DOC024.52.93022

ORBISPHERE Model K1200 Sensor and Model 510 Analyzer

USER MANUAL

07/2023, Edition 15

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Section 1 General Information

1.1 Disclaimer

The information in this manual has been carefully checked and is believed to be accurate. However, Hach assumes no responsibility for any inaccuracies that may be contained in this manual. In no event will Hach 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 reserves the right to make improvements in this manual and the products it describes at any time, without notice or obligation.

1.2 Safety information

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

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.

1.2.1 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.

1.2.2 Safety precautions

⚠ DANGER

Always remove power from the controller before performing maintenance activities.

⚠ WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING

Potential Electrocution Hazard. Connect only safety low voltage < 33 VAC RMS.

⚠ CAUTION

Personal Injury Hazard. Only qualified personnel should conduct the tasks described in this manual.

NOTICE

Install the device in a location and position that gives easy access to the disconnect device and its operation.

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

- ***The power cord plug connection is also used as a main power switch.***
- ***The instrument must be connected to an electrical system which complies with applicable local regulations.***
- ***All the cables connected to the instrument must be fire resistant, type UL94V-1***
- ***The operator must read and understand this manual before using the instrument.***
- ***The instrument will not be used as a safety device. It does not provide a security function in a hazardous process.***

1.2.3 Service and repairs

None of the analyzer'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 analyzer in contravention of these principles could cause damage to the analyzer 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 analyzer and the electrical integrity or the CE compliance of the analyzer.

1.2.4 Precautionary labels

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

	This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and/or death. The user should reference this instruction manual for operation and/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.

1.2.5 Operating altitude

This instrument is rated for an altitude of 2000 m (6562 ft) maximum. Use of this instrument at an altitude higher than 2000 m can slightly increase the potential for the electrical insulation to break down, which can result in an electric shock hazard. The manufacturer recommends that users with concerns contact technical support.

1.2.6 Intended use of this equipment

This high accuracy ORBISPHERE instrument and sensor is designed for the measurement of dissolved oxygen in power applications using the K1200 sensor.

The high accuracy K1200 sensor is a luminescent sensor measuring dissolved oxygen, and has been optimized specifically for measurements in water processes in the power industry.

ORBISPHERE 510 analyzers are available as wall or pipe mount, and rack mount versions. This version of the instrument uses a luminescent dissolved oxygen sensor to determine dissolved oxygen concentrations in the measured sample.

NOTICE

Use of the instrument outside of the environmental conditions described in Technical data on page 13 may cause damage to the instrument but without endangering the user.

1.3 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.*

DEUTSCH

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.*

FRANCAIS

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.*

ITALIANO

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.*

DANSK

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.*

SVENSKA

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.*

ESPANOL

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.*

NEDERLANDS

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.*

POLSKI

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.*

PORTUGUES

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.*

1.4 Product disposal

Note: *The following only applies to European customers.*

Hach 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 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. Hach will then be responsible for the disposal of this equipment.

In addition, Hach 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. Hach 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, please contact your supplier or our After Sales Service department in Geneva for instructions on how to return this equipment for proper disposal.

1.5 Restriction of hazardous substances (RoHS)

Dieses Informationsblatt enthält Angaben, die ausschließlich für den Export dieses Gerätes in die Volksrepublik China erforderlich sind.

This document contains information which is only required for the export of this instrument into the People's Republic of China.

Ce document contient les informations nécessaires pour l'exportation d'instruments vers la République Populaire de Chine.

本手册包含的必要信息只适用于出口到中华人民共和国的仪器。

Type: 410/51x

Name: Controller

	有毒有害物质或元素 (Hazardous Substance)					
部件名称 (Parts)	**铅 (Pb)**	**汞 (Hg)**	**镉 (Cd)**	**六价铬 (Cr6+)**	**多溴联苯 (PBB)**	**多溴二苯醚 (PBDE)**
二极管 (Diode)	X	O	O	O	O	O
连接器 (Connector)	X	O	O	O	O	O
坚果 (Nut)	X	O	O	O	O	O

O:	表示该部件的有毒有害物质在所有均质材料中的含量均为 SJ/T11363-2006 标准规定的限量要求以下 Indicates that the concentration of the hazardous substance in all homogeneous materials in the parts is below the relevant threshold of the SJ/T11363-2006 standard.
X:	表示该部件的有毒有害物质至少在某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求 Indicates that the concentration of the hazardous substance of at least one of all homogeneous materials in the parts is above the threshold of the SJ/T11363-2006 standard.

对销售之日的所售产品，本表显示， 朗讯供应链的电子信息产品可能包含这些物质。注意：在所售产品中可能会也可能不会含有所有所列的部件

This table shows where these substances may be found in the supply chain of “Company” electronic information products, as of the date of sale of the enclosed product. Note that some of the component types listed above may or may not be a part of the enclosed product.

除非另外特别的标注，此标志为针对所涉及产品的环保使用期标志． 某些可更换的零部件会有一个不同的环保使用期（例如，电池单元模块）贴在其产品上． 此环保使用期限只适用于产品的手册中所规定的条件下工作．

The Environmentally Friendly Use Period (EFUP) for all enclosed products and their parts are per the symbol shown here, unless otherwise marked. Certain field-replaceable parts have a different EFUP (for example, battery modules) and so are marked to reflect such. The Environmentally Friendly Use Period is valid only when the product is operated under the conditions defined in the product manual.

Section 2 Specifications

Specifications are subject to change without notice.

2.1 Technical data

<table>
<tr><th colspan="3">Controller</th></tr>
<tr><td>Enclosure ratings</td><td colspan="2">IP 65
Totally protected against dust.
Protected against low pressure jets of water from all directions.

NEMA4X (wall mount only)
Totally protected against dust.
Protected against pressure jets of water from all directions.
⚠ WARNING
  Enclosure rating does not apply to external power supply for benchtop instruments.</td></tr>
<tr><td rowspan="3">Certifications</td><td>EMC requirements</td><td>EN61326-1:2006 Directive 2004/108/EEC</td></tr>
<tr><td>CE compliance</td><td>EN61010-1: 2010 Directive 2006/95/EEC</td></tr>
<tr><td>Safety rating</td><td>ETL, conforming to UL 61010-1 and
CSA 22.2 No. 61010-1</td></tr>
<tr><td>Analog current output version on the measurement board</td><td colspan="2">4-20 mA (default) or 0-20 mA (configuration with software)
3 configurable outputs
Maximum load: 500 ohm
Sensitivity: 20µA
Accuracy: ± 0.5% (between operating temperature limits)</td></tr>
<tr><td>Analog voltage output version on the measurement board</td><td colspan="2">0- 5 V output (hardware option)
3 configurable outputs
Minimum load: 10 KOhm
Sensitivity: 5 mV
Accuracy: ± 0.5% (between operating temperature limits)</td></tr>
<tr><td>Measurement alarm relays on the measurement board</td><td colspan="2">Three alarm relays
1A-30 VAC or 0.5A-50 VDC on a resistance load
Configurable to Normally Open [NO] or Normally Closed [NC] contacts by changing the jumper positions.
⚠ WARNING
  Potential Electrocution Hazard. Connect only safety low voltage < 33 VAC RMS.</td></tr>
<tr><td>System alarm relay on the main board</td><td colspan="2">One "instrument system alarm" relay per instrument
1A-30 VAC or 0.5A-50 VDC on a resistance load
Normally closed [NC] (NO relay also available) when instrument is turned on. Opens when a system alarm is detected, and when it does not receive any signal.
⚠ WARNING
  Potential Electrocution Hazard. Connect only safety low voltage < 33 VAC RMS.</td></tr>
<tr><td rowspan="4">Digital communication</td><td colspan="2">RS485</td></tr>
<tr><td colspan="2">Profibus DP (optional)</td></tr>
<tr><td colspan="2">Ethernet</td></tr>
<tr><td colspan="2">USB-host to download data with a USB memory stick</td></tr>
<tr><td rowspan="2">Data storage</td><td colspan="2">Rolling buffer or store once mode for up to 10,000 measurements</td></tr>
<tr><td colspan="2">Holds calibration records for the last 100 calibrations</td></tr>
</table>

User interface	Touch-screen panel	Displays concentration, trend graph, diagnostics, alarm status, historical data.
	Password protection	Five levels of authorised access to configuration and data management
Sensor		
Sample temperature	Measurement from -5 to 50°C (23 to 122°F)	
	Sensor resistant to temperature from -5 to 100°C (23 to 212°F)	
Sample pressure	1 to 20 bar absolute (14.5 to 290 psia)	
Sample flow rate requirement	50 to 300 mL/min	
Sample types	Water only	
CIP	Not designed for use in CIP processes	
Measurement range	Low range sensors: 0 to 2,000 ppb (dissolved. Indicatives values until 5000 ppb) High range sensors: 0 to 40 ppm (dissolved)	
Repeatability	Low range sensors: ± 0.4 ppb or 1%, whichever is the greater High range sensors: ± 0.015 ppm or ± 2% whichever is the greater	
Reproducibility	Low range sensors: ± 0.8 ppb or 2%, whichever is the greater High range sensors: ± 0.02 ppm or ± 3% whichever is the greater	
Accuracy	Low range sensors: ± 0.8 ppb or 2%, whichever is the greater High range sensors: ± 0.02 ppm or ± 3% whichever is the greater	
Limit of detection (LOD)	Low range sensors: 0.6 ppb High range sensors: 0.015 ppm	
Response time (90%)	Low range sensors: < 10 seconds in gas phase; < 30 seconds in liquid phase High range sensors: < 10 seconds in gas phase; < 50 seconds in liquid phase	
Warm-up time	None	
Display resolution	0.1 ppb	
Calibration	Low range sensors: Single point calibration (zero) High range sensors: Two at cap replacement (zero and air), one during use (air)	
Calibration sample	Low range sensors: Standard 99.999% N_2 (quality 50) or equivalent oxygen free gas High range sensors: Standard 99.999% N_2 (quality 30) or equivalent oxygen free gas, air	
Accessories		
Accessories	Active spots, spare sensors, tool kit, portable calibration setup, etc.	
	Ask your local Hach representative for more details on all available spare parts and accessories.	
Installation		
In process sensor installation devices	ORBISPHERE insertion/extraction valve for installation on Varinline access units	
	ORBISPHERE 28 mm sensor weld-on socket	
	28 mm stationary housing for installation on Varinline access units	
Ambient temperature	-5 to 50 °C (23 to 122 °F)	
Humidity	0 to 95% non-condensing relative humidity	
Power supply	Universal 85-264 VAC @ 50/60 Hz, 25 VA	
	10-36 VDC, 25 W	
Weights		
Wall and pipe mount (H x D x W)	236.5 x 160 x 250 mm - weight 4.25 kg 9.31 x 6.30 x 9.84 in. - weight 8.82 lbs	
Panel mount: Face (housing) (H x D x W)	156 (123) x 250 x 220 (214) mm - weight 3.35 kg 6.14 (4.84) x 9.84 x 8.86 (8.43) in. - weight 6.62 lbs	
K1200 28 mm sensor	0.74 kg (1.63 lbs)	
Calibration device	0.7 kg (1.54 lbs)	

2.2 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 in Figure 1.

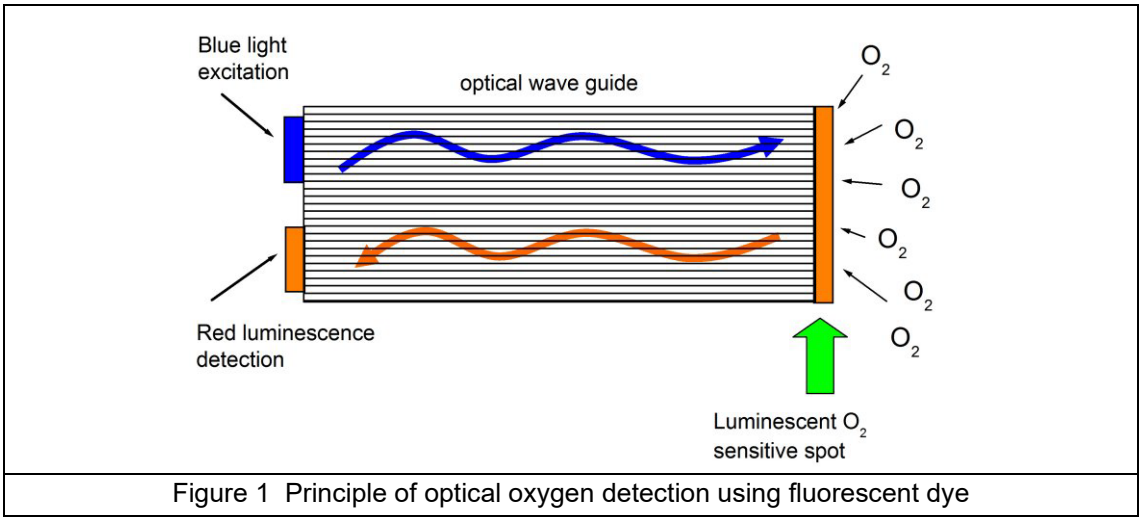


Figure 1 Principle of optical oxygen detection using fluorescent dye

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 as shown by Figure 2 left. 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 (Figure 2 right).

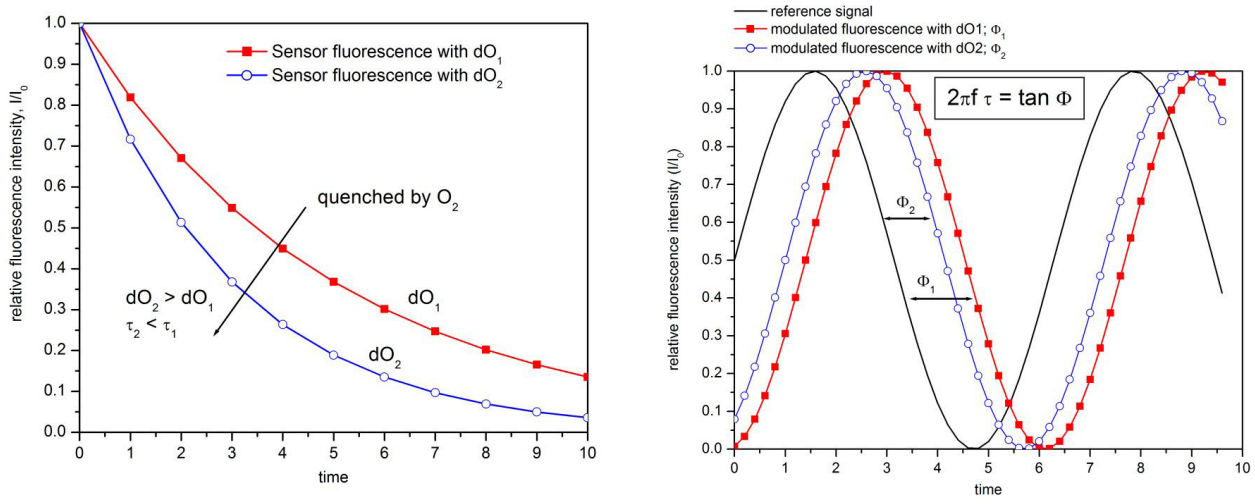


Figure 2 Fluorescence decay time (left) and modulated signals (right)

The oxygen partial pressure (pO_2) is then linked to the corresponding phase-shift measurement (Φ) to build the sensor calibration curve (shown right in Figure 3). This curve is described by the Stern-Volmer equation (shown left in Figure 3) 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.

$$pO_2 = \frac{(\Phi_0 - \Phi)}{K_{sv}[\Phi - \Phi_0(1 - f_0)]}$$

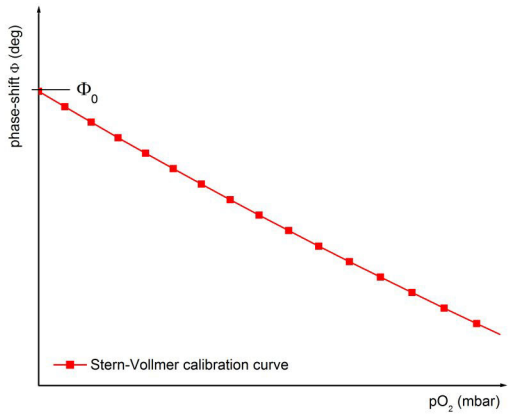


Figure 3 Stern-Volmer equation and calibration curve

2.3 Hardware description

The instrument hardware is made of one main board, and one measurement board for the measurement channel (= the sensor).

The main board includes the controls for power, display, the touch screen, the barometric sensor, the alarms, and communication ports. The measurement board performs measurements and executes commands from the main board. It holds the "Analog output" and "Relays" that send information to external systems.

A hardware watchdog is activated at program start up, to check that the system is not frozen (i.e. infinite loop, system crash, etc.). If the watchdog is not refreshed by the software every minute, the measurement display, the relays and the analog outputs are frozen for up to 2 minutes. Then the reset shuts down the instrument for 10 seconds and the start-up procedure is performed. At the same time all the hardware (sensor, measurement board) are reset.

2.4 Security level table

A cross means that the user who has this user security level can access this function or setting. Refer to User management on page 86.

Note: *When not shown, the sub-levels carry the same security level as the level above.*

Main	0	1	2	3	4
View	X	X	X	X	X
Measurement	X	X	X	X	X
Calibration			X	X	X
Inputs/outputs			X	X	X
Communication				X	X
Security				X	X
Products			X	X	X
Global config				X	X
Services				X	X

View	0	1	2	3	4
Numeric	X	X	X	X	X
Graphic	X	X	X	X	X
Statistical	X	X	X	X	X
Event	X	X	X	X	X
Diagnostic	X	X	X	X	X
Configure				X	X

Diagram Legend:					
Security level :	0	1	2	3	4
Available			X	X	X
Optional				X	X
Not available today				X	X

Measurement	0	1	2	3	4
Config instrument				X	X
Config chan 1				X	X
Config chan 2				X	X
Config chan 3				X	X
Measurement file				X	X

Calibration	0	1	2	3	4
Gas sensor			X	X	X
Interferences			X	X	X
Barometer				X	X
Ext pressure				X	X
Amplifiers					X
Reports			X	X	X

Gas sensor	0	1	2	3	4
Calibration chan 1			X	X	X
Calibration chan 2			X	X	X
Calibration chan 3			X	X	X
Verification chan 1			X	X	X
Verification chan 2			X	X	X
Verification chan 3			X	X	X
Config. chan 1				X	X
Config. chan 2				X	X
Config. chan 3				X	X

Inputs/Outputs	0	1	2	3	4
Snooze				X	X
View			X	X	X
Relays				X	X
Analog outputs				X	X

Reports	0	1	2	3	4
Sensor chan 1			X	X	X
Sensor chan 2			X	X	X
Sensor chan 3			X	X	X
Interf. chan 1			X	X	X
Interf. chan 2			X	X	X
Interf. chan 3			X	X	X
Barometer				X	X
Ext pressure				X	X

Communication	0	1	2	3	4
RS 485				X	X
RS 485 simple				X	X
Profibus DP				X	X
USB-A				X	X
HTTP / TCPIP				X	X

Security	0	1	2	3	4
Configuration					X
Access table					X
View log file				X	X

Products	0	1	2	3	4
Select product			X	X	X
Modify product				X	X

Global config	0	1	2	3	4
Save config				X	X
Select config				X	X

Services	0	1	2	3	4
Diagnostic				X	X
Language				X	X
Clock				X	X
Screen				X	X
Buzzer				X	X
Boards info				X	X
Batteries				X	X
Soft download					X
More					X

Note: *For the USB-A option in the Communication Menu, level 4 access is required to import the access table data.*

2.5 Default parameters

The table below indicates the factory default configurations. The instrument has these settings when started for the first time.

Parameter	Default settings	Customer settings
Security	Enabled	
Measurement		
Measurement mode	Continuous	
Measurement interval	2 seconds, until 2000 ppb	
Data filter	Disabled	
Medium	Liquid	
Gas unit type	Dissolved	
Gas unit	ppm-ppb	
Liquid	Water	
Display resolution	XXX.X	
Storage mode	Rolling buffer	
User offset	Disabled	
Out of range protection	Enabled	
Temp unit	°C	
Pressure unit	bar	
Calibration		
Mode	Zero calibration	
Hold	Enabled	
Auto-end	Enabled	
Analog outputs		
Range	4-20 mA	
Outputs	Gas measurement	
Extended mode	Disabled	
Characteristics	Monolinear mode	
Alarm relays	Disabled	
Thermal cutoff	Enabled	
Thermal cutoff temp	40°C	
Calibration timer	Disabled	
Service timer	Disabled	
Buzzer		
Screen tap	Enabled	
Alarm sound	Disabled	
Display		
Minigraph	Enabled	
Temperature	Disabled	

Section 3 Installation

This section provides necessary information to install and connect the analyzer. The installation of the analyzer should be performed in accordance with relevant local regulations.

⚠ DANGER

Electrocution Hazard. Do not connect AC power to a 5 VDC powered model.

⚠ WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING

Potential Electrocution Hazard. If this equipment is used outdoors or in potentially wet locations a **Ground Fault Interrupt** device must be used for connecting the equipment to its main power source.

⚠ WARNING

Potential Electrocution Hazard. A protective earth (PE) ground connection is required for both 100-240 VAC and 5 VDC wiring applications. Failure to connect a good PE ground connection can result in shock hazards and poor performance due to electromagnetic interferences. ALWAYS connect a good PE ground to the controller terminal.

⚠ CAUTION

Personal Injury Hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

NOTICE

Install the device in a location and position that gives easy access to the disconnect device and its operation.

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

3.1 Unpacking

Remove carefully 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.

You may want to retain the box and other packing material in case later you need to ship the instrument (see Storage, handling and transportation on page 97). Please dispose safely and ecologically of the box and packing material (if not stored for future use).

Please read through this manual thoroughly before carrying out the installation.

3.2 Installation check list

For a complete installation, proceed to the following actions following the instructions in this manual very carefully:

1. Install the 510 analyzer. Refer to section 3.3 on page 21 through section 3.8 on page 32.
2. Install the sensor in the sample pipe or flow chamber and connect it to the instrument. Refer to section 3.9 on page 33.
3. Turn the instrument on and set the operating language. Refer to section 14.2 on page 93.
4. Enter the default login credentials “1007” for the ID and “1234” for the password. Refer to Section 5 Start up on page 45.
5. Change the default login and set the security levels, users ID’s and passwords. Refer to Section 11 on page 85.
6. Verify that the sensor cap selected (i.e. low or high range: K1200-L or K1200-H) corresponds to the sensor in use. Refer to section 7.2 on page 52.
7. Enable thermal cutoff and set it to the minimum possible value (e.g. 10°C if the liquid in the sample line is at 0-5°C). This is critical to ensure long-term stability. Refer to section 7.2 on page 52.
8. Set the measurement interval according to your response time needs. Refer to section 7.2 on page 52.
9. Enable the calibration timer and set the number of days to 180 days (6 months) or according to your quality needs to ensure a regular sensor calibration. Refer to section 14.2 on page 93.
10. Enable the service timer and set the number of days to 360 days (1 year) or according to your quality needs to ensure a regular sensor service. Refer to section 14.2 on page 93.
11. If required, program the relay and analog outputs to ensure an event is set when a calibration or service is required. These can be programmed for each as custom events. Refer to Section 9 on page 61. Note that when a calibration or service timer has expired, the instrument will automatically display this information as a warning message. Refer to the table List of events and alarms on page 99.

As the system is factory calibrated and does not require an initial calibration. Refer to Calibration Menu on page 55 for more details. The instrument and sensor should now be ready for operation. If a problem occurs, refer to Troubleshooting on page 97. If the difficulty cannot be overcome, please contact your Hach representative who will be happy to assist you.

3.3 Wall mount and pipe mount instruments

3.3.1 Instrument dimensions

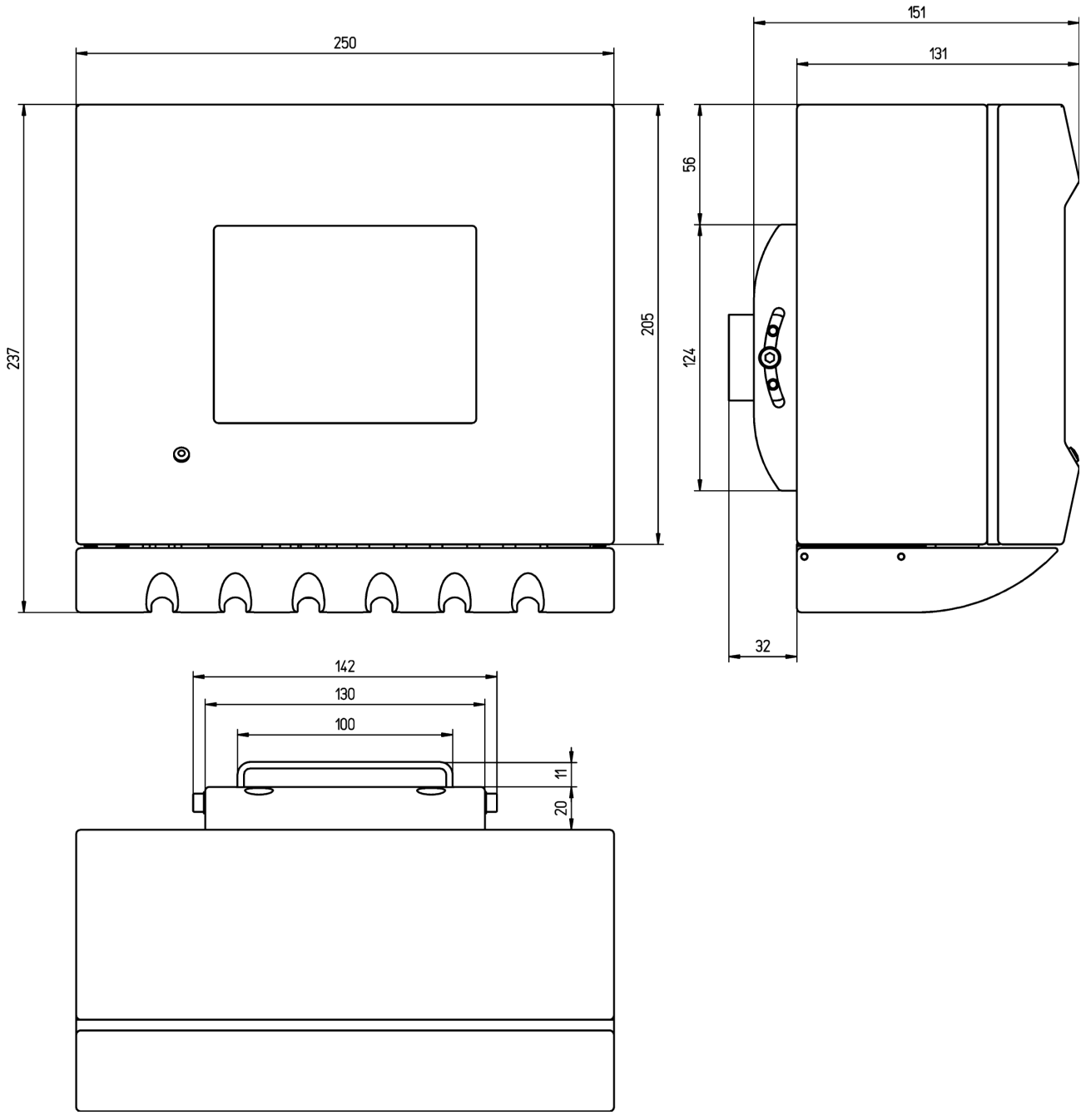
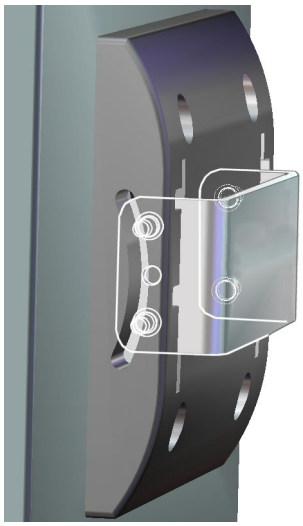
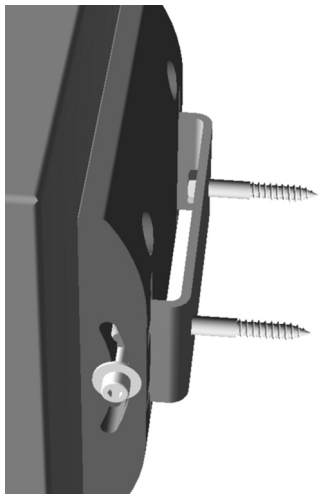


Figure 4 Wall and pipe mount instrument dimensions (in millimeters)

3.3.2 Wall mounting





Attach the U bracket provided to the wall with two screws (not provided).

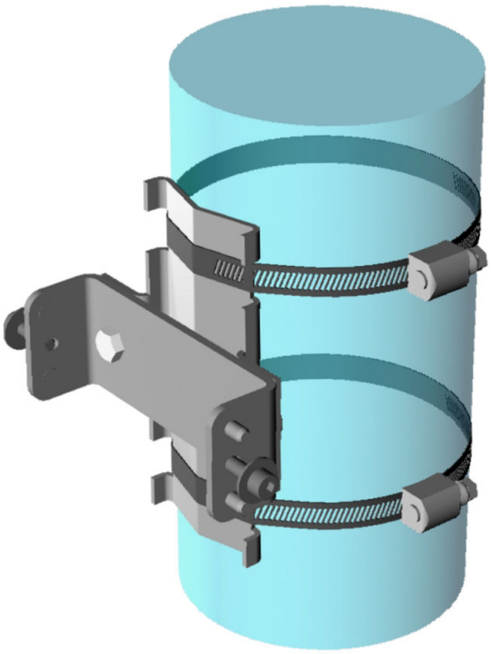
Tilt the instrument slightly backwards to align the bracket pins and the insertion slots, and slide the instrument onto the bracket as shown.

Insert the 2 locking screws with washers through the side slots.

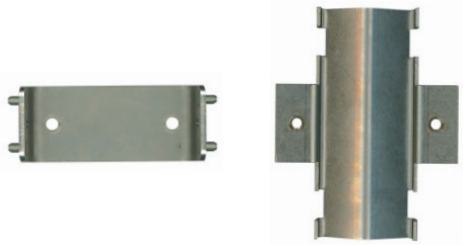
Adjust instrument angle for better screen vision, and lock both side screws.

Figure 5 Wall mount bracket

3.3.3 Pipe mounting



Assemble the pipe mount bracket to the U-bracket, using the two screws provided



Attach this assembly to the pipe using two clamps (not provided) as shown on the left

The rest of the procedure is similar to the wall mount version, pictured above.

Slide the instrument onto the bracket.

Insert the 2 locking screws with washers through the side slots.

Adjust the instrument angle for better screen vision, and lock both side screws.

Figure 6 Pipe mount diagram

3.3.4 Connections (bottom of instrument)

Cable protection shield

The cable protection located at the bottom of the instrument (Figure 7 below) must be lowered, and eventually removed, to get access to the bottom of the instrument.

Pull the plastic protection firmly towards you, then lower it as shown in Figure 8 below. To remove it completely, push it back against the wall. Proceed in reverse order to install the cable protection. Make sure the 4 pins are securely in place.

Front panel door

A square key is provided to open the instrument front panel locks. The two locks are located on the right side of the instrument on the top and bottom panels (number 9 in Figure 9 below).

The front panel can be easily pivoted to the left as shown in Figure 8 below. To retain the instrument waterproof tightness, make sure the seal is clean and in good condition before closing the front panel.

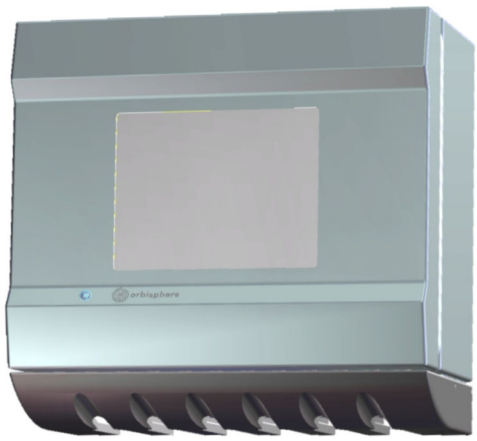


Figure 7 Cable protection shield in place

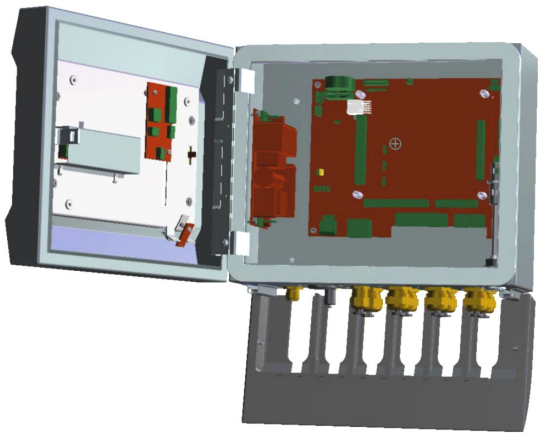


Figure 8 Cable protection shield lowered

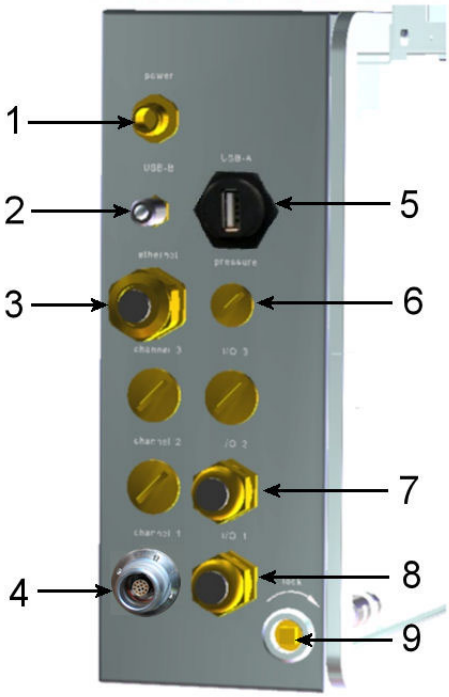


Figure 9 Wall/pipe mount connection panel

1 - Power cable	6 - External pressure sensor connection
2 - USB-B 4 pin connector (reserved for manufacturing)	7 - Input/Output 2 cable gland
3 - Ethernet cable gland	8 - Input/Output 1 cable gland
4 - Sensor connection	9 - Keylock
5 - USB-A host connector for mass storage device	

Note: *The type of power cable connection will vary depending on the instrument specification.*

3.4 Panel mount instrument

3.4.1 Instrument dimensions

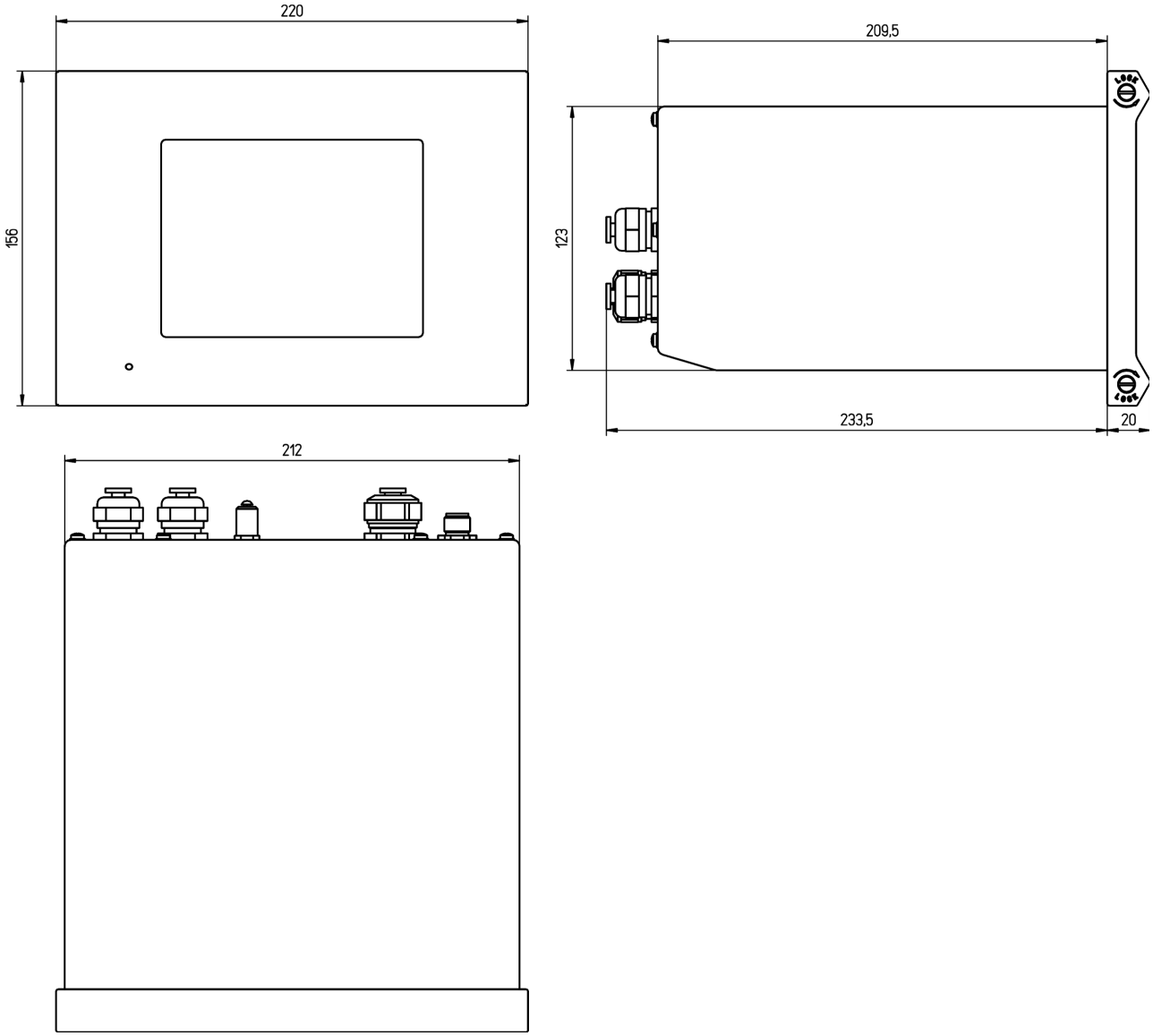


Figure 10 Panel mount instrument dimensions (in millimeters)

3.4.2 Mounting

⚠ WARNING

Electrocution hazard. If the cable and connector for the power supply are not accessible after installation, an accessible local disconnection means for the instrument power is mandatory.

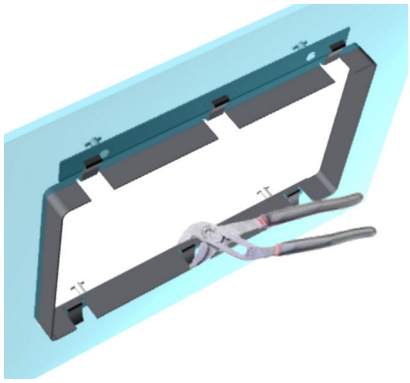


Figure 11 Panel mount bracket frame

1. Cut an opening in the panel to accommodate the bracket frame provided (this is the same size as previous generations of ORBISPHERE type 3600 instruments).

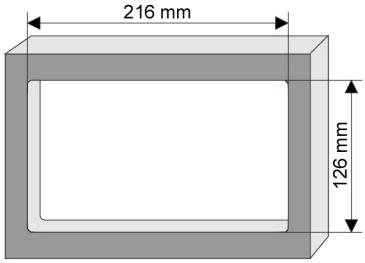
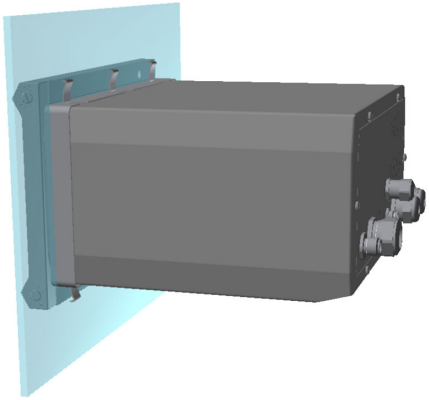
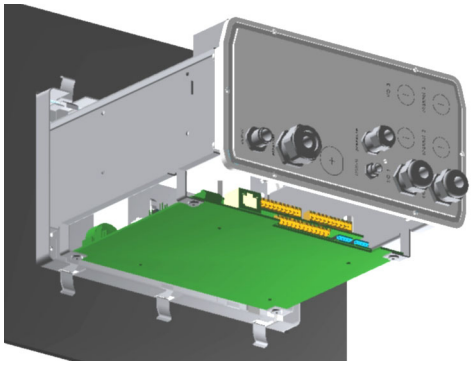


Figure 12 Opening dimensions

2. Install the provided frame in the opening
3. Fold the 6 tabs over the panel lips, using adjustable joint pliers.



4. Slide the instrument in the bracket frame. The instrument should go over the four “T” pins. Rotate the 4 fast locking screws on both sides of the front panel and slide it in.
5. Rotate the 4 fast locking screws 1/4 turn twice in the lock direction as indicated on the side of the front panel. This locks the instrument in place on the four “T” pins.



6. To access the connections inside the instrument, remove the instrument housing (six screws on the back panel, and slide the housing back out)
7. Pass the cables through the housing, then through the cable gland (if applicable) and then perform the connections as detailed below.

Note: *Do not forget to pass the cable through the housing before passing it through the cable gland on the back panel.*

Alternative instrument mounting procedure
When it is not convenient to work from the back of the panel, the instrument can be connected before fitting in the panel.

1. Install the panel support frame in the panel opening
2. Slip the cables through the panel opening
3. Remove the instrument cover
4. Slip the cables through the instrument cover
5. Slip the cables through the instrument back panel cable glands
6. Connect the cables to the instrument electronic boards
7. Tighten the cable glands
8. Reinstall the instrument cover
9. Install the instrument in the panel opening

3.4.3 Connection panel (bottom of instrument)

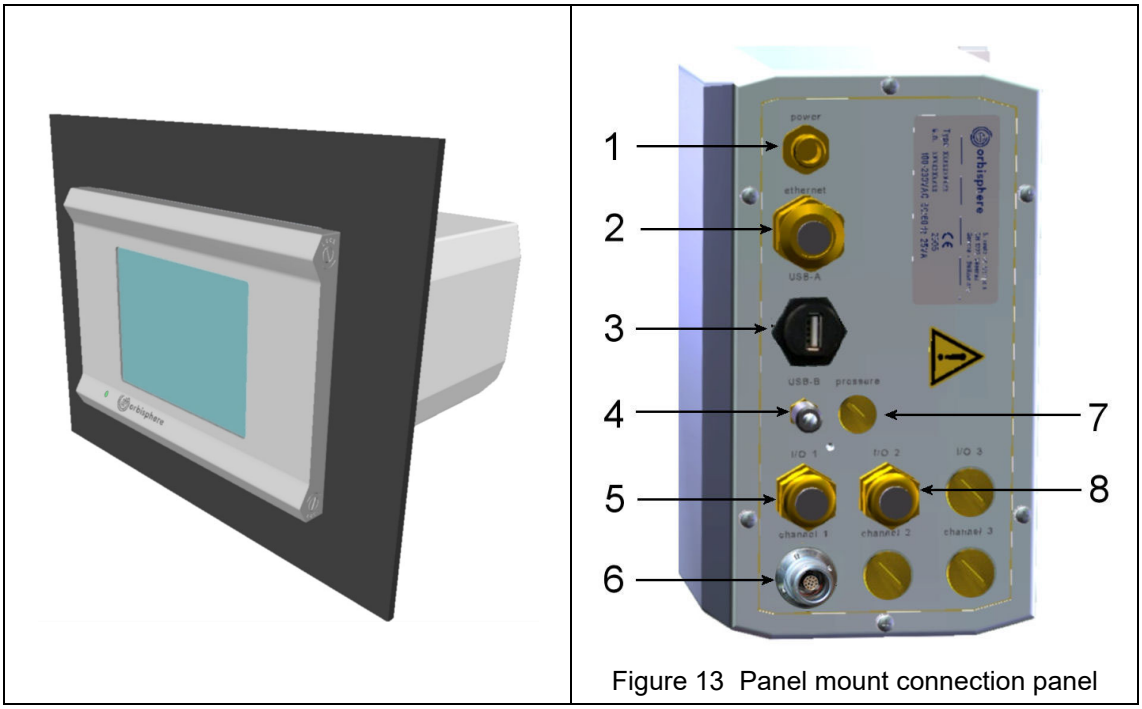


Figure 13 Panel mount connection panel

1 - Power cable	5 - Input/Output 1 cable gland
2 - Ethernet cable gland	6 - Sensor connection
3 - USB-A host connector for mass storage device	7 - External pressure sensor connection
4 - USB-B 4 pin connector (reserved for manufacturing)	8 - Input/Output 2 cable gland

Note: *The type of power cable connection will vary depending on the instrument specification.*

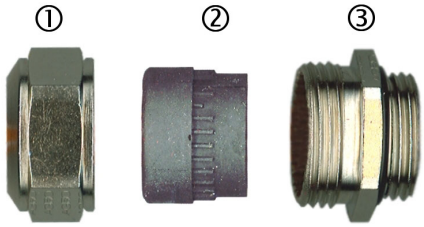
3.5 Connectors assembly instructions

⚠ WARNING

Potential Electrocution Hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP65 to route cables into the instrument.

3.5.1 Cable gland wiring instructions

A waterproof cable gland is provided each time a cable must be connected inside the instrument. The nickel-plated brass cable glands are EMC-types, designed so that the cable shields attach directly to the instrument housing as a ground. Typical cable wiring instructions are detailed below.

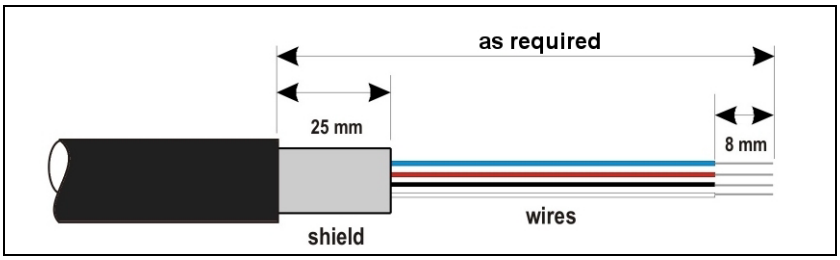


Gland parts (washers not shown):

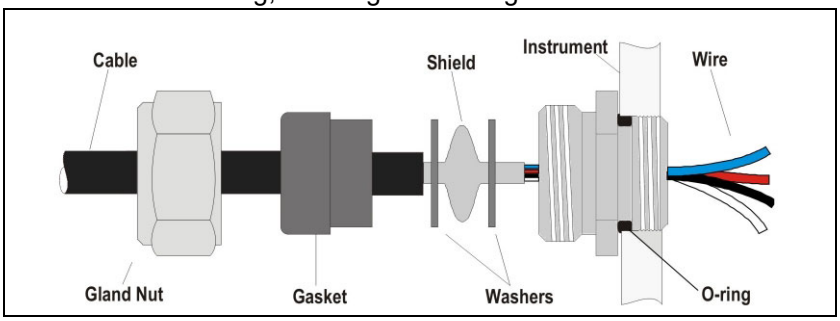
1. Nut
2. Rubber gasket (seal)
3. Gland fitting with O-ring (attached to instrument housing)

1. Unscrew the cable gland nut. Inside, the assembly is composed of a rubber gasket, and two metal washers. Note that the ethernet gland on panel and wall mount instruments does not have washers and the gasket is cut.
2. If wiring a sensor cable, the cable has already been prepared so simply remove the piece of plastic protection from the exposed shielding.

   For other cables, strip off external insulation as required, and 25 mm of shielding. Strip the wires about 8 mm from their ends (see illustration below).



3. Pass the cable through the nut, the rubber gasket, and the two washers
4. Pinch the shield so that its entire circumference is pressed between the two washers and pass the cable into the housing, blocking the cable gland



NOTICE

It is vitally important to ensure the shielding is pinched and secured between the two washers to ensure the shielding attaches directly to the instrument housing as a ground. Failure to do this could cause damage to the instrument, and for sensor cables give incorrect readings.

5. Reattach and tighten the cable gland nut
6. Attach the wires to the corresponding terminal block connections

3.6 Connection to mains power supply

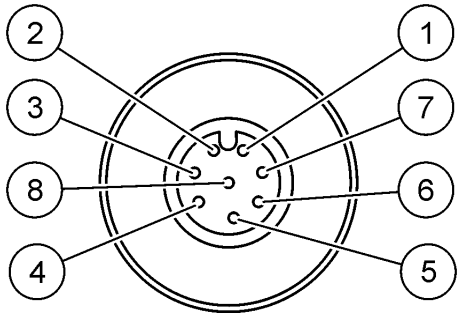
3.6.1 Power supply connection (low voltage instruments)

For low voltage instruments (10-30 VDC), connection to the mains power supply is with a 8-pin BINDER connector (supplied).

Note: *The connectors are grooved to avoid an incorrect fitting to the instrument.*

Connect the power cable to the connector as follows:

Figure 14 Wall mount BINDER connector



Pin Connections:

1. Power 10-30 VDC
2. Ground
3. Ground
4. Ground
5. Not used
6. Power 10-30 VDC
7. Power 10-30 VDC
8. Earth

3.6.2 Power supply connection (high voltage instruments)

High voltage instruments (100-240 VAC) have a 4-pin male connector pre-wired internally with a male BINDER connector ready for mains connection. A compatible female connector is supplied with the instrument.

If this female connector was supplied with a mains power plug already pre-attached (cable part numbers 33031, 33032, 33033 and 33034) then the female connector can be plugged directly into the instrument power connector. The two connectors are grooved to avoid an incorrect fitting. Tighten the female connector to the instrument power connector finger-tight.

If no power cable was ordered with the equipment, a mains power plug must be connected to the supplied female connector as described in the following procedure.

⚠ CAUTION

Personal Injury Hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

User-supplied power cable specifications:

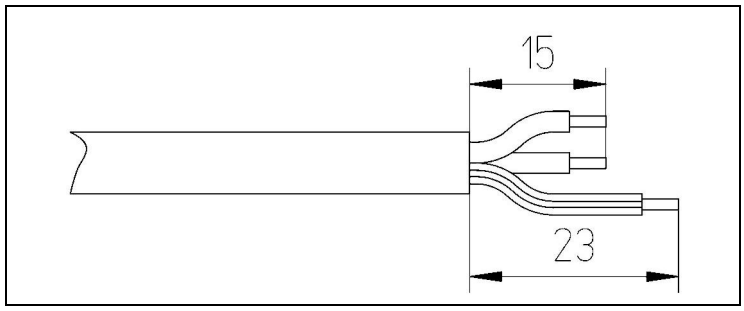
- 3-wire (live, neutral and earth)
- cable Ø ≥ 7mm; ≤ 9.5mm
- wire selection ≥ 1mm^2, AWG18; ≤ 2.5mm^2, AWG14

⚠ WARNING

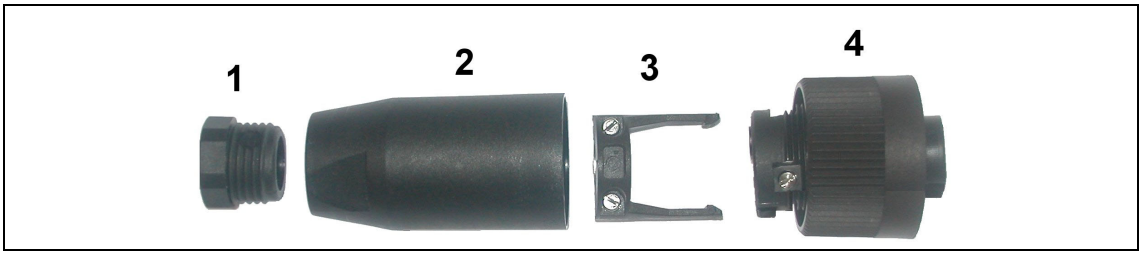
Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

Prepare the user-supplied power cable as follows:

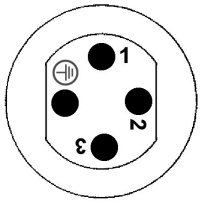
Strip off 23 mm (0.9 ins.) of shielding from the power cable. Cut back the live and neutral wires to 15 mm (0.6 ins.) in length but leave the earth wire as is. Then strip off a small amount of external insulation from the three wires as required:



Wire the female connector as follows:



1. Take the narrow end of the connector (4) in one hand and the main body (2) in the other and unscrew the two. Pull away the cable clamp (3) and unscrew the end plug (1) to reveal the four parts that make up the connector.
2. Loosen the screws on the cable clamp (3) to allow enough room to pass the power cable through.
3. Pass the power cable through the end plug (1), the main body (2), and the cable clamp (3), and then connect the three wires (live, neutral and earth) to the connector (4) as follows:

	1) Live (brown) 2) Neutral (blue) 3) Not used Earth (green and yellow)	***Note:*** *The numbers and earth symbol are stamped on the end of the connector. Ensure it is connected correctly.*

4. Slide the cable clamp (3) back onto the connector (4) and tighten the screws on the clamp to secure the cable.
5. Screw the two parts (4) and (2) back together.
6. Secure the power cable by screwing the end plug (1) back in place.
7. The female connector can now be plugged directly into the instrument power connector. The two connectors are grooved to avoid an incorrect fitting. Tighten the female connector to the instrument power connector finger-tight.

3.7 Connections to electronic boards

NOTICE

Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Note: *Any loose connection wires should be bundled tightly together with the use of nylon cable ties.*

3.7.1 Electronic boards connectors

Connectors P8 on the main board (Figure 15) and J7 on the measurement board (Figure 19) are made of two parts. Push down carefully the black levers on either side of the connector and pull it out securely. Perform all connections with these connectors unplugged. Once finished, attach the connectors to the boards by pushing them firmly in place (levers up).

3.7.2 Main board connections

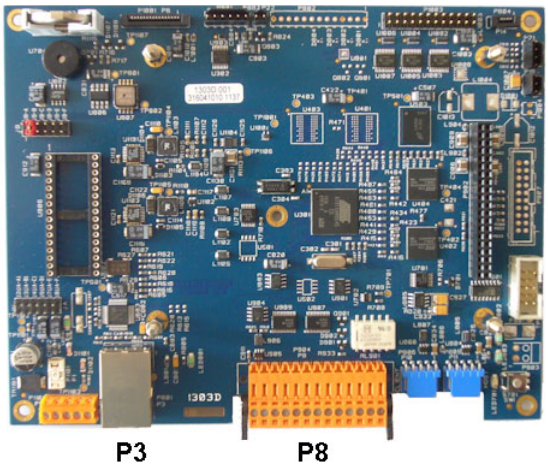


Figure 15 Main board

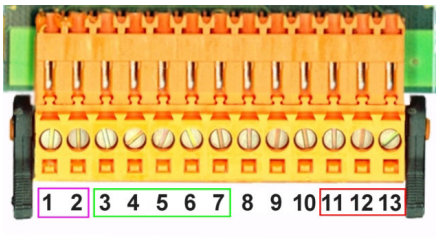


Figure 16 Connector P8

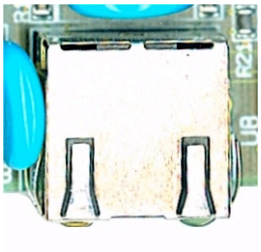


Figure 17 Connector P3

Connector P8:	**7.** PROFIBUS-DP (signal RTS)
1. RS-485 (signal A)	**8.** Not used
2. RS-485 (signal B)	**9.** Not used
3. PROFIBUS-DP (GND)	**10.** Not used
4. PROFIBUS-DP (+ 5 V)	**11.** System alarm relay (N.O.)
5. PROFIBUS-DP (signal -)	**12.** System alarm relay (N.C.)
6. PROFIBUS-DP (signal +)	**13.** System alarm relay (Common)

Connector P3

Ethernet RJ 45. Connect the instrument to the local network by passing an ethernet cable through the ethernet cable gland (refer to Figure 9 on page 23 for the wall mount and Figure 13 on page 26 for the panel mount) and connecting to the P3 connector illustrated above.

3.7.3 Measurement board

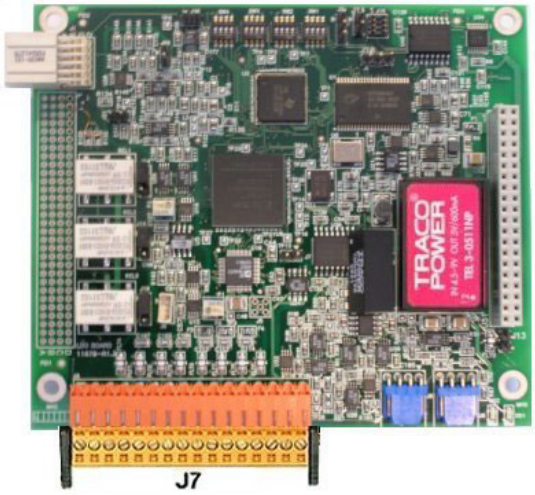


Figure 18 Measurement board

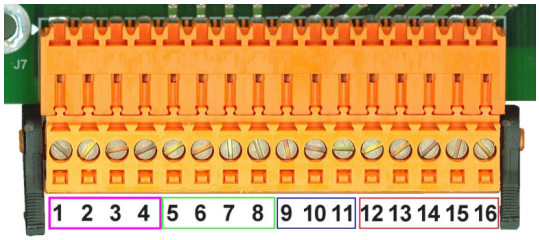


Figure 19 Connector J7

Connector J7 (inputs & outputs)

Measurement alarms relays

1. Common
2. Output relay 1
3. Output relay 2
4. Output relay 3

Analog current (or voltage) outputs

5. Analog GND
6. Output 1
7. Output 2
8. Output 3

Digital inputs

9. Hold input. To deactivate the sensor from a PLC system, connect a dry contact between J7.9 and J7.12

Note: *It is recommended to use this functionality in order to extend the sensor lifetime for installations with a CIP process that can damage the spot.*

10. Not used
11. Not used
12. Digital GND
13. **to 16.** Not used

3.8 Measurement alarm relays

Figure 20 Output relays

The three output relays are located on the measurement board.

They can be individually configured to Normally Open (NO) or to Normally Closed (NC) by physically moving the jumper on each relay. On the picture example on the left:

- Upper relay is set to NC
- Middle relay is set to NO
- Lower relay is shown with no jumper

Note: *J14 (upper relay) is relay 1*
J18 (middle relay) is relay 2
J19 (lower relay) is relay 3

3.9 Sensor installation

3.9.1 Sensor positioning information

The sensor must be installed in a socket or flow chamber that allows contact with the sample fluid to be analyzed.

The sensor and measuring instrument are connected by a cable. The standard sensor cable lengths are 3, 5, 10, 15 and 20 meters.

Ensure that the sensor will be mounted:

- perpendicular to the pipe
- horizontal
- on a horizontal pipe section (or on flow-ascending vertical pipe)
- minimum of 15 meters away from the pump's discharge side
- in a place where the sample flow is stable and rapid, and as far as possible from:
  - valves
  - pipe bends
  - the suction side of any pumps
  - a CO_2 injection system or similar

Note: *There may be situations where not all the above conditions can be met. If this is the case, or you have any concerns, please consult your Hach representative to appraise the situation and define the best applicable solution.*

3.9.2 Recommended sample flow rate

For optimal response time, the recommended sample flow rate is 150 mL/min.

Control the flow with the outlet valve on the flow meter (number 3 in Figure 21 below) to avoid foam developing inside the flow chamber which could lead to erroneous oxygen measurement values.

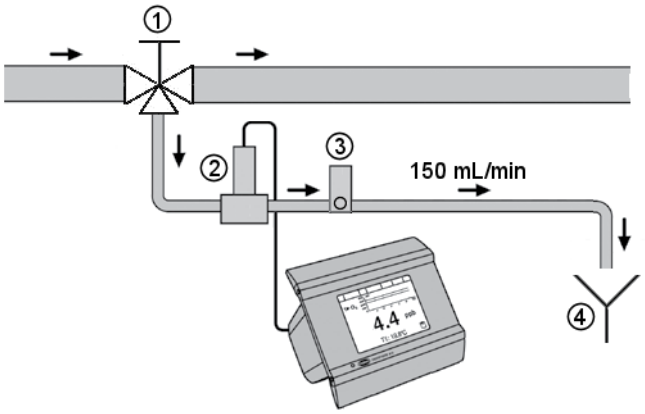


Figure 21 Typical measurement schematic

1. Valve to redirect sample for measurement	**3.** Flow meter with outlet valve
2. Sensor and flow chamber combination	**4.** Drain

3.9.3 Sensor insertion

- Insert the sensor straight into the flow chamber or socket. Do not twist the sensor.
- Hand tighten the attaching collar.
- Connect the sensor cable.
- Check for leaks; replace O-rings if product leaks are visible.

3.9.4 Sensor removal

- If not using the ORBISPHERE 32003 insertion/extraction valve (refer to The 32003 insertion/extraction valve on page 35) you will need to shut off the sample flow and drain the sampling circuit of liquid.
- Remove the sensor cable connected at the sensor end.
- Hold the sensor body in one hand to avoid rotation, and unscrew the collar with the other hand.
- Pull the sensor straight out of the socket or flow chamber.
- Install sensor storage cap and sensor base (to protect the connection).

3.9.5 Weld-on stainless steel socket

The ORBISPHERE 29501 weld-on sensor socket can be used to install a sensor into a stainless steel pipe (min.Ø 50 mm or 2”). When welding the socket to the pipe, check that setback between the pipe’s inner diameter and the sensor tip does not exceed 4 mm (see diagram).

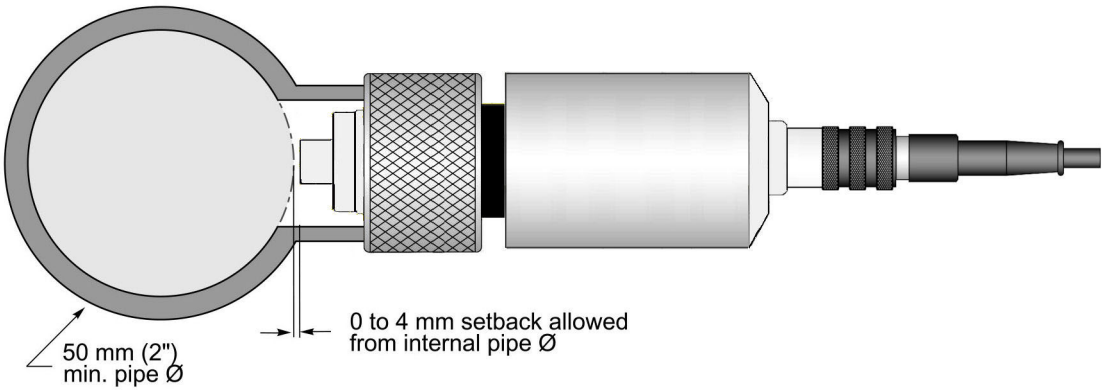


Figure 22 Weld-on sensor socket

Note: *Be sure to remove the two O-rings from the socket before welding and leave the sensor’s stainless steel cap screwed on during welding to prevent thread distortion.*

Recommendation:

To facilitate sensor removal and installation, we suggest installing the socket in a location where the liquid can be drained quickly and easily. By creating a one meter long piece of pipe (see Figure 23) with shut off valves at both ends, just a small volume of liquid needs to be drained to enable sensor removal.

Also, a precise sensor and socket installation can be performed in the workshop, and this assembly can be placed in the production line with minimal down time.

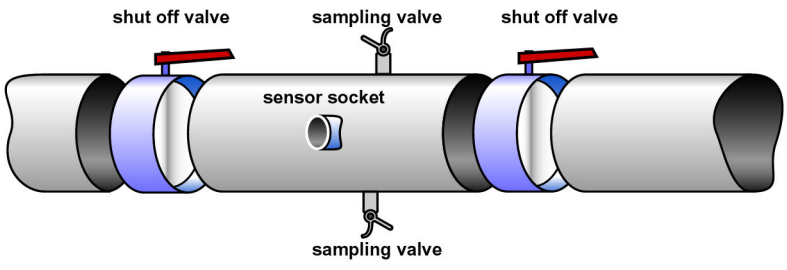


Figure 23 Installation in-line

3.9.6 The 32003 insertion/extraction valve

The ORBISPHERE 32003 insertion/extraction valve (illustrated below) allows for sensor removal and installation without having to drain the fluid in the line. It can withstand a pressure of up to 20 bars, with the sensor in place or not.

Sensor insertion is made by inserting the sensor into the housing and tightening the retaining collar until it stops. As the retaining collar is tightened, the valve will open to allow the sample to flow past the sensor head. Remove the sensor by unscrewing the collar and pulling the sensor out. As the collar is unscrewed, the valve will automatically close to avoid any sample spillage.

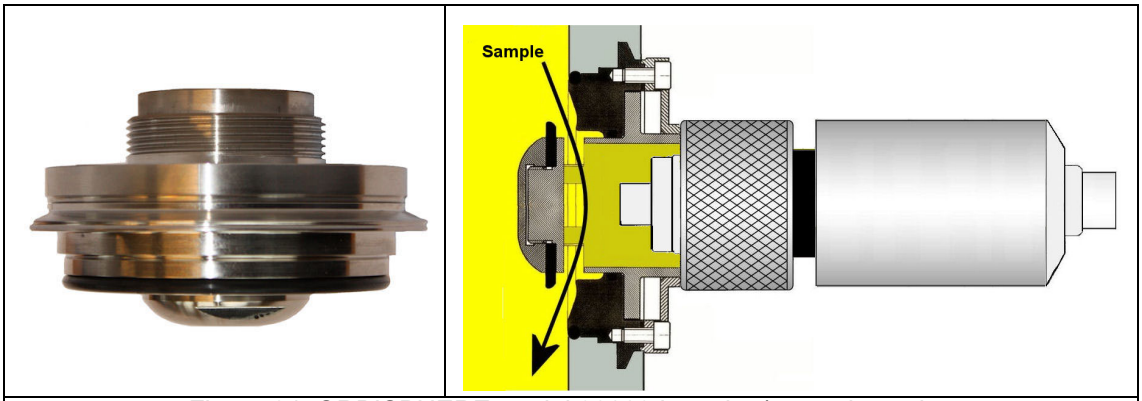


Figure 24 ORBISPHERE model 32003 insertion/extraction valve

The diagram above right, shows the sensor in a sample line with the valve open.

3.9.7 The 33095 sensor housing

Another type of sensor housing (the ORBISPHERE 33095 housing) is available for use with the K1200 sensor but requires that the sample flow be turned off prior to insertion or removal of the sensor.

Sensor insertion is made by inserting the sensor into the housing and tightening the retaining collar until it stops. Removal is made by unscrewing the collar and pulling the sensor out. Be sure that the sample flow has been turned off before inserting or removing the sensor.

3.9.8 Tuchenhagen Varivent in-line access unit

The following illustration shows the Tuchenhagen Varivent In-Line Access Unit.

Figure 25 Tuchenhagen Varivent in-line access unit

Purchasing a Tuchenhagen Varivent in-line access unit, or an equivalent fitting with a 68 mm flange diameter from the fitting manufacturer, is required to make use of the ORBISPHERE model 32003 or 33095 sensor housing devices detailed above.

3.9.9 Instrument connections

The sensor is supplied with a cable having a LEMO connector at both ends. One end is attached to the sensor and the other to the instrument.

A red dot can be seen on each LEMO connector and on both the sensor and instrument sockets. Be sure to line up these red dots when connecting the cable to the sensor and instrument. The LEMO connector can then simply be pushed into place.

Refer to the illustration of the connector panels for the correct instrument socket to attach the cable (refer to Figure 9 on page 23 for the wall and pipe mount instruments and Figure 13 on page 26 for panel instruments).

3.10 Calibration devices

3.10.1 Portable calibration device

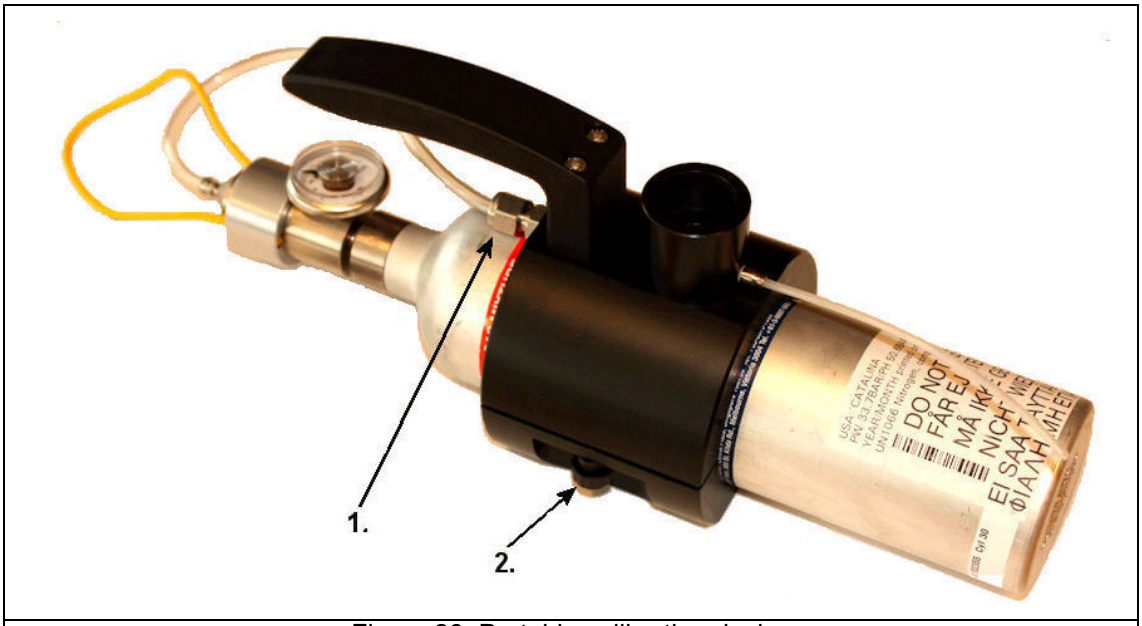


Figure 26 Portable calibration device

The portable calibration device (part number 33088 illustrated above) is ideal for calibrating the sensor close to its location in the sample.

The device is designed to hold a 1 liter gas cylinder (as shown above), but is fully compatible for use with other kinds of gas cylinders. When using other types of gas cylinders, simply connect the gas supply to the Swagelok connector (number **1** in Figure 26), and make sure that the inlet gas pressure does **not** exceed 2 bars absolute.

The gas bottle is not supplied and must be purchased locally. To ensure the calibration works correctly, the calibration gas bottles must be of 99.999% (50) quality or better. Bottles containing 34 liters of compressed gas, with a 5/8-18 UNF (C10) fitting are compatible with the hand-held calibration device and recommended for this purpose.

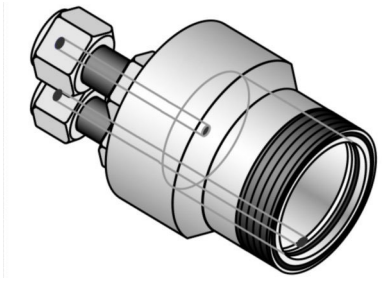
Empty gas bottles are easily removed from the device. Simply unscrew the small black screw (number **2** in Figure 26) a few turns, slide the bottle out of the black plastic holder, and unscrew the bottle from the pressure reducer. Follow this same procedure in reverse order to install a new bottle.

3.10.2 ORBISPHERE flow chambers

Note: *This is the recommended option for the K1200 sensors.*

The ORBISPHERE flow chambers are used to draw the calibration sample past the sensor.

They connect to 6-mm or ¼" stainless steel tubing by means of two Swagelok fittings. If necessary, copper or plastic tubing with low permeability can be substituted.

	Dimensions of sensor and flow chamber assembly : • Width: 50 mm • Height: 210 mm (add 100 mm for connection length)

Section 4 User Interface

4.1 Instrument

The instrument front panel provides these user interfaces:

- A touch screen acting as display, touch pad and keyboard. Contrast can be adjusted.
- A LED, showing when the instrument is on.
- A buzzer which sounds each time the screen is touched, and when an event alarm is set.

Turning instrument On and Off

There is no power switch on the instrument. The mains must be disconnected to turn the instrument off. The LED indicates when the instrument is on.

Measurement window

The main (numeric) measurement window continuously displays:

- Sensor numeric values
- Measured sensor trends (for the last 10 minute to last hour)
- Measured sensor data alarm limits and other events
- Temperature

4.2 Touch screen

The user interface on the front panel is a 320x240 pixels display with touch screen. To make navigation user friendly, the interface software is Windows CE based, providing easy selection through menus.

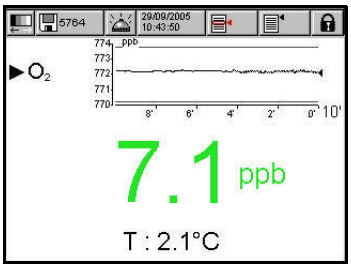


Figure 27 Numeric view

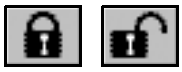
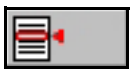
All the measurement, configuration, calibration and "standard service" routines can be called by pressing buttons and menu bars on screen.

Measurement displays shows one measurement slope.

The display can be configured to only show a sensor measurement, or to show a parameterized graphic representation of the last measurements.

Touching some items on the display calls a related function, similar to a shortcut.

4.2.1 Function keys on the header bar

	Shortcut to the user login window. Pressing this button for more than 2 seconds calls the ID and password window. Refer to Identification and authorization level on page 42. • Closed padlock indicates that the touch screen is locked. • Open padlock indicates that the instrument is in view mode only, but no user is logged in (level 0). • When a user is logged in, this box show the authorization level of this user as 1, 2, 3 or 4 (4 being the highest, refer to User management on page 86).
	This icon is used for adjusting the display brightness to improve visibility. It is available all the time to any user, regardless of the user security level. This icon is a shortcut to the backlight adjustment window. Refer to Screen on page 94.
	Short cut to the data storage window. Number shows the number of measurement currently stored in volatile memory. • No storage • Store once: When the buffer is full (10,000 positions), the recording of measurement stops. • Rolling buffer: When the buffer is full, the latest measurement set replaces the oldest one (first-in, first-out)
 normal - snooze	In the event of an alarm, the “snooze” button stops the instrument buzzer and returns all the relays in the instrument to their normal state during the "snooze time". The icon indicates if the alarms is on “snooze” or not. This "snooze" is configurable. Refer to Configure snooze on page 62.
	Current date and time. This is also a shortcut to the date and time setting window.
	Call the contextual menu. This menu is in the header bar and its content is related to the view displayed.
	Opens the main menu page for easy navigation through all available menus.

4.2.2 Menu navigation

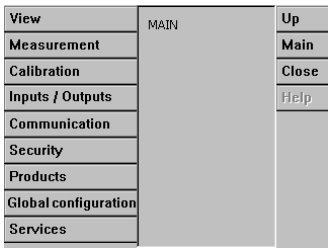


Figure 28 Main menu window

Pressing the “menu” button in the header bar calls the main menu. The display is made of three columns:

- The left column is the menus, or submenus (greyed out options are not available)
- The center column shows a tree view of actual position inside the menu structure
- The right column has the generic controls detailed below.

Up	Return to previous menu (one step back)
Main	Jump directly to main menu
Close	Close the menu and go back to measurement view display. If the menu button is pressed again, the menu returns to its previous state (tree structure is saved)
Help	Help topics concerning current menu

4.2.3 Rolling list

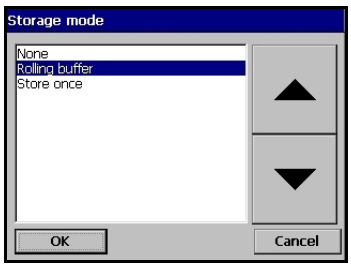


Figure 29 Rolling list example

For convenience, selection through a possible large list of items has been designed with a rolling list, like in this example. Use the up and down arrow to navigate, or select directly one item and press OK.

4.2.4 Virtual keyboard

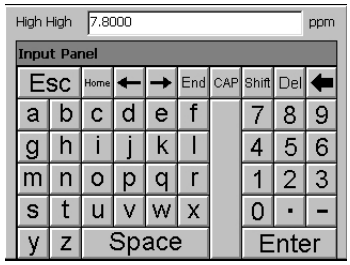


Figure 30 Virtual editing keyboard

When a text box (alphanumeric field) has to be edited and is pressed, a virtual keyboard appears on screen. It can be used as a PC keyboard (pressing CAP gives access to special keys).

Once values have been entered, press the ***Enter*** key to confirm and exit the virtual keyboard.

During the editing, the edited field name is displayed, along with units where applicable.

4.2.5 Identification and authorization level

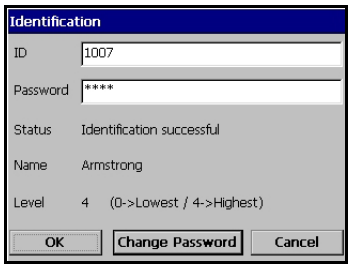


Figure 31 Identification window

Once the access rights have been set, (refer to User management on page 86) it is necessary to log in as an authorized user to get access to the instrument functionalities and settings.

Press the closed padlock  for two seconds to open the identification window. The user identification and password must be entered to access functionalities authorized by the security level of the given user (5 levels available. Refer to User management on page 86).

For security, when the session inactivity delay period has expired (adjustable, refer to Configure security on page 86), the user is logged off automatically.

Note: *To get to level 0, press the unlock button and OK, without entering any ID or password.*

4.2.6 Warning windows

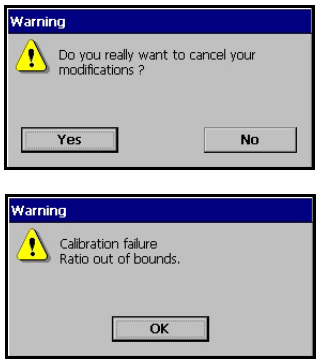


Figure 32 Warnings

At various stages, a warning message may be displayed to request confirmation from the operator that his last action(s) must really be saved or cleared, or that there is a problem that did not enable the requested action, such as during instrument calibration (example shown left).

4.3 Main menu structure

This is the structure of the main menu which is used to control every functionality of the instrument. These submenus are detailed in the following sections of this Operator Manual.

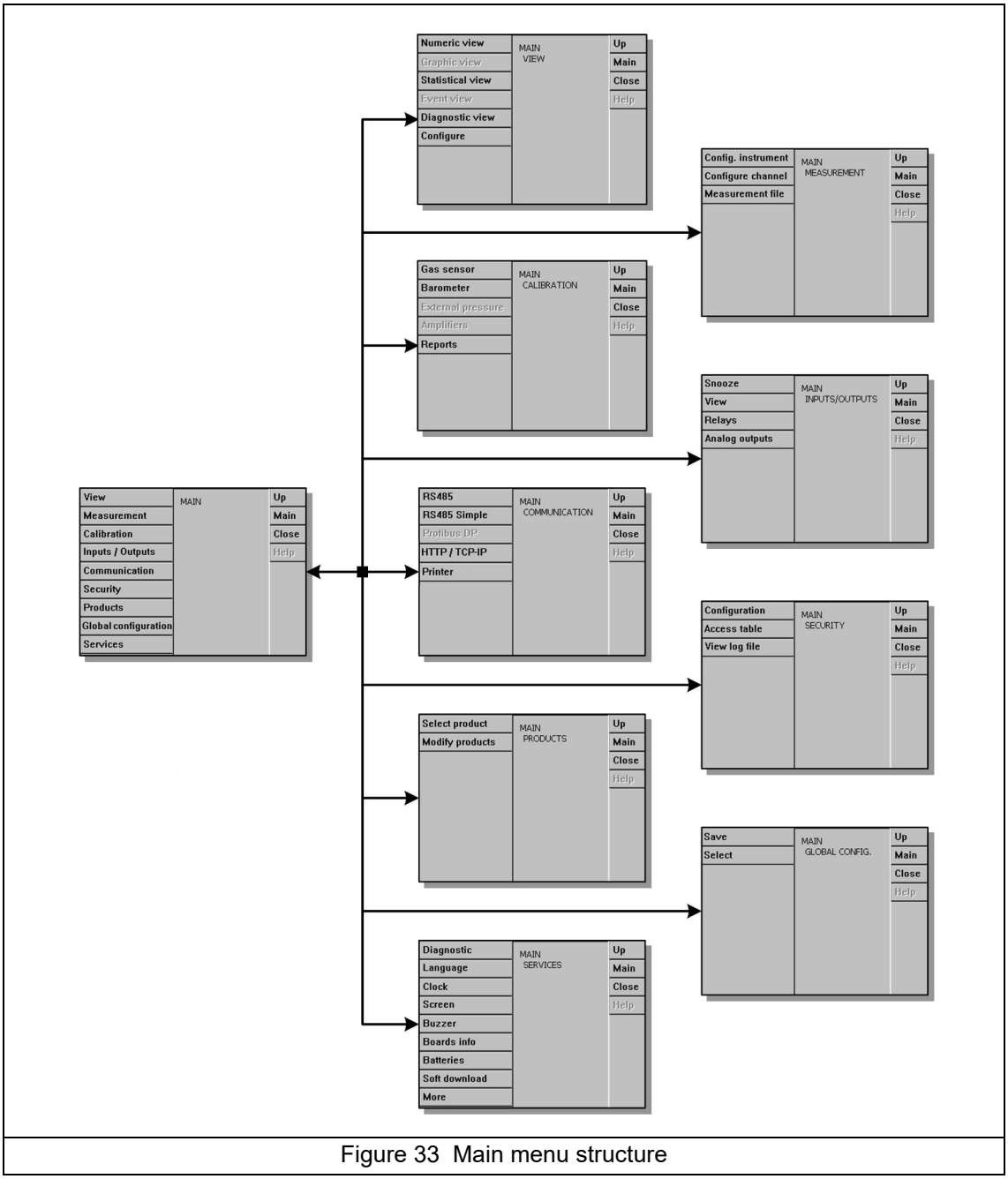
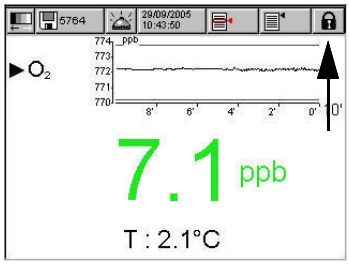


Figure 33 Main menu structure

When the instrument is started for the first time, security is enabled. The user must enter a factory configured login credentials (user ID and password) to get access to the instrument. Make sure to change the default login credentials at startup. Refer to Section 11 Security Menu on page 85 for additional information.

Do the steps that follow to change the default login credentials and add users and user access rights.

	1. Push OK when the message to change the default login credentials shows on the display.
	**2.** Push the padlock icon on the header bar of the top of the display for more than 2 seconds to unlock the touch screen. The login window shows on the display.
	3. Enter the default user login credentials: "**1007**" for the ID and "**1234**" for the password. Push OK.
	4. Push OK when the message to change the defautl loggin credentials shows on the display. The users table, which is used to manage the registered users, shows on the display.

	**5.** Push on the row of the default user. The user modifcation window shows.
	6. Change the Name, ID, Password and security level values. Push OK to save the values.
	7. Complete the table with the necessary users or push OK to leave.

Note: *If the instrument security is enabled and the login credentials are not known, contact Hach Service support with the recovery code to get the login credentials. The recovery code shows on the login window. The supplied login credentials expire in one day. Make sure to change the login credential with known values.*

Figure 34 Recovery code

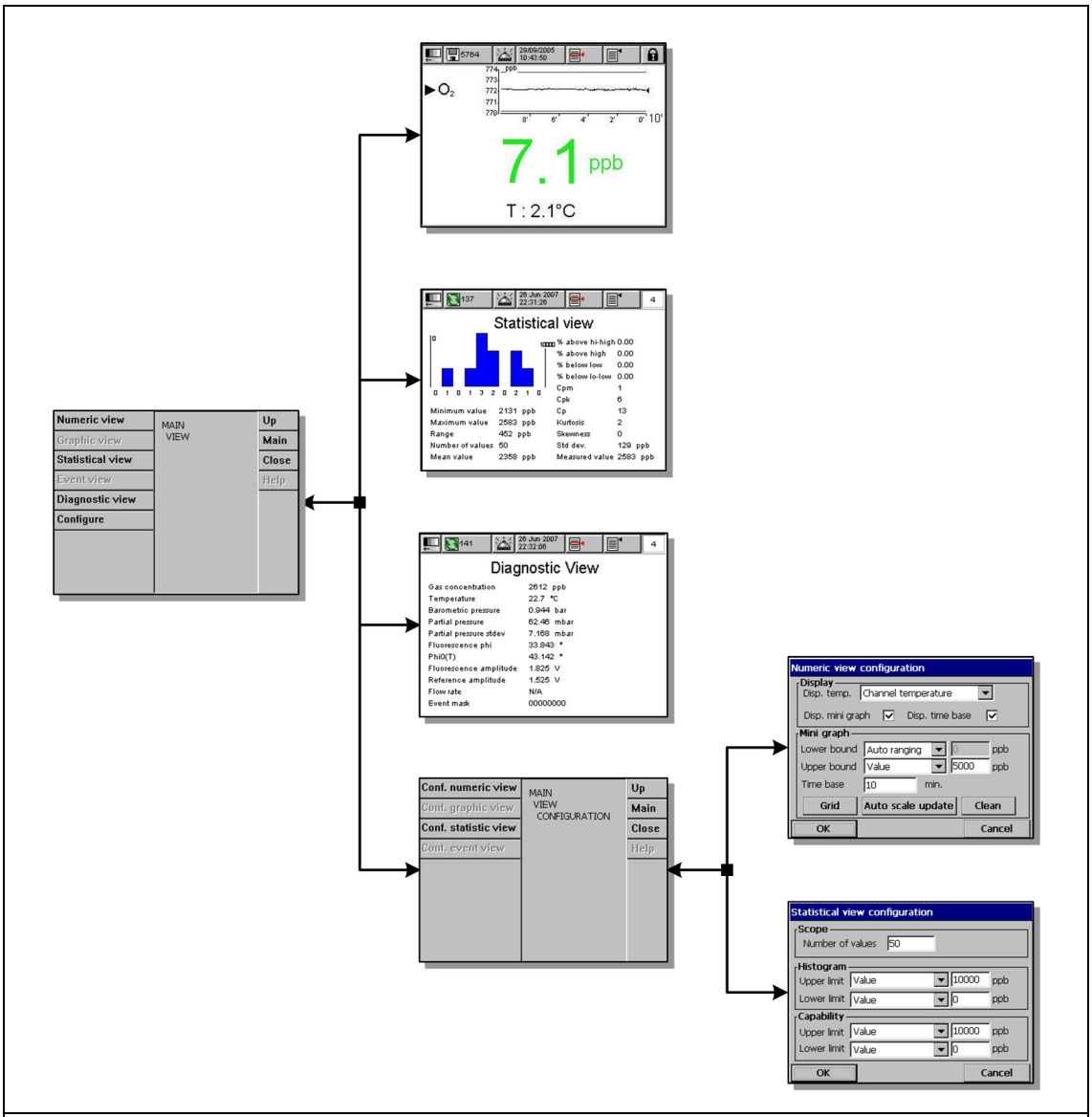


Figure 35 View menu

6.1 Selection of the view style

Numeric view

This is the default view. Display shows the numeric measurement value identified for the gas measurement channel, a graphic showing measurement value evolution during the set time frame, and sample temperature.

The display is refreshed after each measurement cycle (Based on the oxygen level: 2 seconds below 2000 ppb, 30 seconds between 2000 and 3000 ppb and 60 seconds above 3000 ppb).

This display can be configured to suit individual conditions and convenience.

The K1200 **low range sensors** measure dissolved oxygen up to a maximum value of 5000 ppb. Should the measured concentration go above this value a warning screen will be displayed and the measurement cycle increased from 2 to 60 seconds.

The “> 5.0 ppm” value will blink alternately with an “Out of range” message. An arrow symbol to the right indicates if the value is increasing, decreasing or remaining constant.

Once the value falls below the 5000 ppb value, then the measurement cycle returns to a 2 second interval.

For K1200 **high range sensors**, the above also applies but the maximum value measured is 40 ppm. Therefore the out of range message will display “> 40 ppm” which is suppressed when the measured value falls below 40 ppm.

Diagnostic view

The diagnostic view contains useful information for troubleshooting purposes.

Statistic view

This feature offers statistical data that matches with Total Quality management tools. Statistics is a tool to better analyze how a process behave. The 510 statistics window gives some useful information.

The statistics are calculated from the data in the measurement file. The values are updated each time a new value is added to this file. Therefore the changes made in the configuration window are considered only once a new value is added.

Cp process capability

Cp is an index used to assess the width of the process spread in comparison to the width of the specification. It is calculated by dividing the allowable spread by the actual spread.

- A Cp of one indicates that the width of the process and the width of the specification are the same.
- A Cp of less than one indicates that the process spread is greater than the specification. This means that some of the data lies outside the specification.
- A Cp of greater than one indicates that the process spread is less than the width of the specification. Potentially this means that the process can fit inside the specification limits

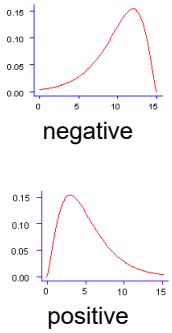
CPk process variability

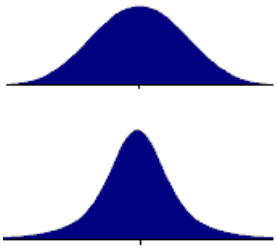
Cpk takes into account the center of the data relative to the specifications, as well as the variation in the process.

- A Cpk value of one indicates that the tail of the distribution and the specification are an equal distance from the overall average.
- A Cpk of less than one means that some of the data is beyond the specification limit.
- A Cpk greater than one indicates that the data is within the specification.
- The larger the Cpk, the more central and within specification the data.

CPm process repeatability

Capability index that takes into account variation between the process average and the target. If the process average and the target are the same value, Cpm will be the same as Cpk. If the average drifts from the target, Cpm will be less than Cpk.

Skewness	
 Figure 36 Skewness	An asymmetric frequency distribution is skewed to the left if the lower tail is longer than the upper tail, and skewed to the right if the upper tail is longer than the lower tail. Distributions of positive-valued random variables values are often skewed right.

Kurtosis	
 Figure 37 Kurtosis	Kurtosis is a parameter that describes the shape of a random variable's probability distribution. The graphs on the left illustrate the notion of kurtosis. The lower curve has higher kurtosis than the upper curve. It is more peaked at the center, and it has fatter tails

6.2 Configuration of the view styles

Numeric view configuration
List of parameters that can be adjusted to customize the numeric view display: • **Display temperature**: no, channel temperature • **Display mini graph**: yes/no • **Display time base**: yes/no • **Upper bound**: Adjust graph upper limit • **Lower bound**: Adjust graph lower limit • **Time base**: Adjust graph time span • **Grid button**: Set up the graph to display the x or y axes, the grid, or the thresholds • **Auto Scale update**: Automatically set the graph upper and lower bounds to best fit the actual values displayed. • **Clean button**: Clear the slope displayed. The slope restarts from the left side.

Statistic view configuration
Scope: • **Number of values**: Statistic calculation range (from 10 to 1,000 values). Number of value taken in consideration in the log file since last value stored. The recorded values with alarms are not considered for calculation, but are part of the log file. **Histogram:** • **Upper limit**: Select High or High High alarm value, or a custom value. • **Lower limit**: Select Low or Low Low alarm value, or a custom value. **Capability:** • **Upper limit**: Select High or High High alarm value, or a custom value. • **Lower limit**: Select Low or Low Low alarm value, or a custom value.

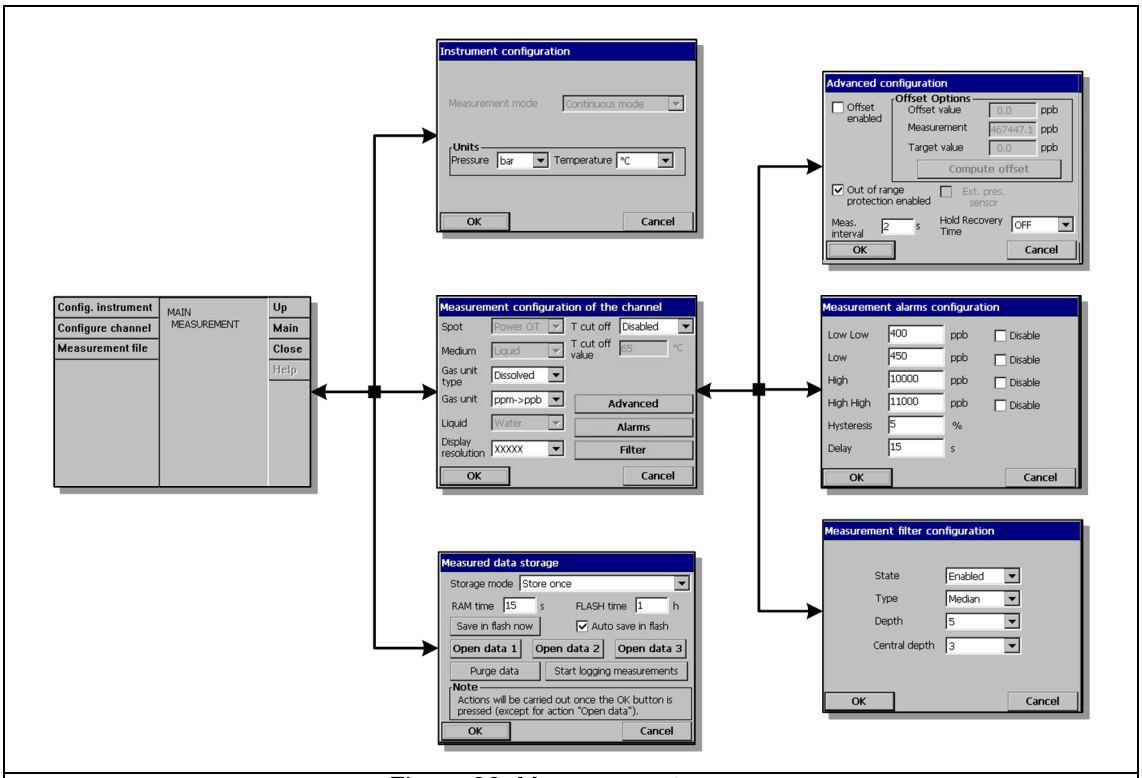


Figure 38 Measurement menu

7.1 Instrument configuration

Continuous mode description
Continuous mode is typically used for process measurement. **Continuous mode cycle** • Every 2 sec. measurements are refreshed on the display • The relays and the analog outputs are updated • Measurements are continuously stored in memory (volatile and non volatile memory) according to individual settings Measurement mode is locked on **Continuous**. Select the units for barometric pressure and temperature.

7.2 Measurement configuration

Measurement configuration

- **Sensor**: Sensor model.
- **Medium**: Liquid or gas phase.
- **Gas unit type**: Partial, Fraction, Dissolved.
- **Gas unit**: The list of available units depends on unit type selected above.

Note: *This is the gas concentration measured by the sensor. When a composite unit is selected (e.g. ppm-ppb) the unit will change depending on the range of the value to display.*

- **Liquid**: For the K1200 sensor this option is locked on water.
- **Display resolution**: Maximum resolution depends on gas, membrane and unit. A maximum of 5 digits can be displayed. Decimals can be limited to 0, 1, 2 or 3 decimals for easier reading. That does not affect the actual resolution of data measured and stored, but only the data displayed.
- **Thermal cutoff**: To protect the sensor, the thermal cutoff function allows for setting a sample high temperature limit. If exceeded (during a Cleaning In Place cycle for example) the electrical signal to the sensor is cut off, the measurement session is suspended and the system displays a “HOT” alarm message. The system resumes when temperature drops to 90% of the specified cutoff temperature.
  - **Thermal cut off**: It is recommended to enable this feature to maximize sensor life and system performance.
  - **Thermal cut off temperature**: Set to 5°C above sample temperature e.g. if sample temperature is 2°C, set thermal cut-off to 7°C.

Measurement advanced configuration

Important Note: *The offset feature described below should be used for minor measurement adjustments only, and not as an alternative to a sensor calibration. Make sure your sensor has been correctly calibrated before applying this feature.*

- **Offset enabled**: Check this box to enable the user measurement offset option. If checked enter an offset value or a target value:
  - **Offset value**: Enter an offset value to manually adjust (increase or decrease) the current measurement value. If the gas unit type or gas unit (defined in the main measurement configuration screen) are changed, the offset value is automatically reset to zero.
  - **Measurement**: This field cannot be updated. It shows the current measurement value with the offset value applied.
  - **Target value**: Enter a target measurement value. The offset value is then automatically computed so that the displayed measurement value will be equal to the target value.
  - **Compute offset**: Use this button to recompute the offset value at any time during the measurement process. The offset value will be computed based on the current and target measurement values.
- **Out of range protection**: Enabled by default. When enabled and the measured value exceeds the instrument specification, the measurement interval will be increased to 1minute to protect the lifetime of the sensor spot. If disabled, the lifetime of the spot can be negatively impacted if the sensor is exposed to high oxygen concentrations for long periods of time.
- **Measurement interval**: This parameter defines the interval for refreshing the measurement value on the display. Set the value to between 2 and 60 seconds, according to your response time requirements.
- **Hold recovery time**: This parameter defines the interval during which the outputs remain frozen after the measurement is no longer on HOLD. Set the value to between OFF and 10 minutes, according to the timing of your setup.

Measurement alarms configuration

Set the thresholds for the low/high concentration levels, according to the application. Each alarm type can be individually enabled or disabled without losing its settings.

These events can activate the relays and can be displayed.

- **Low-low**: 2nd stage for too low concentration
- **Low**: 1st stage for too low concentration
- **High**: 1st stage for too high concentration
- **High-high**: 2nd stage for too high concentration
- **Hysteresis**: A percentage of the above concentration values. The hysteresis is used to prevent relay “flickering” when the measurement is just at the alarm levels. Set this to a minimum, but enough to eliminate flickering.

  As an example, if the High Alarm is set to 40 units and the Hysteresis is set to 10%, then the High Alarm is activated once the measurement reaches 40 units, but only deactivated once the measurement drops below 36 units. With the Low Alarm the opposite is true, in that if the Low Alarm is set to 20 units and the Hysteresis set to 10%, then the Low Alarm is activated when the measurement drops below 20 units, and deactivated when the measurement rises above 22 units.
- **Delay**: The delay in seconds, before alarms go on whenever concentration values go above ”High alarms” or below “Low alarms”. Set this to a minimum value, but enough to avoid alarms for non-representative peaks beyond the set level.

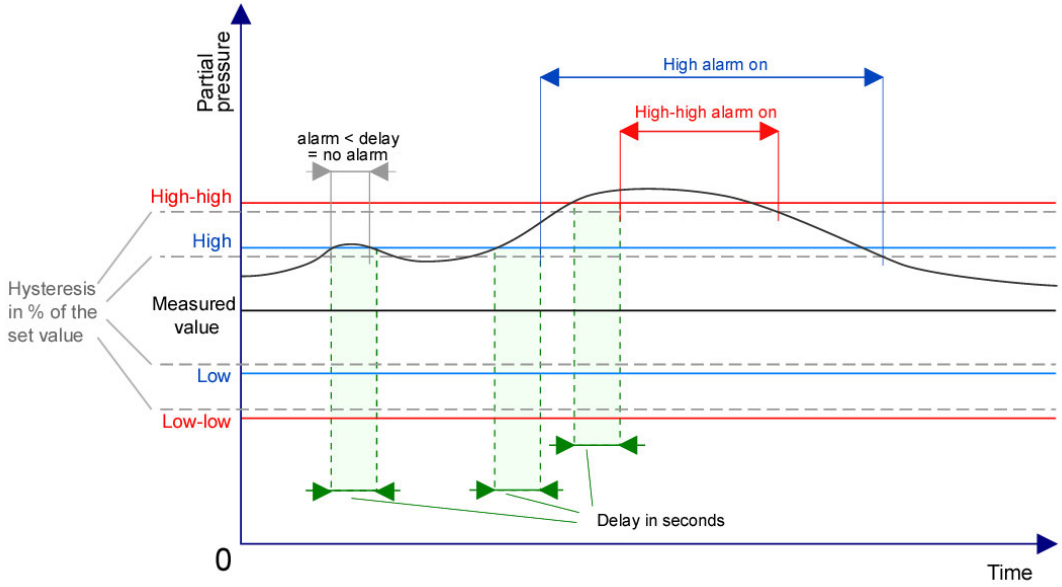


Figure 39 Alarms system diagram

Measurement filter configuration

The filters are aimed at “flattening” the measurement curve in situations where the process shows atypical peak values that could otherwise hamper the interpretation of measurement readings. The filter is applied on the last set of measurements each time a measurement is taken.

- **Mean**: Mathematical average of the last set (depth) of measurement values.
- **Median filter**: Allows for eliminating atypical peak measurement values, and average the remaining ones. The calculation sorts the last measurements set (depth) by values, then delete the highest and lowest values, and averages the remaining values (central depth).

  Example for depth 7, central depth 5:
  Sorted values, both ends eliminated, the average of the center five is then **3.88**.

  0.7 - 1.1 - 4.0 - 4.3 - 4.4 - 5.6 - **7.0**

  Example for depth 5, central depth 3:
  Sorted values, both ends eliminated, the average of the center three is then **4.23**.

  1.1 - 4.0 - 4.3 - 4.4 - **5.6**

  Example for depth 8, central depth 4:
  Sorted values, both ends eliminated, the average of the center four is then **4.43**.

  0.7 - **1.1** - 4.0 - 4.3 - 4.4 - 5.0 - **5.6** - **7.0**

Oxygen interference configuration
These options are available to take into account the influence of some components or gases in the sample during measurement. All available interference corrections are disabled by default. • Select Chlorinity, Salt or disabled. For chlorinity or salt, it is required to enter the actual concentration in sample.

7.3 Measured data storage

Measured data storage
There is one measurement file which contains the data generated by the measurement cycle. The measurement files are updated in volatile memory, and regularly copied in non-volatile memory (file back-up). At start up, the measurement files in volatile memory are updated with the files from the non-volatile memory. ***Note:*** *When the measurement file is full, it is managed as a First in-First out buffer.* This dialog box allows adjustment of the parameters for recording and storing measurements. **Storage modes:** • No storage • **Store once**: When the volatile memory is full (10,000 positions), the recording of measurement stops • **Rolling buffer**: When the volatile memory is full, the latest measurement set replaces the oldest one continuously (first-in, first-out) ***Note:*** *Data stored in volatile memory are lost when instrument is off, non-volatile memory is permanent. In case of an accidental power off event, the instrument resumes measurement storage after the last measurement stored in flash.* • **RAM time (volatile memory)**: Delay in seconds between two recordings of measured data. • **FLASH time (non-volatile memory)**: Delay in seconds between two data file transfers from volatile memory into non-volatile memory. The last data file erases the previous one. This field is only available if the Auto save in flash box is checked. • **Save in flash now**: Press this button to store measurement data in flash (non-volatile memory) immediately. After pressing this button, press OK to initiate the process. A warning screen appears informing you that the operation can take up to 30 seconds. Press Yes to continue with the process, or No to abort. • **Auto save in flash**: Check this box to save measurements in flash (non-volatile memory) automatically. Measurements are saved at regular time intervals as defined in the FLASH time box. • **Start logging measurement**: Store once mode. Starts and stops the measurement recording session. Measurement recording is stopped when the buffer is full. • **Purge data**: Clear all data for all channels in the volatile and non-volatile memories. • **Open data**: Opens a table showing the measured values which are stored in the volatile memory (RAM). Use the scroll bar at the right to move to another data range (the id range will be shown in the title bar). The page number being viewed and the total number of pages are shown at the bottom. Use the keys at the bottom to move directly to the first page, previous page, next page or last page.

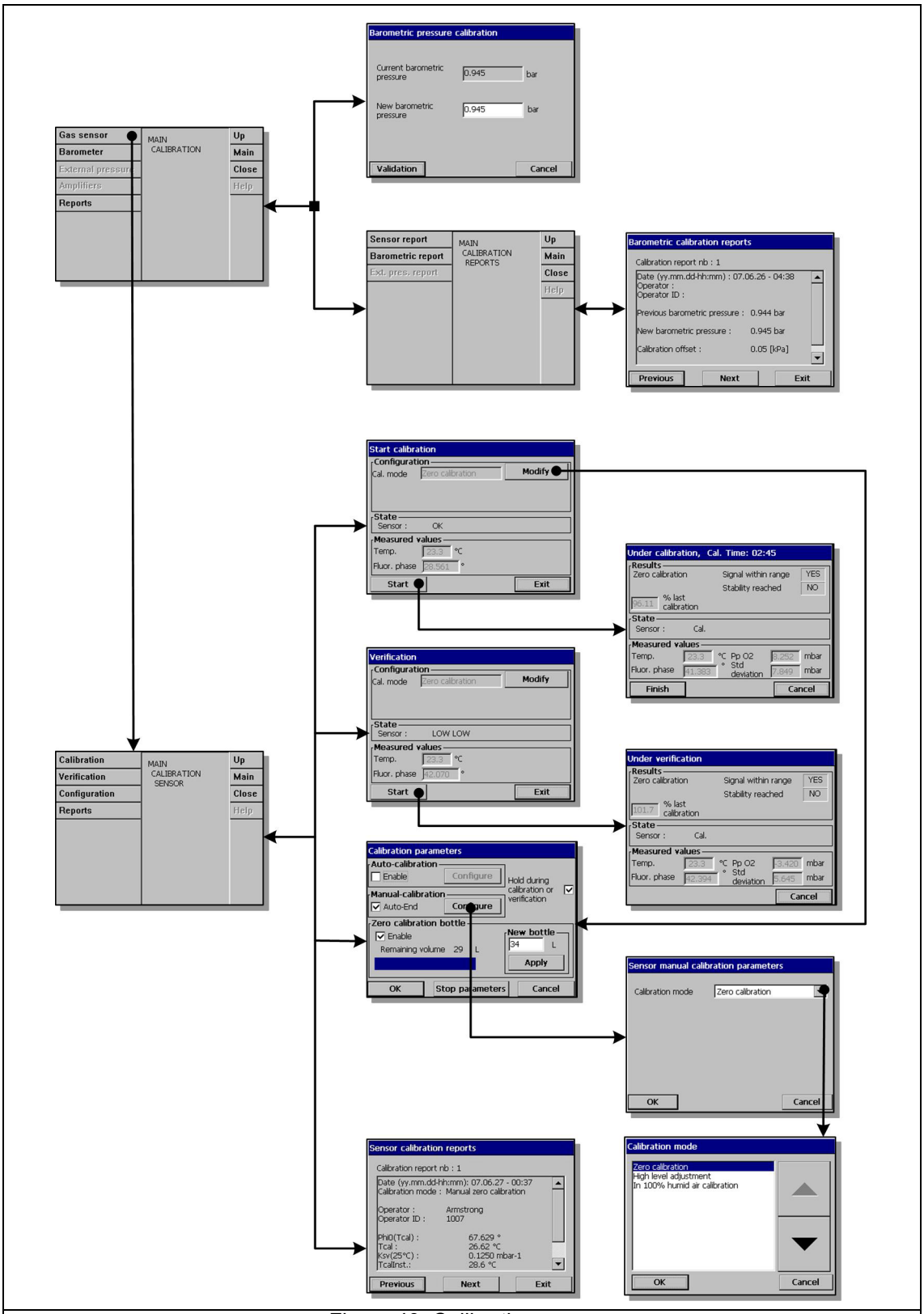


Figure 40 Calibration menu

Calibrations can only be performed once the instrument has been installed, configured, and the channel has been set up. You must also ensure that you have the correct access rights to access the calibration menu.

The temperature sensor is factory calibrated and can only be changed by a Hach representative.

8.1 Sensor calibration

Sensor calibration

The sensor can be calibrated manually on an ad hoc basis. By default, the mode is set to zero calibration with auto-end (refer to Calibration configuration on page 57 for more details), but these parameters can be changed.

For higher level 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 more than 1% oxygen, or a known line sample. However, this should not be done without first ensuring the zero point is accurate. This can be achieved by performing a zero calibration first.

Low range sensors: (K1200-L spots)

There are two calibration modes available - zero or high level adjustment. The sensor is factory calibrated at zero. During use, the zero calibration is the best calibration to guarantee the sensor specifications. After a spot replacement, a zero calibration is recommended.

High range sensors: (K1200-H spots)

There are three calibration modes available - zero, high level adjustment or in 100% humid air.

The sensor is factory calibrated at zero and in 100% humid air. During use, humid air calibration is the best calibration to guarantee the sensor specifications. After a spot replacement, a zero calibration and a 100% humid air calibration are recommended.

Initial sensor calibration

The sensor has been calibrated at the factory prior to shipment and is ready for use upon delivery. However, if the sensor has not been used for a period of more than six months since delivery, or if the sensor spot has been replaced or changed in any way, then a sensor calibration will be required.

Select the **Configuration** option from the **Gas sensor** calibration menu to check the calibration parameters.

Ensure the parameters are set up as illustrated left:

- **Auto-calibration**: This option is not available for the K1200 sensor.
- **Manual-calibration Auto-End**: On by default.
- **Hold during calibration or verification**: On by default.
- **Zero calibration bottle**: Ensure this is **disabled** by unchecking the box as it is not relevant for the K1200 sensor.

Exit from the configuration screen by pressing on **OK**. Then select **Calibration** from the **Gas sensor** calibration menu and perform a manual zero calibration as described in Zero calibration on page 58. For high range sensors perform an additional 100% humid air calibration as described in 100% humid air calibration (high range sensors only) on page 58.

Manual calibration

Manual calibrations can be made at any time. Perform a calibration by following these steps:

1. Remove the sensor from the sample line.
2. Rinse the sensor head with clean water.
3. Wipe the sensor head with a clean soft tissue to remove any excess moisture.
4. If using the supplied calibration device (refer to Portable calibration device on page 36), insert the sensor into the sensor holder on top of the calibration device. If not using the calibration device, insert the sensor into the flow chamber.
5. Flow the calibration sample through the calibration device or flow chamber as applicable. If using the calibration device, fully open the valve on the pressure reducer to give a gas flow rate of 0.1 L/min. If you are **not** using the supplied calibration device with pressure reducer, the **maximum** allowable inlet pressure must be no more than 2 bar absolute.
6. Configure the calibration as described in Calibration configuration on page 57.
7. Start the calibration as described in Zero calibration on page 58, 100% humid air calibration (high range sensors only) on page 58 or 100% humid air calibration (high range sensors only) on page 58 depending on the preferred calibration method.

8.2 Calibration configuration

Calibration configuration

This option can be invoked directly from the main calibration menu by selecting the **Configuration** option, or by pressing the **Modify** button in either the zero calibration or high level adjustment screens. The process sets all the parameters used for sensor calibration.

- **Auto-calibration**: This option is not available for the K1200 sensor.
- **Manual-calibration Auto-End**: On by default. When enabled, a manual calibration will complete automatically when the parameters defined in **Stop parameters** are reached. Press on **Configure** to set the manual calibration parameters (refer to Configure manual calibration on page 57 for details). If the calibration fails, the previous calibration parameters remain unchanged and a warning message displayed.
- **Hold during calibration or verification**: On by default. This keeps the last measured value and stops updating the outputs during the calibration or verification process. This avoids sending invalid information to any connected device. At the end of a calibration, this hold remains for a further 10 minutes to allow the system to stabilize.
- **Zero calibration bottle**: Ensure this is **disabled** by unchecking the box as it is not relevant for the K1200 sensor.

If the **Stop parameters** button is pressed on the main configuration screen, you can view or change the existing values, or restore the default values.

It is highly recommended to leave these parameters at their default values and not change them.

These values apply to manual calibrations with the **Auto-End** parameter set.

- **Start period**: is the minimum time period that must elapse before measurements are considered valid.
- **Number of points**: is the minimum number of measurements that must be taken.
- **Stop criteria**: is the maximum allowable signal standard deviation value to ensure an accurate calibration.

Configure manual calibration

This option sets the parameters required for manual sensor calibration.

- Calibration mode:
  - Zero calibration
  - High level adjustment
  - In 100% humid air calibration (available for high range sensors only)

If zero calibration or 100% humid air calibration is selected, no other parameters are required to be set. However, the following parameters must be set if high level adjustment has been selected.

- **Calibration sample**: Set to **In line sample**, **Gas bottle** or **Factory parameters**. If factory parameters is selected, the Ksv value is displayed but can be changed.

These additional parameters are required if in line sample or gas bottle has been selected as the calibration sample.

- **Medium**: This is automatically set to **liquid** if in line sample has been selected as the calibration sample, or **gas** if gas bottle has been selected.
- **Gas unit type**: Either **partial** or **dissolved** are available for an in line sample. If gas bottle was selected this is set to **fraction**.
- **Gas unit**: The list of available units depends on unit type selected above.
- **Liquid**: This defaults to **water** for K1200 sensors.
- **Reference value**: Enter the reference value for calibration

Press **OK** to return to the main calibration screen.

8.3 Zero calibration

Zero calibration
With this method, the sensor should be removed from the sample and exposed to pure N_2 gas. It is recommended to use the specially designed portable calibration device for this purpose. Refer to Calibration devices on page 36.
Press **Start** to start the calibration.
A screen is displayed showing the measured values and length of time the sensor has been under calibration. These values are continually refreshed.
The value **% last calibration** displayed in the top box is an informational message showing the difference between the current and previous sensor calibrations.
The **Signal within range** and **Stability reached** boxes in the top right corner indicate whether the calibration is within acceptable limits. When both boxes indicate **YES**, press **Finish** to accept the new calibration. A confirmation screen then asks to accept and store the new parameters.
If one or both boxes show **NO**, you can still perform a calibration but it is not recommended, and the calibration should be aborted by pressing the **Cancel** button.
In the case of a calibration failure, attempt a second calibration after about 5 minutes. If the second attempt also fails, then refer to your Hach representative for advice.
Note: *If the Auto-End parameter is set (refer to Calibration configuration on page 57), then the calibration will be deemed successful when the parameters defined in **Stop parameters** are met. You will then be asked to confirm the calibration.*
If you have not accepted or cancelled the calibration after an elapsed time of 10 minutes then the process will time-out, a warning message will be displayed.

8.4 100% humid air calibration (high range sensors only)

In 100% humid air calibration
With this method, the sensor should be removed from the sample and exposed to air saturated with humidity. Do this by putting a drop of water in the calibration cap before installing the cap on the sensor.
Press **Start** to start the calibration. The process is then the same as for the zero calibration described previously.

8.5 High level adjustment

High level adjustment
Note: *Before using this option, ensure a zero calibration has been successfully completed first.*
This calibration exposes the sensor to a gas or a liquid sample with a known gas concentration. You also have the option to reset the sensor's calibration parameters to factory settings (from drop-down list for **Cal. sample**).
Press **Start** to start the calibration. The process is then the same as for the zero calibration described previously.

8.6 Sensor verification

Sensor verification
Similar to the calibration procedure, but used for verifying the calibration values. The results of the measurements made during the verification are not stored and the calibration data is not modified.

8.7 Barometric pressure calibration

Barometric pressure calibration
Note: *The barometric sensor has been factory calibrated but should be periodically verified with a precision certified barometer. This is only necessary if measuring in gas phase with fraction units (%, ppm).*
Upper box shows the barometric pressure measured by the instrument.
Using a precision certified barometer, measure barometric pressure in the location where the measuring instrument is used. Compare the values, if values are the same press **Cancel**, otherwise enter the new barometric value in the lower box and **Validate** the new setting.
On completion a calibration report is created.

8.8 Calibration reports

Calibration reports
Once a calibration is completed (for a gas or pressure sensor), the calibration report is updated with the new details. The calibration report contains data for the last 10 calibrations.
For full details on the data displayed for all the different type of calibration reports, refer to the examples listed under Data available on page 73.
Each calibration record will contain parameters useful for traceability. For instance, it will contain: • the date and time • the calibration mode (zero, 100% humid air, or high level adjustment) • the calibration type (manual or automatic) • the operator name and ID • all the measurements which influence the calibration (temperature, barometric pressure, current, etc.)

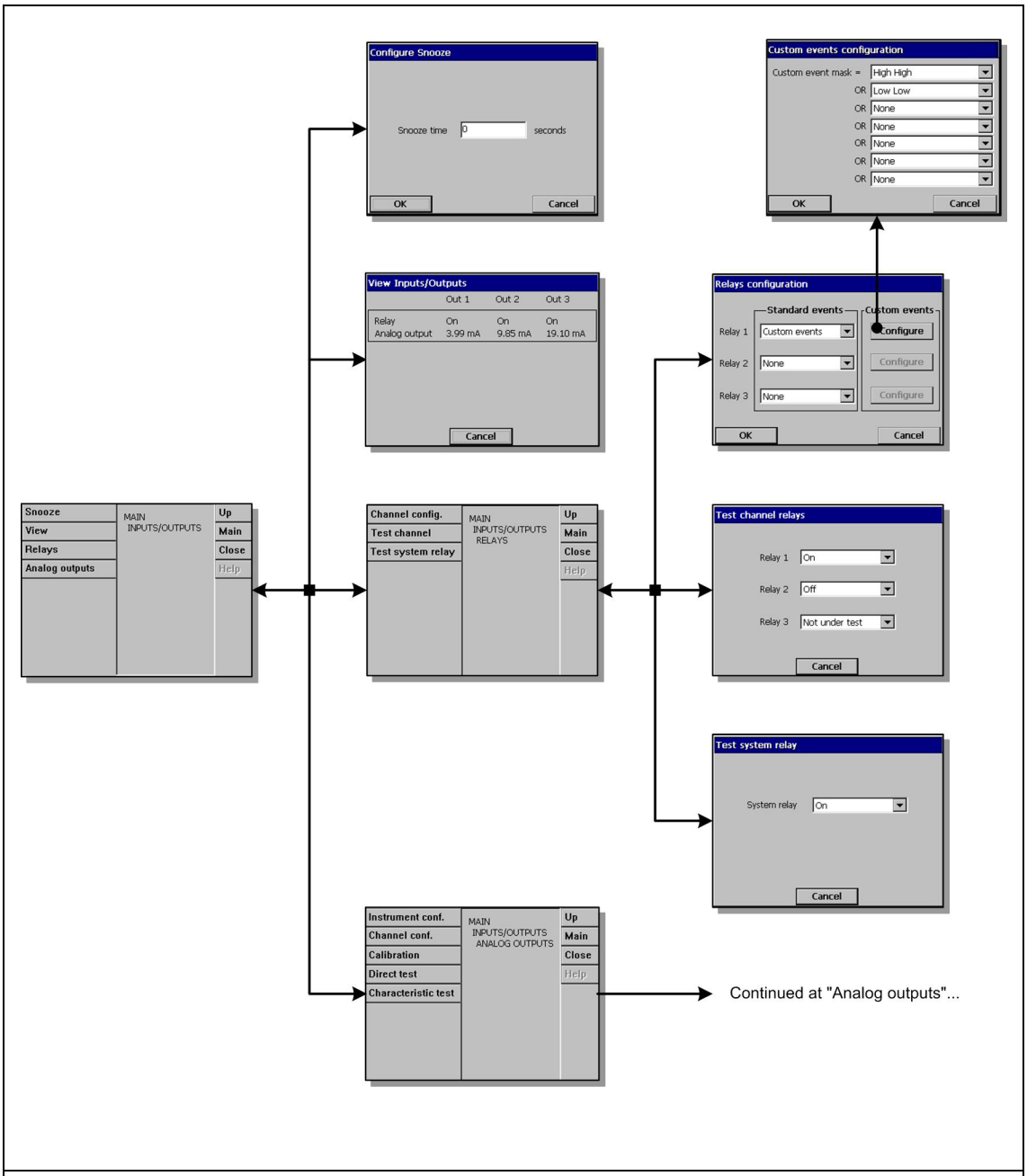


Figure 41 Inputs/Outputs menu

9.1 Configure snooze

Configure snooze
In the event of an alarm, the “snooze” button stops the instrument buzzer and returns all the relays in the instrument to their normal state during a "snooze time". Enter the snooze time in seconds and press **OK**.

9.2 View inputs/outputs

View inputs/outputs
This view option displays the state of the 3 alarm relays (on or off), and the analog output current value for each.

9.3 Relays

Relays	
There are three measurement alarm relays and one system alarm relay for the instrument. These relays are configurable as either standard or custom events through the instrument menu. • An alarm relay can be activated or deactivated • When the alarm is OFF, it is activated, • When the alarm is ON, it is deactivated All the relays are activated as soon as the instrument is ON (but alarms are OFF). When the instrument is OFF, the relays are deactivated, thus in this state, all alarms are ON. The logic "Relay deactivated = Alarm ON" has been chosen for this safety reason. When the main board does not communicate with the measurement board for more than 30 seconds, the measurement board switches all the alarm relays and the analog output to the alarm state.	
Relays configuration	The three relays can be triggered by several standard events, or a combination of events (custom). The relays output can be used to turn on a beacon, horn or PLC. Refer to Connections to electronic boards on page 31. ***Note:*** *Relays can be set to Normally Open [NO] or Normally Closed [NC] by changing the jumper positions on the measurement board. Refer to Measurement alarm relays on page 32.* • Select a standard event in the rolling list • If “Custom event” has been selected, it has to be configured by touching the **configure** button • Press on the text box to open the selection menu (rolling menu). Select the events that must trigger the relay, and press **OK**. Proceed in the same manner for other events that should trigger the relay.
Test channel relays	The three measurement alarm relays can be manually activated for testing purposes: • Select Relay **On**, **Off** or **Not under test**. See note regarding the relays below. “Not under test” means the relay is in operating mode, and it will be triggered normally. ***Note:*** *A relay set to NO will close when activated (**On**), but a relay set to NC will open. Refer to Measurement alarm relays on page 32.*
Test system relay	Similarly, the system alarm relay can be manually activated for testing purpose. • Select Relay **On**, **Off** or **Not under test**.
Note: *In both the Test Channel Relays and Test System Relay options above, once the tests have been completed press Cancel to exit the screen. At the same time, this will reset all relays (including the system relay) back to a status of “Not under test”.*	

9.4 Analog outputs

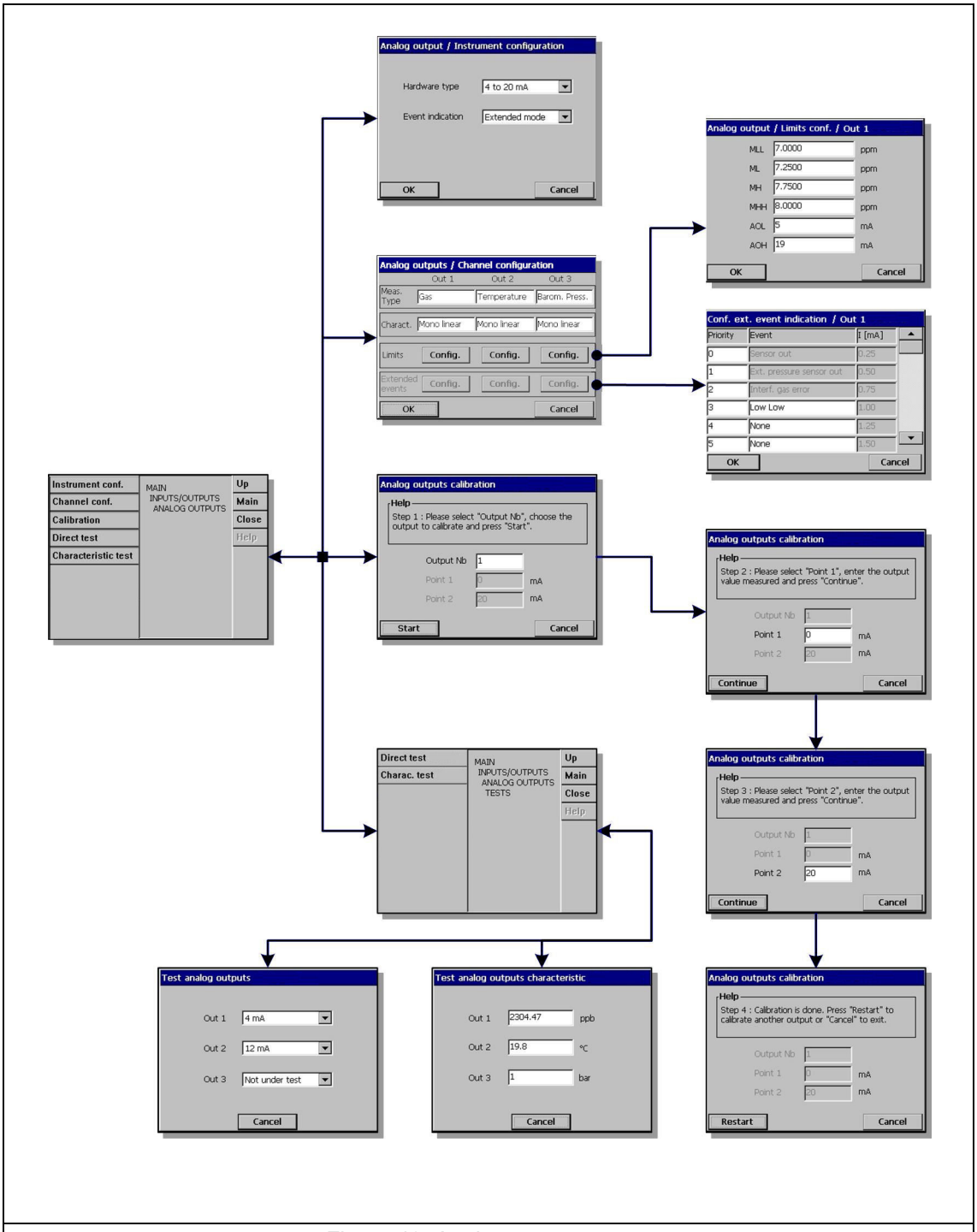


Figure 42 Analog outputs menu

Analog outputs	
There are three analog outputs available. These outputs are configurable in terms of function, content, and behavior through the instrument menus. Analog outputs are used to output a current which is a function (e.g. a linear characteristic) of a measurement: AOut = *f* (M). The analog outputs can be typically connected to a PLC. Knowing the function (*f*), the PLC can compute the value of the measurement.	
Instrument configuration	• Select analog output range of current: 4-20 mA or 0-20 mA • The 4-20 mA range (recommended) allows for an extended event indication mode that can be selected and configured (default = standard mode) For some events (sensor out, purge failure, etc.) the actual measurement is not significant, but the PLC needs to know how the analog output behaves in these cases. Two "Event indication modes" are available: • Standard mode (default) • Extended mode
Standard event indication	Refer to Table 1 Standard event indication below.
Extended event indication	The "Extended event indication" mode is only available when the 4-20 mA output is selected. In this mode, the range between 0 mA and 4 mA is used to indicate selected events. The events are defined using the channel configuration option. Refer to Channel configuration on page 65.

Table 1 Standard event indication

Analog output	Event output range		Event
	0-20 mA	4-20 mA	
Gas concentration	20 mA	20 mA	• Channel out • Sensor out • Thermal cut-off • Interfering gas error
Temperature	20 mA	20 mA	• Channel out • Sensor out

Analog outputs (continued)	
Channel configuration	Set the type of measurement that will be transmitted through each output channel, and the output characteristics. • **Meas. type**: Select between the type of measurements available in the rolling list. • **Characteristics**: Select either Linear, Tri-linear or None. Refer to Analog output characteristics on page 67. • **Limits**: Press the configure button to adjust the analog output set points for each output. Enter values in the appropriate text boxes. In Linear mode, only the ML and MH values can be adjusted. Tri linear mode allows all limits to be adjusted, and the None mode denies access to this screen. The authorized user may define a maximum of 12 customized events for each analog output and change the order of priority of all events. ***Note:*** *This only applies to Tri linear and Linear outputs. It is not available if the output characteristic is set to None.* Configure the events that should be signaled at the corresponding current shown in the right column. • Only one event signal at a time can be sent via the current output. As there is a possibility to have several events at the same time, an order of priority must be set. This order has been set by default, but it can be modified to suit particular needs and conditions. Touch the priority number in the left column and edit it. • The shaded events in the list have preset outputs and only the priority can be changed. The other events can be customized by the user. Touch a white text box to call up the rolling list. Select an event from this list and press **OK**. Then adjust the priority as required. ***Note:*** *When an event occurs, measurement information is superseded by the event information on the output.*

The following table lists the default configuration. The first three events on the list are pre-set and only the priority can be changed:

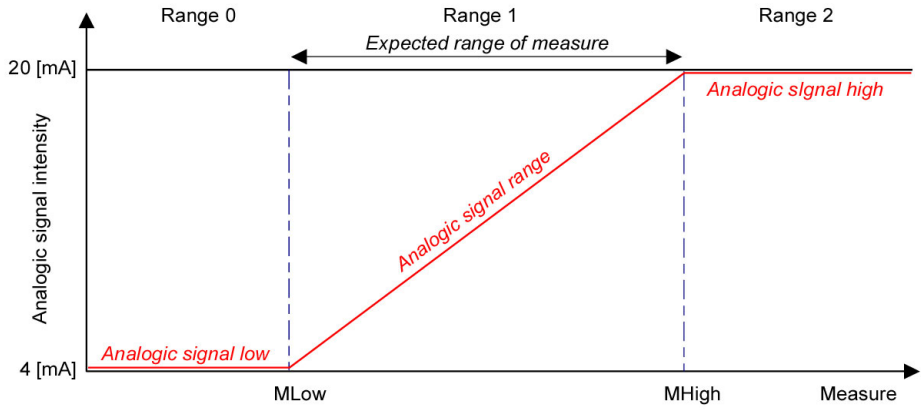
Table 2 Extended event table

Priority	Event	I [mA]
0	Sensor out	0.25
1	External pressure sensor out	0.50
2	Interfering gas error	0.75
3	Custom Event 1	1.00
4	Custom Event 2	1.25
5	Custom Event 3	1.50
6	Custom Event 4	1.75
7	Custom Event 5	2.00
8	Custom Event 6	2.25
9	Custom Event 7	2.50
10	Custom Event 8	2.75
11	Custom Event 9	3.00
12	Custom Event 10	3.25
13	Custom Event 11	3.50
14	Custom Event 12	3.75

Analog outputs (continued)	
Calibration of the analog output	The calibration of the analog output is aimed at aligning the internally calculated current to the real current output. This was performed at factory, but could become necessary again because of electronic tolerances. A precision amperometer connected at the corresponding analog output connection point is required. Refer to Measurement board on page 32. • Select the analog output channel to calibrate and press the **Start** button. • Measure with the amperometer the current value for point 1. It should be below 4 mA • Edit point 1 and enter the same value as read on the amperometer, then press the **Continue** button. • Measure with the amperometer the current value for point 2. It should be above 20 mA. • Edit point 2 and enter the same value as read on the amperometer, before pressing the **Continue** button. Calibration of the selected analog output channel is completed.
Direct test	Test to check the calibration of the analog outputs. A precision amperometer connected at the analog output connection point is required. • Select a value (4, 12, 20 mA available) for each channel and compare this value (± 0.02 mA) with what the amperometer shows. A calibration is required if the value on the amperometer differs from the current selected ± 0.02 mA). ***Note:*** *It is possible to test one analog output without interfering with the others. During the test, the other analog outputs will continue to indicate the measurement.*
Characteristics test	This is a test for the correct operation of the peripherals connected to each analog output, by verifying that the PLC computes the correct value. The analog output will send the current corresponding to the value entered in the text boxes. • Type in a test value for each analog output, and check for the related action on the peripheral.

9.5 Analog output characteristics

Analog output characteristics	
“Linear” analog output	The "Linear" output is the default setting for the analog output. It is illustrated below (4-20 mA output is shown, 0-20 mA settings are similar).



The goal of this setting is to use all the points available on the slope from 4 mA to 20 mA to show the range of measurements that are usual in the measured process. Setting the output this way allows for the highest signal resolution for the actual conditions.

The downside is that any measures below the set range will have the same analog signal locked at 4 mA. Similarly, any measure over the set range will have the same analog signal locked at 20 mA. Settings must be made in balancing these aspects.

Settings

For the output, set ML and MH in the current measuring unit (e.g. °C for a temperature output). When a compound unit is selected the smallest unit will be used (e.g. ppb for a "ppm-ppb" compound unit).

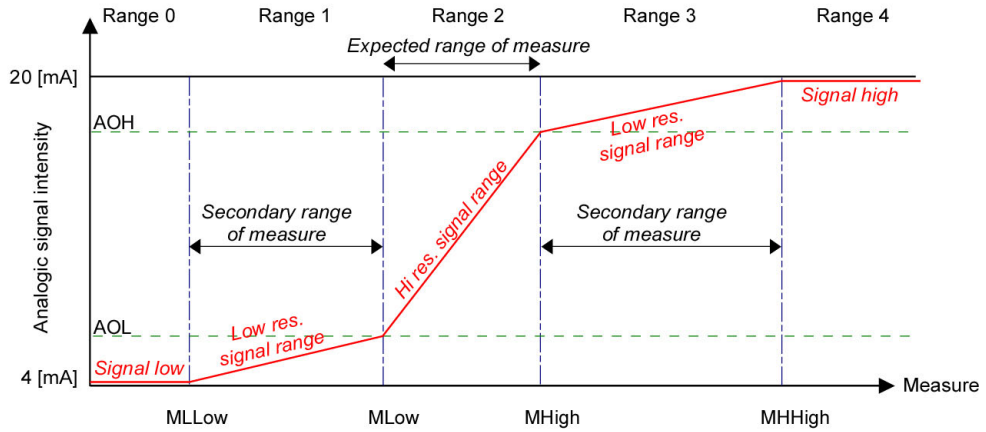
These points should be set keeping in balance the following conditions (see illustration above):

- The smaller is Range 1, the better is the analog signal resolution within the expected range of measure.
- In Range 0 the analog output only shows that measurement is below the ML value. Similarly in Range 2 the analog output only shows that measurement is over the MH value.

The formula to compute the measurement knowing the current I and the resolution R is given in the following table:

Linear	Range	Measurement M	Resolution R
4-20 mA	20 > I > 4	M = ML + (MH - ML) * (I - 4) / 16	R = (MH-ML) / 808
0-20 mA	20 > I > 0	M = ML + (MH - ML) * I / 20	R = (MH-ML) / 1010

Analog output characteristics (continued)	
“Tri-linear” analog output	The "Tri-linear" output brings benefits over the “Linear output” discussed before. It is illustrated below (4-20 mA output is shown, 0-20 mA settings are similar).



Compared to the “Linear” mode, the expected range of measure is Range 2. A Range 1 and 3 are available to show the measures falling out of this Range 2, but normally at a lower resolution. Expected measurements for the measured process are supposed to be in Range 2 most of the time, and in Range 1 or 3 occasionally (problems, calibration, line stop, etc.). The benefits are:

- The PLC can compute the measurement over a large range (1, 2 and 3).
- The PLC can compute a higher resolution signal for the expected measuring range (Range 2: MH > M > ML).
- Carefully selecting the set points allows for an individual resolution for each range, so a different resolution can be applied to Range 1, 2 and 3, allowing to tailor the analog output to the actual conditions.

As before, the downside is that any measure below or over the Range 1, 2 and 3 will have the same signal locked at 4 mA and 20 mA respectively, but Range 1, 2 and 3 should cover a larger range than in the “Linear” mode. Settings must made in balancing these aspects.

Settings

For each output, set MLL, ML, MH, and MHH in the current measuring unit (e.g. °C for a temperature output). When a compound unit is selected, the smallest unit will be used (e.g. ppb for a "ppm-ppb" compound unit). Also set AOL (Analog Output Low) and AOH (High) in mA.

These points should be set keeping in balance the following conditions (see illustration above):

- The smaller is Range 2, the better is the analog signal resolution within the expected range of measure.
- Size of Range 1 and 3 should be set to deliver an adequate level of resolution for the measures falling out of the expected range of measure.
- In Range 0 the analog outputs only shows that measurement is below the MLL value. Similarly in Range 4 the analog output only shows that measurement is over the MHH value.

The formula to compute the measurement knowing the current and the resolution R is given in the following table:

Tri-linear	Range	Measurement M	Resolution R
4-20 mA	1: AOL ≥ I > 4	M=MLL+(ML-MLL)*(I-4)/(AOL-4)	R=(ML-MLL)*20/((AOL-4)*1010)
	2: AOH ≥ I > AOL	M=ML+(MH-ML)*(I-AOL)/ (AOH-AOL)	R=(MH-ML)*20/((AOH-AOL)*1010)
	3: 20 > I > AOH	M=MH+(MHH-MH)*(I-AOH) / (20-AOH)	R=(MHH-MH)*20/((20-AOH)*1010)
0-20 mA	1: AOL ≥ I > 0	M=MLL+(ML-MLL)*I/AOL	R=(ML-MLL)*20/(AOL*1010)
	2: AOH ≥ I > AOL	M=ML+(MH-ML)*(I-AOL)/ (AOH-AOL)	R=(MH-ML)*20/((AOH-AOL)*1010)
	3: 20 > I > AOH	M=MH+(MHH-MH)*(I-AOH)/(20-AOH)	R=(MHH-MH)*20/((20-AOH)*1010)

Analog output characteristics (continued)	
None	This is the default value. Setting the analog output to “None” means that the output value will always be zero and importantly ensures that no current is emitted on that output, so reducing power consumption as well as reducing heat within the instrument.

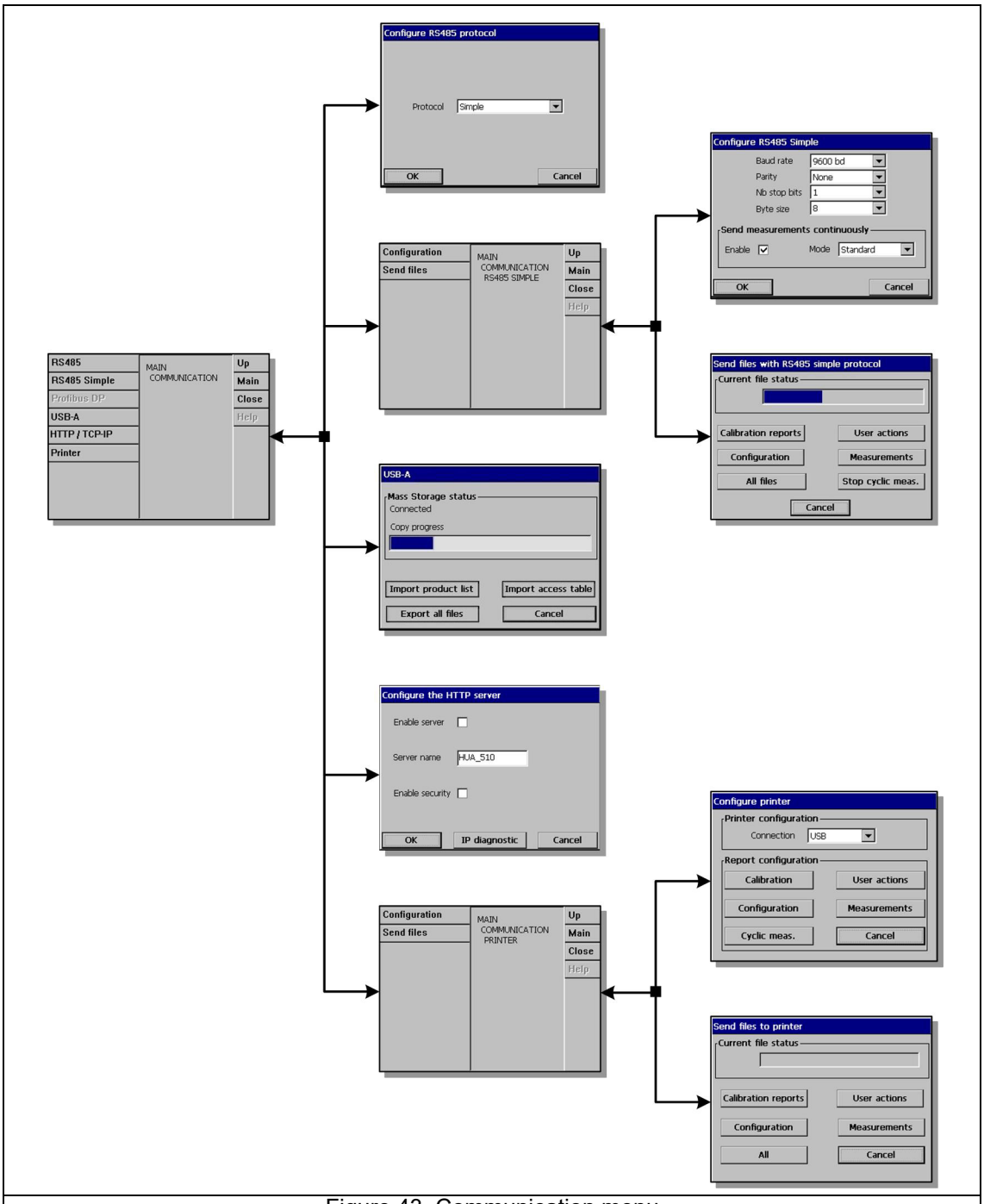
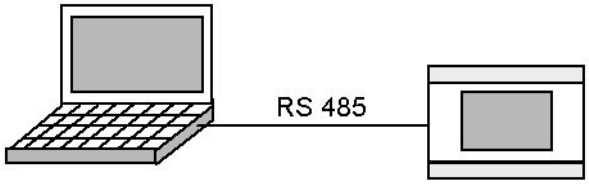


Figure 43 Communication menu

The external RS-485 port of the main board is directly connected to a RS-485 bus (single twisted pair). Optionally it can be connected to a fieldbus module (gateway).

The RS 485 menu allows to select between RS485 simple or Profibus DP communication protocol, depending on application.

- Click on the text box to select either the RS-485 simple or the PROFIBUS-DP communication protocol.



10.1 RS-485 simple mode configuration

This protocol allows the instrument to output data to an external device (PLC, SCADA, PC, etc.). The communication is unidirectional. The data are output on the RS-485 link as simple ASCII text. If for instance you use a PC, the data can be easily visualized and saved in a file using the "Hyperterminal" software.

To use this communications mode, on the instrument:

- Select the **RS-485** option from the **Communication** menu
- Choose the protocol **Simple** (default configuration) and press on **OK**
- Then select the **RS-485 Simple** option from the **Communication** menu:
  - "Baud rate", "Parity", "No of stop bits", "Byte size" Standard parameters of the RS-485 link.
  - "Enable" The measurements can be sent continuously (approximately every 2 sec.). This field allows enabling or disabling this feature.
  - "Mode" This is the format of the measurements sent continuously. Refer to Cyclic measurements on page 73. In "Expert" mode, more data are sent. These additional data can be useful for diagnostic purpose.

Note: *In case of problem verify first that jumper J3 is not installed on the mother board (default configuration).*

Send data

This dialog box is used to send text files to an external device. The possible files are the following:

- Calibration reports
- User actions log file
- Instrument configuration

Measurements stored in the instrument memory.

The button "Stop Cyclic meas." allows to stop and to restart the cyclic transmission of measurements. It is advised to stop the cyclic transmission in order not to mix cyclic measurements and data of the file being transmitted. This button has the same effect as the "Enable" checkbox of the "Communication/RS-485 Simple/Configuration" window.

After stopping the cyclic measurements, select the "Calibration Reports", "User Actions", "Configuration", "Measurements" button to send the corresponding file, or the "All files" button to send all these files in one shot.

Once the button is pressed, the file is sent immediately. The field "Current file status" shows “Sending” alongside the file transmission progress bar. On completion this changes to “Sent”.

10.1.1 Data available

All individual data are separated by at least one tabulation character (ASCII code=0x09).

For the cyclic measurements, the data format is detailed. For the files, only one example for each file is given to explain the data format.

Cyclic measurements

1. If the option "Mode = standard" is chosen, the following message is sent:

CHn\t	Gas\t	Gas Unit\t	Temperature\t	Temperature Unit\t	Barometric Pressure\t	Barometric Pressure Unit\t\	Event\t\r\n

with:

\t .....the ASCII tab character: code=0x09
\r .....the ASCII Carriage Return character: code=0x0D
\n .....the ASCII Line Feed character: code=0x0A
CHn .....the 2 ASCII characters "CH" + the channel no.
Gas.....the gas concentration.
Gas Unit .....the gas unit.
Temperature.....the temperature.
Temperature Unit.....the temperature unit.
Barometric Pressure.....the barometric pressure.
Barometric Pressure Unit .....the barometric pressure unit.
Event .....the event bit mask in hexadecimal format.

The values are not described here. Refer to List of events and alarms on page 99.

- Example of one measurement:

CH1 697.176 ppb 20.1 °C 0.982 bar C00

2. If the option "Mode = expert" is chosen, the following message is sent:

CHn\t	Gas\t	Gas Unit\t	Temperature\t	Temperature Unit\t	BarometricPressure\t	Barometric Pressure Unit\t

Event\t	Phase Shift\t	°\t	Partial Pressure\t	bar\t	Reference Phase\t	°\t

Fluorescent Phase\t	°\t	Reference Amp\t	V\t	Fluorescent Amp\t	V\t

Tinst\t	Tinst Unit\t	Offset\t	Time\t	Index\r\n

with:

Phase shift.....The fluorescence phase shift in [°].
Partial pressure .....The partial pressure in [bar].
Time .....The time of the measurement. Format "hh:mm:ss."
Index.....This is the index of the last measurement.

This number starts at 0 at power up of the program. The following is an example of one measurement:

CH1 697.173 ppb 20.1 °C 0.982 bar 03000000 26.045 ° 0.69700 bar -21.409 ° -64.991 ° 2.349 V 2.499 V 25.531 °C 45.000 22:59:42 5923

Gas sensor calibration report example

Calibration report nb 1
Calibration mode . . . . . .Manual high level adjustment
Date (yy.mm.dd - hh:mm) . . . . .05.02.17 - 18:40
Operator . . . . . .jp
Operator ID 3
Cal. sample . . . . . .In line sample
Medium . . . . . .Liquid
Gas unit. . . . . .ppb
Liquid. . . . . .Water
Ref. value 1.500000
Cal. coefficient Phi0(Tcal) . . . . .25.974°
Cal. coefficient Tcal . . . . . .24.41°C
Cal. coefficient Ksv(25°C) . . . . .-0.1312 mbar-1
Cal. coefficient Tcal.Inst. . . . . .25.20°C
Standard deviation . . . . . .0.003 mbar
Fluor. amplitude. . . . . .0.834 V
Temperature . . . . . .20.1 °C
Calibration duration . . . . . .3 mn

Barometric sensor calibration report example

Calibration report nb 1
Date (yy.mm.dd - hh:mm) . . . . .05.02.16 - 20:38
Operator . . . . . .jp
Operator ID 3
Previous barometric pressure . .0.956 bar
New Barometric pressure . . . . .0.976 bar
Calibration offset . . . . . .3.73 [kPa]

User action log file example

The "User action log file" below contains 3 user actions.

Nr	*mm/dd*	*hh:mm:ss*	*User ID*	*User Name*	*Action ID*	*Description*
1	1/21	15:13:44	1007	Armstrong	139	Change Time/Date
0	1/21	15:13:27	1007	Armstrong	501	Cal. parameters
2	1/21	15:12:15	1007	Armstrong	132	Identification

Measurement file example

6 measurements are illustrated below:

Nr	*mm/dd*	*hh:mm:ss*	*Gas [ppb]*	*Temp [°C]*	*Mask*	*Barom [bar]*	*Ext.P [bar]*	*Phase [deg]*	*T.inst [°C]*	*Offset [ppb]*	*Index*
0	2/17	21:15:37	75.05	20.1	03000000	1.005	0.000	26.39	22.5	35.0	2271
1	2/17	21:15:27	74.95	20.1	03000000	1.005	0.000	26.45	22.5	35.0	2266
2	2/17	21:15:17	75.15	20.1	03000000	1.005	0.000	26.52	22.5	35.0	2261
3	2/17	21:15:57	75.05	20.1	03000000	1.005	0.000	26.41	22.5	35.0	2256
4	2/17	21:15:47	75.00	20.1	03000000	1.005	0.000	26.38	22.5	35.0	2251
5	2/17	21:15:37	74.95	20.1	03000000	1.005	0.000	26.54	22.5	35.0	2246

Configuration report example

GENERAL CONFIGURATION

```
Measurement mode . . . . . .Continuous mode
Pressure unit. . . . . .bar
Temperature unit . . . . . .°C
Storage mode . . . . . .Rolling buffer
Storage RAM time. . . . . .10 [s]
Storage FLASH time . . . . . .3600 [s]
Autosave in FLASH. . . . . .Disabled

Channel 1
Sensor. . . . . .K1200-L
Medium . . . . . .Liquid
Gas unit. . . . . .ppm->ppb
Liquid  . . . . . .Water
Resolution displayed. . . . . .1
Thermal alarm. . . . . .Enabled   90.0 [°C]
Measurement interval . . . . . .5 [s]
Out of range protection . . . . . .Enabled
User offset. . . . . .Enabled
User offset value . . . . . .45
Alarms
Low Low . . . . . .Enabled    100.000000 [ppb]
Low . . . . . .Enabled    200.000000 [ppb]
High. . . . . .Enabled    9000.000000 [ppb]
High High  . . . . . .Enabled    10000.000000 [ppb]
Hysteresis . . . . . .5 [%]
Delay. . . . . .15 [s]
Filter
State . . . . . .Disabled
Type  . . . . . .Median
Depth  . . . . . .5
Central depth  . . . . . .0
```

10.1.2 Example of use

In this example we use:

- One PC with a RS232 port.
- One "RS-485<->RS232 converter"

Procedure:

1. Connect both RS-485 wires of the instrument to the "RS-485<->RS232 converter".
2. Connect the "RS-485<->RS232 converter" to the PC RS232 port using a standard cable (RS232 DB9 straight cable).

On the PC:

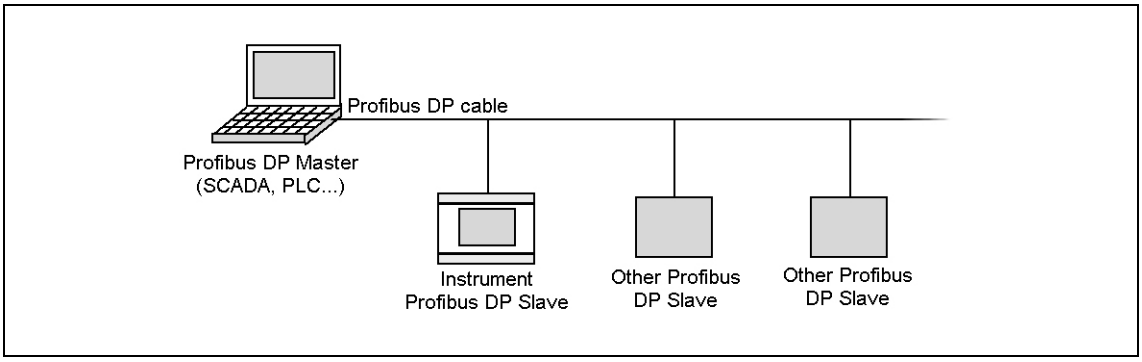
1. Run "Hyperterminal" on the PC.
2. Configure the PC COM port used (e.g. COM2). Menu "File/Properties/Configure".
3. Configure the parameters "Baud rate", "Parity", "Nb of stop bits", "Byte size" (Menu "File/Properties/Configure"). Use the same parameters for the instrument and the PC.
4. Configure the "Font = Courier 10" (Menu "View/Font").
5. Connect "Hyperterminal" (Menu "Call/Call").
6. Save the data received in the file of your choice (Menu "Transfer/Capture Text/Start").

On the instrument:

1. Use the menu "Communication/RS-485 Simple/Send files" and the button "All files".

When the transfer is finished, close the file with "Hyperterminal" (Menu "Transfer/Capture Text/Stop"). Now, all the reports are saved in a text file on your PC.

10.2 PROFIBUS-DP communication (optional)



10.2.1 Installation

On the ORBISPHERE CD, there is an “Orbi3218.gsd” and an “Orbi3218.bmp” file available in the “Profibus DP” folder to help configure the PROFIBUS-DP. The GSD file contains the following elements:

- The module **Gateway Version >= 2.0 - 1 channel** for receiving data from the instrument.
  Note: *Gateway version >= 2.0 and user software version >= 2.15 are mandatory*
- The module **Gateway Version < 2.0** for receiving data from an instrument equipped with a profibus gateway version < 2.0 or user software version < 2.15

⚠ WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

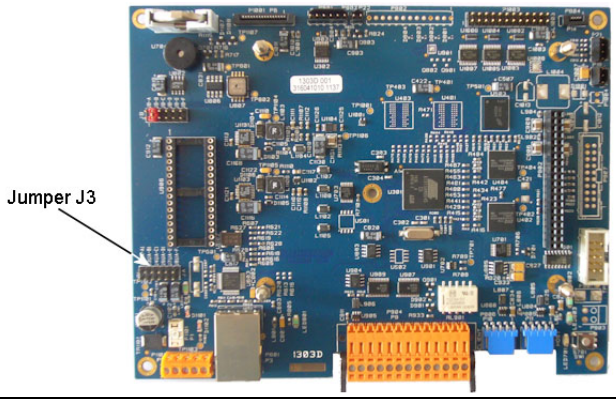
⚠ CAUTION

Personal Injury Hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

NOTICE

Potential Instrument Damage. Proper ESD (electrostatic discharge) protocols must be followed to prevent damage to the product. All fittings must be properly seated and tightened to prevent any water and dust ingress.

1. Install the PROFIBUS-DP module and the jumper J3 on the main board (location highlighted in the illustration below).



2. Select the menu "Configuration/RS-485" and choose "PROFIBUS-DP" as the protocol.

3. Select the menu "Configuration/PROFIBUS-DP", choose the slave address and restart the instrument.

10.2.2 Input/Output data

The main board:

- Writes the latest measurement data to the Profibus Input Buffer.
- Checks if a command written by the Profibus Master must be executed (Profibus Output Buffer). If a command is to be executed, the instrument executes it and writes the result (status, data, etc.) in the Profibus Input Buffer.

All numbers are coded in “Big Endian” format, and float values are coded according to IEEE Standards. The field types “Byte” and “Double Word” are unsigned.

Measurements

Measurements are formatted in the Profibus Input Buffer as follows:

Name	Type	Size	Offset
Barometric pressure	Input float	32 bits	0
Barometric pressure unit	Input byte	8 bits	4
Channel 1 gas concentration	Input float	32 bits	5
Channel 1 gas unit	Input byte	8 bits	9
Channel 1 temperature	Input float	32 bits	10
Channel 1 temperature unit	Input byte	8 bits	14
Channel 1 external pressure	Input float	32 bits	15
Channel 1 external pressure unit	Input byte	8 bits	19
Channel 1 events	Input double word	32 bits	20
Channel 1 measurement index	Input double word	32 bits	24

The gas, temperature and barometric pressure unit values are coded as defined in the following tables:

Gas unit	Value
bar	0
mbar	1
Pa	2
kPa	3
hPa	4
psia	5
atm.	6
mbar->bar	9
Pa->KPa	10
%Vbar	12
ppm Vbar	13
%Vext	14
ppm Vext	15
ppm Vbar->%Vbar	16
ppm Vext->%Vext	17
ppm	18
ppb	19
g/l	20
mg/l	21
µg/l	22
$\%O_2$	23
%Air	24
g/kg	25
V/V	26
%W	27
cc/kg	28
ml/l	29

Temperature unit	Value
K	0
°C	1
°F	2

Barometric pressure unit	Value
bar	0
mbar	1
psia	2
atm.	3
Pa	4
kPa	5
hPa	6

Note: *For the field "Event", refer to the column "Bit mask value" in* *Table 4 on page 99**.*

Note: *If the instrument stops sending measurement data to the module, then after 30 seconds the module sets the event mask to the value* ***PROFIBUS-DP value not updated*** *(0x80000000) bit mask.*

Commands

The “Command Output Buffer” is formatted as follows:

Name	Type	Size	Offset
Output command toggle (OCT)	Output byte	8 bits	0
Output command ID (OCI)	Output byte	8 bits	1
Output command data byte 1 (OCD1)	Output byte	8 bits	2
Output command data byte 2 (OCD2)	Output byte	8 bits	3
Output command data byte 3 (OCD3)	Output byte	8 bits	4
Output command data byte 4 (OCD4)	Output byte	8 bits	5

The “Command Input Buffer” is located just after the measurement data and is formatted as follows:

Name	Type	Size	Offset
Input command toggle (ICT)	Input byte	8 bits	28
Input command status (ICS)	Input byte	8 bits	29
Input command data byte 1 (ICD1)	Input byte	8 bits	30
Input command data byte 2 (ICD2)	Input byte	8 bits	31
Input command data byte 3 (ICD3)	Input byte	8 bits	32
Input command data byte 4 (ICD4)	Input byte	8 bits	33

The following commands are available:

- Change product
- Activate sensor (valid for EC sensors only)
- Set channel hold status (valid for TC and LDO sensors only)

Change product command - output

Name	Value	Comment
OCT	1-2	
OCI	1	Command ID
OCD1	0	Channel number: 0 = Channel 1
OCD2	0-99	Product number
OCD3	0-1	Erase measurement files: 0 = Never erase the measurement files. 1 = Erase measurement file if necessary (e.g. gas unit changes)
OCD4		Not used

Change product command - input

Name	Value	Comment
ICT	1-2	
ICS	0-3	0 = OK 1 = Unknown command ID 2 = Invalid parameter (e.g. invalid channel no or product number) 3 = Execution failure
ICD1		Not used
ICD2		Not used
ICD3		Not used
ICD4		Not used

Activate sensor command - output

Name	Value	Comment
OCT	1-2	
OCI	2	Command ID
OCD1	0	Channel number: 0 = Channel 1
OCD2	0-1	Sensor activation: 0 = Deactivate the EC sensor 1 = Activate the EC sensor
OCD3		Not used
OCD4		Not used

Activate sensor command - input

Name	Value	Comment
ICT	1-2	
ICS	0-3	0 = OK 1 = Unknown command ID 2 = Invalid parameter (e.g. invalid channel no) 3 = Execution failure
ICD1		Not used
ICD2		Not used
ICD3		Not used
ICD4		Not used

Set channel hold status- output

Name	Value	Comment
OCT	1-2	
OCI	3	Command ID
OCD1	0	Channel number: 0 = Channel 1
OCD2	0-1	Status: 0 = Channel enabled 1 = Channel on hold
OCD3		Not used
OCD4		Not used

Set channel hold status - input

Name	Value	Comment
ICT	1-2	
ICS	0-3	0 = OK 1 = Unknown command ID 2 = Invalid parameter (e.g. invalid channel no) 3 = Execution failure
ICD1		Not used
ICD2		Not used
ICD3		Not used
ICD4		Not used

10.3 USB-A port (host)

This option allows the export or import of data from an external mass storage device. The device must first be connected to the instrument through the USB-A port.

Select one of the two import options (product list or access table) to import data from the storage device. This is useful for transferring these files to additional instruments without the need of having to re-enter the data individually on each instrument.

Note: *The imported data will override any current settings on the instrument.*

Select the export option to export data from the instrument to the storage device. This will export all stored data: measurements, calibrations, product list, access table, etc.

For both import and export options, the progress bar is updated to give an indication of the progress of the selected option.

The USB-A port is also used to update the instrument software. If the software is present on the USB storage device, the update process starts automatically.

10.4 HTTP/TCP-IP

10.4.1 Overview

When activated this option downloads data from the instrument directly to a web page that can be accessed from a PC. To be able to use this option, the instrument must be connected to the network (specifically **Connector P3**. Refer to Main board connections on page 31. The network must have a DHCP server installed.

- Check the Enable server box to enable the web server communication link.
- Enter the Server name for the instrument. This is free format text and should typically be used to identify the instrument.
- Check the Enable security box if you require a password to be entered on the PC to access the web page.

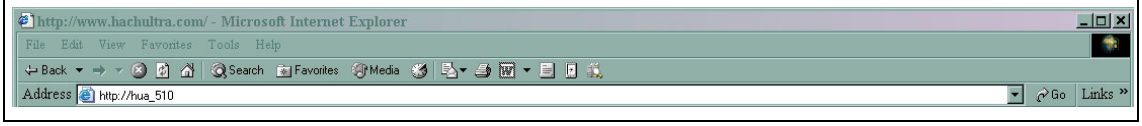
If any of the details on the previous screen have been changed, a warning message will be displayed as illustrated left.

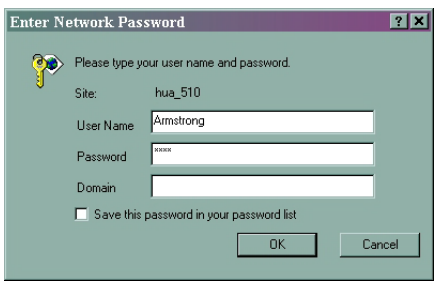
The changes must be confirmed, after which the instrument must be powered down and powered up again for the changes to take effect.

Note: *The IP Diagnostics button at the bottom of the screen is for use by experienced IT personnel only to help resolve any communications problems.*

10.4.2 PC interface

Once the server has been enabled and the interface information set up, access the information by launching an internet browser and typing "**http://**" followed by the server name that has been assigned to the instrument, in the address box as illustrated below:

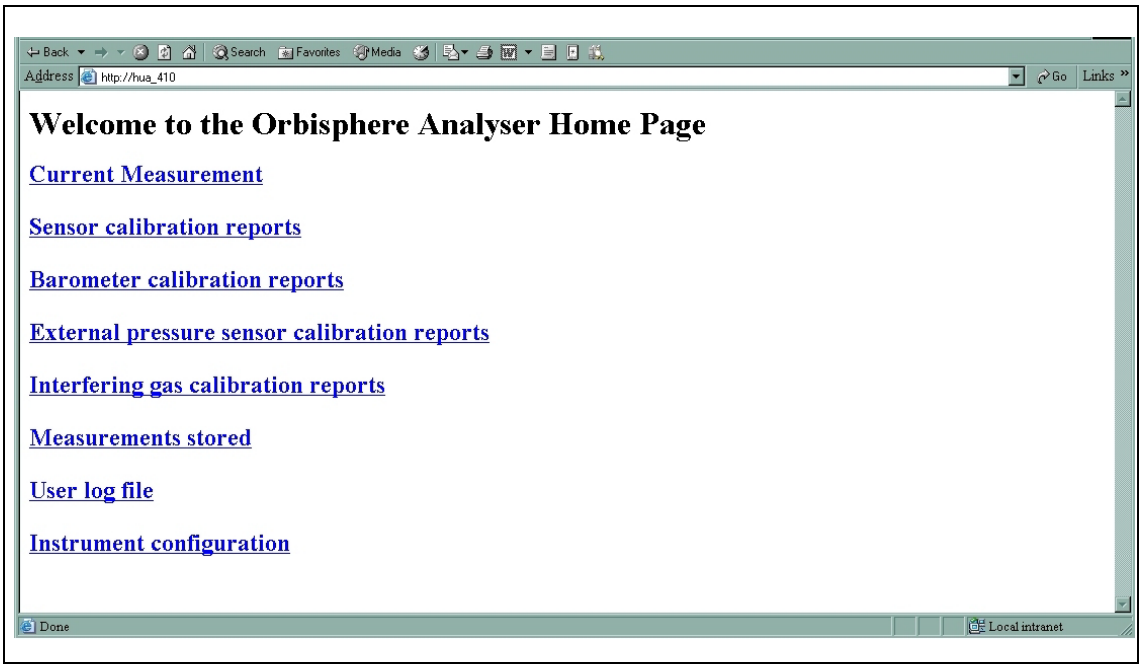




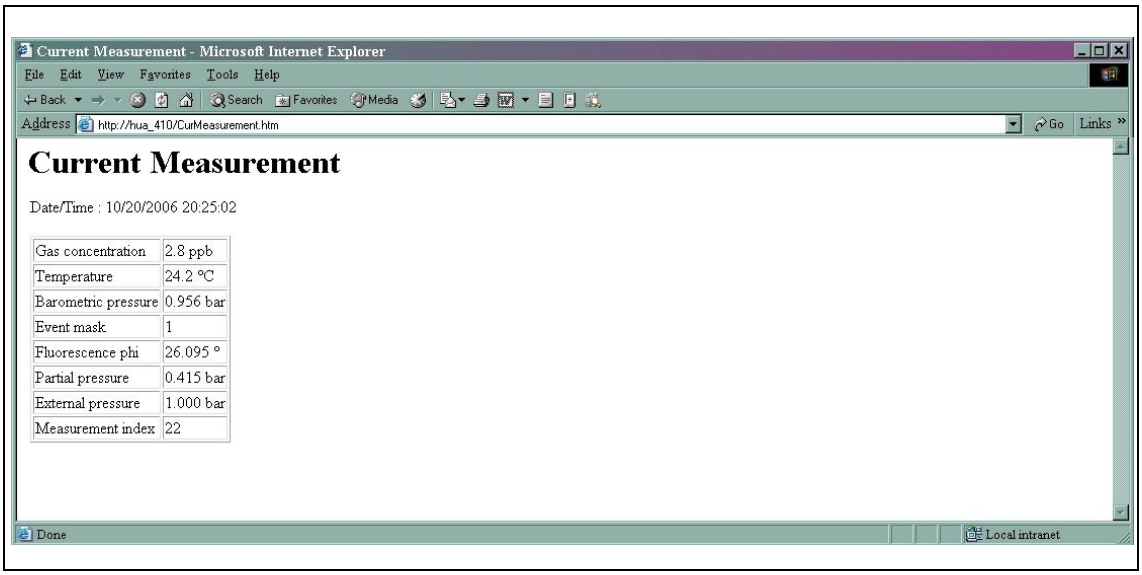
If the enable security option has been checked on the instrument, you will be required to enter a username and password on your PC to gain access to the web page.

The username and password must be a valid username/password combination that has been set up on the instrument. Refer to User management on page 86 for user set up information. Domain information is not required.

Once a valid username/password combination has been entered, the initial web page will be displayed giving a list of options:



Click on any of these options and the data will be displayed on the PC screen. The following shows an example of the screen when selecting the Current Measurement option:



10.5 Printer

This menu provides the facility to print a number of reports directly to a printer. The printer must be connected to the instrument through the instrument USB-A port.

The following information is available for printing:

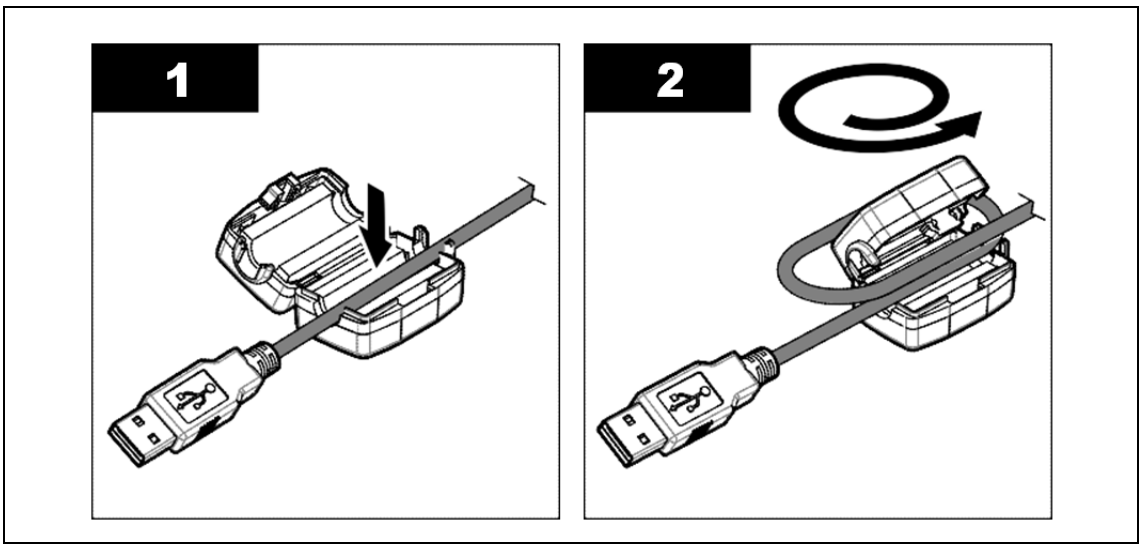
- Calibration reports
- User action log files
- Instrument configuration details
- Measurements stored in the instrument memory
- Cyclic measurements for continuous printing

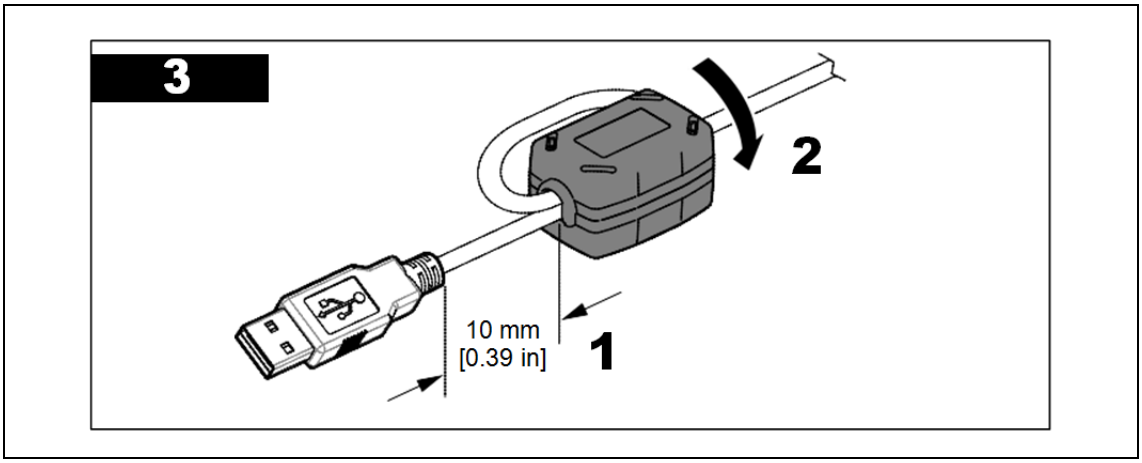
Configuration	
Printer configuration	Currently only the USB port is a valid printer connection.
Report configuration	**Calibration** - Choose the channel(s) for which calibration reports are required. Choose to print the last report or all reports for the selected channel(s). **User actions** - Define the date and time criteria for which user action logs are required. **Configuration** - Choose the channel(s) for which instrument configuration details are required. **Measurements** - Choose the channel(s) for which measurement reports are required. Define the start and end times for the measurement reports. **Cyclic measurements** - Check the enable continuous mode checkbox and choose the channel(s) for which cyclic measurements are required. **Cancel** - Exit the configuration option.

Send files
Choose the report (or **All**) to print the reports that match the configuration criteria. A status bar at the top of the screen shows printing progress. Push the **Cancel** button to cancel a print job.

10.5.1 Install ferrite on the printer cable

Refer to the following steps for the ferrite installation on the USB printer cable included with the LQV161.xx.20000 printer:





10.5.2 Printer error messages

Error message	Meaning
Printer not available	Indicates that no printer has been detected. Check that the printer is connected to the USB-A port and is powered on.
Paper out	Indicates that the printer is out of paper. In cyclic mode, it is necessary to activate cyclic printing after reloading paper in the printer. In other modes, printing can be restarted directly.
Unknown error	An unidentified error has been detected that prevents printing. If this error occurs, refer to the printer User Manual to identify the cause of the problem.

Note: *Cyclic measurement mode is automatically disabled when an error occurs. After the error is corrected, reactivate the cyclic mode in the report configuration option if cyclic measurements are required.*

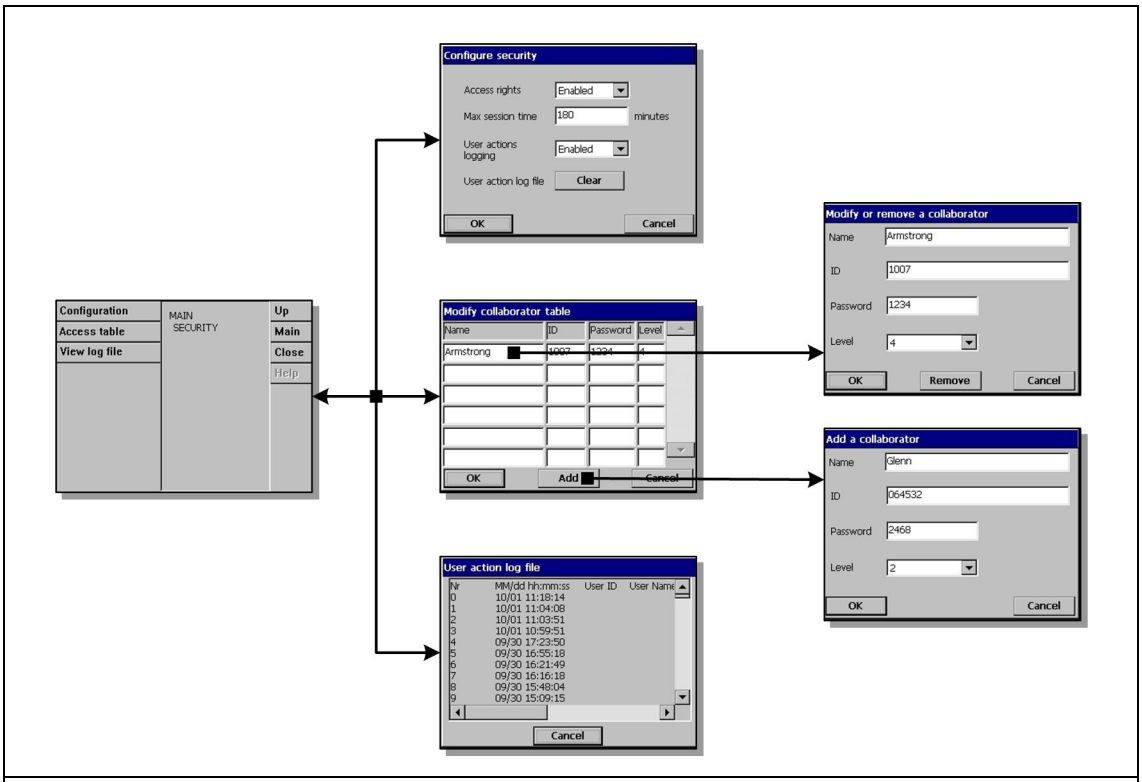


Figure 44 Security menu

Note: *When the instrument is started for the first time, security is enabled. Refer to Section 5 Start up on page 45. It is highly recommended that each user be entered into the system and given appropriate access rights as soon as possible to avoid any unauthorized access. Details of this process are described in this section.*

11.1 Access rights management

Each user has a unique ID and password. The ID and password are used by the software to:

- Allow or deny a user to perform specific actions.
- To trace this action with his "ID" in a log file.

Once the ID and password are entered, the user is allowed to perform actions according to the "Access level" that has been attributed to his ID by the Manager. Refer to Security level table on page 17.

Table 3 Access levels

Level	Typical rights	Comments
0	View parameters, change views	Press the unlock button and OK to access
1	+ Start / Stop measurements	
2	+ Calibration	
3	+ Modify parameters	
4	+ Modify table "User ←→ Access level" + Enable/Disable "Access right" features	There is at least one ID having the level 4

At startup all menus are locked and a valid ID and password combination is required to get access beyond the standard measurement view. Refer to Section 5 Start up on page 45.

Note: *If the instrument security is enabled and the login credentials are not known, contact Hach Service support with the recovery code to get the login credentials. The recovery code shows on the login window. The supplied login credentials expire in one day. Make sure to change the login credential with known values.*

11.2 Configure security

Configure security
This enables defining the users with their access level when the software starts for the first time. It is possible to configure several parameters related to confidentiality. This requires a user access level 4. ***Note:*** *Access rights are disabled by default.* • **Access rights**: When enabled (default), it is required to log in as a registered user. Refer to User management on page 86 to access the menus. When disabled, all menu are access free, and the effect of leaving the text box blank in user login window is that there will be no name recorded for the action in the log file. • Enter a maximum session time in minutes for improved confidentiality. The user is logged out automatically when the set delay for inactivity is over. • **User action logging**: When enabled, every action from a logged on user is recorded in a user log file for traceability. • Clear all user actions log file. Confirm to clear the log file. This functionality is aimed at clearing demo or test logs for example. The log file is a rolling buffer recording the past 100 actions.

11.3 User management

User management
This window shows the list of registered users for the instrument. They are listed by name, ID, password and access level. ***Note:*** *The "User password" must be at least 4 characters long.* Pressing on an empty line, or pressing the Add button brings a window to add a new user. Name, ID, password and access level (from 1 to 4) must be entered. Pressing on a registered user line brings a window for editing or deleting the user data in the list. ***Note:*** *The list can contain up to 99 users*

11.4 User action log file

User action log file
Each time the user performs an important action, a record is written in the "User action log file". It is a rolling buffer which contains the last 1000 user actions. The "User Interface" will allow viewing this log file (Menu Security / View log file). This log file contains the following data: • line number • the action name • the user name and ID • the current date and time. ***Note:*** *Unsuccessful attempts to register are recorded in the log file without a user ID.*

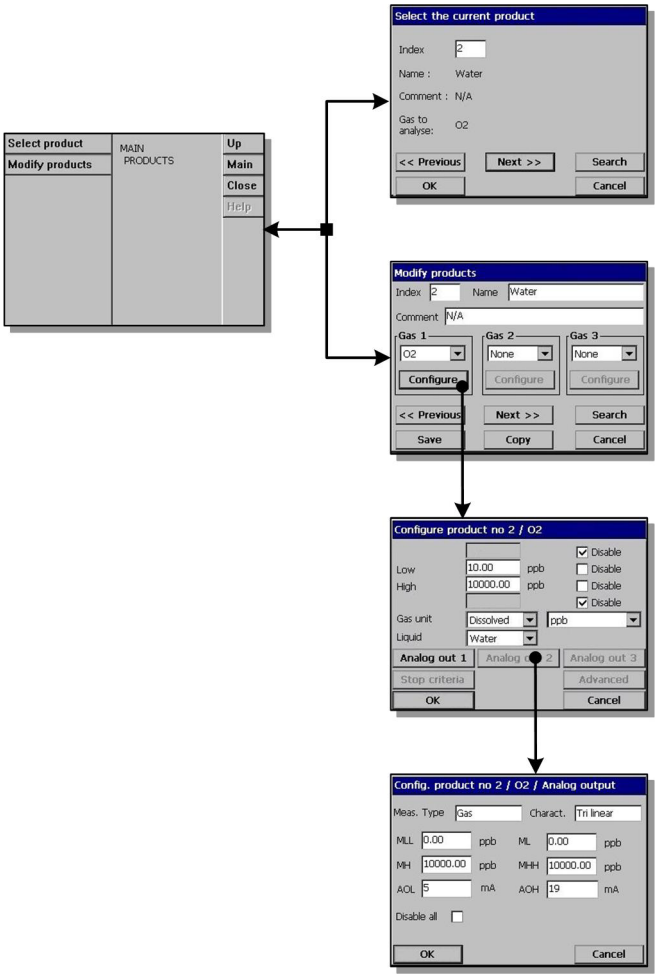


Figure 45 Products menu

Products	
This option allows users to save and/or use previously saved product configurations. A maximum of 100 different product configurations can be stored in the instrument. The basic measurement configuration (gas to analyze, gas unit, alarm limits, analog outputs, etc.) can be set up for a product and will be automatically used by the instrument when that product is selected. Product configurations can be moved from instrument to instrument if required. However, as the sensor only analyzes oxygen, only products configured to analyze oxygen can be selected on this instrument. Products configured to analyze other gases can, however, be set up on this instrument and easily transferred to other 410 or 51x instruments analyzing gases other than oxygen. For ease of use, where product configurations are identical or similar, a **Copy** facility exists on the modify product screen. This enables copying a stored configuration and storing it in one or more additional locations. Then use the modify product option to identify and/or modify the duplicate configurations.	
Select product	***Note:*** *If the PROFIBUS-DP communications protocol has been enabled, products can be selected for analysis using that facility. Refer to Input/Output data on page 77 and Change product command - output on page 79 for detailed information.* • Select the product (0-99) to be analyzed, or use the **Next** and **Previous** buttons to scroll sequentially through the existing product list. Alternatively, use the **Search** facility to search for a product. Enter a full or partial search criteria. If only one match is found, this product is automatically selected. If a number of products match the search criteria, then a list of matches will be displayed. Select a product directly from the list of matching products. • Press **OK** to select the product or **Cancel** to exit.
Modify product	• Select the product (index 0-99) to modify, or use the **Next** and **Previous** buttons to scroll sequentially through the existing product list. Alternatively, use the **Search** facility to search for a product. Enter a full or partial search criteria. If only one match is found, this product is automatically selected. If a number of products match the search criteria, then a list of matches will be displayed. Select a product directly from the list of matching products. • Select the gas to analyze (up to three can be selected) from the drop down list. • After selecting a product and gas, press **Configure** to configure the product. Configure the product as required. Refer to Measurement configuration on page 52 for additional information. • Press **Analog out** to configure the analog outputs. Configure the analog output as required. Refer to The following table lists the default configuration. The first three events on the list are pre-set and only the priority can be changed: on page 65 for additional information. • Press **OK** to accept the configuration, or **Cancel** to exit.

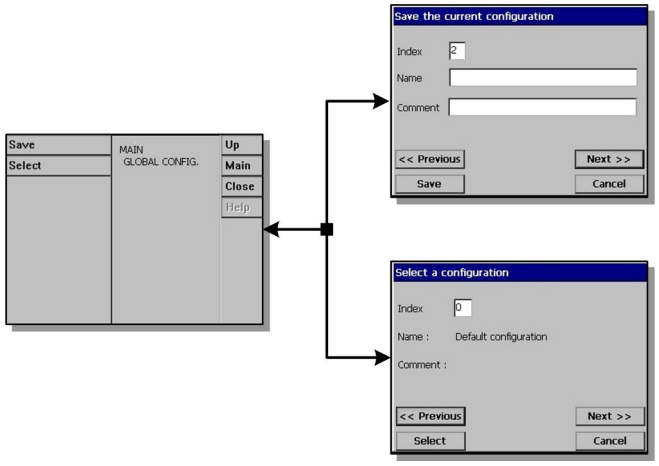


Figure 46 Global configuration menu

Global configuration	
The global configuration option allows users to save, and use previously saved, instrument configurations. A maximum of 10 configurations can be saved, with configuration 0 (zero) the instrument default. Once all the instrument parameters have been set up, use this option to save the configuration. Selecting pre-defined configurations avoids the need to re-enter all the parameters when using the instrument for a different application.	
Save	• Define the index (1-9) to save the current configuration. Use the **Next** and **Previous** buttons to scroll sequentially through existing configurations, to overwrite an existing configuration or save as a new one. • Enter a name to define the current configuration. • Enter any comments to associate with this configuration.
Select	• Select the configuration (index 0-9) to use on the instrument. Confirmation will be required for the selected configuration. The instrument must then be restarted (powered off and then back on) in order for the new configuration to take effect.

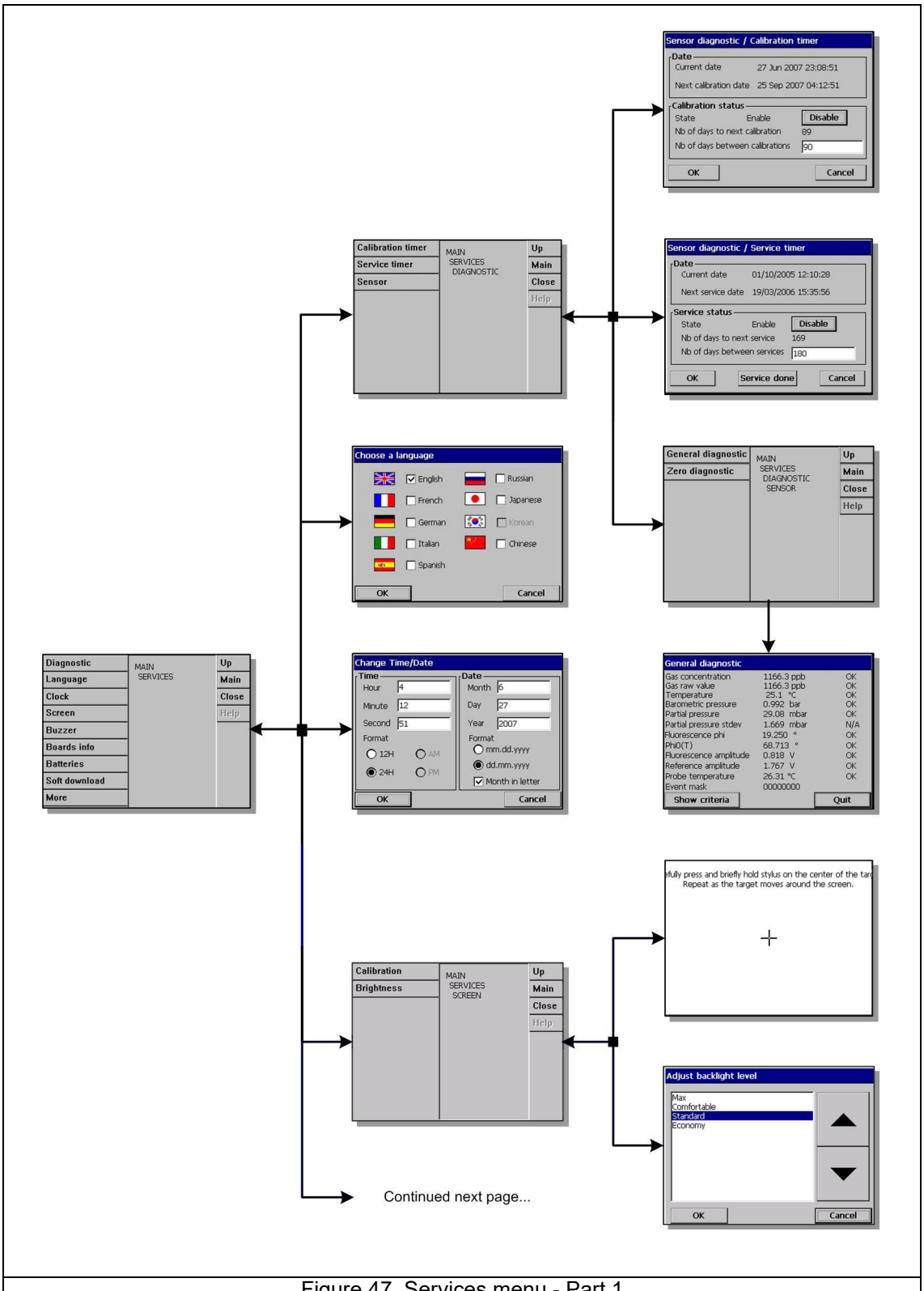


Figure 47 Services menu - Part 1

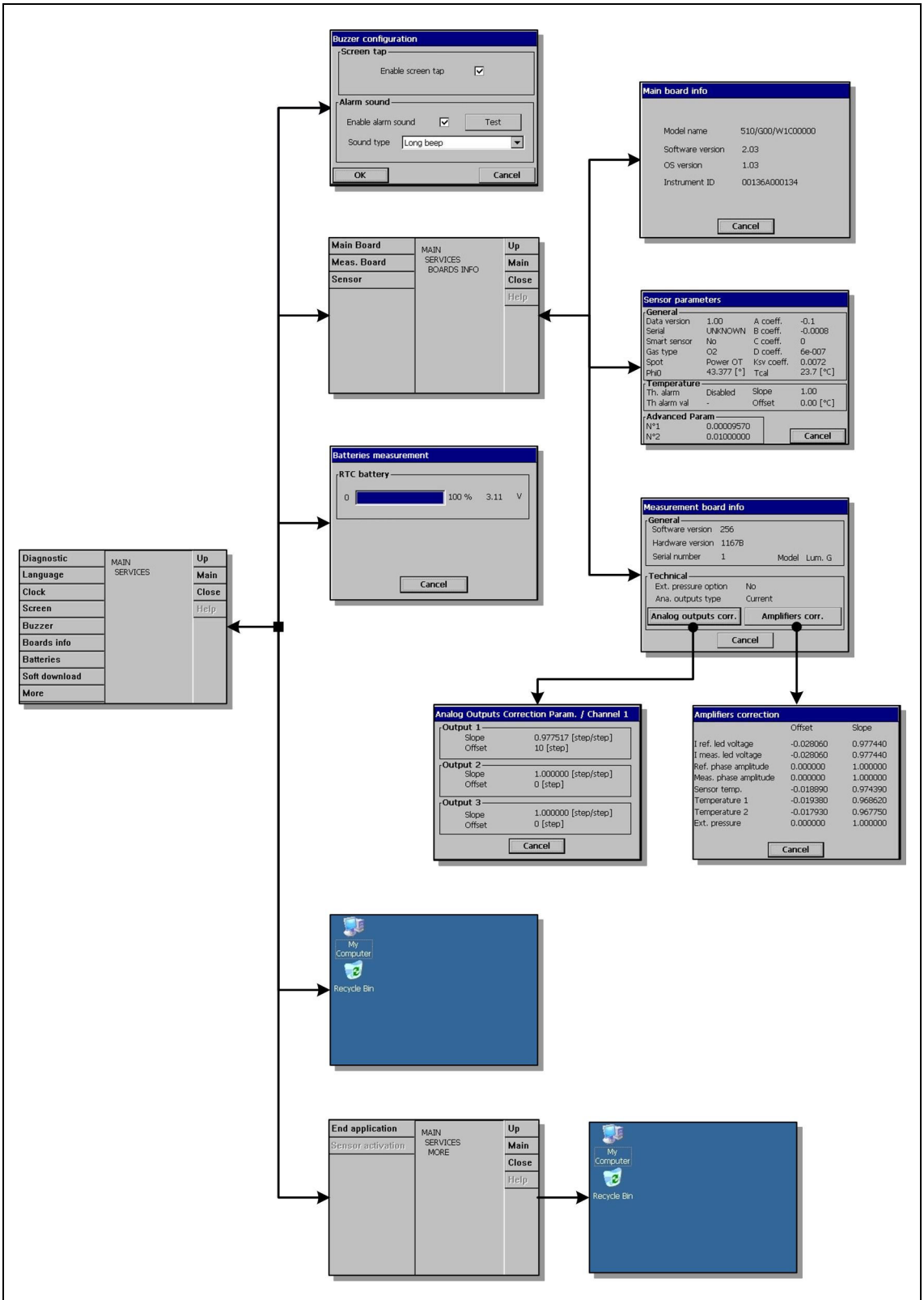


Figure 48 Services menu - Part 2

14.1 Sensor diagnostics

Sensor diagnostics	
Calibration timer	The instrument can automatically remind the user when the next sensor calibration is due. • Select enable and enter a delay in days. • The display shows the current instrument date and time, next calibration due date and time, and the remaining days. The next calibration date is updated when the sensor is calibrated. The event “Cal. required” is generated when the delay has elapsed.
Service timer	The instrument can automatically remind the user when the next sensor service is due. • Select enable and enter a delay in days. This should be validated by a level 3 user. The display shows the current instrument date and time, the next sensor service due date and time, and the remaining days. The next service date is updated when the button **Service done** is pressed after a service. The event “Service required” is generated when the delay has elapsed. The sensor attached to your instrument will require periodic servicing and maintenance. For more information on this, please refer to the manual delivered with the sensor.
Sensor	Select either **General** or **Zero diagnostic** from the menu. **General** will display values for the measurements in the sample, while **Zero** is used to display values when the gas concentration is at zero (e.g. during a zero calibration using pure nitrogen as the calibration medium). The screen layouts are identical for both diagnostic options, and show useful information for troubleshooting purposes. The first screen displays measurement information, with a status (OK or NOK) alongside. A status of NOK indicates the value is outside of the acceptable minimum or maximum value. To view the acceptable range limits press the **Show criteria** button. The criteria screen displays the acceptable range limits (minimum and maximum values) for more in-depth troubleshooting. ***Note:*** *If* ***Zero diagnostic*** *is selected, a warning message appears. Ensure the sensor has been calibrated in pure* N_2 *before selecting this option.*

14.2 Language selection

Language selection
Check the language as required and restart the instrument to apply the change. The instrument will restart in the language selected.

14.3 Clock

Clock
Type in each appropriate box the actual time and date, and select the display format for them.

14.4 Screen

Screen	
Screen calibration	This screen allows you to adjust the click position corresponding to the displayed buttons. Use it if ever the sensitive areas are no longer properly aligned with the buttons on display. Place the stylus right on the cross when asked and proceed. User will be asked to press on the screen to accept the new setting. If not, the new setting is not recorded and no change is made.
Screen brightness	Press the up or down arrow to increase or decrease the screen brightness. Four levels are pre-set: **Max**, **Comfortable**, **Standard** (default setting) and **Economy**. Press **OK** when finished. ***Note:*** *This can also be called through the brightness icon on the main display.* 

14.5 Buzzer

Buzzer
Adjust the sounds available on the instrument. When “screen tap” is enabled, a click sound is heard each time the screen is touched. The instrument alarm sound can be enabled or disabled to suit the application. The sound type can also be adjusted. Press the **Test** button to test the adjustment made. Press again to stop.

14.6 Boards info

Boards info	
Main board info	For reference, this display gives information on the instrument model, software version and instrument ID.
Measurement board info	For reference, this display gives information on the sensor measurement board hardware and software. Pressing the **Analog outputs corr.** button displays the correction factor that is applied to the analog outputs. Pressing the **Amplifiers corr.** button displays the value of the actual correction factor on the amplifiers.
Sensor parameters	For reference this display gives information on the sensor model and type, last calibration, settings and behavior.

14.7 Batteries

Batteries
On all instruments this display gives the real time clock battery charge level and voltage. ***Note:*** *A warning message (and icon) is displayed if the battery level becomes too low and needs to be replaced.*

14.8 Software download

Software download
For Hach technician use only. Used when reloading the software for new versions. This ends the application. User must stop and restart the instrument to restart the program.

14.9 End application

End application
This ends the application. User must stop and restart the instrument to restart the program.

Section 15 Maintenance and Troubleshooting

15.1 Instrument maintenance

⚠ CAUTION

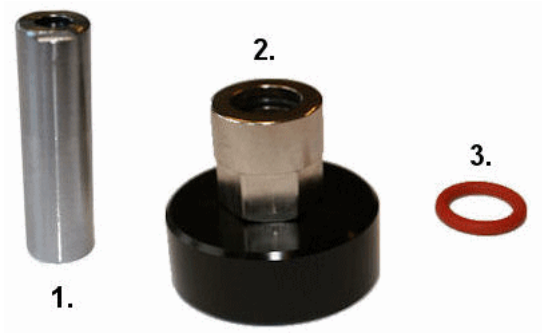
Personal Injury Hazard. Any instrument maintenance should be carried out by a qualified Hach Service Technician. Please contact your local representative should you feel any maintenance or instrument adjustments are required

15.2 Sensor maintenance

The sensor spot needs to be replaced about once a year. The procedure is very simple and takes no more than a couple of minutes. Based on the measurement range of oxygen, the sensor lifetime can be shorter and the maintenance—and calibration—frequency increased. If there are bleaching compounds and strong oxidants (e.g., ClO2) in the sample, the sensor lifetime can also be shorter.

Important Note: *The shelf-life of the K1200 LDO spot is 2 years prior to first use.*

15.2.1 Equipment required

A replacement sensor spot (No. **1**) and O-ring (No. **3**) supplied with the sensor spot. The maintenance tool (No. **2**) which is delivered with the sensor.	

15.2.2 Sensor spot removal

1. Push the maintenance tool (square sides upmost) as far down as possible over the old sensor spot. Continue to push down on the tool and turn gently until the square sides of the tool and the square slots of the sensor spot engage. The tool should then drop into position.	
2. Turn the tool counter clockwise to unscrew the old sensor spot.	

3. When unscrewed completely simply lift out the old sensor spot. Pull off the maintenance tool and discard the old sensor spot.
4. Check the red O-ring (position indicated right). If it appears damaged in any way, then using a pair of tweezers, remove and replace it with the new O-ring from the maintenance kit.

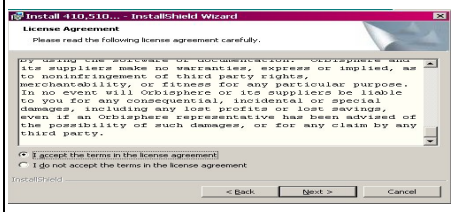
15.2.3 Sensor spot replacement

NOTICE

Avoid scratching or damaging the sensor spot (the black surface on the sensor head) during this process.

1. Push the maintenance tool (square sides upmost) as far down as possible over the new sensor spot. Continue to push down on the tool and turn gently until the square sides of the tool and the square slots of the sensor spot engage. The tool should then drop into position.

2. Make sure the sensor collar is as far down as it will go, so that the top of the collar is aligned with the base of the sensor head.



3. Take the combined maintenance tool and sensor spot and place it in the end of the sensor.

4. Turn the tool clockwise to screw in the new sensor spot, finger tight. Do not overtighten. Once secure, pull off the maintenance tool.	

15.3 Storage, handling and transportation

Protect the instrument against the elements: rain, splashing, direct sunlight, etc.

A properly packaged instrument can be stored and transported at a temperature -20°C to +70°C and relative humidity up to 80%. Best practice for packing the instrument for transportation is to reuse the original packaging in which the instrument was first delivered. The instrument should be stored in suitable premises, free of dust, condensation and chemical evaporation.

In cold weather, avoid sudden temperature change (like when entering a warm room) and give the instrument enough time to adapt to the ambient temperature in order to avoid condensation inside.

To clean the instrument, wipe the housing clean with a cotton cloth or tissue. Always clean the instrument before storage. Pay attention not to scratch the surface of the display to retain good clarity over time.

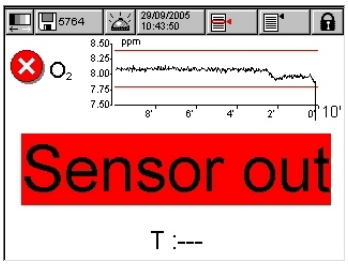
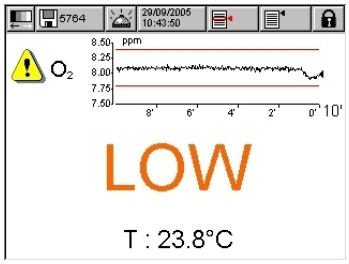
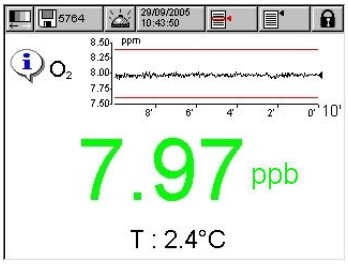
NOTICE
Never use liquids such as oil, benzene, or detergents for cleaning the instrument. A mild glass cleaner can be used to remove greasy stains.

15.4 Troubleshooting

The possible events, along with the text message displayed on the instrument numeric view screen, the reason for the event and its criticality are listed in Table 4 on page 99. An event is something which affects the measurement. In the numeric view, the current events are indicated with the gas concentration at the same place.

Whenever an abnormal event is met, a sign is displayed on the upper left of the screen. Pressing on the sign calls a window giving further details about the actual situation.

There are three levels of abnormal conditions:

	• **Alarm** - There is a severe problem causing the channel to be out of action, and the system alarm relay to be enabled
	• **Warning** - Events less critical than a system alarm (e.g. measurement alarm)
	• **Information -** For information only; no action is required

Note: *Use the Diagnostic view for troubleshooting. Refer to* *Sensor diagnostics on page 93.*

	In addition to the above, if the RTC battery is running low and needs to be changed, the icon illustrated left is displayed in the bottom right corner of the numerical view screen. If using a portable instrument, this icon blinks alternatively with the standard battery icon.

Note: *If the RTC battery is running low, the date and time of the instrument are reset. Also, on startup the instrument will automatically reboot after the initial startup is complete.*

15.5 List of events and alarms

Table 4 List of Events			
Event type	**Name**	**Description**	**Bit mask value (32 bits long)**
Information	Measure	Normal measurement mode.	0x00000000
	Filter enabled	The gas measurements are filtered.	0x00000001
	Out of range protection disabled	The out of range protection has been disabled.	0x00800000
	User offset activated	The user measurement offset is activated.	0x01000000
Warning	Alarm snooze	The alarm snooze is ON.	0x00000004
	Calibration	Channel in calibration.	0x00000008
	Alarm low low	Gas concentration below the Alarm LowLow limit.	0x00000010
	Alarm low	Gas concentration is below the Alarm Low limit.	0x00000020
	Alarm high	Gas concentration is above the Alarm High limit.	0x00000040
	Alarm high high	Gas concentration is above Alarm HighHigh limit.	0x00000080
	Calibration required	A calibration of the sensor is required.	0x00000100
	Service required	The sensor requires a service.	0x00000200
	Hold	The measurement is frozen.	0x00400000
	Out of range	Measurement is greater than the specified range of the sensor (5000 ppb for low range sensors or 40 ppm for high range sensors).	0x02000000
	Low level zero calibration gas	The level of zero calibration gas is very low.	0x04000000
Alarm	Channel disabled	The channel has been disabled.	0x00000400
	Channel out	The measurement board has been disconnected (or does not answer).	0x00000800
	Sensor out	The sensor has been disconnected.	0x00001000
	External pressure sensor out	The external pressure sensor has been disconnected	0x00002000
	Thermal cut-off	The thermal cut-off value has been exceeded	0x00004000
	Profibus-DP	The PROFIBUS-DP module has not received any measurements from the instrument for 30 secs.	0x00080000
	Communication problem	If a fatal error occurs and security is enabled, only a registered user with the correct access rights can access the operating system for troubleshooting.	—

Section 16 Accessories and Spare Parts

16.1 Instrument

Part No.	Description
32531.03	Ethernet cable for wall and panel instruments including connectors, length = 3m
32531.10	Ethernet cable for wall and panel instruments including connectors, total length = 10m
32531.20	Ethernet cable for wall and panel instruments including connectors, total length = 20m
32534.03	PROFIBUS-DP cable including SUB-D 9 female connector (length = 3 m)
32534.MM	PROFIBUS-DP cable including SUB-D 9 female connector, total length = MM, price added per meter of length greater than 3 m
32959A	Converter RS232/RS-485
32963	Wall mounting kit
32964	Panel mounting kit
32965	Locking key for wall instruments
32970	Cap to protect USB connector
32972	Pipe mounting kit for wall instrument
32973	PROFIBUS-DP upgrade kit (includes board and software key)
32975	Power supply connector (10-30 VDC) for panel and wall instruments
33015	Pressure reducer for calibration gas bottles with 0.1 L/min. flow, 5/8" x 18 connection, max 70 bar
33092	Measurement board for K-type and M-type sensors
DG33263	IP65 sealing kit for 410 and 510 panel instruments
LQV161.52.20000	Thermal printer USB for 410/51x controller (EU)
LQV161.53.20000	Thermal printer USB for 410/51x controller (USA)
LQV161.66.20000	Thermal printer USB for 410/51x controller (AUS/NZ)
LQV161.80.20000	Thermal printer USB for 410/51x controller (CN)
LQV161.82.20000	Thermal printer USB for 410/51x controller (UK)
LZP273	Thermal printer paper (4 rolls)

16.2 Sensor

Important Note: *The shelf-life of the K1200 LDO spot is 2 years prior to first use.*

Part No.	Description
K1200-S00	Luminescent oxygen sensor for on-line water applications, low range 0-2000 ppb, 28 mm ORBISPHERE fitting
K1200-S00H	Luminescent oxygen sensor for on-line water applications, high range 0-40 ppm, 28 mm ORBISPHERE fitting
32510.03	Sensor cable (3 m) to connect K1200 type sensors with ORBISPHERE 410/510 instruments
32510.05	Sensor cable (5 m) to connect K1200 type sensors with ORBISPHERE 410/510 instruments
32510.10	Sensor cable (10 m) to connect K1200 type sensors with ORBISPHERE 410/510 instruments
32510.15	Sensor cable (15 m) to connect K1200 type sensors with ORBISPHERE 410/510 instruments
32510.20	Sensor cable (20 m) to connect K1200 type sensors with ORBISPHERE 410/510 instruments
33087	O-ring kit for 28 mm K1200 type sensors
33103	K1200 spot mounting tool
28129	Protection cap for 28 mm sensors
K1200-H	High level spare optical spot for K1200 sensors
K1200-L	Low level spare optical spot for K1200 sensors

16.3 Insertion and sampling devices

Part No.	Description
29006.0	EPDM O-ring set for flow chamber 32001 and sensor socket 29501
29501.0	Stainless steel sensor socket with EPDM O-rings for welding to stainless steel pipe.
32001.010	Flow chamber in stainless steel (316) with 6 mm fittings. Supplied with EPDM O-rings.
32001.011	Flow chamber in stainless steel (316) with ¼" fittings. Supplied with EPDM O-rings.
32001.012	Flow chamber in stainless steel (316) with 8 mm fittings. Supplied with EPDM O-rings.
32003	Sensor insertion and retraction valve for use with Tuchenhagen adapter.
32740	Replacement parts kit for 32003 insertion and retraction valve
33088	Calibration device for K-type and M-type sensors
33090	O-ring kit for 33088 calibration devices
33095	28 mm stationary housing for installation on Varinline access units
33098	O-ring kit for 28 mm stationary housing for installation on Varinline access units

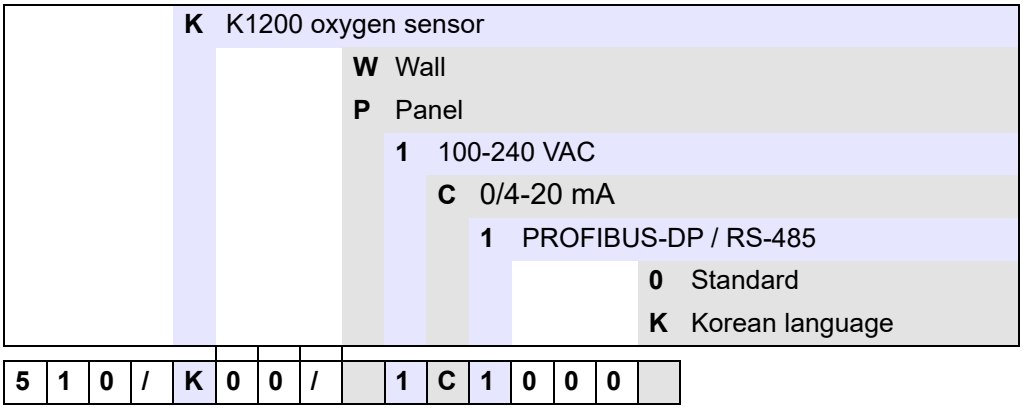
16.4 K1200 kits to order (KTO's)

Part No.	Description
DGKK1200-P1121	Kit contains K1200-S00 sensor, 510/K00/P1C10000 instrument, 10m cable
DGKK1200-P1123	Kit contains K1200-S00 sensor, 510/K00/P1C10000 instrument, 3m cable
DGKK1200-P1125	Kit contains K1200-S00 sensor, 510/K00/P1C10000 instrument, 5m cable
DGKK1200-W1121	Kit contains K1200-S00 sensor, 510/K00/W1C10000 instrument, 10m cable
DGKK1200-W1123	Kit contains K1200-S00 sensor, 510/K00/W1C10000 instrument, 3m cable
DGKK1200-W1125	Kit contains K1200-S00 sensor, 510/K00/W1C10000 instrument, 5m cable

16.5 Instrument options

A number of differently configured 510 instruments are available for use with the K1200 sensor. The different models available are described in the following matrix.

510 Model number matrix



Example:

510/K00/W1C10000

- Analyzer model 510
- Measuring oxygen with a K1200 sensor
- Wall mounted
- 100-240 VAC
- 0/4-20 mA analog output
- PROFIBUS-DP / RS 485
- Standard software (English, French, German, Italian, Spanish, Russian, Japanese, Chinese)

Section 17 Glossary

17.1 Gas units

Unit	Meaning
% air	percentage, by weight. A concentration of 100% air corresponds to liquid saturated with air at current pressure and temperature. The equivalent concentration of O_2 is approximately 20% O_2 in normal conditions.
% O_2	percentage, by weight. A concentration of 100% O_2 corresponds to liquid saturated with pure O_2 at current pressure and temperature.
%Vbar	ratio in percent between the partial pressure of gas measured and the atmospheric pressure
%Vext	ratio in percent between the partial pressure of gas measured and the external pressure. Available when an external pressure sensor is present.
µg/L	micrograms per liter
atm	atmosphere
bar, mbar	bar, millibar
cc/kg	volume of gas per kg of liquid. The volume of gas is calculated considering normal conditions (T = 0°C, p = 1atm)
g/kg	grams per kilogram
g/m^3	grams per cubic meter
mg/L	milligrams per liter
ml/L	milliliters per liter
Pa, hPa, kPa	Pascal, hecto Pascal, kilo Pascal
ppb	parts per billion, by weight
ppm	parts per million, by weight (same as mg/kg)
ppm Vb	parts per million, per volume, barometric pressure referenced. = %Vbar / 10,000
ppm Ve	parts per million, per volume, external pressure referenced. = %Vext / 10,000
psia	pound per square inch, absolute
V / V	volume per volume (ratio)

17.2 Generic terms and definitions

Terms	Meaning
Absolute pressure	This is the total pressure in a system (i.e. relative pressure, plus atmospheric pressure).
Accuracy of measurement	The closeness of agreement between the result of a measurement and a true value of the measurand.
Analog output	A current signal that is a continuous function of the measured parameter.
ASCII	American Standard Code for Information Interchange. A standard character-coding scheme used by most computers to display letters, digits and special characters.
Baud rate	Baud rate means transmission speed (Unit: bits per second, bps), especially for RS-232/422/485 interfaces.
CIP	Cleaning In Place.
Concentration	The relative content of a component in a gaseous or liquid media.
Conductivity	The reciprocal of electrical resistivity.
FIFO (First In First Out)	FIFO is a concept to describe the behavior of a buffer. It means the data which entered first will exit first.
Headspace	The empty volume above a liquid or solid in a closed container.
Limit of detection (LOD)	Statistically, LOD = 3 STD (Standard Deviation) or 3Sigma as it is sometimes called.
Master / Slave modes	A device operating as a master will poll one or more devices operating as a slave. This means a slave device cannot volunteer information; it must wait to be asked for it.
Measurand	A physical parameter being quantified by measurement.

Parallel communication	Parallel communication represents a connection in a computer system in which the bits of a byte are transmitted over separate channels at the same time.
PLC	Programmable Logic Controller. It communicates with other process control components through data links. It is used in process control for simple switching tasks, PID control, complex data manipulation, arithmetic operations, timing and process and machine control.
PROFIBUS-DP	The PROFIBUS-DP (Decentralized Peripheral) fieldbus is designed especially for communication between automation control systems and distributed I/O at the device level. Each DP device has specific parameters such as device version, baud rate, data format, I/O length, user parameters, etc. These parameters are stored in a file with .GSD extension.
PROFIBUS-DP GSD files	The GSD file is provided by the manufacturer and is required for device configuration. A GSD file is a readable ASCII text file that contains both general and device-specific specifications for communication (Communication Feature List) and network configuration.
Relative pressure	Relative pressure is the over pressure in a system (i.e. absolute pressure less atmospheric pressure). This is the customary gauge reading.
Repeatability	The closeness of agreement between the results of successive measurements of the same measurand carried out under the same measurement conditions. Statistically, repeatability = 2 STD (Standard Deviation) or 2Sigma as it is sometimes called.
Reproducibility	The closeness of agreement between the results of measurements of the same measurand carried out under changed measurement conditions.
Resistivity	The opposition offered by a body or substance to the passage through it of a steady electric current.
RS-232	RS-232 is a serial communication standard providing asynchronous communication capabilities with hardware flow control, software flow control, and parity check. Maximum transmission distance is up to 15 meters at a max. 20,000 bps. A converter is required to interface RS-232 with RS-422 or RS-485.
RS-422	RS-422 is intended for point-to-point communications. It provides much longer transmission distance but less signal line compares to RS-232. RS-422 adopts differential transmission technology and thus provides high-speed transmission up to 10mbps and maximum transmission distance up to 1.2km/110kbps.
RS-485	RS-485 is an enhanced version of RS-422 and is used for multipoint communications, meaning that many devices may be connected to a single signal cable. It is compatible to RS-422 interface and provides 2 wire bus topology.
Serial communication	Serial communication represents a connection in a computer system in which the bits of a byte are transmitted sequentially over a single wire.
Single twisted pair	In this version, all devices are connected to a single Twisted Pair. Thus, all of them must have drivers with tri-state outputs (including the Master). Communication goes over the single line in both directions. It is important to prevent more devices from transmitting at once (software problem).
USB	Universal Serial Bus. An external peripheral interface standard for communication between a computer and external peripherals over a cable using bi-serial transmission. The USB host uses a type A connector.

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