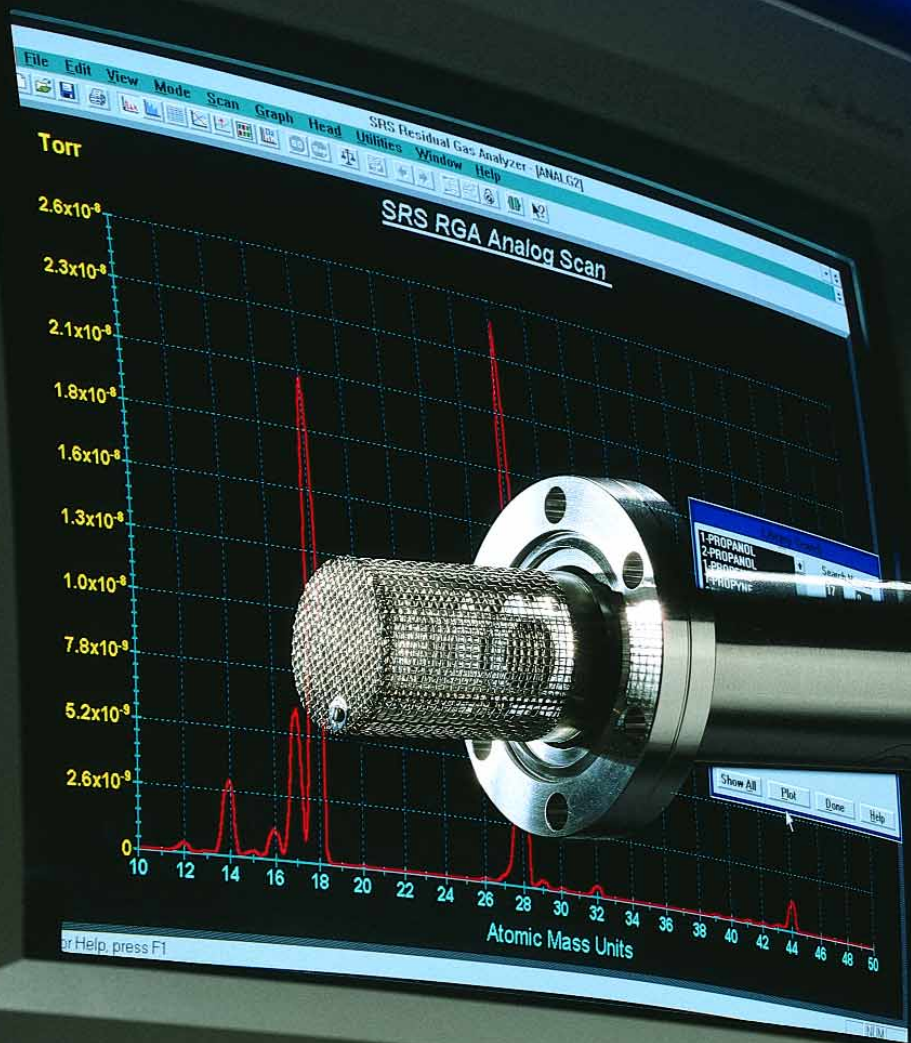




STANFORD RESEARCH SYSTEMS

# Residual Gas Analyzers

RGA100, RGA200 & RGA300



# Residual Gas Analyzers

RGA100

RGA200

RGA300

- 100, 200 and 300 amu systems
- Better than 1 amu resolution
- 6 orders of magnitude dynamic range in a single scan
- Detectable partial pressures to  $10^{-14}$  Torr
- Real-time RGA Windows® software
- Multi-head operation
- Field replaceable electron multiplier and filament



The new 100 and 200 amu residual gas analyzers from SRS offer exceptional performance and value. These RGA's provide detailed gas analysis of vacuum systems at about half the price of competitive models. Each RGA system comes complete with a quadrupole probe, electronics control unit (ECU) and a real-time Windows® software package that is used for data acquisition and analysis as well as probe control.

## *A rugged probe design*

The probe consists of an ionizer, quadrupole mass filter and a detector. The simple design has a small number of parts which minimizes outgassing and reduces the chances of introducing impurities into your vacuum system. The probe assembly is rugged and mounts onto a standard 2 3/4 inch CF flange. It is covered with a stainless steel tube with the exception of the ionizer which requires just 2 1/2 inches of clearance in your vacuum system – about that of a standard ion gauge. The probe is designed using self-aligning parts so it can easily be reassembled after cleaning.

## *Compact electronics control unit*

The densely packed ECU contains all the necessary electronics for controlling the RGA head. It is powered by either an external +24 VDC (2.5 A) power supply or an optional, built-in power module which plugs into an AC outlet. LED indicators provide instant feedback on the status of the electron multi-

plier, filament, electronics system and the probe. The ECU can easily be removed from the probe for high temperature bakeouts.



### Unique filament design

A long-life dual Thoriated-Iridium ( $\text{ThO}_2\text{Ir}$ ) filament is used for electron emission. Dual thoriated filaments last much longer than single filaments, maximizing the time between filament replacement. Unlike other designs, SRS filaments can be replaced by the user in a matter of minutes.



### Continuous dynode electron multiplier

A Faraday cup detector is standard with the 100, 200 and 300 amu systems allowing partial pressure measurements from  $10^{-5}$  to  $10^{-10}$  Torr. For increased sensitivity and faster scan rates an optional electron multiplier is offered that detects partial pressures down to  $10^{-13}$  Torr. This state-of-the-art macro multi-channel continuous dynode electron multiplier (CDEM) offers increased longevity and stability and can also be installed by the user – a first for RGAs!

### Useful features

SRS RGAs have a built-in degassing feature. Using electron impact desorption, the ion source is thoroughly cleaned, greatly reducing the ionizer's contribution to background noise.

A firmware driven filament protection feature constantly monitors (675 Hz) for over pressure. If over pressure is detected the filament is immediately shut off, preserving its life.

A unique temperature compensated logarithmic 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.

### Complete programmability

Communication with computers is made via the RS-232 interface. Analog and histogram (bar) scans, leak detection, total pressure, and probe parameters are all controlled and monitored through a high level command set. This allows easy integration into preexisting processing programs.

### RGA Windows software

The RGA systems are supported with a real-time Windows® software package that runs on IBM compatible PCs (486 or greater). The intuitive graphical user interface allows measurements to be made quickly and easily. The program is fully interactive giving the user complete control of the graphical display. Screens can be split for dual mode operation, scales can be set to linear or log format, and data can be scaled manually or automatically. Data is captured and displayed in real-time or scheduled for acquisition at a given time interval for long term data logging. Features include user selectable units (Torr, mBar, Pascals and Amps), programmable audio and visual alarms, and comprehensive, on-line help.

The software also allows complete RGA head control with easy mass scale tuning, sensitivity calibration, ionizer setup and electron multiplier gain adjustment. For further analysis, data files can be saved in ASCII format for easy transfer into spreadsheets. Graphic images can be saved as META files or copied to the clipboard for importing directly into other Windows® programs. The software also provides password protection for locking out head parameters so that casual users can't alter important settings.

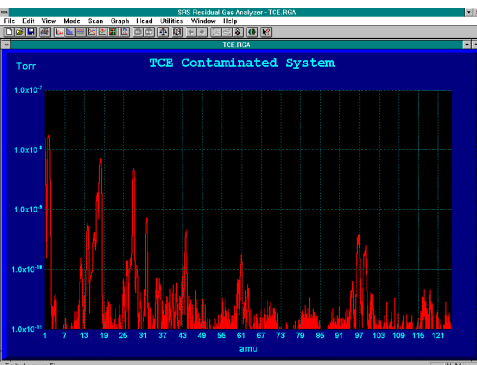
### Multiple-head operation

The software supports multiple head operation when more than one RGA is needed. Up to eight ECUs can be monitored from the software.

### Performance and value

The SRS family of RGAs is ideal for applications involving gas analysis, leak detection and vacuum processing. We offer 100, 200 and 300 amu systems with supporting Windows® software, and options that include electron multiplier and built-in power module (AC line operation). The RGA Windows software is available on the Web at [www.thinkSRS.com](http://www.thinkSRS.com). For more details or to place an order call SRS at (408)744-9040.





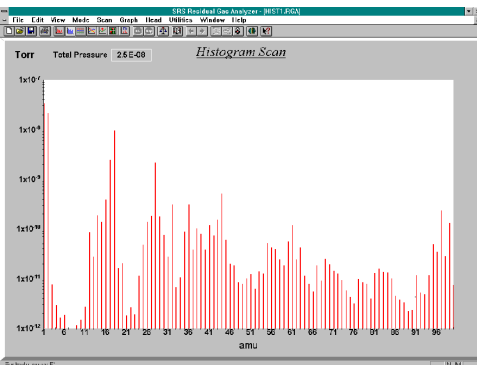
**Analog mode** provides a line graph representation of the acquired mass spectrum (partial pressure vs. mass number). Span, resolution and noise floor can each be set. Scans can be single-shot, timed or taken continuously. Total pressure is available in analog and most other modes of operation.



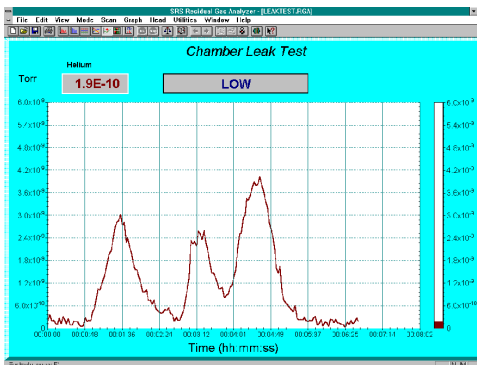
**Pressure vs. time** presents a strip chart of partial pressures for selected masses and provides a complete time history of your data. Complete scrolling and zoom control is available even while data is being acquired. This mode is most often used for monitoring process trends.



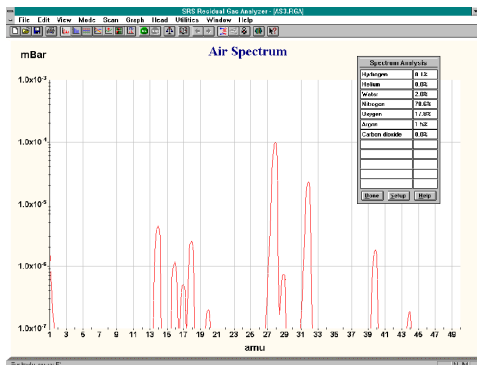
**Library mode** contains a comprehensive list of gases that can be used to compare against the current spectrum. A search mode allows you to select up to 12 masses and identify and display (numerically and graphically) the intensity of all gases that contain these masses.



**Histogram mode** displays a bar graph of partial pressure vs. mass allowing the spectrum to easily be interpreted. This mode is often used for quick and easy vacuum analysis. The screen can be split for viewing two modes of operation simultaneously.



**Leak detection mode** monitors a particular mass number (not just Helium) over time, and combines many features of the previous modes. A vertical bar graph provides a visual reference for viewing changes in intensity from a distance. A programmable audible tone that changes pitch proportionally with partial pressure is useful in detecting the location of a leak. A large numeric read-out and visual alarm are also provided.



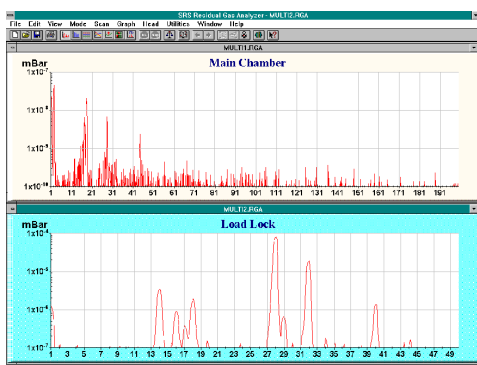
**Analysis utility** provides an approximation of the composition of gases being monitored by the RGA. Since more than one gas can contribute to a particular amu's partial pressure, the analysis mode is extremely useful in determining the make-up of complex gases. Up to 12 common gases can be selected for the analysis.

Chr	Name	Mass	Value	Alarm	Speed	Cal	CEM
1	Hydrogen	2	2.3E-07	NORMAL	1	1.00	OFF
2	Water	18	4.3E-08	ALARM	1	1.00	OFF
3	Nitrogen	28	4.4E-05	ALARM	1	1.00	OFF
4	Oxygen	32	3.5E-08	ALARM	3	1.00	ON
5	CO2	44	2.8E-09	NORMAL	3	1.00	ON
6	Oil	55	1.5E-10	NORMAL	3	1.00	ON
10	Floor	21	1.6E-11	NORMAL	1	1.00	ON

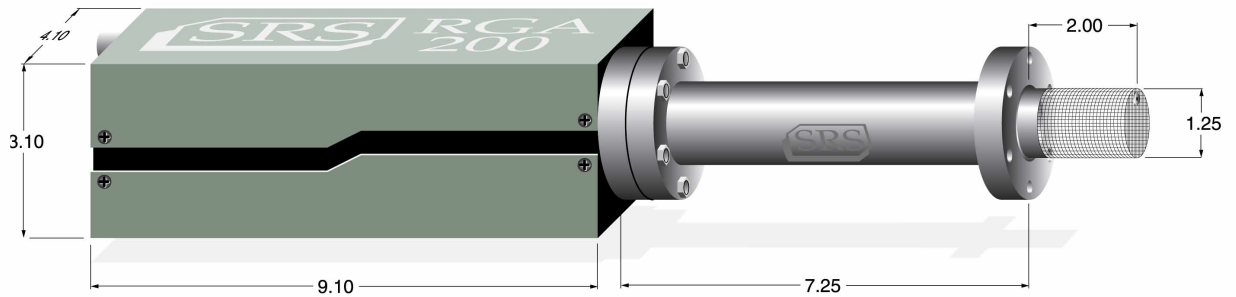
**Table mode** provides a readout of mass, scaling factor and true partial pressure for numerical analysis. The display shows the peak heights and alarm status of up to 10 masses and their corresponding parameters. The electron multiplier can be independently set on or off for each mass being displayed. This allows the user to view minor species even in the presence of high total pressure.

Chr1 Mass#1	Chr2 Mass#2	Chr3 Mass#3	Chr4 Mass#4	Chr5 Mass#5
Hydrogen 1.1E-07 NORMAL	Water 5.6E-08 HIGH	Nitrogen 1.4E-08 NORMAL	Oxygen 2.9E-09 NORMAL	Oil 1.4E-08 EXTREME HIGH
Floor 3.0E-09 NORMAL	Disabled	Disabled	Disabled	Disabled
	OFF	OFF	OFF	OFF

**Annunciator mode** is provided for conveniently monitoring up to 10 masses. The screen is large enough to be seen from across the room. If a particular mass has tripped its preset alarm, the large box will turn red indicating a problem. An audible alarm will also be present until the mass falls back within its preset limits. This mode is most often used for Go/No-Go testing.



**Multi-head operation** is available when more than one RGA is needed for analysis. Up to eight heads can be monitored simultaneously from the software.



## Specifications

### Operational

<b>Mass range</b>	
RGA100	1 to 100 amu
RGA200	1 to 200 amu
RGA300	1 to 300 amu
<b>Mass filter type</b>	Quadrupole
<b>Detector type</b>	Faraday cup (FC) – standard Electron multiplier (CEM) – optional
<b>Resolution</b> (per AVS std. 2.3)	Greater than 0.5 amu @ 10% peak width throughout the mass range.
<b>Sensitivity (A/Torr)</b>	$2 \times 10^{-4}$ (FC), $< 200$ (CEM). User adjustable throughout high voltage range. Measured with $N_2$ @ 28 amu with 1 amu full peak width, 10% height, 70 eV electron energy, 12 eV ion energy and 1 mA electron emission current.
<b>Minimum detectable partial pressure</b>	$5 \times 10^{-11}$ Torr (FC). $5 \times 10^{-14}$ Torr (CEM). Measured with $N_2$ @ 28 amu with 1 amu full peak width, 10% height, 70 eV electron energy, 12 eV ion energy and 1 mA electron emission current.
<b>Operating pressure range</b>	$10^{-4}$ Torr to UHV (FC) $10^{-6}$ Torr to UHV (CEM)
<b>Bakeout temperature</b>	300 °C (without ECU)
<b>Total press. meas.</b>	Always available

### Ionizer

<b>Design</b>	Open ion source. cylindrical symmetry, electron impact ionization.
<b>Material</b>	SS304 construction
<b>Filament</b>	Thoriated Iridium (dual) with firmware protection. Built-in 1 to 10 W degas ramp-up. Field replaceable.
<b>Electron energy</b>	25 to 105 V, programmable.
<b>Ion energy</b>	8 or 12 V, programmable.
<b>Focus voltage</b>	0 to 150 V, programmable.
<b>Electron emission current</b>	0 to 3.5 mA, programmable.

### General

<b>Probe dimension</b>	8.75" from flange face to top of ionizer
<b>Probe insertion</b>	2.0"
<b>Probe mounting flange</b>	2.75" CF
<b>Minimum tube I.D.</b>	1.375"
<b>ECU dimensions</b>	9.1" x 4.1" x 3.1". Easily separated from the probe for bakeout.
<b>LED indicators</b>	Power ON/OFF, filament ON/OFF, degas ON/OFF, Elec. mult. ON/OFF, RS-232 Busy, Error, Overpressure, Burnt Filament.
<b>Warm-up time</b>	Mass stability $\pm 0.1$ amu after 30 minutes.
<b>Computer interface</b>	RS-232C, 28,800 Baud with high level command set.
<b>Software</b>	Windows® based application. Requires 486 or better.
<b>Power Requirement</b>	24 VDC @ 2.5 Amps. Male DB9 connector. Optional 120 VAC adapter.
<b>Weight</b>	6 lbs.
<b>Warranty</b>	One year parts and labor on materials and workmanship.



## About dynamic range

Dynamic range is defined as the ratio between the smallest signal that can accurately be measured and a full scale signal. Residual gas analyzers typically offer 3 to 4 orders of magnitude dynamic range. SRS RGAs use a logarithmic amplifier in the detector to achieve more than 6 orders of magnitude dynamic range. Figure 1 at the right shows a mass spectrum of 99.999% nitrogen, which was measured using the Faraday cup (FC) detector. The partial pressure scale covers seven decades ( $10^{-4}$  to  $10^{-11}$  Torr) and data is acquired in a single scan without range changes. The effect of outgassing of the vacuum chamber has been removed using the background subtraction feature of our software. The RGA has sufficient resolution to detect  $^{15}\text{N}_2$ , which is naturally present at 15 ppm, even though it is only 2 amu away from a peak that is five decades larger.

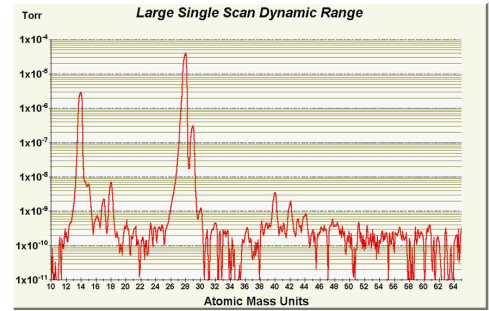


Figure 1

Figure 1 shows a high pressure of  $4 \times 10^{-5}$  Torr ( $^{14}\text{N}_2$ ), which is close to the saturation limit of the detector ( $1 \times 10^{-4}$  Torr), and a noise floor of about  $1 \times 10^{-10}$  Torr. From these values we can determine that the detection limit of the RGA is a few ppm. Switching to the electron multiplier detector (CDEM) we can improve the signal detection limit of the RGA. Using the software's table mode (see figure 2), the RGA can be set for FC or CDEM detection for up to 10 masses. The Faraday cup is used for major species and the electron multiplier for minor species. Note the dynamic range has been significantly improved (8 orders of magnitude) with the noise floor now at about  $10^{-13}$  Torr.

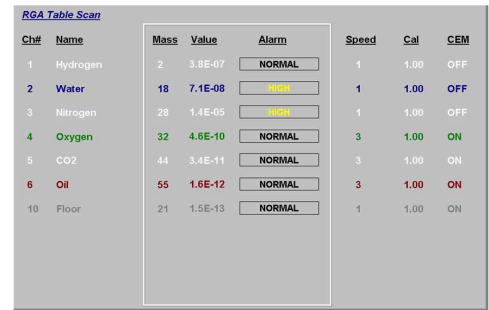


Figure 2

## Ordering Information

### Base Units

RGA100  
100 amu system with software  
RGA200  
200 amu system with software  
RGA200  
200 amu system with software

### Options

Opt 01      Electron multiplier (with HVPS)  
Opt 02      Built-in power module (AC line operation)  
O100RF      Replacement filament  
O100EM      Replacement electron multiplier



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