Intelligent Low Voltage Solid State Motor Control Products

with next generation MX²/MX³ technology

Mission critical reliability
Patented soft start technology
Integral digital protection and metering
Continuous and integral bypass chassis
RXE dual redundant configurations
MXP modular, prepackaged starters
Reversing, two-speed, wound rotor
Synchronous, DC injection braking
24/7 service and support
New MX² Control Technology

Next Generation Intelligent Motor Control

MX² Control Highlights

The new MX² control technology from Benshaw provides a powerful, flexible, intelligent low voltage motor control platform. MX²-based controls offer multiple, user selectable starting modes, an increased selection of configurable digital and analog I/O’s, comprehensive built-in metering capabilities, unprecedented onboard protection and an easy to use, intuitive user interface.

The new control board terminal configuration—coupled with programmable burden CT settings—makes Benshaw’s MX² technology an excellent choice for a wide range of intelligent, soft start motor control applications.

With more built-in starting modes … more built-in protection features … additional communications capabilities … improved noise immunity … a more complete user I/O and CE compliance, Benshaw’s new MX²-based low voltage motor controls raise the bar for intelligent, low-cost, soft start motor control.

When you factor in our unique three-year factory warranty and 24/7 comprehensive technical support, we think you’ll find Benshaw’s MX²-based controls to be the best value on the planet.

Standard Features:

- High performance motor control with multiple starting modes built-in
- Slow Speed 7 and 14%
- 3 user configurable digital inputs
- 2 fixed inputs for start and bypass confirm
- 3 user configurable output relays and 1 fixed bypass confirm
- User configurable analog I/O
- Programmable burden CT settings
- Residual ground fault
- Advanced line/motor metering
- DC braking light and heavy duty
- Power stack thermistor
- Data snapshot of each fault
- Power up on start
- 1000V capable
- Energy saver
- Remote keypad ready
- CE, UL, CUL, NEMA compliance
- Built-in self-testing (BIST)
- ModBus 485 plus expanded communications capabilities with optional bridges
MX² Control Features

Multiple Starting Modes:
- Voltage ramp
- Current ramp
  - Adjustable initial current
  - Adjustable maximum current
  - Adjustable ramp time
- Torque ramp (True Torque)
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Power ramp
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Linear/tach feedback control
- Slow Speed 7 and 14%

Motor Protection:
- Motor thermal overload (40 curves)
- Independent starting and running OL’s
- Up to speed timer exceeded
- Low/High line voltage
- Low/High line frequency
- Stack over temperature
- Phase reversal
- Phase loss
- Instantaneous overcurrent
- Overcurrent
- Undercurrent
- Current imbalance
- Ground fault residual
- Shorted SCR
- Disconnect fault
- Inline contactor fault
- Control power low

Metering:
- +/- 2% accuracy (True RMS)
- Average current
- L1 current
- L2 current
- L3 current
- Current imbalance %
- Ground fault amps/residual
- Average volts

Metering, continued:
- 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

3 Digital Inputs Configurable to:
- Stop
- Fault
- Fault reset
- Bypass/confirmation & inline
- OL reset
- Local/remote selection
- Heater enable
- Heater disable
- Dual ramp selection
- 1 dedicated start input
- 1 dedicated bypass

3 Relay Outputs Configurable to:
- Starter off
- Faulted fail safe and non fail safe
- Running
- Up to speed
- Alarm condition
- Ready condition
- Locked out
- Over current trip
- Under current trip
- OL alarm
- Shunt trip fail safe and non fail safe
- Ground fault

Relay Outputs, continued:
- Energy saver indication
- Heating indication
- Slow speed forward/reverse
- DC braking
- Cooling fan
- 1 fixed bypass

1 Analog 0/4-20mA / 0-10Vdc Input Configurable to:
- Trip high level
- Trip low level

1 Analog 0/4-20mA / 0-10Vdc 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%)
- Firing (0–100%)
- Calibration

User Interface:
- Standard board-mounted LED (4x7) interface
- Optional remote mount LCD display
  - Set/examine operating parameters
  - View status information
  - View line current, voltage and frequency in real time
  - Start and stop the solid state starter

1 Communication Port:
- ModBus RTU/Half Duplex
- RS485 (Isolated at 1,750 Vpk)
- Communication bridges:
  - Profibus
  - Ethernet
  - Devicenet
  - LON Works
  - Can Bus

Advanced Functionality:
- Dual ramp selection
- Adjustable kick current
- Programmable decel modes
- LV BIST test (built-in self test)
New MX³ Control Technology

**NEXT GENERATION INTELLIGENT MOTOR CONTROL**

**Benshaw’s MX³ control technology provides all MX² features, plus:**

- 8 user configurable inputs
- 2 fixed inputs for start and bypass confirm
- 6 user configurable relay outputs
- 1 fixed output for bypass confirm
- Real-time clock
- Motor PTC input
- Zero Sequence Ground Fault
- RTD module support
- Full DC braking with add-on SCR
- Event log (99 events)
- Start per hour limiter
- Back spin timer
- Time between starts limiter
- Zero speed switch input
- Power outage ride through (PORT)
- Power factor trip
- Patented CYCLO control (0-40% speed)

**MX³ Control Highlights**

Benshaw’s next generation MX³ technology propels low voltage motor control to even greater levels of performance and functionality. With its real-time clock, enhanced programming capabilities, ease of use, and a unique, flexible architecture—Benshaw’s MX³ controller delivers advanced motor control and protection with all of the rugged, dependable performance you’ve come to expect from the world leader in advanced controls and drives.

MX³ controllers, power components, software and sensors are all designed, built and tested to perform as an integrated control system, eliminating the coordination and performance problems inherent in other forms of reduced voltage starting.

With more built-in features, more configurable options, greater expandability and a broader communications capability than any other motor control on the market, Benshaw’s next generation MX³ technology will shorten your commissioning times, improve motor performance and protection, enhance diagnostic capability and streamline electrical system monitoring and maintenance tasks.
MX³ Control Features

Multiple Starting Modes:
- Voltage ramp
- Current ramp
  - Adjustable initial current
  - Adjustable maximum current
  - Adjustable ramp time
- Torque ramp (True Torque)
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Power ramp
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Analog input
- Analog output
- Run time - days
- Run time - hours
- # of starts
- Tru Torque %
- Power %
- Peak starting current
- Last starting duration
- Real-time clock

Motor Protection:
- Motor thermal overload (40 curves)
- Independent starting and running OL's
- Up to speed timer exceeded
- Low/High line voltage
- Low/High line frequency
- Motor OL auto lockout level
- Phase reversal
- Phase loss
- Instantaneous overcurrent
- Overcurrent
- Undercurrent
- Current imbalance
- Ground fault (residual or zero sequence)
- Shorted SCR
- Disconnect fault
- Inline contactor fault
- Control power low
- Stack over temperature
- Motor PTC input
- RTD modules

Metering:
- +/- 2% accuracy (True RMS)
- Average current
- L1 current
- L2 current
- L3 current
- Current imbalance %
- Ground fault amps/residual
- Average volts

Metering, continued:
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- Power factor
- Watts
- VA
- VARS
- KW hours
- MW hours
- Phase order
- Line frequency
- Analog input
- Analog output
- Energy saver indication
- Heating indication
- Slow speed forward/reverse
- DC braking
- Cooling fan
- 1 fixed bypass

8 Digital Inputs Configurable to:
- Stop
- Fault
- Fault reset
- Bypass/confirmation & inline
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- Heater enable
- Heater disable
- Dual ramp selection
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- Faulted fail safe and non fail safe
- Running
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- Ready condition
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- Communication bridges:
  - Profibus
  - Ethernet
  - Devicenet
  - LON Works
  - Can Bus

Advanced Functionality:
- Dual ramp selection
- Adjustable kick current
- Programmable decel modes
- LV BIST test (built-in self test)
- Event log (99 events)
# CONTROL FEATURE COMPARISON

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>MICRO II</th>
<th>EXISTING MX</th>
<th>NEW MX²</th>
<th>NEW MX³</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOFT STARTING AND STOPPING</strong></td>
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<td>TruTorque Ramp</td>
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<td>Tach/Speed Control Ramp</td>
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<td>Linear Ramp Profiles</td>
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<td>Squared and S Ramp Profiles</td>
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<td>Dual Ramps</td>
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<td>Kicking</td>
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<td>Slow Speed 7-14%</td>
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<td>Slow Speed CYCLO Operation 0-40% speed</td>
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<td>Inside Delta</td>
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<td><strong>PROTECTION</strong></td>
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<td>Separate Starting/Running Overload Classes</td>
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<td>Adj. Hot/Cold Ratio</td>
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<td>Adj. OL Lockout Level</td>
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<td>Over/Under Current Protection</td>
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<td>Retained OL When Power Lost</td>
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<td>Current Imbalance Protection</td>
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<td>IOC (Instantaneous Over Current)</td>
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<td>Open/Shorted SCR Detection</td>
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<td>Overcurrent/Shear Pin</td>
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<td>Undercurrent/Load Loss</td>
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<td>Residual Ground Fault Protection</td>
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<td>Zero Sequence Ground Fault Protection</td>
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<td>Starts Per Hour</td>
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<td>RTD Monitoring</td>
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<td>Motor PTC</td>
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<td>Stack OT Switch</td>
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<td>Stack Thermistor Input</td>
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<td>Backspin Timer</td>
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<td>Time Between Starts</td>
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<td>Phase Rotation</td>
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<td>Overvoltage</td>
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<td>UTS/Stall Timer</td>
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<tbody>
<tr>
<td><strong>PROTECTION, continued</strong></td>
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<td>Zero Speed Switch</td>
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<td>PF Trip</td>
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<td>PORT (Power Outage Ride Through)</td>
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<td>Keypad Fault Reset</td>
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<td>Adj. Auto Fault Reset Timer</td>
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<td>Adj. Number of Auto Resets Before Lockout</td>
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<tr>
<td>Decel After Fault</td>
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<td>Fault Log</td>
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<td>Time and Date Stamp</td>
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<td>9 Data Snapshots of Each Fault</td>
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<td>Event Log (last 99 events)</td>
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<td>Fault Classes</td>
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<td><strong>USER I/O</strong></td>
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<tr>
<td>Programmable Digital Inputs</td>
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<td>Programmable Digital Outputs</td>
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<td>User Analog Input</td>
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<td>Programmable User Analog Output</td>
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<td>Local/Remote Source Input</td>
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<td>Power Up Start</td>
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<td><strong>METERING</strong></td>
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<td>Full Voltage and Current Metering</td>
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<td>True RMS Calculation</td>
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<td>Current Imbalance Meter</td>
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<td>Ground Fault Meter</td>
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<td>Watt Meters</td>
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<td>KVA Meters</td>
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<td>Line Frequency Meter</td>
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<td>Time Until OL Lockout Release Meter</td>
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<td>Phase Rotation Meter</td>
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<td>% Power and % TruTorque Meter</td>
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<td>Number of Starts Meter</td>
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<td>Peak Current of Last Start Meter</td>
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<td>Analog Input Meter</td>
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<tr>
<td>Real Time Clock</td>
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<td>RTD Meters</td>
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<td><strong>MISCELLANEOUS</strong></td>
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<tr>
<td>LV BIST</td>
<td>✓✓✓✓</td>
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<tr>
<td>MV BIST</td>
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<td>LV Powered BIST</td>
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</table>
Open Chassis Starters with Integral Bypass

RB SERIES WITH NEW MX² TECHNOLOGY (ALSO AVAILABLE WITH MX³ TECHNOLOGY)
RUGGED INDUSTRIAL SOLID STATE STARTERS WITH INTEGRAL BYPASS

RB Series Product Highlights:

Benshaw’s RB series solid state starter combines the high performance MX² or MX³ technology with a rugged, compact, integral bypass RB series power section.

The MX² or MX³ technology provides users with a powerful group of programming parameters, designed for flexibility in across a wide range of industrial applications. Both MX² and MX³ controls provide simple setup and commissioning via the Quick Start Menu.

The RB power section is a rugged, heavy duty solid state starter section designed with integral bypass contactors for a compact, efficient profile. The modular design includes separate poles for each phase for ease of maintenance.

Key Advantages:
- Small, compact design
- Modular power stack assembly for ease of maintenance
- ModBus standard / other Fieldbus optional
- Multiple starting ramps for various applications
- Integrated metering system diagnostics
- Integral bypass contactors for efficient operation, eliminating the need for external fans
- Integrated motor protection
- Dual ramp capability for loaded / unloaded applications
- Power stack has multiple ratings for application flexibility

Guaranteed … for three full years.
Only Benshaw has a three year guarantee.
Every Benshaw open chassis low voltage starter is guaranteed for three full years. Other manufacturers limit their warranties to just one year. But at Benshaw, we believe that, because we build them better, we can guarantee them longer. We call that “the Benshaw Promise.”
Open Chassis Starters
Non Bypassed / Continuous Duty

RC SERIES WITH NEW MX² OR MX³ TECHNOLOGY
RUGGED INDUSTRIAL SOLID STATE STARTERS
1 - 1200 HP / 208 - 600 VAC

RC Series Product Highlights:

The RC Series Solid State Starter combines the high performance MX² or MX³ control with the rugged, continuous duty, fan cooled RC stack.

The MX² or MX³ series control provides users with a powerful group of programming parameters, designed for flexibility in industrial applications. The MX² and MX³ both provide simple setup and commissioning via the Quick Start Menu.

The RC power section is a rugged non-bypassed section. It is an economical solution at low horsepower. In addition, the fan cooled stack provides high duty cycle and high inertia starting and energy saver operation.

Key Advantages:
◆ Economical at low horsepower
◆ High duty cycle starting
◆ Long starting times
◆ Suitable for jogging applications
◆ Fan cooled stack
◆ Energy saver applications
◆ Integrated motor protection
◆ ModBus standard / Profibus, Ethernet, DeviceNet, LON Works, Ethernet IP web addressable communication protocols are available via optional communication bridges
◆ 1.25 service factor
◆ Integrated metering and diagnostics
◆ Multiple starting ramps for various applications

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### Open Chassis Starters with Integral Bypass

**RB2 SERIES**  
**PRODUCT SELECTION GUIDE**

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<th>MODEL NUMBER</th>
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<td><strong>HEAVY DUTY</strong></td>
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<td>500% for 30 sec</td>
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<tr>
<td>125% continuous</td>
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<td><strong>SEVERE DUTY</strong></td>
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<td>600% for 30 sec</td>
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<td>125% continuous</td>
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<td>RB2-1-S-590A-18C</td>
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**PREDATOR™ QuickShip Program**

**FOR LOW VOLTAGE SOLID STATE STARTERS**

Benshaw's PREDATOR™ QuickShip program allows you to custom configure a wide range of low voltage solid state starters for shipment within five working days A.R.O. Simply choose a PREDATOR-QUALIFIED starter from the Engineered Products section of this catalog, then add PREDATOR-QUALIFIED options, as needed. Benshaw will build and ship your custom configured starter within five working days!

**QuickShip Starter Features:**
- Non-combination or combination circuit breaker
- NEMA 1, 12 or 3R enclosed
- Input voltage 208-600V
- Starter sizes 70-1500 amp
- UL listed
- MX² or MX³ technology
- Bypassed

**QuickShip Options:**
- Start-Stop pushbuttons or switch
- On-Off pushbuttons or switch
- Hand-off auto selector switch
- Local off remote switch
- Standard VA control power transformer
- Auxiliary control power transformer 1, 2, 3KVA
- Power factor correction
- Shunt trip on main circuit breaker
- Power on light
- Run light
- Door mounted keypad
- Surge/lightning arrestor
- Auxiliary full voltage starter
- Metering CT
- Auxiliary full voltage starter

**TYPICAL ENGINEERED PRODUCT WORKFLOW**

<table>
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<tr>
<th>ORDER ENTRY</th>
<th>ENGINEERING</th>
<th>PURCHASING</th>
<th>MATERIAL CONTROL</th>
<th>MANUFACTURING</th>
<th>QA/TESTING</th>
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**AVERAGE 8-10 WORKING DAYS**

**PREDATOR™ QUICK SHIP WORKFLOW**

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<th>ORDER ENTRY</th>
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**5 WORKING DAYS**
Prepackaged Starters with ATL Bypass
Severe Duty

REDISTART RX2E SERIES + RX3E
NEMA 12 / COMBINATION / DUAL REDUNDANT

RX2E Series Product Highlights:

RX2E starters provide solid state reduced voltage starting for normal operation and full voltage emergency backup starting with complete electronic motor protection at the flip of a switch. This unique dual redundant design is the ideal solution for critical applications where downtime is extremely disruptive to production operations and cannot be tolerated. Benshaw’s MX solid state controls provide precise digital starting and stopping, motor protection, metering, diagnostics and communications … standard.

Units are stocked with MX² technology, but are also available with MX³ technology.

Rugged. Reliable. Ready.

Standard Features:

- NEMA 12, dual redundant, combination/circuit breaker
- Shunt trip on main circuit breaker
- 500% - 30 seconds rated solid state starter, UL certified and listed
- 1800 PIV ratedSCRs, UL certified and listed
- 125% continuous duty rated solid state starter, UL certified and listed
- Selector switch for selecting solid state or full voltage operation mounted inside enclosure
- Full HP rated bypass contactor with a 1.15 service factor, wired for normal bypass operation and full voltage start and run operation, with normally open auxiliary contact.
- Separately mounted “SPE” series overload relay wired for full voltage start and run operation.
- 110 volt control power transformer with primary and secondary fuses
- Door mounted start and stop push-buttons
- Door mounted keypad
- Door mounted run indicating light
- Door mounted local-off remote switch
- Door mounted overload reset
- Terminal strip mounted inside enclosure for remote start/stop connection
- Auxiliary relay with (2) Form C run contacts
- Benshaw MX² programmable motor controller with soft start, soft stop and motor protection capabilities
- RS485 ModBus communications
- Analog I/O
- Available with MX³ technology

Guaranteed … for three full years.

Only Benshaw has a three year guarantee.

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Prepackaged Starters Non-Bypassed / Continuous Duty and Integral Bypass

MX2PB / MX2PC SERIES
PREPACKAGED STARTERS WITH NEW MX² TECHNOLOGY
MODIFIED FOR NEXT DAY SHIPMENT

Configure the MXPB / MXPC to fit your application …

To choose a stock starter, simply select a unit from the following price pages. To modify a starter, select a unit from the following price pages, then add an alpha board and/or other options as needed from the Options section … Benshaw will modify the stock unit for next day shipment.

1. Select a starter type:
   - MX2PC modular non-bypass or
   - MX2PB modular bypassed
2. Select a horsepower rating
3. Select a voltage
4. Select an enclosure
5. Select a circuit breaker (or none)
6. Select your options

MX2PB / MX2PC configurable solid state starters are stocked as:
- Non-combination
- Combination circuit breaker
- Rotary disconnect operator
- Non-bypass
- Bypass contactor
- NEMA 4 or 12 enclosure
- Modular operator station
- 480 volt
- Standard 120V control power transformer
Engineered Packages

PRODUCT OVERVIEW

Benshaw has developed advanced engineering, drafting, materials management and quality systems focused on designing and building customer solutions. This “Build to Order” capability combined with an extensive inventory of control components, protective relays, circuit breakers, contactors, enclosures and other electrical/electronic devices provides our customers with the quickest shipment of engineered products in the industry.

Control Modifications - Whatever You Specify

◆ Over 250 modifications and accessories are available, including: pilot devices, PLC’s, control power transformers, switches, meters, relays, space heaters, and protective devices.

Combination Starters to Meet Your Requirements

◆ 15 to 2000 amp circuit breakers
◆ 40 to 2000 amp non-fused disconnects
◆ 30 to 800 amp fusible disconnect
◆ Flange or rotary handle mechanism

Power Stacks to Fit Your Application

◆ Continuous duty / non-bypassed
◆ Integral bypass
◆ Standard, heavy, and severe duty
◆ Emergency across-the-line bypass

Enclosures to Match Your Environment

◆ Standard designs - NEMA 1, 12, 4 chassis
◆ Custom enclosures
◆ Special enclosures - 3R, 4X, 7, 9, as specified
◆ Motor control centers

Communication Modules to Match Your Network

◆ ModBus / RS485
◆ Devicenet
◆ IP Internet Web Addressable
◆ Custom interfaces
◆ Ethernet
◆ Profibus
◆ LON Works
For Any Application

APPLICATION SPECIFIC STARTERS OVERVIEW

Benshaw is the trusted expert for any AC motor application. Benshaw provides a full line of application solutions for reversing motors, DC injection braking, wound rotor motors, two speed motors, synchronous motors and more.

Call for price and availability
BENSHAW Inc.
World Headquarters
Glenshaw, PA

BENSHAW Canada
Canadian Headquarters
Listowel, ON.

BENSHAW Inc.
Plant 2 Manufacturing
Glenshaw, PA

BEN-Fab
Custom Fabrication
Waterloo, ON.

BENSHAW West
Western Operations
Scottsdale, AZ.

BENSHAW Pueblo
Trane Division
Pueblo, CO

BEN-Tech
Industrial Automation
Rochester Hills, MI

BENSHAW High Point
EPC Division
High Point, NC

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