

Intelligent Overhead Line Monitoring System

Blue Elf TM

1 Product Overview



The Blue Elf is a CT self-power, multi-functional monitoring device designed for direct installation on overhead transmission and distribution lines. Weighing only 6.4kg, it integrates a comprehensive suite of sensors and intelligent analytic into a single, robust package. Its core mission is to provide real-time, actionable insights into line health and environmental conditions, transforming traditional grid maintenance into a predictive and proactive operation.

It serves as an all-in-one sentinel for your grid, combining Channel Visibility, Conductor State Monitoring, and Dynamic Line Rating (DLR) capabilities. A key advanced feature is its AI-powered ice thickness estimation during winter conditions. Built on a modular philosophy, the

Blue Elf's configuration—from its visual cameras to specialized sensors—can be customized to match specific project requirements and budgets.

2. Core Features & Capabilities

2.1. Visual & Environmental Surveillance

- **Multi-Angle Imaging:** Supports up to three high-definition visible-light cameras (front, rear, and bottom) for full-channel visualization, inspecting vegetation encroachment, foreign objects, and tower structure.
- **Specialized Imaging Options:** Can be optionally equipped with infrared (thermal) imaging cameras for hot spot detection and wildfire monitoring, and ultraviolet (UV) cameras for corona discharge detection.
- **Wildfire Detection:** Utilizes visual and thermal imagery algorithms to identify smoke or fire near the right-of-way, providing early warning.

2.2. Conductor State & Dynamic Monitoring

- **Galloping & Sag Monitoring:** Equipped with an inertial measurement unit (IMU) to precisely measure conductor motion (galloping amplitude/frequency) and sag changes in real-time.
- **Critical Parameter Sensing:** Directly measures conductor temperature and line current (load) using integrated, non-invasive sensors. This data is fundamental for DLR calculations.
- **Dynamic Line Rating (DLR):** Calculates the real-time capacity of the line based on actual conductor temperature, ambient conditions (from its sensors), and load current, enabling safe grid capacity optimization.

2.3. AI-Powered Ice Thickness Estimation

- During icing seasons, the system's AI engine analyzes a combination of data streams:

- **Visual images from the cameras.**

- **Ambient weather context.**

- This fusion allows the Blue Elf to calculate and report estimated ice thickness, providing crucial information for ice-melting dispatch and risk assessment.

2.4. Flexible & Modular Architecture

The Blue Elf is designed around a highly configurable platform. Clients can select and pay only for the modules they need:

- **Sensor Suite:** Choose from core sensors (IMU, temperature, current) and optional add-ons.

- **Visual System:** Configure the number and type of cameras (visible light, infrared, ultraviolet).

- **Communication:** Select from various options (4G/5G, Flora, satellite) for data back haul.

This ensures cost-effectiveness and adaptability for diverse applications, from simple sag monitoring to full-featured health and security surveillance.

3 Core Application Scenarios

3.1 Key Cross-span Monitoring

Applicable Scenarios: Transmission lines crossing key areas such as railways, first-class highways, navigable rivers, and oil and gas pipelines.

Core Functions: Real-time monitoring of the safe distance between conductors

and crossed objects, second-level alarm for abnormal conditions, and prevention of major accidents such as wire breakage and tripping.

3.2 Extreme Environment Defense

Applicable Scenarios: Heavy icing areas, Grade 3 galloping areas, high-frequency wildfire areas, coastal high-salt fog areas, and high-altitude uninhabited areas.

Core Functions:

- **Icing Warning:** Intelligently predicts icing risks by combining conductor temperature and ambient temperature and humidity.
- **Galloping Monitoring:** Real-time collection of conductor vibration data, analysis of amplitude and frequency, and early warning of galloping risks.
- **Wildfire Identification:** AI intelligent recognition of smoke and fire in the channel, supporting multi-scenario alarms such as straw burning and wildfires.

3.3 Overloaded Line Capacity Increase (DLR)

Applicable Scenarios: Overloaded lines with a load rate exceeding 80%, and dynamic capacity-increased reconstructed lines.

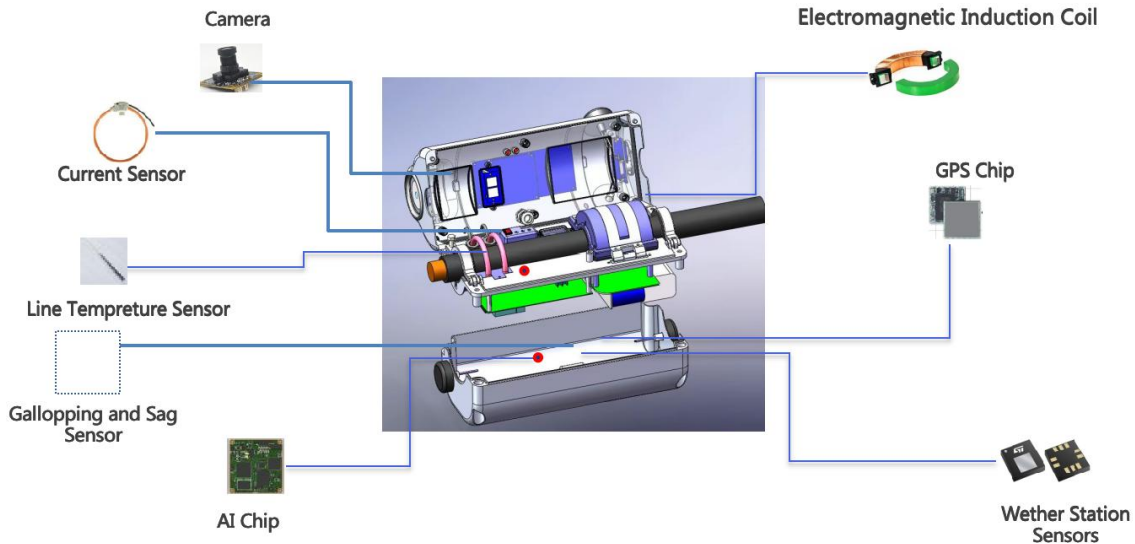
Core Functions: Real-time monitoring of conductor temperature, current, and sag changes to provide data support for dynamic capacity increase and improve line transmission capacity.

3.4 Rapid Fault Location

Applicable Scenarios: Long-distance transmission lines and complex terrain lines.

Core Functions: Traveling wave fault location accuracy ≤ 300 meters, identification accuracy of lightning and non-lightning faults $\geq 95\%$, and fault alarm time ≤ 5 minutes.

3. Technical Specifications (Typical Configuration)



Item	Performance Parameters
Power Supply	CT+ Integrated Li-battery + Solar Panel
Size/Weight	338mm*158mm*222mm/6.4kg
Power Line Type	LGJ-185/25、 LGJ-240/30、 LGJ-300/25、 LGJ-400/35、 LGJ-500/45、 LGJ-630/45、 LGJ-720/50
Voltage Class	35kV/110kV/220kV/330kV/500k/800/1100V
Current Measurement Range	≥1kA
Power line Temperature	Operating Temp Range : -40℃ ~ 180℃ Measurement Accuracy : ≤±1℃ or ±1% Full Scale (FS) Positioning Accuracy:Horizontal: 10 cm / Vertical: 10 cm
Sag	Inclination Measurement: Range: ±60°/Accuracy: ±0.03° Distance Measurement:/Range: 1–200 m
Operating Temperature	-40 ~ 80℃
Camera	Panoramic Monitoring Coverage: Forward, backward, and downward views of the channel HD camera: No less than 16 megapixels (interpolation strictly prohibited)

Night vision camera: No less than 2 megapixels	
CT Starting Current	18A
Storage Battery Capacity	14Ah-30Ah/12VDC
Dicing Thickness Calculation Accuracy	$\leq \pm 1$ mm
Traveling Wave Fault Location Accuracy	≤ 300 m
Galloping Monitoring	· Galloping Amplitude Range and Accuracy: Measurement Range: ± 2 m, Accuracy: 10%
	· Galloping Frequency Range and Accuracy: Measurement Range: 0~5Hz, Accuracy: 5%
	· Supported Conductor Diameter Range: 16 ~ 33mm, with corresponding saddle clamps required for adaptation
	· Synchronous Acquisition Error of Galloping Monitoring Device: <20ms
	· Data Sampling Frequency: Not less than 30Hz
DLR	· Number of Sampling Points per Measurement: More than 400 points Calculation via algorithm model based on sag, conductor temperature and current
Field Data Transmission	4G APN/LTE/Star link/Wireless bridge
Water Prof Class	IP66
AI	Supports edge-side intelligent recognition of construction vehicles, mountain fires, etc., with accuracy $\geq 80\%$ under self-owned test data set

4. Ordering & Customization

The Blue Elf is not a one-size-fits-all product. We work closely with clients to tailor the perfect solution. You can mix and match from the following:

- Base Unit: Includes core data logger, power, and communication.
- Essential Sensors: IMU, Conductor Temperature, Line Current.
- Camera Packages: Choose your combination of visual, thermal, and UV cameras (0 to 3 units).

- Software Features: Subscribe to specific analytic (e.g., DLR, Ice Model, Wildfire Detection).

- Future-Proofing: Discuss integration of the upcoming fault location module.

5. Contact information

Contact the Dyne Technologies sales team today to configure your Blue Elf solution:

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