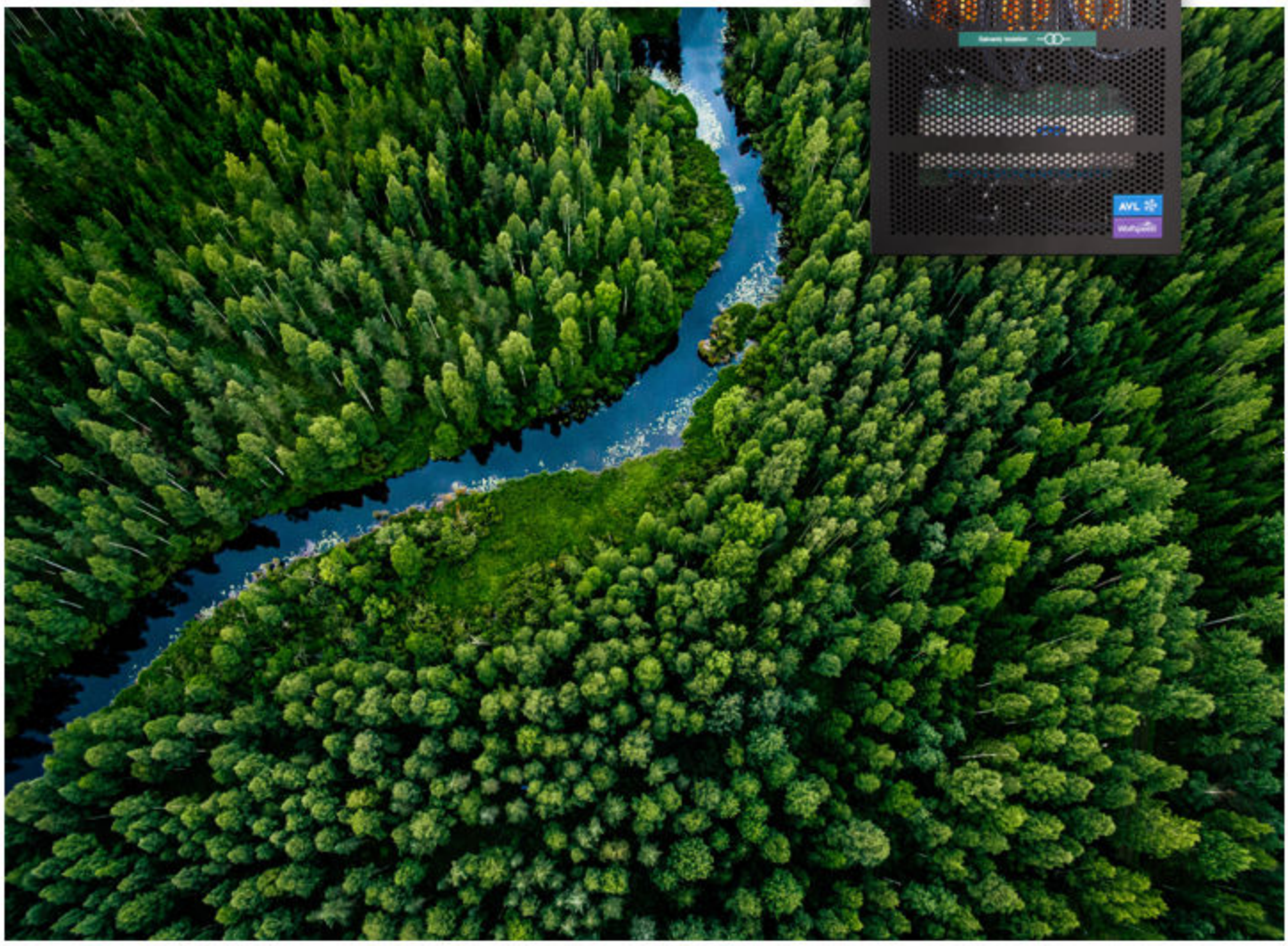
# iE Convert GI

4189370004C

60 kW, 125 kW and 500 kW DC//DC converters with galvanic isolation

## Application notes

Improve Tomorrow

## 1. Applications



## 2. Specifications

# 1. Applications

## 1.1 Introducing the iE Convert GI

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

On board a vessel, galvanic isolation 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 GI?

**High capacity galvanic isolation**: For soft-switching CLLC-topology, 30 to 80 kW per converter is state of the art. The iE Convert 500 GI 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 GI).

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

### Other features

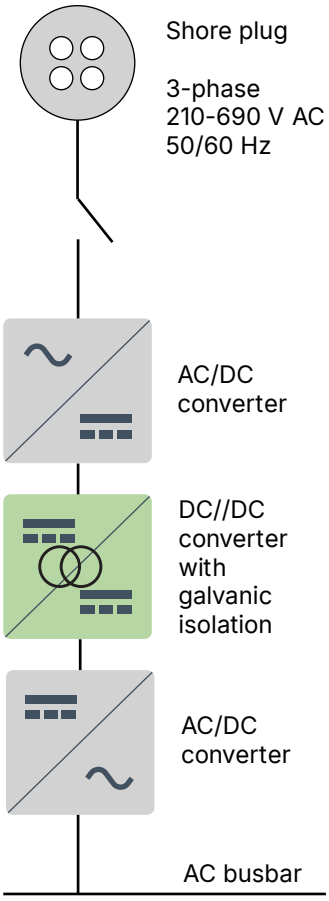
**Faster switching**: Faster switching means more accurate energy transformation. Our converters deliver higher quality power with minimal harmonic distortion.

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

**Voltage level shift**: Boost the input voltage.

**Liquid cooling**: For efficient removal of heat.

## 1.3 Shore connection application



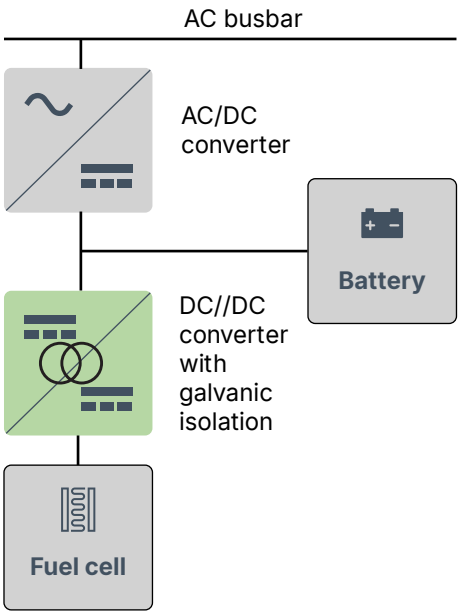

To get the required 3-phase voltage and frequency on the ship busbar, a conventional shore connection may include:

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

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

- If the shore connection power has a different voltage and frequency, the iE Convert GI 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 GI protects the ship.

## 1.4 Fuel cell application




The iE Convert GI has these advantages:

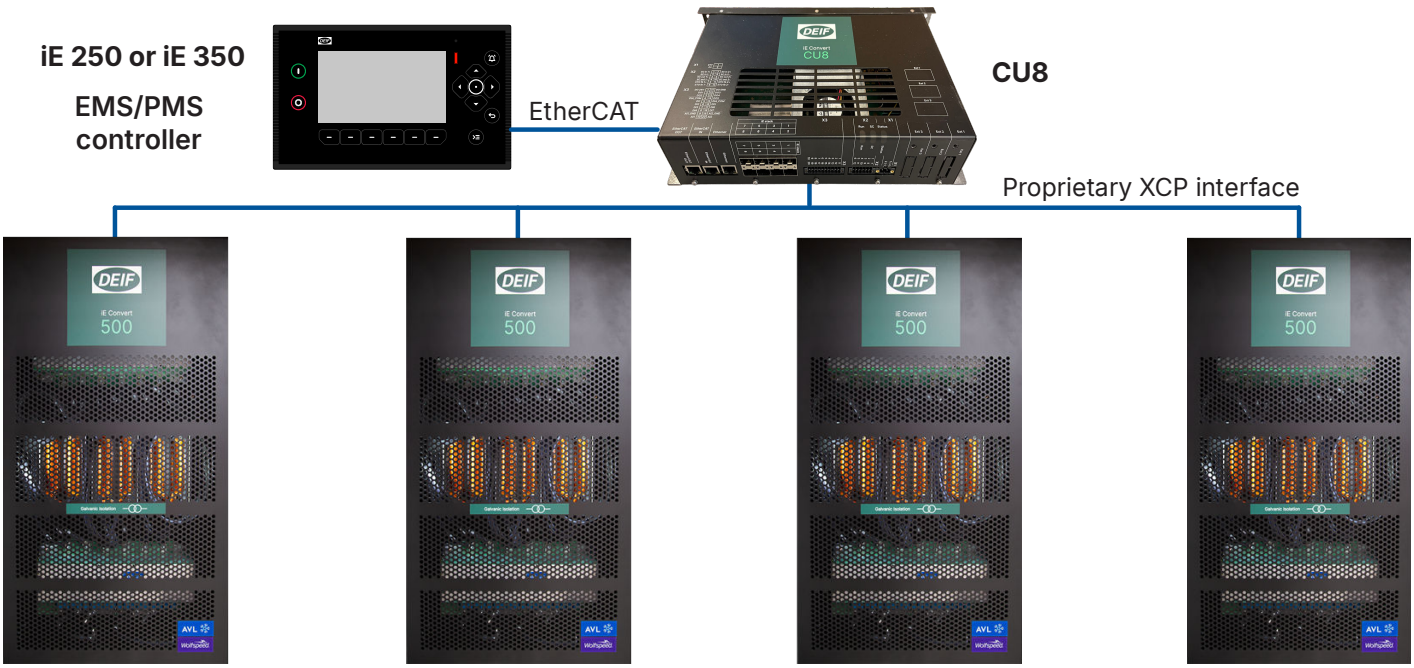
- It separates and protects the fuel cell from the AC or DC busbar.
- It boosts the voltage from the fuel cell to the busbar voltage.
- It also prevents stray currents.

The iE Convert GI 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 GI allow the fuel cell to be loaded, while limiting the voltage.
- While the fuel cell stops: The capabilities of the iE Convert GI 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 GI can run in parallel and synchronise, with less than 5 % capacity derating. You can connect up to four converter control units (CU8) to a DEIF iE controller.




For seamless power/energy management or PLC integration, you can use the CODESYS platform from DEIF.

# 2. Specifications

## 2.1 Specifications for iE Convert 60 GI, 125 GI, and 500 GI

| | iE Convert 60 GI | iE Convert 125 GI | iE Convert 500 GI |
|---|---|---|---|
| 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 |
| Efficiency (at nominal voltages) | >98.0 % | >98.0 % | >98.0 % |
| Voltage ripple<br>Current ripple | 3 % of nominal<br>3 % of nominal | 3 % of nominal<br>3 % of nominal | 3 % of nominal<br>3 % of nominal |
| **DC line (input)** | | | |
| Operating voltage | 500 to 900 V DC | 500 to 900 V DC | 700 to 800 V DC |
| Nominal voltage | 600 V DC | 600 V DC | 750 V DC |
| Maximum current<br>Peak current | 98 A<br>120 % for 10 s, over 60 s | 167 A<br>120 % for 10 s, over 60 s | 667 A<br>120 % for 10 s, over 60 s |
| **DC link (output)** | | | |
| Operating voltage | 1000 to 1100 V DC | 1000 to 1100 V DC | 1250 to 1420 V DC |
| Nominal voltage | 1050 V DC | 1050 V DC | 1330 V DC |
| Maximum current | 60 A, maximum 20 % | 156 A | 376 A |
| **Dimensions** | | | |
| Dimensions (W x H x D) | 260 mm x 395 mm x 550 mm (without connectors)<br>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 |
| **Environment** | | | |
| Protection class | IP2X | IP2X | IP2X |
| Operating temperature ** (derating above 40 °C) | -20 to 60 °C | -20 to 60 °C | -20 to 60 °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** | | | |
| Coolant | Antifrogen N-water mix: 25:75 | Antifrogen N-water mix: 25:75 | Antifrogen N-water mix: 25:75 |
| Inlet temperature (derating above 35 °C) | 20 to 40 °C | 20 to 40 °C | 20 to 40 °C |
| Pressure | 2 to 3 bar | 2 to 3 bar | 2 to 3 bar |
| **Auxiliary supply** | | | |
| Auxiliary supply voltage | 24 V DC at 3 A (+30 %, -25 %)<br>D-sub connector | 24 V DC at 3 A (+30 %, -25 %)<br>D-sub connector | 24 V DC at 3 A (+30 %, -25 %)<br>D-sub connector |
| **Standards** | | | |

| | iE Convert 60 GI | iE Convert 125 GI | iE Convert 500 GI |
|---|---|---|---|
| Communication | EtherCAT (from CU8) | EtherCAT (from CU8) | EtherCAT (from CU8) |
| 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 |
| **Control** | | | |
| 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 |

**NOTE** * Although the converter is bi-directional, the maximum input and output currents are different. The input and output sides are therefore not interchangeable.

**NOTE** ** The coolant inlet temperature must be within the specified range.

## 2.2 Disclaimer

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## 2.3 Contact Information

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