Creating the most from wind – due to perfectly coordinated products and systems

siemens.com/wind-equipment

Answers for industry.
Creating the most from wind

Our products and system offerings interact optimally to get the most from the wind. The result is: maximum availability and efficiency, low production and maintenance costs, time savings in engineering and commissioning, as well as shorter time-to-market for new turbine concepts.

Reliable partner for the future

Siemens is the experienced and reliable partner for all the electrical equipment in a wind turbine: Our range of wind equipment encompasses all the products, systems and solutions for the electrical drive train, and automation and power distribution in wind turbines. Our decades of unique expertise make us the world’s leading supplier of industrial automation. This expertise is directly incorporated in our portfolio for the wind industry. Today, more than 20,000 of our wind generators are operating reliably around the globe. Our experience in industry in general and in the area of wind energy in particular enables us to supply products in large quantities – and to combine them application-specifically.
Maximum turbine availability for minimum lifecycle costs

Our products and systems interact perfectly and thus increase system transparency and availability. They communicate seamlessly across all levels – from the individual terminal to the higher-level control room. This enables continuous monitoring and optimal control of all parts of the system. Even in extreme situations, a swift and precise response can be made to avoid damage to the system. By means of preventive and predictive maintenance concepts, standstill times for repairs can be minimized or completely avoided. Via our global service network, which is accessible for you all year around the clock, we offer customer-oriented services such as remote maintenance, spare parts logistics, and online support.

Intelligent standardization based on field-proven platforms

Within the scope of intelligent standardization, no special production is required for wind-specific and vendor-specific specifications. We work with platform strategies, using components and coordinated systems that have been field-proven hundreds of thousands of times in harsh industrial environments, and that can be combined in such a way as to perfectly match the respective specification. With us, consistent compliance with industrial standards, machine guidelines and safety regulations is a given. Comprehensive hardware and software system tests in advance ensure perfect interaction of the standardized products and systems. Costly system tests on the customer’s site are rendered unnecessary. Standardized engineering tools reduce costs for programming and commissioning, and minimize the risk of faults. One example is the Industry Library with wind-specific blocks in which 80% of all the functions of a wind turbine are stored.

Competitive advantages for series production of wind turbines

Increasing competition and rising cost pressures challenge the wind power industry to optimize its development and manufacturing processes on a sustained basis. Our portfolio supports you in making the transition to optimized standard production with hardware and software: by means of standardized modular systems for your platform strategies, reduced variation in components, and industry-oriented logistics and support processes. Future automation concepts for the manufacture of wind turbines will profit from product lifecycle management software. It already optimizes turbine production layout in the planning phase. This taps into potential energy savings at an early stage and avoids bottlenecks in later production. In addition, our software ensures transparency throughout the entire life cycle. It is the sole data source for all product and process knowledge in turbine production.

New wind turbines are developed and modified using special design software. A wide range of simulation options help to evaluate scenarios correctly, and to replace turbine prototypes that are expensive and complex to produce. As a result of the time saved, wind turbines can be launched onto the market more quickly.

www.siemens.com/wind-equipment
Comprehensive portfolio

As an experienced and reliable partner, Siemens offers optimally matched products and systems for the electrical and electronic equipment of a wind turbine. Their perfect interaction enables maximum efficiency and system availability.
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Totally Integrated Automation for sustained success

All the components under the roof of Totally Integrated Automation (TIA) are designed for combining into solutions which enable the wide ranging demands on wind turbines and wind farms to be fulfilled with maximum efficiency.

A systematic approach to achieving higher productivity

**Engineering**
One engineering tool (TIA Portal) for the whole turbine:
With Totally Integrated Automation, you back an integrated engineering environment. Efficient software supports you comprehensively throughout the complete life cycle of a wind turbine – from the initial planning stages through commissioning and operation, all the way to service and maintenance.

**Communications**
With Totally Integrated Automation you meet the requirement for unrestricted integration into the communication system. By using an open bus system from the terminal through to the control system, you benefit from maximum data transparency across all levels, from the hub, through the nacelle and tower, to the wind farm as a whole, and from easy interfacing to different systems such as pitch and yaw systems.

**Diagnostics**
Totally Integrated Automation supports efficient remote diagnostics right through to the last terminal of the wind turbine. If a fault occurs it will be quickly identified and rectified. This minimizes downtimes and optimizes productivity.

**Safety**
No additional controller required for safety functions within the wind turbine: With an intelligent safety concept that integrates safety technology into the standard automation, you save considerable wiring costs and space in contrast to conventional solutions. Integration into the engineering software also reduces the programming effort and speeds up commissioning.

**Security**
Protection of the turbine against unauthorized access: Scalable IT security mechanisms (access protection, user management, firewall, VPN, etc.) ensure effective security – for a low administration cost.

**Ruggedness**
Selected materials and manufacturing techniques ensure that our products and systems are top quality. For increased ruggedness requirements, special product versions are also available which are ideally suited to harsh environmental conditions, both onshore and offshore.

**Advantages**
- Efficient engineering
- Maximum availability of wind turbines and wind farms
- Simple integration of wind turbines into existing wind farms
- Secure remote access for global servicing of wind turbines and wind farms

www.siemens.com/simatic-wind
Communication and data flow within the wind turbine
Totally Integrated Power – for reliable power distribution

There is a demand for integrated solutions for maximum operational safety in wind turbines. Our response to this is: Totally Integrated Power (TIP). From planning to operation, we assist you with our support tools and with a perfectly coordinated product and system portfolio – from low-voltage, through the transformer, right up to the medium-voltage switchgear.

The integrated product range for efficient power distribution

With Totally Integrated Power, we offer you a complete, integrated spectrum of innovative products and systems and the associated support tools for planning and configuration. In other words: everything for safe, reliable and cost-effective power distribution within the auxiliary circuits, through the main circuit, right up to medium voltage in the area of grid infeed. Because the components are perfectly coordinated, you benefit in numerous ways over the complete life cycle of a wind turbine or wind farm: Totally Integrated Power simplifies planning, reduces costs for procuring, installing and commissioning – and optimizes normal running costs.

Comprehensive support

Totally Integrated Power covers all the phases of a power distribution project: From planning and configuration to installation and operation. Software tools, specification texts, planning manuals and professional advice from specialists support electrical planning engineers and panel builders.

More security and cost efficiency

The power distribution products and systems can be connected to the turbine controller or the wind farm management system via the communication-enabled protection, measuring and monitoring devices of the SENTRON family. The system transparency achieved in this way minimizes fault-related downtimes and the associated yield losses. Totally Integrated Power thus creates the basis for significantly increased system availability, markedly more cost-effective operation – and thus significant reductions in TCO (total cost of ownership).

Advantages

- Integrated support tools for planning and configuration
- Coordinated product portfolio from low-voltage power distribution to the medium-voltage switchgear
- Up-to-date expert advice from planning manuals and specialists

The SIMARIS software family – easy, fast, and safe electrical planning

Comprehensive support – from planning to operation
Quality and ruggedness: maximum security for your investment

Our certified products are characterized by the highest quality and ruggedness. Specially hardened modules of the SIPLUS extreme series are perfectly suited to harsh environments as found in the operation of wind turbines, especially in offshore applications.

Certified for the worldwide use of your wind turbines
Where the quality or our products and systems are concerned, we leave nothing to chance: We only use carefully selected materials and production procedures in their manufacture. Also, specific system tests ensure the planned and required quality of each individual component. The standard products from our comprehensive portfolio fulfill all the relevant international standards and have the appropriate certification, such as:

- GL, BV, LR, ABS, DNV, NKK
- IEC 61132-2 Safety; CE, UL508, UL60950, cULus, C Tick, CSA, FM

The high quality and ruggedness is achieved through coordinated development processes, system design and system tests.

Made for extreme conditions: SIPLUS extreme
In corrosive environments or extreme temperatures: Harsh conditions of whatever type demand extremely rugged products and systems – such as those in our SIPLUS extreme family.

SIPLUS extreme ensures the highest degree of functional capability and operational safety where conventional devices would reach their limits:
- 100% humidity and extreme variations in temperature
- Extreme, highly caustic ambient conditions, such as corrosive gases and salt spray
- Extreme temperature ranges (–40 °C to +70 °C)
- Extended installation altitude –1000 to +5000 meters

Advantages
- Integrated range of products for all application areas – even under the harsh conditions often encountered in the wind power industry
- Maximum ruggedness at all levels of automation and for all applications: from field devices, to control units, to operator panels
- The facility for implementing the components directly at the turbine – often without the need for a special control cabinet and the associated installation and wiring costs

www.siemens.com/siplus-extreme
The safety regulations of the Machinery Directive 2006/42/EC apply as much to wind turbines as to any other machines: wind turbines thus also require the certificate of conformity in accordance with Annex IIA. By this the manufacturer confirms that the equipment complies with all the applicable EU directives.

The way to the safe wind turbine

Manufacturers and operators of wind turbine systems in Europe are legally bound to ensure the safety of human beings and the environment. This means manufacturers must confirm that the system complies with the Machinery Directive. For economic reasons too, all risks emanating from a wind turbine must be eliminated as far as possible right from the start. This turns functional safety into a success factor for wind farm builders and operators. The evidence for this is increased productivity thanks to enhanced system availability, and fewer unplanned down-times. Personal injury, damage to property, and the associated follow-on costs are also avoided.

Applications:
Monitoring of rotor speed, short circuit, tremors, cable twisting, emergency stop, etc.

Safety Integrated offers information and courses on:
- Implementing the Machinery Directive
- Application of the safety standards EN 62061 and EN ISO 13849-1
- Risk assessment according to EN ISO 12100

Furthermore:
- Tailor-made solutions for monitoring rotor speed, short circuit, emergency stop, cable twisting, etc.
- Information about innovative, certified products, fail-safe communication via standard bus systems, and efficient engineering
- Safety Evaluation Tool for standard-compliant evaluation and documentation of your safety concept

Cable twisting example:
The rotation of the nacelle is detected via the position switch and forwarded to the controller via the SIRIUS 3RK3 modular safety system (MSS). If required, it blocks movement in one direction to avoid breaking the hanging cables in the tower.
Industrial Security

With Security Integrated Siemens provides its customers components that not only have communication functions but also include special security functions such as firewall and VPN functionality, in order to implement the cell protection concept.

Protection for your data

Due to the increased use of Ethernet connections all the way down to the field level, the associated security issues are also gaining in importance. To provide a wind farm with comprehensive IT security protection against attacks, the appropriate measures must be taken. Siemens supports you in selectively implementing these measures – within the scope of our integrated range for industrial security. Only total solutions offer maximum protection.

Your company’s know-how must be protected from espionage efficiently and on a sustained basis. Every unauthorized manipulation of your automation processes must be excluded from the start. Only in this way can integrity protection be guaranteed. Another important issue: Reliable protection against sabotage, in other words, protecting your production processes against disturbances. We view industrial security holistically, and we design total solutions that offer your systems maximum protection. Protection and security for your company and your capital.

Firewalls

Security modules that allow or block data communication between interconnected networks according to specified security restrictions. Firewall rules can be configured for this. It is thus possible to specify that only a particular PC may access a given controller, for example.

Virtual private networks (VPN)

A VPN tunnel connects two or more network stations (e.g. security modules) and the network segments behind them. Encrypting the data within this tunnel makes it impossible for third parties to listen in on or falsify the data when it is transmitted over an insecure network (e.g. the Internet). When teamed up with IPSec, VPNs also reduce the potential threat when “outside computers” are temporarily connected for service and support purposes.

Port security

The access control function allows individual ports to be blocked for unknown nodes. If the access control function is enabled on a port, packets arriving from unknown MAC addresses are discarded immediately. Only packets arriving from known nodes are accepted.

RADIUS: Authentication via an external server

The concept of RADIUS is based on an external authentication server. An end device can only access the network after the Industrial Ethernet switch has verified the logon data of the device with the authentication server. Both the end device and the authentication server must support the Extensive Authentication Protocol (EAP).
SCADA wind farm management

There is now a two-part solution for wind turbine manufacturers and independent service providers:

a turbine SCADA with a long-term database, and a central service portal. Both systems offer a standardized operating concept as well as system-wide communication.

SIMATIC WinCC Open Architecture – Wind power plant service portal

The integrated Web-enabled SCADA solution for use in wind turbines and wind farms, and central multi-farm service portals is based on the open SCADA system SIMATIC WinCC Open Architecture. Because it is an open concept and has a variety of interfaces, it is freely configurable and expandable.

High plant transparency – from the turbine to the wind farm level

The integrated architecture and communication facility and the use of long-term databases on the turbine or farm level mean that service engineers can use a central application in the control desk to access the complete range of up-to-the-minute data from all connected turbines to carry out any kind of comparative analysis. This eliminates the need to dial into each turbine separately and change between different applications, while still allowing service teams unrestricted access to any online data, alarms and histories without compromising optimum troubleshooting and analysis. On-demand access to real-time and historical data ensures unrestricted access to data even on narrow-band connections, and it transfers only the data the user currently wants to analyze.

The open nature of SIMATIC WinCC Open Architecture along with its long-term compatibility provides the optimum customer investment security over the long term. There are currently a large number of running applications based on SIMATIC WinCC Open Architecture that can still be upgraded and maintained even after almost 15 years.

Plant transparency due to on-demand access to real-time and historical data

Farm overview in spreadsheet form

Turbine detail view in spreadsheet and graphic form

Farm overview with tree structure
### General properties
- Open, adaptable SCADA solution
- Integrated turbine and farm SCADA architecture
- Diverse functions and interfaces allow integration of a wide range of plants and applications
- Secure, event-oriented, encryptable and seamless communication – data consistency in the control center is ensured in the event of connection failures
- Enables on-demand access to real-time and historical data, and transfers only the data that the user currently wants to analyze
- Multiple user roles – from on-site operating personnel to the manufacturing service engineers
- High availability due to double redundancy
- SNMP network monitoring
- Individually configurable plant screens with live data
- Scalable
- Web capability and support for mobile devices
- Multiple languages – German/English and upgrade option for up to 40 languages
- Platform-independent and available for Windows, Linux and Solaris

Thanks to the use of SIMATIC WinCC Open Architecture, the service portal is open for a variety of expansions on the customer's side. If required, qualified Siemens Solution Partners are available globally for adaptations and expansions.

### Special functions
- Integrated master data maintenance
- Prepared for the application of RDS-PP
- Long-term turbine and farm data storage
- Integrated maintenance management
- Integrated Excel reports
- Plug-and-play configuration for convenient connection of new turbines/farms to the control center
- Tolerant to connection failures
- IEC 61400-25-based tree structure
  - Predefined for 1,500 individual data items per turbine
  - Preconfigured for the SIMATIC Wind Library turbine control

### Integrated functions
- Integrated maintenance management
- Integrated fault log
- Overview assessment of different farms and turbines
- Up-to-the-minute values
- Freely configurable comparative trends
- Video management for access control
LOHER GD Wind Generators

LOHER Geared Drive (GD) Wind Generators have long been familiar in the wind industry. They stand for outstanding quality, which ensures maximum energy yield and highest system availability. Our portfolio extends from 250 kW up to 10 MW for onshore and offshore applications, and is always perfectly adapted to the particular wind turbine system concept.

Optimized over the entire service life

More than 20,000 delivered LOHER GD Wind Generators speak for themselves. Worldwide, people trust their quality, their first-class reliability, and high efficiency. One of the reasons: They have been optimized over their entire service life. The maintenance-friendliness of the high-quality wind generators helps to reduce their total life-cycle costs to an exceptionally low level.

Rugged and weatherproof

Thanks to humidity protection isolation and vibration-proof windings, our wind generators reliably generate power in any climate and in any height of tower. Versions with extended temperature ranges for cold climates and hot climates are also part of our portfolio. Special paint systems, developed for onshore and offshore use ensure optimal corrosion protection – even in salt-laden atmospheres.

Quality spurs us on

Striving for high quality is a priority for our wind generators. Our entire generator production is oriented toward this. Quality controls and the most state-of-the-art test facilities ensure the high level. In addition, the wind generators comply with all regulations of the relevant acceptance societies, as well as international standards for wind turbines. Grid compatibility requirements are also fully met by our generators.

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<th>Cooling method</th>
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<td>Modular air/air</td>
<td>500 – 800</td>
<td>1.5 to 10 MW</td>
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<td>LOHER GD Wind Generator DFIG-F</td>
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<td>LOHER GD Wind Generator EESG-A</td>
<td>Electrically excited</td>
<td>Modular air/air</td>
<td>400 – 800</td>
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<tr>
<td>LOHER GD Wind Generator EESG-W</td>
<td>Electrically excited</td>
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<td>LOHER GD Wind Generator PM-A</td>
<td>Permanent magnet</td>
<td>Modular air/air</td>
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<tr>
<td>LOHER GD Wind Generator PM-W</td>
<td>Permanent magnet</td>
<td>Modular air/water</td>
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<td>0.6 to 10 MW</td>
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<tr>
<td>LOHER GD Wind Generator IG-A</td>
<td>Squirrel-cage</td>
<td>Modular air/air</td>
<td>500 – 800</td>
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<tr>
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<td>Pole changing</td>
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This portfolio only represents the most common product range. There are no limits when it comes to shaft heights, power ratings and cooling concepts. The resulting possibilities allow much more, and we’ll be pleased to prove this to you on request.
Monitoring for even higher availability

To increase availability even further, all generators are equipped with extensive monitoring equipment: Temperature sensors and monitoring for wear and tear on brushes are standard. Sensors for vibration, leakage or other measured variables can be selected optionally. There are no limits to the expandability.

Maximum yield at any location

A yield-optimized efficiency characteristic with an increased power factor increases the energy yield of the wind turbine. Our generators can be designed to suit locally available wind profiles, thus optimizing energy yield at any location. Designs for greater voltage or frequency tolerances enable the use of LOHER GD Wind Generators even at locations with weak grid conditions, at 50 Hz as well as at 60 Hz.

Reduced noise level, if required

Versions with reduced noise levels are available for locations with increased requirements regarding the noise emissions of the generators. This is achieved by means of noise-optimized electrical design, an innovative construction concept, and specially dimensioned forced ventilation.

The bearing concept: user-friendly and flexible

The wind generators are designed in such a way that the bearings can be changed in the nacelle. This pays special dividends in offshore systems. Special requirements can be met using reinforced bearings or roller bearings. Of course, we regard the use of insulated bearings as standard.

Optimized operations management

For optimal operations management of the wind turbine, the machines can be designed for mounting speed switches, rugged speed sensors or incremental encoders, and brakes. This offers the best possible accuracy.

Advantages

- **Well-proven quality:** proven more than 20,000 times
- **Rugged and weatherproof:** smooth operation in all climate zones – even under harsh conditions
- **Tailored:** solutions that precisely fit every wind turbine
- **High yield:** through maximum energy yield and high efficiency
- **Space saving:** through compact designs
- **Competence in all the usual generator concepts**
- **Flexibility regarding the cooling options**
- **Can be used globally:** available as 50-Hz, 60-Hz or combined 50/60-Hz version
- **Maximum reliability:** 100% quality check before shipping
- **Low maintenance costs:** maintenance-friendly design and good spare parts availability
- **Used in onshore and offshore applications:** corrosion-resistant components
- **Comprehensive range of services:** around the clock and around the globe
LOHER DD Wind Generators

Power generation using wind turbine systems must be highly efficient, cost-effective and reliable even under harsh conditions. With the LOHER Direct Drive (DD) Wind Generator – a slow running permanent-magnet synchronous generator – we present a new gearless wind generator that fully addresses the requirements mentioned above, and also offers a high degree of flexibility.

More flexibility by innovative segment concept

Based on the modular, technological platform concept, the generator is not manufactured in a complete unit, but is configured from pre-assembled partial segments. Generator solutions can be assembled from these segments depending on the turbine design. The segments can be individually adapted to the customer’s power requirements, and are optimally integrated into the wind turbine drive train using finite element calculations. This ensures optimal efficiency and minimum costs.

Simplified logistics

The generator can be split up into its individual segments for transporting. This significantly simplifies logistics. As a result, there are no restrictions relating to transport even for very high power ratings. Magnetic forces do not influence the final assembly and transport of the generator pairs.

Efficient and reliable

As a result of both the integrated design, which means the generator does not have to have its own bearings, so bearing friction losses are reduced, and the fact that excitation power and gearbox losses are eliminated. The reduced complexity and elimination of excitation equipment, such as slip rings, permits the highest degree of reliability with minimum maintenance costs.

Technical data

- **Power range:** 2–10 MW
- **Voltage levels:** 690–4200 V
- **Turbine concepts:** inner and outer rotor
- **Segmentation:** stator and rotor
- **Bearing concepts:** individually according to customer specifications
- **Cooling:** air/water cooling according to customer specifications
- **Application area:** onshore and offshore

Advantages

- Simpler transport and easier assembly thanks to segmentation concept
- Based on series production concept
- Platform with standardized components enables series production
- Maximum flexibility for the turbine concept
- Lightweight and space saving thanks to highly integrated mechanical solution
- High efficiency
- Maximum reliability with minimum maintenance cost
Tailor-made converters for every requirement
The wind converter LOHER Dynavert XL system is characterized by the modular design of its power units. The use of standardized components enables fast adaptation to customer-specific requirements, and an optimal maintenance and spare parts concept.

Safe and service-friendly – the reliable converter system
Based on state-of-the-art dual processor technology, the CB08 control board controls the complete converter sequence. The CB08 masters all situations, starting from the grid monitoring, through synchronization to the grid, up to a defined shutdown in case of fault. All components, such as filters, low-voltage switchgear, etc., are already integrated into the cabinet and can be adapted to address specific customer requirements. The converter is structured according to various functional zones. Separate zones for the power units, control electronics and the grid connection mean improved EMC compatibility and maintainability. The units can be simply integrated into any overall concept by using state-of-the-art remote maintenance and remote diagnostics software, which supports all the usual interfaces.

Systematic strength with LOHER Wind Generators
LOHER Wind Generators and wind converters LOHER Dynavert XL are optimally matched – from development, through production and common testing in the test field, certification, up to servicing. The loads on the generator and converter are precisely adjusted to each other and thus ensure optimal operation. The converter is suitable for all offered generator types.

Alternative solution in medium voltage
For power ratings in the upper megawatt range, wind-specific solutions based on SINAMICS medium-voltage converters can be designed by use of innovative modular multilevel topology. This allows the benefits of this technology to be channeled into the wind power industry: Fine scalability of voltage and power, best grid-compliance and generator-friendliness thanks to the outstanding voltage quality, and high availability achieved by simple implementation of redundancy.

Advantages
- Suitable for onshore and offshore use
- Complete converter system including filters and circuit breakers in a single device
- Complies with all the common international grid codes
- Flexible adaptation to turbine conditions
- Modern remote maintenance and diagnostics software
- Simple maintenance
- Easy system integration due to the use of established interfaces
- Small footprint through maximum power density

Wind converter LOHER Dynavert XL
Wind converters connect the generator to the power grid and ensure optimal grid integration.
Like our LOHER Dynavert XL wind converters. A low-voltage converter system for all generator types.
As an alternative our portfolio offers medium-voltage-based concepts for the higher megawatt range.

www.siemens.com/loher-dynavert-xl
Power distribution – low voltage

Wind turbines not only generate electricity; they also depend on both a reliable supply of electrical power, and on its safe and economical distribution. An additional high priority is the protection of people and electrical equipment. We offer you products, systems, and a comprehensive protection concept to ensure that you are always in safe hands.

Comprehensive portfolio for global use

We offer an extensive portfolio of low-voltage power distribution components. The consistency, modularity and reliable interaction of our components and systems from the SENTRON portfolio guarantee a host of benefits – globally and throughout their entire service life.

Safe power distribution in the main circuit

The main circuit of a wind turbine is responsible for power generation via the generator, and the transmission of power up to the infeed into the grid.

High power outputs must be distributed and transmitted in the wind turbine safely and with as little loss as possible. This can be achieved by means of the LD system from the SIVACON 8PS busbar trunking system which can be fitted both quickly and safely. It is ideally suited to the distribution and conveyance of power within the main circuit for a current range of 1,100 A to 5,000 A.

Effective protection of the main circuit

The 3WL air circuit breaker protects the main circuit in the event of overload and short circuit. It can be fitted with various electronic releases which enable the tripping characteristic to be optimally adapted to the conditions required.

The connection between the generator and the converter, which has to contend with variable frequencies, is protected by the externally controlled 3WL air circuit breaker. The sensitive power semiconductors of the converter react sensitively to short circuits and overload. In the event of uncontrolled failure due to extreme circumstances, this can result in substantial damage and downtime for the entire wind turbine. A particularly fast protective device is required for protection. SITOR semiconductor fuses are the ideal solution for meeting these requirements.
Reliable power supply for the auxiliary circuits

Electrical equipment guarantees the vital functions of the wind turbine, e.g. pitch and yaw systems, and ventilation or hydraulic systems. Equipment of this kind must be fitted with coordinated components to ensure effective protection against overvoltages, overloads and short circuits.

Protecting the infeed system

The 3VL molded-case circuit breakers and the 3NP1 fuse switch disconnectors protect the infeed system of the auxiliary circuits against short circuit and overload.

Perfect protection for the feeders

Miniature circuit breakers and fuse systems offer perfect protection for feeders and electrical equipment against short circuit and overload. Residual current operated circuit breakers protect against electrically ignited fires and offer personnel protection, e.g. in the case of insulation faults. UC-sensitive residual current operated circuit breakers of types B and B+ guarantee maximum protection even when smooth DC residual currents occur. These can occur with frequency converters or defective switching network components. Further key functions are available thanks to an extensive range of accessories: remote tripping, remote reconnection and remote querying of switching states.

Protection against damage from lightning and overvoltage

Due to their usually exposed positions, wind turbines are at particular risk of being struck by lightning. In order to protect electrical equipment against lightning and overvoltages, we offer a graded portfolio of surge arresters of types 1, 2 and 3.

High system transparency thanks to measuring devices and communication

Within the electric circuits of a wind turbine, measurement technology allows for the precise display and reliable monitoring of electrical variables. By recording changes in harmonic or current mean values, critical system states and system component defects can be detected at an early stage, and subsequent damage, such as damage caused by fire, can be prevented. Thanks to their many communication options, the high-quality 7KM PAC measuring devices can be very easily integrated into higher-level communication systems of the wind turbine or wind farm control rooms for further processing of the measured data.

Advantages

- Safe power distribution thanks to perfectly coordinated components from the SENTRON portfolio
- Maximum short-circuit strength and low fire load thanks to SIVACON 8PS busbar trunking system
- Reliable protection of the auxiliary circuits against overvoltage, overload and short circuit
- Products certified worldwide for the standard-compliant installation of protection concepts
- Protection of the electrical installation and system thanks to a graded lightning and overvoltage protection concept
- Increased system transparency thanks to intelligent measuring technology and communicationable products
Power distribution – medium voltage

Medium-voltage systems and solutions for wind farms – the reliable connection between wind turbines and the power grid, with modular energy storage. Gas-insulated medium-voltage switchgear (GIS) is used for various applications in wind farms. Reliable integration into the grid is ensured by intelligent energy storage solutions such as SIESTORAGE.

Application areas of intelligent medium-voltage systems and solutions in wind farms

<table>
<thead>
<tr>
<th>Switchgear type</th>
<th>Rated voltage, max.</th>
<th>Rated short-time current, max.</th>
<th>Rated normal current of the busbar, max.</th>
<th>Rated normal current of the feeders, max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8DA</td>
<td>40.5 kV</td>
<td>40.0 kA</td>
<td>5,000 A</td>
<td>2,500 A</td>
</tr>
<tr>
<td>NXPLUS</td>
<td>40.5 kV</td>
<td>31.5 kA</td>
<td>2,500 A</td>
<td>2,500 A</td>
</tr>
<tr>
<td>NXPLUS C Wind</td>
<td>36.0 kV</td>
<td>25.0 kA</td>
<td>1,000 A</td>
<td>1,000 A</td>
</tr>
<tr>
<td>NXPLUS C</td>
<td>24.0 kV</td>
<td>25.0 kA</td>
<td>2,500 A</td>
<td>2,000 A</td>
</tr>
<tr>
<td>SIMOSEC</td>
<td>24.0 kV</td>
<td>25.0 kA</td>
<td>1,250 A</td>
<td>1,250 A</td>
</tr>
<tr>
<td>8DJH</td>
<td>24.0 kV</td>
<td>20.0 kA</td>
<td>630 A</td>
<td>630 A</td>
</tr>
<tr>
<td>8DJH 36</td>
<td>36.0 kV</td>
<td>20.0 kA</td>
<td>630 A</td>
<td>630 A</td>
</tr>
</tbody>
</table>

**SIESTORAGE:** modular design, different arrangements and memory sizes possible
Nominal capacity*: up to 1 MWh in one standard container; power rating: dependent on the C rate of the rated battery
Power (converter): 1–3 MVA for a standard container, scalable with several containers

- Wind farms: NXPLUS C Wind, 8DJH, 8DJH 36, SIMOSEC, NXPLUS, 8DA
- Transformer stations: 8DA, NXPLUS, NXPLUS C, 8DJH
- Reactive-power compensation systems: 8DA, NXPLUS, NXPLUS C, 8DJH
- SIESTORAGE: modular energy storage

*Dependent on the battery manufacturer
Reliable power distribution by gas-insulated medium-voltage switchgears (GIS)

According to the wind farm operator’s requirements, a GIS ensures the reliable connection of the individual wind turbines to typical grid configurations. Cables transmit the power generated in the wind farm to a transformer substation, where another GIS establishes the connection to the high-voltage grid. Within larger wind farms, reactive power compensation systems are additionally used. These systems also operate at medium-voltage level, and they are connected to the wind farm grid via gas-insulated medium-voltage switchgear.

High grid stability due to intelligent energy storage systems

To stabilize the grid, the generated power that cannot flow into the grid is stored with the help of SIESTORAGE, so that it can be fed into the grid on demand. It is therefore not necessary to expand distribution systems with a high share of distributed renewable power generation systems. Furthermore, this solution offers an independent and reliable power supply to stand-alone power systems with renewable power sources.

Advantages

Our gas-insulated medium-voltage switchgears (GIS) and energy storage solutions from Siemens offer

- Maximum reliability
- Personnel and operational safety
- High flexibility thanks to their modular construction

GIS also stands out for

- Compactness
- Maintenance-free design
- Climatic independence

![Diagram of the grid system](https://via.placeholder.com/150)

Reliable power distribution and grid integration by gas-insulated medium-voltage switchgears and intelligent energy storage systems

*Abhängig vom Batteriehersteller*

= number of cells varies according to application
Turbine control

In wind turbines and wind farms, the control technology used plays a central role:

It permanently adapts the operating parameters to the actual wind conditions – and thus fulfills a major requirement for maximum productivity.

Perfect turbine control for a maximum yield

SIMATIC®, the world-leading comprehensive automation system is a core component of Totally Integrated Automation. SIMATIC also supplies the safety technology for compliance with the Machinery Directive – and is therefore the optimum basis for fulfilling the constantly rising requirements in the wind power industry – flexibly and economically. With the SIMATIC Microbox, we offer you the perfect controller for every control task in wind turbines and wind farms:

- For rotor blade adjustment
- For nacelle tracking
- For recording the measured wind data
- For the converter
- For overall control of the wind farm

Compact and complete

For wind turbine control, we offer you the ultracompact, fail-safe software controller WinAC RTX F to enhance productivity. The hardware and software of the ready-to-use Embedded Bundles are perfectly attuned to each other. The omission of rotating parts such as fans and hard disks ensures maintenance-free operation and maximum ruggedness. The software controller performs the actual control task and the fail-safe communication with PROFIsafe on the basis of Industrial Ethernet. Further advantages of our Embedded Bundles with perfectly scalable performance: diagnostics and response in real time, as well as openness in hardware and software.

Advantages

- The only TÜV-certified, fail-safe software controller worldwide for safety-oriented applications
- Faster configuring and commissioning thanks to wind-power-specific software libraries
- Investment security due to long-term availability of the modules
- Easy integration of MATLAB/Simulink applications via the open C interface
- Protection of know-how thanks to integration of high-level languages like DLL
Distributed intelligence

Modern automation is unthinkable without distributed intelligence – and that also applies to wind turbines and wind farms. Flexible, distributed solutions are required that enable the full potential to be efficiently utilized in electricity production.

Distributed intelligence for all requirements

With SIMATIC ET 200, we offer you a multifunctional, modular, finely scalable system for the distributed automation of your wind turbine:

- For the control cabinet of a wind turbine in IP20
- For installation direct in the wind turbine in IP65/67
- As well as for use in hazardous areas

Our offering also comprises systems that work highly reliably even at temperatures down to –40 °C.

The incremental encoder of a rotor blade drive can be directly connected to a standardized input of a SIMATIC ET 200, for example; and the sensors for the generator temperature can be directly connected to an ET 200pro module. Particularly convenient: The configuration of the ET 200 modules can be loaded direct into the STEP® 7 engineering software with the help of the ET 200 configurator; this offers predefined process data that you just have to combine with the control variables of the wind turbine.

The first choice for cabinet-free installation in the wind turbine

SIMATIC ET 200eco PN is a compact block I/O with a PROFINET connection and high IP65/IP67 degree of protection for cabinet-free installation directly in the wind turbine. Thanks to its fully-sealed zinc die-cast housing, it is mechanically very rugged and resistant to vibration, dust, and humidity. The system can be flexibly expanded via PROFINET and supports star and linear topologies within a plant. Further advantages: a system-wide diagnostics concept and the high performance of PROFINET. An IO-Link master is also available as an especially cost-effective point-to-point connection. The system operates reliably across a temperature range from –40 °C to +60 °C. Of particular interest for use in offshore wind farms are our variants with resistance to salt spray.

Advantages

- Salt-spray-resistant variants – particularly suitable for offshore use
- High degree of ruggedness to IP65/67, and can be used down to –40 °C – for cabinet-free installation under harsh environmental conditions
- Highly flexible, modular and finely scalable
- Intelligent diagnostics functions
- Systems with integrated safety functions
- Reduced size for confined spaces
- M12 connector for maximum resistance to vibration

www.siemens.com/simatic-wind/et200
Human machine interface

Whether for erection, operation, or service and maintenance: human machine interfacing is of overriding importance in wind turbines and wind farms. The operator panels can be used to run the wind turbines in service mode, to call up current equipment states and performance/historical data, and to change parameters.

The comprehensive offering of the world market leader

With SIMATIC HMI, we offer you a uniquely complete and integrated spectrum of first-class products and systems for all HMI tasks – from a single source: high-performance operator panels and visualization software for the turbine engineer – for operator control and monitoring at the turbine during commissioning and servicing. The requirements range here from one small panel in the base of the tower, through to a complex PC-based operator input system.

Complete range of operator panels

Our range of operator panels provides the intelligent response to processes that are constantly increasing in complexity, and to higher productivity requirements. The individual components can be perfectly integrated into automation landscapes using open, standardized hardware and software interfaces. Our portfolio covers all performance classes, from standard to high-end, and comprises numerous different device variants:

- For rotor blade adjustment
- For nacelle tracking
- For recording the measured wind data
- For the converter
- For overall control of the wind farm

Advantages

- Efficient plant-wide human machine interfacing in both the wind turbine and the entire wind farm
- During operation: access at any time to local information, current operating states and the status of the overall plant
- In case of maintenance or a fault: detailed information regarding fault correction or maintenance functions
- Complete system spectrum with first-class solutions for all requirements – also in a saline-resistant and temperature-resistant version
- High-luminance displays that are also easy to read in daylight
Engineering software

Whether for configuring and parameterizing the hardware, defining the communication system, programming or testing, commissioning and servicing, documenting and archiving, or for operating and diagnostics functions: When implementing the numerous automation tasks necessary in wind turbines and wind farms, the TIA Portal offers maximum efficiency.

Programming with the TIA Portal

With our TIA Portal Engineering Framework, you can rely on maximum engineering efficiency: You design your operations management logistics, and you have access to extensive block libraries that already offer 80% of the closed-loop control functions. Blocks and libraries make it easy to reuse the program code generated. Whether the blade angle needs adjusting in milliseconds to optimize the output and vibration, or the charging status of back-up systems needs to be monitored slowly: You can freely parameterize the priority and timing intervals used to execute your control algorithms. By optimizing the control loops of your wind turbine with MATLAB®, Simulink®, or GH-Bladed, you can directly integrate these results as control algorithms in the program. You can also integrate your own algorithms, developed, for example, in the high-level languages C++, C#, Visual Basic or SCL.

Wind library (software library for wind turbines)

With our software library specially developed for wind turbine automation, approx. 80% of the functions of a wind turbine are already available in the form of SIMATIC STEP 7 function blocks. These include, for example:

- System functions
- Pitch and hub control
- Nacelle control
- Tower functions
- Status monitoring
- Physical functions

These functions are available in source code. They can thus be adjusted precisely to your specific requirements. The wind library speeds up configuration considerably and reduces the engineering costs. Its basic structure mirrors that of a wind turbine.

Advantages

- Local support for the customer from the special Wind Support Center
- Plant optimization through project-specific applications – e.g. adaptive wind tracking for the nacelle and rotor blades
- Extensive test functionalities, such as
  - 3-D wind turbine simulation and visualization (open and closed) – as well as hardware on-the-loop
  - Interfacing between the simulation PC and the SIMATIC control solution via PROFINET
  - Integration of Simulink as a dynamic library (DLL)

www.siemens.com/simatic-wind/engineering-software
Condition monitoring systems

As well as productivity, the lifecycle costs of wind turbines are increasing in importance. In this context, ensuring maximum plant availability is a central issue. For this reason, operators must succeed in detecting potential fault sources early, and to execute pending service tasks at the right time.

SIPLUS CMS4000 and CMS2000

Early detection of faults thanks to permanent condition monitoring

Faults can be detected early with the SIPLUS CMS condition monitoring systems. Predictable problems can thus be corrected as they arise – before more significant damage occurs, with often cost-intensive results. Depending on requirements, the condition of components subject to wear and tear, such as generators, gears, bearings, is permanently monitored. You can choose between two systems, depending on requirements: SIPLUS CMS2000 or CMS4000. The extensive SIPLUS CMS X-Tools diagnostics tool forms the basis for expert diagnostics.

SIPLUS CMS2000 – the simple system

The modular SIPLUS CMS2000 condition monitoring system supports detailed damage detection – using up to 16 IEPE sensors. The data for this can be recorded and exported.

SIPLUS CMS4000 – the powerful, flexible system

The powerful SIPLUS CMS4000 condition monitoring system can acquire and analyze up to 180 vibration signals in parallel and synchronously. Relevant operating data from the turbine control can be integrated here. This enables an overall analysis of the condition of the turbine.

SIPLUS CMS X-Tools – powerful analysis software

With the extensive SIPLUS CMS X-Tools diagnostics tool, the most diverse parameters and signals can be combined logically – as the basis for expert diagnostics. The interfaces to the wind farm management system can be structured flexibly.

Advantages

- Maximum productivity and protection of the wind turbine – through permanent monitoring of important processes
- Increase in turbine availability and optimization of the service life of the equipment units within the wind turbine
- Implementation of intelligent, scheduled maintenance concepts – including predictive maintenance
- Reduced maintenance costs

www.siemens.com/siplus-cms
Reliable power supply

A reliable DC power supply is a basic requirement for the efficient operation of a wind turbine. The power supply SITOP has been proving itself in automation engineering for decades. As well as the efficient power supplies, the add-on modules protect against faults on the grid and on the 24 V DC side. The power supply system offers safety up to all-round protection – for maximum availability.

Power supplies for any requirement

The product lines of SITOP meet different requirements regarding voltage input, power, ruggedness and functions. Here is an excerpt from our extensive range:

**SITOP compact** – the 12-V and 24-V power supplies for power ratings to 100 W are extremely space-saving and energy-efficient across the entire load range, even in no-load operation.

**SITOP smart** – the 24-V standard power supplies are favorably priced but still offer outstanding overload characteristics.

**SITOP modular** – the rugged devices offer maximum functionality, such as wide-range input, 300% power boost, selectable overload behavior, and high efficiency.

**DC/DC converter for pitch systems**

The SITOP PSU400M power supply with 200–900 V DC input and 94% efficiency enables a maintenance-free power failure concept at the DC link of drive systems. In an electrical pitch system, the rotor blades can be turned out of the wind even when the power fails.

Reliable 24-V supply – even when the power fails

To protect 24-V loads from power failures as well, the power supplies can be upgraded to uninterruptible power supplies. DC UPS modules with temperature-resistant and durable capacitors back up the 24 V for anything up to several minutes, for the purpose of bringing PC-based systems to a defined state, for example. DC UPS modules and battery modules supply up to 40 A and enable further operation for anything up to several hours, e.g. of maintaining obstruction lighting and communication.

**Selective protection**

The selectivity module divides the 24-V supply among several load circuits and monitors them for overload resulting from a fault. The electronic add-on module itself detects short circuit on long cables and reliably shuts the feeder down.

**Simple selection and configuring**

With the SITOP Selection Tool, you can select not only your power supply, but also the DC UPS. You can order the selected products via the Siemens Industry Mall, and you receive information such as product data sheets, 3-D data, or circuit diagram macros.

**Advantages**

- Reliable power supplies for the most diverse requirements
- Wide operating temperature range
- Efficient DC/DC converter for pitch systems
- Add-on modules increase system availability
- Upgrading to DC UPS possible, 24-V backup via capacitors or battery
- Selectivity module reliably monitors individual 24-V feeders
- Simple selection of the power supply and UPS via www.siemens.com/sitop-selection-tool
Communication in wind turbines and wind farms

Whether for controlling and monitoring wind turbines, or coordinating complete wind farms:

Without industrial communication, these complex tasks cannot be fulfilled. We supply SCALANCE as the basis for the data networks required – in the context of our comprehensive range of products and systems for communication in wind turbines.

Maximum integration with PROFINET – also wireless

PROFINET is the leading Industrial Ethernet standard for automation – standardized and specified in the largest fieldbus organization in the world: PROFIBUS & PROFINET International. PROFINET is based on well-proven TCP/IP and IT standards, it uses real-time functions and enables the seamless integration of existing fieldbus systems. Consistent implementation creates the basis for unrestricted integration into the communication system, and ensures maximum data transparency across all levels. PROFINET also supports wireless communication with Industrial Wireless LAN (IWLAN) within the nacelle and the tower – also for safety applications with PROFIsafe, e.g. pitch control.

Integrated diagnostics

Highly efficient diagnostics concepts can be easily implemented with PROFINET – without an additional programming overhead. The hardware components automatically report a fault and supply detailed information about it. We also offer special components for remote diagnostics that signal information about all the relevant events on site by means of plain-text messages. If a maintenance interval is exceeded or a wind farm controller signals an acute fault, the on-call service personnel can be informed by SMS.

Universal web-based management

The wind turbines can also be accessed via Web clients, regardless of the platform and using standardized browsers. Simple and location-independent access to the diagnostics data of the wind turbine is possible on the basis of standard protocols. This results in fast fault diagnostics during testing and maintenance.

Plant transparency due to network management

Thanks to the option of integrated call-up of our SINEMA Server network management system, it is possible to diagnose not just the wind turbine itself, but also the underlying network complete with all the devices networked through Industrial Ethernet.

Efficient cabling systems

For quick and error-free installation or changes on site, with FastConnect, we have developed a sophisticated quick-assembly system of cables, plug-in connectors and assembly tools – for Industrial Ethernet/PROFINET as well as for RJ45, M12 or Sub-D or RS485, and also for fiber-optic cables.

Advantages

- Easy commissioning and maintenance
- Higher availability thanks to redundant mechanisms
- Integrated standard security functions
- Future-proof thanks to simple connection of third-party systems
- Secure connection (VPN), bidirectional communication to the wind turbines
- Diagnostics during operation via PROFINET
- Real-time communication for real-time requirements with all diagnostics possibilities
The right switching solution for every topology

With the network components of the SCALANCE product family, we offer you switching components for Industrial Ethernet for the structured networking of single wind turbines and complete wind farms. A graded portfolio of switches (CSM, SCALANCE X) as well as communications processors with integral switch enables optimum solutions for all types of switching tasks in different topologies such as linear, ring or star. Indispensable for reliable communication: extremely fast reconfiguration of the network in a ring following an error, because the connected data terminals will otherwise disconnect logical communication links. In addition to the ability to configure and diagnose SCALANCE X switches in STEP 7 and TIA Portal, they offer optimized transmission of the PROFINET real-time message frames by means of prioritization. With a temperature range from –40 °C to at least +70 °C, the devices are also suitable for use in extreme climates.

High flexibility through Industrial Wireless LAN (IWLAN)

Greater flexibility can be achieved for the plant by networking the individual wind turbines wirelessly. Maintenance work is simplified and servicing times and downtimes are reduced. Our IWLAN solution makes these advantages available through a coordinated portfolio of WLAN equipment for industrial use, even for fail-safe communication in the context of operator and machine safety. This includes IWLAN access points and client modules (SCALANCE W), wireless interfaces for PROFIBUS and distributed I/O, mobile operator panels, planning software, and extensive accessories.

GSM/GPRS/UMTS

Individual wind turbines and complete wind farms are networked together via GSM/GPRS or UMTS/3G using Industrial Remote Communication. This enables, for example, the infeed power to be measured and then regulated via the pitch system (blade adjustment). Due to the compact construction of the mini controllers, minimal space is required in the case of retroinstallation of the network. Our GSM/GPRS/UMTS products also offer secure remote maintenance access which allows status alarms and diagnostics data to be called up at any time from the wind turbines.

Industrial Security & Security Integrated

The Siemens security concept for protecting automation networks is based on the use of SCALANCE S security modules, the security communication processors (CPs) for S7 and PCs, as well as the SCALANCE M875 UMTS router with integrated security functions (Security Integrated: Firewall, VPN). With these components, automation networks can be segmented according to security criteria, and thus protected against unauthorized access, and the industrial communication system can be protected against manipulation and espionage. The Security Integrated products have been specially designed for automation engineering, so they are the first choice for use in the wind power industry. They can even be used for uncomplicated protection of existing networks. Thanks to the combination of security measures like firewalls and VPN via IPsec tunnel, SCALANCE S, SCALANCE M875 or Security CPs protect individual wind turbines, entire wind farms, or their communication systems, and not least, they thus help to increase the availability of the system.
Pitch systems

Two concepts for pitch systems are available to you:

- the SINAMICS complete solution or the combined solution with our individual components

from the SIRIUS, SENTRON, SIMATIC and SITOP portfolio.

The challenge for the pitch system

An economically viable wind turbine is characterized by maximum energy yield and low lifecycle costs. A high level of investment protection is equally important. A decisive role for optimizing these factors is played by the pitch control thanks to its influence on the efficiency, safety and reliability of a wind turbine. This also refers, for example, to dynamic shutdown of the rotors under extreme weather conditions.

Complete concept with SINAMICS pitch solutions

Customized adaptation of the SINAMICS Pitch drive takes place using a modular system. Lifecycle costs can be reduced and energy efficiency increased through the use of control algorithm to reduce wear, the replacement of hardware functions by software functions, the use of durable and maintenance-free components, and the use of structure-relieving single-blade adjustment. Integrated condition diagnostics save on additional sensors and can be fully integrated into the condition monitoring system of the wind turbine.

Advantages

- Replacement of components by using field-proven safety software, and the use of servomotors without fans
- Integrated motion control functions support the turbine control in reducing load
- Soft pitch control reduces the load on the pitch gears, the blade bearings, and the entire turbine structure
- Integrated condition diagnostics enable preventive maintenance
- Dynamic response to special wind situations
- Integrated safety functionality
Components for the individual solution
Pitch systems can be combined matched exactly for every turbine concept.

<table>
<thead>
<tr>
<th>SIRIUS Industrial Controls</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g.: 3RT2 contactors: specially tested for extreme acceleration and vibration</td>
<td>Individually configurable</td>
</tr>
<tr>
<td>e.g.: 3SE position switches: specially selected and approved for a salt-loaded atmosphere in offshore operation</td>
<td>Flexibly matched to any solution</td>
</tr>
<tr>
<td>SIPLUS extreme products for harsh environmental conditions (e.g. offshore applications)</td>
<td>Field-proven in harsh industrial environments</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIMATIC based controllers</th>
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<tbody>
<tr>
<td>e.g.: comprehensive automation portfolio SIMATIC for control tasks</td>
<td></td>
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<thead>
<tr>
<th>Sitop power supply</th>
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<tbody>
<tr>
<td>e.g.: the efficient DC/DC converter SITOP PSU400M reliably supplies 24 V from capacitors to facilitate turning of the rotor blades out of the wind in the event of a power failure.</td>
<td></td>
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</tbody>
</table>

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<tr>
<th>SENTRON protection devices</th>
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<tbody>
<tr>
<td>Protection devices of the SENTRON family, for a reliable protection against short circuit, overload and overvoltage</td>
<td></td>
</tr>
</tbody>
</table>

www.siemens.com/wind-equipment/pitch
Yaw system

Two concepts for yaw systems are available to you:
the SINAMICS complete solution or the combined solution with our SIRIUS components.

The challenges for the yaw systems
As higher power classes are developed for wind turbines, the requirements placed on the mechanical yaw systems and the drive technology also rise. High availability and reliability of all components are the essential performance criteria, along with adaptability, ruggedness, and high energy efficiency of the electrical systems. Today's wind farm concepts also include innovative service concepts. These are not only based on reliable data for higher-level condition monitoring systems, but also require global availability of spare parts.

Reliable, efficient and flexible complete solution
SINAMICS yaw solutions are available in standard and high-performance versions. These are flexibly oriented around the customer-specific requirements of the respective wind turbine. SINAMICS yaw solutions are consistently based on the reliable SINAMICS and SIMOTICS product families, field-proven industry-wide.

It is unimportant here whether the solution is centralized or distributed, with encoder or without encoder, with braking resistor or with braking energy recovery. If required, field-proven integrated safety functions from Siemens drive technology are available.

Advantages

- Setup with standard components
- Less effort of wiring
- Reduction of loads and wear and tear thanks to integrated drive functions
- Reduced energy consumption thanks to energy recovery capability
- Extensive diagnostics options available, also for higher-level condition monitoring
- Integrated safety functionality available

<table>
<thead>
<tr>
<th>Drive unit</th>
<th>Motors</th>
</tr>
</thead>
<tbody>
<tr>
<td>SINAMICS G120</td>
<td>SIMOTICS GP low-voltage motors</td>
</tr>
<tr>
<td>• Centralized</td>
<td>Optionally SIMOTICS S-1FK7 or</td>
</tr>
<tr>
<td>• Single drive</td>
<td>SIMOTICS GP low-voltage motors</td>
</tr>
<tr>
<td>SINAMICS G120D</td>
<td></td>
</tr>
<tr>
<td>• Distributed</td>
<td></td>
</tr>
<tr>
<td>• Single drive</td>
<td></td>
</tr>
<tr>
<td>SINAMICS S120</td>
<td></td>
</tr>
<tr>
<td>• Single or group drive</td>
<td></td>
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</tbody>
</table>
Individual Yaw systems using SIRIUS Industrial Controls

Since the auxiliary functions of a wind turbine are sure to be in use for twenty years, they must be extremely reliable but nevertheless cost-effective. For this reason, established technologies that enable reliable operation of the wind turbine in the smallest possible space are in demand. In addition, permanent monitoring of the loads as well as gentle treatment of the mechanical components are indispensable to preventive maintenance. SIRIUS switching devices have proved over decades to be especially rugged and powerful.

For example, the universal SIRIUS 3RA6 compact starter combines the functions of a circuit breaker, a solid-state overload relay, and a contactor within an especially compact design. This results in huge space-savings in the control cabinet, with simultaneously reduced wiring. Thanks to integrated functionalities, such as prevention of main contact welding (CPS in accordance with IEC 60947-6-2), as well as shutdown at the end of service life, the compact starter also increases plant availability.

Also possible are a differentiated overload and short-circuit message, and user-friendly remote reset following temporary motor overload. SIRIUS monitoring relay with IO-Link interface is used for full transparency of operating data, such as current, voltage, load, energy and ground fault. Single wires (signal, plus, minus) replace a large number of separate connections here and transfer large volumes of data.

Advantages

- Transparent operating data via IO-Link enable preventive maintenance and reliable operation
- Compact, individual and cost-efficient concepts
- Ease of installation thanks to less internal wiring
- Less error sources due to less connections
- Safe connection even at vibrations and extreme temperature changings due to spring-loaded terminals

**Circuit breaker**

+ **Contactor**

+ **Solid-state overload relay**

+ **Accessories**
  - Auxiliary switch for circuit breaker
  - Auxiliary switch for contactor
  - Surge suppressor
  - Connection blocks

Separated functions

Compact solution

Concept with monitor relay and IO-Link

www.siemens.com/wind-equipment/yaw
Control components for the cabinet

Not only the motors for the pitch and yaw systems of a wind turbine have to be safely and efficiently controlled, but also the host of auxiliary functions such as fans or hydraulic systems. With the extensive range of the SIRIUS modular system, you will find everything you need for switching, protecting or starting motors. The range is rounded off with products for monitoring and controlling, detecting, commanding, signaling and supply.

Industry-tested controls

To ensure the vital functions of a wind farm, the motors (e.g. hydraulic pump, fan motor for the cooling system, or yaw motor) must be safely and reliably controlled, monitored, and protected against short circuit, overheating, or overload. This enables interruption-free operation and preventive maintenance to help counteract disastrous effects: In extreme cases, a fire in the control cabinet can arise and spread to the entire nacelle.

The switching devices for controlling, protecting and monitoring these motors, such as the fan motor for the cooling system, or the yaw motor, are located in a central, air-conditioned control cabinet in the interior of the nacelle. Since space here is extremely limited, the compact design of the SIRIUS range of products enables space-saving, clear control cabinet assembly. Siemens offers the right contactors here, as well as ready-mounted contactor combinations: whether as a single device or as a block for load feeders. Features distinguishing all the devices: their high contact reliability, an especially long service life, and suitability for use even in the most extreme conditions. It goes without saying that the switching devices have Germanic Lloyd certification. Industrial controls in a wind farm must fulfill high requirements since the control cabinets are subject to strong vibrations and high temperature fluctuations.

Easy installation, configuring and service

The SIRIUS components can also be simply and quickly installed. The spring-loaded connections available for all devices are the obvious choice here (to 32 A). Our software range for parameterizing, configuring and visualizing of SIRIUS devices also offer genuine value added here. With clear representation of the device functions and parameters, the user-friendly tools not only accelerate the engineering, but also offer convenient diagnostics functions. In addition, Siemens shows how all the processes involved in control cabinet planning or configuring can be optimized with Planning Efficiency, and how this can generate substantial savings potential. Configurators, download portals, and systems for simple data integration are available to the control cabinet planner for this purpose.

Centralized and compact solutions with SIRIUS compact starters

In a wind turbine, where space is particularly limited, the SIRIUS compact starters enable motor power ratings up to 18.5 kW within a width of just 45 mm. As a universal motor starter in accordance with IEC/EN 60947-6-2, it combines the functions of a circuit breaker, a solid-state overload relay, and a contactor within one compact enclosure. It can be used wherever direct starting of standard induction motors up to 32 A (approx. 15 kW/400 V) is required. Infeed systems, connection blocks, function modules, and spring-loaded connections provide a simple, clear and safe design. This also significantly reduces the installation, wiring and test overhead. Thanks to integrated functionalities such as prevention of main contact welding, and display of end of service life, the compact starter contributes towards high plant availability. The SIRIUS 3RA6 compact starter also optimally protects three-phase motors against overload and short circuit, and thus prevents downtimes. Integrated overload monitoring enables selective fault diagnostics and fast reset. In the event of an overload, resetting the fault message is child’s play.
Ensure the maximum transparency of your turbine – with the SIRIUS monitoring relay for IO-Link

SIRIUS monitoring relays offer maximum protection for your wind turbine, and they now also communicate with the control level thanks to IO-Link. As well as the still available autonomous monitoring function, a host of measured values and data (e.g. power or current) can now be transferred directly to the controller via IO-Link. Only a simple cable (signal, plus, minus) is required here, replacing a host of individual connections. This enables comprehensive and cost-efficient diagnostics up to the motor. It also supports interruption-free operation and preventive maintenance.

Parameters can be assigned locally or via IO-Link. You also profit from significantly simplified device replacement – thanks to data matching and automatic reparameterization via a parameter server.

Standard-compliant and reliable

SIRIUS position switches have special certification for offshore use. With a host of new features, they are a convincing choice in almost all applications. For example, when approaching the neutral position, the position switches detect the end positions of the rotor blades and thus ensure safe shutdown or emergency operation of a wind turbine (see the chapter “Safety Integrated”).

Advantages

- High plant availability thanks to comprehensive operating and diagnostics data, and support for preventive maintenance
- Reduced installation, wiring and configuring overhead with SIRIUS switching devices
- Space savings in the control cabinet thanks to compact design, or combinations of components
- Wind-specific approvals in accordance with GL
- Cost-efficient and system-wide integrated communication by means of IO-Link
- Little cooling required in the control cabinet thanks to reduced internal losses of SIRIUS switching devices
- Efficient parameterizing, configuring and visualizing thanks to diverse range of software
- Substantial time savings in control cabinet planning thanks to Planning Efficiency (see P. 38)
Optimal fire safety solutions for wind turbines

The development of new performance classes of wind turbines and their deployment offshore require higher investment. For this reason, wind turbines must be adequately protected – especially against downtimes and potential total loss. With our extremely reliable fire alarm and extinguishing systems, we guarantee optimal protection for wind farms.

Individualized and complete fire protection concept

Our fire protection concept is based on our latest innovations and long-term experience in the area of fire alarm and extinguishing systems. These include fire alarms with high immunity to false alarms. Our extensive portfolio encompasses products and solutions for all types of fires. Modular system designs and rugged enclosures offer maximum flexibility and enable fast installation. Furthermore, Siemens offers the option of remote monitoring and maintenance – wherever the wind turbine is located.

Reliable fire detection

Fire detectors with our ASAtechnology™ are ideally suited to wind farms (ASA = advanced signal analysis). The signals detected by the sensors are converted to mathematical components using algorithms. The ASAtechnology compares these components in real time with the ASA parameter set and makes dynamic adjustments, if necessary. As a result, the fire detectors detect a genuine fire hazard significantly more accurately, and differentiate this from deceptive false alarms.

Fast and environmentally friendly fire suppression

Automatic extinguishing systems for wind turbines must meet two requirements: First, they must be harmless to personnel if they are unintentionally activated during maintenance work. Second, the extinguishing agent must not create any harmful residues or corrosion on the electronic equipment. This is why we recommend our state-of-the-art Sinorix™ CDT system based on a constant discharge and mass flow technology combined with nitrogen.

Advantages

- Reliable fire detection thanks to ASAtechnology™
- High system availability
- Fast and safe extinguishing – harmless to personnel and the environment
- Simple installation thanks to modular system design and rugged enclosures
- Maximum accessibility to subsystems, as well as space savings thanks to rugged enclosures
- Remote monitoring, remote diagnostics, and optimal preparation of repair work thanks to remote access
Product lifecycle management software

With the PLM (product lifecycle management) software from Siemens, turbine manufacturers can manage the life cycle of their wind turbines efficiently and cost-effectively – from the initial idea, through design and production, right up to servicing. Computer-aided design (CAD), computer-aided manufacturing (CAM), product data management (PDM), and production processes merge seamlessly thanks to PLM.

Product lifecycle management: the starting point for continuous innovation

PLM is crucial to the effective implementation and use of global innovation networks, allowing companies and their partners to cooperate with never-before-seen efficiency. With the required application depth and width for writing, validating and managing detailed product information, PLM creates the ideal basis for turning an idea into a successful wind turbine.

Addressing innovation on two levels

So that the product and the process meet requirements, innovations must be ensured on two levels:

- Development of successful turbines
- Optimal production of the turbines

Business benefits of PLM

With our experience in automation and the PLM solutions, we offer competent support in the production of wind turbines to ensure higher quality, unit quantities and market share. For this purpose, PLM represents the production plants for the foundation, the tower and the rotor blades as simulation models at an early stage using existing CAD models, library components, and 2-D diagrams. Different scenarios provide information about the correct use of personnel, machinery, and robots. In addition, simulation models are used for testing the product versions of turbines. This eliminates surprises following commissioning with regard to feasibility of individual work stages, or the availability of an entire turbine. Existing wind turbine production plants are also further optimized using the “tools” of the digital factory.

Advantages

- Accelerated product launch
- Profitable growth in revenue
- Lower production costs
- Extended profitable product life cycle
- Reusable and field-proven processes
Planning Efficiency™

New standards and directives, time pressure, and increasingly strict quality requirements – control cabinet manufacturers are facing substantial changes in their everyday work, especially in the wind power industry. Planning Efficiency offers 24/7 support for even more efficient process planning. Helpful online functions are available at no cost for every process phase.

Configurators to facilitate the selection of products and systems

With just a few mouse clicks, the respective configurator guides you to the right product or system for your requirements. The relevant product data for the mechanical and electrical planning of the configured solution, such as 3-D modules, circuit diagrams, certificates and operating instructions, are available. Furthermore, the resulting product list can be exported in Excel, or transferred to the shopping basket of the Siemens Industry Mall for ordering.

CAx Download Manager for simple and fast data transfer

With the CAx Download Manager, all required CAx data types for use in all conventional CAE and CAD systems are provided for your desired products free of charge. The process takes only four selection steps, and your individual download package is then provided as a zip file for future use. This facilitates time savings of up to 80% for the product data’s integration in your CAE and CAD system.

Optimal project-specific documentation

In accordance with electronic standards, the documentation forms part of the system and is subject to certification. The purchaser thus has a right to be provided with a complete system documentation. To support you with this, a manual configurator is available with which you can realize individual and standard-compliant documentation – in accordance with the respective project-specific requirements. In this way, you can select the chapters relevant for the respective project from the available manuals of the installed components. You can also integrate FAQs, certificates, data sheets and user-specific content. This means the documentation is perfectly tailored to individual requirements, such as those of the maintenance personnel, and the information is thus easier to find.

Advantages

- Faster to the right product with intuitive product selection
- Up to 80% time savings with universal product data for your CAE and CAD system
- User-friendly assembly of project-specific documentation

With Planning Efficiency easier, faster and more comfortable to the perfect cabinet.
Service, support and training

As your partner, we offer you much more than first-class products and systems. Our Wind Support Centers, which build on our extensive sector and technology know-how, are there to help you worldwide, competently and reliably. With one objective: to realize the optimum solution for your specific requirements.

Comprehensive support – worldwide

Our experts support you in every phase of your project – in the initial planning stages, as well as with engineering and commissioning your wind turbine or even the complete wind farm. You can also count on us during the operating phase. Our service specialists are available to you around-the-clock – 365 days in the year. We are also there for you when it comes to training your employees. And we tailor the specific course content in training units precisely to your requirements – not to mention the place and time for the training.

The services we provide for you

- **Online Support**: the direct route to an answer to your questions
- **Technical Consulting**: sound system know-how for planning and designing your projects
- **Engineering Support**: the skills of experts throughout the automation process
- **Technical Support**: advice on the functions and handling of our products and systems
- **Training**: imparting practical know-how – direct from the manufacturer
- **Field Service**: on-site service for commissioning and maintenance
- **Repair**: fast and reliable execution by qualified experts
- **Modernization**: replacement of out-of-date components with the latest technology – e.g. as retrofits
- **Spare parts**: fast and reliable delivery – worldwide
- **Optimization**: efficient utilization of all the potential for enhancing your equipment
- **Service programs**: tailor-made packages that cover the complete life cycle of your wind turbine or wind farm

**Advantages**

- Local support for the customer from the special Wind Support Center
- Plant optimization through project-specific applications – e.g. adaptive wind tracking for the nacelle and rotor blades
- Siemens contacts in over 190 countries, always in your vicinity
- Fast assistance thanks to worldwide service and support around-the-clock

www.siemens.com/wind-equipment/service
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Creating the most from wind:

› Maximum availability with minimum lifecycle costs
› Intelligent standardization based on field-proven platforms
› Competitive advantages in series production
› Reliable partner for the future

Find out more!

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