

Making every drop count: How smart pressure sensors create more efficient irrigation systems



Introduction

Smart, efficient irrigation systems are the cornerstones of modern sustainable farming. By integrating smart pressure sensors into these systems, farmers can precisely manage water usage, reduce energy consumption and increase crop productivity.

In this white paper, we will explore the key challenges facing the agricultural industry, irrigation's role in addressing these challenges and how pressure sensing technology helps irrigation systems use water more effectively.

Growing food in a rapidly changing climate

Today's farmers face a multitude of challenges. While technology has revolutionized industrial farming, creating more efficient ways to cultivate crops on a larger scale, climate change has made agriculture more challenging and unpredictable. For example, in 2025, the United Kingdom suffered one of the driest springs on record, which severely impacted the development of crops such as wheat, oats and barley. This followed the third worst UK harvest on record in 2024¹. A recent survey of farmers in the UK showed that 78% of them had been impacted by drought in the past 5 years². These statistics give a small glimpse into the impact climate change is having on agriculture, with extreme heatwaves and prolonged droughts at inopportune times taking their toll on farming across the globe.

At the same time, several regions are dealing with water scarcity. Freshwater resources are under increasing pressure due to population growth, and growing demands from industrial and urban areas. UNICEF estimates that half of the world's population could be living in areas facing water scarcity in 2025. And almost two-thirds of the world's population – four billion people – experience severe water scarcity for at least one month each year³. Since water is one of our most precious, and limited, resources, we need to find methods of getting water to the crops that need it, and ways of using that water more efficiently.

¹ <https://eciu.net/media/press-releases/2025/uk-on-course-for-fifth-worst-harvest-after-drought-hits-staple-crops-new-data>

² <https://www.theguardian.com/environment/2025/jul/02/farmers-climate-crisis-livelihood-extreme-weather-study>

³ <https://www.unicef.org/wash/water-scarcity>

Irrigation's role in modern farming

Irrigation, the artificial application of water to land or soil, plays a crucial role in this regard. In addition to supporting crop growth, it is a vital strategy for addressing water scarcity and drought conditions. Yet, there's a challenge. Inefficient irrigation can actually increase water losses

through evaporation, runoff and over-watering, adding to the very challenges it is meant to solve. This is where technology, and specifically smart pressure sensors come into the picture.



How smart pressure sensors **improve** irrigation efficiency

Pressure sensors enable farmers to accurately control water distribution in an irrigation system. They ensure that crops receive the right amount of water at the right time. Thus, they are essential to conserving water resources, as well as reducing energy consumption, improving irrigation system reliability and supporting higher crop yields. Consider how pressure sensors improve efficiency in some of the most common irrigation systems.



Sprinkler irrigation

Sprinkler irrigation systems require a considerable amount of pressure, which needs to be precisely regulated to maintain consistent droplet size and even coverage.

Pressure sensors provide real-time monitoring and control in sprinkler irrigation systems, preventing under- or overwatering and minimizing the risk of pipe bursts and water loss.



Pivot irrigation

To work effectively, pivot irrigation systems require stable accurate pressure along the entire system. By installing pressure sensors at strategic points in the system, farmers can ensure uniform pressure distribution.

Pressure sensors also allow farmers to perform preventive maintenance and optimize pump operation, which enhances yield uniformity and reduces downtime.



Drip irrigation

Drip irrigation systems are highly sensitive to pressure fluctuations. If the pressure is too high or too low, the emitters will malfunction, and water will be distributed unevenly.

Pressure sensors provide accurate pressure readings in real-time, helping farmers to immediately detect pressure anomalies and ensure consistent system performance. This, in turn, helps safeguard crop health and avoid waste.

Leveraging pressure sensors to **optimize** irrigation system performance

Given the central role pressure sensors play in irrigation systems, it stands to reason that by selecting the right pressure sensor, farmers can further optimize their system's performance. Consider how the DST P140 pressure sensor from Danfoss helps optimize irrigation systems. It offers:



Proven durability with more than 10 million pressure cycles in 10-90% of FS



Reliable precision for consistent irrigation system pressure.



A stainless-steel media interface that ensures longevity in demanding agricultural environments.



A compact size and versatile mounting options for easy integration with irrigation systems.



Water hammer and pressure spike resistance, which minimizes downtime and protects system components.



The foundation for digital farming

The DST P140 is also digital ready, meaning it can be incorporated in smart irrigation systems. Smart irrigation systems tailor watering schedules and run times automatically to meet specific landscape needs. They utilize smart irrigation controllers to monitor weather, soil conditions, evaporation and plant water use and adjust the watering schedule accordingly. For example, as outdoor temperatures increase (such as during a heatwave), or as rainfall decreases (such as during drought conditions), smart irrigation controllers incorporate data from sensors throughout the irrigation system to adjust the watering run times or schedules.



Uncover More Possibilities with Danfoss

The dedicated Aqua-drives are designed to deliver stable, efficient water flow in irrigation systems with varying demand. Its dedicated pump protection features ensure reliable operation even under fluctuating water availability. With advanced PID control and multi pump management, the Aqua-drives optimizes energy use, protects equipment, and keeps irrigation systems running smoothly.




Case story


How the DST P140 pressure sensor helps address water scarcity in India


Micro irrigation systems are a crucial part of tackling water scarcity in India, and national and regional water conservation schemes incorporate these systems to distribute available water resources equally between farmers. Using an outlet management system (OMS), Water Resource Departments shift irrigation from open-canal distribution to a pressurized, controlled pipeline system at each outlet, or farm. A typical OMS installation covers a 30–40,000-hectare area and supports 20–25,000 farmers. Each OMS uses **DST P140 pressure sensors** by Danfoss for 24x7 monitoring of water pressure. In a pressurized irrigation network, pressure is the most critical parameter, helping authorities to:


Once deployed, the OMS generates measurable benefits for farmers, including:


- **18-25% water savings** through better pressure control, reduced overflow and optimized distribution;
- **15-20% energy savings** by reducing unnecessary pump running hours;
- **A significant reduction in complaints** related to low pressure and uneven water supply; and
- **Higher irrigation efficiency**, especially during peak demand periods.

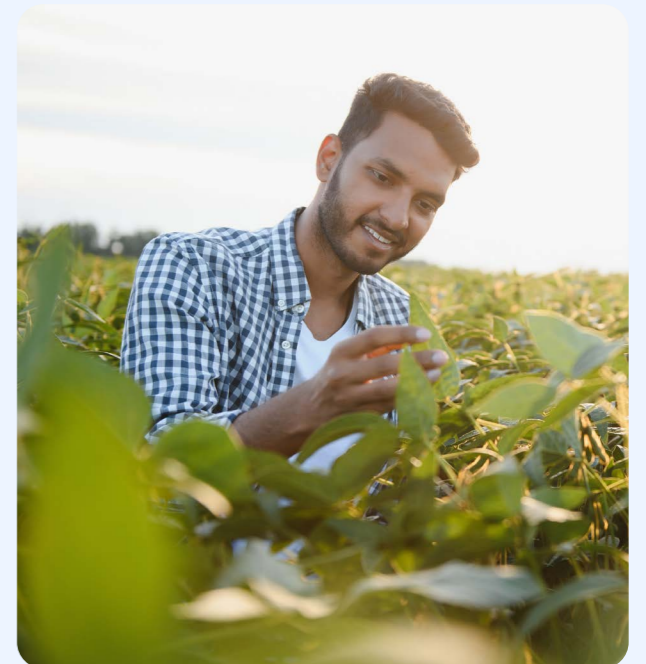
 Monitor line pressure at each outlet

 Maintain a uniform flow to each farm

 Detect leaks or unauthorized water usage

 Enable automation

 Maintain pump efficiency








Conclusion


As we've seen, pressure sensing technology is a key enabler for sustainable agriculture. Smart sensors in irrigation systems help farmers use water more efficiently and overcome the dual challenges of climate change and water scarcity to meet their production goals. And by combining these sensors with other technology-driven approaches to water management and agriculture, such as precision-drip irrigation, soil moisture sensors and automated scheduling, farmers can:

Danfoss is committed to working with pump and irrigation system OEMs, as well as local, regional and national utilities, regulators and authorities to develop intelligent water management solutions that address water scarcity issues and ensure water security. Find out more about our sensor solutions for water applications at [Danfoss.com](https://danfoss.com).

 Conserve water by delivering the right amount at the right time and in the right place.

 Protect ecosystems by preventing over-extraction from rivers, lakes and aquifers.

 Maintain productivity even under drought conditions or restricted water allocations.

 Reduce the environmental impact of their farming operations by lowering soil erosion, minimizing nutrient leaching and reducing energy usage.



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