

PG BREAKERS CERTIFICATION PROCESS

# Help customers to reduce space in the electrical switchboard

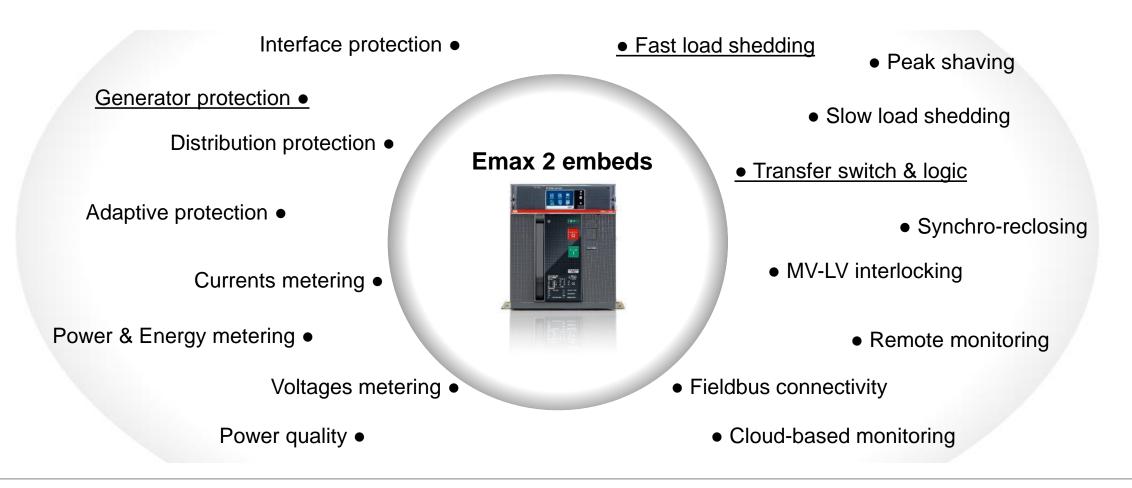
Emax 2 All-in-One innovation



## Emax 2, all-in-one innovation

Much more than a breaker...

Slide 2

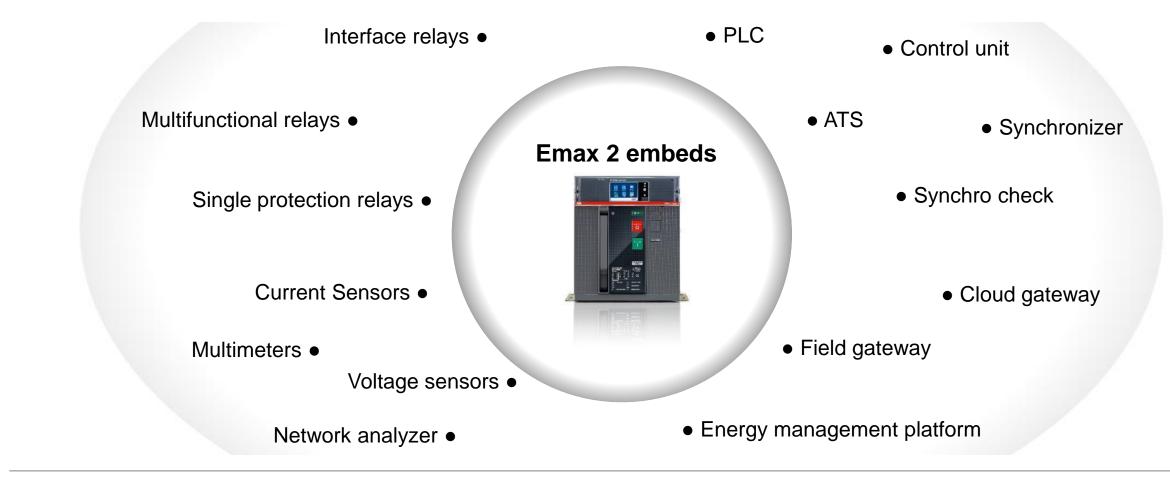




## Emax 2, all-in-one innovation

...many devices in one product

Slide 3





## Marine application

#### Reducing space in the electrical switchboard

#### Customer needs:

- Space reduction
  - I. Most compact breaker in the market
  - 2. Less components: integrated solutions)
  - 3. Robustness and reliability up to 20 g
- Reliability and service continuity
  - 1. Manage redundancy of the power supplies
  - 2. Manage priority and not priority loads
  - 3. Monitoring functions and system alerts
  - 4. Reduce maintenance time and cost
- Reduce the unplanned downtime in case of fault
  - 1. Easily get diagnosis
  - 2. Service
- Registers of Shipping





## The concept

### From 250A up to 6000A











### The range

#### **Emax E1.2**

The most compact power circuit breaker in the world

- Current rating from 250A up to 1200A
- Maximum voltage of 635V AC
- Interrupting rating up to 42kA
- Short time withstand rating of 50kA (1s)
- 20,000 mechanical operations
- Installation in vertical or horizontal position (with rotation of protection trip unit screen when using Ekip touch / hi-touch)
- 1200A used in a 11" (3p) or 14" (4p) wide cubicle space in drawout version





### The range

#### Emax E2.2

The new reference up to 2000A

- Current rating from 250A up to 2000A
- Maximum voltage of 635V AC
- Interrupting rating up to 85kA
- Short time withstand rating of 85kA (1s)
- 25,000 mechanical operations
- No insulation distance required on top of the cradle up to 100kA
- 2000A used in a 16" (3p) or 20" (4p) wide cubicle space in drawout version





### The range

#### **Emax E4.2**

The ultimate performance

- Current rating from 250A up to 3200A
- Maximum voltage of 635V AC
- Interrupting rating up to 200kA
- Short time withstand rating of 100kA (1s)
- 20,000 mechanical operations
- No insulation distance required on top of the cradle up to 100kA
- 3200A used in a 20" (3p) or 24" (4p) wide cubicle space in drawout version
- Fully rated neutral in 4p





### The range

#### **Emax E6.2**

#### Efficiency up to 6000A

- Current rating from 4000A up to 6000A
- Maximum voltage of 635V AC
- Interrupting rating up to 200kA
- Short time withstand rating of 100kA (1s)
- 12,000 mechanical operations
- High current carrying in switchgear
- Double 3200A pole structure
- No insulation distance required on top of the cradle up to 100kA
- 50% and fully rated neutral in 4p





### The concept

#### Moreover...

Emax 2 is also available in Switch version (no protection provided) and fixed or drawout style.



## Emax 2

### Which are the other Emax 2 elements for the promotion to panel builder?

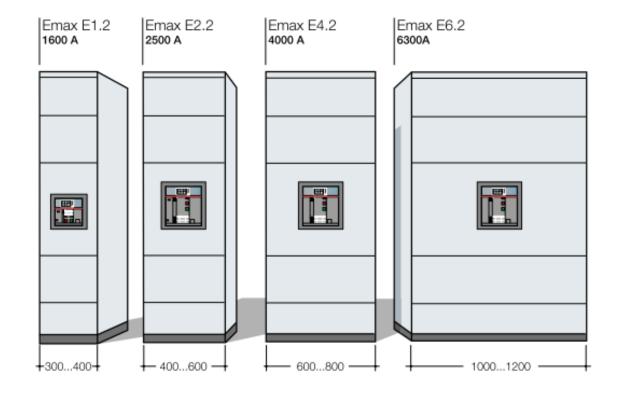
Optimal frame organization

Frame organization of four frame sizes

E1.2 installation in vertical and horizontal

New frame sizes with expanded capacities

Increased short circuit performance and currentcarrying capacity in switchgear





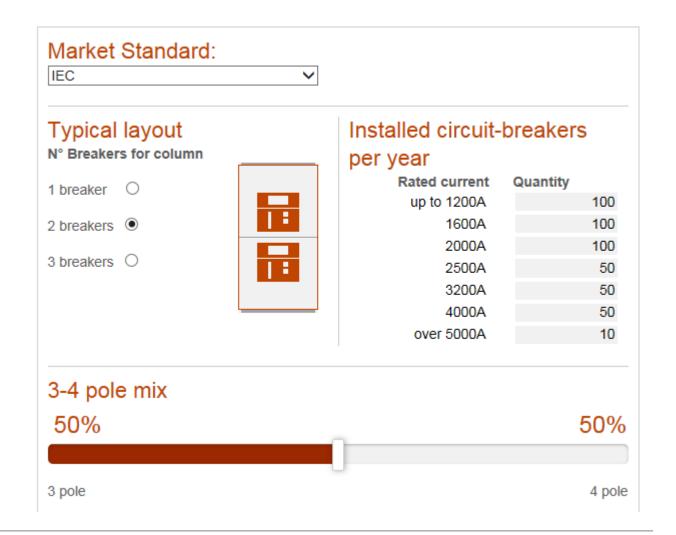
### Emax 2

Switchboard downsizing calculator

## Which is the saving on raw materials?

https://www.youtube.com/watch?v=Cas0U-DG\_-0

http://new.abb.com/low-voltage/products/circuit-breakers/emax2/benefits/switchboardcalculator







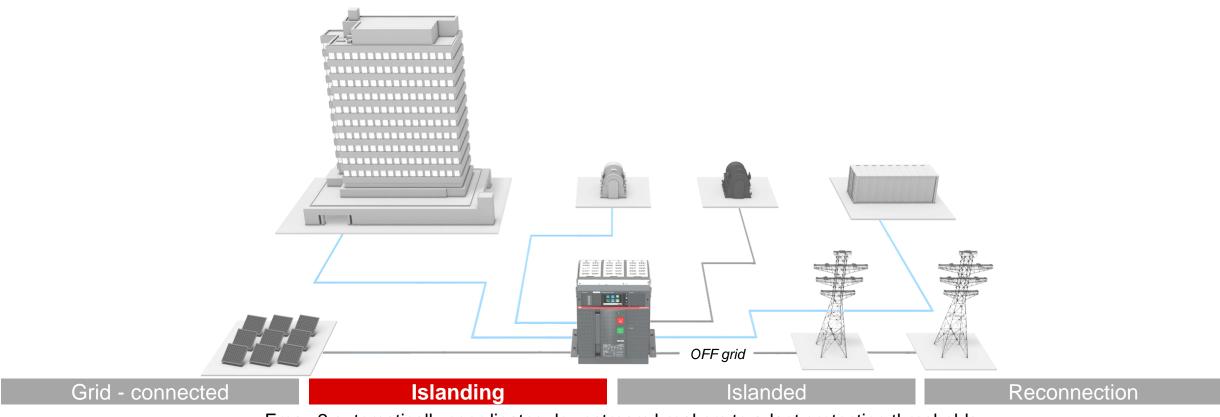
PG BREAKERS CERTIFICATION PROCESS

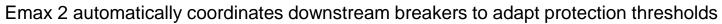
# Help customers to grant continuous operation

ATS, load shedding, adaptive protection



## **MicroGrid**

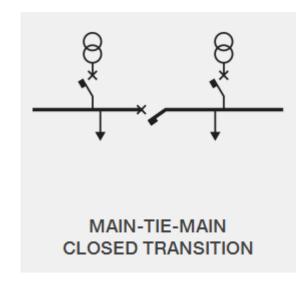




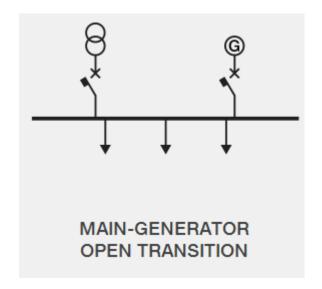


Automatic Transfer Switch is the function for all those electrical installations requiring switching from the main power circuit to another source to ensure the supply of loads.

#### Source scenarios:



Closed transition



Open transition



Main-Tie-Main (closed transition): which is the shopping list?

#### **Air Circuit Breaker**



Emax 2 with one of the following Ekip trip unit:

- Touch + Measuring Pro Module
- Hi-Touch
- G Touch
- G Hi-Touch

#### **Software license**



USB key

#### **Digital signals**



Ekip Signalling 4K

#### **Electrical Accessories**



Closing & Opening Coils (YC-YO)



Spring-charger Motor (M)



**Ekip Com Actuator** 

#### **Ekip Modules**



Ekip Supply



Ekip Link



Ekip Sinchrocheck

#### Benefits for the customer

#### Emax 2 doesn't require any kind of:

- External control unit or external relays
- Sensors and excessive wirings
- Metal work, time and space

#### **Then Emax 2 guarantees**

- Ready to go programming
- Simplified connections
- Compact solution
- Top-rate reliability

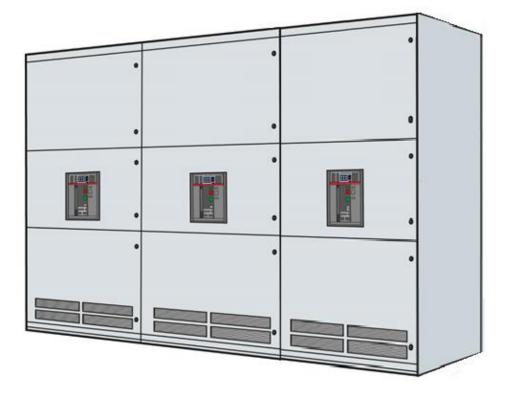
Emax 2 with embedded automatic transfer switch extraordinarily simplify the installation, programming and testing of this function.



### Benefits for the customer

### **Compact solution**

Opportunity to eliminate external units cubicles and optimize your panel up to 30%

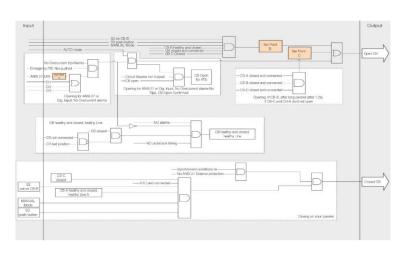


STANDARD APPROACH

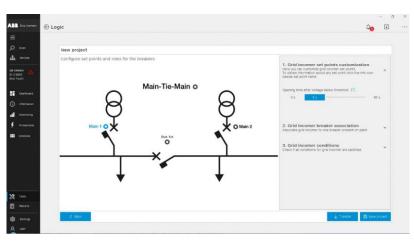


#### Benefits for the customer

### Ready to go programming by Ekip Connect 3







OLD APPROACH

**NEW APPROACH** 

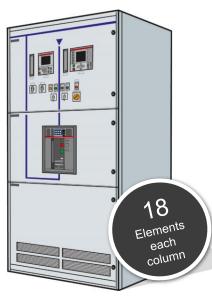
Estimated time and cost savings on the ATS engineering: 95%



#### Benefits for the customer

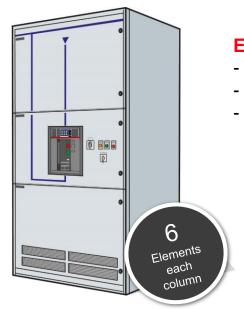
#### **Top-rate reliability**

Ekip Trip Units monitor continuously Ekip Link bus connection, sensors status and breaker diagnostic



#### **Traditional system:**

- Switch disconnector
- external protection units
- Voltage sensors
- Amperometric transformer
- HMI
- Cabling
- Rotary selectors
- Pushbuttons



#### Emax 2 system:

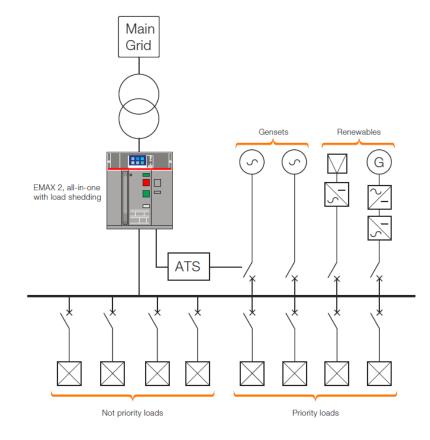
- Circuit breaker
- Rotary selector
- Pushbuttons



### Concept

#### Low voltage microgrid

- Microgrids are the next level of power distribution architecture that improve grid resiliency, thanks to the capability to move from grid-connected to islanded operation mode quickly and without stress.
- Emax 2 is the first circuit breaker able to manage Microgrid islanding ensuring service continuity, space savings and ease of use.





#### How it works

#### **Operating principle – Basic Load Shedding**

#### Microgrid islanding:

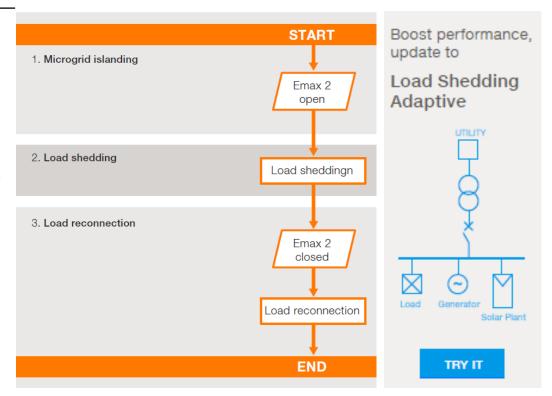
Emax 2 opens for fault events or remote/manual operation.
 In order to avoid a frequency drop that makes generator protections trip, Emax 2 starts load shedding.

#### Load shedding:

 A group of N controlled load (max 15 loads) are simultaneously open by the same digital contact.

#### Load reconnection:

 After Microgrid reconnects to the main grid, each n-load will be gradually reconnected in order to avoid a stressing transient.



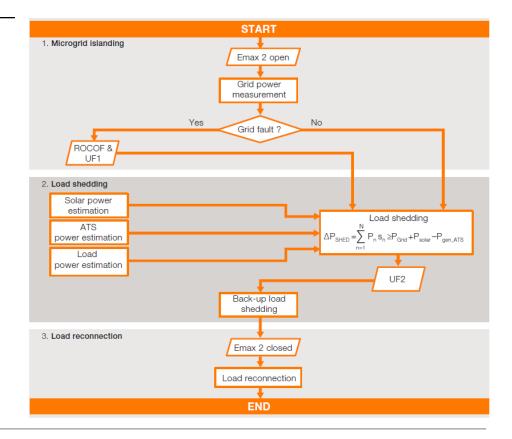


#### How it works

#### **Operating principle – Adaptive Load Shedding**

#### Microgrid islanding:

- The islanding operation starts on Emax 2 opening event.
- Emax 2 understands if the opening has been due to fault events in the main grid or to other reasons (maintenance, inter-tripping with medium voltage switching device or pricing logics).
- In case of fault, Emax 2 sees the frequency trend ROCOF (rate of change of frequency) and under-frequency (UF1).
- In other cases (e.g. ATS situation), Emax 2 acts load shedding immediately.





#### How it works

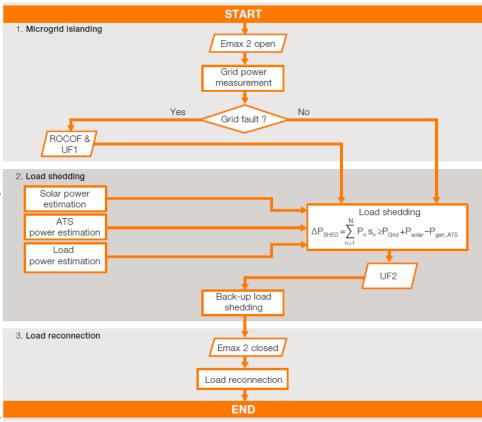
#### **Operating principle – Adaptive Load Shedding**

#### Load shedding

$$\Delta P_{SHED} = \sum_{n=1}^{N} P_n \ S_n \ge P_{Grid} + P_{solar} - P_{gen\_ATS}$$

- $-\Delta P_{SHED}$  is the amount of load power to be shed, adapted to the load-flow scenario.
- Pn is the usage power of the n-load not prioritary (example thermal loads like air conditioning units, ovens, freezing cells or pumps, air compressors chillers, not-emergency lights).
- Sn is the status (open/closed) of the n-load device.
- P<sub>Grid</sub> is the measured power that has been absorbed from the grid before the opening event.
- P<sub>solar</sub> is the estimated power of the photovoltaic plant in the Microgrid.
- Pgen\_ATS is the power of the back-up generator in the Main Gen ATS architectures.

#### **Load reconnection**





### Shopping list

#### **Air Circuit Breaker**



Emax 2 with one of the following Ekip trip unit:

- Touch + Measuring or Measuring Pro Module
- Hi-Touch
- G Touch
- G Hi-Touch

#### **Software license**



Already installed

- Basic Load Shedding USB key
- Adaptive Load Shedding

#### **Auxiliary supply**



**Ekip Supply** 

- 110-240V AC/DC

#### **Digital signals**







- 24-48V AC/DC

Ekip Signalling 2K-1 OR Ekip Signalling 4K (1) OR

Ekip Signalling 10K (2)

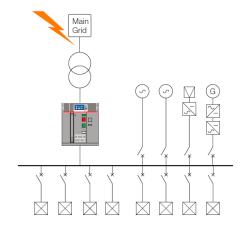
- (1) Ekip 4K is available for E2.2, E4.2 and E6.2 only.
- (2) Ekip 10K can be connected to the breaker through Ekip Link or Local Bus.

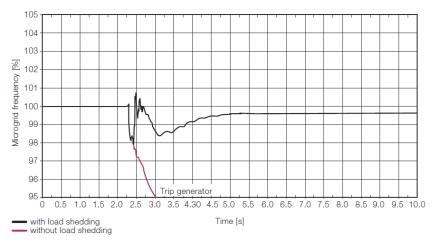


#### Benefits for the customer

#### **Maximize Service Continuity**

- When a plant remain disconnected from the main grid, even if local production is present, there is a significant stress that turns off all the generators with consequent blackout.
- Load Shedding logics embedded in Emax 2 reduce the frequency drop that usually makes the local generation protection trip, maintaining the plant live.





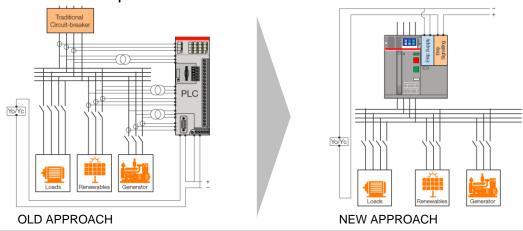
Emax 2, all-in-one, avoids blackouts.



#### Benefits for the customer

#### **Get Space Savings**

- Neither PLC neither external relays are needed as Emax 2 has embedded the intelligence to realize the load shedding logics, taking advantage of the internal current and voltage sensors for electrical parameter measurements.
- In addition, static converters for low voltage photovoltaic production have typically anti-islanding protections: this implies another power deficit to be added to the main grid contribution during the Microgrid islanding. Emax 2 is the first circuit breaker that estimates solar production without additional sensors.



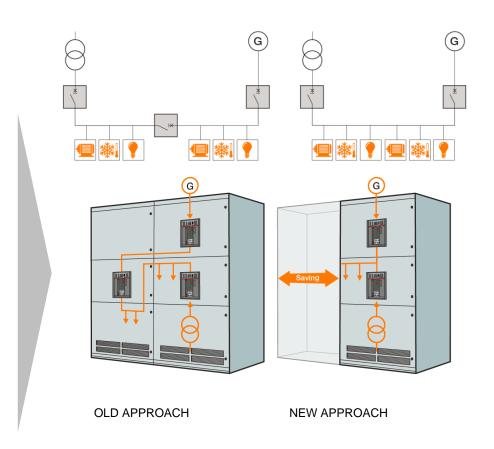
Emax 2, all-in-one, is the first circuit breaker that estimates solar production.



#### Benefits for the customer

#### **Get Space Savings**

- Load Shedding is suitable with ATS architectures like Main-BusTie-Gen used to distinguish priority/not priority loads.
- Where feasible, BusTie switch disconnector is not required anymore and this means:
  - Significant space and material saving up to 50% in the power distribution switchgear for panel builders.
  - Load Shedding is self-tuned with the specific power unbalance identification and dynamically choses the controllable loads to be shed, reducing constraints for consultants during plant design.
  - ATS unit manages only two sources, without interlock, logic programming and wiring connections for the third circuit breaker with less time required for installation.



Emax 2, all-in-one, saves up to 50% of switchgear space with ATS.

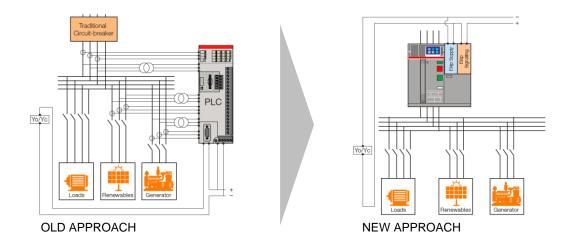


### Emax 2

Which are the components a generic competitor needs to match Emax 2 solution?

#### **Load Shedding**

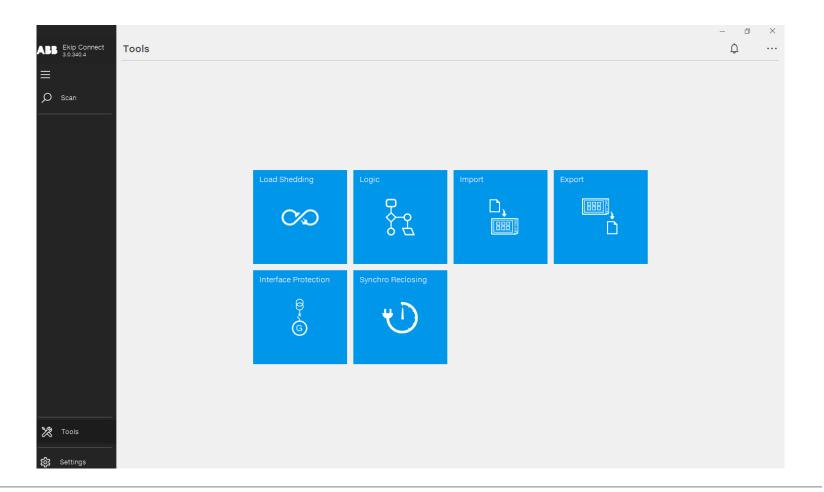
Usually PLCs are used to realize load shedding functions. In complex architectures, Scada supervision systems control loads and realize load shedding.





Benefits for the customer

Commissioning by Ekip Connect 3



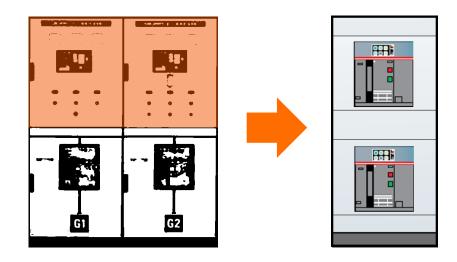


### Emax 2

Which are the components a generic competitor needs to match Emax 2 solution?

#### **Generator protection**

- Current market solutions use a circuit breaker and external relay, plus external shunt trip coil, external power supply and other accessories.
- No need for current and voltage transformers





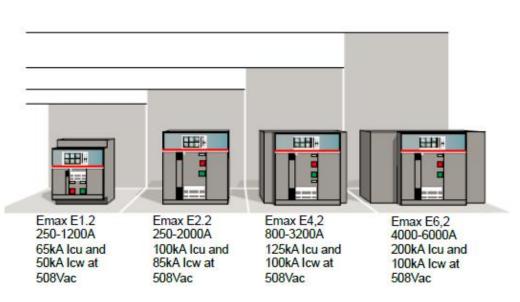
### Main features of the trip units

#### **Trip unit features**

- Simplified browsing
  - Up to 10 languages for a worldwide product
- Faster commissioning
  - New getting started mode
- Proactive maintenance
  - A helpful indicator that identifies when the circuit breaker is in need of routine maintenance
- Mobile connectivity
  - Ekip Bluetooth and Ekip T&P make the circuit breaker accessible on your tablet or smart phone
- Smart display
  - Ekip Display has 90° rotation when E1.2 is installed horizontally and in all Ekip Touch and Hi-Tocuh trip units a "free" page is available for customer notes.









#### Optimal frame organization

 Allows the creation of more narrow switchgear and switchboard designs reducing both materials and space requirements

#### Top level performance

 Enables renewed, small and powerful switchgear and switchboard designs

#### Precision

 Allows the breaker to act as a measurement device so additional devices can be eliminated

#### Zero isolation distance on height

 Near zero isolation distance requirement for height on E2.2-E6.2 drawout breakers up to 100kA allows for optimization of cubicle and switchgear sizing

### Main features of the trip units

#### **Ekip Dip**

Efficient and affordable solution with dip switch adjustments

- Features for standard distribution applications
  - Current protection
  - Permanent LED trip indication on fault with time and date
  - Suitable for use with external Ekip multimeter
  - Thermal memory with separate settings for neutral
  - Available with LI or LSI or LSIG functions





### Main features of the trip units

#### **Ekip Touch**

The smart trip unit

- For standard distribution or generator protection
  - Complete protection set, configurable and matches the AINSI codes
  - · Modern and intuitive touchscreen interface
  - Permanent trip indication directly on display or via de data logger.
  - Voltage, power and energy measurement when equipped with Ekip measuring module.
  - Extended protection settings when equipped with Ekip measuring pro module (voltage, power and energy protections)
  - Available with LI or LSI or LSIG functions for distribution or LSIG for generator protection on G-Touch
  - Ekip Power controller available for energy effiency requirement





### Main features of the trip units

#### **Ekip Hi-Touch**

The multifunction trip unit

- For standard distribution or generator protection
  - Same features as Ekip Touch (G-touch)
  - Built-in voltage, power and energy measurements AND protections
  - Exclusive directional protection for complex grids
  - Dual settings for all protections (smart grids and arc-flash requirements)
  - · Permanent network analyzer function to monitor power quality
  - Available with LI or LSI or LSIG functions for distribution or LSIG for generator protection on G Hi-Touch
  - Ekip Power controller available for energy effiency requirement





## Requirements

## **Generator protection**

The exclusive Ekip G Touch and G Hi-Touch trip units were specifically designed for generator protection requirement. Unlocking a dedicated set of protection for generators, the Ekip G is the perfect solution.

The protections that are available in Ekip G meet the prescriptions of the main international standards and regulations that provide instructions on the correct control of the protections of synchronous generators that are in, for example, ships or traditional plants.

The available protection functions are coded in accordance with IEEE C37.2 "Standard for electrical power system device function numbers, acronyms and contact designations" which is also known as the ANSI code.



## Requirements

## **Ekip G Touch and G Hi-Touch**

Ekip G is available in two versions Ekip G Touch and G Hi-Touch, both of them are always supplied with the Ekip Measuring Pro module.

Ekip G, provides the same current (LSIG), voltage and frequency protection and measurements as the Ekip Touch and Ekip Hi-Touch for power Distribution.

The protection functions are also active with the circuit breaker open (not current protection) preventing closing during fault conditions.

Furthermore, the protection can command the opening of the breaker (trip) or just send a signal through communication or output contact to a supervision system (Alarm).

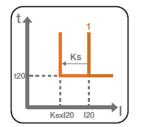






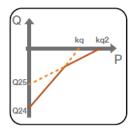
## Requirements

## S(V) protection



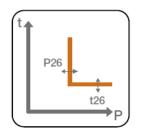
Voltage controlled overcurrent protection (ANSI 51V)

## **RP/RQ** protection



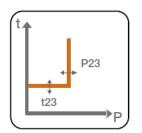
Reverse active / Reverse reactive power (ANSI 32R/40-32R)

## **OP/OQ** protection



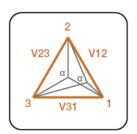
Active and reactive overpower (ANSI 32OF)

## **UP** protection



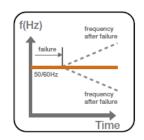
Active under-power protection
(ANSI 32LF

## **RV** protection



Residual overvoltage protection (ANSI 59N)

## **ROCOF** protection



Rate of Change of Frequency protection (ANSI81R)

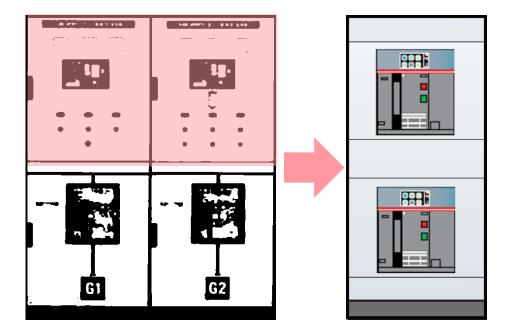


## Requirements

#### **Main benefits**

Using Ekip G protection trip units in generator protection will

- Reduce the installation of components such as
  - Current sensors
  - Cabling
  - External protection devices
- Allow savings on assembly and commissioning
- Increase the reliability of the installation
- Increase the measurement, communication and signaling capabilities
- Make it easy to configure and test
- Optimize the raw material costs, space and dimensions of the switchboard





# **BU LPBS portfolio for marine**

**Certifications** 









ABB product range for marine application, in particular the BU3106 portfolio, have received innumerable international certifications and approval by the major shipping registers









- Lloyd's register of shipping
- Germanischer Lloyd
- Russian Maritime Register of Shipping
- CCS

Certificates are availible on BOL.IT.ABB.COM







DET NORSKE VERITAS



# **Shock-Proof products for Navy**

#### Shock test

 The circuit breaker (equipment under test) is tested in open and closed position, and during shocks it has not to change the position. No damages are allowed

Circuit Breakers in order to guarantee shock resistance

- exceptionally sturdy structures,
- switching and protection parts whose kinematics are fitted with locking devices which, by exploiting the forces of inertia,
   prevent accidental operation caused by the shock.









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# **Tools:**

#### Catalogue

https://library.e.abb.com/public/2d2d9516af434cb49ee45c3a32b974ed/1SXU200040C0201%20Emax%202%20US%20Technical%20Catalog\_0317.pdf

#### Drawing selector:

http://abb-drawings.e-template.it/index.html#/

#### Installation manual

https://library.e.abb.com/public/9ac1be492dd94c8caadabe76f96a127c/1SDH001000R0002.pdf

#### For Design Engineers:

https://library.e.abb.com/public/8c87202ba0e04f19a41efd8cae704452/1SDH001330R0002.pdf

#### Manuel d'installation

https://library.e.abb.com/public/28d05093cb094277b09c34b5c7ac8645/1SDH001000R0004.pdf

#### Wiring diagram

http://search.abb.com/library/Download.aspx?DocumentID=1SDM000091R0001&LanguageCode=en&DocumentPartId=&Action=Launch

#### Le lien pour le catalogue IEC

https://library.e.abb.com/public/bc7c32847e3745189ab2eacd45440784/1SDC200023D0305\_Emax2\_dicembre\_2016\_FR.pdf

#### Le manuel:

https://library.e.abb.com/public/703483ab384e483da82baa2dd0dad512/1SDH001330R0002.pdf

#### Configurator:

https://lowvoltage-configurator.tnb.com/configurator/#/config/emax2



# **Data & Connectivity**

# ABB Ability™ Electrical Distribution Control System

Why?

Customers want to increase awareness on owned resources, improve performance and optimize their assets to reduce total operating costs

What?

ABB Ability™ Electrical Distribution Control System is a **cloud-based energy management and asset supervision solution** for buildings and industrial sites.

How?

It helps simplify facilities management, and reduce energy and maintenance bills, enabling a 30% reduction on operating costs



## The power of understanding at your fingertips

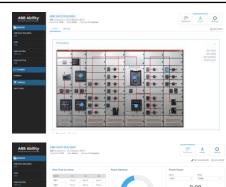


## Features and Benefits

#### **Cloud-based Energy and Asset Management**











#### **Monitor**

Discover plant performance, supervise the electrical system and allocate costs

## **Optimize**

Analyze the relevant information, improve the use of your assets and take the right business decision

#### **Control**

Remotely implement an effective power management strategy to simply achieve energy savings



## Features and Benefits

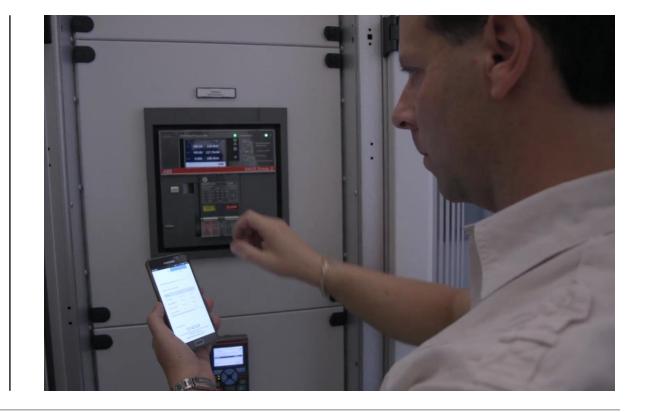
## **Plug & Play Architecture**

Leveraging the connectivity and sensing of ABB devices, we can model new outlines for innovation in the **low-voltage power distribution** business.

Emax 2 air circuit breaker, now becomes the smart hub by managing both **power and data flows**.

A **simple** and **integrated architecture** enabling truly plug & play approach.

Extend the existing application with retrofi opporunities thanks to Ekip Up and Ekip E-Hub





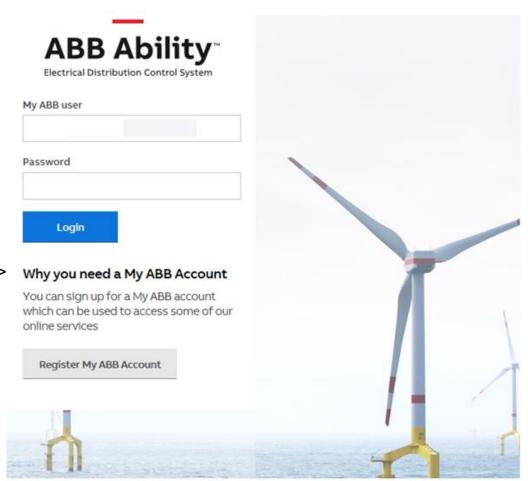
# Web App

https://ekipsmartvision.abb.com/#/account/login

Credentials: ABB mail address and password for internal, myABB Profile for external

To access a connected plant: by invitation (web app > settings > profiles)

To create new connected plant: Ekip Connect 3 wizard





## How it works

#### **Embedded solution**

Plug-in the **Ekip Com Hub** module on Emax 2 or Ekip UP and start Ekip Connect wizard.

In **less than 10 minutes** the panel is connected to the cloud.

#### Plug & play:

- ACBs
- MCCBs
- MCBs
- Energy and Power meters





## How it works

#### **External solution**

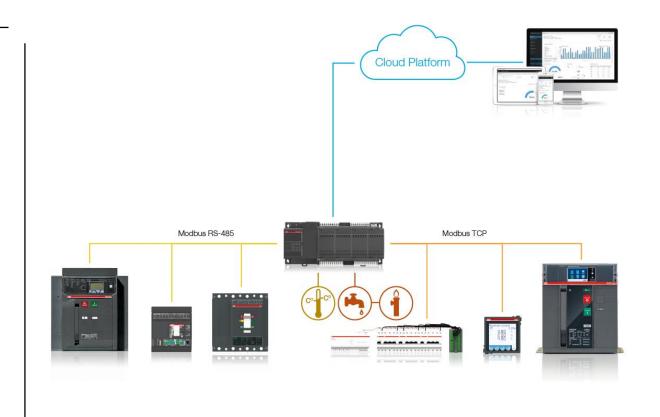
Connect devices to **Ekip E-Hub** DIN rail module.

High flexibility and extended retrofitting.

Easy and fast configuration via Ekip Connect wizard.

#### Plug & play:

- ACBs
- MCCBs
- MCBs
- Energy and Power meters
- Analog and Digital meters





Devices and data logging in **Cloud** 

		INFORMATION												COMMUNICATION
Family	Device	State	Current	Voltage	Power	Energy	Power Factor	Alarms	Maintenance & Diagnostics	Power Quality	Load management	Environmental parameters	General info	Protocol
ACB	Emax 2 *)	•	•	•	•	•	•	•	•	•	•		•	Modbus RS-485, Modbus TCP, Ekip Link"
ACB	New Emax *)	•	•	•	•	•	•	•	•				•	Modbus RS-485
MCCB	Tmax T *)	•	•	•	•	•	•	•	•				•	Modbus RS-485
MCCB	Tmax XT *)	•	•	•	•	•	•	•	•				•	Modbus RS-485
Metering device	M2M		•	•	•	•	•			•			•	Modbus RS-485, Modbus TCP
Netering device	CMS 700		•	•	•	•	•						•	Modbus RS-485, Modbus TCP
usegear	Slimline XR ITS 2	•	•	•	•	•	•	•	•				•	Modbus RS-485
Signalling module for digital inputs e.g. for MCBs)"	Ekip Signalling Modbus TCP	•											•	Modbus TCP
Digital Meters/Sensor	Pulse meter **)											•	•	Digital I/O
Analog Meters/Sensor	Analog meter **)											•	•	Analog I/O
Arc guard	TVOC-2	•						•					•	Modbus RS-485

And many others to come...



<sup>\*</sup> Provided the product with dedicated accessories for communication and metering functions

<sup>\*\*</sup> only with Ekip E-Hub module

# A simple shopping list

#### **Hardware**





- Ekip Com Hub
  - Emax 2 or Ekip UP embedded communication module for cloudconnectivity
- Ekip E-Hub
  - DIN-rail mounted communication module for cloud-connectivity

## **Commissioning tool**



Ekip Connect 3 Software available via free download

#### **Services**



- ABB Ability™ EDCS
  - subscription to monitor, optimize and control your systems
  - Each subscription is valid for one site, up to 15 users' access



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