AXIMA

MAgnetCOntroller

Power supply and control of heavy lifting electromagnets
Battery backup

For safety reasons, an uninterrupted supply of power for lifting magnets must always be guaranteed. This feature is considered a high priority and the company Axima therefore offers a MACO system with a battery backup power supply for lifting electromagnets.
Since it was established, AXIMA has been steadily increasing its manufacturing volume to include designing, manufacturing and servicing power supplies for lifting magnets. Combined with modern technology, our experience guarantees both high quality and reliability of MACO power supplies. An experienced team of designers and electrical engineers enables us to develop and manufacture MACO power supplies with basic functions, and to successfully fill orders for lifting magnets and equipment based on the technical requirements of our clients. We are always ready to design and manufacture any power source in accordance with your requirements.

MACO systems have been employed in a wide range of industrial applications for operating electromagnets used in handling material.

Power supplies features

They involve DC voltage for lifting magnets designed to handle ferromagnetic material with the help of a crane. These power supplies include power and control circuits in high-quality industrial designs. Backup sources are contained inside painted metal enclosures with the dimensions specified by customer requirements and designed to be located and installed on the crane structure. The boxes are a standardized IP54 enclosure. The setup includes forced ventilation and heating, which ensures a long life span for all equipment used in outdoor environments.
The switchboard panel usually consists of two or more boxes according to the output and includes power safeguards and switches, the PLC Simatic S7 control system, the battery portion comes with accessories. As a backup power supply, the switchboard panels are equipped with long-life batteries and electric chargers, including automatic backup switching.
The charger provides automatic charging for backup batteries and maintains the batteries in a fully charged condition. Charging takes place according to the IU characteristic, typically described in DIN 41 773/774 and has an integrated power voltage test. The status of the backup battery is relayed to the control PLC. The system is controlled by an operator in the crane cab or by remote radio control. If a power failure occurs during the transport of a load, battery power takes over, with acoustic and visual indication of the switch to backup mode.

Battery features

The batteries are lead acid batteries secured by a pressure valve and designed for stationary use. This type of battery does not have any special requirements for ventilation and maintenance. Because the electrolyte is not in liquid form, these batteries are considered dry batteries and as such, they can be treated as dry batteries for transport and handling.

Integration with the crane

Ensures the safe operation of lifting equipment in combination with electromagnets.

- The demagnetization function is blocked when the crane is moving
- The tipping function is blocked when the crane is moving
- Lifting signal received – switching to maximum performance
- Lifting sensor – the demagnetization function is blocked before placement of the load
- The signal "crane move allowed" – the backup source is energized

MACO

Description

MACO power supplies are robust, highly reliable, transformer sources of power for lifting magnets. They are available in a wide range of power outputs with many functions, either as a source of electrical power without a backup supply, or with a battery backup supply to ensure an uninterrupted source of electrical power.

Functions

- DC voltage magnetization
- Speed-controlled full demagnetization
- Tipping – short-term weakening of the magnetic attachment force for jettisoning excess material
- Keeps the magnet from overheating
- Check of isolation failure

Optional functions

- Preferences magnet groups
- Magnetization and demagnetization in groups
- Load test (up to 10 degrees) – lowering the power output when capturing a load to ensure safety during transfer at full power
- Return to the load test level – ensure easier handling with magnet in limited iron areas when approaching magnet
- Rotation and extension of beam
- Current measurement of output in groups
- Archiving malfunctions – up to 1000 cycles of magnetization stored in memory – the length of the cycle, value of the electrical current
- Remote monitoring equipment – telecommunication
- Profibus (Process Field Bus – industrial fieldbus)
- Local or radio control
- Battery backup more than 20 minutes

Technical specifications

- Output voltage: 10 V DC to 500 V DC
- Rated power: 1 kW to 50 kW
- Cabinet sizes: according to output power
- Cabinet doors: plain double doors or screwable doors
- Protection degree: IP54
- Material: closed welded steel sheet with plinth
- Color: epoxy-polyester resin powder, textured RAL 7035 or RAL 7032 grey
- Application: indoor or outdoor
- Temperature range: -20 °C to +55 °C
- Safety category: 2 (EN ISO 13849-1)

Safety

For MACO power supplies, the battery backup is connected online throughout the transfer of the load. If a power failure occurs in the network during the course of magnetization, the battery takes over powering the magnet without any interruption. Any variation from the nominal voltage in the event of a loss of one phase or drop in system voltage is closely monitored. These statuses are immediately signaled both visually and acoustically.
Circuits and backup functions are always tested when magnetization is switched on and in the event of a failure, the magnetization process is terminated. The ground connection for the magnet is continuously monitored as well, it is indicated if it occurs and further magnetization is prevented. To prevent the magnet from overheating, the electrical current and duration of magnetization are measured and monitored at the same time.
If the customer desires, a MACO power supplies can be delivered in the 3rd or 4th safety category (EN ISO 13849-1). We also deliver redundant power supplies for use in ports or other highly exposed areas.

Backup

The backup power source consists of gelled batteries with a lifetime of 10 years. These batteries are charged and maintained at full capacity using a high-frequency charger with a precise charging performance. This ensures the maximum lifetime of the batteries. The battery's condition is detected using a load test. The backup circuits include protection against deep discharging the batteries.

Control

After switching magnetization on, the power circuits are connected to the power supply circuits and the electromagnet attracts the load. In order to enable the operator to control the quantity of the material for transfer, a tipping function can be added to the controls. Depending on the length of the signal, undesirable material is detached from the magnet. After demagnetization is activated, the system is disconnected from the power network and the magnet is quickly discharged with discharge resistance. A switch in the polarity of the DC output then occurs, followed by the short demagnetization of the magnet by reverse polarity voltage and reduced intensity. This results in a clean sweep of the activated surface of the magnet. The magnet is automatically prepared for operation.
If the device is equipped with the load test feature, the magnetization is reduced upon activation to 70% of the retaining power for each load, then increased to full power, whereupon the crane is unblocked and can move. This way the operator is certain of the safe conditions for transporting the material.
Prior to magnetization, the power output can be switched to up to ten degrees of magnetization. Working with groups of magnets is possible in full range of standard and optional functions for each group separately.

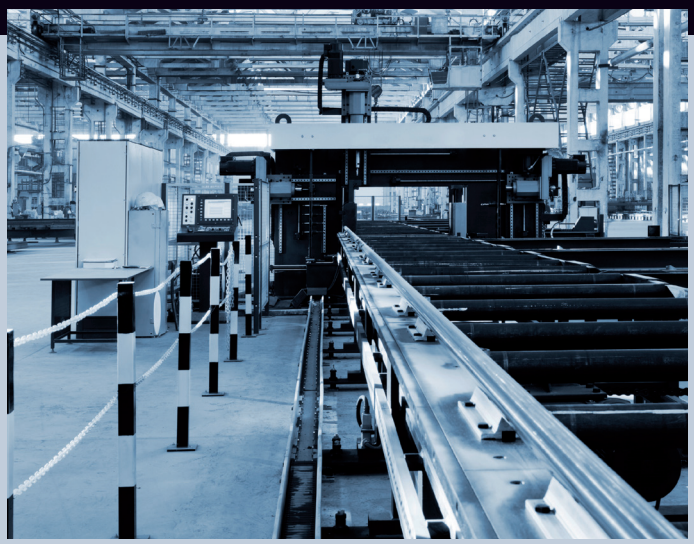
Signalling

The status of the equipment is indicated by visual beacons or signaling components in the crane cabin in combination with acoustic signals. The indicators can be checked by pressing a button.

Use

- Foundries
- Scrap yards
- Loading and unloading depots for railway containers
- Metal waste landfills
- Rolling mills
- Handling sheet metal in manufacturing lines
- Warehouses

MACOdrive



Description

MACOdrive power supplies are fully controllable power supplies for crane electromagnets with an operational four-quadrant converter and dynamic demagnetization using regenerative power to net. This enables the convenient operation of electro-magnets with continuous operational control and extremely fast demagnetization.
They are available in a wide range of outputs without backup supply or, for increased safety, with a battery backup that provides continuous power. MACOdrive power supplies are suitable for magnet systems with higher power outputs from 5 kW to 50 kW.
The advantage of MACOdrive power supplies are their compact features – just a single box can accommodate up to 10 kW of power, including the battery backup.

Functions

- Quick magnetization by increased DC voltage
- Fast-controlled total demagnetization with regenerative energy
- Tipping – short-term weakening of the magnetic force for jettisoning excess material
- Load test fixed or smoothly adjustable – decreasing the power output when capturing a load ensures a safe transfer at full power
- Return to the load test level – ensure easier handling with magnet in limited iron areas when approaching magnet
- Keeps the magnet from overheating – 30-minutes control of magnet power

Optional functions

- Preferences magnet groups
- Current measurement of output
- Archiving malfunctions – up to 1000 cycles of magnetization stored in memory – the length of the cycle, value of the electrical current
- Rotation and extension of beam
- Remote monitoring equipment – telecommunication
- Profibus (Process Field Bus – industrial fieldbus)
- Local or radio control
- Battery backup more than 20 minutes

Technical specifications

Rated supply voltage:	3× 400 – 575 V +15%/-20%, 50/60 Hz
Output voltage:	0 V DC to 500 V DC
Rated power:	5 kW to 50 kW
Cabinet sizes:	according to output power
Cabinet doors:	plain double doors or screwable doors
Protection degree:	IP54
Material:	closed welded steel sheet with plinth
Color:	epoxy-polyester resin powder, textured RAL 7035 or RAL 7032 grey
Application:	indoor or outdoor
Temperature range:	-20 °C to +55 °C
Safety category:	2 (EN ISO 13849-1)

Safety

MACOdrive power supplies include an off-line backup battery. If a power failure occurs in the network during the course of magnetization, the battery takes over powering the magnet without any interruption. Any variation from the nominal voltage in the event of a loss of one phase or drop in system voltage is closely monitored. These statuses are immediately signaled both visually and acoustically. Circuits and backup functions are tested periodically when magnetization is switched on and in the event of a failure, the magnetization process is terminated. To prevent the magnet from overheating, the electrical current and duration of magnetization are measured and monitored at the same time. If the customer desires, a MACOdrive power supplies can be delivered in the 3rd or 4th safety category (EN ISO 13849-1). We also deliver redundant power supplies for use in ports or other highly exposed areas.

Backup

The backup power source consists of gelled batteries with a lifetime of 10 years. These batteries are charged and maintained at full capacity using a high-frequency charger with a precise charging performance. This ensures the maximum lifetime of the batteries. The battery's condition is detected using a load test. The backup circuits include protection against deep discharging the batteries.

Control

When the command magnet on is activated, the DC converter which is standby until this time, supplying DC voltage to the magnet. DC converter supplies magnet short time by increased voltage (boost) in order to achieve the fastest maximum level of magnetization due to induction of the magnet. In case the load test is required, the magnet is powered by low voltage (fixed set or continuously adjustable), and after receiving a signal of the crane lift or after a set time, DC converter supply voltage to magnet at the maximum. Load test and power of the converter is continuously adjustable by potentiometer.
The tipping function for release of undesirable material is provided by reduced voltage of DC converter. As long as the tipping signal is made, voltage is continuously decreasing to 0V DC. Speed of voltage reduction can be set by SW in PLC. Depending on the factory application in this way can be release each individual lifted sheet plates, in case scrap weighed to the containers in foundries, in this way can be supplied different kind of scraps as well.
Demagnetization is provides also by DC converter circuits, therefore it is faster than during switching circuits demagnetization and depolarization by contactors. Working with groups of magnets is possible in the preferences only.

Signalling

The status of the equipment is indicated by visual beacons or signaling components in the crane cabin in combination with acoustic signals. The indicators can be checked by pressing a button.

Use

- Foundries
- Scrap yards
- Loading and unloading depots for railway containers
- Metal waste landfills
- Rolling mills
- Handling sheet metal in manufacturing lines
- Warehouses

MACOperm

Description

MACOperm power supplies are designed for power supply technology and operating of electro permanent magnets. A DC converter is used to power the magnet. Electro permanent magnets retain their magnetization even in the event of power failure or cable damage, so they do not need a backup battery supply.
MACOperm power supplies enable the convenient operation of electro permanent magnets, including adjusting the retaining power and fast demagnetization. It takes a few seconds for magnetization to occur by a pulse of voltage from the converter. The second pulse with reverse polarity causes demagnetization.

Functions

- Quick magnetization with increased DC voltage
- Fast, controlled, total demagnetization
- Tipping – short-term weakening of the magnetic force for jettisoning excess material
- Load test fixed or smoothly adjustable – decreasing the power output when capturing a load ensures a safe transfer at full power
- Return to the load test level – ensure easier handling with magnet in limited iron areas when approaching magnet
- Keeps the magnet from overheating – 30minutes control of magnet power

Optional functions

- Preferences magnet groups
- Current measurement of outputin groups
- Archiving malfunctions – up to 1000 cycles of magnetization stored in memory – the length of the cycle, value of the electrical current
- Rotation and extension of beam
- Remote monitoring equipment – telecommunication
- Profibus (Process Field Bus – industrial fieldbus)
- Local or radio control

Technical specifications

Rated supply voltage:	3× 400 – 575 V +15%/-20%, 50/60 Hz
Output voltage:	0 V DC to 500 V DC
Rated power:	15 kW to 80 kW
Cabinet sizes:	according to output power
Cabinet doors:	plain double doors or screwable doors
Protection degree:	IP54
Material:	closed welded steel sheet with plinth
Color:	epoxy-polyester resin powder, textured RAL 7035 or RAL 7032 grey
Application:	indoor or outdoor
Temperature range:	-20 °C to +55 °C
Safety category:	>3 (EN ISO 13849-1)

Safety

For cranes that use the MACOperm power supplies for electro permanent magnets, safety is ensured primarily by the physical principle of these magnets, which retain their magnetization after being magnetized until they are demagnetized.
A load test is used to ensure there is sufficient retaining force for the transfer of material and involves using a decreased electromagnetic force to grab the material for transfer, followed by increasing the attraction force to maximum before the crane gets underway. In accordance with customer requirements, the power supply can be delivered Ex "p" according to EN/IEC 60079-0, 60079-2.

Backup

Due to the properties and design of this type of electromagnet there is no battery backup required.

Control

When the command magnet on activated, the magnet is powered short term by voltage from the DC converter for achieve full performance of the magnet. Then DC converter is put into standby mode.
The tipping function for release of undesirable material is provided by DC converter circuit so that the magnet is powered reversed polarity reduced voltage than the magnetization. Setting the level of DC voltage is part of the program in the PLC and the parameterization of the drive DC converter.
Demagnetization is provided by DC voltage circuits from converter with reverse polarity to clean the full active area of the magnet. The magnet is automatically ready for operation. Working with groups of magnets is possible in the preferences only.

Signalling

The status of the equipment is indicated by visual beacons or signaling components in the crane cabin in combination with acoustic signals. The indicators can be checked by pressing a button.

Use

- Foundries
- Scrap yards
- Loading and unloading depots for railway containers
- Metal waste landfills
- Rolling mills
- Handling sheet metal in manufacturing lines
- Warehouses
- Oil platforms

Notice:

Installation

For customers we provide complete installation of delivered MACO power supplies, commisioning, or supervision when other assembly capacity is used. Together with the MACO controllers we delivery beams, magnets and provide installation of power and control cables, cable drums including remote control and signaling.
The user is familiar with the MACO control system, there are done operator training and maintenance. Assembly work is completed inspection report electro, and delivery protocol. The customer receive a user manual operation of the MACO system and get documentation of the actual status.

Service

What we are doing for MACO customers and users?

- Maintenance and repair activities
- Preventive service and maintenance
- Technical support
- Spare parts warehouse
- Consulting services
- Commissioning and operator and maintenance training
- Update functionality of the device
- Remote access and diagnostics

Conditions of service are set in service contracts.

AXIMA

AXIMA, spol. s r. o.
Videnská 125, 619 00 Brno, Czech Republic
tel.: +420 547 424 040, fax: +420 547 424 015, e-mail: maco@axima.cz
www.axima.cz, www.elektromagnet.cz, www.magnetcontroller.com

index: april 2012