

INNOVA 3731

SF₆ leak detection system for enclosed GIS substations.



The Innova® 3731 SF₆ leak detection system uses Photoacoustic Spectroscopy (PAS) for highly accurate, reliable, and stable quantitative gas detection. The Innova 3731 system leverages more than 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.

PRODUCT HIGHLIGHTS

- Standalone Multipoint SF₆ 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 SF₆-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

AT A GLANCE

Measurement Technique

Photoacoustic Infrared Spectroscopy

Filter Capacity

Up to 5 + water

Detection Limit

Gas dependent, but typically in the ppb region

Repeatability

1% of measured value

OVERVIEW

Regulatory frames, like the European F-Gas Directive (EC 517/2014), are mandating the use of leak detection systems in the vast majority of high-voltage SF₆-GIS installations in order to better mitigate the risk of SF₆ emissions. Specifically, 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.

The Innova 3731 system leverages more than 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

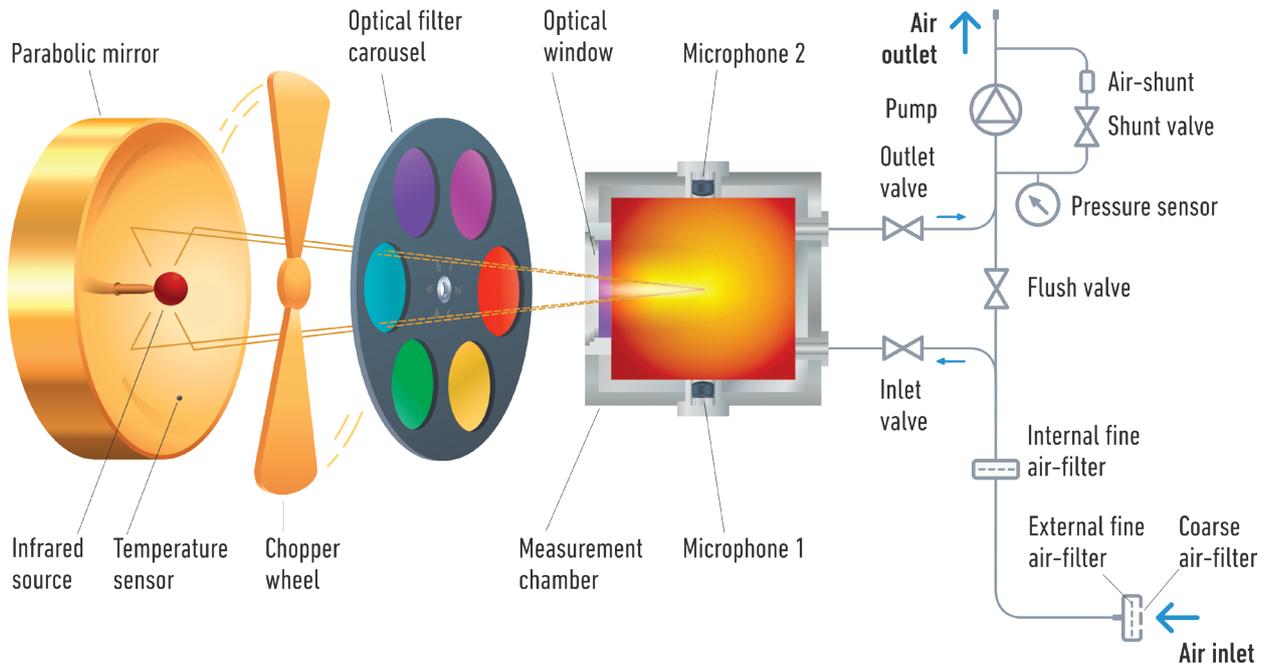
Equipment operates below the industrial target of 0.5% yearly leakage rate or better.

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

Multipoint Sampling

With a multipoint sampler for 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.

PHOTOACOUSTIC SPECTROSCOPY (PAS)



MEASURING DETAILS

Operation

The Innova 3731 leak detection system operates in standalone mode using the gas monitor as 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.

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. The units communicate 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 by using a defined stop time.

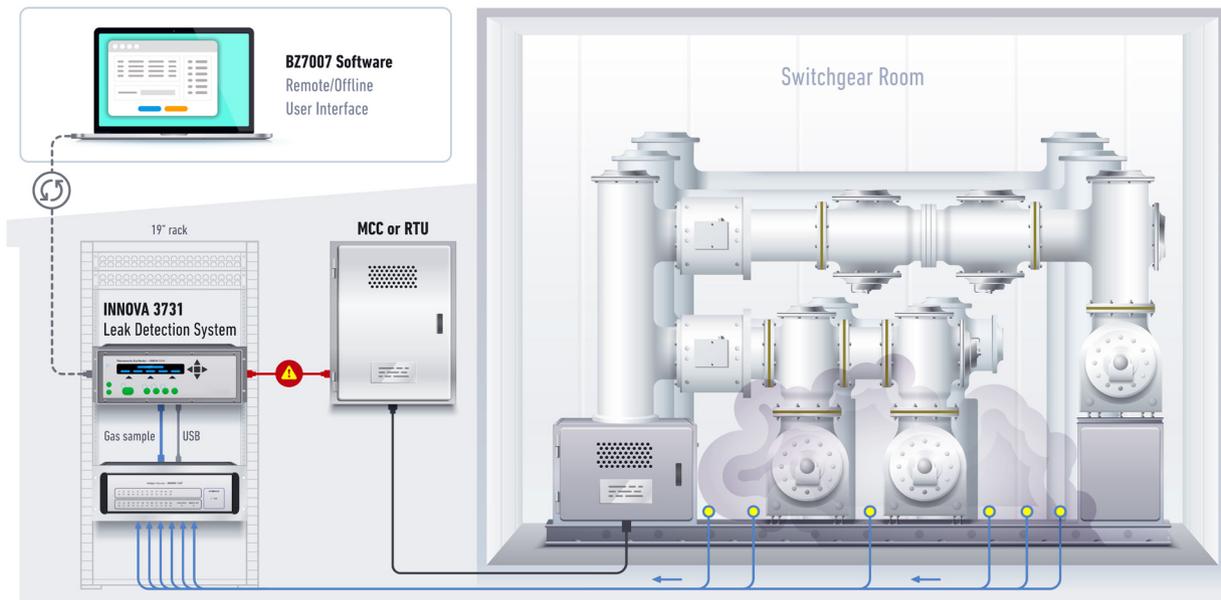


Figure 1: The Innova 3731 SF₆ leak detection system features ultra-high sensitivity with state-of-the-art photoacoustic monitor. It draws air samples from up to 24 locations for maximum coverage of the GIS substation. Tubing lines can easily run into existing control cable trays, or trenches. Analog and alarm relay outputs can be connected to local RTU.

TECHNICAL DATA

Measurement Specifications							
Measurement Technique	Photoacoustic infrared spectroscopy The UA0988 optical filter is installed to measure SF ₆ .						
Response Times	Is dependent on the Sample Integration Time (S.I.T.) and the flushing time defined						
	<table border="1"> <tr> <td>S.I.T.: "Normal" (5 s) Flushing: Auto, (tube 1 m)</td> <td>One gas: ~27 s One gas + water: 40 s</td> </tr> <tr> <td>S.I.T.: "Low Noise" (20 s) Flushing: Auto, (tube 1 m)</td> <td>One gas + water: 70 s</td> </tr> <tr> <td>S.I.T.: "Fast" (1 s) Flushing: Chamber 4 s, (tube "OFF")</td> <td>One gas: ~13 s One gas + water: 22 s</td> </tr> </table>	S.I.T.: "Normal" (5 s) Flushing: Auto, (tube 1 m)	One gas: ~27 s One gas + water: 40 s	S.I.T.: "Low Noise" (20 s) Flushing: Auto, (tube 1 m)	One gas + water: 70 s	S.I.T.: "Fast" (1 s) Flushing: Chamber 4 s, (tube "OFF")	One gas: ~13 s One gas + water: 22 s
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S.I.T.: "Fast" (1 s) Flushing: Chamber 4 s, (tube "OFF")	One gas: ~13 s One gas + water: 22 s						
Detection Limit	0.006 ppm @ 5 S.I.T.						
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						
	<table border="1"> <tr> <td>Influence of temperature³</td> <td>±10% of detection limit¹/°C</td> </tr> <tr> <td>Influence of pressure⁴</td> <td>±0.5% of detection limit¹/mbar</td> </tr> </table>	Influence of temperature ³	±10% of detection limit ¹ /°C	Influence of pressure ⁴	±0.5% of detection limit ¹ /mbar		
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Repeatability	1% of measured value ²						
Range Drift	±2.5 of measured value per three months ²						
	<table border="1"> <tr> <td>Influence of temperature³</td> <td>±0.3% of measured value/°C</td> </tr> <tr> <td>Influence of pressure⁴</td> <td>-0.01% of measured value/mbar</td> </tr> </table>	Influence of temperature ³	±0.3% of measured value/°C	Influence of pressure ⁴	-0.01% of measured value/mbar		
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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 131072 measurement cycles. One cycle is measurement of SF ₆ and water vapor on a given channel.						

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 (19") x 4U (monitor) + 4U (sampler) x 375 mm (14.8")
Weight	24.5 kg (53.5 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 limit¹ 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).	
External Pump Performance	Distance up to 75 m, Tube ID 3 mm, Speed 4 m/s	
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 to 60 Hz
Power Consumption	~135 VA (monitor and sampler)
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
Monitor Interface	Three interfaces: USB, Ethernet, and RS232, for data exchange and remote control of the instrument
Software Communication	Via 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

Safety and Standards Specifications	
Safety	EN/IEC 61010-1 3rd Edition: Safety Requirements for electrical equipment for measurement, control, and laboratory use
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

Warning

The Innova 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 Advanced Energy sales representative for further information.

Scope of Delivery

- Photoacoustic gas monitor with analog/relay module
- Multipoint sampler
- External pump
- Nylon tubing (20 m per channel)
- Airfilter with fittings
- Remote/offline and calibration software
- User manuals

Optional Accessories

- LumaSoft Gas Multi-Point software (online monitoring)

Note

The gas monitor is delivered with the UA0988 optical filter installed. It also features zero-point, humidity interference, SF₆, and water vapor scan calibration.

ADDITIONAL SYSTEM DETAILS

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.

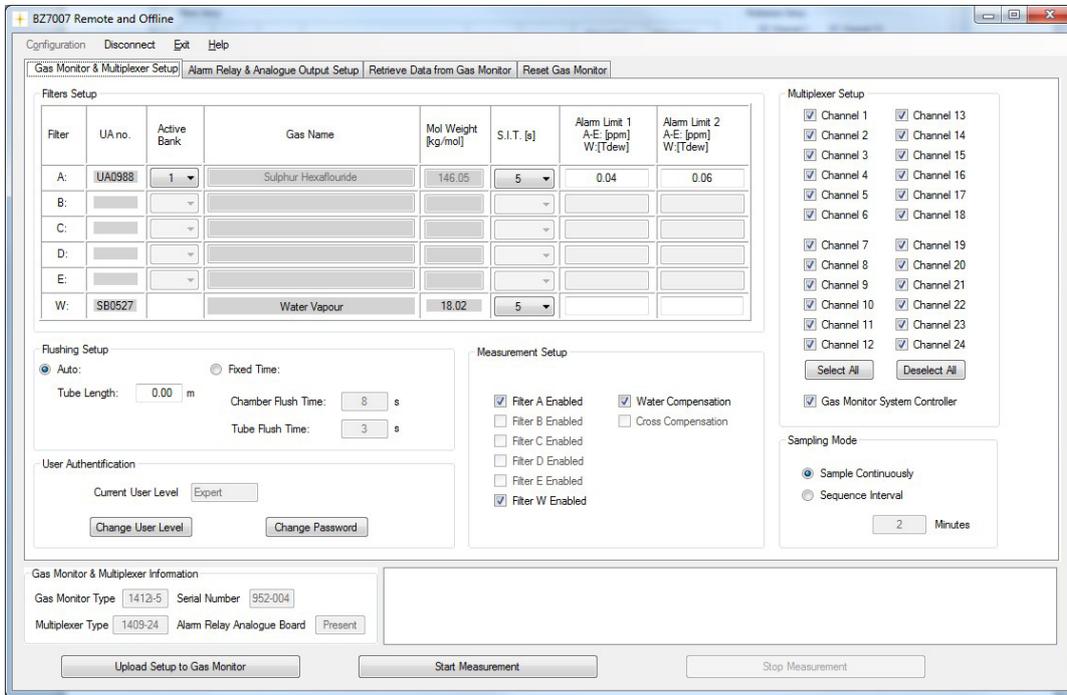


Figure 2: User interface window from the BZ7007 for the complete setup of the monitoring and sampling tasks to be performed by the standalone measurement system. It also reports the current status of the system to which it is connected, and enables the user to start/stop the measurement task.

ADDITIONAL SYSTEM DETAILS (CONTINUED)

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.

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.

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.

OPTIONS AND ACCESSORIES

Multiple Point Monitoring

7880	LumaSoft Gas Multi Point (online monitoring)
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