Medium Voltage Quick Ship Solid State Starters

IN STOCK GUARANTEED!
Mission-Critical Motor Control and Protection

With next generation, patented MX³ technology.

- Mission-critical reliability
- Patented soft start technology
- Integrated electronic protection
- Expanded I/O and communications
- Real-time metering/diagnostics
- Switched capacitance systems
- Global standards compliance
- 24/7 service and support

World leader in mission-critical motor control and protection
- 6 million HP installed worldwide
- 5,000+ units installed in over 40 countries

Prepackaged and engineered control solutions
- Induction, two-speed, synchronous, reversing or wound rotor control
- 5 kV, 7.2 kV or 15 kV to 30,000 HP
- 3, 10 or 20 mW class power electronics
- Intelligent control centers and lineups
- Retrofits and turnkey modernization solutions

Since introducing the world’s first medium voltage solid state starter back in 1989, Benshaw has gained valuable experience in the design, production and installation of high-performance, mission-critical motor controls for heavy-duty continuous process applications.

We’ve tackled some of the toughest challenges—in the harshest environments imaginable—for the most demanding industries on earth, and that experience is reflected in every product we build.

That’s why—when the application is critical, or the environment harsh—customers specify Benshaw.

Download the RediStart™ Solid State Starter MX³ Control User Manual:
http://www.benshaw.com/Support/Downloads/
2017 Information Package

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MVRXE Series

The upgraded/enhanced design of Benshaw’s legacy product that established industry standards for performance and reliability

Emergency ATL Bypass, Severe Duty, Load Break Fusible Disconnect

Key Advantages:
- NEMA 12, UL 347 listed
- 45 kV BIL
- Built-in self test (BIST) features for “quick commissioning”
- 425 A load break
- Switch-selectable emergency back-up full voltage starter
- MX3-embedded digital control

Standard Features:
- 200 MVA (2300 VAC) / 350 MVA (4160 VAC) short circuit fault rated
- 500%–30 seconds rated solid state starter — UL 347 certified and listed
- “R” class fusing protection
- Door-mounted controls
- ModBus communications standards

MVRXE18 — 4160 V

<table>
<thead>
<tr>
<th>Model Number</th>
<th>HP</th>
<th>A</th>
<th>H</th>
<th>W</th>
<th>D</th>
<th>Weight (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVRXE18-1000-4160**</td>
<td>1000</td>
<td>133</td>
<td>92</td>
<td>36</td>
<td>32</td>
<td>2,000</td>
</tr>
<tr>
<td>MVRXE18-1500-4160**</td>
<td>1500</td>
<td>200</td>
<td>92</td>
<td>36</td>
<td>32</td>
<td>2,000</td>
</tr>
<tr>
<td>MVRXE18-3000-4160**</td>
<td>3000</td>
<td>330</td>
<td>92</td>
<td>36</td>
<td>32</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Starters are top entry / bottom exit — top exit available upon request. Dimensions and weights are approximate.

** Insert appropriate option code as shown: NEMA 12 = 12 / NEMA 3R = 3R

Modular Options

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A406</td>
<td>8-Channel RTD Module, 100 ohm Platinum (Also Available for Remote Mounting)</td>
</tr>
<tr>
<td>A407</td>
<td>16-Channel RTD Module(s), 100 ohm Platinum (Also Available for Remote Mounting)</td>
</tr>
<tr>
<td>A875</td>
<td>Ground Fault CT, 2000:1, 4.0:Di. (For MX3 Use)</td>
</tr>
<tr>
<td>A876</td>
<td>Ground Fault CT, 2000:1, 8.13:Di. (For MX3 Use)</td>
</tr>
</tbody>
</table>

2300V options available.
Spare Part Kits
Want to minimize downtime loss of production?

Take advantage of Benshaw’s special pricing on our new spare parts kit packages when purchased with a MVRXE and/or BTO starter.

**Recommended Spare Parts Kits Include the Following:**
- Power phase/stack assembly (x1)
- Includes the following packaged heat sink assembly:
  - Fiber optic SCR firing card
  - SCRs (x6)
  - DVDT filter cards (x3)
- Main control board
- Voltage divider board
- “R” class line fuses (x3)
- Primary fuses for CPT (x2)
- Secondary fuses for CPT (x3)
- Door-mounted keypad
- Door-mounted pilot lights, pushbuttons and switches
- Overload relay
- Control relays

**1,000 HP Starters and 1,500 HP Starters**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Motor AMPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVRXE-400101-SP</td>
<td>46 to 55A</td>
</tr>
<tr>
<td>MVRXE-400102-SP</td>
<td>56 to 75A</td>
</tr>
<tr>
<td>MVRXE-400103-SP</td>
<td>76 to 90A</td>
</tr>
<tr>
<td>MVRXE-400104-SP</td>
<td>91 to 133A</td>
</tr>
<tr>
<td>MVRXE-400105-SP</td>
<td>134 to 180A</td>
</tr>
<tr>
<td>MVRXE-400106-SP</td>
<td>181 to 220A</td>
</tr>
</tbody>
</table>

**3,000 HP Starters**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Motor AMPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVRXE-400107-SP</td>
<td>46 to 55A</td>
</tr>
<tr>
<td>MVRXE-400108-SP</td>
<td>56 to 75A</td>
</tr>
<tr>
<td>MVRXE-400109-SP</td>
<td>76 to 90A</td>
</tr>
<tr>
<td>MVRXE-400110-SP</td>
<td>91 to 133A</td>
</tr>
<tr>
<td>MVRXE-400111-SP</td>
<td>134 to 180A</td>
</tr>
<tr>
<td>MVRXE-400112-SP</td>
<td>181 to 270A</td>
</tr>
<tr>
<td>MVRXE-400113-SP</td>
<td>271 to 361A</td>
</tr>
</tbody>
</table>

*Amp range not shown; consult factory.*
Design your customized starter to ship in 1 week or less

Only one option can be selected from each group, with the exception of the “Control Options” section.

Add the appropriate code for the options chosen to the code string across the center of the page.

Choose Enclosure Options
- 12 NEMA 12
- SH NEMA 12 with space heater
- 3R NEMA 3R with space heater

Choose Core Unit
- MVB41
- MVB43

Choose Motor Current (A)**
- 025
- 045
- 055
- 080
- 090
- 133
- 170

Choose Exit/Landing Option***
- T
- B
- C

Choose Service Entrance Rated (for stand-alone single units)
- S Yes
- N No

Choose Bus Options+
- 8N 800 A non-insulated bus
- 8I 800 A insulated bus
- 1N 1,200 A non-insulated bus
- 1I 1,200 A insulated bus
- 2N 2,000 A non-insulated bus
- 2I 2,000 A insulated bus
- NR None required

+ Bus not required for single stand-alone unit. Bus is required for connection of 2 or more units. Any unit with bus will require additional MLO section. Please contact the factory for pricing and delivery.

*** Exit/Landing Options
- T Top exit with landing pad
- B Bottom exit with landing pad
- C Top or bottom exit landing on bypass contactor
**Motor currents vs. HP are typical; confirm actual motor current. Service factor not accounted for; adjust if required.**

Example: A 3,000 HP (MVB43), 225 A (225) unit with the following options: bottom exit w/landing pad (B), NEMA 12 enclosure (12), service entrance rated (S), with ground fault (G), 1,200 A non-insulated bus (1N), 1,200 A non-insulated bus splice (1N), with DeviceNet (D), 8-channel RTD (2), without ATL option (N), with start and stop buttons (B), without run and stop lights (N), without fault and reset lights (N), with a local-off-remote switch (E), with emergency stop push button (F), would build the following code string: MVB43225B12SG1N1ND2NBNEF

---

### Choose Option Zero Sequence
Ground Fault CT 2000:1
(Residual included)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>No</td>
</tr>
</tbody>
</table>

### Choose Control Options — Choose one option for each item below

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ATL option*</td>
<td></td>
<td>D</td>
<td>N</td>
</tr>
<tr>
<td>B</td>
<td>Green start push button and red stop extended push button*</td>
<td></td>
<td>E</td>
<td>N</td>
</tr>
<tr>
<td>C</td>
<td>Red run light and green stop light</td>
<td></td>
<td>F</td>
<td>N</td>
</tr>
<tr>
<td>D</td>
<td>Amber fault light and black reset push button</td>
<td></td>
<td>G</td>
<td>N</td>
</tr>
<tr>
<td>E</td>
<td>Local-off-remote 3-position switch</td>
<td></td>
<td>H</td>
<td>N</td>
</tr>
<tr>
<td>F</td>
<td>Emergency stop push button</td>
<td></td>
<td>I</td>
<td>N</td>
</tr>
</tbody>
</table>

* ATL option comes with start and stop push buttons (i.e., start stop push buttons cannot be selected).
No selection = keypad control.
Recommend E-stop option be selected.

### Need help sizing your Soft Starter?
Soft Starter sizing guide available on benshaw.com, or call an Application Engineer at 412-968-0100.
Standard MX³ Control Features

**Multiple Starting Modes:**
- Voltage ramp
- Current ramp
  - Adjustable initial current
  - Adjustable maximum current
  - Adjustable ramp time
- Torque ramp (TruTorque)
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Power ramp
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Linear / tach feedback control

**Motor Protection:**
- Motor thermal overload
- Independent starting and running OLs
- Up to speed timer exceeded
- Low line voltage
- Low line frequency
- High line frequency
- Phase reversal
- Phase loss
- Instantaneous overcurrent
- Overcurrent
- Undercurrent
- Current imbalance
- Ground fault (residual or zero sequence)
- Shorted or open SCR
- Disconnect fault
- Inline contactor fault
- Control power low
- Stack over temperature
- Motor PTC input
- RTD modules

**Metering:**
- Accuracy:
  - 3% out-of-box
  - 2% factory calibrated
- Average current
- L1 current
- L2 current
- L3 current
- Current imbalance %
- Ground fault current
- Average volts
- L1 – L2 voltage
- L2 – L3 voltage
- L3 – L1 voltage
- Overload %
- Power factor
- Watts
- VA
- VARS
- kW hours
- MW hours
- Phase order
- Line frequency
- Analog input
- Analog output
- Run time – days
- Run time – hours
- # of starts
- Tru Torque %
- Power %
- Peak starting current
- Last starting duration
- RTD temperatures
- Real-time clock

**8 Digital Inputs Configurable to:**
- Stop
- Fault
- Fault reset
- Bypass / inline confirm
- OL reset
- Local / remote selection
- Heater enable
- Heater disable
- Dual ramp selection
- 1 dedicated start input
- Disconnect
- Slow speed
- Brake enable
- Brake disable

**6 Relay Outputs Configurable to:**
- Faulted
- Running
- Up to speed
- Alarm condition
- Ready condition
- Locked out
- Over current
- Under current
- OL alarm
- Shunt trip
- Ground fault
- Energy saver indication
- Heating indication
- Cooling fan

**1 Analog 4 – 20 mA 0 – 10 VDC Input Configurable to:**
- Trip high level
- Trip low level

**1 Analog 4 – 20 mA / 0 – 10 VDC Output Configurable to:**
- Current (0 – 200%/0 – 800%)
- Voltage (0 – 150%)
- OL (0 – 150%)
- kW (0 – 10 kW/0 – 100 kW)
- MW (0 – 1 MW)
- Analog input (0 – 100%)
- Analog output (0 – 100%)
- Firing (0 – 100%)
- Calibration

**User Interface:**
- Event log (99 events)
- Door-mounted LCD display
  - Set / examine operating parameters
  - View status information, line current, voltage and frequency
  - Start and stop the solid state starter

**1 Communication Port:**
- Modbus / RS485

**Advanced Functionality:**
- Dual ramp selection
- Adjustable kick current
- Programmable decel modes
- MV BIST test (built-in self test)

**Fiber Optic SCR Firing**
- Integrated technology
- Noise immunity
- High voltage isolation
- Safe, reliable SCR control

**Keypad (Included)**
Medium voltage Starter Order
Check List

For additional customized MVSS solutions to satisfy any application

Medium Voltage List to assist in the engineering process of providing a properly manufactured Solid State Starter, which will meet customer specific requirements. Complete each section as this will ensure a timely and accurate response.

Project Name and/or End-User: _____________________________________________________________

Contact Name: ________________________________________________________________________

Email: _______________________________________________________________________________

Phone Number: _________________________________________________________________________

SECTION A — Starter Application

<table>
<thead>
<tr>
<th>Type of Application</th>
<th>Present Starting Method</th>
<th>Starts / Stops per Day</th>
<th>Current Acceleration Time</th>
<th>Current Deceleration Time (if applicable)</th>
<th>Power Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Across the Line</td>
<td>☐ Wye-Delta</td>
<td>☐ Auto Transformer</td>
<td>☐ Other: ___________________________________</td>
<td>☐ Utility (Transformer feed capacity – kVA) (please specify)</td>
</tr>
<tr>
<td></td>
<td>☐ α 1–5</td>
<td>☐ 6–10</td>
<td>☐ 11–15</td>
<td>☐ 16–20</td>
<td>☐ Over 20 (please specify)</td>
</tr>
<tr>
<td></td>
<td>☐ 1–5 seconds</td>
<td>☐ 6–10 seconds</td>
<td>☐ 11–15 seconds</td>
<td>☐ 16–20 seconds</td>
<td>☐ &gt;20 seconds (please specify)</td>
</tr>
<tr>
<td></td>
<td>☐ 1–5 seconds</td>
<td>☐ 6–10 seconds</td>
<td>☐ 11–15 seconds</td>
<td>☐ 16–20 seconds</td>
<td>☐ &gt;20 seconds (please specify)</td>
</tr>
</tbody>
</table>

Power Source:
☐ Utility (Transformer feed capacity – kVA) (please specify) ________________________________
☐ Short Circuit MVA (I) (please specify) ______________________________________________________
☐ Delta
☐ Wye (please specify)

<table>
<thead>
<tr>
<th>Distance from Line to Starter</th>
<th>Conductor Type</th>
<th>Distance from Starter to Motor</th>
<th>Size and Quantity of Conductors</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ &lt; 250 ft.</td>
<td>☐ Shielded</td>
<td>☐ &lt; 250 ft.</td>
<td>☐ Line Side Size:</td>
</tr>
<tr>
<td>☐ 251–500 ft.</td>
<td>☐ Non-Shielded</td>
<td>☐ 251–500 ft.</td>
<td>☐ Line Side Quantity: /Phase</td>
</tr>
<tr>
<td>☐ &gt; 750 ft. (please specify)</td>
<td>☐ Ungrounded</td>
<td>☐ &gt; 750 ft. (please specify)</td>
<td>☐ Load Side Quantity: /Phase</td>
</tr>
</tbody>
</table>

Distance from Line to Starter: ☐ < 250 ft. ☐ 251–500 ft. ☐ 501–750 ft. ☐ > 750 ft. (please specify)

Conductor Type: ☐ Shielded ☐ Non-Shielded

Distance from Starter to Motor: ☐ < 250 ft. ☐ 251–500 ft. ☐ 501–750 ft. ☐ > 750 ft. (please specify)

Size and Quantity of Conductors:
☐ Line Side Size: ____________________________ ☐ Line Side Quantity: _______________________/Phase
☐ Load Side Size: ____________________________ ☐ Load Side Quantity: _______________________/Phase
## Medium Voltage Starter

### Order Check List

### SECTION B — Motor Data

<table>
<thead>
<tr>
<th>Type of Motor:</th>
<th>Induction</th>
<th>Synchronous</th>
<th>Wound Rotor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horsepower:</td>
<td>__________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(If Synchronous or Wound Rotor, see Section “E” or “F” for additional questions.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Voltage:</td>
<td>□ 2300</td>
<td>□ 4160</td>
<td>□ 6900</td>
</tr>
<tr>
<td>Frequency:</td>
<td>□ 25 Hz</td>
<td>□ 50 Hz</td>
<td>□ 60 Hz</td>
</tr>
<tr>
<td>FLA:</td>
<td>_______</td>
<td>Service Factor:</td>
<td>Motor LRA:</td>
</tr>
</tbody>
</table>

### SECTION C — Enclosure / Environment Data

<table>
<thead>
<tr>
<th>Expected Ambient Temperature:</th>
<th>Minimum:</th>
<th>Maximum:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space heater:</td>
<td>□ Yes</td>
<td>□ No</td>
</tr>
<tr>
<td>(Space Heater required if less than 0° C)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Location:</td>
<td>□ Indoor</td>
<td>□ Outdoor</td>
</tr>
<tr>
<td>Size Limitation:</td>
<td>______ “High”</td>
<td>______ “Wide”</td>
</tr>
<tr>
<td>Altitude:</td>
<td>□ up to 3,300 ft.</td>
<td>□ above 3,300 ft. (please specify)</td>
</tr>
<tr>
<td>Excessive Vibration and/or Noise:</td>
<td>□ Vibration</td>
<td>□ Noise</td>
</tr>
<tr>
<td>Color:</td>
<td>□ ANSI 61 Grey (standard)</td>
<td>□ Beige</td>
</tr>
<tr>
<td>Cable Entry Location:</td>
<td>□ Top (option)</td>
<td>□ Bottom (standard)</td>
</tr>
<tr>
<td>Horizontal Bus:</td>
<td>□ None (standard)</td>
<td>□ 800 Amp</td>
</tr>
<tr>
<td>Insulation on Bus:</td>
<td>□ Yes (price adder)</td>
<td>□ No (standard)</td>
</tr>
<tr>
<td>UL Rating (NEMA Type):</td>
<td>□ 1</td>
<td>□ 3R</td>
</tr>
</tbody>
</table>

### SECTION D — Miscellaneous

| Disconnect: | □ Fusible Disconnect | □ None |
| Starting Method: | □ Keypad (standard) | □ 2-Wire Control | □ 3-Wire Control | □ Other: (please specify) |
| Across-the-Line Starting Option: | □ Yes | □ No (standard) | |
| Will any of the following be present?: | □ Power Factor Correction Capacitors | Note: PFCC must be located on the line side of the starter and must be isolated from the line during starting. | □ Lightning Arrestors | Note: May be placed on either the line or load side of the starter. | □ Surge Capacitors | Note: Must be at the motor terminals and must be isolated during starting to prevent damage. |
# Medium Voltage Starter Order Check List

## SECTION E — Synchronous Motor Data:

<table>
<thead>
<tr>
<th>Normal Field Current: (ADC)</th>
<th>Max. Field Current: (ADC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________________________</td>
<td>_________________________</td>
</tr>
<tr>
<td>Field Discharge Resistor Rating:</td>
<td>Synchronous Motor Field Voltage: (VDC)</td>
</tr>
<tr>
<td>__________________________</td>
<td>_________________________</td>
</tr>
</tbody>
</table>

## SECTION F — Wound Rotor Motor Data:

<table>
<thead>
<tr>
<th>Wound Rotor Motor:</th>
<th>□ Starting Duty Resistor</th>
<th>□ Continuous Running Duty Resistor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Steps/Resistance:</td>
<td>Present Number of Steps:</td>
<td>__________________________</td>
</tr>
<tr>
<td>__________________________</td>
<td>_________________________</td>
<td></td>
</tr>
<tr>
<td>Secondary Voltage: (VAC)</td>
<td>Secondary Current: (Amps)</td>
<td></td>
</tr>
<tr>
<td>__________________________</td>
<td>_________________________</td>
<td></td>
</tr>
</tbody>
</table>

## SECTION G — Additional Modifications, Accessories and/or Information:

_______________________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________________
_______________________________________________________________________________________________________________________________

Customer’s Signature __________________________________________________________

Customer’s Company __________________________________________________________

Date ______________________________
All drawings packages are available on BenshawExpress.com.
Notes:

1. Removable lifting eyebolts.
2. Cable entry/exit area. Cutout with cover plate supplied.
3. Cable entry/exit area. No cutout supplied. Customer to cut as required.
4. Enclosure color: ANSI 61 grey.
5. Tighten bolts per chart below.

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
\text{Steel bolt} & \text{Torque in pound-foot} & \text{Newton-Meter} \\
\hline
\hline
5 & 12 & 20 & 50 & 95 \\
\text{6.8} & \text{16.3} & \text{27} & \text{67.8} & \text{128.8} \\
\hline
\end{array}
\]

6. Approximate weight is 1600 lbs (726 kg).

R-fuses shown for reference. Reference sales order for fuse size.

Shop notes:

- Add BUINS-PMC1203 insulation sleeving to power cable thru CT's, 2” minimum past edge of CT each side. Tie wrap CT's to bracket BRKT-100302-01 where applicable.
- Ensure enclosure side holes are plugged when not used to bolt adjacent enclosures together. Use sealing plugs for 3R enclosures (EN-SP1/2-13/16-.5). Non 3R enclosures use EN-100007-01.
- Removable lifting eyebolts.
- Cable entry/exit area. Cutout with cover plate supplied.
- Cable entry/exit area. No cutout supplied. Customer to cut as required.
- Enclosure color: ANSI 61 grey.
- Tighten bolts per chart below.

All drawings packages are available on BenshawExpress.com.
Drawings

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**UNICO Technologies Group**

**Power and Precision in Motion**

Taking care of our customers’ power needs has been our single focus for 88 years. Our two leading brands bring innovative control and electrical solutions to solve your challenges. Through thousands of systems in a broad array of applications, we’ve learned what it takes to make your system live up to its potential.

**At a glance:** With facilities in 12 countries, we combine the convenience of local service with the economies-of-scale and efficiency of a large global organization.

**Innovative solutions via technology:** We bring you mission-critical motor control and protection products, designed and built with expertise and precision to maximize your output and minimize downtime.

**Engaged and knowledgeable:** We like to think of ourselves as “Application Smart,” which always includes critical dependencies such as standards, compliance and regulatory issues.

Visit us online at unicotg.com, or contact:

**UNICO Technologies Group**

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Franksville, WI 53126-0505

**After Hours Tech Support**

Phone: 800.203.2416

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