



Automation Products

# Low Voltage Switchgear MNS System Overview

# Introduction to the MNS System

**ABB is the global leader for production of a wide range of low voltage energy distribution systems.**

In 1992 ABB started operations in Baltic States. Low voltage systems factory in Keila (Estonia), offers to its customers a wide choice of switchgear systems inclusive of the MNS system.

Permanently developing the product range, ABB draws wealth of background experience in project management and low voltage switchgear manufacturing for its customers, as well as offers a great command of state-of-the-art technologies.

The MNS low voltage switchgear system is designed and built to be the heart of any modern, highly automated motor control or power distribution system.

The consistent application of the modular principle both in electrical and mechanical design as well as the use of standardized components allows its flexible and compact design. Depending on customer requirements, operating and environmental conditions different design levels are available.

System safety is confirmed with plenty of type-tests according to IEC 60439-1 such as: verification of temperature rise limits, verification of dielectric properties, verification of the short-circuit withstand strength, verification of the effectiveness of the protective circuit, verification of clearances and creepage distances, verification of mechanical operation, verification of the degree of protection. In addition ABB adopted as a standard IEC 61641 for testing under conditions of arcing due to an internal fault. Earthquake-, vibration- and shock-proof designs are available.

**It is no surprise that the MNS system is the benchmark for operational safety, reliability and quality.**

MNS proves to have the approved solutions for pulp and paper, metal and petrochemical industry, power stations, shipbuilding industry and marine applications, and also for infrastructure objects (such as waste water treatment plants, airports, hospitals, data centres, etc.)

**Safety, unique design and innovativeness of the MNS system, as well as global service and support network ensure that the choice of MNS will be the right decision.**



# Switchgear Design

The MNS switchgear is divided into separate equipment, busbar and cable compartments.

The design solutions used clearly decrease the possibility of damages occurring to components inside the switchgear. In the unlikely event of arcing, damage is localized in the compartment where the arc occurred. This allows fast repair and recommissioning of the switchgear.

The basic elements of the MNS frame construction are “C” shaped steel profiles with a 25 mm (=1 ) hole pitch according to DIN 43660. The profiles are galvanic protected (Zn or Al/Zn) against corrosion. The assembly is maintenance free.

MNS switchboard enclosure is made of sheet steel protected by galvanic coating and powder coating for maximum durability. Final construction varies depending upon the required degree of protection (IP) 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.

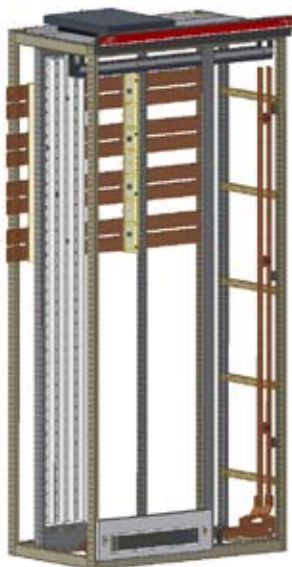
The MNS main busbar system is arranged in the rear of the switchgear in the busbar compartment. This assures a maximum distance between the busbars and the operator and maintenance staff. Special fastening method guarantees safe connections during the whole life cycle without the need of additional tightening. Main busbars are divided into sections depending on transportation units. Main busbars can be ma-

nufactured from aluminium or copper. As option fully insulated solution utilizing heat shrinkable sleeving is available.

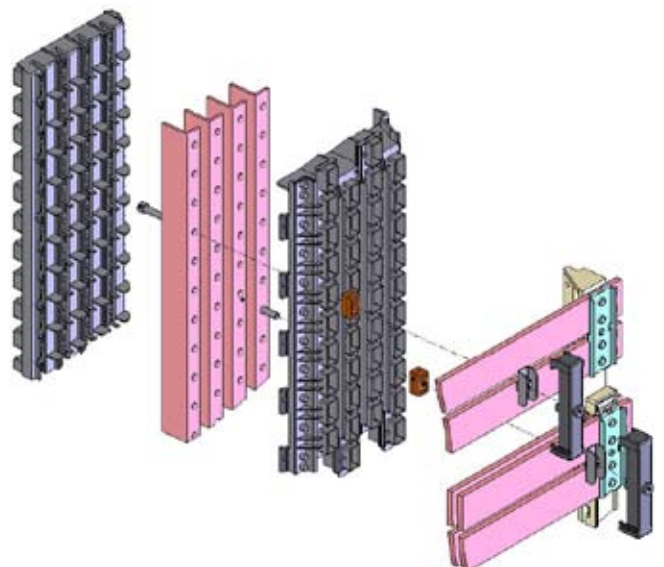
Copper or aluminium (optional) distribution busbars run vertically the full height of the cubicle and are used for feeding of outgoing modules. In case of withdrawable module solution distribution busbars are manufactured from silver plated copper and embedded into a multifunction wall. The multifunction wall is a unique MNS 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.

## System highlights:

- **Maintenance free busbar construction**
- **Easy switchgear extension**
- **Main busbar arrangement at the rear thus assuring**
  - maximum 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 busbars system**
- **Option for Form 4 separation for both incoming and outgoing assemblies**
- **Active and passive arc fault prevention tested according to IEC 61641**
- **Isolating materials are free of CFC and halogens**



MNS frame with copper main busbars and L-shaped silver coated distribution busbars for withdrawable modules



Installation of busbars (from left to right: busbar cover, distribution busbars, multifunctional wall, main busbars)

# Different Module Application

## The MNS system offers different standardized solutions for incoming and outgoing feeders.

Switchgear requirements differ from project to project. The MNS system easily allows the assembly to be configured to suit all technical conditions and plant operational procedures and to decrease operational expenses and when possible general investments.

## Different types of modules can be combined in one common switchgear.











The MNS switchgear with **fixed outgoing modules**, in which all electrical connections made with screws and bolts are fixed, has proved to be a reliable solution. The front door is locked, when the main switch is on. The door can be opened for visual inspection of the equipment without interrupting the supply by using a specially designed method. Fixed modules are used for power distribution feeders with circuit breakers or fuse switches or for motor starters.

The **withdrawable module** technique has proved to be the appropriate solution for use in industrial applications where requirements for high availability are a must particularly in Motor Control Centres (MCC). All electrical connections are realized using sliding contacts, what makes possible fast and easy exchange of modules under live conditions.

Thanks to the specially constructed power contacts and use of the multifunction wall, full phase segregation is assured prior to the connection of the power contacts to the distribution bars. That design minimizes the possibility of an accidental arc occurrence.

Withdrawable modules are operated with the multifunction operating handle. This handle also activates the electrical and mechanical interlocking of the module and the module door. No further tools or unlocking devices are necessary to withdraw a module. Thus replacing a module takes less than a minute.

### Interlocking System/Operating Handle Position

Position			Mechanical status		Electrical status		
8E/4, 8E/2	4E...40E	Designation	Module inter-locked	Padlock possible	With-drawable contacts	Main switch	Control circuit
		ON position (I)	✓	—			
		OFF position (O)	✓	✓			
		Test position	✓	✓			
		Disconnected position (isolated position)	✓ 30 mm with-drawn	✓	○		
		Moving position (withdrawn position)	— removal possible	—	or		

Withdrawable modules are mostly used for motor starters up to 355 kW.

**Standard control circuit diagrams are available on request.**

### MNS withdrawable modules:



8E/4 module up to 18,5 kW



8E/2 module up to 30 kW



8E module up to 75 kW

# Different Module Application

Thanks to its inherent modular design MNS can easily be adapted to house the ABB range of AC Industrial Drives.

The switchgear can accommodate multiple drives in a single section. Each drive compartment has an individual isolator; options are available for auxiliary relays, filters and breaking choppers to be installed in the same switchgear. It is also possible to mount the drive control panel on the door for parameters overview and modification. This solution excludes the need for cabling between a drive and a feeder, and streamlines commissioning, as well as creates a suitable environment for sensitive equipment.

Standard solutions are available for installation of ABB frequency converters range ACS800 into the MNS low voltage switchgear system.

MNS also offers the possibility of integrating reactive power compensation modules into its standard design.

The standard range covers:

- Network voltages up to 690 V
- 50 or 60 Hz
- All common reactor rates (if required)
- Modules 12,5, 25 and 50 kVar
- Controllers available for 6 or 12 step regulation

The MNS system has standardized solutions for **incoming modules**.

A load break switch or a circuit-breaker can be used as a main switch. If required, it is possible to install an earthing switch. Cable entry solutions or entry solutions with busducts are available.



Incomer 3200A with air Emax circuit breaker and two earthing switches



Switchboard example with withdrawable modules. One partly withdrawn, others in TEST position



Frequency converters integrated into the MNS system

# Integration into the Process Control System

More than thirty years ago, ABB introduced MNS as the first arc contained Low Voltage switchboard design based on separated functional areas. In 1983, the first modular designed fully withdrawable MNS switchboard was delivered. Seven years later, in 1990, the Intelligent Motor Control system with INSUM was the first switchboard including electronic protection and control devices and communication interfaces. **Following the long series of innovations during the past years, ABB offers the fully integrated Low Voltage Motor Control center platform, the MNS iS.**

MNS iS platform offers the basic characteristics of an intelligent motor control system: micro processor protection, monitoring and control of motor and distribution circuits, and interfacing to upper plant-wide control systems via fieldbus communications.

**MNS iS** is one integrated MCC system configurable for all possible customer specifications. It can be provided based on conventional up to sophisticated Intelligent Motor Control System requirements.

**MNS iS** makes modifications and enhancement of control and protection functions possible at any time and at any project stage during the complete project life cycle. Thus it provides much needed flexibility for engineers, system integrators and end users.

**MNS iS** secures customer investments as it provides step-up possibilities with future technology developments with the same system.

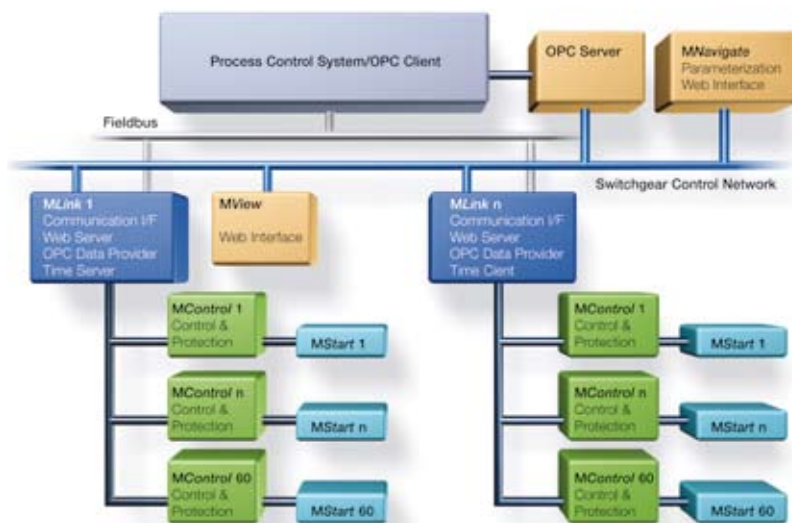
**MNS iS** enables flexible usage of spare parts as a result of the system standardization. A very few standard motor starter variants are needed for a complete plant.

**MNS iS is uniquely safe and simple to operate.**

Power modules and control devices are physically separated and situated in separate compartments; installation of power cables is possible without adverse effect on control and communication equipment. On the other hand all installation jobs in the control compartments can be carried out without the danger of touching live power cables. This unique design is now a standard in MNS iS.

**MNS iS** promotes predictable plant maintenance. Online information at any time and any point of the plant helps to ensure maximum plant operational flexibility.

Predictive maintenance will become integral part of plant operation to ensure reliability of the process.



MNS iS system architecture



MNS iS cubicle

# MNS Technical Data

<b>Standards</b>		Type-tested switchgear assemblies (TTA)	IEC 60439-1, CEI 60439-1, DIN NE 60439-1, VDE 0660 part 500, UTE 63-412
<b>Test certificates</b>		ASTA, Great-Britain (resist. to accidental arcs acc. IEC 61641 and IEC 60298, Appendix AA), DLR German Research Institute for Aerospace e. V. Julich, Earthquake Test for Security Areas in Nuclear Power Stations IABG Industrieanlagen Betriebsgesellschaft, Vibration and shock tests Complying with Germanischer Lloyd, Hamburg	
<b>Electrical data</b>	<b>Rated voltages</b>	Rated insulation voltage $U_i$ Rated operating voltage $U_e$ Rated impulse withstand voltage $U_{imp}$ Overvoltage category Degree of pollution Rated frequency	1000 V 3~, 1500 V- 690 V 3~, 750 V- 6 / 8 / 12 kV II / III / IV 3 up to 60 Hz
	<b>Rated current</b>	<b>Main busbars:</b> Rated current $I_e$ Rated peak withstand current $I_{pk}$ Rated short-time withstand current $I_{cw}$ <b>Distribution busbars:</b> Rated current $I_e$ Rated peak withstand current $I_{pk}$ Rated short-time withstand current $I_{cw}$	up to 6300 A up to 250 kA up to 100 kA up to 2000 A up to 176 kA up to 100 kA
	<b>Arc fault Containment</b>	Rated operational voltage Prospective short-circuit current Duration Criteria	690 V 100 kA 300 ms 1 to 5
	<b>Forms of separations</b>		Up to Form 4
<b>Mechanical characteristics</b>	<b>Dimensions</b>	Cubicles and frames Height Panel width Depth Basic grid size	DIN 41488 2200 mm 400, 600, 800, 1000, 1200 mm 400, 600, 800, 1000, 1200 mm E = 25 mm acc. to DIN 43660
	<b>Degrees of Protections</b>	According to IEC 60529	External from IP 30 to IP 54 Internal from IP 2X
	<b>Steel components</b>	Frame, incl. internal subdivisions Cladding, internal Cladding, external	2,0 / 2,5 mm Minimum 1,5 mm Minimum 2,0 mm
	<b>Surface protection/ Paint</b>	Frame, incl. internal subdivisions Cladding, internal Cladding, external	Zinc or Alu-zinc coated Zinc or Alu-zinc coated Zinc or Alu-zinc coated Powder coated RAL 7035 (light grey)
	<b>Plastic components</b>	Halogen-free, self-extinguishing, flame retardant, CFC-free	IEC 607070 DIN VDE 0304 part 3
<b>Optional Extras available on request</b>	<b>Busbar system</b>	Busbars	Fully insulated Silver plating Tin plating
	<b>Special qualification</b>	Test certificates	See test certificates listed above
	<b>Paint</b>	Enclosure	Special colors on request

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