HAMILTON

Hamilton Arc

Operating Instructions

HAMILTON arc Air

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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 Preface

Welcome to the World of Hamilton Arc System

Congratulations on your purchase of Hamilton's Arc System. This technology enables the online monitoring and visualization of pH, dissolved oxygen, conductivity, dissolved carbon dioxide, cell density, ORP and glucose during biotechnological processes. A standard measuring loop consists of an Arc sensor connected directly to the process control system (PCS). With the ArcAir application, it is possible to communicate wirelessly with Arc sensors in parallel to the process control system interface when an Arc Wi Bluetooth adapter is connected between the Arc sensor and the sensor cable. Within the ArcAir application, Hamilton provides a validation functionality that offers central management functionality of users and validation reports for calibration, verification, configuration, and communication within the GMP guidelines for all Arc sensors. Those functionalities are also ready for compliance with FDA CFR 21 Part 11 and Eudralex Volume 4 Annex 11.

2 General Information

2.1 Intended Use

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

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

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

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

2.2 About this Operating Instruction

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

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

NOTE: Important instructions or interesting information.

3 Liability

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

4 Safety Precautions and Hazards

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

4.1 General Precautions

For safe and correct use of Arc system, it is essential that both operating and service personnel follow the generally accepted safety procedures as well as the safety instructions given in this document, the operating instruction of the Arc System.

The specification given in the specification sheets on the Hamilton website (www.hamiltoncompany.com) may under no circumstances be exceeded. Inappropriate use or misuse can be dangerous.

Cleaning, assembly, and maintenance should be performed by personnel trained in such work and according to this instruction manual. When removing and cleaning the sensor, it is recommended to wear personal protective equipment (PPE) including safety goggles and protective gloves. If the system cannot be repaired by the operator, it must be sent back to Hamilton for inspection.

Necessary precautions should be taken when transporting the sensors. For repair or shipment, the System should be sent back in the original reusable packaging box. Every Arc sensor sent back for repair must be decontaminated. If the conditions described in these operating instructions manual are not adhered to or if there is any inappropriate interference with the equipment, all our manufacturer's warranties become obsolete.

4.2 Operation of the Arc System

You must wear a suitable personal protective equipment (PPE), e.g., safety glasses and protective gloves when using the Arc System in a process environment, particularly when dealing with a malfunction where the risk of contamination from spilled liquids exist.

Installation and maintenance of Arc sensors must be performed only by trained personnel. The mobile devices and sensors must be used for their intended applications, and in optimum safety and operational conditions.

SAFETY PRECAUTIONS AND HAZARDS

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

Make sure that the PG13.5 thread and the O-ring are not damaged when screwing the sensor into the process. O-rings are consumable parts which must be replaced 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 housing. Wherever there are seals or screws, gases or liquids may leak out undetected. Always make sure that no process medium can be accidentally spilled before removing the sensor from its measurement setup. Make sure that no air or gas bubbles sticks to the sensitive part of the Arc sensor. As a consequence, the measurement value could be unstable. Do not put stress on the system by vibration, bending or torsion. Before use, verify that the sensor is properly configured for your application.

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

In compliance with CFR 21 Part 11 and Eudralex Volume 4 Annex 11, if ArcAir Advanced is used to manage Arc sensors, any GMP-relevant action performed by users, such as calibration or change settings, is traceable in the software audit trail.

4.3 Electrical Safety Precautions

Do not connect the Arc products to a power source of any voltage beyond the range stated in the Specification Sheet (www.hamiltoncompany.com).

Consequently the measurement value could be wrong.

Always use original Hamilton cables for safe connection. Make sure the cable is intact and properly plugged to avoid any short circuit.

Keep the Arc products away from other equipment which emits electromagnetic radio frequency fields and minimize static electricity in the immediate environment of the measuring parts. Carefully follow all the instructions in Chapter 6.21 to avoid electrical damage to the sensor. Any contact must be clean and dry before connection.

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

4.4 Chemical, Radioactive or Biological Hazard Precautions

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

5 Arc System Description

5.1 General Information

Hamilton was the first supplier of intelligent sensors for process measurement. With their integrated transmitter, Arc sensors enable direct communication to the process control system via 4-20 mA standard signal or digital Modbus. Incyte Arc, Dencytee Arc, Visiferm RS485, CO_2NTROL and GlucoSense require the Arc Wi 2G or Arc Wi Pivot mA adapter to enable 4-20 mA output.

Bluetooth wireless communication with the Arc Wireless Adapters may be used for monitoring, configuration, and calibration saves time without compromising the quality of the wired connection.

This Bluetooth interface enables wireless data exchange with a smartphone, tablet or computer.

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

Key benefits include:

- No separate transmitter needed
- Simple maintenance
- Easy to install
- Direct digital Modbus communication to the process control system
- Ethernet communication via OPC UA, using the Arc Modbus OPC Converter (REF 10089359) or Arc Modbus Profinet Converter (REF 10116586)
- Full online wireless option via Bluetooth for easy monitoring, configuration and calibration of up to 100 sensors with internal Bluetooth
- Experiments functionality with data export
- Reporting and central data management of users and validation reports for calibration, verification, configuration, and communication within the GMP guidelines, including FDA CFR21 Part 11 and Eudralex Volume 4 Annex 11
- Easy integration to Profibus using our Arc Modbus Profibus Converter REF: 243555

Bluetooth Communication in ArcAir

Hamilton ArcAir software communicates with Arc sensors and accessories via Bluetooth®. Connections can be established either directly to the sensor or through the Arc Wi Adapter portfolio.

Bluetooth Technology

Bluetooth technology continues to evolve. Each new version introduces improvements in connectivity, stability, and compatibility, as well as bug fixes. As Hamilton releases new sensors and accessories, these devices adopt the latest Bluetooth standards to ensure optimal performance.

Compatibility

ArcAir 3.11 supports Bluetooth version 4.0 and higher.
Not all Hamilton peripherals are fully supported with Bluetooth 4.0.
For full functionality and best performance, use devices with Bluetooth 5.0 or higher.

⚠ IMPORTANT: The Arc Wi Pivot Family requires Bluetooth 5.0 or higher. Devices running with Bluetooth 4.2 or lower are not compatible.

Recommendation

To ensure reliable communication and access to all available features in ArcAir, Hamilton strongly recommends operating with Bluetooth 5.0 or later.

The following illustrations show different types of Arc connection to ArcAir. There are two different modes of Arc sensor connection to ArcAir:

1) **Peer-to-peer mode**
   The Arc sensor is in an active Bluetooth or wired connection to ArcAir and all functions and information of that specific Arc sensor are available. No further connection to other Arc sensors is possible.

2) **Advertiser mode**
   Advertiser mode is a wireless broadcast mode in which multiple sensors send information wireless to PC or mobile device.
   The following information can be read from a PC or mobile device without any active peer to peer connection to the Arc sensor:

   - Measured value and unit
   - Temperature value and unit
   - Sensor status

The experiments use advertiser mode to record multiple sensors.

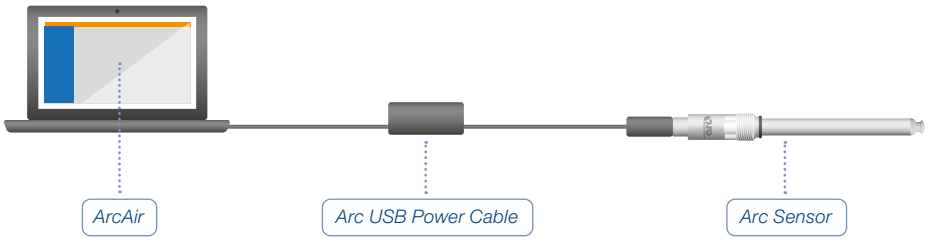


Figure 1: Arc system wired connection to ArcAir application

ARC SYSTEM DESCRIPTION

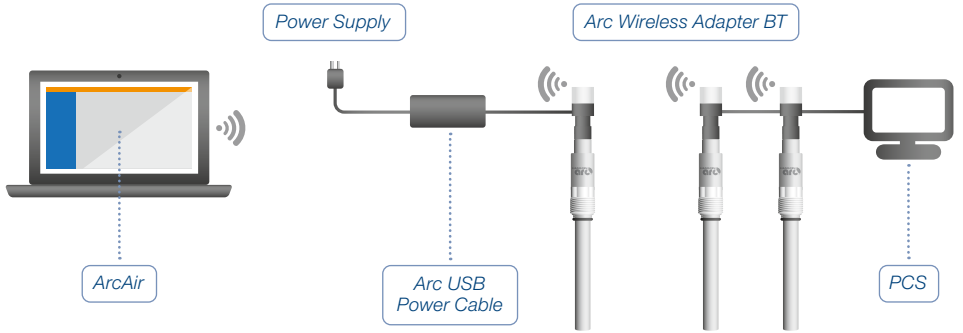


Figure 2: Arc System wireless connection to ArcAir application

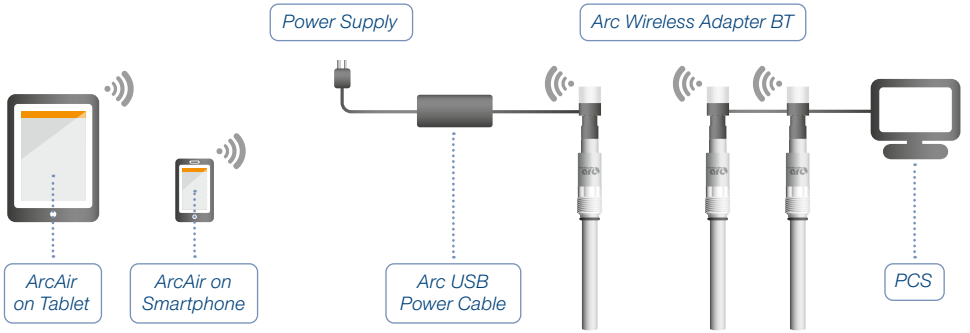
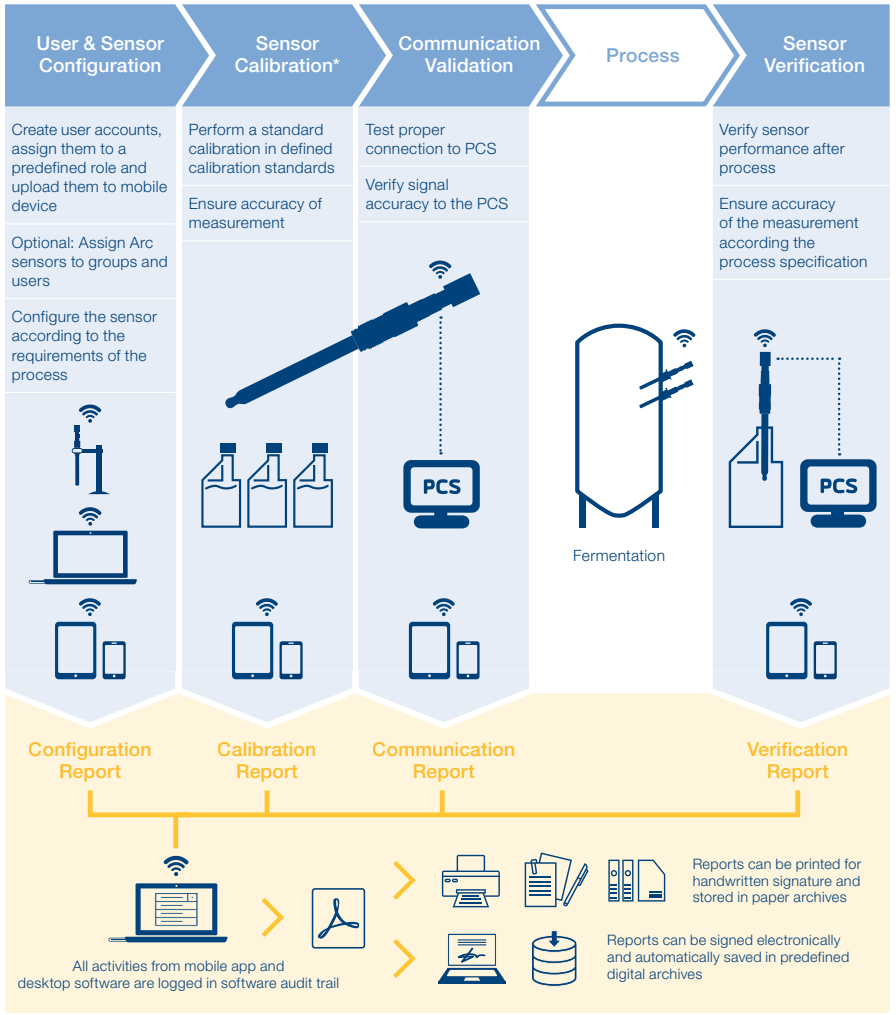


Figure 3: Arc System wireless connection to tablets or smartphones with ArcAir application

5.2 GMP for Arc Sensors

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



**Not for Incyte Arc, Dencytee RS485 or GlucoSense RS485 Sensors*

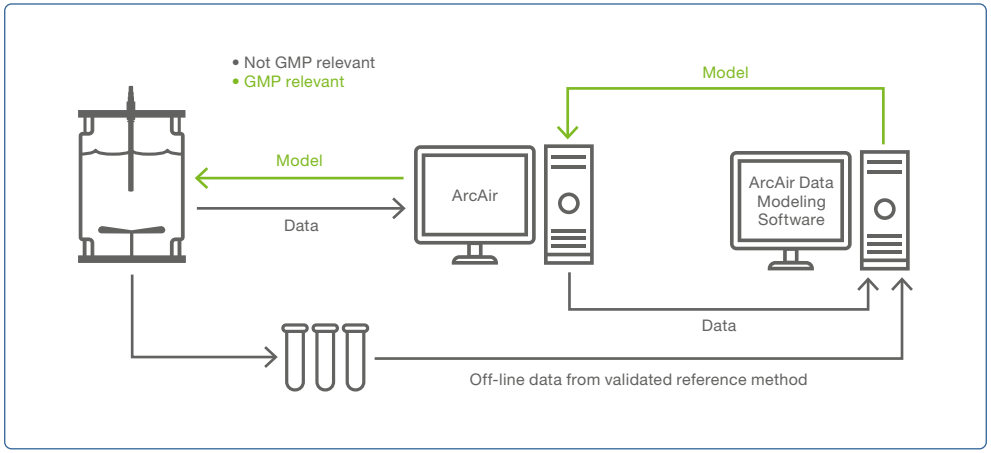
5.2.1 ArcAir Data Modeling in GMP Environment with Incyte sensors

The permittivity measurement represents the viable biovolume. This viable cell volume (VCV) can be directly proportional to the viable cell density (VCD) in the exponential growth phase.

To have the viable cell count available online, a transformation based on the viable biovolume is possible with a linear correlation. This can change when the cells enter the stationary growth phase. One of the reasons can be, that the number of viable cells remains the same while the cells swell towards the end of their life cycle (initiation of apoptosis), which can be detected with the measuring principle of the Incyte Arc sensor and leads to an increase in permittivity.

An improvement of the correlation can be achieved by using multiple frequencies and multivariate data analysis tools. ArcAir Data Modeling is Hamilton's tool to develop a multifrequency model to improve the correlation strength of viable cell counts throughout the entire bioprocess.

A



The correlation between online and offline data at the process end is not necessarily GMP relevant. The use of correlation models developed with ArcAir Data Modeling to perform online measurement of cell density during the process is GMP relevant. The correlation at the process end is performed in the ArcAir Data Modelling Software. It is the user's decision to transfer a specific model onto a sensor for routine measurement after its validation. This transfer is performed only via ArcAir. Therefore, ArcAir records the GMP relevant actions as indicated in Figure 4 electronically.

ARC SYSTEM DESCRIPTION

B

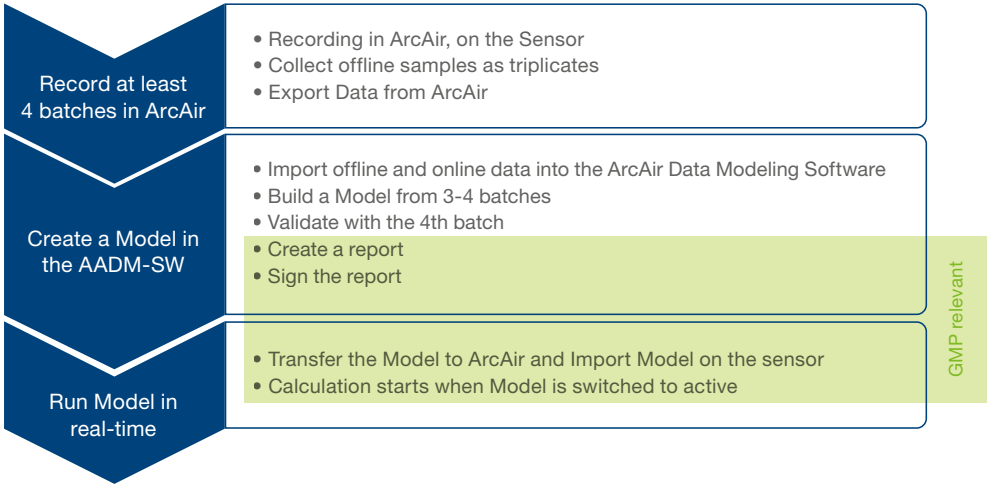


Figure 4: ArcAir Data Modeling Overview (A) and Procedure (B)

5.3 ArcAir Application

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

The application combines the cost savings and reliability of Arc sensors with the power, convenience, and portability of mobile devices. Users benefit from automated standard calibrations and configuration in the laboratory, along with product calibrations and validations in the process environment.

The additional reporting functionality offers management of validation reports for calibration, verification, configuration, communication, and user profiles within the GMP regulatory requirements for all Arc sensors.

ArcAir offers an overview of all the Arc sensors in your environment, through a computer, tablet and mobile phone.

Two different ArcAir versions are available. The basic version offers the functions of measurement, sensor status, experiment, configuration, and firmware update. The advanced version offers the full range of functions including verification, communication validation, user management, audit trail, and reporting functionality for GMP processes. See Chapter 6.3.

NOTE: Functionality on Mobile is limited to:

- Check sensor information
- Configure sensors settings and profiles
- Calibrate sensors (Incyte Arc not included)
- Adjust process settings
- Perform sensor verification (Incyte Arc not included)
- Report generation (viewable in ArcAir desktop only)
- Log of audit trail events (viewable in ArcAir desktop only)
- Inoculate for Incyte Arc
- Validate Communication
- Experiment with Arc Sensors (Incyte Arc not included)

NOTE: Connection of two Arc Wireless Converters BT to a computer results in an inability to recognize sensors and establish connection with any sensors.

5.3.1 ArcAir Application Description

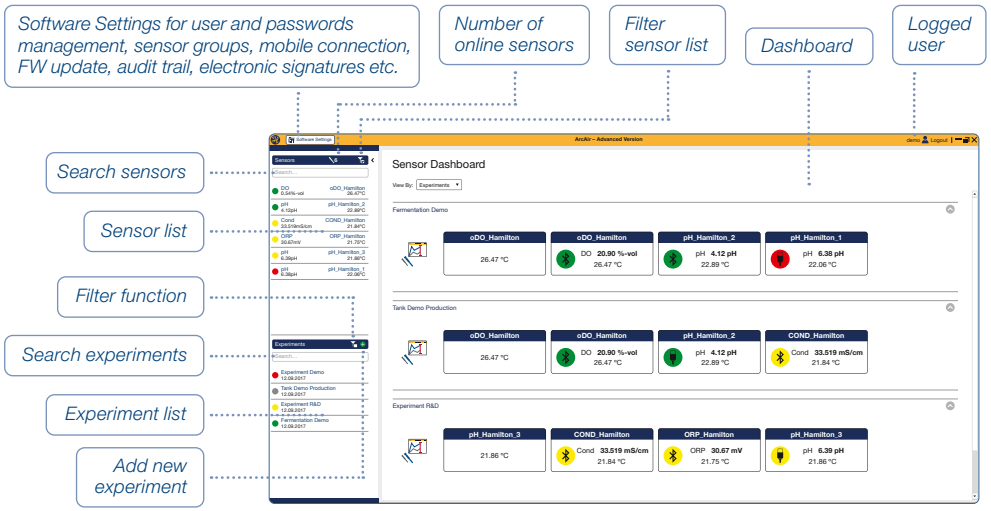


Figure 5: ArcAir Software application on computer

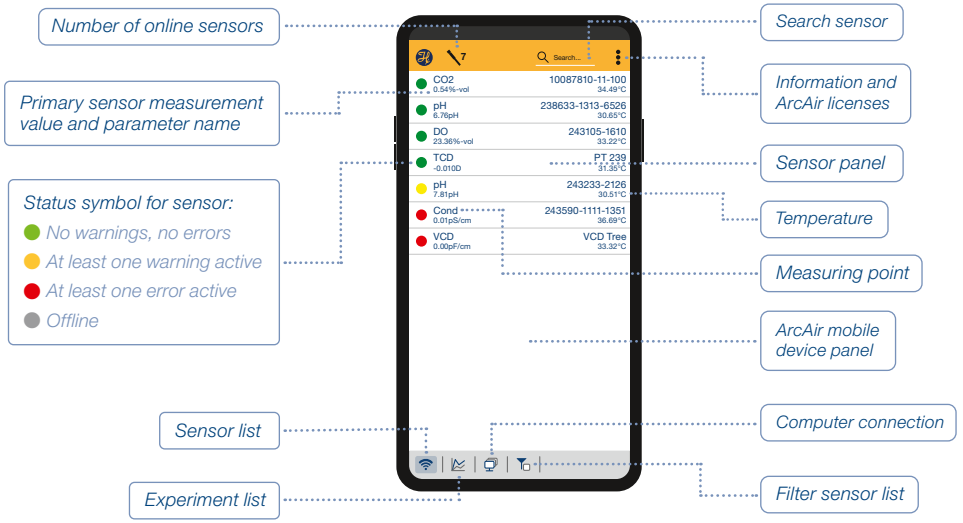


Figure 6: The ArcAir application on mobile

5.4 Arc Sensor Description

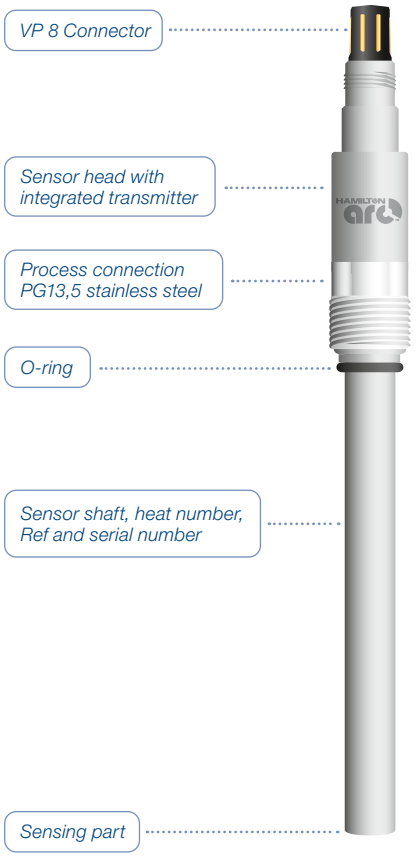


Figure 7: Arc Sensor

5.5 CFR 21 Part 11 and Eudralex Annex 11 Compliance

Arc sensors with ArcAir Advanced (see Chapter 6.5), constitute a computerized system ready for compliance with FDA CFR 21 Part 11 and Eudralex Volume 4 Annex 11 guidance. This is valid for all the GMP relevant entries and actions performed by Arc system users as described in Chapter 5.5.1 of the present manual.

5.5.1 Audit Trail

In compliance with CFR 21 Part 11 and similar EU Annex 11 recommendations, ArcAir enables the use of a secure, computer-generated, time-stamped audit trail to independently record the date and time of users entries and actions that create, modify or delete electronic records.

The Audit Trail is automatically generated and can be viewed by every user, independently from the user's roles described in Chapter 6.10.

To view the ArcAir audit trail:

1) Start ArcAir on the computer.
2) Log in with user name / password.
3) Click on "Software Settings" left upper corner.
4) Select "Audit Trail".

NOTE: The Audit trail can also be synced together with reports and users with the "sync all" button.

⚠ ATTENTION! In order to enable complete traceability of all GMP relevant actions, no user is enabled to edit the ArcAir audit trail.

Figure 8: ArcAir Audit Trail Example

In ArcAir the GMP relevant operator entries and actions are defined as "Events". As per example in the Figure 8, each event is tracked by:

- Timestamp
- Event Name
- User Name
- Measuring Point
- Information (event details)
- Source (desktop or mobile)
- Comments (e.g., unsuccessful validation)

The complete list of the events recorded in the ArcAir Audit-trail are:

GMP event's group	Event logged in Audit trail
User Roles Management	Adding a role Editing a role Deleting a role Create a user Edit a user User Login/Logout (manual or automatic) Creation of new user role Assign role to a user Assign a new role to a user Edit of a user role Inactivate a user
Process Groups Management	Create a process Edit a process Delete a process
System Management	Change of language Synchronization mobile-desktop Backup of database ArcAir application start or close
Electronic Signature	Electronic signature

GMP event's group	Event logged in Audit trail
Sensor management	Communication validation Calibration (not for Incyte Arc) Verification Product calibration Sensor settings changes Connection and disconnection from a sensor (manual or automatic) Firmware update Importing a configuration profile Changes to "Process Settings" Changes to "Communication validation" Changes to "Information" Single-use sensors calibration data saving
Report Archive Management	Creation of new report Deletion of a report

Specific information logged into the audit trail can be searched compiling the "Search" field identified by the magnifier lens and choosing the appropriate "Search Column" drop-down menu.

NOTE: In compliance with CFR 21 Part 11/ Eudralex Volume 4 Annex 11, it is responsibility of the end-user to validate all Arc sensors, desktop computers and mobile devices intended to be used in GMP environments.

System validation and maintenance should be compliant to standard computerized system lifecycle steps comprising: Design Qualification, Installation Qualification, Operation Qualification and Performance Qualification.

It is also the sole responsibility of the end-user to operate Arc sensors only with validated computer, mobile devices and/or any other computerized system intended to be used for Arc sensors management. If other software tools are used (e.g PCS, HDM), the user is responsible to validate and document the changes according to their own internal procedures.

5.5.2 Transfer Audit Trail Entries

User's entries and actions performed with mobile devices are logged in the Audit Trail as soon as a synchronization between mobile and desktop is performed.

ARC SYSTEM DESCRIPTION

1) Start ArcAir advanced on the mobile device.
2) Go to "Software Settings" in the computer version and select "Mobile Connection".
3) Follow the instruction on screen to connect the computer and the mobile device.
4) Click on "Fetch Audit Trail" on bottom left corner.
5) Verify Audit Trail entries as described in Chapter 5.5.1.

NOTE: It is strongly recommended to regularly synchronize the audit trail entries from all validated devices in order to ensure full traceability of GMP events. The audit trail records every time a synchronization is performed, in order to support full traceability of the regular execution of this action.

5.5.3 ArcAir Database

The Arc system is a closed computerized system. All the GMP-relevant electronic records mentioned in Chapter 5.2 can be accessed only by authorized users. Such users log-in the system tough a unique combination of user-name and password as described in Chapter 6.10 and their actions are tracked in the audit trail as explained in Chapter 5.5.1. The audit trail, user's accounts and all the others GMP relevant electronic records are saved in ArcAir SQL Lite database.

The database is secured and can be accessed only through ArcAir software. After the software installation it is automatically placed in C:\ProgramData\HAMILTON\ArcAir.

Administrators can manage the database by performing operations such as "database backup" or "database change" to older backups (equal to the function "database restore"). Administrators can change the path where the database is saved, as well.

To access the database management:

1) Start ArcAir on the computer.
2) Log in with the Administrator username / password.
3) Click on "Software Settings" left upper corner.
4) Select "General Settings".
5) Select "Database".
6) Perform the required operations.

5.5.4 ArcAir Data Modeling Software

When using the ArcAir Data Modeling Software the GMP relevant parts are tracked in ArcAir, please refer to Figure 4 for details. The GMP relevant parts are indicated in green and must be approved and released by at least one specific user.

The relevant data is recorded or exported via ArcAir and has to be imported into ArcAir Data Modeling Software. Here the model is built and validated. After validation the model is defined by creation date and time as well as s checksum. This checksum works by hash and salt identification and ensures that the data was not changed between model-export from ArcAir Data Modeling onto the sensor via ArcAir.

6 Installation

6.1 System Requirements

The following system requirements must be met when installing and using the ArcAir Software.

Operating system	PC / Notebook	Windows 10, Windows 11
	Mobiles	- iOS 17, 18 - Android 12, 13, 14, 15, 16
Tested Mobile Devices	Apple: iPhone 13, iPhone 15, iPhone SE Android: Google Pixel 6, Samsung S22, Samsung Galaxy Tab Active 5, Google Pixel 8, Samsung Galaxy A54, Samsung Galaxy Tab Active 3	
Installation rights	Administrator	
Free hard disk space	2 GB	
Free space for data	20 GB	
USB port	2 Type A USB ports	
Minimum Display Resolution (PC / Notebook)	1280 x 768 px	
RAM	16 GB	
Bluetooth Version	≥ 5.0 (if using internal/USB Bluetooth)	
Software	.NET 4.8.1	

6.2 Unpacking Arc Sensors and Accessories

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

Figure 9: Arc sensor delivery package (e.g., Visiferm RS485-ECS)

6.3 Configuring the Arc Sensor with ArcAir

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

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

> For more details see Chapter 6.15

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 their functionality:

	ArcAir Basic	ArcAir Advanced
Availability	Free download from Hamilton website or App Store	Update from the basic version
Intended for	PC/Mobile	PC/Mobile
Functions	Measuring, Sensor Status, Experiment function, Configuration, Firmware update	Basic functions plus, Verification, Communication Validation, User Management, Audit Trail, Report functionality

6.4 Installing ArcAir Basic on the Computer

1) Download the Zip file “ArcAir” from the Hamilton webpage www.hamiltoncompany.com (search for “ArcAir Software”).
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 following the instructions on the screen.

NOTE: The old specific chart functionality of Incyte Arc is no longer available in ArcAir. Therefore, the measurement data from ArcAir 3.5 or older should be exported before installing 3.6, and higher.

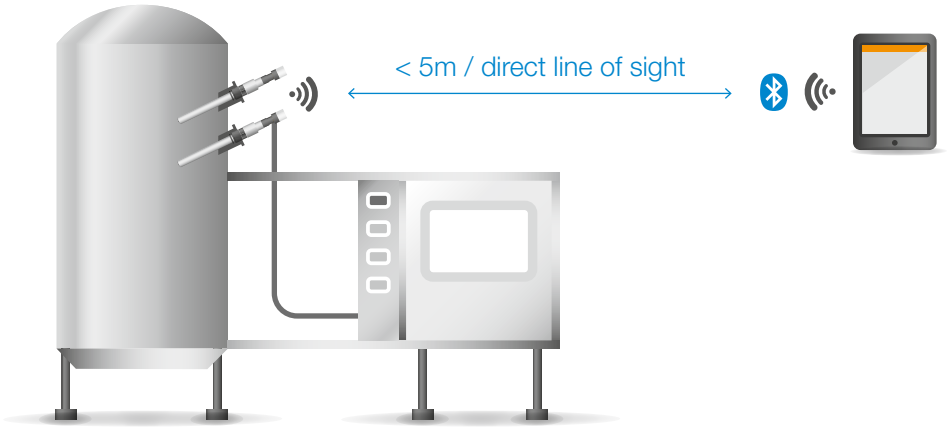
NOTE: Hamilton releases the updates of ArcAir Windows software on www.hamiltoncompany.com. The webpage directs you to download the latest released version of the software. To install it, perform the same steps described in Chapter 6.4. The install file will automatically uninstall the old release and install the new release without the need to manually uninstall the previous version.

INSTALLATION

6.5 Configuring your Bluetooth Connection

Note on Bluetooth connectivity

Bluetooth is a short-range wireless technology standard. While a state-of-the-art technology, it too has its shortcomings. Most notably is the limited range and attenuation in metal and liquid. In a biopharma environment, both factors are heavily present. When using Bluetooth communication make sure you have a clear line of sight of the sensor (no obstacles) and where possible, be closer than 5m away from the sensor.



Using an Internal Bluetooth chip or standard USB BT converter

Together with ArcAir 3.8.1, the ability to use 3rd party Bluetooth chips with ArcAir was introduced. The use of 3rd Party chips is encouraged and enables the latest Bluetooth features to be used in conjunction with ArcAir.

To use Bluetooth connection with more than 30 devices in the Bluetooth range of the computer an internal BT chip or standard USB BT adapter must be used.

NOTE: While technically ArcAir will function with all BT adapters with BLE 4.1 and greater, some are better than others and are out of our control. Something as simple as the position of the ariel can severely jeopardize the performance. Please make sure that you use a trusted, tested, and high-quality BT adapter together with ArcAir.

Changing from Hamilton BT adapters to an internal BT chip or standard USB BT adapter or vice-versa.

1) Open the “Software Settings” menu (top left-hand corner).
2) Select “Settings”.
3) Select “Bluetooth Settings”.
4) Use the radio button to select either “Use Hamilton Arc Wireless Converter” or “Use Internal BT chip or standard USB BT converter”.
5) Restart ArcAir for changes to take effect.

NOTE: The startup process with an Internal BT chip or standard USB BT converter takes longer than the Hamilton BT devices as they do not have dedicated firmware and need to be configured by ArcAir before use.

Upgrading to ArcAir Advanced with an internal BT chip or standard USB BT adapter selected

Upgrading to arc air advanced can be done as normal detailed in Chapter 6.6 however if you have an Arc Wireless Converter BT Advanced REF 242333, this will not automatically be detected by the system if an internal BT chip or standard USB BT adapter is configured.

In this case, to Upgrade to ArcAir advanced you will need to:

1) Change the Bluetooth settings as indicated in the chapter “Changing from Hamilton BT adapters to an internal BT chip or standard USB BT adapter or vice-versa.” To “Use Hamilton Arc Wireless Converter”.
2) Upgrade with automatically take place on restart of ArcAir.
3) Change the Bluetooth settings as indicated in the chapter “Changing from Hamilton BT adapters to an internal BT chip or standard USB BT adapter or vice-versa.” To “Use Hamilton Arc Wireless Converter”.
4) ArcAir is now Advanced and will stay advanced for 180 days, after which it is necessary to perform the above procedure again.

NOTE: Upgrades via mobile devices are not affected.

6.6 Upgrade ArcAir to Advanced Version

To upgrade ArcAir computer version, ArcAir Advanced Mobile device (Ref 10071113), Arc Advanced Upgrade Key, or a mobile device with an advanced version of ArcAir installed is required.

Upgrade via Arc Wireless Converter BT (no longer available)

1) After installing ArcAir on the Computer, connect the Arc Wireless Converter BT with ArcAir Advanced license key / Arc Advanced Upgrade Key.
2) Once your computer has identified the licence key, a pop up appears with the message “Your ArcAir is upgraded successfully to Advanced”.
3) Restart ArcAir to gain access to the advanced features.

Upgrade via ArcAir Mobile

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

6.7 Installing ArcAir on non-Hamilton Mobiles

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

Download on the App Store

GET IT ON Google Play

NOTE: In territories, such as China, the Google Play Store is not an option. Please contact Hamilton customer support (customersupport.pa.ch@hamilton.ch)

6.8 Upgrade ArcAir via In-App Purchase

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

6.9 Update ArcAir on Arc View Mobile Basic or Advanced

6.9.1 Arc View Mobile Revision 12 or lower / Samsung Galaxy Tab Active 3 or lower

1) Touch 5 times on the Arc View Mobile screen.
2) Enter the app blocker administrator password.
3) Select “Exit SureLock” (this will end SureLock and go back to the original Android home screen).
4) Touch “Exit”.
5) Uninstall the old ArcAir Advanced version.
6) In case you own a Arc View Mobile Basic (Ref 10071111), download the .apk file “ArcAir Basic” from Hamilton webpage www.hamiltoncompany.com (search for “Arc Mobile Devices”). In case you own a Arc View Mobile Advanced (Ref 10071113 or Ref 243690 for the versions before ArcAir 3.0), download the .apk file “ArcAir Advanced” from the same webpage (search for “Arc Mobile Devices”).
7) Click on the .apk file to start the installation.
8) Touch Install.
9) After installation switch on the app blocker “SureLock” by opening SureLock application.
10) Update completed

NOTE: On Hamilton's pre-configured mobile devices an app blocker application is installed. The App blocker administrator mode gives you access to the Android user interface of the mobile and system functionality. To access the administration mode a password is required for the application (Default Password 0000 or 1234). The Password must be changed by entering the default password, open App blocker:
> Left menu > SureLock Settings > Change Password

NOTE: It is possible to update Arc View Mobile Basic only with .apk file «ArcAir Basic» and Arc View Mobile Advanced only with .apk file «ArcAir Advanced». It is not possible to install the .apk file «ArcAir Advanced» on a ArcView Mobile Basic device.

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

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

6.9.2 Arc View Mobile Revison 13 or higher / Samsung Galaxy Tab Active 5 or higher

Upgrades are done via the Hamilton eMDM system.

1) In order to Upgrade Arc Air you need to contact Hamilton Customer support (customersupport.pa.ch@hamilton.ch) to arrange an upgrade. Please quote your IMEI (International Mobile Equipment Identity) number found in the Phone app.
2) Dial *#06#.
3) A screen will pop up showing the IMEI number.
4) In order to upgrade, you will need to connect the device to WIFI with an active internet connection, the device will be remotely configured and updated.

6.10 Connecting an Arc Sensor to ArcAir

1) Connect one of the Arc sensors with the power supply, e.g., by using the Arc USB Power Cable on a standard USB 2.0 or 3.0 port (see Figure 1).
2) Switch on the mobile's Bluetooth connection or connect a Wireless Converter BT to USB Port of your computer (only for wireless connection, see Figure 2 and Figure 3).
3) The ArcAir application recognizes and displays the connected sensors automatically.

NOTE: For automatic sensor login a unique and global Operator Level S password for all Arc sensors is required. Please make sure you have added the same Operator Level S Password for all Arc sensors in the ArcAir application under Software Settings/Settings/ Operator Level S Password. Otherwise, the Arc sensors are not displayed in ArcAir.

6.11 Securing the Hamilton Sensors: Changing the Operator Level S Password

To enhance the security of the Hamilton sensors at your facility, it's highly recommended to change the global Operator Level S password routinely. This security measure ensures that unauthorised or unmonitored changes cannot be made to your sensors during operation.

6.11.1 On the PC application

Here's how to change the Operator Level S password:

1) Navigate to the main screen and select "Software Settings".
2) From the menu bar on the left-hand side, choose "Settings".
3) Within the settings menu, locate and select "Operator Level S password".
4) Click on "Change password".
5) Follow the on-screen prompts to complete the password change.

These prompts will guide you through the process.

NOTE: When changing the S-Level password on a sensor, users now receive a confirmation message clarifying the action.

ArcAir will prompt you to input the old password when the sensor's current password is unknown. Without the correct old password, the connection cannot be established.

6.11.2 Mobile Application Instructions

Standalone Application

If you're utilizing the mobile app as a standalone application, you have the ability to change the Operator Level S password directly within the mobile app. Here's how to do so:

1) Tap on the three dots icon (⋮) located in the top right-hand corner.
2) Choose "Operator Level S Password".
3) Follow the on-screen prompts to complete the process.

Integration with ArcAir Advanced System

If you're using the ArcAir Advanced system with user profiles already created on ArcAir, the Operator Level S password is automatically transferred to your mobile device along with the user profiles. To do this, simply follow the mobile synchronization instructions to transfer the password.

NOTE: If no user accounts have been created on ArcAir, no password will be transferred as the passwords are inherently tied to user accounts.

6.12 Create User Accounts

ArcAir advanced allows System Administrators to create user accounts and assign them to user roles with pre-defined role rights.

1) Start the ArcAir application on the computer.
2) Log in as an administrator.
3) Click on “Software Settings” left upper corner.

4) Select “User Management”.
5) Click the “Add” Button for opening the “New User” window.
6) Type in the user details and define a temporary password.
7) Click on tab “Role” and assign the user to one of the user-roles listed. If no role is chosen, the user will automatically get the role “Calibration Technician”.
8) Click on “Save all” right lower corner.
9) In compliance with Part 11 and Annex 11, the first time the new user will log-in, he/she will be requested to enter the temporary password and set his/her own personal password.

ArcAir has built-in user roles with pre-defined role rights:

Role Name	Role Rights
Administrator	Sensor Calibration* Database Management Security Settings Language Changes Role Management System Settings Delete Reports Mobile connection Sensor Settings Sensor Firmware Update User Management System Process Communication Validation Audit-trail Verification Electronic Report Signing
Calibration Technician	Sensor Calibration* Mobile connection Audit-trail Verification Electronic Report Signing
Production Technician	Mobile connection Communication Validation Audit-trail Verification Electronic Report Signing
Quality Manager	Audit-trail Electronic Report Signing

**Not for Incyte Arc, Dencytee RS485 and GlucoSense RS485*

NOTE: First user is the administrator and all user rights are assigned as default.

NOTE: User Accounts are created first on the computer. In order to apply the changes to the users on your mobile devices, one needs to transfer the user information as described at Chapter 6.15.

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

6.13 Create Customized User Roles

This function allows administrators to define customized user roles.

1) Start the ArcAir application on the computer.
2) Log in as an administrator.
3) Click on “Software Settings” left upper corner.
4) Select “User Roles”.
5) Click “Add Role”.
6) Enter the new role name.
7) Check the role rights to be assigned to the new role.
8) Click the save button in the right lower corner.

NOTE: The standard roles of Administrator, Calibration Technician, Production Technician and Quality Manager cannot be edited or deleted in order to ensure full traceability of the OQ tests. An administrator still has the possibility to add and edit user roles according to his/her needs. In this case, a user-added role cannot be deleted as long as it is assigned at least to one user.

6.14 Security Settings for Password and Auto Log-out

In compliance with the GMP guidance for computerized systems, ArcAir Advanced enables Administrators to set rules for passwords management and users log-out. Such rules include:

- Password length
- Password complexity
- Password expiration
- Users automatic log-out

To access the security settings:

1) Start ArcAir on the computer.
2) Log in with the Administrator username and password.
3) Click on “Software Settings” left upper corner.
4) Select “Settings”.
5) Select “Security Settings”.
6) Apply the required settings.
7) Click on the button “Save” on the bottom.

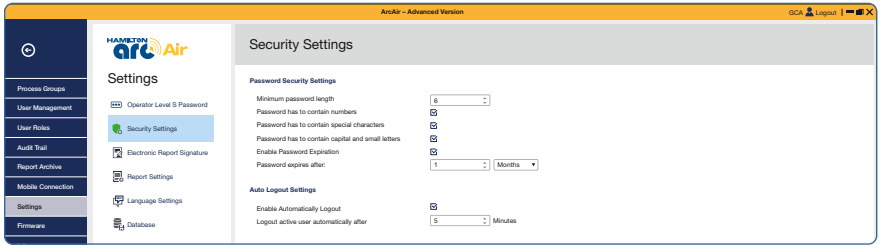


Figure 10: ArcAir Security Settings

NOTE: As soon as an administrator changes the password settings, every user will be requested to set a new password compliant to updated rules at first log-in.

NOTE: After failed login attempts, the system now introduces a delay between retries instead of locking the user account, enhancing protection against brute-force attacks.

INSTALLATION

NOTE: Since ArcAir 3.10.1 Login attempts experience increasing delay (instead of account blocking) after incorrect logins for improved security compliance.

6.15 Create Process Groups

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

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

6.16 Assign Process Groups to User Accounts

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

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

1) Start the ArcAir application on the computer.
2) Click on “Software Settings” left upper corner.
3) Select “User Management”.
4) Double click on a user or create a new one (see Chapter 6.10) for opening the user editor.
5) Click the “Process Groups” tab within the user editor.
6) Assign process groups to the user by selecting the assigned check boxes.
7) Click “Save all”.

INSTALLATION

6.17 Configuring the Arc Sensor Parameters

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

A description of the available settings is given below:

Parameter Name	Description	Default Value	Configuration
Measuring point	User can define a sensor name for better identification of the measuring point	e.g., 242111-1234	Optional
Measurement Unit	This is the measurement’s physical unit	pH: pH DO/CO_2: %-vol ORP: mV eDO: %-vol COND: µS/cm VCD, TCD: pF/cm or mS/cm GLC: g/l	Required
T unit	This is the temperature’s physical unit	°C	Required

Interface Settings:

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

SIP/CIP Cycles Settings:

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

NOTE: For more information about measurement and calibration settings, please refer to the corresponding operating instructions of the individual Arc sensors.

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

6.18 Managing Measuring Point Names

The measuring point name of a Hamilton Arc sensor is designed to be user-configurable, facilitating easy identification of a specific sensor at a specific measuring point. To avoid confusion, it is highly recommended to ensure that these names remain unique since ArcAir relies on these identifiers to distinguish between sensors.

Effective measuring point names should be distinctive and contain pertinent information to identify the point accurately. The default measuring point name provided by the factory (REF + SN) is advisable to retain.

However, you may customise the sensor's name by adding a specific title followed by a unique identifier for more intuitive identification. For example, the probe's serial number (SN) is a suitable unique identifier. For instance, "B1pH2 31524".

Handling Duplicate Measuring Points

ArcAir only permits one unique name per measuring point. Should a duplicate name be entered, the system will alert the user. You will then be prompted to alter the name of one of the sensors if it matches an existing name in the database.

Should you need to retain the name (for instance, when replacing an existing sensor), the current offline sensor bearing that name should be removed from the list on the screen's left side. Once this action is completed, the duplicate name warning will be cleared, allowing you to proceed as usual.

6.19 Create Configuration Profiles

1) Start the ArcAir application.
2) Select the desired sensor.
3) Open settings.
4) Select configuration profile.
5) Enter a profile name.
6) Click Create.
7) Message pops up "Configuration Profile was successfully created".

6.20 Import Configuration Profiles to Arc Sensor

1) Start the ArcAir application.
2) Select the desired sensor.
3) Open settings.
4) Select the configuration profile from the dropdown list.
5) Decide if a configuration report is required or not.
6) Message pops up "Configuration Profile was successfully imported to sensor".

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

6.21 Transfer and Electronically Sign Reports

In compliance with GMP guidelines for electronic data management, it is possible to generate and electronically sign reports to document the Arc sensors management operations executed with ArcAir software. Such events include sensor calibration, validation, configuration, and communication validation.

In order to validate and electronically sign an existing report, it is necessary to transfer it first from mobile devices to ArcAir computer version:

1) Start ArcAir advanced on the mobile device.
2) Go to "Software Settings" in the computer version and select "Mobile Connection".
3) Follow the instruction on the screen to connect the computer and the mobile device.
4) Click on "Fetch Reports" in the bottom left corner.
5) Once all reports are transferred go to "Report Archive".
6) New reports will be displayed on top.
7) Double click or select the report to validate.
8) A new window opens showing the selected report, with the electronic signature of the user who created the report.

9) Validate that sensor data in the report are correct.

10) Go back to “Report Archive” and flag the validated report.

11) Click on “Add Approval”.

12) A new window opens automatically showing the report, with the electronic signature of the user who approved the report.

13) A copy of the signed report is automatically exported in the standard path C:\Hamilton\ArcAir\Reports

If the reports are generated using only the ArcAir computer version, only the steps from 5 to 13 are needed to validate and sign them.

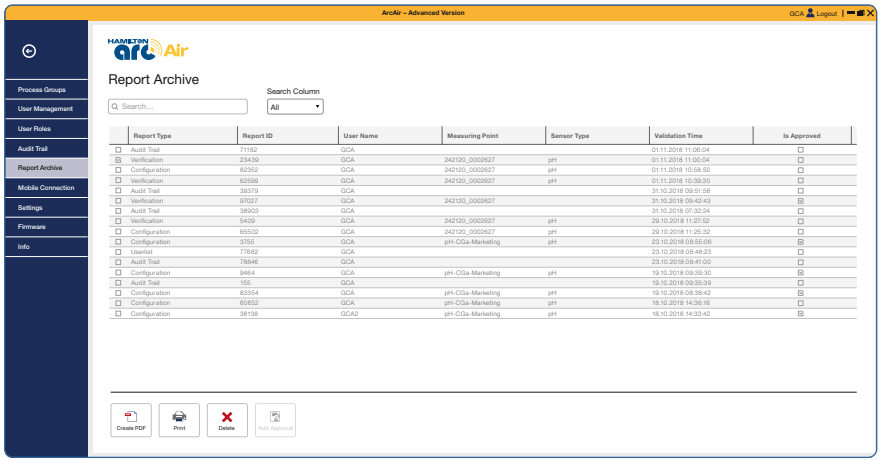


Figure 11: Report Archive View

NOTE: The electronic signature of reports must be activated by a system Administrator in ArcAir Software Settings as described in chapter 6.18.1. If the electronic signature is not activated, the reports will be created with the space to add a handwritten signature, after printing them.

NOTE: All reports (incl. audit trail data) downloaded to the ArcAir computer version will be automatically removed from the mobile device.

6.22 Electronic Signature and Report Settings

6.22.1 Electronic Signature Activation

ArcAir Advanced requires Administrators to activate electronic signatures in order to use them as explained in Chapter 6.17.

1) Start ArcAir on the computer.

2) Log in with the Administrator username and password.

3) Click on “Software Settings” left upper corner.

4) Select “Settings”.

5) Select “Electronic Report Signature”.

6) Flag “Electronic Report Signature”.

7) Click on the button “Save” on the bottom.

6.22.2 Report Settings

ArcAir Advanced enables users to customize the reports, such as including the Company logo and information, as well as changing the path folder, where the reports are automatically copied after electronic signature approval (see Chapter 6.17).

1) Start ArcAir on the computer.

2) Log in with your username and password.

3) Click on “Software Settings” left upper corner.

4) Select “Settings”.

5) Select “Report Settings”.

6) Apply the required changes.

7) Click on the button “Save” on the bottom.

6.23 System Language

Administrators can change the language of the ArcAir user interface. The available languages are: English, German, French, Spanish, Italian, Chinese, Hungarian, Russian and Japanese.

1) Start ArcAir on the computer.
1) Log in with the Administrator username and password.
2) Click on “Software Settings” left upper corner.
3) Select “Settings”.
4) Select “Language settings”.
5) Choose the language form the drop-down menu.
6) Click on the button “Save” on the bottom.

NOTE: The language change will not affect the reports, graph or exported files. They are set to be generated always in English.

6.24 Install Arc Sensor in your Measuring Loop

The mechanical design of the Arc sensor is compatible with all Hamilton process housings, including FlexiFit, Retractex, RetractoFit and Hygienic Sockets.

Before installing the armatures, you should test that the seal is tight and the parts are all in working order. Ensure that there is no damage to the sensor or the armature.

Check whether all O-rings are in place in the appropriate grooves and are free of damage. To avoid any mechanical damage to O-rings on the assembly, they should be lightly greased.

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

6.24.1 VP 8 or M12 Pin Designation

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

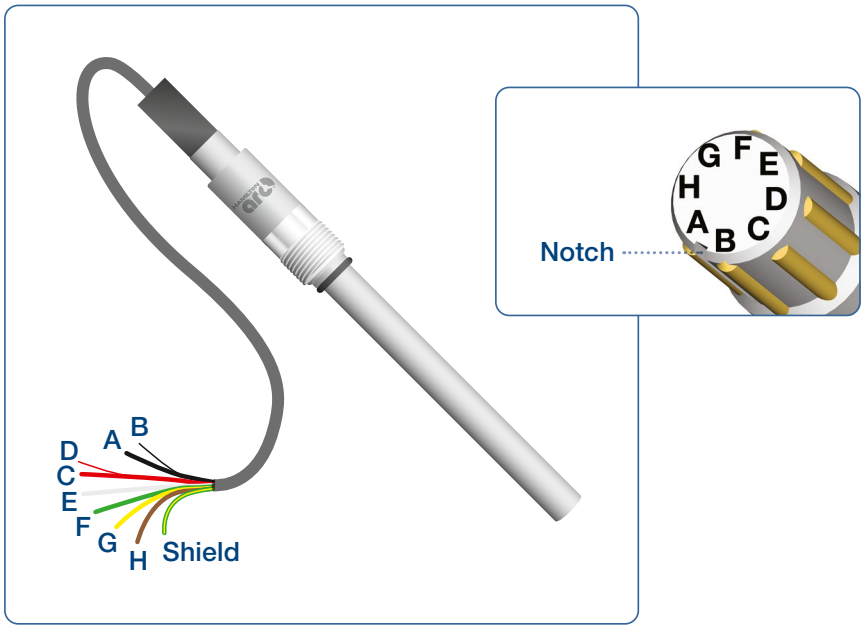


Figure 12: Arc sensor with VP8 double coaxial open-end cable

VP Pin	Function	Color Double Coaxial Cable	Color Data Cable
A	4–20 mA interface (mA interface 2)* or for VisiFerm DO the ECS interface	Coaxial core black transparent	Yellow
B	4–20 mA interface (mA interface 1)*	Coaxial shield black	Green
C	Power supply: +24 VDC (10 to 27 VDC)	Coaxial core red transparent	Red
D	Power supply: Ground	Coaxial shield red	Blue
E	Temperature sensor NTC 22 kOhm** for ECS mode	White	Brown
F	Temperature sensor NTC 22 kOhm for ECS mode**	Green	White
G	RS485 (A)	Yellow	Gray
H	RS485 (B)	Brown	Pink
Shaft	Sensor shaft connected to earth	Green/Yellow	Green/Yellow

**Not for Incyte Arc, Dencytee Arc, CO_2NTROL and GlucoSense. No 4-20 mA output is possible without an Arc Wi 2G or Arc Wi Pivot mA / **Only for Visiferm ECS/RS-485*

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

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

6.24.2 Electrical Connection for Analog 4-20 mA Connection

The 4–20 mA interface enables direct connection of the Arc sensor to a data recorder, indicator, control unit or PCS with analog I/O. The Arc sensor works as a current sink sensor and is passive. Connect the sensor according to the pin designations (see Chapter 6.21.1).

The 4–20 mA interface of the Arc sensors is pre-configured with default values for the 4–20 mA range, and measurement unit. Configure the 4–20 mA interface according to your requirements for proper measurement (see Chapter 6.15).

NOTE: Incyte Arc, Dencytee Arc, CO_2NTROL and GlucoSense requires an Arc Wi 2G Adapter to provide 4–20 mA signal.

Examples of circuit arrangement

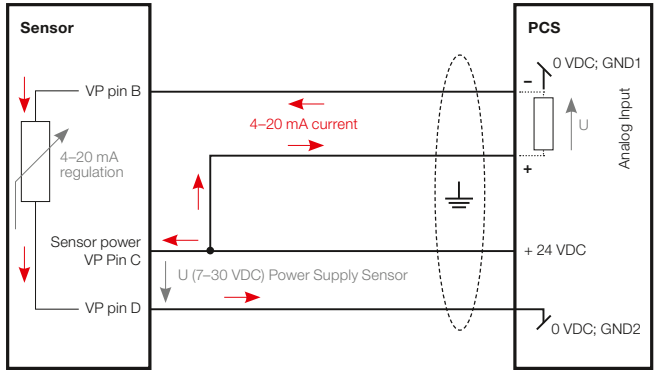


Figure 13: Three-wire loop wiring diagram for the 4–20 mA interface

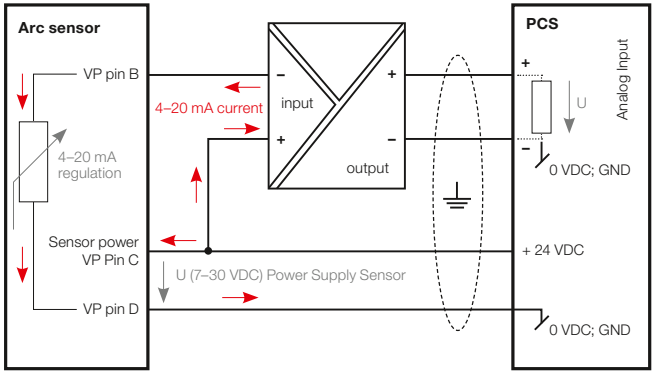


Figure 14: The safest form of wiring, using an external isolation amplifier. The figure represents 4–20 mA interface. (For detailed technical advice, please contact the technical support at Hamilton.)

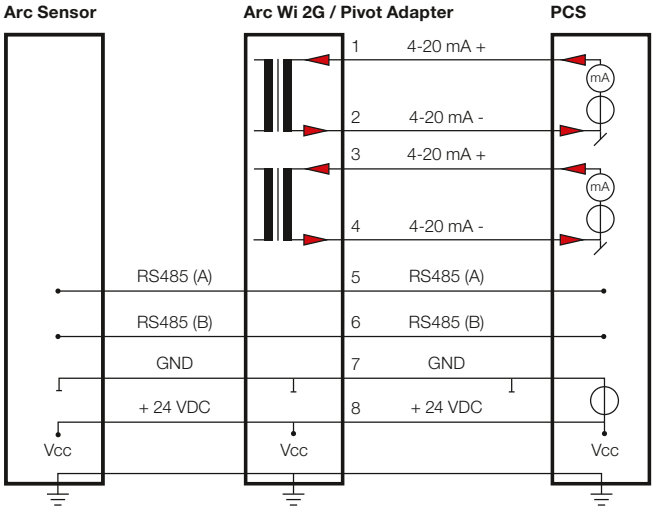


Figure 15: Typical connection to PCS using the Arc Wi 2G Adapter BT or Arc Wi Pivot Adapter. This is the safest form of wiring an Arc sensor. The Arc Wi 2G Adapter BT provides internal galvanic isolators for enhanced analog signal quality. Connection to the PCS is simplified. Connection to the process control system is simplified. enhanced analog signal quality. Connection to the process control system is simplified.

6.24.3 Controlling 4–20 mA current interface signals by pulse-width modulation (not for Incyte Arc, Dencytee Arc, CO_2NTROL or GlucoSense)

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 Figure 13 and Figure 14).

The PWM-loads of the Sensors have low-pass filters which are not able to eliminate all AC fractions of the used PWM frequency of 5 kHz due to technical impossibilities. Therefore, the current signals of the 4–20 mA interfaces are still overlaid by a certain AC which should be masked by lag smearing or input filters of the current input card of the process control system (PCS).

Recommended PCS settings are a sampling rate below 3.5 kHz, an averaging over more than 1 s, and the use of galvanically separated inputs to avoid oscillations. It is also possible to use mathematical functions or isolating amplifiers for signal processing filtering if necessary. For detailed technical advice about suitable isolating amplifiers, please contact Hamilton technical support.

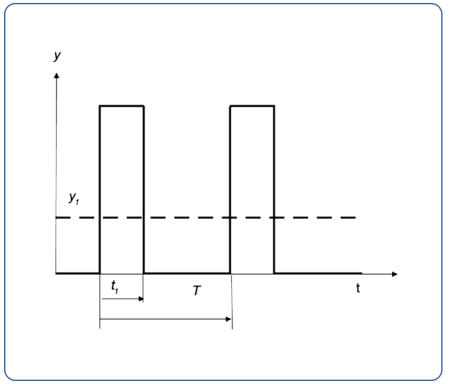


Figure 16: Progress of a rectangular signal with a period T and a pulse duration t_1 for the generation of an analog signal with the value y_1

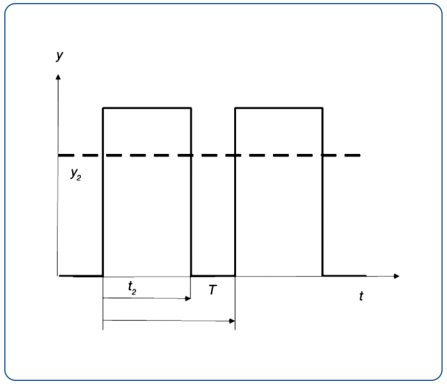


Figure 17: Progress of a rectangular signal with a period T and a pulse duration t_2 for the generation of an analog signal with the value y_2

INSTALLATION

NOTE: The Arc sensors generates the 4-20 mA signals by pulse with modulation (PWM) which is not compatible to all PCS systems. Also a galvanic separation between the power supply and the PCS is necessary for correct sensor functionality when used in 4-20 mA setups. Figure 14 illustrates a solution for the problem.

Analog interface 1 and 2

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

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

6.24.4 Electrical Connection for the ECS interface (only for Visiferm RS485-ECS famlily)

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

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

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

In an electromagnetically noisy environment, it is advisable to assign the sensor's shaft and/or VP cable shield to earth. This significantly improves noise immunity and signal quality.

The NTC temperature sensor attached to the pins E and F is isolated from the integrated electronics and is used for the temperature compensation of the oxygen signal in the measuring device.

Usually, classic sensors are operated with a polarization voltage between anode and cathode. This polarization voltage is supplied by the measuring device. VisiFerm DO can be operated with polarization voltages usual for electrochemical sensors.

The sensor is optimized for a polarization voltage of -675 mV. For adjustment to different measuring devices and/or for simulation of different amperometric sensors the current can be adjusted between 0 and 500 nA.

When using the ECS interface, the pins have the following designations with respect to VP cable conductor colors:

VisiFerm DO only	VP Pin	Color Double Coaxial Cable
Cathode	A	Coaxial core black transparent
ECS Anode (Voltage range may not exceed -2V ... +2V)	B	Coaxial shield black
Power supply: + 24 VDC (10 - 27 VDC), max. 1000 mW	C	Coaxial core red transparent
Power supply: Ground	D	Coaxial shield red
NTC 22 kOhm	E	White
NTC 22 kOhm	F	Green
sensor shaft (connect with the mass of the power supply)	shield	Cable shield green-yellow

Examples of circuit arrangement

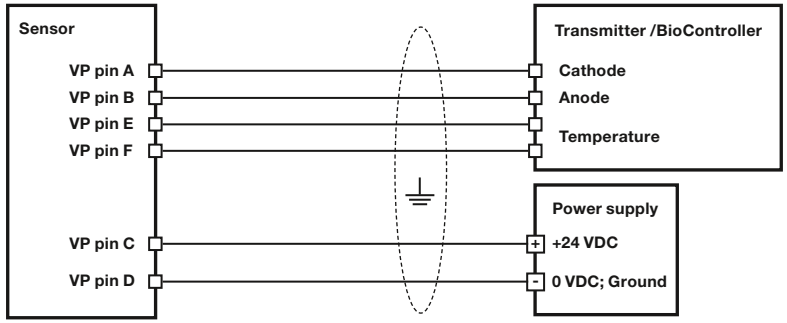
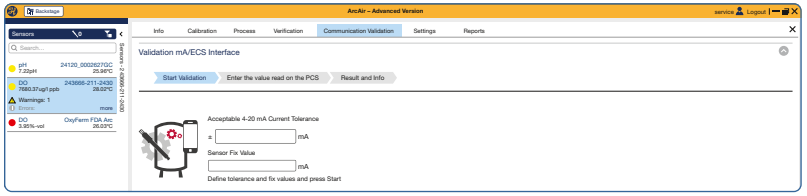


Figure 18: Wiring diagram for the ECS interface

6.24.5 Validate 4-20 mA Measuring Loop

In this chapter, the validation of the 4-20 mA interface is described according to the process of Arc sensors in GMP environment (see also chapter 5.2).

1) Connect the Arc sensors with the power supply, e.g., by using the Arc USB Power or the power connection from the process in combination with the wireless option.
2) Select the desired sensor from the sensor list in ArcAir.
3) Open the communication validation tab and select one of the analog interfaces.
4) Define the measurement tolerance and press “Start”.
5) Select the fixed value for the 4-20 mA measuring loop.
6) Enter the current value from the process control system and press next.
7) Follow the description on the screen.
8) Continue with other communication points or generate a report.



6.24.6 Electrical Connection for the digital RS485 Interface

The digital RS485 interface enables communication with Arc sensor for performing measurements, for calibrating the Arc sensor and for changing the sensor’s configuration parameters.

Arc sensors are always connected to digital controlling devices as a Modbus master. To function, they require a power supply (VP 8 pins C and D, see below). The section entitled “Configuring the Arc sensor parameters” describes operation in digital mode.

Additional information:

The Modbus RTU communication protocol corresponds to the Modbus-IDA standard (see www.modbus.org). Arc sensors use an open register set developed by Hamilton.

Additional information about the register content and structure can be found in the programmers manual under www.hamiltoncompany.com.

The Modbus physical layer is described in detail with requirements on cabling and line termination in the “Modbus Serial line Protocol and Implementation Guide” www.modbus.org > Technical Resources / Modbus Specifications / Modbus Serial line Protocol and Implementation Guide.

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

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

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

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

Example of circuit arrangement

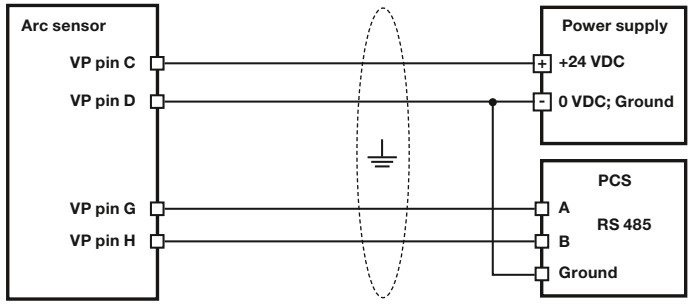


Figure 19: Wiring diagram for the RS485 interface

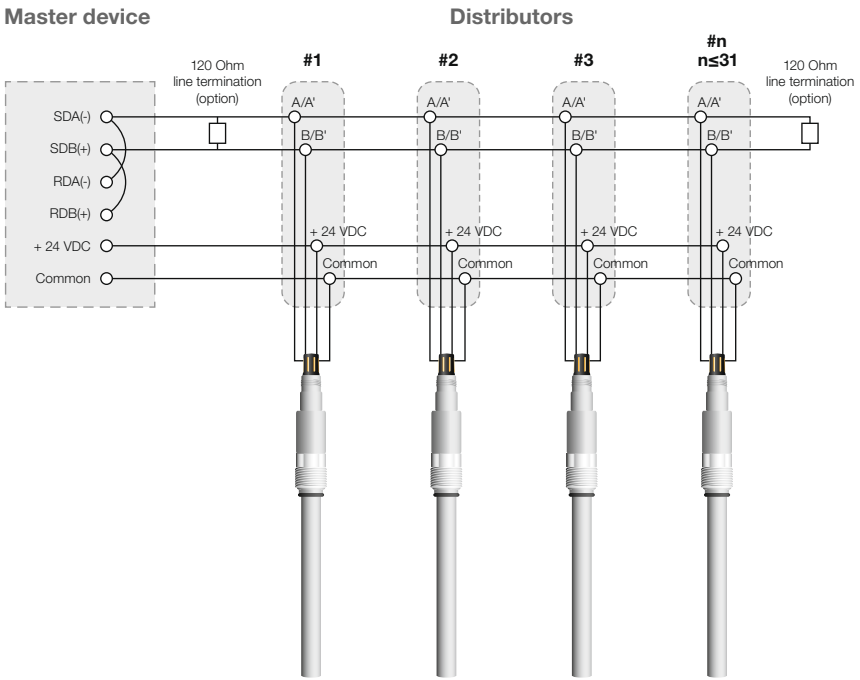


Figure 20: Multi-drop bus wiring for the Modbus two-wire mode. Each sensor functions as a Modbus slave.

NOTE: 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 must be ensured according to the EIA/TIA RS485 standard. Only one sensor can communicate with the master at any time.

7 Arc Sensor Operation

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

1) Remove the watering or yellow protective caps from the Arc sensor shaft, and from the VP 8 sensor head.
2) Check the O-ring on the sensor shaft.
3) Verify if the sensing material is not damaged.
4) If using a pH sensor: Check inside of pH glass membrane for unwanted air bubbles. Shaking the sensor gently will cause any bubbles to rise to the top.
5) Verify the functionality of the Arc sensor.
6) Calibrate the sensor (see Chapter 8.2).
7) Connect the sensor to the process control system (see Chapter 6.21).
8) Verify the measurement on your control system and create a communication validation report.
9) Mount the sensor to the armature or process connection (see Chapter 6.21).

NOTE: No measurement is performed at a temperature higher than 85°C (optical DO), 110°C (pH, ORP, electrochemical DO and conductivity sensors), 60°C (cell density) or 80°C (Glucose) to protect sensing part and enhanced the sensor lifetime.

NOTE (only optical DO sensors): To ensure a correct measurement after changing the ODO Cap type (e.g., ODO Cap H0) the reference number of the ODO Cap must be configured in the Sensing Material register (see Chapter 6.15). Firmware version ODOUM042 or higher is required.

ARC SENSOR OPERATION

7.1 Run Experiments

With the ArcAir Experiment function, up to six Arc sensors can be monitored and recorded at the same time. The data is now exported to an Excel file (.xlsx) instead of .csv.

Incyte Arc can now be monitored together with other Arc sensors in one graph. The old specific chart functionality of Incyte Arc is no longer available in ArcAir.

Figure 21: Experiment View

NOTE: Incyte Arc must be connected via the Arc USB power cable if the mark zero or clear zero function need to be used in parallel with other Arc sensors e.g., pH.

NOTE: In previous versions, if no data was received from a sensor during an experiment, ArcAir would continue recording the last known value. Starting with Version 3.10, this behavior has been corrected. No value will be written when data is missing. This ensures the integrity of experiment logs and avoids misleading continuity in data trends.

NOTE: If Incyte Arc is used via Bluetooth connection, then no other Arc sensor can be recorded in the graph.

NOTE: 6 sensors can be recorded at the same time in one experiment (Windows) and 3 in the mobile version.

NOTE: 3s interval for Incyte, Dencytee and GlucoSense is not allowed due to data volume, a minimum of 6 seconds is allowed.

NOTE: It is possible to create an unlimited number of experiments limited only by the hardware of your system.

7.1.1 Create new experiment

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

7.1.2 Edit an experiment

1) Select settings in the experiment view.
2) Adjust the settings according to your requirements.
3) Save settings.

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

Before the experiment, ensure which measuring unit of the sensor is set and if it is correct. Changing the unit of measurement during the experiment is not possible. Restarting the experiment is necessary if the measuring unit needs to be changed.

8 Arc Sensor Maintenance

Periodic maintenance routines need to be run to ensure safe and reliable operation as well as the measurement of Arc sensors and accessories.

NOTE: For more information about maintenance and description of the individual sensors, please refer to the corresponding operating instructions of the individual sensors.

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

1) Connect one of the Arc sensors with the power supply, e.g., by using the Arc USB Power Cable on a standard USB port (see Figure 1).
2) Control the traffic lights in the Quick View or sensor list (see Figure 22).
3) Please refer to the troubleshooting (see Chapter 9) for the next steps if the traffic light is not green.
4) Control the quality of the sensor under Info “Quick View” or sensor if required (see Chapter 9).

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

ARC SENSOR MAINTENANCE

8.1 Verify Arc Sensor Status and Functionality

1) Connect one of the Arc sensors with the power supply, e.g., by using the Arc USB Power Cable with a standard USB port (see Figure 1).
2) Control the traffic lights in the sensor list or Quick View (see Figure 22).

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

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

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

Offline

Figure 22: Description of the traffic lights on ArcAir

NOTE: Starting with ArcAir 3.11, a Bluetooth signal strength indicator is available. This feature shows the connection quality between your device (PC, tablet, or smartphone) and the Arc sensor. A weak signal may result in reduced performance or interruptions. To improve connectivity, move closer to the sensor and ensure there are no obstacles (e.g., walls, equipment) between the sensor and your device.

8.2 Calibration

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

NOTE: Incyte Arc, Dencytee Arc and GlucoSense do not provide user calibration functionalities.

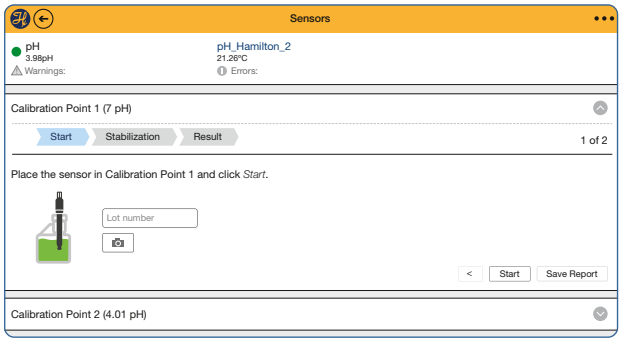


Figure 23: ArcAir Calibration Wizard with an Arc pH sensors (symbolic picture)

Automatic standard Calibration Wizard

The calibration points should be chosen within the measuring range of the specific application. Correct measuring parameters should be set in order to meet the process tolerances.

Arc sensors can be calibrated at one or two points:

	oDO	eDO	pH	ORP	Conductivity	CO_2
Cal. Point 1	Air	Air	pH 7 (factory)	475 mV (factory)	1413 µS/cm (factory)	Air or CO_2 free environment
Cal. Point 2	Zero Point	Zero Point	pH 4 (factory)	–	–	CO_2 Point Calibration

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

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

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

8.3 Product Calibration

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

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

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

8.4 Sensor Verification

In this chapter the verification after a process is described according to the validation process of Arc sensors in GMP environment (see also Chapter 5.2).

1) Remove the sensor from the measuring setup.
2) Connect the Arc sensors with the power supply, e.g., by using the Arc USB Power or the power connection from the process in combination with the wireless option.
3) Select the desired sensor from the sensor list.
4) Open the verification tab.

5) Define the measurement tolerance criteria.
6) Place the sensor in the calibration standard. For pH, Cond, ORP and GlucoSense: enter the lot number or scan the barcode.
7) Select in the drop-down menu the standard.
8) Press “Verify” and follow the description on the screen.
9) Continue with other verification points or generate a verification report.

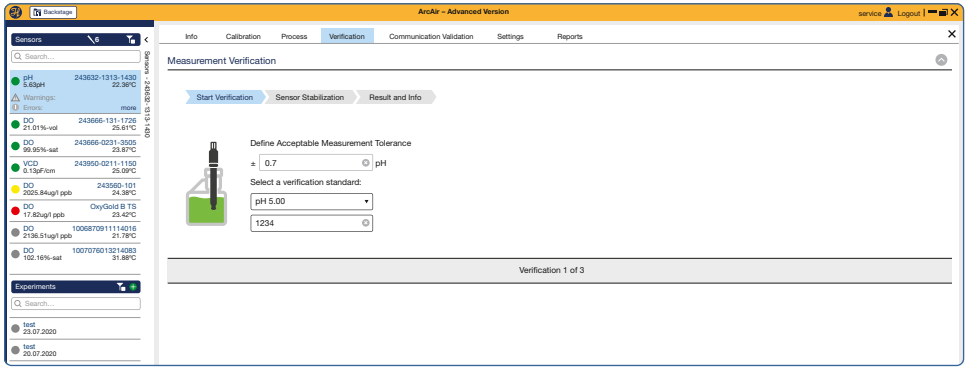


Figure 24: Sensor verification process

NOTE: The pH Arc sensor only allows a verification in the unit pH and not in mV.

8.5 Arc Sensor FW Updates incl. Accessories

1) Start the ArcAir application on the computer.
2) Go to “Software Settings”.
3) Select “Firmware” and click on “Arc Sensors” or Arc Wi Adapters.
4) Follow the instructions on the screen.

ARC SENSOR MAINTENANCE

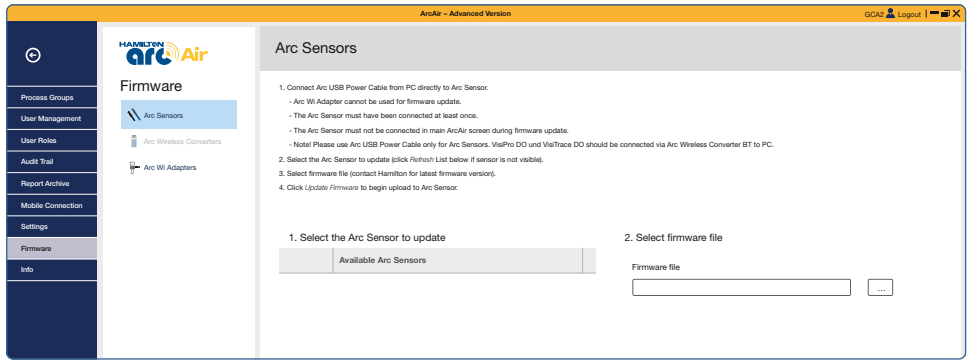


Figure 25: Firmware update for Arc sensors and accessories

NOTE: Make sure that the Arc sensor is not in an active Bluetooth or serial connection, when starting the FW update process.

9 Troubleshooting

9.1 Sensor Self-Diagnostic

Arc sensors provide a self-diagnostic functionality to detect and identify the most common sensor malfunctions. Both interfaces, analog 4-20 mA or digital Modbus, may provide warning and error messages.

The analog 4-20 mA interface can be configured according to the NAMUR recommendations to indicate an abnormal event (see Chapter 6.21.2). Use ArcAir for monitoring the sensor status and for troubleshooting. The following types of messages are provided by the self-diagnosis function.

The Quick View (see Figure 27) provides an overview of all sensor status information.

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

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

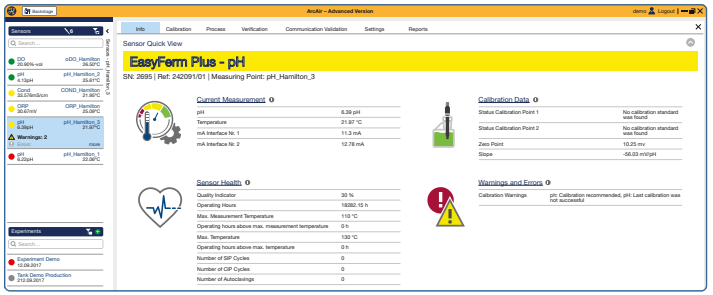


Figure 26: Quick View of pH Arc sensor with an active warning

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

9.2 Warnings for DO Arc Sensors

Warning	Cause / Solution
DO reading below lower limit	The oxygen reading is too low (DO < 0%-sat). Make a new zero-point calibration (see chapter 8.3).
DO reading above upper limit	The oxygen reading is too high (DO > 300 %-sat). Make a new calibration in oxygen saturated medium (see chapter 8.2). If not successful, replace the sensor cap.
DO reading unstable	If continuously happening, use a new cap or check the process regulation. If the problem still appears, call our Technical Support.
T reading below lower limit	The temperature is below the user defined measurement temperature range. If the process temperature is outside this range, the sensor will not perform DO readings.
T reading above upper limit	The temperature is above the user defined measurement temperature range. If the process temperature is outside this range, the sensor will not perform DO readings.
Measurement not running	The measurement interval is set to 0 or the measurement temperature is out of the range.
DO calibration recommended	Perform a calibration in order to ensure reliable measurement (see Chapter 8.2).
DO last calibration not successful	The last calibration failed. The sensor is using the old successful calibration values. In order to ensure reliable measurement perform a new calibration (see Chapter 8.2).
DO replace sensor cap	Replace the ODO Cap and calibrate the sensor cap sensor cap sensor. This warning remains active as long as the sensor quality is below 35%. Make sure that after new cap replacement the sensor reaches at least 60% cap quality. See Chapter 8.6 for replacement conditions. The quality indicator takes sensor and cap into account.
4–20 mA value below 4 mA	The measurement value is below the lower limit of the 4–20 mA interface output. Reconfigure the 4–20 mA interface (see Chapter 6.21).
4–20 mA value above 20 mA	The measurement value is above the upper limit of the 4–20 mA interface output. Reconfigure the 4–20 mA interface (see Chapter 6.21).
4–20 mA current set-point not met	The 4–20 mA interface is not able to regulate the current requested for the current measurement value according to your 4–20 mA interface configuration. Check the 4–20 mA wiring and supply voltage (see Chapter 6.21).

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

9.3 Warnings for pH / eDO / Conductivity Arc Sensors

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

9.4 Warnings for Incyte Arc Sensors

Description	Warning	Cause	Solution
T reading below lower limit	Temperature too low, no measurement possible	The temperature is below the specified range, so no measurement of the permittivity is possible	Please ensure at least 4°C temperature
T reading above upper limit	Temperature too high, no measurement possible	The temperature is below the specified range, so no measurement of the permittivity is possible	Please ensure max. 60°C temperature
Recording Memory full	Memory full, no further rcording possible	The internal memory of the sensor is full.	Please download the data (see Incyte Arc Operating Instructions, REF 10072078)

TROUBLESHOOTING

Description	Warning	Cause	Solution
Out of calibration range: lower limit	Conductivity too low	The conductivity is below the specified range, so no measurement of the permittivity is possible.	Increase conductivity (> 1 mS/cm)
Out of calibration range: upper limit	Conductivity too high	The conductivity is above the specified range, so no measurement of the permittivity is possible.	Decrease conductivity (< 80 mS/cm)
SNR too high	External interferences detected	The permittivity measurement is disturbed by external electrical interferences.	Please check your environment and ground the sensor as described in chapter 4.3 (Incyte Arc Operating Instructions, REF 10072078)
Preamp overtemp (analog supply off)	Ambient temperature too high, no measurment is possible	Electronic overheat because of high ambient and process temperature.	Please ensure temperature conditions below 50 °C.
Power supply too weak (measurement off)	Power too low, no measuremnt possible	The supply power not sufficient	Check power supply has sufficient power output (>1.5 W). With USB Power Cable, please use the provided power supply (power supply from the USB connection not sufficient)
Sensor supply voltage too low	Sensor supply voltage too low	The supply voltage is too low	Check power supply is above 21.6 VDC. With USB Power Cable, please use the provided power supply (power supply from the USB connection not sufficient)
Sensor supply voltage too high	Sensor supply voltage too high	The supply voltage is too high	Check power supply is below 26.4 VDC. The electronics are regulated down to not get damaged.
FSCAN fitting poor input data (R2)	Parameter fitting cannot be applied, as the input data quality is not good enough	Parameter fitting cannot be applied, as the input data quality is not good enough	The Cole-Cole parameter fitting cannot be calculated as the measured viable cell density values are too low. This may be the case if the sensor is in medium only, or at process start, as well as low density cultures.

9.5 Warnings for Dencytee Arc Sensors

Warning	Cause / Corrective Action
TCD reading below lower limit	The TCD reading is too low. Make a new correlation.
TCD reading above upper limit	The TCD reading is too high. Make a new correlation.
T reading below lower limit	The temperature is below the user defined measurement temperature range. If outside this range, the sensor will not perform TCD readings.
T reading above upper limit	The temperature is above the user defined measurement temperature range. If outside this range, the sensor will not perform TCD readings.
Measurement not running	Causes that trigger this warning: 1) Sensor operating voltage range is not between 10-27 VDC. 2) The temperature measurement is outside the user defined temperature range. 3) The measurement is switched off via the parameter measurement interval.
TCD calibration recommended	Send to Hamilton Technical Support (TS) for standard calibration.
Sensor supply voltage too low	The sensor supply voltage is below 10V. Please check your power supply.
Sensor supply voltage too high	The sensor supply voltage is above 27V. Please check your power supply.
Replace sensor recommended	The Sensor Quality Indicator is below 40%. The quality of the sensor is sufficient for reliable measurement, but replacement of the sensor will be needed in near future

TROUBLESHOOTING

9.6 Warnings for CO_2NTROL Arc Sensors

Warning	Cause / Corrective Action
Below calibration range	The value entered by the user for Zero Point (Calibration Point 1) and for CO_2 Point (Calibration Point 2) is below consented calibration limits.
Above calibration range	The value entered by the user for Zero Point (Calibration Point 1) and for CO_2 Point (Calibration Point 2) is above consented calibration limits.
Temperature was too low	Temperature during the calibration is below 15°C. Adjust the temperature and repeat the calibration process.
Temperature was too high	Temperature during the calibration is above 45°C. Adjust the temperature and repeat the calibration process.
Reading too low	Applied calibration standard is not consistent with the required calibration range. The S/R value measured is too low. Check the calibration standard and repeat the calibration process.
Reading too high	Applied calibration standard is not consistent with the required calibration range. The S/R value measured is too high. Check the calibration standard and repeat the calibration process.
Drift temperature	Temperature during the calibration is not stable. Stabilize the temperature and repeat the calibration process.
Drift measurement	The CO_2 value during the calibration is not stable. Stabilize the CO_2 gas-flow and repeat the calibration process.
Assigned value was out of calibration range	The value entered by the user for Calibration is outside the consented calibration limits.
Calibration is not complete, Calibration Point 1 required	The sensor requires a 2 points calibration. The CO_2 point calibration (Calibration Point 2) is still required.
Calibration is not complete, Calibration Point 2 required	The sensor requires a 2 points calibration. The Zero point calibration (Calibration Point 1) is still required.
Calibration coefficients were out of range	Applied product calibration value is not consistent with the required product calibration range. The S/R value measured is out of range. Check and repeat the product calibration process.

Warning	Cause / Corrective Action
CO_2 reading is below lower limit	CO_2 reading too low (CO_2<0mbar). Re-calibration recommended.
CO_2 reading is above upper limit	CO_2 reading too high (CO_2>1000mbar). Re-calibration recommended.
CO_2 calibration recommended	CO_2 reading too low (CO_2<0mbar) or too high (CO_2>1000mbar). Repeat the sensor calibration.
Temperature reading is below lower limit	The temperature is below the user defined lower limit temperature range. If the process temperature is outside this range, the sensor will not perform CO_2 readings.
Temperature reading is above upper limit	The temperature is above the user defined upper limit temperature range. If the process temperature is outside this range, the sensor will not perform CO_2 readings.
Measurement is not running	Applied voltage is too high or too low. Sensor operating voltage range is between 10-27VCD or the temperature measurement is outside user defined temperature range.
Sensor supply voltage too low	Applied voltage is too low. Sensor operating voltage range is between 10-27VDC.
Sensor supply voltage too high	Applied voltage is too low. Sensor operating voltage range is between 10-27VDC.
IR power limit reached	Light source consumes too much power. Contact the technical support.
Replace sensor	Quality indicator of the sensor is below 40%. The quality of the sensor is sufficient for reliable measurement, but replacement of the sensor will be needed in near future.

TROUBLESHOOTING

9.7 Warnings GlucoSense Arc Sensors

Warning	Cause / Solution
Below calibration range	The value entered by the user for the Zero Point (Calibration Point 1) and Glucose Point (Calibration Point 2) is below the acceptable calibration limits. Make sure the value entered for the Zero Point (Calibration Point 1) and Glucose Point (Calibration Point 2) is within the acceptable calibration limits.
Above calibration range	The value entered by the user for the Zero Point (Calibration Point 1) and Glucose Point (Calibration Point 2) is above the acceptable calibration limit. Make sure the value entered for the Zero Point (Calibration Point 1) and Glucose Point (Calibration Point 2) is within the acceptable calibration limits.
Temperature is too low	Temperature during the calibration is below 15°C. Adjust the temperature accordingly and repeat the calibration process.
Temperature is too high	Temperature during the calibration is above 45°C. Adjust the temperature accordingly and repeat the calibration process.
Reading too low	The applied Calibration Standard is not consistent with the required calibration range. Check the Calibration Standard and repeat the calibration process.
Reading too high	The applied Calibration Standard is not consistent with the required calibration range. Check the Calibration Standard and repeat the calibration process.
Drift temperature	The temperature is unstable during the calibration process. Stabilize the temperature and repeat the calibration process.
Drift measurement	The Glucose value is unstable during the calibration process. Stabilize the Glucose value and repeat process.
Assigned value is out of calibration range	The value entered by the user for the calibration limits is outside the acceptable range. Make sure the value entered for the Calibration is within the acceptable calibration limit.
Calibration is not complete. A 2-Point Calibration is required.	The sensor requires a 2-Point Calibration. Do a 2-Point Calibration for the Glucose measurement.
Calibration coefficients are out of range	The applied Product Calibration value is not consistent with the required product calibration range. The S/R value measured is out of range. Check and repeat the Product Calibration process (see Section 6.2).

Warning	Cause / Solution
Glucose reading is below lower limit	Glucose reading is too low (possible interference from air bubbles). Remove the GlucoSense Membrane from the GlucoSense Sensor, clean the sensor element, and install a new membrane.
Glucose reading is above upper limit	Glucose reading is too high (Glucose > 25 g/L). Remove the GlucoSense Membrane from the GlucoSense Sensor, clean the sensor element, and install a new membrane.
Product calibration not passed	The sensor has not been calibrated correctly. Repeat the Product Calibration.
Temperature reading is below lower limit	The temperature is below the predefined lower temperature limit. If the process temperature is outside this range, the sensor will not perform glucose measurements. Adjust the lower temperature limit to the predefined temperature value.
Temperature reading is above upper limit	The temperature is above the predefined upper temperature limit. If the process temperature is outside this range, the sensor will not perform glucose measurements. Adjust the lower temperature limit to the predefined temperature value.
Measurement is not running	The applied voltage is too high or too low. Make sure the sensor operating voltage range is between 10 to 27 VDC.
Sensor supply voltage too low	The applied voltage is too low. Make sure the sensor operating voltage range is between 10 to 27 VDC.
Sensor supply voltage too high	The applied voltage is too high. Make sure the sensor operating voltage range is between 10 to 27 VDC.
Replace sensor	The sensor is defective, or the sensor Quality Indicator (QI) is below 10%. The quality of the sensor is not sufficient for reliable measurement. Replace the sensor. Contact Hamilton Technical Support for assistance (see Section 8.3).

TROUBLESHOOTING

9.8 Errors for DO Sensors

Error	Cause / Solution
DO reading failure	Sensor cap is missing or the sensor is broken.
DO p(O_2) exceeds air pressure	Measured partial pressure of oxygen is higher than the air pressure set by the operator. Reconfigure the air pressure parameter (see Chapter 6.21).
T sensor defective	The internal temperature sensor is defect, please call our Technical Support.
DO sensor cap missing	The DO sensor cap has been removed. Do not immerse the sensor in a measurement solution. Mount an DO Cap and calibrate the sensor prior measurement (see Chapter 8.6).
Red channel failure	Measurement channel failure. Please call our Technical Support.
Sensor supply voltage far too low	The sensor supply voltage is below 6 V. Please check your power supply.
Sensor supply voltage far too high	The sensor supply voltage is above 40 V. Please check your power supply.
Temperature reading far below min	The measured temperature is below the operation temperature.
Temperature reading far above max	The measured temperature is above the operation temperature.

9.9 Errors for pH / ORP Arc Sensors

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

9.10 Errors for Conductivity Arc Sensors

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

9.11 Errors for Incyte Arc Sensors

Error	Error	Cause	Solution
Temperature sensor defective	No temperature measurement possible	Temperature measurement not possible, please contact your Hamilton Responsible	Please contact your local representative.
	Any other error	Sensor is not working as intended	Please contact your local representative.

9.12 Errors for Dencytee Arc Sensors

Error	Cause / Solution
TCD reading failure	TCD algorithm error.
T sensor defective	The internal temperature sensor is defective.
Temperature reading far below min	The measured temperature is below the operation temperature.
Temperature reading far above max	The measured temperature is above the operation temperature.
Sensor defective	Sensor is defective or Sensor Quality Indicator is below 10%. The quality of the sensor is not sufficient for reliable measurement. Sensor needs to be replaced.
Dark current too low	If the dark current is too low.
EEPROM comm. (I2C) error	Userend EEPROM communication error. Reset the sensor and try again.
Internal communication (I2C) failure	Userend Internal I2C communication error. Reset the sensor and try again.
Internal communication failure (Frontend)	No communication between Frontend and Userend Reset the sensor and try again.
Stackoverflow Internal memory failure	Reset the sensor and try again.

9.13 Errors for CO_2NTROL Arc Sensors

Error	Cause / Solution
CO_2 reading failure	CO_2 measurement failure. Contact the technical support.
CO_2 exceeds air pressure	Sensor measures a CO_2 partial pressure higher than the value set for total air pressure in sensors settings. Check the total air pressure set value or re-calibrate the sensor. If error persist, contact Hamilton Technical support.
Sensor defective	Sensor is defective or quality indicator of the sensor is below 10%. The quality of the sensor is not sufficient for reliable measurement. Sensor needs to be replaced. Contact Hamilton Technical Support.
Temperature sensor is defective	Temperature sensor defective. Sensor needs to be replaced. Contact Hamilton Technical Support.
Temperature reading is far below lower limit	Temperature is far below -10°C. Contact Hamilton Technical Support.
Temperature reading is far above upper limit	Temperature is far above 140°C. Contact Hamilton Technical Support.
Internal communication error, please contact your Hamilton Responsible	Contact Hamilton Technical Support.
Internal communication failure front-end	Contact Hamilton Technical Support.
Internal communication error, please contact your Hamilton Responsible	Contact Hamilton Technical Support.
Internal memory failure Restart the sensor	If restarting the sensor does not solve the issue, contact Hamilton Technical Support.

TROUBLESHOOTING

9.14 Errors for GlucoSense Arc Sensors

Error	Cause / Solution
Glucose reading failure	Glucose measurement failure. Contact Hamilton Technical Support for assistance.
Sensor is defective	The sensor is defective, or the sensor Quality Indicator (QI) is below10%. The quality of the sensor is not sufficient for reliable measurement. Replace the sensor. Contact Hamilton Technical Support for assistance.
Temperature sensor is defective	The temperature sensor is defective. Replace the sensor. Contact Hamilton Technical Support for assistance.
Temperature reading is below the lower limit	Temperature is below -10°C. Contact Hamilton Technical Support for assistance.
Temperature reading is above the upper limit	Temperature is above 140°C. Contact Hamilton Technical Support for assistance.
Internal communication error	Internal communication error. Contact Hamilton Technical Support for assistance
Internal communication failure front-end	Internal communication failure front-end. Contact Hamilton Technical Support for assistance.
Internal memory failure. Restart the sensor	Internal memory failure. Contact Hamilton Technical Support for assistance.

9.15 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.

In order to be able to find the root cause of errors in ArcAir faster, ArcAir saves all activities in a log file. The file is available at the following location:

- Windows: C:\ProgramData\Hamilton\ArcAir\logs\
- Android: Internal Storage\Android\data\ch.hamilton.arcair2\files\logs*
- Data Format: ArcAir-XXX.log (XXX = Date)

**log files can not be opened on the android device itself, they can however, be copied to a Windows machine via USB and opened in Notepad*

If you have a complaint about ArcAir, please always send these log files along.

NOTE: If the smartphone was already connected to the PC, the USB cable must be briefly disconnected and reconnected in order to obtain a current log file under Android. Otherwise, Android always delivers the file status that was current when the smartphone and PC were connected.

9.16 Return Back for Repair

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

10 Disposal

The design of Arc sensors optimally considers environmental compatibility. In accordance with the EC guideline 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

11 Ordering Information

11.1 Arc Sensors

	Ref	Description
Visiferm RS485-ECS Family	10118255-1111	VisiFerm RS485-ECS 120 H0
	10118255-1121	VisiFerm RS485-ECS 120 H2
	10118255-1131	VisiFerm RS485-ECS 120 H3
	10118255-1141	VisiFerm RS485-ECS 120 H4
	10118255-1211	VisiFerm RS485-ECS 160 H0
	10118255-1221	VisiFerm RS485-ECS 160 H2
	10118255-1231	VisiFerm RS485-ECS 160 H3
	10118255-1241	VisiFerm RS485-ECS 160 H4
	10118255-1311	VisiFerm RS485-ECS 225 H0
	10118255-1321	VisiFerm RS485-ECS 225 H2
	10118255-1331	VisiFerm RS485-ECS 225 H3
	10118255-1341	VisiFerm RS485-ECS 225 H4
	10118255-1411	VisiFerm RS485-ECS 325 H0
	10118255-1421	VisiFerm RS485-ECS 325 H2
	10118255-1431	VisiFerm RS485-ECS 325 H3
	10118255-1441	VisiFerm RS485-ECS 325 H4
	10118255-1511	VisiFerm RS485-ECS 425 H0
	10118255-1521	VisiFerm RS485-ECS 425 H2
	10118255-1531	VisiFerm RS485-ECS 425 H3
	10118255-1541	VisiFerm RS485-ECS 425 H4
VisiTrace RS485 Family	10140043-1111	VisiTrace RS485 120 L1
	10140043-1211	VisiTrace RS485 160 L1
	10140043-1311	VisiTrace RS485 225 L1
	10140043-1411	VisiTrace RS485 325 L1
	10140043-1511	VisiTrace RS485 425 L1

ORDERING INFORMATION

	Ref	Description
VisiFerm SU Family	10140046-11	VisiFerm SU RS485-ECS 120
	10140046-12	VisiFerm SU RS485-ECS 225
	10140046-13	VisiFerm SU RS485-ECS 325
	10140046-14	VisiFerm SU RS485-ECS 425
	10078255	VisiFerm DO SU Arc 120 C
	10087920	VisiFerm DO SU Arc 225 C
	10116427	VisiFerm DO SU ECS 225
VisiFerm mA Family	10070760-1111	VisiFerm mA 120 H3
	10070760-1121	VisiFerm mA 120 H4
	10070760-1211	VisiFerm mA 160 H3
	10070760-1221	VisiFerm mA 160 H4
	10070760-1311	VisiFerm mA 225 H3
	10070760-1321	VisiFerm mA 225 H4
	10070760-1411	VisiFerm mA 325 H3
	10070760-1421	VisiFerm mA 325 H4
	10070760-1511	VisiFerm mA 425 H3
	10070760-1521	VisiFerm mA 425 H4
VisiTrace mA Family	10068709-1111	VisiTrace mA 120 L1
	10068709-1211	VisiTrace mA 160 L1
	10068709-1311	VisiTrace mA 225 L1
	10068709-1411	VisiTrace mA 325 L1
	10068709-1511	VisiTrace mA 425 L1

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

	Ref	Description
Polilyte Plus Arc Family	242428-1313	Polilyte Plus H Arc 120
	242428-1323	Polilyte Plus H Arc 225
	242428-1333	Polilyte Plus H Arc 325
	242428-1353	Polilyte Plus H Arc 425
	242428-2313	Polilyte Plus HB Arc 120
	242428-2323	Polilyte Plus HB Arc 225
	242428-2333	Polilyte Plus HB Arc 325
	242428-2353	Polilyte Plus HB Arc 425
	242428-3313	Polilyte Plus HF Arc 120
	242428-3323	Polilyte Plus HF Arc 225
	242428-3333	Polilyte Plus HF Arc 325
	242428-3353	Polilyte Plus HF Arc 425
	242428-4313	Polilyte Plus PHI Arc 120
	242428-4323	Polilyte Plus PHI Arc 225
	242428-4333	Polilyte Plus PHI Arc 325
	242428-4353	Polilyte Plus PHI Arc 425

	Ref	Description
Conducell 4UxF Family	243590-1171	Conducell 4USF Arc TC 1.5 21
	243590-3171	Conducell 4UHF Arc TC 1.5 21
	243590-1151	Conducell 4USF Arc 30
	243590-2151	Conducell 4UPtF Arc 30
	243590-3151	Conducell 4UHF Arc 30
	243590-4151	Conducell 4UTF Arc 30
	243590-1161	Conducell 4USF Arc 60
	243590-2161	Conducell 4UPtF Arc 60
	243590-3161	Conducell 4UHF Arc 60
	243590-4161	Conducell 4UTF Arc 60

ORDERING INFORMATION

	Ref	Description
Conducell 4UxF Arc Family	243590-1113	Conducell 4USF Arc 120
	243590-1123	Conducell 4USF Arc 225
	243590-1133	Conducell 4USF Arc 325
	243590-1143	Conducell 4USF Arc 425
	243590-1213	Conducell 4UPtF Arc 120
	243590-1223	Conducell 4UPtF Arc 225
	243590-1233	Conducell 4UPtF Arc 325
	243590-1243	Conducell 4UPtF Arc 425
	243590-1313	Conducell 4UHF Arc 120
	243590-1323	Conducell 4UHF Arc 225
	243590-1333	Conducell 4UHF Arc 325
	243590-1343	Conducell 4UHF Arc 425
	243590-1413	Conducell 4UTF Arc 120
	243590-1423	Conducell 4UTF Arc 225
	243590-1433	Conducell 4UTF Arc 325
	243590-1443	Conducell 4UTF Arc 425
Conducell UPW Family	243578	Conducell UPW Arc TC 1.5"
	243579	Conducell UPW Arc PG13,5
Conducell SU Family	10071707	Arc Module Cond P-SU
FlowCell COND Family	10168201-XYZ	FlowCell COND 4UPtF Arc (+ pH)
MecoTrode	10110152	MecoTrode H Arc 120
ORP Arc Family	243050	EasyFerm Plus ORP Arc 120
	243051	EasyFerm Plus ORP Arc 225
	243052	EasyFerm Plus ORP Arc 325
	243053	EasyFerm Plus ORP Arc 425
	243060	Polilyte Plus ORP Arc 120
	243061	Polilyte Plus ORP Arc 225
	243062	Polilyte Plus ORP Arc 325
	243063	Polilyte Plus ORP Arc 425

ORDERING INFORMATION

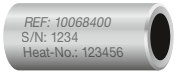
	Ref	Description
OxyFerm DO Arc Family	243100	OxyFerm FDA Arc 120
	243101	OxyFerm FDA Arc 160
	243102	OxyFerm FDA Arc 225
	243103	OxyFerm FDA Arc 325
	243104	OxyFerm FDA Arc 425
	243140-25	OxyFerm FDA Arc XL
Incyte Arc	243950-0211	Incyte Arc 120 – Expert
	243950-0212	Incyte Arc 220 – Expert
	243950-0213	Incyte Arc 320 – Expert
	243950-0214	Incyte Arc 420 – Expert
	10087686	Arc Module Incyte-W SU
	10073158	Arc Module Incyte-P SU
CO_2NTROL RS485	10087810-11	CO_2NTROL RS485 120
	10087810-12	CO_2NTROL RS485 160
	10087810-13	CO_2NTROL RS485 225
	10087810-14	CO_2NTROL RS485 325
	10087810-15	CO_2NTROL RS485 425
Dencytee RS485	11064919-11	Dencytee RS485 120
	11064919-12	Dencytee RS485 225
	11064919-13	Dencytee RS485 325
	11064919-14	Dencytee RS485 425
GlucoSense RS485	10184106-111	GlucoSense RS485 120
	10184106-113	GlucoSense RS485 160
	10184106-114	GlucoSense RS485 225
	10184106-115	GlucoSense RS485 325
	10184106-116	GlucoSense RS485 425

VisiTrace Family Parts

Ref	Description	Wetted parts
10107102	ODO Cap L1	Stainless steel 1.4435 Silicone (FDA compliant and USP Class VI)

Application: For low ppb ranges in breweries and soft drink processing.

VisiFerm Family Parts



Ref	Description	Wetted parts
243515	ODO Cap H0	Stainless steel 1.4435 Silicone (FDA compliant and USP Class VI)
10068400	ODO Cap H3	Stainless steel 1.4435 Silicone (FDA compliant and USP Class VI)

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

Ref	Description	Wetted parts
243505	ODO Cap H2	Stainless steel 1.4435 PTFE (USP <87>, USP <88> class VI)
10078261	ODO Cap H4	Stainless steel 1.4435 PTFE (USP <87>, USP <88> class VI)

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

OxyFerm FDA Family Parts

Ref	Description
237123	OXYFERM Membrane Kit
237126	CIP Membrane Kit
237140	FDA Membrane Kit
237118	OXYLYTE Electrolyte 50 ml
242000	Autoclavation Cap OXYFERM
237306	Replacement Cathode OXYFERM

GlucoSense Parts

Ref	Description
10190449-1	1 x Membrane
10190449-5	5x Membrane

11.2 ArcAir Software

ArcAir Application

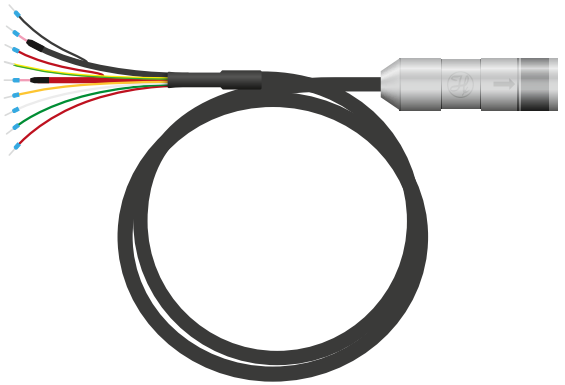
Download on the App Store

GET IT ON Google Play

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

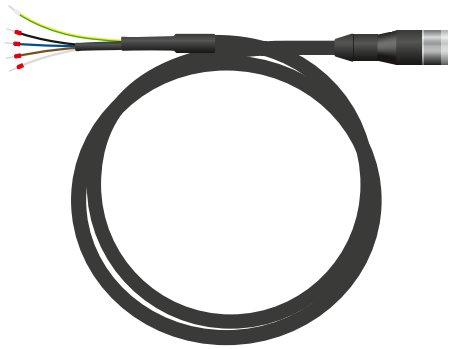
ORDERING INFORMATION

11.3 Arc 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
355217	Sensor Cable VP 8	1 m	ECS mode
355218	Sensor Cable VP 8	3 m	ECS mode
355219	Sensor Cable VP 8	5 m	ECS mode
355220	Sensor Cable VP 8	10 m	ECS mode
355221	Sensor Cable VP 8	15 m	ECS mode
355222	Sensor Cable VP 8	20 m	ECS mode
10109026	Data Cable (4 wire)	1 m	Modbus
10109251	Data Cable (4 wire)	2 m	Modbus
10109250	Data Cable (4 wire)	3 m	Modbus

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



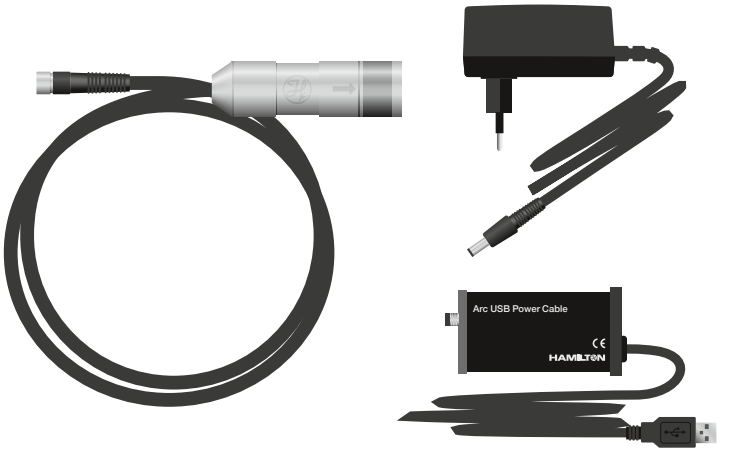
Ref	Product Name	Length
355283	Sensor Cable M12	3 m
355284	Sensor Cable M12	5 m
355285	Sensor Cable M12	10 m

Description: The Sensor Cable M12 - open is designed for connection to a data recorder, indicator, control unit or PCS (Process Control System) with analog I/O.

Ref	Product Name	Length
355288	Sensor Power Cable M12	3 m

Description: This cable includes a power adapter to supply the sensor with operation power.

ORDERING INFORMATION

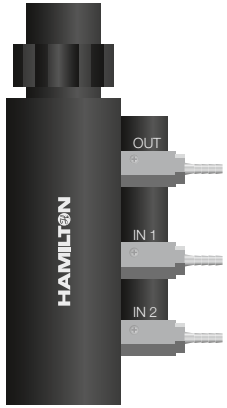


Ref	Product Name	Connection to
243490-01	Arc USB Power Cable VP 8	Arc Sensor / Arc Wi 1G Adapter BT
243490-02	Arc USB Power Cable M12 - 8	Arc Wi 2G Adapter BT
242176	Arc Sensor Cable VP 8	
355339	Arc Wi 2G BT Service Cable 2m	
355289	Arc Wi 2G Service Cable 2m	

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

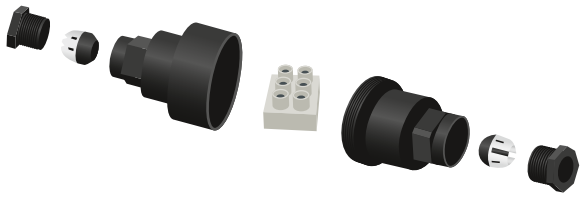
Ref	Product Name	Connection to
355298-xx	2,5 m Power Cable VP8 / AMP	Old BioController with AMP connection
355296-xx	3 m Power Cable VP8 / BNC	Old BioController with BNC connection
355297-xx	1 m Power Cable VP8 / BNC	Old BioController with BNC connection
355245-xx	2,5 m Power Cable VP8 / Lemo	Old BioController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

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



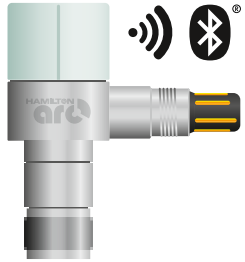
Ref	Product Name	Materials
243575	Calibration Station	PEEK material with aluminium holder

Description: Specify for two point calibration with two test gases connection e.g., 20% volume and nitrogen with 5.0 purity.



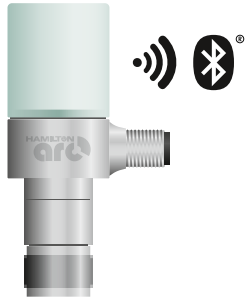
Ref	Product Name
10076282	Junction Box

Description: For connection between process and sensor open end cables. IP 68 specified.



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
10089359	Arc Modbus OPC Converter

Description: The Arc Modbus OPC Converter transforms Modbus protocol into OPC UA. All Arc parameters are supported. The conversion script is pre-installed and developed in compliance with GAMP 5.

Ref	Product Name
10116586	Arc Modbus Profinet Converter

Description: 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.

ORDERING INFORMATION

Ref	Product Name
243555	Arc Modbus Profibus Converter

Description: The Arc Modbus Profibus Converter is a 24VDC DIN rail mounted device that powers up to four Arc sensors and converts their Modbus output to Profibus DP.

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 all Arc sensors. 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
10071113	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 all Arc sensors. The Arc View Mobile is based on the Samsung Galaxy Tab Active tablet and comes pre-configured with the ArcAir advanced application, including features for CFR 21 Part 11 and Eudralex Volume 4 Annex 11 compliance, app blocker application, power supply cable, instruction manual and Hamilton quick guide.

Ref	Product Name
10071123	ArcAir Validation & Regulatory Compliance Report

Description: Validation Report for the ArcAir software dedicated to GMP customers, supporting them in the qualification and validation processes, in compliance with GAMP 5 good practices for suppliers. It describes the Quality Management System of Hamilton and its involvement throughout the software lifecycle, including the innovation process, change management, risk assessment and others. It includes a chapter detailing which features enable ArcAir to be ready for compliance with FDA CFR 21 Part 11 and Eudralex Volume 4 Annex 11.

11.4 Arc Services

Hamilton Field Service Engineers provide customers with on-site services. Hamilton offers a wide range of services from technical support to installation support, qualification, IQOQ, 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

ORDERING INFORMATION

Overview of service offers


Online service


Technical support


Installation support


Qualification IQ/OQ


Service contract


Maintenance


User training


Repair


Application support

REF 10071115/10 — 11/2025

HAMILTON

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