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# Integra2 Integrated EA-IRMS



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## INTEGRA2 INTEGRATED $^{15}\text{N}$ and $^{13}\text{C}$ ANALYSER

Sercon are dedicated to the design, manufacture and support of **Isotope Ratio Mass Spectrometers** and their associated **sample preparation systems**.

The Integra2 is a combination of our HS2022 mass spectrometer and the EArth elemental analyser. This unique product provides the isotope researcher with the most compact instrument. Capable of analysing samples for both  $^{15}\text{N}$  and  $^{13}\text{C}$  simultaneously, with an  $^{18}\text{O}$  option and a  $^{34}\text{S}$  option.

### THE KEY FEATURES OF THE INTEGRA2 INCLUDE:

- The world's only combined EA-IRMS.
- $^{13}\text{C}, ^{15}\text{N}$  analysis with  $^{18}\text{O}$  and  $^{34}\text{S}$  options.
- Lightweight, compact, semi portable.
- No need for a reference gas (combusted sample gas used to tune the source).
- Can be placed in remote research stations and on board ships.
- Data generated in the field.
- No sample storage, transportation and associated risk of fractionation effects.
- No harmful chemicals to preserve samples.
- $120^\circ$  extended geometry with an 11 cm radius magnetic sector giving an effective 21 cm radius dispersion, and true stigmatic focussing.
- Truly universal Faraday triple collectors for simultaneous collection of adjacent masses in the range 28, 29, 30 - 64, 66 with no adjustment of collectors or amplifiers.
- Asymmetric extended geometry to give true stigmatic focusing with twice the dispersion of normal geometry with the same radius sector. Design allows greater tolerance of the known variables of ion optics making the manufacture of the analyser more reproducible and less sensitive to magnet positioning. Small analyser footprint and wide flat peak shape reduce the effect of temperature drift.
- Shorter path length than traditional extended geometry to decrease ion/molecule interactions and produce near 100% transmission through the analyser.
- Electron impact ion source with thoria-coated iridium filament for long-life and easy replacement.
- Use of a permanent magnet, active pressure gauge and turbomolecular vacuum pump to keep maintenance down to a minimum.
- 80, 120 and 180 place autosamplers are available, with holes of different diameter for a variety of sample sizes.
- High quality stainless steel diaphragm regulators for gas control, digital flow and pressure sensors, normally closed valves configured to save gas and preserve consumables in the event of a power failure.

Specification	Integra2
Design	Integrated bench-top unit of a mass analyser and Dumas combustion unit with vertical mounted furnaces. Built in pressure and flow sensors, isothermal GC and software controlled variable oxygen input.
Analyser Geometry	120° extended geometry with an 11 cm radius magnetic sector giving an effective 21 cm radius dispersion and double direction focusing. Truly universal Faraday triple collectors for simultaneous collection of masses 28, 29 and 30 or 44, 45 and 46.
Analytical Mode	Samples in capsules are converted to N <sub>2</sub> and CO <sub>2</sub> by combustion and measured by the integrated isotope ratio mass spectrometer.
Ion Source	High sensitivity, electron impact, plug-in design.
Magnet	Permanent.
Resolution	m/Δm = 95 (N <sub>2</sub> ) 10% valley definition.
Sensitivity	< 1500 molecules per mass 44 ion.
Abundance Sensitivity	< 300 ppm for CO <sub>2</sub> at 4 x 10 <sup>-6</sup> mbar in continuous flow mode. (Software function allows calibration to zero to ensure accuracy).
Linearity	Changing from 40 to 400 μg C will effect a change of ≤0.5‰.
Vacuum	Turbomolecular pump (70 L/s) backed by a two-stage rotary pump. Ultimate vacuum of 1 x 10 <sup>-8</sup> mbar. Source pressure monitored by active gauge.
Inlet	Built-in capillary inlet with fail-safe pneumatic valve.
Combustion Furnace	Operating range, ambient to 1000°C.
Reduction Furnace	Operating range, ambient to 1000°C.
Column Oven	Operating range, ambient to 250°C (isothermal).
Combustion Packing (Standard)	Chromium Trioxide, Copper Oxide and Silver Wool
Water Removal	Refillable magnesium perchlorate trap.
CO <sub>2</sub> Removal	Refillable EMAsorb trap. Software selectable.
Gas Control	High quality stainless steel diaphragm regulators. Software controlled oxygen pulse for efficient and economical combustions. A software controlled flow diverter valve selects the GC effluent to go to the mass spectrometer or to waste. Normally closed solenoid valves to prevent gas wastage during laboratory power cuts.
Referencing	References of known isotopic and elemental composition are placed in the autosampler carousel with the unknown samples.
Sample Range	Solids/Liquids: - 5 to 1000 μg N, 5 to 2000 μg C.
Analytical Cycle	4 min per sample ( <sup>15</sup> N only). 6 min per sample ( <sup>15</sup> N and <sup>13</sup> C).
Autosampler	Software controlled pneumatic autosampler. Optional carousels include 180 samples (5mm diameter), 120 samples (8mm diameter) or 80 samples (12 mm diameter).
Data Acquisition	Data acquisition system uses state of the art highly stable and linear high frequency converters which produce integral slices with zero dead time and quantisation below the beam statistical noise floor at all signal levels.
Software	Proprietary operational software for system control and data handling. System uses Sercon Callisto which is fully compatible with all versions of Windows.
Electronics	Flashover resistant source electronics. Full control and monitoring of all instrument parameters through software and on-board micro-processors.

- Data acquisition system uses state of the art highly stable and linear high frequency converters which produce integral slices with zero dead time and quantisation below the beam statistical noise floor at all signal levels.
- Two long-life furnaces capable of operating to 1000°C.
- On-board microprocessor for storage of furnace temperatures and valve status (guards against PC failure or temporary detachment).
- Total software control of the instrument system and data processing. Allows storage of sample analysis protocols to comply with good laboratory practice. Inter-file import/export facility from instrument PC to laboratory server or internet. Fully compatible with all versions of Windows.
- Standby mode to preserve the life of consumable during periods of low usage.
- Proprietary GC column to achieve baseline separation of N<sub>2</sub> and CO<sub>2</sub> which is essential for this mode of analysis.
- Software controlled oxygen injection to match sample requirements thereby preserving the life of consumables.
- Refillable water and CO<sub>2</sub> chemical traps. CO<sub>2</sub> trap is switched in/out of line by software to avoid leaks on changing analytical mode.

## DESCRIPTION OF OPERATION

During operation, a capsule containing the sample falls into the combustion tube and is converted in the presence of oxygen to CO<sub>2</sub>, N<sub>2</sub>, NO<sub>2</sub>, and H<sub>2</sub>. An elemental copper stage reduces NO<sub>x</sub>, a MgClO<sub>4</sub> trap removes water vapour, a switchable EMAsorb trap can be used to remove CO<sub>2</sub> (for <sup>15</sup>N only analysis) and a GC column separates CO<sub>2</sub> from N<sub>2</sub> (allowing dual isotope analysis). Organic <sup>18</sup>O analysis is possible by analysing CO.

Specification	Integra CN
Power	100 - 240 VAC
Helium	99.999%
Oxygen	99.998%
Compressed Air	50 psi



### EXTERNAL PRECISION

All specifications are for n=10 samples.

Gas	Combustion/Pyrolysis (% vs. Ref)
N <sub>2</sub> ( <sup>15</sup> N)	0.15 (100 µg*, n=5)
CO <sub>2</sub> ( <sup>13</sup> C)	0.1 (100 µg*, n=5)
CO ( <sup>18</sup> O)	0.4 (100 µg*, n=5)

Integra2 Typical Data (from Test Records)		
Dual	400 µgC	0.1
	100 µgN	0.1

\*denotes amount of element per capsule

**ISO 9001:2015 Certified**

**ISO 13485:2016 Certified**

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