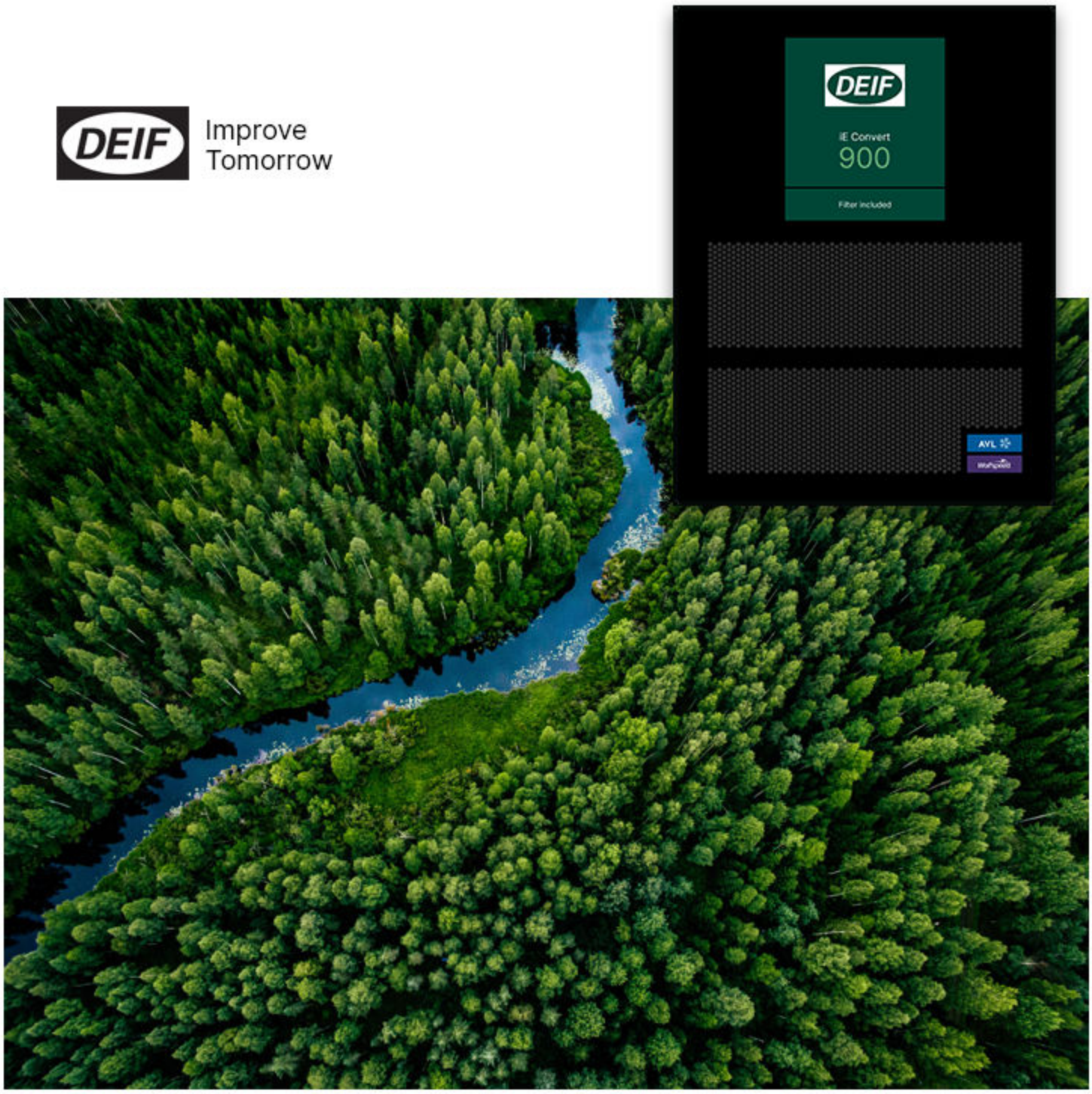
iE Convert

4921270006A

900 kW AC/DC Drive

Data sheet

Improve
Tomorrow



1. iE Convert

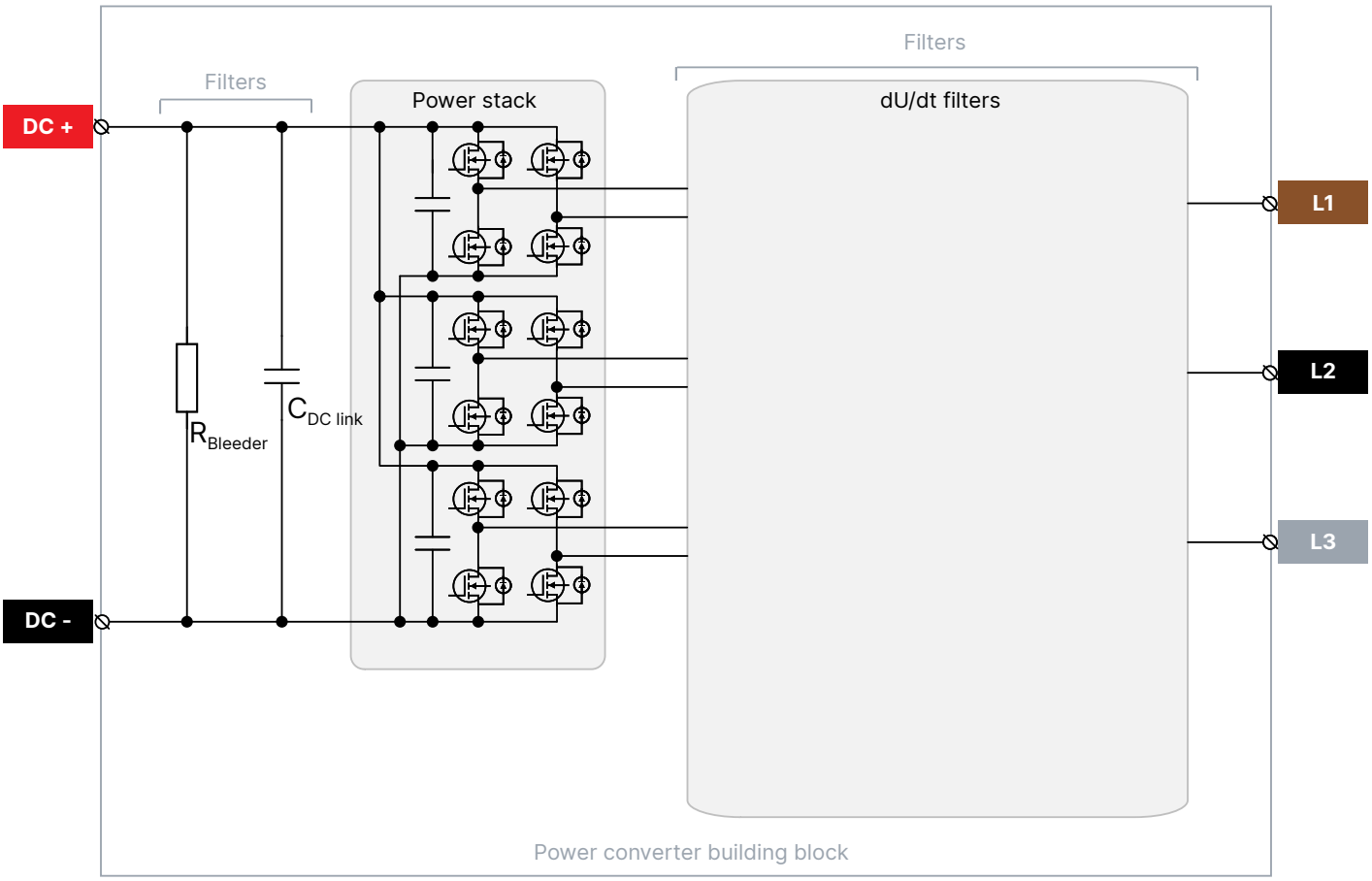
1.1 About the iE Convert 900 kW AC/DC Drive

The iE Convert 900 kW AC/DC Drive is a bidirectional power converter. It can be used in a wide variety of applications, including as a variable-speed driver for propellers and thrusters, integration of shaft generators, and integration of variable-speed generators. The AC/DC drive converts DC to AC (and vice versa), with controllable frequency, controllable voltage, and low harmonic distortion. To improve energy efficiency, the AC/DC drive regenerative functionality allows energy recovery.

The iE Convert uses SiC module power switching technology. This results in a more compact design with a very high efficiency. The iE Convert is liquid cooled.

Power converter electrical diagram

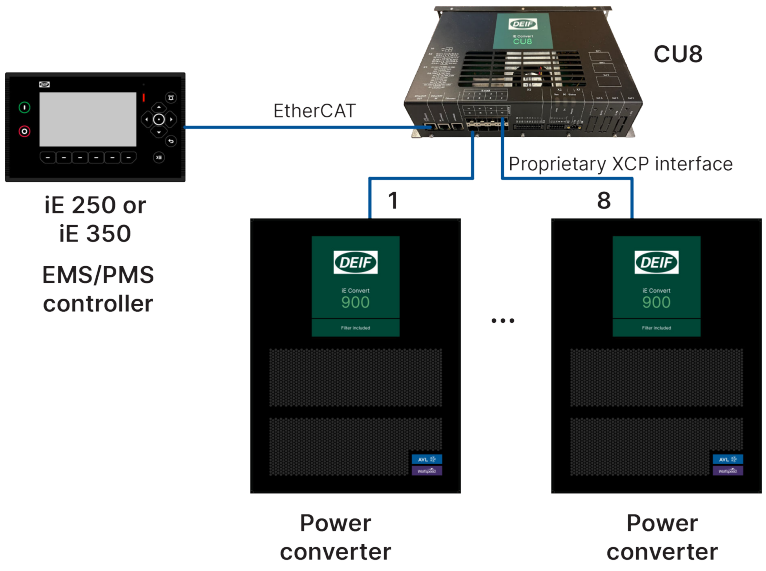
This electrical diagram shows the operation and parts of the power converter.



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

1.1.3 Software versions

The information in this document relates to software version:

Software	Details	Version
CU8*	CU8 controller	1.x.x

NOTE * The CU8 writes application software to the power converters.

1.1.4 Easy configuration

Select the power converter building blocks that your application(s) require. You can then use the CU8 controller to select the power converter application(s) and the parameters.

For faster and easy integration, you can use a DEIF iE 250 or iE 350 controller for energy/power management (EMS/PMS). For PLC control, you can use the DEIF iE 250, iE 350 or iE 650 PLC.

1.2 Functions and features

	Functions
Bidirectional	• Motor drive: Convert DC power to variable voltage and frequency AC power • Generator: Convert variable voltage and frequency AC power to DC 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
Features	Very dynamic FPGA-based control loop
	Regenerative function (motor or generator)
	Self-tuning
Applications	Supply AC power for a propeller or thruster
	Integrate a shaft generator
	Integrate a variable-speed generator
	Pumps and fans
	Brake chopper
	Soft-starter
Local control	Optional multi-line display with function keys (for example, using iE 250)
Other DEIF products	One-click integration

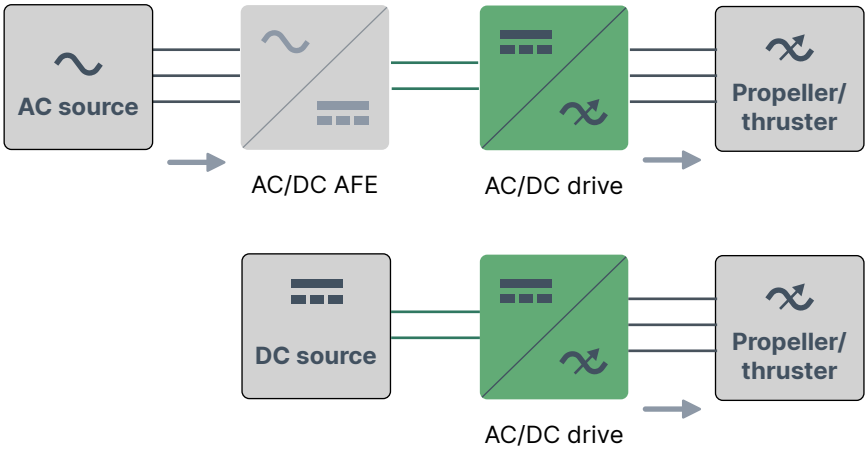
1.3 Application examples

More information
See the iE Convert Land Application Guide and the iE Convert Marine Application Guide for more application examples.

Supply AC power for a propeller or thruster

The AC/DC drive converts DC power to variable frequency AC power, to control an electric propeller or thruster. For azimuth thrusters, the AC/DC drive can also be used to control the motors that regulate the thruster angle.

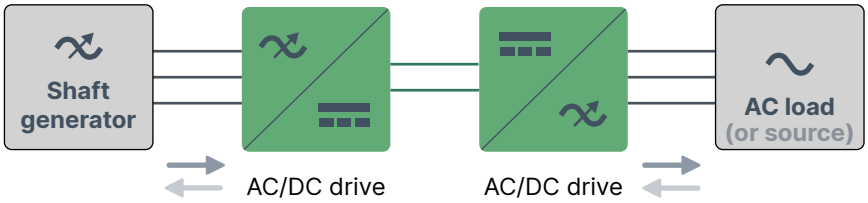
The AC/DC drive instantly regulates AC voltage and frequency, which allows precise and fast control of a ship's course and speed. The active front end (AFE) design allows recovery of braking energy.



Integrate a shaft generator

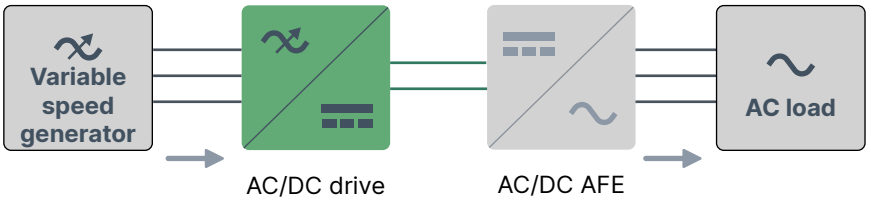
The AC/DC drive is part of a system to integrate the shaft generator into the ship's energy system.

Despite the variable shaft speed, the AC/DC drive ensure that the energy (power take-out, or PTO) from the shaft generator is delivered at a steady voltage and frequency. This design also allows other energy sources to drive the propeller (using power take-in (PTI) or power take-home (PTH) functions).



Integrate a variable-speed generator

The AC/DC drive is part of a system to deliver AC power at a fixed voltage and frequency. This allows the variable-speed generator to run at its optimum speed.



2. Technical specifications

2.1 Electrical specifications

	1200 V DC
Efficiency	Peak efficiency (stack and filter): 99 %
Power Apparent power	900 kW 1170 kVA
Power quality, DC link to AC line, at 20 kHz	dV/dt < 5 kV/µs
Power quality, AC line to DC link, at 20 kHz	Maximum ripple voltage: < 2 % RMS Maximum ripple current: < 2 % RMS
Overload current	110 % of nominal current for 2 s, over 60 s
Short circuit current	< 100 kA
DC link	
Nominal voltage	1100 V
Operating voltage range	100 to 1200 V
Maximum voltage	1350 V (transient)
Nominal current	820 A
DC link-side capacitance (inside the converter)	212 µF
AC line	
Nominal voltage	690 V AC
Operating voltage range	0 to 806 V AC
Nominal current	980 A
Nominal frequency	Up to 4000 Hz, with current derating
AC phase configuration	Standard: 3-phase, 3-wire
Auxiliary supply	
Auxiliary supply	Voltage range: 12 to 36 V DC Nominal voltage: 24 V DC Power: 200 W Connector: D-sub
Standby power consumption (zero power output)	< 100 W

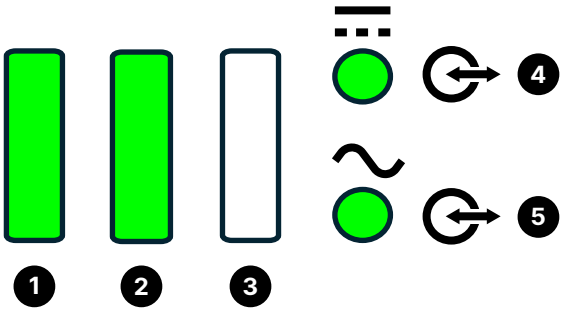
2.2 Alarms and protections

Protections
Hardware over-current trip
Hardware over-voltage trip
Inverter temperature protection
Inverter temperature trip
Short circuit protection
External temperature measurement

Protections
Software over-current trip
Software over-voltage trip
Coolant leak
Voltage and load change response

2.3 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

CU8 controller LEDs

Name	Function
Controller front	
Status LED	Green: Status OK
Safety chain LED	Green: Safety chain in okay, and RCM okay. Orange: Safety chain in okay, and RCM not okay. Orange: Safety chain in not okay, and RCM not okay.
EtherCAT status	Green: Okay Green and orange flashing: Transmission error

Name	Function
	Red: Not okay OFF: Initialising
EtherCAT	Red: Transmission error
Communication connections	
EtherCAT connection (RJ45)	Green: Connection OK
Ethernet connection (RJ45)	Green: Connection OK Yellow: Activity
SFP+ connection (Enhanced small form-factor pluggable)	Green Red

Using an iE 7 display

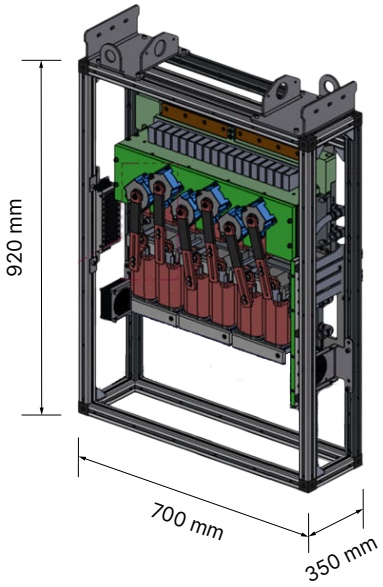
If you connect iE 250 or iE 350 to the CU8, you can use the iE 7 (the display for iE 250 or iE 350) to view the operation of the power converter(s). This configuration fulfils cybersecurity requirements.

CU8 controller display

You can connect a display to the CU8. This configuration does not fulfil cybersecurity requirements.

2.4 Dimensions and weight

iE Convert 900 AC/DC Drive



Dimensions and weight	
Power converter (W x H x D)	700 mm x 920 mm x 350 mm
Cabinet	19" rack mount, 600 mm depth
Weight	~200 kg

2.5 Mechanical specifications

Mechanical	
DC link	Busbars
AC line	Busbars

Mechanical	
Input to control auxiliary power supply	Terminal block
Safety chain	2 inputs, 2 outputs
Breaker control	2 digital outputs
Design life	10 years
Mean time between failures (MTBF)	40000 hours

2.6 Environmental specifications

Operating conditions	
Ambient temperature	-20 to 60 °C, with derating over 50 °C (2.5 % per °C)
Altitude	0 to 2000 m, with derating from 1500 m
Humidity	95 % relative humidity, non-condensing

Storage conditions	
Ambient temperature	-20 to 70 °C
Altitude	Maximum 3000 m
Humidity	95 % relative humidity, non-condensing

Coolant	
Type	Antifrogen N-water mix: 25:75
Flow rate	16 litres/minute for each power converter
Maximum inlet temperature	40 °C, with derating above 35 °C (1 % per °C)
Minimum inlet temperature	20 °C
Pressure	Maximum: 3 bar Pressure drop: < 1.5 bar
Connectors	½", female quick connectors

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

2.7 Communication specifications

CU8 to iE 250/iE 350/iE 650 (or another controller)

Connections	Protocols
• Ethernet • CAN bus	• EtherCAT • CANopen • Modbus RTU • Modbus TCP

Power converter building blocks to CU8

Connection	Protocol
Fiber optic	Proprietary XCP interface

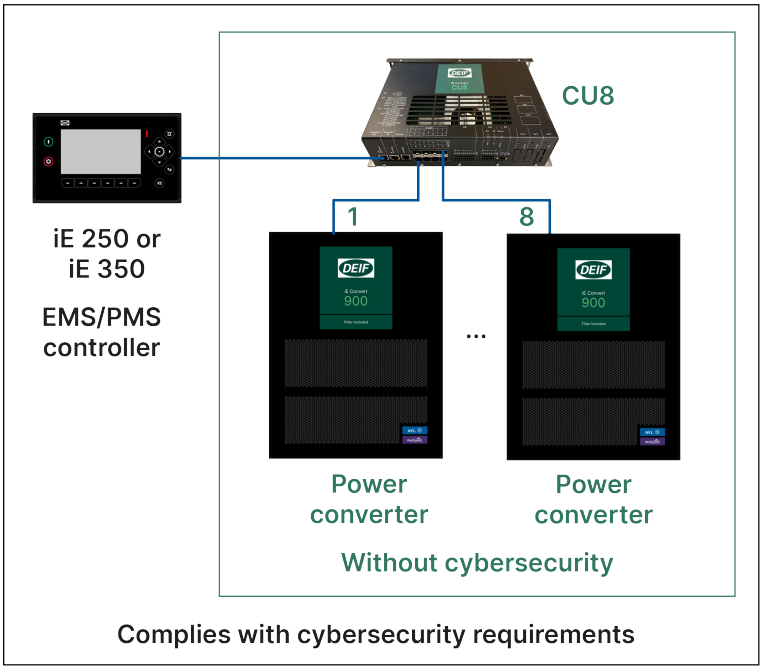
2.8 Approvals

Standards
Marine: DNV, ABS, LR, BV, CCS, KR, RINA and NK1
Land: CE to 61800-5-1, UL 6200

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

2.9 Cybersecurity

The power converters and the CU8 controller do not include cybersecurity features. However, if these are used with an iE 250, iE 350 or iE 650 to interface to the CU8, the whole system complies with cybersecurity requirements.



3. Compatible products

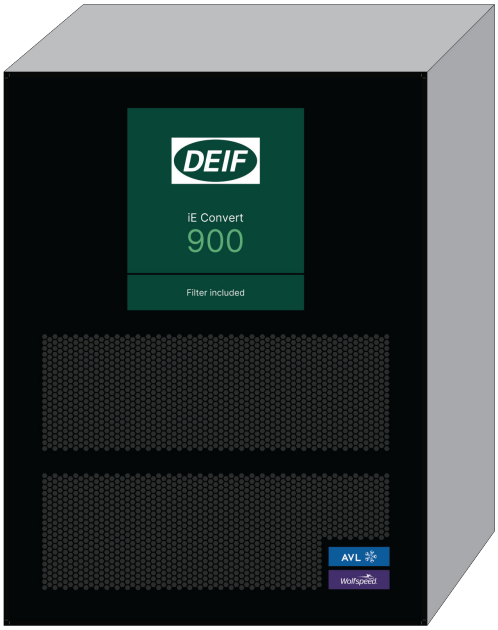
3.1 iE Convert power converters

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

Modules

iE 125

iE 500



iE 900

Applications

AC/DC
AFE

DC//DC
Galvanic isolation

AC/DC
Drive

DC/DC
Buck-Boost

Voltage ratings

Maximum 850 V DC		Maximum 1500 V DC	
350 to 850 V DC	208 to 520 V AC	850 to 1500 V DC	400 to 690 V AC

3.2 Compatible equipment

Controllers with power management and cybersecurity

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

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

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:

- **Synchroscopes**
  - **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

The product described in this data sheet is still under development. All information is therefore preliminary.

Trademarks

DEIF and the DEIF logo are trademarks of DEIF A/S.
Bonjour® is a registered trademark of Apple Inc. in the United States and other countries.
*Adobe®, Acrobat®, and Reader®*are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States and/or other countries.
CANopen® is a registered community trademark of CAN in Automation e.V. (CiA).
SAE J1939® is a registered trademark of SAE International®.
EtherCAT®, *EtherCAT P®*, *Safety over EtherCAT®*, are trademarks or registered trademarks, licensed by Beckhoff Automation GmbH, Germany.
VESA® and DisplayPort® are registered trademarks of Video Electronics Standards Assocation (VESA®) in the United States and other countries.
Google® and Google Chrome® are registered trademarks of Google LLC.
Modbus® is a registered trademark of Schneider Automation Inc.
Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

All trademarks are the properties of their respective owners.

Copyright

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.