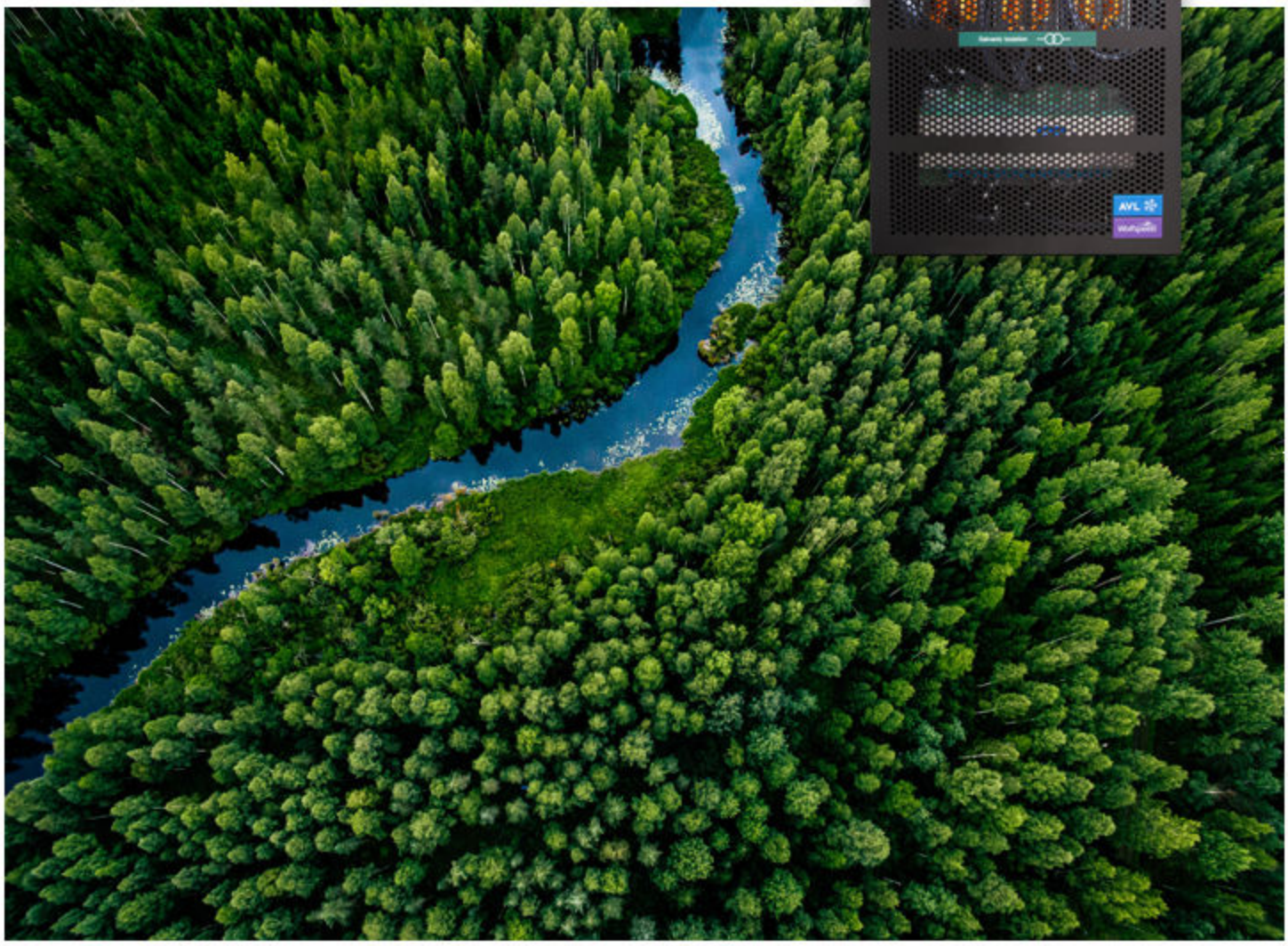
iE Convert GS

4189370004B

DC-DC converter with galvanic separation

Application notes

Improve Tomorrow



1. Applications

2. Specifications

1. Applications

1.1 Introducing the iE Convert GS

The iE Convert GS is a DC-DC converter with galvanic separation. Galvanic separation can be used to safely connect yachts and other vessels to shore power. Galvanic separation electrically isolates a power source from the supply busbar. Our technology provides separation through soft-switching CLLC topology, with a switching frequency up to 75 kHz.

On board a vessel, galvanic separation is typically used in fuel cell applications. Fuel cells are highly susceptible to faults on the direct current busbar (DC bus). It is also important to isolate any stray currents that may be produced in fuel cells.

1.2 Why iE Convert GS?

High capacity galvanic separation: For soft-switching CLLC-topology, 30 to 80 kW per converter is state of the art. The iE Convert 500 GS can deliver 500 kW per converter. For even higher capacity, up to four converters can run in parallel, with advanced power sharing control.

High energy efficiency: Lower energy losses mean a higher efficiency. Lower losses also means less cooling demand. The system-level efficiency is more than 98 %.

High efficiency over a wide range: SiC technology has an almost flat efficiency curve. This means energy savings at all load factors (rather than at one sweet spot).

High energy density: Compared to IGBTs, the power converters require 60 % of the volume. In marine applications, this saves valuable engine room space, with a market leading energy density of 2.25 kW/litre.

Lower weight: Compared to IGBTs, the power converter weight is 30 to 40 %. The lower weight means lower energy consumption over the life of the vessel.

Thermal performance: SiC MOSFETs can withstand a junction temperature up to 175 °C, which is much higher than IGBTs. This thermal performance enables operation at sustained higher loads and flexibility in handling peak loads.

Applications

Ready for fuel cell applications
Current control: CANopen to stack rack master controller.
Load dump: During start: Load the fuel cell, and limit the voltage. During stop: Limit the input voltage.
Pre-charge circuit: Pre-charge the booster input voltage.
Wide voltage range: 500 to 900 V (input voltage for 60 GS).

Shore connection
Convert shore power to the required voltage and frequency. Safely run sensitive equipment on shore power.

Other features

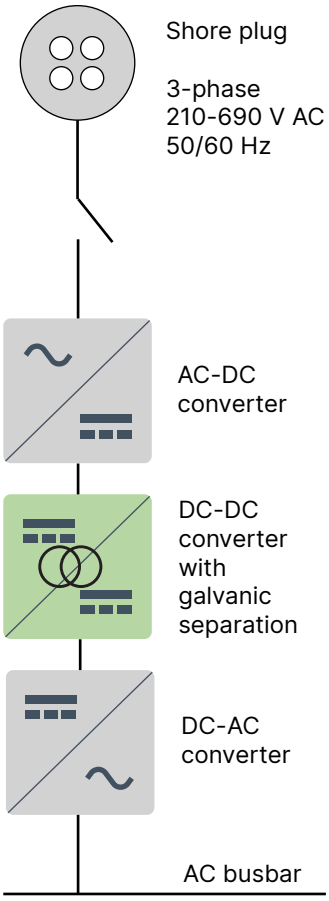
Faster switching: Faster switching means more accurate energy transformation. Our converters deliver higher quality power with minimal harmonic distortion.

Bi-directional: iE Convert 60 GS, iE Convert 125 GS, and iE Convert 500 GS are bi-directional.

Voltage level shift: Boost the input voltage.

Liquid cooling: For efficient removal of heat.

1.3 Shore connection application



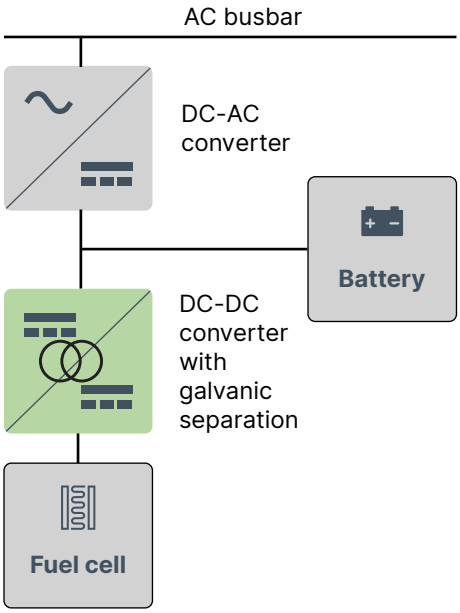
To get the required 3-phase voltage and frequency on the ship busbar, a conventional shore connection may include:

- A transformer
- An AC-DC converter
- A DC-AC converter

The iE Convert GS is placed between the AC-DC converter and the DC-AC converter. The iE Convert GS has these advantages:

- If the shore connection power has a different voltage and frequency, the iE Convert GS transforms the shore connection power to the required voltage and frequency.
- The shore connection transformer is not required.
- The shore connection system is lighter and more compact.
- If there are any problems with the shore connection power quality, the iE Convert GS protects the ship.

1.4 Fuel cell application



The iE Convert GS has these advantages:

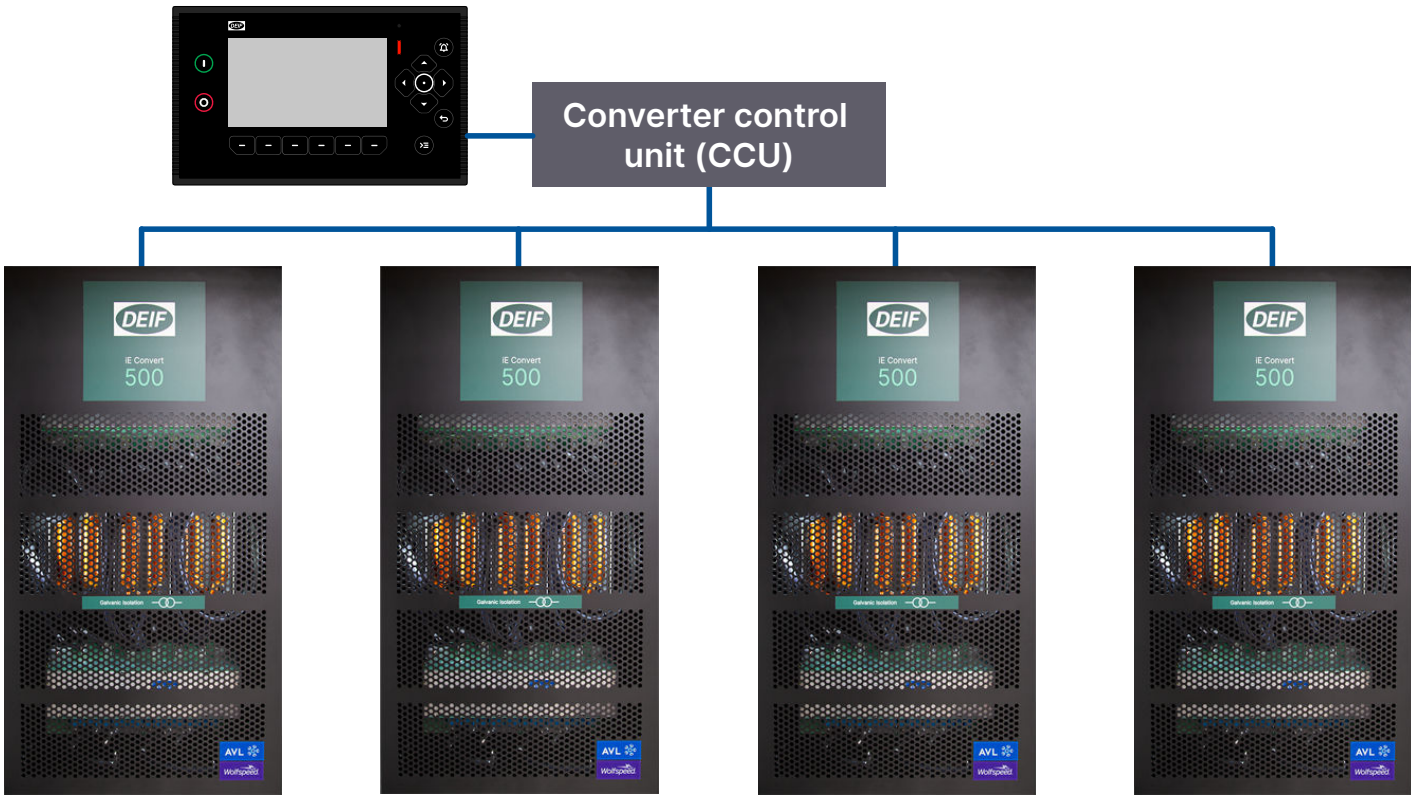
- It separates and protects the fuel cell from the AC or DC busbar.
- It boosts the voltage from the fuel cell to the busbar voltage.
- It also prevents stray currents.

The iE Convert GS includes these functions:

- The pre-charge circuit pre-charges the booster input voltage.
- While the fuel cell starts: The load-dump capabilities of the iE Convert GS allow the fuel cell to be loaded, while limiting the voltage.
- While the fuel cell stops: The load-dump capabilities of the iE Convert GS limit the input voltage.
- Controls the breaker between the fuel cell and the booster.

1.5 Paralleling for higher capacity

Up to four iE Convert GS can run in parallel and synchronise, with less than 5 % capacity derating. You can connect up to four converter control units (CCU) to a DEIF iE controller.



For seamless power/energy management or PLC integration, you can use the CODESYS platform from DEIF. Use the MATLAB platform for simulation and verification.

2. Specifications

2.1 Specifications for iE Convert 60 GS, 125 GS, and 500 GS

	iE Convert 60 GS	iE Convert 125 GS	iE Convert 500 GS
Type	Bi-directional	Bi-directional	Bi-directional
Fuel cell control type	Input current control	Input current control	Input current control
Power (input side)	60 kW	125 kW	500 kW
Input voltage range (nominal)	500 to 900 V (607 V)	700 to 850 V (750 V)	700 to 800 V (750 V)
Output voltage range (nominal)	1000 to 1100 V (1050 V)	250 to 950 V (850 V)	1250 to 1420 V (1330 V) 1320 to 1510 V (1410 V)
Input current Peak current	98 A 120 % for 2 s, over 60 s	167 A 200 % for 2 s, over 60 s	667 A 200 % for 2 s, over 60 s
Efficiency	96.0 to 98.0 %	96.0 to 98.0 %	96.0 to 98.0 %
Voltage ripple Current ripple	3 % of nominal 3 % of nominal	3 % of nominal 3 % of nominal	3 % of nominal 3 % of nominal
Protection class	IP22	IP22	IP22
Dimensions (W x H x D)	260 mm x 395 mm x 550 mm (without connectors) 269 mm x 397 mm x 672 mm (with connectors)	270 mm x 400 mm x 625 mm (without connectors)	700 mm x 1270 mm x 250 mm (without connectors)
Weight	55 kg	70 kg	<200 kg
Operating temperature (derating above 50 °C)	5 to 60 °C	-20 to 75 °C	-20 to 75 °C
Relative humidity	95 %, non-condensing	95 %, non-condensing	95 %, non-condensing
Altitude	Up to 2000 m	Up to 2000 m	Up to 2000 m
Coolant Inlet temperature Pressure	Antifrogen N 20 to 40 °C 2 to 3 bar	Antifrogen N 20 to 40 °C 2 to 3 bar	Antifrogen N 20 to 40 °C 2 to 3 bar
Auxiliary supply voltage	24 V DC at 3 A (±25 %) D-sub connector	24 V DC at 3 A (±25 %) D-sub connector	24 V DC at 3 A (±25 %) D-sub connector
Communication	EtherCAT (from CCU)	EtherCAT (from CCU)	EtherCAT (from CCU)
Cybersecurity	IEC 62443	IEC 62443	IEC 62443
Approvals	DNV, LR, UL, CE, RoHS	DNV, LR, UL, CE, RoHS	DNV, LR, UL, CE, RoHS
Protections	Voltage, current, over-temperature, and fault monitoring	Voltage, current, over-temperature, and fault monitoring	Voltage, current, over-temperature, and fault monitoring
Electrical control	External controller	External controller	External controller
Converters in parallel	Up to 4	Up to 4	Up to 4
Power management	Use in DEIF power management solutions	Use in DEIF power management solutions	Use in DEIF power management solutions

2.2 Disclaimer

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2.3 Contact Information

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