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ORBISPHERE Model 3100 Portable Analyzer

USER MANUAL

10/2021, Edition 12

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1.1 Safety information

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

1.1.1 Use of hazard information

⚠ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially or imminently hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

1.1.2 Safety recommendations

For safe operation, 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.

The instrument normally runs on battery power but can use an external power supply by connecting it through the supplied adapter to an external power socket. To disconnect the external power, unplug the adapter from the external power socket. Once disconnected the instrument will revert back to battery power.

⚠ WARNING

When using an external power supply to power the instrument, ensure the external power socket is earthed.

⚠ WARNING

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

The power supply connector on the rear panel must be easily accessible so the power can be disconnected quickly in case of emergency.

1.1.3 Safety precautions

The 3100 Oxygen Analyzer is powered with a lithium battery pack. To ensure the safe use of this instrument, read and pay close attention to the safety related information that follows.

When using the analyzer (also includes storage):

⚠ WARNING

Fire, Explosion, Burn Hazard.

- The temperature range over which the battery can be used, stored or discharged is -10 to 60°C. Use of the battery outside of this temperature range may result in:
  - Damage to the analyzer's battery, resulting in a potential fire hazard from a battery rupture and electrolyte leakage, and
  - Reduced battery life expectancy
- Immediately discontinue use of the instrument if, while using or charging the battery, the battery emits an unusual smell, smoke or the enclosure feels unusually hot to the touch. Contact your Hach Service Center, if any of these problems are observed.
- In the event of a battery electrolyte leakage from the enclosure, avoid contact of the electrolyte with the eyes. Do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated the battery fluid could cause damage to the eye.
- Never place the analyzer and its batteries in microwave ovens, high-pressure containers, or on induction cookware.

⚠ WARNING

Fire, Explosion, Burn Hazard.

- Use of the analyzer should immediately be discontinued if the battery compartment is exposed to moisture or flooding due to leakage, wear or misuse.
- Misuse of the analyzer may cause the internal battery to get hot, explode, or ignite and cause serious injury.
- Do not expose the internal battery to any liquid such as water, beer or salt water, or allow the battery to get wet.
- Do not disassemble or modify the analyzer or its battery. The internal battery pack contains safety and protection devices which, if damaged, may cause the battery to generate heat, explode or ignite.
- Do not place the battery/instrument on or near fires, stoves, or other high temperature locations (above 60°C). Do not place the battery/instrument in direct sunlight, or use or store the battery inside cars in hot weather. Doing so may cause the battery to generate heat, explode, or ignite. Using the battery in this manner may also result in a loss of performance and a shortened life expectancy.

When charging the battery:

⚠ WARNING

Fire, Explosion, Burn Hazard.

Be sure to follow the rules listed below while charging the battery. Failure to do so may cause the battery to become hot, explode, or ignite and cause serious injury.

- The temperature range over which the battery can be charged is 10 to 45°C. Charging the battery at temperatures outside of this range may cause the battery to become hot or to rupture. Charging the battery outside of this temperature range may also harm the performance of the battery or reducethe battery's expectancy.
- When charging the batteries use the specified battery charger provided with the instrument.
- When charging batteries, do not place the analyzer in or near fire, or into direct sunlight. The additional heat can result in increased battery heating that can damage the battery's built-in protection circuitry necessary for prevention of ignition of the battery. Additionally, increased heat may cause activation of the batteries built-in protection circuitry, thus preventing the battery from charging further.
- Do not continue charging the battery if it does not recharge within the specified charging time. Doing so may cause the battery to become hot, explode, or ignite. Contact your Hach Service Center, if any charging problems are observed.

Hach assumes no liability for problems that occur when the precautions listed above are not followed.

1.1.4 Internal batteries

The instrument contains a rechargeable lithium battery pack as the main source of power, and an RTC lithium metal battery on the mother board. Please read the following important safety information regarding these batteries:

- Do not attempt to dismantle the rechargeable battery pack. If you feel it needs to be replaced, please contact your local Hach representative for assistance.
- Used or end-of-life battery packs must be disposed of locally in a safe manner and consistent with Local Authority regulations. If this cannot be done locally they can be returned to Hach, but must be sent back in accordance with **Packaging Instruction 965 issued by IATA**.
- Faulty or defective battery packs may only be shipped (for repair or replacement) with them inside the instrument. Disconnect the power supply (by reversing the process explained in Reconnect battery power on page 13) before shipping.
- The mother board contains an RTC Lithium metal battery. It is forbidden to ship a used mother board with the battery. If the mother board needs to be returned, then the battery must be removed and disposed of locally in a safe manner and consistent with Local Authority regulations. The mother board without the battery can then be shipped safely.

1.1.5 Service and repairs

None of the instrument’s components can be serviced by the user. Only personnel from Hach 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.

1.1.6 Precautionary labels

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

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	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.

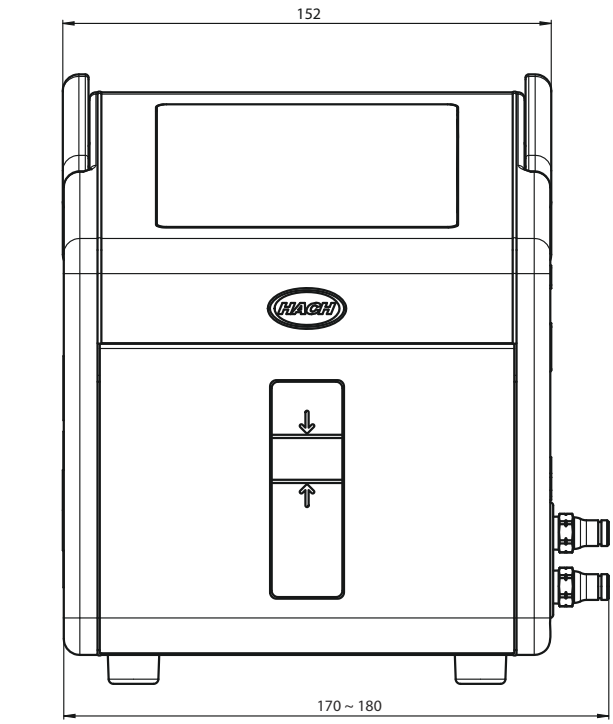
Section 2 Specifications

2.1 Technical specifications

Specifications are subject to change without notice.

ANALYSIS		
Sample	Non-flammable gaseous or liquid samples	
	Sample temperature	-5 to 45°C (23 to 113°F)
	Sample pressure	0 to 10 bar (0 to 140 psi)
Measurement range	O_2	0 to 2000 ppb
Accuracy	O_2	± 0.8 ppb or ± 2% of reading whichever is the greater ***Note:*** *Measurements above 400 ppb will require a high level adjustment to guarantee accuracy*
Repeatability r_{95}	O_2	± 0.4 ppb or ± 1% of reading whichever is the greater
Detection limits	O_2	0.6 ppb
Response time t_{90}	Usually less than 15 seconds but will vary depending on the sampling method	
Measurements	Holds up to 5,760 measurements • 8 hours of data at a sampling frequency of 5 seconds • 96 hours of data at a sampling frequency of 1 minute	
Display units	O_2 concentration	ppb, ppm, µg/L, mg/L, mL/L, %O_2, %air, %Vbar, ppmVbar
	Pressure	mbar, bar, Pa, hPa, kPa, MPa, psia, psig, atm, kgf/cm^2
	Temperature	°C, °F, K
Operating conditions	Ambient temperature	-5 to 45°C (23 to 113°F)
	Relative humidity	0 to 95% non-condensing for temperatures less than 30°C (86°F) 0 to 70% non-condensing for temperatures from 30 to 45°C (86 to 113°F)
	Environmental conditions	Indoor use only
ENCLOSURE		
Weight	3.4 kg (7.5 lbs)	
Dimensions (L x W x H)	200 x 170 x 190 mm (7.87 x 6.69 x 7.48 ins)	
Altitude	2000 m (6562 ft) maximum	
Waterproof protection	Stainless steel IP66 with polycarbonate sides	
Power supply	Internal rechargeable battery pack: Li-Ion 46Wh	
	External power supply input: 100-240 VAC ±10% @ 47-63 Hz External power supply output: 12 VDC, 3 A The power cord must be rated for the supply voltage and current. External power supply is **not** IP66	
Battery life	> 10 hours of continuous measurement	
Battery charge time	< 4 hours ***Note:*** *Charge time increases by 20% at a temperature above 35°C (95°F)*	
CERTIFICATIONS		
Compliance	CE, ETL certified to UL and CSA safety standards (with all sensor types), KC, RCM, UKCA	
Overvoltage category	II	
Pollution degree	2	
INTERFACE		
Digital display	TFT color display 72 x 54mm (2.83 x 2.13 ins)	
Digital connections	1 x USB (5 VDC)	Input/Output mass storage device
	1 x RS232 (0-5 V) serial output	Baud rate: 9600 (adjustable) Stop Bits: 1 Start Bits: 0 Parity: None

2.2 Instrument dimensions



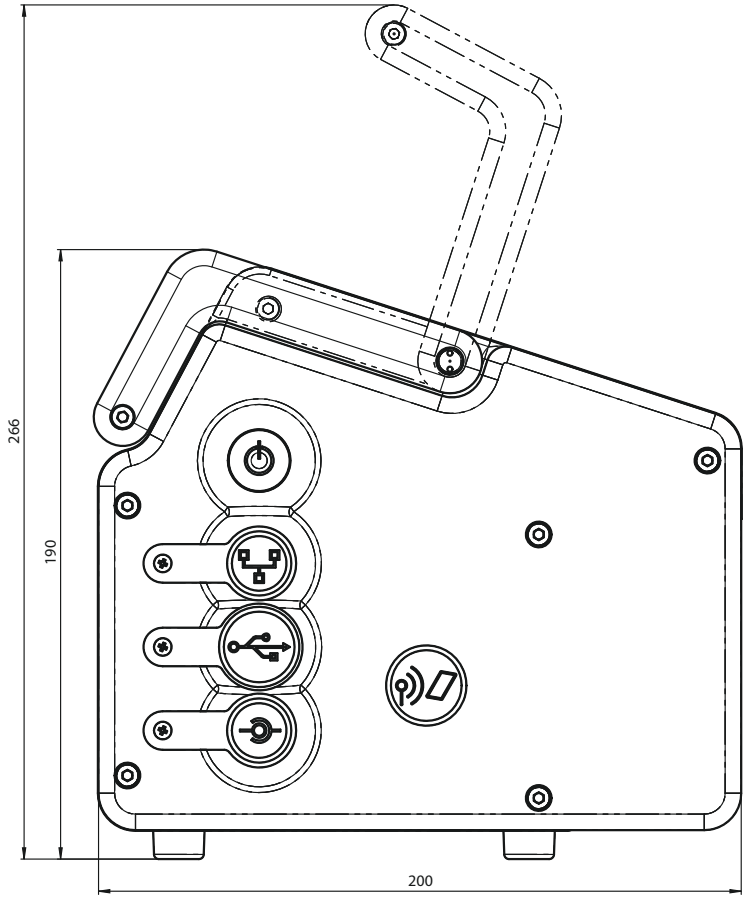


Figure 1 3100 instrument dimensions (mm)

2.3 General principle of operation

Optical sensing of oxygen originates from the work of Kautsky in 1939 where he demonstrated that oxygen can dynamically quench the fluorescence of an indicator (decrease the quantum yield). This principle has been reported in various fields of application such as monitoring aquatic biology in waste water, tests for blood gas analysis and cell culture monitoring. The method is now recognized by ASTM (American Society for Testing and Materials) for the measurement of oxygen in water. Compared to classical oxygen detection using electrochemical sensors, luminescent technology offers several advantages such as no oxygen consumption, independence from sample flow velocity, no electrolyte and low maintenance.

Optical sensing of oxygen is based on the measurement of the red fluorescence of a dye/indicator illuminated with a blue light as shown below.

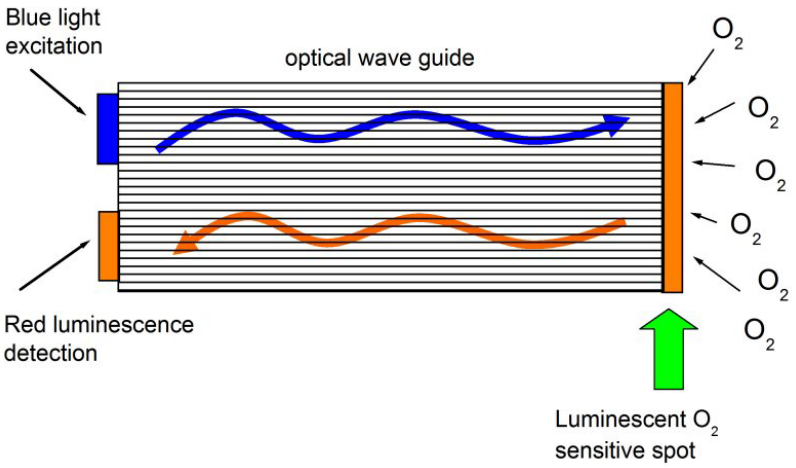


Figure 2 Principle of optical oxygen detection using fluorescent dye

The dye fluorescence is quenched by the presence of oxygen. The oxygen concentration can be calculated by measuring the decay time of the fluorescence intensity. The higher the oxygen concentration is, the shorter the decay time will be. By modulating the excitation, the decay time is transformed into a phase-shift of the modulated fluorescence signal, which is independent of fluorescent intensity and thus of potential aging.

The oxygen partial pressure (pO_2) is then linked to the corresponding phase-shift measurement (Φ) to build the sensor calibration curve. This curve is described by the Stern-Volmer equation where K_{sv} is the indicator quenching constant (in $mbar^{-1}$) representing the quenching efficiency of the oxygen and thus the sensor sensitivity, f_0 is a constant and Φ_0 is the phase-shift at zero oxygen representing the unquenched fluorescence decay time of the dye.

The calibration curve thus relies on two parameters: the phase-shift at zero oxygen and the luminescent spot sensitivity, K_{sv}. The dissolved oxygen concentration is then calculated with Henry's law using the water solubility curve as a function of the temperature.

Section 3 Installation

NOTICE

This instrument is for indoor use only.

3.1 Overview

The ORBISPHERE 3100 instrument is a self-contained portable analyzer, configured to make oxygen concentration measurements in gaseous or liquid samples. Up to 5,760 measurement values can be stored in memory and downloaded to a personal computer for further analysis.

The analyzer is available in 3 different versions (for 4mm, 6mm and 1/4 inch connections).

This section provides all the necessary information to set up the instrument. If you have any questions or experience any difficulties, do not hesitate to contact your Hach representative regarding this procedure.

3.2 Unpacking

Carefully remove the instrument and its accessories from the box and packing material, referring to the packing list included to confirm that everything has been delivered. Please visually inspect the instrument for shipping damage. If anything is missing or damaged, contact the manufacturer or your dealer immediately.

A thin protective film has been placed over the screen of the ORBISPHERE 3100 analyzer to protect it from damage during transportation. For a clear view of the screen, this film must be peeled off before using the analyzer for the first time.

NOTICE

A secondary more robust protective film has been factory installed over the screen to protect it from damage and moisture ingress. Under no circumstances should this protection be removed. If it becomes damaged in any way, please contact your local Hach representative.

You may want to retain the box and other packing material in case you need to ship the instrument at a later date. Please dispose safely and ecologically of the box and packing material (if not being stored for future use).

It is recommended that you read through this manual before carrying out the installation.

3.3 What you have received

If you have ordered a DGK3100-XXXX kit, you will have received the following items:

Quantity	Description
1	3100 instrument
1	External power supply adapter with plug
1	3 meters of plastic tubing
1	Tool kit (Refer to Figure 3 on page 12)
1	Instrument carrying strap
1	Operator manual

Figure 3 Tool kit (4mm instrument version illustrated)

1.	1 x Cross head screwdriver	**5.**	1 x Particle filter
2.	1 x Syringe	**6.**	1 x Flat head screwdriver
3.	1 x Box 5 syringe/instrument connectors (4mm version only)	**7.**	1 x Stainless steel or flexible tubing (stainless steel illustrated)
4.	1 x Box 10 meshes for particle filter	**8.**	1 x USB key containing PC software

3.4 Installation startup checklist

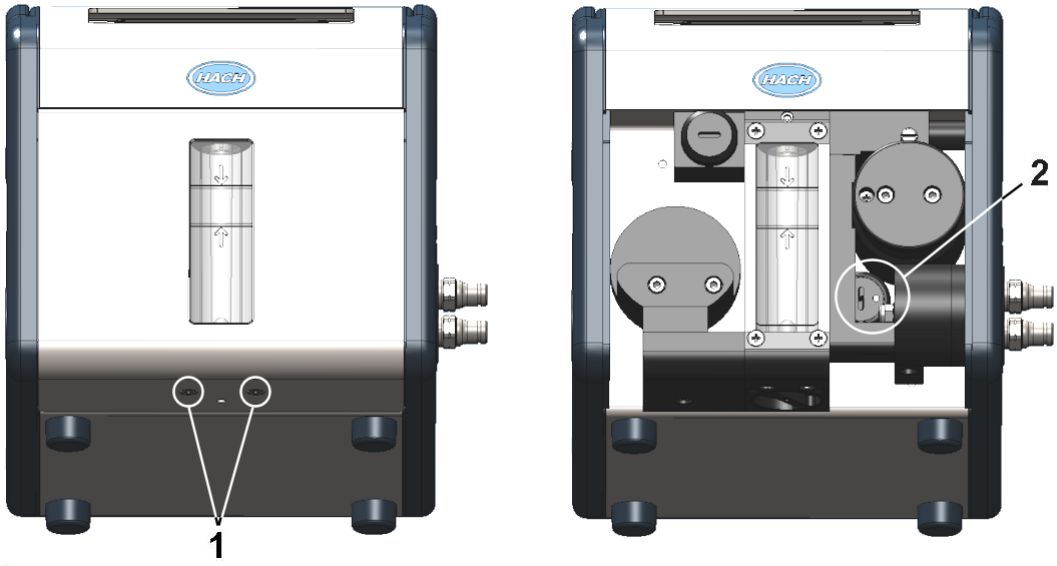
1. Reconnect the battery pack in order to supply power to the instrument as described in Reconnect battery power on page 13
2. Switch the machine **ON** using the ON/OFF switch (refer to Figure 4 on page 14) and check that the batteries have sufficient power (refer to Figure 6 on page 26 for location of remaining power indicator). If the batteries need charging, connect the instrument to an external power source as described in External power on page 16.

Note: *Once the battery pack has been reconnected and is fully charged, the instrument is ready to use. However, to take advantage of its full functionality it is recommended to complete the following additional steps before taking any measurements.*

3. Next, familiarize yourself with using the instrument by reading the next section in this manual entitled User Interface on page 23.
4. Set the date and time of the instrument's internal clock, as described in Basic settings on page 32.
5. Install the 3100 PC software on your PC as described in PC software installation on page 18.
6. Set up the user configuration table using the PC software as described in Create new user table on page 19.
7. Set up the measurement configuration table using the PC software as described in Create new measurement configuration table on page 20.
8. Upload the user and measurement configuration tables to the instrument as described in Transfer files to the instrument on page 21.

3.5 Reconnect battery power

For safety reasons, the battery pack will not be connected during shipment. Once the instrument has been unpacked, the battery power should be reconnected using the following procedure:



1. Tilt the instrument towards the rear, to reveal two screws underneath (**No. 1**) that hold the instrument front panel in place.
2. Using the cross screwdriver supplied in the tool kit, unscrew and remove these screws. Lift off the front panel to reveal the internal battery power switch (**No. 2**).
3. Using the long-bladed flat-head screwdriver supplied in the tool kit, turn the switch a quarter of a turn clockwise to reconnect the battery power. The diagrams below show the switch in the **OFF** position as delivered (left) and in the **ON** position (right).

4. Replace the front panel and secure back in place with the two screws.

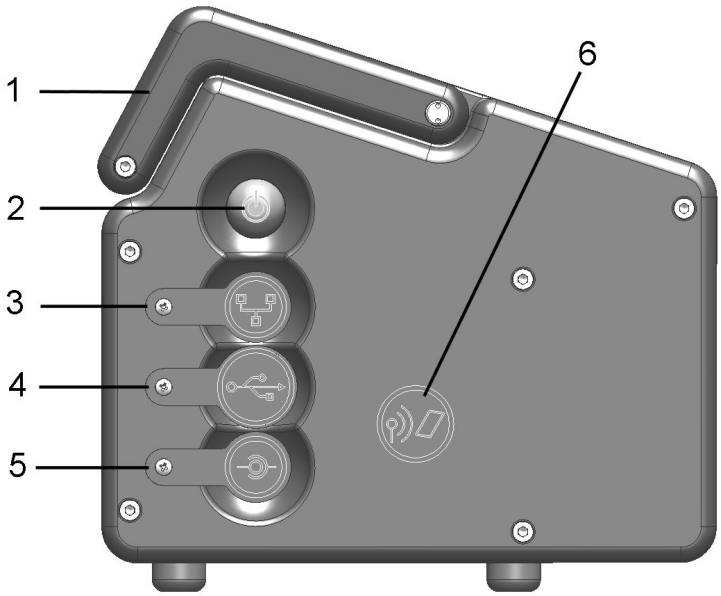
NOTICE

To avoid any damage to the instrument, it will be necessary to perform the above procedure in reverse (i.e. turn the connection OFF) prior to any future transportation of this instrument.

3.6 Instrument switches and connectors

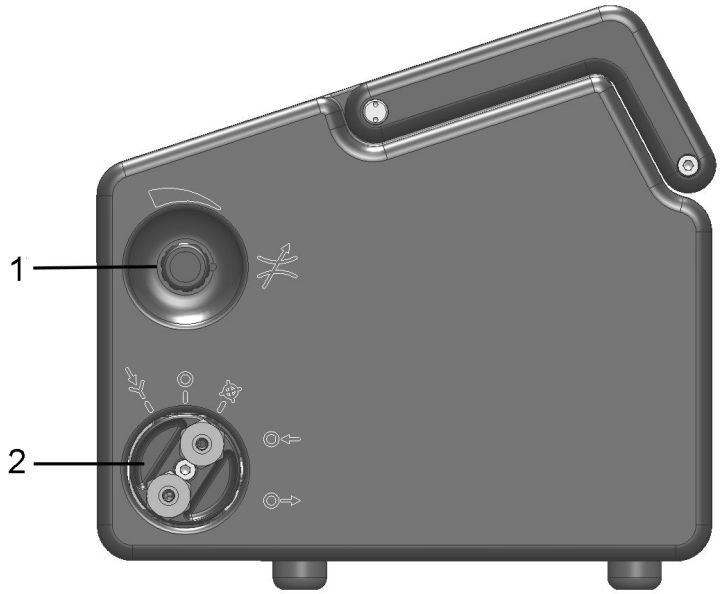
The following diagrams illustrate the side views of the instrument and their key features:

Figure 4 Left side view



1	Handle	**4**	USB connection
2	Instrument ON/OFF switch	**5**	External power supply connection
3	RS232 connection	**6**	Card identification system (option not yet available)

Figure 5 Right side view

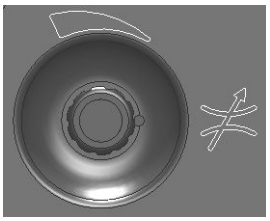
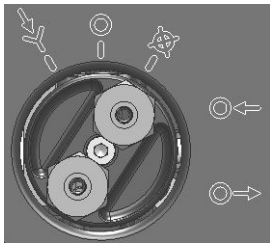


1	Sample flow adjustment valve	**2**	Sample flow valve with inlet and outlet connections (the sample inlet is at the top of the valve and the outlet at the bottom). The valve has three positions: Sample line PURGE; Sample flow ON; Sample flow OFF

There is one switch and three connectors located on the left side of the instrument. The three connectors are protected with a metal tab which must be unscrewed and removed before use. Each tab has a symbol on it to indicate its function. Refer to Figure 4 on page 14 and the table that follows:

	This switch is used to turn the instrument ON or OFF. Push the button to turn the instrument ON. A green indicator light on the lower left of the keyboard will be illuminated when ON. To turn the instrument OFF, push the button for a few seconds until the screen display is dimmed. The instrument will then perform closing down procedures. Once the green indicator light is extinguished, the instrument is OFF.
	This is the RS-232 connection socket which uses an 8-pin LEMO plug to connect the instrument directly to a PC.
	This is the USB connection for mass storage devices, allowing uploading and downloading of specific data files to and from the instrument.
	This socket allows the instrument to be powered by an external power source. A cable, with a 3-pin plug and adapter are supplied with the instrument.
	This additional symbol is reserved for future use.

The sample inlet/outlet and sample flow adjustment valve are located on the right side of the instrument. Refer to Figure 5 on page 14 and the table that follows:

	Two symbols can be found relating to the sample flow adjustment valve. The symbol to the right indicates it is the flow adjustment valve, and the symbol at the top indicates the direction for increasing and decreasing the flow (turn clockwise to decrease the flow rate and counter-clockwise to increase the flow rate).
	Five symbols are located around the sample inlet and outlet connections. The first three symbols from left to right in the illustration indicate the PURGE position, followed by the sample flow ON position, then the sample flow OFF position. The illustration shows the sample flow in the OFF position. The other two symbols indicate that the top connection is for sample input and the bottom connection for sample output.

The **PURGE** position is used to clear the sample line of any build up of air bubbles. For a thorough purge, it is recommended to keep the valve in this position for 5 seconds. During this operation, the sample flows directly from the inlet tubing to the outlet tubing. All measurements are suspended during this time as the sample does not come into contact with the sensor.

The **ON** and **OFF** positions turn the sample flow on and off respectively.

3.7 Instrument connections

3.7.1 External power

⚠ WARNING

When using an external power supply to power the instrument, ensure the external power socket is earthed.

In addition to the internal rechargeable battery pack, the instrument can be powered by an external power source using the supplied adapter and cable. Connect the adapter to the power supply connection socket on the instrument (Refer to Figure 4 on page 14), and plug into an external power supply socket.

Note: *When the instrument is connected to an external power source, the internal battery pack is automatically recharged.*

3.7.2 RS232 connection

This connection can be used to download measurement data and for real-time monitoring of the measurements.

The data sent to the PC via this link is identical in format and content to that stored in the measurement file on the instrument and which can be transferred using the USB mass storage device (Refer to Exported files on page 36 for details).

3.7.3 USB connection

The USB connection (in Figure 4 on page 14) is used for exporting and importing data from and to the instrument. Tables can be set up on the PC using the 3100 PC software application and then uploaded to the instrument using a USB mass storage device.

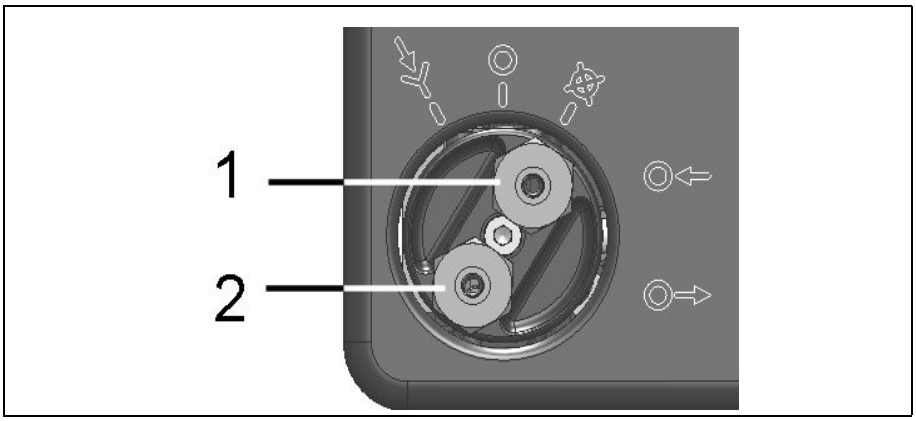
In addition, tables can be exported from the instrument to the USB storage device and then imported to other 3100 instruments to standardize configurations.

For more details on this, refer to Import / Export on page 35.

3.8 Connecting sample lines

Measurements can be taken on a continuous or sample by sample basis. In either mode, the instrument must be connected to the sample line as follows:

1. The sample inlet and outlet connections on the instrument are located on the ON/OFF sample flow valve (refer to Figure 5 on page 14 and enlarged in the diagram below):



1.	Sample inlet
2.	Sample outlet

2. Connect the inlet and outlet tubing to the sample source and to the drain, respectively. The diagram above, shows the valve in the **OFF** position. To turn the sample flow fully **ON**, turn the valve counter-clockwise until it clicks into position (about 1/8th of a turn). To remove any residual air bubbles from the sample line, turn the valve to the **PURGE** position for 5 seconds before turning to the **ON** position.

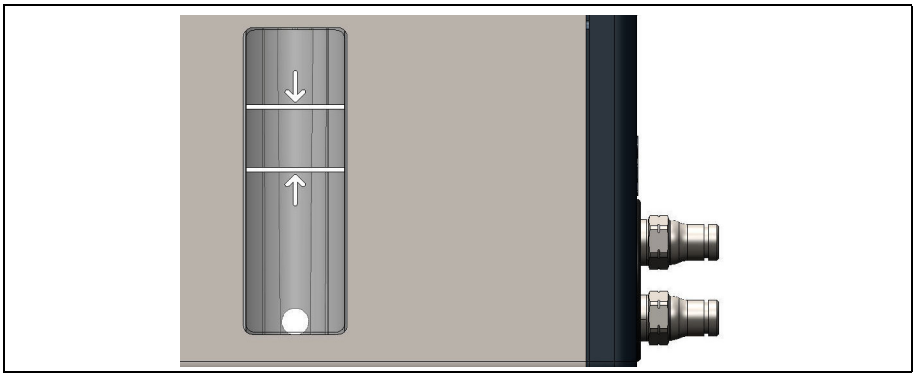
Note: *A length of stainless steel tubing is supplied in the tool kit (4mm instrument) and can be used instead of plastic tubing on the outlet valve if the pressure in the instrument is high enough to cause excessive movement of the plastic tubing.*

3. If the sample contains particles, it is recommended to use a filter on the inlet tube to avoid any clogging of the sample flow. The filter (including a box of 10 meshes) is contained in the tool kit supplied with the instrument. It is also available separately as spare part number DG33216 (4mm instrument), DG33317 (6mm instrument) or DG33318 (1/4 inch instrument) and the set of 10 meshes as spare part number DG33217.
4. Control the sample flow using the adjustment valve located above the sample flow valve. Refer to Figure 5 on page 14.

Flow rate guidelines:

- For cans and bottles the minimum recommended flow rate is 150mL/min. For small volume packages a lower flow rate can be used but this should **not** be below 100mL/min.
- For tank and in-line applications the recommended flow rate should be above 200mL/min and up to a maximum of having the flow adjustment valve fully open.

Note: *The flow rates indicated with arrows on the flow meter (as illustrated below) are approximately 150mL/min (lower arrow) and 200mL/min (upper arrow). The silver bead gives an indication of the flow rate.*



3.9 PC software installation

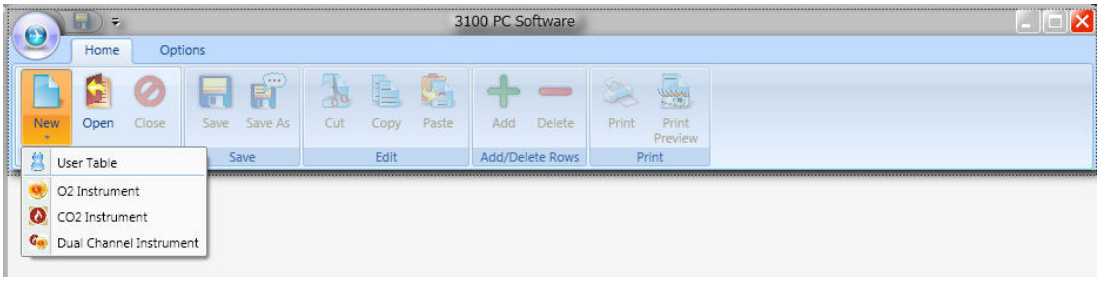
The instrument is delivered with default user and measurement configuration tables. However, to personalize the instrument by setting up your own tables you will need to use the PC software which is included on the USB key supplied with the tool kit.

Install the PC software by inserting the USB key into your PC and running the setup program (entitled **setup.exe**) from the directory **Orbisphere 3100\Installation Files\PC Software** on the USB drive. Follow the on-screen instructions and the software will be installed on your hard disk in a new directory: **C:\Program Files\Hach Lange\3100 PC Software**.

On completion, a program icon will have been installed on your desktop for easy access to the application.

Note: *The PC software is compatible with the Windows 7, Vista, and XP operating systems.*

Once the software has been installed, click on the desktop icon on the PC to launch the application.

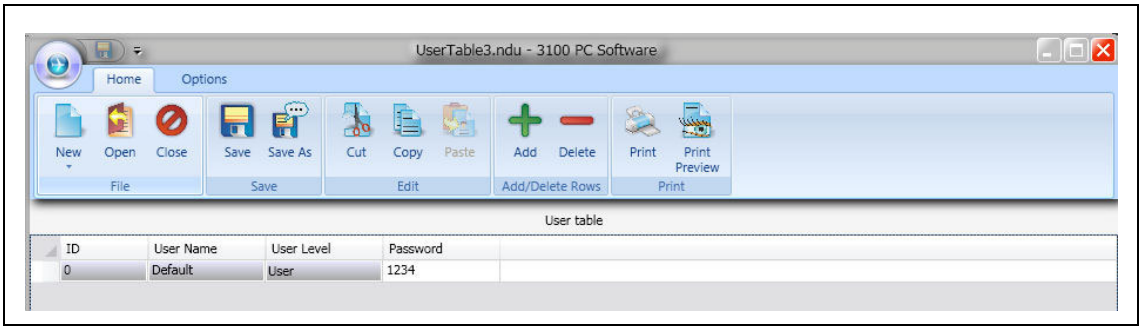


You will then be able to:

- Create or modify User Tables and Measurement Configuration Tables.
- Print any of the tables.

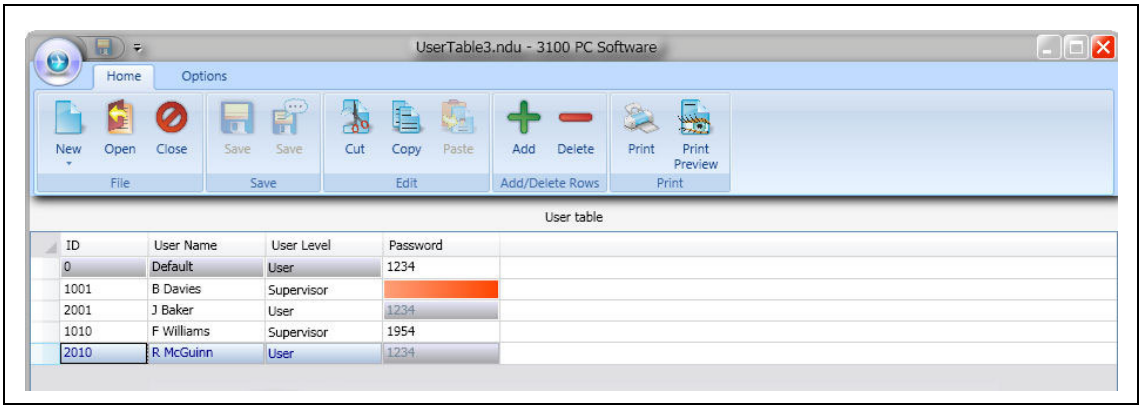
3.9.1 Create new user table

From the application's **File** menu, select **New** and then **User Table**.



A default user is created automatically, with an ID of "0", a User Name of "Default", and a level of "User". None of these fields can be changed. The password is set automatically to "1234", but this can be changed.

Use the **Add** option to add new users, and **Delete** to remove existing users. **Copy** and **Paste** can also be used to add new users, and **Cut** can be used to delete existing users. Double click on a field to edit the contents.



The table can be populated with a list of valid users. The following information is required:

- ID - 4 character numeric
- User Name - 16 character alphanumeric
- User Level - User or Supervisor
- Password - 4 character numeric for supervisor level only (not required for user level)

Note: *Even if a password is set up at user level, when logging onto the instrument a password will not be requested for user level access (only supervisor level access).*

If any fields are invalid they are highlighted in red. In the example on the previous page, the password is missing for user ID 1001. Greyed out fields indicate they cannot be updated.

Once the table is complete, select **Close**, **Save** or **Save as** from the **File** menu to save the file to disk.

Note: *The table can only be saved if there are no invalid fields (highlighted in red).*

Once a table has been saved to disk, it can be edited using the **Open** option from the **File** menu, to open an existing table.

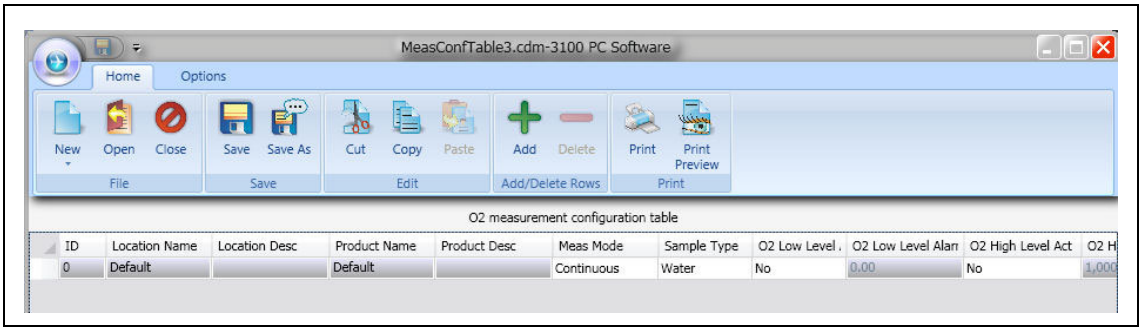
The table can also be printed using the **Print** option in the **File** menu.

3.9.2 Create new measurement configuration table

From the application's **File** menu, select **New** and then **O2 Instrument** to create a new measurement configuration table.

Note: *The other two options,* ***CO2 Instrument*** *and* ***Dual Channel Instrument*** *are for future use.*

A default entry is created automatically, with an ID of "0", a Location Name and Product Name of "Default". None of these fields can be changed.



Use the same functionality as described for the user table, to add entries to the table. The following information is required:

- Entry ID - 5 character numeric
- Location Name - 8 character alphanumeric
- Location Description - 32 character alphanumeric
- Product Name - 8 character alphanumeric
- Product Description - 32 character alphanumeric
- Measurement Mode - Continuous or Sample
- Sample Type - Select from a drop-down list of valid entries
- O2 Low Level Activation - Yes or No
- O2 Low Level Alarm - If activation set to yes, enter the low level value to trigger the alarm
- O2 High Level Activation - Yes or No
- O2 High Level Alarm - If activation set to yes, enter the high level value to trigger the alarm
- O2 Gas Unit Type - Select from a drop-down list of valid entries
- O2 Gas Unit - Select the display unit from a drop-down list of valid entries
- O2 Calibration Offset - Enter a calibration offset value if required

Once the table is complete, select **Close**, **Save** or **Save as** from the **File** menu to save the file to disk.

Once a table has been saved to disk, it can be edited using the **Open** option from the **File** menu, to open an existing table.

The table can also be printed using the **Print** option in the **File** menu.

3.9.3 Transfer files to the instrument

When the two tables have been populated, they can be transferred to the instrument using a USB storage device (typically a USB key).

1. From the PC copy the files to the USB storage device in a top-level directory of **3100**. The files will typically be located in:

   C:\Program Files\Hach Lange\3100 PC Software with file extensions of **.cdm** (for measurement configurations) and **.ndu** (for user tables).

Note: *It is important that the file name extensions (**.cdm and .ndu**) are not changed as they will not be recognized by the instrument software. Similarly, the files must be located in a top-level directory of **3100**.*

2. With the instrument switched ON, insert the USB storage device into the USB connection on the left side of the instrument, and press the USB icon on the instrument front panel.
3. The first screen is for exporting files from the instrument to a USB storage device, so press the right arrow to move to the next screen.
4. The next screen is the **Import User Table** screen. The user table will be recognized by the instrument and the file name displayed in the highlighted box. If more than one user table is on the USB storage device, press the **Enter** key to view a list of all the user tables, and use the up/down arrows to scroll through the list. Press the **Enter** key to select.

   When a table has been selected, press the down arrow key until the **Import File** text is highlighted and press the **Enter** key to import the file. On completion, a message will appear saying the instrument will have to be turned off and on again for the new table to take effect, but as the measurement configuration table is still to be imported this message can be ignored at this stage.
5. Press the right arrow to move to the **Import Measurement Configurations** screen. As with the user table, select the measurement configuration table to import and press the down arrow key until the **Import File** text is highlighted. Press the **Enter** key to import the file. Again, on completion, a message will appear saying the instrument will have to be turned off and on again for the new table to take effect.
6. As both tables have now been transferred to the instrument, turn the instrument OFF and then back ON again for the new tables to take effect. When switched ON the two default table entries will be loaded (i.e. default user and default measurement configuration). These can be changed by following the instructions in User lists on page 24 and Measurement configuration list on page 28.

3.10 Instrument storage

3.10.1 General guidelines

When not in use, ensure the instrument is turned OFF by pressing the ON/OFF switch until the green indicator light is extinguished. Refer to Figure 4 on page 14.

NOTICE

If the instrument is to be stored in an environment where the temperature is likely to be 0°C (32°F) or below, then to avoid any damage to the instrument make sure there is no liquid inside. Do this by first running warm water through the instrument and dry by flowing dry air or N2 through it. Then turn the sample flow valve to the OFF position. Refer to Figure 5 on page 14.

3.10.2 Short term storage

For short term storage (between measurements or up to a maximum of 6 hours), leave the sample in the instrument by turning the sample flow valve to the OFF position. Refer to Figure 5 on page 14.

3.10.3 Overnight or weekend storage

When storing the instrument overnight or over a weekend, run clean water through the instrument to prevent passageways from becoming clogged and then turn the sample flow valve to the OFF position. Refer to Figure 5 on page 14. Wipe down the outside of the instrument with a clean damp cloth.

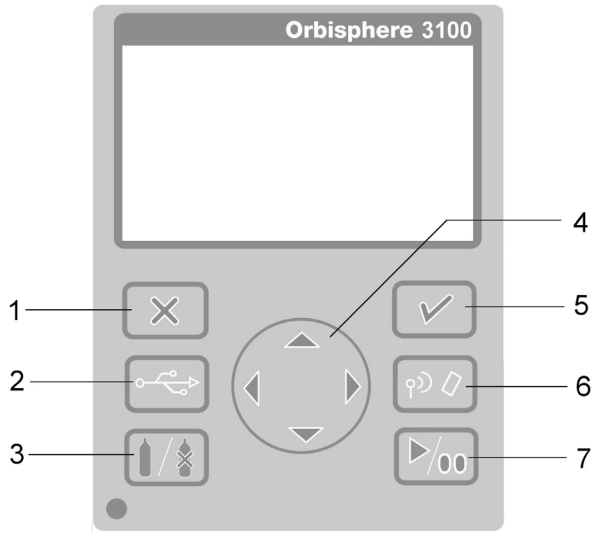
3.10.4 Long term storage

For long term storage (more than 1 week), run warm water through the instrument followed by 20 mL of ethanol (EtOH). Dry by flowing dry air or N_2 through the instrument, and then turn the sample flow valve to the OFF position. Refer to Figure 5 on page 14. Wipe down the outside of the instrument with a clean damp cloth. It is recommended to fully charge the battery prior to any long term storage.

Note: *If the instrument has been in storage for more than 4 weeks, remember to fully recharge the battery pack before use.*

Section 4 User Interface

4.1 Keypad and function keys



1. Cancel key	**4.** Arrow keys
2. USB key	**5.** Enter key
3. Sample or continuous mode key	**6.** RFID key
	7. Measurement key

The user interface of the instrument consists of a display screen, 6 function keys and a set of 4 arrow keys in the center. A green light at the bottom left of the keypad indicates if the instrument is ON. No light indicates the instrument is OFF. The keypad is touch sensitive and will respond to each key being pressed. As the key is touched a blue light will be appear underneath to indicate selection of that key. If a key is selected that is not available or has no meaning during the current operation, then the key will be displayed above the measurement value with a line drawn through it.

Note: *The keypad can be locked and unlocked pressing the keys* ***RFID****,* ***USB*** *and* ***RFID*** *in sequence.*

The keys have the following functions:

	• Cancel data input. • Exit from a menu and display the measurement screen. ***Note:*** *This key will be referred to as the* ***Cancel*** *key in this manual.*
	• Display the main menu. • Select an option. • Validate the input and go on to the next step. ***Note:*** *This key will be referred to as the* ***Enter*** *key in this manual.*
	• Import data from a USB mass storage device. • Export data to a USB mass storage device.
	• Card identification system (not yet available). • When pressed twice in quick succession a screenshot will be taken (maximum of 10) that can be transferred to a USB key using the **Import / Export** option from the **Main Menu** (refer to Import / Export on page 35).
	• Define if measurements are in sample or continuous mode. Continuous mode displays the bottle symbol with a cross through it in the top right of the measurement screen. Sample mode displays the bottle symbol without the cross.
	• When in sample mode use this icon to Start/Stop measurements. When started the bottle symbol is shown in green. When stopped the symbol is greyed out and a “**Measurement stopped**” message displayed.
	• Up arrow - Scroll up through a list or menu. • Down arrow - Scroll down through a list or menu. • Left arrow - Go back to the previous screen (or data element) in sequence. • Right arrow - Go to the next screen (or data element) in a sequence.

4.2 Data entry

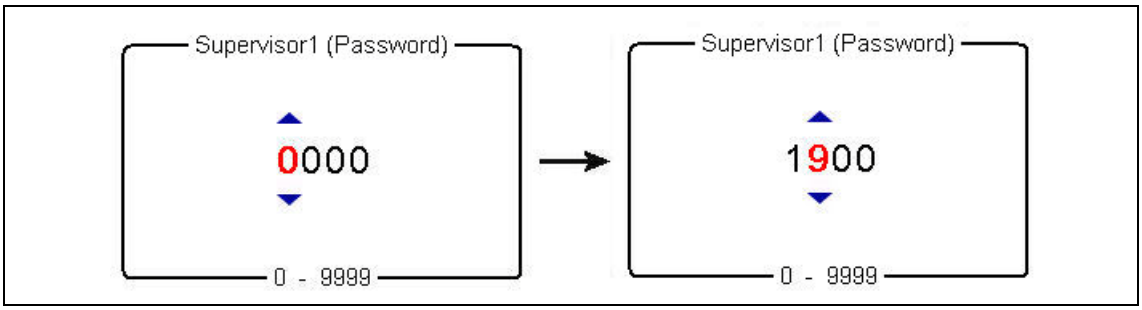
4.2.1 Select data

To select a data item from a list, use the up and down arrow keys to highlight the required value, followed by the **Enter** key to select it.

4.2.2 Enter data

When required to enter data (e.g. a password in the following example), a screen will be displayed showing the field default value (0000) and the valid range (0 - 9999) below it.

The first character will be highlighted in red with arrows above and below. Press the up and down arrow keys to increase or decrease the value. When the correct value is showing, press the right arrow key to move to the next character and enter that value until all characters have been entered.



On completion, press the **Enter** key to validate the field. If the field is invalid an appropriate message will be displayed.

The **Cancel** key can be pressed at any time during data entry to abort the process.

4.3 User access

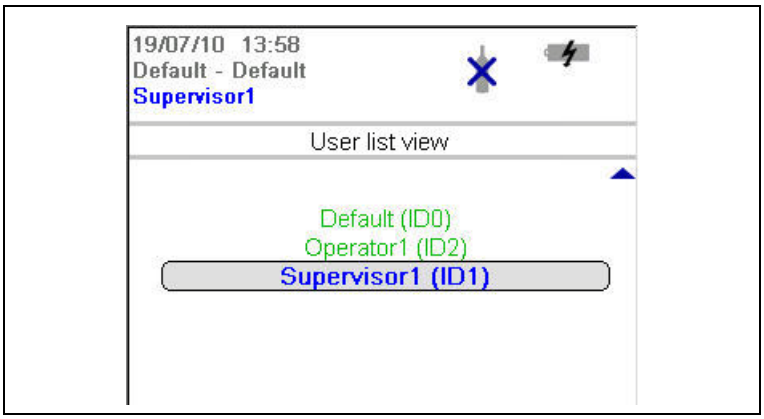
Two access levels are available:

- User - basic measurement functions
- Supervisor - password protected with access to additional views and the Main Menu

4.3.1 User lists

From the measurement screen, press the right arrow key until the list of users stored in the instrument is displayed. Standard users will be displayed in green and supervisors in blue.

Note: *These user lists are defined by the user on the PC (refer to Create new user table on page 19) and imported into the instrument (refer to Transfer files to the instrument on page 21).*



Press the up and down arrow keys to scroll through the list of users. When the required one is highlighted press the **Enter** key to select it. If a supervisor level user is selected a password will be required (by default **Supervisor1** is **5678**). On completion, the display returns to the measurement screen.

4.4 Measurement

4.4.1 Measurement mode

Two measurement modes are available:

- Continuous mode
- Sample mode

Continuous mode is typically used for process measurement, whereas sample mode is aimed at laboratory measurements of small volume individual samples such as cans, bottles, etc.

Continuous mode cycle

- Measurements are taken and refreshed on the display every 5 seconds
- The measurement data is stored in the measurement file at the user defined storage interval (defined in Advanced settings on page 32)

Sample mode cycle

- Measurements are taken and refreshed on the display every 5 seconds once the **Start/Stop** measurements button is pressed
- Measurements are stopped if:
  - The timeout is exceeded (2 minutes)
  - The **Start/Stop** measurements button is pressed
  - The measurement is stable
- When the measurement process is stopped, the screen displays the final measurement value alternating with a **Measurement stopped** message. The final measurement value is then stored in the measurement file

4.4.2 Measurement file

The measurement file is configured from the Main Menu (refer to Advanced settings on page 32). Supervisor access is required for this.

Two storage modes are available:

- Rolling buffer - When the file is full, the latest measurement set replaces the oldest one continuously (first-in, first-out)
- Store once - When the file is full (5,760 positions), the recording of measurement stops

4.4.3 Standard measurement display

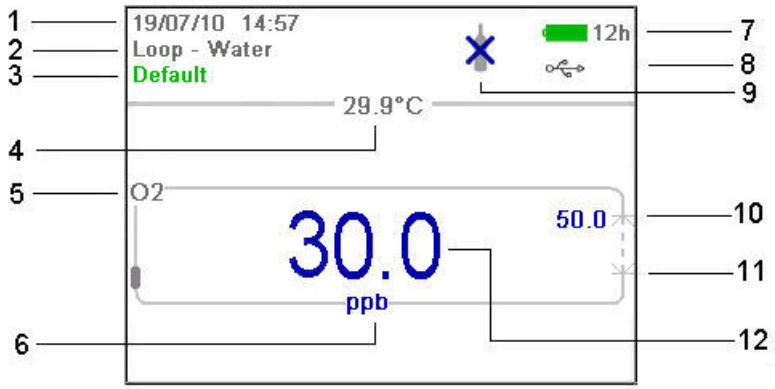


Figure 6 Measurement display

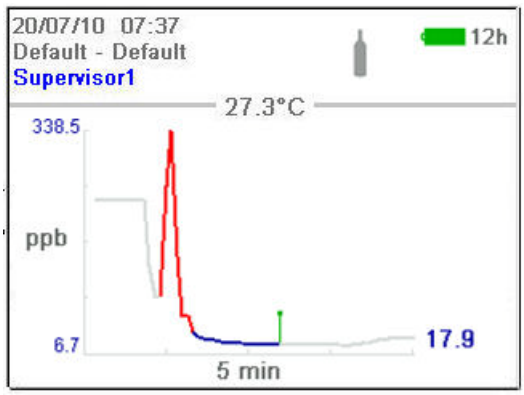
1. Instrument date and time	**7.** Battery life remaining
2. Measurement location and product name	**8.** USB symbol indicates USB key attached
3. User name	**9.** Measurement mode (continuous shown)
4. Sample temperature	**10.** High level alarm value (if set)
5. Measured gas	**11.** Low level alarm value (if set)
6. Measurement unit	**12.** Measurement value

Note also:

- The user name will be displayed in green for a standard user, or blue for a supervisor
- The battery life remaining will not be displayed if using mains power supply, instead the icon will show the battery recharging symbol:
- The measurement value is normally displayed in blue, but will be displayed in red if it is outside the high or low value alarm limits
- If measurement is in sample mode, the bottle icon is displayed at the top right of the screen. If measurement mode is set to continuous, the bottle icon will be displayed with a cross through it
- The measurement display is refreshed every 5 seconds

4.4.4 Graphical measurement display

To access this display from the standard measurement display screen, press the right arrow key on the keypad until the graphic screen is displayed:



This screen gives a graphical representation of the measurement with the numeric value of the measurement displayed at the end of the curve. The above example shows the measurement in sample mode.

The numeric measurement value at the end of the curve is refreshed every 5 seconds. The curve is refreshed every 5 seconds in sample mode. In continuous mode, the refreshment rate is the same as that defined as the storage interval parameter (see Advanced settings on page 32).

The graphic timescale is displayed at the bottom of the screen. This value can be increased or decreased (4 zoom levels) by pressing the up and down arrows on the keyboard. These values are also dependant on the storage interval parameter; the greater the storage interval, the greater the available timescales.

The measurement scale is calculated automatically with the maximum and minimum values displayed at the top and bottom of the y axis respectively.

In sample mode, a symbol is displayed to denote the end of the measurement (illustrated right). This is displayed in green if the stop criteria are met, or red to denote an erroneous measurement.

The color of the curve has the following meaning:

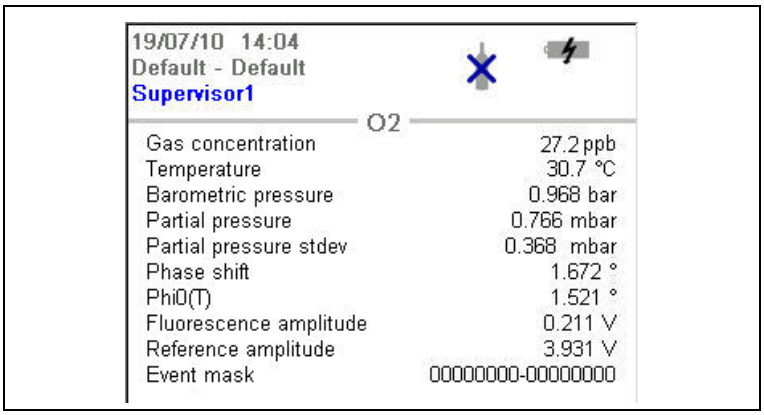
- Grey (normal): The channel is out or the measurement is out of range
- Green (bold): The channel is being calibrated
- Grey (bold): The measurement has not started (sample mode only)
- Red (bold): An alarm has been activated
- Blue (bold): Normal measurement

The graphical display is cleared and restarted after the following events:

- At instrument startup
- After a change to the storage mode (refer to Advanced settings on page 32)
- After a change to the measurement mode (sample or continuous)
- After a change to the current measurement configuration

4.4.5 Diagnostic measurement display

The diagnostic measurement display is only accessible if the user is logged on at supervisor level. To access this display from the standard measurement display screen, press the right arrow key on the keypad until the following screen is displayed:



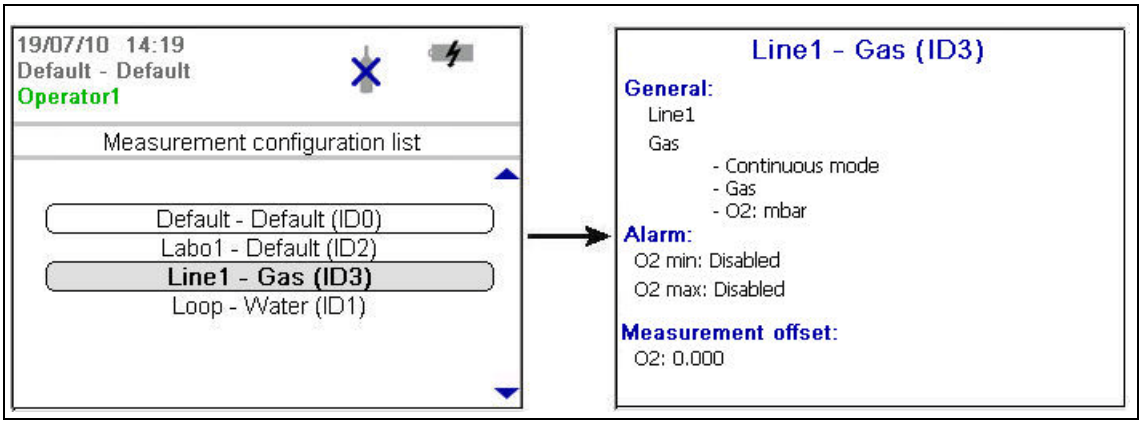
The information displayed can be useful for troubleshooting purposes.

Note: *There are two event masks at the bottom right of the screen. The first is the common event mask and the second is the oxygen channel event mask. For details of their meanings refer to the tables in* *List of events on page 41*.

4.4.6 Measurement configuration list

From the measurement screen, press the right arrow key until the list of measurement configurations stored in the instrument (below left) is displayed.

Note: *These configurations are defined by the user on the PC (refer to Create new measurement configuration table on page 20) and imported into the instrument (refer to Transfer files to the instrument on page 21). Only the default configuration (**ID0**) can be edited by the user from the instrument. To do this the user must be logged on at supervisor level and the default parameters can then be edited from the Main Menu as described in Default measurement configuration settings on page 34.*

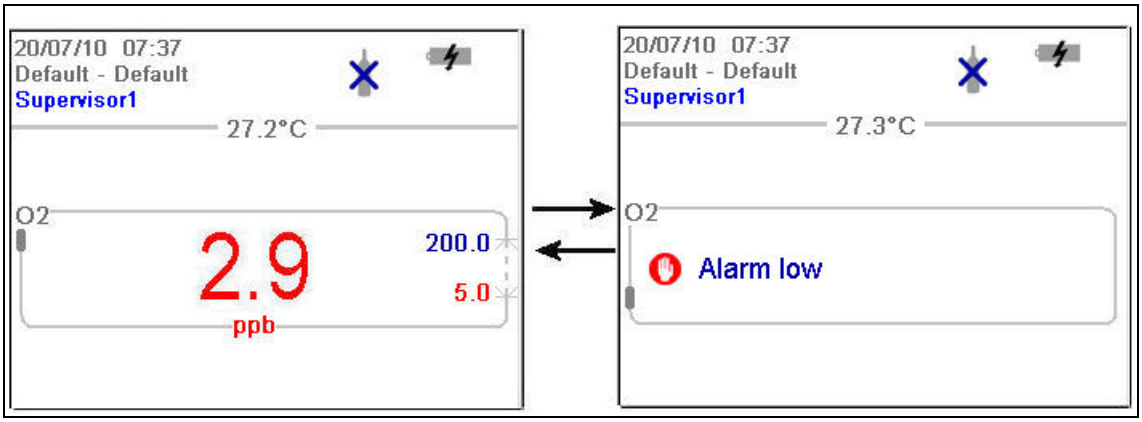


Press the up and down arrow keys to scroll through the list of measurement configurations. When the required one is highlighted press the **Enter** key to select it. The selected configuration details will be displayed on screen (above right).

Press the **Enter** key again to select this configuration and return to the measurement screen, or **Cancel** to reject it and return to the measurement configuration list screen.

4.4.7 Measurement alarms

If a problem occurs during measurement, the system will alternate every second between the measurement screen (shown left below) and the error message screen (shown right below).



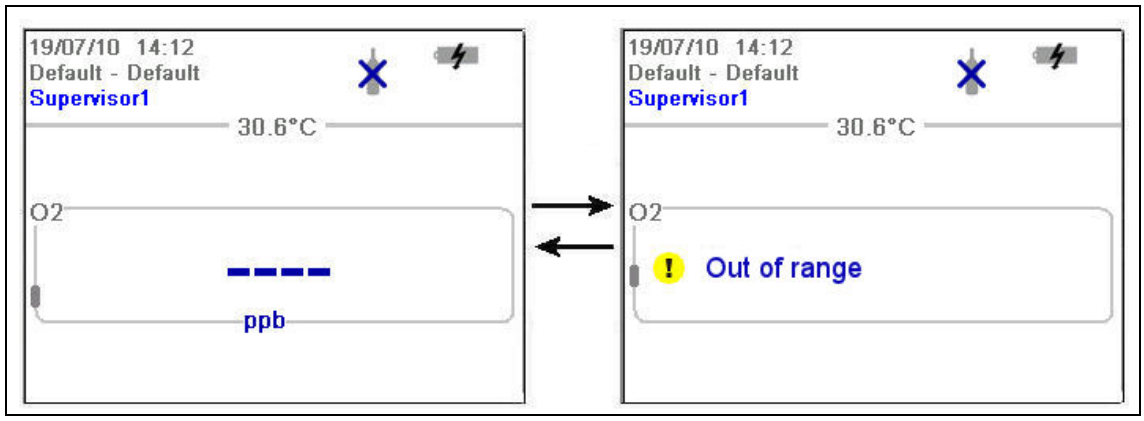
In the example illustrated above, the measurement value is displayed in red to indicate a measurement outside the pre-defined alarm limits. The alarm low value on the right side of that screen is also displayed in red to indicate the reason the measurement value is in error.

The error message screen gives the reason why the measurement is invalid (i.e. Alarm low in the example above).

Note: *If the measured value goes back above this low value, the value is again displayed in blue and the error message screen is no longer shown.*

4.4.8 Out of range display

The sensor measures dissolved oxygen up to a maximum value of 2 ppm. Should the measured concentration go above this value, then the screens illustrated below will be displayed.



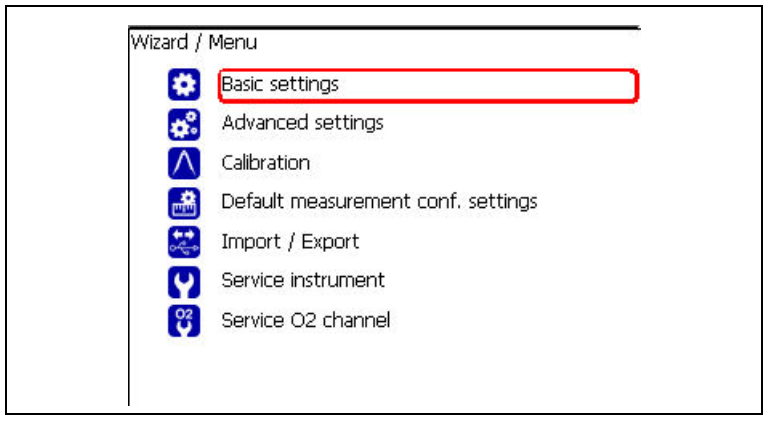
The measurement value will be displayed as hyphens and will alternate with an “Out of range” message.

If the measurement is still out of range after 5 minutes of continuous measurements, the measurement cycle will increase from 5 to 60 seconds.

Once the value falls below the out of range limit, then the measurement cycle returns to a 5 second interval and the measured value is displayed.

4.5 Main menu

The main menu is only accessible if the user is logged on at supervisor level and is accessed using the **Enter** key from the standard or diagnostic measurement display.



The main menu options are described in detail in Main Menu on page 31 of this manual. There are 7 main options:

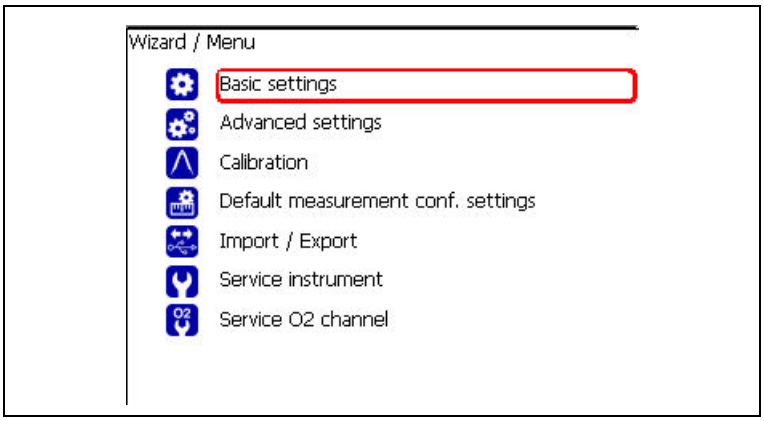
1. Basic settings
   - Language selection
   - Date and time adjustment
   - Backlight management
   - Units management
2. Advanced settings
   - File measurement management
   - Communication
   - Miscellaneous
3. Calibration
   - Barometer calibration
   - O2 zero calibration
   - O2 high level adjustment
4. Default measurement configuration settings
   - Instrument settings
   - O2 channel settings
   - O2 advanced settings
5. Import / Export
   - Export files
   - Import user table
   - Import measurement configuration table
   - Import solubility parameters
   - Import instrument basic settings
6. Service instrument
   - Board information
   - Temperature checking
   - Sample temperature calibration
   - Miscellaneous
7. Service O2 channel
   - O2: Calibration parameters
   - O2: DC measurement parameters
   - O2: AC diagnostic parameters
   - O2: Calibration timer

Section 5 Main Menu

5.1 Overview

The main menu is only available to users logged on at supervisor level.

To access the main menu from the measurement screen, press the **Enter** key on the main keypad to display the following options:



Scroll through the menu using the up and down arrow keys. When the required option is highlighted, press the **Enter** key to select it and display the sub option screens. If, as in the example above, the Basic Settings option is selected, the first of the sub-option screens is displayed as illustrated below:

This screen allows you to select the working language of the instrument.

Choose the field to update from those available using the up and down arrows and then press the **Enter** key to select it.

The arrows at the bottom of the screen indicate that you can use the left and right arrows to scroll through the sub-options available from the Basic Settings menu option.

The chevrons at the top of the screen indicate how many sub-options are available. The one currently selected is highlighted in blue. In the above example, this indicates that this is screen 1 in a series of 4 available.

5.2 Basic settings

Language Selection	
Language	Select the working language for the instrument from the list available
Date and Time Adjustment	
Date format	Define the display format for the date (DD/MM/YY or MM/DD/YY)
Date	Enter the day, the month and the year in the format defined above
Time format	Enter the display format for the time using a 12 or 24 hour clock
Time	Enter the hour and minutes in the format defined above
Backlight Management	
Backlight level	Enter the scale of brightness (max, comfortable, standard, economy or min)
Units Management	
Pressure unit	Choose the barometric pressure unit from the list available
Temperature unit	Choose the temperature unit from the list available

5.3 Advanced settings

File Measurement Management	
Storage mode	Choose from a rolling buffer or store once: • Rolling buffer: When the file is full, the latest measurement set replaces the oldest one continuously (first-in, first-out) • Store once: When the file is full (5,760 positions), the recording of measurement stops
Storage interval	Define the interval for storing measurements from the list available. The interval is in seconds with the number of hours of measurements available shown in brackets e.g. 10s (16h) indicates measurements are stored every 10 seconds, which will give 16 hours of continuous storage. ***Note:*** *This parameter also defines the refreshment rate for the graphic measurement display.*
Clear data	Select this option to erase the measurement storage file
Communication	
RS232	Check the box if the RS232 link is required
Baud rate	Select the baud rate from the list available
Miscellaneous	
This option allows the default measurement configuration parameters to be restored	

5.4 Calibration

5.4.1 Barometric sensor calibration

Barometer Calibration
The upper box shows the current barometric pressure as measured by the instrument. Using a precision certified barometer, measure the barometric pressure in the location where the instrument is used. If the values differ, enter the correct value in the box provided and select **Validate calibration**

5.4.2 Gas sensor calibration

There are two calibration modes available

- Zero calibration
- High level adjustment

The zero calibration method is the best method to guarantee the sensor specifications.

To get more accurate measurements for samples with higher oxygen concentrations (above 1% oxygen which corresponds to about 400 ppb dissolved O_2) a high level adjustment can be performed using a gas mixture containing 2% oxygen. However, this should not be done without first ensuring the zero point is accurate (i.e. by performing a zero calibration first).

Zero calibration

O_2 zero calibration	
1.	Rinse flow path with 20 mL of ethanol (EtOH) using the syringe and connectors supplied in the tool kit
2.	Connect a cylinder of oxygen free gas (minimum 99.999% purity) to the instrument and adjust the flow to approximately 100 mL/min
3.	Let the oxygen free gas run through the instrument for 5 minutes
4.	Press the **Enter** key to start the calibration
5.	Wait until the **Signal in range** and **Stability reached** fields display **Yes** which indicates the calibration is within acceptable limits. The **Calibration possible** field should also display **Yes** at this point. Press the **Enter** key to complete the calibration
6.	Accept (**OK**) or reject (**Cancel**) the new calibration data

High level adjustment

There are three possible modes for high level adjustments:

- Using a reference gas mixture (gas cylinder)
- Using a known oxygen sample (reference sample)
- Enter a factory parameter provided by Hach (this option is **only** required when the sensor spot has been replaced)

If the calibration mode displayed is not the required mode, then press the **Enter** key and select the required mode from the three options available in the drop-down list:

- Factory parameter
- Reference sample
- Ref. gas bottle

O2 high level adjustment - Factory parameter	
1.	In the **Calibration mode** window select **Factory parameter**
2.	Scroll down to the **Reference value** window and enter the factory parameter as found on the package of the LDO spot (model number DG33218)
3.	Scroll down to the **Start Calibration** window and press the **Enter** key to start the calibration
4.	Accept (**OK**) or reject (**Cancel**) the new calibration data

O2 high level adjustment - Reference sample
1. Run the reference sample through the instrument and adjust the flow to approximately 150 mL/min.
2. In the **Calibration mode** window select **Reference sample**
3. Scroll down to the **Reference value** window and enter the oxygen value of the sample
4. Let the sample run through the instrument for 5 minutes to stabilize the measurement
5. Scroll down to the **Start Calibration** window and press the **Enter** key to start the calibration
6. Wait until the **Signal in range** and **Stability reached** fields display **Yes** which indicates the calibration is within acceptable limits. The **Calibration possible** field should also display **Yes** at this point. Press the **Enter** key to complete the calibration
7. Accept (**OK**) or reject (**Cancel**) the new calibration data

O2 high level adjustment - Ref. gas bottle
1. Rinse flow path with 20 mL of ethanol (EtOH) using the syringe and connectors supplied in the tool kit
2. In the **Calibration mode** window select **Ref. gas bottle**
3. Scroll down to the **Reference value** window and enter the oxygen value of the reference gas in %Vbar
4. Connect the gas sample to the instrument and adjust the flow to approximately 100 mL/min.
5. Let the gas mixture run through the instrument for 5 minutes to stabilize the measurement
6. Scroll down to the **Start Calibration** window and press the **Enter** key to start the calibration
7. Wait until the **Signal in range** and **Stability reached** fields display **Yes** which indicates the calibration is within acceptable limits. The **Calibration possible** field should also display **Yes** at this point. Press the **Enter** key to complete the calibration
8. Accept (**OK**) or reject (**Cancel**) the new calibration data

5.5 Default measurement configuration settings

Instrument Settings	
Instrument mode	Select between continuous or sample mode. Continuous mode is typically used for process measurement, whereas sample mode is aimed at lab measurements of small volume individual samples such as cans, bottles, etc.
Sample type	Select the sample type from the list available
O2 Channel Settings	
O2 gas unit type	Select the gas unit type from the list available
O2 gas unit	Select the display unit from the list available
O2 high alarm	Check the box to set the measurement high alarm. If set, enter the high level value to trigger the alarm. When measurements exceed this value an alarm will be triggered
O2 low alarm	Check the box to set the measurement low alarm. If set, enter the low level value to trigger the alarm. When measurements fall below this value an alarm will be triggered
O2 Advanced Settings	
O2 measurement offset	If required, enter a value (positive or negative) for the measurement offset. This value will be used to adjust the measurement accordingly

5.5.1 Measurement configuration factory settings

The following table shows the factory defined oxygen measurement configuration settings for the instrument:

Instrument Settings	
Instrument mode	Continuous mode.
Sample type	Beer
Gas unit type	Dissolved
Gas unit	ppb
High alarm	Disabled
Low alarm	Disabled
O2 measurement offset	0.0 ppb

5.6 Import / Export

Export Files
This option allows you to export a number of different files (refer to Exported files on page 36 for details) to a USB mass storage device. Once written to the USB device, it can then be used to load these files to other 3100 instruments or to a PC. Make sure a USB device is connected and then press the **Enter** key to start the process. A progress bar is displayed at the bottom of the screen. Wait until the export complete message is displayed on screen before removing the USB device.
Import User Table
This option allows you to import user tables from a USB mass storage device. These tables could be exported from other 3100 instruments or from the 3100 software application installed on your PC. The tables are recognized by having an extension of **.ndu**. If more than one table is found on the device, you will need to select the table you want from the list. Press the down arrow key to highlight the **Import File** option and press the **Enter** key to start the process. You will need to restart the instrument before the new table takes effect.
Import Measurement Configuration Table
This option allows you to import measurement configuration tables from a USB mass storage device. These tables could be exported from other 3100 instruments or from the 3100 software application installed on your PC. The tables are recognized by having an extension of **.cdm**. If more than one table is found on the device, you will need to select the table you want from the list. Press the down arrow key to highlight the **Import File** option and press the **Enter** key to start the process. You will need to restart the instrument before the new table takes effect.
Import Solubility Parameters
This option allows you to import solubility parameters from a USB mass storage device. The tables are recognized by having an extension of **.sol**. If more than one file is found on the device, you will need to select the file you want from the list. Press the down arrow key to highlight the **Import File** option and press the **Enter** key to start the process. You will need to restart the instrument before the new table takes effect.
Import Instrument Basic Settings
This option allows you to import instrument user settings from a USB mass storage device. The tables are recognized by having an extension of **.ius**. If more than one file is found on the device, you will need to select the file you want from the list. Press the down arrow key to highlight the **Import File** option and press the **Enter** key to start the process. You will need to restart the instrument before the new table takes effect.

Note: *To import files into the instrument from a USB mass storage device, they **must** be under a top-level directory of **3100** for them to be recognized.*

5.6.1 Exported files

The following files will be automatically exported from the instrument to the USB mass storage device under a top-level directory of **3100**:

- All measurement configuration tables (*.cdm)
- All user tables (*.ndu)
- All solubility tables (*.sol)
- All user settings tables (*.ius)
- Instrument configuration details (InstrumentConf.txt)
- Measurement details (Measurements.txt)
- Instrument model details (Model.txt)
- A number of internal files (*.dat)

The following files can be found under sub-directories **CalibrationReports** and **Screenshots**.

- Calibration reports (O2CalibrationReport*.txt)
- Screenshots (View*.bmp)

The text files (*.txt extension) are in a readable format for your PC. Most document editors can be used to open these files, as well as spreadsheet and other reporting tools. The measurement configuration tables and user tables can be modified using the PC software (refer to PC software installation on page 18).

Note: *There are a maximum of 10 oxygen sensor calibration reports, 10 barometric sensor calibration reports and 10 screenshots. The illustration below shows measurement data imported into Microsoft Excel.*

Microsoft Excel - Measurements.txt

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Date	Time	User ID	User name	Meas. conf. ID	Product location	Product name	Liquid name	Temperature	Temp. unit	Barom. pressure	Barom. pressure unit	Common event	Channel type	Concentration	Conc.
2	26-05-10	13:42:18	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	40.9	ppb
3	26-05-10	13:42:23	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	68.6	ppb
4	26-05-10	13:42:28	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	57.9	ppb
5	26-05-10	13:42:33	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	62.3	ppb
6	26-05-10	13:42:38	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	35.5	ppb
7	26-05-10	13:42:43	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	71.9	ppb
8	26-05-10	13:42:48	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	52.9	ppb
9	26-05-10	13:42:52	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	57.6	ppb
10	26-05-10	13:42:57	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.949	bar	0	O2	84.4	ppb
11	26-05-10	13:43:02	1	John	0	Pipe 1	Brew 6	Beer	27.77	°C	0.95	bar	0	O2	62.5	ppb
12	26-05-10	13:43:07	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	72.5	ppb
13	26-05-10	13:43:12	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	77.9	ppb
14	26-05-10	13:43:17	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	33.3	ppb
15	26-05-10	13:43:22	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	73.1	ppb
16	26-05-10	13:43:27	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	48.7	ppb
17	26-05-10	13:43:32	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	72.6	ppb
18	26-05-10	13:43:37	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	53.2	ppb
19	26-05-10	13:43:42	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.95	bar	0	O2	39.1	ppb
20	26-05-10	13:43:47	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	74.4	ppb
21	26-05-10	13:43:52	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	71.9	ppb
22	26-05-10	13:43:57	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	66.1	ppb
23	26-05-10	13:44:02	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	56.4	ppb
24	26-05-10	13:44:07	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	41.6	ppb
25	26-05-10	13:44:12	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	53.2	ppb
26	26-05-10	13:44:17	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	50.6	ppb
27	26-05-10	13:44:22	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	68	ppb
28	26-05-10	13:44:27	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	63.4	ppb
29	26-05-10	13:44:32	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	55.9	ppb
30	26-05-10	13:44:37	1	John	0	Pipe 1	Brew 6	Beer	27.78	°C	0.949	bar	0	O2	50.8	ppb
31	26-05-10	13:44:42	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	23.9	ppb
32	26-05-10	13:44:47	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	38.4	ppb
33	26-05-10	13:44:52	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	51.4	ppb
34	26-05-10	13:44:57	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	39.4	ppb
35	26-05-10	13:45:02	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	46.6	ppb
36	26-05-10	13:45:07	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	61.1	ppb
37	26-05-10	13:45:12	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	62.4	ppb
38	26-05-10	13:45:17	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	59.5	ppb
39	26-05-10	13:45:22	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	49.2	ppb
40	26-05-10	13:45:27	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	56.4	ppb
41	26-05-10	13:45:32	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	64.5	ppb
42	26-05-10	13:45:37	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	51.9	ppb
43	26-05-10	13:45:42	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	75.8	ppb
44	26-05-10	13:45:47	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	57.8	ppb
45	26-05-10	13:45:52	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	79.7	ppb
46	26-05-10	13:45:57	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	59.5	ppb
47	26-05-10	13:46:02	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.95	bar	0	O2	51.1	ppb
48	26-05-10	13:46:07	1	John	0	Pipe 1	Brew 6	Beer	27.8	°C	0.949	bar	0	O2	61.9	ppb
49	26-05-10	13:46:12	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	44.9	ppb
50	26-05-10	13:46:17	1	John	0	Pipe 1	Brew 6	Beer	27.79	°C	0.949	bar	0	O2	67.7	ppb

Figure 7 Sample measurement file imported into Microsoft Excel

5.7 Service instrument

Board Information	
This option is useful for troubleshooting purposes and displays information about the mother board, measurement board and battery	
Temperature Checking	
This option is useful for troubleshooting purposes and displays the temperature readings of the measurement board, pigtail, battery pack and sample	
Sample Temperature Calibration	
You will need a sensor simulator for this option. Follow the on-screen instructions to calibrate the sample temperature	
Miscellaneous	
Enable raw data logger	Check the box to enable the capture of raw data which is useful for troubleshooting purposes
Activate service timer	Check the box to activate the service timer option. When activated, the instrument will automatically remind the user when the next sensor service is due. Enter the **Nb of days between services** in the box provided. This defines the due date of the next sensor service. If activated, select the **Reset service timer** option each time the instrument has been serviced. This automatically sets the **Last service date** parameter to the current date.
The total uptime of the instrument is displayed at the bottom of the screen.	

5.8 Service O_2 channel

O2: Calibration Parameters	
This option is useful for troubleshooting purposes and will display a number of values associated with the measurement channel	
O2: DC Measurement Parameters	
This option is useful for troubleshooting purposes and will display the values of the fluorescent and reference LED current	
O2: AC Diagnostic Parameters	
This option is useful for troubleshooting purposes and will display the values of the fluorescent and reference amplitude and phase, plus the phase shift value	
O2: Calibration Timer	
Activate calibration timer	Check the box to activate the calibration timer option. When activated, the instrument will automatically remind the user when the next sensor calibration is due. The **Last calibration date** parameter is shown for information. This is automatically updated each time a calibration is performed on the sensor. Enter the **Nb of days between calibrations** in the box provided. This defines the due date of the next sensor calibration.

Section 6 Maintenance and Troubleshooting

6.1 Maintenance

6.1.1 Maintenance schedule

This following table shows the recommended maintenance schedule for the ORBISPHERE 3100 instrument. This proposed schedule should be modified according to operating conditions.

Interval	Item
Daily	Clean outside of the instrument with a damp cloth and run clean water through the instrument to clean the internal passageways
Weekly	Clean outside of the instrument with a damp cloth and run 20 mL of ethanol (EtOH) through the instrument to clean the internal passageways
Monthly	Run warm water through the instrument followed by 20 mL of ethanol (EtOH). Dry by flowing dry air or N_2 through the instrument
Yearly	Calibrate the oxygen sensor
Every 4 years	Replace the oxygen sensor spot and perform a sensor calibration

6.1.2 Instrument batteries

The instrument is designed to operate on rechargeable batteries. When battery power becomes low, the batteries can be recharged by connecting the instrument to the mains power supply using the supplied power adapter and cable. When connected, the batteries are automatically recharged.

6.1.3 Oxygen sensor

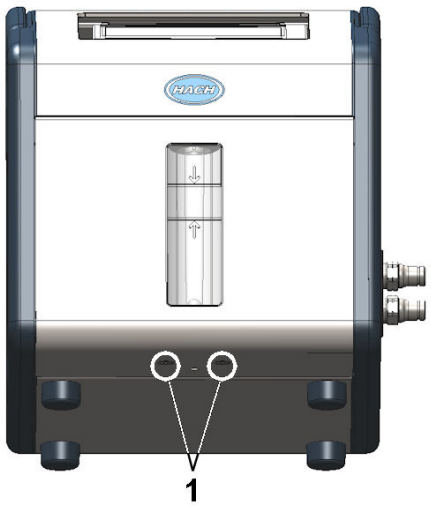
⚠ WARNING

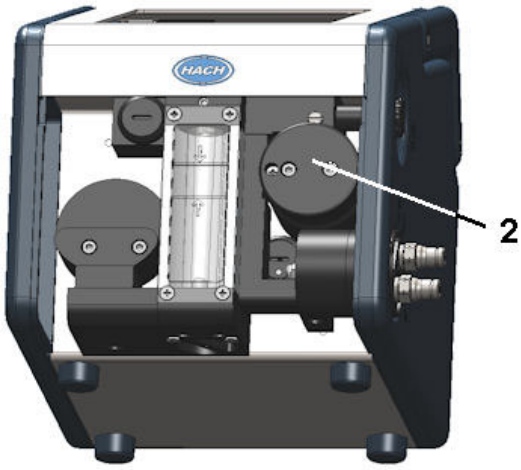
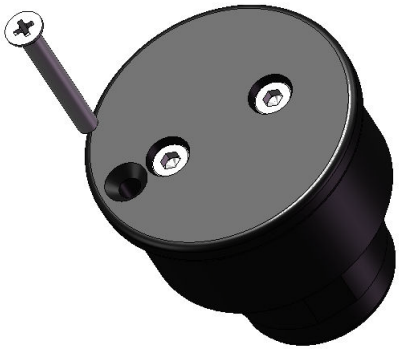
If the instrument is being powered by mains power, disconnect the instrument from the power supply before carrying out this procedure.

Based on instrument usage of 8 hours/day and 365 days/year, the sensor spot will need to be replaced about once every 4 years. The procedure is very simple and takes no more than a few minutes.

Before starting, ensure you have the replacement flow chamber assembly as supplied with the maintenance kit (part number DG33228). Switch the instrument OFF and make sure it is disconnected from any mains power supply.

Follow these instructions:

1. Remove the front panel from the instrument by unscrewing the 2 screws underneath the instrument (No. **1**) that secure it in place. Use the cross screwdriver supplied in the tool kit for this purpose.	

2. Once removed, the flow chamber assembly (No. **2**) can be seen located to the right of the flow meter.	
3. Remove the holding screw from the flow chamber assembly. **4.** Holding the assembly between thumb and forefinger, gently ease it out of the instrument and discard.	
5. Replace the assembly with the new one from the maintenance kit, Put the new assembly back in place in the instrument and secure with the holding screw. A guide rod is in place to ensure correct positioning. **6.** Replace the front guard and secure in place with the 2 screws underneath the instrument. **7.** After changing the spot, a sensor calibration **must** be performed before using the instrument for measurement purposes (refer to Calibration on page 33 for details).	

6.2 Troubleshooting

6.2.1 List of events

The following bit mask tables can be viewed on the diagnostic measurement screen (supervisor option only) as illustrated in Diagnostic measurement display on page 27. They are also included in the measurement file (Measurement.txt) an example of which is shown in Figure 7 on page 36.

Common events

Bit mask	Event
0x00000000	No event
0x00000001	Sample mode started
0x00000002	Sample mode stopped by user
0x00000004	In sample mode, O_2 stop criteria reached
0x00000010	Sample mode stopped by timeout
0x00000020	Auto test failed
0x00000040	Communication with measurement board error

Oxygen channel events

Bit mask	Event
0x00000000	No event
0x00000001	O_2 channel out
0x00000002	Calibration in progress
0x00000004	Alarm low
0x00000008	Alarm high
0x00000010	Out of range
0x00000020	Calibration required

The O_2 channel out event can occur under the following circumstances:

- Fluo amp < 0.1 V (Refer to Diagnostic measurement display on page 27)
- Ref amp < 0.1 V (Refer to Diagnostic measurement display on page 27)
- T°sample ≤ -25°C (Refer to Diagnostic measurement display on page 27)
- T°pigtail ≤ -25°C (Refer to Service instrument on page 37 - Temperature Checking option)

6.2.2 Measurement troubleshooting

Symptom	Possible solution
Display appears to be frozen - no active cursor	Check measurement mode (continuous or sample)
Display appears to be frozen out of range	When “Out of Range”, measurement interval is 60 seconds
Degassing in flow meter	Adjust flow rate to between 150 and 200 mL/min
	Verify that the filter (if using) is not blocked
Measurement spiking	Ensure all tubing is tightly and correctly connected to the sample inlet and outlet connections
	Remove any residual air bubbles from the sample line by turning the sample inlet/outlet valve to the **PURGE** position for 5 seconds
Response time too long	Use tubes supplied with 3100 instrument (low O_2 permeable material)
	Check flow rate and connections
	Prior to package sampling, purge the piercer with N_2 gas
	Perform the **monthly** cleaning procedure as described in Maintenance schedule on page 39
Channel out	Change LDO spot
	Contact Hach service
Silver bead does not move freely in the sample	Perform the **monthly** cleaning procedure as described in Maintenance schedule on page 39

6.2.3 O_2 zero calibration troubleshooting

Symptom	Possible solution
Signal not in range - calibration value very different from last calibration value	Open sample flow adjustment valve completely
	Calibration gas has too much oxygen, use quality 50 N_2 or CO_2 bottle
	Oxygen leaks between reference bottle and 3100. Can be checked by increasing gas flow rate and checking partial pressure (mbar) decrease
Stability not reached - signal not stable	Wait for stability and check N_2 gas flow rate
	Presence of liquid on LDO membrane. Check presence of liquid in flow meter and if so, dry by injecting 20 mL of EtOH then 5 minutes of N_2 gas

6.2.4 High level calibration troubleshooting

Symptom	Possible solution
Signal not in range - calibration value very different from last calibration value	Check your theoretical sample O_2 content and reference configuration
	If gas bottle calibration, completely open the sample flow adjustment valve to avoid gas overpressure in 3100, hence wrong O_2 concentration
Stability not reached - signal not stable	Wait for stability and check reference gas or liquid flow rate
	Presence of liquid on LDO membrane. Check presence of liquid in flow meter and if so, dry by injecting 20 mL of EtOH then 5 minutes of N_2 gas

Section 7 Parts and Accessories

7.1 3100 Kits

Kit N°	Description
DGK3100-MB100	Beverage kit includes: 3100 instrument (4 mm), EU power plug, and accessories
DGK3100-MB200	Beverage kit includes: 3100 instrument (4 mm), US power plug, and accessories
DGK3100-MB200K	Beverage kit includes: 3100 instrument (4 mm), Korean version, US power plug, and accessories
DGK3100-MB2040	Beverage kit includes: 3100 instrument (1/4 inch), US power plug, and accessories
DGK3100-MB204K	Beverage kit includes: 3100 instrument (1/4 inch), Korean version, US power plug, and accessories
DGK3100-MB1040	Beverage kit includes: 3100 instrument (1/4 inch), EU power plug, and accessories
DGK3100-MB1060	Beverage kit includes: 3100 instrument (6 mm), EU power plug, and accessories
DGK3100-MI100	Industrial kit includes: 3100 instrument (4 mm), EU power plug, and accessories
DGK3100-MI200	Industrial kit includes: 3100 instrument (4 mm), US power plug, and accessories
DGK3100-MI200K	Industrial kit includes: 3100 instrument (4 mm), Korean version, US power plug, and accessories
DGK3100-MI2040	Industrial kit includes: 3100 instrument (1/4 inch), US power plug, and accessories
DGK3100-MI204K	Industrial kit includes: 3100 instrument (1/4 inch), Korean version, US power plug, and accessories
DGK3100-MI1040	Industrial kit includes: 3100 instrument (1/4 inch), EU power plug, and accessories
DGK3100-MI1060	Industrial kit includes: 3100 instrument (6 mm), EU power plug, and accessories
DGK3100-MC100	Craft Brewery kit includes: 3100 instrument (4 mm), EU power plug, and accessories
DGK3100-MC1040	Craft Brewery kit includes: 3100 instrument (1/4 inch), EU power plug, and accessories
DGK3100-MC1060	Craft Brewery kit includes: 3100 instrument (6 mm), EU power plug, and accessories
DGK3100-MC200	Craft Brewery kit includes: 3100 instrument (4 mm), US power plug, and accessories
DGK3100-MC2040	Craft Brewery kit includes: 3100 instrument (1/4 inch), EU power plug, and accessories
DGK3100-MC2060	Craft Brewery kit includes: 3100 instrument (6 mm), US power plug, and accessories

⚠ WARNING

Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

7.2 Spare parts and accessories

Part N°	Description
3100-M0-000	Portable O_2 instrument 4mm
3100-M0-00K	Portable O_2 instrument 4mm, Korean version
3100-M0-040	Portable O_2 instrument 1/4 inch.
3100-M0-04K	Portable O_2 instrument 1/4 inch., Korean version
3100-M0-060	Portable O_2 instrument 6mm
3100-M0-06K	Portable O_2 instrument 6mm, Korean version
DG33216	Inlet filter for 3100 (4mm)
DG33317	Inlet filter for 3100 (6mm)
DG33318	Inlet filter for 3100 (1/4 inch)
DG33217	Meshes for particle filter (x10)
DG33218	LDO Spot for 3100
DG33219	3m of 4mm inlet tubing
DG33319	3m of 6mm inlet tubing
DG33320	3m of 1/4 inch inlet tubing
DG33222	External power supply for 3100
DG33223	Power board (battery pack) for 3100
DG33224	Connectors protection flaps
DG33225	Rubber feet for 3100 (4x)
DG33226	Front cover, 3100, flowmeter side
DG33227	Complete handle assembly kit, 3100
DG33228	Maintenance kit for 3100 (4mm)
DG33228-4	Maintenance kit for 3100 (1/4 inch)
DG33228-6	Maintenance kit for 3100 (6mm)
DG33270	Cleaning accessories for 3100 (4mm)
DG33270-4	Cleaning accessories for 3100 (1/4 inch)
DG33270-6	Cleaning accessories for 3100 (6mm)
DG33277	RS232 cable for 3100
DG33321	Adapter 4mm to 1/4 inch Swagelok
DG33322	Adapter 4mm to 6mm Swagelok
3100-MC-000	Portable O_2 instrument 4 mm - Craft Brewery
3100-MC-040	Portable O_2 instrument 1/4 inch. - Craft Brewery
3100-MC-060	Portable O_2 instrument 6 mm - Craft Brewery

HACH COMPANY World Headquarters
P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

HACH LANGE GMBH
Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info-de@hach.com
www.de.hach.com

HACH LANGE Sàrl
6, route de Compois
1222 Vésenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499