OPTI-SCIENCES Presents - ADC BioScientific Ltd.

SRS-1000 and SRS-2000 Field Portable Soil Respiration Systems

Highly Field Portable Precision Soil CO_2 Flux Measuring Systems Used for Survey and Diurnal measurements

- *Truly portable*
- *Precision CO_2 IRGA*
- *Optimized soil chamber*
- *Easy to use*
- *Integral data storage*

U.S. warrantee and repair center

40 years experience measuring CO_2

Field Soil Flux Experimentation

There is an increasing interest in the measurement of CO_2 exchange from soil samples in ambient field conditions. This may be associated with a variety of research applications including:

- Carbon Balance
- Microbial Ecology
- Soil Biomass
- Bioremediation
- Pesticide Impact
- Eddy Covariance

To enable researchers to conduct this experimentation, ADC BioScientific has developed the SRS-1000 and SRS-2000, for the measurement of soil flux. Both Units are compact, battery operated and highly accurate gas exchange systems.

Accurate Soil Respiration

The SRS-1000 consists of a console programming unit and a soil respiration chamber. The highly accurate miniaturized CO_2 infrared gas analyzer is housed directly adjacent to the soil chamber, ensuring the fastest possible response to gas exchanges from the soil. This “open system” has an operating range of 0-2000ppm, with a resolution of 1ppm. The IRGA has been designed to have minimal drift. All measurements are automatically compensated for atmospheric pressure and temperature.

The SRS-2000, although slightly heavier, offers humidity control designed for wet soils and a longer battery charge life.

Pressure variations in some soil chamber designs can lead to a suppressing or enhancing of CO_2 exchanges. The ADC Soil Respiration Chamber has been specifically designed to ensure that there is no internal pressure gradient. Incorporation of an integral pressure release valve ensures that there is no significant difference between the chamber head space and outside atmospheric pressure. The chamber consists of an upper chamber and a metal collar.

The collar is inserted into the soil to ensure a good seal and optimal upper chamber positioning, regardless of soil condition, and to ensure that total soil flux activity is measured with the chamber area. This collar maybe left in the soil for long term comparative studies.

In addition to gas exchange data and soil flux calculations the system also measures soil temperature. Both systems are supplied with a high quality soil temperature sensor.

SRS-1000 vs. SRS-2000

Field Portable Soil Respiration System

Specification	SRS-1000	SRS-2000
Weight of console	**5.3 lbs**	9.7 lbs
Weight of hand held Soil chamber	1.7 lbs	1.7 lbs
Battery time between recharges	10 Hours	**16 Hours**
Soil chamber size **Pressure release valve**	1 liter, 5.5" X 4.3" X 3.5" Yes, not affected by wind	1 liter, 5.5" X 4.3" X 3.5" Yes, not affected by wind
Open system	Yes	Yes
CO_2 measurement	IRGA 0-2000 ppm 1ppm resolution. Repeatability 0.1% at 350 ppm	IRGA 0-2000 ppm 1ppm resolution. Repeatability 0.1% at 350 ppm
Ce and NCER measurement	Yes	Yes
IRGA attached to soil chamber	Yes	Yes
Solid state ultra-stable humidity sensors attached to soil chamber	Yes 0-75 mbars with 0.1mbar resolution and 0.5% repeatability	Yes 0-75 mbars with 0.1mbar resolution and 0.5% repeatability
Thermistor solid state soil temperature sensor	Yes 0-50 degrees C with 1.5% repeatability	Yes 0-50 degrees C with 1.5% repeatability
Chamber solid state temperature thermistor	Yes, 050 degrees C with 1.5% repeatability	Yes, 050 degrees C with 1.5% repeatability
PAR sensor	Silicon photocell with a range of 3000 umols	Silicon photocell with a range of 3000 umols
RS232 output	Yes	Yes
Ram data cards	Yes	Yes
Flow rate	100 -500 ml min	100 -500 ml min
Graphic display of measurement	No	**Yes**
Humidity control	No	**Yes, above and below ambient**

Measuring diurnal soil respiration trends using the SRS-1000

Soil respiration can be defined as the net CO_2 production and O_2 consumption of a soil. The amount of gas exchange taking place is frequently used as an indicator of microbial soil activity. Because microorganisms are the driving force for many biochemical processes (decomposition, humidification), their activity in the soil is sometimes used to characterize the "health" of that soil. In practice, net soil respiration is the result of many organisms within the soil including roots, bacteria, fungi, protozoa and animals.

The rate of soil respiration is influenced by many parameters including organic matter content and soil moisture, but the most commonly defined relationship is that of soil temperature and soil respiration rate. Interest in this relationship has increased in recent years as global warming and rising atmospheric CO_2 levels have risen up the international political agenda.

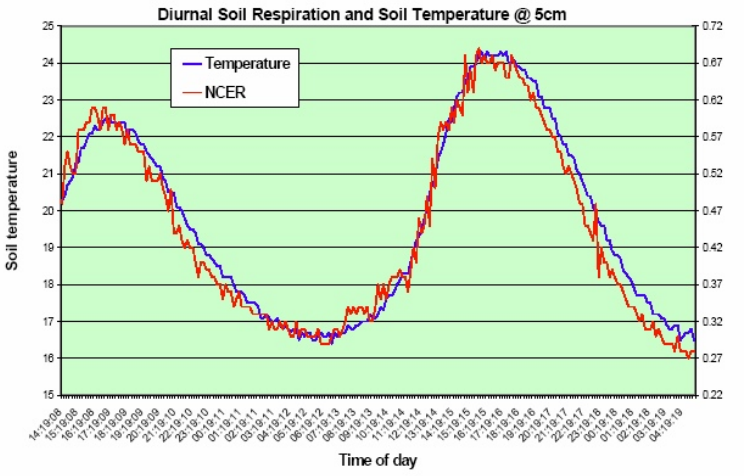
Most soil types are characterized by a Q10 value that is the proportional increase in respiration for each 10°C rise in temperature. Typically most soils have a Q10 value of between 1.5 and 3.0. As the daily soil temperature changes, so the soil respiration changes and this leads to the characteristic diurnal variation seen over a 24-hour period.

The ADC SRS-1000 is an ideal choice of instrument to characterize this diurnal respiration pattern. The battery portable device is small and compact making it easy to transport and use in even the remotest of field site. The automated, on-board logging provides enough space for weeks of soil respiration data and so allows for replication of the diurnal pattern.

The miniaturized CO_2 IRGA is housed directly next to the chamber itself, ensuring a fast measurement response to any CO_2 concentration changes. The open system design, with ambient air flowing through the chamber, ensures that the soil is not subject to a build up in CO_2 concentration above the soil, so inhibiting respiration.

ADC's unique pressure release valve importantly ensures that there is no pressure gradient between the air inside and outside the chamber as this could affect the rate of gas exchange from the soil. Measurements are also unaffected by external wind currents.

The diurnal variation in soil respiration, shown at the right, is plotted at 10 minute intervals against soil temperature at a 5cm depth. The close correlation of soil temperature and respiration rate can be seen clearly from the graph.



One feature of the graphs generated by the SRS-1000 is the lack of "noise" on the diurnal pattern. This has the benefit that the shape of the curve can be seen with great precision and excursions caused by events such as rain or freeze-thawing will be obvious This is not always the case with other designs of soil respiration systems.

Truly Portable

Weighing only 5.3 lbs., the battery operated SRS-1000 is a truly portable system incorporating the latest in low power consumption technology. It will operate fully for up to 10 hours from a single charge. The SRS-2000 weighs only 9.7lbs and provides a battery charge for up to 16 hours.

Full functionality, flow control and data logging are all contained within the ultra compact console. Experimental programming and operation of the SRS-1000 and SRS-2000 is achieved with just five buttons to drive a series of simple menus. All soil respiration data and calculations are clearly presented on a large high definition liquid crystal display.

Both units feature unlimited data storage. All data and calculations are stored on easily exchangeable PC cards. This popular feature, already incorporated into other ADC gas exchange instrumentation, allows separate PC cards to be used for individual users or specific experimental applications.

Experimental data may be downloaded via the RS232 port or transferred directly from the PC card to a computer.

Versatile Research Instrument

Both the SRS-1000 and the SRS-2000 are a highly versatile gas exchange systems. A variety of easily interchangeable *plant leaf chambers* are available which quickly convert into the most portable research photosynthesis system ever.

Full photosynthetic data and calculations are displayed and recorded.

This multi-purpose gas exchange system offers endless applications and outstanding value for money for any multi-disciplined research laboratory.

OPTI-SCIENCES

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Technical Specifications

Gas exchange:	CO_2:	0-2000 ppm, 1 ppm resolution. Infrared gas analyzer next to soil sample chamber. repeatability is 0.1% of reading at 350 ppm. Temperature effect <0.05% of f.s.d. per degree C.
	H_2O:	0-75mbars, 0.1 mbars resolution Solid state ultra stable laser trimmed water vapor sensors next to soil sample chamber. 0.5% repeatability.
	Other sensors:	Chamber temperature: Precision thermistor 0 to 50°C, 1.5% repeatability
		Soil temperature: Precision thermistor 0 to 50°C, 1.5% repeatability
		PAR: Silicon photocell with a range of 0-3000 umols
Flow rate to chamber:	100 - 500 ml min	
Display:	240 X 64 dot matrix LCD	
Warm up time:	5 minutes at 20 degrees C.	
Recorded data:	Removable RAM cards typically stores 2000 sets of data on a 128K Byte card. Up to 1 MB cards are supported.	
Battery:	2.6Ah lead acid 12V battery 10 hour charge.	
Battery charger:	90 -260 V 50/60 Hz	
Analog output:	Single 0-5V user selected parameter	
RS232 Output:	User selected up to 19,200 baud for printer or PC connection	
Temperature range:	5 to 45 degrees C	
Dimensions:	Soil chamber - 1 liter, 5.5”X4.3”X3.5” Console: 9.5”X 5.5”X5”	
Weight:	Console : 5.3 lbs Soil chamber : 0.4 lbs	

SRS-2000 specifications only -

Graphic display of measured data

Control over Humidity level 0-75 mbrs with 0.1 mb resolution

Console Weight:	9.7 lbs
Console dimensions:	9.1” X 6.7” X 4.3”