INNOVA 1314i

Highly accurate, reliable, stable, and remote controllable quantitative gas monitoring system

The Innova® 1314i Photoacoustic 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.

PRODUCT HIGHLIGHTS

- Selectively measures a wide range of gases/vapors
- Linear response over a wide dynamic range
- Stable and reliable: ensuring a maximum of only two calibrations a year
- User-friendly: easy calibration, configuration, and viewing/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
- Remote control capability via TCP/IP network interface protocol
- Expandable up to 24 locations with the Innova 1409 Multipoint Sampler: the gas monitor can operate as the system controller for full standalone operation

TYPICAL APPLICATIONS

- 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

AT A GLANCE

Measurement Technique

Photoacoustic Infrared Spectroscopy

Filter Capacity

Up to 5 + water from 27 different filter options

Detection Limit

Gas dependent, but typically in the ppb region

Repeatability

1% of measured value

OVERVIEW

Gas selectivity for the Innova 1314i monitor is achieved through the use of optical filters. By installing up to five filters, the 1314i can measure the concentration of up to five component gases and water vapor in any air sample. The detection limit is gas-dependent, but is typically in the ppb region.

Reliability is ensured by a series of self tests performed by the monitor. The self tests check software, data integrity, and the 1314i'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.

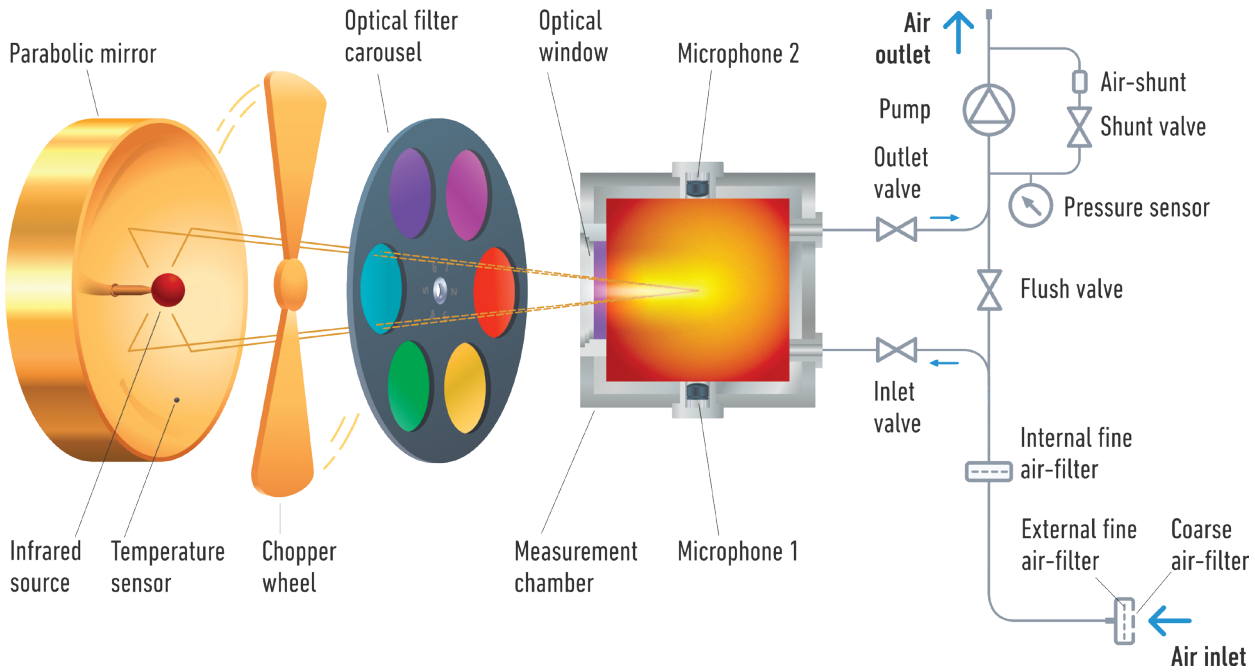
The 1314i measurement system requires no consumables and very little regular maintenance. For most applications, recalibration is only necessary one to two times a year.

The monitoring system is easily operated through either the front panel, with its push-buttons and display providing short explanatory texts, or through the PC software. Both methods 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 standard interfaces: USB, Ethernet, and RS232. These enable the monitor to be integrated into automated process systems.

To ensure easy placement of the 1314i, 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.

PHOTOACOUSTIC SPECTROSCOPY (PAS)



MEASURING DETAILS

Selectivity

The gas selectivity of the 1314i 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 1314i 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 1314i is seldom necessary more than once a year. Calibration is performed using either the Calibration Software BZ7002 or directly from the 1314i's front panel.

Operation

The 1314i monitoring system is easy to operate using either the application software or by using the front panel push-keys (which can be locked and accessed at three levels using passwords). The monitor can be operated as both an online and offline instrument (i.e. standalone operation). 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. When used as a system controller for multipoint monitoring, the same menu enables the setup of the Innova 1409's multipoint sampling tasks.

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 by using a defined stop time.

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 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.

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 the relay outputs. In addition, the application software allows four alarm levels to be displayed.

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.

TECHNICAL DATA

Measurement Specifications[1]		
Measurement Technique	Photoacoustic infrared spectroscopy	
Response Times	S.I.T.: "Normal" (5 s) Flushing: Auto, (tube 1 m)	One gas: ~27 s
		Five gases + water: 60 s
	S.I.T.: "Low Noise" (20 s) Flushing: Auto, (tube 1 m)	Five gases + water: 150 s
	S.I.T.: "Fast" (1 s) Flushing: Chamber 4 s, (tube "OFF")	One gas: ~13 s
		Five gases + water: 26 s
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 four 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 five orders of magnitude.	
Zero Drift	Typically ± Detection limit[1] per three months[2]	
	Influence of temperature[3]	±10% of detection limit[1]/°C
	Influence of pressure[4]	±0.5% of detection limit[1]/mbar
Repeatability	1% of measured value[2]	
Range Drift	±2.5 of measured value per three months[2]	
	Influence of temperature[3]	±0.3% of measured value/°C
	Influence of pressure[4]	-0.01% of measured value/mbar
Interference	The 1314i 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 1314i can cross compensate for the interferent.	
Acoustic Sensitivity	Not influenced by external sound	
Vibration Sensitivity	Strong vibrations @ 20 Hz can affect the detection limit	
Internal Data Storage Capacity	The total space available in Display Memory to store data is 131,072 measurement cycles. If a measurement cycle takes 15 sec, then the display Memory space will be sufficient for a 22-day monitoring task.	

Environmental Specifications	
Operating Temperature	5 to 40°C (41 to 104°F)
Storage Temperature	-25 to 55°C (-13 to 131°F)
Humidity	Max relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity @ 40°C
Altitude	Up to 2000 m
Other Environment	UL 61010A-1: Environmental conditions
	Pollution Degree 2
	Installation Category II
	Indoor Use
Enclosure	IP 20
Dimensions (W x H x D)	483 mm x 175 mm x 375 mm (19" x 6.9" x 14.8")
Weight	14 kg (30.8 lb)

1 Detection limit is @ 5 s S.I.T.

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

3 Measured @ 1013 mbar and RH: 60%.

4 Measured @ 20°C and RH: 60%.

TECHNICAL DATA (CONTINUED)

Pumping System Specifications		
Pumping Rate	30 cm^3/s (flushing sampling tube)	
	5 cm^3/s (flushing measurement chamber).	
Air Volume Per Sample	**Flushing Settings**	**Volume of Air**
	Auto: Tube Length 1 m	140 cm^3/sample
	Fixed Time: Chamber 2 s, Tube 3 s	100 cm^3/sample
	Fixed Time: Chamber 2 s, Tube "OFF"	10 cm^3/sample
Total Internal Volume	60 cm^3 (of the measurement system)	

Electrical and Communication Specifications	
Power Requirement	100 to 240 VAC ±10%, 50 and 60 Hz
Power Consumption	~85 VA
Alarm Relay Socket	For connection to one or two alarm relays (visual/audio)
	Alarm levels for each gas are user-defined
	System On/Running status available
	Max 25 VDC, max 100 mA
Back-Up Battery	3 V lithium battery, lifetime 5 years. This protects data stored in memory and powers the internal clock.
Monitor Interface	Three interfaces: USB, Ethernet, and RS232, for data exchange and remote control of the instrument
Software Communication	Via USB, Ethernet, or RS232 interface
Computer Requirements	Hardware: 2 GHZ Quad-core or equivalent. Min 512 MB RAM. (4096 MB RAM on Windows 8). Min 500 MB space available on hard drive.
	Software (7820/BZ7002/BZ7003): Windows® 7, 8.1, and Windows® 10

Safety and Standards Specifications	
Safety	EN/IEC 61010-1 3rd Edition
	CAN/CSA C22.2 No. 61010-1-04
	UL 61010-1 3rd Edition
EMC	EN 61326-1:2013: Electrical equipment for measurement, control and laboratory use – EMC requirements; Part 1: General requirements
Standards Compliance	CE-mark indicates compliance with: EMC Directive and Low Voltage Directive
	NEMKO mark indicates compliance with: CSA and UL Standards

Warning

The Innova 1314i 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 1314i. Contact your Advanced Energy sales representative for further information.

MEASUREMENT DATA

Online Measurement Results

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

In the 7820/7880 software, the graphs can be configured to display only the desired gases, defined concentration ranges, and results from statistical analyses. Also, when using the 7880 software, all measurement data is stored in user-defined SQL Server 2014 database.

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

Offline Measurement Results

Gas measurement result data is displayed on the 1314i's screen (display memory) as soon as it is available, and is constantly updated. During a task, the 1314i 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. The internal memory stores the measurement readings on a gas per gas basis, but also across the sampling channels when applicable.

Data stored in Background Memory can be recalled to Display Memory. From this memory, data can be uploaded to the BZ7003 Offline Software in either excel or text file format or alternatively printed out on a standard printer.

Remote Control Option

Advanced Energy offers remote control capability through the user's local area network using the LumaSoft Gas Single Point 7820 or Multi Point 7880 software. Online access to the measurement data is available via a built in OPC server (alternatively via Microsoft Excel).

Optional Analog/Relay Interface Module UA1374

The functions of the 1314i can be expanded through the additional Analog/Relay Module UA1374.

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

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

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

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

With the Analog/Relay Interface Module, 12 alarm relays can be configured: either as two alarm levels for each gas (plus water) on any active sampling channel, or as alarm relays for selective channels on any monitored gas. Furthermore, two alarm relays are available for warning/error messages and for system watchdog function. Max 25 V DC, Max 100 mA.

Purge Module

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

ORDERING INFORMATION

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

Included Accessories

- 4 m PTFE tubing (AT 2177)
- Particle filter (DS 0759B)
- Fuse (VF0102A)
- Set-up tree (BR6011)
- Mains cable
- USB cable (AS0001A)
- Calibration software (BZ7002)
- Offline software (BZ7003)
- LumaSoft single point monitoring software (7820)
- Instruction manual

OPTIONS AND ACCESSORIES

Calibrations	
UA0181	Automated Calibration
UA0182	Complex Calibration
UA0183	Advanced Calibration

Optical Filters (27 Options)	
UA0968 to UA0989	UA6009
UA0936	UA6010
UA6008	UA6016
DS0806 Particle filters	

Multiple Point Monitoring	
7880	LumaSoft Gas Multi Point
1409	Multiple Point Sampler

Additional Option

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

Cables, Adapters, and Tubings	
WL0950-003	RS232 Interface cable (9pin–9pin) null modem
JP0600	6-pin DIN plug (male) with locking collar for alarm relay
AF0614	PTFE tubing
UA 1357A	Genie membrane separator
UA1365	Genie membrane separator (inline)
UA 1373	Analog/relay interface module
JZ0102A	37-pin Sub-d to 37-pin screw terminal (for analog relay)
AO1431A	I/O cable one meter (for analog relay)
AO1432A	I/O cable three meters (for analog relay)
UA 1361A	Purge module

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

PRECISION | POWER | PERFORMANCE

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