



GE VERNOVA

governova.com/power-conversion

DIGITAL SOLUTION

An intuitive, modular range of
Digital applications, tools and
services

DIGITAL





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SOFTWARE AND ANALYTICS ARE CHANGING THE WAY WE DO BUSINESS

Every year industries spend billions of dollars on equipment – not just capital costs but also maintenance, downtime and even inefficiencies. That's a lot of money. And because industrial machines are often critical to infrastructure and economies, we all still pay it every year. Of course, it's good to invest to keep assets healthy. But what if we could get more out of that investment – more predictability, better and simpler situational awareness, improved performance?

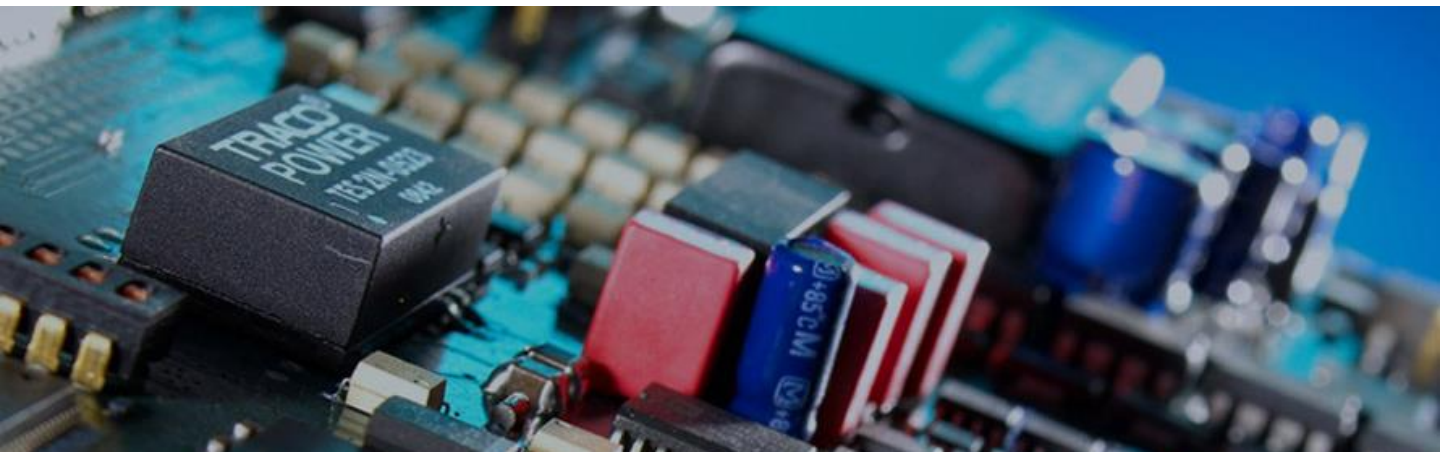
Software and analytics are changing the way we all do business. They can provide us with a wealth of information, but it needs to be accessible, useful.

At GE Vernova Power Conversion business, we put to play software and analytics, connecting the physical world with data, to enable operational and business outcomes that matter.

We create usable tools and valuable insights to help you optimize asset integrity and operational performance. This helps better adaptation of operations to different priorities and changing environments. It means that decision-making can be driven by data, information and insights.

In addition to GE Vernova expertise in digital solutions, our deep domain experience means we understand applications across the marine, energy, process industry and infrastructure sectors. We have more than 100 years of electrification expertise and one of the largest installed bases of electrical and control assets. They work to high performance and availability requirements, and in rugged and remote operating conditions.

Our engineering and software know-how unite to enable intelligent asset strategies. We build solutions that work for your business model, helping to improve investment return on your valuable business assets.





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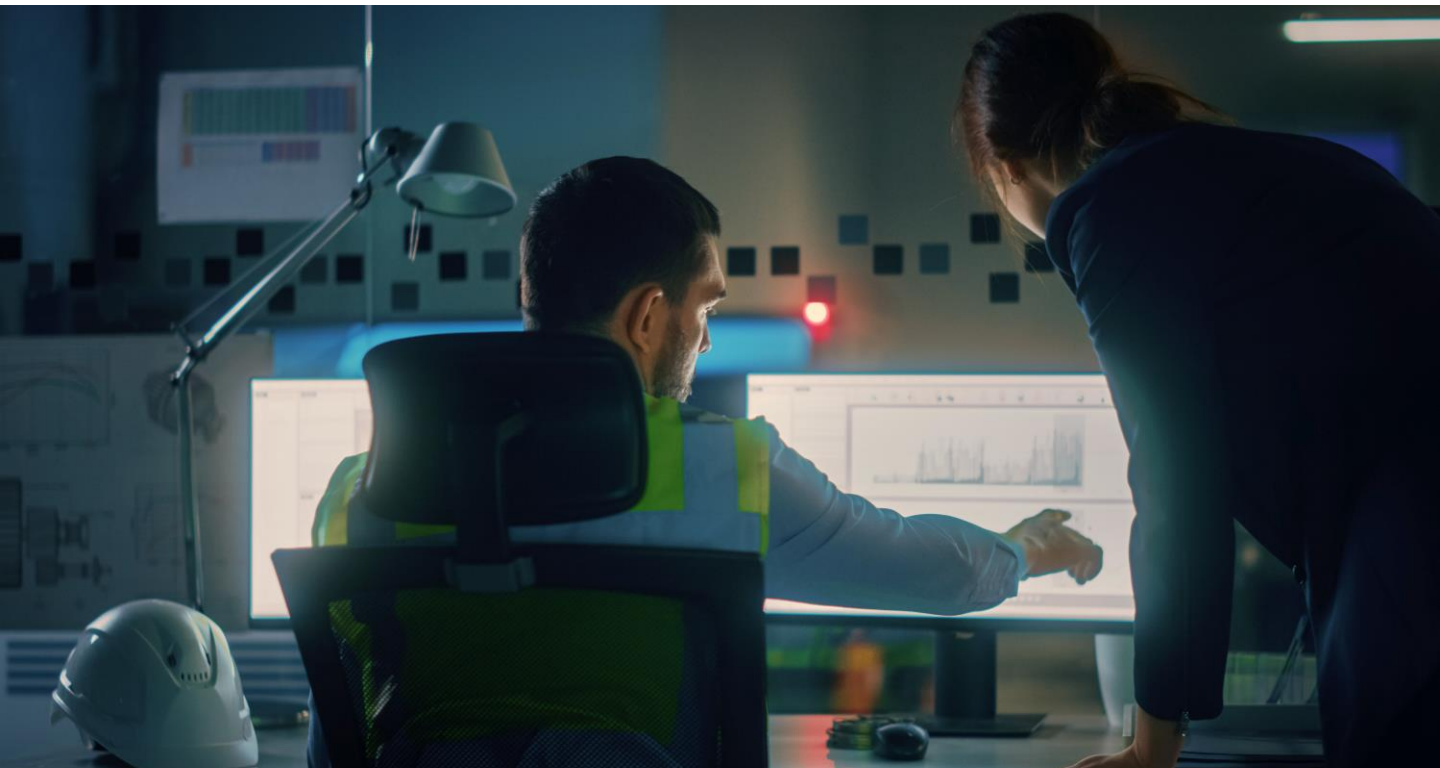
MAKING DATA WORK HARDER, ENHANCING PERFORMANCE

If you're looking for ways to reduce downtime and enhance the performance of operations and assets, GE Vernova Power Conversion's simple suite of clever software applications can help. Its flexibility includes 'site or local' and cloud-based options which help to optimize operations and energy and enable predictive maintenance and cyber-secure service solutions.

GE Vernova Power Conversion's digital suite is based on a straightforward, modular range of digital app's, tools and services, connecting data with the right people. Already, more than 500 sites are benefiting from Power Conversion's digital solutions.

Each of our three easy-to-navigate offerings focuses on a key area of improvement:

Operations+, **Maintenance+** and **Services+** tools and apps provide solutions for organizations of all sizes, regardless of their current level of digital transformation. Simple to install and user-friendly, Power Conversion's digital suite is about connecting people with their machines and equipment through useful, actionable intel and real results.





UNDERSTANDING PERFORMANCE

Critical assets may not always perform at their peak. Understanding when and why they perform below peak levels unlocks the opportunity to improve performance. Even the smallest unplanned downtime and loss of efficiency can hit the bottom line.

Analyzing past and present performance in detail and using that information to improve efficiency can leverage more from your investment in critical equipment and operations.

This is where Power Conversion business can help.



Services+

Access remote services and experts for on-tap asset health support.



Maintenance+

Improve reliability and availability, right-timing maintenance and planning downtime.



Operations+

Unlock greater efficiency in ops performance and energy efficiency.

Powered by Visor: Security | Connectivity | Data

1

Remote Services and Support

Lean mindset, expand the capability and resource of your organisation

2

Asset Performance Management (APM)

Monitor **health** of assets, **optimize** maintenance and **prevent unplanned downtime**

3

Optimiser

Enhance operations **efficiency**, **predictability**, **reliability**, and **safety**



OUR DIGITAL SOLUTION



Services+

Access remote services and technical experts for asset health support

- Real time asset monitoring for rapid remote support
- Industrial Data Historian with visualization tools
- Optional remote software upgrades and patching



Maintenance +

APM : Advanced asset prognostics using high frequency data

- Increase reliability and availability of assets.
- Early warnings in asset degradation to prevent unplanned down-time.
- Move from reactive maintenance to proactive maintenance approach



Operations+

Access remote services and technical experts for asset health support

Operations+ solutions include Energy and Performance for Dynamic Positioning Optimization.

Operational efficiency, repeatability and safety are enhanced with the help of real-time feedback on operational Key Performance Indicators (KPIs), with advisories for timely and targeted intervention.



SERVICES+

Remote Engineering

Delivers on-tap expertise to remotely manage, update and check on the health of your assets.

As the world adapts and even benefits from increased digital remote operations, GE's Services+ Engineering solution is the secure interface between your operations and our Ops Centers. It provides peace of mind to have your teams and equipment connected quickly and directly with an engineering specialist and our diagnostic tools. Reducing the time and travel costs associated with experts visiting your site, this cost-effective remote solution can help keep your teams lean.

How does it work? Connectivity for the Services+ Engineering solution's remote monitoring and diagnostics (RM&D) of drives and automation systems is enabled by GE's Visor Service Portal. The Visor data platform, which sits at the heart of GE Vernova Power Conversion's digital suite of solutions, provides a single, encrypted tunnel meeting security compliance standards to your site or vessel. Read more about GE's cyber security and the Visor platform and the Visor platform in the Implementing Your Solution section below.

The Services+ Engineering tool enables remote and secure software updates.

Cyber Services

We offer cyber security services to complement your Cyber Security Management System (CSMS), specifically aimed at supporting IEC62443 certified automation and control solutions. Our services include:

- Automation inventory creation and regular update surveys
- Advice on recommended product and system updates
- Risk assessments and threat modeling prior to updates/changes
- Patch monitoring to help enable quick mitigation of new exploits
- IEC62443 training





MAINTENANCE+

Asset Performance Management

Unexpected Failure of Rotating Machines including motors and generators can become a highly costly event with associated downtime, production disruption and unsafe conditions.

How can we help?

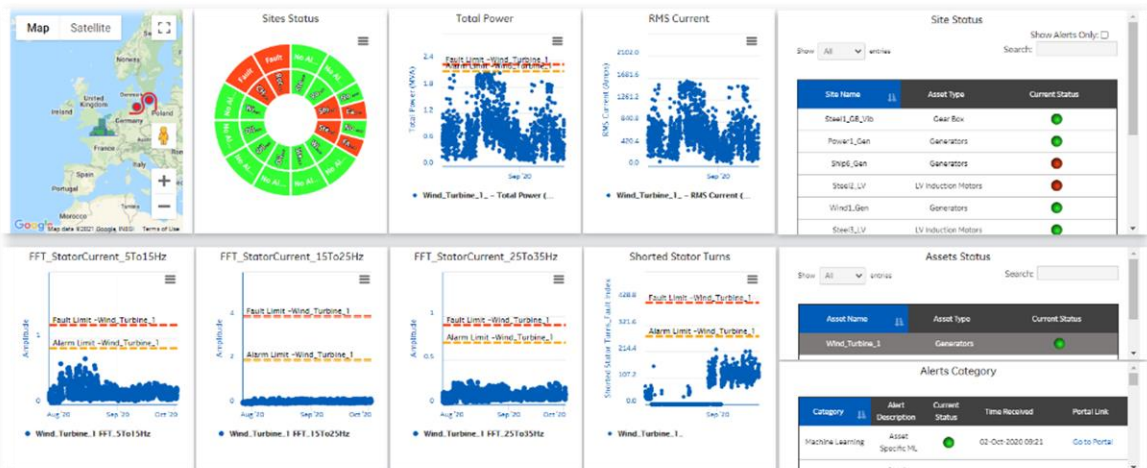
As part of the Maintenance+ offering, our Asset Performance Management (APM) solution helps to improve asset reliability, availability, schedule maintenance and reduce downtime.

Predicting failures on critical assets in time for them to be avoided, or at least mitigated. Detecting early degradations and performance problems is possible by using Predictive Maintenance methods based on Motor Current Signature Analysis (MCSA) and Electrical Signature Analysis (ESA) while the asset is in service (online)

- A wide range of mechanical and electrical degradations can be detected as compared to vibration or temperature monitoring only.
- No additional sensors are required, except CTs, VT/PTs.
- High fidelity power system waveforms are taken from the motor/control cabinet.
- The Rotating Machines Health is continuously monitored. No need to stop operations to assess the machine condition.

Anomaly detection powered by machine learning (ML) is also part of the solution, uncovering hidden patterns and identifying additional issues.

In the case of the drive system health, continuous monitoring using Key Performance Indicators (KPI) trending along with other advanced algorithms allows to provide early warnings on potential failures that could result in downtime.





MAINTENANCE+

Asset Performance Management

What is the Value of the Solution?

- Increased operations predictability and asset availability.
- Enabling timely corrective actions.
- Mitigate the impact of failure and repair or replacement costs.
- Contribute to avoidance of downtime altogether and prevent safety issues.
- Reduce emergency calls and reduce downtime resulting in lower maintenance cost.
- Identify issues before they can cause disruptive failures.
- Display health of your drive system.
- Real time drive monitoring, trending, historical data.
- Reduces troubleshooting time, identifying the drive failure RCA and recommend inspections on affected areas.
- Access to KPI data to perform analytics for early detection of mechanical and electrical degradation.

Failure modes

<p>Electrical Faults Negative Seq. Current Negative Seq. Voltage* Stator Faults Rotor Faults Stator insulation degradation**</p> <p>* Need both voltage and current signature analysis ** Adding online partial discharge detectors to the system</p>	<p>Mechanical Faults Mixed Eccentricity Gearbox issues Coupling/ Bearing/Vibration (FTT) Bearing Faults (ball/roller) Outer/ Inner race Ball/ Bearing Fault Bearing Faults (thrust/sleeve)</p>
<p>Electric Supply - KPIs KPI -Frequency, Current RMS, Voltage RMS, Negative sequence current and voltage, Active power, Reactive Power ,Total power, PF, dv/dt at the point of sampling, Estimated speed</p>	
<p>Anomaly Detection (ML) - With Individual asset baselining - In comparison to a healthy asset</p>	



OPERATION+

Energy Optimiser

Helps Maximizing Operational and Energy Efficiency with minimum emissions as a result of real time feedback using operational key performance indicators (KPIs) including advisories for timely and targeted on-site actions.

How can we help?

As part of the Operations+ offering, our Energy Optimiser solution unlock greater efficiency in operations performance and energy efficiency.

Minimize the energy footprint when fuel consumption and emissions are reduced as a result of an optimized system configuration. Several factors have impact on the fuel consumption and associated emissions.

When comparing current vessel status to historical operating states, profiling similar speed, system load and weather conditions, the optimum system configuration can be determined, enabling real-time decisions on how best to operate the power system.

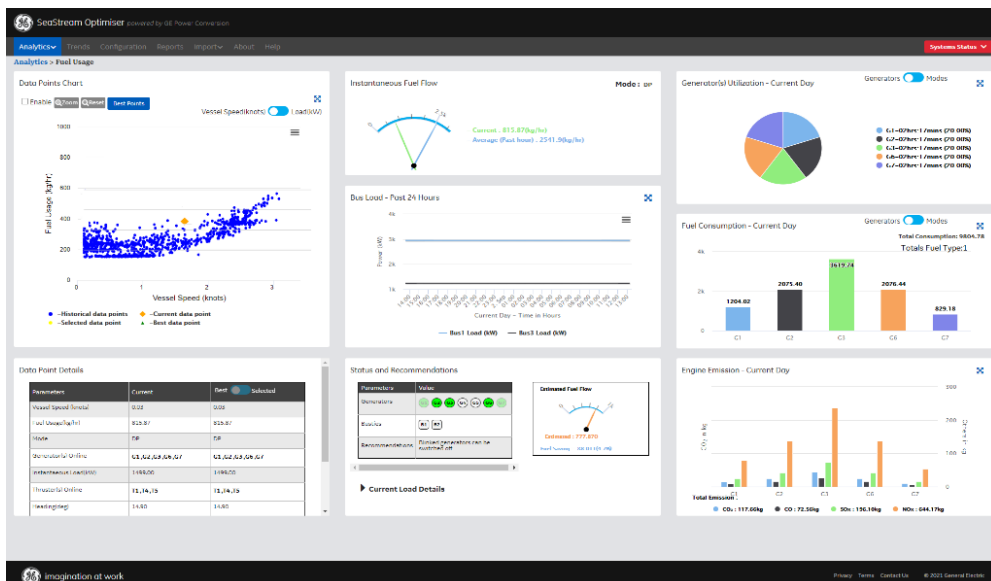
- Suitable for any marine applications, but in particular for those with high fuel and energy usage.
- Help to achieve cleaner operations and reduce operational expenditure.
- Provide insights for the IMO reporting

What is the Value of the Solution?

- Provide savings to the vessel in fuel costs without compromising on the efficiency of your journey.
- Reduces cost of engine maintenance due to reduction of running hours and more efficiently
- Enable informed decision making to operate the power system.

What is the impact on Environment and associated regulations?

- Helps you comply with IMO regulations of Energy Efficiency and sustainability.
- Helps protect the water mass quality by reducing emissions of Sulphur Oxide (SOx)
- Reduce air pollution by reducing the emissions.
- Transparency reporting to customers and stakeholders





OPERATION+

Performance Optimiser: Dynamic Positioning

Deliver enhanced insights that help drive operational improvement, including settings adjustments, tolerances and operator training.

How can we help?

As part of the Operations+ offering, our Energy Optimiser solution unlock greater efficiency in operations performance and energy efficiency

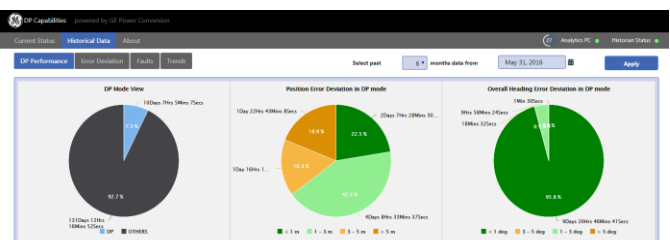
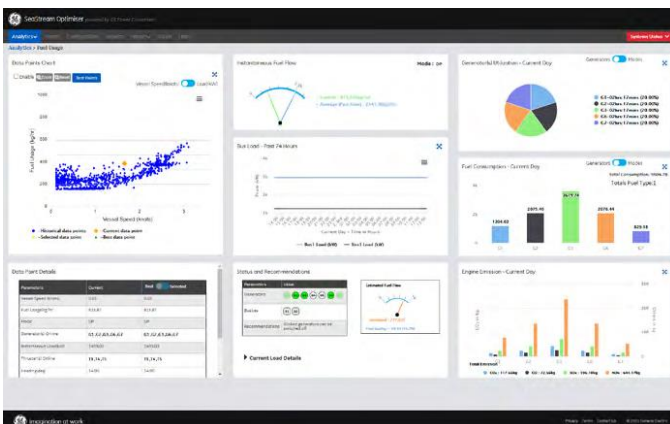
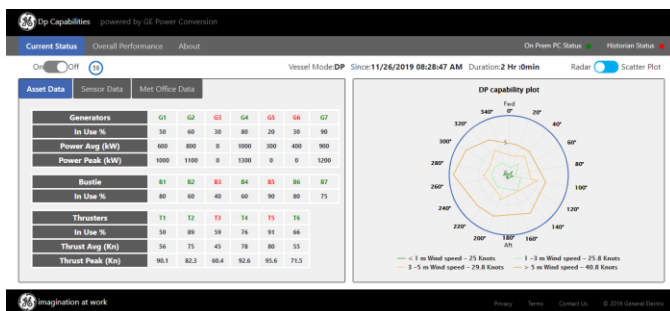
Our solution is designed to capture and display real time performance and accuracy of your Dynamic Positioning (DP) System.

Compatibility with Performance (DP) Optimiser and Dynamic Positioning systems

Energy & Performance (DP) Optimiser are combined into a single app and designed to work seamlessly on vessels with GE's own Vessel Control and Dynamic Positioning Systems, or as a standalone product with any 3rd party vessel control/automation system.

What is the Value of the Solution?

- Improve situational awareness, operations reliability, and generate reports with transparency
- Provide up-to-date insights of the performance and capability of the vessel's DP system
- Visualize failures that take place during DP operations and drill down into the details
- Best practices sharing for vessel energy efficiency or across fleet and defined mitigation actions.
- Vessels comparison within the same fleet.
- Compact and cost-effective solution





IMPLEMENTING YOUR SOLUTION

Conceived for operators

The suite is built on Power Conversion’s industry wide expertise in IT, OT (operating technology) and IIoT (the industrial internet of things). Above all we believe it should be intuitive, visual, and customized for your operational needs. Featuring simple, clear interfaces it provides organizations of all sizes with access to Power Conversion’s powerful data analytics, made accessible and usable by providing better intel and situational awareness. Genuine performance improvements are within reach, to help your organization work with increased efficiency and profitability.

Selecting your solution

Choose a single app or a custom suite of tools from our three modules—Operations+, Maintenance+, and Services+. We are here to help you learn more about Power Conversion’s digital suite value package, including the most cost-effective way to access solutions through integration with your Long-Term Service Agreement with GE Vernova.

Whether you have a single site, complex vessel, entire fleet or a multiple-site operation, we can answer your questions and help align your selection with your organization’s KPIs and operational priorities.

Common Architecture – Flexible and Scalable

Analytics + Dashboards

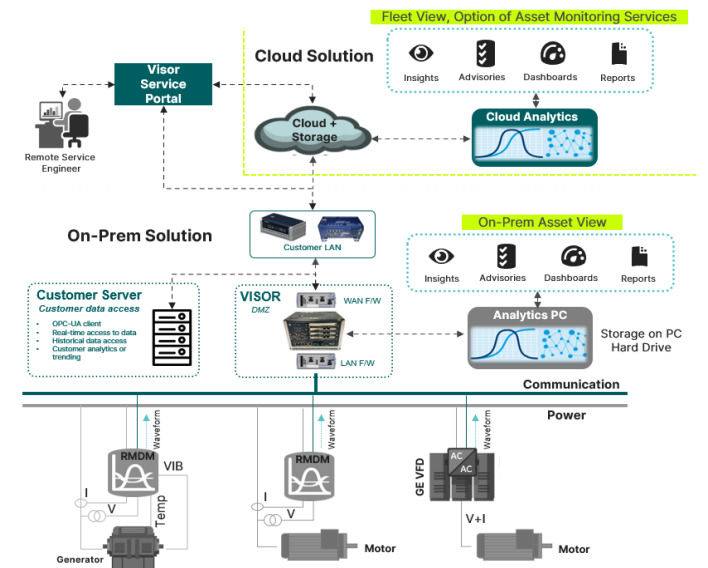
- Advanced algorithms and Machine Learning
- Single or multi-site asset views
- Data storage (Cloud or Analytics PC option)
- Auto-reporting

Site Data Storage and Secure Transport

- Communications interface to site equipment
- Storage of collected data and files
- Deadband and reporting options for streaming
- Automatic file push to cloud (buffered)

Data Collection

- Direct from PC or customer owned non-PC equipment/systems
- Indirect using existing equipment
- Variable capture frequency to suit specific applications





INSTALLING THE SUITE

Peace of mind with GE Vernova Power Conversion's Visor platform

One powerful data platform brings GE Vernova Power Conversion's digital solutions together - seamlessly and securely

Backed by more than 15 years of proven product experience, PC's Visor platform's common architecture — scalable to multiple sites — delivers the remote monitoring you need, while meeting the much needed security standards. The Visor Service Portal and Visor Connect Box enable data storage and remote connectivity and provide a unified cloud dashboard for displaying analytics and insights.

The Visor Connect Box provides remote access securely through a simple, compact hardware installation that is connected to your system control network.

It collects data and stores it in compliance with security standards. It also acts as a gateway, sending data to be discussed to GE Vernova Power Conversion's cloud storage and allowing our experts access to the system – under your control – to provide Services+ Engineering support. As an important data and network interface it incorporates our security management suite in alignment with the IEC62443-4-2 protocols. Firewalls isolate Visor from administration and control networks.

CYBER SECURITY

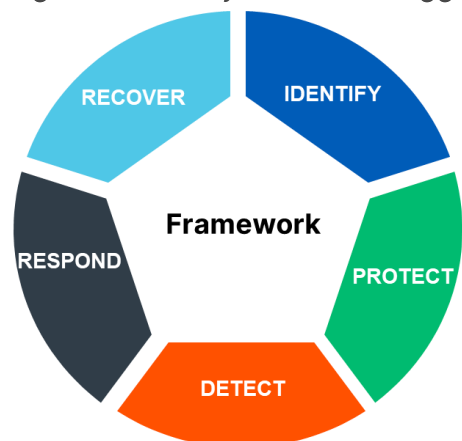
Reducing exposure to vulnerabilities associated with software and connected systems

Industrial applications benefit from enhanced operational performance enabled by electrification, connectivity and advanced controls, with increased use of software and analytics. Even in long-cycle industries, there is now a need to update systems more frequently than in the past - as people expect to do with personal tech - to reduce exposure to vulnerabilities associated with software and connected systems.

The latest standards specific to industrial applications reflect how important cyber security is for critical infrastructures. They also help to demystify and formalize security for both system providers and operators in a series of risk management outcomes.

GE Vernova Power Conversion's digital suite and our control and automation platforms are aligned with the NIST framework, IEC

standards 62443 and 61508 for cyber security and integrity, and with specific industry sector requirements such as IMO security guidelines. The platforms also are verified by Exida and Achilles certification. At a practical level our Visor data platform provides centralized user access management and system audit logging.





GE VERNOVA

About GE Vernova's Power Conversion Business

GE Vernova's Power Conversion business applies the science and systems of power conversion to help drive the electric transformation of the world's energy infrastructure. It does so by making and delivering advanced motor, drive and control technologies that evolve today's industrial processes for a cleaner, more productive future. Serving specialized sectors such as energy, marine, renewables and industry through customized solutions and advanced technologies, GE Vernova's Power Conversion business works with customers to increase efficiency.

To find out more:

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