



THE SWITCH DC-HUB FOR MULTI-MEGAWATT DC SWITCHBOARDS

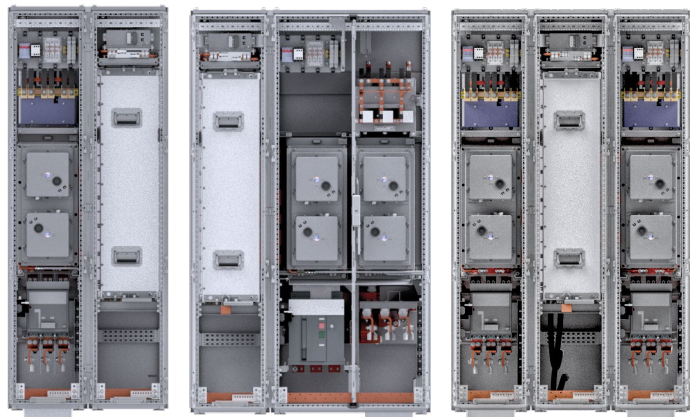


BUILDING BLOCKS



Motor/generator inverter (MI/GI)

- Motor and variable-speed generator applications
- Shaft generator support (PTO, PTI, PTH)
- IM, PM, IPM and EESM supported
- Torque, speed, power, DC voltage and scalar control modes



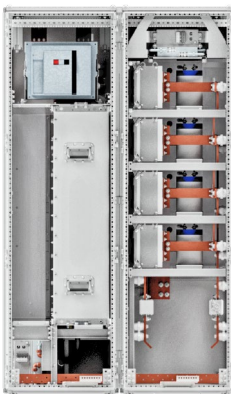
Active front end (AFE)

- Grid compliance, THDu <5% (typically <3%)
- Grid or DC voltage control
- Island mode support with blackout start
- Active harmonics damping
- Possible to connect several AFEs to the system
- Possible to parallel units with LCL or dedicated winding



Electronic Bus Link (EBL)

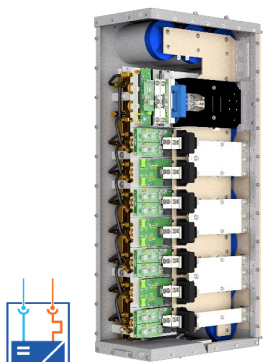
- Connects The Switch DC-Hubs together
- Critical faults are detected and disconnected in approximately 10 microseconds
- Allows a ring network
- Improves redundancy while enabling fuel savings
- DP3 tested and approved by DNV
- Several units can be connected to the system



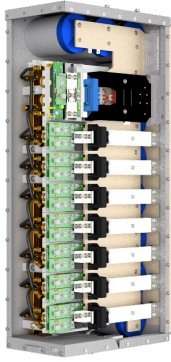
DC/DC chopper for batteries

- Links battery, fuel cells and other DC-source connections to the DC-Hub with maximum efficiency
- Enables numerous applications: reserve power, peak shaving, backup power and more
- Ensures constant DC voltage
- Allows DC voltage, current or power control modes
- Configurable output
- Several units can be connected to the system

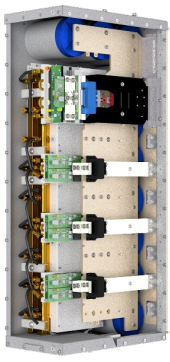
POWER MODULES



High-power module with EDCB



Flexible module with EDCB

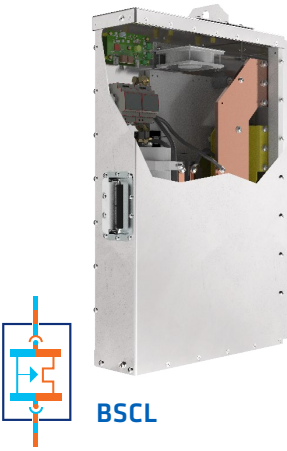


Half module with EDCB

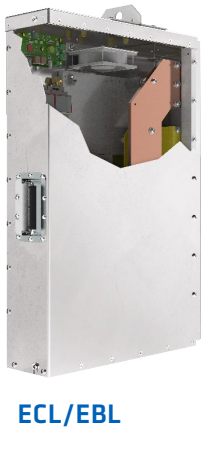
	Normal duty current continous (A)	Short circuit capacity 500 ms (A) *	Dimensions		
			W	D	H
High-power module	1,600	2,500	305	580	1,140
Flex module	2 x 800	2 x 1,250			
Half module	800	1,250			

*for AFE function. Longer duration with derating

PROTECTION MODULES



BSCL



ECL/EBL



EBL

	Normal duty current continous (A)	Number of protected poles	Dimensions		
			W	D	H
BSCL	1,800	1	147	563	805
ECL	1,800	1 or 2			
EBL	1,800	1			

SWITCH TRACKS TO DC DISTRIBUTION

1 How can you connect a battery directly to the DC link?

ECL (Electronic Current Limiter) protects the DC link and ensures operational continuity

2 How can you ensure system redundancy?

EBL (Electronic Bus Link) offers ultrafast protection between DC-Hubs. EBL allows a ring network and DP3 operation

4 How do you connect large batteries to a DC system?

BSCCL (Battery Short-Circuit Limiter) blocks any high short-circuit current from the battery

3 How can you protect against short circuits in an inverter module?

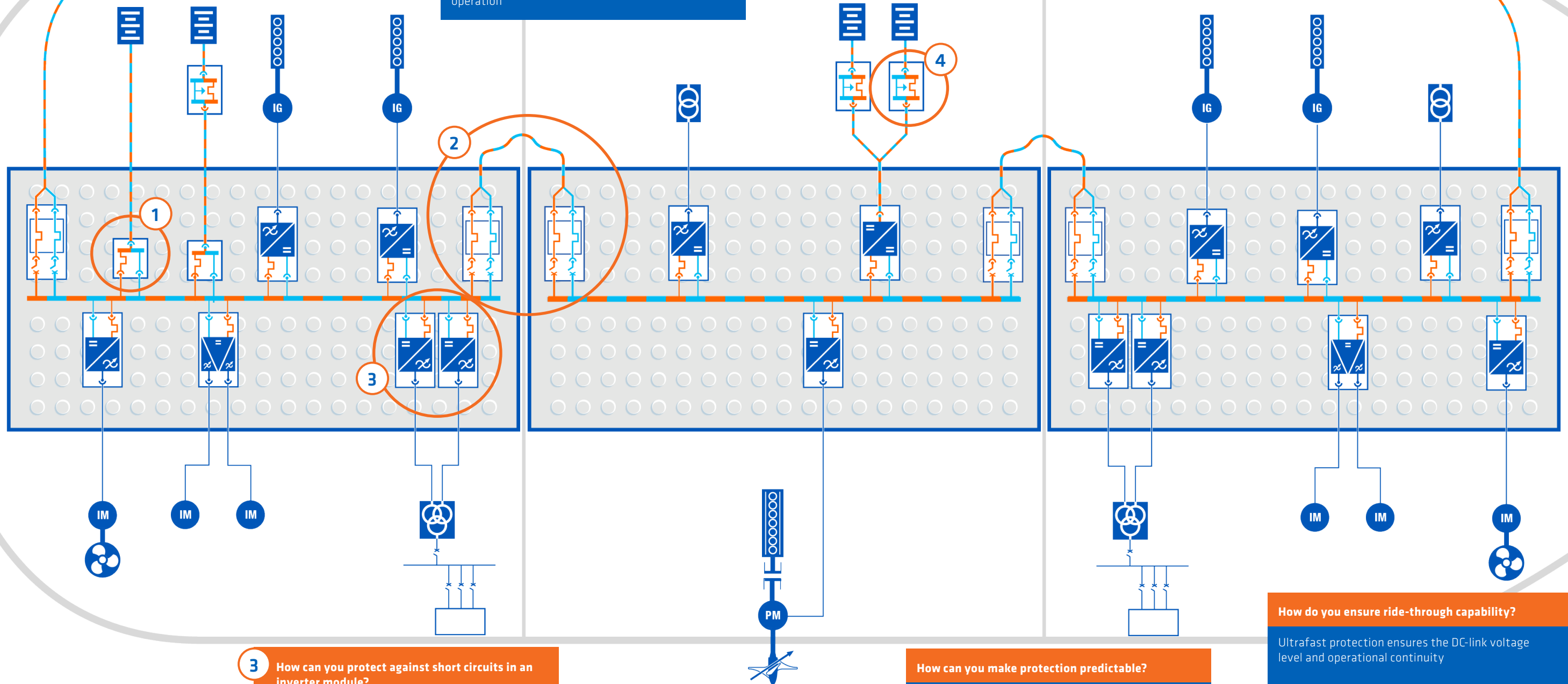
EDCB (Electronic DC Breaker) offers ultrafast protection inside a DC-Hub toward the inverter module failure

How can you make protection predictable?

After a critical fault, only a reset is required. Faulty components are removed from the circuit. Protection based on current measurement provides predictable selectivity

How do you ensure ride-through capability?

Ultrafast protection ensures the DC-link voltage level and operational continuity



SMOOTH RIDE THROUGH THE WAVES

The Switch Electronic DC Breaker (EDCB) –
Handles short-circuit faults
inside a DC-Hub

The Switch Electronic Bus Link (EBL) –
Handles short-circuit
faults **between** DC-Hubs

The Switch Electronic Current Limiter (ECL) –
Handles short-circuit faults
toward the battery on the
DC-Hub end of the cable

The Switch Battery Short-Circuit Limiter (BSCL) –
Handles short-circuit current **from**
the battery, typically installed at
the battery end of the cable

Full suite for safety covering entire DC switchboard
Our protection concept now includes 4 ultra-fast devices,
which protect **inside** DC-Hubs, **between** DC-Hubs and **to** and **from** batteries

MARINE-SPECIFIC DESIGN

NO COMPROMISES IN FEATURES, MATERIALS OR SOLUTIONS

Ready for harsh marine operation

- Allows system-level optimization and easy at-sea servicing
- Rigid foundation with vibration dampers
- Can be connected to the vessel's freshwater cooling system

Unique ultrafast semiconductor-based protection concept

- Suite of 4 fit-for-purpose, game-changing products
- Electronic DC Breaker (EDCB) is unique in the market
- Ride-through capability

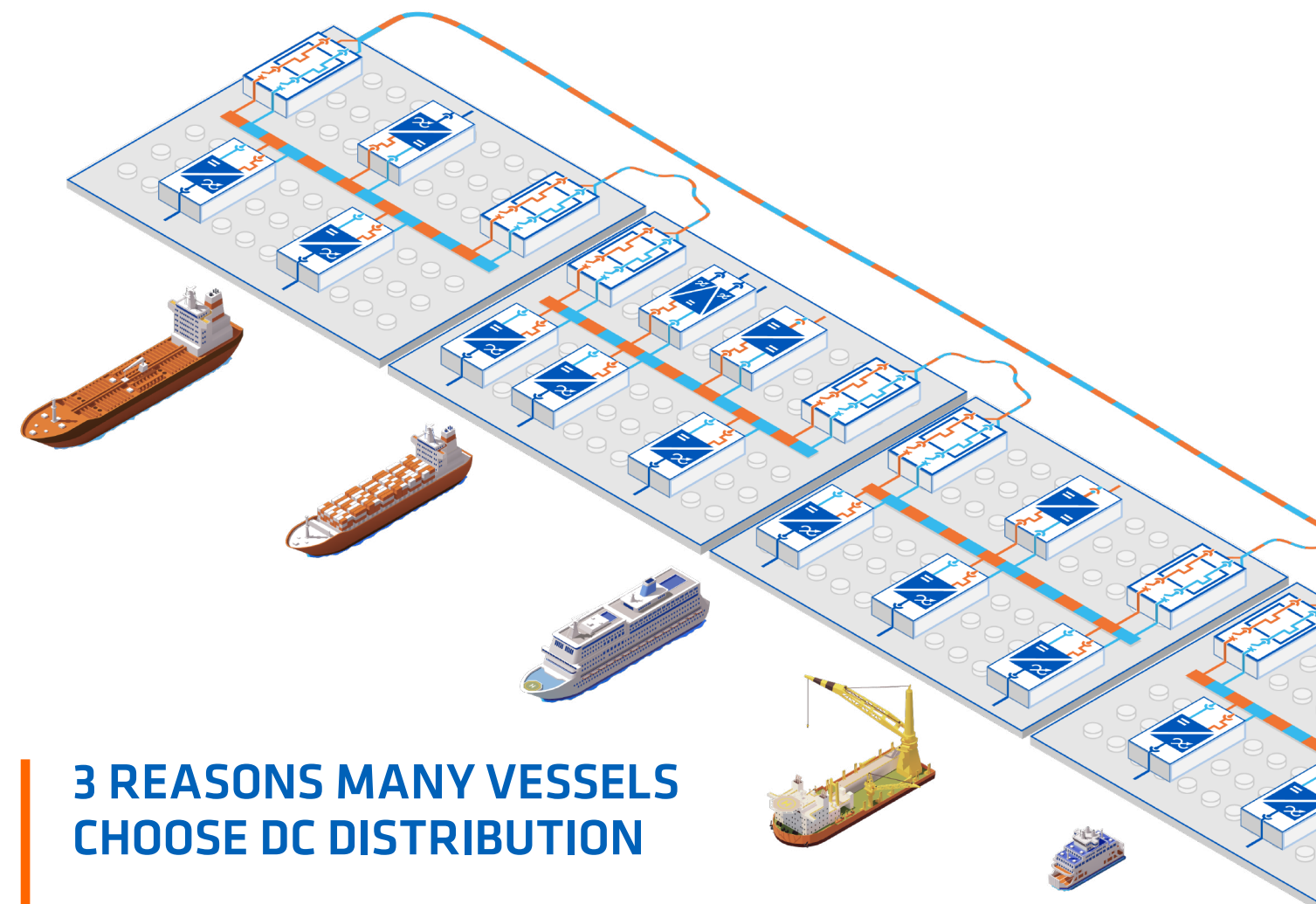
Fast and reliable maintenance

- Crew can change the module
- Power module with precharge included
- Fast AC and DC connectors in power module
- Closed IP44 power module and cabinet structure
- No bolt connections in the main electrical path

THE SWITCH DC-HUB: ENGINEERED FOR COMPLEX MEGAWATT-CLASS POWER

WHY DC DISTRIBUTION?

- Fewer components mean higher efficiency
- Efficient use of regenerated energy
- Smaller footprint
- Lower fuel use thanks to variable speed generators
- Easy integration with batteries and other energy sources
- Future-flexible for changing regulations
- High fault tolerance and system redundancy with semiconductor-based protection



3 REASONS MANY VESSELS CHOOSE DC DISTRIBUTION

#1 – Lowers fuel use, higher efficiency

Variable speed gensets and batteries optimize energy use for longer operation.

#2 – Increased system redundancy and fault tolerance

Ultrafast protection devices enable safe closed bus tie operations, even for DP3 operations.

#3 – Easy to operate and maintain

Reliable, user-friendly products maximize uptime and simplify operations.

DC distribution is the future.

WIDEST RANGE OF PERMANENT MAGNET (PM) MACHINES AVAILABLE

Our wide range of PM machines improves overall efficiency for propulsion and onboard electricity generation, helping reduce CO₂ emissions and operating expenses.

Advantages of PM technology

- Higher efficiency, lowering fuel consumption and emissions
- Simple construction
- Higher reliability
- Less maintenance
- Reduced space requirements
- Enhanced shaft line dynamics



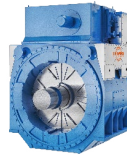
PMM850M

Up to 400 rpm / 230 kNm
Typically used in 0.5-2 MW shaft generators and propulsion motor applications



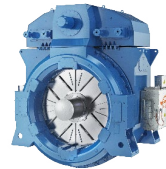
PMM1000M

Up to 250 rpm / 230 kNm
Typically used in 1-2 MW direct-drive systems



PMM1200M

Up to 250 rpm / 450 kNm
Typically used in 1-3 MW direct-drive systems



PMM1500M

Up to 220 rpm / 630 kNm
Typically used in 2-4 MW direct-drive systems

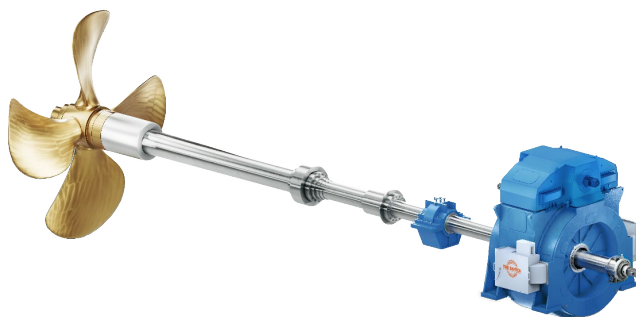


PMM2000M

Up to 130 rpm / 2,100 kNm
Typically used in 4-12 MW direct-drive systems

DIRECT-DRIVE PROPULSION

The Switch permanent magnet machine (PMM) can be used conventionally as a direct-drive propulsion motor with its own bearings. It can also be used as a novel concept, utilizing the common bearings between the propulsion shaft and the motor. A tandem setup is also possible on request.



DRIVE-SPECIFIC TESTING AVAILABLE

The Switch offers full-power testing and drive-specific test setups at its various locations in Finland, Norway and China.

All tests fulfill international standards and class requirements.



Heiane test center – Norway

Member of the Energy House.
System integration testing for DC-Hubs with batteries, fuel cells and more



Vaasa test center – Finland

DC-Hub testing, including all applications – AFE MI, DC/DC.
Full-power testing over 3 MW



Lappeenranta Large Drive Test Center – Finland

Full-load testing capability for electrical machines and drives up to 18 MW



www.theswitch.com

■ The Switch is part of the BEMAC Group.