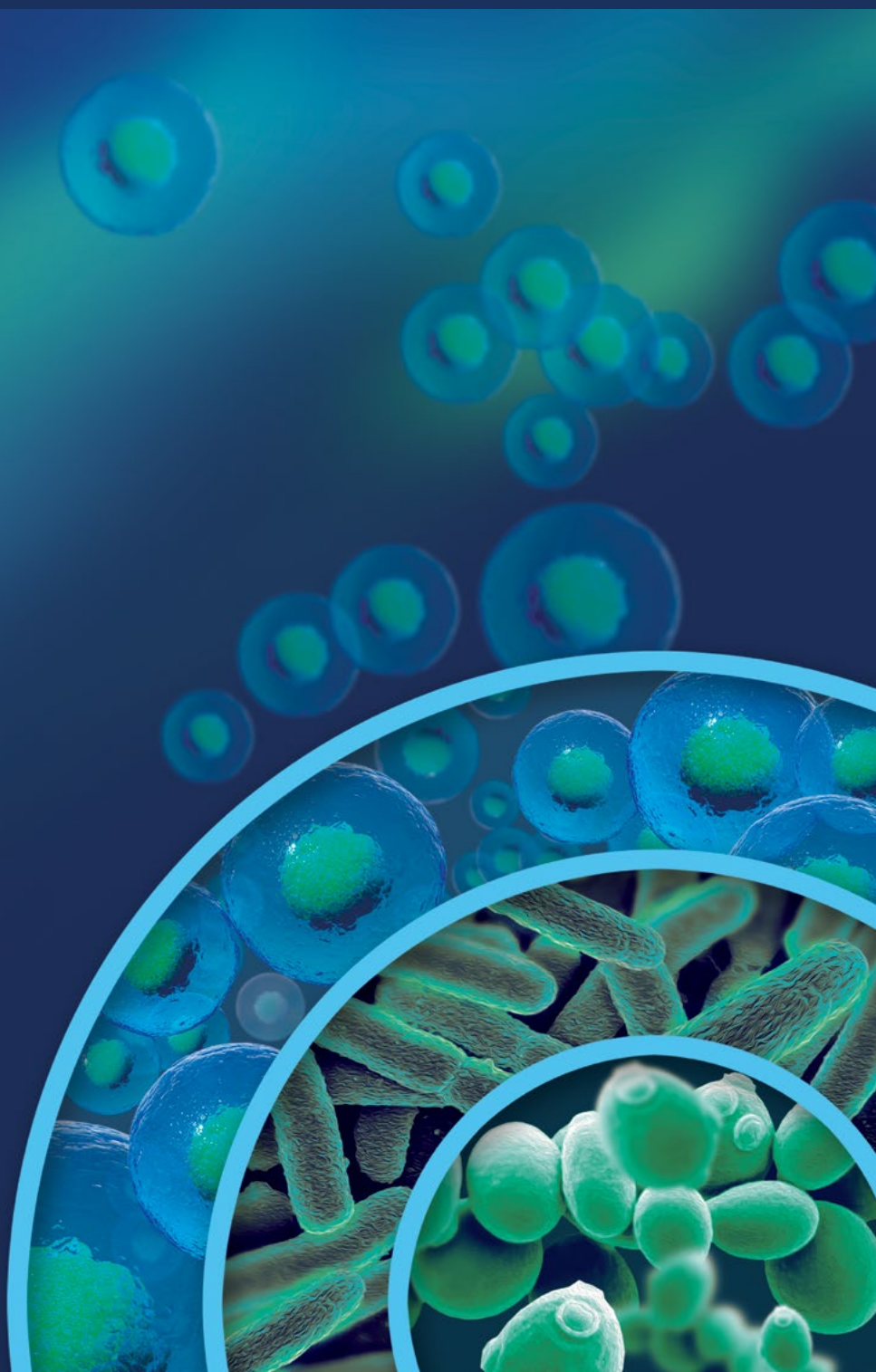




# Viable and Total Cell Density Sensors

On-Line Data, Real-Time Decisions



# On-Line Cell Density Monitoring

## Measure Cell Density in Real-Time for Immediately Actionable Data and Automated Process Control

On-line, or in-situ, measurement is the pinnacle of process monitoring and necessary for true process control as evidenced with control of pH and dissolved oxygen, common for most biological processes. In fact, many parameters can be monitored but those directly related to cell physiology are typically time consuming off-line measurements that provide only a reactionary window into the past.

Cell Density Arc® sensors provide a means for directly measuring viable and total Cell Density in realtime, meeting the increasing need for Process Analytical Technology (PAT) in the biopharmaceutical industry. Achieve advanced process control with unprecedented data availability. Clear, instantly available information ensures critical events that could have been missed between offline samples are now immediately recognizable. Learn more about each process in R&D, strategize process development, and automate production with one sensor that can be used at all stages.

### 1 Viable Cell Density

Permittivity measurements are the most reliable method of monitoring Viable Cell Density (VCD). This measurement is immediately affected by changes in Viable Cell Density and can be used to time process-specific actions for maximum yield. Permittivity can also be used to detect changes in cell physiology and is the most immediate method for determining the beginning of the cell death phase.



### 2 Total Cell Density

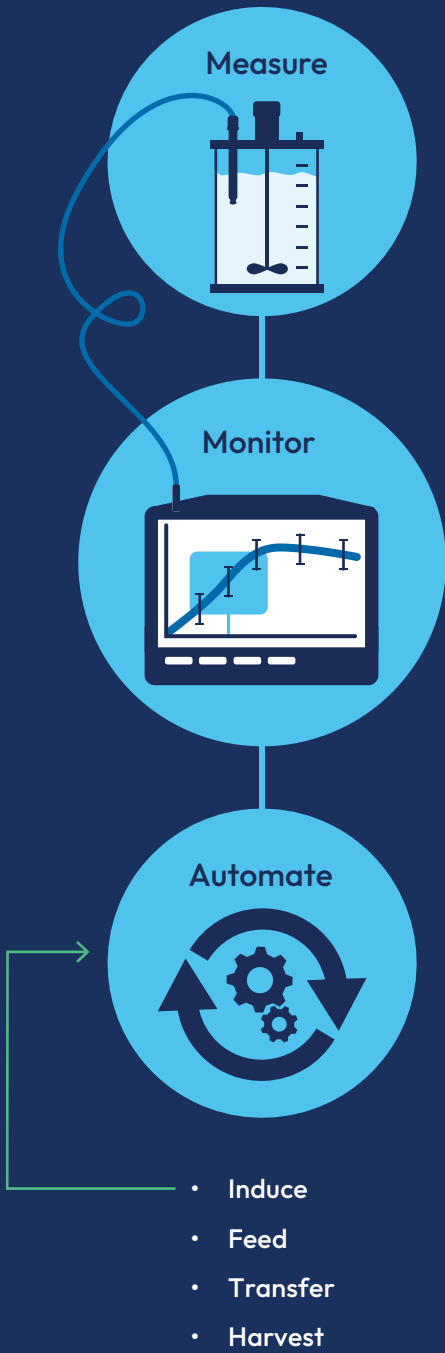
Total Cell Density (TCD) is a reliable parameter for measuring cell growth. The most relevant information is obtained during the lag and growth phase before significant cell death occurs. With on-line, or in-situ measurements, it is possible to detect process deviations and make the required adjustments.

### 3 Other Sensors

Use additional sensors in the Hamilton Sensor portfolio to utilize the full power of the PAT. pH, dissolved oxygen and CO<sub>2</sub>, and even conductivity are sensors that are suitable for process monitoring as well as for efficient process control.



**Measure to Control**  
Increased data from real-time measurement provides enhanced control opportunities resulting in desirable quality metrics like increased yield, lower operating costs, and improved reproducibility.





# Your Way for On-Line Measurement



## Incyte Arc®

### Viable Cell Density (VCD)

The Incyte® sensor enables real-time, on-line measurement of viable cells without need for sampling. Typical applications include mammalian cell culture, yeast, and high-density bacterial fermentation. The measurement is independent of changes in media, microcarriers, dead cells, and debris. Online measurement of viable cells makes it possible to detect events and respond in real time without off-line sampling.

- Increase Yield and Lower Production Costs
- Detect Changes in Cell Physiology with Frequency Scanning
- Enable Process Control for Improved Process Consistency
- Early Detection of Process Deviations



## Dencytee Arc®

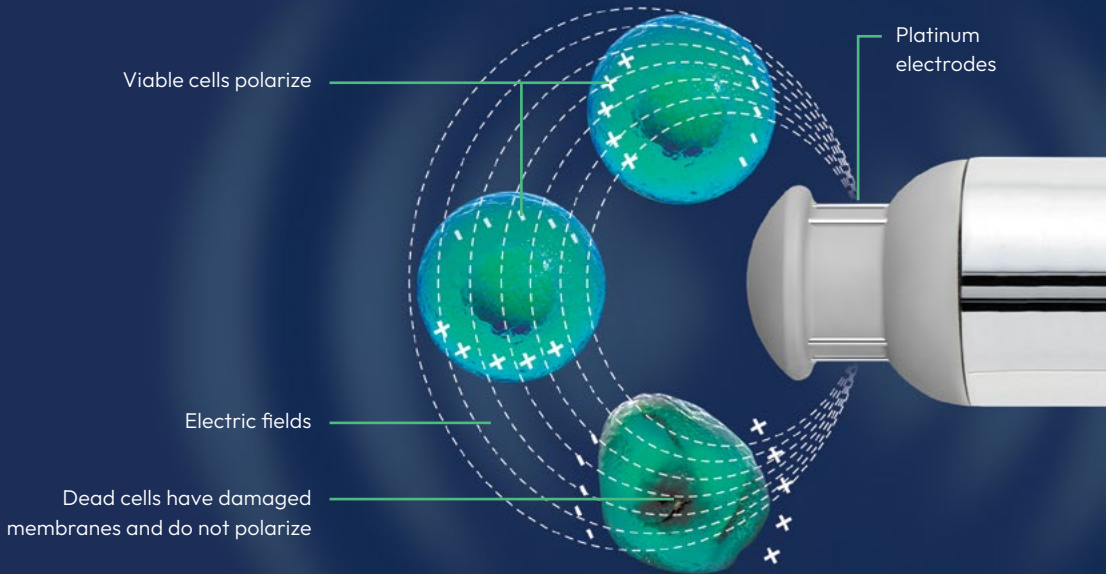
### Total Cell Density (TCD)

The Dencytee Arc® sensor performs on-line measurement of Total Cell Density in solution. The sensor is designed to measure the turbidity of the cell suspension. The measurement is made at NIR (near-infrared) wavelengths so it is insensitive to changes in media color. All particles and molecules that scatter light at 860 nm will be detected, including living and dead cells as well as cell debris. This measurement is effective after inoculation when cells are expanding quickly but concentrations are low, making capacitance-based readings less reliable.

- Simple On-Line Measurement of Cell Growth
- Reliable Values During the Growth Phase
- Improved Linearity at High Concentrations
- Early Detection of Process Deviations

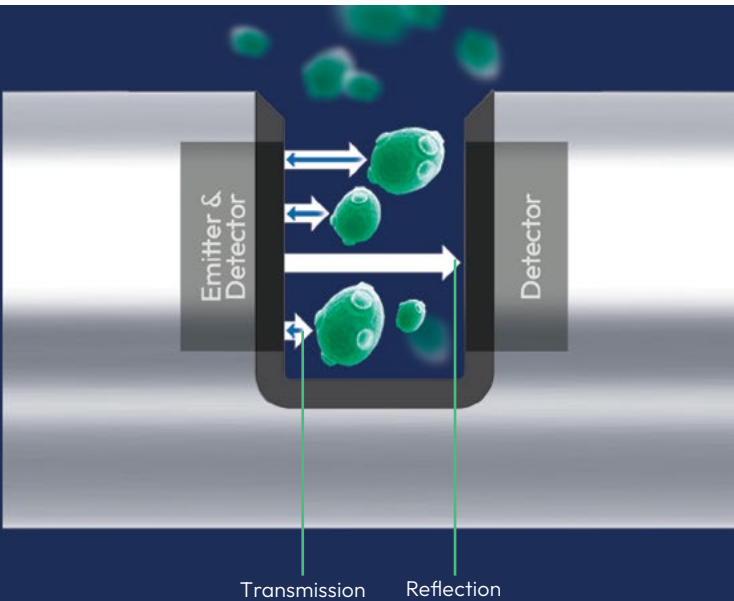
## How it Works

The Incyte measurement principle is based on capacitance. In an alternating electrical field, viable cells behave like small capacitors. The charge from these small capacitors is measured by the sensor and reported as permittivity (capacitance per area).



## How it Works

The Dencytee Arc sensor measures over a 5 mm sensing gap. A light source is on one side with one detector, while a second detector is on the other side of the gap. Depending on the cell concentration, the light is reflected by the cells or finds its way past the cells. Dencytee Arc combines the signal transmission at the front detector and reflection at the back detector into a single measurement value of the on-line total cell density.



To be able to measure low and high cell density at a high quality signal the sensor is able to measure the reflected light of the cells as well. This is especially beneficial at high cell densities.

# Innovate with Real-Time Cell Density Measurement

## Incyte Arc® Dencytee Arc® in Action

From increasing yield to shortening process time, the real power of in-line measurement is in your hands. As shown in the examples below, ask yourself what you could do with continuous process data.



### Process Understanding:

Expand your PAT capabilities with viable and total cell density and gain process insights such as cell physiology through use of multi-frequency scan.



### Process Optimization:

Real-time data means never missing a key process event. Use these data to develop enhanced process decisions for increased efficiency and prolonged productivity. ArcAir® Datamodeling and the Off-Line Correlation can be used to improve the measurement performance.



### Automated Control:

Precisely time key process events such as feeding, induction, and harvest for lower production cost, increased yield, and enhanced product quality.



### Consistent Quality:

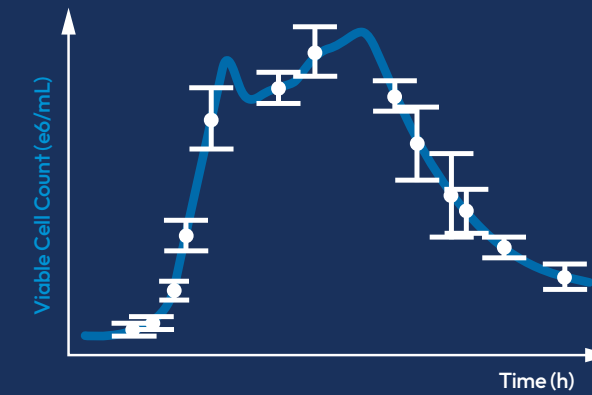
Compare viable and total cell density data to ensure batch-to-batch and scale-up reproducibility.



### Continuous Process Improvement:

Expand your PAT capabilities with viable and total cell density and gain process insights such as cell physiology through use of multi-frequency scan.

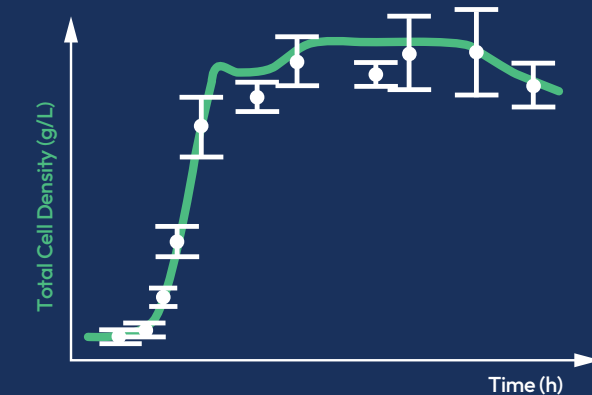
## VCD Measurement with Incyte Arc®



### Viable Cell Density Measurement is Best for Cell Culture:

- Mammalian Cell Culture
- Insect Systems
- High Cell Density Bacteria Fermentation
- Filamentous Applications

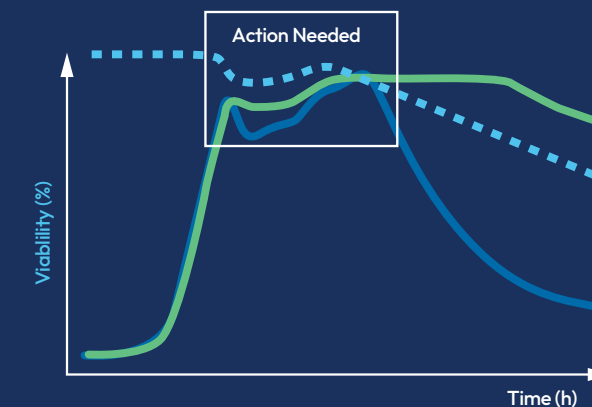
## TCD Measurement with Dencytee Arc®



### Total Cell Density Measurement is Best for Fermentation:

- Bacteria Application
- Yeast Application
- Mycoplasma, etc.

## Viability Measurement with Incyte Arc® and Dencytee Arc®



### Best for Viability Estimation in Cell Culture:

- Applications with Sensitivity Viability
- Long Duration Application
- Mammalian Cell Culture
- Perfusion

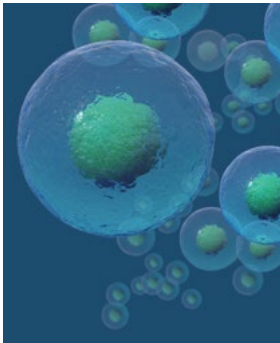
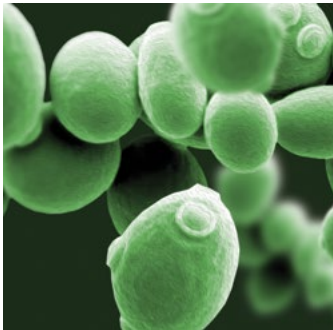
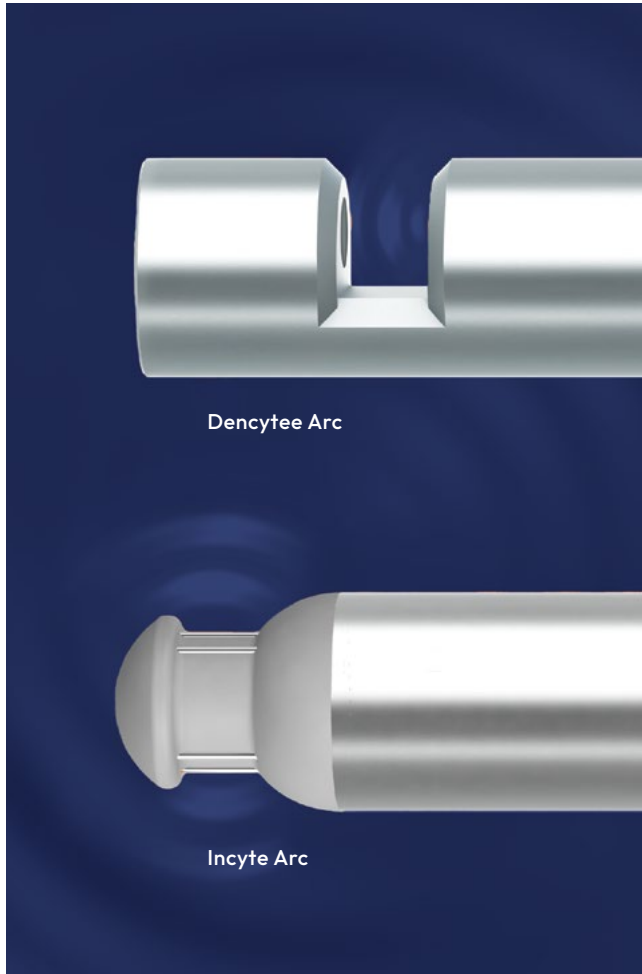
# Arc®-The Power to Connect

Wide Range of Integrations with No Transmitter.  
Don't Waste Valuable Workspace.

### Integrated Micro-Transmitters

Arc sensors integrated microtransmitter amplifies the sensor signal for direct connection to the control system. Sensor configuration occurs via USB or wireless Bluetooth®. Arc sensors save space and cost with their integrated microtransmitters.

Factory calibration and diagnostic data are saved within the sensor, so you can always check a sensor's performance, even mid-run. Built-in memory also provides back-up storage of process data for ensured reliability.



### Process Connectivity

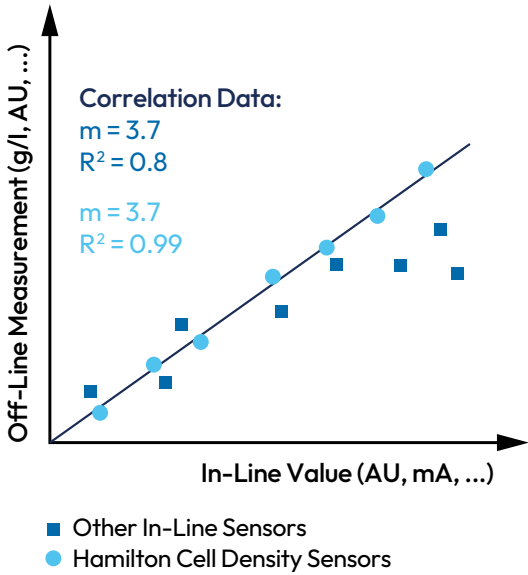
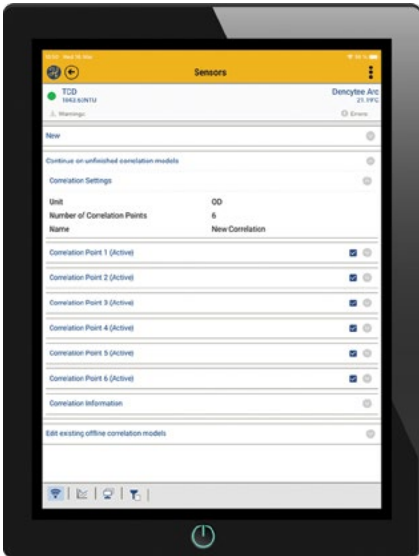
Arc sensors provide a robust connection directly to the Process Control System. Analog (with an Arc Wi 2G BT adapter) and digital communication protocols allow effortless integration into existing systems:

### ArcAir®

ArcAir® is Hamilton's intuitive software for daily use with the PAT sensors. View the signals of the Dencytee Arc and Incyte Arc with up to 6 other sensors together in a graph and record data. With one click the sensors can be configured, measurement parameters can be adjusted, and automated recording of maintenance actions can be saved. The report function can be used for export, which accesses a centralized database.

### Off-Line Correlation

A process specific solution to improve the signal quality is given by off-line correlation. With this, the optical properties of the cells are integrated into the signal processing. The creation is supported by ArcAir on the laptop or via the app.

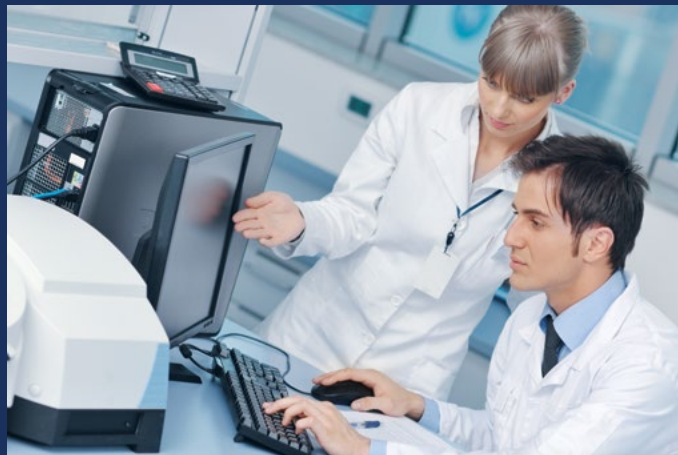


- Profibus
- OPC UA
- 4-20 mA
- Profinet
- Modbus
- Foundation Fieldbus



# Leverage Hamilton Expertise

Utilize Hamilton's Application Team and Proven Evaluation Process for Rapid Implementation and Robust Product Evaluation



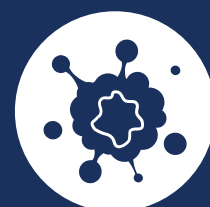
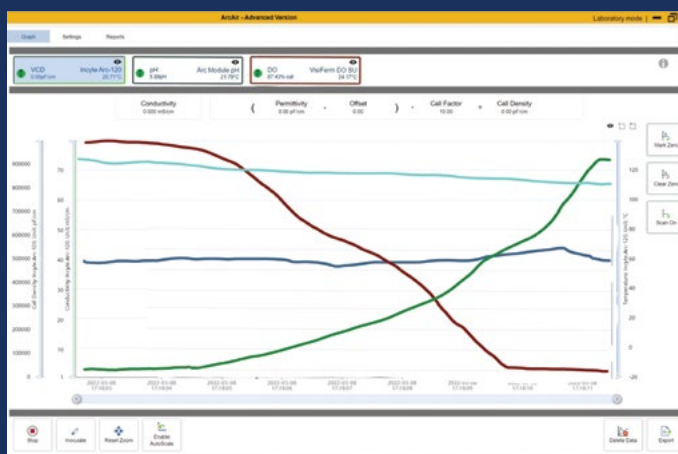
## Setup

A team of experts guide implementation with quick-start settings chosen for your process.



## Collection

Our Application Team is readily available to answer questions while you collect robust data.



## Analysis

Data is analyzed toward your specific objectives with the addition of insights based on an existing knowledge base of applications.

# Unlock The Secrets of Bioprocessing Excellence

[Download And Find Out More](#)

**Biopharma Brochure:**  
Innovative Solutions for  
Process Analytics

**Biopharma White Paper:**  
How does PAT Apply  
to the Bioreactor

**Cultivated Meat Brochure:**  
Cultivated Meat and Seafood

**Cultivated Meat White Paper:**  
PAT for Cultivated Meat  
Production and Optimization

**PA Product Catalog:**  
Process Analytics  
Measuring Solutions

## 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.

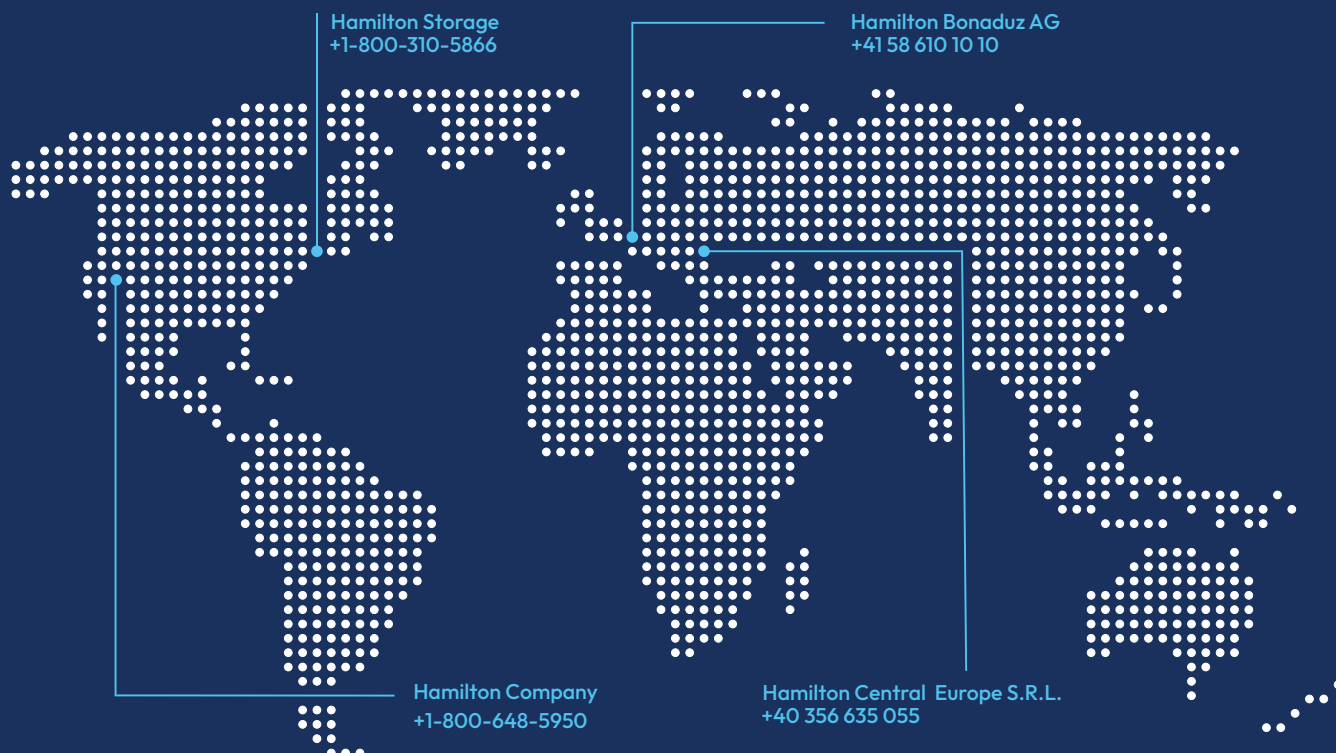


### On-site Training

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](http://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.



● Headquarters / Manufacturing



Years of Experience  
**75+**



Locations Worldwide  
**22+**



Employees Internationally  
**3,000+**

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your area, please visit:  
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