TECHNICAL INFO

MNS 3.0

Low Voltage Switchgear

- Safer, more reliable, more intelligent, more value to customers

ABB's MNS platform for switchgear has been evolving for over 40 years with about 2 millions sections of MNS® switchgear delivered worldwide since the inception of this system in 1973.

MNS® is the registered trademark of the ABB low voltage switchgear system, which has been registered in China since 1996.

ABB Xiamen Low Voltage Equipment Co., Ltd. is ABB's wholly-owned production facility in China for MNS low voltage switchgear.

Our advantages:

- MNS® is ABB's advanced technology product platform, which provides highly safe and reliable Low-voltage Switchgear Assemblies for customers in different segments, including industry, infrastructure, utilities, building, etc.

- Diverse market and customer needs are met by the global R&D system. Our R&D teams are deployed around the world. The Technology Centers for MNS® Switchgear are located in China, Czech Republic, Poland, India, North America, etc.

- We have MNS® production bases and service centers in over 30 locations worldwide to provide our customers with the first-rate global expertise and local service.

- The concept of modular system and pioneering digital technology are innovatively integrated into the MNS digital solution, so that the MNS switchgear keeps up-to-date and becomes a member of the Internet of Things.

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MNS® Switchgear Overview

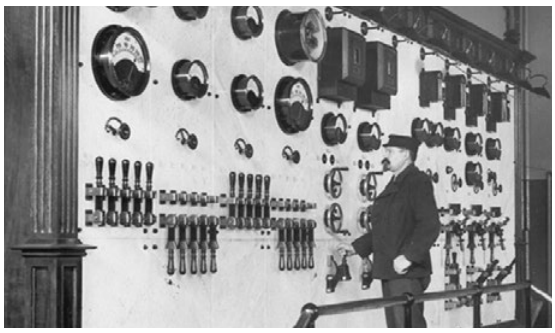
Up-to-date low-voltage switchgear
ABB's MNS platform for switchgear has been evolving for over 40 years with about 2 millions sections of MNS® switchgear delivered worldwide since the inception of this system in 1973. ABB's history in switchgear can be traced back even further, to the 1890's when we first manufactured switchgear systems in Sweden. With these credentials it is no surprise that the MNS system is the benchmark for operational safety, reliability and quality.

Nowadays, the social cost of unexpected power outage is getting higher and higher with the development of integrated automation of process industry. Further demanding requirements have been put forward for the low-voltage switchgear with the rapid development of digital technology & gradually increasing labor cost.

How to minimize the risk of failures in the switchgear and prevent unnecessary downtime so as to increase the system reliability and reduce the operational expenditure as far as possible?

To achieve increased safety/reliability/efficiency, MNS Digital extends the proven system platform, with the latest technologies for data analytics and data communication providing switchgear ready for Industry 4.0. Concept of modular system and digital technology are innovatively integrated into the MNS digital switchgear, so that the MNS® switchgear keeps up-to-date becoming a member of the Internet of Things.

ABB draws on this wealth of background knowledge in designing and manufacturing low voltage switchgear for its global and local customers. MNS® production bases and support networks established in over 30 locations worldwide ensure that the choice of MNS® will be the right decision. When sourcing low voltage switchgear systems from ABB, customers can be assured they are buying the same high-quality design regardless of the factory from which they order, as ABB engineers and project managers collaborate using a global design platform and rich practice experience, ensuring global consistency of design.



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Hofors power station & rolling mills, Sweden, 1890

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Zoetermeer hospital, Netherlands

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MNS Digital Low Voltage Switchgear in ABB Xiamen Hub

Features & Applications

ABB Xiamen Low Voltage Equipment Co., Ltd. is the one and only MNS® low voltage switchgear production base set up by ABB Group in China and introduced the advanced technologies of MNS® modular low voltage system from ABB Germany. The ABB MNS system is a low-voltage switchgear assembly verified in accordance with GB/T 7251.1/2, IEC 61439 -2 and certified according to IEC TR 61641 Ed. 3 guide for testing under conditions of arcing due to internal faults.

Comprehensive application solutions and services

- Full range of low-voltage switchgear solutions can meet the application needs of customers in different industries
- Products and services around the world can help customers develop overseas market
- All-round services can prolong the service life of equipment and shorten the time of field modification

Safe and reliable low-voltage switchgear

- Anti-arc design and complete type tests can ensure the safety of operators
- Effective prevention from high temperature rise, overvoltage and earthquake can ensure the continuous operation of equipment
- Maintenance-free busbars and reliable electrical/mechanical components can effectively prolong the service life of switchgear

Flexible, compact and highly available

- Single front(front access or rear access), back-to-back or duplex (more space-saving) design with different technologies withdrawable, fixed and plug-in are available to meet multiple layout requirements.
- By virtue of the modular design & compact structure, reduced design time, optimized footprint and high-efficient system upgrade & retrofit are all achievable for MNS® Switchgear.
- The withdrawable design provides the better availability and interchangeability to reduce the loss caused by downtime and maintenance.
- Plug-in and fixed designs provide users with scalable and flexible solutions that meet customers' diversified needs across the entire value chain, taking into account the system reliability, availability and flexibility.

Digital intelligent solutions

- Multiple digital and intelligent solutions are used to help customers reduce operating costs
- Intelligent temperature measurement technology is used for realtime monitoring of key components temperature, to reduce the risk of power failure
- Various monitoring and diagnostic data are provided to help customers conduct data analysis and make maintenance plans

Thus MNS® proves to have the approved solutions for the following industries:

- Chemical, oil and gas, on and off shore
- Petrochemical/coal chemical
- Metals, mining and mineral
- Electronics and semiconductors
- Marine
- Cement/glass
- Automotive
- Pulp and paper
- Food & beverage
- Pharmaceutical
- Water

As well as for infrastructure requirements:

- Power stations
- Data centers
- Railway
- Airports
- Hospitals
- Commercial buildings
- Residence community

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Typical Layout

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Technical Data

Standards	Design verified and Type-tested switchgear assemblies			GB/T 7251.1/2, IEC 61439-1/2, EN 61439-1/2, DIN_VDE 0660, Part 500 BS 5486, UTE 63-412
Test certificates	China Compulsory Product Certification(CCC) & CQC Mark Certification			China Quality Certification Centre
	Type tests			ASTA, DEKRA, Shanghai Testing & Inspection Institute For Electrical Equipment Co. Ltd
	Short-circuit withstand strength tests			ASTA, DEKRA, Shanghai Testing & Inspection Institute For Electrical Equipment Co. Ltd
	Resist to accidental arcs acc. to IEC TR 61641 and part 508 of VDE0660			ASTA, Great-Britain
	Classification Society Certification (Ships)			GL, ABS, BV, DNV, CCS
	Earthquake tests for Security Areas in Nuclear Power Stations			DLR German Research Institute / China National Center for Quality Supervision and Test of Electrical Apparatus Products
Electrical data	Rated voltages	Rated insulation voltage Ui		up to 1000V AC, 3P, 1500V DC*
		Rated operational voltage Ue		up to 690V AC, 3P, 750V DC*
		Rated impulse withstand voltage Uimp		6/8/12 kV*
	Overvoltage category			II/III/IV*
	Degree of pollution			3
	Rated frequency			up to 60 Hz
	Rated currents	Main busbars	Rated current Ie	up to 7300 A
			Rated peak withstand current Ipk	up to 264 kA
			Rated short-time withstand current Icw	up to 120 kA, 1s up to 100 kA, 3s
		Distribution bars	Rated current Ie	up to 2000 A
			Rated peak withstand current Ipk	up to 220 kA
			Rated short-time withstand current Icw	up to 100 kA, 1s
		Arc proof	Rated operational voltage	up to 690 V
			Prospective short-circuit current	up to 100 kA
			Duration of short-circuit	300 ms
			Arcing Classification of the Assembly (IEC TR 61641)	Arcing Class C
Mechanical characteristics	Dimensions	Sections and frames		DIN41488
		Recommended height		2200, 2300 mm
		Recommended width		400, 600, 800, 1000, 1200 mm
		Recommended depth		800, 1000, 1200 mm
		Basic grid size		E=25 mm acc. to DIN 43660
	Surface protection/ paint	Frame, Incl. internal subdivisions		Zn or Al-Zn coated
		Cladding, Internal		Zn or Al-Zn coated
		Cladding, external		Plastic, Zn or Al-Zn coated and powder coated RAL 7035 (light grey)
	Degree of protection of enclosure	IEC 60529		up to IP54
	Plastic components	Halogen-free, self-extinguishing		DIN VDE0304 Part 3
		Flame retardant, CFC-free		IEC 60707
	Forms of separation			up to Form 4
	Paint	Enclosure		Standard RAL 7035, other colors on request

* Depending on the electrical equipment.

Operational safety and availability

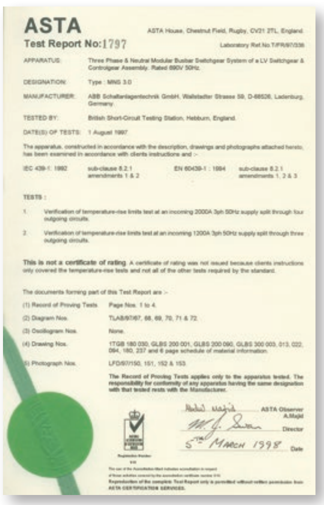
The fulfillment of all instructions of the relevant standards for Low Voltage switchgear and controlgear assemblies assures a basic level for personal and system protection. With MNS, ABB exceeds these levels as a standard. This has been proven by design verification & type tests in accordance with IEC 61439-1 and -2. ABB goes beyond these standards with the proven Safety "Plus" for Operators and Plants and additionally in cases where a high degree of exposure is anticipated, or specific risks (e.g. earthquake risk) have to be observed.

The MNS low voltage switchgear system has been subjected to verification by testing in compliance with the standards. In order to ensure the high degree of safety, ABB continues to conduct tests as per a continuous development program. These tests are based on more critical representative applications of the entire product or performance range of the switchgear with respect to the test standards.

In addition to the above specifications, ABB adopted the standard IEC TR 61641 for testing under conditions of arcing due to an internal fault. To meet the requirements of IEC TR 61641, the switchgear is connected and supplied corresponding to the normal service arrangement. An arc is then initiated within the switchgear, with the point of ignition chosen to probably produce the most stress on the assembly. There are five criteria observed for the tests of personal protection. In line with its ‘Safety Plus’ statement, ABB ensures that all five criteria are met. In addition to these five criteria ABB also meets the additional plant protection criteria as detailed in IEC TR 61641 (criteria 6 and 7).

For more information on arc fault containment the “MNS® Safety Aspects” brochure delivers essential considerations concerning high level of personnel and property safety assured by MNS, such as:

- Basic safety philosophy
- Switchgear assembly verified by testing
- Arc fault protection
- Degrees of protection (IP code)
- Internal separation
- Earthquake, vibration and shock
- Neutral conductor dimensioning



Service conditions & operating environment
MNS switchgear is designed to operate under the environmental conditions as described in IEC 61439-1 & IEC 61439-2. It is essential to keep the installation & operation environment surrounding the switchboard to the design as described in IEC standard. MNS 3.0 low voltage switchgear are type tested switchgear assemblies suitable for indoor installation. Its enclosure protection degree could be as high as IP54 under normal service conditions.

Ambient air temperature for indoor installations

Highest temperature in short-term	+40°C
The highest average temperature in 24 hours	+35°C
The lowest temperature	-5°C

MNS switchgear assemblies are intended for use under the normal ambient air temperature conditions described above. Under certain indoor installation conditions, MNS® switchgear can operate at higher temperatures. In this case, derating factor shall be taken into consideration for the performance of switchgear.

Vendor's instructions shall be followed with regards to the service conditions for measuring and metering instruments as well as protection relays.

Humidity conditions for indoor installations
As per GB/T 7251.1/2, IEC 61439-1/2, EN 61439-1/2 and Part 500 of VDE 0660, the relative humidity of the air does not exceed 50 % at a maximum temperature of +40 °C under normal service conditions.

Where condensation may occur, anti-condensation measures such as ventilation or anti-condensation heater shall be taken into consideration.

Altitude
Under certain installation conditions, MNS® switchgear can operate at an altitude above 2000 m. In this case, derating factor shall be taken into consideration for the performance of switchgear.

Switchgear for other special applications
The surface of the tropical type switchgear has to be coated with special paint.

With accessories and enhanced structural design, MNS 3.0 system can meet the safety requirements for switchgear in earthquake zones.

When the shock resistant separators are added, the switchgear with air circuit breakers or fuse switch disconnectors can meet the requirement of the federal civil defense equipment for civil military defense bunkers with shock resistance value 0.63/6.3.

Standard type MNS 3.0 low voltage switchgear has been tested and certified based on marine standards of German Lloyd's Register of Shipping with resistance against shock of 5-100 Hz.

Special Operating Environment Design
- Tropical
- The earthquake zone
- Shelter
- Marine & Offshore

Switchgear structure

MNS Front Access Switchgear

Functional Compartments and Segregation
The assembly is divided into compartments thus separating different functional areas.

Structure of circuit breaker section

❶ Equipment compartment
The equipment compartment is divided into 3 sub sections, each sub section having its own door.

The center sub section accommodates the circuit breaker and associated equipment in fixed or withdrawable design.

Depending upon the option for cable entry, for example with top entry solution access to incoming connections is via the door in the upper sub section, the auxiliary compartment is then located behind the door in the lower sub section. For bottom entry, the configuration is vice versa.

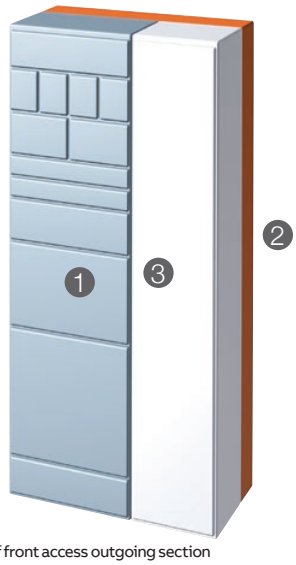
❷ Busbar compartment
Contains the MNS® main busbar system.

Outgoing section structure
❶ Equipment compartment
It is used to accommodate the withdrawable/fixed/plug-in outgoing circuits, such as the withdrawable motor starter circuits.

❷ Busbar compartment
Contains the MNS® main busbar system.
The distribution bars are embedded in the multifunction separator (MFS) which is located between the equipment compartment and the busbar compartment (MFS is not applicable for fixed design).

❸ Cable compartment
Contains control cables and terminals, as well as power cables and connection units. Cable entry may be top or bottom.

Structure of front access circuit breaker section



Structure of front access outgoing section

Switchboard Arrangements

MNS 3.0 front access switchgear can be arranged in the following configurations.

- Standard arrangement as free standing or back to wall
- Duplex arrangement with a common main busbar configuration
- Back to back arrangement with two main busbar configuration

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Free standing

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Back-to-back (no common bus for mounting)

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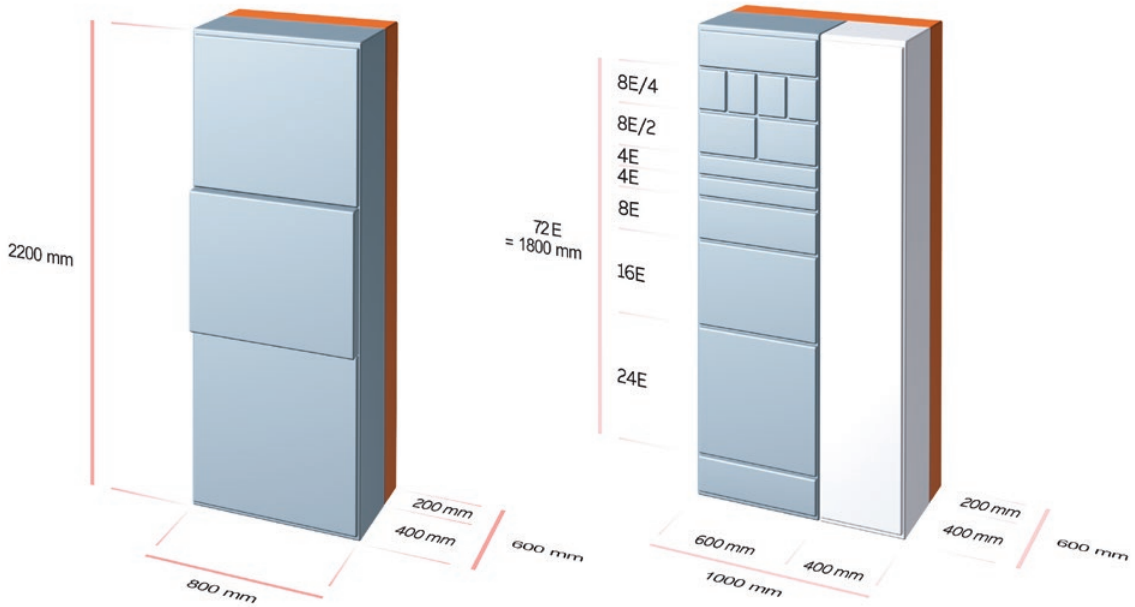
Duplex (common bus for mounting)

Switchboard Dimensions

Dimensions of MNS 3.0 front access switchgear:



Mechanical Design

Frame construction
The basic elements of the MNS frame construction are “C” shaped steel profiles with a 25 mm (1E) hole pitch according to DIN 43660.

Each cubicle is precisely constructed by bolting horizontal and vertical profiles together, to form a rigid modular structure.

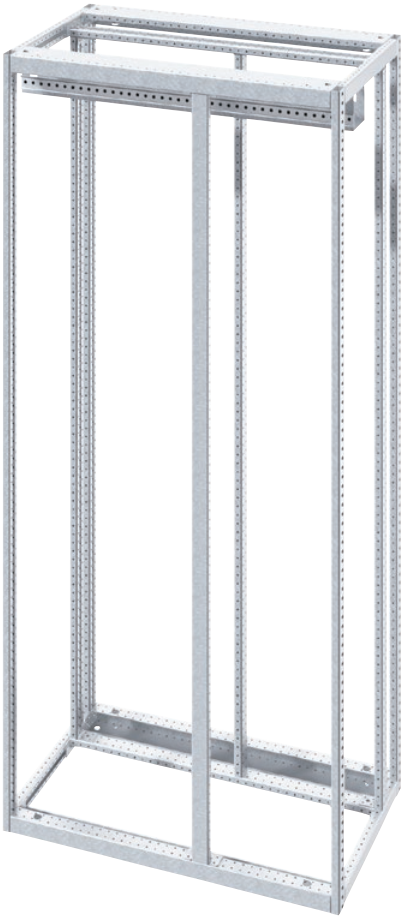
The assembly is maintenance free as a result of the construction method utilizing a combination of thread locking ESLOK screws with bolted pressure plates and thread forming screws.

The profiles are galvanic protected (Zn or Al/Zn) against corrosion.

Enclosure
MNS 3.0 switchboard enclosure is made of sheet steel protected by galvanic coating and powder coating for great durability.

The fixing of the enclosure with respect to doors, roof plates, rear and side walls is achieved with thread forming screws. Final construction varies depending upon the required degree of protection.

In accordance with the general safety philosophy followed with MNS®, each compartment and sub-compartment which requires access for commissioning, operation or maintenance, has its own door.



— Frame construction

— Enclosure

Busbar System

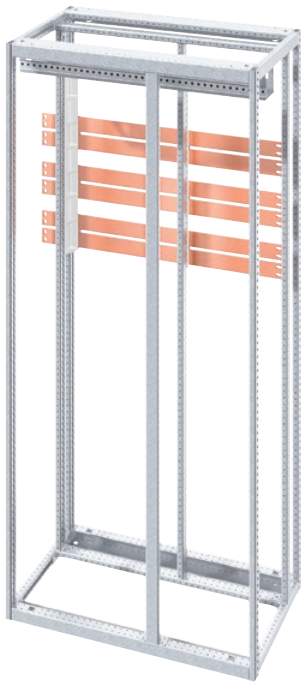
Main Busbars

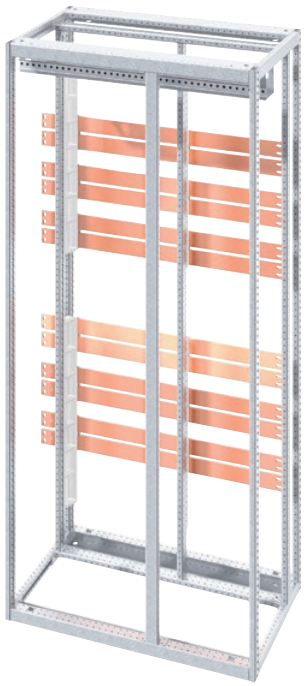
The main busbar system is fully separated from the equipment compartment as well as from the cable compartment thus ensuring a possible maximum distance between the busbars and the operators & maintenance staff.

The busbar system is a maintenance free construction as a result of utilizing thread locking ESLOK screws together with conical spring washers. This technology remains relatively unchanged since the introduction of MNS® switchgear, and has been extensively applied in some demanding industries.

The busbar system and all associated parts are manufactured from copper in accordance with DIN 40500. Options are available for tin / silver plating and/or a fully insulated solution utilizing heat shrinkable sleeving.

The busbars are separated by transport units. The cross-sections can be 20mm × 10mm, 30mm × 10 mm, 40mm × 10 mm, 50mm × 10mm and 60mm × 10 mm.

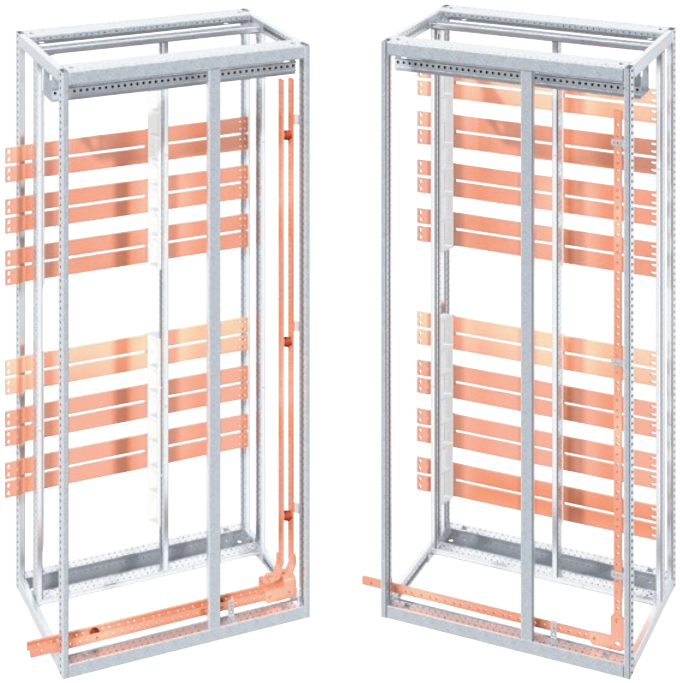


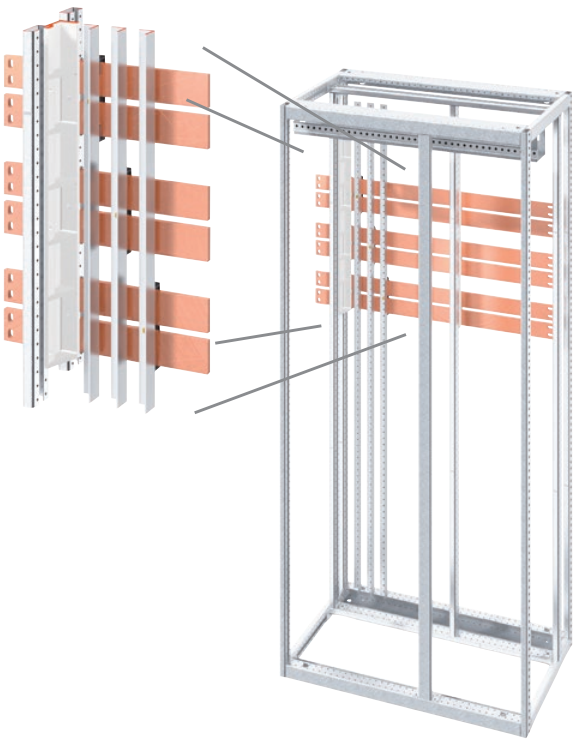


Distribution bars
A fully phase segregated and encapsulated 3 or 4 pole distribution bar system runs the full height of the cubicle. The distribution bars are tin coated as standard and silver coated as optional.
Rated current of distribution bar could be up to 2000 A.

Protective Earth and Neutral Bars
As a standard, protective earth and neutral bars run horizontally within the front of the switchboard just above the base. The PE bar is fastened to the frame to assure electrical continuity. Inside the cable compartment they run vertically, located on the front right hand side of the compartment.

For applications where a 50% or 100% neutral size is required due to unbalance or harmonic distortion as well as for 4 pole switching, the neutral conductor can be arranged within the busbar compartment running in parallel with the main busbars.





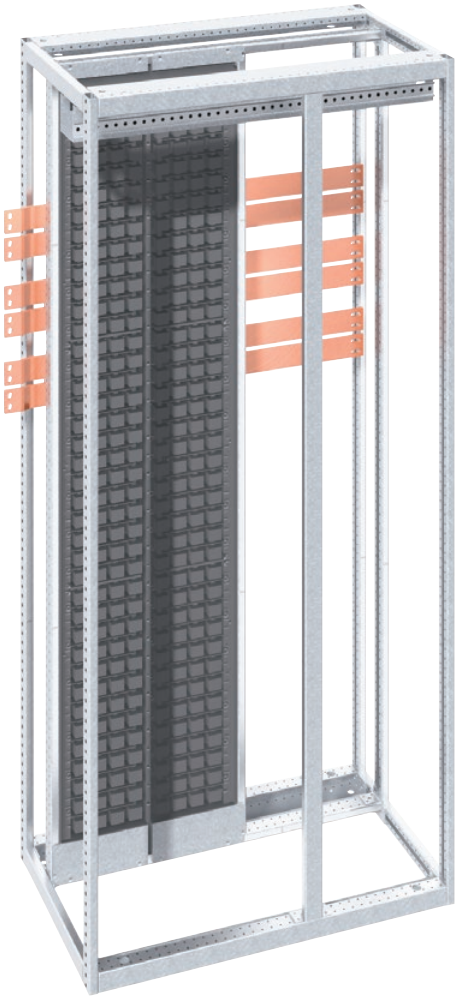
Multifunction Separator
The multifunction separator (MFS) with the embedded distribution bars is a unique MNS 3.0 design. It constitutes a complete barrier between the main busbars and the equipment compartment.

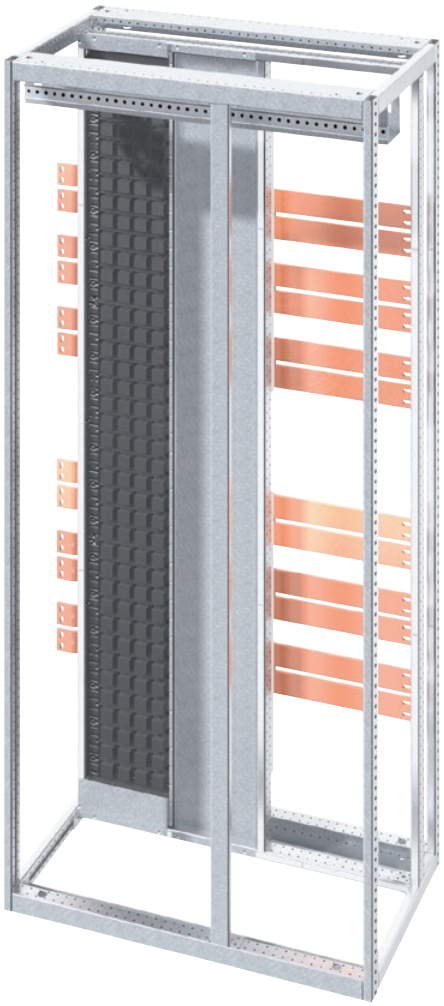
The distribution bars are fully phase segregated and insulated. This design makes it virtually impossible for an arc to pass between distribution bar phases or between main busbars and equipment compartment. The insulation material is CFC and halogen free, flame-retardant and self-extinguishing.

Contact openings are finger proof (IP 2X) so that personal safety is guaranteed even when modules are removed.

With the use of MNS 3.0 specific power contact housings full single phase segregation is assured prior to the connection of the power contacts to the distribution bars.

System Highlights:
- Maintenance free busbars construction
- Easy switchgear extension
- Main busbars arrangement at the rear thus assuring
  - adequate safety to personnel
  - effective withstand against highest stresses in case of short circuit
  - optimum heat dissipation
- Gas tight seals for connection from the equipment compartment to the main busbar system.
- Option for Form 4 separation for both incoming and outgoing assemblies.
- Active and passive arc fault prevention tested according to IEC TR 61641
- Isolating materials are free of CFC and halogens





Design of MNS® rear access switchgear

Highlights

- The rated current of main busbars can be up to 7300 A and the depth of section is up to 1,200 mm only.
- Package and transport for one single section is allowed to enhance the flexibility of site installation.
- The separation inside the cubicle can reach Form 4.
- Design of the switchgear satisfies the requirement for arc fault protection.
- With modularization design, the multifunction separator can form in different heights and segregate the different phases of distribution bars.
- A single section with section width ≥600 mm could be packed as one shipping unit.

An optimized footprint with reduced section width could be achieved by the application of MNS® rear access switchgear. Same materials and functions applied in front access switchgear are also applied for rear access switchgear with respect to the frameworks, door, multifunction separators, power contacts and outgoing units, etc.

The main busbars of the rear access switchgear are horizontally installed at the top front of the switchgear. The rear part of the switchgear is cable compartment, where incoming and outgoing cables are connected. The equipment compartment is at the front, where switches and other devices are installed as the functional unit. The rear access solution dramatically reduces the width of switchgear, so as to fit the substation layout demands in a better way.

The standard width of outgoing sections is 600 mm. Independent main busbar compartment is on the top which is separated from the equipment compartment. The maximum available installation height of 72 E (E=25 mm) is designed for the front equipment compartment which is separated from the rear cable compartment via the multifunction separator. Thus the installation space of the switchgear is fully utilized for a compact structure and flexible unit arrangement. The rear cable compartment has a door for easy installation and maintenance.

The width of the incoming section depends on the current rating of main switching device.

— Structure of rear access incoming / outgoing circuit breaker section

— Structure of rear access outgoing section

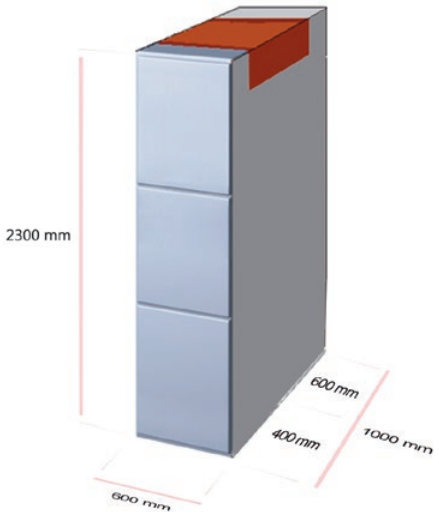
1 **Equipment compartment**

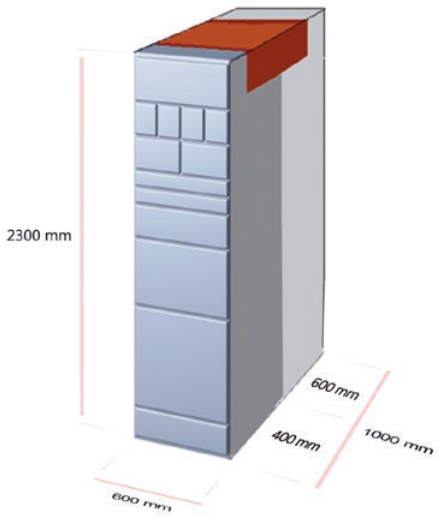
2 **Cable compartment**

3 **Busbar compartment**

Switchboard Dimensions

MNS® rear access switchgear could be configured as single-sided operation only, with the following dimensions.





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Dimensions and main busbar system configuration

Main busbars rated current (In*)	In≤3350 A	3350 A<In≤4000 A	4000 A<In≤5250 A	5250 A<In≤7300 A
Main busbars	Single group busbars	Single group busbars	Single group busbars	Dual group busbars
Depth of Cubicle	1000 mm	1000 mm or 1200 mm	1200 mm	1200 mm
Height of Equipment compartment	72E(1800 mm)	72E(1800 mm)	72E(1800 mm)	64E(1600 mm)

* In: Main bus rated current with degree of protection of enclosure IP42 or below.

Busbar System
The main busbars are installed horizontally in the busbar compartment on the top of the switchgear. Each phase comprises an even number of busbars.

Special structural design is adopted for the main busbar system which optimizes the heat dissipation of the switchgear. Meanwhile, no drilling is needed for the switchgear connection. Installation and maintenance are also easy to realize.

There are two configurations for the main busbar system:
1. Single group busbar system with maximum rated current of 5,250 A.
2. Dual group busbar system with maximum rated current of 7,300 A.

MNS® rear access switchgear adopts “single panel bus bar set”, then every single vertical section has its own bus bar sets; the bus bars of two neighboring sections are linked by bus bar connectors. So package and transport for one single section is allowed to enhance the flexibility of site installation.

Distribution bars
A fully phase segregated and encapsulated 3 or 4 pole distribution bar system runs the full height of the cubicle. The distribution bars are tin coated copper bar as standard and silver coated bar as optional.
Rated current of distribution bar could be up to 2000 A.

Protective Earth and Neutral Bars
As a standard, protective earth and neutral bars are arranged horizontally within the rear of the switchgear. The PE bar is fastened to the frame to assure electrical continuity. Within the cable compartment they run vertically, located on the rear side of the compartment.

For applications where a 100% neutral size is required due to unbalance or harmonic distortion, the neutral conductor can be arranged within the busbar compartment running in parallel with the main busbars.

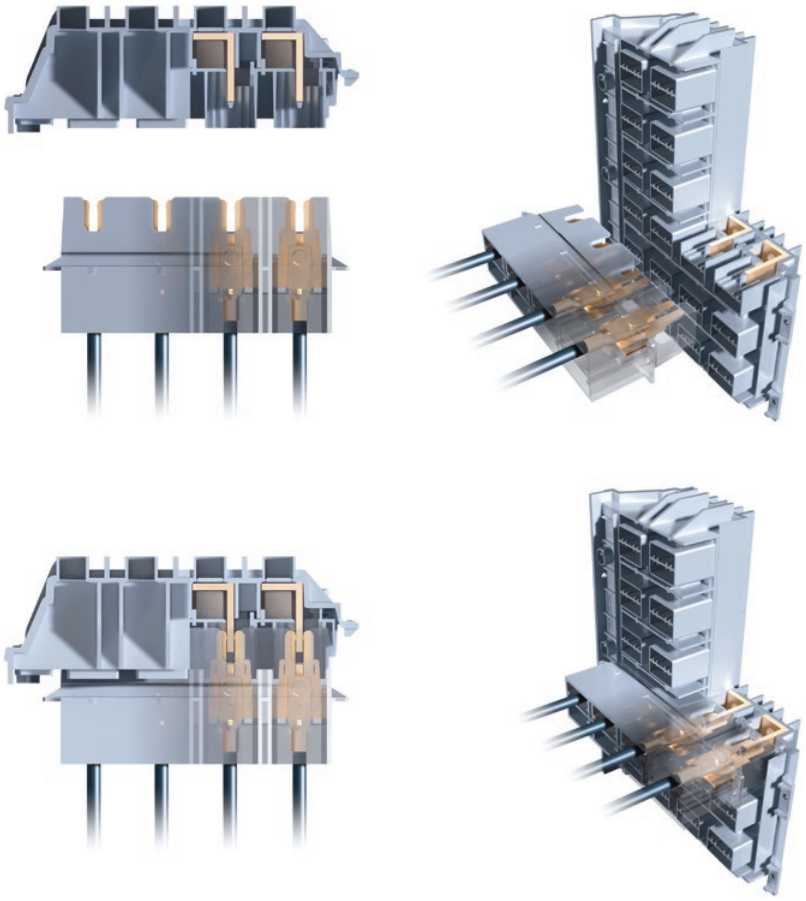
Power Contact
Connection to the distribution bar is realized using the precision-engineered MNS power contacts. MNS® power contact is characterized by a turnable bearing, thus decoupling cable stress and electrical contact. Consequently any cable bending forces cannot affect the stability of the power contact.

The mechanical stabilisation is achieved by the supporting plate and the contact spring where the contact fingers ensure positive electrical contact. Contact fingers are silver plated or tin plated as standard.

The contact has been subjected to several tests in order to prove the sophisticated design and the high quality, which provides a life cycle up to 1000 insertions.

Tests
- Type tests GB/T 7251.1/2, IEC 61439-1/2
- Corrosion tests acc. DIN 50017, IEC 60068-2- 60
- Crimping quality check acc. IEC 61238-1
- Vibration and shock tests acc. IEC 60068-2-6, IEC 60068-2-27

System Highlights:
- Operational life cycle up to 1000 insertions (independently certified), exceeding the requirements of IEC 61439-1.
- Bearing construction eliminating cable stress
- Full single phase segregation assured prior to the connection of the power contacts to the distribution busbars



Incoming solutions

All incoming solutions of the MNS 3.0 system are verified in accordance with GB/T 7251.1/2, IEC 61439-1/2, in addition to IEC 60947-1 required for the switchgear/controlgear/circuit-breakers, and engineered to meet the requirements of IEC TR 61641. This ensures ABB's offering of 'Proven Safety Plus' for operators and plants.

Incoming options
All ACBs have as a minimum the following features:
- Manual charging lever and 'Charged' indication
- Manual Open/Close push buttons
- Mechanical 'Open'/'Closed' indication
- Mechanical signaling of 'Overcurrent' release
- 4 auxiliary contacts

Operation of Emax 2
Emax 2 ACB consists of two parts, namely the fixed part (base) and the mobile part (circuit breaker). Thus, Emax2 can have below three positions:

Connection: The moving part is inserted into the fixed part, and both the main contact and the auxiliary contact are connected. The circuit breaker is operable and the mechanical indicator shows "connected".

Test isolated: The moving part is inserted into the fixed part, with
- Main contact disconnected/auxiliary contacts connected
- Power terminals of the cabinet disconnected/ auxiliary contacts connected.

The circuit breaker can be used for off-line tests, and the mechanical indicator shows "test isolated".

Disconnection: The moving part is inserted into the fixed part, and neither the main contact nor the auxiliary contact is connected. In this position, all electrical operations of circuit breaker are not allowed. Mechanical indicator shows "disconnected". The door of the switch chamber can be kept closed, so the IP class of the switchgear is not affected.

Emax 2 base (fixed part) is fitted with shutters. As a further guarantee of safety, the shutters of the fixed part can be locked from the front when the circuit breaker is removed.

System Integration
Emax 2 series circuit breakers can be highly reliably integrated with all automation and electric energy management systems for efficiency improvement, energy consumption reduction and the implement-ation of remote monitoring.

All circuit breakers can be configured with communication unit compatible with protocols of Modbus, Profibus and Devicenet as well as modernized protocols Modbus TCP, Profinet and Ethernet IP.

— Emax2 series circuit breakers

— Outgoing section

Outgoing solutions

As previously described, the MNS platform is a modular construction enabling flexible configuration of the assembly in accordance with project requirements, the modular assembly comprises:
• Sections
• Functional units

A section is a full height construction based upon the “C” profile frame construction. A functional unit is a sub-assembly contained within the section. The MNS system enables the following solutions to be configured
F – Fixed connection
P – Plug-in connection
W – Withdrawable

MNS 3.0 offers users the scalability they need to take advantage of the customized solutions.

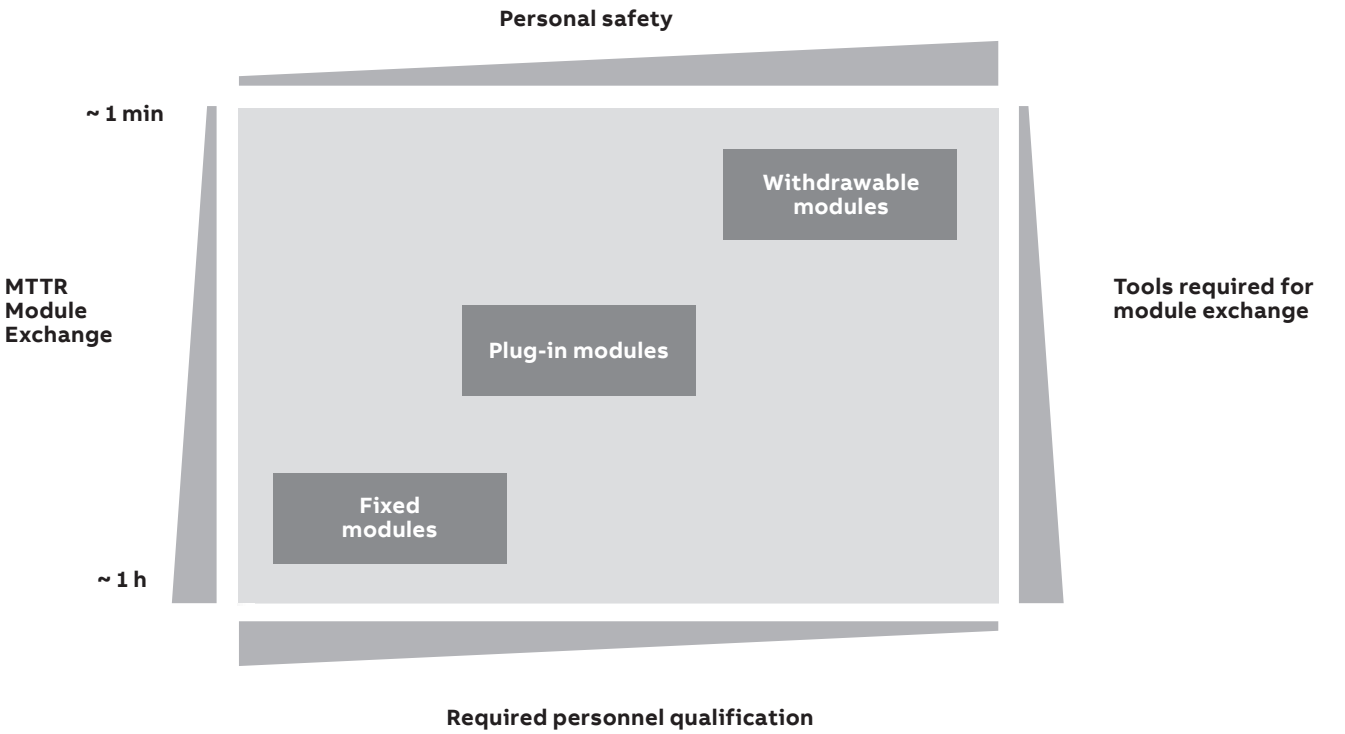
The figure below details the scalability of the system from Fixed to Withdrawable and operational aspects associated with the different functional unit designs. Where high process availability is essential and minimal time is required for module exchange the withdrawable solution has proved to be the optimal choice.

When a longer MTTR (mean time to repair) is allowed, the fixed solution could be a good choice providing more reliable and flexible connections for outgoing units, easily connecting the modules to the supporting frame with screws at any height allowed.

Plug-in design takes advantage of both unique power contact technology of withdrawable solution and flexible component arrangement of fixed solution, therefore plug-in outgoing units could be widely used across a range of industries.

Withdrawable design, fixed design and plug-in design are well compatible to suit various operational requirements with excellent space utilization.

Depending upon the types of outgoing modules selected, the skill sets required for related personnel may differ, but no personnel could work on any electrical apparatus until approval has been granted by the responsible authority and the working environment has been classified as safe.



Plug-in Unit

MNS® offers numerous alternatives for plug-in modules. The target segments for plug-in solution are marine, water treatment, data center, infrastructure, etc.

The flexibility of the system allows power distribution units and motor starter units to be offered in more economical Form 2 solution. From this as a basis, below options are available

- Internal/external operation;
- Internal separation Form 4.

Fixed Unit

ABB's unique fixed switchgear could provide more reliable and flexible connections for outgoing units, easily connecting the modules to the supporting frame with screws at any height allowed.

The fixed front access switchgear offers innovative space-saving design hence enables great footprint reduction compared with other solutions by means of

- space saving on the outgoing section width for energy distribution solutions (more compact module design)
- increased height option within an outgoing section
- shared cable compartment option to reduce overall space further

Withdrawable design, fixed design and plug-in design are well compatible, matching requirements under diverse conditions.

With the advanced digital technology, digital options could be seamlessly integrated into MNS® fixed solution while keeping the cost-effectiveness of switchgear as a basis.

AC Industrial Drives & Softstarters
Thanks to its inherent modular design, MNS can easily be adapted to house the different series of ABB industrial drivers and softstarters. The switchgear can accommodate multiple drives or softstarters in one single section.

Switch fuse is recommended as the standard main protection device. Meanwhile, filter and door mounted control panel can be options for AC industrial drives.

Reactive Power Compensation Solution
MNS 3.0 can provide various compensation solutions for AC system. Compensation solutions with different reactor rates are available. With centralized design, the widths of vertical sections may vary from 600 mm to 1,200 mm based on different compensation capacity. The maximum capacity per section is up to 450kVAR.

—
Variable frequency drive section

—
Softstarter section

—
Capacitor section

Design of Withdrawable Modules

The withdrawable technique of MNS 3.0 system has been proved to be the appropriate solution for industrial applications where requirements for high availability are a must particularly in Motor Control Centers (MCCs).

The withdrawable design enables the replacement of functional units without the necessity of shutting off the power supply, minimizing any loss from an unexpected downtime.

Meanwhile modules can be easily exchanged under service condition thus ensuring the possible maximum flexibility.

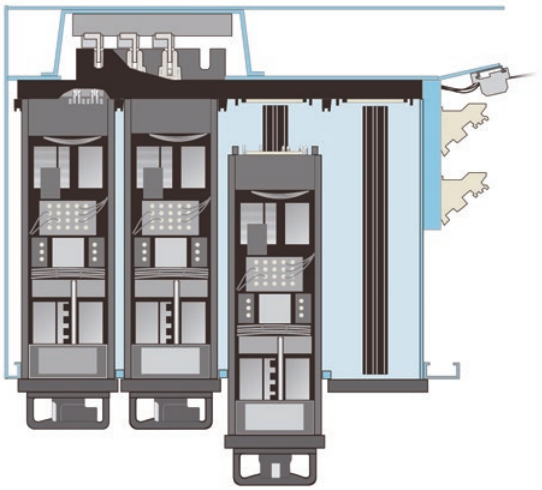
Small modules
Withdrawable technique is distinguished by its compact design where, with the smallest 8E/4 module it is possible to physically define a maximum of 36 modules in the equipment compartment. This modularity enables the user to use the assembly space more efficiently which in turn reduces the overall footprint of the switchgear.

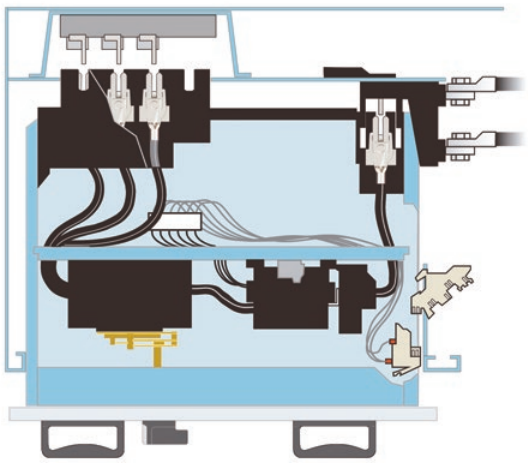
For withdrawable module design there are condaptors to be used to connect the small withdrawable modules to the distribution bars, which allows 2 modules (8E/2) or 4 modules (8E/4) to be located adjacently on the same horizontal position inside the switchgear. Condaptors are available in 3 or 4 pole options. Cable connections for main and auxiliary circuits are integrated into the condaptors and are accessible from the cable compartment.

Full width module
These modules are available ranging from 4E to 24E in physical sizes. The construction of the full modules differs slightly from that of the small modules in utilizing a full width hinged door which is mechanically interlocked to the isolator.

All operation procedures for the modules are possible without the need to open the door of the module.

Full width modules connect directly to the distribution bars through the multifunction separator. The design of the module enables auxiliary components to be located on both the vertical and horizontal mounting plates within the module, thus optimizing the available space usage within the module. Cable connections for main and auxiliary circuits are accessible from the cable compartment.





Module operation
MNS® modules are operated with the multifunction operating handle. This handle also activates the electrical/mechanical interlocking of the module and the module door. No further tool or unlocking device is necessary to withdraw a module, thus replacing a module takes less than a minute. Replacement as well as retrofit of modules can be performed under service condition, should plant operation procedures allow.

System Highlights
- High stacking density, resulting in a reduced footprint
- Complete phase isolation of main power contacts prior to connection to the distribution bars
- Full module functionality with external operation
- Module replacement possible in less than 1 minute, no tool required

Withdrawable module positions
All main and auxiliary connections are self-locating, without the need of additional tools.

All positions/status are clearly marked on the fixed section of the operation handle in accordance with IEC 61439-1/-2 and GB/T 7251.1/2.

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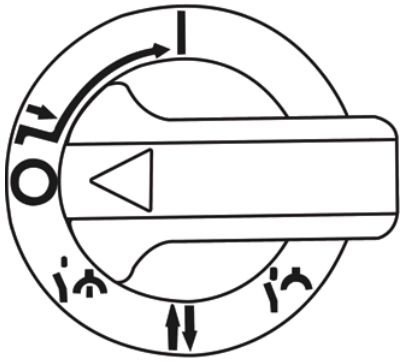
8E/4 Withdrawable Module

—
8E/2 Withdrawable Module



—
Module Operating Handle

Standard Module Solutions
- Switch fuse or molded case circuit breaker
- Power distribution circuit with FC61x or FC710 feeder monitoring and control unit
- The motor starter with switch fuse
- The motor starter with molded case circuit breaker
- The motor starter with M10x or MC510 motor control and protection device

Size of the modules:
8E/4, 8E/2, 4E, 6E, 8E, 12E, 16E, 20E, 24E

8E/4 and 8E/2 Withdrawable Modules
Withdrawable units size 8E/4 and 8E/2 comprise:
1. One or two base profile sections for mounting snap-on components
2. One rear wall with main conductors and control plug (one or two 16- or 20-pole control plugs for 8E/2 modules on request)
3. A front panel made of insulating material
4. The side walls, etc.

And each 8E/2 module can be provided with one or two 20-pole terminal blocks on request.

The front panel is provided with knockouts for mounting measuring, operating and indicating instruments. The operation of the main switch is achieved by the handle installed on the panel which is furnished with the function of electrical and mechanical interlocking. A micro switch with 1 × NO and 1 × NC contacts is provided for electrical interlocking.

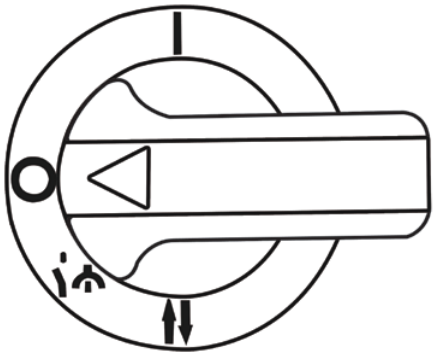
The switch handle can be moved from position “OFF” to position “ON” only after the handle has been depressed (push-to-turn feature). The switch handle can be locked in “OFF”/“TEST”/“ISOLATED” position respectively with up to three padlocks. Switch handles of withdrawable units that are not used must be in position “OFF” or “ISOLATED”.

8E/4 and 8E/2 withdrawable module positions

		ON position-Main and control circuits are closed. Module is locked.
		OFF position-Main circuit are disconnected, the control circuits are closed. Module is locked.
		TEST position-Main circuit are disconnected, the control circuits are closed. Module is locked.
		MOVE position-Main and control circuits are disconnected.
		ISOLATED position-The module is 30 mm drawn out of the section. Main and control circuits are disconnected and the isolating distance is fulfilled.

—
4E Withdrawable Module

—
8E Withdrawable Module



—
Module Operating Handle

Full width modules
These modules are available ranging from 4E to 24E in physical sizes. The full width module comprises metal side walls, a front cover plate, an instrument panel, a module baseplate with rear wall, and wiring ducts, etc.

Module door facilitates the replacement of components from the front side (e.g. replacing the fuse) without drawing out the module. In case the module is in ON or TEST position, the front door has to be opened with tools (such as screwdrivers). The switch handle can be locked in the ISOLATED position with two padlocks.

The withdrawable unit of standard arrangement can be equipped with an instrument panel made of insulating material for the installation of measuring, operating and indicating instruments. The hinged instrument panel is mounted to the withdrawable unit and is visible via a door cut out. This panel remains in position when the front cover is opened.

The main switch is operated by the operating handle which is also used for the mechanical/ electrical interlocking. Two micro switches with 1 × NO and 1 × NC contacts is provided for electrical interlocking.

Full width withdrawable module positions

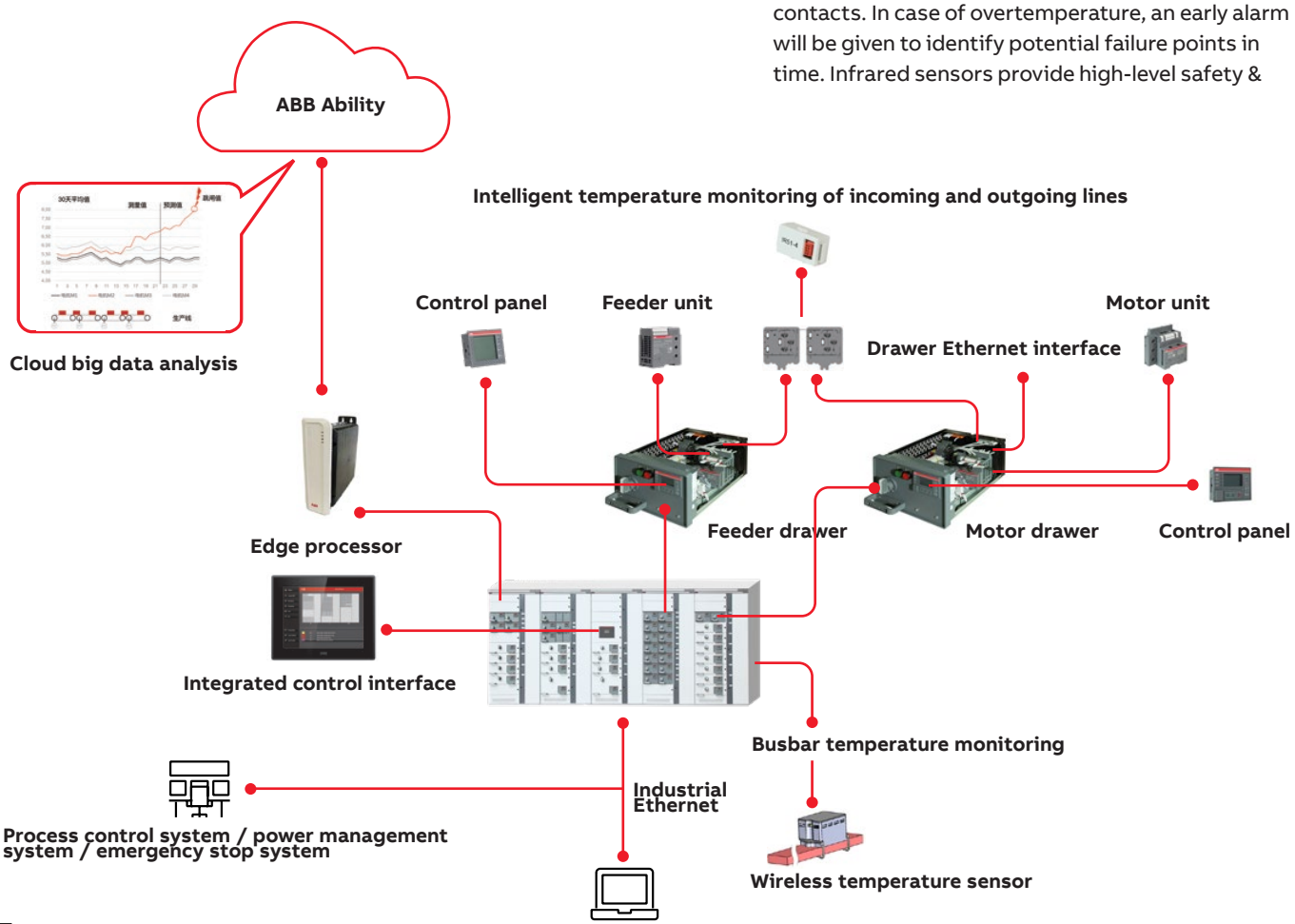
		ON position-Main and control circuits are closed. Module is locked.
		OFF position- Main circuit are disconnected, the control circuits are closed. Module is locked.
		TEST position-Main circuit are disconnected, the control circuits are closed. Module is locked. Can be locked with 3 padlocks.
		MOVE position-Main and control circuits are disconnected.
		ISOLATED position-The module is 30 mm drawn out of the section. Main and control circuits are disconnected and the isolating distance is fulfilled. Can be locked with 3 padlocks.

Digital solutions

A new generation of MNS Digital solution, which inherits the excellent quality standards and manufacturing technology of MNS® system and integrates Internet and smart sensor technology, can realize remote monitoring, control and setting, and provide detailed fault diagnosis and event log to help users to carry out large data analysis; it can provide early alarm of equipment faults, and achieve proactive maintenance to ensure safe, reliable and continuous electricity demand. Safe and continuous production 24/7 is critical to process industry users. MNS Digital solution has maintained and developed the safety and reliability of MNS®, which can provide more reliable continuous power supply for customers and ensure the higher personal safety of operating personnel.

Powerful Ethernet communication
Industrial standard communication interfaces is applied and the communication rate is a few hundred times of that of traditional communication network, so that the information can be transmitted to the relevant people (such as operators & maintenance staff, and management personnel) in an allround way. Reliable Ethernet connection technologies are adopted to meet the operating requirements for industrial environment; A loop structure is achieved to establish a redundant system for the safer communication. And full certification for the network security is available to prevent the network from being attacked.

Advanced temperature measurement
Infrared technology is used for realtime online monitoring of incoming and outgoing power contacts. In case of overtemperature, an early alarm will be given to identify potential failure points in time. Infrared sensors provide high-level safety &



System diagram

easy to maintain features due to its plug-in design & contactless monitoring in high current areas of the switchgear assembly. Therefore no additional insulation measure is needed for the intelligent temperature monitoring system.

Scalability of control modules
Optional control modules are provided for better system scalability based on diverse requirements.
- simple or complex motor starting types (14 starting types for selection)
- protection functions (16 protection functions for selection)
- feeder management (monitoring and diagnosis)
- field input/output signal

System access based on "off-the-shelf" universal web browser
Through the network browser, authorized users can easily access to the system via any device with embedded network server. Information could be obtained by just clicking the link under a friendly operating interface.

Ethernet communication connection

Industrial Ethernet has been widely used for high-speed communication between the same industrial network backbones and for data collection & long-term preventive maintenance. Ethernet is also being used gradually at the device layer. This means that Ethernet provides an ideal environment for interoperability between control layers of the plant.

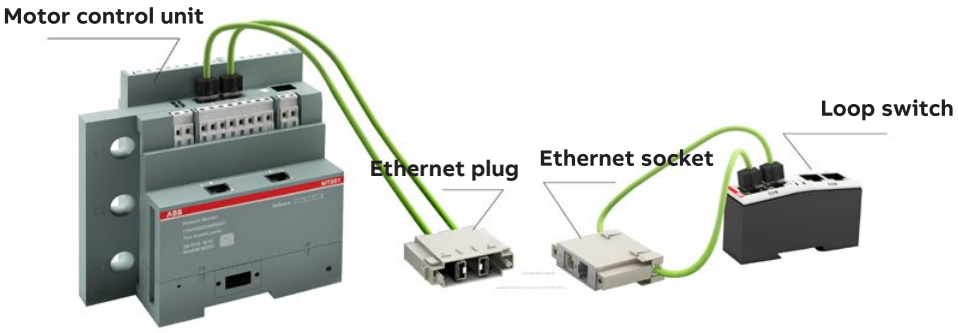
The operation is more transparent, more reliable and more cost-effective under the unified Ethernet communication environment.

Features and advantages:
- Support multiple topologies
- Support ring redundancy
- Support MRP (Media Redundancy Protocol)
- Support removable withdrawable modules with loop switch

Demanding connection and wiring requirements of Ethernet high-speed communication could be fulfilled with switchgear and Ethernet communication integrated in the same MNS Digital solution. For withdrawable modules, not only high-speed communication requirements of Ethernet systems but also requirements of system connection reliability against mechanical shock could be met by MNS Digital solution. The Ethernet interface consists of two parts, namely the plug and the socket.

For 8E/2 withdrawable modules, the Ethernet plug is embedded in the rear panel of the withdrawable modules and the Ethernet socket is integrated into the adapter.

For 4-24E withdrawable modules, the Ethernet plug is mounted on the right side of the withdrawable modules and the Ethernet socket is mounted in the cable compartment.



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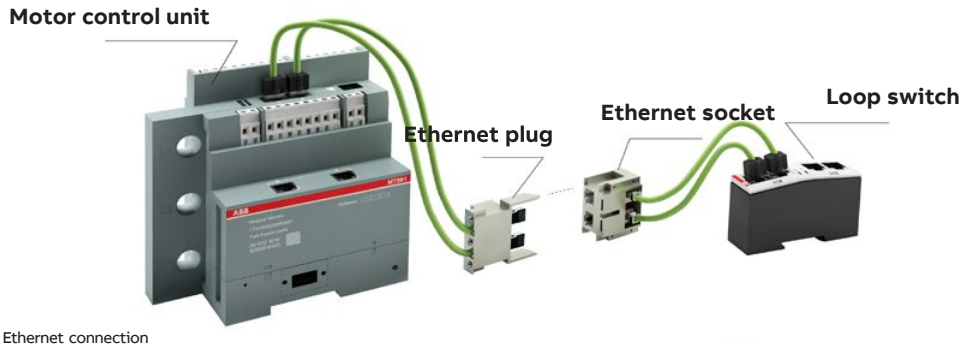
8E/2 Ethernet connection



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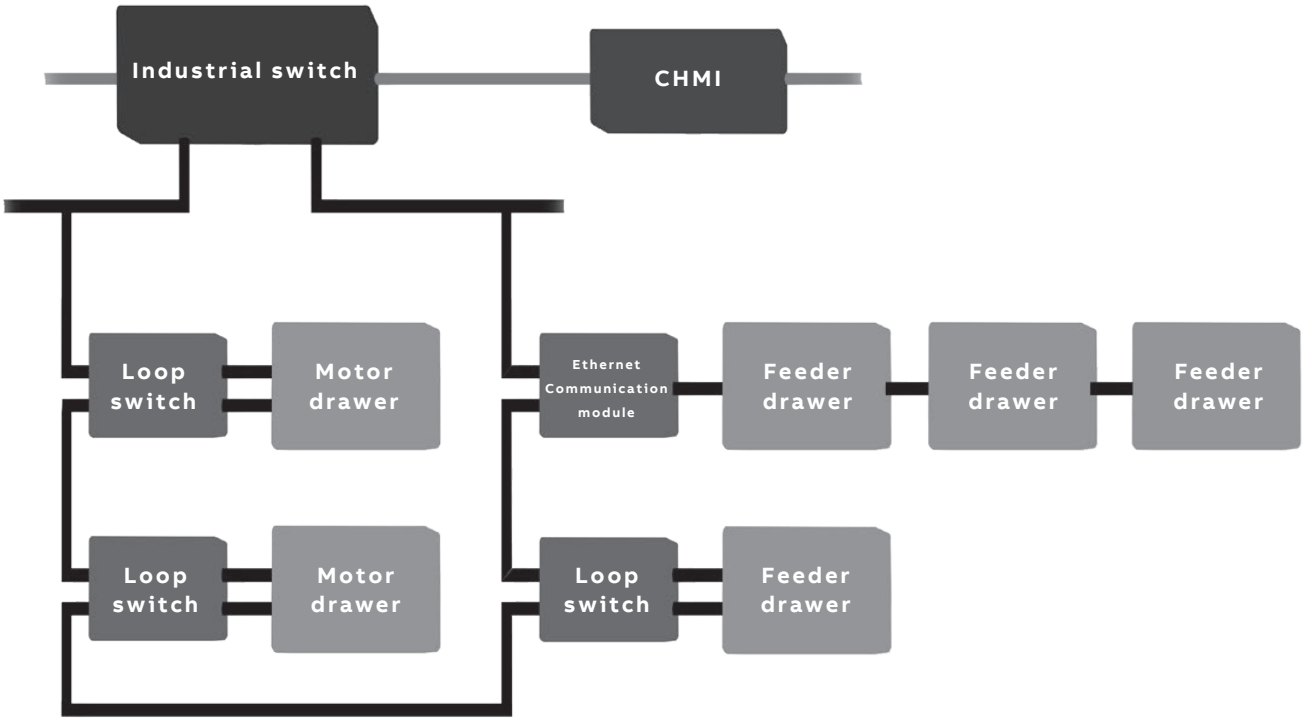
4E-24E Ethernet connection

Ethernet ring-type communication

The process operation needs to be highly reliable. The MNS Digital solution can be configured for ring-type communication. With a managed switch, MNS Digital solution integrates the switchgear, human-machine interface, background system and other Internet devices into the network system.

Features and advantages:
• Prevent cable from falling off causing communication failure



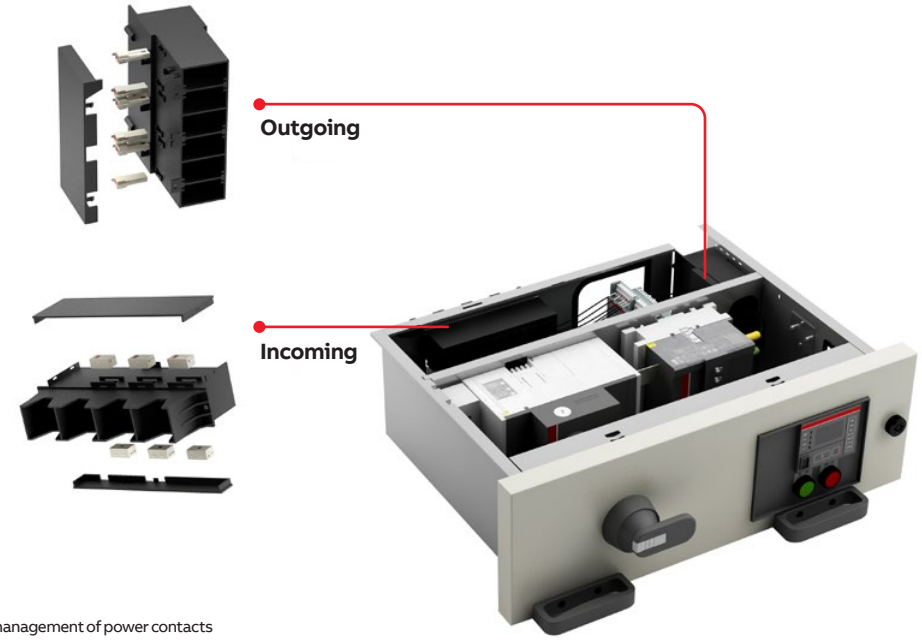
Integrated temperature measurement management
The MNS Digital solution monitors the environment temperature and temperature of critical parts of withdrawable modules & switchgear sections, e.g. the power contact temperature of withdrawable modules. Realtime monitoring data and maintenance & diagnosis information can help customers to detect and deal with the faults as early as possible, so as to prevent the fault expansion and minimize the fault consequences by reducing equipment downtime.

Temperature management of power contacts
Infrared sensor technology is adopted for MNS Digital solution to measure the temperature of power contacts in a non-contact manner on the incoming/outgoing side of the withdrawable module, and analyze the measured temperature.

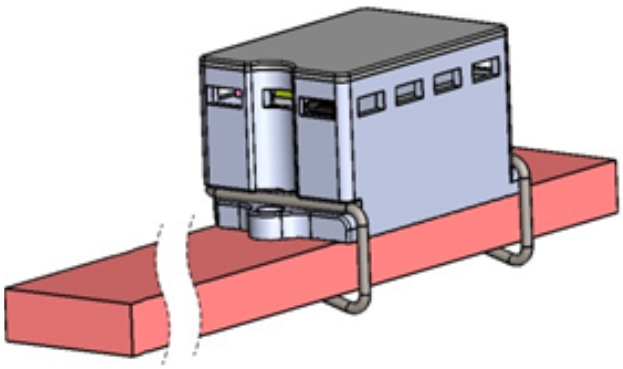
When the power contact temperature exceeds the set threshold, signals of “alarm” or “tripping” would be generated accordingly.

Busbar temperature management
Zigbee wireless temperature sensor technology is adopted for MNS Digital solution to directly measure and assess the busbar temperature without external power supply.

When the busbar temperature exceeds the set threshold, signals of “alarm” or “tripping” would be generated accordingly.



—
Temperature management of power contacts



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Busbar temperature management

Motor management

Motor management module MC510

MC510 is a scalable controller used for motor starter circuits and contactor feeder circuits, which can help users control, protect and monitor these circuits more professionally. It can perform all the required tasks, and its advantages include:

- Modular design concept
- High operation performance and enhanced safety
- Supporting various motor starting types
- Excellent motor protection functions
- Multifarious measurement and diagnostic functions
- Proactive maintenance possibility
- Flexible logic programming

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Motor management module MC510

—
Operation panel MP51

Feeder management

Feeder management module FC61x

FC61x is an intelligent feeder controller based on current/voltage measurement and maintenance data monitoring, and it is capable of temperature measurement. FC61x provides proper monitoring and protection functions for incomers, busties and feeders. Modbus RTU communication mode is adopted for FC61x.

Its features include:
- Temperature monitoring
- Logic programming
- Modular design
- System integration communication
- Diagnosis and event recording
- Comprehensive parameter measurement and management

Feeder protection module FC710

FC710 is an intelligent controller based on current/voltage measurement and maintenance data monitoring, and it is capable of temperature measurement. FC710 provides proper monitoring, protection and alarming functions for incomers, busties and feeders. FC710 adopts Modbus RTU communication mode.

Its features include:
- Feeder protection
- Temperature monitoring
- Logic programming
- Modular design
- System integration communication
- Diagnosis and event recording
- Comprehensive parameter measurement

Extension module

MC510/FC61x/FC710 provides an expansion interface for complex applications to meet various customer needs. It can be connected to the following expansion modules:
- Digital input/output
- Analog input/output
- Hotspot monitoring module
- Wireless temperature measurement module
- Residual current monitoring module
- Ethernet extension module
- Loop switch

—
Operation panel MP53

—
Feeder management unit FC61x/FC710

In-situ monitoring scheme

Human-machine interface MV570
MNS Digital solution provides a human-machine interface MV570 to display the operating condition of connected devices. In addition, MV570 is also a web interface enabling the access via any standard personal computer web browser, such as Microsoft's Internet Explorer. MV570 is a touch tablet conforming to industry standard, which is mounted directly on the switchgear. ABB's “plant-wide informatization” concept is fully reflected here.

Based on users' access rights, MV570 provides the following functional options:

1. Monitoring:
- Realtime data for circuit operation (current, voltage, power, power factor, power contact temperature, etc.)
- Circuit status: run/stop
- Alarm and trip information

2. Parameterization
- Access control and protection parameters
- Download control and protection parameters

3. Control:
- Start/stop/trip reset

4. Maintenance:
- SOE
- Motor start/stop time
- Number of starts
- Number of trips
- MC510 firmware upgrading

5. Project management:
- Create new project, copy project or delete project
- Switchgear layout interface editing

6. User management:
- Add or delete accounts for different types of users
- Password management

Monitoring system integrated into plant area

MNS Digital is a LV switchgear platform integrated with control system which is really based on the Internet technology. ABB’s digital switchgear solutions integrates innovative protection, control and sensing devices, where all measurements, status and commands are reliably transferred on a realtime Ethernet communication bus via the Modbus TCP, OPC-UA or IEC 61850 protocol as applicable and desired based on the final needs. MNS Digital solution provides process operators, electrical engineers, maintenance teams and plant management personnel with the required engineering information.

Plant control system
The application of industrial process control system needs the support of multiple systems that are connected to the switchgear and motor control center via an Ethernet communication interface.

This is because specific users raise different control operational requirements and need different information at different operating locations.

MNS Digital solution strives to meet users’ needs and effectively support multiple industrial Ethernet communication interfaces and applications.

Grid monitoring / SCADA
The plant's electricity demand is increasing, so is the need for electrical monitoring and site conditions monitoring.

Being able to provide the right information at the right time is so vital that it may determine whether or not a plant is profitable.

This function is an important part of MNS Digital solution.

With the standard industry Ethernet interface, it is easy to access to the below electrical data:
- Measured values, equipment status and failure analysis
- Time records of alarms and events

Engineering operation and maintenance
When the user rights are recognized, the users can access all system parameters and related settings via the Ethernet interface.

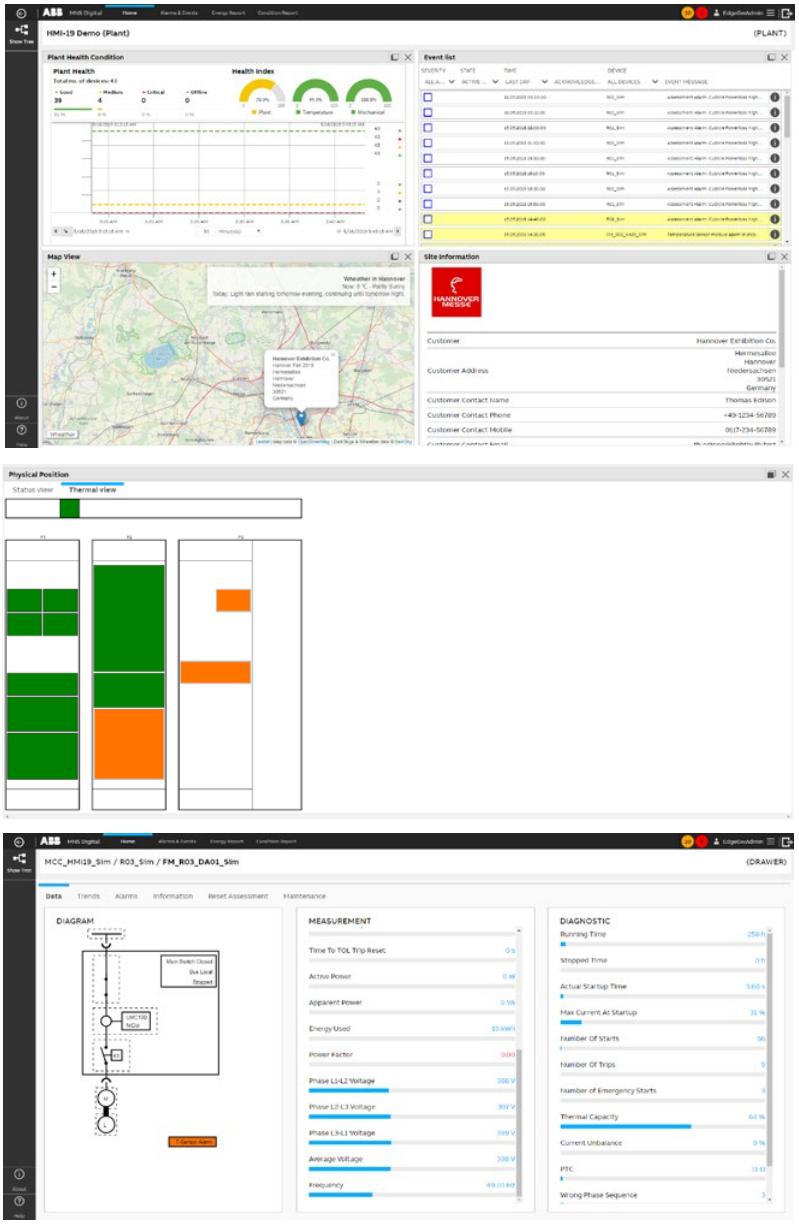
MNS Digital solution provides engineers with an Internet-based optimized engineering tool to configure all system parameters through network connection.

Condition monitoring of MNS Digital solution
Maintenance costs are one of the major expenses for plant operations.

MNS Digital solution provides a structured approach to organize repairs and work with predictive maintenance procedures to reduce maintenance costs.

Condition monitoring system of MNS Digital solution continuously monitors the realtime information of switchgear operation.

Any change in status will be monitored and analyzed, and the received data will be converted into valuable system information.



Primary circuit solutions

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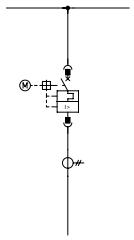
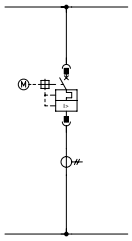
MNS 3.0 front access, ACB-Emax2 - Incomer, feeder, bus tie

Solution No.									**01**			**02**		
Singleline														
Application									Incomer, feeder			Bus tie		
Switchgear type									MNS front access					
Main switching device	Icu kA (400 V)	Icu kA (690 V)	Current transformer	Functional instrument	Current carrying capacity (A)	Width (mm)	Depth (mm)	Height	Width (mm)	Depth (mm)	Height			
E1.2C 800 3P	50	42	LN4C 800/5	FC61x	800	400	1000	85E	400	1000	85E			
E1.2C 800 4P	50	42	LN4C 800/5	FC61x	800	600	1000	85E	600	1000	85E			
E1.2C 1000 3P	50	42	LN4C 1000/5	FC61x	1000	400	1000	85E	400	1000	85E			
E1.2C 1000 4P	50	42	LN4C 1000/5	FC61x	1000	600	1000	85E	600	1000	85E			
E2.2N 1250 3P	66	66	LN5C 1250/5	FC61x	1250	400	1000	85E	400	1000	85E			
E2.2N 1250 4P	66	66	LN5C 1250/5	FC61x	1250	600	1000	85E	600	1000	85E			
E2.2N 1600 3P	66	66	LN5C 1600/5	FC61x	1600	400	1000	85E	400	1000	85E			
E2.2N 1600 4P	66	66	LN5C 1600/5	FC61x	1600	600	1000	85E	600	1000	85E			
E2.2N 2000 3P	66	66	LN5C 2000/5	FC61x	2000	400	1000	85E	400	1000	85E			
E2.2N 2000 4P	66	66	LN5C 2000/5	FC61x	2000	600	1000	85E	600	1000	85E			
E2.2N 2500 3P	66	66	MCT105.38 2500/5	FC61x	2500	600	1000	85E	600	1000	85E			
E2.2N 2500 4P	66	66	MCT105.38 2500/5	FC61x	2500	800	1000	85E	800	1000	85E			
E4.2N 3200 3P	66	66	MCT127.10A 3000/5	FC61x	3200	800	1000	85E	800	1000	85E			
E4.2N 3200 4P	66	66	MCT127.10A 3000/5	FC61x	3200	1000	1000	85E	1000	1000	85E			
E4.2N 4000 3P	66	66	MCT127.10A 4000/5	FC61x	4000	800	1200	85E	800	1200	85E			
E4.2N 4000 4P	66	66	MCT127.10A 4000/5	FC61x	4000	1000	1200	85E	1000	1200	85E			
E6.2H 5000 3P	100	100	MCTE6 5000/5	FC61x	5000	1000	1200	85E	1000	1200	85E			
E6.2H 5000 4P	100	100	MCTE6 5000/5	FC61x	5000	1200	1200	85E	1200	1200	85E			
E6.2H 6300 3P	100	100	MCT4X160 6000/5	FC61x	6300	1200	1200	85E	1200	1200	85E			
E6.2H 6300 4P	100	100	MCT4X160 6000/5	FC61x	6300	1200	1200	85E	1200	1200	85E			

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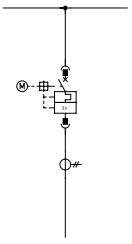
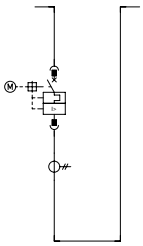
MNS 3.0 rear access ACB-Emax2 - Incomer, feeder, bus tie

Solution No.					**03**				**04**		
Singleline											
Application					Incomer, feeder				Bus tie		
Switchgear type					MNS rear access						
Main switching device	Icu kA (400 V)	Icu kA (690 V)	Current transformer	Functional instrument	Current carrying capacity (A)	Width (mm)	Depth (mm)	Height	Width (mm)	Depth (mm)	Height
E1.2C 800 3P	50	42	LN5C 800/5	FC61x	800	400	1000	89E	600	1000	89E
E1.2C 800 4P	50	42	LN5C 800/5	FC61x	800	600	1000	89E	600	1000	89E
E1.2C 1000 3P	50	42	LN5C 1000/5	FC61x	1000	400	1000	89E	600	1000	89E
E1.2C 1000 4P	50	42	LN5C 1000/5	FC61x	1000	600	1000	89E	600	1000	89E
E2.2N 1250 3P	66	66	LN5C 1250/5	FC61x	1250	400	1000	89E	600	1000	89E
E2.2N 1250 4P	66	66	LN5C 1250/5	FC61x	1250	600	1000	89E	600	1000	89E
E2.2N 1600 3P	66	66	LN5C 1600/5	FC61x	1600	400	1000	89E	600	1000	89E
E2.2N 1600 4P	66	66	LN5C 1600/5	FC61x	1600	600	1000	89E	600	1000	89E
E2.2N 2000 3P	66	66	LN5C 2000/5	FC61x	2000	400	1000	89E	600	1000	89E
E2.2N 2000 4P	66	66	LN5C 2000/5	FC61x	2000	600	1000	89E	600	1000	89E
E2.2N 2500 3P	66	66	LN7A 2500/5	FC61x	2500	600	1000	89E	600	1000	89E
E2.2N 2500 4P	66	66	LN7A 2500/5	FC61x	2500	600	1000	89E	600	1000	89E
E4.2N 3200 3P	66	66	MCT105.10 3000/5	FC61x	3200	800	1000	89E	800	1000	89E
E4.2N 3200 4P	66	66	MCT105.10 3000/5	FC61x	3200	1000	1000	89E	1000	1000	89E
E4.2N 4000 3P	66	66	MCT127.10 4000/5	FC61x	4000	800	1000/1200	89E	1000	1000/1200	89E
E4.2N 4000 4P	66	66	MCT127.10 4000/5	FC61x	4000	1000	1000/1200	89E	1000	1000/1200	89E
E6.2H 5000 3P	100	100	MCT129.10 5000/5	FC61x	5000	1000	1200	89E	1200	1200	89E
E6.2H 5000 4P	100	100	MCT129.10 5000/5	FC61x	5000	1200	1200	89E	1200	1200	89E
E6.2H 6300 3P	100	100	MCT129.10 6000/5	FC61x	6300	1200	1200	89E	1200	1200	89E
E6.2H 6300 4P	100	100	MCT129.10 6000/5	FC61x	6300	1200	1200	89E	1200	1200	89E

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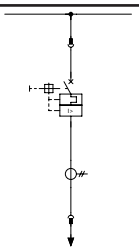
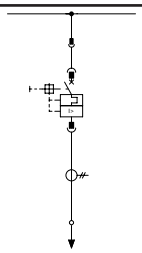
Feeder, lighting XTmax - Withdrawable / Fixed module

Solution No.				**05**	**06**
Singleline					
Application				Feeder	
Width (mm)				1000 (600[1])	
Module type				Withdrawable	Fixed
Main switching device	Adjustable thermal threshold	Current transformer	Functional instrument	Height	
XT2S160TMD20,3P	14-20	LNC2A	FC61x	8E/2,8E	6E
XT2S160TMD32,3P	22.5-32	LNC2A	FC61x	8E/2,8E	6E
XT2S160TMA63,3P	44-63	LNC2A	FC61x	8E/2,8E	6E
XT2S160TMA80,3P	56-80	LNC2A	FC61x	8E	6E
XT2S160TMA100,3P	70-100	LNC2A	FC61x	8E	6E
XT2S160TMA125,3P	88-125	LNC2A	FC61x	8E	6E
XT2S160TMA160,3P	112-160	LNC2A	FC61x	8E	6E
XT4S250TMA200,3P	140-200	LNC2	FC61x	8E	8E
XT4S250TMA250,3P	175-250	LNC2	FC61x	8E	8E
T5S400In320,3P	128-320	LNC3	FC61x	12E	12E
T5S400In400,3P	160-400	LNC3	FC61x	12E	12E
T6S630In630,3P	252-630	LN4A	FC61x	16E	16E
XT2S160TMD20,4P	14-20	LNC2A	FC61x	8E/2,8E	8E
XT2S160TMD32,4P	22.5-32	LNC2A	FC61x	8E/2,8E	8E
XT2S160TMA63,4P	44-63	LNC2A	FC61x	8E/2,8E	8E
XT2S160TMA80,4P	56-80	LNC2A	FC61x	8E	8E
XT2S160TMA100,4P	70-100	LNC2A	FC61x	8E	8E
XT2S160TMA125,4P	88-125	LNC2A	FC61x	8E	8E
XT2S160TMA160,4P	112-160	LNC2A	FC61x	8E	8E
XT4S250TMA200,4P	140-200	LNC2	FC61x	8E	8E
XT4S250TMA250,4P	175-250	LNC2	FC61x	8E	8E
T5S400In320,4P	128-320	LNC3	FC61x	16E	16E
T5S400In400,4P	160-400	LNC3	FC61x	16E	16E
T6S630In630,4P	252-630	LN4A	FC61x	24E	24E

Remark:dimension [1] is for MNS rear access.

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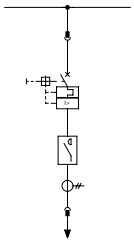
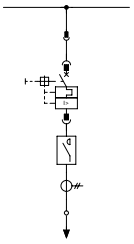
Contactor feeder - Withdrawable / Fixed module

Solution No.					**07**	**08**
Singleline						
Application					Feeder	
Width (mm)					1000 (600[1])	
Module type					Withdrawable	Fixed
Main switching device	Adjustable thermal threshold	Contactor	Current transformer	Functional instrument	Height	
XT2S 160 TMD 10	7-10	AF38	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMD 16	11.2-16	AF38	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMD 20	14-20	AF38	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMD 25	17.5-25	AF38	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMD 32	22.5-32	AF40	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMA 40	28-40	AF40	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMA 50	35-50	AF52	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMA 63	44-63	AF65	LNC2A	FC61x	8E/2	TBD
XT2S 160 TMA 80	56-80	AF80	LNC2A	FC61x	8E	TBD
XT2S 160 TMA 100	70-100	AF116	LNC2A	FC61x	8E	TBD
XT2S 160 TMA 125	88-125	AF116	LNC2A	FC61x	8E	TBD
XT2S 160 TMA 160	112-160	AF140	LNC2A	FC61x	16E	TBD
XT4S 250 TMA 200	140-200	AF190	LNC2	FC61x	16E	TBD
XT4S 250 TMA 250	175-250	AF205	LNC2	FC61x	16E	TBD

Remark:dimension [1] is for MNS rear access.

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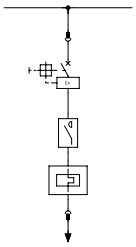
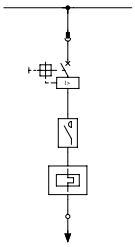
Motor Starter, Direct-on-line Starter, Withdrawable/ Fixed Module (MO+AF), type 2

Solution No.						**09**	**10**
Singleline							
Application						Motor Starter (Direct-on-line)	
Width (mm)						1000 (600[1])	
Module type						Withdrawable	Fixed
Power (kW)	Rating (A)	Main switching device	Contactor	Overload relay	Current range	Height	Height
0.06	0.2	MO132-0.25	AF09	TF42-0.23	0.17-0.23	8E/2	8E
0.09	0.3	MO132-0.4	AF09	TF42-0.31	0.23-0.31	8E/2	8E
0.12	0.44	MO132-0.63	AF09	TF42-0.55	0.41-0.55	8E/2	8E
0.18	0.6	MO132-0.63	AF09	TF42-0.74	0.55-0.74	8E/2	8E
0.25	0.85	MO132-1.0	AF09	TF42-1.0	0.74-1.0	8E/2	8E
0.37	1.1	MO132-1.6	AF09	TF42-1.3	1.0-1.3	8E/2	8E
0.55	1.5	MO132-1.6	AF09	TF42-1.7	1.3-1.7	8E/2	8E
0.75	1.9	MO132-2.5	AF09	TF42-2.3	1.7-2.3	8E/2	8E
1.1	2.7	MO132-4.0	AF26	TF42-3.1	2.3-3.1	8E/2	8E
1.5	3.6	MO132-4.0	AF26	TF42-4.2	3.1-4.2	8E/2	8E
2.2	4.9	MO132-6.3	AF26	TF42-5.7	4.2-5.7	8E/2	8E
3	6.5	MO132-10	AF26	TF42-7.6	5.7-7.6	8E/2	8E
4	8.5	MO132-10	AF26	TF42-10	7.6-10	8E/2	8E
5.5	11.5	MO132-12	AF26	TF42-13	10-13	8E/2	8E
7.5	15.5	MO132-16	AF26	TF42-16	13-16	8E/2	8E
11	22	MO132-25	AF26	TF42-24	20-24	8E/2	8E

Remark:dimension [1] is for MNS rear access.

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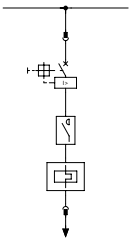
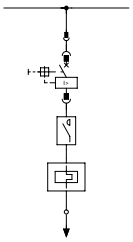
Motor Starter, Direct on Line, Withdrawable/ Fixed Module (XTmax+EOL), type 2

Solution No.						**11**	**12**
Singleline							
Application						Motor Starter (DOL)	
Width (mm)						1000 (600[1])	
Module type						Withdrawable	Fixed
Power (kW)	Rating (A)	Main switching device	Contactor	Overload relay	Current range	Height	
0.37	1.1	XT2S160 MF2	AF09	EF19-2.7	0.8 ... 2.7	8E/2,8E	TBD
0.55	1.5	XT2S160 MF2	AF09	EF19-2.7	0.8 ... 2.7	8E/2,8E	TBD
0.75	1.9	XT2S160 MF2	AF09	EF19-2.7	0.8 ... 2.7	8E/2,8E	TBD
1.1	2.7	XT2S160 MF4	AF26	EF19-6.3	1.9 ... 6.3	8E/2,8E	TBD
1.5	3.6	XT2S160 MF4	AF26	EF19-6.3	1.9 ... 6.3	8E/2,8E	TBD
2.2	4.9	XT2S160 MF8.5	AF38	EF19-6.3	1.9 ... 6.3	8E/2,8E	TBD
3	6.5	XT2S160 MF8.5	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
4	8.5	XT2S160 MF12.5	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
5.5	11.5	XT2S160 MF12.5	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
7.5	15.5	XT2S160 MA20	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
11	22	XT2S160 MA32	AF40	EF65-56	20 ... 56	8E/2,8E	TBD
15	29	XT2S160 MA32	AF40	EF65-70	25 ... 70	8E/2,8E	TBD
18.5	35	XT2S160 MA52	AF40	EF65-70	25 ... 70	8E/2,8E	TBD
22	41	XT2S160 MA52	AF52	EF65-70	25 ... 70	8E/2,8E	TBD
30	55	XT2S160 MA80	AF65	EF65-70	25 ... 70	8E	TBD
37	66	XT2S160 MA160	AF116	EF146-150	54 ... 150	8E	TBD
45	80	XT2S160 MA160	AF116	EF146-150	54 ... 150	8E	TBD
55	97	XT2S160 MA160	AF116	EF146-150	54 ... 150	8E	TBD
75	132	XT2S160 MA160	AF140	EF146-150	54 ... 150	8E	TBD
90	160	XT4S250 Ekip I In 250	AF190	EF205-210	63 ... 210	12E	TBD
110	195	T5S 400 PR221DS-I In 400	AF265	EF370-380	115 ... 380	16E	TBD
132	230	T5S 400 PR221DS-I In 400	AF265	EF370-380	115 ... 380	16E	TBD
160	280	T5S 400 PR221DS-I In 400	AF305	EF370-380	115 ... 380	24E	TBD
200	350	T6S 630 PR221DS-I In 630	AF460	EF460-500	150 ... 500	24E	TBD
250	430	T6S 630 PR221DS-I In 630	AF460	EF460-500	150 ... 500	24E	TBD

Remark:dimension [1] is for MNS rear access.

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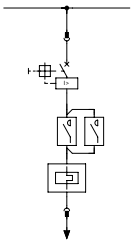
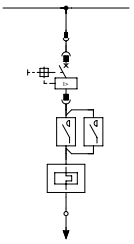
Motor Starter, Reversing Starter, Withdrawable/ Fixed Module (XTmax+EOL), type 2

Solution No.						**13**	**14**
Singleline							
Application						Motor Starter (Reversing)	
Width (mm)						1000 (600[1])	
Module type						Withdrawable	Fixed
Power (kW)	Rating (A)	Main switching device	Contactorx2	Overload relay	Current range	Height	
0.37	1.1	XT2S160 MF2	AF09	EF19-2.7	0.8 ... 2.7	8E/2,8E	TBD
0.55	1.5	XT2S160 MF2	AF09	EF19-2.7	0.8 ... 2.7	8E/2,8E	TBD
0.75	1.9	XT2S160 MF2	AF09	EF19-2.7	0.8 ... 2.7	8E/2,8E	TBD
1.1	2.7	XT2S160 MF4	AF26	EF19-6.3	1.9 ... 6.3	8E/2,8E	TBD
1.5	3.6	XT2S160 MF4	AF26	EF19-6.3	1.9 ... 6.3	8E/2,8E	TBD
2.2	4.9	XT2S160 MF8.5	AF38	EF19-6.3	1.9 ... 6.3	8E/2,8E	TBD
3	6.5	XT2S160 MF8.5	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
4	8.5	XT2S160 MF12.5	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
5.5	11.5	XT2S160 MF12.5	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
7.5	15.5	XT2S160 MA20	AF38	EF19-18.9	5.7 ... 18.9	8E/2,8E	TBD
11	22	XT2S160 MA32	AF40	EF65-56	20 ... 56	8E/2,8E	TBD
15	29	XT2S160 MA32	AF40	EF65-70	25 ... 70	8E/2,8E	TBD
18.5	35	XT2S160 MA52	AF40	EF65-70	25 ... 70	8E/2,8E	TBD
22	41	XT2S160 MA52	AF52	EF65-70	25 ... 70	8E/2,8E	TBD
30	55	XT2S160 MA80	AF65	EF65-70	25 ... 70	8E	TBD
37	66	XT2S160 MA160	AF116	EF146-150	54 ... 150	16E	TBD
45	80	XT2S160 MA160	AF116	EF146-150	54 ... 150	16E	TBD
55	97	XT2S160 MA160	AF116	EF146-150	54 ... 150	16E	TBD
75	132	XT2S160 MA160	AF140	EF146-150	54 ... 150	16E	TBD
90	160	XT4S250 Ekip I In 250	AF190	EF205-210	63 ... 210	16E	TBD
110	195	T5S 400 PR221DS-I In 400	AF265	EF370-380	115 ... 380	24E	TBD
132	230	T5S 400 PR221DS-I In 400	AF265	EF370-380	115 ... 380	24E	TBD
160	280	T5S 400 PR221DS-I In 400	AF305	EF370-380	115 ... 380	24E	TBD

Remark:dimension [1] is for MNS rear access.

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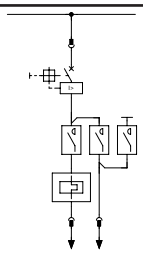
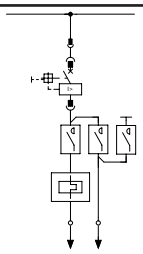
Motor Starter, Star-delta Starter, Withdrawable/ Fixed Module(XTmax+EOL), type 2

Solution No.						**15**	**16**
Singleline							
Application						Motor Starter (Star-delta)	
Width (mm)						1000 (600[1])	
Module type						Withdrawable	Fixed
Power (kW)	Rating (A)	Main switching device	Contactor	Overload relay	Current range	Height	
0.37	1.1	XT2S160 MF2	2*AF09+AF09	EF19-1.0	0.3 ... 1.0	8E	16E
0.55	1.5	XT2S160 MF2	2*AF09+AF09	EF19-2.7	0.8 ... 2.7	8E	16E
0.75	1.9	XT2S160 MF2	2*AF09+AF09	EF19-2.7	0.8 ... 2.7	8E	16E
1.1	2.7	XT2S160 MF4	2*AF26+AF26	EF19-2.7	0.8 ... 2.7	8E	16E
1.5	3.6	XT2S160 MF4	2*AF26+AF26	EF19-6.3	1.9 ... 6.3	8E	16E
2.2	4.9	XT2S160 MF8.5	2*AF38+AF26	EF19-6.3	1.9 ... 6.3	8E	16E
3	6.5	XT2S160 MF8.5	2*AF38+AF26	EF19-6.3	1.9 ... 6.3	8E	16E
4	8.5	XT2S160 MF12.5	2*AF38+AF26	EF19-6.3	1.9 ... 6.3	8E	16E
5.5	11.5	XT2S160 MF12.5	2*AF38+AF26	EF19-18.9	5.7 ... 18.9	8E	16E
7.5	15.5	XT2S160 MA20	2*AF38+AF26	EF19-18.9	5.7 ... 18.9	8E	16E
11	22	XT2S160 MA32	2*AF40+AF40	E45DU-30	9 ... 30	8E	16E
15	29	XT2S160 MA32	2*AF40+AF40	E45DU-30	9 ... 30	8E	16E
18.5	35	XT2S160 MA52	2*AF40+AF40	EF65-56	20 ... 56	8E	16E
22	41	XT2S160 MA52	2*AF52+AF40	EF65-56	20 ... 56	8E	16E
30	55	XT2S160 MA80	2*AF65+AF40	EF65-70	25 ... 70	8E	16E
37	66	XT2S160 MA100	2*AF96+AF40	EF96-100	36 ... 100	16E	24E
45	80	XT2S160 MA100	2*AF96+AF40	EF96-100	36 ... 100	16E	24E
55	97	XT2S160 MA160	2*AF116+AF116	EF146-150	54 ... 150	16E	24E
75	132	XT2S160 MA160	2*AF116+AF116	EF146-150	54 ... 150	16E	24E
90	160	XT4S 250 Ekip I In 250	2*AF116+AF116	EF146-150	54 ... 150	16E	24E
110	195	T5S 400 PR221DS-I In 400	2*AF190+AF116	EF205-210	63 ... 210	24E	28E
132	230	T5S 400 PR221DS-I In 400	2*AF190+AF116	EF205-210	63 ... 210	24E	28E
160	280	T6S 630 PR221DS-I In 630	2*AF265+AF190	EF370-380	115 ... 380	24E	40E
200	350	T6S 630 PR221DS-I In 630	2*AF265+AF190	EF370-380	115 ... 380	24E	40E

Remark:dimension [1] is for MNS rear access.

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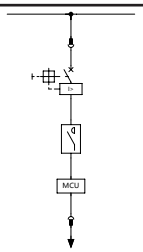
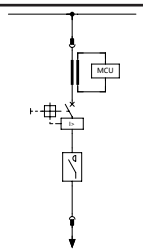
Motor Starter, Direct on line Starter with XTmax+M102, type 2

Solution No.						**17**	**18**
Singleline							
Application						Motor Starter (M102 Direct on line)	
Width (mm)						1000 (600[1])	
Module type						Withdrawable	
Power (kW)	Rating (A)	Main switching device	Contactor	Motor protector	Protective transformer	Height	
0.37	1.1	XT2S160 MF2	AF09	M102/MC510		8E/2,8E	
0.55	1.5	XT2S160 MF2	AF09	M102/MC510		8E/2,8E	
0.75	1.9	XT2S160 MF2	AF09	M102/MC510		8E/2,8E	
1.1	2.7	XT2S160 MF4	AF26	M102/MC510		8E/2,8E	
1.5	3.6	XT2S160 MF4	AF26	M102/MC510		8E/2,8E	
2.2	4.9	XT2S160 MF8.5	AF38	M102/MC510		8E/2,8E	
3	6.5	XT2S160 MF8.5	AF38	M102/MC510		8E/2,8E	
4	8.5	XT2S160 MF12.5	AF38	M102/MC510		8E/2,8E	
5.5	11.5	XT2S160 MF12.5	AF38	M102/MC510		8E/2,8E	
7.5	15.5	XT2S160 MA20	AF38	M102/MC510		8E/2,8E	
11	22	XT2S160 MA32	AF40	M102/MC510		8E/2,8E	
15	29	XT2S160 MA32	AF40	M102/MC510		8E/2,8E	
18.5	35	XT2S160 MA52	AF40	M102/MC510		8E/2,8E	
22	41	XT2S160 MA52	AF52	M102/MC510		8E/2,8E	
30	55	XT2S160 MA80	AF65	M102/MC510		8E	
37	66	XT2H160 MA160	AF116	M102/MC510	PCT 3L 200/5R		8E
45	80	XT2H160 MA160	AF116	M102/MC510	PCT 3L 200/5R		8E
55	97	XT2S160 MA160	AF116	M102/MC510	PCT 3L 200/5R		8E
75	132	XT2S160 MA160	AF140	M102/MC510	PCT 3L 200/5R		8E
90	160	XT4S250 Ekip I In 250	AF190	M102/MC510	PCT 3L 200/5R		12E
110	195	T5S 400 PR221DS-I In 400	AF265	M102/MC510	PCT 4L 300/5R		16E
132	230	T5S 400 PR221DS-I In 400	AF265	M102/MC510	PCT 4L 300/5R		16E
160	280	T5S 400 PR221DS-I In 400	AF305	M102/MC510	PCT 4L 300/5R		24E
200	350	T6S 630 PR221DS-I In 630	AF460	M102/MC510	PCT 5L 500/5R		24E
250	430	T6S 630 PR221DS-I In 630	AF460	M102/MC510	PCT 5L 500/5R		24E

Remark:dimension [1] is for MNS rear access.

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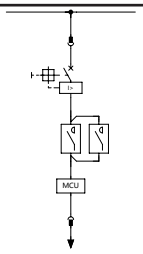
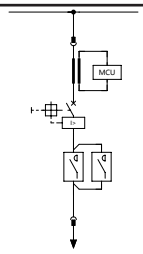
Motor Starter, Reversing Starter with XTmax+M102, type 2

Solution No.						**19**	**20**
Singleline							
Application						Motor Starter (M102 Reversing)	
Width (mm)						1000 (600[1])	
Module type						Withdrawable	
Power (kW)	Rating (A)	Main switching device	Contactor2x	Motor protector	Protective transformer	Height	
0.37	1.1	XT2S160 MF2	AF09	M102/MC510		8E/2,8E	
0.55	1.5	XT2S160 MF2	AF09	M102/MC510		8E/2,8E	
0.75	1.9	XT2S160 MF2	AF09	M102/MC510		8E/2,8E	
1.1	2.7	XT2S160 MF4	AF26	M102/MC510		8E/2,8E	
1.5	3.6	XT2S160 MF4	AF26	M102/MC510		8E/2,8E	
2.2	4.9	XT2S160 MF8.5	AF38	M102/MC510		8E/2,8E	
3	6.5	XT2S160 MF8.5	AF38	M102/MC510		8E/2,8E	
4	8.5	XT2S160 MF12.5	AF38	M102/MC510		8E/2,8E	
5.5	11.5	XT2S160 MF12.5	AF38	M102/MC510		8E/2,8E	
7.5	15.5	XT2S160 MA20	AF38	M102/MC510		8E/2,8E	
11	22	XT2S160 MA32	AF40	M102/MC510		8E/2,8E	
15	29	XT2S160 MA32	AF40	M102/MC510		8E/2,8E	
18.5	35	XT2S160 MA52	AF40	M102/MC510		8E/2,8E	
22	41	XT2S160 MA52	AF52	M102/MC510		8E/2,8E	
30	55	XT2S160 MA80	AF65	M102/MC510		8E	
37	66	XT2S160 MA160	AF116	M102/MC510	PCT 3L 200/5R		16E
45	80	XT2S160 MA160	AF116	M102/MC510	PCT 3L 200/5R		16E
55	97	XT2S160 MA160	AF116	M102/MC510	PCT 3L 200/5R		16E
75	132	XT2S160 MA160	AF140	M102/MC510	PCT 3L 200/5R		16E
90	160	XT4S250 Ekip I In 250	AF190	M102/MC510	PCT 3L 200/5R		16E
110	195	T5S 400 PR221DS-I In 400	AF265	M102/MC510	PCT 4L 300/5R		24E
132	230	T5S 400 PR221DS-I In 400	AF265	M102/MC510	PCT 4L 300/5R		24E
160	280	T5S 400 PR221DS-I In 400	AF305	M102/MC510	PCT 4L 300/5R		24E

Remark:dimension [1] is for MNS rear access.

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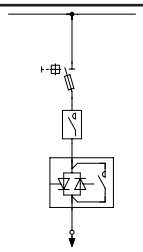
Motor Starter, PSTX Softstarter, type 2

Solution No.							**21**
Singleline							
Application							Motor Starter (softstarter)
Module type							Fixed
Power (kW)	Rating (A)	Main switching device	Fuse (aR)	Main contactor	Pass-by contactor	Softstarter	Height
15	30	OS32GD12	100	AF30	Built-in	PSTX30	24E
18.5	37	OS63GD12	125	AF38	Built-in	PSTX37	24E
22	45	OS63GD12	160	AF52	Built-in	PSTX45	24E
30	60	OS63GD12	160	AF65	Built-in	PSTX60	24E
37	72	OS125GD12	250	AF80	Built-in	PSTX72	24E
45	85	OS125GD12	315	AF96	Built-in	PSTX85	24E
55	106	OS250D12	400	AF116	Built-in	PSTX105	32E/400x2200(2300[1])
75	143	OS400D12	500	AF140	Built-in	PSTX142	400x2200(2300[1])
90	171	OS400D12	630	AF190	Built-in	PSTX170	400x2200(2300[1])
110	210	OS400D12	630	AF205	Built-in	PSTX210	400x2200(2300[1])
132	250	OS400D12	700	AF265	Built-in	PSTX250	400x2200(2300[1])
160	300	OS630D12	800	AF305	Built-in	PSTX300	600x2200(2300[1])
200	370	OS630D12	900	AF370	Built-in	PSTX370	600x2200(2300[1])
250	470	OS630D12	900	AF460	Built-in	PSTX470	600x2200(2300[1])
315	570	OS630D12	1000	AF580	Built-in	PSTX570	600x2200(2300[1])
400	720	OT800D12	1250	AF750	Built-in	PSTX720	800x2200(2300[1])
450	840	E2.2N1600	1,500	AF1350	Built-in	PSTX840	1000x2200(2300[1])
560	1050	E2.2N2000	1,800	AF1650	Built-in	PSTX1050	1000x2200(2300[1])
710	1250	E2.2N2000	2,000	-	Built-in	PSTX1250	1000x2200(2300[1])

Remark: Dimension [1] is for MNS rear access.
Millimeter (mm) is used as length unit unless otherwise noted.

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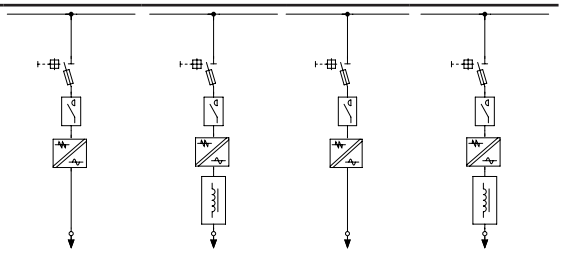
Motor Starter, Variable Frequency Driver ACS880, type 2

Solution No.							**22**	**23**	**24**	**25**
Singleline										
Application							Motor Starter (Variable Frequency Driver)		Motor Starter (Variable Frequency Driver)	
Cubicle type							MNS front access		MNS rear access	
Module type							Fixed		Fixed	
Power (kW)	Rating (A)	Main switching device	Fuse （aR）	Contactor	Variable Frequency Driver	Output Filter (optional)	Height	Height (with output filter)	Height	Height (with output filter)
0.75	2.4	OS32GD12	25	AF09	ACS880-01-02A4-3		24E	24E	24E	24E
1.1	3.3	OS32GD12	25	AF09	ACS880-01-03A3-3		24E	24E	24E	24E
1.5	4	OS32GD12	25	AF09	ACS880-01-04A0-3		24E	24E	24E	24E
2.2	5.6	OS32GD12	25	AF09	ACS880-01-05A6-3		24E	24E	24E	24E
3	7.2	OS32GD12	25	AF09	ACS880-01-07A2-3		24E	24E	24E	24E
4	9.4	OS32GD12	25	AF09	ACS880-01-09A4-3		24E	24E	24E	24E
5.5	12.6	OS32GD12	25	AF09	ACS880-01-12A6-3	NOCH0016-6x	24E	24E	24E	24E
7.5	17	OS32GD12	40	AF30	ACS880-01-017A-3		24E	24E	24E	24E
11	25	OS32GD12	40	AF30	ACS880-01-025A-3	NOCH0030-6x	24E	24E	24E	24E
15	32	OS63GD12	63	AF40	ACS880-01-032A-3		32E	32E	32E	32E
18.5	38	OS63GD12	63	AF40	ACS880-01-038A-3		32E	32E	32E	32E
22	45	OS125GD12	80	AF52	ACS880-01-045A-3		36E	36E	36E	36E
30	61	OS125GD12	100	AF52	ACS880-01-061A-3	NOCH0070-6x	36E	36E	36E	36E
37	72	OS125GD12	125	AF80	ACS880-01-072A-3		400*2200	400*2200	400*2300	400*2300
45	87	OS125GD12	160	AF80	ACS880-01-087A-3		400*2200	400*2200	400*2300	400*2300
55	105	OS250D12	200	AF116	ACS880-01-105A-3	NOCH0120-6x	400*2200	400*2200	400*2300	400*2300
75	145	OS250D12	250	AF146	ACS880-01-145A-3		400*2200	400*2200	400*2300	400*2300
90	169	OS250D12	315	AF146	ACS880-01-169A-3		400*2200	600*2200	400*2300	400*2300
110	206	OS250D12	350	AF190	ACS880-01-206A-3		400*2200	600*2200	400*2300	400*2300
132	246	OS400D12	450	AF205	ACS880-01-246A-3		400*2200	800*2200	400*2300	400*2300
160	293	OS400D12	500	AF265	ACS880-01-293A-3	FOCH0260-70	400*2200	800*2200	400*2300	400*2300
200	363	OS400D12	630	AF305	ACS880-01-363A-3		600*2200	800*2200	600*2300	600*2300
250	430	OS630D12	700	AF400	ACS880-01-430A-3	FOCH0320-50	1000*2200	1000*2200	800*2300	800*2300
250	505	OS630D12	800	AF460	ACS880-04-505A-3		1000*2200	1000*2200	1000*2300	1000*2300
315	585	OS800D12	1000	AF580	ACS880-04-585A-3		1000*2200	1000*2200	1000*2300	1000*2300
355	650	OS800D12	1000	AF580	ACS880-04-650A-3		1000*2200	1000*2200	1000*2300	1000*2300
400	725	OT1000E12P	1250	AF750	ACS880-04-725A-3	FOCH0610-70	1000*2200	1000*2200	1000*2300	1000*2300
450	820	OT1000E12P	1600	AF750	ACS880-04-820A-3		1000*2200	1000*2200	1000*2300	1000*2300
500	880	OT1000E12P	1600	AF750	ACS880-04-880A-3	FOCH0875-70	1000*2200	1000*2200	1000*2300	1000*2300

Remark: Dimension [1] is for MNS rear access.
Millimeter (mm) is used as length unit unless otherwise noted.

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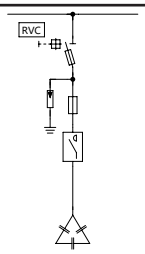
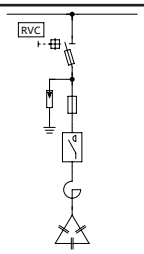
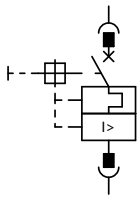
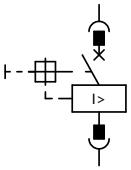
Reactive Power Compensation

Solution No.			**26**	**27**	
Singleline					
Application			Reactive	Reactive Power Compensation (with reactor)	Controller
Cubicle Width (mm)			600 (800、1000)		
Module type			Fixed		
Compensation capacity	Main switching device	Contactor	Capacitor	Reactor	Controller
15kVAR	XLP00	UA30-R	CLMD33 430-17.3		RVC/RVT
30kVAR	XLP00	2*UA30-R	2*CLMD33 430-17.3		RVC/RVT
45kVAR	XLP00	2*UA50-R	2*CLMD33 430-26.8		RVC/RVT
60kVAR	2*XLP00	4*UA30-R	4*CLMD33 430-17.3		RVC/RVT
90kVAR	2*XLP00	4*UA50-R	4*CLMD33 430-26.8		RVC/RVT
105kVAR	3*XLP00	4*UA30-R+2*UA50-R	4*CLMD33 430-17.3+2*CLMD33 430-26.8		RVC/RVT
120kVAR	4*XLP00	8*UA30-R	8*CLMD33 430-17.3		RVC/RVT
150kVAR	4*XLP00	4*UA30-R+4*UA50-R	4*CLMD33 430-17.3+4*CLMD33 430-26.8		RVC/RVT
180kVAR	4*XLP00	8*UA50-R	8*CLMD33 430-26.8		RVC/RVT
200kVAR	5*XLP00	4*UA30-R+6*UA50-R	4*CLMD33 430-17.3+6*CLMD33 430-26.8		RVC/RVT
225kVAR	5*XLP00	10*UA50-R	10*CLMD33 430-26.8		RVC/RVT
240kVAR	6*XLP00	4*UA30-R+8*UA50-R	4*CLMD33 430-17.3+8*CLMD33 430-26.8		RVC/RVT
270kVAR	6*XLP00	12*UA50-R	12*CLMD33 430-26.8		RVC/RVT
315kVAR	7*XLP00	14*UA50-R	14*CLMD33 430-26.8		RVC/RVT
360kVAR	8*XLP00	16*UA50-R	16*CLMD33 430-26.8		RVC/RVT
400kVAR	9*XLP00	18*UA50-R	18*CLMD33 430-26.8		RVC/RVT
275kVAR	6*XLP00	1*UA50+5*UA95	2*CLMD33/16.7kVAR 480V+15*CLMD33/22.5kVAR 480V	1*7%,25kVAR,400V+5*7%,50kVAR, 400V	RVC/RVT
300kVAR	6*XLP00	6*UA95	18*CLMD33/22.5kVAR 480V	6*7%,50kVAR,400V	RVC/RVT

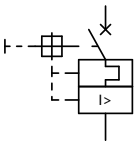
Legends



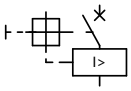
Plug-in/withdrawable circuit breaker
(overload and short-circuit protection)



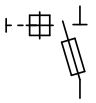
Plug-in/withdrawable circuit breaker
(short-circuit protection only)



Fixed circuit breaker
(overload and short-circuit protection)

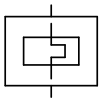


Fixed circuit breaker
(short-circuit protection only)

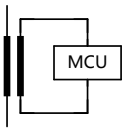


Switch fuse

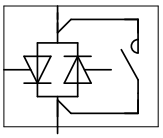
Contactor



Thermal relay

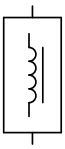


Motor control and protection unit



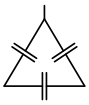
Softstarter

Variable speed drive



Du/Dt filter

Fuse switch disconnector



Capacitor

Reactor

Arrester

Current transformer

Motor operator of circuit breaker

Cable plug
(plug-in/fixed connection)

After sales and service

ABB's goal is to ensure the assets' maximum performance and availability. ABB has supplied about 2 millions sections of MNS® switchgear from its worldwide manufacturing locations. Each of these locations has an after-sales and service department in operation, offering timely and efficient global support.

On completion of commissioning, the switchgear is at the peak of its performance. To maintain this condition it is essential to adopt a service and maintenance plan for this asset. If the switchgear does not receive maintenance, this could result in downtime. In production the availability of the switchgear ensures productivity, and any downtime can result in a profit loss. Down time can be attributed to the following maintenance practices.

- Reactive maintenance is costly for both production and unplanned downtime.
- Preventive or Continuous maintenance is usually performed on an annual basis, during a scheduled shutdown.
- By evaluating information from the intelligent switchgear it is possible to adopt a Predictive maintenance schedule.

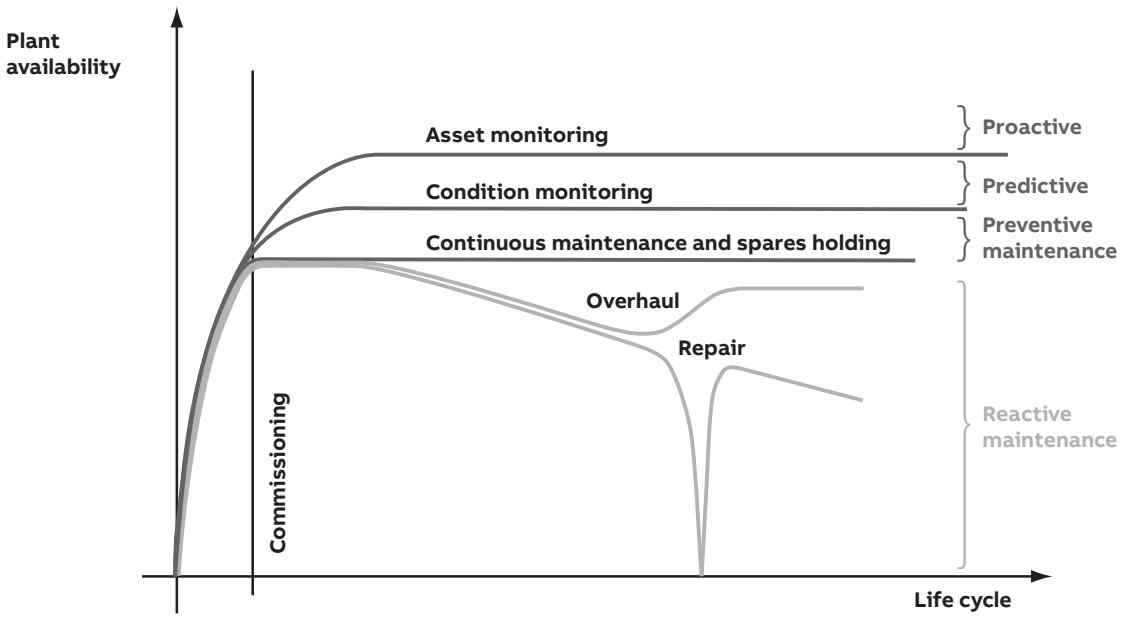
Utilizing an ABB expertise can help to lengthen the life cycle of the switchgear.

Regular Services
ABB offers comprehensive service and support during the whole life time of the switchgear:

- Engineering assistance
- Product training
- Spares holding
- Installation and commissioning
- Service planning
- Hardware and software support
- Upgrades, expansions and modification

Contract Services
ABB can offer comprehensive maintenance contracts designed specifically for each particular process. Through preventive maintenance programs unscheduled outages can be reduced and maintenance workflows are streamlined.

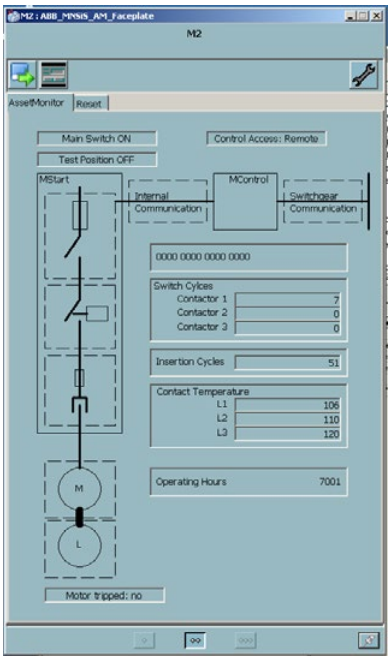
Utilization of integrated switchgear enables the maintenance to be taken into an even predictive maintenance practice, where information available from the switchgear can further assist with maintenance workflow.

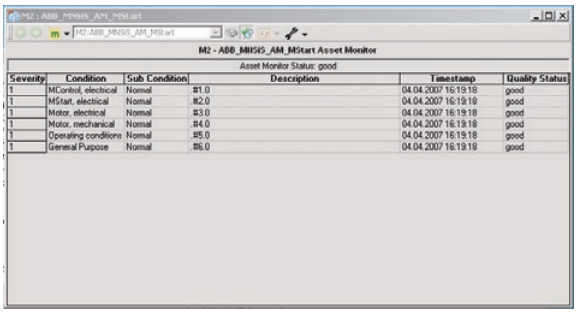


Asset Monitoring System
To further improve maintenance, ABB's service technology could help customers achieve self-monitoring of switchgear, saving maintenance effort and money that would otherwise be wasted on equipment that is in good condition.

All events, alarms and trips information assessed by the Asset Monitoring System is used by the user to plan predictive maintenance and important basic work. All condition information, such as electrical/ mechanical information or information related to plant systems, can be monitored and classified by the Asset Monitoring System. A cause and a suggested solution are to be given for each condition.

Asset Monitoring System develops the next plan for a comprehensive maintenance program to help customers achieve higher switchgear availability through Proactive maintenance.





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Asset Monitoring

Technical descriptions relate to MNS 3.0.

MNS 3.0 Low Voltage Switchgear Technical Info

The brochure is associated with other MNS® Low Voltage Switchgear publications, such as:
MNS® Low Voltage Switchgear Service Manual-Installation, operation and Commissioning
MNS® iPDU (Intelligent Power Distribution Unit) Technical Info
MNS® Low Voltage Distribution Board and Power Cabinet Technical Info
MNS® & MNS *i*S Low Voltage Switchgear Safety Solution

About Intelligent Low Voltage Switchgear more information:
MNS Digital Switchgear
MNS *i*S Motor Control Center System Guide
MNS *i*S Condition Monitoring-Enhanced availability through innovative design
MNS *i*S Switchgear System - Your Platform to success Values for End Users
MNS *i*S Switchgear System - Your Platform to success Values for EPCs
MNS with M10x Intelligent motor management