Class 6805
March, 2011

MAGNIFIER AC™

AC Sourced Lifting Magnet Control

The Electric Controller and Manufacturing Company, LLC

March, 2011

MAGNIFIER AC™
TYPE R LIFTING MAGNET CONTROLLERS FOR 10 TO 350 AMPERE MAGNETS

GENERAL INFORMATION AND SELECTION

Class 6805 MAGNIFIER AC, Type R, high performance lifting magnet controller (patent pending) is used for DC magnets rated 10 to 350 Amperes. Typical applications include AC supplied scrap, slab handling and coil handling cranes. The controller is rated for up to 55ºC ambient (enclosed) and is suitable for full or partial voltage magnets. The MAGNIFIER AC may use existing LIFT / DROP master switch. The MAGNIFIER AC alone replaces the transformer, rectifier, and DC magnet controller. For DC supplied cranes, reference Class 6815, Type M Magnet Controls.

Class 6805 Type 4R210-175

- AC to DC solid-state magnet controller, patent pending
- Maximum energy recovery as discharge energy is returned directly to the AC line
- Eliminates DC rectifier for reduced maintenance, weight and energy loss
- Voltage boost is standard for fast magnet charge and discharge for all magnets
- Adjustable overvoltage to 550VDC for magnified lifts, without a special DC rectifier or magnet
- Voltage and current control for full control of magnet lift and drop operations
- Voltage cutback is standard for scrap applications to allow cooler running magnets
- Control self-protection against cut cables and short circuits
- Magnet over-temperature monitor for alarm or for operations cutback
- Voltage spikes eliminated in the magnet
- Diagnostics with fault indicators
- Standard AC input voltages are 380VAC or 480VAC, 3Ø, 50/60HZ*
- Eliminates all contactor tip maintenance
- Available PC software for logic check, parameter adjustment, drive input and output monitoring, etc. via RS485 communications port

Standard Class 6805 MAGNIFIER AC Controller contains:

1 – AC Main Line Circuit Breaker, Motor operated, with shunt trip for local and/or remote operation (MLB)
1 – Programmable AC to DC Magnet Power Source (MPS)
1 – Ride-Through Module for capture of fault indication and logging in the event of a power loss trip (RTM)
6 – Relays, interposing for LIFT / DROP, SWEEP, DRIBBLE (Fanning), ALARM, TRIP functions
1 – Control Circuit Transformer, fused (CTR)
1 – Cabinet Space Heater, thermostat controlled (SH)
1 – Line Reactor for power conditioning of recovered magnet energy
1 – RS485 communications port for input and output monitoring, and parameter changes via PC
Energy savings software to assess ongoing energy consumption difference between original system and **MAGNIFIER™**.

Standard programmed features available when activated:

Magnet temperature detection and alarm for single magnet or for average value of several magnets
Microprocessor communications link (RS485) for output of magnet parameters, running conditions, etc.
Sweep mode; with programmable reduced current levels for clean up
Programmable output voltage level for full or partial voltage magnets.
(For factory pre-programmed partial voltage levels, see **Controller Modifications, Form P,** page 3)

Pre-programmed features available. Reference Controller Modifications table or consult factory

MAGNIFIER AC™ SELECTION TABLE

Type*	Magnet Cold Current Range for altitude below 1000m (3300ft)♦			AC Input Voltage*	Enclosure
	40°C	50°C	55°C		
4R105 - ▼	10-105A	10-90A	10-82A	480VAC, 3Ø	NEMA12
4R210 - ▼	106-210A	91-175A	83-160A		
4R350 - ▼	211-350A	176-300A	161-270A		

* For 380VAC systems, replace '4R' with '3R'. Alternate voltage and higher current rated controllers available, consult factory.
▼To complete the Type number, add magnet cold current nameplate rating, or total of rated magnet cold currents (see **Form W1,** pg. 3).
♦ For altitudes above 1000m (3300ft) see **RATINGS and FEATURES**, pg. 3.

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CONTROLLER MODIFICATIONS

Form	Description	Function
E29	Enclosure Fan and Filter	Enclosure cooling for outdoor and in direct sun only
G100	Wireless Communications Link	Provides wireless parameter view, live operations check, and data log of magnet operation (Uses RS485 port)
G101*	Single Sheet Lift	Single sheet or billet lift from stack of similar material
G102*	Single Sheet Drop	Release of a single sheet or billet from lifted group of similar product
P▼	Partial Voltage Magnet	Pre-programmed for use with partial voltage magnet, requires continuous voltage rating
V99	Special Power Supply Voltage Rating	Supplies a separately mounted power transformer for input line voltage other than 460 or 380, advise supply voltage
W1	Multiple magnets wired in parallel	Changes the wiring diagram for connection to paralleled magnets. Equal value magnets recommended.

***** Requires field adjustment, consult factory

▼Requires magnet nameplate continuous voltage rating. Form number will be completed by this voltage value. E.g. **Form P185** describes a magnet with maximum **continuous** voltage rating of 185VDC.

RATINGS and FEATURES

Crane Applications:
Suitable for all AC supplied cranes that handle scrap, plates, billets, or other ferrous products.

Temperature and Altitude ratings:
Reference the **SELECTION TABLE** for controller sizes and ratings at each ambient. Panel ratings are based on external enclosure ambient, without internal air conditioning for altitude less than 3300ft (1000m). Where the site is above 1000m (3200ft), reduce the normal full load current by 1.0% for each additional 100m (320ft), up to a maximum of 4000m (13,200ft).

Input Voltage:
With proper voltage code, standard units are suitable for use with line power from 380VAC / 480VAC (+/- 10%), 50 / 60HZ, 3Ø sources. Other AC system voltages (**Form V99**) require a separately supplied and mounted 3 phase input transformer, sized to handle the necessary AC load.

Output for Magnet Applications:
Voltage is programmable to all DC electromagnet applications, full or partial voltage, up to 450VDC (380VAC input) or 550VDC (480VAC input). Magnet cold current levels programmable from 10% of rated, up to maximum rated cold current.

Magnet Duty:
Suitable for magnets with up to 100% control on time allowed. Consult magnet manufacturer for allowable magnet duty rating.

Disconnects:
The **MAGNIFIER™** has motor operated circuit breaker with shunt trip for remote or local operation as line disconnect. However, this does not disconnect the line reactor or control power in the enclosure. A separate AC line disconnect will be required. An appropriately rated AC safety switch, or **EC&M Class 6440** Manual & Magnetic Disconnect Switch (see page 8), may be used. Local standards may also require a DC magnet disconnect, wired between the **MAGNIFIER™** and the magnet, reference **EC&M Class 6823** Magnet Manual Disconnects.

Input Pilot Devices:
Standard controllers accept:
- LIFT / DROP master switches, reference **EC&M Class 6815 Type MG1,** see page 4.
- Pushbuttons, selector switches, etc.
- Multi-stepped master switches for various operating levels (reference **EC&M Class 9004**) as needed for the application.

Protection:
- **MAGNIFIER™** systems are self-protected from magnet short circuit, magnet circuit opening under load, and loss of supply voltage.
- Magnet temperature detect is based on the magnet rated (hot) resistance and current rating. For multi-magnet operation (**Form W1**) with several magnets in parallel, the magnet temperature reading will indicate the average temperature of all magnets connected.

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OPERATING MODES

Standard Lift mode:
Upon LIFT command, the **MAGNIFIER AC** system will apply a preset, elevated voltage for the fastest possible magnet charge. Upon attaining magnet cold current, the system reverts to a voltage controlled system. Magnet voltage may be reduced to just enough to hold the lifted load without loss or may be set to a maximum equal to magnet rated voltage. The unit assures an initial cold current LIFT for each operation for maximum attraction of material, before reducing to preset 'hold' power levels. This ensures maximum lifted load at minimum energy expenditure and minimum magnet heating.

Standard Drop and Discharge Mode:
Upon DROP command, the **MAGNIFIER AC** system will apply a preset, elevated reverse voltage for the fastest possible magnet discharge. Upon attaining the preset magnet reverse current consistent with clean drop, the system returns to system ready-state (no current or voltage), awaiting the next LIFT command. During the discharge operation, magnet power is returned to the AC system, at 1 Volt over line voltage at unity power factor, for maximum system energy recovery.

Sweep Mode:
SWEEP Mode reduces voltage and current levels in the magnet to preset values. SWEEP values are field set and adjusted to remove ('clean') final pieces from a ferrous container without lifting the container. A selector switch or pushbutton input is required to activate the SWEEP power levels. Standard power levels are preset to 65-70% of magnet rated voltage. Sweep parameters are field adjustable to fit the application.

Custom Lift modes:
With field adjustment, the LIFT mode can be preset to allow lift a preset amount of material, such as single sheets or billets. Change in material or material composition will require change in parameters. (Requires **Form G101**).

Custom Drop / Dribble / Fanning Modes:
MAGNIFIER AC systems have several preset and custom release modes available, which allow material to be released more quickly or slowly, as programmed. Available modes include:

- Release of single sheet or billet. Requires **Form G102**, and field adjustment for material size and composition. Upon release, voltage levels are automatically increased to ensure a hold on remaining material.
- Slow release of scrap material, initiated by pushbutton or master switch input(s), which activate:
  - Preset, reduced voltage points.
    Or
  - Adjustable pre-set voltage ramps. Operator initiates ramp start, and material is released. Operator stops the ramp as needed to hold remaining material. Hold voltage levels may be automatically increased to ensure a hold on remaining material.

CLASS 6815 MAGNET CONTROLLER PILOT DEVICES

Class 6815 master switches and push button stations are designed for use with all EC&M magnet controllers.

Class 6815 Type MG1
Lever Type Lift-Drop Master Switch

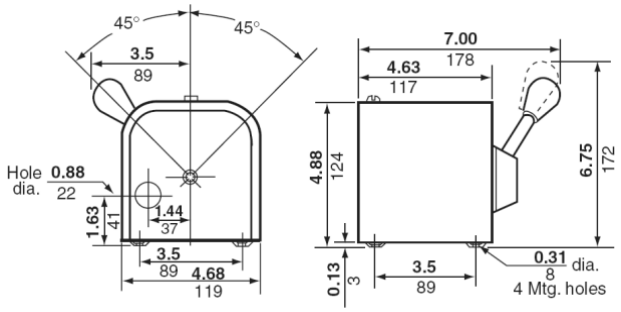
- NEMA 1 enclosure
- Double-pole overlapping contacts
- Horizontal or vertical mounting

Class 9001 Type KYK312
Push Button Station

- NEMA 12 enclosure
- Mushroom head operators
- Horizontal or vertical mounting

Other pushbutton configurations available, consult factory

Approximate Dimensions and Weights
Net Weight – 5Lbs (2.3 kg)



INCHES
mm

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MAGNIFIER AC™
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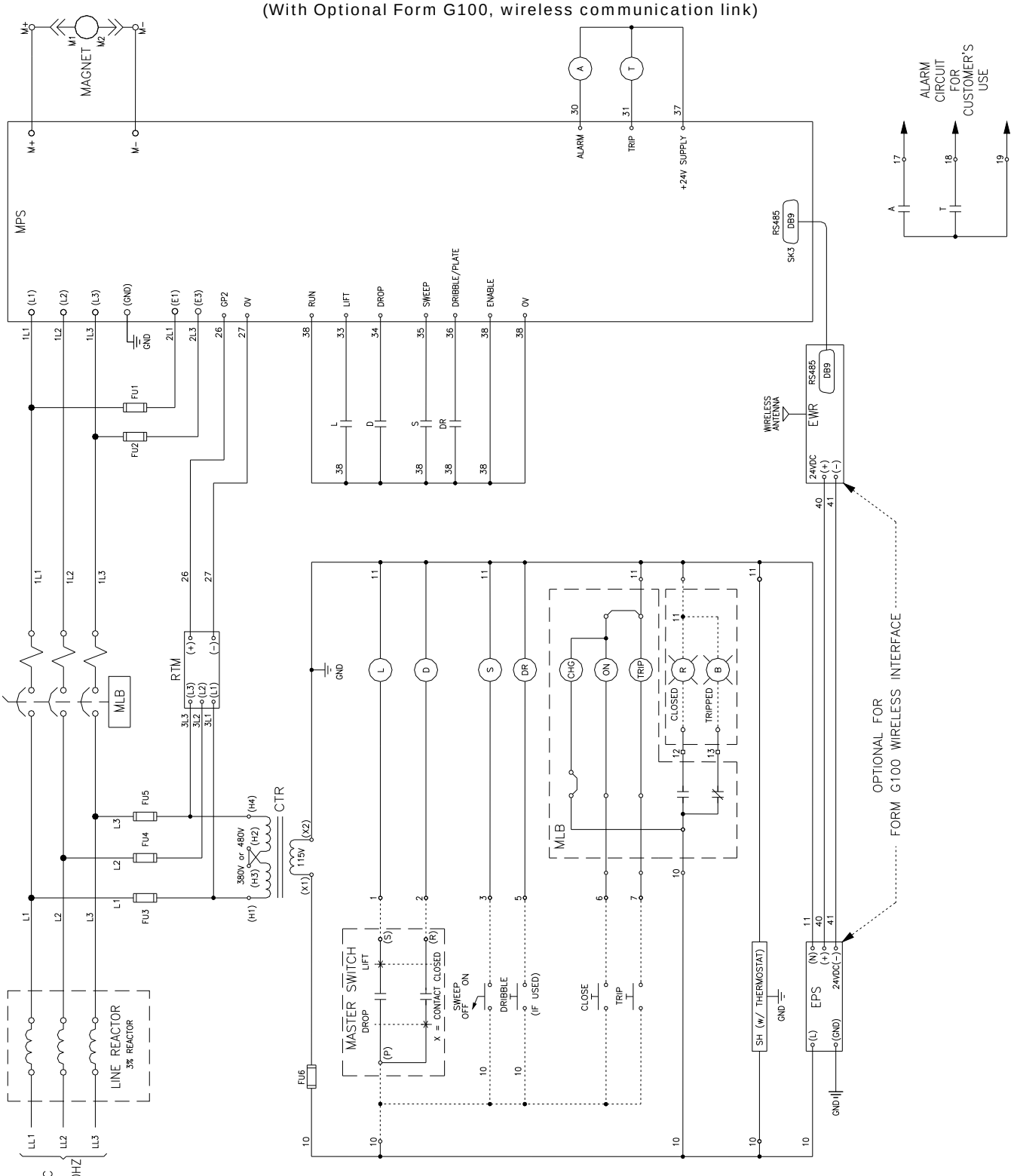
ELEMENTARY DIAGRAM

(With Optional Form G100, wireless communication link)



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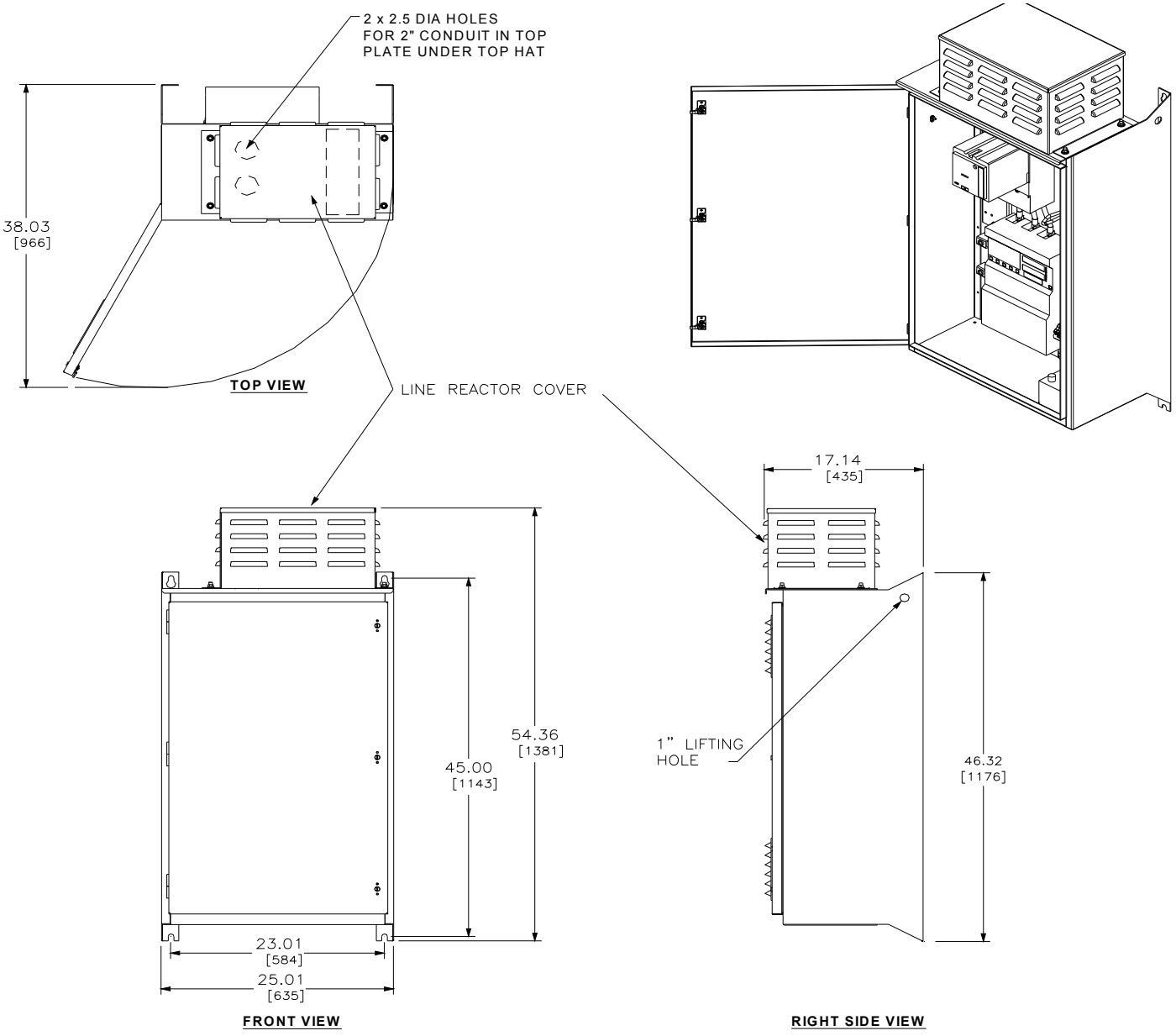
APPROXIMATE DIMENSIONS AND WEIGHTS
3R105, 4R105, 3R210, or 4R210 CONTROLLERS



Estimated Weight: 225Lbs [102kg]
For Weights and Dimensions for 350A controllers:
Consult factory

INCHES
[mm]

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AC SUPPLIED MAGNIFIER AC™ vs. RECTIFIER SUPPLIED DC MAGNET CONTROL

System		MAGNIFIER ™	Rectifier Based DC Control
Crane Components		380VAC or 480VAC, 3Ø Power AC Disconnect MAGNIFIER AC™ Magnet Control Standard or partial voltage magnet	380VAC or 480VAC, 3Ø Power AC or DC Disconnect AC/ DC Power Transformer and Rectifier DC Magnet Control, electromechanical or solid-state Standard magnets Partial voltage magnets require special control
Energy Savings		Magnet discharge energy placed into AC line with very low voltage rise. Allows maximum power demand reduction and AC energy return. Energy returned can be used by other systems. Transformer / rectifier power losses eliminated. No discharge / dump resistors or varistors used. Energy savings calculator software is standard.	<u>Electromechanical (Contactor) or DC solid-state:</u> The rectifier blocks any power return to the AC system. No energy is returned for use by other systems. Demand reduction available for solid-state controls. Transformer & rectifier power losses required. Losses in discharge resistors or varistors needed to limit discharge energy to the DC line.
Magnet Performance and Operation	**Magnet Charge & Discharge**	Overvoltage with cutback allows fastest magnet charge and discharge available **without** special rectifier, special magnet control or special magnet.	<u>Electromechanical (Contactor) or DC solid-state:</u> Standard 230VDC rectified voltage systems, electromechanical or solid-state, take up to 7 times longer to charge and discharge. Overvoltage / Cutback available only with special voltage transformer / rectifier and (or) special magnet control and (or) special magnet.
	Magnet Operation	Initial cold current on every lift without magnet overheating, for maximum lifted material. Voltage control after initial charge allows higher current when the magnet is cool, for maximum lifted material. As the magnet resistance increases during operation, magnet current is inherently reduced, protecting the magnet from overheating.	<u>Electromechanical (Contactor):</u> Lifting current limited by the magnet resistance change leads to inconsistent operation. Initial lifting current reduced by 35-50% as the magnet reaches operating temperature. <u>DC solid-state:</u> Magnet lifts must be programmed to cutback current on every lift to avoid magnet overheating.
	Sweep Mode	SWEEP mode selection allows next operation current reduction, for scrap cleanup of railcars, vessels, or other scrap containers without lifting the container.	<u>Electromechanical (Contactor) or DC solid-state:</u> SWEEP mode not available as standard, may be special programmed or designed.
Magnet Protection		Magnet temperature indication, with magnet resistance available via communications port or alarm relay. Three programmable levels of monitoring and protection for magnet overheating: • Response via alarm output • Current (lifting capacity) cutback upon next operation • Time delay of next lift command	<u>Electromechanical (Contactor):</u> Magnet Temperature protection or indication is not available without special design. <u>DC solid-state:</u> Magnet temperature alarm available via alarm relay and display
		Shorted magnet protection included. Discharge energy control during line voltage loss without resistors or varistors. Protection via magnet power supply (patent pending) and high speed circuit breaker	<u>Electromechanical (Contactor):</u> Shorted Magnet protection requires fuses; standard units without fuses may be damaged. Fused circuits may not be allowed in certain installations for safety reasons. Line Voltage loss protection requires resistors or varistors. <u>DC solid-state:</u> Shorted Magnet protection available. Line Voltage loss protection requires resistors or varistors.
Maintenance Savings		No main line contactor & no contactor tip maintenance. No power resistors required.	<u>Electromechanical (Contactor)</u>: Contactor tip maintenance required. Power resistors required. <u>DC Solid-State</u>: One main line contactor required, with little maintenance required. Power resistors required.

CLASS
6440

AC DISCONNECTS
FOR LIFTING MAGNET CONTROLLERS AND CRANES
150 TO 1350 AMPERES

March, 2011

AC MANUAL MAGNETIC DISCONNECT SWITCHES

The Manual Magnetic Disconnect Switch is used for protecting electrical crane circuits, and AC sourced lifting magnet controls. The disconnect meets OHSA requirements for a crane disconnect switch.

The standard disconnect switch consists of:

3—Class 8503 Type M, Form Y781 (with silver faced power contact tips), SPNO Contactors. The contactors are mechanically tied. One normally open and one normally closed electrical interlocks are included for indicating lights

1—Two pole Control Molded Case Switch with padlock clip (CMCS)

1—460/380/230 to 255 volt fused Control Circuit Transformer (CTR)

1—Intermediate Control Relay (CR)

1—Class 9999AI1 Arc Suppressor

- CAM OPERATOR PREVENTS CONTACTOR FROM CLOSING WHEN HANDLE IS IN OFF POSITION
- CONTACTORS OPERATED REMOTELY OR BY HANDLE ON THE ENCLOSURE

Volts 50/60HZ	NEMA Contactor Size	Continuous Ampere Rating	Enclosure	
			NEMA Type 1 Gasketed General Purpose	NEMA Type 12 Dusttight NEMA Type 3 Outdoor
			Type	Type
380 or 460	4	150	**MFS12**	**MFA12**
	5	300	**MGS12**	**MGA12**
	6	600	**MHS12**	**MHA12**
	8	1350	**MKS12**	**MKA12**

DISCONNECT MODIFICATIONS

Form	Description
F30*	3 Main Line Power Fuses
A	START-STOP Push Button
X11	Additional Control Circuit Interlocks. A maximum of 4 N.O. / N.C. interlocks can be added
A3	ON-OFF Pushbutton
P1	Red ON Pilot Light
P2	Green OFF Pilot Light
T12	200VA Additional Transformer capacity

* Class L fuse mounting is standard. Customer to supply fuse rating.

DISCONNECT SWITCH SELECTION

When applied to AC sourced magnet controls, AC continuous ampere rating in amps (at line volts, 3Ø) to be greater than or equal to 0.83 x total DC magnet cold current applied.

When applied to cranes, the continuous ampere rating of the disconnect switch shall not be less than 50 percent of the total rated current required by all motors on the crane, nor less than 75 percent of the rated motor current required by any single crane motion.

PILOT DEVICE SELECTION

The pilot devices should be selected so that the current rating is adequate for operating the disconnect switch. For main contactor coil currents, refer to Class 9998 Coil Data catalog sheets. An arc inhibitor may be required depending upon the ratings of the pilot device.

ORDERING INFORMATION REQUIRED: 1. Class 2. Type 3. Voltage 4. Controller Modifications: Specify Form

Crane Control Selection Guide

For more details, please see our crane control catalog, at www.ECandM.net

CLASS 5010 WB DRUM BRAKES

- AIST rated and suitable for all crane classes
- Spring set, electrically released, DC drum type
- Available for AC operation with brake rectifier controller
- Hold drive stationary when motor is off
- Available in 8” to 30” wheel diameters
- Torque ratings 100 through 9000 ft-lbs
- Corrosion resistant pins are standard on all brake sizes
- Grease fittings are standard on 19”, 23” and 30” brake sizes
- Available with optional self-adjuster for 8” through 23” brake sizes

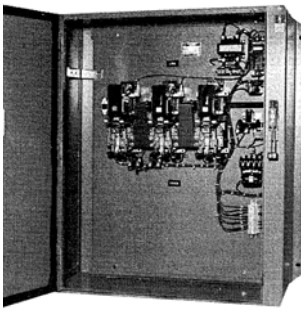
CLASS 6417/6418 VARIABLE FREQUENCY CONTROL

- Stepped or stepless drives for wound rotor or squirrel cage motors
- Open loop travel and closed loop hoist drives available
- Crane specific software included
- Complete drive systems with torque proving, stationary auto tune, brake and power limit switch interface
- Rated 50°C as standard
- Software to monitor inputs, outputs, system logic, parameters, and drive power output as an oscilloscope trace
- Onboard diagnostics and fault history

CLASS 6420 to CLASS 6426 AC CONSTANT POTENTIAL (Contactor) CONTROLS

- Hoist drive styles include Eddy-Current Brake, Contra-Torque®, AC Dynamic Lowering, and Reversing Hoist controls
- Reversing Plugging control for bridge and trolley (travel) drives
- Rugged devices for extreme duty, control meets NEMA Service Classification I
- Available in NEMA contactor sizes 2 through 6, through 300HP for single or multiple motors
- Numerous modifications available
- Class 8503 Type M LineARC® contactors, with static timers, frequency relays for acceleration
- Industrial duty contactor versions available to meet NEMA Service Classification II

CLASS 6440 AC MANUAL MAGNETIC DISCONNECT SWITCHES



- Meets OSHA & NEC requirements for AC crane disconnect switch
- Available in continuous ratings of 150 to 1350 Amperes
- Operated remotely by pushbutton or by the enclosure handle
- Mechanical & electrical interlocks prevent switch operation with handle in OFF

CLASS 6170 YOUNGSTOWN® HOIST POWER LIMIT SWITCHES

- Final safety limits for hoist upper travel
- Interrupts motor power directly
- Available ratings up to 500HP at 230VDC, or up to 400HP at 480VAC and 550VAC
- Available auxiliary contacts set to operate prior to main contacts, for variable frequency hoist applications

Please visit our website for additional details on:

DC MILL DUTY CONTACTOR CONTROL, DC DISCONNECT SWITCHES, DC MAGNET CONTROL, DC REDUCED VOLTAGE STARTERS, MASTER SWITCHES, MILL DUTY RELAYS, OVERLOAD RELAYS, AC CONTACTORS, AND OTHER MILL DUTY CONTROL COMPONENTS

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SEE SEPARATE PRICE SHEET OR CONTACT EC&M FOR PRICE AND LEAD-TIME AT **WWW.ECandM.NET** OR CALL **803-874-3922**