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BTD-300
Thunderstorm (Lightning) Detector
Datasheet



Standalone lightning detector giving range and direction data to FAA requirements

Unique quasi-electrostatic operating principle virtually eliminates false alarms

Warns of overhead thunderstorm risk before the first lightning discharge

KEY FEATURES & BENEFITS

- Warns of overhead lightning risk even before the first lightning discharge
- Highly immune to radio interference which is the major cause of false alarms in traditional standalone detectors
- 83 km (45 NM) detection range exceeds the US Federal Aviation Administration requirements
- Detects cloud-to-ground and as well as weaker but more common cloud-to-cloud lightning
- Detects charged precipitation
- Meets FAA performance requirements for aerodrome use
- Meets EN50536:2011+A1:2012 requirements for a Class 1 detector
- Meets IEC 62793 performance requirements for a Class A detector
- Optional direction finder

The BTD-300 Thunderstorm Detector is a standalone sensor that reliably detects the presence of all forms of lightning to a range of 83 km. The unique quasi electrostatic operating principle gives the detector a very low false alarm rate and the ability to warn of the risk of overhead lightning. Virtually maintenance free, the BTD-300 can operate with the supplied PC compatible display software, seamlessly integrate with sophisticated weather monitoring systems or directly activate local warning devices.

Lightning Detection

Virtually all commercially available lightning detection sensors and systems use the reception of radio waves generated by lightning discharges as the primary detection technique. Whilst providing a sensitive method of detection the many other sources of radio waves such as arcs from electrical equipment, vehicle ignition systems and fixed or mobile transmitters can result in very high false alarm rates. Lightning detection networks resolve this problem through the use of multiple sensors spaced tens or hundreds of kilometres apart combined with signal processing and triangulation. Such networks are typically very costly to install and operate and are therefore only usually operated by national weather services. Standalone radio based lightning detectors often employ secondary measurements such as optical flash detection in an attempt to reduce false alarms and employ complex signal analysis to estimate range. These techniques are only partially effective, giving these older technology standalone lightning detectors a poor reputation due to their high false alarm rate and poor distance accuracy.

The BTD-300 uses quasi electrostatic measurements to avoid the problems associated with the detection of lightning using radio waves and to provide the ability to issue warnings prior to the first discharge.

Electrostatic Lightning Detection

When a lightning discharge occurs there is a significant transfer of electric charge which causes a disturbance in the atmospheric electric field detectable to a distance of more than a hundred kilometres. The low frequency (<50 Hz) disturbance is detected by the three BTD-300 antennas and the signals are processed to both detect and range lightning discharges. Due to the low frequency nature of the lightning discharge signal, the BTD-300 filters out the higher frequency electromagnetic radio waves which confuse other sensors. As virtually no manmade or natural source can disturb the Earth's electric field in same way as a lightning discharge, the BTD-300 has an almost zero false alarm rate.

All forms of lightning result in a neutralisation of charge within the thunderstorm. The associated disturbance in the atmospheric electric field enables the BTD-300 to detect all



forms of lightning with high sensitivity. The rate at which the disturbance reduces with distance and the more uniform charge redistribution associated with lightning discharges allows the BTD-300 to determine range with greater accuracy than systems which rely solely on radio waves. By contrast the strength of radio waves produced by lightning varies significantly both with discharge type and between individual discharges, resulting in very poor range estimation performance for traditional radio based standalone lightning detectors.

True Thunderstorm Detection

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. 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.

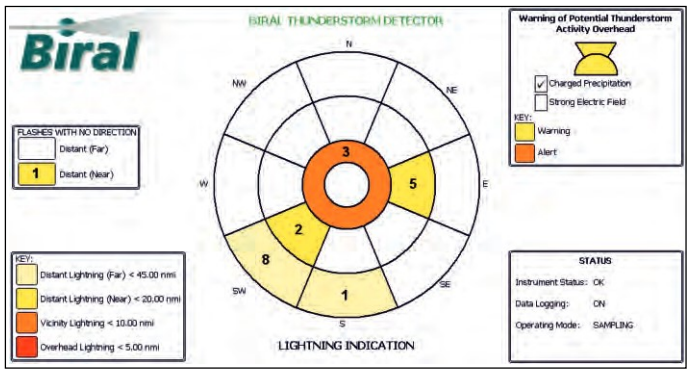
The electrostatic operating principle allows the BTD-300 to monitor the strength of the local electric field and the presence of charged precipitation, both of which are strong indicators of lightning risk. This allows the BTD-300 to provide warnings of the risk of an overhead strike even before any lightning has been produced, giving users time to take the necessary safety measures ahead of the first strike.

Range and Direction

The BTD-300 has exceptional lightning detection and ranging capability as a result of the quasi-electrostatic design, but 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.

Applications

There are many applications where the ability to reliably warn of the presence of thunderstorms can increase both safety and



productivity. Aerodromes need to protect staff working on open airfields who can be especially vulnerable and face the added dangers associated with refuelling. Aircraft must also be made aware of the presence of thunderstorms in the critical take-off and approach zones. Many industrial plants that process or store volatile chemicals may wish to suspend certain operations or maintenance activities when there is a risk of lightning that could cause catastrophic damage. Such interruptions are costly, making the reliable detection of thunderstorms an important cost control method. Maintenance workers on tall exposed plant or structures such as wind turbines are at particular risk from thunderstorms. Both their safety and productivity can be enhanced by reliable local thunderstorm warnings.

The leisure industry must also consider the risks posed by thunderstorms to customers and staff at outdoor events whether they are concerts, funfair rides, stadia or golf courses. Reliable thunderstorm detection allows the operator to take the appropriate action only when necessary, protecting both life and revenues.

Interfacing, Connectivity and Cost of Ownership

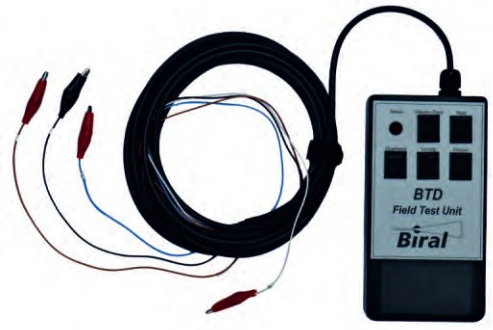
The BTD-300 can either interface directly to an integrated system or be operated using the supplied PC compatible display and logging software. Both RS422 serial and Ethernet interface options are available to ease system integration. For true standalone operation the optional warning relay module allows the sensor to automatically sound alarms whenever a storm approaches, without the need for a computer connection.

Virtually maintenance free in operation the BTD-300 has a very

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low cost of ownership but can produce significant gains by ensuring only genuine thunderstorm warnings suspend operations.

The BTD-300 Field Test Unit is a simple battery powered device which simulates lightning in several range bands. It can be used as part of commissioning tests or during routine maintenance activities to enhance user confidence.



BTD-300 Field Test Unit

Sensor Configuration Information

For a detailed explanation of the configuration options please refer to the table below.

30 – BTD-300 Sensor
- **Direction Finder:**
  - **WF** – With direction finder
  - **NF** – Without direction finder
- **Heating:**
  - **EH** – Extended heating
  - **NH** – No additional heating
- **Data Output:**
  - **TE** – Ethernet output
  - **TD** – RS422 Serial
- **Relay Output:**
  - **NR** – Without relay outputs
  - **WR** – Including relay outputs
- **Configuration:**
  - **RC** –Regular configuration
  - **SC** –Special configuration

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Example: ***30.WF.EH.TE.WR.RC*** (Please use this code when ordering your sensor).

Configuration Options Explained

Option	Description
Direction Finder	The standard sensor detects all types of lightning flashes and provides range information. The optional direction finding module enables the BTD-300 to provide both range and direction information for each flash. Option **WF**: Including integrated direction finder Option **NF**: Without direction finder NOTE: The standard BTD-300 can be updated in the field using the BTD.DIRUP Direction finder field upgrade kit as described in the accessories section.
Heating Options	The standard sensor operates from -40°C to 60°C. Extended heating enabling the sensor to operate from -50°C is an option. Option **EH**: Extended heating Option **NH**: No additional heating
Data Output	The sensor may be configured to communicate over either Ethernet or serial RS422. Option **TE**: Ethernet communication Option **TD**: RS422 Serial communication
Relay Output	The sensor can be supplied with three relays each representing a warning level. Option **NR**: Without relay option Option **WR**: With relay option
Configuration	Reserved for customer specific configurations. Option **RC**: No customer specific configuration Option **SC**: Special customer specific configuration. The exact nature of the configuration will be defined in a separate document

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BTD-300

Thunderstorm (Lightning) Detector Specifications

Measurement

Detects	Cloud-to-Cloud, cloud-to-ground and intra-cloud lightning discharges
Output	Ethernet or Serial data
Detection efficiency	95% for single lightning flash (any type) 99% for storm with 2 flashes 99.9% for storm with 3 flashes For flashes within 56km
Range	83km (51 statute miles)
Range Measurement Uncertainty	0 to 20km ±5km 20 to 83km ±10km
Range Measurement Repeatability	0 to 20km ±300m 20 to 83km ±1000m
Range Resolution	10m
False alarm rate	<2%
Maximum flash rate	120 per minute
Time of flash	Nearest 10ms (internal clock)
Measurement principle	Passive, quasi-electrostatic No moving parts
Direction (optional)	Resolution 1°

Outputs and Reports

Update rate	2s
Serial outputs	Ethernet (virtual com port) or RS422
Message content	Self-test status Thunderstorm warning status Flash time Flash range Flash direction (optional)

Power Requirements

Sensor supply	100 to 240Vac 50-60Hz universal
Sensor power	~10W
Extended heating (optional)	30W

Environmental

Operating temperature - with extended heating	-40°C to +60°C -50°C to +60°C
Relative humidity	0 – 100% RH
Protection rating	IP66
Wind	To 50ms^{-1}

Certification & Compliance

CE Certified
EMC compliance with EN61326-1997, 1998, 2001
Compliance with EN50536:2011+A1:2012 for a Class 1 detector
Performs in accordance with IEC 62793 for a Class A detector
RoHS and WEEE compliant

Additional Features

Warning state relays (optional)	3 Relays with volt free contacts: Caution state, Warning state and Alert state Can be disabled at user configurable times
Warning thresholds	User configurable

Physical

Material	Stainless steel and powder paint coated aluminium
Weight	25kg
Height	2,460mm
Warranty	2 years
Lifetime	>10 years

Maintenance

Self-test capability	As standard
Visual inspection	6 to 12 months

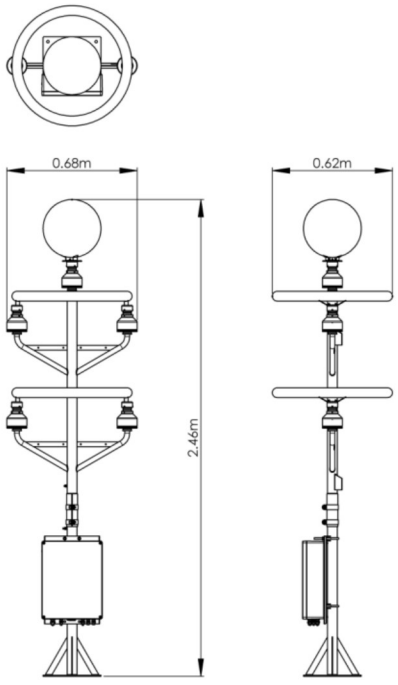
Included with Sensor

The sensor is delivered in sturdy recyclable foam filled packaging with:
- Display and logging software
- User manual and calibration certificates

Accessories – Optional

BTD.DIRUP	Direction finder field upgrade
BTD.FTU	BTD-300 Field Test Unit
BTD.SK300	BTD-300 Spares Kit
BTD.WTY300	1 Year Extended Warranty

Specifications are subject to review and change without notice. E&OE.



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