Marine and Cranes Energy Solutions
Winch Retrofit
Dedicated drives for marine and offshore applications

ABB's winch control program enables the ABB variable frequency drive range, rated from 0.55 kW to 5600 kW up to 690 V, to be used in different winching control configurations found on board ships, offshore oil or gas platforms and in harbors.

ABB variable frequency drives are certified for marine applications, enabling stepless speed and torque control of:

- Anchor winches
- Mooring winches
- Ro-Ro (roll on, roll off) quarter ramp winches
- Towing winches

In these applications, ABB variable frequency drives with built-in brake chopper can be used as well as low harmonic or regenerative industrial drives.

Built-in brake choppers connect the DC bus voltage to an external resistor, where the braking energy is converted to heat. Low harmonic drives help to maintain power supply quality and meet the strictest harmonic standards without any need for additional filtering equipment.

Regenerative drives can recover energy from a process and feed it back into the network, thus saving energy.

A key feature of the ABB variable frequency drive is its motor control platform, direct torque control (DTC).

DTC enables the drive to achieve full torque at zero speed with or without the need for a feedback encoder. This is an advantage, because the harsh environment on a vessel’s open deck can often damage an encoder or interfere with the feedback signal to the motors.

Eliminating hydraulic system inefficiencies
Together with the winch control program, ABB variable frequency drives replace traditional and costly hydraulic winch controllers, thereby eliminating high maintenance costs.
and performance inefficiencies, while improving overall system reliability.

Compared to the hydraulic control of winch systems, an AC drive provides substantial power and energy savings when continuous running of the hydraulic pump is not required.

Additionally, hydraulic systems pose a pollution risk to the environment, through their use of oils. Using an AC drive based electrical winch control system can eliminate this risk.

**Winch interface for control stands**
The electrical interface can be traditional inputs and outputs (I/O) based or fieldbus gateways from an overriding PLC and can be used to control the winch directly from control stands located on the port, starboard and upper deck of the vessel. Four control stands can be supported: three via digital I/O and a fourth via fieldbus gateway.

**Anchor control**
Ready-made control logic provides stepless speed control of the anchor whether it is being raised or lowered. Slip detection and anchor-in protection are also provided as safeguards for anchor movements.

**Mooring control**
When mooring a vessel to a harbor or pier, the tension within the mooring ropes can be controlled either manually or automatically.

**Hand-mooring:** The control logic can be configured to allow the operator to control the winch manually from the harbor using stepless speed control. The logic also allows for high speed slack rope when paying out the ropes, thereby speeding up operating time in hand-mooring control mode.

- Peak torque protection prevents breakage in the rope. It detects severe tightening of the rope and immediately sends a signal to adjust the speed, thereby protecting the rope and the winch system from overload.

**Auto-mooring:** Following the hand-mooring procedure, and with the rope already pre-tensioned, auto-mooring can be enabled. This is a speed control application with torque limitation for smooth stepless mooring. Pre-defined auto-mooring modes are available as follows:

- Time control – auto-mooring rope tension control is based on programmable re-mooring time interval
- Load cell sensor – auto-mooring rope tension control is based on real measured status
- Constant on – auto-mooring rope tension control is always on, without closing the mechanical brake and stopping the winch motor

The rope tension set-point can be a fixed internal parameter value or can be sent via external digital input and analog input signals. The actual rope tension can also be defined without any sensor with the help of unique torque measuring logic.

**Power control**
The power control function, limits the speed of the winch according to the load. With a very light load, for example, the winch can run at high speed whereas if there is a high load then the speed can be limited. The speed is adjusted according to a series of cross points located on the forward power curve and reverse power curve. These cross points, each of which has a speed and torque connection, can be identified by the user, by way of power control parameters within the winch control program.

**Ro-Ro control**
Ro-Ro quarter ramp control logic is for lifting or lowering the ship’s vehicle access ramp. Special protection is provided to slowdown the speed and torque before closing the access ramp in the upper end position. With the Ro-Ro access ramp in the loading position, the special holding and tension control mode can be used.
**Mechanical brake control logic and torque memory**

The winch control program features integrated brake control logic to control the winch motor’s external disk or drum brake. The brake control logic utilizes torque memory and premagnetizing to open and close the mechanical brake safely and reliably.

The brake control logic, together with the DTC-controlled winch motor, enables the drive to hold the winch machinery until the mechanical brake takes over.

**Master-follower for winch motors working together**

When several winch motors are connected to the same machinery, the ready-made master-follower arrangement supports speed and torque control mode with load sharing mode.

**Motor heating**

Winch motor heating can be controlled with the help of the drive’s DC injection functionality. This is enabled by the winch operator to keep the winch motor dry when it is in standby mode which is beneficial for open-deck motors.

**Benefits**

- DTC eliminates need for pulse encoder
- Safe and accurate anchor and mooring winch control through the whole speed range
- Cost reduction compared to closed loop systems
- Environmentally friendly electrical solution
- Reduction of mechanical wear
- External PLC not needed due to winch control program that includes winch operation and protection functions
- Multi I/O functionality allowing three different control stands to be connected directly to the drive
- Anchor-in or anchor-slowdown protection reduces speed as anchor approaches its end position. Slip protection operates between winch drum and winch motor
- Handmooring function provides slack rope speed operation with peak torque protection for fast and safe stop of rope when tightened
- Adjustable automooring provides accurate rope tension control
- Mechanical brake control with torque memory
- Easy start-up and maintenance of drive system
- Ideal solution for retrofits

**Fast and simple projects**

ABB provides specialized solutions and services for projects onboard ships and has extensive process knowledge combined with in-depth system competence in variable frequency drives, motors and deck machinery. We take full responsibility for complete retrofit projects – ensuring quick and simple project execution which saves customers time and money.

For more information contact your local ABB representative or visit:

[www.abb.com/marine](http://www.abb.com/marine)

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