BENSHAW
ADVANCED CONTROLS & DRIVES

Intelligent Medium & High Voltage Motor Control Solutions

with next generation MX³ technology

A Regal Brand

REGAL

Overview

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

- 6,000,000 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.

The MX³ difference

At the heart of every medium and high voltage control solution from Benshaw is our next generation, patented, multi-processor based control technology—developed through an extensive research effort and the experience we've gained from more than 5,000 installations totaling well over 6,000,000 horsepower.

Solid state MX³ motor control technology brings mission critical reliability, integrated electronic protection, configurable I/Os, expanded communications and real-time metering and diagnostics to the medium/high voltage marketplace—all in one elegantly designed, highly reliable control package. With more standard features, more integrated protection and more available options than any other medium or high voltage control on the market, Benshaw's MX³ based controls will shorten your commissioning times, improve motor performance, enhance protection, simplify diagnostics and streamline many electrical system monitoring and maintenance tasks.

Rugged. Reliable. Ready.

Engineered solutions

Benshaw's family of medium and high voltage starters solve a variety of heavy duty applications. If the job calls for induction, synchronous, two-speed, reversing or wound rotor motor control—5, 7.2 or 15 kV—to 30,000 HP, Benshaw offers a rugged, reliable solution.

- MX³ soft start technology
- NEMA 12/3R enclosures
- Fiber optic firing
- Service entrance labeled
- Built-in self test (BIST) for "quick commissioning"
- Load break disconnect

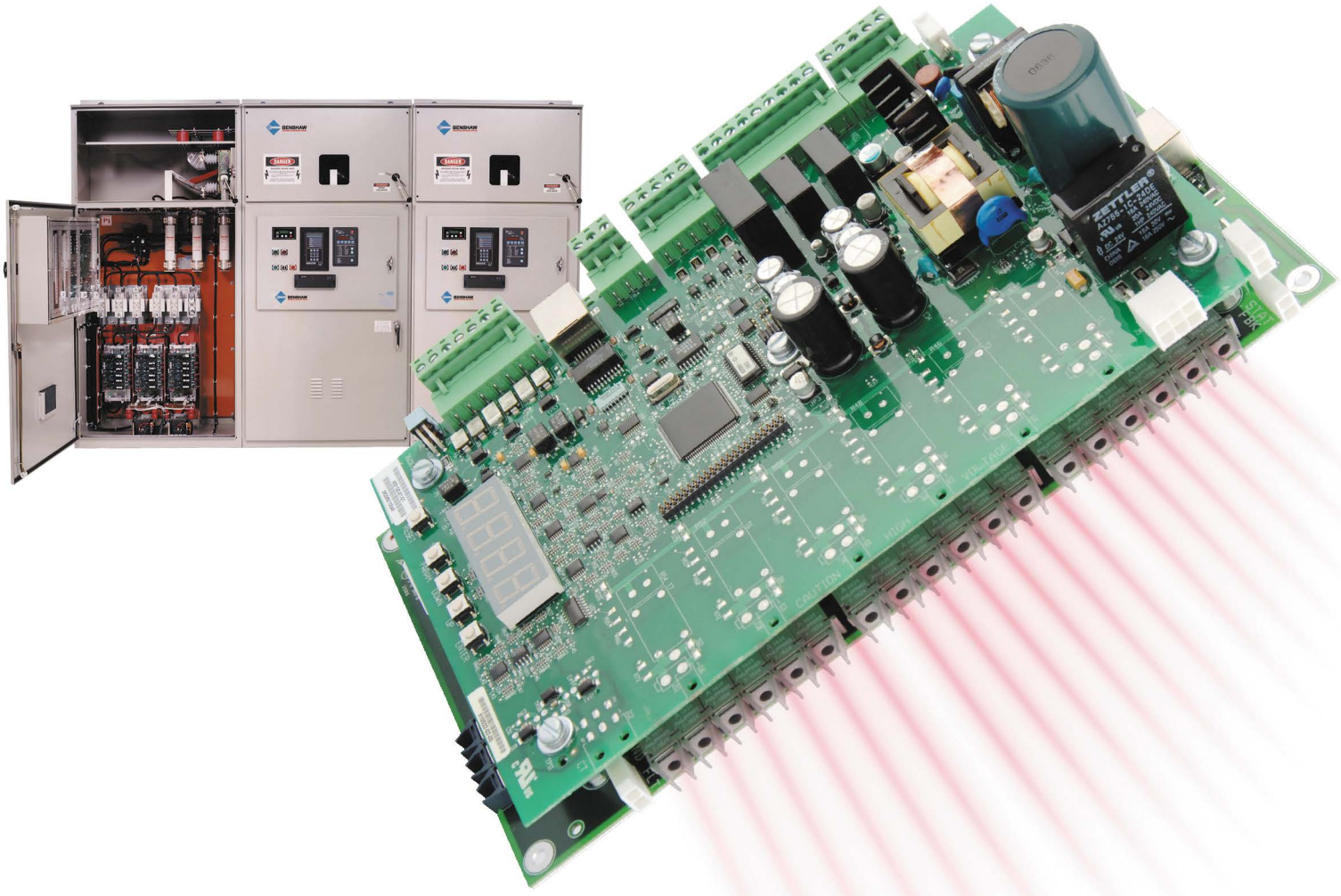
All of Benshaw's starters include integrated control and power electronics, bypass and isolation contactors, and a myriad of user-friendly, user-selectable features.

On-board metering, real-time data displays, ModBus communications and integrated motor, load and power quality fault protection are standard.

Engineered solutions for any application

Benshaw designs and manufactures application-specific controls and custom-configured, intelligent, medium and high voltage control centers and coordinated lineups to meet your specific motor control requirements.

Benshaw can perform power system studies and detailed analyses of your machine, motor, system and control configuration requirements, on request, to determine the optimum control solution for your soft start application. Installation, commissioning, control retrofits and turnkey modernization programs are also available.



MX³ Mission Critical Reliability

Benshaw's medium and high voltage solid state controls offer proven performance, with a track record of mission critical reliability in the most demanding continuous process applications.

With more than 5,000 units operating in over 40 countries, Benshaw has more experience in mission critical motor control applications than any other company in the world.

We manufacture an extensive range of medium and high voltage control solutions—from standard, web-stocked medium voltage solid state starters to engineered, built-to-order controls and highly specialized, application-specific, control packages—for 3, 10 and 20 mW class applications.

Benshaw motor controls start and protect many different motors in many industries, but we're particularly well known for rugged, reliable performance in severe duty, continuous process applications.

We design our products for durability, and we test them rigorously to ensure the highest degree of reliability.

That's why, when it absolutely has to work, it absolutely has to be Benshaw.

20 MW, 13.8 kV

When it absolutely has to work,
it absolutely has to be Benshaw.

In Any Configuration

When it absolutely has to work, it absolutely has to be Benshaw.

Industry experience

- Power generation
- Chemical processing
- Pulp and paper production
- Oil and gas production
- Municipal fresh and waste water treatment
- Aggregate and mining
- Cement production
- Steel and aluminum

Application experience

- Pumps
- Fans and blowers
- Crushers/hydra pulpers
- Mixers and refiners
- Conveyors
- Ball/hammer/rolling mills
- Compressors
- Chillers
- Centrifuges

Upright skid mounted

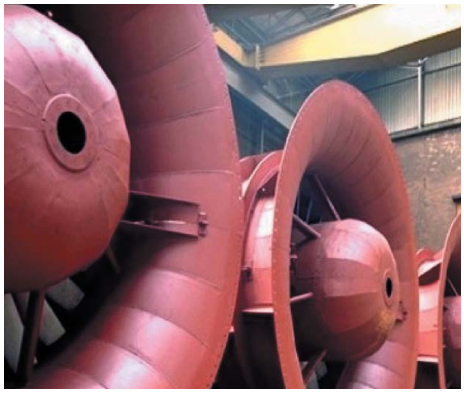
Low profile skid mounted

Protective relays and PLC logic

Fixed-mount circuit breaker MTM

Motor control center with power factor correction

Solid State Soft Start Advantages



Benshaw's MX³ based solid state starters offer superior performance when compared to any electro-mechanical starting technology.

For most applications, Benshaw's solid state starting technology offers important performance advantages over other starting techniques.

- Lower acquisition and operating costs
- Stepless torque control
- Precise control over starting and stopping times
- Less mechanical stress on drive train components
- Extended motor life
- Fewer power distribution problems

Cost benefits

Solid state starters typically cost less than competing reduced voltage motor starting technologies, but they also offer operating cost advantage by helping to lower energy costs and by reducing wear on motors, drive train components and driven machinery.

Benshaw's solid state soft start technology provides precise, stepless control over motor starting voltages (torque), which results in smoother acceleration of the motor, reduced shock loading to the drive train and machinery and better control of motor inrush currents.

Electrical benefits

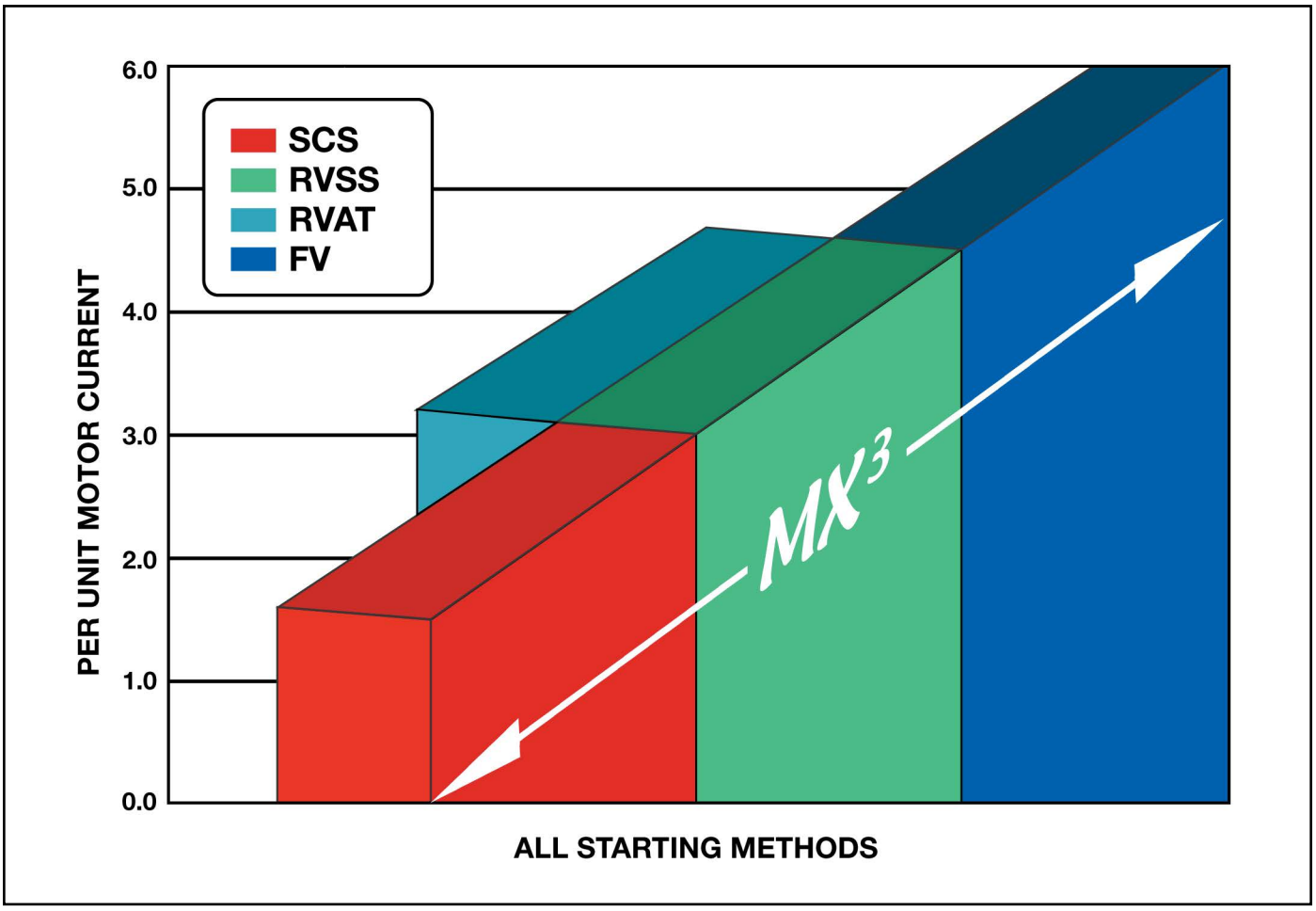
The advantages of Benshaw's solid state control technology are particularly important when process conditions create varying load demands on a motor during startup.

For example, with competing technologies a loaded motor will require more inrush current—over a longer period of time—to achieve the torque needed to begin moving a load. During that time, circuits can trip and motor overheating may occur, placing significant demands on your power distribution system.

In contrast, Benshaw's patented MX³ soft start technology ramps voltage to the motor in a smooth, stepless manner, eliminating excessive inrush currents, expensive voltage surges, overheating and the damaging effects of a sudden, stressful start.

Additional electrical benefits include:

- Reduced supply line voltage drop
- Compliance with utility company starting restrictions
- Elimination of oversized generators
- Fewer branch circuit protection trips
- Improved power quality
- Reduced rotor and stator stress
- Extended motor life



Mechanical benefits

Benshaw's MX³ technology allows different starting ramps to be programmed for loaded and unloaded conditions, providing maximum soft start efficiency in any situation.

- Reduced shock to motors, machinery, drive trains, loads and the manufacturing process
- Reduction of transient accelerating forces that can result in damage to belts, end pulleys, gearboxes and chains

Process benefits

- Fewer process disruptions resulting from a restart in mid-process (while product is loading the system)
- Reduced material damage
- Reduced downtime
- Increased productivity
- Longer system life
- Prevention of catastrophic system failures

Benshaw's solid state starters also provide superior built-in protection for your motor and machine.

Intelligent motor control

Benshaw's intelligent MX³ based medium and high voltage controls provide—as standard—a level of advanced functionality not available with traditional motor starters or competitive control equipment:

- Motor heater control
- Anti-windmilling
- Patented slow speed Cyclo™ converter ramp
- Phase controller
- Current follower
- ATL bypass
- Precise SCR firing

Solid State Switched Capacitance

MX³ FUSION

Using MX³ technology, Benshaw can also incorporate switched capacitance to further reduce the demand on your power distribution system.

Using MX³ technology, Benshaw integrates a modular switched power factor correction capacitor bank with a RediStart™ medium voltage soft starter to further reduce the VAR demand (and therefore the current) on the distribution system voltage bus.

This technology, known as MX³ Fusion, reduces the starting current on the supply system, resulting in an increase in the motor bus voltage. This is graphically depicted in Figure 1, a motor start comparison graph of voltage versus time.

MX³ Fusion

The MX³ control platform provides precise control over capacitance, switching in and out of the system as needed to lower per unit current demand on the utility.

The effect of reducing the per unit current and a comparison of the MX³ Fusion technology to variable frequency drives (VFD), reduced voltage auto-transformers (RVAT), reduced voltage solid state (RVSS) and full voltage (FV) starting can be observed graphically in Figure 2.

Variable frequency drives can start almost all motors and connected loads at 1.0 per unit current whereas RVATs (reduced voltage auto-transformers) and RVSS (reduced voltage solid state starters) require a higher per unit current—although not as high as with full voltage starting. MX³ Fusion Technology SCS (switched capacitance systems) result in further reduction of per unit starting current, to less than that of an RVAT.

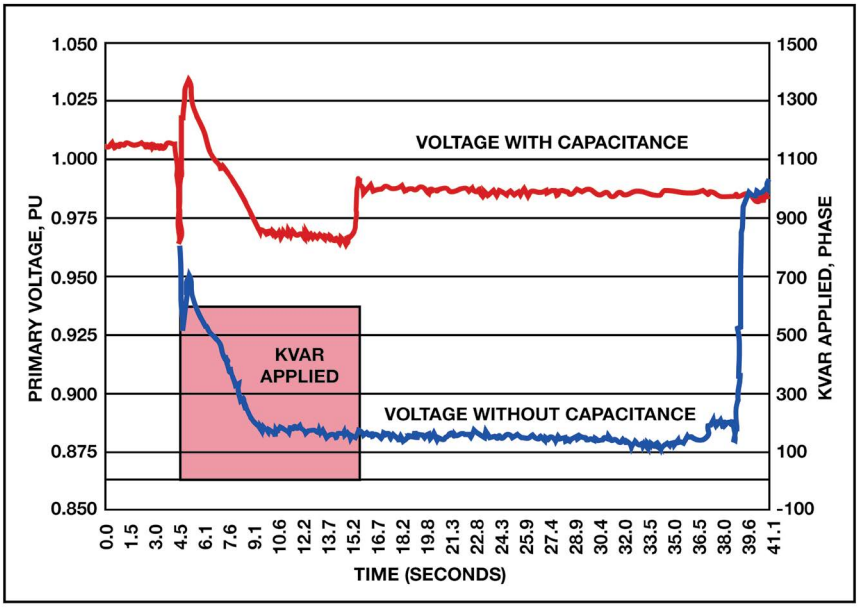


FIGURE 1. Motor start comparison with and without capacitance.

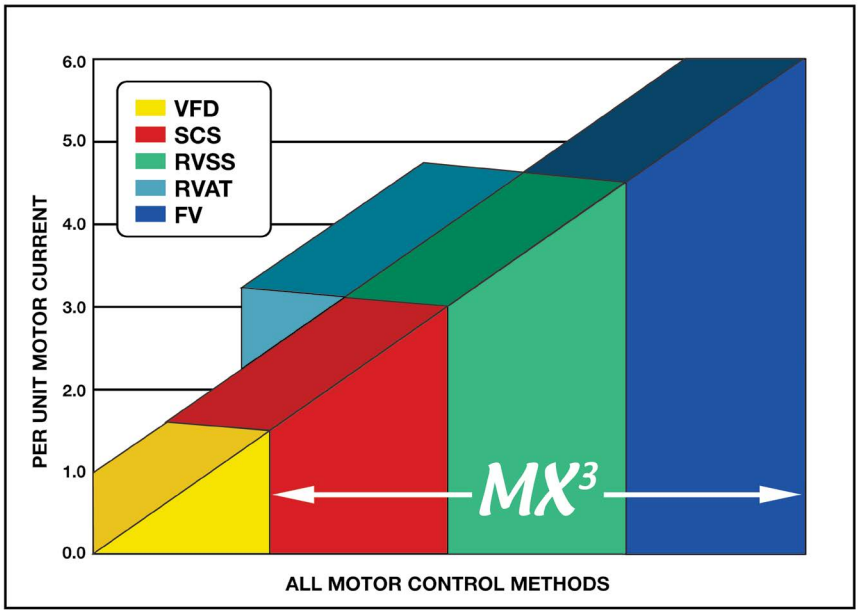
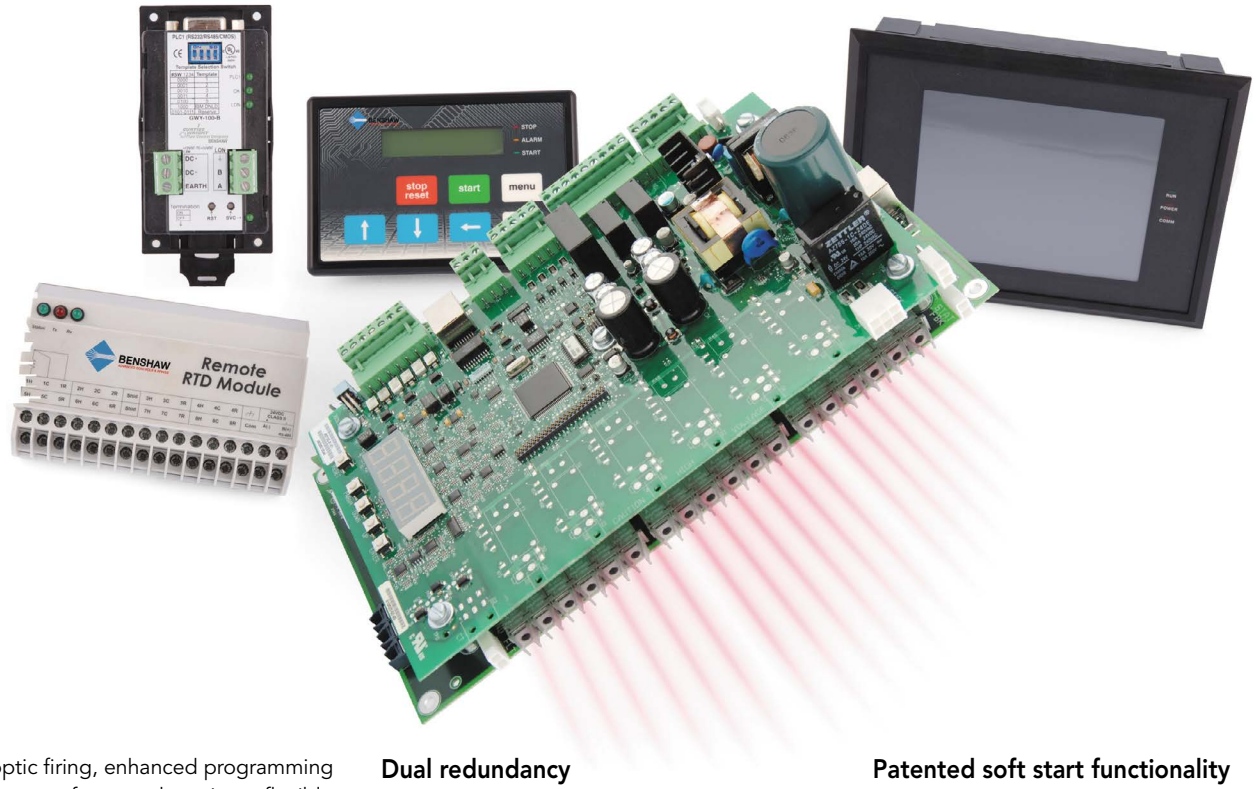


FIGURE 2. Starting current comparison.

Rugged. Reliable. Ready.
FUSION

And Next Generation MX³ Control Technology

Next generation, patented MX³ technology forms the backbone of Benshaw's entire line of intelligent medium and high voltage motor controls.



With fiber optic firing, enhanced programming capabilities, ease of use, and a unique, flexible architecture—MX³ based controls deliver unprecedented functionality and all of the rugged, dependable performance you've come to expect from the world leader in solid state motor controls.

All hardware, software, sensors and accessories are designed and built to work as a single, integrated system, eliminating coordination and performance issues inherent in systems compiled from dissimilar, third party components.

With a comprehensive set of standard hardware features, hundreds of available engineered components and dozens of software selectable functions, Benshaw's family of medium and high voltage controls can be configured to provide peak motor performance and comprehensive protection for any motor, serving any load, in any industry.

Dual redundancy

For mission critical motor control and applications, Benshaw can provide switch selectable dual redundancy to keep your continuous process application online in the unlikely event of a primary starter failure.

Fiber optic firing

Benshaw's MX³ based controls utilize an embedded, robust fiber optic firing technology for optimum isolation of low and high voltage starter circuits. The MX³ fiber optic firing module is immune to AC line sag, permitting continuous monitoring of an "intelligent" power pole and safe, reliable SCR control.

Additionally, Benshaw's precise SCR firing technique guarantees a symmetric waveform and eliminates any composite of DC current flow to the motor.

Patented soft start functionality

- Dual ramp selection
- Adjustable kick current
- Programmable decel modes
- MV built-in self test (BIST)
- Voltage ramp
- Current ramp
  - Adjustable initial current
  - Adjustable max. current
  - Adjustable ramp time
- TruTorque™ ramp
  - Adjustable initial torque
  - Adjustable max. torque
  - Adjustable ramp time
- Power ramp
  - Adjustable initial torque
  - Adjustable max. torque
  - Adjustable ramp time
- Linear/tach feedback control
- Cyclo™ converter control

Integrated electronic protection

- Motor thermal overload
- Independent starting and running OL's
- Up to speed timer exceeded
- Low line voltage
- Low line frequency
- High line frequency
- Phase reversal
- Phase loss
- Instantaneous overcurrent
- Overcurrent
- Undercurrent
- Current imbalance
- Residual ground fault
- Zero sequence ground fault
- Shorted or open SCR
- Disconnect fault
- Inline contactor fault
- Control power low
- Stack over temperature
- Motor PTC input
- RTD modules

Real-time metering and diagnostics

- ±3% accuracy
- 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
- TruTorque™ %
- Power %
- Peak starting current
- Last starting duration
- RTD temperatures
- Real-time clock

Rugged. Reliable. Ready.

Expanded integrated I/O

8 digital inputs configurable to:

- Stop
- Fault
- Fault reset
- Bypass/inline confirmation
- OL reset
- Local/remote selection
- Heater enable
- Heater disable
- Dual ramp selection
- 1 dedicated start input
- Disconnect
- Slow speed
- Brake enable/disable

6 relay outputs configurable to:

- Faulted
- Running
- Up to speed
- Alarm condition
- Ready condition
- Locked out
- Over/under current
- OL alarm
- Shunt trip
- Ground fault
- Energy saver indication
- Heating indication
- Slow speed forward/reverse
- DC braking
- Cooling fan

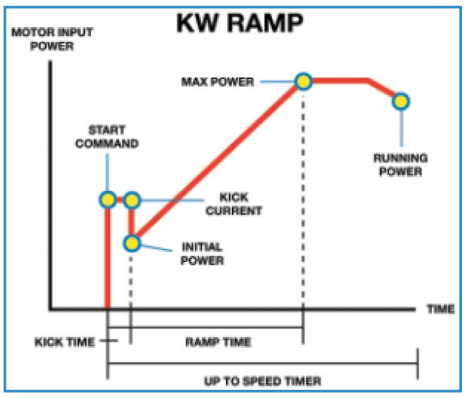
1 analog 4–20 mA / 0–10 Vdc input configurable to:

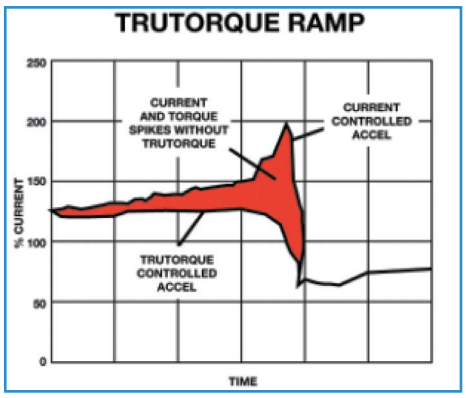
- Trip high/low level

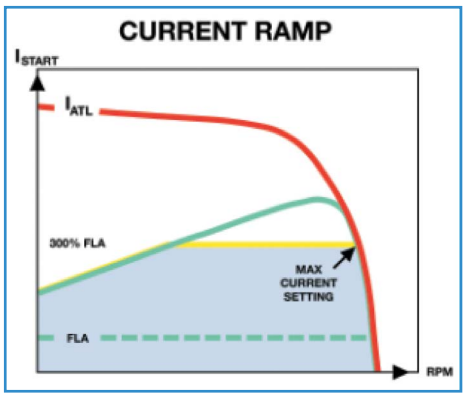
1 analog 4–20 mA / 0–10 Vdc output configurable to:

- 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%)
- Firing (0–100%)
- Calibration

Patented Soft Start Technology







MX³ technology allows for precise, application-defined configuration of Benshaw motor controls.

Selectable starting modes

High-performance MX³ based controls provide soft start, soft jog and soft stop capability through a variety of built-in, selectable ramps, allowing you to choose the optimum starting method for any application.

- Voltage ramp
- Current ramp
- TruTorque™ ramp
- Cyclo™ converter ramp
- KW ramp
- Linear/tach ramp
- Dual ramps
- Adjustable kick currents
- Full voltage

TruTorque™ control

TruTorque™ is Benshaw's unique, closed loop, sensorless method for precision acceleration and deceleration of motors and driven machinery.

In TruTorque™ mode, your Benshaw starter can automatically compensate for the actual system voltage and load conditions at any time, providing for smoother acceleration and deceleration cycles, while minimizing the stress that can result from torque spikes on pumps, belts, couplings and machinery.

TruTorque™ technology also reduces the peak power (KW) demand of your medium and high voltage motors during each start-up cycle, which can lower your energy costs.

Cyclo™ converter control

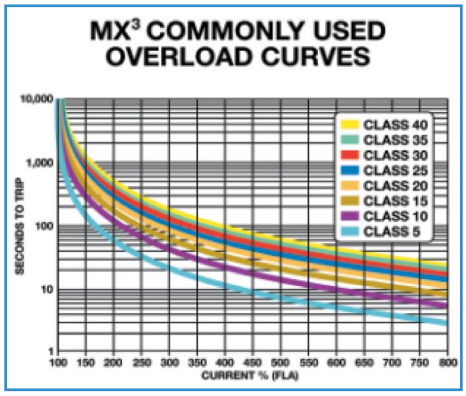
MX³ based controls also feature Benshaw's patent pending Cyclo™ Converter Ramp, a high performance algorithm that provides continuous low operating speeds of three-phase AC motors. Cyclo™ Converter action rotates three-phase AC motors with control of the stator current—at speeds less than the rated synchronous speed of the motor. Cyclo™ Converter Control can be used in conjunction with a standard three-phase, SCR-based soft starter.

The advantages over other "soft start" techniques include:

- Low speed motor rotation is accomplished without any additional hardware
- Peak phase currents are reduced when compared with other jogging techniques
- Motor heating is minimized

Integrated Electronic Protection

All of Benshaw's medium and high voltage controls offer comprehensive on-board protection.



Benshaw solid state controls provide a comprehensive set of onboard, programmable protection features, including motor/load fault protection, power quality protection, power outage ride through and permissive start protection.

High-speed sampling, integrated voltage and current sensing capabilities and pre-programmed algorithms allow you to select the precise overload curve and protection feature set needed to meet the requirements of your industry and application.

Standard protection features

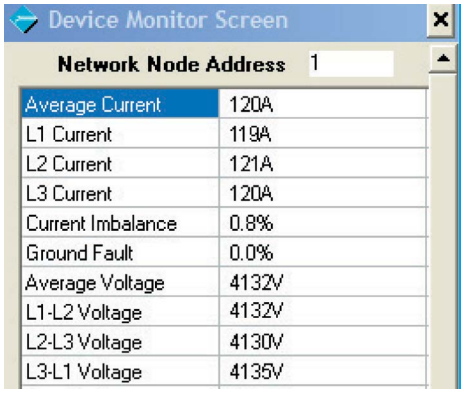
- Motor thermal overload
- Independent starting and running OL's
- Up to speed timer exceeded
- Low line voltage
- Low line frequency
- High line frequency
- Phase reversal
- Phase loss
- Instantaneous overcurrent
- Overcurrent
- Undercurrent
- Current imbalance
- Ground fault (residual or zero sequence)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

Protect machinery from failure and excessive maintenance caused by mechanical shock during starting or stopping with Benshaw's smooth, stepless acceleration and controlled deceleration ramps.

Protect electrical systems from disruptive voltage drops and power outages caused by motor locked rotor inrush current with precision control of the current ramp during startup.

Protect mission critical motors from failure or an unscheduled outage caused by machine or electrical system faults. Benshaw RediStart™ MVRMX starters provide complete, coordinated line monitoring, high performance motor control and comprehensive protection.

Real-Time Metering and Diagnostics



MX³ technology provides full visualization of real-time motor status and prior events to support operators and maintenance personnel.

Benshaw controllers calculate, analyze and present monitoring and diagnostics data in plain English displays to ensure that operating and maintenance personnel have real-time visibility of motor, load and power system conditions at all times.

Embedded digital meters, programmable alarms, outputs, revolving events and communications are presented in straightforward messages that provide complete visualization of the real-time status and prior events to support machine operators and maintenance personnel.

Built-in diagnostics

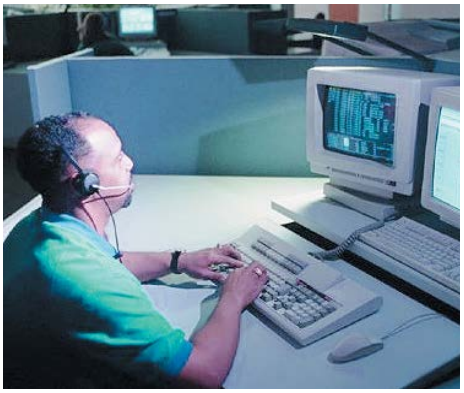
- Event log
- Fault log
  - Pre-fault voltage
  - Pre-fault current
  - Time
  - Date
- Time and date stamp
- Built-In Self Test (BIST)
- Door-mounted and remote keypads
- Onboard LEDs
- Fault classes

Onboard metering

- Average current
- Peak starting current
- L1, L2, L3 current imbalance
- Last starting duration
- L1, L2, L3 voltages
- Average volts
- Ground fault amps/residual
- Overload %
- Power factor
- Watts
- VA
- VARS
- kW hours
- MW hours
- Phase order
- Line frequency
- Analog input/output
- Run time—days/hours
- # of starts
- TruTorque™ %
- Power %

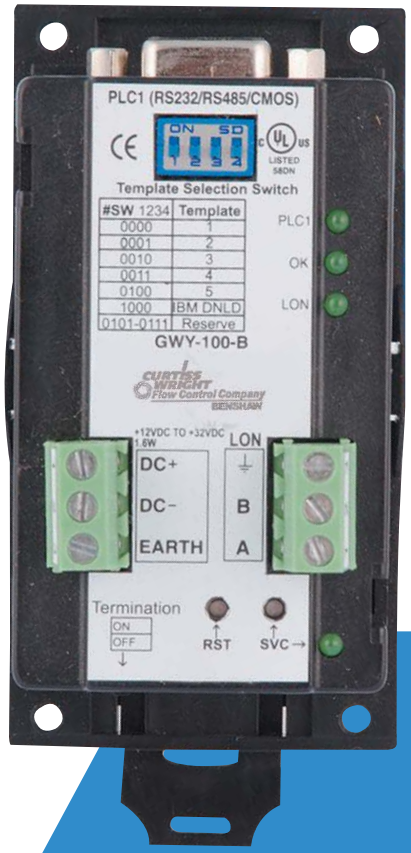
Expanded Communications

Expanded communications options simplify remote monitoring and connection of Benshaw controls to your network.



MX³ based medium and high voltage starters from Benshaw include an integrated Modbus/RS485 communications port as standard. Additional communications protocols are supported through optional communications bridges for simple, plug-and-play networking:

- Modbus/ RS485 (standard)
- Profibus DP
- Ethernet/Modbus TCP
- DeviceNet
- Lon Works



Rugged. Reliable. Ready.

MVRXE Series Prepackaged Solutions

Ratings:

2,300 V to 1,500 HP+
4,160 V to 3,000 HP+

WEB STOCKED

RediStart™ prepackaged, solid state starters provide reduced voltage starting for normal operation and full voltage emergency back-up starting for mission critical applications.

Benshaw's RediStart™ prepackaged solid state starters are microprocessor controlled reduced voltage starters for three-phase induction motors. These starters provide closed-loop soft start control for smooth stepless motor acceleration, and emergency full voltage back-up starting capability, if required. They are supplied in a rugged, free-standing NEMA 12 enclosure.

Each enclosure consists of two distinct compartments; the medium voltage (power pole) section is located in the main body of the enclosure, and the low voltage section containing control logic is located behind the door in an isolated compartment.

Prepackaged medium voltage starters are supplied with a load break isolation switch, Class "R" motor fuses, inline vacuum contactor, solid state power poles and a vacuum bypass contactor, which is used to bypass the SCR power poles once the motor is up to full speed.

MX³ control technology

Benshaw's powerful MX³ controls provide precise, user-selectable digital starting and stopping capabilities, motor protection, metering, diagnostics and communications. It also provides the circuitry required to drive the power semi-conductors, which are located in the power section.

All RediStart™ prepackaged medium voltage controls 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 mission critical applications where downtime is extremely disruptive and cannot be tolerated.

RediStart™ MVRXE key features:

- NEMA 12 solid state starter
- Benshaw MX³ controller
- 45/60KV BIL
- 8,000 PIV – UL347 certified and listed at 2.4KV
- 12,000 PIV – UL347 certified and listed at 4.2KV
- 200MVA (2300 Vac) / 350 MVA (5000 Vac) short circuit fault rated
- 500% - 30 seconds rated++
- Service entrance labeled option
- Built-In Self Test (BIST) for "quick commissioning"
- Fiber optic firing
- Selectable solid state or full voltage operation via selector switch mounted inside the low voltage compartment
- 400 A load break, 5 kV rated disconnect switch, with viewing window, grounding assembly and lockable handle mechanism
- Load matched Class R fusing with blown fuse indication
- 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 overload device
- 120 Vac, 1000 VA CPT with primary and secondary fusing
- Door-mounted start/stop/reset pushbuttons, LCD keypad and local-off-remote switch
- Terminal strip included for remote start/stop control and up-to-speed indication
- Modbus communications

+ Maximum 360A load including SF.
++ Motor and load dependent.

Benshaw MVRXE -vs- any autotransformer

Motor Control & Protection Functions	Any Std. Auto Transformer	Benshaw MVRXE
Reduced voltage start	YES	YES
Soft start	NO	YES
Soft stop	NO	YES
Full voltage bypass starting	NO	YES
Load break disconnect switch	NO	YES
Built-in self test	NO	YES
UL 347/service entrance rated	NO	YES
3 year warranty	NO	YES
Plain English digital display	NO	YES
Electronic overload protection	NO	YES
Electronic power quality monitoring	NO	YES
Digital metering	NO	YES
Plain English diagnostics	NO	YES
Embedded Modbus RS485	NO	YES
Incoming line landing pad	NO	YES
Integrated control and protection	NO	YES
UL zero sequence ground fault	NO	YES
Space saving design (in.)	92h X 54w X 36d	92h x 36w x 30d

The Benshaw Promise

Every Benshaw solid state starter is guaranteed for three full years.* Other manufacturers limit their warranties to just one year. But at Benshaw, we believe that since we build them better, we can guarantee them longer. That's "the Benshaw Promise."

**With factory startup.*

Engineered Solutions Plus Global Compliance

Structured Engineering Process

Benshaw's ISO 9001 certified engineering process and production system deliver engineered solutions precisely matched to your requirements—with guaranteed quality and global compliance to any standard you specify.

Benshaw provides custom engineered systems designed to customer requirements and ISO 9001 certified quality by paying attention to the details right from the beginning. Benshaw starts by understanding the customer's machine—the load that the motor is operating. Understanding the machine load, particularly during start, is a critical first step towards an engineered solution. Often, Benshaw can assist by suggesting optimal motor characteristics required for a satisfactory design solution.

Whether the motor is induction, wound rotor or synchronous, Benshaw has the technical expertise to understand how the motor will perform during starting with a solid state reduced voltage motor starter.

Combining the motor, the driven load and the starter together to predict the performance of the combination of the component parts as a system is the next step in the process. When the effect of starting such a system is critical to the utility supplying power to the system, Benshaw understands all of the details and can predict performance of the system and the effect on the utility power source. The result is detailed system requirements and motor starter settings for the system.

Our machine, motor, systems and packaging analysis for a customer's oil refinery catalytic cracker results in the world's first 15 kV 22,000 HP solid state starter.

Mechanical packaging is a function of not only the required components to get the motor and driven load up and running, but also manufacturing the motor starter so that it fits the size or site requirements.

Whether the mechanical requirements are per detailed specifications or through detailed onsite engineering meetings, the engineering methods are the same. The result is a predictable engineering solution.

Solid state reduced voltage starters

- Standard induction
- Synchronous
- Wound rotor
- P.A.M. motor

Full voltage starters

- Standard across the line
- *Smart* across the line

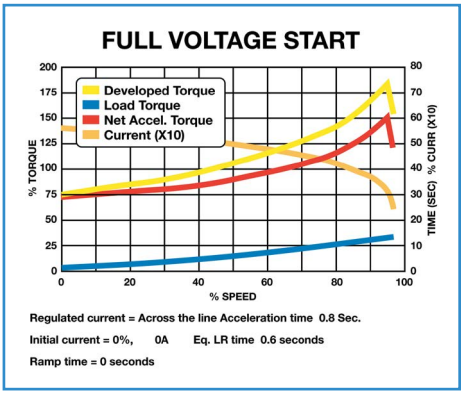
Configurations

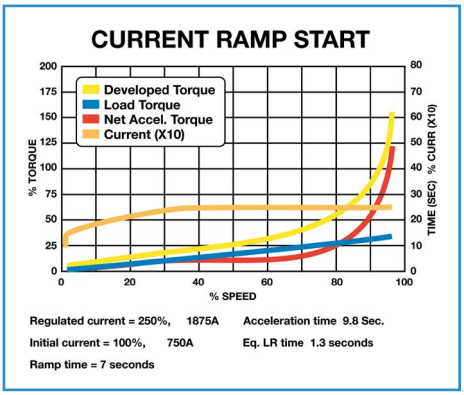
- Two speed
- Reversing
- Multiple motor
- Combination and non-combination
- Mining duty skid mounted
- NEMA 1, 12, 3R enclosures

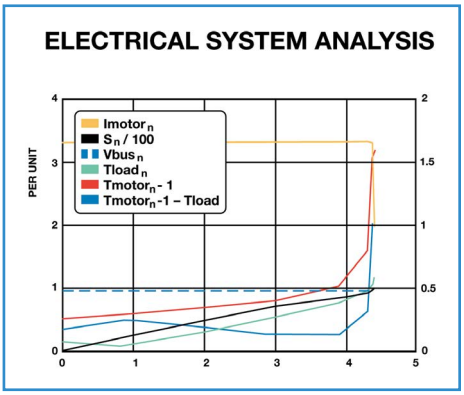
Intelligent motor control centers

- Coordinated lineups
- Incoming sections
- MTM arrangements
- Feeder switches
- Communications

Precision Systems Analysis







Benshaw can custom configure intelligent, MX³ based motor control centers and lineups to meet the control needs of any load, in any industry.

With a firm understanding of the objective (or technical concern—such as utility voltage sag or motor bus voltage sag), Benshaw's engineering analysis starts with gathering system information either by e-mail, phone conversation or a site visit.

Once the pertinent information is available, a motor starting analysis is performed using Benshaw proprietary engineering software. Using motor inertia, speed torque curves, motor damage curves and load data, an optimum safe current starting profile is generated using proprietary computer software programs developed by Benshaw based upon years of engineering experience.

The control topology is selected as determined by the application (such as TruTorque™ for pumps, current ramp for fans and KW control for generators) in conjunction with the customer's main objective. Once the motor starting time and maximum current is determined, a system voltage drop analysis is performed to determine the sag on both the utility and the motor bus. MATHCAD® worksheets based upon sound engineering fundamental principles allow precise engineering calculations to be performed based upon the system topology. Further data integrity checks are performed to assure that the power system, motor and load data look reasonable from a technical viewpoint.

In order to correct for system voltage drop, power factor correction capacitors can be used to compensate for reactive power demanded by the motor.

Further detailed engineering simulations are completed using additional software such as EMTP to assure that there are no other technical issues to resolve. This is particularly important when using power factor correction capacitors on the motor bus.

Application-Specific Controls

From application-specific motor and machine controls to precision systems analysis, Benshaw is your source for custom control solutions.

Applications specialists at Benshaw are available to help you evaluate current and future control system requirements and develop a sound strategy for retrofit, upgrade or replacement. And when you're ready to make a move, Benshaw can follow through with a complete design, production, installation and testing package.

Whatever your control needs, Benshaw's engineering teams and application specialists can help you find a cost-effective, reliable solution.

Synchronous motor solid state starters

- Soft start stator control
- Synchronous speed monitoring packages
- Solid state dc field exciter

Synchronous motor dc positioning controls

- Integrated synchronous motor starter
- Solid state positioning control

Two-speed/P.A.M. motor starters

- Solid state starter
- Vacuum contactors for speed changing

Reversing motor starters

- Solid state starter
- Vacuum contactors for motor reversing

Wound rotor motor starters

- Solid state starter
- Rotor resistors, shorting contactors and interface

Capacitive start/switching controls

- Solid state starter
- Capacitor banks, switching contactors, power monitoring devices

Multiple motor starting

- Solid state starter
- Individual motor protection

15 kV class solid state starters

- 10,000, 11,000, 13,000 V nominal operating voltages to 30,000 HP
- Combination or non-combination configurations
- Standalone or motor control center lineups
- Custom enclosures and transition sections

MX³ Intelligent Motor Control Centers, Lineups, and Main-Tie-Main Arrangements

Benshaw can custom configure intelligent, MX³ based motor control centers and lineups to meet the control needs of any load, in any industry.

Incoming sections

- Main breakers or disconnects
- Main-Tie-Main arrangements
- Main lug only sections
- 1200 / 2000 / 3000 amp circuit breakers
- 400 / 600 / 1200 amp load break fault make disconnects
- Surge protection devices
- Metering and communications

Custom configured multiple unit 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

Intelligent MCC integration

- Easy MCC networking
- MTMS, disconnects, feeders, SSRV, ATL, PAM, 2 speed starters
- Diagnostics and communications
- Intelligent SSRVS power poles

Integrated supervisory control and predictive maintenance systems

In applications requiring the coordination and control of multiple RediStart™ starters and third party equipment, Benshaw has the experience and technology to design and deliver integrated control systems:

- PC-based systems
- Local area networks
- Local/remote communications and control
- Data collection and monitoring
- PLC design, programming and integration
- Online and offline predictive maintenance

FUSED DISCONNECT MTM 7.2 kV motor control center with integrated power factor correction

48" space savings vs. typical 96" competitive unit

FIXED MOUNT CIRCUIT BREAKER MTM (only 48" deep)

Packaged electrical and control systems

Benshaw can also design and manufacture completely packaged portable or stationary electrical systems for applications requiring self-contained modules, including:

- 20- or 40-foot containers
- Self-contained air conditioning and lighting
- Low and medium voltage equipment
- Remote monitoring and control
- Personnel and support facilities

DRAW OUT CIRCUIT BREAKER MTM with (6) 5 kV solid state starters

24/7 Technical Support

Benshaw is dedicated to providing comprehensive 24-hour-a-day, 7-day-a-week phone support. Benshaw provides repair, spare parts, field engineering, retrofit and training services, when and where you need us. You can count on our experienced team, backed by the latest diagnostics and repair tools and an extensive parts inventory to support your operations.
Call 1.800.203.2416

24/7 Hotline Support from our operations in Pittsburgh and Listowel (Canada):

- Technical phone support
- Overnight parts shipment
- 24-hour service dispatch
- Coordination of all service capabilities

Repairs

Repairs are made on Benshaw equipment by trained, experienced personnel, using the latest diagnostic and test equipment.

Field Services are performed on-site by skilled technicians, engineers or complete teams if needed, including:

- Start-up commissioning
- Field repairs
- Field analysis/data collection
- Preventative maintenance

The Benshaw Product Line

A wide range of motor controls and drives is available.

- Solid state starters fractional up to 30,000 HP at 15 kV
- LV AC drives to 700 HP, MV AC drives to 3,000 HP
- Electromechanical controls to 800 A

Benshaw Express is a 24/7 online inventory and order entry system for authorized Benshaw distributors:

- 24/7 shipment
- Either air or truck delivery

BENSHAW
ADVANCED CONTROLS & DRIVES

Visit us online at
benshaw.com and
benshawexpress.com,
or contact:

BENSHAW, Inc.
615 Alpha Drive
Pittsburgh, PA 15238
Phone: 412.968.0100
Fax: 412.968.5415

BENSHAW Canada
550 Bright Street East
Listowel, Ontario N4W 3W3
Phone: 519.291.5112
Fax: 519.291.2595

A Regal Brand

REGAL

www.regalbeloit.com

Specifications are subject to change without notice.
©2014 Regal-Beloit Corporation MKT 125-004R Printed in the USA