Senvion Integration and Control.

Integrated management for your wind turbines.
Guarantee for efficiency and high availability: Integration and control.

**SCADA SOLUTIONS**

The Senvion SCADA Solutions system offers high-performance software and hardware products for the comprehensive management of wind turbines or wind farms. It comprises various applications which are characterised by their user-friendliness, easy system integration and safety:

1. **SCADA Access**
   Full-service application for a Web-based, encrypted access to wind farms and individual modules which can be operated from anywhere in the world.

2. **Interfaces and Communication**
   Various solutions to connect our wind turbines to superordinate SCADA or existing software systems of our customers.

3. **Windfarm Management**
   Premium application for the efficient management of wind turbines on large wind farms with up to 250 wind farm units.

**GRID INTEGRATION**

The worldwide demand for electricity from renewable energies is increasing constantly. To satisfy this demand the operation of wind farms, like that of conventional power plants, has to be grid-compatible and integrated seamlessly into the grid control mechanism. We have already taken this step: Senvion wind turbines actively support the grid, fulfil all technological requirements and guarantee reliable power generation even in the event of a malfunction.

**ENVIRONMENTAL INTEGRATION**

Wind turbines cannot be considered or operated in isolation. They are part of a system. For this reason the integration of our wind turbines into the environment is our first concern. Whether it is an open field, near residential areas, a hilly landscape or an existing wind farm: we analyse the desired location for your wind turbine and recommend the optimal turbine type to meet the specific environmental conditions.
SCADA Access: Functional, user-friendly and up to date.

SCADA Access is an online portal that allows a Web-based, encrypted access to a wind farm or individual modules such as a wind turbine, a power-management unit or a meteorological station.

Individual analysis options.
The advantage of SCADA Access: you don’t need your own infrastructure, you can access our central server and retrieve the wind farm data via your computer from anywhere in the world. Based on one second and ten minute intervals as well as operating states and operating meters, relevant data can be analysed, graphically displayed and evaluated. Menus give you quick and easy access to the various analysis functions and modules of the wind turbines.

Geographical visualisation.
An integrated map tool allows a geographical overview of each wind turbine location.

Two components: monitoring and Web reporting.
SCADA Access essentially consists of two components: the monitoring component for the live analysis of the wind farm and the Web reporting component for the analysis of stored historical data.

> Apart from operating functions such as start, stop and reset, the monitoring component offers access to the intelligent wind farm management system. Operational and performance data are put out live in one-second intervals. In addition, status reports as well as lists with defined events can be generated. The controller of the wind turbine stores the data, ensuring that nothing gets lost even in the event of a malfunction.

> The Web reporting component facilitates database-supported performance analyses throughout the entire service life of the wind turbine, as well as comparisons between wind turbines and wind farms. Any information can be exported and made available for other applications. In addition, both pre-defined reports and reports created by the user can be executed. Reports created by the user can be permanently stored and reused. There are options for time-controlled, automated processing and automatic transmission via e-mail.
Our Interfaces and Communication products guarantee an easy integration of various wind turbine types and software systems into a superordinate SCADA system.

More freedom through flexibility. The interfaces and communication products offer maximum flexibility, allowing you to choose the best solution from various protocols and methods for your application. All Interfaces and Communication products can be combined with each other. Your advantage: you are not tied to a specific SCADA system and are free to choose from different providers.

Interface OPC DA. Combines years of experience with numerous features and has established itself as the tried-and-tested communication standard in the industry. It is linked to the wind farm via a central interface, collecting the data of individual components and makes them – OPC DA-compliant – available to the wind farm. This ensures a safe data transfer to the customer control centre where you can call up one-second readings, status codes and operating conditions.

Interface FTPS. Is ideally suited to export data from wind farms of any size to an external database system via a central interface. There are various interface operating modes available (alarm, database and ten-minute modes) which can be freely combined. The ten-minute mode delivers ten-minute mean values, status codes and operating data as well as specified historical data. The specific alarm mode ensures that an alarm is transmitted promptly so that appropriate measures can be taken. The database mode transmits ten-minute mean values as well as status codes, operating data and historical data in configurable intervals of at least four hours. Interface FTPS uses the standardised FTPS protocol which is encrypted via an SSL connection and has intelligent methods for data storage on the wind farm, ensuring that no data is lost during potential communication problems.

Interfaces IEC 61400-25. Is based on the international standard for wind turbines IEC 61400-25. We have been actively involved in the development of this standard from the beginning and are one of the first wind turbine manufacturers to apply this standard to our products. Our Interface IEC 61400-25 provides a standardised system for all Senvion wind turbines which are equipped with Senvion Control as well as all other Senvion wind farm components to communicate with the outside world. In addition to the data volume of the other Interfaces and Communication products, this solution offers auxiliary services such as alarm messages, per second values, ten-minute mean values, status codes and operating conditions. Furthermore, individual wind turbines or the whole wind farm can be accessed and controlled via the interface. It is also possible to set rated values via the power management unit for the wind farm management.
Demands regarding the monitoring, documentation and optimising of wind farms are growing steadily. In order to fulfil those we have developed the premium application Windfarm Management. With this application, wind farms of up to 250 turbines can be managed efficiently – either directly on site with an independent SCADA system or from your central office, monitoring several wind farms simultaneously.

Safety is paramount.
As an integrated system, Windfarm Management is characterised by a broad performance spectrum: comprehensive tools for analysis and monitoring, access to the wind farm control system, user-friendly monitoring and operating functions, local software and hardware applications, designed for redundancy and therefore safe IT infrastructure, sophisticated tools for data synchronisation as well as a local database with an interface for immediate access to the data.

High availability with systems designed for redundancy.
All IT infrastructure in the form of servers, databases and associated software is either located in an on-site switch cabinet on the wind farm or has a central set-up in the customer control centre. A VPN connection can be used to link the solution to an external customer control centre. In order to ensure high availability, all systems are designed for redundancy. Windfarm Management can be adapted to a variety of site-specific factors to guarantee the best possible performance of the wind farm. Windfarm Management contains all features of the SCADA Access products and can be combined with all Interfaces and Communication products.
Wind farm communication with the Senvion SCADA Solutions system.

SCADA Access

SCADA Access offers a central Web application as well as high-performance products for comprehensive monitoring, analysis and operation of the entire wind farm and individual components.

Monitoring
> Presentation and monitoring of current operating data via exact-to-the-second data access
> Direct communication and direct access to all Senvion wind farm units

Web Reporting
> Evaluation of historical wind farm data for performance and production analysis
> Creation of reports (configured individually) and automatic transmission in the time intervals requested

ComBox
> Scalable, central switch cabinet and communication hub for wind farm internal and external communication, for wind farms of one to 48 turbines
> Necessary prerequisite for Interface FTPS and OPC DA

Power Management Unit (PMU)
> Measurement acquisition of the actual electricity, voltage and frequency value at the grid connection point on the wind farm
> Central regulation of active and reactive power of the wind farm

Meteo Station
> Measurement acquisition of relevant meteorological data on the wind farm, independent of the wind turbines
> Wind speed and direction at different measuring heights, temperature, air pressure, humidity, air density, precipitation

Interfaces and Communication

Interfaces and Communication provide constant access to your wind farm data. You are connected to your superordinate Senvion SCADA Solutions system via standardised data and communication models.

OPC DA
> Exact to-the-second access to all current status codes and operating conditions as well as relevant operating data

FTPS
> Several operating modes with various data acquisition intervals
> Access to, e.g., ten-minute data, statistical values, accumulated data (meter readings)
IEC 61400-25
> Exact to-the-second access to live data, ten-minute data, statistical values, etc.
> Control functionality via write access to the controllers

Windfarm Management

The integrated Windfarm Management application is a control system for wind farms of up to 250 turbines. The addition of a local control room, data acquisition and analysis or a database with ODBC database access is also easy to implement. The various components of the Senvion SCADA Solutions system can be combined with all Interfaces and Communication products.

Online Portal Local (OPL)
> Local (on the wind farm) SCADA Access Solution with an extended range of functions (compared to the central solution) for the customer-based operation of wind farms independent of Senvion
> Alarm control centre, extended error analysis through analysis options of high-resolution error records, individual user management, possession of wind farm data
> Redundant IT infrastructure on the wind farm: backup, application server, database and network storage system

SCADA Cabinet
> Scalable, central switch cabinet and communication hub for wind farm internal and external communication, for wind farms of up to 250 turbines
> Redundancy options for large wind farms
> Prerequisite for the products Online Portal Local and the interface products FTPS and OPC DA

PMS – Permanent Monitoring System
In addition to the functions described in the Senvion SCADA Solutions products, Senvion offers an optional permanent monitoring of operation. The Senvion Permanent Monitoring System monitors all wind farms around the clock, 365 days a year. Any reported errors are either fixed online or a service visit is arranged if required.
Senvion wind turbines offer ideal solutions for every location, constantly providing optimal energy yields. With intelligent control functions and excellent performance our wind turbines ensure the grid connection in your projects.

We connect your wind turbines safely to the grid.

Perfect grid integration.
Grid compatibility is a constant challenge for wind turbine operators. Wind farms, like conventional power plants, must be grid-compatible and integrated into all grid control mechanisms. Senvion wind turbines meet those requirements: they actively support the grid, fulfill all technological requirements and guarantee reliable power generation even in case of a malfunction. Our tried-and-tested concept combining gearbox, converter and generator with our control and monitoring system makes this possible. It offers direct access to the power management unit which measures voltage and frequency at the grid connection point. If these deviate from the desired value, active and reactive power is regulated automatically.
Reactive power during blackouts.
Our wind turbines can be controlled in all operating conditions and dynamically feed reactive power into the grid, even during periods of no wind. This is how they support the grid voltage. Even during temporary voltage drops the wind turbine remains connected to the grid. It supports the grid with a high reactive power load. After the fault has been remedied – there is no need to switch the turbine off – the full active power can be fed into the grid immediately. An important indicator for a stable grid is constant frequency. In case of an underfrequency our wind farms have an active power reserve on standby. In case of an overfrequency, power production can be scaled back to protect grid stability.

Tested grid compatibility.
Integrating wind turbines into the grid and generating reliable energy is routine for us. We know the requirements for all important markets. We use extensive type testing on our wind turbines to establish their power quality, regulation capabilities or how they cope with grid failures and have their performance accredited by independent certifiers. This gives you the guarantee that your wind turbines are grid-compatible. The accredited turbine qualities are also illustrated in simulation models. Those studies enable grid operators to examine how wind turbines behave in their grid. In this way we offer you the best possible test basis for grid compatibility.
Products for yield optimisation.

Our incentive is the consistent optimisation of our wind turbines for a harmonic integration into the environment. The protection of humans and animals from negative and disruptive influences is as important as maximising your yields.

For wind turbines that adapt to their environment.
Noise level reductions, shadow casting, bat protection, extreme climatic conditions – there is a plethora of aspects which make a site-specific adaptation necessary. This is why we have developed a series of optional products which allow an ideal integration of the wind turbine into its environment. Additionally, our control system permanently monitors all turbine-specific data and operates the wind turbine in a way which reduces its impact on the environment and fulfils all requirements while achieving outstanding results in efficiency and yield.

Sound Management I and II – minimising sound emissions.
Our wind turbines are among the quietest in their class. We achieve a low sound power level for instance by optimising our rotor blades. In order to fulfil specific requirements in sound-sensitive locations we employ our Sound Management, reducing the sound power level of the whole wind turbine in all wind speeds even further. There is a variety of sound characteristics to choose from, depending on the local conditions. The Senvion control system controls and monitors the activation through relevant parameters such as time of day, wind direction, day of the week or date. This is how we consistently achieve optimal yields whilst adhering to individual location requirements.

![Sound Management I (example MM92)](image1)

![Sound Management II (example MM92)](image2)
Load Management – for higher yields.
Load Management helps us optimise the layout of the wind farm in complex or confined locations, so that additional wind turbines can be installed in order to maximise the efficiency of the wind farm. In practice, this means: the wind farm layout can be optimised according to the main wind direction. The control system also protects the wind turbines from excessively high loads caused by unusual wind directions. This increased flexibility is good for the turbines and profitable for the energy yields.

Bat protection – for bat-friendly wind turbine operation.
In the vicinity of bat colonies, flight paths or feeding grounds, bat activity increases during certain times of the day, night or year. Our control system monitors these conditions, activates the bat protection if required and automatically switches the wind turbine off. Thus we actively avoid the endangerment of the animals.

Shadow Management – avoiding shadow casting.
With the help of our Shadow Management we can adhere to the specified standards for shadow casting. The module calculates the conditions for shadow casting and controls the wind turbine or wind farm to avoid it.

Drive train CMS (Condition Monitoring System) based on structure-borne sound.
Drive train CMS based on structure-borne sound is an additional source for information regarding abnormalities which can be installed in Senvion wind turbines. This system monitors changes in the condition of the drive train such as changes in alignment, tension, unbalance and loosening. Initial damage is recognised and located, followed by an assessment which is part of our concept of preventive maintenance.

Ice recognition system – controlled operation in icy conditions.
The wind turbines are equipped with an ice recognition system, ensuring optimal operation during the winter months. If the sensors detect the formation of ice, the control system can stop the turbine reliably and safely. As soon as the ice disappears, the wind turbine can be restarted either automatically or manually. Depending on the location the wind turbine can also operate with a certain amount of ice accretion. The robust blade profiles are still capable of producing a good yield. Intelligent control algorithms ensure that the wind turbine can continue to operate in a safe mode even in very icy conditions.
To contact our international partners visit:
www.senvion.com

Senvion SE
Überseering 10
22297 Hamburg
Germany
T +49 40 5555 090-0
F +49 40 5555 090-3999
info@senvion.com
www.senvion.com

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Status 02/2014.