Operator Manual

ORBISPHERE 3625



HACH ULTRA™

EXCELLENCE IN PROCESS ANALYTICS

Revision F - 04/04/2008

Product Recycling Information



ENGLISH

Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

Note: *For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.*

GERMAN

Elektrogeräte, die mit diesem Symbol gekennzeichnet sind, dürfen in Europa nach dem 12. August 2005 nicht mehr über die öffentliche Abfallentsorgung entsorgt werden. In Übereinstimmung mit lokalen und nationalen europäischen Bestimmungen (EU-Richtlinie 2002/96/EC), müssen Benutzer von Elektrogeräten in Europa ab diesem Zeitpunkt alte bzw. zu verschrottende Geräte zur Entsorgung kostenfrei an den Hersteller zurückgeben.

Hinweis: *Bitte wenden Sie sich an den Hersteller bzw. an den Händler, von dem Sie das Gerät bezogen haben, um Informationen zur Rückgabe des Altgeräts zur ordnungsgemäßen Entsorgung zu erhalten.*

FRENCH

A partir du 12 août 2005, il est interdit de mettre au rebut le matériel électrique marqué de ce symbole par les voies habituelles de déchetterie publique. Conformément à la réglementation européenne (directive UE 2002/96/EC), les utilisateurs de matériel électrique en Europe doivent désormais retourner le matériel usé ou périmé au fabricant pour élimination, sans frais pour l'utilisateur.

Remarque: *Veuillez vous adresser au fabricant ou au fournisseur du matériel pour les instructions de retour du matériel usé ou périmé aux fins d'élimination conforme.*

ITALIAN

Le apparecchiature elettriche con apposto questo simbolo non possono essere smaltite nelle discariche pubbliche europee successivamente al 12 agosto 2005. In conformità alle normative europee locali e nazionali (Direttiva UE 2002/96/EC), gli utilizzatori europei di apparecchiature elettriche devono restituire al produttore le apparecchiature vecchie o a fine vita per lo smaltimento senza alcun costo a carico dell'utilizzatore.

Nota: *Per conoscere le modalità di restituzione delle apparecchiature a fine vita da riciclare, contattare il produttore o il fornitore dell'apparecchiatura per un corretto smaltimento.*

DANISH

Elektriske apparater, der er mærket med dette symbol, må ikke bortskaffes i europæiske offentlige affaldssystemer efter den 12. august 2005. I henhold til europæiske lokale og nationale regler (EU-direktiv 2002/96/EF) skal europæiske brugere af elektriske apparater nu returnere gamle eller udtjente apparater til producenten med henblik på bortskaffelse uden omkostninger for brugeren.

Bemærk: *I forbindelse med returnering til genbrug skal du kontakte producenten eller leverandøren af apparatet for at få instruktioner om, hvordan udtjente apparater bortskaffes korrekt.*

SWEDISH

Elektronikutrustning som är märkt med denna symbol kanske inte kan lämnas in på europeiska offentliga sopstationer efter 2005-08-12. Enligt europeiska lokala och nationella föreskrifter (EU-direktiv 2002/96/EC) måste användare av elektronikutrustning i Europa nu återlämna gammal eller utrangerad utrustning till tillverkaren för kassering utan kostnad för användaren.

Obs! *Om du ska återlämna utrustning för återvinning ska du kontakta tillverkaren av utrustningen eller återförsäljaren för att få anvisningar om hur du återlämnar kasserad utrustning för att den ska bortskaffas på rätt sätt.*

SPANISH

A partir del 12 de agosto de 2005, los equipos eléctricos que lleven este símbolo no deberán ser desechados en los puntos limpios europeos. De conformidad con las normativas europeas locales y nacionales (Directiva de la UE 2002/96/EC), a partir de esa fecha, los usuarios europeos de equipos eléctricos deberán devolver los equipos usados u obsoletos al fabricante de los mismos para su reciclado, sin coste alguno para el usuario.

Nota: *Sírvase ponerse en contacto con el fabricante o proveedor de los equipos para solicitar instrucciones sobre cómo devolver los equipos obsoletos para su correcto reciclado.*

DUTCH

Elektrische apparatuur die is voorzien van dit symbool mag na 12 augustus 2005 niet meer worden afgevoerd naar Europese openbare afvalsystemen. Conform Europese lokale en nationale wetgegeving (EU-richtlijn 2002/96/EC) dienen gebruikers van elektrische apparaten voortaan hun oude of afgedankte apparatuur kosteloos voor recycling of vernietiging naar de producent terug te brengen.

Nota: *Als u apparatuur voor recycling terugbrengt, moet u contact opnemen met de producent of leverancier voor instructies voor het terugbrengen van de afgedankte apparatuur voor een juiste verwerking.*

POLISH

Sprzęt elektryczny oznaczony takim symbolem nie może być likwidowany w europejskich systemach utylizacji po dniu 12 sierpnia 2005. Zgodnie z europejskimi, lokalnymi i państwowymi przepisami prawa (Dyrektywa Unii Europejskiej 2002/96/EC), użytkownicy sprzętu elektrycznego w Europie muszą obecie przekazywać Producentowi stary sprzęt lub sprzęt po okresie użytkowania do bezpłatnej utylizacji.

Uwaga: *Aby przekazać sprzęt do recyklingu, należy zwrócić się do producenta lub dostawcy sprzętu w celu uzyskania instrukcji dotyczących procedur przekazywania do utylizacji sprzętu po okresie użytkownia.*

PORTUGESE

Qualquer equipamento eléctrico que ostente este símbolo não poderá ser eliminado através dos sistemas públicos europeus de tratamento de resíduos sólidos a partir de 12 de Agosto de 2005. De acordo com as normas locais e europeias (Directiva Europeia 2002/96/EC), os utilizadores europeus de equipamentos eléctricos deverão agora devolver os seus equipamentos velhos ou em fim de vida ao produtor para o respectivo tratamento sem quaisquer custos para o utilizador.

Nota: *No que toca à devolução para reciclagem, por favor, contacte o produtor ou fornecedor do equipamento para instruções de devolução de equipamento em fim de vida para a sua correcta eliminação.*

Product Disposal

Note:
The following only applies to European customers.

Hach Ultra is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible. The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) that came into force on August 13 2005 aims to reduce the waste arising from electrical and electronic equipment; and improve the environmental performance of all those involved in the life cycle of electrical and electronic equipment.



In conformity with European local and national regulations (EU Directive 2002/96/EC stated above), electrical equipment marked with the above symbol may not be disposed of in European public disposal systems after 12 August 2005.

Hach Ultra will offer to take back (**free of charge to the customer**) any old, unserviceable or redundant analyzers and systems which carry the above symbol, and which were originally supplied by Hach Ultra. Hach Ultra will then be responsible for the disposal of this equipment.

In addition, Hach Ultra will offer to take back (**at cost to the customer**) any old, unserviceable or redundant analyzers and systems which do not carry the above symbol, but which were originally supplied by Hach Ultra. Hach Ultra will then be responsible for the disposal of this equipment.

Should you wish to arrange for the disposal of any piece of equipment originally supplied by Hach Ultra, please contact your supplier or our After Sales Service department in Geneva for instructions on how to return this equipment for proper disposal.

Restriction of Hazardous Substances

Note:
The following only applies to exports of the product into the People's Republic of China.

Marking 标记



Products contain toxic or hazardous substances or elements.
含有有毒或者危险物质及成分的产品。

Environment Protection Use Period Marking (years).
环保使用期限标记（年）

	Toxic or Hazardous Substances and Elements 有毒或者危险物质和成分					
Part Name 部件名称	**Lead (Pb) 铅**	**Mercury (Hg) 汞**	**Cadmium (Cd) 镉**	**Hexavalent Chromium (Cr VI) 六价铬**	**Polybrom Biphenyls (PBB) 多溴联苯**	**Polybrom Diphenyls (PBDE) 多溴联苯醚**
1106A Backplane Board	X					
1062C Keypad Board	X					
1100B Logic Board	X					
1104A Analog Board	X					
1121B Options Board	X					
1067C Supply Board	X					
1063G Supply Board	X					
1127 Connection Board	X					
1117C Measurement Board	X					
70467 LCD Board	X					
Spacer	X					

O: Indicates that this toxic or hazardous substance contained in all homogeneous material for this part is below the limit requirement
表示所有此类部件的材料中所含有毒或危险物质低于限制要求

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement
表示至少有一种此类部件材料中所含有毒或危险物质高于限制要求

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Manual Overview

About this Manual

The information in this manual has been carefully checked and is believed to be accurate. However, Hach Ultra assumes no responsibility for any inaccuracies that may be contained in this manual. In no event will Hach Ultra be liable for direct, indirect, special, incidental, or consequential damages resulting from any defect or omission in this manual, even if advised of the possibility of such damages. In the interest of continued product development, Hach Ultra reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

Published in Europe.

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CAUTION:
This product is designed to work with beverages having no pulps or suspended particles, as these would rapidly clog the system.

Note:
Depending on the application, the beverage Package Analyzer has either a CO_2 or a N_2 thermal conductivity sensor. Both systems are for the most part identical in operation. Thus this manual generally describes the CO_2 procedures, and when appropriate, specifies any N_2 related procedure.

Revision History

- Initial Release, January 1999, Orbisphere
- Revision A, March 2003, Hach Ultra Analytics
- Revision B, October 2003, Hach Ultra Analytics
- Revision C, January 2004, Hach Ultra Analytics
- Revision D, February 2006, Hach Ultra
- Revision E, March 2007, Hach Ultra
- Revision F, May 2007, Hach Ultra

Safety Conventions

WARNING
A warning is used to indicate a condition which, if not met, could cause serious personal injury and/or death. Do not move beyond a warning until all conditions have been met.

CAUTION:
A caution is used to indicate a condition which, if not met, could cause minor or moderate personal injury and/or damage to the equipment. Do not move beyond a caution until all conditions have been met.

Note:
A note is used to indicate important information or instructions that should be considered before operating the equipment.

Safety Precautions

Please read the entire manual before unpacking, setting up, or operating this instrument.

Pay particular attention to all warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Safety Recommendations

For safe operation, it is imperative that these service instructions be read before use and that the safety recommendations mentioned herein be scrupulously respected. If repairs or adjustments are necessary, the instrument should be returned to an authorized Hach Ultra service center.

If danger warnings are not heeded to, serious material or bodily injury could occur.



WARNING

In accordance with safety standards, it must be possible to disconnect the power supply of the instrument in its immediate vicinity.



WARNING

The installation of the instrument should be performed exclusively by personnel specialized and authorized to work on electrical installations, in accordance with relevant local regulations.

Service and Repairs

None of the instrument's components can be serviced by the user. Only personnel from Hach Ultra or its approved representative(s) is (are) authorized to attempt repairs to the system and only components formally approved by the manufacturer should be used. Any attempt at repairing the instrument in contravention of these principles could cause damage to the instrument and corporal injury to the person carrying out the repair. It renders the warranty null and void and could compromise the correct working of the instrument and the electrical integrity or the CE compliance of the instrument.

If you have any problems with installation, starting, or using the instrument please contact the company that sold it to you. If this is not possible, or if the results of this approach are not satisfactory, please contact the manufacturer's Customer Service.

EMC and Safety Requirements

The instrument conforms to the following EMC and safety standards:

EMC Requirements	EN 61326:1997 + A1:1998 + A2:2001 + A3:2003
Safety Requirements	EN 61010-1

Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.
	This symbol, when noted on the product, indicates that the marked item can be hot and should not be touched without care.
	This symbol, when noted on the product, indicates the presence of devices sensitive to electrostatic discharge and indicates that care must be taken to prevent damage to them.
	This symbol, when noted on the product, identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for protective earth (ground).
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	Products marked with this symbol indicates that the product contains toxic or hazardous substances or elements. The number inside the symbol indicates the environmental protection use period in years.

Acknowledgements

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- Saran is a registered trademark of Dow Chemical Co.
- Swagelok is a registered trademark of Swagelok Co.
- Microsoft and Windows are registered trademarks of Microsoft Corporation.

1 System Description

1.1 Main components

Equipment included	Part number	Notes
Measuring instrument	3625 / 4110 3625 / 5110	with O_2 & CO_2 sensors (N_2 calculated) with O_2 & N_2 sensors (CO_2 calculated)
Beverage package piercer	29 995	two step model, with lock release spacer
Cutting knife for PET	32 111A	for plastic caps
Piercing knife for metal	32 106A	for metal caps and cans
Package positioning plate	32 108	for glass bottle and cans
PET bottle neck positioning fork	32 112	for PET bottles
Inclined base for cans, used with 32108	32 945	for increasing the headspace
O_2 electrochemical sensor	31 110.02	
CO_2 thermal conductivity sensor, or N_2 thermal conductivity sensor	31 450 31 550	without external temp. sensor
OrbiPack V5.00 PC software CD	32 694.E	
Calibration flow chamber	32 001.030	Thermal conductivity sensors calibration
Test thimble, in stainless steel	32 820	Pneumatic valve D’ and D” test
Maintenance kit for O_2 electrochemical sensors	32 702	Includes membranes 2952A, electrolyte 2959, membrane holding ring 29228, and tools for sensor maintenance.
Maintenance kit for CO_2 & N_2 thermal conductivity sensors, with protection cap 29111	32 760	Includes membranes 29561A, membrane holding ring 29228, 28002 washers, and tools for sensor maintenance.
Spares kit for 3625	32 944	Includes membranes, O-rings, seals, filters, tools, and valve cleaning block assembly.
0°C temperature simulator plug	32 116	Used for PT1000 temperature sensor calibration

1.2 System Layout

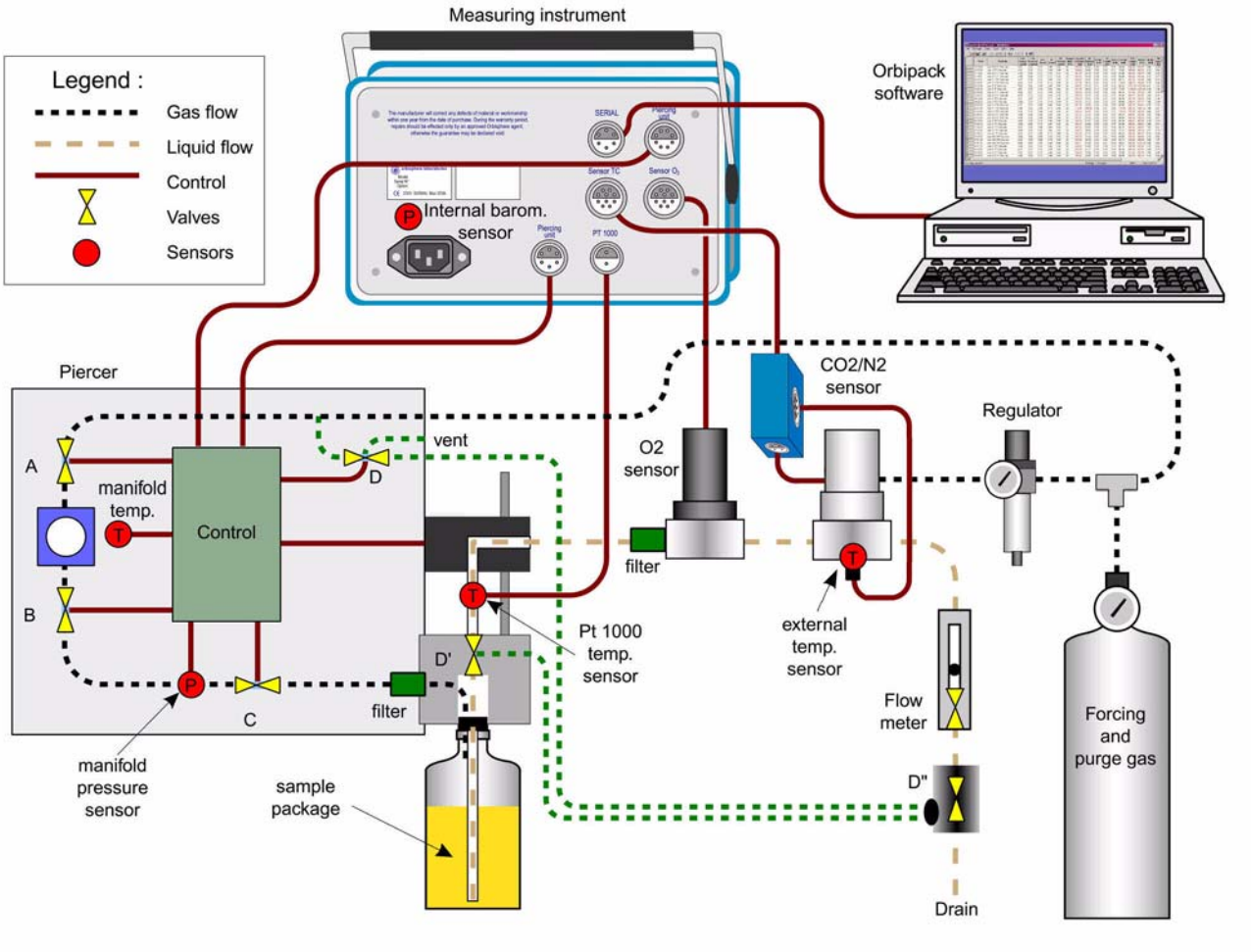
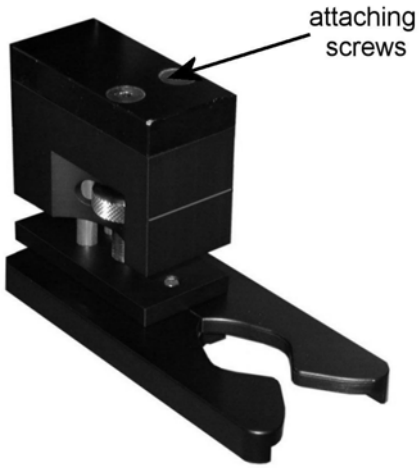


Fig 1-1: System Layout

1.3 Package Positioning Systems



Holding plate for cans and glass bottles (swivel 90° to accommodate cans or bottle).

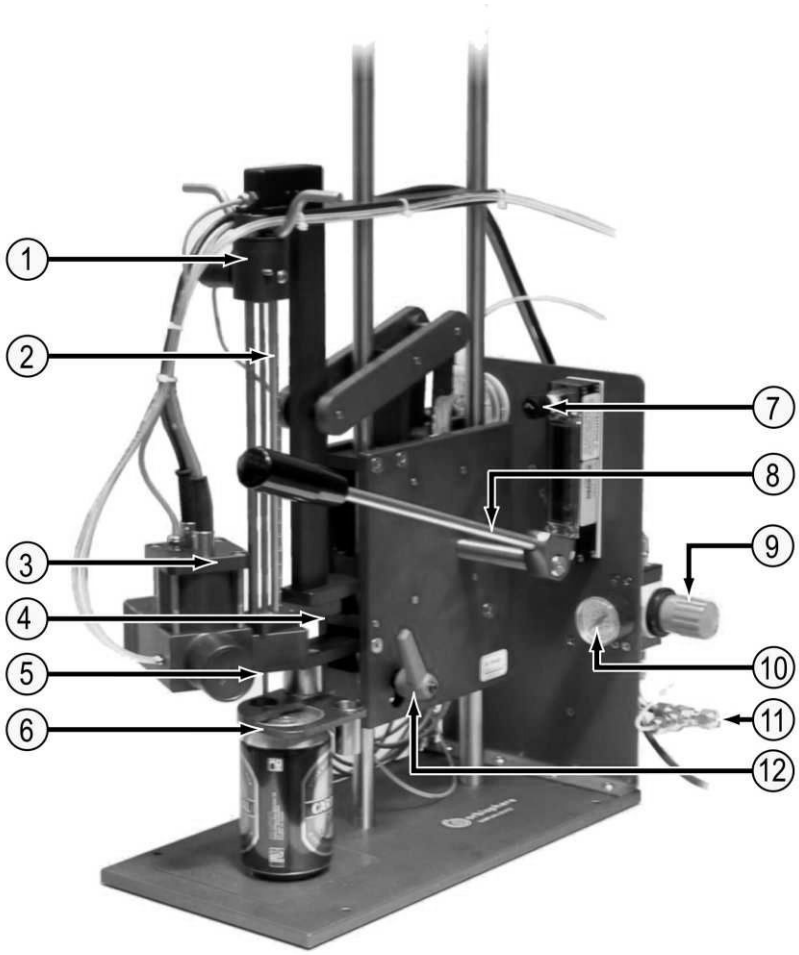


Holding clamp for PET bottle neck, with a positioning groove (level of cap top)



The wedge plate allows for a higher headspace in cans, to facilitate headspace volume sampling. This support device must be installed on the piercer mat, having the can inclined to the right (when facing the piercer). The higher headspace created avoids sampling foam or liquid during the headspace analysis process.

1.4 Package Piercer Components



Components identification

1) Sampling tube insertion device and handles
2) Sampling tube adjustable lower stop
3) Analyzer manifold
4) Two step device (left side) for cans analyze, with release spacer
5) Piercing knife, metal or plastic type
6) Package positioning system (cans, glass, PET bottles)
7) Flow meter to regulate product flow past sensors
8) Piercer lever, to lower or raise the piercing knife
9) Adjustable pressure regulator for purge gas (behind panel)
10) Pressure gauge showing purge gas regulated pressure
11) Purge and forcing gas inlet
12) Locking lever for the package positioning system height adjustment

1.4.1 Package Piercer Manual Operation Sequence

According to instructions given on instrument display and PC:

- Install a package in position
- Pierce the package
- Lower the sampling tube (only when asked !)
- Raise the sampling tube (end of analysis)
- Lift the piercing lever to remove package (slowly to avoid spillage)

Note:
Sequence is controlled by the instrument.

1.5 Measuring Instrument Controls

1.5.1 Display

The instrument front panel provides a two line liquid crystal display (LCD), having 16 characters per line.





3 position key switch:

OFF: Measuring device power off

ON locked: Function keys locked
(avoids unwanted modification).
Device starts in measuring mode.

ON unlocked: Function keys are active.
Calibration and Options mode.



1.5.1.1 Back light switch:

1.5.1.2 Press to turn on the LCD backlight for 3 minutes.

1.5.2 Function Keys



- **ESC** back one step.
- ⇧ or ⇩ move through the loop of available data (selection blinks).
- **ENTER** confirm selection.

1.5.3 Main Menu

Main menu is reached by pressing **ESC** as many times as needed:

- MEASURE: Measurement
- OPTIONS: Set up the instrument
- CALIBRATE: Calibration procedures



1.5.4 Entering Values

When entering numbers, several digits are displayed. The caret symbol ^ represents the cursor. After entering the last digit, the new value is saved.



- ⇧ ⇩ increase or decrease the number value
- **ENTER** move cursor one digit to right
- **ESC** move cursor one digit to left
- **ENTER** confirm last value entered
- ⇧ ⇩ move decimal point (when applicable)
- **ENTER** confirm and exit

Note:
When power is disconnected, the system remembers each value previously saved.

1.5.5 OrbiPack V5.00 PC Software

The Beverage Package Analyzer system works with the OrbiPack software. An RS232 cable must be connected from the PC to the instrument and the software must be running.

The latest version of the OrbiPack PC software is compatible with all previous versions and operates under Microsoft Windows® 95/98/NT/2000/ME/XP (min. 7Mb free disk space required). Refer to “PC Software Installation” on page 21 for instructions on installing the software, and to “OrbiPack PC Software” on page 23 for information on using the software.

Note:
Any new OrbiPack fields will be empty when reading previous versions of measurement files.

2 Installation

Your Beverage Package Analyzer includes the components listed in the Introduction section of this manual.

Hach Ultra recommends installing the Beverage Package Analyzer on a laboratory table. Place it on a clean flat area, close to water and drain location, such as a sink. Locate the instrument convenient to the power source, the piercer and sensor connectors, and the PC running the OrbiPack software.

Table 2-1: Supplies

Power	220 V or 110 V
Purge and forcing gas for O_2 / CO_2 Beverage Package Analyzer	N_2 at 5 bar purity > 99.5%
Purge and forcing gas for O_2 / N_2 Beverage Package Analyzer	CO_2 at 5 bar purity > 99.5%

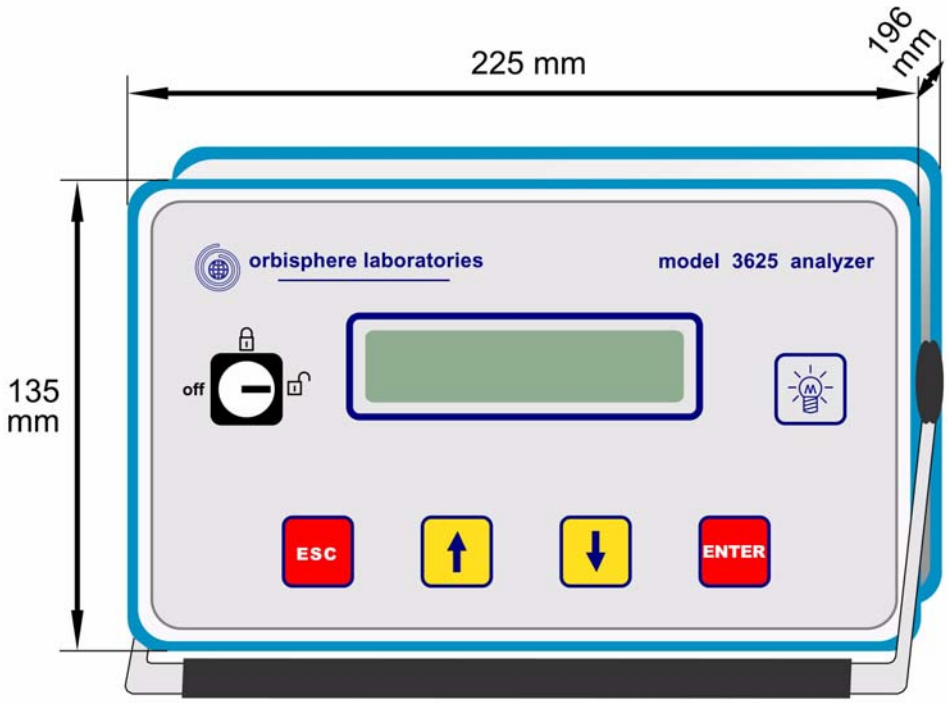
CAUTION:
Purge and forcing gas MUST be dry.

2.1 Installation Steps

1) Perform the O_2 sensor maintenance (see sensor Maintenance manual).
2) Install O_2 electrochemical sensor.
3) Install CO_2 or N_2 thermal conductivity sensor.
4) Connect piercer outlet to drain.
5) Connect piercer to purge and forcing gas.
6) Connect all the cables.
7) Install the OrbiPack software.
8) Turn the instrument on.
9) Check the voltage V3 in continuous purge option (see “Thermal Conductivity Sensor Continuous Purge” on page 56)

2.2 Measuring Instrument

The 3625 measuring instrument controls the measurement sequence of the Package Analyzer. It computes data and communicates results to the PC.



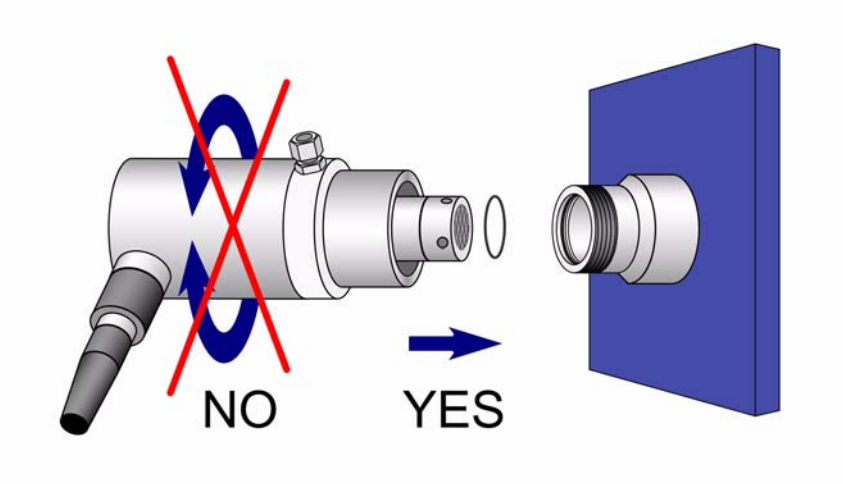
2.3 Package Piercer Installation

The piercer operates under control of the 3625 instrument. The piercer is connected to the measuring instrument, the sensors, and the forcing gas supplies. The gas sensors are mounted onto the back panel of the piercer, into the micro-volume flow chambers.

2.3.1 Sensors Installation

Check that the small O-ring at the bottom of the flow chamber is present during removal and installation of the sensor, as it may stick to the sensor head and fall.

Do not twist the sensors when inserting them into micro volume flow chambers. Such a rotation may twist the attaching ring for the sensor membrane, thus modifying the membrane position. This may modify the membrane measuring conditions, and affect the measurement precision.



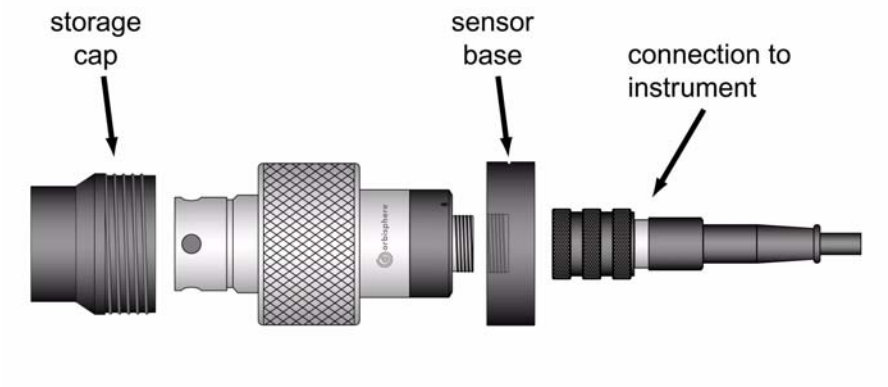
O_2 Electrochemical Sensor

Your Orbisphere electrochemical sensor has been thoroughly cleaned and tested at the factory. To protect the electrodes from oxidation, the cell has been filled with electrolyte and a membrane has been installed.

However, shipping and storage conditions can adversely affect electrochemical sensor cells, therefore a sensor service (cell cleaning & membrane replacement) must be performed before start up.

See service instructions in sensor's Maintenance manual. If you are not familiar with Orbisphere sensor servicing, your Hach Ultra representative will be glad to assist you.

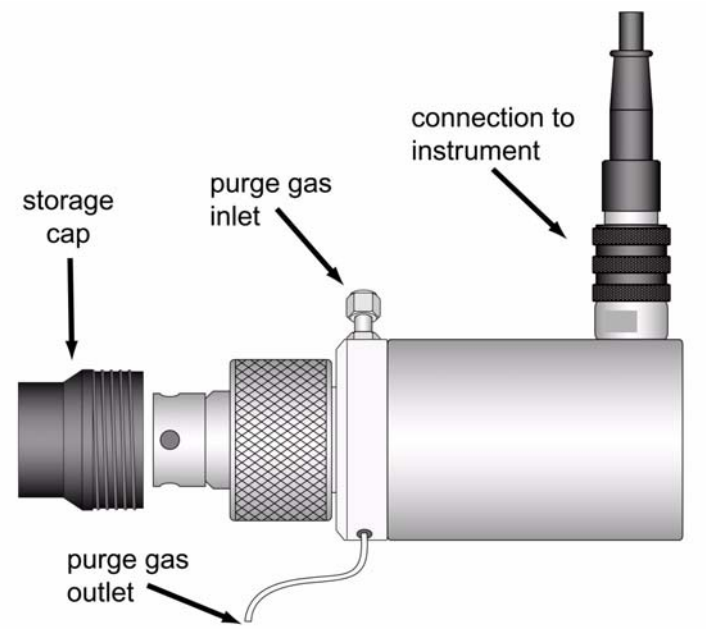
Once serviced, install the O_2 sensor into the lower flow chamber.



CO_2 or N_2 Thermal Conductivity Sensor

Install first the external temperature sensor into the front of the upper flow chamber (same flow chamber as the thermal conductivity sensor). Install thermal conductivity sensor into the upper flow chamber.

Note:
The connection box located on the piercer base connects the external temperature sensor to the analyzer. This device allows to use the Package Analyzer without having the thermal conductivity sensor installed, in the situation where the measurements it delivers are not needed.



2.3.2 Purge and Forcing Gas Supply

The thermal conductivity sensor must have a supply of purge gas running before operating the system. Purge and forcing gas are the same gas. Connect the main inlet port of the piercer to the supply line.

CAUTION:
This sensor, when exposed to a liquid sample, will be damaged if purge gas is not flowing.

- CO_2 sensor requires N_2 as purge gas
- N_2 sensor requires CO_2 as purge gas
- Purge and forcing gas cylinder pressure setting:
  1 bar > package pressure < 5.5 bar
- Set the purge gas regulator at 2 bar gauge (60 psig) with the pressure regulator on the piercer



Purge gas outlet on thermal conductivity sensor:

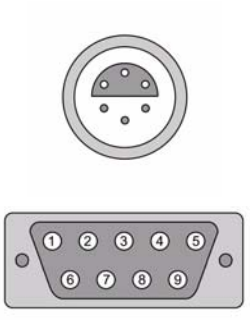
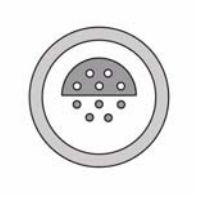
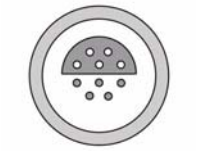
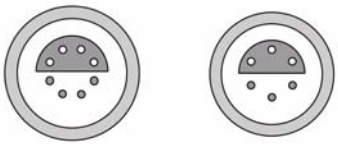
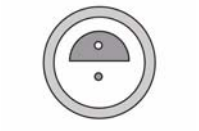
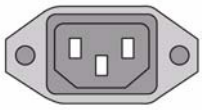
- Connect about 25 cm (10") of 1/8" diameter nylon tube.
- Push the tube firmly into the purge gas outlet
- Put the other end into a cup of water for testing

Select **Continuous Purge** in the **Options** menu

- Put the purge gas outlet tube in water.
- Control the purge gas sequence by looking at the bubbles generated.

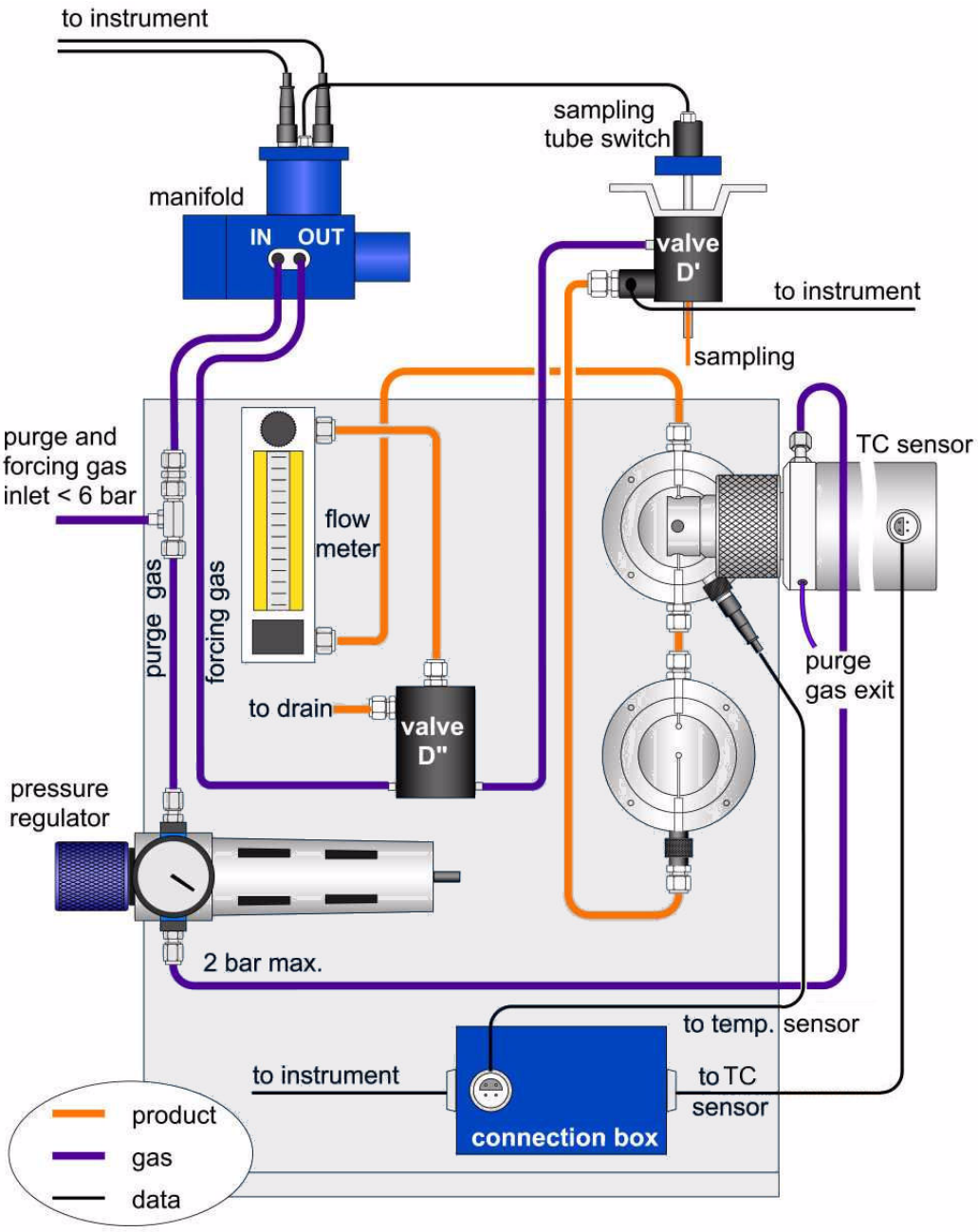
CAUTION:
Do not leave tube in water, as moisture may be sucked in sensor's cell, thus damaging it.

2.3.3 Instrument Back Panel Connections

	**Personal Computer (PC)** Connect, using the RS 232 "serial" cable, the 6 pin socket on rear panel of the instrument to the RS-232 port on the PC operating the OrbiPack software. Pin 2 = RCD / Pin 3 = TXD / Pin 5 = GND RS-232 communications parameters: Baud rate: 9600 / Stop bit: 1 / Start bit: 0 / Parity: None
	**O_2 Electrochemical Sensor** Connect the sensor to the 10 pin socket labeled "Sensor O_2" on rear panel of measuring instrument. **CAUTION:** *Please connect the oxygen sensor to the correct socket, because it can be damaged if it is plugged into the socket labeled "Sensor CO_2 (or N_2)".*
	**CO_2 or N_2 Thermal Conductivity Sensor** Connect the sensor to the connection box located on the piercer base. Then connect the connection box wire to the 10 pin socket labeled "Sensor CO_2 or N_2" on the instrument back panel.
	**External Temperature Sensor** Connect the sensor cable to 4 pin socket of the connection box located on piercer base.
	**Piercer Manifold** Connect the two cables from the top of the gas channeling manifold to the two "Piercing unit" sockets on the rear panel of the instrument. (Inside the gas manifold are the external pressure sensor and gas temperature sensor, which connect to the measuring instrument by these cables)
	**PT 1000 Temperature Sensor** Connect the temperature sensor cable to the 2 pin socket on rear panel of measuring instrument.
	**Measuring Instrument** Connect the power cable supplied with the instrument for AC power connection. **CAUTION:** *Check voltage requirement sticker on the rear panel of the instrument before connecting the instrument.*

2.3.4 Liquid and Pneumatic Connections

Connect all components according to diagram below.

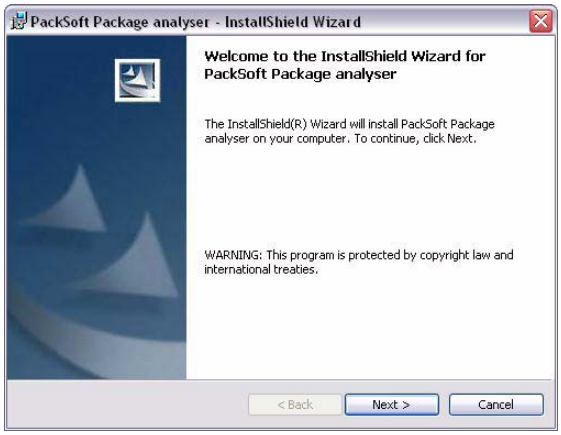


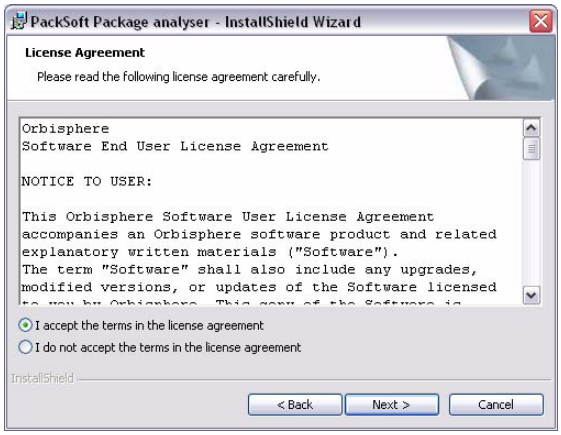
2.4 PC Software Installation

Note:
*Before installing, be sure to remove any previous versions of the software from your computer using the standard **Add or Remove Programs** option available from the Windows **Control Panel**. This will remove the software but leave all measurement files intact.*

The OrbiPack V5.00 software must be installed on your PC hard drive. To install, insert the OrbiPack software CD into your disk drive (designated here as "D").

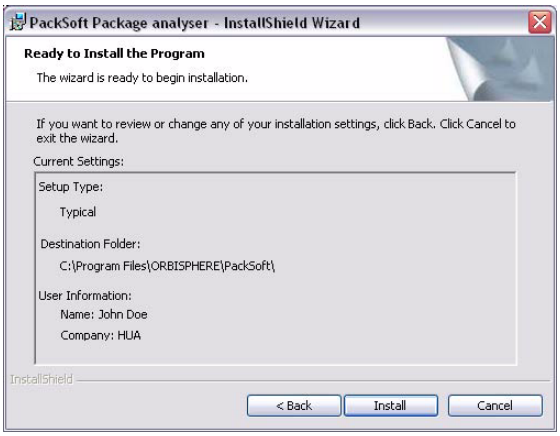
- The installation should start automatically. If not, select **Run** from the **Start** menu, and type: **D:\ Setup.**
- Click **Next** to start the installation and then follow the on-screen instructions on the InstallShield Wizard.
- On the **Customer Information** screen (third screen) make sure the **Anyone who uses this computer (all users)** option is selected.













- Click **Finish** to complete the installation.
- The OrbiPack program icon will be installed on the desktop as part of the installation.

Note:
If you intend to use the inter-process communication option (see “Communication” on page 37) then we recommend you also download and install the OPC Toolbox Client software available free from www.softing.com.

2.5 Installation Completion Check List

To complete the installation, proceed to following actions:

1) Turn the measuring instrument on (see “Start the Instrument” on page 49).
2) Adjust the package piercer (see “Package Piercer Adjustments” on page 48).
3) Start the OrbiPack software (see “PC Software” on page 49).
4) Set the software options and package settings (see “Setup” on page 28).
5) Perform a barometric sensor calibration (see “Barometric (internal) Pressure Sensor Calibration” on page 64).
6) Perform an external pressure calibration (see “Package (external) Pressure Sensor Calibration” on page 64).
7) Perform an oxygen EC sensor calibration (see “Electrochemical Oxygen Sensor Calibration” on page 65).
8) Perform a carbon dioxide (or nitrogen) TC sensor calibration (see “Thermal Conductivity CO_2 and N_2 Sensor Calibration” on page 66).
9) Set the humidity factor correction (nitrogen TC sensor only - see “Humidity Factor Correction” on page 57).

The 3625 Package Analyzer system is now ready for use.

3 OrbiPack PC Software

The Package Analyzer system cannot function without the OrbiPack software. Before attempting any measurements with the analyzer, ensure that:

- An RS232 cable connects the PC to the instrument
- The PC is turned on
- No screen savers have been set on the PC
- The OrbiPack program is running

3.1 General Information

3.1.1 OrbiPack Startup



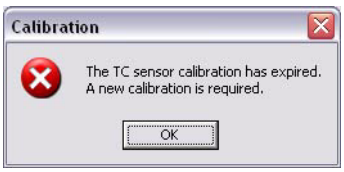
Click the OrbiPack program icon on the desktop, or select OrbiPack from the Windows Start menu.



Depending the communications setup that has been defined (see “Communication” on page 37 for more details), when the program is launched and for each new file, the operator user name and password may be requested.

The very first time the OrbiPack program is run, a username of **Orbisphere** with no password can be used to gain full access to the system. Change the security levels as soon as possible to remove this facility and protect your system (see “Change Supervisor Password” on page 38 for more details).

Note:
If the "Cancel" button is pressed, with no username or password entered, the program is still launched, but the data file is opened as read only.



The software checks if any calibration delay has expired (see “Calibration Management” on page 38). If so, a popup window appears as illustrated left.

This is a reminder only and will not prevent measurements being taken. Click **OK** to continue.



After a valid username and password are entered, the message illustrated left will be displayed to remind you, for safety reasons, to use the package shield prior to piercing any package.

Press on **OK** to continue.

3.1.2 Getting Help

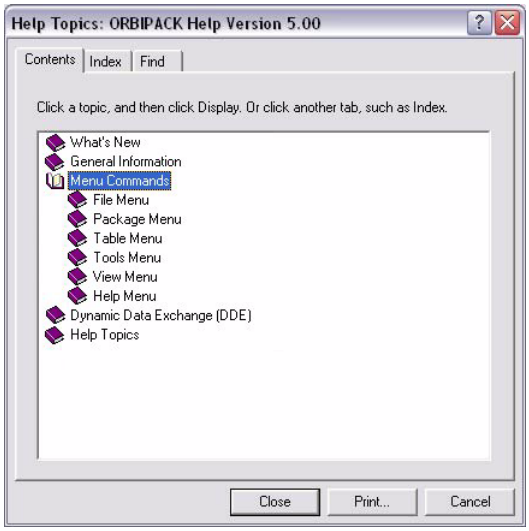
A sophisticated on-line help system is available with the software. This manual gives an overview of the most important features of the software. For detailed and in-depth information of any screen or its contents, select the **Help** button associated with that screen.

Alternatively, or if no Help button is available, press the **F1** key to get help on the screen you are currently viewing.



Also, when displayed, you can press the interactive help button (illustrated left) and move the resulting question mark symbol to the area of the screen where you want additional help.

For a list of all the help topics available, select **Help - Contents** from the options on the main toolbar to display the main help screen. Then click on the tab appropriate to your needs (**Contents**, **Index** or **Find**). An example of the contents is illustrated below.



3.1.3 Measurement Without the TC Sensor

The system can still function without the thermal conductivity sensor. In this case, the corresponding measurements are left empty in the display.

3.1.4 Measurement Data Display

The illustration below is an example of the measurement display (the data and column definitions displayed are an example only). The display is user definable to meet different customer requirements.

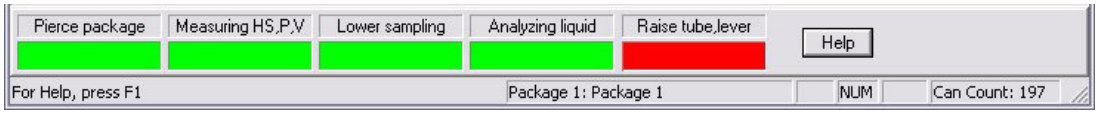


	Date	Time	Package	CO2 Sensor [V/V]	CO2 PT [V/V]	CO2 Norm. [V/V]	DO2 [ppb]	DH2 [ppm]	HS Pressure [bar]	Temperature [°C]	Liquid Volume [ml]	HS Volume [ml]	O2 HS [mg]	O2 Li [m
4	10/05/2006	10:48:29	Can 7-1 "G" 1	1.39	1.37	1.45	690.03	1.17	2.00	28	819.85	180.15	4.14	0.56
5	10/05/2006	10:51:01	Can 7-1 "G" 1	1.70	1.68	1.70	793.54	1.32	1.94	20	824.79	175.21	4.14	0.65
6	10/05/2006	10:52:22	Can 7-1 "G" 1	1.71	1.69	1.71	795.26	1.33	1.94	20	825.06	174.94	4.14	0.66
7	10/05/2006	10:54:01	Can 7-1 "G" 1	1.59	1.57	1.61	756.36	1.27	1.96	23	823.27	176.73	4.14	0.62
8	10/05/2006	10:55:26	Can 7-1 "G" 1	1.57	1.55	1.59	748.43	1.26	1.97	23	822.71	177.29	4.15	0.61
9	10/05/2006	10:56:56	Can 7-1 "G" 1	1.52	1.50	1.55	731.70	1.23	1.97	24	821.95	178.05	4.14	0.60
10	10/05/2006	10:58:16	Can 5 "E" 500	1.52	1.50	1.58	733.12	1.23	1.97	24	322.02	177.98	4.14	0.24
11	10/05/2006	10:59:56	Can 5 "E" 500	1.42	1.41	1.52	700.80	1.19	1.99	27	320.63	179.37	4.14	0.22
12	10/05/2006	11:01:22	Can 5 "E" 500	1.40	1.39	1.51	694.20	1.18	2.00	28	320.28	179.72	4.14	0.22
13	10/05/2006	11:02:46	Can 5 "E" 500	1.38	1.37	1.50	687.76	1.17	2.00	28	319.94	180.06	4.14	0.22
14	10/05/2006	11:04:08	Can 5 "E" 500	1.46	1.44	1.55	713.12	1.21	1.98	26	321.05	178.95	4.14	0.23
15	10/05/2006	11:05:46	Can 5 "E" 500	1.73	1.71	1.72	801.80	1.34	1.94	19	325.31	174.69	4.14	0.26
16	10/05/2006	11:07:16	Can 7-1 "G" 1	1.67	1.65	1.68	782.28	1.31	1.95	21	824.35	175.65	4.14	0.64
17	10/05/2006	11:08:29	Can 7-1 "G" 1	1.53	1.51	1.56	735.08	1.24	1.97	24	822.10	177.90	4.14	0.60
18	10/05/2006	11:10:07	Can 7-1 "G" 1	1.62	1.60	1.63	765.35	1.28	1.96	22	823.85	176.15	4.14	0.63
19	10/05/2006	11:11:41	Can 5 "E" 500	1.54	1.52	1.59	738.55	1.24	1.97	24	322.27	177.73	4.14	0.24
20	10/05/2006	11:13:07	Can 5 "E" 500	1.60	1.58	1.63	759.04	1.27	1.96	22	323.38	176.62	4.14	0.24
21	10/05/2006	11:14:27	Can 8-2 "J" 4	1.52	1.50	1.60	732.46	1.23	1.97	24	222.19	177.81	4.14	0.16
22	10/05/2006	11:16:04	Can 8-2 "J" 4	1.70	1.68	1.70	793.38	1.32	1.94	20	224.78	175.22	4.14	0.18
23	10/05/2006	11:17:29	Can 8-2 "J" 4	1.67	1.65	1.68	784.55	1.31	1.95	20	224.44	175.56	4.14	0.18
24	10/05/2006	11:19:01	Can 8-2 "J" 4	1.82	1.79	1.76	831.35	1.38	1.93	17	226.39	173.61	4.14	0.19
25	10/05/2006	11:20:22	Can 8-2 "J" 4	1.43	1.42	1.55	704.33	1.19	1.99	27	220.61	179.39	4.14	0.15
26	10/05/2006	11:22:01	Can 8-2 "J" 4	1.69	1.67	1.69	790.26	1.32	1.94	20	224.66	175.34	4.14	0.18
27	10/05/2006	11:23:27	Can 8-2 "J" 4	1.66	1.64	1.68	781.50	1.31	1.95	21	224.31	175.69	4.14	0.17
28	10/05/2006	11:24:57	Can 8-2 "J" 4	1.61	1.59	1.65	763.04	1.28	1.96	22	223.76	176.24	4.14	0.17
29	10/05/2006	11:26:17	Can 8-2 "J" 4	1.61	1.59	1.65	764.62	1.28	1.96	22	223.62	176.38	4.14	0.17

3.1.5 Process Bar

The process bar is displayed at the bottom of the application window. It shows five boxes indicating the sequences of the current analysis. They correspond to the display messages on the measuring instrument.

When one analysis step is completed, the corresponding box turns green. However, if a problem is found, the box turns red. Click the **Help** button for details.

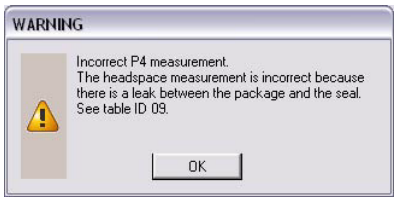


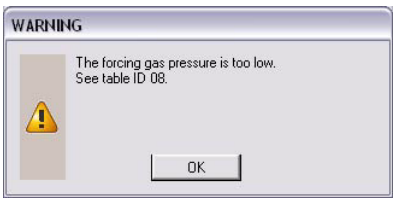
Note:
The last box on the right turns red at the end of the sampling process. Lift the sampling tube all the way up and raise the piercing lever. When both conditions are met, the whole process bar turns grey, indicating the system is ready for the next package measurement.

3.1.6 Warning Messages

During measurements, warning messages may pop up informing the user of potential problems with the measurement.

The error will point the user to a table for more information. For example **See table ID 09** as illustrated in the illustration below left.





For more information refer to the table in “OrbiPack Software Error Messages” on page 78. The **table ID** displayed in the warning message, cross-references the value in the column entitled **Error No**.

3.1.7 Selecting Measurement Data

A number of options described in the following sections require that one or more measurement lines are selected from the table data (see, for example, “Statistics” on page 33).

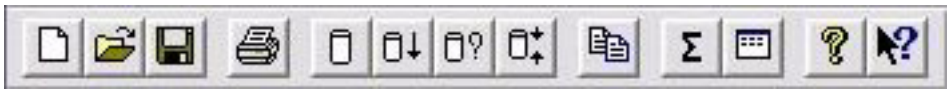
The following process describes how to select measurement lines:

- Select an individual measurement by moving the cursor over the measurement number in the left most column. An arrow symbol will appear. Left click on the mouse to select it. The selected measurement line will be highlighted.
- Select multiple adjacent measurements by selecting an individual line as described above, and then dragging the arrow symbol over the measurements to change while holding down the left mouse button.
- Select multiple non-adjacent measurements by selecting an individual line as described above, and then select the additional measurements to change while holding down the **Ctrl** button on the keyboard.

Note:
If an option is selected where one or more measurement lines need to be selected, but none are selected using the processes above, then the last measurement line will be selected by default.

3.1.8 Toolbar Shortcuts

A number of shortcuts to menu options are available from the toolbar. In order from left to right in the illustration below:



- Start a new measurement run
- Open a previous measurement file
- Save the current measurement file

- Print the current measurement file

- Select a new package
- Modify a package
- View package information
- Change the fill volume of a package

- Copy the current measurement selection

- View statistics of the current measurement selection
- Show the diagnostics window

- Display information about the current installed OrbiPack software
- Get interactive help

3.2 File Menu

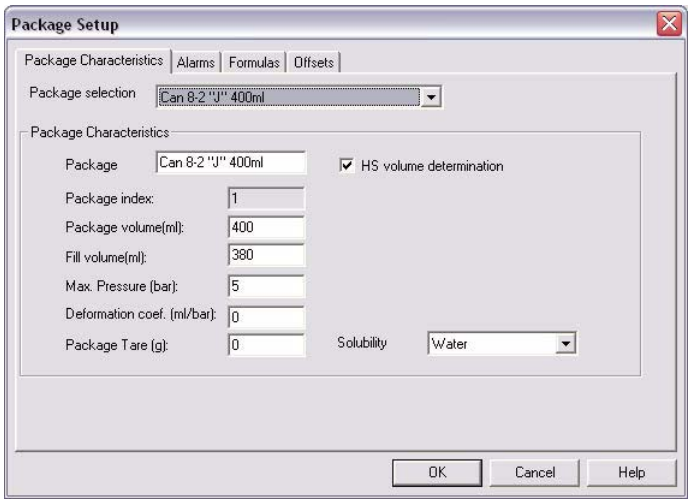
- New - starts a new measurement run and creates an empty measurement data file
- Open - open an existing measurement data file
- Save and Save As - save the current measurement data file but do not end the current measurement run
- Properties - displays the properties of the current measurement data file
- Print Setup, Print Preview and Print - standard printing options for the current measurement file
- Merge Files - merges two or more measurement files into one and opens the newly created file
- Exit - exit the application

3.3 Package Menu

3.3.1 Setup

3.3.1.1 Package Characteristics

Enter the data corresponding to the package to be tested. Up to 500 different package specifications can be saved.

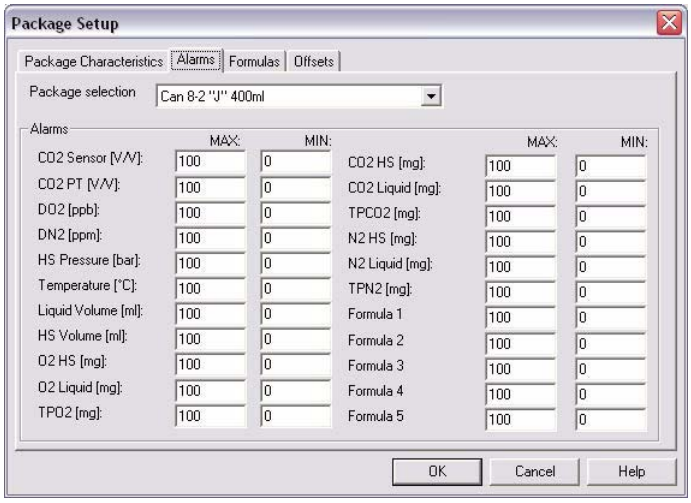


Select the package to define from the drop-down list. The current settings for that package will be displayed:

- Package name - Up to 20 characters can be used to identify the package
- Package index - Display purposes only. Internal index number from 1-500
- Package volume (ml) - Volume of the package
- Fill volume (ml) - The fill volume of the package. This value can be adjusted after each measurement (see “Fill Volume” on page 30) provided the option is enabled (see “General” on page 34)
- Max. pressure (bar) - The maximum allowable pressure inside the package
- Deformation coeff. (ml/bar) - The pressure coefficient of package deformation
- Package tare (g) - Not used
- Solubility - This indicates the liquid in which the measurement is performed
- HS volume determination - If this is enabled the headspace volume is determined by the 3625 Instrument and the fill volume calculated from the difference between the headspace volume and the package volume. This calculated value overrides any value entered in the fill volume box of this menu

Alarms

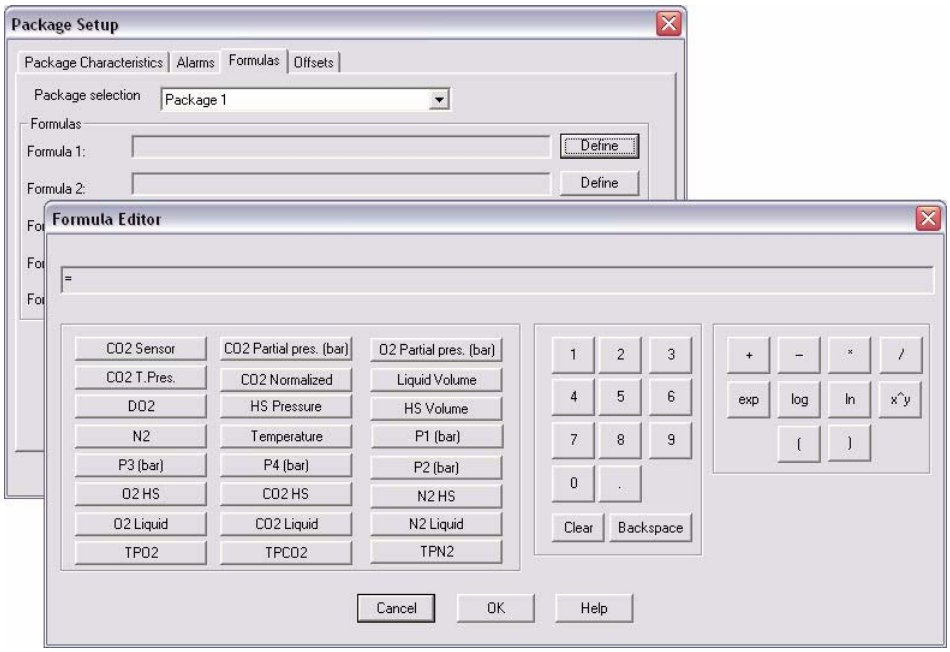
Alarm limits can be set on all measured and computed values. The example screen shot below shows all the values against which alarm limits can be set. The limits illustrated (MAX of 100 and MIN of 0) are the standard default values.



If the values of the measurements listed are higher than the maximum value set, or lower than the minimum value set, the value is displayed in **red** in the tabular display (see examples in “Measurement Data Display” on page 25).

Formulas

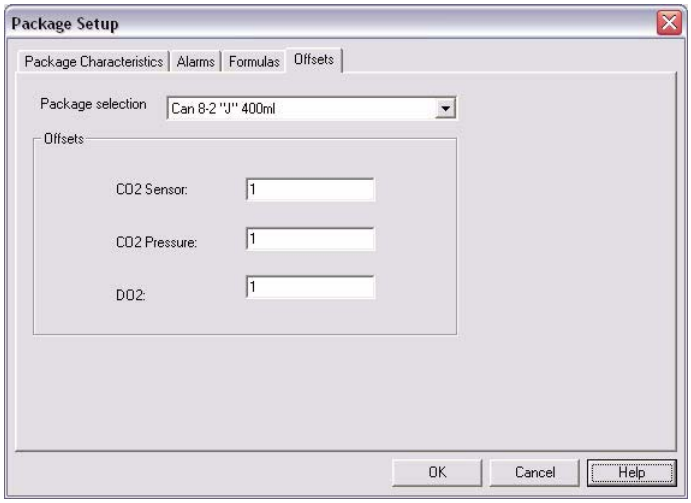
Five formula lines are available to allow users to create and compute a new parameter, or a different CO_2 solubility equation. The columns corresponding to any formula are displayed in the data table.



To define a formula, click on the **Define** button and an editor dialog box appears. Create the formula using the keypad and click on **OK**. Then assign a name to the formula.

Offsets

Three of the measured values sent to the PC from the 3625 instrument can be modified.



The offset value is used as a multiplication factor against the measured value received from the 3625 instrument (e.g. an offset factor set at 1.01 will increase the value by 1%). Keep the default value of one to retain the measurements from the 3625 instrument intact. Any new computed values will be displayed on the PC.

3.3.2 Selection

This option is used to select the package being analyzed. All four screens illustrated in the Setup section above can be displayed, but only the **Package selection** box can be updated. Select the package to analyze from the drop-down list.

3.3.3 Modify

This option is used to change the package being analyzed, after measurements have been made and provided they have not been saved. The measurement data is recalculated based on the new package details and the selected line(s) of results are updated to reflect what would have been displayed if this new package type had been selected originally.

Select one or more measurement lines. Once the measurement lines are selected, click on the **Modify** option in the **Package** menu. A window will then be displayed and the new package can be selected from a drop-down list.

3.3.4 Fill Volume

This command is only available if the parameter **Fill volume change** is enabled (see “General” on page 34).

Select one or more measurement lines. Once the measurement lines are selected, click on the **Fill volume** option in the **Package** menu. A window will then be displayed and the new fill volume can be entered directly.

Once the fill volume has been changed, the measurement data is recalculated based on the new value and the selected line(s) of results are updated accordingly.

3.3.5 Info

This option is used to view details of the package being analyzed. All four screens illustrated in the Setup section above can be displayed, but nothing can be updated.

3.4 Table Menu

All the options available under this menu apply to the measurement lines (table data) displayed on the PC screen.

3.4.1 Delete

Select one or more measurement lines to delete, then select **Delete** from the **Table** menu. A password will be required if the parameter **Delete measurements** is set to **Password protected** (see “General” on page 34).

3.4.2 Copy

Select one or more measurement lines to copy from the table data onto the Windows Clipboard, for pasting into other applications (e.g. spreadsheet applications).

3.4.3 Select Package

This option allows selection of all measurements associated with a specific package. Select a package from the drop-down list. All measurement lines for this package will be selected and highlighted.

The selected measurements can then be copied or deleted (as described above), viewed in a statistics summary (see “Statistics” on page 33), or modified (see “Modify” and “Fill Volume” on page 30).

3.4.4 Select All

This option is similar to the select package option, except measurement data for all packages will be selected and highlighted.

3.4.5 Base Styles

Opens the Base styles dialog box to set styles for row header, column headers, and table cell contents. Each style includes a text font, a cell color, a cell border, and the text alignment within the cell.

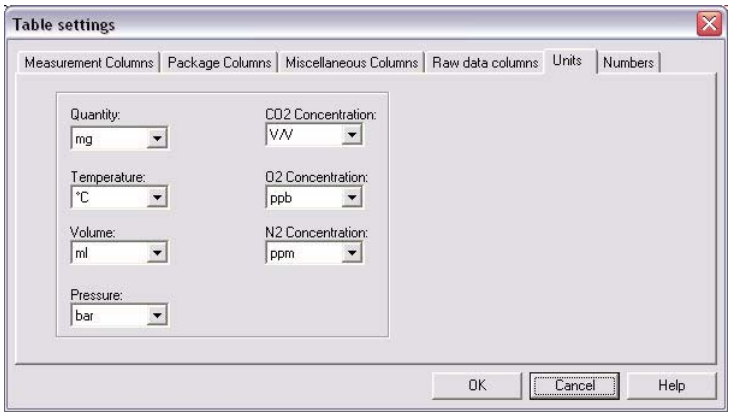
Four styles can be selected for change:

- Column Header
- Row Header
- Standard (data contents within the table cells)
- Constraint Violation (formula)

Highlight one of these style names and select the **Change** button.To save any changes for subsequent program use, check the **Save as default** box.

3.4.6 Table Settings

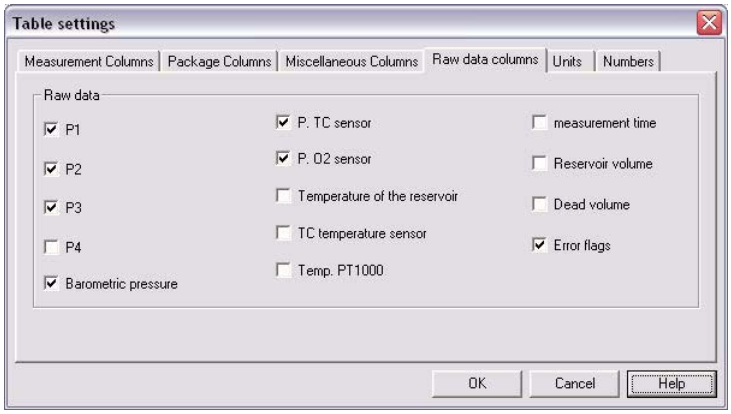
This password protected option allows the user to define the parameters for the tabular measurement display on the PC.



The dialog box contains six tabs that set the display parameters. Select each in turn to define what data to display, the data format, and the measurement units (screen illustrated above).

The **Raw Data** tab is especially useful for troubleshooting purposes. This allows the user to view the raw data measurements taken by the instrument prior to any calculations.

If viewing raw data measurements, it is also advisable to check the **Error flags** checkbox. This is a 32 digit field filled with either a zero or one (0 = OK and 1 = error). Refer to the table in “OrbiPack Software Error Messages” on page 78 for a description and example of the flag position, operation and error condition when the flag is set to 1 indicating an error.



3.4.7 Resize Rows

Select one, several or all rows, and then use this option to resize the selected rows to fit the cell contents.

Note:
You may also resize a row manually with the mouse by dragging the bottom border of the row header. Alternatively, by double clicking the left mouse button on the bottom row line, the row will be resized automatically.

3.4.8 Resize Columns

Select one, several or all columns, and then use this option to resize the selected columns to fit the cell contents.

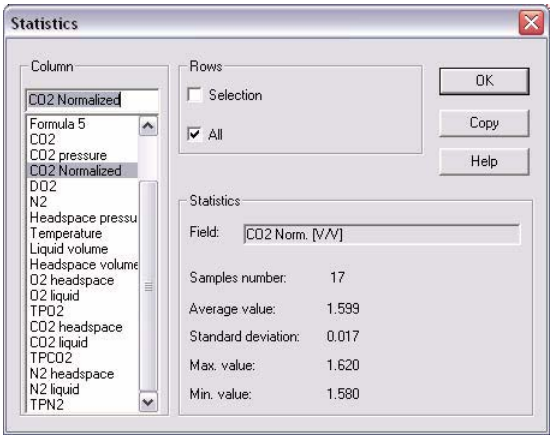
Note:
You may also resize a column manually with the mouse by dragging the right border of the column header. Alternatively, by double clicking the left mouse button on the right column line, the column will be resized automatically.

3.5 Tools Menu

3.5.1 Statistics

This option opens a dialog box that displays statistics about selected measurements in the table. Choose to view statistics from a column or row:

- Column - To view the statistics of a data column, choose the column name from the list. Only one column may be selected at a time.
- Rows - To view the statistics of rows in the table, choose the appropriate check box (**All** or **Selection**). If selection is chosen, select the rows for which statistics are required.

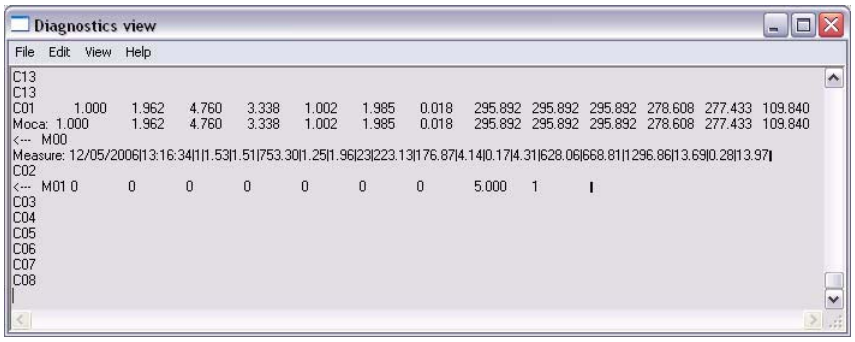


Statistics for the chosen column and the selected rows are displayed in the bottom right of the dialog box, indicating the number of samples selected, the average value, standard deviation, maximum, and minimum values.

To copy the statistics to the clipboard for use in another application, click on the **Copy** button.

3.5.2 Diagnostics

Displays the data exchanged on the serial link between the 3625 instrument and the OrbiPack program, while the data is being sent or received.



Use the **File** menu option to save the diagnostic data in a text file or exit the window. The **Edit** menu option allows the user to copy, clear, or select the diagnostic data. The **View** menu option allows the user to determine which diagnostics are displayed (measurements, communications messages, or both).

The data received by the OrbiPack program are displayed exactly as received, whereas the data sent by the program is preceded by **<---**.

3.5.3 File Conversion

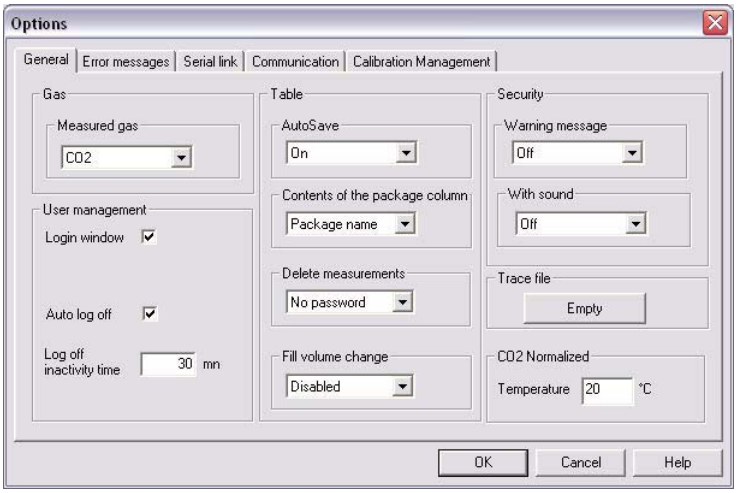
This option is used to convert the current measurement results to a text file that can be used as input to other applications (word processors, spreadsheets, etc.).

3.5.4 Options

Before performing any measurements, several options can be set with regards to the measurements. However, once the OrbiPack program has received analysis results from the instrument, these options can only be viewed; they can no longer be changed.

They can only be changed once a new measurement run is selected.

General

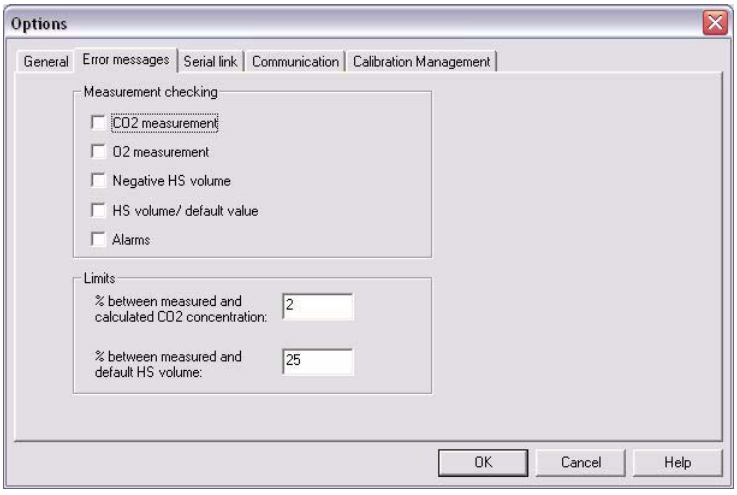


- Measured gas - Select **CO_2** or **N_2** as the gas to be measured by the TC sensor. Do not change this option unless you change the sensor.

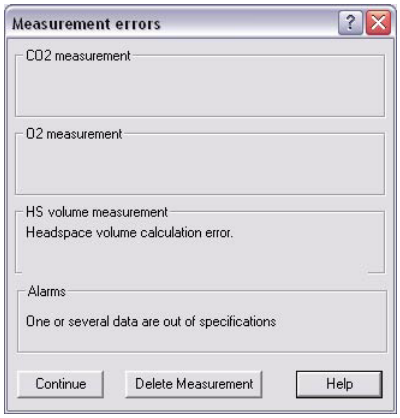
- Login window - If this box is not checked, then no username or password is requested at login or when a new measurement run is selected.
- Auto log off - If this box is checked, and if there is no access to the software after the time elapsed in the **Log off inactivity time** box has expired, no measurements will be allowed. A valid username and password will be required to regain access to the software.
- Auto Save - Choose **On** to save the results after each measurement. This data is stored in the **backup.pck** file, located in the OrbiPack directory.
- Contents of the package column - Choose **Package name** to display a user-defined package name in the package column of the tabular display. Choose **Package index** to display the package index number.
- Delete measurements - Choose **Password protected** to prevent data from being accidentally erased from the data file. If set, each time the delete measurements option is selected, a password will be required.
- Fill volume change - Choose **Enabled** to allow adjustment of the fill volume on selected measurements.
- Warning message - If **On**, the warning message is displayed each time a new measurement run is started, to warn the user to use the protection shield around the package to be analyzed before piercing (see illustration in “OrbiPack Startup” on page 23).
- With sound - Set to **On** to display the warning message with the addition of an audible reminder.
- Trace file - A trace file records all information about measurements into a file named **trace.txt**. It is used by Technical Support to analyze any measurement problems. The file can become very large, so it should be periodically deleted using this option. A new one will be created next time a measurement is performed.
- CO2 Normalized - Enter the temperature (in degrees centigrade) to be used in the normalized CO_2 calculation.

Error Messages

You can enable or disable warning messages for errors that may occur during package analysis.



- CO2 measurement - Activate if the CO_2 sensor result is greater than the calculated pressure-temperature CO_2 result by a specified percentage. This limit is selectable in the **% between measured and calculated CO_2 concentration** edit box. This is an indication of CO_2 sensor or external pressure sensor problem.
- O2 measurement - Activate if the O2 measurement is 0 ppb or negative. This is an indication of O2 sensor or external pressure sensor trouble.
- Negative HS volume - Activate if the headspace volume is negative and the CO2 measurement is good. Indicates a problem with the external pressure sensor.
- HS volume/default value - Activate if headspace volume is different from the default value by a specified percentage. This limit is selectable in the **% between measured and default HS volume** edit box.
- Alarms - Gives an alarm at the end of the measurement, according to the thresholds entered in the package setup windows (see “” on page 29).

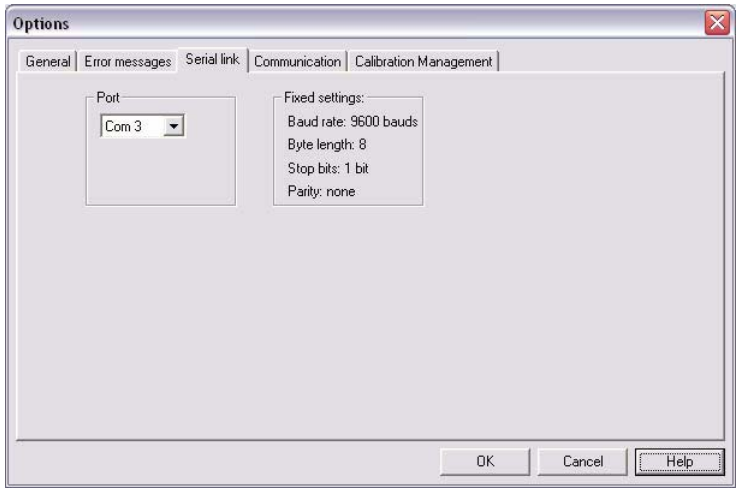


If one or more of the boxes described above is checked, and one or more of the corresponding errors occur, a pop up window (as illustrated left) displays the error(s).

Select **Continue** to save the measurement regardless of the error, or **Delete Measurement** to remove it.

Serial Link

Select, from a drop-down list, the PC communications port that is connected to the 3625 instrument.



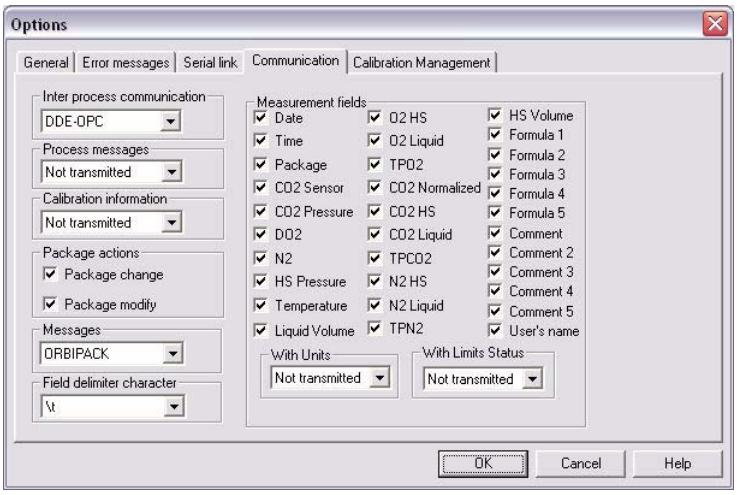
Note:
Use the System Properties function of the Windows Control Panel to ensure that the Com port selected is set to the fixed settings listed in this dialog box.

Communication

The software allows for communication with other control and management systems such as SCADA and LIMS, etc. OPC is used as the inter-process communication solution. The communication option is used to define the necessary parameters.

If using the OPC inter-process communication solution, you must have the appropriate communications software installed on your PC (see “PC Software Installation” on page 21 for additional information).

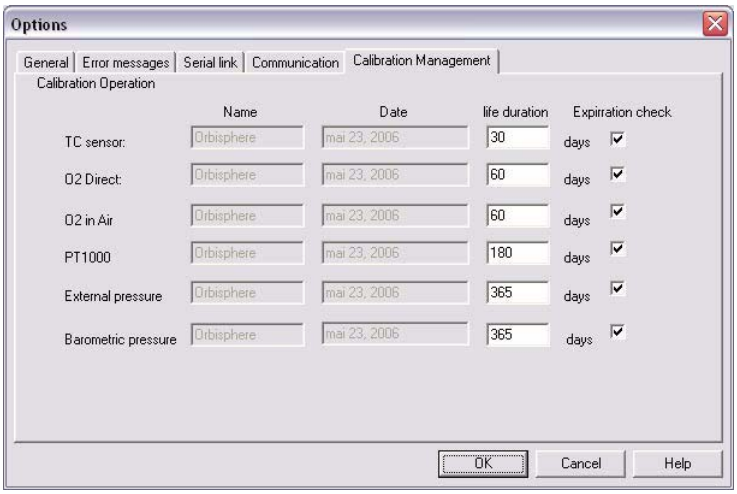
For the DDE solution you can use the excel file for DDE simulation, which is found on your hard disk in **Program Files\Orbisphere\OrbiPack** and called **DDE_ORBIPACK.xls**.



- Inter process communication - Turn this on by selecting **DDE-OPC** or turn off by selecting **OFF**. If turned off, none of the other parameters can be set.
- Process messages - Select **Transmitted** to exchange process messages between OrbiPack and the client application.
- Calibration information - Select **Transmitted** to send calibration information from OrbiPack to the client application.
- Package actions - Tick the appropriate checkbox if you require the client control system to be allowed to change the selection of the package number or to modify the selected package.
- Messages - Set to **REDIRECTED** to redirect all popup messages to the selected communications tool. No acknowledgement will be required from the control software for warning or error messages, but OrbiPack will keep any erroneous measurements. For application login messages, the client control system must supply the username and password. Setting this parameter to **ORBIPACK** means that the OrbiPack software retains control of all messages.
- Field delimiter character - Select the field delimiter character required by the client application from the drop-down list.
- Measurement fields - Check the measurement data required to be sent to the client application from the elements displayed.
- With units - Select **Transmitted** to send the measurement units.
- With limits status - Select **Transmitted** to send the measurement limits data.

Calibration Management

Each time a calibration is successfully completed, the operator's name and the calibration date are recorded. This option displays these details and allows the time interval between calibrations (life duration column) to be set for each of the sensors.



Once the time period since the last calibration has expired, and if the expiration check box has been checked, a message indicating that a calibration for that particular sensor is required will be displayed when a new measurement run is started (see illustration in “OrbiPack Startup” on page 23).

3.5.5 Factory Settings

This option requires a special password that is only available to qualified Hach Ultra service technicians.

3.5.6 Can Counter Reset

This password protected option resets the can counter to zero. The counter is displayed in the status bar at the bottom of the screen and shows the total number of completed measurements.

3.5.7 Change Supervisor Password

When accessing this option for the first time, the default supervisor password is set to **Hach Ultra**. You will be required to change it before continuing.

There are access levels for the functions and settings:

1) **Guest** access (Read only) - Press **ESC** when prompted for ID and password. Allows for free browsing of data.
2) **Operator** access - Insert operator ID and password. Measurement and calibration are authorized.
3) **Supervisor** access - Access to configuration menu requires a supervisor password (the operator password must be logged on first).
4) **Factory** setting - Requires a password available to Hach Ultra service technicians only.

The following table lists the operations allowed for the different access levels:

Table 3-1: Security Access Levels

Operation	Guest (no password)	Operator	Supervisor	Factory
Read measured data	Yes	Yes	Yes	Yes
Calibration	No	Yes	Yes	No
Delete measured data	No	Yes	Yes	No
Comments addition	No	Yes	Yes	No
Package set-up	No	No	Yes	No
Data table settings	No	No	Yes	No
Factory setting modification	No	No	No	Yes



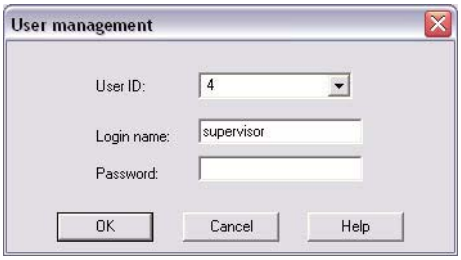
From the “tool” menu, select “modify supervisor password”.

For first operation, leave “Current password” field blank.

Enter a new password in the middle box, and confirm it in the lower box.

3.5.8 User Management

A Supervisor password is required for this option. Up to 30 different operators can be registered and a password assigned.



- To add an operator, select an available ID number, fill in **login name** field, and enter a password (optional).
- To remove an operator from the list, select his ID number and clear the **login name** field.

3.6 View Menu

Use the view menu to hide or display:

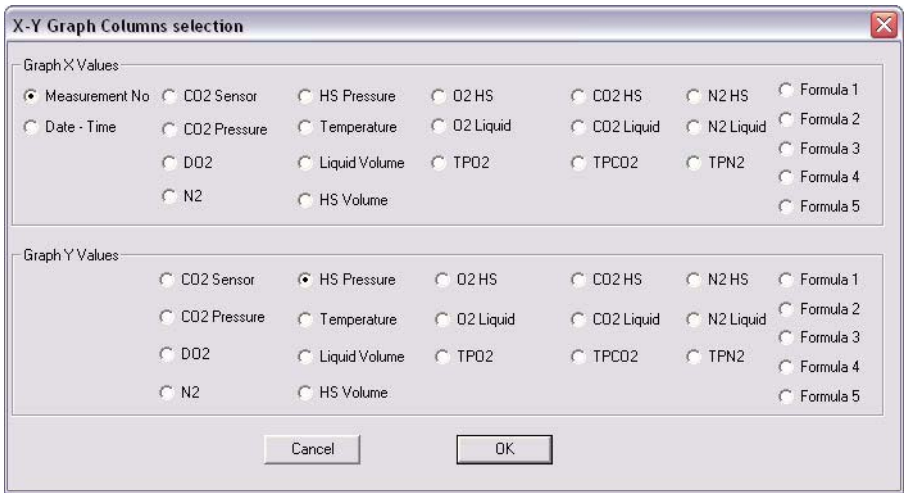
- The **Toolbar** at the top of the screen
- The **Status Bar** at the bottom of the screen
- The **Process Bar** at the bottom of the screen

Split Option

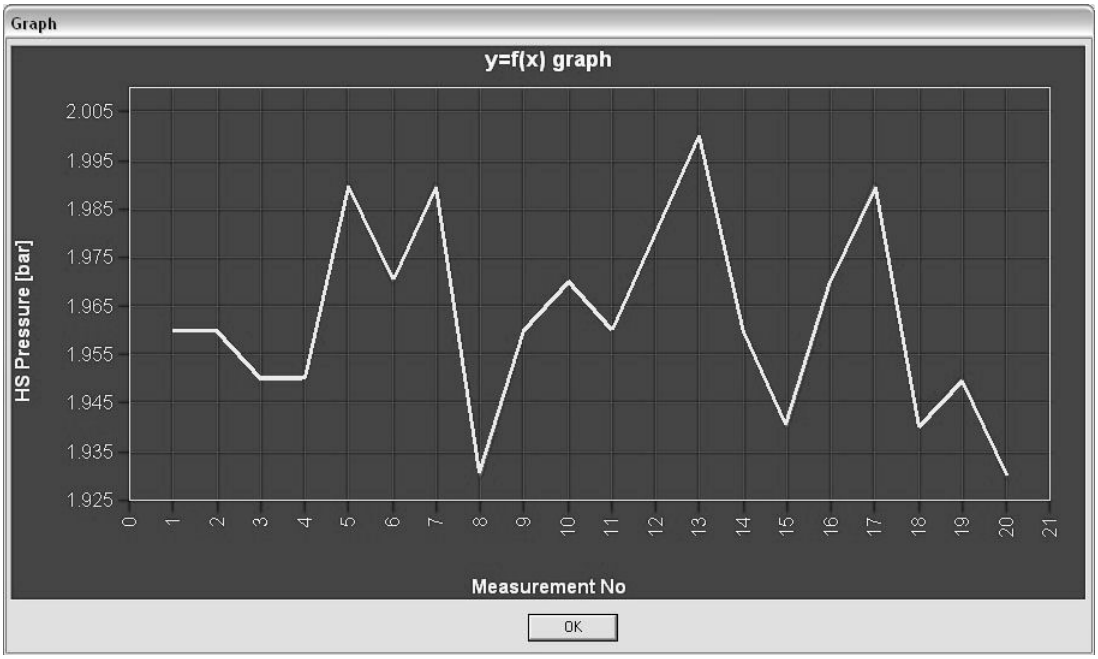
The view menu also allows the user to split the screen display if necessary. Select split from the menu and then move the cursor to the required position. To display a full screen, move the cursor to one of the corners of the screen.

Graph Option

It is possible to view the results graphically rather than in a tabular format. Selecting the graph option to display a screen showing all the possible x and y coordinate values.

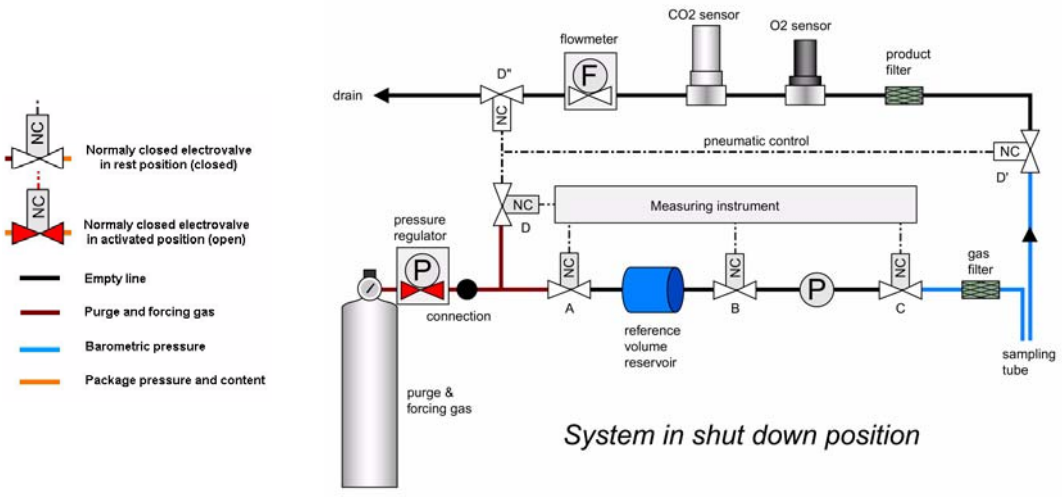


Select the values you wish to see and a graphical representation of those values will be displayed as illustrated below.



4 Automatic Analysis Sequence

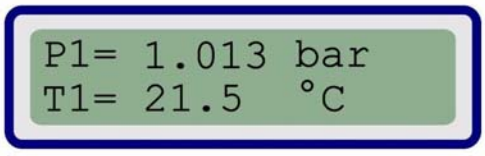
This section describes the sequence of actions that the Beverage Package Analyzer automatically performs during the analysis of a sample package (operator actions are indicated by the sign "**=>**"). A process drawing shows valves activated with gas and liquid path.

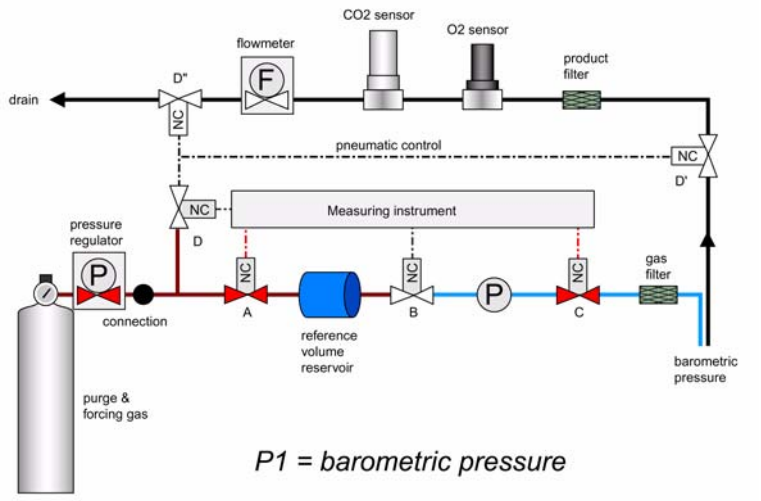


4.1 Start

=> Clamp package in position.

The instrument indicates it is ready when prompting to pierce the package. This message remains on for a few seconds, and then the display alternates with P1/T1 until a package is pierced. P1 is atmospheric pressure, and T1 is manifold temperature.





=> Lower the piercing lever and pierce the package.

Once the package is pierced, the pressure change gives a signal to start the analysis sequence. The instrument checks the package specifications, as entered in the "Package Selection" in the PC OrbiPack software.

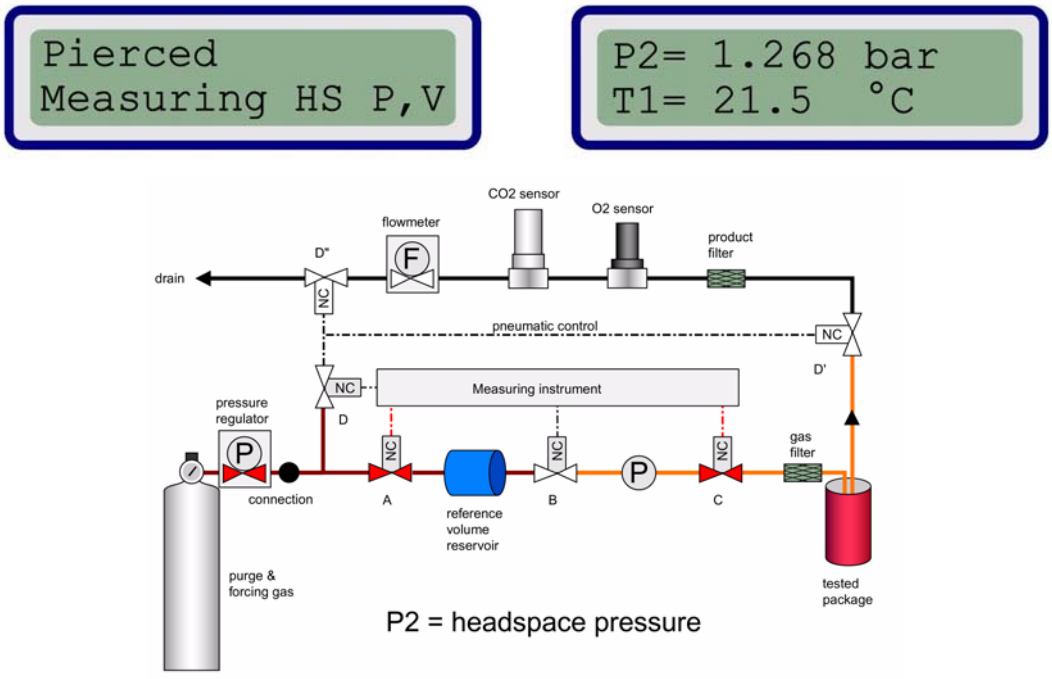
If the specification received indicates that there has been a change in package type, a "Package has changed" message displays briefly, then the measurement sequence continues with the new parameters.

Note:
*If communication with the PC fails, the instrument displays a **Check Reception** message and waits for the link to be re-established. This message may also appear during normal operation, when the instrument and the computer are synchronizing automatically.*

4.2 Headspace (HS) Measurement

Note:
Headspace volume measurement can be disabled in the package setup on OrbiPack software

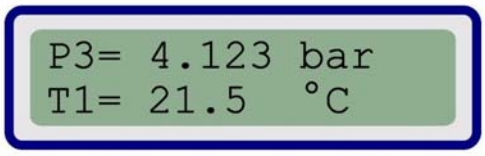
The instrument displays the **Pierced Measuring HS P,V** message indicating the start of headspace measurement. This is followed by a display of the current headspace pressure (P2) and manifold temperature T1.

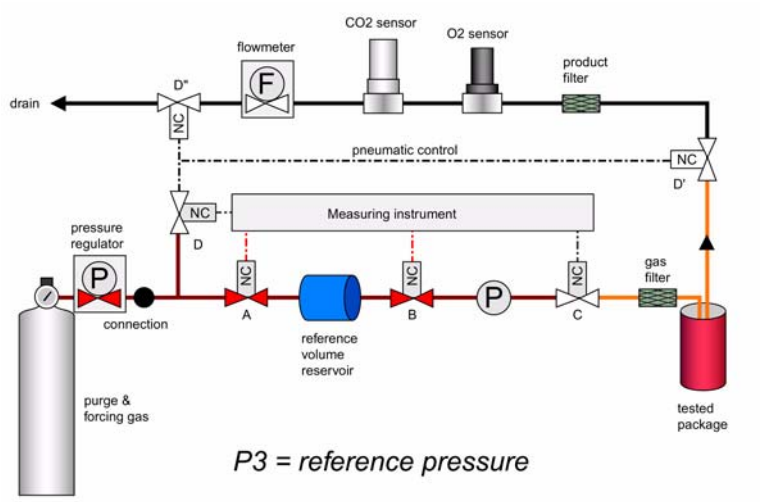


The forcing gas is then allowed into the reference volume reservoir, and pressure in the reference volume is measured for later reference. The instrument displays the forcing gas pressure (P3) and manifold temperature.

Note:

*If the pressure exceeds the "safe limit" for this package type, or is insufficient to lift the liquid to the sensors (at least 0.5 bar greater than package pressure is required), the instrument displays a **Too high** or **Too low** error message, and the measurement sequence stops. Once pressure is again within limits, (or if the **ESC** key is pressed), the sequence continues.*





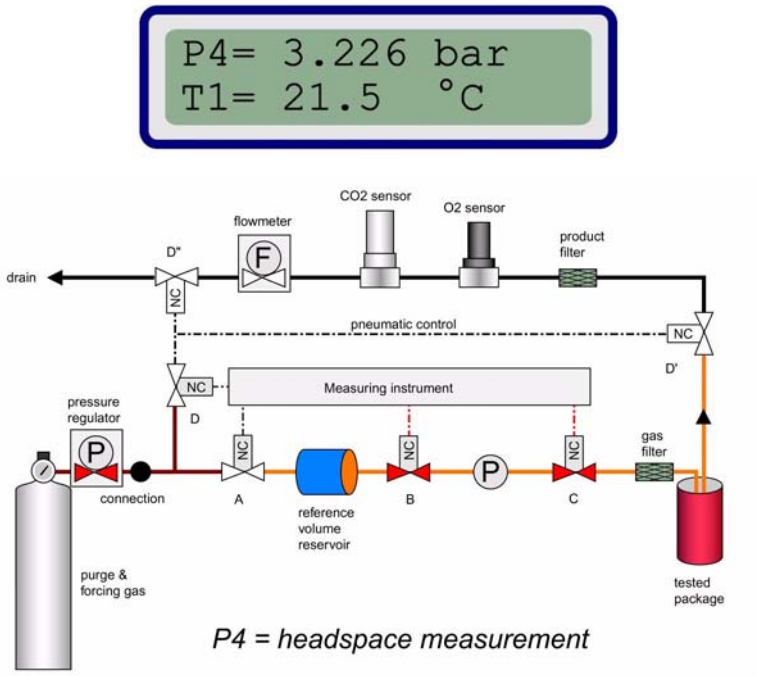
Headspace calculation

The Beverage Package Analyzer releases a given volume of forcing gas at known pressure into the package headspace, measures the pressure drop (15 seconds) and computes the headspace volume. Result is sent to the PC software and is displayed in the data table. It is not seen on the instrument display.

Note:

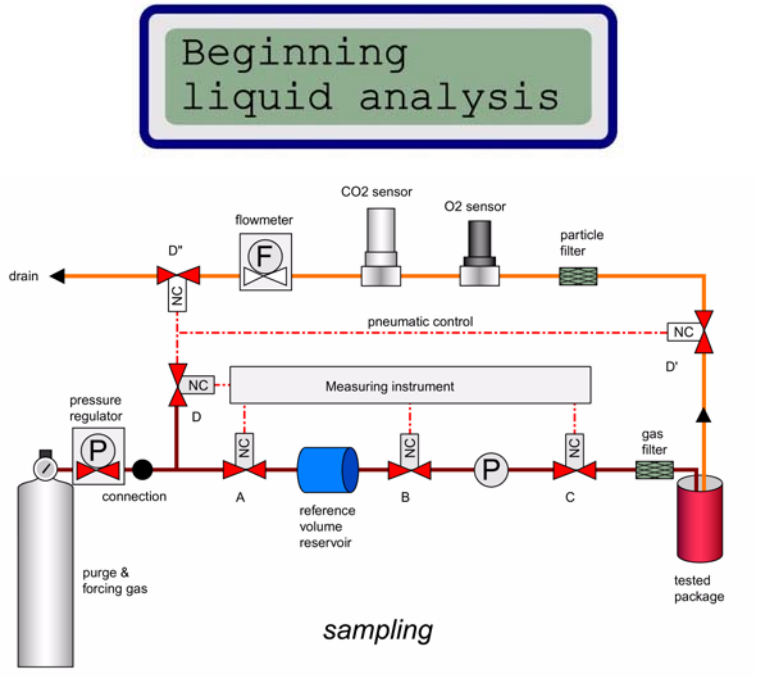
*The pressure drop speed also tells if the manifold hydrophobic filter is clogged. In that case, a **Warning/Change the Filter** message appears and the analysis stops. Pressing **ENTER** bypasses it, however the headspace volume measurement might be inaccurate if filter is blocked. Clean filter before next measurement.*

If the pressure change is within limits, the next screen shows pressure P4, which is used for calculations, and manifold temperature (actual volume is shown on the PC only).



4.3 Product Sampling and Analysis

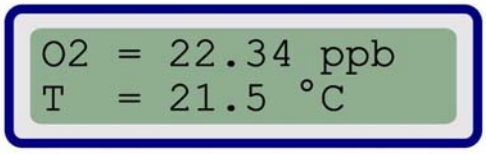
=> Lower the piercing lever and sampling tube.

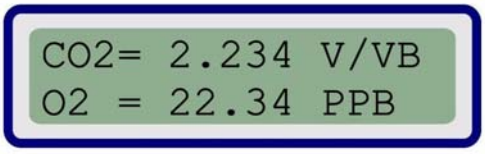


Lowering the sampling tube all the way triggers the sampling process. Forcing gas is sent through the sampling tube into the package. The forcing gas applies a down force to the product, pushing it through the sampling tube into the flow chambers. The **Beginning liquid analysis** message confirms that the process has started.

Dissolved gas analysis

The package content is pushed past the sensors. The next two displays indicate the results of gas concentration measurement.





Note:
On the CO_2 analyzer, the O_2 and CO_2 concentrations are obtained from the sensors, while the N_2 concentration is computed by the software.
On the N_2 analyzer, the O_2 and N_2 concentrations are obtained from the sensors, while the CO_2 concentration is computed by the software.

4.4 Results Calculation and Transfer

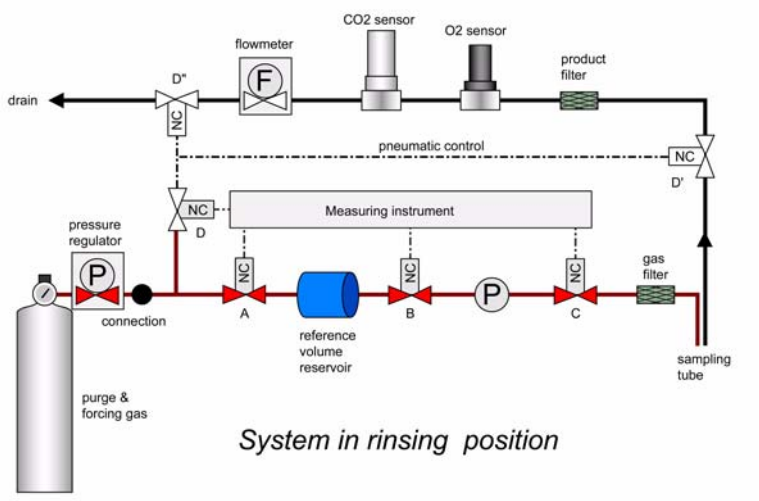
The measuring instrument computes the data measured, and transfers them to the PC. The OrbiPack software performs further computations, and displays the result as one line per package in the data table.

4.5 Remove Package, Line Rinsing

=> Raise the sampling tube all the way.

=> Lift the piercing lever and remove the package.

Once the piercing lever is up, the Beverage Package Analyzer blows briefly forcing gas through the manifold, to purge remaining liquid out of the system.



System in rinsing position

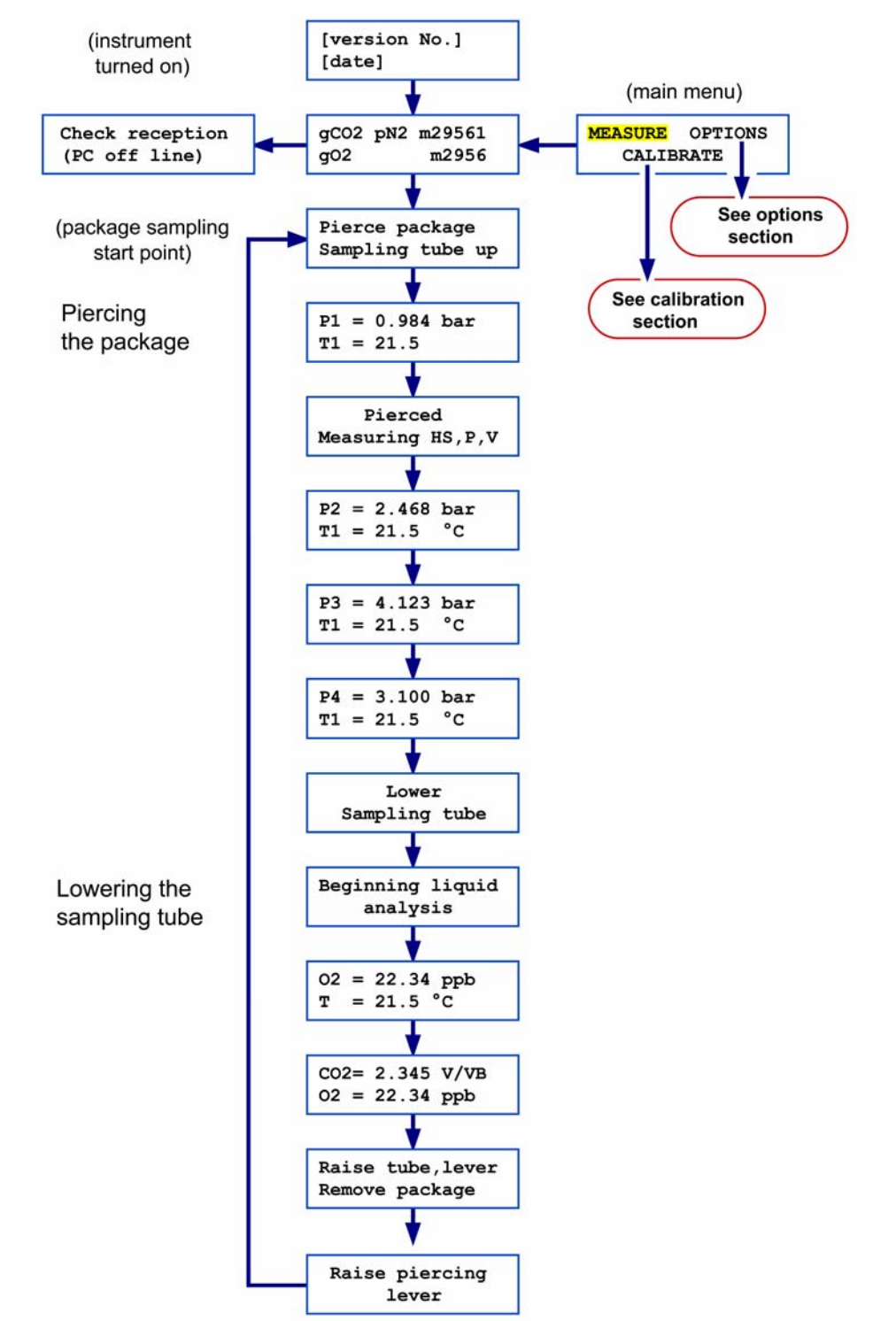
4.6 Instrument Warning Messages

The instrument regularly performs diagnostic checks, and should an abnormal condition happen, displays a warning message on the instrument display. Refer to “Troubleshooting” on page 77 for description of warning messages, troubleshooting, and possible solutions.

5 Operating Instructions

5.1 Measurement Menu

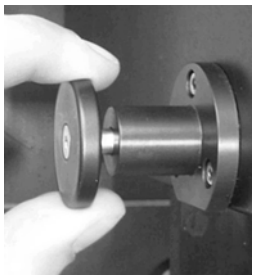
The flow chart below gives an overview of the **MEASURE** menu and sequence.



5.2 Package Piercer Adjustments

5.2.1 Two Step Device for Cans

Note:
When testing other packages than cans, block the two step knob out, using the spacer provided.



For analyzing cans' headspace, the two step device must be used to limit the travel of the piercing knife. During the first step, only a small orifice is created on can surface to sample the headspace, while avoiding chance of pressure leakage. Additionally, the sampling tube is maintained above foam and liquid.

Pulling the knob (second step) allows for full travel of the piercing knife, creating a bigger hole to allow the sampling tube to the bottom of the can for liquid sampling. Sampling tube down travel is limited by the adjustable stop (see below).

5.2.2 Change the Piercer Configuration

This procedure describe the conversion of the piercer from metal cans or glass bottle configuration to PET bottle configuration (revert the procedure to convert piercer back to metal cans and glass bottle configuration).

Piercing device

Remove both black plastic spacers (push them out laterally), located on top of the two guide rods.

Unscrew both piercing rod upper stops (below spacers), pull them all the way up, and lock in place.

Piercing head



When piercing plastic caps, the material is cut (with the cutting knife 32111A). For metal (caps and cans), the material is pierced (with the piercing knife 32106A). Remove the metal piercing knife (ref. 32106A) and install the PET cutting knife (ref. 32111A).

PET Bottle Neck Holding Clamp

Remove the can holding plate attaching screws and attach the PET bottle holding clamp. Use the adjustment knurl to set the fork height. Top of the bottle cap must be aligned with the groove mark on the clamp body.

5.2.3 Adjust Piercing System Height

Check and eventually adjust the piercing system height:

1) Raise the piercing lever to vertical position.
2) Support the piercer assembly with your hand, release the orange locking handle, and lift up the assembly.
3) Place a sample package in position.
4) Positioning plate: Lower the assembly until the positioning plate rests on the top of the can, or glass bottle.

PET holding clamp: Lower the assembly until the bottom of the PET bottle touches down the rubber mat, the neck being supported by the clamp.

5) Lock orange lever when height is correct for the package used.
6) Check that positioning plate clears the package when the piercing lever is tilted backward (away from the operator), allowing easy substitution of packages.

5.2.4 Adjust the Sampling Tube Lower Stop

After the height of the package positioning device has been set, adjust the position of sampling tube lower stop:

1) Pierce a sample package.
2) Loosen the locking screw from the adjustable stop.
3) Slowly lower the sampling tube to touch the bottom of the package, then raise it by about 1/2 cm.
4) Continue to raise the sampling tube, until the next available hole on the rod is visible. Tighten the adjustment stop screw in this hole.

Note:
Goal is to create a safety gap below sampling tube, to avoid piercing the bottom of the package during the sampling process.

5.3 Turning on the System

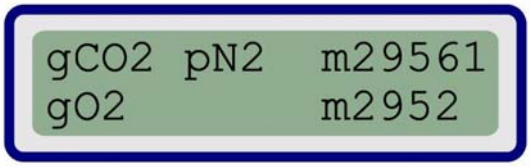
5.3.1 PC Software

The OrbiPack software is required for measurement. Most operation-related information is displayed and controlled from the PC. Therefore, the PC must be connected to the instrument, turned on, and the OrbiPack software running.

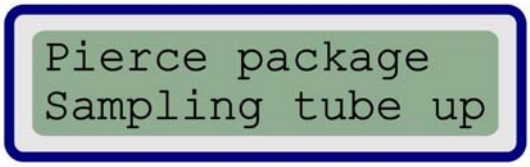
5.3.2 Start the Instrument

As the OrbiPack software controls the measurement process, the key switch on the instrument must remain in the vertical position to perform measurements. This avoids unwanted setting changes.

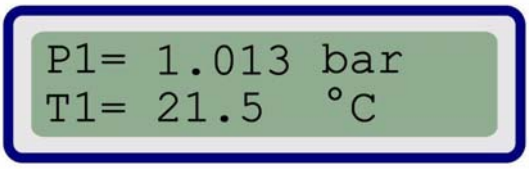
- **g** indicates the gas measured
- **p** indicates the purge gas required for the sensor
- **m** indicates the membrane model installed in that sensor

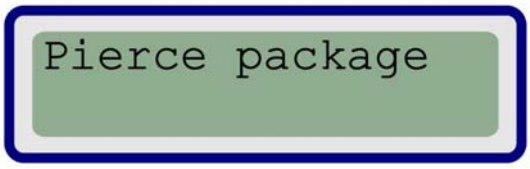


The configuration screen remains for a few seconds, and then the message prompts for the start of the measurement sequence.



This message remains on for a few seconds, and then the display shows the atmospheric pressure (P1) and temperature (T1) in the analyzer manifold. The pressure and temperature screen alternates with the preceding message until you either pierce a package (or press **ESC** to return to the main menu).





5.4 Measurement Process

5.4.1 Package Pressure Equalization

In order to perform an accurate analysis, partial pressures in the package must be balanced between the gas phase (head space) and the liquid phase (beverage). The packages to be tested must be gently agitated in the longitudinal direction for at least three minutes, using a reciprocating shaker (Orbisphere model 32816).

We recommend the use of the Orbisphere's reciprocating shaker, as it provides an agitating frequency adjustable from 0 to 300 cycles, with a span of about 5 cm (2 inches), and offers a timer function.

Note:
It is recommended to perform the package analysis with packages at room temperature. Contact your Hach Ultra agent for measuring cold packages.

When a series of cold packages follows a series of warm packages (or the opposite), the sensors will measure an evolution in temperature, until thermal equalization is reached. In such situation, pierce two packages and perform the measurement routine without saving the results. The product flow created will stabilize the temperature in the system.

5.4.2 Prepare for Piercing

First, make sure the piercing knife used is correct for the application (metal or plastic).

Check that sampling tube is fully retracted inside the piercing knife, then that the rubber seal is in good condition, and extends slightly below piercing knife tip.

To clamp a package into position, tilt the piercing lever backward, install a package on mat, and bring lever to vertical position. Package must be vertical on the base mat, and centered in upper positioning plate. During the analysis, the package must remain firmly clamped; if not check positioning device height adjustment.

Following instructions given by the system, pierce the can’s top, or the bottle cap, where the surface is smooth and flat, to get a good seal. On cans, the best area is usually opposite the tab.

Note:
During analysis, any pressure leak past rubber seal will alter results. If a leak is noticed and rubber seal is in good condition, try another position on the package top surface, where sealing can be complete.

5.4.3 Pierce the Package



When prompted, pull the piercing lever down all the way in a uninterrupted move.

During analysis, any pressure leak past the rubber seal will alter results. Do not release the piercing lever until it is all the way down.

Headspace analysis is automatically triggered. When done, the display will prompt to lower the sampling tube.

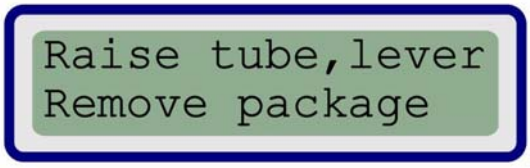


Holding the piercing lever (the pressure in the package may move it up):

- Lower the sampling tube until all the way. The product sampling and analysis is then automatically triggered.
- **Adjust the flow meter to 150 ml/min**.
- Visually check that the liquid in the tubing and flow chambers is not foaming. Increase the forcing gas pressure if necessary.

5.4.4 Remove Package

When analysis sequences are over, the display will ask to remove package.



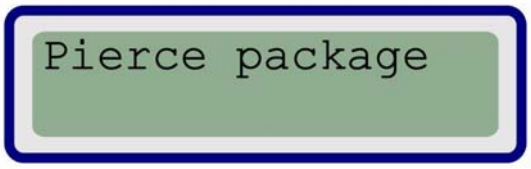
- Raise the sampling tube to its upper position, holding it **only by the handle bar**.
- Lift the piercing lever all the way (past the 2 step device, if applicable).
- Remove the empty package

CAUTION:
***Do not pull** on cables and connections. This could damage the equipment.*

A position switch sends a signal saying that the tube is up. The instrument will not continue until such signal is received.

Note:
Once the piercing lever is up, forcing gas is briefly sent through the manifold to purge liquid out. A high pressure warning may be displayed on the OrbiPack process bar during this process. This indication is cleared after the purging cycle is over.

The instrument should display the **Pierce package** message, saying that the equipment is now ready for a new package sampling.



5.5 Daily Cleaning (user maintenance)

Every 8 hours of use, or when a measurement session is over, whichever comes first, the sampling circuit must be flushed to remove any product deposit in sampling lines and chambers. Perform a measurement routine, using a package filled with clean water and some non aggressive liquid detergent (do not use caustic soda). Use either:

- 0.5% bleach (sodium hypo chlorite) at room temperature, or...
- 5% Contrad (dilute caustic detergent) at 40° C.

The measuring instrument waits for the evidence of piercing to go on, so press **ENTER** to bypass this step. Repeat this operation with two packages filled with water low in dissolved oxygen.

Let the System purge (see “Sampling System Purge” on page 57) run for 5 minutes to purge liquid out and dry the system.

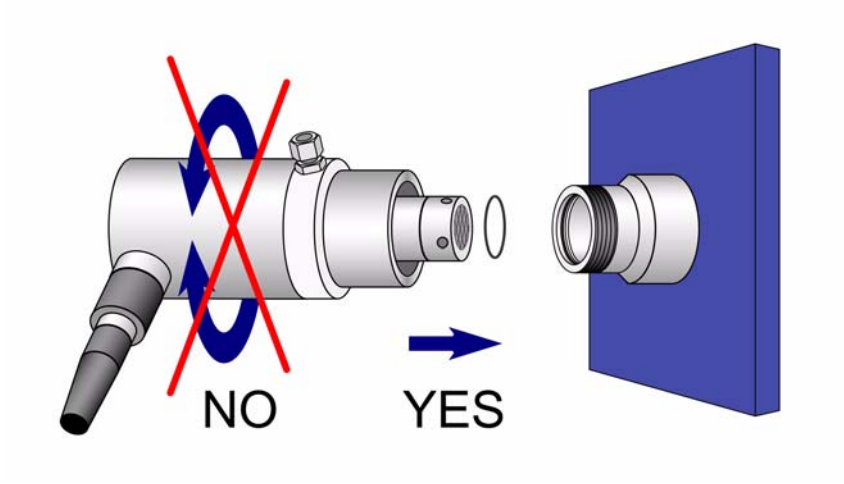
5.6 When Instrument is not Used

CAUTION:
Always remove the thermal conductivity sensor from flow chamber when the measuring instrument is either disconnected or purge gas supply is turned off (and a backup purge unit is not used). Moisture can buildup inside the sensor cell and damage it if purge gas does not circulate (see section regarding the back-up unit entitled “Optional Purge Backup Unit” on page 53*).*

During a short shutdown period (such as weekends), the sensor may stay in place with the instrument turned on and purge gas supplied. If the inactive period is likely to last longer, remove sensor, wipe it dry and store properly, using the storage cap.

Note:
Do not twist the sensor when inserting it into the micro volume flow chamber. This rotation may twist the membrane holding ring, thus changing the membrane position. This can modify the membrane measuring conditions, and affect measurement precision.

Note:
Check that the small O-ring at the bottom of the flow chamber is present during removal and installation of the sensor, as it may stick to the sensor head and fall.



Optional Purge Backup Unit

Using the optional purge backup unit allows for switching off the instrument, still having the purge gas system running.

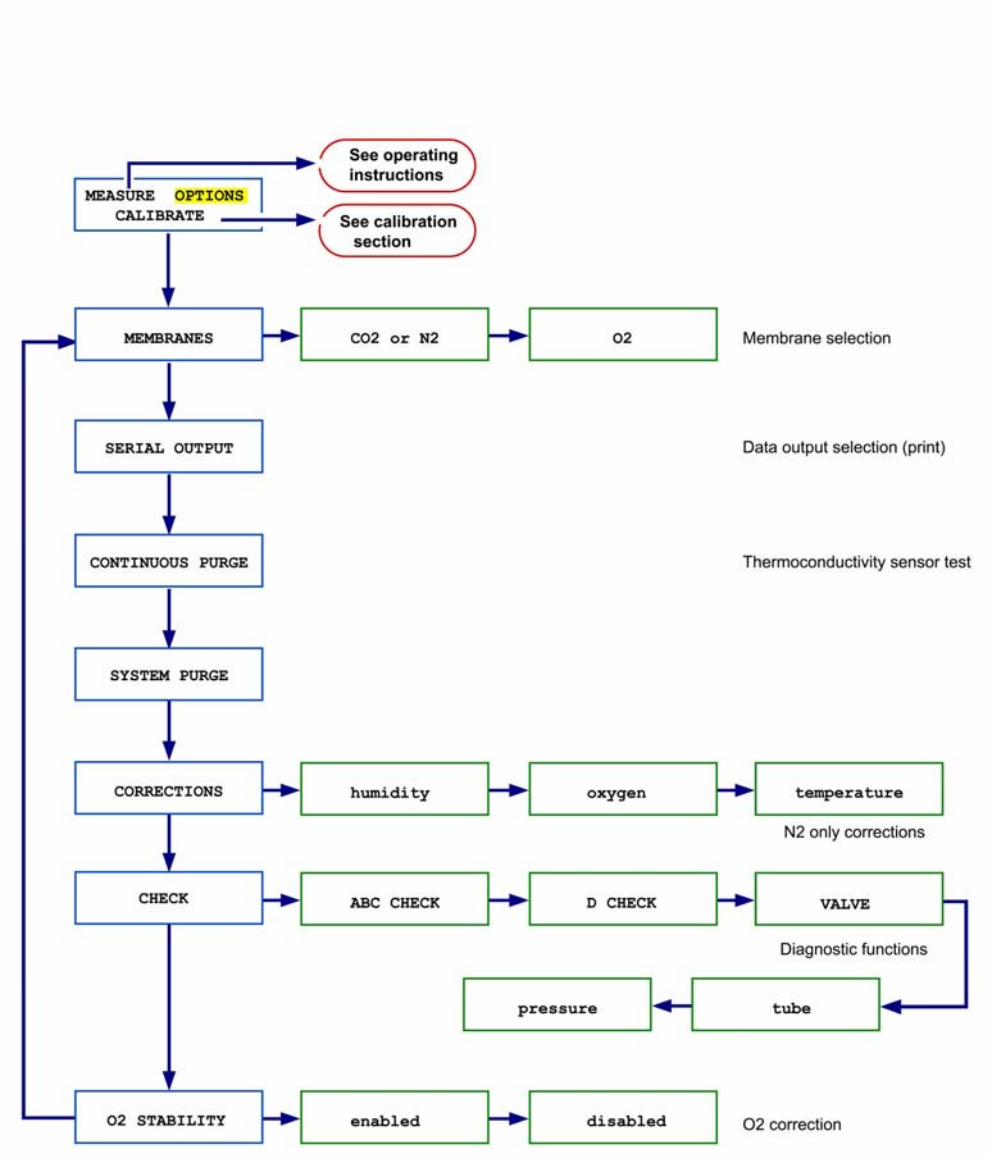
Since the instrument has a non-volatile memory, parameters will remain in memory when the instrument power is turned off.



6 Options

The flow chart below gives an overview of the **OPTIONS** menu and sequence.

Note:
Always note on the test report the set values, as entered in the instrument, for traceability.



6.1 Membrane Selection

Note:
The selection of a membrane is a compromise between sensor services frequency (calibration, maintenance) and sensor sensitivity. It is also dependent of plant conditions (frequency of analysis, O_2 level being measured).
Default membrane for the O_2 sensor is 2956A. It allows to measure within the ppb range. If sensor measure drifts, or sensor service frequency is too high (less than once a month), the membrane 2952A is recommended.

Enter or update the membrane reference number which is used on the sensors.

After each sensor service, update the membrane selection, in order to receive the message **NOW XX.X% OF EXPECTED CURRENT** during calibration. This makes sensor performance monitoring much easier over the time.

6.2 Serial (RS-232) Output

The serial RS-232 interface provides communication with an external computer or printer. Select **SERIAL OUTPUT**, then select the Serial Output mode as needed

Print

Provides formatted list of results as text to a PC or printer.

PC Com

Communication link between OrbiPack software and measuring instrument. Instrument sends the result data, and the PC sends the package setup data.

Diagnostic

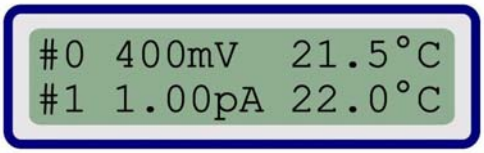
Provides formatted data list. There are two diagnostic data formats, depending on whether the instrument is in Measure or Calibrate mode.

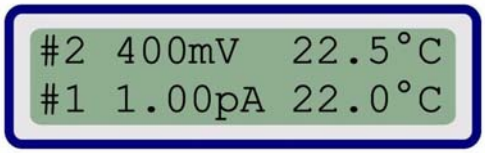
Upload

Test function that generates a text file of the measuring instrument memory. From the OrbiPack software, select Tools and open the Diagnostic window. Select **Upload** to create the text file in the PC Diagnostic window. Save the file created.

6.3 Thermal Conductivity Sensor Continuous Purge

This is a test function. When enabled, the system continuously purge the thermal conductivity sensor, and the measuring instrument gives the sensor reading for a 100% purge gas.





- Line #0 shows TC sensor voltage, plus external sensor temperature
- Line #1 shows EC sensor current, plus analyzer manifold temperature
- Line #2 shows TC sensor voltage again, plus PT 1000 temperature

TC sensor voltage values (V3):

- CO_2 sensorV3 = 0 V-500 < V3 < 100 [mV] for the CO_2 sensor
- N_2 sensorV3 = 2.5 V2200 < V3 < 2800 [mV] for the N_2 sensor

If not within tolerance, contact your Hach Ultra representative.

6.4 Sampling System Purge

This command opens the purge gas to the beverage sampling system. This is used to flush and dry the system during daily maintenance. This used also to rapidly bring the O_2 sensor to the working range.

6.5 Nitrogen TC Sensor Corrections

6.5.1 Humidity Factor Correction

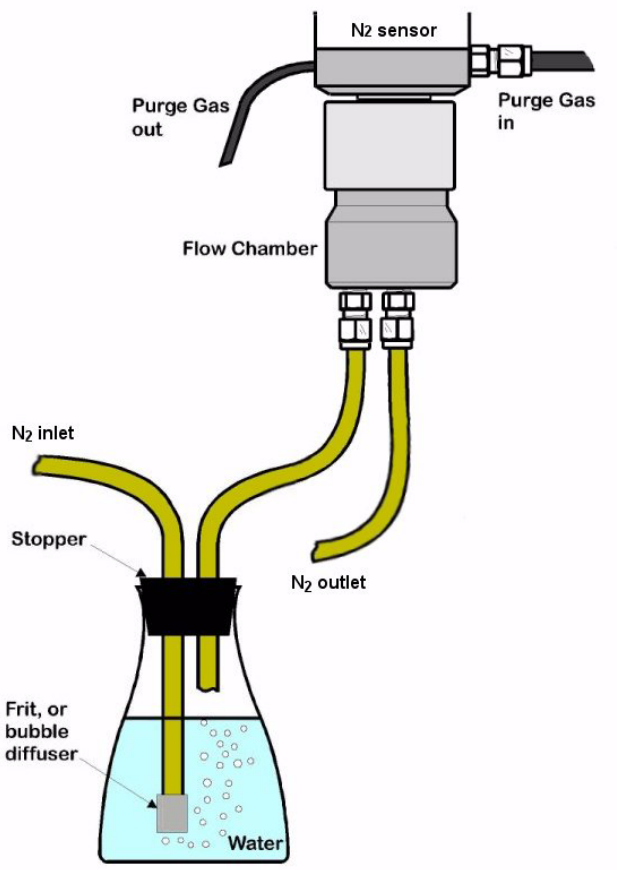
Depending on N_2 concentration, H_2O may affect the N_2 sensor readings. The following section concerns setting the humidity correction factor of the N_2 sensor.

Note:
Calibrate both O_2 and N_2 sensors before performing this correction.

Using the external calibration flow chamber accessory, the sensor is exposed to a known composition of N_2, as per diagram.

Preparation

- On PC, start the OrbiPack software.
- From the "Tools" menu select "Diagnostic view".
- Disconnect the external temperature sensor cable.
- Remove the sensor from piercer.
- Make sure that the grille in the front of the sensor is clean and dry.
- Insert the sensor into the calibration flow chamber.
- Connect a source of pure N_2 to the flow chamber inlet, as per illustration.
- Adjust gas flow to visualize approximately 3 bubbles per second.



Procedure

- **ESC** displays main menu
- ⇧ ⇩ select **OPTIONS**; **ENTER**
- ⇧ ⇩ select **SERIAL OUTPUT**; **ENTER**
- ⇧ ⇩ select **DIAGNOSTIC**; **ENTER**
- ⇧ ⇩ select **CORRECTIONS**; **ENTER**
- ⇧ ⇩ select **HUMIDITY**; **ENTER**
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- Wait for stabilization of slope value.
- Check value slope on the **Diagnostic View** window of the PC.
- When slope is stable (-1 [mV/sec] ±1), press **ENTER** to save the new humidity correction factor.



6.5.2 Oxygen Factor Correction

Depending on concentration, O_2 in the measured gas may affect the N_2 sensor readings. The following section concerns setting the oxygen correction factor of the N_2 sensor.

Note:

Calibrate both O_2 and N_2 sensors before performing this.

Procedure

- Expose the N_2 sensor to the atmosphere, beside the O_2 sensor.
- On PC, start the OrbiPack software.
- Display **Diagnostic view** by selecting it in the **Tools** menu.

On measuring instrument:

- ⇧ ⇩ select **OPTIONS**; **ENTER**
- ⇧ ⇩ select **CORRECTIONS**; **ENTER**
- ⇧ ⇩ select **OXYGEN**; **ENTER**
- ⇧ ⇩ select **CALIBRATE**; **ENTER**



- Check slope value on the OrbiPack **Diagnostic view** window.
- Wait for stabilization of value (-15 [mV/sec] ± 10).
- When value is stable, press **ENTER** to save the new oxygen correction factor.



6.5.3 Temperature Correction

A significant change in the sample temperature influences the N_2 sensor reading. The temperature correction reduces this influence.

Choose **CORRECTIONS** from the Modify Options menu, then choose **TEMPERATURE** from the Corrections menu. Choose **ENABLED** to apply a stored correction, or **DISABLED**.

6.6 Check Routine

These are test functions for the piercer system.

A, B, C valves check routine

Automatic test routine for manifold electro-valves. See “Troubleshooting” on page 77 for details about results.

D valve check routine

Automatic test routine for pneumatic valves D’ and D”. Install the 32820 test thimble (provided with your analyzer) inside the small opening of the 32108 package holding plate. Lower the piercing lever to bring the knife seal in contact with the thimble top. Start the D check routine. See “Troubleshooting” on page 77 for details about results.

Valve

This a manual valve test function allows for individually opening and closing each electro valve. Select **CHECK** from the **OPTIONS** menu, then select **VALVE**.

- Select one valve (A,B,C or D).
- Select open or close status.
- As needed, select the same way other valves and their open or close status.
- Select continue to activate the valves accordingly.
- The instrument will open or close the valve accordingly.
- Forcing gas pressure is displayed for 2 seconds, as measured in the manifold.

Note:
The role of valve D is to pneumatically control the valves D' and D". Install the 32820 test thimble (provided with your analyzer) inside the small opening of the 32108 package holding plate. Lower the piercing lever to bring the knife seal in contact with the thimble top.

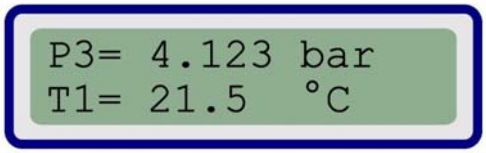
Tube

Test function for the positioning switch on the sampling tube. Move the sampling tube all the way up and then lower it. Switch position is shown as:

- **OPEN** indicates that the tube is all the way up.
- **CLOSED** indicates that the tube has been lowered.

Pressure

Forcing gas pressure check. Select **PRESSURE**. The instrument opens valves A and B, and closes valve C, and displays the forcing gas pressure P3 for 2 seconds.



6.7 Oxygen Stability

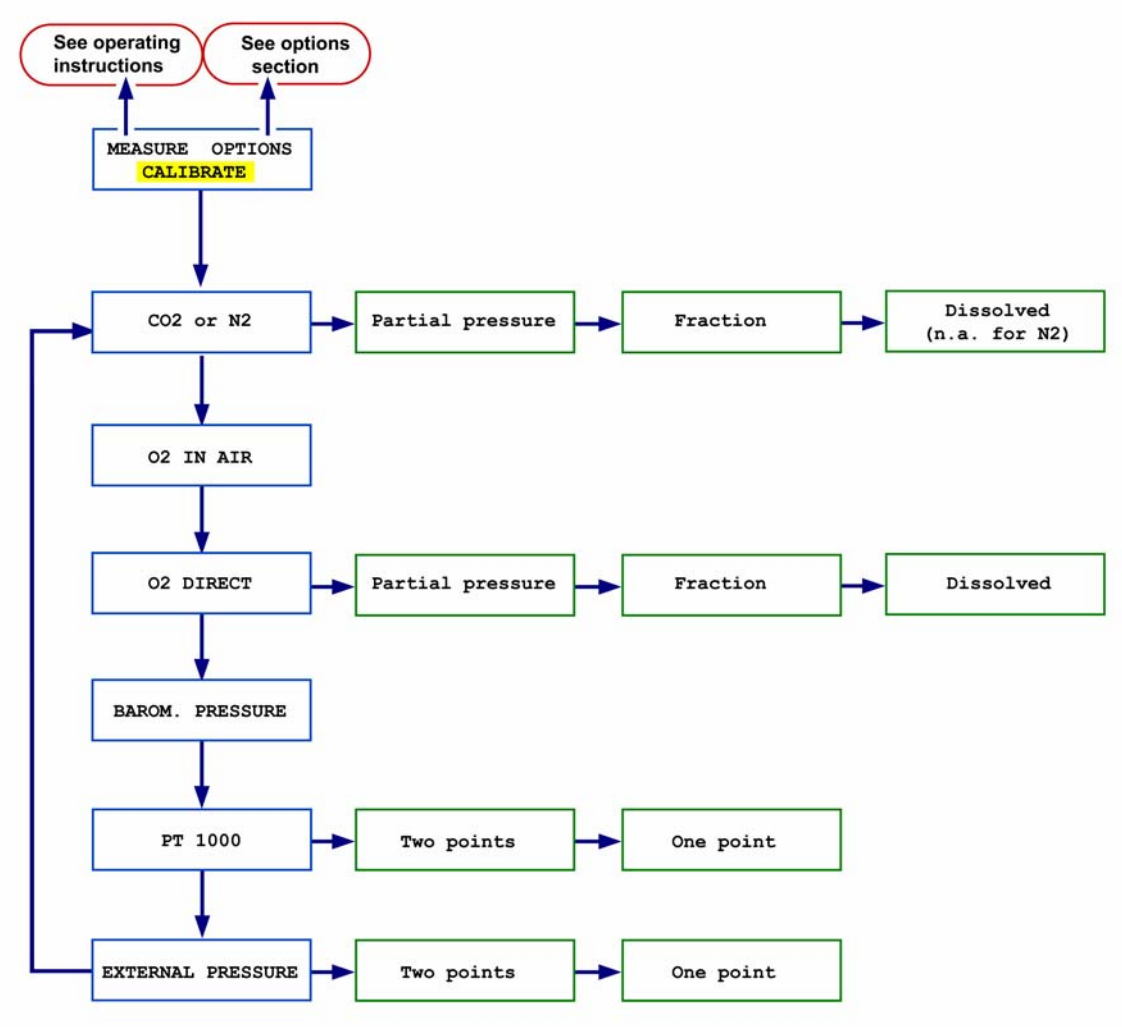
Used to monitor the O2 sensor. Check the deviation on last [x] measurements. If deviation exceeds [y] ppb or [z] %, an alarm message is displayed.

- Select enabled (or disabled).
- Enter [x] value of measurement considered for the deviation.
- Enter O_2 [y] value threshold in ppb.
- Enter O_2 [z] % threshold.

When the O_2 stability criteria is not met, the data on the PC screen will be displayed with a red background.

7 Calibrations

The flow chart below gives an overview of the **CALIBRATE** menu and sequence.



7.1 Planning Sensor Calibrations

This table shows recommended sensor calibration intervals for an average of 500 package analyses per week. This proposed schedule should be modified according to operating conditions.

Sensor calibration	Interval	Notes
PT 1000 temperature sensor	1 year	Calibrate gas sensor after each membrane change. Wait 30 minutes minimum before performing a calibration. **Note:** *After each sensor service, update the membrane selection from the Option menu (see "Membrane Selection" on page 56), in order to receive the message* **NOW XX.X% OF EXPECTED CURRENT** *during calibration. This makes sensor performance monitoring much easier over the time.*
Barometric (internal) pressure sensor (located inside instrument)	6 months	
Package (external) pressure sensor (located inside manifold)	3 months	
Electrochemical O_2 sensor with membrane 2952A	4-6 weeks	
Electrochemical O_2 sensor with membrane 2956A (special)	2-4 weeks	
Thermal conductivity sensor	3 months	

7.1.1 Validation of the Gas Sensors Calibration

After calibration has been performed, the variation in sensitivity of the sensor is displayed as a percentage of the last calibration. The percentage must be between 50% and 150% of the last calibration in order to proceed and validate the new calibration.



When calibration is performed for the first time after selecting a new membrane, the calibration measured value refers to the expected current for this membrane, instead of referring to the last calibration value as above.



Calibration out of bounds

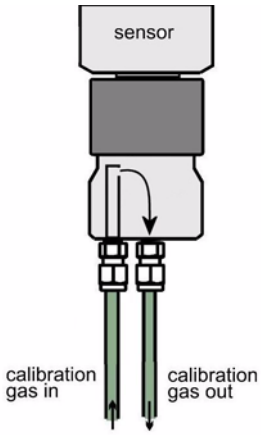
If outside range, the instrument displays message **CALIBRATION OUT OF BOUNDS**. Press **ESC** to return to the calibration menu. Check for leaks. Sensor may require servicing (see sensor's maintenance manual).



7.1.2 Tools Needed



- Sensor storage cap (sensor's head plastic cover)
- Certified barometer with a precision of ± 3 mbar
- Certified pressure gauge
  - range: 0 - 5 bar
  - precision: ± 5 mbar
- Orbisphere 32001.xxx calibration flow chamber



The Orbisphere 32001.xxx flow chamber is needed for the calibration of the thermal conductivity sensor.

Connect the flow chamber inlet and outlet as per diagram, using 6-mm or ¼-inch tubing and the Swagelock fittings provided.

The sensor must be in vertical position, with the flow chamber pointing downward.

7.2 PT-1000 Temperature Sensor Calibration

Requires the use of the 0°C simulator (model 32116), supplied with your Beverage Package Analyzer, which plugs in the PT1000 socket located on instrument's back panel.

Preparation

Prepare a package of water at room temperature, and measure the temperature of water with a certified thermometer. Note this temperature.

Procedure

- Unplug the PT-1000 cable from instrument back panel.
- Select and start the **PT-1000** calibration routine.
- Select the **two point** calibration.
- Plug the simulator in the PT-1000 socket.
- When prompted for low point temperature, enter 0°C.
- Select **Resistor** calibration.
- When low point voltage is displayed, press **ENTER**.
- Remove the simulator, and connect the PT 1000 cable.
- When prompted for high point temperature, enter previously measured water temperature.
- Select **Liquid** calibration.
- Lower sampling tube in water package, and press **ENTER**.
- Wait until voltage is stable, and press **ENTER** to validate.
- The PT1000 temperature sensor is calibrated.



7.3 Barometric (internal) Pressure Sensor Calibration

- **ESC** displays the main menu
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **BAROM. PRESSURE**; **ENTER**

The instrument displays current barometric pressure reading.

Measure barometric pressure using a certified barometer in the location where the measuring instrument is used. The reference barometric pressure must be within ± 5 mbar. If pressure value meets barometric pressure, press **ESC**; otherwise:



- ⇧ ⇩ enter the barometric pressure in mbar (here 1013 mbar); **ENTER**

7.4 Package (external) Pressure Sensor Calibration

Two calibration methods can be selected:

- Two point calibration (recommended)
- One point calibration

Connect a certified pressure gauge to the forcing gas inlet line. Adjust the forcing gas pressure at 4 bar (gauge pressure).

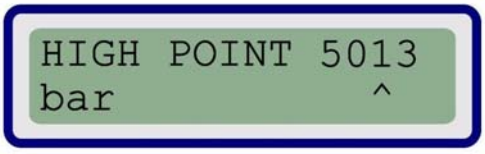
- **ESC** displays main menu
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **EXTERN. PRESSURE**; **ENTER**
- ⇧ ⇩ select unit of pressure as needed; **ENTER**

7.4.1 Two Point Calibration (recommended)

Close the forcing gas supply, as atmospheric pressure is used for the lower point. The two point calibration starts with barometric pressure. If pressure value meets barometric pressure, press **ESC**; otherwise press **ENTER** to bring up the calibration display.



- ⇧ ⇩ enter the barometric pressure in bar (here 1.013 bar); **ENTER**
- ⇧ ⇩ move decimal point; **ENTER**



- Open forcing gas supply
- ⇧ ⇩ enter the pressure value in bar, as read on the certified pressure gauge, plus barometric pressure (4 bar + 1.013 bar, in this example); **ENTER**
- ⇧ ⇩ move decimal point **ENTER**

7.4.2 One Point Calibration

The one point calibration starts with the following screen.



- Open forcing gas supply
- ⇧ ⇩ enter the pressure value in bar, as read on the calibrated pressure gauge, plus barometric pressure (4 bar + 1.013 bar, in this example); **ENTER**
- ⇧ ⇩ move decimal point; **ENTER**

7.5 Electrochemical Oxygen Sensor Calibration

The O_2 electrochemical sensor must be calibrated after servicing. After installing a new membrane, wait 30 minutes minimum before performing a calibration. Two methods of calibrations are available:

- **In air calibration**: Expose sensor to 100% humid air (recommended)
- **Direct calibration**: Expose sensor to a known source of O_2 (requires an optional flow chamber)

Table 7-1: Electrochemical Sensor Calibration Methods

Calibration method	Indicative time	Benefits	Drawbacks
In air calibration	10 min.	Quick and easy	Could be slightly less accurate
Direct calibration	10 min.		Requires a certified gas mixture cylinder

7.5.1 In Air Calibration Method

Calibration is best achieved using the storage cap that protected the sensor during shipment.

Preparation

- Extract the sensor from its mounting or flow chamber, and wipe dry the sensor protection grille (if applicable).
- Put several drops of tap water in the storage cap, shake out the excess, and then attach it to the sensor by means of its collar.
- Leave the cap slightly loose, to avoid compressing the air inside.
- The cap and sensor should be about the same temperature.

Procedure

- On the instrument, pressing **ESC** displays the main menu.
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **O2 IN AIR**; **ENTER**
- Wait 5 minutes until the values read on the instrument display are stable.
- **ENTER** to save value and terminate calibration.



The instrument will accept the calibration with **CALIBRATION COMPLETE**, then returns to the calibration menu. A message is sent to the PC software.

7.6 Thermal Conductivity CO_2 and N_2 Sensor Calibration

The thermal conductivity sensor must be calibrated after servicing. After installing a new membrane, wait 30 minutes minimum before performing a calibration. See sensor maintenance manual for calibration gas specification.

Four calibration methods are available:

- **Fraction**: Using a known composition (preferably pure) of CO_2 (or N_2) at atmospheric pressure.
- **Partial pressure**: Using a known composition of CO_2 (or N_2) at ~5 bar (recommended).
- **Calibration kit**: Requires optional HUA calibration kit. Using a known concentration of dissolved CO_2.
- **Reference package**: Using a package with a known gas concentration content as a reference.

Table 7-2: Thermal Conductivity Sensor Calibration Methods

Calibration method	Indicative time*	Benefits	Drawbacks
Fraction (barometric pressure)	10 min	Quick and easy	Less reliable than partial pressure
Partial pressure (at 2-3 bar)	10 min	Quick and easy	Slight risk of accuracy loss when installing the sensor back into flow chamber
Dissolved (using optional equilibrium vessel)	2 hours	Most accurate method when properly handled	Long operation, Risk of manipulation mistakes
Dissolved	5 min	Accurate and quick	Requires optional Orbisphere Calibration kit

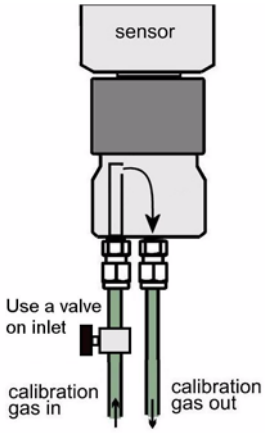
7.6.1 Fraction Calibration Method

Using the external calibration flow chamber accessory, the sensor is exposed to a known composition of CO_2 (or N_2) at atmospheric pressure.

Note:
Make sure the flow chamber is absolutely dry inside and out before use.

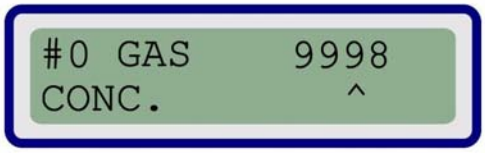
Preparation

- Disconnect the external temperature sensor cable from the connection box.
- Remove the sensor from the piercer.
- If sensor's head is wet, rinse the sensor head with water, and wipe dry.
- Make sure that the grille in the front of the sensor is clean and dry.
- Insert the sensor into the calibration flow chamber.
- Connect a source of pure calibration gas to the flow chamber inlet.
- Purge air and water out of the flow chamber system.
- Leave outlet tube in water and adjust the gas flow rate at 3 bubbles per second.



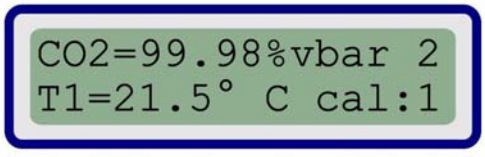
Procedure

- **ESC** displays main menu
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **CO2**; **ENTER**
- ⇧ ⇩ select **FRACTION**; **ENTER**
- The instrument displays the slope in mV/s, and then the display below.



- Enter the percentage of CO_2 (or N_2) in calibration gas (99.98% in this example)
- ⇧ ⇩ move decimal point; **ENTER**
- **ENTER** to terminate calibration

The instrument will performs 3 calibration cycles, displaying the partial pressure and temperature measurement along with the cycle number in the bottom right of the display.



After the third calibration cycle, the variation in sensitivity of the sensor is displayed as a percentage of the last calibration.

Note:
*If the 3 calibration cycles show a variation over 1%, the 3 cycles are restarted. The instrument displays **RECAL ERR XX%** until the 3 cycles are within range.*



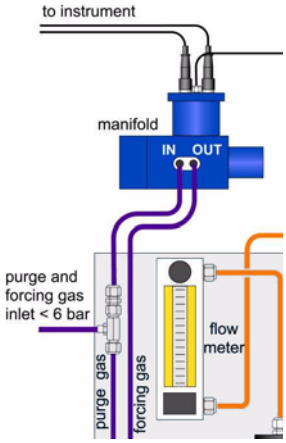
7.6.2 Partial Pressure Calibration

Using the Orbisphere 32001.xxx calibration flow chamber, the sensor is exposed to a known composition of CO_2 (or N_2) between 3 and 5 bar absolute pressure (ideally close to the partial pressure being measured), measured with an external certified pressure gauge having a precision of ± 5 mbar.

Note:
Make sure the flow chamber is absolutely dry inside and out before use.

Preparation

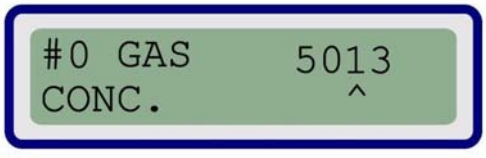
- Disconnect the external temperature sensor cable.
- Remove the sensor from piercer.
- If sensor's head is wet, rinse the sensor tip with water, and dry with a tissue.
- Make sure that the grille in the front of the sensor is clean and dry.
- Insert the sensor into the calibration flow chamber.
- Connect a source of calibration gas to the flow chamber inlet.
- Close flow chamber outlet valve to build up the requested pressure in the system.



Procedure

- **ESC** displays main menu
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **CO2**; **ENTER**
- ⇧ ⇩ select **PARTIAL PRESSURE**; **ENTER**
- ⇧ ⇩ select the appropriate pressure unit; **ENTER**

Next, enter the pressure of the calibration gas. Enter the *absolute* pressure (gauge pressure *plus* atmospheric pressure).



- ⇧ ⇩ enter the absolute pressure of CO_2 (or N_2) in the calibration gas, plus barometric pressure (4 bar + 1.013 bar, in this example); **ENTER**
- ⇧ ⇩ move decimal point; **ENTER**

The instrument will follow the same procedure as detailed in previous section (fraction calibration).

7.6.3 Dissolved Calibration with CO_2 Calibration Kit

Dissolved calibrations exposes the CO_2 sensor to a known source of dissolved CO_2 using the Orbisphere calibration kit part numbers 32313 or 32314.

The system checks for 3 calibration cycles (20 sec. each) within a CO_2 sensor output range of 1%. The reference value is entered at the end of the procedure as the operator needs to know the liquid temperature of the reference sample being used, which will be shown by the analyzer.

Table 7-3: Calibration Kit Part Numbers

Part No.	Description	Contents
32313	Starter kit, high level	1 reusable calibration bottle, 1 cap adapter, 32314 refill kit, instructions and calibration table
32314	Refill kit high level	10 x tubes of $CaCO_3$ powder, 10 x flasks of diluted citric acid, 10 x metal caps

Preparation

Please follow the instructions supplied with the calibration kit to prepare a CO_2 reference sample.

Increase the forcing gas pressure of the piercer according to the CO_2 calibration kit table (included with the kit). Set the forcing gas pressure to 1 bar above the value shown in the column **Pressure** and which corresponds to the ambient temperature.

Procedure

- **ESC** displays main menu
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **CO2**; **ENTER**
- ⇧ ⇩ select **DISSOLVED**; **ENTER**
- ⇧ ⇩ select **CAL KIT**; **ENTER**
- ⇧ ⇩ select the appropriate concentration unit; **ENTER**
- Pierce the package; **ENTER**
- Lower the sampling tube
- The analysis starts automatically and the display shows temperature, measurement cycle number and the gas concentration (**GC**)
- At the end of the analysis the display shows the message **Raise tube**; **ENTER**
- When prompted for **Cal kit CO2 value**, enter the concentration shown in the calibration kit table (water column) corresponding to the temperature shown by the instrument; **ENTER**

Note:

*During the whole procedure the **ESC** key can be pressed to abort the calibration procedure. The maximum number of cycles is 7.*

At high ambient temperatures (above 25ºC) the calibration kit bottle is at a high CO_2 pressure. Remove the piercer lever carefully to avoid splashing.

7.6.4 Dissolved Calibration with Reference Sample

In this method a beverage sample containing a known CO_2 concentration is used.

The system checks for 3 measurement cycles (20 sec. each) within a range of 1%. The reference value is introduced at the end of the procedure as the operator needs to know the liquid temperature of the reference being used, which will be shown by the analyzer.

Preparation

Select a beer from a batch having a known CO_2 concentration.

Procedure

- **ESC** displays main menu
- ⇧ ⇩ select **CALIBRATE**; **ENTER**
- ⇧ ⇩ select **CO2**; **ENTER**
- ⇧ ⇩ select **DISSOLVED**; **ENTER**
- ⇧ ⇩ select **SAMPLE**; **ENTER**
- ⇧ ⇩ select the appropriate concentration unit; **ENTER**
- Enter the fraction $\%CO_2$ in dry gas (should be close to 99.50%)
- Pierce the package; **ENTER**
- Once the measurements are stable, press **ENTER**

Note:

*During the whole procedure the **ESC** key can be pressed to abort the calibration procedure. The maximum number of cycles is 7.*

8 Maintenance

Wear on the membrane and chemical reactions within the gas sensors requires that the sensors be serviced regularly to restore original sensitivity. A clear sign that a sensor maintenance is required is when measurements are noticeably less stable than usual, and when a calibration does not improve the situation.

The table below shows recommended sensor maintenance interval for an average of 500 package analysis per week. This proposed schedule has to be modified according to operating conditions.

Table 8-1: Recommended Maintenance Schedule

Operation	Daily	Weekly	Monthly	Yearly
Clean with mild detergent and rinse sampling circuit	1 x shift			
Check purge gas cylinder (it must never be empty)	1 x			
Clean and lubricate sampling tube	1 x			
Check piercing tool seal tightness		1x		
Check sampling tube seal tightness			1 x	
Replace sampling tube seal				1 x
Replace gas filter cartridge (in manifold assembly)			1 x	
Clean the particle filter (in flow chamber inlet)		1 x		
Replace the particle filter mesh (in particle filter)			1 x	
Replace O-rings and seals of flow chambers				1 x
Electrochemical O_2 sensor with membrane 2952A				6 x
Electrochemical O_2 sensor with membrane 2956A				12 x
CO_2 or N_2 TC sensor membrane replacement				2 x

8.1 Daily Cleaning (user maintenance)

Every 8 hours of use, or when a measurement session is over, whichever comes first, the sampling circuit must be flushed to remove any product deposit in sampling lines and chambers. Perform a measurement routine, using a package filled with clean water and some non aggressive liquid detergent (do not use caustic soda). Use either:

- 0.5% bleach (sodium hypo chlorite) at room temperature, or...
- 5% Contrad (dilute caustic detergent) at 40° C.

The measuring instrument waits for the evidence of piercing to go on, so press **ENTER** to bypass this step. Repeat this operation with two packages filled with water low in dissolved oxygen.

Let the system purge (see “Sampling System Purge” on page 57) run for 5 minutes to purge liquid out and dry the system.

8.2 Pressure Regulator

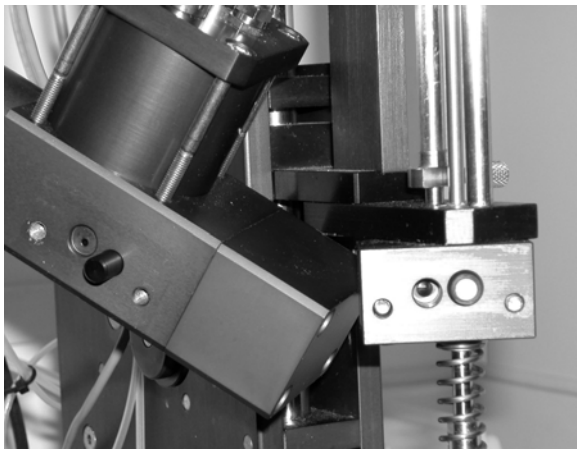
Drain the condensate periodically. Unscrew the drain at bottom of bowl. If filter is dirty:

- Turn off the gas supply.
- Unscrew the bowl by hand.
- Unscrew the black disc at the bottom.
- Remove the white composite filter.
- Wash under clean tap water, blow dry, and install.

8.3 Servicing the Filters

Replacing gas filter, in manifold:

- Remove 2 Allen screws at the back of manifold.
- Gently pull the manifold assembly away from its base.
- Remove the hydrophobic filter cartridge, located between manifold and base.
- Install a new filter. The filter side marked with a cross must sit in the base



Note:
Check for trace of liquid on the manifold side of the filter. If so, valve cleaning must be performed. See “Servicing the Manifold” on page 74.

Cleaning product filter, at flow chamber inlet:

- Unscrew by hand the connection at product inlet line to lower flow chamber.
- Open the cartridge inlet, and clean/replace the mesh screen.
- Clean cartridge with warm water and blow dry.
- Replace filter assembly if required.



8.4 Sampling Tube Maintenance

The sampling tube and sliding piece are sensitive items. Avoid scratching tube surface, as this will damage the rubber seals. Wipe tube daily with a cloth impregnated with Monolykote® PG 21 (silicon lubricant) to keep tube lubricated. Test the seal tightness:

- Install an empty package on the piercer.
- Pressurize it with forcing gas (always use the protection shield provided).
- Spray soapy water on top of the bushing and seal. Check for gas leaks.
- If bubbles are visible, replace the seal assembly.

8.5 Replacing Knife and Seals

CAUTION:
Piercing tip and knife are sharp. Be careful and protect your hand with suitable gloves when removing and installing the knife.

To replace PET knife and/or seal, follow the below procedure. Procedure is similar on the metal type knife (for caps and cans). Only the use of the installation guide is not required.

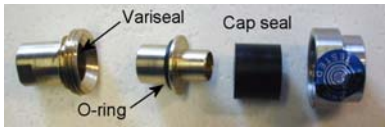
- Remove the knife assembly with a wrench, as illustrated.



- Unclip the seal assembly from the spring.
- Unscrew the inner part, and take it out of the outer part.



- Replace the rubber seal, the O-ring and the variseal®.



- Use the special PET knife insertion tool.



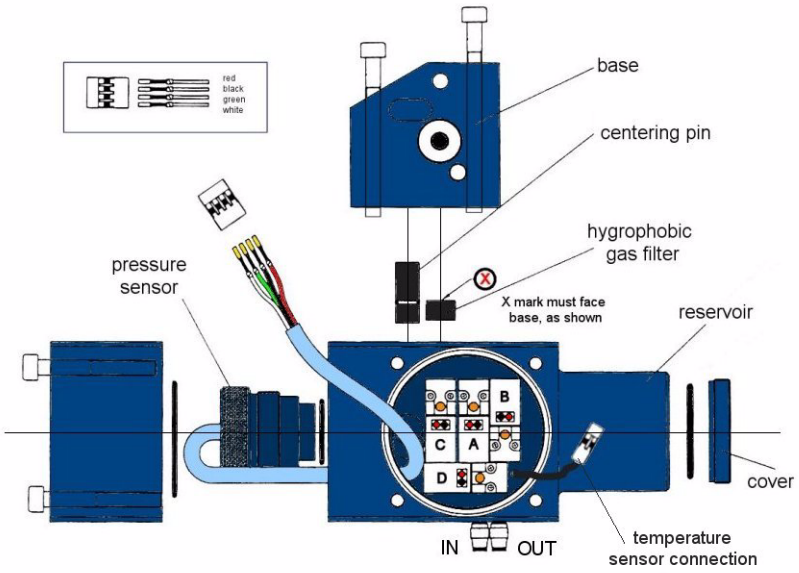
- Install the guide inside the knife with the long screw provided.
- Slightly lubricate with silicon grease.



- Slide the knife assembly inside the seal assembly.
- Clip spring back in place.



8.6 Servicing the Manifold



Whenever it is suspected that some product may have entered the manifold, manifold and electro valves require cleaning and testing. Product seen in the transparent lines connected to the manifold means that electro valves inside may be leaking.

Manifold reservoir

- Using an appropriate sized coin, unscrew the round cap on right side of the manifold.
- Check for presence of product, as it might have penetrated beyond valve B.
- Carefully clean the housing, then screw round cap back in place.

Pressure sensor

- Remove 4 Allen screws on left side cover, and remove cover.
- Remove the pressure sensor.
- Check for presence of product as it might have penetrated beyond valve C.

Electro valves “A” “B” “C” and “D”

- Remove 4 Allen screws on manifold top, and gently pull cover away, paying attention to the connections inside.
- Identify and remove the electro valves' screws.
- Install the electro valve on optional cleaning device.
- Either leave the valves connected to the piercer, with the instrument operating on "Continuous Purge" (which opens the normally closed valves), or connect the valve leads to 12V DC).
- Clean with clean tap water, followed by alcohol if available, and blow dry.
- Rinse the manifold channels the same way.
- Replace all seals and O-rings, paying attention to correct placement.
- Let the instrument run the continuous purge function.

Note:
During disassembly, carefully note location and orientation of components. For proper operation, tightness of the complete assembly is mandatory.

8.7 Instrument Service

To open the instrument, disconnect the AC power, remove the front-panel key, and place the instrument face down. Remove the four 3-mm Allen head screws, and carefully pull off the rear panel, taking care not to disconnect any wires.

8.7.1 Fuse Replacement

A power supply card is attached to the inside of the rear panel. Position F1 is a black plastic fuse holder. Remove the fuse cover, using a small flat blade screwdriver to push down and turn.

- The 230 VAC power supply uses a T 100 mA fuse.
- The 115 VAC power supply uses a T 250 mA fuse.

8.7.2 AC Voltage Switch

A 115/230 VAC voltage switch is located next to the fuse holder. If necessary, change this with a small flat-bladed screwdriver. Check that the correct fuse (identified above) for your voltage is installed before connecting the instrument to a power supply.

Note:
Change the marking accordingly on the voltage label, located on the instrument rear panel.

9 Troubleshooting

9.1 Control Valves Check Routine

The measuring instrument Check Routine function allows checking forcing gas pressure and control valves operation. Select **CHECK ROUTINE** from the **OPTIONS** menu, then select **ABC check** or **D check**. The measuring instrument will run the corresponding test. Results are sent as error messages in the OrbiPack software window.

Note:
All control valves in the system are of the normally closed type, so they are open when activated.

Table 9-1: Electro Valve A, B, and C Check

Valves activated:				Error code	Probable cause
A	B	C	D		
O	O	O		40	package still under the piercer
O	O	O		41	no forcing gas
O	O			42	-gas filter clogged -valve B closed -valve C blocked open or leaks
O		O		43	clogged gas filter
O				44	valve B blocked open or leaks
O				45	valve B leaks
	O			46	valve B closed
	O			47	valve B leaks
	O	O		48	clogged gas filter
	O	O		49	valve A blocked open or leaks

Table 9-2: Electro Valve D Check (pilots the pneumatic valves D’ and D")

Valves activated:				Error code	Probable cause
A	B	C	D		
O	O			50	no forcing gas
		O		51	D, D’ or D" valves are blocked open or leak
		O		52	-valve C leak -leak at manifold reservoir seal
		O	O	53	D and D’ valves remain closed
		O	O	54	-valve D" closed -flow meter closed
				55	gas filter missing or too porous

9.2 OrbiPack Software Error Messages

See also “Table Settings” on page 32 for details on how to view the error flags on the measurement display.

The error flag is a 32 digit field filled with either a zero or one (0 = OK and 1 = error). On completion of a measurement, check the status of the error flag. If any of the digits are set to 1 indicating an error, refer to the table below to determine the probable cause.

For example, an error message of 00010000010000000000000000000000 has the flag positions 4 and 10 set to 1. From the table below, this indicates problems in the fill reservoir and bottle piercing stages. The likely reason for each problem is indicated in the probable cause column of the table.

The error number column relates to pop-up warning messages during measurement (see “Warning Messages” on page 26).

Operation	Error No.	Flag Pos.	Probable Cause
O_2 stability	**60**	**1**	Measure deviation for the last 5 measurement is over the threshold value set in the **option** menu (**O2 stability**).
Fill reservoir	**7**	**3**	Forcing gas pressure set too high.
	8	**4**	Low forcing gas press. Foam in the system.
Raise piercing lever	**14**	**5**	Lever not up, package pressure still present. Wrong calibration of pressure sensors (int. or ext.). Blocked electro valve.
	15	**6**	The pressure gradient indicates a clogged filter.
Rinsing	**17**	**8**	Forcing gas pressure set too high. Gas filter clogged.
Bottle pierced	**21**	**10**	Leak in testing system. Package is empty.
Pierce package	**20**	**11**	Product filter clogged. Low package pressure. Poor piercing, too slow.
Head-space	**19**	**12**	Leak or foam in system.
	22	**13**	Leak or foam in system.
	23	**14**	Leak or foam in system.

9.3 Measuring Instrument Error Messages

Message	Reason	Recommended action
Prg	Purge gas failure Damaged sensing element	Restore purge gas to specifications Perform the Continuous Purge test (Options menu) Return sensor to Hach Ultra
Chk	Purge voltage drifting	Check purge gas Perform the Continuous Purge test (Options menu)
Lmt	Ramp limit violated	Reduce gas permeation Perform the Continuous Purge test (Options menu)
Too low	Forcing gas pressure is insufficient to lift the liquid to the sensors	Check forcing gas pressure Verify that the forcing gas pressure is set at 500 mbar higher than the package pressure (P2)
Too high	Forcing gas pressure exceeds the limit set in the OrbiPack software for this package type	Check forcing gas pressure, and check OrbiPack software max press. set limit. Verify that the forcing gas pressure is set at 500 mbar higher than the package pressure (P2)
Check Reception	The PC communication has failed	Check PC cable connection Verify correct PC link and setup
Change the Filter	The gas filter in manifold may be clogged	Replace the gas filter
Calibration out of bounds	Wrong membrane installed Perforated or torn membrane Two membranes instead of one (or the opposite)	Correct accordingly

9.4 Troubleshooting Guide

The following table lists possible problems, causes, and proposed solutions.

Symptom	Possible cause	Correction	Sensor
Instrument does not start. No display or backlight.	No power. Incorrect voltage.	Check connections. Check instrument voltage label on the instrument rear panel.	-
	Blown fuse.	Unplug the instrument and replace the fuse.	-
Downward drift during measurement.	Purge gas pressure too low.	Adjust pressure at regulator to get over 3 bubbles per second from sensor exit tube (immerged in water).	CO_2
	Sample flow stopped.	Correct and start a new test.	CO_2
Low reading.	Leak in purge gas.	Check line for leaks with soapy water.	CO_2
	Sample flow too low.	Adjust sample flow according to procedure.	O_2
High reading.	Incorrect calibration in gas (wet membrane & protection grille ?)	Recalibrate the sensor according to procedure.	O_2 CO_2
High/low readings.	Calibration values entered did not match sample used.	Check that the entered numerical data and units fit the gas concentration or pressure.	O_2 CO_2
Unstable reading during calibration.	Calibration gas flow restricted, generating pressure pulse.	Make sure calibration gas flows freely; unscrew sensor collar ¼ turn to create a leak, thus increasing gas flow during calibration.	CO_2
Calibration impossible	Improperly mounted protection cap or membrane.	Sensor needs servicing.	O_2 CO_2
	Leaking purge gas solenoid valve in TC sensor.	Check purge gas sequence. If purge gas solenoid leaks during measurement phase (more than 1 bubble in 15 seconds), the sensor needs servicing.	CO_2
Erratic readings.	Water condensation into the thermal conductivity element.	In Options menu, turn on Continuous Purge mode overnight to dry the sensor cell. **Note:** *Water condensation may seriously damage the TC sensor cell.*	CO_2
Forcing gas pressure P3 ≈ P4 during measurement cycle.	Product in manifold electro valves.	Perform cleaning and testing of the manifold valves.	-

9.5 Diagnostic Information on PC

9.5.1 Diagnostic Information During the Measure Procedure

#	Vi [mV]	nA	Vf [mV]	Slope [mV/s]	Temp [°C]	No	Part. press [bar]	St-Dv [%]	H_2O/O_2 [mv/s]	T corr [mv/s]	PT 1000 [°C]	Tm [°C]
#0	-256.8		-301.2	-3.170	24.53	1	-0.2825	0.0	0.000	0.000	25.1	24.5
#1		14245.18			24.98	3	0.1216	70.0	0.000			
#1		16729.77			25.47	4	0.1409	60.5	0.000			
#0	-263.7		-366.3	-7.329	25.69	2	-0.6380	38.6	0.000	0.000	26.2	25.7

- # - Sensor #0 = TC / sensor #1 = oxygen sensor
- **Vi** - Initial voltage from the TC sensor at beginning of measurement ramp, in mV
- **nA** - Oxygen sensor current, in nano-amperes
- **Vf** - Final voltage at the end of the measurement ramp, in mV
- **Slope** - Change of sensor voltage, divided by the duration of the ramp, in mV/s
- **Temp** - TC sensor temperature
- **No** - Measurement sequence number for this sensor
- **Part Press** - Partial pressure measurement
- **StDv** - Standard deviation of partial pressure
- **H_2O/O_2** - Correction for humidity or oxygen, in mV/s
- **T corr** - Contribution to the Slope from the drift of temperature, in mV/s
- **PT1000** - PT1000 temperature measurement
- **Tm** - Calculated temperature

9.5.2 Diagnostic Information During the Calibrate Procedure

% last cal	Vi [mV]	Vf [mV]	Slope [mV/s]	Temp [°C]	H2O corr	T corr	O_2 corr	O_2
92.3	3990.5	3985.3	-0.516	12.93	-0.525	-0.000	-0.006	0.0002
93.4	3992.7	3987.5	-0.520	12.92	-0.525	-0.000	-0.006	0.0003

- **% last cal** - Percent change in calibration from last calibration
- **Vi** - Initial voltage from the sensor at the beginning of the measurement ramp, in mV
- **Vf** - Final voltage at the end of the measurement ramp, in mV
- **Slope** - Change of sensor voltage, divided by the duration of the ramp, in mV/s
- **Temp** - Sensor temperature
- **H_2O corr** - Contribution to Slope from humidity according to previous calibration, in mV/s
- **Tcorr** - Contribution to the Slope from the drift of temperature, in mV/s
- **O_2 corr** - Contribution to the Slope from oxygen present in the water, in mV/s
- **O_2** - Oxygen partial pressure, in bar

10 Spare Parts

10.1 Piercer Parts

Part N°	Description
2952A	Tefzel membranes for electrochemical sensors Ø 32 mm 25 µm. (25 piece set)
2956A	PFA membranes for electrochemical sensors Ø 32 mm, 25 µm. (25 piece set)
28078A	Filters for filter assembly (gas filters- 5 piece set)
28114	Membrane support mounting tool
28116	Membrane holding ring removal tool
28117	Pressure sensor, 0-5 bar absolute
28129	Delrin calibration cap (sensor's storage cap)
29089	Pressure regulator and filter for purge gas
28504	Tool for protection cap removal and installation
29561A	PFA membranes for TC sensors Ø 32 mm, 25 µm. (25 piece set)
29977	Equilibration vessel for calibration in known dissolved gas concentrations
32009	Micro-volume flow chamber
32011	Micro-volume flow chamber with temperature sensor mounting
32103	Flow meter, 0–30 l/hr., and nylon connector
32111A	Piercing head, spring loaded. For use with PET caps and cans. Use with package positioning fork 32110. Replaces 32111.
32106A	Piercing head, spring loaded, for 3625. For use with crown caps and all beverage cans. Use with package positioning plate 32108. Replaces 32106.
32115	Bottle protection screen (Protection against package explosion)
32205	Sensor support (base) for 31xxx sensors (connection protection cap)
32505.01	1 meter sensor cables
32537	RS-232 cable
32605	Back up purge unit
32816	Reciprocating shaker, for beverage packages
32837	Pneumatic valve assembly, at drain tube (valve D")
32838	Pneumatic valve assembly, at sampling tube, complete (valve D')
32872	Seal kit for piercing head
32883	Piercing tip (TiN gold coated) and pushrod assembly
32884	Electro valve, at piercer manifold (incl. gasket and screws)
32885	Mesh screens, used in the in line particle filter (10 piece set)
32890	Large O-ring for in line particle filter (10 piece)
32896	O-ring, external pressure sensor (10 piece set)

Part N°	Description
32910	Package piercing seal to package (10 piece set)
32912	O-ring set for micro-volume flow chambers (5 inner + 5 outer o-ring set)
32914	In line particle filter assembly, complete
32915	O-ring for in line particle filter (10 piece set)
32920	Membrane mounting tool, including centering sleeve and plunger
32921	Electro valves cleaning tool
32923	Sampling tube assembly, with PT1000, with abrasion resistant tube coating
32924	Seal assembly (sampling tube bushing and seal assembly)
32933	Monolykote® PG 21 synthetic lubricant, for sample tube
32937	Set of seals for 3625 measuring instrument (5 O-ring and 5 quadrings set)
32940	Spare exit valve D" plunger
32941	Spare sampling tube valve D' plunger
32948	Dacron gauze inserts, Ø 12 mm for 32914 in line particle filter (10 piece set)
60407-A	Key for measuring instrument switch

10.2 Sensor Specific Parts

Gas	Sensor model	Membrane	Holding ring	Protection cap	Protection cap kit	Maint. kit
Oxygen	31 110.02	1 x 2952A	29228	29111 (TC sensor type)	28002 Tefzel washers only	32702
Carbon dioxide	31 450	1 x 29561	29228	29111	28002 Tefzel washers only	32760
Nitrogen	31 550	1 x 29561	29228	29111	28002 Tefzel washers only	32760

Appendix A: Glossary

A.1 Common Units

Table A-1: Common Units

Unit	Meaning
%	percentage, by weight
% vbar	percentage per volume, barometric pressure referenced
% vext	percentage per volume, sample pressure compensated
cc/kg	cubic centimeters per kilogram
g/kg	grams per kilogram
mg/L	milligrams per liter
ml/L	milliliters per liter
ppb	parts per billion, by weight
ppm	parts per million, by weight
V/V	volume per volume (ratio)

A.2 Terms and Definitions

Table A-2: Terms and Definitions

Terms	Meaning
Absolute pressure	Absolute pressure is relative pressure, plus atmospheric pressure
Headspace	The empty volume above a liquid or solid in a closed container.
Relative pressure	Relative pressure is absolute pressure, less atmospheric pressure (this is the customary gauge reading).

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