Motor Management
Offer Panorama

Offer Selection for High Power Electric Motor Applications above 100 kW

se.com/motor-management
Did you know?

Electric motors consume...

45%
...of the electricity produced worldwide

60%
...of the electricity produced in manufacturing industries

>90%
...of the electricity produced in electro-intensive industries.

Source: U.S. Department of Energy Office of Industrial Technologies
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Introducing Motor Management by Schneider Electric
Up to 20% investment savings thanks to the suitable voltage level.

Up to 30% savings thanks to the proper engineering of Motor Management solutions.

Improved productivity and energy efficiency thanks to the digital services and analytics.
Overview of EcoStruxure™ Power

Introduction

At Schneider Electric, we envision a digital-electric world with zero electrical safety incidents, zero unplanned downtime, zero energy waste and zero cyber intrusions that impact operations. We are striving to make this vision a reality with EcoStruxure™ Power, our IoT-enabled architecture and platform, that enhances productivity, reduces risks and unlocks new growth opportunities.

At the core of EcoStruxure™ Power are three interwoven levels of innovation: connected products, edge control, apps, analytics and services. Continuously communicating in real-time in a cyber-secure environment, they give you complete visibility so you can optimize your network.

In a world that is increasingly digital and electric, the ways to manage business are challenged:
• Keeping staff and occupants safe is a priority that cannot be compromised
• Business Continuity is equally important, with power outages dramatically impacting profitability
• Environmentally-conscious public, customers and shareholders expect energy efficiency and sustainability initiatives
• Safeguarding intellectual property and data against cyber risks demands new level of vigilance
Introducing Motor Management by Schneider Electric

Motor Management Offer Panorama

Motor management is part of a complete industrial installation with 3 levels:

1. **Apps, Analytics & Services**
   - Cloud Analytics
   - Services
   - Predictive maintenance and services, based on cloud analytics, for proactive and preventive maintenance

2. **Edge Control/Process Automation**
   - Communication
   - Software
   - Process automation and supervisory systems for local asset monitoring

3. **Connected Products**
   - Power Quality
   - Circuit Breaker and Contactor
   - Protection Relay
   - Start and Operate
   - Motor
   - Connected Products, to make data available for analysis

---

1. Circuit breakers and fused contactors associated with protection relays are typically used to connect, protect and start motors.
2. Soft starters or variable speed drives are used to start and operate motors by adapting the electrical and mechanical characteristics to the load and the network.
3. Cables are mainly sized according to the installation requirements. Their cross-section is defined by normal and fault currents. The control mode selection can influence cable sizing and bring optimization benefits.
4. Motors are essentially defined by application requirements. In high power ranges, their optimization can bring overall cost savings in terms of reactive power consumption, heat losses, upstream transformers and generator sizing.
5. Power quality concerns extra power consumption and financial penalties from utility or equipment malfunctioning. Motors affect power quality through their control mode.
Motor Management by Schneider Electric

Schneider Electric has developed a complete approach to meet the challenges you are facing. With five fundamental domains of expertise and a rich offer portfolio, we ensure the optimization of your investment and operating costs. Every relevant parameter of your electrical system and process is considered to build the most suitable and complete solution for your motor applications.
Introducing Motor Management by Schneider Electric

Motor Management is crucial for heavy industries where service continuity and process availability are key.

How Can Motor Management Help Tackle the Challenges of Industries with High-power motors?*

Electrical motor management is often associated with motor maintenance, but involves much more. It concerns multiple electrical, mechanical and maintenance challenges for end-users, designers and equipment manufacturers. With its extensive offer portfolio, competencies and know-how, Schneider Electric helps you for a sustainable motor integration in the electrical system and the industrial process.

**Electrical installation**
- Maintain system voltage at acceptable level during start-up
- Control power factor and harmonics in normal operation
- Limit fault current contribution and impact on equipment sizing and cost

**Process and mechanics**
- Define an adequate torque and speed control solution for the application
- Avoid premature aging by limiting the mechanical stress on start-up

**Maintenance**
- Adapt maintenance actions to the specific characteristics of high-power motors
- Properly schedule maintenance operations
- Integrate preventive maintenance in the electrical installation from the design stage

* > 100 kW rated power

Motor Management is crucial for heavy industries where service continuity and process availability are key.

Water and Wastewater  Mining, Minerals and Metals  Oil and Gas  Marine
A Range of Tools to Upscale your Motor Management Awareness

To understand our Motor Management approach

To know more about your key applications

Brochure "Motor Management for LV and MV high-power motor applications"
998-20034028_GMA-US

Technical guide "Solving the LV vs MV Dilemma When Optimizing Costs for Motor Management"
998-20348705_GMA-US

Case study "LNG Ship Motor Starting Analysis"
998-20231311_GMA-US

Blog post "5 steps for efficient motor management design"

Blog post "How motor protection can help in optimal power management"

Blog post "3 safety measures for motors with individual power factor correction"
DEDICATED EXPERTS TO SUPPORT YOUR MOTOR MANAGEMENT APPROACH

From analyzing your needs to proposing the most suitable technical solutions, the "Motor Management Competency Center" by Schneider Electric brings you true benefits in the design of LV and MV high-power motor applications: in-depth technical analysis, impartial advice, optimization and simplification of the technical solutions, guaranted operation, and optimized total cost of ownership.

To improve your technical background

White paper "Three Steps for Reducing Total Cost of Ownership in Pumping Systems"
998-2095-02-19-14AR0_EN

White paper "Modeling of Motor Starting Methods in EMTP-ATP"
998-2095-11-08-18AR0_EN

To get an overview of our range of solutions

Brochure "Motor Management Offer Panorama"
NRJED316712EN

To design Motor Management applications

EcoStruxure™ Motor Management Design web application

se.com/motor-management
Motor Management Offer
Selection Panorama
Expertise is at the heart of the Motor Management solution. With dedicated software, relevant analyses, or services for electrical equipment, Schneider Electric supports your projects from the design phase through setup and commissioning to operation and maintenance.

EcoStruxure™ Motor Control Configurator ........ p. 14
Altivar Process Configurator ........................... p. 15
EcoStruxure™ Motor Management Design .......... p. 16
Services ......................................................... p. 18
EcoStruxure™ Motor Control Configurator

Web application to select the right combination for protection and control of your motors.

Depending on the needs of your application, the EcoStruxure™ Motor Control Configurator supports you in the selection of components to control and protect the electric motor.

3 STEPS TO BUILD YOUR COMPLETE MOTOR CONTROL SOLUTION

Select the motor starter technology, supply voltage, power and application
Adjust the configuration and accessorize the products
Save the Bill of Materials (BOM)
Share the BOM with your colleagues and partners

Purpose of the app
To select the right motor starter combination in a few clicks.

Group of users
- OEM
- Specifiers
- Panel builders
- Contractors

Key values
- Easy to use tool for motor control configuration
- Print, save, export and share your solution
- Suitable for any device:
  - Desktop
  - Tablet
  - Smartphone

Save time selecting the right motor starter combination
Get a complete and proven motor starter solution, including accessories
Be ready with associated product documentation accessible at the click of a button

LET’S CONFIGURE YOUR MOTOR CONTROL SOLUTION AT: INDUSTRIAL-AUTOMATION-CONTROL/TOOLS/MOTOR-CONTROL-CONFIGURATOR.JSP
Altivar Process Configurator

Web application for quick quotation and configuration for typical drive applications.

3 STEPS TO CONFIGURE YOUR INDIVIDUAL DRIVE

SELECT your drive by range, voltage and power

ASSEMBLE your drive by selecting your required options

SUMMARIZE your configured drive with options

SEND configuration file to Customer Care Center

Purpose of the app

To configure and get a quotation for typical drive applications.

Group of users

• Specifiers
• Panel builders
• Contractors
• End-users

Key values

• Configure and quote your individual Drive System using the same tool
• Easily customizable Configured Drive Systems (CTO) to suit your specific requirements
• Pre-defined CTO options (e.g. enclosure plinth, cabling from top/bottom, braking unit, enclosure lighting/heating, front display module, motor heating, circuit breaker, etc.).

Reduce the delivery time significantly for individually adapted drives, thanks to pre-defined options

Quickly customize Configured Drive Systems to meet your requirements

LET'S CONFIGURE YOUR DRIVE AT: ALTIVAR-PROCESS-CONFIGURATOR.SCHNEIDER-ELECTRIC.COM
Expert Services for Motor Applications

EcoStruxure™ Motor Management Design

Web application for quick, easy calculation and offer selection for high-power motor applications.

3 STEPS TO MOVE FROM PROJECT TO SOLUTION

PROJECT

Define your project by activity and application type

CALCULATION

Compare starting modes and electrical network design

SOLUTION

Build your motor management architecture with recommended offers

PROJECT REPORT

Get an exhaustive project report (.pdf)

ALL ALONG YOUR JOURNEY

GET SUPPORT

to use the tool

Detailed explanations to understand THE inputs and outputs

GET HELP

to make choices

Decision tables with qualitative criteria

GO FURTHER

with digital content in connection

Blog posts, Guides, White papers, online tools, etc.

Purpose of the app

To design Motor Management architectures for high-power motor applications.

Group of users

• Consultants
• Panel builders
• Contractors

Key values

• Complete motor management design approach: application, start & control, protection, power quality and asset management
• Easily achievable optimized and competitive designs, with limited input data
• Easy to use for newcomers and experts, with built-in help
• Management of multiple projects
• Embedded user feedback routines

Save time and gain efficiency in electrical design when upgrading/extending with high-power motors

Benefit from simplified offer selection procedures to build a complete motor management architecture (from starting & control to services)

Access to the most relevant digital content for a concrete case

LET’S START YOUR JOURNEY AT: ECOSTRUXURE-MOTOR-MANAGEMENT.SE.APP/DESIGN
Life Cycle Services

PLAN
Schneider Electric helps you plan the full design and execution of your solution, including securing your process and optimizing your time.

Technical feasibility studies: Support your design solution in a given environment.

Basic design: Accelerate turnaround time to achieve a final solution design.

INSTALL
As an original manufacturer, Schneider Electric provides unparalleled knowledge and expertise to help ensure the best possible start for your equipment:

• It is installed according to manufacturer specifications and is ready to operate safely
• Your products and equipment will function correctly after installation
• You receive the best experts’ advice for sustainable operation.
Schneider Electric helps you maximize your installation uptime and control your capital expenditure through its service offering.

**Advantage Service Plan**: Take complete control of your maintenance costs. It helps you anticipate issues, extend the lifetime of your System and Components, and reduce the risk of unscheduled downtime. It also helps improve reliability and safety of operations.

**Maintenance Services**: Motor management and equipment longevity are highly dependent on the quality and reliability of the electrical equipment. We provide a suite of maintenance services for your electrical distribution, including manufacturer preventive maintenance and advanced diagnostics to help keep your electrical distribution running smoothly.

*Note: Contact your Schneider Electric service sales representative to build a maintenance plan of your site.*

**Spare parts management**: Identify critical parts and define the right level of required stock based on the lifecycle of your equipment to secure the availability of spare parts.

**Technical Training**: It is important to build up the necessary skills and competencies for your electrical and non-electrical staff in order to operate your installations properly and safely. Experience our virtual training courses that will help your staff manage the equipment safely.

**OPTIMIZE**

Schneider Electric provides you with tailored recommendations to help reduce risks and improve the performance, and reliability of your equipment.

**MPS Electrical Assessment**: Prevent downtime events and avoid safety issues by understanding the lifecycle and operating conditions of your critical electrical assets. Ensure effective maintenance and management practices, while modernizing equipment where necessary.

**Arc Flash Protection**: Prevent accidents such as high-temperature explosions and help protect your site with Schneider Electric’s arc flash protection solutions for both safety and productivity.

**RENEW**

Schneider Electric extends the lifetime of your system while providing upgrades. It offers to take full responsibility for the end-of-life processing of old electrical equipment.

**Ecofit**: Keep up to date and improve the performance of your electrical installations (LV, MV, Protection relays, etc.).

**Asset Connect**: Achieve business continuity and extend your equipment’s lifetime by monitoring the thermal and environmental conditions of your electrical installation.
Motor Management Offer
Selection Panorama
Motor starting and control of operation are fundamental to your process and definition of the Motor Management solution. Schneider Electric offers a complete range of advanced motor controls for meeting all your process constraints with regard to power system requirements.

- Autotransformer Starters........................................ p. 22
- Soft Starters .............................................................. p. 23
- Variable Speed Drives ............................................... p. 24
### Advanced Motor Control

#### Electromechanical Solutions

**Autotransformer Starters**

<table>
<thead>
<tr>
<th>Model &amp; MCC/iMCC</th>
<th>Motorpact</th>
<th>Altistart</th>
<th>Altistart</th>
<th>BlokSet PMCC/PMCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RVAT</td>
<td>RVAT</td>
<td>ATS22</td>
<td>ATS48</td>
<td>soft starter</td>
</tr>
</tbody>
</table>

**Distribution and motor control switchboard**

- Autotransformer motor starter
- Soft starters for pumps and fans
- Soft starters for heavy duty industry & pumps
- LV distribution and motor control center

**Main standards and certifications**

- NEMA, CSA, UL, ABS
- IEC, NEMA, DNV, BV, LR, ABS
- IEC/EN, UL, CSA, EAC (GOST), CCC, C-Tick
- IEC, UL, CSA, EAC (GOST), CCC, C-Tick, DNV, NOM, SEPRO, TCF
- IEC, CCC

**Motor voltage range**

- 208...600 V
- 2.2...7.2 kV
- 230...440 V / 208...600 V
- 230...415 V / 208...690 V
- 400...690 V

**Motor power range**

- 15...300 kW
- 20...400 HP
- 100...3,800 kW
- 4...400 kW
- 4...900 kW
- Up to 250 kW (315 kW @ 500 V)

**Application segments**

- Pump
- Compressor
- Fan
- Piston pumps
- Centrifugal pumps
- Compressors
- Conveyors
- Fans
- Centrifugal pump
- Centrifugal compressor
- Fan

**Motor applications**

- Gradual motor starting in steps
- Motor protection through protection relay
- Direct stop
- Circuit breaker or fused switch disconnects
- Start and bypass contactors
- Fixed, disconnectable, and withdrawable functional units
- Monitoring of temperature rise
- Soft start/soft stop unit for 3-phase asynchronous motors
- Integrated motor protection
- Integrates bypass and safety functions
- Modbus Serial link
- Soft start/soft stop unit for 3-phase asynchronous motors
- Integrated motor protection
- Control of starter bypass contactor
- Dual ramp setup
- Cascaded starting and deceleration of a number of motors
- TCS patent: Torque Control System
- Integrated ATS48 soft starter
- Centralized and modular motor control, using conventional and intelligent motor control centers (MCC/iMCC)
- Mixed feeders (power distribution/motor control)

**Motor Management functions**

- IAC 100 kA/0.4 s
- Seismic qualified
- Recommended communication architecture with TVDA
- IAC 50 kA/0.25 s (including autotransformer)
- Seismic 2.7G
- Available with PFC
- Small footprint
- Standalone or coupled to PIX/MCset switchboard
- One tool and all operations from front
- Saves time on wiring
- Saves space with integrated bypass
- Increases the service life of your installations
- Reduces mechanical stress (jolts and shocks) on the machines
- Integrated ATS48 soft starter
- Earthquake/seismic 2G
- Integration of capacitor banks and harmonic compensation
- Recommended communication architecture with TVDA

**Motor Management benefits**

- IAC 100 kA/0.4 s
- Seismic qualified
- Recommended communication architecture with TVDA
- IAC 50 kA/0.25 s (including autotransformer)
- Seismic 2.7G
- Available with PFC
- Small footprint
- Standalone or coupled to PIX/MCset switchboard
- One tool and all operations from front
- Saves time on wiring
- Saves space with integrated bypass
- Increases the service life of your installations
- Reduces mechanical stress (jolts and shocks) on the machines
- Integrated ATS48 soft starter
- Earthquake/seismic 2G
- Integration of capacitor banks and harmonic compensation
- Recommended communication architecture with TVDA
Soft Starters

<table>
<thead>
<tr>
<th>Okken PMCC/iMCC soft starter</th>
<th>Model 6 MCC/iMCC soft starter</th>
<th>Motorpact RVSS</th>
<th>Motorpact RVSS S3</th>
<th>Motorpact RVSS standalone</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV power distribution and motor control center</td>
<td>Distribution and motor control switchboard</td>
<td>Reduced voltage soft starter</td>
<td>Reduced voltage sequential soft starter</td>
<td>Reduced voltage soft starter</td>
</tr>
</tbody>
</table>

Main standards and certifications
- IEC, DNV, RINA, BV, Shell DEP, EAC (GOST), CCC
- NEMA, CSA, UL, ABS
- IEC, NEMA, DNV, BV, LR, ABS
- IEC, NEMA, DNV, BV, LR, ABS
- IEC, NEMA, DNV, BV, LR, ABS

Motor voltage range
- 400...690 V
- 208...600 V
- 2.2...7.2 kV
- 2.2...7.2 kV
- 2.2...7.2 kV

Motor power range
- Up to 250 kW (315 kW @ 500 V)
- 2.2...450 kW
- 3...600 HP
- 100...3,800 kW
- 100...3,800 kW
- 100...3,800 kW

Application segments
- Centrifugal pump
- Centrifugal compressor
- Fan
- Pump
- Compressor
- Fan
- Pump
- Compressor
- Fan
- Pump
- Compressor
- Fan

Motor applications
- Integrated ATS48 soft starter
- Centralized and modular motor control, using conventional and intelligent motor control centers (MCC/iMCC)
- Mixed feeders (power distribution/motor control)
- Fixed, disconnectable, and withdrawable functional units
- Soft start/soft stop unit for 3-phase asynchronous motors
- Dual ramp setup
- Integrated bypass contactor for motor running
- Motor protection through protection relay
- Thermal withstand 5 s In for 80 s
- LSC2A-PI with line disconnector
- Soft start/soft stop unit for 3-phase asynchronous motors
- Dual ramp setup
- Integrated bypass contactor for motor running
- Motor protection through protection relay
- Thermal withstand 5 s In for 60 s
- LSC2A-PI with line disconnector
- Multi-motor sequential (cascaded) starting
- Soft start/soft stop unit for 3-phase asynchronous motors
- Dual ramp setup
- Integrated bypass contactor for motor running
- Motor protection through protection relay
- Thermal withstand 5 s In for 60 s

Motor Management functions
- IAC 100 kA/0.5 s
- Seismic 2.7 & 5G (nuclear)
- Recommended communication architecture with TVDA
- IAC 100 kA/0.4 s
- Seismic qualified
- Recommended communication architecture with TVDA
- IAC: 50 kA/0.25 s
- Seismic 2.7G
- Available with PFC
- Space saving
- Reduced number of maintenance points (<40%)
- Standalone or coupled to PIX/MCset switchboard
- One tool and all operations from the front
- IAC: 50 kA/0.25 s
- Seismic 2.7G
- Space saving
- Reduced number of maintenance points (<40%)
- Standalone or coupled to PIX/MCset switchboard
- One tool and all operations from the front
- Available with PFC
- IAC: 50 kA/0.25 s
- Seismic 2.7G
- Available with PFC
- Space saving
- Reduced number of maintenance points (<40%)
- One tool and all operations from the front
- Standalone coupled to existing circuit breaker/contactor
# Advanced Motor Control

## Variable Speed Drives

<table>
<thead>
<tr>
<th>Drive products</th>
<th>Drive products</th>
<th>Drive systems</th>
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<th>Drive systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV630/650</td>
<td>ATV930/950</td>
<td>ATV660, ATV6A0</td>
<td>ATV680, ATV6B0</td>
<td>ATV960, ATV9A0</td>
</tr>
</tbody>
</table>

### Drive products for pumping & fan applications
- ATV660, ATV6A0 compact drive systems
- ATV680, ATV6B0 low harmonic drive systems
- ATV960, ATV9A0 high performance drive systems

### Main standards and certifications
- IEC, NEMA, DNV, UL
- EN/IEC, UL
- EN/IEC, UL, IEEE 519
- EN/IEC, UL

### Motor voltage range
- 200…240 V
- 380…480 V

### Motor power range
- 0.75…315 kW
- 0.75…1,200 kW
- 90…1,200 kW

### Application segments
- Mining Metals & Minerals
- Wastewater
- Oil and Gas
- Marine

### Motor applications
- Compressor
- Fan
- Pump
- Artificial lift
- Conveyors
- Crushing
- Mills
- Special cranes
- Archimedes screws
- Centrifugal and volumetric pumps
- Compressors
- Fans
- Oil and fuel pumps
- Archimedes screws
- Centrifugal and volumetric pumps
- Compressors
- Fans
- Oil and fuel pumps
- Artificial lift
- Centrifuges
- Conveyors
- Hoisting
- Mills
- Mixers
- Slurry pumps

### Motor Management functions
- Motor control for asynchronous and synchronous motors
- Smart services: power measurement, Web server, dynamic QR code
- Advanced features for single pump and multipump system management
- Advanced features for power consumption and pumping system monitoring
- Advanced motor control for asynchronous, synchronous, and special motors
- Smart services: power measurement, Web server, dynamic QR code
- Full digital Master/Slave
- EcoStruxure™ Plant Hybrid DCS process automation systems
- Motor control for asynchronous and synchronous motors
- Smart services: power measurement, Web server, dynamic QR code
- Open loop control
- No braking nor 4Q
- Multi-pulse solutions
- Motor control for asynchronous and synchronous motors
- Smart services: power measurement, Web server, dynamic QR code
- Open loop control
- Motor braking
- Low harmonic drive (for THDI <5%)
- Motor control for asynchronous and synchronous motors
- Smart services: power measurement, Web server, dynamic QR code
- Open and closed loop control
- Motor braking
- Multi-pulse solutions
- Embedded dual Ethernet

### Motor Management benefits
- Up to 60% energy savings on standby due to the innovative "Stop & Go" operation
- Designed for harsh environments (IEC/EN60721 3C3-3S3, and high temperature range)
- Improved lifetime of the system due to pump protection and monitoring features
- Optimization of pumping system operating point
- Up to 60% energy savings on standby due to the innovative "Stop & Go" operation
- Designed for harsh environments with high level of conformal coating on circuit boards and high temperature range
- Excellent motor performance on any type of motor
- Total control of any kind of coupling in master/slave applications
- Up to 60% energy savings on standby due to the innovative "Stop & Go" operation
- Fully customizable drive systems
- Ready-to-use drive systems
- Tested at full load
- Up to 60% energy savings on standby due to the innovative "Stop & Go" operation
- Designed for harsh environments with high level of conformal coating on circuit boards and high temperature range
- Fully customizable drive systems
- Ready-to-use drive systems
- Tested at full load

---

For typical motor characteristics: | Eff=0.96 | PF=0.88 |

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### Variable Speed Drives

<table>
<thead>
<tr>
<th>Drive systems</th>
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<th>Drive systems</th>
<th>Drive systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV980, ATV9B0</td>
<td>ATV990 MultiDrive systems</td>
<td>ATV61 Plus drives for variable torque</td>
<td>ATV61 Plus-Marine drives for variable torque</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ATV71 Plus drives for heavy duty industry</td>
</tr>
</tbody>
</table>

#### Main standards and certifications
- EN/IEC, UL, IEC 519
- EN/IEC, UL, ATEX, IEEE 519
- DNV, BV, CCS, LR, IEEE 519
- EN/IEC, UL, ATEX, IEEE 519

<table>
<thead>
<tr>
<th>Motor voltage range</th>
<th>380...480 V</th>
<th>380...690 V</th>
<th>380...690 V</th>
<th>380...690 V</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Motor power range</th>
<th>1...1,000 kW</th>
<th>1...2,400 kW</th>
<th>90...2,400 kW</th>
<th>1...2,400 kW</th>
</tr>
</thead>
</table>

#### Application segments
- **Motor applications**
  - Artificial lift
  - Centrifuges
  - Conveyors
  - Crushers, slurry pumps
  - Hoisting
  - Mills
  - Mixers
  - Industrial cranes for heavy loads
  - Harbor cranes
  - Overhead traveling and gantry cranes
  - Tunnel boring machines
  - Archimedes screws
  - Centrifugal and volumetric pumps
  - Compressors
  - Fans
  - Oil and fuel pumps
  - HVAC applications
  - Propulsion
  - Seawater and mud pumps
  - Thrusters (azimuth, tunnel, and jet thrusters)

#### Motor Management functions
- Advanced motor control for asynchronous, synchronous, and special motors
- Smart services: power measurement, Web servers, dynamic QR code
- Open and closed loop control
- Motor braking and 4Q applications
- Highly efficient power regeneration
- Embedded dual Ethernet
- Motor control for asynchronous and synchronous motors
- Open loop control
- No braking nor 4Q applications
- Low harmonic variant for THD <5%
- Multi-pulse solutions
- Motor control for asynchronous and synchronous motors
- Open loop control
- No braking nor 4Q applications
- Low harmonic variant for THD <5%
- Multi-pulse solutions

#### Motor Management benefits
- Up to 60% energy savings on standby due to the innovative "Stop & Go" operation
- Fully customizable drive systems
- Ready-to-use drive systems
- New low harmonic system concept based on unique 3-level technology
- Improved lifetime of the motor due to reduced voltage load
- Less heat loss compared to the classic AFE architecture
- Fully customizable drive systems
- Ready-to-use drive systems
- Tested at full load
- Designed for harsh environments IP55 (water-cooled)
- Fully customizable drive systems
- Ready-to-use drive systems
- Tested at full load
- Designed for harsh environments IP55 (water-cooled)
- Fully customizable drive systems
- Ready-to-use drive systems
- Tested at full load
- Designed for harsh environments IP55 (water-cooled)
## Advanced Motor Control

### Variable Speed Drives

<table>
<thead>
<tr>
<th>Drive systems</th>
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<th>Drive systems</th>
<th>BlokSet PMCC/PMCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV71 Plus-Marine</td>
<td>ATV6000</td>
<td>Altivar 1200H</td>
<td>VSD</td>
</tr>
</tbody>
</table>

**ATV71 Plus-Marine drives for heavy duty industry**

**Medium voltage variable speed drive**

**Medium voltage variable speed drive**

**LV motor control center**

### Main standards and certifications

<table>
<thead>
<tr>
<th>ATV71 Plus-Marine</th>
<th>ATV6000</th>
<th>Altivar 1200H</th>
<th>VSD</th>
</tr>
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<tbody>
<tr>
<td>DNV, BV, CCS, LR, IEEE 519</td>
<td>EN/IEC, IEEE 519, EAC, CSA, UL</td>
<td>EN/IEC, IEEE 519, GOST</td>
<td>IEC</td>
</tr>
</tbody>
</table>

### Motor voltage range

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<tr>
<th>ATV71 Plus-Marine</th>
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<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>380…690 V</td>
<td>2.4…13.8 kV</td>
<td>2.4…10 kV</td>
<td>Up to 690 V</td>
</tr>
</tbody>
</table>

### Motor power range

<table>
<thead>
<tr>
<th>ATV71 Plus-Marine</th>
<th>ATV6000</th>
<th>Altivar 1200H</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>90…2,000 kW</td>
<td>300…20,000 kW</td>
<td>240…7,000 kW</td>
<td>Up to 160 kW</td>
</tr>
</tbody>
</table>

### Application segments

- **Motor applications**
  - Hoist applications (winches, cranes)
  - HVAC applications
  - Propulsion, thrusters
  - Seawater and mud pumps
  - Top drive, rotary table
  - Conveyor
  - Ball mill
  - Crusher
  - Fan
  - Pump
  - Compressor
  - Extruder
  - 2Q applications
  - Ball mill
  - Compressor
  - Conveyor
  - Fan
  - Pump
  - Centrifugal pump
  - Compressor
  - Fan
  - Volumetric pump

### Motor Management functions

- Motor control for asynchronous and synchronous motors
- Dedicated application control features
- Motor protection
- Load and Energy monitoring
- Speed and torque control mode
- Master slave up to 10 drives
- Open and closed loop control
- Soft start function, incl. synchronization and bypass
- IIoT-enabled solution
- Motor control for asynchronous and synchronous motors
- Multi-level topology featuring a 18-48 pulse diode rectifier and a low-voltage IGBT (THDi<3%)
- Large 10'' touch screen
- Soft start function (including synchronization and bypass)
- Multi-motor control
- Master-slave and droop control
- Motor control for asynchronous and synchronous motors
- LV distribution and motor control switchboard integrating VSD
- Mixed feeders power distribution/motor control
- Fixed/withdrawable functional units

### Motor Management benefits

- Fully customizable drive systems
- Ready-to-use drive systems
- Tested at full load
- Designed for harsh environments IP55 (water-cooled)
- For on- and off-shore applications
- Service Oriented Offer. Increase availability and reduce downtime for service continuity by 20%
- Digital Services (EcoStruxure™ Asset Advisor). More uptime & shorter recovery time with predictive maintenance and reduced TCO by up to 20%
- Energy management. Optimize usage of energy and reduce consumption by up to 30%
- Process optimization. Improve productivity and availability by up to 20%
- Tailored solutions. Optimize your operation efficiency and investment (time & expenditure)
- Seismic UBC4, high altitude 2000 - 4000 m.a.s.l
- Complete range of services
- Open to most communication networks
- All-in-one cabinet for reduced installation costs and quick commissioning
- Adapted to retrofit integration for DOL-operated motors
- IAC 85 kA/0.4 s
- Seismic 2G
- EtherNet/IP
- dv/dt harmonic filters embedded
- Flexible and simple keypad
- Recommended communication architecture with TVDA

---

For typical motor characteristics: | EFF=0.96 | PF=0.88 |
## Variable Speed Drives

<table>
<thead>
<tr>
<th>Okken PMCC/iPMCC VSD</th>
<th>Model 6 MCC/iMCC VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV motor control center</td>
<td>Distribution and motor control switchboard</td>
</tr>
<tr>
<td>IEC, DNV, RINA, BV, Shell DEP, EAC (GOST), CCC</td>
<td>NEMA, CSA, UL, ABS</td>
</tr>
<tr>
<td>380…690 V</td>
<td>208…600 V</td>
</tr>
<tr>
<td>Up to 160 kW</td>
<td>0.75…250 kW (1…350 HP (500 HP @480 V))</td>
</tr>
</tbody>
</table>

- Centrifugal pump
- Compressor
- Fan
- Volumetric pump

- Motor control for asynchronous and synchronous motors
- LV distribution and motor control switchboard integrating VSD
- Mixed feeders power distribution/motor control
- Fixed/withdrawable functional units

- Motor control for asynchronous and synchronous motors
- LV distribution and motor control center integrating VSD
- Mixed feeders power distribution/motor control
- Fixed functional units

- IAC 100 kA/0.5 s
- Seismic 2.7G
- EtherNet/IP
- dv/dt harmonic filters embedded
- Flexible and simple keypad
- Recommended communication architecture with TVDA

- IAC 100 kA/0.4 s
- Seismic qualified
- EtherNet/IP
- dv/dt harmonic filters embedded
- Flexible and simple keypad
- Recommended communication architecture with TVDA
Motor Management Offer
Selection Panorama
A Motor Management solution not only provides a method for motor starting, but also includes a protection unit comprising switchgear and protection relays. Schneider Electric offers a wide range of circuit breakers, fuses, contactors, and protection relays integrated in enclosures for protecting the motor and ensuring correct starting, while helping to ensure operator safety by means of type-tested equipment.
Motor Protection and Control (for Asynchronous Machines)

Protection Relays

<table>
<thead>
<tr>
<th>TeSys T</th>
<th>MicroLogic</th>
<th>Easergy P3</th>
<th>Easergy P5</th>
<th>MiCOM P211</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellige nt Motor Management system</td>
<td>Electronic trip unit for ComPact NS/NSX circuit breaker</td>
<td>Compact protection relays</td>
<td>Withdrawable protection relays</td>
<td>Intelligent motor controller and protection relays</td>
</tr>
</tbody>
</table>

Main standards and certifications

| IEC/EN, UL, CSA, DNV, ATEX | IEC, ANSI, UL | IEC | IEC | IEC, UL, CSA, ANSI |

Motor voltage range

| Low voltage | Low voltage | Medium voltage | Medium voltage | Medium voltage |

Motor power range

| 4…560 kW | 0.37…1,250 kW | 200…750 kW | > 500 kW | 200…750 kW |

Application segments

| | | | |

Motor control type

| DOL, star-delta, reverse speed | DOL, soft start, VSD | DOL, soft start, reverse speed, autotransformer | DOL, soft start, reverse speed, autotransformer | DOL |

Motor Management functions

- Communication protocols: EtherNet/IP, Modbus RTU, Profinet-IP, CANopen, DeviceNet
- Custom logic
- Measurements: current, voltage, active, and reactive power
- Protections: current/voltage: over/under, thermal protection, etc.
- Current/voltage phase and balance, load shedding, auto restart
- Motor temperature sensors: PTC, NTC, etc.

- 4 levels of protection against overloads and short circuits
- 4 types of measurement: A (Ammeter), E (Energy), P (Power)
- Measurement accuracy: Class 0.5 for voltage, class 1.5 for current and class 2 for active power and energy
- Compatible with both Ethernet and Modbus SL protocols
- Extensive communication protocols
- Motor protection: overcurrent, earth fault, thermal overload, start-up supervision, restart inhibition, differential
- Embedded arc protection (Easergy P3 Advance)
- Built-in virtual injection testing
- 9 communication protocols, including IEC 61850, Profinus, DeviceNet
- Intuitive withdrawable design
- Built-in arc flash protection function
- Nearby control with a mobile app
- 7 communication protocols, including IEC 61850
- Advanced cybersecurity IEC 62443
- Appropriate for use in MV and LV applications
- Easily adaptable and equipped with Modbus RTU protocol
- Modbus RTU protocol allows interfacing with substation control and SCADA systems
- The relay is housed in a small case for rail or flush mounting

Motor Management benefits

- Advanced motor protection from basic to mission-critical applications
- Warning of potential issues through intuitive prefault alarms
- Maximum flexibility with expandable I/O module
- Adaptable to any process control system through custom programmable logic
- FDR: Fast Device Replacement service with screen to allow easy maintenance
- Integration into a power monitoring system
- Interchangeable, easy to upgrade
- All-in-one compact relay avoiding use of additional relays for measurement
- Simplified configuration with eSetup Easergy Pro setting tool
- Simpler operation and maintenance with the EcoStruxure™ Power Device app
- Off-the-shelf availability of standard configurations
- Enhanced safety
- Simplified configuration with eSetup Easergy Pro setting tool
- Simpler operation and maintenance with the EcoStruxure™ Power Device app
- EcoStruxure Power Build for quicker and easier ordering
- Cost-effective, flexible solution featuring a wide range of functions
## Protection Relays

<table>
<thead>
<tr>
<th>Easergy MiCOM P24x</th>
<th>Easergy Sepam 60 &amp; 80</th>
<th>Switchboards and Motor Starters</th>
<th>ComPact NS/NSX</th>
<th>TeSys GV5/GV6</th>
<th>TeSys GV5/GV6PB (NAM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="image1.jpg"><img src="image1.jpg" alt="Easergy MiCOM P24x" /></a></td>
<td><a href="image2.jpg"><img src="image2.jpg" alt="Easergy Sepam 60 &amp; 80" /></a></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rotating machine and motor protection relays
- Protection relays for complex applications
- Molded case circuit breakers
- Thermal-magnetic circuit breakers for motor protection and control
- Motor protection circuit breaker

### Main standards and certifications
- IEC, UL, CSA, ANSI
- IEC, UL, CSA, IACS, EAC (GOST), ANSI
- IEC, EN, CCC, EAC (GOST)
- IEC, UL, CSA, EAC (GOST)
- UL, CSA, NOM

### Motor voltage range
- Medium voltage: 220...690 V
- >500 kW: 0.37...1.25 kW, 55...400 kW, 22...375 kW, 30...500 HP

### Motor power range
- >500 kW: 208......600 V

### Application segments
- Mining, Metals & Minerals
- Oil and Gas
- Wastewater
- Marine

### Motor control type
- DOL, VSD (CT only, 40-70 Hz)
- DOL, soft start, reverse speed, autotransformer
- DOL, soft start, YSD
- DOL, soft start, Star-delta, VSD
- DOL, star-delta, reverse speed

### Motor Management functions
- **Applicable for both asynchronous and synchronous machines**
- **Includes differential protection function (87)**
- **Optimization of thermal image monitoring for machines**
- **Phase-to-ground and inter-turn fault protection**
- **Underload and overload protection**
- **Operating time**
- **Breaker failure**
- **Directional ground fault protection**
- **Directional active and reactive power**
- **Under/overvoltage**
- **Optimized thermal image, temperature monitoring**
- **Field loss**
- **Machine differential protection, Series 80**
- **Tripping context**
- **Flexible installation: any position; switchboard or wall-mounted**
- **Large range of electronic and thermal-magnetic protections**
- **Advanced trip unit with integrated power metering; I, U, P, E, THD, f, CosPhi**
- **Interchangeable trip units to upgrade your panel with smarter functions**
- **Embedded earth leakage protection (ELCB)**
- **Ensures motor protection (Type 1 & 2 coordination)**
- **Electronic protection against short-circuits, overload, phase loss and phase unbalance**
- **Adjustable overload and short-circuit current settings**
- **Field-selectable class of protection: Class 5, 10, 20**
- **2 device motor starter solutions providing Type 1 & Type 2 coordination with TeSys contactors**
- **Built-in thermal memory**
- **Breaking capacity: 36 kA & 70 kA/400 V**
- **Branch circuit protection, Motor overload, phase loss & phase unbalance protection**
- **Adjustable overload and short-circuit current settings**
- **Selectable trip class 5, 10 & 20**
- **2-component solution with IEC or NEMA contactor**

### Motor Management benefits
- **Redundancy and GOOSE messaging via IEC 61850 and Modbus TCP/IP simultaneously**
- **Adaptability to specific applications through logic equations editor or Logipam (ladder) Series 80**
- **Visualize the motor start report and motor trend record on the display and in COMTRADE format**
- **Programmable curve for ANSI 50/51 and ANSI 50N/51N**
- **SIL 2 certification**
- **Two standardized frame sizes**
- **Highly resistant to environmental stress**
- **Local and remote communication with trip alarm**
- **Easy to swap trip units and standardized accessories over time**
- **QR code for accessing information and support**
- **Wide choice of auxiliaries/accessories**
- **Suitable for multiple geographical locations**
- **Easy installation thanks to universal fixing with screws**
- **Highly reliable as the thermal elements include automatic compensation for ambient temperature variations**
- **Suitable for isolation, provides user protection**
- **Built-in thermal memory prevents motor overheating in the event of frequent overload conditions**
- **Remote reset and fault differentiation**
- **Remote indication and electrical voltage releases for emergency stops and interlocks**
- **Automatic compensation for ambient temperature variations**
- **Reduces panel space with 2 components solution**
# Switchboards and Motor Starters

| Motor Protection and Control (for Asynchronous Machines) |
|---|---|---|---|---|
| **TeSys F** | **TeSys B** | **BlokSet PMCC/iPMCC** | **BlokSet MB PMCC/iPMCC** | **Okken PMCC/iPMCC** |
| ![Image](PM105299.png) | ![Image](PM105300.png) | ![Image](PM105301.png) | ![Image](PM105302.png) | ![Image](PM105260.png) |

**Contactors for motor control**
- Bar contactors for motor control
- LV power distribution and motor control
- LV power distribution and motor control
- LV power distribution and motor control

**Main standards and certifications**
- IEC, CCC, CB, UL, CSA, DNV
- IEC, CSA, EAC (GOST)
- IEC
- IEC, DNV, GL, RINA, BV, CCS, ABS
- IEC, DNV, RINA, BV, Shell DEP, EAC (GOST), CCC

**Motor voltage range**
- 220…1,000 V
- 220…1,000 V
- 380…690 V
- 440 or 690 V
- 380…690 V

**Motor power range**
- < 670 kW @ 440 V
- < 450 kW @ 1,000 V
- < 900 kW @ 690 V
- ≤ 250 kW
- ≤ 250 kW

**Application segments**
- Mining Metals & Minerals
- Wastewater
- Oil and Gas
- Marine

**Motor control type**
- DOL, star-delta, reverse speed, etc.
- DOL, autotransf., star-delta, slip-ring motors
- DOL, VSD (standalone)
- DOL, star-delta, reverse speed
- DOL, VSD (standalone)

**Motor Management functions**
- **TeSys F**
  - Integrated in iMCC (with LR9 electronic relay, GV5/GV6 motor circuit breaker)
  - Can be coordinated with fuse and circuit breaker
  - Magnetic latching contactors suitable for long switching times (TeSys CR1F)
  - Control coils can operate in DC mode or from 40 to 400 Hz in AC mode
  - Shock-proof contactor (TeSys FG)
  - Withdrawable type coils
  - Mechanical interlocking with horizontal or vertical mounting kits

- **TeSys B**
  - Control for AC and DC motors (< 2,500 A @ 1,500 VDC)
  - Application in severe switching conditions (AC-4, DC-5, etc. categories)
  - Numerous adaptation possibilities: number and type of poles, number and type of auxiliary contacts, control circuit voltages, mounting bar length and fixing points
  - Mechanical interlocking

- **BlokSet PMCC/iPMCC**
  - Fixed and withdrawable distribution and motor feeders

- **BlokSet MB PMCC/iPMCC**
  - Fixed and withdrawable distribution and motor feeders

- **Okken PMCC/iPMCC**
  - Fixed and withdrawable distribution and motor feeders

**Motor Management benefits**
- **TeSys F**
  - Easy maintenance (withdrawable control coils)
  - Electrical coordination provided by different protection devices (relay, fuse, circuit breaker)
  - Similar frame sizes optimize panel size and reduce assembly time
  - Long mechanical and electrical life and consistent low-voltage architecture ensure low OPEX and safer, more reliable operation

- **TeSys B**
  - Reduced maintenance
  - Designed for high performance applications: high operating rate, high electrical durability, reduced clearance distance, high performance in DC
  - Flexible and adaptable
  - Proven service life 40+ years

- **BlokSet PMCC/iPMCC**
  - IAC 85 kA/0.4 s
  - Earthquake/seismic 2G
  - Up to 36 DOL functional units in a single column
  - EtherNet/IP embedded
  - Recommended communication architecture with TVDA (32 units)
  - Fast device replacement (FDR)

- **BlokSet MB PMCC/iPMCC**
  - IAC 65 kA/0.3 s @ 690 V
  - Up to 8 DOL functional units in the fixed type column
  - Up to 32 DOL functional units in the withdrawable type cubicle
  - Fast device replacement (FDR)

- **Okken PMCC/iPMCC**
  - IAC 100 kA/0.5 s
  - Earthquake/seismic 2.7G
  - Up to 36 DOL functional units in a single column
  - Recommended communication architecture with TVDA (32 units)
  - EtherNet/IP embedded
  - Fast device replacement (FDR)
## Switchboards and Motor Starters

<table>
<thead>
<tr>
<th>Model 6 MCC/iMCC</th>
<th>EasyPact EXE</th>
<th>CBX</th>
<th>MCSet</th>
<th>PIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution and motor control switchboard</td>
<td>Vacuum circuit breaker</td>
<td>Vacuum contactor</td>
<td>MV primary distribution switchboard</td>
<td>MV primary distribution switchboard</td>
</tr>
</tbody>
</table>

### Main standards and certifications

<table>
<thead>
<tr>
<th>Distribution and motor control switchboard</th>
<th>Vacuum circuit breaker</th>
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<th>MV primary distribution switchboard</th>
<th>MV primary distribution switchboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMA, CSA, UL, ABS</td>
<td>IEC</td>
<td>IEC</td>
<td>IEC, EAC (GOST)</td>
<td>IEC, EAC (GOST)</td>
</tr>
</tbody>
</table>

### Motor voltage range

<table>
<thead>
<tr>
<th>Motor voltage range</th>
<th>Model 6 MCC/iMCC</th>
<th>EasyPact EXE</th>
<th>CBX</th>
<th>MCSet</th>
<th>PIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>208...600 V</td>
<td>208...600 V</td>
<td>2.2...13.8 kV</td>
<td>2.2...13.8 kV</td>
<td>2.2...13.8 kV</td>
<td></td>
</tr>
</tbody>
</table>

### Motor power range

<table>
<thead>
<tr>
<th>Motor power range</th>
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<th>MCSet</th>
<th>PIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25...300 kW</td>
<td>0.25...300 kW</td>
<td>100...3,800 kW</td>
<td>Circuit breaker: up to 10,000 kW</td>
<td>Circuit breaker: up to 10,000 kW</td>
<td></td>
</tr>
<tr>
<td>0.33...400 HP</td>
<td>0.33...400 HP</td>
<td>2.2...13.8 kV</td>
<td>Contactor: up to 2,300 kW</td>
<td>Contactor: up to 2,300 kW</td>
<td></td>
</tr>
</tbody>
</table>

### Application segments

<table>
<thead>
<tr>
<th>Application segments</th>
<th>Distribution and motor control switchboard</th>
<th>Vacuum circuit breaker</th>
<th>Vacuum contactor</th>
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<tr>
<td></td>
<td>Distribution and motor control switchboard</td>
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<td>Vacuum contactor</td>
<td>MV primary distribution switchboard</td>
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</tbody>
</table>

### Motor control type

<table>
<thead>
<tr>
<th>Motor control type</th>
<th>Model 6 MCC/iMCC</th>
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<th>CBX</th>
<th>MCSet</th>
<th>PIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOL, star-delta (non-UL), reverse speed, etc.</td>
<td>DOL, soft start, VSD</td>
<td>DOL</td>
<td>DOL</td>
<td>DOL</td>
<td></td>
</tr>
</tbody>
</table>

### Motor control type

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</tr>
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<tbody>
<tr>
<td>DOL, soft start, VSD</td>
<td>DOL, soft start, VSD</td>
<td>DOL</td>
<td>DOL</td>
<td>DOL</td>
<td></td>
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### Motor control type

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<th>MCSet</th>
<th>PIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed and withdrawable version</td>
<td>Fixed and withdrawable version</td>
<td>Fixed contactor</td>
<td>Withdrawable circuit breaker or contactor</td>
<td>Withdrawable circuit breaker or contactor</td>
<td></td>
</tr>
<tr>
<td>Fixed contactor</td>
<td>Fixed contactor</td>
<td>Fixed contactor</td>
<td>Withdrawable circuit breaker or contactor</td>
<td>Withdrawable circuit breaker or contactor</td>
<td></td>
</tr>
<tr>
<td>Up to 10,000 operating cycles with preventive maintenance</td>
<td>Up to 10,000 operating cycles, magnetically held, up to 300,000 with mechanical latch</td>
<td>Up to 6 kA short-circuit breaking capacity</td>
<td>Withdrawable circuit breaker or contactor</td>
<td>Withdrawable circuit breaker or contactor</td>
<td></td>
</tr>
<tr>
<td>A spring-operated mechanism to give the device an opening and closing speed that is independent of the operator</td>
<td>A spring-operated mechanism to give the device an opening and closing speed that is independent of the operator</td>
<td>EasyPact EXE circuit breaker (vacuum)</td>
<td>EasyPact EXE circuit breaker (vacuum)</td>
<td>EasyPact EXE circuit breaker (vacuum)</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker: up to 10,000 kW</td>
<td>Circuit breaker: up to 10,000 kW</td>
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<td>Circuit breaker: up to 10,000 kW</td>
<td>Circuit breaker: up to 10,000 kW</td>
<td></td>
</tr>
<tr>
<td>Contactor: up to 2,300 kW</td>
<td>Contactor: up to 2,300 kW</td>
<td>Contactor: up to 2,300 kW</td>
<td>Contactor: up to 2,300 kW</td>
<td>Contactor: up to 2,300 kW</td>
<td></td>
</tr>
</tbody>
</table>

### Motor Management benefits

<table>
<thead>
<tr>
<th>Motor Management benefits</th>
<th>Model 6 MCC/iMCC</th>
<th>EasyPact EXE</th>
<th>CBX</th>
<th>MCSet</th>
<th>PIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>IAC 100 kA/0.4 s</td>
<td>IAC 100 kA/0.4 s</td>
<td>IAC - AFLR 50 kA/1s</td>
<td>IAC - AFLR 50 kA/1s</td>
<td>IAC - AFLR 50 kA/1s</td>
<td></td>
</tr>
<tr>
<td>Earthquake/seismic qualified</td>
<td>Earthquake/seismic qualified</td>
<td>Earthquake/seismic qualified</td>
<td>Earthquake/seismic qualified</td>
<td>Earthquake/seismic qualified</td>
<td></td>
</tr>
<tr>
<td>Recommended communication architecture with TVDA</td>
<td>Recommended communication architecture with TVDA</td>
<td>Recommended communication architecture with TVDA</td>
<td>Recommended communication architecture with TVDA</td>
<td>Recommended communication architecture with TVDA</td>
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</tr>
<tr>
<td>Ethernet/IP embedded</td>
<td>Ethernet/IP embedded</td>
<td>Ethernet/IP embedded</td>
<td>Ethernet/IP embedded</td>
<td>Ethernet/IP embedded</td>
<td></td>
</tr>
<tr>
<td>Fast device replacement (FDR)</td>
<td>Fast device replacement (FDR)</td>
<td>Fast device replacement (FDR)</td>
<td>Fast device replacement (FDR)</td>
<td>Fast device replacement (FDR)</td>
<td></td>
</tr>
<tr>
<td>Remote control and enhanced safety features</td>
<td>Remote control and enhanced safety features</td>
<td>Remote control and enhanced safety features</td>
<td>Remote control and enhanced safety features</td>
<td>Remote control and enhanced safety features</td>
<td></td>
</tr>
<tr>
<td>Suitable for motors in continuous processes</td>
<td>Suitable for motors in continuous processes</td>
<td>Suitable for motors in continuous processes</td>
<td>Suitable for motors in continuous processes</td>
<td>Suitable for motors in continuous processes</td>
<td></td>
</tr>
<tr>
<td>Simplicity of use</td>
<td>Simplicity of use</td>
<td>Simplicity of use</td>
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<td>Simplicity of use</td>
<td></td>
</tr>
<tr>
<td>QR code for accessing information and support</td>
<td>QR code for accessing information and support</td>
<td>QR code for accessing information and support</td>
<td>QR code for accessing information and support</td>
<td>QR code for accessing information and support</td>
<td></td>
</tr>
<tr>
<td>Can be adapted to be withdrawable</td>
<td>Can be adapted to be withdrawable</td>
<td>Can be adapted to be withdrawable</td>
<td>Can be adapted to be withdrawable</td>
<td>Can be adapted to be withdrawable</td>
<td></td>
</tr>
<tr>
<td>Suitable for motors in frequent start-stop operations</td>
<td>Suitable for motors in frequent start-stop operations</td>
<td>Suitable for motors in frequent start-stop operations</td>
<td>Suitable for motors in frequent start-stop operations</td>
<td>Suitable for motors in frequent start-stop operations</td>
<td></td>
</tr>
<tr>
<td>Reduced maintenance and probability of failure: monitoring of temperature rise, indication of the fault zone</td>
<td>Reduced maintenance and probability of failure: monitoring of temperature rise, indication of the fault zone</td>
<td>Reduced maintenance and probability of failure: monitoring of temperature rise, indication of the fault zone</td>
<td>Reduced maintenance and probability of failure: monitoring of temperature rise, indication of the fault zone</td>
<td>Reduced maintenance and probability of failure: monitoring of temperature rise, indication of the fault zone</td>
<td></td>
</tr>
<tr>
<td>Provided with VAMP arc detection</td>
<td>Provided with VAMP arc detection</td>
<td>Provided with VAMP arc detection</td>
<td>Provided with VAMP arc detection</td>
<td>Provided with VAMP arc detection</td>
<td></td>
</tr>
<tr>
<td>Safety function: easy to use, safety interlock to prevent unauthorized operation</td>
<td>Safety function: easy to use, safety interlock to prevent unauthorized operation</td>
<td>Safety function: easy to use, safety interlock to prevent unauthorized operation</td>
<td>Safety function: easy to use, safety interlock to prevent unauthorized operation</td>
<td>Safety function: easy to use, safety interlock to prevent unauthorized operation</td>
<td></td>
</tr>
<tr>
<td>Motorized withdrawal of the circuit breaker</td>
<td>Motorized withdrawal of the circuit breaker</td>
<td>Motorized withdrawal of the circuit breaker</td>
<td>Motorized withdrawal of the circuit breaker</td>
<td>Motorized withdrawal of the circuit breaker</td>
<td></td>
</tr>
</tbody>
</table>

### For typical motor characteristics

- Eff: 0.96
- PF: 0.88

[se.com/motor-management](se.com/motor-management)

[Motor Management Offer Panorama](se.com/motor-management)
## Switchboards and Motor Starters

<table>
<thead>
<tr>
<th>MV motor control center</th>
<th>Full voltage motor starter</th>
<th>Full voltage motor starter</th>
<th>MV secondary distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main standards and certifications</strong></td>
<td><strong>IEC, BV</strong></td>
<td><strong>IEC, NEMA, UL, DNV, BV, LR, ABS</strong></td>
<td><strong>NEMA, UL</strong></td>
</tr>
<tr>
<td><strong>Motor voltage range</strong></td>
<td><strong>2.2...13.8 kV</strong></td>
<td><strong>2.2...7.2 kV</strong></td>
<td><strong>2.2...7.2 kV</strong></td>
</tr>
</tbody>
</table>
| **Motor power range** | **100...2,400 kW** | **100...4,200 kW** | **100...6,800 kW** | **Circuit breaker: up to 10,000 kW**
| **Contactor: 100...2,300 kW** |
| **Application segments** | **DOL, reverse speed, 2-speed** | **DOL** | **DOL** | **DOL** |
| **Motor control type** | **Compact single-tier fused vacuum contactor (CVX)** | **Standalone or coupled to PIX/MCset switchboard** | **Standalone or coupled to PIX/MCset switchboard** | **Fixed, disconnectable, or withdrawable metal-enclosed switchgear** |
| **LSC2B-PM** | **LSC2A-PI with line disconnector** | **LSC2A-PI with line disconnector** | **SF6 or vacuum technology circuit breakers** |
| **Designed to meet O&G client specifications i.e. DEP Shell** | **All operations from the front** | **All operations from the front** | **switch-disconnector** |
| **Suitable for motor, feeder, and capacitor switching** | **Controls and fully protects the motor with a protection relay** | **Controls and fully protects the motor with a protection relay** | **circuit breakers: SF1, SFset, Evolis** |
| **Motor Management functions** | **Integrates a capacitor bank up to 450 kvar** | **Integrates a capacitor bank up to 450 kvar** | **Disconnector** |
| **Motor Management benefits** | | **Standalone or coupled to PIX/MCset switchboard** | **Fixed, disconnectable, or withdrawable metal-enclosed switchgear** |
| **IAC - AFLR 50 kA/1 s** | **IAC - AFLR 50 kA/1 s** | **SF6 or vacuum technology circuit breakers** |
| **Earthquake/seismic qualified** | **Reduced maintenance and probability of failure: monitoring of temperature rise, indication of the fault zone (MDT relay)** | **all operations from the front** |
| **Directly coupled to PIX switchboard** | **Space saving (375 mm wide in DOL version)** | **Controls and fully protects the motor with a protection relay** |
| **Easy access to the main cabling at the front of the cubicle** | **Simple use, comprehensive interlocking, with all operations from the front** | **Motor starter contactor: CVM** |
| **Space saving, 400 mm wide panel** | **Local cost-effective reactive power compensation** | | **Easy installation and maintenance** |
| **Compact** | **Standardized engineering** | | **Easy and safe to operate** |
| **Easy to operate** | | | **Easy extension** |
Motor Management Offer
Selection Panorama
Power Quality

Choosing the correct capacitor bank, harmonic mitigation system, or transformer will ensure correct operation of the motor in the process with minimum impact on the power supply system. 30 to 40% of business downtime is caused by power quality disturbances; 60% of motor failures are due to overheating, for which poor power quality is a common cause.

Power Factor Correction: Capacitor Banks.........p. 38
Harmonic Mitigation Transformers (in. & out.).....p. 38
Transformers (indoor & outdoor).......................p. 39
## Power Quality

### Power Factor Correction: Capacitor Banks

<table>
<thead>
<tr>
<th>VarSet LV</th>
<th>VarSet LV with detuned reactor</th>
<th>BlokSet DC</th>
<th>AccuSine PCS+ (LV active filters)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="PM105275" alt="Image" /></td>
<td><img src="PM105276" alt="Image" /></td>
<td><img src="PM105277" alt="Image" /></td>
<td><img src="PM105278" alt="Image" /></td>
</tr>
<tr>
<td>LV capacitor banks for smart power factor correction</td>
<td>LV capacitor banks for polluted networks</td>
<td>Integrated power factor correction</td>
<td>LV active harmonic filters</td>
</tr>
</tbody>
</table>

### Main standards and certifications
- IEC, CSA, UL
- IEC, CSA, UL
- IEC
- IEC, UL, cUL, ABS, C-Tick, CE

### Motor voltage range
- 230…690 V (50 Hz)
- 240…600 V (60 Hz)
- 230…690 V
- 380…690 V

### Power range
- 6…1,150 kvar
- 230…690 V (50 Hz)
- 240…600 V (60 Hz)
- 6…1,150 kvar
- up to 540 kvar
- 230…690 V
- 50…250 kvar @ 480 V (60…300 A)

### Application segments
- Mining Metals & Minerals
- Wastewater
- Oil and Gas
- Marine

### Motor Operation Type *
- DOL
- DOL, VSD
- DOL
- VSD

### Motor Management functions
- Reduces voltage drop during motor operation
- Fixed (individual motor or static loads) or automatic type (frequently started motors)
- Applicable in systems with THD <3%
- Reduces voltage drop during motor operation
- Fixed (individual motor or static loads) or automatic type (frequently started motors)
- Applicable in systems with THD <7%
- Avoids harmonic amplification
- Power factor compensation
- Fixed type correction
- For systems with THDi up to 7%
- Reduces voltage drop during motor start and operation
- Ultra-fast response at <2 cycles
- Corrective capability: THDi <3% and near unity displacement power factor

### Motor Management benefits
- Reduced reactive energy billing penalties, saves up to 10% operating expenses
- Improved power system and equipment reliability
- Improved active power capacity of the installation
- Reduced conductor cross-section (motor cable) when installed at the motor terminals
- Reduced reactive energy billing penalties and operating expenses
- Improved power system and equipment reliability
- Improved active power capacity of the installation
- Reduced conductor cross-section (motor cable) when installed at the motor terminals
- Specially designed for networks containing harmonics
- Reduced reactive energy billing penalties
- Easy to install, integrated solution within switchboard
- Benefits from certifications and tests of the BlokSet range
- Complies with harmonic standards worldwide
- Can be operated as a displacement power factor correction and load balancing device independent of or in conjunction with harmonic mitigation
- Maximizes uptime when used for harmonic and/or power factor correction
- Stops voltage sags and flicker due to load current fluctuations

*Motor Operation Type
DOL = rated speed
VSD = variable speed
### Transformers (indoor & outdoor)

<table>
<thead>
<tr>
<th>Oil distribution transformers: Minera</th>
<th>Cast resin transformers:</th>
<th>Minera MP</th>
<th>Minera Ex</th>
<th>BC Imprego</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor-mounted distribution transformer</td>
<td>Cast resin dry-type transformer (including 12-pulse and step-up)</td>
<td>Medium power transformer (MPT)</td>
<td>Oil-type transformer for explosive atmosphere</td>
<td>Vacuum pressure impregnated transformer</td>
</tr>
</tbody>
</table>

### Main standards and certifications
- IEC, ANSI, ABS, AU
- IEC, ANSI, ABS, BS, AU, GOST
- IEC, ANSI, ABS, BS, AU
- IEC, ANSI, BS, AU, DNV, BV, LR
- IEC, ROHS, REACH, DNV, LLOYD’S, VERITAS, etc.

### Motor voltage range
- **Primary:** up to 52 kV
- **Secondary:** up to 36 kV
- **Primary:** up to 40.5 kV
- **Secondary:** up to 36 kV
- **Primary:** up to 170 kV
- **Secondary:** up to 36 kV
- **Primary:** LV up to 36 kV
- **Secondary:** up to 36 kV
- **Primary:** up to 5 MVA

### Power range
- Up to 3.15 MVA
- Up to 15 MVA
- Up to 60 MVA
- Up to 5 MVA

### Application segments
- **Motor Operation Type**
  - DOL, VSD
  - DOL, VSD
  - DOL, VSD
  - DOL, VSD
  - VSD

### Motor Operation Type*
- For MV/LV distribution
- For HV/MV and MV/LV distribution
- For HV/MV/LV transmission and distribution
- For HV/MV/LV transmission and distribution
- Coupling option: Dd0Y11, Zig Zag, extended delta, Yd5y6, angle shifting (±15°)

### Motor Management functions
- Normal, low, or very low level of losses (Ecodesign)
- Normal, low, or very low level of losses (Ecodesign)
- Normal, low, or very low level of losses (Ecodesign)
- Normal, low, or very low level of losses (Ecodesign)
- Normal, low, or very low level of losses (Ecodesign)
- Ambient temperature range: up to 60°C
- Dry-type transformers
- Optional: one or more output windings connected to the rectifier

### Motor Management benefits
- Specific electrical design to match customer requirements
- Can be designed according to the harmonics present on the primary and secondary sides
- Low noise level
- Reduced risk of fault between windings
- Can be designed according to the harmonics present on the primary and secondary sides
- Low noise level
- Reduced risk of fault between windings
- Easy installation and minimum maintenance
- Indoor and outdoor application
- Protected against fire hazards
- Specific electrical design to match customer requirements
- Low noise level
- Secured on-site process and operations
- Electrostatic screen between primary and secondary coils
- Specific electrical design to match customer requirements
- Low noise level
- Secured on-site process and operations
- Electrostatic screen between primary and secondary coils
- Simple and reliable solution for harmonic reduction
- Avoids need for additional switchgear for connection to busbar
- Eliminates need for passive or active harmonic filter on large drives
- Galvanic insulation between network and drive

---

*Motor Operation Type: DOL = rated speed \ VSD = variable speed*
Motor Management Offer
Selection Panorama
Motor maintenance is key to industrial process availability. Through condition assessment or by using historian data, motor and application failures can be avoided in the early stages. Schneider Electric offers an extensive range of products to help you in this approach.

Portfolio Management ...................................................... p. 42
Operation Performance ..................................................... p. 42
Asset Condition Assessment .............................................. p. 42
## Portfolio Mgmt. | Operation Performance | Asset Condition Assessment
--- | --- | ---
EcoStruxure™ Maintenance Advisor | EcoStruxure™ Hybrid DCS | EcoStruxure™ Power | EcoStruxure™ Asset Advisor | TeSys T

### Main standards and certifications

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>IEC/EN, UL, CSA, EAC, GL</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Application segments

<table>
<thead>
<tr>
<th>Mining Metals &amp; Minerals</th>
<th>Wastewater</th>
<th>Oil and Gas</th>
<th>Marine</th>
</tr>
</thead>
</table>

### Motor Management benefits

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maximize operational uptime</td>
<td>• Simplified engineering, operation, and maintenance activities</td>
<td>• Prevent asset failure and reduce downtime</td>
</tr>
<tr>
<td>• Minimize operation and maintenance costs</td>
<td>• Reduced energy consumption and increased process efficiency</td>
<td>• Advanced motor protection from basic to mission-critical applications</td>
</tr>
<tr>
<td>• Maximize workforce productivity and safety</td>
<td>• Avoid downtime</td>
<td>• Warning of potential issues through intuitive pre-fault alarming</td>
</tr>
</tbody>
</table>

### Motor Management functions

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Condition monitoring</td>
<td>• DCS functionality based on HMI/PLC</td>
<td>• On cloud platform</td>
</tr>
<tr>
<td>• Unified workspace to report health of all asset categories</td>
<td>• Ethernet-based architectures</td>
<td>• Condition-based maintenance</td>
</tr>
<tr>
<td>• Clear and understandable asset alerts, with action recommendations</td>
<td>• Single environment for engineering, operation, and maintenance</td>
<td>• Analytics</td>
</tr>
<tr>
<td>• Mobility and workflow capability</td>
<td>• Integrated solution power &amp; process for small and large industries</td>
<td>• Smart alarms</td>
</tr>
<tr>
<td>• Integration with AVEVA IntelaTrac data collection from non-connected or stranded assets</td>
<td>• Full Ethernet redundancy based on IEC 62439</td>
<td>• Dedicated Service Bureau Expert</td>
</tr>
</tbody>
</table>

### Preventive and Predictive Maintenance

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduced planning risks and CAPEX</td>
<td>• Ensure people's safety and avoid electrical fire risks</td>
<td>• Covers all load monitoring and protection needs, from feeders to critical process automation</td>
</tr>
<tr>
<td>• Simplified engineering, operation, and maintenance activities</td>
<td>• Avoid electrical work flow</td>
<td>• Multiple industrial protocols: Modbus, Profinet, CANopen, DeviceNet, Modbus/TCP, and EtherNet/IP</td>
</tr>
<tr>
<td>• Reduced energy consumption and increased process efficiency</td>
<td>• Efficient operations/peace of mind</td>
<td>• Modularity, redundancy, and communication via network, switchgear, trends, and connection to data logging</td>
</tr>
</tbody>
</table>

### Energy Management & Control System

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Full Ethernet redundancy based on IEC 62439</td>
<td>• On Line Condition Monitoring &amp; service bureau</td>
<td>• Machine diagnosis: temperature, voltage, frequency, etc.</td>
</tr>
<tr>
<td>• Electrical asset modeling based on IEC 61850 with TOP/DOWN engineering workflow</td>
<td></td>
<td>• Data logging: voltage, frequency, power, etc.</td>
</tr>
<tr>
<td>• On Line Condition Monitoring &amp; service bureau</td>
<td>• Communication of protocols: Modbus, DeviceNet, Modbus/TCP, and EtherNet/IP</td>
<td>• Measurements: current, power, energy, etc.</td>
</tr>
<tr>
<td>• Cybersecurity certification IEC 63443</td>
<td></td>
<td>• Measurements: voltage, frequency, power, energy, current, etc.</td>
</tr>
</tbody>
</table>

### Predictive Maintenance Software

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maximum flexibility</td>
<td>• Network, switchgear, trends, reports and motor start time after tripping, etc.</td>
<td>• Cover all load monitoring system (motor protection)</td>
</tr>
<tr>
<td>• Adaptability to specific applications through logic equations editor</td>
<td>• Modularity, redundancy, and connection to accessories</td>
<td>• Protection relays for industrial applications</td>
</tr>
<tr>
<td>• Modularity, redundancy, and communication via network, switchgear, trends, and connection to data logging</td>
<td>• Event records are readily available for changes to logic inputs, generated by status alarms</td>
<td>• Oscillographic analysis, disturbance records, fault records, viewing on the LCD display, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Event records are readily available for changes to logic inputs, generated by status alarms</td>
</tr>
</tbody>
</table>

### Distributed Control System (DCS) for hybrid applications

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Covers all load monitoring and protection needs, from feeders to critical process automation</td>
<td>• Multiple industrial protocols: Modbus, Profinet, CANopen, DeviceNet, Modbus/TCP, and EtherNet/IP</td>
<td>• Covers all load monitoring and protection needs, from feeders to critical process automation</td>
</tr>
<tr>
<td>• Warning of potential issues through intuitive pre-fault alarming</td>
<td>• Modularity, redundancy, and communication via network, switchgear, trends, and connection to data logging</td>
<td>• Machine diagnosis: temperature, voltage, frequency, etc.</td>
</tr>
<tr>
<td>• Maximum flexibility with expandable I/O and custom-programmable logic</td>
<td></td>
<td>• Data logging: voltage, frequency, power, etc.</td>
</tr>
</tbody>
</table>

### Easergy P3/P5

<table>
<thead>
<tr>
<th>Portfolio Mgmt.</th>
<th>Operation Performance</th>
<th>Asset Condition Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Covers all load monitoring and protection needs, from feeders to critical process automation</td>
<td>• Multiple industrial protocols: Modbus, Profinet, CANopen, DeviceNet, Modbus/TCP, and EtherNet/IP</td>
<td>• Machine diagnosis: temperature, voltage, frequency, etc.</td>
</tr>
<tr>
<td>• Warning of potential issues through intuitive pre-fault alarming</td>
<td>• Modularity, redundancy, and communication via network, switchgear, trends, and connection to data logging</td>
<td>• Data logging: voltage, frequency, power, etc.</td>
</tr>
<tr>
<td>• Maximum flexibility with expandable I/O and custom-programmable logic</td>
<td></td>
<td>• Measurements: current, power, energy, etc.</td>
</tr>
</tbody>
</table>
## Asset Condition Assessment

<table>
<thead>
<tr>
<th>MicroLogic</th>
<th>Sepam 40, Easergy Sepam 60 &amp; 80</th>
<th>MiCOM 10, 20, Easergy MiCOM 40</th>
<th>Easergy P3/P5</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Electronic trip unit for ComPact NS/NSX circuit-breaker</td>
<td>Protection relays for industrial applications (motor protection)</td>
<td>Comprehensive protection relays</td>
<td>Protection relays</td>
</tr>
</tbody>
</table>

### Main standards and certifications

| IEC, ANSI, UL | IEC, UL, IEEE | IEC, UL, IEEE | IEC |

### Application segments

| Mining Metals & Minerals | Wastewater | Oil and Gas | Marine |

### Motor Management functions

- Measurement of current, voltage, energy, power
- Communication through Ethernet and Modbus SL protocols
- Communication of settings

- Measurements: current, voltage, frequency, power, temperature, etc.
- Data logging
- Machine diagnosis: temperature rise, motor starting time, remaining operating time before overload tripping, waiting time after tripping, etc.
- Reports: motor start trend reports and motor start trends
- Network, switchgear, and self-diagnosis

- Measurements: current, voltage, frequency, power, etc.
- Event records are generated by status changes to logic inputs, outputs, settings, and alarms
- Readily available for viewing on the LCD display
- Fault records
- Disturbance records
- Oscillographic analysis using Easergy Studio software

- Measurements: voltage, current, power, energy, min/max values, harmonic THDi, THDv, voltage sags and swells
- Disturbance record

### Motor Management benefits

- Integration in a power monitoring system
- Modularity, redundancy, and connection to accessories
- Communication via multiple protocols
- Adaptability to specific applications through logic equations editor

- These relays not only improve monitoring conditions, but they also facilitate machine maintenance and save on wiring costs

- Communication via multiple protocols
- Modularity and redundancy
# Asset Condition Assessment

<table>
<thead>
<tr>
<th>PowerLogic PM5000 series</th>
<th>PowerLogic PM8000 series</th>
<th>PowerLogic ION 9000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic multi-function meter</td>
<td>Intermediate meter</td>
<td>Advanced power quality meter</td>
</tr>
</tbody>
</table>

## Main standards and certifications
- IEC/EN, cUL, CE, EAC (GOST), RCM
- IEC/EN, cUL, CE, RCM, EAC (GOST)
- IEC/EN, cUL, CE, RCM

## Application segments

## Motor Management functions
- Monitor control panels with basic metering power, amps, volts, harmonics, alarms, digital I/O
- Class 0.5S (PM55xx 0.2S) active energy accuracy
- Serial and Ethernet communications to tie into SCADA with Modbus/TCP and Modbus
- Monitor critical motors with energy and basic power quality metering
- Class 0.2S active energy accuracy
- Modular digital and analog I/O, and voltage sag/swell detection
- Programmable, including simple control functionality
- Multiple communication options
- Monitor the most critical motors with advanced power quality monitors
- On-board power quality compliance monitoring – ENS0160, IEEE519
- Web-based motor derating curve
- Class 0.1S active energy accuracy
- Modular digital and analog I/O and display options
- Sag/swell and transient detection, disturbance direction detection, flicker
- Programmable, including simple control functionality (ION)
- Multiple communication options
- Cybersecurity event logging and hardening

## Motor Management benefits
- Better understanding of operational costs driven by energy usage
- Alarm to warn of voltage unbalance and harmonic issues
- Trending functionality to track usage and detect changes in energy use that may indicate maintenance issues
- Capture voltage sags that can cause contactor dropout (ITI-CBEMA plots)
- Determine if voltage problems originate from the utility company or from within the facility
- NEMA motor voltage unbalance derating curve
- Better understanding of operational costs driven by energy usage
- Trending functionality to track usage and detect changes in energy use that may indicate maintenance issues
- Capture voltage sags that can cause contactor dropout (ITI-CBEMA plots)
- Determine if voltage problems originate from the utility company or from within the facility
- Detect high-speed transients that cause premature aging (or failure) and motor malfunction
- Use high-speed meter inputs from drive trip signals to record voltage sags causing drive trips
- Timestamp status changes to within ±1 ms to understand the sequence of events for faster issue resolution
Motor Management Glossary

This glossary explains all the technical terms and acronyms used in this high power Motor Management offer selection panorama.

Glossary ............................................................................................................. p. 48
2-speed Motors
Asynchronous motors can be built for 2 different speeds. This can be by means of a Dahlander arrangement, with a common point in the winding, where the ratio between the 2 speeds is always 2. Another method is to use 2 independent windings per phase, allowing any speed. In both cases one speed or the other is selected by changing the wiring of the windings. This will change the number of pole pairs.

4 Quadrants (4Q)
In motor control solutions using variable speed drives, 4-quadrant refers to the capability of the drive to reverse the power flow, for example, for cranes or downhill conveyors, where the load will temporarily transform the motor into a generator.

Advanced Control
A means of control where there is a possibility of gradual starting/stopping and/or control of the speed.

AFLR
Access Front Lateral Rear

Asset Condition Assessment
The assessment consists of providing condition status, alarm, and diagnostic information for a particular asset, motor, generator, transformer, etc.

Autotransformer
In a motor management context, an autotransformer is a power component used to transform the voltage applied to its primary side into a lower voltage, with a common connection between the primary and the secondary. It does not provide any galvanic isolation between the primary and secondary.

Autotransformer Starters
This type of motor starter uses an autotransformer in order to start a motor in 3 steps:

- The motor power is supplied through the autotransformer at a reduced voltage compared to that of the network. The starting current and torque, as well as mechanical stress, are greatly reduced compared to a DOL start.
- After a predefined time, the starting point of the autotransformer is opened, changing it into a series inductance, supplying the motor with a voltage value between the autotransformer and the network voltage. This step provides a higher current and torque allowing the motor to continue to accelerate.
- Finally, the motor is connected directly to the line for the end of starting and continuous operation.

Capacitor Banks
Power factor correction is important for the correct sizing of electrical network components (transformer, cables, etc.) and to avoid penalties on the energy bill. This correction is often achieved by connecting capacitors as a source of reactive energy. When the necessary reactive power is high and the network load is varying, it is necessary to arrange the capacitors in several banks that will be connected sequentially to provide only the required amount of compensation (automatic compensation).

Capital Expenditure (CapEx)/Operational expenditure (OpEx)

- Capital expenditure encompasses all the expenses linked to the installation of an asset.
- Operational expenditure covers all the expenses linked to the operation of an asset. It represents 90% of the total cost of a motor.

Control Systems
Device or set of devices, including software programs, used for controlling the industrial process or machines.
Cooling Types (ONAN, ONAF, OFAF, OFWF, ODWF, ODAF, AN, AF)

Mainly used for transformers, this acronym indicates the type of cooling system used. 2 letters are used to represent a single cooling method and 4 letters are used if 2 methods exist, indicating either inside or outside the tank for oil-immersed transformers or normal or boosted modes for dry-type transformers.

- The first letter indicates the nature of the fluid:
  - O = oil, A = air, W = water.
- The second letter indicates the type of circulation:
  - N = natural convection, F = forced circulation, D = directed circulation.

Distributed Control System (DCS)

System (hardware and software) used to control the process in continuous and hybrid process industries.

Direct-On-Line (DOL)

The starting method is called direct-on-line when a motor is started by connecting it directly to the electrical network line through a contactor or circuit breaker without any other equipment in series with the stator or the rotor. This is one of the least expensive starting methods but it needs a large amount of energy from the electrical network and imposes mechanical and electrical stress on the motor.

Drive Systems

Drive systems are customized variable speed drive (VSD) solutions, fully tested and ready to connect to the electrical network and industrial process.

Energy Management and Control System (EMCS)

Energy management and control systems are used for controlling energy-consuming devices in order to minimize energy demand and consumption.

Fast Device Replacement (FDR)

The capability to replace a configured device with a new one while keeping time and effort to a minimum in order to optimize system availability. The new device boots, is configured with the same parameters as the original device, then switches to operating mode.

Harmonics/5th Harmonic

- Harmonics represent pollution or distortion in the form of the voltage and the current in industrial electrical systems. Harmonics are signals at frequencies which are multiples of the fundamental 50 or 60 Hz in industrial systems.
- The 5th harmonic is produced from the rectifier part of a 6-pulse variable speed drive. It is the highest harmonic in magnitude.

Harmonic Mitigation

Solution for reducing the harmonic content in the electrical system (typically a filtering solution).

Harmonic Voltage Factor

The harmonic voltage factor measures pollution of the voltage in the presence of harmonics (5th and above). It is used for determining derating of the motor. The HVF is typically below 2%, but for some motors it can be up to 3%.

Human Machine Interface (HMI)

Usually comprises a keypad and a (touch) display.

IAC

Internal Arc Classification.

Insulated Gate Bipolar Transistor (IGBT)

Power electronic component used in the input and output stages of variable speed drives.

LSC1/LSC2A/LSC2B(-PI/-PM)

Introduced in 2003 by the standard IEC 62271-200, it defines the loss of service continuity level of a switchboard when opening compartments (other than a busbar, in single busbar designs) as follows:

- LSC1: Other functional units or some of them can be disconnected
- LSC2A: All other functional units can be energized
- LSC2B: All other functional units and all cable compartments can be energized:
  - PI (Isolated Partition): with one or more non-metallic partitions and/or shutters
  - PM (Metallic Partition): with metallic partitions and/or shutters that are intended to be grounded
MDT Relay
Temperature electronic module used for thermal diagnosis in MV switchboards by permanently monitoring the connection temperatures and reducing maintenance costs.

Motor Control Center (MCC)/Intelligent Power & Motor Control Center (iPMCC)
A system integrating intelligent motor protection relays (iMCC) and intelligent circuit breakers (iPCC) in a functional installation system (i.e. switchboard, panel, etc.) providing connectivity to a DCS and/or SCADA through an industrial communications network.

Off-Circuit Tap Changer (Off-Load Tap Changer)
The tap changer is used to modify the transformer ratio in a limited range, such as adapting to the variation in magnitude of the supply voltage. This adaptation is made with the transformer off-load.

On-Load Tap Changer (OLTC)
A tap changer with the possibility to make the adaptation with the transformer on-load.

Power Factor Correction (PFC)
The source (generator, transformer, etc.) is designed for a rated apparent power that is the sum of the active and reactive power. The power factor is the ratio of active power over apparent power. Power factor correction consists of limiting the reactive power the source has to deliver. The reactive power is provided by another source: capacitor banks.

Programmable Logic Controller (PLC)
A device used in automation systems for controlling the industrial process or machines.

Process Control
A device or set of devices controlling the industrial process or machines.

Protection Relays
A protection relay continuously measures the electrical parameters of the equipment it protects, either directly, in low voltage, or through signal conditioners (current transformers and voltage transformers), in medium voltage. When a parameter passes a threshold set by the user, the relay issues an alarm or a trip signal. A trip signal is used to open the circuit breaker connecting the equipment to the network. Modern digital relays also offer metering of acquired and calculated signals, diagnosis of network and equipment, communication, and control-command possibilities.

Reverse Speed
The rotation of the rotor in the opposite direction.

Root Mean Square (RMS)
This is the constant characteristic of alternating current or voltage used for calculating the power dissipation in a load.

Supervisory Control and Data Acquisition (SCADA)
Generic name for monitoring and control systems – used for energy or process control of customer installations.

Slip-ring Motors/Winding Motors
Motors with a wound rotor that can be connected to an auxiliary power supply, or to starting resistor in order to reduce the current on starting and increase the torque.

Soft starter (SS)/Reduced Voltage Soft Starter (RVSS)
Power electronics-based solution used for smoothing motor starting by controlling the current supplied to the motor, without modifying its frequency, in contrast to a variable speed drive. For low voltage applications, the usual term is soft starter (SS), whereas reduced-voltage soft starter is used for medium voltage applications.

Soft Stop
Smooth stopping of the motor, typically for soft-starter devices, by linearly reducing the supplied current. Reduces the mechanical stress on the load, very useful in pump applications.

Star-Delta
Starting method used to reduce the startup current. Needs a motor with a delta arrangement designed for the voltage network. It is first connected to the line with a wye arrangement, being equivalent to a higher voltage motor supplied by a lower voltage. After a delay, the arrangement is changed to delta to finish acceleration and for normal operation. Mainly used for low to medium power LV motors.
Switchboard and Motor Starters

A switchboard is the point at which an incoming power supply divides into separate circuits, each of which is controlled and protected by the fuses or switchgear in the switchboard. Motor starters can be integrated in the switchboard, or connected to it in standalone configuration.

Synchronous/Asynchronous Machine

In a rotating machine, there is one static part, typically called the stator, and another rotating part, called the rotor.

- In synchronous machines, the rotation speed is equal to the speed of the magnetic flux in the stator (i.e. they are synchronized) and to achieve this the rotor is also supplied with energy through a dedicated system.
- In asynchronous machines, the rotor is not supplied with power; it rotates at a speed close to but not equal to the speed of the magnetic flux, and the difference in the speeds is used to provide the energy necessary to make the rotor spin.

Total Cost of Ownership (TCO)

Refers to the cost of the initial investment and operating costs from the purchase of the equipment to its end of life.

Total Harmonic Distortion (THD/THDi)

- THD refers to the ratio of the square root of the sum of the square of the powers of all harmonic components to the power of the fundamental voltage.
- THDi is the same ratio applied to the current.

Transformers

In a motor management context, a transformer is a power component used to transform the voltage applied to its primary side into another voltage, providing galvanic isolation between them. It can be either step-down, where the secondary voltage is lower than the primary, or step-up, where the opposite is true.

Tripping Context

When a digital protection relay issues a trip command it can record several parameters, other than the one at the origin of the trip. These parameters, like currents, voltages, powers, and frequency, are saved together in a record. This record is called a tripping context record.

Variable Speed Drive (VSD) / Variable Frequency Drive (VFD)

- VSDs are electronic power systems used to adapt the speed of an electric motor.
- VFDs are dedicated to AC asynchronous and synchronous motors where the speed is modified by changing the applied frequency.

Tested, Validated, and Documented Architecture (TVDA)

TVDAs are generic solutions supplying comprehensive system documentation, wiring diagrams, HMI application, and project templates that reduce the time required for design, installation, and commissioning.

Torque Control System (TCS)

A patented principle for controlling motors using an LV soft starter, integrated in the ATS48 offer.