HydroMet

FieldRay

Precision irrigation. Complete solution for irrigation management

KISTERS

Empowering decisions of tomorrow

Irrigation Management

The optimal timing and amount of irrigation is a complex decision. It not only depends on the phenological phase of the crop and the weather, but also the amount of water the crop loses through evapotranspiration, the conditions of the soil and the current moisture status in the root zone, and last but not least the amount of water available for irrigation.

Irrigation has effects on soil salinity and oxygen, the balance of micro-organisms, and the effects of fertilizers. Other factors like energy costs and the performance of aging equipment should also be considered. These all add up to complex irrigation decisions.

The more information a grower has at hand, the greater the confidence when planning and scheduling irrigation. Data-based decisions for irrigation management help growers to optimise crop and yield, save water and energy while better managing the use of pesticides and fertilizers. The saving of time, work and over-irrigation allows growers to get the best results in the most efficient way.

Solution for Irrigation Management

KISTERS offers with FieldRay Irrigation and FieldRay Plant Protection (advanced irrigation monitoring system) a complete end-to-end monitoring network for irrigation management: from the sensors (weather, soil moisture, ...) to the data loggers for setting up an application-specific internet of things at affordable costs, to the software for viewing data and visualising water uptake from the soil.
With this solution, the grower knows what is happening 24/7 and at any place: The most advanced data basis for optimal decisions on irrigation and other tasks.

Components

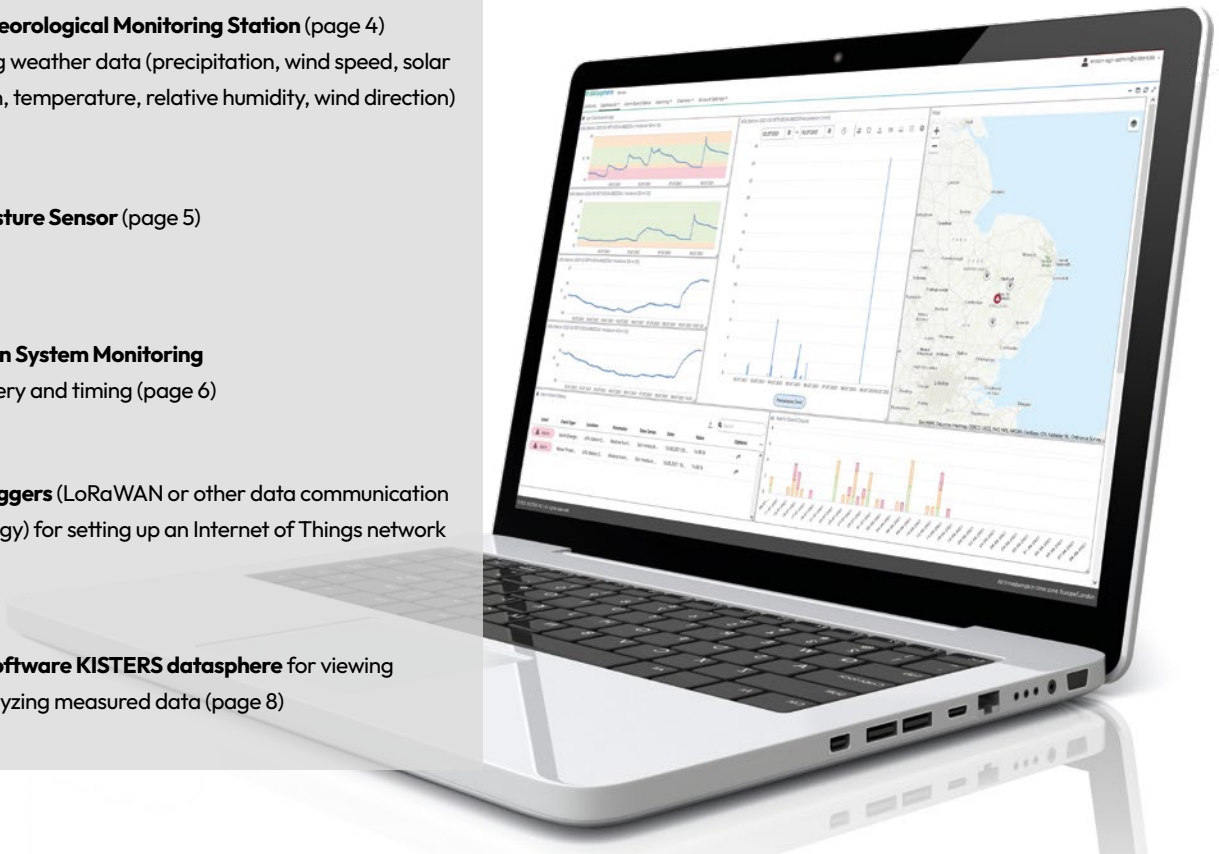
Agrimeteorological Monitoring Station (page 4) providing weather data (precipitation, wind speed, solar radiation, temperature, relative humidity, wind direction)

Soil Moisture Sensor (page 5)

Irrigation System Monitoring for delivery and timing (page 6)

Data Loggers (LoRaWAN or other data communication technology) for setting up an Internet of Things network (page 7)

Cloud Software KISTERS datasphere for viewing and analyzing measured data (page 8)



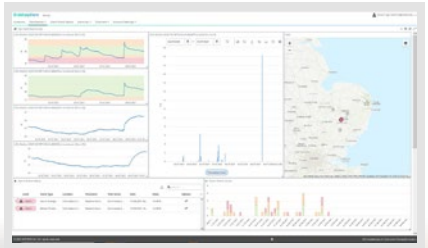
Benefits for Growers

More effectiveness, efficiency and cost reduction for irrigation.
By balancing irrigation appropriate to weather, soil moisture and crop growth stages, growers improve their results.

Your benefits

- Improve crop quality and yield
- Save water and energy
- Save pesticides and fertilizers
- Save time and labor
- Optimise available resources
- Detect your active root zones
- Control irrigation uniformity by monitoring flow rates and pressures

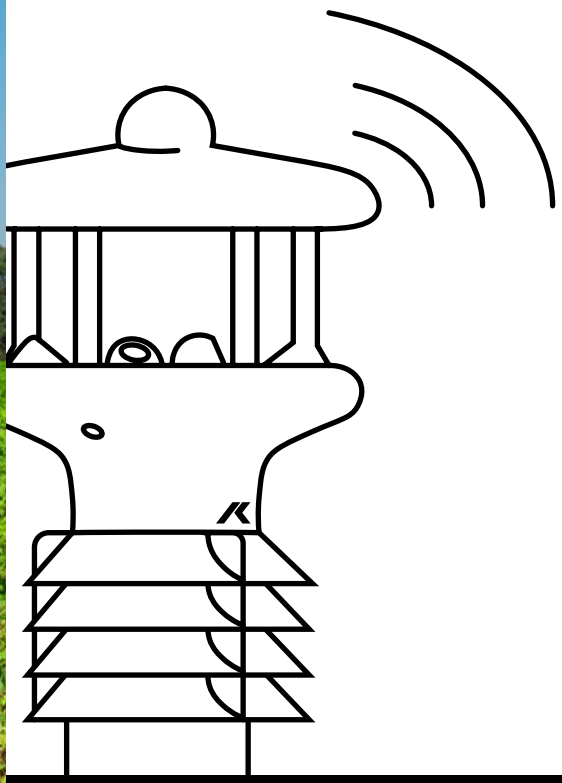
View sensor data on any device



Agrimeteorological dashboard: Observed soil moisture, precipitation and alarm overview

Precipitation: observed (blue) and forecast (red) in one single view

Forecast view for several parameters (e.g. temperature, precipitation) for the next 2.5 days in 3-hourly timesteps



FieldRay Plant Protection - Agrimeteorological Monitoring Station: Rain Gauge with solar panel (left), Weather Station that measures wind speed, solar radiation, temperature, relative humidity, wind direction (right)

Evapotranspiration (ET)

Generally, water transpired by the crop has to be replaced. The amount of water and when to apply it can be directly determined by weather conditions.

A good estimation can be derived from evapotranspiration (Et) which sums up the amount of water lost by the crop (transpiration) and the soil surface (evaporation). This relationship changes heavily depending on weather conditions, crop type and crop stages. This is why growers need precise information about the weather as well as specific characteristics about the development of their crop. Only with this knowledge can they determine the amount of water to optimise crop development and marketable yields.

KISTERS' industry-leading agricultural weather stations provide robust, accurate, and reliable sensors to measure temperature, wind speed and direction, precipitation, relative humidity, and solar radiation. With these specific parameters, KISTERS' cloud software datasphere is able to calculate crop evapotranspiration rates accurately so growers can manage soil moisture with confidence.

Soil Moisture Monitoring

Water in the soil is needed for nourishing the plants as well as for transporting substances to the roots. Not enough water is as bad as too much, because over-irrigation leaches nutrients from the rooting zone, putting them beyond the reach of the plants' roots and raises issues relating to the pollution of groundwater and run-off. Water logging caused by over irrigation starves the roots and soil organisms of oxygen leading to reduced crop performance. Using direct soil moisture measurement at multiple depths allows growers to track rooting depth throughout the growing season. This provides insight into how much water is available to the crop, the depth of water that is being actively extracted from the soil and how soil compaction may have impacted on root development. The complex interaction of all factors frequently makes it difficult to determine the best amount and time for irrigation.

Soil moisture monitoring is like having a camera in the soil showing the grower what is happening at each depth. KISTERS' multi-depth and multi-parameter probes allow growers to view soil moisture, temperature, and salinity at several depths throughout the soil profile. Summed or average trends allow the whole root zone to be treated as a single sensor operating as a gauge, showing if the root zone is at an optimum state or requires topping up.

In order to determine runtime and/or volume of irrigations, pressure sensors, flow meters and rain gauges are typically used in conjunction with soil moisture sensors. This combination of end-to-end monitoring gives greater confidence to growers to make simple changes in their irrigation schedules to get water to target depths.

The measured data of KISTERS' multi-parameter and multi-depth soil moisture probes allow growers to gain valuable insights in, e.g.

- Depth of infiltration after irrigation or rainfall events
- Rate of infiltration during irrigation events
- Crop water use (by depth)
- Irrigation runtime or volume

Irrigation System Monitoring

Irrigation delivery and timing is critical for maximizing crop quality and yield. The simple task of turning the irrigation system on and off can be restricted by scarce resources, energy prices, and even by governmental regulations, permits and licenses. Equipment reliability and performance can add further significant challenges. These can now be minimised through active remote monitoring and alarm notifications throughout the irrigation season. This provides optimal applications through scheduling and being able to visualise the performance of the farm's irrigation infrastructure in near realtime.

Simple monitoring of the irrigation system by using KISTERS datasphere software documents that irrigation is being applied as intended, helping to identify when something has failed, and to support timely decision makings of adjustments, service and maintenance, etc. KISTERS datasphere can be connected to flow meters, pressure sensors and water level sensors. The software allows growers and irrigation managers to set alarm triggers and thresholds is pumps, flow rates or pressure rise or fall below desired levels.

Typical information from irrigation system monitoring includes:

- Volume applied
- Flow rates
- Operating pressure
- Water availability
- Changing well depths
- Leaks
- Clogged filters
- Daily, weekly, monthly, and seasonal water use
- Allocation management
- Operating license and permitting returns

datasphere

Monitoring Hardware

KISTERS provides two datalogger families to provide flexible, cost-effective, state-of-the-art technology for a large range of agricultural weather and water management applications.

FieldRay Irrigation (basic irrigation monitoring system) based on the IoTa Datalogger, TB7 tipping bucket rain gauge and a soil moisture senor provides quality data for precipitation and soil moisture, soil temperature and as option also soil salinity.

FieldRay Plant Protection (advanced irrigation monitoring system) based on the iRIS Datalogger, TB7 tipping bucket rain gauge, WeatherSens compact weather sensor and a soil moisture senor provides quality data for ET calculation and soil moisture, soil temperature and as option also soil salinity. Both irrigation monitoring setups are completed with the KISTERS datasphere application software, which presents the quality data for decision support.

IoTa Dataloggers

KISTERS' IoTa sensor nodes interconnect sensors with data management software by means of adding modern wireless connectivity to digital sensors.

Low-power IoTa sensor nodes are available in two variants, either integrated into a rain gauge (HyQuest Solutions' TB7) or as a stand- alone device, both either with LTE-M or LoRaWAN.

IoTa sensor nodes are battery-powered and operate autonomously for several years on a single battery charge. They collect data from sensors connected via SDI-12 and counter input. Between readings of the input channels, the integrated low-power microprocessor falls into hibernation. To further reduce power consumption, the sensors are powered only to make a reading and then switched off.

Main characteristics

- GPRS/LTE/LoRa
- Sensors for multiple applications
- Easy installation
- Low maintenance
- Low power
- Low Cost

iRIS Dataloggers

KISTERS' iRIS dataloggers are reliable and multifunctional devices with data transmission via GPRS/UMTS/LTE, LoRaWAN and satellite. The devices are the ideal foundation for building Internet of Things networks. Functionalities of the low-power dataloggers include data collection, processing and storage, control of limit values and alarming.

Main characteristics

- GPRS/UMTS/LTE
- Sensors for multiple applications
- Easy installation
- Low maintenance
- Low power

Monitoring Software

datasphere

Data-based decision-making is crucial for modern precision farming.
The bigger and more varied your data pool the easier and faster it is to make informed management decisions with far greater confidence when it comes to irrigation and disease control.

With KISTERS datasphere, the global all-in-one solution for sensor data, you are always informed and empowered via smart phone, tablet or laptop to make the right decisions at the right time.

Functionalities of KISTERS datasphere

KISTERS datasphere is a cloud-based solution that allows you to see and manage your data live. Its powerful functionalities include:

- **Easy to use data viewing, data validation and editing**
  - Site-specific monitoring of soil moisture, soil temperature, and soil salinity
  - Multi-layer moisture graphs, stacked graphs, summed/averaged graphs, agronomical thresholds (e.g. full point)
  - Easily correlate soil moisture with ET and weather
  - Analyze irrigation system monitoring data to see cause and effect
- **Alarming** when thresholds of measured data are exceeded
- Compatible with a variety of SDI12 soil sensors for every crop, every soil and every budget
- Integration of web cams
- **Forecasting**
- Ability to integrate remote valve and pump control (customized solution)
- Cloud software solution: available on any computer or mobile device, from anywhere, at any time (optional: KISTERS datasphere on-premise solution)
- Combining site-specific measurements with open or licensed forecasts data
- Data sharing with third parties

About KISTERS:

For over four decades, KISTERS has been dedicated to the development of precise instruments and data loggers for hydrological, meteorological and air quality monitoring. The scope covers a wide range of applications including precipitation measurement, water level assessment, water flow analysis and comprehensive data acquisition services. The company is involved in the entire process of design, manufacture, distribution, installation and operational support of these instruments and data acquisition systems.

KISTERS has established itself as a major producer of tailor-made software solutions for the management of hydrological, meteorological, air quality, environmental and energy-related data. In particular, KISTERS boasts ISO9001 quality certification, underlining its commitment to high quality standards.

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KISTERS
Empowering decisions of tomorrow