## CS230 Carbon/Sulfur Determinator Specification Sheet

### Instrument Range at 1 gram*
- **Carbon:** 4 ppm to 3.5%
- **Sulfur:** 4 ppm to 0.4%

### Precision**
- **Carbon:** 2 ppm or 0.5% RSD, whichever is greater
- **Sulfur:** 2 ppm or 1.5% RSD, whichever is greater

### Readability†
- Carbon and Sulfur: 0.1 ppm (DSP)
  15 digits (PC)

### Calibration
- **DSP:** Linear, single point
- **PC:** Linear, multi-point

### Analysis Time
- Nominal 45 seconds

### Sample Size
- 1 gram nominal

### Detection Method
- Solid-state infrared absorption

### Chemical Reagents
- Anhydrous Magnesium Perchlorate
- Sodium Hydroxide on an inert base
- Platinized Silica
- Cellulose

### Gas Requirements
- **Carrier Gas:** Oxygen 99.5% pure, 40 psi (2.8 bar)
- **Pneumatic:** Air, Nitrogen, or Argon, 40 psi (2.8 bar); source must be oil and water free

### Gas Consumption
- Measure - 3 liters/minute
- Pneumatic - 1 liter/minute

### Furnace
- Induction, 18 MHz, 2.2 kW

### Data Storage
- **DSP:** 50 analyses, 10 weights, 5 methods
- **PC:** Limited only by hard drive space

### Data Transmit‡‡
- RS-232 (included)

### Keyboard
- **DSP:** Internal membrane (External optional)
- **PC:** External keyboard

### Display
- **DSP:** LCD, 16 x 26 characters
- **PC:** Flat-panel monitor

### Printer
- **DSP:** Dot matrix
- **PC:** Deskjet

### Physical Dimensions‡‡
- **Determinator with Crucible Box:**
  - 31.75 in. H x 36.0 in. W x 23.5 in. D
  - (80.65 cm x 91.44 cm x 59.7 cm)

### Weights (approximate)
- **Determinator:** 320 lb. (145 kg)
- **Total Shipping:** 410 lb. (186 kg)

### Environmental Conditions
- **Operating Temp:** 50 to 86°F (10 to 30°C)
- **Rel. Humidity:** 20 to 80%, non-condensing

### Electrical Power
- **Requirements:** 230 V~ (±10%; at max load), 50/60 Hz, single phase, 15 A, 11,800 BTU/hr

### Part Numbers
- CS230 Carbon/Sulfur Determinator, DSP model
- CS230H Carbon/Sulfur Determinator, DSP model w/Autocleaner
- CS230C Carbon/Sulfur Determinator, PC model
- CS230HC Carbon/Sulfur Determinator, PC model w/Autocleaner

### Options
- **TBD** Dot Matrix Printer Kit (120V)
- **TBD** Dot Matrix Printer Kit (220V)
- **TBD** Deskjet Printer Kit
- **605-980** External Keyboard
- **751-000-120** LECO 050 Balance Kit (1.0 mg sensitivity)
- **751-300-150** LECO 250 Balance Kit (0.1 mg sensitivity)
- **CF10** CF-10 Gas Purification Unit
- **608-816** Balance Interface Kit
- **621-897** Autocleaner/Dust Removal Kit (requires 621-891)
- **621-891** Vacuum Cleaner Kit
- **766-036** Compressed Air Regulator
- **501-291** Oxygen Regulator
- **764-216** Inert Gas Regulator
- **621-895** PC Software Upgrade (Windows®-based software only)
- **621-896** PC Upgrade Kit (computer, monitor, keyboard, mouse, software)
- **625-513** Shuttle Loader Kit (without Autocleaner)
- **625-514** Shuttle Loader/Autocleaner Kit
- **615-763** SmartLine® Modem-Based Remote Diagnostics
- **710-198-B/O** SmartLine Internet-Based Remote Diagnostics

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*The range may be extended by reducing sample weight.
**1 Sigma conformance tested by gas dose analysis.
Display Capability.
†Allow 6-inch (15 cm) minimum access area around all units.
‡‡Please consult your LECO sales engineer or quotation for current part numbers.
‡‡® PC Models only.
V~ denotes VAC.
Theory of Operation

The CS230 Carbon/Sulfur Determinator is designed to measure carbon and sulfur content in metals, ores, ceramics, and other inorganic materials. The instrument is available with either a DSP or Windows®-based operating system.

A pre-weighed sample of ~1 gram is combusted in a stream of purified oxygen. The carbon in the sample is oxidized primarily to carbon dioxide (CO$_2$) with some carbon monoxide (CO) possibly being produced. The sulfur is oxidized to sulfur dioxide (SO$_2$). These gases are then routed through a heated catalyst which converts CO$_2$ and SO$_2$ to sulfur trioxide (SO$_3$). The SO$_3$ is removed by a filter and the gases are swept, along with oxygen, through a dust filter and drying to CO$_2$ with some carbon monoxide (CO) possibly being produced. The sulfur is oxidized to sulfur dioxide (SO$_2$). These gases are then routed through a heated catalys which converts CO$_2$ and SO$_2$ to sulfur trioxide (SO$_3$). The SO$_3$ is removed by a filter and CO$_2$ is measured in a separate IR cell.

CO$_2$ and SO$_2$ absorb IR energy at precise wavelengths within the IR spectrum. Energy at these wavelengths is absorbed as the gases pass through respective IR absorption cells. Changes in energy are then observed at the detectors. The absorption of IR energy is attributed to only CO$_2$ or SO$_2$ (depending on the cell), and its concentration is then determined. Each IR cell serves as both a reference and measure chamber.

The optional autocleaner and autoloader systems reduce maintenance and operator time, and are ideal for high-volume applications.

Flow Diagram

Specifications and part numbers may change. Consult LECO for latest information.

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