Motor Starting and Protection

Keep things moving with protection and control - at every level.

- Essential solutions for stand-alone machinery
- Enhanced solutions for discrete automation
- Advanced solutions for process industries
When it comes to keeping total cost of ownership down and boosting profitability, continuous operation and energy efficiency is essential. This is just what our broad portfolio of motor starting and protection solutions delivers.

Thanks to our best in-class, innovative technology, our solutions prevent downtime and can stand up to any conditions. And with our Selected Optimized Coordination (SOC) tool, choosing the right solution for your needs couldn’t be easier.

So don’t compromise. Keep things moving with protection and control - at every level.
Table of contents

004 Overview
008 Essential solutions
012 Enhanced solutions
016 Advanced solutions
022 Related products
Reduce the total cost of ownership
Easy selection of IE3 compatible solutions

The purchasing price makes up only a fraction of the total cost of ownership. Discover how ABB constant speed motor starting and protection solutions can help drive down the total cost of ownership of your installations.

Cost of purchasing
Cost of running
Cost of not running
Total cost of ownership

Total cost of ownership
The cost of running an electric motor-driven system is reduced to three variables: purchase cost, cost of running and cost of not running. The proportion of the variables change depending on the products and applications.

Cost of purchasing
Even if the purchase price has the least impact on the total cost of ownership, using ABB products significantly decreases the design work and installation and commissioning effort, further driving down the cost of purchasing.

Cost of running
Electrical motors are found everywhere- from simple pumps and fans to more sophisticated applications in the material processing or oil and gas industry. The energy costs contribute decisively to the total costs of a motor system. ABB has been offering premium efficiency IE3 motors for years, leading the way towards even higher energy savings, effectively reducing the cost of running an electric motor-driven system. ABB’s low voltage motor starting and protection solutions are IE3 compatible, offering users of high-efficiency motors solutions with small footprints and low operation energy consumption.

Cost of not running
The most overlooked costs are often the ones incurred by interrupting the process: equipment damage, lost revenue, late fees and lost opportunities, which impact the bottom line. Take an active step in driving down costs of not running, with ABB’s advanced solutions:
- Voltage sags, dips and surges pose no threat thanks to the AF contactor’s electronically controlled coil
- Push-in Spring motor starting solutions provide vibration-proof and robust electrical contact with easier than ever wiring
- Universal Motor Controller and Tmax XT offer advanced motor protection, integrated data and flexible communication as well as market leading software and ABB Ability™ cloud connectivity
Energy-efficient motor starting solutions
Reduce CO₂ emissions with ABB's solutions

One of the biggest challenges of our time is the reduction of CO₂ emissions. ABB’s motor starting solutions are ready for premium efficiency motors and help reduce the CO₂ footprint with energy-efficient technology.

IE3 - Premium efficiency motors
During the starting phase of an IE3 motor, the starting current can be roughly 25% higher than in IE1/IE2 motors, which may lead to unwanted tripping of the protection device. In addition, a correct evaluation of the electrical endurance of the contactor should be carried out. ABB’s control and protection low voltage products are IE3 compatible, offering users premium motor starting solutions, with small footprints.

Selected optimized coordination (SOC) tables
ABB provides coordination tables for the selection of low voltage equipment, specifically tested for starting and protecting IE3 motors in the SOC tool. Essential, enhanced and advanced solutions as introduced in this brochure can be selected there. Product selection for different types of starting methods are available as well, including direct-on-line, star-delta and softstarters.
Usage of coordination tables helps reduce the time for selection and design of solutions as well as the risk of unwanted downtime, e.g. caused by nuisance tripping. This provides protection and safety, further driving down the total cost of ownership.

Link to SOC tables

~80 % of all motors are used in full speed applications
up to 80 % reduced coil energy consumption with the AF contactor range
more than 1800 tested and validated coordination tables available
Motor starting and protection
Keep things moving with protection and control - at every level.

Our broad portfolio of motor starting and protection solutions are fully scalable, allowing you to keep things moving whatever the extent of your operations.
Essential solutions
Get the essentials right with fast, reliable installations

Cut control panel assembly time by up to 50%. This provides savings on labor costs, cuts the total cost of the installation and reduces time to market.

- Wide range of easy-to-use accessories and connection sets
- Push-in Spring technology opens up new possibilities. With its unmatched ease of use, wiring becomes far more intuitive

Ensure continuous operation so that your machines are even more competitive in the market, thanks to reliable connections, reliable power and a reliable partner.

- AF contactors ensure distinct operation in unstable networks and are a major advancement in motor control and power switching
- Push-in Spring motor starting solutions provide vibration-proof and robust electrical contact with easier than ever wiring
- More than 1800 tested and validated coordination tables available in the SOC tool, so that you can quickly and easily choose the right ABB solution

Compact design requires less space in the control panel, allowing you to reduce control panel dimensions and costs.

- Takes up less space in the control panel thanks to AF contactor widths reduced by up to 30%
- Interlocking reversing pairs don’t require spacing between contactors
- Connection kits for reverse/star-delta starters and kits for starter and short circuit protection device (SCPD) connection require less space
- Thanks to 80% coil consumption reduction of AF contactors less heat is dissipated, so that the installation density in the panel can be increased
Essential solutions

Key features

Protection

Short-circuit and overload protection with single devices

<table>
<thead>
<tr>
<th>Model</th>
<th>MS116</th>
<th>MS132</th>
<th>MS132-K</th>
<th>MS165</th>
<th>Tmax XT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<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>
<td><img src="image5.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Motor power at 400 V AC (IEC) and at 480 V AC (UL)

<table>
<thead>
<tr>
<th>From 0.03 up to 15 kW, from ¼ up to 20 hp</th>
<th>From 0.03 up to 15 kW, from ¼ up to 20 hp</th>
<th>From 0.03 up to 15 kW, from ¼ up to 20 hp</th>
<th>From 4 up to 45 kW, from 7 ¼ up to 60 hp</th>
<th>From 0.25 up to 355 kW, from ½ up to 400 hp</th>
</tr>
</thead>
</table>

Key features

<table>
<thead>
<tr>
<th>Protection</th>
<th>Short-circuit and overload protection with single devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase loss sensitivity, switch position ON/OFF, common accessories throughout the complete MS/MO range</td>
<td>Push-in Spring terminals, vibration-proof according to IEC 60068-2-27 and IEC 60068-2-6, self-tightening terminals, tool-less connecting links, phase loss sensitivity, switch position ON/OFF/Trip, magnetic trip indication, common accessories throughout the complete range, ATEX &amp; IECEx certified, UL Type E ratings and UL Type F with AF contactors</td>
</tr>
<tr>
<td>Electronic trip unit Ekip M LIU available up to 800 A, short circuit, overload, phase loss and unbalance protections are embedded in the trip unit. Wide range of internal and external accessories, high breaking capacity</td>
<td></td>
</tr>
</tbody>
</table>

Control

Contactors

<table>
<thead>
<tr>
<th>Contactors</th>
<th>AF09 ... AF1650 (AC-3)*</th>
<th>AF09..K ... AF38..K</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Motor power at 400 V AC (IEC) and at 480 V AC (UL)

<table>
<thead>
<tr>
<th>From 4 up to 560 kW, From 5 up to 900 hp</th>
<th>From 4 up to 18.5 kW, from 5 up to 25 hp</th>
</tr>
</thead>
</table>

Key features

<table>
<thead>
<tr>
<th>Control</th>
<th>Contactors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic AC/DC coil, wide control voltage range, only 4 coils cover 24 V–500 V AC and 20 V–500 V DC</td>
<td>Push-in Spring terminals, vibration proof, electronic AC/DC coil, wide control voltage range, only 4 coils cover 24 V–500 V AC and 20 V–500 V DC</td>
</tr>
</tbody>
</table>

* AC-1 ratings available up to 2850 A.
**Protection**

**Short-circuit protection**

<table>
<thead>
<tr>
<th>MO132</th>
<th>MO165</th>
<th>OS switch fuse</th>
<th>Tmax XT</th>
</tr>
</thead>
</table>

- **Motor power at 400 V AC (IEC) and at 480 V AC (UL)**
  - From 0.03 up to 15 kW, from ¾ up to 20 hp
  - From 4 up to 45 kW, from 7 ¼ up to 60 hp
  - From 5.5 up to 1000 kW, from 7 ½ up to 500 hp
  - From 0.25 up to 450 kW, from ½ up to 500 hp

- **Key features**
  - Switch position ON/OFF/Trip, common accessories throughout the complete MS/MO range, UL type F ratings with AF contactors and EF/TF overload relays
  - Switch position ON/OFF/Trip, common accessories throughout the complete MS/MO range, UL type F ratings with AF contactors and EF/TF
  - Supports many IEC and UL fuse standards. Front, side and motor operated versions. Special terminals: left-right or back-back. Knife contact technology, modular structure. Adjustable shaft, interlocked fuse cover, wide range of accessories
  - Magnetic MA/MF trip units up to 500 A. MA adjustable, MF fixed. Adjustable electronic trip unit with short-circuit protection Ekip M Dip I is up to 1600 A. Wide range of internal and external accessories, high breaking capacity

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**Protection**

**Overload relays**

- TF - Thermal overload relay
- EF - Electronic overload relay

- **Motor power at 400 V AC (IEC) and at 480 V AC (UL)**
  - From 0.06 up to 110 kW and from ½ up to 150 hp
  - From 0.06 up to 710 kW and from ½ up 900 hp

- **Key features**
  - Trip class 10, separate stop button, manual / automatic reset selectable, test function, sealable cover, ATEX & IECEx certified types
  - Trip class 10E, 20E, 30E, separate stop button, manual / automatic reset selectable, test function, sealable cover, ATEX & IECEx certified types
Enhanced solutions
Get robust protection with enhanced safety, control and monitoring

Safety and protection
Enhanced safety and protection for solutions with higher specification requirements.

- Integration in machine manufacturer's systems complying with main standards EN ISO 13849, EN 62061 and IEC/EN 61508
- Trouble-free and economic operation of machines and installations thanks to the monitoring of all important parameters in your three-phase network
- Prevent overheating, overload and insufficient cooling. Irregularities are signaled early to avoid plant downtime

Speed up your projects
Reduce time in planning, designing, assembly and delivery of custom panels to market.

- Use the same starters in Europe, Asia and North America as one contactor coil now handles 100 V – 250 V AC / DC, 50 / 60 Hz
- Push-in Spring allows you to insert both ferruled and rigid cables without the need to use any tools, boosting your productivity like never before
- With more than 1800 tested and validated coordination tables available in the SOC tool, you can quickly and easily choose the right ABB solution

Space-saving
Space is usually very limited for control panels, but our compact solutions are designed to easily fit into your application.

- Motor starters can be controlled directly by PLC thanks to AF contactor versions with low consumption coil, external or built-in PLC interface. No need for interface relays, which requires extra space
- Motor starters up to 3 kW / 3 hp require 90 % less space thanks to ABB’s HF electronic compact starter. At just 22.5 mm width, it still provides motor starting functionalities with embedded protection and safety
Enhanced solutions
Key features

Protection

The short-circuit and overload protection device used for enhanced solutions includes the same protection products and can be selected from the essential solutions group, on pages 10 and 11.

Monitoring and protection

<table>
<thead>
<tr>
<th>Electronic relays</th>
<th>CM-MSS</th>
<th>CM-MPS</th>
<th>CM-TCS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermistor motor protection</td>
</tr>
<tr>
<td>Dynamic interrupted wire detection, short-circuit monitoring of sensor circuit, non-volatile fault storage, remote reset, screw or push-in terminals available, ATEX-certified</td>
</tr>
<tr>
<td>Three phase monitoring relay</td>
</tr>
<tr>
<td>Over-/undervoltage, phase unbalance, phase sequence monitoring, phase failure detection, screw or push-in terminals available</td>
</tr>
<tr>
<td>Temperature monitoring relays</td>
</tr>
<tr>
<td>Different types of sensors and monitoring functions (over-/under-temperature, window monitoring), open- or closed-circuit principle configurable, short-circuit monitoring and interrupted wire detection</td>
</tr>
</tbody>
</table>

Control and protection

Electronic Compact Starter

| HF starter with overload protection | HF emergency stop application |

Motor power at 400 V AC (IEC) and at 480 V AC (UL)

| From 0.18 up to 3 kW, from 0.4 up to 3 hp | From 0.18 up to 3 kW, from 0.4 up to 3 hp |

<table>
<thead>
<tr>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of only 22.5 mm, direct and reverse switching of motors up to 3 kW/400 V AC, integrated overload (trip class 10 A) and phase unbalance protection, fault auxiliary, three reset modes, LED indication</td>
</tr>
<tr>
<td>Safety variants offer same functionality as standard variants, emergency-stop rated up to SIL 3 (IEC 61508-1) and PL e (ISO 13849-1), ATEX certification</td>
</tr>
</tbody>
</table>
## Control

### Contactors

<table>
<thead>
<tr>
<th>AF09Z ... AF38Z</th>
<th>AF09Z..K ... AF38Z..K</th>
<th>AF40 ... AF1650</th>
<th>AFS09Z...AFS38Z</th>
<th>AFS09...AFS750</th>
</tr>
</thead>
</table>

**Motor power at 400 V AC (IEC) and at 480 V AC (UL)**

<table>
<thead>
<tr>
<th>From 4 up to 18.5 kW, from 5 up to 25 hp</th>
<th>From 4 up to 18.5 kW, from 5 up to 25 hp</th>
<th>From 18.5 up to 560 kW, from 30 up to 900 hp</th>
<th>From 4 up to 18.5 kW, from 5 up to 25 hp</th>
<th>From 4 up to 400 kW, from 5 up to 500 hp</th>
</tr>
</thead>
</table>

### Key features

- **Versions for PLC**
  - 24 V DC ≥ 250 mA, or other specific applications: low consumption coil, 24 V DC fast operating time, Semi F47: voltage dips and voltage sags immunity

- **Push-in Spring terminal**
  - vibration proof, versions for PLC 24 V DC ≥ 250 mA, or other specific applications: low consumption coil, 24 V DC fast operating time, Semi F47: voltage dips and voltage sags immunity

- **Built-in or external PLC interface, electronic AC/DC coil, wide control voltage range, only 4 coils cover 24 V–500 V AC and 20 V–500 V DC**

- **Dedicated for safety applications:**
  - mirror and mechanically linked contacts, factory-mounted, cover-shield, guaranteeing the right contactor status and preventing unexpected operations. Versions for PLC 24 V DC ≥ 250 mA: low consumption coil, 24 V DC fast operating time

- **Dedicated for safety applications:**
  - mirror and mechanically linked contacts, factory-mounted, cover-shield, guaranteeing the right contactor status and preventing unexpected operations, electronic AC/DC coil, wide control voltage range. Built-in PLC Interface available AFS116…AFS750
Advanced solutions
Get ahead with intelligent, predictive operations thanks to integrated data and advanced connectivity

Data and precise measurements accessible via flexible communication options ensure reliable operations and efficient energy management. Adapt to future needs without big investments.

- The UMC100.3 is compatible with more communication protocols than any other motor controller. This allows you to have software that enables predictive maintenance and acts as an intelligent data hub.
- The SACE Tmax XT range enables you to monitor and manage a wealth of information easily, no matter where you are and allows you to easily upgrade trip units to suit your changing needs.

Detect problems earlier and prevent plant stand-stills with integrated protection functions as well as extensive diagnostic and status information.

- Protect your motors at all times with the UMC100.3, even if your control or communication system (Ethernet or Fieldbus) breaks down.
- With the SACE Tmax XT up to 30% more data is available on the cloud, making diagnosis and maintenance much easier.
- Ensure continuity of service and equipment protection at all times with the advanced electronic trip unit and intelligent motor management systems.

Design, commissioning and maintenance are easy, cutting costs and saving you time. Flexible design allows you to find a tailor made solution.

- With the UMC100.3, simple software configuration means that you’re always in control. Parameters can be set via quality FDI-based software or directly using the operating panel.
- With the SACE Tmax XT range, simplified installation of frames, integration of circuit breakers into a communication network, trip unit settings performed via front display and bluetooth and Ekip Mobile connectivity, can save you up to 40% time overall.

Integrated and future ready

Continuous operation

Speed up your project

Continuous operation
Advanced solutions
UMC100.3 application example

Connection to DCS, ABB Ability™ System 800xA and gateway for ABB Ability™ EDCS

Industrial Ethernet
- EtherNet/IP™
- Profinet IO
- Modbus TCP

Fieldbus
- Modbus RTU
- DeviceNet™
- Profibus DP

Universal Motor Controller UMC100.3

Manual motor starter

AF contactor

Voltage module

Digital module

Analog / temperature module
Advanced solutions
UMC100.3 key features

Easy expansion for higher functionality
Its modular design means that the UMC meets all motor management requirements, greatly simplifying planning, construction and inventory. Easy-to-attach modules – such as digital expansion modules, analog and temperature modules and voltage modules – give you complete flexibility and cover a wide range of applications.

Integrated into distributed control systems (DCS)
The UMC100.3 connects to ABB Ability™ System 800xA and acts as a gateway for ABB Ability™ EDCS. Due to the support of many communication systems, it also fits into other control systems and programmable logic controllers (PLC).

Software tool FIM UMC edition
The FIM UMC Edition is the standard software that provides all the functionalities you need for effective use of the UMC100.3. Device parametrization and operating and monitoring modes allow a fast and easy configuration of UMC100.3, testing and online diagnosis. Project management is included for the handling of larger projects and the localized software allows for multilingual use.

Communication modules
Fieldbus interfaces are available for Profibus DP, DeviceNet and Modbus RTU. Ethernet interfaces are available for EtherNetIP™, Modbus TCP and Profinet IO. They meet all relevant standards and are tested and approved by relevant certification bodies, to ensure a proper function with the control system. The modules can be mounted in two ways:
- Directly onto the UMC100.3
- Separately in the cable chamber of an MCC

Motor protection
- The UMC provides comprehensive motor protection
- Overload protection for single- and three-phase AC motors according to EN/IEC 60947-4-1
- Rated motor currents from 0.24 to 63 A with integrated measuring system in a single version
- Rated motor currents up to 850 A with external current transformer CT4L / CT5L
- Selectable tripping classes 5E, 10E, 20E, 30E or 40E
- Locked rotor protection
- Phase failure, asymmetry and sequence protection
- Under-/overcurrent protection
- Thermistor motor protection
- Ground leakage detection – internally or using CEM11 sensor
- Limitation of motor starts per time
- Motor protection independent from bus communication

In combination with voltage module VI150/VI155-FBP.0
- Undervoltage/overvoltage protection
- Power supervision
- Power factor supervision (cos φ)
- Voltage-based detection of phase failure, asymmetry and sequence

Motor control
- Integration of the most important motor control functions as ready, easily parameterizable blocks
- Direct, reversing, star-delta starters
- Pole changing Dahlander / Actuator mode
- Inching / jog mode
- Adjustable restart strategy (load shedding)

Extended motor control
- Freely programmable for special, application-specific control functions
- Simple adaptation to specified control functions
- Comprehensive library
- Blocks for logic, counters, timing
- Access to all I/Os and internal signals
**Advanced solutions**

Tmax XT Ekip M Touch LRIU

application example

7 communication protocols plus cloud connectivity

**Fieldbus networks**
- Modbus RTU
- Profibus DP
- DeviceNet™

**Ethernet networks**
- Modbus TCP
- Profinet
- Ethernet/IP™
- IEC 61850

**Ekip Cartridge**
- Ekip Supply
- Ekip CI
- Ekip Com...
- Ekip Com Hub

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**ABB Ability™ EDCS**

XT5 Ekip M Touch LRIU

AF contactor

Interface to the contactor

PTC thermistor

20 M MOTOR STARTING AND PROTECTION
**Advanced solutions**

**Tmax XT Ekip M Touch LRIU**

**Ekip M Touch LRIU**
It allows a large number of specific protections, thus ensuring high trip accuracy and extremely reliable operations, while granting a complete motor protection fully integrated into Tmax XT2-XT4-XT5-XT7 circuit breakers, up to 1250 A.

This solution is even able to interact directly with the contactor and can also be connected to a PTC sensor, to monitor the temperature of the motor and open the contactor in case the motor over heats.

**Ekip M Touch LRIU allows several protection functions:**

- **Overload protection**, with thresholds complying with IEC 60947-4-1 and relevant Annex 2. The tripping time is defined by choosing the appropriate trip class. Moreover, with the thermal memory function always active, the unit trips in a shorter time than the time set for a cold fault condition whenever a new overload occurs before the thermal memory automatically resets.

- **Locked rotor protection**, which ensures the operating conditions defined by IEC 60947-4-1 Annex 2.
  - The “Jam” condition to protect the motor against rotor jamming during normal operation, to ensure the start-up phase is properly performed
  - The “Stall” condition to protect and operate the motor against rotor jamming upon start-up

- **Short-circuit protection**, which guarantees an immediate trip when a short-circuit occurs, thus ensuring the correct start-up in the presence of high current values flowing for some milliseconds.

- **Phase unbalance protection**, which acts against unbalances among the currents circulating in the phases.

- **Earth fault protection**, which trips in case of faults between the phases and the earthing conductor.

- **Undercurrent protection**, which avoids damages to the motor under conditions of reduced or null load.

**Ekip CI module**
The Ekip CI module can be installed into the Ekip Cartridge giving the chance of additional functionalities:

- **PTC connection**: with thresholds complying with IEC 60947-8, it is possible to connect a PTC (PT100) sensor to the trip unit. When the temperature is exceeded the trip unit opens the circuit breaker.

- **Interface to the contactor**: motor protection and operation are optimized when both contactor and circuit-breaker are used. In case of fault, instead of opening the circuit breaker, the trip unit commands the contactor, which can guarantee a consistently higher operation numbers than a circuit-breaker (about 1 million).

**Connectivity and measurements with Ekip M Touch LRIU**
Ekip M Touch LRIU enables connectivity through several communication protocols, and thanks to ABB Ability™ Electrical Distribution Control System, data is always quickly available on the cloud.

Ekip M Touch LRIU also allows measuring of the main parameters of the system with extreme accuracy (current, voltage, energy, power, power factor, etc.).
Complete solutions for control panels

ABB’s broad portfolio offers all you need for your application, at every level.