

**FAG**



**FAG WiPro**  
**Wind Turbine Protection**  
Technical Information

A Member of the  
Schaeffler Group

# FAQ Wind Turbine Protection

Focusing on the essentials

An approach which has for years been used very successfully in other industry sectors is now also being increasingly adopted in the wind power sector – condition-based maintenance. Investment in wind power technology requires a significant financial commitment. Condition-based monitoring is an essential and optimum means of protecting this investment in regenerative energy and ensuring maximum availability of wind turbines. Implementing such a concept requires a new strategic orientation in the maintenance and repair of wind turbines. Unlike industrial plants, wind turbines are scattered over large areas in large numbers, and some are difficult to access, which significantly increases maintenance expenditures. With the online monitoring system WiPro, FAG Industrial Services have developed a cost-effective condition-based maintenance system with considerable advantages and potential cost-cutting benefits.



# FAG Wind Turbine Protection

## Increased availability and avoidance of unplanned shutdowns

Thanks to permanent, thorough monitoring of the turbines with the WiPro system, operators are always informed about the condition of the turbines' key components. Sudden shutdowns and the costs associated with these can be reliably prevented with the help of the early warning system. For operating companies this also means a high level of investment security and, at the same time, active machine protection. Early detection and observation of damage enables operators to take appropriate measures. In the simplest case, this may mean reducing the output in order to reduce the load on the damaged component.



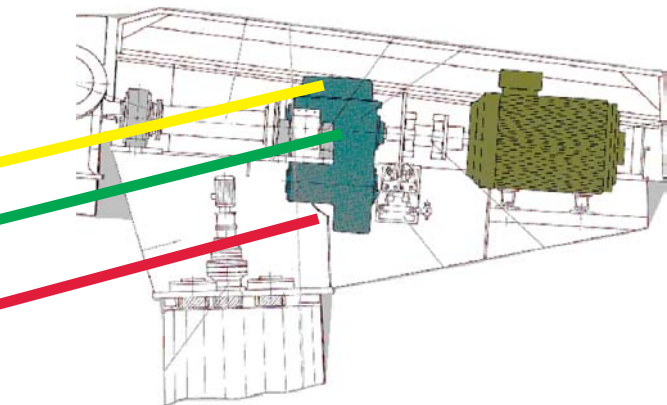
## Condition-based maintenance must be plannable

Those responsible for wind turbine maintenance recognize the need for punctual plant maintenance planning. Especially in the offshore sector, demands on maintenance will increase significantly in the future. As there is no unlimited number of personnel available for this task, the deployment of specialist staff requires very careful and foresighted planning. WiPro supplies operators with the necessary information on the condition of the turbines at any time, enabling them to optimally plan maintenance work.



# FAG Wind Turbine Protection

Frequency selective monitoring of machine parts



	Monitoring-strategie strategy	Characteristics
less appropriate	<ul style="list-style-type: none"> <li>Regular offline measurement</li> </ul>	<ul style="list-style-type: none"> <li>High traveling costs</li> <li>High personnel costs</li> <li>Reduced equipment costs</li> <li>Gaps in data history</li> <li>Damage progress hard to validate</li> </ul>
suboptimal	<ul style="list-style-type: none"> <li>Online measurement</li> <li>Collection of data in the turbine</li> </ul>	<ul style="list-style-type: none"> <li>High personnel costs</li> <li>Increased investment requirement for equipment</li> <li>Complete data history available</li> <li>Information on status of turbine not always available</li> </ul>
optimal	<ul style="list-style-type: none"> <li>Online measurement</li> <li>Access to data via telephone line, TCP/IP</li> </ul>	<ul style="list-style-type: none"> <li>Increased investment in online monitoring</li> <li>Reduced manpower requirement</li> <li>Complete data history available</li> <li>Up-to-date information available on status of turbine</li> <li>Immediate response in case of damage</li> </ul>

# WiPro

# FAG Wind Turbine Protection

## Identifying problems at an early stage

Especially in the wind power sector it is of immense importance that problems are detected at an early stage, as considerable secondary damage may otherwise develop unnoticed. If incipient damage is detected in time, it can usually be repaired at a low cost. As a result, turbine shutdowns can be avoided, and the damage can be prevented from spreading to other components and even causing total failure of large components (gearbox). Analysis of the data can also help to determine the cause of the damage so that it can be avoided in this area in future.



## Condition Monitoring can improve your insurance terms and conditions

The insurance industry was the first to realise that the costs of operating a wind turbine can be significantly reduced by using a condition monitoring system. Operators using the WiPro system can benefit from a suspension or modification of the revision clause (replacement of all bearings, regardless of their condition, after 40,000 operating hours or no later than 5 years).

“Since initial damage can be repaired very quickly, secondary damage and long shutdown periods are prevented. As a result, we reduce our indemnities, and operators pay lower premiums,” notes a representative of a leading insurance company. (Neue Energie 11/2003, „Versicherungen für Windmüller“, p. 31). Avoiding even a single revision means considerable cost savings for the customer. As the WiPro system, after being tested by Allianz Zentrum für Technik (AZT) is recognised as a condition monitoring system by the insurer Allianz (certification by Germanischer Lloyd is underway), insurance companies offer more favourable conditions to operators using WiPro.

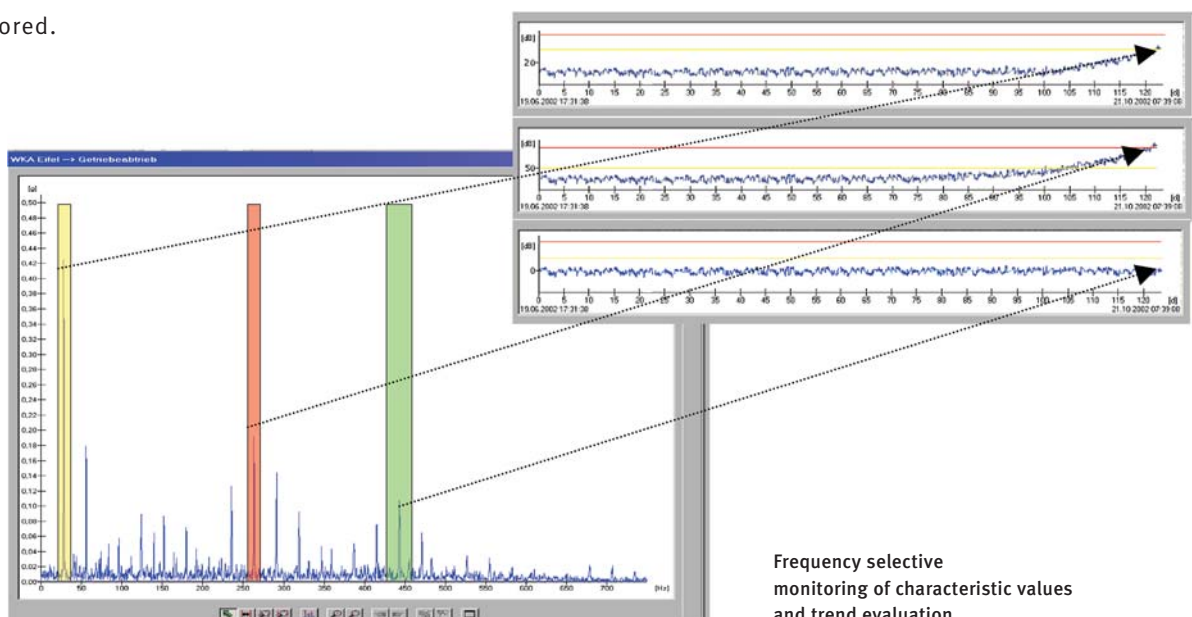
# FAG Wind Turbine Protection

## Any existing turbine can be upgraded

The modular design of WiPro makes it possible to retrofit the system into any existing wind turbines. Any wind farm can be networked to the WiPro system, regardless of whether the turbines are connected to copper or optical fibre cables, whether they are equipped with an ISDN, an analog or no telephone connection at all.

Wireless networking (GSM or other wireless standard) is also possible if no existing lines can be used.

Instead of a flood of measurement data, the system supplies only the information that is needed to monitor the turbines in a compressed form. WiPro is designed in such a way that only comparatively small amounts of data need to be transmitted, which is an undeniable advantage, especially if large numbers of turbines are being monitored.



Frequency selective monitoring of characteristic values and trend evaluation

# FAG Wind Turbine Protection

## Full service from FAG Industrial Services

Our service concept aims to assist our customers in increasing the availability of their turbines. Our range of services goes far beyond simply selling our products. We have developed various service concepts for the wind power sector which allow our customers to choose the service that constitutes the optimum monitoring strategy for his situation. For the customer this means that gradually, and with our support, he will be able to perform all monitoring activities himself.

### CM service model 1

- Installation and initial operation of the WiPro systems by FAG Industrial Services
- Complete monitoring and analysis by FAG Industrial Services
- Regular reports to the operating company

### CM service model 2

- Installation and initial operation of the WiPro systems by FAG Industrial Services
- Customer-specific employee training
- Partial monitoring of the wind turbines by the wind farm operator
- Analysis of the data by FAG Industrial Services in case of alarm and whenever required

### CM service model 3

- Installation and initial operation of the WiPro systems by FAG Industrial Services
- Customer-specific employee training
- Complete monitoring and analysis of the wind turbines by the operator

Other CM service models can also be realized jointly with our customers.



# FAQ Wind Turbine Protection

WiPro: Technical Specifications

<b>Inputs:</b>	ICP inputs (standard) for ICP sensors, 24V, 4mA supply Optional: +/- 10 V voltage input or input switchable between ICP and +/- 10V for other sensors Amplifier: x1 to x1024 or autoranging with the option of activating an overload detection, additional channel (validator) 0-10V, e.g. for speed, load or any other freely selectable units, optional: second validation channel	broad band or definable frequency bands Speed dependent tracking of frequency bands with RMS and demodulation incl. speed dependent alarm limits
<b>Measuring units:</b>	Units in the frequency domain: acceleration (standard) convertible into vibration velocity and vibration displacement by integration other units e.g. speed, force, pressure, sound pressure or temperature can be measured if other sensors are connected Optional: online measurement oil quality; stationary torque measurement	<b>Channels:</b> 8 channels with up to 16 monitoring configurations and per configuration up to 12 frequency bands, additional 2 trigger / validation channels
<b>Parameters:</b>	Parameters in the time domain RMS, peak value, peak-to-peak value, constant component and crest factor Parameters in the frequency domain RMS value of acceleration, vibration velocity and vibration displacement (ISO 10816) broad band or definable frequency bands RMS value of demodulation (envelope processing)	<b>Filter:</b> Analog antialiasing filters for band limitation, Butterworth 24dB/oct. cut-off frequencies 200 Hz, 1, 5 and 10 KHz, optional 5, 10,20,50,100,200,500 Hz, 1, 2, 5, 10 and 20kHz. Filter envelope analysis: high-pass, Butterworth 12dB/oct. Switchable 100 Hz and 2 kHz <b>A/D converter:</b> Resolution 12 bit, max. overall sampling rate: 80 kHz <b>Memory:</b> for instrument/monitoring configurations, spectrum and time signal as well as a circular memory (FIFO) for parameters with 264 to 3834 data records (depending on the number of parameters and the type of information to be stored together with these parameters, e.g. speed and time) <b>FFT:</b> 2048 lines <b>Outputs:</b> 2 switching outputs for main alarm and pre-alarm 2 analog outputs 4-20mA, optional 0-20mA, 0-10V or 0-5V. Raw sensor signal on BNC socket

# FAG Wind Turbine Protection

WiPro: Technical Specifications

<b>Display:</b>	LCD display, 2 lines of 16 characters each LED signal lights r/y/g for alarm status
<b>Interfaces:</b>	RS 232 serial connection modem / GSM / ISDN / TCP/IP etc.
<b>Sensors:</b>	Special sensors for low frequency monitoring range
<b>Housing:</b>	Dimensions: W xH xD = 400 x600 x220 Construction: steel case IP66 Temperature range: 0 to +50 °C optional -20 to + 50 °C
<b>EMC:</b>	EN 61000-6-2/1999 EN 61326/1997 EN 55011-A

## WiPro-Server-Software

### Operating

<b>system:</b>	Windows 98, NT (SP 6a), 2000, XP
<b>Features:</b>	Integrated database (no additional database required) Software available in various languages Various communication options (Ethernet, GSM-modems, standard or ISDN modems, Internet, etc.) Configurable remote operation with automatic data transmission Information in case of an alarm (email, SMS) Continuous registration and storage of the routine data Speed dependent tracking of frequency bands in specific monitoring configurations Possibility of data export (ASCII) for further processing with other software

*certified by Allianz*



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