



Wind Energy

Solutions from a small wind turbine to a wind farm

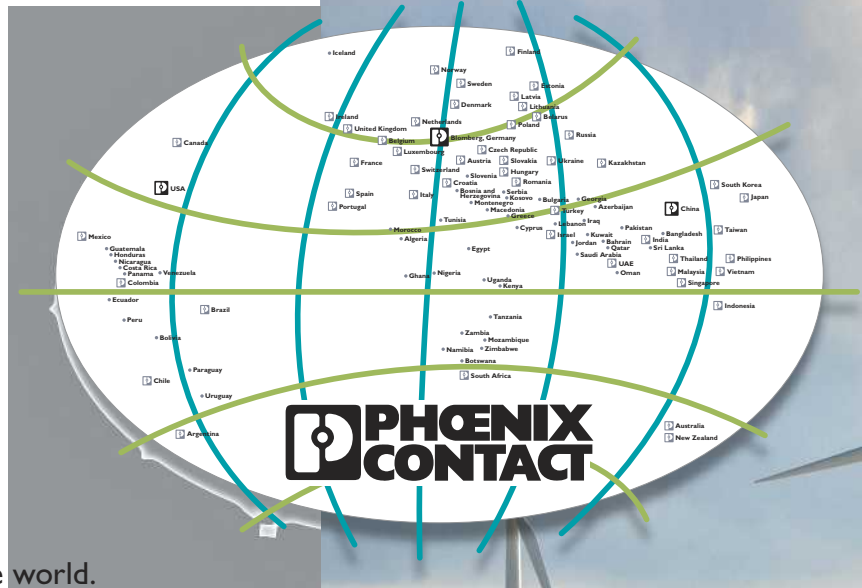
In dialog with customers and partners worldwide

Phoenix Contact is a global market leader in the field of electrical engineering, electronics, and automation. Founded in 1923, the family-owned company now employs around 14,000 people worldwide. A sales network with over 50 sales subsidiaries and more than 30 additional global sales partners guarantees customer proximity directly on site, anywhere in the world.

Our range of services consists of all kinds of products with a wide range of electrotechnical applications. This includes numerous connection technologies for device manufacturers and machine building, components for modern control cabinets, and tailor-made solutions for many applications and industries, such as the automotive industry, wind energy, solar energy, the process industry or applications in the field of water supply, power transmission and distribution, and transportation infrastructure.



Company independence is an integral part of our corporate policy. Phoenix Contact therefore relies on in-house competence and expertise. We are constantly coming up with innovative product ideas in order to meet the requirements of our customers. Numerous patents emphasize the fact that many of Phoenix Contact's products have been developed in-house.

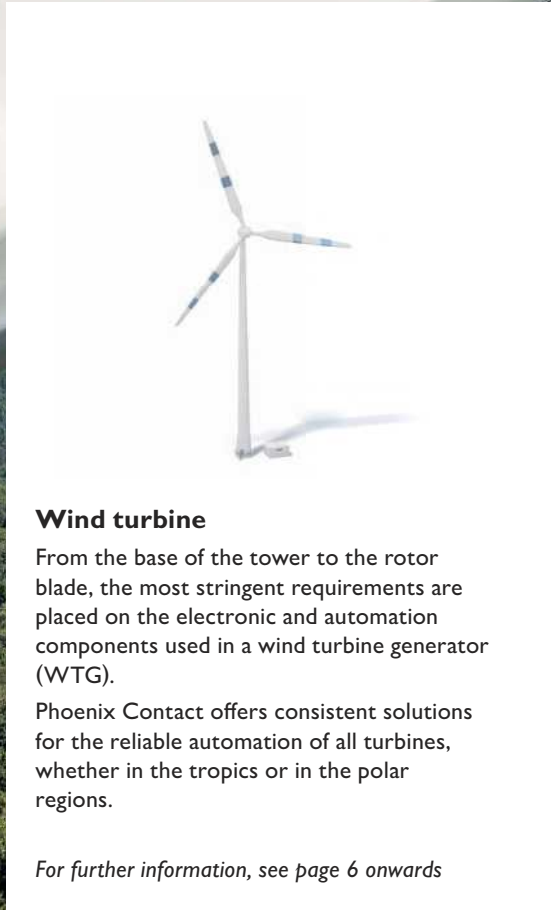


“Of all the forms of renewable energy, wind turbines use the most sophisticated technology. The diverse climate zones place the most stringent demands on the materials and technology used. Vibration and shock-resistant high-performance technology is therefore essential for maximum availability. In order to satisfy these requirements, plant designers and manufacturers have for many years looked to Phoenix Contact with its solution expertise, comprehensive product portfolio, and its globally networked and experienced team.”

Stefan Gallmann, Global Industry Manager

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Wind turbine

From the base of the tower to the rotor blade, the most stringent requirements are placed on the electronic and automation components used in a wind turbine generator (WTG).

Phoenix Contact offers consistent solutions for the reliable automation of all turbines, whether in the tropics or in the polar regions.

For further information, see page 6 onwards



Overview: solutions for wind energy



Wind farms

The systems that control and monitor a wind farm must perform to a high level. For automation this means: high data volumes, redundant system configuration, secure network technology and software, as well as detailed monitoring.

For further information, see page 22 onwards



Offshore wind farm

Offshore WTGs do not just have to be equipped to deal with variations in temperature, their electrical equipment must also be resistant to salt spray. Unplanned maintenance must also be avoided at all costs.

For further information, see page 26 onwards



Small wind turbine

When it comes to the automation of small wind turbines (SWTs), Phoenix Contact offers cost-effective comprehensive solutions that allow you to equip your application quickly and reliably.

For further information, see page 30 onwards



Solutions for wind turbines

Harsh environmental conditions and long lifecycles – wind turbines (or WTGs) place high demands on electrical engineering. Phoenix Contact offers innovative solutions that are especially reliable for all aspects of WTGs. Decades of experience and specially developed products provide the foundation for high-performance solutions ranging from lightning monitoring systems to wind farm management. Our priority is maximum availability for efficient energy production.

Overview: wind turbines

Hub and pitch

Controllers and charging monitors for reliable pitch control.

Tower

Lighting systems for safe descent, even in the event of a power failure.

Converters and grid feed-in

Products and solutions for grid feed-in in accordance with standards.

Drive train

Condition monitoring for longer system service life.

Nacelle

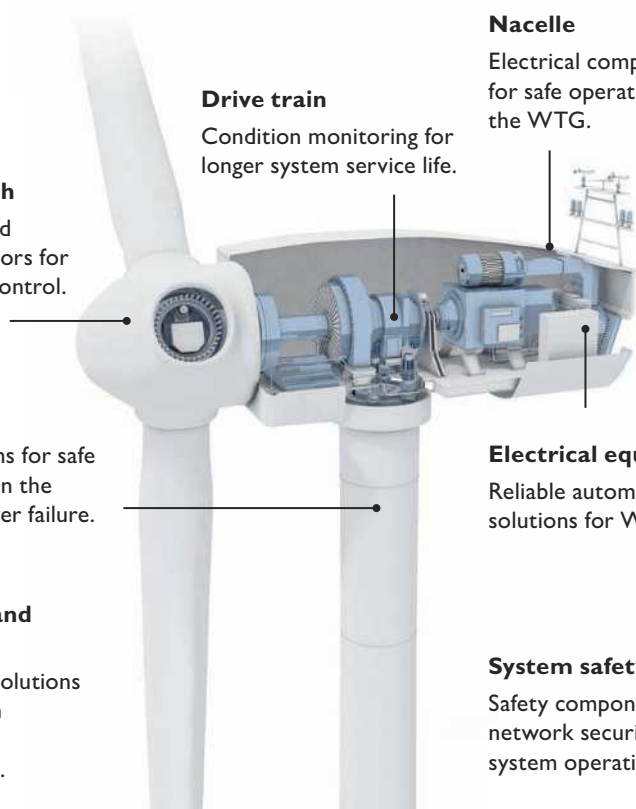
Electrical components for safe operation of the WTG.

Electrical equipment

Reliable automation solutions for WTGs.

System safety

Safety components and network security for safe system operation.



Solutions for wind turbines

Nacelle

The optimal alignment of the nacelle to the wind is essential for efficient turbine operation. This requires sub-systems like the yawing drives, the wind speed and direction sensors and monitoring systems to be controlled in a smooth, safe and efficient way. This is provided by the Profinet-based automation system from Phoenix Contact.

Your advantages:

- Reliable yawing system, thanks to high-availability control systems
- Optimum data acquisition for the yawing system with solutions for wind measurement
- Protection of personnel and machinery, thanks to powerful safety systems





Yawing system

Ensure an optimum yawing system by controlling motors efficiently. Phoenix Contact offers tailor-made solutions for all tasks relating to yawing, from robust cabling with heavy-duty connectors to the control system.

Wind measurement

Information about the strength and direction of the wind is essential to the operation of a wind turbine. Functional Safety and maximum reliability of the components therefore play a significant role. We offer comprehensive solutions that always keep you informed of all the relevant values. Both hardware and software-based data processing is supported, for example, with SAFE AI safe analog value processing.

Protection and safety

A reliable condition monitoring on WTGs safeguards the life of service technicians. You can use safety relay modules for easily implementing emergency stop applications, for example. Safety relay modules are customizable and allow for a combination of multiple safety functions.

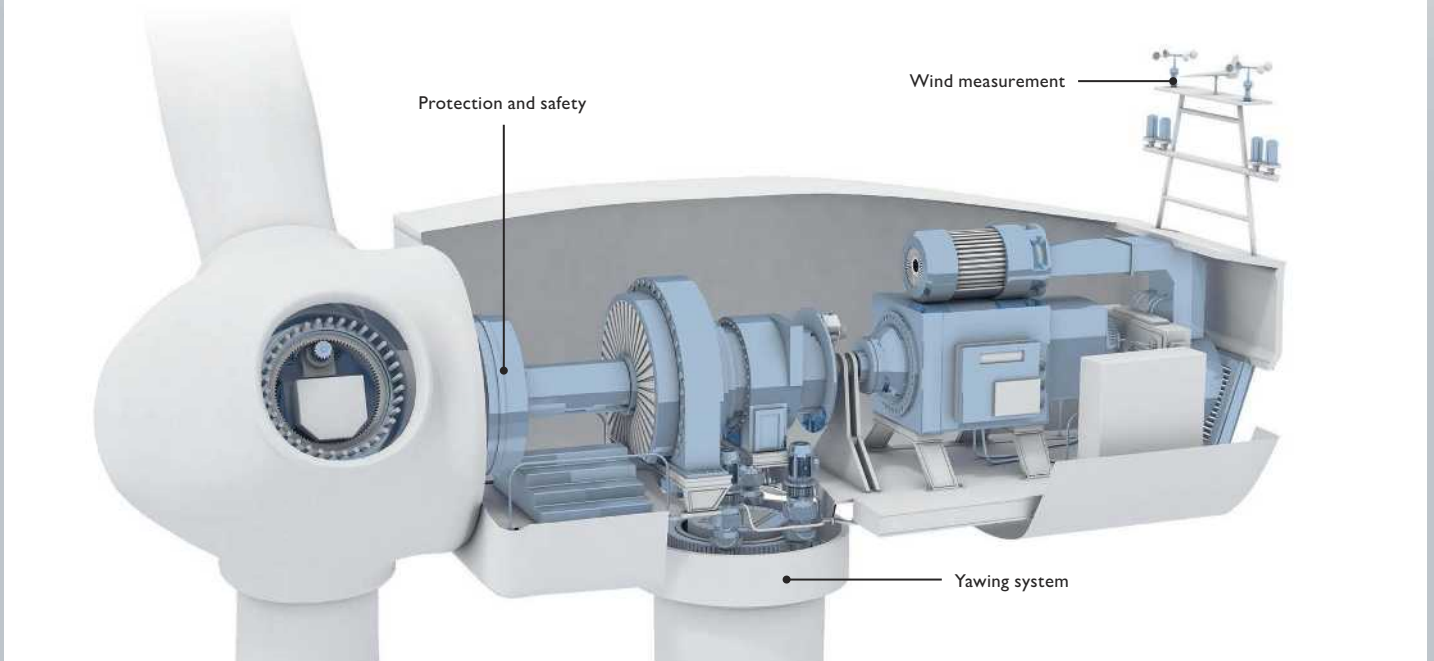
Safety solutions from Phoenix Contact are not only suitable for networked systems, they can also be used for stand-alone applications.

Solutions for complex system monitoring

In order to extend the service life of components such as the gear box and generator, the operating conditions should be observed as closely as possible. To

achieve this, numerous sensor measured values must be recorded which the plant control system will use as the basis for monitoring states. In addition, safety

equipment and wind measuring systems must be seamlessly integrated into the system.



Solutions for wind turbines

Hub and pitch

For optimum energy yield, the pitch system must operate reliably at all times ensuring exact control of the blade angle of attack. At the same time, the pitch system is the most important item of safety equipment. When necessary it will rotate the blades away from the wind in order to prevent damage. Reliable communication via the slip ring is therefore essential. Solutions from Phoenix Contact can be used to configure failsafe communication in the hub. In addition, we offer retrofit solutions for Ethernet connection configuration.

Your advantages:

- Fast and reliable pitch control with robust technology for the hub
- Failsafe communication in the hub with redundant slip ring solutions
- Monitoring of rotor blade, lightning strikes, and blade load





Active pitch control

All components for pitch control must be designed to withstand strong vibrations and variations in temperature. The HEAVYCON EVO heavy-duty connectors provide a reliable connection.

These requirements also apply to the safety products and surge protection devices.



Data transmission

There are ideally two different methods available for data transmission in the hub. Since conventional slip ring transmission is often susceptible to errors, Phoenix Contact offers a combined solution: SHDSL modems and WDM transmitters on the one hand provide fast communication via single-phase fiber optics for controlled operation and on the other hand provide the redundant path via the copper slip ring. Robust connectors ensure reliable communication around the slip ring.



Condition monitoring at the blade

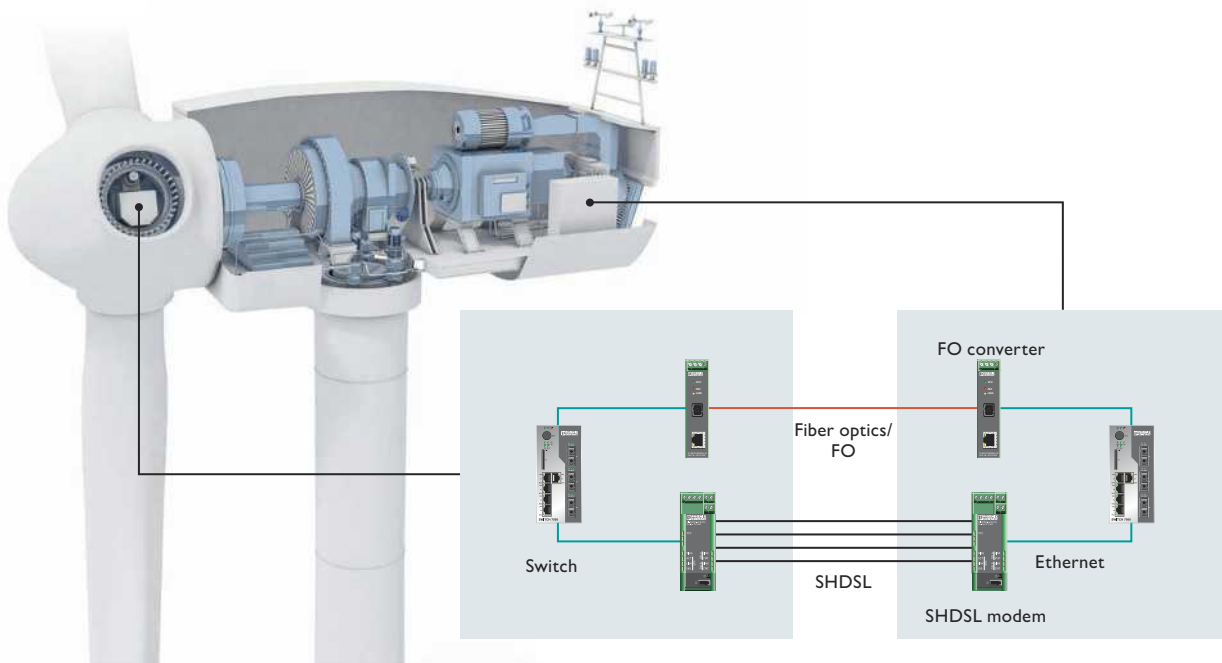
Nowadays rotor blades are over 60 meters long and 10 tons in weight. The demands placed on monitoring have also changed as a result of these increased dimensions. The rotor blade tension monitoring (RBTM) system can be used to measure the loads on the blades. This means that you can detect damage at an early stage or optimize the pitch behavior. In addition, the LM-S lightning monitoring system can be used to measure lightning strikes and therefore plan maintenance work more efficiently.

Reliable and cost-efficient data transmission

Ensure high-performance data communication between hub and nacelle. WDM transmitters enable error-free data transmission through a single fiber.

Additional SHDSL modems, which communicate via the copper slip ring, provide double redundancy. Even if two out of the four slip ring channels fail, communication will still be

possible. Combining the two systems is a cost-efficient solution for achieving high operational reliability.



Solutions for wind turbines

Drive train

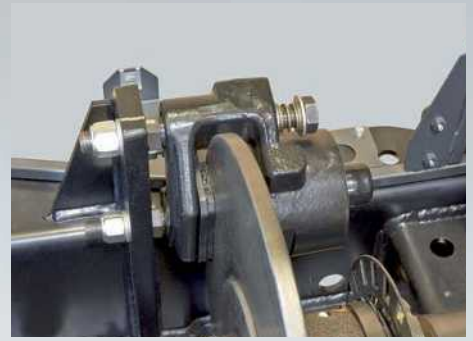
In transmission systems, the drive train is at the heart of the WTG. Continuous monitoring and optimized control can not only improve availability, but also reduce wear on components. In addition to conventional condition monitoring for vibration monitoring it is now also necessary to reliably monitor a range of additional parameters.

Along with solutions relating to condition monitoring, Phoenix Contact also provides a wide range of products for connecting and monitoring currents at the generator.



Your advantages:

- Reliable condition monitoring with EMC-resistant measuring solutions for all relevant parameters
- Reliable connection technology with robust metal or plastic versions
- Reduced maintenance, thanks to condition-based component monitoring



Monitoring

Nowadays monitoring at the drive train involves more than just vibration monitoring: the temperatures and speeds in the various sections are just as important. Data acquisition is particularly difficult at the generator due to EMC. In many areas, Functional Safety is also required for data transmission.

Special connector systems from Phoenix Contact ensure safe data transmission.

High current distribution

Power transmission from the generator to the converter places high demands on the components used. Cabling solutions such as HEVYCON EVO can cope with strong vibrations and variations in temperature, making them ideal for power, data, and signal transmission in the WTG. The modular structure supports customer-specific configurations, allowing a considerable amount of time and money to be saved with regard to plant construction.

Braking system

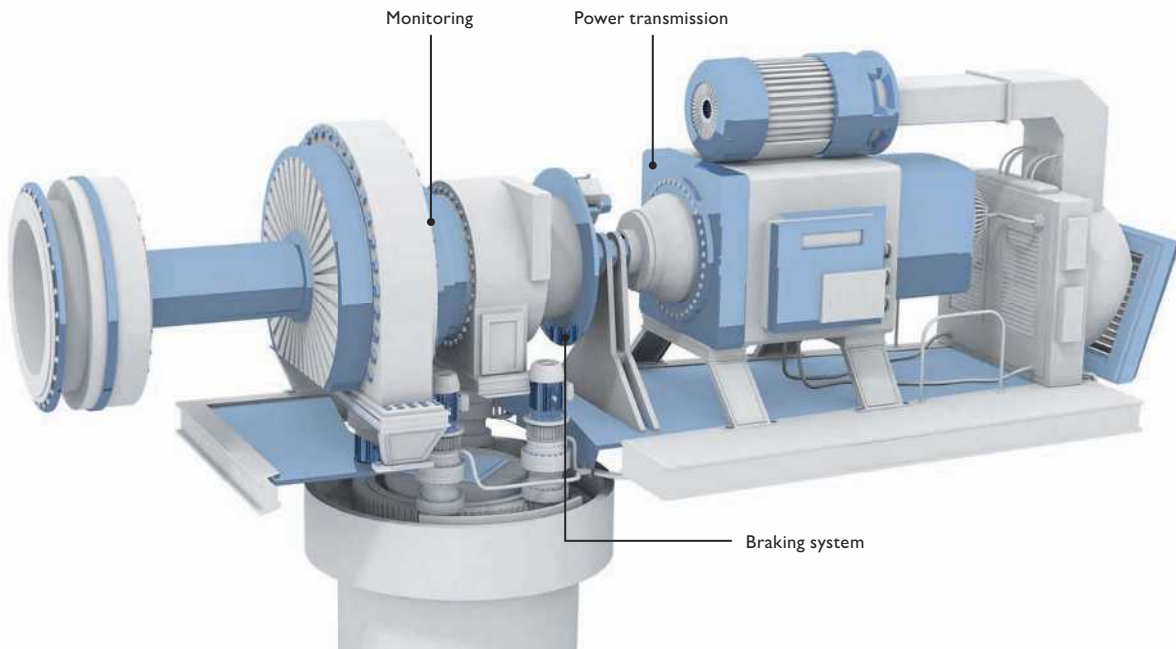
In order to intelligently control a brake, the current states must be monitored. Control and evaluation is therefore carried out via the plant control system. An intelligent brake is not only able to increase the durability of wear parts, it also makes it easier to schedule maintenance. With its robust components for field wiring, Phoenix Contact provides the ideal solution for integrating the braking systems.

Efficient condition monitoring for greater durability

The drive train with connected generator requires a comprehensive condition monitoring system in order to avoid expensive failures. At the same time, due

to the nature of its mechanical design and EMC conditions, it causes environmental conditions which the technology must be able to withstand. Robust monitoring

systems from Phoenix Contact are the ideal solution.

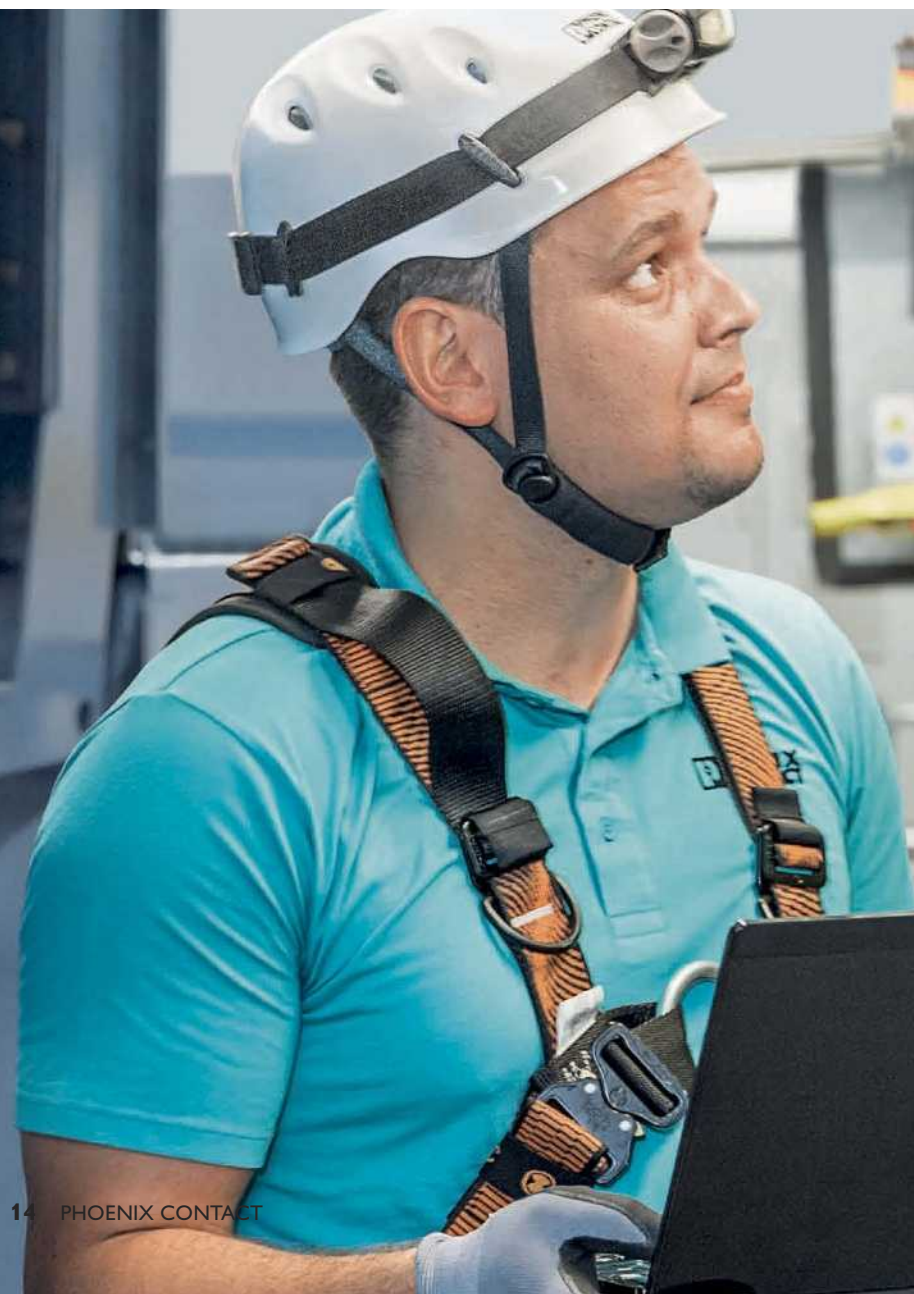


Solutions for wind turbines

Converters and grid feed-in

When it comes to feeding generated energy into the power supply network, the latest requirements are much more stringent than they were a few years ago. In order to ensure grid stability, almost every country has significantly tightened the regulations governing grid feed-in. Each wind turbine or wind farm therefore requires an independent feed-in management system.

Phoenix Contact offers comprehensive solutions for your feed-in management and grid monitoring so that you can meet these requirements using standard-compliant systems.



Your advantages:

- Safe connection of power electronics using solutions for every cross section
- Easy-to-maintain plant protection, thanks to remote querying function
- Feed-in complies with regulations, with solutions for feed-in management



Connection technology

Due to EMC, more stringent requirements regarding data and signal communication must be met for the converter. In addition, the PCB connection technology must be designed appropriately and must also be able to transmit currents of up to 125 A. Regardless of the size of your plant or which local directives must be observed, you'll find the right technology from Phoenix Contact.

Protection and distribution

Due to their exposed location, WTGs are at increased risk from lightning strikes. With POWERTRAB, Phoenix Contact offers an extremely robust high-performance type 1 lightning arrester which reliably protects your plant against damage caused by surge voltages.

When it comes to the quick and easy distribution of high currents in your electronics, the CLIPLINE complete range offers the ideal solution for every requirement.

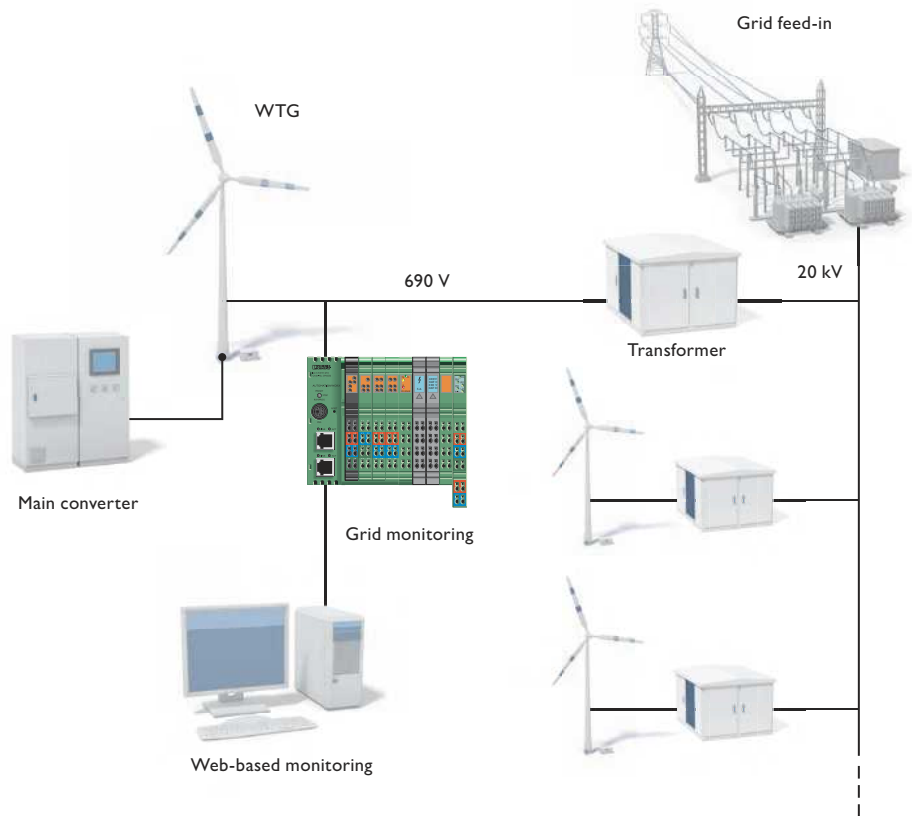
Grid feed-in

From retrofitting to new installations: with comprehensive solutions from Phoenix Contact for the grid feed-in of your WTG, local directives are met in accordance with standards and, above all, efficiently. PACT RCP current transformers, for example, are at the heart of a time-saving retrofit solution covering all aspects of data acquisition for grid feed-in.

Standard-compliant energy feed-in at all times

Modern WTGs also have the task of compensating for mains fluctuations and therefore increasing the stability of the network. They must meet the network connection requirements that are based on VDE-AR-N 4105 in Germany, for example. Also, they must integrate mains and plant protection, which acquires the condition values of the network and implements emergency shutdown in accordance with defined procedures, if necessary.

In line with these requirements, the operation of the WTG must be consistently ensured and the main network must be continuously monitored at the same time. Solutions for feed-in management from Phoenix Contact can be used to continuously monitor the power supply network, enabling the plant control system to respond to events in the network.



Solutions for wind turbines

Tower

In addition to the converter and all the data, signal, and power cabling, the tower of the WTG also houses the complete infrastructure for WTG servicing, such as lighting or the service elevator. These systems, which operate semi-autonomously from the main control system, still have to be monitored and designed in compliance with local safety standards. Whether it is inverter cabling, bottom-box electronics, lighting or monitoring systems – at Phoenix Contact you can find innovative comprehensive solutions for WTG towers.



Your advantages:

- Reduce servicing with maintenance-free lighting solutions
- Functional Safety with solutions for autonomous or networked systems
- Save time with clever cabling solutions



Cabling

We offer numerous solutions for a permanently reliable cabling concept for the WTG tower: for both signal and data transmission. Through the use of customer-specific assembled cables, installation times are reduced further since the cables and connectors can be tailored to the specific requirements.

Lighting

Lighting solutions from Phoenix Contact impress with their maintenance-free operation. Thanks to the use of special plug technology, the tower lighting can be wired more quickly and above all more easily, thereby eliminating the need for the services of an electrically skilled person. The integrated UPS ensures that adequate lighting is provided in an emergency. Emergency lights are not required, since the economical LEDs can be supplied without any problems via this battery.

Service elevator

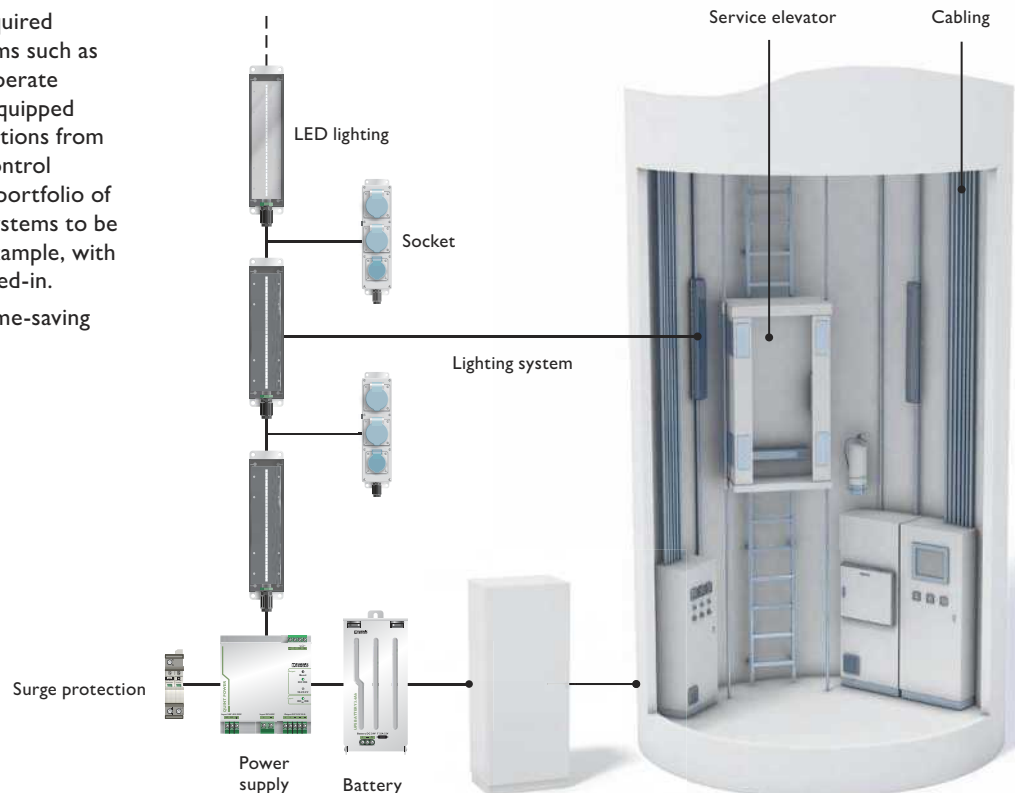
In order to ensure the safety of personnel in the service elevators, we offer stand-alone systems with Functional Safety for reliable shutdown in the event of an emergency.

They are based on modular small-scale controllers which perform the monitoring functions. Communication with the plant control system is established by Radioline wireless modules.

Technology for autonomous and networked subsystems

Robust technology is also required in the WTG tower. Subsystems such as the service elevator, which operate semi-autonomously, can be equipped with reliable and durable solutions from Phoenix Contact. Modular control technology and an extensive portfolio of I/O modules also allow the systems to be flexibly extended later, for example, with energy data acquisition for feed-in.

When it comes to lighting, time-saving simple wiring is essential.



Solutions for wind turbines

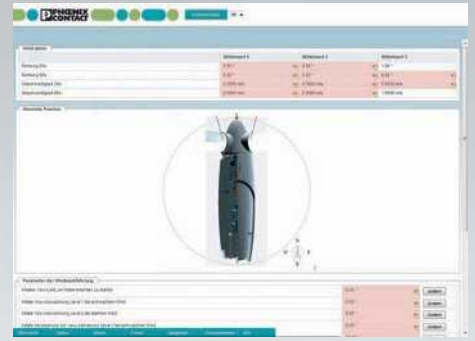
Electrical equipment

When it comes to the consistent automation of WTGs from the sensor to the control room, particularly robust, high-performance technology is required. Phoenix Contact offers intelligent solutions which can be used to reliably and efficiently automate subapplications as well as the complete wind turbine and even a wind farm. These industry solutions are based on products that have been specifically developed for harsh conditions and interact with one another perfectly, such as surge protection, connection technology, controllers, I/O systems and network technology.



Your advantages:

- One point of contact for everything, thanks to our extensive portfolio
- Consistent automation with coordinated components
- Save resources, thanks to professional engineering support



Engineering

With our know-how and years of experience, we are happy to handle the engineering for your wind energy application: from programming a small wind turbine and rapid prototyping to visualizing an entire wind farm. In addition, we offer comprehensive concepts for protecting your plants against the damage caused by surge voltages.

Hardware

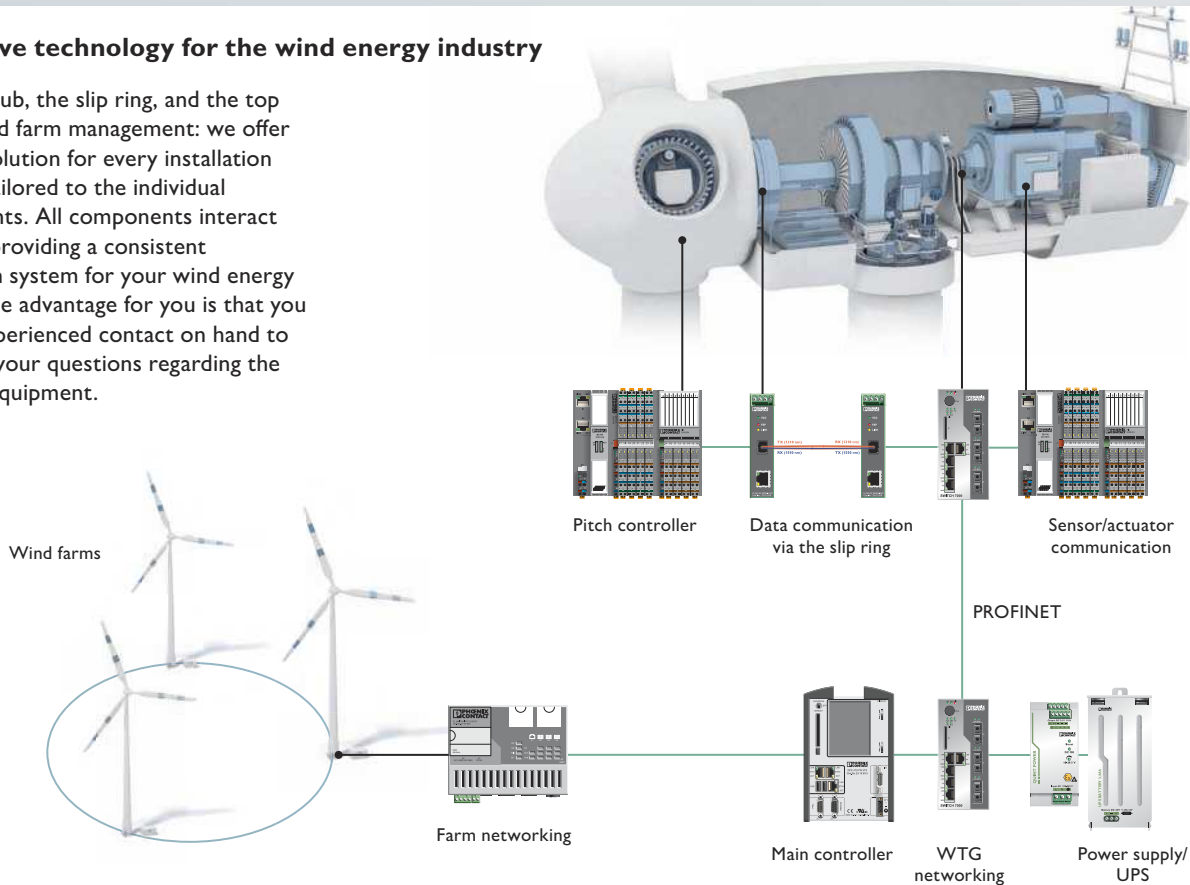
Our components for the wind industry are characterized by their high performance and reliability. AXIOCONTROL control systems and AXIOLINE I/O systems are particularly resistant to vibrations and are therefore ideal for use in the hub. Phoenix Contact offers the right hardware for every aspect of automation in your wind turbine: network technology, safety controllers, surge protection, connection technology, and much more.

Software

Save engineering time by performing updates and adjustments to the programming while your WTG is in operation. Function block libraries such as the Wind Power Control Library (WPCL) make it much easier for you to integrate wind turbine-specific functions and web access to your plant.

Impressive technology for the wind energy industry

From the hub, the slip ring, and the top box to wind farm management: we offer the ideal solution for every installation location, tailored to the individual requirements. All components interact perfectly, providing a consistent automation system for your wind energy project. The advantage for you is that you have an experienced contact on hand to answer all your questions regarding the electrical equipment.



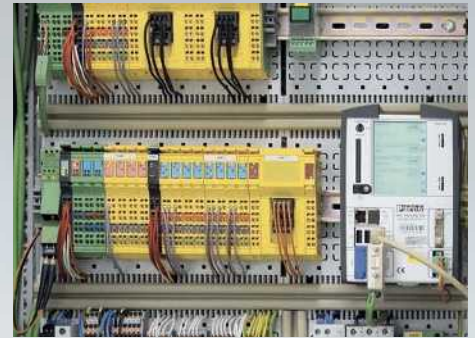
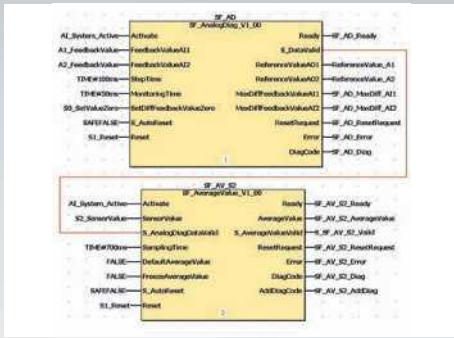
Solutions for wind turbines

System safety

Every WTG in Europe is required by law to meet the requirements of the Machinery Directive. Functional Safety is therefore integral to every part of the wind turbine, both in terms of hardware and software. With its comprehensive portfolio of safety products and services for every area and every size of plant, Phoenix Contact offers the right solution for designing your wind energy application in accordance with these directives. Our safety experts provide support with products and advice in all phases from planning to startup or even retrofitting.

Your advantages:

- Flexible safety systems with TÜV-certified hardware or software solutions
- Keep an eye on speeds and downtimes, thanks to controller-independent switching devices
- Secure networks, thanks to reliable security concepts through to the control room



Safe analog value processing

With the SAFE AI solution package, safety-related analog I/O modules are no longer required in order to process safe signals from wind measurement, for example. TÜV-certified software is used for this. This enables you to implement safety functions up to SIL 3 and PL e in your WTG. The consultation service provided by our safety experts for the wind industry completes the package.

Network security

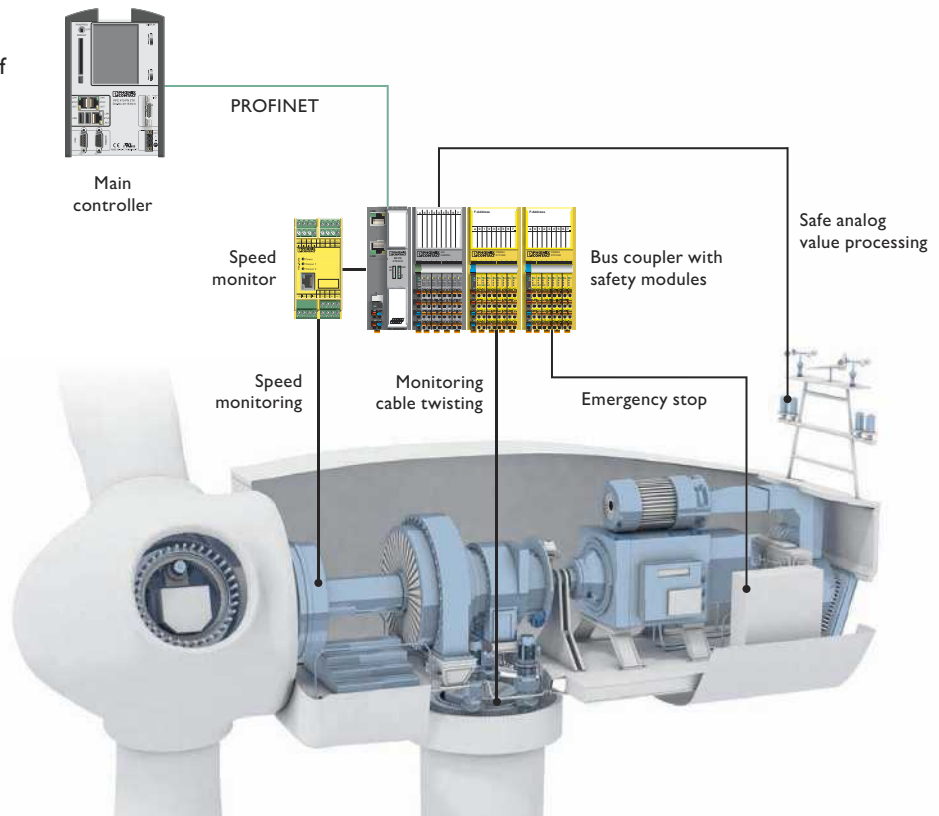
Communication from WTGs via the Internet must satisfy increasingly stringent requirements. Operators, operational management, and service personnel all place different demands on online access. With distributed remote control solutions based on our MGUARD security routers with integrated firewall, you can protect your plants reliably against unauthorized access. The corresponding software allows you to assign the correct rights to the various different users.

Safe status monitoring

All sensors and rotating parts in a WTG must be monitored continuously. This includes safe processing of digital values, as well as safe downtimes and speed monitoring. This helps to design monitoring systems e.g., for the pitch or yawing system.

Safe monitoring of the WTG

Safe monitoring of a wide range of signals is a challenge when controlling WTGs. Thanks to the comprehensive portfolio of safety products from Phoenix Contact, you can also implement the high requirements set by machinery directives for wind energy.

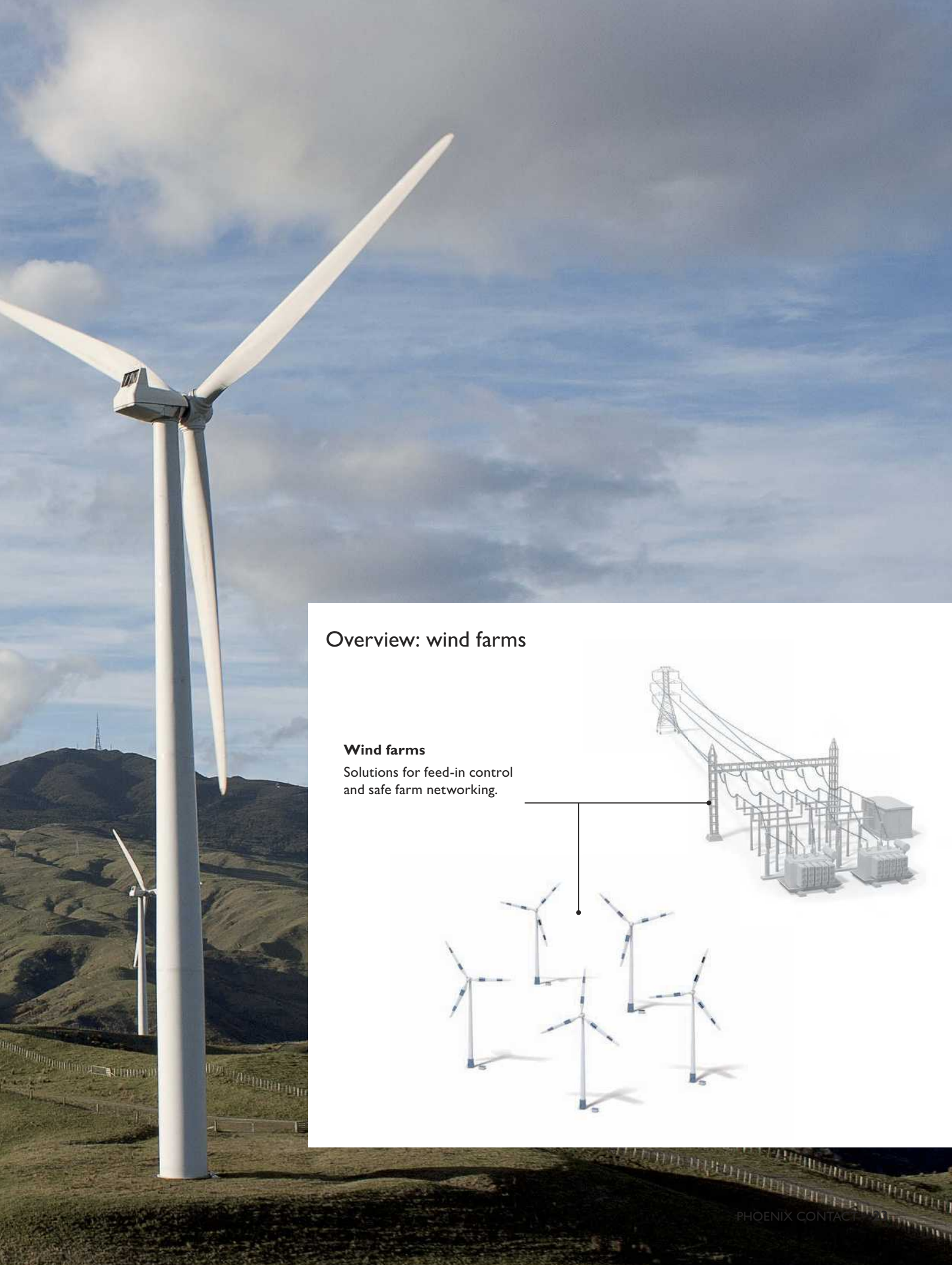


Solutions for wind farms

Wind farms are increasingly thought of as virtual power plants. Consequently, it is irrelevant as to whether the farm consists of one or many turbines. In order to compensate for fluctuations in power generation, the virtual power plants must also take on a growing number of more grid-stabilizing functions. With this in mind, many existing wind farms are equipped with additional communication and control options.

Thanks to intelligent comprehensive solutions for feed-in management from Phoenix Contact, you can make your wind farm fit for the future.

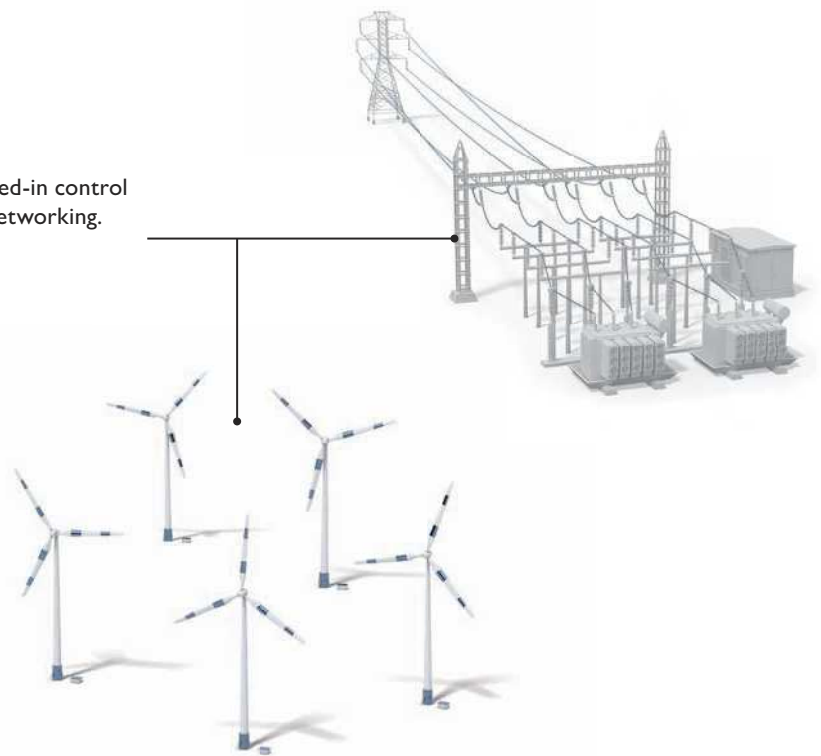




Overview: wind farms

Wind farms

Solutions for feed-in control
and safe farm networking.



Solutions for wind farms

Wind farms

The interaction between the plants in a wind farm is becoming increasingly complex. Where once there was a group of plants that were operated as individual power stations, modern wind farms now frequently have to be able to act as a homogenous power station connected to the grid. In order to ensure that the increasingly stringent directives governing grid feed-in are satisfied, communication between the plants must meet much higher standards. This results in a complex closed-loop control circuit, which is in constant communication with the network so that it can respond to changes by adapting feed-in accordingly. In addition, the network connection via DSL must be protected against unauthorized access.

Your advantages:

- Regulation-compliant feed-in management, with solutions for retrofitting, too
- Failsafe communication, thanks to redundant network technology
- Subsystems can be extended flexibly, thanks to modular I/O and control technology



Grid feed-in

Whether a new installation or retrofitting, with comprehensive solutions for the feed-in management of your wind farm, local directives are met in accordance with standards and efficiency. PACT RCP current transformers, for example, are at the heart of a time-saving retrofit solution covering all aspects of data acquisition for grid feed-in.

Farm network

Wind farm networks must have a high-performance and above all failsafe design. Whether you want your network to be wired or wireless, Phoenix Contact has the right solution for you: robust cabling systems or flexible WLAN applications. Everything is based on durable industrial electronics and the low installation and maintenance costs to make a winning combination.

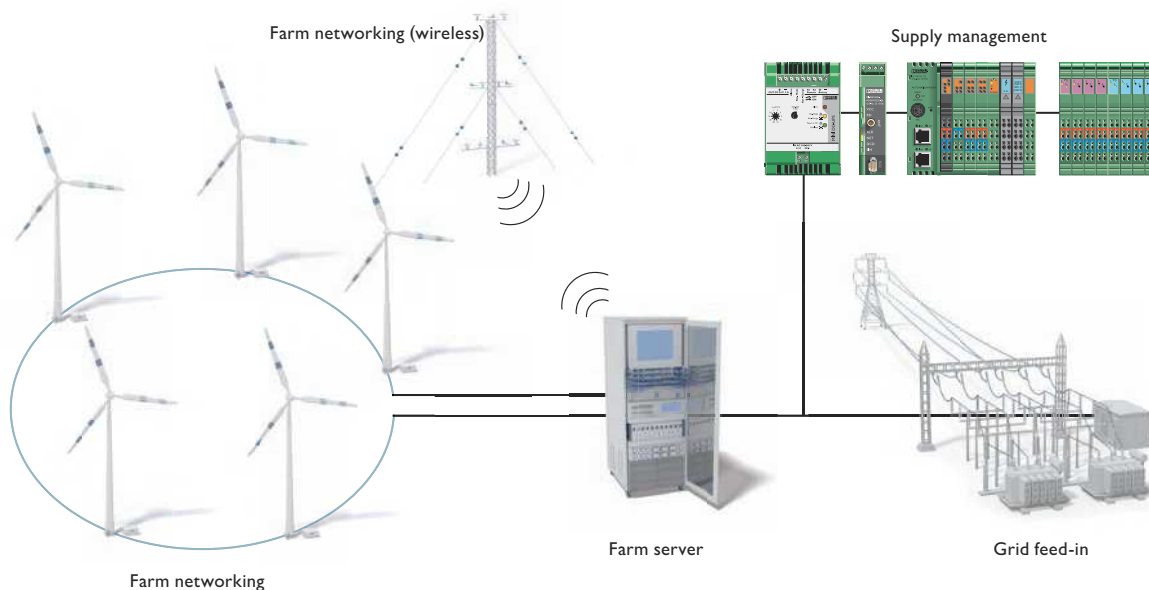
Weather station

In order for wind farms to be operated as efficiently as possible, a dedicated wind measurement mast is often installed. The data that is acquired and processed is forwarded via fiber optics or wirelessly to the farm control system. Phoenix Contact offers systems based on PROFINET for this, which ensure easy and consistent communication across all levels and beyond. M12 connector systems are ideal for connecting sensors in all weather.

Everything for optimum networking

Redundancy and high performance are the key words for networking wind turbines. With our solutions you can ensure failsafe and access-protected communication with the control room and the power supply

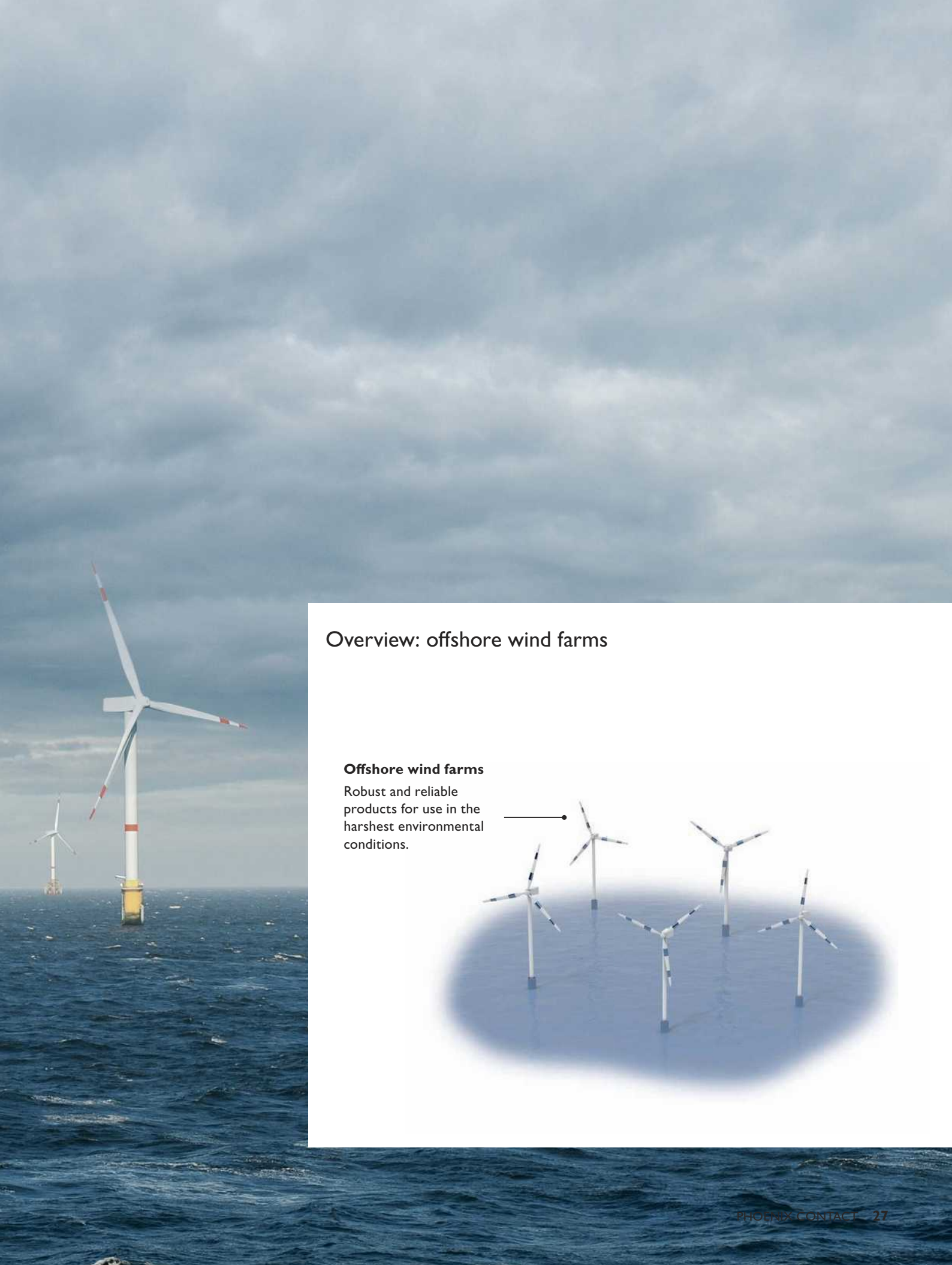
company's grid at every level. You can thereby achieve the best possible yield because the wind turbines are optimally harmonized with the feed-in requirements.



Solutions for offshore wind farms

The ongoing trend of offshore wind farms is also bringing new challenges to the supplier industry. All WTG parts have to function reliably even under extreme conditions out at sea. As such, the availability of the components plays an even greater role at sea than it does on land. Redundancy, and therefore high fault tolerance, ensure that the effort required for repair and maintenance can be kept to a minimum. Keep the costs of your servicing to a minimum by planning maintenance in a targeted way.





Overview: offshore wind farms

Offshore wind farms

Robust and reliable products for use in the harshest environmental conditions.



Solutions for offshore wind farms

Offshore wind farm

Offshore WTGs provide the greatest yield, however they must also be able to satisfy the most stringent requirements: vibrations, variations in temperature, and salt spray. Condition monitoring and maximum availability are therefore particularly important due to the extremely high maintenance costs.

With automation solutions from Phoenix Contact, you can reliably equip your offshore wind turbines and benefit in every phase from the know-how of our wind energy experts. You can therefore utilize your plants as efficiently as possible and always keep an eye on all parameters.

Your advantages:

- Keep informed at all times, thanks to surge protection and online evaluation
- Failsafe, thanks to redundant control concepts
- Reliable cabling, thanks to robust connection technology for assembly



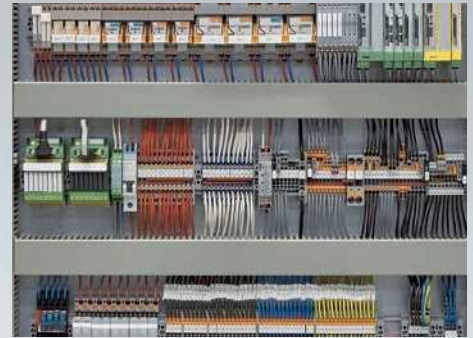
Surge protection

The damage caused by lightning strikes can be extremely costly for an offshore WTG as it is so difficult to access. With comprehensive solutions from Phoenix Contact for surge protection and condition monitoring, you can keep these costs as low as possible because POWERTRAB surge protection ensures that your electrical equipment is reliably protected. The LM-S lightning monitoring system monitors the rotor blades for lightning strikes and keeps you informed directly online.



Redundancy concepts

Failsafe automation systems are a must for offshore WTGs. The solution uses redundant control concepts based on the RFC 460R high-performance controller. This ensures that the automation system always functions correctly, even in large wind farms, because when one controller fails, another takes over immediately and seamlessly.

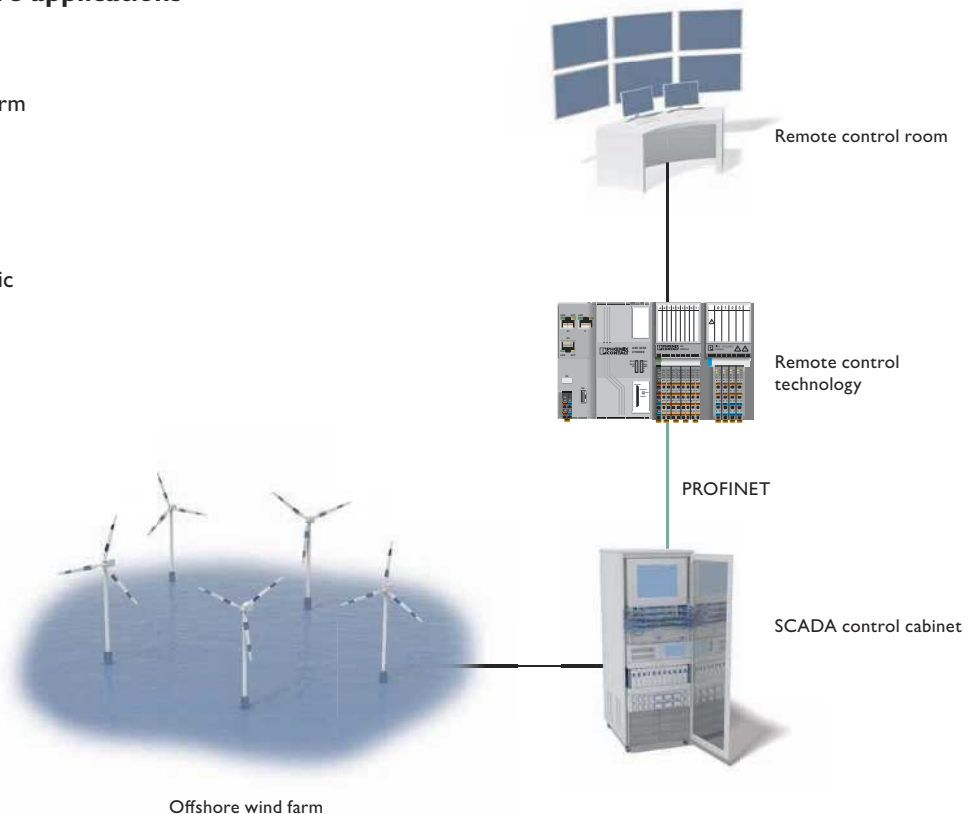


Connection technology

From salt-spray resistant terminal blocks to heavy duty connectors combining power and data lines – a dedicated range of our connection products fulfills the strong requirements of offshore applications. In addition you can save time and space by using compact and easy-to-operate connection technology from the sensor to the control room.

Safe remote control in offshore applications

Standardized protocols and security solutions ensure safe communication. With Phoenix Contact, you can perform preventive maintenance and process optimization and therefore save costs. Monitor WTGs and wind farms with remote control technology and software libraries. By doing so, you are kept informed of all the generic measured values at any given time. The use of protocols such as ODP or IEC 60870-5-101/104 enables you to network the wind turbines with the control system.



Solutions for small wind turbines

Small wind turbines are not only practical where limited space requirements prevent multi-megawatt systems from being put into place: the small-format systems are always a real alternative option, if an independent power supply is required. In rural areas or in developing or emerging countries, small wind turbines are the ideal solution for an energy supply without a local power grid.

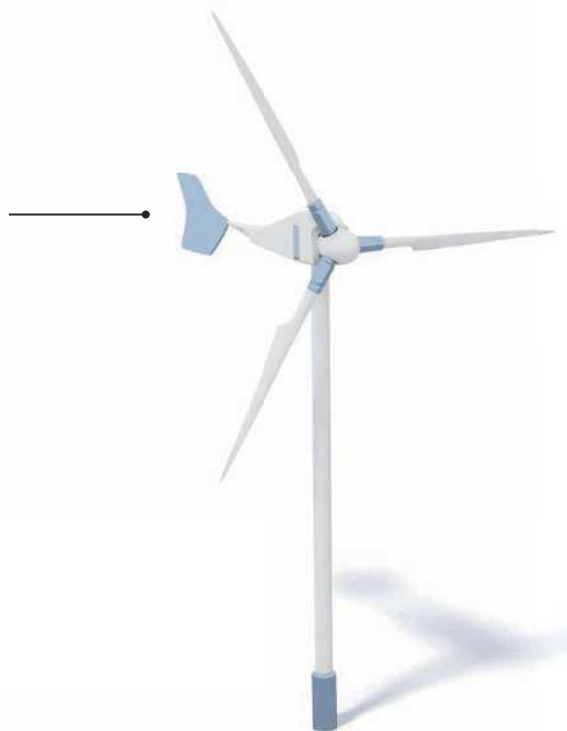
Benefit from our experience and our high-quality product portfolio for robust industrial components for all aspects of your small wind turbine.



Overview: small wind turbines

Small wind turbine

Scalable control solutions
for small wind turbines.



Solutions for small wind turbines

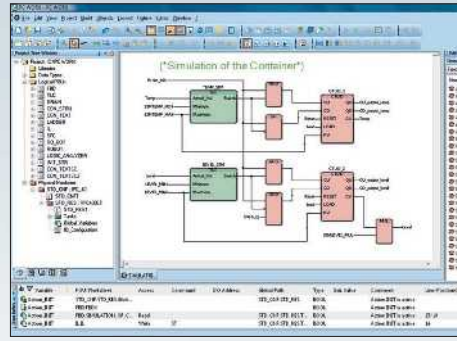
Small wind turbine

Small wind turbines are the ideal solution for generating renewable energy even in locations where space is limited. Phoenix Contact offers comprehensive solutions for the efficient automation of your entire plant. The focus is on cost-effectiveness and easy operation. Our wind energy experts are on hand to answer all your questions regarding hardware, software, engineering and Functional Safety. All of this provides the foundation for your tailor-made solution.



Your advantages:

- Everything from a single source with complete control cabinets for the automation of small wind turbines
- Save engineering time, thanks to function blocks for the wind industry
- Always keep an eye on WTGs, thanks to web-based remote maintenance via mobile terminal devices



Complete hardware solutions

At Phoenix Contact you'll find everything that you need for the wind turbine control cabinet, tailored to your small wind turbine: controllers, I/O systems, surge protection, connector systems, power supplies, network technology, and much more. With our years of expertise, we can create a comprehensive solution that reduces your engineering, installation, and maintenance effort considerably.

Function blocks for WTGs

Save time when programming your small wind turbine. In the Wind Power Control Library (WPCL) function block library, we have compiled the key functions required for the automation of a wind turbine. You can therefore quickly and easily integrate field devices and access the components error-free even during operation.

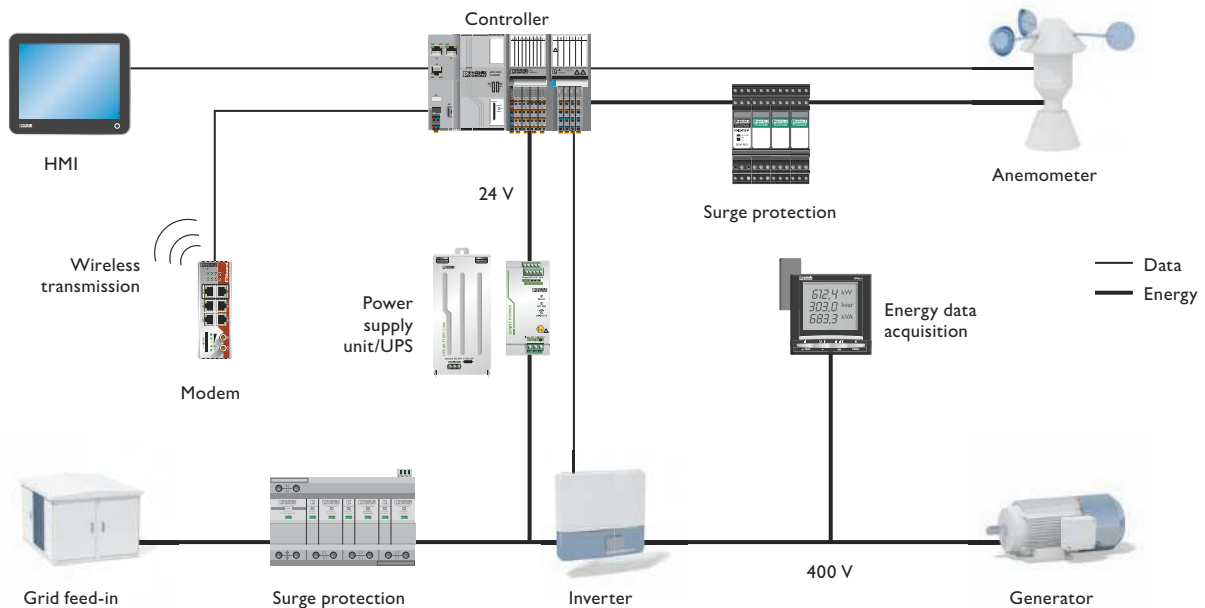
Mobile plant access

You can also be kept informed of the status of your wind turbine at all times using mobile termination devices. Phoenix Contact offers a web-based remote monitoring concept which displays all relevant parameters, controls user management, and provides access to system functions. Using a global SIM card, you can therefore ensure the increased availability of your WTGs even across different regions.

Comprehensive solutions for small wind turbines

In Phoenix Contact's large portfolio you'll find everything that you need for an efficiently automated small wind turbine. The central element is always the modular

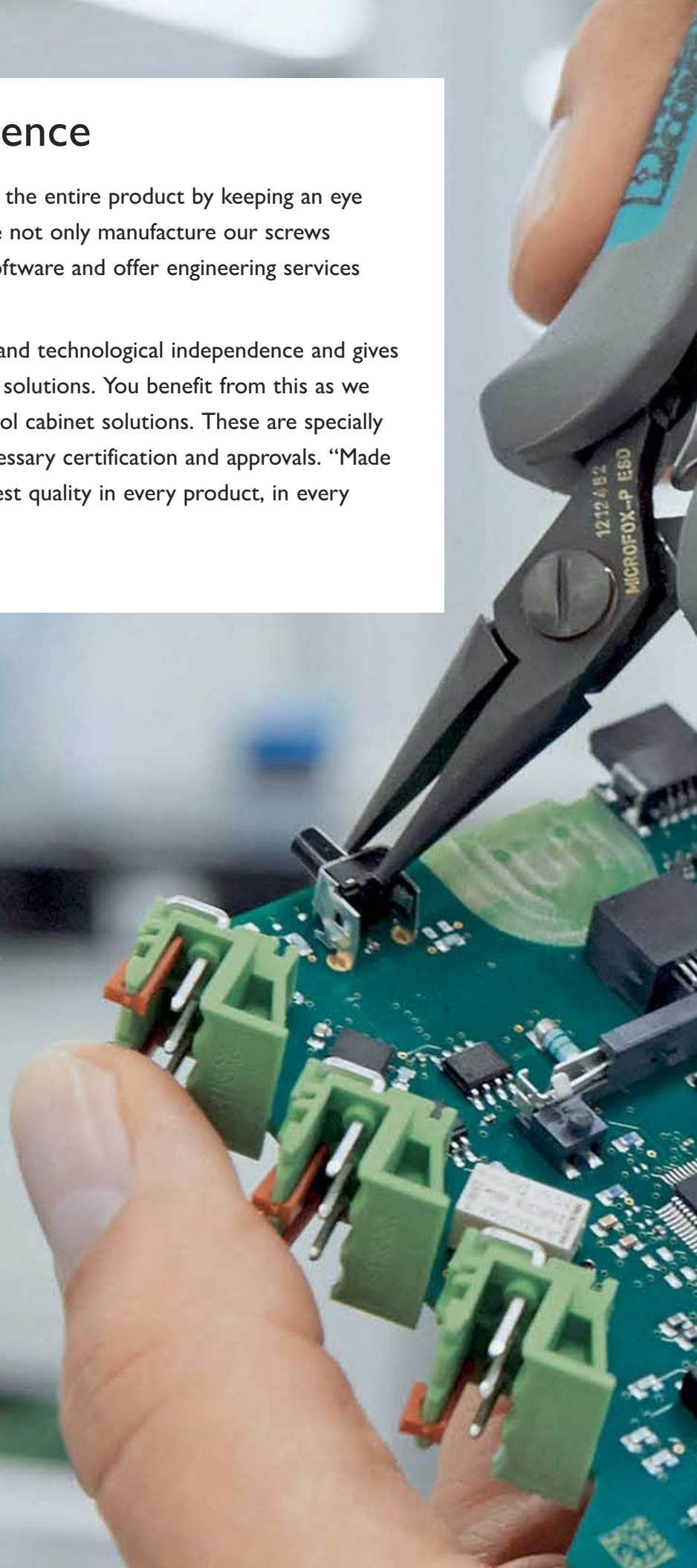
and robust control technology and I/O systems. You can therefore remain flexible even when it comes to operating or retrofitting the plant.

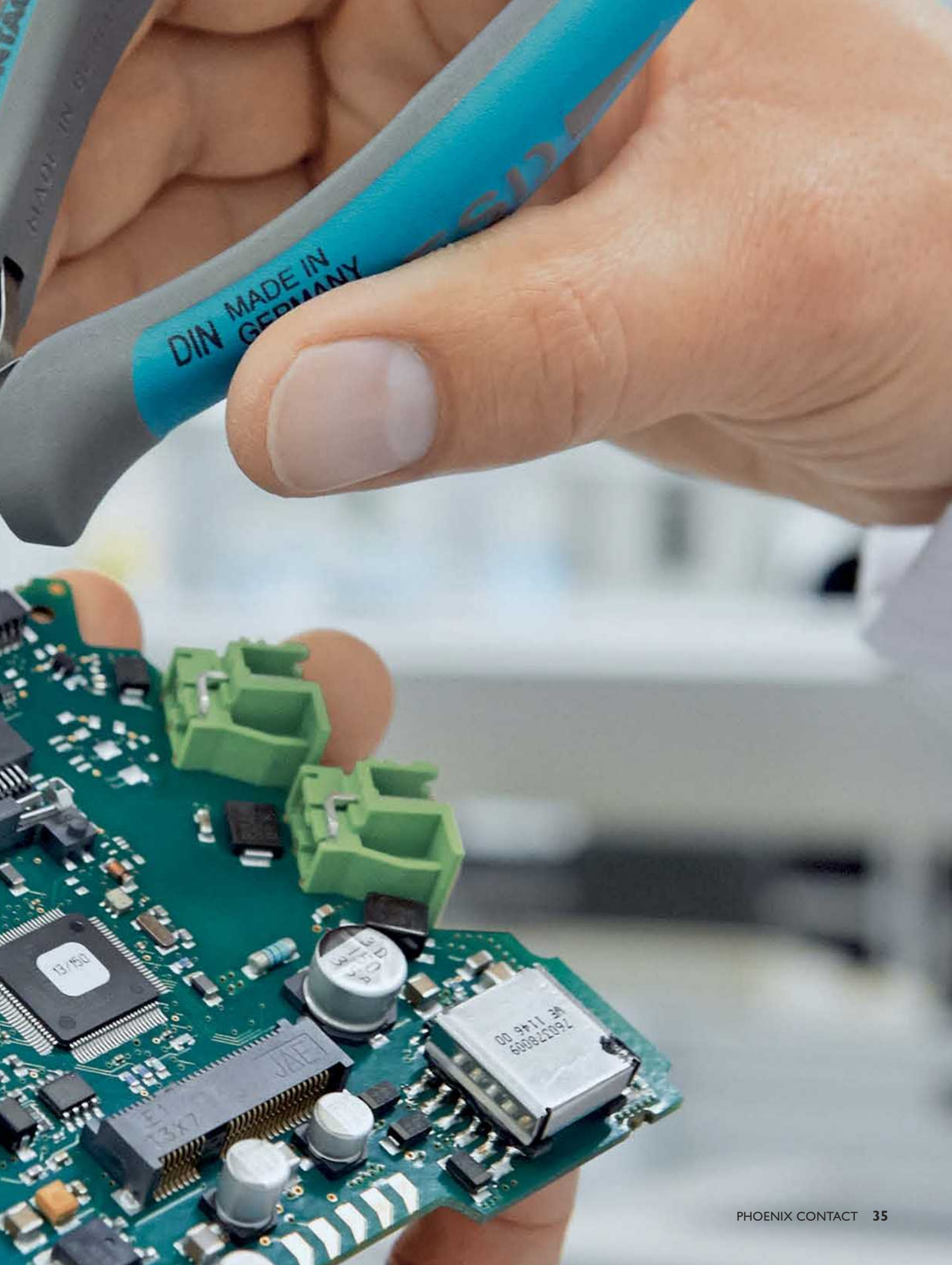


Quality is no coincidence

It is only possible to ensure the quality of the entire product by keeping an eye on the smallest detail. For this reason, we not only manufacture our screws ourselves, but also develop tailor-made software and offer engineering services from industrial professionals.

This allows us to secure our commercial and technological independence and gives us the freedom to develop new industrial solutions. You benefit from this as we are able to offer you pre-assembled control cabinet solutions. These are specially tailored to your industry and have all necessary certification and approvals. “Made by Phoenix Contact” means for us: the best quality in every product, in every discussion, for the entire solution.





Quality is no coincidence

Engineering and control cabinet solutions

We set the highest standards for your solution: everything is tested and certified from the pre-wired and pre-programmed control cabinet solution through to the engineering service. Our industry experts advise you during every phase of your project cycle, and if required, take over the engineering of your plant.

All Phoenix Contact components are tested intensively in the independent and accredited Phoenix Testlab. Control cabinet solutions are designed and developed according to the required standards and directives. This allows you to be sure that our finished solution products meet the highest requirements.



Your advantages:

- Expert consultation from industry professionals
- Comprehensive support throughout all the phases of your project
- Develop know-how with training courses for your employees



Engineering

Regardless of the challenge facing you when implementing your wind energy project, we will be glad to support you. Simply give us an outline of the application you would like to implement and we will provide you with a technical concept that includes suitable hardware and software:

- Configuration
- Programming
- Visualization
- Coaching

Control cabinet solutions

We develop control cabinet solutions together with our customers, which depending on the requirement, are already read-to-use or prewired so that you are able to carry out final installation.

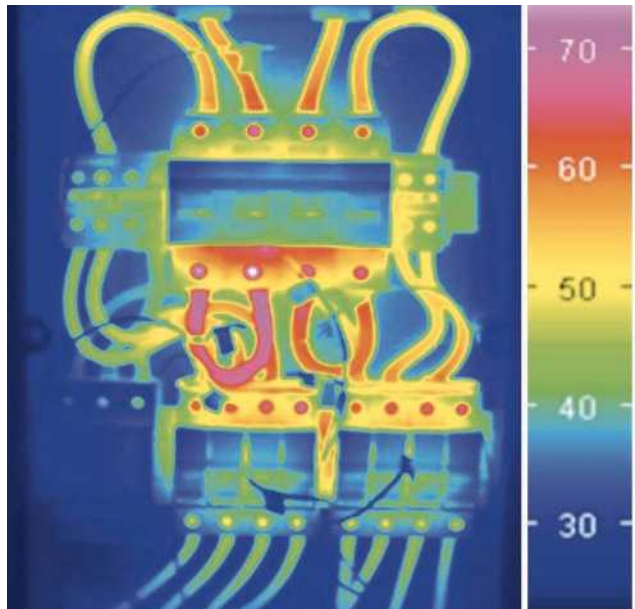
This allows specific industry solutions from a partner network made up of proven control cabinet manufacturers that meet the highest requirements.

At the same time, quality is ensured at every step of the development process. A process-oriented, integrated management system based on international standards DIN EN ISO 9001 and 14001 ensures: legislation and standards such as EU directives 2002/96/EC (WEEE) and 2002/95/EC (RoHS) as well as customer specifications are taken into account during product manufacturing.

Quality from planning to production

During preliminary development clarification, all divisions work closely with customers. After clarification and the construction phase, the prototype undergoes specific testing. The knowledge gained is integrated into product optimization.

As part of project processing, we support you during development of solutions: from initial planning and configuration to layout and construction up to evaluation and testing of the specified standards as well as making the documentation and EPLAN-based circuit diagrams available. After that, production planning and control follows and, if necessary, series production.



Quality is no coincidence

Services for Functional Safety

In addition to the comprehensive Functional Safety product range, Phoenix Contact supports you with an individual range of services for machine safety in wind turbines. Our industry experts advise you, in a product-neutral way, on all questions relating to conformity assessment (CE) and on the safety requirements for certifying the WTG in line with GL 2010 or IEC 61400.



Your advantages:

- Comprehensive support from industry professionals
- Flexible help during all project phases
- Time savings, thanks to outsourcing
- Building competence through employee qualification



Presentation

Our experts support your developers and design engineers with on-site assistance. The joint processing of our WTG-specific document templates for verification documentation is a particularly effective knowledge transfer.

Possible contents:

- Risk assessment for the WTG safety concept
- Creation of the safety concept with the definition of WTG safety functions

Engineering

We create individual parts or the entire Functional Safety for your WTG project.

- Programming of safety-related user software in line with regulations
- Proof of safety integrity (SIL/PL) of the overall safety functions or of partial systems (e.g., pitch)
- Definition of diagnostic interfaces between the safety system and the operation controller.

Support and seminars

We provide support to:

- Select the right safety hardware
- Test the safety functions in the area of field tests and initial commissioning

In industry-specific seminars, we advise you on the practical application of the safety lifecycle.

Safety hotline: +49 (0) 52 81 9 46 27 77

safety-service@phoenixcontact.com

Safety services in every project phase

Our phase model for the safety lifecycle is based on the harmonized standards of the Machinery Directive. The safety lifecycle represents a process, that when implemented, allows you to fulfill the requirements of EN ISO 13849-1 or EN 62061 for the Functional Safety of the WTG.

This structured procedure, from the risk assessment of the WTG to safety function specifications right through to the validation of safety functions, helps to apply and adhere to regulations on the finished WTG.

Save time by transferring safety requirements to Phoenix Contact. Through the knowledge and experience of TÜV-certified safety experts for the wind energy industry, you will therefore have maximum legal certainty in every phase of the safety lifecycle.



Quality is no coincidence

Service and support

Implement your wind energy projects even more quickly and efficiently. Regardless of whether you operate, plan, produce or maintain systems – Phoenix Contact's services provide professional support that is tailored to your requirements during all phases. This includes an excellent telephone and online service as well as industrial professionals on site. Numerous seminars at Phoenix Contact headquarters or at your company premises are available for training your employees. We always provide expert consultation on all aspects of your products and solutions during after sales.



Hotline:

- Expert consultation from industry professionals
- Comprehensive support throughout all the phases of your project
- Develop know-how with training courses for your employees



Service

Do you need customized advice? We can offer the necessary technological expertise, combined with vast experience in the wind energy sector. Our expert project management team will guide you through all the important phases of your project. Together with you, we will arrange the necessary services and handle the subtasks during the implementation phase.

Training and workshops

Thanks to intensive contact with our customers and years of on-site experience, we have developed a qualification concept whereby we can specify employee qualifications in order to meet your individual requirements: we offer you the appropriate service depending on the project phase, target group, and prior knowledge.

After sales

Our service teams stand out, thanks to their focused expertise, years of practical experience, and maximum degree of flexibility.

Our service network is available to you during installation, startup, and operation even in the most remote regions of the world, for example, a free system hotline with 24 hour product support. In the event of an emergency, we can provide you with replacement parts outside of office hours.

Phone: + 49 (0) 52 81 9 46 28 88

Local expertise

Phoenix Contact supports you worldwide with professional service and support with everything surrounding products, services and solutions.

Depending on requirements, we ensure fast replacement of products or support you in the case of problems by switching into your system.

Our experts are familiar with the regional conditions and specific challenges of your industry. We are happy to support you all over the world with a finely-meshed network of sector experts. Contact us for more information.



Quality is no coincidence

Inspiring industry solutions, thanks to excellent products

Phoenix Contact provides you with innovative automation and connection technology to equip your wind turbine or your entire wind farm.

Many products were specially developed for the wind sector and excel, thanks to their particularly robust nature and clever functions. These naturally include user-friendly operation and seamless integration. Experience our product solutions for the wind energy sector.



Excellent products

Innovative systems

Excellent products



Functional Safety

Our portfolio based on Functional Safety offers the right solution for every part of your WTG. In addition to hardware and software products, we support you with safety services in every phase of your wind energy project.



I/O systems

Gather and transmit signals and data from every area of your wind turbines. Whether it's the pitch controller in the hub or inverters in the bottom box, here you can find the right I/O system for every requirement.



Industrial Ethernet

Ethernet provides maximum freedom for designing your WTG infrastructure. Thanks to Industrial Ethernet products from Phoenix Contact, you can communicate reliably in the WTG, wind farm or even with the control room.



Connectors

From space-saving circular connectors in the gears, to data connectors in the top box, right through to high-current connectors in the inverter – we have the right solution for every connection requirement in your WTG.



Controllers

Robust and powerful – that is how our control technology comes to excel in the wind energy sector. Thanks to the high-performance controllers, you ensure redundant system design and the maximum availability of your WTG or wind farm.



Power supplies and UPS

The key to maximum availability from the pitch controller right through to the service elevator and lighting is our uninterruptible power supplies and redundancy modules.



Surge protection and interference suppression filters

Whether it is a lightning strike or fluctuation in voltage: all electrical equipment in a WTG must be protected from damage caused by surge voltages at all times.



Modular terminal blocks

Save time and space: our range of modular terminal blocks provides connection technology that is quick and easy to operate for every conductor cross section and for every use in a WTG, even in the hub.



Inspiring Industry Solutions

Passionate about your industry

Each industry places particular demands on system automation. In our dedicated industry teams, we focus on these challenges with technical know-how and passion, and together with our customers we develop tailor-made solutions. Excellent products are at the heart of our

solutions. Cleverly combined to create innovative systems and supplemented by industry-specific features, they ultimately become industry solutions of proven Phoenix Contact quality.



Excellent products



Innovative systems



Inspiring Industry Solutions

phoenixcontact.com

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