
TECHNICAL CATALOG

SACE Tmax T/ML, Emax 2/ML Shockproof circuit breakers



SACE Tmax T/ML, Emax 2/ML

Consultation guide



Chapter 1

Main characteristics

Introduction to the ML family, distinctive features of the series, product conformity and service.



Chapter 4

Advanced features

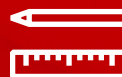
New and simple to use functionalities suitable for every kind of marine power system.



Chapter 2

The ranges

Overview of ML family circuit breaker for naval application and critical environment.



Chapter 5

Dimensional drawings

Overall dimensions for ML family circuit breakers.



Chapter 3

Protection trip units

Latest generation protection trip units for power distribution and generation.



Chapter 6

Ordering codes

Ordering codes with configurator example.

Table of contents

| | |
|--------------|---------------------------------------|
| 01-10 | Main characteristics |
| 02-03 | Overview of the SACE ML family |
| 04-05 | Distinctive features |
| 06-07 | Product conformity |
| 08-09 | ABB SACE Global service |
| 11-28 | The ranges |
| 12-13 | Product selection |
| 14-15 | Tmax T4/ML |
| 16-17 | Tmax T5/ML |
| 18-19 | Tmax T6/ML |
| 20-21 | Tmax T7/ML |
| 22-23 | Emax 2 E2.2/ML |
| 24-25 | Emax 2 E4.2/ML |
| 26-27 | Emax 2 E6.2/ML |
| 29-60 | Trip units |
| 30-31 | Protection trip units |
| 32-33 | TMD/TMA and TMG |
| 34-35 | PR222DS/P, PR222DS/PD |
| 36-37 | PR223DS and PR223EF |
| 38-39 | Ekip E-LSIG |
| 40-41 | PR232/P |
| 42-45 | PR332/P |
| 46-46 | Ekip Touch |
| 47-47 | Ekip Hi-Touch |
| 48-48 | Ekip G Touch |
| 49-49 | Ekip G Hi-Touch |
| 61-70 | Advanced functionalities |
| 62-63 | Advanced features |
| 64-65 | Ekip G generator protection trip unit |

Table of contents

| | |
|----------------|--------------------------------------|
| 66-67 | Zone selectivity for Tmax T/ML |
| 68-69 | Logic zone selectivity for Emax 2/ML |
| 70-70 | Load shedding |
| 71-84 | Dimensional drawings |
| 72-72 | Reading information |
| 73-73 | Tmax T4/ML |
| 74-74 | Tmax T5/ML |
| 75-76 | Tmax T6/ML |
| 77-78 | Tmax T7/ML |
| 79-80 | Tmax T7/ML motorized |
| 81-81 | Emax E2.2/ML |
| 82-82 | Emax E4.2/ML |
| 83-83 | Emax E6.2/ML |
| 84-84 | Accessories |
| 85-110 | Ordering codes |
| 86-87 | Ordering examples |
| 88-89 | Tmax T4/ML |
| 90-91 | Tmax T5/ML |
| 92-92 | Tmax T6/ML |
| 93-93 | Tmax T7/ML |
| 94-95 | Emax 2.2/ML |
| 96-96 | Emax 4.2/ML |
| 97-97 | Emax 6.2/ML |
| 98-100 | Electrical accessories |
| 101-102 | Mechanical accessories |
| 103-103 | Switching devices |
| 104-106 | Ekip modules |
| 107-108 | Terminals |
| 109-109 | Service |



CHAPTER 1

Main characteristics

- 02-03** **Overview of the SACE ML family**
- 04-05** **Distinctive features**
- 06-07** **Product conformity**
- 08-09** **ABB SACE Global service**

Overview of the SACE ML family

Based on the long experience, ABB SACE is proud to offer a new family of circuit breakers for naval application and critical environment which sets a new circuit breaker benchmark for the needs of today and tomorrow.

A modern ship's operational ability is fully dependent on its onboard electrical infrastructure. Over the years, the growth in the number of electrically powered subsystems on a typical naval vessel has made this infrastructure ever more complex and extensive. It has also led to a steady increase in power requirements. These trends lead to new customer and application needs. To meet these demands, ABB has now unveiled the innovative ML family, the evolution of the ABB circuit breaker into a multifunctional platform that is able to manage the next generation of electrical plants such as microgrids.

For over 50 years, ABB SACE has been building shockproof equipment for navies around the world. The considerable installed base of the company's products on ships of the world's main navies underlines the reliability of ABB SACE electrical equipment. Since the 1950s, the company has been manufacturing circuit breakers with special features not available on the same series of equipment destined for general use.





Distinctive features

SACE ML series is the ABB low voltage circuit breakers available from 160 A up to 6300 A and with the ability to efficiently and simply control electrical navy installations – from the traditional to the more complex with the highest availability and continuity of service.

The circuit breakers of the ML series have been realized with opportune changes of the standard version with the purpose to guarantee the operations also in presence of critical environmental conditions.

The low-voltage electrical distribution plants inside the modern ship are driven by these following growing needs:

- Ensure **service continuity** by minimizing the time needed to identify and isolate faults
- Guarantee **space optimization**
- Optimize energy efficiency **maintaining the performance**
- **Safety** and **ease** of use

Reliability and service continuity

ABB SACE ML circuit breakers are the most advanced and complete solution for ensuring service continuity.

With redundant actuators and built in communication modules, ABB ML circuit breakers take electrical system reliability to new levels.

ABB's solution is the only one that uses both a communication bus and electrical connections to prevent, detect and isolate electrical faults. Its unique "digital zone selectivity" function, identifies the fault zone faster and isolate it reducing the stress in the remaining active zone. As a result, the electrical protection is more robust and costly shutdowns are more effectively prevented. Moreover ML series features enhancements to the standard circuit breaker that guarantees operation under stressful conditions:

- **Shock resistance up to 20g (IEC 60068-2-27 and BR8470)**
- High temperatures and humidity range in a saline atmosphere; ML circuit breakers can be used in ambient conditions where air temperature varies between **-25 °C and +70 °C (-13 °F and +158 °F)**
- Presence of vibrations that are persistent and have a high amplitude in specific frequency ranges



—
(*) only MCCB

Dimension and weight optimization

SACE ML series offers maximum protection, best efficiency and it is the ABB low voltage circuit breakers available from 160 A up to 6300 A. The different levels of rated nominal current and breaking capacity levels have been studied to ensure optimal sizing for all ships' configurations. SACE Emax 2 /ML is the most compact circuit breaker on the market, which makes it possible to reduce the size of switchboards up to 30%. SACE Emax 2 /ML offers the highest performances in the smallest space. Less space is required in the switchgear and in the metal structures. The result is less oversizing, lower weight and, therefore, higher saving related to space optimization. SACE ML series makes it possible to standardize the circuit breaker support structures, considerably simplifying construction of the switchboards themselves. All trip units are easily interchangeable and all communication units can be installed directly on the terminal box with a few simple operations, making the complex system ready for a new digital experience.

Performance

Next-generation ships will use more advanced microgrid technologies to overcome current power distribution challenges. Electrical distribution on a ship is an islanded microgrid, connecting multiple power generators and energy storage systems, that manages directional power flows. By using smart technologies to protect, connect and control the electrical system, ships can operate more efficiently and productively. ML low-voltage circuit breaker is the industry's first smart circuit breaker. Its embedded connectivity and load management software provides a comprehensive energy management solution. The load profile optimization functions of ML circuit breaker reduce CO₂ emissions and fuel costs. The innovative circuit breaker safeguards a ship's mission-critical loads and generators, using advanced adaptive protection to maximize productivity under all conditions.

Safety and ease of use

The ML range is available in fixed(*), plug-in(*) and withdrawable versions, with double insulation between the front of the switchgear and the live parts to ensure operation in complete safety. All essential information is available in front shield and enables immediate identification of the status of the circuit breaker: open, closed, ready to close, charged and discharged springs. Maintenance is simple and safe. Thanks to the new front shield design, the main accessories can be installed without completely removing it. As a further guarantee of safety, the shutters of the fixed part can be locked from the front when the circuit breaker mobile part is removed. The shutters of the upper terminals are independent of those of the lower terminals to facilitate checking and maintenance operations. The protection trip units are equipped with a large display which enables safe and intuitive operation. Furthermore the trip units can be programmed and consulted from a tablet, smart phone or portable PC via the Ekip Connect application some the advanced functionalities can be easily programmed thanks to predefined logic templates.

Product conformity

Quality, Sustainability and Customer Satisfaction have always been ABB's major commitment.

Resistance to shock and vibration

The ML circuit breakers are unaffected by vibrations generated mechanically or due to electromagnetic effects, in compliance with the IEC 60068-2-6 Standards and the RINA MIL regulations. Moreover ML circuit breaker are compliant with the following International SHOCK standard:

- IEC 60068-2-27 (20s-11ms)
- BR8470 (20s-25ms)

Approvals and certifications

ABB ML circuit breakers and their accessories conform to the international IEC 60947, EN 60947 (harmonized in 30 CENELEC countries), CEI EN 60947 and IEC 61000 Standards and comply with the following EC directives:

- "Low Voltage Directives" (LVD) no. 2006/95/EC
- "Electromagnetic Compatibility Directive" (EMC) no. 2004/108/EC.

Certification of conformity with the above-mentioned product Standards is carried out in compliance with the European EN 45011 Standard, by the Italian certification body ACAE (Association for the Certification of Electrical Equipment), which is recognized by the European organization LOVAG (Low Voltage Agreement Group), and by the Swedish Intertek SEMKO certification organization Intertek Semko which is recognized by the international organization IECCE.

Product conformity

The involvement of all company departments and organization of processes have led the company to develop, implement and certify management systems in compliance with international Standards:

- ISO 9001 for quality management
- IRIS for the quality of supplies in the railway sector (International Railway Industry Standards)
- ISO 14001 for environmental management
- OHSAS 18001 for the management of the health and safety of employees in the workplace
- SA 8000 for the management of social responsibility.



—

The ABB SACE testing laboratory, accredited by ACCREDIA in compliance with ISO/IEC 17025 Standard, provides both ABB and external customers with a qualified service for performing certification tests on devices and electric equipment of low and medium voltage in accordance with the relevant product Standards.

Thanks to the implementation of systems and their integration (Integrated Management System), ABB SACE, with a view to continuous improvement, has implemented processes with a focus on:

- quality, preventing defects and faults along the entire supply chain

- environment, reviewing production processes in terms of ecology and waste reduction, rationalizing the consumption of raw materials and energy, preventing pollution, containing noise emissions and reducing the quantity of rejects in the production processes
- health and safety of employees, offering a healthy and safe workplace in all of the various stages of work with a “zero accident objective”
- social responsibility, guaranteeing the respect of human rights and the absence of any discrimination throughout the supply chain, and offering a favourable and transparent working atmosphere.

A further commitment aimed at safeguarding the environment has been achieved by assessing products' life cycles (LCA, Life Cycle Assessment): this includes the assessment and improvement of the environmental performance of products from the engineering stage throughout their entire life cycle. The materials, processes and packaging used are chosen with a view to optimising the actual environmental impact of each product, including its energy efficiency and recyclability.



ABB SACE Global service

—

ABB's technical assistance service offers solutions aimed at supporting the customer in all stages of the lifespan of the circuit breaker in service and covering the entire chain of value; ABB is present from the moment of selection to the end of the life of the product, thereby guaranteeing the investments of its customers.

ABB supplies annual updates regarding the evolution of the circuit breaker ranges (Life Cycle Management) and for each product it provides details of associated services and the level of support available, so that customers can choose the products and spare parts best suited to their needs. ABB's organisation offers services that include installation and commissioning, technical training on the use and maintenance of products, the supply of original spare parts, corrective and preventive maintenance, equipment diagnostics, modernisation of systems with upgrades and retrofitting kits, consultancy services and personalised maintenance and service contracts. All this is supported by one of the most extensive global sales and service networks.

Retrofitting kit

Through continuous research targeted at the needs of the customer, ABB SACE Service has developed innovative retrofitting kits in order to simplify and speed up installation of a new circuit breaker, updating the customer's investment with the latest technology available and with very limited down times. The retrofitting kit between Emax2 and Emax is a retrofit solution: it is therefore possible to replace the withdrawable version of Emax with an equivalent Emax2 model without changing the switchboard busbars, by simply removing the fixed part of Emax replacing it with a fixed part of Emax2 which has been suitably modified with dedicated terminals.



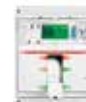


CHAPTER 2

The ranges

| | |
|--------------|--------------------------|
| 12-13 | Product selection |
| 14-15 | Tmax T4/ML |
| 16-17 | Tmax T5/ML |
| 18-19 | Tmax T6/ML |
| 20-21 | Tmax T7/ML |
| 22-23 | Emax 2 E2.2/ML |
| 24-25 | Emax 2 E4.2/ML |
| 26-27 | Emax 2 E6.2/ML |

Product selection



| Breaker type | T4/ML | T5/ML | T6/ML | T7/ML |
|---|----------------|----------------|----------------|----------------|
| Rated Current [A] | 250 - 320 | 400 - 630 | 630 -1000 | 800 - 1600 |
| Rated service voltage (Ue) | 690 Vac | 690 Vac | 690 Vac | 690 Vac |
| Rated ultimate short-circuit breaking capacity (Icu) at Ue [kA] | 25 - 80 | 25 - 80 | 20 - 30 | 30 - 60 |
| Trip unit | Thermomagnetic | Thermomagnetic | Thermomagnetic | Electronic |
| | Electronic | Electronic | Electronic | |
| International standard | IEC 60068-2-27 | IEC 60068-2-27 | IEC 60068-2-27 | IEC 60068-2-27 |
| | BR8470 | BR8470 | BR8470 | BR8470 |
| Shock resistance | 22g 11ms | 22g 11ms | 22g 11ms | 22g 11ms |
| | 20g 25 ms | 20g 25 ms | 20g 25 ms | 20g 25 ms |
| Page | 14 | 16 | 18 | 20 |



| E2.2/ML | E4.2/ML | E6.2/ML |
|----------------|----------------|----------------|
| 800 - 2500 | 2000 - 4000 | 4000 - 6300 |
| 690 Vac | 690 Vac | 690 Vac |
| 66 - 85 | 66 - 100 | 100 |
| Electronic | Electronic | Electronic |
| IEC 60068-2-27 | IEC 60068-2-27 | IEC 60068-2-27 |
| 20g 11ms | 20g 11ms | 20g 11ms |
| 22 | 24 | 26 |

Tmax T4/ML

Tmax T4/ML is available in **fixed**, **plug in** and **withdrawable** version

| Common data | |
|---|----------------------------|
| Rated uninterrupted current, Iu | [A] 250/320 ⁽¹⁾ |
| Number of poles | 3/4 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 8 |
| Rated insulation voltage, Ui | [V] 1000 |
| Test voltage at industrial frequency 1 min. | [V] 3500 |

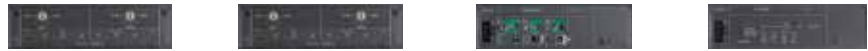
(1) T4 250 only L and V version



| Version | Circuit-breakers | | | | Switch-disconnectors | |
|---|------------------|--|------|------|----------------------|-------------|
| | S | H | L | V | D | |
| Rated ultimate short-circuit breaking capacity | | | | | | |
| Icu AC 50-60 Hz 440 V | [kA] | 40 | 65 | 100 | 180 | - |
| Icu AC 50-60 Hz 690 V | [kA] | 25 | 40 | 70 | 80 | - |
| Rated service short-circuit breaking capacity | | | | | | |
| Ics AC 50-60 Hz 440 V | [kA] | 100% | 100% | 100% | 100% | - |
| Ics AC 50-60 Hz 690 V | [kA] | 100% | 100% | 100% | 100% | - |
| Rated service short-circuit making capacity | | | | | | |
| Icm AC 50-60 Hz 440 V | [kA] | 84 | 143 | 220 | 396 | - |
| Icm AC 50-60 Hz 690 V | [kA] | 52,5 | 84 | 154 | 176 | 5,3 |
| Rated short-time withstand current | | | | | | |
| Icw (1s) | [kA] | - | - | - | - | 3,6 |
| Reference Standard | | IEC 60947-2 Utilization category A IEC 60947-4 | | | | IEC 60947-3 |

| Dimensions | Fixed version 3 pole | Fixed version 4 pole |
|-------------|----------------------|----------------------|
| W [mm] | 105 | 140 |
| D [mm] | 103,5 | 103,5 |
| H [mm] | 205 | 205 |
| Weight [kg] | 2,35 | 3,05 |

| | |
|---|----------------------------|
| Mechanical life [No. operat.] | 20000 |
| Electrical life (at 415 V) [No. operat.] | 8000 (250A) 6000 (320A) |



| Trip units | TMD*/TMA** | MA | PR222DS | PR223DS |
|------------|------------|---------|---------|---------|
| | pag. 32 | pag. 32 | pag. 34 | pag. 36 |

* up to 50A

**up to 250A

| Accessories * | T4 |
|---|----|
| Control | |
| Shunt opening release (YO) | ● |
| Shunt closing release (YC) | ● |
| Undervoltage release (YU) | ● |
| Time-delay device for undervoltage release (D) | ● |
| Stored energy motor operator (M) | ● |
| Signalling | |
| Electrical signalling of circuit-breaker open/closed | ● |
| Electrical signalling of circuit-breaker connected/isolated for test/isolated | ● |
| Dialog unit (to be specified with the cbs) | ● |
| PR021/K Signalling unit | ● |
| Safety | |
| Front flange for lever operating mechanism | ● |
| Lock in open position | ● |
| Circuit-breaker lock in connected/isolated/isolated for test position | ● |
| Test | |
| Extension for testing electrical accessories | ● |
| TT1 Trip test Unit | ● |

* These are non-standard accessories. For further details, please contact ABB.

Tmax T5/ML

Tmax T5/ML is available in **fixed**, **plug in** and **withdrawable** version

| Common data | |
|---|-------------|
| Rated uninterrupted current, Iu | [A] 400/630 |
| Number of poles | 3/4 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 8 |
| Rated insulation voltage, Ui | [V] 1000 |
| Test voltage at industrial frequency 1 min. | [V] 3500 |



| Version | Circuit-breakers | | | | Switch-disconnectors | |
|---|------------------|---|---------------------|---------------------|----------------------|----|
| | S | H | L | V | D | |
| Rated ultimate short-circuit breaking capacity | | | | | | |
| Icu AC 50-60 Hz 440 V | [kA] | 40 | 65 | 100 | 180 | - |
| Icu AC 50-60 Hz 690 V | [kA] | 25 | 40 | 70 | 80 | - |
| Rated service short-circuit breaking capacity | | | | | | |
| Ics AC 50-60 Hz 440 V | [kA] | 100% | 100% | 100% | 100% | - |
| Ics AC 50-60 Hz 690 V | [kA] | 100% | 100% ⁽¹⁾ | 100% ⁽¹⁾ | 100% ⁽²⁾ | - |
| Rated service short-circuit making capacity | | | | | | |
| Icm AC 50-60 Hz 440 V | [kA] | 84 | 143 | 220 | 396 | - |
| Icm AC 50-60 Hz 690 V | [kA] | 52,5 | 84 | 154 | 176 | 11 |
| Rated short-time withstand current | | | | | | |
| Icw (1s) | [kA] | - | - | - | - | 6 |
| Reference Standard | | IEC 60947-2 Utilization category B (400 A) ^(*) Utilization category A (630 A) IEC 60947-4 | | | IEC 60947-3 | |

(1) 75% for T5 630

(2) 50% for T5 630

(*) Icw = 5 kA

| Dimensions | Fixed version 3 pole | Fixed version 4 pole | Mechanical life [No. operat.] | 20000 |
|-------------|----------------------|----------------------|--|--------------|
| W [mm] | 140 | 186 | Electrical life (at 415 V) [No. operat.] | 7000 (400 A) |
| D [mm] | 103.5 | 103.5 | | 5000 (630 A) |
| H [mm] | 205 | 205 | | |
| Weight [kg] | 3.25 | 4.15 | | |



| Trip units | TMA/TMG* | PR222DS | PR223DS | Ekip E/LSIG** |
|------------|----------|---------|---------|---------------|
| | pag. 32 | pag. 34 | pag. 36 | pag. 38 |

* up to 500A

**Available for Tmax T5 in

| Accessories * | T5 |
|---|----|
| Control | |
| Shunt opening release (YO) | ● |
| Shunt closing release (YC) | ● |
| Undervoltage release (YU) | ● |
| Time-delay device for undervoltage release (D) | ● |
| Stored energy motor operator (M) | ● |
| Signalling | |
| Electrical signalling of circuit-breaker open/closed | ● |
| Electrical signalling of circuit-breaker connected/isolated for test/isolated | ● |
| Dialog unit (to be specified with the cbs) | ● |
| PR021/K Signalling unit | ● |
| Safety | |
| Front flange for lever operating mechanism | ● |
| Lock in open position | ● |
| Circuit-breaker lock in connected/isolated/isolated for test position | ● |
| Test | |
| Extension for testing electrical accessories | ● |
| TT1 Trip test Unit | ● |

* These are non-standard accessories. For further details, please contact ABB.

Tmax T6/ML

Tmax T6/ML is available in **fixed** and **withdrawable** version

| Common data | |
|---|---------------------------------|
| Rated uninterrupted current, Iu | [A] 630/800/1000 ⁽⁴⁾ |
| Number of poles | 3/4 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 8 |
| Rated insulation voltage, Ui | [V] 1000 |
| Test voltage at industrial frequency 1 min. | [V] 3500 |

(4) W version is not available on T6 1000 A



| Version | Circuit-breakers | | | | Switch-disconnectors | |
|---|------------------|---|------|------|----------------------|-------------|
| | N | S | H | L | D | |
| Rated ultimate short-circuit breaking capacity | | | | | | |
| Icu AC 50-60 Hz 440 V | [kA] | 30 | 45 | 50 | 80 | - |
| Icu AC 50-60 Hz 690 V | [kA] | 20 | 22 | 25 | 30 | - |
| Rated service short-circuit breaking capacity | | | | | | |
| Ics AC 50-60 Hz 440 V | [kA] | 100% | 100% | 100% | 75% | - |
| Ics AC 50-60 Hz 690 V | [kA] | 75% | 75% | 75% | 75% | - |
| Rated service short-circuit making capacity | | | | | | |
| Icm AC 50-60 Hz 440 V | [kA] | 63 | 94.5 | 105 | 176 | - |
| Icm AC 50-60 Hz 690 V | [kA] | 40 | 46 | 52.5 | 63 | 30 |
| Rated short-time withstand current | | | | | | |
| Icw (1s) | [kA] | - | - | - | - | 15 |
| Reference Standard | | IEC 60947-2 Utilization category B (630A - 800A) ⁽⁵⁾ Utilization category A (1000A) IEC 60947-4 | | | | IEC 60947-3 |

(5) Icw = 7.6 kA (630 A) - 10 kA (800 A)

| Dimensions | Fixed version 3 pole | Fixed version 4 pole |
|-------------|----------------------|----------------------|
| W [mm] | 210 | 280 |
| D [mm] | 103.5 | 103.5 |
| H [mm] | 268 | 268 |
| Weight [kg] | 9.5 | 12 |

| Mechanical life [No. operat.] | 20000 |
|--|--|
| Electrical life (at 415 V) [No. operat.] | 7000 (630A) 5000 (800A) 4000 (1000A) |



| Trip units | TMA | PR222DS | PR223DS |
|------------|---------|---------|---------|
| | pag. 32 | pag. 34 | pag. 36 |

| Accessories * | T6 |
|---|----|
| Control | |
| Shunt opening release (YO) | ● |
| Shunt closing release (YC) | ● |
| Undervoltage release (YU) | ● |
| Time-delay device for undervoltage release (D) | ● |
| Stored energy motor operator (M) | ● |
| Signalling | |
| Electrical signalling of circuit-breaker open/closed | ● |
| Electrical signalling of circuit-breaker connected/isolated for test/isolated | ● |
| Dialog unit (to be specified with the cbs) | ● |
| PR021/K Signalling unit | ● |
| Safety | |
| Front flange for lever operating mechanism | ● |
| Lock in open position | ● |
| Circuit-breaker lock in connected/isolated/isolated for test position | ● |
| Test | |
| Extension for testing electrical accessories | ● |
| TT1 Trip test Unit | ● |

* These are non-standard accessories. For further details, please contact ABB.

Tmax T7/ML

Tmax T7/ML is available in **fixed** and **withdrawable** version

| Common data | |
|---|---------------------------------------|
| Rated uninterrupted current, Iu | [A] 800/1000/1250/1600 ^(*) |
| Number of poles | 3/4 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 8 |
| Rated insulation voltage, Ui | [V] 1000 |
| Test voltage at industrial frequency 1 min. | [V] 3500 |

(*) for T7D Iu=1000/1250/1600



| Version | Circuit-breakers | | | | Switch-disconnectors | |
|---|------------------|---------------------------------------|------|------------------|----------------------|-------------|
| | S | H | L | V ⁽⁶⁾ | D | |
| Rated ultimate short-circuit breaking capacity | | | | | | |
| Icu AC 50-60 Hz 440 V | [kA] | 50 | 65 | 100 | 130 | - |
| Icu AC 50-60 Hz 690 V | [kA] | 30 | 42 | 50 | 60 | - |
| Rated service short-circuit breaking capacity | | | | | | |
| Ics AC 50-60 Hz 440 V | [kA] | 100% | 100% | 100% | 100% | - |
| Ics AC 50-60 Hz 690 V | [kA] | 100% | 75% | 75% | 75% | - |
| Rated service short-circuit making capacity | | | | | | |
| Icm AC 50-60 Hz 440 V | [kA] | 105 | 143 | 220 | 286 | - |
| Icm AC 50-60 Hz 690 V | [kA] | 63 | 88.2 | 105 | 132 | 52,2 |
| Rated short-time withstand current | | | | | | |
| Icw (1s) | [kA] | - | - | - | 20 ⁽⁷⁾ | 20 |
| Reference Standard | | IEC 60947-2 Utilization category B | | | | IEC 60947-3 |

(6) only for T7 800/1000/1250 A

(7) Icw = 20 kA (S,H,L versions) - 15 kA (V version)

| Dimensions | Fixed version 3 pole | Fixed version 4 pole | Mechanical life [No. operat.] | 10000 |
|-------------|-------------------------------------|-------------------------------------|--|---|
| W [mm] | 210 | 280 | Electrical life (at 415 V) [No. operat.] | 2000 (S, H, L versions) 3000 (V, versions) |
| D [mm] | 154 (manual) / 178 (motorizable) | 154 (manual) / 178 (motorizable) | | |
| H [mm] | 268 | 268 | | |
| Weight [kg] | 9.7 (manual) 11 (motorizable) | 12.5 (manual) 14 (motorizable) | | |



| Trip units | PR232/P | PR332/P |
|------------|---------|---------|
| | pag. 40 | pag. 42 |

| Accessories * | T7 |
|---|----|
| Control | |
| Shunt opening release (YO) | ● |
| Shunt closing release (YC) | ● |
| Undervoltage release (YU) | ● |
| Time-delay device for undervoltage release (D) | ● |
| Stored energy motor operator (M) | ● |
| Signalling | |
| Electrical signalling of circuit-breaker open/closed | ● |
| Electrical signalling of circuit-breaker connected/isolated for test/isolated | ● |
| Dialog unit (to be specified with the cbs) | ● |
| PR021/K Signalling unit | ● |
| Safety | |
| Front flange for lever operating mechanism | ● |
| Lock in open position | ● |
| Circuit-breaker lock in connected/isolated/isolated for test position | ● |
| Test | |
| Extension for testing electrical accessories | ● |
| TT1 Trip test Unit | ● |

* These are non-standard accessories. For further details, please contact ABB.
(1) for T7M only

Emax 2 E2.2/ML

Emax 2 E2.2/ML is available in **withdrawable** version

| Common data | |
|---------------------------------------|-----------------------------|
| Rated uninterrupted current, Iu | [A] 800/1250/1600/2000/2500 |
| Number of poles | 3 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 12 |
| Rated insulation voltage, Ui | [V] 1000 |



| Version | Circuit-breakers | | | Switch-disconnectors | | |
|---|------------------|---------------------------------------|------|----------------------|--|-----|
| | N | S | H | N/MS | H/MS | |
| Rated ultimate short-circuit breaking capacity | | | | | | |
| Icu AC 50-60 Hz 440 V | [kA] | 66 | 85 | 100 | - | - |
| Icu AC 50-60 Hz 690 V | [kA] | 66 | 66 | 85 | - | - |
| Rated service short-circuit breaking capacity | | | | | | |
| Ics AC 50-60 Hz 690 V | [kA] | 100% | 100% | 100% | - | - |
| Rated service short-circuit making capacity | | | | | | |
| Icm AC 50-60 Hz 440 V | [kA] | 145 | 187 | 220 | 145 | 187 |
| Icm AC 50-60 Hz 690 V | [kA] | 145 | 145 | 187 | 145 | 187 |
| Rated short-time withstand current | | | | | | |
| Icw (1s) | [kA] | 66 | 66 | 85 | 66 | 85 |
| Reference Standard | | IEC 60947-2 Utilization category B | | | IEC 60947-3 Utilization category AC-23A | |

| Dimensions | |
|-------------------------------------|-----|
| W [mm] | 317 |
| D [mm] | 383 |
| H [mm] | 425 |
| Weight Including fixed part [kg] | 84 |

| SACE EMAX 2 / ML | | E2.2 | | |
|--|---------------------|-------|------|------|
| Mechanical and electrical life with regular ordinary maintenance prescribed by the manufacturer | | | | |
| | [Iu] | <1600 | 2000 | 2500 |
| | [No. cycles x 1000] | 25 | 25 | 20 |
| Frequency | [Oper./Hour] | 60 | 60 | 60 |
| Electrical life | | | | |
| 440 V | [No. cycles x 1000] | 15 | 10 | 8 |
| 690 V | [No. cycles x 1000] | 15 | 8 | 7 |
| Frequency | [Oper./Hour] | 30 | 30 | 30 |



| Trip units | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|------------|------------|---------------|--------------|-----------------|
| | pag. 46 | pag. 47 | pag. 48 | pag. 49 |

- Standard accessory for mobile part
- Standard accessory for mobile part
- Accessory on request for mobile part
- ▲ Standard accessory for fixed part
- △ Accessory on request for fixed part
- * Only closing release YC

| | Automatic circuit-breaker E2.2 | Switch disconnecter E2.2 |
|---|--------------------------------|--------------------------|
| Signalling | | |
| Standard open/closed auxiliary contacts - AUX 4Q | ●● | ○ |
| Open/closed auxiliary contacts - AUX 6Q | ○ | ○ |
| Auxiliary position contacts - AUP | △ | △ |
| Ready to close signalling contact - RTC | ○ | ○ |
| TU Reset mechanical signalling of the tripping of protection trip unit - TU Reset | ●● | - |
| Contact signalling tripping of Ekip protection trip unit - S51 | ●● | - |
| Contact signalling loaded springs - S33 M/2 (supplied with Motor) | ○ | ○ |
| Control | | |
| Opening and closing release - YO/YC | ○ | ○ |
| Second opening and closing release - YO2/YC2 | ○ | ○ |
| Undervoltage release - YU | ○ | ○ |
| Electronic time-delay device for undervoltage release - UVD | ○ | ○ |
| Motor - M | ○ | ○ |
| Remote reset - YR | ○ | - |
| Opening and closing release test unit - YO/YC Test Unit | △ | △ |
| Safety | | |
| Key lock in open position - KLC | ○ | ○ |
| Key lock in racked-in / test / racked-out position - KLP | ○ | ○ |
| Mechanical operation counter - MOC | ○ | ○ |
| Protection devices | | |
| Protection device for opening and closing pushbuttons - PBC | ○ | ○ |
| IP30 Protection | ▲ | ▲ |
| IP54 Protection | △ | △ |
| Terminal covers - HTC/LTC | - | - |
| Separators - PB | △ | △ |
| Connections | | |
| Orientable rear terminal - HR/VR | ▲ | ▲ |
| Front terminal - F | △ | △ |
| Other configurations | △ | △ |

These are all standard supply accessories.

Emax 2 E4.2/ML

Emax 2 E4.2/ML is available in **withdrawable** version

| Common data | |
|---------------------------------------|-------------------------|
| Rated uninterrupted current, Iu | [A] 2000/2500/3200/4000 |
| Number of poles | 3 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 12 |
| Rated insulation voltage, Ui | [V] 1000 |



| Version | Circuit-breakers | | | Switch-disconnectors | | | |
|---|------------------|---------------------------------------|------|----------------------|--|------|------------|
| | N | H | V | N/MS | H/MS | V/MS | |
| Rated ultimate short-circuit breaking capacity | | | | | | | |
| Icu AC 50-60 Hz 440 V | [kA] | 66 | 100 | 150 | - | - | - |
| Icu AC 50-60 Hz 690 V | [kA] | 66 | 85 | 100 | - | - | - |
| Rated service short-circuit breaking capacity | | | | | | | |
| Ics AC 50-60 Hz 690 V | [kA] | 100% | 100% | 100% ⁽²⁾ | - | - | - |
| Rated service short-circuit making capacity | | | | | | | |
| Icm AC 50-60 Hz 440 V | [kA] | 145 | 220 | 330 | 145 | 187 | 220 |
| Icm AC 50-60 Hz 690 V | [kA] | 145 | 187 | 220 | 145 | 187 | 220 |
| Rated short-time withstand current | | | | | | | |
| Icw (1s) | [kA] | 65 | 85 | 100 | 65 | 85 | 100 |
| Reference Standard | | IEC 60947-2 Utilization category B | | | IEC 60947-3 Utilization category AC-23A | | |

(2) Ics: 125kA for 400V...440V voltage;

| Dimensions | |
|-------------------------------------|-----|
| W [mm] | 425 |
| D [mm] | 383 |
| H [mm] | 425 |
| Weight Including fixed part [kg] | 110 |

| SACE EMAX 2 / ML | | E4.2 | | |
|--|---------------------|--------|------|------|
| Mechanical and electrical life with regular ordinary maintenance prescribed by the manufacturer | | | | |
| | [Iu] | < 2500 | 3200 | 4000 |
| | [No. cycles x 1000] | 20 | 20 | 15 |
| Frequency | [Oper./Hour] | 60 | 60 | 60 |
| Electrical life | | | | |
| 440 V | [No. cycles x 1000] | 10 | 7 | 5 |
| 690 V | [No. cycles x 1000] | 10 | 7 | 4 |
| Frequency | [Oper./Hour] | 20 | 20 | 20 |



| Trip units | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|------------|------------|---------------|--------------|-----------------|
| | pag. 46 | pag. 47 | pag. 48 | pag. 49 |

- Standard accessory for mobile part
- Standard accessory for mobile part
- Accessory on request for mobile part
- ▲ Standard accessory for fixed part
- △ Accessory on request for fixed part
- * Only closing release YC

| | Automatic circuit-breaker E 4.2 | Switch disconnecter E 4.2 |
|---|---------------------------------|---------------------------|
| Signalling | | |
| Standard open/closed auxiliary contacts - AUX 4Q | ●● | ○ |
| Open/closed auxiliary contacts - AUX 6Q | ○ | ○ |
| Auxiliary position contacts - AUP | △ | △ |
| Ready to close signalling contact - RTC | ○ | ○ |
| TU Reset mechanical signalling of the tripping of protection trip unit - TU Reset | ●● | - |
| Contact signalling tripping of Ekip protection trip unit - S51 | ●● | - |
| Contact signalling loaded springs - S33 M/2 (supplied with Motor) | ○ | ○ |
| Control | | |
| Opening and closing release - YO/YC | ○ | ○ |
| Second opening and closing release - YO2/YC2 | ○ | ○ |
| Undervoltage release - YU | ○ | ○ |
| Electronic time-delay device for undervoltage release - UVD | ○ | ○ |
| Motor - M | ○ | ○ |
| Remote reset - YR | ○ | - |
| Opening and closing release test unit - YO/YC Test Unit | △ | △ |
| Safety | | |
| Key lock in open position - KLC | ○ | ○ |
| Key lock in racked-in / test / racked-out position - KLP | ○ | ○ |
| Mechanical operation counter - MOC | ○ | ○ |
| Protection devices | | |
| Protection device for opening and closing pushbuttons - PBC | ○ | ○ |
| IP30 Protection | ▲ | ▲ |
| IP54 Protection | △ | △ |
| Terminal covers - HTC/LTC | - | - |
| Separators - PB | △ | △ |
| Connections | | |
| Orientable rear terminal - HR/VR | ▲ | ▲ |
| Front terminal - F | △ | △ |
| Other configurations | △ | △ |

These are all standard supply accessories.

Emax 2 E6.2/ML

Emax 2 E6.2/ML is available in **withdrawable** version

| Common data | |
|---------------------------------------|--------------------|
| Rated uninterrupted current, Iu | [A] 4000/5000/6300 |
| Number of poles | 3 |
| Rated service voltage, Ue AC 50-60Hz | [V] 690 |
| Rated impulse withstand voltage, Uimp | [kV] 12 |
| Rated insulation voltage, Ui | [V] 1000 |



| Version | Circuit-breakers | | Switch-disconnectors | |
|---|---------------------------------------|------|--|------|
| | H | V | H/MS | X/MS |
| Rated ultimate short-circuit breaking capacity | | | | |
| Icu AC 50-60 Hz 440 V | [kA] 100 | 150 | - | - |
| Icu AC 50-60 Hz 690 V | [kA] 100 | 100 | - | - |
| Rated service short-circuit breaking capacity | | | | |
| Ics AC 50-60 Hz 690 V | [kA] 100% | 100% | - | - |
| Rated service short-circuit making capacity | | | | |
| Icm AC 50-60 Hz 440 V | [kA] 220 | 330 | 220 | 264 |
| Icm AC 50-60 Hz 690 V | [kA] 220 | 220 | 220 | 264 |
| Rated short-time withstand current | | | | |
| Icw (1s) | [kA] 100 | 100 | 100 | 120 |
| Reference Standard | IEC 60947-2 Utilization category B | | IEC 60947-3 Utilization category AC-23A | |

| Dimensions | |
|-------------------------------------|-----|
| W [mm] | 803 |
| D [mm] | 383 |
| H [mm] | 425 |
| Weight Including fixed part [kg] | 207 |

| SACE EMAX 2 / ML | | E6.2 | |
|--|---------------------|------|------|
| Mechanical and electrical life with regular ordinary maintenance prescribed by the manufacturer | | | |
| | [Iu] | 4000 | 6300 |
| | [No. cycles x 1000] | 12 | 12 |
| Frequency | [Oper./Hour] | 60 | 60 |
| Electrical life | | | |
| 440 V | [No. cycles x 1000] | 4 | 2 |
| 690 V | [No. cycles x 1000] | 4 | 2 |
| Frequency | [Oper./Hour] | 10 | 10 |



| Trip units | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|------------|------------|---------------|--------------|-----------------|
| | pag. 46 | pag. 47 | pag. 48 | pag. 49 |

- Standard accessory for mobile part
- Standard accessory for mobile part
- Accessory on request for mobile part
- ▲ Standard accessory for fixed part
- △ Accessory on request for fixed part
- * Only closing release YC

| | Automatic circuit-breaker E 6.2 | Switch disconnecter E 6.2 |
|---|---------------------------------|---------------------------|
| Signalling | | |
| Standard open/closed auxiliary contacts - AUX 4Q | ●● | ○ |
| Open/closed auxiliary contacts - AUX 6Q | ○ | ○ |
| Auxiliary position contacts - AUP | △ | △ |
| Ready to close signalling contact - RTC | ○ | ○ |
| TU Reset mechanical signalling of the tripping of protection trip unit - TU Reset | ●● | - |
| Contact signalling tripping of Ekip protection trip unit - S51 | ●● | - |
| Contact signalling loaded springs - S33 M/2 (supplied with Motor) | ○ | ○ |
| Control | | |
| Opening and closing release - YO/YC | ○ | ○ |
| Second opening and closing release - YO2/YC2 | ○ | ○ |
| Undervoltage release - YU | ○ | ○ |
| Electronic time-delay device for undervoltage release - UVD | ○ | ○ |
| Motor - M | ○ | ○ |
| Remote reset - YR | ○ | - |
| Opening and closing release test unit - YO/YC Test Unit | △ | △ |
| Safety | | |
| Key lock in open position - KLC | ○ | ○ |
| Key lock in racked-in / test / racked-out position - KLP | ○ | ○ |
| Mechanical operation counter - MOC | ○ | ○ |
| Protection devices | | |
| Protection device for opening and closing pushbuttons - PBC | ○ | ○ |
| IP30 Protection | ▲ | ▲ |
| IP54 Protection | △ | △ |
| Terminal covers - HTC/LTC | - | - |
| Separators - PB | △ | △ |
| Connections | | |
| Orientable rear terminal - HR/VR | ▲ | ▲ |
| Front terminal - F | △ | △ |
| Other configurations | △ | △ |

These are all standard supply accessories.

CHAPTER 3

Trip units

| | |
|--------------|------------------------------|
| 30-31 | Protection trip units |
| 32-33 | TMD/TMA and TMG |
| 34-35 | PR222DS/P, PR222DS/PD |
| 36-37 | PR223DS and PR223EF |
| 38-39 | Ekip E-LSIG |
| 40-41 | PR232/P |
| 42-45 | PR332/P |
| 46-46 | Ekip Touch |
| 47-47 | Ekip Hi-Touch |
| 48-48 | Ekip G Touch |
| 49-49 | Ekip G Hi-Touch |

Protection trip units

SACE ML trip units are the new benchmark for the protection, measurement and control of low voltage electrical systems. The result of ABB SACE’s experience and research, they make ML circuit-breaker, embedding advanced functionalities, to become an all-in-one solution for as well distribution systems and microgrid.

The protection units are divided into different families which can be suitable for distribution protection and for generator protection. The range of trip units is available with many levels of performance to satisfy simple to advanced applications. Thanks to their simplicity of assembly, the end customer can change the type of trip unit extremely rapidly, according to their own requirements and needs. This means an increased flexibility of use of the circuit-breakers with considerable savings in terms of costs thanks to better rationalisation of stock management. The complete, flexible protection trip unit offering, which can be adapted to the actual level of protection required, is shown in the following pages.

The Tmax T4/ML, T5/ML and T6/ML circuit-breakers can be equipped either with TMD/TMA or TMG thermomagnetic trip units, moreover there is also a wide portfolio of electronic trip units composed by PR221DS, PR222DS/P, PR222DS/PD, PR223DS and Ekip E-LSIG. Similarly, Tmax T7 can also mount the latest generation PR231/P, PR232/P, PR331/P⁽¹⁾ and PR332/P⁽¹⁾ electronic trip units.

SACE Emax 2 Ekip protection trip units are the new benchmark for the protection, measurement and control of low voltage electrical systems.

The protection units, available in the LSI and LSIG versions, are divided into two families: Ekip for distribution protection and Ekip G for generator protection.

The Ekip trip units are designed to protect a vast range of applications, such as use with transformers, motors and drives. Ekip Dip, Ekip Touch or Ekip Hi-Touch can be selected, depending on the complexity of the system, the need to take voltage or energy measurements or to include control systems in switchgear.

Ekip G enables the protection of generators without the use of external devices that require dedicated relays and wiring. Ekip G increases efficiency from the design stage to installation, minimizing the time needed for realization and commissioning of the system, and ensuring high levels of accuracy and reliability of all protection devices required for running generators in applications such as naval, GenSet or cogeneration. Thanks to the Network Analyzer function integrated in all Hi-Touch versions, the quality of energy in terms of harmonics, micro-interruptions or voltage dips is monitored without the need for dedicated instrumentation. This allows effective preventive and corrective action to be implemented through accurate analysis of the faults, thereby improving the efficiency of the system. Here below there is a summary of the trip units portfolio for Emax 2 ML circuit breaker.

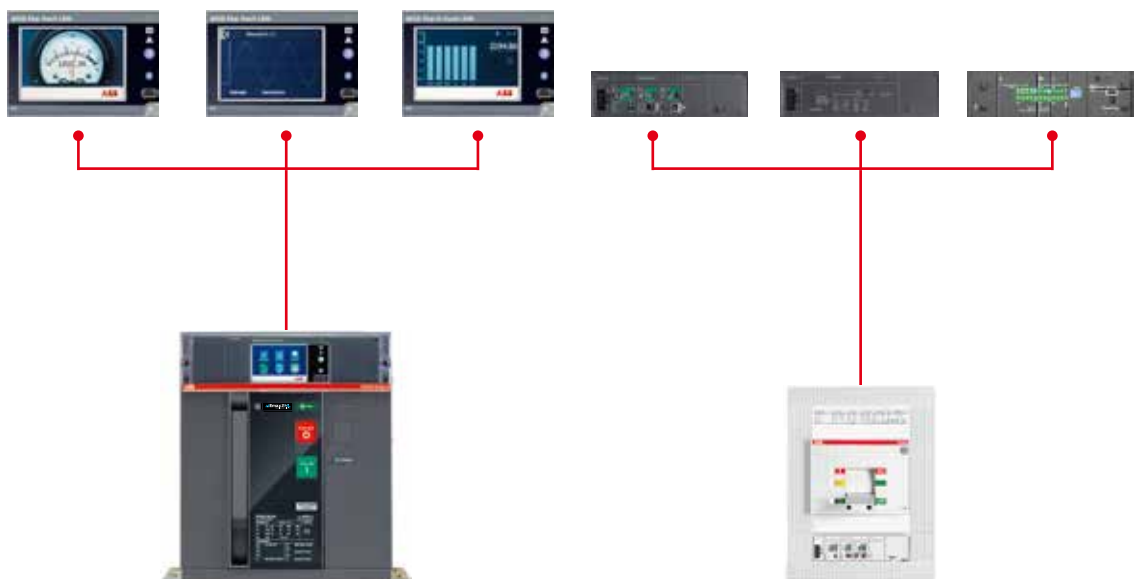
(1) If ordered loose PR331/P and PR332/P must be completed with the "trip unit adapters"

| | Fields of application | Measurement and Protection of Current | Measurement of Voltage, Power, Energy | Measurement and Protection of Voltage, Power, Energy | Network analyzer |
|-----------------|-----------------------|---------------------------------------|---------------------------------------|--|------------------|
| Ekip Dip | Distribution | with Ekip Multimeter | - | - | - |
| Ekip Touch | | ● | with Ekip Measuring | with Ekip Measuring Pro | - |
| Ekip Hi-Touch | | ● | ● | ● | ● |
| Ekip G Touch | Generators | ● | ● | ● | - |
| Ekip G Hi-Touch | | ● | ● | ● | ● |

All ML circuit-breakers are equipped with protection trip units that are interchangeable from the front with just a few, simple operations by the customer.

This enables personalization of the functions available, even during commissioning or when the circuit-breaker has already been installed. In particular, consists of:

- **Protection trip unit**, available with different interfaces and versions that range from basic to more complete; it contains a latest generation microprocessor that performs all the functions of protection and control.
- **Ekip Measuring Module**, connected internally to Emax 2/ML, performs voltage, power and energy measurements with high accuracy without requiring any external connection or voltage transformer. The Ekip Measuring Pro version also performs all protection functions based on voltage and power without the need for external units, thereby simplifying design and construction of the system.
- **Interchangeable rating plug** enables all protection thresholds to be adjusted according to the rated current, increasing flexibility for the customer. It is useful in installations that are prepared for future development or in cases in which the power supplied may be limited temporarily.
- **Main board** is the mechanical housing of the trip unit, which includes a micro-controller for measuring currents and the self-protection functions. The separation of trip units ensures excellent reliability and immunity to conducted and radiated emissions. Integrated new generation Rogowski sensors, which are sensitive to the true r.m.s. value of the current, guarantee high accuracy of both measurements and protection.



TMD/TMA and TMG

The Tmax ML circuit-breakers can be fitted with thermomagnetic trip units and are used in protection of alternating and direct current networks with a range of use from 20 A to 800 A. They allow the protection against overload with a thermal device realised using the bimetal technique and

protection against short-circuit with a magnetic device. The four-pole circuit-breakers are always supplied with the neutral protected by the trip unit and with protection of the neutral at 100% of the phase setting.



Threshold adjustable

Thermal threshold adjustable from 0.7 to 1 x I_n

TMA = thermomagnetic trip unit with adjustable thermal threshold ($I_1 = 0.7...1 \times I_n$) and adjustable magnetic threshold ($I_2 = 5...10 \times I_n$)
 TMG (for T5) = thermomagnetic trip unit with adjustable thermal threshold ($I_1 = 0.7...1 \times I_n$) and adjustable magnetic threshold ($I_2 = 2.5...5 \times I_n$)

| TMD/TMA - T4 | | | | | | | | | | |
|--|-------------------------------|-------------|-----|-----|-----------|-------------|------------|------------|-------------|-------------|
| L $I_1 = 0.7...1 \times I_n$ | In [A] | 20 | 32 | 50 | 80 | 100 | 125 | 160 | 200 | 250 |
| | Neutral [A] - 100% | 20 | 32 | 50 | 80 | 100 | 125 | 160 | 200 | 250 |
| | Neutral [A] - 50% | - | - | - | - | - | 80 | 100 | 125 | 160 |
| I $I_3 = 10 \times I_n$ $I_3 = 5...10 \times I_n$ | $I_3 = 10 \times I_n$ [A] | 320 | 320 | 500 | | | | | | |
| | $I_3 = 5...10 \times I_n$ [A] | | | | 400...800 | 500...1000 | 625...1250 | 800...1600 | 1000...2000 | 1250...2500 |
| | Neutral [A] - 100% | 320 | 320 | 500 | 400...800 | 500...1000 | 625...1250 | 800...1600 | 1000...2000 | 1250...2500 |
| | Neutral [A] - 50% | - | - | - | - | - | 400...800 | 500...1000 | 625...1250 | 800...1600 |
| TMA - T5 | | | | | | | | | | |
| L $I_1 = 0.7...1 \times I_n$ | In [A] | 320 | | | | 400 | | | 500 | |
| | Neutral [A] - 100% | 320 | | | | 400 | | | 500 | |
| | Neutral [A] - 50% | 200 | | | | 250 | | | 320 | |
| I $I_3 = 5...10 \times I_n$ | I_3 [A] | 1600...3200 | | | | 2000...4000 | | | 2500...5000 | |
| | Neutral [A] - 100% | 1600...3200 | | | | 2000...4000 | | | 2500...5000 | |
| | Neutral [A] - 50% | 1000...2000 | | | | 1250...2500 | | | 1600...3200 | |
| TMG - T5 | | | | | | | | | | |
| L $I_1 = 0.7...1 \times I_n$ | In [A] | 320 | | | | 400 | | | 500 | |
| | Neutral [A] - 100% | 320 | | | | 400 | | | 500 | |
| I $I_3 = 2.5...5 \times I_n$ | I_3 [A] | 800...1600 | | | | 1000...2000 | | | 1250...2500 | |
| | Neutral [A] - 100% | 800...1600 | | | | 1000...2000 | | | 1250...2500 | |
| TMA - T6 | | | | | | | | | | |
| L $I_1 = 0.7...1 \times I_n$ | In [A] | 630 | | | | | | | 800 | |
| | Neutral [A] - 100% | 630 | | | | | | | 800 | |
| | Neutral [A] - 50% | 400 | | | | | | | 500 | |
| I $I_3 = 5...10 \times I_n$ | I_3 [A] | 3150...6300 | | | | | | | 4000...8000 | |
| | Neutral [A] - 100% | 3150...6300 | | | | | | | 4000...8000 | |
| | Neutral [A] - 50% | 2000...4000 | | | | | | | 2500...5000 | |

Notes

- I_n identifies the setting current for protection of the phases (L1, L2 and L3) and of the neutral.
- The TMA and TMG thermomagnetic trip units which equip the Tmax T4, T5 and T6 circuit-breakers have the thermal element with adjustable threshold $I_1 = 0.7...1 \times I_n$. The set current value which is obtained using the special selector is intended at 40 °C. The magnetic element has adjustable trip threshold ($I_3 = 5...10 \times I_n$ for TMA and $I_3 = 2.5...5 \times I_n$ for TMG) with a tolerance of $\pm 20\%$ according to what is indicated in the IEC 60947-2 (par. 8.3.3.1.2) Standard. The trip thresholds of the magnetic protection I_3 are a function of the setting used both by the phase and neutral protection.

PR222DS/P and PR222DS/PD

The PR222DS/P trip unit has protection functions against overload L, delayed S and instantaneous I short-circuit (version PR222DS/P-LSI). Setting of the PR222DS trip unit can be carried out by means of dip switches on the front of the circuit-breaker or electronically, using the Ekip T&P programming and Ekip Connect.

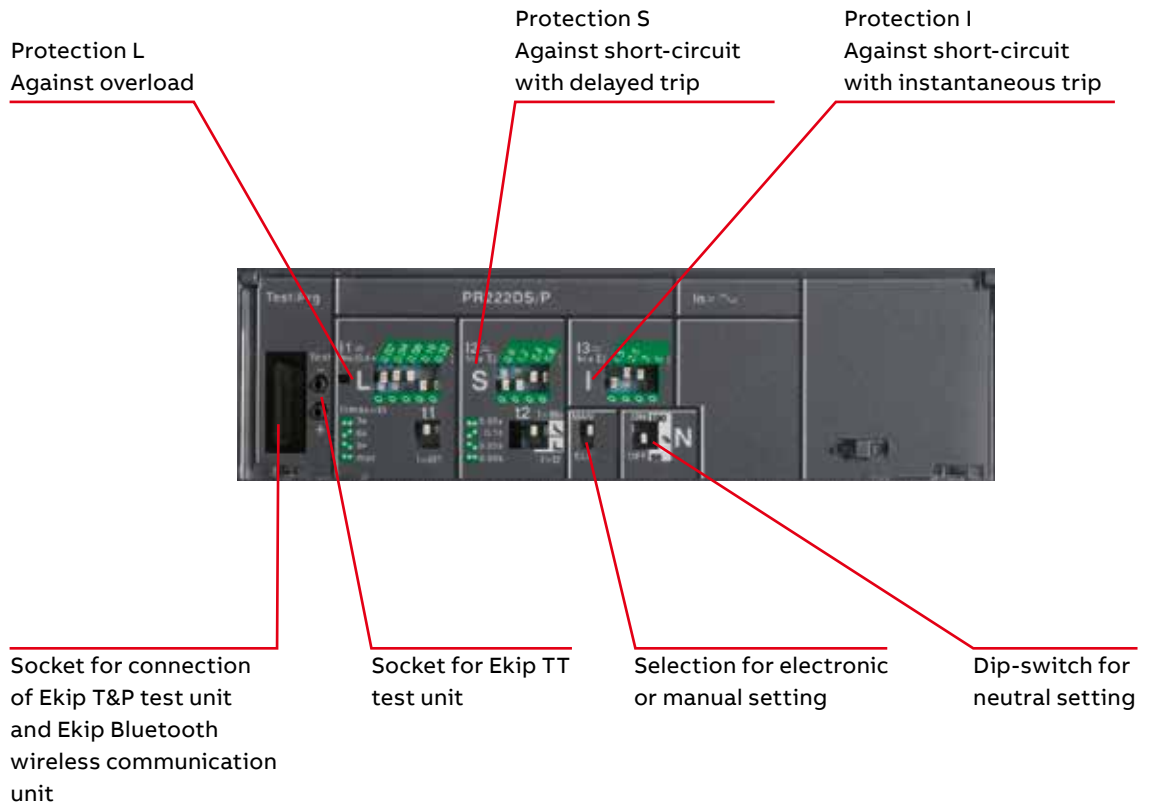
There is a single setting for the phases and neutral, for which one can decide whether to set the threshold of the protection functions to OFF, to 50% or to 100% that of the phases by means of two dedicated dip switches.

Furthermore, on the front of the PR222DS/P (or PR222DS/PD) trip units, signalling of pre-alarm and alarm of protection L is available. It is also possible to transmit remotely the alarm of protection L, simply connecting connector X3 to the dedicated contact.

The PR222DS/PD trip units allow circuit-breakers to be integrated in a communication network based on the Modbus® RTU protocol.

The PR222DS/PD release, with integrated communication and control functions, allows a wide range of information to be acquired and transmitted remotely.

PR222DS/P



| | PR222DS/P - PR222DS/PD | PR222DS/P - PR222DS/PD |
|----------------------|------------------------|------------------------|
| Protection functions | LSI | LSIG |

PR222DS/P, PR222DS/PD - Protection functions and parameterisations

| Protection functions | Trip threshold | Trip curves ⁽¹⁾ | Excludability | Relation t = f(I) |
|---|---|---|---------------|-------------------------------------|
| L Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve (I ² t=k) according to IEC 60947-2 Standard | Manual setting I1 = 0.40...1 x In step = 0.02 x In | Manual setting at 6 x I1 t1 = 3 - 6 - 9/12 - MAX ⁽²⁾ | no | t = k/I ² |
| | Electronic setting I1 = 0.40...1 x In step 0.01 x In Trip between 1.1...1.3 x I1 | Electronic setting at 6 x I1 t1 = 3...18s step 0.5s ⁽²⁾ Tolerance: ± 10% | | |
| S Against short-circuit with inverse short time delay trip and trip characteristic with inverse time (I ² t=k) or definite time | Manual setting I2 = 0.6-1.2-1.8-2.4-3-3.6-4.2-5.8-6.4-7-7.6-8.2-8.8-9.4-10 x In ⁽³⁾ | Manual setting at 8 x In t2 = 0.05 - 0.1 - 0.25 - 0.5s | yes | t = k/I ² |
| | Electronic setting I2 = 0.60...10 x In step 0.1 x In Tolerance: ± 10% | Electronic setting at 8 x In t2 = 0.05...0.5s step 0.01s Tolerance: ± 10% ⁽⁴⁾ | | |
| | Manual setting I2 = 0.6-1.2-1.8-2.4-3-3.6-4.2-5.8-6.4-7-7.6-8.2-8.8-9.4-10 x In ⁽³⁾ | Manual setting t2 = 0.05 - 0.1 - 0.25 - 0.5s | yes | t = k |
| | Electronic setting I2 = 0.60...10 x In step 0.1 x In Tolerance: ± 10% | Electronic setting t2 = 0.05...0.5s step 0.01s Tolerance: ± 10% ⁽⁴⁾ | | |
| I Against short-circuit with instantaneous trip | Manual setting I3 = 1.5-2.5-3-4-4.5-5-5.5-6.5-7-7.5-8-9-9.5-10.5-12 x In ⁽³⁾ | instantaneous | yes | t = k |
| | Electronic setting I3 = 1.5...12 x In ⁽³⁾ step 0.1 x In Tolerance: ± 10% | | | |
| G Against earth fault with inverse short time delay trip and trip characteristic according to an inverse time curve (I ² t=k) | Manual setting I4 = 0.2-0.25-0.45-0.55-0.75-0.8-1 x In | Manual setting up to 3.15 x I4 up to 2.25 x I4 up to 1.6 x I4 up to 1.10 x I4 t4 = 0.1s t4 = 0.2s t4 = 0.4s t4 = 0.8s | yes | t = k/I ² ⁽⁶⁾ |
| | Electronic setting I4 = 0.2...1 x In step 0.1 x In Tolerance: ± 10% | Electronic setting t4 = 0.1...0.8s step 0.01s Tolerance: ± 15% | | |

(1) These tolerances hold in the following conditions:
 - self-powered trip unit at full power and/or auxiliary supply
 - two or three-phase power supply
 In conditions other than those considered, the following tolerances hold:

| | Trip threshold | Trip time |
|----------|----------------|-----------|
| S | ± 20% | ± 20% |
| I | ± 20% | ≤ 50ms |
| G | ± 20% | ± 20% |

(2) t₁ values for MAX setting:

| CB | Electronic setting | Manual setting |
|---------|---------------------|----------------|
| T4 320 | | |
| T5 630 | 3...10.5s Step 0.5s | 3-6-9-10.5 |
| T6 1000 | | |
| T4 250 | 3...18s Step 0.5s | 3-6-9-18 |
| T5 400 | | |
| T6 800 | 3...18s Step 0.5s | 3-6-9-18 |
| T6 630 | 3...18s Step 0.5s | 3-6-12-18 |

(3) For T4 In = 320 A and T5 In = 630 A. T6 In = 1000 A ⇒ I_{2,max} = 9.5 x In and I_{3,max} = 9.5 x In
 For T6 In = 800 A ⇒ I_{3,max} = 10.5 x In

(4) Tolerance: ± 10 ms

(6) t = k/I² up to the current value indicated, t = k (equating to the chosen setting) beyond the current value indicated

PR223DS and PR223EF

Apart from the traditional L, S, I, and G protection functions, the PR223DS release, available on T4 and T6, also offers the possibility of measuring the main electrical values. In fact, using the accessory VM210, and without using any voltage transformers, the user has access not only to the current values but also to the voltage, power and energy values.

For the neutral, it is possible to set the protection threshold of the functions to OFF, to 50% and to 100% of that of the phases. The pre-alarm and alarm signalling of protection L are also available by means of a dedicated LED on the front of the release. The PR223DS trip unit, with integrated ModBus RTU protocol based dialogue unit, allows a wide range of information to be acquired and transmitted remotely and to carry out opening and closing commands.

If the PR223DS trip unit is inserted in a supervision system, during the test and configuration with the PR010/T unit, communication is automatically abandoned and starts again on completion of these operations.

The PR223EF electronic trip unit available on T4, T5 and T6 in the L version (120 kA @ 380/415 V) for use in alternating current, is able to isolate a fault present in extremely rapid times. This performance is made possible thanks to the EFDP (Early Fault Detection and Prevention) algorithm, which is able to detect the short-circuit at its onset, exploiting analysis of the trend of the shunted current in relation to the current. The PR223EF trip unit therefore offers two performances simultaneously which, until today, were antithetic: selectivity and trip rapidity.

PR223DS and PR223EF



Socket for connection of Ekip T&P test unit and Ekip Bluetooth wireless communication unit

Socket for Ekip TT test unit

LED signalling alarm of the circuit-breaker

LED signalling the status of the circuit-breaker

Push button for operation mode selection (local/remote) and on-board diagnosis system

| | |
|--------------------------|---------|
| PR223DS - PR223EF | |
| Protection functions | L S I G |

Protection functions and parameterisations

| Protection functions | Trip threshold | Trip curves ⁽¹⁾ | Excludability | Relation $t = f(I)$ | EFDP zone selectivity* |
|---|--|--|---------------|------------------------|---------------------------|
| L Against overload with long inverse time-delay trip and trip characteristic according to an inverse time curve ($I^2t=k$) according to the IEC 60947-2 Standard | Electronic setting $I1=0.18...1 \times I_n^{(3)}$, step $0.01 \times I_n$ Trip between $1.1...1.3 \times I1$ (IEC 60947-2) | Electronic setting at $6 \times I1$ $t1 = 3...18s^{(2)}$, step $0.5s$ Tolerance: $\pm 10\%$ | no | $t = k/I^2$ | no |
| S Against short-circuit with short inverse time-delay trip and trip characteristic with inverse time ($I^2t=k$) or with definite time | Electronic setting $I2 = 0.60...10 \times I_n^{(3)}$, step $0.1 \times I_n$ Tolerance: $\pm 10\%$ | Electronic setting at $8 \times I_n$ $t2 = 0.05...0.5s$, step $0.01s$ Tolerance: $\pm 10\%$ | yes | $t = k/I^2$ | yes |
| | Electronic setting $I2 = 0.60...10 \times I_n^{(3)}$, step $0.1 \times I_n$ Tolerance: $\pm 10\%$ | Electronic setting $t2 = 0.05...0.5s$, step $0.01s$ Tolerance: $\pm 10\%$ | yes | $t = k$ | yes |
| EF Against short-circuit with ultra rapid trip ⁽⁴⁾ | | | yes | $t = k$ | yes |
| I Against short-circuit with instantaneous trip with adjustable threshold | Electronic setting $I3 = 1.5...12 \times I_n^{(3)}$, step $0.1 \times I_n$ Tolerance: $\pm 10\%$ | instantaneous | yes | $t = k$ | no |
| G Against earth fault with inverse short time delay trip and trip characteristic with inverse time ($I^2t=k$) | Electronic setting $I4 = 0.2...1 \times I_n$, step $0.1 \times I_n$ Tolerance: $\pm 10\%$ | Electronic setting $t4 = 0.1...0.8s$, step $0.01s$ Tolerance: $\pm 15\%$ | yes | $t = k/I^2$ | yes |

(1) These tolerances are valid under the following conditions:
 – trip unit self-supplied at full power and/or auxiliary supply;
 – two or three-phase power supply.

In conditions other than those considered, the following tolerances hold:

| Trip threshold | Trip time |
|---------------------|-------------|
| S $\pm 20\%$ | $\pm 20\%$ |
| I $\pm 20\%$ | $\leq 50ms$ |
| G $\pm 20\%$ | $\pm 20\%$ |

(2) For T4. $I_n = 320 A$ and T5. $I_n = 630 A$ $\square t1 = 10.5s$

(3) For T4 $I_n = 320 A$, T5 $I_n = 630 A$ and T6 $I_n = 1000 A$
 $\square I2max = 9.5 \times I_n$, $I3max = 9.5 \times I_n$
 For T6 $I_n = 800 A$ $\square I3max = 10.5 \times I_n$

(4) Active in auxiliary power supply (24 V DC)

(5) For $I1 < 0.4 \times I_n$ in the neutral setting must be at 100% of that of the phases

* only for PR223EF

Ekip E-LSIG

Available for Tmax T5 in three pole and four pole version, Ekip E-LSIG is the integrated energy metering solution from 320 A to 630 A.

This trip unit can be set using manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off. But also using electronic setting, made both locally using Ekip T&P accessory and also via remote control, with version of trip unit with communication function.

The electronic setting have a wider range and a thicker regulation step.

With this new electrical trip unit, ABB offers an optimal solution for energy and power measurements without the usage of external accessories, as the device VM210

With Ekip E-LSIG T5, upon request, will be available simultaneously the communication, through internal bus, with ABB interface on the front of the switchgear HMI030 and, through system bus, with an external MODBUS network.



| Protection function | Trip threshold | Trip curve ⁽¹⁾ | Excludability | Relation | Thermal memory |
|---|---|--|---------------|-------------|----------------|
| L Against overloads with long inverse time delay trip according to IEC 60947-2 | Manual setting: $I_1 = 0.4...1 \times I_n$, step 0.04 Tolerance: trip between 1.1...1.3 I_1 (IEC 60947-2) | Manual setting: $t_1 = 12-60s$ ⁽⁴⁾ at $I = 3 \times I_1$ Tolerance: $\pm 10\%$ | no | $t = k/I^2$ | no |
| | Electronic setting: $I_1 = 0.18...1 \times I_n$, step 0.01 Tolerance: trip between 1.1...1.3 I_1 (IEC 60947-2) | Electronic setting: $t_1 = 3...72s$ ⁽⁴⁾ at $I = 3 \times I_1$, step 0.5 Tolerance: $\pm 10\%$ | no | $t = k/I^2$ | yes |
| S Against short-circuits with inverse short ($t=k/I^2$) or independent ($t=k$) time delay trip | Manual setting: $I_2 = \text{OFF } 3-6-9$ Tolerance: $\pm 10\%$ | Manual setting: $t_2 = 0.25-0.50s$ Tolerance: $\pm 10\%$ | yes | $t = k$ | no |
| | Electronic setting: $I_2 = 0.6...10 \times I_n$ ⁽³⁾ , step 0.1 Tolerance: $\pm 10\%$ | Electronic setting: $t_2 = 0.05...0.5s$, step 0.01 Tolerance: $\pm 10\%$ | yes | $t = k$ | no |
| | Electronic setting: $I_2 = 0.6...10 \times I_n$ ⁽³⁾ , step 0.1 Tolerance: $\pm 10\%$ | Electronic setting: $t_2 = 0.05...0.4s$, step 0.01 at $10 \times I_n$ Tolerance: $\pm 10\%$ | yes | $t = k/I^2$ | no |
| I Against short-circuits with adjustable threshold and instantaneous trip time | Manual setting: $I_3 = \text{OFF } 1.5-4-5.5-6-7.5-10-11.5$ ⁽³⁾ I_n Tolerance: $\pm 10\%$ | $\leq 40ms$ | yes | $t = k$ | no |
| | Electronic setting: $I_3 = 1.5...12 \times I_n$ ⁽³⁾ , step 0.1 Tolerance: $\pm 10\%$ | $\leq 40ms$ | yes | $t = k$ | no |
| G Against earth fault with independent time delay trip ⁽²⁾ | Electronic setting: $I_4 = 0.2...1 \times I_n$, step 0.02 Tolerance: $\pm 10\%$ | Electronic setting: $t_4 = 0.1...0.8s$, step 0.01s Tolerance: $\pm 15\%$ | yes | $t = k$ | no |
| UV Standard adjustable constant time | Electronic setting: $U_9 = 0.5...0.95 \times U_n$, step $= 0.01 \times U_n$ Tolerance: $\pm 5\%$ | Electronic setting: $t_9 = 0.1...5s$, step 0.1s Tolerance: min ($\pm 10\% \pm 100ms$) | yes | $t = k$ | no |
| OV Against overvoltage with adjustable constant time | Electronic setting: $U_9 = 1.05...1.2 \times U_n$, step $= 0.01 \times U_n$ Tolerance: $\pm 5\%$ | Electronic setting: $t_9 = 0.1...5s$, step 0.1s Tolerance: min ($\pm 10\% \pm 100ms$) | yes | $t = k$ | no |
| Neutral | Electronic setting: OFF, 50% and 100% | For $I_1 < 0.4 I_n$ mandatory neutral Setting 100% | | | |

(1) Tolerances in case of:
 - self-powered trip unit at full power;
 - 2 or 3 phase power supply.
 In conditions other than those considered, the following tolerance hold:

| Protection | Trip threshold | Trip time |
|------------|----------------|-------------|
| S | $\pm 20\%$ | $\pm 20\%$ |
| I | $\pm 20\%$ | $\leq 50ms$ |
| G | $\pm 20\%$ | $\pm 20\%$ |

(2) Protection G is inhibited for currents higher than 4 In.
 (3) T5 630 $I_2 \text{ max} = I_3 \text{ max} = 9.5 I_n$.
 (4) T5 630 $t_1 \text{ max} = 42s$.

| | | Value | Range | Accuracy | Specified measuring range |
|----------------------|-----------------|---|----------------------------------|------------------------|---|
| Current | | Phase current (I1, I2, I3, IN) | 0.1 ... 12 In | Cl 1 | 0.2 ... 1.2 In |
| | | Phase current minimum value | | | |
| | | Phase current maximum value | | | |
| | | Ground current (I _g) | 0 ... 4 In | - | - |
| Voltage | | Phase voltage runtime, max and min (V1N, V2N, V3N) ⁽³⁾ | 5 ... 480 V | ±0.5% | 30 ... 400 V |
| | | Line voltage runtime, max and min (U12, U23, U31) | 10 ... 828 V | ±0.5% | 50 ... 690 V |
| Power | Active | Phase power runtime, max and min (P1, P2, P3) ⁽³⁾ | -5.76 In kW ... 5.76 In kW | Cl 2 | -480In W ... -6In W 6In W ... 480In W ⁽¹⁾ |
| | | Total power runtime, max and min | -17.28 In kW ... 17.28 In kW | Cl2 | -1.44In kW ... -18In W 18In W ... 1.44In kW ⁽¹⁾ |
| | Reactive | Phase power runtime, max and min (Q1, Q2, Q3) ⁽³⁾ | -5.76 In kvar ... 5.76 In kvar | Cl 2 | -480In var ... -6In var 6In var ... 4.80In var ⁽¹⁾ |
| | | Total power runtime, max and min | -17.28 In kvar ... 17.28 In kvar | Cl2 | -1.44In kvar ... -18In var 18In var ... 1.44In kvar ⁽¹⁾ |
| | Apparent | Phase power runtime, max and min (S1, S2, S3) ⁽³⁾ | In VA ... 5.76 In kVA | Cl 2 | 6In VA ... 480In VA |
| | | Total power runtime, max and min | 3 In VA ... 17.28 In kVA | Cl 2 | 18In VA ... 1.44In kVA |
| Energy | Active | Total energy | 1 kWh ... 214.75 GWh | Cl 2 | 1 kWh ... 214.75 GWh |
| | | Incoming energy | | | |
| | | Outgoing energy | | | |
| | Reactive | Total energy | 1 kvarh ... 214.75 Gvarh | Cl 2 | 1 kvarh ... 214.75 Gvarh |
| | | Incoming energy | | | |
| | | Outgoing energy | | | |
| Apparent | Total energy | 1 kVAh ... 214.75 GVAh | Cl 2 | 1 kVAh ... 214.75 GVAh | |
| Power quality | | Harmonic analysis ⁽²⁾ | 11th (50 - 60Hz) | - | - |
| | | THD of phase L1, L2, L3 ⁽²⁾ | 0 ... 1000% | ±10% | 0 ... 500% |
| | | Frequency runtime, max, min | 44 ... 440 Hz | ±0.2% | 45 ... 66 Hz |
| | | PF of phase L1, L2, L3 ⁽³⁾ | -1 ... 1 | ±2% | -1 ... -0.5 0.5 ... 1 |

(1) For: $0.2I_n < I_i < 1.2 I_n$ and $30V < V_i < 400V$

(2) Available on demand by sending a Modbus command

(3) Not available if Neutral is not connected

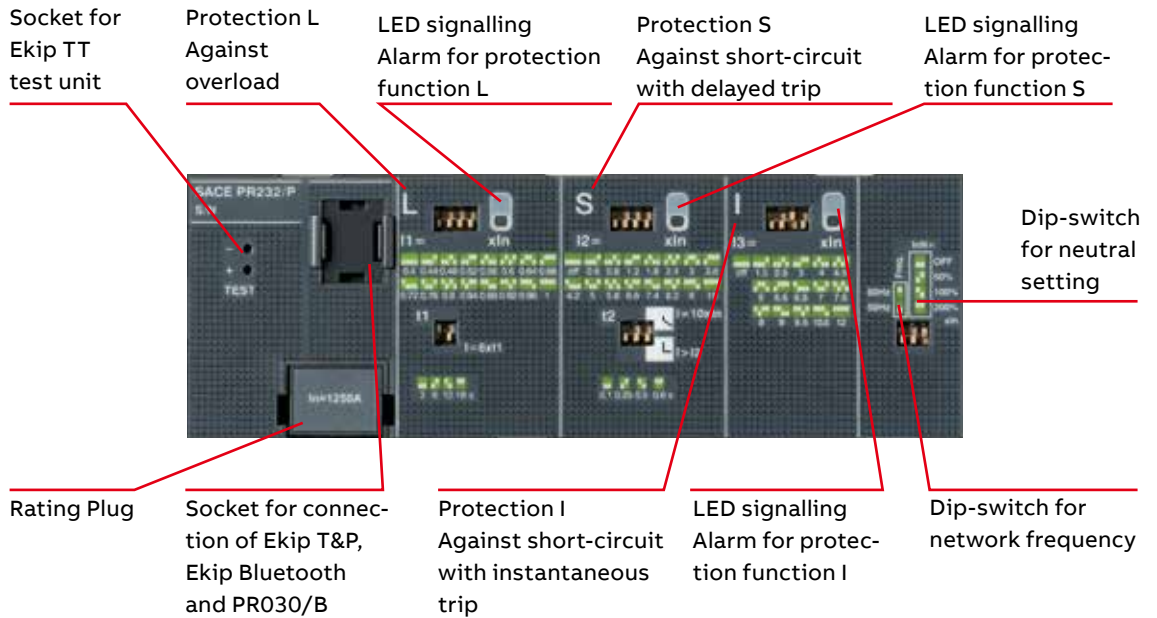
PR232/P

The PR232/P release, available for T7, provides protection functions against overload L, delayed short-circuit S and instantaneous short-circuit I (version PR232/P-LSI).

Setting the trip parameters of the PR232/P release can be carried out by means of the dip-switches. In particular, adjustment of the neutral

to 200% of the phase current requires setting protection L to respect the current-carrying capacity of the circuit-breaker.

To guarantee protection of the installation by means of the PR232/P protection release, it is necessary to select the rated network frequency (50/60 Hz), by means of the special dipswitch.



Protection functions and parameterisations

| Protection functions | Trip threshold | Trip curves ⁽¹⁾ | Thermal memory ⁽²⁾ | Excludability | Relation $t = f(I)$ |
|---|--|--|-------------------------------|---------------|---------------------|
| L Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve ($I^2t=k$) according to IEC 60947-2 Standard | $I_1 = 0.40...1 \times I_n$, step = $0.04 \times I_n$ Trip between $1.1...1.3 \times I_1$ | at $6 \times I_1$ $t_1 = 3s$ $t_2 = 6s$ $t_1 = 12s$ $t_2 = 18s$ Tolerance: $\pm 10\%$ | ■ | – | $t = k/I^2$ |
| S Against short-circuit with inverse short time delay trip and trip characteristic with inverse time ($I^2t=k$) or definite time | $I_2 = 0.6 - 0.8 - 1.2 - 1.8 - 2.4 - 3 - 3.6 - 4.2 - 5 - 5.8 - 6.6 - 7.4 - 8.2 - 9 - 10 \times I_n$ Tolerance: $\pm 10\%$ | at $10 \times I_n$ $t_2 = 0.1s$ $t_2 = 0.25s$ $t_2 = 0.5s$ $t_2 = 0.8s$ Tolerance: $\pm 10\%$ | ■ | ■ | $t = k/I^2$ |
| | $I_2 = 0.6 - 0.8 - 1.2 - 1.8 - 2.4 - 3 - 3.6 - 4.2 - 5 - 5.8 - 6.6 - 7.4 - 8.2 - 9 - 10 \times I_n$ Tolerance: $\pm 10\%$ | $I > I_2$ $t_2 = 0.1s$ $t_2 = 0.25s$ $t_2 = 0.5s$ $t_2 = 0.8s$ Tolerance: $\pm 10\%$ | – | ■ | $t = k$ |
| I Against short-circuit with instantaneous trip | $I_3 = 1.5 - 2.5 - 3 - 4 - 4.5 - 5 - 5.5 - 6.5 - 7 - 7.5 - 8 - 9 - 9.5 - 10.5 - 12 \times I_n$ Tolerance: $\pm 10\%$ | instantaneous | – | ■ | $t = k$ |

(1) These tolerances hold in the following conditions:
 – self-powered trip unit at full power (without start-up)
 – two or three-phase power supply.

In conditions other than those considered, the following tolerances hold:

| | Trip threshold | Trip time |
|----------|----------------|-------------|
| S | $\pm 10\%$ | $\pm 20\%$ |
| I | $\pm 15\%$ | $\leq 60ms$ |

(2) Active up to 7 min. after tripping of the breaker
 (ON/OFF setting by means of PR010/T test unit).

PR332/P

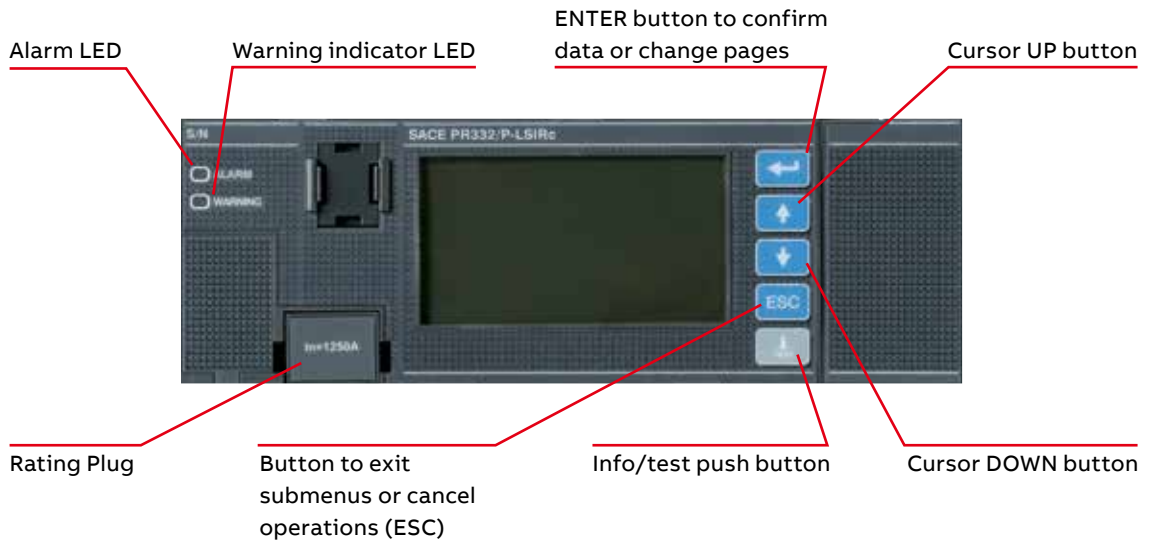
The SACE PR332/P trip unit for Tmax T7 (available in four versions: PR332/P-LI, PR332/P-LSI, PR332/P-LSIG and PR332/P-LSIRc) is a sophisticated and flexible protection system based on a state-of-the-art microprocessor and DSP technology. Fitted with the optional internal PR330/D-M dialogue unit, PR332/P turns into an intelligent protection, measurement and communication device, based on the Modbus® RTU protocol. By means of the PR330/D-M, PR332/P can also be connected to the ABB EP010 Fieldbus plug adapter, which makes it possible to choose among several different networks, such as Profibus and DeviceNet.

The new PR332/P is the result of ABB SACE's experience in designing protection trip units.

The exhaustive range of settings makes this protection unit ideal for general use in power distribution. Access to information and programming using a keyboard and graphic liquid crystal display is extremely simple and intuitive.

An integrated ammeter and many other additional features are provided over and above the protection functions. These additional functions can be further increased with addition on board of the dialogue, signalling, measurement, and wireless communication units. All the thresholds and trip curve delays of the protection functions are stored in special memories which retain the information even when no power is supplied.

PR332/P



PR332/P - Protection functions and parameterisations

| Protection functions | Trip threshold | Trip curves ⁽¹⁾ | Excludability | Relation $t = f(I)$ | Thermal memory ⁽²⁾ | Zone selectivity ⁽²⁾ |
|---|---|--|---------------|--|----------------------------------|------------------------------------|
| L Against overload with inverse long-time delay trip according to IEC 60947-2 Standard ($I^2t=k$) or in accordance with the IEC 60255-3 Standard ($t=f(\alpha)^{(3)}$) | $I_1 = 0.4...1 \times I_n$, step = $0.01 \times I_n$ Trip between $1.05...1.2 \times I_1$ | at $3 \times I_1$ $t_2 = 3...144s$, step = 3s Tolerance: up to $6 \times I_n$ $\pm 20\%$ above $6 \times I_n$ | - | $t = k/I^2$ | ■ | - |
| | $I_1 = 0.4...1 \times I_n$, step = $0.01 \times I_n$ Trip between $1.05...1.2 \times I_1$ | at $3 \times I_1$ $t_2 = 3...144s$, step = 3s Tolerance: $\pm 10\%$ up to $6 \times I_n$ $\pm 20\%$ above $6 \times I_n$ | ■ | $t = f(\alpha)^{(3)}$ $\alpha = 0.02-1-2$ | ■ | - |
| S Against short-circuit with short inverse time-delay trip and trip characteristic with inverse time ($I^2t=k$) or with definite time | $I_2 = 0.6...10 \times I_l$, step = $0.1 \times I_n$ Tolerance: $\pm 7\%$ up to $6 \times I_n$ $\pm 10\%$ above $6 \times I_n$ | at $10 \times I_n$ $t_2 = 0.05...0.8s$, step = $0.01s$ Tolerance: $\pm 15\%$ up to $6 \times I_n$ $\pm 20\%$ over $6 \times I_n$ | ■ | $t = k/I^2$ | ■ | - |
| | $I_2 = 0.6...10 \times I_n$, step = $0.1 \times I_n$ Tolerance: $\pm 7\%$ up to $6 \times I_n$ $\pm 10\%$ above $6 \times I_n$ | $t_2 = 0.05...0.8s$, step = $0.01s$ $t_2 \text{ sel} = 0.04...0.2s$, step = $0.01s$ Tolerance: min ($\pm 10\%$; $\pm 40ms$) | ■ | $t = k$ | - | ■ |
| I Against short-circuit with adjustable instantaneous trip | $I_3 = 1.5...15 \times I_n$, step = $0.1 \times I_n$ Tolerance: $\pm 10\%$ | $\leq 30 \text{ ms}$ | ■ | $t = k$ | - | - |
| G Against earth fault with short inverse time-delay trip and trip characteristic according to an inverse time curve ($I^2t=k$) or with definite time | $I_4 = 0.2...1 \times I_n$, step = $0.02 \times I_n$ Tolerance: $\pm 7\%$ | $t_4 = 0.1...1s$, step = $0.05s$ Tolerance: $\pm 15\%$ | ■ | $t = k/I^{2(5)}$ | - | - |
| | $I_4 = 0.2...1 \times I_n$, step = $0.02 \times I_n$ Tolerance: $\pm 7\%$ | $t_4 = 0.1...1s$, step = $0.05s$ $t_4 \text{ sel} = 0.04...0.2s$, step = $0.05s$ Tolerance: min ($\pm 10\%$; $\pm 40ms$) | ■ | $t = k$ | - | ■ |
| Rc Against residual current fault with definite time-delay trip | $I_\Delta = 3-5-7-10-20-30 \text{ A}$ Tolerance: 0-20% | $t_\Delta = 0.06-0.1-0.2-0.3-0.4-0.5-0.8s$ Tolerance: $\pm 20\%$ | ■ | $t = k$ | - | - |
| OT Against overtemperature of the trip unit with instantaneous trip | Trip unit temperature over $85 \text{ }^\circ\text{C}$ | instantaneous | - | temp = k | - | - |
| U Against unbalanced phase with definite time-delay trip | $I_6 = 2\%...90\% \times I_1$, step = $1\% \times I_1$ Tolerance: $\pm 10\%$ | $t_6 = 0.5...60 \text{ s}$, step = $0.5s$ Tolerance: min ($\pm 20\%$; $\pm 100ms$) | ■ | $t = k$ | - | - |

(1) These tolerances are valid under the following conditions:
- trip unit self-supplied at full power and/or auxiliary supply
- two or three-phase power supply
In conditions other than those considered, the following tolerances hold:

| | Trip threshold | Trip time |
|--------------|--|-------------|
| L | Release between 1.05 and $1.25 \times I_1$ | $\pm 20\%$ |
| S | $\pm 10\%$ | $\pm 20\%$ |
| I | $\pm 15\%$ | $\leq 60ms$ |
| G | $\pm 15\%$ | $\pm 20\%$ |
| Other | $\pm 10\%$ | $\pm 20\%$ |

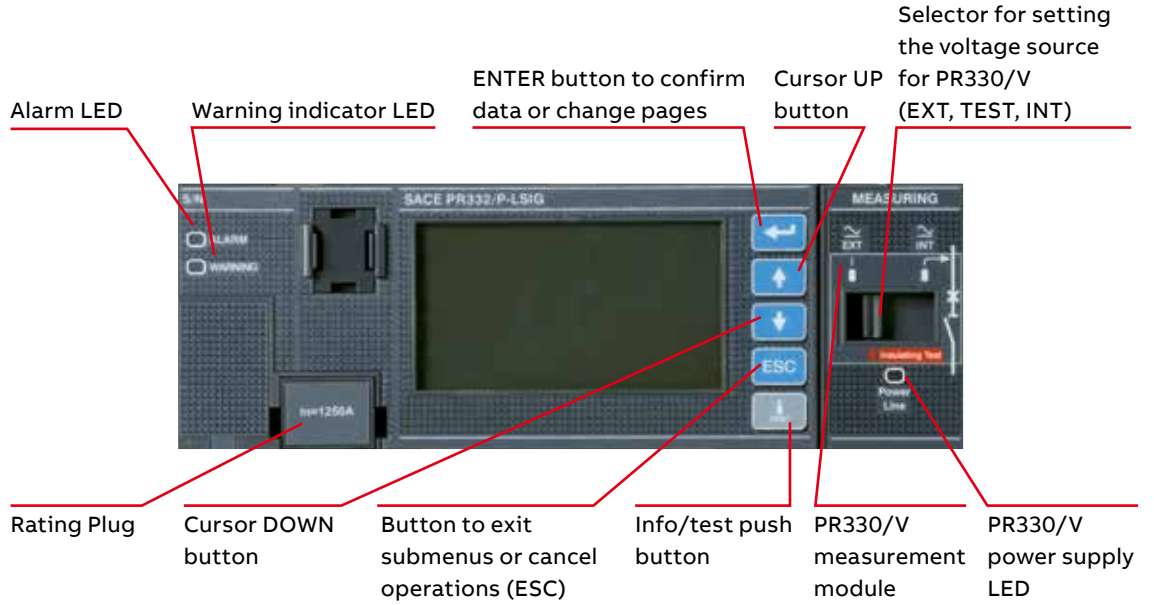
(2) Active with 24V auxiliary power supply

$$(3) t = \frac{(3^\alpha - 1)}{\left(\frac{I}{I_1}\right)^\alpha - 1} t_1 (3 \times I_1)$$

(4) For T7 $I_n = 1250 \text{ A}/1600 \text{ A}$ $I_{3 \text{ max}} = 12 \times I_n$
(5) $k = (2s) \cdot (I_1)^2$

PR332/P

PR332/P with PR330/V



PR332/P with PR330/V - Advanced protection functions and parameterisations

| Advanced protection functions | | Trip threshold | Trip curves ⁽¹⁾ | Excludability | Relation t = f(I) | Thermal memory ⁽²⁾ | Zone selectivity ⁽²⁾ |
|-------------------------------|---|--|---|---------------|----------------------|----------------------------------|------------------------------------|
| UV | Against undervoltage with adjustable constant time | $U_g = 0.5...0.95 \times U_n$, step = $0.01 \times U_n$ Tolerance: $\pm 5\%$ | $t_g = 0.1...5s$, step = $0.1s$ Tolerance: min ($\pm 20\% \pm 100ms$) | ■ | t = k | - | - |
| OV | Against overvoltage with adjustable constant time | $U_g = 1.05...1.2 \times U_n$, step = $0.01 \times U_n$ Tolerance: $\pm 5\%$ | $t_g = 0.1...5s$, step = $0.1s$ Tolerance: min ($\pm 20\% \pm 100ms$) | ■ | t = k | - | - |
| RV | Against residual voltage with adjustable constant time | $U_{10} = 0.1...0.4 \times U_n$, step = $0.01 \times U_n$ Tolerance: $\pm 5\%$ | $t_{10} = 0.5...30s$, step = $0.5s$ Tolerance: min ($\pm 10\% \pm 100ms$) | ■ | t = k | - | - |
| RP | Against reversal of power with adjustable constant time | $P_{11} = -0.3...-0.1 \times P_n$, step = $0.02 \times P_n$ Tolerance: $\pm 10\%$ | $t_{11} = 0.5...25s$, step = $0.1s$ Tolerance: min ($\pm 10\% \pm 100ms$) | ■ | t = k | - | - |
| UF | Against underfrequency with adjustable constant time | $f_{12} = 0.90...0.99 \times f_n$, step = $0.01 \times f_n$ Tolerance: $\pm 5\%$ | $t_{12} = 0.5...3s$, step = $0.1s$ Tolerance: min ($\pm 10\% \pm 100ms$) | ■ | t = k | - | - |
| OF | Against overfrequency with adjustable constant time | $f_{13} = 1.01...1.10 \times f_n$, step = $0.01 \times f_n$ Tolerance: $\pm 5\%$ | $t_{13} = 0.5...3s$, step = $0.1s$ Tolerance: min ($\pm 10\% \pm 100ms$) | ■ | t = k | - | - |

(1) These tolerances are valid under the following conditions:
 - trip unit self-supplied at full power and/or auxiliary supply
 - two or three-phase power supply
 In conditions other than those considered, the following tolerances hold:

| | Trip threshold | Trip time |
|--------------|--|-------------|
| L | Release between 1.05 and $1.25 \times I_1$ | $\pm 20\%$ |
| S | $\pm 10\%$ | $\pm 20\%$ |
| I | $\pm 15\%$ | $\leq 60ms$ |
| G | $\pm 15\%$ | $\pm 20\%$ |
| Other | $\pm 10\%$ | $\pm 20\%$ |

(2) Active with 24V auxiliary power supply

$$(3) t = \frac{(3^a - 1)}{\left(\frac{I}{I_1}\right)^b - 1} t_1 (3 \times I_1)$$

(4) For T7 In = 1250 A/1600 A \square $I_{3max} = 12 \times I_n$
 (5) $k = (2s) \cdot (I_a)^2$

Ekip Touch

Ekip Touch is the new protection trip unit for SACE Emax 2 that provides a complete series of protections and high accuracy measurements of all electric parameters and can be integrated perfectly with the most common automation and supervision systems.

The simple and intuitive interface enables the operator to access all the information and settings rapidly and easily by minimizing installation and commissioning time.

The Ekip Touch protection functions can be further increased by using the Ekip Measuring Pro measuring and protection module. With this module, all the protection functions linked to voltage, frequency and power can be enabled, thus making Ekip Touch a multifunction unit that can measure, control and protect even the most complex installation.

Key:

1. Wide high-resolution colour touch-screen display
2. Power-on LED to indicate correct operation (watchdog)
3. Pre-alarm LED
4. Alarm LED
5. Home pushbutton to return to home page
6. Pushbutton for test and indicating cause of trip
7. Test and programming connector



Ekip Hi-Touch

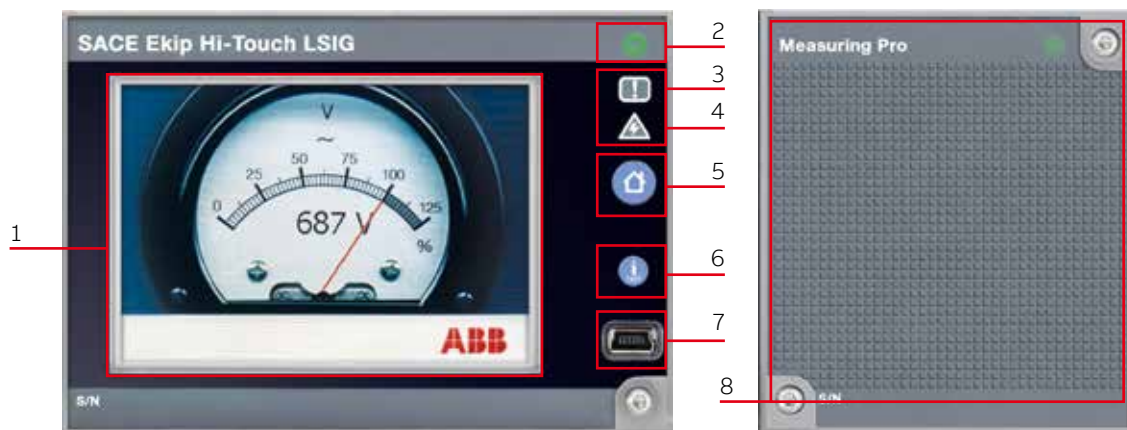
Ekip Hi-touch of SACE Emax 2 is a high-performance multifunction unit that is extraordinarily versatile and can be used in even the most complex installations. Ekip Hi-Touch, in fact, features exclusive functions such as: directional protection, restricted earth fault and dual setting of the protections. In addition, Ekip Hi-Touch is supplied with the exclusive Network Analyzer function that can monitor the quality of the power absorbed by the installation in accordance with existing standards.

Ekip Hi-Touch boasts all the features of Ekip Touch; as standard, it features the measuring and protection module Ekip Measuring Pro and can also be fitted, like Ekip Touch, with the additional features provided by the internal modules and by the external accessories.

The front interface of the unit, which is common to Ekip Touch, is extremely simple because of the touchscreen colour display; it is able to show measurements, bar graphs and sine curves of the different electrical values.

Key:

1. Wide high-resolution colour touch-screen display
2. Power-on LED indicating correct operation
3. Pre-alarm LED
4. Alarm LED
5. Home pushbutton to return to home page
6. Pushbutton for test and for indicating cause of the trip
7. Test and programming connector
8. Ekip Measuring Pro module, with relative LED power on

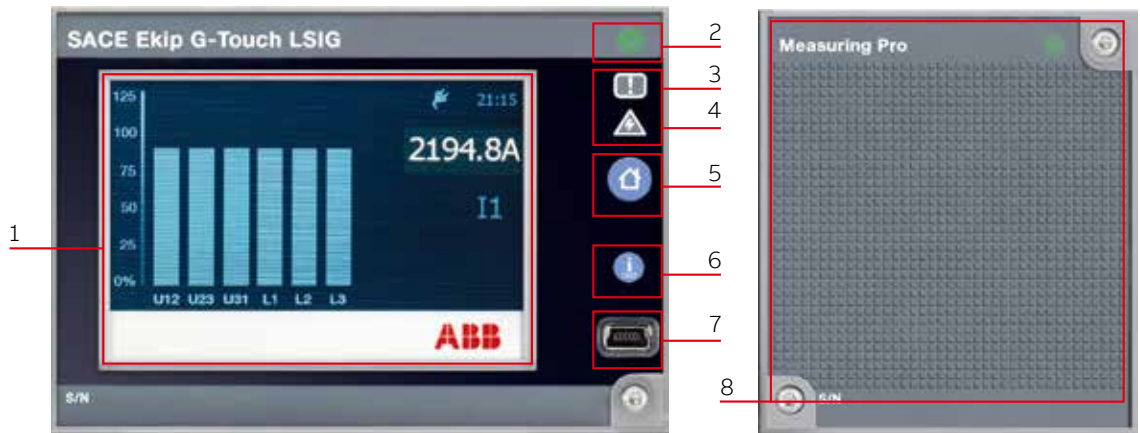


Ekip G Touch

Ekip G Touch is the new protection trip unit designed for use in applications with generators, such as Genset, cogeneration and marine applications, in conformity to international standards IEC 60034-1 and IEEE C37.102. Ekip G Touch has been approved by the main shipping registers and enables the number of components installed, such as external protection devices, current sensors, voltage transformers and the relative cabling, to be reduced. The reductions allow the installation to be significantly simplified. In addition, all the protection functions can be tested individually, using the Ekip T&P device that enables the function to be tested before commissioning.

The unit is available in the Ekip G Touch LSIG version and features all the characteristics provided by Ekip Touch. The Ekip Measuring Pro measuring and protection module is supplied as standard and, like Ekip Touch; the functions can be increased further using the internal modules and the external accessories. The front interface of the unit, which is common to the Ekip Touch family, is characterised by a wide, high resolution touchscreen display that is simple to use and displays measurements and alarms clearly and accurately.

- Key:
1. Wide, high resolution touchscreen display
 2. Power-on LED indicating correct operation
 3. Pre-alarm LED
 4. Alarm LED
 5. Home pushbutton to return to home page
 6. Pushbutton for test and for indicating cause of the trip
 7. Test and programming connector
 8. Ekip Measuring Pro module with relative power-on LED



Ekip G Hi-Touch

Ekip G Hi-Touch is the new benchmark for the protection of low voltage electric generators. It provides optimum protection, even in complex installations, due to exclusive functions such as protection against frequency creep and maximum directional current.

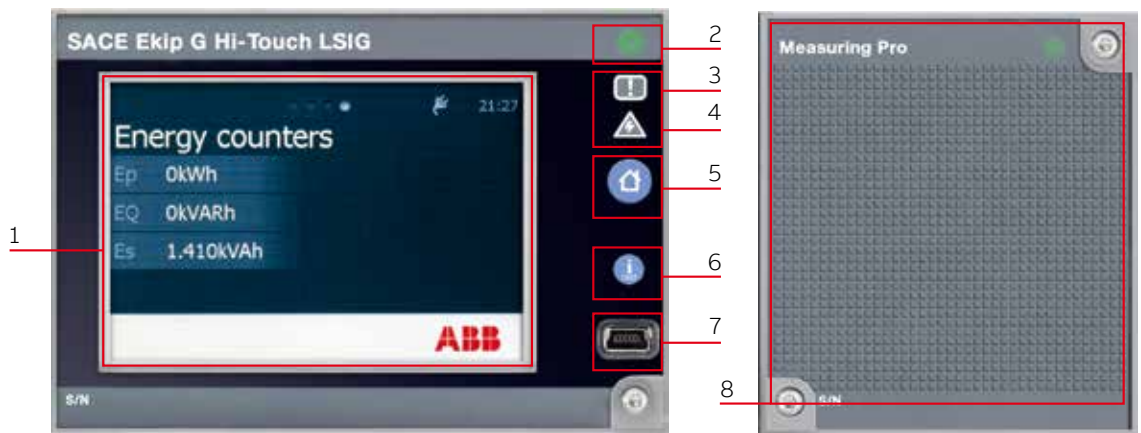
Ekip G Hi-Touch, like all Hi-Touch trip units, is supplied as standard with the Ekip Measuring Pro measuring and protection module and enables an independent second set of protections to be set.

In addition, the Network Analyzer function enables it to monitor the quality of the power delivered by the generator.

Ekip G Hi-Touch is available in the LSIG version and ensures all the protection, measuring and control functions of Ekip Hi-Touch and the specific protections for Ekip G Touch generators. The user interface and the accessories are common to the rest of the family.

Key:

1. Wide, high resolution touchscreen display
2. Power-on LED indicating correct operation
3. Pre-alarm LED
4. Alarm LED
5. Home pushbutton to return to home page
6. Pushbutton for test and for indicating cause of the trip
7. Test and programming connector
8. Ekip Measuring Pro module with relative power-on LED



Protection functions

| ABB Code | ANSI Code | Function | Threshold | Threshold step | Trip time | Time Step |
|-----------|-----------|---|--|--------------------------------|---|---|
| L | 49 | Overload Protection | $I_1 = 0.4...1 \times I_n$ | $0.001 \times I_n$ | with $I = 3 I_1$, $t_1 = 3...144 \text{ s}$ | 1s |
| | | Thermal Memory Tolerance | trip between 1.05 and $1.2 \times I_1$ | | $\pm 10\% I \leq 6 \times I_n / \pm 20\% I > 6 \times I_n$ | |
| | 49 | Overload Protection | $I_1 = 0.4...1 \times I_n$ | $0.001 \times I_n$ | with $I = 3 I_1$, $t_1 = 3...144 \text{ s}$ Standard inverse SI: $k=0.14 \alpha=0,02$ Very Inverse VI: $k=13.5 \alpha=1$ Extremely Inverse EI: $k=80 \alpha=2$ $t=k/I_4$: $k=80 \alpha=4$ | 1s |
| | | Tolerance | trip between 1.05 and $1.2 \times I_1$ | | $\pm 10\% I \leq 6 \times I_n / \pm 20\% I > 6 \times I_n$ | |
| S | 50TD | Time-delayed overcurrent protection | $I_2 = 0.6...10 \times I_n$ | $0.1 \times I_n$ | With $I > I_2$, $t_2 = 0.05...0.8\text{s}$ | 0.01s |
| | 68 | Zone selectivity | | | $t_{2sel} = 0.04...0.2\text{s}$ | 0.01s |
| | | Start up | Activation: $0.6...10 \times I_n$ | $0.1 \times I_n$ | Range: $0.1...30\text{s}$ | 0.01s |
| | | Tolerance | $\pm 7\% I \leq 6 \times I_n$ $\pm 10\% I > 6 \times I_n$ | | The better of the two data: $\pm 10\%$ or $\pm 40\text{ms}$ | |
| | 51 | Time-delayed overcurrent protection | $I_2 = 0.6...10 \times I_n$ | $0.1 \times I_n$ | with $I = 10 I_n$, $t_2 = 0.05...0.8\text{s}$ | 0.01s |
| | | Thermal Memory Tolerance | $\pm 7\% I \leq 6 \times I_n$ $\pm 10\% I > 6 \times I_n$ | | $\pm 15\% I \leq 6 \times I_n$ $\pm 20\% I > 6 \times I_n$ | |
| I | 50 | Istantaneous overcurrent protection | $I_3 = 1.5...15 \times I_n$ | $0.1 \times I_n$ | With $I > I_3$, instantaneous | - |
| | | Start up | Activation: $1.5...15 \times I_n$ | $0.1 \times I_n$ | Range: $0.1...30\text{s}$ | 0.01s |
| | | Tolerance | $\pm 10\%$ | | $\leq 30 \text{ ms}$ | |
| G | 50N TD | Earth fault protection | $I_4^{(1)} = 0.1...1 \times I_n$ | $0.001 \times I_n$ | with $I > I_4$, $t_4 =$ Instantaneous (with Vaux) + $0.1...1 \text{ s}$ | 0.05s |
| | 68 | Zone selectivity | | | $t_{4sel} = 0.04...0,2\text{s}$ | 0.01s |
| | | Start up | Activation: $0.2...1 \times I_n$ | $0.02 \times I_n$ | range: $0.1...30\text{s}$ | 0.01s |
| | | Tolerance | $\pm 7\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$ or 50ms with $t_4 =$ instantaneous | |
| | 51N | Earth fault protection | $I_4^{(1)} = 0.1...1 \times I_n$ | $0.001 \times I_n$ | with $I = 4 I_n$, $t_4 = 0.1...1\text{s}$ | 0.05s |
| | | Tolerance | $\pm 7\%$ | | $\pm 15\%$ | |
| | IU | 46 | Current unbalance protection | $I_6 = 2...90\% I_n$ unbalance | $1\% I_n$ | with unbalance $> I_6$, $t_6 = 0.5...60\text{s}$ |
| Tolerance | | | $\pm 10\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$ (for $t < 5\text{s}$) / $\pm 100\text{ms}$ (for $t \geq 5\text{s}$) | |
| 2I | 50 | Programmable instantaneous overcurrent protection | $I_{31} = 1.5...15 \times I_n$ | $0.1 \times I_n$ | with $I > I_{31}$, instantaneous | |
| | | Tolerance | $\pm 10\%$ | | $\leq 30 \text{ ms}$ | |
| MCR | | Closing on short-circuit protection | $I_3 = 1.5...15 \times I_n$ | $0.1 \times I_n$ | With $I > I_3$, instantaneous Monitor time range: $40...500\text{ms}$ | 0.01s |
| | | Tolerance | $\pm 10\%$ | | $\leq 30 \text{ ms}$ | |
| Gext | 50G TD | Earth fault protection | $I_{41}^{(1)} = 0.1...1 \times I_n$ Toroid | $0.001 \times I_n$ Toroid | with $I > I_{41}$, $t_{41} = 0.1...1\text{s}$ | 0.05s |
| | 68 | Zone selectivity | | | $t_{41sel} = 0.04...0,2\text{s}$ | 0.01s |
| | | Start up | Activation: $0.1...1 \times I_n$ | $0.02 \times I_n$ | range: $0.1...30\text{s}$ | 0.01s |
| | | Tolerance | $\pm 7\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$ | |
| | 51G | Earth fault protection | $I_{41}^{(1)} = 0.1...1 \times I_n$ | $0.001 \times I_n$ | with $I = 4 I_n$, $t_{41} = 0.1...1\text{s}$ | 0.05s |
| Tolerance | $\pm 7\%$ | | $\pm 15\%$ | | | |
| Rc | 64 50N TD | Residual current protection | $I_{\Delta n} = 3 - 5 - 7 - 10 - 20 - 30\text{A}$ | | with $I > I_{\Delta n}$, $t_{\Delta n} = 0.06 - 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.8\text{s}$ | |
| | 87N | Differential ground fault protection Tolerance | $- 20\% \div 0\%$ | | $140\text{ms} @ 0.06\text{s}$ (max trip time) $950\text{ms} @ 0.80\text{s}$ (max trip time) | |
| UV | 27 | Undervoltage Protection | $U_8 = 0.5...0.98 \times U_n$ | $0.001 \times U_n$ | with $U < U_8$, $t_8 = 0.05...120\text{s}$ | 0.01s |
| | | Tolerance | $\pm 2\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$ (for $t < 5\text{s}$) / $\pm 100 \text{ ms}$ (for $t \geq 5\text{s}$) | |
| OV | 59 | Overvoltage protection | $U_9 = 1.02...1.5 \times U_n$ | $0.001 \times U_n$ | with $U > U_9$, $t_9 = 0.05...120\text{s}$ | 0.01s |
| | | Tolerance | $\pm 2\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$ (for $t < 5\text{s}$) / $\pm 100 \text{ ms}$ (for $t \geq 5\text{s}$) | |



| Excludibility | Excludibility trip | Pre-alarm | Trip curve | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|--------------------------------|--------------------|-----------------------|--|------------|---------------|--------------|-----------------|
| yes, with rating plug L=off | no | 50...90% I1, step 1% | $t = k / I^2$ | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes, with rating plug L=off | no | 50...90% I1, step 1% | $t = \frac{k t1}{\left(\frac{if}{If}\right)^{\alpha-1}}$ | ● | ● | ● | ● |
| yes | yes | no | $t = k$ | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | yes | no | $t = k / I^2$ | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | no | no | $t = k$ | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | yes | 50...90% I4, step 1% | $t = k$ | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | yes | 50...90% I4, step 1% | $t = k / I^2$ | ● | ● | ● | ● |
| yes | yes | no | $t = k$ | ● | ● | ● | ● |
| yes | no | no | $t = k$ | ● | ● | ● | ● |
| yes | no | no | $t = k$ | ● | ● | ● | ● |
| yes | yes | 50...90% I41, step 1% | $t = k$ | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | | | | ● | ● | ● | ● |
| yes | yes | 50...90% I41, step 1% | $t = k / I^2$ | ● | ● | ● | ● |
| Attivabile with rating plug Rc | no | no | $t = k$ | ● | ● | ● | ● |
| yes | yes | no | $t = k$ | ○ | ● | ● | ● |
| yes | yes | no | $t = k$ | ○ | ● | ● | ● |

Protection functions

| ABB Code | ANSI Code | Function | Threshold | Threshold step | Trip time | Time Step |
|-------------------------------|-----------|---|---|-------------------------------|---|-----------|
| VU | 47 | Voltage unbalance protection | $U14 = 2...90\% U_n$ unbalance | 1% U_n | with unbalance > $U14$, $t14 = 0.5...60s$ | 0.5s |
| | | Tolerance | $\pm 5\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| UF | 81L | Underfrequency protection | $f12 = 0.9...0.999 \times f_n$ | $0.001 \times f_n$ | with $f < f12$, $t12 = 0.15...300s$ | 0.01s |
| | | Tolerance | $\pm 1\%$ (with $f_n \pm 2\%$) | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| OF | 81H | Overfrequency protection | $f13 = 1.001...1.1 \times f_n$ | $0.001 \times f_n$ | with $f > f13$, $t13 = 0.15...300s$ | 0.01s |
| | | Tolerance | $\pm 1\%$ (with $f_n \pm 2\%$) | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| RP | 32R | Reverse active power protection | $P11 = -1...-0.05 S_n$ | $0.001 S_n$ | with $P > P11$, $t11 = 0.5...100s$ | 0.1s |
| | | Tolerance | $\pm 10\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| ABB: Cyclical direction | 47 | Cyclical direction of the phases | 1-2-3 or 3-2-1 | | | |
| ABB: Power factor | 78 | 3phase Power factor | $PF3 = 0.5...0.95$ | 0.01 | | |
| LC1/2 Iw1/2 | | Current threshold | $LC1 = 50\%...100\% I1$ $LC2 = 50\%...100\% I1$ $Iw1 = 0.1...10 I_n$ $Iw2 = 0.1...10 I_n$ Activation: up/down | 1% 1% $0.01 \times I_n$ | | |
| | | Tolerance | $\pm 10\%$ | | | |
| S2 | 50TD | Time-delayed overcurrent protection | $I5 = 0.6...10 \times I_n$ | $0.1 \times I_n$ | With $I > I5$, $t5 = 0.05...0.8s$ | 0.01s |
| | | Zone selectivity | | | $t5sel = 0.04...0.2s$ | 0.01s |
| | | Start up | Activation: $0.6...10 \times I_n$ | $0.1 \times I_n$ | Range: $0.1...30s$ | 0.01s |
| | | Tolerance | $\pm 7\% I \leq 6 \times I_n$ $\pm 10\% I > 6 \times I_n$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ | |
| D | 67 | Directional overcurrent protection (forward &/or backward) | $I7 = 0.6...10 \times I_n$ | $0.1 \times I_n$ | with $I > I7$, $t7 = 0.1...0.8s$ | 0.01s |
| | | Zone selectivity | | | $t7sel = 0.1...0.8s$ | 0.01s |
| | | Start up (forward &/or backward) | Activation: $0.6...10 \times I_n$ | $0.1 \times I_n$ | Range: $0.1...30s$ | 0.01s |
| | | Trip direction | forward &/or backward | | | |
| | | Minimum angle direction (°) | 3.6, 7.2, 10.8, 14.5, 18.2, 22, 25.9, 30, 34.2, 38.7, 43.4, 48.6, 54.3, 61, 69.6 | | | |
| | | Tolerance | $\pm 7\% I \leq 6 \times I_n$ $\pm 10\% I > 6 \times I_n$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ | |
| UV2 | 27 | Undervoltage Protection | $U15 = 0.5...0.98 \times U_n$ | $0.001 \times U_n$ | with $U < U15$, $t15 = 0.05...120s$ | 0.01s |
| | | Tolerance | $\pm 2\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| OV2 | 59 | Overvoltage protection | $U16 = 1.02...1.5 \times U_n$ | $0.001 \times U_n$ | with $U > U16$, $t16 = 0.05...120s$ | 0.01s |
| | | Tolerance | $\pm 2\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| UF2 | 81L | Underfrequency protection | $f17 = 0.9...0.999 \times f_n$ | $0.001 \times f_n$ | with $f < f17$, $t17 = 0.15...300s$ | 0.01s |
| | | Tolerance | $\pm 1\%$ (with $f_n \pm 2\%$) | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| OF2 | 81H | Overfrequency protection | $f18 = 1.001...1.1 \times f_n$ | $0.001 \times f_n$ | with $f > f18$, $t18 = 0.15...300s$ | 0.01s |
| | | Tolerance | $\pm 1\%$ (with $f_n \pm 2\%$) | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |
| S(V) | 51V | Voltage controlled overcurrent protection | $I20 = 0.6...10 \times I_n$ | $0.1 \times I_n$ | With $I > I20$, $t20 = 0.05...30s$ | 0.01s |
| | | Step mode | $U1 = 0.2...1 \times U_n$ | $0.01 \times U_n$ | | |
| | | | $Ks = 0.1...1$ | 0.01 | | |
| | | Linear mode | $U1 = 0.2...1 \times U_n$ | $0.01 \times U_n$ | | |
| | | | $U_h = 0.2...1 \times U_n$ | $0.01 \times U_n$ | | |
| | | | $Ks = 0.1...1$ | 0.01 | | |
| | | Tolerance | $\pm 10\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | |



| Excludibility | Excludibility trip | Pre-allarm | Trip curve | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|---------------|--------------------|------------|------------|------------|---------------|--------------|-----------------|
| yes | yes | no | t = k | ○ | ● | ● | ● |
| yes | yes | no | t = k | ○ | ● | ● | ● |
| yes | yes | no | t = k | ○ | ● | ● | ● |
| yes | yes | no | t = k | ○ | ● | ● | ● |
| yes | only signalling | no | - | ○ | ● | ● | ● |
| yes | only signalling | no | - | ○ | ● | ● | ● |
| yes | only signalling | no | - | ● | ● | ● | ● |
| yes | yes | no | t = k | | ● | | ● |
| yes | yes | | | | ● | | ● |
| yes | | | | | ● | | ● |
| yes | yes | no | t = k | | ● | | ● |
| yes | | | | | ● | | ● |
| yes | | | | | ● | | ● |
| yes | yes | no | t = k | | ● | | ● |
| yes | yes | no | t = k | | ● | | ● |
| yes | yes | no | t = k | | | ● | ● |
| | | | | | | ● | ● |
| | | | | | | ● | ● |
| | | | | | | ● | ● |

Protection functions

| ABB Code | ANSI Code | Function | Threshold | Threshold step | Tripping time | Time Step | |
|------------------|------------|---|---|--|--|-----------------------|--|
| RV | 59N | Residual overvoltage protection Tolerance | $U_{22} = 0.05...0.5 \times U_n$ $\pm 5\%$ | $0.001 \times U_n$ | with $U > U_{22}$, $t_{22} = 0.5...120s$ The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | 0.01s | |
| OP | 32OF | Active overpower protection Tolerance | $P_{26} = 0.4...2 S_n$ $\pm 10\%$ | $0.001 S_n$ | with $P > P_{26}$, $t_{26} = 0.5...100s$ The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | 0.5s | |
| OQ | 32OF | Reactive overpower protection Tolerance | $Q_{27} = 0.4...2 S_n$ $\pm 10\%$ | $0.001 S_n$ | with $Q > Q_{27}$, $t_{27} = 0.5...100s$ The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | 0.5s | |
| UP | 32LF | Active underpower protection Start up Tolerance | $P_{23} = 0.1...1 \times S_n$ $\pm 10\%$ | $0.001 \times S_n$ | with $P < P_{23}$, $t_{23} = 0.5...100s$ range: $0.1...30s$ The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | 0.5s 0.01s | |
| RQ | 40/32R | Loss of field or reverse reactive power protection | $Q_{24} = -1...-0.1 S_n$ $K_{q2} = -2...2$ | $0.001 S_n$ 0.01 | with $Q > Q_{24}$, $t_{24} = 0.5...100s$ | 0.1s | |
| | | Loss of field or reverse reactive power protection | $Q_{25} = -1...-0.1 S_n$ $K_{q2} = -2...2$ | $0.001 S_n$ 0.01 | with $Q > Q_{25}$, $t_{25} = 0.5...100s$ | 0.5s | |
| | | Voltage minimum threshold | $V_{min.} = 0.5...1.2$ | 0.01 | | | |
| | | Tolerance | $\pm 10\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | | |
| S2(V) | 51V | Voltage controlled overcurrent protection | $I_{21} = 0.6...10 \times I_n$ | $0.1 \times I_n$ | With $I > I_{21}$, $t_{21} = 0.05...30s$ | 0.01s | |
| | | Step mode | $UI_{21} = 0.2...1 \times U_n$ $K_{s2} = 0.1...1$ | $0.01 \times U_n$ 0.01 | | | |
| | | Linear mode | $UI_{21} = 0.2...1 \times U_n$ $Uh_{21} = 0.2...1 \times U_n$ $K_{s2} = 0.1...1$ | $0.01 \times U_n$ $0.01 \times U_n$ 0.01 | | | |
| | | | | | | | |
| | | Tolerance | $\pm 10\%$ | | The better of the two data: $\pm 10\%$ or $\pm 40 ms$ (for $t < 5s$) / $\pm 100 ms$ (for $t \geq 5s$) | | |
| ROCOF | 81R | Rate of change of frequency protection | $f_{28} = 0.4...10 Hz/s$ | $0.2 Hz/s$ | with $f > f_{28}$, $t_{28} = 0.5...10s$ | 0.01s | |
| | | Trip direction | up &/or down | | | | |
| | | Tolerance | $\pm 5\%$ | | The better of the two data: $\pm 20\%$ or $\pm 200 ms$ | | |
| Synchro-check SC | 25 | Synchrocheck (Live busbars) | $U_{live} = 0.5...1.1 U_n$ $\Delta U = 0.02...0.12 U_n$ $\Delta f = 0.1...1 Hz$ $\Delta \Phi = 5...50^\circ \text{ elt}$ | $0.001 U_n$ $0.001 U_n$ $0.1 Hz$ 5° elt | Stability voltage time for live state = $100...30000ms$ Minimum matching Time = $100...3000ms$ | $0.001 s$ $0.01 s$ | |
| | | Tolerance | $\pm 10\%$ | | | | |
| | | Synchrocheck (Live,Dead busbars) | $U_{live} = 0.5...1.1 U_n$ $U_{dead} = 0.02...0.2 U_n$ | $0.001 U_n$ $0.001 U_n$ | $t_{ref} = 0.1...30s$ | 0.1s | |
| | | Frequency check off | | | | | |
| | | Phase check off | | | | | |
| | | Dead bar configuration | Reverse/standard | | | | |
| | | Primary voltage | 100...1150 | 100, 115, 120, 190, 208, 220, 230, 240, 277, 347, 380, 400, 415, 440, 480, 500, 550, 600, 660, 690, 910, 950, 1000, 1150 | | | |
| | | Secondary voltage | 100...120 | 100, 110, 115, 120 | | | |
| Tolerance | $\pm 10\%$ | | | | | | |

(1) With Vaux all thresholds are available. Without Vaux minimum threshold is limited to: $0.3I_n$ (with $I_n = 100A$), $0.25I_n$ (with $I_n = 400A$) or $0.2I_n$ (for all other ratings)
The tolerances above apply to trip units already powered by the main circuit with current flowing in at least two-phases or an auxiliary power supply.
In all other cases the following tolerance values apply:

| ABB Code | Trip threshold | Trip time |
|------------------|--|-------------|
| L | Trip between 1.05 and $1.2 \times I_1$ | $\pm 20\%$ |
| S | $\pm 10\%$ | $\pm 20\%$ |
| I | $\pm 15\%$ | $\leq 60ms$ |
| G | $\pm 15\%$ | $\pm 20\%$ |
| Other protection | $\pm 15\%$ | $\pm 20\%$ |



| Excludibility | Excludibility trip | Pre-allarm | Trip curve | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|---------------|--------------------|------------|------------|------------|---------------|--------------|-----------------|
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | yes | no | t = k | | | ● | ● |
| yes | only signalling | no | - | ○ ○○ | ○○ | ○○ | ○○ |
| yes | only signalling | no | - | | | | |
| yes | yes | | | | | | |
| yes | yes | | | | | | |
| yes | yes | | | | | | |

Key:
 - not available
 ● available
 ○ available with Ekip Measuring and Ekip Measuring Pro
 ○○ available with Ekip Synchrocheck

Measurement functions

| Instantaneous measurements | Parameters |
|-----------------------------|-------------------------|
| Currents (RMS) | [A] L1, L2, L3, Ne |
| Earth fault current (RMS) | [A] Ig |
| Phase-phase voltage (RMS) | [V] U12, U23, U31 |
| Phase-neutral voltage (RMS) | [V] U1, U2, U3 |
| Phase sequence | |
| Frequency | [Hz] f |
| Active power | [kW] P1, P2, P3, Ptot |
| Reactive power | [kVAR] Q1, Q2, Q3, Qtot |
| Apparent power | [KVA] S1, S2, S3, Stot |
| Power factor | total |
| Peak factor | L1, L2, L3, Ne |

| Counters recorded from installation or from the last reset | Parameters |
|--|--|
| Active energy | [kWh] Ep total, Ep positive, Ep negative |
| Reactive energy | [kVARh] Eq total, Ep positive, Ep negative |
| Apparent energy | [KVAh] Es total |

| Network Analyzer | Parameters |
|------------------------------|--|
| Hourly average voltage value | [V] - Umin= 0.75...0.95 x Un [no] - Umax= 1.05...1.25 x Un - Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime) |
| Short voltage interruptions | [no] - Umin= 0.75...0.95 x Un - Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime) |
| Short voltage spikes | [no] - Umax= 1,05...1,25 x Un - Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime) |
| Slow voltage sags and swells | [no] - Umin1= 0.75...0.95 x Un - Umin2= 0.75...0.95 x Un - Umin3= 0.75...0.95 x Un - Umax1= 1.05...1.25 x Un - Umax2= 1.05...1.25 x Un - Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime) |
| Voltage unbalance | [V] - U neg. seq.= 0.02...0.10 x Un [no] - Events counter (nr. of events day by day in the last year plus the total events in the breaker's lifetime) |
| Harmonic analysis | Current and voltage: - up to 50° - Alarm THD: 5...20% - Single harmonic alarm: 3...10% plus a count of minutes the harmonic has been exceeded |



| | Ekip Touch | Ekip Hi-Touch | Ekip G Touch | Ekip G Hi-Touch |
|------------------|------------|---------------|--------------|-----------------|
| Precision | | | | |
| 1% | ● | ● | ● | ● |
| 2% | ● | ● | ● | ● |
| 0.5% | ○ | ● | ● | ● |
| 0.5% | ○ | ● | ● | ● |
| | ○ | ● | ● | ● |
| 0.2% | ○ | ● | ● | ● |
| 2% | ○ | ● | ● | ● |
| 2% | ○ | ● | ● | ● |
| 2% | ○ | ● | ● | ● |
| 2% | ○ | ● | ● | ● |
| | ○ | ● | ● | ● |
| Precision | | | | |
| 2% | ○ | ● | ● | ● |
| 2% | ○ | ● | ● | ● |
| 2% | ○ | ● | ● | ● |
| Intervals | | | | |
| t = 5...120min | - | ● | - | ● |
| t <40ms | - | ● | - | ● |
| t <40ms | - | ● | - | ● |
| t = 0.02s...60s | - | ● | - | ● |
| t = 5...120min | - | ● | - | ● |
| | - | ● | - | ● |

Measurement functions

| Record of values: of the parameter for each interval with time-stamping | Parameters |
|--|----------------------|
| Current: minimum and maximum | [A] I Min, I Max |
| Phase-phase voltage: minimum and maximum | [V] U Min, U max |
| Active power: average and maximum | [kW] P Mean, P Max |
| Reactive power: average and maximum | [kVAR] Q Mean, Q Max |
| Apparent power: average and maximum | [KVA] S Mean, S Max |

| Data logger: record of high sampling rate parameters | Parameters |
|---|--------------------------|
| Currents | [A] L1, L2, L3, Ne, Ig |
| Voltages | [V] U12, U23, U31 |
| Sampling rate | [Hz] 1200-2400-4800-9600 |
| Maximum recording duration | [s] 16 |
| Recording stop delay | [s] 0-10s |
| Number of registers | [no] 2 independent |

| Information on trip and opening data: after a fault without auxiliary supply | Parameters |
|---|--|
| Type of protection tripped | eg. L, S, I, G, UV, OV |
| Fault values per phase | [A/V/Hz w/ VAR] eg. I1, I2, I3, neutral for S protection V12, V23, V32 for UV protection |
| Time-stamping | Date, time and progressive number |

| Maintenance indicators | Parameters |
|--|--|
| Information on last 30 trips | Type of protection, fault values and time-stamping |
| Information on last 200 events | Type of event, time-stamping |
| Number of mechanical operations ⁽¹⁾ | [no] Can be associated to alarm |
| Total number of trips | [no] |
| Total operating time | [h] |
| Wear of contacts | [%] Prealarm >80% Alarm = 100% |
| Date of maintenance operations performed | Last |
| Indication of maintenance operation needed | |
| Circuit-breaker I.D. | Type of circuit-breaker, assigned device name, serial number |

| Self-diagnosis | Parameters |
|--|---|
| Check of continuity of internal connections | Alarm due to disconnection: rating plug, sensors, trip coil |
| Failure of circuit-breaker to open (ANSI 50BF) | Alarm following non-tripping of protection functions |
| Temperature (OT) | Prealarm and alarm for abnormal temperature |

(1) with auxiliary supply present

CHAPTER 4

Advanced functionalities

| | |
|--------------|--|
| 62-63 | Advanced features |
| 64-65 | Ekip G generator protection trip unit |
| 66-67 | Zone selectivity for Tmax T/ML |
| 68-69 | Logic zone selectivity for Emax 2/ML |
| 70-70 | Load shedding |

Advanced features

A modern ship's operational ability is fully dependent on its onboard electrical infrastructure. Over the years, the growth in the number of electrically powered subsystems on a typical naval vessel has made this infrastructure ever more complex and extensive, and has led to a steady increase in power requirements.

ABB provides the first smart circuit-breaker that combine advanced protection, programmable logic, full connectivity, and comprehensive energy management in all-in-one revolutionary device. ML circuit breaker integrates the functions of Interface Protection System and Interface Device in order to check the Main Grid conditions and disconnect the User's plant whenever grid voltage and frequency are out of the ranges prescribed by the connection standard.

ML circuit breaker and its adaptive protections recognize the network change and automatically set new thresholds to guarantee protection and coordination in on-grid and off-grid conditions. Emax 2/ML is more than a circuit breaker as traditionally defined, compactness and high reliability from pre-tested functions makes Emax 2/ML highly suitable for applications in ships and marine vessels.

Emax 2/ML is an all-in-one innovative concept, in fact it is the first intelligent circuit breaker designed to protect, connect and optimize low-voltage microgrid applications. Accessories (modules) are added to the breaker to achieve all the additional functions needed.

Besides the advanced functionalities described on the following page, Emax 2 integrates in a single device the following function:

**Synchro reclosing,
Automatic Transfer Switch,
Watchdog.**

For further detail please refer to your local ABB referent.





Ekip G generator protection trip unit

ABB SACE ML family, with the new Ekip G generator protection trip unit, offers an effective and reliable solution designed for the protection of low voltage generators.

Ekip G is the new generator protection release, which has all the protection embedded and it can monitor all the key critical parameters for connecting the generator to the system. These functions, generally provided by multifunction independent relays, are now integrated into SACE ML circuit breaker to guarantee a solution that is easy to install, compact, and reliable.

The generator is one of the most delicate part of the ship's electrical system. The protections, especially those that safeguard this machine from the most heavy failures, are often redundant. Hence the protection system for a generator is complex and complicated to be calibrated and to be managed. The protections available on Ekip G are individually activated and cover a wide spectrum of onboard electrical system. They also comply with the major international regulations and standard that provide guidance on the type of protections to be used to control generators, for example in the naval field.

Ekip G is compliant with the standard IEC 60034-1 "Rotating electrical machines - Part 1: Rating and performance" of with the IEEE C37.102 "Guide for AC Generator Protection" and IEEE 242 "Protection and Coordination of Industrial and Commercial Power Systems" or requirements requested by naval standard such RINA, DNV etc. Nevertheless, the most commonly required protections according also to the indications given in the above mentioned Standards and rules are summarized in the Table below.

| Protections for synchronous generators | SnG < 500kVA | 500kVA < SnG < 1500kVA | SnG > 1500kVA |
|--|--------------|------------------------|---------------|
| Protections against loss of prime mover: | | | |
| - Active power directional protection | ● | ● | ● |
| Protections against overloads: | | | |
| - Overload and overcurrent | ● | ● | ● |
| - Current unbalance | ● | ● | ● |
| Protections against failures of the excitation system: | | | |
| - Loss of field | - | ● | ● |
| - Under/Overvoltage | ● | ● | ● |
| Protections against frequency variations: | | | |
| - Under/Overfrequency | ● | ● | ● |
| Protection against network loss: | | | |
| - Rate of change of frequency | - | ● | ● |
| Protection against failures of the insulation system: | | | |
| - Stator earth fault | ● | ● | ● |

The Ekip G trip unit is able to:

- monitor the frequency and voltage inside the machine whereby tripping the machine main circuit breaker would isolate the generator from the rest of the plant without eliminating the fault;
- monitor the interaction conditions between the generator and the rest of the plant and provide for the separation and protection of the two systems when the conditions for interconnection are missing.

In both cases, programmable contacts are available that can be used to determine the shutdown of the generator, of the prime mover and of excitation. Ekip G, which is supplied as standard with Ekip Measuring Pro module, is comprised of current, frequency, voltage and power protection functions specific for generators.

The main features available are summarized in the table below.



| Function | Description | ANSI | ABB |
|--|--|----------------|-------------------|
| Synchrocheck | Control of adequate conditions for parallel connection | 25 | SC |
| Active overpower protection | Protection against active overpower supply | 32OF | OP |
| Reactive overpower protection | Protection against reactive overpower supply | 32OF | OQ |
| Reverse active power protection | Protection against active power absorption (reverse power) | 32R | RP |
| Directional overcurrent protection | Protection against directional current | 67 | D |
| Active underpower protection | Protection against active underpower supply | 32LF | UP |
| Loss of field or reverse reactive power protection | Protection against energizing anomalies, check of reactive power absorption | 40/32R | RQ |
| Overload protection | Current protection against temperature rise | 49 | L |
| Instantaneous overcurrent protection | Instantaneous protection against phase overcurrents | 50 | I |
| Time-delayed overcurrent protection | Inverse/definite time protection against phase overcurrents | 51 50TD | S |
| Earth fault protection | Inverse/definite and instantaneous time protection against earth overcurrents | 51N 50NTD 50N; | G; Gext 51G 50GTD |
| Differential ground fault protection | Definite time protection against earth overcurrents in the generator windings | 87N | Rc |
| Voltage controlled overcurrent protection | Protection against short circuit between phases with current threshold depending on voltage (controlled/restrained mode) | 51V | S(V) |
| Residual overvoltage protection | Protection detecting loss of insulation in the machine | 59N | RV |
| Undervoltage protection | Protection against voltage decrease | 27 | UV |
| Overvoltage protection | Protection against voltage increase | 59 | OV |
| Current unbalance protection | Protection against phase current unbalance | 46 | IU |
| Voltage unbalance protection | Protection against voltage unbalance and detection of rotation direction of phases | 47 | VU |
| Rate of change of frequency protection | Protection against rapid frequency variations | 81R | Rocof |
| Overfrequency protection | Protection against frequency increase | 81H | OF |
| Underfrequency protection | Protection against frequency reduction | 81L | UF |

Zone selectivity for Tmax T/ML

Using zone selectivity is possible to obtain selectivity considerably reducing the trip times and therefore the thermal stresses all the plant components are subjected to during the fault.

This type of selectivity, a development of time coordination, is made by means of logic connections between current measuring devices which, once the set threshold having been exceeded is detected, allow just the fault area to be identified and to have its power supply cut off. Each circuit-breaker which detects a fault communicates this to the one on the supply side sending a timed locking signal.

Thanks to extremely rapid detection and quenching of the short-circuit, the Tmax ML equipped with PR223EF or PR332/P trip unit are totally selective up to over 100 kA, and are not subject to any limits regarding the number of hierarchical levels of the installation.

All the protection functions can be programmed remotely using the dialogue function present on the trip unit or locally through the Ekip T&P which can be connected to a serial port on the front of the PR223EF.

The trip unit can be supplied from a 24 V DC auxiliary source or directly through the current transformers (self-supply). The electronic trip unit operation is guaranteed even in the case of single-phase load up to $0.18 \times I_n$.

In the presence of an auxiliary power supply:

- the device implements the L, S, EF and G protection functions; if the EF is disabled by the user, function I is enabled
- EFDP zone selectivity is implemented on the S, EF and G functions.

With the PR332/P trip unit it is now possible to extend the ZS zone selectivity function, already available on ABB SACE air circuit-breakers to the moulded-case circuit-breakers. The ZS zone selectivity, which is applicable to protection functions S and G, can be enabled in the case where the curve with fixed time is selected and the auxiliary power supply is present. ZS of selectivity is identical to that which can be obtained through the Emax 2 ML trip units. Tmax T7/ML circuit-breaker equipped with PR332/P can be connected directly without external accessories on the load side of a zone selectivity chain created through the other devices (Emax 2 ML trip units).

PR223EF



PR332/P



Logic zone selectivity for Emax 2/ML

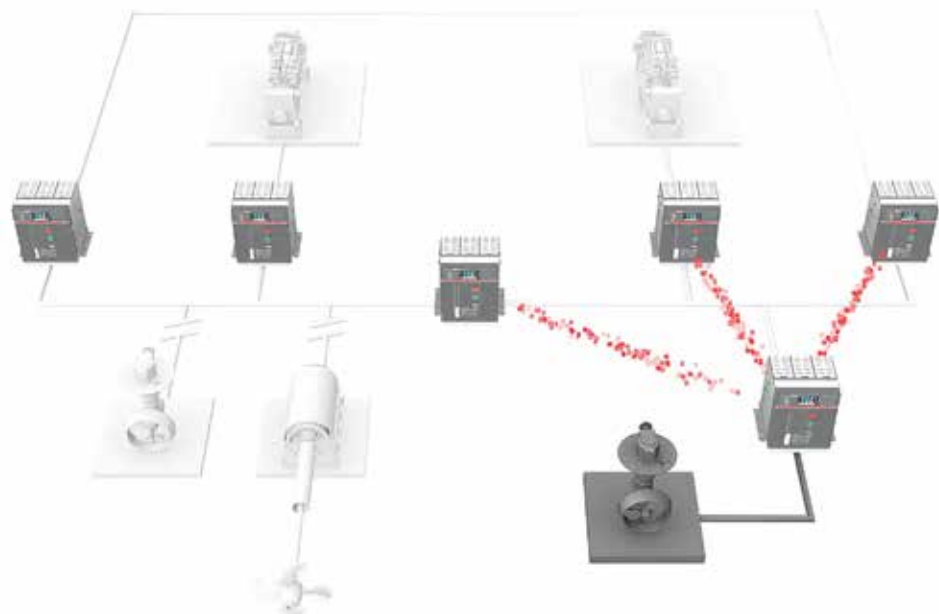
Emax 2/ML can manage the logic zone selectivity using the reliability, flexibility and efficiency of Ekip link, the ABB proprietary communication bus.

A major element of vessel power system design is protection against electrical faults. One very efficient method of handling faults is logic zone selectivity (or “discrimination”), which allows rapid fault isolation without users, other than those directly affected, seeing any effect. This approach can accurately isolate the fault branch by quickly opening the adjacent circuit breaker(s) and reduce the transitory on fault time and the electrical stresses.

Logic zone selectivity combines zone selectivity and directional protection. In contrast with traditional selectivity methods, which are based on time and/or current, the principle of logic zone selectivity is that the breaker that should trip for a fault sends a blocking signal to other breakers (upstreams) to prevent them from tripping. The principally impacted breaker can block other breakers from tripping, when appropriate. With Emax2, locking signal can be realized by traditional hardwire or by bus communication using Ekip Link.

Behind this scheme lies a logic that defines which breakers should and should not be tripped in certain situations. This logic is managed by Ekip Connect, the ABB software for the configuration of the electronic trip units.

Ekip Link, the ABB communication module for low voltage circuit breaker, communicate between circuit breaker using an internal ABB proprietary bus. The use of a proprietary bus guarantees very fast and predictable communication (independent of traffic on other buses)



Using ABB communication protocol, Ekip Link can:

- Create complex logic selectivity without using complex wiring
- Provide redundancy, using both Ekip link bus and standard wiring
- Provide diagnostics (configurable) to test the wiring selectivity

ABB's Emax 2 is the first low-voltage circuit breaker with fully integrated directional protection and zone directional selectivity functions. using directional protection, there is also a possibility to set different delay times for the different directions.

Emax 2 air circuit breaker equipped with Ekip Link form the basis of a unique solution for low-voltage logical zone discrimination that has been designed to meet the most demanding requirements of reliability, flexibility and efficiency in vessels. This solution is easy to install, commission and test.



Load shedding

Emax 2/ML with embedded Load Shedding innovation creates the new benchmark for the service continuity in the naval electrical system.

ABB Emax 2, the all-in-one smart circuit breaker, embeds patented functions based on load shedding. This innovative algorithm manages the available resources maximizing the efficiency. Load Shedding functions are adopted to protect Microgrids, as vessels power system, during fault operation.

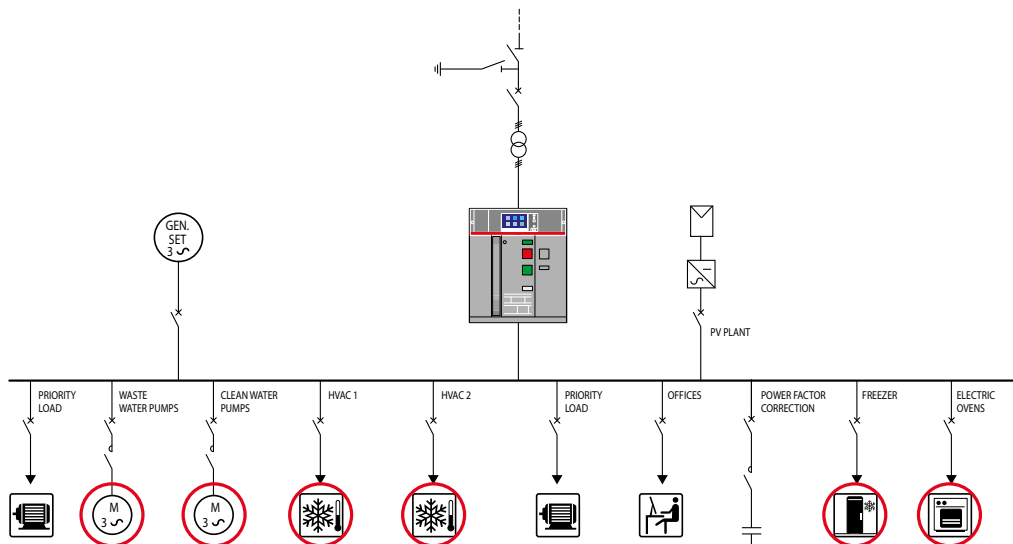
The load shedding function is able to switch from one source of energy to the other one, this happens when a fault occurs in one of the energy sources present in the power system. During this switch, the total amount of energy in the system falls down and not all loads can be fed. Load shedding, giving priority to the loads, maintains active only the primary loads while disconnecting the secondary. In this way the main functions are kept active even in case of a fault. This advanced function for Microgrid can be managed by an automatic transfer switching (ATS) logic. Emax 2/ML can provide two different customizations of the load shedding which are mentioned below:

- **Basic Load Shedding**, simple logic able to recognize the Microgrid disconnection event and shed a group of non-priority loads thus ensuring a fast time response and power balance.
- **Adaptive Load Shedding**, the advanced algorithm available with Emax 2 as an enhancement of the basic version. The intelligent software embedded in the circuit breaker sheds very quickly the non-priority loads according to the Microgrid power consumption and frequency measurements.

Moreover, such software has a dedicated configuration for backup generation related to ATS and the software itself is even able to estimate the energy produced by the backup energy source. Emax 2/ML with embedded Load Shedding provides the following benefits:

- **Service continuity:** When a naval system has a problem in one of the main generators, 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.
- **Space saving:** 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. Significant space and material saving up to 50% in the power distribution switchgear for panel builders.
- **Ease of use:** Load shedding logics are generally set with high engineering skills and customization effort with devices as programmable logic controllers. While Emax 2 guarantees easy installation thanks to predefined templates and the user-friendly graphic interface in the SW commissioning tool.

For further information, please refer to the White Paper "Emax 2, all-in-one innovation – Load Shedding" (1SDC007119G0201)



CHAPTER 5

Dimensional drawings

| | |
|--------------|-----------------------------|
| 72-72 | Reading information |
| 73-73 | Tmax T4/ML |
| 74-74 | Tmax T5/ML |
| 75-76 | Tmax T6/ML |
| 77-78 | Tmax T7/ML |
| 79-80 | Tmax T7/ML motorized |
| 81-81 | Emax E2.2/ML |
| 82-82 | Emax E4.2/ML |
| 83-83 | Emax E6.2/ML |
| 84-84 | Accessories |

Reading information

Information on the overall dimensions is available on the web site <http://www.abb.com/abblibrary/DownloadCenter> in particular with the SACE Emax 2 IEC catalogue 1SDC210015D0208 and SACE Tmax IEC catalogue 1SDC210015D0208.

Tmax T4/ML

The following drawings are also available in .dxf format:

Fixed version

| Poles | Document Number | Title |
|-------|-----------------|---|
| 3p | 1SDH000436R0100 | T4 3p fixed version front terminals |
| 3p | 1SDH001291R0011 | T4 3 poles Fixed (left connectors) |
| 3p | 1SDH001291R0012 | T4 3 poles Fixed (right connectors) |
| 3p | 1SDH001291R0013 | T4 3 poles Fixed |
| 4p | 1SDH000436R0114 | T4 4p fixed version rear terminals residual current release |
| 4p | 1SDH001291R0018 | T4 4 poles Fixed (left connectors) |
| 4p | 1SDH001291R0019 | T4 4 poles Fixed (right connectors) |
| 4p | 1SDH001291R0021 | T4 4 poles Fixed |
| 3p/4p | 1SDH000436R0163 | T4 3p/4p fixed version motor operator |

Plug-in version

| Poles | Document Number | Title |
|-------|-----------------|--|
| 3p | 1SDH000436R0124 | T4 III plug-in configuration rear vertical terminals |
| 3p | 1SDH000436R0126 | T4 III plug-in configuration rear horizontal terminals |
| 3p | 1SDH001291R0014 | T4 3 poles Plug-in fixed part (right connectors) |
| 3p | 1SDH001291R0015 | T4 3 poles Plug-in fixed part |
| 4p | 1SDH000436R0125 | T4 IV plug-in configuration rear vertical terminals |
| 4p | 1SDH000436R0127 | T4 IV plug-in configuration rear horizontal terminals |
| 4p | 1SDH001291R0020 | T4 4 poles Plug-in fixed part (right connectors) |
| 4p | 1SDH001291R0022 | T4 4 poles Plug-in fixed part |

Withdrawable version

| Poles | Document Number | Title |
|-------|-----------------|--|
| 3p | 1SDH000436R0140 | T4 3p withdrawable version front terminals |
| 3p | 1SDH000436R0144 | T4 III withdrawable configuration rear vertical terminals |
| 3p | 1SDH000436R0146 | T4 III withdrawable configuration rear horizontal terminals |
| 3p | 1SDH001291R0016 | T4 3 poles Withdrawable fixed part |
| 3p | 1SDH001291R0017 | T4 3 poles Withdrawable Plug-in fixed part (left connectors) |
| 4p | 1SDH000436R0145 | T4 IV withdrawable configuration rear vertical terminals |
| 4p | 1SDH000436R0147 | T4 IV withdrawable configuration rear horizontal terminals |
| 4p | 1SDH001291R0023 | T4 4 poles Withdrawable fixed part |
| 4p | 1SDH001291R0024 | T4 4 poles Withdrawable Plug-in fixed part (left connectors) |
| 3p/4p | 1SDH000436R0166 | T4 3p/4p withdrawable version motor operator |

Tmax T5/ML

Fixed version

| Poles | Document Number | Title |
|-------|-----------------|---|
| 3p | 1SDH000437R0100 | T5 3p fixed version front terminals |
| 3p | 1SDH000437R0108 | T5 3p fixed version front extended terminals |
| 3p | 1SDH000437R0110 | T5 3p fixed version front spread terminals |
| 3p | 1SDH000437R0197 | T5 UL 3p Fixed 600 A front terminals for cables 2x240mm² |
| 3p | 1SDH001291R0025 | T5 3 poles Fixed (left connectors) |
| 3p | 1SDH001291R0026 | T5 3 poles Fixed (right connectors) |
| 3p | 1SDH001291R0027 | T5 3 poles Fixed |
| 4p | 1SDH000437R0101 | T5 4p fixed version front terminals |
| 4p | 1SDH000437R0114 | T5 4p fixed version rear terminals residual current release |
| 4p | 1SDH000437R0199 | T5 4p fixed version terminals for cables FCCu 1000V |
| 4p | 1SDH001291R0034 | T5 4 poles Fixed (left connectors) |
| 4p | 1SDH001291R0035 | T5 4 poles Fixed (right connectors) |
| 4p | 1SDH001291R0036 | T5 4 poles Fixed 630 A |
| 4p | 1SDH001291R0037 | T5 4 poles Fixed |
| 3p/4p | 1SDH000437R0160 | T5 3p/4p fixed version rotary handle direct |
| 3p/4p | 1SDH000437R0161 | T5 3p/4p fixed version adjustable depth rotary handle |
| 3p/4p | 1SDH000437R0164 | T5 3p/4p fixed version front panel for locking devices |

Plug-in version

| Poles | Document Number | Title |
|-------|-----------------|---|
| 3p | 1SDH000437R0128 | T5 3p plug-in version 400 A front spread terminals |
| 3p | 1SDH001291R0028 | T5 3 poles Plug-in fixed part (right connectors) |
| 3p | 1SDH001291R0029 | T5 3 poles Plug-in fixed part 630 A |
| 3p | 1SDH001291R0030 | T5 3 poles Plug-in fixed part |
| 4p | 1SDH000437R0127 | T5 4p plug-in version 400 A rear horizontal terminals |
| 4p | 1SDH000437R0137 | T5 4p plug-in version 630 A front spread terminals |
| 4p | 1SDH001291R0038 | T5 4 poles Plug-in fixed part |
| 4p | 1SDH001291R0039 | T5 4 poles Plug-in fixed part (right connectors) |
| 4p | 1SDH001291R0043 | T5 4 poles Plug-in fixed part 630 A |

Withdrawable version

| Poles | Document Number | Title |
|-------|-----------------|---|
| 3p | 1SDH000437R0144 | T5 3p withdrawable version 400 A rear vertical terminals |
| 3p | 1SDH001291R0031 | T5 3 poles Withdrawable fixed part 630 A |
| 3p | 1SDH001291R0032 | T5 3 poles Withdrawable fixed part |
| 3p | 1SDH001291R0033 | T5 3 poles Withdrawable Plug-in fixed part (left connectors) |
| 4p | 1SDH000437R0143 | T5 4p withdrawable version 400 A terminals for copper or copper-aluminum cables |
| 4p | 1SDH000437R0191 | T5 4p Withdrawable motor operator |
| 4p | 1SDH001291R0040 | T5 4 poles Withdrawable fixed part 630 A |
| 4p | 1SDH001291R0041 | T5 4 poles Withdrawable fixed part |
| 4p | 1SDH001291R0042 | T5 4 poles Withdrawable Plug-in fixed part (left connectors) |
| 3p/4p | 1SDH000437R0169 | T5 3p/4p withdrawable version 630 A motor operator |

Tmax T6/ML

Fixed version

| Poles | Document Number | Title |
|-------|-----------------|--|
| 3p | 1SDH000479R0104 | T6 3p Fixed extended front terminals |
| 3p | 1SDH000479R0132 | T6 3p Fixed extended front terminals 1000A |
| 3p | 1SDH000783R0104 | T6V 3p F extended front terminals |
| 3p | 1SDH000479R0100 | T6 3p Fixed front terminals-rear for cables 630A |
| 3p | 1SDH000479R0102 | T6 3p Fixed front terminals-rear for cables 800A |
| 3p | 1SDH000479R0125 | T6 3p Fixed front terminals for cables 1000A |
| 3p | 1SDH000479R0127 | T6 3p Fixed front terminals 1000V |
| 3p | 1SDH000783R0100 | T6V 3p F front terminals for cables 630A |
| 3p | 1SDH000783R0102 | T6V 3p F front terminals for cables 800A |
| 3p | 1SDH000783R0108 | T6V 3p F front terminals |
| 3p | 1SDH000479R0108 | T6 3p Fixed front spread extended terminals |
| 3p | 1SDH000479R0106 | T6 630-800A 3p Fixed front and rear terminals |
| 3p | 1SDH000479R0129 | T6 3p Fixed rear terminals 1000V |
| 3p | 1SDH000479R0134 | T6 1000A 3p Fixed rear terminals |
| 3p | 1SDH000783R0106 | T6V 3p F rear terminals |
| 3p | 1SDH000479R0116 | T6 3p Fixed rotary handle |
| 3p | 1SDH000479R0118 | T6 3p Fixed adjustable rotary handle |
| 3p | 1SDH000783R0116 | T6V 3p F rotary handle |
| 3p | 1SDH000783R0118 | T6V 3p F with transmitted rotary handle |
| 3p | 1SDH000783R0114 | T6V 3p F front panel with padlock device |
| 3p | 1SDH000479R0114 | T6 3p Fixed front panel with padlock device |
| 4p | 1SDH000479R0105 | T6 4p Fixed extended front terminals |
| 4p | 1SDH000479R0133 | T6 4p Fixed extended front terminals 1000A |
| 4p | 1SDH000783R0105 | T6V 4p F extended front terminals |
| 4p | 1SDH000479R0101 | T6 4p Fixed front terminals-rear for cables 630A |
| 4p | 1SDH000479R0103 | T6 4p Fixed front terminals-rear for cables 800A |
| 4p | 1SDH000479R0126 | T6 4p Fixed front terminals for cables 1000A |
| 4p | 1SDH000479R0128 | T6 4p Fixed front terminals 1000V |
| 4p | 1SDH000783R0101 | T6V 4p F front terminals for cables 630A |
| 4p | 1SDH000783R0103 | T6V 4p F front terminals for cables 800A |
| 4p | 1SDH000783R0109 | T6V 4p F front terminals |
| 4p | 1SDH000479R0109 | T6 4p Fixed front spread extended terminals |
| 4p | 1SDH000479R0107 | T6 630-800A 4p Fixed front and rear terminals |
| 4p | 1SDH000479R0130 | T6 4p Fixed rear terminals 1000V |
| 4p | 1SDH000479R0135 | T6 1000A 4p Fixed rear terminals |
| 4p | 1SDH000783R0107 | T6V 4p F rear terminals |
| 4p | 1SDH000479R0117 | T6 4p Fixed rotary handle |
| 4p | 1SDH000479R0119 | T6 4p Fixed adjustable rotary handle |
| 4p | 1SDH000783R0117 | T6V 4p F rotary handle |
| 4p | 1SDH000783R0119 | T6V 4p F with transmitted rotary handle |
| 4p | 1SDH000479R0115 | T6 4p Fixed front panel with padlock device |
| 4p | 1SDH000783R0115 | T6V 4p F front panel with padlock device |
| 3p/4p | 1SDH000479R0120 | T6 3p-4p Fixed motor operator |
| 3p/4p | 1SDH000783R0120 | T6V 3p-4p F motor operator |

Tmax T6/ML

Withdrawable version

| Poles | Document Number | Title |
|-------|-----------------|--|
| 3p | 1SDH000479R0110 | T6 3p Withdrawable front terminals |
| 3p | 1SDH000479R0112 | T6 3p Withdrawable rear terminals |
| 4p | 1SDH000479R0111 | T6 4p Withdrawable front terminals |
| 4p | 1SDH000479R0113 | T6 4p Withdrawable rear terminals |
| 3p/4p | 1SDH000479R0121 | T6 3p-4p Withdrawable motor operator |
| 3p/4p | 1SDH000479R0124 | T6 3p-4p Withdrawable with rotary handle |

Tmax T7/ML

Fixed version

| Poles | Document Number | Title |
|-------|-----------------|--|
| 3p | 1SDH001291R0136 | T7 III F EF Down - Extended front terminals EF down |
| 3p | 1SDH001291R0137 | T7 III F EF Up - Extended front terminals EF up |
| 3p | 1SDH001291R0146 | T7 III F ES Down - Spreaded extended front terminals ES down |
| 3p | 1SDH001291R0147 | T7 III F ES Up - Spreaded extended front terminals ES up |
| 3p | 1SDH000529R0102 | T7 3p Fixed front terminals |
| 3p | 1SDH001291R0148 | T7 III F FCCuAl Down - Front terminals for cables CuAl down |
| 3p | 1SDH001291R0149 | T7 III F FCCuAl Up - Front terminals for cables CuAl Up |
| 3p | 1SDH001291R0138 | T7 III F RH Down - Rear terminals RH down |
| 3p | 1SDH001291R0139 | T7 III F RH Down - Rear terminals RH orientable down |
| 3p | 1SDH001291R0140 | T7 III F RH Up - Rear terminals RH orientable up |
| 3p | 1SDH001291R0141 | T7 III F RH Up - Rear terminals RH up |
| 3p | 1SDH001291R0142 | T7 III F RV Down - Rear terminals RV down |
| 3p | 1SDH001291R0143 | T7 III F RV Down - Rear terminals RV orientable down |
| 3p | 1SDH001291R0144 | T7 III F RV Up - Rear terminals RV orientable up |
| 3p | 1SDH001291R0145 | T7 III F RV Up - Rear terminals RV up |
| 3p | 1SDH000529R0100 | T7 3p Fixed |
| 3p | 1SDH001291R0135 | T7 III F - T7 3 poles Fixed |
| 3p | 1SDH001291R0150 | T7 III F HTC Down - High insulating terminal cover down |
| 3p | 1SDH001291R0151 | T7 III F HTC Up - High insulating terminal cover up |
| 3p | 1SDH001291R0152 | T7 III F LTC Down - low insulating terminal cover down |
| 3p | 1SDH001291R0153 | T7 III F LTC Up - low insulating terminal cover up |
| 3p | 1SDH000529R0104 | T7 3p Fixed with rotary handle |
| 3p | 1SDH001291R0154 | T7 III F with RHD - Fixed with rotary handle |
| 4p | 1SDH001291R0164 | T7 IV F EF Down - Extended front terminals EF down |
| 4p | 1SDH001291R0165 | T7 IV F EF Up - Extended front terminals EF up |
| 4p | 1SDH001291R0166 | T7 IV F ES Down - Spreaded extended front terminals ES down |
| 4p | 1SDH001291R0167 | T7 IV F ES Up - Spreaded extended front terminals ES up |
| 4p | 1SDH000529R0103 | T7 4p Fixed front terminals |
| 4p | 1SDH001291R0168 | T7 IV F FCCuAl Down - Front terminals for cables CuAl Down |
| 4p | 1SDH001291R0169 | T7 IV F FCCuAl Up - Front terminals for cables CuAl Up |
| 4p | 1SDH001291R0170 | T7 IV F RH Down - Rear terminals RH down |
| 4p | 1SDH001291R0171 | T7 IV F RH Down - Rear terminals RH orientables down |
| 4p | 1SDH001291R0172 | T7 IV F RH Up - Rear terminals RH orientables up |
| 4p | 1SDH001291R0173 | T7 IV F RH Up - Rear terminals RH up |
| 4p | 1SDH001291R0174 | T7 IV F RV Down - Rear terminals RV down |
| 4p | 1SDH001291R0175 | T7 IV F RV Down - Rear terminals RV orientables down |
| 4p | 1SDH001291R0176 | T7 IV F RV Up - Rear terminals RV orientables up |
| 4p | 1SDH001291R0177 | T7 IV F RV Up - Rear terminals RV up |
| 4p | 1SDH000529R0101 | T7 4p Fixed |
| 4p | 1SDH001291R0163 | T7 IV F - T7 4 poles Fixed |
| 4p | 1SDH001291R0179 | T7 IV F HTC Down - High insulating terminal cover down |
| 4p | 1SDH001291R0180 | T7 IV F HTC Up - High insulating terminal cover up |
| 4p | 1SDH001291R0181 | T7 IV F LTC Down - Low insulating terminal cover down |
| 4p | 1SDH001291R0182 | T7 IV F LTC Up - Low insulating terminal cover up |
| 4p | 1SDH000529R0105 | T7 4p Fixed with rotary handle |
| 4p | 1SDH001291R0178 | T7 IV F with RHD - With rotary handle |
| 3p/4p | 1SDH000529R0113 | T7 3p 4p fixed front terminals |

Tmax T7/ML

Withdrawable version

| Poles | Document Number | Title |
|-------|-----------------|---|
| 3p | 1SDH001291R0155 | T7 III W Front terminals Down |
| 3p | 1SDH001291R0156 | T7 III W Front terminals Up |
| 3p | 1SDH001291R0158 | T7 III W RH Down - Rear terminal RH Down |
| 3p | 1SDH001291R0159 | T7 III W RH Up - Rear terminal RH Up |
| 3p | 1SDH001291R0160 | T7 III W RV Down - Rear terminals RV Down |
| 3p | 1SDH001291R0161 | T7 III W RV Up - Rear terminals RV Up |
| 3p | 1SDH001291R0157 | T7 III W - T7 3 poles Withdrawable |
| 3p | 1SDH001291R0162 | T7 III W with RHD - With rotary handle |
| 4p | 1SDH001291R0184 | T7 IV W Front terminals Down |
| 4p | 1SDH001291R0185 | T7 IV W Front terminals Up |
| 4p | 1SDH001291R0186 | T7 IV W RH Down - Rear terminals RH down |
| 4p | 1SDH001291R0187 | T7 IV W RH Up - Rear terminals RH up |
| 4p | 1SDH001291R0188 | T7 IV W RV Down - Rear terminals RV down |
| 4p | 1SDH001291R0189 | T7 IV W RV Up - Rear terminals RV up |
| 4p | 1SDH001291R0183 | T7 IV W - T7 4 poles Withdrawable |
| 4p | 1SDH001291R0190 | T7 IV W with RHD - With rotary handle |
| 3p/4p | 1SDH000529R0114 | T7 3p 4p withdrawable rear terminals for cables |
| 3p/4p | 1SDH000529R0119 | T7 3p 4p Withdrawable rear spread terminals |
| 3p/4p | 1SDH000529R0120 | T7 3p 4p withdrawable rear terminals for cables |
| 3p/4p | 1SDH000529R0111 | T7 3p 4p Withdrawable with rotary handle RH RV EF |
| 3p/4p | 1SDH000529R0109 | T7 3p 4p Withdrawable RH RV EF |
| 3p/4p | 1SDH000529R0110 | T7 3p 4p Withdrawable stored energy motor operator RH RV EF |
| 3p/4p | 1SDH000529R0121 | T7 3p 4p withdrawable spread terminals for cables |

Accessories

| Poles | Document Number | Title |
|-------|-----------------|--|
| | 1SDH000529R0117 | T7 3p 4p with rotary handle |
| | 1SDH000529R0106 | T7 3p 4p with RH RV |
| | 1SDH000529R0107 | T7 3p 4p FCCuAL 4x240 |
| | 1SDH000529R0108 | T7 3p 4p Fixed EF ES |
| | 1SDH000529R0112 | T7 3p 4p Fixed/withdrawable with interlock |
| | 1SDH000529R0116 | T7 3p 4p with lever mechanism R |
| | 1SDH000529R0118 | T7 3p 4p with lever mechanism FCCuA 2x240 |
| | 1SDH001291R0193 | T7 - Flange for the rotary handle |
| | 1SDH001291R0195 | T7 - Rotary handle |
| | 1SDH001291R0191 | T7 - Flange for compartment door, max distance 164mm |
| | 1SDH001291R0192 | T7 - Flange for compartment door |
| | 1SDH001291R0194 | T7 - Reduced flange for the compartment door |

Tmax T7/ML motorized

Fixed version

| Poles | Document Number | Title |
|-------|-----------------|---|
| 3p | 1SDH001291R0197 | T7M F III ES Down - Spreaded extended front terminals ES down |
| 3p | 1SDH001291R0198 | T7M F III ES Up - Spreaded extended front terminals ES up |
| 3p | 1SDH001291R0201 | T7M F III EF Down - Extended front terminals EF down |
| 3p | 1SDH001291R0202 | T7M F III EF Up - Extended front terminals EF up |
| 3p | 1SDH001291R0199 | T7M F III FCCuAl Down - Front terminals for cables CuAl down |
| 3p | 1SDH001291R0200 | T7M F III FCCuAl Up - Front terminals for cables CuAl up |
| 3p | 1SDH001291R0203 | T7M F III RH Down - Rear terminals RH down |
| 3p | 1SDH001291R0204 | T7M F III RH Down - Rear terminals RH orientable down |
| 3p | 1SDH001291R0205 | T7M F III RH Up - Rear terminals RH orientable up |
| 3p | 1SDH001291R0206 | T7M F III RH Up - Rear terminals RH up |
| 3p | 1SDH001291R0207 | T7M F III RV Down - Rear terminals RV down |
| 3p | 1SDH001291R0208 | T7M F III RV Down - Rear terminals RV orientable down |
| 3p | 1SDH001291R0209 | T7M F III RV Up - Rear terminals RV orientable up |
| 3p | 1SDH001291R0210 | T7M F III RV Up - Rear terminals RV up |
| 3p | 1SDH001291R0196 | T7M F III - T7M 3 poles Fixed |
| 3p | 1SDH001291R0211 | T7M F III HTC Down - High insulating terminal cover down |
| 3p | 1SDH001291R0212 | T7M F III HTC Up - High insulating terminal cover up |
| 3p | 1SDH001291R0213 | T7M F III LTC Down - Low insulating terminal cover down |
| 3p | 1SDH001291R0214 | T7M F III LTC Up - Low insulating terminal cover up |
| 4p | 1SDH001291R0227 | T7M IV F ES Down - Spreaded extended front terminals ES down |
| 4p | 1SDH001291R0228 | T7M IV F ES Up - Spreaded extended front terminals ES up |
| 4p | 1SDH001291R0231 | T7M IV F EF Down - Extended front terminals EF down |
| 4p | 1SDH001291R0232 | T7M IV F EF Up - Extended front terminals EF up |
| 4p | 1SDH001291R0229 | T7M IV F FCCuAl Down - front terminals for cables CuAl down |
| 4p | 1SDH001291R0230 | T7M IV F FCCuAl Up - front terminals for cables CuAl up |
| 4p | 1SDH001291R0233 | T7M IV F RH Down - Rear terminals RH down |
| 4p | 1SDH001291R0234 | T7M IV F RH Down - Rear terminals RH orientable down |
| 4p | 1SDH001291R0235 | T7M IV F RH Up - Rear terminals RH orientable up |
| 4p | 1SDH001291R0236 | T7M IV F RH Up - Rear terminals RH up |
| 4p | 1SDH001291R0237 | T7M IV F RV Down - Rear terminals RV down |
| 4p | 1SDH001291R0238 | T7M IV F RV Down - Rear terminals RV orientabledown |
| 4p | 1SDH001291R0239 | T7M IV F RV Up - Rear terminals RV orientable up |
| 4p | 1SDH001291R0240 | T7M IV F RV Up - Rear terminals RV up |
| 4p | 1SDH001002R0101 | T7D - T7DM PV Fixed 4P 1100V 2+2 |
| 4p | 1SDH001291R0222 | T7M IV F - T7M 4 poles Fixed |
| 4p | 1SDH001002R0100 | T7D - T7DM PV Fixed 4P 1100V 2+2 FC |
| 4p | 1SDH001291R0223 | T7M IV F HTC Down - High insulating terminal cover down |
| 4p | 1SDH001291R0224 | T7M IV F HTC Up - High insulating terminal cover up |
| 4p | 1SDH001291R0225 | T7M IV F LTC Down - Low insulating terminal cover down |
| 4p | 1SDH001291R0226 | T7M IV F LTC Up - Low insulating terminal cover up |

Tmax T7/ML motorized

Withdrawable version

| Poles | Document Number | Title |
|-------|-----------------|--|
| 3p | 1SDH001291R0215 | T7M III W Front terminals Down |
| 3p | 1SDH001291R0216 | T7M III W Front terminals Up |
| 3p | 1SDH001291R0218 | T7M III W RH Down - Rear terminals RH down |
| 3p | 1SDH001291R0219 | T7M III W RH Up - Rear terminals RH up |
| 3p | 1SDH001291R0220 | T7M III W RV Down - Rear terminals RV down |
| 3p | 1SDH001291R0221 | T7M III W RV Up - Rear terminals RV up |
| 3p | 1SDH001291R0217 | T7M III W - T7M 3 poles Withdrawable |
| 4p | 1SDH001291R0242 | T7M IV W Front terminals down |
| 4p | 1SDH001291R0243 | T7M IV W Front terminals up |
| 4p | 1SDH001291R0244 | T7M IV W RH Down - Rear terminals RH down |
| 4p | 1SDH001291R0245 | T7M IV W RH Up - Rear terminals RH up |
| 4p | 1SDH001291R0246 | T7M IV W RV Down - Rear terminals RV down |
| 4p | 1SDH001291R0247 | T7M IV W RV Up - Rear terminals RV up |
| 4p | 1SDH001291R0241 | T7M IV W - T7M 4 poles Withdrawable |

Emax E2.2/ML

Withdrawable version 3 poles

| Document Number | Title |
|-----------------|--|
| 1SDH001000R0110 | E2.2 2000A withdrawable flat terminals FL |
| 1SDH001000R0111 | E2.2 2500A withdrawable flat terminals FL |
| 1SDH001252R0431 | E2.2 III W 2000A N0761 |
| 1SDH001252R0104 | E2.2 III W 2500A N0761 |
| 1SDH001252R0105 | E2.2 III W Compartment door drilling |
| 1SDH001252R0436 | E2.2 III W Flat term 2000A lower |
| 1SDH001252R0435 | E2.2 III W Flat term 2000A upper |
| 1SDH001252R0438 | E2.2 III W Flat term 2500A lower |
| 1SDH001252R0437 | E2.2 III W Flat term 2500A upper |
| 1SDH001252R0106 | E2.2 III W Floor fixing |
| 1SDH001252R0168 | E2.2 III W IP30 Protection for switchgear |
| 1SDH001252R0323 | E2.2 III W Terminals F lower |
| 1SDH001252R0324 | E2.2 III W Terminals F upper |
| 1SDH001252R0107 | E2.2 III W Terminals HR lower 2000A |
| 1SDH001252R0108 | E2.2 III W Terminals HR lower 2500A |
| 1SDH001252R0109 | E2.2 III W Terminals HR upper 2000A |
| 1SDH001252R0110 | E2.2 III W Terminals HR upper 2500A |
| 1SDH001252R0111 | E2.2 III W Terminals SHR lower 2000A |
| 1SDH001252R0112 | E2.2 III W Terminals SHR lower 2500A |
| 1SDH001252R0113 | E2.2 III W Terminals SHR upper 2000A |
| 1SDH001252R0114 | E2.2 III W Terminals SHR upper 2500A |
| 1SDH001252R0115 | E2.2 III W Terminals SVR lower 2000A |
| 1SDH001252R0116 | E2.2 III W Terminals SVR lower 2500A |
| 1SDH001252R0117 | E2.2 III W Terminals SVR upper 2000A |
| 1SDH001252R0118 | E2.2 III W Terminals SVR upper 2500A |
| 1SDH001252R0119 | E2.2 III W Terminals VR lower 2000A |
| 1SDH001252R0120 | E2.2 III W Terminals VR lower 2500A |
| 1SDH001252R0121 | E2.2 III W Terminals VR upper 2000A |
| 1SDH001252R0122 | E2.2 III W Terminals VR upper 2500A |
| 1SDH001000R0103 | E2.2 III-IV Withdrawable front terminals F |

Emax E4.2/ML

Withdrawable version 3 poles

| Document Number | Title |
|-----------------|--|
| 1SDH001001R0110 | E4.2 3200A withdrawable flat terminals FL |
| 1SDH001001R0102 | E4.2 3-4p Withdrawable HR-VR |
| 1SDH001001R0111 | E4.2 4000A withdrawable flat terminals FL |
| 1SDH001252R0433 | E4.2 III W 3200A N0761 |
| 1SDH001252R0185 | E4.2 III W 4000A N0761 |
| 1SDH001252R0186 | E4.2 III W Compartment door drilling |
| 1SDH001252R0444 | E4.2 III W Flat term 3200A lower |
| 1SDH001252R0443 | E4.2 III W Flat term 3200A upper |
| 1SDH001252R0446 | E4.2 III W Flat term 4000A lower |
| 1SDH001252R0445 | E4.2 III W Flat term 4000A upper |
| 1SDH001252R0187 | E4.2 III W Floor fixing |
| 1SDH001252R0188 | E4.2 III W IP30 Protection for switchgear |
| 1SDH001252R0327 | E4.2 III W Terminals F lower |
| 1SDH001252R0328 | E4.2 III W Terminals F upper |
| 1SDH001252R0189 | E4.2 III W Terminals HR lower 3200A |
| 1SDH001252R0190 | E4.2 III W Terminals HR lower 4000A |
| 1SDH001252R0191 | E4.2 III W Terminals HR upper 3200A |
| 1SDH001252R0192 | E4.2 III W Terminals HR upper 4000A |
| 1SDH001252R0193 | E4.2 III W Terminals VR lower 3200A |
| 1SDH001252R0194 | E4.2 III W Terminals VR lower 4000A |
| 1SDH001252R0195 | E4.2 III W Terminals VR upper 3200A |
| 1SDH001252R0196 | E4.2 III W Terminals VR upper 4000A |
| 1SDH001001R0103 | E4.2 III-IV Withdrawable Front Terminals F |

Emax E6.2/ML

Withdrawable version 3 poles

| Document Number | Title |
|-----------------|--|
| 1SDH001060R0105 | E6.2 3-4p Withdrawable HR |
| 1SDH001060R0106 | E6.2 3-4p Withdrawable VR |
| 1SDH001252R0456 | E6.2 4 FS W Flat term 6300A lower |
| 1SDH001252R0455 | E6.2 4 FS W Flat term 6300A upper |
| 1SDH001060R0107 | E6.2 4p FS Withdrawable HR-VR |
| 1SDH001252R0237 | E6.2 III W 6300A N0761 |
| 1SDH001252R0238 | E6.2 III W Compartment door drilling |
| 1SDH001252R0452 | E6.2 III W Flat term 6300A lower |
| 1SDH001252R0451 | E6.2 III W Flat term 6300A upper |
| 1SDH001252R0239 | E6.2 III W Floor fixing |
| 1SDH001252R0240 | E6.2 III W IP30 Protection for switchgear |
| 1SDH001252R0337 | E6.2 III W Terminals F LOWER |
| 1SDH001252R0338 | E6.2 III W Terminals F upper |
| 1SDH001252R0241 | E6.2 III W Terminals HR lower 5000A |
| 1SDH001252R0242 | E6.2 III W Terminals HR lower 6300A |
| 1SDH001252R0243 | E6.2 III W Terminals HR upper 5000A |
| 1SDH001252R0244 | E6.2 III W Terminals HR upper 6300A |
| 1SDH001252R0245 | E6.2 III W Terminals VR lower 5000A |
| 1SDH001252R0246 | E6.2 III W Terminals VR lower 6300A |
| 1SDH001252R0247 | E6.2 III W Terminals VR upper 5000A |
| 1SDH001252R0248 | E6.2 III W Terminals VR upper 6300A |
| 1SDH001060R0108 | E6.2 III-IV Withdrawable Front Terminals F |
| 1SDH001060R0110 | E6.2 Withdrawable flat terminals 6300A FL |

Accessories

| Document Number | Title |
|-----------------|--|
| 1SDH001000R0811 | Ekip AUP auxiliary contacts position - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0501 | Ekip COM actuator - E2.2-E4.2-E6.2 |
| 1SDH001000R0514 | Ekip COM Hub, IEC61850, Modbus TCP, ProfiNet, Ethernet IP, Ekip Link - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0512 | Ekip COM Modbus RS-485, Profibus, DeviceNet - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0505 | Ekip Measuring / Ekip Measuring Pro - E2.2-E4.2-E6.2 |
| 1SDH001000R0520 | Ekip Multimeter - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001257R0001 | Ekip Programming - E1.2-E2.2-E4.2-E6.2-XT2-XT4 |
| 1SDH001000R0508 | Ekip protection release - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0524 | Ekip Signalling 2K - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0516 | Ekip Signalling 4K - E2.2-E4.2-E6.2 |
| 1SDH001000R0511 | Ekip supply - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0513 | Ekip Synchrocheck - E1.2-E2.2-E4.2-E6.2 |
| 1SDH001000R0517 | Ekip T&P - E1.2 - E2.2 - E4.2 - E6.2 |
| 1SDH001000R0519 | Ekip TT, trip test unit - E1.2-E2.2-E4.2-E6.2 |

Installation

| Document Number | Title |
|-----------------|---|
| 1SDH001000R0821 | Installation instructions PF E2.2/E6.2 ML |

For the complete information about current-limiting curve, temperature derating, installation environment, wiring diagrams and other dimensions please refer to the technical catalogue of the standard version.

CHAPTER 6

Ordering codes

| | |
|----------------|-------------------------------|
| 86-87 | Ordering examples |
| 88-89 | Tmax T4/ML |
| 90-91 | Tmax T5/ML |
| 92-92 | Tmax T6/ML |
| 93-93 | Tmax T7/ML |
| 94-95 | Emax 2.2/ML |
| 96-96 | Emax 4.2/ML |
| 97-97 | Emax 6.2/ML |
| 98-100 | Electrical accessories |
| 101-102 | Mechanical accessories |
| 103-103 | Switching devices |
| 104-106 | Ekip modules |
| 107-108 | Terminals |
| 109-109 | Service |

Instructions for ordering

Ordering examples

The code for molded case circuit breakers includes a fixed list of accessories.
For further detail please contact ABB.

Example no. 1

Tmax T4L/ML 250 TMA 160-1600 3p P MP

| | |
|--------------|---|
| 1SDA079912R1 | T4L 250 TMA 160-1600 3p F F KIT MP T4 P 3p SOR-C T4-T5-T6 220..240V AC - 220..250V DC MOE T4-T5 220...250 V AC/DC AUX-C T4-T5-T6 3Q 1SY 250 V AC/DC ADP 12pin AUX T4-T5-T6 P/W ADP 10pin MOE AUE T4-T5-T6 P/W |
|--------------|---|

Ordering examples

- Terminal kit codes (other than standard supply) for fixed part of withdrawable circuit-breaker. The codes refer to 3 or 4 pieces (for mounting on

top or bottom terminals). To convert a complete circuit-breaker, 1 kit for upper terminals and 1 kit for lower terminals must be specified in the order.

Example no. 2

Emax E2.2 2000A 3 poles fixed part with spread upper vertical terminals (SVR) and rear bottom adjustable horizontal (HR) terminals (standard supply)

| | |
|--------------|--------------------------------------|
| 1SDA083381R1 | E2.2/ML W FP Iu=2000 3p HR HR |
| 1SDA074057R1 | Kit SVR upper E2.2 Iu=2000 3pcs INST |

- **Ordering for Ekip modules.** In addition to Ekip Supply modules, up to 3 cartridge modules can be installed on E2.2, E4.2 and E6.2.
Ekip Supply module enables Ekip Com, Ekip Link, Ekip 2K, Ekip Syncrocheck cartridge modules to be installed.

Example no. 3

Emax E4.2H 3 poles with modules: Ekip Supply, Ekip Com Modbus TCP, Ekip Signalling 2K-1, Ekip Com Modbus TCP Redundant and Ekip Signalling 4K

| | |
|--------------|------------------------------------|
| 1SDA083492R1 | E4.2H/ML 3200 Ekip Hi-Touch LSI 3p |
| 1SDA074173R1 | Ekip Supply 24-48V DC E1.2..E6.2 |
| 1SDA074151R1 | Ekip Com Modbus TCP E1.2..E6.2 |
| 1SDA074158R1 | Ekip Com R Modbus TCP E1.2..E6.2 |
| 1SDA074167R1 | Ekip Sign. 2K-1 E1.2..E6.2 |
| 1SDA074170R1 | Ekip Sign. 4K E2.2..E6.2 |

Example no. 4

Emax E4.2H 3 poles with modules: Ekip Supply, Ekip Com EtherNet/IP™, Ekip Com Modbus RS-485 and Ekip Measuring Pro

| | |
|--------------|-----------------------------------|
| 1SDA083492R1 | E4.2H/ML 3200 Ekip Touch LSI 3p |
| 1SDA074173R1 | Ekip Supply 24-48V DC E1.2..E6.2 |
| 1SDA074155R1 | Ekip Com EtherNet/IP™ E1.2..E6.2 |
| 1SDA074150R1 | Ekip Com Modbus RS-485 E1.2..E6.2 |
| 1SDA074189R1 | Ekip Measuring Pro E4.2 |

- **Ordering for electrical accessories.** All the accessories are available. In particular up to 4 coils for E2.2, E4.2 and E6.2.

Example no. 5

Emax E2.2S 3 poles with accessories: opening release, closing release, motor for automatic charging of the springs, second opening release

| | |
|--------------|-------------------------------------|
| 1SDA083426R1 | E2.2S/ML 2000 Ekip Touch LSi LSi 3p |
| 1SDA073674R1 | YO E1.2..E6.2 220-240V AC/DC |
| 1SDA073687R1 | YC E1.2..E6.2 220-240V AC/DC |
| 1SDA073725R1 | M E2.2...E6.2 220-250V AC/DC |
| 1SDA073674R1 | YO E1.2..E6.2 220-240V AC/DC |

Tmax T4/ML

Fixed version

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|---------------|--|--------------|
| 3p | 250 | TMA 250-2500 | T4H/ML 250 TMA 250-2500 3p F F - T45 | 1SDA060462R1 |
| 3p | 250 | TMA 250-2500 | T4S/ML 250 TMA 250-2500 3p F F | 1SDA063696R1 |
| 3p | 250 | | T4D/ML 250 3p F F | 1SDA063677R1 |
| 3p | 250 | PR222DS/P-LSI | T4H/ML 250 PR222DS/P-LSI In=250 3p F F | 1SDA070372R1 |
| 3p | 320 | PR222DS/P-LSI | T4H/ML 320 PR222DS/P-LSI In=320 3p F F | 1SDA070371R1 |

Plug-in moving part

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|----------------|--|--------------|
| 3p | 250 | TMA 250-2500 | T4N/ML 250 TMA 250-2500 3p P MP | 1SDA063643R1 |
| 3p | 250 | TMA 200-2000 | T4N/ML 250 TMA 200-2000 3p P MP | 1SDA063644R1 |
| 3p | 250 | TMA 160-1600 | T4N/ML 250 TMA 160-1600 3p P MP | 1SDA063645R1 |
| 3p | 250 | TMA 125-1250 | T4N/ML 250 TMA 125-1250 3p P MP | 1SDA063646R1 |
| 3p | 250 | TMA 125-1250 | T4N/ML 250 TMA 125-1250 3p P MP | 1SDA063647R1 |
| 3p | 250 | TMA 80-800 | T4N/ML 250 TMA 80-800 3p P MP | 1SDA063648R1 |
| 3p | 250 | TMA 250-2500 | T4L/ML 250 TMA 250-2500 3p P MP | 1SDA069994R1 |
| 3p | 250 | TMA 160-1600 | T4L/ML 250 TMA 160-1600 3p P MP | 1SDA079912R1 |
| 3p | 250 | TMA 250-2500 | T4L/ML 250 TMA 250-2500 3p P MP | 1SDA079913R1 |
| 3p | 250 | TMA 125-1250 | T4L/ML 250 TMA 125-1250 3p P MP | 1SDA079914R1 |
| 3p | 250 | TMA 250-2500 | T4L/ML 250 TMA 250-2500 3p P MP | 1SDA079915R1 |
| 3p | 250 | TMD 32-320 | T4L/ML 250 TMD 32-320 3p P MP | 1SDA079916R1 |
| 3p | 250 | TMA 100-1000 | T4L/ML 250 TMA 100-1000 3p P MP | 1SDA079917R1 |
| 3p | 250 | TMD 20-320 | T4L/ML 250 TMD 20-320 3p P MP | 1SDA079918R1 |
| 3p | 250 | TMA 160-1600 | T4L/ML 250 TMA 160-1600 3p P MP | 1SDA079919R1 |
| 3p | 250 | TMD 32-320 | T4L/MP 250 TMD 32-320 3p P MP | 1SDA079920R1 |
| 3p | 250 | MA 100-1400 | T4L/ML 250 MA 100-1400 3p P MP | 1SDA080362R1 |
| 3p | 250 | TMA 250-2500 | T4S/ML 250 TMA 250-2500 3p P MP | 1SDA080987R1 |
| 3p | 250 | TMA 200-2000 | T4S/ML 250 TMA 200-2000 3p P MP | 1SDA080988R1 |
| 3p | 250 | TMA 80-800 | T4S/ML 250 TMA 80-800 3p P MP | 1SDA080989R1 |
| 3p | 250 | TMA 100-1000 | T4S/ML 250 TMA 100-1000 3p P MP | 1SDA080990R1 |
| 3p | 250 | TMA 125-1250 | T4S/ML 250 TMA 125-1250 3p P MP | 1SDA080994R1 |
| 3p | 250 | TMA 250-2500 | T4S/ML 250 TMA 250-2500 3p P MP | 1SDA080995R1 |
| 3p | 250 | TMA 80-800 | T4S/ML 250 TMA 80-800 3p P MP | 1SDA080996R1 |
| 3p | 250 | TMA 50-500 | T4S/ML 250 TMA 50-500 3p P MP | 1SDA080997R1 |
| 3p | 250 | TMA 250-2500 | T4H/ML 250 TMA 250-2500 3p P MP | 1SDA082395R1 |
| 3p | 250 | TMA 200-2000 | T4H/ML 250 TMA 200-2000 3p P MP | 1SDA082396R1 |
| 3p | 250 | TMA 160-1600 | T4H/ML 250 TMA 160-1600 3p P MP | 1SDA082397R1 |
| 3p | 250 | TMA 100-1000 | T4S/ML 250 TMA 100-1000 3p P MP | 1SDA085231R1 |
| 3p | 250 | TMA 160-1600 | T4S/ML 250 TMA 160-1600 3p P MP | 1SDA085241R1 |
| 3p | 250 | TMA 200-2000 | T4S/ML 250 TMA 200-2000 3p P MP | 1SDA085238R1 |
| 3p | 250 | TMA 200-2000 | T4H/ML 250 TMA 200-2000 3p P MP | 1SDA082478R1 |
| 4p | 250 | TMA 250-2500 | T4V/ML 250 TMA 250-2500 4p P MP InN=100% | 1SDA063592R1 |
| 4p | 250 | TMA 160-1600 | T4V/ML 250 TMA 160-1600 4p P MP InN=100% | 1SDA063594R1 |
| 3p | 100 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=100 3p P MP | 1SDA063636R1 |
| 3p | 100 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=100 3p P MP | 1SDA063623R1 |
| 3p | 100 | PR221LS/I | T4H/ML 250 PR221LS/I In=100 3p P MP | 1SDA069041R1 |
| 3p | 100 | PR222DS/P-LSI | T4H/ML 250 PR222DS/P-LSI In=100 3p P MP | 1SDA085418R1 |
| 3p | 100 | PR222DS/PD-LSI | T4L/ML 250 PR222DS/PD-LSI In=100 3p P MP, UVR, AUX | 1SDA085413R1 |
| 3p | 100 | PR222DS/PD-LSI | T4L/ML 250 PR222DS/PD-LSI In=100 3p P MP | 1SDA085412R1 |
| 3p | 100 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=100 3p P MP | 1SDA085411R1 |
| 3p | 160 | PR222DS/PD-LSI | T4L/ML 250 PR222DS/PD-LSI In=160 3p P MP | 1SDA085410R1 |

The code for molded case circuit breakers includes a fixed list of accessories. For further details please contact ABB.

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|----------------|--|--------------|
| 3p | 160 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=160 3p P MP | 1SDA085409R1 |
| 3p | 160 | PR222DS/PD-LSI | T4L/ML 250 PR222DS/PD-LSI In=160 3p P MP, UVR, AUX | 1SDA085406R1 |
| 3p | 160 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=160 3p P MP | 1SDA063621R1 |
| 3p | 160 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=160 3p P MP | 1SDA063622R1 |
| 3p | 160 | PR221LS/I | T4H/ML 250 PR221LS/I In=160 3p P MP | 1SDA069040R1 |
| 3p | 160 | PR221DS-LS/I | T4S/ML 250 PR221DS-LS/I In=160 3p P MP | 1SDA085236R1 |
| 3p | 250 | PR221DS-LSI I | T4S/ML 250 PR221DS-LSI In=250 3p P MP | 1SDA085240R1 |
| 3p | 250 | PR221LS/I | T4H/ML 250 PR221LS/I In=250 3p P MP | 1SDA069039R1 |
| 3p | 250 | PR221DS-LS/I | T4N/ML 250 PR221DS-LS/I In=250 3p P MP | 1SDA063590R1 |
| 3p | 250 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=250 3p P MP | 1SDA063620R1 |
| 3p | 250 | PR222DS/P-LSI | T4L/ML 250 PR222DS/P-LSI In=250 3p P MP | 1SDA063635R1 |
| 3p | 250 | PR222DS/P-LSI | T4H/ML 250 PR222DS/P-LSI In=250 3p P MP | 1SDA063670R1 |
| 3p | 250 | PR222DS/P-LSI | T4S/ML 250 PR222DS/P-LSI In=250 3p P MP | 1SDA069694R1 |
| 3p | 250 | PR221LS/I | T4H/ML 250 PR221LS/I In=250 3p P MP | 1SDA076110R1 |
| 3p | 250 | PR222DS/P-LSI | T4H/ML 250 PR222DS/P-LSI In=250 3p P MP | 1SDA079906R1 |
| 3p | 250 | PR223EF | T4L/ML 250 PR223EF In=250A 3p P MP | 1SDA082475R1 |
| 3p | 320 | PR221DS-LS/I | T4N/ML 320 PR221DS-LS/I In=320 3p P MP | 1SDA063642R1 |
| 3p | 320 | PR222DS/P-LSI | T4H/ML 320 PR222DS/P-LSI In=320 3p P MP | 1SDA063690R1 |
| 3p | 320 | PR222DS/P-LSI | T4L/ML 320 PR222DS/P-LSI In=320 3p P MP | 1SDA069281R1 |
| 3p | 320 | PR221DS-LS/I | T4S/ML 320 PR221DS-LS/I In=320 3p P MP | 1SDA080986R1 |
| 3p | 320 | PR221DS-LS/I | T4S/ML 320 PR221DS-LS/I In=320 3p P MP | 1SDA085230R1 |
| 3p | 320 | PR222DS/PD-LSI | T4L/ML 320 PR222DS/PD-LSI In=320 3p P MP | 1SDA085416R1 |
| 3p | 320 | PR222DS/PD-LSI | T4L/ML 320 PR222DS/PD-LSI In=320 3p P MP | 1SDA085415R1 |
| 3p | 320 | PR222DS/P-LSI | T4L/ML 320 PR222DS/P-LSI In=320 3p P MP | 1SDA085414R1 |
| 3p | 320 | PR221DS-LS/I | T4N/ML 320 PR221DS-LS/I In=320 3p P MP | 1SDA063591R1 |

Plug-in fixed part

| Type | Code |
|---------------------|--------------|
| T4/ML P FP 3p EF | 1SDA085403R1 |
| T4/ML P FP 3p HR | 1SDA085250R1 |
| T4/ML P FP 3p VR | 1SDA063626R1 |
| T4/ML P FP 3p EF | 1SDA063699R1 |
| T4/ML P FP 3p HR | 1SDA063704R1 |
| T4/ML P FP 4p VR | 1SDA063706R1 |
| T4/ML P FP 3p HR-EF | 1SDA080012R1 |

Withdrawable moving part

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|---------------|---|--------------|
| 3p | 100 | PR222DS/P-LSI | T4H/ML 250 PR222DS/P-LSI In=100 3p W MP | 1SDA085403R1 |
| 3p | 250 | PR222DS/P-LSI | T4H/ML 250 PR222DS/P-LSI In=250 3p W MP | 1SDA085250R1 |
| 3p | 250 | PR222DS-LSI I | T4S/ML 250 PR222DS-LSI In=250 3p W MP | 1SDA063626R1 |
| 3p | 250 | PR222DS/P-LSI | T4V/ML 250 PR222DS/P-LSI In=250 3p W MP | 1SDA063699R1 |
| 3p | 250 | PR222DS-LSI I | T4S/ML 250 PR222DS-LSI In=250 3p W MP | 1SDA063704R1 |
| 3p | 320 | PR221DS-LS/I | T4S/ML 320 PR221DS-LS/I In=320 3p W MP | 1SDA063706R1 |
| 3p | 320 | | T4D/ML 320 3p W MP | 1SDA080012R1 |

Withdrawable fixed part

| Type | Code |
|------------------|--------------|
| T4/ML W FP 3p HR | 1SDA063610R1 |
| T4/ML W FP 3p HR | 1SDA080967R1 |
| T4/ML W FP 3p EF | 1SDA081105R1 |

The code for molded case circuit breakers includes a fixed list of accessories. For further details please contact ABB.

Tmax T5/ML

Fixed version

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|---------------|--|--------------|
| 3p | 400 | TMA 320-3200 | T5N/ML 400 TMA 320-3200 3p F F +AUX- T45 | 1SDA065328R1 |
| 3p | 400 | TMA 320-3200 | T5N/ML 400 TMA 320-3200 3p F F +AUX- T45 | 1SDA065329R1 |
| 3p | 630 | PR221DS-LS/I | T5N/ML 630 PR221DS-LS/I In=630 3p F R | 1SDA063641R1 |
| 3p | 630 | PR221DS-LS/I | T5N/ML 630 PR221DS-LS/I In=630 3p F EF | 1SDA069077R1 |
| 3p | 630 | PR221DS-I | T5L/ML 630 PR221DS-I In=630 3p F ES | 1SDA069581R1 |
| 3p | 400 | PR222DS/P-LSI | T5S/ML 400 PR222DS/P-LSI In=400 3p F F | 1SDA070689R1 |
| 3p | 630 | | T5D/ML 630 3p F F | 1SDA063681R1 |
| 3p | 630 | | T5D/ML 630 3p F F + AUX - T45 | 1SDA065327R1 |
| 4p | 630 | | T5D/ML 630 4p F F | 1SDA063675R1 |

Plug-in moving part

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|----------------|--|--------------|
| 3p | 400 | PR222DS/P-LSI | T5L/ML 400 PR222DS/P-LSI In=400 3p P MP | 1SDA063618R1 |
| 3p | 400 | PR222DS/P-LSI | T5L/ML 400 PR222DS/P-LSI In=320 3p P MP | 1SDA063619R1 |
| 3p | 400 | PR222DS/P-LSI | T5L/ML 400 PR222DS/P-LSI In=320 3p P MP | 1SDA063634R1 |
| 3p | 400 | PR222DS/P-LSI | T5H/ML 400 PR222DS/P-LSI In=400 3p P MP | 1SDA063668R1 |
| 3p | 400 | PR222DS/P-LSI | T5L/ML 400 PR222DS/P-LSI In=400 3p P MP | 1SDA063680R1 |
| 3p | 400 | PR222DS/P-LSI | T5H/ML 400 PR222DS/P-LSI In=400 3p P MP | 1SDA079905R1 |
| 3p | 400 | PR221DS-LS/I | T5L/ML 400 PR221DS-LS/I In=400 3p P MP | 1SDA079911R1 |
| 3p | 400 | PR221DS-LS/I | T5H/ML 400 PR221DS-LS/I In=400 3p P MP | 1SDA082398R1 |
| 3p | 400 | PR221DS-LS/I | T5H/ML 400 PR221DS-LS/I In=400 3p P MP | 1SDA082399R1 |
| 3p | 400 | PR221DS-LS/I | T5H/ML 400 PR221DS-LS/I In=400 3p P MP | 1SDA082400R1 |
| 3p | 400 | PR221DS-LS/I | T5H/ML 400 PR221DS-LS/I In=320 3p P MP | 1SDA082401R1 |
| 3p | 400 | PR221DS-LS/I | T5S/ML 400 PR221DS-LS/I In=400 3p P MP | 1SDA085232R1 |
| 3p | 400 | PR223EF | T5L/ML 400 PR223EF In=400A 3p P MP | 1SDA085408R1 |
| 3p | 400 | PR222DS/PD-LSI | T5L/ML 400 PR222DS/PD-LSI In=400 3p P MP | 1SDA085405R1 |
| 3p | 400 | PR222DS/P-LSI | T5L/ML 400 PR222DS/P-LSI In=400 3p P MP | 1SDA085407R1 |
| 3p | 630 | PR222DS/P-LSI | T5H/ML 630 PR222DS/P-LSI In=630 3p P MP | 1SDA063667R1 |
| 3p | 630 | PR222DS/P-LSI | T5L/ML 630 PR222DS/P-LSI In=630 3p P MP | 1SDA063691R1 |
| 3p | 630 | PR222DS/P-LSI | T5L/ML 630 PR222DS/P-LSI In=630 3p P MP | 1SDA069272R1 |
| 3p | 630 | PR222DS/P-LSI | T5S/ML 630 PR222DS/P-LSI In=630 3p P MP | 1SDA069692R1 |
| 3p | 630 | PR221DS-LS/I | T5L/ML 630 PR221DS-LS/I In=630 3p P MP | 1SDA079909R1 |
| 3p | 630 | PR221DS-LS/I | T5L/ML 630 PR221DS-LS/I In=630 3p P MP | 1SDA079910R1 |
| 3p | 630 | PR221DS-LS/I | T5S/ML 630 PR221DS-LS/I In=630 3p P MP | 1SDA080983R1 |
| 3p | 630 | PR221DS-LS/I | T5H/ML 630 PR221DS-LS/I 630 P MP | 1SDA083069R1 |
| 3p | 400 | | T5D/ML 400 3p P MP | 1SDA085417R1 |
| 3p | 630 | | T5D/ML 630 3p P MP | 1SDA081004R1 |
| 4p | 400 | TMA 320-3200 | T5V/ML 400 TMA 320-3200 4p P MP InN=100% | 1SDA063593R1 |
| 4p | 630 | TMA 500-5000 | T5V/ML 630 TMA 500-5000 4p P MP InN=100% | 1SDA063597R1 |
| 4p | 630 | TMA 500-5000 | T5V/ML 630 TMA 500-5000 4p P MP InN=100% | 1SDA063598R1 |

The code for molded case circuit breakers includes a fixed list of accessories. For further details please contact ABB.

Plug-in fixed part

| | Type | Code |
|--|----------------------|--------------|
| | T5/ML 400 P FP 3p EF | 1SDA085404R1 |
| | T5/ML 400 P FP 3p HR | 1SDA085249R1 |
| | T5/ML 630 P FP 3p VR | 1SDA063624R1 |
| | T5/ML 400 P FP 3p VR | 1SDA063625R1 |
| | T5/ML 630 P FP 3p HR | 1SDA063700R1 |
| | T5/ML 400 P FP 3p HR | 1SDA063701R1 |
| | T5/ML 630 P FP 4p VR | 1SDA063707R1 |
| | T5/ML 630 P FP 3p ES | 1SDA069548R1 |

Withdrawable moving part

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|---------------|--|--------------|
| 3p | 400 | PR221DS-LS/I | T5V/ML 400 PR221DS-LS/I In=400 3p W MP | 1SDA063181R1 |
| 3p | 400 | PR221DS-LS/I | T5N/ML 400 PR221DS-LS/I In=400 3p W MP | 1SDA063599R1 |
| 3p | 400 | PR222DS/P-LSI | T5S/ML 400 PR222DS/P-LSI In=400 3p W MP | 1SDA069693R1 |
| 3p | 400 | PR222DS/P-LSI | T5V/ML 400 PR222DS/P-LSI In=400A 3p W MP | 1SDA083067R1 |
| 3p | 630 | PR221DS-LS/I | T5V/ML 630 PR221DS-LS/I In=630 3p W MP | 1SDA063182R1 |
| 3p | 630 | PR221DS-LS/I | T5N/ML 630 PR221DS-LS/I In=630 3p W MP | 1SDA063639R1 |
| 3p | 630 | PR221DS-LS/I | T5N/ML 630 PR221DS-LS/I In=630 3p W MP | 1SDA063640R1 |
| 3p | 630 | PR221DS-LS/I | T5S/ML 630 PR221DS-LS/I In=630 3p W MP | 1SDA080984R1 |
| 3p | 630 | PR221DS-LS/I | T5S/ML 630 PR221DS-LS/I In=630 3p W MP | 1SDA081884R1 |

Withdrawable fixed part

| | Type | Code |
|--|----------------------|--------------|
| | T5/ML 400 W FP 3p EF | 1SDA063185R1 |
| | T5/ML 630 W FP 3p EF | 1SDA063186R1 |
| | T5/ML 630 W FP 3p HR | 1SDA063702R1 |
| | T5/ML 400 W FP 3p HR | 1SDA063705R1 |
| | T5/ML 630 W FP 3p ES | 1SDA069052R1 |
| | T5/ML 400 W FP 3p HR | 1SDA083066R1 |

The code for molded case circuit breakers includes a fixed list of accessories. For further details please contact ABB.

Tmax T6/ML

Fixed version

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|-----------|--------------------|--------------|
| 3p | 630 | | T6D/ML 630 3p F EF | 1SDA070208R1 |

Withdrawable moving part

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|---------------|---|--------------|
| 3p | 800 | PR222DS/P-LSI | T6N/ML 800 PR222DS/P-LSI In=800 3p W MP | 1SDA063595R1 |
| 3p | 800 | PR222DS/P-LSI | T6N/ML 800 PR222DS/P-LSI In=800 3p W MP | 1SDA063596R1 |
| 3p | 800 | PR222DS/P-LSI | T6L/ML 800 PR222DS/P-LSI In=800 3p W MP | 1SDA069814R1 |

Withdrawable fixed part

| | Type | Code |
|--|---------------------|--------------|
| | T6/ML W FP 3p HR | 1SDA063713R1 |
| | T6/ML W FP 3p VR/HR | 1SDA069815R1 |

Tmax T7/ML

Withdrawable moving part

| Poles | Iu | Trip unit | Type | Code |
|-------|-----|-------------|--|--------------|
| 3p | 800 | PR332/P LSI | T7H/ML 800 PR332/P LSI In=800A 3p W MP | 1SDA063607R1 |

Withdrawable fixed part

| Type | Code |
|------------------------|--------------|
| T7-X1/ML W FP 3p HR-HR | 1SDA063608R1 |
| T7-X1/ML W FP 3p VR-VR | 1SDA069833R1 |
| T7-X1/ML W FP 3p HR-HR | 1SDA080964R1 |

Emax E2.2/ML

Circuit breaker moving part

| lu | performance frame | Type | Code |
|------|-------------------|-----------------------------------|--------------|
| 800 | N | E2.2N/ML 800 Ekip Dip LSI | 1SDA083405R1 |
| 800 | N | E2.2N/ML 800 Ekip G Hi-Touch LSI | 1SDA083409R1 |
| 800 | N | E2.2N/ML 800 Ekip G Touch LSI | 1SDA083408R1 |
| 800 | N | E2.2N/ML 800 Ekip Hi-Touch LSI | 1SDA083407R1 |
| 800 | N | E2.2N/ML 800 Ekip Touch LSI | 1SDA083406R1 |
| 1250 | N | E2.2N/ML 1250 Ekip Dip LSI | 1SDA083410R1 |
| 1250 | N | E2.2N/ML 1250 Ekip G Hi-Touch LSI | 1SDA083414R1 |
| 1250 | N | E2.2N/ML 1250 Ekip G Touch LSI | 1SDA083413R1 |
| 1250 | N | E2.2N/ML 1250 Ekip Hi-Touch LSI | 1SDA083412R1 |
| 1250 | N | E2.2N/ML 1250 Ekip Touch LSI | 1SDA083411R1 |
| 1600 | N | E2.2N/ML 1600 Ekip Dip LSI | 1SDA083415R1 |
| 1600 | N | E2.2N/ML 1600 Ekip G Hi-Touch LSI | 1SDA083419R1 |
| 1600 | N | E2.2N/ML 1600 Ekip G Touch LSI | 1SDA083418R1 |
| 1600 | N | E2.2N/ML 1600 Ekip Hi-Touch LSI | 1SDA083417R1 |
| 1600 | N | E2.2N/ML 1600 Ekip Touch LSI | 1SDA083416R1 |
| 2000 | N | E2.2N/ML 2000 Ekip Dip LSI | 1SDA083420R1 |
| 2000 | N | E2.2N/ML 2000 Ekip G Hi-Touch LSI | 1SDA083424R1 |
| 2000 | N | E2.2N/ML 2000 Ekip G Touch LSI | 1SDA083423R1 |
| 2000 | N | E2.2N/ML 2000 Ekip Hi-Touch LSI | 1SDA083422R1 |
| 2000 | N | E2.2N/ML 2000 Ekip Touch LSI | 1SDA083421R1 |
| 2500 | N | E2.2N/ML 2500 Ekip Dip LSI | 1SDA083425R1 |
| 2500 | N | E2.2N/ML 2500 Ekip G Hi-Touch LSI | 1SDA083429R1 |
| 2500 | N | E2.2N/ML 2500 Ekip G Touch LSI | 1SDA083428R1 |
| 2500 | N | E2.2N/ML 2500 Ekip Hi-Touch LSI | 1SDA083427R1 |
| 2500 | N | E2.2N/ML 2500 Ekip Touch LSI | 1SDA083426R1 |
| 800 | S | E2.2S/ML 800 Ekip Dip LSI | 1SDA083435R1 |
| 800 | S | E2.2S/ML 800 Ekip G Hi-Touch LSI | 1SDA083439R1 |
| 800 | S | E2.2S/ML 800 Ekip G Touch LSI | 1SDA083438R1 |
| 800 | S | E2.2S/ML 800 Ekip Hi-Touch LSI | 1SDA083437R1 |
| 800 | S | E2.2S/ML 800 Ekip Touch LSI | 1SDA083436R1 |
| 1250 | S | E2.2S/ML 1250 Ekip Dip LSI | 1SDA083440R1 |
| 1250 | S | E2.2S/ML 1250 Ekip G Hi-Touch LSI | 1SDA083444R1 |
| 1250 | S | E2.2S/ML 1250 Ekip G Touch LSI | 1SDA083443R1 |
| 1250 | S | E2.2S/ML 1250 Ekip Hi-Touch LSI | 1SDA083442R1 |
| 1250 | S | E2.2S/ML 1250 Ekip Touch LSI | 1SDA083441R1 |
| 1600 | S | E2.2S/ML 1600 Ekip Dip LSI | 1SDA083445R1 |
| 1600 | S | E2.2S/ML 1600 Ekip G Hi-Touch LSI | 1SDA083449R1 |
| 1600 | S | E2.2S/ML 1600 Ekip G Touch LSI | 1SDA083448R1 |
| 1600 | S | E2.2S/ML 1600 Ekip Hi-Touch LSI | 1SDA083447R1 |
| 1600 | S | E2.2S/ML 1600 Ekip Touch LSI | 1SDA083446R1 |
| 2000 | S | E2.2S/ML 2000 Ekip Dip LSI | 1SDA083450R1 |
| 2000 | S | E2.2S/ML 2000 Ekip G Hi-Touch LSI | 1SDA083454R1 |
| 2000 | S | E2.2S/ML 2000 Ekip G Touch LSI | 1SDA083453R1 |
| 2000 | S | E2.2S/ML 2000 Ekip Hi-Touch LSI | 1SDA083452R1 |
| 2000 | S | E2.2S/ML 2000 Ekip Touch LSI | 1SDA083451R1 |
| 2500 | S | E2.2S/ML 2500 Ekip Dip LSI | 1SDA083455R1 |
| 2500 | S | E2.2S/ML 2500 Ekip G Hi-Touch LSI | 1SDA083459R1 |
| 2500 | S | E2.2S/ML 2500 Ekip G Touch LSI | 1SDA083458R1 |
| 2500 | S | E2.2S/ML 2500 Ekip Hi-Touch LSI | 1SDA083457R1 |
| 2500 | S | E2.2S/ML 2500 Ekip Touch LSI | 1SDA083456R1 |

| lu | performance frame | Type | Code |
|------|-------------------|------------------------------------|--------------|
| 800 | H | E2.2H/ML 800 Ekip Dip LSI | 1SDA083460R1 |
| 800 | H | E2.2H/ML 800 Ekip G Hi-Touch LSIG | 1SDA083463R1 |
| 800 | H | E2.2H/ML 800 Ekip G Touch LSIG | 1SDA083462R1 |
| 800 | H | E2.2H/ML 800 Ekip Hi-Touch LSI | 1SDA083461R1 |
| 800 | H | E2.2H/ML 800 Ekip Touch LSI | 1SDA083374R1 |
| 1250 | H | E2.2H/ML 1250 Ekip Dip LSI | 1SDA083464R1 |
| 1250 | H | E2.2H/ML 1250 Ekip G Hi-Touch LSIG | 1SDA083467R1 |
| 1250 | H | E2.2H/ML 1250 Ekip G Touch LSIG | 1SDA083466R1 |
| 1250 | H | E2.2H/ML 1250 Ekip Hi-Touch LSI | 1SDA083465R1 |
| 1250 | H | E2.2H/ML 1250 Ekip Touch-LSI | 1SDA083378R1 |
| 1600 | H | E2.2H/ML 1600 Ekip Dip LSI | 1SDA083468R1 |
| 1600 | H | E2.2H/ML 1600 Ekip G Hi-Touch LSIG | 1SDA083471R1 |
| 1600 | H | E2.2H/ML 1600 Ekip G Touch LSIG | 1SDA083470R1 |
| 1600 | H | E2.2H/ML 1600 Ekip Hi-Touch LSI | 1SDA083469R1 |
| 1600 | H | E2.2H/ML 1600 Ekip Touch-LSI | 1SDA083377R1 |
| 2000 | H | E2.2H/ML 2000 Ekip Dip LSI | 1SDA083472R1 |
| 2000 | H | E2.2H/ML 2000 Ekip G Hi-Touch LSIG | 1SDA083476R1 |
| 2000 | H | E2.2H/ML 2000 Ekip G Touch LSIG | 1SDA083475R1 |
| 2000 | H | E2.2H/ML 2000 Ekip Hi-Touch LSI | 1SDA083474R1 |
| 2000 | H | E2.2H/ML 2000 Ekip Touch LSI | 1SDA083473R1 |
| 2500 | H | E2.2H/ML 2500 Ekip Dip LSI | 1SDA083477R1 |
| 2500 | H | E2.2H/ML 2500 Ekip G Hi-Touch LSIG | 1SDA083480R1 |
| 2500 | H | E2.2H/ML 2500 Ekip G Touch LSIG | 1SDA083479R1 |
| 2500 | H | E2.2H/ML 2500 Ekip Hi-Touch LSI | 1SDA083478R1 |
| 2500 | H | E2.2H/ML 2500 Ekip Touch-LSI | 1SDA083376R1 |

Switch disconnecter moving part

| lu | performance frame | Type | Code |
|------|-------------------|-------------------------|--------------|
| 800 | N | E2.2N/ML/MS 800 3p WMP | 1SDA083571R1 |
| 1250 | N | E2.2N/ML/MS 1250 3p WMP | 1SDA083572R1 |
| 1600 | N | E2.2N/ML/MS 1600 3p WMP | 1SDA083573R1 |
| 2000 | N | E2.2N/ML/MS 2000 3p WMP | 1SDA083574R1 |
| 2500 | N | E2.2N/ML/MS 2500 3p WMP | 1SDA083575R1 |
| 800 | H | E2.2H/ML/MS 800 3p WMP | 1SDA083576R1 |
| 1250 | H | E2.2H/ML/MS 1250 3p WMP | 1SDA083577R1 |
| 1600 | H | E2.2H/ML/MS 1600 3p WMP | 1SDA083578R1 |
| 2000 | H | E2.2H/ML/MS 2000 3p WMP | 1SDA083579R1 |
| 2500 | H | E2.2H/ML/MS 2500 3p WMP | 1SDA083580R1 |

Fixed part

| Size | performance | lu range | Type of terminal | Type | Code |
|------|-------------|----------|------------------|----------------------------|--------------|
| E2.2 | N, S, H | 400-2000 | HR-HR | E2.2/ML W FP lu=2000 HR HR | 1SDA083381R1 |
| E2.2 | N, S, H | 2500 | HR-HR | E2.2/ML W FP lu=2500 HR HR | 1SDA083382R1 |

Emax E4.2/ML

Circuit breaker moving part

| lu | performance frame | Type | Code |
|------|-------------------|-----------------------------------|--------------|
| 3200 | N | E4.2N/ML 3200 Ekip Dip LSI | 1SDA083481R1 |
| 3200 | N | E4.2N/ML 3200 Ekip G Hi-Touch LSI | 1SDA083485R1 |
| 3200 | N | E4.2N/ML 3200 Ekip G Touch LSI | 1SDA083484R1 |
| 3200 | N | E4.2N/ML 3200 Ekip Hi-Touch LSI | 1SDA083483R1 |
| 3200 | N | E4.2N/ML 3200 Ekip Touch LSI | 1SDA083482R1 |
| 4000 | N | E4.2N/ML 4000 Ekip Dip LSI | 1SDA083486R1 |
| 4000 | N | E4.2N/ML 4000 Ekip G Hi-Touch LSI | 1SDA083490R1 |
| 4000 | N | E4.2N/ML 4000 Ekip G Touch LSI | 1SDA083489R1 |
| 4000 | N | E4.2N/ML 4000 Ekip Hi-Touch LSI | 1SDA083488R1 |
| 4000 | N | E4.2N/ML 4000 Ekip Touch LSI | 1SDA083487R1 |
| 3200 | H | E4.2H/ML 3200 Ekip Dip LSI | 1SDA083491R1 |
| 3200 | H | E4.2H/ML 3200 Ekip G Hi-Touch LSI | 1SDA083494R1 |
| 3200 | H | E4.2H/ML 3200 Ekip G Touch LSI | 1SDA083493R1 |
| 3200 | H | E4.2H/ML 3200 Ekip Hi-Touch LSI | 1SDA083492R1 |
| 3200 | H | E4.2H/ML 3200 Ekip Touch LSI | 1SDA083375R1 |
| 4000 | H | E4.2H/ML 4000 Ekip Dip LSI | 1SDA083495R1 |
| 4000 | H | E4.2H/ML 4000 Ekip G Hi-Touch LSI | 1SDA083498R1 |
| 4000 | H | E4.2H/ML 4000 Ekip G Touch LSI | 1SDA083497R1 |
| 4000 | H | E4.2H/ML 4000 Ekip Hi-Touch LSI | 1SDA083496R1 |
| 4000 | H | E4.2H/ML 4000 Ekip Touch LSI | 1SDA083380R1 |
| 2000 | V | E4.2V/ML 2000 Ekip Dip LSI | 1SDA083499R1 |
| 2000 | V | E4.2V/ML 2000 Ekip G Hi-Touch LSI | 1SDA083503R1 |
| 2000 | V | E4.2V/ML 2000 Ekip G Touch LSI | 1SDA083502R1 |
| 2000 | V | E4.2V/ML 2000 Ekip Hi-Touch LSI | 1SDA083501R1 |
| 2000 | V | E4.2V/ML 2000 Ekip Touch LSI | 1SDA083500R1 |
| 2500 | V | E4.2V/ML 2500 Ekip Dip LSI | 1SDA083504R1 |
| 2500 | V | E4.2V/ML 2500 Ekip G Hi-Touch LSI | 1SDA083508R1 |
| 2500 | V | E4.2V/ML 2500 Ekip G Touch LSI | 1SDA083507R1 |
| 2500 | V | E4.2V/ML 2500 Ekip Hi-Touch LSI | 1SDA083506R1 |
| 2500 | V | E4.2V/ML 2500 Ekip Touch LSI | 1SDA083505R1 |
| 3200 | V | E4.2V/ML 3200 Ekip Dip LSI | 1SDA083509R1 |
| 3200 | V | E4.2V/ML 3200 Ekip G Hi-Touch LSI | 1SDA083513R1 |
| 3200 | V | E4.2V/ML 3200 Ekip G Touch LSI | 1SDA083512R1 |
| 3200 | V | E4.2V/ML 3200 Ekip Hi-Touch LSI | 1SDA083511R1 |
| 3200 | V | E4.2V/ML 3200 Ekip Touch LSI | 1SDA083510R1 |
| 4000 | V | E4.2V/ML 4000 Ekip Dip LSI | 1SDA083514R1 |
| 4000 | V | E4.2V/ML 4000 Ekip G Hi-Touch LSI | 1SDA083518R1 |
| 4000 | V | E4.2V/ML 4000 Ekip G Touch LSI | 1SDA083517R1 |
| 4000 | V | E4.2V/ML 4000 Ekip Hi-Touch LSI | 1SDA083516R1 |
| 4000 | V | E4.2V/ML 4000 Ekip Touch LSI | 1SDA083515R1 |

Switch disconnecter moving part

| lu | performance frame | Type | Code |
|------|-------------------|-------------------------|--------------|
| 3200 | N | E4.2N/ML/MS 3200 3p WMP | 1SDA083581R1 |
| 4000 | N | E4.2N/ML/MS 4000 3p WMP | 1SDA083582R1 |
| 3200 | H | E4.2H/ML/MS 3200 3p WMP | 1SDA083583R1 |
| 4000 | H | E4.2H/ML/MS 4000 3p WMP | 1SDA083584R1 |
| 2000 | V | E4.2V/ML/MS 2000 3p WMP | 1SDA083585R1 |
| 2500 | V | E4.2V/ML/MS 2500 3p WMP | 1SDA083586R1 |
| 3200 | V | E4.2V/ML/MS 3200 3p WMP | 1SDA083587R1 |
| 4000 | V | E4.2V/ML/MS 4000 3p WMP | 1SDA083588R1 |

Fixed part

| Size | performance | lu range | Type of terminal | Type | Code |
|------|-------------|-----------|------------------|---|--------------|
| E4.2 | N, H | 3200 | HR-HR | E4.2/ML W FP lu=3200 HR HR | 1SDA083383R1 |
| E4.2 | V | 2000-4000 | HR-HR | E4.2/ML W FP lu=4000 o versione V HR HR | 1SDA083596R1 |

Emax E6.2/ML

Circuit breaker moving part

| lu | performance frame | Type | Code |
|------|-------------------|------------------------------------|--------------|
| 4000 | H | E6.2H/ML 4000 Ekip Dip LSI | 1SDA083519R1 |
| 4000 | H | E6.2H/ML 4000 Ekip G Hi-Touch LSIG | 1SDA083523R1 |
| 4000 | H | E6.2H/ML 4000 Ekip G Touch LSIG | 1SDA083522R1 |
| 4000 | H | E6.2H/ML 4000 Ekip Hi-Touch LSI | 1SDA083521R1 |
| 4000 | H | E6.2H/ML 4000 Ekip Touch LSI | 1SDA083520R1 |
| 5000 | H | E6.2H/ML 5000 Ekip Dip LSI | 1SDA083524R1 |
| 5000 | H | E6.2H/ML 5000 Ekip G Hi-Touch LSIG | 1SDA083528R1 |
| 5000 | H | E6.2H/ML 5000 Ekip G Touch LSIG | 1SDA083527R1 |
| 5000 | H | E6.2H/ML 5000 Ekip Hi-Touch LSI | 1SDA083526R1 |
| 5000 | H | E6.2H/ML 5000 Ekip Touch LSI | 1SDA083525R1 |
| 6300 | H | E6.2H/ML 6300 Ekip Dip LSI | 1SDA083529R1 |
| 6300 | H | E6.2H/ML 6300 Ekip G Hi-Touch LSIG | 1SDA083533R1 |
| 6300 | H | E6.2H/ML 6300 Ekip G Touch LSIG | 1SDA083532R1 |
| 6300 | H | E6.2H/ML 6300 Ekip Hi-Touch LSI | 1SDA083531R1 |
| 6300 | H | E6.2H/ML 6300 Ekip Touch LSI | 1SDA083530R1 |
| 4000 | V | E6.2V/ML 4000 Ekip Dip LSI | 1SDA083534R1 |
| 4000 | V | E6.2V/ML 4000 Ekip G Hi-Touch LSIG | 1SDA083538R1 |
| 4000 | V | E6.2V/ML 4000 Ekip G Touch LSIG | 1SDA083537R1 |
| 4000 | V | E6.2V/ML 4000 Ekip Hi-Touch LSI | 1SDA083536R1 |
| 4000 | V | E6.2V/ML 4000 Ekip Touch LSI | 1SDA083535R1 |
| 5000 | V | E6.2V/ML 5000 Ekip Dip LSI | 1SDA083539R1 |
| 5000 | V | E6.2V/ML 5000 Ekip G Hi-Touch LSIG | 1SDA083543R1 |
| 5000 | V | E6.2V/ML 5000 Ekip G Touch LSIG | 1SDA083542R1 |
| 5000 | V | E6.2V/ML 5000 Ekip Hi-Touch LSI | 1SDA083541R1 |
| 5000 | V | E6.2V/ML 5000 Ekip Touch LSI | 1SDA083540R1 |
| 6300 | V | E6.2V/ML 6300 Ekip Dip LSI | 1SDA083544R1 |
| 6300 | V | E6.2V/ML 6300 Ekip G Hi-Touch LSIG | 1SDA083548R1 |
| 6300 | V | E6.2V/ML 6300 Ekip G Touch LSIG | 1SDA083547R1 |
| 6300 | V | E6.2V/ML 6300 Ekip Hi-Touch LSI | 1SDA083546R1 |
| 6300 | V | E6.2V/ML 6300 Ekip Touch LSI | 1SDA083545R1 |

Switch disconnecter moving part

| lu | performance frame | Type | Code |
|------|-------------------|-------------------------|--------------|
| 4000 | H | E6.2H/ML/MS 4000 3p WMP | 1SDA083589R1 |
| 5000 | H | E6.2H/ML/MS 5000 3p WMP | 1SDA083590R1 |
| 6300 | H | E6.2H/ML/MS 6300 3p WMP | 1SDA083591R1 |
| 4000 | X | E6.2X/ML/MS 4000 3p WMP | 1SDA083592R1 |
| 5000 | X | E6.2X/ML/MS 5000 3p WMP | 1SDA083593R1 |
| 6300 | X | E6.2X/ML/MS 6300 3p WMP | 1SDA083594R1 |

Fixed part

| Size | performance | lu range | Type of terminal | Type | Code |
|------|-------------|-----------|------------------|---|--------------|
| E6.2 | H, V | 4000-5000 | HR-HR | E6.2/ML W FP lu=5000 HR HR | 1SDA083597R1 |
| E6.2 | H, V, X | 4000-5000 | HR-HR | E6.2/ML W FP lu=6300 o versione X HR HR | 1SDA083598R1 |

Accessories

Electrical accessories



First and second opening release - YO

| Size | Type | Code |
|------------|--|--------------|
| E1.2..E6.2 | YO E1.2..E6.2 24V AC/DC | 1SDA073668R1 |
| E1.2..E6.2 | YO E1.2..E6.2 30V AC/DC | 1SDA073669R1 |
| E1.2..E6.2 | YO E1.2..E6.2 48V AC/DC | 1SDA073670R1 |
| E1.2..E6.2 | YO E1.2..E6.2 60V AC/DC | 1SDA073671R1 |
| E1.2..E6.2 | YO E1.2..E6.2 110-120V AC/DC | 1SDA073672R1 |
| E1.2..E6.2 | YO E1.2..E6.2 120-127V AC/DC | 1SDA073673R1 |
| E1.2..E6.2 | YO E1.2..E6.2 220-240V AC/DC | 1SDA073674R1 |
| E1.2..E6.2 | YO E1.2..E6.2 240-250V AC/DC | 1SDA073675R1 |
| E1.2..E6.2 | YO E1.2..E6.2 380-400V AC | 1SDA073677R1 |
| E1.2..E6.2 | YO E1.2..E6.2 415-440V AC | 1SDA073678R1 |
| E1.2..E6.2 | YO E1.2..E6.2 480-500V AC | 1SDA073679R1 |

First and second closing release- YC

| Size | Type | Code |
|------------|--|--------------|
| E1.2..E6.2 | YC E1.2..E6.2 24V AC/DC | 1SDA073681R1 |
| E1.2..E6.2 | YC E1.2..E6.2 30V AC/DC | 1SDA073682R1 |
| E1.2..E6.2 | YC E1.2..E6.2 48V AC/DC | 1SDA073683R1 |
| E1.2..E6.2 | YC E1.2..E6.2 60V AC/DC | 1SDA073684R1 |
| E1.2..E6.2 | YC E1.2..E6.2 110-120V AC/DC | 1SDA073685R1 |
| E1.2..E6.2 | YC E1.2..E6.2 120-127V AC/DC | 1SDA073686R1 |
| E1.2..E6.2 | YC E1.2..E6.2 220-240V AC/DC | 1SDA073687R1 |
| E1.2..E6.2 | YC E1.2..E6.2 240-250V AC/DC | 1SDA073688R1 |
| E1.2..E6.2 | YC E1.2..E6.2 380-400V AC | 1SDA073690R1 |
| E1.2..E6.2 | YC E1.2..E6.2 415-440V AC | 1SDA073691R1 |
| E1.2..E6.2 | YC E1.2..E6.2 480-500V AC | 1SDA073692R1 |

YO/YC test unit

| Size | Type | Code |
|--------------|---|--------------|
| E1.2...E6.2* | YO/YC test unit E1.2...E6.2 | 1SDA082751R1 |

*Only as loose part

Undervoltage release - YU

| Size | Type | Code |
|------------|--|--------------|
| E1.2..E6.2 | YU E1.2..E6.2 24V AC/DC | 1SDA073694R1 |
| E1.2..E6.2 | YU E1.2..E6.2 30V AC/DC | 1SDA073695R1 |
| E1.2..E6.2 | YU E1.2..E6.2 48V AC/DC | 1SDA073696R1 |
| E1.2..E6.2 | YU E1.2..E6.2 60V AC/DC | 1SDA073697R1 |
| E1.2..E6.2 | YU E1.2..E6.2 110-120V AC/DC | 1SDA073698R1 |
| E1.2..E6.2 | YU E1.2..E6.2 120-127V AC/DC | 1SDA073699R1 |
| E1.2..E6.2 | YU E1.2..E6.2 220-240V AC/DC | 1SDA073700R1 |
| E1.2..E6.2 | YU E1.2..E6.2 240-250V AC/DC | 1SDA073701R1 |
| E1.2..E6.2 | YU E1.2..E6.2 380-400V AC | 1SDA073703R1 |
| E1.2..E6.2 | YU E1.2..E6.2 415-440V AC | 1SDA073704R1 |
| E1.2..E6.2 | YU E1.2..E6.2 480-500V AC | 1SDA073705R1 |

Electronic time-delay device for undervoltage release - UVD

| Size | Type | Code |
|-------------|----------------------------------|--------------|
| E1.2...E6.2 | 24...30V DC | 1SDA038316R1 |
| E1.2...E6.2 | 48V AC/DC | 1SDA038317R1 |
| E1.2...E6.2 | 60V AC/DC | 1SDA038318R1 |
| E1.2...E6.2 | 110...127V AC/DC | 1SDA038319R1 |
| E1.2...E6.2 | 220...250V AC/DC | 1SDA038320R1 |

**Remote Reset - YR**

| Size | Type | Code |
|--------------|---|--------------|
| E2.2...E6.2 | YR 24V DC E2.2...E6.2 | 1SDA073747R1 |
| E2.2...E6.2* | YR 110V AC/DC E2.2...E6.2 | 1SDA073748R1 |
| E2.2...E6.2* | YR 250V AC/DC E2.2...E6.2 | 1SDA073749R1 |

* when YR is used in DC, the activation of YR must be done with a maximum impulse time of 50ms.
The YR cannot be powered permanently.

Motor - M

| Size | Type | Code |
|-------------|---|--------------|
| E2.2...E6.2 | M E2.2...E6.2 24-30V AC/DC+S33 M/2 400V | 1SDA073722R1 |
| E2.2...E6.2 | M E2.2...E6.2 48-60V AC/DC+S33 M/2 400V | 1SDA073723R1 |
| E2.2...E6.2 | M E2.2...E6.2 100-130V AC/DC+S33 M/2 400V | 1SDA073724R1 |
| E2.2...E6.2 | M E2.2...E6.2 220-250V AC/DC+S33 M/2 400V | 1SDA073725R1 |
| E2.2...E6.2 | M E2.2...E6.2 380-415V AC+S33 M/2 400V | 1SDA073727R1 |
| E2.2...E6.2 | M E2.2...E6.2 24-30V AC/DC + S33 M/2 24V DC | 1SDA073729R1 |
| E2.2...E6.2 | M E2.2...E6.2 48-60V AC/DC + S33 M/2 24V DC | 1SDA073730R1 |
| E2.2...E6.2 | M E2.2...E6.2 100-130V AC/DC + S33 M/2 24V DC | 1SDA073731R1 |
| E2.2...E6.2 | M E2.2...E6.2 220-250V AC/DC + S33 M/2 24V DC | 1SDA073732R1 |

**Open/closed auxiliary contacts - AUX**

| Size | Type | Code |
|--------------|--|--------------|
| E2.2...E6.2* | AUX 4Q 400V E2.2...E6.2 | 1SDA073753R1 |
| E2.2...E6.2 | AUX 4Q 24V E2.2...E6.2 | 1SDA073754R1 |
| E2.2...E6.2 | AUX 2Q 400V + 2Q 24V E2.2...E6.2 | 1SDA073755R1 |
| E2.2...E6.2 | AUX 6Q 400V E2.2...E6.2 | 1SDA073756R1 |
| E2.2...E6.2 | AUX 6Q 24V E2.2...E6.2 | 1SDA073757R1 |
| E2.2...E6.2 | AUX 3Q 400V AC + 3Q 24V DC E2.2...E6.2 | 1SDA075973R1 |

* Standard supply with automatic circuit-breakers



Accessories

Electrical accessories



Auxiliary position contacts - AUP

| Size | Type | Code |
|-------------|---|--------------|
| E2.2...E6.2 | AUP 5 contacts 400V E2.2...E6.2 - left set | 1SDA073764R1 |
| E2.2...E6.2 | AUP 5 contacts 24V E2.2...E6.2 - left set | 1SDA073765R1 |
| E2.2...E6.2 | AUP 5 suppl. contacts 400V E2.2...E6.2 - right set | 1SDA073766R1 |
| E2.2...E6.2 | AUP 5 suppl. contacts 24V E2.2...E6.2 - right set | 1SDA073767R1 |
| E2.2...E6.2 | AUP 5 suppl. contacts 400V E2.2...E6.2 - 1in 3test 1out - right set | 1SDA082749R1 |
| E1.2...E6.2 | AUP Ekip auxiliary position contact E1.2..E6.2 | 1SDA073768R1 |

Ready to close signalling contact- RTC

| Size | Type | Code |
|-------------|--|--------------|
| E2.2...E6.2 | RTC 250V E2.2...E6.2 | 1SDA073773R1 |
| E2.2...E6.2 | RTC 24V E2.2...E6.2 | 1SDA073774R1 |
| E2.2...E6.2 | RTC Ekip 24V E2.2...E6.2 | 1SDA073775R1 |



Contact signalling tripping of Ekip protection trip unit - S51

| Size | Type | Code |
|-------------|--------------------------------------|--------------|
| E2.2...E6.2 | S51 250V E2.2...E6.2 | 1SDA073778R1 |
| E2.2...E6.2 | S51 24V E2.2...E6.2 | 1SDA073779R1 |



Terminals for auxiliary connection

| Size | Type | Code |
|-------------|-----------------------------------|--------------|
| E1.2...E6.2 | Terminals 10 pcs. | 1SDA073906R1 |

Accessories

Mechanical accessories



Mechanical operation counter - MOC

| Size | Type | Code |
|-------------|--|--------------|
| E2.2...E6.2 | MOC Mechanical operation counter | 1SDA073781R1 |



Key lock in open position - KLC

| Size | Type | Code |
|-------------|--|--------------|
| E2.2...E6.2 | KLC-D Key lock open E2.2...E6.2 | 1SDA073791R1 |
| E2.2...E6.2 | KLC-S key lock open N.20005 E2.2..E6.2 | 1SDA073792R1 |
| E2.2...E6.2 | KLC-S key lock open N.20006 E2.2..E6.2 | 1SDA073793R1 |
| E2.2...E6.2 | KLC-S key lock open N.20007 E2.2..E6.2 | 1SDA073794R1 |
| E2.2...E6.2 | KLC-S key lock open N.20008 E2.2..E6.2 | 1SDA073795R1 |
| E2.2...E6.2 | KLC-S key lock open N.20009 E2.2..E6.2 | 1SDA073796R1 |



Key lock in racked-in / test / racked-out position- KLP

| Size | Type | Code |
|---------------|--|--------------|
| E2.2...E6.2 | KLP-D Bl. Racked in/out E2.2...E6.2 1st key | 1SDA073806R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20005 E2.2..E6.2 1st key | 1SDA073807R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20006 E2.2..E6.2 1st key | 1SDA073808R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20007 E2.2..E6.2 1st key | 1SDA073809R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20008 E2.2..E6.2 1st key | 1SDA073810R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20009 E2.2..E6.2 1st key | 1SDA073811R1 |
| E2.2...E6.2 | KLP-D Bl. Racked in/out E2.2...E6.2 2nd key | 1SDA073812R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20005 E2.2..E6.2 2nd key | 1SDA073813R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20006 E2.2..E6.2 2nd key | 1SDA073814R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20007 E2.2..E6.2 2nd key | 1SDA073815R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20008 E2.2..E6.2 2nd key | 1SDA073816R1 |
| E2.2...E6.2 | KLP-S Bl. Racked in/out N.20009 E2.2..E6.2 2nd key | 1SDA073817R1 |
| E2.2...E6.2** | KLP-A Bl. Racked in/out RoProKirk E2.2..E6.2 1st key | 1SDA073818R1 |
| E2.2...E6.2** | KLP-A Bl. Racked in/out RoProKirk E2.2..E6.2 2nd key | 1SDA073819R1 |
| E2.2...E6.2** | KLP-A Bl. Racked in/out Castell E2.2..E6.2 1st key | 1SDA073820R1 |
| E2.2...E6.2** | KLP-A Bl. Racked in/out Castell E2.2..E6.2 2nd key | 1SDA073821R1 |

When the PLP is already present, you have to order the KLP 2nd key and not the KLP 1st key
* only mounted. For loose supply contact ABB SACE; ** arrangement only



Accessory for supplementary lock in racked-out position

| Size | Type | Code |
|-------------|--|--------------|
| E2.2...E6.2 | Suppl. locks in racked-out E2.2...E6.2 | 1SDA073839R1 |

Accessories

Mechanical accessories



Lock for racking in / racking out the mobile part when the door is open - DLR

| Size | Type | Code |
|--------------|---------------------------------|--------------|
| E2.2...E6.2* | DLR E2.2...E6.2 | 1SDA073845R1 |

*Only as loose part



Lock to prevent door opening when circuit-breaker is in racked-in / test position - DLP

| Size | Type | Code |
|--------------|---------------------------------|--------------|
| E2.2...E6.2* | DLP E2.2...E6.2 | 1SDA073849R1 |

*Only as loose part



Protection device for opening and closing pushbuttons - PBC

| Size | Type | Code |
|-------------|---|--------------|
| E2.2...E6.2 | PBC Prot. Pushbuttons AP/CH E2.2...E6.2 | 1SDA073858R1 |
| E2.2...E6.2 | PBC Prot. Pushbuttons AP/CH D=4mm E2.2...E6.2 | 1SDA073859R1 |
| E2.2...E6.2 | PBC Prot. Pushbuttons AP/CH D=7mm E2.2...E6.2 | 1SDA073860R1 |
| E2.2...E6.2 | PBC Prot. Pushbuttons AP/CH D=8mm E2.2...E6.2 | 1SDA073861R1 |



Circuit-breaker flange

| Size | Type | Code |
|--------------|--|--------------|
| E2.2...E6.2 | IP30 Flange E2.2...E6.2 F | 1SDA073864R1 |
| E2.2...E6.2 | IP30 Flange E2.2...E6.2 W | 1SDA073865R1 |
| E2.2...E6.2* | IP54 Flange different keys E2.2...E6.2 | 1SDA073867R1 |
| E2.2...E6.2* | IP54 Flange key No. 20005 E2.2...E6.2 | 1SDA073869R1 |
| E2.2...E6.2 | Sealable trip unit cover | 1SDA073870R1 |

*Only as loose part

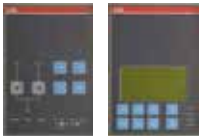
Accessories

Switching devices



Separators - PB*

| Size | Type | Code |
|-------------|---|--------------|
| E2.2...E6.2 | PB Separators 2 pz E2.2..E6.2 F 3P | 1SDA076166R1 |
| E2.2...E6.2 | PB Separators 2 pz E2.2..E6.2 W FP 3P | 1SDA076168R1 |



Automatic transfer switch

| Size | Type | Code |
|------------|------------------------|--------------|
| E1.2..E6.2 | ATS021 | 1SDA065523R1 |
| E1.2..E6.2 | ATS022 | 1SDA065524R1 |

Accessories

Ekip modules



Ekip electrical trip units - loose supply

| Size | Type | Code |
|----------------|---|--------------|
| E1.2..E6.2 | Ekip Dip LI | 1SDA074194R1 |
| E1.2..E6.2 | Ekip Dip LSI | 1SDA074195R1 |
| E1.2..E6.2 | Ekip Dip LSIG | 1SDA074196R1 |
| E1.2..E6.2* | Ekip Touch LI | 1SDA074197R1 |
| E1.2..E6.2* | Ekip Touch LSI | 1SDA074198R1 |
| E1.2..E6.2* | Ekip Touch LSIG | 1SDA074199R1 |
| E1.2..E6.2* ** | Ekip G Touch LSIG | 1SDA074200R1 |
| E1.2..E6.2* ** | Ekip Hi-Touch LSI | 1SDA074201R1 |
| E1.2..E6.2* ** | Ekip Hi-Touch LSIG | 1SDA074202R1 |
| E1.2..E6.2* ** | Ekip G Hi-Touch LSIG | 1SDA074203R1 |
| E1.2..E6.2* ** | Ekip LCD LI | 1SDA074204R1 |
| E1.2..E6.2* ** | Ekip LCD LSI | 1SDA074205R1 |
| E1.2..E6.2* ** | Ekip LCD LSIG | 1SDA074206R1 |
| E1.2..E6.2* ** | Ekip G LCD LSIG | 1SDA074207R1 |
| E1.2..E6.2* ** | Ekip Hi-LCD LSI | 1SDA074208R1 |
| E1.2..E6.2* ** | Ekip Hi-LCD LSIG | 1SDA074209R1 |
| E1.2..E6.2* ** | Ekip G Hi-LCD LSIG | 1SDA074210R1 |
| E1.2..E6.2 | Battery for Ekip trip units | 1SDA074193R1 |

* Ekip TT standard supply; **provided without Ekip Measuring/Ekip Measuring Pro.

Options for Ekip electrical trip units

| Size | Type | Code |
|------------|--|--------------|
| E1.2..E6.2 | Upper internal installed voltage outlets | 1SDA074216R1 |
| E1.2..E6.2 | External installed voltage outlets | 1SDA074217R1 |
| E1.2..E6.2 | Arrangement for cables with lower internal voltage outlets | 1SDA074213R1 |
| E1.2..E6.2 | Arrangement for cables with upper internal voltage outlets | 1SDA074214R1 |
| E1.2..E6.2 | Arrangement for cables with external voltage outlets | 1SDA074215R1 |

Power Supply modules

| Size | Type | Code |
|------------|--|--------------|
| E1.2..E6.2 | Ekip Supply 110-240V AC/DC | 1SDA074172R1 |
| E1.2..E6.2 | Ekip Supply 24-48V DC | 1SDA074173R1 |





Connectivity modules

| Size | Type | Code |
|------------|--|--------------|
| E1.2..E6.2 | Ekip Com Modbus RS-485 | 1SDA074150R1 |
| E1.2..E6.2 | Ekip Com Modbus TCP | 1SDA074151R1 |
| E1.2..E6.2 | Ekip Com Profibus | 1SDA074152R1 |
| E1.2..E6.2 | Ekip Com Profinet | 1SDA074153R1 |
| E1.2..E6.2 | Ekip Com DeviceNet™ | 1SDA074154R1 |
| E1.2..E6.2 | Ekip Com EtherNet/IP™ | 1SDA074155R1 |
| E1.2..E6.2 | Ekip Com IEC61850 | 1SDA074156R1 |
| E1.2..E6.2 | Ekip Com Hub | 1SDA082894R1 |
| E1.2..E6.2 | Ekip Com R Modbus RS-485 | 1SDA074157R1 |
| E1.2..E6.2 | Ekip Com R Modbus TCP | 1SDA074158R1 |
| E1.2..E6.2 | Ekip Com R Profibus | 1SDA074159R1 |
| E1.2..E6.2 | Ekip Com R Profinet | 1SDA074160R1 |
| E1.2..E6.2 | Ekip Com R DeviceNet™ | 1SDA074161R1 |
| E1.2..E6.2 | Ekip Com R EtherNet/IP™ | 1SDA074162R1 |
| E1.2..E6.2 | Ekip Com R IEC61850 | 1SDA076170R1 |
| E1.2..E6.2 | Ekip Link | 1SDA074163R1 |
| E1.2..E6.2 | Ekip Bluetooth | 1SDA074164R1 |
| E1.2..E6.2 | Ekip Com GPRS-M | 1SDA074165R1 |
| E1.2..E6.2 | Ekip Com Actuator | 1SDA074166R1 |



Signalling modules

| Size | Type | Code |
|-------------|--------------------------------------|--------------|
| E1.2..E6.2 | Ekip Signalling 2K-1 | 1SDA074167R1 |
| E1.2..E6.2 | Ekip Signalling 2K-2 | 1SDA074168R1 |
| E1.2..E6.2 | Ekip Signalling 2K-3 | 1SDA074169R1 |
| E2.2..E6.2 | Ekip Signalling 4K | 1SDA074170R1 |
| E1.2..E6.2* | Ekip Signalling 10K | 1SDA074171R1 |

*Only as loose part



Measuring and Measuring Pro modules

| Size | Type | Code |
|------|------------------------------------|--------------|
| E2.2 | Ekip Measuring | 1SDA074186R1 |
| E2.2 | Ekip Measuring Pro | 1SDA074187R1 |
| E4.2 | Ekip Measuring | 1SDA074188R1 |
| E4.2 | Ekip Measuring Pro | 1SDA074189R1 |
| E6.2 | Ekip Measuring | 1SDA074190R1 |
| E6.2 | Ekip Measuring Pro | 1SDA074191R1 |



Synchrocheck modules

| Size | Type | Code |
|------------|-----------------------------------|--------------|
| E1.2..E6.2 | Ekip Synchrocheck | 1SDA074183R1 |



Accessories

Ekip modules



Displaying and supervision systems

| Size | Type | Code |
|-------------|---|--------------|
| E1.2..E6.2 | Ekip T&P - Programming and Test unit | 1SDA066989R1 |
| E1.2..E6.2 | Ekip TT - Trip Test unit | 1SDA066988R1 |
| E1.2..E6.2 | Ekip Programming | 1SDA076154R1 |
| E1.2..E6.2* | Ekip Multimeter Display on front of switchgear | 1SDA074192R1 |
| E1.2..E6.2 | Ekip Control Panel for 10 circuit-breakers | 1SDA074311R1 |
| E1.2..E6.2 | Ekip control panel for 30 circuit-breakers | 1SDA074312R1 |
| E1.2..E6.2 | Ekip View Software for 30 circuit-breakers | 1SDA074298R1 |
| E1.2..E6.2 | Ekip View software for 60 circuit-breakers | 1SDA074299R1 |
| E1.2..E6.2 | Ekip View software for unlimited circuit-breakers | 1SDA074300R1 |

*Only as loose part

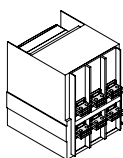


Rating plug for Ekip trip units

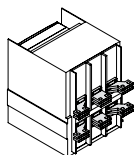
| Size | Type | Code (loose supply) | Code (installed) |
|------------|---|------------------------|---------------------|
| E1.2..E6.2 | Rating Plug 400A | 1SDA074221R1 | 1SDA074261R1 |
| E1.2..E6.2 | Rating Plug 630A | 1SDA074222R1 | 1SDA074262R1 |
| E1.2..E6.2 | Rating Plug 800A | 1SDA074223R1 | 1SDA074263R1 |
| E1.2..E6.2 | Rating Plug 1000A | 1SDA074224R1 | 1SDA074264R1 |
| E1.2..E6.2 | Rating Plug 1250A | 1SDA074225R1 | 1SDA074265R1 |
| E1.2..E6.2 | Rating Plug 1600A | 1SDA074226R1 | 1SDA074266R1 |
| E2.2..E6.2 | Rating Plug 2000A | 1SDA074227R1 | 1SDA074267R1 |
| E2.2..E6.2 | Rating Plug 2500A | 1SDA074228R1 | 1SDA074268R1 |
| E4.2..E6.2 | Rating Plug 3200A | 1SDA074229R1 | 1SDA074269R1 |
| E4.2..E6.2 | Rating Plug 4000A | 1SDA074230R1 | 1SDA074270R1 |
| E6.2 | Rating Plug 5000A | 1SDA074231R1 | 1SDA074271R1 |
| E6.2 | Rating Plug 6300A | 1SDA074232R1 | - |
| E1.2..E6.2 | Rating Plug 400A L OFF | 1SDA074236R1 | 1SDA074276R1 |
| E1.2..E6.2 | Rating Plug 630A L OFF | 1SDA074237R1 | 1SDA074277R1 |
| E1.2..E6.2 | Rating Plug 800A L OFF | 1SDA074238R1 | 1SDA074278R1 |
| E1.2..E6.2 | Rating Plug 1000A L OFF | 1SDA074239R1 | 1SDA074279R1 |
| E1.2..E6.2 | Rating Plug 1250A L OFF | 1SDA074240R1 | 1SDA074280R1 |
| E1.2..E6.2 | Rating Plug 1600A L OFF | 1SDA074241R1 | 1SDA074281R1 |
| E2.2..E6.2 | Rating Plug 2000A L OFF | 1SDA074242R1 | 1SDA074282R1 |
| E2.2..E6.2 | Rating Plug 2500A L OFF | 1SDA074243R1 | 1SDA074283R1 |
| E4.2..E6.2 | Rating Plug 3200A L OFF | 1SDA074244R1 | 1SDA074284R1 |
| E4.2..E6.2 | Rating Plug 4000A L OFF | 1SDA074245R1 | 1SDA074285R1 |
| E6.2 | Rating Plug 5000A L OFF | 1SDA074246R1 | 1SDA074286R1 |
| E6.2 | Rating Plug 6300A L OFF | 1SDA074247R1 | 1SDA074287R1 |
| E1.2..E6.2 | Rating Plug RC 400A | 1SDA074251R1 | 1SDA074291R1 |
| E1.2..E6.2 | Rating Plug RC 630A | 1SDA074252R1 | 1SDA074292R1 |
| E1.2..E6.2 | Rating Plug RC 800A | 1SDA074253R1 | 1SDA074293R1 |
| E1.2..E6.2 | Rating Plug RC 1250A | 1SDA074254R1 | 1SDA074294R1 |
| E2.2..E6.2 | Rating Plug RC 2000A | 1SDA074255R1 | 1SDA074295R1 |
| E4.2..E6.2 | Rating Plug RC 3200A | 1SDA074256R1 | 1SDA074296R1 |
| E4.2..E6.2 | Rating Plug RC 4000A | 1SDA074257R1 | 1SDA074297R1 |

Accessories

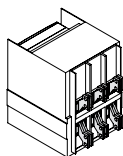
Terminals



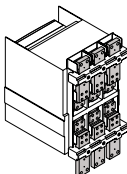
Rear adjustable terminal - HR VR



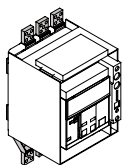
Horizontal rear terminal - SHR



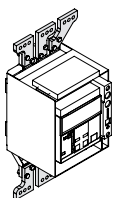
Vertical rear spread terminal - SVR



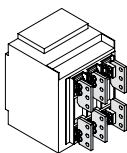
Front terminal - F



Extended front terminal - EF



Front spread terminal - ES



Terminal for cable FcCuAl
4x240mm² - Fc CuAl

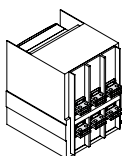
Kit for terminals - installed for fixed part of withdrawable circuit-breaker

| Size | Version | lu max | Type | 3 Poles code |
|--------|---------|--------|---------------|--------------|
| E2.2 | W | 2000 | Kit FL Upper | 1SDA081120R1 |
| E2.2 | W | 2000 | Kit FL Lower | 1SDA081122R1 |
| E2.2 | W | 2000 | Kit VR Upper | 1SDA074577R1 |
| E2.2 | W | 2000 | Kit VR Lower | 1SDA074579R1 |
| E2.2 | W | 2500 | Kit VR Upper | 1SDA074581R1 |
| E2.2 | W | 2500 | Kit VR Lower | 1SDA074583R1 |
| E2.2 | W | 2000 | Kit SHR Upper | 1SDA074585R1 |
| E2.2 | W | 2000 | Kit SHR Lower | 1SDA074587R1 |
| E2.2 | W | 2500 | Kit SHR Upper | 1SDA074589R1 |
| E2.2 | W | 2500 | Kit SHR Lower | 1SDA074591R1 |
| E2.2 | W | 2000 | Kit SVR Upper | 1SDA074593R1 |
| E2.2 | W | 2000 | Kit SVR Lower | 1SDA074595R1 |
| E2.2 | W | 2500 | Kit SVR Upper | 1SDA074597R1 |
| E2.2 | W | 2500 | Kit SVR Lower | 1SDA074599R1 |
| E2.2 | W | 2500 | Kit FL Upper | 1SDA074069R1 |
| E2.2 | W | 2500 | Kit FL Lower | 1SDA074071R1 |
| E2.2** | W | 2500 | Kit F Upper | 1SDA074090R1 |
| E2.2** | W | 2500 | Kit F Lower | 1SDA074092R1 |
| E4.2 | W | 3200 | Kit FL Upper | 1SDA081125R1 |
| E4.2 | W | 3200 | Kit FL Lower | 1SDA081128R1 |
| E4.2 | W | 3200 | Kit VR Upper | 1SDA074601R1 |
| E4.2 | W | 3200 | Kit VR Lower | 1SDA074603R1 |
| E4.2 | W | 3200 | Kit SHR Upper | 1SDA082840R1 |
| E4.2 | W | 3200 | Kit SHR Lower | 1SDA082842R1 |
| E4.2 | W | 3200 | Kit SVR Upper | 1SDA082848R1 |
| E4.2 | W | 3200 | Kit SVR Lower | 1SDA082850R1 |
| E4.2 | W | 4000 | Kit VR Upper | 1SDA074605R1 |
| E4.2 | W | 4000 | Kit VR Lower | 1SDA074607R1 |
| E4.2** | W | 4000 | Kit F Upper | 1SDA074098R1 |
| E4.2** | W | 4000 | Kit F Lower | 1SDA074100R1 |
| E4.2 | W | 4000 | Kit FL Upper | 1SDA074075R1 |
| E4.2 | W | 4000 | Kit FL Lower | 1SDA074077R1 |
| E4.2 | W | 4000 | Kit HR Upper | 1SDA076878R1 |
| E4.2 | W | 4000 | Kit HR Lower | 1SDA076880R1 |
| E4.2 | W | 4000 | Kit SHR Upper | 1SDA082844R1 |
| E4.2 | W | 4000 | Kit SHR Lower | 1SDA082846R1 |
| E4.2 | W | 4000 | Kit SVR Upper | 1SDA082852R1 |
| E4.2 | W | 4000 | Kit SVR Lower | 1SDA082854R1 |
| E6.2 | W | 5000 | Kit VR Upper | 1SDA074609R1 |
| E6.2 | W | 5000 | Kit VR Lower | 1SDA074612R1 |
| E6.2 | W | 6300 | Kit VR Upper | 1SDA074615R1 |
| E6.2 | W | 6300 | Kit VR Lower | 1SDA074618R1 |
| E6.2** | W | 6300 | Kit F Upper | 1SDA074106R1 |
| E6.2** | W | 6300 | Kit F Lower | 1SDA074109R1 |
| E6.2 | W | 6300 | Kit FL Upper | 1SDA074081R1 |
| E6.2 | W | 6300 | Kit FL Lower | 1SDA074084R1 |

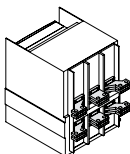
** terminals supplied, but not physically installed.

Accessories

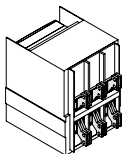
Terminals



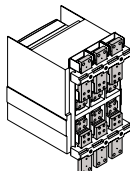
Rear orientable terminal - HR VR



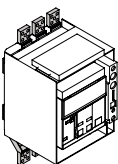
Horizontal rear terminal - SHR



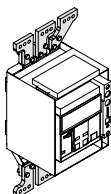
Vertical rear spread terminal - SVR



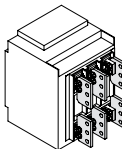
Front terminal - F



Extended front terminal - EF



Front spread terminal - ES



Terminal for cable FcCuAl
4x240mm² - Fc CuAl

Kit for terminals - loose supply for fixed part of withdrawable circuit-breaker

| Size | Version | lu max | Type | Code | Pieces |
|------|---------|--------|----------------------|--------------|--------|
| E2.2 | W | 2000 | Kit Adjustable HR/VR | 1SDA074007R1 | 3 |
| E2.2 | W | 2500 | Kit Adjustable HR/VR | 1SDA074013R1 | 3 |
| E2.2 | W | 2000 | Kit SHR | 1SDA074049R1 | 3 |
| E2.2 | W | 2500 | Kit SHR | 1SDA074055R1 | 3 |
| E2.2 | W | 2000 | Kit SVR | 1SDA074061R1 | 3 |
| E2.2 | W | 2500 | Kit SVR | 1SDA074067R1 | 3 |
| E2.2 | W | 2500 | Kit F Upper | 1SDA074094R1 | 3 |
| E2.2 | W | 2500 | Kit F Lower | 1SDA074096R1 | 3 |
| E4.2 | W | 3200 | Kit Adjustable HR/VR | 1SDA074019R1 | 3 |
| E4.2 | W | 3200 | Kit SHR | 1SDA082820R1 | 3 |
| E4.2 | W | 3200 | Kit SVR | 1SDA082832R1 | 3 |
| E4.2 | W | 4000 | Kit Adjustable HR/VR | 1SDA074025R1 | 3 |
| E4.2 | W | 4000 | Kit F Upper | 1SDA074102R1 | 3 |
| E4.2 | W | 4000 | Kit F Lower | 1SDA074104R1 | 3 |
| E4.2 | W | 4000 | Kit SHR | 1SDA082826R1 | 3 |
| E4.2 | W | 4000 | Kit SVR | 1SDA082838R1 | 3 |
| E6.2 | W | 5000 | Kit Adjustable HR/VR | 1SDA074033R1 | 6 |
| E6.2 | W | 6300 | Kit Adjustable HR/VR | 1SDA074042R1 | 6 |
| E6.2 | W | 6300 | Kit F Upper | 1SDA074112R1 | 6 |
| E6.2 | W | 6300 | Kit F Lower | 1SDA074115R1 | 6 |

Accessories

Service



Note:
Warranty periods are measured from the date the circuit breaker leaves the factory.

Extended warranty

| Size | Type | Code*** |
|-------------|---|--------------|
| E1.2...E6.2 | Warranty 2 years E1.2...E6.2* | 1SDA082413R1 |
| E2.2 | Warranty 4 years E2.2** | 1SDA082415R1 |
| E4.2 | Warranty 4 years E4.2** | 1SDA082416R1 |
| E6.2 | Warranty 4 years E6.2** | 1SDA082417R1 |
| E2.2 | Warranty 5 years E2.2** | 1SDA082419R1 |
| E4.2 | Warranty 5 years E4.2** | 1SDA082420R1 |
| E6.2 | Warranty 5 years E6.2** | 1SDA082421R1 |

The registration in the Extended Warranty online tool is mandatory

* Free-of-charge with site details entered

** Warranty durations:

- 4 years when site details not entered into the Extended Warranty online tool
- 5 years when site details entered into the Extended Warranty online tool

*** Order only with the circuit breaker. Specify Registration code in the order to activate the warranty.

Test certificate

| Size | Type | Code |
|-------------|------------------------------------|--------------|
| E2.2...E6.2 | Test certificate - Italian version | 1SDA070197R1 |
| E2.2...E6.2 | Test certificate - English version | 1SDA070198R1 |
| E2.2...E6.2 | Test certificate - German version | 1SDA070199R1 |
| E2.2...E6.2 | Test certificate - French version | 1SDA070200R1 |
| E2.2...E6.2 | Test certificate - Spanish version | 1SDA070201R1 |

RINA stamp and RINA certificate

| Size | Type | Code |
|-------------|-----------------------------|--------------|
| E2.2...E6.2 | RINA label E1.2-E6.2/ML EXT | 1SDA083599R1 |

—

ABB SACE

A division of ABB S.p.A.
L.V. Breakers
Via Pescaria 5,
24123 Bergamo - Italy
Phone: +39 035 395.111
Fax: +39 035 395.306-433

abb.com/low-voltage

