

# Wärtsilä ELAC DL 3000

Doppler log for high-performance  
speed measurement



The electronic Doppler Log ELAC DL 3000 is a system which measures the individual speed of a surface ship or a submarine through water and over ground. Using ultrasound and applying the Doppler Effect, highly accurate measurements up to more than 400 metres water depth are possible.





# Doppler log Wärtsilä ELAC DL 3000

## High-performance speed measurement

### General

Submarine operations often require transits in and through unknown and dangerous waters. However, the accuracy of inertial navigation systems (INS) is degrading with time. Without further information about the current position, heavy mismatches compared to the real position do appear.

To assure safe navigation, Wärtsilä ELAC Nautik offers a high-precision Doppler Log system which supports the INS and keeps the submarine on track for an extended period of time. The ship's speed is measured accurately by echo sounding over ground (bottom track) and through the water (water track). If both measurements are available, the system also calculates the speed of the ambient water current as well as its direction.

One special feature of the ELAC DL 3000 is the capability to measure the ship's velocity in all three dimensions. This offers the possibility to control diving and surfacing manoeuvres using an independent measurement method.

Knowing about the ship's drift is essential for safe navigation which can be achieved by the 3D speed measurement.

Resulting from highly accurate speed measurements, a high-precision distance measurement has been evolved, giving information about the distance travelled over ground and through water.

In parallel to the ship's speed, the current depth is calculated. Thereby, a redundant echo sounding system can be

established. Because of the selection of the system frequency and the systems performance, depth measurement is possible up to 400 metres and beyond while still maintaining high-performance speed measurement.

### System description

ELAC DL 3000 operates according to the Janus principle, measuring the difference of the frequency shift along and across the course. Via a hydroacoustic transducer sound, pulses are transmitted in five directions (ahead/astern, starboard/port, vertical). The Doppler measurements are performed at an angle of approximately 60 degrees relative to the vessel's horizontal plane. By combining the information from all directions, a 3D speed measurement is generated, giving maximum knowledge about the platforms movement.

The duration and repetition rate of the pulses are automatically adapted to the depth of water below the transducer. Due to ELAC DL 3000's nominal operating frequency of 180 kHz, no acoustic interferences with other ships' own sonar devices are expected. Using this high frequency, the risk of interception is strongly reduced due to the facts that absorption rises with frequency and most intercept sonar systems are detecting signals in a lower frequency range only.

# System overview

## High-performance speed measurement

The calibration of the ELAC DL 3000 system is performed after setting-up the system onboard of the desired platform to reach the specified performance. Thereby, negative effects due to installation onboard can be minimised or even be completely avoided.

### System purpose

The ELAC DL 3000 is used as navigation aid or as speed sensor (water track and bottom track). The following data are provided by the ELAC DL 3000, either as measured or as calculated data:

- speed over ground (longitudinal, transverse and vertical components)
- speed through water (longitudinal, transverse and vertical components)
- distance covered over ground and through water
- water depth below transducer
- speed of current
- direction of current

In case of a loss of the bottom track, ELAC DL 3000 includes processing algorithms allowing to re-establish the bottom track, e.g. bottom-finding algorithms or measurement windows.

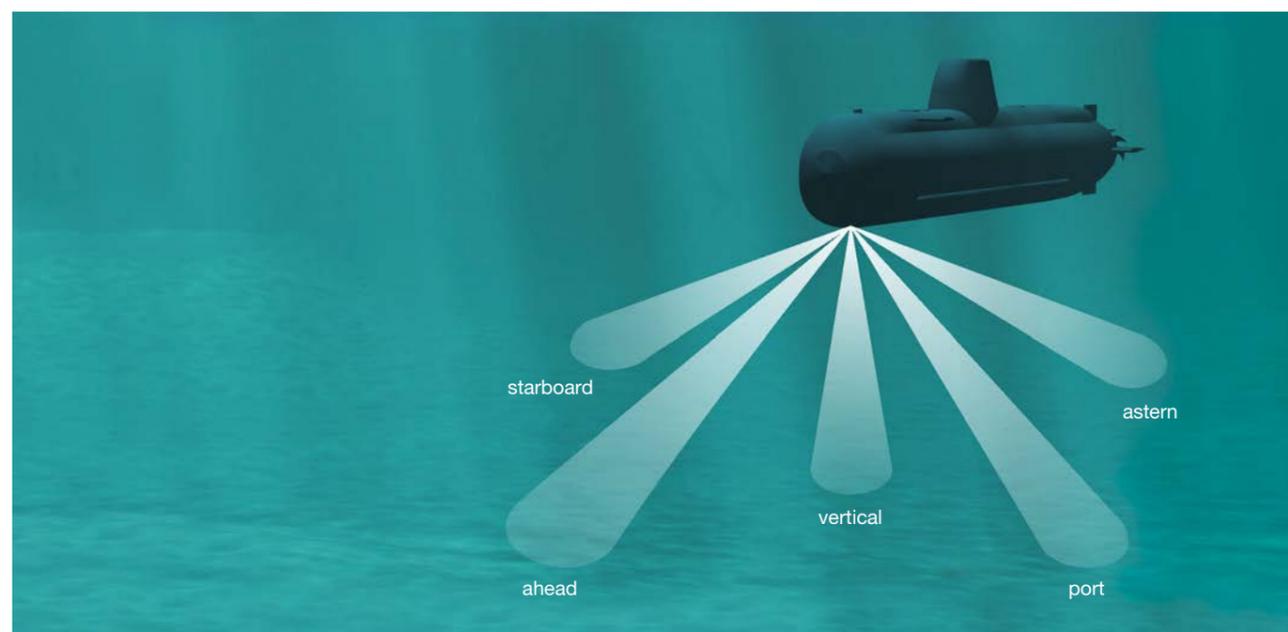
### System components – electronic unit SEE 40 and transducer LSE 336

The transmit-receive unit SEE 40 contains all necessary electronic units such as an eight-channel transmitter for pre-defined pulse forms, an eight-channel receiver consisting of a low-noise pre-amplifier, a filter, a quadrature mixer, an AD-converter and a controller unit. In addition, a receive-transmit decoupling is included. The controller unit generates the transmission pulse, processes the reception signals and provides the interfaces to the external systems.

The transducer LSE 336 is a plain Rx/Tx transducer to be installed in the vessel's hull. The nominal operating frequency is 180 kHz. The transducer consists of two orthogonal orientated segments, each of them producing two beams tilted by 30 degrees with respect to the perpendicular of the transducer surface and one perpendicular beam for depth measurement.

### System performance

Due to the transducer design and the electronic design, the system is able to work at a very high performance up to a velocity of 35 knots, which is sufficient for all relevant vessels.



Electronic Unit SEE 40

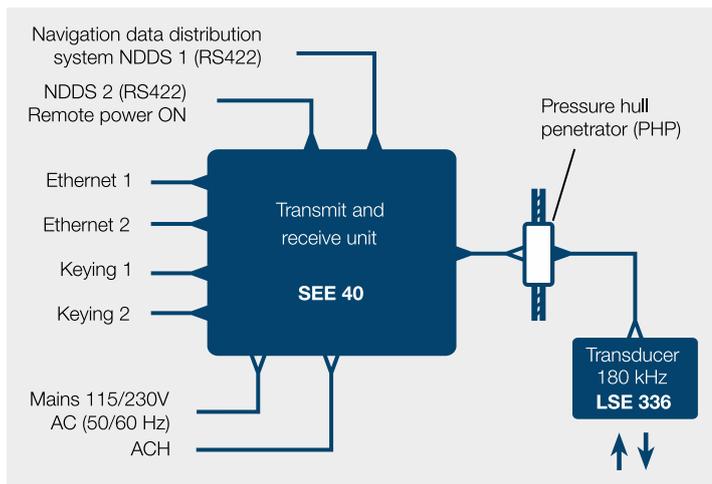


Transducer LSE 336

# Specifications and technical data

## Wärtsilä ELAC DL 3000 at a glance

Technical data	
<b>Speed range</b>	± 35 kn ahead/ astern/ starboard/ port
<b>Accuracy</b>	Speed over ground Speed through water
	± (0.04 kn + 0.5 % of resulting speed) ± (0.1 kn + 1 % of resulting speed)
<b>Depth range for speed over ground</b>	2 - 400 m below transducer
<b>Depth measurement range</b>	2 - 400 m below transducer 2 - 600 m below transducer (cold water)
<b>Depth accuracy</b>	± 2% of depth or ± 0.1 m (whichever is greater)
<b>Distance measurement accuracy</b>	0.2 % of distance for distance >2 nm 0.1 % of distance for distance >10 nm
Environmental data	
<b>EMC</b>	According to MIL-STD 461 D
<b>Shock</b>	According to BV 0430
<b>Pressure resistance</b>	Transducer: 50 bar



ELAC DL 3000 system overview – System data will be controlled and displayed by the navigation system or dedicated units.

