Medium Voltage Solid State Starters
300 - 6,000 hp
2,300 - 6,900 volts
The TEAMMaster™ Advantage

Today’s global economy is in many ways driven by the AC Induction Motor. Industrial facilities worldwide depend on these motors to drive the machinery that enhances their efficiency and increases their production output.

However, many industrial operations unknowingly subject their machinery to severe stress during motor start-up. When motor operation is activated, high inrush currents flow into the motor’s windings, producing very high levels of torque. This torque at the motor’s shaft can result in a substantial shock to the driven equipment. The result may be belts slipping or breaking, couplings disengaging, and gears or other components failing completely.

Therefore, it is often a cost-effective decision to protect your machinery investment with a TEAMMaster™ medium voltage soft starter. Available only from TECO-Westinghouse Motor Company, the TEAMMaster™ protects your machinery by controlling motor torque. The TEAMMaster™ also reduces current demand and creates a more stable line voltage which benefits facilities that have weak electrical systems.

TEAMMaster™ medium voltage soft starters provide several advantages including:

- Protection of machinery from failure and excessive maintenance caused by mechanical shock during starting or stopping. The TEAMMaster™ provides smooth, stepless acceleration and controlled deceleration.
- Control of the current ramp during start-up. The TEAMMaster™ protects electrical systems from disruptive voltage drops and power outages caused by motor locked rotor inrush current.
- Complete line monitoring, motor control and protection. These functions protect mission-critical motors from failure or unscheduled outages caused by machine or electrical system faults.
- Programming capabilities. The TEAMMaster™ includes control and power electronics, as well as bypass and isolation contactors that reduce maintenance and operating costs.
- A UL listing, CE mark, and a CSA approval.
SEVERE DUTY

TEAMMaster™ Product Highlights

The TEAMMaster™ Medium Voltage Starter is a microprocessor controlled solid state reduced voltage starter for three phase induction motors. The starter provides a closed-loop current ramp for smooth stepless motor acceleration, supplied in a free standing enclosure.

Enclosures are available in NEMA 12 or NEMA 3R configurations. The medium voltage enclosure consists of two distinct compartments. The medium voltage, or power pole section, is located in the main body of the enclosure, whereas the low voltage section containing the control logic is located behind the door as an isolated compartment.

Each starter is supplied with a load break isolation switch, Class “R” motor fuses, an inline vacuum contactor, solid state power poles, and a vacuum bypass contactor. This bypass connector is used to bypass the SCR power poles once the motor is up to full speed.

The logic control incorporates the proprietary software that has all the circuitry required to drive the power semiconductors, which are located in the power section.

TEAMMaster™ starters provide solid state reduced voltage starting for normal operation and full voltage emergency back-up starting, with complete electronic motor protection at the flip of a switch.

This unique redundant design is ideal for critical applications where downtime is extremely disruptive and cannot be tolerated.

The proprietary solid state controls provide precise digital starting and stopping, motor protection, metering, diagnostics and communications as a standard.

STANDARD FEATURES

- NEMA 12 or NEMA 3R Enclosure
- UL374 listed Class E-2 Solid State Starter
- 45kv Base impulse level (bil)
- 200MVA (2300V)/ 350 mVA (4160 VAC) short circuit fault load
- 500% - 30 second rated
- 8000 peak inverse voltage (PIV) (2100V); 12,000 PIV (4.2kV) both UL347 certified and listed
- Fiber optic cabling
- Modbus/ RS485
- Selectable solid state or emergency full voltage operation via selector switch mounted inside of LV compartment
- Load matched Class R fusing with blown fuse indication
- 400A load break, 600A continuous, 5KV rated disconnect switch, with viewing window, grounding assembly and lockable handle mechanism. Mechanically interlocked for safety.
- Fixed mounted, start duty rated vacuum contactors for isolation and SCR bypass, wired for normal bypass operation and full voltage start operation, with (2) N/O and (2) N/C auxiliary contacts.
- Separately mounted “SPE” series electronic overload device has the following standard features:
  - Class 10-30 adjustable
  - Phase imbalance protection
  - 1 NO/1 NC trip contact
  - Phase reversal protection
  - “Trip free” design
  - Phase loss protection
- Built-in self test (BIST) features for “quick commissioning”
- 120VAC, 1000VA CPT with primary and secondary fusing, with 500VA available for customer use
- Door-mounted start and stop push buttons.
- Door-mounted LCD keypad
Feature rich, the TEAMMaster™ Starters allow for a wide variety of settings

2 Selectable ramp times
Ramp profile (Linear, S curve, Squared)
Start up mode
Starts per hour
Time between starts
Ground fault current
Local and Remote run source selections
L1-L2, L1-L3, L2-L3 voltage
Motor amps
Motor “Kick” level and times
Service factor
Overload class select
Stop via ramp, coast, or DC braking
Decel ramp profile
Slow speed operation (Jog simulation)

Selectable trip levels and times
- Over and Under voltage
- Over and Under current
- Ground fault
- Phase loss and imbalance
Analog input for trip level
Analog and Meter output configuration
RS 485 configuration
Up to speed time limit
Initial and Max currents for ramps 1 & 2
Initial voltage
Initial and Max torque settings
Auto reset of faults
Auto start on power up

Real-Time metering goes far beyond simply starting a motor and ramping it up to speed. Monitoring capabilities are as follows:

±3% accuracy
Average current
Input current at each phase (L1, L2, L3)
Current imbalance %
Ground fault current
Average volts
L1-L2, L1-L3, L2-L3 voltage
Overload %
Power factor
Watts
Volt-Amps
kW and MW hours
Phase order

VARS
Line frequency
Analog input
Analog output
Run time: Days, Hours
# of Starts
TruTorque® %
Power %
Peak starting current
Last starting duration (Elapsed time)
Real time clock
RTD temperatures

Motor protection features for overall equipment protection and safety

Up-to-speed timer exceeded
Low line voltage
Low line frequency
Phase reversal
Phase Loss
Instantaneous overcurrent
Over and Under current
Current imbalance
Shorted SCR

Ground fault (Residual or Zero sequence)
Disconnect fault
In-line contactor fault
Control power low
Independent starting and running overloads
Motor thermal overload
Stack over temperature
Motor PTC input
**Performance**

**MVRXE Medium Voltage Solid State Starters offer superior performance when compared to Across-The-Line or Auto Transformer Starts, as shown below.**

**ACROSS THE LINE (ATL)**
Motor Inrush Current ($I_{start}$) Typically 500-800%
Motor Full Load ($I_n$) Current

**AUTO TRANSFORMER REDUCED VOLTAGE STARTER**
Starting current is reduced as the square of the applied voltage reduction. Current spikes occur at transition.

![Graph showing I_{start} and I_{ATL} vs RPM]

**Soft Start Motor Current Ramp**
Lower peak currents and absence of spikes reduces energy costs and produces less motor/process equipment wear and tear.

**TYPICAL CLOSED LOOP CURRENT RAMP PROFILE**

**CURRENT RAMP WITH MAX CURRENT SETTING**

![Graph showing I_{start}, I_{soft}, 300% FLA, and Max Current vs RPM]
**Powerful, Intuitive User Interface Provided with each Starter**

**Selectable Starting Modes**
- Voltage ramp
- Current ramp
- kW ramp
- Linear / Tach ramp
- Dual ramps
- TruTorque® ramp
- Cyclo® converter ramp
- Full voltage
- Adjustable kick currents

**Available Options**
- Pilot lights
- Hand-Off-Auto selection
- Local-Off-Remote selection
- Metering: Amps, Volts, Watts
- Control relays
- Ground Fault relays and current
- RTD modules
- Control power supply/ 1000VA
- Additional control power up to 2000VA
- Door interlocks
- Surge arrestors
- Additional RS485 protocols:
  - Profibus
  - Ethernet
  - DeviceNet
  - LonWorks
- Transformers
- Output signal transducers
- Multilins
- Space heaters
- E-Stops

**TEAMMaster™ has been applied in Successful Solutions as follows**

**Industries**
- Power generation
- Chemical processing
- Pulp and paper production
- Oil and gas processing
- Municipal fresh water
- Wastewater
- Aggregate and mining
- Cement production
- Steel and aluminum

**Applications**
- Pumps
- Fans and blowers
- Mixers and refiners
- Crushers
- Ball and hammer mills
- Compressors
- Chillers
- Conveyors
- Centrifuges
SEVERE DUTY

Prepackaged Solid State Starters with ATL Bypass

MVRXE12 - 2300 VOLT

<table>
<thead>
<tr>
<th>MODEL</th>
<th>HP</th>
<th>FLA AMPS</th>
<th>DIMENSIONS (IN)</th>
<th>WT (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVRXE12-650-2300-**</td>
<td>650</td>
<td>160</td>
<td>H 92 W 36 D 32</td>
<td>1,800</td>
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<tr>
<td>MVRXE12-750-2300-**</td>
<td>750</td>
<td>180</td>
<td>H 92 W 36 D 32</td>
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<tr>
<td>MVRXE12-1500-2300**</td>
<td>1,500</td>
<td>360</td>
<td>H 92 W 36 D 32</td>
<td>1,800</td>
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</tbody>
</table>

MVRXE18 - 4160 VOLT

<table>
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<tr>
<th>MODEL</th>
<th>HP</th>
<th>FLA AMPS</th>
<th>DIMENSIONS (IN)</th>
<th>WT (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVRXE18-1000-4160-**</td>
<td>1,000</td>
<td>133</td>
<td>H 92 W 36 D 32</td>
<td>2,000</td>
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<tr>
<td>MVRXE18-1500-4160-**</td>
<td>1,500</td>
<td>200</td>
<td>H 92 W 36 D 32</td>
<td>2,000</td>
</tr>
<tr>
<td>MVRXE18-3000-4160-**</td>
<td>3,000</td>
<td>360</td>
<td>H 92 W 36 D 32</td>
<td>2,000</td>
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For ratings larger than 3,000 hp, or input voltages above 4,160 VAC, please consult the factory.

Notes:
Starters are top entry/ bottom exit - top exit available upon request.
Dimensions and weights are approximate.
Insert appropriate option code as shown below:
**NEMA 12 = 12
**NEMA 3R = 3R
Power fuses ship loose. Please provide motor full load amps at time of order for proper fuse sizing.

Model | Standard Options
--- | ---
A171  | Space Heater with Thermostat (Included in NEMA 3R Option)
A008  | E-Stop Push Button, Mushroom Head, Red
A406  | 8 Channel RTD Module, 100 OHM Platinum (Also Available for Remote Mounting, Call Factory for Details)
A407  | 16 Channel RTD Module(s), 100 OHM Platinum (Also Available for Remote Mounting, Call Factory for Details)
A408* | Top Hat Enclosure Module for Top Entry (18"H x 30"W x 20"D), Top Left or Top Right Mounting. Accomodates Stress Cones.
A409  | Service Entrance Labeled
A106  | Additional 1000VA Control Power Transformer

Protective Relay Options

<table>
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<tr>
<th>Model</th>
<th>Standard Options</th>
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</thead>
<tbody>
<tr>
<td>A875</td>
<td>Ground Fault CT, 2000:1, 4.0:Dia. (For Internal Processor Use)</td>
</tr>
<tr>
<td>A876</td>
<td>Ground Fault CT, 2000:1, 8.13:Dia. (For Internal Processor Use)</td>
</tr>
</tbody>
</table>

The TeamMaster series was designed as an integrated package.
Listed above are the available modular options. For systems requiring more extensive requirements, please contact TECO-Westinghouse Motor Company directly.

*Top hat will ship loose for customer installation.

Lead Time:
Built-to-order: Please allow 1-2 weeks for shipment of complete TeamMaster™ unit when ordering these options to a stock starter.

TECO-Westinghouse Motor Company offers a three year warranty on TEAMMaster™ products when an authorized factory start-up is included with the order. For other warranty arrangements, such as starter/motor/combined packages, please consult the factory.
Full Voltage Controllers for Three Phase Induction Motors

**TECO-Westinghouse Medium Voltage Control is not limited strictly to TEAMMaster™ reduced voltage starters. A whole new dimension of capabilities and solutions for medium voltage is also available as well.**

Full voltage motor starters are full voltage controllers for three phase induction motors. Combination CFMVATL starters are supplied in a NEMA 1, 3R, or 12 free standing enclosure.

CFMVATL series starters are supplied with a load break/fault make disconnect isolation switch, Class R motor current limiting fuses, vacuum motor starting contactor, and SPE Series electronic overload protection.

Enclosures consist of two distinct components. The medium voltage section is located in the main body of the enclosure, while the low voltage section containing the control logic is located behind the door in an isolated compartment.

**Key Advantages:**
- NEMA 1, 12, 3R enclosures
- Disconnect switch (load break/ fault make, grounding bar, viewing window)
- Class R current limiting motor fusing
- Vacuum motor starting contactor
- Start/ Stop pushbuttons
- SPE Series electronic overload protection

**Reversing Motor Starters**
- Solid state starter
- Vacuum contactors for motor reversing
- Applications in aggregate crushers, shredders, rubber mills, coal mills, plus many more.

**Synchronous Motor Solid State Starters**
- Soft start stator control
- Synchronous speed monitoring packages
- Solid state DC field excitor
- Applications for chillers, compressors, ball mills, pumps, chippers, and shredders.
Full Voltage Controllers for Three Phase Induction Motors

15KV Class Solid State Reduced Voltage Starters
- 10,000/11,000/13,000 volt nominal operating voltages up to 30,000 horsepower
- Combination or non-combination configurations
- Standalone or motor control center lineups
- Custom enclosure and transition sections

Intelligent MV Motor Control Centers/Lineups
Incoming Section(s)
- Main breakers or disconnects
- Main-Tie-Main (MTM) arrangements
- Main lug only sections
- 400/600/1200 amp load break fault make disconnects
- Surge protection devices
- Metering and communications

Custom Configured Multiple Unit Motor Control Center (MCC) Lineups
- Transition sections to third party equipment
- 800/1200/2000/3000 amp horizontal bus
- Reduced voltage/full voltage/feeder controls
- Back to back construction
Full Voltage Controllers for Three Phase Induction Motors

Two Speed/ P.A.M. Motor Starters
- Solid state starter
- Vacuum contactors for speed changing
- Applications include power generation plant ID fans, FD fans, Banbury mixers

Multiple Motor Starting
- Solid state starter
- Individual motor protection
- Applications include aggregate and coal conveyors, crushers, grinders, shredders

Wound Rotor Motor Starters
- Solid state starter
- Rotor resistors, shorting contactors, and interface
- Applications in aggregate, steel, mining, paper, power generation industries

Capacitive Start/ Switching Controls
- Solid state starter
- Capacitor banks, switching contactors, power monitoring devices
- Excessive voltage drop improvement, plant bus support, remote utility grid access

Mine Duty Skid-Mounted Starters
- Low profile skid mount mining packages
- Stand up skid mount mining packages
- 2300-13,800V
TeamMaster™ starters are designed for use with medium voltage and synchronous motors such as those offered by TECO-Westinghouse Motor Company shown below.

**Global-Plus™ TEFC NEMA Premium Efficiency**
- Designs up to 2,000 hp
- Factory Self-Certified for Class I, Division II, Groups B, C, D
- 1.15 Service Factor Continuous
- Cast Iron Frame ( Rolled Steel Fan Covers)
- Copper/ Copper Alloy Rotor Construction
- 1045 Carbon Steel Shaft
- Applications: Pumps, Fans, Blowers

**Global-HD™ WP1 Medium Voltage**
- Designs to 1,250 hp
- 1.15 Service Factor-Continuous
- Cast Iron Frame, End Bells, and Conduit Box
- Copper/ Copper Alloy Rotor Construction
- 1045 Carbon Steel Shaft
- Applications: Pumps, Compressors, Fans, Blowers

**World Series® Motors**
- 250 hp - 30,000 hp Range
- Rugged Frame Construction
- Copper Rotor Bar Construction
- Split Sleeve Bearings - Outstanding Service
- High Operating Efficiency
- Custom Designed for Specific Applications

**Synchronous Motors**
- 1,000 hp - 30,000 hp Plus
- Constant Speed Operation
- High-Efficiency Ratings
- Low In-Rush Currents
- Performance Optimized Air Gaps, Slot Openings, and Slot Rates
- Stranded Copper on Stator Windings to Minimize Eddy Current Losses