Highly Accurate, Reliable and Stable Quantitative Gas Monitoring System

INNOVA 1314

- Selectively measures a wide range of gases/vapors
- Linear response over a wide dynamic range
- Stable and Reliable: self-testing ensures a maximum of two calibrations a year
- User-friendly: Easy calibration, configuration, and viewing and analyzing of data via PC
- Accurate: compensates for temperature and pressure fluctuations, water vapor interference and interference from other known gases
- Operates immediately: virtually no warm-up time necessary

The INNOVA 1314 Photoacoustic Multi-Gas Monitor is a highly accurate, reliable and stable quantitative gas monitoring system. Its measurement system, based on the photoacoustic infrared detection method, is capable of measuring almost any gas that absorbs infrared light.

Gas selectivity is achieved through the use of optical filters. By installing up to five filters, the 1314 can measure the concentration of up to five component gases and water vapor in any air sample. Detection limit is gas-dependent, but is typically in the ppb region. The accuracy of these measurements is ensured by the 1314's ability to compensate for temperature and pressure fluctuations, water vapor interference and interference from other gases known to be present. Reliability of measurement results can be ensured by regular self tests. This measurement system requires no consumables and very little regular maintenance. For most applications, recalibration is only necessary one to two times a year.

The monitoring system is easily operated through either the front panel, with its push-buttons and display providing short explanatory texts, or the PC software. Both interfaces allow the user to configure the monitor, start a measurement sequence and view the resulting concentration values of specific gases.

The monitor is equipped with two standard interfaces: IEEE-488 and RS-232 (optional JV 0901 converter RS-232 to USB). These enable the monitor to be integrated into automated process systems.

To ensure easy placement of the 1314, it is housed in a rugged box that fits in a standard 19 inches rack and has a built-in pump system that allows samples to be drawn from up to 50 meters away.

Application areas:

- Emission monitoring - of exhausts from chemical processes, NH_3 in stacks, scrubber efficiency and filter break-through
- Process quality control measurements - of trace impurities in pure gas production
- Occupational health and safety measurements - of possible production or accumulation of toxic/carcinogenic substances in working areas
- Automotive monitoring - of alcohol content in vehicle exhausts and production of NH_3 and N_2O in diesel exhausts

Selectivity

The gas selectivity of the 1314 is determined by the optical filters installed in its filter wheel. Because water is nearly always present in ambient air and absorbs infrared light at most wavelengths, it contributes to the total acoustic signal in the analysis cell. Therefore, the monitor is permanently fitted with a special filter that measures water vapor and enables the 1314 to compensate for water vapor interference. By selecting different filters, this technique can also be used to cross-compensate for known interferent gases.

Calibration

After the relevant optical filters are installed, the monitor must be calibrated. This is achieved through easy-to-use menu driven instructions. Thanks to its high stability, calibration of the 1314 is seldom necessary more than once a year. Calibration is performed using either the PC software for Photoacoustic Field Gas-Monitor 7304 or directly from 1314's the front panel.

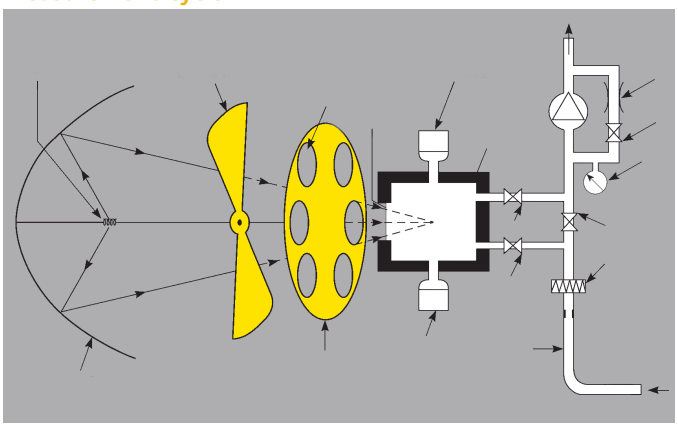
Operation

The 1314 monitoring system is easy to operate using either the PC software or the front panel push-keys (which can be locked and accessed at three levels using passwords). The monitor can be operated as both an on-line and off-line instrument. Using these user-interfaces with their logical division of information, everything that needs to be defined is achieved prior to starting the monitoring task.

Configuring the Monitor

The Set-up option enables all the parameters necessary to complete the monitoring task to be defined.This includes setting the Sample Integration Times (S.I.T.) option, which enables measurement results to be weighted - sensitivity against speed.

Measurement Cycle



1. The pump draws air from the sampling point through the air filter to flush out the "old" air in the measurement system and replace it with a "new" air sample. The pressure sensor is used to check that the pump sequence is elapsed successfully and to measure the actual air pressure.
2. The "new" air sample is hermetically sealed In the analyses cell by closing the inlet and outlet valves.
3. Light from an infrared light source is reflected off a mirror, passed through a mechanical chopper, which pulsates it, and then through one of the optical filters in the filter wheel.
4. The gas being monitored, causing the temperature of the gas to increase selectively absorbs the light transmitted by the optical filter. Because the light is pulsating, the gas temperature increases and decreases, causing an equivalent increase and decrease in the pressure of the gas (an acoustic signal) in the closed cell.
5. Two microphones mounted in the cell wall measure this acoustic signal, which is directly proportional to the concentration of the monitored gas present in the cell.
6. The filter wheel turns so that light is transmitted through the next optical filter, and the new signal is measured. The number of times this step is repeated is dependent on the number of gases being measured.
7. The response time is approximately 13 seconds for one gas or water vapor, or approximately 26 seconds if five gases and water vapor are measured.

Starting Measurements

Once the set-up parameters have been defined, measurements can be started immediately or later using a delayed start time. Once started, the monitoring task continues until it is stopped either manually or using a defined stop time.

Alarms

Two Alarm trigger levels, which provide high alarm limits for each measured gas, can be defined. These can also be linked to audible alarms. Using LumaSoft Gas Multi Point 7850 four alarm levels can be displayed.

Online Measurement Results

Using one or more of the monitor's standard interfaces, measurement results are transferred directly to a PC. Here they can be displayed on screen as real-time values in tables and graphs (see Fig. 1) or integrated into the process system.

In the 7850 software, the graphs can be configured to display only the desired gases, defined concentration ranges and results from statistical analyses. Also, when using the 7850 software, all measurement data is stored in user-defined SQL Server 2005 database.

Offline Measurement Results

Gas measurement result data is displayed on the 1314's screen (display memory) as soon as it is available, and is constantly updated. During a task, the 1314 performs running statistical analyses of the measured gas concentrations, calculating a variety of values for each monitored gas.

This data (in Display Memory) can be copied to the Background Memory, which is a non-volatile storage area.

Data stored in Background Memory can be recalled to Display Memory. From this memory, data can be uploaded to the 7304 software and printed out in list form on any standard text printer via the 1314's IEEE and RS-232 (optional JV 0901 converter RS-232 to USB) interfaces.

Reliability

Reliability can be ensured by a series of self tests performed by the monitor. The self tests check software, data integrity, and the 1314's components to ensure that they function properly. If a fault is found, it is reported in the measurement results, so that the integrity of the results can be ensured.

If the power-supply fails, the 1314 will automatically start up again when power is restored. Measurement data stored in the monitor's memory is not affected by power loss.

Fig. 1 The graphical window shows up to seven graphs. The user selects the data plotted, the scaling, the style and the color of the lines and the background to build the graphical window

Maintenance

The only maintenance tasks necessary are calibration and replacement of the air filter. Both tasks are easily performed. The frequency for changing the air-filter depends on the individual applications.

Remote Control Options

When remote control and multiple sampling points are required, LumaSense Technologies offers an additional application software program, LumaSoft Gas Multi Point 7850. Using the 7850 software, a computer can remotely control a 1314 together with one or two INNOVA 1309 Multipoint Samplers or up to four INNOVA 1303 Multipoint Sampler and Dosers for sequentially monitoring air-samples from up to 24 locations. Measurement data is stored in an SQL Server 2005 database. Online access to the measurement data is available via Microsoft Excel.

Optional Modules

The functions of the 1314 can be expanded through three additional modules.

Purge Module

The 1314 can be fitted with a "sealed box" which ensures that the measurement system inside the 1314 can be purged using an inert gas.

Analog Interface and Analog/Relay Interface Module

For each gas, barometric pressure and chamber temperature, the following outputs are available:

- 0-20mA, 4-20mA
- 0-10Volts (0-5V with loss of dynamic range)

Accuracy:	Zero Drift: ±0.25%
Voltage Output:	±1.5% of measured value
Current Output:	±0.5% of measured value
Resolution:	16 bit (0-20mA and 0-10V)
Measurement Range:	Range and zero-point are scalable in the software. Maximum load resistance on current output is 800Ω. Minimum load resistance for the voltage output is 1000Ω.

The analog outputs are galvanically isolated from the rest of the analyser, but NOT from each other.

With the Analog/Relay Interface Module, two alarm relays are available for each gas (programmable for upper/lower concentration). Furthermore two alarm relays are available for warning/error messages.

Ordering Information

Innova 1314 Photoacoustic Field Gas Monitor

Optical filters necessary for the user's monitoring task can be ordered together with the 1314, and installed by LumaSense Technologies. The 1314 is then delivered zero-point and humidity interference calibrated.

Accessories

AT 2177	PTFE tubing
DS 0759B	Particle filter
VF 0087A	Fuse
7304	Gas monitoring SW (CD)
BR6010	1412 Set-up tree
Mains Cable	
WL 0945	RS-232 Interface cable (9pin–25pin) null-modem included

PC Software for Photoacoustic Field Gas-Monitor 7304

LumaSoft Gas Single Point 7800 monitoring software

Instruction Manual (CD Rom)

Optional Accessories

The 1314 can be span-calibrated for certain gases – contact your local LumaSense Technologies representative for details of the gases for which this can be done.

27 Optical Filters:

UA 0968 – UA 0989 and

UA 0936

UA 6008

UA 6009

UA 6010

UA 6016

UA 0181	Automated Calibration
UA 0182	Complex Calibration
UA 0183	Advanced Calibration
1309	Multipoint Sampler
JV 0901	Converter RS-232 to USB
WL 0946	RS-232 Interface cable (25pin–25pin) null-modem included
JP 0600	6-pin DIN plug (male) with locking collar for alarm relay
AF 0614	PTFE tubing
UA 1357A	Genie Membrane separator
UA 1365	Genie Membrane separator (inline)
UA 1363A	Analog Interface Module
UA 1364A	Analog/Relay Interface Module
JZ 0102A	37-pin Sub-d to 37-pin screw terminal
AO 1431A	I/O cable one meter (for analog relay)
AO 1432A	I/O cable three meters (for analog relay)
UA 1361A	Purge Module
7850	LumaSoft Gas Multi Point

Technical Specifications

Measurement Technique
Photoacoustic infrared spectroscopy.

Your LumaSense sales representative will assist in the selection of suitable optical filters. Details are provided in the Gas Detection Limits chart.

Response Time
Is dependent on the Sample Integration Time (S.I.T.) and the flushing time defined. Please see the examples below:

Measurement Specifications[1]

Monitor-Setup	Response Times
S.I.T.: „Normal“ (5 s) Flushing: Auto, (tube: 1 m)	One gas: ~27s 5 gases + water: ~60s
S.I.T.: “Low Noise” (20s) Flushing: Auto, (tube 1 m)	5 gases + water: ~150s
S.I.T.: “Fast” (1s) Flushing: Chamber 4s, Tube “OFF”	One gas: ~13s 5 gases + water: ~26s

Detection Limit: Gas-dependent, but typically in the ppb region. Using the Gas Detection Limits chart, the detection limit for a selected sample integration time (S.I.T.) can be calculated.

Dynamic Range: Typically 4 orders of magnitude (i.e. 10,000 times the detection limit at 5 S.I.T.). Using two span concentrations it can be expanded to 5 orders of magnitude.

Zero Drift: Typically ± Detection limit[4] per 3 months[1].

Influence of temperature[2]: +/- 10 % of detection limit[4]/°C.

Influence of pressure[3]: +/-0,5 % of detection limit[4]/mbar.

Repeatability: 1 % of measured value[1]

Range Drift: +/- 2,5 % of measured value per 3 months[1].

Influence of temperature[2]: 0,3 % of measured value/°C.

Influence of pressure[3]: -0,01 % of measured value/mbar.

Reference conditions:

[1] Measured at 20 7C, 1013 mbar, and relative humidity (RH): 60%. (A concentration of 100x detection limit[4] was used in determining these specifications.)

[2] Measured at 1013 mbar, and RH: 60 %.

[3] Measured at 20 °C and RH: 60 %.

[4] Detection limit is @5s S.I.T

Interference:
The 1314 automatically compensates for temperature and pressure fluctuations in its analysis cell and can compensate for water vapor in the air sample. If an optical filter is installed to measure a known interferent, the 1314 can cross compensate for the interferent.

Acoustic Sensitivity: not influenced by external sound.

Vibration Sensitivity: strong vibrations at 20Hz can affect the detection limit.

Internal Data Storage Capacity
Dependent on the number of gases being measured. Sufficient for a 12-day monitoring task, monitoring 5 gases and water vapor every 10 min.

General
Pumping Rate: 30 cm³/s (flushing sampling tube) and 5 cm³/s (flushing measurement chamber).

Power Requirement: 100-240 VAC. 50-60 Hz.

Power Consumption: ~120 VA.

Air Volume per sample:

Flushing Settings	Volume of Air
Auto: Tube Length: 1m	140 cm³/sample
Fixed time: Chamber 2s, Tube 3s	100 cm³/sample
Fixed time: Chamber 2s,Tube “OFF”	10 cm³/sample

Total Internal Volume: The total Internal Volume of the measurement system: 60cm³

Alarm Relay Socket: for connection to one or two alarm relays (visual/audio). Alarm levels for each gas are user-defined. Max. 25 VDC, max.100 mA.

Back-up Battery: 3V lithium battery, lifetime 5 years. This protects data stored in memory, and powers the internal clock.

Dimensions:
Height: 175 mm (6.9 in)
Width: 483 mm (19 in)
Depth: 375 mm (14.8 in)
Weight: 14 kg (30.8lbs)

Communication
The monitor uses two interfaces, IEEE 488 and RS-232, for data exchange and remote control of the 1314. The software communicates using the RS-232 interface.

Software Requirements
Hardware:
Pentium processor 1 GHz or better. Min. 512 MB of RAM. Min. 500 MB space available on the hard-disk. One RS-232 port.

Software:
7800/7850: Windows® XP (SP2), Windows® Vista, Microsoft Windows® 2003 (SP1).

WARNING: *The 1314 must not be placed in areas with flammable gases/vapors in explosive concentrations or be used to monitor explosive concentrations of these. Monitoring of certain aggressive gases or a very high concentration of water vapor may damage the 1314. Contact your LumaSense sales representative for further information.*

CE c SP us	**COMPLIANCE WITH STANDARDS:** CE-mark indicates compliance with: EMC Directive and Low Voltage Directive. CSA mark indicates compliance with: CSA and UL Standards.	
Safety	EN/IEC 61010–1, 2nd (2001)	Safety requirements for electrical equipment for measurement, control and laboratory use.
	CAN/CSA-C22.2 No. 1010.1-92	Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General Requirements.
	UL Std. No. 61010A-1 (1st Edition)	Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General Requirements.
EMC	EN 61000-3-2:1995 + A1/A2:98 + A14:00 Harmonic Currents	
	EN 61000-3-3:1995 Voltage Fluctuations	
	EN 55022: 1994 + A1:95 + A2:97/EN 55022:1998 Radio disturbance char. – IT equipment	
	EN 55024 : 1998	Immunity Standard – IT equipment
	EN 61000-4-2:95	Electrostatic Discharge Requirements
	EN 61000-4-3:96	Radiated Radio-frequency EM Field
	EN 61000-4-4:95	Electrical Fast Transient/burst Requirements
	EN 61000-4-5:95	Surge Immunity Test
	EN 61000-4-6:96	Conducted Disturbances induced by RF Fields
	EN 61000-4-8:93	Power Frequency Magnetic Field Immunity
	EN 61000-4-11:94	Voltage dips, Interruptions and Variations
Environment	UL 61010A-1: Environmental conditions.	
	Altitude up to 2000 m	
	Operating Temperature: +5 °C to +40 °C	
	Storage Temperature: –25 °C to +55 °C	
	Humidity: Maximum relative humidity 80 % for temperatures up to 31 °C decreasing linerly to 50 % relative humidity at 40 °C	
	Pollution Degree II	
Enclosure	IP20	

LumaSense Technologies — Temperature and Gas Sensing Solutions

Americas and Australia
Sales & Service
Santa Clara, CA
Ph: +1 800 631 0176
Fax: +1 408 727 1677

Europe, Middle East, Africa
Sales & Service
Frankfurt, Germany
Ph: +49 69 97373 0
Fax: +49 69 97373 167

India
Sales & Support Center
Mumbai, India
Ph: +91 22 67419203
Fax: +91 22 67419201

China
Sales & Support Center
Shanghai, China
Ph: +86 133 1182 7766
Fax: +86 21 5039 8096

info@lumasenseinc.com

www.lumasenseinc.com

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Rev. B July 2011