Motor Starting and Protection

**Essential**
Get the essentials right with fast, reliable installations

**Enhanced**
Get robust protection with enhanced safety, control and monitoring

**Advanced**
Get ahead with smart data and predictive applications, to keep your plant running

- **Integrated and future ready**
- **Continuous operation**
- **Easy to install**
- **Safety and protection**
Contents

Introduction
Solution selector
Essential solutions
Enhanced solutions
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Reduce the total cost of ownership
Easy selection of IE3 compatible solutions

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

<table>
<thead>
<tr>
<th>2011</th>
<th>2015</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE2 minimum</td>
<td>IE3 or IE2 + variable speed drive (for motors 7.5-375 kW)</td>
<td>IE3 or IE2 + variable speed drive (for motors 0.75-375 kW)</td>
</tr>
</tbody>
</table>

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.

~80% of all motors are used in full speed applications
up to 80% reduced coil energy consumption with the AF contactor range
Solution selector

Our broad portfolio of motor starting and protection solutions are fully scalable, allowing you to keep things moving whatever the extent of your operations.

- Continuous operation and energy efficiency
- Best in-class, innovative technology
- Prevents downtime and can stand up to any conditions
- Choosing the right solution for your needs is easy
**Essential solutions**
Get the essentials right with fast, reliable installations

- Easy to install
- Continuous operation
- Space saving

Compressor
Ventilation
Water pump
Easy to install

Cut control panel assembly time by up to 50%. This provides savings on labor costs, cut 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
Continuous operation

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.

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.
Space saving

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 reversing/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 |
|-----------------|----------------|-----------------|-----------------|-----------------|
| MS116 | MS132 | MS132-K | MS165 | Tmax XT |

#### 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 0.03 up to 15 kW, from ¾ up to 20 hp | From 0.03 up to 15 kW, from ¾ up to 20 hp | From 4 up to 45 kW, from 7 ½ up to 60 hp | From 0.25 up to 355 kW, from ½ up to 400 hp |

#### Key features

- Phase loss sensitivity
- Switch position ON/OFF
- Common accessories throughout the complete MS/MO range
- Phase loss sensitivity
- Switch position ON/OFF/Trip
- Magnetic trip indication
- Common accessories throughout the complete MS/ MO range
- Push-in Spring terminals
- Vibration-proof according to IEC 60068-2-27 and IEC 60068-2-6
- Self-tightening terminals
- Tool-less connecting links
- Magnetic trip indication
- Common accessories throughout the complete range
- ATEX & IECEx certified
- UL Type E ratings and UL Type F with AF contactors
- ATEX & IECEx certified
- UL Type E ratings and UL Type F with AF contactors
- 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
Essential solutions

Key features - Protection

### Short-circuit protection

- MO132
- MO165
- OS switch fuse
- Tmax XT

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

| Power Range | From 0.01 up to 15 kW | From 0.03 up to 15 kW, from ¾ up to 20 hp | From 4 up to 45 kW, from 7 ½ 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
- Supports many IEC and UL fuse standards
- Front, side and motor operated versions
- Supportless 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

### Overload protection

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

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

| Power Range | From 0.06 up to 110 kW and from ¼ up to 150 hp | From 0.06 up to 710 kW and from ¼ up to 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

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ABB
**Essential solutions**

**Key features - Control**

### Contactors

| AF09 ... AF1650 (AC-3)* | AF09..K ... AF38..K |

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

- From 4 up to 560 kW, From 5 up to 900 hp
- From 4 up to 18.5 kW, from 5 up to 25 hp

**Key features**

- Electronic AC/DC coil
- Wide control voltage range
- Only 4 coils cover 24 V–500 V AC and 20 V–500 V DC
- 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

*AC-3 ratings available up to 2850 A.
Enhanced solutions
Get robust protection with enhanced safety, control and monitoring

Enhanced solutions
Safety and protection
Speed up your projects
Space saving
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

- 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 require 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 - monitoring, protection & control

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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.

Electronic relays

<table>
<thead>
<tr>
<th>Model</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM-MSS</td>
<td>Thermistor motor protection • 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>CM-MPS</td>
<td>Three phase monitoring relay • Over-/undervoltage • Phase unbalance • Phase sequence monitoring • Phase failure detection • Screw or push-in terminals available</td>
</tr>
<tr>
<td>CM-TCS</td>
<td>Temperature monitoring relays • 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>

Electronic Compact Starter

<table>
<thead>
<tr>
<th>Function</th>
<th>Key features</th>
</tr>
</thead>
</table>
| HF starter with overload protection | 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 |
| HF emergency stop application | From 0.18 up to 3 kW, from 0.4 up to 3 hp |
| Key features | |
| • Width of only 22.5 mm | • Safety variants offer same functionality as standard variants |
| • Direct and reverse switching of motors up to 3 kW/400 V AC | • Emergency-stop rated up to SIL 3 (IEC 61508-1) and PL e (ISO 13849-1) |
| • Integrated overload (trip class 10 A) and phase unbalance protection | • ATEX certification |
| • Fault auxiliary, three reset modes, LED indication | |
# Enhanced solutions

## Key features - Control

<table>
<thead>
<tr>
<th>Contacts</th>
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</tr>
</thead>
<tbody>
<tr>
<td>AF09Z ... AF38Z</td>
<td>AF09Z ... AF38Z.K</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Range</th>
<th>Key features</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 4 up to 18.5 kW, from 5 up to 25 hp</td>
<td><strong>Versions for PLC</strong>&lt;br&gt;24 V DC · 500 mA, or other specific applications: low consumption coil, 24 V DC fast operating time&lt;br&gt;<strong>Semi F47:</strong> voltage dips and voltage sags immunity&lt;br&gt;<strong>Push-in Spring terminals</strong>&lt;br&gt;<strong>Vibration proof</strong>&lt;br&gt;<strong>Versions for PLC 24 V DC · 500mA, or other specific applications:</strong> low consumption coil, 24 V DC fast operating time&lt;br&gt;<strong>Semi F47:</strong> voltage dips and voltage sags immunity</td>
</tr>
<tr>
<td>From 4 up to 18.5 kW, from 5 up to 25 hp</td>
<td><strong>Built-in or external PLC interface</strong>&lt;br&gt;<strong>Electronic AC/DC coil</strong>&lt;br&gt;<strong>Wide control voltage range</strong>&lt;br&gt;Only 4 coils cover 24 V–500 V AC and 20 V–500 V DC</td>
</tr>
<tr>
<td>From 18.5 up to 560 kW, from 30 up to 900 hp</td>
<td><strong>Dedicated for safety applications:</strong> mirror and mechanically linked contacts, factory-mounted, cover-shield, guaranteeing the right contactor status and preventing unexpected operations&lt;br&gt;<strong>Versions for PLC 24 V DC · 500 mA, low consumption coil, 24 V DC fast operating time</strong></td>
</tr>
<tr>
<td>From 4 up to 18.5 kW, from 5 up to 25 hp</td>
<td><strong>Dedicated for safety applications:</strong> mirror and mechanically linked contacts, factory-mounted, cover-shield, guaranteeing the right contactor status and preventing unexpected operations&lt;br&gt;<strong>Electronic AC/DC coil</strong>&lt;br&gt;<strong>Wide control voltage range</strong>&lt;br&gt;Built-in PLC interface available AFS116...AFS750</td>
</tr>
<tr>
<td>From 4 up to 400 kW, from 5 up to 500 hp</td>
<td><strong>Dedicated for safety applications:</strong> mirror and mechanically linked contacts, factory-mounted, cover-shield, guaranteeing the right contactor status and preventing unexpected operations&lt;br&gt;<strong>Electronic AC/DC coil</strong>&lt;br&gt;<strong>Wide control voltage range</strong>&lt;br&gt;Built-in PLC interface available AFS116...AFS750</td>
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</table>

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**Extension**
Advanced solutions
Get ahead with intelligent, predictive operations thanks to integrated data and advanced connectivity.
Universal Motor Controller UMC100.3

The Universal Motor Control UMC100.3 is future-ready – and equipped to take your motor control to the next level. With outstanding ease of use, unrivalled communication, and simple configuration, the smooth running of your operations has never been so simple. ABB's intelligent motor controllers combine motor protection and control functions, fieldbus and Ethernet communication, and fault diagnosis in a single device. They provide detailed operational, diagnostic and service data continuously, giving any plant an effective data source for predictive maintenance systems.

SACE® Tmax® XT

The SACE® Tmax® XT series of Moulded Case Circuit Breakers (MCCBs) are designed to maximize ease of use, integration and connectivity while reliably delivering safety and quality. Rather than just offering standalone protection, they are seen as key elements of the system that give you complete flexibility, extreme breaking capabilities and reliable performance under pressure. With seven different sizes and protection features of up to 1600A there's a solution for every purpose.
Integrated and future ready

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.
Continuous operation

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
Speed up your project

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.
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™
- Profinet DP

Manual motor starter

Universal Motor Controller UMC100.3

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 parameterization 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 EtherNet/IP, 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 CEMS1 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

ABB Ability™ EDCS

XT5 Ekip M Touch LRIU

Interface to the contactor

AF contactor

PTC thermistor
**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.

**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.).
Related products
Complete solutions for control panels

ABB's broad portfolio offers all you need for your application, at every level
Materials
Marketing material

Brochure →

Flyer →

Advertisement →

Website →
Materials
Technical material - Online data sheet

Online data sheets

Access the online data sheet by simply typing http://new.abb.com/products/ and adding either the order code or the type.

For example for AF09-30-10K-11 type:
new.abb.com/products/1SBL137005R1110 or new.abb.com/products/af09-30-10k-11

Clicking directly on the order codes in this document and other material like the catalog will also lead to the online data sheets.

By default, the language is English. By adding the country code in front of the product ID or type code you get the information in your language. Example: http://new.abb.com/products/de/1SAM350000R1011

Country code

Open online data sheets by clicking on the document number

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<tbody>
<tr>
<td>Data Sheet, Technical Information (Part 2):</td>
<td>1SAM300505F0011</td>
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</table>
Materials
Technical material - SOC

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.

You can find SOC tables here

more than 1800 tested and validated coordination tables available
e-Configure is a product and application configuration tool for low voltage products and solutions that provides customers a quick and easy configuration process.

- Browse for products by categories, product code or description
- Retrieve product related information (specs, prices, availability)
- Select and configure products and accessories
- Create, modify and order the bill of material
- Re-order custom configured units

You can find e-Configure here
EPLAN Electric P8 is a CAE tool to create wiring diagrams. EPLAN Pro Panel Professional is a tool for 3D switchboard constructions.

Widely used by panel builders and machine builders in Europe and Asia.

You can find the EPLAN Data Portal here. You can find EPLAN data in the ABB Library here.
Cadenas provides 3D and 2D data for ABB Motor Starting & Safety products.

- Download CAD models in different file formats
- Generate Pdf data sheets

You can find 3D Portal [here](#).