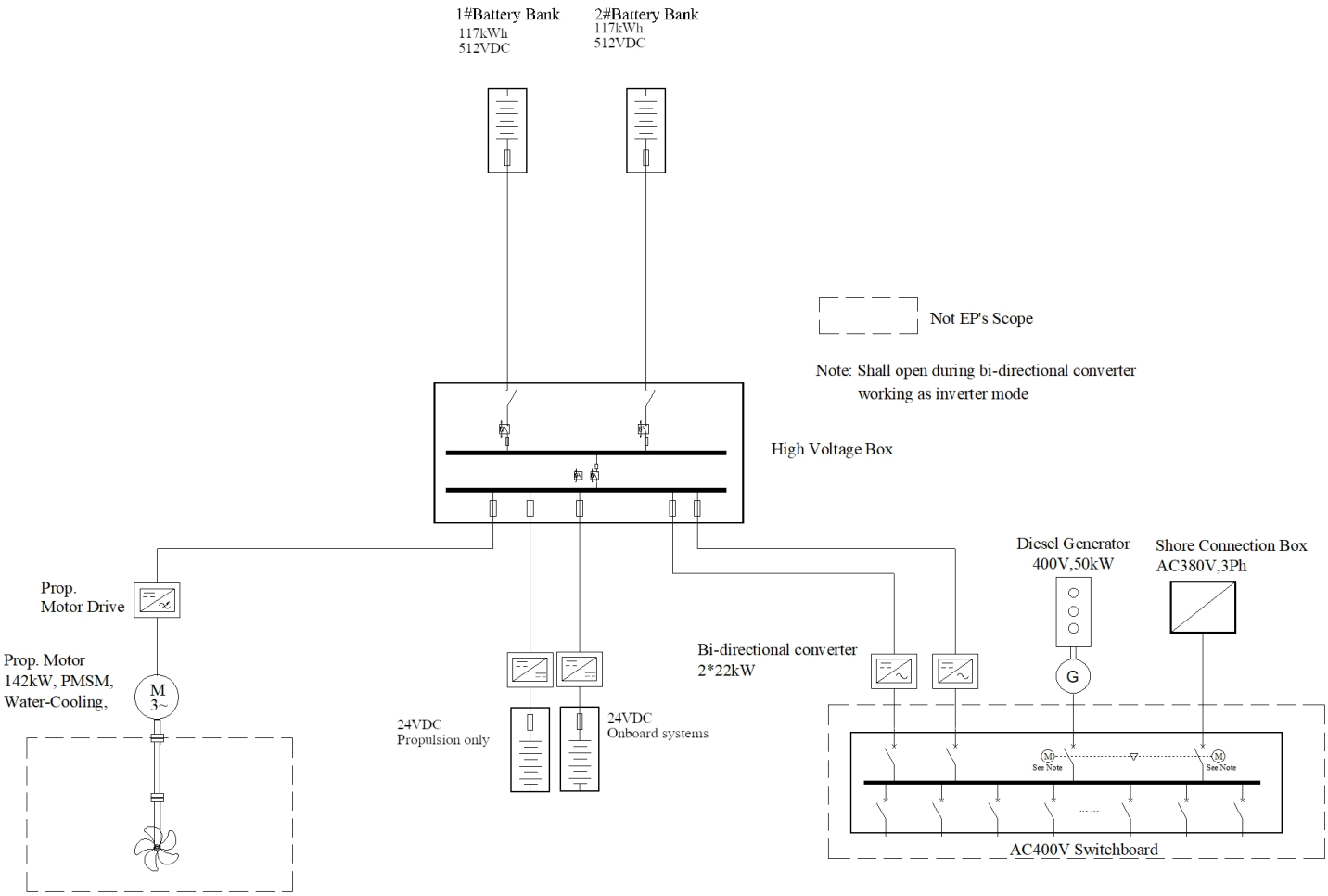
Workboat German

1. Single Line Diagram



2. Equipment List

No	System	Equipment	Quantity	Unit	Remark
1	Battery System	Battery Pack	20	pcs	2 battery boxes.
2		High Voltage Box	1	pcs	
3	Bi-directional Converter DCDC	22kW Bi-directional Converter 50a	2 2	pcs pcs	

4	Propulsion System	Propulsion Motor	1	pcs	
5		Propulsion Motor Drive	1	pcs	
6		Propulsion Remote Control System	1	set	

3. Equipment Technical Characteristics

3.1 Battery System

The battery system of this project consists of two independent battery clusters. Each battery cluster consists of 10 battery packs connected in series. The two battery clusters are connected to the same high-voltage box, which is the power supply and distribution center of the entire ship. Other power supply and distribution equipment on the ship are also connected to this high-voltage box.

3.1.1 Battery Pack

Model:EP-51.2V230Ah-C

Type: lithium iron phosphate battery pack

This battery pack designed and produced by Guangdong ePropulsion Technology Co., Ltd. And it is designed for marine power or energy storage applications.

3.1.1.1 Dimensions and Appearance

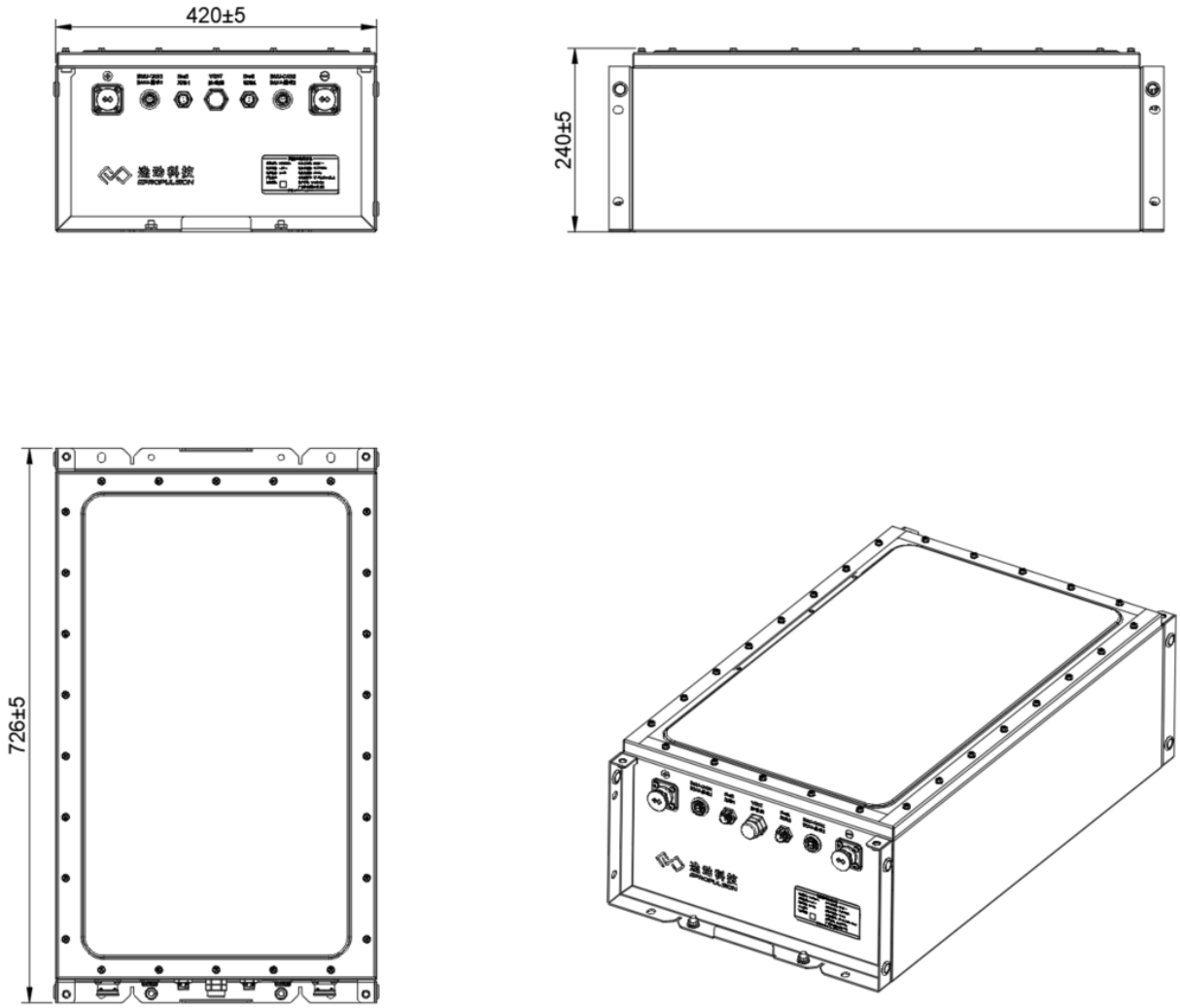


Figure 1 Battery pack dimensions (unit: mm)

3.1.1.2 Specifications

	Items	Parameters	Remarks
1	Battery Type	Lithium iron phosphate battery pack	/
2	Configurations	1P16S	/
3	Cell Model	L173F230	16 PCS
4	Cell Module Model	H173F230A-1P8SA H173F230A-1P8SB	/
5	Energy	11.776 kWh	/
6	Rated Voltage	51.2 V	/

7	Rated Capacity	230 Ah	Temperature: 25 ± 2 °C Relative Humidity: 25~ 75% Atmospheric Pressure: 86kPa~ 106 kPa
8	Charge Cut-off Voltage	57.6 V	/
9	Discharge Cut-off Voltage	40 V	/
10	Cell Charge Limit Voltage	3.6 V	/
11	Cell Discharge Limit Voltage	2.5 V	/
12	Maximum Continuous Discharge Current	230A (1C)	/
13	Maximum Continuous Charge Current	230A (1C)	/
14	Insulation Resistance	Battery pack positive or negative to case ⩾ 50MΩ (DC 1000V)	/
15	Working Temperature	Discharge: -10~60°C	Cell temperature
		Charge: 0~55°C	
16	Environment Temperature	0~45°C	/
17	Weight	89.5Kg（±3kg）	/
18	Dimensions	Length 726±10mm Width 420±10mm Height 240±10mm	/
19	Pack Structure	Metal	/
20	Fixing method	Bolt	/
21	IP Level	IP67	/
22	Cooling	Air Cooling	/

3.1.1.3 Storage Requirements

Items	Requirements

Environment	<1 month	-20°C ~ +55°C， 5~75%RH
	> 3 months	-10°C ~ + 45°C， 5~75%RH
	Recommendation	15°C -35°C， 5~75%RH

If the battery pack is stored for a long time, it is recommended to be maintained at SOC 50%~60%. In addition, it is recommended to charge and discharge the battery every six months.

3.1.2 High Voltage Box

3.1.2.1 Dimensions (Only For Reference, should be confirmed by approval drawing)

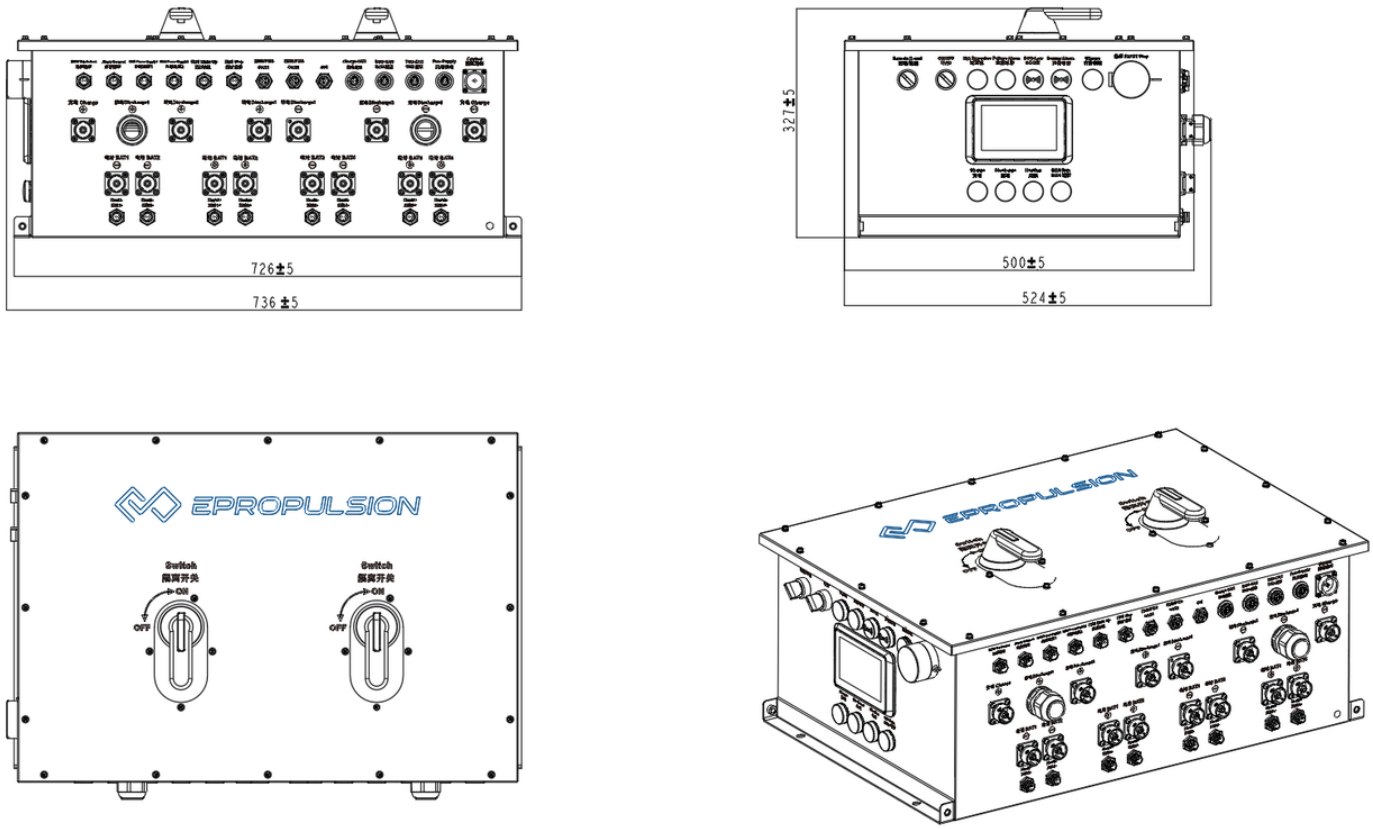


Figure 2 HVB dimensions (only for reference)

3.1.2.2 Specifications

No.	Items	Parameters	Remark
1	Operating temperature range	-10~60°C	
2	Operating relative humidity	5%~95%	
3	Storage temperature	25~55°C	
4	Insulation impedance	⩾20MΩ	
5	IP rating	IP44	
6	Weight	<50kg	
7	Thermal management mode	Natural cooling	
8	Material	Hot-dip galvanized steel sheet	

3.2 Bi-directional Converter

CEC-22800

Highest power density with fulll charging flexibility

Experience the future of EV charging with our innovative 22kW Compact Efficient Charger platform. Designed for maximum power and convenience, this platform delivers exceptional performance without compromising on reliability. The innolectric CEC combines the power electronics and the innolectric D3C communication module enabeling AC and DC charging without the need for additional devices. This is based on the innolectric concept, which

requires only the integration of a single-unit solution for all charging functionalities on the customer side.

EV charging the most comfortable way

There is a multitude of possible applications for the innolectric CEC, e.g.

- Heavy-duty, construction and mining machinery
- Municipal and agricultural vehicles
- Light and heavy duty trucks
- Marine applications such as ferries and yachts
- Stationary and mobile applications such as refrigeration and energy storage systems

AC and DC charging with one compact component

The innolectric CEC is designed to meet the highest industry standards, offering both AC and DC charging in a single compact component. The charger supports AC charging based on the common international standards, ensuring reliable performance and compatibility across a wide range of electric vehicles. The CEC´s distinguishing feature is its integrated charging communication controller, which enables DC charging as well. This facilitates seamless communication between any charging station and your EV, optimizing the charging process and designed for optimal convenience of use and efficiency.

Innolectric develops its products in-house, from the hardware to the software, to ensure the highest quality and functionality. With so many projects underway, and the changing needs of our international customer base, our aim is to drive electromobility forward with our products.

Highlights

- On-board chargers with the highest power density in its class: ~2,0 kW/l
- High efficiency of at least 96%
- Compatible with almost all common energy grids In Europe, North America, India, and the Asia-Pacific region
- Full interoperability according to all major charging standards: IEC 61851, SAE J1772, DIN SPEC 70121 and ISO 15118-20
- Integrated bidirectionality (V2X)
- Developed and tested according to ECE r10 rev.6

Technical Data

Product	CEC-22800
Input power	22 kW
Input voltage (3~ AC)*	327 — 480 V
Input voltage (1~ AC)*	102 — 265 V
Input current (AC)	32 A (per phase)
Frequency	50 — 60 Hz (+/- 1 %)
Efficiency	typically 96 %
Output voltage (DC)*	520 - 850 V
Output current (DC)	Up to 45 A
AC charging communication	IEC 61851, J1772 Type 1, Type 2, NACS
DC charging communication	DIN SPEC 70121, ISO 15118-20 CCS1, CCS2, NACS
Charging mode	Unidirectional, bidirectional (V2X)
Protection class	IP6K9K
Interfaces*	1 x CAN J1939 / 1 x Service CAN
Dimensions (L x W x H)	460 x 460 x 93 mm
Weight	~ 19 kg
Operating temperatures	- 40 °C to +65 °C

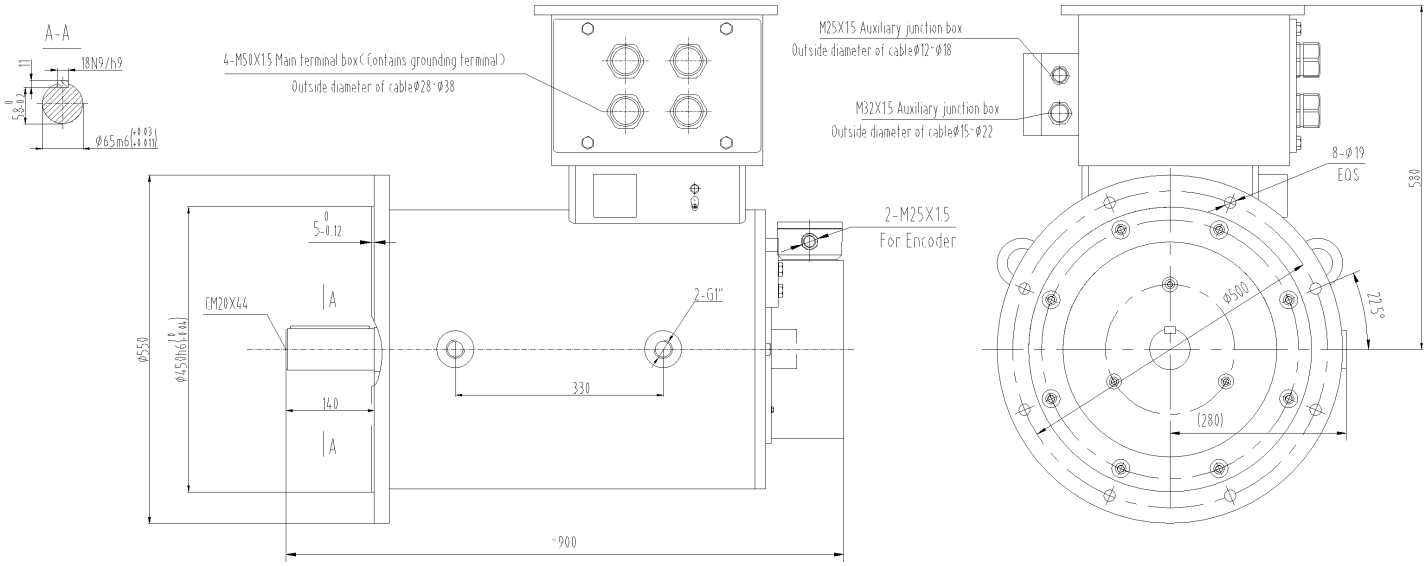
* Parameters can be customised to the customer application.

Information is subject to be changed.

3.3 Propulsion System

The propulsion system is fitted with one marine water-cooled permanent magnet synchronous motor, with a rated power of 142kW at 2078rpm, driving the propeller

3.3.1 Propulsion Motor



Permanent Magnet Synchronous Mo							
Output (kW)	Rate Voltage (V)	Permissible current : (A)	Speed : (r/min)	Frequency (Hz)	Efficiency (%)	(COS Φ)	
142	380	255	2078	140	96.8	0.95	
Starting Method	Connection	Duty	Mounting	Cooling	Insulation	IP Rating	
Vector frequency	Y	S1	IMV1	IC71W	H	IP54	

Accessories
With winding RTD：PT100，6 PCS
With bearing RTD：PT100，2 PCS
With space heater：220~240V 60W

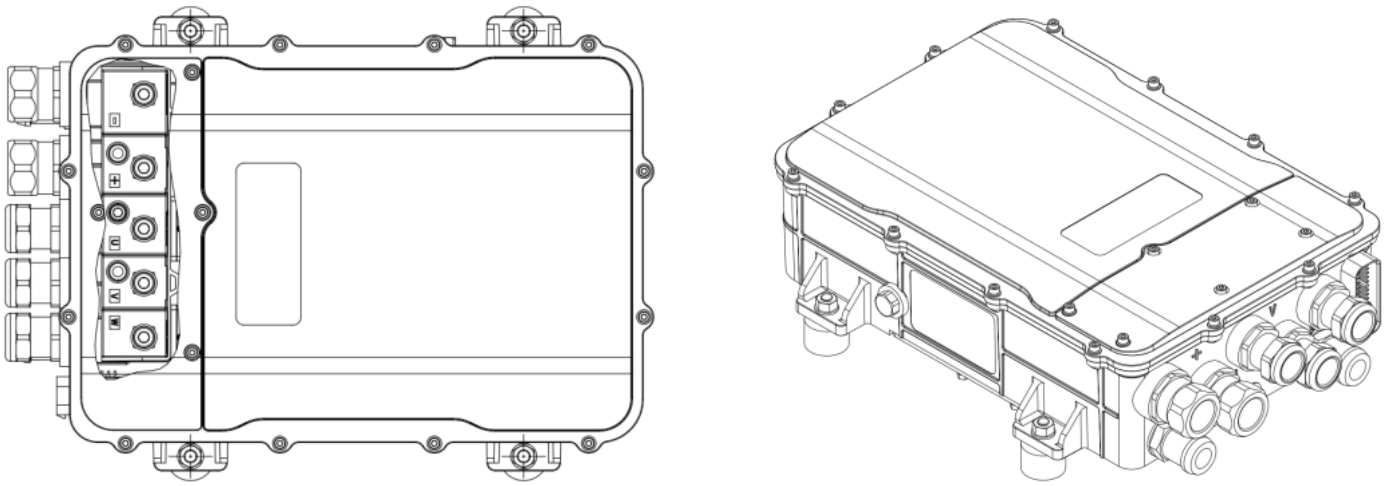
3.3.2 Propulsion Motor Drive

The boat is equipped with the propulsion motor inverters, which control and adjust motor speed continuously based on commands from the propulsion control system. These inverters ensure optimal control and protection by managing dynamic load changes under various operating conditions, guaranteeing the propulsion system's optimal performance and safe operation.

The main parameters of the propulsion motor inverter are shown in Table:

Parameter table of the propulsion motor inverter

Item	Tech index	Remark
Rated capacity	160kVA	
Input voltage range	DC400~720V	
Cooling mode	Liquid cooling	
Dimension W×H×D[mm]	400×120×280mm(3) (TBC on approval drawing)	
Weight	11kg (TBC on approval drawing)	
Cooling flow	16L/min	
Pressure drop	⩽6600Pa	



Outline diagram of propulsion motor inverter

3.3.3 Propulsion Remote Control System

The propulsion remote control system is designed to work for remote the propulsion motor in the wheelhouse, offering the following functionality:

- Control of propulsion motor speed
- Start/stop control of the propulsion system

- Emergency stop for disconnection
- Speed indicators
- Propulsion power limitation
- Electric propulsion system fault alarms
- System status display