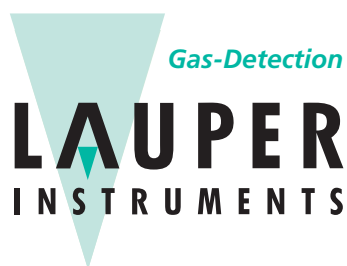




# Instruction Manual

## Multipoint Sampler INNOVA 1409



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# 1409 Multipoint Sampler

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## Safety Considerations

# SAFETY CONSIDERATIONS

**PLEASE READ THESE SAFETY CONSIDERATIONS CAREFULLY AND MAKE SURE YOU UNDERSTAND THEM PROPERLY BEFORE YOU START OPERATING THE 1409 MULTIPOINT SAMPLER.**

### EXPLOSION HAZARD



**THE 1409 MULTIPOINT SAMPLER IS NOT DESIGNED FOR USE IN POTENTIALLY EXPLOSIVE ENVIRONMENTS.**

This means that the instrument must **not** be placed and operated in an area with a potentially explosive atmosphere.

When monitoring potentially flammable or toxic gases it is essential that:

- 1) the instrument itself is placed in a well-ventilated area **outside** the potentially hazardous zone; and
- 2) a sufficiently long tube is connected to the "Sampler Waste Air Outlet" so that the sampled gas is carried **away** to the open air or to an extraction and/or filtration unit.

**TO AVOID THE POSSIBILITY OF AN EXPLOSION, MONITORING OF FLAMMABLE GASES IN EXPLOSIVE CONCENTRATIONS MUST NEVER BE ATTEMPTED.**



**AVOID WATER CONDENSATION IN THE INSTRUMENT.**

Liquids must be prevented from entering the instrument. It is therefore important that warm humid gases are not drawn into a cold instrument because condensation will take place. If such a situation is likely to occur you should ensure that the gases are drawn through water-trap filters before they enter the sampler channels of the 1409. This will remove water vapour in the gases and thus prevent condensation within the instrument. The water-trap filter should be used in the immediate environment of the instrument so it maintains either the same temperature, or a lower temperature than the instrument.

## SAFETY CONSIDERATIONS

The 1409 Multipoint Sampler complies with EN/IEC 61010-1 3<sup>rd</sup> Ed. (2010): Safety requirements for electrical equipment for measurement, control and laboratory use. To ensure safe operation and retain the 1409 in safe condition, note the following:

### APPLYING POWER

Before using the 1409 check that the available mains voltage match the specified voltage and frequency for the instrument.

### CONNECTING TO THE USB-CONNECTOR

The USB connector is only to be used to connect to LumaSense A/S Gas Monitors 1512, 1412i, 1314i, and 3434i.

### SAFETY SYMBOLS



The apparatus is marked with this symbol when it is important that the user refer to the associated warning statements given in the User Manual.



Frame or Chassis



Protective earth



Hazardous Voltage

### WARNINGS

Before connecting or disconnecting interface cables, switch off the power to all instruments.

To secure that safety is not impaired the instrument is only to be used according to the description in this User Manual BE6037.

Whenever it is likely that correct function or operating safety of the apparatus has been impaired, the apparatus must be made inoperative and secured against unintended operation.

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# Chapter 1

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## Description and Functions

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## 1.1 Description and Function

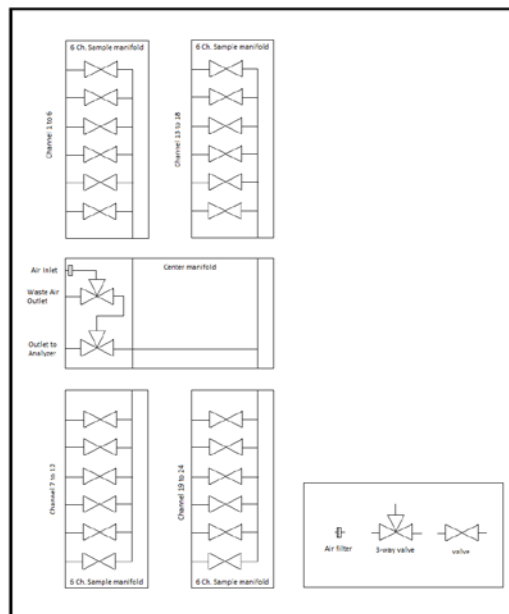
### 1.1.1 The Sampler System

The pneumatic system of the 1409 is shown schematically in Fig.1.1. The sampler system is constructed of stainless steel (AISI 316) to minimize adsorption of samples. 1409 is delivered with 6, 12, 18 or 24 channels. All inlet channels are with a solenoid valve. Each inlet channel has a tube-mounting stub on the back-plate of the 1409; to connect each channel to the respective sampling point. The inlet channels converge into one; a three-way valve then directs the gas sample to the Gas Monitor for analysis, or through the waste-air outlet on the 1409's back-plate.

An external pump (option) can be connected in the airway system to the waste air outlet.

The 1409's sampler system functions efficiently, transporting gas samples from the sampling point at approximately 4 metres per second. However, this speed depends on the type of pump, the diameter of the tubing and the length of tubing attached to the 1409. An air-filter is attached to the end of each sampling tube to keep the samples free of particles.

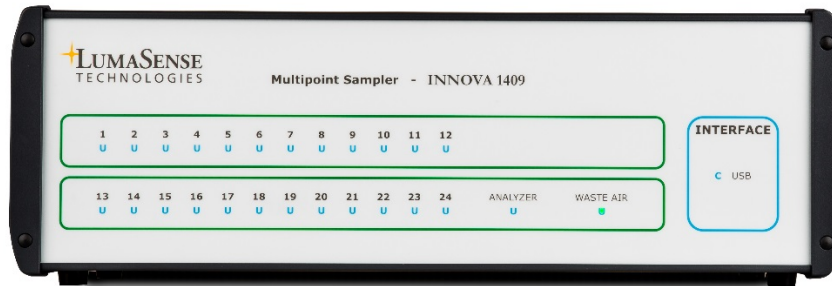
*Fig. 1.1 A schematic diagram of the 1409's pneumatic system.*





## 1.2 Front Panel

Fig.1.2 The front panel of the 1409



### LED indicators:

Each channel is numbered, and has a correspondingly-numbered lamp. When the lamp is lit, it indicates that the corresponding sampling valve is open, see [section 3.3](#).

The **Analyzer** and **Waste Air** lamps indicate which way the internal 3 way valve is set, see [section 3.3](#).

### Interface:

1 lamp indicates that the USB interface is connected.

## 1.3 Back Panel

Fig.1.3 The back panel of the 1409



- Sampler:** From 6 to 24 mounting stubs depended on the 1409 version for connection of tubing to sampling points. Each stub is numbered, and has a correspondingly-numbered lamp on the Front Plate. When the lamp is lit, it indicates that the corresponding sampling valve is open.
- AC Mains:** A 3-pin connector accepting Power Cable for connection to a single phase AC mains supply with protective Earth.
- Mains Voltage:** Connect 1409 to mains supply with 100-240 Vac, 50/60 Hz.
- Outlet to Analyzer:** Mounting stub for connecting the sampler system of the 1409 to the inlet of an INNOVA Gas Monitor via tubing. See [section 2.6.4](#). Usable models are 1512, 1412i, 1314i, and 3434i. In the following referred to as "Gas Monitor". Please contact LumaSense Technologies A/S for available models.
- Waste Air Outlet:** Mounting stub for connecting the external pump to the 1409's sampler system. See [section 2.6.4](#).
- Interface:** USB 2.0 Standard
- Air Inlet:** The Air Filter is used for an external pump to flush Air when it does not flush a Sample Channel.

## Chapter 2

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# Preparing to Use the 1409

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## 2.1 Preliminary

### 2.1.1 Environment and Handling

The Type 1409 Multipoint Sampler is designed for use in environments with temperatures between +5°C and +40°C (+41°F and +104°F) and with up to 80% relative humidity (non-condensing) at 31°C decreasing linearly to 50% relative Humidity at 40°C.

Make sure to leave some space between the Rear Panel and the Wall, or other obstacles, to ensure easy tube connect and access to the mains supply. No other special handling precautions are necessary.

### 2.1.2 Connecting the Mains Supply

The 1409 is operated from a 50 to 60 Hz single phase AC mains supply. Voltage 100 – 240 Vac.

Before connecting the mains supply, the following checks and adjustments should be performed to ensure safe operation of the 1409.

### 2.1.3 Checking the Power Cord

Use the Power Cord delivered with the 1409 or check that the Cord used is rated minimum 10A / 250V.

## 2.2 Connecting the 1409 to the Gas Monitor

The 1409 is connected to the Gas Monitor by the USB interface, over which the 1409 receives the commands and data, which control it. Further information about the cables available from LumaSense to connect the 1409 to the Gas Monitor and about the USB interface of the 1409, are given in [section 4.1](#).

## 2.3 Standalone Multipoint System use with a Gas Monitor

The 1409 can be used with a Gas Monitor in a Multipoint Standalone System.

In the Standalone System, the Gas Monitor is set-up to be the system controller. The system can either be set-up from the Gas-monitor's front panel or by using the BZ7007 Remote and Offline SW. The BZ7007 SW have two functions; set-up and retrieve data-blocks upon

request. Data can be transferred from the Standalone System as excel sheets hence ready to save.

Please consult the Stand Alone Multipoint System (BE6043) and BZ7007 (BE6042) user Manuals for further information.

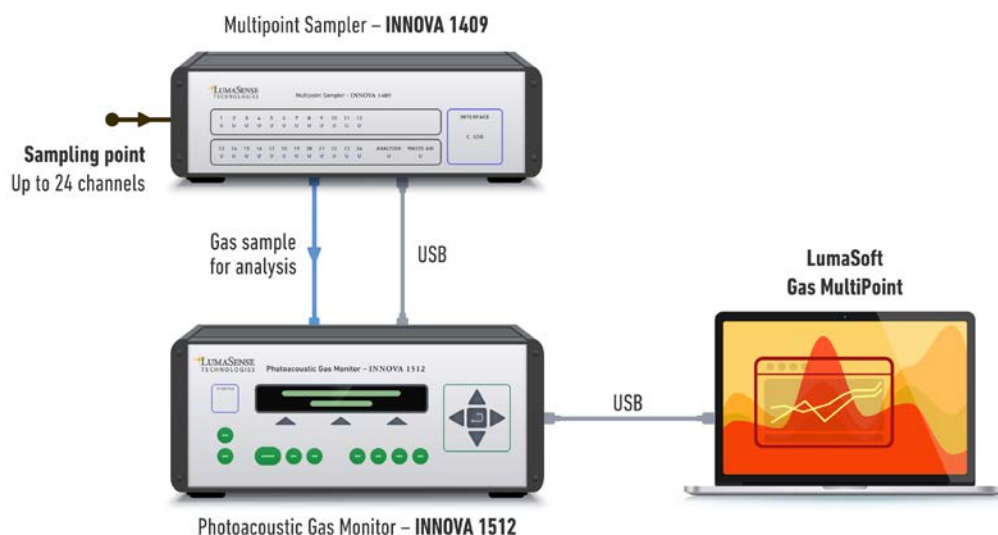
To use the Gas Monitor as the system controller in the Standalone Multipoint System serial number: 1314i 702-130, 1412i 713-500, 3434i 952-110 and 1512 110-001 or higher is required.

## 2.4 System Use with LumaSoft Gas 7880

The 1409 combined with a Gas Monitor and a controlling computer with LumaSoft Gas Multipoint INNOVA-7880 provides a system that offers wide-ranging monitoring capabilities. The 1409 makes it possible to perform multipoint monitoring tasks in many different situations and environments, without changing the system components.

An example of a multipoint, multi-gas monitoring system is shown in [fig. 2.3](#). In such a system, the sampler system takes a sample of the return-air from the room, and delivers it to the Gas Monitor for analysis. While the Gas Monitor performs one analysis, the 1409 takes the next sample for analysis from the room.

*Fig. 2.3 A typical sampling system, shown with an application example. Up to 24 analyses can be performed simultaneously using one Type 1409. LumaSoft Gas Multipoint INNOVA - 7880 Application Software gives control of all the functions of the system.*



LumaSense Technologies has a 7880 Application Software to give full coordination and control of all the sampling and monitoring functions of such a system. The application software package can control one 1409 unit and one Gas Monitor.

## 2.5 Installing the 1409 in a 19" rack

When installing the 1409 Multipoint sampler in a 19" systems rack Place the Multipoint Sampler on a Shelf or support it by using Slide Rails.

Secure the Front frame to the 19" section with appropriate screws.

## 2.6 Connecting Tubing to the 1409

The 1409 is connected via tubing to:

- the sampling points;
- to the Gas Monitor being used to analyse the gases that are sampled;
- to the external pump ( optional).

**Note:** the performance of the 1409's sampling system is dependent on the type of external pump used and the length and diameter of the sampling tubing.

**Sampler** tubing for use with the 1409 is available from LumaSense: polytetrafluoroethylene (PTFE), 50m roll, accessory number AF0614.

Using this tubing material minimizes the risk of gases being adsorbed onto the tube's surface, which would result in inaccurate measurements.

**WARNING!** Avoid water condensation in the instrument.

Liquids must be prevented from entering the instrument. It is therefore important that warm humid gases are not drawn into a cold instrument because condensation will take place. If such a situation is likely to occur, you must ensure that the gases are drawn through water-trap filters before they enter the sampler channels of the 1409. This will remove the water vapour in the gases and thus prevent condensation within the instrument. Use the water-trap filter in the immediate environment of the instrument so it maintains either the same temperature, or a lower temperature than the instrument. See [section 2.6.3](#) for details of how to fit a water-trap filter.

## 2.6.1 Connecting Sampling Tubing

Before connecting sampling tubing to the 1409, determine approximately where the sampling points will be in the area to be monitored. This will allow you to estimate the length of tubing you need to connect to the mounting-stubs of the 1409.

To connect sampling tubing (see Fig.2.8):

*Fig.2.8 Attaching sampling tubing to the 1409's mounting stubs*



1. Remove the knurled nut from the mounting stub of the sampler channel you wish to use, on the front panel of the 1409.
2. Push one end of the length of PTFE through the non-threaded end of the nut.
3. Push the end of the tubing onto the mounting stub as far as it will go, and secure the tube by re-tightening the knurled nut onto the threads of the mounting stub.

## 2.6.2 Connecting External Filters to the Sampling Tubes

The external filters, LumaSense accessory number DS2306, and fitting, LumaSense accessory number UD5041 for one time use or UD5023 with changeable filters LumaSense number DS0759 (optional accessories) , protect the 1409's sampling airways from airborne particles such as dust, thus helping to prevent blockage of the airways.

*Fig.2.9 Fitting the external filter UD5023 to sampling tube*



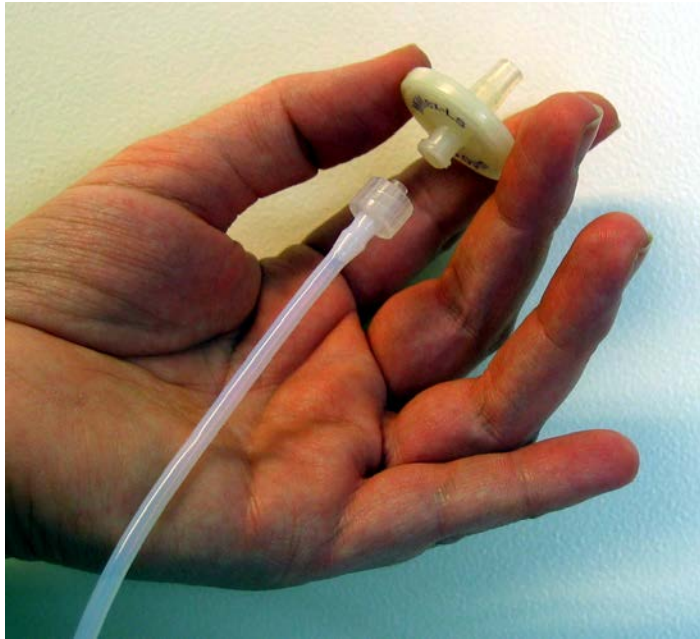
1. Remove the knurled nut from the UD5023 filter unit.
2. Push one end of the length of PTFE through the non-threaded end of the nut.

For filter replacement in the external filter UD5023 please refer to [section 5.1.1](#).

The filter unit DS2306 is attached to the tubing as follows (see figure 2.10):



*Fig.2.10 Attaching Fitting UD5041 and Filter DS2306 to sampling tubing*



1. Push the Fitting UD5041 into the tubing.
2. Screw the short stub of the Filter DS2306 into the Fitting.

### **2.6.3 Connecting a Water-trap Filter**

The In-line Genie Membrane Separator (LumaSense order no. UA1365) avoids condensation in the sampling and measuring instruments. Use the filter in the immediate environment of the instrument so it maintains either the same temperature, or a lower temperature than the instruments.

**Note:** some gases may be absorbed by the water trapped in the filter. This will reduce the gases' concentrations.

### ***To connect sampling tubing to the water-trap filter***

Push the sampling tubing into the connector as far as it will go and tighten the nut.

*Fig. 2.11 The In-line Genie Membrane Separator.*



**Note:** make sure that the gas flows through the filter in the direction indicated - shown by the arrows on the filter.

### ***To disconnect the sampling tubing***

Loosen the nut and pull the sampling tubing out of the connector.

## **2.6.4 Connecting the Sampler Outlet to the Gas Monitor**

This connection uses the same tubing (PTFE, LumaSense No. AF0614) as for the sampling tubes, [section 2.6.1](#). The tubing is connected to the **Outlet to Analyzer** stub on the rear panel of the 1409, and to the **Air Inlet** stub on the rear panel of the Gas Monitor. The tubing is connected as described in [section 2.6.1](#).

The **Waste Air Outlet** stub, next to the **Outlet to Analyzer**, (see [fig. 1.3](#)) stub on the rear panel of the 1409, connects the external pump (optional) to the 1409's sampler system. If you do not wish the waste air from the pump to mix with the air in the room where the 1409 is positioned, connect a length of PTFE tubing (LumaSense no. AF0614) to the waste air outlet stub on the external pump and direct the tubing to a suitable exhaust-point.

## **Chapter 3**

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## **Operation**

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All tasks performed by the 1409 are controlled over the USB interface from a System Controller; there is no other control possibility. This chapter deals with the control of the 1409 from the user's point of view; for details of the USB interface specifications, refer to [Chapter 4](#) of this manual.

[Sections 3.1](#) and [3.2](#) deal with switching-on and the general principles of controlling the 1409. [Section 3.3](#) describes the use of the Type 1409. [Chapter 4](#) deal with the specific commands and requests, known as *interface jobs*, which set-up and control the 1409. Each interface job is dealt with by giving an example which states the effect of the job. For quick reference, an overview of all interface jobs is given in [section 4.2](#) of this manual.

## 3.1 Switching-On

The 1409 can be switched on using the **AC Mains** switch on the back-plate. After switching-on, the 1409 is set as follows:

- The sampling-valves closed.
- Internal three-way valve set to **Waste Air Outlet**.

## 3.2 General Principles of Controlling the 1409

The 1409's functions are controlled over the USB interface using a range of commands and data requests, each of which is specific to a particular function or item of data. These commands and requests are known as *interface jobs*. This section describes the structure of the interface jobs used to control the 1409. Further details about the USB interface of the 1409 are given in [Chapter 4](#) of this manual.

## 3.3 Using the Sampler System

Using the 1409's sampler system, see [Fig. 1.1](#), to deliver a sample to the Gas Monitor is a 3-stage process:

1. The required sample valve is opened; all other sample valves are closed automatically.
2. The sample valve is connected to the **Waste Air Outlet** via the internal 3-way valve, allowing an external Pump (optional) to flush the 1409 with a fresh Gas sample from the Sampling point. see , [section 2.6.4](#)
3. When the new sample has been drawn to the 1409, the internal 3-way valve is set to direct the sample to the Gas Monitor. The Gas Monitor's pump draws the sample for analysis.

While the Gas Monitor is analysing this sample, the next sample can then be drawn ready for the next analysis.

Interface jobs control the sampling process. For further Information on the interface jobs see [Chapter 4](#).

## **Chapter 4**

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# **USB Interface and Interface Job Overview**

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## 4.1 Introduction

This chapter describes the USB communication with the 1409 Multipoint Sampler.

The digital interface of the 1409 Multipoint Sampler is designed according to USB 2.0 Standard.

The 1409 is connected to other instruments with USB interface using the LumaSense cable.

- USB Cable order number AS0001A

## 4.2 Overview of 1409 Interface Jobs

In this section, each 1409 interface job is grouped according to its function, with a short description of its effect. The correct syntax for each job is given.

USB is intended to be exchanged between the PCs and peripherals and data exchanged in binary blocks.

### 4.2.1 Data pipes

USB is configured for bulk communication.

USB uses logical "pipes" or "endpoints" to divide communication in several data channels. The first two endpoints is used to control the information, which is used to transfer system information, as for example the device description, which is displayed on a PC when connecting via USB without installed drivers.

To transfer data physical endpoint 4 and 5 are used, i.e. logical ENP2\_OUT and ENP2\_IN because the LPC176x CPU is dedicated for Bulk transfers of data blocks up to 64 bytes and is double buffered in the CPU.

### 4.2.2 Data syntax

For integer of byte size <low> <high> bytes are used. The highest bits are at the highest addresses.

When the 1409 receives data signals the start indicates if it is a request and the command.

All commands and responses start with: Command, offset and length:

USB_command	USB_index	USB_lenght
-------------	-----------	------------

After these first 3 bytes, follows more data, the number of bytes are specified by the USB length (although USB drivers also have a length specification).

If the most significant bit is set in the USB\_command, it is a write-only, where no response is to be generated.

### 4.2.3 Commands

The commands are grouped into blocks USB\_ID, USB\_CONFIG, USB\_STATUS, USB\_VALVES.

Command	Value	Read/write
USB-ID	1	R
USB_CONFIG	2	R
USB_STATUS	3/131	R/W
USB_VALVES	4/132	R/W

**Note** that the commands for **writing** in general are 128 (0x80) greater than for **reading**.

Each of these commands has its own indexing and are described in the following.

### 4.2.4 Identification

USB\_ID command is allowed to deviate from the general form, as the first bytes here can be

\* IDN?

The answer is ASCII text:



**"INNOVA, 1409,24,VP9999"**

(24 may also be 6, 12 or 18 depending on the number of channels in the 1409).

The command **USB\_ID**, is answered with a binary identification:

Index	Read	Write
0	Type Number (1409)	
2	3-Way valve configuration: 0: none 1: operational	
3	Valve count (6-24)	
4	Firmware version number	
5	Firmware subversion number	
6	Firmware VP number 1-9999	
8	Firmware build year ex. 2014	
10	Firmware build month 1-12	
11	Firmware build date 1-31	

### 4.2.5 Configuration

Configuration reads the number of valve blocks mounted.

Index	Read	Write
0	Valve Blocks 0..4	
1	Valve mask; bit 0..4	

The Valve Mask Bit 4 indicates whether the 3-way valves are mounted. When they are mounted, there will be 1-4 valve blocks in succession.

## 4.2.6 Status

Status indicates whether the device has been reset - and commands it to be reset. Status also includes a power failure, USB job errors and internal / software errors.

Index	Read	Write
0	Reset done , bit 0	0; to clear Reset done 1; to execute a Reset sequence
1	Power failure after reset, bit 0	0; to clear Power failure
2-3	Job errors 0-65535	0; to clear job error count
4-7	Soft Error address ( 4 bytes)	0; to clear Error Address
8-11	Current 12 V power(float)	
12-15	Lowest 12 V Power (float)	100.0 or another high value
16-19	Highest 12 V power (float)	0.0

## 4.2.7 Valve blocks and 3 - way valves.

There is an index for each of the four valve blocks with which valve to be open.

Index 0 indicates that all are closed.

Here, a bit mask, is used where bit position 0 and 1 controls the two 3-way valves. Internally the unit's valves are grouped with 6 valves in each block and 1-4 valve blocks are mounted with one center block with a three-way valve system.

Index	Read	Write
0	3-way valves	3-way valves
1	Valve 1-6 ; 0..6	Valve 1-6; 0..6
2	Valve 7-12; 0..6	Valve 7-12; 0..6
3	Valve 13-18; 0..6	Valve 13-18; 0..6
4	Valve 19-24; 0..6	Valve 19-24; 06

For index 1-4 valve blocks the value 0 means that all valves are closed, value 1-6 indicates which valve in the valve block is open.

## The 3-way Valves

Value	Description
0	Waste Air Active
1	Analyzer Valve active

### 4.2.8 Allowed valve settings

On receipt of a valve set, it is checked that it is valid with respect to the apparatus configuration of the valve.

#### The 3-way valves

- Only one valve in block 1-4 is set.
- The valve number is to be within the number in a mounted valve block.
- If all valves in block 1-4 is closed, the 3-way valve is not to be set to analyzer mode.
- If a valve in block 1-4 is open, then the three-way valve is to be in analyzer mode.
- Both bits of the 3-way valve setting must not be set simultaneously.

## **Chapter 5**

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# **Maintenance**

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## 5.1 Cleaning the Instrument

It is recommended to clean the Instrument using a soft damped cloth.

### 5.1.1 Changing the Filter-paper in the External Air-filtration Unit

Tools and equipment required:

Acetone (analytically pure)  
Spare fine filter-paper DS 0759  
Tweezers with Teflon coating  
Cotton buds

To change the filter-paper:

Switch off the Monitor.

Pull the external fine air-filtration unit off the end of the Teflon® sampling tube. Hold the stub-end of the external air-filter unit between your thumb and fingers, and unscrew the coarse air filter from the end of the Unit.

Remove the used (old) filter-paper and the retaining disc from the unit using the tweezers. Refer to [Fig.5.1](#).

*Fig.5.1 The parts of the external air-filtration unit UD 5023*



Moisten a cotton bud with pure acetone and use it to clean the surfaces of the unit, the retaining disc and the coarse air-filter. Refer to Fig.5.1.

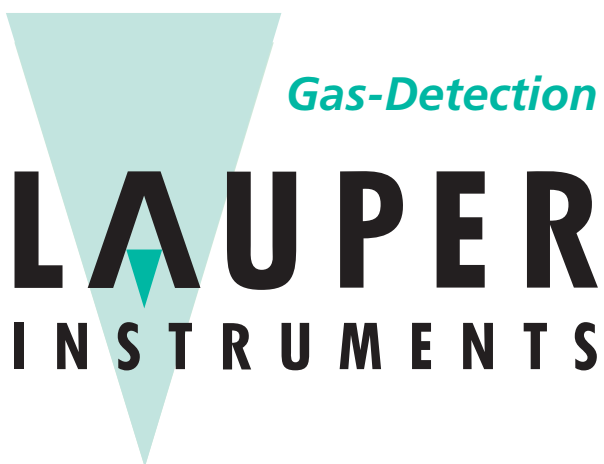
**Caution:** Make sure that no cotton fibres remain on the mesh of the retaining disc otherwise they could be sucked up into, and block the measurement system when the analyser is operated.

Reassemble when the acetone has completely evaporated from the cleaned surfaces.

**Note:** Each of the fine filter-papers DS 0759 are packed between two pieces of packing paper. The fine filter-paper is always white in colour.

## 5.2 Service and repair

The Type 1409 Multipoint Sampler is designed and constructed to provide the user with many years of safe, trouble-free operation. However, should a fault occur which impairs its correct function and operating safety, then it should be immediately disconnected at the mains source and secured against further operations. For repair contact your local [LumaSense Technologies A/S](#) service representative. Under no circumstances should repair be attempted by persons not qualified in the service of electronic instrumentation.



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