



FlowCell COND

Operating Instructions

Applicability: FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH

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HAMILTON 

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The liability of Hamilton Bonaduz AG is detailed in the *General Terms and Conditions of Sale* (GTS) document. Hamilton is expressly *not* liable for direct or indirect losses arising from the 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. Hamilton recommends regular calibration of the sensor. In the case of critical sensor applications, Hamilton recommends using backup measuring points to avoid consequential damages. The user is responsible for taking suitable precautions in the event of a sensor failure.

Hamilton Warranty

To download the latest version of the GTS, visit the Hamilton Process Analytics website: <https://www.hamiltoncompany.com/general-terms-and-conditions#purchase>

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Document History

Manual revision No.	Date of issue	Change summary
00	November 2024	First release of the FlowCell COND Sensor Operating Instructions
01	July 2025	• New variant of the FlowCell COND Sensor introduced: FlowCell COND 4UPtF Arc + pH • Content updated with specific information applicable to the FlowCell COND 4UPtF Arc + pH • Overall content updated and restructured to improve comprehension and usability

Preface

Conventions used in this guide/manual

Safety messages are displayed as follows:

WARNING

Alerts the user to the risk of injury, death, or other severe adverse reactions associated with the correct or incorrect use of the device.

CAUTION

Alerts the user to the possibility of a problem with the device associated with its use or misuse, such as device malfunction, device failure, damage to the device, or damage to other property.

NOTICE

Emphasizes information of particular importance.

In tables and some descriptive text, safety messages are indicated as follows:

 **WARNING!**

 **CAUTION!**

 **NOTICE!**

Typographic conventions

Table 1. Overview of the typographic conventions used in this manual

Typographic effect	Example	Function
Bold	Settings	Indicate the name of an icon or a button in the software/application.
	Touch the Settings tab > Measurement Settings subtab	The notation XX > XX shows the sequence of buttons to touch to open the associated window in the software/application.
<i>Italic</i>	<i>Operating Instructions / Quick Start Guide</i>	Indicates the names of other documents.
	<i>Moving Average: 50 / Measurement Interval: 3</i>	Emphasizes information of particular importance.
Software graphical user interface (GUI) text	"Initialization of the correlation point has been completed."	Indicates text or message quoted directly from the software/application window or screen.
Procedural sequence	1. Step 1 in a sequence 2. Step 2 in a sequence	Organizes a sequence of actions into steps.
Illustration number sequence	1: Identifies part/item 1 of an illustration 2: Identifies part/item 2 of an illustration	- Used in illustrations/graphics to identify the part/item for cross-referencing in a procedure or description. - It also relates to the specific part/item description in the legend table for the corresponding illustration/graphic.
Hyperlink text, for example, see Chapter 2 or see Figure 7-2	See Chapter 2 or see Figure 7-2	If you are viewing this file with PDF software, you can click on the hyperlinked text /reference number to instantly access the corresponding information in another part of this document.

Graphics or illustrations used in this manual

- The graphics or illustrations used in this manual are for illustrative purposes only.
- The colors used in the graphics or illustrations may not be an exact representation of the actual product.

In this manual:

- Some figures use callouts in a white circle with a blue border.
 - ①: These figures may have an associated legend table or may describe a single item legend in the title of the figure. Callouts may be numeric or alphabetic. Callouts are unrelated to any nearby procedures and refer only to the figures themselves and their associated legend.
- Some figures use small dark blue callouts.
 - A: These callouts show the sequence of steps. They are not related to the numbering of any associated procedure.

The latest version of the English manual, related documents, and translated manuals can be downloaded from the Hamilton Process Analytics website (<https://www.hamiltoncompany.com/process-analytics>).

1 Introduction

This chapter provides information about the intended use of the FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors and the operating instructions. These Operating Instructions refers to the FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors as "FlowCell COND" Sensors unless stated otherwise.

These Operating Instructions are intended to support users/operators with the integration, operation, and qualification of the FlowCell COND Sensors. This manual describes the features of the FlowCell COND Sensors and their integration into a Process Control System (PCS).

You must not exceed the specifications; thus, the electrical wiring, temperature and pressure ranges provided in the Specification document for the FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors.

The FlowCell COND Sensors are compatible with other Hamilton Arc System, which includes the complete family of intelligent sensors for pH, dissolved oxygen and conductivity measurements in a process control.

You must read and understand this manual and observe all safety precautions before using the sensor in your process setup. Hamilton assumes no responsibility for damage and operational disruptions arising from failure to observe these instructions.

1.1 Intended use

CAUTION

- *The FlowCell COND Flow-through Sensor is not intended for use in hazardous atmospheres.*
- *The measurement values transmitted over wireless communication are not intended to be used for process control.*

NOTICE

The FlowCell COND Flow-through Sensors have a built-in temperature sensor (NTC 22 k Ω). This temperature sensor is used to monitor the sensor conditions only and does not control the process temperature.

FlowCell COND Flow-through Sensor was developed for the measurement of conductivity in liquids used in downstream and other flow cell applications. The engineering design is based on a 4-electrode measuring principle which guarantees an excellent linearity from 1 to 300,000 $\mu\text{S}/\text{cm}$.

The FlowCell COND 4UPtF Arc + pH Sensor includes a pH sensor tube. It allows the user to install a pH Sensor to measure accurate pH and conductivity in downstream applications or bioprocess. For additional information on the pH Sensor, refer to the user manual for the pH sensor installed.

The main application of the FlowCell COND Flow-through Sensor is the in-line measurement of conductivity and pH under demanding conditions in biotechnology and pharmaceutical applications including chromatography, viral filtration, and other flow cell applications. The measurement is taken through the process line or bypass when in-line measurement is not possible due to small pipe dimensions.

1.2 Initial operation

Check the sensor for damage at the time of unpacking. A damaged sensor must be returned to your Hamilton dealer in the original packaging.

You must follow the maintenance procedures by paying particular attention to cleaning and decontamination if you work with hazardous liquids. You must decontaminate the sensor if it becomes contaminated with biohazardous, radioactive, or chemical substance.

1.3 General precautions

For safe and correct use of the FlowCell COND Flow-through Sensor, it is important that both operating and service personnel follow standard safety procedures and observe the safety precautions and hazards described in Chapter 2.

Only authorized/trained service personnel can assemble/install, operate, clean, calibrate, or maintain the Flow-through Sensor or do other service-related tasks.

The service life of a FlowCell COND Flow-through Sensor is determined by the specific conditions of the applications. The measuring conditions, especially high temperatures, pressure, and aggressive chemicals/solutions can shorten the service life of the FlowCell COND Flow-through Sensor. For details about replacement conditions, see Chapter 7.

2 Safety Precautions and Hazards

CAUTION

- *Carefully read and observe the following safety precautions and hazards before installing, setting up, and operating the sensor.*
- *Failure to observe and follow through with the maintenance procedures can affect the reliability and correct function of the system.*
- *Failure to observe the safety precautions and hazards described in this manual, improper use of the sensor, and unauthorized interference with the sensor by external devices will void all warranties provided by the manufacturer.*
- *The measurement values transmitted over wireless communication are not intended to be used for process control.*
- *Do not expose the sensor to corrosive media or substances. This will help to protect the sensor from deterioration.*

You should only use the sensor for its intended purpose while observing the necessary safety precautions. Incorrect use or misuse of the sensor can be dangerous for personnel and can cause damage to equipment. Make sure the sensor is in good condition before use.

2.1 Operating precautions for the Flow-through Sensor

CAUTION

- *FlowCell COND Flow-through Sensor must be used for their intended applications and in optimum safety and operational conditions. The specifications (such as temperature or pressure) as defined in the Technical Specifications must not be exceeded under any circumstances. Potential hazards can exist if the sensor is not operated correctly or appropriately. For details, refer to the Hamilton Process Analytics website (www.hamiltoncompany.com).*
- *Trained personnel must only do assembly, installation, and maintenance.*
- *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 Flow-through Sensor from its measurement setup, always make sure that no process medium can be accidentally spilt.*
- *The integrated temperature sensor is only for monitoring the sensor conditions, not for controlling the process temperature.*

2.2 Electrical safety precautions

CAUTION

Before you remove/disconnect the Flow-through Sensor from the process tank, benchtop, or bioreactor, you must always turn off the power supply and disconnect the cable connector from the Flow-through Sensor.

NOTICE

The PCS will show incorrect readings when the power supply (230 VAC / 24 VDC) is tuned off or disconnected.

Do not connect the sensor to a power source of any voltage beyond the range stated in the *Power Rating Technical Specifications*. For details, refer to the Hamilton Process Analytics website (www.hamiltoncompany.com).

Always use Hamilton VP8 cables for safe connection. Cables are available in a broad range of lengths (see Section 11.2). Make sure the cable is intact and plugged in correctly to prevent short circuit.

Keep the FlowCell COND Sensor away from other equipment which emit electromagnetic radio frequency fields and minimize static electricity in the immediate environment of the optical measuring parts.

Make sure the electrical contacts on the FlowCell COND Sensor head is clean and dry before you connect the sensor data cable.

2.3 Chemical, radioactive, and biological hazard precautions

Selection of the appropriate safety level and implementation of the required safety measures for working with FlowCell COND Flow-through Sensor is the sole responsibility of the user.

You must follow the maintenance procedures by paying particular attention to cleaning and decontamination if you work with hazardous liquids. You must decontaminate the FlowCell COND Flow-through Sensor if it becomes contaminated with a biohazardous, radioactive, or chemical substance.

3 Product Description

This chapter describes the FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors. It also provides an overview of the key features and benefits of each Flow-through Sensor.

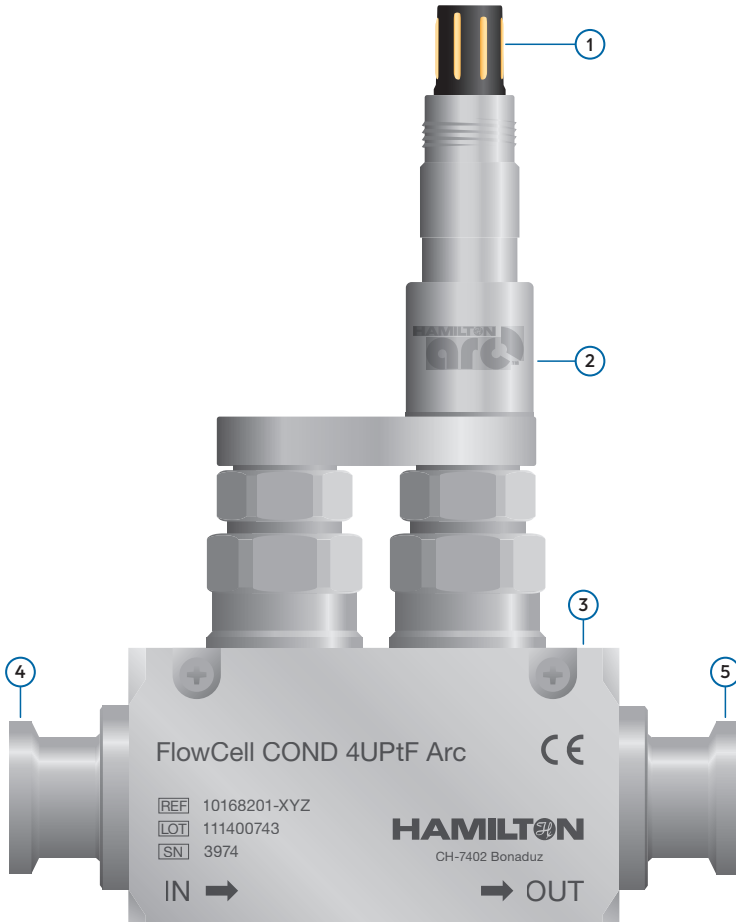
3.1 FlowCell COND 4UPtF Arc Sensor

The FlowCell COND Flow-through Sensor was developed to measure conductivity in liquids for downstream applications. The sensor is primarily used for in-line measurements in biotechnology and pharmaceutical applications, such as chromatography and viral filtration. Using a 4-electrode principle, the sensor can achieve an accuracy of $\pm 3\%$ or better for a wide range of conductivity measurements with linearity between 1 to 300,000 $\mu\text{S}/\text{cm}$.

Key features and benefits include:

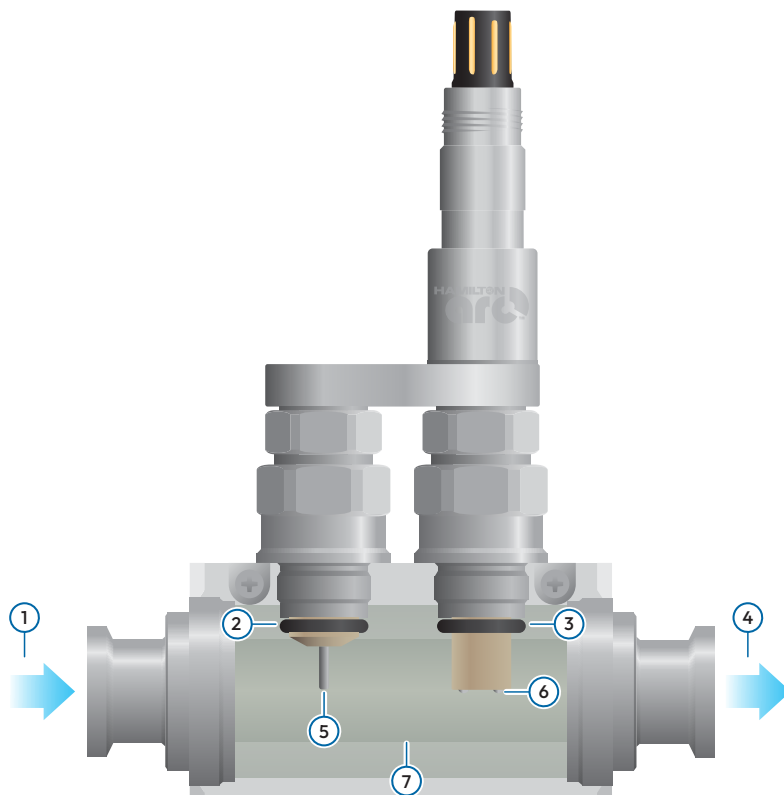
- **Simplified installation:** Easy to install with minimal effort.
- **Integrated design:** Eliminates the need for a separate transmitter, simplifying system architecture and reducing complexity.
- **Robust Industrial construction:** Built to withstand the rigors of industrial environments, its robust design minimizes maintenance needs and maximizes operation time.
- **Extended conductivity range:** Provides accurate and linear conductivity measurements from 1 to 300,000 $\mu\text{S}/\text{cm}$.
- **Rapid temperature response:** Ensures quick adaptation to temperature changes for accurate real-time measurements.
- **Flexible Connectivity:** The FlowCell COND 4UPtF Arc Sensor offers variable communication options:
 - **Wired:** Connect to your Process Control System (PCS) using standard 4–20 mA analog signals or digital Modbus.
 - **Wireless:** Offers a wireless communication option via Bluetooth® 4.0 or higher for easy, online configuration

Figure 3-1. Overview of the FlowCell COND 4UPtF Arc Sensor [1/2]



- | | | | |
|---|---|---|--------------------------|
| 1 | VP8 connector | 4 | Flow connector port: IN |
| 2 | Conductivity sensor head with integrated microtransmitter | 5 | Flow connector port: OUT |
| 3 | FlowCell block: FlowCell COND 4UPtF Arc Sensor | | |

Figure 3-2. Overview of the FlowCell COND 4UPtF Arc Sensor: Internal view [2/2]



- | | | | |
|---|--|---|---|
| 1 | Direction of flow: IN | 5 | Temperature sensor |
| 2 | Temperature sensor O-ring
ⓘ NOTICE! The O-ring is a non-serviceable part. | 6 | Conductivity sensor tip with current and potential electrodes |
| 3 | Conductivity sensor O-ring
ⓘ NOTICE! The O-ring is a non-serviceable part. | 7 | Polyether ether ketone (PEEK) inlet |
| 4 | Direction of flow: OUT | | |

3.2 FlowCell COND 4UPtF Arc Sensor + pH

The FlowCell Cond 4UPtF Arc + pH is an integrated solution for precise and simultaneous measurement of conductivity and pH in downstream bioprocessing applications. This FlowCell COND Flow-through Sensor features advanced Arc sensor technology to provide highly accurate and rapid data acquisition, optimizing process control and performance. Using a 4-electrode principle, the sensor can achieve an accuracy of $\pm 3\%$ or better for a wide range of conductivity measurements with linearity between 1 to 300,000 $\mu\text{S}/\text{cm}$. The FlowCell Cond 4UPtF Arc + pH also features a pH tube for a pH sensor installation.

Key features and benefits include:

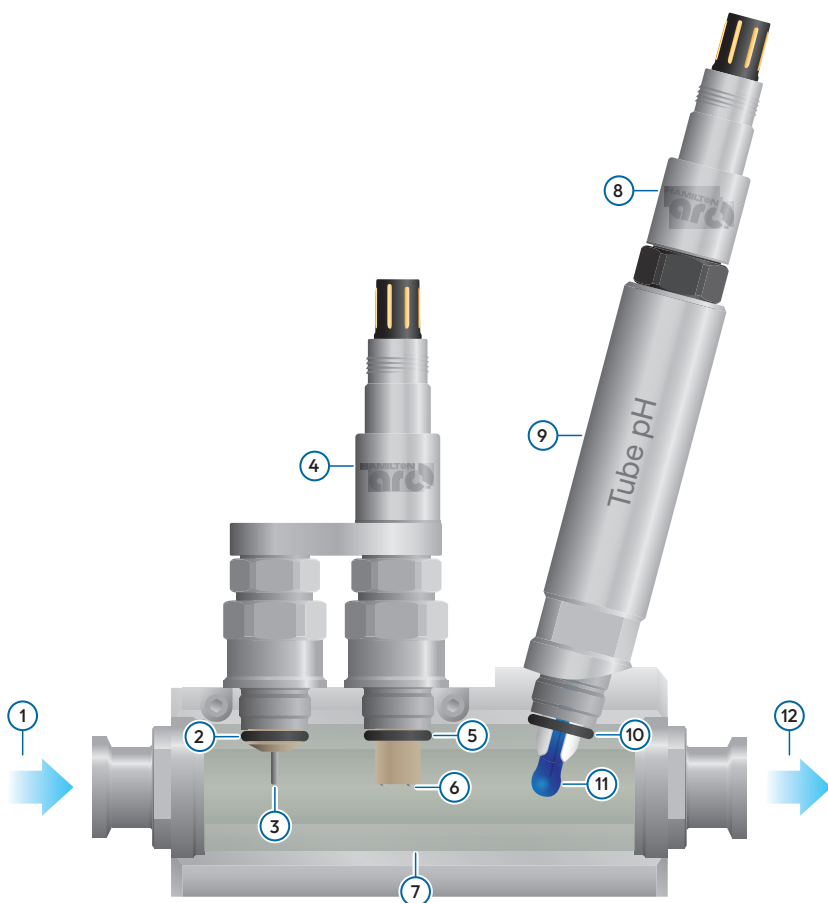
- **Simplified installation:** Easy to install with minimal effort.
- **Integrated design:** Eliminates the need for a separate transmitter, simplifying system architecture and reducing complexity.
- **Robust Industrial construction:** Built to withstand the rigors of industrial environments, its robust design minimizes maintenance needs and maximizes operation time.
- **Extended conductivity range:** Provides accurate and linear conductivity measurements from 1 to 300,000 $\mu\text{S}/\text{cm}$.
- **Reduced deviations:** Minimizes cell constant deviations and mitigates sensor aging for long-term stability.
- **Rapid temperature response:** Ensures quick adaptation to temperature changes for accurate real-time measurements.
- **Integrated pH tube:** Accommodates a certified biocompatible pH sensor that enables comprehensive process monitoring.
- **Pre-pressurized reference design:** Enhances the accuracy and stability of pH measurements, particularly in challenging applications.
- **Flexible Connectivity:** The FlowCell COND 4UPtF Arc Sensor offers variable communication options:
 - **Wired:** Connect to your Process Control System (PCS) using standard 4–20 mA analog signals or digital Modbus.
 - **Wireless:** Offers a wireless communication option via Bluetooth® 4.0 or higher for easy, online configuration.
- **Customization:** The system can be customized to specific application requirements to ensure optimal performance for various downstream processes.

Figure 3-3. Overview of the FlowCell COND 4UPtF Arc Sensor + pH [1/2]



- | | | | |
|---|---|---|--|
| 1 | Flow connector port: IN | 5 | Hamilton pH Arc Sensor
ⓘ NOTICE! A certified biocompatible pH sensor from a third-party can also be installed. |
| 2 | FlowCell block: FlowCell COND 4UPtF Arc Sensor + pH | 6 | pH tube for sensor installation |
| 3 | VP8 connector | 7 | Flow connector port: OUT |
| 4 | Conductivity sensor head with integrated microtransmitter | | |
-

Figure 3-4. Overview of the FlowCell COND 4UPtF Arc Sensor + pH: Internal view [2/2]



- | | | | |
|---|--|----|---|
| 1 | Direction of flow: IN | 7 | Polyether ether ketone (PEEK) inlet |
| 2 | Temperature sensor O-ring
! NOTICE! The O-ring is a non-serviceable part. | 8 | Hamilton pH Arc Sensor
! NOTICE! The Hamilton pH Sensor is not supplied with FlowCell COND 4UPtF Arc + pH. The pH Sensor can be ordered separately from Hamilton.

! NOTICE! A certified biocompatible pH sensor from a third-party can also be installed. |
| 3 | Temperature sensor | 9 | pH tube for sensor installation |
| 4 | Conductivity sensor head with integrated microtransmitter | 10 | pH sensor O-ring
! NOTICE! The O-ring is a non-serviceable part. |
| 5 | Conductivity sensor O-ring
! NOTICE! The O-ring is a non-serviceable part. | 11 | pH sensor tip |
| 6 | Conductivity sensor tip with current and potential electrodes | 12 | Direction of flow: OUT |
-

FlowCell COND Flow-through Sensor hardware and Bluetooth® communication

Hardware overview

The FlowCell COND Sensor is designed for direct contact with the measured medium. The key components that come into contact with fluid include the temperature sensor and the conductivity sensor. For the FlowCell COND + pH variant, a pH sensor can also be integrated to directly measure the pH of the medium.

The FlowCell COND Sensor head has an integrated microtransmitter that enables direct communication to a PCS via 4–20 mA standard signal or digital Modus. The microtransmitter is located in the sensor head stores all the relevant sensor data, including calibration, diagnostic information, which simplifies calibration and maintenance. With the integrated microtransmitter, the FlowCell COND Sensor can provide more reliable measurements directly to the Process Control System (PCS).

The sensor housing is designed for direct integration into piping systems. It features clearly marked IN and OUT flow connection ports to ensure correct integration into piping systems. Figures 3-1 and 3-3 provide an overview of the FlowCell COND Flow-through Sensor and its components.

Bluetooth® communication

Bluetooth® communication can be used with the Arc Wireless Adapter for configuring and troubleshooting the Arc sensors. This saves time without compromising the quality of the wired connection (see Figure 4-1). Wireless communication is available via a smart phone, tablet, or computer.

4 Hardware and Software Installation

This chapter provides information, and instructions on how to install and set up the FlowCell COND Flow-through Sensor, hardware, and the ArcAir application.

4.1 Unpacking

1. Carefully unpack the FlowCell COND Flow-through Sensor. Inside the packaging, you will find the Flow-through Sensor, Declaration of Quality (DoQ), Operating Instructions, and Material Certificate.
2. Inspect the Flow-through Sensor for damage or missing parts.

4.2 Configuring the Flow-through Sensor with ArcAir application

Arc sensors require an application-specific configuration. The following parts are required to configure and calibrate Arc sensors:

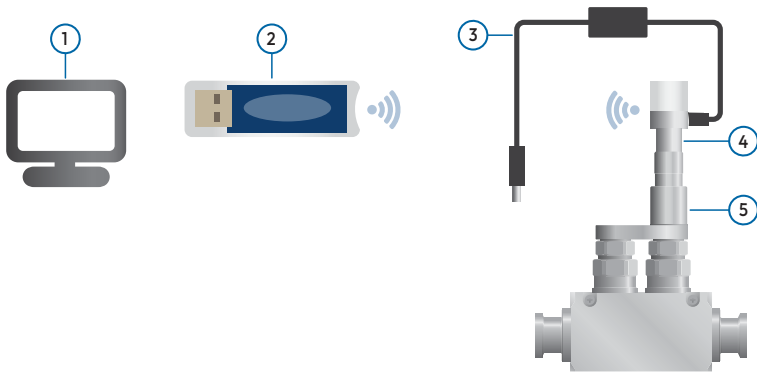
- Arc View Mobile (REF 10071111) / Arc View Mobile Advanced (REF 10071113) application
- External Power Supply with Arc USB Power Cable (REF 243490-XX)

Table 4-1 provides an overview of the different ArcAir versions and their functionality.

Table 4-1. Overview of the ArcAir App versions and functionality

ArcAir version	ArcAir application functionality				
	Read	Calibrate	Configure	Documentation	Remark
Basic	✓	✓	✓	-	• Free download from Hamilton website or App Store / Play Store • Intended for PC, mobile phone, or tablet • Basic functions, including: - Measuring, - Sensor status - Experiment function - Configuration - Firmware update
Advanced	✓	✓	✓	✓	• Update from the basic version • Intended for PC, mobile phone, or tablet • Offers all the ArcAir Basic functions, including: - Verification - Communication validation - User management - Audit trail - Report functionality

Figure 4-1. Arc sensor system setup: Wireless connection to ArcAir application



- | | | | |
|---|---|---|-----------------------------------|
| 1 | ArcAir application installed on a PC/
Notebook | 4 | Arc wireless BT adapter |
| 2 | Arc wireless BT converter | 5 | FlowCell COND Flow-through Sensor |
| 3 | Arc USB power cable | | |

4.3 Installing ArcAir Basic on a computer

1. Download the **ArcAir.zip** file from the Hamilton website www.hamiltoncompany.com (search for ArcAir).
2. Unpack the Zip file.
3. Do not connect to the Wireless Converter or the Arc USB Power Cable before the ArcAir installation is completed.
4. Install the ArcAir application by double-clicking the **ArcAir.exe** file, then follow the instructions on the screen.

4.4 Connecting the Flow-through Sensor to ArcAir application

1. Connect the power supply cable, for example, the Arc USB Power Cable (REF 243490-XX) to the sensor.
2. Turn on the Bluetooth® connection on the mobile device, tablet, or computer.

NOTICE

- The ArcAir application recognizes and displays the connected sensor automatically on the mobile device, tablet, or computer.
- For automatic sensor login, a unique and global Operator Level S password for all intelligent sensors is required. 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.

4.5 Creating user accounts in ArcAir

1. Start the ArcAir application on your computer.
2. Click the **Backstage** button in the upper left corner.
3. Select the **User Management**.
4. Click the **Add** button to open the **User Editor** window.
5. Type the user details and password.
6. Select the specific rights for the user.

NOTICE

- Initial operation of the ArcAir application will be in laboratory mode as long as no user account is created. Laboratory mode does not require a login password and enables all features that are available with the license version installed.
- The first user is the administrator, and all user rights are assigned by default.

4.6 Configuring the FlowCell COND Flow-through Sensor parameters

- 1. Start the ArcAir application.
- 2. Select the desired sensor.
- 3. Open the **Settings** menu. Make sure you have **Sensor Settings** user rights.
- 4. Configure the sensor.

Table 4-2 provides an overview and description of ArcAir configuration parameters for FlowCell COND Flow-through Sensor.

Table 4-2. ArcAir configuration parameters for FlowCell COND Flow-through Sensor

Parameter	Description	Default value	Configuration	Location
COND unit	Physical measure- ment units: µS/cm mS/cm	µS/cm	Required	Measurement/ Values
T unit	Physical tempera- ture units: °C, °F, or K	°C	Required	Measurement/ Values
T comp. Temp value	Temperature compensation value can be set between 20 °C and 25 °C	25 °C	Recommend default param- eter	Measurement/ Values
T comp. factor value	Temperature compensation factor can be set between 0%/K and 10%/K	0 %/K	Recommend default param- eter	Measurement/ Values
Moving average	The sensor uses a moving average over the measuring points	2	Recommend default param- eter	Measurement/ Values

NOTICE

pH Configuration Parameters in ArcAir: Hamilton pH Arc Sensor

For the Hamilton pH Arc Sensor configuration parameters in ArcAir, refer to the *pH and ORP Arc Sensors Operating Instructions* (REF 10119689).

4.7 Configuring the temperature settings for SIP / CIP process

Table 4-3 provides an overview and description of the temperature settings for SIP / CIP process in ArcAir application.

Table 4-3. Configuring the temperature setting of SIP / CIP process in ArcAir application

Parameter	Description	Default value	Configuration	Location
SIP process definition	User defines the conditions for the SIP counter	Temp. min. 120 °C Temp. max. 140 °C Time: 20 min.	Recommend default parameter	Status / SIP / CIP
CIP process definition	User defines the conditions for the CIP counter	Temp. min. 80 °C Temp. max. 100 °C Time: 20 min.	Recommend default parameter	Status / SIP / CIP

4.8 Configuring the analog interface for PCS

Table 4-4 provides an overview and description of the analog interface for a Process Control System (PCS) configuration in ArcAir application.

Table 4-4. Configuring the analog interface for a PCS

Parameter	Description	Default value	Configuration	Location
Interface Mode	The output of the 4-20 mA can be configured as linear, bi-linear or with a fixed value	4- 20 mA	Recommend default parameter	Interface/ Analog
Value at 4 mA	Defined measurement value for 4 mA output	1 μ S / cm / 0 °C	Required	Interface/ Analog Output
Value at 20 mA	Defined measurement value for 20 mA output	10,001 μ S / cm / 40 °C	Required	Interface/ Analog Output
Mode in the event of a warning	Current output mode in case of a warning	No output	Recommend default parameter	Interface/ Analog Output
Mode in the event of an error	Current output mode in case of an error	Continuous output	Recommend default parameter	Interface/ Analog Output
Output in the event of a warning	Current output mode in case of a warning	3.5 mA	Recommend default parameter	Interface/ Analog Output
Output in the event of an error	Current output mode in case of an error	3.5 mA	Recommend default parameter	Interface/ Analog Output
Output for T out of limit	Current output mode in case of temperature out of limit	3.5 mA	Recommend default parameter	Interface/ Analog Output

NOTICE

Configuring the pH Arc Sensor Analog Interface for a PCS

To configure the Hamilton pH Arc Sensor analog interface for a PCS, refer to the *pH and ORP Arc Sensors Operating Instructions* (REF 10119689).

4.9 Process identification: Define a measuring point name

Table 4-5 provides an overview and description of the measuring point setup in ArcAir application

Table 4-5. Process identification: Define a measuring point name

Parameter	Description	Default value	Configuration	Location
Measuring point	You can define a sensor name for better identification of the measuring point	Product REF. No.-Serial No.: 12345678-1234	Optional	Information / Info User Space

5 Install the FlowCell COND Flow-through Sensor in the measuring loop

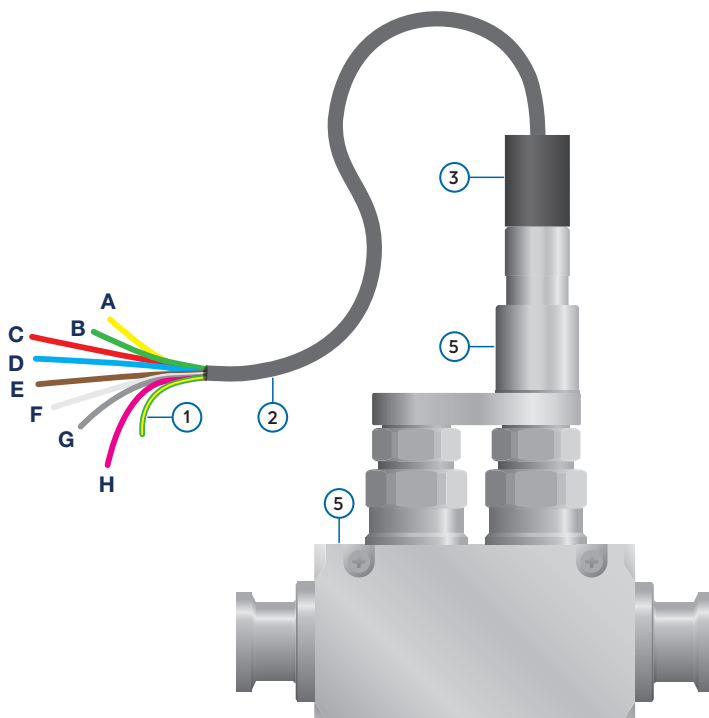
This chapter provides information, and instructions on how to install and set up the Flow-through Sensor and its hardware in the measuring loop.

5.1 VP8 cables Pin assignment

Always use Hamilton Sensor Data Cables, for example, VP8 connect which are available in different lengths for safe connection. For additional information about the Sensor Data Cables, see Chapter 11.

VP8 double coaxial / open-end data cable

Figure 5-1. FlowCell COND Flow-through Sensor electrical connection: VP8 double coaxial / open-end data cable Pin assignment



- | | | | |
|---|---------------------------------------|---|-----------------------------------|
| 1 | VP8 earth/ground cable (yellow/green) | 4 | FlowCell COND Flow-through Sensor |
|---|---------------------------------------|---|-----------------------------------|

⚠ CAUTION! Do not ground/earth the sensor via the VP8 earth/ground cable, as the sensor is grounded via the metallic pipes/chromatography system.

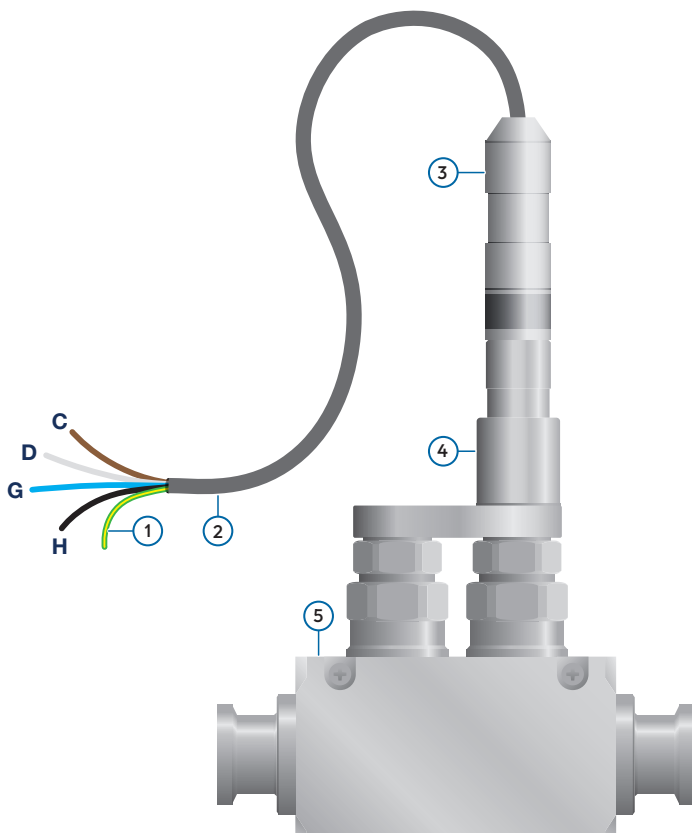
- | | | | |
|---|---|---|----------------|
| 2 | Cable shield (double coaxial open-end cable and data cable conductor) | 5 | FlowCell block |
| 3 | VP8 double coaxial / open-end data cable | | |

Table 5-1. FlowCell COND Flow-through Sensor electrical connection: VP8 double coaxial / open-end cable Pin assignment

VP Pin	Function	Color
A	4-20 mA interface # 2	Yellow
B	4-20 mA interface # 1	Green
C	Power supply: + 24 VDC (7 VDC to 30 VDC)	Red
D	Power supply: Ground	Blue
E	Not used	Brown
F	Not used	White
G	RS485 (A)	Gray
H	RS-485 (B)	Pink

VP8 open-end / 4-wire data cable

Figure 5-2. FlowCell COND Flow-through Sensor electrical connection: VP8 open-end / 4-wire data cable



- 1

VP8 earth/ground cable (yellow/green)
- 4

FlowCell COND Flow-through Sensor
-  **CAUTION!** Do not ground/earth the sensor via the VP8 earth/ground cable, as the sensor is grounded via the metallic pipes/chromatography system.
- 2

Cable shield (double coaxial open-end cable and data cable conductor)
- 5

FlowCell block
- 3

VP8 open-end / 4-wire data cable

Table 5-2. FlowCell COND 4UPtF Arc Sensor electrical connection: VP8 open-end / 4-wire data cable Pin assignment

VP Pin	Function	Color
C	Power supply: + 24 VDC (7 VDC to 30 VDC)	Brown
D	Power supply: Ground	White
G	RS485 (A)	Blue
H	RS-485 (B)	Black

5.2 Controlling the 4–20 mA current interface signals with PWM

Hamilton FlowCell COND Flow-through Sensor uses the method of Pulse-Width Modulation (PWM) to adjust the direct current (DC) of the 4–20 mA interfaces which corresponds to the measured values. In principle, the pulse width (t_i) of a rectangular signal with a constant frequency and the duty cycle (t_i/T) are modulated, then 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 5-3 and 5-4).

The PWM-load of the sensors have a low-pass filters which cannot eliminate all alternating current (AC) fractions of the used PWM frequency of 3.5 kHz due to technical limitations. Therefore, the current signals of the 4–20 mA interfaces are still superimposed by a certain AC, which should be masked by lagging or input filters of the current input card of the PCS.

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, contact Hamilton Technical Support (see Section 8.4).

NOTICE

We recommend the following settings for PCS:

- Sampling rate below 3.5 kHz
- An average of more than 1 second
- Use galvanically-separated inputs to avoid oscillations.

Figure 5-3. Overview of a rectangular signal with a period (T) and pulse duration (t_1) is used to generate an analog signal value (y_1)

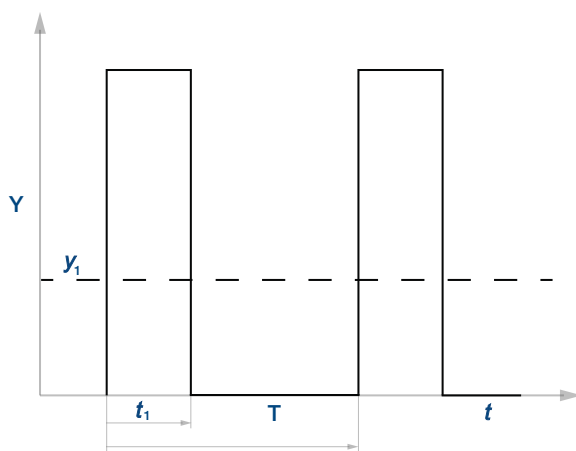
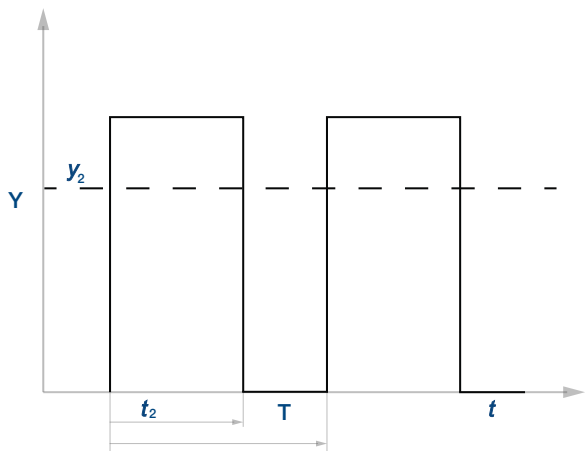


Figure 5-4. Overview of a rectangular signal with a period (T) and pulse duration (t_2) is used to generate an analog signal value (y_2)



CAUTION

- The FlowCell COND Flow-through Sensor generates 4-20 mA signals by Pulse-Width Modulation (PWM), which is not compatible with 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 5-7 illustrates a solution for such a situation.

Analog interface 1 and 2

Recommended settings for PCS wiring without galvanic isolation connected to sensors with pulse width modulation of 3.5 kHz:

- Use galvanically-separated inputs
- Sampling rate < 3 kHz and $\neq n \times 3.5$ kHz
- Average over > 1 second

5.3 Electrical connection for the analog 4-20 mA interface

The 4-20 mA interface enables direct connection of the FlowCell COND Flow-through Sensor to a data recorder, indicator, control unit or PCS with analog I/O. The FlowCell COND Flow-through Sensor works as a current sink sensor and is passive. Connect the sensor according to the Pin assignment (see Section 5.1).

For detailed technical advice on the electrical connections, contact Hamilton Technical Support (see Section 8.4).

Examples of circuit arrangement:

Figure 5-5. Three-wire loop wiring diagram for the 4-20 mA interface

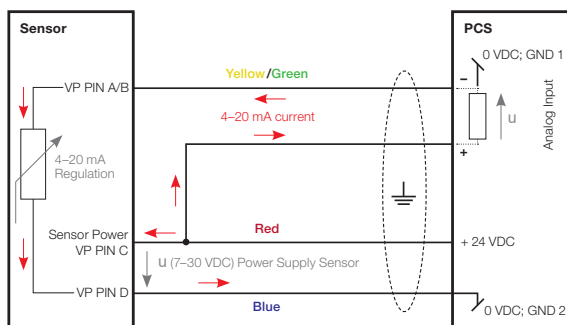
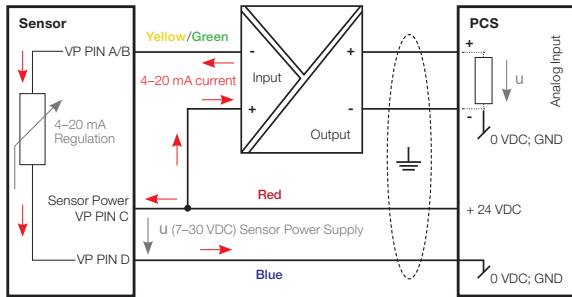


Figure 5-6. Wiring diagram with an isolation amplifier (safest form of wiring)



5.4 Electrical connection for the digital RS-485 interface

The digital RS-485 interface enables communication with FlowCell COND Flow-through Sensor for performing measurements and for calibrating and changing the configuration parameters. FlowCell COND Flow-through Sensor is always connected to digital controlling devices as a Modbus server. To function, they require a power supply (VP8 Pins C and D, see below). Section 4.2 describes the configuration for digital mode.

Additional information: Modbus RTU communication protocol

- The Modbus RTU communication protocol corresponds to the Modbus-IDA standard. For more information, refer to the Modbus organization website (<https://modbus.org/>). The Modbus physical layer is described in detail with requirements on cabling and line termination in the *Modbus Serial line Protocol and Implementation Guide*. For more information on the Modbus physical layer, refer to the *Modbus Serial Line Protocol and Implementation Guide* ► *Technical Resources* ► *Modbus Specifications*.
- The FlowCell COND Flow-through Sensor connection via Modbus can be found in the Arc sensor *Programmer's Manual* (REF 624299).

⚠ CAUTION

- All the sensors are delivered with the factory-default setting. Each sensor must be configured for its specific application before first use (see Section 4.2).
- In an electromagnetically noisy environment, we recommend that you connect the VP cable shield to the earth/ground. This significantly reduces noise interferences and improves the signal quality.

Figure 5-7. Wiring diagram for the RS-485 interface

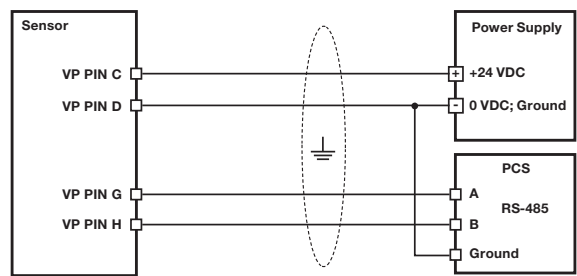


Table 5-3 provides an overview of the Pin assignment for the RS485 digital interface with the VP cable conductor.

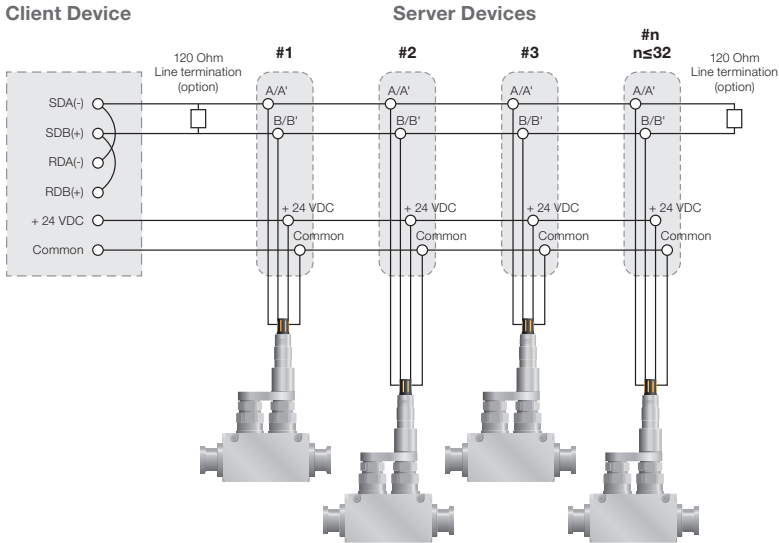
Table 5-3. Pin assignment for RS-485 digital interface

VP Pin	Function	Color
C	Power Supply: + 24 VDC (7 VDC to 30 VDC)	Red
D	Power Supply: Ground	Blue
G	RS-485 (A)	Gray
H	RS-485 (B)	Pink
Shaft	Shield	Green/ Yellow

 CAUTION

You must assign a unique Modbus device address to each sensor to ensure correct communication for the wiring configuration shown Figure 5-8.

Figure 5-8. Multi-drop bus wiring: Two-wire mode for the Modbus connection



NOTICE

- Each sensor functions as a Modbus server.
- Only one sensor can communicate with the client at a time.
- To prevent signal reflection on the lines, we recommend that you use a line termination resistor of 120 Ω on each line.
- The effect of signal reflections becomes noticeable with long cable and/or high baud rates.
- The serial Modbus connection between the RS-485 port of the client and the corresponding interfaces of the sensors must comply with the EIA/TIA RS-485 standard.

6 Assembly and Operation

This chapter describes in detail how to assemble and operate the FlowCell COND Flow-through Sensor in the process setup.

CAUTION

- *To protect the analog electronics and extend the service life of the sensor, analog measurements at temperatures above 110 °C are prohibited.*
- *Only use the sensor within the specifications (see www.hamiltoncompany.com). Failure to do so may lead to damage or measurement failure.*

General information: Responsibility and liability

Hamilton accepts no responsibility for damage cause by incorrect assembly or modification of the FlowCell COND Flow-through Sensor by third parties.

Hamilton assumes no liability and no further warranty if the FlowCell COND Flow-through Sensor is modified.

Mounting the Flow-through Sensor

The FlowCell COND Flow-through Sensor can be easily mounted to the wall or a board by using two Hex screws (M4 x 50 mm) provided in the package.

To mount the Flow-through Sensor, follow these steps:

CAUTION

Make sure that there is no damage to the temperature sensor and the FlowCell COND Flow-through Sensor during the installation.

NOTICE

The O-rings are non-serviceable parts.

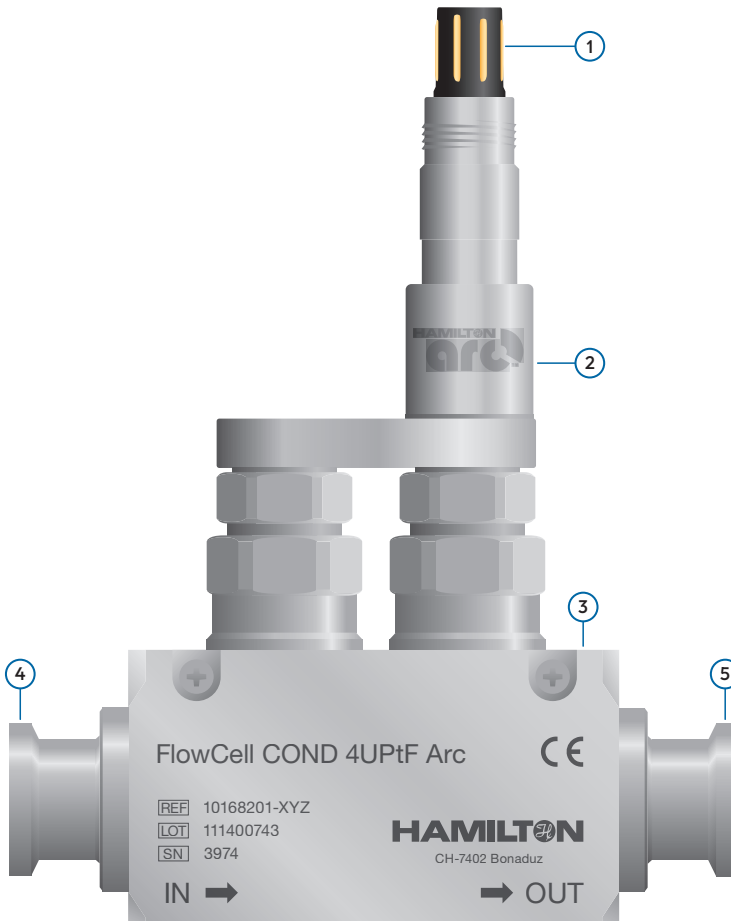
1. Position the Flow-through Sensor in the installation pipe of the process setup.
2. Connect the Flow-through Sensor to the pipe.
3. Make sure the flow Connector Ports (4 and 5) for the direction of flow (IN ➡ to ➡ OUT) indicated on the Flow-through Sensor Block align with process setup direction of flow (IN to OUT) (see Figure 6-1 and 6-2).

NOTICE

Mounting FlowCell COND the Flow-through Sensor this way will enable minimal air volume, self-draining of the flow-through, and the optimal functionality of the Flow-Cell COND Sensor.

4. Connect the flow Connector Ports (4 and 5) on the Flow-through Sensor to the process pipe: IN to IN and OUT to OUT (see Figures 6-1 and 6-2).
If required, use the two Hex screws (M4 x 50 mm) provided to mount the FlowCell COND Flow-through Sensor Block to the wall or board.
5. Verify that the Flow-through Sensor Connector Ports (IN and OUT) are correctly attached and the connection are tight.

Figure 6-1. Overview of the FlowCell COND 4UPtF Arc Sensor [1/2]



- | | | | |
|---|---|---|--------------------------|
| 1 | VP8 connector | 4 | Flow connector port: IN |
| 2 | Conductivity sensor head with integrated microtransmitter | 5 | Flow connector port: OUT |
| 3 | FlowCell block: FlowCell COND 4UPtF Arc Sensor | | |

Figure 6-2. Overview of the FlowCell COND 4UPtF Arc Sensor + pH [1/2]



-
- | | | | |
|---|---|---|--|
| 1 | Flow connector port: IN | 5 | Hamilton pH Arc Sensor
ⓘ NOTICE! A certified biocompatible pH sensor from a third-party can also be installed. |
| 2 | FlowCell block: FlowCell COND 4UPtF Arc Sensor + pH | 6 | pH tube for sensor installation |
| 3 | VP8 connector | 7 | Flow connector port: OUT |
| 4 | Conductivity sensor head with integrated microtransmitter | | |
-

7 Maintenance

You must do routine maintenance to ensure the safe operation, accurate measurement, and reliability of the sensor and its accessories.

CAUTION

Do not expose the sensor to corrosive media or substances. This will help to protect the sensor from deterioration.

CAUTION

Non-serviceable parts

Do not attempt to remove or replace the non-serviceable parts, for example, the O-rings, temperature sensor, tricalmp, FlowCell COND Flow-through Sensor, FlowCell, or other parts.

NOTICE

Hamilton will not be liable for damage to the FlowCell COND Flow-through Sensor if the operator attempts to remove the non-serviceable parts.

7.1 Verify the FlowCell COND sensor status

1. Power the sensor with the Sensor Power Cable and connect the sensor to the ArcAir application.
2. Check the FlowCell COND Sensor Status Indicator in ArcAir application for Warnings or Errors (see Table 7-1).
3. Resolve the Warnings or Errors displayed by the sensor. Refer to the Troubleshooting corrective actions (see Chapter 8).
4. Control the quality of the sensor under **Sensor Status ► Quality Counter and Temperature ► Quality Indicator**.

The status/condition of the sensor is indicated by the traffic light identification (ID) system (see Table 7-1).

Table 7-1. Sensor status indicator in ArcAir application: Overview of the traffic light ID system

Sensor status indicator: Traffic light ID system	Description
Green 	• The sensor is functioning correctly. • No errors or warnings have been registered.
Yellow 	• At least a warning has been registered. • Verify the warnings of the sensor under Sensor Status.
Red 	• At least an error has been registered. • Verify the error of the sensor under Sensor Status.
Gray 	The sensor is offline.

NOTICE

The quality of the sensor is affected by the following factors:

- Warnings
- Errors
- Verification procedure running in ArcAir application

7.2 Calibration: FlowCell COND 4UPtF Arc / FlowCell COND 4UPtF Arc + pH

CAUTION

Calibration Procedures for FlowCell COND Flow-through Sensor:

For the calibration and measurement to be successful, you must set up the calibration system as shown in Figures 7-1 and 7-2.

CAUTION

Conditions for Product Calibration:

Hamilton recommends performing a Product Calibration whenever the process conditions change to ensure the cell constant of the FlowCell COND adapts to the new conditions.

NOTICE

Calibrating the FlowCell COND Flow-through Sensor:

- The calibration procedures described below is applicable to both FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors unless stated otherwise.
- Both Automatic Standard Calibration and Product (in situ) Calibration of the FlowCell COND Sensor can be done during the process.
- For further information on how to calibrate the pH sensor, refer to the user manual for the pH sensor installed.

The FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors are delivered pre-calibrated from the factory. Note that the pH Sensor is *not* supplied with the FlowCell COND 4UPtF Arc + pH. The stability of the measurement and temperature signals are controlled automatically by the sensor during the calibration.

Two different calibration methods can be used to calibrate the FlowCell COND 4UPtF Arc and FlowCell COND 4UPtF Arc + pH Sensors. The calibration procedures are as follows:

1. Automatic standard calibration
2. Product (in situ) calibration

For additional information about the Automatic Standard Calibration and Product (in situ) Calibration, refer to the *Hamilton Arc Operating Instructions* (REF 10071115).

Conductivity standard solutions for calibration

The following Hamilton standard solutions are defined as factory defaults for calibration with automatic standard recognition:

- 1.3 $\mu\text{S}/\text{cm}$
- 5 $\mu\text{S}/\text{cm}$
- 15 $\mu\text{S}/\text{cm}$
- 1413 $\mu\text{S}/\text{cm}$
- 12880 $\mu\text{S}/\text{cm}$
- 100 mS/cm

7.2.1 Automatic standard calibration with ArcAir

CAUTION

Conditions for Accurate Conductivity Measurement:

To achieve accurate conductivity measurement, make sure that the temperature difference between the calibration medium and the process medium is minimal.

CAUTION

Calibration Conditions for FlowCell COND 4UPtF Arc + pH:

- If you use a pH sensor in the FlowCell COND 4UPtF Arc + pH, it must be calibrated separately outside of the FlowCell before you do the Automatic Standard Calibration. For further information on how to calibrate the pH sensor, refer to the user manual for the pH sensor installed.
- The pH sensor and the FlowCell COND 4UPtF Arc + pH sensor must be calibrated on the same day. Maintain a minimum interval of 4 hours between the calibrations.
- If no pH sensor is used in the FlowCell COND 4UPtF Arc + pH, you must install a dummy pH sensor (REF 242231) into the pH tube before calibrating the FlowCell COND 4UPtF Arc + pH.

The FlowCell COND Sensor provides Automatic One-point Standard Calibration, Automatic or Manual Two-point Standard Calibration.

One-point Calibration generates a linear calibration function that intersects the calibration Point 1 and the coordinate origin with the cell constant as a slope, whereas the Two-point Calibration generates a bilinear calibration function with two sections.

The first section of the calibration diagram extends from the coordinate origin to the first calibration point, which uses the first cell constant as the gradient/slope (see Figure 7-3).

The second section of the calibration diagram starts at the first calibration point and intersects the second calibration point, which uses the second cell constant as a gradient/slope and an additive element (see Figure 7-3).

NOTICE

The Two-point Calibration is useful when a wide measuring range is required.

7.2.2 Two-point calibration with a conductivity standard solution

To do Two-point Calibration with a conductivity standard solution, follow these steps:

CAUTION

Precaution for a Two-point calibration

To achieve accurate measurement for a Two-point calibration, you must first calibrate the sensor with a low conductivity standard, followed by a high conductivity standard.

CAUTION

Calibration Conditions for FlowCell COND 4UPtF Arc + pH:

- *If you use a pH sensor in the FlowCell COND 4UPtF Arc + pH, it must be calibrated separately outside of the FlowCell before you do a Two-point Calibration. For further information on how to calibrate the pH sensor, refer to the user manual for the pH sensor installed.*
- *The pH sensor and the FlowCell COND 4UPtF Arc + pH sensor must be calibrated on the same day. Maintain a minimum interval of 4 hours between the calibrations.*
- *If no pH sensor is used in the FlowCell COND 4UPtF Arc + pH, you must install a dummy pH sensor (REF 242231) into the pH tube before calibrating the FlowCell COND 4UPtF Arc + pH.*

1. Install the FlowCell COND Sensor in the calibration device (see Figure 7-1).
2. Verify that the appropriate conductivity standard flows throughout the calibration device.
3. Supply power to the FlowCell COND Sensor and connect it to ArcAir application via the Arc Wireless BT Converter or the Arc USB Power Cable.
4. Select the applicable sensor from the **Sensors** list.
5. Open the **Settings** tab and check the **Two-point Calibration**.

6. Open the **Calibration** tab.
7. Select **Manual** from the drop-down menu.
8. Enter the value for the Two-point Calibration.
9. Click **Start** to start the calibration wizard.
10. Follow the on-screen instructions in the ArcAir application to complete the calibration process.

7.2.3 One-point calibration with a conductivity standard solution

Follow these steps to do a One-point Calibration with a conductivity standard / calibration solution:

CAUTION

Conditions for Accurate Conductivity Measurement:

For accurate conductivity measurement, we recommend that you always use a conductivity standard solution with a value that best matches the measuring range of your application.

CAUTION

Calibration Conditions for FlowCell COND 4UPtF Arc + pH:

- If you use a pH sensor in the FlowCell COND 4UPtF Arc + pH, it must be calibrated separately outside of the FlowCell before you do the One-point Calibration. For further information on how to calibrate the pH sensor, refer to the user manual for the pH sensor installed.
- The pH sensor and the FlowCell COND 4UPtF Arc + pH sensor must be calibrated on the same day. Maintain a minimum interval of 4 hours between the calibrations.
- If no pH sensor is used in the FlowCell COND 4UPtF Arc + pH, you must install a dummy pH sensor (REF 242231) into the pH tube before calibrating the FlowCell COND 4UPtF Arc + pH.

1. Install the FlowCell COND Sensor in the calibration device (see Figure 7-1).
2. Verify that the appropriate conductivity standard flows throughout the calibration device.
3. Supply power to the FlowCell COND Sensor and connect it to ArcAir application via the Arc Wireless BT Converter or the Arc USB Power Cable.
4. Select the applicable sensor from the **Sensors** list.
5. Open the **Calibration** tab.

6. Select **Calibration Point 1**.
7. Click **Start** to start the calibration wizard.
8. Follow the on-screen instructions in the ArcAir application to complete the calibration process.

7.2.4 Product calibration (CP6)

Product Calibration is an in-process calibration to adapt the measurement to specific process conditions or if the sensor cannot be removed for the standard calibration.

Product Calibration adapts the cell constant to the process conditions applicable at the time of the product calibration. To restore the original cell constant, the product calibration can be deleted at any time. Note that a new standard calibration also deletes the existing product calibration.

CAUTION

Calibration Conditions for FlowCell COND Flow-through Sensor:

- *If you use a pH sensor in the FlowCell COND 4UPtF Arc + pH, it must be calibrated separately outside of the FlowCell before you do the Product Calibration. For further information on how to calibrate the pH sensor, refer to the user manual for the pH sensor installed.*
 - *The pH sensor and the FlowCell COND 4UPtF Arc + pH sensor must be calibrated on the same day. Maintain a minimum interval of 4 hours between the calibrations.*
 - *If no pH sensor is used in the FlowCell COND 4UPtF Arc + pH, you must install a dummy pH sensor (REF 242231) into the pH tube before calibrating the FlowCell COND 4UPtF Arc + pH.*
-

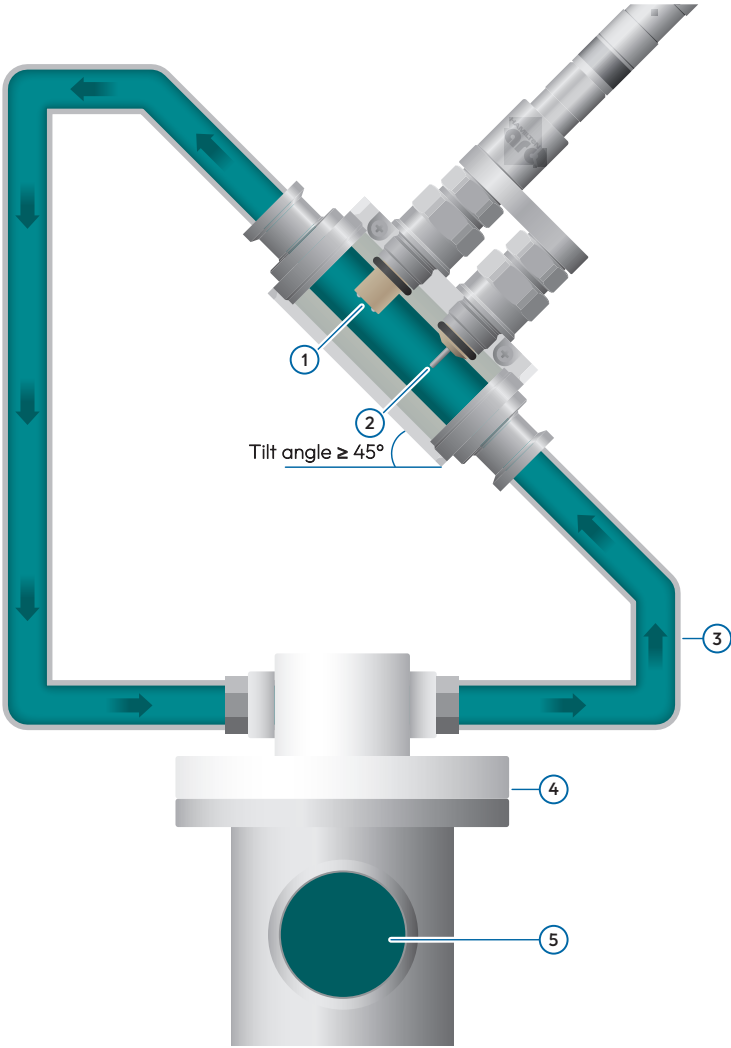
Follow these steps to do a product calibration with a conductivity standard / calibration solution:

NOTICE**On-site Calibration Service:**

Hamilton offers on-site Product Calibration of FlowCell COND Sensors as a service. Contact Hamilton technical support for additional information (see Section 8.4).

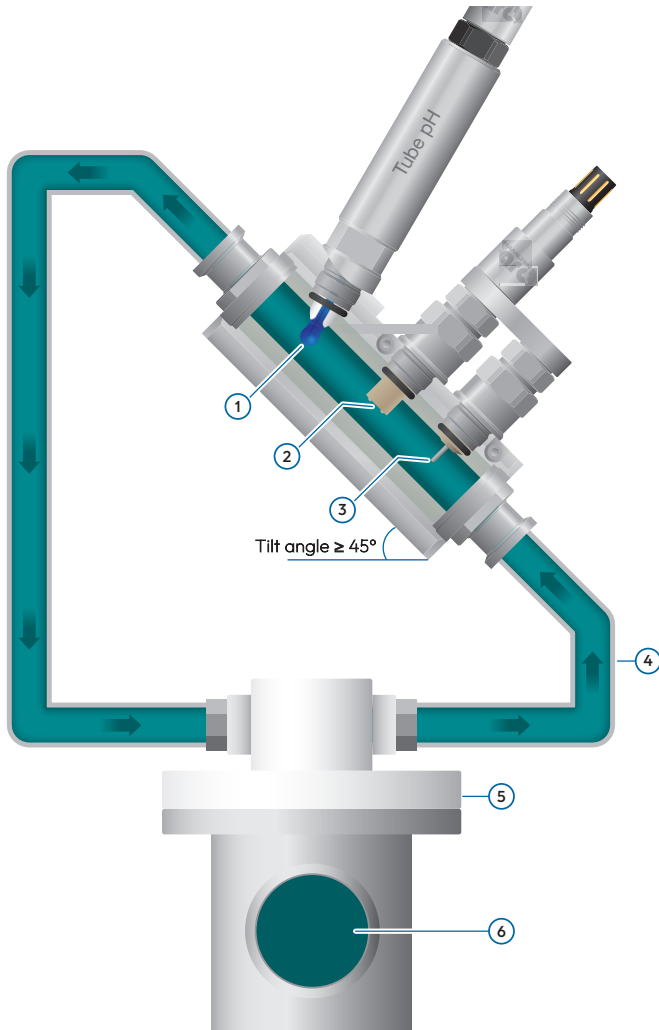
1. Connect one of the FlowCell COND Sensor to the power supply. For example, the USB Power Cable (REF 243490) and install a Wireless BT Converter (REF 242333) in your process.
2. Make sure that the sensor is mounted at an angle $\geq 45^\circ$ and the flow direction is from bottom to top. Refer to the calibration setup Figure that applies to your FlowCell COND Sensor: Figure 7-1 or Figure 7-2. Note that the FlowCell COND Sensor can also be mounted vertically for the calibration.
3. Select the applicable sensor from the **Sensors** list.
4. Select the **Process settings** tab.
5. Click **Start** to start the calibration wizard.
6. Follow the on-screen instructions in the ArcAir application to complete the calibration process.

Figure 7-1. Overview of the FlowCell COND 4UPtF Arc Sensor calibration setup



1	Conductivity sensor tip with current and potential electrodes	4	Calibration system with integrated pump for pumping the conductivity standards
2	Temperature sensor	5	Conductivity standard / Calibration solution
3	Pipe/tube connected to the FlowCell COND 4UPtF Arc Sensor and the calibration system		

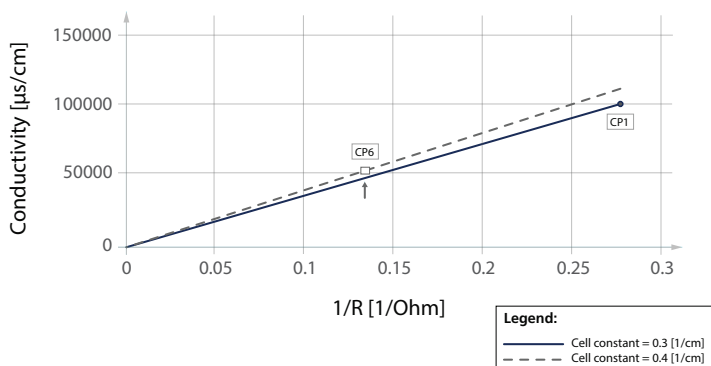
Figure 7-2. Overview of the FlowCell COND 4UPtF Arc + pH Sensor calibration setup



- | | |
|---|--|
| <p>1 Hamilton pH Arc Sensor
 ⓘ NOTICE! A certified biocompatible pH sensor from a third-party can also be installed.</p> | <p>4 Pipe/tube connected to the FlowCell COND 4UPtF Arc + pH Sensor and the calibration system</p> |
| <p>2 Conductivity sensor tip with current and potential electrodes</p> | <p>5 Calibration system with integrated pump for pumping the conductivity standards</p> |
| <p>3 Temperature sensor</p> | <p>6 Conductivity standard / Calibration solution</p> |

Figure 7-3. Graph illustrating the process calibration (CP6) in situ for the FlowCell COND Sensor compared to an established standard calibration function based on Zero Point calibration (CP1)

**Product Calibration (in situ) of the FlowCell COND Sensor:
 Product calibration (CP6) compared to an established standard
 calibration function based on Zero Point calibration (CP1)**



7.3 Cleaning

CAUTION

- *Only authorized/trained service personnel can install, operate, clean, or maintain the FlowCell COND Sensor or do other service-related tasks.*
- *Always make sure that the system is depressurized and cold, and that no process medium can be accidentally spilled before you remove the sensor from the measuring system.*
- *Always wear protective eyewear and gloves before you remove the sensor from the system, for example, cleaning the bioreactor.*
- *Do not use abrasive tissues or cleaning agents/solutions other than the recommended standard cleaning agents/solutions to clean the sensor.*
- *You must decontaminate every sensor or product before shipping it back to Hamilton Process Analytics for repair.*

CAUTION

Do not attempt to remove or replace the non-serviceable parts during cleaning, for example, the O-rings, sensor, tricalmp, FlowCell COND Sensor, FlowCell, or other parts.

NOTICE

It is possible that the electrodes will show a slow response time for a brief time after cleaning.

NOTICE

Hamilton will not be liable for damage to the FlowCell COND Flow-through Sensor if the operator attempts to remove the non-serviceable parts.

8 Troubleshooting

This chapter offers troubleshooting guidelines, tips for self-diagnosis, method of contacting Hamilton and provides Hamilton's product return procedures.

8.1 Sensor self-diagnostic

CAUTION

- You must acknowledge **warnings** by following through with the recommended corrective actions. The required corrective action will vary for each warning depending on the root cause. The warning will be displayed continuously until the corrective action is completed.
- You must address sensor **Errors** by following through with the recommended corrective actions.

The FlowCell COND Sensors provide self-diagnostic functionality to detect and identify the most common sensor malfunctions. Both interfaces, analog 4–20 mA and 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 Section 4.5).

Use the ArcAir application for monitoring the sensor status and for troubleshooting. The following types of messages are provided by the self-diagnosis function.

For additional information about the sensor status and the diagnostics features, refer to this FlowCell COND Sensor *Operating Instructions* or the *Conducell 4UxF/FlowCell COND Sensor Programmer's Manual* (REF 624299).

8.2 Warnings

Table 8-1. Warnings with the corresponding corrective actions

Warning	Possible cause	Corrective action
COND reading below lower limit	The conductivity reading is too low.	Contact your local representative at Hamilton Shanghai.
COND calibration recommended	The conductivity reading is out of range	Contact your local representative at Hamilton Shanghai.

NOTICE

pH Sensor Troubleshooting: Warnings

For detailed information on how to resolve the pH sensor Warnings, refer to the user manual for the pH sensor installed.

8.3 Errors

Table 8-2. Errors with the corresponding corrective actions

Errors/Failures	Possible cause	Corrective action
COND reading failure	An error is active.	- Investigate the cause of the error. - Contact your local representative at Hamilton Shanghai if the problem persists.
Resistance 4 electrodes too high	- The electrodes are not in liquid. - The electrodes are damaged.	Contact your local representative at Hamilton Shanghai. or Contact Hamilton Technical Support (see Section 8.4).
Resistance 4 electrodes too low	- The electrodes are not in liquid. - The electrodes are damaged.	Contact your local representative at Hamilton Shanghai. or Contact Hamilton Technical Support (see Section 8.4).
Resistance 2 electrodes too high	- The electrodes are not in liquid. - The electrodes are damaged.	Contact your local representative at Hamilton Shanghai. or Contact Hamilton Technical Support (see Section 8.4).
Resistance 2 electrodes too low	- The electrodes are not in liquid. - The electrodes are damaged.	Contact your local representative at Hamilton Shanghai. or Contact Hamilton Technical Support (see Section 8.4).

Errors/Failures	Possible cause	Corrective action
Temperature sensor defective	The temperature sensor is defective.	Contact your local representative at Hamilton Shanghai. or Contact Hamilton Technical Support (see Section 8.4).
Sensor failure	The sensor Quality Indicator is < 15%.	Contact your local representative at Hamilton Shanghai.
Internal communication error	No internal communication.	Contact your local representative at Hamilton Shanghai. or Contact Hamilton Technical Support (see Section 8.4).

NOTICE

pH Sensor Troubleshooting: Errors

For detailed information on how to resolve the pH sensor Errors, refer to the user manual for the pH sensor installed.

8.4 Request for technical support

If a problem persists after you have attempted to correct it, contact Hamilton Technical Support via email (contact.pa.ch@hamilton.ch) or phone (+41-58-610-10-10).

8.5 Return the sensor for repair

WARNING

- Make sure you decontaminate the FlowCell COND Sensor and remove health hazards such as radiation, hazardous chemicals, or infectious agents before returning the sensor to Hamilton.
 - Provide a complete description of any hazardous materials that have been in contact with the sensor.
-

CAUTION

- *Do not return an Arc Sensor to Hamilton without an RMA number. The RMA number ensures that your sensor can be tracked, so your request can be handled by the right department.*
 - *FlowCell COND Sensor that are returned without an RMA number will be sent back to the customer without being repaired.*
-

Before returning an Arc sensor to Hamilton for repair, contact our Technical Support and request Return Material Authorization (RMA) number (see Section 8.4).

9 Disposal

⚠ CAUTION

- *Do not dispose of the sensor(s) at an unsorted waste disposal point.*
- *Hamilton sensors that are worn out or no longer required must be sent to a dedicated collection point for electrical and electronic devices.*

NOTICE

You can also send the sensor to Hamilton for disposal.

The design of the Hamilton sensors optimally considers environmental compatibility and regulations compliance (see Table 9-1).

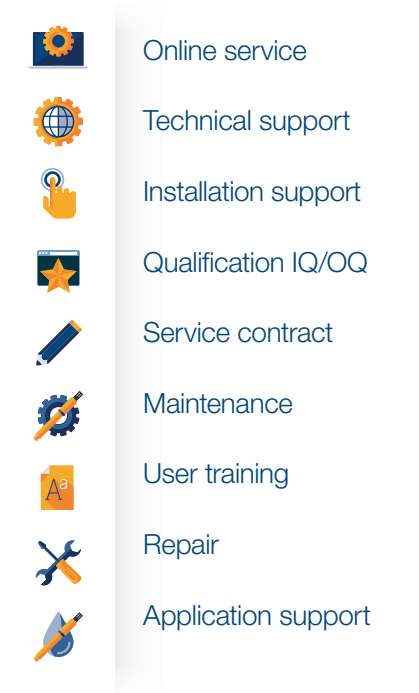
Table 9-1. Symbols used on the sensor labels and packaging

Symbol	Definition
	Dispose of in accordance with the EU Directive 2012/19/ EU or WEEE (Waste Electrical and Electronic Equipment)
	有關危險物質的列表，請參閱 Hamilton Process Analytics 符合性聲明。如需了解更多信息，請訪問 Hamilton 的網站：www.hamiltoncompany.com。 For a list of hazardous substances, see the Hamilton Process Analytics Declaration of Conformity. For additional information, visit the Hamilton website: www.hamiltoncompany.com.

10 Services

This chapter provides an overview of the services offered by Hamilton Process Analytics (see Figure 10-1).

Figure 10-1. Overview of the services provided by Hamilton Process Analytics



11 Ordering Information

This chapter provides an overview of the different types of FlowCell COND Sensors and accessories that are available to order.

11.1 FlowCell COND 4UPtF Arc Sensor ordering information

Figure 11-1. Overview of the FlowCell COND family ordering information: FlowCell COND 4UPtF Arc / FlowCell COND 4UPtF Arc + pH

Ordering Information					
10168201-XYZ	FlowCell COND Family: FlowCell COND 4UPtF Arc / FlowCell COND 4UPtF Arc + pH				
Interface					
Arc (Modbus RS-485) / Analog 4-20 mA signal					
REF 10168201-	Code X	Internal Diameter (ID) of the FlowCell			
	1	120 mm			
	2	15 mm			
	3	20 mm with tube for pH sensor			
	TBD	Special (upon request)			
	Code Y	Pipe Connection (Pipe ID)			
		1	1/4" TC 25 (4.57 mm)		
		2	3/8" TC 25 (7.74 mm)		
		3	1/2" TC 25 (9.4 mm)		
		4	3/4" TC 25 (15.75 mm)		
		5	1" TC 50 (22.1 mm) Note: Not possible for internal diameter (flow connector port) of 15 mm.		
		TBD	Special Note: Other connectors, for example, Swagelock and Hose Barb can be implemented upon request.		
		Code Z	O-ring Material		
			1	EPDM	
			2	FFPM	
			TBD	Special	

11.2 Parts, accessories, and software

 **CAUTION**

Use only original spare parts or accessories when replacement is necessary.

Sensor data cable: VP8 double coaxial / open-end data cable

The VP8 Sensor Data Cable with open-end wires is designed to enable interface connection between the sensor and a data recorder, indicator, control unit, or PCS with an analog I/O (input/output).

Figure 11-2. Arc sensor data cable: VP8 double coaxial / open-end wiring

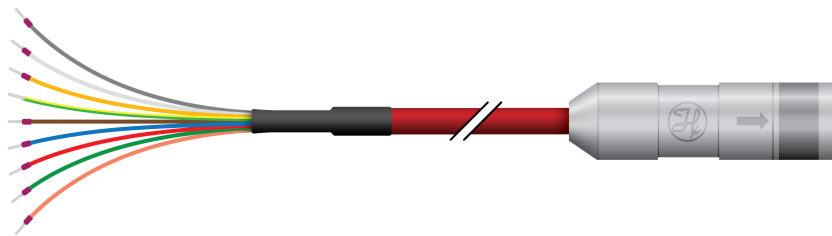


Table 11-1. VP8 double coaxial / open-end data cable

REF	Product description	Length (m)	Interface
355263	VP8 double coaxial / open-end data cable	1 m	4-20 mA/Modbus
355264	VP8 double coaxial / open-end data cable	3 m	4-20 mA/Modbus
355265	VP8 double coaxial / open-end data cable	5 m	4-20 mA/Modbus
355266	VP8 double coaxial / open-end data cable	10 m	4-20 mA/Modbus
355267	VP8 double coaxial / open-end data cable	15 m	4-20 mA/Modbus
355268	VP8 double coaxial / open-end data cable	20 m	4-20 mA/Modbus

Sensor data cable: VP8 open-end / 4-wire data cable

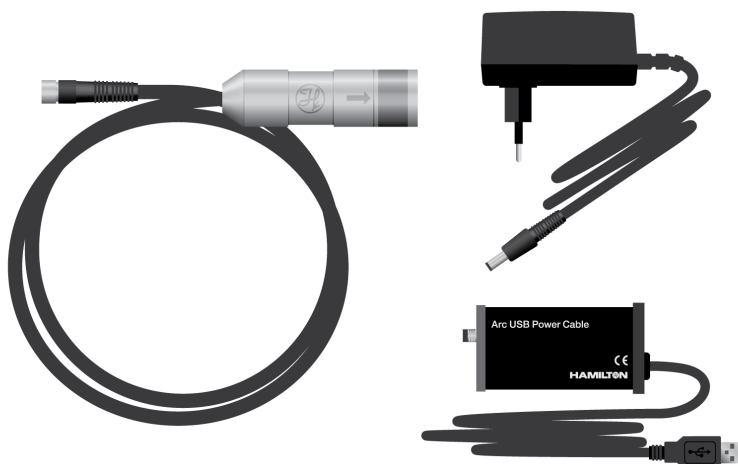
Table 11-2. VP8 open-end / 4-wire data cable

REF	Product description	Length (m)
10109026	VP8 open-end / 4-wire data cable	1 m
10109251	VP8 open-end / 4-wire data cable	3 m
10109250	VP8 open-end / 4-wire data cable	5 m

Arc USB power cable: USB/VP8 and USB/M12-8 Pole

The Arc USB Power Cable provides power via a USB port for the Arc sensors and digital communication with the ArcAir application for monitoring, configuration, calibration, and firmware updates.

Figure 11-3. Arc USB power cable: USB/VP8 and USB/M12-8 pole connector



REF	Product description
243490-01	Arc USB power cable: USB/VP8 for direct connection to the sensor
243490-02	Arc USB power Cable: USB/M12-8 pole for connection to the sensor with Arc Wi 2G BT Adapter

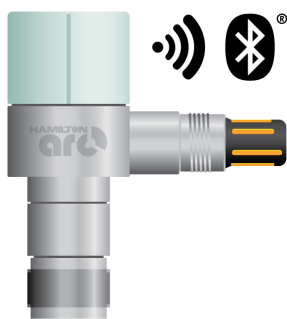
NOTICE

An additional power supply is supplied with the Arc USB Power Cable in case the PC/ Notebook does not provide enough power to power the sensor. A PC/Notebook with a USB 2.0 port or higher can provide sufficient power to the sensor.

Arc Wi 1G BT adapter

The Arc Wi 1G BT Adapter enables wireless communication between the Arc sensors and mobile devices via Bluetooth®.

Figure 11-4. Arc Wi 1G BT adapter



REF	Product description
243460	Arc Wi 1G BT adapter

Arc Wi 2G BT adapter

The Arc Wi 2G BT Adapter converts Modbus digital communication protocol to 4-20 mA signals and enables Bluetooth® communication for sensor configuration and monitoring.

Figure 11-5. Arc Wi 2G BT adapter



REF	Product description
243470	Arc Wi 2G BT adapter

Arc view tablet

The pre-configured Arc view tablet is Hamilton's solution for monitoring measurement values, calibrating Arc sensors, and configuring various parameters with the unified user interface for pH, DO, Conductivity, VCD, TCD, and ORP.

The Basic Arc View runs on the Samsung Galaxy Tab Active tablet and it comes pre-configured with the ArcAir basic software and an app blocker application. The Basic Arc View tablet is supplied with a Power Supply Cable, Operating Instructions, and Hamilton's Quick Start Guide.

The pre-configured Advanced Arc View tablet is Hamilton's solution for monitoring measurement values, calibrating Arc sensors, and configuring various parameters with the unified user interface for pH, DO, Conductivity, VCD, TCD, and ORP.

The Advanced Arc View runs on the Samsung Galaxy Tab Active tablet and it comes pre-configured with the advanced ArcAir application, including features for CFR 21 Part 11 and Eudralex Volume 4, Annex 11 Compliance, and app blocker application. The Advanced Arc view tablet is supplied with a power supply cable, a manual and Hamilton's Quick Guide.

Figure 11-6. Basic Arc view tablet for non-Ex environments



Table 11-3. Arc View Mobile

REF	Product description
10071111	Basic Arc view tablet for non-Ex environments
10071113	Advanced Arc view tablet for non-Ex environments

Arc Modbus Profinet converter

The Arc Modbus Profinet Converter is a 24VDC DIN rail mounted device that can power up to four Arc sensors and converts their Modbus output to Profinet.

Figure 11-7. Arc Modbus Profinet converter



REF	Product description
10116586	Arc Modbus Profinet converter

Arc Modbus Profibus converter

The Arc Modbus Profibus Converter is a 24 VDC with DIN rail mounting feature. The Arc Modbus Profibus Converter has the capability to power up to four Arc sensors and converts their Modbus output to Profibus DP.

Figure 11-8. Arc Modbus Profibus converter



REF	Product description
243555	Arc Modbus Profibus converter

ArcAir application download

Download the ArcAir application from the App Store or Google Play.

Figure 11-9. ArcAir application download from the App Store or Google Play





More information and free software simulation:

www.hamiltoncompany.com/process-analytics



HAMILTON®



Hamilton Europe, Asia & Africa

Via Crusch 8, 7402 Bonaduz, Switzerland

☎ +41 (0)58 610 10 10

contact.pa.ch@hamilton.ch

Website & Contact Details:

Web: www.hamiltoncompany.com

☎ USA: 800 648 5950

☎ Europe: +41 58 610 10 10



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