Conducell UPW Arc Sensors

Operating Instructions

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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

This manual refers to the Conducell UPW Arc sensor from Hamilton Bonaduz AG. These sensors are compatible with all other components of the Hamilton Arc System, including a complete family of intelligent sensors for pH, dissolved oxygen and conductivity measurements in a process control.

Hamilton Arc sensors are quality products manufactured according to the very latest research findings. Follow the instructions given here to be sure of optimal safety and durability.

⚠ **ATTENTION! These instructions must be read, understood and followed by all staff using Conducell UPW Arc sensors. Hamilton can assume no responsibility for damage and operational disruption arising from failure to observe these instructions.**

1.1 Intended Use

Conducell UPW Arc sensors were developed for the measurement of conductivity in pure and ultrapure water.

Other applications and uses are not recommended. Hamilton will not take liability if damage to persons or equipment arises by improper use. For more details about liability, please refer to the section entitled «Liability».

Conducell UPW Arc sensors provide both standard analog (4 – 20 mA) and digital Modbus interfaces. These are built into each sensor and are supported directly from the sensor. They do not require any additional equipment such as amplifier or transmitter.

The Conducell UPW Arc sensor consists of a conductivity cell part with a VP 11 head and an Arc Module with a VP 8 head. Conductivity cell and Arc Module will be shipped as one unit with identical serial numbers. Hereafter the unit will be called sensor.

Additionally, for warnings and alarms according to USP <645>, two digital outputs are integrated into the sensor.

⚠ **ATTENTION! The Conducell UPW 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! Conducell UPW Arc is not intended for hazardous atmospheres.**

⚠ **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 Conducell UPW Arc sensors. To achieve this, it describes the features of Conducell UPW Arc and its integration in Process Control Systems (PCS). Both the hardware and the communication between the Conducell UPW Arc sensor and Process Control Systems are detailed in this manual. After reading this manual the user should be capable of installing and operating Conducell UPW 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, maintenance 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.

3 Safety Precautions and Hazards

> ⚠ **ATTENTION! Read the following safety instructions carefully before installing and operating the Conducell UPW Arc sensor.**

3.1 General Precautions

For safe and correct use of Conducell UPW 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 Conducell UPW 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 Conducell UPW Arc sensor highly depends on the specific conditions of the application. Temperature, pressure, chemicals used may accelerate the ageing of the 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 that 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 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 Operating of Conducell UPW Arc Sensor

Conducell UPW Arc sensors must be used for their intended applications and in optimum safety and operational conditions. The specifications (such as temperature or pressure) defined in the section entitled 'Technical Specification' must not be exceeded under any circumstances. Potential hazards can exist if the sensor is not operated correctly or appropriately.

Assembly and maintenance must be performed only by trained personnel.

Make sure that the PG13,5 thread and the O-ring are not damaged when screwing the sensor into the process (PG 13,5 version only). 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 can leak out undetected.

Before removing the sensor from its measurement setup, always make sure that no process medium can be accidentally spilled. The built-in temperature sensor can only be used for monitoring the sensor conditions, not for controlling the process temperature.

⚠ **ATTENTION! When unscrewing the PG13,5 thread connection never turn the sensor at the connector head.**

3.3 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 (see www.hamiltoncompany.com).

Always use Hamilton VP 8 cables for safe connection. Cables are available in a broad range of lengths (Chapter 11). Make sure the cable is intact and properly plugged to avoid any short circuit.

Keep the Conducell UPW Arc sensor 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 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 un-plug the connector before dismounting the Conducell UPW Arc sensor.**

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

3.4 Earthing

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

3.5 Chemical, Radioactive or Biological Hazard Precautions

Selection of the appropriate safety level and implementation of the required safety measures for working with Conducell UPW 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 Conducell UPW Arc sensor becomes contaminated with biohazardous, radioactive or chemical mate-rial, it should be cleaned. Failure to observe and carry out the maintenance procedures may impair the reliability and correct function of the measuring module.

4   Product Description

Conducell UPW Arc sensors provide both standard analog (4 – 20 mA) and digital Modbus interfaces. These are built into each sensor and are supported directly from the sensor. They do not require any additional equipment such as amplifier or transmit-ter. The Conducell UPW Arc sensor consists of a conductivity cell part with a VP 11 head and an Arc Module with a VP 8 head. Conductivity cell and Arc Module will be shipped as one unit with identical serial numbers. Hereafter the unit will be called sensor.

The sensor can monitor the water quality according to USP <645> criteria. Additionally, for warnings and alarms according to USP <645>, two digital outputs are integrated into the sensor. For details, see the chapter «Interface for the signals according to USP <645>.» Full details, including serial number and most

important specifications, can be found on the certificate provided with each sensor. A temperature compensation in the range between 0 and 10% per K is possible and can be set manually.

The Conducell UPW sensor has been carefully tested and is ready for use.

4.1 Hardware Description

The Conducell UPW Arc sensor consists of a sensor head with integrated electronic and a sensor tip in contact with the measured medium. All materials in contact with the solution meet the FDA requirement.
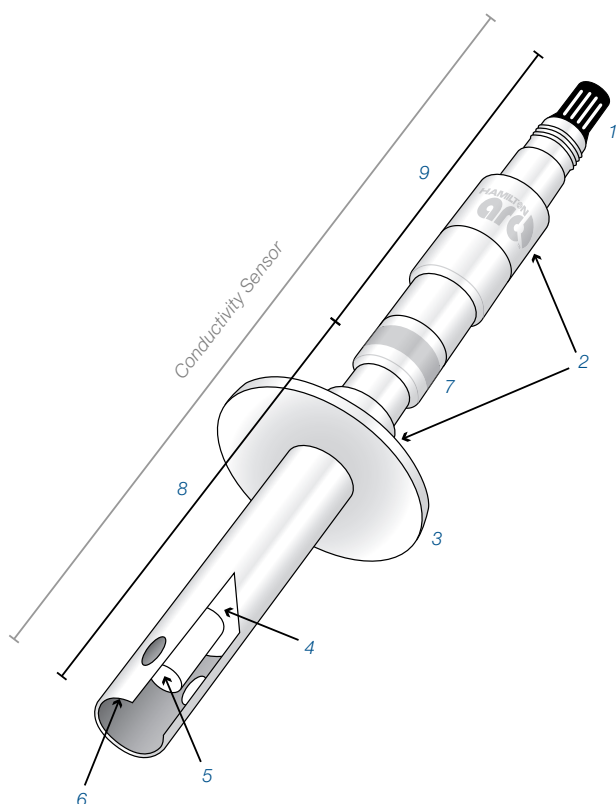
Figure 1: Components of Conducell UPW Arc exemplarily shown with a TriClamp process connection.

1   Socket head with VP 8 connector

2   Arc logo, serial and reference number

3   TriClamp 1.5"

4   Insulation: PEEK

5   Inner electrode

6   Outer electrode

7   VP 11 connection

8   Conductivity cell

9   Arc Module

4.2 Conducell UPW Arc with Micro-Transmitter inside

With the micro-transmitter integrated,Conducell UPW 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 Conducell UPW Arc sensor. Enclosed you will find the sensor, the Declaration of Quality, the sensor Instruction Manual, and the material Certificate.

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

Figure 2: Conducell UPW Arc sensor delivery package.

5.2 Configuring the Conducell UPW Arc 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:

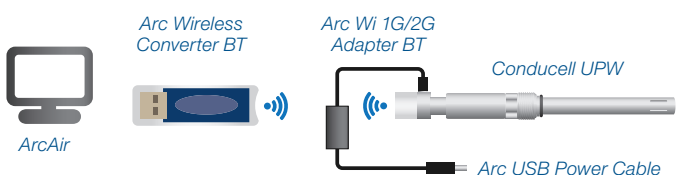| ArcAir	Read	Calibrate	Configure	Documentation
Free	✔	–	–	–
Basic	✔	✔	✔	–
Advanced	✔	✔	✔	✔

Figure 3: Conducell UPW 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 Conducell UPW 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 Conducell UPW 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
COND Unit	These are the measurement physical units: µS/cm, mS/cm	µS/cm	Required	Measurement/Values
T unit	These are the temperature physical units °C, °F, K	°C	Required	Measurement/Values
T comp. Temp value	Temperature compensation value can be set between 20°C and 25°C	25°C	Recommended default parameter	Measurement/Values
T comp. factor value	Temperature compensation factor can be set between 0 %/K to 10 %/K	0%/K	Required	Measurement/Values
Moving average	The sensor uses a moving average over the measuring points	2	Recommended default parameter	Measurement/Values

5.2.5 Configuring the calibration settings

Parameter Name	Description	Default Value	Configuration	Location
Drift stability	Higher drift will interrupt the calibration process. Warning comes up «drift oxygen»	1%/Min	Recommend default parameter	Calibration/Calibration Settings
	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	Configu-ration	Location
Measuring point	User can define a sensor name for better identification of the mea-suring point	243605-1234	Optional	Information / Info Userspace

5.3 Install Conducell UPW Arc sensor in your Measuring Loop

5.3.1 Mechanical Process Connection

The mechanical PG 13,5 design of the Conducell UPW 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

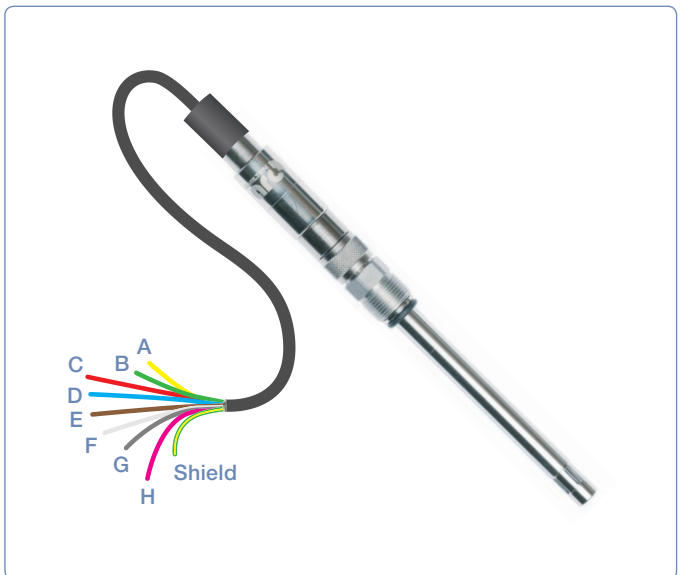Always use Hamilton Sensor Data Cable VP 8 for safe connection, which are available in different lengths (Chapter 10).

Figure 4: Pin description for electrical connection of Conducell UPW 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	USP warning	Brown
F	USP alarm	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 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 Arc 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 current which should be masked by lag smearing or input filters of the current input card of the 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 technical support.
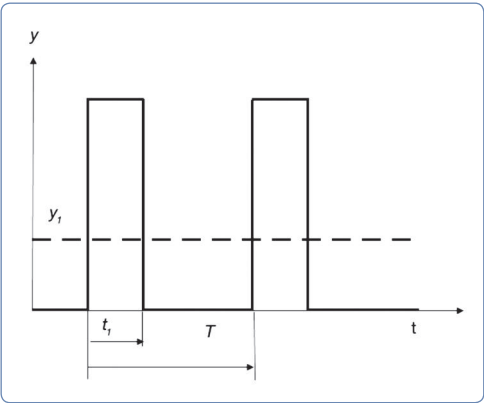

Figure 5: Progress of a rectangular signal with a period T and a pulse duration t_1 for the generation of an analog signal with the value y_1.
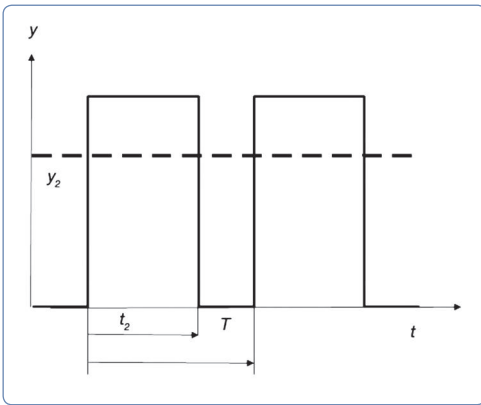
Figure 6: Progress of a rectangular signal with a period T and a pulse duration t_2 for the generation of an analog signal with the value y_2.

⚠ **ATTENTION! The 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 a correct function of the sensor when used in 4 – 20 mA setups. If this is not given, figure 10 shows a solution of 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 Conducell UPW Arc sensor to a data recorder, indicator, control unit or PCS with analog I/O. The Condcuell UPW Arc 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 Conducell UPW 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 5.2.8).

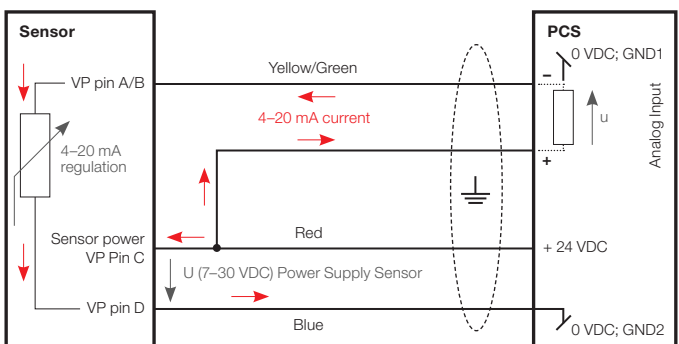## Examples of circuit arrangement

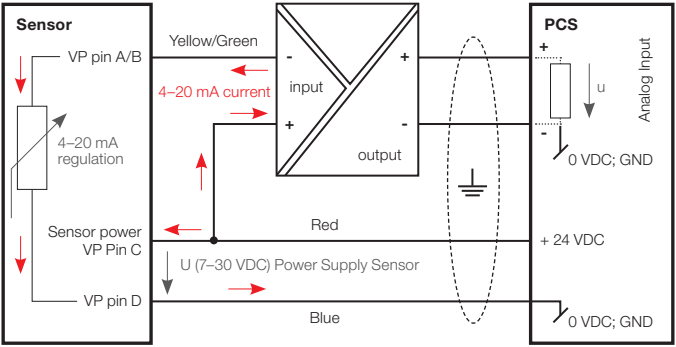*Figure 7: Three-wire loop wiring diagram for the 4–20 mA interface.*

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 Conducell UPW Arc sensor for performing measurements, for calibrating and changing the configuration parameters. Conducell UPW 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). Conducell UPW 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 Conducell UPW 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.
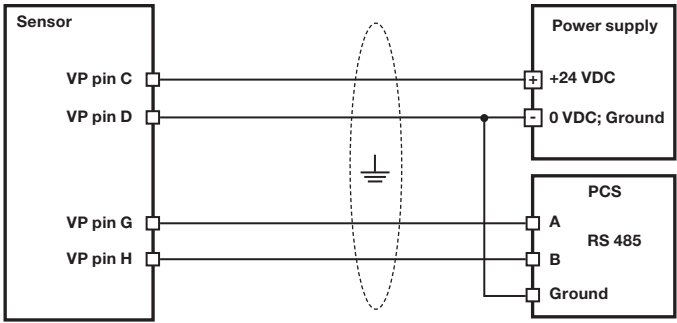
Example of circuit arrangement
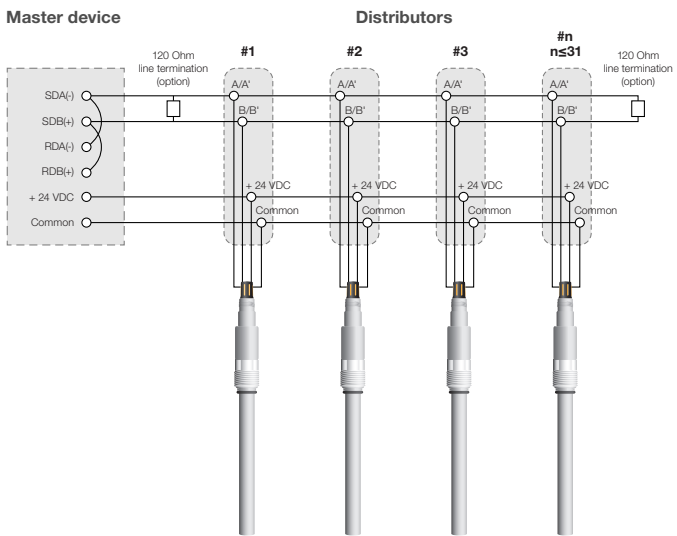

Figure 9: Wiring diagram for the RS485 interface.

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.

5.4 Interface for the signals according to USP <645>

The sensor can monitor water quality according to USP <645> by activating the USP warnings and alarms. Once these are activated, the sensor checks if uncompensated specific conductivity is

below specific limits, depending on temperature. If the conductivity is above a user defined limit, a warning is issued. If it is above the limit defined in the table «Temperature Limits for USP Alarm,» an alarm is issued. Both USP warnings and alarms can also be retrieved as warnings with the RS485 Modbus interface.

Pins E and F are connected to NPN transistors inside the Arc Module which can be used as open collectors. Electrical limits and connection examples are given below. USP warnings and alarms can be signalized at Pin E and F respectively.

If the USP function is activated, the uncompensated raw conductivity is measured and it is not possible to set any temperature compensation.

The functionality to issue alarms and warnings according to USP <645> can be turned on or off by means of the Hamilton Device Manager or Arc View Handheld.

⚠ **ATTENTION! The electric circuit must contain a load resistor. Use only Ohm resistive loads. Use capacitive or inductive loads always with protection mechanism.**

⚠ **ATTENTION! The electrical values given below must not be exceeded.**

Maximum electrical values at VP pin E and F:

- U_{max}: 40 V DC
- I_{max}: 15 mA DC
- P_{max}: 50 mW

The transistor inside the sensor is capable to sink up to 15 mA.

VP Pin	Function
C	Power supply: +24 VDC (7 to 30 VDC)
D	Power supply: Ground
E	USP warning
F	USP alarm

Examples of circuit arrangements for USP warnings and alarms
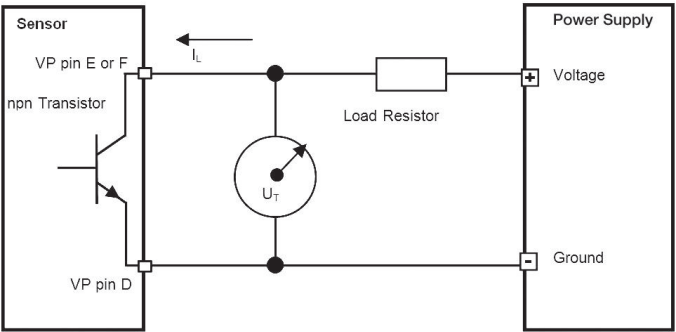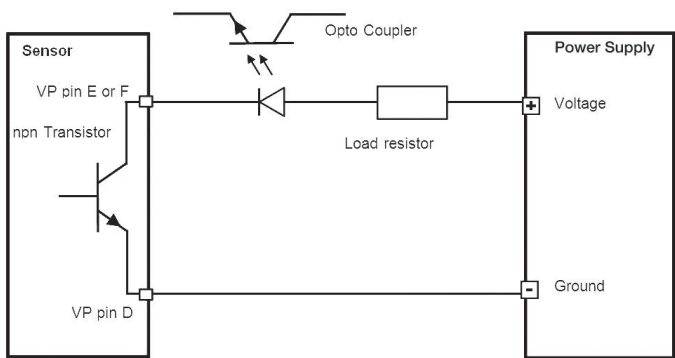

Figure 11: Basic setup.

Figure 12: Galvanic separation of the sensor from the control module can be achieved by means of an optocoupler.
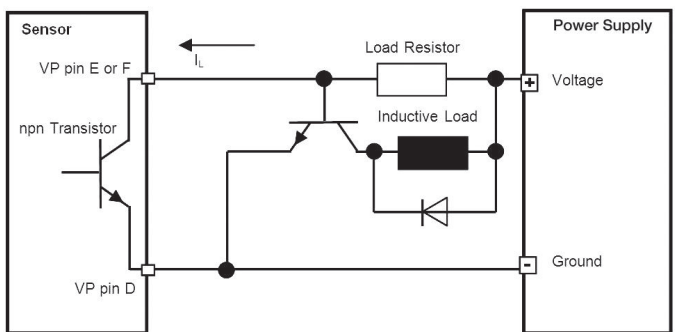

Figure 13: If an inductive load is used, a free-wheeling / snubber diode must be connected in parallel.

USP <645> alarm limits

Temperature Range in °C	Conductivity Limit in µS/cm
0 – 5	0.6
5 – 10	0.8
10 – 15	0.9
15 – 20	1
20 – 25	1.1
25 – 30	1.3
30 – 35	1.4
35 – 40	1.5
40 – 45	1.7
45 – 50	1.8
50 – 55	1.9
55 – 60	2.1
60 – 65	2.2
65 – 70	2.4
70 – 75	2.5
75 – 80	2.7
80 – 85	2.7
85 – 90	2.7
90 – 95	2.7
95 – 100	2.9
100	3.1

6   Operation

> ⚠ **ATTENTION! Only use the sensor within the specifications (Chapter 10). Failure to do so may lead to damages or measurement failure.**

1) Remove the protective caps from the Conducell UPW Arc tip, and 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.

6.1   Typical Installation e.g. Triclamp Version

Ideally, the sensor is mounted where no air bubbles or solid deposits can accumulate in the sensor. The sample medium should flow directly into the sensor at the tip and leave through the side holes.

Figures 14-18 show examples of recommended and not recommended mounting positions for the sensor version with TC1.5" process connection. Sensors with PG13,5 must be mounted similarly.
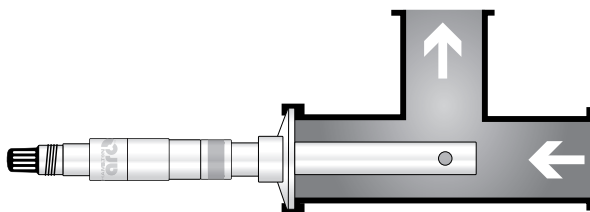

Figure 14: Sample medium should flow directly into the sensor. Be sure that no air bubbles and/or deposits can be trapped at the sensor tip.
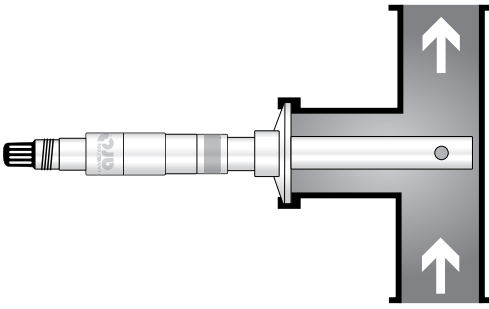
Figure 15: Mounted horizontally in a vertical pipe, the direction of flow should be upward.
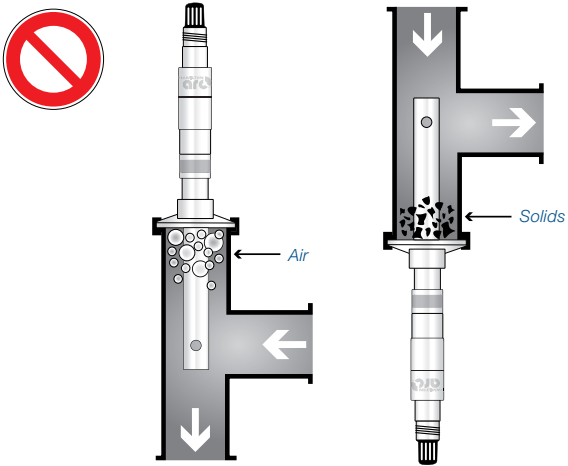

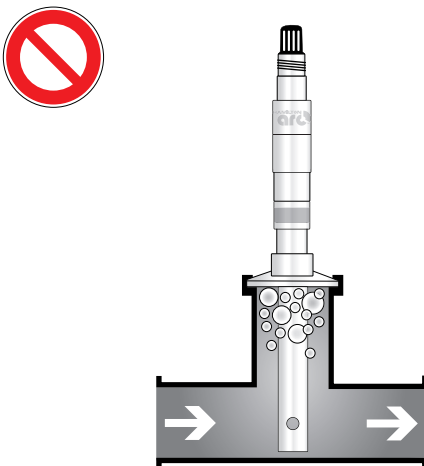Figure 16: The sensor should not be mounted in a way that solids or air can be trapped.

Figure 17: Vertical mounting is not recommended if there is air in the pipe.
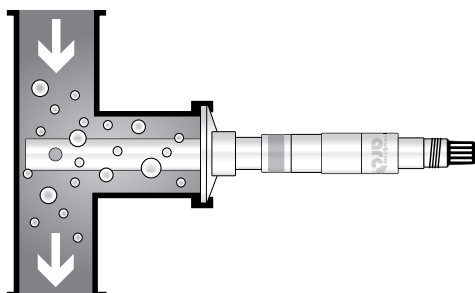
Figure 18: The sensor should not be mounted in a flow that goes downward, because air bubbles can stand in the stream.

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 19).

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

7.2   Calibration

Conducell UPW Arc sensors are delivered pre-calibrated from the factory. During calibration, the sensor controls automatically the stability of the measurement and temperature signals. The Conducell UPW 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).

7.2.1   Automatic Standard Calibration with ArcAir

Conducell UPW Arc sensors utilize a one-point calibration procedure with automatic standard recognition. The conductivity values and temperature dependence data for a number of predefined conductivity standards are stored in the sensor. If the corresponding standard is activated for automatic calibration, the sensor recognizes a standard, examines the correctness and stability of the conductivity and temperature signals, and performs the calibration.

> NOTE: The cell constant of the sensor can change by corrosion of the electrodes in aggressive media, high temperature or by contamination of the electrodes during the sensor's lifetime. The quality indicator of the Conducell UPW Arc sensor shows deviation of the cell constant. The quality indicator status is updated automatically after each calibration.

> NOTE: Do not activate the Hamilton standards 84 μS/cm, 100 μS/cm and 147 μS/cm together, because their temperature/conductivity functions can overlap.

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

7.2.2   One Point Calibration in Conductivity Standard Solutions

1) Install the sensor into the calibration setup into corresponding conductivity standard (see picture 20)

2) Power the Conducell UPW and connect to ArcAir via the Arc Wireless Converter BT or USB Power Cable.

3   Select the sensor in the sensor list.

4) Open the Calibration tab.

5) Select Calibration Point 1

6) Click Start to start the calibration wizard.

7) Follow the instructions on the screen.

The following standards can be activated:

- Hamilton: 1.3 µS/cm, 5 µS/cm, 15 µS/cm, 84 µS/cm, 100 µS/cm, 147 µS/cm, 706 µS/cm, 1413 µS/cm. The standards 1.3 µS/cm, 5 µS/cm, 15 µS/cm and 100 µS/cm contain glycerine

- Reagecon: 10 µS/cm, 20 µS/cm, 50 µS/cm, 200 µS/cm, 500 µS/cm, 1000 µS/cm

- KCl solution (0.01 mol/l): 1413 µS/cm

However, the sensors are pre-calibrated at the factory.

The use of standards with other conductivities will yield an error and reject of the calibration.

> 🗐 NOTE: To ensure optimal measurement accuracy always use conductivity standard with a value which fits most to the measuring range of your application.

> 🗐 NOTE: The reference temperature for the linear temperature compensation function of the Conducell UPW Arc sensor is 20 °C or 25 °C.

> 🗐 NOTE: The concept behind Conducell UPW Arc 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. However, if the propagation of the electrical field is influenced by the mounting situation an adjustment of the cell constant by a product calibration on-site might be necessary.

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 cell constant to the process conditions in force at the time of product calibration. In order to restore the original cell constant, the product calibration can be deleted at any time. A new standard calibration deletes the product calibration as well.
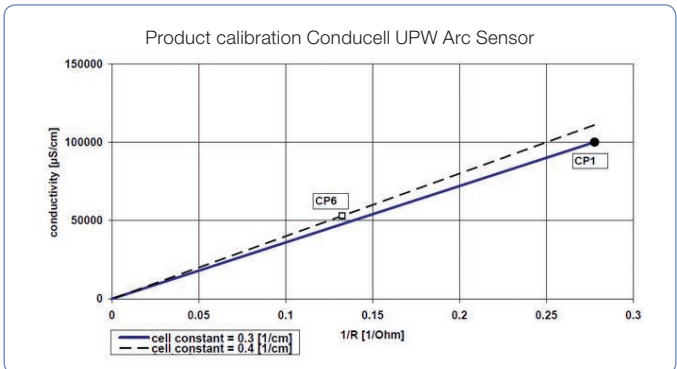

Figure 20: Effect of product calibration (CP6) on an existing standard calibration function based on the one point calibration (CP1).

> 🗋 NOTE: The product calibration is possible for conductivity values of +/- 70%.

A product calibration is performed as follows:

1) Connect one of the Conducell UPW sensor with the power supply, e.g. USB Power Cable Ref 243490 and install a Wireless Converter BT Ref 242333.

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.

7.2.4   Verification according to USP <645>

Water conductivity must be measured accurately with calibrated instrumentation. It is the cell constant and the resistance measurement that must be verified and adjusted, if necessary.

Verification of the cell constant can be done in two ways:

- Directly by using a solution of traceable conductivity (i.e. Hamilton conductivity standards) if the sensor can be removed from the ultra-pure water loop

- Indirectly by comparing the instrument reading taken with the Conducell UPW sensor in question to readings from a conductivity sensor of known or traceable cell constant if the sensor cannot be removed from the ultra-pure water loop. The two conductivity sensors should be positioned close enough together to measure the same water sample at the same temperature and water quality

Verification of the resistance measurement:

- The Conducell UPW sensor electrodes (i.e. conductivity cell) have to be disconnected from the instrument (here: Arc Module) and replaced by the UPW simulator. The simulator contains a high precision resisitor with a resistance of 1 MOhm (exact value stated in the certificate) and is traceable to PTB (Germany), resp. NIST. Temperature compensation has to be turned off

- The accuracy of the resistance measurement is acceptable if the measured resistivity with the traceable resistor is within 1 MOhm ± 20 kOhm, resp. ± 2 nS/cm (USP: ± 100 nS/cm)

System verification
(the sensor remains in the ultra-pure water loop):

- The verification can be made by comparing the conductivity (or resistivity) values displayed by the measuring equipment with those of an external calibrated conductivity-measuring device

- The two non-temperature-compensated conductivity (or resistivity) values should be equivalent or within ± 5% of each other

- The two conductivity sensors should be positioned close enough together to measure the same water sample at the same temperature and water quality

8   Troubleshooting

8.1   Sensor Self-Diagnostic

Conducell UPW 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 5.2.7). Use ArcAir for monitoring 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
COND reading below lower limit	The conductivity reading is too low. Make a new calibration (Chapter 7.2.2).
COND calibration recommend	Perform a calibration in order to ensure reliable measurement (Chapter 7.2).
COND last calibration not successful	Start a new calibration or ensure that not air bubbles are sticking to the electrodes. Always use new calibration solutions (Chapter 7.2.2).

8.1.2   Errors

Errors (failures)	Cause / Solution
COND reading failure	At least one error is active.
Measured resistance too high	Electrodes are not in liquid or damaged.
Measured resistance too low	Electrodes are not in liquid or damaged.
Resistance between electrodes too high	Electrodes are not in liquid or damaged.
Resistance between electrodes too low	Electrodes are not in liquid or damaged.
Temperature sensor defective	Temp. Sensor defective. Please call 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 Conducell UPW Arc sensor for Repair

Before returning a Conducell UPW 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 Conducell UPW Arc sensor to Hamilton without an RGA number. This number assures proper tracking of your sensor. Conducell UPW Arc sensors that are returned without an RGA number will be sent back to the customer without being repaired.

Decontaminate the Conducell UPW 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.

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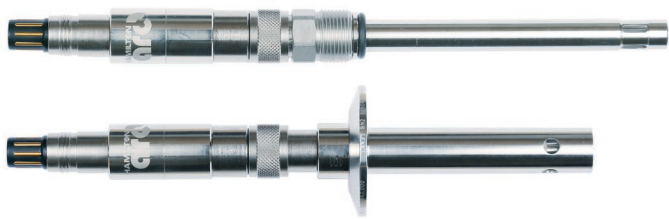
有害物質表，請參閱www.hamiltoncompany.com，章節過程分析，符合性聲明

10 Ordering Information

Parts below may only be replaced by original spare parts.

10.1 Conducell UPW Arc

Ref	Description	Interface
243579	Conducell UPW Arc PG13,5	2x 4-20 mA/Modbus
243578	Conducell UPW Arc TC1.5"	2x 4-20 mA/Modbus

The Conducell UPW Arc 225 have, in reality, a shaft length of 215 mm.
This ensures optimal rinsing in replaceable armatures, such as Retractex.

10.2 Parts and Accessories
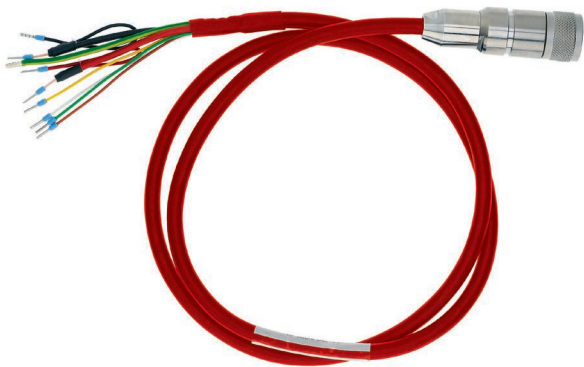
Ref	Product Name	Length	Interface
355263	Sensor Data Cable VP 8	1 m	4-20 mA/Modbus
355264	Sensor Data Cable VP 8	3 m	4-20 mA/Modbus
355265	Sensor Data Cable VP 8	5 m	4-20 mA/Modbus
355266	Sensor Data Cable VP 8	10 m	4-20 mA/Modbus
355267	Sensor Data Cable VP 8	15 m	4-20 mA/Modbus
355268	Sensor Data Cable 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
243580	UPW Simulator

Description: The UPW Simulator is intended to be used for the verification of the Arc electronics according to USP <645>.
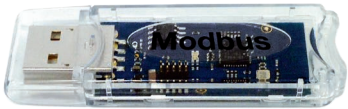
Ref	Product Name
243499	Arc Wireless Converter BT

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.
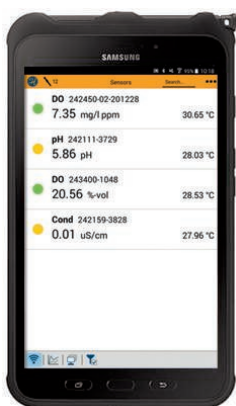

Ref	Product Name
243460	Arc Wi 1G Adapter BT

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 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.

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

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contact.pa.ch@hamilton.ch

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.