LumaSense® TECHNOLOGIES

**INNOVA** Multi Gas Monitoring Instruments

## Highly Accurate, Reliable and Stable Quantitative Gas Monitoring System

# INNOVA 3433

CE

- 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 3433 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 3433 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 3433'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 3433 has one RS232 port (25-pin) for data exchange and remote control by automated process systems.

To ensure easy placement of the 3433, 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:

- Automotive monitoring - of alcohol content in vehicle exhausts and production of $NH_3$ and $N_2O$ in diesel exhausts
- Automotive SHED Evaporative Emission Testing

## Selectivity

The gas selectivity of the 3433 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 3433 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 3433 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 3433's the front panel.

## Operation

The 3433 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.

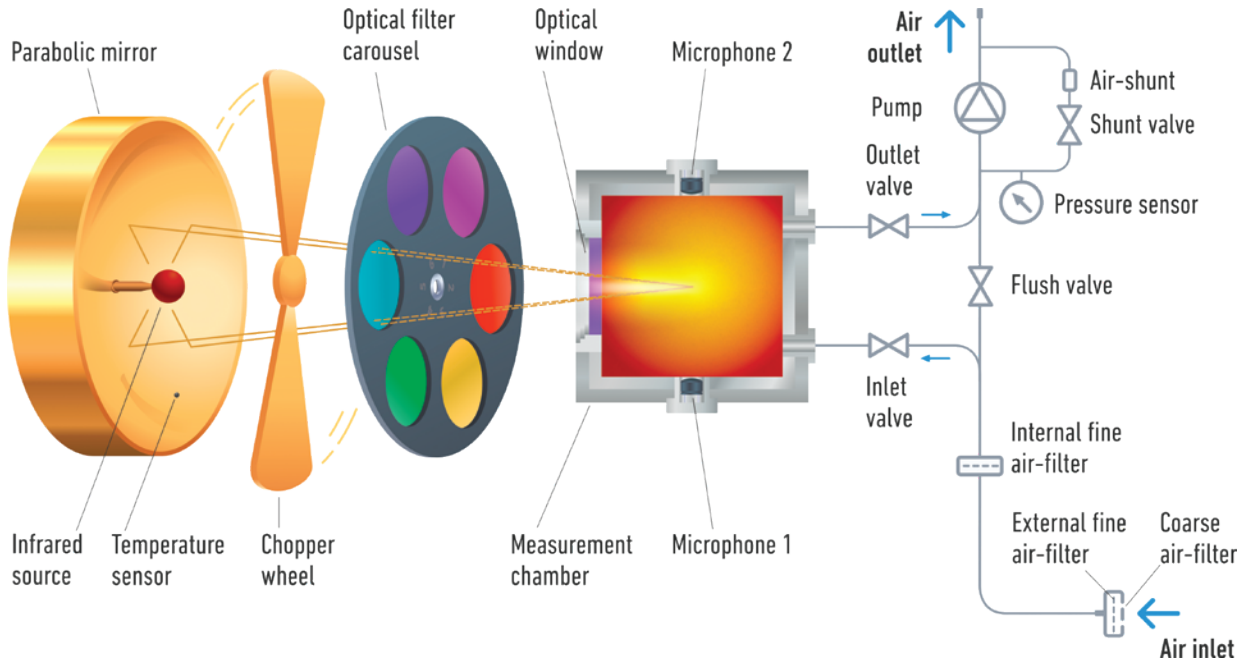
3. Light from an infrared light source is reflected off a mirror, passed through a mechanical chopper, which pulsates it, and then through one of the optical filters in the filter wheel.

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.

### Online Measurement Results
Using the monitor's standard interface, measurement results are transferred directly to a PC or integrated into the process system.

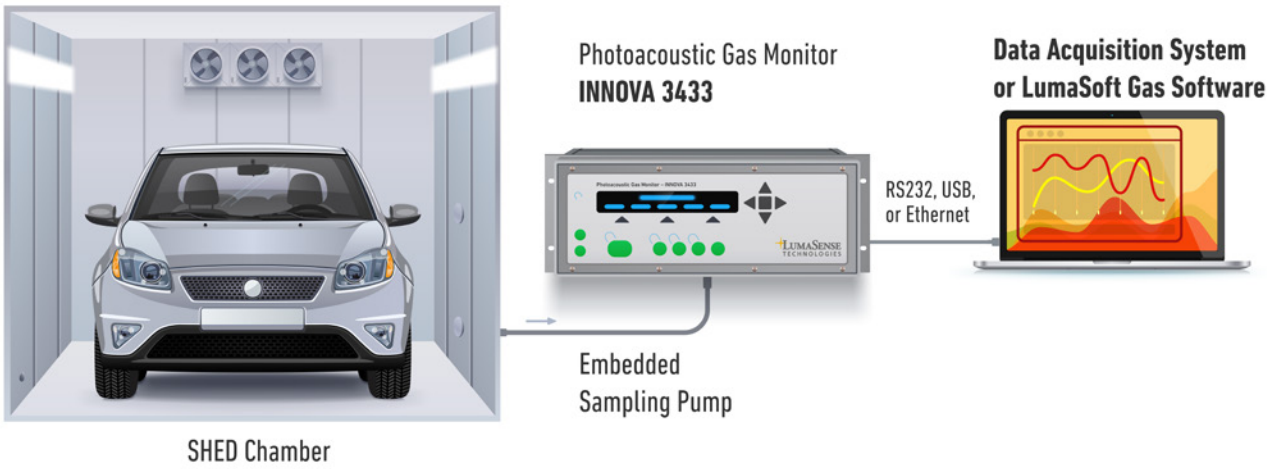
### Reliability
Reliability can be ensured by a series of self tests performed by the monitor. The self tests check software, data integrity, and the 3433's components to ensure that they function properly. If a fault is found, it is reported in the measurement results, so that the integrity of the results can be ensured. If the power-supply fails, the 3433 will automatically start up again when power is restored. Measurement data stored in the monitor's memory is not affected by power loss.

### 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.

### Standard Modules
The 3433 is equipped with the following standard modules.

### Purge Module
The 3433 is fitted with a"sealed box" which ensures that the measurement system inside the 3433 can be purged using an inert gas. The Purge Inlet is fitted with a 6mm tube fitting.

### Cushion Pump Module
The 3433 is fitted with a cushion pump modules which reduce the noise from the pump when the 3433 is operated in the Continuously pumping sequence mode. This module includes Stainless Steel tubing from the Gas Inlet to the Measurement Chamber.




## Ordering Information
**Innova** 3433 **Photoacoustic Field Gas Monitor**

Optical filters necessary for the user's monitoring task can be ordered together with the 3433, and installed by LumaSense Technologies. The 3433 is then delivered zero-point and humidity interference calibrated.

### Accessories
| | |
|---|---|
| **VF0087A** | Fuse |
| **7304** | Gas monitoring SW (CD) |
| **Mains Cable** | |
| **WL0945** | RS232 Interface cable (9pin–25pin) null-modem included |

PC Software for Photoacoustic Field Gas-Monitor 7304

Instruction Manual (CD Rom)

## Optional Accessories
The 3433 can be span-calibrated for certain gases – contact your local LumaSense Technologies representative for details of the gases for which this can be done.

### Calibration:
| | |
|---|---|
| **UA0181** | Automated Calibration |
| **UA0182** | Complex Calibration |
| **UA0183** | Advanced Calibration |

### Optical Filters:
**UA0968 – UA0989** and

**UA0936**

**UA6008**

**UA6009**

**UA6010**

**UA6016**

## Optical Filter Configurations:
The 3433 is typically configured with two different sets of optical filters depending on the type of application.

### Automotive Exhaust Emmissions
| | |
|---|---|
| **UA0976** | Ammonia |
| **UA0985** | Nitrous Oxide |
| **UA0974** | Ethanol |
| **UA0983** | **Carbon Dioxide** |
| **UA0984** | Carbon Monoxide |

### SHED Evaporative Emissions
| | |
|---|---|
| **UA0974** | Methanol |
| **UA0936** | Ethanol |
| **UA0981** | Toluene |
| **UA0983** | Carbon Dioxide |
| **UA0971** | Freon R134A |

# 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)<br>Flushing:<br>Auto, (tube: 1 m) | One gas: ~27s<br>5 gases + water:<br>~60s |
| S.I.T.: "Low Noise" (20s)<br>Flushing:<br>Auto, (tube 1 m) | 5 gases + water:<br>~150s |
| S.I.T.: "Fast" (1s)<br>Flushing:<br>Chamber 4s, Tube "OFF" | One gas: ~13s<br>5 gases + water:<br>~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 3433 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 3433 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
**Inlet and Outlet Fittings:** Ø 6 mm

**Pumping Rate:** 30 $cm^3/s$ (flushing sampling tube) and 5 $cm^3/s$ (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:<br>Tube Length: 1m | 140 $cm^3$/sample |
| Fixed time:<br>Chamber 2s, Tube 3s | 100 $cm^3$/sample |
| Fixed time:<br>Chamber 2s,Tube "OFF" | 10 $cm^3$/sample |

**Total Internal Volume:** The total Internal Volume of the measurement system: 60$cm^3$

**Back-up Battery:** 3V lithium battery, life-time 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 RS232, for data exchange and remote control of the 3433. The software communicates using the RS232 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 RS232 port.

**WARNING:** *The 3433 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 3433. Contact your LumaSense sales representative for further information.*

| | | |
|---|---|---|
| | **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 | |

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