LumaSense™ TECHNOLOGIES

# Instruction Manual

## INNOVA -1316A-2
## Multi Gas Monitor

BZ6013 – 1316A-2 PC Software

BE6021-11

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# 1316A-2
# Multi Gas Monitor

# BZ6013 – 1316A-2 PC Software

February 2011

# Safety Considerations

The 1316A-2 Multi Gas Monitor is designed and tested to comply with EN 61010-1.2nd (2001) Safety requirements for electrical equipment for measurement, control, and laboratory use. The protection provided by the instrument may be impaired if not used as specified by LumaSense Technologies A/S. To ensure safe operation and retain the monitor in safe condition, special note should be made of the following:

## Explosion Hazard!

TO AVOID THE POSSIBILITY OF AN EXPLOSION, MONITORING OF FLAMMABLE GASES **IN EXPLOSIVE CONCENTRATIONS** MUST NEVER BE ATTEMPTED.
Never operate this monitor in potentially explosive environments.

When monitoring potentially flammable or toxic gases it is essential:

- The instrument itself is placed in a well-ventilated area **outside** the potentially hazardous zone; and
- That a sufficiently long tube is connected to the **Gas Outlet** on the back panel so that the sampled gas is carried **away** to the open air or to an extraction and/or filtration unit.

## Warnings!

- Water condensation in the instrument will damage it severely, and must therefore be avoided.
- Switch off all equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment.
- Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, the apparatus must be made inoperative and be secured against unintended operation.
- Any adjustment, maintenance and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out by trained service personnel only.

## Applying power

Before using this apparatus, verify that the correct fuses are installed.

The instrument must always be operated with its chassis at earth potential. Only use power outlets that can supply an earth to the instrument.

## Safety Symbol

⚠ Caution: Refer to associated instructions given in this Manual.

# About this Manual

This Reference Manual is for a monitoring system comprising a 1316A-2 Multi Gas Monitor and its associated PC software package BZ6013.

The software for 1316A-2 is available in a Windows® XP version, Vista and Windows 7 version as:

BZ6013 for 1316A-2 Multi Gas Monitor

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# Chapter 1

# Introduction and Specifications

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## 1.1 Broad Overview

The 1316A-2 Multi Gas Monitor simultaneously measures the concentration of up to 4 Gases. The concentration of each gas is expressed as ppm or a volume percentage referenced to dry gas condition.

The measurement principles are based on Non Dispersive Infrared (NDIR) and Electrochemical Sensors. A full discussion of these principles is contained in section 1.4.

The monitor is designed to be integrated into permanent monitoring systems to provide fast and accurate measurement results over a wide range of concentrations.

The monitor comes complete with PC software that allows you to configure and calibrate the monitor prior to measuring, display the measurement data numerically and/or graphically while measurements are being made. The stored data can be recalled at a later stage for closer examination.

## 1.2 Monitor System Description

Fig.1.1 shows a flow diagram of the 1316A-2 Multi Gas Monitor.

There are three basic blocks:

1. Pneumatic with pump and three-way-valve.
2. Control Software and PC Interface
3. NDIR Module VM0100A and Module (UA1372) with Electro Chemical Sensors

### 1.2.1 Control Software and PC Interface

This block contains microprocessor based electronics that take care of interfacing the monitor to a PC via an RS-232 or USB link, send control data to the measuring system and receive measurement data from the measuring system.

There are no external controls on the monitor apart from the mains On/Off switch. All configuration of the monitor is, therefore, done over the serial link or USB link using a PC running the specially developed BZ6013 software.

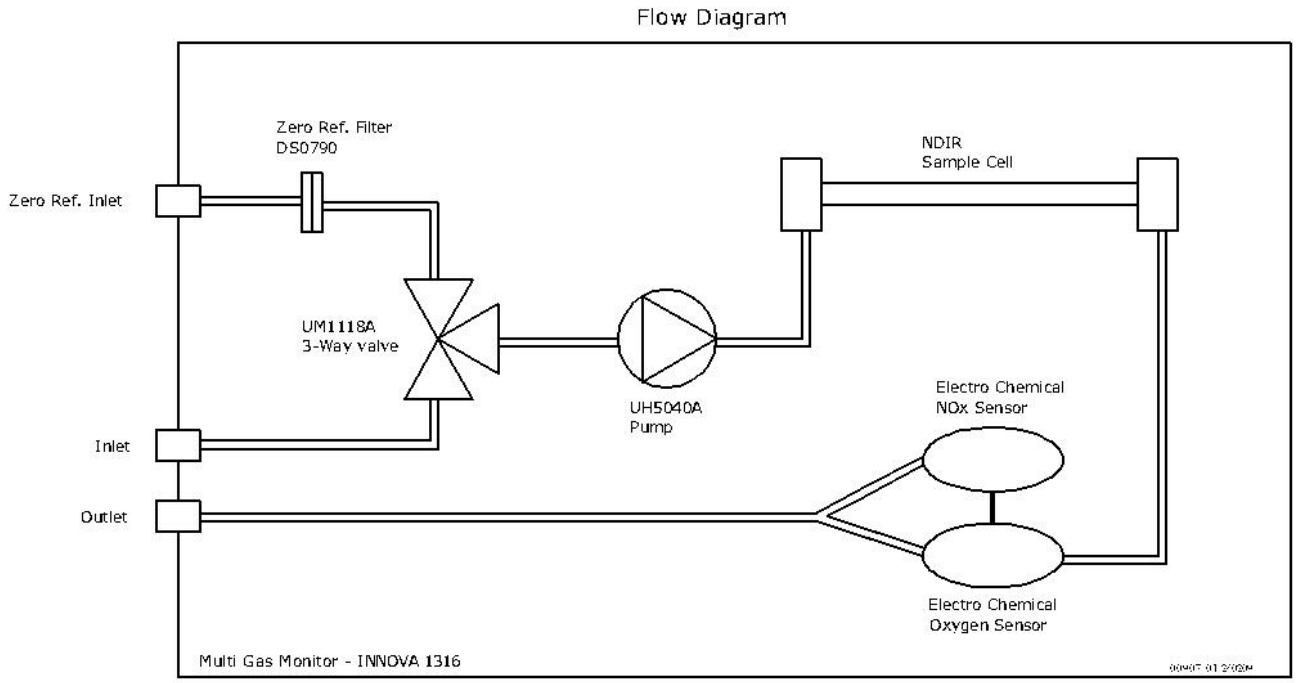


*Fig.1.1 Flow diagram of the 1316A-2 Multi Gas Monitor*

### 1.2.2 NDIR Module and UA1372 Module (Optional) Measuring System

This block is the heart of the monitor. It contains the Infrared source the sample cell and the Detector with specialized optical filters and processing electronics necessary to do highly accurate measurement of gas concentrations.
The UA1372 are connected to the NDIR module for data transfer to the Controlling PC Software.
Measurement samples are sucked into the measurement chambers via the Gas Inlet or the Zero Gas Inlet, depending upon the command from the BZ6013. The internal gas-circuits are arranged such that samples pass through the measurement chamber in a continuous flow and directed from the NDIR sample cell to the UA1372 Module to the Electrochemical Sensors. Exhaust gases are expelled via the gas outlet. The Zero Gas used for zero calibration of the NDIR Module and for Span Calibrating the Oxygen Sensor is drawn via the Zero Gas inlet.

### 1.2.3 Power Supply

The power supply included in the 1316A-2 can be directly connected to a wide range of single phase mains supplies and still be able to produce the stable voltages required to keep the monitor within calibration.

## 1.3 Software Description

The BZ6013 software is menu driven specifically written to control the 1316A-2 monitor. The software allows you to change the operational parameters and see the results of measurements on the PC screen.

The software can be used to control up to four Multi Gas Monitors 1316A-2 including these instruments in your system allows up to 4 different sample points to be controlled measured by the BZ6013.

You can also use the PC's filing system to save a series of measurements for later recall  any other PC software that can interpret a space delimited file, for example certain spreadsheet programs.

Note though that the save-to-disk process is not a dump of data from the 1316A-2 to the PC, but a process in which the data log file on the PC is updated continuously.

Therefore, to use the PC to log data, it must be constantly attached to the 1316A-2.

As well as providing control over the measurement configuration of the monitor, the software also has calibration procedures that allow you to calibrate the monitor against known reference gas concentrations.

### 1.3.1 NDIR Module and the optional UA1372 Module Versions

LumaSense offers several NDIR modules giving the possibility to configure the Multi Gas Monitor 1316A-2 for different applications. Please contact your local LumaSense A/S representative for further information.

LumaSense Electrochemical Sensors to be mounted in the Manifold of the UA1372. Beside Oxygen (VM0200 A) it is possible to install a, NO (VM0201A) sensor. Please contact your local LumaSense A/S representative for further information.

The NDIR Module and the Electrochemical Sensors are to be specified prior to purchase.

The Multi Gas Monitor INNOVA 1316A-2 is delivered as specified by the Customer.

## 1.4 NDIR Gas Measurement

The Module VM0101A measures the following sample gas concentrations: Carbon Dioxide ($CO_2$) and Freon either with reference to FREON1 or FREON2 (selectable from the BZ6013 Application Software)

And the UA1372 is as an example given with an $O_2$ and NO sensor installed.

### 1.4.1 Freon and CO2 Measurement

The NDIR measurement method uses fixed, non-scanning infrared light frequencies to characterize Freon and $CO_2$ gas concentrations. NDIR absorption profiles are the basis for measurement. The concentration of a gas volume is a function of the quantity of gas molecules in the sample. The absorption of infrared light increases with the number of gas molecules in the light path. As the concentration of infrared-absorbing gas increases, the transmission of infrared light decreases. A basic NDIR measurement system includes the following elements:

**Sample Delivery:** The portion of the gas is transported to the 1316A-2 where particulates are removed before the gas is introduced to the NDIR module.

**Infrared Source:** An infrared light source produces a wide range of light at frequencies covering the infrared band and extending into the visible spectrum.

**Sample Cell:** The gas to be measured is transported through a sample cell that allows infrared light to pass through the sample.

**Infrared Filters:** An optical band pass filter is used to select a specific band of infrared light. The filter wavelength is based on the gas to be measured. Separate infrared filters are used in the measurement of Freon and $CO_2$ gas concentrations.

**Infrared Detector:** Infrared light not absorbed by the sample gas is transmitted to infrared detectors. The detectors produce an output voltage that is proportional to the measured light.

See figure 1.2

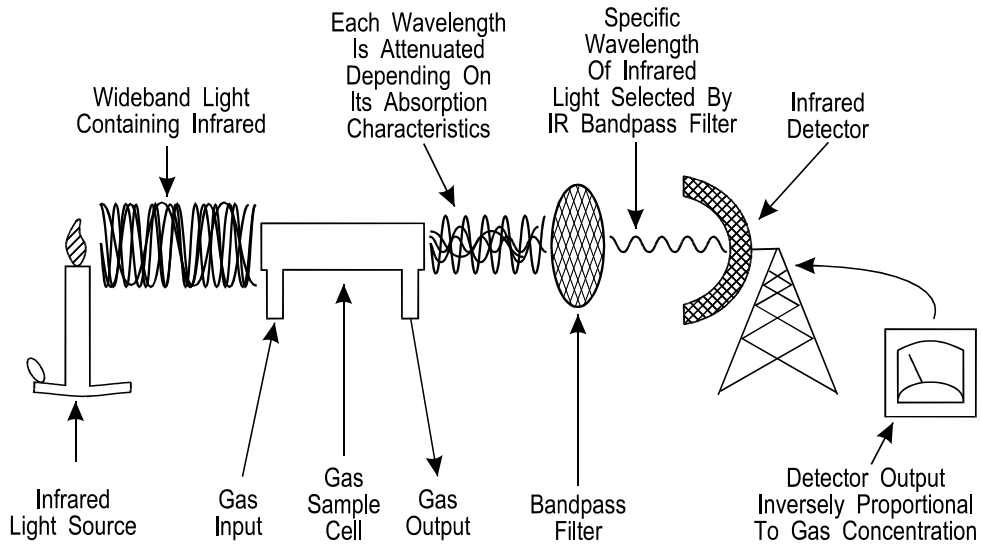


*Fig.1.2 Simple NDIR Gas Monitor*

### 1.4.2 The Infrared Transmission Spectra.

The concentration of a subject gas in the sample is computed as a function of the light intensity measured by the detector. The figure below characterizes the band pass filters for Freon and $CO_2$ gases.

| **Filter** | **Centre Wavelength** µm | **Band Width** µm | **Centre Wavelength** cm-1 | **Band Width** cm-1 |
|---|---|---|---|---|
| Freon | 8.73 | 1.24 | 1145 | 163 |
| Carbon dioxide | 4.425 | 0.07 | 2260 | 36 |

*Fig.1.3 Infrared optical filters for Freon and Carbon Dioxide.*

### 1.4.3 The NDIR Module Building blocks

#### Infrared Source

A current-regulated infrared (IR) source provides a photon stream. Light is collimated and directed through the sample cell to the optical block. The source is modulated at 1 Hz, with a duty cycle of 50%.

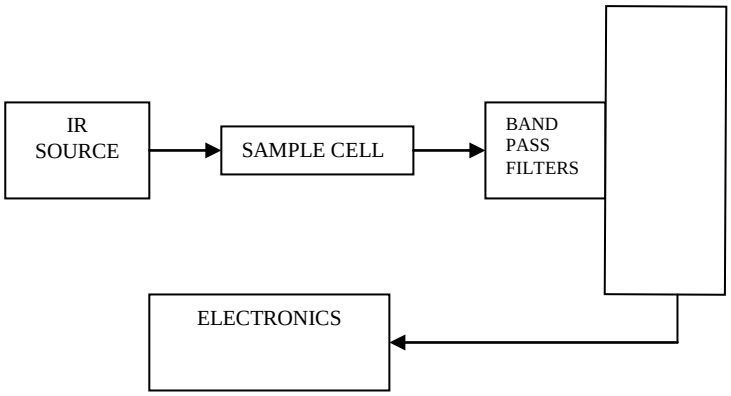


*Fig.1.4 The Optics of the NDIR Module.*

### Sample Cell

The sample cell is a gold-coated glass chamber that provides a means for the infrared source to pass through the sample gas. Infrared-transparent sapphire windows are provided at each end of the cell. A microprocessor controlled transducer and thermistor provide measurement compensation for sample gas temperature and pressure variances. Sample gas exits the cell at the end opposite the IR source and is directed to the UA1372 manifold for $O_2$ or $O_2$/NO measurement.

### Optical Block

Infrared light not absorbed by the sample gas is transmitted to the optical assembly. The remaining light is directed to the band pass filters and on through to the quad detector.

The filter wavelengths are optimised to match the absorption spectra of Freon's and Carbon Dioxide.

The filter associated with Freon's is centred on 8.73 µm (1145 $cm^{-1}$), and the filter associated with Carbon dioxide is centred on 4.43 µm (2260 $cm^{-1}$), see Figure 1.3.

In the measurement chamber the three beams, which differ in wavelength frequency, each excite their respective gas (if present). The absorption of the incident light will be registered by the Detector.

**System Board Assembly**

The system board assembly is a surface-mount printed circuit board that includes the digital and analogue electronic components and the IR detector assembly. The IR detector assembly includes thermopile IR detectors for the Freon, $CO_2$ and reference channels. Light passed through the band pass filters is directed through the thermopile window to a detector substrate. The substrate has a light-sensitive coating, which produces a voltage that is proportional to light intensity. A reference voltage is produced by the reference detector, which provides an output that varies with light intensity and is not affected by the sample gas. The detector block temperature measurement facilitates compensation for IR filter and IR detector temperature variances. The detector outputs are amplified and sent through a multiplexer to an ADC converter. The microprocessor samples the ADC converter output at 200 Hz and derives an uncompensated digital value representing each gas concentration. The data are subjected to a compensation routine that provides adjustment for temperature and pressure variances. The digital value representing each gas concentration is derived.

### 1.4.4 The NDIR Temperature Measurements.

The analyzer incorporates several thermistors for the measurement of temperatures.

**IR Detector/Filter Temperature :**

A thermistor located in the optical assembly measures the IR detector and IR filter temperature. It is used as follows:

“Gas law compensation” and detector response compensation during Freon and $CO_2$ gas concentration measurement.

Span calibration (via the use of temperature compensated Freon and $CO_2$ data).

An “out of range” IR detector/filter temperature condition causes Freon and $CO_2$ data to be declared “data invalid.”

In the Module the IR Detector/Filter Temperature is monitored to set the zero request bit as follows:

Zero Request if a ±5°C temperature change has occurred.

Ambient Temperature Out Of Range is set when the IR Detector/Filter Temperature is not within its allowed range.

**Sample Cell Temperature:**

The Module sample cell temperature is monitored by a thermistor in contact with the sample cell. This temperature measurement is used as follows:

An “out of range” sample cell temperature condition causes Freon and $CO_2$ data to be declared “data invalid.”

Sample Cell Temperature Out Of Range is set when the Sample Cell Temperature is not within its allowed range.

**NO Sensor Temperature:**

A thermistor located in each NO sensor assembly monitors NO sensor temperature. It is used as follows:

Sensor response during NO gas concentration measurement.

An “out of range” NO sensor temperature condition causes NO data to be declared “data invalid”.

### 1.4.5 The NDIR Pressure Measurements.

The Module includes two pressure transducers for measurement of the pressures. An absolute pressure transducer measures the pressure in the sample cell. A differential pressure transducer on the power section of the Printed Circuit Board (PCB) measures the difference between ambient pressure and the sample gas pressure between the inlet port and the pump. These pressure measurements are used as follows:

**Sample Cell Pressure (absolute)**. Sample cell pressure is used as follows:

Gas law compensation during Freon and $CO_2$ gas concentration measurement.

Zero/$O_2$ Span and Span calibration (via the use of temperature compensated Freon and $CO_2$ data).

During a Zero/$O_2$ Span calibration, sample delivery pressure is compared to ambient pressure. If the difference is too great, the Out Flow Fault status bit is set true and the pump is switched Off.

### 1.4.6 The $O_2$ and NO Measurement

$O_2$ and NO gas concentration are measured using electrochemical (fuel cell) sensors. A fuel cell sensor provides an electrical response that is proportional to the concentration of the sample gas.

The NDIR Module sample-cell exhaust is directed to UA1372 manifold for $O_2$ or $O_2$/NO measurement. Sample gas is delivered to the $O_2$ and NO sensors through this manifold. The $O_2$ sensor provides a linear output of approximately 9 to 13 milli-volts that is proportional to the Oxygen concentration in the sample. The NO sensor provides a linear output of approximately 50 nano-amperes per ppm of nitric oxide over the range of 0 to 5.000 ppm in the gas sample. A 3-volt lithium battery is included on the NO sensor to retain bias voltage when source power is not applied.

Both $O_2$ and NO sensor outputs are sent to an ADC converter that provides digital values representing gas concentration. Gas concentration is determined by comparing sensor output at calibration with the output of the sample measurement.

By calibrating the system with known concentrations of Freon, Carbon Dioxide and for the UA1372 option Oxygen and NO the absolute concentration values can be calculated.

In normal practice ambient air is used as the reference gas for the oxygen measurement as it contains a stable amount of oxygen – 20.95 % referenced to dry gas condition.

# Chapter 2

# Installation and Getting Started

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# 2.1 Installing the Monitor

The rear panel has a serial-link and a USB socket for the PC interface. The mains input, sample gas inlet and outlet for expelled gas samples are located on the rear panel.

### 2.1.1 Operating Environment

The following environmental conditions must be observed:

- Safe ambient operating temperatures range from 5°C to 40°C
- Humidity should not exceed 90% RH non-condensing.

**Warning!** The monitor is not intended for use in explosive environments.

### 2.1.2 The Gas Sample Line

The gas to be sampled (measured) is drawn from the sample point via a sample line at a flow rate of 800 ml/min. Various types of sample lines are available depending on the individual application. The sample line tubing between the sample point and the monitor should be kept as short as possible to assist response times. If you are unsure about the type of sample line for your application, contact your *LumaSense* representative for advice before installing the system.

**Note:** You must use a filter in the gas-line immediately before the gas-line enters the monitor. The UD 5091A in-line filter (optional accessory) is ideal for this purpose.
The gas inlet for the sample line is located on the rear panel of the monitor. If the dew point of the gas sample is comparable to the temperature in the monitor remove water and eliminate the risk of condensation inside the monitor

### 2.1.3 Mains Supply

**Warning**. The monitor must be used with protective earth.

The monitor operates in the AC voltage range from 100 – 240 V on a single phase supply, 50 Hz – 60 Hz, 40 VA.

The power cable is connected to a socket on the rear panel. The on-off switch is located immediately above this socket.

### 2.1.4 Checking and Changing the Fuses

On delivery ensure that the correct fuses are used. See section 5.1.2.

## 2.2 The BZ6013 Software

This software provides procedures to:

- Set-up and Calibrate the monitor prior to measuring
- Display measurement data as coloured graphics or numeric values
- Store measurement data in a log file on the PC's disk while measurements are being made
- Control up to four Multi Gas Monitors INNOVA 1316A-2

The BZ6013 application can be installed by using the BZ6013 software CD-ROM.

### 2.2.1 Computer Requirements

The minimum requirements to run this software are:

| | |
|---|---|
| Processor | Minimum: 1 gigahertz (GHz) Pentium processor |
| Operating System | Windows XP (minimum Service Pack 2)<br>Windows Vista<br>Windows 7 |
| RAM | Minimum: 512 MB (Vista or 7: 1024 MB |
| Hard Disk | Up to 100 MB of available space may be required. |
| Display | Minimum: 1024 x 768 high color, 32-bit |
| Total port connections | 1 RS232 port or 1 USB port |
| CD-ROM drive | |

### 2.2.2. Installing the BZ6013 Software on the PC

Before the software can be installed and started, the PC must fulfil the necessary requirements (see section 2.2.1). It is recommended that the person who installs the BZ6013 application is familiar with installing programs i.e. your system administrator.

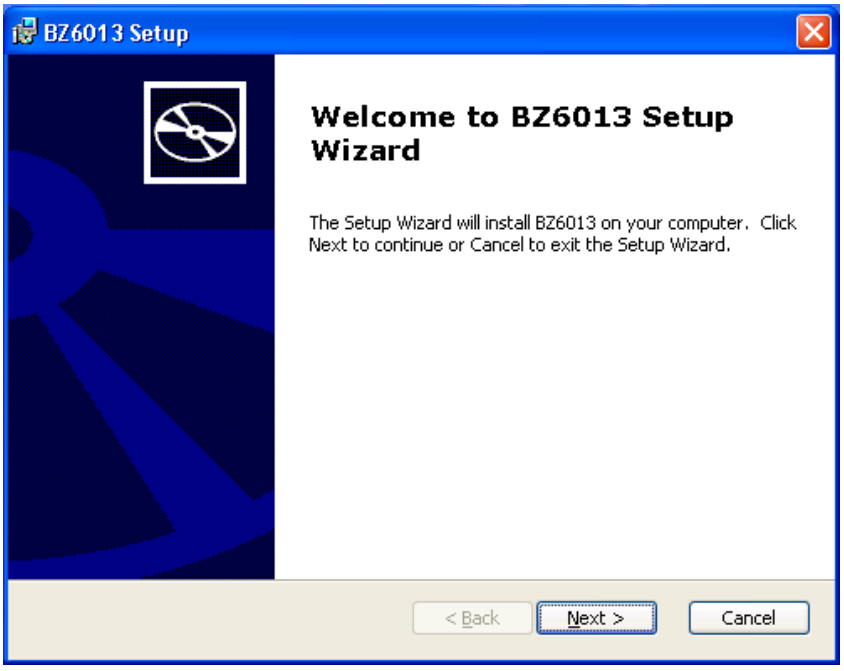
1. Switch on the computer and its peripherals.

2. Login as Administrator and make a new User Account in the Control Panel with the user name 'BZ6013'. Create this BZ6013 user with Administrator rights.

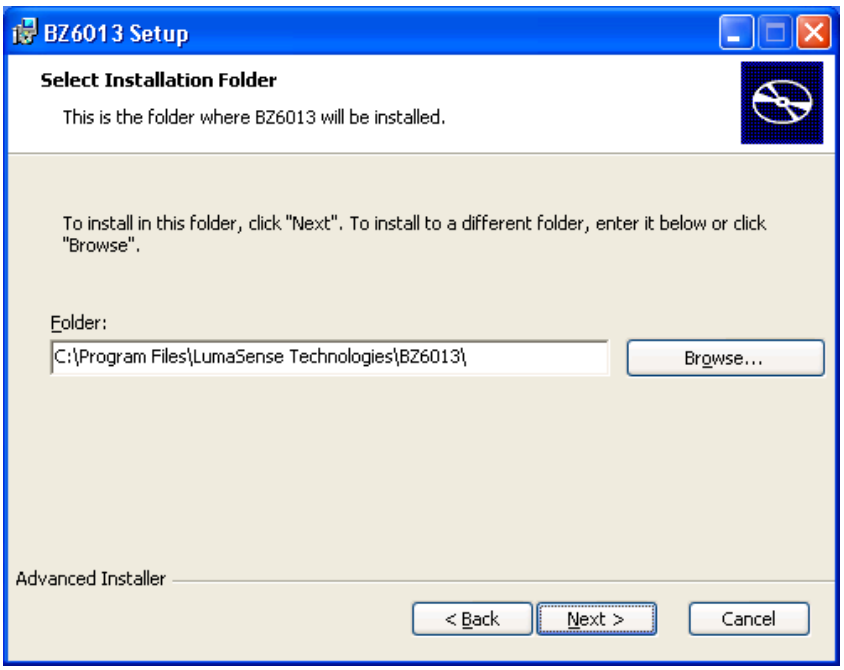
3. Logout and login as the new user named BZ6013.

4. Insert the BZ6013 Application software CD-ROM disk into the CD-ROM drive and wait for the auto-start of the BZ6013 installation package. In case that auto-start is disabled for your CD drive, you will manually need to start the BZ6013 installation package found on the software CD-ROM disk.

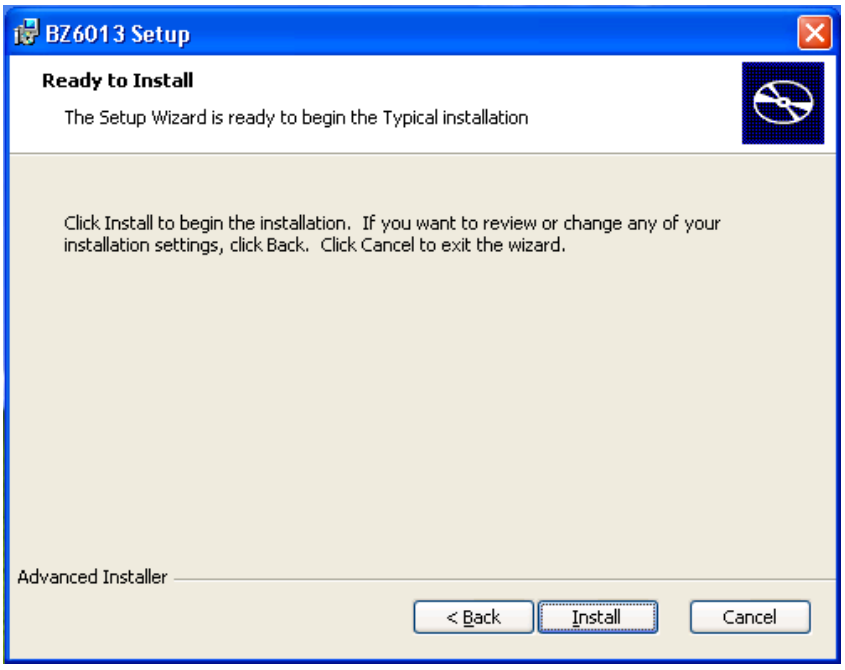
5. After a while the welcoming window appears. Select 'Next' to continue installation.



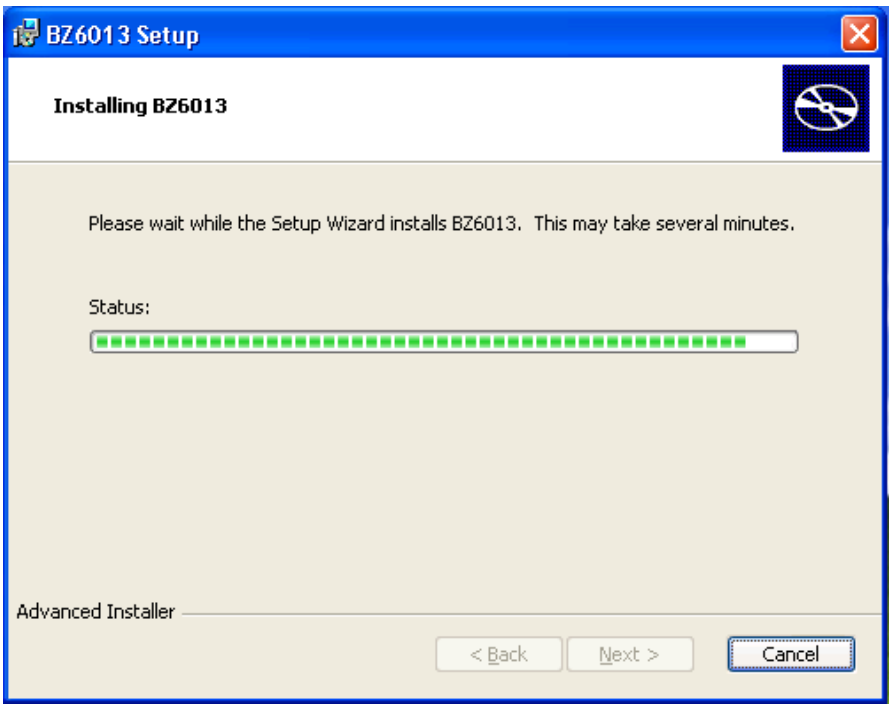

6. In the next window it's possible to change the directory on the hard disk where the BZ6013 program will be installed. Normally this should not be changed. Select 'Next' to continue installation.



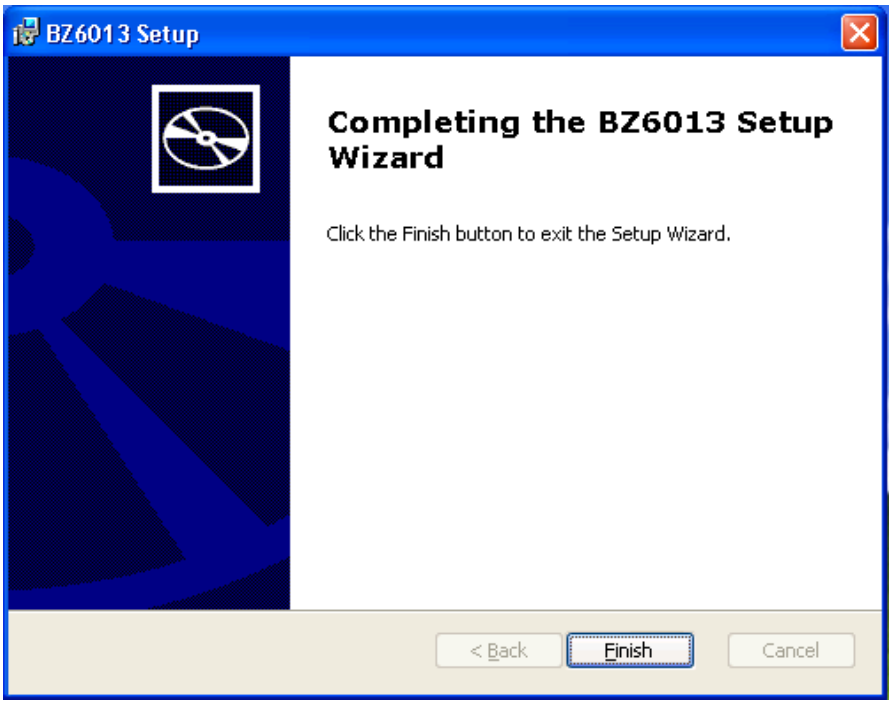

7. Now you're ready to install the BZ6013 software. Select 'Install' to begin the installation.




8. During installation the following window appears.




9. When installation is completed you just select 'Finish' in order to finish the installation of the BZ6013.




10. It is now possible to start the BZ6013 Application by using BZ6013 shortcuts found

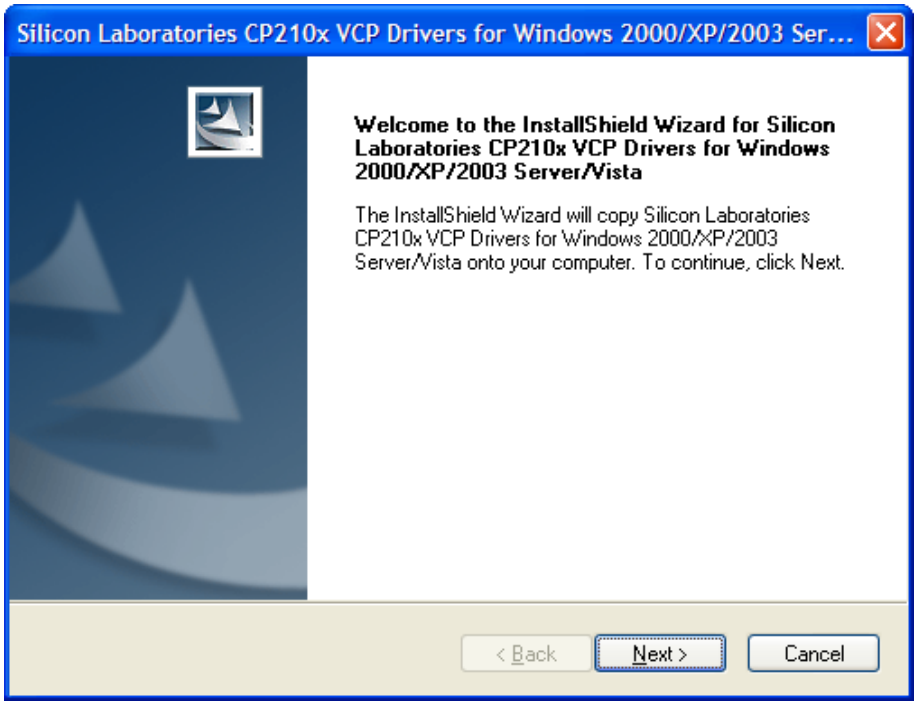
    a. on the desktop or
    b. in Start -> All Programs -> LumaSense Technologies -> BZ6013.

### 2.2.3 Installing the USB driver for the 1316A-2

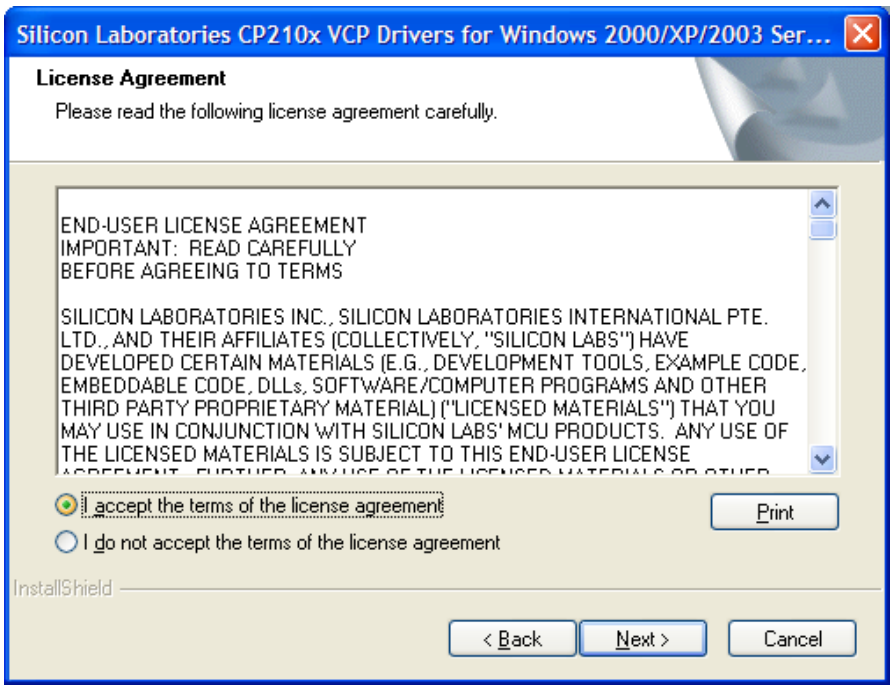
Before connecting the 1316A-2 monitor the USB driver for the 1316A-2 USB interface must be installed.

1. Insert the “USB driver for Multi Gas Monitor – INNOVA 1316A-2” CD-ROM disk into the CD-ROM drive and wait for the auto-start of the USB driver. In case that auto-start is disabled for your CD drive, you will manually need to start the executable driver file named “CP210x_VCP_Win2K_XP_S2K3.exe” found on the software CD-ROM disk.

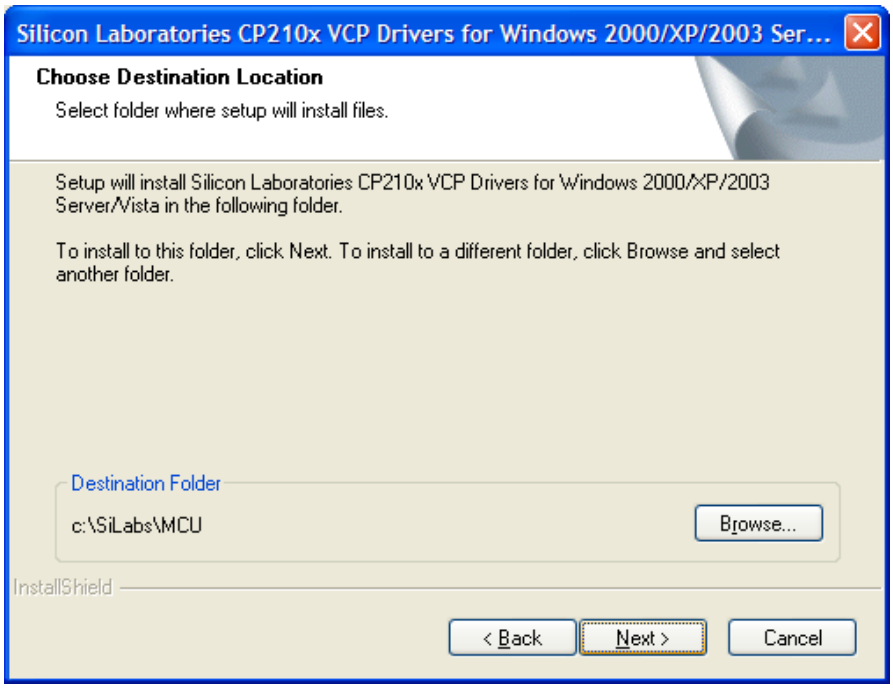
2. After a while the welcoming window appears. Select ‘Next’ to continue installation.



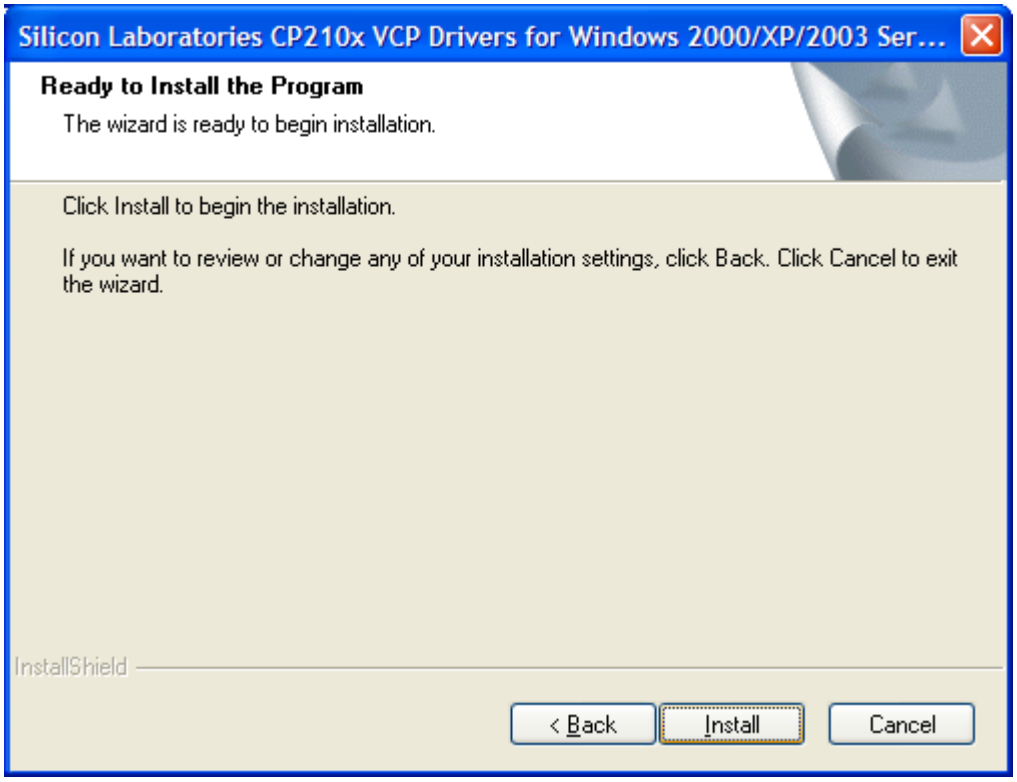

3. In the “License Agreement” window accept the terms. Select ‘Next’ to continue installation.



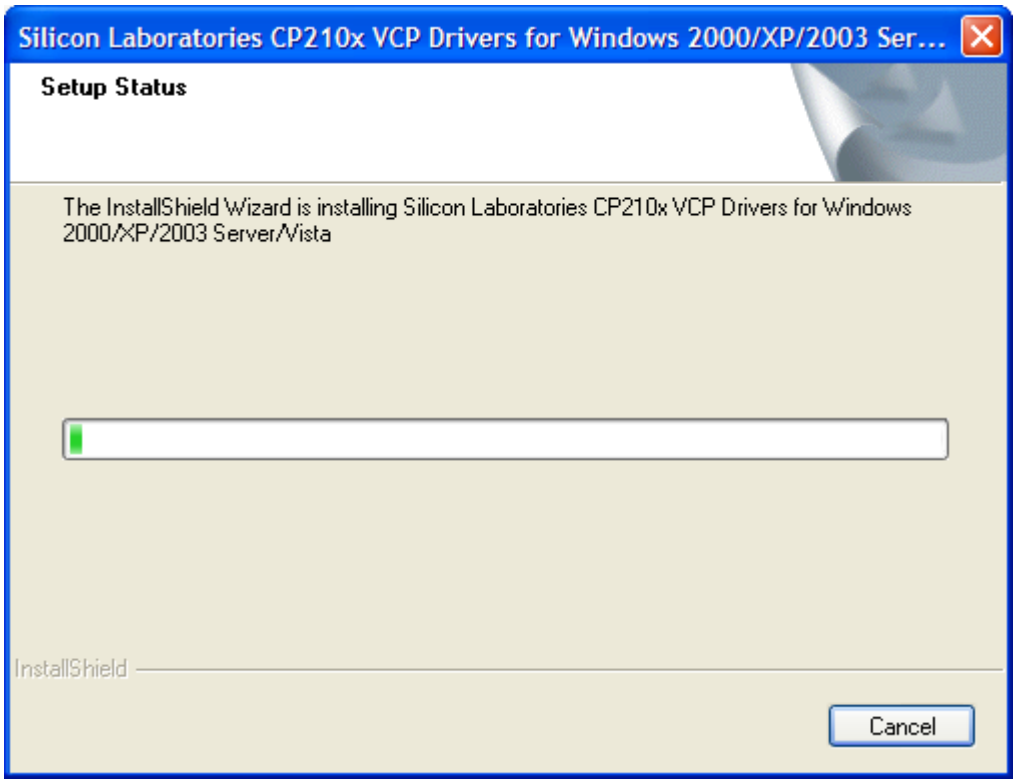

4. In the “Choose Destination Location” window select ‘Next’ to continue installation.



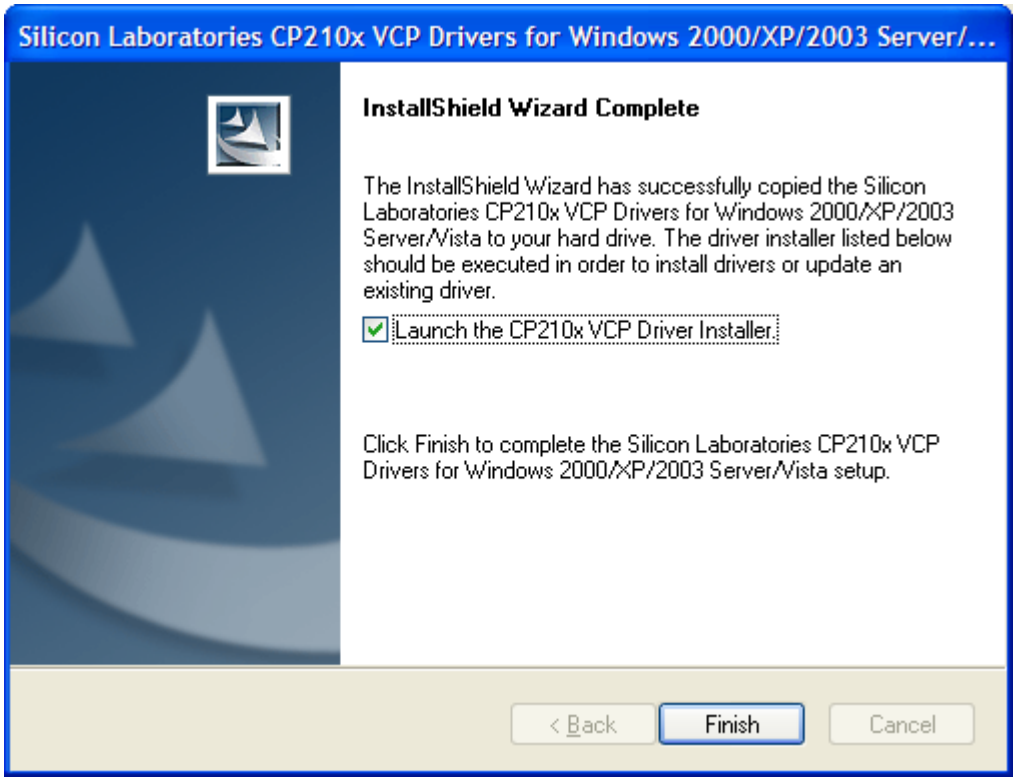

5. In the “Ready to Install the Program” window select ‘Next’ to continue the installation.



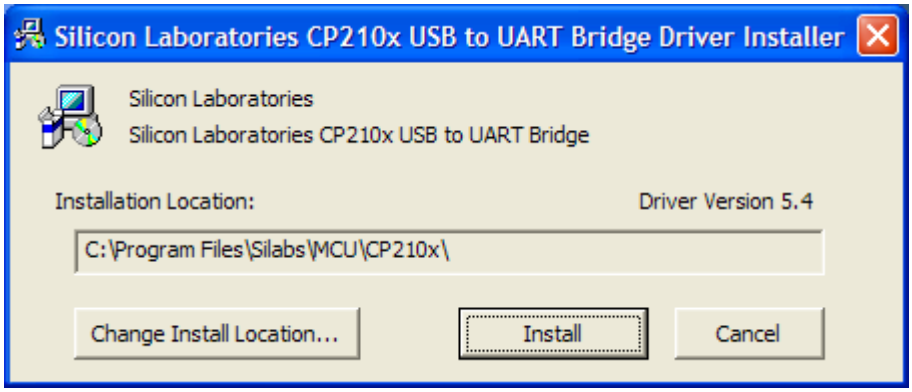

6. Wait for the “Setup Status” window to finish.



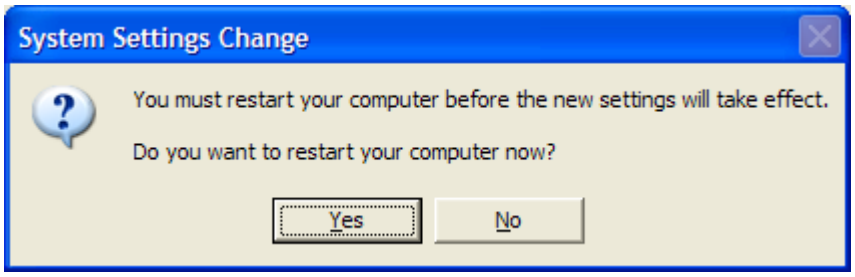

7. In the “InstallShield Wizard Complete” window select ‘Finish’ to continue the installation. Please do not un-tick or change the “Launch the CP210x VCP Driver Installer” setting.




8. In the following pop-up window select 'Install' to install the USB driver for 1316A-2.




9. After installing the USB driver for 1316A-2 you are asked to restart your PC.




10. This concludes the installation of the USB driver for the 1316A-2.

### 2.2.4 Verification of the Software BZ6013 Version.

Pull down the Help Menu

Select About.

Following Window is shown

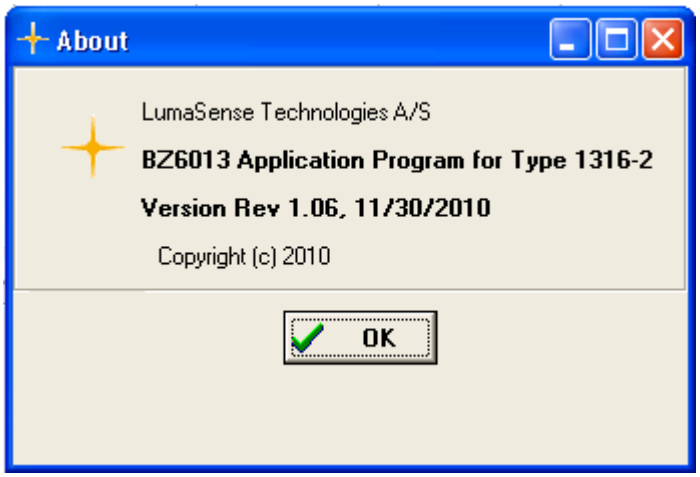



*Figure 2.3. About Window*

## 2.3 Connecting the Monitor to the PC

For the 1316A-2 monitor and PC to communicate, the two must be linked together. The 1316A-2 monitor can be connected to the PC either using the RS-232 connector or the USB connector on the monitor's rear panel.

The monitor has a standard RS – 232, 9 pin male/female socket on its rear panel. This is the digital interface used to communicate with the 1316A-2 monitor. This must be connected to a free serial port (COM port) on the computer using a serial interface cable. Before connecting either end of the selected RS-232 interface cable to the respective instrument, ensure that both instruments are turned off, otherwise you are liable to damage the sensitive circuitry in either the monitor, the computer, or both.

The 1316A-2 monitor also has a standard USB socket on its rear panel. This is the digital interface used to communicate with the

1316A-2 monitor. This must be connected to a free USB port on your computer using a USB cable. Please make sure that the USB driver is installed before connecting the 1316A-2 with the PC. The USB cable is hot pluggable, meaning that it can be connected while the PC and the 1316A-2 monitor is on.

When making the connection to the computer, note down which COM port you have used – you will require this information to set up the communication parameters. You may choose to use the ports COM1 to COM4. If you are unsure, refer to information about your computer to identify the port name. When using an USB connection between the 1316A-2 and the PC the USB connection will appear as a USB virtual COM port (Silicon Labs CP210x USB to UART Bridge), which can be checked in the “Device Manager”-view on the PC, see figure 2.4.

The (USB) virtual COM port must be between COM1-COM4 in order for the BZ6013 to communicate with the 1316A-2 monitor. If it is COM5 or higher it must be assigned to a COM port in the range COM1-COM4, by changing the properties of the virtual COM port using the “Device Manager”.

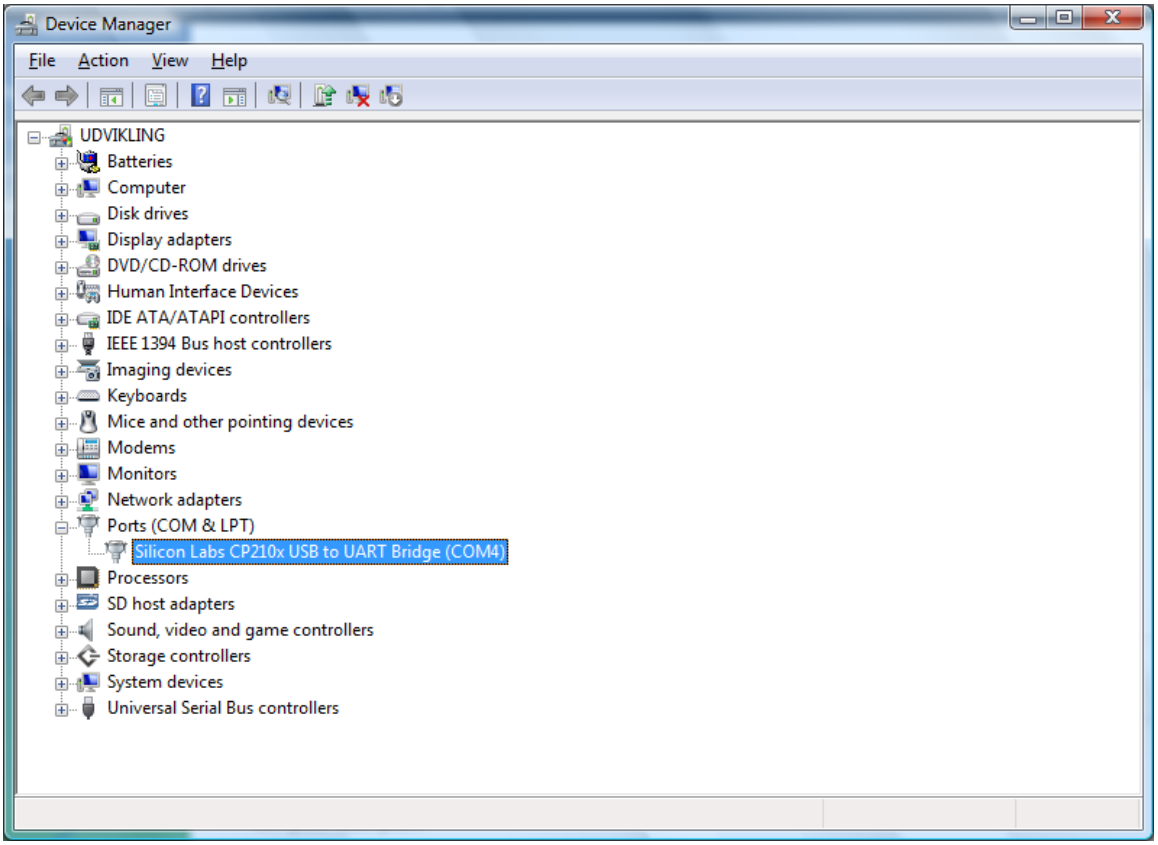



*Figure 2.4 : Windows “Device Manager” showing the virtual COM port for the USB connection.*

## 2.4 Starting the Monitor

After connecting the PC to the monitor, you can turn on the PC and the monitor.

There is a signal lamp (LED) on the front panel of the monitor, giving:

- Power Signal (green) — lights constantly when power is applied to the power supply.

## 2.5 Starting the BZ6013 Software

Once the software has been installed on the PC as described in section 2.2.2 and the interface connections between the monitor and the PC have been made (section 2.3), you can start the software.

Please make sure that the 1316A-2 monitor is connected and powered up before starting the BZ6013 software, or else the BZ6013 software will not be able to detect and communicate with the 1316A-2 monitor.

When using an USB connection between the 1316A-2 monitor and the PC, please make sure that the (USB) virtual COM port is assigned in the range COM1-COM4 or else the BZ6013 will not be able to detect the 1316A-2 monitor. Please refer to section 2.3 how to reassign the virtual COM port.

### 2.5.1 To start the Software

1. Double click on the BZ6013 Icon on the Desktop or browse for the program by clicking on start.

2. Browse for the BZ6013 program in Start -> All Programs -> LumaSense Technologies -> BZ6013.

3. After installation the Software is setup to start automatically when making a logon as the BZ6013 user.

The main menu screen will be displayed on screen (see Fig. 2.5).

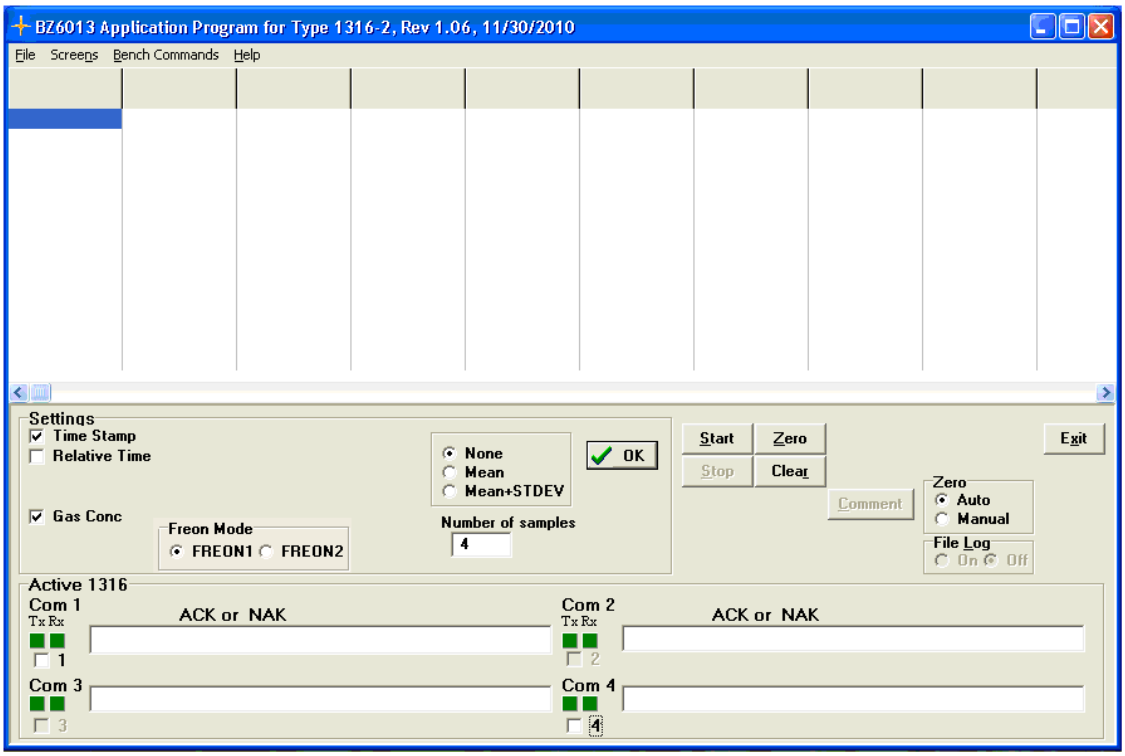



*Fig.2.5 The BZ6013's Main Menu Screen*

## 2.6 Using the Software

This section explains the various parts of the screen and tells you how to use the menu system to "drive" the software. Feel free to try the various movement commands as you read through this text. Note: If an incorrect COM port is set, not every screen will be available to you.

### 2.6.1 Screen Layout

Nearly every screen presented in the BZ6013 software is based upon the same screen design. The main exception to this is the measurement screen. The Main Menu screen, see Fig.2.5, is an example of a "standard" screen.

### 2.6.2 Title Bar

Located at the top of the screen, this area gives the title of the BZ6013 program.

### 2.6.3 Menu Bar

Located below the title bar, this area offers pull-down menus used for choosing the different setups, measurement, calibration or utilities.

### 2.6.4 Workspace

The workspace is the main area of a screen on which information and parameter values are printed.

### 2.6.5 Settings

Located below the workspace area.

Used to select the settings for the measurement task to perform.

Soft Keys to Start and Stop a measurement task and to Start a Zero calibration are also located in the Settings area.

### 2.6.6 Active Benches

Located in the bottom part of the Main screen.

Show the COM ports used for up to four Type 1316A-2 attached to the BZ6013.

### 2.6.7 Moving around the Screen

The BZ6013 is menu-driven software. You move around the screen to **highlight** the parameter or option fields you want to work with.

The <**Tab**> key will move the cursor to the next field.

<**Shift**> <**Tab**> will move you to the previous field.

### 2.6.8 Entering Values

Enter numeric values via the keyboard.

If you enter a value that is out of the expected range, there will be an error window and you must enter a value within range.

Pressing on <ok> returns you to the Main Menu and writes any changes you have made either to the configuration file or to the 1316A-2 monitor, whichever is appropriate.

## 2.7 Selecting the Correct Serial Port

Before using the monitor, it must be ensured that the BZ6013 software is set to use the same serial port (COM port) as that physically used. Please refer to section 2.3 to select the correct port

for your 1316A-2 monitor. To set the correct port, do the following procedure:

1. With the Main Menu screen displayed, Select the COM port in the bottom part of the screen.
2. The system should now be ready for use.

## 2.8 Starting a Measurement

Press the Soft Key, **START.** A measurement task is started and with the Gas Conc ticked in the Settings Field on the Main Screen data is shown as numeric values in the Work Space part of the screen (See figure 2.5).

## 2.9 Stopping a Measurement Task

To stop the measurement task press the **STOP** soft key. To exit the Program and return to the Windows desktop press the **EXIT** Soft Key.

# Chapter 3

# Configuration and displaying measurement results

February 2011

# 3.1 General Information

This chapter guides you through the configuration options available on the Main Menu. You should configure both the software (the BZ6013 program) and the hardware (the 1316A-2 monitor(s) installed) to suit your local requirements before calibrations and measurements are made.

It is assumed that your 1316A-2 monitor and computer have been installed correctly and you are familiar with using the software. For instructions on installation and using the software see Chapter 2 .

**Note:** the calibration procedure is covered in Chapter 4.

# 3.2 Software Configuration

### 3.2.1 BZ6013 Main Menu

From the main Menu (see figure 3.1) select the appropriate settings for the monitoring task.

If the COM ports are set up correctly it is possible to select just to press the Start Soft key and the measured data will be displayed.

### 3.2.2 Description of the Settings in the Main Menu Screen.

**Time stamp**:

Activating the Time Stamp gives a read out of measurement data with the PC's time stamp.

**Relative Time:**

Using the relative Time the data is presented on a time axis in seconds from the time when measurement was started.

**Gas Conc:**

Selecting this gives a read out of Gas concentrations, see figure 3.1.

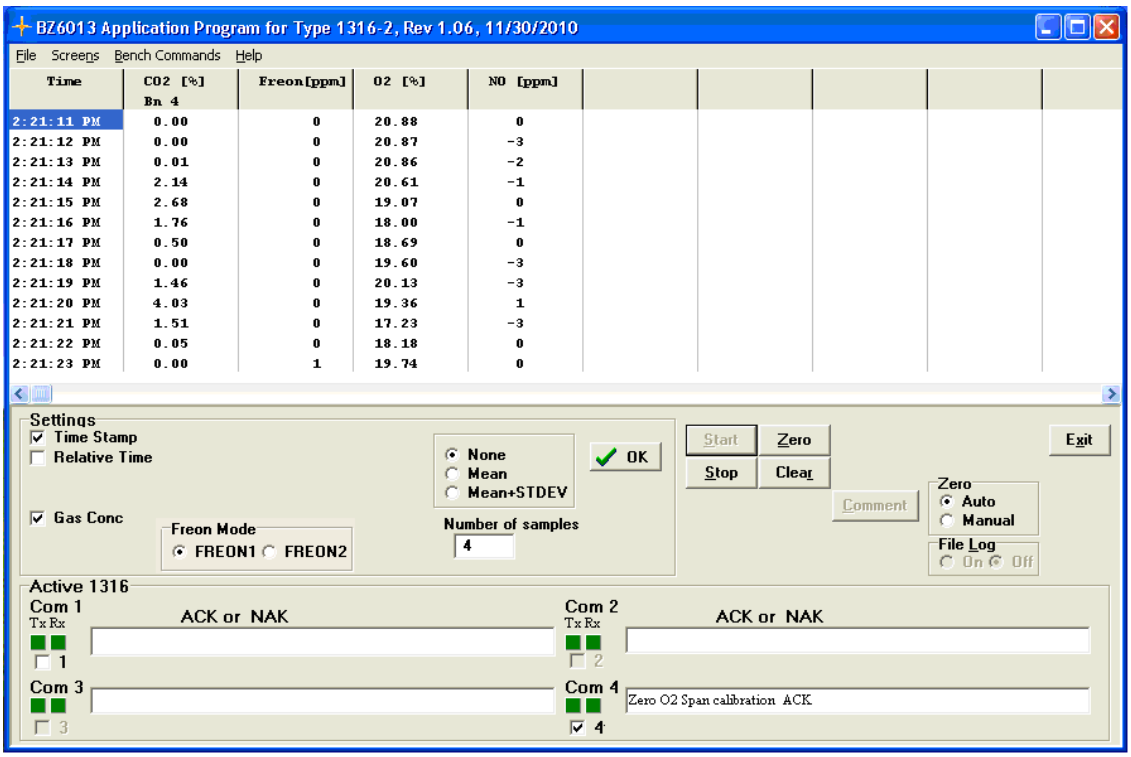



*Figure 3.1. BZ6013 Main Window showing real time measurement results. Averaging None*

### Freon mode

Gives the possibility to select the reference for measurement of Freon. It is possible to have the data presented as either FREON1 or FREON2.

### Averaging

None, Mean or Mean +STDEV
Using ***None*** the data will be displayed in real time without averaging see figure 3.1.
Using ***Mean*** the number of samples selected in the **Number of samples** field will be read out as Mean values in the upper part of the Main Window and the real time results in the bottom part of the window see figure 3.2

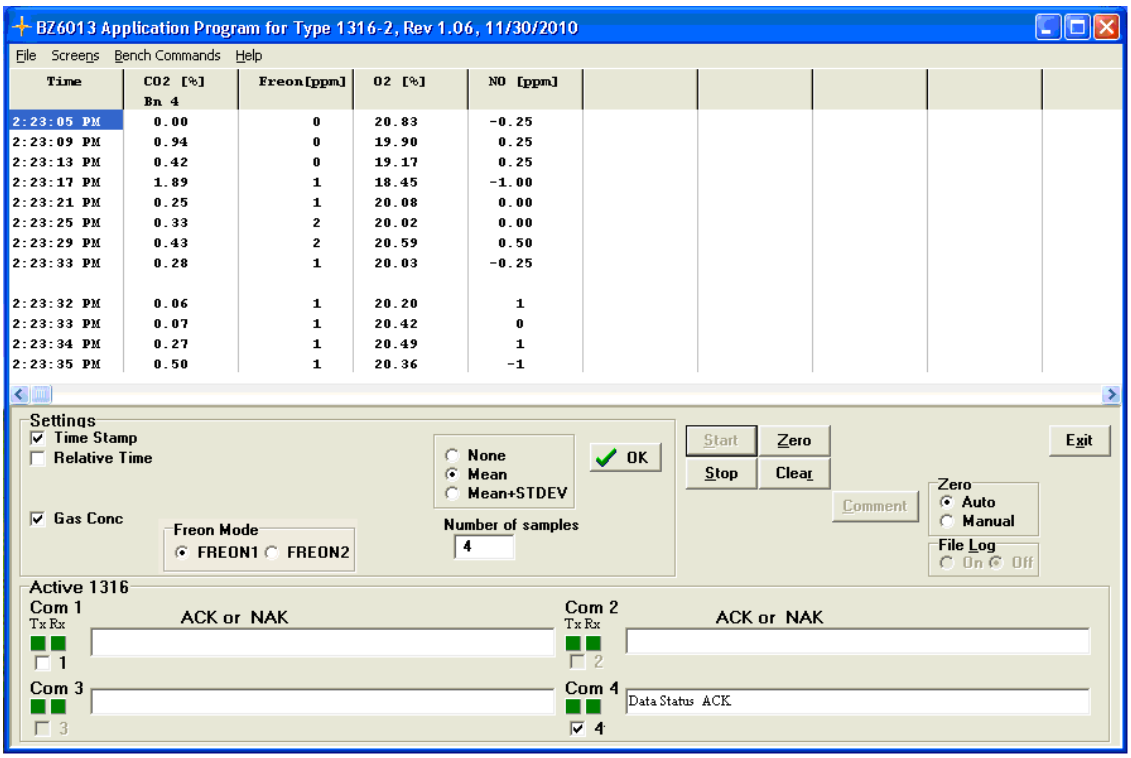



*Figure 3.2. BZ6013 Main Window showing measurement results using averaging over 4 samples. Mean values are in the upper part and real time values in the bottom part.*

***Mean +STDEV*** gives the mean value and the standard deviation. The Standard deviation value for the number of samples selected is given in the Middle part of the window, see figure 3.3.

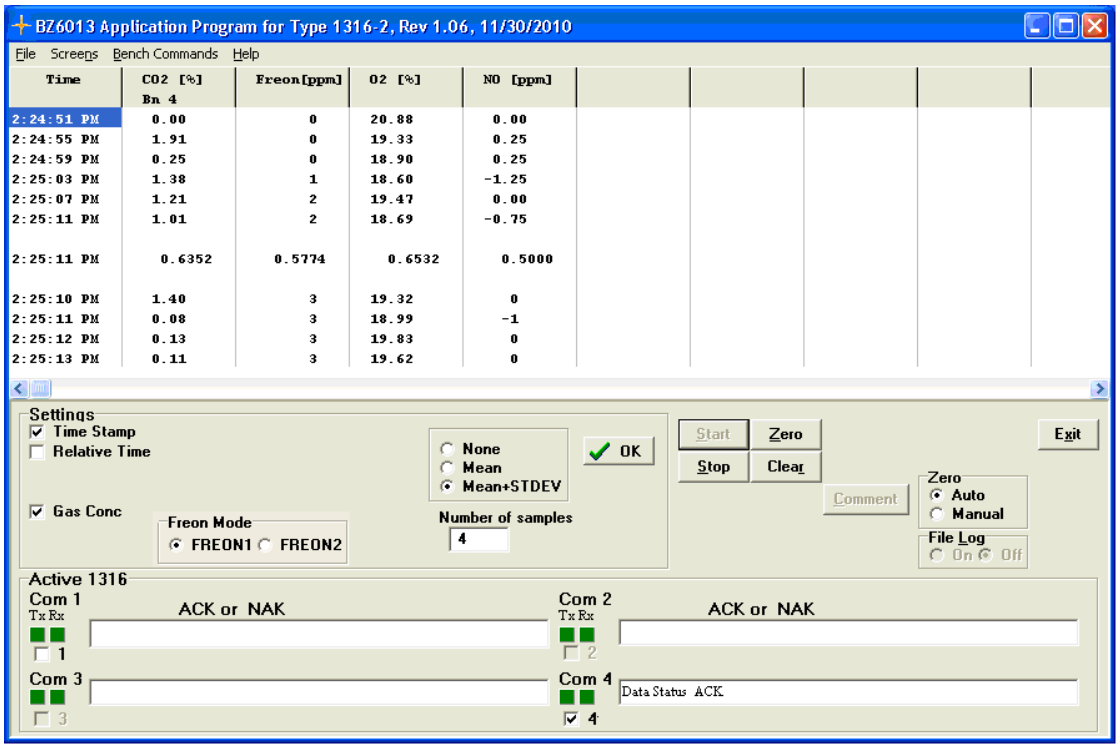



*Figure 3.3. BZ6013 Main Window showing measurement data. Upper part giving the mean value, Middle part the Standard deviation for the selected number of samples. Bottom part displays the real time measurement values.*

To change the settings select, none, mean or mean+STDEV and the number of samples to use during averaging. Press **OK** and then **START** the window is now updated according to the new settings.

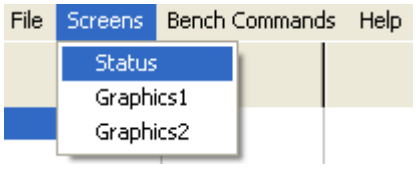
### Zero

It is possible to select either ***Auto*** or ***Manual***.

If ***Auto*** is selected then the Monitor will automatically perform zero calibrations upon request from the Module. Notice that during a zero calibration the Oxygen sensor (option) will be span calibrated with ambient oxygen level.

If ***Manual*** is selected press the Soft Key **Zero** to perform a Zero calibration.

To see if a zero calibration is requested pull down the Screens drop down and select Status.



The Status screen will be displayed, see figure 3.4.

Please also see the section **Zero Soft Key**.

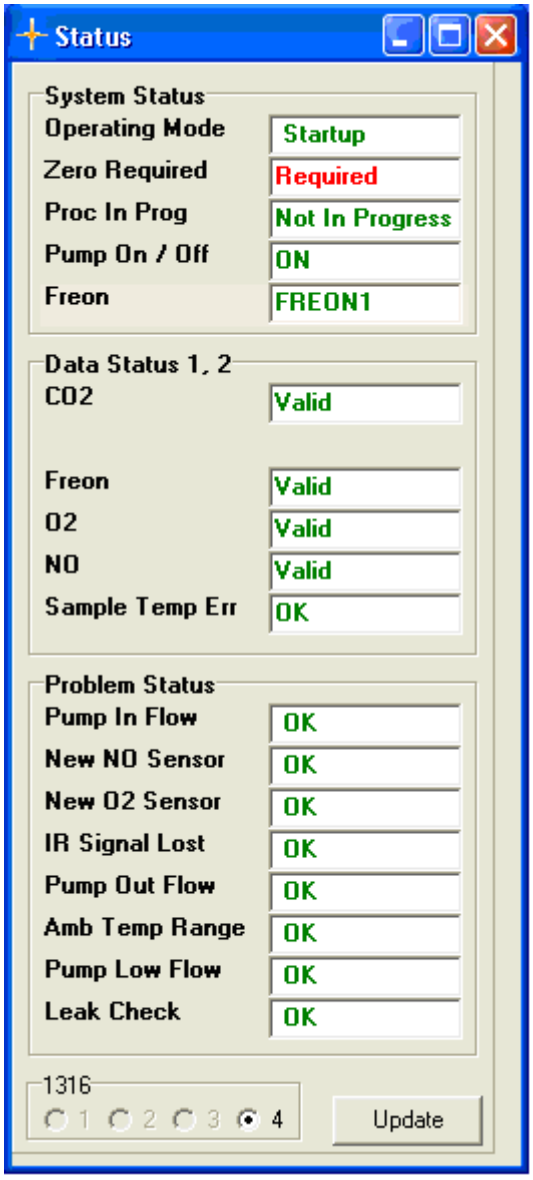



*Figure 3.4. The Status screen*

**File Log.**

Selecting File Log on gives the opportunity to have the measured data stored in a log file on the PC's Hard Disk.

To create a data log file pull down the File menu bar and select "New File":

Following picture will occur:

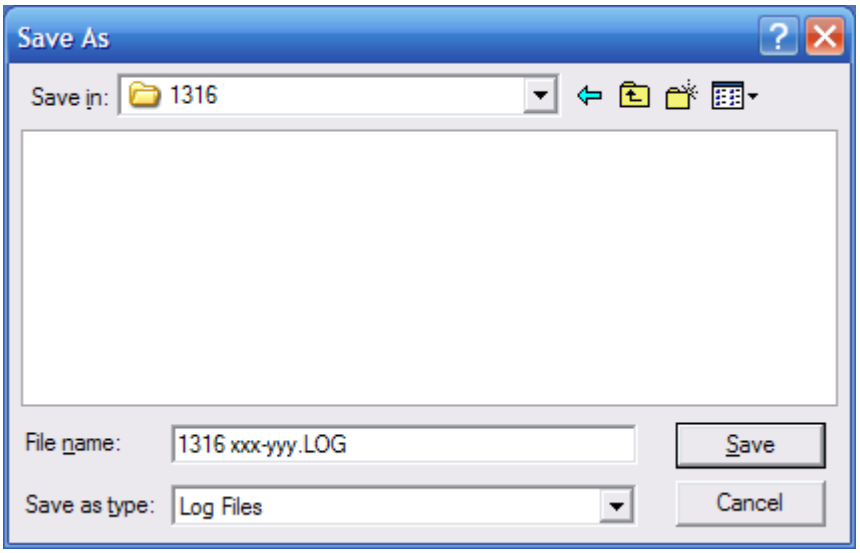



*Figure 3.5. Creating a log file.*

Change the file name and select the location where to save the file.

To switch ON/Off the data log use the

setting on the Main Window workspace.

When you stop a measurement, the current data file can be closed. To close a log file pull down the file menu and select Close File:

Should you restart measurement in the same software session you will be given the choice to append the new measurement data to the file. To do so pull down the file menu and select Append to file.

The measured data is stored in a format that is easily transferred to, and used by, spreadsheet programs like for instance Microsoft Excel.

The format of the data in the file is shown below.

Data separator: space

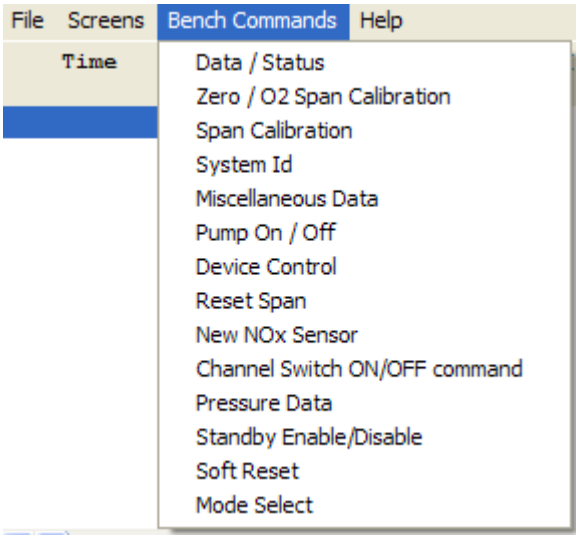
Text delimiter: none

Decimal separator: 0.00

**Start Soft Key**

On pressing the **Start** Soft Key data is collected by the BZ6013 Application Software to be displayed on the screen.

Start can also be activated by pulling down the Bench Command menu and select Data/Status




The following window will appear:

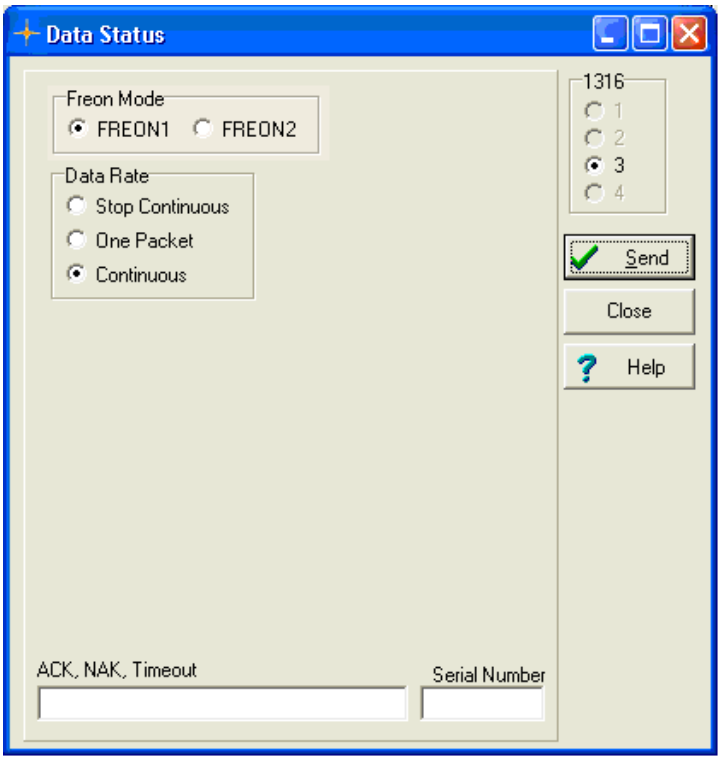



*Figure 3.6. The Data Status window.*

It is from this window (see figure 3.6) possible to select to have the data transmitted as **One Packet** for a number of measurement results or to have the data transmitted continuously.

### Stop Soft Key

On pressing the **Stop** Soft Key data transmission is stopped.
Stopping a measurement sequence can also be accomplished by pulling down the Bench Command menu and select Data/Status.
Using Stop Continuous in the Data Status picture (See figure 3.6) data transmission is stopped.

### Zero Soft Key

On pressing the **Zero** Soft Key a zero calibration is performed on the NDIR Module and if an Oxygen sensor is mounted the Oxygen sensor are span calibrated with room air.

Gas concentration data is only valid after a successful zero calibration.

Zero request interval timeout (90 seconds after POR (power-on-reset), followed by a 3 minute then a 6 minute interval and 30 minutes thereafter).

Zero is also done when:

- After a ±3°C change in detector temperature.
- When an ADC input range error occurs on one or more IR channel ($CO_2$, Freon, reference).

Zero calibration compensates for conditions that affect gas concentration measurement.

Examples of these conditions are as follows:

Changes in ambient temperature.

Short-term sample cell contamination caused by inadequate particle filtering.

Long-term sample cell contamination caused by deposits on the sample cell wall or windows.

Zero calibration execution time is typically 30 to 45 seconds, including a purge time that depends on the pneumatics configuration and a fixed calibration time of 20 seconds. The process will take longer under the following conditions:

### Clear Soft Key

Using the **Clear** Soft Key the data is removed from the screen.

### Comment Soft Key.

Activating the **Comment** Soft Key gives the opportunity to have a text / comment stored in the log file on the PC's Hard disk.

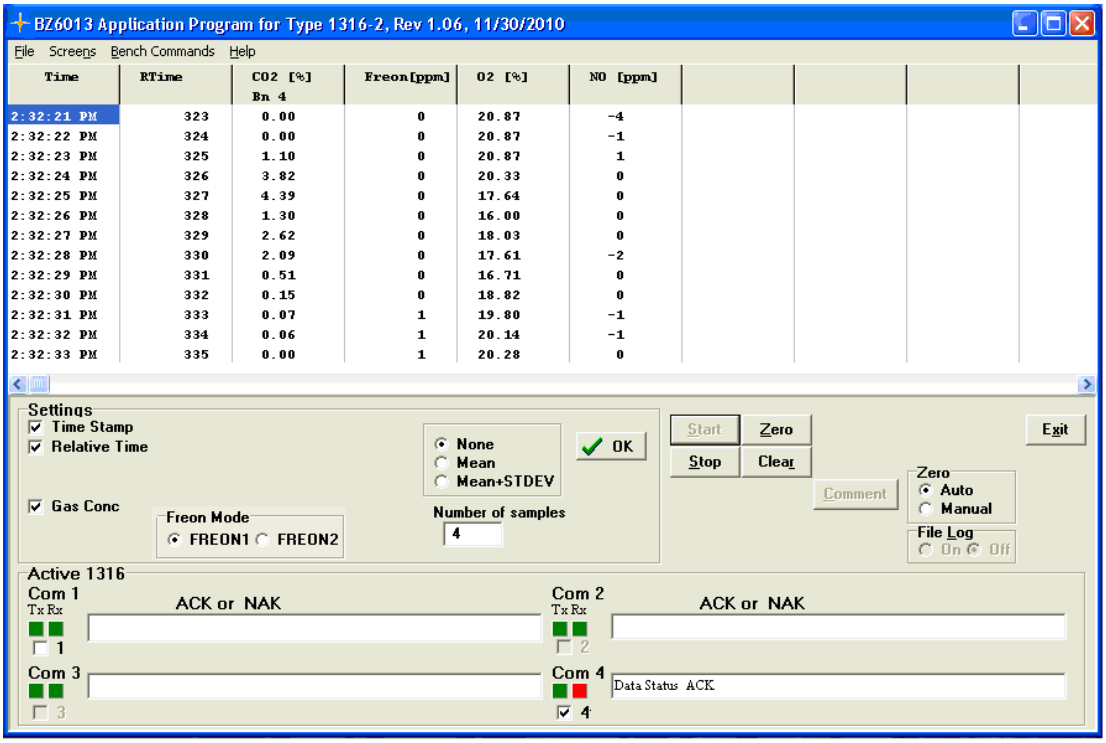
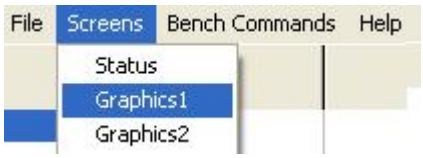



*Fig.3.7. The BZ6013 Main menu screen showing Time, Relative time and Gas Concentrations for a 1316A-2 attached to COM port 4.*

### 3.2.3 Gas Curves

To have a graphical presentation of the measurement data Select the ***Screens*** pull down and select either Graphics1 or Graphics2.




**Graphics1.**

In the Graphics 1 mode the x-axis is a time axis.
The concentrations of all gases are presented using 2 y-axis. The primary y-axis for CO2 and $O_2$ in a percentage (%) scale. And the secondary y-axis to present measurement data for Freon and NO in a ppm scale. See figure 3.8.

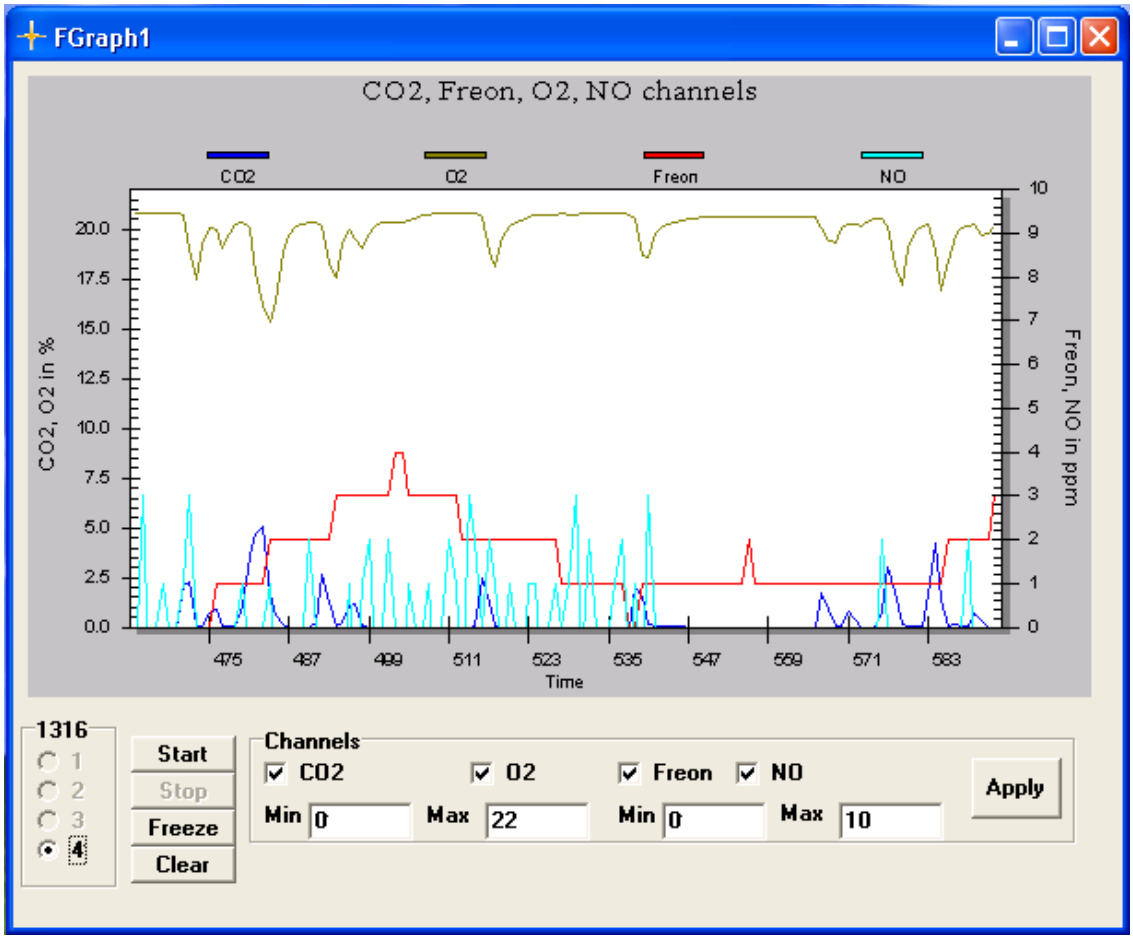



*Fig.3.8 The BZ6013 Graphics1 screen showing Concentration measurement results on two axis. Primary axis used for gases reported in % the secondary axis for gases reported in ppm.*

**Channels Field.**

The Channels field in the bottom part of the Graphics1 screen is used to:

***Select the gases*** for which the measurement data is to be presented in the graphical screen by setting a tick-mark.

***Change the scaling for the two axis***. The scale is changed by keying in appropriate values in the Min, Max boxes for each Channel.

After changing the scale and selection of the gases to be shown on the graph press the **APPLY** Soft Key to activate the new settings.

**1316A-2 Field.**

This field is used to change the screen displayed between the up to four different 1316A-2 to display the measurement result.

**Start, Stop, Freeze, Clear Soft Keys .**
**START** and **STOP** Soft Keys is used to start and stop a measurement display respectively.
**CLEAR** Soft Key is used to refresh the screen display.
**FREEZE** is used to freeze the displayed screen while the monitoring task is still running.

**Graphics2.**

In the Graphics2 mode the x-axis is a time axis. The y-axis is divided to present an individual axis for each gas.
See Figure 3.9.

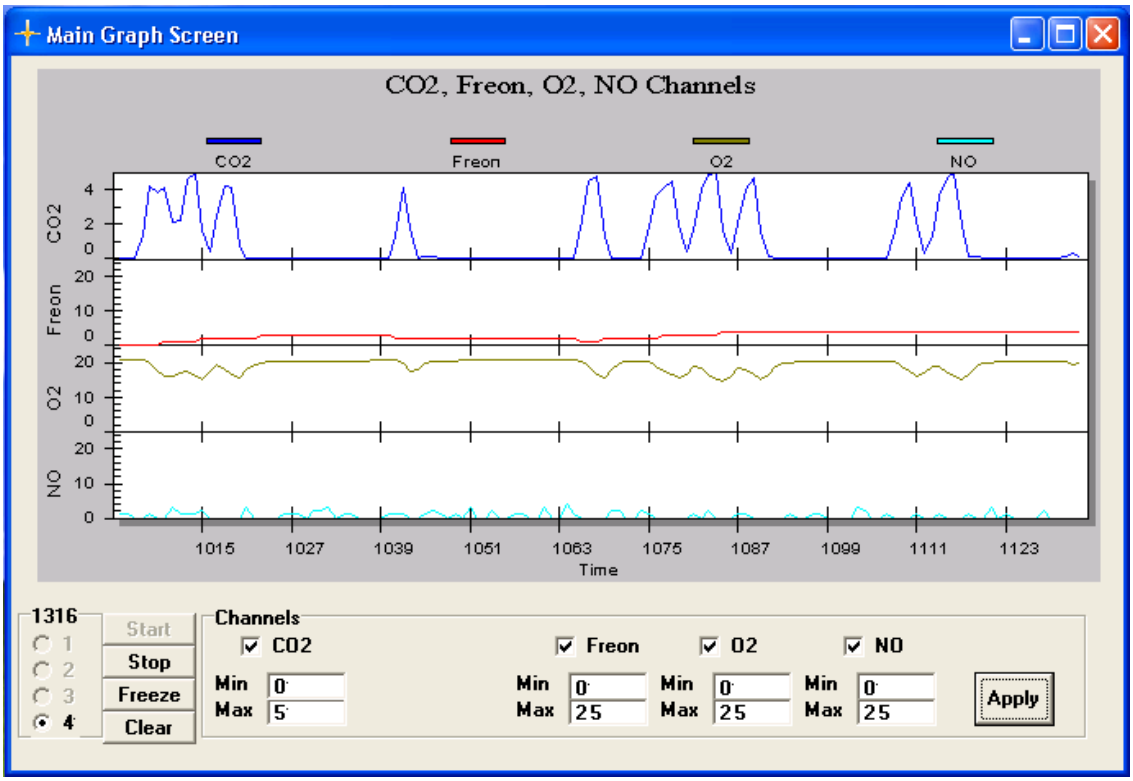



*Fig.3.9 The BZ6013 Graphics screen showing Concentration measurement results on individual axis for each gas.*

**Channels Field.**

The Channels field in the bottom part of the Graphics2 screen is used to :

***Select the gases*** for which the measurement data is to be presented in the graphical screen by setting a tick-mark.

***Change the scaling for the individual axis***. The scale is changed by keying in appropriate values in the Min, Max boxes for each Gas.

After changing the scale and selection of the gases to be shown on the graph press the **APPLY** Soft Key to activate the new settings.

**1316A-2 Field.**

This field is used to change the screen displayed between the up to four different 1316A-2 to display the measurement result.

**Start, Stop, Freeze, Clear Soft Keys.**

**START** and **STOP** Soft Keys is used to start and stop a measurement task respectively.
**CLEAR** Soft Key is used to refresh the screen display.
**FREEZE** is used to freeze the displayed screen while the monitoring task is still running.

## 3.3 Status

Selecting the option Status from the Screens Pull-down menu brings up a screen showing a status report and internally logged errors detected by the monitor.

This is useful in helping with the diagnosis of any problems you may be having with the system.

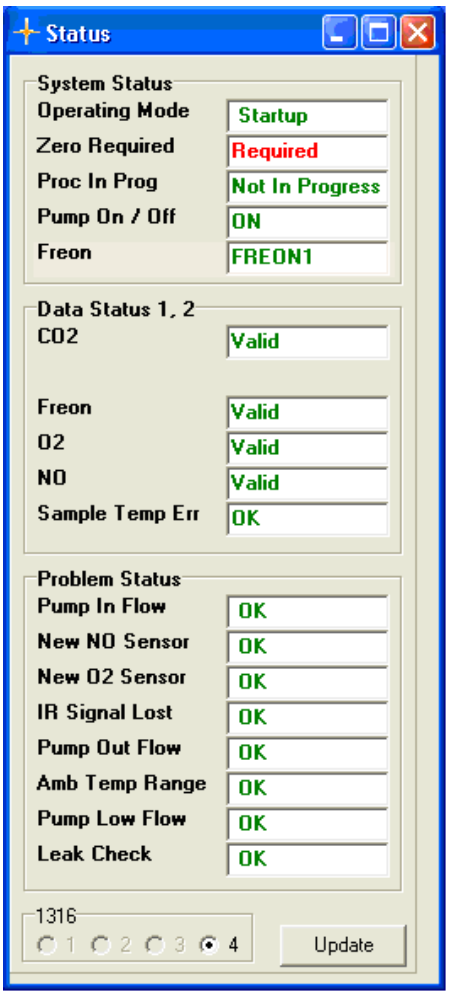



*Fig.3.10. The BZ6013's status Screen*

The BZ6013 and 1316A-2 have built-in test procedures that are able to monitor various electronic and mechanical parts – for example, the flow rate. If anything abnormal is detected with any of the parameters tested for, the error will be reported in the status screen see figure 3.10.

The status screen in figure 3.10 shows that zero is required.

The ***System status*** and ***Data Status*** messages are described in this manual when relevant for the task performed in a given section.

The problem status messages are described in section 3.4 below.

## 3.4 Screen Problem Status

In the bottom part of the Status screen, see figure 3.10, error and warnings are displayed. If a fault status is discovered the text box text is changed from OK to Check.

### 3.4.1 Pump In Flow.

This fault might indicate one of the following errors. There is an occlusion in the sample inlet or outlet. A probable course for this could be occluded (or blocked) tubing, external filter, inlet filter or a defective pump.

Corrective actions eliminate occlusion.

### 3.4.2 New NO Sensor

This fault indicate that the Full-scale output of the NO sensor is ≤80% of full scale value when sensor was installed. The NO sensor must be replaced with a new NO sensor.

Please refer to section 4.3.8 and 5.1.8 when installing a new NO sensor

### 3.4.3 New $O_2$ Sensor

The $O_2$ sensor output is detected to be below a specified limit during Zero/$O_2$ Span Calibration. Replace the $O_2$ sensor. Please refer to section 5.1.8 when installing a new $O_2$ sensor.

### 3.4.4 IR signal lost

This fault indicate that the sample Cell is contaminated. The sample cell and windows must be cleaned. Might also display $CO_2$ and Freon data invalid in the Data Status section of the status window see figure 3.10.

### 3.4.5 Pump Out Flow

Sample gas path is occluded at outlet during Zero/$O_2$ span calibration.

Corrective action: Clear outlet occlusion. Use the pump on command see section 5.1.3 and perform a new Zero/$O_2$ span calibration see section 4.2.1.

Might also display a Zero calibration fail error in the Data status of the status screen.

$CO_2$, Freon, NO Zero calibration fail and $O_2$ span calibration fail will be displayed.

### 3.4.6 Ambient Temperature range

The detector temperature is out of range. Measurement accuracy might be affected. Verify that the monitor is operating within the specified operating temperature range

### 3.4.7 Pump Low Flow

This fault might indicate one of the following errors. There is an occlusion in the sample inlet or the pump is defective. A probable course for this could be occluded tubing, external filter, inlet filter. Corrective actions eliminate occlusion.

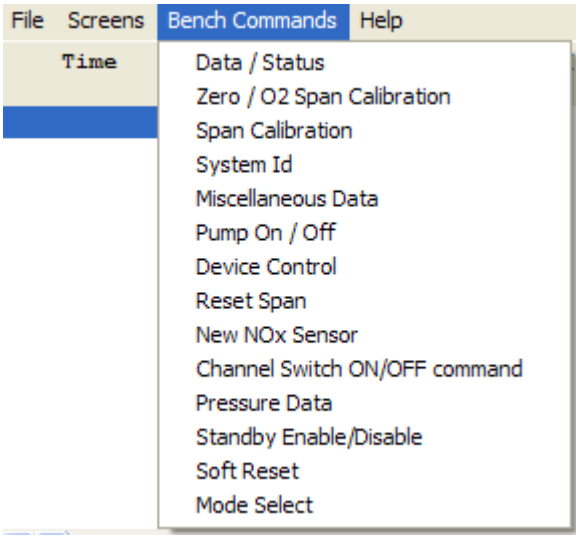
### 3.4.8 Leak Check

Not included in the 1316A-2.

## 3.5 Reset.

At any time it is possible to perform a reset to restart the 1316A-2 monitor.

Pull down the Bench Command Menu




Select Soft Reset.
Following window appear.

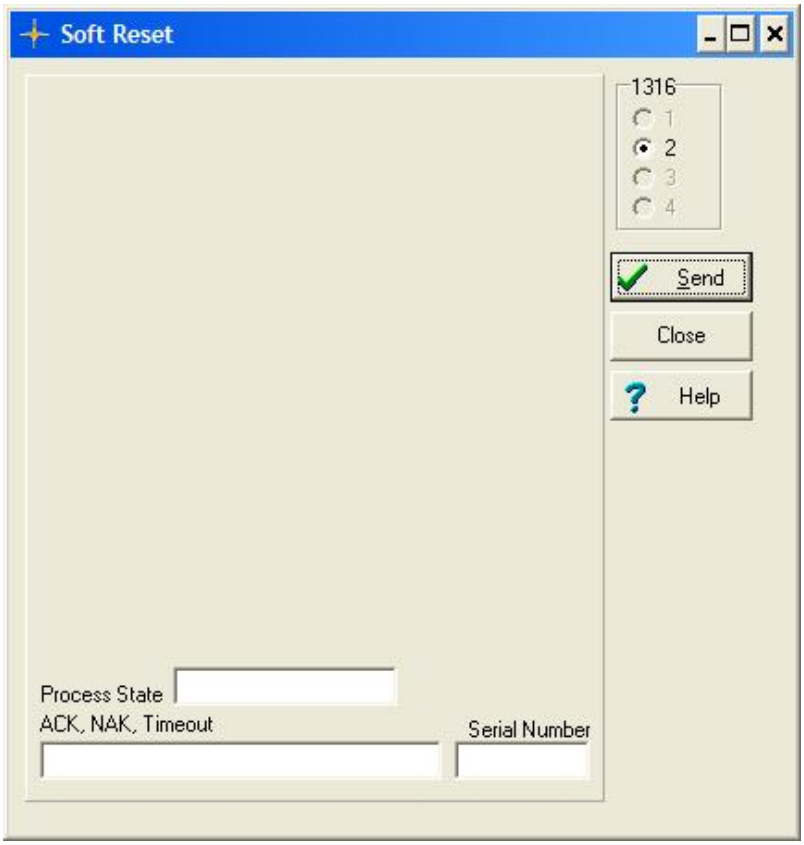



*Figure 3.11: The Soft Reset Window.*

Press the Send Button and the Instrument is Reset and ready for set-up.

## 3.6 Operating Modes of the Multi Gas Monitor 1316A-2

The Multi Gas Monitor 1316A-2's operations comprise four modes of operation.

- Start-up
- Normal
- Standby
- System Fault

### 3.6.1 Start-up Operating Mode

After POR (power on / reset), the Multi Gas Monitor 1316A-2 performs the following:

- Start-up and initialization.
- Self-test.
- Thermal warm-up. After a cold start or a Software Reset bench command the warm-up time period is 35 seconds maximum. After leaving standby mode the typical warm-up time period is 20 seconds after completion of the first zero.

The following actions are not allowed during the start-up mode:

- Zero calibration.
- Span calibration.

### 3.4.2 Normal Operating Mode

When the Start-up time has elapsed, the Multi Gas Monitor 1316A-2 enters **Normal** Operating Mode.
All actions are allowed, like measurement, calibration or any other bench command.

If measurement has not been requested for >2 minutes, the Multi Gas Monitor 1316A-2 leaves **Normal** mode and enters **Standby** mode.

### 3.4.3 Standby Operating Mode

The 1316A-2 Gas Monitor's Pump is turned OFF when the **Standby** mode is entered.

The 1316A-2 enters standby mode as a result of any of the following:

- 2 minutes after any POR if measurement has not been started.
- 2 minutes after measurement has been stopped.

During **Standby** mode, the Pump is turned OFF and the following actions are not allowed:

- Zero calibration.
- Span calibration.

This explains why measurement should be started before doing any calibration.

Normally, **Standby** mode is terminated, and **Start-up** mode is entered, when measurement is being started. If the **Standby** mode was activated by a sample cell over-temperature condition, the only way to resume normal operation is via a software reset (bench command) or via a hardware reset (power off).

Upon leaving **Standby** mode, the Multi Gas Monitor 1316A-2 turns ON the pump, attains thermal stability during a 20-second start-up mode, and resumes **Normal** mode operation.

### 3.4.4 System Fault Operating Mode

**System fault** mode is entered if any of the following error conditions occur:

- Self-test error.
- ADC data acquisition error.
- IR source error.
- Flash memory error.

Recovery from system fault mode requires a power-down/power-on reset, and may call for product service.

# Chapter 4

# Calibration

February 2011

# 4.1 Introduction

### 4.1.1 Factory calibration

Multi Gas Monitor –INNOVA 1316A-2 component tolerances result in small, but relevant differences in measurement of a given gas concentration. The IR source, pressure transducers, thermistors, band pass filters, and detectors are subject to these variances. During the Type 1316A-2 manufacturing process, each unit is individually characterized. Characterization results in a set of unique response characteristics for each IR gas channel. These individual response curves are stored in the NDIR module flash memory, and enable the Multi Gas Monitor 1316A-2 to measure gas concentration accurately.

### 4.1.2 Field Calibration

The Multi Gas Monitor –INNOVA 1316A-2 is designed to be zero and span stable in normal operation.

Zero calibration establishes the baseline for gas concentration measurement. These responses vary depending on existing temperature conditions (ambient, sample gas, and IR filters/detectors).

Span calibration compensates for the normal component drift that slowly occurs over the life of the instrument.

# 4.2 Zero Calibration and $O_2$ Span Calibration

LumaSense recommends that zero calibration be performed as follows:

Whenever Zero Request is shown in the Status window see figure 4.1

Immediately prior to taking any important set of gas concentration data.

Immediately prior to any span calibration.

Zero calibration is a recommended step in recovering from several types of malfunctions.

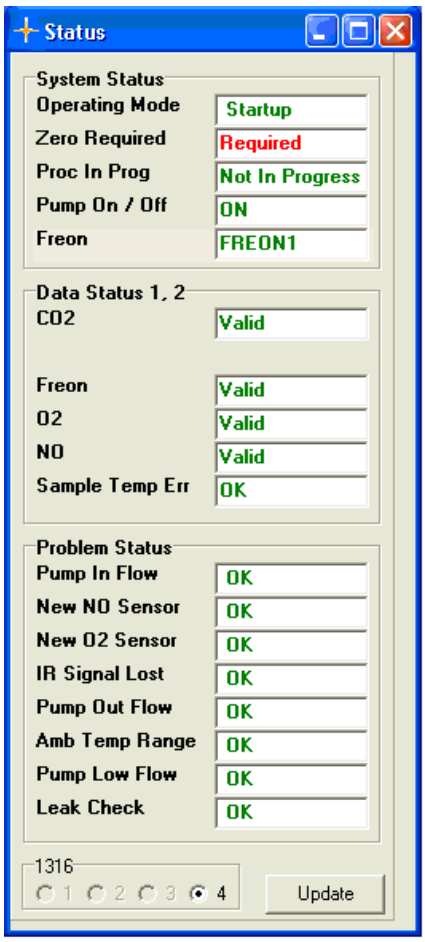



*Figure 4.1. Status Window displaying "Zero required".*

During a zero point calibration the sample gas is taken through the Zero inlet on the rear panel of the monitor with a flow rate of 700 ml/min. ambient air is used for the zero calibration.

### Zero Request

The Zero Request (see figure 4.1) is set true under the following conditions:

At POR (power on / reset). When the Multi Gas Monitor is turned ON or reset, all gas channels will temporarily report 0 gas concentrations (volume % or ppm). Gas concentration data is only valid after a successful zero calibration.

After transitioning from standby to normal operating mode.

Zero request interval timeout (90 seconds after POR, followed by a 3 minute then a 6 minute interval and 30 minutes thereafter).

After a ±3°C change in detector temperature.

When an ADC input range error occurs on one or more IR channel ($CO_2$, Freon, reference).

**Purpose**

Zero calibration compensates for conditions that affect gas concentration measurement. Examples of these conditions are as follows:

Changes in ambient temperature.

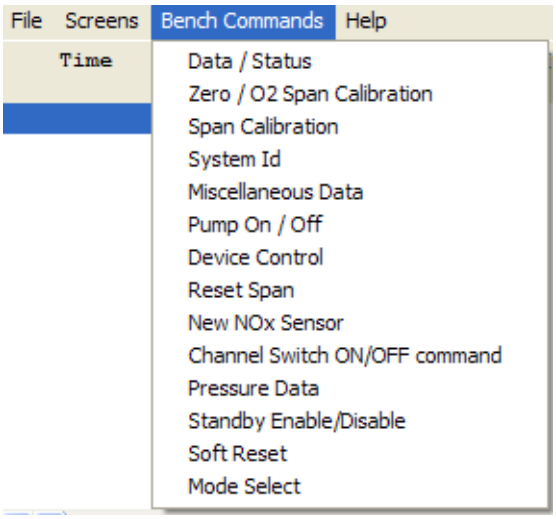
Short-term sample cell contamination caused by inadequate particle filtering.

Long-term sample cell contamination caused by deposits on the sample cell wall or windows.

Zero calibration execution time is typically 30 to 45 seconds, including a purge time that depends on the pneumatics configuration and a fixed calibration time of 20 seconds. The process will take longer under the following conditions:

**1. Extended Purge time ( PT) is used.**

Purge time ( PT) can be extended . Pull down the Bench Command menu select Zero/$O_2$ Change the PT value).




Select the Zero/ O2 Span Calibration.

The following window is displayed.

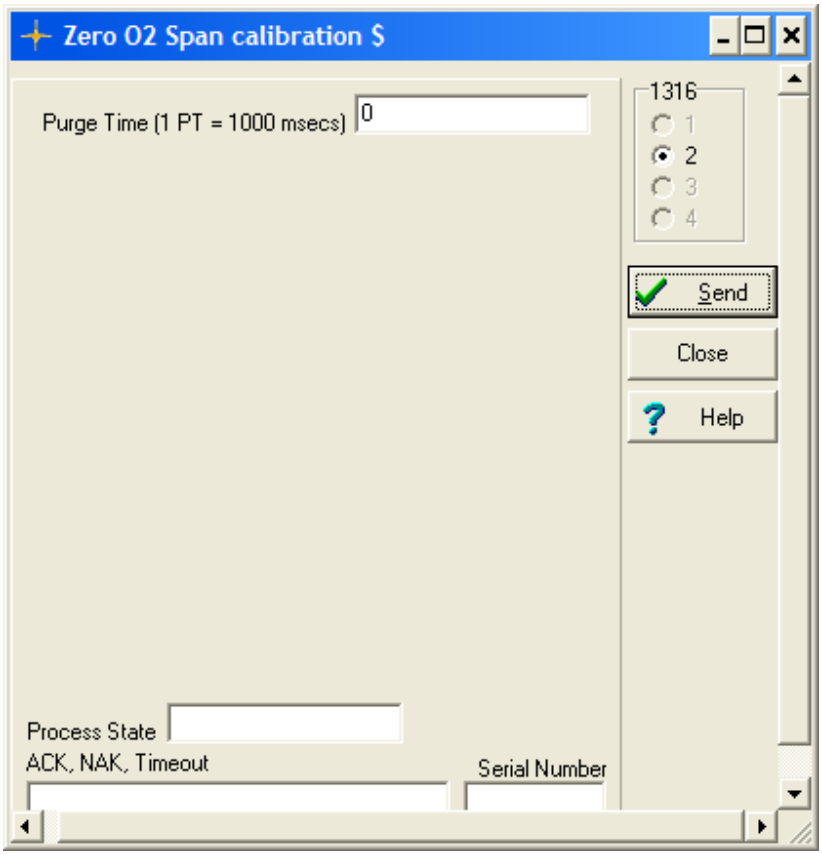



*Figure 4.2. The Zero O2 span calibration window to select Purge time during a calibration.*

Using the Window above the BZ6013 can extend the Purge Time (PT) in 1-second increments.

**2. Power on.**

The first Zero during a power on cycle takes 5 seconds longer than a subsequent Zero with the same PT value.

**3. NO Concentration**

When the Zero/$O_2$ Span Calibration command is transmitted, and the NO concentration is above a set value. The purge time is extended in order to completely purge the NO sensor.

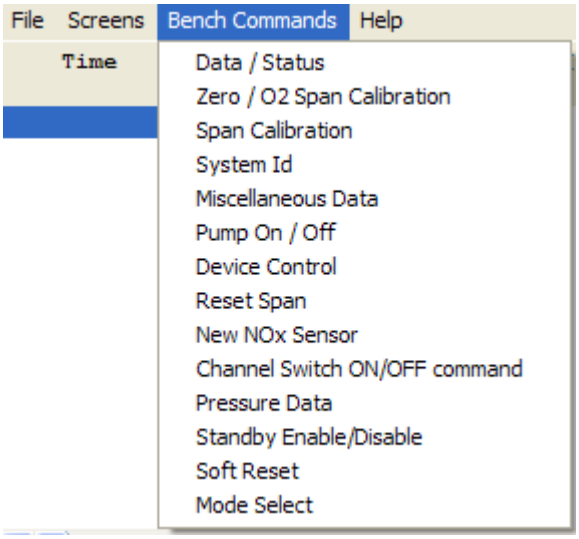
### 4.2.1 Zero Calibration Procedure

The $CO_2$, Freon and NO channels are zero calibrated and the $O_2$ channel is span calibrated. Using the selected Purge Time (PT) (see figure 4.2 ).

Assuming that the monitor and the PC are connected and the software is running (displaying the Main Menu), the zero calibration continues as follows:

1. Ensure that the monitor has been switched on for at least 30 minutes.

2. When the Main Menu screen is displayed, select Zero / $O_2$ Span from the Bench Command pull-down menu.




When the Multi Gas Monitor – INNOVA 1316A-2 receives the Zero command, it checks the system status.

When all conditions for zero calibration are met, the Process In Progress is activated (see figure 4.3).

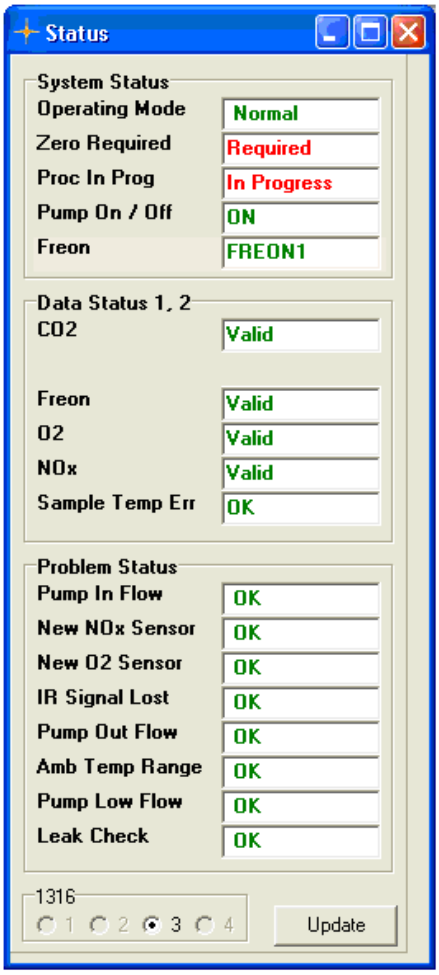



*Figure 4.3. The Status Window displaying Zero calibration in Progress.*

The Zero/$O_2$ Span is started controlled by the BZ6013 going through the following steps:

i) The pump is turned OFF and all solenoid valves are deactivated.

ii) After a settling delay, the ambient pressure (Atm Press) is measured and stored.

iii) The pump is turned ON.

iv) After a settling delay, the sample cell pressure (Abs Press) is measured and stored.

v) The absolute pressure limit is checked (Abs Press – Atm Press Pressure Limit).

If this test fails, the Pump Out Flow Check is shown in the Status window (see figure 4.4) and the zero calibration procedure is aborted:

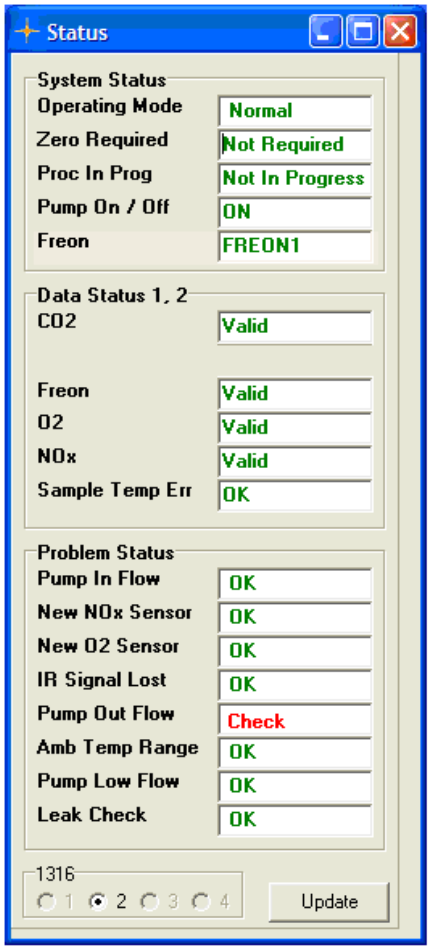



*Figure 4.4. The Status Window displaying the Pump Out Flow Check.*

The Multi Gas Monitor – INNOVA 1316A-2 is purged with sample gas by pumping room air from the zero inlet on the rear panel through the entire flow system..

During the zero calibration purge period, the $O_2$ sensor's electrical zero offset is calculated and stored. The optimum gain is calculated for each IR channel.

The new calibration constants:

$CO_2$, Freon and NO zero calibration constants.

$O_2$ span calibration constant.

Are calculated and stored in flash memory:

When the zero calibration process is successful, the following actions are performed:

The red **Zero Required** in the Status screen, see figure 4.3, is changed to show a green **Not Required,** see figure 4.5.

The **Proc In Progress** in figure 4.3 is changed from a red **In Progress** to a green **Not in Progress** in the status screen, see figure 4.5.

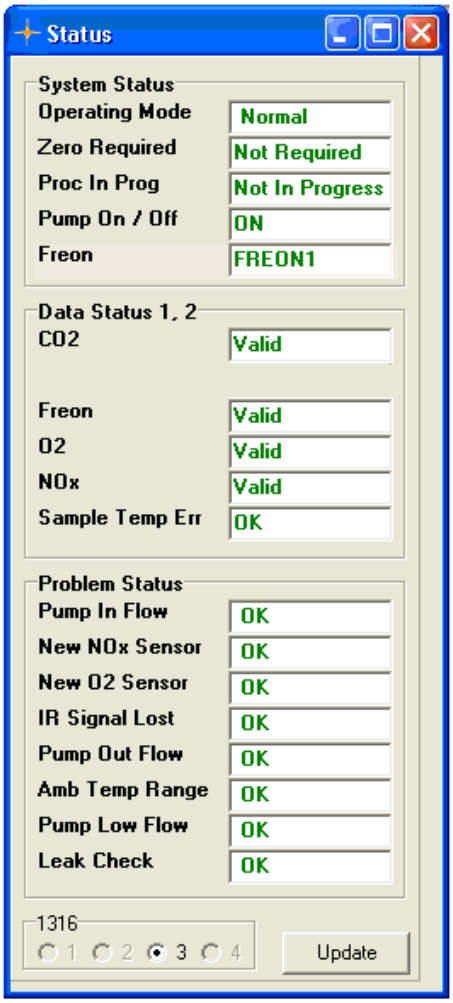



*Figure 4.5. Status Window showing Zero not required.*

The 30-minute zero request interval timer is reset.

### 4.2.2 Error and Warnings Related to a Zero Calibration

The following conditions cause the Multi Gas Monitor –INNOVA 1316A-2 to refuse to execute the zero calibration.

1. The Multi Gas Monitor –INNOVA 1316A-2 is in Start-Up mode See figure 4.6, Operating Mode.

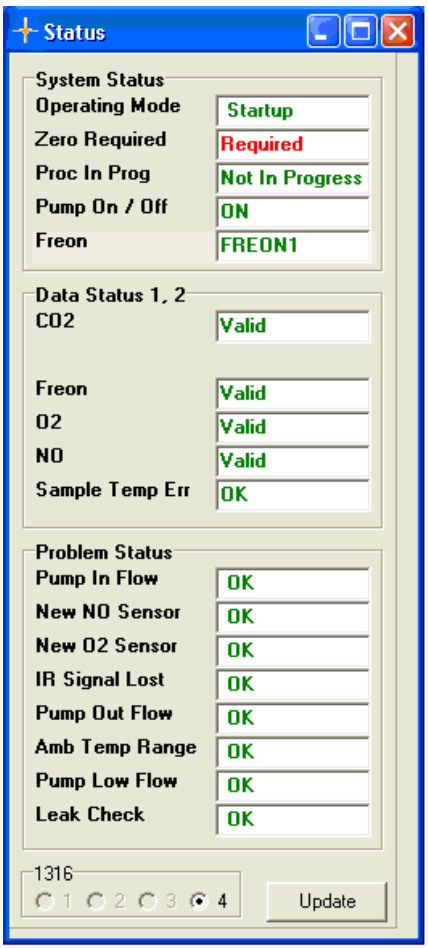



*Figure 4.6. Status Window displaying Operation Mode "Start up".*

2. The Multi Gas Monitor – INNOVA is in Stand By mode.

3. A Flow Fault has been detected, see figure 4.4,"Pump Out Flow" caused by exceeded pressure limits.

4. If the $CO_2$ or Freon channel gain cannot be set (e.g., the IR signal is too strong), the following warnings occur.(see figure 4.7).

   $CO_2$ Zero Fail.

   Freon Zero Fail

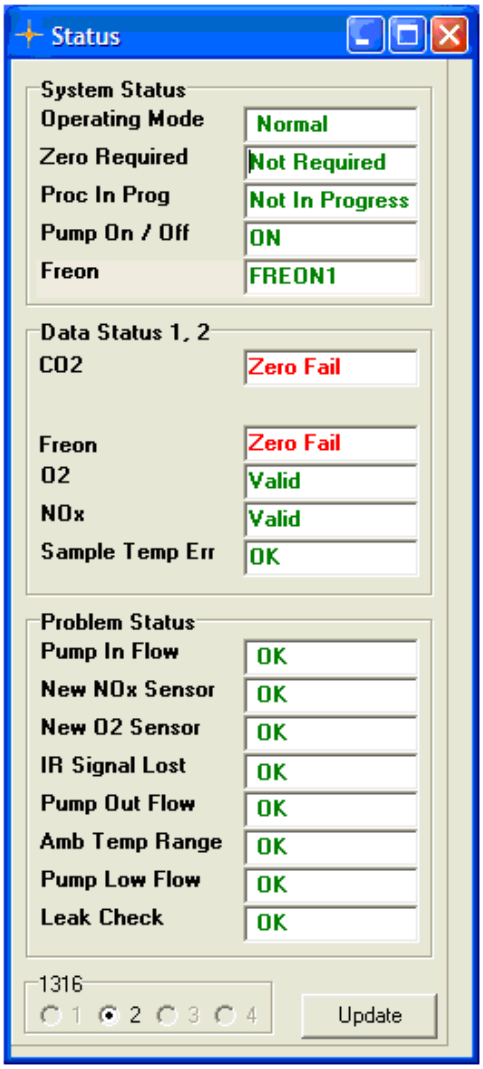



*Figure 4.7. The Status Window displaying Zero failed.*

5. If the reference channel gain cannot be set, the following warnings occur( see figure 4.7).

   $CO_2$ Zero Fail.

   Freon Zero Fail

6. If the peak-to-peak value for any IR channel is less than a flash-memory-resident minimum value, the following warnings occur see figure 4.8:

   IR Signal Lost

   $CO_2$ Data Invalid

   Freon Data Invalid

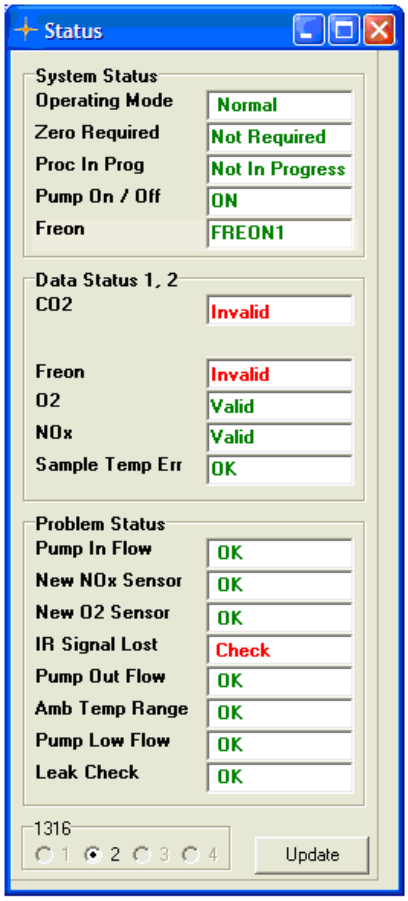



*Figure 4.8. The Status window showing  Data Invalid and IR signal lost.*

7. If the $O_2$ sensor's output is lower than a flash-memory-resident minimum value, the New $O_2$ Sensor Required warning is shown see figure 4.9.

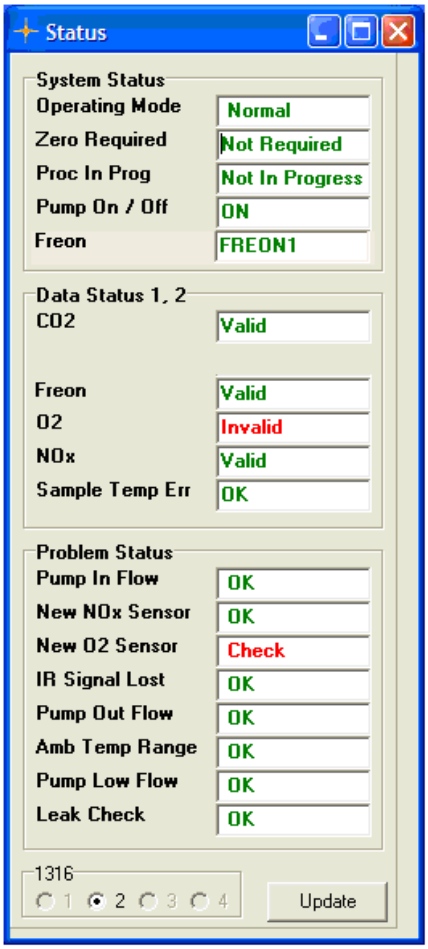



*Figure 4.9 . The Status Window displaying " New $O_2$ Sensor Required".*

**Notice:**

In the Main screen see figure 4.10 it is possible to select that zero calibrations are performed automatically whenever requested. By using the AUTO mode.

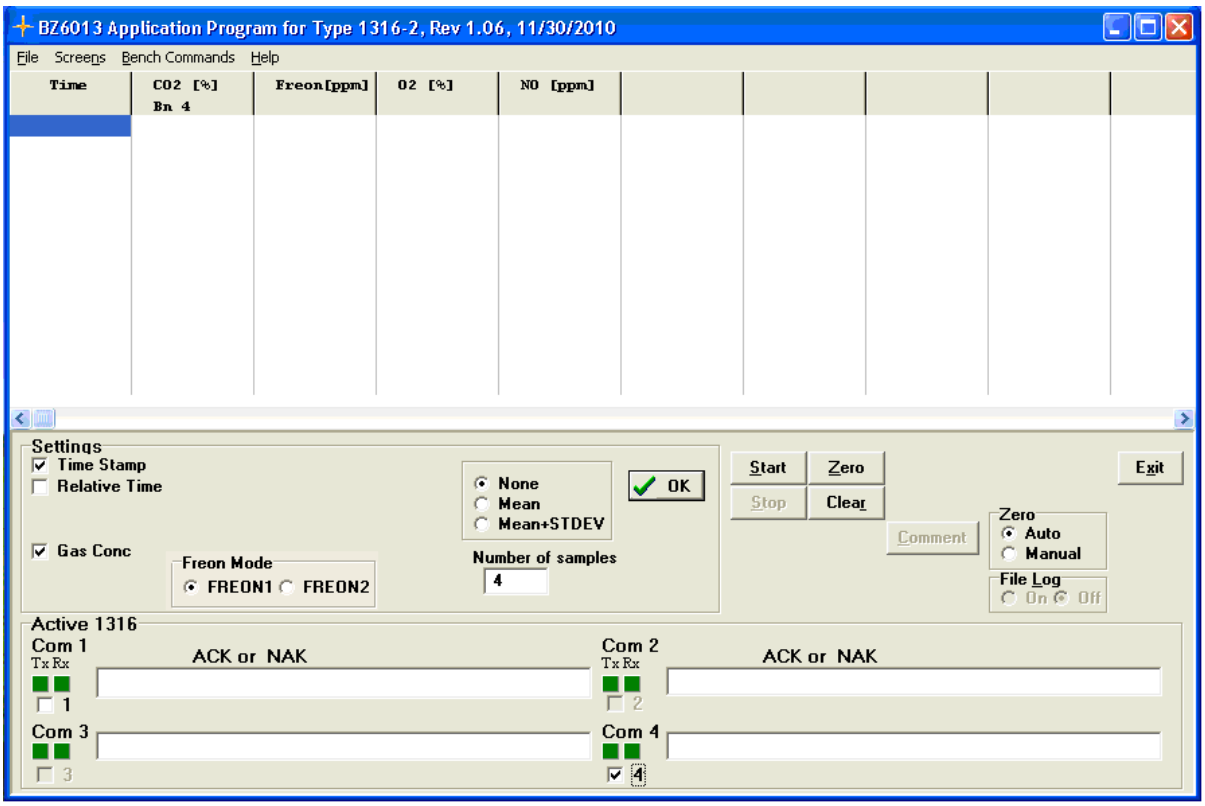



*Figure 4.10. The Main Menu Screen displaying Zero Auto mode.*

## 4.3 Span Calibration

### 4.3.1 Introduction.

The Multi Gas Monitor – INNOVA 1316A-2 is designed to be span-stable. Frequent span calibration is not required to maintain accurate gas concentration measurements. The Multi Gas Monitor may need to be routinely span calibrated with suitable mixtures of calibration gases. Span calibration is recommended at the following intervals:

- The VM0101A module measuring Freon and $CO_2$: Once every 12 months.
- NO sensor VM0201A: After replacement of a NO sensor, and once every month during normal operation.
- $O_2$ Sensor VM0200A: Span calibration is performed during every Zero/$O_2$ Span Calibration execution.
- When any span calibration has failed.

### 4.3.2 Checking and Changing the Particle Filters

It is recommended to change the inlet filter DS2306 before performing any calibration.

*Fig.4.11.The particle filterDS2306*

The particle filter is attached to the rear panel of the monitor.
Dismantle the filter from the luerlok fittings and replace it with a new DS2306.

### 4.3.3 Calibration Gases

To perform a full calibration gases are required.
Special gas mixtures containing known concentrations of Freon (FREON1 or FREON2) and Carbon Dioxide are required to span calibrate the VM0101A
If UA1372A is mounted with electrochemical sensors $O_2$ (VM200A) and NO (VM0201A) then calibration gases to span calibrate the sensors are also needed.

The gas mixture shown in Table 4.1 is allowed concentration ranges for calibrating the monitor

| Gas | Concentration Range |
|---|---|
| Freon | 100 ppm to 1000 ppm |
| Oxygen | 1% to 25 % |
| Carbon Dioxide | 1 % to 20 % |
| Nitrous Oxide | 100 ppm to 5000 ppm |
| Nitrogen | Balance |

*Table 4.1 Allowed gas concentration ranges for 1316A-2 Span calibration*

### 4.3.4 Connecting the Calibration Gas

**Warning!** Never make a direct connection from the pressure valve on a gas cylinder. Always use a side-stream connection like the one shown in Fig.4.12.

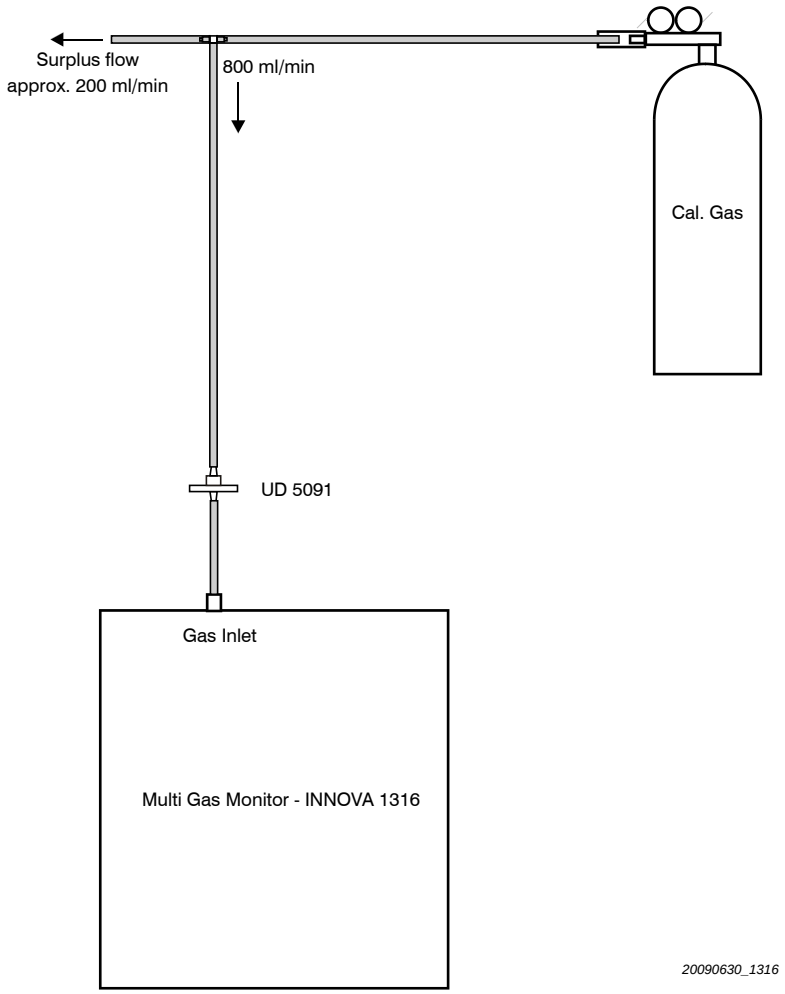



*Fig.4.12 Typical side-stream connection set-up used during calibration*

### 4.3.5 Span Calibration

Turn ON the Multi Gas Monitor. You need to let the Multi Gas Monitor – INNOVA 1316A-2 warm up for at least 5 minutes. For optimum span calibration accuracy, let the Multi Gas Monitor –INNOVA 1316A-2 warm up for at least 30 minutes.

While the Multi Gas Monitor –INNOVA 1316A-2 is warming up, perform the following steps:

1) If a New NO Sensor is required see the Status window figure 4.13., install a new NO sensor Order number VM0201A.
2) If the New $O_2$ Sensor is required see the Status window figure 4.14, install a new $O_2$ sensor. Order number VM0200A.

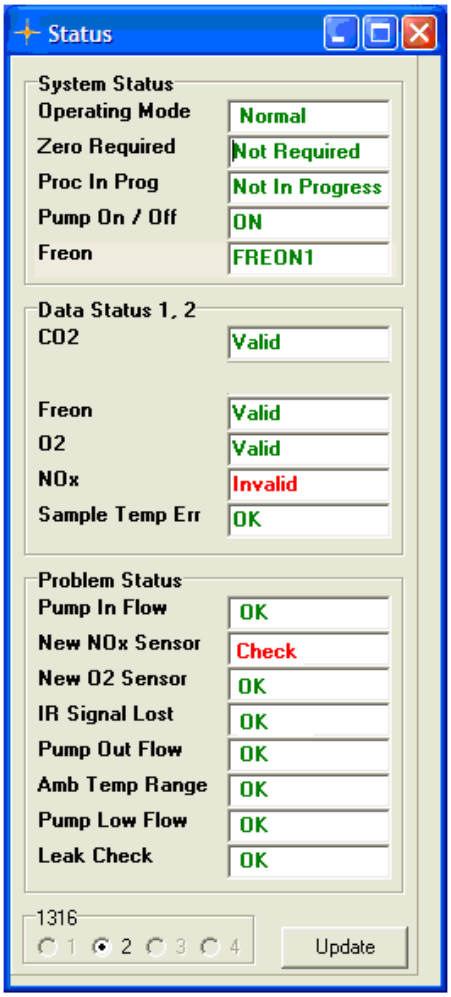



*Figure 4.13. The Status window displaying that a new NO sensor is required*

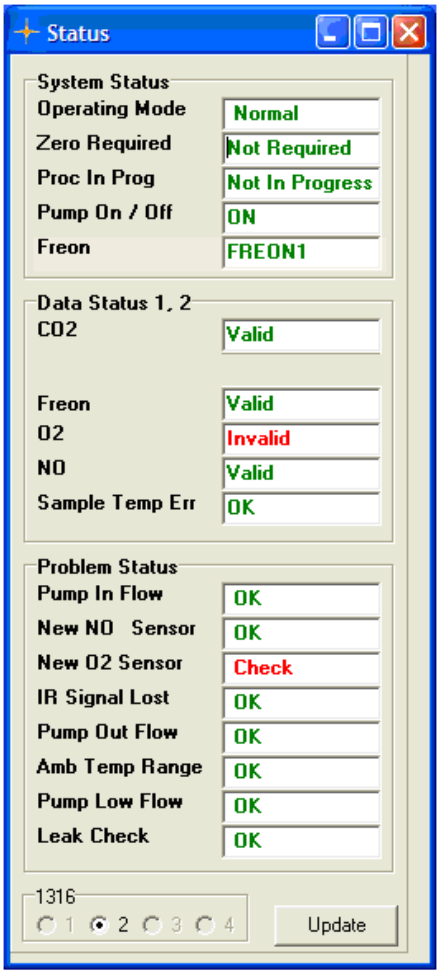



*Figure 4.14. The Status window displaying that a new $O_2$ sensor is required.*

Prior to any span calibration perform a Zero/$O_2$ span calibration after completion of the warm up time.

Initially set Zero Calibration to "Manual" in “Zero Group”, see figure 4.15. This will avoid the Zero calibration to interfere with the Span calibration.

*Figure 4.15 Set Zero calibration to Manual*

Start the measurement by pressing the “Start”-button in the Main window, see figure 4.16

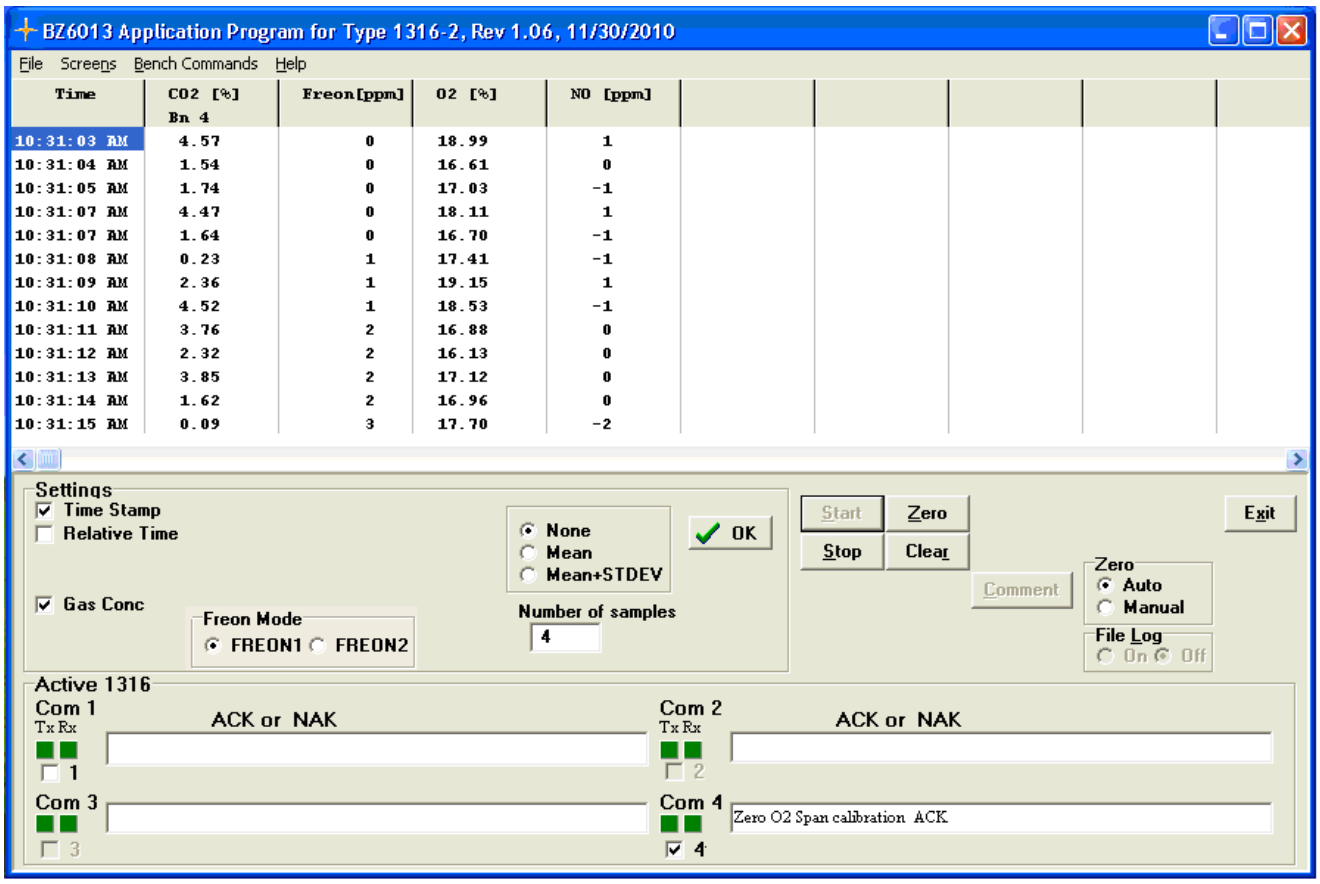



*Figure 4.16 Main window displaying measurement started..*

Open the status window and press the “Zero”-button in the Main window, in order to perform a Zero calibration.

The ambient air is taken from the Zero reference inlet on the rear panel during Zero calibration. In the Status window observe that the “Proc in prog”-status is “In Progress”, while Zero calibration. is done, see figure 4.17.

When Zero calibration has successfully finished the “Proc in prog”-status is “Not in Progress”, see figure 4.18.

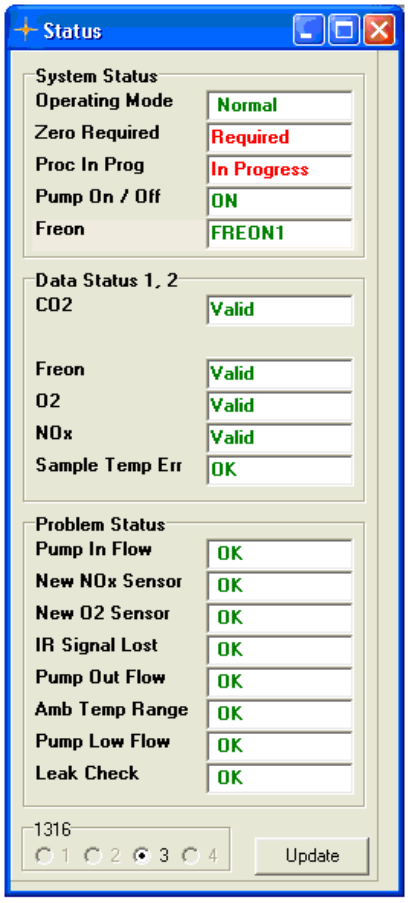



*Figure 4.17 Status window during Zero calibration.*

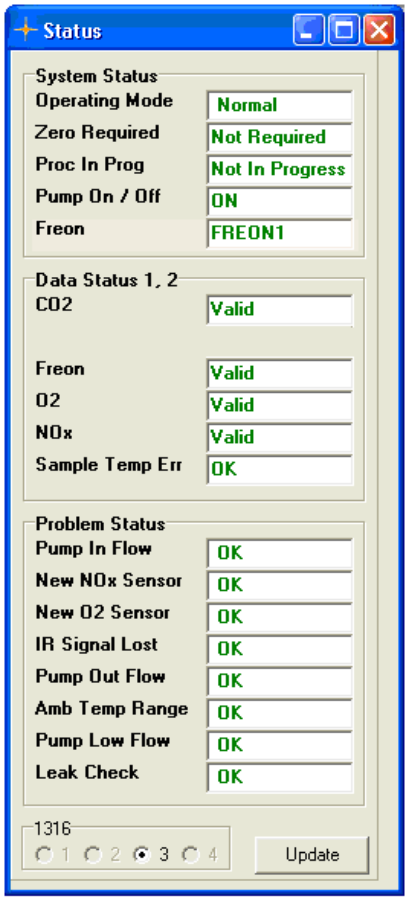



*Figure 4.18 Status window when Zero calibration has finished.*

Pull Down the Bench Command menu and select the "Mode Select" bench command, see figure 4.19.

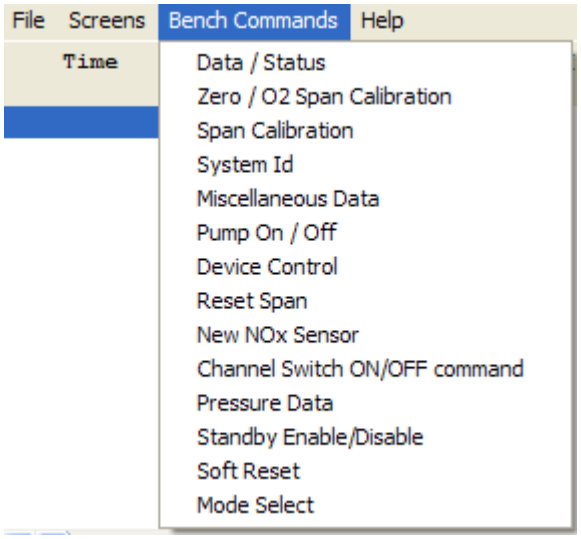



*Figure 4.19 The Bench Command Menu showing "Mode Select"*

In the "Mode Select"-window set the group "Action" to "Temporary Change" and the group "New Mode" to "3 – 6601, New"., see figure 4.20. Press the "Send" button to set mode 3 temporary.

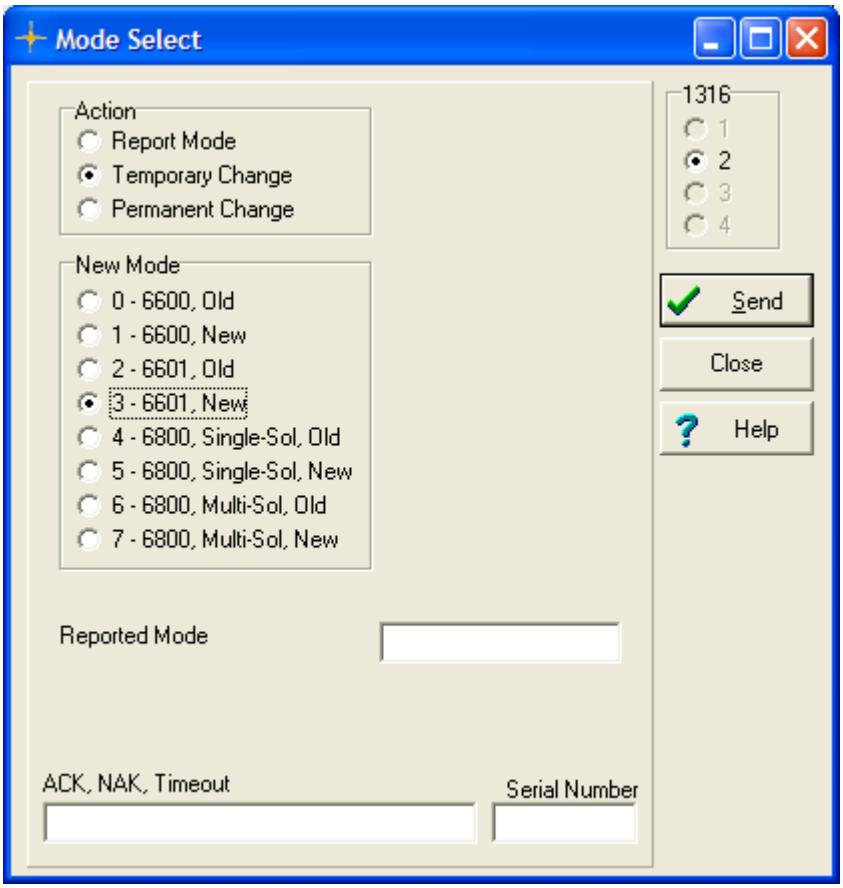



*Figure 4.20 The Mode select window With Mode 3 selected.*

Connect the SPAN gas to the INLET on the rear panel of the Multi Gas Monitor INNOVA-1316A-2.

Pull down the **Bench Command** Menu

And select Span Calibration see figure 4.21.

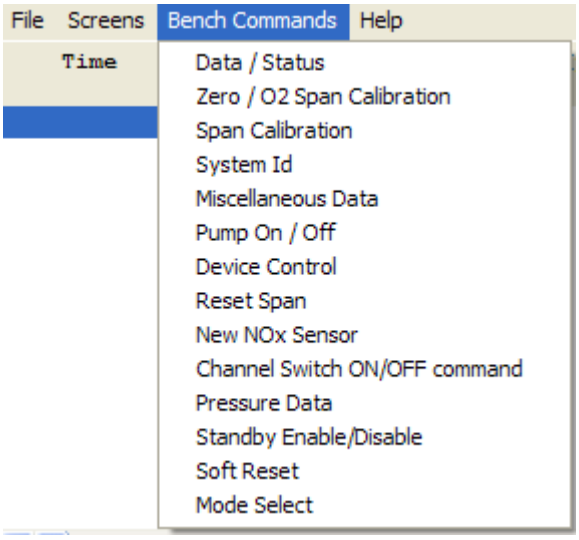



*Figure 4.21. The Bench Command Menu*

The following window will appear, see figure 4.22.

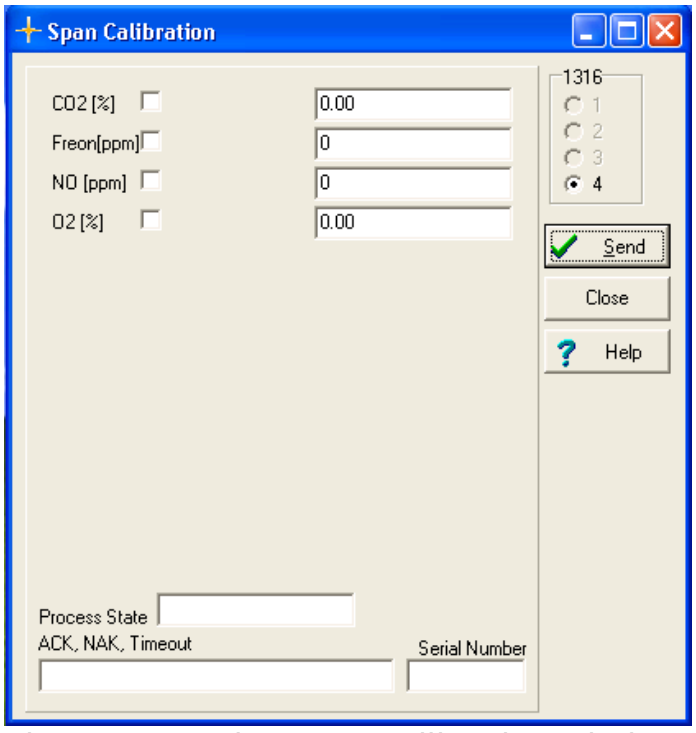



*Figure 4.22. The Span Calibration window.*

Tick the gas(ses) to be Span calibrated, and its concentration value(s), see figure 4.23. Press the “Send” button to perform the Span calibration. Observe the “Process State” change to “In Progress” during the Span calibration, see figure 4.24.

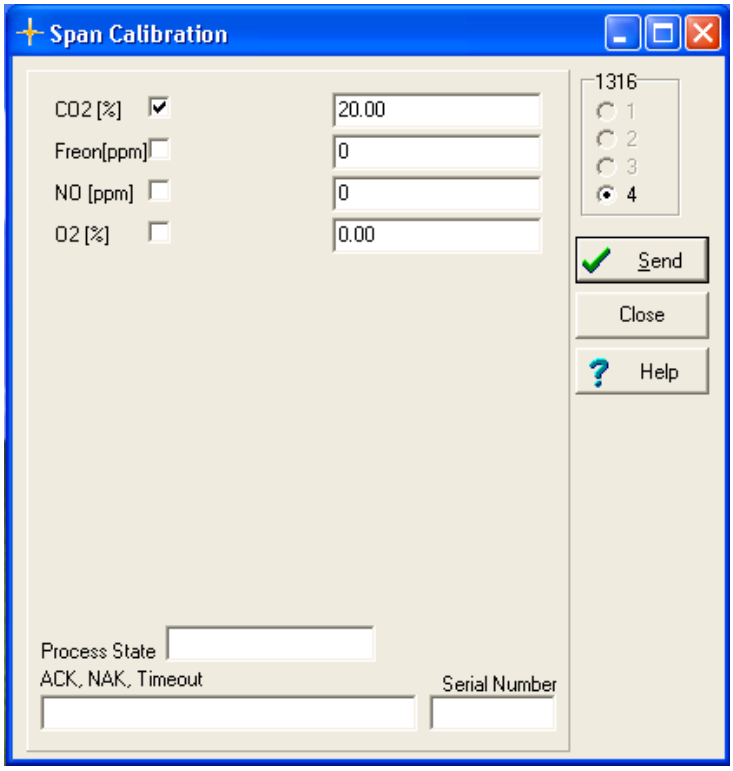



*Figure 4.23 The Span Calibration Window to select the gasses and the concentrations for Span calibration*

The text box in the Span Calibration window now displays Span Calibration ACK. The Span Calibration is in progress.

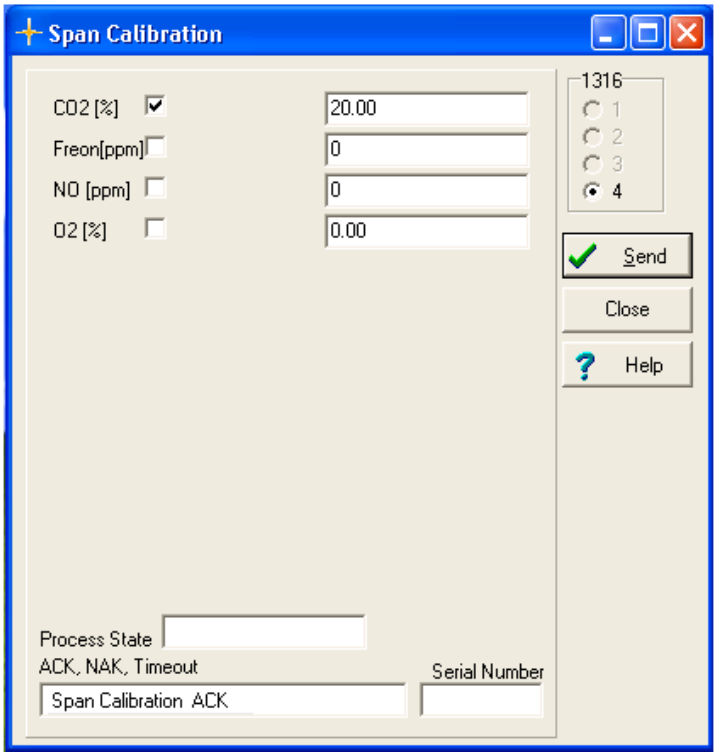



*Figure 4.24 Span Calibration window showing Span calibration in progress.*

During Span calibration the Status window will show the “in progress” status, see figure 4.25.

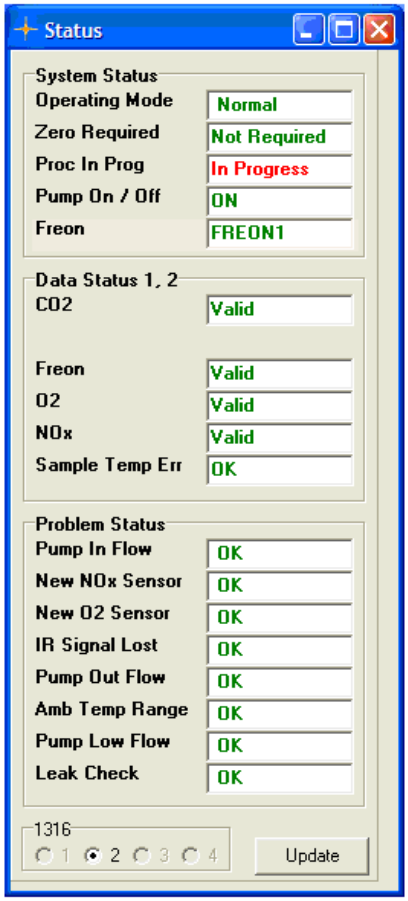



*Figure 4.25 Status window during the Span Calibration*

After a successful Span calibration the gasses calibrated will show the status "Valid" for each of the gasses which where Span calibrated, see figure 4.26.

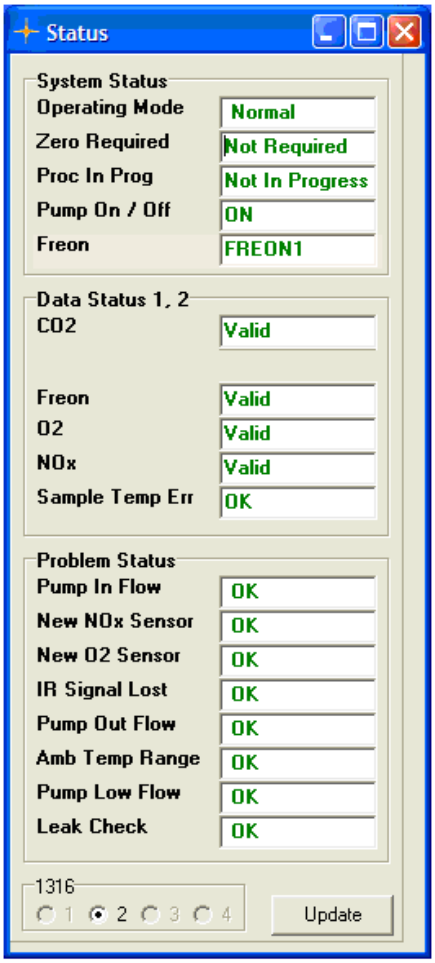



*Figure 4.26 Status window after successful Span calibration*

If the Span calibration fails the Status window will show the “Span Fail” status for the gasses failing to be Span calibrated, see figure 4.27.

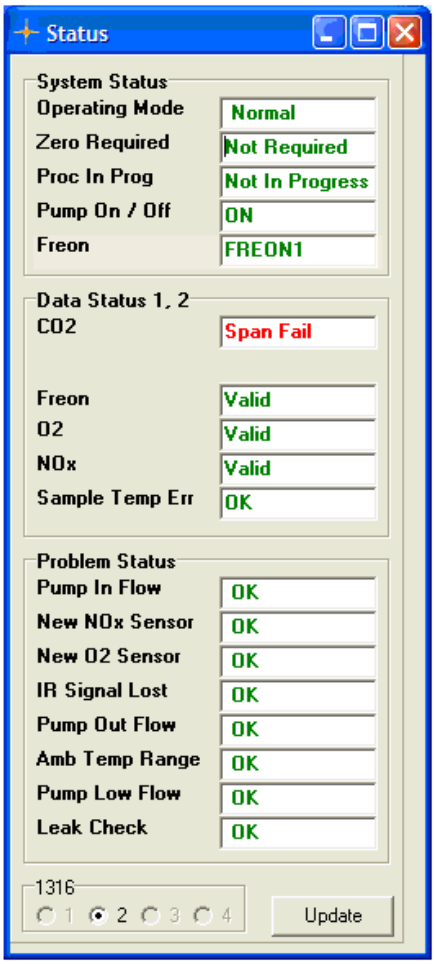



*Figure 4.27 Status window after a failing Span calibration*

After SPAN calibration revert to default mode 5. In the “Mode Select”-window set the group “Action” to “Temporary Change” and the group “New Mode” to “5 – 6800, Single-SOL, New”. see figure 4.28. Press the “Send” button to set mode 5.

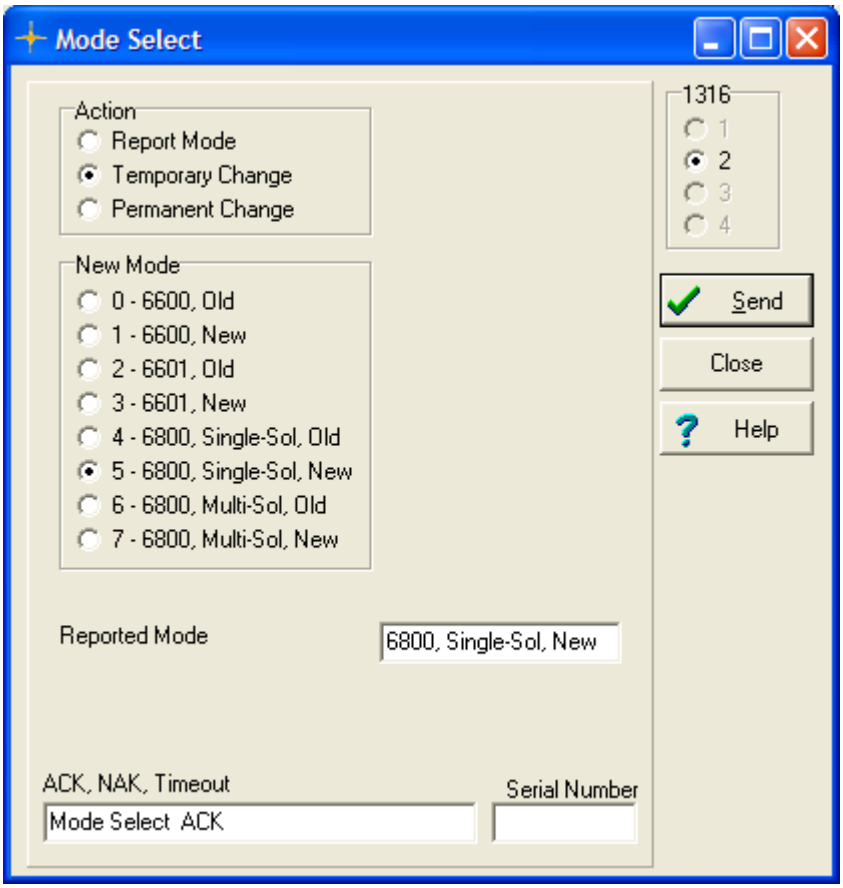



*Figure 4.28 Select Mode 5 in the Mode Select window*

Stop the measurement by pressing the “Stop”-button in the Main window. Finally set the group “Zero” to "Auto" in the Main window, see figure 4.29

*Figure 4.29 Set Zero calibration to Auto*

This concludes the Span calibration.

### 4.3.6 To perform a span calibration with single component gas.

If only one gas is to be span calibrated this can be performed using a single component gas in Nitrogen balance.

Before doing the Span calibration please make sure that Zero calibration is set to “Manual” and the mode is set to 3 as described in section 4.3.5.

1. Use ☑ to tick which of the CO2 or Freon gasses that you want to be calibrated.

2. Type in the correct concentrations for the ticked CO2, Freon gas.

   The gas concentration must be the same as that stated on the calibration gas bottle.

3. Connect the calibration-gas bottle as described in section 4.3.4.

4. Open the gas valve and adjust the flow so that a small surplus flow exists in the side-stream tube.

5. Press the Send button to start the gain calibration.

After making the Span Calibration please make sure that the Mode is set back into 5 and that the Zero calibration is set to “Auto”, as described in section 4.3.5.

The monitor is now ready for making measurements.

Press Send.

The Process State In Progress is displayed in the Span Calibration window (see figure 4.30) and the Data Status in the Status window is changed to show Freon Span, see figure 4.31.

The 1316A-2 is calibrated with the selected gas at the concentration keyed in.

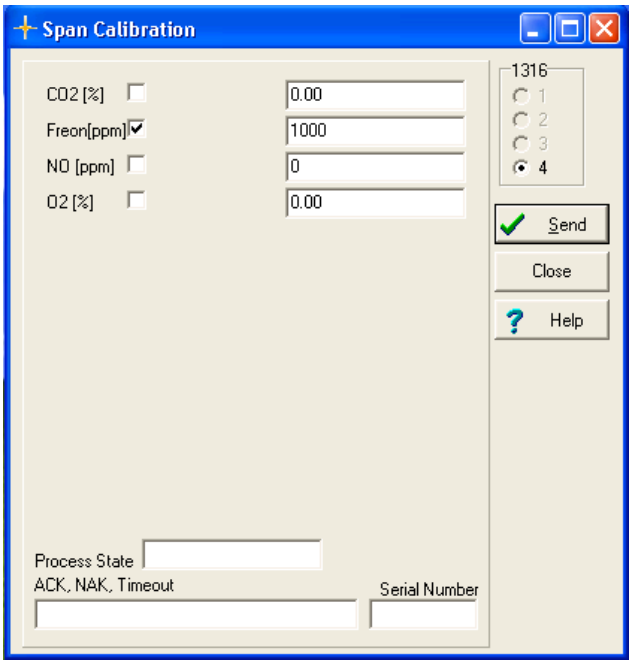



*Figure 4.30. Span Calibration window showing Freon calibration in Progress.*

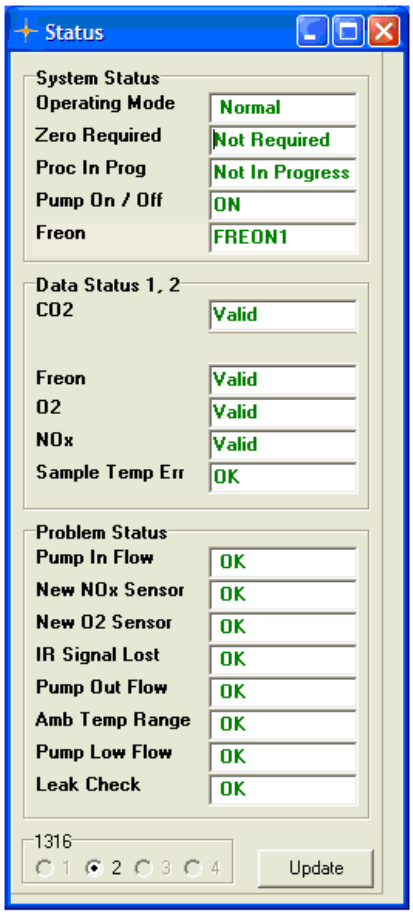



*Figure 4.31. The Status window showing that Freon is Span Calibrated (Valid).*

Before starting a Freon calibration verify that the Freon selected in the Freon Mode (FREON1/FREON2) is as for the supplied gas from the gas cylinder.

Consult the Main Menu see figure 4.32 or in the **Bench Command** menu (see figure 4.21) select Data/Status and select the Freon to be used for the calibration.

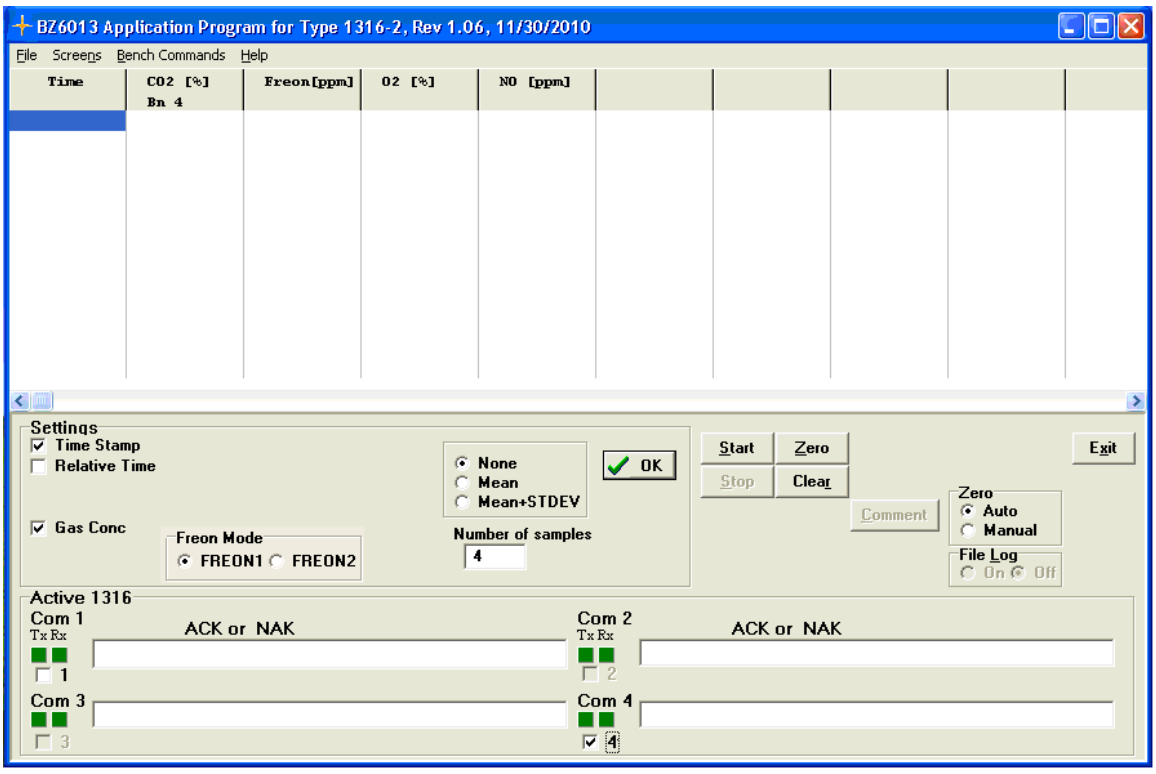



*Figure 4.32: The Main window with Freon mode selected to be FREON1.*

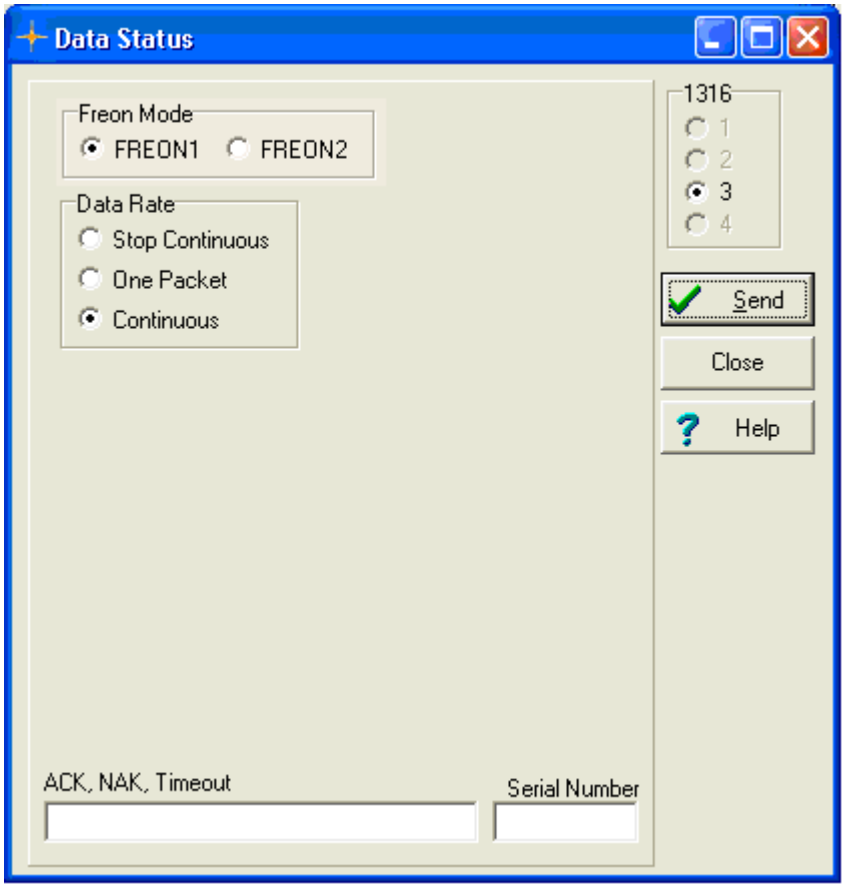



*Figure 4.33: Data Status window to select Freon Mode.*

### 4.3.7 To perform a span calibration with multi component gas mixture.

If more than one gas is to be span calibrated at the same time this can be performed using multi component gas mixtures.

In the Span calibration window (see figure 4.22) select the gases to be calibrated and key in the appropriate concentrations from the certificate from the gas cylinder.

Before doing the Span calibration please make sure that Zero calibration is set to “Manual” and the mode is set to 3 as described in section 4.3.5.

1. Use ☑ to tick which of the $CO_2$, Freon gasses that you want to be calibrated.

2. Type in the correct concentrations for the ticked $CO_2$, Freon gasses.

   The gas concentrations must be the same as that stated on the calibration gas bottle.

3. Connect the calibration-gas bottle as described in section 4.3.4.

4. Open the gas valve and adjust the flow so that a small surplus flow exists in the side-stream tube.

5 Press the Send button to start the gain calibration.

After completion of the span calibration routine:

The validity of each new span calibration constant ($CO_2$, Freon) is checked.

New span calibration constants for the Freon and $CO_2$ channels should not significantly differ from the factory span calibration constants.

If a newly calculated span calibration constant does differ by greater than ±30% from the original factory value, the appropriate span fail status ($CO_2$ Span Fail, Freon Span Fail). is set true see figure 4.34.:

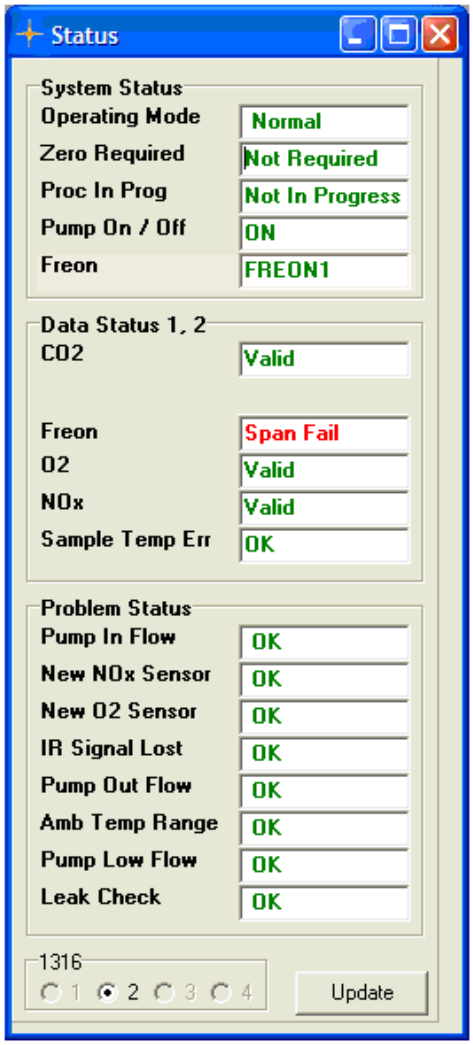



*Figure 4.34. Status window showing a Freon span failed.*

If the NO channel is being span calibrated, the current full-scale NO output is calculated and saved. If the current full-scale NO output is less than or equal to a preset value (The Low NO Sensor Limit) the New NO Sensor Required is shown in the Status window, see figure 4.13.

After making the gain Calibration please make sure that the Mode is set back into 5 and that the Zero calibration is set to “Auto”, as described in section 4.3.5.

### 4.3.8 Installing a new NO sensor.

After installation the new NO sensor it must be span calibrated following the procedure described above..

After performing the NO span calibration:

Select the New NO sensor in the Bench command menu, see figure 4.35.

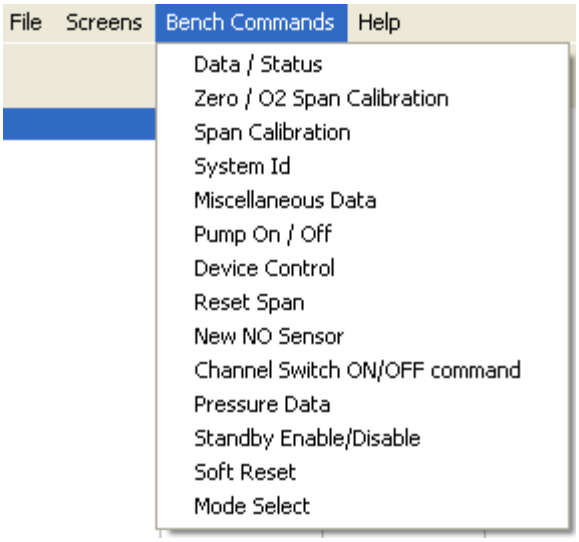



*Figure 4.35. Bench command menu select New NO sensor*

The following window appears.

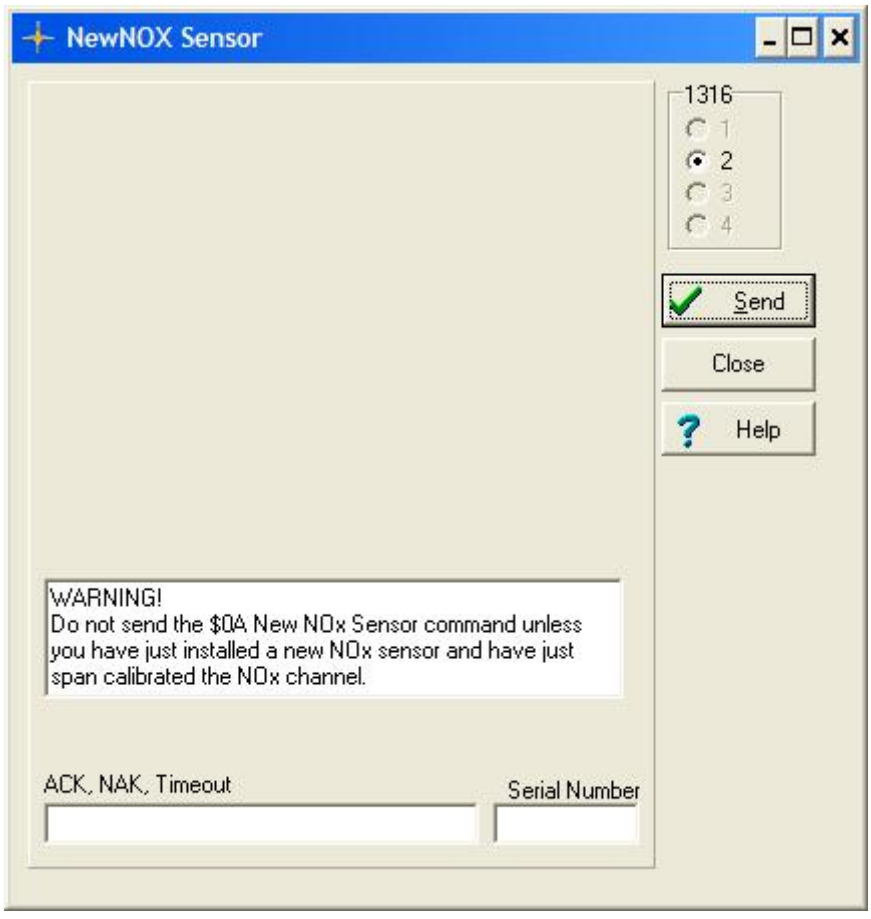



*Figure 4.36 . The New NO sensor window.*

If a new sensor is installed Press **SEND**.

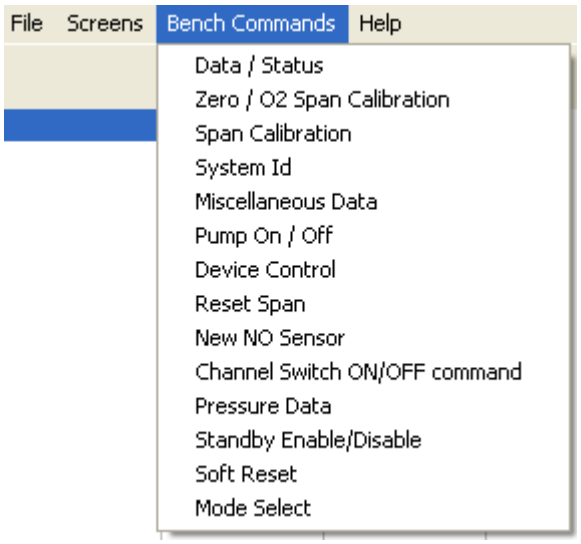
**Warning:** never attempt to send the new NO sensor command after a NO span calibration unless a new NO sensor has been installed.

The Low NO Sensor Limit is calculated and saved.

## 4.4 Reset Span Calibration

At any time it is possible to return to the factory saved calibration factors.

Pull down the Bench Command Menu.




Select Reset Span.

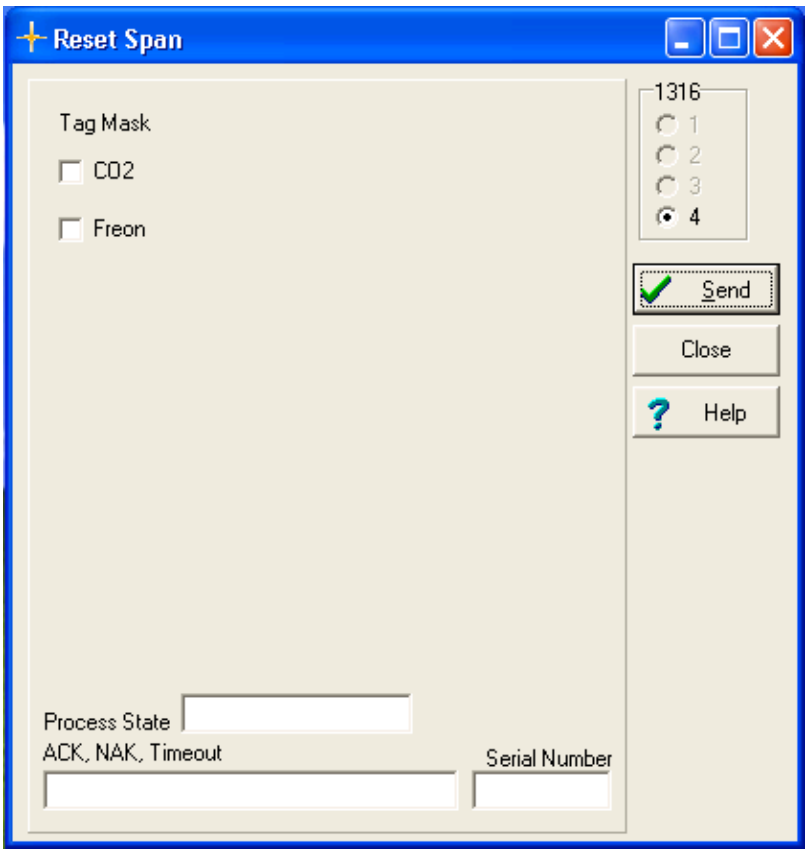



*Figure 4.37. Reset Span Window*

Put in a tick mark for the gases to be set back to default calibration factors.

# Chapter 5

# Maintenance

February 2011

# 5.1 Maintenance Items

### 5.1.1 Changing Zero Channel inlet filter

It is recommended to change the zero gas inlet filter at least once a year.

- Remove the top cover.

- Remove the DS0790 filter by detaching the luerlok fittings.

- Install a new DS0790 filter.

*Figure 5.1. Picture showing the DS0790 zero inlet dust filter.*

### 5.1.2 Changing the fuses

On delivery, two 20 mm T 1.6A (VF0007A) slow-blow fuses are installed in the monitor – one in the live and one in the neutral mains feed. When replacing fuses always ensure that the correct fuses are used.

To check and change the fuses:

1. Remove the power cable from the mains socket.

2. Insert a suitable screwdriver into both of the fuse holders and unscrew the fuse holders. See figure 5.2.

*Figure 5.2 Opening the fuse holders*

*Figure 5.3 Accessing the fuses*

3. Remove the fuses from the holders and check that they have the correct rating (T 1.6 A slow-blow), see figure 5.3.

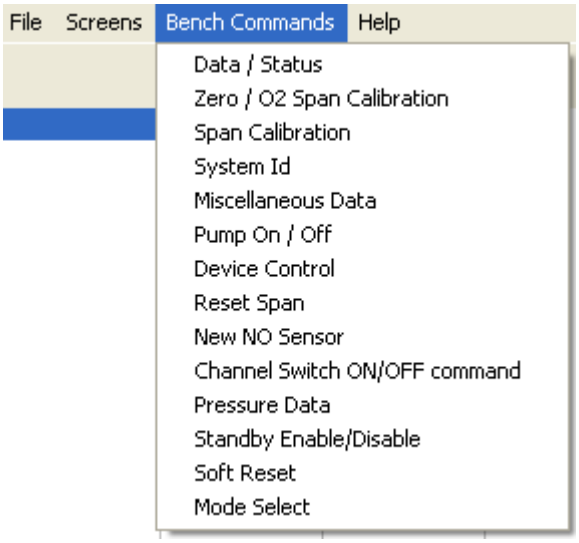
4. If the installed fuses do not have the correct rating or are faulty, install the correct fuses.

5. Screw the fuse holders into the monitor.

6. Attach the mains cable.

### 5.1.3 Checking the Pump

Pull down the Bench Commands menu.




Select Pump On/Off

Following window will appear.

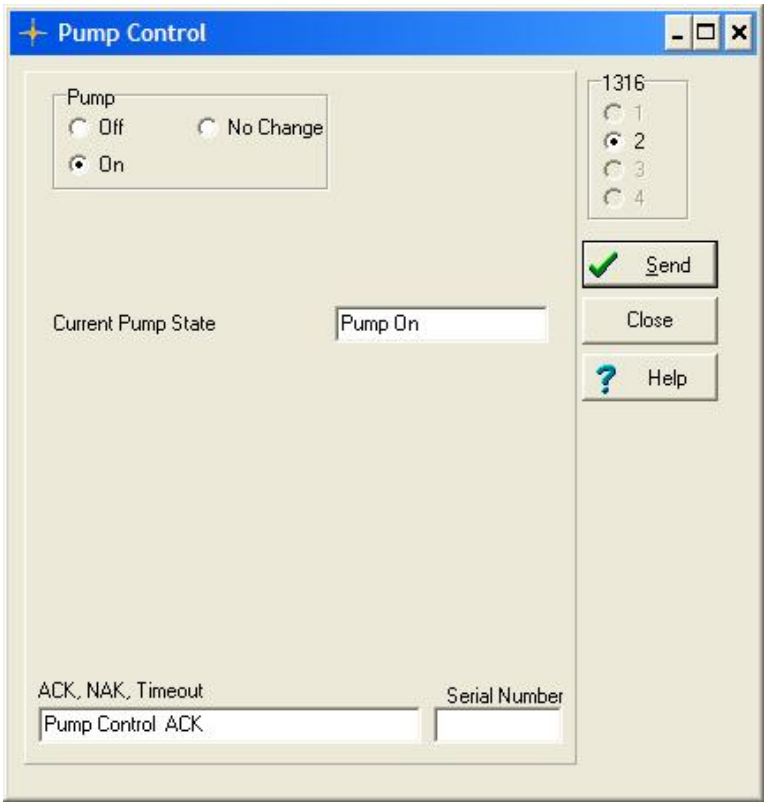
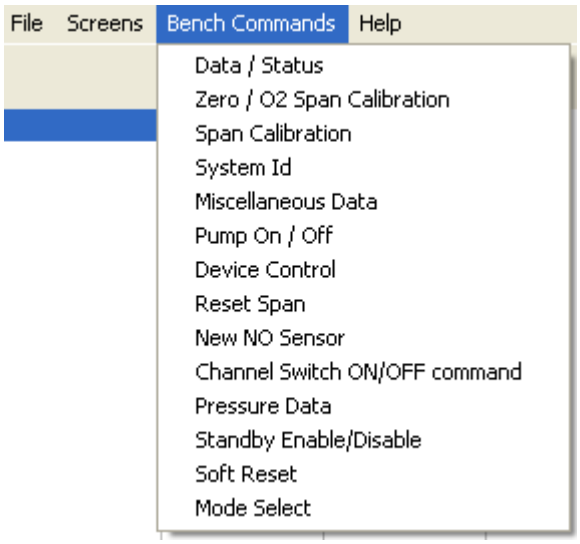



*Figure 5.4. The Pump Control Window.*

By selecting **On** and **Send** it can be verified that the Pump is working properly.

### 5.1.4 System ID

Pull down the Bench Command Menu




Select System ID.

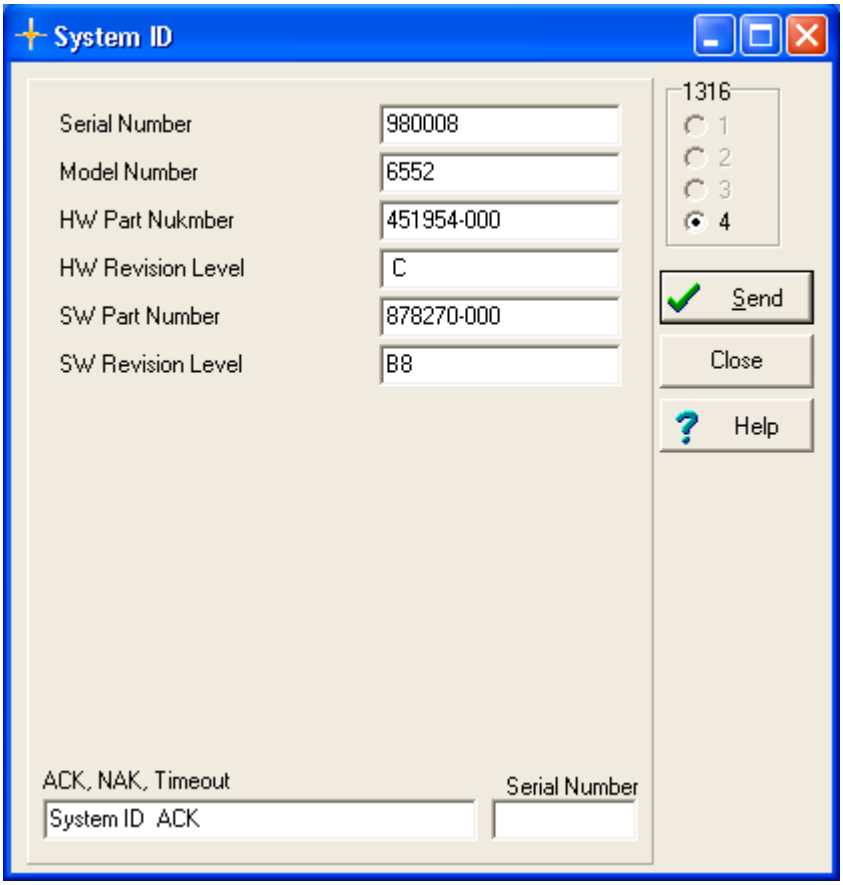


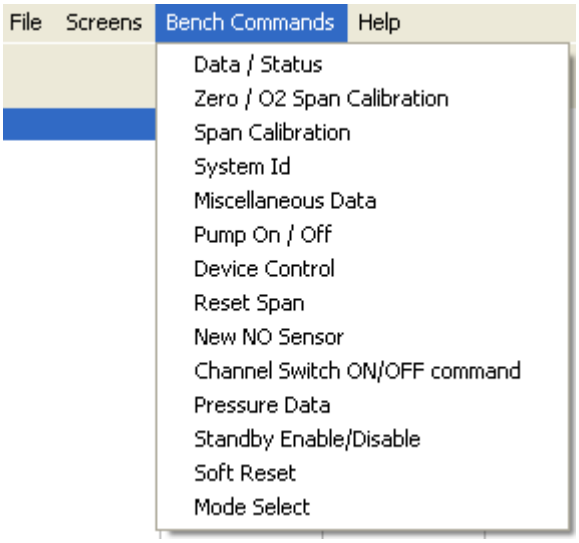

*Figure 5.5: The System ID Window.*

The System ID window displays the Serial Number, Model number and Revision level after pressing the **Send** soft-key button.

### 5.1.5 Valve Test

To verify that the tree-way valve is working properly.

Pull down the Bench Command Menu




Select Device Control

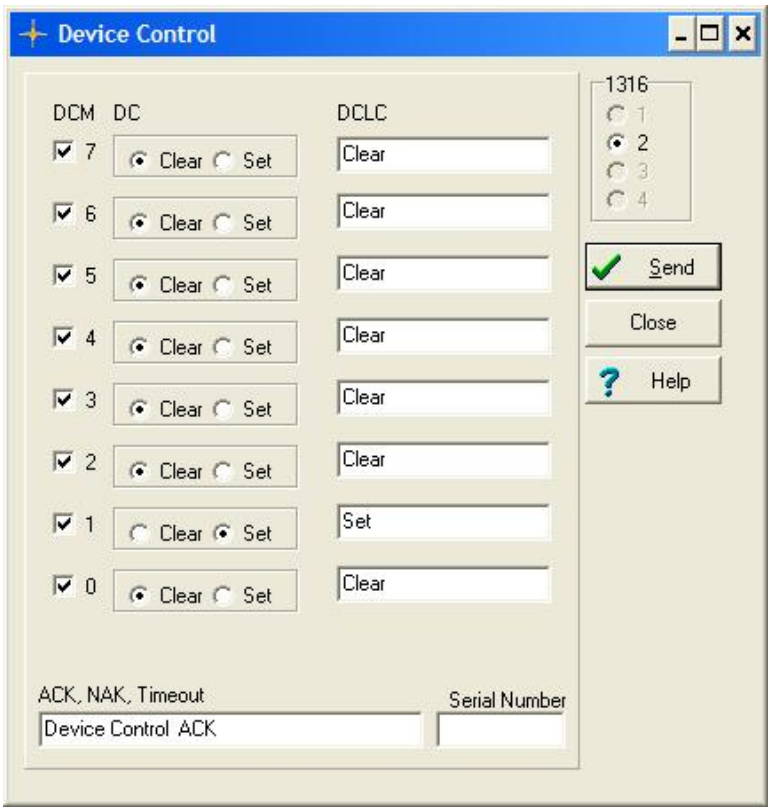



*Figure 5.6. The Device Control Window.*

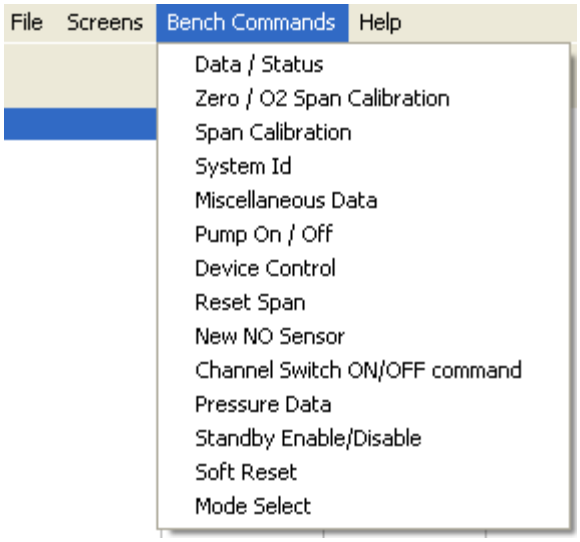
In the DCM 1 select DC to be **Set** the remaining DCM /DC are set as shown in Figure 5.6. Press the **Send** button.

Now it is possible to hear the click from the Valve if the valve is functioning properly.

Please remember to clear the DCM 1 by selecting **Clear** and pressing the **Send** button.

### 5.1.6 Miscellaneous Data.

Pull down the Bench Command Menu.




Select Miscellaneous Data.

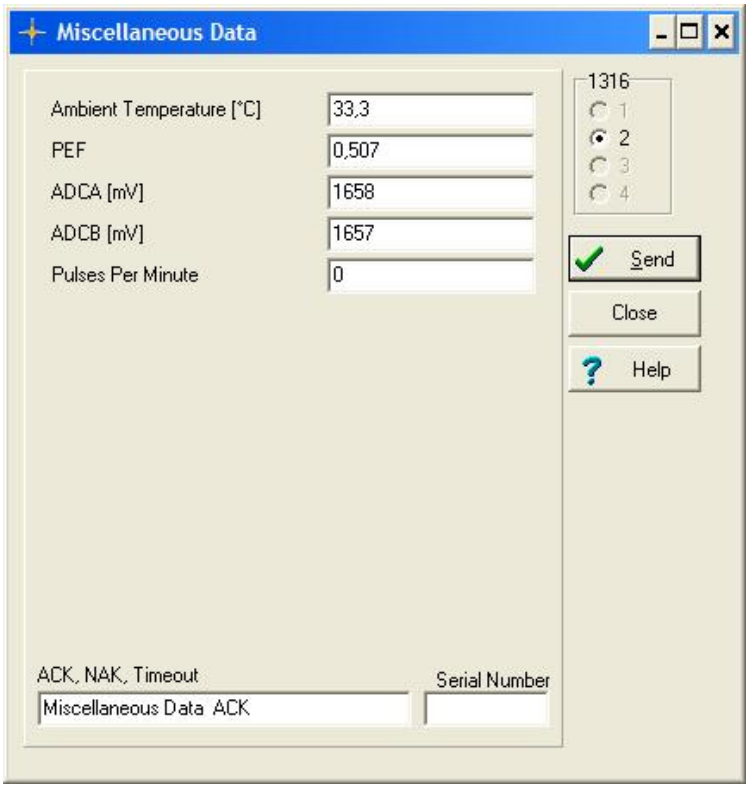



*Figure 5.7. The Miscellaneous Window.*

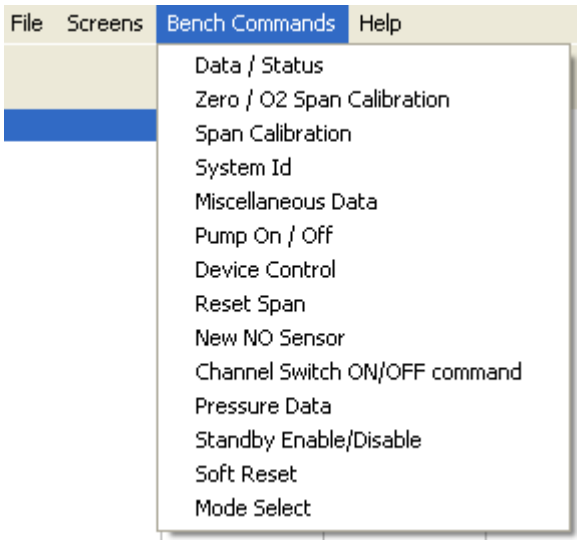
In the Miscellaneous window the Ambient Temperature is shown after pressing the **Send** button.

The PEF value displayed is the Relation between the Calibration factor for Hexane and Propane.

ADCA and ADCB are of use whenever Analogue output is to be used. Please Contact Your Local LumaSense Representative for further information.

### 5.1.7 Pressure Data.

Pull down the Bench Command Menu




Select Pressure Data.

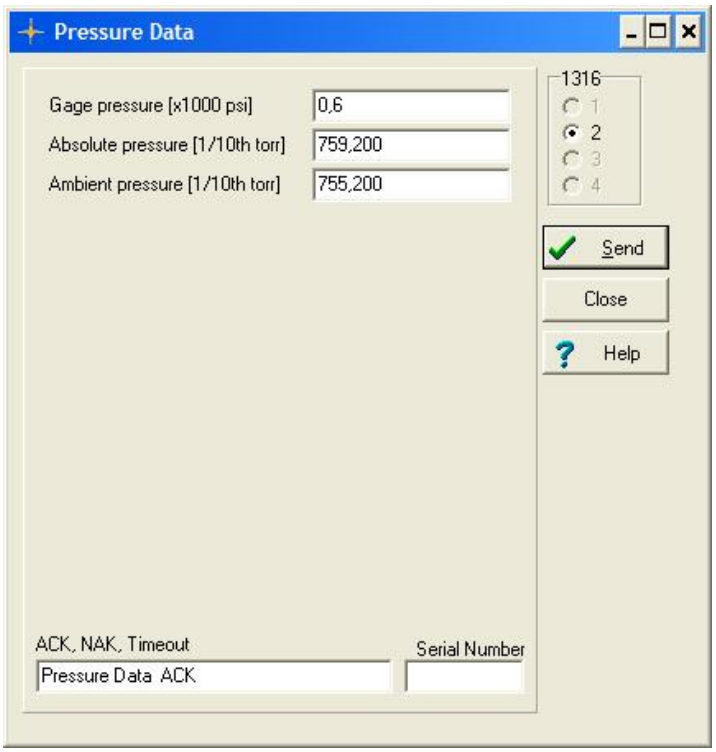



*Figure 5.8. The Pressure Data Window.*

The Ambient Pressure through the Zero Reference inlet and the Absolute pressure in the Sample cell are displayed after pressing the **Send** button.

The Pressure Data can be used as an indication if occlusion through either of the inlets occurs.

### 5.1.8 $O_2$ and NO Sensor Replacement

The optional $O_2$ and NO sensors have an expected life of 18 months under normal operating conditions. Follow the procedure defined below to replace these sensors.

a) Verify that main power turned OFF.

b) Remove the cover.

2) ***Sensor Removal***:

a) Each sensor includes a pull tab. Be careful not to tear it.

b) Carefully pull on the tab and remove the sensor from the 1316A-2 Multi Gas Monitor UA1372 manifold.

3) ***Sensor Installation***:

a) Position the new sensor at the sensor manifold. Ensure that the sensor's connector pins are aligned.

b) Carefully push on the sensor to seat it in the Manifold UA1372.

c) Replace the cover.

4) ***Sensor Calibration***: Refer to Chapter 4.

5) ***Verification***: Consult the Status window and verify that no errors are reported.

### 5.1.9 Field replaceable parts.

| LumaSense Part number | Description |
|---|---|
| DS0790 | Zero ref. filter |
| DS2306 | Inlet filter |
| VF0007A | Fuse 1.6A T |
| VM0200A | $O_2$ electrochemical Sensor |
| VM0201A | NO electrochemical Sensor |
| UA1372A | Mounting kit for electrochemical Sensors |
| UH5040A | Pump |
| UM1118A | Tree way valve |
| ZG0370A | Power supply |

# 1316A-2

LumaSense Technologies A/S
Energivej 30
DK-2750 Ballerup, Denmark

Tel.:(+45) 44 20 01 00
Fax: (+45) 44 20 01 01
http://www.lumasenseinc.com