Certificate no.:
**TAA00003FC**

# TYPE APPROVAL CERTIFICATE

## This is to certify:

**that the Power Management System**

with type designation(s)
**iE 350 Marine & ML300 series included from existing TAC**

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**

for **DNV**

Approval Engineer: **Torsten Dzillak**

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.

## iE 350 Marine & ML300 series included from existing TAC

## Product description

Multi-line 300 and iE 350 Marine product lines is built as modular 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:

GPU 300 (Generator Protection Unit) combines the following basic functions:
• Breaker trip and alarms
• Synchronization check
• Breaker close (external command)
• Breaker position detection

PPU 300/iE 350 Marine with CORE software package (Paralleling and Protection Unit) has in addition to GPU 300 the following basic functions:
• Breaker open and close (external command)
• Synchronization (dynamic and static) and deloading
• Diesel generator start and stop commands
• Load sharing (isochronous, over DEIF Ethernet ring network)

PPM 300/iE 350 Marine with Power Management software package (Protection & Power Management) has in addition to PPU 300 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 Multi-line 300 system are the following modules:
• Power supply module PSM3.1 and PSM3.2
• Alternating current modules ACM3.1 and ACM3.2
• Input output modules IOM3.1, IOM3.2, IOM3.3 and IOM3.4
• Engine interface module EIM3.1 (iE 350 Marine, PPU 300 and PPM 300 only)
• Governor and AVR module GAM3.1 and GAM3.2 (iE 350 Marine, PPU 300 and PPM 300 only)
• Processor and communication module PCM3.1 (Multi-line 300, GPU/PPU/PPM 300)
• Processor and communication module PCM3.3 (iE 350 Marine)
• Display unit DU 300 (Multi-line 300, GPU/PPU/PPM 300)
• Display unit iE7 (iE 350 Marine)

iE 350 PLC Programmable Automation Controller (PLC) with EtherCAT based I/O modules. It consists of the following modules:

Programmable Computer Modules
PCM3.3 ( iE 350 PLC )

Software: iE 350 PLC

Application: C/C++ and CODESYS application

Interface: 5 x Ethernet (1 independent, 4 switched (managed), 4 x CAN,
2 x RS-422/485 ( 1 x RS-232), 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 )

Power Supply Modules
PSM3.1 Power supply: 12 or 24 V DC nominal (8 to 36 V DC continuously)

Consumption: Typical 20 W, maximum 35 W

PSM3.2 Power supply: 12 or 24 V DC nominal (8 to 36 V DC continuously)
Consumption: Typical 20 W, maximum 35 W

Input/Output Modules
IOM3.1 4 changeover relay outputs
10 digital inputs

IOM3.2 4 relay outputs
4 analogue multifunctional outputs
4 digital inputs

IOM3.3 10 analogue multifunctional inputs

IOM3.4 16 digital inputs
12 digital outputs

Measurement and Production Modules
ACM3.1 2 direct 3-phase AC voltage measurements
3-phase AC current measurement
4th current measurement

ACM3.2 3-phase AC current measurement - Consumer side
3-phase AC current measurement - Neutral side

Engine Interface Modules
EIM3.1 Engine Interface module

Govenor and AVR module
GAM3.1 Govenor and AVR module with configurable inputs and outputs
GAM3.2 Govenor and AVR module with configurable inputs and outputs

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