Hamilton Arc

Operating Instructions

HAMILTON®

Hamilton Warranty

Please refer to the General Terms of Sales (GTS).

Important note

Contents of this manual can be modified without previous announcement. Technical modifications reserved. Greatest possible care was used on the correctness of the information in this manual. If errors should be discovered nevertheless, Hamilton Bonaduz AG is pleased to be informed about it. Regardless of this, Hamilton Bonaduz AG cannot assume liability for any errors in this manual or for their consequences.

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1 Preface

Welcome to the World of Hamilton Arc System

Congratulations on your purchase of a transmitter integrated Arc sensors combined with Hamilton`s computer and mobile hybrid software solution ArcAir. This technology enables the online monitoring and visualization of pH, dissolved oxygen, conductivity and ORP during biotechnological processes. A standard measuring loop consists of an Arc sensor, which is connected via VP8 cables directly to the process control system (PCS). With the ArcAir application, it is possible to communicate wirelessly with up to 30 Arc sensors at the same time parallel to the process control system interface when an Arc Wi Bluetooth adapter is connected between the VP head of an Arc sensor and the VP sensor cable. Within the ArcAir application, Hamilton provides a validation functionality that offers central management functionality of users and validation reports for calibration, verification, configuration and communication within the GMP guidelines for all Arc sensors.

Hamilton would like to thank you for your purchase of Arc system.

2 General Information

2.1 Intended Use

The Arc system consist of Arc sensors, the ArcAir software application, and accessories. Arc sensors are designed to measure pH, dissolved oxygen, conductivity and ORP in a liquid medium. These measurements may be used for the control of biotechnological processes within the defined specifications (see specification sheets www.hamiltoncompany.com). The ArcAir software application and the Arc accessories are used to monitor, configure and calibrate Arc sensors.

⚠ **ATTENTION! Arc sensors are not intended for hazardous atmospheres.**

⚠ **ATTENTION! The Arc sensor has a built-in temperature sensor (NTC 22 kOhm). This temperature sensor is to be used only for monitoring the sensor conditions, not for controlling the process temperature.**

⚠ **ATTENTION! The measurement values transmitted over wireless communication are not intended to be used for process control.**

2.2 About this Operating Instruction

This Operating Instruction is designed to support the integration, operation and qualification of the Arc components. This document describes the different components of the system and how they function. The Operating Instructions describe both the hardware and software of the Arc System in a depth enabling the user to operate the Arc components. After introducing the various parts, it is shown step by step how to operate the system. After reading the Operating Instructions, users should be capable of installing and operating each component of the Arc System. The user is responsible for taking suitable precautions in the event of a product failure. Following information are highlighted within this document:

⚠ **ATTENTION! Essential information for avoiding personal injury or damage to the equipment.**

NOTE: Important instructions or interesting information.

NOTE: The advanced ArcAir application is not intended and specified as a 21 CFR Part 11 tool with digital signature. It is in the sole responsibility of the operator to validate the Arc sensors, print and double sign manually the validation reports.

3 Liability

The liability of Hamilton Bonaduz AG is detailed in the document «General Terms and Conditions of Sale and Delivery,» Hamilton is expressly not liable for direct or indirect losses arising from the use of the products. It must in particular be insured in this conjunction that malfunctions can occur on account of the inherently limited useful life of products contingent upon their relevant applications. The user is responsible for the calibration, maintenance and regular replacement of the products. In the case of critical product applications, Hamilton recommends using back-up measuring points in order to avoid consequential damages. The user is responsible for taking suitable precautions in the event of a product failure.

4 Safety Precautions and Hazards

⚠ ATTENTION! Read the following safety instructions carefully before installing and operating the Arc System.

4.1 General Precautions

For safe and correct use of Arc system, it is essential that both operating and service personnel follow generally accepted safety procedures as well as the safety instructions given in this document, the operating instruction of the Arc System. The specification given in the specification sheets on the Hamilton website (www.hamiltoncompany.com) may under no circumstances be exceeded. Inappropriate use or misuse can be dangerous. Cleaning, assembly and maintenance should be performed by personnel trained in such work and according to this instruction manual. When removing and cleaning the sensor, it is recommended to wear safety goggles and protective gloves. If the system cannot be repaired by the operator, it has to be sent back to Hamilton for inspection. Necessary precautions should be taken when transporting the sensors. For repair or shipment the System should be sent back in the original reusable packaging box. Every Arc sensor sent back for repair must be decontaminated. If the conditions described in these operating instructions manual are not adhered to or if there is any inappropriate interference with the equipment, all of our manufacturer's warranties become obsolete.

4.2 Operation of the Arc System

When using the Arc System in process environment suitable protective clothing, safety glasses and protective gloves must be worn, particularly when dealing with a malfunction where the risk of contamination from spilled liquids exists. Installation and maintenance of Arc sensors must be performed only by trained personnel. The mobile devices and sensors must be used for their intended applications, and in optimum safety and operational conditions.

Use only wired digital or analog connection for the process control. The Arc wireless interface is designed for sensor monitoring, maintenance and service purposes.

Make sure that the PG13,5 thread and the O-ring are not damaged when screwing the sensor into the process. O-rings are consumable parts which must be exchanged regularly (at least once per year). Even when all required safety measures have been complied with, potential risks still exist with respect to leaks or mechanical damage to the armature. Wherever there are seals or screws, gases or liquids may leak out undetected. Always make sure that no process medium can be accidentally spilled before removing the sensor from its measurement setup. Make sure that no air or gas bubbles sticks to the sensitive part of the Arc sensor. As a consequence, the measurement value could be unstable. Do not put stress on the system by vibration, bending or torsion. Before use, verify that the sensor is properly configured for your application.

Failure to observe and carry out the maintenance procedures may impair the reliability and correct functioning of the Arc system.

4.3 Electrical Safety Precautions

Do not connect the Arc products to a power source of any voltage beyond the range stated in the Specification Sheet (www.hamiltoncompany.com). As a consequence, the measurement value could be wrong. Always use Hamilton VP 8 cables for safe connection. Make sure the cable is intact and properly plugged to avoid any short circuit. Keep the Arc products away from other equipment which emits electromagnetic radio frequency fields, and minimize static electricity in the immediate environment of the measuring parts. Carefully follow all the instructions in chapter 6.16 to avoid electrical damage to the sensor. Any contact must be clean and dry before connection.

⚠ ATTENTION! Switch off the power supply and unplug the connector before dismounting the Arc sensors.

4.4 Chemical, Radioactive or Biological Hazard Precautions

Selection of the appropriate safety level and implementation of the required safety measures for working with Arc products is the sole responsibility of the user. If working with hazardous liquids observe and carry out the maintenance procedures, paying particular attention to cleaning and decontamination. If Arc sensor becomes contaminated with biohazardous, radioactive or chemical material, it should be cleaned.

5 Arc System Description

Hamilton was the first supplier of intelligent sensors for process measurement. With their integrated transmitter, Arc sensors enable direct communication to the process control system via 4-20mA standard signal or digital Modbus. Bluetooth wireless communication with the Arc Wireless Adapter may be used for monitoring, configuration and calibration, and saves time without compromising the quality of the wired connection.

The sensor features furthermore an Bluetooth 4.0 interface enabling in this way wireless data exchange with smartphones, tablets or computer.

With the integrated micro transmitter, Arc sensors provide more reliable measurement directly to the process control system. The integrated transmitter located in the sensor head stores all relevant sensor data, including calibration and diagnostic information, simplifying calibration maintenance.

Key benefits include:

- No separate transmitter needed
- Simple maintenance
- Easy to install
- Direct digital Modbus or analog communication to the process control system
- Full online wireless option via Bluetooth 4.0 for easy monitoring, configuration and calibration up to 30 sensors
- Experiments functionality with data export
- Reporting and central data management of users and validation reports for calibration, verification, configuration and communication within the GMP guidelines

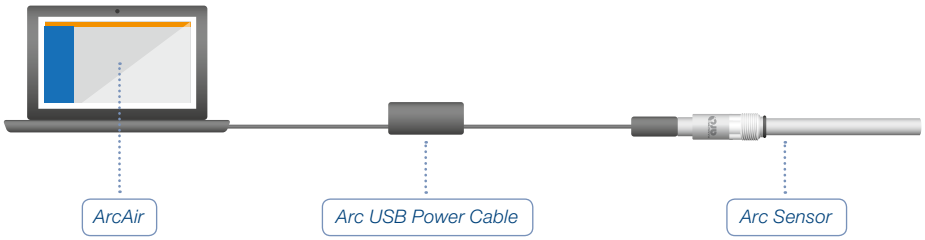


Fig. 1: Arc System wired connection to ArcAir application

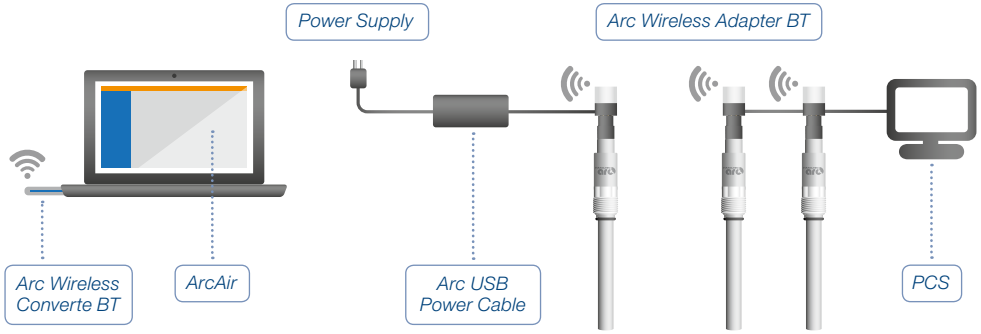


Fig. 2: Arc System wireless connection to ArcAir application

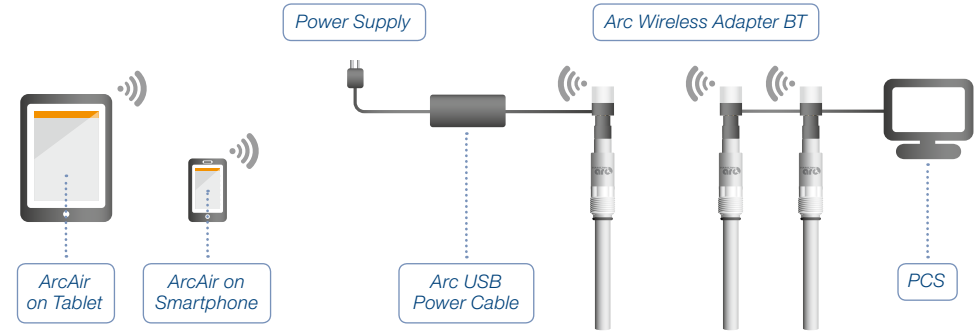
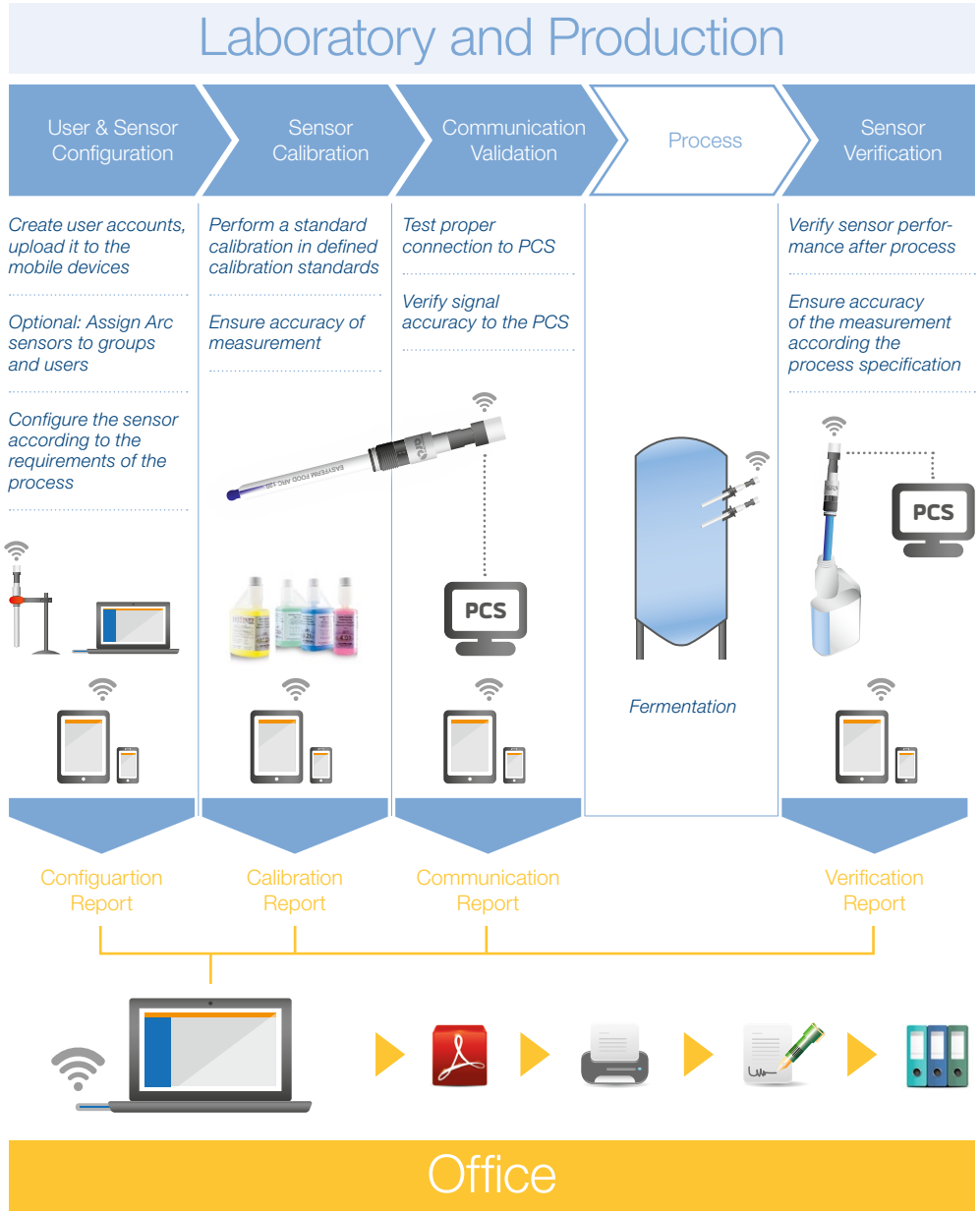


Fig. 3: Arc System wireless connection to tablets or smartphones with ArcAir application

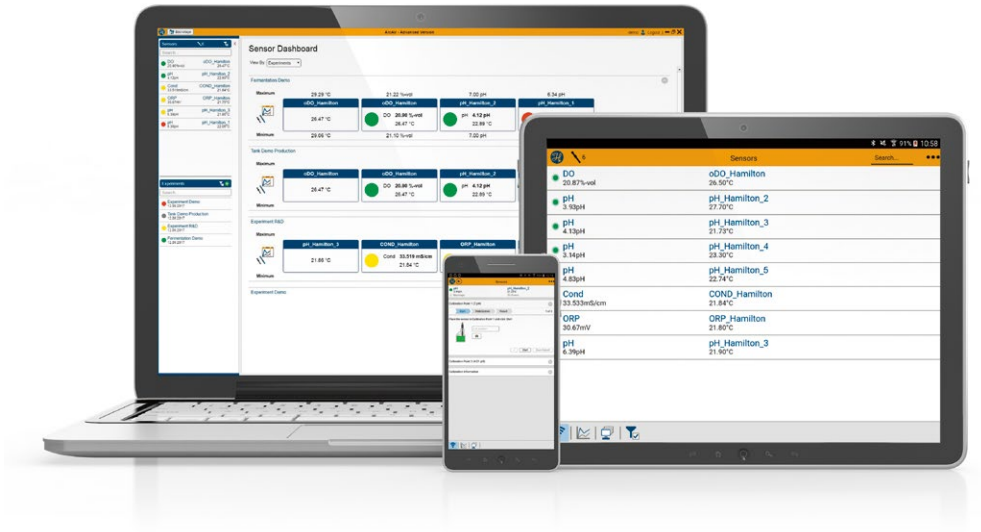
Below the validation process of Arc sensors in GMP environments or laboratory:



5.1 ArcAir Application

The ArcAir application offers efficient and safe communication for monitoring, validating and management of users and sensors.

Combining the cost savings and reliability of Arc sensors with the power, convenience and portability of the mobile devices, users benefit from automated standard calibrations and configuration in the laboratory, along with product calibrations and validations in the process environment. The additional reporting functionality offers management of validation reports for calibration, verification, configuration, communication and user profiles within the GMP regulatory requirements for all Arc sensors. ArcAir offers an overview of ALL the Arc sensors in your environment, through computer, tablet and your mobile phone.



5.1.1 ArcAir Application Description

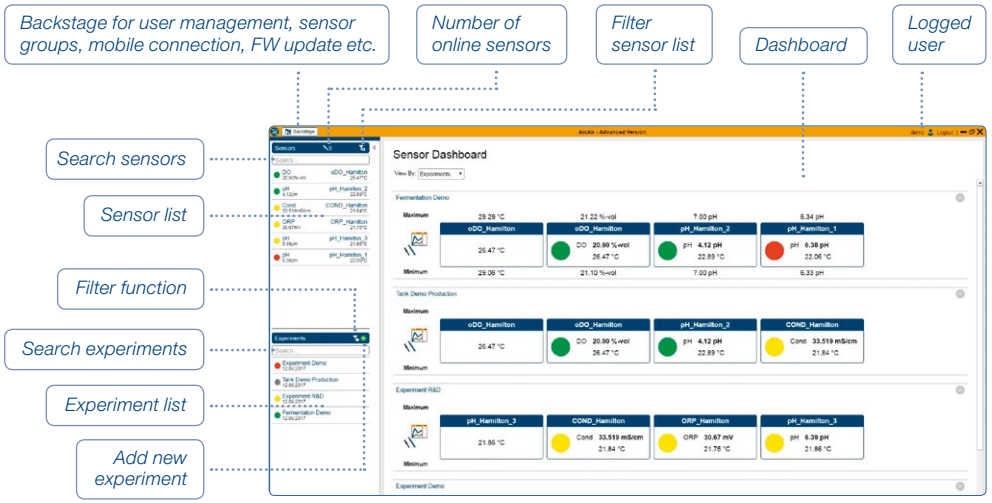


Fig. 4: ArcAir Software application on computer

Fig. 5: The ArcAir application on mobile

5.2 Arc Sensor Description

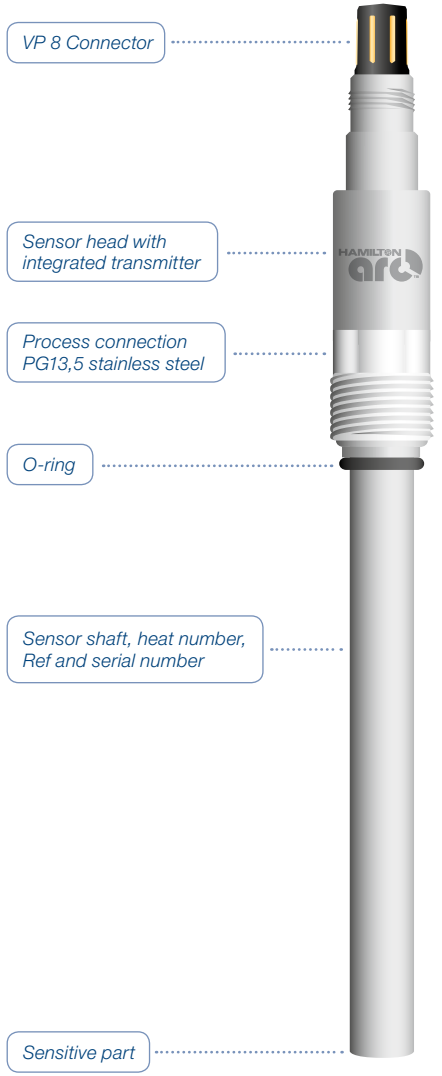


Fig. 6: Arc Sensor

6 Installation

6.1 Unpacking Arc Sensors and Accessories

1) Unpack carefully the Arc sensor. Enclosed you will find the Arc sensor, the Declaration of Quality, the specific Instruction Manual and the material certifications.
2) Inspect the sensor for shipping damages or missing parts.

Fig. 7: Arc sensor delivery package (e.g. VisiFerm DO Arc)

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6.2 Configuring the Arc Sensor with ArcAir

Arc sensors require application specific configuration. Following parts are required to configure and calibrate Arc sensors:

- Arc View Mobile (Ref 243690) or ArcAir computer Software Solution.
- Arc Wi Sensor Adapter BT (Ref 243460 or 243470) (Wireless option, each Arc sensor requires an Arc Wi Adapter BT).
- External Power supply with Arc USB Power Cable (Ref 243490-01 or -02).

> See figure 1 to 3 (Chapter 5)

To configure and set up the Arc sensors at least ArcAir Basic is required. Below in this table you will find the different ArcAir licenses and its functionality:

ArcAir	Read	Calibrate	Configure	Documentation
Free License	✓	–	–	–
Basic License	✓	✓	✓	–
Advanced License	✓	✓	✓	✓

6.3 Installing ArcAir Basic on the Computer

1) Download the Zip file «ArcAir» from the Hamilton webpage www.hamiltoncompany.com (search for ArcAir).
2) Unpack the ZIP-File.
3) Do not plug in the Wireless Converter before the installation of ArcAir is completed.
4) Install «ArcAir» by double clicking «ArcAir.exe» and follow the instructions on the screen.

6.4 Upgrade ArcAir to Advanced Version

To upgrade ArcAir computer version a special Arc Wireless Converter BT (Ref 242333) or Arc View Mobile (Ref 243690) is required which transfers the ArcAir Advanced license key.

Upgrade via Arc Wireless Converter BT

1) After installing ArcAir on the Computer connect the Arc Wireless Converter BT with ArcAir Advanced license key.
2) Once your computer has identified the Arc Wireless Converter BT and its advanced license key, a pop up appears with the message «Your ArcAir is upgraded successfully to Advanced».

Upgrade via Arc View Mobile

1) Enable ArcAir Advanced on the mobile device
2) Click «Scan for mobile device» in the ArcAir computer version
3) On the mobile device click on the screen icon and select the computer to establish the connection
4) Once your computer has identified the mobile device, a pop up appears with the message «ArcAir has been upgraded from Basic to Advanced. Please restart the application to enable the new features.»
5) Restart ArcAir

6.5 Installing ArcAir on non-Hamilton Mobiles

1) Connect your mobile device to AppStore or PlayStore with your user account.
2) Download the ArcAir from the AppStore or PlayStore by scanning the barcodes below or entering «ArcAir» into the search field.

Download on the App Store

GET IT ON Google Play

6.6 Upgrade ArcAir via In-App Purchase

1) Select the symbol with three points on the right upper corner.
2) Select Buy Basic Version or Buy Advanced Version
3) Enter your personal AppStore or PlayStore account password.
4) Message pops up «Please restart the application to enable the new version»
5) Restart ArcAir

6.7 Update ArcAir on Arc View Mobile

1) Click 5 times on the Arc View Mobile sceen
2) Enter the app blocker administrator password
3) Select «Exit SureLock» (this will end SureLock and go back to original Android home screen)
4) Click «Exit»
5) Uninstall the old ArcAir Advanced version
6) Download the .apk file «ArcAir Advanced» from the Hamilton webpage www.hamiltoncompany.com (search for ArcAir).
7) Click on the .apk file to start the installation
8) Press Install
9) After installation switch on the app blocker «SureLock» by clicking on the SureLock application
10) Update completed

NOTE: On Hamilton pre-configured mobile devices an app blocker application is installed. The App blocker administrator mode gives you access to the Android user interface of the mobile and system functionality. To access the administration mode a password is required for the application (Default Password 1234). The Password must be changed by entering the default password, open App blocker:
> Left menu > SureLock Settings > Change Password

NOTE: ArcAir Advanced.apk works on Arc View Mobile only.

NOTE: Please make sure that the app blocker is switched on after updating ArcAir Advanced.

6.8 Connecting an Arc Sensor to ArcAir

1) Connect one of the Arc sensors with the power supply, e.g. by using the Arc USB Power Cable on a standard USB port (see figure 1)
2) Switch on the mobile's Bluetooth connection or connect a Wireless Converter BT to USB Port of your computer (only for wireless connection, see figure 2 and 3)
3) The ArcAir application recognizes and displays the connected sensors automatically

⚠ ATTENTION! For automatic sensor login a unique and global Operator Level S password for all Arc sensors is required. Please make sure you have added the same Operator Level S Password for all Arc sensors in the ArcAir application under Backstage/Settings/Operator Level S Password.

6.9 Create User Accounts

1) Start ArcAir application on computer
2) Click on «Backstage» left upper corner
3) Select «User Management»
4) Click the «Add» Button for opening the user editor
5) Type in the user details and password
6) Select the specific rights for the user

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⚠ ATTENTION! First user is the administrator and all user rights are assigned as default.

NOTE: Initial operation of ArcAir is in the laboratory mode as long as no user account is created. Laboratory mode does not require a login password and enable all features in the installed license version.

6.10 Create Process Groups

This function allows sensors to be organized into Process Groups. A Process Group is used to filter the Sensor Dashboard View or to assign a group of sensors to specific ArcAir users.

1) Start ArcAir application on computer
2) Log in as administrator
3) Click on «Backstage» left upper corner
4) Select «Process Groups»
5) Click the «Add» Button for opening the sensor list
6) Enter a process group name
7) Select the sensors for the process group
8) Click the save button next to the sensor list

6.11 Assign Process Groups to User Accounts

Users that have been assigned one or more process groups will only be able to see and select sensors that are within the assigned process groups.

In order to assign process groups to users follow the procedure below.

1) Start ArcAir application on computer
2) Click on «Backstage» left upper corner

3) Select «User Management»
4) Double click on a user or create a new one (see chapter 6.10) for opening the user editor
5) Click the «Process Groups» tab within the user editor
6) Assign process groups to the user by selecting the assign check boxes
7) Click «Save all»

NOTE: Arc sensors and users are linked to Arc Wi Adapter BT ID. If a sensor change is required please make sure the new Arc sensor is connected to the same Arc Wi Adapter BT again.

6.12 Configuring the Arc Sensor Parameters

1) Start the ArcAir application
2) Select the desired sensor
3) Open the drawer «Settings» (make sure you have the «Sensor Settings» user right)
4) Configure the sensor.

A description of the available settings is given below:

Parameter Name	Description	Default Value	Configuration
Measuring point	User can define a sensor name for better identification of the measuring point	e.g. 242111-1234	Optional
Measurement Unit	This is the measurement's physical unit	pH: pH DO: %-vol ORP: mV eDO: %-vol COND: µS/cm	Required
T unit	This is the temperature's physical unit	°C	Required

INSTALLATION

Measurement Settings:

Parameter Name	Description	Default Value	Configuration
Salinity (oxygen sensor only)	The concentration of dissolved oxygen in saturated water is dependent on the salinity	0 mS/cm	Default parameter recommended
Atmospheric Pressure (oxygen sensor only)	The partial pressure of oxygen is proportional to the atmospheric pressure or the pressure of the air supply to the process	1013 mbar	Required, application dependent
Measuring Interval (VisiFerm DO family only)	The measuring interval can be set between 1 sec. and 300 sec. The LED flashes once in the set measure interval	3 sec.	Default parameter recommended
Moving average	The sensor uses a moving average for filtering the measurement signal	2 (auto: VisiFerm DO family only)	Default parameter recommended
Sensing Material (VisiFerm DO family only)	The type of ODO Cap can be set by entering the Ref number of the ODO Cap	243515	Required, application dependent
Moving Avarage Resistance (pH Arc only)	The sensor uses a moving average for filtering the resistance signal	16	Default parameter recommended
Temperature Compensation (Conductivity Arc only)	Compensate the measurement value to 25°C or 20°C	25°C	Required, application dependend
Temperatur Compensation Factor (Conductivity Arc only)	The temperature dependency of both the ion mobility and the viscosity of a given measurement solution is defined as a factor	0	Required, application dependend

INSTALLATION

Interface Settings:

Parameter Name	Description	Default Value	Configuration
Interface Mode	The output of the 4-20 mA or ECS interface is a function of the value of the measurment variable	4-20mA linear	Optional
Measurement	Define the measurement variable that controls the 4-20 mA current		Optional
Value at 4mA	Measurement value for 4mA output	0%-vol, pH 1 (example)	Required, application dependent
Value at 20mA	Measurement value for 20mA output	62.85-%vol or pH 10 (example)	Required, application dependent
Mode in event of warning	Current output mode in case of warnings	No output	Default parameter recommended
Mode in event of errors	Current output mode in case of errors	Continuous Output	Default parameter recommended
Output current for warning	Current output in case of warnings	3.6 mA	Default parameter recommended
Output current for error	Current output in case of error	3.6 mA	Default parameter recommended
Output current T out of range	Current output in case of temperature out of limit	3.6 mA	Default parameter recommended

SIP/CIP Cycles Settings:

Parameter Name	Description	Default Value	Configuration
SIP process definition	User defined temperature range for SIP	Temp. min: 120°C Temp. max: 130°C Time: 20min	Default parameter recommended
CIP process definition	User defined temperature range for CIP	Temp. min: 80°C Temp. max: 100°C Time: 20min	Default parameter recommended

Calibration Settings:

Parameter Name	Description	Default Value	Configuration
Maximum Measurement Drift DO, pH, COND, ORP	Higher drift will interrupt the calibration process. Warning comes up drift e.g. oxygen	0.5%/min	Default parameter recommended
Maximum Temperature Drift T	Higher drift will interrupt the calibration process. Warning comes up «drift temperature»	0.5K/min	Default parameter recommended

NOTE: To create a configuration report please navigate to «Settings» and «Configuration report». All data from the sensor is read out and stored in the configuration report.

6.13 Create Configuration Profiles

1) Start ArcAir application
2) Enter a profile name
3) Click Create
4) Message pops up «Configuration Profile was successfully created»

6.14 Import Configuration Profiles to Arc Sensor

1) Start ArcAir application
2) Select configuration profile from the dropdown list
3) Decide if a configuration report is required or not
4) Message pops up «Configuration Profile was successfully imported to sensor»

NOTE: If Modbus device address has been changed the import will lead to a sensor disconnection.

6.15 Transfer and Print Reports

1) Start ArcAir Advanced at the mobile device
2) Go to «Backstage» in the computer version and select «Mobile Connection»
3) Follow the instructions on the screen
4) Once all reports are transferred go to «Report Archive»
5) New reports will be displayed on top
6) Double click or select on one of the reports
7) A separate window opens showing the selected report
8) Verify that sensor data in the report are correct
9) Click «Print»
10) Double sign the reports in the signature fields

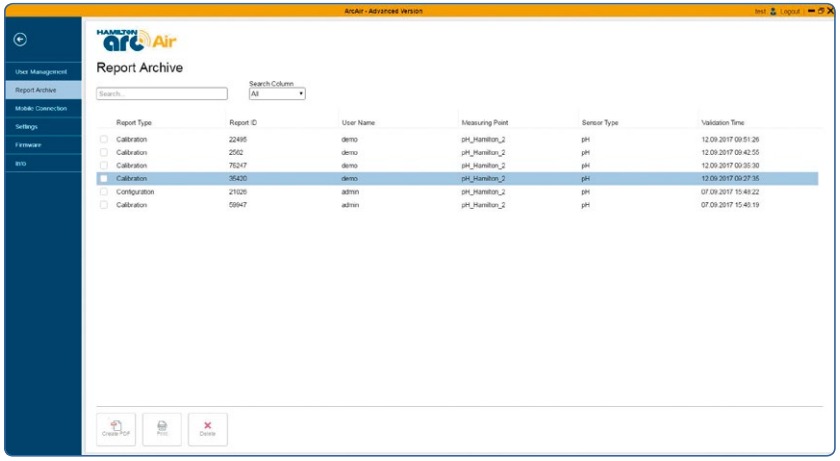


Fig. 8: Report Archive view

NOTE: All reports downloaded to the ArcAir computer version will be automatically deleted from the mobile device memory.

6.16 Install Arc Sensor In Your Measuring Loop

The mechanical design of the Arc sensor is compatible with all Hamilton process housings, including FlexiFit, Retractex, RetractoFit and Hygienic Sockets. Before installing the armatures, you should test that the seal is tight and the parts are all in working order. Ensure that there is no damage to the sensor or the armature. Check whether all O-rings are in place in the appropriate grooves and are free of damage. To avoid any mechanical damage to O-rings on assembly, they should be slightly greased.

Please note that O-rings are wetted parts and greasy compounds must comply to your FDA application needs.

6.16.1 VP 8 or M12 Pin Designation

Always use Hamilton VP8 or M12 sensor cables for safe connections, which are available in different lengths (Chapter 11.3).

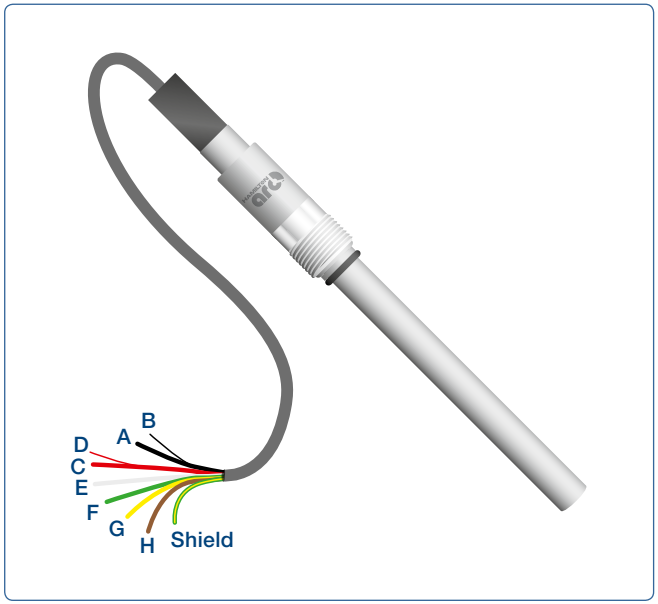


Fig. 9: Arc sensor with VP8 double coaxial open end cable.

VP Pin	Function	Color Double Coaxial Cable	Color Data Cable
A	4–20 mA interface (mA interface 2) or for VisiFerm DO the ECS interface	Coaxial core black transparent	Yellow
B	4–20 mA interface (mA interface 1)	Coaxial shield black	Green
C	Power supply: +24 VDC (7 to 30 VDC)	Coaxial core red transparent	Red
D	Power supply: Ground	Coaxial shield red	Blue
E	Temperature sensor NTC 22 kOhm for ECS mode	White	Brown
F	Temperature sensor NTC 22 kOhm for ECS mode	Green	White
G	RS485 (A)	Yellow	Gray
H	RS485 (B)	Brown	Pink
Shaft	Sensor shaft connected to earth	Green/Yellow	Green/Yellow

M12 (A coded) Pin Designation with Respect to Hamilton M12 Sensor Cable Conductor Colors:

M12 Pin	Function	Color	Description
1	+4-20 mA # 1	White	4-20 mA two-wire interface, functions as a current sink and needs to be powered. It regulates the input current according to the sensor measurements and galvanically isolated from the power supply.
2	-4-20 mA # 1	Brown	
3	+4-20 mA # 2	Green	
4	-4-20 mA # 2	Yellow	
5	RS485 (A)	Gray	Modbus RTU RS485
6	RS485 (B)	Pink	Modbus RTU RS485
7	GND	Blue	Ground
8	+ 24 VDC	Red	Power supply: +24 VDC (7-30 VDC) (Power supply can be external; not from PCS)
Housing	Shield	Green/Yellow	Connected to the housing including the VP8 female connector.

6.16.2 Electrical Connection for Analog 4-20 mA Connection

The 4–20 mA interface enables direct connection of the Arc sensor to a data recorder, indicator, control unit or PCS with analog I/O. The Arc sensor works as a current sink sensor and is passive. Connect the sensor according to the pin designations (Chapter 6.16.1). The 4–20 mA interface of the Arc sensors is pre-configured with default values for the 4–20 mA range, and measurement unit. Configure the 4–20 mA interface according to your requirements for proper measurement (Chapter 6.12).

Examples of circuit arrangement

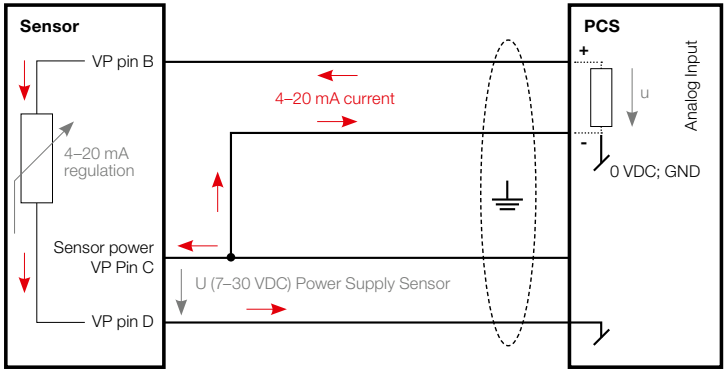


Fig. 10: Three-wire loop wiring diagram for the 4–20 mA interface.

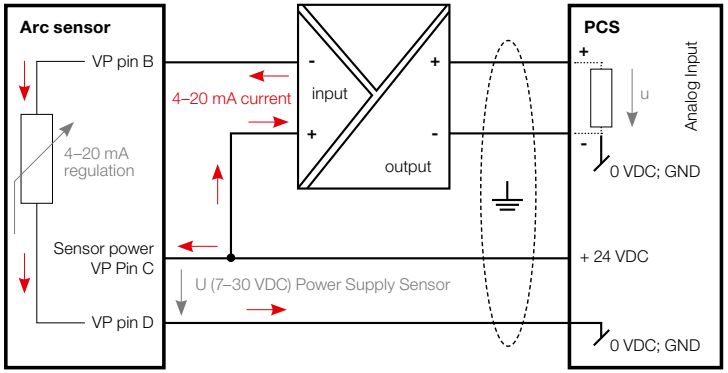


Fig. 11: The safest form of wiring, using an external isolation amplifier. The figure represents 4–20 mA interface. (For detailed technical advice, please contact the technical support at Hamilton.)

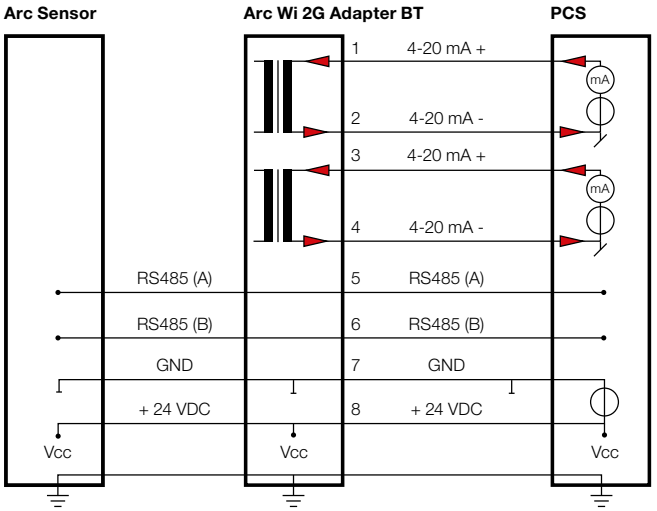


Fig. 12: Typical connection to PCS using the Arc Wi 2G Adapter BT. This is the safest form of wiring an Arc sensor. The Arc Wi 2G Adapter BT provides internal galvanic isolators for enhanced analog signal quality. Connection to the PCS is simplified. Connection to the process control system is simplified. enhanced analog signal quality. Connection to the process control system is simplified.

6.16.3 Controlling 4–20 mA current interface signals by pulse-width modulation

Hamilton Arc sensors use the method of pulse-width modulation (PWM) to adjust the DC currents of the 4–20 mA interfaces corresponding to the measured values. In principle, the pulse width (ti) of a rectangular signal with a constant frequency, the pulse duty factor (ti/T), is modulated and afterwards demodulated by a low-pass filter to generate continuous analog DC signals. The resulting value yi corresponds to the average of the PWM signal (see Figures 12 and 13). The PWM-loads of the Sensors have low-pass filters which are not able to eliminate all AC fractions of the used PWM frequency of 5 kHz due to technical impossibilities. Therefore, the current signals of the 4–20 mA interfaces are still overlaid by a certain AC which should be masked by lag smearing or input filters of the current input card of the process control system (PCS). Recommended PCS settings are a sampling rate below 3.5 kHz, an averaging over more than 1 s, and the use of galvanically separated inputs to avoid oscillations. It is also possible to use mathematical functions or isolating amplifiers for signal processing filtering if necessary. For detailed technical advice about suitable isolating amplifiers, please contact Hamilton technical support.

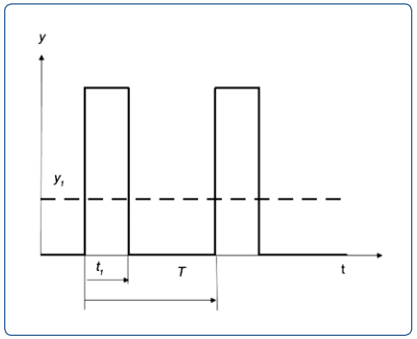


Fig. 13: Progress of a rectangular signal with a period T and a pulse duration t_1 for the generation of an analog signal with the value y_1.

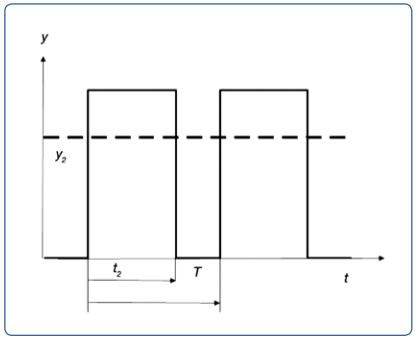


Fig. 14: Progress of a rectangular signal with a period T and a pulse duration t_2 for the generation of an analog signal with the value y_2.

⚠ ATTENTION! The Arc sensors generates the 4-20 mA signals by pulse with modulation (PWM) which is not compatible to all PCS systems. Also a galvanic separation between the power supply and the PCS is necessary for correct sensor functionality when used in 4-20 mA setups. Figure 11 illustrates a solution for the problem.

Analog interface 1 and 2

Galvanically not isolated, pulse width modulation with 5 kHz, recommended PCS settings:

- Use galvanically separated inputs
- Sampling rate < 3 kHz and ≠ n * 3.5 kHz
- Average over > 1 s

6.16.4 Electrical Connection for the ECS interface (only for VisiFerm DO famlily)

The ECS mode enables the simulation of an electrochemical sensor. Thus a VisiFerm DO sensor can be connected to classical measuring devices instead of amperometric oxygen sensors (Clark cells). Furthermore only the power supply of the VisiFerm DO sensor is necessary.

NOTE: The ECS mode is only available for VisiFerm DO ECS and not for The Arc sensors.

⚠ ATTENTION! Do not apply any high voltage (max. 2 VDC) at pin B (anode)! This can result in a destruction of the sensor in ECS mode! Note: Only in 4-20 mA mode a high voltage (max. 24 VDC) may be applied in order to operate the current interface!

In an electromagnetically noisy environment, it is advisable to assign the sensor's shaft and/or VP cable shield to earth. This significantly improves noise immunity and signal quality. The NTC temperature sensor attached to the pins E and F is isolated from the integrated electronics and is used for the temperature compensation of the oxygen signal in the measuring device. Usually classical sensors are operated with a polarization voltage between anode and cathode. This polarization voltage is supplied by the measuring device. VisiFerm DO can be operated with polarization voltages usual for electrochemical sensors. The sensor is optimized for a polarization voltage of -675 mV. For adjustment to different measuring devices and/or for simulation of different amperometric sensors the current can be adjusted between 0 and 500 nA. When using the ECS interface, pins have the following designations with respect to VP cable conductor colors:

VisiFerm DO only	VP Pin	Color Double Coaxial Cable
Cathode	A	Coaxial core black transparent
Anode **ATTENTION:** In ECS mode never connect with a potential higher as + 2 V	B	Coaxial shield black
Power supply: + 24 VDC (7 to 30 VDC), max. 1000 mW	C	Coaxial core red transparent
Power supply: Ground	D	Coaxial shield red
NTC 22 kOhm	E	White
NTC 22 kOhm	F	Green
sensor shaft (connect with the mass of the power supply)	shield	Cable shield green-yellow

Examples of circuit arrangement

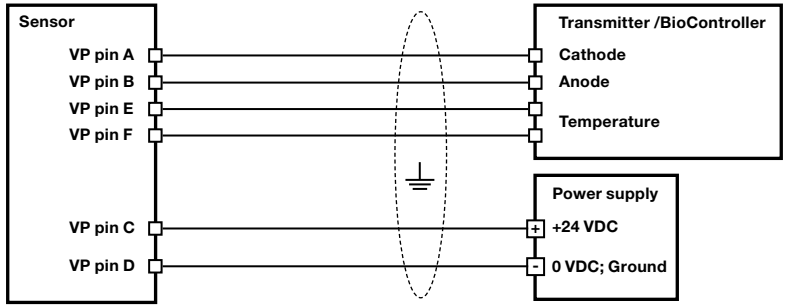


Fig. 15: Wiring diagram for the ECS interface.

6.16.5 Electrical Connection for the digital RS485 Interface

The digital RS485 interface enables communication with Arc sensor for performing measurements, for calibrating the Arc sensor and for changing the sensor's configuration parameters. Arc sensors are always connected to digital controlling devices as a Modbus slave. To function, they require a power supply (VP 8 pins C and D, see below). The section entitled «Configuring the Arc sensor parameters» describes operation in digital mode.

Additional information:

The Modbus RTU communication protocol corresponds to the Modbus-IDA standard (see www.modbus.org). Arc sensors use an open register set developed by Hamilton. Additional information about the register content and structure can be found in the programmers manual under www.hamiltoncompany.com The Modbus physical layer is described in detail with requirements on cabling and line termination in the «Modbus Serial line Protocol and Implementation Guide» www.modbus.org > Technical Resources / Modbus Specifications / Modbus Serial line Protocol and Implementation Guide.

⚠ ATTENTION! Because all sensors are delivered with factory-default settings, each sensor must be configured for its specific application before first use (see the section entitled «Configuring Arc Sensors»).

The pins for digital the RS485 interface have the following designation with respect to VP cable conductor colors:

Arc sensor	VP Pin	Color Double Coaxial Cable	Color Data Cable
Power supply: +24 VDC (7 to 30 VDC), power consumption 1 W.	C	Coaxial core red transparent	Red
Power supply: Ground	D	Coaxial shield red	Blue
RS485 (A)	G	Yellow	Gray
RS485 (B)	H	Brown	Pink
Sensor shaft	Shield	Green/Yellow	Green/Yellow

In an electromagnetically noisy environment, it is advisable to connect the VP cable shield to the earth. This significantly improves noise immunity and signal quality.

Example of circuit arrangement

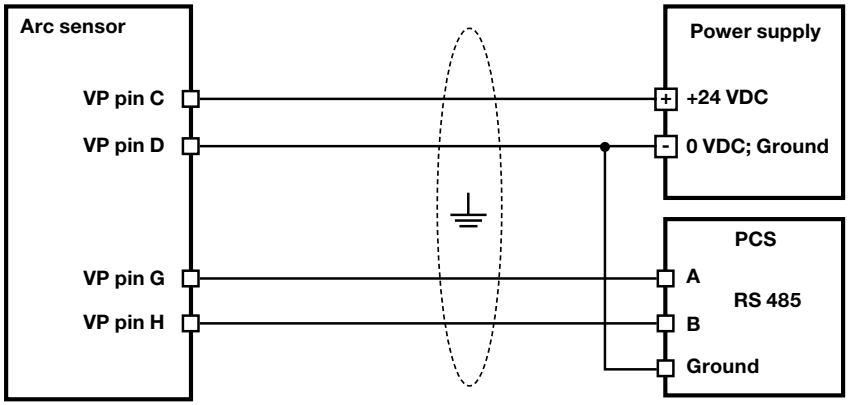


Fig. 16: Wiring diagram for the RS485 interface.

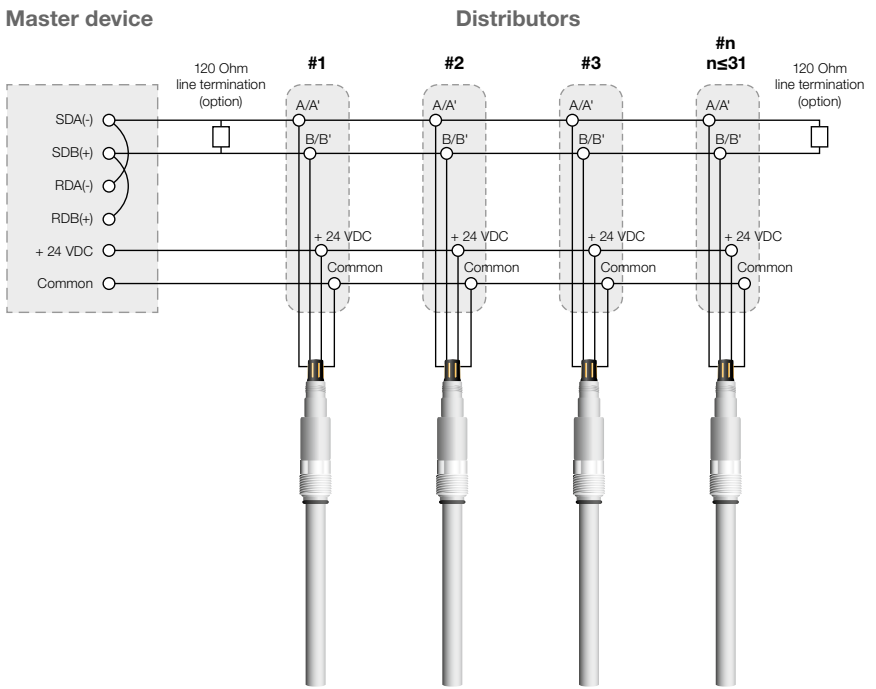


Fig. 17: Multi-drop bus wiring for the Modbus two-wire mode. Each sensor functions as a Modbus slave.

NOTE: In order to avoid signal reflection on the lines the use of line termination resistors (120 Ohm each) is recommended. The effect of signal reflections becomes more relevant with long cable length and/or high baud rates.

NOTE: In the connection scheme shown above, each sensor must have the unique Modbus device address for proper communication.

The serial Modbus connection between the RS485 port of the master and the corresponding interfaces of the sensors has to be ensured according to the EIA/TIA RS485 standard. Only one sensor can communicate with the master at any time.

ARC SENSOR OPERATION

7 Arc Sensor Operation

⚠ ATTENTION! Only use the sensor within the specifications (www.hamiltoncompany.com). Failure to do so may lead to damages or measurement failure.

1) Remove the watering or yellow protective caps from the Arc sensor shaft, and from the VP 8 sensor head
2) Check the O-ring on the sensor shaft
3) Verify if the sensing material is not damaged
4) If using a pH sensor: Check inside of pH glass membrane for unwanted air bubbles. Shaking the sensor gently will cause any bubbles to rise to the top.
5) Verify the functionality of the Arc sensor
6) Calibrate the sensor (Chapter 8.2)
7) Connect the sensor to the process control system (Chapter 6.16)
8) Verify the measurement on your control system and create a communication validation report
9) Mount the sensor to the armature or process connection (Chapter 6.16)

NOTE: No measurement is performed at a temperature higher than 85°C (optical DO) or 110°C (pH, ORP, electrochemical DO and conductivity sensors) to protect sensing part and enhanced the sensor lifetime.

NOTE (only optical DO sensors): To ensure a correct measurement after changing the ODO Cap type (e.g. ODO Cap H0) the reference number of the ODO Cap must be configured in the Sensing Material register (See Chapter 6.11). Firmware version ODOUM042 or higher is required.

7.1 Run Experiments

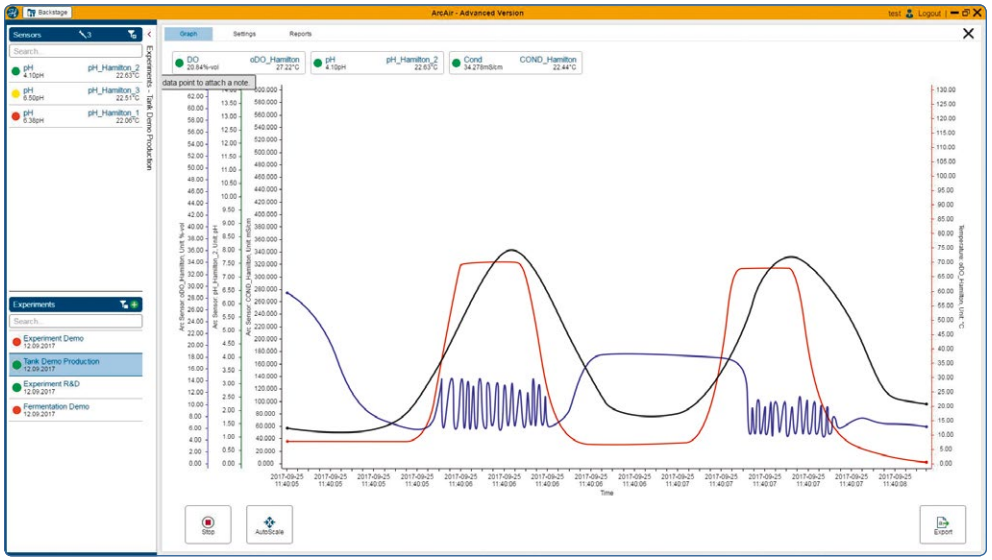


Fig. 18: Experiment View

7.1.1 Create new experiment

1) Click the Add Icon
2) Select up to three Arc sensors for data recording and graph
3) Set an experiment name
4) Enable or disable data recording in the background
5) Set an appropriate sampling time
6) Choose the temperature reading from one of the three selected Arc sensors
7) Define the path for the .csv export file
8) Save the settings and the experiment starts automatically

7.1.2 Edit an experiment

1) Select settings in the experiment view
2) Adjust the settings according you requirements
3) Save settings

NOTE: Changing one of the three Arc sensors in the experiment is not possible. Please create new experiment, if sensor change is required.

8 Arc Sensor Maintenance

Periodic maintenance routines need to be run in order to ensure safe and reliable operation and measurement of Arc sensors and accessories.

⚠ **ATTENTION! Avoid any contact of the equipment with corrosive media.**

1) Connect one of the Arc sensors with the power supply, e.g. by using the Arc USB Power Cable on a standard USB port (see figure 1)
2) Control the traffic lights in the Quick View or sensor list (Figure 19)
3) Please refer to the troubleshooting (Chapter 9) for the next steps if the traffic light is not green
4) Control the quality of the sensor under Info «Quick View» or sensor if required (Chapter 9)

NOTE: The lifetime of the Arc sensors highly depends on the specific conditions of the application. Temperature, pressure, chemicals used may accelerate the ageing of both the sensor electronic and sensing material.

ARC SENSOR MAINTENANCE

8.1 Verify Arc Sensor Status and Functionality

1) Connect one of the Arc sensors with the power supply, e.g. by using the Arc USB Power Cable on a standard USB port (see figure 1)
2) Control the traffic lights in the sensor list or Quick View (Figure 24).

The sensor is performing correctly.
No errors or warnings have been registered.

At least a warning has been registered.
Verify the sensor warnings in Sensor Status.

At least an error has been registered.
Verify the sensor errors in Sensor Status.

Offline

Figure 19: Description of the traffic lights on the ArcAir.

8.2 Calibration

The Arc sensors provide two kinds of sensor calibration: automatic standard calibration, and product calibration. The automatic standard calibration and the product calibration may be performed using ArcAir.

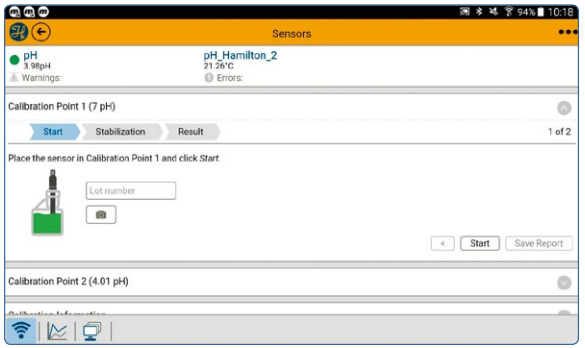


Fig. 20: ArcAir Calibration Wizard with an Arc pH sensors.

ARC SENSOR MAINTENANCE

Automatic standard Calibration Wizard

The calibration points should be chosen withing the measuring range of the specific application. Correct measuring parameter should be set in order to met the process tolerances.

Arc sensors are calibrated at one or two points:

	oDO	eDO	pH	ORP	Conductivity
Cal. Point 1	Air	Air	pH 7 (factory)	475 mV (factory)	1413 µS/cm (factory)
Cal. Point 2	Zero Point	Zero Point	pH 4 (factory)	–	–

During calibration, the sensor checks automatically the stability of the measurement and temperature signals.

NOTE: For greater measurement accuracy ensure that temperature difference between calibration medium and process medium is minimal.

1) Connect one of the Arc sensors with the power supply, e.g. by using the Arc USB Power Cable on a standard USB port (see figure 1)
2) Select the desired sensor from the sensor list
3) Open the calibration tab
4) Place the sensor in the calibration standard. For pH, Cond and ORP: enter the lot number or scan the barcode
5) Click «Start» to start the calibration wizard
6) Follow the instruction on the screen

Important information for the calibration

Air calibration:

NOTE: Calibration with air-saturated water is less accurate due to the slow saturation process of air in water.

NOTE: The value of the saturated oxygen concentration at different temperatures, different pressures and air humidity play an important role for the calibration of dissolved oxygen. Oxygen DO sensors refers to a concentration in water saturated air and from the factory settings of atmospheric pressure of 1013 mbar at 25°C.

Effect of humidity

Humidity may only impact oxygen concentration measurement in gas but not in liquids. All Hamilton optical DO sensors refer to a concentration in water saturated air (100% humidity). Figure 21 shows the effect of humidity on the measured oxygen concentration at different temperature. This effect is greater at higher temperatures.

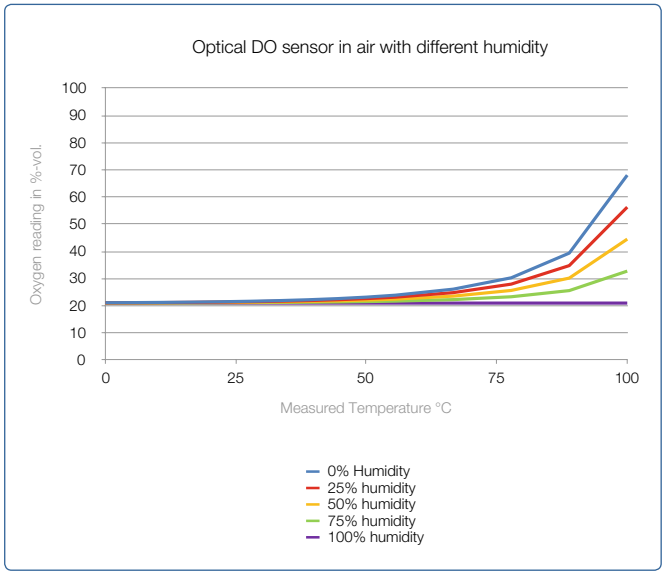


Fig. 21: Humidity influence on the oxygen reading at different temperature.

Zero calibration:

NOTE: To ensure an accurate zero point calibration use nitrogen gas with 5.0 purity (99.999%) and nitrogen flow rate: 0.5 L/min with 3 to 4 bar pressure (no overpressure). Let the system equilibrate and ensure stable conditions for at least three minutes.

Calibration solution for COND, pH and ORP:

NOTE: Buffer solutions will degrade over time. Before calibrating, always check that the buffer solution has not expired.

NOTE: Calibration buffers should be selected which roughly approximate to the process range.

NOTE: The calibration solution defined for automatic calibration must have at least two pH units difference in their value.

8.3 Product Calibration Wizard

The product calibration is an in-process calibration procedure in order to adjust the measurement to specific process conditions. Product calibration is an additional calibration procedure to a standard calibration. In order to restore the original standard calibration curve, the product calibration can be deleted at any time by selecting on the Product calibration command «cancel». A new standard calibration cancels a product calibration as well.

1) Connect one of the Arc sensors with the power supply, e.g. by using the Arc USB Power Cable on a standard USB port (see figure 1)
2) Select the desired sensor from the sensor list
3) Go to «Process Settings»
4) Click «Start» to start the product calibration wizard
5) Follow the instruction on the screen

NOTE: Alternatively, the product calibration may be performed with a mobile device on site the measuring point.

ARC SENSOR MAINTENANCE

Product calibration with oxygen sensors:

NOTE: The new DO value is accepted and active, if the difference between initial measurement and laboratory values is not greater than 20 %-sat units.

NOTE: The product calibration is possible for DO values in the range of 2 to 55 %-vol (20 – 550 mbar pO_2).

Product Calibration with pH / ORP sensors:

NOTE: The difference between initial measurement and laboratory values for pH sensors can not be greater than two pH units and for ORP sensors it can not be greater than 400 mV.

8.4 Cleaning

This chapter outlines a manual cleaning procedure for the care and maintenance of Arc sensors including a procedure for the cleaning the sensing part in particular.

Cleaning the Sensor

Carry out the cleaning procedure as follows:

1) Remove sensor from the measuring setup
2) Soak a dust-free cloth or tissue paper with water and wipe the wetted parts with it. Thoroughly rinse the wetted parts and the sensing part of the sensor with deionised water afterwards
3) Dry the wetted parts with a clean dust-free cloth or tissue. Store the optical DO sensors in dry and dark conditions (ODO Caps are light-sensitive)
4) If the sensing part of the sensor is contaminated with oil, grease or other organic matter, soak a clean dust-free cloth with isopropyl alcohol. Rinse residual isopropyl alcohol immediately from the sensing part with deionised water and gently wipe over

5) After cleaning always perform a new calibration before carrying out measurements. (See chapter 8.4 in the corresponding Operating Instruction Manual)

⚠ **ATTENTION! Cleaning, assembly and maintenance should be performed by personnel trained in such work. Do not use any abrasive tissues or cleaning materials and do not use any cleaning chemicals other than described above. Before removing the sensor from the measuring setup, always make sure that the setup is pressure-less and cold and that no process medium can be accidentally spilled. When removing and cleaning the sensor, it is recommended to wear safety glasses and protective gloves.**

NOTE: pH sensor with Ceramic diaphragms only: In the event of protein contamination, immerse the sensor's electrode for several hours in 0.4% HCl +5 g/l pepsin. If blackening of the diaphragm is noted (due to silver compounds), immerse the electrode in 0.4% HCl + 76 g/l thiourea.

NOTE: To regenerate pH or ORP Arc sensors, immerse sensor for 10 minutes in 0.1–1.0 M NaOH, then 10 minutes in 0.1–1.0 M HCl. After regeneration, place it in a storage solution for 15 minutes.

Regeneration for pH and ORP Arc sensors

Immerse sensor for 10 minutes in 0.1–1.0 M NaOH, then 10 minutes in 0.1–1.0 M HCl. After regeneration, place it in a storage solution for 15 minutes.

8.5 Replacing the DO Cap (only for oxygen sensors)

The exchange of DO caps can be performed very easily:

1) Unscrew the DO Cap from the shaft (Figure 22)
2) Exchange the O-ring
3) Screw firmly the new DO Cap onto the sensor shaft again
4) Perform sensor calibration (Chapter 8.2)

Fig. 22: Replacing the ODO Cap of the VisiFerm DO Arc sensor.

8.6 Arc Sensor FW Updates incl. Accessories

1) Start ArcAir application on computer
2) Go to «Backstage»
3) Select «Firmware» and click on «Arc Sensors», «Arc Wireless Converters» or Arc Wi Adapters
4) Follow the instructions on the screen

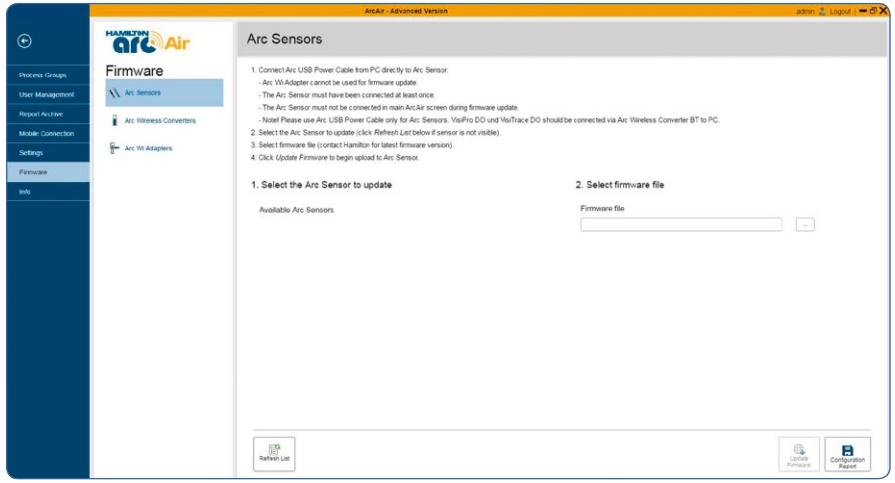


Fig. 23: Firmware update for Arc sensors and accessories

TROUBLESHOOTING

9 Troubleshooting

9.1 Sensor Self-Diagnostic

Arc sensors provide a self-diagnostic functionality to detect and identify the most common sensor malfunctions. Both interfaces, analog 4–20 mA or digital Modbus, may provide warning and error messages. The analog 4–20 mA interface can be configured according to the NAMUR recommendations to indicate an abnormal event (see Chapter 6.15). Use ArcAir for monitoring the sensor status and for troubleshooting. The following types of messages are provided by the self-diagnosis function.

NOTE: Errors must be addressed and corrective action is immediately necessary.

NOTE: Warnings must be acknowledged. Corrective action is depending on the root cause. The warning will be displayed continuously until the corrective action is successfully completed.

NOTE: For additional information about the sensor status and the diagnostics features refer to the sensor's operation instruction manual or the programmer`s manual.

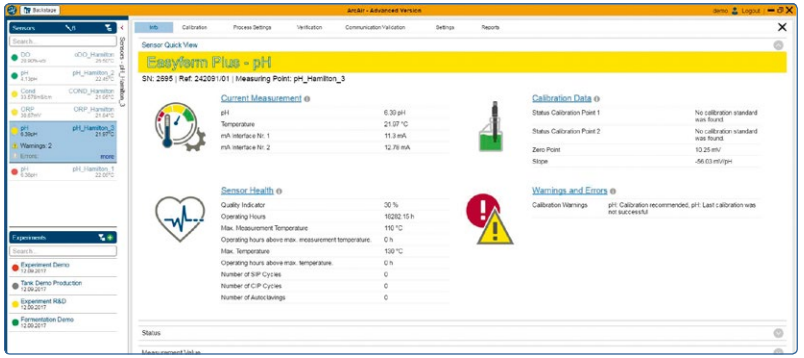


Fig. 24: Quick View of pH Arc sensor with an active warning

9.2 Warnings for DO Arc Sensors

Warning	Cause / Solution
DO reading below lower limit	The oxygen reading is too low (DO < 0%-sat). Make a new zero-point calibration (Chapter 8.2).
DO reading above upper limit	The oxygen reading is too high (DO > 300 %-sat). Make a new calibration in oxygen saturated medium. (See chapter 8.2). If not successful, replace the sensor cap.
DO reading unstable	If continuously happening, use a new cap or check the process regulation. If the problem still appears, call our Technical Support.
T reading below lower limit	The temperature is below the user defined measurement temperature range. If the process temperature is outside this range, the sensor will not perform DO readings.
T reading above upper limit	The temperature is above the user defined measurement temperature range. If the process temperature is outside this range, the sensor will not perform DO readings.
Measurement not running	The measurement interval is set to 0 or the measurement temperature is out of the range.
DO calibration recommended	Perform a calibration in order to ensure reliable measurement (Chapter 8.2).
DO last calibration not successful	The last calibration failed. The sensor is using the old successful calibration values. In order to ensure reliable measurement perform a new calibration (Chapter 8.2).
DO replace sensor cap	Replace the ODO Cap and calibrate the sensor cap sensor cap sensor. This warning remains active as long as the sensor quality is below 35%. Make sure that after new cap replacement the sensor reaches at least 60% cap quality. See chapter 8.5 for replacement conditions. The quality indicator takes sensor and cap into account.
4–20 mA value below 4 mA	The measurement value is below the lower limit of the 4–20 mA interface output. Reconfigure the 4–20 mA interface (Chapter 6.12).
4–20 mA value above 20 mA	The measurement value is above the upper limit of the 4–20 mA interface output. Reconfigure the 4–20 mA interface (Chapter 6.12).
4–20 mA current set-point not met	The 4–20 mA interface is not able to regulate the current requested for the current measurement value according to your 4–20 mA interface configuration. Check the 4–20 mA wiring and supply voltage (Chapter 6.12).

Warning	Cause / Solution
Sensor supply voltage too low	The sensor supply voltage is too low for the sensor to operate correctly. Ensure stable supply voltage within the sensors specifications.
Sensor supply voltage too high	The sensor supply voltage is too high for sensor to operate correctly. Ensure stable supply voltage within the sensors specifications.

9.3 Warnings for pH / eDO / Conductivity Arc Sensors

Warning	Cause / Solution
Conductivity reading below lower limit	The conductivity measurement is too low. Make new calibration (chapter 8.2).
(pH/ORP/COND) calibration recommended	Perform a calibration in order to ensure reliable measurement (chapter 8.2)
(pH/ORP/COND) last calibration not successful	The last calibration failed. The sensor is using the old successful calibration values. In order to ensure reliable measurement perform a new calibration (chapter 8.2)

TROUBLESHOOTING

9.4 Errors for DO Sensors

Warning	Cause / Solution
DO reading failure	Sensor cap is missing or the sensor is broken.
DO p(O_2) exceeds air pressure	Measured partial pressure of oxygen is higher than the air pressure set by the operator. Reconfigure the air pressure parameter (Chapter 6.12).
T sensor defective	The internal temperature sensor is defect, please call our Technical Support.
DO sensor cap missing	The DO sensor cap has been removed. Do not immerse the sensor in a measurement solution. Mount an DO Cap and calibrate the sensor prior measurement (Chapter 8.5).
Red channel failure	Measurement channel failure. Please call our Technical Support.
Sensor supply voltage far too low	The sensor supply voltage is below 6 V. Please check your power supply.
Sensor supply voltage far too high	The sensor supply voltage is above 40 V. Please check your power supply.
Temperature reading far below min	The measured temperature is below the operation temperature.
Temperature reading far above max	The measured temperature is above the operation temperature.

9.5 Errors for pH / ORP Arc Sensors

Warning	Cause / Solution
pH reading failure (this error occurs, when any other error is active)	Sensor sensitive parts are broken.
Glass resistance too high	pH/ORP glass is ageing during the process and cleaning cycles at high temperature. Perform sensor cleaning and regeneration (chapter 8.4)
Glass resistance too low	Sensitive pH glass may crack. Replace sensor.
Reference electrode resistance too high	Diaphragm may be clogged. Clean and regenerate sensor (chapter 8.4)
Reference electrode resistance too low	Reference system is broken. Check against external reference. Replace sensor.
Temperature sensor defective	Replace sensor
Sensor failure (Quality value < 15%)	Replace sensor
Internal communication error	Communication between measuring and interface electronic failed. Replace sensor.

9.6 Errors for Conductivity Arc Sensors

Warning	Cause / Solution
COND reading failure (this error occurs, when any other error is active)	Sensor electrodes are broken.
Resistance 4 electrodes too high	Electrodes are not in contact with liquid or are broken.
Resistance 4 electrodes too low	Short circuit between the electrodes.
Resistance 2 electrodes too high	Electrodes are not in contact with liquid or are broken.
Resistance 2 electrodes too low	Short circuit between the electrodes.
Temperature sensor defective	Replace sensor.
Sensor failure (Quality value < 15%)	Replace sensor.
Internal communication error	Communication between measuring and interface electronic failed. Replace sensor.

9.7 Getting Technical Support

If a problem persists even after you have attempted to correct it, contact Hamilton`s Customer Support: Please refer to the contact information at the back of this operating instruction.

9.8 Return Back for Repair

Before returning an Arc sensor to Hamilton for repair, contact our Customer Service (see Chapter 9.7) and request a Returned Goods Authorization (RGA) number. Do not return an Arc sensor to Hamilton without an RGA number. This number assures proper tracking of your sensor. Arc sensors that are returned without an RGA number will be sent back to the customer without being repaired. Decontaminate the Arc sensor and remove health hazards, such as radiation, hazardous chemicals, infectious agents etc. Provide complete description of any hazardous materials that have been in contact with the sensor.

10 Disposal

The design of Arc sensors optimally considers environmental compatibility. In accordance with the EC guideline 2002/96/EG Hamilton sensors that are worn out or no longer required must be sent to a dedicated collection point for electrical and electronic devices, alternatively, must be sent to Hamilton for disposal. Sensors must not be sent to an unsorted waste disposal point.

此标志表示某一电子和电气产品不含任何有害物质,是绿色环保产品,并且可在废弃之后进行回收,不应随意废弃.

ORDERING INFORMATION

11 Ordering Information

11.1 Arc Sensors

	Ref	Description
VisiFerm DO Family	243666-111	VisiFerm DO Arc 120 H0
	243666-112	VisiFerm DO Arc 120 H2
	243666-121	VisiFerm DO Arc 160 H0
	243666-122	VisiFerm DO Arc 160 H2
	243666-131	VisiFerm DO Arc 225 H0
	243666-132	VisiFerm DO Arc 225 H2
	243666-141	VisiFerm DO Arc 325 H0
	243666-142	VisiFerm DO Arc 325 H2
	243666-151	VisiFerm DO Arc 425 H0
	243666-152	VisiFerm DO Arc 425 H2
	243666-211	VisiFerm DO ECS 120 H0
	243666-212	VisiFerm DO ECS 120 H2
	243666-221	VisiFerm DO ECS 160 H0
	243666-222	VisiFerm DO ECS 160 H2
	243666-231	VisiFerm DO ECS 225 H0
	243666-232	VisiFerm DO ECS 225 H2
	243666-241	VisiFerm DO ECS 325 H0
	243666-242	VisiFerm DO ECS 325 H2
	243666-251	VisiFerm DO ECS 425 H0
	243666-252	VisiFerm DO ECS 425 H2

	Ref	Description
EasyFerm Plus Family	238633-1313	EasyFerm Plus PHI Arc 120
	238633-1323	EasyFerm Plus PHI Arc 160
	238633-1333	EasyFerm Plus PHI Arc 200
	238633-1343	EasyFerm Plus PHI Arc 225
	238633-1353	EasyFerm Plus PHI Arc 325
	238633-1373	EasyFerm Plus PHI Arc 425
	238633-2313	EasyFerm Plus HB Arc 120
	238633-2323	EasyFerm Plus HB Arc 160
	238633-2333	EasyFerm Plus HB Arc 200
	238633-2343	EasyFerm Plus HB Arc 225
	238633-2353	EasyFerm Plus HB Arc 325
	238633-2373	EasyFerm Plus HB Arc 425
EasyFerm Bio Arc Family	243632-1313	EasyFerm Bio PHI Arc 120
	243632-1323	EasyFerm Bio PHI Arc 160
	243632-1333	EasyFerm Bio PHI Arc 200
	243632-1343	EasyFerm Bio PHI Arc 225
	243632-1353	EasyFerm Bio PHI Arc 325
	243632-1373	EasyFerm Bio PHI Arc 425
	243632-2313	EasyFerm Bio HB Arc 120
	243632-2323	EasyFerm Bio HB Arc 160
	243632-2333	EasyFerm Bio HB Arc 200
	243632-2343	EasyFerm Bio HB Arc 225
	243632-2353	EasyFerm Bio HB Arc 325
	243632-2373	EasyFerm Bio HB Arc 425
Polilyte Plus Arc Family	242428-1313	Polilyte Plus H ARC 120
	242428-1323	Polilyte Plus H ARC 225
	242428-1333	Polilyte Plus H ARC 325
	242428-1353	Polilyte Plus H ARC 425
	242428-2313	Polilyte Plus HB ARC 120
	242428-2323	Polilyte Plus HB ARC 225

ORDERING INFORMATION

	Ref	Description
	242428-2333	Polilyte Plus HB ARC 325
	242428-2353	Polilyte Plus HB ARC 425
	242428-3313	Polilyte Plus HF ARC 120
	242428-3323	Polilyte Plus HF ARC 225
	242428-3333	Polilyte Plus HF ARC 325
	242428-3353	Polilyte Plus HF ARC 425
	242428-4313	Polilyte Plus PHI ARC 120
	242428-4323	Polilyte Plus PHI ARC 225
	242428-4333	Polilyte Plus PHI ARC 325
	242428-4353	Polilyte Plus PHI ARC 425
Conducell 4USF Arc Family	243590-1113	Conducell 4USF Arc 120
	243590-1123	Conducell 4USF Arc 225
	243590-1133	Conducell 4USF Arc 325
	243590-1143	Conducell 4USF Arc 425
	243590-1213	Conducell 4UPtF Arc 120
	243590-1223	Conducell 4UPtF Arc 225
	243590-1233	Conducell 4UPtF Arc 325
	243590-1243	Conducell 4UPtF Arc 425
	243590-1313	Conducell 4UHF Arc 120
	243590-1323	Conducell 4UHF Arc 225
	243590-1333	Conducell 4UHF Arc 325
	243590-1343	Conducell 4UHF Arc 425
	243590-1413	Conducell 4UTF Arc 120
	243590-1423	Conducell 4UTF Arc 225
	243590-1433	Conducell 4UTF Arc 325
	243590-1443	Conducell 4UTF Arc 425
Conducell UPW Family	243578	Conducell UPW Arc TC 1.5”
	243579	Conducell UPW Arc PG13,5

	Ref	Description
ORP Arc Family	243050	EasyFerm Plus ORP Arc 120
	243051	EasyFerm Plus ORP Arc 225
	243052	EasyFerm Plus ORP Arc 325
	243053	EasyFerm Plus ORP Arc 425
	243060	Polilyte Plus ORP Arc 120
	243061	Polilyte Plus ORP Arc 225
	243062	Polilyte Plus ORP Arc 325
	243063	Polilyte Plus ORP Arc 425
OxyFerm DO Arc Family	243100	OxyFerm FDA Arc 120
	243101	OxyFerm FDA Arc 160
	243102	OxyFerm FDA Arc 225
	243103	OxyFerm FDA Arc 325
	243104	OxyFerm FDA Arc 425
	243140-25	OxyFerm FDA Arc XL

VisiFerm DO Family Parts

Ref	Description	Wetted parts
243515	ODO Cap H0	Stainless steel 1.4435 Silicone (FDA approved and USP Class VI)

Application: For general application in biotechnology, water treatment and monitoring as well as in breweries, wineries and soft drink processing.

Ref	Description	Wetted parts
243505	ODO Cap H2	Stainless steel 1.4435 PTFE (USP Class VI)

Application: For fermentation processes where sterilization in place (SIP) is performed in media containing higher amounts of lipophilic compounds. It comes with a hygienic design.

OxyFerm FDA Family Parts

Ref	Description
237123	OXYFERM Membrane Kit
237126	CIP Membrane Kit
237140	FDA Membrane Kit
237118	OXYLYTE Electrolyte 50 ml
237137	Optional protective cap with chain
237306	Replacement Cathode OXYFERM

ORDERING INFORMATION

11.2 ArcAir Software

ArcAir Application

Download on the App Store

GET IT ON Google Play

ArcAir	Read	Calibrate	Configure	Documentation
Lite License	✓	–	–	–
Basic License	✓	✓	✓	–
Advanced License	✓	✓	✓	✓

NOTE: Can be upgraded via In-App purchase in the ArcAir application.

11.3 Arc Parts and Accessories

Ref	Product Name
243499	Arc Wireless Converter BT

Description: Designed for wireless communication between ArcAir PC version and Arc Sensors.

Ref	Product Name
242333	Arc Wireless Converter Advanced

Description: Designed for wireless communication between ArcAir and Arc Sensors. The advanced version enables ArcAir Advanced in the computer version.

Ref	Product Name	Length	Interface
355263	Sensor Data Cable VP 8	1 m	4-20 mA/Modbus
355264	Sensor Data Cable VP 8	3 m	4-20 mA/Modbus
355265	Sensor Data Cable VP 8	5 m	4-20 mA/Modbus
355266	Sensor Data Cable VP 8	10 m	4-20 mA/Modbus
355267	Sensor Data Cable VP 8	15 m	4-20 mA/Modbus
355268	Sensor Data Cable VP 8	20 m	4-20 mA/Modbus
355217	Sensor Cable VP 8	1 m	ECS mode
355218	Sensor Cable VP 8	3 m	ECS mode
355219	Sensor Cable VP 8	5 m	ECS mode
355220	Sensor Cable VP 8	10 m	ECS mode
355221	Sensor Cable VP 8	15 m	ECS mode
355222	Sensor Cable VP 8	20 m	ECS mode

Description: The Sensor Cable VP 8 – open end is designed for connection to a data recorder, indicator, control unit or PCS (Process Control System) with analog I/O.

Ref	Product Name	Connection to
243490-01	Arc USB Power Cable VP 8	Arc Sensor / Arc Wi 1G Adapter BT
243490-02	Arc USB Power Cable M12 - 8	Arc Wi 2G Adapter BT
242176	Arc Sensor Cable VP 8	
355339	Arc Wi 2G BT Service Cable 2m	
355289	Arc Wi 2G Service Cable 2m	

Description: The Arc USB Power Cable provides power supply via USB port for Arc sensors and digital communication to Hamilton's computer software for monitoring, configuration, calibration and firmware updates.

Ref	Product Name	Connection to
355298-xx	2,5 m Power Cable VP8 / AMP	Old BioController with AMP connection
355296-xx	3 m Power Cable VP8 / BNC	Old BioController with BNC connection
355297-xx	1 m Power Cable VP8 / BNC	Old BioController with BNC connection
355245-xx	2,5 m Power Cable VP8 / Lemo	Old BioController with Lemo connection
355258-xx	4 m Power Cable VP8 / Binder	Old BioController with Binder connection

Power cords: 01 CH / 02 EU / 03 US / 04 UK / 05 AU/NZ

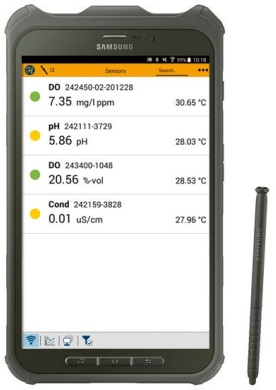
Ref	Product Name
243460	Arc Wi 1G Adapter BT

Description: The Arc Wi 1G Adapter BT provides the wireless communication between the Arc sensors and mobile devices via Bluetooth 4.0.

Ref	Product Name
243470	Arc Wi 2G Adapter BT

Description: The Arc Wi 2G Adapter BT not only provides wireless communication via Bluetooth 4.0, but also simplifies analog connection of Arc sensors to the process control system (PCS).

ORDERING INFORMATION



Ref	Product Name
243690	Arc View Mobile

Description: The pre-configured Arc View Mobile, Hamilton`s mobile solution for monitoring measurement values, calibrating Arc sensors and configuring various parameters with the unified user interface for pH, DO, Conductivity and ORP. The Arc View Mobile is based on the Samsung Galaxy Tab Active tablet and comes pre-configured with the ArcAir application, app blocker application, power supply cable, instruction manual and Hamilton quick guide.

11.4 Arc Services

Hamilton service engineers are available in Europe and China in order to provide customers with on-site services. Hamilton offers a wide range of services from technical support to initial operation, qualification and maintenance of the sensors.

Various tailored services are offered especially for the BioPharma, ChemPharma and brewery industries. Experienced service engineers ensure an optimal and professional service.

Overview of service offers

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