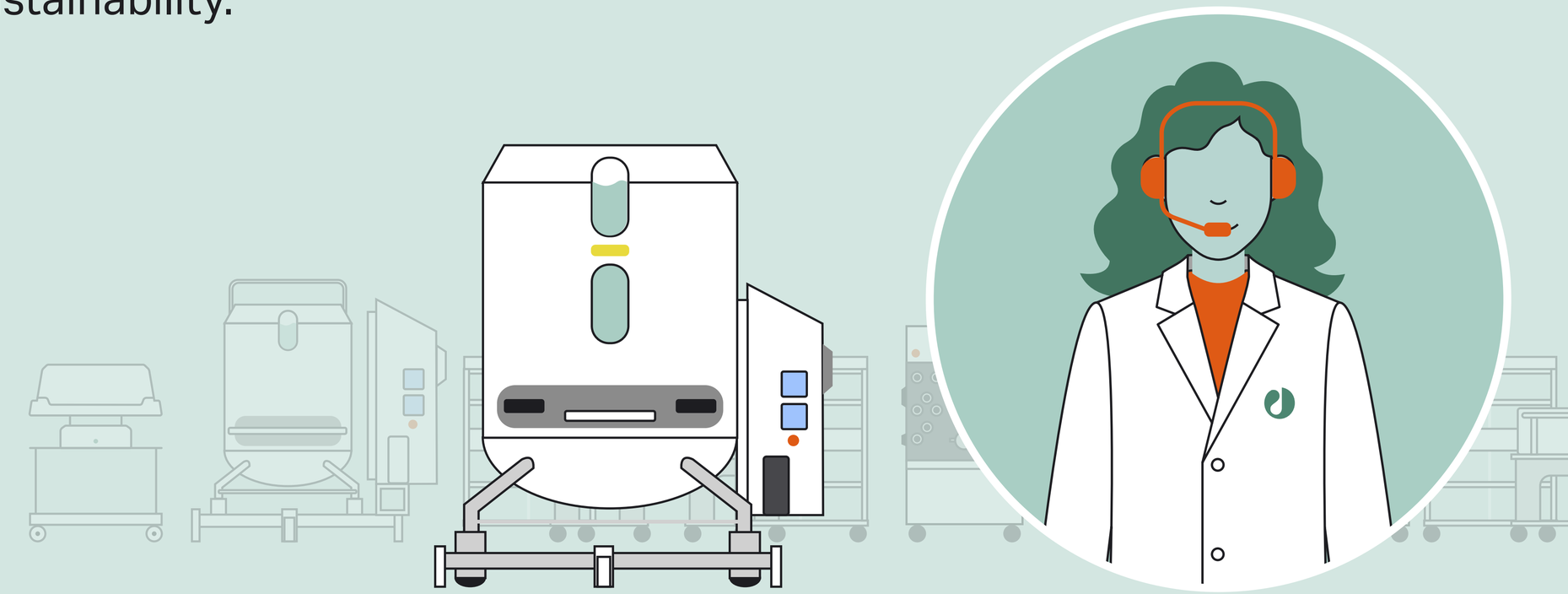
ebook

Remote equipment monitoring

From the touch of a button, gain control over your bioprocesses, building efficiency, and sustainability.



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Introduction

In today's increasingly digital world, life science companies that embrace and capitalize on the latest technologies are the ones moving faster, working smarter, and achieving greater success. Yet many organizations still rely on outdated, reactive approaches for monitoring their equipment, taking action only after equipment fails. In an industry where efficiency and reliability are key for success, this approach is no longer sustainable, as it results in unplanned downtime, wasted batches and resources, extra costs, and missed deadlines.

Many forward-thinking bioprocessing facilities are turning to remote, cloud-based equipment monitoring, which provides real-time visibility into equipment performance. This approach allows teams to make adjustments, diagnose issues, and fix problems remotely before they affect production. In this eBook, we explore how remote equipment monitoring is helping address some of the industry's biggest current challenges, including sustainability, efficiency, and compliance. You can also find practical guidance to help you seamlessly integrate remote monitoring into your biomanufacturing, optimizing your set-up for reliability and performance.

Remote equipment monitoring has never been more important

As pressures within the bioprocessing industry continue to mount, remote equipment monitoring is proving more valuable than ever. Here are the key challenges faced in the sector today, and how remote monitoring can help address them:

Sustainability

Sustainability is now a major priority for life science companies, who are under increasing pressure to cut energy use, reduce waste, and lower carbon emissions. Remote monitoring is essential for supporting more sustainable ways of working, by improving efficiency and resource use. For example, by tracking performance and energy use in real time, these systems can identify when equipment is running inefficiently or outside scheduled hours, helping teams reduce waste. And because many issues can be diagnosed and resolved remotely, fewer site visits are needed, significantly cutting travel-related emissions and saving around 40 kg of CO_2 per remote service call (Cytiva ServiceMax, 2025, data on file). Predictive insights also make it possible to plan maintenance before issues arise, preventing product losses and avoiding the extra resources needed to repeat a batch. Digital record-keeping in the cloud also cuts paper use, making day-to-day operations more sustainable.

You can find more information on sustainability in the biopharma industry in our latest report.

Financial pressures

Companies ranging from start-ups and SMEs through to big pharma are all feeling the pinch. Inflation, rising energy costs, and geopolitical uncertainty have pushed up expenses, while investor caution and funding gaps are limiting available money. To stay competitive, companies must find smarter ways to reduce costs and boost productivity without compromising quality or compliance.

Remote equipment monitoring can offer a financial lifeline, cutting the costs linked to downtime, maintenance, and inefficiency. Online engineers can access live performance data to detect and diagnose faults in real time, and often guide users to fix problems remotely, achieving same-day resolution in many cases. In many instances, response times can be as quick as two hours, helping facilities get back up and running before production is affected.

When a site visit is needed, engineers already know the cause of the problem and can arrive with the right parts and tools to complete repairs quickly. In some cases, augmented reality tools can even help on-site staff carry out immediate troubleshooting, saving costs on engineer callouts.

Shifting towards continuous biomanufacturing

Although the shift to continuous biomanufacturing boosts efficiency, consistency, and scalability, these systems demand uninterrupted equipment performance. Even brief downtime or parameter drift can derail production and harm product quality. This makes remote equipment monitoring essential, to provide continuous, real-time insights into process conditions and equipment performance.

With remote monitoring, you can receive instant alerts if performance values drift out of range, giving you the chance to act before quality, yield, or timelines are affected. Most remote approaches are supported by a centralized online platform, making it easier to manage your equipment portfolio by giving you access to manuals, service histories, and the option to book maintenance in just a few clicks. Remote systems can also send reminders for when preventive maintenance should be completed, so that servicing can be scheduled. This approach ensures equipment continues to perform reliably and reduces the risk of breakdowns.

Regulatory compliance

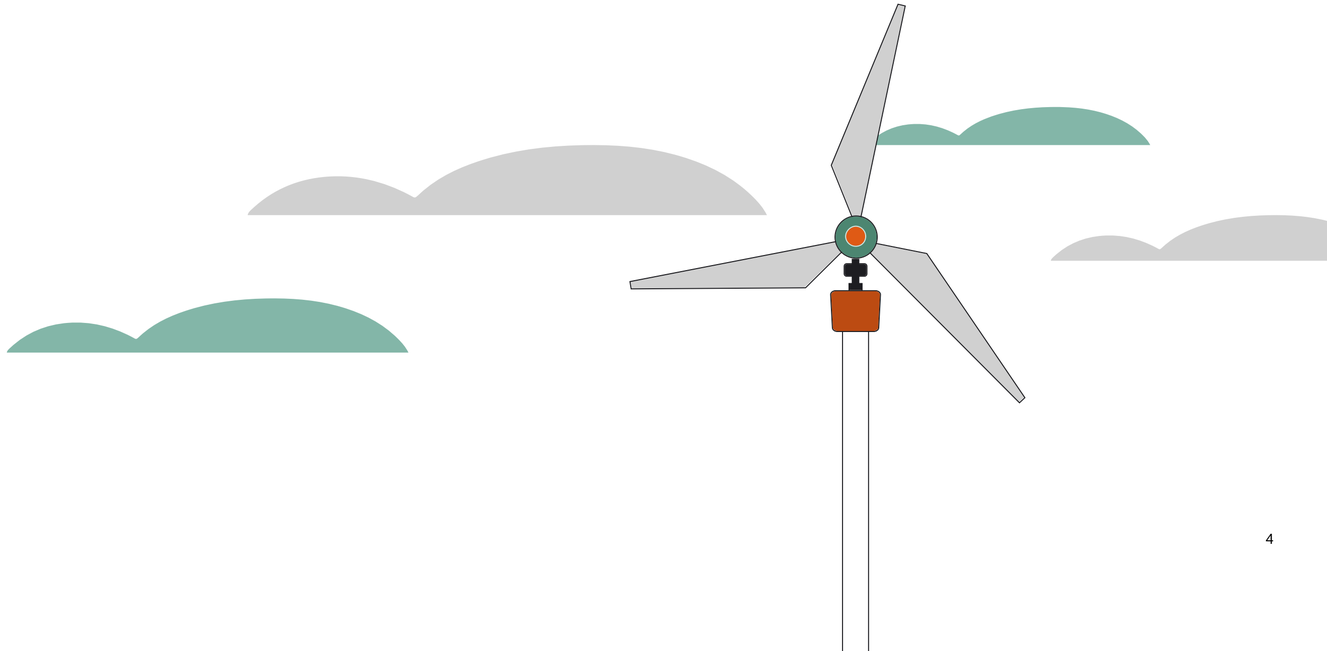
As digital transformation continues throughout the industry, regulators expect reliable, traceable, and transparent documentation of every process step. Remote equipment monitoring supports these expectations by providing verifiable, real-time data and continuous process oversight. Automated, time-stamped records replace error-prone manual entries, improving traceability, audit readiness, and confidence that processes are actively controlled and corrective actions are taken when needed.

To remain compliant, remote monitoring systems must also comply with recognized quality and data integrity frameworks. These include ISO 9001, ISO 13485, and good automated manufacturing practice (GAMP) 5, which outline best practices for quality management, risk mitigation, and system validation. Also, the upcoming ISO 9001:2026 will place greater emphasis on digital transformation, data integrity, and cybersecurity, raising compliance expectations for digital systems. Alignment with these standards not only demonstrates good quality practices but also supports compliance with key regulatory requirements, including FDA 21 Code of Federal Regulations (CFR) Part 11, EU Annex 11, and other good manufacturing practice (GMP) guidelines.

Data security

Data security is one of the biggest concerns for bioprocessing facilities as they become increasingly digital. With so much sensitive process data now being generated, and the average life science cybersecurity breach costing $5.1 million USD[1], it's vital to keep it safe to maintain compliance and prevent costly cybersecurity breaches. Yet many facilities still rely on, on-premise systems, where data is stored and managed locally. This places the full responsibility for maintenance and protection on internal IT teams, who may not have the time or expertise to keep pace with evolving cyber threats.

Choosing a provider with a cloud-based system offers a more reliable alternative. With providers investing heavily in cybersecurity infrastructure, dedicated security teams, and compliance with international data-protection standards, they deliver a higher and more consistent level of protection. These platforms use advanced encryption to secure data, with continuous monitoring to detect and respond to threats quickly, and built-in access controls to ensure only authorized users can view or modify information. Regular software updates also keep defenses current, and automatic backups across multiple secure locations safeguard against data loss.



1 IBM. Cost of a Data Breach Report 2024. https://www.ibm.com/downloads/documents/us-en/107a02e94948f4ec

Our top recommendations for remote monitoring in bioprocessing

To get the best results from remote monitoring, it's crucial to choose a system that connects effortlessly with your existing bioprocessing operations and evolves as your facilities grow. The following suggestions outline how to create a secure, compliant, and optimized setup for long-term success.

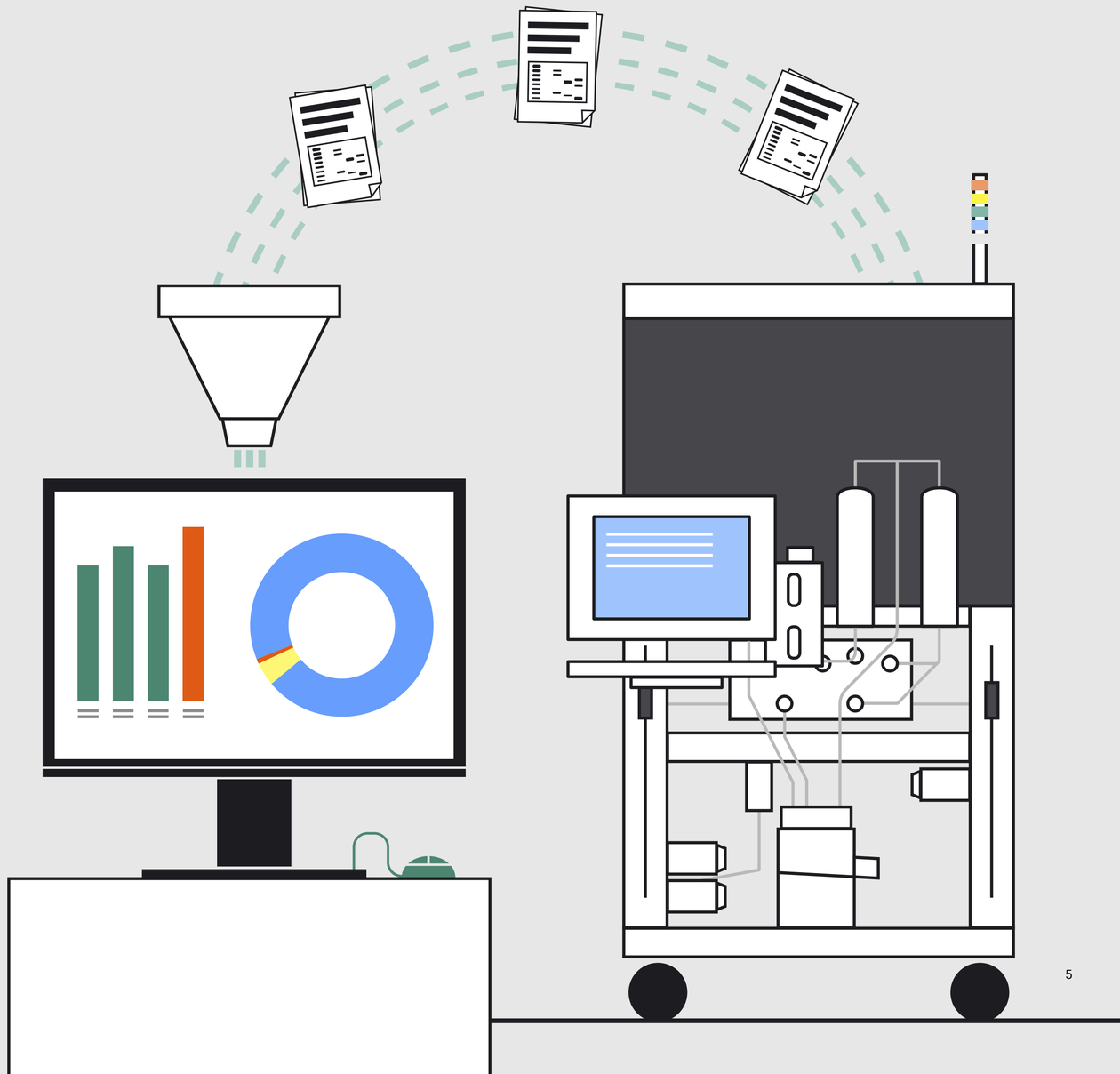
1 Make sustainability a top priority

Remote equipment monitoring and sustainability go hand in hand. To optimize your systems while minimizing your environmental footprint, you should leverage real-time data on energy consumption to identify inefficiencies. Also, remote diagnostics and troubleshooting should be implemented to minimize engineer site visits, in addition to digitized documentation to replace paper-based records. Your choice of provider is also key—they should align with your sustainability goals, with energy-efficient solutions and transparent environmental practices.

Learn more about sustainability at Cytiva

2 Ensure software compatibility

Check that your chosen remote monitoring platform supports your existing equipment and any new models, instruments, or software versions you plan to introduce. Seamless compatibility across devices and operating systems prevents data silos, integration issues, and downtime during upgrades or expansion. It's also important to confirm that your provider offers regular software updates and security patches to maintain reliable performance and protect against emerging cyber threats.



3 Ensure seamless integration

A remote monitoring system should fit naturally into your existing digital ecosystem. Assess how easily it can be installed and connected with workflow management tools such as laboratory information management systems (LIMS) or manufacturing execution systems (MES). Seamless integration ensures data flows smoothly between equipment and central systems, reducing manual work and improving visibility across operations. It's also worth thinking about scalability—the platform should be able to accommodate new instruments and upgrades without major disruption.

Many facilities benefit from using an online equipment management tool linked to the monitoring system, allowing teams to track service needs, review maintenance histories, and schedule upcoming maintenance in one place.

4 Customize for site-specific needs

Every facility has its own layout, equipment mix, and operational priorities, so a one-size-fits-all solution rarely works. Choose a monitoring platform that can be configured to match your site's specific setup, from how instruments are grouped and displayed, to how alerts and dashboards are structured. Customization ensures the data and notifications are relevant, actionable, and aligned with how your teams work day to day.

Before rolling the system out, evaluate your network infrastructure to confirm it can support consistent connectivity and data flow between all monitored systems. A reliable network is critical to ensure accurate, real-time data capture and avoid gaps in visibility.

5 Prioritize information security

Data security is a critical consideration when implementing any digital technology. Confirm that the remote monitoring platform includes strong cybersecurity measures such as data encryption (both in transit and at rest), multi-factor authentication, and strict access controls to ensure only authorized personnel can view or modify information. Regular security testing and audit logs further help protect against unauthorized access or data loss.

The system should also comply with your organization's internal information technology (IT) policies and align with external data protection regulations, such as the UK General Data Protection Regulation (UK GDPR) or equivalent international standards. Transparent documentation on how data is stored, transferred, and protected provides additional reassurance that security is treated seriously.

6 Maintain regulatory compliance

In regulated environments, remote monitoring systems must fully support good documentation and data integrity practices. Verify that the platform enables GxP-compliant data logging, detailed audit trails, and validation protocols that demonstrate it performs as intended. Your system should also include data security safeguards, like those discussed in this eBook, to ensure information remains accurate and protected throughout its lifecycle.

Ensure that the platform aligns with the expectations of relevant regulatory authorities, including the U.S. Food and Drug Administration (FDA), the European Medicines Agency (EMA), and other national bodies depending on your site's location and product type. Adhering to internationally recognized standards such as ISO 9001, ISO 13485, and GAMP 5 provides a structured framework that supports these regulatory requirements.

7 Support staff training and onboarding

onboarding resources such as user manuals, video tutorials and responsive technical support. This will help build more informed, self-reliant teams who are able to interpret performance data accurately, spot issues early, and sort out routine problems without needing to call in external engineers for small problems. Ongoing education and refresher sessions are important to keep teams up to date as workflows evolve and new features are introduced, and to make sure knowledge isn't lost when new staff join.

8 Evaluate alert and notification procedures

A good alert system helps catch and fix issues before they disrupt operations. Understand how alerts are sent and make sure they can be tailored by severity, equipment type, or process stage. This flexibility helps you focus on what really matters and prevents unnecessary notifications.

Alerts should also go immediately to the right people so they can act quickly. Having clear escalation steps and contact lists makes sure nothing slips through the cracks, even during shift changes or out-of-hours periods. A well-designed alert system keeps everyone in the loop and helps teams respond quickly and efficiently when problems arise.

9 Assess customer support and troubleshooting

Reliable technical support is key to keeping equipment running smoothly and minimizing downtime. Look for providers that offer access to skilled remote engineers who can diagnose and resolve issues quickly. The best support teams use secure digital tools, such as screen sharing, file transfer and live chat, to guide you step-by-step through troubleshooting, helping you get systems back up and running faster without the need for on-site visits.

Some providers also offer augmented reality assistance, allowing engineers to see exactly what you see through your phone or tablet and provide visual guidance. This not only speeds up problem-solving but also builds operator confidence in handling simple fixes independently.

The new standard for bioprocessing

Remote monitoring is setting a new standard in bioprocessing, helping companies move from reactive maintenance to proactive, data-driven operations. As the industry faces increasing financial pressures, tighter regulations, ambitious sustainability goals, growing data security demands and the shift toward continuous manufacturing, the ability to monitor equipment in real-time has never been more critical. These systems give you the visibility and control to spot and resolve issues quickly and often remotely, reducing downtime.

The shift toward connected, data-driven processes will only continue as more organizations see the benefits of faster response times, empowered teams, and continuous improvement. To make the most of these advantages, it's vital to choose and implement remote monitoring systems carefully, ensuring robust data security, seamless integration, and effective training and support for your teams.

For life science companies looking to stay resilient and competitive, remote monitoring isn't just a safety net—it's the pathway to smarter, more efficient, operations. The future of the industry will be shaped by those who harness the power of real-time data to optimize performance, prevent disruption, and empower their teams to solve problems faster than ever before.

Looking for a reliable remote monitoring system to maximize your uptime? Find out more about how we can support you by visiting our website.

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For local office contact information, visit cytiva.com/contact

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