



# ADVANCED DEGAUSSING SYSTEMS

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from

Polyamp



Proven equipment from an experienced supplier

# The company and our products

Polyamp AB is a well-established company located in Sollentuna, a suburb of Stockholm, in Sweden, which has successfully supplied power conversion systems to customers throughout the world for over 35 years.

Our main markets are to supply high performance equipment to the Railway, Nuclear, Process Control, and Power Distribution Industries. Also Forklifts, electrical vehicles, military and Naval applications.

The Polyamp core technology has always been switch mode power conversion for a wide range of DC/DC converters but we also design, produce and market an extensive range of DC/DC converter Power supplies from 30 to 1000 W.



*Industrial and custom power supplies*

*RSwN Gotland*



*RSwN Visby*



*RSwN Styrso*

Within this organization the Systems Division specializes in the design, manufacture and supply of various magnetic and electric signature control systems for applications within the naval industry; both surface vessels and submarines.

Products include:

- **Advanced Degaussing Systems**
- **Influence Magnetic Sweep Supply Systems**
- **UEP and ELFE measurement Systems**
- **Underwater Multi influence sensor platform UMISS®**
- **Multi influence signature management prediction and evaluation software SWECADE®**

## The Threat

Modern influence sea mines detect a vessel's magnetic signature, i.e. the magnetic disturbance of a vessel, in the Earth's Magnetic Field. This Signature is the most significant of the influences that trigger the mine.

## The Countermeasure

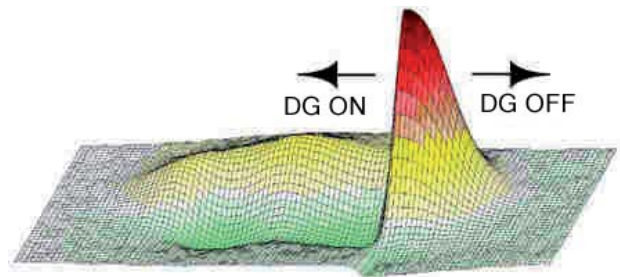
To minimise this magnetic threat, Naval vessels are normally fitted with on-board Degaussing Systems that generate a counter-acting field to reduce their magnetic signature. This is achieved by controlling the currents through the individual loops of their internal coiling system configurations. Typically 90- 95% of the ship's signature can be neutralised with a well-designed 3-dimensional Degaussing system.

# Degaussing System Capability

Polyamp specialise in the design, manufacture and support of Advanced Degaussing Systems (ADG), which in general terms means that the coil system is 3-dimensional and that each coil in the configuration, is individually controlled by one loop coil amplifier.

The naval operational area priority has shifted from blue to brown/shallow water. This increases the threat as ships come much closer to the influence mines and consequently improved performance degaussing systems, relative to those previously used, are now required.

The effective answer to this increased threat is the Advanced Degaussing System. Polyamp implement a modular design philosophy and offer several types of loop-coil amplifiers for different sizes of vessels. The location of the loop coil amplifiers can either be "centralised" or "distributed" to be close to the coil in question. The ADG methodology improves the signature, time and efforts needed at ranging and on large vessels there is significant weight benefit. Polyamp have delivered a wide range of DG systems, all of which are computer



*Magnetic signature management*

controlled Advanced Degaussing Systems.

Polyamp is an international supplier of ship's degaussing systems and has a proven capability in the design and project management of modern systems as used by the Royal Swedish Navy and other Navies of the world. Polyamp also has the experience to provide, where appropriate, a complete magnetic package which includes equipment design, coiling system design, signature prediction, optimization of ships cabling, guidance during ship design, magnetic ranging and full trials support, installation and documentation.

## Relevant Experience

The Company's experience in degaussing is considerable and includes all phases from feasibility and design studies, through system development to manufacture and supply of all types of degaussing systems. Experience over the past 25 years covers the design and supply of degaussing equipment for submarines, steel surface ships and the more demanding mine countermeasure vessels (MCMVs).

Polyamp degaussing systems and equipment are currently installed in over 35 in-service or under construction naval vessels around the world. These vessels have now accumulated a total of well over 50 years of elapsed running hours of successful operation. They include:

- Royal Swedish Navy Landsort Class Minehunters
- Royal Swedish Navy Styrsö Class MCMVs
- Royal Swedish Navy Stockholm Class Corvettes
- Royal Swedish Navy Gothenburg Class Corvettes
- Royal Swedish Navy Sjöormen Class Submarines
- Royal Swedish Navy Gotland Class Submarines
- Royal Swedish Navy Visby Class Stealth Corvettes
- Republic of Singapore Navy Bedok Class Minehunters
- Republic of Singapore Navy Challenger Class Submarines
- US Navy CVN77 carrier San Antonio Class Landing Platform Docks
- Royal Danish Navy Flexible Support Ships and more
- Reactivated Hunt Class of MCMV

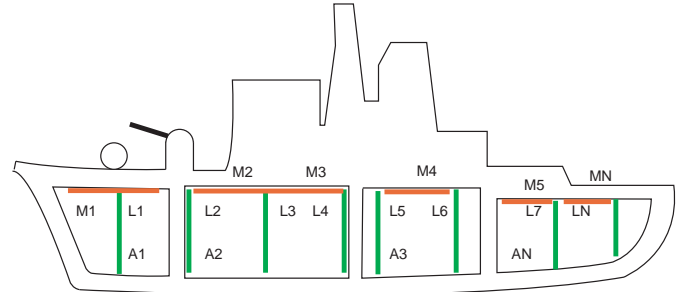


# Degaussing Performance

System configuration, complexity and detailed design depend on the vessel's characteristics, the geographic operational area and the target residual magnetic signature. In conjunction with the customer and shipbuilder, Polyamp provide complete assessment, design, production, installation and support services. The SWECADE software packages and modeling techniques are used for both signature prediction and system design.

The optimised coiling system and compatible power and control system are selected to achieve the specified target residual signature. Coil positions and cable details are defined as well as the power system requirements. The undegaussed signature and operational performance are then predicted.

Within the coiling configuration Horizontal (M) coils counter vertical fields and pairs of athwartship (A) coils counter the athwartship disturbances. Longitudinal compensation is achieved by a series of longitudinal (L) coils along the length of the vessel.



## Degaussing, Modes of operation

All Polyamp Advanced Degaussing Systems are fully automatic. They are normally controlled by one or more magnetometers to achieve the lowest signature, but several control modes are available depending on system requirements.

- Magnetometer control - The use of local 3 axis field measurement for either prime or fall back control. Open to later CLDG control.
- Gyro / Geomagnetic map control - The use of roll, pitch and position information taken from the Navigation system / Gyro System and an electronic geomagnetic map system to compute local earth's field data.
- Manual mode - Longitude, latitude and heading entered manually

Magnetometers give the ultimate best control signals for the Degaussing system. This is because magnetic deviations and natural changes in the earth magnetic field are continuously measured by the magnetometer and used as control signals in the DG. Navigational system data control combined with a magnetic map system such as GEOMAG cannot track those small but important details of the earth magnetic field. Magnetometers also have very favourable MTBF and reliability. Real time performance is also superior compared to gyro systems. All this will enable a vessel equipped with magnetometer control to achieve far better magnetic compensation and thus magnetic signature when it is most needed. I.e. Particularly in brown (shallow) water areas.



*Typical magnetometer*

Polyamp have proven magnetometer experience on MCMVs, Corvettes and Submarines.

With ADG the signature is adjusted by changing loop-coil currents. Worldwide operation can be maintained without the need to change connections at the junction boxes or to check ranging before reaching the operational area

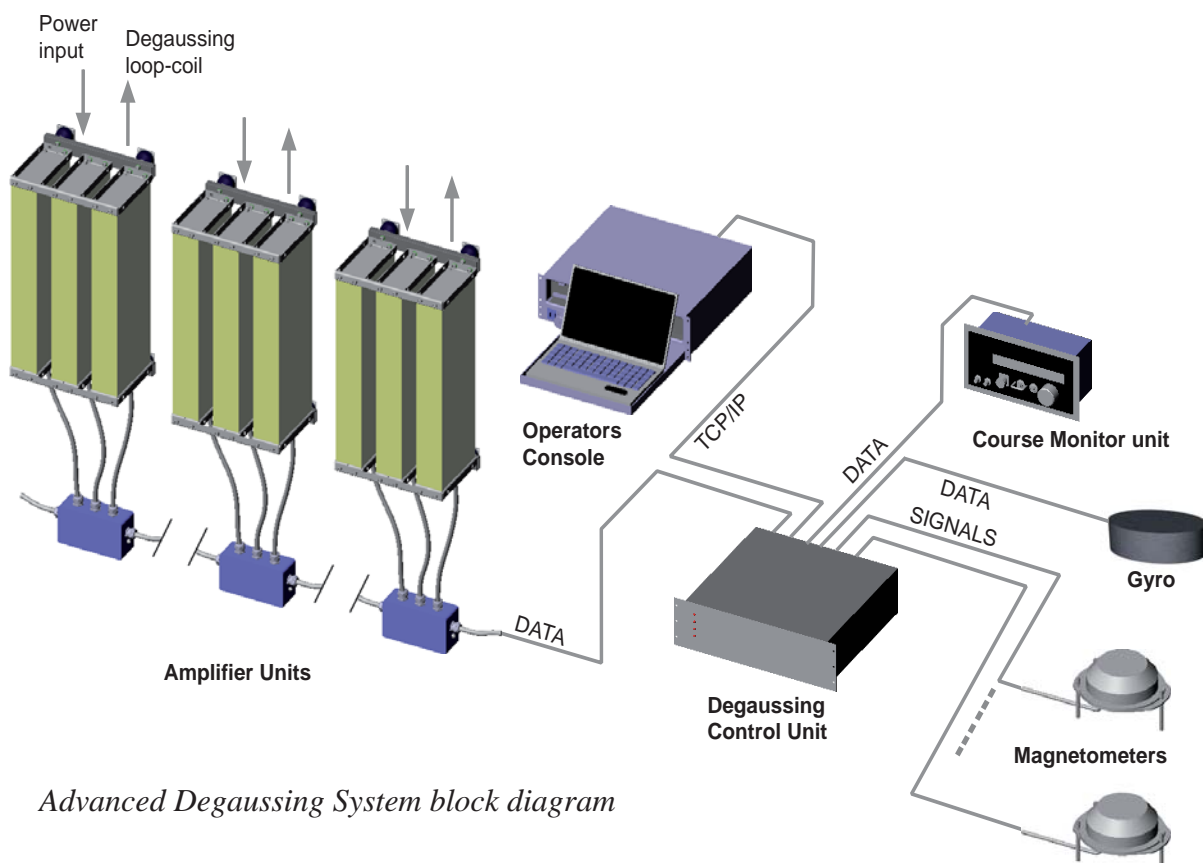
# Magnetic and Electric Signature Control

An Advanced Degaussing System (ADG) with a full 3-dimensional coil arrangement and distributed Bi Polar Amplifier Units (BPAUs) is required to meet current performance requirements. A computerised Degaussing Control Unit (DCU) controls the amplifiers with inputs from Magnetometer and Navigational sensors for world-wide operation.

The degaussing equipment provides computer controlled currents to the ship's degaussing coils based on the Earth's magnetic field encountered by the ship in each of its three axes (induced magnetization). The magnetometer determines the magnitude and direction of the earth's field in relation to the ship's reference plane. Then, using the magnetometer parameters, the DCU calculates the outputs in real time current demand signals to control the BPAU output currents into the coils. The Royal Swedish Navy Stealth Corvette VISBY Class and its Polyamp degaussing system make use of two magnetometer inputs. Magnetometer control has a proven record on Corvettes and Submarines using a unique steel hull distortion algorithm. The magnetometer interface allows the use of multiple magnetometer inputs to the ADG with appropriate CLDG algorithms for future CLDG enhancements. An automatic backup mode of control uses input data from the ship's navigation system. In this case the DCU determines the magnitude and direction of the Earth's field in relation to the ship's course and position by reference to an in-built geomagnetic map. Then using ship motion and heading parameters from the ship's gyro system, the controller calculates the outputs in real time current demand signals to control the coil drivers for the compensation the induced magnetization.

Compensation for the ship's permanent magnetization in all of the axes of the vessel is done by adding a suitable constant current to the above-mentioned induced compensation current used in respective amplifier units.

In the manual mode of control the ship's heading and local magnetic parameter can be entered at the keyboard on the Operators Console. The 3-axis control signals to the BPAU's are generated if the magnetometer/navigation system fails to give correct inputs. This redundant mode enables a very high degree of magnetic compensation to be achieved even with major system damage.



*Advanced Degaussing System block diagram*

# Magnetic and Electric Signature Control

The Bipolar Power Amplifier Units (BPAU's) operate with a very high efficiency. Therefore cooling of the BPAU can be made by convection / forced air-cooling.

The fully computerized Polyamp Degaussing System enables the operators and maintainers to easily measure, store & print all the relevant system parameters. The degaussing system has an extremely user friendly MMI with pull-down menus and fault tree analysis facilities for ease of use during setting up, calibration, fault diagnosis and routine maintenance.

A remote control interface link, intended for a transceiver unit facility, can be included in the ADG, enabling the remote control of the ADG. from a shore range site during magnetic ranging of the vessel. This considerably reduces the ranging time period and allows the magnetic signatures to be handled with greater safety during ranging.

The modular flexibility of the ADG is ideally suited to the modern principles of sectional building of ships and the location of the degaussing system components.

*Typical BPAUs for distributed and centralised systems*



## Key Features

- Centralized digitally controlled bipolar current loop-coil amplifiers
- Very low ripple on the coil outputs eliminate interference to a passive sonar system
- Computerized multiprocessor system running Polyamp Degaussing control software
- Operators Interface uses a standard PC design for ease of operating
- Operators Interface may be integrated as a Software Window
- Facilities to measure and store important parameters in the degaussing system
- Built-in test equipment for fault analysis and recording
- Suitable for a wide range of ships with favorable commonality

## Key Benefits

- A high level of protection – Guaranteed reduced magnetic signatures
- Unattended automatic operation - Reduced manning levels
- High efficiency bipolar loop coil amplifiers – Minimal wild heat generated
- High accuracy bipolar loop coil amplifier- Optimized performance
- Fully computerized digital control - Optimized performance
- Operators Interface software (Microsoft Windows) - Ship compatibility
- Modular design - System flexibility and growth potential
- Full logistics and support - Maximum availability and favorable Life Cycle Cost
- High reliability and availability - High user confidence
- Optimized design from a proven degaussing supplier - Low risk procurement

# Design and Evaluation Criteria

The ship characteristics and environment in which the Degaussing system has to operate directly influence its design. The design criteria used by Polyamp are the same criteria used by the shipbuilders. To gain maximum benefit from this approach the impact of that design on the overall Degaussing System, other ship systems and through life support should be considered and not only the initial hardware procurement costs.

<b>Benefits of the Polyamp Advanced Degaussing System</b>	Performance	Weight	Cost	Risk
<b>The Advanced Degaussing System Features</b> <ul style="list-style-type: none"> <li>Unattended automatic operation - Potential for reduced manning levels</li> <li>Magnetometer, Gyro with Geomagnetic Map, and Manual control modes available</li> <li>Distributed higher voltage system - less cables, increased flexibility, improved system redundancy and significant overall cost saving.</li> </ul>	▲ ▲ ▲	▲	▲	▲
<b>Technical performance and ease of use in service</b> <ul style="list-style-type: none"> <li>Compliant with the technical requirement.</li> <li>Improved worldwide operation performance and less risk in not achieving the target signature.</li> <li>Less sensitive to individual failures and battle damage</li> <li>Automatic digital control &amp; monitoring of a distributed system from a central controller</li> <li>Facilities to measure, store or print important system parameters</li> <li>Operators Console uses a standard PC design and ship compatibility software (WinNT)</li> </ul>	▲ ▲ ▲ ▲ ▲ ▲		▲	▲ ▲ ▲ ▲
<b>Initial and production quantity equipment procurements</b> <ul style="list-style-type: none"> <li>Existing Equipment Designs - No significant NREs</li> <li>Established manufacturing facilities - Current production</li> </ul>			▲ ▲	▲ ▲
<b>Flexibility and Support during ship design, system integration &amp; installation</b> <ul style="list-style-type: none"> <li>Accommodates sectional "modular block" shipbuilding techniques</li> <li>Reduced ranging complexity and time duration</li> <li>Reduced size and quantity of cables for easier installation by the shipyards</li> <li>Allows a multi turn, smaller diameter cable to be used for the coiling system.</li> <li>Reduced number and smaller diameter tank penetrating pipes for the coil cables</li> <li>Minimum overall system cost and weight to achieve target signature</li> <li>High efficiency bipolar loop-coil amplifiers - No heat management problems</li> </ul>	▲ ▲ ▲ ▲ ▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲ ▲
<b>Flexibility to accommodate ship design changes &amp; capability to provide future growth</b> <ul style="list-style-type: none"> <li>Modular design - System flexibility and growth potential</li> <li>Potential to upgrade at a later date</li> <li>Remote control facility- more efficient ranging</li> </ul>	▲ ▲ ▲		▲ ▲	▲ ▲
<b>Integrated Logistic Support and Through life costs</b> <ul style="list-style-type: none"> <li>Built-in online users manual and test equipment for fault tree analysis &amp; recording</li> <li>Proven in service operational reliability</li> <li>Full logistic and support facilities - Maximum availability</li> <li>Designed for operation, full support and design growth throughout the ship's life</li> </ul>	▲ ▲ ▲ ▲		▲ ▲	▲ ▲ ▲
<b>Low Risk Procurement</b> <ul style="list-style-type: none"> <li>Proven equipment - Successfully qualified and operational</li> <li>Experienced Supplier - Established International system &amp; equipment contractor</li> </ul>	▲ ▲	▲ ▲	▲ ▲	▲ ▲

## Polyamp ADG Advantages

- Systems for the smallest vessel to aircraft carriers
- Turnkey systems including signature design, management and trials
- Favorable total ownership solution
- Efficient signature handling with control, evaluation and prediction
- Modularised and digitized open systems, upgradeable for future threats and CLDG control
- High performance, low risk and cost effective procurement



# Magnetic and Electric Signature Control

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## Signature Control

SWECADE® (Swedish Computer Aided Degaussing and Evaluation) software packages for signature management.

Provides:

- Ship modeling and coiling system design
- Signature prediction
- Trials evaluation
- Upgrade capability for conventional range systems

## Company assesment

Polyamp is currently operating in accordance with ISO9001, ISO14001, and health, safety and security assessment plans stipulated by Swedish and EU laws.



*Head office and Systems Division  
in Sollentuna (Stockholm)*

## Through Life Support

In addition to the design, manufacture and supply of equipment, the Company also provides total through life support:

- Installation and setting to work
- Land and sea trials
- Reliability Assessment
- Handbooks and documentation
- Spares assessment and supply
- Training courses and equipments
- Maintenance support and repair

## The Company

Polyamp is a family owned business located in Sollentuna, Stockholm, Sweden, with production facilities in Sweden at Åtvidaberg some 240km south of Stockholm and in Switzerland at La Chaux-de-Fonds.

Established for over 30 years, the company has developed from a National Contractor to its present status of an "International Supplier of high quality Power Electronic Equipment".

*Main factory in Åtvidaberg*



*La Chaux-de-Fonds factory*

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