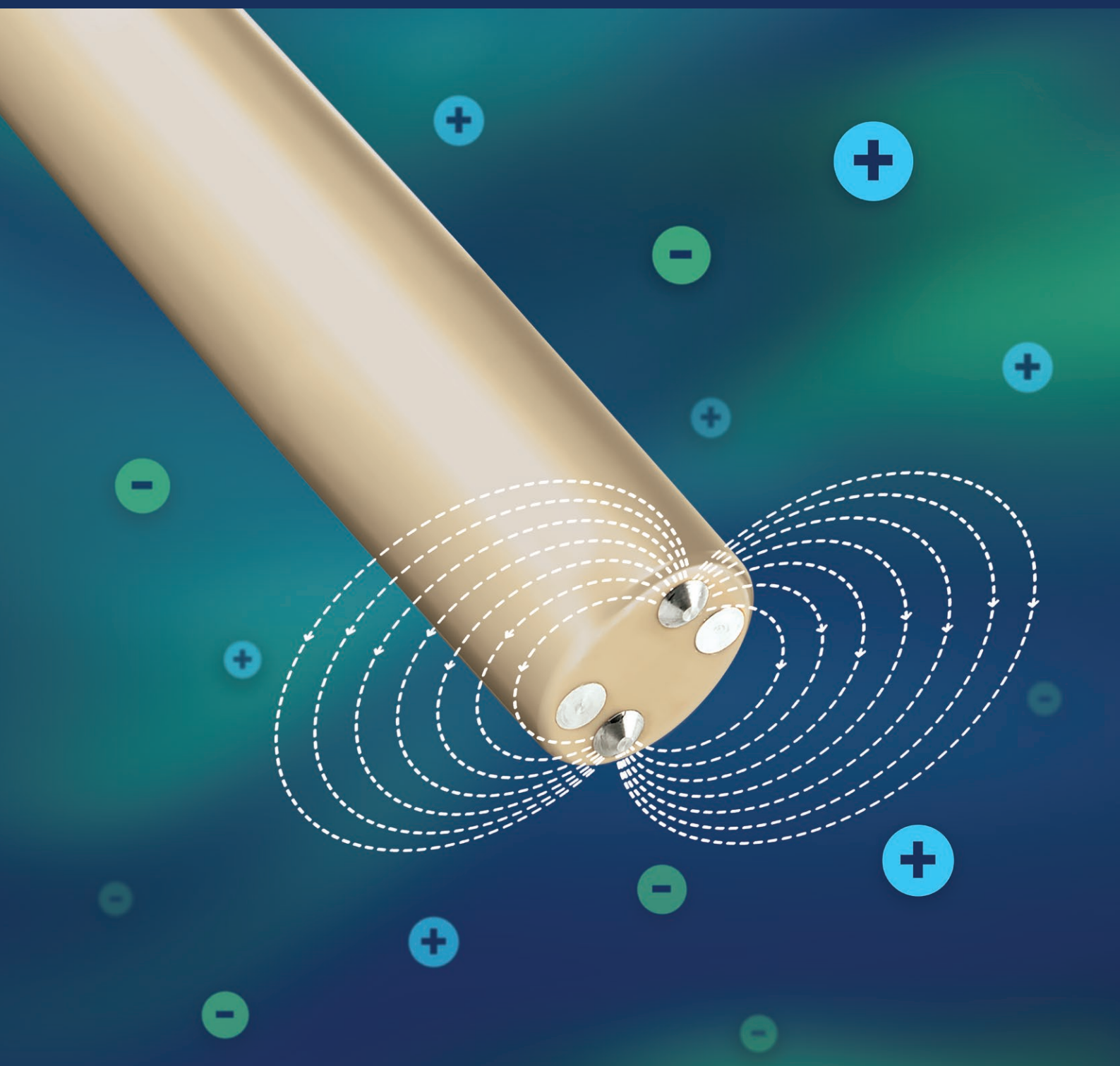


HAMILTON

4-Pole Conductivity Sensors

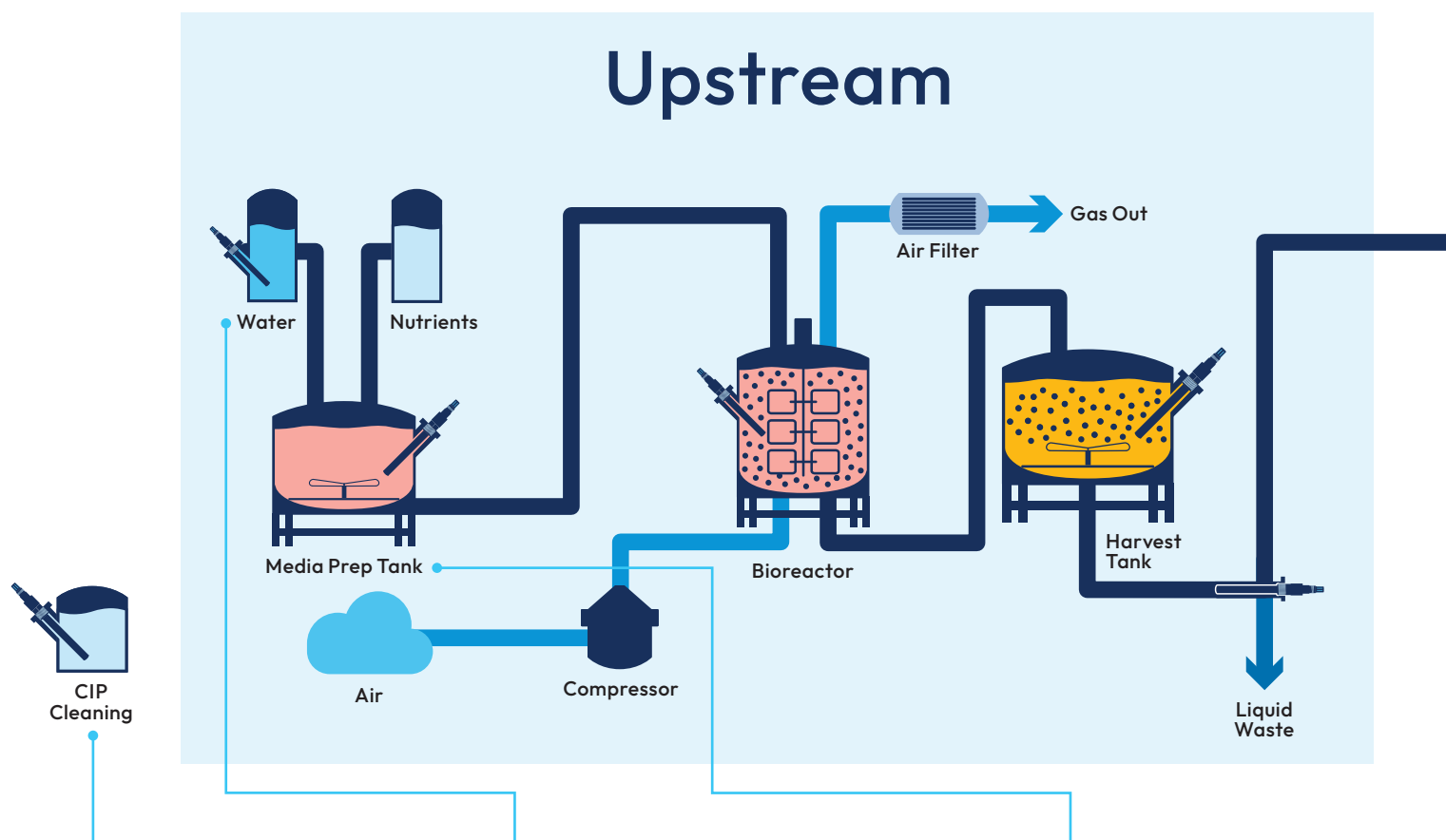
Accuracy and Precision for Bioprocessing



Precision Across Applications

The Versatile Power of Our Conductivity Sensors

Variations in conductivity can impact separation performance, product purity, and yield.



CIP Cleaning

Enjoy effortless, hands-free maintenance of optimal concentrations of cleaning solutions with our conductivity sensors, ensuring a consistently clean and safe environment and eradicating the risk of incomplete cleaning cycles.

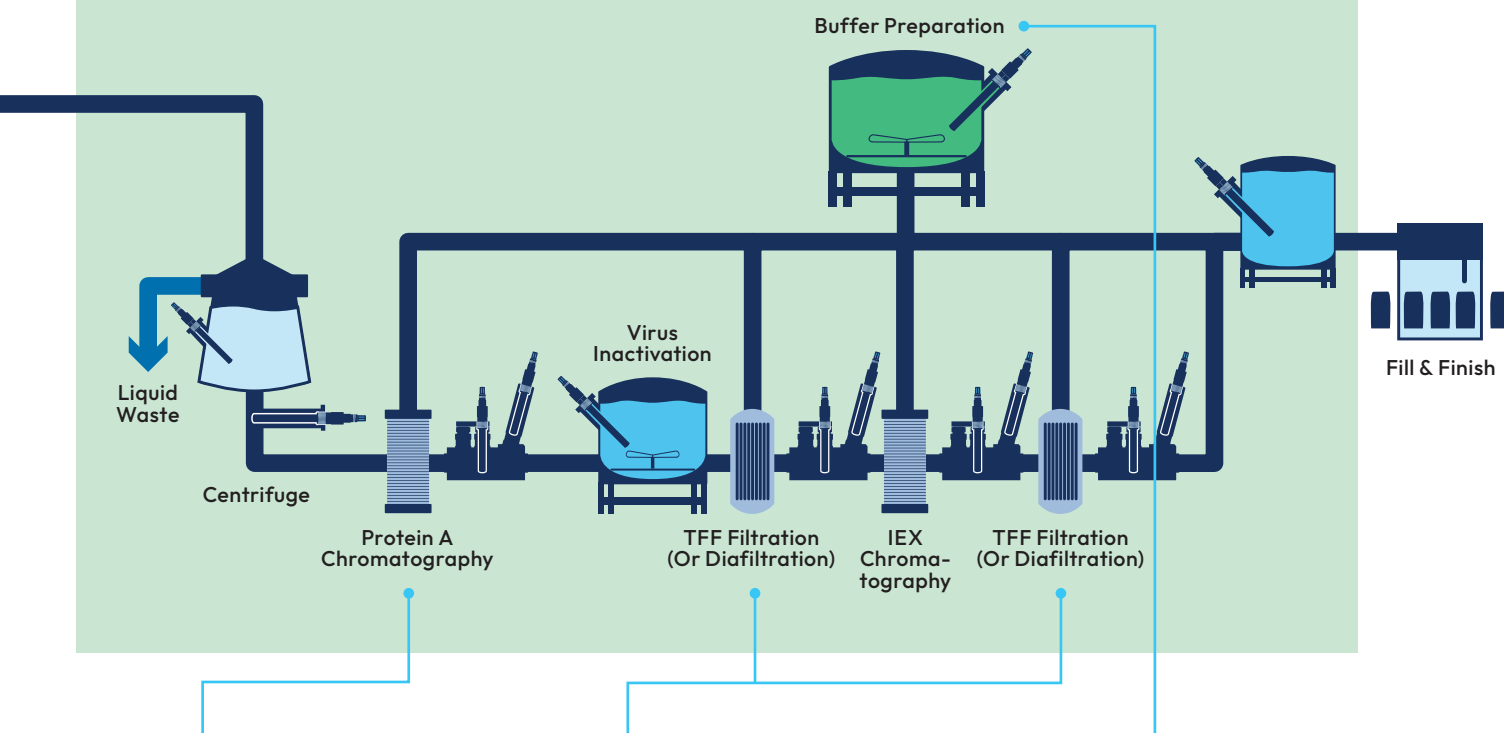
Water

Water quality is non-negotiable in pharmaceutical production. Our conductivity sensors ensure water purity throughout your processes, meeting stringent regulatory requirements, and safeguarding the integrity of your products.

Media Prep Tank

In the pharmaceutical industry, precise control of media preparation is paramount. Our conductivity sensors monitor in real-time: guaranteeing the accuracy of your media composition, reducing the risk of contamination, and ultimately expediting life-saving drug production.

Downstream



Chromatography

Chromatography demands precise control of eluent composition and conductivity to achieve optimal separation. Adopt our Conducell sensors during your processes to monitor conductivity and enable informed actions to minimize fluctuations in conductivity, ensuring stable chromatographic results, increased purity, and reduced production time.

Filtration

In filtration processes, monitoring and controlling the conductivity of the filtrate is essential to prevent damage to downstream processes and maintain product integrity. Our sensors offer continuous monitoring, allowing you to respond immediately to changes in conductivity, reducing the risk of costly equipment damage and product loss.

Buffer Preparation In-line Dilution

Buffer solutions are crucial in downstream processes, but achieving precise pH and conductivity levels can be challenging. Our conductivity sensors provide real-time monitoring, ensuring accurate buffer preparation, reducing errors, and maintaining appropriate ionic strength, resulting in improved product quality.

Challenges During Bioprocess Manufacturing



① Contamination Risks



② Low Quality and Inaccuracies



③ High Costs and Improper Resource Utilization



④ Concentration Control



⑤ Phase Separation



⑥ Fast Response Time and Real-Time Monitoring

How To Overcome These Challenges

①

Contamination Prevention

In BioPharma and Food and Beverage industries, product purity is paramount. Accurate conductivity measurement signals potential contamination, preventing costly recalls and ensuring consumer safety.

②

Product Quality Assurance

Precise conductivity measurement is essential in BioPharma processes to maintain product quality. Variations in conductivity can impact critical parameters in drug formulation and bioprocessing, ensuring consistent quality and efficacy of pharmaceutical products.

③

Resource Optimization

Accurate conductivity measurement optimizes water, chemical, and energy use. In BioPharma, it reduces costly reagent and utility use during drug manufacturing.

④

Concentration Control

In BioPharma, precise concentration control is vital for drug formulation. Accurate conductivity measurement ensures correct concentrations, avoiding costly deviations.

⑤

CIP Process Integrity

In BioPharma, conductivity guides Clean in Place (CIP) processes, preventing product loss and ensuring purity during chromatography and viral filtration. Tighter controls increase yields and efficiency in downstream processing.

⑥

Real-Time Efficiency

Rapid conductivity sensor responses enable real-time adjustments, optimizing cleaning cycles and resource utilization in chromatography and viral filtration processes. This leads to improved process efficiency and productivity in BioPharma manufacturing.

4-Pole Conductivity Sensing Solutions

The Conducell 4UxF family of 4-pole conductivity sensors is suitable for measuring a broad range of conductivities with excellent linearity

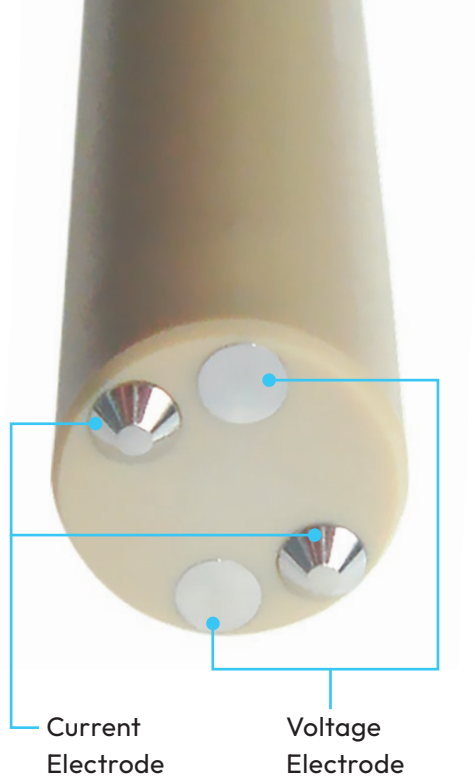
Conducell 4UxF saves one measuring point by using broad range measurement. Its hygienic design allows users to measure conductivity in various biopharma applications. You can choose between traditional conductivity sensors with an analog output or an intelligent “Arc” version.

The Arc version leverages digital sensor capabilities, enabling direct connection to the control system, eliminating the need for a transmitter, and offering flexibility in communication protocols for seamless integration. Electrodes are available in Stainless Steel (USF, 1.4435, & UHF, 2.4602), Platinum (UPtF), and Titanium (UTF), all of which are material certified.

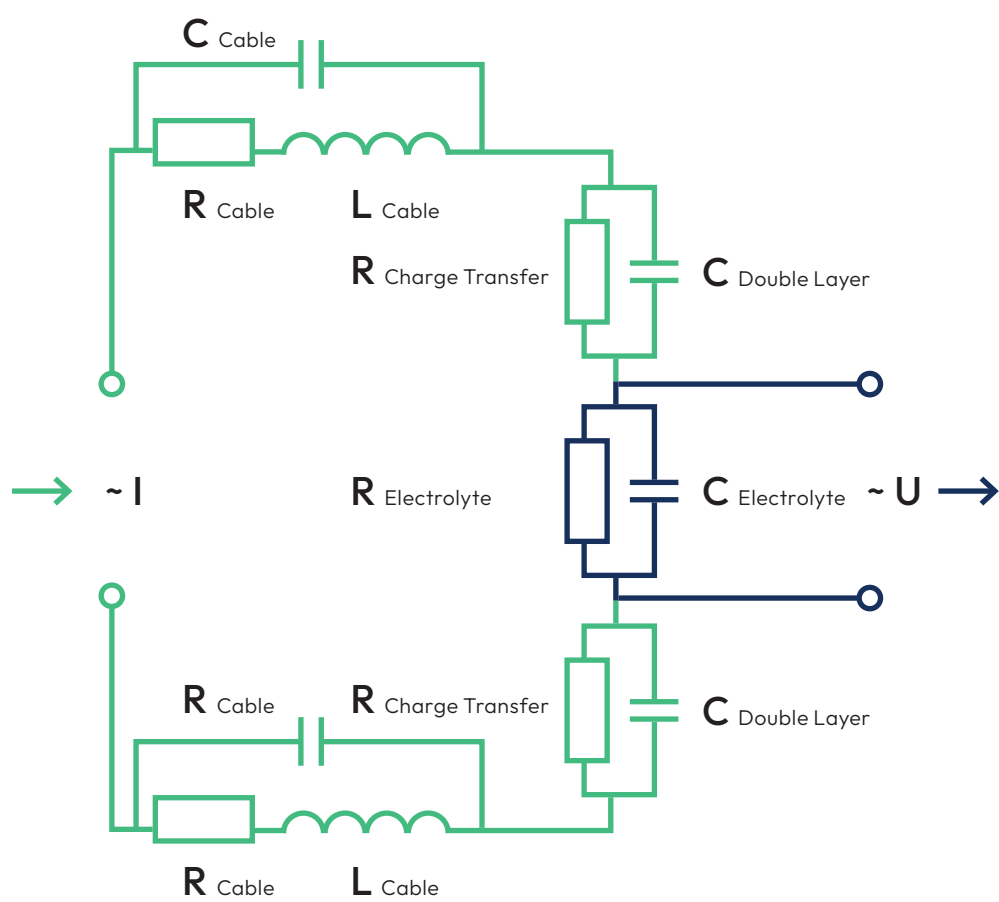
- A small, well-designed sensor that accurately measures conductivity and can easily be integrated into control systems to provide continuous data, even with limited sample volumes.
- A sensor that is customizable to the user’s application and suitable for low and high conductivity broad range measurements from 1 to 300’000 $\mu\text{S}/\text{cm}$ (Arc) with good linearity.
- All wetted parts (DIN 1.4435, PEEK, EPDM) are FDA compliant and suitable for CIP, SIP and autoclavation.
- An easy-to-clean sensor due to the forward facing, flush arrangement of electrodes.

Conducell 4UxF Sensor





4-Pole Conductivity



NOTE: Figure depicts Conducell 4UPtF VP 225 sensor

Arc Hardware

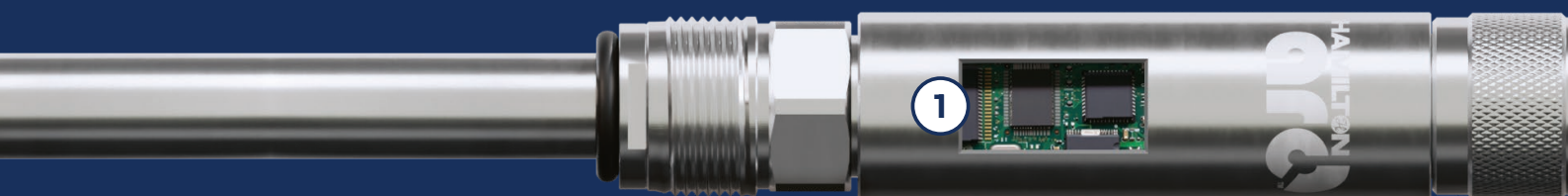
Rethink Sensor Management by Eliminating the Transmitter

Arc seamlessly connects with existing R&D, PD, and production infrastructure and reduces startup costs and integration footprint on new projects and expansions. ArcAir software reduces operational costs with:



Anatomy of an Arc Sensor

Arc's integrated microtransmitter amplifies sensor signal for direct connection to the control system. Sensor configuration and calibration occur via USB or wireless Bluetooth®.



1 Arc Microtransmitter

Arc sensors save space and cost with their integrated microtransmitter. Calibration and diagnostic data is saved within the sensor, allowing for more reliable in-lab calibration.

2 Hardwired Process Control Data

Arc sensors provide a robust connection directly to the Process Control System. A wide array of analog and digital communication protocols allows effortless integration into existing systems:

- 4-20 mA
- Modbus RS485 RTU
- PROFINET®
- PROFIBUS®
- OPC UA
- FOUNDATION Fieldbus

3 Arc Wi Pivot Adapter (optional)

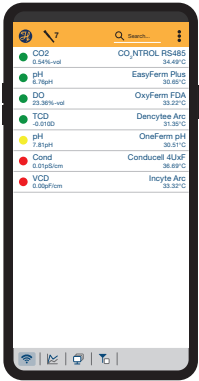
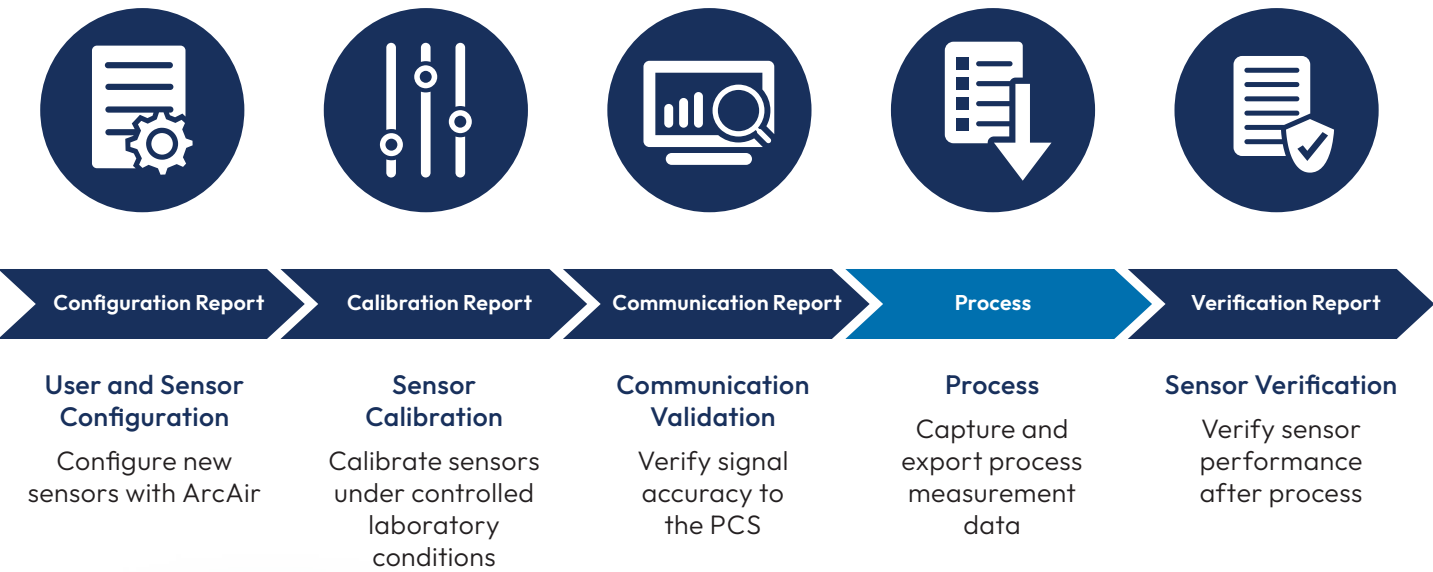
Arc Wi Pivot Adapters enable wireless communication from the sensors to the ArcAir application without interrupting the hardwired signal. An LED in the adapter provides visual indication of sensor status.

Status Lights

- Normal Operation
- Sensor Warning
- Sensor Errors
- Active BT Connection

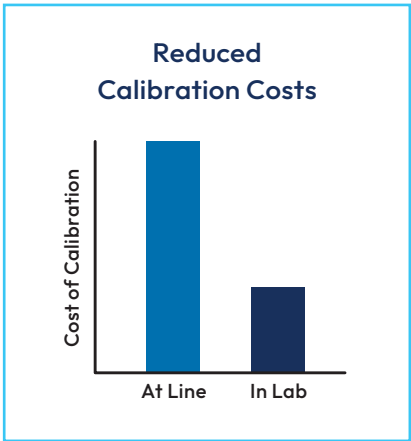
Process Documentation

ArcAir automatically generates and archives pre and post-process documentation.



Wireless Configuration, Calibration, and Diagnostics

The Arc Wi converters enable Bluetooth 4.0+ connectivity for easy sensor configuration and calibration via smart devices. Diagnostics are also transmitted wirelessly, allowing for remote troubleshooting directly from your device. Manage and monitor sensors conveniently from anywhere.



4-Pole Sensors

4-Pole Conductivity

Hamilton's offerings – Benefits that matter



Wide Range Sensitivity

4-pole sensors can be used across a wide range of conductivity, including low and high conductivity / concentration solutions.



Low Maintenance

4-pole sensors compensate for minor fouling of the electrodes, are highly sensitive even to low conductivities, and reducing the need for frequent sensor maintenance; overall increasing operational efficiency.



Robustness

4-pole sensors have a comparatively longer lifespan. Users benefit from reduced replacement costs and increased return on investment, ultimately saving valuable resources.



Chemical Resistance

The sensor shaft of our 4-pole sensors is made of Polyetheretherketone (PEEK). PEEK's exceptional chemical resistance ensures that the sensor remains unaffected by corrosive biopharmaceutical solutions, guaranteeing long-term durability and reliable performance.



Configurable

Choose from a range of process connections and sensor a-lengths. Option to pair with pH sensor and flow cell tailored to customer's BioPharma needs.

Platinum Excellence

Elevating precision and reliability in 4-pole sensors



Higher Precision and Linearity

Platinum electrodes exhibit less aging and are known for their high repeatability. The platinum electrodes in Hamilton's 4-pole sensors transmit signals with utmost efficiency, resulting in precision and linearity for more accurate conductivity measurements.



Higher Stability in FlowCell

Platinum electrodes demonstrate outstanding stability within FlowCells ensuring consistent performance across a diverse range of conductivity levels, even in dynamic measurements.



Chemical Inertness

Platinum's chemical inertness is a cornerstone for accurate and stable conductivity measurement. This property makes it an ideal choice for diverse applications where resistance to chemical reactions is paramount.



Biocompatibility for BioPharma Applications

In biopharmaceutical and biotech applications, platinum's biocompatibility is crucial as it ensures that the sensors composite material does not interfere with sensitive biological processes.

Customer Testimonials

« Hamilton's 4UxF Arc Conductivity Sensors have become an integral part of our processes, seamlessly performing in downstream applications. The sensors are $\pm 3\%$ to $\pm 5\%$ accurate, provide consistent and repeatable measurements over a wide range (1 $\mu\text{S}/\text{cm}$ to 300 mS/cm) of conductivity values. The conductivity sensors have helped us to improve our product quality, reduce our production costs, and ensure the consistency of our products. »



Marko Scharfe
Teva Pharma

« The VERDOT Ips² FlexiPro is a benchtop system adaptable to a wide range of chromatography processes. Inline dilution or gradient of aqueous buffers can be performed with the FlexiPro system. Only the most precise and reliable disposable sensors such as the Hamilton Conducell 4USF are used in order to monitor the Conductivity of the process and control the flow rate and dilution. »



Verdot Ips²

Sourced From:

Biopharma Downstream Critical
Process Parameters White Paper

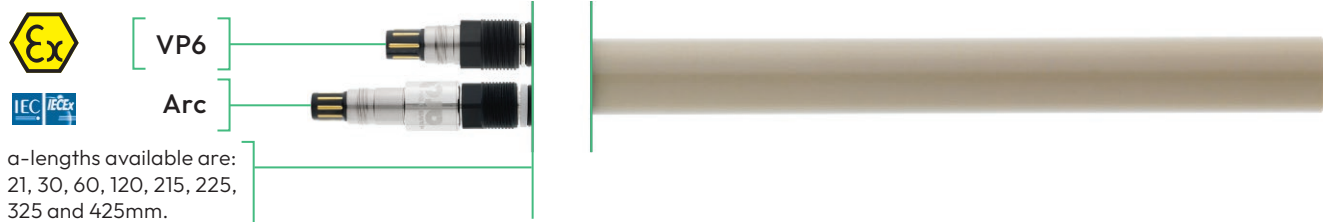
Hamilton's Conductivity Portfolio Overview

Conducell 4UxF

The Conducell 4UxF is capable of measuring a broad range of conductivity (from 1 to 500'000 $\mu\text{S}/\text{cm}$ (Analog) and 1 to 300'000 $\mu\text{S}/\text{cm}$ (Arc)), making it suitable for both low and high conductivity measurements. All wetted parts (DIN 1.4435, PEEK, EPDM) are FDA compliant and are CIP, SIP and autoclaving compatible, with good linearity. Hamilton offers Conducell 4UxF sensors made from different materials which are suitable for various applications and come in Traditional or Arc models.

Benefits

- Can measure a broad range of conductivity (trace – very high)
- Real-time self-diagnostic capabilities
- FDA compliant and suitable for CIP, SIP and autoclaving
- Compatible with wired or wireless transmission
- Customizable to your application

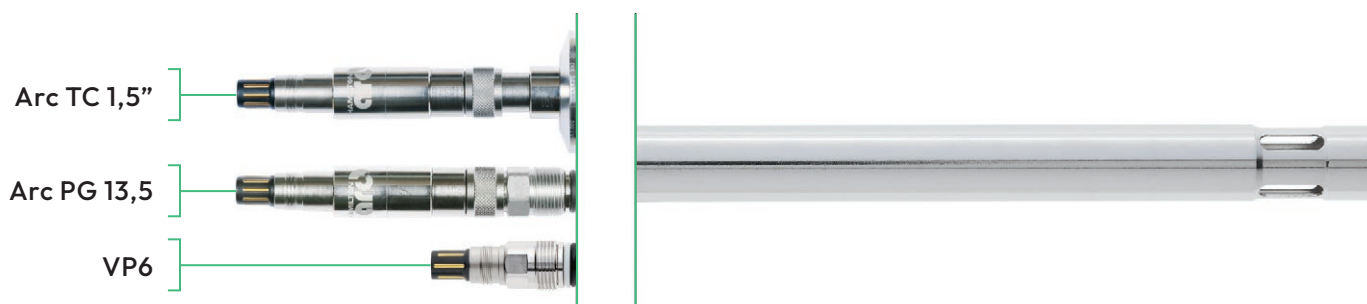


Conducell UPW

The Conducell UPW sensor provides industry-leading accuracy and sensitivity for producing pure and ultra-pure water in the pharmaceutical industry. The sensor is USP 645, EP, JP and FDA compliant, therefore appropriate for Pharmaceutical and pure water treatment applications. The Arc model can be directly integrated into standard control systems, eliminating the need for a transmitter. Arc technology allows calibrations, predictive diagnostics, automated documentation, as well as user and process assignment to be stored in the sensor. The Traditional model is suitable for use in hazardous areas and is ATEX and IECEx approved.

Benefits

- Industry leading accuracy and precision
- Exceptional temperature compensation
- Seamless integration
- Easy cleaning - USP 645, EP and JP compliant
- All wetted parts are FDA compliant



NEW

FlowCell COND 4UPtF

The FlowCell COND 4UPtF Arc sensor was developed for the measurement of conductivity used in downstream and other flow applications. Its four-electrode platinum design ensures exceptional measurement accuracy of $\pm 3\%$ or better and excellent linearity across the whole measurement range. The FlowCell COND 4UPtF Arc + pH is also available with a optional pH measurement, enabling simultaneous measurement of conductivity and pH across a wide range of applications.



Benefits

- Extremely high accuracy and linearity across the entire measuring range
- Fast temperature response ≤ 30 sec or faster ensuring real-time process adjustments
- Can measure a broad range of conductivity between 1 to 300,000 $\mu\text{S}/\text{cm}$

Typical Applications

- Downstream Bioprocessing
- Chromatography
- Tangential Flow Filtration
- Low-pH virus inactivation
- Other flow-cell dependent bioprocess monitoring

Conductivity Standards

Hamilton's conductivity standards are high-quality, high-purity calibration solutions designed for accurate and consistent verification of (all) conductivity meters and electrodes. They are ISO 17034 certified reference materials, with accreditation granted by the Swiss Accreditation Service (SAS), demonstrating production under rigorous quality control with traceability and reliability built into every step.

The standards are available in a diverse range of values and are suitable for various applications in pharmaceutical, chemical, food and beverage, and environmental monitoring industries. They are NIST traceable and stable for 12-36 months.



Benefits

- Best-in-class, patented conductivity standards of 1.3 and 5 $\mu\text{S}/\text{cm}$ with a certified accuracy of $\pm 1\%$
- NIST traceable and fulfills all requirements of United States Pharmacopeia USP Chapter 625



Hamilton's Conductivity Portfolio Overview

Cond

Conducell 4US

The Conducell 4US is ideal for measuring a broad range of conductivity (from 0.1 to 500'000 $\mu\text{S}/\text{cm}$) with superior accuracy, resolution, and temperature compensation. All wetted parts are FDA compliant and suitable for biopharma application (DIN 1.4435, PEEK, EPDM). The Conducell 4US is powered with a conductivity transmitter such as the H100.



Benefits

- All of your conductivity needs in one sensor: Capable of measuring a broad range of conductivity
- All wetted parts are FDA compliant and suitable for biopharma application
- No need for separate housing, already integrated

Typical Applications

- Fermentation
- Chemical Industry

Conducell SU

The unique Conducell single-use sensor can be easily integrated into single-use bags for broad range conductivity measurement. The integrated Arc technology enables easy digital integration, calibrations to be stored in the sensor, predictive diagnostics and automated GMP documentation.

Typical Applications

- Mixing bags for buffer preparation, virus inactivation or intermediate storage

Benefits

- Suitable for low and high conductivity measurements (100 $\mu\text{S}/\text{cm}$ to 300'000 $\mu\text{S}/\text{cm}$)
- Fulfills bio-compatibility, perfect for all biopharma applications
- Ready to integrate in single-use bags: Long shelf life of 36 months
- Pre-calibrated and pre-gamma and x-ray-sterilized



Arc Wi Pivot Adapter
(Optional)



Conducell SU Bioreactor Patch Handle



Label with
Calibration Data



Bioreactor Patch

Explore Hamilton's Field Services

We offer various Hamilton field service options to fit your facility's needs. Our Field Service Team is factory trained and ready to help you at any stage, from installation to long-running maintenance. See which Hamilton field service fits your needs.



Installation Support

Installation, set-up, and calibration support directly on-site. Our field service team ensures your sensors and cables are installed and functioning correctly.



Maintenance and Calibration Services

Preventative maintenance and regular service contracts. Schedule on-site service dates to ensure your sensors are properly maintained and your process is optimized.



Qualification IQ/OQ

Support for the installation qualification (IQ) and operational qualification (OQ) of Hamilton equipment including complete documentation. Ready your process for GMP manufacturing activities.



On-site Training

User trainings and on-site trainings for technicians. Tailored training ranging from basic operation to advanced calibration and maintenance.

Learn More: www.hamiltoncompany.com/field-services

Note: Our sensors are made to last. To increase sensor lifetime and avoid down-times, Hamilton suggests maintaining their sensors at least once a year by a Hamilton factory trained technician.

Unlock The Secrets of Bioprocessing Excellence

Download and find out more



App Note

Arc DO, Cond in monitoring of heating and cooling systems



App Note

Arc DO, pH, Cond in production scale fermentation process



White Paper

Biopharma Downstream Critical Process Parameters



Brochure

BioPharma



● Headquarters / Manufacturing



Years of Experience
75+



Locations Worldwide
22+



Employees Internationally
3,000+

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