

# Thermo Scientific iCAP 7400 ICP-OES

For routine analysis requirements and mid-range sample thru-put

The Thermo Scientific™ iCAP™ 7400 ICP-OES is ideal for QA/QC and contract laboratories requiring highest sensitivity from full wavelength coverage.



The Thermo Scientific™ iCAP™ 7400 ICP-OES is a powerful simultaneous spectrometer based on the core technologies of the Thermo Scientific iCAP 7000 Plus Series ICP-OES for performance, versatility and productivity. Utilizing the latest technique designs, the instrument achieves an advanced level of performance for regulatory compliance, extensive and routine liquids applications with the minimum of user set-up and maintenance. The iCAP 7400 ICP-OES offers laboratories broad analytical capabilities with stability and sensitivity combined with a low cost of analysis.

The instrument is driven by the Thermo Scientific Qtegra™ Intelligent Scientific Data Solution™ (ISDS). Developed to combine highly efficient workflow, easy data management, scalability and compliance, Qtegra ISDS delivers simplicity, productivity, efficiency and quality in the analysis workflow.

## Performance

A 4-channel, mini peristaltic pump with a unique drain sensor, provides smooth, low noise signals and safe operation. The enhanced, high efficiency free-running 27.12 MHz solid state RF plasma generator delivers rugged reliable performance with the power and stability to cope with even the most difficult sample matrices. The high resolution echelle spectrometer has a unique optical layout, resulting in high efficiency light transmission and excellent resolution with enhanced sensitivity and detection capability. The iCAP 7400 ICP-OES is also an extremely compact instrument and therefore requires minimal laboratory bench space. A powerful Charge Injection Device (CID) detector, the CID86, enables free choice of wavelengths over the complete 166 – 847 nm range. More stable, with lower noise and greater dynamic range than previous CID designs, its non-destructive readout allows optimum signal-to-noise measurements at all concentration levels.

## Versatility

The iCAP 7400 ICP-OES uses a full mass flow controlled gas box for all gasses for improved long-term signal stability. A comprehensive range of liquid sample handling kits are available to enable simple and effective configuration of the iCAP 7400 ICP-OES for optimum analytical performance with the required sample matrices. Instrument configurations are also available with dedicated Radial plasma viewing or Duo (Axial and Radial) plasma viewing, depending on sample type and elements of interest. Flexible, intuitive Qtegra ISDS software and data reporting tools make the instrument simple to learn and use due to its minimized workflow from sample introduction to reporting and data interpretation.

## Productivity

The large sample compartment with full visibility door and ergonomically designed components ensures the simplest, most reliable installation and adjustment of the torch and sample handling kits, making maintenance simpler and increasing up-time and productivity. Ducted airflows and a thermostatically controlled polychromator (controlled to within 0.1°C) ensure an extremely stable spectrometer, enabling extended analytical runs with fewer re-calibrations. A powerful data acquisition mode, 'Speed mode', enables analysis of larger sample loads, while intelligently grouped wavelengths, compatible with the relative plasma view, enhance data acquisition speed and increase sample thru-put capability. Qtegra ISDS minimizes task times with few clicks from creation of an analytical LabBook, the start of your intelligent analysis sequence, with full QA/QC protocols and processes, to powerful results reports. Full software control of autosampler sequencing and system optimization ensures simplicity of use and the highest productivity.

## Accessories

A range of liquid autosampler accessories are available that allow for 180 to 720 samples, to run unattended. An integrated hydride generation system accessory, with its high efficiency membrane gas/liquid separator, yields sub-ppb performance for hydride forming elements such as As, Bi, Hg, Sb, Se, Sn and Te. Specific sample handling kits are available for organic and volatile solvent-based solutions. Further sampling kits allow use of hydrofluoric acid solutions or high solids solutions containing up to 25% dissolved solids. An argon humidifier minimizes blockages with glass concentric nebulizers when used to analyze samples containing high dissolved solids. The ceramic D Torch accessories can also be configured as part of the sample introduction system and provide enhanced torch longevity with aggressive sample matrices.

## Detection Limits

Detection limits (DL) are key indicators of an instrument's capabilities; useful as an aid in determining its suitability for a chosen task. They demonstrate the lowest level of analyte distinguishable from the background noise under optimal conditions and are typically determined several times to improve the statistical accuracy. As a comparison between instruments, instrument detection limits (IDL) provide useful indicators to the laboratory chemist either in the decision process for instrument acquisitions or as a measure of performance for current instruments.

An IDL is a generic value that defines the lowest concentration of an analyte that can be detected under ideal conditions; and normally measured on a single element basis, using clean sample e.g. ultrapure water.

Typical detection limits are measured on several instruments of the same type to assess the average level of performance that can be expected. The typical detection limits, presented in table 1, are the IDLs of an iCAP 7400 ICP-OES as determined by applications chemists in a standard laboratory and are an excellent indication of what is achievable with the instrument. The detection limits were determined on an iCAP 7400 ICP-OES using standard sample introduction components, consisting of a concentric nebulizer and cyclonic spraychamber.

## Detection Limit Determination

To determine the detection limit for an element, a standard of 50-times the expected value and a blank were prepared. The instrument was allowed to stabilize and then 10 measurements of each solution were taken using 15 second integration times. The detection limits were calculated using the raw intensity data from the standard and the blank as follows:

$$IDL = 3SD_{blk} \frac{STD_{conc}}{STD_x - BLK_x}$$

### Where:

IDL is the instrument detection limit

$SD_{blk}$  is the standard deviation of the intensities of the multiple blank measurements

$STD_x$  is the mean signal for the standard

$BLK_x$  is the mean signal for the blank

$STD_{conc}$  is the concentration of the standard

The multiplier of three is based on the student's t-test table and shows that a confidence interval of 99% is used to calculate the detection limit.

Table 1. The detection limits for the iCAP 7400 Series ICP-OES.

Element	Wavelength nm	iCAP 7400 ICP-OES Duo (axial view) DL µg/l (15s)	iCAP 7400 ICP-OES Radial DL µg/l (15s)
<b>Ag</b>	328.068	0.32	2.46
<b>Al</b>	167.079	0.12	1.51
<b>As</b>	189.042	1.43	4.74
<b>Ba</b>	455.503	0.03	0.17
<b>Be</b>	311.107	0.017	0.07
<b>Ca</b>	393.366	0.003	0.02
<b>Cd</b>	214.438	0.07	0.19
<b>Co</b>	228.616	0.51	1.16
<b>Cr</b>	205.560	0.21	0.85
<b>Cu</b>	324.754	0.39	2.36
<b>Fe</b>	259.940	0.25	0.80
<b>Hg</b>	184.950	0.14	1.10
<b>K</b>	766.490	0.6	5.10
<b>Li</b>	670.784	0.03	0.83
<b>Mg</b>	279.553	0.01	0.04
<b>Mn</b>	257.610	0.07	0.21
<b>Mo</b>	202.030	0.38	1.11
<b>Na</b>	589.592	0.37	1.80
<b>Ni</b>	231.604	0.36	2.29
<b>P</b>	177.495	1.55	5.66
<b>Pb</b>	220.353	1.06	4.50
<b>S</b>	180.731	1.05	2.22
<b>Sb</b>	206.833	3.25	9.36
<b>Se</b>	196.090	3.05	7.36
<b>Sn</b>	189.989	1.1	1.57
<b>Sr</b>	407.771	0.01	0.04
<b>Ti</b>	336.121	0.30	0.58
<b>Tl</b>	190.856	4.4	7.33
<b>V</b>	309.311	0.23	0.80
<b>Zn</b>	213.856	0.19	0.60

iCAP 7400 ICP-OES	
Dimensions (mm)	840 W x 750 D x 590 H
Peristaltic pump	4-channel, mini peristaltic pump Speed 0-125 rpm
Standard sample introduction kit	Concentric glass nebulizer Glass cyclonic spray chamber Semi-demountable EMT torch 1.5 mm bore quartz center tube (Radial) 2 mm bore quartz center tube (Duo)
Plasma gas	Mass flow control, 0-20 L/min
Auxiliary gas	Mass flow control, 0-2 L/min
Nebulizer gas	Mass flow control, 0-1.5 L/min
Plasma Viewing	Duo or radial
RF source	27.12 MHz solid state 750 – 1500 W output power Duo restricted to 1350 W
Spectrometer	Simultaneous echelle type 52.91 groves/mm ruled grating 383 mm effective focal length 9.5 UV fused silica cross dispersion prism
Spectral bandpass	7 pm at 200 nm
Wavelength range	166 – 847 nm
Detector	High performance solid state CID86 chip
Data acquisition mode	Normal mode Speed mode Sprint mode Fullframe imaging
Productivity features	Intelligent introduction and rinse Speed data acquisition mode

Ordering information	
<b>Required items</b>	
iCAP 7400 ICP-OES Duo	BRE0002947 or BRE0002950 (N. America)
iCAP 7400 ICP-OES Radial	BRE0002948 or BRE0002951 (N. America)
TF900 Turbine Pump Chiller (230 V/50Hz)	101163010000001 (or user supplied equivalent)
TF900 Turbine Pump Chiller (115 V/60Hz)	101163010000003 (or user supplied equivalent)
TF900 Turbine Pump Chiller (208 V/60Hz)	101163010000000 (or user supplied equivalent)
Data Station (110 or 220 V)	8423 140 50004 (or user supplied equivalent)
<b>Optional accessories</b>	
Auto Sampler: CETAC ASX-260 (up to 180 samples)	8423 470 04002
CETAC ASX-520 (up to 360 samples)	8423 470 04001
CETAC XLR8 (up to 720 samples)	8423 470 04061
CETAC ASX-1400 Stirring autosampler	8423 470 04004
Duo sample introduction kit	
Organics (Radial/Duo)	8423 120 52311/52261
Volatile organics (Radial/Duo)	8423 120 52301/52251
HF resistant (Radial/Duo)	8423 120 52291/52241
High solids (Radial/Duo)	8423 120 52281/52231
Standard aqueous (Radial/Duo)	8423 120 52271/52221
Duo Ceramic D torch kit	8423 120 52202
Radial Ceramic D torch kit	8423 120 52201
Argon humidifier	8423 120 52090
Internal standards mixing kit	8423 120 52661
Integrated hydride generation accessory	8423 180 50101

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