Solid State Motor Starters...

Quarry Duty™

- Minimize Inrush Starting Currents
- Maximize Power Grid & Generator Capacity
- Eliminate Starting Torque Damage
- Prevent Belt Failure

For The Mining & Aggregate Industries
The MaX-L Starter

Ideally Suited to the Mining & Aggregate Industries
The MaX-L solid state reduced voltage starter provides the ideal solution to electrical and mechanical problems that occur when starting AC motors across-the-line. High starting currents, slipping belts, gear box damage, sudden jolts when starting and stopping conveyors, product damage and premature motor failures are just a few examples of problems that can lead to costly downtime and maintenance.

The "Heavy Duty" Starter for Tough Applications
This heavy duty "soft start" motor starter provides smooth, stepless acceleration of your motor and load while keeping the inrush current to a minimum. Ramp time and torque adjustments can easily be changed as equipment is moved from job site to job site. Unlike traditional electro-mechanical methods of reduced voltage starting, the MaX-L provides the power you need to start even the toughest loads.

Maximized Performance
The MaX-L monitoring and protective features mean reliable, trouble-free operation. The built-in dual ramp control can be used to jog the motor when material is left in the equipment or a jam condition occurs. Why burn up contactors when the MaX-L solid state starter can carry the load...

Choose the MaX-L for maximum starting torque and excellent ramp control in a rugged, heavy duty design.

Easy Set-up and Operation
The MaX-L features a Status Display/Operator Module that is mounted on a dead-front panel inside the standard NEMA 4/12 enclosure. Two independent ramp control settings can be changed with a simple twist of a potentiometer. In other words, no programming parameters to remember. The Status Display is also mounted on the outside of the enclosure with large, easy-to-read LEDs that indicate Run, Fault and additional LEDs that provide status information for both the motor and the soft starter.

Status Indicator LEDs
Run and Fault
- Run light comes on at start signal
- Fault light comes on at any fault trip
Power On
- Indicates control power is present
- Shows blown control fuses or remote disconnect
At Speed
- Closed loop current feedback monitors the motor to sense when it reaches full speed, not just end-of-ramp time
- Contact closes at the same time to bring in a bypass contactor

Heavy Duty Design
- Rated at 500% overload for 60 seconds
- Designed to handle locked rotor torque
- No need to oversize

Reliable, Trip-Free Operation
- Exclusive "Auto Synchronizing" feature prevents misfiring or nuisance tripping
- Automatically tracks generator voltage and frequency

The "Credentials" To Do The Job
- UL and cUL listed to be used behind any circuit breaker or MCP
- The only soft starter to pass the UL short circuit test at 85,000 amps for 3 cycles

Status Display/Operator Module
**Smooth Ramp Every Time**

Some soft starters are just current limit controls which cause the motor to jump during the initial start. Others are just voltage ramp controls which cause oscillation as the motor comes up to full speed. The MaX-L blends both current limit and voltage ramp control to provide the smoothest soft start possible. Its unique "anti-oscillation" circuit ensures smooth, vibration-free ramp control without readjustment...set it and forget it.

**Built-In Dual Ramp/Jog Control**

When machinery shuts down out of sequence due to a power failure or overload condition, extra starting torque may be needed to restart under load. The MaX-L solves this problem by providing two independent ramp settings controlled by a simple contact closure. If the second ramp setting is needed, simply turn a switch and the MaX-L can deliver the necessary amount of starting power to the motor, from extra high to extra low.

**Flexibility = Increased Productivity**

The dual ramp feature can also act as a slow speed jog for access hatch positioning, a "bump" start to check direction and rotation, or a mid-range purge for clearing out jammed jaws or augers. No matter how you use it, the MaX-L can save you money by increasing your machine thru-put, minimizing downtime and increasing the overall system productivity.

**All The Protection You Need**

**Shorted SCR**
- Illuminates if any SCR is shorted
- Can be set-up to allow critical equipment to continue to run, yet still indicate the condition exists.

**Shunt Trip**
- Indicates power flowing through the SCRs in an off state. The shunt trip relay activates and trips the factory installed circuit breaker when provided.

**Over Current**
During start:
- Exclusive "Toe-in-the-Water" circuit electronically pre-checks for shorts in both the motor lead wires and the windings. It can detect damage to flexible cords lying on the ground or winding insulation damage that may have occurred while the machine was off or moved.

While running:
- An "electronic fuse" detects short circuit current much faster than a circuit breaker or fuses can and shuts down the starter safely.

**Over Temp**
- Monitors heat sink temperature, trips at 185°F to avoid SCR damage.

**Over Load**
- This LED ties into the standard Class 20 motor overload protection and indicates a trip condition

**Phase Loss**
- Indicates one or more phases are missing from either the line power or the motor connection
- Also protects against severe phase imbalance and loss of load

**During Start...**

**While Running...**
Conveyors
- Smooth voltage ramping prevents belt damage and tracking problems
- The second ramp allows "Loaded Re-Start" selection

Horizontal & Vertical Impactors
- The built-in, fully adjustable current limit feature allows downsizing of portable power plants or transformers, which reduces overall jobsite costs
- The dual motor/common shaft option allows simple sequenced starting of two motors on one machine

Cone & Roll Crushers
- No "light duty" ratings that might fail to start a tough job
- Every starter can handle ANY machine
- Highest overload duty rating available on the market: 500% overload for up to 60 seconds
- The MaX-L delivers any amount of starting torque, right up to locked rotor if necessary

Jaw Crushers
- Built-in dual ramp feature in every MaX-L provides power to clear leftover rocks on the bottom of the jaw after a power failure
- Gentle ramp for normal starting reduces maintenance costs

Portable Plants
- Exclusive "Toe-in-the-Water" circuit detects cut and damaged motor cables
- The second ramp checks rotation without stressing the bypass contactors

Feeders & Screens
- Electronic braking option can eliminate damaging "buck & bounce" that occurs at shut down
- Feeder drive option uses variable speed drives to replace hydraulic drives

Comminution Equipment
- The MaX-L provides dual ramps and high overload capacity for easy restarts after power failures
- Vacuum bypass contactors provide reliable and profitable operation in dusty environments
Designed to Perform In Your Industry's Toughest Applications

The MaX-L complete "Combination Starter" includes the following standard components:

1. Solid state soft starter chassis with a finger-safe, dead front panel and built-in operator interface/status display
2. Across-the-line rated bypass contactor (vacuum or air break style) controlled by an at-speed output contact
3. Circuit breaker disconnect equipped with a shunt trip mechanism
4. Exterior operating handle interlocked with the lockable enclosure door
5. Class 20 motor thermal overload relay
6. 120V control power transformer (CPT) with primary and secondary fusing
7. Door-mounted status display
8. Dual ramp/jog control selector switch
9. NEMA 4/12 dust tight and weather tight enclosure with outdoor rated heavy duty polyester powder coat paint
Simple Selection/ Flexible Options

MAXL - [Select Max. Amps: 39 - 1250 Amps (See Chart)]
Select Voltage: 208V, 230V, 380 = 380V, 400 = 400V, 600 = 600V
Enclosure: E = NEMA 4/12 (Standard)

A variety of options and accessories are available to meet your specific application needs. These should be listed as separate line items when ordering.

<table>
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<th>Model Number</th>
<th>Max Amps</th>
<th>MCP Size</th>
<th>Max HP 208V</th>
<th>Max HP 230V</th>
<th>Max HP 380V</th>
<th>Max HP 400V</th>
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</table>

* The MaxL Series unit should be selected based on the actual HP, voltage, FLA rating and service factor of the motor to insure proper overload protection.

Vacuum Bypass Contactor is standard in these ratings.

Other General Accessories Available

Door Mounted Devices
• Push Buttons & Pilot Lights
• Selector Switches
• Emergency Stop Buttons
• Ammeters
• Elapsed Time Meters

Performance Options
• Motor Protection Relays
• Under Load Relays
• Shock Relay/ Shear Pin
• Control Relays & Timers

Enclosure Options
• Space Heaters
• Thermostats
• Viewing Windows
• Legs or Pedestals

Power Options
• Ground Fault Protection
• Surge/Lightning Arrestors

Options for Mining, Aggregate and Related Applications

<table>
<thead>
<tr>
<th>Options</th>
<th>Option Designator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Motor</td>
<td>-DMCS</td>
<td>Two motors connected to a common shaft. The first motor is started with the soft starter and the second motor is started with an across-the-line starter after the first motor is at or near full speed. Provides overload relays for each motor.</td>
</tr>
<tr>
<td>Jog Button</td>
<td>-B</td>
<td>Adds a momentary push button to the enclosure door and is wired directly to the Ramp 2 input for &quot;bumping&quot; the motor during rotation checks or other jog ramp functions.</td>
</tr>
<tr>
<td>Auxiliary Starter</td>
<td>-AXP</td>
<td>Adds an across-the-line starter inside the MaxL to operate small motors associated with a crusher application. Starter can be interlocked with the crusher controls for either &quot;pre-start&quot; or &quot;service.&quot;</td>
</tr>
<tr>
<td>Auxiliary Variable Speed Drive</td>
<td>-ADF</td>
<td>Adds a Motortronics variable frequency drive (CSD Series) for control of a motor associated with the application for either &quot;Feeder Drive&quot; or &quot;Output Drive&quot;:</td>
</tr>
<tr>
<td>Electronic Motor Brake</td>
<td>-ABC</td>
<td>Adds a Motortronics electronic brake (ABC Series) to bring the motor to a rapid stop. This feature is useful on screen applications to eliminate the mechanical harmonic that causes &quot;bucking&quot; of the screen or overtravel on downhill conveyors.</td>
</tr>
<tr>
<td>Power Zone</td>
<td>-PZ</td>
<td>Changes the standard control power transformer to 5kVA 120V, wired to two additional single-pole circuit breakers for powering job site tools and/or space heaters. Includes a covered weatherproof 120V, 15A duplex outlet on the side of the enclosure.</td>
</tr>
<tr>
<td>Motor Winding Heater</td>
<td>-MWH</td>
<td>Adds a Motortronics winding heater (MH Series) to keep the motor warm when not in use and prevents internal condensation and insulation deterioration.</td>
</tr>
<tr>
<td>Bottom Entry</td>
<td>-BE</td>
<td>Additional mechanical lugs mounted near the bottom of the enclosure for terminating portable cords from below.</td>
</tr>
</tbody>
</table>
The MaX-L Specifications

Type of Load
Three phase AC induction motors

AC Supply Voltage
208 - 600VAC +10%, 50/60 Hz

Unit Overload Capacity (% of motor FLA)
125% - Continuous
500% - 60 Seconds
600% - 30 Seconds

Control
2 or 3 wire 120 VAC (CPTs are standard)
Alternate 240VAC for 380 & 415V

SCR Peak Inverse Voltage
Line Voltage PIV Rating
208 - 480V 1200V
575 - 600V 1500V

Transient Voltage Protection
RC snubber dv/dt networks on each phase

Bypass Contactor
Standard with either a vacuum or air gap style
"line-start rated" bypass contactor
Optional "shunt rated" contactors available

Ambient Condition Design
0 - 40° C (32 - 104°F); 5 - 95% relative humidity
0 - 3300 ft. (1000m) above sea level w/o derating

Acceleration Adjustments (Two independent ramps)
Start Voltage 0 - 100% of line voltage
Ramp Time 0 - 60 seconds
Current Limit 200 - 500%

Motor and Soft Start Protection
Overload Relay NEMA Class 20 inverse time trip
Phase Loss / Trips on any phase current less
Imbalance than 15% of nominal unit rating
Phase Rotation Phase sequence insensitive
Shorted Load Voltage injected during first ¼ sec.,
looks for current surges of 9x current
Short Circuit Trips in 12.5ms at 10 x unit
current rating during run
Shorted SCR Trips on a voltage drop of less than
1 ½ V across any SCR pair
Shunt Trip Separate relay trips on current flow
while in the Off mode
Over Temperature Thermal sensors on heat sinks trip
when temperature exceeds 158 °F

Auxiliary Contacts
Type/Rating FORM C (SPDT), rated 5Amps,
Run Relay Changes state on start/stop command
Shunt Trip Relay Changes on power flow when OFF
Programmable Relay Changes state on Fault or At Speed
Fault Indicator AC triac solid state switch

Approvals
UL listed and Canadian UL (cUL) listed
A Wide Range of Products

The Product You Need...

Motortronics has been a manufacturer of solid state motor controls for over fifteen years. During this time, Motortronics has gained a reputation for providing high quality, cost-effective products for a wide range of motor starting applications. With one of the broadest lines of solid state AC motor controls on the market today, Motortronics has the product to meet your needs.

A Company You Can Count On...

From our staff of knowledgeable sales and application engineers to our strong network of qualified representatives and distributors around the world... you can count on getting the service you deserve. You can always expect the best from Motortronics... in our products, our prices, our service and our support.

With the Experience to Do it Right...

The company has become a leading supplier of solid state controls for some of the most demanding industries... from custom products for use in semiconductor equipment to standard "off-the-shelf" products for general industrial applications... we know how to do it right.