

xEnergy Main - power distribution switchgear
IEC Low Voltage Power Distribution Center and Motor Control Center

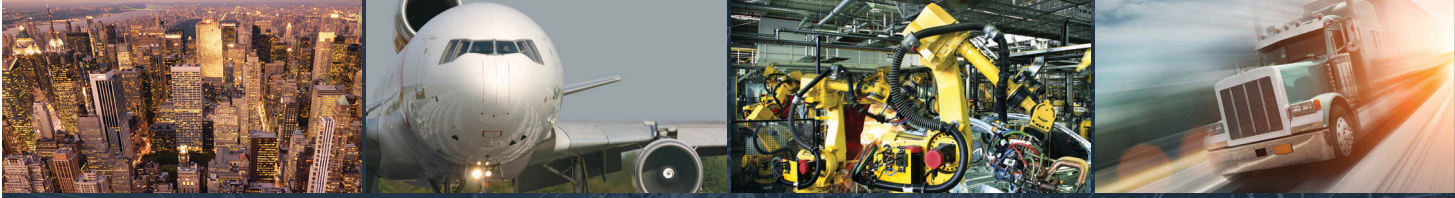
xEnergy Main

Flexible switchgear solutions
maximizing safety & uptime



EATON

Powering Business Worldwide



Energizing a world that demands more.

We deliver:

- **Electrical solutions** that use less energy, improve power reliability and make the places we live and work safer and more comfortable
- **Hydraulic and electrical solutions** that enable machines to deliver more productivity without wasting power
- **Aerospace solutions** that make aircraft lighter, safer and less costly to operate, and help airports operate more efficiently
- **Vehicle drivetrain and powertrain solutions** that deliver more power to cars, trucks and buses, while reducing fuel consumption and emissions

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As a global power management company, we help customers worldwide manage the power needed for buildings, aircraft, trucks, cars, machinery and businesses.

Eaton's innovative technologies help customers manage electrical, hydraulic and mechanical power more reliably, efficiently, safely and sustainably.

We provide integrated solutions that help make energy, in all its forms, more practical and accessible.

With 2018 sales of \$21.6 billion, Eaton has approximately 99,000 employees around the world and sells products in more than 175 countries.

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Powering Business Worldwide

Eaton's global platforms for motor control and power distribution

xEnergy Main is part of the xEnergy product family that covers the entire range of applications. xEnergy Main focusses on power distribution and motor control and is fully scalable and complementary, enabling you to create a fit-for-purpose low voltage system comprising entirely of Eaton components

xEnergy Main

Power distribution and motor control

The xEnergy Main is Eaton's IEC low voltage power assembly up to 7100 A. The system provides reliable power distribution and motor control functionality for all commercial and industrial applications.

The innovative design combined with Eaton's expertise in the area of low voltage applications delivers a platform that is at the heart of any power distribution and motor control application. xEnergy Main is a flexible system which maximizes safety and uptime.

xEnergy Main is a reliable solution for applications where the supply of energy is vital for your business process. Providing form of separation to form 2, 3b and 4b, the withdrawable units can be exchanged without having to disconnect power and / or control cabling.

Complete power solutions

In conjunction with Eaton's comprehensive medium voltage switchgear range, UPS, busbar trunking, panel and distribution boards, project management, service and support, the xEnergy Main platform is part of a complete turnkey solution for your motor control and your power distribution needs.

Global solution

The standardised xEnergy Main platform allows global sourcing of a consistently reliable low-voltage solution, with no regional variation. This helps to reduce delivery times, enhance support and service, and reduce your operating costs – to increase your overall efficiency.



A flexible solution for low voltage power distribution



xEnergy Main power section with four ACB's, in IP42 configuration.

xEnergy Main is Eaton's IEC low voltage power assembly up to 7100 A. The system provides reliable power distribution and motor control functionality for all commercial and industrial applications.

xEnergy Main is a flexible system which maximizes safety and uptime. xEnergy Main offers maximum flexibility with multiple possibilities for fixed, plug-in, removable or fully withdrawable sections, with accessibility for front and/or rear access. Eaton innovations maximize uptime by preventing unscheduled process interruptions and minimizing downtime. Replacing devices can be accomplished within seconds or depending on the configuration a few minutes, even under live conditions. xEnergy Main provides the maximum level of protection for personnel and equipment.

xEnergy Main is verified by testing according to IEC 61439-2

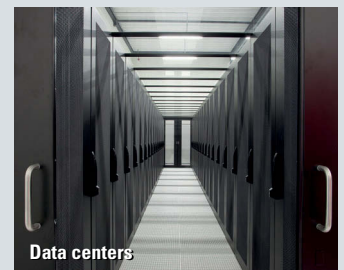
The xEnergy Main comes from more than a century of experience in the design and manufacturing of low voltage systems. This experience and expertise came together in the development of this latest

generation of power distribution Centers: xEnergy Main. To provide a fully integrated and tested solution, Eaton has used their state of the art switching and distribution components within the xEnergy Main platform. Eaton's reputation in the industry is built on the legacy of brands like Cooper, Cutler-Hammer, Bussmann, Crouse-Hinds, Westinghouse, Holec, MEM and Moeller.

xEnergy Main is manufactured and assembled in Eaton facilities or by our licensed panelbuilders all across the world. With the local application knowledge backed up with a multinational diversified industrial organisation and experience, Eaton can offer a comprehensive service tailored to customer requirements, ranging from consultancy, engineering to total project management. xEnergy Main offers a state of the art solution for power distribution and motor control in a single low voltage platform.

Complete range up to 7100 A

xEnergy Main is a complete range for power distribution and motor control up to 7100 A. In combination with Eaton's medium voltage switchgear, UPS (Uninterruptible Power Supplies), busbar trunking, panelboards, distribution boards, project management and service capabilities, xEnergy Main is part of any complete turn-key solution for all power distribution and control applications.



Data centers



Process industry



Hospitals



Water treatment plants



Infrastructure

Features and benefits

xEnergy Main is a broad platform with multiple possibilities.

Reliable in operation

- Complete product design third party certified in accordance with IEC 61439-2 (Verification by testing).
- Designed and tested according to IEC / TR 61641 criteria 1-7.
- Quality assurance in accordance with DIN EN 9001 / ISO 9001.
- Routine tested in ISO certified manufacturing locations.
- External degree of protection is third party tested for IP31, IP42 and IP55 according to the IEC 60529.
- Full internal separation of all functional units designed in accordance with forms 2b, 3b, 4a and 4b (up to BS-EN forms of separation types 6 and 7).

Safe in operation

- Plug-in and Withdrawable compartments can be modified without the need for complete system shutdown.
- Automatic door interlocking of withdrawable and removable feeders to prevent access to devices when the disconnect switch is in the ON position.
- xEnergy Main assemblies are built by licensed panelbuilders or Eaton factories with Eaton devices with a proven track record.
- Padlock facilities available for all operating and interlock mechanisms.
- 3-point-lock system is available on all cableway doors to ensure maximum safety.

System flexibility

- Modular design.
- Small footprint.
- Fixed, removable and withdrawable units.
- Variable widths for cableways.
- Easy to upgrade and extend the switchboard.
- Suitable for universal use as the dimensions are in accordance with the main industrial standards (DIN VDE, CEI, UNE, NF and BSEN).
- Cable connection from top and/or bottom (front and rear) optimised for multiple IEC 61439-6 compliant busbar trunking systems.
- Corner cubicles for flexible line-ups optimising space-usage in the switch room.
- Multiple main busbar positions allowing front and rear access, multiple stacked ACB's and footprint reduction.

Total cost of ownership

- Up to 24 feeders (160 A frame MCCB or FCS) or 25 motor starters (15 kW DOL) can be installed in one single section to reduce footprint and achieve maximum density.
- Possibility of 4 air circuit breakers in a single 800 mm wide section.
- Compartments or devices can be quickly and easily changed to ensure maximum uptime for the business processes.
- The use of high-grade materials and components, reduces maintenance to a minimum.



xEnergy Main is able to combine multiple functionalities into one configuration.

Basic design

xEnergy Main is modular in construction. It is a self-supporting sheetsteel structure, consisting of profiles and sheet-steel side walls and covers.

The xEnergy Main panels have three major areas:

1. The busbar section

The fully segregated main busbar chamber can be located in the back (top/ bottom position) of the structure or available as a top configuration (top/ middle/ bottom position).

2. The cabling section

Located in a separate fully segregated cable chamber at the rear or besides the equipment section.

3. The equipment section

Located at the front where the functional units are fitted.

The system is designed for 'front cable access' for applications where the panels must be located adjacent to a rear wall.

Alternatively the system can be arranged for rear access, a 'single line of structures' giving all around access to panels for operation and cabling.

Arrangements for 'back to back' configurations are possible.

Busbar back configuration



Distribution panel (example)
Busbar back design

1. Outgoing cable connection compartment
2. Main incoming feeder unit
3. Flushed key lockable door handles
4. Mounting plinth
5. High density outgoing feeder
6. Outgoing cable connection compartment
7. Outgoing feeder
8. Empty compartment
9. Ventilation

Busbar top configuration



Distribution panel (example)
Busbar top design

1. Main busbars
2. Incoming or outgoing feeder unit
3. Outgoing feeder
4. Main busbars
5. Riser panel
6. Mounting plinth

Main busbar system

The xEnergy Main main busbars are arranged in a separate compartment to ensure the right form of separation and internal degree of protection. All main and distribution busbars are maintenance free. Two busbar designs are available, busbar back and busbar top.

The main busbar system is maintenance free and fully separated from the equipment and cable compartments. The busbars are rated up to 7100 A - 105 kA / 1 s.

On site extension of the main busbar system can be easily and quickly accomplished with the appropriate busbar coupling clamps; no drilling is required.

The material specification of the busbars is copper: EN 13601-Cu-ETP-R250.

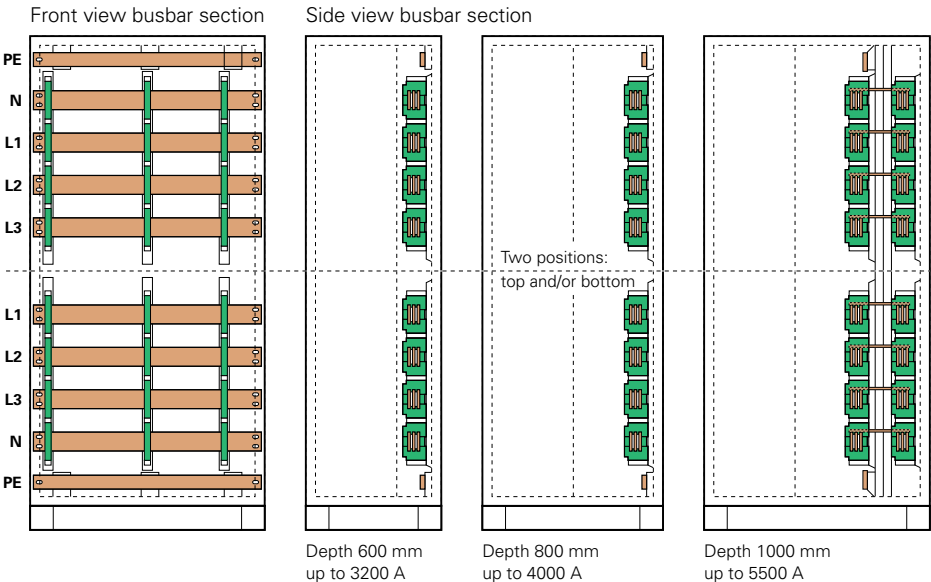
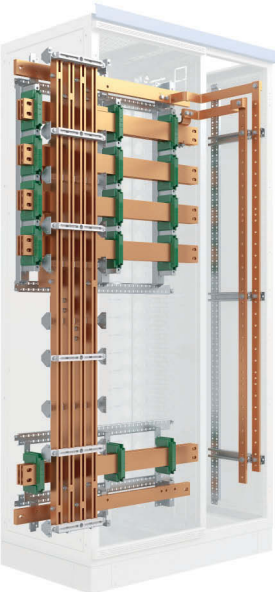
Main busbar Systems

Busbar type	Positions	Current	Short circuit capacity		
		I_n	$I_{cw} (1s)$	$I_{cw} (3s)$	I_{pk}
Busbar back (BBB)	Top / bottom	800 A - 5500 A	up to 100 kA	up to 50 kA	up to 220 kA
Busbar top (BXT)	Top / middle / bottom	800 A - 7100 A	up to 105 kA	up to 66 kA	up to 231 kA

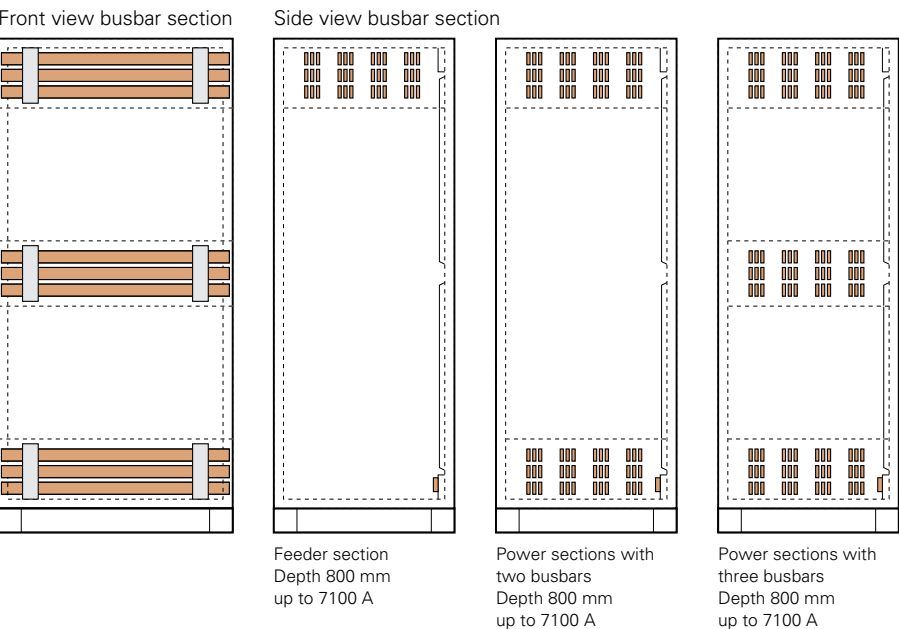
Main busbar systems

Busbar type	Frame rating	Depth
Busbar back (BBB)	up to 3200 A	600 mm
Busbar back (BBB)	up to 4000 A	800 mm
Busbar back (BBB)	up to 5500 A	1000 mm
Busbar top (BXT)	up to 7100 A	800 mm

Busbar back configuration (BBB)



Busbar top configuration (BXT)



Flexible power distribution solutions



NRX air circuit breakers.



NZM2 circuit breaker with removable neutral link.



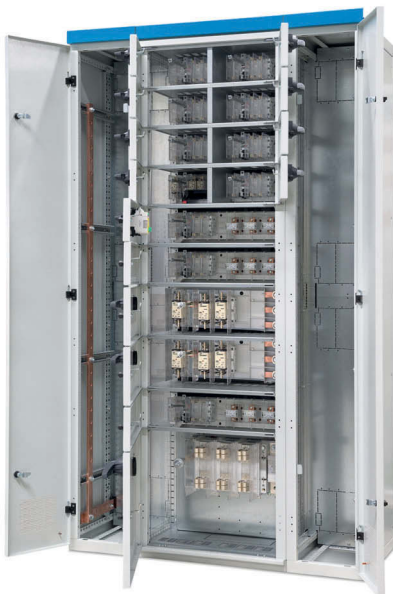
Plug-in adapter.

Power sections

- Incoming, outgoing and bus coupling solutions
- Air circuit breakers, moulded case circuit breakers and switch disconnectors
- Safety due to internal separation up to form 4
- Flexibility by choice of cable and busbar trunking connection from the top or bottom

Fixed outgoing sections

- Power Distribution feeders with NZM circuit breakers up to 1250A
- Internal separation ranging from form 2b up to form 4b (type 6 and 7)
- Toggle and rotary operation
- Available with plug-in adapter



Fused combination switch, QSA 400A, form 4a compartment.



Withdrawable compartment.



15 kW DOL motor starter.

Removable outgoing sections

Busbar back configuration only

- Power distribution feeders with removable NZM circuit breakers and QSA fused combination switches up to 630 A
- Internal separation up to Form 4
- Easy maintenance and reduced down times

Withdrawable outgoing sections

- Power distribution feeders with NZM circuit breakers up to 630 A
- Motor starters up to 250 KW
- Drawers can be replaced under live-line working conditions ensuring minimum down times
- Internal separation up to form 4
- Remote monitoring and control with Smart-Wire DT and C440 based communicating solutions

Flexible by design

Modular design and small footprint

xEnergy Main offers a switchgear solution flexibly tailored to the needs of project demands. Whether this requires front access or rear access with a busbar at the top or in the back, xEnergy Main has the answer. With the increasing focus on cost and space the xEnergy Main provides many features and many possibilities to maximise performance while optimising footprint.

Examples are the quad stacked Air Circuit Breaker sections or the dual compartment high density outgoing units with either moulded case circuit breakers or fused combination switches enabling up to 24 feeders (160 A frame MCCB or FCS) or 25 motor starters (15 kW) in a single cubicle. Remote operation or plug-in adapters for MCCBs will dramatically increase the functionality and flexibility with little effort.

Distribution and motor control

Distribution and motor control units can be included in the same panel. A MCCB feeder unit and withdrawable motor starter can be placed in the same structure.

Different position of main and distributions busbars

With the two main busbar designs, busbar back and busbar top, 5 busbar positions are possible. Distribution busbars are placed behind and adjacent to the functional units.

Fused and breaker solutions

Power distribution applications with fused combination switches and moulded case circuit breakers are available in xEnergy Main.

xEnergy Main is offering the best of two worlds in component integration for overcurrent and short-circuit protection. Both breaker and fused technologies are key competencies of Eaton.

Fused solutions offer high breaking capacity and current limiting properties and make coordination and selectivity of multiple switching devices connected in series possible.

MCCB's offer ease in operation like simple resetting and easy adjustable settings. MCCB's don't require spare parts and several functions (other than switching and protection) can be combined in a single device: earth-fault protection, remote operation and communication.

Variable widths for cable compartments

Generous sized cableways are available for top and bottom cable entry. Depending on the application the cable compartments for wiring range from 175 up to 600 mm wide.

Easy to upgrade and extend the switchgear

The switchgear can be extended at either end and whenever this is required. So when the demands for the switchgear changes it can be upgraded and panels can be added with minimal process interruptions.

Suitable for cable and busbar connections

xEnergy Main is designed for flexible customer connection methods: whether cables or busbar trunking systems. Both xEnergy Main and multiple busbar trunking systems are verified by testing according to the IEC 61439-2 and IEC 61439-6.

Corner cubicles to allow for flexible line-ups to suit the switch room

Switch rooms come in many dimensions and that is why the xEnergy Main is able to be manufactured

in various flexible shapes with the help of corner cubicles. L-shape, U-shape or back-to-back configurations are available to fit the switch room lay-out.

Add safety, measuring and Power factor correction equipment

Maximum flexibility in one switchgear system.

- Eaton's patented Arcflash Reduction Maintenance System™
- Zone Selective Interlocking (ZSI)
- Seismic qualifications according IEC, IEEE and IBC
- Visualization and logging Systems
- Mechanical interlocking for restricted access
- Automatic transfer switching
- Arc proof assembly according IEC/TR 61641 criteria 1 to 7
- Plug-and-play metering options
- Surge protection devices
- Power factor correction



xEnergy Main equipped with power factor correction.

xEnergy Main solutions (see page 8)

	Power sections	Fixed outgoing	Removable outgoing	Withdrawable outgoing
Form of separation	up to form 4b	up to form 4b	up to form 4b	up to form 4b
Operation	Toggle / rotary	Toggle / rotary	Toggle / rotary	Toggle / rotary
Busbar top - positions	Top / middle / bottom	Top	-	Top
Busbar back - positions	Top / bottom	Top / bottom	Top / bottom	Top / bottom
Cable access	Front / rear	Front / rear	Front	Front / rear

Reliable and safe in operation



Standards and technology

As standards evolve, and clients demand higher levels of reliability and safety, Eaton meets these market requirements with the latest technology.

Whether it is meeting the latest requirements of IEC 61439 for low voltage switchgear, personal safety under arc fault conditions according to IEC/TR 61641, addressing safety concerns while working near equipment, you can rely on Eaton's 100 year heritage and leadership in switchgear design.

When it comes to system and process integrity, additional safety and uptime improvement features are included in the xEnergy Main designs. Full compliance and arc fault third party certification according to IEC / TR 61641 criteria 1-7 or the inclusion of Eaton's patented Arcflash Reduction Maintenance

System feature will increase the safety of your operating and maintenance personnel.

Complete design certified in accordance with IEC 61439-2.

Eaton's proven technologies have been integrated in the design and development of the latest generation xEnergy Main switch gear in order to ensure the complete system flexibility, safety and uptime:

- IEC 61439-1/2 verification by test.
- Components meet the requirements of IEC 60947 and related series of specific component standards.
- Operator safety has been central in the design philo-

sophy of the system. xEnergy Main is designed and tested to meet the criteria for personnel protection as described in IEC/TR 61641. The xEnergy Main assemblies have been tested with optional arc mitigation features to improve safety performance under arcing conditions.

In addition to the stringent type test requirements laid down in the IEC 61439 standard, xEnergy Main is subjected to a full range of routine tests and a thorough quality control regime.

Compartment for outgoing units can be modified without process interruption

The design of the plug-in, removable and withdrawable units offers optimum personnel protection and rapid interchangeability of the functional units without having to isolate the entire system, in compliance with appropriate local regulations. This means that module replacements and additions to the system requires minimum downtime. This enables safe and convenient modification and exchange under energised conditions.

Increased robustness to meet seismic conditions

For increased robustness, xEnergy Main is available in a seismic compliant version to level AG5 of the IEC 60068-3-3 and IEEE 344.

Quality assurance in accordance with DIN EN 9001/ISO9001 with routine tests carried out in ISO 9001 certified Eaton manufacturing locations

Various routine tests are carried out during the production of the system. To assure quality, all processes are in accordance with DIN EN 9001. This means that at every stage of manufacture and production, the cubicles and the components; circuit-breakers, control components, current transformers and logic components are all inspected and tested in accordance with their own specific IEC standard.

When the entire installation has been assembled, a thorough visual inspection is carried out, together with mechanical, functional, and electrical checks. As a minimum the routine tests required by IEC 61439 are carried out on each panel.

Safety due to use of standardised components which have a proven track record of distribution and control

xEnergy Main uses standard Eaton components, offering a wide range of distribution and motor starter ranges and applications. The experience and proven track record of these components like NRX, NZM, QSA, PKZ, PKE and DIL make xEnergy Main the system you can rely on.



Busbar trunking systems

xEnergy Main is designed and standardised to be used with different busbar trunking systems.

xEnergy Main power sections equipped with fixed or withdrawable IZMX16, IZMX40, IZM26 and NZM4 breakers can be connected with flange units from different busbar trunking systems.

Different grid configuration are supported entering the power section from either the top or bottom.

Flexibility and safety - process changes under live conditions

Process changes, for example the up rating of motor power or exchanging of compartments, may require on-site modification of motor starter circuits or reconfiguration of compartments.

The xEnergy Main design is able to meet these requirements under live conditions.

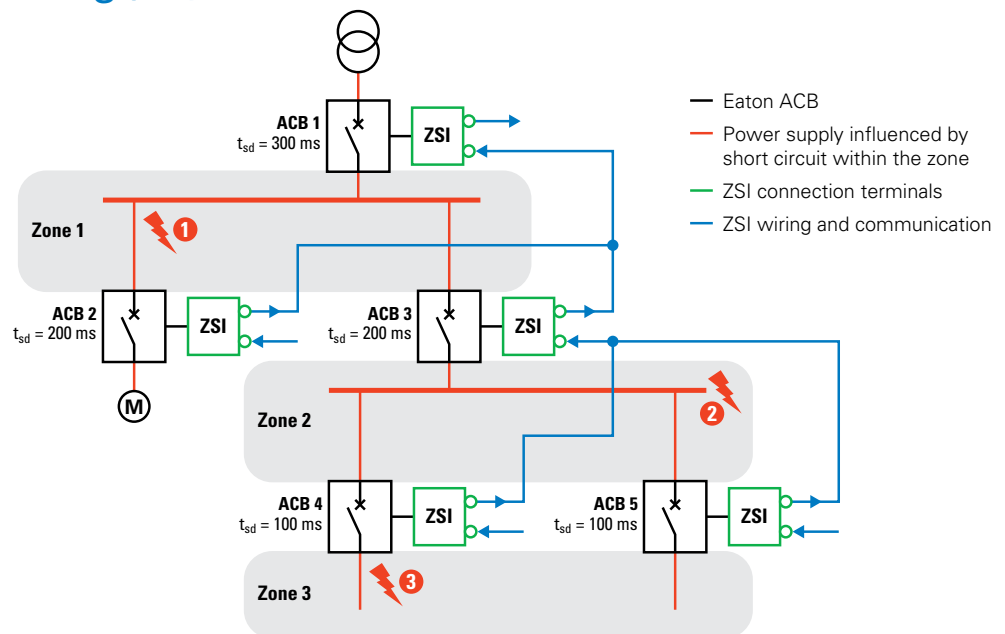
In cubicles with a vertical distribution busbar system, screening plates provide isolation from live parts allowing for safe modification or exchange under live conditions. The distribution bars allow for the connection of contacts along its entire length thus allowing for the modification of outgoing compartment sizes to be safely carried out under live conditions.

Compartment separation plates are secured at the front of the cubicle. The separation plates can be easily and quickly removed and secured in a different location to create a new compartment layout and size all safely under live conditions.

Zone Selective Interlocking (ZSI)

Eaton Air Circuit Breakers equipped with Zone Selective Interlocking (ZSI) will significantly reduce incident energy levels.

With the ZSI technology an unneeded shut down of a total assembly is prevented in case of short circuit. ZSI is the controlling of the circuit breakers to provide selectivity with very short interruption times for the breaker closest to the fault. With ZSI integrated in your assembly additional communication between the ACB trip units is established. This enables breakers, in case of a short circuit, to trip faster than the trip unit settings which will reduce the incident energy levels dramatically.



Arcflash Reduction Maintenance System™

Eaton air circuit breakers equipped with Arcflash Reduction Maintenance System™



Personnel safety is of paramount importance in today's work environment. Of recent concern is the potential for serious injury due to exposure to electrical arcs. There has been significant research performed and recent standards have been written to address the risks of arc flash hazards for personnel working on or near energized electrical equipment.

An Eaton air circuit breaker equipped with Arcflash Reduction Maintenance System™ can improve safety by providing a simple and reliable method to reduce fault clearing time.

Benefits of Arcflash Reduction Maintenance System™ are:

- Increased personnel safety by limiting the available arc flash energy.
- Simple to operate.
- Enabled with the circuit breaker door closed by a door mounted lockable switch or through communication to the breakers trip unit.
- Enabled only for the time required to perform the work.
- Preserves overcurrent coordination under normal conditions.



Equipment downstream of a circuit breaker equipped with an Arcflash Reduction Maintenance System™ can have a significantly lower incident energy level, thus protecting operators or maintenance.

Maximise the uptime of your distribution system



Multiple critical business services are running within buildings, data centers or industrial premises. These services are vulnerable to power problems, both in terms of power availability and quality. To secure maximum uptime

xEnergy Main is offering a wide range of solutions:

Multiple interlocking possibilities

Restricted access to avoid human mistakes.

Zone Selective Interlocking (ZSI)

Preventing unneeded shutdown in case of short circuit (see page 11).

Integrated metering solutions

Integrated metering solutions for real-time monitoring, overload pre-warning and breaker health indication.

Automatic Transfer Switching systems (ATS)

Within xEnergy Main the integration of Automatic Transfer Switching systems is playing an important role when maximising the uptime of an installation. The solutions we offer vary from synchronised switching between two power sources with Eaton's ATS-PWR up to controlling multiple transformer and generator feeds, switching numerous breakers based on Eaton PLC technology.

Power System Automation (PSA)

With Power System Automation solutions we maximise the uptime and resilience of a power distribution installation. Power System Automation is the act of automatically controlling the power system via instrumentation and control devices. The domain of Power System Automation can be split in two typical functions:

- Power system control and power monitoring. Power system control covers logic and relay control schemes with integrated functionalities like automatic source transfer, generator test, load shedding, load sharing and peak shaving and visualisation.
- Power monitoring is the collection of accurate data, providing trend information, including alarm and event functions.

Energy Monitoring



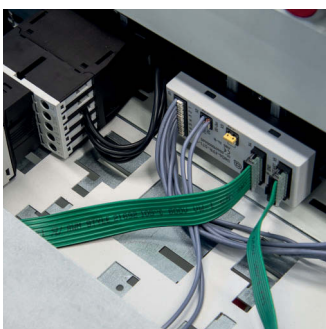
Monitoring the energy consumption is one of the key elements for asset management. Eaton technology supports this task and can provide integrated visualisation and logging within xEnergy Main switchgear. Data is collected from devices like air circuit breakers, moulded case circuit breakers and fused combination switches and displayed on a panel mounted HMI. The operating data from the connected devices is communicated via modbus RTU or other communication platforms.

The information can be obtained onsite on an Eaton HMI or remotely when connected to your network or control system.

Energy monitoring and control increases the uptime capabilities of the power distribution system by not only logging and displaying energy consumption but also by providing predictive maintenance information to reduce unexpected outages. Providing prewarnings of overload before breakers will trip so that preventive

maintenance can be performed before failure. With the new NZM moulded case circuit breakers the unique feature BreakerHealth provides up-to-date status of the longevity of the installed base. BreakerHealth provides contact wear information and is registering mechanical and electrical operations providing lifespan information and warning messages when the lifespan is low to support maintenance and budget requirements for replacement of breakers.

SmartWire DT - connectivity



Eaton's SmartWire-DT communication system is used in xEnergy Main to record information from motor starters, soft starters and variable frequency drives. The retrieved information is transferred via standard fieldbus protocols to the higher-level PLC. Thanks to the use of

intelligent SmartWire-DT switchgear, this not only consists of digital signals for switching or monitoring of positions or overload information but also analogue values such as the actual current or the condition of a trip unit can be determined and evaluated.

Form of internal separation

xEnergy Main panels are designed around three different areas:

1. The main busbar and distribution busbar section segregated from the equipment section.
2. The cabling section located in a separate fully segregated cable chamber for feeding cables to the functional sections and/or housing control and power cable terminations, depending on the form of separation.
3. The equipment section at the front where the functional units are fitted.

IEC 61439-2 defines the various forms of internal separation. The form of internal separation determines how busbars, functional units and terminals are separated from each other. xEnergy Main is designed to provide separation in form 2b, 3b, 4a and 4b solutions.

Form 3b, 4a and 4b are defined as: *the separation of the busbars from each functional unit and the separation of each functional unit from each other.*

The difference between form 4a and form 3b/4b is the position of the terminals to the functional units. In a form 4a

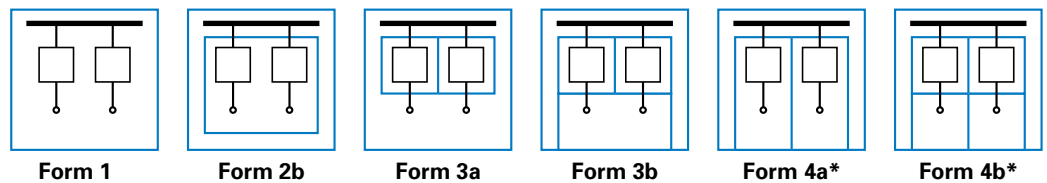
solution these terminals are located in the same compartment as the functional unit.

The difference between form 3b and form 4b is based on how the terminals for outgoing conductors are separated from each other.

Form 3b solution is defined as: *the separation of terminals for external conductors from the functional units, but not from those of other functional units, i.e. a common cable chamber where all outgoing terminals are grouped together. Internal separation in accordance with IEC 61439-2.*

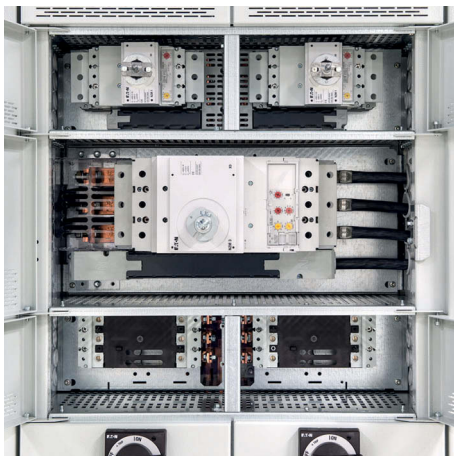
Form 4b solution is defined as: *the separation of the terminals for external conductors associated with a functional unit from those of any other functional unit and the busbars. i.e. individual separation of each functional units outgoing terminals from each other.*

Internal separation in accordance with IEC 61439-2



	Form 1	Form 2b	Form 3a	Form 3b	Form 4a*	Form 4b*
Busbars (main + distribution) are separated from functional units		✓	✓	✓	✓	✓
Functional units are separated from other functional units			✓	✓	✓	✓
Terminals are external to functional units			✓	✓		✓
Terminations to functional units are separated from each other			✓		✓	✓
Terminals are separated from the busbars		✓		✓	✓	✓
xEnergy Main supported forms of separation		✓		✓	✓	✓

* BS-EN 61439 compliance for form 4a type 2 and form 4b type 6 and 7. Form 4b type 6 is available as "compartmentalised" or "group-mounted".

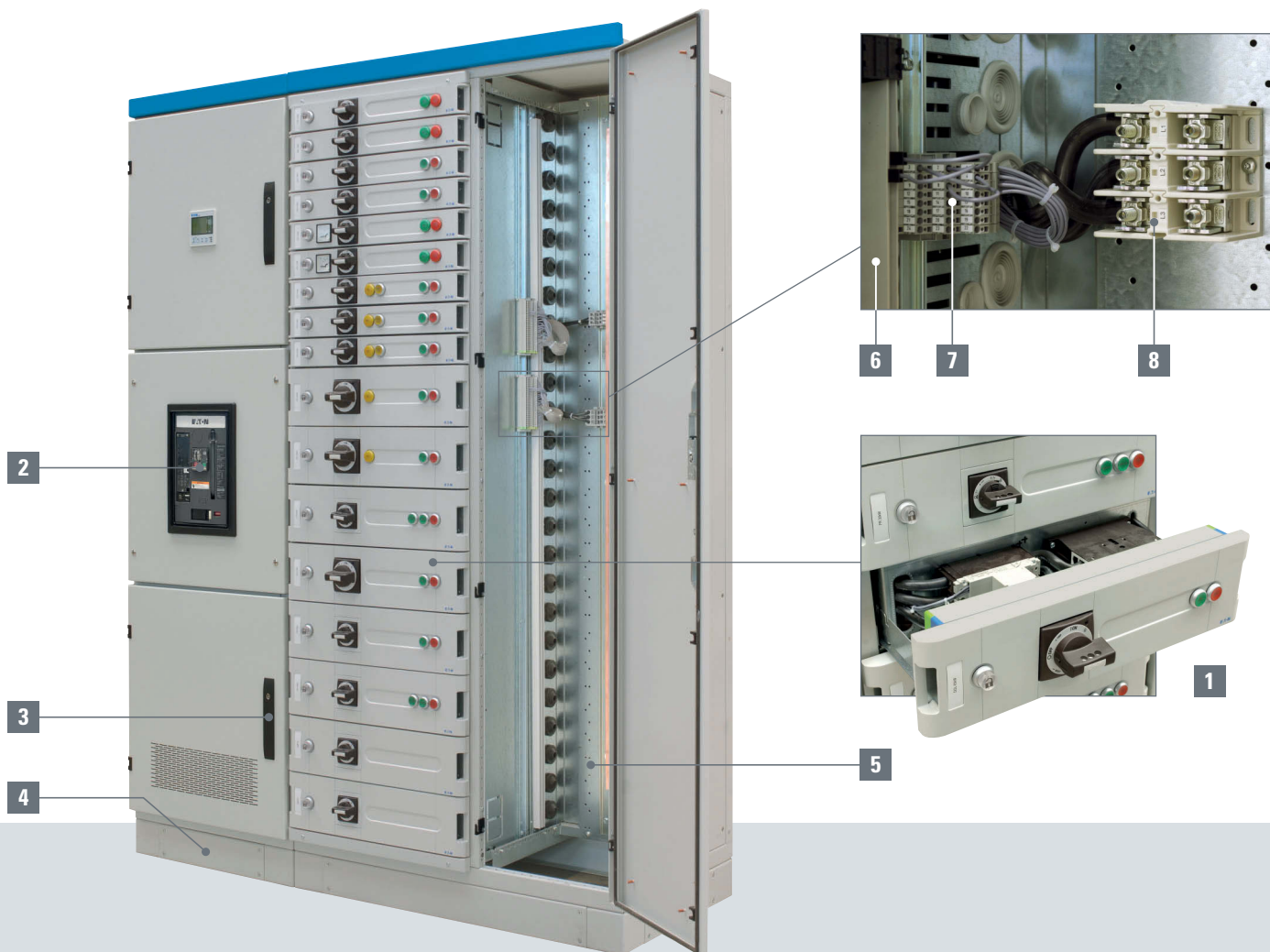


Form 4a with MCCB's on plug-in adapters and a removable neutral link.



Form 4a with type QSA fused combination switches.

Design withdrawable technology



Motor control panels (example)

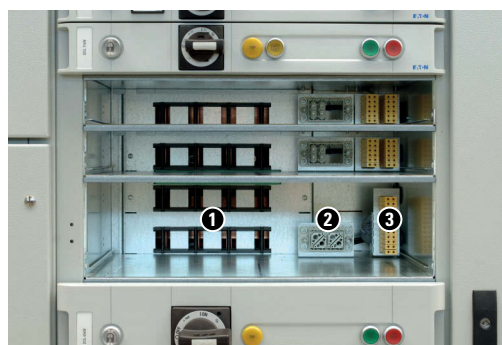
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|--------------------------------------|---|--|
| 1. Withdrawable unit | 5. Outgoing cable connection compartment | 8. Main power terminal block - can be shrouded to provide form 4b form of separation |
| 2. Main incoming feeder unit | 6. Auxiliary control voltage busbar | |
| 3. Flushed key lockable door handles | 7. Control circuit terminal block - can be shrouded to provide form 4b form of separation | |
| 4. Mounting plinth | | |

Distribution busbar system

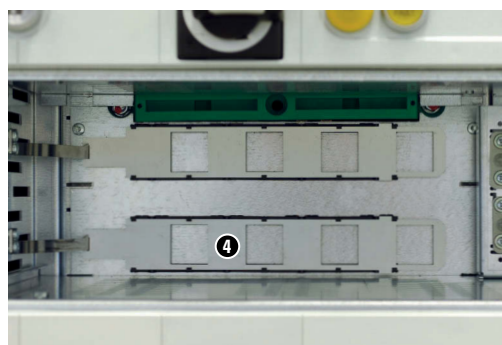
For cubicles with outgoing withdrawable units, vertical busbars are rated at 1000 A and 2000 A and up to 80 kA / 1 s allowing a high density of outgoing units to reduce the total footprint of the installation.

A protective shield which covers the entire height of the bar system, guarantees a level of protection IP2x against accidental direct contact when the drawer has been removed and when the door is open. An automatic shutter mechanism can be fitted as an option to increase this level of protection.

Switchgear and controlgear compartments for withdrawable units



IP2x shielding of the vertical busbar **1**, the outgoing contacts **2**, and auxiliary contacts **3**.



As an option the level of safety can be increased by adding an automatic shutter **4** that totally shields the empty functional unit from the busbar area.

Draw out units

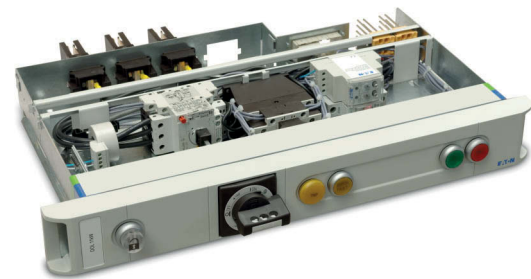
The outgoing units are available in the following heights based on a 75 mm height pitch:

Height of unit	Motor starter	Feeder
75 mm	15 kW	32 A
150 mm	45 kW	175 A
225 mm	75 kW	200 A
300 mm	90 kW	225 A
450 mm	160 kW	400 A
600 mm	200 kW	630 A
750 mm	250 kW	NA

The units connect directly to the distribution bars and can be additionally protected by an optional automatic shutter. The design of the unit enables auxiliary components to be

located in an optimized way because of the innovative use of Eaton's patented DIN mounting rail. This allows for maximum usage of the compartment space, enabling a very easy and flexible way to upgrade or make additions to the withdrawable units. The cable connections for main and auxiliary circuits are accessible through the cableway in either a form 3b or 4b separation solution.

All the withdrawable units are available for distribution and motor control functionality. Up to 25 drawers of 75 mm can be installed in one panel to reduce footprint and maximize density.

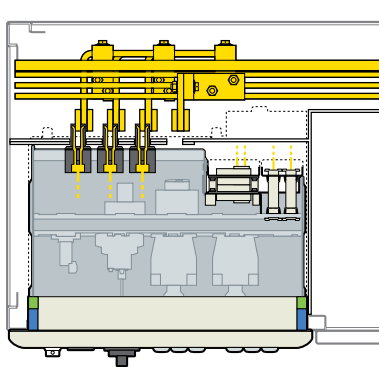


Front view of a withdrawable motor starter unit up to 15 kW (75 mm).

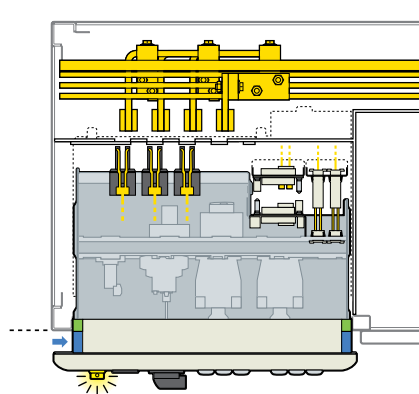


Rear view of a withdrawable motor starter unit up to 15 kW (75 mm).

Unique mechanical test position of MCC withdrawable units

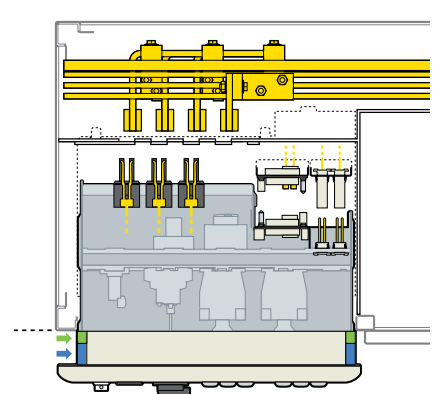


Connected position - ON



Test position

Test button is illuminated and colour blue visible.



Disconnected position

Colours green and blue are visible.

The withdrawable units in xEnergy Main are designed around safety, ease of operation using Eaton's patented mechanical test position, ergonomic design and flexibility. These units can be easily exchanged without having to disconnect any power or control cabling.

The following positions are available for each unit:

- **Connected position**

- **Connected - ON**

The unit is inserted, main disconnect is closed, main and control circuit is connected.

- **Connected - OFF**

The unit is inserted, main disconnect is open, main and control circuits are connected, padlocking is possible.

- **Test position**

The unit is partially withdrawn and is separated 30 mm from the distribution bars, main disconnect is open, main circuit is disconnected, control circuit is connected, the test button is illuminated, padlocking is possible.

- **Disconnected position**

The unit is partially withdrawn and is separated 45 mm from the distribution bars, main disconnect is open, main and control circuits are disconnected, padlocking is possible

- **Removed unit**

The unit is completely withdrawn from the motor control center and the optional dummy unit can be inserted.

When the unit is in the "ON" position, the mechanical test position mechanism is interlocked with the operating shaft of the main disconnect device (MCP) to ensure that the compartment can not be withdrawn.

All positions are also clearly marked on the drawer position indicator strip with the blue (test) and green (disconnect) colours for extra visual aid.

The units are fully withdrawable without using tools and the different positions of withdrawable parts (connected, test, isolated and removed) will be achieved in accordance with table 103 of IEC 61439-2.

The degree of protection in the test and isolation position shall be at least IP3X. This allows the operator to leave the compartments in the panel when in the various positions without impacting the integrity of the complete system.

Design philosophy of MCC withdrawable units

Type 2 coordination



The International Electrotechnical Commission (IEC) developed short circuit performance criteria for contactors and motor starters called type 1 and type 2 coordination. This standard defines motor controller protection levels following a short circuit fault.

Performance levels

Either type 1 or type 2 coordination are determined by the level of damage to components within a motor

controller after a short circuit fault on the outgoing side of the controller. The combination of a motor controller (contactor or starter) and short circuit protective device (manual motor protector, circuit breaker or fuse) must meet the following criteria as specified by IEC 60947-4-1.

Motor controllers with type 1 coordination protection level are allowed to have significant damage after a short circuit and may not be suitable for further service without repair and replacement of parts.

Type 2 coordination protection provides confidence that the motor control components will be operable following a short circuit fault. This reusability translates into huge savings due to reduced downtime and replacement costs.

xEnergy Main motor control units are designed and tested to provide type 2 protection in the entire system thus ensuring the highest uptime during its lifetime.

M2L integrated power distribution system

Compact, integrated solution for medium voltage connection, transformer and low voltage distribution

Eaton has power distribution products from medium voltage down to low voltage level. The M2L electrical distribution system integrates these products into a complete factory build solution, which combines the medium voltage

connection and the low voltage distribution, including transformer. A turnkey solution which offers significant benefits, in terms of investment and usage, for installers and end customers:

- Minimise expensive low voltage cables
- Limit power losses in the cables
- Limit assembly costs
- Save on building costs for the technical room
- Very short assembly time
- Factory tested



M2L-configuration with 24 kV Xiria medium voltage switchgear, 1600 kVA Eaton dry-type transformer and xEnergy Main.

Intelligent motor control center

with Eaton's C400 series electronic overload relays

To provide reliable, accurate, and intelligent motor protection, xEnergy Main utilizes Eaton's C400 series of advanced motor protection. Eaton's C400 series provides varying levels of electronic overload devices to enhance energy awareness, improve diagnostic capability, increase operator safety, and maximize uptime through superior monitoring and protection.

C440 electronic overload relays



Eaton's C440 electronic overload relays provide reliable, accurate and value-driven protection – including communications capabilities in a single compact device. The electronic design of Eaton's C440 electronic overload relay delivers enhanced motor protection based on the ability to directly monitor motor current in each phase. Thermal modeling is performed electronically with precision solid-state components. The electronics accurately identify excessive current or phase loss and react to the condition with greater speed, reliability and repeatability than a traditional electromechanical device.

The C440 overload relay is designed to provide enhanced protection over competitive models. The C440 provides

predictive indication via an LED indicator. At a glance, you can determine the status of the overload as well as an impending trip to provide enhanced protection of your most important assets.

- Extends the life of plant assets with selectable motor protection features such as trip class, phase imbalance and ground fault eliminating the need for separate Current transformers and specialty modules
- Status LED provides added assurance that valuable assets are protected by indicating the overload operational status
- Improves return on investment by reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Flexible communication (PROFIBUS, Modbus RTU, Modbus TCP, EtherNet/IP, and DeviceNet) with optional I/O enables easy integration into plant management systems for remote monitoring and control

Motor failure has the potential to cause production downtime, costly repair bills and numerous safety concerns for plant personnel. For these reasons, motor protection is a key element in protecting an organization's most valuable assets. Selecting accurate and reliable motor overload protection is the best way to manage costs and maintain system integrity.

Power Xpert™ C445 electronic overload relays



The Power Xpert™ C445 global motor management relay is Eaton's newest addition to the C400 series of advanced motor protection. The Power Xpert™ C445 is fully configurable, providing the highest level of monitoring accuracy and protection for the entire power system – from the incoming power source feeding the motor all the way to the individual pump or load. By utilizing integrated power quality and energy usage analytics along with built-in efficiency and deviation algorithms, users can save significant energy costs through simple indication of unwanted changes in energy usage. With advanced diagnostics like performance trending, fault analysis, and high-accuracy data monitoring, users can prioritize their maintenance schedules to address the most critical pending issues in their system first - before a catastrophic failure occurs.

- By separating the monitoring and control functionality into separate modules, users can easily customize the Power Xpert™ C445 mounting configuration to match their individual application.
- The Power Xpert™ C445 global motor management relay enables users to access, monitor, and configure data parameters within the device without opening the panel door via a standard USB port on the front of the user interface.
- This module also offers local status indication, control, and fault diagnostics, thus providing greater system awareness with a variety of fixed and customizable LED indicators.
- To configure the Power Xpert™ C445, users can utilize Eaton's Power Xpert™ inControl programming software.
- In addition to this software tool, the Power Xpert™ C445 can be easily integrated into a variety of PLC and DCS systems through integrated communication protocols including Modbus RTU, PROFIBUS, Modbus TCP, and EtherNet/IP.

Protection	C440	C445
Thermal overload	■	■
Phase loss	■	■
Selectable trip class	■	■
Ground fault	■	■
Current unbalance	-	■
Voltage unbalance	-	■
Phase reversal	-	■
Jam	-	■
Under/overpower	-	■
Under/overvoltage	-	■
Under/overcurrent	-	■
Under/over frequency	-	■
Voltage loss restart	-	■
Stall	-	■
Instantaneous overcurrent	-	■
PTC (motor temperature)	-	■
Energy deviations	-	■
Voltage loss restart	-	■

Monitoring	C440	C445
Thermal capacity	■	■
Phase currents	■	■
Current unbalance	■	■
Ground fault current	■	■
Frequency	-	■
Voltage unbalance	-	■
Phase voltages	-	■
Real power (kW)	-	■
Under/overpower trip	-	■
Under/overvoltage trip	-	■
Under/overcurrent trip	-	■
Motor start time/count	-	■
Motor efficiency	-	■
Motor speed	-	■

Control	C440	C445
Hard wire/local reset	■	■
Network/electronic reset	■	■
Programmable alarms	-	■
Programmable trips	-	■
Multiple operating modes	-	■
Control user interface	-	■

Communications	C440	C445
Modbus RTU	■	■
PROFIBUS	■	■
Modbus TCP	■	■
Ethernet / IP	■	■
DeviceNet	■	Future
USB	-	■

Main components for distribution and MCC

xEnergy Main uses only the best components in the design of the structure and in the functional units. Eaton power switching and protection components are among the best in the world. A system is only as strong as its weakest link and so the quality of the individual components used determines the performance and quality of the system as a whole.

Eaton delivers xEnergy Main with Eaton's air circuit breaker (ACB), moulded case circuit breaker (MCCB) and fused combination switch functionality.

Understanding the interaction of each individual component and how they operate within a complete system is essential to delivering a fully type tested,

reliable and efficient power distribution and motor control application. All the critical components used in xEnergy Main are Eaton components. Ranging from the main incoming feeders to the pushbuttons and indication lights all the components come from Eaton.

Eaton components are:

Air circuit breakers



Eaton type magnum and NRX air circuit breakers

- Tested according to IEC 60947-2
- Ranging up to 6300 A - 100 kA / 1 s
- Comprehensive and innovative electronic trip unit range (LSIG)
- Fixed and withdrawable mounting
- Complete with extensive range of accessories
- Zone Selective Interlocking
- Arcflash Reduction Maintenance System™

Moulded case circuit breakers and motor circuit protectors



NZM plug-in adapter

Eaton type NZM moulded case circuit breakers

- Only 4 frame sizes cover up to 1600 A - 100 kA
- Up to 690 V - 80 kA
- Innovative switching technology with a double break contact system speeds up the switching process
- Universal and modular accessories
- Eaton BreakerHealth diagnostics available for accurate lifecycle status (wear indication)
- Plug-in adapter available up to 500 A for flexible and safe installation



Eaton type PKZ and PKE motor protective circuit breakers

- Only 2 variants for PKZ to cover the entire range from 0.1 to 65 A
- PKE enables a wide range of electronically-controlled settings
- Common range of accessories for PKE and PKZ including Smart-Wire DT
- No need for additional current limiters

Contactors and fused combination switches



Eaton type DILM contactors

- Tested according IEC 60947-2 for a complete range of motor starter types like Direct-on-line (DOL), Forward-Reverse and Star Delta
- Type 2 co-ordination motor starter combination with PKZ, PKE and NZM circuit breakers



Eaton type QSA fused combination switches

- Switches will accommodate up to 630 A DIN fuses and up to 800 A BS fuses
- Only 3 frame sizes covering the entire range
- Double break per phase
- Mounted on smart and removable adapter to increase flexibility, safety and optimal performances during operation and maintenance
- With patented snap-on CT accommodation

Soft starters and variable frequency drives



Eaton type DS7 soft starters

- Soft starting: the modern alternative to star-delta starters
- Designed for applications such as pumps, fans and small conveyors, the compact DS7 is ideal
- For kW ratings up to 110 kW
- Smart-Wire DT provides direct access to all soft starter parameters



Eaton type PowerXL™ variable frequency drives

- DC1 compact drive for fans, pumps, and conveyor systems (ratings from 0.37 to 11 kW)
- DA1 advanced machinery drive (ratings from 0.75 to 250 kW)
- Compliant with IE2, IE3, and future IE4 energy efficiency standards
- Smart-Wire DT provides direct access to all soft starter parameters

C400 series electronic overload relays



C440 electronic overload relays

- 0.3 - 1500 A, Up to 690 V_{ac} (50/60 Hz)
- Selectable trip class (10 A, 10, 20, 30), earth fault, and phase imbalance protections
- Flexible communication options for both monitoring and control
- PROFIBUS, Modbus RTU, Modbus TCP, EtherNet/IP, and DeviceNet



Power Xpert™ C445 electronic overload relays

- 0.3 - 820 A, Up to 690 V_{ac} (20 - 80Hz)
- Full line, load, and motor system coverage including advanced monitoring and protection algorithms
- Multiple predefined operating modes with corresponding control station options reduces complexity
- Modbus RTU, PROFIBUS, Modbus TCP, and EtherNet/IP



= Personal safety



= SmartWire DT



= Energy efficiency



= Maintenance friendly

Global customer experience

xEnergy Main is Eaton's global platform

Enables customers to standardise globally on their LV system solution

xEnergy Main is offered globally by our local partners and plants providing local access to an internationally recognised and standardised design xEnergy Main.

We can offer customers the platform xEnergy Main in the same standards worldwide.

xEnergy Main is part of Eaton's global offer for power distribution and motor control switchgear. The production takes place in multiple plants all over the world. Customers can benefit from local partner presence and global availability.

A global product does not mean lack of focus on local requirements. Items like local standards, wiring practices, customer contact and utility requirements are fulfilled while maintaining the advantages of a worldwide manufacturer.

Using Eaton's standard configuration tools to reduce leadtime and costs of engineering will help drive the total project time and budget down.

Personal contact plays a crucial role between people despite automated logistics and global availability. This direct connection with customers, their requirements and challenges, is indispensable.

That is why Eaton offers efficient service at a local level throughout the world.

Whether it is the main incomer, the contactor or the pushbutton in the compartments, everything comes from the same source: Eaton. That is why xEnergy Main is designed to meet the best standards in product technology with local service and support.



xEnergy Main

Power Distribution with focus on footprint reduction to limit the need for increased non-revenue generating floor space.

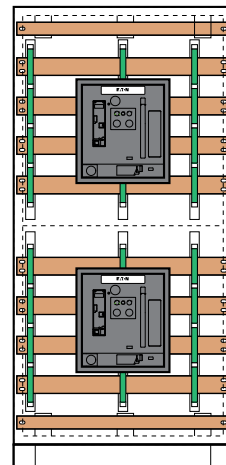
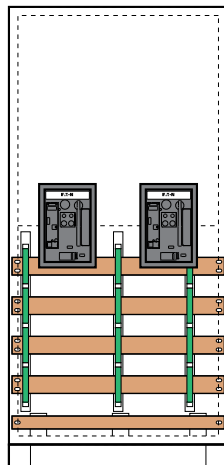
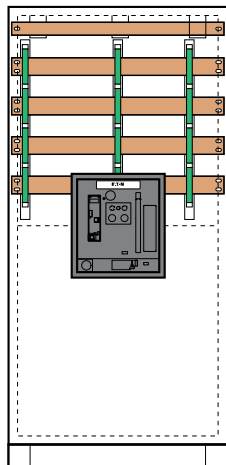
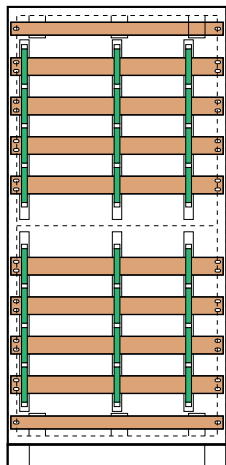


Customers of Eaton **benefit** from a worldwide network of excellence



Power Breaker (ACB and MCCB) sections

Busbar back configurations



Busbar type

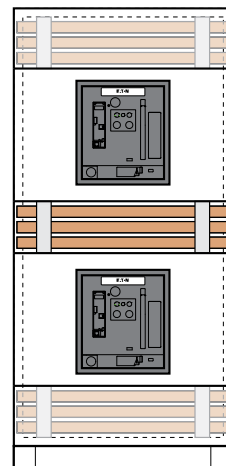
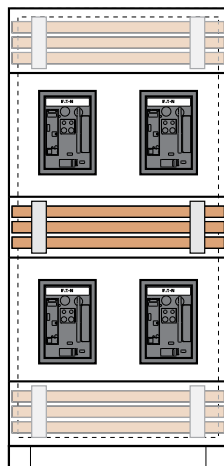
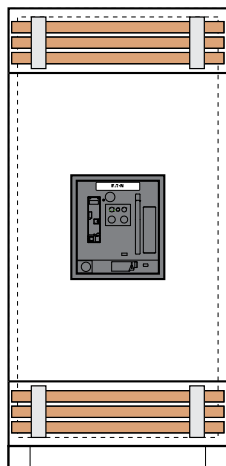
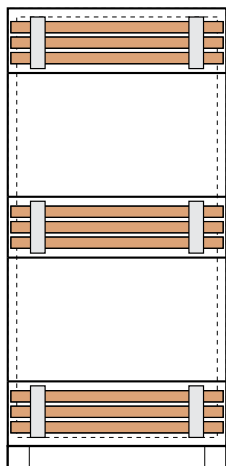
BBB

BBB

BBB

Stacking configuration		Single	Side-by-side	Stacked
Busbar back position		Top and/or bottom	Top and/or bottom	Top and/or bottom
Devices	Frame rating			
NZM3	up to 630 A	✓	✓	
NZM4	up to 1600 A	✓	✓	
IZMX16 - NRX NF	up to 1600 A	✓	✓	✓
IZMX40 - NRX RF	up to 4000 A	✓		✓
Magnum	up to 6300 A	✓		
Standard dimensions (mm)				
Height		2000	2000	2000
Width		425/600/800/1000/1100/1200/1350	600/800/1000	425/600/800
Depth		600 - 1000	600 - 1000	600 - 1000

Busbar top configurations



Busbar type

BXT

BXT

BXT

Stacking configuration		Single	Side-by-side (stacked)	Stacked
Busbar top position		Top and/or bottom	Middle and/or top/bottom	Middle and/or top/bottom
Devices	Frame rating			
NZM4	up to 1600 A	✓	✓	✓
IZMX16 - NRX NF	up to 1600 A	✓	✓	✓
IZMX40 - NRX RF	up to 4000 A	✓		✓
Magnum	up to 6300 A	✓		✓
Standard dimensions (mm)				
Height		2000	2000	2000
Width		425/600/800/1000/1100/1200/1350	800/1000	425/600/800
Depth		800	800	800

Electrical data

System	xEnergy Main
Rated operational voltage	380 - 690 Vac
Rated frequency	50 / 60 Hz
Main busbar data	
Rated insulation voltage	1000 Vac
Rated impulse withstand voltage	up to 12 kV
Rated current	800 - 7100 A
Rated short-time withstand current	50 - 105 kA / 1 s and 50 - 66 kA / 3 s
Rated peak withstand current	231 kA
Vertical distribution busbar data	
Rated insulation voltage	1000 Vac
Rated impulse withstand voltage	up to 12 kV
Application	fixed / removable / withdrawable
Rated current	800 - 2000 A
Rated short-time withstand current	35 - 80 / kA 1 s
Rated peak withstand current	176 kA
Enclosure data	
Degree of protection	IP31 / IP42 / IP55
Form of separation	form 2b / form 3b / form 4a & 4b form 4a type 2 / form 4b type 6 & 7
Entry of cables	Top and / or bottom
Access	Front or rear
Standard colour	RAL 7035

General dimensions (mm)

Busbar back configuration



Busbar top configuration



Standards

xEnergy Main complies with the following international standards

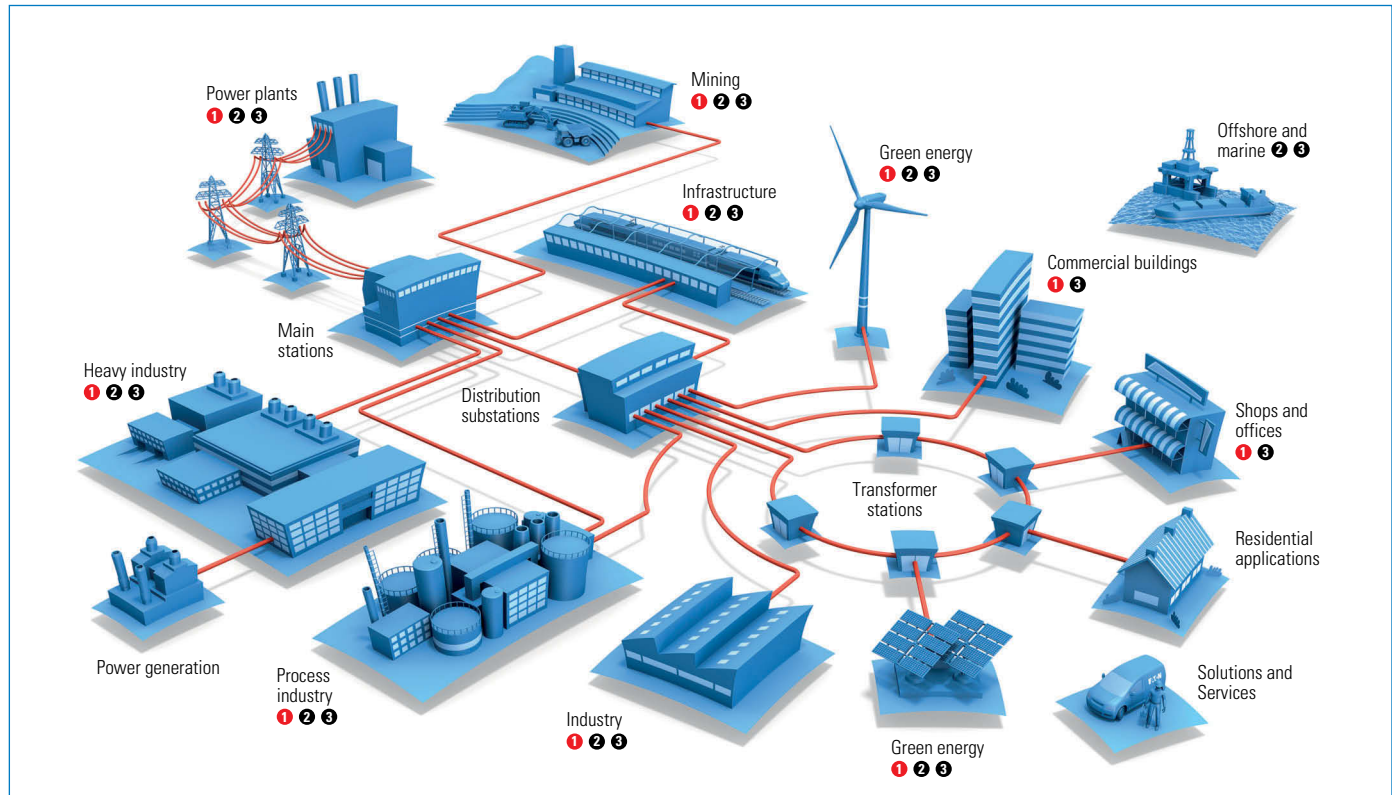
IEC 61439-1	General rules
IEC 61439-2	Power switchgear and controlgear assemblies
IEC/TR 61641 Ed 2.0	Enclosed low-voltage switchgear and controlgear assemblies - Guide for testing under conditions of arcing due to internal fault
IEC 60529	Degrees of protection (IP Code)
IEC 60068-3-3	Environmental testing - Part 3: Guidance. Seismic test methods for equipment
IEEE 344	IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations
IEEE 693	IEEE Recommended Practice for Seismic Design of Substations
IBC	International Building Code



At Eaton, we're energized by the challenge of powering a world that demands more. With over 100 years experience in electrical power management, we have the expertise to see beyond today. From ground-breaking products to turnkey design and engineering services, critical industries around the globe count on Eaton.

We power businesses with reliable, efficient and safe electrical power management solutions. Combined with our personal service, support and bold thinking, we are answering tomorrow's needs today. Follow the charge with Eaton. Visit eaton.com/electrical.

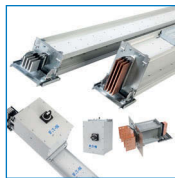
Eaton low voltage products in the energy chain



1 xEnergy Main®



2 Capitole 40



3 Busbar trunking

Eaton Industries (Netherlands) B.V.
P.O. Box 23
7550 AA Hengelo
The Netherlands

Tel.: +31 (0)74 - 246 40 10
Fax: +31 (0)74 - 246 40 25
info.electric@eaton.com
www.eaton.eu

Eaton Electric Limited
Grimshaw Lane
Middleton
Manchester M24 1GQ
United Kingdom

Customer Support Centre
Tel.: +44 (0)8700 545 333
Fax: +44 (0)8700 540 333
ukcommorders@eaton.com
www.eaton.uk.com/electrical

Eaton FZE (Dubai Branch)
P.O. Box 261768
Techno Park, Dubai
United Arab Emirates

Tel.: +971 4 806 6100
Fax: +971 4 889 4813
EEME-Sales@Eaton.com
www.eaton.ae

Eaton Electric (South Africa) (Pty) Ltd
Osborn Road,
Wadeville, 1428 Gauteng,
South Africa

Tel.: +27 (0) 11 824-7400
Fax: +27 (0) 86 861 9302
InfoSouthAfrica@eaton.com