

Closed Ion Source Gas Analyzers

CIS120 systems — 120 amu, 220 amu, and 320 amu



CIS Series Closed Ion Source Gas Analyzers

- 120, 220 and 320 amu systems
- 1 ppm detection
- 10 mTorr max. operating pressure
- Built-in I/O ports, relay & GPIO
- Easy peak tuning
- Hybrid electrometer for improved baseline sensitivity
- USB, RS-232 and Ethernet interfaces std.
- RGA and CIS mode

- CIS120 ... \$9750 (U.S. list)
- CIS220 ... \$10,750 (U.S. list)
- CIS320 ... \$12,750 (U.S. list)

The new 120, 220 and 320 amu closed ion source gas analyzers from SRS offer increased mass range, better performance and new capabilities like built-in analog I/O. Building on the previous CIS100 series, SRS continues to offer unmatched value with the CIS120 series. On-line process monitoring and control, verification of process gas purity at the point of use, high-vacuum residual gas analysis, and process equipment leak checking are some of the areas where these systems will prove indispensable.

Compact Design

The probe consists of a quadrupole mass spectrometer with a CIS ionizer mounted inside a 2.75" Conflat® Tee. The control unit mounts directly on the probe's feedthrough flange and contains all the necessary electronics for operating the instrument. The side port of the CIS nipple provides a connection for the differential pumping system that keeps the quadrupole, filament and detector at high vacuum. The system can be connected directly to a process chamber through its standard CIS mounting flange (2.75" CF). All parts in the unit are self-aligning making servicing easy. You can clean and reassemble the probe, and replace the filament and electron multiplier in the field, without ever calling the factory.

Gold Plated Ionizer

The entire ionizer is made of gold-plated stainless steel. This reduces outgassing and background signals in the ionization region, improves long-term stability, and permits operation

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while exposed to reactive and corrosive gases. A tungsten filament is used, which resists corrosive and reactive gases

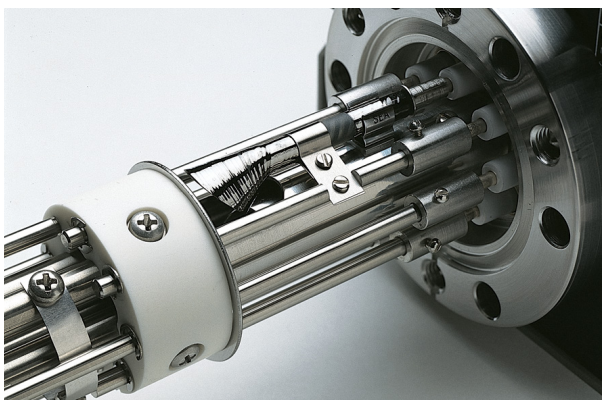


CIS gold plated ionizer

like WF_6 and silane, and leads to extended lifetime. The closed (gas tight) design of the ionizer prevents commonly interfering species from backstreaming into the ionization volume. This produces peaks free of spectral overlap.

A Choice of Detectors

The CIS series analyzers come standard with both a Faraday cup detector (10 ppm detection) and a continuous dynode electron multiplier (1 ppm detection). The software allows you to easily switch between detectors.



Continuous dynode electron multiplier

Versatility

The CIS systems can also be used in a so-called “RGA mode”. In this mode, the unit has a lower minimum detectable partial pressure, but a lower maximum operating pressure as well. The RGA mode is used, for example, in the first stage of a sputtering process when the chamber is evacuated to a low pressure, and the quality of the vacuum is checked for leaks and harmful contaminants. The unit can then be switched to a CIS mode for sampling directly at higher pressure.

Automatic Peak Tuning

Efficient RF generation with dynamic RF resonance frequency tracking is used to provide increased mass range. It also enables automatic peak tuning using independent RF/DC control, while increasing scan speeds up to 130 AMU/s (260 AMU/s with 10 points per AMU).

New Hybrid Electrometer

A wider dynamic range hybrid electrometer works as a linear amplifier with low current ($< 1 \text{ nA}$) and as a log amplifier with higher current (up to 2 uA). At low or negative current values, the linear mode leads to improved baseline sensitivity.

This temperature-compensated, hybrid log electrometer detects ion current from 10^{-7} to 10^{-15} amps in a single scan, with better than 2% precision. This huge dynamic range means you can make measurements of small and large gas concentrations simultaneously.

Built-in I/O

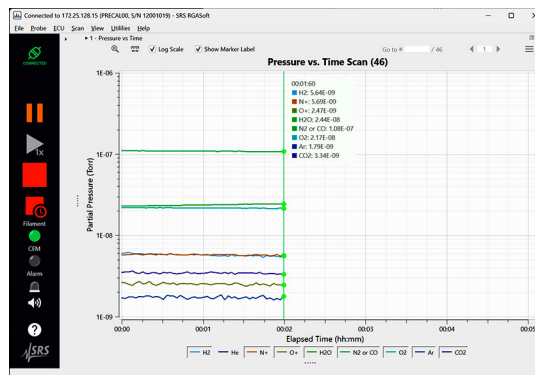
A rich set of input/output connections provide monitoring and control of the CIS, and also enable external process control. An external scan trigger, a configurable event based relay, GPIO, and an RTD input for temperature monitoring during scanning are included. An analog output provides a signal proportional to any scanned variable, including partial pressure.

Complete Programmability

Communication with computers is made via USB, Ethernet, or RS-232 interfaces. Analog and histogram (bar) scans, leak detection, and probe parameters are all controlled and monitored through an extensive SCPI command set. This allows easy integration into existing programs.

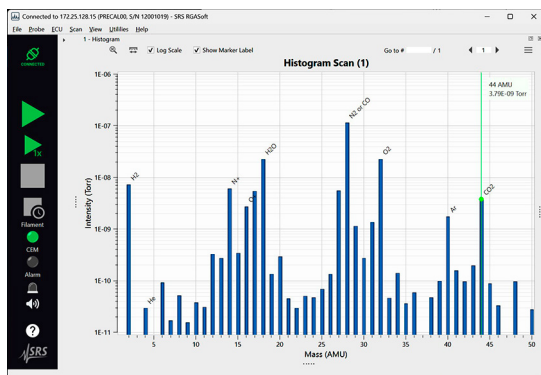
Windows Software

A brand new RGASoft Windows application is included. With a rich feature set and modern UI design, scan data is captured



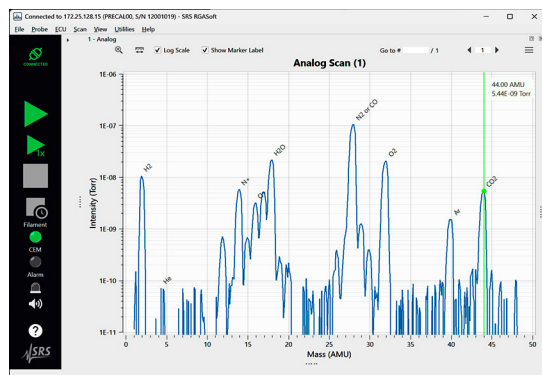
RGASoft — P vs. T mode

and displayed in real-time or scheduled for acquisition at a given time interval for long-term data logging. Multiple



RGASoft—Histogram mode

spectral data and individual measurements can be collected together in one sequence. Versatile docking windows and widgets give the user various ways to organize the display. Data can be scaled manually or automatically, in linear or log format on plots. Units are selectable among Torr, Bar, Pascal and Amp. Features include common gas labels, programmable audio and visual alarms, expandable library, composition analysis, and comprehensive on-line help.



RGASoft—Analog mode

The software also allows complete CIS control with easy mass scale tuning, sensitivity calibration, ionizer setup, and electron multiplier gain adjustment. For further analysis, data files can be saved in CSV text format for easy transfer into spreadsheets. Graphic images can be saved in common formats (PNG, BMP, TIFF, JPG, SVG, PDF) or copied to the clipboard for importing directly into other programs.

The software supports multiple head operation when more than one CIS is needed. Multiple CISs can be controlled

and run concurrently with multiple software instances. The number of CISs is only limited by the system resources.

Pumping Requirements

The CIS instruments require connection to a pumping system with an effective pumping speed of at least 40 L/s and a base pressure of less than 10^{-7} Torr. The connection port is a 2.75" CF flange. Option O100TDP provides a turbo pump which mounts directly to the CIS head along with a diaphragm roughing pump. When this option is ordered, the entire analyzer is assembled, tested, and calibrated at the factory. Users can provide their own pumping station; however, it is the user's responsibility to ensure that the pumping system does not damage or limit the performance of the instrument.

Affordable Performance

The SRS CIS systems offer state-of-the-art performance for a fraction of the cost of competing models. Standard systems include faraday cup detector, electron multiplier detector and Windows software. Options include built-in power module for AC line operation, and a pumping package that includes a turbomolecular pump and diaphragm pump.



CIS120 rear panel (with AC power module)

Operational

Mass range	
CIS120	1 to 120 amu
CIS220	1 to 220 amu
CIS320	1 to 320 amu
Mass filter type	Quadrupole
Detector type	Faraday cup and electron multiplier
Resolution	Better than 0.5 amu @ 10 % peak
(per AVS std. 2.3)	height. Adjustable to constant
	peak width throughout mass range.
Operating temperature	70 °C (max.)
Bakeout temperature	Up to 300 °C (without ECU)

Ionizer

Design	Closed ion source, cylindrical symmetry, electron impact ionization.
Material	Gold plated SS304
Filament	Tungsten or ThO ₂ /Ir with firmware protection (field replaceable)
Electron energy	25 to 105 eV, programmable
Ion energy	4 to 16 eV, programmable
Focus voltage	0 to 150 V, programmable
Electron emission current	0 to 1 mA, programmable

Input/Output

Analog Output	Emission Current, RTD Temperature, Flange Temperature, Total Pressure, Mass Ion Current, Analog Scan Ion Current, or User Value
Range	Voltage 0 to 20 V
	Current 4 to 20 mA
Analog Input	User Value or Overpressure Indicator
Range	Voltage 0 to 10 V, Current 4 to 20 mA, 4 to 20 mA with Loop Power

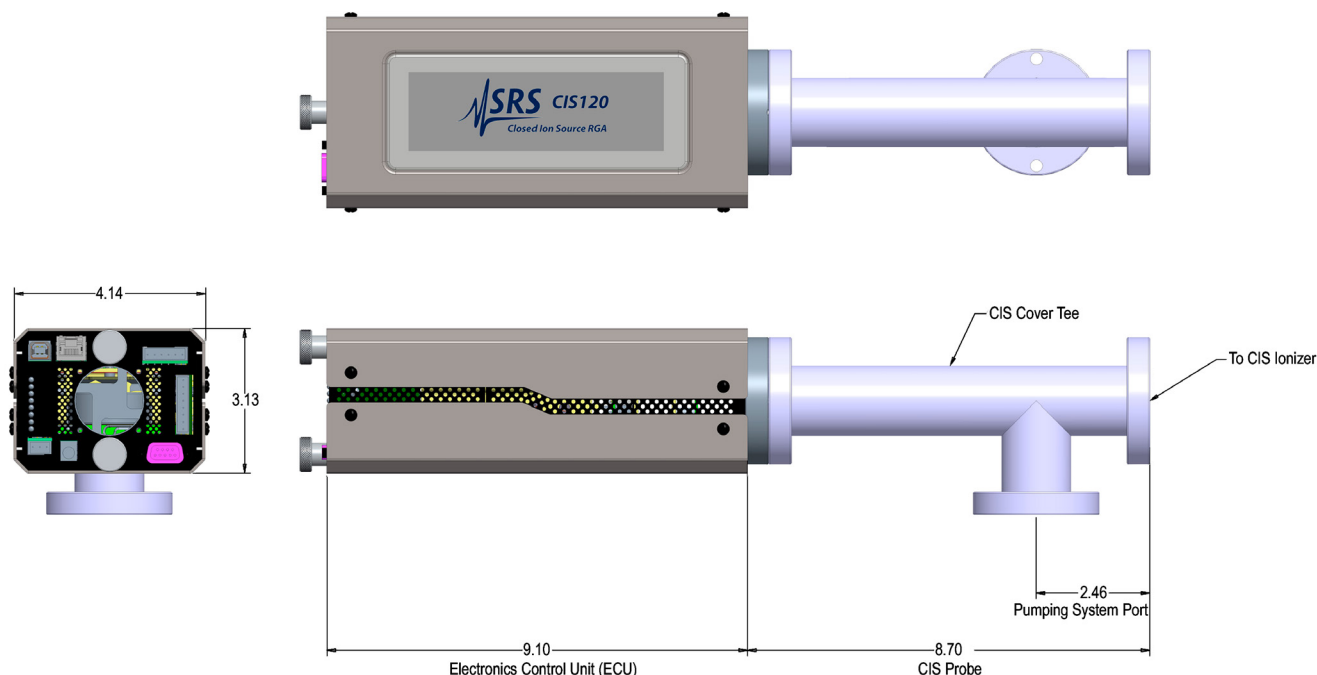
Event Relay	DPDT relay, For analog input current or voltage limits, mass ion current limit, or communications idle timer.
GPIO	Digital I/O. For analog input current or voltage limits, mass ion current limit, or communications idle timer.
RTD Input	Nominal Pt RTD 100 Ω
Trigger Input	0 to 3.3 V

General

Probe mounting flange	2.75" CF
ECU dimensions	4.1" × 3.1" × 9.1" (WHD). Easily separated from the probe for bakeout.
Probe dimensions	See drawing
LED indicators	Power ON/OFF, filament ON/OFF, Electron multiplier ON/OFF, RS-232 Busy, Error, Overpressure, Burnt Filament
Warm-up time	Peak height ±2 % after 3 minutes. Mass stability ±0.1 amu after 30 minutes
Computer interface	USB, Ethernet, RS-232
Software	Windows based application
Power	24 VDC @ 2.5 amps. Male DB9 connector, optional built-in power module for AC line operation
Weight	6 lbs.
Warranty	One year parts and labor on defects in materials and workmanship

Ordering Information

CIS120	120 amu CIS w/ electron multiplier	\$9750
CIS220	220 amu CIS w/ electron multiplier	\$10,750
CIS320	320 amu CIS w/ electron multiplier	\$12,750
Option 02	AC power module	\$395
O100RFT	ThO ₂ /Ir filament (qty. 2)	\$300
O100TDP	Turbo pump/diaphragm pump	\$11,950



CIS dimensional drawing

CIS Parameter	Range	CIS mode	RGA mode
Electron emission current (mA)	0 to 1	0.05	0.5
Electron energy (eV)	25 to 105	70 or 35	70
Ion energy (eV)	4 to 16	4 to 16	4 to 16
Extraction voltage (V)	0 to -150	-50 (typ.)	-50 (typ.)
Sensitivity (A/Torr) (for N ₂ @ 28 amu)		10 ⁻⁶	10 ⁻⁵
Linear range upper limit (Torr)		2 × 10 ⁻³	10 ⁻⁴
MDPP (Torr)		10 ⁻⁸	10 ⁻⁹

Notes

1. The CIS tests were performed with a 70 L/s hybrid turbomolecular pump, backed by a diaphragm pump, attached to the side port of the CIS Cover Tee.
2. The RGA mode sensitivities reported were calculated for N₂ at less than 10⁻⁵ Torr.
3. The CIS mode sensitivities were calculated for N₂ at 1 × 10⁻⁴ Torr.
4. MDPP (minimum detectable partial pressure) is determined by measuring baseline levels for Faraday cup detection in the presence of ²⁸N₂ at 10⁻⁵ (RGA mode) and 10⁻³ Torr (CIS mode). Up to 3 orders of magnitude improvement in detectability is possible when the electron multiplier is turned on.