



Variable Frequency Drive (VFD)

State of the art submarines having DC-mains as their primary source are today more and more fitted out with Squirrel Cage Motors. These motors require their own right sized controllable power supply. Based on pulse width modulation (PWM) conversion technology, the Variable Frequency Drives have the same features and advantages as the well known static inverters and fulfill all relevant requirements for naval applications.

The Drives have been designed to convert the DC submarine battery voltage of 270 to 504 VDC into a frequency-adjustable 3-ph AC voltage of 0...180 V whereas the output voltage depends on the adjustable frequency (0...120 Hz) and is directly proportional.

All parameters for driving a motor can be programmed by a parameterization console integrated in the switchboard. A certain number of parameters are factory settings to be programmed by using a password. Basically two speed selections are programmed which are accessible by the switchboard command Low Speed and High Speed. During normal operation the parameterization console displays the actual values of the variable frequency drive. During malfunction the respective failure is displayed in plain text. A digital signal processor (DSP) is used to control the motor starter's foreseen function as starting the connected motor, regulate to the required speed and lastly stopping the motor.

Output over current and short current detection as well as the general remote control of a number of equipment parameters via the interfaced ship control system are common for all different VFD's.



For Submarines

Standard Features

- Completely qualified
- Remotely controllable
- Easy programmable
- Low weight
- Small size
- Low noise

- High efficiency
- High reliability
- Low life cycle costs
- Short circuit protected

Support Service

- Complete Integrated
- Logistic Support (ILS)



Electrical Characteristics	5 kW	10 kW	25 kW	50 kW
Input voltage	270 - 504 VDC			
Dynamic range	230 - 580 VDC for 2 s			
Ripple	Max. 20 Vrms			
Input current (at 360 V and nominal load)	15 A	30 A	75 A	150 A
Inrush current	Less than nominal current			
Voltage spikes	1 kV ± 10% for 6 ms			
Output voltage	0 - 180 V, 3-phases			
THD	≤ 3% at balanced load			
Voltage transients	≤ 10% at load steps: 50%-100% / 100%-50%			
Recovery time	≤ 50ms at load steps: 50%-100% / 100%-50%			
Frequency	0 -120 Hz, programmable			
Waveform	Pure sinewave			
Efficiency	≥ 94% at 100% load			
Output Power				
Overload	120% for 1 min.			
Digital communication	Ethernet Modbus			
Physical Characteristics				
Dimensions (H x W x D) mm	366x530x340	410x530x340	550x530x340	730x530x500
Weight (kg)	47	55	85	153
Protection grade	IP 43			
Cooling	Air cooled by integrated fans			
Environmental Characteristics				
Operation temperature	0°C to +55°C			
Storage temperature	-20°C to +65°C			
Relative humidity	Max. 85%			
Shock	Double sinus 10 g, 1.3 m/s in all 3 directions			
Vibration	From 0.1 to 1 Hz: a = 20 mm (pp) From 1 to 50 Hz: y = 40 mg (a = amplitude, y = acceleration, pp = peak to peak)			
Noise	68 dB(A) at 1 m			
EMI/EMC	MIL-STD 461E: CE101, CE102; RE 101, RE102; RS 101, RS 103; CS 101, CS 114, CS 115, CS 116			