# A GUIDE TO WEATHER STATIONS


VAISALA
**WXT520**

MONITORING
**SYSTEMS**

REAL-TIME
**DATA**

FLEXIBLE
**OPTIONS**

## MULTI-PARAMETER WEATHER MONITORING

Fondriest Environmental only offers equipment that passes the most rigorous tests for durability and quality. With our integrated weather-monitoring solutions, you can count on precise, reliable meteorological data.

FONDRIEST ENVIRONMENTAL

# A WEATHER SYSTEM OVERVIEW

Chances are, you'd rather achieve results with your meteorological data than spend time configuring a weather station. That's why Fondriest Environmental offers complete weather-monitoring systems with carefully selected equipment that meets only the most stringent performance and quality standards. Multi-parameter sensors, such as the highly popular all-in-one Vaisala WXT520, provide an unparalleled combination of value and performance. Add that to the versatility of a NexSens data logging solution with plug-and-play ease, and the result is a powerful, reliable, yet user-friendly solution that can be up and running quickly. These weather stations a have solid core system that is still customizable enough to meet a wide range of needs. Each station consists of a WXT520 sensor to measure the most essential weather parameters; a pre-configured NexSens iSIC Data Logger with user-defined telemetry solution; iChart software to receive, display, and export weather data; one of three platform choices; and a solar or AC charger. To learn more, call (888) 426.2151 to speak with an Applications Engineer.


## 1 The VAISALA WXT520 & other sensor options

Fondriest weather stations can assess more than a dozen different weather parameters. Six of those are measurable by one compact instrument with no moving parts. The Vaisala WXT520 measures wind speed and direction, liquid precipitation, barometric pressure, temperature, and relative humidity.

The wind speed and direction measurement is based on the Vaisala WINDCAP sensor, which uses ultrasonic waves to calculate accurate readings from any horizontal wind direction without blind angles and corrupted readings. A single module housed inside the sensor reads barometric pressure, temperature, and humidity using capacitive measurement for each parameter. The precipitation measurement in the WXT520 is unique, as it records accumulated rainfall, rain intensity, and duration – all in real time. The WXT520 is water resistant and classified as IP66. The wind and rain sensors can optionally be equipped with a heating element to prevent snow and ice buildup in severe weather conditions. A bird deterrent kit is also available.

In addition to these six parameters, Fondriest weather stations can be accommodated with sensors for solar radiation, soil, hydrology, and water quality measurements.

Wind Speed
Humidity
Wind Direction
Rainfall
Barometer
Temperature

## NexSens iSIC

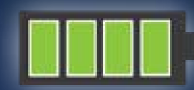
# 2 Data Logger

### & telemetry options

At the heart of every remote weather station is a NexSens iSIC (Intelligent Sensor Interface & Control) Data Logger. These data loggers can connect to virtually any sensor via analog and digital interfaces. Specifically designed for remote environmental monitoring applications, the iSIC offers superior data acquisition performance in extreme conditions. It delivers unmatched sensor interface and data collection with options for landline phone, cellular, radio, Ethernet, WiFi, and satellite telemetry. An iSIC simultaneously supports (8) analog inputs and (4) digital inputs for multi-sensor data logging capability. All electronics are housed in a rugged, NEMA 4X enclosure constructed of heavy-duty fiberglass. The built-in 8.5 amp-hour sealed lead acid battery provides 12-volt power to the system, and the battery can continuously charge using AC or solar power. Polymer-coated circuit boards, sealed connectors, corrosion-resistant stainless steel hardware, and built-in lightning protection ensure reliable performance in even the harshest conditions. All sensor cables run through Sealcon gland fittings to ensure protection from the elements.

# 3 Charging

### Options

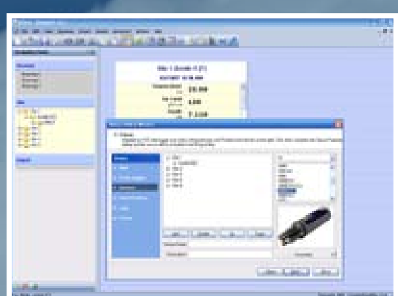


With solar and AC charging options, our weather stations are ideal for both portable and permanent applications. For systems near an electric outlet, the best way to charge is by simply plugging it in with an AC charger kit. Alternatively, a 20-watt solar panel kit can provide sufficient charging for most remote applications.

# 4 Platform Choices

Three platform options ensure this powerful weather station can go wherever needed. A fixed platform suits stationary, land-based applications. Additionally, there is a tripod option for portability or a buoy platform for systems situated in the water.

# 5 iChart Software



On the receiving end of iSIC data logger transmissions is NexSens' iChart data collection and processing software. It simplifies and automates many of the tasks associated with acquiring, processing, analyzing, and publishing environmental data. iChart is a complete, ready-to-use environmental data toolkit. It is designed with an open architecture and offers a straightforward interface. The software makes it easy for anyone to configure and customize weather monitoring and data collection projects, so professional results are possible without programming or IT experience.

# 6 WQData

### Online in real-time

iChart software can export data directly into WQData, a secure web datacenter providing an online interface for viewing environmental data. It offers 24/7 instant access to project data using any web browser.

Project datacenter sites can be password-protected or publicly accessible. Using WQData, visitors can view dynamic project area maps overlaid with weather data, recent and historical data, time series graphs, statistical summaries, and project-specific information.

An administrator login provides an intuitive interface for setting up the project, modifying data views, and adding relevant project information. Administrators can select from a library of predefined themes for a unique look and feel, enter site descriptions, set up data filters, and graph scales and other data attributes. Also included with WQData is the NexSens embeddable Web-Data Applet. Simply add the HTML code to any web page to present visitors with a quick snapshot of project data that also links back to the complete project datacenter.

# ADDITIONAL SENSORS

In addition to monitoring the typical weather parameters, NexSens data logging systems can accommodate several options for solar radiation, soil, hydrology, and water quality evaluation. This can expand a typical meteorological monitoring platform to agricultural and hydromet applications.

## Solar Radiation

LI-COR sensors are available to measure both solar and photosynthetically active radiation (PAR). The LI-COR 190 Quantum Sensor can measure PAR in the 400 to 700 nm waveband. The LI-COR 200 Pyranometer is designed for field measurement of global solar radiation and is suitable for measuring global sun plus sky radiation. It is ideal for agricultural, meteorological, and solar energy studies.

## Soil

Soil moisture, conductivity, salinity, and temperature can all be calculated instantly by the Stevens Hydra Probe II Soil Moisture Sensor. It can assist in understanding the impact soil conditions have on plants and the climate. The sensor is compact and rugged, making it easy to deploy and ideal for harsh conditions.

## Hydrology

Weather stations can be equipped to measure both water level and flow velocity. Level is measurable either with a NexSens AccuStage vented pressure sensor or with a non-contact OTT Radar Level Sensor. The OTT RLS can mount to a bridge, frame, pipeline, or extension arm and determine level based on its distance from the water surface. Velocity measurements are possible by incorporating a SonTek's Argonaut current profiling systems, which use Doppler sonar to measure water velocity. Different models are available depending on application needs.

## Water Quality

YSI multi-parameter sondes make it possible for a weather station to measure a multitude of water parameters. Sensor options include temperature, conductivity, pH, dissolved oxygen, turbidity, and many more.

# PLATFORM CHOICES

## fixed, portable, or floating

With fixed, portable, and even floating platform options, it is possible to collect weather data from almost anywhere. Each system ships preconfigured and ready for plug-and-play deployment.

## Fixed

Weather stations are most commonly installed for long-term or permanent applications, making the fixed platform ideal. The system is mounted to an aluminum pole mast that easily threads into a pre-installed 2" NPT pipe using the included female coupling. No additional mounting is required. Fixed stations can be installed in a wide variety of locations, including bridges, building roofs, towers, and open fields. Ideally, there should be at least 150 meters of open area in all directions from the weather station regardless of where it is set up.

## Portable

Some weather measurement applications are better suited for a moveable platform. For a weather station that needs to be moved quickly and conveniently, this portable option includes a tripod to hold the Vaisala WXT520 weather sensor as well as an iSIC Data Logger. The data logger's internal battery can power the system for weeks before requiring recharging or replacement, allowing extended, unattended monitoring on a lightweight stand. The portable platform is useful in situations when the monitoring location will change periodically or for shorter projects.

## Floating

For weather monitoring at sea, a complete weather station can be mounted onto a buoy. The buoy platform makes weather measurements in small reservoirs, lakes, rivers, streams, and protected coastal waters possible. The NexSens MB-300 and MB-500 buoy platforms support the Vaisala WXT520 sensor, submersible data logger, and three 5-watt solar power kits to provide continuous power. This platform option can be paired with a wireless telemetry option, such as radio or cellular, to enable real-time communication with the weather station from the shore.


# NexSens iSIC Data Logger
# TELEMETRY OPTIONS

There is almost nowhere on Earth from which a NexSens iSIC Data Logger cannot transmit. These data loggers can communicate using technologies as simple as a telephone landline to ones as sophisticated as satellite telemetry, capable of transmitting from even the deepest reaches of the wilderness. NexSens provides telemetry solutions for every application and every price range.

## Standalone Data Logger or Direct-Connect

The standalone setup consists of the iSIC data logger storing weather data to the internal 2MB memory. Data can be periodically uploaded using a laptop computer with iChart software. When a nearby dedicated computer is available, the data logger can automatically transmit data in real-time.

## Landline

The NexSens 2100-iSIC data logger features an integrated landline modem for real-time data telemetry via standard telephone lines. All it needs to connect is a location with access to a phone line. A computer with iChart software and a dial-up modem can then periodically call the data logger to retrieve new information.

## Cellular

For weather stations beyond the reach of landline access, the 3100-iSIC data logger with an integrated cellular modem is available. The 3100-iSIC makes real-time remote data collection from almost anywhere in the U.S. possible. This data logger can use cellular data plans from many U.S. providers, such as AT&T, Verizon, or Sprint Nextel. A computer with iChart software can then access the data logger via the Internet.

## Radio

A 4100-iSIC data logger with an integrated license-free spread-spectrum radio allows for wireless communication to a weather station without the fees associated with a cellular plan. The 4100-iSIC can connect wirelessly to a 4100-BASE radio base station, which serves as a central hub for one or more remote data loggers with radio telemetry and can plug directly into a computer running iChart software. Antenna options are available according to application needs, offering radio range as far as five miles line-of-sight.

## Ethernet

The 5100-iSIC with Ethernet connection is an ideal solution for weather stations near an Ethernet port or router. Unlike its landline telephone counterpart, the 5100-iSIC can provide continuous real-time weather data instead of needing to dial up the iSIC for new information periodically.

## WiFi

The 5500-iSIC with WiFi communication ability allows for the same convenience of local network access as the Ethernet model, but without the need for a hardwire connection. This wireless model can connect from anywhere within a WiFi network's range.

## Satellite

For the remotest weather station applications where cellular telemetry is unfeasible, there is the NexSens 6100-iSIC data logger with satellite telemetry. The 6100-iSIC communicates with Iridium satellites, allowing it to transmit data from just about anywhere on the planet.

# APPLICATION: Green Roof Monitoring

## OVERVIEW

Conservation Consultants Inc. has been a strong advocate of energy conservation education for nearly 30 years. Its downtown Pittsburgh office building, formerly an old vacant building, has become a green showcase with solar panels, state-of-the-art lighting, and efficient energy usage. One of CCI's most recent green projects was the installation of a green roof atop its office building.

A green roof involves partially or completely covering a building roof with vegetation and soil, or another growing medium, planted on top of a waterproof membrane. The popularity of green roofs continues to grow as organizations realize the benefits of implementation. These benefits are ecological, economic, aesthetic, and psychological in nature.

The green roof was part of 28 innovative green projects throughout Pennsylvania funded by a state Department of Environmental Protection grant. Melanie Tuck, a green roof consultant, spent 15 months planning and designing the green roof project. Part of Tuck's system design was to include a highly accurate, low-maintenance green roof monitoring system. NexSens Technology was contacted to help provide this solution.

## SYSTEM DESCRIPTION

The CCI project consists of a four-inch layer of fully vegetated green roof with a public walkway built of recycled pavers, solar panel between the skylights for a domestic solar-powered hot water system, rain barrel to capture storm water runoff for irrigation use, and real-time monitoring equipment with computer kiosk for the public to view the benefits of green roof implementation.

The NexSens green roof monitoring system consists of a Vaisala WXT520 multi-parameter weather sensor, NexSens AccuStage water level sensor, and Hydra Probe II Soil Moisture Sensor, which can calculate conductivity, salinity, and temperature in addition to soil moisture. The WXT520 weather sensor simultaneously measures wind speed and direction, liquid precipitation, air temperature, relative humidity, and barometric pressure.

Each sensor is strategically placed on the roof to help quantify the reduced amount of storm water runoff from the green roof implementation. The weather sensor measures the amount of precipitation falling. Soil moisture sensors provide an indication of the amount of rainfall absorbed by the soil. Finally, the water level sensor quantifies the amount of water running into the roof drain. According to the Environmental Protection Agency, three-to-five inches of green roof soil can absorb as much as 75% of rain events that are half an inch or less.

Data from the green roof monitoring sensors is collected and processed by a NexSens iSIC Data Logger connected to the nearby computer kiosk. At the computer, both iChart 6 software and WQData are used to view current data and analyze historical data — all on a graphical, user-friendly interface.

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