DEWESoft®

WIND TURBINE TOWER MONITORING

WELCOME TO THE DEWESOFT EXPERIENCE. ONE SOFTWARE, ONE HARDWARE, ONE SOLUTION.

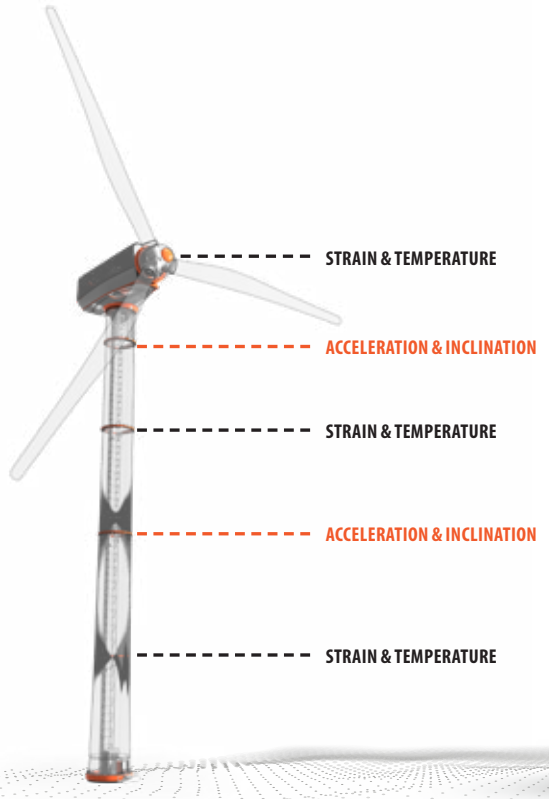
V23-1

DEWESoft®
7 YEAR WARRANTY

WIND TURBINE TOWER MONITORING

STRUCTURAL HEALTH MONITORING OF WIND TURBINES

Structural component failures can significantly affect wind turbine operational costs. In fact, some failures can result in a complete loss of the turbine. Offshore wind turbines are exposed to harsh winds, wave load and salt corrosion. Therefore, it is essential to monitor structural components to both reduce maintenance costs and avoid catastrophic failures, including tower collapses.



DISTRIBUTED MEASUREMENT DEVICES

Dewesoft devices are designed to be distributed in a variety of topologies. EtherCAT® technology allows devices to be placed near the sensors, and interconnected using a single cable for power, data, and synchronization.

Cables can be up to 100m (328 ft.) in length between devices, or virtually unlimited using EtherCAT-to-fiberoptic converters.

A COMPLETE TURN-KEY SOLUTION

Dewesoft WT is a complete tower monitoring solution that includes the sensors, highly accurate signal conditioning amplifiers, mounting accessories plus processing software, including Operational Modal Analysis (OMA), Database and third-party integration capabilities.

SUPPORT FOR ANY SENSOR

Signal conditioning amplifiers support any strain gage, low-frequency accelerometers, temperature sensors, weather and wind power sensors, and wind turbine performance monitoring sensors.

POWERFUL SOFTWARE

DewesoftX software offers real-time diagnostics, pre- and post-processing and data reduction based on its powerful math engine. Rich data visualization is built in, and a wide variety of storage options are available.

OPERATIONAL MODAL ANALYSIS

DewesoftX files can be easily imported to Dewesoft-Artemis OMA for identification of natural frequencies, modal shapes and damping ratios.

OPEN INTERFACES

DewesoftX data is available in a wide variety of standard data formats. It can output "live" data via OPC UA interface, the REST API, or modern cloud data services.

A WIDE VARIETY OF CONFIGURATIONS

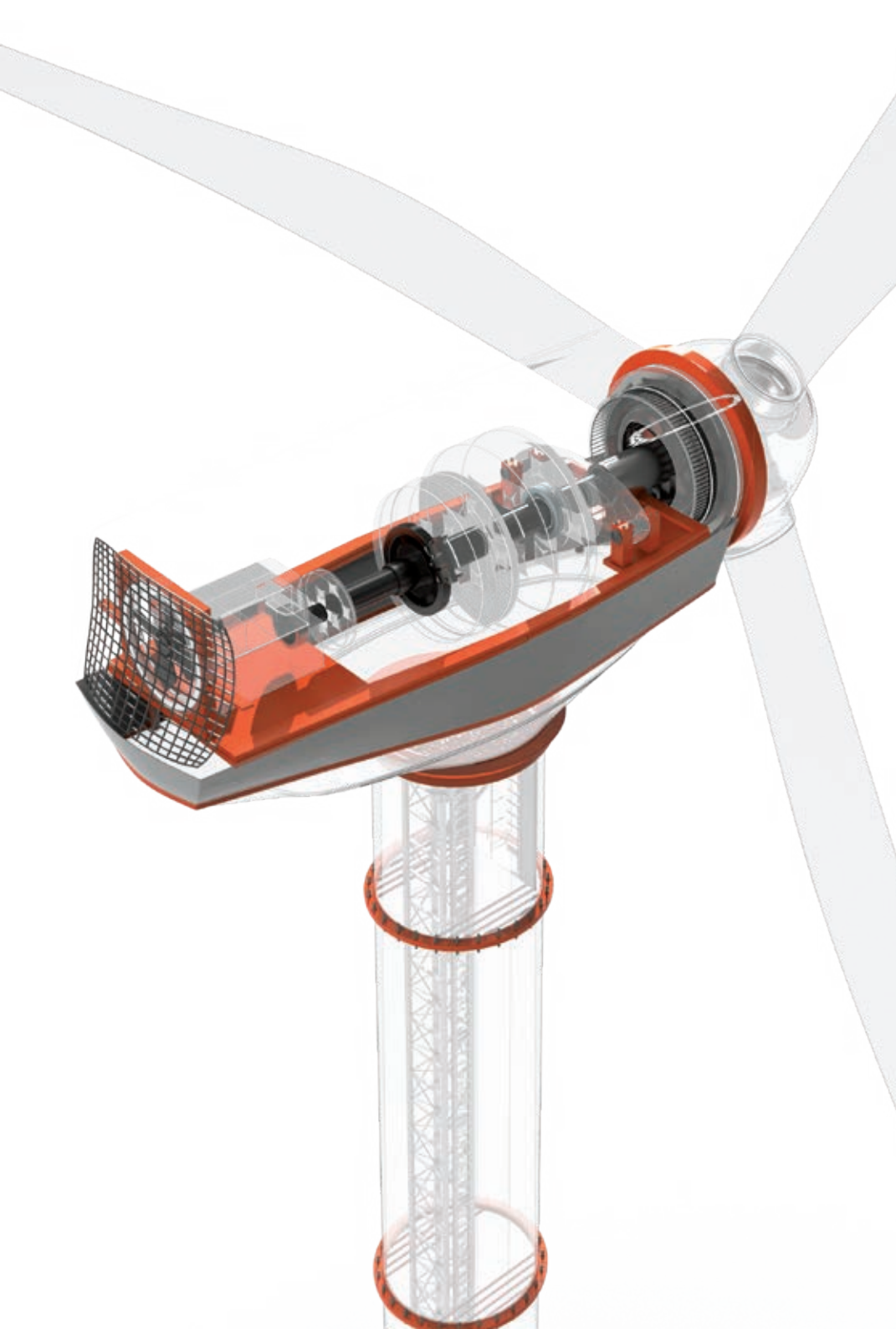
Our DAQ devices are extremely rugged, with IP67 protection for use in challenging environments. Our systems adapt to virtually any structure, and monitor and analyze thousands of data points.

REMOTE OPERATION

The entire system can be remotely operated, with triggered storing, alarms, and other monitoring features. Data can be stored locally, remotely or both.

FREE LIFETIME SOFTWARE UPDATES

DEWESoft systems are bundled with our award-winning DewesoftX DAQ software. This software package is always evolving, and new capabilities are added regularly. DewesoftX includes free software update for the life of the system!



STRUCTURAL HEALTH MONITORING (SHM)

Structural monitoring of offshore wind turbines is essential for ensuring their safety, reliability, and longevity. Offshore wind turbines are exposed to harsh environmental conditions, including high winds, waves, and corrosion from seawater and salt spray. As a result, they are subject to structural fatigue, erosion, and other forms of wear and tear that can compromise their integrity over time.

Monitoring the structure of offshore wind turbines helps detect and assess any damage or changes that may occur over time. It enables maintenance crews to identify and fix any problems before they escalate into more significant issues, such as component failure or collapse.

The most common sensors for wind turbine structural health monitoring are:

- **Accelerometers** – to perform OMA (operational Modal Analysis)
- **Strain gages** – to verify design assumptions under applied loads
- **Temperature sensors** – especially in combination with strain gages, for temperature compensation
- **Inclinometers** – to monitor the stability of the tower
- **Anemometers** – to monitor wind speed and direction
- **Wave RADARs** – to monitor wave height

Dewesoft offers a complete SHM solution for monitoring all the necessary parameters (vibration, strain, inclination, temperature measurements) needed to assess the condition of wind turbine structural components.

VIBRATION MONITORING OF WIND TURBINE TOWERS

Vibration monitoring of wind turbine towers is critical for ensuring their safe and reliable operation. Changes in geometric and stiffness properties as well as cracks and deformations are identified via modal analysis, which analyzes natural frequencies, modal shapes, and damping ratios.

Towers are subject to fatigue damage due to the cyclic loading caused by the wind. Vibration monitoring helps to identify the frequency and magnitude of these loads, allowing operators to adjust the turbine's performance and minimize fatigue damage.

Vibration monitoring also provided insight into the condition of the tower's components, such as the gearbox, rotor, and generator. Vibration monitoring can help prevent dangerous situations and failures by detecting vibrations that are outside the tower's normal operating range.

The efficiency of wind turbines can be improved by detecting any imbalances in the rotor or drivetrain that can cause unnecessary wear and tear. By correcting these imbalances, operators can maximize energy production and reduce maintenance costs.

MONITORING INSTRUMENTATION FOR WIND TURBINES

Wind Turbines live in a challenging environment. High stresses, temperatures, wind, rain, sleet, snow, vibration, and more. This is not the place for ordinary laboratory instruments and accessories: but this is where Dewesoft WT tower monitoring solutions call home.

RUGGED & DISTRIBUTABLE MODULES

IOLITEiw-3xMEMS-ACC-INC

Dewesoft triaxial MEMS-based accelerometer and static inclinometer with EtherCAT interface. Provides 8 g measurement range for wind turbine vibration analysis.

NEMOSENSE-3xMEMS-ACC-INC

Dewesoft triaxial MEMS-based accelerometer, static inclinometer and data logger. This TCP/IP device doesn't require an external computer. Provides 8 g measurement range for wind turbine vibration analysis.

KRYPTON MODULES

For the toughest environments, Dewesoft provides rugged, all-weather KRYPTON® DAQ modules that work flawlessly across a wide range of temperatures, from -40°C to +85°C (-40 to +185 °F).

Sealed to IP67 against water, dust and other elements, KRYPTON modules operate in the most humid and wet environments. 100 G protection means that they work in even high shock and vibration environments.

But perhaps the best part is that KRYPTON modules are easily daisy-chained together. This means that you can place them close to the sensor.

Shorter sensor cables increases signal quality, and decreases chances of cabling errors. These modules are available in single channel and multiple channel versions.

A single cable is used for data, power, and data synchronization.

EtherCAT protocol provides easy distribution of devices across even the largest structures. Devices can be located up to 100 meters from node to node, and this can be expanded to kilometers by use of EtherCAT-to-fiberoptic converters.

ACCESSORIES

CABINETS

Dewesoft can provide custom-made cabinets with all instrumentation preinstalled.

OTHER ACCESSORIES

Cable tear protection can be provided to prevent bending or damaging the cables.

When cable trays are not installed, cable clamps (with or without magnets) to fix cables to a tower, are also available.

INDUSTRIAL PC

We can provide our own (or third-party) industrial computers to run DewesoftX software, which acquires data from analog and digital sensors. Power supply and UPS also available.

MOUNTING BRACKETS

Custom-made mounting brackets and other accessories can be provided by Dewesoft.

CABLES

Single CAT6 cables are used to daisy-chaining EtherCAT devices. We offer inexpensive and high-end, robust cables (UV resistant, oil resistant, ozone resistant, water and humidity resistant, shielded, flame retardant, low emission of smoke and other acidic gases, halogen-free), as well as off-shore certified (MUD- resistant following NEK 606) cables.

MONITORING SYSTEM ARCHITECTURE

AT THE HEART OF DEWESOFT'S MONITORING SYSTEMS: DISTRIBUTABLE ETHERCAT MODULES

HOW DOES IT WORK?

DAQ modules like IOLITE and KRYPTON are daisy-chained by a single cable that carries the data, power, and synchronization. These DAQ modules act as EtherCAT slaves, whereas DewesoftX software running on the PC acts as the EtherCAT master.

Raw data from DAQ modules are collected and processed by measurement units also running the same software. DewesoftX provides a wide range of configurable triggered recording and math capabilities. Data can be sent over the TCP/IP network to the factory or cloud server in batch files, or streamed via the MQTT protocol.

Devices on the same tower are synchronized by the EtherCAT network down to 1µs. EtherCAT devices one different towers are synchronized via the local NTP server. The synchronization between them depends on the latency of the network but is typically within 10 ms. If better synchronization is required, a GPS sync option is available.

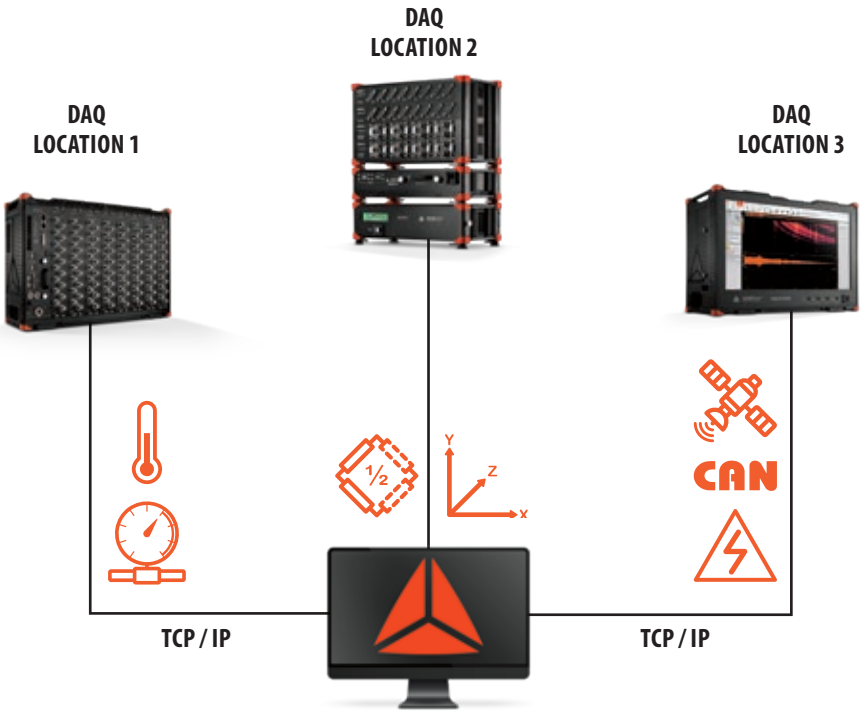
TCP/IP interface data loggers like NEMOSENSE acquire data, store it to an internal memory, and send it to the server over MQTT when the connection is active. Devices are synchronized to the local NTP server. The synchronization between them depends on the latency of the network but again, is typically within 10 ms.

FLEXIBLE DATA STORAGE STRATEGY FOR WIND FARM MONITORING

DewesoftX software offers easy and flexible data flow configurations. You can store data locally, i.e. near or even inside the wind turbine. Or you may prefer to use standard interfaces such as OPC UA, to send and store data remotely to the cloud or to another database. There are no restrictions on setting up your data flow topology.

Our licensing model allows you to connect an unlimited number of desktop or web-based view clients to monitor data in real-time.

This powerful capability is inluded with our systems, without any additional cost whatsoever.



DEWESOFT HISTORIAN

DEWESOFT HISTORIAN TIME-SERIES DATABASE STORAGE FOR LONG-TERM MONITORING

The **Dewesoft Historian** software package adds a time-series database for long-term or permanent data storage. The database can be either located locally, on the remote server, or in the cloud. The solution is based on the InfluxDB time-series database open source project.

Historian provides several useful features for your historic data:

- **Raw and reduced data:** while raw data is always stored on the measurement unit for an in-depth analysis, Dewesoft Historian is responsible for writing long-term *reduced data* into the cloud database.
- **Data safety and retransmit:** if the connection between the measurement hardware and the database is lost, the data is safely stored locally on the measurement unit, and then retransmitted to the database when the connection becomes active again.
- **Trending and analysis:** historical data can always be recalled and loaded from the Historian database and used for trend analysis, as well as for in-depth analysis and root cause identification.

NEMOSENSE • LOW-NOISE VIBRATION IoT DATA LOGGER

Dimensions:	119 x 119 x 42 mm 4.68 x 4.68 x 1.65 in.
Weight:	500 grams 1.1 lbs.
Power:	48 VDC PoE
Consumption:	1.3 W
Interface:	Ethernet TCP/IP
Synchronization:	NTP
Sync. Delay	10 ms

ALL-IN-ONE DATA LOGGER

NEMOSENSE is a data logger and DAQ instrument with an embedded low-noise triaxial MEMS accelerometer. It performs the analog-to-digital conversion and connects via Ethernet TCP/IP.

NTP SYNCHRONIZATION

NEMOSENSE devices connected to the same network are synchronized within 10 ms. This is done using NTP synchronization (Network Time Protocol) on Ethernet.

NEMOSENSE is an IoT instrument that combines a vibration data acquisition system, a data logger, and a low-noise triaxial MEMS accelerometer. It's the ideal solution for permanent vibration condition monitoring of wind turbines and structures like bridges, buildings, antennas, and stadiums. And all at a great price-performance ratio.

ONBOARD PROCESSING

NEMOSENSE includes a small microprocessor that handles sytsem setup and performs useful calculations including, RMS, Peak-to-Peak, and other statisticals, right on board.

WATERPROOF ENCLOSURE

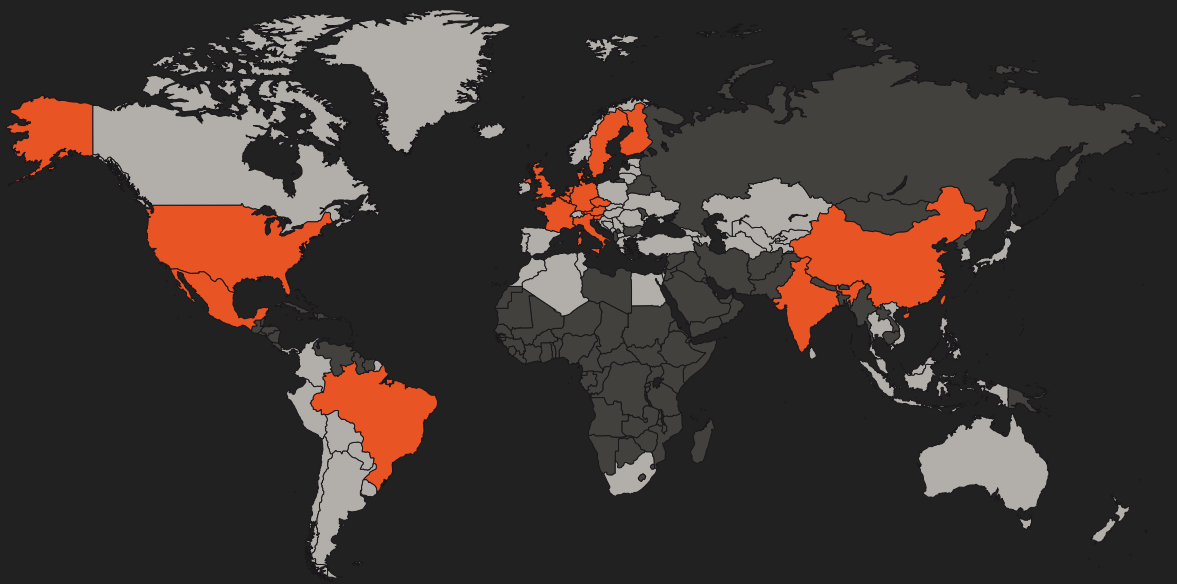
NEMOSENS enclosure is fully waterproof with a Harting push-pull RJ45 connector. It is rated to IP67 protection against the ingress of liquids, dust and other particulates.

LOW NOISE DENSITY

NEMOSENSE data loggers have great noise performance: just 25 µg√Hz spectral noise density at the 2 g measurement range.

BIG INTERNAL STORAGE

NEMOSENSE data loggers have 16 GB of internal data storage, and can save up to one month of measured data at 125 Samples/second.



DEWESOFT® WORLDWIDE: SLOVENIA, Austria, Belgium, Brazil, Czech, China, Denmark, Finland, France, Germany, Hong Kong, India, Italy, Mexico, Singapore, Sweden, UK, USA and PARTNERS IN MORE THAN 50 COUNTRIES

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