

All you want to know about Wirescan Digital in What? How? Where? Who?

What is Wirescan Digital and how does it work?

Wirescan Digital is a complete decision support tool for low risk, cost and labour efficient operation and maintenance of power cables. It utilizes Wirescan's proprietary LIRA and LIRA Live technologies for cable condition assessment and monitoring for energized and de-energized power cables.

What does it do: Wirescan Digital aggregates, stores and analyzes cable condition data and provides valuable cable health indicators/information. It can automatically detect anomalies in the measurement results, indicate local and global health condition, provide regular reports on status, notable changes complete with localization and severity, health indicator trending, ageing information, and recommended actions.

What it means for you: Wirescan Digital means a data-driven and predictive cable operation service for targeted/preventive maintenance, rapid decisions, knowledge-based flexibility, increased uptime confidence, and security of your power production, transmission, and distribution. Wirescan Digital follows your changing world: Wirescan Digital adapts to the user needs, targets, and new challenges by providing cable health indications in different contexts. Cable health data can be enhanced with relevant meta data such as map and weather data, and additional cable test information and health indicators from other sources as Time Domain Reflectometry (TDR), Distributed Temperature/Acoustic Sensing (DTS/DAS), Partial Discharge (PD), etc. Wirescan Digital is a complete cable condition service.

Will Wirescan Digital take much of your time? The opposite. The Wirescan Digital system is designed to free users' time and resources by automatically providing relevant cable health information needed to decide and plan maintenance, operation, budgets and investments in your power cable grid.

How will you know: Automatic and scheduled reporting with executive summaries and detailed health assessment can be provided by email, or the user can actively use Wirescan Digital as an online tool to access everything from measurement data to analysis results to manually or automatically generated reports.

If an event develops at a critical rate or magnitude, e.g. an early stage failure, Wirescan Digital can immediately notify you with a notification with a report with status and location.

Should you want to go deeper, look at an overall condition of your whole global portfolio, a single cable, a phase, or a specific hot spot - the interactive dashboard with map-based visualization of data and analysis results is easily accessible through a web browser on your laptop or mobile device. Wirescan Digital has all the options.

Wirescan Digital will help you to:

- Reduce Costs / Reduce OPEX, CAPEX, penalty cost and loss of revenue;
- Optimize Operations / Life extension, Lean asset management, Fast Fault Location, Decision Support;
- Project & Plan / elective condition-based repair & replacement, Early Warnings, Risk reduction.

The Wirescan Digital is a cloud based system consisting of a back end and a front end. The back end is where the data is stored, processed and analysed. The front end is the Wirescan Digital Dashboard where data and analysis results are visualized. And accessed by a user. This dashboard consists of a Cable Portfolio view (map based cable(s) visualization a global view of all the data that is stored in the system, in an intuitive and easily navigable manner), Measurement Explorer (to quickly explore and compare measurement data on a cable/phase/spot level), Measurement Analysis (to take a deeper dive in cable condition, comparison, trending, ageing rate, etc.), Report View (to view automatically generated reports or create, edit and review reports; the report types currently available are detailed Analysis reports for a set of measurements or Time Lapse reports for all measurements taken on a set of cables during a given time interval).

What is behind Wirescan Digital cloud analysis?

LIRA technology and LIRA algorithms are the cornerstone and basis of the Wirescan Digital cloud analysis.

The cable is exposed to a vector of 5,000-30,000 discrete frequencies and the resulting impedance spectrum, $Z(f)$, is the basis for the methodology. From the $Z(f)$, the patented signal processing and algorithms of Wirescan deliver a wealth of measurements as shown in the table.

LIRA Technology Value

Wide Spectrum Impedance [Z(f)]				
Spot Signature	Cable Characteristics	TDR	DeltaG	BTS
Impedance variations as function of cable length	Transmission line parameters	FDR impulse response	Wirescan patented ageing indicator	Far end termination condition assessment
Suitable for <ul style="list-style-type: none"> • condition assesment • condition monitoring • fault detection • fault localization • fault characterization 	Characteristics <ul style="list-style-type: none"> • Resistance (R') • Inductance (L') • Conductance (G') • Capacitance (C') • Characteristic impedance (Z_0) • Attenuation (α) • Phase velocity (β) • Effective permittivity (ϵ_{eff}) 	Suitable for <ul style="list-style-type: none"> • condition assesment • condition monitoring • fault detection • fault localization • fault characterization 	Suitable for <ul style="list-style-type: none"> • condition assesment • condition monitoring 	Suitable for <ul style="list-style-type: none"> • condition assesment • condition monitoring
		(TDR – Time Domain Reflectometry)		(BTS – Balanced Termination Signature)

What data can be uploaded into Wirescan Digital?

LIRA data acquired with LIRA One, LIRA GO! and LIRA LIVE.

Wirescan Digital is utilizing META data for visualization: geographic location and GPS coordinates, geographic extent of an asset, relevant construction information, bathymetry data, cultural data that may be of relevance, soft information, e.g. historical repairs, historical cable issues etc.

Wirescan Digital is a democratic platform and is designed to include cable data from other sources as Time Domain Reflectometry (TDR), Distributed Temperature/Acoustic Sensing (DTS/DAS), Partial Discharge (PD), etc. Wirescan Digital is a complete cable condition service. Apart from an obvious benefit of having all your data centralized in one well-structured data-base, additional information on cable condition will allow for more in-depth assessment of cable health, trends, aging rate and yield even more value from comprehensive LIRA analysis.

What are cost and HSE benefits of Wirescan Digital?

Moving from a fail and fix to a predict and prevent operation has proven to be a successful transition for many industries. It releases the wealth of cost savings. The cable network business has lagged behind this development for a simple reason – there has until now been no comprehensive and affordable condition assessment and monitoring technology available, which is the basis for condition-based maintenance. Wirescan is now changing this with Wirescan Digital.

Wirescan Digital system influences OPEX positively and increases reliability and predictability. It releases the potential available in large quantities of high quality collected cable condition data by analyzing them in the right context. This improves control of day-to-day operations and helps to optimize the size and management of operational and maintenance teams.

In a situation where operators have insufficient cable condition information to choose between replace or repair, they are often left to hope for the best, financial risk is introduced. If the cable is replaced too early, CAPEX will be higher than necessary. If the cable is replaced too late, OPEX will be higher than necessary.

Downtime is accompanied by penalties in addition to loss of income. Being able to plan downtime based on actual cable condition information will help operators manage and predict also this cost.

If you have cables you are most probably encounter at least one of the three challenges: the data are not available at all, the data are difficult to access or the data are in format which makes it difficult to utilize.

A “Fail & Fix” model is basically firefighting. More time and effort go in to creating procedures rather than processes. In a “Predict & Prevent” model, the fact that the operator will know well in advance where faults are more likely to occur puts him in a position to introduce condition-based maintenance.

As has been demonstrated in other industries, condition-based maintenance reduces downtime and maintenance cost while it improves equipment performance and increases asset life. Instead of being on “fire duty”, operations teams can spend their energy on prioritizing actions, ensure safe operations, preserve asset value and minimise environmental impact.

What is the price and terms of Wirescan Digital?

Wirescan Digital is based on a renewable subscription with a fixed annual fee.

A minimum subscription period is 12 (twelve) months. Long-term agreements are available.

An annual fee includes all software licenses, support, updates, Wirescan Digital maintenance and services within a chosen package. Scaling or upgrade is possible at any time.

An annual fee is calculated based on a number of cables, an asset capacity or scope of a project.

Hardware for data acquisition is a one-time cost and is additional to an annual fixed fee of the first year.

All data acquisition software is included in the Wirescan Digital annual fee.

We offer Wirescan Digital of different levels. Please contact us for further information.

What cables can be monitored in Wirescan Digital - in operation or de-energized?

Wirescan Digital is for all electrical cables. You can include unlimited number of cables into the system – from one to hundreds of thousands or millions.

Wirescan Digital is applicable for monitoring of de-energized cables and cables in operation.

As it is based on the LIRA technology, it has no limitation in terms of voltage or lengths for de-energized cables.

Commercial solution with Wirescan Sensors for monitoring of cables in operation is currently available for LW and MW cables (up to 33 kW) with a length limitation up to 16 km. Wierscan

Sensors are developed for T-type terminations and are installed permanently. They do not require any changes in termination.

Wirescan is interested in industrial partnership to develop solution for 66 KW and other types of terminations. Please contact us to declare your interest.

How do I integrate Wirescan Digital in the existing digital platform of my company?

Wirescan Digital is prepared for full integration with the operator's other management and operations systems through Wirescan API.

How Wirescan Digital will influence my operation and asset management?

Wirescan's offering will enable the operator to guarantee uptime, say goodbye to outages and strongly reinforce the reputation of a reliable provider. Our offering is not "another system" but can be integrated with other business systems in a plug & play model.

Wirescan enables digitalized predictive asset management. A cable network operator will at all times have a portfolio overview and can zoom in on different parts of his network. A flexible detail level puts the operator in a position to make a global assessment of all his assets, zoom down to a geographical or systematic level, identify the cables in need of maintenance and the cables where a "repair or replace" decision has to be made. Analytics enabled by the online database will in turn help the operator optimising the "repair or replace" decision.

Wirescan is offering a breakthrough in cable assessment. There is no other technology as comprehensive and it is the only online system that provides the operator this wealth of opportunities without the need for huge investments. Wirescan provides its data by using the cable itself as sensor, eliminating the need for additional systems like fibre optics with follow-on costs and risks.

How many cables can I include in Wirescan Digital?

Wirescan Digital has no limitation as to number of cables or geographical locations. Please see also "Where do I start with Wirescan Digital?"

How do I collect data?

Wirescan has created data acquisition tools to ensure high quality of data. You cannot acquire LIRA data with any other tools.

DATA ACQUISITION TOOLS FOR WIRESCAN DIGITAL		
De-energized cables		Energized cables
Manual data acquisition		Automated continuous data acquisition
LIRA ONE	LIRA GO!	LIRA LIVE

How Wirescan Digital helps to optimize operation?

Operational excellence requires a process focused mindset and the ability to take informed, operational decisions at all times. Decisions are supported by data and analysis. If the data quality is low, downside protection and contingency planning become very important. In a cable network, lack of quality data introduces operational risk that can be reduced by investing early enough to avoid breakdowns, installing redundancy or by having a very efficient repair capability that quickly fixes faults as they appear.

By providing high quality online data, build a database, apply analytics and carry out trend analyses, the operator can rely less on downside protection and contingency. He will, instead, have a tool that allows condition-based maintenance, ensures efficient asset management, provides cable life extension and optimises “replace or repair” decisions.

And if a cable for some reason fails, Fast Fault Location enabled by Wirescan’s technology will reduce the downtime to a minimum.

How results of Wirescan Digital are communicated to me?

All data and results are available at any time and are displayed in a user-friendly metacontextual map-based visualization. Visualization levels range from Portfolio (if applicable) to a specific Asset, to a single Cable to a single Phase. Wirescan Digital does not have geographical restrictions nether in terms of access or visualization. Your will see new results, new cables or assets as soon

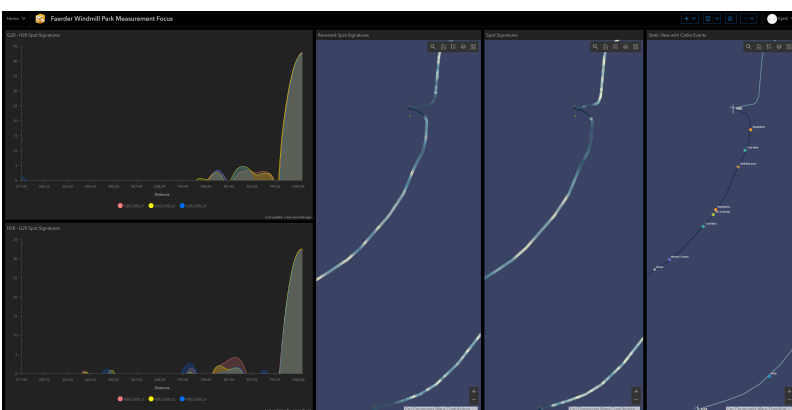
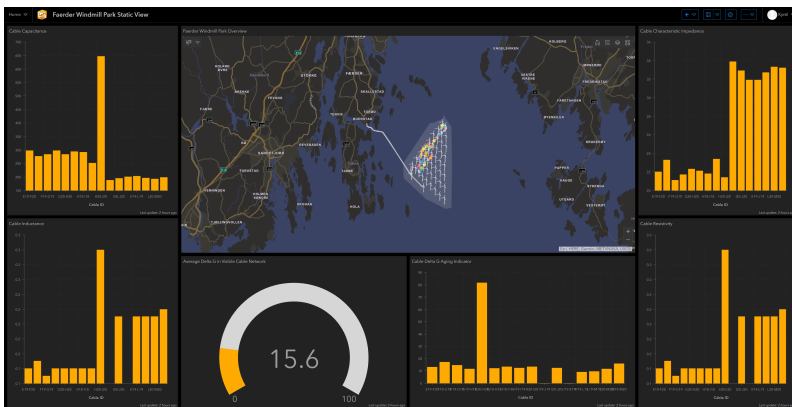
as they are added to the cloud. You can see overall condition of your cables as well as assess historical data and specific events.

Wierscan Digital is easily accessible through a simple log-in via a browser on a laptop or tablet in your office, home or on site. [unchanged part] Automatic and scheduled reporting with executive summaries and detailed health assessment can be provided by email, or the user can actively use Wierscan Digital as an online tool to access everything from measurement data to analysis results to manually or automatically generated reports.

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You are always up to date on the condition of your power cable grid, and timely notified when and where things start to go wrong. Wierscan Digital is your predict and prevent tool for efficient cable operation and maintenance with potential significant savings in cost and time. Your gain is operational excellence and security.





How can Wirescan Digital enhance grid investment value and positively impact ROI and operational cost?

Valuation is at the heart of any investment or budgeting decision, whether that decision is to buy, sell, increase your ROI or optimize the cost of the operation and maintenance of your power production, transmission, and distribution. Wirescan Digital is a complete data-driven and predictive cable condition assessment service which allows you to increase the value of your grid, reduce cost and increase earnings through the actual knowledge based valuation and reducing various risks which affect your operation, hence your financial results.

What are the financial and investment enhancement benefits a Wirescan Digital serviced grid owner can enjoy:

- optimize and reduce a maintenance budget through targeted condition-based operation;
- avoid early life failures and associated unplanned cost, penalties and a loss of production;
- a basis to reduce insurance premiums or ensure better terms with your insurance provider;

- shorten and simplify processing of warranty and supplier liability cases and associated cost;
- reduce ROI time and enhanced investment value through enhanced grid uptime, cost control and extended life-time;
- reduce response time and cost due to early warning and high accuracy failure localization;
- avoid emergency repair cost (*quantified as 8 to 10 times higher than planned maintenance cost based on customer data);
- ensure valuation and benefits at sale or acquisition of grid through cable portfolio condition and ageing assessment.

Where in the project life cycle can I utilize Wirescan Digital?

Wirescan Digital is applicable during the whole lifetime of the project i.e. from manufacturing to decommissioning. It can be introduced to new installations and existing facilities in operation.

You can start getting tangible benefits already at manufacturing stage. Cables are exposed to extensive external impact during pre-commissioning activities.

LIRA measurements (fingerprinting) at crucial manufacturing milestones, factory acceptance tests, after transportation, before, during and after installation provides quality assurance along the whole cable journey. If any event occurs, it can be swiftly detected and corrected before any additional cost or unpleasant contractual and liability issues kick in. At the same time while you progress in your project, you create an invaluable data log and reference base for the future use. Where shall you use it? First of all, in operation. Forget uncertainties, ever present stress and unforeseen cost of the Fail & Fix mode and move to the confidence and security of the Predict & Prevent asset management. Whenever you monitor your cables – regularly during planned maintenance or continuously during operation, Wirescan Digital will not only assess the current actual health of your cable but will compare it to the reference data and detect any changes, deviation, trends, hot spots which will require your attention and will help you to decide on next steps in your maintenance plan. You should not forget that reference data base proved to be invaluable in any guarantee, insurance or liability issues which may arise in the post-commissioning period.

Where shall I start?

Wirescan Digital allows the operator to monitor his network and tailor an array of tools and services based on his needs. As an owner or operator, you may already know weak points of your cables.

We recommend starting at least with your critical cables i.e. either ones prone to failure or the ones you will never want to fail – the consequences will be dire. Wirescan Digital allows you to combine regular monitoring of cables in de-energized mode or monitoring in operation. You can scale as you go and include more cables when you need. The beauty of Wirescan Digital is that it has no limitation on number of cables or geographical spread. You can start with one cable or one facility and grow from there.

Wirescan can always help you with a cable portfolio assessment based on your existing data and information or assisting you in fingerprinting your cables.

To get started, we use Wirescan's Digital tool for data acquisition on de-energized cables to carry out a portfolio review. The data from this review are uploaded to the cloud. Based on the overall network condition, a selection of cables to be monitored in operation is made and sensors are installed on these cables.

Wirescan's systems are easy to install and to commission. Depending on the operator's preferences, Wirescan, a local partner or the customer himself can do the actual installation, Wirescan is also able to offer training for this purpose.

For the initial portfolio review measurements, less than 30 minutes is spent on each cable. For the sensor installation, in average two hours is required per cable depending on a site logistics and practical conditions.

Following the sensor installation, the system is ready, and monitoring can start. It is important to remember that the initial portfolio review measurements are available in the cloud and constitutes a basis for future extensions of the system.

In conclusion, all Wirescan needs to enable condition-based monitoring of the operator's cable network is access to the network.

We are always there for you with our advice and recommendation. Have more questions? Please contact us today.

Where can my company use Wirescan Digital?

- Operation & Maintenance;
- Life extension;
- Investment and budgeting;
- Procedures and resource management;
- Insurance and liability claims;
- Quality assurance and cost control in project implementation.

Who owns the data in Wirescan Digital?

Data in Wirescan Digital is always property of a cable owner. Wirescan teams will need access to data to ensure high quality of the process, updates and proper maintenance and management of the system. We do continuous development of the system and plan to add new features and functionality following the needs and requirements of our customer. This way you will yield maximum benefit as Wirescan Digital customer. We can work with anonymized data.

Should you have any concerns or limitations, please contact us to discuss.

Who in my organization can benefit from WD results?

Who	Application
C-level executives	asset performance, investment assessment, overall economic and strategic planning
Financial & Legal Council	asset economics, insurance, liability claims, guarantee claims
Operation & Maintenance	procedures, maintenance and resource planning, budgeting, operation planning
Engineering division	Project engineering, life extensions, modifications
Onsite personnel & emergency response teams	Asset condition, hot spots or fault location
HR	resource management and requirements