pH and ORP Arc sensors

Operating Instructions

HAMILTON®

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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.

1 General Information

1.1 Intended Use

The EasyFerm and Polilyte Arc sensor families (pH/ORP Arc sensors) are intended for the measurement of pH and ORP (Oxidation Reduction Potential).

> ⚠ **ATTENTION! pH/ORP Arc sensors are not intended for hazardous atmospheres.**

> ⚠ **ATTENTION! The pH/ORP Arc sensors 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.**

1.2 About this Operating Instruction

These Operating Instructions are designed to support the integration, operation and qualification of the EasyFerm and Polilyte Arc sensor families. To achieve this, it will describe the features of EasyFerm and Polilyte Arc sensor families and its integration in Process Control Systems (PCS). Both the hardware and the communication between the pH/ORP Arc sensor and Process Control Systems are detailed in this manual. After reading this manual the user should be capable of installing and operating pH/ORP Arc sensors.

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

> ⎘ NOTE: Important instructions or interesting information.

2 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 use of the sensors. It must in particular be insured in this conjunction that malfunctions can occur on account of the inherently limited useful life of sensors contingent upon their relevant applications. The user is responsible for the calibration, main-

tenance and regular replacement of the sensors. In the case of critical sensor 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 sensor failure.

> ⎘ NOTE: The pH/ORP Arc sensor is not intended and specified as a safety device. A SIL (Safety Integrity Level) certification is not available. It is in the sole responsibility of the user to validate the pH/ORP Arc sensor according the safety requirements of his application.

3 Safety Precautions and Hazards

> ⚠ **ATTENTION! Read the following safety instructions carefully before installing and operating the pH/ORP Arc sensor.**

3.1 General Precautions

For safe and correct use of pH/ORP Arc sensor, 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 pH/ORP Arc sensor operation instruction manual. The specification given in the «Specification Sheet» as regards temperature, pressure etc. may under no circumstances be exceeded. Inappropriate use or misuse can be dangerous.

The lifetime of the pH/ORP Arc sensor highly depends on the specific conditions of the application. Temperature, pressure, chemicals used may accelerate the ageing of the pH/ORP Arc sensor. See chapter 7 for replacement conditions.

Cleaning, assembly and maintenance should be performed by personnel trained in such work. Before removing the sensor from the measuring setup, always make sure the no process medium can be accidentally spilled. When removing and cleaning the sensor, it is recommended to wear safety goggles and protective gloves. The sensor can not be repaired by the operator and has to be sent back to Hamilton for inspection.

Necessary precautions should be taken when transporting the sensors. For repair or shipment the sensor should be sent back in the original reusable packaging box. Every pH/ORP 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.

3.2 Operation of pH/ORP Arc Sensor

When using the pH/ORP sensors 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 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 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 measurement system.

The integrated 4–20 mA analog output has been configured according to factory defaults. You can find full details, including serial number and most important specifications, on the certificate provided with each sensor. Before use, verify that the sensor is properly configured for your application.

> ⚠ **ATTENTION! To avoid drying out the diaphragm and a potential decrease in sensor performance, make sure the sensor is always stored with a cap containing Storage Solution (Ref 238931).**

3.3   Earthing

The sensor has to be mounted at the mounting location with an electrostatically conductive of < 1MOhm. It is recommended to assign the VP 8 cable shield to earth (PE potential equalization) especially in electromagnetically noisy environments. This significantly improves noise immunity and signal quality.

3.4   Electrical Safety Precautions

Do not connect the sensor to a power source of any voltage beyond the range stated in the power rating Technical Specifications (www.hamiltoncompany.com).

Always use Hamilton VP 8 cables for safe connection. Cables are available in a broad range of lengths (Chapter 10). Make sure the cable is intact and properly plugged to avoid any short circuit. Keep pH/ORP Arc sensor away from other equipment which emits electromagnetic radio frequency fields, and minimize static electricity in the immediate environment of the optical measuring

parts. Carefully follow all the instructions in chapter 5.3 to avoid electrical damage to the sensor. The contacts must be clean and dry before sensor is connected to the cable.

> ⚠ **ATTENTION! Switch off the power supply and unplug the connector before dismounting the pH/ORP Arc sensors.**

> ⚠ **ATTENTION! If the power supply (230VAC/24VDC) is switched off or disconnected the reading on the PCS is wrong.**

3.5   Chemical, Radioactive or Biological Hazard Precautions

Selection of the appropriate safety level and implementation of the required safety measures for working with pH/ORP Arc sensor 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 pH/ORP Arc sensor becomes contaminated with biohazardous, radioactive or chemical material, it should be cleaned. Failure to observe and carry out the maintenance procedures may impair the reliability and correct functioning of the measuring module.

4   Product Description

4.1   General Description

pH/ORP Arc sensors are critical measurement and control parameters for many liquid processes. Hamilton offers a wide selection of sensors for use in all bioprocesses, as well as many other industries that require high accuracy and reliability from their sensors. Hamilton is one of the few manufacturers to have multiple pH membrane glass options and reference designs to tailor the sensor for the specific application. With their micro transmitter, pH/ORP Arc sensors enable direct communication to the process control system via 4–20 mA standard signal or digital Modbus. 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 integrated Bluetooth 4.0, enabling in this way wireless data exchange with smartphones and tablets.

With the transmitter integrated, Arc sensors provide more reliable measurements directly to your process control system. The μ-transmitter located in the sensor head stores all relevant sensor data, including calibration and diagnostic information, simplifying calibration and maintenance. The integrated quality indicator predicts the remaining sensor and cap life time.

Key benefits include:

- Multiple pH membrane glass options for different application

- No separate transmitter needed

- Easy to install

- Direct digital Modbus or analog communication to the process control system via 4–20 mA standard signal.

- Full online wireless option via Bluetooth 4.0 for easy monitoring, configuration and calibration

4.2 Hardware Description

The pH/ORP sensor consists of a sensor head with integrated electronic and a sensor pH sensitive glass membrane in contact with the measured medium. The pH glass shaft is terminated by the sensitive glass membrane and diaphragm with the reference measurement system. During development, special attention was paid to an optimum sanitary design. All materials in contact with the solution meet the FDA requirement.

VP 8 Connector

Sensor Head with µ-transmitter

Process connection PG13,5

O-ring

Sensitive Glas Membrane
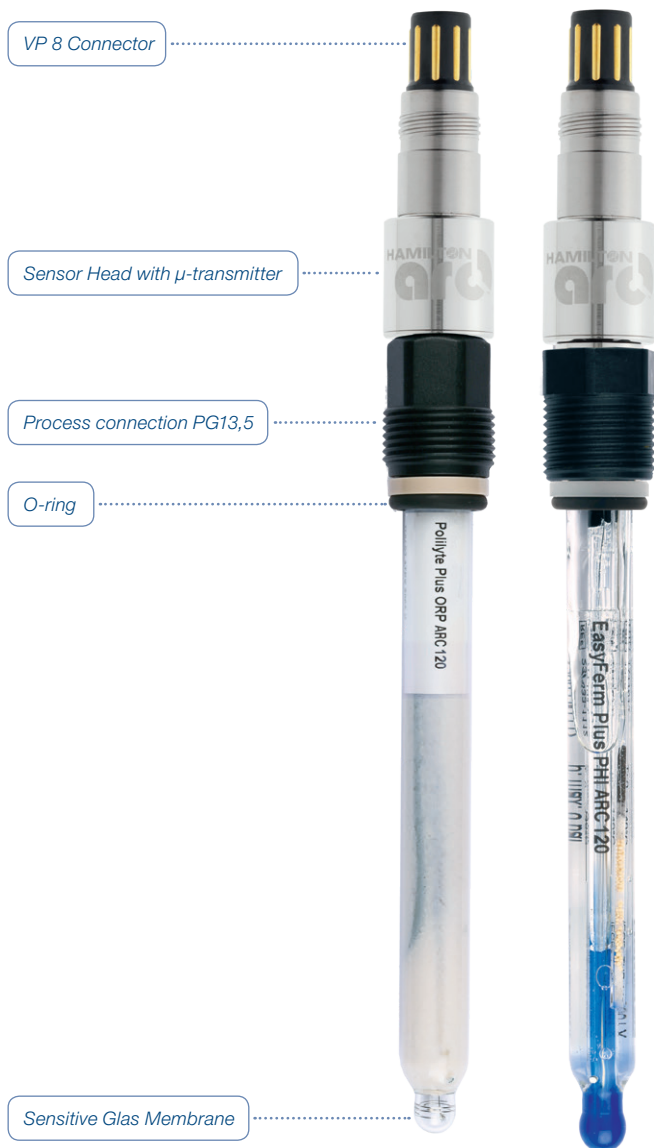
Figure 1: Sensor description

4.3 pH/ORP Arc Sensor with Micro-Transmitter inside

With the micro-transmitter integrated, pH/ORP Arc sensors offer fully compensated signal directly to the process control system. Communication protocols include standard analog 4–20 mA. The micro transmitter located in the sensor head stores all relevant sensor data, including calibration and diagnostic information, simplifying calibration and maintenance.

5 Installation

5.1 Unpacking

1) Unpack carefully the pH or ORP Arc sensor. Enclosed you will find the pH/ORPArc sensor, the Declaration of Quality, the Instruction Manual, and Material certifications.

2) Inspect the sensor for shipping damages or missing parts.

Figure 2: pH/ORP Arc sensor delivery package.

5.2 Configuring the pH/ORP Arc sensor with ArcAir

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

- Arc View Mobile or ArcAir computer Software Solution

- External Power supply with Arc USB Power Cable (Ref 243490-xx)

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	✔	–	–	–
Basic	✔	✔	✔	–
Advanced	✔	✔	✔	✔

Figure 3: Arc pH/ORP Sensor configuration with ArcAir.

5.2.1 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.
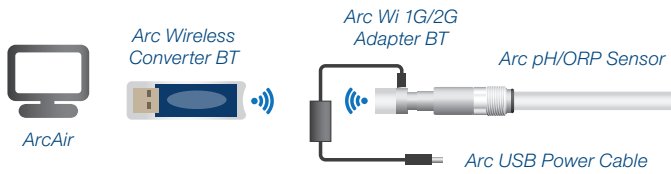
3) Do not plug in the Wireless Converter before the installation of ArcAir is completed.

4) Install «ArcAir» by double clicking «ArcAir.exe» and follow the instructions on the screen.

5.2.2 Connecting a pH /ORP Arc sensor to ArcAir

1) Connect a sensors with the power supply, e.g. Arc USB Power Cable Ref 243490-xx

2) Switch on the mobile's Bluetooth connection or connect a Wireless Converter BT to USB Port of your computer (only for wireless connection)

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 intelligent 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.**

5.2.3 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

> ⚠ **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.

5.2.4 Configuring the pH/ORP 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	Location
Meas. Unit	These are the measurement physical units	pH mV	Required	Settings/ Measurement
T unit	These are the temperature physical units	K °F °C	Required	Settings/ Measurement
*Moving average	The sensor uses a moving average over the measuring points	ORP/ Temp.: 2 R_{Glass}: 16	Recommended default parameter	Settings/ Values Measurement

In calibration mode the sensor will automatically switch to 3 sec sampling rate after the first calibration.

5.2.5 Configuring the calibration settings

Parameter Name	Description	Default Value	Configuration	Location
Drift pH/ORP	Higher drift will interrupt the calibration process. Warning comes up «drift pH/ORP»	1%/Min	Recommend default parameter	Calibration/ Calibration Settings
Drift T	Higher drift will interrupt the calibration process. Warning comes up «drift temperature»	0.5 K/min	Recommend default parameter	Calibration/ Calibration Settings

5.2.6 Configuring the temperature settings of SIP / CIP process

Parameter Name	Description	Default Value	Configuration	Location
SIP process definition	User defines conditions for the SIP counter	Temp. min: 120°C Temp. max. 130°C Time: 20 min	Recommend default parameter	Status / SIP / CIP
CIP process definition	User defines conditions for the CIP counter	Temp. min: 80°C Temp. max. 100°C Time: 20 min	Recommend default parameter	Status / SIP / CIP

5.2.7 Configuring the analog interface for your process control system

Parameter Name	Description	Default Value	Configuration	Location
Interface Mode	The output of the 4-20 mA can be configure linear, bilinear or with a fix value	4-20 mA linear	Recommended default parameter	Interface/Analog
Value at 4 mA	Defined measurement value for 4 mA output	1 µS/cm / 0 °C	Required	Interface/Analog Output
Value at 20 mA	Defined measurement value for 20 mA 20 mA output	10'001 µS/cm / 40°C	Required	Interface/Analog Output
Mode in event of warning	Current output mode in case of warnings	No output	Recommended default parameter	Interface/Analog Output
Mode in event of errors	Current output mode in case of errors	Continuous output	Recommended default parameter	Interface/Analog Output
Output in event of warning	Current output in case of warnings	3.5 mA	Recommended default parameter	Interface/Analog Output
Output in event of errors	Current output in case of errors	3.5 mA	Recommended default parameter	Interface/Analog Output
Output for T out of limit	Current output in case of temperature out of limit	3.5 mA	Recommended default parameter	Interface/Analog Output

5.2.8 Defining a measuring point name for identification of the process

Parameter Name	Description	Default Value	Configuration	Location
Measuring point	User can define a sensor name for better identification of the measuring point	243605-1234	Optional	Information / Info Userspace

5.3 Install pH/ORP Arc Sensor in Your Measuring Loop

5.3.1 Mechanical Process Connection

The mechanical design of the pH/ORP 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.

5.3.2 VP 8 Pin Designation

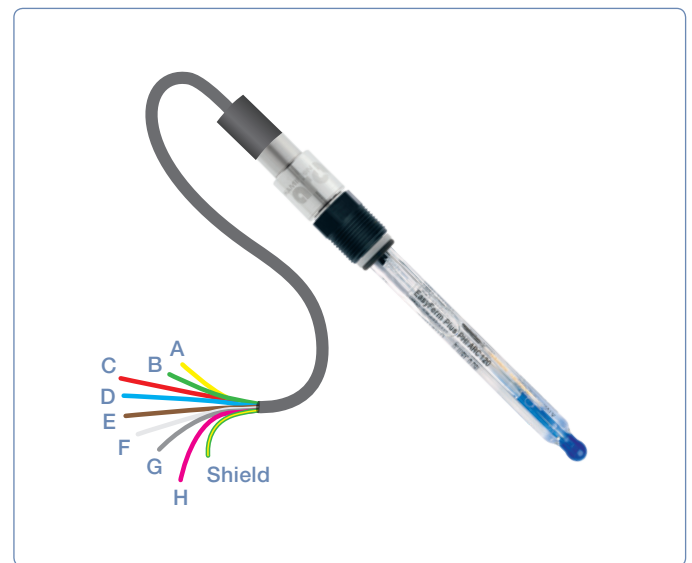Always use Hamilton Sensor Data Cable VP 8 for safe connection, which are available in different lengths (Chapter 10).

Figure 4: Pin description for electrical connection of pH/ORP Arc sensors

VP pin	Function	Color*
A	4-20 mA interface # 2	Yellow
B	4-20 mA interface # 1	Green
C	Power supply: + 24 VDC (7 to 30 VDC)	Red
D	Power supply: Ground	Blue
E	Not used	Brown
F	Not used	White
G	RS485 (A)	Gray
H	RS485 (B)	Pink
Shaft	Shield	Green/Yellow

Sensor Data Cable VP 8

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

Hamilton pH/ORP 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 5 and 6). 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 3.5 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.
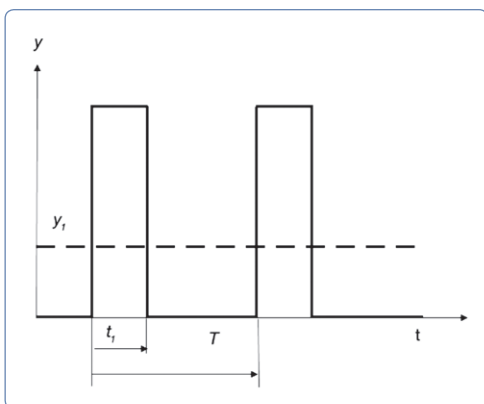

Figure 5: Progress of a rectangular signal with a period T and a pulse duration t_1 for the generation of an analog signal with the value y_1.
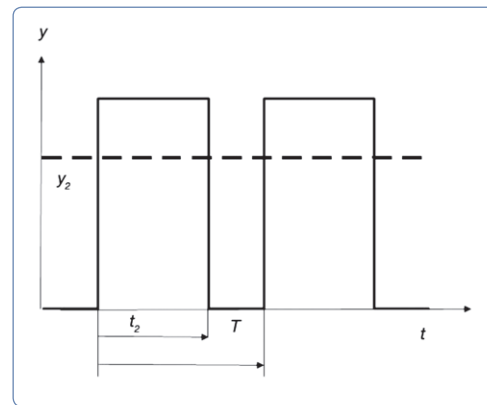
Figure 6: Progress of a rectangular signal with a period T and a pulse duration t_2 for the generation of an analog signal with the value y_2.

⚠ **ATTENTION! The pH/ORP Arc sensor generates the 4-20 mA signals by pulse width 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 10 illustrates a solution for the problem.**

Analog interface 1 and 2

Galvanically not isolated, pulse width modulation with 3.5 kHz, recommended PCS settings:

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

5.3.4 Electrical Connection for Analog 4–20 mA Connection

The 4–20 mA interface enables direct connection of the pH/ORP Arc sensor to a data recorder, indicator, control unit or PCS with analog I/O. The pH/ORP Arc sensor works as a current sink sensor and is passive. Connect the sensor according to the pin designations (Chapter 5.3.2). The 4–20 mA interface of the pH/ORP Arc sensor 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 5.2.7).

Examples of circuit arrangement

Figure 7: Three-wire loop wiring diagram for the 4–20 mA interface.

Figure 8: The safest form of wiring, using an external isolation amplifier.
(For detailed technical advice, please contact the technical support at Hamilton)

5.3.5 Electrical connection for the digital RS485 interface

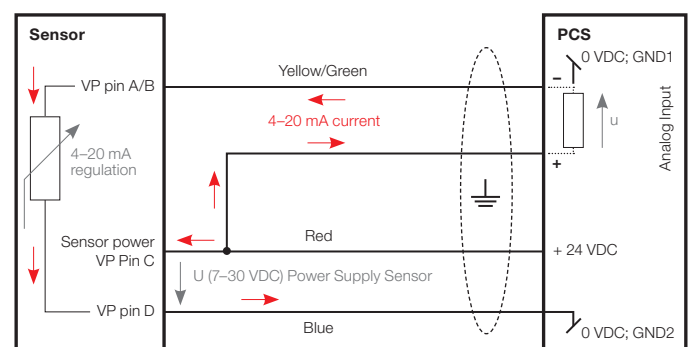The digital RS485 interface enables communication with pH/ORP Arc sensor for performing measurements, for calibrating and changing the configuration parameters. pH/ORP Arc sensors are always connected to digital controlling devices as a Modbus slave. To function, they require a power supply (VP 8 pins C and D, see below). The section in chapter 5.2 describes configuration in digital mode.

Additional information:

The Modbus RTU communication protocol corresponds to the Modbus-IDA standard (see www.modbus.org). pH/ORP Arc sensor uses 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 pH/ORP Arc sensor» chapter 5.2).**

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

VP pin	Function	Color
C	Power supply: + 24 VDC (7 to 30 VDC)	Red
D	Power supply: Ground	Blue
G	RS485 (A)	Gray
H	RS485 (B)	Pink
Shaft	Shield	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

Figure 9: Wiring diagram for the RS485 interface.

Figure 10: 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.

6   Operation

> ⚠ **ATTENTION! Only use the sensor within the speci-fications (see www.hamiltoncompany.com). Failure to do so may lead to damages or measurement failure.**

1) Remove the watering caps from the pH/ORP Arc tip, and yellow cap from the VP 8 sensor head

2) Check the O-ring on the sensor shaft and verify for shipping damages or missing parts.

3) Verify the functionality of the sensor (Chapter 7.1)

4) Calibrate the sensor (Chapter 7.2)

5) Connect the sensor to the process control system (Chapter 5.3)

6) Verify the measurement in standard solution and on your control system

7) Mount the sensor to the armature or process connection (Chapter 5.3)

> 🗐 NOTE: No analog reading is performed at a temperature higher than 110°C to protect the analog electronics and enhanced the sensor lifetime.

7   Maintenance

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

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

7.1   Verify Sensor Status

1) Power the sensor with the Sensor Power Cable and connect the sensor to ArcAir.

2) Control the traffic lights (Figure 11).

3) Refer to the troubleshooting (Chapter 8) for the next steps if the traffic light is not green.

4) Control the quality of the sensor in Sensor Status / Quality Counter and Temperature / Quality Indicator.

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

● At least an error or a warning has been registered. Verify the sensor errors and warnings in Sensor Status.

● No communication between the sensor and ArcAir. This may be due to a hardware failure.

Figure 11: Description of the traffic lights on ArcAir.

7.2   Calibration

The pH/ORP 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 (see chapter 5.2).

pH/ORP Arc sensors can be calibrated automatically with buffer solution defined in sensor configuration profile.

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

Six sets of the pH calibration standards are provided with each Arc pH sensor:

- Hamilton
- Merck Titrisol®
- DIN 19267
- NIST Standard
- METTLER TOLEDO
- Radiometer

The pH Arc sensors are pre-calibrated at the factory using two Hamilton standards: pH 4 (Calibration point 1), and pH 7 (Calibration point 2) at room temperature. The following buffers within Hamilton standards set are defined as factory default for calibration with automatic buffer recognition: pH 4.01, pH 7.00 and pH 10.01. The use of the same buffer to both calibration points will yield an error and reject this calibration.

> 🗐 NOTE: The concept behind Arc pH sensors enables calibration and configuration in the lab before use in the process control. Another calibration for the installation in the process setup is not required.

> 🗐 NOTE: ORP Arc sensors utilize a one-point calibration procedure with automatic standard recognition. The ORP values and temperature dependence data for a number of predefined redox buffers are stored in the sensor. Therefore the sensor recognizes a standard, examines the accuracy and stability of the ORP and temperature signals, and performs the calibration.

One set of Hamilton redox calibration standards is provided with each Arc ORP sensor:

- Hamilton
- METTLER TOLEDO
- Reagecon

7.2.1 One Point Calibration in pH or ORP Buffer Solution

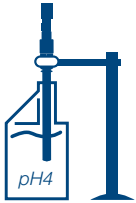1) Power the pH/ORP Arc sensor and connect to ArcAir via the Arc Wireless Converter BT or Arc USB Power Cable.

Figure 12: Calibration setup

2) Install the sensor into the buffer solution bottle and connected

3) Select the sensor in the sensor list.

4) Open the Calibration tab.

5) Select Calibration Point 1

6) Immerse the sensor into buffer solution (default pH 4.0 or 475mV) (Figure 19)

7) Click Start to start the calibration wizard.

8) Follow the instructions on the screen.

7.2.2 Two Point Calibration in pH Buffer Solution

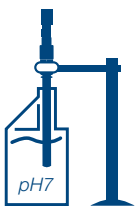1) Power the pH/ORP Arc sensor and connect to ArcAir via the Arc Wireless Converter BT or Arc USB Power Cable.

Figure 13: Calibration setup

2) Install the sensor into the buffer solution bottle and connected

3) Select the sensor in the sensor list.

4) Open the Calibration tab.

5) Select Calibration Point 1

6) Immerse the sensor into buffer solution (default pH 7.0) (Figure 20)

7) Click Start to start the calibration wizard.

8) Follow the instructions on the screen.

7.2.3 Product calibration

The product calibration is an in-process calibration procedure in order to adjust the measurement to specific process conditions, or in case the sensor cannot be removed for the standard calibration. Product calibration adapts the calibration point 2 to the process conditions in force at the time of product calibration. In order to restore the original calibration point 2, the product calibration can be deleted at any time. A new standard calibration deletes the product calibration as well.

> 🗒 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.
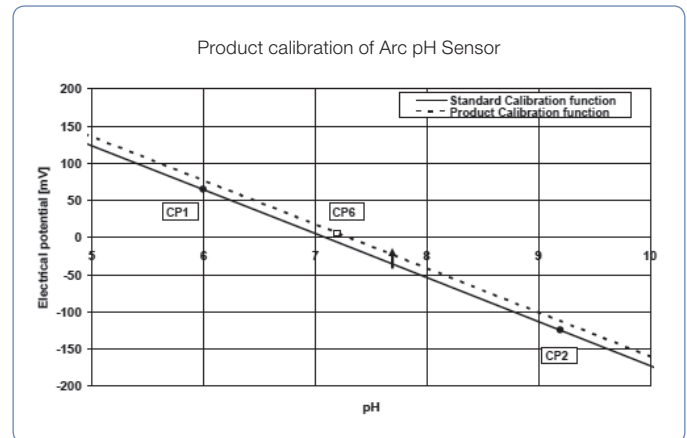

Figure 14: Effect of product calibration (CP6) on an existing standard calibration function based on the one point calibration (CP1).

A product calibration is performed as follows:

1) Connect one of the pH/ORP Arc sensor with the power supply, e.g. USB Power Cable Ref 243490-xx and install a Wireless Converter BT.

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 field device on side the measuring point.

7.3 Cleaning

In general, acids, alkalis and other common solvents can be used for brief periods to clean sensors. Rinse with water immediately afterwards. Sensors exhibit sluggish response times for some time after cleaning, so place them in storage solution for 15 min. before using them again.

Ceramic diaphragms: In the event of protein contamination, immerse the sensor's electrode for several hours in 0.4% HCl + 5 g/l pepsin or Hamilton's Cleaning Solution Set Ref 238290. If blackening of the diaphragm is noted (due to silver compounds), immerse the electrode in 0.4% HCl + 76 g/l thiourea.

⚠ **ATTENTION! Cleaning, assembly and mainte-nance should be performed by personnel trained in such work. Do not use any abrasive tissues or clean-ing materials and do not use any cleaning chemicals other then 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 recommend-ed to wear safety glasses and protective gloves.**

8 Troubleshooting

8.1 Sensor Self-Diagnostic

pH/ORP 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 warn-ing and error messages. The analog 4–20 mA interface can be configured according to the NAMUR recommendations to indi-cate an abnormal event (See Chapter 5.2.3). Use ArcAir for moni-toring the sensor status and for troubleshooting. The following types of messages are provided by the self-diagnosis function.

▯ NOTE: Errors cannot be ignored and corrective action is immediately necessary.

▯ NOTE: Warnings can be ignored but 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 operation instruction manual or the programmer`s manual.

8.1.1 Warnings

Warning	Cause / Solution
pH calibration recommended	Perform a calibration in order to ensure reliable measurement (Chapter 7.2)
pH last calibration not successful	Start a new calibration and ensure that always use new calibration solutions (Chapter 7.2)

8.1.2 Errors

Errors (failures)	Cause / Solution
pH reading failure	At least one error is active
Glass resistance too high	Make sure the pH glass membrane is not damaged. Perform a cleaning procedure (Chapter 7.3)
Glass resistance too low	Make sure the pH glass membrane has not a crack
Reference electrode resistance too high	Diaphragm is clogged, perform a cleaning procedure (Chapter 7.3)
Reference electrode resistance too low	Short circuit at the reference electrode, please contact our Technical Support.
Temperature sensor defective	Temp. sensor defective, please contact our Technical Support.
Sensor failure	Sensor quality value < 15% Perform new calibration
Internal communication error	No internal communication, please call our Technical Support

8.2 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.

8.3 Returning Arc sensors for Repair

Before returning a pH/ORP Arc sensor to Hamilton for repair, contact our Customer Service (see Chapter 8.2) and request a Returned Goods Authorization (RGA) number.

Do not return a pH/ORP Arc sensor to Hamilton without an RGA number. This number assures proper tracking of your sensor. pH/ORP 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. Pro-vide complete description of any hazardous materials that have been in contact with the sensor.

9   Disposal

The design of Hamilton sensors optimally considers environmental compatibility. In accordance with the EC guideline 2012/19/EU 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.

有害物質表，請參閱www.hamiltoncompany.com，章節過程分析，符合性聲明

10   Ordering Information

Parts below may only be replaced by original spare parts.

10.1   pH/ORP Arc Sensors

Ref	Description
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
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
243050	EasyFerm Plus ORP Arc 120
243051	EasyFerm Plus ORP Arc 225
243052	EasyFerm Plus ORP Arc 325
243053	EasyFerm Plus ORP Arc 425
242428-2313	Polilyte Plus HB Arc 120
242428-2323	Polilyte Plus HB Arc 225
242428-2333	Polilyte Plus HB Arc 325
242428-2353	Polilyte Plus HB Arc 425

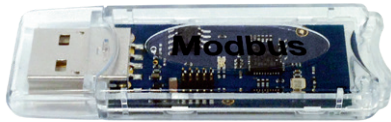| Ref	Description
242428-4313	Polilyte Plus PHI Arc 120
242428-4323	Polilyte Plus PHI Arc 225
242428-4333	Polilyte Plus PHI Arc 325
242428-4353	Polilyte Plus PHI Arc 425
242428-1313	Polilyte Plus H Arc 120
242428-1323	Polilyte Plus H Arc 225
242428-1333	Polilyte Plus H Arc 325
242428-1353	Polilyte Plus H Arc 425
242428-3313	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
243060	Polilyte Plus ORP Arc 120
243061	Polilyte Plus ORP Arc 225
243062	Polilyte Plus ORP Arc 325
243063	Polilyte Plus ORP Arc 425

10.2   Parts and Accessories
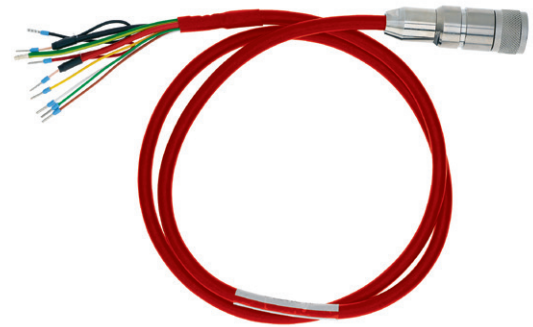
Ref	Product Name	Length	Interface
355263	Sensor Data Cable VP 8	1 m	4-20 mA/Modbus
355264	Sensor Data Cable VP 8	3 m	4-20 mA/Modbus
355265	Sensor Data Cable VP 8	5 m	4-20 mA/Modbus
355266	Sensor Data Cable VP 8	10 m	4-20 mA/Modbus
355267	Sensor Data Cable VP 8	15 m	4-20 mA/Modbus
355268	Sensor Data Cable VP 8	20 m	4-20 mA/Modbus

Description: The Sensor Data 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 PC software for monitoring, configuration, calibration and firmware updates.

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.
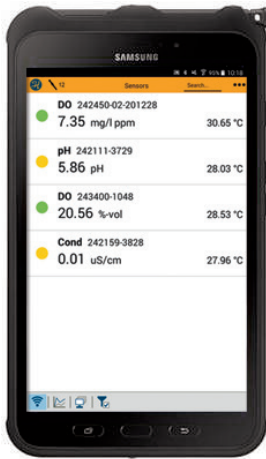

Ref	Product Name
243460	Arc Wi 1G Adapter BT

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).

Ref	Product Name
10071111	Arc View Mobile Basic

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 basic, app blocker application, power supply cable, instruction manual and Hamilton quick guide.

Ref	Product Name
100071113	Arc View Mobile Advanced

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 advanced application, including features for CFR 21 Part 11 and Eudralex Volume 4 Annex 11 compliance, app blocker application, power supply cable, instruction manual and Hamilton quick guide.

ArcAir Application

Download the ArcAir application from the AppStore and PlayStore.

AppStore >   PlayStore >

10.3   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

- Online service
- Technical support
- Initial Operation/Calibration
- Qualification (IQ/OQ)
- Service packages
- Maintenance
- Training

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To find a representative in your area, please visit www.hamiltoncompany.com.

This guide may be available in other languages.
Visit www.hamiltoncompany.com for more information.