

# *Operator Quick Guide*

## ORBISPHERE 3654



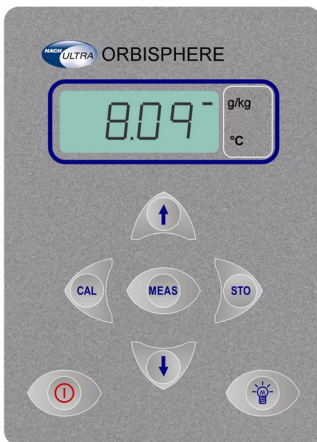
# Operating Information

## About this Guide

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## Instrument Controls

The front panel of the instrument has a three-digit liquid crystal display (LCD). The LCD includes a right-side marker to distinguish between gas concentration and temperature display. This marker also indicates the measurement display units depending on the instrument model. To the LCD's right is a label showing the measurement units configured at the factory for your application.



The button in the bottom right corner backlights the LCD for approximately three minutes. The other push-button controls are:

- **POWER** turns instrument power on or places it in standby. The instrument performs a series of start-up tests before switching to measurement mode

- **MEAS** places the instrument in measurement mode
- **CAL** calibrates the analyzer against a reference sample. This button can be locked out from the WIN3654 PC program
- **STO** stores a measurement value into memory
- The  $\uparrow$   $\downarrow$  keys toggle between gas concentration and temperature measurement displays in measurement mode, increases or decreases the storage number during storage or memory view, or sets a calibration value during calibration
- **POWER + CAL** selects dissolved or gaseous measurement phase
- **POWER + STO** starts automatic data acquisition.
- **POWER +  $\uparrow$**  starts memory storage view
- **POWER +  $\downarrow$**  starts continuous purge mode

In addition to the controls indicated on the front panel, there is also a pressure relief valve on top of the instrument. This button need only be pressed as part of the installation procedures, and/or if pressure builds up inside the instrument due to large temperature changes.

## Startup

To start the instrument, press the keyboard **POWER** switch. When you turn power on, the instrument displays the software version number briefly, and then starts a series of start-up tests. This process should take only a few minutes, during which time a [tSt] message is displayed on the LCD. Once the tests are completed, a clearing message [---] is displayed for a further sixty seconds before the instrument switches automatically to measurement mode.

The analyzer can be operated independently, making measurements as a portable hydrogen or nitrogen gas analyzer.

You may store these measurement values for later analysis via the WIN3654 program (on your personal computer) or the memory view mode (on the instrument).

# Measurement

## Taking Measurements

Measurement updates are displayed every 20 seconds. For accurate measurements, the sensor's membrane must be at the same temperature as the sample to be analyzed. If this not the case, allow some sample to pass through the flow chamber for about 3 minutes before taking any measurements.

The LCD includes a right-side marker to distinguish between gas concentration measurements and temperature. To switch between gas measurement and temperature measurement, press the  $\uparrow$   $\downarrow$  buttons.

The analyzer will store up to 500 gas measurement values, labeled by numbers 0 through 499, along with the current date and time of each measurement. You have the choice of acquiring this information manually or automatically, as described below.

## Automatic Data Acquisition

Before starting automatic measurement storage, first select the sampling rate desired using the Sampling Rate menu of the WIN3654 program.



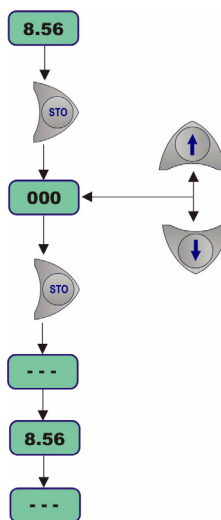
Put the instrument into standby (by pressing the **POWER** key). Then hold down the **STO** button while switching the instrument back **ON**. The LCD displays the message `sto` for about one second.

Gas concentration measurements are displayed for about two minutes. After two minutes the instrument displays the sample number (starting at 000), then the gas concentration measurement value followed by [---] to indicate the measurement is being stored.

This storage sequence repeats automatically, at the rate specified.

To end automatic storage, put the instrument into standby (by pressing the **POWER** key) while it is in normal measurement mode. Switching **ON** again without holding down the **STO** button returns the instrument to measurement mode.

## Manual Data Acquisition



For the first measurement you wish to store, press the **STO** button once to display a sample number. The default sample number is 000 (for first time access), or the last used memory position where data was stored, incremented by a value of 1.

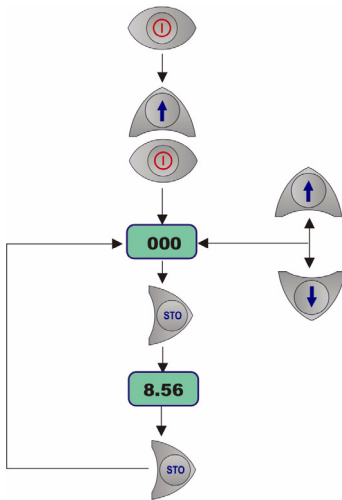
You can increase or decrease this number by pressing the  $\uparrow$   $\downarrow$  buttons within three seconds.

Press **STO** a second time, within five seconds of the first. The instrument then displays the gas concentration measurement value for about three seconds, followed by a clearing message as the value is stored.

Repeat to store additional measurements.

## Measurement (cont)

### Viewing Stored Measurements



Put the instrument into standby (by pressing the **POWER** key). Hold down the ↑ button while switching the instrument back **ON**. The LCD displays a sample location number.

Scroll through the numbered sample locations of all the stored values using the ↑ ↓ buttons.

To view the actual gas concentration measurement value at a particular sample number, press the **STO** button. The LCD now displays the stored value for that sample number.

Press **STO** a second time to return to the next numbered location display, to continue scrolling or view another stored value.

To return to the measurement mode, put the instrument into standby and then turn back **ON** again without holding down any additional buttons.

### Downloading Data

If you have made measurements and stored them in the analyzer, you should be ready to bring them into the WIN3654 program for viewing, copying, saving and printing. To download stored data from the instrument to the PC, choose the

**DownLoad** data command from the **Logger** menu.

The window displays the stored measurements from the instrument showing the sample number, gas concentration, a date and time stamp, and a sample description.

### Sample Point Description

For help in identifying the locations of various sampling points that are stored, you may choose the **Sampling Point Description** command from the **Logger** menu.

The measurement values to be placed in positions 0 through 499 can be described however you wish. Double-click on a particular position (or click **Modify**), then type a description in the box.

### Copy Data

To copy the results to the Windows Clipboard, so that the data can be pasted into a spreadsheet, word processor or other Windows program that accepts tabular text information, choose the **Clipboard** command from the **Export** menu.

### Save Data

To save this list of measurements as a text file, capable of being recalled by the WIN3654 program or imported as a file into other Windows programs, choose the **Save As** command from the **File** menu and enter the device and file name.

### Print Data

To place this list of measurements into a tabular format and send it to the printer, choose the **Print** command from the **File** menu.

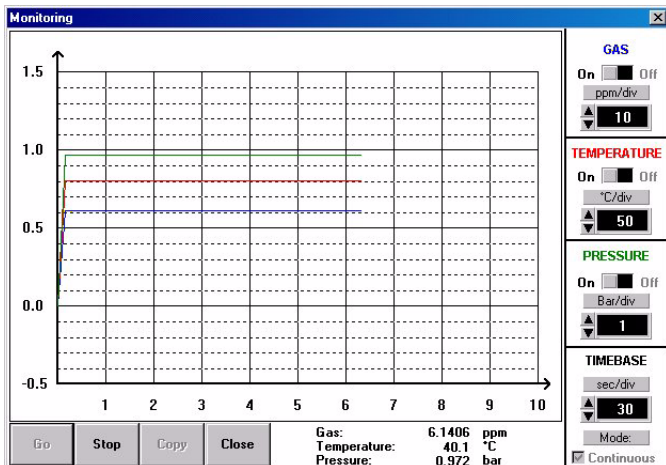
### Clear Data

To **clear** all the values stored in the instrument, choose the **Clear Data** command from the **Logger** menu. Since this action will clear the storage memory of the instrument, a warning appears which you must confirm. Choose **Clear** to start the memory clear operation.

## Measurement (cont)

### Monitor Measurements in Real-Time

You may wish to analyze a particular sampling point via the WIN3654 program's **Monitoring** menu. To use this Monitoring chart, the analyzer must be connected to your PC.



Choose **Monitoring** from the WIN3654 menu to bring up a chart display.

The chart shows the gas concentration (in blue), temperature (in red), and pressure (in green) as the sample is being measured by the 3654 instrument. The chart is updated directly from instrument measurements, at a rate determined by the time scale set in the **TIMEBASE** box at the lower right corner of the chart.

Click the **TIMEBASE** up/down pointers to change the time scale of the

divisions of the chart. Each division mark along the baseline (1, 2, ...10) can be made to represent from 30 seconds to 2½ hours, providing from 5 minutes to 25 hours, continuously displayed samples (as illustrated in the table).

Timebase	Updating Rate	Max. Samples
30 Seconds/Division	5 Secs/Sample	60
1 Minute/Division	5 Secs/Sample	120
10 Minutes/Division	5 Secs/Sample	1,200
30 Minutes/Division	9 Secs/Sample	2,000
1 Hour/Division	18 Secs/Sample	2,000
2.5 Hours/Division	45 Secs/Sample	2,000

Click on the **Continuous** box to enable or disable continuous charting. When this box is checked, the chart scrolls continuously after reaching the **10** division, and the oldest samples are lost off the left of the chart.

When **Continuous** is not checked, the chart stops displaying new results after reaching the **10** division, and all subsequent measurements are lost.

Click the up/down pointers for each measurement variable (**GAS**, **TEMPERATURE** and **PRESSURE**) to

change the scaling of that value on the chart. The display of each measurement variable may be turned on or off by choosing the appropriate **On** or **Off** switch.

A running display of latest sample **Gas**, **Temperature** and **Pressure** is also shown in the bottom-right corner of the chart.

Use the buttons at the bottom of the chart to control real-time monitoring. Choose **Go** to clear the chart and start real-time monitoring, **Stop** to stop monitoring and **Copy** to copy the data from the chart as text information to the Windows Clipboard. This information can be pasted from the clipboard into any Windows application, such as a spreadsheet or word processor.

Choose **Close** to close the Monitoring window.

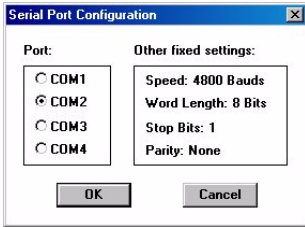
# Instrument Configuration

The following commands are all available from the **Configuration** menu in the WIN3654 software installed on your PC.

The instrument must be connected to your PC in order to change its configuration.

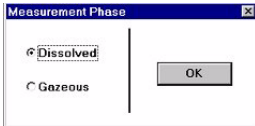
## ANALYZER - PC CONNECTION

The **Serial port** menu lets you choose one of four serial communication ports. Usually, **COM1** is used to connect to a mouse, so try **COM2** first.



## GAS MEASUREMENT PHASE

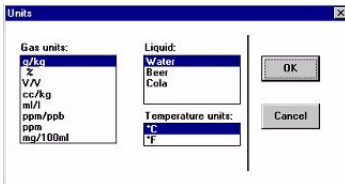
The instrument can measure N<sub>2</sub> or H<sub>2</sub> in either a liquid or a gaseous sample, but you must select which gas phase to use.



Choosing the WIN3654 program's **Gas Phase** option lets you select the gas measurement phase.

## MEASUREMENT UNITS

Choose the **Units** option to select gas measurement units, temperature measurement units, and the liquid medium in which you are measuring.



You may change the LCD label on the instrument to match the new units selected. Different LCD labels are supplied with the recharge kit.

## MEMBRANE SELECTION

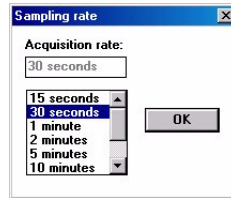
You may find it necessary to use a different type of membrane for different applications.



To re-configure the analyzer, choose **Membrane** to bring up the box which reveals the membrane models available.

## SETTING SAMPLING INTERVALS

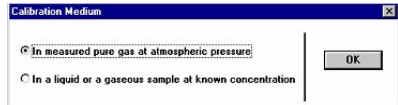
The analyzer can perform as a standalone data acquisition device, automatically recording gas measurements with the date and time, and storing up to 500 of these values.



Choosing **Sampling Rate** lets you select time intervals (acquisition rate) for this storage capability.

## CALIBRATION MEDIUM

Use the **Calibration medium** command to select how the sensor is to be calibrated.



Choose either in pure H<sub>2</sub> or N<sub>2</sub> gas at atmospheric pressure or in a liquid or gaseous solution at a known concentration of gas.

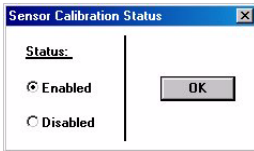
# Instrument Configuration (cont)

## ROLLING AVERAGE

Choose **Rolling Average Status** to enable or disable the averaging of gas concentration measurements. To enable averaging on three successive gas measurements, choose **Enable**. Choose **Disable** to disable rolling average.

## CALIBRATION KEY STATUS

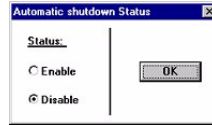
You can use the **Calibration Key Status** menu to prevent an accidental sensor re-calibration from the instrument keyboard.



**Enable** or **Disable** the instrument front panel **CAL** button. Disabling the button will prevent accidental sensor re-calibration.

## AUTOMATIC SHUTDOWN

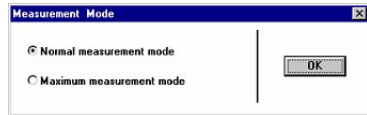
Choose **Automatic Shutdown Status** from the **Configuration** menu to activate the Automatic Shutdown feature.



If you select **Enable**, the instrument switches off automatically after 10 minutes of inactivity, thereby economizing battery power.

## MEASUREMENT MODE

Choose **Measurement Mode** to enable maximum measurement mode for sampling in bottles and cans.

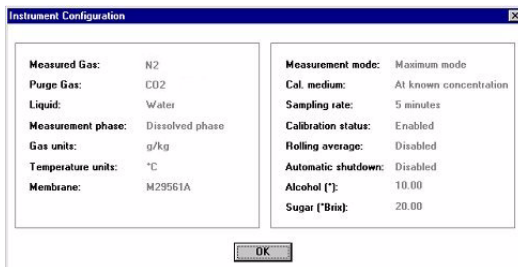


In **Maximum measurement mode**, the instrument searches for two consecutive measurements with less than a 2% difference.

When this occurs, the display is frozen and you may store the data. The instrument remains in this mode until you select **Normal measurement mode**.

## INSTRUMENT CONFIGURATION REVIEW

To review if the analyzer is set up as expected, choose the **Configuration view** command.



# Calibration

## BAROMETRIC PRESSURE SENSOR

The instrument internal barometric pressure sensor is calibrated at the factory, and normally requires no further attention. However, you may wish to calibrate it against your own instrumentation, or simply check the instrument for accuracy.

Select **Troubleshooting, Pressure Calibration** from the WIN3654 program, and enter the current atmospheric pressure, in mbars, in the calibration pressure entry box.

## GAS SENSOR

Before calibrating, check that the sensor membrane surface is tight, smooth and wrinkle free. Select the gas measurement phase for calibration, and the calibration medium using the WIN3654 program.

Ensure that normal measurement mode is selected in the Measurement Mode menu of the WIN3654 program.

Calibration must only be carried out once the TC sensor is giving a stable measurement. Expose the membrane to the calibration sample until this stable reading is obtained. This usually takes about 5 minutes.

For calibration it is important that the sensor's membrane is at the same temperature as the calibration sample. Therefore, allow some sample to pass through the flow chamber for 3 minutes before calibrating.

When calibrating in gaseous phase, ensure that the flow chamber and sensor components are dry. Dry the sensor head surface with a clean soft tissue.

Ensure that the purge gas is flowing at the recommended rate through the sensor by placing the purge gas exit tubing into water. This rate should be more than four bubbles during the purge which lasts for 4 seconds. This purge cycle is repeated every 20 seconds.

### Note :

When press the **CAL** button, remember that this button may have been locked out by the WIN 3654 program to prevent an accidental reset.

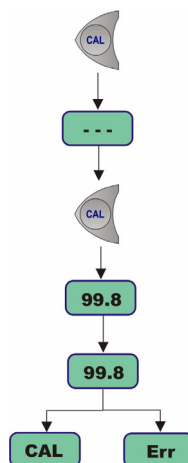
In all calibration methods, calibration is successful or in error, as per the following definitions:

- If the instrument makes two consecutive measurements with less than 1% difference, it calibrates against this stabilized value. The LCD then displays the message [CAL] to indicate calibration has been successfully completed
- If the calibration does not complete, the LCD displays the message [Err]. The reason for this calibration error is either that the measured gas partial pressure is under 5 mbar, or that a wrong instrument key was pressed during the calibration steps.

## Calibration at Atmospheric Pressure

The sensor can be calibrated in pure H<sub>2</sub> or N<sub>2</sub> gas at atmospheric pressure. Set the gas measurement phase to **Gaseous** and set the calibration medium to **In measured pure gas at atmospheric pressure**.

Connect a source of pure H<sub>2</sub> or N<sub>2</sub> gas to the inlet of the flow chamber, and adjust the gas flow to one bubble per second when the exit tube is immersed in water.



Press the **CAL** button. A brief clearing message [---] appears. Press **CAL** again within a 3 second period. Calibration is successful or in error, as defined earlier.



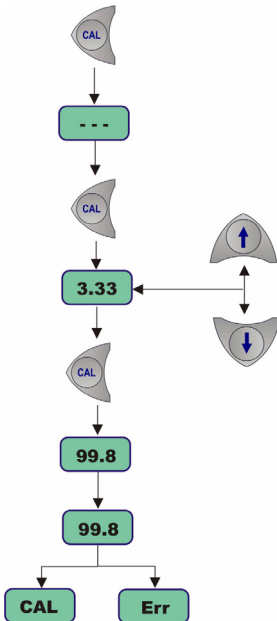
## Calibration (cont)

### Calibration at Elevated Pressure

This method requires an accurate pressure gauge connected to the exit of the flow chamber.

Set the gas measurement phase to **Gaseous** and set the calibration medium to **In a liquid or a gaseous sample at known concentration**.

Connect a source of pure H<sub>2</sub> or N<sub>2</sub> gas to the inlet of the flow chamber, and adjust the gas flow exiting from the flow chamber to be in the range of 1 to 5 bar (it is best to use a pressure close to the application conditions).



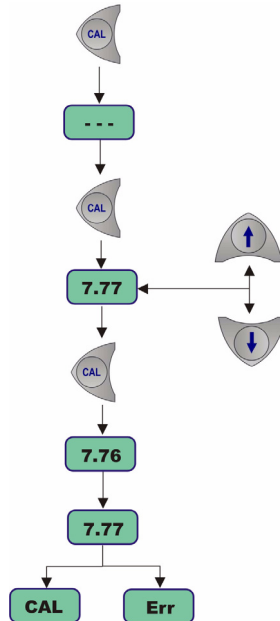
Press the **CAL** button. A brief clearing message [---] appears. Press **CAL** again within a 3 second period. The instrument then displays the absolute pressure of calibration gas (i.e. gauge pressure plus atmospheric pressure).

Modify this reading using the **↑ ↓** keys until the displayed pressure agrees with that of the gauge plus atmospheric pressure. Press **CAL** again.

Calibration is successful or in error, as defined earlier.

### Calibration in a Liquid Solution

The sensor can be calibrated in a standard liquid solution that has a known concentration of H<sub>2</sub> or N<sub>2</sub>.



Set the gas measurement phase to **Dissolved** and set the calibration medium to **In a liquid or a gaseous sample at known concentration**.

Press the **CAL** button. A brief clearing message [---] message appears. Press **CAL** again within a 3 second period. The instrument then displays the concentration of gas, based on the last value of the calibration coefficient.

Modify this reading using the **↑ ↓** keys until the displayed concentration agrees with that of the calibration solution. Press **CAL** again.

Start the flow of the standard (calibration) solution through the flow chamber. Adjust the flow until the liquid is foam-free. The flow rate should be a minimum of 150 ml/min and be stable.

Calibration is successful or in error, as defined earlier.

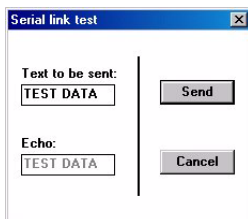
## Troubleshooting

You may wish to use the **Troubleshooting** menu to make sure that the instrument is configured correctly for your application, and is in good working order.

The instrument must be connected to your PC to perform these tests.

### SERIAL LINK TEST

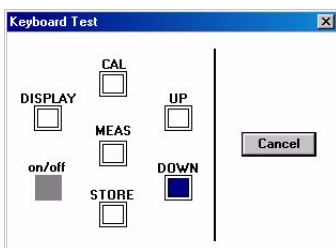
Normally, the instrument will inform you of a disconnected RS-232 (serial) link when appropriate. However, you can confirm a good connection using the **Serial Link Test** option, and echoing a test message via the instrument.



Enter text characters in the **Text to be sent** box, then click **Send**. If the serial link is operating correctly, the exact same text will be displayed back from the instrument in the **Echo** box.

### KEYBOARD TEST

The **Keyboard Test** option will reveal whether all the instrument buttons are functioning correctly.



Press any one of the instrument's buttons (**except** the **on/off** button) for a full second or more. The appropriate square on-screen should darken.

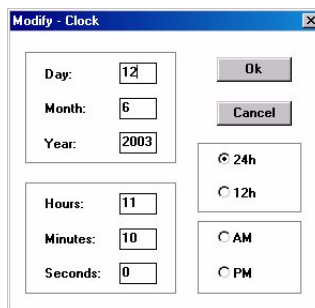
### DISPLAY TEST

Choosing the **Display Test** option lets you perform a one-way communication between computer and instrument.

Type a number in the **Number** box (you may also select one of three units positions for the LCD's rightmost indicator bar as well). Then choose **Send**. The number and indicator bar placement should appear on your instrument LCD.

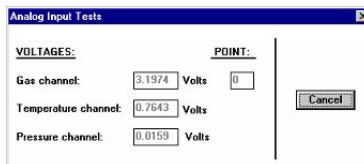
### CLOCK SETTINGS

Choose the **Clock settings** option to set the date and time in the instrument.



### ANALOG VOLTAGES VIEW

The **Analog Voltage View** option gives a real-time look at voltages used by the system to transmit information about sensor current, temperature and pressure. This is useful when trying to identify an instrument problem with an Orbisphere service representative either on-site or over the phone.



The voltage limits for normal operation are:

- Current channel: 0.1 V to +4 V
- Temperature channel: +10 mV to +4 V
- Pressure channel: -100 mV to +100 mV

### MEASUREMENTS VIEW

The **Measurements View** option confirms, on your PC monitor, what your instrument should be displaying on the LCD for gas concentration and sample temperature.

## Troubleshooting (cont)

The following table lists possible measurement errors.

Symptom	Cause	Possible Solution
Unstable measurement	Degassing	Adjust sample flow rate
	Flow chamber and/or membrane not clean	Clean system
	Sensor's membrane not tight smooth and wrinkle free	Replace membrane and recalibrate
	Leaking solenoid valve	No gas bubbles should escape from the purge gas outlet during measurement. If the solenoid leaks (more than 1 bubble in 15 seconds) contact your Orbisphere representative.
	An external power supply is used but the power supply is not clean	Switch to battery power
Low readings	Sample flow rate too low	Check flow rate
	Degassing	Adjust forcing gas and/or sample flow rate
	Membrane is not at sample temperature	Allow sample to flow past the membrane to make sure the membrane is at sample temperature before making measurements
	Membrane not clean	Clean system
	Incorrect solubility curve	Change solubility
	Incorrect calibration	Recalibrate
High readings	Membrane is not at sample temperature	Allow sample to flow past the membrane to make sure the membrane is at sample temperature before making measurements
	Incorrect solubility curve	Change solubility
	Incorrect calibration	Recalibrate

The following are warning messages that may appear on the instrument LCD in place of the gas concentration measurement.

Message	Meaning
<b>Pur</b>	This message appears on the LCD if the purge gas supply fails. To detect this condition, the voltage signal from the TC sensor is measured. This is normally between 1-3 volts, depending which gas is being measured. If the flow of purge gas stops, the sensor voltage wanders outside the permitted range of 100mV to 4 V.
<b>Out</b>	This message appears if the sensor is unplugged from its correct position, or if the temperature is outside the range -5°C to 100°C.
<b>Err</b>	During start-up, this message indicates the instrument cannot complete the start-up tests successfully. If the problem persists, contact your local Orbisphere service representative for assistance.
	During calibration, this message indicates that the partial pressure of gas is below the acceptable range (<5 mbar), or that you have pressed a wrong key.

# Sensor Maintenance

## General

Service includes membrane replacement and external cleaning to restore the original sensor sensitivity. This means low running costs and down time reduced to a minimum.

The membrane(s) needs to be replaced once or twice a year depending on application conditions. This can be tailored accordingly.

Periodically, inspect visually the sensor head for any deposits. Rinse it under clean tap water, and dry with a clean tissue.

To verify if the membrane(s) needs to be replaced, check sensor measurements against a known standard sample value. If the deviation exceeds 10% of the original value, replace the membrane.

## Mounting Dual Membranes

In order to prevent unwanted stretching of the membrane on a hydrogen sensor it is recommended to simultaneously mount a support membrane beneath the primary membrane.

The primary membrane, or top membrane, determines the rate at which the H<sub>2</sub> gas enters the measurement chamber of the sensor. The secondary membrane, or support membrane on the bottom, is extremely permeable and is installed to stabilize the position of the primary membrane.

The support or secondary membrane for all H<sub>2</sub> measurement applications is the 29562A.

### CAUTION :

*Carry out any maintenance in a clean dry place in order to avoid damaging the sensor's precision components, and also to prevent water or humidity from getting into the sensor.*

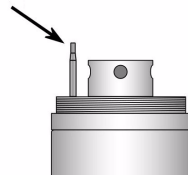
It is recommended to leave the sensor in place in the instrument when changing the membrane.

To remove the membrane, follow the steps below:

First remove the flow chamber from the sensor by turning the flow chamber locking nut counter-clockwise and gently lifting the flow chamber off the sensor.

### CAUTION :

*A thermistor at the top of the sensor (illustrated right) is used to measure the sample temperature. Do not bend or damage this component by trying to twist the flow chamber off the sensor.*



Unscrew the protection cap, using the tool provided in the maintenance kit.

### CAUTION :

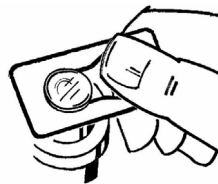
*Never remove the protection cap, unless you plan to replace the membrane.*



## Sensor Maintenance (cont)

Pull up the membrane holding ring with the tool provided in the maintenance kit.

Remove membrane(s) and mask (if applicable).



**Note :**

*The membrane mounting surface must be clean and even (on top of the sensor, where the membrane and sensor have contact).*

Replace the membrane O-ring on the sensor head with a new one.

**Note :**

*The 29039.0 Nitril O-ring can be reused if it is still in good condition. Membrane O-rings are part of the protection cap kit.*



In the maintenance kit, pick up the two part membrane mounting tool.

Install the sleeve over the sensor head (end with shoulder downwards).



To mount a **single** membrane:

- Take a few membranes out of the storage box.
- Using tweezers included in the kit, pick up one membrane from the stack, and gently place it on the sensor tip.
- Make sure it is centered.

To mount **dual** membranes:

- Remove one 29562A secondary membrane along with one piece of the separation paper from its box. Place the membrane and paper, paper side down, on a clean flat surface.
- Remove a primary membrane along with its separation paper.
- With the separation paper on top of the primary membrane place the primary membrane directly over the secondary membrane, taking care to center the two membranes.
- Rub your finger on the paper of the primary membrane to remove any air bubbles between the membranes. The two membranes should now be sandwiched together and appear as one membrane.
- Pick up the sandwiched membranes with tweezers and remove the separation paper.
- Gently place them on the sensor tip ensuring the secondary membrane (29562A) is on the bottom.
- Make sure they are centered.



**CAUTION :**

*Distinguish the membrane from the protection paper:*

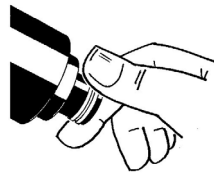
- *The membrane is transparent (translucent)*
- *The protection paper is opaque*

**Note :**

*The membrane diameter is larger than the sensor head diameter. This is normal, as the membrane will fold over the sensor tip.*

The membrane holding ring comes in two slightly different internal diameters, depending on the membrane(s) total thickness. For a correct membrane installation, be sure to use the correct holding ring for the application. If mounting dual membranes, always use mounting ring part number 29229.

Place the membrane holding ring on the installation tool tip.



**CAUTION :**

*To avoid damaging the membrane, make sure that the tool tip is totally clean and its surface is even.*

## Sensor Maintenance (cont)

Insert the installation tool inside the guiding sleeve.

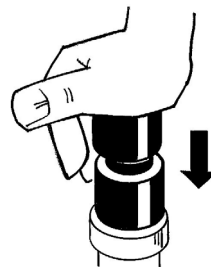


Push the installation tool firmly downwards. This clasps the mounting ring onto the sensor head, folding the membrane over the sensor tip.

Remove the installation tool and guiding sleeve.

Visually check for correct ring placement, try to push it down with your fingers.

Check that the membrane is tight, with no wrinkles.



### Note :

*Once installed, a membrane cannot be reused. Avoid touching membranes with bare fingers, as this may affect its sensitivity.*

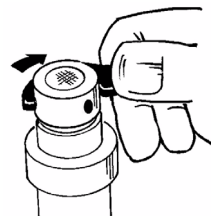
Clean and dry the protection cap ready for installation.

Replace the O-ring inside the protection cap with a new one. Tighten the protection cap finger tight.

Then, complete the process using the tool provided in the maintenance kit. Insert into each of the four holes in turn, and tighten as far as possible. Tighten each hole only once.

### Note :

*The grille inside the protection cap should be free to move during tightening. Therefore, and to avoid damage to the membrane, do not touch the grille during the tightening process.*



Finally replace the flow chamber, by gently lowering it onto the sensor and guiding the thermistor on the sensor into the hole in the flow chamber base. Turn the flow chamber locking nut clockwise to secure it in place.

Check that the membrane has not been damaged. The alarm message [Err] will be displayed on your analyzer if the membrane leaks in any way.

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