Biral visibly better

WIND ENERGY

Visibility, Present Weather and lightning warning systems you can trust…

METEOROLOGICAL SENSORS

Obstruction Light Control using Visibility Measurements

All wind turbine parks are equipped with aviation obstruction (warning) lights mounted onto turbine nacelles. For a number of years the light pollution created by these lights has been used by local residents as an objection to wind farm development. Germany has had legislation in place since 2004 requiring developers and manufacturers to install turbines with visibility sensor controlled obstruction lights. These visibility sensors constantly monitor the local meteorological conditions and when the visibility varies, the light intensity for the warning lights is automatically adjusted. For example, on clear days where the visibility is greater than 10km the light intensity is reduced to 10%. When the visibility is measured at 5km or higher, the light intensity is set to 30%. At all other times of lower visibility due to fog or rain etc. it is set to 100%. The visibility sensors work equally well during the day and at night, keeping the warning lights dimmed during a clear night greatly reduces light pollution for the local inhabitants.

Present Weather data is also Beneficial

In addition to visibility data being used to control the obstruction light brightness on wind turbines, we also have many wind turbine customers who install our present weather sensors. These sensors also output the specific weather conditions being experienced by the sensor in addition to the visibility information. Over recent years, in latitudes where freezing conditions are common during winter months, the additional information of the current weather conditions at nacelle height can be very helpful for safe and efficient turbine operation. In particular this is important when the turbines are subjected to freezing conditions and the blades can become coated in ice. This ice is not only a significant safety threat when thrown from a blade; it also greatly reduces the efficiency of the turbine and reduces energy generation. In most cases, the turbines have to be shut down and the blades de-iced before they can re-start. Having real-time weather data from the nacelle (freezing conditions, hail, snow etc.) allows the operators to either plan for this eventually more proactively or to start their blade heating systems to reduce the ice build-up more effectively.

Technical Advantages

Depending upon the country's regulations, the type of obstruction warning lights can vary considerably. In Europe it is common to have synchronised flashing white lights during the day and red flashing ones at night. In the USA it is common to have continuous or flashing lights. These lights are now generally all LED technology which consume less power and are more reliable. These obstruction lights are usually mounted on top of the nacelle so that they are visible from 360° and not obscured by the blades. The visibility or present weather sensors also need to be mounted on the nacelle to have a free passage of air through the sampling volume.

Due to the type of light emitted by the obstruction lights, their intensity and their close proximity to the visibility or present weather sensor, there is the possibility of the sensors also detecting their emitted light. In fact, this has been a major cause of poor or incorrect visibility readings from sensors over many years.

Biral has overcome these tough measuring conditions in a number of ways resulting in the most robust and reliable sensors available today used throughout the world in this application. The Biral sensors use high frequency modulated light transmission partnered with narrow pass optical filtering to ensure that only the light of the wavelength transmitted by the sensor is measured by the sensor. In this way, external light reflections from the obstruction lights is removed from the measured signal and ignored.

In addition to this, many measurement errors can come from light reflected from the (usually white) nacelle which is typically situated below the sensor. This is a particular problem for sensors which have their optical detectors pointing downwards. The Biral sensors all have their measurement optics in a horizontal plane which reduces the possibility of reflected light entering the receiver to effectively zero. To combat the possibility of snow and ice being trapped in the Biral sensor optics, the sensors can be supplied with automatic hood heaters which only operate when the ambient temperature drops below 4°C. These high-power heaters are very effective and remove the possibility of snow building up completely.

Features / Benefits:

- Visibility and Present Weather sensors certified by Deutscher Wetterdienst (DWD)
- No influence from nearby obstruction lights
- Proven to be compatible with latest generation of Infrared obstacle lights
- High powered hood heaters prevent snow and ice build up
- Horizontal measurement results in no errors due to reflections
- 3 or 5 year warranty depending upon sensor range

Biral Test-Mode Software

Biral visibility and present weather sensors are supplied with enhanced internal software featuring a new test setting. The sensors can be switched into a "Test Mode" via the serial PC connection. This test mode allows the user to set the output data message to contain user-defined data for visibility, present weather, window contamination and fault status for a fixed period of time. This can be used at the system design stage and at Factory or Site Acceptance Testing (FAT or SAT), demonstrating the functionality of the overall control system. For wind turbine installations, the correct dimming operation of the warning lights can be demonstrated as the output of the sensor is adjusted. This is becoming an important part of site acceptance and approval testing / certification of new turbine installations.

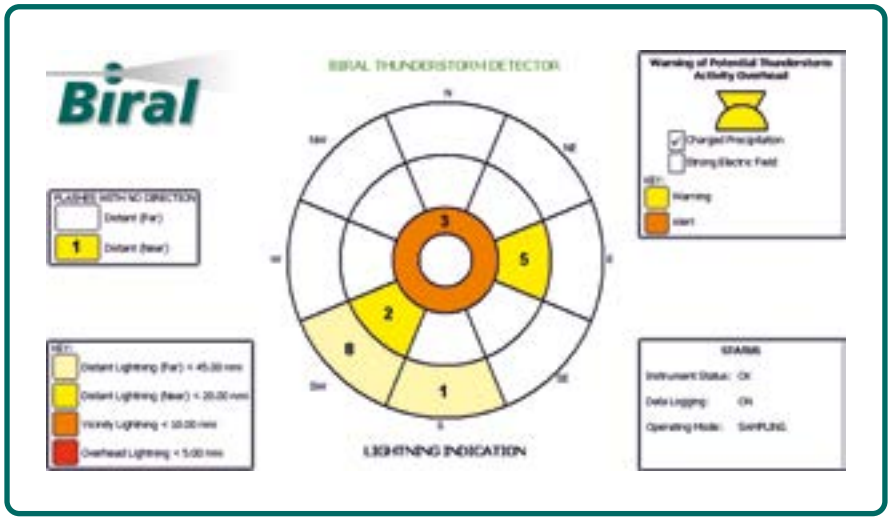
Thunderstorm Detection and Warning

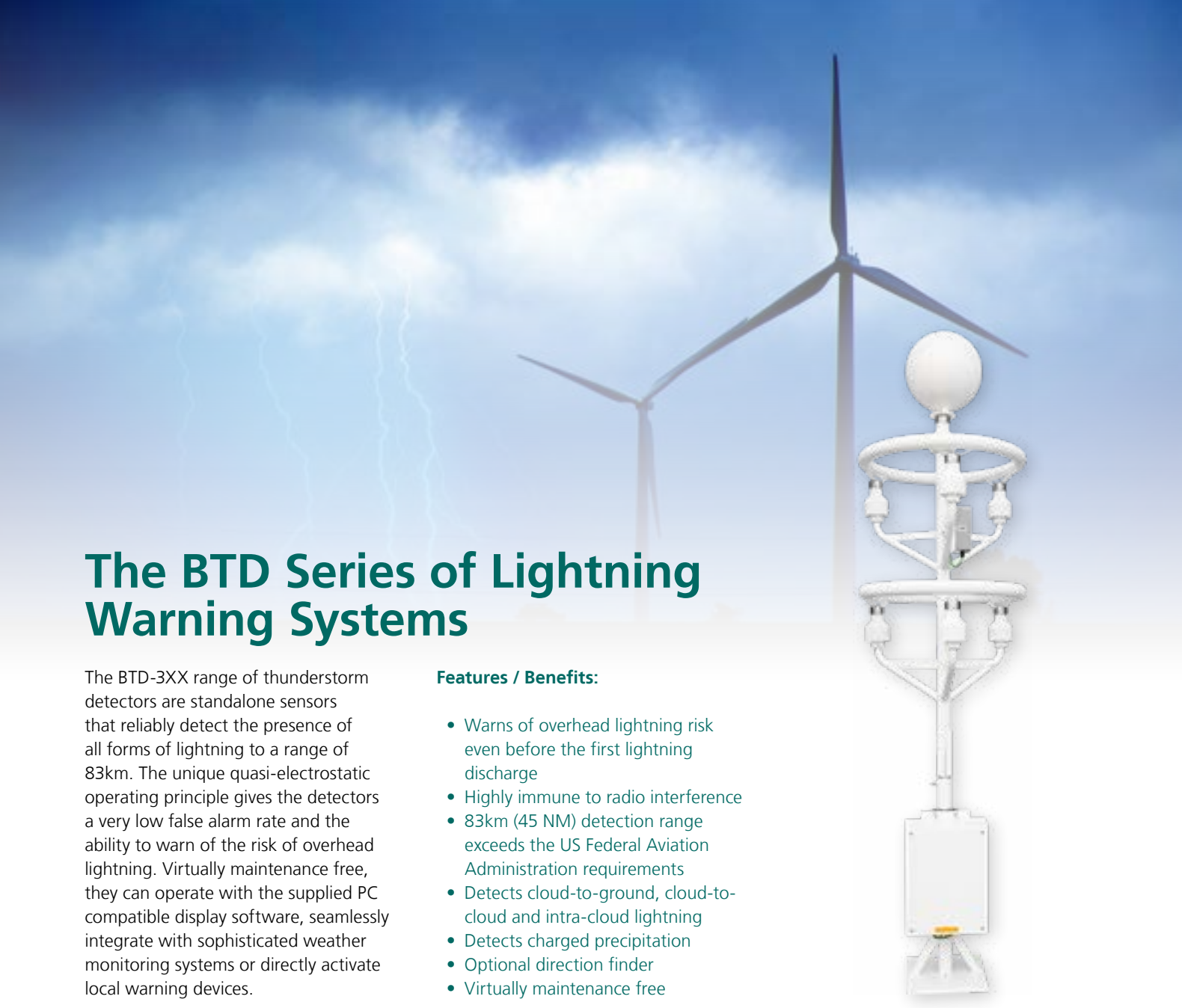
In many applications the thunderstorm detector is used to help protect people and equipment from the dangers of a lightning strike by providing advanced warning of a storm's approach. This is especially true of tall structures sited on either exposed or flat landscapes where they are likely to initiate a lightning strike. Detectors which rely on lightning alone are only effective if the storm is already producing lightning at a distance before moving closer towards the detector. If the first lightning strike of the storm is overhead there is no advanced warning and so no protection.

The quasi electrostatic operating principle used by the BTD range allows the sensors to monitor the strength of the local electric field and the presence of charged precipitation, both of which are strong indicators of lightning risk. This allows the BTD range to provide warnings of the risk of an overhead strike even before any lightning has been produced; giving users more time to take the appropriate safety measures ahead of the first strike.

The BTD range has exceptional lightning detection and ranging capability, and for those applications where knowledge of both the range and direction of lightning is necessary there is an optional direction finding module. The module uses traditional radio direction finding techniques but the output is qualified by the electrostatic ranging system to ensure only true lightning discharges are reported.

In wind turbine applications the BTD's advanced warning of overhead lightning is of enormous benefit for installation teams as well as for operation and maintenance staff located on-site. By their very nature, turbines will generally be installed on exposed sites on land where the turbines will be the highest structures. Turbines are prone to lightning strikes and all staff on-site need to be warned of a storm's approach to make their way to a safe area. The same is true of off-shore wind farms where the support vessels require warning of approaching storms to allow them to make their staff and operations safe.





The BTD Series of Lightning Warning Systems

The BTD-3XX range of thunderstorm detectors are standalone sensors that reliably detect the presence of all forms of lightning to a range of 83km. The unique quasi-electrostatic operating principle gives the detectors a very low false alarm rate and the ability to warn of the risk of overhead lightning. Virtually maintenance free, they can operate with the supplied PC compatible display software, seamlessly integrate with sophisticated weather monitoring systems or directly activate local warning devices.

Features / Benefits:

- Warns of overhead lightning risk even before the first lightning discharge
- Highly immune to radio interference
- 83km (45 NM) detection range exceeds the US Federal Aviation Administration requirements
- Detects cloud-to-ground, cloud-to-cloud and intra-cloud lightning
- Detects charged precipitation
- Optional direction finder
- Virtually maintenance free

The BTD-300

Used in land based applications and sited either inside or adjacent to the wind farm. With a detection radius of 83km a single sensor will reliably provide warnings for an entire farm. Its real-time output can be taken into any control or monitoring system and used to initiate alarms or warnings either locally or across the whole wind farm via remote communications.

The BTD-350

A specially developed version of the BTD for use in both on-shore and off-shore marine applications. The BTD-350 features a vibration resistant design with extensive use of both stainless steel and marine grade paint technology to ensure a long life in this tough working environment. Mounted on a marine sub-station, one BTD-350 can offer advance warnings of an approaching electrical storm to even the largest of off-shore wind farms. Mounted onto a service or support vessel, it becomes a mobile warning system which can be used at any wind farm, offering protection to all staff at that location.

The SWS Sensor Range

The SWS sensor series was introduced in 2009 and shares much of the advanced technology used in the VPF range. With a powder coated, all metal enclosure, the sensors are proven to be reliable for extended periods of operation. All SWS series sensors are supplied with a 3 year warranty as standard. This can be extended up to 10 years if required.

Sensor	Visibility Range	Present Weather Codes	
SWS-200	10m to 99.99km	14 WMO	0 METAR
SWS-100	10m to 99.99km	Visibility and precipitation type	
SWS-050	10m to 40km	Visibility only	

The VPF Sensor Range

The VPF range offers outstanding reliability and corrosion resistance combined with the most accurate measurements and greatest number of reported present weather codes. They have been proven in use over 20 years and remain at the forefront of visibility and present weather technology.

Sensor	Visibility Range	Present Weather Codes	
VPF-730	10m to 99.99km	15 WMO	17 METAR
VPF-710	10m to 99.99km	Visibility only	

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