



KINECTRICS

a **BWXT** company

LineVue® Conductor Inspection Tool

Improve safety, reliability, and reduce environmental impact



We Inspect What Matters

Kinectrics' inspection tools can help utilities make informed asset management decisions on aged lines, leading to improved system reliability, safety, and reduced replacement costs.



Do You Know The Condition Of Your Lines?



Many transmission and distribution lines are very old. Some conductors and shield wires have been in service for more than 70 years—well past their design life—with rates of deterioration largely unknown.

As lines continue to age, it becomes increasingly important for utilities to know the existing physical condition of conductors to optimize management of these important assets.

Knowledge of actual conductor steel core condition is important for utilities in determining if utilities need to commit to expensive capital programs, such as conductor replacement.

Kinectrics' LineVue® is a cost-effective inspection tool used to collect information about conductor condition. LineVue® helps utilities better manage these key assets, address safety concerns, increase infrastructure reliability, and reduce replacement costs.

Why Measure Remaining Steel Cross Section?



Although the steel core has lost all the zinc galvanizing and appears to be severely corroded, this sample still retained 90% of its original cross section.

Zinc galvanizing on steel strands of ACSR (Aluminum Conductor Steel Reinforced) and ACSS (Aluminum Conductor Self-Supporting) conductors will delay deterioration of the base metal, although zinc does not contribute to the mechanical strength. Even after zinc galvanizing has been compromised, the tensile strength of steel wires (and conductors) can remain close to the rated strength for many years.

Measuring the remaining steel core cross-section provides a direct assessment of the most important conductor parameter—actual remaining strength—and LineVue® does this.

“We are satisfied that LineVue® is capable of providing acceptable and accurate data. The tool provides a viable method to assess our conductors without cutting out samples. Most importantly, using LineVue® eliminates the need for Hydro One to schedule an outage when we assess the condition of our conductors.”

— Hydro One Networks

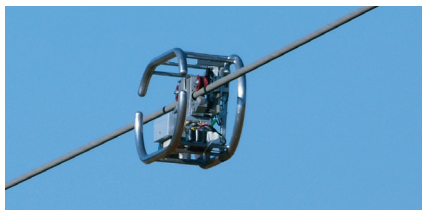
Quality

Our Quality Management System is registered to ISO 9001 by SAI Global, North America's leading QMS registrar. Our adherence to this standard provides one of the strongest assurances of service quality available and we strive not only to meet requirements, but also to exceed expectations.

Kinectrics is committed to continually improving our effectiveness in providing customers with service to agreed standards of quality, timelines and cost.



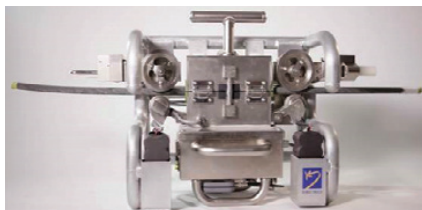
Advanced Technology For Non-Destructive In Situ Conductor Assessment



TRANSMISSION LINEVUE® INSPECTION UNIT

LineVue® is a proven technology, used worldwide, that rapidly obtains data on the condition of the steel core of a conductor. Collecting this information aides electric utilities in establishing an accurate health index to support better capital expenditure decisions and reduces safety concerns.

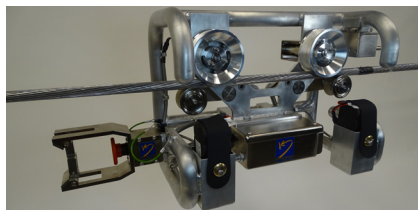
LineVue® is easy to transport and install on the conductor by line crew personnel. It is a non-destructive inspection device that is capable of inspecting energized and de-energized lines. This capability allows utilities to use the device on energized lines up to 500kV with no outage requirements.



MODULAR LINEVUE® INSPECTION UNIT

The Modular LineVue® Inspection Unit was developed to carry out inspections on both transmission and distribution size conductors.

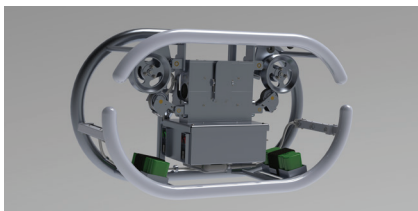
The unit is comprised of a modular system (drive module, sensor module, and recovery module). The unit enables easy lifting and installation by a single line operator and two drive modules maximize sensor utilization through a leap frog application. The robust recovery system ensures that the LineVue® unit is fully recoverable in case of an emergency rescue.



LINEVUE® RECOVERY UNIT

The LineVue® Recovery Unit was developed for utilities to inspect spans that are not easily accessible. The unit can operate in a manual mode with tethered rope for control or in a fully automatic mode that is useful for recovery on energized lines.

Upon installing the recovery unit on the line and turning on the power, the unit travels along the conductor to the LineVue® unit. A catch mechanism attaches the recovery unit to the LineVue® unit and assists in disabling the breaks on the LineVue® unit. The recovery unit then travels in reverse pulling the LineVue® unit back to the installation location for easy removal by the line crew.



DISTRIBUTION LINEVUE® INSPECTION UNIT

The Distribution LineVue® Inspection Unit offers many new features for inspecting distribution conductors, including: reduced dimensions and weight, an accurate sensor head designed for distribution conductors, and an on-board camera to view exterior conductor condition.

Main Components of LineVue® Devices



- a. Industrial motor drive
- b. Free floating encoder accurately indicates distance travelled
- c. Sensing head gathers 5 sample readings per inch
- d. LineVue® transmits real-time data for on-site review
- e. Corona rings enable use on energized lines

LineVue® Specifications

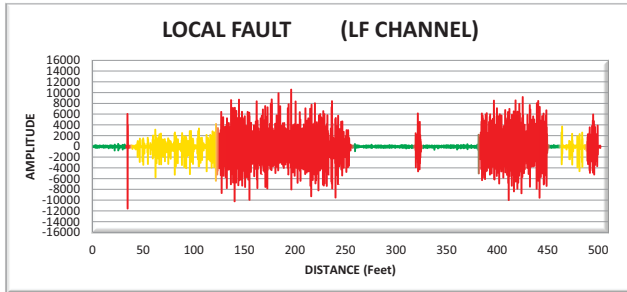
Parameter	Transmission Line Vue [®]	Distribution Line Vue [®]	Modular Line Vue [®]
Dimensions	L=90 cm, W=35 cm, H=53 cm (L=35 in, W=14 in, H=21 in)	L=61 cm, W=38 cm, H=32 cm (L=24 in, W=15 in, H=13 in)	L=55 cm, W=34 cm, H=46 cm (L=22 in, W=14 in, H=18 in)
Weight	31 kg (68 l b)	20 kg (45 l b)	Max 22.6 kg (50 l b) (includes drive module and sensor module) Sensor Module: 11.3 kg (25 l b) Drive Module: 11.3 kg (25 l b)
Diameter of Conductor	15 mm-45 mm (0.59 in-1.77 in)	6 mm-19 mm (0.24 in-0.75 in)	14 mm-29 mm (0.55 in - 1.14 in)
Voltage	Designed Voltage - to 765 kV Tested Voltage - to 500 kV	Designed and tested to 120 kV	De-Energized Only
Sensors	Loss of Metallic Area (LMA) – Measures average of the remaining cross-sectional area of all steel core wires over ~ 0.75 m (2-3 ft) length with better than +/- 5% accuracy Local Flaw (LF) – Indicator which detects local flaws such as pitting or broken steel wires Sensing head gathers 5 sample readings per inch (one reading every 5.08 mm or 0.2 inch).		
Speed	Approximately 40 m /min (130 ft/min)		
Operating Temperature	-20°C to 45°C (-4°F to 113°F)		
Operating Weather Conditions	Up to moderate rain and snow (i.e. 7.6 mm /hr or 1 km of visibility, 0.3in /hr or 0.62 mi)		
Power Supply	Two (2) 12V nickel metal hydride batteries		
Computer Battery Runtime*	Up to 5 hours		
Motor Battery Runtime*	Three (3) ~300 m (1,000 ft) spans on one charge (i.e. total of 1,800 m or 6,000 ft as Line Vue travels in forward and reverse). This distance is approximate and depends on the inclination of the spans.		
Data Transmitters	Data and control signals telemetered to ground based laptop in real time. Guaranteed minimum range of 1 kilometer (0.62 miles). Transceivers are 2.4 GHz.		
On-board Memory	~ 2 Giga bytes (Gb)		
Additional Features	High definition camera and Recoverable - Optional recovery system for fail safe operation	High definition camera	High definition camera and Recoverable - Optional recovery system (with belays) for fail safe operation

*Depending on field conditions, multiple battery packs maybe used during the inspection day.

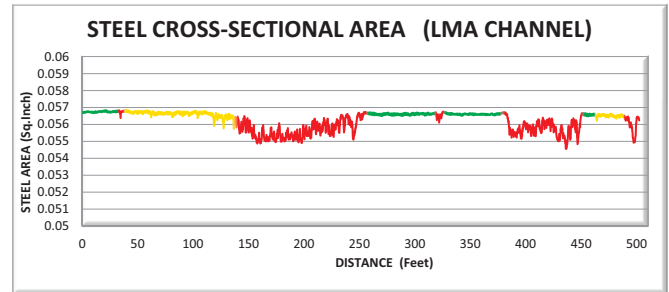
Live voltages tested: 60 kV, 128 kV, 230 kV, 345 kV (500 kV lab tested)

LineVue® Data – LF And LMA Graphs Analysis

LineVue® is a non-destructive device for measuring the remaining cross-sectional area of the steel core wires in conductors. The LineVue® tool can also detect any local breaks and corrosion pits in the steel core wires, all accomplished in the field, on both energized and de-energized conductors. The colorized LF and LMA graphs and conductor images below highlight the sections of a single conductor span that were considered to be in good condition with no corrosion and/or pitting (green), had some signs of corrosion and/or pitting (yellow), and had severe corrosion and/or pitting (red).



Local Fault (LF) - Indicator which detects local faults such as severe pitting or broken steel wires



Loss of Metallic Area (LMA) - Measures average of the remaining cross-sectional area of all metallic core wires over an approximate length of 2-3 ft. with better than +/-5% accuracy



These representative pictures demonstrate the extent of deterioration detected along the transmission line, as displayed in the LF and LMA charts above.

Kinectrics now utilizes the power of Artificial Intelligence and Machine Learning to analyze the data collected by the LineVue® device. Artificial Intelligence and Machine Learning actively removes signal noise from the collected data, reduces the need for human intervention, and provides a computer system with the ability to make decisions such as selecting the best algorithm for analysis of the data. In addition, using this state-of-the-art technology, Kinectrics is able to reduce the time required for the data reporting process and ensure that this complex task is performed consistently without errors by all operators.

Proven. Reliable. Accurate.

READY TO START ASSESSING? HERE ARE SOME OPTIONS:

1

Pilot Project

- Launch a 2-3 day mini-project
- Experience our LineVue® technology first-hand
- Gain confidence with in-situ, non-destructive evaluation
- Gain initial insight on the condition of your steel core wires

2

Launch Inspection Program

- Establish periodic inspection projects
- If new to OHL conductor inspections, start with 1-2 week program to identify critical areas
- Economic choice for less than 150 span inspections per year
- Full turn-key service - no previous training or knowledge required

3

Lease a Unit

- Perfect choice if planning to inspect over 150 spans per year
- We train your staff and certify LineVue® operators
- Provides the option to deploy LineVue® and start inspections when it works for you
- Off-site and on-site support and/or replacement unit provided, if needed

Installation Methods

The LineVue® units were developed with ease of installation in mind and can be installed by bucket truck/lift platforms, ropes/ladders, and helicopter. The units incorporate dedicated lifting points and/or structural components to facilitate the installation on the conductor. The exterior frame on all the units serve a dual purpose by providing an ergonomic handle when carrying the device and shielding the electronics and sensor from impacts during the installation or transport process.



Installation from Bucket Trucks



Installation from Ropes/Ladders

Installation Methods – Helicopter

Kinectrics has partnered with Haverfield Aviation to provide our clients with the option to install the LineVue® device on their conductors via helicopter. During a LineVue® inspection, other aerial inspections can be performed to maximize utilization of the helicopter. Installation by helicopter is a fast, efficient and cost effective method of deploying the LineVue® device, especially in remote or hard to access locations.



About Kinectrics

Kinectrics is the category leader in providing life cycle management services for the electricity industry. Trusted by clients worldwide, our expertise in engineering, testing, inspection, and certification is backed by our independent laboratory and testing facilities, a diverse fleet of field inspection equipment and an award-winning team of over 1,100 engineers and technical experts.

From initial design and type testing to operational deployment and maintenance services, Kinectrics collaborates closely with customers to ensure that utility assets perform safely, reliably and efficiently throughout their entire life cycle.



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