

## SF<sub>6</sub> Leak Detection System for Enclosed GIS substations

### SF<sub>6</sub> Leak Detection System - 3731



- Standalone Multipoint SF<sub>6</sub> leak monitor with superior photoacoustic detection (detection limit = 6 ppb)
- Cost-effective solution for a direct and integral leak detection method applicable to a complete SF<sub>6</sub>-GIS
- Independent from any pressure or density reading
- Available in 12- or 24-channel configuration to monitor large GIS installation
- Simple installation procedure, not requiring any outage on your installation
- Highly reliable and stable for a low cost of ownership



The SF<sub>6</sub> Leak Detection System 3731 from LumaSense Technologies offers unmatched performance. Based on Photoacoustic Spectroscopy (PAS) technology, the system offers highly accurate, reliable and stable quantitative gas detection.

#### Leak Detection for Enclosed GIS substations

New regulatory frames, like the F-Gas Directive (EC 517/2014), are mandating the use of leak detection systems in the vast majority of high-voltage SF<sub>6</sub>-GIS installation in order to better mitigate the risk of SF<sub>6</sub> emissions in particular when the existing gas instrumentation is not accurate enough to provide early detection: Pressure/density switches used for safety considerations (to prevent catastrophic failure) lack of sensitivity, and manual leak checks only provide discrete check points. Instead, stationary leak detection systems enable a permanent monitoring and early warning in the case of a leakage event occurring.

Our 3731 system leverages 20-years of leadership on the ultra-sensitive photoacoustic sensing technique to provide a direct and integral leak detection solution capable of monitoring large switchgear rooms. The system verifies that the GIS Equipment operates below the industrial target of 0.5% yearly leakage rate or better.

The 3731 system can detect within a short response time any excessive increase in the leak rate, enabling to decrease the number – hence the cost – of periodic leak checks while providing early leak detection.

#### Multipoint Sampling

Including a multipoint sampler with up to 24 different channels, the 3731 system enables an extensive distribution of sampling points over the whole enclosed substation in order to maximize the coverage area and minimize the detection response time. The length of each individual channel can be extended up to 75 m.

#### Detection Trending and Automatic Alarms

Analog output is available for detection trending over time. Measurements are also stored in the internal memory and can be exported to a remote LAN computer via user-friendly software interface. Finally, configurable zone alarms can be relayed to a local RTU.

#### Low Maintenance

It is only recommended to calibrate the gas monitor only once per year. The calibration can be done without the requirement of an equipment outage. The only other maintenance task necessary is changing the air filter on each active sampling channel.

### Selectivity and Accuracy

The monitor is permanently fitted with a special filter that measures water vapor and enables the monitor to compensate for water vapor interference. Additional auto-compensation for temperature and pressure fluctuations helps to achieve exceptional accuracy.

### Calibration

Calibration is performed using either the Calibration Software BZ7002 or directly from the front panel using the easy-to-use menu-driven instructions.

### Operation

The 3731 leak detection system operates nominally in standalone mode. The gas monitor is the system controller. It self-synchronizes the monitoring and sampling tasks. The system follows a fixed sampling sequence, measuring the active sampling channels in their basic order. The user can define a fixed interval in between two sequences.

### Reliable by Design

The leak detector's extended self-test routines maintain the reliability of the results, which are stored in the internal memory of the gas monitor and can be downloaded as required. Alarm relays are available to report any warning/error on the system to the end user.

If the power supply fails, the 3731 system will automatically restart when power is restored. Measurement data stored in the monitor's memory is not affected by power loss.

### Setting-up the system

The monitor and sampler units are rack-mountable on a standard 19" chassis. The user decides where the measurement points should be located and connects the sampler unit to each location with tubing. A short tubing piece connects the sampler's outlet to the monitor's inlet. Finally, the units are communicating via USB interface.

Setting-up the tasks of the leak detection system is easy using either the remote/offline software (BZ7007) or the front panel push-keys (which can be locked and accessed at three levels using passwords). Using these user-interfaces with their logical division of information, everything that needs to be defined is achieved prior to starting the multipoint monitoring task.

Within the setup tree, the Sample Integration Time (S.I.T.) is set, enabling measurement results to be weighted — sensitivity versus speed.

### 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 pre-defined stop time.

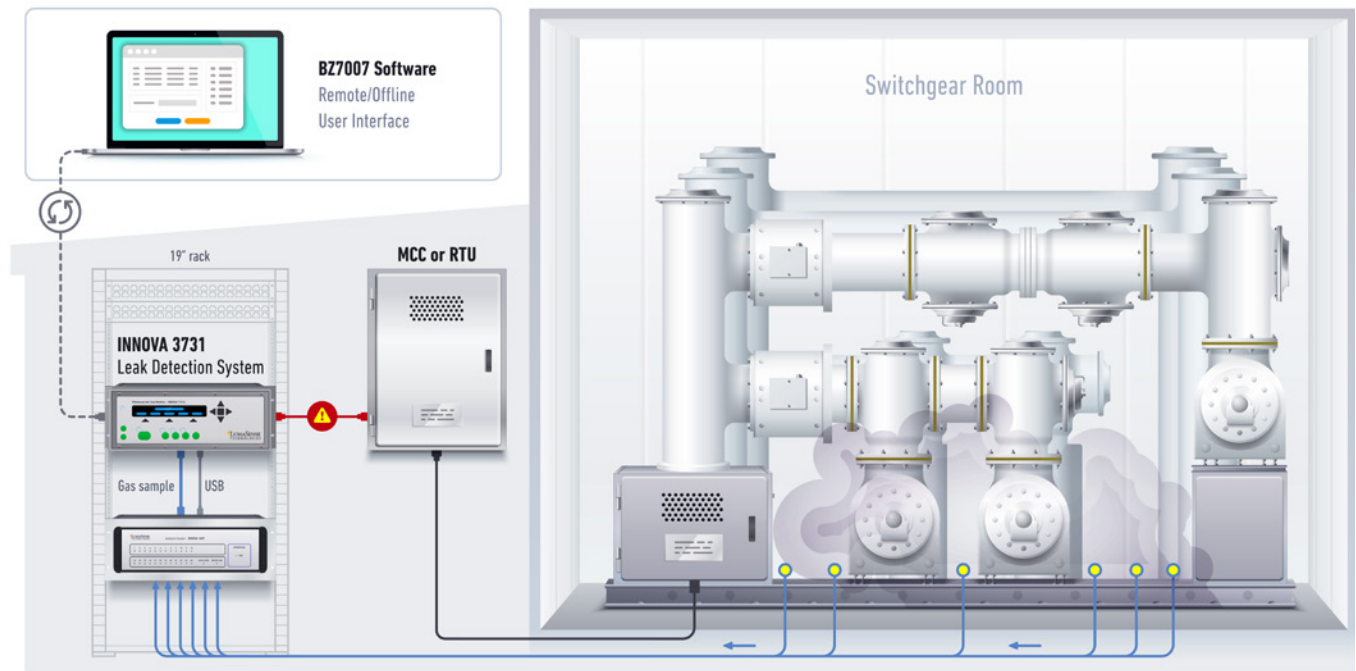


Figure 1:

The SF<sub>6</sub> leak detection system – INNOVA 3731 – features ultra-high sensitivity with its state-of-the-art photoacoustic monitor. It draws air samples from up to 24 locations for maximum coverage of the GIS substation. Tubing lines can easily run into existing control cable trays, or trenches. Analog and alarm relay outputs can be connected to local RTU.

### Offline Measurement Results (Standalone Operation)

Gas measurement result data is displayed on the monitor's screen (Display Memory) as soon as it is available, and is constantly updated.

The internal database structures the measurement readings on a gas per gas basis, and across the sampling channels. 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 also be recalled to Display Memory.

From this memory, data can be exported via the Remote/Offline Software in either excel or text file format.

### Remote Control Option

The 3731 system offers remote control capability through the user's LAN, USB, or RS232 interfaces using the optional LumaSoft Gas Multi Point 7870 software. This option enables the online monitoring of the leak detection system. The user-friendly interface of the LumaSoft 7870 can provide real time graphical display of the measurements on a channel-per-channel basis. The online software opens a SQL database to log the measurement values.

### Analog and Alarm Relay Outputs

The 3731 system features an analog/relay module with analog output (0-10 V, or 4-20 mA) for detection trending and 12 configurable alarm relay outputs for more detailed reporting of alarm conditions. Furthermore, two outputs are also available for relaying warning/error flags and for system watchdog function.

In particular, the Channel Mode is useful for multi-zone monitoring applications with the need to alarm on a zone-by-zone basis. Alarm relays are attributed to one or multiple sampling channels (defining a specific zone) and will trigger upon detection of alarm concentration on any of the monitored gas (for that zone). The Remote/Offline BZ7007 software enables the setup of the alarm levels and of the relay module.

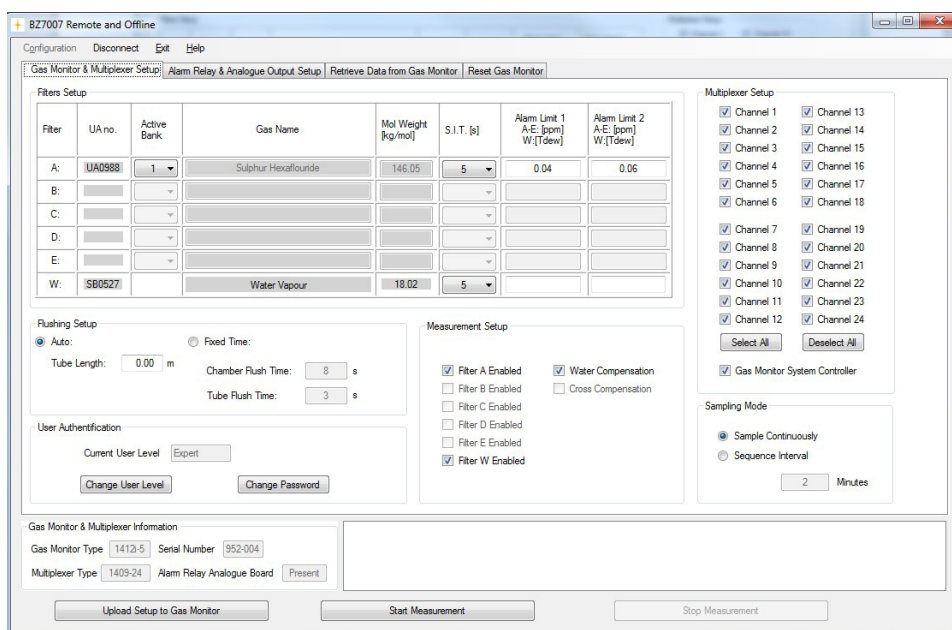


Figure 2:

User interface window from the BZ7007 for the complete setup of the monitoring and sampling tasks to be performed by the standalone measurement system. It also reports the current status of the system to which it is connected, and enables the user to start/stop the measurement task.

### Ordering Information

#### SF<sub>6</sub> Leak Detection System - 3731

The scope of delivery includes: photo-acoustic gas monitor with analog/relay module, multipoint sampler, external pump, nylon tubing (20 m per channel), airfilter with fittings, remote/offline and calibration softwares, and user manuals.

The gas monitor is delivered with the UA0988 optical filter installed. It also features zero-point, humidity interference, SF<sub>6</sub> and water vapor scan calibration.

#### Optional Accessories

7870

LumaSoft Gas Multi Point (online monitoring)

# Technical Specifications

## Measurement Technique

Photoacoustic infrared spectroscopy.

The UA0988 optical filter is installed to measure SF<sub>6</sub>.

## Response Time

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

## Measurement Specifications<sup>1</sup>

Monitor-Setup	Response Times
S.I.T.: "Normal" (5 s) Flushing: Auto, (tube: 1 m)	One gas: ~27s 1 gas + water: ~40s
S.I.T.: "Low Noise" (20s) Flushing: Auto, (tube 1 m)	1 gas + water: ~70s
S.I.T.: "Fast" (1s) Flushing: Chamber 4s, Tube "OFF"	One gas: ~13s 1 gas + water: ~22s

**Detection Limit:** 0.006 ppm at 5 S.I.T.

**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<sup>4</sup> per 3 months<sup>1</sup>.

Influence of temperature<sup>2</sup>: +/- 10 % of detection limit<sup>4</sup>/°C.

Influence of pressure<sup>3</sup>: +/- 0.5 % of detection limit<sup>4</sup>/mbar.

**Repeatability:** 1 % of measured value<sup>1</sup>

**Range Drift:** +/- 2.5 % of measured value per 3 months<sup>1</sup>.

Influence of temperature<sup>2</sup>: +/- 0.3 % of measured value/°C.

Influence of pressure<sup>3</sup>: -0.01 % of measured value/mbar.

## Reference conditions:

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

<sup>2</sup> Measured at 1013 mbar, and RH: 60 %.

<sup>3</sup> Measured at 20 °C and RH: 60 %.

<sup>4</sup> Detection limit is @5s S.I.T.

**Acoustic Sensitivity:** not influenced by external sound.

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

## Internal Data Storage Capacity

Memory to store data is 131,072 measurement cycles. One cycle is measurement of SF<sub>6</sub> and water vapor on a given channel.

## General

**Pumping Rate (Gas Monitor):** 30 cm<sup>3</sup>/s (flushing sampling tube) and 5 cm<sup>3</sup>/s (flushing measurement chamber).

**External Pump Performance:** Distance up to 75m, Tube ID 3mm, Speed 4m/s

**Power Requirement:** 100-240 VAC +/- 10%, 50-60 Hz.

**Power Consumption:** 135 VA (monitor+sampler).

**Air Volume per sample:**

Flushing Settings	Volume of Air
Auto: Tube Length: 1m	140 cm <sup>3</sup> /sample
Fixed time: Chamber 2s, Tube 3s	100 cm <sup>3</sup> /sample
Fixed time: Chamber 2s, Tube "OFF"	10 cm <sup>3</sup> /sample

**Total Internal Volume:** The total Internal Volume of the measurement system: 60cm<sup>3</sup>

**Back-up Battery:** 3V lithium battery, life-time 5 years.

**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.

## Dimensions:

Height: 4U (monitor) + 4U (sampler)

Width: 483 mm (19 in)

Depth: 375 mm (14.8 in)

Weight: 24.5 kg (53.5 lbs)

## Communication

The remote/offline software (BZ7007) software communicates using the USB or Ethernet interface.

## Computer Requirements

### Hardware:


Pentium processor 2 GHZ Quad-core or equivalent. Min. 512 MB RAM. (4096 MB RAM on Windows 8). Min. 500 MB space available on hard disk.

### Software:

#### BZ7002/BZ7007:

Windows® 7, 8, 8.1, and Windows® 10.

**WARNING:** The 3731 system 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 system. Contact your LumaSense sales representative for further information.

	<b>COMPLIANCE WITH STANDARDS:</b> CE-mark indicates compliance with: EMC Directive and Low Voltage Directive.	
<b>Safety</b>	EN/IEC 61010-1 3rd Edition	Safety Requirements for electrical equipment for measurement, control, and laboratory use.
<b>EMC</b>	EN 61326-1:2006 (IEC 61326-1:2005) Electrical equipment for measurement, control and laboratory use – EMC requirements; Part 1: General requirements	
<b>Environment</b>	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 linearly to 50% relative humidity at 40 °C Pollution Degree 2 Installation category II Indoor Use	
<b>Enclosure</b>	IP20	

## LumaSense Technologies

## Awakening Your 6<sup>th</sup> Sense

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