

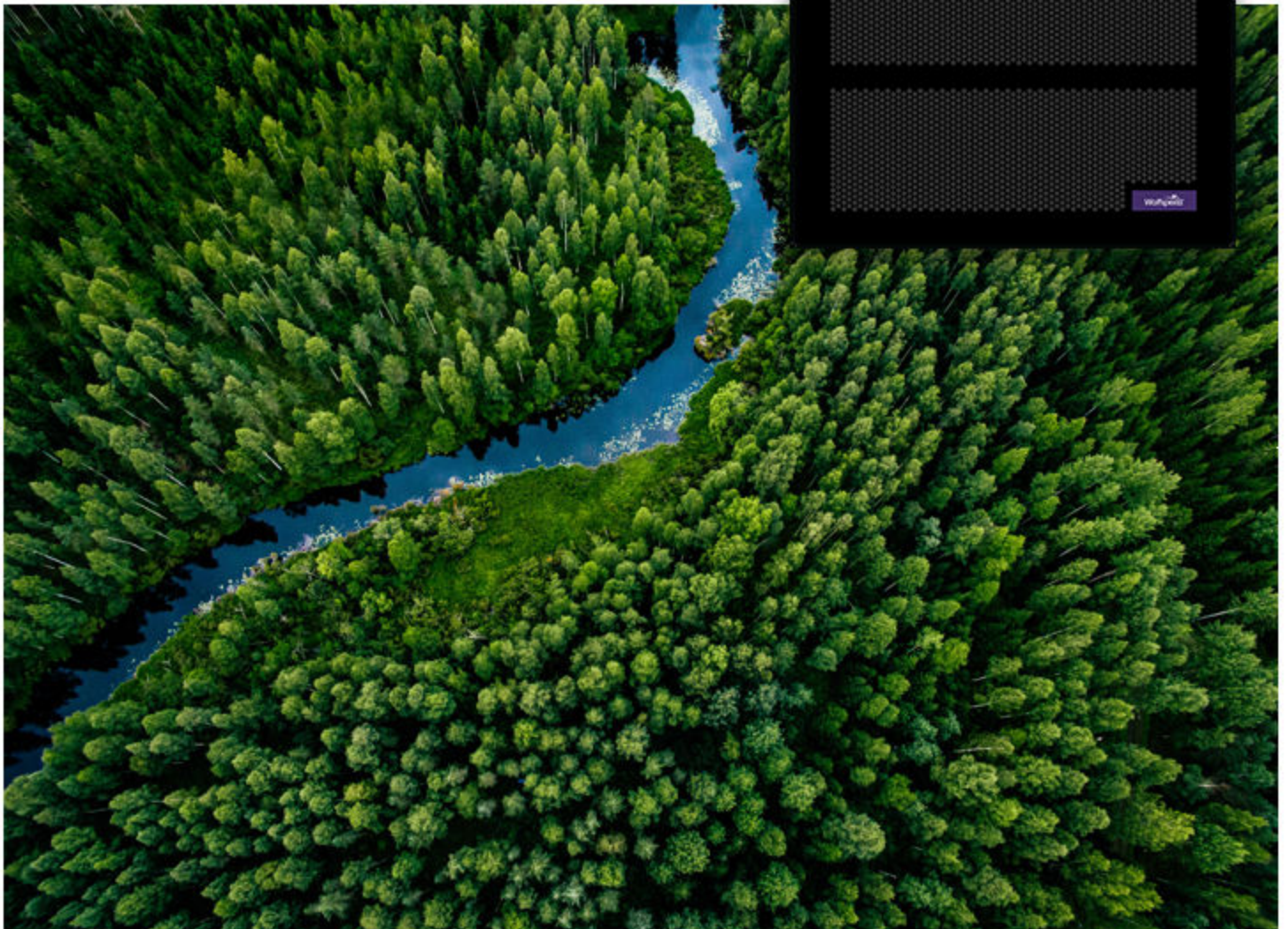
iE Convert

500 kVA AC/DC grid converter

Data sheet



Improve
Tomorrow



1. iE Convert

1.1 About the iE Convert 500 kVA AC/DC converter.....	3
1.1.1 Power converter control.....	3
1.1.2 Flexible packages.....	4
1.2 Functions and features.....	4
1.3 Application examples.....	5

2. Technical specifications

2.1 Electrical specifications.....	7
2.2 Power, current, and voltage curves.....	8
2.3 Temperature curves.....	9
2.4 Alarms and protections.....	9
2.5 HMI and display.....	9
2.6 Dimensions and weight.....	10
2.7 Mechanical specifications.....	10
2.8 Environmental specifications.....	10
2.9 Communication specifications.....	11
2.10 Grid codes.....	11
2.11 Approvals.....	11

3. Compatible products

3.1 iE Convert power converters.....	12
3.2 Compatible equipment.....	12

4. Legal information

4.1 Disclaimer and copyright.....	14
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1. iE Convert

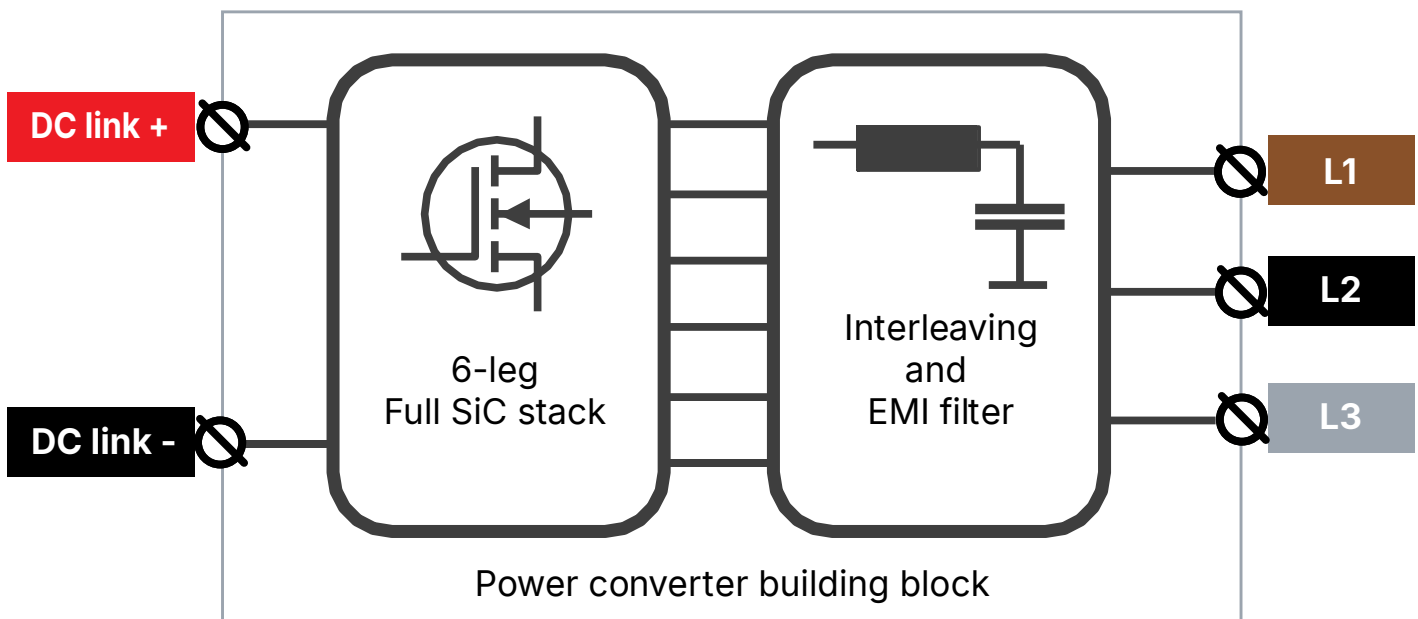
1.1 About the iE Convert 500 kVA AC/DC converter

The iE Convert 500 kVA AC/DC grid converter is a bidirectional power converter. It can be used in a wide variety of applications, including Active Front End (AFE), microgrid, and battery charging, with seamless transfer between gridfollowing and grid-forming. The iE Convert converts AC to DC (and vice versa), with controllable power flow and low harmonic distortion. The converters can be used to improve the power factor and for harmonic mitigation.

The iE Convert uses high frequency (up to 100 kHz) soft switching technology, using SiC MOSFET. This higher switching frequency results in a more compact design with a very high efficiency. The iE Convert is liquid cooled.

Power converter electrical diagram

This electrical diagram shows the operation and parts of the power converter.

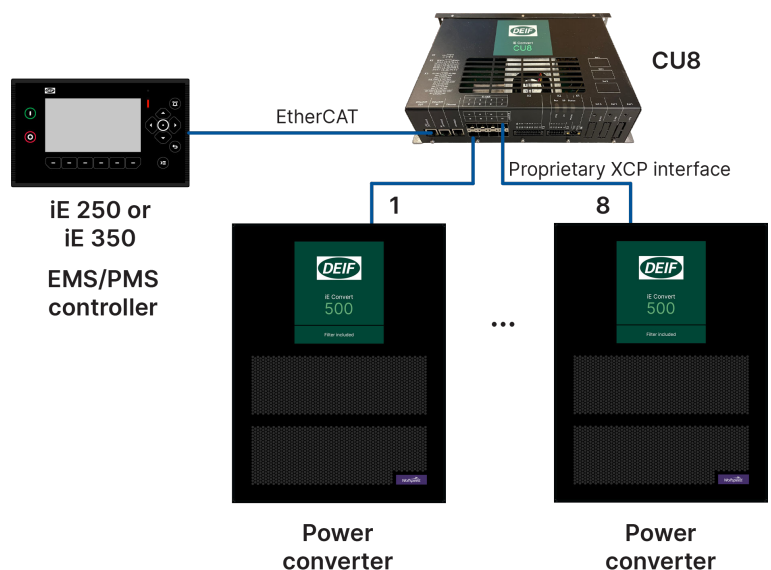


Optional: A neutral line connection, with a filter.

1.1.1 Power converter control

The power converter building blocks are controlled by a CU8 controller. One CU8 controller controls up to eight iE Convert power converters. For one CU8 controller, the power converters can be in two groups, which have different applications. The CU8 controller allows the power converters to run in parallel, which allows higher power capacity and/or redundancy.

For easy connectivity and configuration, you can connect the CU8 controller to a DEIF controller. For energy/power management (EMS/PMS) functions, and connections to external interfaces, you can use a DEIF iE 250 or iE 350 controller. If you want to use a PLC, you can use the DEIF iE 250, iE 350, or iE 650 PLC. Alternatively, you can use another EMS/PMS controller or PLC brand.





More information
See the **CU8 controller Data sheet**.

1.1.2 Flexible packages

DEIF supply

	Package A Components*	Package B Building blocks	Package C Complete IP2X sets
Tested power stacks, filters, capacitor boards, chokes, and so on	●		
With covers			●
Assembled and tested power converter building blocks		●	●
Reference designs	●	●	●

Customer responsibilities

	Package A Components*	Package B Building blocks	Package C Complete IP2X sets
Assemble the power converter building blocks	●		
I/O test the power converter building blocks	●		
Suitable containment	●	●	
Connection to a chiller	●	●	●
Energy management system**	●	●	●
Protection products**	●	●	●

NOTE * Subject to minimum order quantity and commercial approval.

NOTE ** The DEIF energy management system and protection products are recommended.

1.2 Functions and features

	Functions
Bidirectional	- Rectifier: Convert AC power to DC power - Inverter: Convert DC power to AC power
Modularity	Connect up to eight power converters for higher capacity
Redundancy	Supports individual power converters, and clusters of power converters - Example: A CU8 controller with two groups of power converters - Example: Redundant/parallel systems, each with a CU8 controller and two groups of power converters

	Functions
Features	Very dynamic FPGA-based control loop
	Active front end (AFE), grid-following, and PQ mode
	Microgrid, grid-forming, and VF mode
	Transition between grid-forming and grid-following
	Seamless transfer (< 4 ms)
	Black start (from 0 V, 0 Hz)
	Battery charging and discharging
	Inertia for grid frequency stabilisation
	High-frequency supply, up to 400 Hz
Applications	Export power to grid
	Battery energy storage system (BESS)
	Frequency converter
	Ground power units (GPU) for aircraft
	Shore power to ships
	Connect gensets to a DC grid
Local control	Optional multi-line display with function keys (for example, using iE 250)
Other DEIF products	One-click integration

1.3 Application examples



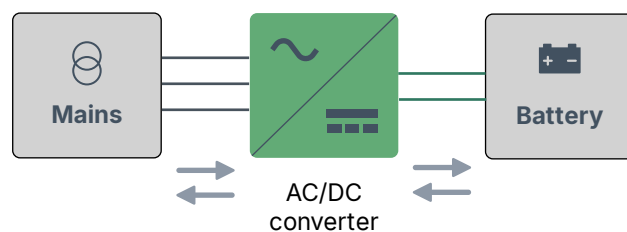
More information

See the [iE Convert Land Application Guide](#) and the [iE Convert Marine Application Guide](#) for more application examples.

Battery systems

The power converter converts AC power to DC to charge the battery. When power is required from the battery, the power converter converts DC power to AC.

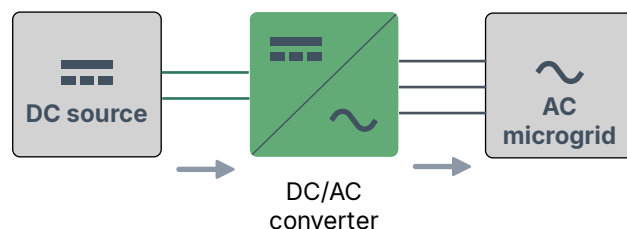
The battery increases the system efficiency, since it can be charged using excess power. The battery also increases the system robustness, since it can discharge when demand surges.



Microgrid

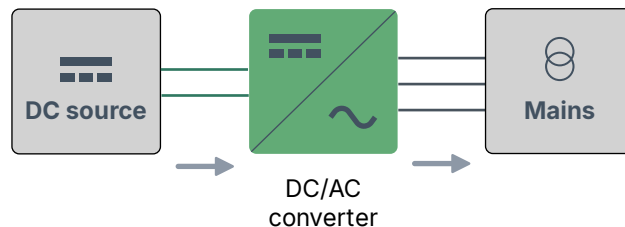
The power converter converts power from a DC source to AC power. The AC power then supplies a microgrid.

The DC/AC converter is grid-forming. That is, the microgrid runs at the required voltage and frequency, without the need for another AC power source.



Grid-following

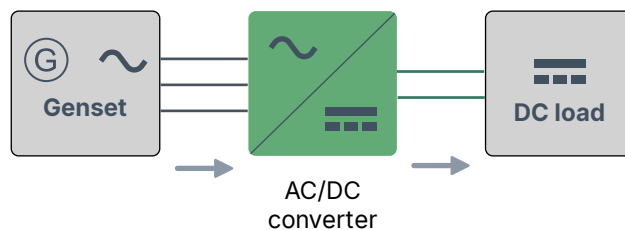
The power converter converts power from a DC source to AC power. The DC/AC converter is grid-following. That is, it runs at the mains voltage and frequency.



Active front end (AFE) and genset

The power converter converts AC power from a genset to DC power.

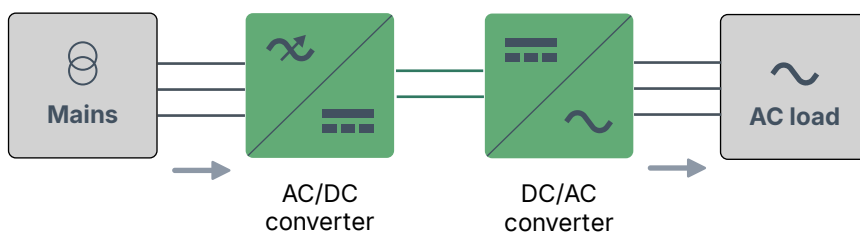
Through the power converter, the genset can supply the DC power alone. The genset is not a variable speed generator. Alternatively, the genset and power converter can supplement other DC power sources.



Shore power connection

Convert any shore power voltage and frequency to supply the voltage and frequency required onboard.

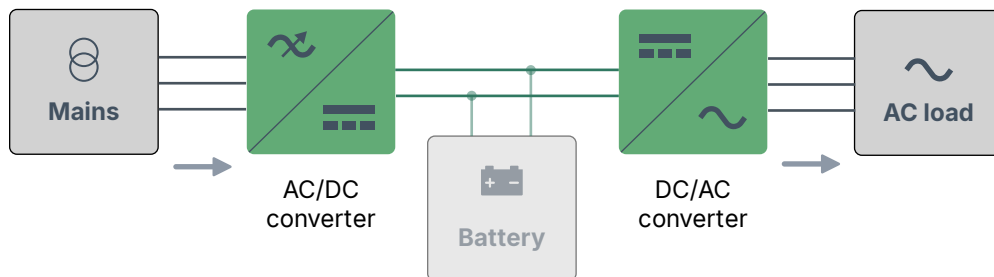
If galvanic separation is required, a DC//DC galvanic separation converter can be installed between the AC/DC converter and the DC/AC converter.



Aviation high frequency ground power unit

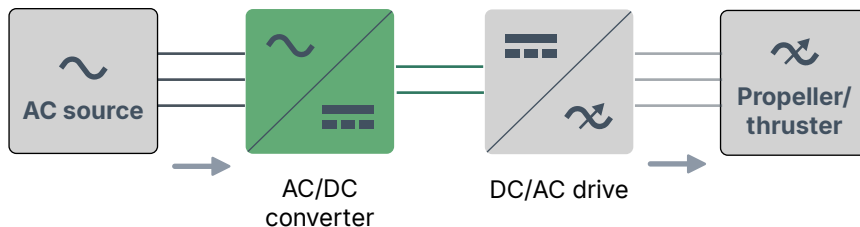
The power converter converts 50 Hz or 60 Hz AC power to 400 Hz AC power.

For critical power applications, a battery can be installed between the AC/DC converter and the DC/AC converter.



Supply DC power for a propeller or thruster drive

The power converter converts AC power to DC power. The DC power can then be used by another power converter to drive a propeller or thruster.



NOTE The standard configuration for all applications is 3-phase, 3-wire AC wiring. On request, 3-phase, 4-wire AC wiring is available.

2. Technical specifications

2.1 Electrical specifications

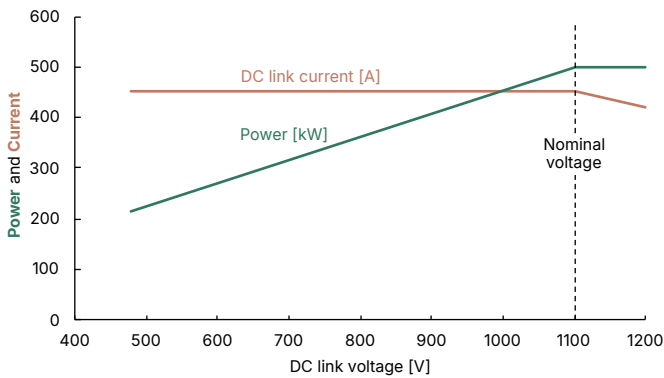
	1200 V DC
Efficiency	Peak efficiency (stack and filter): 99 %
Apparent power	500 kVA (at nominal voltage) • $V_{line} = 690 \text{ V}$ and $I_{line} = 419 \text{ A}$
Power quality, DC link to AC line	Voltage total harmonic distortion: < 3 %
Power quality, AC line to DC link	Maximum ripple voltage: < 2 % RMS
Overload current *	110 % of nominal current for 2 s, over 60 s
DC link	
Nominal voltage	1100 V
Operating voltage	480 to 1200 V
Nominal current	454 A at 1100 V
DC link-side capacitance (inside the converter) **	2500 μF
AC line	
Nominal voltage	690 V AC
Operating voltage	300 to 690 V AC
Nominal current	419 A at 690 V
Frequency	50 Hz/60 Hz 400 Hz (with derating)
AC phase configuration	Standard: 3-phase, 3-wire Optional: 3-phase, 4-wire (with neutral) (requires a separate filter).
Auxiliary supply	
Auxiliary supply	Nominal voltage: 24 V DC Power: 200 W
Standby power consumption (zero power output)	< 100 W

NOTE * After 2 seconds at the overload level, the current must stay at or below nominal current for at least 58 seconds.

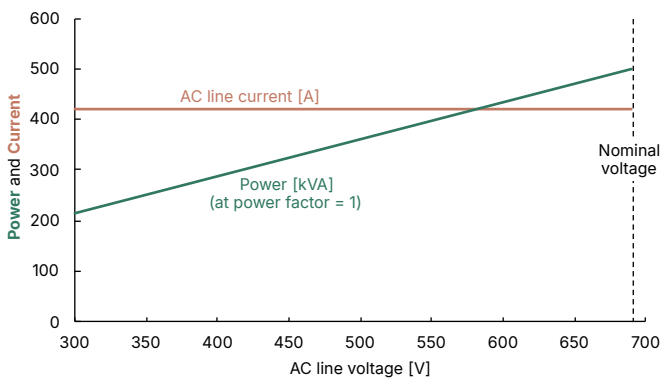
NOTE ** The converter DC link requires external pre-charging.

2.2 Power, current, and voltage curves

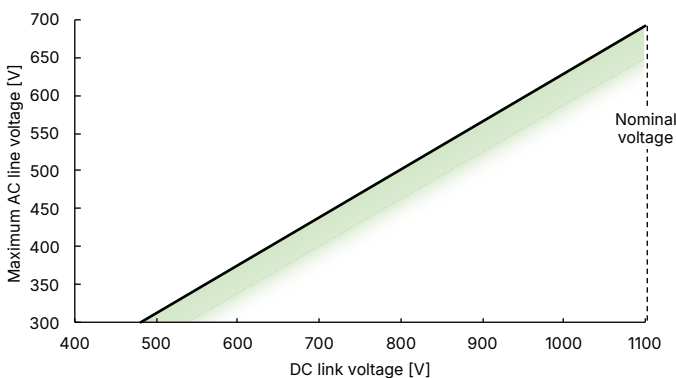
DC link power, current, and voltage curve



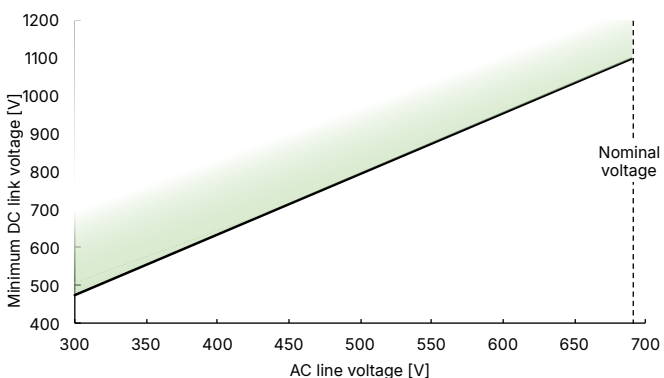
AC line power, current, and voltage curve



AC line voltage relative to the DC link

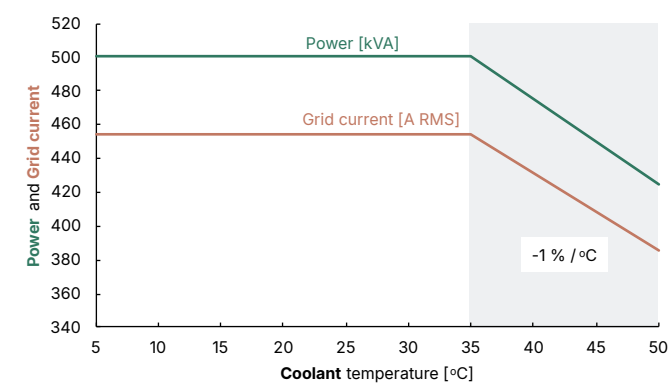


DC link voltage relative to the AC line

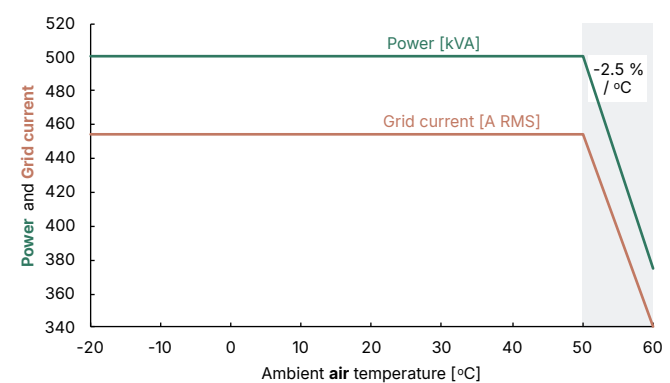


2.3 Temperature curves

Coolant



Ambient air

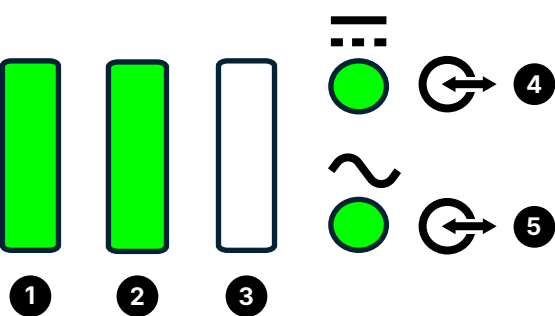


2.4 Alarms and protections

Protections	
Hardware over-current trip	
Hardware over-voltage trip	
Hardware temperature trip	

2.5 HMI and display

Power converter LEDs



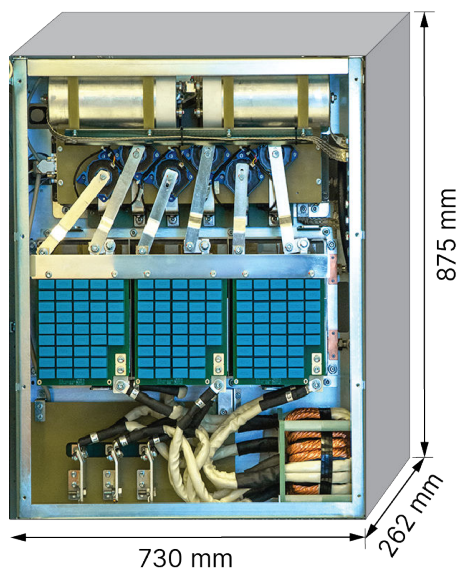
No.	Name	Function
1	Auxiliary power	Green: Power OK OFF: No power
2	Converter	Green: Converter OK OFF: Converter not running
3	Error	Red: Error OFF: No error
4	DC link	Green: DC link OK OFF: No DC voltage input
5	AC line	Green: AC line OK OFF: No AC voltage input

Using an iE 7 display

If you connect iE 250 or iE 350 to the CU8, you can use the iE 7 (the display for iE 250 or iE 350) to view the operation of the power converter(s).

2.6 Dimensions and weight

iE Convert 500 AC/DC



Dimensions and weight

Power converter (W x H x D)	730 mm x 875 mm x 262 mm
Weight	~220 kg

2.7 Mechanical specifications

Mechanical

DC link	Busbars
AC line	Busbars
Input to control auxiliary power supply	Terminal block
Interlock	2 inputs, 2 outputs
Design life	10 years
Mean time between failures (MTBF)	40000 hours

2.8 Environmental specifications

Operating conditions

Ambient temperature *	-20 to 60 °C, with derating over 50 °C
Altitude	0 to 4000 m Derating applies above 2000 m
Humidity	95 % relative humidity, non-condensing

NOTE * This refers to the temperature inside the cabinet where the converter is installed.

Storage conditions

Ambient temperature	-20 to 70 °C
Altitude	Maximum 10000 m
Humidity	95 % relative humidity, non-condensing

Coolant	
Type	Antifrogen N-water mix: 25:75 to 50:50
Flow rate	16 litres/minute for each power converter
Maximum inlet temperature	50 °C, with derating above 35 °C (1 % per °C)
Minimum inlet temperature	5 °C *
Pressure	Maximum: 3 bar Pressure drop: < 1.5 bar
Connectors	½", female quick connectors

NOTE * Non-condensing environment.

Ratings	
Protection degree	IP2X
Pollution degree	II
Over-voltage category	III
Noise	<63 dB from 1 m

2.9 Communication specifications

Power converter building blocks to CU8

Connection	Protocol
Fiber optic	Proprietary XCP interface

2.10 Grid codes

Standards
UL 1741 SB / IEEE 1547-2018 (North America)
EN 50549-2 / VDE-AR-N 4110 (Europe)
AS/NZS 4777.2 (Australia/NZ for <200 kVA)

2.11 Approvals

Standards
UL 1741 Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
Marine: DNV, ABS, LR, BV, CCS, KR, RINA and NK1
Land: CE to IEC/EN 62477-1
Cybersecurity: IEC/EN 62443-4-2

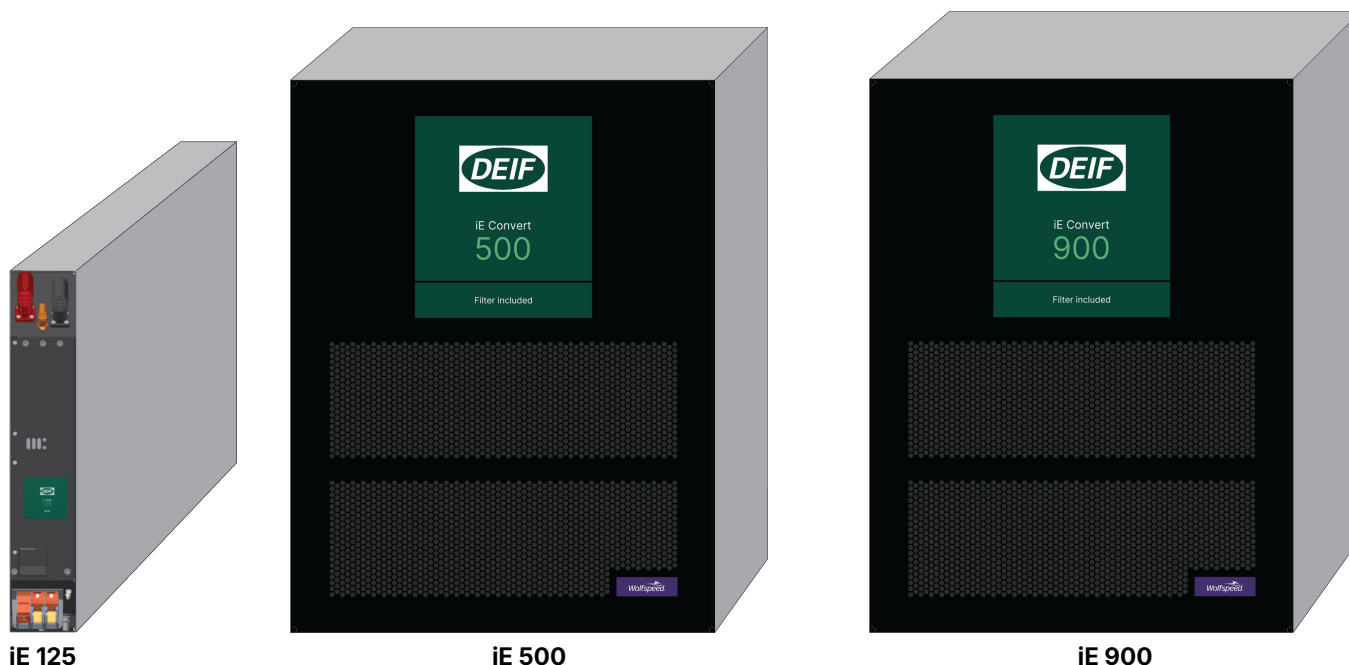
NOTE Refer to www.deif.com for the most recent approvals.

3. Compatible products

3.1 iE Convert power converters

iE Convert power converters are available for a range of specifications and applications.

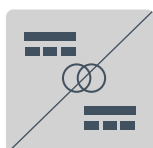
Modules



Applications



AC/DC
Grid



DC//DC
Galvanically isolated



AC/DC
Drive



DC/DC
Buck/boost

Voltage ratings

Maximum 850 V DC		Maximum 1500 V DC	
350 to 850 V DC	208 to 480 V AC	850 to 1500 V DC	300 to 690 V AC

3.2 Compatible equipment

Controllers with grid codes, power management and cybersecurity

- iE 250 www.deif.com/products/ie-250

Controllers with power management and cybersecurity

- iE 350 www.deif.com/products/ie-350
- iE 250 Marine www.deif.com/products/ie-250-marine
- iE 350 Marine www.deif.com/products/ie-350-marine

Controllers with grid codes and power management

- AGC-4 Mk II www.deif.com/products/agc-4-mk-ii

Controllers with power management

- iE 150 www.deif.com/products/ie-150
- iE 150 Marine www.deif.com/products/ie-150-marine
- AGC 150 www.deif.com/products/agc-150-generator

PLCs with cybersecurity

- iE 250 PLC www.deif.com/products/ie-250-plc/
- iE 350 PLC www.deif.com/products/ie-350-plc/
- iE 650 PLC www.deif.com/products/ie-650-plc/

Isolation monitoring

- DC networks, ADL-111Q96 www.deif.com/products/adl-111q96
- AC networks, AAL-2 www.deif.com/products/aal-2

DC voltage measurement

iE Measure

Protection relays

Medium voltage relays, MVR-200 series www.deif.com/products/mvr-200-series/

Other equipment

DEIF has a wide variety of other equipment that is compatible. Here are some examples:

- **Synchrosopes**
 - CSQ-3 (www.deif.com/products/csq-3)
- **Battery chargers/power supplies**
 - DBC-1 (www.deif.com/products/dbc-1)
- **Current transformers**
 - ASK (www.deif.com/products/ask-asr)
 - KBU (www.deif.com/products/kbu)
- **Transducers**
 - MTR-4 (www.deif.com/products/mtr-4)

4. Legal information

4.1 Disclaimer and copyright

Preliminary information

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