MAGNETEK
MATERIAL HANDLING

Advances in Motor Control Technology

Ever since the Industrial Revolution, cranes and hoists have been in manufacturing plants and other industrial facilities. Surprisingly, in the 100 or so years since their introduction, there has been little change in the basic structure of these fundamental production tools.

What has changed, however, is how overhead cranes and hoists are controlled. Advances in motor control technology have increased the performance, reliability, and safety of overhead material handling systems. As with all evolutionary processes, initial advances in motor control technology were slow and only partially successful. They laid the foundation, however, for the development of today's sophisticated electronic controls. The present trend toward precision handling of materials has created a demand for simple, dependable, high performance controls, capable of communication with computers, displays, and other types of operator interfaces.

The "Crane Control Comparison" chart shown below illustrates the advances in motor control technology and the wide range of controls available to the crane builder. Some of these controls are widely used today, while others are becoming obsolete.

AC MAGNETIC CONTROLS

Single and two-speed magnetic controls are the most basic type of crane controls and are still used on light and moderate duty cranes and hoists. Soft Starters were the next step towards digital controls for bridge and trolley applications, providing cushioning during acceleration and a corresponding dampening of load swing. However, variable frequency drives (VFD) have become more cost competitive and safety oriented. VFD control is more prevalent versus single and two-speed contractor controls, and the trend is growing across the globe.

Three- and five-speed multi-step controls, using wound rotor motors and secondary resistors, have also been largely replaced by VFD Open Loop and Flux Vector controls, using squirrel cage motors. Not only are VFD controls less costly, they also provide enhanced performance, safety, and improved duty cycles. Wound rotor motors and eddy current load brakes are costly and not readily available, further contributing to the demise of wound rotor controls.

AC Static Stepless controls were once the "premier" crane control, providing infinite speed regulation and precision load handling for the most demanding applications. However, prolonged use at low speeds often resulted in abnormal motor heating. VFDs with Flux Vector controls have proven to provide superior performance, at a lower cost and without motor heating problems.

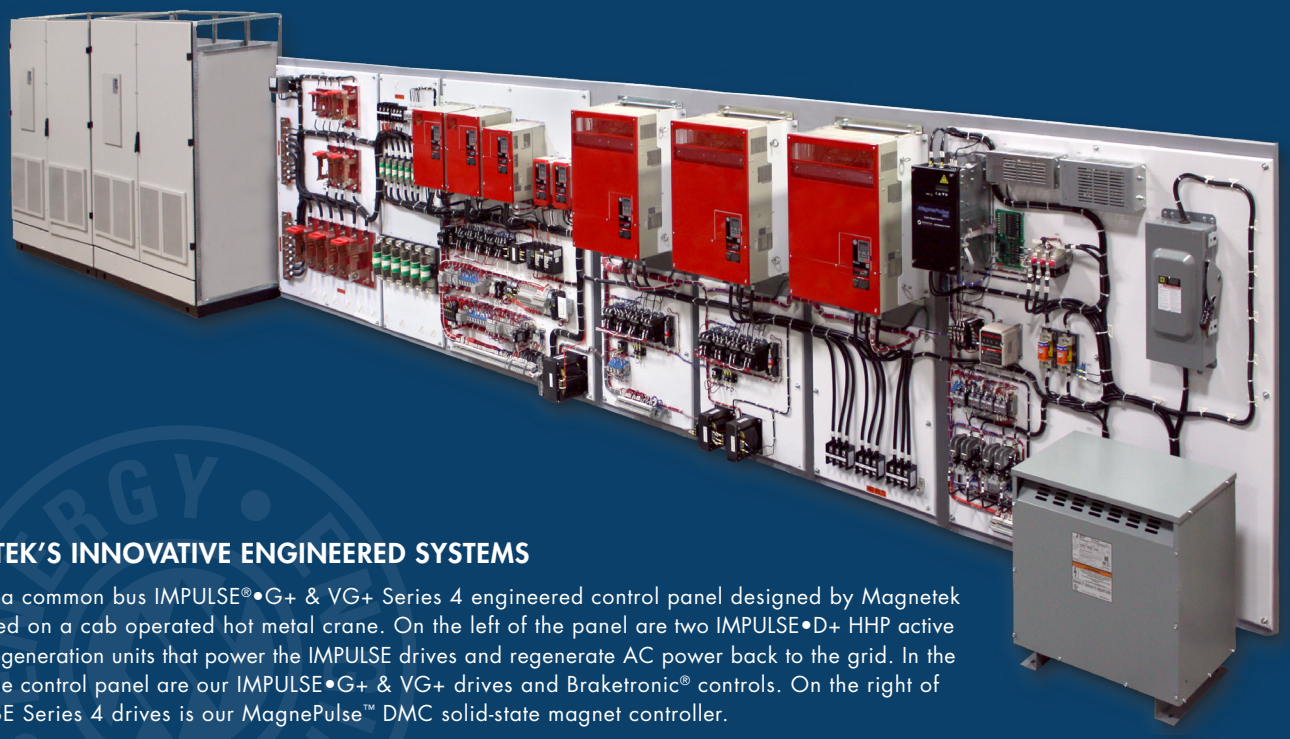
Industry-Leading Variable Frequency Drives

YOUR ONE-STOP SOURCE FOR MATERIAL HANDLING CONTROL SOLUTIONS

AC VFD OPEN LOOP AND FLUX VECTOR CONTROLS

There has been perhaps no other technological development in the past 30 years that has done more to revolutionize AC crane controls than the Variable Frequency Drive. VFD technology offers the crane and hoist user several benefits over traditional types of AC motor control systems, such as:

- No mechanical switching of power circuits, thus greatly reducing stress on the motor
- Simple, low cost AC squirrel cage motors
- Fewer control relays
- Fewer hard-wired power connections
- Built-in electronic diagnostic and troubleshooting capabilities
- Standard programmable performance and safety features
- Superior speed control, torque control, and regulation
- Adjustable acceleration and deceleration times which guarantee a consistent and predictable control
- Less space required (in most cases)
- Virtually maintenance-free operation
- Longer brake life (mechanical brakes used only for holding and emergency stopping)
- Easily communicates with other drives, computers, radio receivers, and other devices through a serial or industrial communication link
- Enhanced safety by monitoring brake performance and retaining control if a mechanical failure occurs
- Improved productivity by allowing motor overspeed during lightly loaded and safe conditions
- Regenerative systems are possible due to dynamic braking



MAGNETEK'S INNOVATIVE ENGINEERED SYSTEMS

Pictured is a common bus IMPULSE®•G+ & VG+ Series 4 engineered control panel designed by Magnetek and installed on a cab operated hot metal crane. On the left of the panel are two IMPULSE•D+ HHP active front-end regeneration units that power the IMPULSE drives and regenerate AC power back to the grid. In the center of the control panel are our IMPULSE•G+ & VG+ drives and Braketronic® controls. On the right of the IMPULSE Series 4 drives is our MagnePulse™ DMC solid-state magnet controller.

DC CRANE CONTROLS

While the trend within the metals industry is leaning towards modern AC VFD Open Loop and Flux Vector Controls, a market still exists for DC controls.

DC Magnetic controls are normally used with DC series wound motors. Historically, they have been used in steel mills and other severe duty applications. They have the advantage of providing normal speed under rated load and higher speeds (overspeeding) under no-load or light-load conditions. While high production can be achieved with this type of control, it does not allow for accurate positioning of loads.

DC Variable Voltage Drive controls have become an attractive alternative to magnetic contactor controls, especially in high performance applications. They provide good speed control and regulation. Additionally, they allow high hoist speeds under no-load or light-load conditions and offer many of the same diagnostic capabilities of an AC VFD.

CRANE CONTROL TECHNOLOGY TODAY

With the application of Variable Frequency Drives expanding worldwide, the demand for more compact, lower cost drives is growing. Recent improvements in drive technology, such as a new generation of IGBTs, sensorless vector control, powerful microprocessors with flash memory, and improved algorithms, have allowed for the downsizing of power platforms and the inclusion of many high performance features.

Increased interest in wireless and cloud-based technologies have allowed VFDs to be accessible remotely. Serial and industrial (e.g. Ethernet/IP) communication now provides a reliable digital linkage to various peripheral crane devices, sensors, PLCs, and radio controls. Remote diagnostic technology provides direct feedback to the operator, maintenance department, or crane service provider. Sophisticated wireless transmitters/transceivers now allow the crane operator to access data on load weights, order picking information, processing instructions, etc. The application possibilities are endless.

You can be assured that Magnetek will continue to be the leader in crane control technology, and the first to bring you innovations to improve the performance of your overhead material handling system.

OmniPulse™ DDC Series 2 and MagnePulse DMC

Diagnostic Technology

CRANE CONTROL COMPARISON

	AC VFD Open Loop	AC VFD Closed Loop (Flux Vector)	AC Magnetic Squirrel Cage (Two-Speed)	AC Magnetic Wound Rotor	AC Magnetic Wound Rotor with Eddy Current Brake	AC Static Stepless	DC Magnetic Controller	DC Variable Voltage Drives
Speed Range	40:1 V/f 200:1 Open Loop Vector	1500:1 Zero Speed with Load Float	3:1	6:1	10:1	12:1	10:1	Infinitely variable
Initial Cost	Low-Medium	Low-Medium	Low	Medium	Medium	High	Medium	Medium
Maintenance	Less maintenance due to the use of solid-state components.	Less maintenance due to the use of solid-state components.	Periodic maintenance requires renewing contact tips.	Periodic maintenance requires replacement of contactors or the renewal of contact tips.	Periodic maintenance requires replacement of contactors or the renewal of contact tips.	Less maintenance of control section due to solid-state devices. Contactor and resistors require higher level of periodic maintenance.	Periodic maintenance requires replacement of contactors or the renewal of contact tips.	Less maintenance due to the use of solid-state components.
Serviceability	Built-in diagnostics help greatly with troubleshooting. Modular VFD platform has few components.	Built-in diagnostics help greatly with troubleshooting. Modular VFD platform has few components.	Average level electrician skills required to understand and service controls	Average level electrician skills required to understand and service controls	Average level electrician skills required to understand and service controls	Requires service personnel experienced in solid-state drive operation.	Average level electrician skills required to understand and service controls	Built-in diagnostics help greatly with troubleshooting. Modular drive platform has few components.
Performance	Excellent speed control and regulation from no load to full load. Mechanical load brakes required on most hoists.	Superb speed control and regulation from no-load to full load. Mechanical load breaks not required on hoists.	Good speed regulation, but poor overall performance. Mechanical drive train subjected to severe shock loads during start and plugging operation	Poor speed regulation and poor overall performance with varying loads. Mechanical load brake required on hoists.	Good speed regulation through use of eddy current brake. Mechanical load brake not required.	Good speed control and regulation from no-load to full load through use of eddy current brake	Poor speed regulation under varying loads. High hoist speed under no-load conditions.	Good speed control, regulation, and load placement capability. High hoist speed under any load condition. High starting torque.
Crane Class Duty Cycle	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8	CMAA Class A-D FEM* 1Bm-3m ISO M3-M6	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8	CMAA Class A-F FEM* 1Bm-5m ISO M3-M8

*Machinery Class

MAGNETEK'S UNBEATABLE SERVICE, TESTING, AND SUPPORT

All Magnetek Material Handling products are backed with:

- On-site technical support
- Emergency control replacement
- Field start-up service available
- Complete application and engineering support
- Factory-certified dynamic performance testing available with every job
- On-site and in-house training programs

Our highly trained team of service technicians offers superior aftermarket support. We're always on call—available to you 24/7, 365 days per year. Our team is unsurpassed at providing you with service and support—where and when you need it.

FOR MORE INFORMATION, CONTACT MAGNETEK MATERIAL HANDLING OR YOUR LOCAL MAGNETEK SALES REPRESENTATIVE.

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