Certificate no.:
TAA00003FB

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Power Management System

with type designation(s)
iE250 Marine Power Management components

issued to
DEIF A/S
Skive, Midtjylland, **Denmark**

is found to comply with
DNV rules for classification – Ships, offshore units, and high speed and light craft

Application:

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Location classes:

Temperature	**B**
Humidity	**B**
Vibration	**A**
EMC	**A**
Enclosure	**Required protection according to DNV Rules shall be provided upon installation on board**

Issued at **Hamburg** on **2024-10-30**
This Certificate is valid until **2029-10-29**.
DNV local unit: **Denmark CMC**

Approval Engineer: **Torsten Dzillak**

for **DNV**

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This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

Product description iE 250 Marine

iE 250 Marine product lines is built as modular front- or base mounted hardware platform ranging from simple stand-alone units for generator / bus-tie / shore connection / shaft breaker protection to integrated power management systems. Flexible units can be expanded with input and output modules. The units are designed for the following applications:

iE 250 with CORE software package (Paralleling and Protection Unit) has the following basic functions:
• Breaker trip and alarms
• Breaker open and close (external command)
• Breaker position detection
• Synchronization check
• Synchronization (dynamic and static) and deloading
• Diesel generator start and stop commands
• Load sharing (isochronous, over DEIF Ethernet ring network)

iE 250 Marine with Power Management software package (Protection & Power Management) has in addition to iE 250 Marine with CORE software package the following basic functions:
• Load-dependent start and stop of generators
• Generators priority selection
• Automatic blackout recovery
• Heavy consumer function
• Stop of non-connected generator

The hardware building blocks for a iE 250 Marine are the following modules:
• Plug-in module 8 Digital I/O
• Plug-in module 4 Analogue I/O
• AC measurement and I/O board MIO2.1
• Display unit iE7 remote display

iE 250 PLC Programmable Automation Controller (PLC) with local I/O and optional expansion modules. It consists of the following modules:

iE 250 PLC (Base Mounted)

Software: iE 250 PLC
Application: C/C++ and CODESYS application
I/O: 8 Bi-directional digital channels
4 Bi-directional analogue channels
Interface: 4 x Ethernet (1 independent, 3 switched managed), 3 x CAN, 3 x RS-485,
1 x USB Host, 1 x DisplayPort
Processor: 1.6 GHz quad core
Memory: 2 GB DDR4 RAM
128 kB FRAM
Storage: 32 GB non-volatile (~8 GB user available)

iE 250 PLC (Front Mounted)

Software: iE 250 PLC
Application: C/C++ and CODESYS application

Display: 7”, Touch, Project Capacitive (PCAP)

Interface: 4 x Ethernet (1 independent, 3 switched managed), 3 x CAN, 3 x RS-485,
1 x USB Host
Processor: 1.6 GHz quad core
Memory: 2 GB DDR4 RAM
128 kB FRAM
Storage: 32 GB non-volatile (~8 GB user available)

Optional expansion modules
Measurement and Input/Output Module MIO2.1
2 direct 3-phase AC voltage measurements
3-phase AC current measurement
4th current measurement

8 Digital input channels
8 Digital bi-directional channels
4 Analogue bi-directional channels
Analogue load sharing
Analogue Tacho (MPU/N/NPN/PNP) input
2 Analogue output

The following alarm and protection functions as defined by ANSI are available:

Protection function	ANSI no.	Levels
Over-voltage U>, U>>	59	2
Under-voltage U<, U<<	27	2
Voltage unbalance UUB>	47	1
Positive sequence undervoltage U1<,	27D	1
Zero sequence voltage Uo	59Uo	1
Negative sequence voltage U2>	47	1
Over-current 3I>, 3I>>	50TD	2
Fast over-current 3I>>>	50/50TD	2
Current unbalance IUB> (average) (nominal)	46	2
Directional overcurrent I>	67	2
Over-frequency f>, f>>	81O	2
Under-frequency f<, f<<	81U	2
Directional power P>, P>>	32	3
Reverse power P<, P<<	32R	2
Reactive power export Q>, Q>>	40O	2
Reactive power import Q<, Q<<	40U	2
Inverse time over-current It>	51	1
Negative sequence current I2>	27	2
Zero sequence currentcurrent Io>	51Io	1
Earth inverse time over-current	51G	1
Neutral inverse time over-current	51N	1
Lockout relay	86	

Software versions of functional modules will be covered by separate certificate with the following number TAA00003H9 and cyber security with certificate TAA00003G3.

Software revisions valid for this approval are placed in DEIF Software Quality Plan documents. Project specific functions are achieved by setting limits for alarms and parameters.

Application/Limitation

- The Type Approval is valid for systems made by production facilities listed under Place of Manufacture
- The Type Approval covers hardware and software listed under Product description
- The Type Approval does not cover functions implemented in Custom Logic. Any functions implemented therein shall be documented on case-by-case basis
- For high-speed vessels category B (ref. Pt.4 Ch.8 Sec.2 [6]) and for ships with additional class notations DYNPOS(AUTR) or DYNPOS(AUTRO) (ref. Ship Rules Pt.6 Ch.3 Sec.2 [8.4]) the PPM 300 system must be configured so as to ensure that the power management functions are active for each busbar section when the bus-tie breaker is open. Also, the communication network between DGUs for one busbar section must not be affected by a defective communication network for the other busbar section
- Hybrid-controller application shall be approved on a case-by-case bases.

Product certificate

Each system to be certified according to Pt.4 Ch.9 Sec.1. The certification test is to be performed before the system is installed onboard at the company defined as responsible for the system, typically at the switchboard manufacturer. The product certificate must identify this Type Approval Certificate and the parameter settings for the specific project. After the certification the clause for application software control will be in force.

The following documentation of the actual application is to be submitted for approval in each case:

- Reference to this Type Approval Certificate
- System block diagram
- Power supply arrangement (may be part of the System block diagram)
- List of hardware and software modules as identified in this Type Approval Certificate
- Functional description
- A document describing the specific functions for hybrid mode operation stating operating modes, hard- and software configuration and integration/ interfacing with other system.
- List of implemented alarm and protection functions (ref. the ANSI list above) with proposed limits and time delays Software versions used in specific delivery
- Test program for the certification test

Software update notification
When the type approved software is revised (affecting all future deliveries) DNV is to be informed by forwarding updated software version documentation. If the changes are judged to affect functionality for which rule requirements apply a new functional type test may be required and the certificate may have to be renewed to identify the new software version.

Type Approval documentation

Tests carried out

Applicable tests according to class guideline DNV-CG-0339, August 2021.
Functional Type Tests on a representative 5 generator / 1 bus-tie breaker / shaft generator, shore connection and one Hybrid system including a non essential load at DEIF's test bench on 2024-05-27.
Functional Type Tests on a representative 4 generator / 1 bus-tie breaker / shaft generator, emergency generator, shore connection and one Hybrid system under consideration of two heavy consumers a non essential load at DEIF's test bench on 2024-05-28.
Functional Performance Type Tests on representative configuration at DEIF's test bench on 2024-05-14. Functional Performance Type Tests on representative configuration at DEIF's test bench on 2024-05-16.

Marking of product

Each module shall be externally marked to enable identification in accordance with the documentation and be marked with the manufacturer's name.

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the type are complied with, and that no alterations are made to the product design or choice of systems, software versions, components and/or materials.
The main elements of the assessment are:
Inspection on factory samples, selected at random from the production line (where practicable)
Results from Routines (RT) checked (if not available tests according to RT to be carried out)
Review of type approval documentation
Review of possible change in design, materials and performance
Ensuring traceability between manufacturer's product type marking and Type Approval Certificate.
Assessment to be performed at 2 and 3.5 year and at renewal.
END OF CERTIFICATE