HAMILTON

Innovative Solutions for Process Analytics

Bioprocessing Upstream and Downstream



Continuous Innovation for Biotech and Biopharma

More measurement parameters and less measurement error yield tighter process control

«With our pioneering sensor technology, we solve biopharma challenges»

Complete Portfolio

Measure all critical process parameters which enable the holistic understanding and control of your process.

Seamless Integration

Minimize the time and effort required to discover, procure, validate, and effectively utilize a Hamilton sensor.

Highest Quality

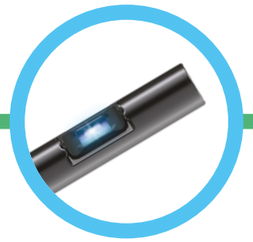
Benefit from products with the highest manufacturing standards to meet or exceed all FDA and GMP regulatory requirements.

Process Analytics Know-how

Hamilton provides 30+ years of experience of process sensors developed for biopharma applications.

Innovation for a Better World

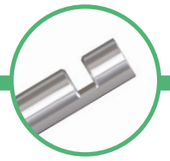
From Bioprocessing Needs to PAT Solutions
Over 35 years pioneering sensor solutions in process analytical technology development.



2025
NEW Optical Glucose Sensor



2025
FlowCell
COND + pH



2022
Total Cell
Density



2021
Solid-State Optical
CO_2 Sensors



2014
In-Line Viable
Cell Density



2015
Single-Use
pH



2017
Single-Use
DO



2010
Intelligent
Sensors



2007
Optical Oxygen
Sensors



2004
Pre-Pressurized
pH Sensors



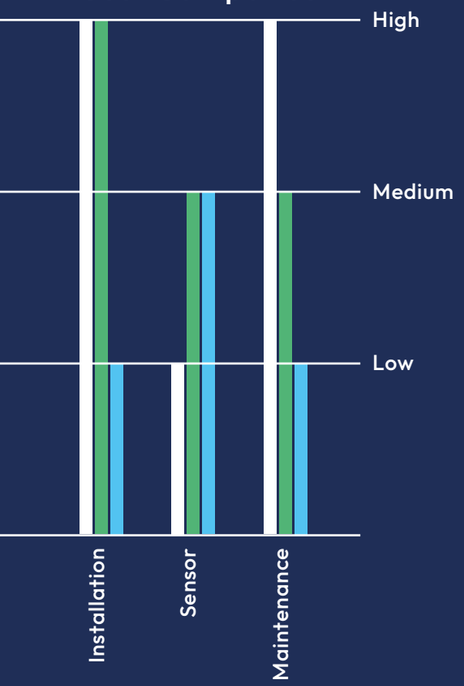
1989
Glass
Formulations

The Intelligent Sensor Revolution

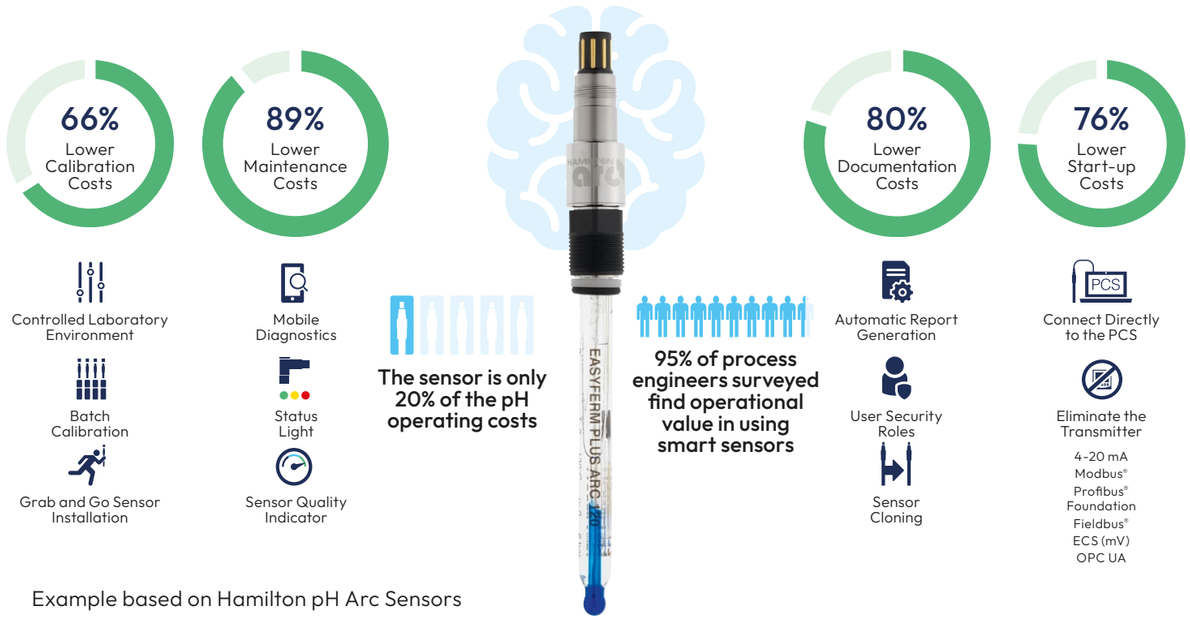
Over 95% of process engineers surveyed find value in using intelligent sensors

Less than half of engineers felt they fully utilized their smart sensor. The key to getting the most out of your smart sensor is choosing the implementation that best fits your application. Hamilton offers two versions of smart sensors each equipped with our best-in-class measurement technology.

Cost Comparison



Benefits of Replacing Analog with Intelligent Sensors



Example based on Hamilton pH Arc Sensors

Analog Sensors

Traditional analog sensors offer the lowest sensor cost which is ideal for implementations that discard the sensor after each run. They rely on a transmitter to read the sensor's electrochemical signal (ECS) and transmit it to the process control system.

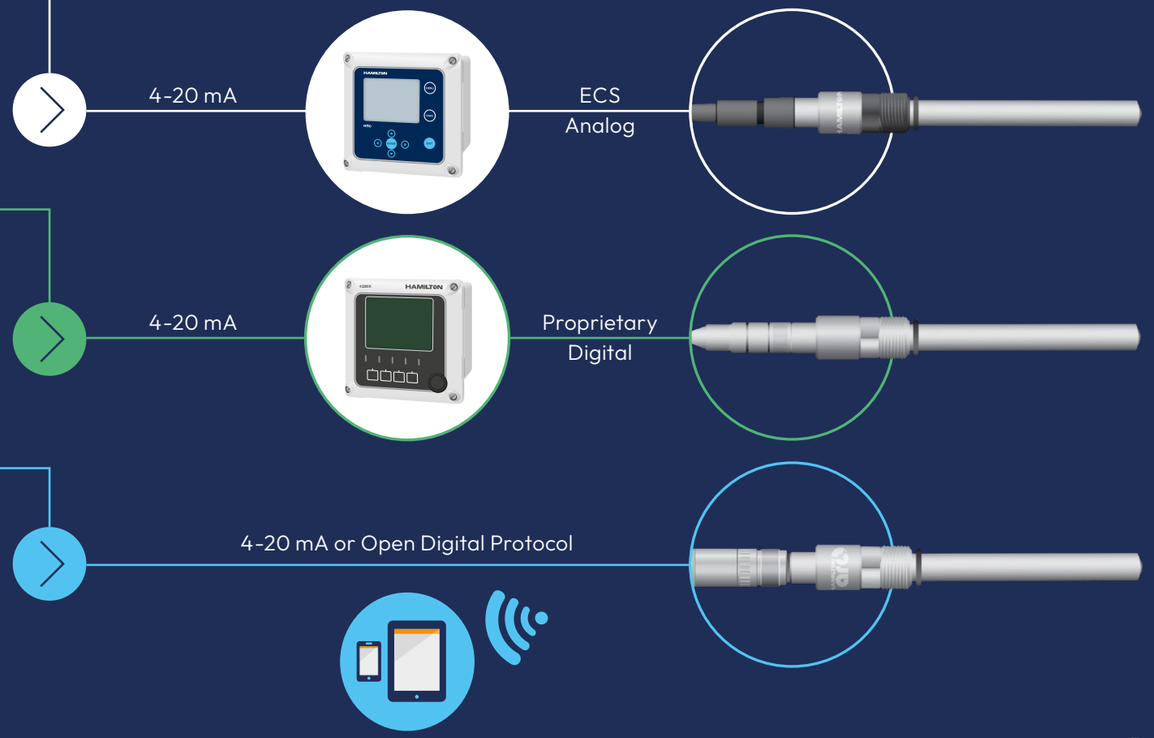
Digital Sensors

Memosens

Digital sensors eliminate signal errors from electromechanical noise near the cable and reduce maintenance cost by enabling in-lab calibration instead of at-line. This is accomplished with an integrated processor to convert the electrochemical signal to a digital output.

Arc Intelligent Sensors

Intelligent sensors have the lowest start-up and operating costs. They provide advanced alarms, troubleshooting, quality indicators, and diagnostics simultaneously to the control system and to an optional mobile device.
An integrated micro-transmitter eliminates a point of failure by directly connecting the sensor to the PCS.



A Trusted Partner

The top bioreactor manufacturers deliver reactors with Hamilton sensors installed

Bioreactor and fermenter performance is dependent on having reliable access to actionable data. Manufacturers choose Hamilton's diverse product offering to deliver to their customers relevant process parameters with exceptional life and low maintenance.

Retrofitting Existing Reactors

Hamilton offers sensors that are compatible with any bioreactor and provide exceptional measurement stability and sensor life. Upgrading to an intelligent sensor will lower operating costs with automatic reporting, batched in-lab calibration, quality indicators, and wireless troubleshooting.

Next Generation Systems

In recent years bioreactor manufacturers have incorporated 4–20 mA inputs to enable direct input from intelligent sensors. Now they are taking the next step by incorporating digital control of the sensors. This enables the user to check the sensor health, calibrate, and troubleshoot all from the reactor controller.



New Solutions

Dissolved CO_2

CO_2NTROL
The first solid-state sensor designed to directly measure DCO_2 in bioprocesses. The sensor provides a low maintenance, in-line measurement for the control of DCO_2. This parameter is useful for optimizing cell viability, product yield, and when scaling a process up or down.

Cell Density Sensors

Incyte Arc (VCD) and Dencytee Arc (TCD)
Real-time measurement of Viable Cell Density and Total Cell Density provides continuous data resulting in faster optimization of feeding and harvesting strategies.

Glucose Measurement

Glucose is a critical process parameter in cell cultures. Yet, its real-time control remains a significant challenge in bioprocessing R&D. Hamilton's new GlucoSense sensor offers a pioneering solution: an easy-to-use, robust, optical MIR glucose sensor designed for real-time, in-situ monitoring of glucose in mammalian cell culture bioreactors. The need for external spectrometers and complex calibrations is eliminated, enabling accurate measurements and faster process development.

Single-Use pH, DO, VCD, and COND

Hamilton developed a gamma sterilizable glass pH sensor that arrives factory calibrated and can be stored dry for up to 18 months. This can be delivered in the bag ready to use alongside Hamilton's single-use DO, VCD, and Conductivity solutions.

ArcAir Monitoring and Configuration Tools

Transform any Bluetooth-enabled iOS, Android, or PC device into a potent troubleshooting tool at no cost with ArcAir Software. Establishing a seamless Bluetooth connection, ArcAir grants comprehensive access to all your sensor data. For a more enriching experience, consider upgrading to our advanced version to unlock the full potential of our GMP package.

Arc Wi Pivot Adapter

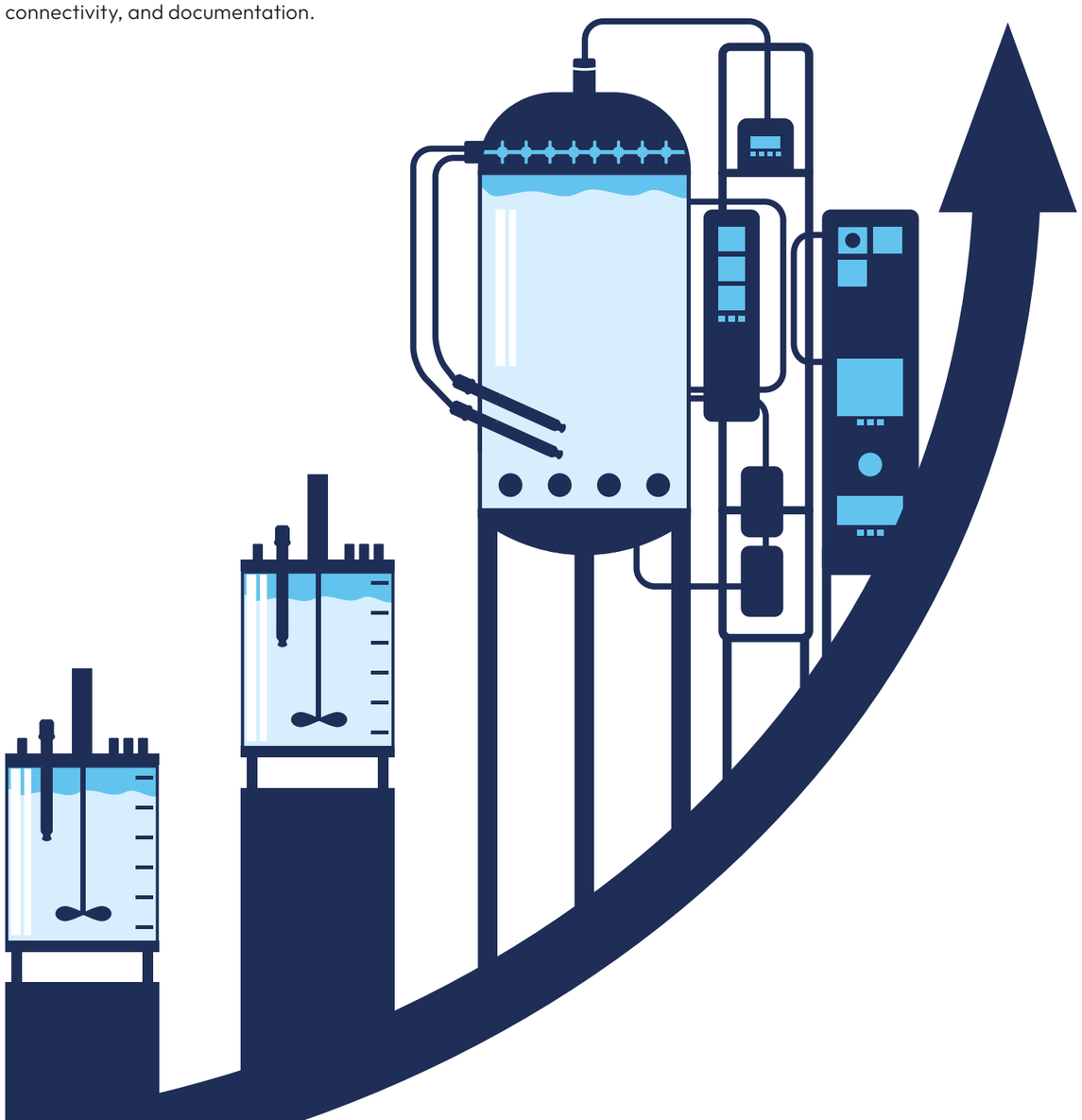
Arc Wi Pivot provides a compact, pivoting adapter that improves installation flexibility and delivers clean, stable 4–20 mA signals with full galvanic isolation. It supports encrypted Bluetooth setup on selected models or fully wired operation when required. With Arc Wi Pivot, users move from cramped, inconsistent installations to a secure and flexible, process-ready configuration.



Seamless Scale-up to Production

Sensors that last longer and require less maintenance

Hamilton is known for high quality materials and craftsmanship that result in exceptional sensor life. With the introduction of the Arc sensors Hamilton took ownership of the measurement loop and pioneered advances in sensor calibration, troubleshooting, connectivity, and documentation.



Services

Hamilton assists you to better understand the functionality and use of your sensors with a familiarization demonstration. Trained service engineers are available to commission, qualify, and verify your sensor installation and deliver audit-quality reports that can be shared with your regulatory body.

Calibration

On-site calibrations require a lot of preparation and logistic effort. Arc sensors can be calibrated in the lab and stored ready to use on the shelf.

Cleaning

Cleaning in Place (CIP) and Sterilization in Place (SIP) are very challenging treatments for the functionality of sensors. Hamilton sensors are engineered to achieve no offset and no drift shortly after cleaning.

Maintenance & Troubleshooting

Wirelessly troubleshoot up to 30 sensors at a time without having to enter the production environment. The sensor's quality indicator as well as errors and warnings are easily accessible via the ArcAir App on the Arc View Mobile.

Plant Expansion

Arc sensors eliminate the need for costly transmitters and simplify wiring with a variety of analog and digital communication options.

Documentation

Best practices require documentation of sensor calibration, communication verification, and post-process sensor verification. This is normally a manual process, but with Arc reports are generated automatically. The reports are saved in an encrypted GMP-compliant database, printed, and signed for compliance to 21 CFR Part 11 and Eudralex Vol. 4 Annex 11.

Product Offering

Single-Use Sensors

Reusable sensors are commonly used in single-use applications but require additional handling, sterilization, and insertion devices. Hamilton adapted these proven sensor technologies into single-use options that come from your single-use supplier: pre-installed, precalibrated, and gamma sterilized.



Factory Calibration Labels

Every single-use sensor comes with factory calibration data printed on the sensor tag. This data can be scanned into ArcAir with the 2D barcode, manually input, or directly entered into the bioreactor control system.

	pH	oDO	VCD	Cond
Reusable Electronic (not in media contact)				
Single-Use Sensor Element (wetted part)				

Compatible with Existing Single-Use Reactors

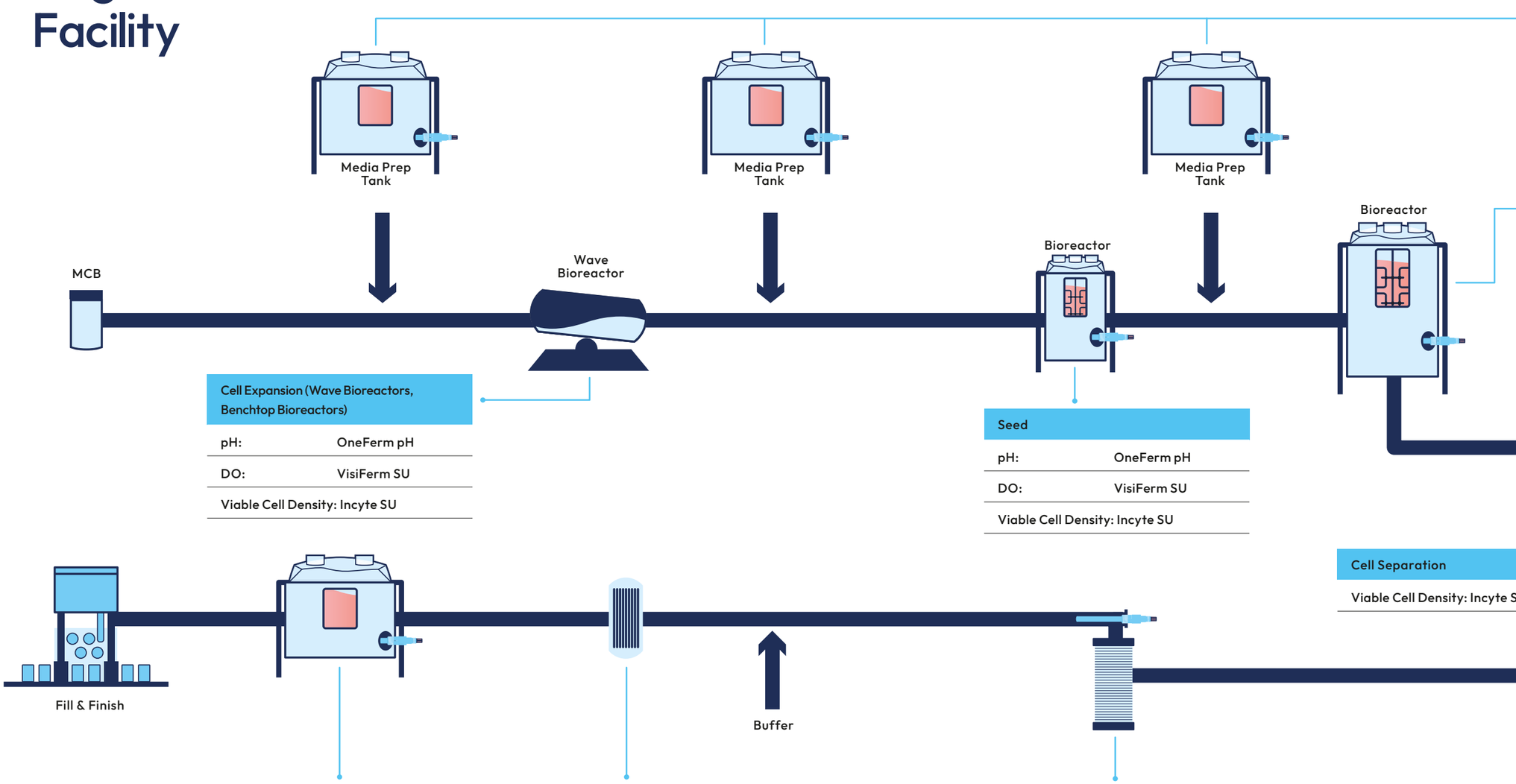
Hamilton's single-use solutions fit in a variety of different reactor styles and have already been evaluated for performance by many of the top single-use system providers.

Compatibility Options				
	pH	Dissolved Oxygen	Viable Cell Density	Conductivity
Rigid-Wall	✓	✓	✓	✓
Bag Application	✓	✓	✓	✓

Single-Use Sensors

Biopharmaceutical CPPs and KPIs

Single-Use Facility



Media & Feed Preparation

pH:	OneFerm pH
Conductivity:	Conducell SU

Production (Stirred Bioreactors)

pH:	OneFerm pH
DO:	VisiFerm SU
Viable Cell Density:	Incyte SU

Cell Expansion (Wave Bioreactors, Benchtop Bioreactors)

pH:	OneFerm pH
DO:	VisiFerm SU
Viable Cell Density:	Incyte SU

Seed

pH:	OneFerm pH
DO:	VisiFerm SU
Viable Cell Density:	Incyte SU

Cell Separation

Viable Cell Density: Incyte SU

Formulation

pH:	OneFerm pH

TFF

pH:	OneFerm pH
Conductivity:	Conducell SU

Chromatography

pH:	OneFerm pH
Conductivity:	Conducell SU

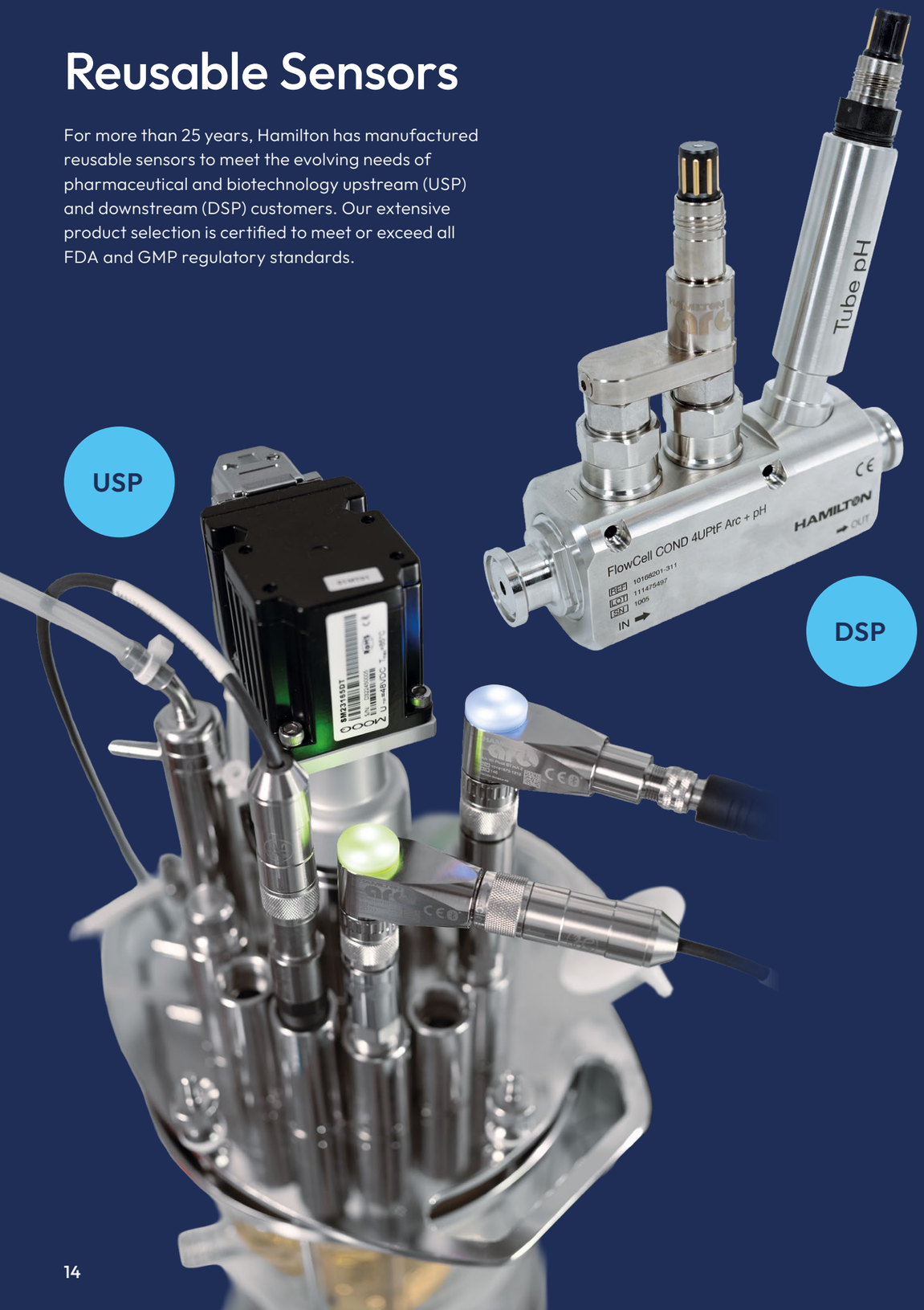
Capture Harvest

pH:	OneFerm pH
Conductivity:	VisiFerm SU

Product Offering

Reusable Sensors

For more than 25 years, Hamilton has manufactured reusable sensors to meet the evolving needs of pharmaceutical and biotechnology upstream (USP) and downstream (DSP) customers. Our extensive product selection is certified to meet or exceed all FDA and GMP regulatory standards.



Measurement Parameters

All relevant measurement parameters for BioPharma applications are part of the Hamilton portfolio.





Electrical Connectors

Regardless of which electrical connector, analog or digital, Hamilton provides sensors with the compatible head.





Reusable Sensors

Biopharmaceutical CPPs and KPIs

Every step of the biopharmaceutical process has specific requirements for sensors to monitor and control it precisely. The roadmap below shows the individual recommendations from the Hamilton portfolio.

Pharmaceutical Grade Water (PW, UPW, WFI)	
pH:	Polilyte Plus
Conductivity:	Conducell UPW

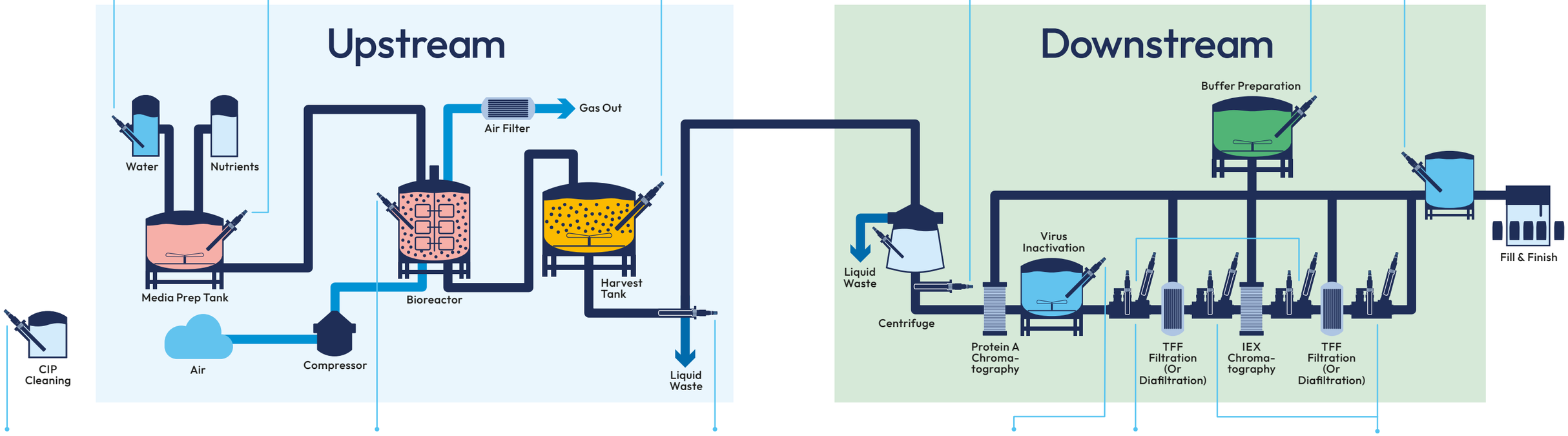
Media Prep Tank	
pH:	EasyFerm Bio, Polilyte Plus
Conductivity:	Conducell 4USF

Harvest Tank	
pH:	EasyFerm Bio
DO:	VisiFerm

Centrifuge	
DO:	VisiFerm
Turbidity:	Dencytee Arc

Buffer Preparation	
pH:	EasyFerm Bio
Conductivity:	Conducell 4USF

Formulation	
pH:	Polilyte Plus



Cleaning In Place (CIP) Preparation	
pH:	Polilyte Plus
Conductivity:	Conducell 4USF

Bioreactor	
pH:	EasyFerm Bio
DO:	VisiFerm, OxyFerm FDA
CO_2:	CO_2NTROL
GLC:	GlucoSense
Viable Cell Density:	Incyte Arc
Total Cell Density:	Dencytee

Monitoring of the Disinfection	
pH:	Polilyte Plus

Virus Inactivation	
pH:	EasyFerm Bio

Protein A/IEX Chromatography	
pH:	EasyFerm Bio
Conductivity:	FlowCell COND

TFF Filtration	
pH:	EasyFerm Bio
Conductivity:	Conducell 4USF

Sensor Families

pH

EasyFerm Bio

The Foodlyte electrolyte of the EasyFerm Bio sensors is Certified for bio-compatibility, making it the ideal choice for Food or Biopharma applications. Different glass membrane formulations are suitable for different applications, allowing the user to optimize their processes. Hamilton's clog-free diaphragm increases the stability and accuracy of readings, while increasing the lifetime of the sensor.

Benefits

- Certified Bio-compatible
- Pre-pressurized reference design for accurate pH measurement
- Clog-free diaphragm ensures extremely low drift over the sensor's lifetime
- Customizable to your application



pH

EasyFerm Plus

The EasyFerm Plus with the different glass membrane formulations are suitable for different applications, allowing the user to optimize their processes. Pairing Hamilton's Phermlyte electrolyte with a pre-pressurized reference and their clog-free HP Coatramic diaphragm increases the stability and accuracy of readings, while increasing the lifetime of the sensor.

Benefits

- Suitable for all industries
- Pre-pressurized reference design for accurate pH measurement
- Clog-free diaphragm ensures extremely low drift over the sensor's lifetime
- Customizable to your application



pH

Polilyte Plus

Polilyte Plus sensors have been designed to withstand demanding industrial processes in chemical, petrochemical, process water, and wastewater treatment applications. The sensor has a maintenance-free design as clogging is eliminated by the two single pore junctions. The Polilyte sensors show good measurement accuracy in highly alkaline solutions as well as in samples with low conductivity. Additionally, the Everef-L reference cartridge ensures a long lifetime. The integrated Liquid Earth in the VP6 stabilizes sensor signal and extends sensor diagnosis.

Benefits

- Maintenance free design: elimination of clogging with two single pore junctions
- Good performance in highly alkaline solutions and in samples with low conductivity
- Suitable for cleaning procedures in biopharma (CIP) and demanding industrial applications in chemical, petrochemical, process water, and wastewater treatment



DO

VisiFerm Family

The VisiFerm is delivered ready-to-use without polarization and low maintenance. It has improved measurement performance and no CO_2 fouling issues, delivering the lowest drift of available Hamilton DO sensors and requires 80% less calibration. The VisiFerm performs real-time self-diagnostics on sensor and cap health to further ensure optimum performance and reduce process downtime or batch losses. The new generation of VisiFerm also has a 50% longer lifetime compared to the older generation of VisiFerm sensors.

Benefits

- Ready-to-use
- Real-time self-diagnostic capabilities
- Most stable and robust DO sensor: no CO_2 fouling issues



Sensor Families

DO

OxyFerm FDA

The OxyFerm FDA sensor is an electrochemical polarographic dissolved oxygen (DO) sensor capable of the detecting a wide range of concentrations. The FDA approved membrane is suitable for industries requiring sterile applications (e.g. biopharma, biotech, food & beverage) and is capable of withstanding intensive sterilization and cleaning procedures (steam sterilization, autoclaving, CIP cleaning). The traditional nanoamp (nA) current output offers multiple options for electrical connectors and process mounting connections.

Benefits

- Wide measuring range
- FDA approved hygienic design: ideal for biopharma, biotech, food and beverage applications
- Robust construction: compatible with steam sterilization, autoclaving, CIP cleaning
- Increased versatility through optional accessories



CO_2

CO_2NTROL

Hamilton's CO_2NTROL is a solid-state sensor (no electrolyte) that directly measures DCO_2 and provides maintenance free (no consumables), real-time, and in-line control of this important critical process parameter. Automated control of DCO_2 enables increased titer, better batch-to-batch reproducibility, and more consistency from R&D to production-scale bioreactors.

Benefits

- Automated control of DCO_2 in bioproduction.
- Maintenance Free (save cost and time)
- Simple Calibration



GLC

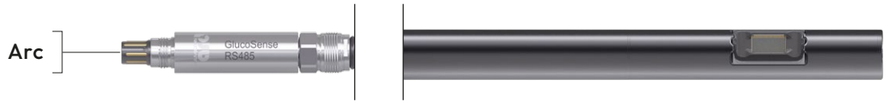
GlucoSense

Hamilton's GlucoSense is a solid-state infrared (IR) optical sensor (no enzymes, no reagents) that enables direct, in-line, real-time measurement of glucose & glucose epimers in cell culture media – without the need for external spectrometers or fiber optics. Designed for biopharma and biotech environments, it is maintenance-friendly, autoclavable and fully integrated with the ArcAir software platform via RS-485 Modbus communication.

Automated glucose control using GlucoSense supports increased bioprocess productivity, optimized feeding strategies, and improved consistency across development and manufacturing-scale bioreactors.

Benefits

- Easy to Operate: Accurate measurement with just in-situ process calibration. Safe to use, no laser protection required.
- Robust: Fiber-optic free, and compatible with autoclavation
- Ready to use: Monitor cell cultures from day one



VCD

Incyte Arc

When used on-line, the Incyte Arc sensor delivers real-time viable cell density measurements for deeper process insights and data driven process optimization and control.

Benefits

- Never miss an important event during your bioprocess by measuring viable cell density
- Gain deeper process insights e.g., cell size and morphology
- Determine viability in real-time for data-driven process optimization.



Sensor Families

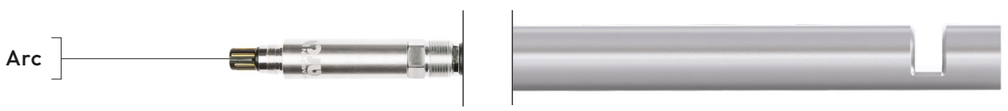
TCD Turb

Dencytee Arc

Hamilton's Dencytee Arc sensor is an on-line optical Transmittance and Reflectance sensor capable of accurately measuring the total cell density of cultures from 0-200 g/L. Beyond upstream process monitoring, the Dencytee Arc probe is equally well-suited for downstream applications where clarification efficiency and process consistency are paramount. By providing immediate feedback on turbidity levels, operators can quickly identify deviations, optimize centrifuge settings, and ensure that the clarified product meets quality specifications.

Benefits

- 1% accuracy over the whole measuring range from 0 to 200 g/L
- Never miss an important event during your bioprocess
- Robust design adapts to changes in ambient light and temperature
- Easy air verification with our Maintenance Tool Kit



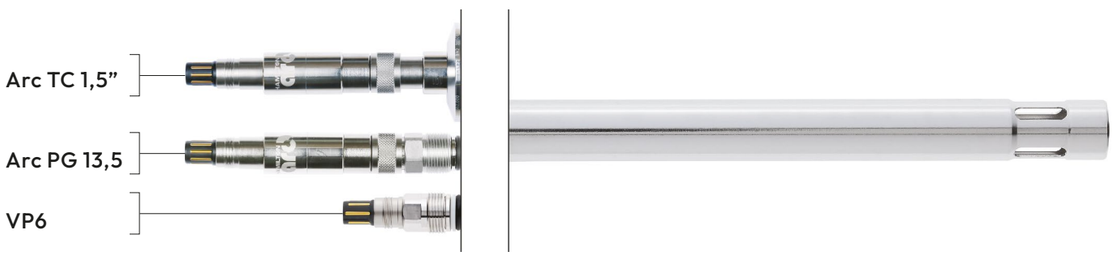
Cond

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



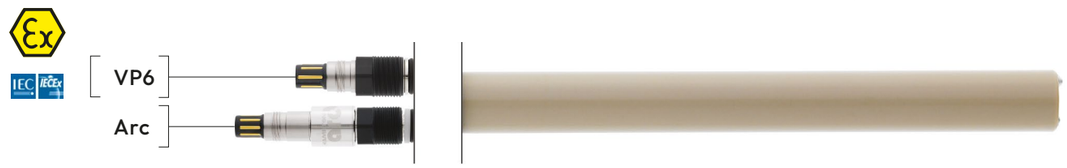
Cond

Conducell 4UxF

The Conducell 4UxF is capable of measuring a broad range of conductivity (from 1 to 500’000 µS/cm (Analog) and 1 to 300’000 µS/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



Cond

FlowCell COND

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 ±3% or better and excellent linearity across the whole measurement range. The FlowCell COND 4UPtF Arc + pH is also available with an 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 uS/cm



Housings

Retractex B

The retractable pneumatic or manual housing Retractex B was designed for sanitary applications in biotechnology, food & beverage and pharmaceutical industry. The Retractex B with its patented HyCIP cleaning principle offers the best available cleaning efficiency for Ingold sockets (G 1 ¼"). Due to the availability of Various other process connections it can be used with all vessels used in these branches.

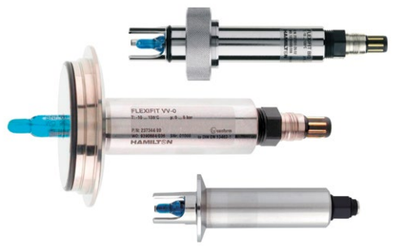


Benefits

- Extremely compact design
- Integrated safety concept: no sensor – no insertion
- Very low maintenance due to sterile safety and unique cleaning efficiency

FlexiFit

Easy and tailored integration for PG 13,5 enabling optimal positioning for the best measurement performance.



Benefits

- Easy integration for PG13,5 sensors in various stainless steel tanks or pipes
- Optimal sensor positioning for best measurement performance
- 185 versions (connection, insertion length, angled, o-ring position, sensor protection) to meet all the requirements of process connections

FlowCell

Flexible and space saving two parameter measurement point for bypasses when inline measurement is not possible or desired. The FlowCells comes in two sizes, which in turn are available with various connections.



Benefits

- Flexible design for one or two measuring points
- PEEK insert of high chemical resistance
- Low dead volume and self draining

Calibration

pH Buffers

DuraCal Buffer pH are patented pH calibration solutions available in a wide range of independently verified pH values (pH 1.68 - pH 12). Their high buffering capacity accurately provides rapid and stable calibration (± 0.01 pH). Hamilton's pH calibration solutions are stable for up to 5 years and their unique bottle design ensure convenient calibration with minimal waste (15 mL per calibration) and contamination.



Benefits

- Convenient: bottle has a built-in calibration compartment
- Economical: only 15 mL used per calibration
- Certified and traceable pH value from an accredited DakkS laboratory

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



Benefits

- Unique certified conductivity standards of 1.3 and 5 µS/cm at an accuracy of ±1%
- NIST traceable and fulfills all requirements of United States Pharmacopeia USP Chapter 625

GlucoSense Verification Kit

Hamilton provides convenient GMP-ready verification kits to ensure quick and reliable glucose sensor validation. Each kit includes a setup solution and a glucose solution, ensuring fast, reliable verification before starting a new bioprocess.



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. Readying 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.

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

Learn More

hamiltoncompany.com/field-services



Unlock the Secrets of Bioprocessing Excellence

Download and Find Out More

MEASUREMENT GUIDES

O_2
Measurement Guide

pH
Measurement Guide

WHITE PAPERS

Biopharma Downstream
Critical Process Parameters

Measurement Challenges
Optical Dissolved Oxygen Sensors White Paper

Dissolved CO_2 Series
White Paper, Part 1

Glucose
White Paper

Biopharma PAT
White Paper

Cell Density
Applications eBook

Dissolved CO_2 Series
White Paper, Part 2

Cultivated Food
White Paper

HAMILTON



Years of Experience
75+

Locations Worldwide
22+

Employees Internationally
3,000+

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