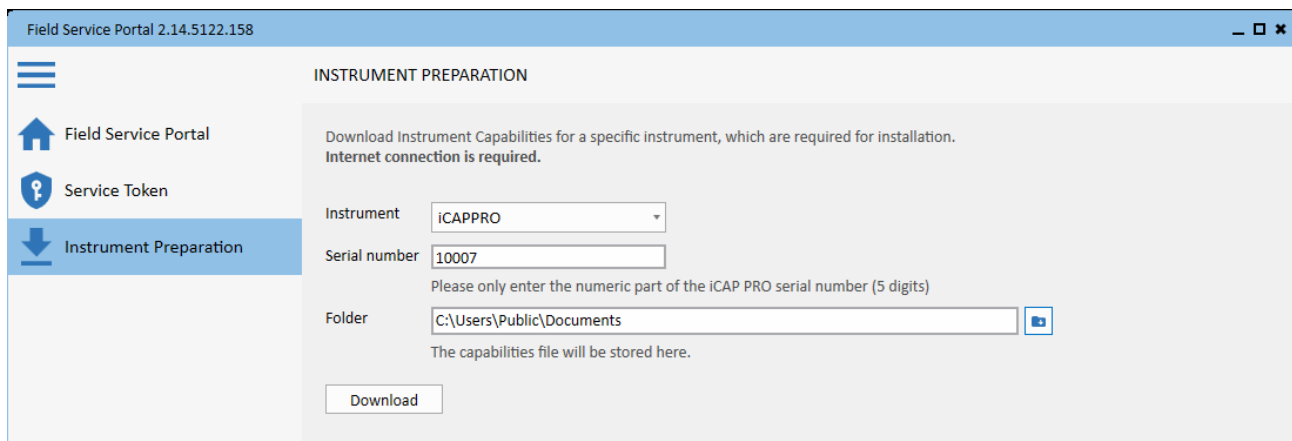


Figure 6-2. Downloading the license file

Connecting to the Service Software

Open the Service Software. Enter the generated Activation Key from the Field Service Portal.

On the Service Software Dashboard, confirm the status of iCAP PRO, Instrument Control board and camera to be connected. See Figure 6-3 as an example.

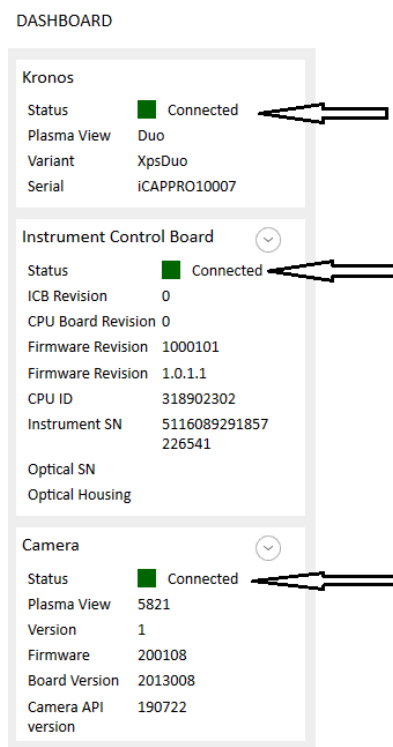


Figure 6-3. Connected status for instrument, instrument control board and camera^a

^a Example only. SNs and firmware etc. will not match.

Activation of the Instrument Capabilities

In the Service Software, run the Test Set (Service) **Configure Instrument Capabilities from Intermediate File** to write the Instrument capabilities to the instrument and confirm the successful writing.

If writing was not successful, restart the Services of Qtegra or load an empty configuration and switch back to the iCAP PRO configuration. See [Figure 6-4](#) and [Figure 6-5](#).

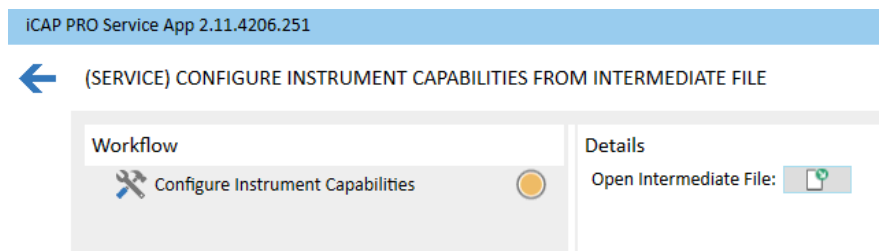


Figure 6-4. Test set (service) configure instrument capabilities from intermediate file

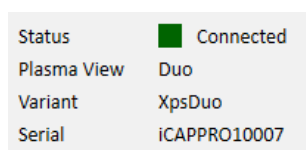


Figure 6-5. Service Software > Dashboard: Variant and Serial (model and serial number) successfully written (example)

Cooling Water Conductivity Check (Recirculating Chiller)

Now that the connection to the instrument has been established, the main water valve needs to be opened and cooling water will flow through the camera, but not the RF unit (plasma off).

1. Allow for at least three minutes of mixing time. Confirm the conductivity of the cooling water.
2. Measure the conductivity of the cooling water in the chiller reservoir using a conductivity meter. Required value: $< 1000 \mu\text{S}/\text{cm}$
3. If the conductivity is too high, adjust it by adding more clean filtered fresh water. The typical range of fresh water is $150\text{--}500 \mu\text{S}$.

Cooling Water Conductivity Check (Recirculating Chiller)

Service Software Readback Control

Fine tune the adjustments for:

- extraction flow (exhaust pressure) and
- water flow (with plasma off)

using the readbacks in the Service Software (**Hardware Control > Instrument Control**) to approximately -1 to -1.2 mbar and 2.5 L/min. See [Figure 8-1](#).

Verify “green Qtegra Interlocks”.

Water Flow in l/m	2.48
Exhaust Pressure in mBar	-1.17

Figure 8-1. Service Software readbacks for water flow and exhaust pressure

PC Configuration

Windows Settings

1. Set the default web browser's homepage to the current Trace Elemental Analysis website and save.

e.g. <https://www.thermofisher.com/uk/en/home/industrial/spectroscopy-elemental-isotope-analysis/trace-elemental-analysis.html>
(as per 10/02/2020).
2. Modify the **Region & language settings** of Windows to the country and language of the choice of your customer.
3. Modify the **Power & sleep settings** of Windows to "Sleep = Never when plugged in" by default¹.
4. Create shortcuts to Qtegra and the Configurator in the Windows taskbar by right-clicking the icons and choosing **Pin to taskbar**.

¹ Main reason is to never put the hard disk to sleep. A measurement of Qtegra may stop when sleep mode is activated.

PC Configuration

Windows Settings

Installation of the Sample Introductory System

Contents

- Torch Assembly (Torch Holder, Torch and Injector) on page 10-2
- Positioning of the Coil on page 10-3
- Kitchen Glassware and Sample and Drain Tubing on page 10-4
- Solvent Waste on page 10-5

NOTICE

Use only the standard sample introduction kits for installation performance verification. See “Installation Kit, Test Solutions, Country Kit, Data Station” on page 3-3.

Torch Assembly (Torch Holder, Torch and Injector)

NOTICE

Always wear gloves when you handle glass or ceramic torches. Fingerprints reduce the life of the torch and might cause the torch not to light.

1. Install the required O-rings to the injector and torch holder. Visually check for damage.
2. Install the injector into the injector holder.
3. Install the torch body and injector holder with injector into the torch holder:
 - 2 mm injector DUO (single blue ring) and
 - 1.5 mm injector Radial Only (single red ring).
4. The circular mark on the torch body must be centrally aligned with the semicircular cut-out on the torch holder.
5. Push the torch body all the way into the holder.

For details about the standard procedure, refer to the *iCAP PRO Series ICP-OES Operating Manual*.

The **torch holder** is sometimes referred to as **metal torch mount**, whereas the **injector** is sometimes referred to as **center tube**.

Orientation of the Torch (DUO only)

The slot on the DUO torch body must be aligned symmetrically to the slot of the Radial cone. When fitting the torch holder with the torch, the holder must be rotated all the way into the torch box until its end-stop. Verify the symmetric alignment of the slots of torch body and Radial cone relative to each other.

If the slots are not aligned, remove the torch holder with the torch body and rotate the torch body slightly. Refit the torch holder and verify the alignment. Repeat rotating the torch body slightly and refitting the torch holder until the alignment is correct.

The same procedure is true for the ceramic DUO torch. The slot of the ceramic DUO torch must be aligned to the marker on the Radial cone. See [step 3](#).

Positioning of the Coil

Before fitting the torch assembly into the torch box, the position of the coil relative to the torch must be aligned. The Engineering Tool Kit comes with a metal torch dummy to be used for this purpose.

- Two engravings on top mark the upper and lower limit for the coil position. This will have an influence on the analytical performance.
 - Make sure that the coil does not touch the body of the torch dummy. This will avoid burn marks on coil and torch.
1. Remove the injector holder with injector and the torch from the torch holder.
 2. Place the torch dummy in the torch holder and push it all the way down.
 3. Insert the torch holder with the torch dummy into the torch box.
 4. Verify the correct position of the coil and adjust if necessary. See [Figure 10-1](#).

You may carefully move the coil **up and down** when the torch dummy is installed.

To carefully move the coil **forward and backward**, you have to remove the torch dummy and reinsert it afterwards.

NOTICE

Right and left movement is not possible and can harm the sealing to the RF insulating plate. Do not bend the legs or feet of the coil.



Figure 10-1. Metal torch dummy with alignment marks (left) and relative coil positioning (right)

5. Reassemble the torch assembly for standard usage, reinsert into the torch box and verify once more visually that:
 - a. the coil does not touch the Radial cone (about 0.5 mm distance from the bottom of the cone to the upmost top of the coil)

- b. the coil does not touch the torch body.

Kitchen Glassware and Sample and Drain Tubing

NOTICE

Only use the standard sample introduction kit, which was delivered with the instrument for the installation and performance verification.

1. Fit the adapter piece to the spray chamber into the injector holder.
2. Fit the drain outlet connector with capillary tubing into the lower end of the spray chamber.
3. Guide the drain outlet capillary tubing through the drain sensor (for tidy routing; from top to bottom is recommended).
4. Connect the spray chamber to the adapter piece with the metal clamp.
5. Slide the spacer (“collar”) onto the nebulizer tip.
6. Insert the nebulizer into the spray chamber. Push it all the way in until the spacer makes contact.
7. Connect the gas tubing push-fit connector to the gas inlet of the nebulizer. Connect the tubing to the nebulizer gas outlet in the kitchen area.
8. Insert the sample inlet connector with capillary tubing into the right end of the nebulizer.
9. Fit both capillary tubing (drain and sample) to the respective peristaltic pump tubing.
 - 2-stop white-orange = sample
 - 2-stop white-white = drain
10. Connect the peristaltic pump tubing to the peri-pump. One channel each.

NOTICE

Pay attention to the counterclockwise movement of the pump. Guide the drain tubing from right to left, and the sample tubing from left to right.

11. Assemble the rigid sample probe to the capillary sample tubing.
12. Shorten the sample inlet capillary tubing from the rigid sample probe to the peristaltic pump sample tubing to minimize sample uptake time.

13. Connect the drain outlet capillary tubing to the peristaltic pump drain tubing. Cut a suitable length which allows guiding the tubing to the solvent waste container.

For details and figures, refer to the *iCAP PRO Series ICP-OES Operating Manual*.

Solvent Waste

Route the drain outlet capillary tubing to the solvent waste.

A suitable waste container (solvent-proof, shatter-proof and vented away from the instrument) must be provided by the customer. During installation, the waste container must be inert against 0.2% nitric acid.

The drip tray, which is part of the cover set of the spectrometer, is only meant to protect the instrument from minor spillage from the sample introduction system.

NOTICE

Thermo Fisher Scientific recommends placing the waste containers in some type of secondary containment, such as a plastic bin, in case of a spill or overflow. To prevent the laboratory from being accidentally contaminated by solvent waste, protect the waste container against overturning.




















Installation of the Sample Introductory System

Solvent Waste

Interlock Check

Verify the correct display of all Interlocks for “green” and “red” events represented on the **Qtegra > Dashboard > Home** in agreement with [Table 11-1](#).

Table 11-1. Overview of Interlocks on Qtegra Dashboard

 Door lock	Torch box door closed	 Door lock	Torch box door open
 Torch holder	Torch not installed	 Torch holder	Torch not installed
 Door lock	Torch box door closed		
 Torch holder	Torch installed		
 Exhaust flow	Exhaust flow: 180 – 220 m ³ /h	 Exhaust flow	Exhaust off
	Exhaust pressure: -1 – -1.2 mbar		Exhaust pressure < 0.8 mbar
 Optics temperature	Optics temperature between 30 °C and 50 °C	 Optics temperature	Temperature is < 30 °C or > 50 °C
 Cooling water	Flow > 2.7 L/min (plasma off)	 Cooling water	Flow < 2.7 L/min (plasma off)
 Plasma gas pressure	Argon p > 5.5 bar	 Plasma gas pressure	Argon p < 5.5 bar
 Purge gas pressure	Purge gas p > 5.5 bar	 Purge gas pressure	Purge gas p < 5.5 bar
 Water leak	Red interlock indicates a leak, which has reached the bottom of the chassis. Must be green.		
 Detector temperature	Must be red if plasma is off. TEC ^a cooling will start when plasma is lit only.		
 Detector temperature	Green interlock indicates that the camera was electrically cooled to -45 °C.		

^a TEC: Thermo Electric Cooler

Interlock Check

System Pre-Check

Contents

- [Getting Ready](#) on page 12-2
- [Full Frame Leak Check](#) on page 12-5
- [Test Set Echellogram Position Detection](#) on page 12-6
- [Auto Tuning of Fore Optics Alignment](#) on page 12-7
- [Auto Tuning of Nebulizer Flow](#) on page 12-8
- [Auto Peak](#) on page 12-9

After the iCAP PRO ICP-OES system has been fully installed including hardware, software, and sample introduction system, you switch on the plasma for the first time on the customer site, perform some pre-checks on the optical system and performance before you continue with the high-level performance checks. See “[Test Set High-Level Performance Test](#)” on page 13-2.

This will generate an Installation Acceptance Report if the instrument has passed all necessary performance verification tests.

Getting Ready

Preconditioning of Glassware

To precondition the glassware (particularly the spray chamber) you will flush with a 10% Decon™ 90 solution - or similar diluted analytical grade detergent/surfactant¹ - with the plasma off and the nebulizer flow on (about 0.5 L/min) as well as the peristaltic pump running at about 45 rpm.

Diluted surfactant is not supposed to be aspirated with plasma on to avoid introducing the surfactant into the optical system.

1. Aspirate the diluted Decon™ solution for approximately five minutes.
2. Pull the nebulizer out so that the side arm (connection port to nebulizer gas) is approximately 8 mm from the end of the neck of the spray chamber. Run deionized water for about 20 minutes.

Start Plasma

1. Place the sample probe in deionized water.
2. Open Qtegra ISDS. Navigate to **Dashboard > Home**.
 - a. Switch off the Purge Gas Boost (**Additional Settings** below **Interlocks**).
 - b. Open **Get Ready**.

Select a Warm-up Time of 30 minutes. See [Figure 12-1](#).
 - c. Click **OK**.

The plasma will be switched on.

NOTICE

The red Detector temperature interlock does not prevent you from switching on the plasma. It will turn to green when the camera temperature has reached -45 °C.

The TEC (Thermo Electric Cooler) is switched on when the plasma has been ignited.

¹ Typically, any lab dish washers will be used with such a solution. Ask the customer about this.

iCAP PRO

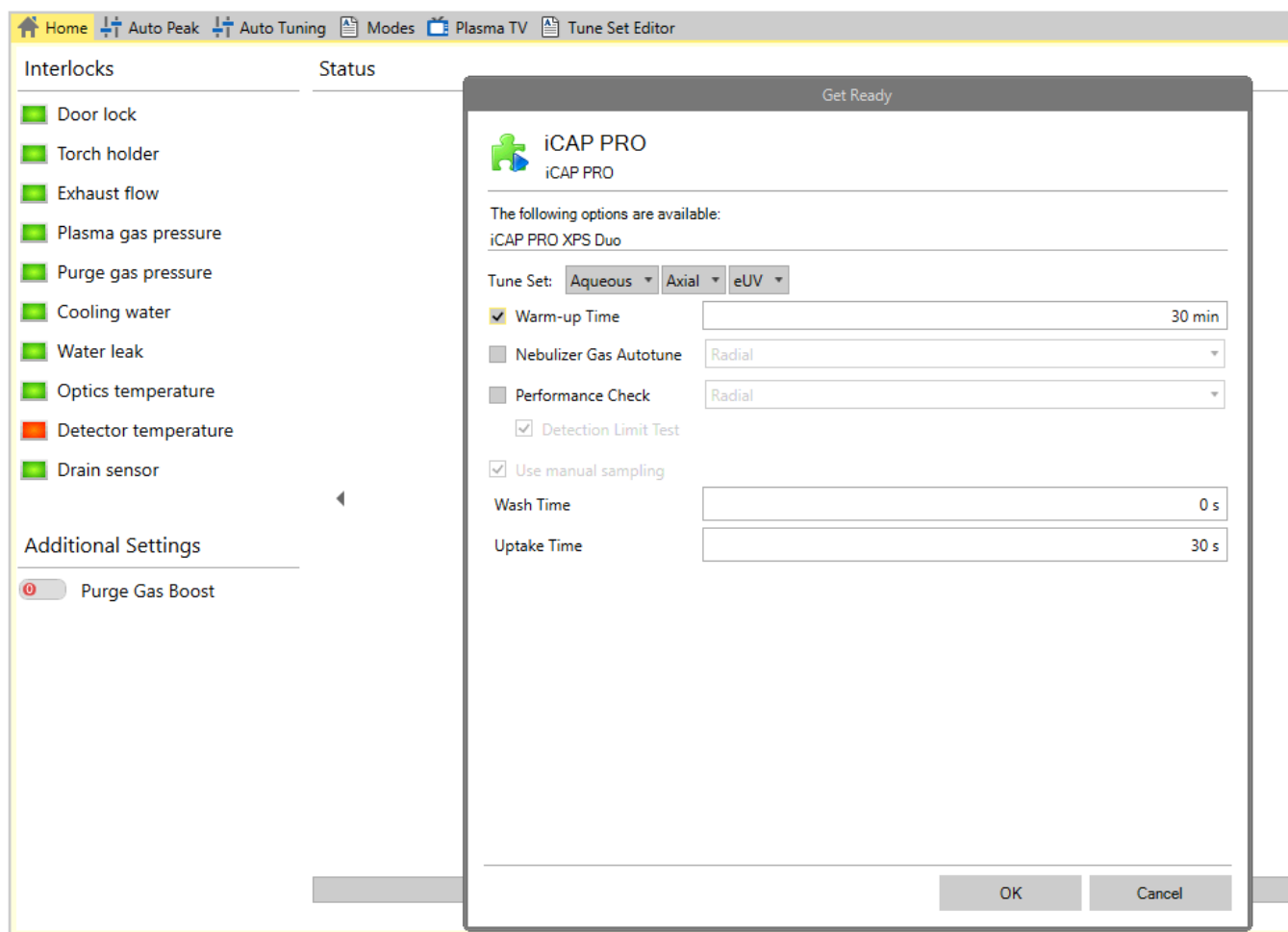


Figure 12-1. Qtegra ISDS – lighting plasma and warm-up (display of Interlocks just after lighting of plasma)

Interlock Check Operate Mode (Camera Temperature and Drain Sensor)

Detector temperature Interlock must turn to green when the camera has reached $-45\text{ }^{\circ}\text{C}$.

Drain sensor Interlock must turn to green when the first bubbles have been detected.

Setting the Peristaltic Pump Clamp Pressure

The following instruction is usable for a standard freely aspirating nebulizer as delivered within the standard sample introduction kits within the Installation Kit.

1. With the plasma ignited, stop the peristaltic pump.
2. With the nebulizer gas switched on, gradually reduce the tubing pressure by releasing the screw on the tension finger until the water freely aspirates through the pump tubing.

You may want to briefly remove the capillary or sipper probe from the rinse for a short period to introduce a small air bubble which can be detected by the eye more easily.

3. Tighten the tension finger until the flow stops.
4. Tighten by another 1/4 of a turn.
5. Turn on the pump and - only if necessary - tighten the tension screw on the pump finger until a smooth flow is produced.
6. With the pump turned on, adjust the drain pressure to let small bubbles flow within the drain tube.

Any pulsing of the liquid in the spray chamber can affect the precision of the results.

RF Power Check

At **Qtegra > Dashboard > Home**, under **Source Settings**, set the maximum RF power, which is available for the instrument model. To set the RF power, click **Apply**, which will also set the adjusted cool gas flow. Confirm that the plasma stays on for about three minutes.

Full Frame Leak Check

For the following instructions, you will acquire full frames for METS (Multi Element Test Solution):

- **Service Software > Acquisition**
- Exposure Settings = Exposure Interval 2 s
Other values remain unchanged.

Switch between views and slits by using the Get Ready dialog as required. See upper right part of [Figure 12-1](#).

FF is the abbreviation of Full Frame.

iCAP PRO DUO/Radial (All Models)

Take a FF on Axial and Radial View (DUO) or Radial View (Radial only) on iFR slit.

Verify visibility of the order lines down to 177.495 P {94} or lower. See left part of [Figure 12-2](#).

On the full frames for all views, zoom in to order line {89}. Verify that background absorption cannot be detected.

iCAP PRO DUO/Radial (XP and XPS Models only)

Take a FF on Axial and Radial View (DUO) or Radial View (Radial only) on eUV slit.

Verify visibility of the order lines down to 177.495 P {94} or lower.

Verify “elongated” slit image eUV compared to iFR, that is successful switching of slit selector. See right part of [Figure 12-2](#).

System Pre-Check

Test Set Echellogram Position Detection

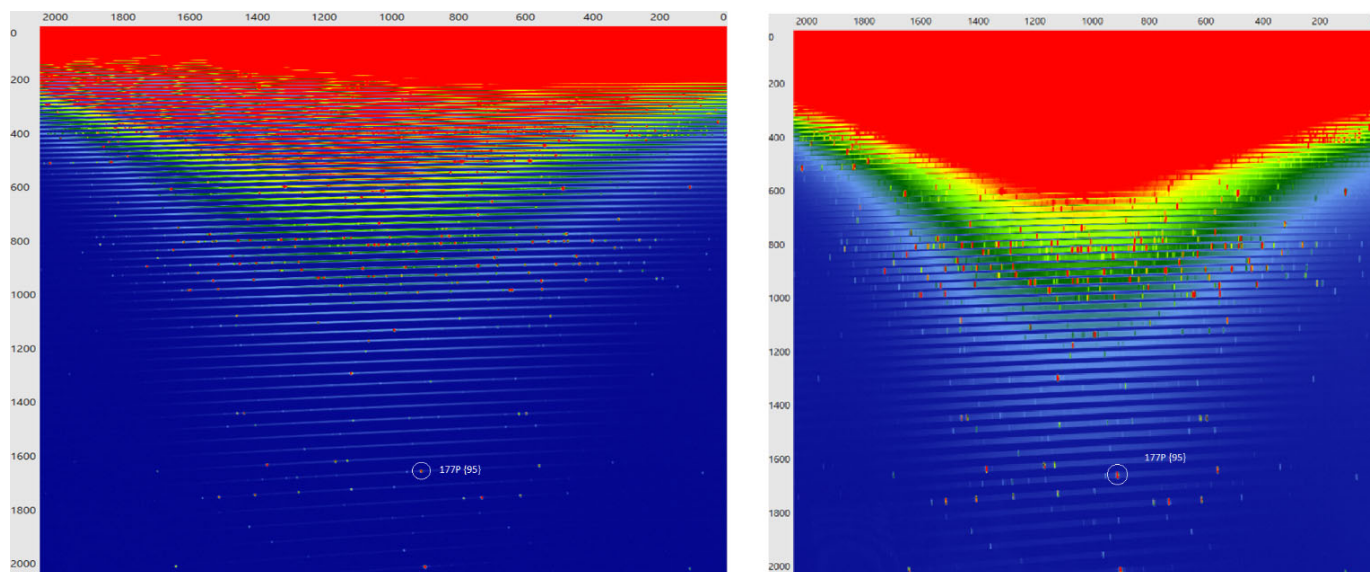


Figure 12-2. Full frames iFR (left) and eUV (right) – order lines visible for order {95} and below

Test Set Echellogram Position Detection

Confirm the position of the 193C line on the camera image and overall purge level by following the instructions at:

Service Software > Test Sets > Echellogram Position Detection. See [Figure 12-3](#).

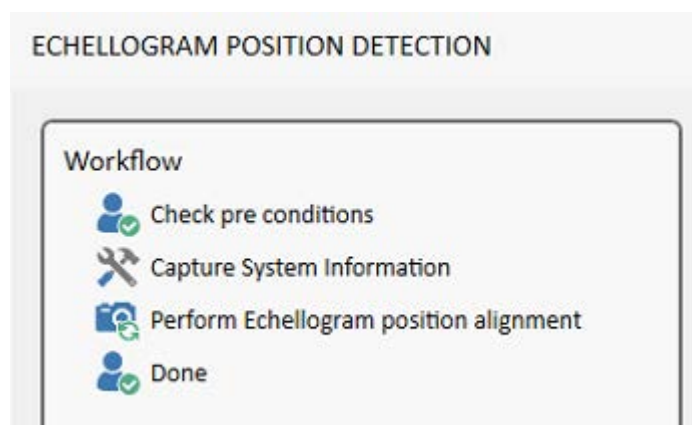


Figure 12-3. Test Set Echellogram Position Detection

NOTICE

Check C position after the plasma is on since at least 30 min and the polychromator is at 38 °C. Checking the C position before the instrument is properly warmed up, C will not be at the final position.

Auto Tuning of Fore Optics Alignment

For a maximum sensitivity and optimum results, the alignment of the plasma image is eminent.

Qtegra > Dashboard > Auto Tuning > Fore Optics Alignment. See [Figure 12-4](#).

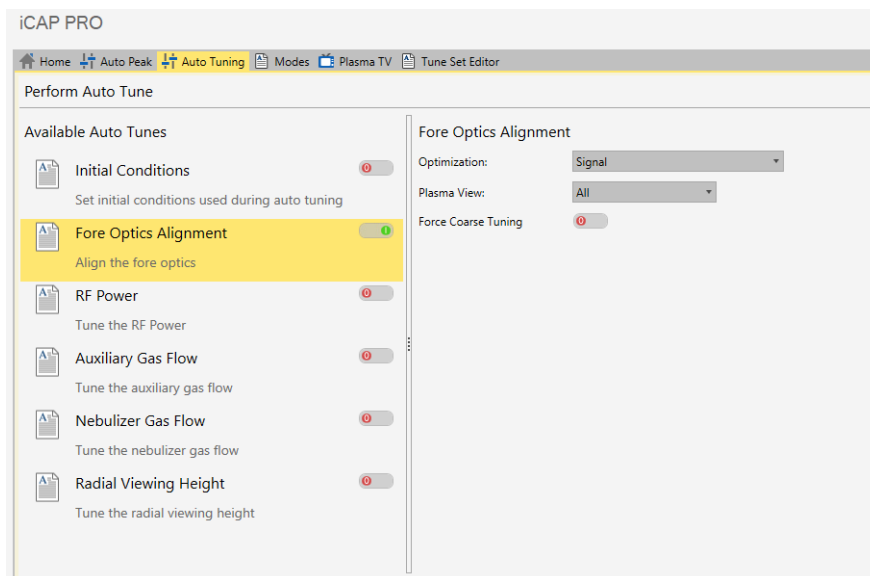


Figure 12-4. Auto Tuning: Fore Optics Alignment

- Optimization = Signal
- Plasma View = All (Radial for Radial Only)
- Force Coarse Tuning = Off (switch is red)

The optimized values for Axial and Radial (or Radial only) view will be saved.

Auto Tuning of Nebulizer Flow

Since every nebulizer is slightly different in terms of flow, the nebulizer flow optimization is required before performing the IAT tests.

Qtegra > Dashboard > Auto Tuning > Nebulizer Gas Flow

See [Figure 12-5](#).

- Optimization = Signal
- Plasma View = All (Radial for Radial Only)

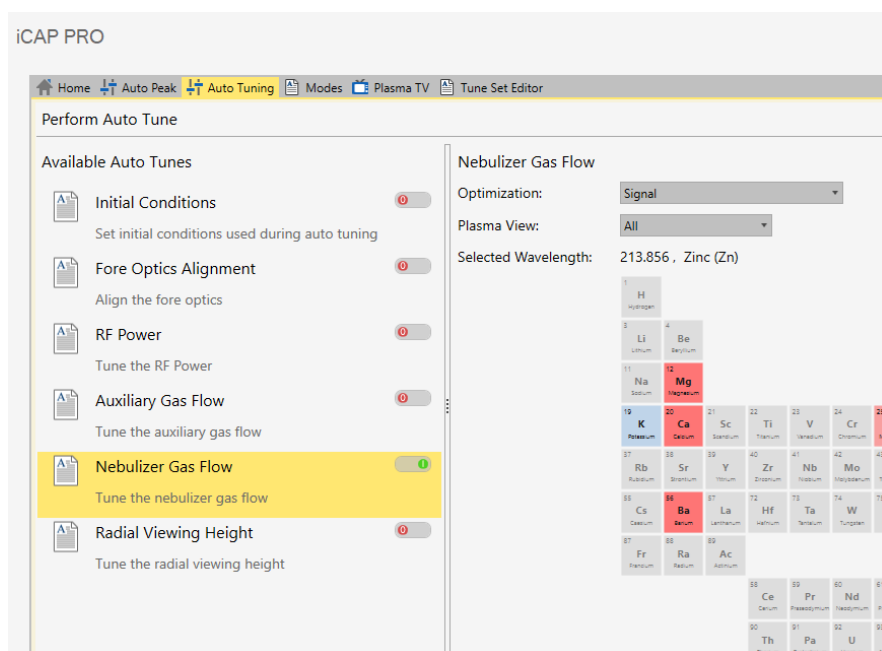


Figure 12-5. Auto Tuning: Nebulizer Gas Flow

The optimized values for Axial and Radial view will be saved to the respective Tune Sets.

Auto Peak

The Auto Peak measurement will detect the Peak of incoming light and change the position of the selected peaks in their subarray.

Go to **Qtegra > Dashboard > Auto Peak**. Select **Perform Auto Peak**.

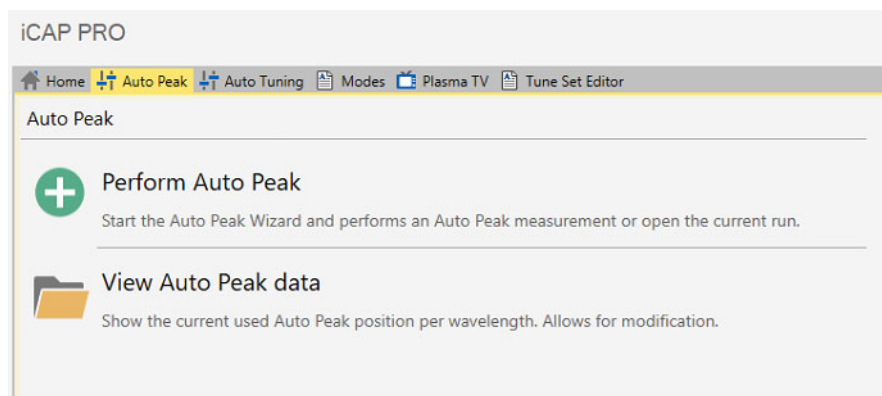


Figure 12-6. Starting Auto Peak

Leave the Auto Peak Options parameters as set by default:

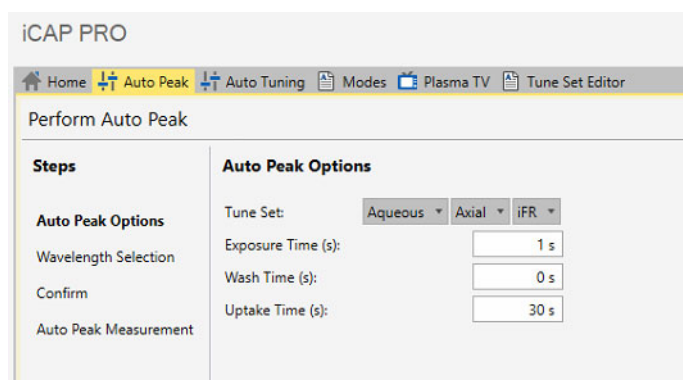


Figure 12-7. Auto Peak: options

From the next wizard page, select all elements, which are included in METS and switch to the used wavelengths (see [Table 12-1](#)). In the end, an Auto Peak is needed for all elements the customer is measuring.

Table 12-1. Wavelength of the elements in METS

Element	Wavelength [nm]
Al	396.152
Ba	455.40
Cu	324.754
K	766.490
Mg	279.553

Table 12-1. Wavelength of the elements in METS, continued

Element	Wavelength [nm]
Mn	257.610
Ni	221.647
P	185.942
Zn	213.856

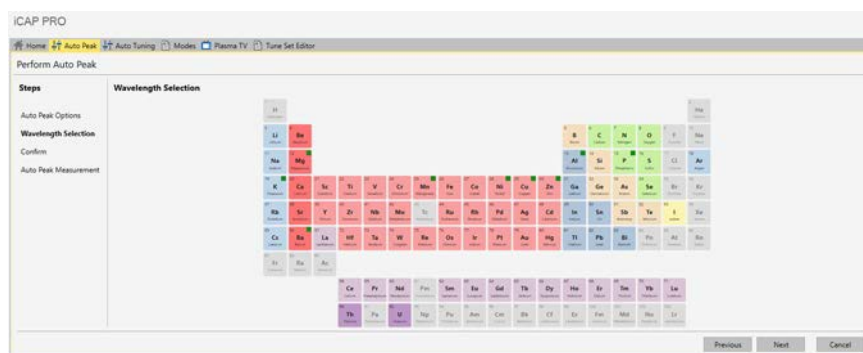


Figure 12-8. Auto Peak: wavelength selection

Perform the auto peak after the plasma is on since at least 30 min.

Performance Verification

Contents

- Test Set Sensitivity Quick Check on page 13-1
- Test Set High-Level Performance Test on page 13-2

Test Set Sensitivity Quick Check

Run **Service Software > Test Sets > IAT - Sensitivity Quick Check** to verify good sensitivity of the factory specified lines of interest. See [Figure 13-1](#).

This is a prerequisite for passing the High-Level Performance Checks at “[Test Set High-Level Performance Test](#)” on page 13-2.

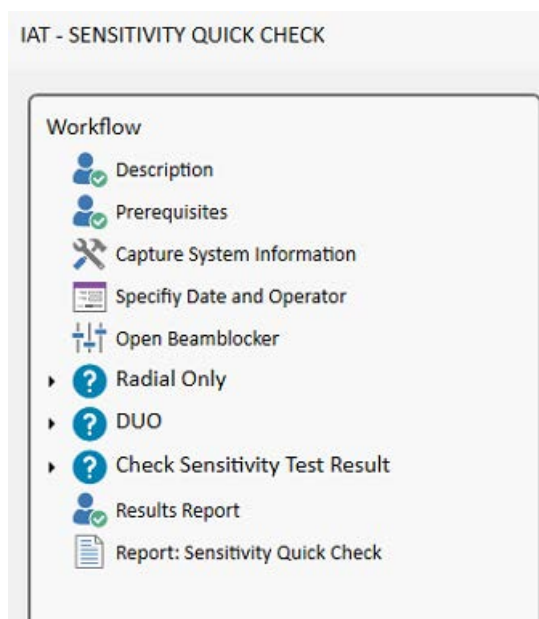


Figure 13-1. Test Set IAT - Sensitivity Quick Check

NOTICE

A spraychamber, which was not previously cleaned, is likely the root cause of bad RSD and detection limits.

You have to successfully pass the Sensitivity Quick Check before continuing with the IAT High Level Performance Check. Troubleshoot the system until you pass before continuing.

Test Set High-Level Performance Test

Run **Service Software > Test Sets > IAT - High-Level Performance Test**. See [Figure 13-2](#).

Follow the user instructions on screen. During the workflow of the Test Set, the instrument model will be detected automatically to decide about the required views and slit modes for the tests.

All three test level (Sensitivity, Repeatability, Detection Limit) must be fulfilled successfully. PASS for all lines, views and slits:

- Sensitivity Test (on Multi Element Test Solution)
- Repeatability Test (on 20 repeats on Multi Element Test Solution)
- Detection Limit Test (on 20 repeats on Loaded Blank Solution)

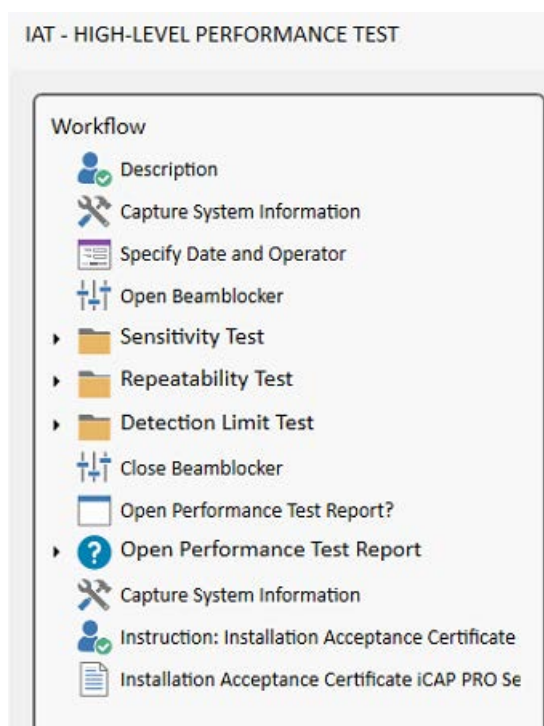


Figure 13-2. Test Set IAT - High-Level Performance Test

If any of these tests fail for a specific line, the Test Set will show a Troubleshooting Guide. A “High-Level Performance Report” will always be printed for diagnostic purposes, even if a test fails.

Installation Acceptance Report

If all tests have passed for all factory specified lines, the iCAP PRO Installation Acceptance Report will be generated for export at the end of the Test Set IAT - High-Level Performance Check.

This document can be signed by the field service representative and the customer.

Options - for all XP and XPS Models

Contents

- [Ceramic Torch](#) on page 14-1
- [Additional Gas](#) on page 14-2

Ceramic Torch

A ceramic torch is only delivered with the iCAP PRO Radial XP and XPS instrument but can be ordered as an option.

1. Shut off the plasma. Wait for about 3–5 min. until the torch body has cooled.
2. Remove the torch holder.

NOTICE

Always wear gloves when you handle glass or ceramic torches. Fingerprints reduce the life of the torch and might cause the torch not to light.

3. Replace the quartz torch with the ceramic torch and insert it back into the torch box.

The slot on the DUO torch body must be aligned symmetrically to the marker of the slot of the Radial cone. See [“Orientation of the Torch \(DUO only\)”](#) on page 10-2.

4. Light the plasma to confirm proper ignition.

Additional Gas

The customer can use compressed air, oxygen or argon as additional gas. The purity of all gases must be $\geq 99.99\%$. The add gas MFC will operate in a range from 2–6 bar. 2.5 bar is a good choice for operation. 6 bar is not required.

The Additional Gas Installation Kit (BRE0021099) comes with:

- PE tubing, Ø4, black, L = 3000 mm (wall regulator to instrument)
- PE tubing, Ø6, black, L = 100 mm (kitchen outlet to sample intro)

Installation

1. Connect the black 3 m long 4 mm outer diameter tubing to the 2-stage pressure regulator for the additional gas.
2. Flush the gas line with compressed air, argon or oxygen at approximately 1–2 bar for about three minutes by opening the supply.



The open end of the tubing must be oriented towards the exhaust. Do not let the gas flow freely into the room.

3. Close the respective gas supply after flushing.
4. Connect the open end of the tubing to the instrument. See [Figure 14-1](#).
5. Open the Additional Gas (“Add Gas”) supply. Set the pressure to 2.5 bar (approximately 36 psi).
6. Leak check: Close the supply and monitor the pressure on the wall regulator for three minutes. The gas pressure must remain stable to proof leak tightness. If a loss of pressure occurs, check all

connections and repeat [step 4](#) and [step 6](#) until leak tightness is guaranteed.



Figure 14-1. Gas Connection panel (Add Gas, right)

Operation

Argon is used as a sheath gas in high salt applications, in combination with the sheath gas adapter. If this is the intention of the customer, make sure the customer knows that this additional hardware will be required.

Compressed air or oxygen are used for organic matrices as additional gas to oxidize excessive carbon in the plasma.

The additional gas can be added to the auxiliary line directly or switched to exit into the kitchen area. This is the choice of the customer and the desired application.

Try out both options with a flow of 0.2 L/min in **Qtegra > Dashboard > Home > Source Settings**.

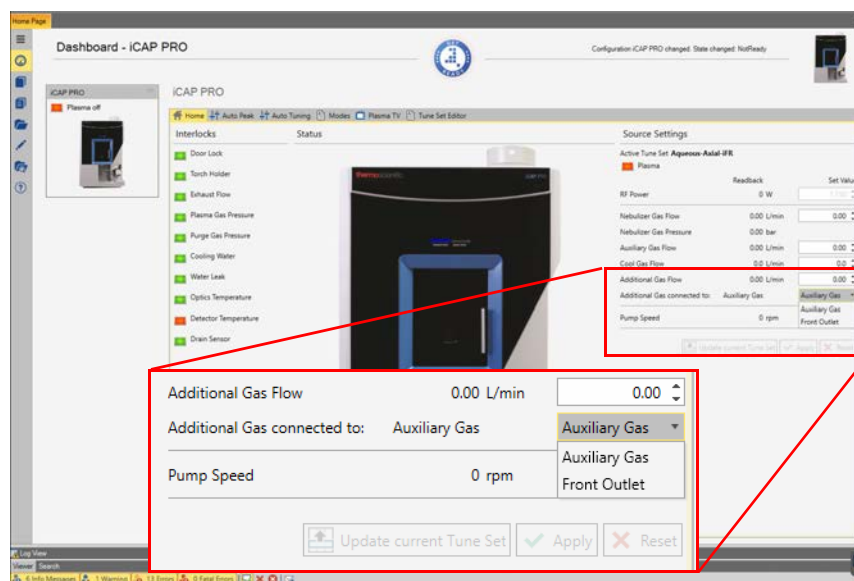


Figure 14-2. Gas Connection panel (Add Gas, right)

Additional Gas connected to Auxiliary Gas

Additional Gas connected to Front Outlet

Options - Customer's Choice

Contents

- [Non-Standard Sample Introduction Systems](#) on page 15-1
- [Autosampler and Other Plug-In Supported Hardware](#) on page 15-2

Non-Standard Sample Introduction Systems

The customer may have ordered non-standard sample introduction systems with the instrument. [Table 15-1](#) gives an overview.

Check the packages for damage and the content for completeness against the included packing list.

Table 15-1. Non-standard sample introduction systems

Application	Part number DUO	Part number Radial Only
High Solids	BRE0019682	BRE0019957
Organics	BRE0019683	BRE0019958
Volatile Organics	BRE0019684	BRE0019959
HF	BRE0019685	BRE0019960

The installation and operation of any non-standard sample introduction system is the responsibility of the customer. You may help and give advice to your best knowledge, but this does not belong to the standard installation procedure.

Autosampler and Other Plug-In Supported Hardware

Installation and Operation

Any plug-in supported hardware will have to be installed and checked for functionality in agreement with the respective Operating Manuals.

Software Activation

Create configurations for each hardware/plug-in combination requested by the customer. [Figure 15-1](#) shows an example.

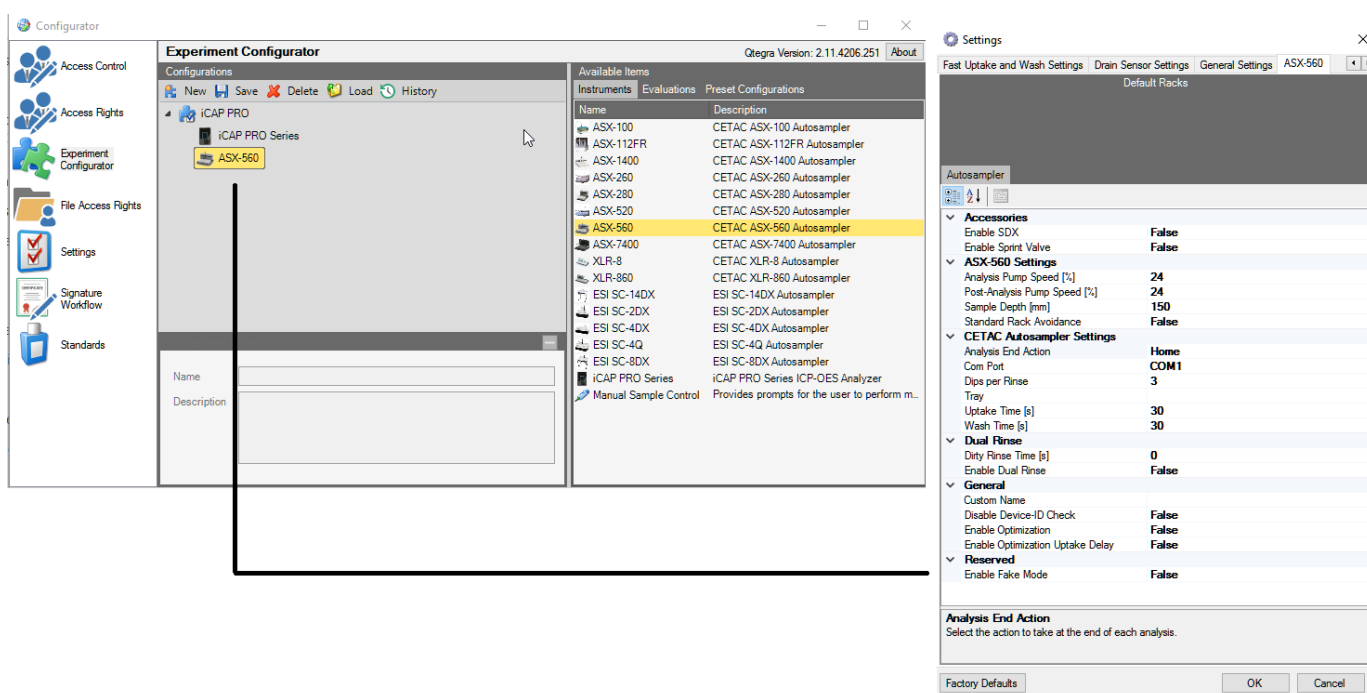


Figure 15-1. iCAP PRO with ASX-560 – example settings

Customer Familiarization

At this step of the Installation Procedure, the iCAP PRO ICP-OES system has been installed and passed the final acceptance check in the form of the Test Set IAT-High-Level Performance Check.

Any options and accessories on the same delivery with the instrument have been handed over to the customer and discussed or installed as necessary.

The so-called “Customer Familiarization” which is the initial customer trainings on the day of installation, will finalize the hand-over of the system to the customer.

It is mandatory for a validated installation (Qualification Kit) as part of the OQ (Operational Qualification).

Refer to the *iCAP PRO Series ICP-OES Customer Familiarization Guide*.

List of Abbreviations

Table 17-1. List of abbreviations

Abbreviation	Term
DI	Deionized water
FF	Full Frame
LB	Loaded Blank Solution
METS	Multi Element Test Solution
OQ	Operational Qualification
PE	Polyethylene
TEC	Thermo Electric Cooler

List of Abbreviations

