LumaSense™ TECHNOLOGIES

Multipoint Sampler and Doser – INNOVA 1303

Uses:

- Air sampling in six locations, and delivery of the sample to a Photo-acoustic Field Gas-Monitor – INNOVA 1412
- Delivery of tracer-gas to six locations for air-exchange analyses with a 1412

Features:

- Full remote-control from a personal computer over the IEEE488/IEC 625-1 interface
- Six sample-input channels
- Six tracer-gas dosing channels
- Six temperature-transducer inputs
- Automatic calculation of the amount of tracer-gas delivered, to the dosing location
- Discontinuous dosing facility
- Self-calibrating dosing system
- Self-test function
- Pneumatic system constructed of AISI-316 Stainless Steel and PTFE tubing to minimize gas adsorption

Introduction

Increasing numbers of legislative measures are aimed at improving air quality in working place environments, for both employee comfort and safety. Such improvements in air quality require gas-monitoring equipment with the flexibility to provide sensitive and accurate monitoring under many different conditions, in different environments.

The Multipoint Sampler and Doser – INNOVA 1303 is remote-controlled from a personal computer over the IEEE488/IEC625-1 interface, and is used in conjunction with a Photoacoustic Field Gas-Monitor – INNOVA 1412 to provide a monitoring system which fulfills the above requirements of flexibility, sensitivity and accuracy.

The 1303 greatly increases the area monitoring capabilities of the 1412 by drawing air-samples through tubing from up to six different sampling points each being up to 50m distant and delivering the samples to the 1412.

Comprehensive air-exchange analyses and ventilation-efficiency checks are easily performed using the dosing facilities of the 1303. Tracer-gas is delivered through tubing to 'label' the air in up to six different locations, each being up to 50m away; the amount of tracer-gas delivered is automatically calculated by the 1303. The 'labelled' air is then sampled by the 1303, and delivered to the 1412 for analysis. Up to six temperature transducers, connected to the 1303, can be positioned at the sampling/dosing points to give information about the environment at that point. The 1303's self-calibrating and self-checking routines allow easy checks of the unit's operation, and ensure reliable functioning.

Description and Functions

The Sampler System

The pneumatic system of the 1303 is shown schematically in Fig.1. The sampler system is constructed of AISI-316 stainless steel and PTFE (polytetra-fluoroethylene) tubing to minimize adsorption of samples. The system has six inlet channels, each with a solenoid valve. Each inlet channel has a tube-mounting stub on the front-plate of the 1303.

Six tubes of up to 50m length connect each channel to the respective sampling point. The six inlet channels converge into one; a three-way valve can then direct the gas sample to the 1412 for analysis, or through the pump to the waste-air outlet on the 1303's back-plate. A pressure transducer checks the efficiency of the sampling pump and allows checks for blocked airways.

An air-filter is attached to the end of each sampling tube to keep the samples free of particles.

The Doser System

The doser system has six outlet channels, each with a solenoid valve. Each channel has a nozzle which reduces the internal diameter of the channel. The nozzles ensure that the rate of flow of tracer-gas to the dosing points is dependent only upon the tracer-gas supply pressure and temperature, and is unaffected by the pressure in the dosing tubes or at the dosing point itself.

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Three different nozzle sizes are used: one small (nozzle 1), four medium (nozzle 2-5) and one large (nozzle 6). Each size gives a different volume flow rate so that the amount of tracer-gas delivered to a particular dosing point can be matched to the requirement at that point by using the outlet channel which has the appropriate nozzle.

Each of the six dosing outlet channels has a tube-mounting stub on the front plate of the 1303. Six tubes of up to 50m length connect each stub to the respective dosing point.

Two separate inlet channels mounted on the backplate of the 1303 serve the dosing channels: the tracer-gas inlet, and the carrier-air inlet.

The tracer-gas inlet channel is pressurized by the tracer-gas supply cylinder, which is connected to the inlet on the 1303's backplate by tubing. A pressure and a temperature transducer give information on the tracer-gas supply; a fine filter ensures that the dosing channels are particle-free. The main valve on the tracer-gas inlet channel is used to enclose a volume of tracer-gas between itself and the dosing valves. This volume is used when calibrating the doser system. The carrier-air inlet pumps extra air to the dosing outlets to speed delivery of the tracer-gas to the dosing point. This inlet has a coarse air-filter, a pump, and a pressure transducer for checking the efficiency of the pump. Delivering a dose of tracer-gas to a dosing point 50m distant takes one minute.

The dosing system can deliver a continuous dose, that is, an uninterrupted flow of tracer-gas over a period of time; or a discontinuous dose, in which the amount of tracer-gas delivered is reduced by interrupting the flow at regular intervals during the dosing period.

The doser system is set up for use by specifying a dosing time-out such that the 1303 will stop any current dosing procedure after a given time has elapsed without instructions from the controlling computer. This value is specified from the controlling computer.

Calibrating the Doser System

The 1303 can calibrate each dosing-nozzle automatically, so that the amount of tracer-gas delivered during a dosing procedure can be accurately determined by the 1303. A volume of tracer-gas is enclosed between the main valve and the dosing valves; this volume is then released through the nozzle to be calibrated. As the internal volume of the airways are known, the effective outflow area for each nozzle is calculated from the rate of pressure-decrease measured in the dosing airway. The amount of tracer-gas delivered can then be calculated from the effective outflow area, the tracer-gas supply pressure and temperature, and the dosing time-period.

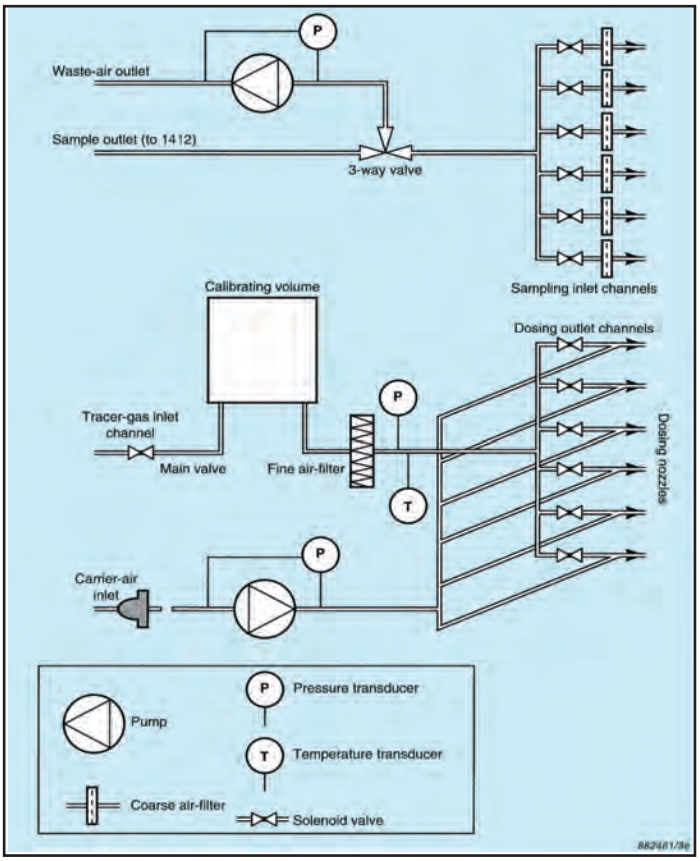

Fig.1 A schematic diagram of the 1303's pneumatic system: the sampler system is depicted at the top, the doser system at the bottom. The use of non-reactive materials throughout minimizes gas adsorption in the internal air-channels.

Temperature Measurement

To complete the information about the air environment at the sampling/dosing points, the 1303 is equipped with six temperature transducer inputs, suitable for use with Air Temperature Transducer MM0034, Surface Temperature Transducer MM0035 and Operative Temperature Transducer MM0060. Each transducer can be positioned up to 50m away from the 1303.

Reliability

Reliability is ensured by automatic self-tests of both hardware and software. A check of the pneumatic system can be performed on request by the controlling computer. The 1303's operating status can be read-out at any time: if an error exists, the type of error is given to help repair.

Control of the 1303

The 1303 is fully remote-controlled from a personal computer over the IEEE/IEC interface. Control via the 1412 is also possible: the controlling computer communicates with the 1412 over the RS232 interface; the message is then transferred to the 1303 via the IEEE/IEC interface. Commands and information requests are sent over the interface in clear language to the 1303 to control the sampler system; to set-up, calibrate, and control the dosing system; and to read-out data and command the performance of self-tests.

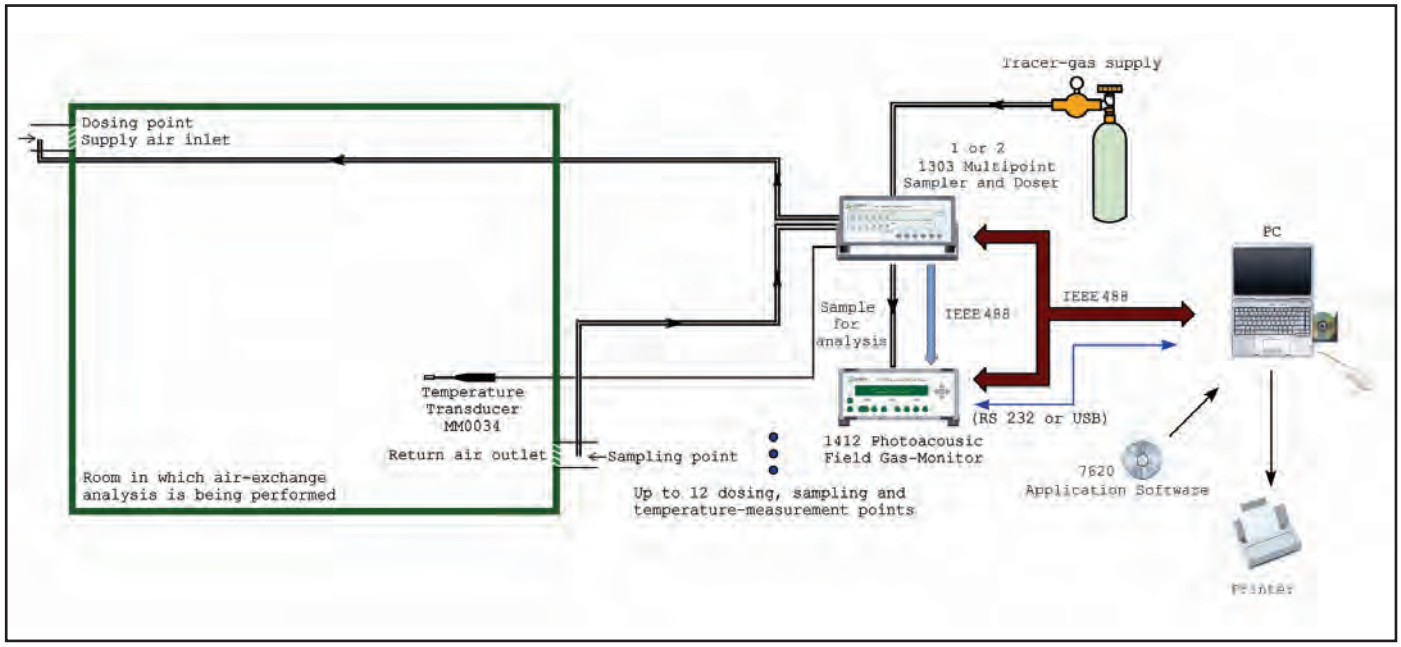

Fig.2 A typical air-exchange analysis system, shown with an application example. In this case, the aim of the analysis is to determine the size of the air-change in the mechanically ventilated room. The diagram shows only one dosing and sampling point, for clarity. Up to six similar analyses can be performed simultaneously using one 1303. Application Software 7620 gives control of all the functions of the system.

System Use

The 1303 combines with the 1412 and a controlling computer to provide a system which offers wide-ranging monitoring capabilities. The 1303 makes it possible to perform multi-point air-exchange analyses and multi-point monitoring tasks in many different situations and environments, without changing the system components.

An example air-exchange analysis system is shown in Fig.2. In such a system, the doser/sampler systems of the 1303 are used as follows. The doser system marks the supply-air of the room with a known amount of tracer-gas. The sampler system then takes a sample of the return-air from the room, and delivers the sample to the 1412 for analysis. While the 1412 performs one analysis, the 1303 takes the next sample for analysis from the room. As the amount of tracer-gas delivered to the room is known, and the remaining concentration of tracer-gas in the samples is determined by the 1412, the ventilation-system performance can be calculated.

LumaSense Technologies' Application Software – INNOVA 7620 for control of Tracer-gas Monitoring Systems is available to give full coordination and control of all the dosing/sampling and monitoring functions of such systems. The 7620 controls one 1412 and up to two 1303 units.

A similar system set-up can be used for multi-point, multi-gas monitoring, using only the 1303's sampler system. This system can be remotely-controlled using LumaSense Technologies' Application Software for Gas Monitoring – INNOVA 7300. The software coordinates the functions of the monitor and up to two multiplexers, which, via tubing, can perform gas-monitoring tasks in up to 12 different locations.

Both the 7620 and 7300 software display data in easy to read windows.

Ordering Information

1303 Multipoint Sampler and Doser

Includes the following accessories:

2xVF0032	Fuse 630mA
2xVF0027	Fuse 1.25A
3xYM0652	Knurled nuts to secure tubing to nozzles
AT2247	Nylon tubing for connection of tracer-gas supply (1.5 m)

Mains cable
Instruction Manual

Optional Accessories

7300	Application Software (monitoring only)
7620	Application Software (for dosing and sampling)
MM0034	Air Temperature Transducer
MM0035	Surface Temperature Transducer
MM0060	Operative Temperature Transducer
AO0265	IEEE488 Interface cable
WL0845	IEEE488 Interface cable for connecting 1303 to 1412 (1m)
AF0614	PTFE tubing
AF0005	Red nylon tubing
AF0006	Green nylon tubing
AF0007	Nylon tubing
UD5023	External air-filter
DS0759	Filters (25) for air-filter unit (UD5023)

Specifications – INNOVA 1303

WARNING!
The 1303 must not be placed in areas with flammable gases/vapours in explosive concentrations, or be used for tasks in which explosive concentrations of these gases/vapors are monitored. Also note that certain aggressive gases could damage the internal airways of the 1303. Ask your LumaSense Technologies' representative for further information.

SAMPLING SYSTEM:
The following pressure and volume-flow data assumes the use of tubing of length 50m and Internal diameter 3mm
Pump Performance:
Working pump suction: 20kPa
Volume flow rate: 15ml/s
Sample transport speed: 2m/s
Three-way valve routes samples either to waste-air outlet or to the connected 1412
Minimum pressure, blocked airways: 40kPa
Maximum leakage into system: 10µl/s at 30kPa suction and 10ml/s volume flow

DOSING SYSTEM:
The following pressure and volume-flow data assumes the use of Sulphur Hexafluoride (SF_6) as tracer-gas, and Nylon tubing of length 50m and internal diameter 3mm
Pump Performance:
Minimum working pump-pressure: 10kPa
Volume flow rate of supplementary air per dosing channel: 4 ml/s
Tracer-gas Supply:
From pressurized cylinder
Maximum supply pressure:450kPa absolute
Minimum supply pressure: 300kPa absolute
Volume flow rate of tracer-gas at supply pressure of 300kPa absolute:
Small: Approximately 0.5ml/s (nozzle no.1)
Medium: Approximately 3.0ml/s (nozzle no. 2-5)
Large: Approximately 15.0ml/s (nozzle no. 6)
Max, time taken to deliver a dose of tracer-gas over a 50m distance through standard tubing: 1 minute
Pressure Transducer (Tracer-gas Supply):
Measurement range: 0 - 500kPa
Internal Volume of Doser System: 70ml
Accuracy of Dosage Calculation: ± 2%
Maximum Leakage from Doser System: 0.4µl/s at 400kPa supply pressure absolute

TEMPERATURE TRANSDUCER INPUTS:
Compatible with: Air Temperature Transducer MM0034; measurement range: -20 to + 50°C (-4 to 122°F)
Surface Temperature Transducer MM0035; measurement range: -20 to + 100°C (-4 to 212°F)
Operative Temperature Transducer MM0060; measurement range: -20 to + 50°C (-4 to 122°F)

SET-UP PARAMETERS:
Three set-up parameters are used
Dosing Time-out: specifies the maximum time for which the 1303 will supply a dose of tracer-gas without further instructions from the controlling computer. Range of values: 1-3600s; default value: 60s
Characteristic Gas Constant: the ratio, $^R/_M$, of the universal gas constant (R = 8314 $Jmol^{-1}\ K^{-1}$) and the gram molecular weight (M, $gmol^{-1}$) of the tracer-gas used
Range of values: from 1 - 10000
Calibration Data: the effective outflow area of a specified dosing nozzle: measured in m^2*10^{-9}

IEEE INTERFACE:
Conforms with IEEE Std. 488-1978, compatible with IEC 625-1. All functions of the 1303 are controlled over the interface; output of status information and dosing data

Functions Implemented:
Source Handshake - SH 1
Acceptor Handshake - AH 1
Talker - T5
Listener - L3
Service Request - SR 1
Parallel Poll - PP 1
Device Clear - DC 1

POWER SUPPLY:
100 - 127V; 200 - 240V AC 50 - 400Hz, 70VA Complies with Safety Class I of IEC Publication 536

DIMENSIONS:
Height: 175 mm (6.9 inch)
Width: 395mm (15.6 inch)
Depth: 300mm (11.8 inch)
Weight: 9kg (19.8 lbs)

CE	**COMPLIANCE WITH STANDARDS:** CE-mark indicates compliance with: EMC Directive and Low Voltage Directive.
Safety	**EN 61010-1 (1993) & IEC 1010-1 (1990):** Safety requirements for electrical equipment for measurement, control and laboratory use.
EMC Emission	**EN 50081-1 (1992):** Generic emission standard. **Part 1:** Residential, commercial and light industry. **EN 50081-2 (1993):** Generic emission standard. **Part 2:** Industrial environment. **CISPR 22 (1993):** Limits and methods of radio disturbance characteristics of information technology equipment. Class B Limits. FCC Class B Limits.
EMC Immunity	**EN 50082-1 (1992):** Generic immunity standard. **Part 1:** Residential, commercial and light industry. **EN 50082-2 (1995):** Generic immunity standard. **Part 2:** Industrial environment. *Note: The above is guaranteed using accessories listed in this Product Data sheet only.*
Temperature	**IEC 68-2-1 & IEC 68-2-2:** Environmental Testing. Cold and Dry Heat. **Operating Temperature:** +5°C to +40°C (41°F to 104°F) **Storage Temperature:** -25°C to +70°C (-13°F to 158°F)
Humidity	**IEC 68-2-3:** 90% RH (non-condensing at 40°C)
Enclosure	**IEC 529:** IP 20
Mechanical	**IEC 68-2-6:** Vibration: 0.3 mm, 20 m/s^2, 10-500 Hz **IEC 68-2-27:** Shock: 1000 m/s^2 **IEC 68-2-29:** Bump: 3000 bumps at 250 m/s^2

LumaSense Technologies reserves the right to change specifications and accessories without notice.

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