HAMILTON®

Arc Module SU pH

Operating Instructions

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.

Table of Contents

1 General Information

1.1 Intended Use

The Arc Module SU pH is intended to be used with dedicated OneFerm pH sensors for the measurement of pH in Single-Use (SU) applications (see Chapter 9.2). This Module provides both a 4-20 mA and a digital Modbus signal, when connected to a OneFerm pH sensor. Additional equipement such as an amplifier or transmitter are not required.

The Arc Module SU pH is not gamma irradiable or steam sterilizeable.

1.2 About these Operating Instructions

This manual refers to the Arc Module SU pH for the OneFerm pH sensors from Hamilton Bonaduz AG.

⚠ **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 Arc Module SU pH or sensor. It must in particular be insured in this conjunction that malfunctions can occur on account of the inherently limited useful life of the Arc Module SU pH or sensor contingent upon their relevant applications. The user is responsible for the calibration and maintenance of the Arc Module SU pH or sensor. In the case of critical 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 module failure.

3 Safety Instructions

⚠ **ATTENTION! Read and follow the safety instructions carefully before installing and operating the Arc Module SU pH.**

3.1 General Precautions

For the safe and correct use of the Arc Module SU pH, 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 «Arc Module SU pH Operating Instructions».

Cleaning, assembly and maintenance should be performed by personnel trained in such work. When removing and cleaning the Arc Module SU pH, it is recommended to wear safety goggles and protective gloves.

The Arc Module SU pH cannot be repaired by the operator and has to be sent back to Hamilton for inspection.

Necessary precautions should be taken when transporting the Arc Module SU pH. For repair or shipment the Arc Module SU pH should be sent back in the original reusable packaging box. Every Arc Module SU pH sent back for repair must be decontaminated (see also Chapter 7.3).

If the conditions described in these Operating Instructions 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 the Arc Module SU pH

The Arc Module SU pH must be used for its Intended Use (Chapter 1.1), and in optimum safety and operational conditions. The specifications such as temperature or pressure defined in the Specification Sheet available at www.hamiltoncompany.com must not be exceeded under any circumstances. Potential hazards exist if the Arc Module SU pH is not operated correctly.

Strictly follow the instructions given to connect (Chapter 6.1) and disconnect (Chapter 6.3) the Arc Module SU pH from an OneFerm pH sensor. Do not apply any forces to the bag or the OneFerm pH sensor. Failure to do so may break the OneFerm pH sensor and/or damage the bag integrity.

⚠ **ATTENTION! Do not twist or turn the Arc Module SU pH to avoid damage or leakage.**

3.3 Earthing

It is recommended to assign the VP8 cable shield to ground or earth especially in electromagnetically noisy environments. This significantly improves noise immunity and signal quality. The VP8 thread is connected to the metallic housing of the Arc Module SU pH.

NOTE: Avoid earth loops (see figure 1), and damage of the sensor due to electrostatic discharge while mounting and dismounting of the sensor or the cable. Do not touch contacts of the connector.

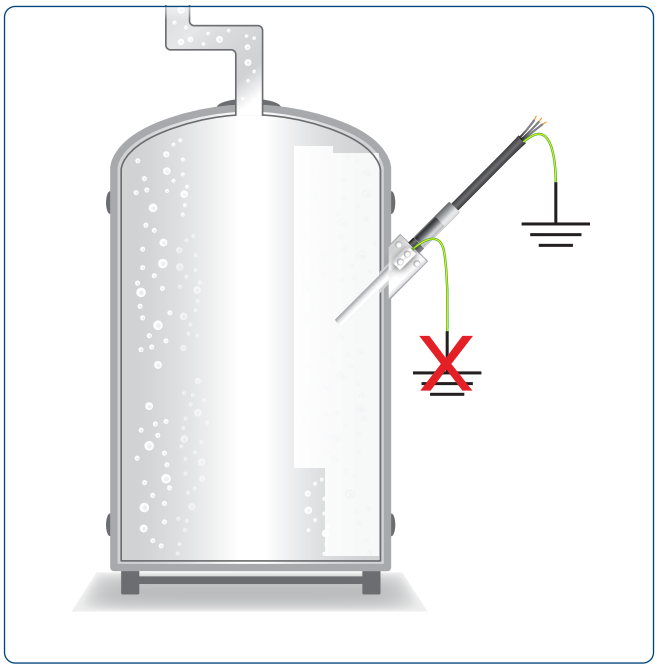


Figure 1: Single-use container with no earth connection: Connect cable shield to earth.

3.4 Electrical Safety Precautions

Do not connect the Arc Module SU pH to a power source of any voltage beyond the power rating stated in the Specification Sheet (www.hamiltoncompany.com).

Always use Hamilton VP cables for safe connection. Cables are available in a broad range of lengths (Chapter 9.3). Make sure the cable is intact and properly plugged in to avoid any short circuit.

Keep the Arc Module SU pH away from other equipment that emits an electromagnetic radiofrequency field, and minimize static electricity in the immediate environment of Arc Module SU pH and sensor. Carefully follow all the instructions in Chapter 5 to avoid electrical damage to the sensor. The contacts must be clean and dry before the sensor is connected to the cable.

⚠ ATTENTION! Switch off the power supply and unplug the connector before dismounting the Arc Module SU pH.

3.5 Chemical, Radioactive or Biological Hazard Precautions

Selection of the appropriate safety level and implementation of the required safety measures for working with the Arc Module SU pH 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 the Arc Module SU pH 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

Optimal yields in bio-processes are only obtained with the use of extensive process control systems, especially the precise monitoring of pH value. The glass pH electrode is the most robust and reliable device available for the measurement of pH.

The reusable Arc Module SU pH converts the weak electrochemical signal of the OneFerm pH sensor into a digital signal. The Arc Module SU pH stores all relevant sensor data, including calibration and diagnostic information, simplifying calibration and maintenance. It directly connects to the PCS without a transmitter and provides either 4-20 mA or digital Modbus communication.

The Arc Module SU pH used with the OneFerm pH sensor is compatible with all other components of the Hamilton Arc family, including a complete family of intelligent sensors (pH, ORP, dissolved oxygen and conductivity) and accessories. Reusable and single-use sensors can work on the same system. Additional wireless sensor diagnostics functionality is enabled by the ArcAir™ App running on mobile devices (e.g. Hamilton's Arc View Mobile) and computers.

Key benefits include:

- Electrochemical pH measurement with a stable measurement signal
- Reusable electronic, detachable from the sensor
- No separate transmitter needed
- Simple maintenance with robust industrial design
- Direct digital Modbus or analog communication to the PCS system via 4-20 mA standard signal

4.2 Hardware Description

Always check the Arc Module SU pH for defects after first unpacking. In the unlikely event of a damaged Arc Module SU pH, return it immediately in original packing to your Hamilton representative.

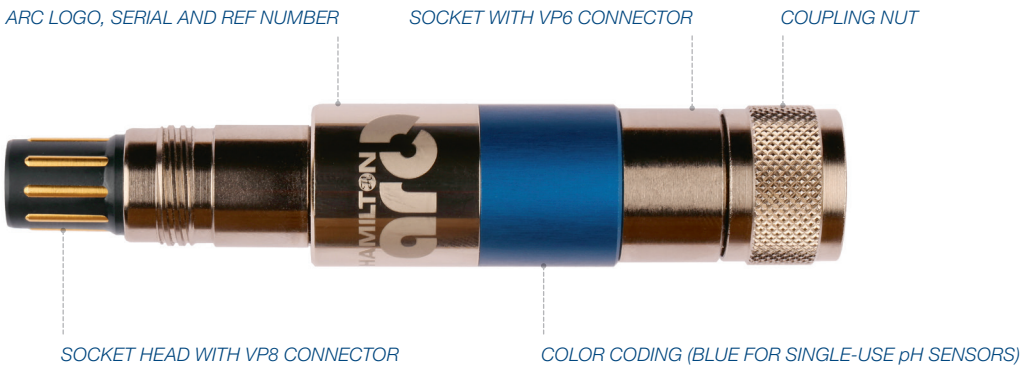


Figure 2: Arc Module SU pH

The Arc Module SU pH and OneFerm pH sensors are delivered directly from the factory, pre-configured. The integrated 4–20 mA analog interface and RS485 digital interface (Modbus RTU) are configured according to factory defaults. Full details, including serial number and the most important specifications can be found on the sensor tag provided with each sensor.

To be sure to avoid electrical damage to the sensor, carefully follow all the instructions in the section entitled «Electrical Connection.» Before using the sensor for measurement, monitoring or regulation, be sure to first check its configuration with an operational test.

5 Installation

5.1 Unpacking and Cleaning

1. Carefully unpack the Arc Module SU pH. Enclosed you will find the Arc Module SU pH and the Arc Module SU pH Quick Guide.
2. Inspect the Arc Module SU pH for shipping damages or missing parts.
3. To clean the Arc Module SU pH, soak a paper towel with Isopropanol 70% and wipe down the module. After cleaning the module, air dry the isopropanol prior to connecting with the sensor. Make sure that all contacts of module and sensor are completely dry to prevent electrical damage (short circuit).

NOTE: The Arc Module SU pH is not designed for gamma or steam sterilization.

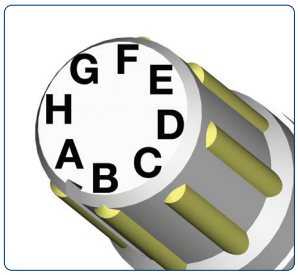
⚠ **ATTENTION! The Arc Module SU pH can measure and communicate over a digital RS485 interface up to a temperature of 60 °C. If the process temperature exceeds 50 °C, both 4-20 mA interfaces are set to 3.5 mA output. The analog measurements will continue when the temperature drops back below 50 °C.**

NOTE: The performance of the OneFerm pH sensor can change by damage of the electrodes in aggressive media, high temperature, or by contamination of the electrodes during the sensor's lifetime. The quality indicator of the Arc Module SU pH shows a deviation of the zero point when performing a product calibration. The quality indicator status is updated automatically after each product calibration.

5.2 Electrical Connection

The Arc Module SU pH is fitted with a VP8 socket head. The eight golden contacts are denoted as pin A to pin H. For easy identification of each pin, the head has a notch between pin A and pin B.

For the easiest and safest connection of Arc Module SU pH, always use Hamilton VP8 cables, available in a range of different lengths. To ensure the highest signal quality standard, a cable between the OneFerm pH sensor and the Arc Module SU pH is not recommended.



VP Pin	Function
A	4–20 mA interface (mA interface #2)
B	4–20 mA interface (mA interface #1)
C	Power supply: +24 VDC (7 to 30 VDC)
D	Power supply: Ground
G	RS485 (A)
H	RS485 (B)

Figure 3: Pin configuration of the Arc Module SU pH

5.3 Connection to PCS or Controller

5.3.1 Layout and Overview

The Arc Module SU pH can be connected to the PCS or controller by a wired connection (for reference numbers see also «Parts and Accessories»):

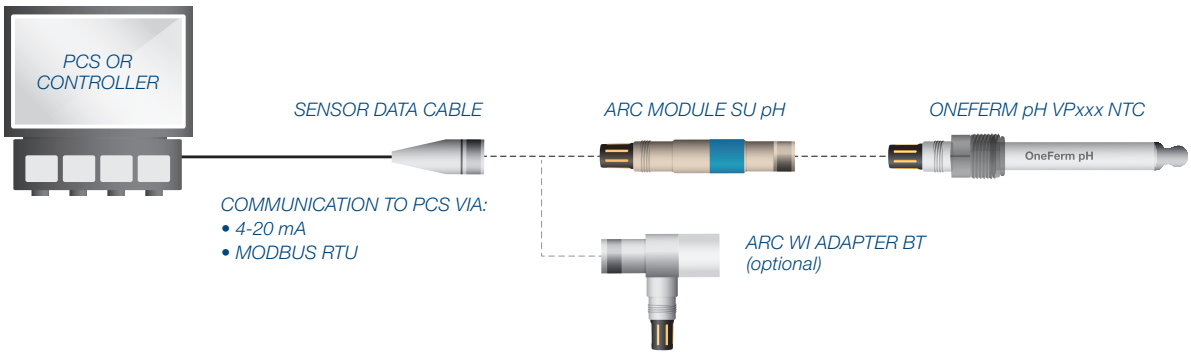


Figure 4: Layout wired connection to PCS or controller

The digital RS485 interface of the Arc Module SU pH can be accessed by operators when integrated by the OEM system supplier. The three-tier operator levels and factory default passwords are shown in the table below.

Operator Status	Operator Level	Password	Read	Calibrate	Configure
User	U	–	✓	–	–
Administrator	A	18111978	✓	✓	–
Specialist	S	16021966	✓	✓	✓

5.3.2 Electrical connection of the 4–20 mA current interfaces

The 4–20 mA interface enables direct connection of the Arc Module SU pH to a data recorder, indicator, control unit or PCS with analog I/O. Apart from the two wires used for 4–20 mA current loop no additional equipment is required for analog signalling. The Arc Module SU pH is delivered from the factory with the analog 4–20 mA interface set «active».

The 4–20 mA interface is configured at the factory with the range, value and measurement units as indicated on the certificate. Follow the instructions in the section entitled «Configuration and Monitoring of the Sensor» to adjust the sensor according to the requirements of your application.

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

Hamilton Arc Module SU pH 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 y_i corresponds to the average of the PWM signal (see Figures 5 and 6). The PWM-loads of the Arc Module SU pH 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 current 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 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's technical support.

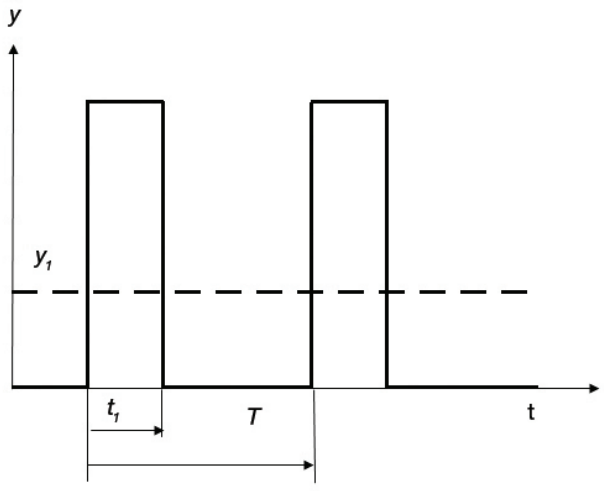


Figure 5: Progress of a rectangular signal with a period T and a pulse duration t1 for the generation of an analog signal with the value y_i.

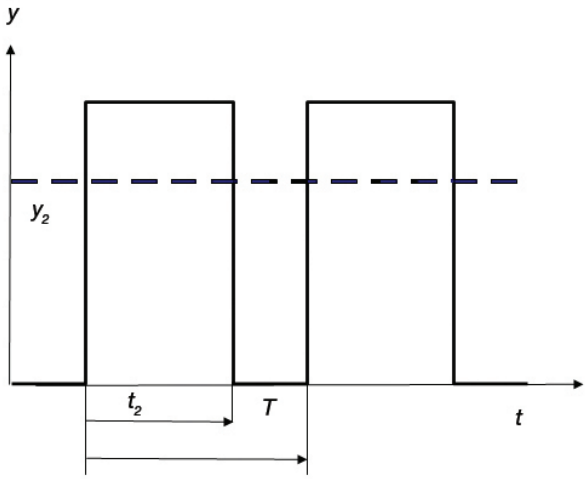


Figure 6: Progress of a rectangular signal with a period T and a pulse duration t2 for the generation of an analog signal with the value y_2.

⚠ ATTENTION! The Arc Module SU pH generates the 4–20 mA signals by pulse width modulation (PWM) which is not compatible with all PCS systems. A galvanic separation between the power supply and the PCS is necessary for correct sensor functionality when used in 4–20 mA setups.

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

Examples of a circuit arrangement

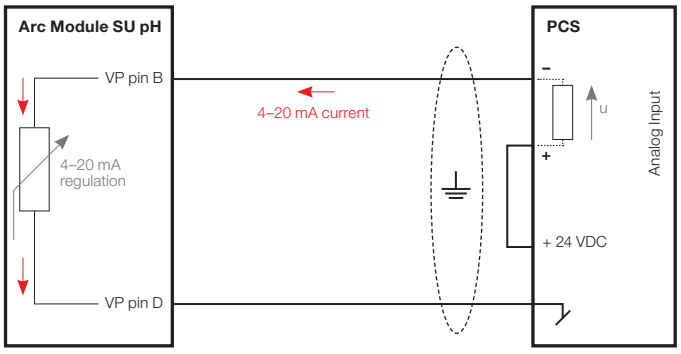


Figure 7: Two-wire loop wiring diagram for the 4–20 mA interface (mA interface #1). In this wiring scheme, power is not supplied to the sensor VP pin C, therefore the wiring is not applicable to a sensor with the Arc Wi Adapter BT.

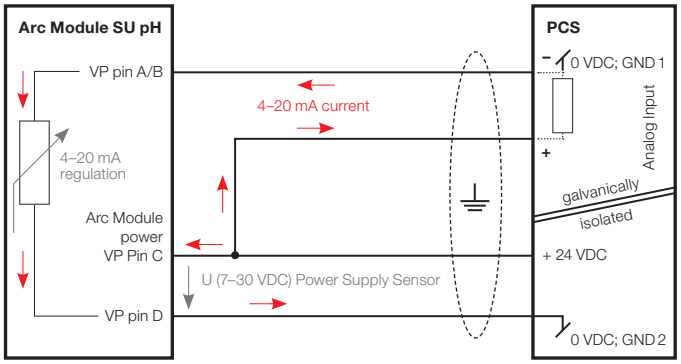


Figure 8: Three-wire loop wiring diagram for the 4–20 mA interfaces. The figure represents both 4–20 mA interfaces at pin A and pin B.

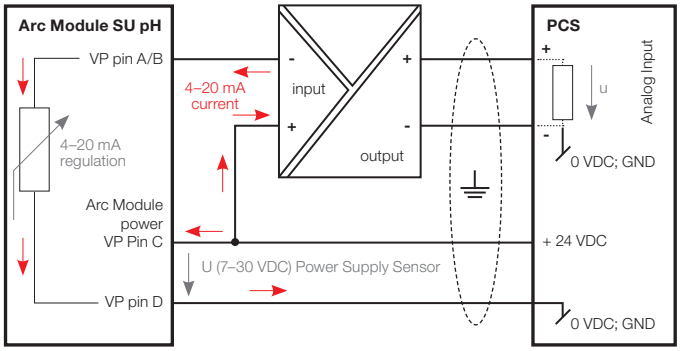


Figure 9: The safest form of wiring, using an isolation amplifier. The figure represents both 4–20 mA interfaces at pin A and pin B. For detailed technical advice, please contact Hamilton technical support.

5.3.3 Electrical connection for the digital RS485 interface

The digital RS485 interface enables communication with Arc Module SU pH for the OneFerm pH sensor to perform measurements, calibrate the sensor and change the sensor's configuration parameters. Arc Modules SU pH are always connected to digital controlling devices as a Modbus slave. To function, they require a power supply using VP8 pins C and D. See Figure 10 below. The section entitled «Configuration and Monitoring of the Sensor» describes the operation in digital mode.

By using the correct access password the system operator can adapt the Arc Module SU pH to many tasks by:

- Selecting the 4–20 mA interface
- Scaling (configuring) the 4–20 mA interface
- Selecting the measured parameter:
  - pH: mV, pH
  - Temperature T: °C; K; °F

In addition, operators can read sensor information from the RS485 interface such as:

- The sensor's serial number (SN), reference number (Ref) and manufacturing number (Lot)
- The Arc Module SU pH firmware version
- The Arc Module SU pH status (e.g., operation hours, warnings and errors)

Additional information:

The Modbus RTU communication protocol corresponds to the Modbus-IDA standard (see www.modbus.org). Arc Module SU pH for OneFerm pH sensors use an open register set developed by Hamilton. Additional information about the Modbus RTU communication protocol can be found in the «Arc Module SU pH Programmers Manual» at www.hamiltoncompany.com.

⚠ ATTENTION! Because all Arc Module SU pH are delivered with factory-default settings, each sensor must be configured for its specific application before first use (See the section entitled «Configuration of the Arc Module SU pH» for more information).

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

Examples of the circuit arrangement

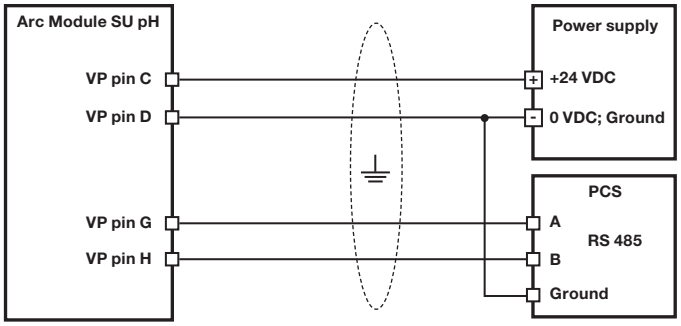


Figure 10: Wiring diagram for the RS485 interface.

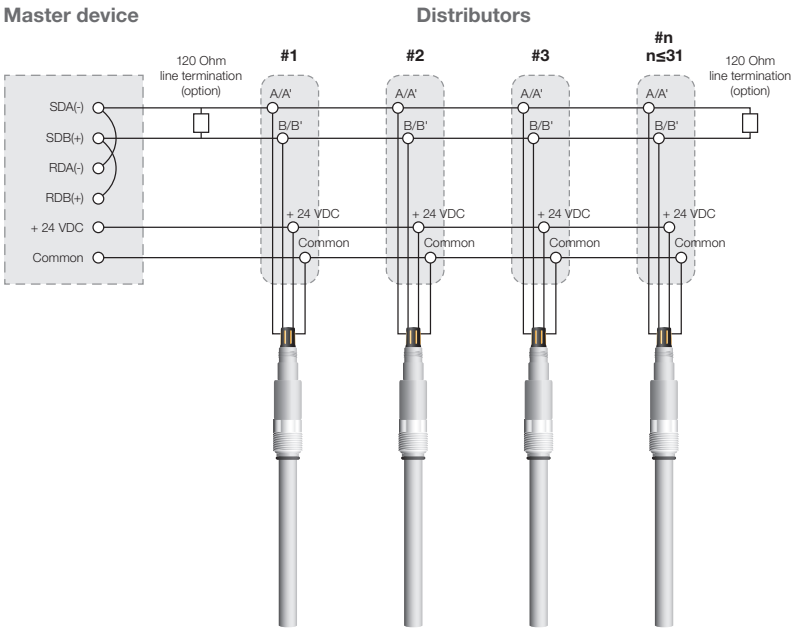


Figure 11: Multi-drop bus wiring for the Modbus two-wire mode. Each sensor functions as a Modbus slave.

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.

5.4 Connection to PC or Mobile

5.4.1 Layout and Overview

The Hamilton Arc View Mobile (Ref 10071111 / Ref 10071113) represents an ideal solution for Arc sensor management. This includes an automated calibration by scanning the QR-code of the OneFerm pH sensor tag. The Arc View Mobile included in the package is a compact mobile wireless device with long battery

lifetime and broad functionality. When using with a mobile device, each Arc Module SU pH requires an Arc Wi Adapter BT (Ref 243460 or 243470) and an Arc USB Power Cable (Ref 243490-01 or -02) for external power supply. The Arc View Mobile is based on the Samsung Galaxy Tab Active tablet and comes pre-configured with ArcAir™ App, app blocker application, power supply cable, instruction manual and Hamilton quick guide.

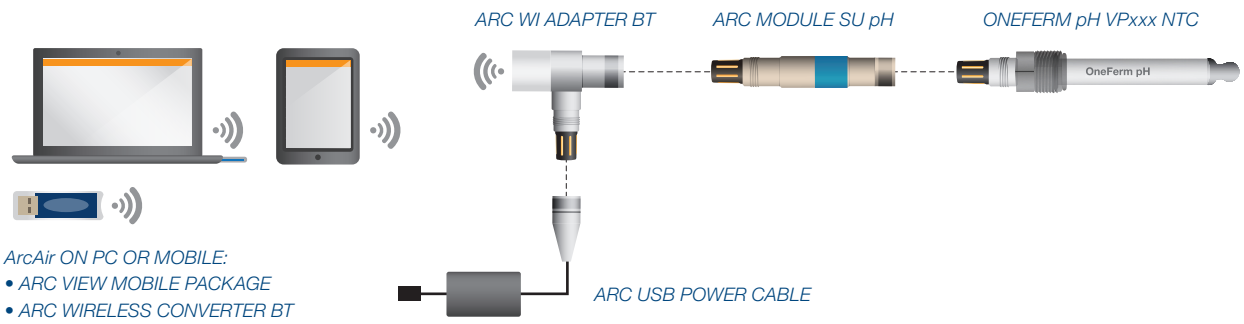


Figure 12: Layout for wireless connection

A wired connection to the PC is possible using the USB port. For connection to the PC, an Arc USB Power Cable (Ref 243490-01) is needed.

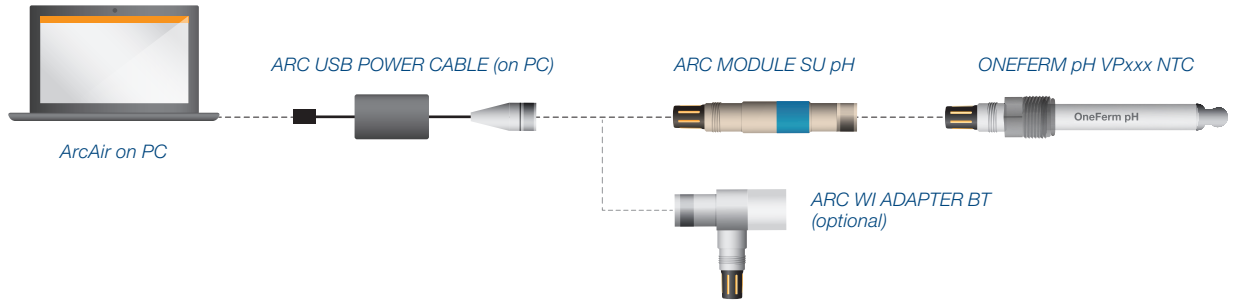


Figure 13: Layout wired connection to PC or notebook

5.4.2 ArcAir™ App

The ArcAir™ App can be used to display measurement values, for configuration and calibration or to generate GMP reports for calibration, verification, communication and configuration. It can be downloaded from App Store, Google Play or for PC on www.hamiltoncompany.com.

1. Download the Zip file «ArcAir» from 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.

To upgrade your PC version from Basic to Advanced version, you must connect your PC using the Arc Wireless Converter BT with your mobile device. For this purpose, the mobile device must run on the correct ArcAir version (Advanced) to activate the upgrade on your PC (for more details, see also «ArcAir™ App – Operating Instructions» on www.hamiltoncompany.com).

ArcAir Basic user can use ArcAir Lite functionality and in addition:

- Execute initial calibration including calibration report (see Chapter 6.2)
- Product calibration (follow the wizard of the ArcAir™ App)
- Configure the Arc Module SU pH and sensor setting including configuration report

ArcAir Advanced user can use ArcAir Basic functionality and in addition can create:

- Audit trail,
- User management
- CFR Part 11 Digital signature

The Arc Module SU pH require application specific configuration. To configure and set up the Arc Module SU pH at least ArcAir Basic is required. In the table below you will find the different ArcAir licenses and their functionality:

ArcAir Version	Read	Calibrate	Configure	Documentation
Basic	✓	✓	✓	–
Advanced	✓	✓	✓	✓

NOTE: For more detail information and configuration see Hamilton Arc System Operating Instructions.

5.4.3 Connecting Arc Module SU pH Sensor to ArcAir

1. Connect the Arc Module SU pH with the power supply, e.g. Arc USB Power Cable or connect the optional Arc Wi Adapter BT
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.

5.4.4 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 (see also ArcAir™ Operating Instructions) as long as no user account is created. Laboratory mode does not require a login password and enables all features in the installed license version.

5.4.5 Configuring the Arc Module SU pH 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 Setting	Range	Configuration	Location
Measurement Unit	These are the measurement physical units	pH	pH mV	Required	Measurement Settings
Temperature unit	These are the temperature physical units	°C	°C K	Required	Measurement Settings
Moving average	The sensor uses a moving average 1-16 over the measuring points	2	1 to 16	Recommended default parameter	Measurement Settings
Moving average Resistance	The sensor uses a moving average 1-16 over the measuring points	4	1 to 16	Recommended default parameter	Measurement Settings

5.4.6 Configuring the Analog Interface for Your Process Control System

Parameter Name	Description	Default Setting	Range	Configuration	Location
Interface Mode	The output of the 4-20 mA can be configured linear, bilinear or with a fix value	4 to 20 mA linear	Off 4 to 20 mA fixed / linear / bilinear	Recommended default parameter	mA Interface
Assigned Measurment Channel	Defined measurement for this mA Interface	pH*	pH Temperature	Recommended default parameter	mA Interface
Value at 4mA	Defined measurement value for 4 mA output	3	not empty	Must (application dependent)	mA Interface
Value at 20mA	Defined measurement value for 20 mA output	10	not empty	Must (application dependent)	mA Interface
Warning Mode	Current output mode in case of warnings	No output	Off Continuous Warning	Recommended default parameter	mA Interface
Error Mode	Current output mode in case of errors	Continuous output	Off Continuous Error	Recommended default parameter	mA Interface
Warning Value	Current output mode in case of warnings	3.5 mA	not empty	Recommended default parameter	mA Interface
Error Value	Current output mode in case of errors	3.5 mA	not empty	Recommended default parameter	mA Interface
Temperature out of range value	Current output mode in case of temperature out of limit	3.5 mA	not empty	Recommended default parameter	mA Interface

5.4.7 Defining a Measuring Point Name for Identification of the Process

Parameter Name	Description	Default Setting	Range	Configuration	Location
Measuring point	User can define a sensor name for better identification of the measuring point	243233-1234	not empty	Recommended default parameter	Info / Measurement Point or Settings / Measurement Settings

**for mA Interface Nr. 1; Temperature for mA Interface Nr. 2*

6 Operation

NOTE: This operation description refers to ArcAir™ App. For operation with PCS refer to operating instructions from the OEM system supplier.

⚠ ATTENTION! Only use the Arc Module SU pH according to the «Specification Sheet» on www.hamiltoncompany.com. Failure to do so may lead to damages or measurement failure.

6.1 Connecting the Arc Module SU pH to a OneFerm pH sensor

⚠ ATTENTION! Do not screw in the OneFerm pH sensor while connecting the Arc Module SU pH to avoid any leakage.

Prepare the sensor for measurement as follows:

1. Carefully remove the protective caps from the VP head.
2. Connect the Arc Module SU pH to the OneFerm pH sensor (Hold the Arc Module SU pH housing and screw in the coupling nut)
3. Make sure that the Arc Module SU pH is configured as required. If in doubt, test as described in Chapter 5.3 «Connection to PCS or Controller»
4. Connect the Arc Module SU pH to the OneFerm pH sensor according to the section «Electrical Connection» in the desired configuration (analog 4–20 mA interface, digital RS485 interface or both).

The signal stabilizes itself within a few minutes. The Arc Module SU pH is programmed with default calibration values. To achieve the best accuracy, execute calibration of the sensor (Chapter 6.2).

6.2 Calibration

The OneFerm pH sensor has been pre-calibrated at pH 4 and pH 7 at 25 °C; hence calibration prior to the process is not necessary. The calibration values for zero point and slope can be found on the label attached to the sensor head.

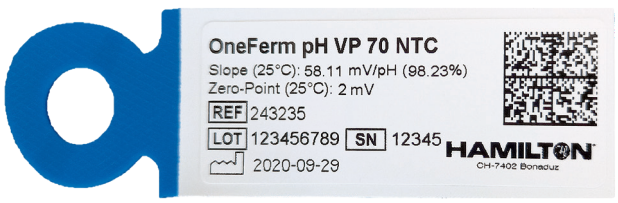


Figure 14: Example of sensor label with calibration data.

1. Read the zero point (mV) and slope (mV/pH) written on the sensor label (see figure 14).
2. Enter the calibration and sensor data into the Arc Module SU pH:

   Calibration data (mandatory):
   - Zero-Point
   - Slope

   Sensor data (enter data for traceability):
   - Ref-number
   - Name
   - Lot-number
   - Lot date
   - SN-number
   - Sensor ID
   - a-length

   Push the save button to save the data.
3. If required, perform a product calibration step to increase accuracy to ± 0.1 pH (valid within 2 pH units from the product calibration point and at measurement temperature).
4. Save the data to the Arc Module SU pH.

NOTE: The Arc View Mobile supports automatic calibration for pre-defined calibration values by scanning the QR-code. Use ArcAir software on a tablet or PC to perform manual input of the calibration data.

The concept behind Hamilton single-use Arc System enables calibration based on the pre-calibrated values. Additional 2-point calibration for the installation in the process setup is not required.

Product calibration

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 «Discard Existing Product Calibration». A new standard calibration deletes a product calibration as well.

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

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

NOTE: The difference between initial measurement and laboratory values for pH sensors cannot be greater than two pH units.

Product calibration with deviation greater then 0,8 pH units will result in an error due to low quality indicator (<30%). Product calibration with a deviation greater then 0,25 pH units will result in an reduced quality indicator (<100%).

6.3 Disconnecting the Arc Module SU pH from an OneFerm pH Sensor

⚠ ATTENTION! Do not unscrew the OneFerm pH sensor while disconnecting the Arc Module SU pH to avoid any leakage.

1. Hold the Arc Module SU pH housing
2. Unscrew the coupling nut
3. Remove the Arc Module SU pH from the OneFerm pH sensor

7 Troubleshooting

7.1 Arc Module SU pH and OneFerm pH Sensor Self-Diagnostics

7.1.1 Verify Status of Arc Module SU pH and OneFerm pH Sensor

The Arc Module SU pH and OneFerm pH sensor provides a self-diagnosis functionality to detect and identify the most common sensor malfunctions. The communication interfaces can be used for warning and error messages. The analog 4-20 mA interface can be configured according to the NAMUR recommendations to indicate an abnormal event. Use the ArcAir™ App for monitoring the sensor status and for troubleshooting. The following types of messages are provided by the self-diagnosis function.

Indicator status	What does it mean?
The Status symbol on the ArcAir™ App respectively LED on Arc Wi Adapter BT are green.	The connectivity to the sensor is OK. The sensor is operating correctly and no warnings or errors have been registered.
The Status symbol on the ArcAir™ App respectively LED on Arc Wi Adapter BT are yellow.	The connection to the sensor is OK. However, the sensor indicates a warning. Verify the sensor warnings in «Info > Status».
The Status symbol on the ArcAir™ App respectively LED on Arc Wi Adapter BT are red.	The connection to the sensor is OK. However, the sensor indicates an error. Verify the sensor error in «Info > Status».
The Status symbol on the ArcAir™ App is grey respectively LED on Arc Wi Adapter BT for a sensor is flashing red.	The ArcAir™ App lost connection to the sensor due to one of the following reasons: • The wireless signal strength is low (ArcAir indicator grey; LED on Arc Wi Adapter BT can be green/yellow/red) • The Arc Wi Adapter BT has been removed from the sensor. • The Arc Module SU pH or Arc Wi Adapter BT electronic is defective.

7.1.2 Warnings

Warnings	Cause	Solution
pH reading below lower limit	pH-reading too low (pH < 3)	Apply calibration data (Chapter 6.2)
pH reading above upper limit	pH-reading too high (pH > 10)	Apply calibration data (Chapter 6.2)
Verify / set calibration data	Arc Module SU pH was disconnected from power supply or from the OneFerm pH sensor	Apply calibration data (Chapter 6.2)

7.1.3 Errors

Errors (failures)	Cause	Solution
pH reading failure	The OneFerm pH sensor is not properly immersed in solution (media/buffer) or is broken	Immerse the tip of the probe in solution (media/buffer). Replace the OneFerm pH NTC.
Glass resistance too high	The OneFerm pH sensor is not properly immersed in solution (media/buffer) or is broken	Immerse the tip of the probe in solution (media/buffer). Replace the OneFerm pH NTC.
Glass resistance too low	The reference system of the OneFerm pH sensor is broken	Replace the OneFerm pH NTC
Temperature out of measurement range	The measured temperature is outside the defined measurement temperature range (4-50 °C)	If the process temperature is outside this range, the OneFerm pH NTC sensor will not perform pH readings
Temperature out of operating range	The measured temperature is outside the defined operating temperature range (0-60 °C)	The OneFerm pH NTC sensor can be damaged
Sensor missing	No sensor connected to the Arc Module SU pH	Connect OneFerm pH NTC sensor
Sensor not matching	Wrong sensor connected to the Arc Module SU pH	Connect OneFerm pH NTC sensor
Temperature sensor	The temperature sensor in the OneFerm pH sensor is broken	Replace the OneFerm pH NTC sensor
Sensor quality low	Quality indicator too low	Apply calibration data or repeat product calibration (Chapter 6.2)
Internal communication failure	Hardware defect of Arc Module SU pH	Replace Arc Module SU pH

7.2 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 Manual.

7.3 Returning Arc Module SU pH for Repair

Before returning an Arc Module SU pH to Hamilton for repair, contact our Customer Service and request a Returned Material Authorization (RMA) number.

Do not return an Arc Module SU pH to Hamilton without a RMA number. This number assures proper tracking of your sensor. Arc Modules SU pH that are returned without an RMA number will be sent back to the customer without being repaired.

Decontaminate the Arc Module SU pH and remove health hazards, such as radiation, hazardous chemicals, infectious agents, etc. Provide the complete description of any hazardous materials that have been in contact with the sensor.

8 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

9 Ordering Information

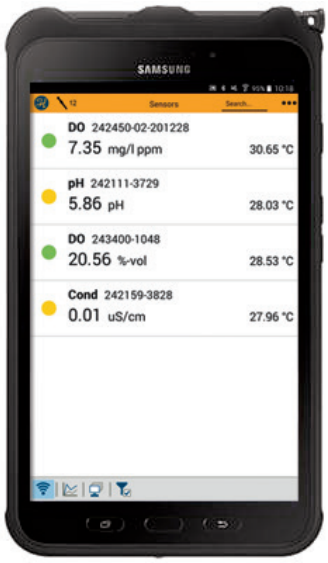
9.1 Arc Module SU pH

Ref	Description
243233	Arc Module SU pH

9.2 OneFerm pH Sensors for the Arc Module SU pH

Ref	Description	Length
243235	OneFerm pH VP70 NTC	70
243236	OneFerm pH VP120 NTC	120

9.3 Parts and Accessories



Ref	Product Name
10071111	Arc View Mobile Basic for none Ex environment

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.

10071113	Arc View Mobile Advanced for none Ex environment

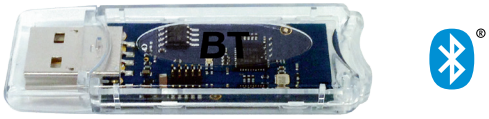
Description: The pre-configured Arc View Mobile, Hamilton`s mobile solution for monitoring measurement values, calibrating Arc sensors and configuring various parameters with the unified user interface for pH, DO, Conductivity and ORP. The Arc View Mobile is based on the Samsung Galaxy Tab Active tablet 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.

Ref	Description
243490-01	Arc USB Power Cable with VP8 connector (for the Arc Wi 1G Adapter BT)
243490-02	Arc USB Power Cable with M12 8-pole connector (for the Arc Wi 2G Adapter BT)

Description: The Arc USB Power Cable provides power supply via USB port for Arc sensors and digital communication.

Ref	Description
243460	Arc Wi 1G Adapter BT
243470	Arc Wi 2G Adapter BT

Description: Designed to add Bluetooth communication to the Arc Module SU pH when connecting directly to the PLC via modbus. The Arc Wi 2G Adapter BT also simplifies analog connection (4-20 mA) to the PLC.



Ref	Description
242333	Arc Wireless Converter BT Advanced

Description: Designed for wireless communication between ArcAir and Arc Wi Adapter BT.

Ref	Description	Ref	Description
355263	Sensor Data Cable VP8, 1m	355266	Sensor Data Cable VP8, 10m
355264	Sensor Data Cable VP8, 3m	355267	Sensor Data Cable VP8, 15m
355265	Sensor Data Cable VP8, 5m	355268	Sensor Data Cable VP8, 20m

Ref	Description	Ref	Description
10070910	Data Cable VP8 / M12, 1m	10067844	Data Cable VP8 / M12, 5m
10071905	Data Cable VP8 / M12, 3m	10067846	Data Cable VP8 / M12, 10m

9.4 Services

Hamilton service engineers 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 OEM customers. Experienced service engineers ensure an optimal and professional service.

In order to find your local service support please visit: www.hamiltoncompany.com/process-analytics/support

Overview of service offers

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

NOTES

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