



GE VERNOVA

Power Conversion

# MV3 SERVICE SOLUTIONS



# AT YOUR SERVICE

**Every industry is looking to maximize productivity, improve reliability and reduce costs. At Power Conversion, a business of GE Vernova, we understand that the goals of your organization are demanding and evolving. Let us know your priorities and our service experts will work with you to understand parts inventory, historical maintenance, environmental conditions, budget and operational constraints and propose services aligned to your business imperatives.**

Our proven electrification technologies and engineering solutions are readily available to help customers achieve optimized efficiency, reliability and availability, as well as grid compliance and stability if required. Power Conversion's converter and generator technologies are recognized around the globe.

With more than a century of expertise in the design, manufacture, installation and service of converters, and continuous commitment to innovation through investing in research and development, our converter technologies continue to grow and evolve with industry needs and long-term strategies. Whether you are an Industry & Power, Wind, O&G or Marine customer that installed recently or 10+ years ago our MV3 converters, we can service your strategic assets and discuss optimization and upgrade solutions.

## Lifecycle support for your installed base, for sustained efficiency and operability

Given the drive to reduce operations and maintenance spend and achieve an improved Levelized Cost of Energy (LCOE) in the energy market, efficient operation of assets is critical. Power Conversion offers lifecycle services which can help maximize uptime and improve energy production. Our global presence, local footprint and responsiveness mean we can offer comprehensive service packages for electrical systems.

**Power Conversion's services program can be tailored to meet your needs to include:**

- Spares and replacement parts
- Onsite troubleshooting and repair services
- Retrofits, refurbishments and upgrades
- Customized training on site or at a GE Vernova facility
- 24/7 remote support via cyber-secured VISOR
- Preventive maintenance
- Service contracts
- Obsolescence Management

### Benefits of our support and services

Engaging us to support your installed base can provide you:

- Optimized converter reliability and/or performance
- Reduced turbine down-time through on-time and expert support
- Customized management of your software updates - solely supported by Power Conversion
- Complete obsolescence management and support throughout converter's design life
- Secure and environmentally friendly delta packaging, for improved protection where handling at site may risk damage



## Providing original spare parts

**Holding the right spares in stock is vital for keeping your operations running efficiently, as well as avoiding long lead times and the unavailability of critical parts.**

As a leading OEM (Original Equipment Manufacturer), we commit to supporting your MV3000 converter installed base, offering genuine spares that can be purchased directly from us. We ensure all parts supplied are fully compatible for optimizing system reliability or performance (Fit-Form-Function), including obsolescence management.

Our experts can also work with you to build an **optimal spares strategy based on the criticality of each component for your specific operational process** and the related spares' delivery lead time.

- **Capital spare parts** - large spare parts can take a long time for delivery
- **Operational spare parts** - key parts for unplanned maintenance and upfront insurance is required
- **Maintenance spare parts** - key parts for planned maintenance, personalized by unit and by maintenance type
- **Spare parts packages** - commissioning spare parts packages / operational spare parts packages / insurance spare parts packages
- Recommended spare parts list
- Inventory refill
- Repair services
- Spare parts obsolescence management

## Performing repairs

**A repair requires appropriate special tools and technical knowledge as per specified standards**

Failure to follow these standards may increase risk of equipment failure due to lack of expertise, mishandling of tools or reuse of already damaged components. As part of our repair service, we will inspect and thoroughly test returned components and as far as site and customer information may allow, analyse probable cause for failure.

**We only reuse component parts that have been tested and confirmed to meet the required operating standards for reuse.**

As a starting point, to manage your outages better and/or minimize production disturbances, it is recommended to consider the insurance and operational spare packages in the table below.

Part	Type of part	Function	Risk in case of failure
<b>Rectifier</b>	Capital & operational parts	Conversion of AC to DC	Drive out of order
<b>DC</b>	Capital & operational parts	Storage and stabilization of electric energy	Voltage unbalancing, output power fluctuation, decrease of the power stacks lifetime, drive trip
<b>Inverter</b>	Capital & operational parts	Heart of drive technology	Drive out of order
<b>Cooling</b>	Capital & operational parts	Keep power stacks at working temperature	Drive out of order
<b>Delta</b>	Capital & operational parts	The brain of the drive	Drive out of orderw

## Extending equipment life and accommodating power increase

At Power Conversion we are developing upgrade paths to enable customers to migrate to the latest RXi based control technology, that can help to increase converter life and reliability. The low-risk CDC to PECe upgrade solution not only simplifies your drive system, but also brings added flexibility for future enhancements and enables digital connectivity. Power Conversion is also developing new Delta Module Replacements (DMR) that are an enabler to potentially increasing the power output. The DMR is a fit-form-function replacement and offers higher reliability and an increase in turn off capability of up to 50%, in case of a failure event.

### The CDC to PECe upgrade

Modernization to the PECe platform can be a low cost option for replacement of CDC with PECeLite controller. This enables to keep systems up to date, without the need to undertake a complete system replacement. PECe provides improved core product security, establishes the foundation for meeting IEC 62443-3-2 Cyber Security requirements and helps ensure robust systems, networks and application protection. The PECe platform is the standard performance drive controller of choice for all Power Conversion's AC and DC drives, across the LV and MV power range. PECe can deliver a powerful, rugged and cost-effective configuration which works in stand-alone mode or with existing drive systems, to help meet stringent operational requirements.

### Upgrade benefits

- Modern control system with fast network access and enhanced security features
- Scalable performance, simplified upgrade process and futureproof modular configuration, based on a range of power stacks, I/O interfaces, and modern COMeCPU module
- Adaptability to new grid code regulation through software
- Remote monitoring and diagnostics capability via Power Conversion's Visor solution, enabling remote service support and providing automatic drive trip notification/trip history
- Reduced requirement for spares through use of modular control hardware configuration, enabling application for a wide range of drives
- Total lifecycle care through our global expert network and local presence



## Replacing your Delta Modules holds many advantages

**Over the last 25 years, Power Conversion has been a reliable provider of Delta modules for industrial drives, wind converters in renewable energy, and marine propulsion applications. In order to consistently assist our customers in these dynamic markets even beyond the Delta product life, we have introduced an advantageous replacement solution.**

The LV3 Delta Module Replacement (DMR)\* represents a significant advancement, offering a high current density and 3-phase liquid-cooled power module that serves as an effective upgrade to our existing MV3000 Liquid Cooled Delta (LCD) module range.

Designed with meticulous attention to detail, the LV3 DMR seamlessly integrates as a “Fit, Form and Function” replacement for MV3000 Liquid Cooled Delta (LCD) module range. Compatibility with the MV3000 CDC and PECE control interfaces, identical dimensions to the liquid-cooled DELTA modules, and matching electrical characteristics ensure a smooth transition.

**The DMR is available in two current ratings, 850A and 1000A, both at 690V, with the flexibility to achieve larger power ratings by connecting modules of the same rating in parallel. All familiar options and variants from the previous generation power modules remain available, maintaining consistency.**

Key components from the LCD, such as the reliable capacitor bank, sharing resistors, return pipe, bleed valve, fan assembly, mechanical support, and switch mode power supply (SMPS), have been seamlessly incorporated into the DMR, ensuring a seamless integration of proven elements.

The advantages of the DMR over the DELTA module are manifold.

With a proven operational history dating back to 2018, the DMR is expected to enhance reliability by 40% compared to DELTA modules, thanks to a more robust design. This improvement is driven by leveraging insights from our previous generation modules and an improved cooling concept. It is further impacted by using cutting edge semiconductors with a higher Safe Operating Area (SOA) margin in all operating states. An enhanced lamination technique with improved isolation significantly reduce partial discharge issues. The LV3 DMR helps in reduction of losses, leading to improved efficiency and lower cooling requirements.

Opting for the DMR means an unchanged upgrade process, minimizing downtime as the rest of the system remains unaffected. Moreover, the identical characteristics of the DMR and DELTA module translate to minimal re-training requirements for site personnel, ensuring a seamless transition to the enhanced system. Embrace the future of power modules with the LV3 Delta Module Replacement, where innovation meets reliability.

### Key Advantages

#### Proven operational excellence

Field-tested since 2018, the LV3 DMR boasts a robust track record

#### Enhanced Reliability

Up to 40% improvement in reliability compared to DELTA modules, thanks to an optimized design incorporating practical field experiences and improved materials

#### Efficiency Boost

Experience improved overall system efficiency

**LV3 DMR - your reliable and efficient upgrade solution.**

\* Reach out to us at [services.powerconversion@ge.com](mailto:services.powerconversion@ge.com) to plan your replacement

# LV3 DMR 850A CDC

Scalable. Flexible. Powerful.

The LV3 DMR Power Stack is a high current density, liquid-cooled, power electronics module developed for a wide application range. It forms the basis of a modular, low voltage drive portfolio. Together with a scalable control architecture, the LV3 DMR Power Stack covers the range of sub- to multi-megawatt power conversion and variable frequency drive applications.

## LV3 DMR Key data summary

- Modernization Voltage rating: 400–690V
- Maximum current: 850 Amps
- IGBT based power module
- 3-phase in-/output and DC link connections
- Grid or electric machine applications
- Liquid-cooled
- Weight: 115 kg

## Technical Specifications

Electrical Data	
Network type	TN, TT, IT
Voltage range	690 V <sub>AC</sub> +10% / -20%
Current rating	850 A <sub>rms</sub>
Overload	110% Full-load current for 10s/10min at T <sub>in</sub> =50°C
Supply frequency (nominal)	50Hz, 60Hz
Output frequency range	20Hz to 200Hz, below on request
Switching frequency	2,500Hz
Interlock time	4.8µs
DC Link	
Nominal voltage	1,100V <sub>dc</sub>
Maximum voltage	1,200V <sub>dc</sub> (transient <100ms)
Capacitance	11.6mF
Capacitor bank cooling	air-forced
Environmental Data	
Max. operating temperature	+55°C
Min. operating temperature	+5°C (non-condensing)
Non-operational temperature	-20°C to +70°C
Storage and transport	-20°C to +60°C
Coolant	
Type	Water/Glycol mixture: 60%/40%
Maximum voltage	+60°C
Capacitance	+5°C, below on request
Capacitor bank cooling	25 l/min (400mBar)
Mechanical	
Dimensions	1,265mm H x 251mm W x 542mm D
Weight	115kg
IP rating	IP00
Power terminals	2 studs M10 per AC phase 2 studs M10 per DC connection
Water connection in/out	Return pipe/staubli with Ø22mm  Hosetails with Ø 22mm Vent/return pipe/hosetails with Ø 22mm options

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- Maximum current: 1000 Amps
- IGBT based power module
- 3-phase in-/output and DC link connections
- Grid or electric machine applications
- Liquid-cooled
- Weight: 115 kg

## Technical Specifications

Electrical Data	
Network type	TN, TT, IT
Voltage range	690 V <sub>AC</sub> +10% / -20%
Current rating	1000 A <sub>rms</sub>
Overload	110% Full-load current for 10s/10min at T <sub>in</sub> =50°C
Supply frequency (nominal)	50Hz, 60Hz
Output frequency range	20Hz to 200Hz, below on request
Switching frequency	2,500Hz
Interlock time	4.8µs
DC Link	
Nominal voltage	1,100V <sub>dc</sub>
Maximum voltage	1,200V <sub>dc</sub> (transient <100ms)
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Environmental Data	
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Storage and transport	-20°C to +60°C
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Type	Water/Glycol mixture: 60%/40%
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Capacitance	+5°C, below on request
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Mechanical	
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# LV3 DMR 850A PECe

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## LV3 DMR Key data summary

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- Maximum current: 850 Amps
- IGBT based power module
- 3-phase in-/output and DC link connections
- Grid or electric machine applications
- Liquid-cooled
- Weight: 115 kg

## Technical Specifications

Electrical Data	
Network type	TN, TT, IT
Voltage range	690 V <sub>AC</sub> +10% / -20%
Current rating	850 A <sub>rms</sub>
Overload	110% Full-load current for 10s/10min at T <sub>in</sub> =50°C
Supply frequency (nominal)	50Hz, 60Hz
Output frequency range	20Hz to 200Hz, below on request
Switching frequency	2,500Hz
Interlock time	4.8µs
DC Link	
Nominal voltage	1,100V <sub>dc</sub>
Maximum voltage	1,200V <sub>dc</sub> (transient <100ms)
Capacitance	11.6mF
Capacitor bank cooling	Air-forced
Environmental Data	
Max. operating temperature	+55°C
Min. operating temperature	+5°C (non-condensing)
Non-operational temperature	-20°C to +70°C
Storage and transport	-20°C to +60°C
Altitude	1,000 nominal
Coolant	
Type	Water/Glycol mixture: 60%/40%
Maximum voltage	+60°C
Capacitance	+5°C, below on request
Capacitor bank cooling	25 l/min (400mBar)
Mechanical	
Dimensions	1,265mm H x 251mm W x 542mm D
Weight	115kg
IP rating	IP00
Power terminals	2 studs M10 per AC phase 2 studs M10 per DC connection
Water connection in/out	Return pipe/staubli with Ø22mm  Hosetails with Ø 22mm Vent/return pipe/hosetails with Ø 22mm options



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Supply frequency (nominal)	50Hz, 60Hz
Output frequency range	20Hz to 200Hz, below on request
Switching frequency	2,500Hz
Interlock time	4.8µs
DC Link	
Nominal voltage	1,100V <sub>dc</sub>
Maximum voltage	1,200V <sub>dc</sub> (transient <100ms)
Capacitance	16.8mF
Capacitor bank cooling	Air-forced
Environmental Data	
Max. operating temperature	+55°C
Min. operating temperature	+5°C (non-condensing)
Non-operational temperature	-20°C to +70°C
Storage and transport	-20°C to +60°C
Altitude	1000m nominal
Coolant	
Type	Water/Glycol mixture: 60%/40%
Maximum voltage	+60°C
Capacitance	+5°C, below on request
Capacitor bank cooling	25 l/min (400mBar)
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## Deltasafe Bag

### Protective solution for delta module transportation

Storage and transportation of delta modules can present challenges as it is time-consuming, involves manual handling and requires special storage conditions. To safeguard the delta modules and to enable a quick exchange in the event of a failure, we offer a reusable and sustainable delta protection bag, that will help transportation and lifting of delta modules more easily and quickly.

DELTA safe is a strong and lightweight multi-function protective bag for lifting and transporting delta modules. It enables technicians to lift the sensitive equipment safely and securely. It also helps the service teams by transporting the delta modules and protecting them from external damage.



### Benefits

- **Reuseability** - DELTA safe bag is a reusable and sustainable inverter protective system that can help reduce costs and save time. Once the change-over is complete, the faulty product can be put into the DELTA safe bag and returned to the manufacturer.
- **Ease for transportation** - The bag can be easily moved around warehouses and vehicles. It has multiple handles enabling four people to lift and move the product easily. It is also durable for mechanical lifting, such as by forklift or tower crane.
- **Optimized protection** - It is a lightweight solution strong enough to provide maximum protection to protect the internal critical

## Other enhancements to your Converter

### Converter Replacement Fan

The MV3000 fan panel assembly provides essential forced air flow cooling in the drive cubicle.

To keep the power cubicle of Wind turbine generator converters within the optimal temperature we use an assembly of three fans operating together which provide air flow while the drive is in operation. If one of these fans shuts down, the risk of downtime due to overheating is a threat to the turbine's operation, reflecting directly on repair expenses.

#### Help minimize risk of failures and improve equipment lifetime

GE Vernova have developed a new enhanced cooling fan with hybrid bearing system which protects from external influences, avoiding bearing currents.

Replace your MV3000 converter fans with our fit form function enhanced fan against risk of overheating and increases the lifetime of your MV3000 converter cooling system

#### Benefits of Fan Replacement

- **Low risk replacement:** The fan is a fit form and function replacement.
- **Extended lifetime:** Hybrid bearings offer greater protection from external influences.
- **Reduce heat build-up:** Reduced heat build-up: Designed to minimize circulating current.
- **Helps converter to keep running:** Reduces unplanned downtime due to single fan failures.



### Convertor Colling Upgrade Kit

The 3.6MW generator convertor is fitted with a fan panel assembly to provide essential forced cooling for the power devices in the power cubicle. These assemblies comprise of a row of three fans operating together to maintain a cooling airflow while the drive is in operation. Loss of fan air flow will allow temperatures to increase and eventually the turbine can shut down and result in a costly unplanned stoppage and emergency maintenance interventions at the turbine.

#### Benefits of converter cooling upgrade kit

GE offers cooling upgrade kit which can greatly reduce the risk of unplanned stoppage enabling the following benefits:

- **Fan isolation :** In the event of single fan failure the failed fan is isolated, the remaining fans will keep running.
- **Activated warning:** Sent to the convertor controller highlighting a fan has failed and has shut down.
- **Warning alarm:** Alarm trigger by the cooling upgrade kit which can be seen in all the leading wind farm operating Scada System
- **Helps converter to keep running:** Reduces unplanned downtime due to single fan failures.
- **Perform planned Maintenance:** Cooling upgrade kit feature helps to replace the failed fan during scheduled maintenance. The replacement can be planned at a convenient time by the wind farm operator.



## Training

The MV3000 converter uses unique hardware and software to control the power system flow. The converter is an essential component in the power conversion process, and understanding how it works and is maintained is critical in supporting the operating lifetime of equipment.

Investment in converter maintenance and troubleshooting training develops the operators' expertise in MV3000 converters, supporting improved productivity through sustainably safe and efficient operations. Maintenance technicians can build new skills, develop their existing skill sets, and gather new knowledge about MV3000 product and services. The training benefits are realized through increased performance, availability and reliability of the MV3000 drive.

Onsite training offers a convenient option that is flexible in both content and delivery, by avoiding attendee travel costs and enabling a group of engineers to be trained together on the installed equipment

Training can:

- Be bespoke to your installation
- Target real life situations
- Limit disruption to operations, by enabling site engineers to remain on hand
- Offer workshops which accommodate application of customer specific data, securely and with complete confidence
- Keep maintenance technicians up to date with industry leading technology and practices

Training is delivered by Power Conversion's team of expert engineers with extensive experience of the MV3000 converter equipment range.

## Service Contracts

Power Conversion offers Service Agreements adapted to customers' operational requirements, to help minimize risk of losses through downtime and repair work.

Our service contractual agreements offer

- A dedicated resource for day to day contact
- Fast and responsive mobilization of field service engineers
- A scheduled maintenance program aligned to planned outages, that reduces the risk of failure, therefore minimizing downtime and losses
- A dedicated remote support engineer, highly product trained, who can reinforce customers' local engineering team, providing enhanced capability, especially on remote sites
- KPI monitoring and obsolescence management that can support customers in making strategic decisions for minimizing risk
- Expert recommendations for optimizing efficiency of existing equipment and options to upgrade/ extend life of the fleet
- Services and Asset Performance Management (APM) enabling to plan ahead and improve availability.





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## About Power Conversion, a GE Vernova business

We apply the science and systems of power conversion to help drive the electric transformation of the world's energy infrastructure. Designing and delivering advanced motor, drive and control technologies that help improve the efficiency and decarbonization of energy-intensive processes and systems, helping to accelerate the energy transition across marine, energy and industrial applications.

**We are at the heart of electrifying tomorrow's energy.**

[www.gepowerconversion.com/services](http://www.gepowerconversion.com/services)