

LOW VOLTAGE AIR CIRCUIT-BREAKERS EMAX E1.2-E2.2-E4.2-E6.2

SACE Emax 2

Operating instructions for the design engineer



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Glossary

Term	Description
SACE Emax 2	New series of ABB SACE air circuit-breakers
CB	Circuit-breaker
Protection release	Electronic unit connected to the CB (Mainboard), which provides measuring, monitoring and protection functions for the CB if faulty operating conditions occur. In the event of an alarm, it commands a TRIP
Trip unit	Protection release
Mainboard	Electronic board of the CB to which the Trip Unit and all the main accessories and electronic actuators connect
Ekip Touch	Trip unit for SACE Emax 2 CBs, equipped with touchscreen display and available in four different versions
Ekip Dip	Trip unit SACE Emax 2 CBs, equipped with dip-switch type interface
Ekip LCD	Trip unit for SACE Emax 2 CBs, equipped with LCD display; alternative to Ekip Touch for applications in particular environmental conditions
Trip coil	CB opening actuator controlled directly by Trip unit
TRIP	Concluding action of protection timing or a test command which, except in special configurations applicable to the trip unit, coincides with activation of the trip coil, which instantly opens the bars of each pole and interrupts the circulating current
Vaux	Auxiliary power supply
4P / 3P / 3P + N	CB configuration: four-pole (4P), three-pole (3P) and three-pole with external neutral (3P + N)
If	Fault current measured by Trip unit, useful for calculating the trip time t_t

Circuit-breakers E1.2-E2.2-E4.2-E6.2

1 - Introduction

Foreword SACE Emax 2 is the new series of low voltage air circuit-breakers up to 6300 A, designed for managing all low voltage electrical installations with the maximum efficiency: from industrial installations, marine applications, conventional power generation and renewable energy installations, to buildings, malls, data centers and communication networks.

Overview This manual contains all the useful information for:

- Facilitating the choice of the product and of the features required.
- Rapid access to all the necessary information for proper design.
- Proper use of all the features available with the solid-state protection trip units.
- All the supporting documentation.
- Link to management software.

recipients This manual refers to two user profiles, as defined by standard IEC 60050:

- skilled person, in the electrical field (IEV 195-04-01): person with sufficient training and experience to enable him or her to perceive risks and avoid the dangers potentially created by electricity)
- instructed person, in the electrical field (IEV 195-04-02): person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid danger which electricity can create



IMPORTANT: operations which can be performed by persons trained on the subject of electricity are specifically indicated in this manual. All the remaining operations described in this manual must be performed by skilled persons, in the field of electricity. ABB declines all liability for damage to persons or property caused by failure to comply with the instructions in this document.

Specifications and supporting documents To ensure that the Emax 2 circuit-breaker is installed and configured correctly, please read the information in this manual and in the technical documentation of the product, supplied with the circuit-breaker or available in the website [ABB LIBRARY](#)

Document	Description
1SDH000999R0002	Installation, operation and maintenance instructions for Sace Emax E1.2 CBs and Ekip Dip Trip units
1SDH001000R0002	Installation, operation and maintenance instructions for Sace Emax E2.2-E4.2-E6.2 CBs and Ekip Dip Trip units
1SDH001316R1002	Manual of Ekip Touch Trip units for Sace Emax 2 CBs
1SDH001140R0001	Communication System Interface for Emax 2 CBs
1SDC200023D0906	Sace Emax 2 CBs General catalog
1SDM000091R0001	Sace Emax 2 CBs Circuit diagrams

Design notes The information in this manual was written in Italian and then translated into other languages to conform to the laws and/or commercial requirements concerning the product.

Regulations Emax 2 circuit-breakers and their accessories comply with the following international standards:

- IEC 60947
- EN 60947
- CEI EN 60947
- IEC 61000
- UL 1066

They comply with the following EC directives:

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

Emax 2 circuit-breakers also feature a range certified according to these standards:

- Russian - GOST (Russia Certificate of Conformity)
 - Chinese - China CCC (China Compulsory Certification)
-

2 - Safety

Warnings

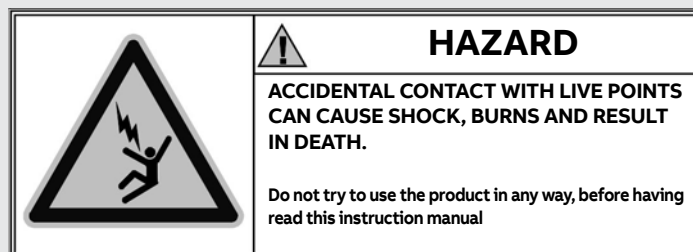


Figure 1

The following warnings must be respected:

- **READ THE INSTRUCTIONS CAREFULLY BEFORE TRYING TO INSTALL, OPERATE OR REPAIR THE CIRCUIT BREAKER.**
- Store these instructions along with other documents for instruction, maintenance and installation, drawings and descriptive notes on the circuit-breaker.
- Keep these documents available during the installation, operation and maintenance of the appliance. The use of these instructions facilitates proper maintenance.
- install the circuit-breaker within the limits of the project described in the instruction manual shipped with the unit. These circuit-breakers are designed to operate with values of voltage and current within the limits of plate ratings. Do not install this equipment in systems operating at nominal values exceeding these limits.
- follow the safety procedures indicated by Your Company.
- Do not open any covers or doors, do not work on devices before removing power from all circuits, and after making sure of that with a measuring instrument.



WARNING!

- Detailed descriptions of standard procedures for installation, use, maintenance and principles for safe operation are not included. It is important to note that this document contains safety instructions and caution against certain methods (installation, operation and maintenance) that could cause injury to personnel, damage equipment, or make them unsafe.
- these warnings and alarms do not include all the conceivable methods of performing the installation, operation and maintenance operations recommended by ABB and others, which could be performed, or the possible consequences and complications of each conceivable method, neither will ABB investigate all those methods.
- anyone using maintenance procedures or devices, recommended by ABB or not, must check thoroughly that neither personal safety nor the safety devices are endangered by mode of installation, use, maintenance or the instruments used. For more information, questions or specific problems contact your nearest ABB representative.
- This manual is written for qualified personnel only and is not intended as a substitute for a proper course, or experience about safety procedures for this device.
- regarding products equipped with communication systems, the purchaser, installer or end customer are responsible for applying all the IT security measures to prevent risks deriving from connection to communication networks; among others, these risks include use of the product by unauthorized persons, alteration of its normal operation, access to and modification of the information.
- the purchaser, installer or end customer are responsible for ensuring that safety warnings and notices are affixed and moreover, that all points of access and operating devices are securely blocked when the switchgear is left even momentarily unattended.
- all the information contained in this document reflects the latest product information available at the time of printing. We reserve the right to edit the document at any time and without notice

3 - Environmental conditions

Installation environment Install the circuit-breaker in a dry environment, without dust or corrosive acids, and so that it is not subject to shock or vibration.

If this is not possible, mount the circuit-breaker in a compartment protecting it adequately.

For the dimensions to be considered for installation, see the chapter "3 - Installation" on page 166 where the references for following information can be found:

- minimum installation volumes of the circuit-breakers and derived versions in a cell
- overall dimensions of the circuit-breakers and the fixed parts
- drilling of mounting holes
- drilling of the cell door

Temperatures of the installation environment The mechanical and electrical characteristics are guaranteed between -25 °C and +70 °C, -13 °F e +158 °F.

Particular weather conditions The circuit breaker is designed to operate in particularly difficult industrial environments.

It was tested according to:

- IEC 60068-2-1: endurance at low temperatures
- IEC 60068-2-2: hot dry climate
- IEC 60068-2-30: hot humid climate
- IEC 60068-2-52 severity 2: saline mist atmosphere
- IEC 60947 (pollution level ≤ 3)
- IEC60721-3-6 class 6C3
- IEC60721-3-3 class 3C2



NOTE: the circuit-breaker is suitable for installation in environments with saline concentrations no higher than 10 mg/m³.

Dusty environments It is recommended to install the circuit breaker in suitably ventilated switchgear where penetration by dust is minimized.

In case of dusty environments (dust > 1 mg/m³) second level maintenance procedures must be followed.

Vibration The circuit-breaker is insensitive to mechanical or electromagnetic vibrations that meet the following standards:

- IEC 60068-2-6 a) From 1 to 13 Hz with movement equal to 1 mm - 0.04 in b) From 13 to 100 Hz with constant acceleration equal to 0.7 g - 0.025 lbs
- Shipping Registers' specifications: RINA, BV, GL, ABS, LRs, DNV

Altitude The circuit breaker maintains its rated operating characteristics up to 2000 m above sea level.

Once this altitude is passed, you need to consider reduction of dielectric strength and reduced cooling capacity of the air.

The following are the corrections expressed as a percentage to be applied to the parameters according to altitude:

Altitude	2000 m / 6600 ft	3000 m / 9900 ft	4000 m / 13200 ft	5000 m / 16500 ft
Rated service voltage (V) U _e	100%	88%	78%	68%
Rated current (A) at 40°C	100%	98%	93%	90%

Electromagnetic compatibility The use of specific devices in industrial installations may cause electromagnetic interference in the electrical system.

The SACE Emax 2 circuit-breakers were developed and tested in an EMC environment in accordance with IEC 60947-2, Annex J and F.

Storage Environment Store the circuit breaker in a dry, dust-free environment free of harsh chemicals.

The storage ambient temperature must be:

- Circuit-breaker in the original packaging, without protection trip unit or Ekip Dip trip unit, between -40 °C and +85 °C, -40 °F e +185 °F.
- Circuit-breaker in the original packaging, with Ekip Touch protection trip unit, between -25°C and + 85°C, -22°F e +185°F.



NOTE: *the storage conditions may differ from the usage conditions.*

4 - Guide to the product choice

Foreword The circuit-breaker must check and protect, in case of failure and malfunction, the installation components that are connected to it. To perform this function, Emax 2 circuit-breakers offer a series of options, that can be selected by the user according to the particular requirements of the installation.

For a good design, the main characteristics the components must be selected with the greatest care.

In order to help the design engineers in selecting the Emax2 circuit-breakers, a sheet is provided below containing the main selection criteria for air circuit-breakers. This sheet can be completed (in whole or in part) by the design engineer to guide subsequent design choices and can be used by the client for work contracts. Besides, this sheet is a useful tool for rapid configuration in CAT selection software.

Device

Type of device
Circuit-breaker
Switch-disconnector

Standard

Reference standard
IEC (EN 60947-2)
UL (UL 1066-ANSI C37.50)

Mechanical characteristics

Insulation function
Yes
No
N° poles
3
4
Installation version
Fixed
Withdrawable
Terminals
Horizontal/Vertical
Spread
Front
Extended front
Spread front
Floor
For 4x240 FcCuAl cable



NOTE: consult the technical catalog for details about the terminals.

Electrical characteristics

Service rated voltage					
400 V AC					
415 V AC					
500 V AC					
525 V AC					
690 V AC					
_____ V AC					
Rated uninterrupted current (40°C) (Iu)					
100 A		800 A		2500 A	
200 A		1000 A		3200 A	
250 A		1200 A		4000 A	
400 A		1250 A		5000 A	
600 A		1600 A		6000 A	
630 A		2000 A		6300 A	
Ultimate short-circuit breaking capacity (Icu)					
42 kA		120 kA			
50 kA		130 kA			
66 kA		150 kA			
85 kA		200 kA			
100 kA		a _____ V:			
Service short-circuit breaking capacity (Ics)					
According to the reference standard: _____ % of Icu					
Admissible rated short-time withstand current (Icw)					
Without intentional delay (class A)					
With intentional time-delay (category B):					
1 s Icw _____ kA					
3 s Icw _____ kA					



NOTE: make sure that the combination of all the electrical values selected is available. Consult the technical catalog for further details.

Electronic protections

Ekip Dip can be configured with the following protections:

Current protections	
	Overload (L - ANSI 49)
	Time-delayed overcurrent
	Instantaneous overcurrent (I - ANSI 50)
	Earth fault current (G - ANSI 51N & 50N TD)

Ekip Touch can be configured with the following protections:



NOTE: the protections are either present by default or must be installed by means of an additional package, depending on the Trip unit model and version (consult Trip unit Overview for details)

Current protections	
	Overload (L - ANSI 49)
	Time-delayed overcurrent
	Second time-delayed overcurrent (S2 - ANSI 50TD)
	Instantaneous overcurrent (I - ANSI 50)
	Earth fault current (G - ANSI 51N & 50N TD)
	Zone selectivity for S, I and G protections (ANSI 68)
	Directional overcurrent (D - ANSI 67)
	Zone Selectivity for D protection (ANSI 68).
	Programmable instantaneous overcurrent (2I - ANSI 50)
	Earth fault current with external toroid (Gext - ANSI 51G & 50GTD)
	Modified differential ground fault (MDGF)
	Residual current (Rc - ANSI 64 & 50 NTD)
	Current unbalance (IU - ANSI 46)
	Voltage controlled overcurrent (S(V) - ANSI 51V)
	Second voltage controlled overpower (S2(V) - ANSI 51V)
Voltage protections	
	Undervoltage (UV - ANSI 27)
	Overvoltage (OV - ANSI 59)
	Second undervoltage protection (UV2 - ANSI 27)
	Second overvoltage protection (OV2 - ANSI 59)
	Voltage unbalance (VU - ANSI 47)
	Cyclical direction of the phases (ANSI 47)
	Residual overvoltage (RV - ANSI 59N)
Frequency protections	
	Underfrequency (UF - ANSI 81L)
	Overfrequency (OF - ANSI 81H)
	Second minimum frequency protection (UF2 - ANSI 87L)
	Second maximum frequency protection (OF2 - ANSI 87H)
	Rate of change of frequency (ROCOF - ANSI 81R)
Power protections	
	Reverse active power (RP - ANSI 32R)
	Power factor (ANSI 78)
	Loss of field or reverse reactive power (RQ - ANSI 40 or 32RQ)
	Reactive overpower (OQ - ANSI 32OF)
	Active overpower (OP - ANSI 32OF)
	Active underpower (UP - ANSI 32LF)
Miscellaneous protections	
	Synchronism between two supply sources - Synchrocheck (SC - ANSI 25)
	Interface protections (IPS)

Electrical and mechanical accessories

Electrical signalling	
	Open/closed auxiliary contacts - AUX
	Ready to close signalling contact - RTC
	Ready to close signalling contact Ekip – RTC
	Ekip protection trip unit tripping signalling contact – S51
	Remote resetting - YR
Service trip units	
	First and second opening coil - YO
	First and second closing coil - YC
	Undervoltage coil - YU
Motor operator	
	Motor
Protections	
	Protection device for opening and closing push buttons - PBC
	Compartment door flange
Terminal-covers and separators	
	High terminal-covers - HTC
	Low terminal-covers - LTC
	Phase separators PB
Other accessories	
	mechanical operation counter - MOC



NOTE: for full details on Emax 2 electrical and mechanical accessories see chapter “**Electrical accessories**” starting on page **192**.

Electronic accessories

Electronic accessories	
	Measurement Module - Protection and measurements of voltage, power and energy
	Ekip Signalling 10K/ 4K/ 2K/ 3T/ Modbus TCP - Programmable input and output contacts
	Ekip Supply - Power supply for trip units and modules
	Ekip COM - Communication with multiple protocols
	Ekip Synchrochek - Synchronism between two power supply sources
	Ekip Multimeter - Power supply and measurements from switchgear front
	Ekip LCD - Interface with LCD display for particular environmental conditions



NOTE: for full details on Emax 2 electronic accessories see chapter “**Accessories**” starting on page **176**.

5 - Selectivity between ABB SACE circuit-breakers

Foreword It is possible to obtain selectivity between ABB SACE circuit-breakers (including Emax 2).

There is selectivity in an installation when, in the event of an overload or short-circuit, it is possible to identify and isolate the point of overload or fault by opening only some circuit-breakers to guarantee service continuity to the installation.



NOTE: *selectivity is recommended in all installations with multiple switchgears or circuit-breakers connected, for example cascading or in a tree (with a main circuit-breaker on the supply side, and other circuit-breakers downstream to protect areas on the other side). Thus, only the circuit-breaker immediately upstream the overload or fault trips, and avoids opening of the circuit-breakers further upstream.*

Types of selectivity With ABB SACE electronic trip units selectivity can be:

- **Current-based selectivity**, activated in the event of over-current, and in which the protections of the trip units are set with different current thresholds, based on the principle the closer the fault point is to the power supply the greater the current will be.
- **Time selectivity**, activated in the event of a short-circuit in which the S protection normally trips, and in which the protections of the trip units are set with different tripping times, so that with cascading circuit-breakers the circuit-breakers further downstream open before those further upstream.
- **Time-current selectivity**, which is a combination of the previously mentioned types, and in which the protections of the trip units are set so that the tripping times and current thresholds increase with proximity to the power supply.
- **Energy selectivity**, which uses current-limiting circuit-breakers, characterized by extremely short tripping times in the event of a short-circuit to avoid the current reaching the peak value (in the case of ABB SACE circuit-breakers, for example, all the moulded-case circuit-breakers of the Tmax series and certain air circuit-breakers of the Emax series are limiters).
- **Zone Selectivity**, which is an evolution of time selectivity, and in which is a dialog created between the trip units by means of output and input blocking signals. For more information on Zone Selectivity with ABB SACE circuit-breakers and in particular Emax 2, see the chapter "1 - Zone Selectivity" starting on page 138.

Further documents For each type of selectivity, the protections must be set so that only those circuit-breakers capable of isolating the overload or fault open, without the rest of the installation being de-energized. Relevant definitions, operating principles, areas of application, advantages and disadvantages, requirements, indications for setting the protections and examples are provided in the Technical Application Paper QT1 [1SDC007100G0205](#) Low voltage selectivity with ABB circuit-breakers

6 - Documents and Tools for the design engineer

Supporting software Different softwares are available; the majority are free of charge and are designed to facilitate, optimize and extend the functions and configurations of SACE Emax 2 in your installation:

Ekip Connect 3

ABB software to interface with Ekip Touch and other low voltage devices ([LINK](#))

EPiC

ABB APP to interface with Ekip Touch using a smartphone / tablet via Bluetooth ([LINK](#))

Ekip View

ABB software which supervises the communication network, analyzes the trend of the electricity values and monitors the plant conditions ([LINK](#))



NOTE: the link launches the software package download, which requires about 1.3 Gb of space.

e-Design

ABB software suite ([LINK](#)) which includes the following tools:

- DOC, to design the single-line diagrams of low and medium voltage electrical installations, choose the operating and protection devices and check and coordinate the protections
- CAT, for technical / commercial cost estimating of ABB products
- Curves, for drawing, calibrating and printing the trip curves of the protection devices
- OTC, for assessing the thermal behavior of the switchgear and sizing its fans and air conditioners
- UniSec, for configuring medium voltage switchgear

Front CAD

Software comprising libraries of block graphics for ABB panel-making products to be used with the latest versions of AutoCAD, AutoCAD LT, IntelliCAD ([LINK](#))

Slide Rules

App for sizing low voltage electrical cables according to the installation methods specified by current regulations and installation practices.

Further information on the documentation is available on the Apple Store, in particular: [SLIDE RULES](#).

Further documents

Various documents available free of charge in the ABB libraries describe SACE Emax 2 and the functions it supports:

Brochure: introductory overview

Main features of SACE Emax 2 circuit-breakers ([1SDC200023B0201](#))

Brochure: History of air circuit-breakers

Presentation of the origin and evolution of ABB air circuit-breakers ABB for low voltage applications ([1SDC200024B0201](#))

Brochure: retrofitting kit

Overview of retrofitting kits for New Emax circuit-breakers ([1SDC200034L0202](#))

Product notes for consultants

General overview of the features of Emax 2 circuit-breakers, specifically for consultants ([1SDC200032L0201](#))

Product notes for switchgear engineers

General overview of the features of Emax 2 circuit-breakers, specifically for switchgear engineers ([1SDC200028L0201](#))

Product notes the Ekip Link system

Introduction to the new Ekip Link switchgear control system ([1SDC200031L0202](#))

Product notes for Power Controller

Introduction to the new Power Controller load management system ([1SDC200030L0202](#))

Product notes for generator protections

General features for the new generator protections available with Emax 2 protection trip units ([1SDC200035L0202](#))

Product notes: migration to Emax 2

Advantages and details of migration from New Emax to Emax 2 circuit-breakers ([1SDC200036L0201](#))

White Paper for generator protections

White Paper on generator protections ([1SDC007409G0202](#))

White Paper for Ekip Power Controller

White Paper on the Power Controller function ([1SDC007410G0202](#))

White Paper for communication

White paper of communication modules for Emax 2 ([1SDC007412G0201](#))

Continued on the next page

Product Notes for IEC 61850

Overview of the new IEC 61850 communication modules [\(1SDC200038L0201\)](#)

Product notes for Network Analyzer

Introduction to the new Network Analyzer measurement and analysis system [\(1SDC200037L0202\)](#)

Catalogue

Emax 2 general catalogue [\(1SDC200023D0209\)](#)

Handbook

The purpose of this manual for electrical installations is to provide designers and users of such installations with rapidly consulted reference material [\(1SDC010002D0206\)](#)

IPS

White paper on the Interface protection System (IPS) and Interface Device (DDI) [\(1SDC007117G0202\)](#)

Load shedding

White paper on Load Shedding - Load shedding priority [\(1SDC007119G0201\)](#)

Synchronism and reclosing

White paper for *Synchro reclosing* synchronization solutions [\(1SDC007118G0201\)](#)

Trip unit Overview

1 - General characteristics

Families SACE Emax 2 can be configured to operate with two Trip unit families:

- Ekip Dip with interface via DIP switches
- Ekip Touch with touchscreen display

Both families provide protection and measuring functions related to signals from the installation and are available in different models and versions.

Ekip Dip is available in three versions:

- Ekip Dip LI
- Ekip Dip LSI
- Ekip Dip LSIg

There are four Ekip Touch models available:

- Ekip Touch (LSI, LSIg)
- Ekip Hi-Touch (LSI, LSIg)
- Ekip G Touch (LSIg)
- Ekip G-Hi Touch (LSIg)

All Ekip Touch models are also available in the version with LCD display for installations situated in particularly aggressive environmental conditions.

Main functions The Ekip Touch Trip unit provides the following functions:

Ekip Dip and Ekip Touch provides the following functions:

1. *Measurement:* measurement of different quantities, such as: current, voltage, power, energy
2. *Protection:* depending on the measurements made and the parameters configured by the user, the Trip unit checks for the presence of alarms and commands circuit-breaker opening if necessary
3. *Signalling:* management of contacts and communication networks to optimize plant efficiency, communication among different CB and other functions

The functions are provided both by transducers and actuators inside the circuit-breaker, and by means of a vast range of external accessories.

Presentation

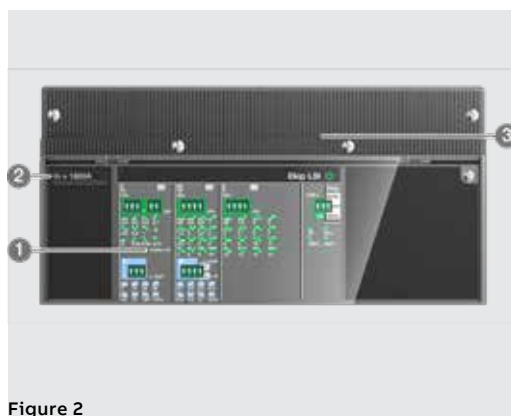


Figure 2



Figure 3

Ekip Dip (Figure 2) has a dip-switch (1) interface for configuring and verifying the protections and main parameters (page 21).

Ekip Touch (Figure 3) has a touchscreen display (1) for accessing the configuration menus and checking parameters, measurements and information (page 38).

The nominal size of the Rating plug (2) can be checked on the front.

All the external connections, including the supply and communication modules, the external sensors and mechanical accessories, are available in the upper terminal box (3) (page 19 for an overview of the electronic accessories).

2 - Ekip Touch models and versions

Default functions and extensions

Every Ekip Touch module has default measurement and protection functions, which can be extended with the aid of additional software packages.

The extensions (additional SW packages) can be pre-engineered when the circuit-breaker is ordered or at a later date (in this case, via ABB Ability Marketplace™)

Overview



Figure 4

Model	Ekip Touch	Ekip Hi-Touch	Ekip G Touch	Ekip G Hi-Touch	Page
Versions	LSI, LSIG	LSI, LSIG	LSIG	LSIG	
Standard protections	X	X	X	X	55
Voltage protections	O ⁽¹⁾	X	X ⁽³⁾	X	65
Voltage advanced protections	O ⁽¹⁾	O	X ⁽³⁾	X	68
Frequency protections	O ⁽¹⁾	X	X ⁽³⁾	X	72
Power protections	O ⁽¹⁾	X ⁽³⁾	X ⁽³⁾	X	75
ROCOF protections	O ⁽¹⁾	O	O	X	81
Adaptive protections	O	X	O	X	82
Standard Measurements	X	X	X	X	113
Measuring Measurements	O	X	X	X	117
Class 1 Power & Energy Metering	O ⁽²⁾	X	O	X	120
Datalogger	O ⁽¹⁾	X	X	X	121
Network Analyzer	O ⁽¹⁾	X	O	X	123

X = Available by default; O = Optional

⁽¹⁾ Configurable if Measuring Measurements package is present

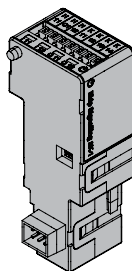
⁽²⁾ Only available at the time circuit-breaker is ordered

⁽³⁾ Certain protections of the complete package are available by default; the remaining ones can be activated on request

3 - Accessories and software

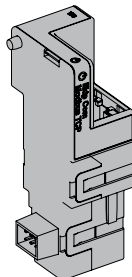
Internal and external accessories

The functions of Ekip Touch can be expanded by further internal and external accessories, which differ as to function and assembly position; certain accessories can also be configured with Ekip Dip.



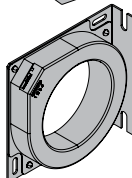
Internal modules

Name	Function	Page
Measurement ⁽¹⁾	Measurement and supply from installation voltages	205
Ekip Signalling 4K ⁽²⁾⁽⁵⁾	Programmable digital inputs/outputs	208
Ekip LCD	LCD interface for aggressive environments	211
Rating Plug ⁽³⁾⁽⁶⁾	Defines rated current In	204



External modules for assembly in upper terminal box⁽⁵⁾:

Name	Description	Page
Ekip Supply ⁽⁶⁾	Power supply of Trip unit and modules in terminal box	212
Ekip Com ⁽⁴⁾	Communication between Trip unit and external buses (various protocols)	213
Ekip Link ⁽⁴⁾⁽⁶⁾	Communication between Trip units via an intranet with ABB proprietary protocol	236
Ekip Signalling 2K	Programmable digital inputs/outputs	244
Ekip Signalling 3T	Measurement from current loop and temperature sensors	253
Ekip Synchrocheck	Measurement of an external voltage and management of synchronism between two supply sources	247



Other external modules and accessories:

Name	Description	Page
Ekip Signalling 10K ⁽⁵⁾⁽⁶⁾	Programmable digital inputs/outputs	256
Ekip Multimeter ⁽⁵⁾⁽⁶⁾	Panel front display	257
Toroid S.G.R.	Sensor for protection from earth fault currents	257
Toroid Rc	Sensor for protection from residual currents	257
External neutral ⁽⁶⁾	Sensor for protecting the external neutral line with 3P circuit-breaker	258

In addition, the supervision, configuration and reporting functions are provided by further modules for temporary communication and supply:

Name	Description	Page
Ekip TT ⁽⁶⁾	Supply and tests	259
Ekip T&P ⁽⁶⁾	Supply, communication, programming and tests	
Ekip Programming ⁽⁶⁾	Supply, communication and programming	

⁽¹⁾ Version and availability of the module depend on the Trip unit model and on activation of the measurements package

⁽²⁾ Configurable with circuit-breakers E2.2, E4.2 and E6.2

⁽³⁾ Assembled by default at the time equipment is ordered; can be replaced afterwards with a model of a different size

⁽⁴⁾ Always supplied with contacts Ekip AUP and Ekip RTC

⁽⁵⁾ Presence of auxiliary supply required and, for terminal box models, of Ekip Supply

⁽⁶⁾ Accessory also available and compatible with Ekip Dip

Additional functions

Ekip Touch can be equipped with further software configurations compliant with different functional applications:

- Power Controller
- Load Shedding
- Interface protections (IPS)
- Synchro reclosing
- Embedded ATS

For details consult the *Technical catalog* or the summary documents of each function (page 14).

4 - Operating features

Introduction

Ekip Dip and Ekip Touch have been developed and certified to function in specific environmental, electrical and mechanical conditions; full details are available in the *Technical catalog* (page 16).

The following sections describe the electrical and power supply characteristics that enable Trip unit and the relative electronic accessories to operate correctly.

Electrical characteristics

The Ekip Touch and Ekip Dip measurement and protection functions described in this document are provided with primary voltage and current values within the following nominal ranges:

Parameter	Rated operating range
Primary current	0,004 ÷ 16 In ⁽¹⁾
Primary voltage	5 ÷ 690 V AC ⁽²⁾
Rated frequency	45 ... 55 Hz (with fn= 50 Hz) / 54 ... 66 Hz (with fn= 60 Hz)
Peak factor	Complying with standard IEC 60947-2

⁽¹⁾ range with reference to each phase; In refers to the rated size defined by the Rating plug installed on the Trip unit, available in models from 100 A to 6300 A, depending on the circuit-breaker model used

⁽²⁾ for Ekip Touch rated highest line-to-line voltage connected directly to Trip unit, also to sockets inside the CB; external transformers must be used for higher voltage values, consult the chapter dedicated to the Measurement modules

Self-supply

The internal current sensors are able to supply the Trip unit directly; Ekip Touch versions Hi-, G, G Hi- are also fitted with the *Measurement enabler with voltage sockets* module, which allows the Trip unit to be supplied by the installation voltages as well:

Parameter	Operating limits
Minimum three-phase turn-on current	> 30 A (E1.2-E2-2-E4.2 with Rating Plug < 400 A)
	> 80 A (E1.2-E2-2-E4.2 with Rating Plug ≥ 400 A)
	> 160 A (E6.2)
Minimum three-phase turn-on voltage	> 80 V

Auxiliary power supply

Ekip Dip and Ekip Touch can be connected to an external auxiliary supply source, which is useful for activating certain functions such as communication via Local Bus, recording manual operations, certain measurements and the datalogger if available.

The auxiliary supply can be provided by modules from the *Ekip Supply* range or by direct connection to the terminal box.

Direct connection must guarantee the following operating conditions:

Parameter	Operating limits
Voltage	24 V DC galvanically isolated
Tolerance	±10%
Maximum ripple	±5%
Maximum inrush current @ 24 V	10 A per 5 ms
Maximum rated power @ 24 V	4 W
Connection cable	Insulated with grounding cable (same characteristics as Belden 3105A/B or higher)



IMPORTANT: if connection is direct, the power supply must be galvanically insulated and provide the insulation characteristics established by standard IEC 60950 (UL 1950) or equivalent.

Ekip Dip

1 - Operator interface

Introduction

The operator interface of the Ekip Dip protection release allows you to:

- Set the parameters relating to the available protections.
- View the status of the trip unit and alarms.
- Connect to the frontal connector to communicate and perform the opening test.

Components of the interface

The Ekip Dip operator interface appears as follows:

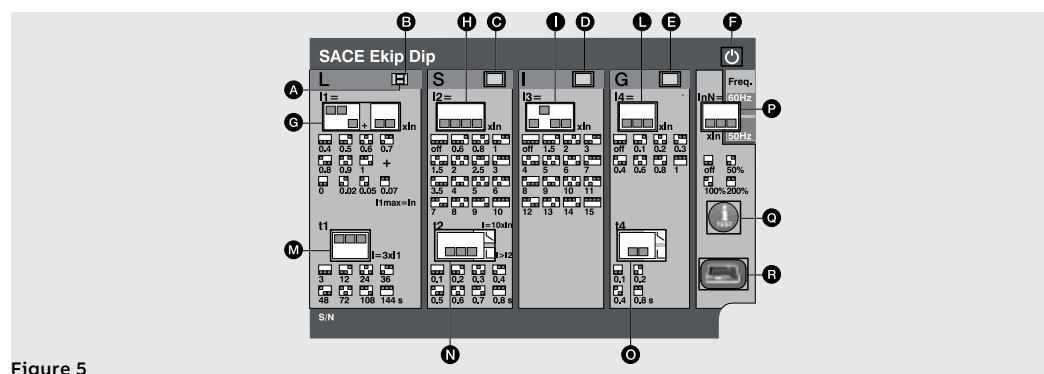


Figure 5

The following table provides a description of the components of the interface:

Position	Type	Description
A	LED	L Protection LED (alarm and trip)
B		L Protection LED (pre-alarm)
C		S Protection LED (alarm and trip)
D		I Protection LED (trip)
E		G Protection LED (alarm and trip)
F		Power-on LED (trip unit powered and on)
G	Protections: thresholds	L Protection dip-switch (threshold I1)
H		S Protection dip-switch (threshold I2)
I		I Protection dip-switch (threshold I3)
L		G Protection dip-switch (threshold I4)
M	Protections: times	L Protection dip-switch (time t1)
N		S Protection dip-switch (time t2 and type of curve)
O		G Protection dip-switch (time t4 and type of curve)
P	Settings	Neutral and frequency dip-switch
Q	Test	Test pushbutton
R		Test connector



IMPORTANT: the figure above refers to an Ekip Dip, LSIG version. In the case of Ekip Dip LI or LSI versions, LEDs and dip-switches related only to the protections present are available.

LED

The LEDs are useful on Ekip Dip in order to distinguish and identify various types of information on the protection trip unit, the circuit-breaker and state of the line currents.

Operational conditions

The operation of the LED is determined by the power supply conditions of the trip unit:

- With the trip unit energized (by current sensors or by auxiliary power supply or by Ekip TT or by Ekip T&P) the LEDs are operational for all the signals.
- With the trip unit de-energized, the LEDs are limited to the signalling of the last switch-off or trip event (combined with the check via iTest, described below).

Continued on the next page



NOTE: with the trip unit off, the operation of the LEDs is guaranteed if the internal battery of the trip unit is working properly.

About

The LEDs combined with the protections provide various information, through different combinations of lighting and blinking.



NOTE: all the combinations related to protection LED signals are described in chapter **Self-diagnosis and signalling**, on page 32.

The power-on LED provides information about the power status of the protection trip unit:

- LED on (default configuration) fixed or blinking, signals trip unit energized.
- LED off signals trip unit de-energized.



NOTE: with Ekip T&P module and Ekip Connect software, it is possible to configure how the power LED functions (LED fixed or blinking).

Protections: thresholds

The thresholds of all the protections can be modified with various dip-switches, as specified on the serigraph of the interface.

The values of the protections make reference to the current I_n , a nominal value defined by the Rating Plug.



IMPORTANT:

- **Modification of the thresholds must be performed in the absence of protection alarms.**
- **Modifications carried out in alarm conditions are accepted by the trip unit when resting condition is restored (absence of protection alarms).**

Protections: times

The times and the curves of the protections can be modified with various dip-switches, as specified on the serigraph of the interface.



IMPORTANT:

- **Modification of the times must be performed in the absence of protection alarms.**
- **Modifications carried out in alarm conditions are accepted by the trip unit when resting condition is restored (absence of protection alarms).**

Settings

Two further settings are available:

- **Neutral** allows activation and adjustment of the protections on the neutral pole.
- **Frequency** allows the selection of the installation frequency.

iTest pushbutton

The iTest pushbutton is useful for three operations:

- Perform tests (circuit-breaker opening test and LED test). Consult chapter 4 - Test on page 31.
- Reset the signal of the tripped protection. This operation can be performed when the circuit-breaker is both open and closed and with currents present, by pressing the push-button for about 1 second (the signal disappears when the push-button is released).
- With the trip unit off, check the information relating to the switch-off or tripping event.



NOTE: with the trip unit off, pressing of the iTest button switches on (for approximately 4 seconds):

- the power-on LED, if the trip unit is off due to an energy drop (primary current less than the minimum level of operation, removal of auxiliary power supply with circuit-breaker open, etc...).
- the protection tripped LED if the trip unit is off due to a protection trip.

Test connector

The test connector allows the connection of Ekip TT and Ekip T&P modules, in order to perform the following operations:

- Temporary energizing of the trip unit to check the status, and perform the trip test (option possible with all the front interface modules).
- Analysis, supervision and setting of additional parameters through external communication test units (Ekip T&P).

2 - Protections - Introduction

Operating principle

The protection functions are available with all Ekip Dip versions.

1. If the signal measured exceeds the set **threshold**, the specific protection activates (prealarm and/or **alarm** condition).
2. The **alarm** appears on the display and, after a period of time (timing t_p), depending on the protection parameters set, can convert into a **trip command (TRIP)** transmitted to the internal Trip Coil of the CB.



NOTE:

- if the signal measured drops below the set threshold before the trip time has elapsed, Ekip Dip quits the alarm and/or timing state and returns to the normal operating condition
- all protections have a default configuration: check the parameters and change to suit the installation requirements before putting into service
- to allow circuit-breaker tripping to be controlled by a specific protection, the protection itself must be enabled

L Protection

L protection protects against overloads

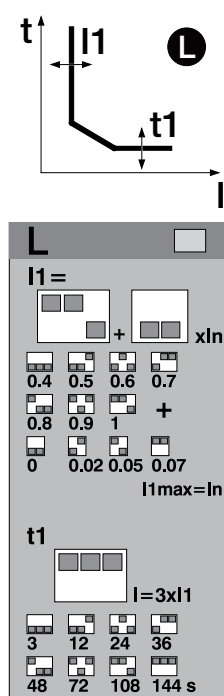


NOTE: the protection is available and active for all the versions of the trip unit.

When the activation threshold is exceeded, the protection trips in a time that decreases as the current read increases.

Parameters

All the parameters that can be modified by the user affect the response curve, and related tripping times.



Parameter	Description
Threshold I1	<p>The value I1 contributes in calculating the tripping time, and also defines the current value that, if exceeded, activates the protection (with reference to the curve, it is the part parallel to the y-axis).</p> <p>IMPORTANT:</p> <ul style="list-style-type: none"> • The protection is activated and starts timing for currents between 1.05 and 1.2 of the threshold I1 set ⁽¹⁾. • The delay is interrupted if the current drops below the activation threshold.
Time t1	<p>The value t1 contributes in calculating the tripping time (with reference to the curve, T1 affects the entire curve by shifting it as a whole along the y-axis).</p> <p>IMPORTANT:</p> <p>The protection limits the tripping time to 1 second in two cases:</p> <ul style="list-style-type: none"> • if, according to the calculation, the time is less than 1 second. • If the fault current is greater than 12 In.

⁽¹⁾ Example (with I1 set to 400 A): the protection is activated for currents between 420 A and 480 A.

With the module Ekip T&P and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**, and adjust the threshold of **Pre-alarm**.

S Protection

S protection protects against selective short circuit.

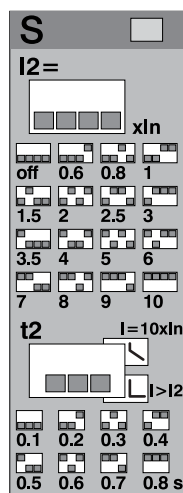
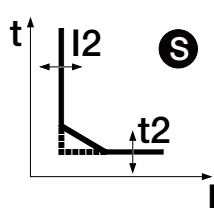


NOTE: the protection is available for LSI and LSIG versions of the trip unit.

When the activation threshold is exceeded, the protection trips within a fixed or dynamic time (the time decreases as the current reading increases).

Parameters

All the parameters that can be modified by the user affect the response curve, and related tripping times.

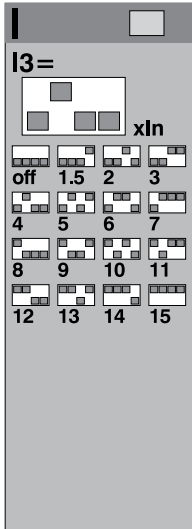
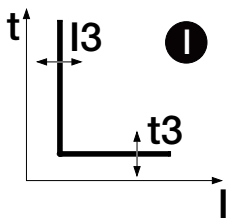


Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Type of curve	It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: NOTE: calculation of the tripping time of the inverse time curve is based on a mathematical expression. The details are provided in the table on page#s#29.
Threshold I2	It defines the current value that activates the protection when exceeded (with reference to the curve, it is the part parallel to the y-axis). IMPORTANT: <ul style="list-style-type: none"> • The I2 threshold set must be higher than the I1 threshold. An incorrect configuration returns an alarm signal. • The delay is interrupted if the current drops below the activation threshold.
Time t2	The selected function determines the contribution of t2: <ul style="list-style-type: none"> • Fixed time: t2 is the delay time between exceeding the I2 threshold and sending the opening command. • Dynamic time: t2 contributes in calculating the tripping time (with reference to the curve, t2 affects the entire curve, shifting it as a whole along the vertical axis). IMPORTANT: <ul style="list-style-type: none"> • The minimum tripping time of the protection is t2. If, according to the calculation, the tripping time is less, it is automatically limited to t2. • For all the UL versions, the maximum time allowed is 0.4 s. If a higher value is set, the trip unit signals the error and forces the parameter to 0.4 s.

With the module Ekip T&P and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**.


I Protection

I protection protects against instantaneous short circuit.
When the activation threshold is exceeded, the protection trips within a fixed non-adjustable time.



Parameters

The user can set the intervention threshold.

Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Threshold I3	It defines the current value that activates the protection when exceeded (with reference to the curve, it is the part parallel to the y-axis). <div> IMPORTANT: The I3 threshold set must be higher than the I2 threshold. An incorrect configuration returns an alarm signal.</div>

G Protection

G protection protects against a ground fault.

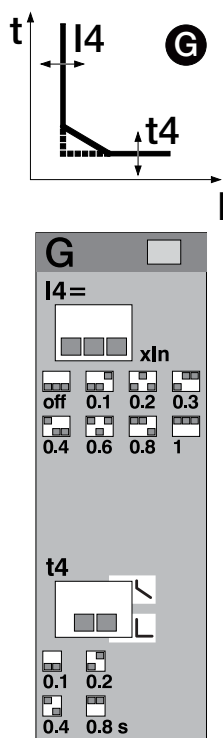


NOTE: the protection is available for the LSIG version of the trip unit.

When the activation threshold is exceeded, the protection trips within a fixed or dynamic time (the time decreases as the current reading increases).

Parameters

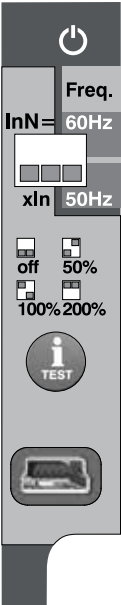
All the parameters that can be modified by the user affect the response curve, and related tripping times.



Parameter	Description
Enable	<p>By setting the dip-switches of the threshold in one of the available combinations other than Off, the protection is enabled. If enabled, the protection is inhibited automatically by the trip unit under two conditions:</p> <ul style="list-style-type: none"> • Disconnection of one or more current sensors. • Current measured on one of the phases higher than a maximum value. <p>! IMPORTANT: the maximum current value that deactivates G protection varies according to the threshold set:</p> <ul style="list-style-type: none"> • 8 In (with $I4 \geq 0.8 I_n$) • 6 In (with $0.5 I_n \leq I4 < 0.8 I_n$) • 4 In (with $0.2 I_n \leq I4 < 0.5 I_n$) • 2 In (with $I4 < 0.2 I_n$)
Type of curve	<p>It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection:</p> <p>i NOTE: calculation of the tripping time of the inverse time curve is based on a mathematical expression. The details are provided in the table on page#s#29.</p>
Threshold I4	<p>It defines the current value that activates the protection when exceeded (with reference to the curve, it is the part parallel to the y-axis).</p> <p>! IMPORTANT:</p> <ul style="list-style-type: none"> • The delay is interrupted if the current drops below the tripping threshold. • For all the UL versions the maximum threshold allowed by the trip unit is 1200 A. If a higher value is set, the trip unit signals the error and forces the parameter to 1200 A.
Time t4	<p>The selected function determines the contribution of t4:</p> <ul style="list-style-type: none"> • Fixed time: t4 is the delay time between the exceeding of the I4 threshold and the sending of the opening command. • Dynamic time: t4 contributes in calculating the tripping time (with reference to the curve, t4 affects the entire curve, shifting it as a whole along the y-axis). <p>! IMPORTANT:</p> <ul style="list-style-type: none"> • The minimum tripping time of the protection is t4. If, according to the calculation, the tripping time is less, it is automatically limited to t4. • For all the UL versions, the maximum time allowed by the trip unit is 0.4s. If a higher value is set, the trip unit signals the error and forces the parameter to 0.4 s.

With the Ekip T&P module and with the Ekip Connect software it is possible to adjust the threshold of **Pre-alarm**.

Neutral and frequency



Adjusting of the neutral setting is used to customize the L, S and I protections on the Neutral pole with a control factor different from the other phases.

NOTE: use the adjustment of the neutral setting only with four-pole or three-pole circuit-breakers with external neutral: with three-pole circuit-breakers and neutral protection active, the trip unit signals the absence of the current sensor.

The adjustment of the frequency is used in order to set the installation frequency (between 50 and 60 Hz).

Neutral parameters

The user can activate the protection and set the percentage for calculation of the protection thresholds.

Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection on the Neutral is disabled.
Threshold InN	It establishes the multiplication factor applied to the trip thresholds of the protections: <ul style="list-style-type: none">• 50%: trip threshold of the neutral current lower than other phases.• 100%: same trip thresholds for all poles.• 200%: trip threshold of the neutral current higher than other phases.

Limitations

The adjustment of the Neutral threshold to value of 200 % must be performed considering the following formula: $(I1 * InN) \leq Iu$.

I1 indicates the threshold of L protection in amperes (example: In = 1000 A; I1 = 0.45 In = 450 A), InN is the neutral threshold expressed as a multiplication factor (example: 2), Iu indicates the size of the circuit-breaker (example: 1000 A).

WARNING! With 200% threshold and measured neutral current exceeding 16In, the Trip unit resets the protection to 100% by itself

Additional protections

The Ekip T&P module, and the Ekip Connect software, allow you to set some protections not available via dip-switch:

- Thermal Memory
- T Protection
- Prealarm threshold
- Hardware Trip

Thermal Memory

The function, which is available for L and S protections, allows overheating in the cables connected to the circuit-breaker to be prevented: in the case of trips within brief intervals, the unit considers the time between commands and the entity of the faults so as to reduce opening time.



IMPORTANT: for the S protection the function can be activated if the selected curve is time-dependent.



NOTE: the function also reduces the trip time in the case of overloads which have not led to the open command (longer than 100ms)

T Protection

T protection protects the circuit-breaker against abnormal temperatures recorded by the protection trip unit.

T protection is always active; via Ekip Connect it is possible to enable tripping, which takes place for temperatures $t < -40\text{ °C}$ or $t > 85\text{ °C}$.

Pre-alarm

The purpose of the pre-alarm, available for L and G protections, is to signal that the measured current is near the activation threshold of the protection itself.

It is possible to set the pre-alarm threshold in order to establish the pre-alarm activation values; the pre-alarm threshold is expressed as a percentage in relation to the protection thresholds (I1 and I4) and is adjustable between 50% and 90% (default value).

Example: with $I1 = 0.6 I_n$ and pre-alarm threshold $L=50\%$, the pre-alarm is activated for currents greater than $0.3 I_n$

The pre-alarm condition is activated for currents higher than the threshold set, and is deactivated for:

- Current less than the pre-alarm threshold.
- Current greater than the activation threshold of protection.

Hardware Trip

If enabled, the protection activates if one or more disconnections of the current sensors, Rating plug, Trip coil or an alarm inside the unit are detected.

The protection activates with a TRIP if the disconnections persist for more than one second; in the case of Trip coil disconnection, the unit merely handles alarm signaling.

Inst

The purpose of this protection is to maintain the integrity of the circuit-breaker and installation in the case of particularly high current values requiring shorter reaction times than those provided by the instantaneous short-circuit-protection.

The protection cannot be disabled, the tripping threshold and time are defined by ABB.

Summary table of protections

ABB	ANSI ⁽⁵⁾	Threshold ⁽¹⁾	Threshold tolerance ⁽³⁾	Time ⁽¹⁾	Calculation formula t_t ⁽²⁾	Calculation example t_t ⁽²⁾	Tolerance t_t ⁽³⁾
L	49	$I_1 = 0.4 \dots 1 I_n$	activation for I_f in the range $(1.05 \dots 1.2) \times I_1$	$t_1 = 3 \dots 144 \text{ s}$	$t_t = (9 t_1) / (I_f / I_1)^2$	$t_t = 6.75 \text{ s}$ with: $I_1 = 0.4 I_n$; $t_1 = 3 \text{ s}$; $I_f = 0.8 I_n$	$\pm 10 \%$ with $I_f \leq 6 I_n$ $\pm 20 \%$ with $I_f > 6 I_n$
S ($t = k$)	50 TD	$I_2 = 0.6 \dots 10 I_n$	$\pm 7 \%$ with $I_f \leq 6 I_n$ $\pm 10 \%$ with $I_f > 6 I_n$	$t_2 = 0.1 \dots 0.8 \text{ s}$	$t_t = t_2$	-	The better of the two values: $\pm 10 \%$ or $\pm 40 \text{ ms}$
S ($t = k / I^2$)	51	$I_2 = 0.6 \dots 10 I_n$	$\pm 7 \%$ with $I_f \leq 6 I_n$ $\pm 10 \%$ with $I_f > 6 I_n$	$t_2 = 0.1 \dots 0.8 \text{ s}$	$t_t = (100 t_2) / (I_f)^2$	$t_t = 5 \text{ s}$ con: $I_2 = 1 I_n$; $t_2 = 0.8 \text{ s}$; $I_f = 4 I_n$	$\pm 15 \%$ with $I_f \leq 6 I_n$ $\pm 20 \%$ with $I_f > 6 I_n$
I	50	$I_3 = 1.5 \dots 15 I_n$	$\pm 10 \%$	Not adjustable	$t_t \leq 30 \text{ ms}$	-	-
G ($t = k$)	50N TD	$I_4^{(4)} = 0.1 \dots 1 I_n$	$\pm 7 \%$	$t_4 = 0.1 \dots 0.8 \text{ s}$	$t_t = t_4$	-	The better of the two values: $\pm 10 \%$ or $\pm 40 \text{ ms}$
G ($t = k / I^2$)	51N	$I_4^{(4)} = 0.1 \dots 1 I_n$	$\pm 7 \%$	$t_4 = 0.1 \dots 0.8 \text{ s}$	$t_t = 2 / (I_f / I_4)^2$	$t_t = 0.32 \text{ s}$ with: $I_4 = 0.8 I_n$; $t_4 = 0.2 \text{ s}$; $I_f = 2 I_n$	$\pm 15 \%$
Inst	-	Defined by ABB	-	Instantaneous	-	-	-

⁽¹⁾ See the serigraph for the available combinations.

⁽²⁾ t_t calculation is valid for I_f values that have exceeded the trip threshold of the protection. Use fault current and threshold values expressed in I_n to calculate t_t , as shown in the example.

⁽³⁾ Tolerances valid with trip unit energized in service conditions or with the auxiliary; tripping time $\geq 100 \text{ ms}$, temperature and currents within operating limits. If these conditions are not guaranteed, the tolerances in the table shown below apply.

⁽⁴⁾ In the presence of auxiliary power supply, you can select all the thresholds. In self-supply mode the minimum threshold is limited to: $0.3 I_n$ (with $I_n = 100 \text{ A}$), $0.25 I_n$ (with $I_n = 400 \text{ A}$) or $0.2 I_n$ (for all other sizes).

⁽⁵⁾ ANSI / IEEE C37-2 encoding.

Key

- ($t=k$) - Fixed time curve
- ($t=k/I^2$) - Dynamic time curve
- t_t - Tripping time
- I_f - Primary fault current

Tolerances in particular cases

If the conditions defined in point ⁽³⁾ of the above table are not guaranteed, the following tolerances apply:

Protection	Tolerance threshold	Tolerance t_t
L	Activation for I_f in the range $(1.05 \dots 1.2) \times I_1$	$\pm 20 \%$
S	$\pm 10 \%$	$\pm 20 \%$
I	$\pm 15 \%$	$\leq 60 \text{ ms}$
G	$\pm 15 \%$	$\pm 20 \%$

3 - Measurements

List Ekip Dip is able to take various measurements, all available via Ekip Connect::

Parameter	Description
<i>Instantaneous currents</i>	Phase current and earth fault measurements in real time
<i>Trip</i>	List of current protection trips (TRIP)
<i>Min Max Measurements</i>	History of minimum and maximum currents, recorded at a settable interval
<i>Operation counters</i>	Number of mechanical and electrical operations

All information are available via the Ekip T&P module and via Ekip Connect software; instantaneous measurements are also available via the Ekip Multimeter unit.

Instantaneous currents The instantaneous currents, available in the Measurements pages, are real time measurements of the phase and earth fault currents expressed in root mean square value; the measurement time and performance depend on the rated current defined by the *Rating plug* (In):

Measurement	Monitor time (min-max)	Normal operating range	Accuracy of value read ⁽¹⁾
<i>Phase currents</i>	0,004...64 In	0,2...1,2 In	1 %
<i>Internal earth fault currents</i> ⁽²⁾	0,08...64 In	0,2...1,2 In	2 %

⁽¹⁾ the accuracies refer to normal operating ranges, as established by IEC 61557-12

⁽²⁾ available with LSIG versions

Maximum and minimum currents The trip unit is able to record the maximum and minimum current, measured inside an interval that can be programmed by the user.

Every measurement recorded is accompanied by the following information:

- Recording interval.
- Phase and value of maximum and minimum current measured.
- Date and time of the recording (referring to the internal clock).



NOTE: in the case of the minimum current, if the value drops below the 0.03 In threshold, it will be recorded and represented by the symbol “...” in the measurement field.

Trips The trip unit is able to record the last 30 openings of the circuit-breaker caused by protection functions (trips).

The trips include useful information:

- The protection that caused the trip
- The progressive number of the opening
- The date and time of the opening (referring to the internal clock)
- The measurements associated to the trip protection.

Contact Wear Contact wear indicates the state of deterioration of the main contacts of the circuit-breaker.

The value is expressed as a percentage, and is 0 % in the case of no wear, and 100 % in the case of total wear.

The contact wear is calculated automatically by the trip unit at every opening for protection or, in the presence of an auxiliary power supply, also at every manual opening of the circuit-breaker.

Number of operations In the presence of auxiliary power, the trip unit records a series information relating to the openings of the circuit-breaker:

- Number of manual operations
- Total number of operations (manual + trips)

4 - Test

Presentation The Ekip TT and Ekip T&P modules connected to the Ekip Dip allow you to perform various tests:

- Trip unit LED test
- Check on the presence of the internal battery
- Circuit-breaker opening test (trip test)
- Protection test.

LED test The LED test can be performed directly on Ekip Dip:

Phase	Operation
1	Connect a module to the front test connector of frontal test.
2	Press the iTest pushbutton for at least 6 seconds, but less than 9 seconds.
3	When the protection LEDs light up, trip unit the iTest pushbutton.
4	Check the following switch-on sequence: <ul style="list-style-type: none"> • S, I, G LEDs on fixed • Led pre-alarm L and alarm L that alternate three times • All the protection LEDs off

Battery test The battery check is integrated in the LED test procedure, except for the battery error signal:

- If the battery is absent or not working, after iTest is pressed the error is signalled by five flashes of the pre-alarm LED L.
- If the battery is present and working, the LED test proceeds as in the normal procedure.

Protection test In order to perform the protection test, follow the instructions below:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no primary currents.
2	Connect Ekip T&P to the front test connector.
3	Start the communication with Ekip Connect.
4	Open the Information page and select the Test command, which opens the protection test page.
5	Set up the test as required and verify that the trip unit functions properly.

Opening test The opening test can be performed directly on the trip unit or from Ekip Connect.

To perform the test:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no primary currents.
2	Connect a module to the front test connector of frontal test.
3	Press the iTest pushbutton for at least 9 seconds.
4	Check that the circuit-breaker opens and that the TU Reset button comes out

To perform the test from Ekip Connect:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no primary currents.
2	Connect Ekip T&P to the front test connector.
3	Start the communication with Ekip Connect.
4	Select the trip test command.
5	Check that the circuit-breaker opens and that the TU Reset button comes out

Further information on Ekip Connect is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the manual [1SDH000891R0002](#).

5 - List of alarms and signals

LED view

Ekip Dip continuously monitors its own operating condition and that of all the devices to which it is connected. All the signals are available with the front LEDs. The protection LEDs provide information with various combinations of lighting and flashing, while the power-on LED, as described on page 22, indicates the power-on conditions of the trip unit.



NOTE: the number of LEDs depends on the version of Ekip Dip (LI, LSI, LSI^G).

Summary table of LED signals

The following table summarises the signals available with the protection LEDs and the operations to be carried out in response to alarms or fault conditions signalled.

Type of Information	Slow flashing (0.5Hz)			Fast flashing (2 Hz)				On and fixed			2 flashes every 2 s		3 flashes every 3 s	4 flashes every 4 s	HELP
Colour and LED	All R	G	All R+G	All R	R (single)	G	All R+G	All R	R (single)	G	All R	G	G	G	
Internal configuration error ⁽⁵⁾			x				x	x							A
Trip coil disconnected or trip command failed				x											B
Current sensors disconnected	x														B
Rating Plug error											X				B+E
Protection delay					x										C
Temperature alarm ⁽¹⁾					x										C
Pre-alarm L										x					C
Trip ⁽²⁾									x						C
Hardware Trip ⁽³⁾									x	x					B
Installation error						x									E
Parameter error												x			D
Circuit-breaker state not defined or in error		x													B
Error on Local Bus														x	F
Maintenance alarm													x		F
Software incompatibility								x		x					G
Low battery (during self-test) ⁽⁴⁾						x									H

⁽¹⁾ The temperature alarm is signalled by lighting of the protection L and I red LEDs.

⁽²⁾ The last trip can also be displayed with trip unit off, by pressing the iTest key.

⁽³⁾ The Hardware Trip is signalled by lighting of the pre-alarm L yellow LED and the protection I red led.

⁽⁴⁾ Five flashes when self-test is started up

⁽⁵⁾ Error present with one of the three flashing options displayed alongside.

Key to LED colours

The above table lists the colors of the LEDs, to be interpreted as follows:

- R = red LED (alarm LED L, S, I, G).
- G = yellow LED (pre-alarm LED L).



NOTE: for further details refer to the table listing the components of the interface, available on page 21.

Continued on the next page

HELP

Some LED signals indicate connection errors or operational errors that require corrective or maintenance operations. The following are the suggestions for checking with reference to the preceding LED table:

HELP note	Operation
A	Contact ABB and give details about the state of the LEDs on the unit.
B	Check the connections between trip unit and accessories (Rating Plug, trip coil, sensors, etc).
C	Normal operation/signalling provided by the trip unit.
D	Error in setting of the dip-switches. Check and correct the following conditions: <ul style="list-style-type: none"> • $I_1 \geq I_2$ or $I_2 \geq I_3$. • $I_u < (2 * I_n * I_1)$ in the case where $I_n = 200\%$. • $I_4 < 0.3 I_n$ (con $I_n = 100\text{ A}$), $0.25 I_n$ (con $I_n = 400\text{ A}$) or $0.2 I_n$ (for all other sizes), in the absence of auxiliary power supply. • $t_2 > 0.4\text{ s}$ (in the case of UL circuit-breaker) • $t_4 > 0.4\text{ s}$ (in the case of UL circuit-breaker) • $I_4 > 1200\text{ A}$ (in case of UL circuit-breaker)
E	Install by pressing and holding the itest pushbutton for at least 5s.
F	Connect via Ekip Connect in order to set the Local Bus or to confirm maintenance.
G	Replace the battery.

6 - Additional functions

Presentation Ekip T&P and Ekip Programming allow the protection trip unit to be connected to Ekip Connect software and to access parameters and commands that cannot be accessed directly from the front interface: a description of the various functions is given below.

The additional protections available via Ekip Connect are described on page 28.

Maintenance The Maintenance function allows signalling to the user, via LED, that:

- One year has passed since the last maintenance.
- Contact wear has increased by more than 10% compared with the value at the last maintenance.

Via Ekip Connect there are two selections available:

- Activation: it allows the maintenance function to be activated.
- Reset: it allows confirmation of maintenance on the trip unit; the present date and contact wear values are recorded, and the signal is reset.

The reference date is that of the internal clock, and the elapsed time is calculated both with the trip unit on and off (provided that the internal battery is working).



NOTE: *manual modification of the date can cause variations in the calculation of the time elapsed, and therefore in the date of the next maintenance.*



NOTE: *the maintenance signal due to increased contact wear is active for values higher than 20 %.*

Local Bus In order to activate communication on the Local Bus with the Ekip Link, Ekip Multimeter or Ekip Signalling 10K modules, the Local Bus parameter must be enabled.



NOTE: *communication with the modules is active if the auxiliary power supply is present.*

Date and time The Ekip Dip trip unit has a user-adjustable internal clock.

Setting the date can be useful for some functions such as the recording of trips and minimum and maximum currents, and maintenance.

The clock is active if the internal battery of the trip unit is working.

Programmable States

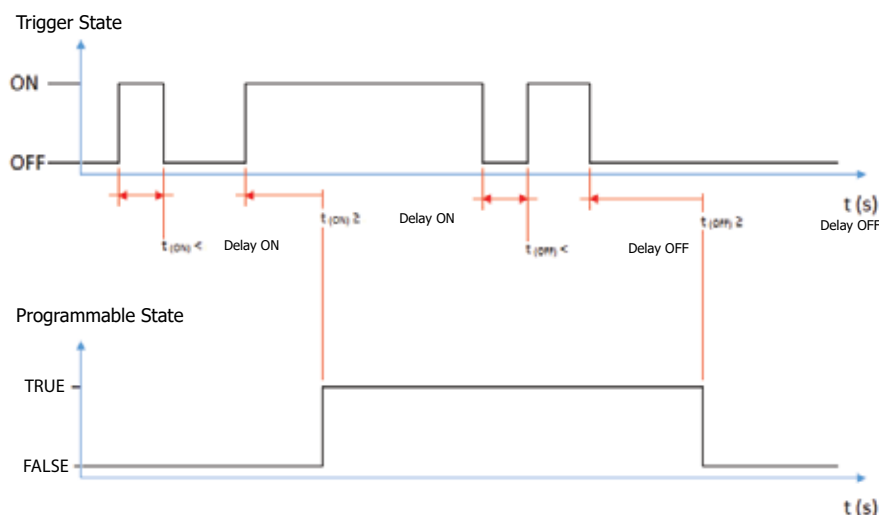
There are sixteen independent programmable states identified by the letters A, B, C, D, E, F, G, H, I, L, M, N, O, P, Q, R, offering different solutions for event control.

The value of each programmable state can be either "True" or "False". Different configuration parameters are available:

- **Trigger:** event or combination of more events of state activation (up to 24, in AND or OR logic configuration).
- **On Delay:** state activation delay calculated from trigger presence onwards.
- **Off Delay:** state de-activation delay calculated from trigger absence onwards.



NOTE: the state become activate if the trigger is present for longer than the On delay setting and become inactive if the trigger is absent for longer than the Off delay setting.



The states can be used with the external Ekip Signalling 10K module, on Link Bus or with the programmable functions, to transfer the desired signalling combination on contacts.

Programmable Functions

Ekip Dip allows you to program five commands so that they are automatically activated according to the signalling state or the events selected by the user. The commands are:

- Trip
- Reset of the trip signal.
- Reset signalling contacts of the Ekip Signalling 10K module.
- Opening coil command (YO).
- Closing coil command (YC).

Each command provides two programming parameters:

- Activation function: event or events (up to eight, in logical AND or OR configuration) that activate the command.
- Delay: command sending delay, calculated starting from the occurrence of the activation event.



NOTE: the command is sent if the event is present for a time greater than the delay that has been set.



NOTE: the YO and YC commands are possible only if the coils and Ekip Actuator are present, and if all the operating conditions exist (see page 136).

Circuit-breaker label and user Data	Labels that can be configured by the user so as to facilitate remote identification of the trip unit; in detail the CB label , the trip unit model and the communication address form the identifier used by Ekip Connect for the devices connected.
Date of installation	Installation date of the circuit-breaker.
Load Profile Timers	<p>SACE Emax 2 has 4 counters which display how long the maximum current measured has remained in each percentage band.</p> <p>The counters are expressed in seconds and the bands are: 0-49%In, 50-79%In, 80-89%In, >90%In.</p>
LED Alive	<p>The parameter allows the behaviour of the power-on LED indicator of the trip unit and of all modules that can be connected to Ekip Supply to be changed. If activated:</p> <ul style="list-style-type: none"> • Trip unit: it comes on at a frequency of 0.5 Hz. • Modules connected to Ekip Supply: if there are no communication errors, they synchronize with the flashes of the trip unit LED. <p>If deactivated, the power-on leds on the respective devices come on with a steady light.</p>
Modules network settings retention	<p>It allows the communication parameters of the circuit-breaker to be controlled if the trip unit is replaced:</p> <ul style="list-style-type: none"> • Overwrite: the parameters of the new trip unit are valid, so it is advisable to make sure that the communication parameter settings suit the communication network. • Keep module data: the new trip unit updates its communication parameters with the ones in the Ekip Com modules of the circuit-breaker, used up to that moment in the various communication networks. <p>The trip units are supplied with the parameter set as Overwrite.</p>
Wink	<p>The command allows the power-on LED on the protection trip unit to flash at 3 Hz so as to physically identify a trip unit that would not be identifiable in other ways.</p> <p>3 Hz flashing is disabled by sending another Wink command or by switching off the trip unit.</p>
Glitch	The commands of Glitch 16 to 23 activate the respective glitch registers, which can be used for customizing programmable functions or output contacts.

7 - Default parameters

The Ekip Dip trip units are supplied with the following default parameters, some adjustable with the front DIPs (protections, Frequency, Neutral), other via front bus.

Protection/Parameter	Value
L	1 In; 144 s
S ⁽¹⁾	Off; 0.1 s
I	4 In
G ⁽¹⁾	Off; 0.1 s
Frequency	50 Hz (IEC) / 60 Hz (UL)
Neutral	Off (for three-pole circuit breakers). 50 % (for four-pole circuit-breaker)
Hardware Trip	Disabled
Local Bus	Off
LED Alive	Disabled (Power-on LED fixed)
Maintenance	Off

⁽¹⁾ S Protection available with LSI and LSIG versions of the trip unit. G Protection available with LSIG version.

Ekip Touch - Interface and menus

1 - Presentation of interface

- Functions**
- The Ekip Touch operator interface allows you to:
- display signals and measurements of the functions in progress or recorded events
 - configure the parameters, the protections present and other functions of the unit
 - Set parameters for the connected accessory modules
 - perform tests

Components

The Ekip Touch interface includes an LCD display, short-cut and navigation menu push-buttons, status leds and a service connector for certain external accessories:



Figure 6

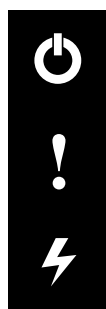
Pos.	Description
A	Single-touch color touchscreen display
B	LED Power
C	LED Warning
D	LED Alarm
E	HOME push-button
F	iTEST push-button
G	Service connector

Display

The touchscreen display of Ekip Touch is the single-touch, color type.
The touchscreen function is active when the unit is on.



LED



LED	Colour	Description
Power 	Green	Indicates the on status of Ekip Touch: <ul style="list-style-type: none"> • off: no power and unit off • on, steady (<i>Power mode</i>) or flashing (<i>Alive mode</i>): unit on and self-supplied by external Vaux or service connector The <i>Power mode</i> or <i>Alive mode</i> can be selected via Ekip Connect: if the <i>Alive mode</i> has been selected and external modules are connected, the Power leds of Ekip Touch and the modules flash in the synchronized mode.
Warnings 	Yellow	Signals that certain alarms are present: <ul style="list-style-type: none"> • off: no alarm • on: steady prealarm of an active protection or status contacts error • two fast flashes every 0.5 s: trip unit parameter configuration error • fast flash: <i>Rating Plug</i> or <i>Measurement</i> module installation error
Alarm 	Red	Signals that an alarm is present: <ul style="list-style-type: none"> • off: no alarm • on and steady: TRIP signalling due to protection or internal error; check message on diagnosis bar to find out which • fast flash: one or more of the following signals: protection timing active, disconnection of a current sensor, trip coil disconnected, failed trip command • two fast flashes every 2 seconds: <i>Rating Plug</i> error

If on at the same time, the Warning and Alarm leds provide further signals:

- LEDs on and flashing fast: absence of communication between Trip unit and Mainboard or T protection timing
- leds on with slow flashing: internal error

These cases need assistance from ABB.

Push-buttons



Push-button	Description
HOME 	Allows different areas of the menu to be accessed: <ul style="list-style-type: none"> • from pages <i>HOME</i>, <i>Histograms</i>, <i>Measuring instruments</i>, <i>Measurements</i>, <i>Main measurements</i> open the page <i>Main page</i>; • from pages <i>Main page</i>, <i>Alarm list</i>, at any point of the menu area open: <i>HOME</i> page.
iTest 	Allows certain pages of information about the unit to be rapidly consulted; press the button in succession to display the following pages: <ul style="list-style-type: none"> • <i>Alarm list</i>, if messages are present; • <i>Info</i>, if Customer Page option is active; • <i>Protection unit</i>, with information about Ekip Touch; • <i>Circuit breaker</i>, with information about the CB; • <i>Last trip</i>, with information about the last trip, if available. Consultation is active from pages: <i>HOME</i> , <i>Histograms</i> , <i>Measuring instruments</i> , <i>Measurements</i> , <i>Main measurements</i> NOTE: with <i>Ekip Touch</i> off and the internal battery charged, press iTEST to temporarily switch on the Power led and, in the case of a trip, the display with information about the trip protection and the Alarm led

Service connector



The service connector enables Ekip Touch to be connected to *Ekip TT*, *Ekip T&P* and *Ekip Programming*, allowing the unit to be temporarily supplied, parameter configuration prior to putting into service, tests and extension of the configuration functions.



IMPORTANT: only use cables supplied by ABB or with ABB accessories

2 - Navigation

Levels and pages The Ekip Touch menu is divided into several levels, all accessible using the touchscreen display and buttons available in the units:

Level 1 (HOME)

Page shown on power up; appears when push-button of the same name appears, as described on page 39; from here you can:

1. access the *MAIN PAGE* (level 2), by pressing the **HOME** button
2. access the *Alarm list*, by selecting the diagnostic bar at the bottom
3. access the *Summary pages* of some of the measurements by pressing on the edges

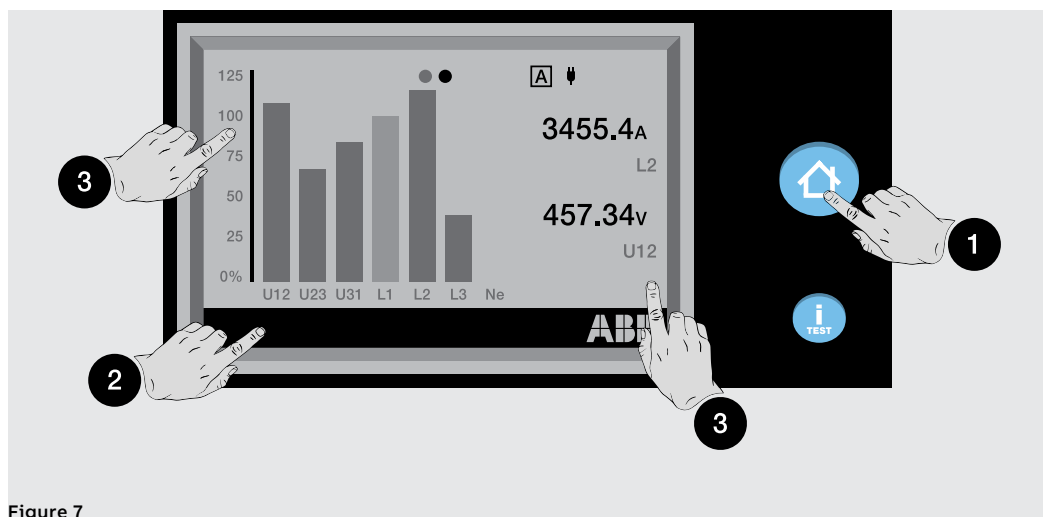


Figure 7



NOTE: Ekip Touch is supplied with the Histograms page configured as HOME; if the configuration is different, the Histograms can be set as the main page by pressing and holding the **HOME** key for five seconds and confirming the message on the display

Level 2 (MAIN PAGE)

This page allows you to:

4. access one of the graphic pages: *Histograms*, *Measuring instruments* and *Measurements*
5. access the MENU AREA (level 3)



Figure 8

Continued on the next page

Level 3 (MENU AREA):

You can access all the configuration menus and consult the parameters in this page

- 6. *Protections and Advanced*
- 7. *Measures*
- 8. *Settings*
- 9. *Test*
- 10. *About*

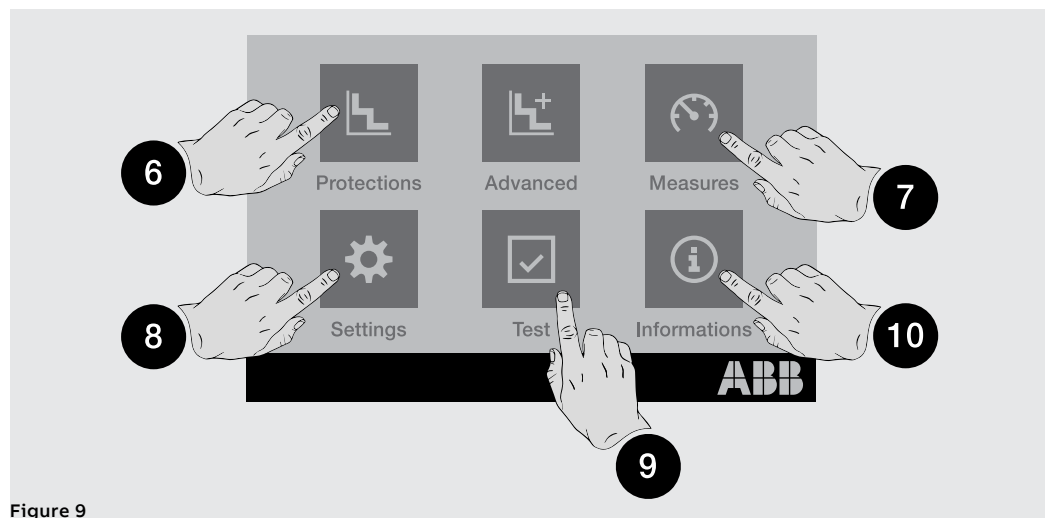


Figure 9

Level 4 (MENUS and SUBMENUS)

Selection of one of the level 3 menus accesses a set of submenus with the list of available options, which are organized into several levels through to details of the specific parameter.

Each submenu has a command for returning to the previous menu (11); if the list contains more than five options, there is also a scroll bar (12) for full consultation.

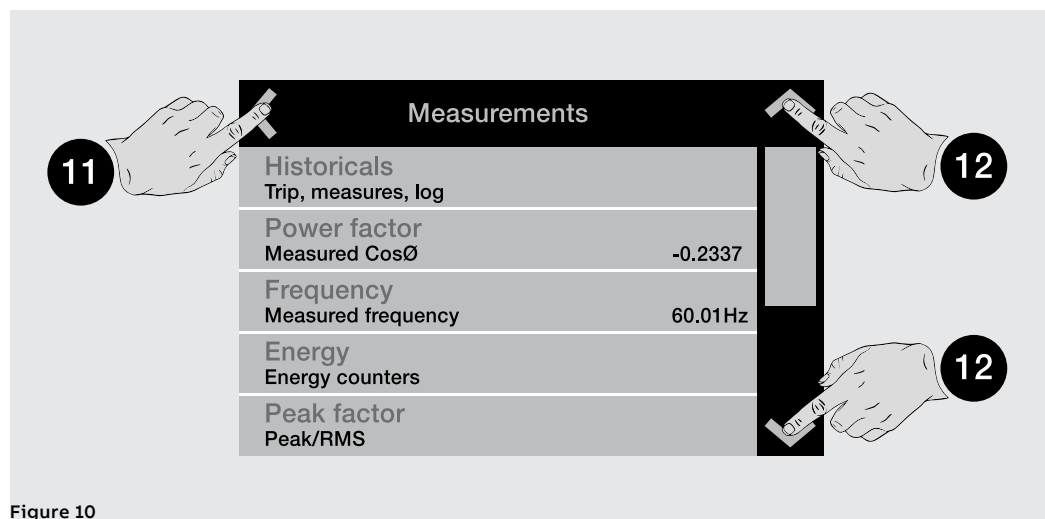


Figure 10

To consult a parameter, it just needs to be selected.

Consult the dedicated section for instructions on how to configure and save the parameters (page 51).

3 - Graphic pages

Histograms The page displays the histograms of the current and voltage measurements acquired in real time and certain status information:

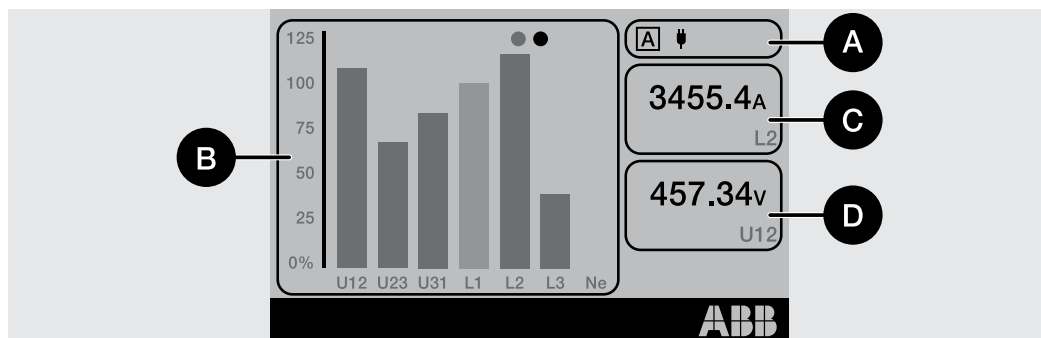














Figure 11

Pos.	Description
	Up to four information icons are available:
A	 or  The letter corresponding to the active configuration is displayed if <i>Adaptive Protections</i> package is present and with <i>Dual Set enabled</i> ;
	 or  External power supply present (<i>Vaux</i> or through a service connector); the plug icon indicates <i>Vaux</i>
	 Remote parameter writing configuration active, modules <i>Ekip Com</i> connected, <i>Vaux</i> present
	 Bluetooth antenna state; four options available, see next chapter for details
	 Datalogger active
B	Histograms of the voltage and current measurements acquired in real time. The bar of each signal is represented in scale 0 to 125 % with reference to the rated current and voltage values of the unit and can be of three colors: <ul style="list-style-type: none"> • light blue: no protection in alarm status • yellow: one of the tripped protections is in prealarm status with respect to set thresholds • red: one of the tripped protections is in alarm status with respect to set thresholds  NOTE: Histogram <i>Ne</i> is available with <i>4P</i> or <i>3P + N</i> configurations
C	Maximum phase current measured in real time
D	Maximum line-to-line voltage measured in real time

The Bluetooth icon changes, depending on the state of the antenna and the wireless communication:

Icon	Description
	Antenna off or being powered (approx. two seconds from being enabled via the menu)
	Antenna on but no device connected
	Pairing in progress (Pairing command executed via menu)
	External device connected to Trip unit

- Summary page** Press on the sides of the display **(1)** from the Home page to access further summary pages for certain measurements:
- *Main measurements* page: maximum phase current, maximum line-to-line voltage, power factor, total active/reactive/apparent powers
 - *Ekip Synchrocheck main measurements* page (when module is present): Int and Ext frequencies and voltages, phase difference, synchronism status (page 48)

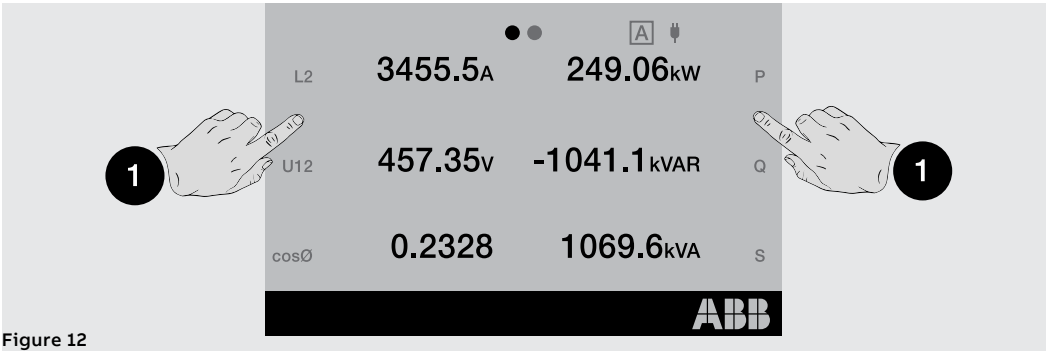


Figure 12

NOTE: both pages can be set as the main page by pressing **HOME**, holding it for five seconds and confirming the message on the display

Measuring instruments

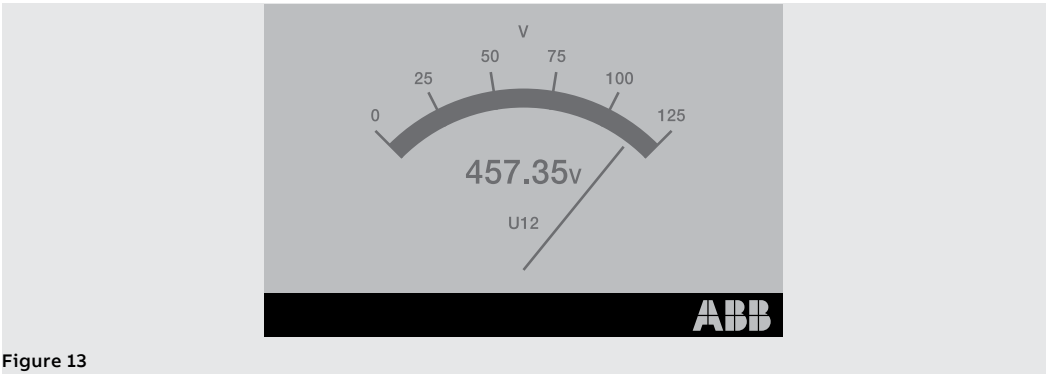


Figure 13

Depending on the Trip unit model, certain measurements acquired in real time are shown on these pages by means of a pointer; each page displays a specific measurement:

Page	Measurement type page	Unit of measurement/indicator
1	Maximum phase current	A
2	Maximum line-to-line voltage	V
3	Total active power	kW
4	Total reactive power	kVAR
5	Total apparent power	kVA

The scale of values ranges from 0 to 125 % and refers to the rated values set (for powers: rated current x rated voltage x $\sqrt{3}$).

Press on the sides of the display to browse the pages; quit the *Measurement tools* section with the **HOME** key.

Page orientation (horizontal by default) can be changed in the *Settings* menu.

NOTE: each page can be set as the main page by pressing **HOME**, holding it for five seconds and confirming the message on the display

Measurements

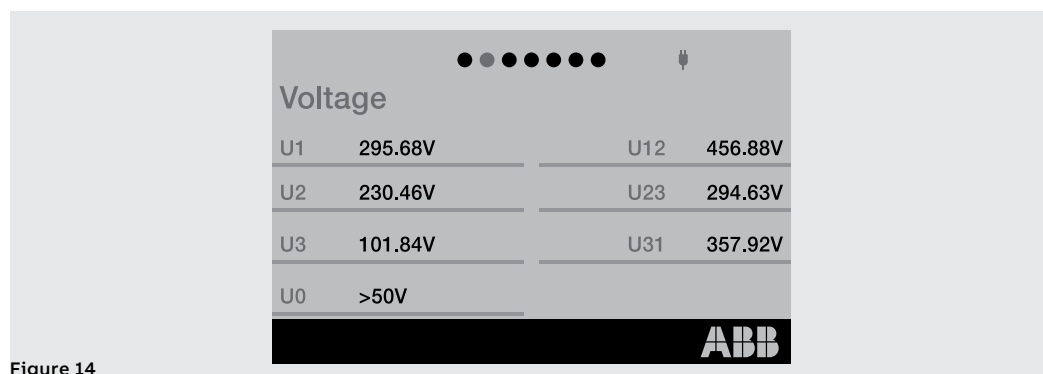


Figure 14

If provided for by Trip unit model, the **Measurements** pages contain a list of measurements acquired in real time, expressed in absolute value:

Page	Name	Measurements
1	Current	Currents: phase, earth fault, external earth fault/Rc
2	Voltage	Voltages: line-to-line, phase, neutral
3	Active power	Phase and total active powers
4	Reactive power	Phase and total reactive powers
5	Apparent power	Phase and total apparent powers
6	Energy counters	Total active, reactive and apparent energies
7	Power Controller	Power Controller measurement summary, if installed
8	Load shedding	Summary of Load Shedding measurements, if present
9	Ekip Signalling 3T	Summary of <i>Ekip Signalling 3T</i> module measurements, if installed

Ekip Touch configuration involves certain exceptions:

- the Ne current measurements are available with 4P and 3P + N configurations
- the phase voltage measurements are available with the 4P and 3P + active external neutral voltage configuration
- with the 3P configuration, pages: *Active Power*, *Reactive Power* and *Apparent Power* are replaced by the *Powers* page with the total active, reactive and apparent power measurements
- Ige/Rc current available with external toroid activated
- *Power Controller* page available with Power Controller function activated
- *Load Shedding* available with Load Shedding function activated

Press the sides of the display to browse the pages; press the **HOME** key to quit.



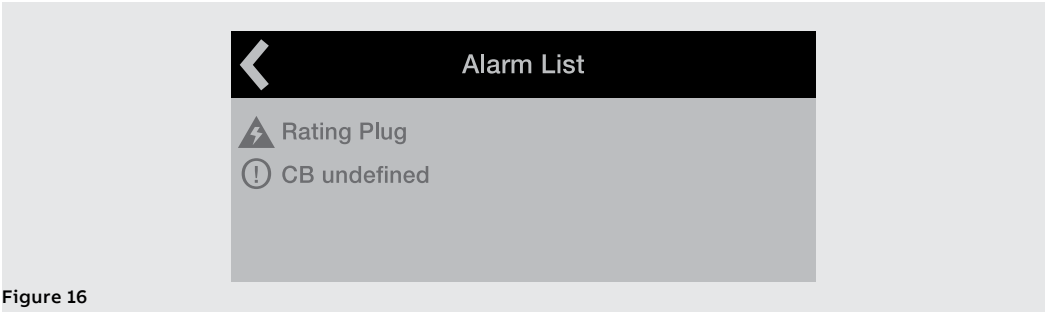
NOTE: each page can be set as the main page by pressing **HOME**, holding it for five seconds and confirming the message on the display

Diagnosis bar and Alarm list

The Diagnosis bar lists the faults detected by the unit. It shows a detail of each alarm for about two seconds.







Select the bar to access the *Alarm List* page, with the list of alarms present.



 **NOTE:** the *Alarm List* page also appears when the *iTEST* button is pressed in the cases provided for and described on page 39

Each signal is followed by an icon that identifies the type of alarm:

Icon	Alarm type
	Alarm
	Warning, error or prealarm
	About
	Timing due to tripped protection

The complete list of alarms is given on page 291.

4 - Menu

Introduction Press **Enter** or **ESC** from the main page to access the different menus of the Trip unit.

The menus are the 4th level pages that can be displayed and comprise list of:

- submenus
- settable parameters
- information and measurements
- commands that can be executed

Selection of each menu item enables: access to submenus, consultation of information in detail, configuration of a parameter, execution of a command.

Elements of each item The items in each list consist of:

- main name (white color)
- additional description or set value (light blue color)

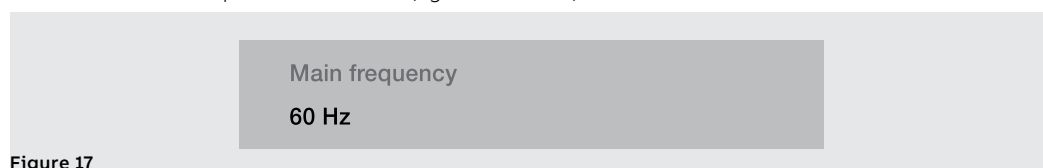
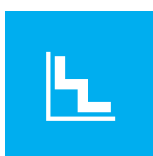


Figure 17

Protections Menu The *Protections* menu can be used to configure the following protections ⁽¹⁾:



Name	Parameters	SW package	Page
L	List and description in dedicated chapter	Standard Protections	56
S	List and description in dedicated chapter		57
S2	List and description in dedicated chapter		58
I	List and description in dedicated chapter		59
G ⁽²⁾	List and description in dedicated chapter		60
Gext ⁽²⁾	List and description in dedicated chapter	⁽³⁾	87
MDGF ⁽²⁾	List and description in dedicated chapter	⁽⁴⁾	88

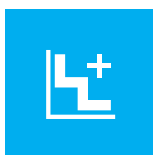
⁽¹⁾ if the *Adaptive Protections* package is available and *Dual set* has been activated, an intermediate menu where the set can be selected (*Set A / Set B*) will be available before the list of protections

⁽²⁾ available for *LSIG* versions

⁽³⁾ available if the presence of toroid *S.G.R.* has been activated previously

⁽⁴⁾ available if the presence of the *MDGF* toroid has been previously activated

Advanced menus



The *Advanced* menu can be used to configure the following protections ⁽¹⁾:

Name	Parameters	SW package	Page
MCR	List in dedicated chapter	Standard Protections	61
2I	List in dedicated chapter		62
IU	List in dedicated chapter		63
UV ⁽²⁾	List in dedicated chapter	Voltage protections	65
OV ⁽²⁾	List in dedicated chapter		66
UV2 ⁽²⁾	List in dedicated chapter		66
OV2 ⁽²⁾	List in dedicated chapter		67
VU ⁽²⁾	List in dedicated chapter		67
S(V) ⁽²⁾	List in dedicated chapter	Voltage Advanced protections	68
S2(V) ⁽²⁾	List in dedicated chapter		69
RV ⁽²⁾	List in dedicated chapter		71
UF ⁽²⁾	List in dedicated chapter	Frequency protections	72
OF ⁽²⁾	List in dedicated chapter		73
UF2 ⁽²⁾	List in dedicated chapter		73
OF2 ⁽²⁾	List in dedicated chapter		74
RP ⁽²⁾	List in dedicated chapter	Power protections	75
D ⁽²⁾	List in dedicated chapter		76
RQ ⁽²⁾	List in dedicated chapter		79
OQ ⁽²⁾	List in dedicated chapter		78
UP ⁽²⁾	List in dedicated chapter		79
OP ⁽²⁾	List in dedicated chapter		78
ROCOF ⁽²⁾	List in dedicated chapter	ROCOF protections	81
V DIR, VINV ⁽²⁾	List in dedicated chapter	Interface protections (IPS)	145
59 S1 ⁽²⁾	List in dedicated chapter		145
Warnings	<i>VS Warning, FS Warning, FW1 Warning</i>		145
Signallings	<i>Threshold 1 I1, Threshold 2 I1, Threshold Iw1, Threshold Iw2, Phase Sequence ⁽²⁾, Cosϕ ⁽³⁾</i>	Standard Protections	95
Functions	<i>External Trip, Trip Reset, Switch On SET B ⁽⁴⁾</i>		95
Synchrocheck	List in dedicated chapter	⁽⁵⁾	92
RC	List in dedicated chapter	⁽⁶⁾	90

⁽¹⁾ if the *Adaptive Protections* package is available and *Dual set* has been activated, an intermediate menu where the set can be selected (Set A / Set B) will be available before the list of protections. The only menu always present via *Advanced* is *Functions*.

⁽²⁾ available if provided for by Trip unit model or if the relative SW package has been activated, where possible (page 17)

⁽³⁾ Cos ϕ available if provided for by Trip unit model or if the *Power Protections* package has been activated

⁽⁴⁾ SET B available when *Adaptive Protections* package is present

⁽⁵⁾ available when *Ekip Synchrocheck* is present

⁽⁶⁾ available when *Rating Plug* type Rc is installed in unit and when presence of toroid Rc has been previously activated in *Settings* menu

Measurements Menu



Menu	Submenus	Description	Page
<i>Historicals</i>	<i>Trip</i>	Description in dedicated chapter	114
	<i>Events</i>	List of events recorded	114
	<i>Measurements</i>	List and description in dedicated chapter	114
<i>Power factor⁽¹⁾</i>	-	Power factor measurement	117
<i>Frequency⁽¹⁾</i>	-	Frequency measured	117
<i>Energy⁽¹⁾</i>	<i>Energy counters</i>	Measurement of energies	117
	<i>Reset counters</i>	Meter reset command	
	<i>Energy RESET</i>	List and description in dedicated chapter	117
<i>Peak factor⁽¹⁾</i>	-	Peak factor of each phase	117
<i>Harmonic dist.</i>	-	Activation command for current harmonic distortion monitoring	64
<i>Ekip Synchrocheck⁽²⁾</i>	-	Description in dedicated chapter	251
<i>Network Analyzer⁽³⁾</i>	<i>V Sequences</i>	Measurements associated with Network Analyzer function: list and description in dedicated chapter	123
	<i>3s V Sequences</i>		
	<i>THD Current</i>		
	<i>THD Voltages</i>		
	<i>Counters</i>		
	<i>Waveforms</i>		
<i>Maintenance</i>	<i>Contact Wear</i>	Installation and maintenance dates and commands	133
	<i>LastServiceContactWear</i>		
	<i>Installation</i>		
	<i>Last Maintenance</i>		
	<i>Service RESET</i>		

⁽¹⁾ available if provided for by Trip unit model or if SW Measuring Measurements package has been activated

⁽²⁾ available when Ekip Synchrocheck module is present

⁽³⁾ available if provided for by Trip unit model or if Network Analyzer SW package has been activated

Settings Menu



Menu	Submenus	Description and parameters	Page
Bluetooth Low Energy	Enable ⁽⁵⁾	Enabling and configuration of Bluetooth Low Energy communication	131
	-		
Circuit Breaker	Configuration	Phase number selection	130
	Hardware Trip	Protection activation command	64
	T Protection	Protection activation command	
	Neutral Protection ⁽²⁾	Enable, Neutral threshold	
	Earth protection ⁽⁷⁾	External toroid configuration	132
	Installation	Installation of modules	50
Main Frequency	-	Grid frequency configuration	130
Phase Sequence	-	Phase sequence configuration	67
Modules	Local/Remote	Parameter writing configuration	131
	Local Bus	Configuration of local bus presence	
	Modul x ⁽³⁾	Details in chapters of each module	
	Functions	Switch On LOCAL, Signalling RESET	
Monitor time	-	Measuring range configuration	115
Test Bus	-	Test bus activation	133
Power Controller ⁽⁴⁾	Enable ⁽⁵⁾	Function enabling and parameters: see details in dedicated chapter	142
	-		
Load Shedding ⁽⁴⁾	Enable ⁽⁵⁾	Function enabling and parameters: see details in dedicated chapter	143
	-		
Network Analyzer ⁽⁶⁾	Enable ⁽⁵⁾	Function enabling and parameters: see details in dedicated chapter	123
	-		
Datalogger ⁽⁶⁾	Enable ⁽⁵⁾	Function enabling and parameters: see details in dedicated chapter	121
	-		
Dual Set ⁽⁶⁾	Enable ⁽⁵⁾	Function enabling and parameters: see details in dedicated chapter	82
	Default set		
System	Date	Configuration of unit date	133
	Time	Configuration of unit time	
	Language	Configuration of menu language	
	New PIN	PIN Configuration	
View	-	Representation parameters of menus and measurements: see details in dedicated chapter	133
Functions	YO Command	Function, Delay	92
	YC Command		
Maintenance	Alarms	Activation of maintenance signals	116

⁽¹⁾ with CB in 3P configuration

⁽²⁾ available with CB in 4P or 3P with neutral configuration

⁽³⁾ the menu populates with the list of accessory modules detected by the unit with Local Bus activated and in the envisaged connection and supply conditions

⁽⁴⁾ available if the function has been installed in the Trip unit

⁽⁵⁾ additions are only made to the list of the specific submenu when the function is enabled (=On)

⁽⁶⁾ available if provided for by Trip unit model or if relative SW package has been activated

⁽⁷⁾ available with LSIG versions

Installation menu

If Ekip Touch detects that *Rating Plug* or *Measurement* module have not been installed properly, it signals an alarm (page 291) and completes *Settings* menu with the specific installation section:

Menu	Submenus 1	Submenus 2	Commands
Circuit Breaker	Installation	Rating Plug	Install
		Ekip Measuring	Install

Correct installation is confirmed by a message on the display and disappearance of the alarm signal and installation menu.



NOTE: availability of submenus depends on the module, which appears to have not been installed

Test Menu

Menu	Submenus	Description, parameters and Commands
Autotest	-	Autotest command
Trip Test	-	TRIP command
Test CB	-	Close CB, Open CB
Ekip Signalling 4K ⁽¹⁾	-	Module autotest command
Ekip Signalling 2K ⁽¹⁾	Ekip Signalling 2K-1 ⁽¹⁾	Module autotest command
	Ekip Signalling 2K-2 ⁽¹⁾	
	Ekip Signalling 2K-3 ⁽¹⁾	
ZoneSelectivity ⁽²⁾	S Protection ⁽³⁾	Input, Force Output, Release Output
	G Protection ⁽⁴⁾	
Rc Test ⁽⁵⁾	-	Test instructions

⁽¹⁾ available if one or more Ekip Signalling modules are connected and detected by Ekip Touch

⁽²⁾ available if Ekip Touch is on with auxiliary supply

⁽³⁾ available with S and/or S2 and/or D protection enabled, for S protection the set curve must be t=k

⁽⁴⁾ available with G and/or D protection enabled and curve t=k available with G and/or Gext and/or MDGF and/or D protection enabled and curve t=k

⁽⁵⁾ available if the Ekip CI module is connected and detected by Ekip Touch

About Menu

Menu	Submenus	Information provided
Protection Unit	-	Information about Ekip Touch: Trip unit serial number, type, version, standard, SW version, date and time, language
Protection Unit	-	Information about Ekip Touch: Mainboard serial number, Trip unit serial number, type, version, standard, SW version, date and time, language
Circuit Breaker	-	CB information: TAG name, CB name, rated current, number of poles, CB status and position, total operations, CB serial number
IEC 61557-12 ⁽¹⁾	-	Status of 1% measurements (from Class 1 Power & Energy Metering package), serial number of assembly and current sensors connected
Feature Collection	-	List of tripped protections in Trip unit
Modules	Modul x ⁽²⁾	Module information: serial number, SW version, status of inputs/outputs/contacts (if present)
Power Controller ⁽³⁾	Load Input Status	Status of loads (open/closed)
	Load Active	Load configuration (activated/not activated)
Load shedding ⁽³⁾	Load Input Status	Status of loads (open/closed)
	Load Active	Load configuration (activated/not activated)

⁽¹⁾ available if Class 1 Power & Energy Metering SW package is provided for by Trip unit module or if it has been previously activated

⁽²⁾ available if one or more modules are connected and detected by unit

5 - Changing parameters and commands

Changing parameters



Comply with the following procedure to change one or more parameters:



IMPORTANT: parameters can be changed with Trip unit in the Local mode and in the absence of timing alarms

1. select parameter and enter PIN, if required
2. select new value from list or with the aid of page commands
3. select Confirm command if present:

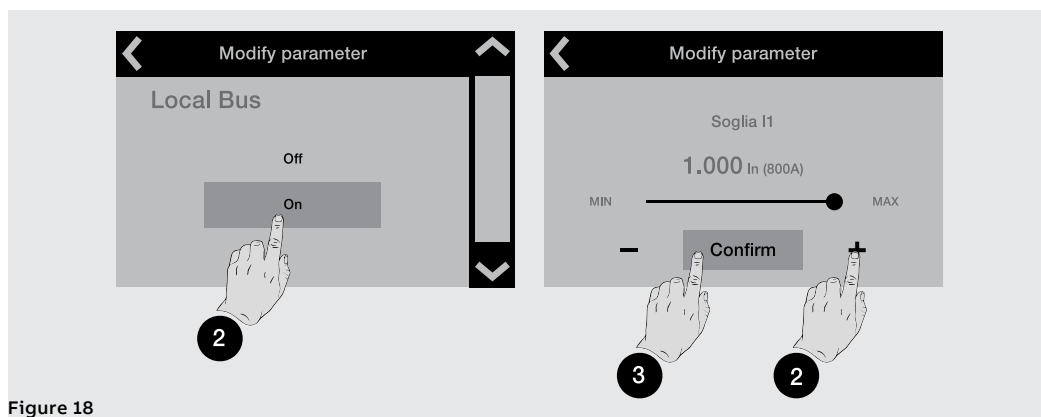


Figure 18

4. When the new value has been selected/confirmed, the menu of the parameter is accessed automatically, the changed item presents the new value in light blue and a tick to confirm:



Figure 19

Now proceed by confirming the programming (Step 5) and make further changes (Step 1).

or access other parameters

5. Select the arrow at the top left to access the top menu until the *Programming* page appears:



Figure 20

6. Various commands are enabled in the programming page:

- *Confirm* to validate the new parameters and conclude the programming procedure
- *Abort* to interrupt the save data process
- *Modify* to go back to the menus and change the parameter or others

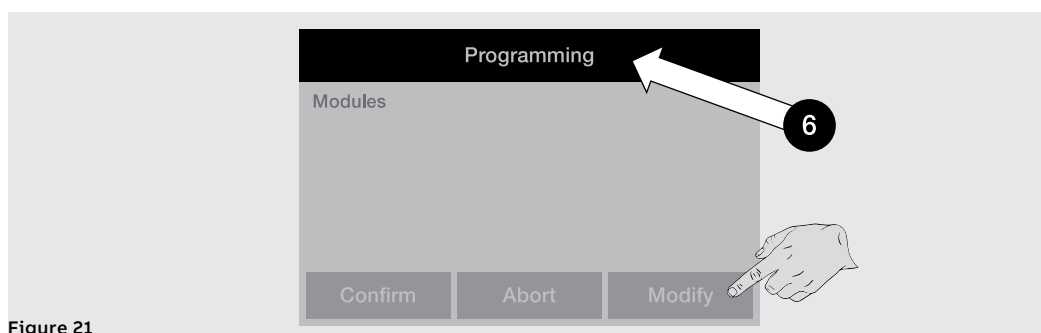


Figure 21

Commands



Selection of a command implies its immediate execution or opening of an intermediate confirm window. Correct execution is indicated by a confirm window, which disappears automatically from the display. Certain commands, selection of which immediately activates the respective test sequences without any confirm window, are an exception to this rule:

- *Auto Test*
- *Ekip Signalling 2K* module commands



IMPORTANT: confirmation on the display refers to launching the command, not to verification of the operation required, which is at the user's charge whichever type of command is concerned: reset parameters, display, open/close contacts

Exceptions



Before validating a change to a parameter, the Trip unit checks all its parameters to make sure there is no conflict or incorrect condition:

- if the Trip unit detects an incorrect condition, the relative details appear on the display and parameter modification is annulled.

Before executing a command, the Trip unit checks all its parameters to ensure there is no conflict or incorrect condition:

- if the Trip unit detects an incorrect condition, the relative details appear on the display and command execution is annulled.



WARNING! aborting the programming affects all the parameters modified during the same session

6 - PIN and security

Safety



WARNING! the user is responsible for security against unauthorized access and modification: configure all Trip unit access points (display menu and, if present, Ekip Connect and remote communication systems) using the access PIN and controlled and authorized connection systems

Function

The PIN code enables access to certain areas of the Trip unit and prevents unintentional setting errors from being entered via the display.

However, parameters can still be modified without having to enter the PIN via:

- service connector, using *Ekip T&P* or *Ekip Programming* and the Ekip Connect application
- bus, in the presence of Ekip Com modules and with Trip unit configured as Remote (page 132).

To ensure your unit is in secure conditions, the Wizard window immediate asks you to change the PIN code on first power up; this is strongly recommended by ABB.

Description

The PIN code is a number formed by five digits, each of which can be given a value from 0 to 9; the default value is: **00001** and can be changed in the *Settings-New PIN* menu.

The PIN code must be entered to:

- change a parameter (including the PIN code itself)
- access the *Test* menu

Once the PIN code has been entered, all menus can be browsed for two minutes: once two minutes have elapsed, the PIN code must be entered again (depending on the case in question).



NOTE: the PIN code must also be entered again if a programming session has been annulled (page 51).

Entry

The following page will appear when the PIN code is requested: change **(1)** and confirm **(2)** each digit to complete the entry process.

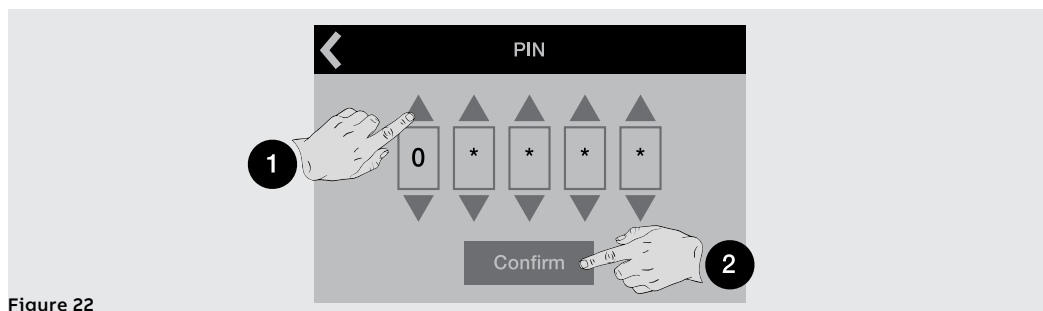


Figure 22



NOTE:

- if the PIN is wrong, "Wrong PIN" will appear for three seconds after which the entry page will be displayed again; use the command at the top left to quit
- there is no limit to the number of wrong PIN that can be entered

Disabling

The PIN code can be disabled by entering its value as: 00000; In this case, the PIN is only required to change the PIN itself in the *Settings* menu.

Recovery

Contact ABB directly if PIN code is lost.

Ekip Touch - Protections

1 - Protections - Introduction

Operating principle The protection functions are available with all Ekip Touch models and versions.

Each protection is associated with a different signal (current, voltages, frequencies, powers, etc) but the operating principle is the same:

1. If the signal measured exceeds the set **threshold**, the specific protection activates (prealarm and/or **alarm** condition).
2. The **alarm** appears on the display and, after a period of time (timing t_p), depending on the protection parameters set, can convert into a **trip command (TRIP)** transmitted to the internal Trip Coil of the CB.



NOTE:

- if the signal measured drops below the set threshold before the trip time has elapsed, Ekip Touch quits the alarm and/or timing status and returns to the normal operating condition
- all protections have a default configuration: check the parameters and change to suit the installation requirements before putting into service

References Many of the protection thresholds are displayed in two different quantities: absolute value and relative value.

The relative value depends on the type of measurement:

Type of protection	Reference	Description
Current	I_n	Nominal current of the <i>Rating plug</i>
Voltage	U_n	Line-to-line voltage setting
Frequency	f_n	Frequency setting
Power	S_n	$\sqrt{3} \times I_n \times U_n$

Protections packages The protections described in the following chapters are grouped into packages, the availability of which depends on the model and version of the Trip unit, and on their ability to be installed as additional package:

Package	Page
Standard Protections	55
Voltage protections	65
Voltage Advanced protections	68
Frequency protections	72
Power protections	75
ROCOF protections	81
Adaptive protections	82
Additional protections and functions	83

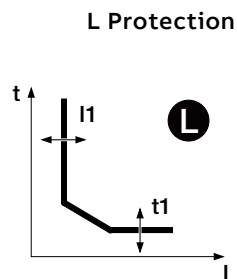
2 - Standard Protections

List The Standard protections available for all Ekip Touch models, are:

Name	Type of protection	Page
L	Overload with inverse long-time delay	56
S	Selective short-circuit	57
S2	Short-circuit with adjustable delay	58
I	Instantaneous short-circuit	59
G ⁽¹⁾	Earth fault with adjustable delay	60
MCR	Instantaneous short-circuit on circuit-breaker closing	61
2I	Instantaneous short-circuit programmable	62
IU	Current unbalance	63
Neutral	Different protection on neutral phase	63
Harmonic distortion	Distorted waveforms	64
T	Abnormal temperatures	64
Hardware Trip	Internal connection errors	64
Inst ⁽²⁾	Instantaneous short-circuit at high currents	64

⁽¹⁾ not available with LSI version of Ekip Touch

⁽²⁾ protection cannot be deactivated; its trip parameters are set by ABB and cannot be edited



Function

If the current of one or more phases exceeds threshold I_1 , the protection trips and, after a time established by the value read and by the parameter settings, transmits the TRIP command.

To check and simulate the trip times in relation to all the parameters, please consult:

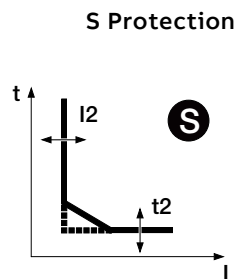
- the summary table of the protections with the calculation formulas (page 95)
- the graph with trip curve (from page 98)

Parameters

Parameter	Description	Default
<i>Curve</i>	Establishes curve dynamics and trip time calculation: <ul style="list-style-type: none"> • $t = k / I^2$ according to IEC 60947-2 • IEC 60255-151 SI • IEC 60255-151 VI • IEC 60255-151 EI • $t = k / I^4$ according to 60255-151 	$t = k/I^2$
<i>Threshold I_1</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (A) and relative value (In) and can be set within the range: 0.4 In to 1 In, in 0.001 In steps	1 In
<i>Time t_1</i>	Contributes towards calculating the trip time. The value is given in seconds and can be set within the range: 3 s .. 144 s, in 1 s steps	144 s
<i>Thermal memory</i>	Activates/deactivates the thermal memory function (page 83)	OFF
<i>Prealarm I_1</i>	Warns that the measured current is near to protection activation threshold I_1 . The value is given in percentage of threshold I_1 and can be set within the range: 50% I_1 to 90% I_1 , in 1% steps. NOTA: the prealarm condition deactivates in two cases: <ul style="list-style-type: none"> • current lower than prealarm threshold I_1 • current higher than threshold I_1 	90 % I_1

Limitations and additional functions

- threshold I_1 must be lower than threshold I_2 (if S protection is activated)
- L protection: the trip time of the protection is forcibly set at 1 s if the calculation results give a lower theoretical t_t value and/or if the current reading is more than 12 In
- with CB in UL standard configuration, the only available curve is $t = k/I^2$



Function

If the current of one or more phases exceeds threshold I_2 , the protection trips and, after a time established by the value read and by the parameter settings, transmits the TRIP command.

To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 95)
- the graph with trip curve (page 101)

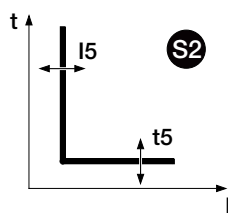
Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu.	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command. If disabled, the alarm and exceedance of protection time are only managed as information.	ON
<i>Curve</i>	Establishes curve dynamics and the threshold or trip time calculation: <ul style="list-style-type: none"> • $t = k$: fixed time trip • $t = k/I^2$: inverse time-delay dynamic trip 	$t = k$
<i>Threshold I_2</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (A) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
<i>Time t_2</i>	It is the trip time or contributes towards timing calculation, depending on the type of curve selected. The value is given in seconds and can be set within the range: 0.05 s to 0.8 s, in 0.01 s steps	0.1 s
<i>Thermal memory</i>	Activates/deactivates the thermal memory function (page 83) NOTE: the function is only available with curve $t=k/I^2$	OFF
<i>ZoneSelectivity</i>	Activates/deactivates the function and selectivity time availability on the display (page 83) NOTE: the function is only available with curve $t=k$	OFF
<i>Selectivity time</i>	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present (page 83) The value is given in seconds and can be set within the range: 0.04 s to 0.2 s, in 0.01 s steps	0,04 s
<i>StartUp enable</i>	Activates/deactivates the function and availability of the associated parameters on the display (page 86)	OFF
<i>StartUp Threshold</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 86) The value is given as both absolute value (A) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	0,6 In
<i>StartUp Time</i>	This is the time for which the StartUp threshold remains activated, as calculated from the moment the activation Threshold is exceeded (page 86) The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

Limitations and additional functions

- threshold I_2 must be higher than threshold I_1 (if S protection is activated)
- in the presence of curve $t = k/I^2$, the protection trip time is forced to t_2 if the calculation results give a theoretical value lower than t_2 itself
- the block functions and type of selectivity can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 83)
- with CB in UL standard configuration, the maximum value of t_2 is 400 ms

S2 Protection Function



NOTE: unlike S protection, S2 protection only has one fixed time trip curve and has no thermal memory

It is independent of S protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with S and open command with S2 or vice versa, or both S and S2 for signaling or tripping).

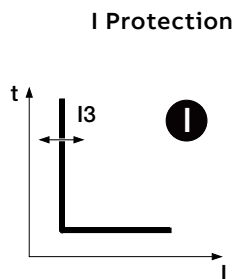
To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 95)
- the graph with trip curve (page 101)

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu.	OFF
Trip Enable	Activates/deactivates transmission of the open command. If disabled, the alarm and exceedance of protection time are only managed as information.	ON
Threshold I_5	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (A) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
Time t_5	This is the trip time of the protection. The value is given in seconds and can be set within the range: 0.05 s to 0.8 s, in 0.01 s steps	0,05 s
ZoneSelectivity	Activates/deactivates the function and selectivity time availability on the display (page 83) NOTE: if at least two of the selectivity S, S2, I, 2I and MCR are enabled, the input and output are shared with the OR function; it is sufficient that even a selectivity is activated to stimulate inputs and outputs	OFF
Selectivity time	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present (page 83) The value is given in seconds and can be set within the range: 0.04 s to 0.2 s, in 0.01 s steps	0,04 s
Startup enable	Activates/deactivates the function and availability of the associated parameters on the display (page 86)	OFF
Startup Threshold	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 86) The value is given as both absolute value (A) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
Startup Time	This is the time for which the Startup threshold remains activated, as calculated from the moment the activation Threshold is exceeded (page 86) The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

Limitations and additional functions

- threshold I_5 must be higher than threshold I_1 (if S2 protection is activated)
- the block functions and type of selectivity can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 85)
- with CB in UL standard configuration, the maximum value of t_5 is 400 ms



Function

If the current of one or more phases exceeds threshold I3, the protection trips and, after a non-programmable fixed time, transmits the TRIP command.

To check and simulate the trip times in relation to all the parameters, please consult:

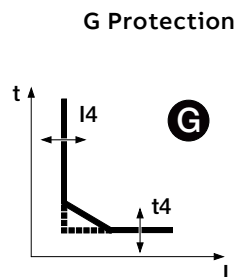
- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 102)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu.	ON
<i>Threshold I3</i>	Establishes the value that activates the protection. The value is given as both absolute value (A) and relative value (In) and can be set within the range: 1.5 In to 15 In, in 0.1 In steps	5,5 In4 In
<i>ZoneSelectivity</i>	Activates/deactivates the function i NOTE: if at least two of the selectivity S, S2, I, 2I and MCR are enabled, the input and output are shared with the OR function; it is sufficient that even a selectivity is activated to stimulate inputs and outputs	OFF
<i>Startup enable</i>	Activates/deactivates the function and availability of the associated parameters on the display (page 85)	OFF
<i>Startup Threshold</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 85) The value is given as both absolute value (A) and relative value (In) and can be set within the range: 1.5 In to 15 In, in 0.1 In steps	1,5 In
<i>Startup Time</i>	This is the time for which the Startup threshold remains activated, as calculated from the moment the activation Threshold is exceeded (page 85) The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

Limitations and additional functions

- protection cannot be deactivated in “Non-defeatable instantaneous protection” version; consult catalog for further details ([1SDC200023D0209](#))
- threshold I3 must be higher than threshold I2 (if S and I protections are activated)
- I protection can be activated with MCR protection disabled
- the block functions can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 86)

**Function**

Ekip Touch calculates the vector sum of the phase currents (L1, L2, L3, Ne) and obtains the internal earth fault current (I_g): if current I_g exceeds threshold I_4 , the protection trips and, after a time established by the value read and by the parameter settings, transmits the TRIP command.

To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 95)
- the graph with trip curve (page 103)

Parameters

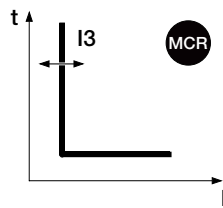
Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu.	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command. If disabled, the alarm and exceedance of protection time are only managed as information.	ON
<i>Curve</i>	Establishes curve dynamics and the threshold or trip time calculation: <ul style="list-style-type: none"> • $t = k$: fixed time trip • $t = k/I^2$: inverse time-delay dynamic trip 	$t = k$
<i>Threshold I_4</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (A) and relative value (I_n) and can be set within the range: 0.1 I_n to 1 I_n , in 0.001 I_n steps	0,2 I_n
<i>Time t_4</i>	It is the trip time or contributes towards timing calculation, depending on the type of curve selected. The value is given in seconds and can be set within the range: 0.1 s to 1 s, in 0.05 s steps NOTE: in the presence of curve: $t = k$, t_4 can also be configured as: instantaneous; in this mode, the trip time is comparable to that given for I protection (page 95)	0.1 s
<i>Prealarm I_4</i>	Warns that the measured current is near to the protection activation threshold. The value is given in percentage of threshold I_1 and can be set within the range 50% I_4 to 90% I_4 , in 1% steps. The prealarm condition deactivates in two cases: <ul style="list-style-type: none"> • current lower than prealarm threshold I_4 • current higher than threshold I_4 	90 % I_4
<i>ZoneSelectivity</i>	Activates/deactivates the function and selectivity time availability on the display (page 83) NOTE: the function is only available with curve $t = k$	OFF
<i>Selectivity time</i>	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present (page 83) The value is given in seconds and can be set within the range: 0.04 s to 0.2 s, in 0.01 s steps	0,04 s
<i>StartUp enable</i>	Activates/deactivates the function and availability of the associated parameters on the display (page 86)	OFF
<i>StartUp Threshold</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 86) The value is given as both absolute value (A) and relative value (I_n) and can be set within the range: 0.2 I_n to 1 I_n , in 0.02 I_n steps	0,2 I_n
<i>StartUp Time</i>	This is the time for which the StartUp threshold remains activated, as calculated from the moment the activation Threshold is exceeded (page 86) The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

Continued on the next page

Limitations and additional functions

- in the presence of curve $t = k/I^2$, the protection trip time is forced to t_4 if the calculation results give a theoretical value lower than t_4 itself
- in the absence of Vaux, the minimum threshold is $0.3 I_n$ (for $I_n \leq 100$ A), $0.25 I_n$ (for $I_n \leq 400$ A) or $0.2 I_n$ (for all the other sizes); if lower values are set, the Trip unit forces the threshold to the minimum admissible value and the "Configuration" error appears
- depending on the I_4 threshold setting, the protection deactivates for an I_g higher than: $8 I_n$ with threshold $I_4 \geq 0.8 I_n$; $6 I_n$ with $0.8 I_n > I_4 \geq 0.5 I_n$; $4 I_n$ with $0.5 I_n > I_4 \geq 0.2 I_n$; $2 I_n$ with $I_4 > 0.2 I_n$
- with t_4 =instantaneous operation is guaranteed in the presence of Vaux; in self-supply mode, the Trip unit forces the time to 100 ms and the "Configuration" error appears
- the block functions and type of selectivity can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 83)
- with CB in UL standard configuration, some parameters have different maximum values: I_{41} maximum = 1200A, Startup maximum = 1200A, t_4 maximum = 400ms

Protection MCR Function



The protection remains activated for a time interval running from the open - closed change of status of the CB, after which it deactivates.

If, during this time interval, the current of one or more phases exceeds threshold I_3 , the protection transmits the TRIP command after a non-programmable fixed time.


The MCR protection only functions with Vaux. The MCR protection only functions with Vaux or with supply via the *Measurement enabler with voltage sockets* module.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 102)

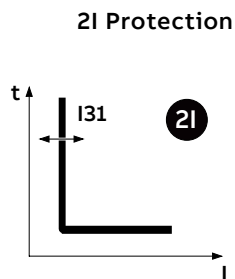


NOTE: to activate MCR, protection I must be disabled

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu.	OFF
<i>Threshold I3</i>	Establishes the value that activates the protection. The value is given as both absolute value (A) and relative value (I_n) and can be set within the range: $1.5 I_n$ to $15 I_n$, in $0.1 I_n$ steps	$6 I_n$
<i>Monitor Time</i>	Defines the time interval in which the MCR protection remains activated, as calculated from the open - closed change of status The value is given in seconds and can be set within the range: 0.04 s to 0.5 s, in 0.01 s steps	0,04 s
<i>ZoneSelectivity</i>	Activates/deactivates the function  NOTE: if at least two of the selectivity S, S2, I, 2I and MCR are enabled, the input and output are shared with the OR function; it is sufficient that even a selectivity is activated to stimulate inputs and outputs	OFF

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 83)



Function

If the current of one or more phases exceeds threshold I31 and a trip event is present, the protection transmits the TRIP command after a non-programmable fixed time.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 102)

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu.	OFF
<i>ZoneSelectivity</i>	Activates/deactivates the function i NOTE: if at least two of the selectivity S, S2, I, 2I and MCR are enabled, the input and output are shared with the OR function; it is sufficient that even a selectivity is activated to stimulate inputs and outputs	OFF

Protection enabling renders *2I Mode* section available in *Advanced - Functions* menu, where the protection activation event can be configured:

Parameter	Description	Default
<i>Activation</i>	Two alternative modes are available: <ul style="list-style-type: none"> • Dependent function, the protection is activated if the programmed activation event has occurred, this configuration makes the function and delay parameters available; • Activated, the protection is always activated. 	Dependent function
<i>Function</i>	The activation event between the input contacts of Ekip Signalling 2K, the statuses of the unit (open/closed) and the Custom function can be selected i NOTE: Ekip Connect allows the Custom function to be customized so as to associate the activation event with up to eight statuses in AND or OR configuration	Disabled
<i>Delay ON</i>	Protection activation delay calculated from the presence of the activation event onwards. The value is given in seconds and can be set within the range: 0 s ÷ 100 ms, in 0.01 s steps. i NOTE: the protection trips if the event is present for longer than the set time lag	0 s
<i>Delay OFF</i>	Protection deactivation delay calculated from disappearance of activation event onwards. The value is given in seconds and can be set within the range: 0 s ÷ 15 s, in 0.01 s steps. i NOTE: protection deactivates if event is not present for longer than set delay	15 s

RELT - Ekip signalling 2K-3

If the RELT module is present a dedicated command (RELT Wizard) will be displayed. This will program the 2I protection and other related parameters; for details see page 244.

Commands by remote control

Two further temporary protection activation/deactivation commands are available when the unit is connected to one or more Ekip Com modules:

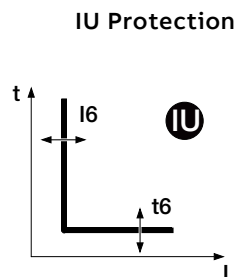
- **2I Mode ON:** activates the protection.
- **2I Mode OFF:** deactivates the protection.

For further details consult the document [1SDH002031A1101](#)

i NOTE: if the protection has been activated by command *2I ON Mode*, it is deactivated by command *2I OFF Mode* or when the unit shuts down

Signallings

When protection 2I is activated, the message “*2I active*” appears in the diagnostic bar and in the Alarm List page, and the alarm led will be on steady.



Function

The protection trips if the current readings are unbalanced; the protection sends a TRIP command if the detected unbalance exceeds threshold I_6 for longer than t_6 .

The protection is automatically self-excluding in two cases:

- the measurement of at least one current exceeds $6 I_n$
- the maximum current value between all the phases is less than $0.25 I_n$ (in I Avg configuration) or $0.3 I_n$ (in I Max configuration)

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 105)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Algorithm</i>	Allows the unbalance calculation mode to be selected: <ul style="list-style-type: none"> • With respect to I_{max}: % Sb1l = $100 \times (I_{max} - I_{min}) / I_{max}$ • With respect to: I_{Avg}: % Sb1l = $100 \times (\max I_{Avg}) / I_{Avg}$ NOTE: $\max I_{Avg}$: maximum deviation among the measured currents, calculated by comparing each current with the mean value; I_{Avg} : mean value of the current readings	With respect to I_{max}
<i>Threshold I_6</i>	Establishes the unbalance value that trips the protection. Unbalance is given in percentage value within the range: 2% to 90% with 1% steps.	50 %
<i>Time t_6</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 60 s, in 0.5 s steps	5 s

Neutral Protection Function

Neutral protection characterizes protections L, S and I differently on the neutral phase by introducing a different control factor from the other phases.

The protection is available with the 4P and 3P + N configuration; the configuration parameters can be accessed via the Settings menu (page 49).

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection	OFF
<i>Neutral threshold</i>	Defines the multiplicative factor applied to the trip thresholds and curves of the protections for the current read on phase Ne: <ul style="list-style-type: none"> • 50 %: lowest trip thresholds for the neutral current • 100 %: same trip thresholds for all phases • 150 %: highest trip thresholds for the neutral current • 200 %: highest trip thresholds for the neutral current 	50 %

Limitations and additional functions

Ekip Touch rejects modification of thresholds I_1 and I_nN in the absence of the following limitation: $(I_1 \times I_nN) \leq I_u$

- I_1 is the threshold of L protection in amperes (example: $I_n = 400$ A and $I_1 = 0.6$ becomes $I_1 = 240$ A)
- I_1 is the threshold of L protection in amperes (example: $I_n = 800$ A and $I_1 = 0.6$ becomes $I_1 = 480$ A)
- I_nN is the neutral threshold expressed as multiplicative factor (example: $I_nN = 200\%$ becomes $I_nN = 2$)
- I_u is the size of the CB



WARNING! With 150% and 200% threshold; if the measured neutral current exceeds $16I_n$, the Trip unit resets the protection to 100% by itself

Harmonic Distortion Protection

Allows an alarm to be activated in the case of distorted waveforms.

The protection can be enabled in the *Measurements* menu; if enabled an alarm is activated (page 48).



IMPORTANT: the protection does not handle the trip, just the signal

T Protection

T protection protects against abnormal temperatures measured and transmitted to the sensor inside the unit; temperature verification is always active and includes three operating states:

State	Temperature range [°C]	Ekip Touch actions
Standard	$-25 < t < 70$	Normal operation; display state depending on type ⁽¹⁾
Warnings	$-40 < t < -25$ or $70 < t < 85$	Warning led @ 0.5 Hz; display state depending on type ⁽¹⁾
Alarm	$t < -40$ or $t > 85$	Display off; Alarm and Warning leds @ 2 Hz; TRIP if Trip enable is activated

⁽¹⁾ with Ekip Touch, the display remains on within range: -20°C / $+70^{\circ}\text{C}$; with Ekip LCD, the display remains on within range: -30°C / $+80^{\circ}\text{C}$

All protections enabled in the unit are active in all operating states.

The Trip Enabling parameter can be enabled in the *Settings - Circuit breaker* menu in order to handle an open command if an alarm occurs (page 49).

Hardware Trip Protection

Hardware Trip protects against connection errors in Ekip Touch and is available in the *Settings - Circuit breaker - Hardware Trip* menu (page 48).

If enabled, with the CB closed, if one or more of these events are detected:

- current sensors disconnected (phase or external if enabled)
- *Rating Plug* disconnected
- *Trip Coil* disconnected
- faults inside the unit

the alarm is signaled and a TRIP command is transmitted.



IMPORTANT:

- the protection trips if the error statuses persist for more than one second
- the signal is activated in the case of an alarm due to Trip coil disconnection and, in the presence of Vaux, output YO is commanded until the Trip unit detects the CB Open state (make sure that YO, Ekip Actuator, YO coil supply are present)

Inst

The purpose of this protection is to maintain the integrity of the circuit-breaker and installation in the case of particularly high current values requiring shorter reaction times than those provided by the instantaneous short-circuit-protection.

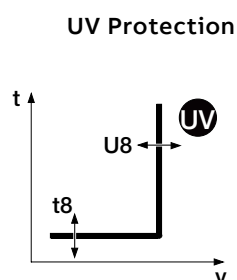
The protection cannot be disabled, the tripping threshold and time are defined by ABB.

3 - Voltage protections

List The Voltage protections, available by default for Ekip Hi-Touch, Ekip G Touch, Ekip G-Hi Touch models and configurable in the remaining models as additional SW package, are:

Name	Type of protection	Page
UV	Minimum voltage	65
OV	Maximum voltage	66
UV2 ⁽¹⁾	Minimum voltage	66
OV2 ⁽¹⁾	Maximum voltage	67
Phase Sequence	Phase sequence error	67
VU	Voltage unbalance	67

⁽¹⁾ protections UV2 and OV2 are not available by default with Ekip G Touch. However, they can be integrated by requesting the relative SW package



Function

The protection sends a TRIP command if one or more line-to-line voltages detected by the unit drop below threshold U_8 for longer than t_8 .

To check and simulate the trip times in relation to all the parameters, please consult:

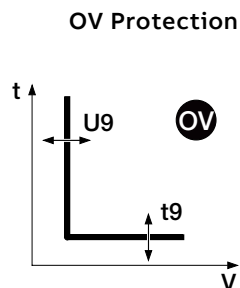
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 105)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U_8</i>	Establishes the value that activates the protection. The value is given as both absolute value (Volts) and relative value (U_n) and can be set within the range: $0.05 U_n$ to $1 U_n$ in $0.001 U_n$ steps	$0.9 U_n$
<i>Time t_8</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: $0.05 s$ to $120 s$, in $0.01 s$ steps	$5 s$

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

**Function**

The protection sends a TRIP command if one or more line-to-line voltages detected by the unit exceed threshold U9 for longer than t9.

To check and simulate the trip times in relation to all the parameters, please consult:

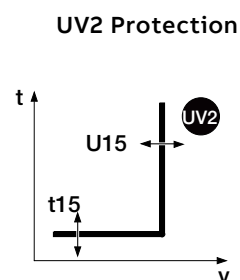
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 106)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U9</i>	Establishes the value that activates the protection. The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 1 Un to 1.5 Un in 0.001 Un steps	1,05 Un
<i>Time t9</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	5 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 83).

**Function**

UV2 protection functions in the same way as UV protection: the protection sends a TRIP command if one or more line-to-line voltages detected by the unit drop below threshold U15 for longer than t15.

It is independent of UV protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with UV and open command with UV2 or vice versa, or both for signaling or tripping).

To check and simulate the trip times in relation to all the parameters, please consult:

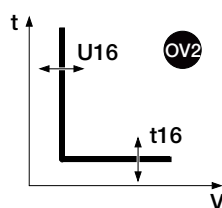
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 105)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U15</i>	Establishes the value that activates the protection. The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 0.05 Un to 1 Un in 0.001 Un steps	0,9 Un
<i>Time t15</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	5 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 83).

OV2 Protection**Function**

OV2 protection functions in the same way as OV protection: the protection sends a TRIP command if one or more line-to-line voltages detected by the unit exceed threshold U16 for longer than t16.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 106)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U16</i>	Establishes the value that activates the protection. The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 1 Un to 1.5 Un in 0.001 Un steps	1,05 Un
<i>Time t16</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	5 s

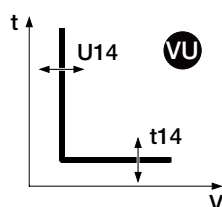
Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

Phase sequence protection

The *Phase Sequence* protection enables an alarm to be activated when the sequence of line-to-line voltages is not aligned with the sequence set by the user.

The required sequence can be set in the *Settings* menu and the protection activated in the *Advanced* menu (page 49 and page 47).

VU Protection**Function**

The protection trips if the line-to-line voltages read by the unit are unbalanced; the protection sends a TRIP command if the detected unbalance exceeds threshold U14 for longer than t14.

The protection excludes itself if the maximum value of the line-to-line voltage is less than 0.3 Un

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 106)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U14</i>	Establishes the unbalance value that trips the protection. Unbalance is expressed in percentage value and is calculated in the following way: % Unba = $100 \times (\Delta \max U_{mi}) / U_{mi}$ in range: 2% to 90% in 1% steps. i NOTE: $\Delta \max U_{mi}$: maximum deviation among the three voltages calculated by comparing each line-to-line voltage with the mean value; U_{mi} : mean value of the line-to-line voltages	50 %
<i>Time t14</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 60 s, in 0.5 s steps	5 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

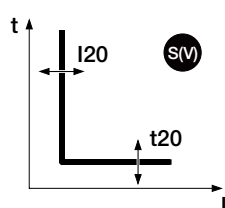
4 - Voltage Advanced protections

- List** The Advanced Voltage protections, available by default for the Ekip G Touch and Ekip G Hi-Touch models and configurable in the remaining models as additional SW package, are:

Name	Type of protection	Page
S(V)	Short-circuit with voltammetric control	68
S2(V) ⁽¹⁾	Short-circuit with voltammetric control	69
RV	Residual voltage	71

⁽¹⁾ S2(V) protection is not available by default with Ekip G Touch. However, it can be integrated by requesting the relative SW package

S(V) Protection Function



S(V) protection protects against short circuits, with a threshold sensitive to the value of the voltage.

If the current of one or more phases exceeds threshold I_{20} for longer than time t_{20} , the protection activates and sends a TRIP command.

Following a voltage drop, the I_{20} threshold varies according to two different modes:

- **Step** provides for a stepped variation, depending on parameters U_I and K_s .
- **Lin** (linear) provides for a dynamic variation, depending on parameters U_I , U_h and K_s .

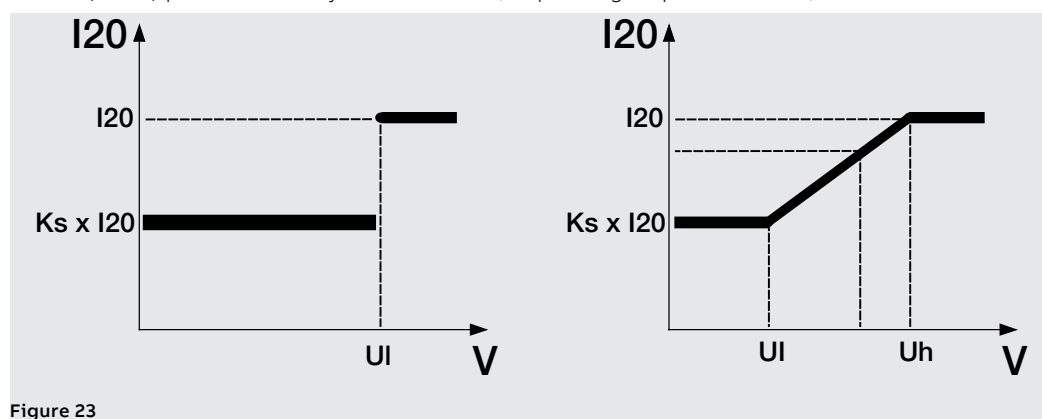


Figure 23

To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 96)
- the graph with trip curve (page 107)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Curve</i>	Allows the operating mode, Step or Lin, to be selected	Scal
<i>Threshold I20</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (amperes) and relative value (I_n) and can be set within the range: $0.6 I_n$ to $10 I_n$, in $0.1 I_n$ steps	$1 I_n$

Continued on the next page

Parameter	Description	Default
Threshold U_l	This is the voltage that determines the change in trip threshold I_{20} ; the behavior differs, depending on the mode selected ⁽¹⁾ The value is given as both absolute value (V) and relative value (U_n) and can be set within the range: $0.2 U_n$ to $1 U_n$ in $0.01 U_n$ steps	$1 U_n$
Threshold U_h	The parameter is shown by the Lin curve and contributes towards I_{20} trip threshold calculation: • with voltage reading $< U_h$ (and $\geq U_l$), the threshold changes gradually ⁽¹⁾ • with voltage reading $\geq U_h$, the threshold is I_{20} The value is given as both absolute value (V) and relative value (U_n) and can be set within the range: $0.2 U_n$ to $1 U_n$ in $0.01 U_n$ steps	$1 U_n$
Threshold K_s	I_{20} threshold calculation constant. The value is given as percentage of threshold I_{20} and can be set within the range: $0.1 I_{20}$ to $1 I_{20}$, in 0.01 steps	$0,6 I_{20}$
Time t_{20}	This is the trip time of the protection. The value is given in seconds and can be set within the range: 0.05 s to 30 s , in 0.01 s steps	0.1 s

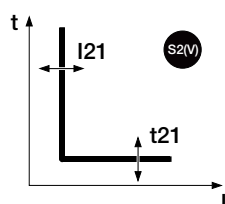
(1) Trip threshold (depending on the operating curve)

Mode	Voltage reading	Trip threshold
Scal	$< U_l$	$K_s \times I_{20}$
	$\geq U_l$	I_{20}
Lin	$< U_l$	$K_s \times I_{20}$
	$\geq U_l$ (e $< U_h$)	$((I_{20} \times (1 - K_s) \times (U_{\text{mis}} - U_h)) / (U_h - U_l)) + I_{20}$

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

S(V) Protection Function



$S_2(V)$ protection functions in the same way as $S(V)$ protection and protects against short-circuits, with threshold sensitive to the voltage value.

It is independent of $S(V)$ protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with $S(V)$ and open command with $S_2(V)$ or vice versa, or both $S(V)$ and $S_2(V)$ for signaling or tripping).

If the current of one or more phases exceeds threshold I_{21} for longer than time t_{21} , the protection activates and sends a TRIP command.

Following a voltage drop, the I_{21} threshold varies according to two different modes:

- **Step** provides for a stepped variation, depending on parameters U_{l2} and K_{s2} .
- **Lin** (linear) provides for a dynamic variation, depending on parameters U_{l2} , U_{h2} and K_{s2} .

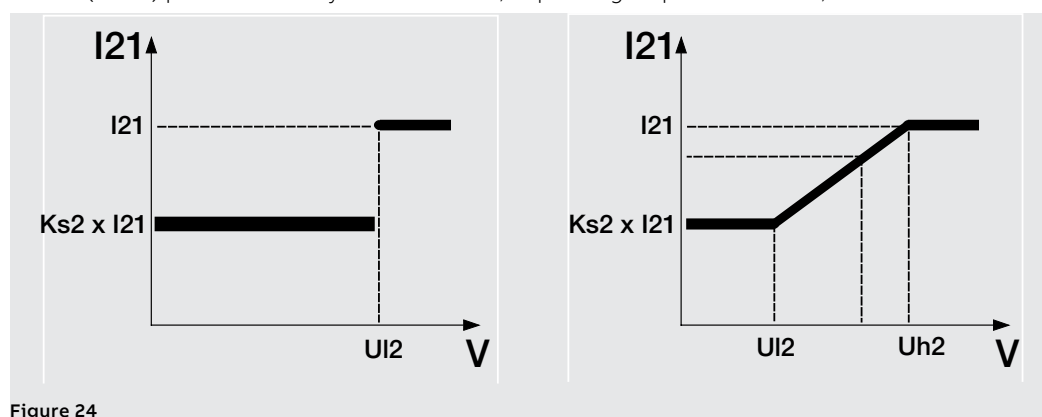


Figure 24

To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 96)
- the graph with trip curve (page 107)

Continued on the next page

Parameters

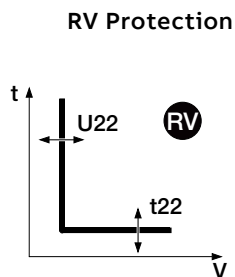
Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Curve</i>	Allows the operating mode, Step or Lin, to be selected	Scal
<i>Threshold I21</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	1 In
<i>Threshold UI2</i>	It is the voltage that determines the change in trip threshold I21; the behavior differs, depending on the mode selected ⁽¹⁾ The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
<i>Threshold Uh2</i>	The parameter is shown by the Lin curve and contributes towards I21 trip threshold calculation: • with voltage reading < Uh2 (and ≥ UI2), the threshold changes gradually ⁽¹⁾ • with voltage reading ≥ Uh2, the threshold is I21 The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
<i>Threshold Ks2</i>	I21 threshold calculation constant. The value is given as percentage of threshold I21 and can be set within the range: 0.1 I21 to 1 I21, in 0.01 steps	0,6 I21
<i>Time t21</i>	This is the trip time of the protection. The value is given in seconds and can be set within the range: 0.05 s to 30 s, in 0.01 s steps	0.1 s

(1) Trip threshold (depending on the operating curve)

Mode	Voltage reading	Trip threshold
Scal	< UI2	Ks2 x I21
	≥ UI2	I21
Lin	< UIs	Ks2 x I21
	≥ UI2 (e < Uh2)	$((I21 \times (1 - Ks2) \times (U_{mis} - Uh2)) / (Uh2 - UI2)) + I21$

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).



Function

The protection trips if loss of insulation occurs (verification of residual voltage U_0); the protection sends a TRIP command if voltage U_0 exceeds threshold U_{22} for longer than t_2 .

Protection is available in 3P and 3P + N configuration by activating the presence of neutral voltage in Ekip Measurement module or in external V0 configuration if Ekip Synchrocheck is present.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 107)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold U_{22}</i>	Establishes the value that activates the protection. The value is given as both absolute value (V) and relative value (U_n) and can be set within the range: 0.05 U_n to 0.5 U_n in 0.001 U_n steps	0,15 U_n
<i>Time t_{22}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	15 s
<i>Reset Time</i>	This is the time the alarm is retained after the protection has quit the alarm condition; it can be useful for keeping the timing activated when the protection is temporarily deactivated. The value is given in seconds and can be set within the range: 0 s to 0.2 s, in 0.02 s steps	0 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

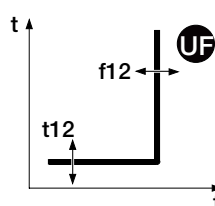
5 - Frequency protections

List The Frequency protections, available by default for Ekip Hi-Touch, Ekip G Touch, Ekip G-Hi Touch models and configurable in the remaining models as additional SW package, are:

Name	Type of protection	Page
UF	Minimum frequency	72
OF	Maximum frequency	73
UF2 ⁽¹⁾	Minimum frequency	73
OF2 ⁽¹⁾	Maximum frequency	74

⁽¹⁾ protections UF2 and OF2 are not available by default with Ekip G Touch. However, they can be integrated by requesting the relative SW package

UF Protection Function



The protection sends a TRIP command if the grid frequency read by the unit drops below threshold f12 for longer than t12.

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

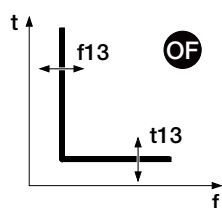
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 108)

Parameters

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu	OFF
Trip Enable	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
Threshold f12	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 0.9 Fn to 1 Fn in 0.001 Fn steps	0,9 Fn
Time t12	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

OF Protection**Function**

The protection sends a TRIP command if the grid frequency read by the unit exceeds threshold f_{13} for longer than t_{13} .

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

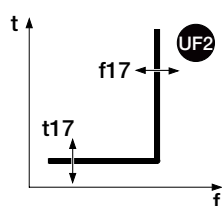
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 108)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f_{13}</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 1 Fn to 1.1 Fn in 0.001 Fn steps	1,1 Fn
<i>Time t_{13}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

UF2 Protection**Function**

UF2 protection functions in the same way as UF protection: the protection sends a TRIP command if the grid frequency read by the unit drops below threshold f_{17} for longer than t_{17} .

It is independent of UF protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with UF and open command with UF2 or vice versa, or both for signaling or tripping).

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

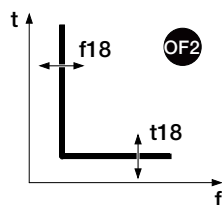
- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 108)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f_{17}</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 0.9 Fn to 1 Fn in 0.001 Fn steps	0,9 Fn
<i>Time t_{17}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

OF2 Protection**Function**

OF2 protection functions in the same way as OF protection: the protection sends a TRIP command if the grid frequency read by the unit exceeds threshold f18 for longer than t18.

It is independent of OF protection, thus thresholds and functions of the two protections can be programmed so as to take advantage of different plant solutions (example: signaling with OF and open command with OF2 or vice versa, or both for signaling or tripping).

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 108)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f18</i>	Establishes the value that activates the protection. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 1 Fn to 1.1 Fn in 0.001 Fn steps	1,1 Fn
<i>Time t18</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	3 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

6 - Power protections

List The Power protections, available by default for Ekip Hi-Touch, Ekip G Touch, Ekip G-Hi Touch models and configurable in Ekip Touch as additional SW package, are:

Name	Type of protection	Page
RP	Reverse active power	75
D ⁽²⁾	Directional short-circuit with adjustable delay	78
OQ ⁽¹⁾	Maximum reactive power	78
OP ⁽¹⁾	Active overpower	78
UP ⁽¹⁾	Active underpower	79
RQ ⁽¹⁾⁽²⁾	Reverse reactive power	79
CosΦ	Minimum cosφ	80

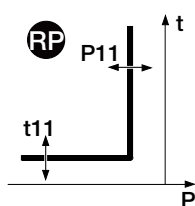
⁽¹⁾ the protection is not available by default with Ekip Hi-Touch. However, it can be integrated by requesting the relative SW package

⁽²⁾ the protection is not available by default with Ekip G Touch. However, it can be integrated by requesting the relative SW package



WARNING! The Power flow parameters effect the sign of the power and power factor values measured by the unit. Power flow must be configured and verified on the basis of your installation to ensure that all the protections of the Power Protections package function correctly

RP Protection




Function

The protection sends a TRIP command if the reverse total active power exceeds threshold P11 for longer than t1.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 109)

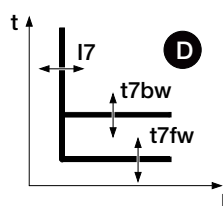
Parameters

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu	OFF
Trip Enable	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
Threshold P11	Establishes the value that activates the protection. The value is given as both absolute value (kW) and relative value (Sn) and can be set within the range: -0.05 Sn to -1 Sn in 0.001 Sn steps  NOTE: the threshold expressed in Sn is preceded by the “-” sign to indicate that inverse power is involved	-0,1 Sn
Time t11	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.05 s to 120 s, in 0.01 s steps	10 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

D Protection Function



D protection is very similar to S protection, with the additional capability of recognizing the direction of the current during a fault.

The current direction allows the user to find out whether the fault is on the supply side or load side of the device controlled by Ekip Touch.

In ring type distribution systems, D protection allows the distribution section in which the fault has occurred to be identified and disconnected without affecting the rest of the installation (using zone selectivity).

Depending on the direction of the fault, if the current of one or more phases exceeds threshold $I7$ ($I7fw$ or $I7bw$) for longer than time $t7$ ($t7fw$ or $t7bw$), the protection activates and sends a TRIP command.

The **fault direction** is established by comparing the **detected fault current** with the **reference direction**.

i **NOTE:** the reference direction is calculated considering the set value of the power flow direction and the phase sequence (cyclic direction of the phases):

Phase sequence (set)	Power flow (set)	Phase sequence (detected)	Reference direction (forward direction)
123	High-->Low	123	High-->Low
123	Bottom --> Top	123	Bottom --> Top
123	High-->Low	321	Bottom --> Top
123	Bottom --> Top	321	High-->Low
321	High-->Low	123	Bottom --> Top
321	Bottom --> Top	123	High-->Low
321	High-->Low	321	High-->Low
321	Bottom --> Top	321	Bottom --> Top

To check and simulate the trip times in relation to all the parameters, please consult:

- the summary table of the protections with the calculation formulas (page 95)
- the graph with trip curve (page 109)

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	ON
<i>Threshold I7 Fw</i>	Establishes the value that activates the protection with forward direction. The value is given as both absolute value (amperes) and relative value (I_n) and can be set within the range: 0.6 I_n to 10 I_n , in 0.1 I_n steps	2 I_n
<i>Threshold I7 Bw</i>	Establishes the value that activates the protection with backward direction. The value is given as both absolute value (amperes) and relative value (I_n) and can be set within the range: 0.6 I_n to 10 I_n , in 0.1 I_n steps	2 I_n
<i>Time t7 Fw</i>	This is the trip time in the case of forward direction. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,2 s
<i>Time t7 Bw</i>	This is the trip time in the case of backward direction. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,2 s
<i>ZoneSelectivity⁽¹⁾</i>	Activates/deactivates the function and selectivity time availability on the display. i NOTE: configure selectivities S, S2, I, 2I, MCR and G OFF to ensure that selectivity D functions correctly i NOTE: configure selectivities S, S2, I, 2I, MCR, G, Gext and MDGF OFF to ensure that selectivity D functions correctly	OFF
<i>Selectivity time Fw⁽¹⁾</i>	This is the trip time of the protection with the zone selectivity function activated, forward direction and selectivity input Fw not present. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,13 s
<i>Selectivity time Bw⁽¹⁾</i>	This is the trip time of the protection with the zone selectivity function activated, backward direction and selectivity input Bw not present. The value is given in seconds and can be set within the range: 0.1 s to 0.8 s, in 0.01 s steps	0,13 s

Continued on the next page

Parameter	Description	Default
<i>StartUp enable</i>	Activates/deactivates the function and availability of the associated parameters on the display	OFF
<i>StartUp Threshold Fw⁽²⁾</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated and with forward current direction ⁽²⁾ . The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
<i>StartUp Threshold Bw⁽²⁾</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated and with backward current direction. The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.6 In to 10 In, in 0.1 In steps	2 In
<i>StartUp Time⁽²⁾</i>	This is the time for which the StartUp threshold remains activated and is calculated from the moment the activation Threshold is exceeded. The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s
<i>Direction Min Angle</i>	Ekip Touch calculates the phase displacement angle between active and apparent power measured: when phase displacement exceeds the set Direction Min Angle parameter, the unit considers the fault direction to have been identified. The value is given in degrees and can be set within a range of 15 values from 3.6° to 69.6°	3,6 °

⁽¹⁾ details on page 84

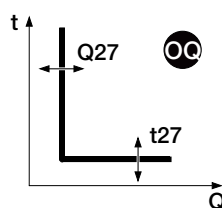
⁽²⁾ details on page 86

Limitations and additional functions

the functions blocking the type of selectivity and the *Trip only Forward* and *Trip Only Backward* parameters can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 86).

Notes

- activation of D directional protection automatically activates the alarm that monitors phase sequence (which can also be excluded and activated in the manual mode): note how, in the case of a cyclic sequence of phases that differs from the set value, in the event of a fault the directional protection inverts the reference direction with respect to the expected direction; details of the phase sequence protection are available on page 67
- in the case of small overcurrents, the behavior of the directional protection is influenced by the type of load: to prevent the direction of the fault current from being incorrectly interpreted in the case of capacitive loads, it is advisable for the setting of that protection to be made on the basis of real fault conditions and not overloads

OQ Protection**Function**

The protection sends a TRIP command if one or more of the reactive power values detected by the unit exceed threshold Q27 for longer than t27.

To check and simulate the trip times in relation to all the parameters, please consult:

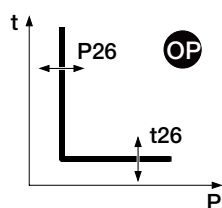
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 110)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold Q27</i>	Establishes the value that activates the protection. The value is given as both absolute value (kVAR) and relative value (Sn) and can be set within the range: 0.4 Sn to 2 Sn in 0.001 Sn steps	1 Sn
<i>Time t27</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.5 s steps	1 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

OP Protection**Function**

The protection sends a TRIP command if one or more of the active power values detected by the unit exceed threshold P26 for longer than t26.

To check and simulate the trip times in relation to all the parameters, please consult:

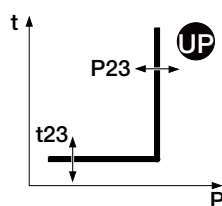
- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 110)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold P26</i>	Establishes the value that activates the protection. The value is given as both absolute value (kW) and relative value (Sn) and can be set within the range: 0.4 Sn to 2 Sn in 0.001 Sn steps	1 Un
<i>Time t26</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.5 s steps	1 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

UP Protection**Function**

The protection sends a TRIP command if one or more of the active power values detected by the unit drop below threshold P23 for longer than t23.

The protection is active also for negative (reverse) active power, but is independent from the RP protection (Reverse active power protection).

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

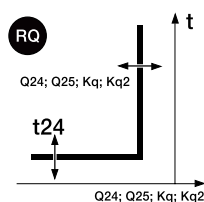
To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 111)

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold P23</i>	Establishes the value that activates the protection. The value is given as both absolute value (kW) and relative value (Sn) and can be set within the range: 0.1 Sn to 1 Sn in 0.001 Sn steps	1 Sn
<i>Time t23</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.5 s steps	1 s
<i>StartUp enable</i>	Activates/deactivates the function and availability of the StartUp Time parameter in the menu	OFF
<i>StartUp Time</i>	This is the time for which the threshold remains disabled and is calculated from the moment the activation Threshold is exceeded. The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

RQ Protection**Function**

RQ protection protects against reactive power reversal; the threshold can be adjusted on the basis of the active power.

The protection sends a TRIP command when inverse reactive power enters the TRIP area, determined by the protection parameters and power value readings, for longer than t24.

Adjustment of constants Kq and Kq2 allows the trip threshold of the protection (determined by the intersection of the two TRIP areas, whose limits depend on the parameters configured in the unit) to be changed.

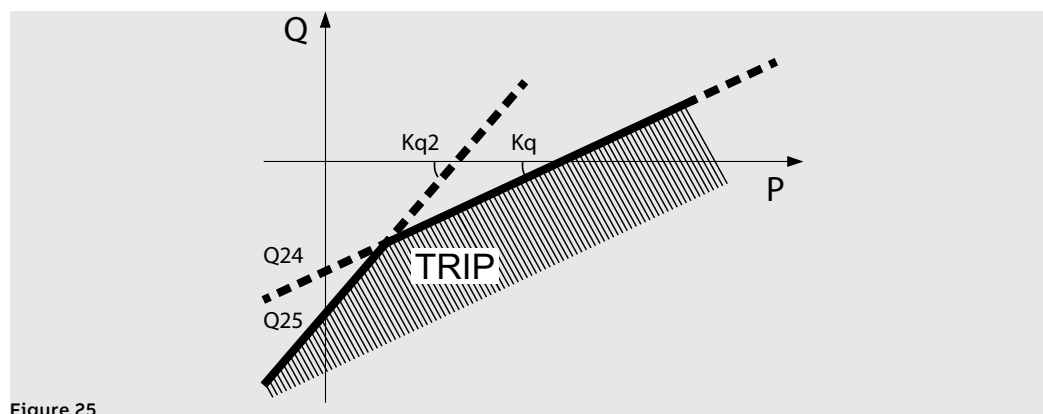




Figure 25

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 111)

Continued on the next page

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold Kq</i>	Defines the gradient of the line relating to threshold Q24. The value is given as absolute value (slope of the line) and can be set within the range: -2 to 2 in 0.01 steps	-2
<i>Threshold -Q24</i>	This is the reactive power required to define the trip line and relative TRIP area. The value is given as both absolute value (kVAR) and relative value (Sn) and can be set within the range: 0.1 Sn to 1 Sn in 0.001 Sn steps  NOTE: the threshold expressed in Sn is not preceded by the “-” sign, but should still be understood as inverse reactive power	0,1 Sn
<i>Threshold Kq2</i>	Defines the gradient of the line relating to threshold Q25. The value is given as absolute value (slope of the line) and can be set within the range: -2 to 2 in 0.01 steps	2
<i>Threshold -Q25</i>	Defines the reactive power value at which the protection trips and is required for the purpose of defining the relative TRIP area The value is given as both absolute value (kVAR) and relative value (Sn) and can be set within the range: 0.1 Sn to 1 Sn in 0.001 Sn steps  NOTE: the threshold expressed in Sn is not preceded by the “-” sign, but should still be understood as inverse reactive power	0,11 Sn
<i>Time t24</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.5 s to 100 s, in 0.1 s steps	100 s
<i>Threshold Vmin</i>	It is the minimum voltage for activation of the protection. If there is at least one line-to-line voltage present below the Vmin threshold, the protection is not active. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.5 Un to 1.2 Un in 0.01 Un steps	0.5 Un

Limitations and additional functions

- Ekip Touch accepts parameters in accordance with the following limitations: $Q24 < Q25$ and $Kq < Kq2$
- the block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

CosΦ Protection

The protection activates an alarm when the total cosφ value drops below the set threshold.

Total cosφ is calculated as ratio between total active power and total apparent power.

Parameters

The parameters are available in the Advanced - Signaling menu (page 47)

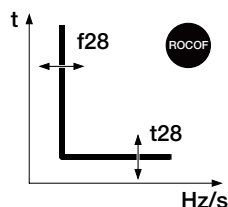
Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and availability of the threshold in the menu	OFF
<i>Threshold</i>	Defines the value that activates the protection; can be set within the range: 0.5 to 0.95 in 0.01 steps	0,95

7 - ROCOF protections

The ROCOF Protection package is available by default for Ekip G Hi-Touch and configurable in the remaining models as additional SW package

The protection is described below:

ROCOF Protection



Function

ROCOF protection protects against rapid frequency variations: the protection sends a TRIP command if the frequency changes faster than control variation f_{28} set in the unit for longer than t_{28} .

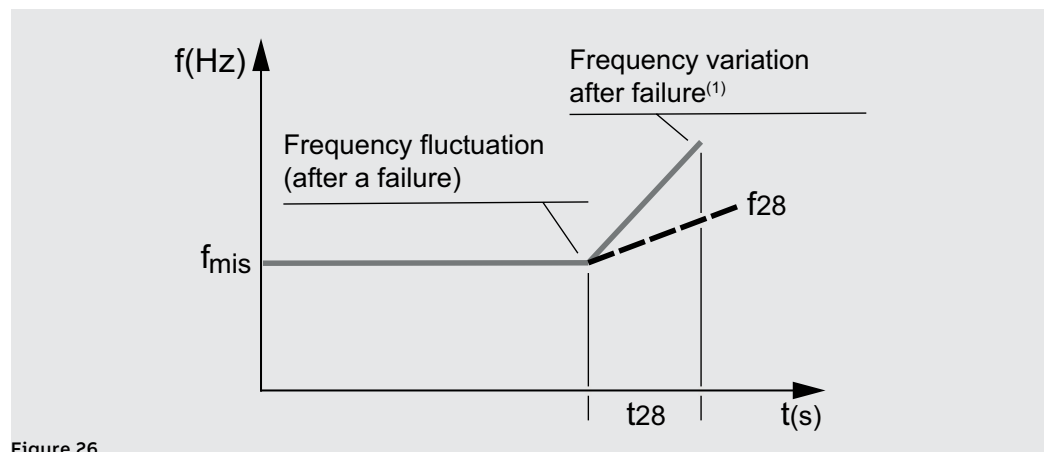


Figure 26

⁽¹⁾ example with positive linear variation of the higher frequency of the set f_{28} value; the protection also manages negative variations

The protection excludes itself if the maximum value of the line-to-line voltage is less than 30 V.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 96)
- the graph with trip curve (page 112)

Parameters

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	OFF
<i>Threshold f_{28}</i>	establishes the maximum admissible frequency variation rate over time; the protection trips if this rate is exceeded. The value is given as absolute value (Hz/s) F_n and can be set within the range: 0.4 Hz/s to 10 Hz/s in 0.2 Hz/s steps	0,6 Hz/s
<i>Trip Direction</i>	Establishes whether the protection monitors an increase (Up), a decrease (Down) or both variations (Up and Down)	Up or Down
<i>Time f_{28}</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 0.06 s to 300 s, in 0.01 s steps	0,5 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 86).

8 - Protection Adaptive

The Adaptive Protection package is available by default for Ekip Hi-Touch and Ekip M Touch and configurable in the remaining models as additional SW package.

The protection is described below:

Dual Set The function enables two different protection configurations to be made, one as an alternative to the other, by means of a set change with programmable events.

The function can be activated in the *Settings-Dual Set* menu (page 49)

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the function	OFF
<i>Default Set</i>	Defines the sets of main and secondary protections (which activate in the presence of the programmed event)	Set A

The event that determines set change (from default to secondary) can be programmed in the *Advanced-Functions* menu, see the paragraph Programmable Functions and Commands (page 92).

9 - Additional protections and functions

Introduction Some protections have additional functions which extend their characteristics and performance:

Name	Type of protection	Page
Thermal Memory	overheating of the cables	83
Zone selectivity	management of trip commands in a network of circuit-breakers	83
Blocks	blocking of protection on the basis of programmable events	86
Startup	different thresholds on the basis of monitoring thresholds	86
Current thresholds	Current control with programmable thresholds	91
Programmable Commands	programmable commands with trip unit events or statuses	92

Installation of accessory modules allows the respective functions to be activated:

Name	Type of protection	Page
Gext	External earth fault with adjustable delay	87
Rc	Residual current	90
Synchrocheck	Synchronism between two independent voltage sources	92
MDGF	Modified differential ground fault	88

Thermal Memory Protection The function, which is available for L and S protections, allows overheating in the cables connected to the circuit-breaker to be prevented: in the case of trips within brief intervals, the unit considers the time between commands and the entity of the faults so as to reduce opening time.



IMPORTANT: for the S protection the function can be activated if the selected curve is time-dependent.



NOTE: the function also reduces the trip time in the case of overloads which have not led to the open command (longer than 100 ms)

S, S2, I, 2I, MCR, G zone selectivity ProtectionS, S2, I, 2I, MCR, G, Gext, MDGF zone selectivity Protection

The function, which can be activated for S, S2, I, 2I, MCR, G, Gext and MDGF protections (if available and enabled), allows several devices belonging to the same installation (including Ekip Touch) to be interconnected, so as to handle trip commands in the best possible way in the case of S, S2, I, 2I, MCR, G, Gext and MDGF protections.

The function allows the devices to be coordinated so that, if a fault occurs:

- The device nearest to the fault trips
- the other devices are blocked for a programmable time



NOTE: connection can be made between ABB devices that have the zone selectivity function

Characteristics

Ekip Touch has five selectivity connections, located on the rear connectors of the CB:

Name	Type	Description	Connection
Szi	Input	S, S2, I, 2I and MCR protection selectivity input	From devices on the load side
Szo	Output	S, S2, I, 2I and MCR protection selectivity output	To devices on the supply side
Gzi	Input	G, Gext and MDGF protection selectivity input	From devices on the load side
Gzo	Output	G, Gext and MDGF protection selectivity output	To devices on the supply side
Szc	Common	Common connection of selectivity network	The entire selectivity network

Continued on the next page

Configuration

To correctly configure the selectivity network of one or more protections:

1. Connect zone selectivity outputs of the same type (example: Szo) of devices belonging to the same zone, to the zone selectivity input of the device immediately upstream (example: Szi).
2. Connect all the Szc of devices in the same network together.
3. Time t2 must be configured at $t2\ sel + 50\ ms$ or more, with the exclusion of the device further along its network.

Logic table

The table includes all cases in which, with zone selectivity enabled in the device, an alarm condition occurs or a zone selectivity signal is received from another device.



NOTES:

- the table gives the S protection cases, but is also valid for the other protections: G, S2, I, 2I, MCR, Gext and MDGF, each with its respective connections
- if the selectivities of protections that share the same connections are active at the same time (example: S, S2, I, 2I and MCR), the inputs/outputs are managed with OR logic

Condition	Szi	Szo	Tripping time	Remarks
If < I2	0	0	No TRIP	TRIP II device not in alarm status
If < I2	1	1	No TRIP	The device is not in the alarm status, but sends the selectivity signal received from the device upstream
If > I2	0	1	$t2\ sel^{(1)}$	The device is in the alarm status and is the first to detect the fault: trips within time $t2\ sel^{(1)}$
If > I2	1	1	$t2^{(2)}$	The device is in the alarm status but is not the first to detect the fault: trips within time $t2^{(2)}$

⁽¹⁾ the trip time of protection I is that of protection

⁽²⁾ for I protection tripping time is 100ms

D zone selectivity Protection Foreword

This function, which can be activated for D protection (if available and enabled), enables devices belonging to the same installation (including Ekip Touch) to be connected together so as to handle the trip commands in a better way in the case of D protection.

It is especially useful in ring and grid type systems where, besides the zone, it is essential to also define the direction of the power flow that supplies the fault.

The function allows the devices to be coordinated so that, if a fault occurs:

- the device nearest to the fault trips
- The other devices are blocked for a programmable time



NOTES:

- connection can be made between ABB devices that have the zone selectivity function
- disable the zone selectivities of protections S, S2, I, 2I, MCR, G, Gext and MDGF to correctly use the selectivity D function

Characteristics

Ekip Touch has five selectivity connections, located on the upper terminal box of the CB:

Name	Type	Description	Denomination for D
Szi	Input	Forward direction selectivity input	DFin
Szo	Output	Forward direction selectivity output	DFout
Gzi	Input	Backward direction selectivity input	DbIn
Gzo	Output	Backward direction selectivity output	Dbout
Szc	Common	Common connection of selectivity network	SZc

Continued on the next page

Configuration

To correctly configure selectivity D in a ring system:

1. Connect the zone selectivity outputs of each device (example: DFin) to the selectivity input of the same direction as the device immediately after (example: DFout).
2. Connect all the Szc of devices in the same network together.

Logic table

The table includes all cases in which, with zone selectivity enabled in the device, an alarm condition occurs or a zone selectivity signal is received from another device.

The Forward output is activated if the **fault direction** coincides with the **reference direction** otherwise, if it is in the opposite direction, the Backward output is activated (page 76)

Fault direction	Condition	DFin	Dbin	Dfout	Dbout	Tripping time	Remarks
Forward	If < I7 Fw	0	x	0	x	No TRIP	Device not in alarm status
Backward	If < I7 Bw	x	0	x	0		
Forward	If < I7 Fw	1	x	1	x	No TRIP	The device is not in the alarm status, but sends the selectivity signal received to the output of the reference direction
Backward	If < I7 Bw	x	1	x	1		
Forward	If > I7 Fw	0	x	1	x	t7 Fw sel	The device is in the alarm status and is the first to detect the fault: trips within time t7 Fw sel or t7 Bw sel
Backward	If > I7 Bw	x	0	x	1	t7 Bw sel	
Forward	If > I7 Fw	1	x	1	x	t7 Fw	The device is in the alarm status but is not the first to detect the fault: trips within time t7 Fw (or t7 Bw)
Backward	If > I7 Bw	x	1	x	1	t7 Bw	



NOTE: when zone selectivity is active and the direction of the fault cannot be established, the unit trips by considering the first threshold to be exceeded between I7 Fw and I7 Bw, without activating any output (DFout or Dbout); if both the thresholds have been exceeded (for example, if they have been set with the same value), the unit trips after the shortest time between t7 Fw and t7 Bw.

Trip Only Forward and Backward

D protection can be configured (if available and enabled) with 2 additional parameters via the service connector (via Ekip Connect) or via system bus communication:

- *Trip only Forward:* if activated, D protection only controls open commands if forward direction is detected
- *Trip only Backward:* if activated, D protection only controls open commands if backward direction is detected.

faults in the opposite direction are only handled as alarm information.

Type of selectivity

The zone selectivity inputs and certain of the outputs can be configured via service connector (via Ekip Connect) or via system bus communication for protections S, S2, I, 2I, MCR, G, Gext, MDGF and D (if available and enabled):

- *Standard:* operation as by zone selectivity standard logic (default configuration)
- *Customized:* the event that activates the zone selectivity input or output can be selected in this mode.



IMPORTANT: in the Customized configuration, the only zone selectivity activation event is the one set and standard selectivity operation is therefore not active (changes should only be made by expert technical personnel)

Startup Protection

The function, which can be activated for protections S, I, G, Gext, MDGF, S2, D and UP (if available and enabled), allow the protection threshold (*StartUp threshold*) to be changed for a period that can be set by the user (Startup time).



NOTE: for UP protection, startup means the time for which the protection is disabled

The period begins after a threshold has been exceeded (activation threshold), user-programmable via Ekip Connect or system bus, valid and verified for all phase currents.

The Startup condition elapses after Startup time and re-activates the next time the activation threshold is exceeded



NOTE: startup does not occur again until at least one current remains above activation threshold level

A graphic representation with S protection follows:

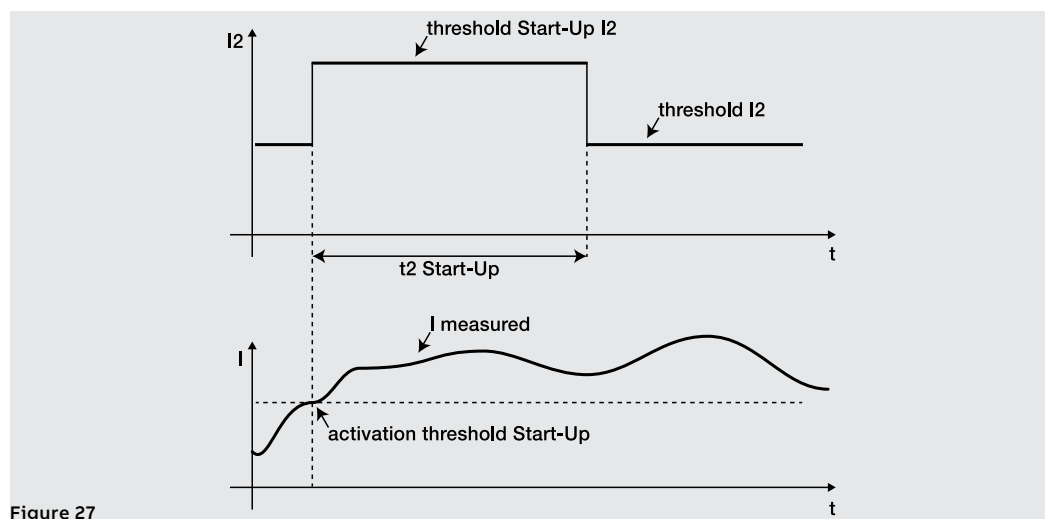


Figure 27

Block functions

Six blocks can be configured for certain protections by means of the service connector (via Ekip Connect) or communication via system bus. These blocks are useful for deactivating the protections relating to programmable events:

Block name	Description
BlockOnProgStatusA	Block active if programmable status A is true
BlockOnProgStatusB	Block active if programmable status B is true
BlockOnProgStatusC	Block active if programmable status C is true
BlockOnProgStatusD	Block active if programmable status D is true
BlockOnStartup	Block active during StartUp time (if StartUp for the specific protection is available and activated)
BlockOnOutOfFrequency	Block active if frequency measured is not within 30 Hz to 80 Hz range

Each block is independent and has its own activation command (Block On); however, each protection can be configured with several block conditions (operation in OR logic condition).

The protections which have blocks are: S, I, G, Gext, MDGF, MCR, S2, D, S(V), S2(V), UV, OV, VU, UV2, OV2, UP, OP, RP, RQ, OQ, RV, UF, OF, UF2, OF2, ROCOF, UC, U.



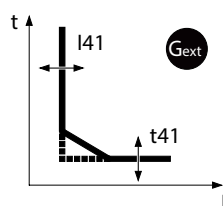
IMPORTANT: the blocks can cause:

- increase of protection trip times (max: + 30 ms), owing to verification of the event itself (example: (frequency check))
- undesired deactivation of the protection, if the block is associated with statuses or signals to modules via local bus and auxiliary power supply is absent. In this case, it may be useful to also consider the status of the auxiliary power supply (Supply from Vaux) when programming the event
- undesired deactivation of the protection, if the block is associated with frequency measurements and the voltage is less than the minimum calculation threshold



IMPORTANT: if the function is activated, the blocks are deactivated during startup (except for BlockOnStartup, which functions during this period)

Gext Protection



Function

Gext protection protects against earth faults and detects the fault current with a dedicated external toroid S.G.R.

if S.G.R. toroid current exceeds threshold I_{41} , the protection trips and, after a time established by the value read and by the parameter settings, transmits the TRIP command.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 103)

Parameters

Toroid configuration is available in the Settings menu (page 49)

Parameter	Description	Default
<i>External Toroid</i>	It allows the presence of <i>external toroid S.G.R.</i> to be activated	OFF
<i>Toroid size</i>	Allows the reference current of the protection to be selected from among four available quantities, from 100 A to 800 A ! IMPORTANT: the current selected from the menu must be consistent with the size of the external toroid S.G.R. connected to the unit	100 A

The protection configuration is available in the Advanced menu (page 47)

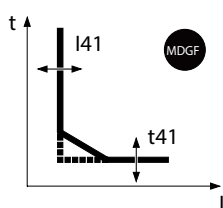
Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	ON
<i>Curve</i>	Establishes curve dynamics and the threshold or trip time calculation: • $t = k$: fixed time trip • $t = k/I^2$: inverse time-delay dynamic trip	$t = k$
<i>Threshold I_{41}</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. The value is given as both absolute value (amperes) and relative value (I_n) and can be set within the range: 0.1 I_n to 1 I_n , in 0.001 I_n steps	0,2 I_n
<i>Time t_{41}</i>	It is the trip time or contributes towards timing calculation, depending on the type of curve selected. The value is given in seconds and can be set within the range: 0.1 s to 1 s, in 0.05 s steps	0,4 s
<i>Threshold I_{41}</i>	Warns that the measured current is near to the protection activation threshold. The value is given in percentage of threshold I_1 and can be set within the range 50% I_{41} to 90% I_{41} , in 1% steps. The prealarm condition deactivates in two cases: • current lower than prealarm threshold I_{41} • current higher than threshold I_{41}	90 % I_{41}

Continued on the next page

Parameter	Description	Default
ZoneSelectivity	Activates/deactivates the function and selectivity time availability on the display ⁽¹⁾ NOTES : <ul style="list-style-type: none"> the function is only available with curve t = k if at least two of the selectivity G, Gext and MDGF are enabled, the input and output are shared with the OR function; it is sufficient that even a selectivity is activated to stimulate inputs and outputs 	OFF
Selectivity time	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present ⁽¹⁾ The value is given in seconds and can be set within the range: 0.04 s to 0.2 s, in 0.01 s steps	0,04 s
StartUp enable	Activates/deactivates the function and availability of the associated parameters on the display ⁽²⁾	OFF
StartUp Threshold	Protection threshold valid during Startup time, in the conditions in which the function is activated ⁽²⁾ Value is given as both absolute value (Amperes) and relative value (In) and can be set within range: 0.2 In to 1 In, in 0.02 In steps	0,2 In
StartUp Time	This is the time for which the StartUp threshold remains activated and is calculated from the moment the activation Threshold is exceeded ⁽²⁾ The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

⁽¹⁾ details on page 83⁽²⁾ details on page 86**Limitations and additional functions**

- in the presence of curve t = k/I², the protection trip time is forced to t₄₁ if the calculation results give a theoretical value lower than t₄₁ itself
- Ekip Touch activates and displays Gext protection parameters if the presence of toroid S.G.R has been enabled in the Settings menu (page 49); protection activation includes checking for the presence of toroid S.G.R and signaling on the diagnosis bar in the event of alarm/absence
- the protection is automatically inhibited by the unit if absence of toroid S.G.R is detected
- the block functions and type of selectivity can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 85)
- with CB in UL standard configuration, some parameters have different maximum values: I₄₁ maximum = 1200 A, Startup maximum = 1200 A, t₄₁ maximum = 400 ms

MDGF Protection**Function**

MDGF protection protects against earth faults and detects the fault current with a dedicated toroid MDGF.

If the MDGF toroid current exceeds threshold I₄₁, the protection trips and, after a time established by the value read and by the parameter settings, transmits the TRIP command.

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 104)



NOTE: Functionality valid from version FW Mainboard ≥3.23 and trip unit ≥4.04. Please contact ABB for previous versions.



Parameters

Toroid configuration is available in the Settings menu (page 49)

Parameter	Description	Default
External Toroid	It allows the presence of <i>toroid MDGF</i> to be activated	OFF
MDGF in Size	Visible if External Toroid parameter setting is ON. Size of MDGF Toroid installed must be set. Value can be set within the 100 A to I _u value range, given in Amperes and in 1A steps.	I _u (given in Amperes)

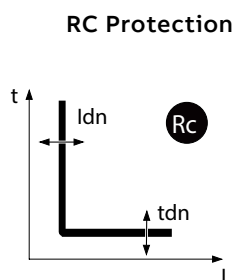
Continued on the next page

Protection configuration is available in the Advanced menu (page 47)

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	OFF
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	ON
<i>Curve</i>	Establishes curve dynamics and the threshold or trip time calculation: • $t = k$: fixed time trip • $t = k/I^2$: inverse time-delay dynamic trip	$t = k$
<i>Threshold I41</i>	Establishes the value that activates the protection and contributes towards calculating the trip time. Value is given as both absolute value (Amperes) and relative value (I_n , with reference to MDGF In Size parameter) and can be set within a range: 0.1 I_n to 1 I_n , in 0.001 I_n steps	0,2 I_n
<i>Time t41</i>	It is the trip time or contributes towards timing calculation, depending on the type of curve selected. The value is given in seconds and can be set within the range: • 0.05 s to 1 s, in 0.05 s steps for $t = k$ • 0.1 s to 1 s, in 0.05 s steps for $t = k/I^2$  NOTE: with CB in UL configuration, the maximum settable value of t41 is 0.4 s	0,4 s
<i>Threshold I41</i>	Warns that the measured current is near to the protection activation threshold. Value is given in percentage of MDGF In Size and can be set within the range of 50% I_{41} to 90% I_{41} , in 1% steps. The prealarm condition deactivates in two cases: • current lower than prealarm threshold I_{41} • current higher than threshold I_{41}	90 % I_{41}
<i>ZoneSelectivity</i>	Activates/deactivates the function and selectivity time availability on the display ⁽¹⁾  NOTES : • the function is only available with curve $t = k$ • if at least two of the selectivity G, Gext and MDGF are enabled, the input and output are shared with the OR function; it is sufficient that even a selectivity is activated to stimulate inputs and outputs	OFF
<i>Selectivity time</i>	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present ⁽¹⁾ The value is given in seconds and can be set within the range: 0.04 s to 0.2 s, in 0.01 s steps	0,04 s
<i>Startup enable</i>	Activates/deactivates the function and availability of the associated parameters on the display ⁽²⁾	OFF
<i>Startup Threshold</i>	Protection threshold valid during Startup time, in the conditions in which the function is activated ⁽²⁾ Value is given as both absolute value (Amperes) and relative value (I_n , with reference to MDGF In Size parameter) and can be set within a range: 0.2 I_n to 1 I_n , in 0.1 I_n steps	0,2 I_n
<i>Startup Time</i>	This is the time for which the Startup threshold remains activated and is calculated from the moment the activation Threshold is exceeded ⁽²⁾ The value is given in seconds and can be set within the range: 0.1 s to 30 s, in 0.01 s steps	0.1 s

⁽¹⁾ details on page 83⁽²⁾ details on page 86**Limitations and additional functions**

- in the presence of curve $t = k/I^2$, the protection trip time is forced to t41 if the calculation results give a theoretical value lower than t41 itself
- Ekip Touch activates and displays MDGF protection parameters if the presence of toroid MDGF has been enabled in the Settings menu (page 49);
- the block functions and type of selectivity can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 85)
- with CB in UL standard configuration, some parameters have different maximum values: I_{41} maximum = 1200 A, Startup maximum = 1200 A, t41 maximum = 400 ms
- an error is generated if MDGF In Size value exceeds rated current value of CB



Function

Rc protection protects against the residual current earth faults by detecting the fault current with the appropriate external Rc toroid.

The protection sends a TRIP command if the current from toroid Rc exceeds threshold I_{dn} for longer than T_{dn} .

To check and simulate the trip times in relation to all the parameters, please consult:

- summary table of the protections with the operating characteristics (page 95)
- the graph with trip curve (page 103)

Parameters

Parameter	Description	Default
Threshold I_{dn}	Defines the value that activates the protection; the value is given in amperes and can be set within a range of values from 3 A to 30 A	3 A
Time T_{dn}	This is the trip time of the protection; the value is given in seconds and can be set within a range of values from 0.05 s to 0.8 s	0,06 s

Limitations and additional functions

Ekip Touch activates and displays the Rc protection parameters if the following conditions are observed:

- *Rating Plug* Rc model assembled and installed
- *Measurement* module assembled and installed

protection activation includes checking for the presence of toroid Rc and signaling on the diagnosis bar in the event of alarm/absence

Current thresholds Function

The Current thresholds allow checks to be set along the current lines, to be associated with the programmable contacts of the *Ekip Signalling* modules (in all versions).

Two pairs of programmable contacts are available:

- Threshold 1 I1 and Threshold 2 I1, with control referring to I1
- Threshold Iw1 and Threshold Iw2, with control relating to In

The thresholds can be enabled and set in the Advanced - Signaling menu (page 47).



IMPORTANT:

- the current thresholds do not manage the trip, but only the signal
- the function is activated if the trip unit is powered by auxiliary voltage

Parameters

Threshold	Available parameters	Default
Threshold 1 I1	<i>Enable</i> : Activates the protection and availability of the threshold in the menu	OFF
	<i>Threshold</i> : The value is given in percentage of threshold I1 and can be set within the range: 50% I1 to 100% I1, in 1% steps.	50 % I1
Threshold 2 I1	<i>Enable</i> : Activates the protection and availability of the threshold in the menu	OFF
	<i>Threshold</i> : The value is given in percentage of threshold I1 and can be set within the range: 50% I1 to 100% I1, in 1% steps.	75 % I1
Threshold Iw1	<i>Enable</i> : Activates the protection and availability of the threshold in the menu	OFF
	<i>Direction</i> : allows the user to choose whether to have the signal when the current is higher (Up) or lower (Down) than the threshold.	Down
	<i>Threshold</i> : The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.1 In to 10 In, in 0.01 In steps	3 In
Threshold Iw2	<i>Enable</i> : Activates the protection and availability of the threshold in the menu	OFF
	<i>Direction</i> : allows the user to choose whether to have the signal when the current is higher (Up) or lower (Down) than the threshold.	Up
	<i>Threshold</i> : The value is given as both absolute value (amperes) and relative value (In) and can be set within the range: 0.1 In to 10 In, in 0.01 In steps	3 In

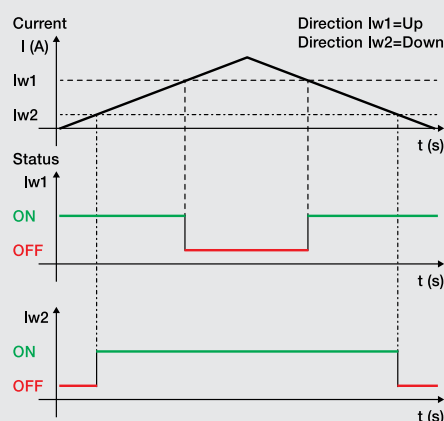


Figure 28

Synchrocheck

With regard to closing the interconnection switch, the *Ekip Synchrocheck* module recognizes and reports whether there are synchronism conditions between two independent voltage sources (example: generator + grid).

A description of the module, the protection function and performance is given in the chapter dedicated to the modules (page 247).

Programmable Functions and Commands

Eight commands are available, with activation that can be programmed on the basis of signals or events. Distributed among different Ekip Touch menus, the commands are:

Name	Description	Path (page)
External Trip	Sends a TRIP command	<i>Advanced - Functions</i> (47)
Trip RESET	Reset of the trip signal	
Turn on SET B	Changes the protections set, from Set A to Set B	
2I Mode	It activates 2I protection, if configured for this function	<i>Advanced - Functions - 2I Menu</i> (62)
RESET Energy	Resets the energy meters	<i>Measurements - Energy</i> (48)
YO Command	Sends an open command	<i>Settings - Functions</i> (49)
YC Command	Sends a close command ⁽¹⁾	
LOCAL Switch On	Changes the configuration, from Remote to Local	<i>Settings - Modules - Functions</i> (49)
Signaling RESET	Reset the contacts of the signalling modules	

⁽¹⁾ the MOE-E storage command must be present

Parameters

Each command provides two programming parameters:

Parameter	Description	Default
<i>Function</i>	Event or several command activation events (up to eight, in AND or OR logic configuration). The Custom configuration can be programmed via Ekip Connect.	Deactivated
<i>Delay</i>	This is the minimum time the expected event must be present in order to activate the command; the value is given in seconds and can be set within a range: 0 s to 100 s, in 0.1 s steps	0 s



IMPORTANT: the commands are sent if all the operating conditions expected by the unit are present (connections, power supplies, alarms, etc.)

10 - Logic selectivity

Presentation Zone Selectivity via Link Bus is indicated as Logic Selectivity.

Logic Selectivity can be actuated for up to 12 of 15 actors that can be associated with Ekip Touch via Link Bus (see *Ekip Link* module, page 236).

Parameters

The function enabling parameter, available from among the parameters that can be set for the protection, must be set for each protection for which Zone Selectivity must be activated.

In this case, in addition to these parameters, Selectivity time is also activated for the setting.

Otherwise, Zone Selectivity can only be set up via the Ekip Connect software.



NOTE: *all the following parameters and configurations are available via Ekip Connect, with Ekip Link connected and on*

Setting Certain parameters can be configured in the *Ekip Link configuration* page:

selectivity masks are available in the *Ekip Link advanced selectivity* page for each actor present: the mask allows the protections of the actors (S, I, 2I, MCR, G, D-Forward, D-Backward, S2, Gext, MDGF) that activate the selectivity input of Ekip Touch to be selected (example: actor 1, protection mask S= S2: selectivity S of Ekip Touch will be active in the presence of signals S2 of actor 1).

In this configuration, if the function is enabled for S protection and is in the alarm status, the S/D-Forward hardware block signal and the logic selectivity S bit are activated on the output; depending on the block signals:

- if, on the input, the S/D-Forward hardware block signal and the logic selectivity S2 bit of actor 1 is not activated, the open command is sent in accordance with the selectivity time set for S protection
- a time equal to the trip time of S protection is waited if, on the input, the S/D-Forward hardware block signal is activated or mixed selectivity has been selected and the S2 logic selectivity bit of actor 1 is activated (and the open command is only sent if S protection is still in the alarm status once this time has elapsed)



NOTES:

- *the output and input logical selectivity bits are those in the data packets shared by the trip units via Link Bus*
- *the S/D-Forward (G/D-Backward) hardware output is only activated if the S or D-Forward (G or D-Backward) protections are in the alarm status, and the S/DForward (G/D-Backward) hardware input only acts as a block for the S and D-Forward (G and D-Backward) protections, regardless of whether solely hardware or mixed selectivity has been selected*



IMPORTANT: *if solely hardware selectivity has been selected, the logic selectivity bits are ignored on the input, but are still activated on the output*

Selectivity masks

Remote Programmable States A and B are also included in the **selectivity masks**: these 2 parameters, which are available in the *Ekip Link configuration* page, enable the event (or combination of several events) and reference actor that activates the selectivity input to be selected.

2 further states are available, C and D, but they cannot be configured for Zone Selectivity. All 4 programmable states are used for the Programmable Logic function (see *Ekip Link* module on page 236).



NOTE: *the Programmable Logic function is independent from that of Zone Selectivity*

Repetition The **Repeat Configuration mask** parameter is available in the *Ekip Link advanced selectivity* page. It enables the selection of protections whose logic selectivity bit, if present on the input, must be propagated regardless of the status of the protection on the current unit.



NOTE: *the parameter only acts on the selectivity bits. It does not involve the outputs*

Diagnostic In the presence of both hardware and logic *Selectivity*, the *diagnosis* highlights any errors in the hardware Selectivity cabling by checking its continuity.

The *Ekip Link diagnosis configuration* page allows you to: enable diagnosis, configure the interval of time between one inspection and the next, select the inputs to be checked for each active actor (S/D_Forward, G/D_Backward).

Then:

- the hardware inputs are checked at regular intervals
- if, in Ekip Touch, the input of an actor is configured for diagnosis (e.g. input S of actor 3) and this input is not active when the test is performed, the actor stimulates its output (e.g. actor 3 activates output S) for a short time: Ekip Touch considers the test result to be positive if it receives the signal correctly at its input, otherwise it will signal error
- the diagnosis check will not be performed if the hw input is active: if the input configured for diagnosis is active when the test is performed, diagnosis check will not be performed and the **Detection state** parameter in the *Ekip Link state* page will indicate: Unknown

Errors and inconsistencies Regardless of the diagnosis, if a hardware input is active and none of the logic selectivity bits of the associated actors is active, a line inconsistency for this input is reported in the *Ekip Link state* page.



NOTE: *line inconsistency is ascertained by checking all the actors associated with the unit, even those for which the function has not been enabled (the Selectivity Actor parameter has not been assigned value: True)*

A line inconsistency (independent of diagnosis) is indicative of a possible configuration error (example: a hardware input of the release is connected to the hardware output of a device not associated via Link Bus, or of an actor for which the function has not been enabled).

- To prevent a line inconsistency from being signaled, devices whose hardware outputs are connected to the hardware inputs of Ekip Touch must also be connected to the Link Bus and associated with Ekip Touch, while the function need not be enabled for them (the Selectivity Actor parameter need not be assigned value: *True*)
-

11 - Performance table

- General notes:**
- The performance values given in the next table are valid with ≥ 100 ms trip time, temperature and signals within the operating limits; failure to comply with these limitations could lead to an increase in the tolerances.
 - Ekip Touch sends the TRIP command if the signal read exceeds the threshold for longer than the set time (or the time resulting from the calculation formula)
 - with an inverse time-delay trip curve, the calculation refers to a signal with a constant value throughout the timing; variation of the alarm signal causes a different trip time
 - The additional notes are given after all the tables

Standard Protections

Protection [ANSI code]	Trip time t_t ⁽¹⁾	Trip threshold tolerance ⁽³⁾	Trip time tolerance ⁽³⁾
L [49]	$t_t = \frac{t1 \times 9}{\left(\frac{If}{I1}\right)^2}$ (with curve $t = k / I^2$)	Activation for If within range: $(1.05 \text{ to } 1.2) \times I1$	with $If \leq 6 I_n$: $\pm 10 \%$ / with $If > 6 I_n$: $\pm 20 \%$
	$t_t = \frac{t1 \times k \times b}{\left(\left(\frac{If}{I1}\right)^a - 1\right)}$ (with curves 60255-151)		
S [50TD / 51]	$t_t = t2$ (with curve $t = k$)	with $If \leq 6 I_n$: $\pm 7 \%$ / with $If > 6 I_n$: $\pm 10 \%$	The best between $\pm 10\%$ and 40 ms
	$t_t = \frac{t2 \times 100}{If^2}$ (with curve $t = k / I^2$)		with $If \leq 6 I_n$: $\pm 15 \%$ / with $If > 6 I_n$: $\pm 20 \%$
S2 [50TD]	$t_t = t5$	with $If \leq 6 I_n$: $\pm 7 \%$ / with $If > 6 I_n$: $\pm 10 \%$	The best between $\pm 10\%$ and 40 ms
I [50]	$t_t \leq 30$ ms	$\pm 10 \%$	--
G [50N TD / 51N]	$t_t = t4$ (with curve $t = k$)	$\pm 7 \%$	The best between $\pm 10\%$ and 40 ms ⁽²⁾
	$t_t = \frac{2t4}{\left(\frac{If}{I4}\right)^2}$ (with curve $t = k / I^2$)		$\pm 15 \%$
MCR	$t_t \leq 30$ ms	$\pm 10 \%$	--
2I [50]	⁽¹⁰⁾	$\pm 10 \%$	--
IU [46]	$t_t = t6$	$\pm 10 \%$	with $t6 \geq 5$ s: ± 100 ms / with $t6 < 5$ s the best between $\pm 10 \%$ and ± 40 ms

Startup

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
S StartUp	$t_t = t2$ startup	with $If \leq 6 I_n$: $\pm 7 \%$ / with $If > 6 I_n$: $\pm 10 \%$	The best between $\pm 10\%$ and 40 ms
I StartUp	$t_t \leq 30$ ms	$\pm 10 \%$	--
G StartUp	$t_t = t4$ startup	$\pm 7 \%$	The best between $\pm 10\%$ and 40 ms
S2 StartUp	$t_t = t5$ startup	with $If \leq 6 I_n$: $\pm 7 \%$ / with $If > 6 I_n$: $\pm 10 \%$	The best between $\pm 10\%$ and 40 ms

Voltage protections

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
UV [27] / UV2 [27]	$t_t = t8$ (t15)	$\pm 2\%$ ⁽⁴⁾	with $t8 \geq 5$ s: ± 100 ms / with $t8 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
OV [59] / OV2 [59]	$t_t = t9$ (t16)	$\pm 2\%$ ⁽⁴⁾	with $t9 \geq 5$ s: ± 100 ms / with $t9 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
VU [47]	$t_t = t14$	$\pm 5\%$ ⁽¹¹⁾	with $t14 \geq 5$ s: ± 100 ms / with $t14 < 5$ s: the best between $\pm 10\%$ and ± 40 ms

Voltage Advanced protections

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
S(V) [51V] / S2(V) [51V]	$t_t = t20$ (t21)	$\pm 10\%$	with $t20 \geq 5$ s: ± 100 ms / with $t20 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
RV [59N]	$t_t = t22$	$\pm 10\%$	with $t22 \geq 5$ s: ± 100 ms / with $t22 < 5$ s: the best between $\pm 10\%$ and ± 40 ms

Frequency protections

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
UF [81L] / UF2 [87L]	$t_t = t12$ (t17)	$\pm 1\%$ ⁽⁵⁾	with $t12 \leq 5$ s: ± 100 ms / with $t12 < 5$ s: the best between $\pm 10\%$ (min = 30 ms) and ± 40 ms
OF [81H] / OF2 [87H]	$t_t = t13$ (t18)	$\pm 1\%$ ⁽⁵⁾	with $t13 \geq 5$ s: ± 100 ms / with $t13 < 5$ s: the best between $\pm 10\%$ and ± 40 ms

Power protections

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
UP [32LF]	$t_t = t23$	$\pm 10\%$	with $t23 \geq 5$ s: ± 100 ms / with $t23 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
OP [32OF]	$t_t = t26$	$\pm 10\%$	with $t26 \geq 5$ s: ± 100 ms / with $t26 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
RQ [40 o 32R]	$t_t = t24$	$\pm 10\%$	with $t24 \geq 5$ s: ± 100 ms / with $t24 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
OQ [32OF]	$t_t = t27$	$\pm 10\%$	with $t27 \geq 5$ s: ± 100 ms / with $t27 < 5$ s: the best between $\pm 10\%$ and ± 40 ms
D [67]	$t_t = t7$	with $I_f \leq 6 I_n$: $\pm 7\%$ / with $I_f > 6 I_n$: $\pm 10\%$	with $t7 \geq 400$ ms: ± 40 ms / with $t7 < 400$ ms: ± 20 ms and $\pm 10\%$, whichever is the highest
RP [32R]	$t_t = t11$	$\pm 10\%$	with $t11 \geq 5$ s: ± 100 ms / with $t11 < 5$ s: the best between $\pm 10\%$ and ± 40 ms

Startup

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
D StartUp	$t_t = t7$ startup	$\pm 10\%$	The best between $\pm 10\%$ and 40 ms
UP StartUp	$t_t = t23$ startup	$\pm 10\%$	with $t23 \geq 5$ s: ± 100 ms / with $t23 < 5$ s: the best between $\pm 10\%$ and ± 40 ms

ROCOF Protection

Protection [ANSI code]	Trip time t_t	Trip threshold tolerance ⁽³⁾	Trip time tolerance
ROCOF [81R]	$t_t = t28$	$\pm 10\%$ ⁽⁶⁾	the best between $\pm 20\%$ and 200 ms

Additional protections

Protection [ANSI code]	Trip time $t_t^{(1)}$	Trip threshold tolerance ⁽³⁾	Trip time tolerance
Gext [50GTD / 51G]	$t_t = t_{41}$ (with curve $t = k$)	$\pm 7 \%$	The best between $\pm 10\%$ and 40 ms
	$t_t = \frac{2}{\left(\frac{I_f}{I_{41}}\right)^2}$ (with curve $t = k / I^2$)		$\pm 15 \%$
Rc [64 50N TD 87N]	$t_t = t_{dn}$	-20 % ÷ 0	140 ms @ 0,06 s ⁽⁹⁾ 950 ms @ 0,8 s ⁽⁹⁾
MDGF	$t_t = t_{41}$ (with curve $t = k$)	$\pm 7 \%$	The best between $\pm 10\%$ and 40 ms
	$t_t = \frac{2}{\left(\frac{I_f}{I_{41}}\right)^2}$ (with curve $t = k / I^2$)		$\pm 15 \%$

Startup

Protection [ANSI code]	Trip time $t_t^{(1)}$	Trip threshold tolerance ⁽³⁾	Trip time tolerance
Gext StartUp	$t_t = t_{41}$ startup	$\pm 7 \%$	the best between: $\pm 10 \%$ and ± 40 ms
MDGF StartUp	$t_t = t_{41}$ startup	$\pm 7 \%$	the best between: $\pm 10 \%$ and ± 40 ms

Note on protections

⁽¹⁾ use trip and threshold current values expressed in I_n for calculating t_t (example: $I_f = 0.8 I_n$, $I_1 = 0.6 I_n$)

⁽²⁾ with $t_4 =$ instantaneous, the maximum tolerance is 50 ms

⁽³⁾ Tolerance values valid with Trip unit at steady state or on with auxiliary power supply, trip time ≥ 100 ms, temperature and signals within operating limits; the tolerances in the table after the notes are applicable if the conditions are not guaranteed

⁽⁴⁾ the trip unit considers 3% hysteresis for quitting alarm condition

⁽⁵⁾ tolerance valid for frequencies within range: $f_n \pm 2 \%$. A $\pm 5 \%$ tolerance is applicable for off range frequencies

⁽⁶⁾ $\pm 20 \%$ for threshold 0.4 Hz / s

⁽⁹⁾ maximum trip time

⁽¹⁰⁾ with $I_f \geq 18$ kA, $t_t \leq 3$ ms;

with $I_f < 18$ kA and $I_f \geq I_{31} * 3$, $t_t \leq 7$ ms (If three-phase) or $t_t \leq 9$ ms (If single-phase);

with $I_f < 18$ kA and $I_f < I_{31} * 3$, $t_t \leq 15$ ms.

(operating parameters guaranteed with Vaux auxiliary power supply)

⁽¹¹⁾ tolerance valid with threshold $U_{14} > 10 \%$; with $U_{14} \leq 10 \%$ (and $> 6 \%$), the tolerance is 10%; with $U_{14} < 5 \%$, the tolerance is 15%

Performance guaranteed in all operating conditions

Protection	Trip threshold tolerance	Trip time tolerance
L	Activation within range: (1.05 to 1.2) x I_1	$\pm 20 \%$
S	$\pm 10 \%$	$\pm 20 \%$
I / 2I	$\pm 15 \%$	≤ 60 ms
G	$\pm 15 \%$	$\pm 20 \%$ (60 ms with $t_4 =$ instantaneous)
Gext	$\pm 15 \%$	$\pm 20 \%$
MDGF	$\pm 15 \%$	$\pm 20 \%$
UF / UF2 / OF / OF2	$\pm 2 \%$	$\pm 20 \%$
RV	$\pm 10 \%$	$\pm 20 \%$; in the case of single-phase self-supply: the highest between $\pm 20 \%$ and 30 ms
Other	--	$\pm 20 \%$

12 - Functions

- Introduction** This chapter includes the trip curves of the protections, which are shown in different point charts:
- The curves are represented considering the maximum and minimum values of the parameters of each protection, including the TRIP functions provided (current, time).
 - Protections with several curves (example: S protection), are shown in several graphs.
 - The curves do not take account of the effects of special parameters, such as thermal memory and startups.



NOTE: it is advisable to always use the mathematical function in the summary table of the protections to calculate the trip time (page 95)

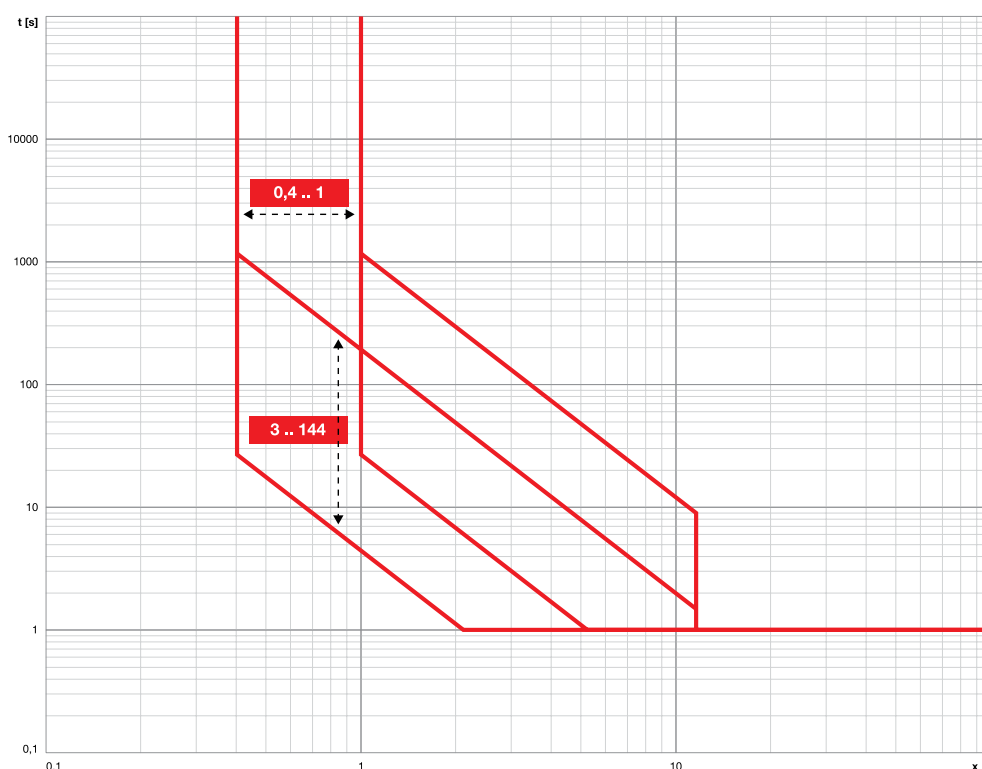
This chapter illustrates the electronic trip curves of the available protections with all the protection trip units for SACE Emax 2 circuit-breakers, represented in various dot diagrams. Some notes for reading the diagrams:

- The curves are illustrated considering the minimum and maximum values and of the parameters of each protection.
- The curves do not take account of the effects of special parameters such as thermal memory, startup, etc.
- Where version is not present, the curves are valid for both the IEC version and the UL version.

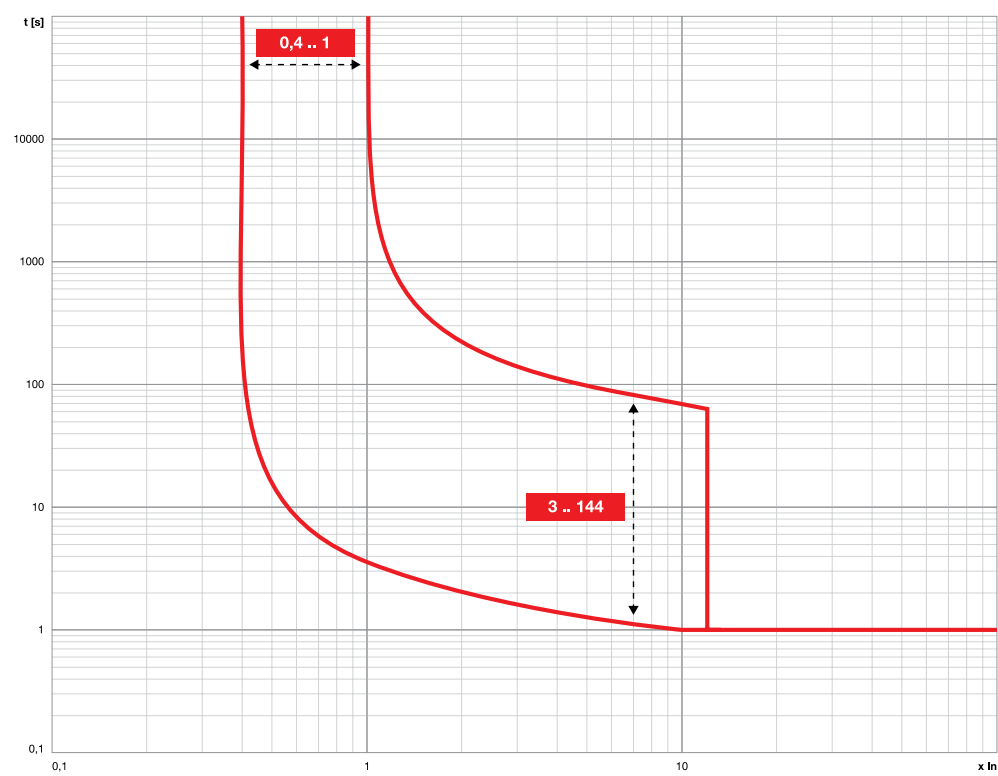


NOTE: trip curve modeling software should be consulted when conducting a coordination or arc flash study as these are simplified representations of the protection curves.

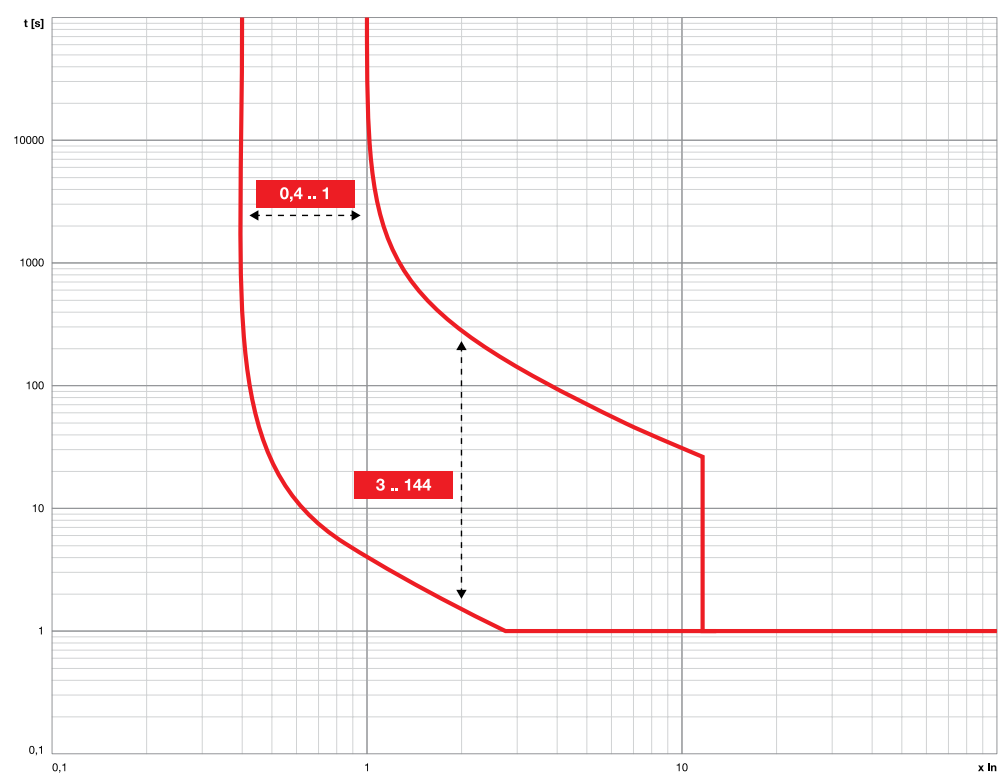
Function L ($t = k/I^2$)



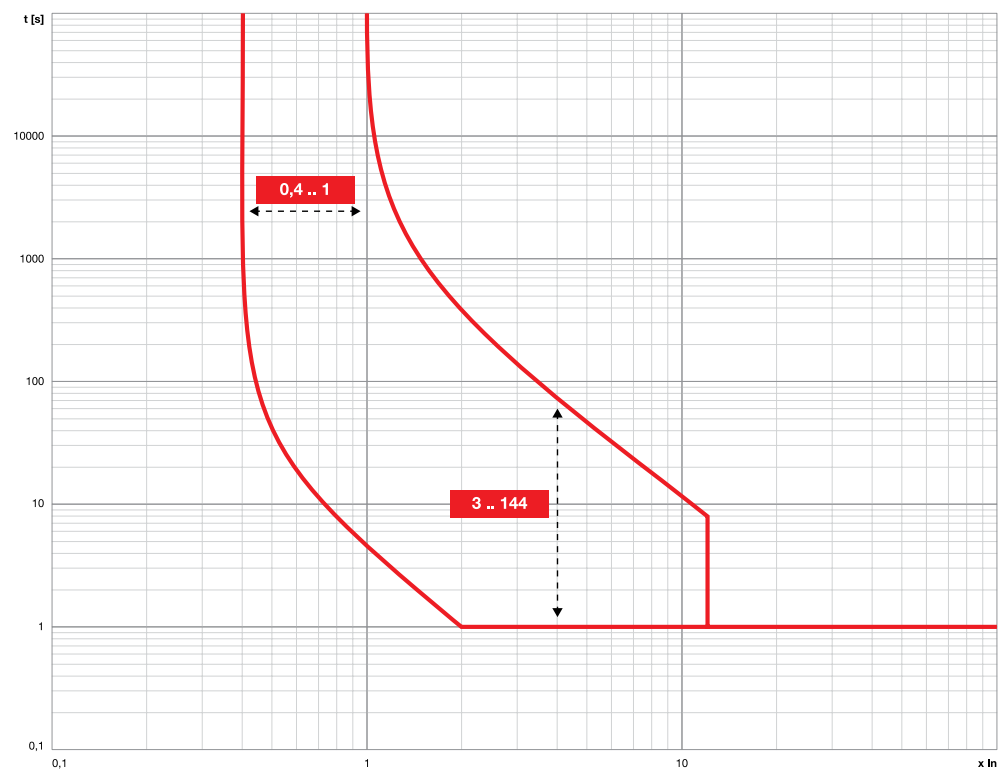
Function L (IEC 60255-151 SI)



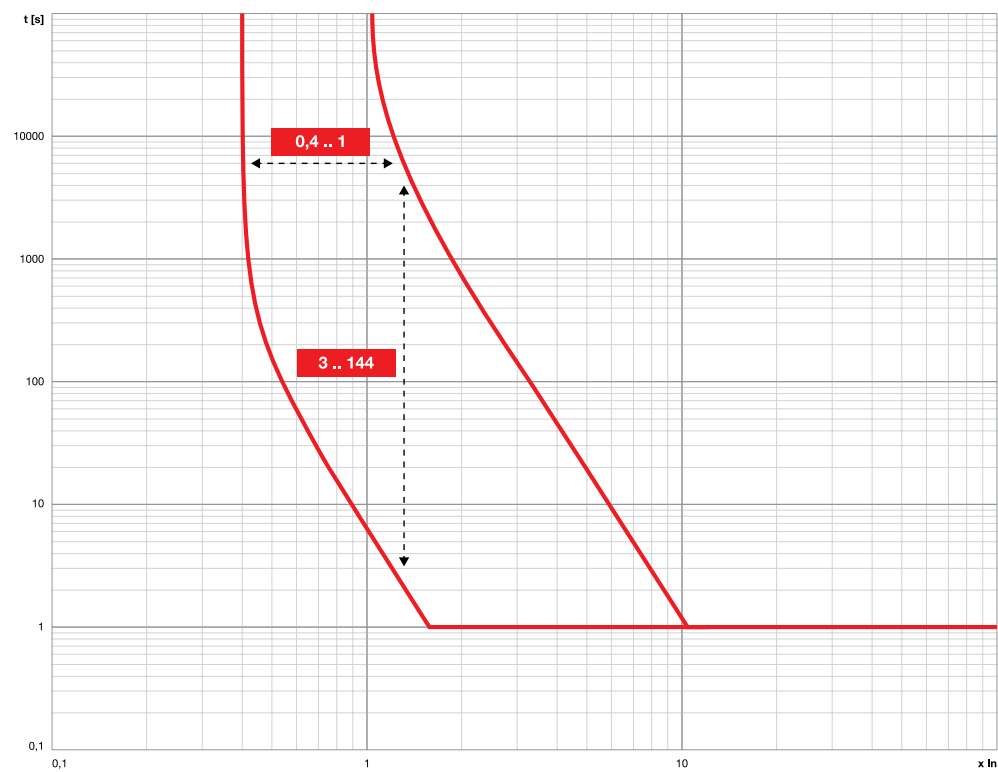
Function L (IEC 60255-151 VI)



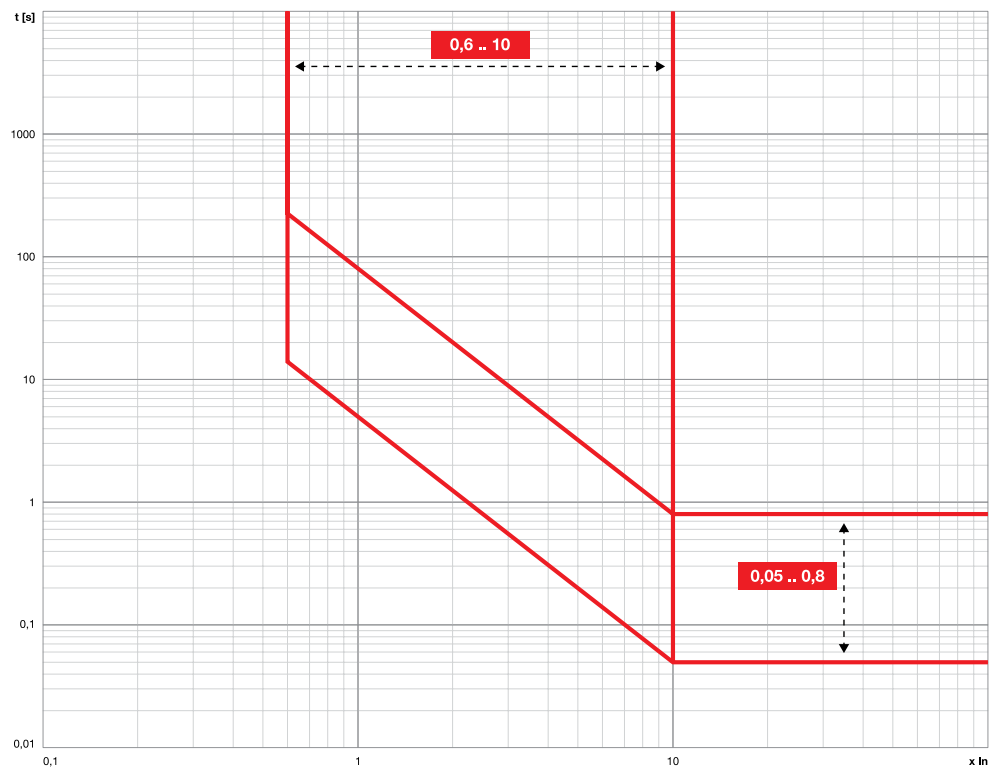
Function L (IEC 60255-151 EI)



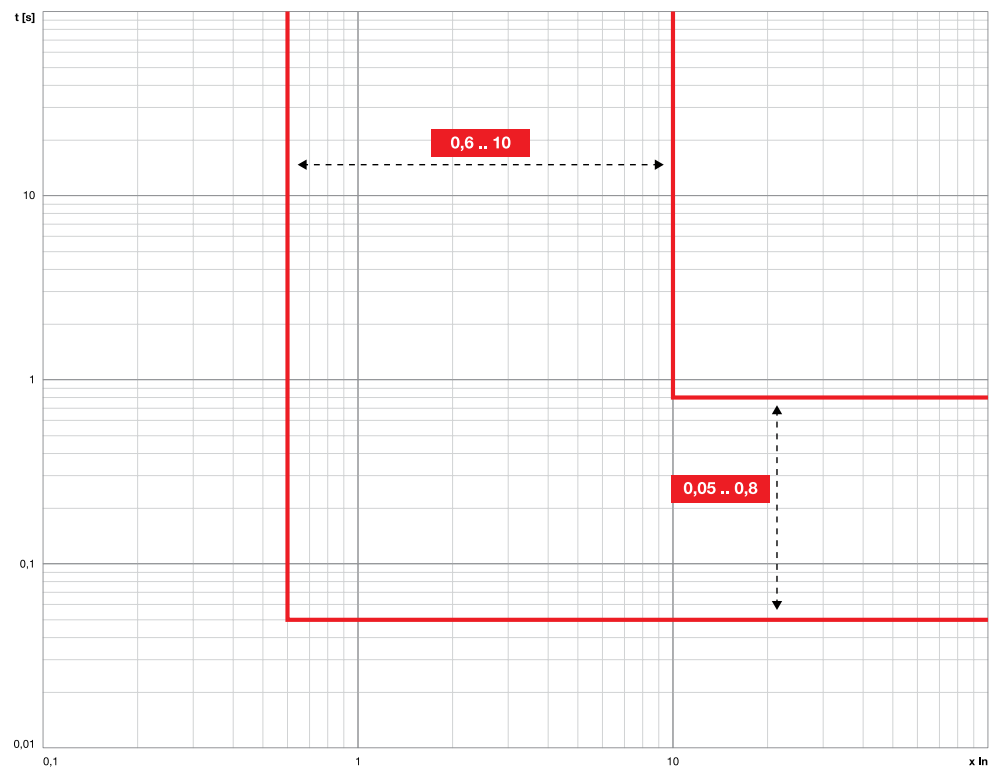
Function L ($t = k/I^4$)



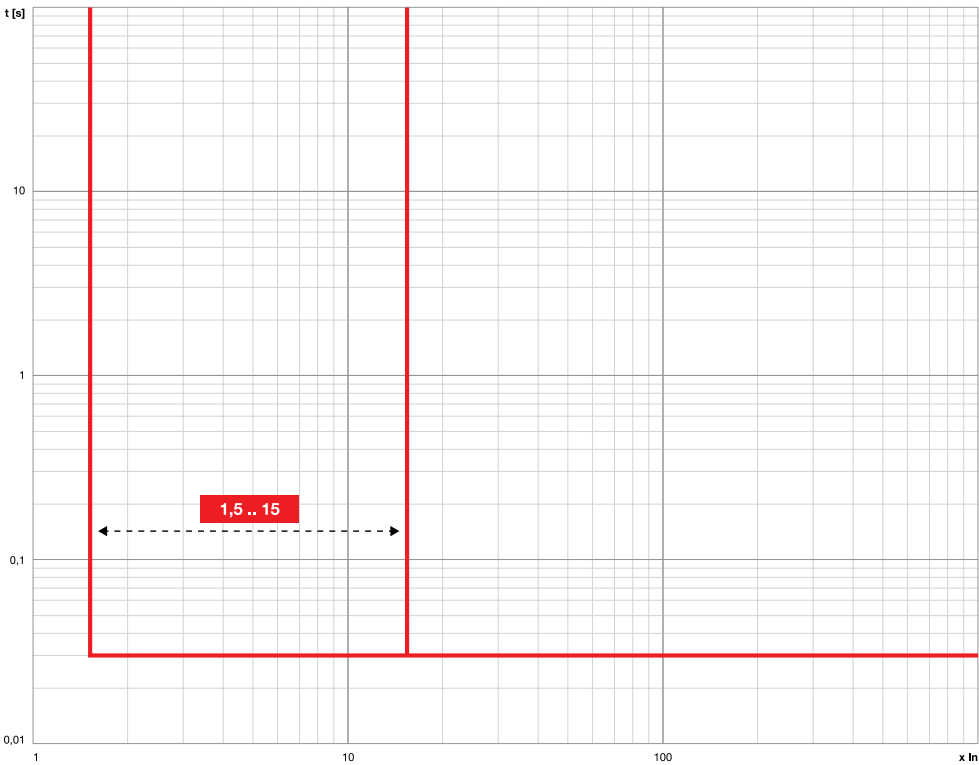
Function S ($t = k/I^2$)



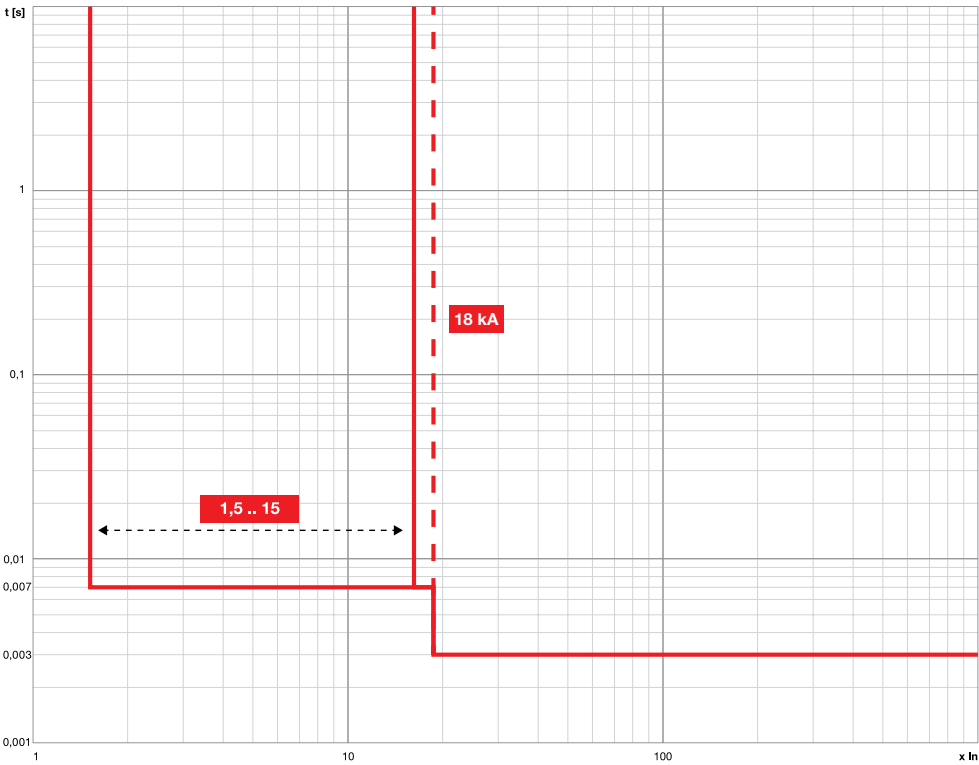
Function S ($t = k$) \ Function S2



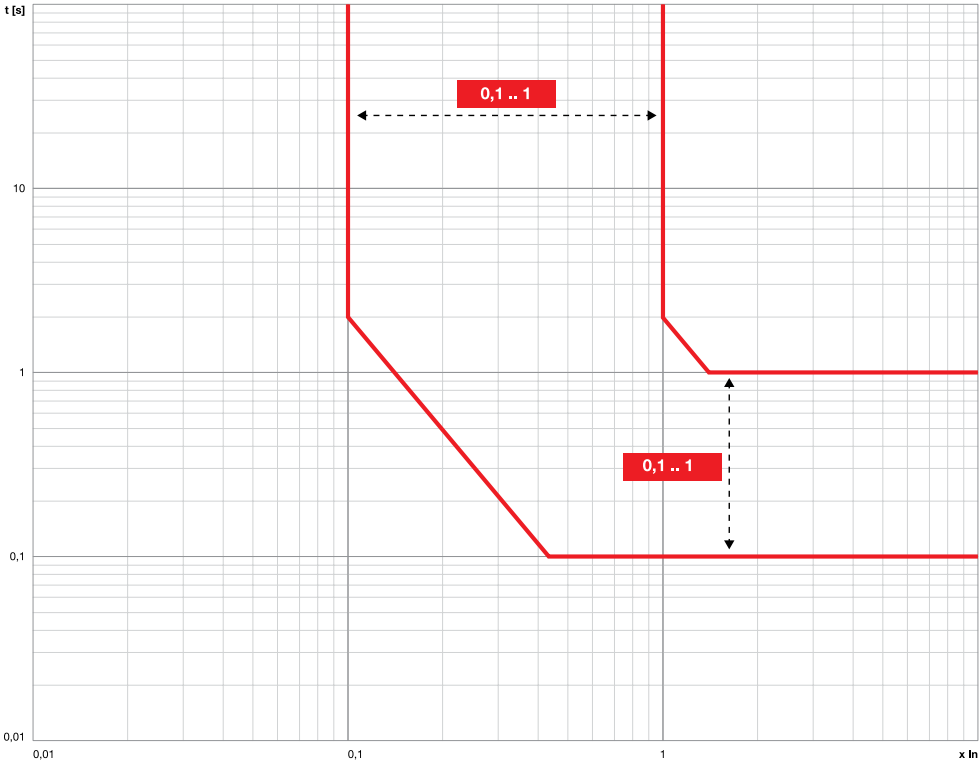
Function I \ Function MCR



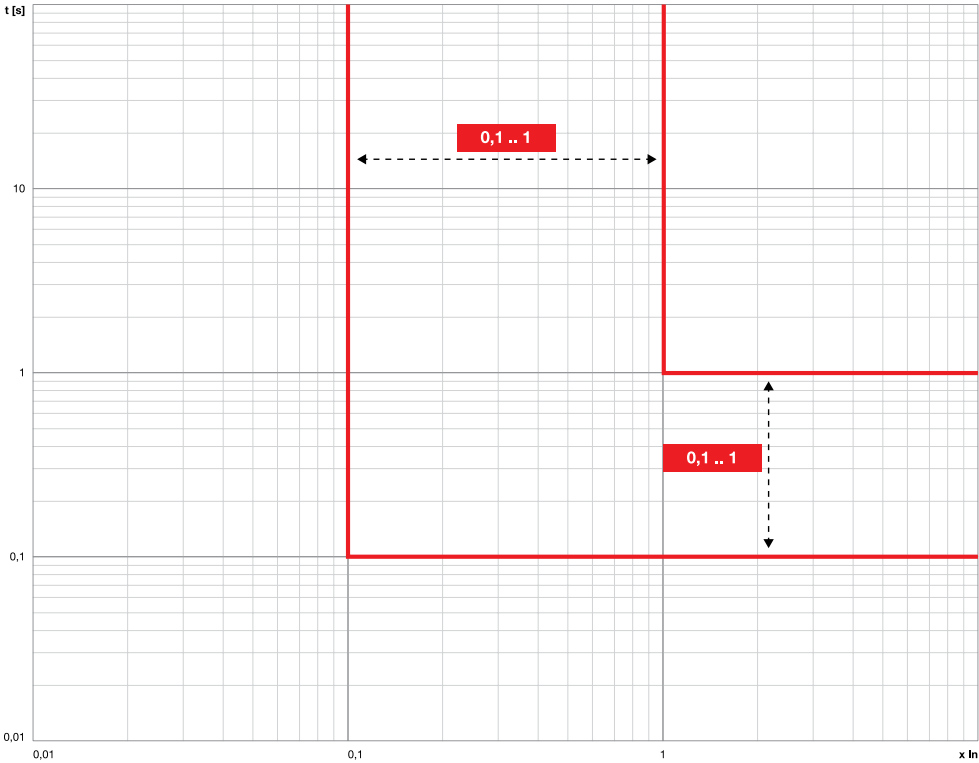
Function 2I



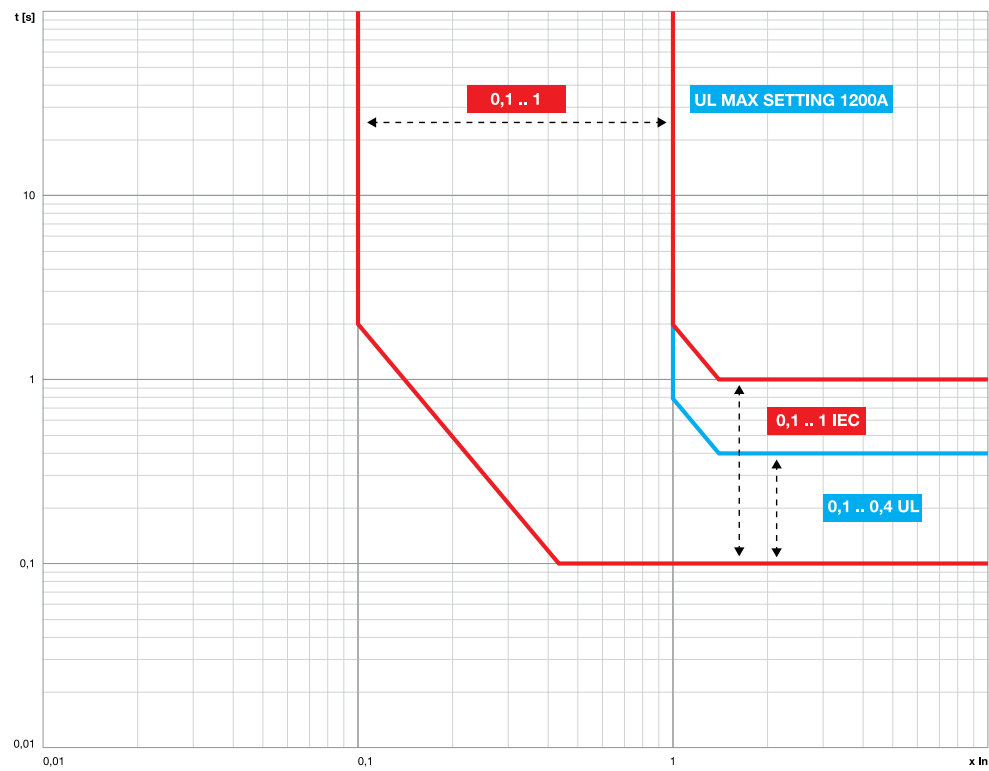
Function G ($t = k/l^2$) \ Function
Gext ($t = k/l^2$)



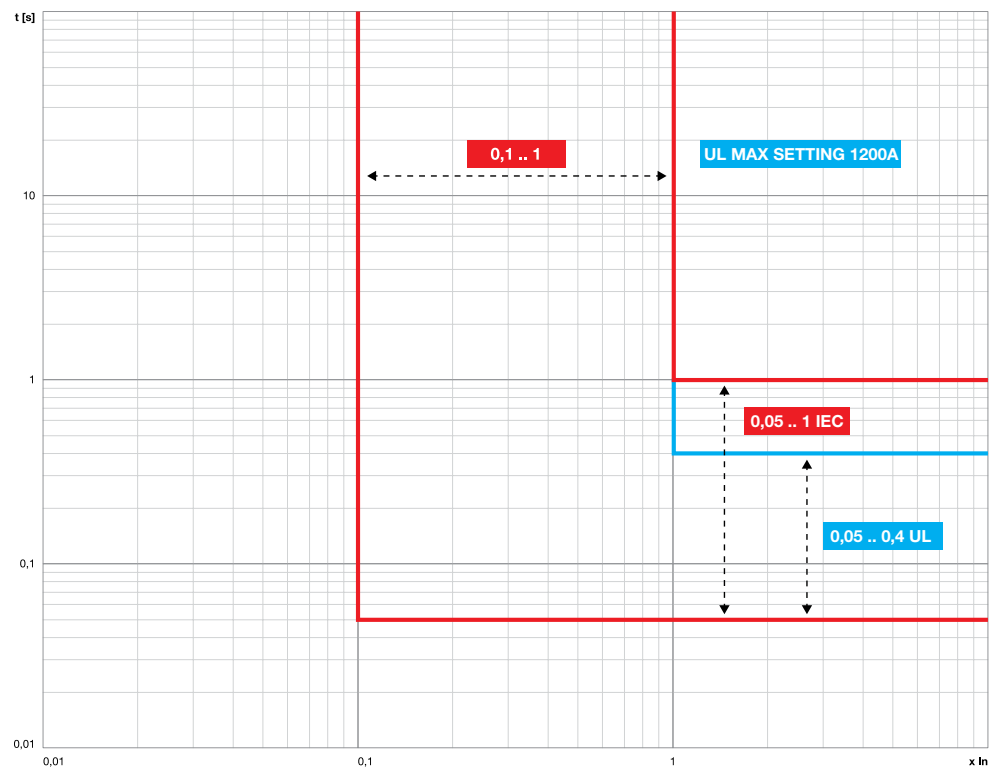
Function G ($t = k$) \ Function
Gext ($t = k$)



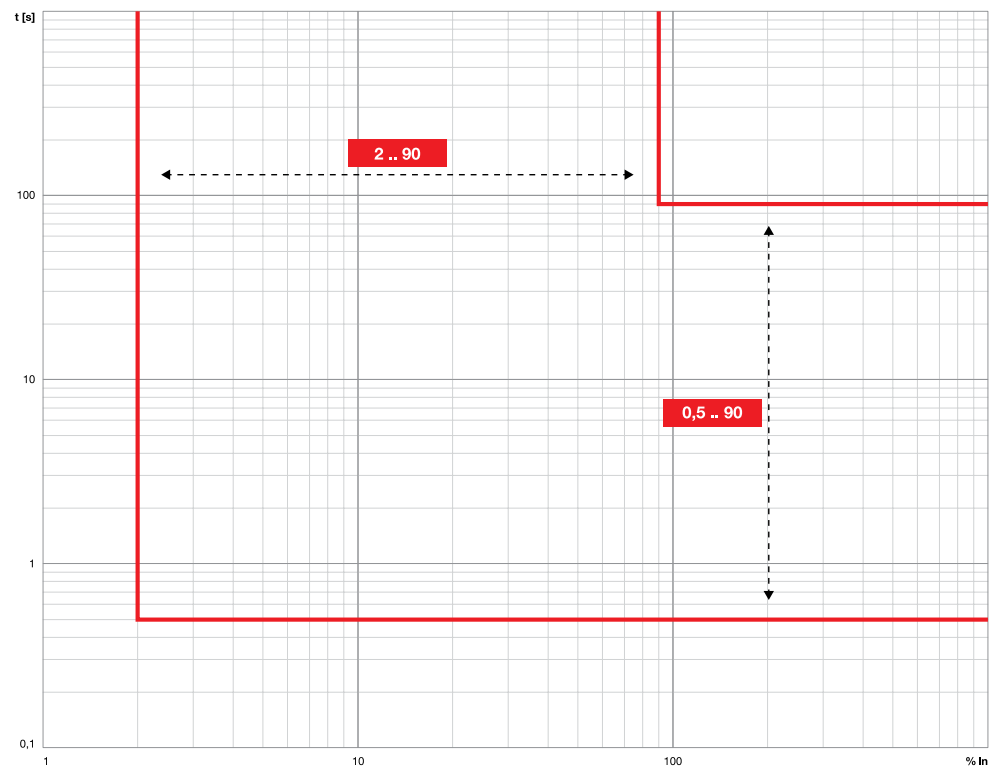
Function MDGF ($t = k/I^2$)



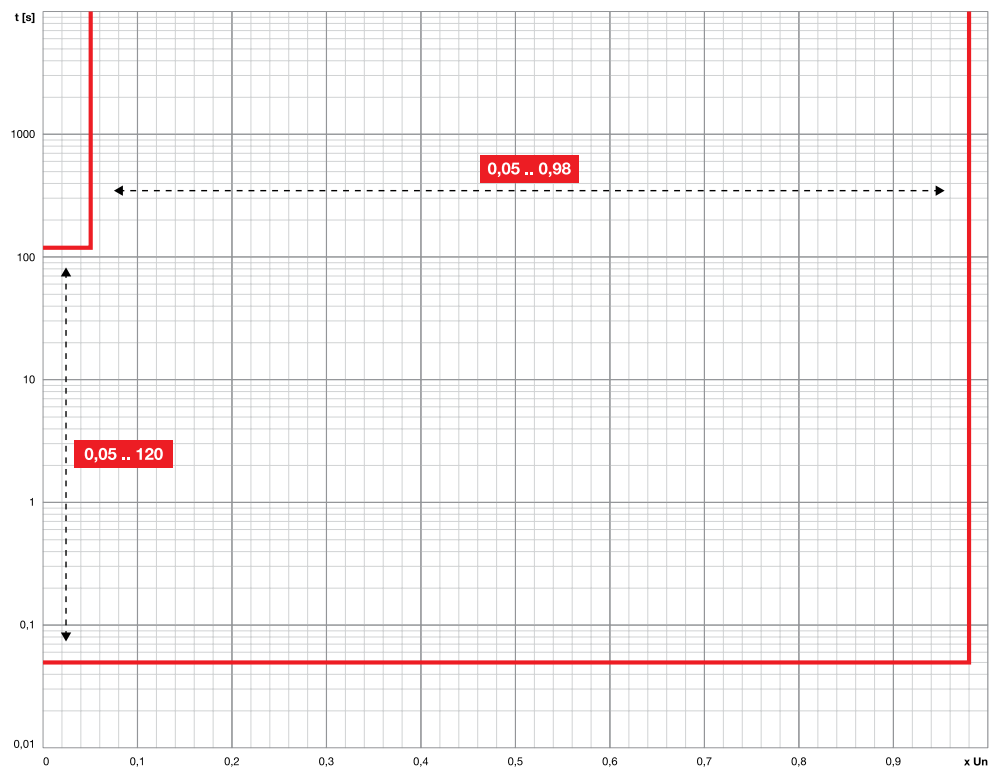
Function MDGF ($t = k$)



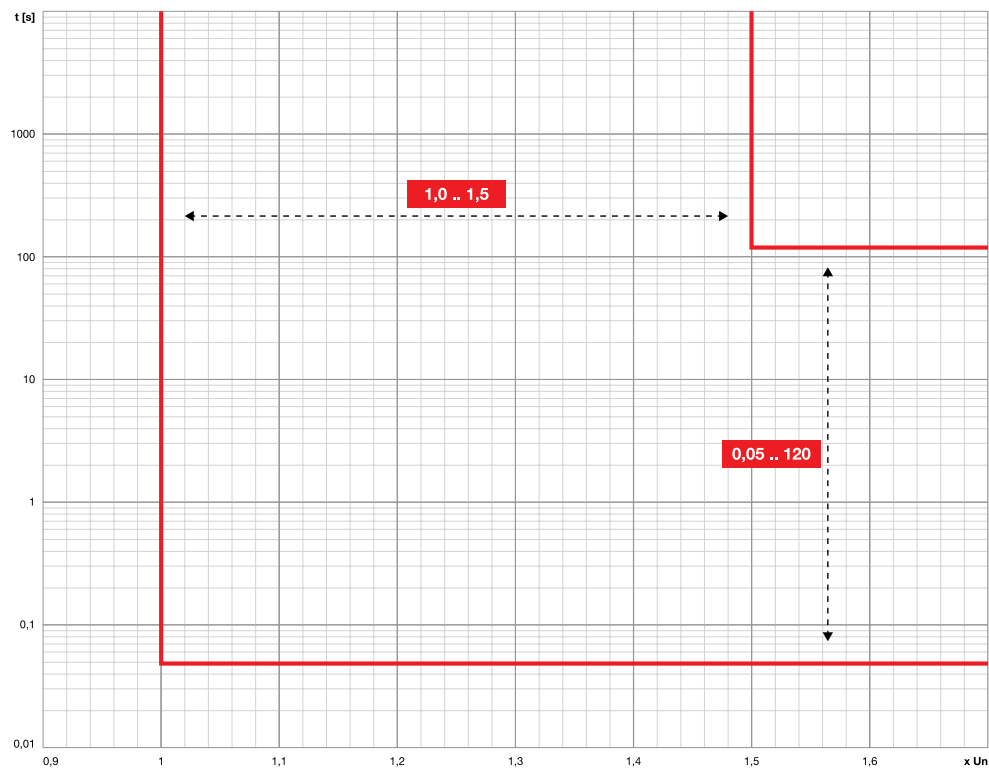
Function IU



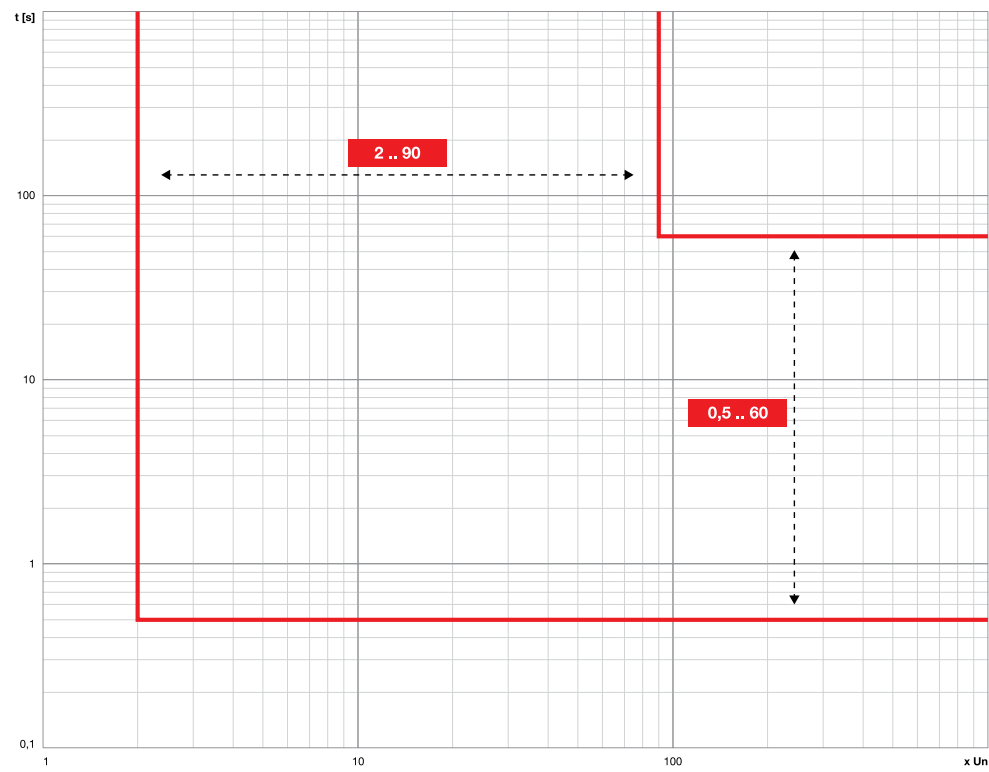
Function UV \ Function UV2



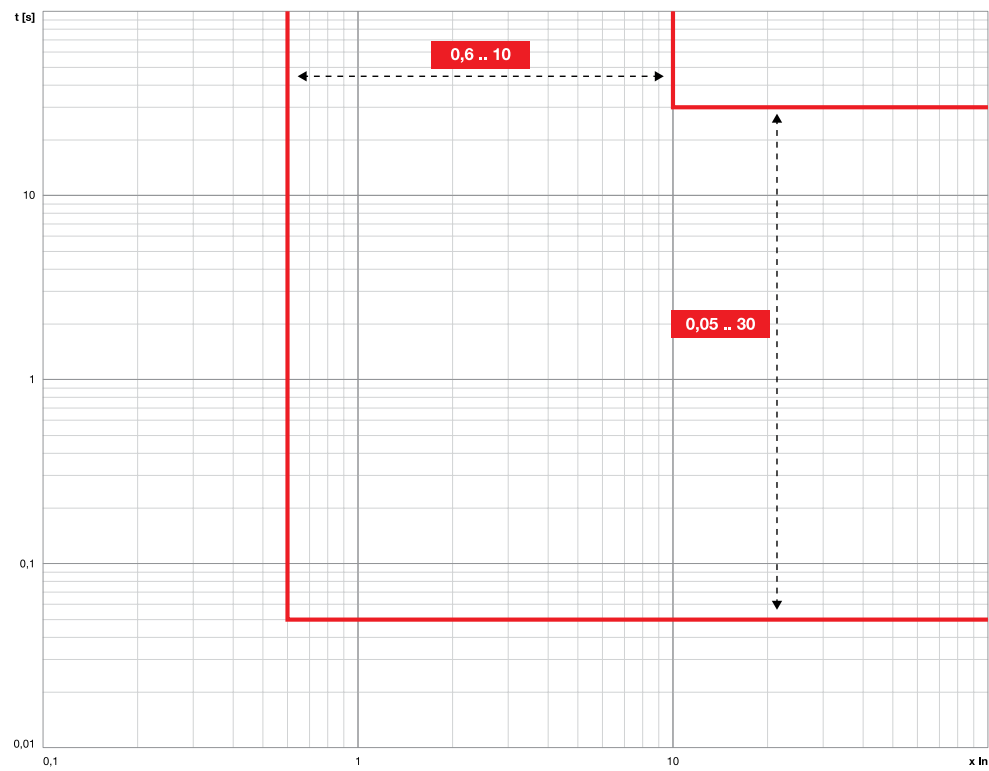
Function OV \ Function OV2



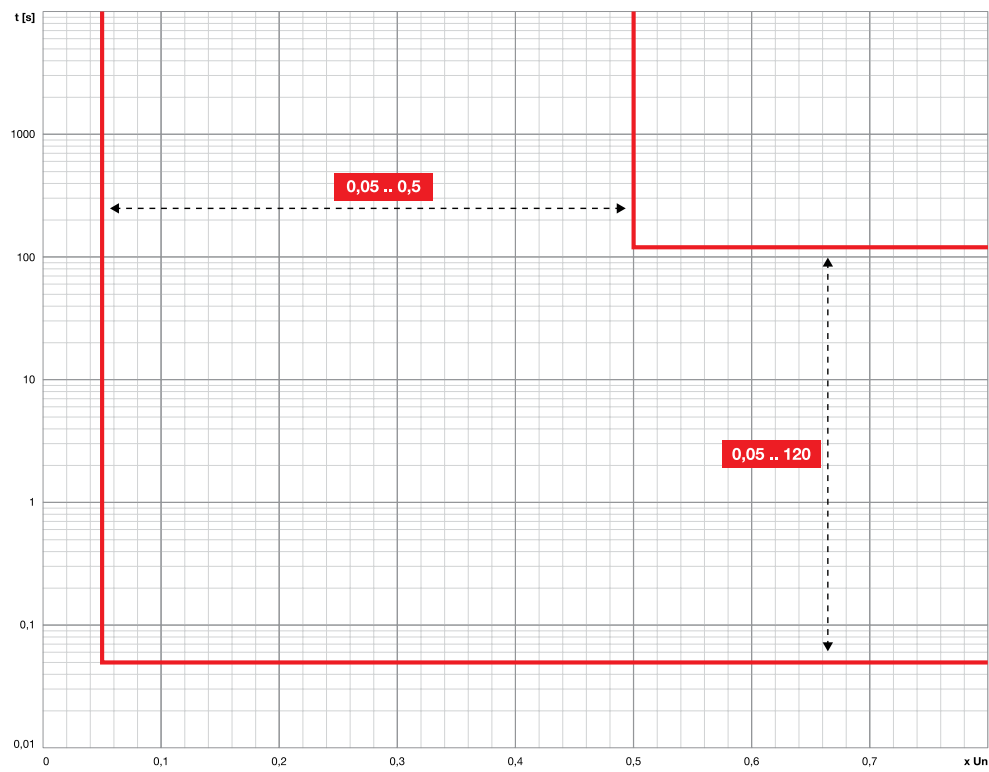
Function VU



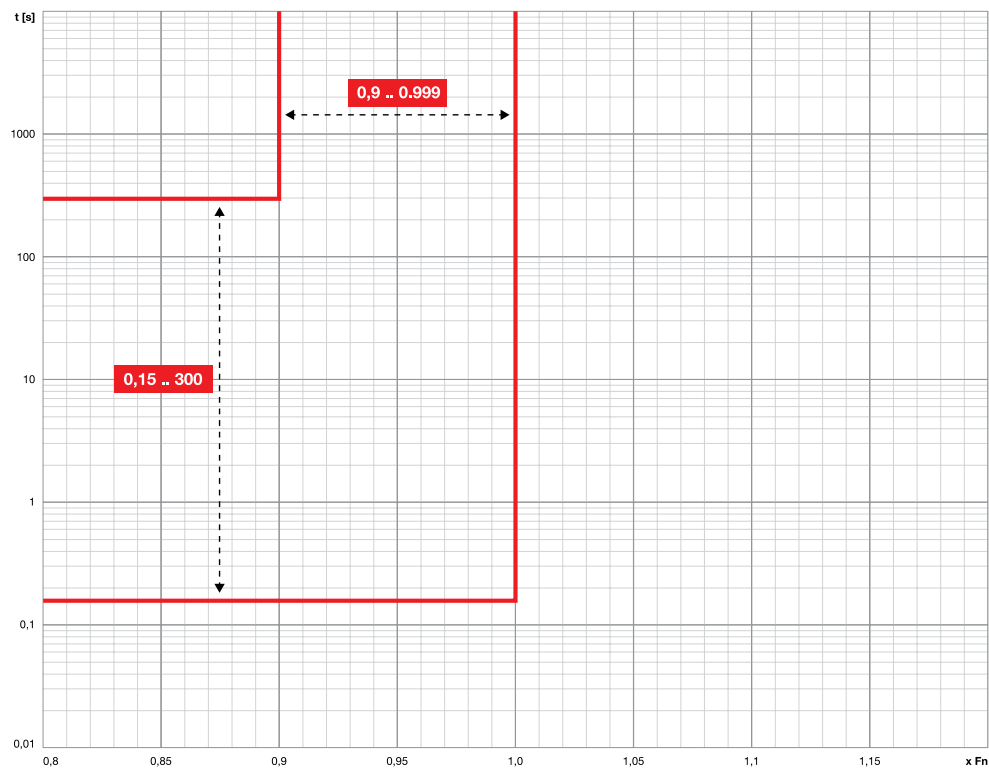
Function S(V) \ Function S2(V)



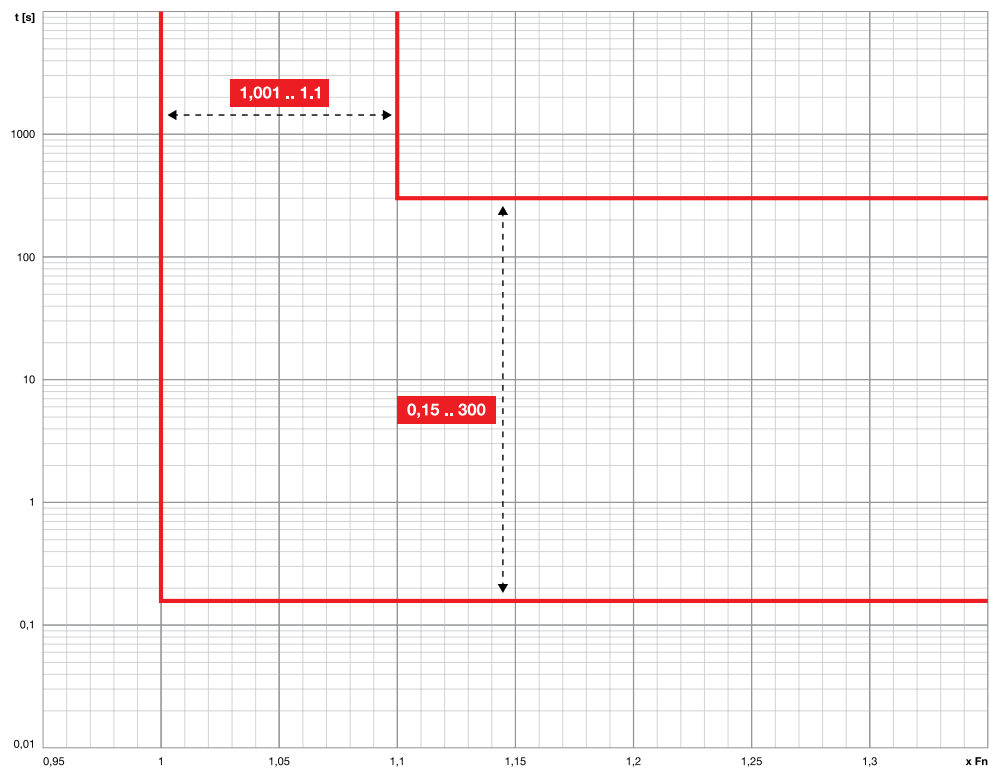
Function RV



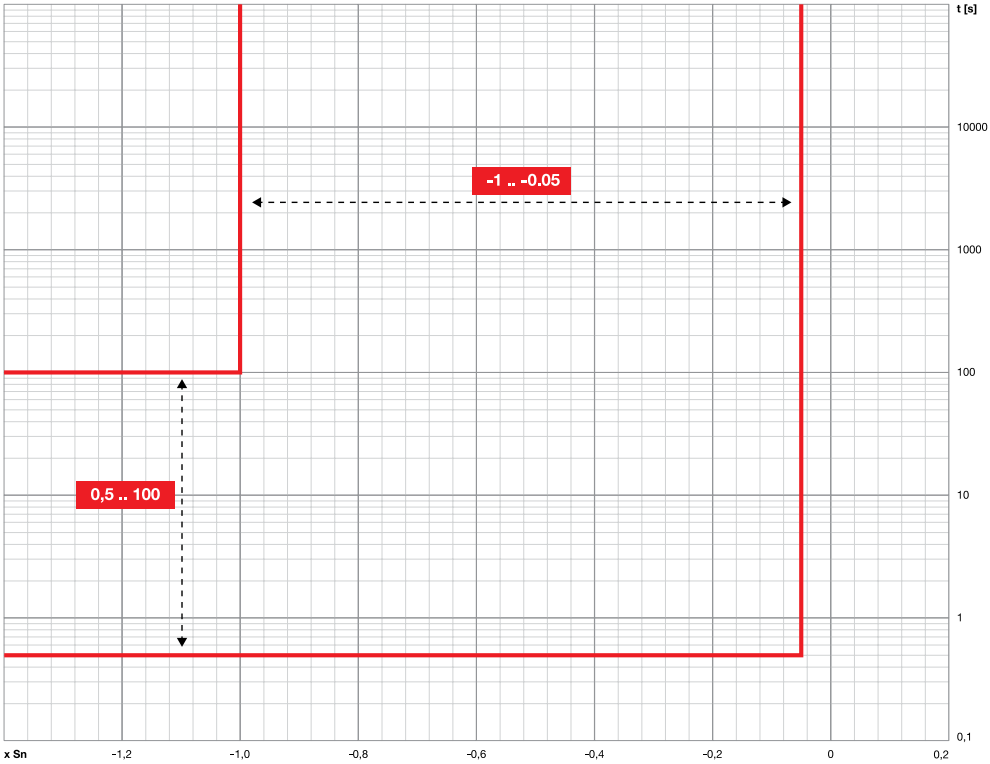
Function UF \ Function UF2



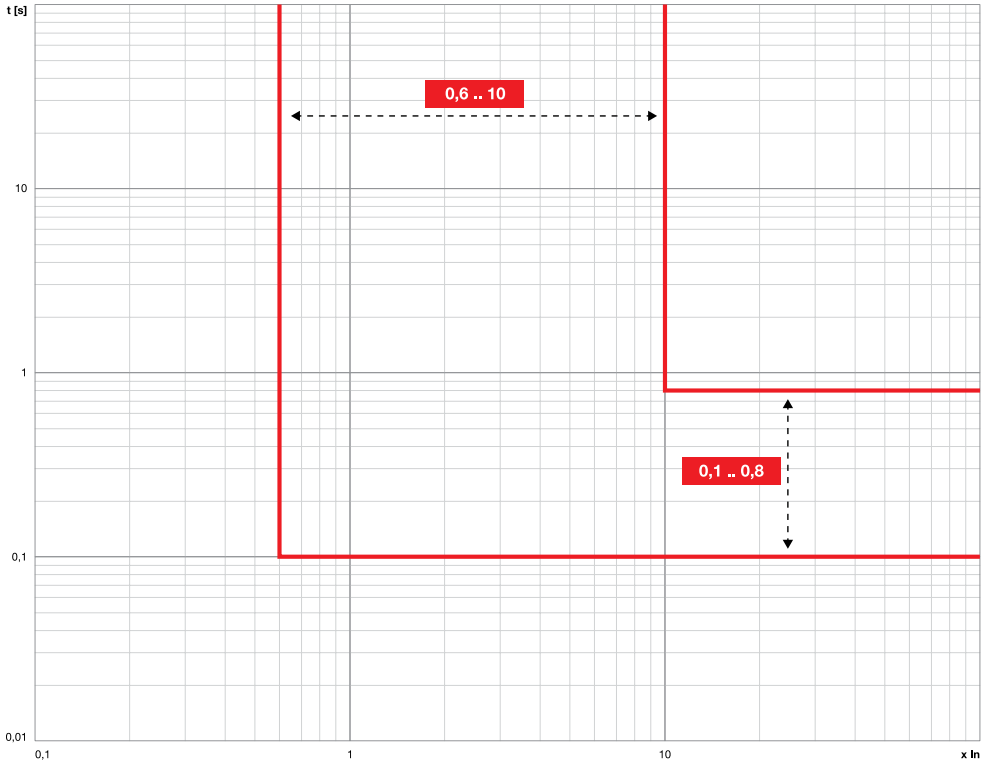
Function OF \ Function OF2



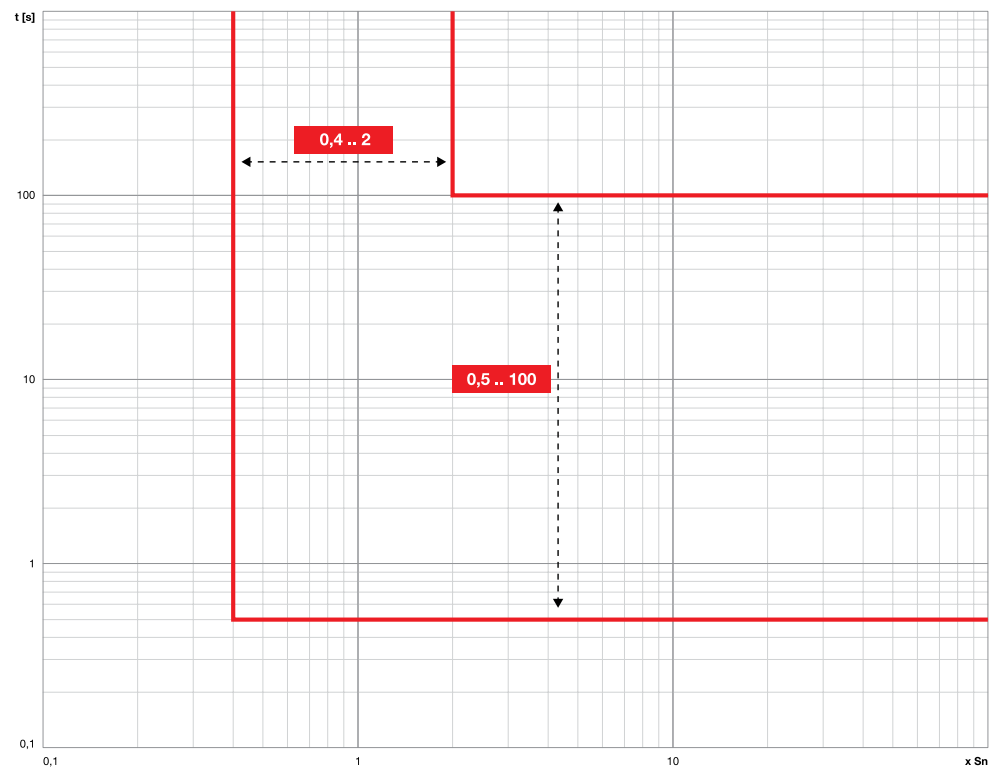
Function RP



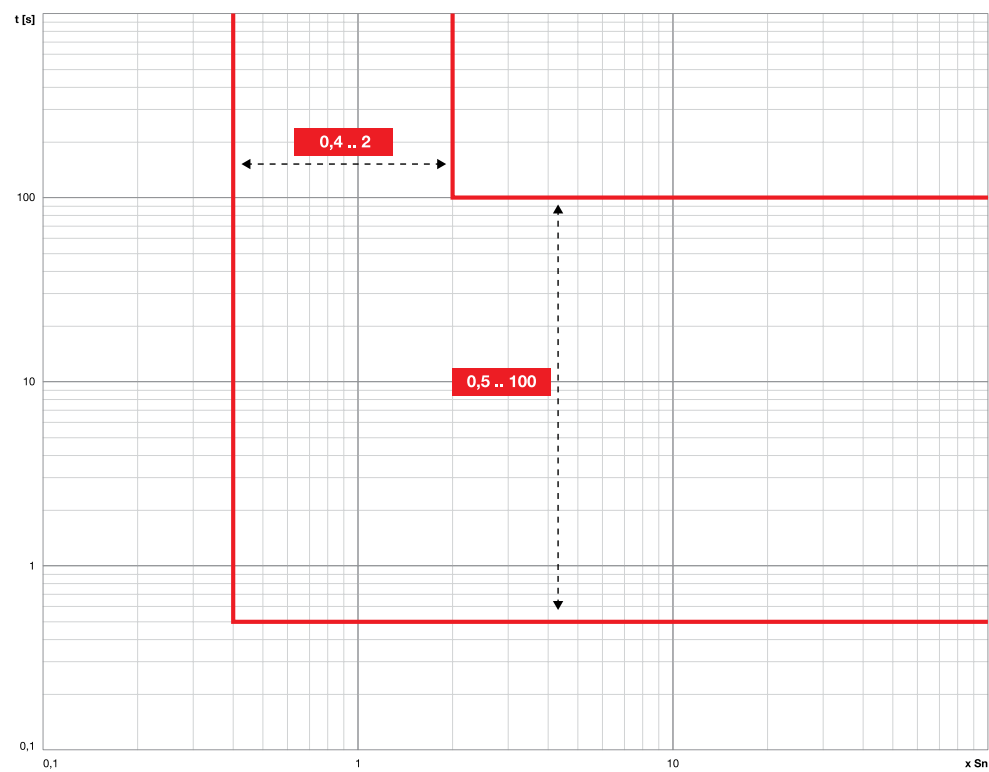
Function D



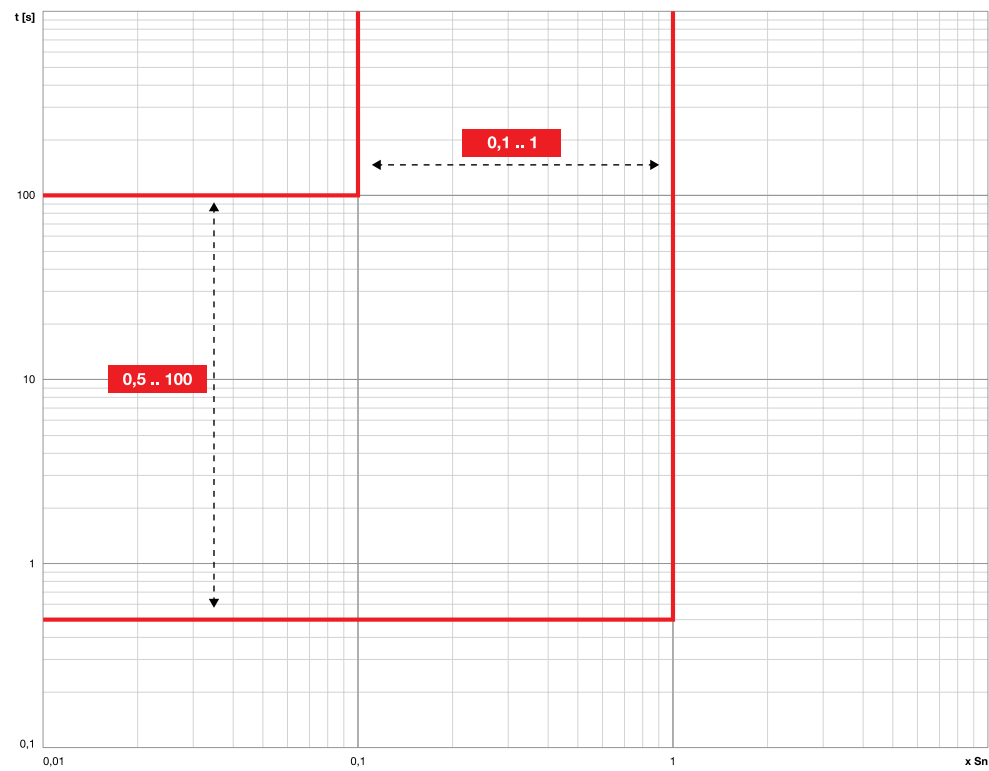
Function OQ



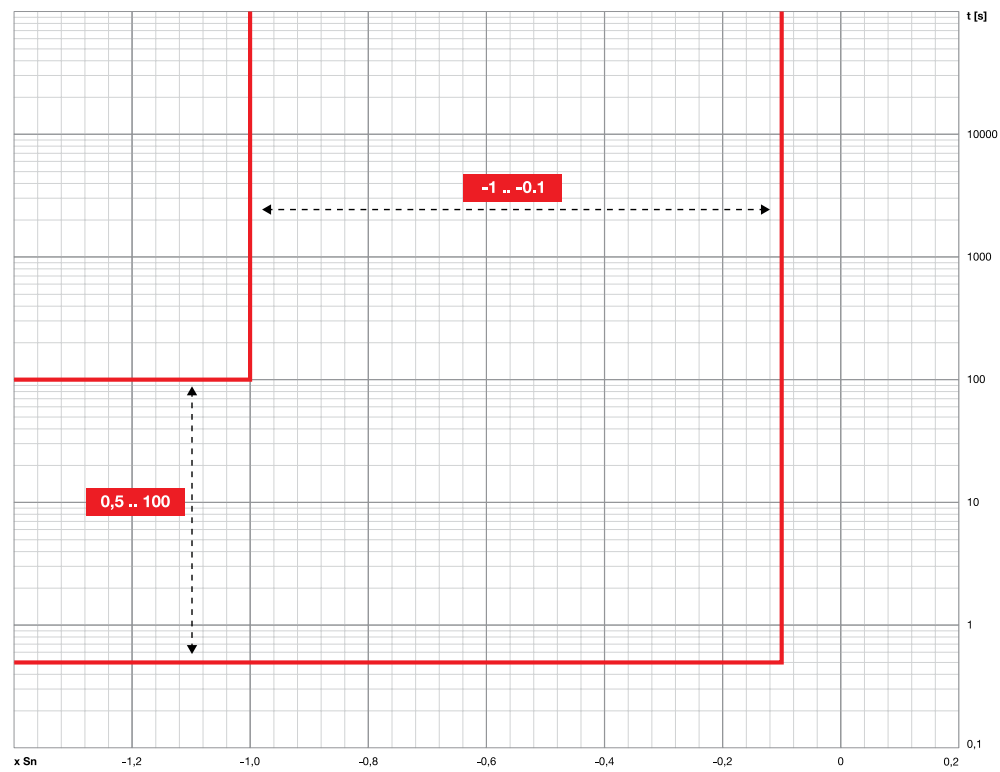
Function OP



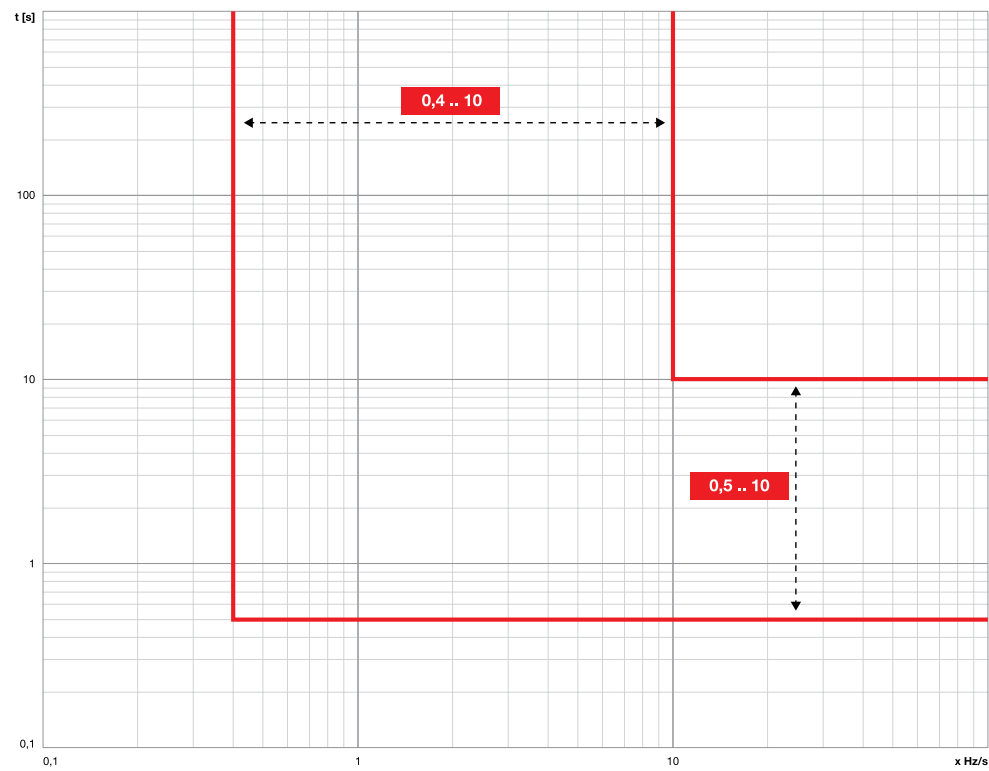
Function UP



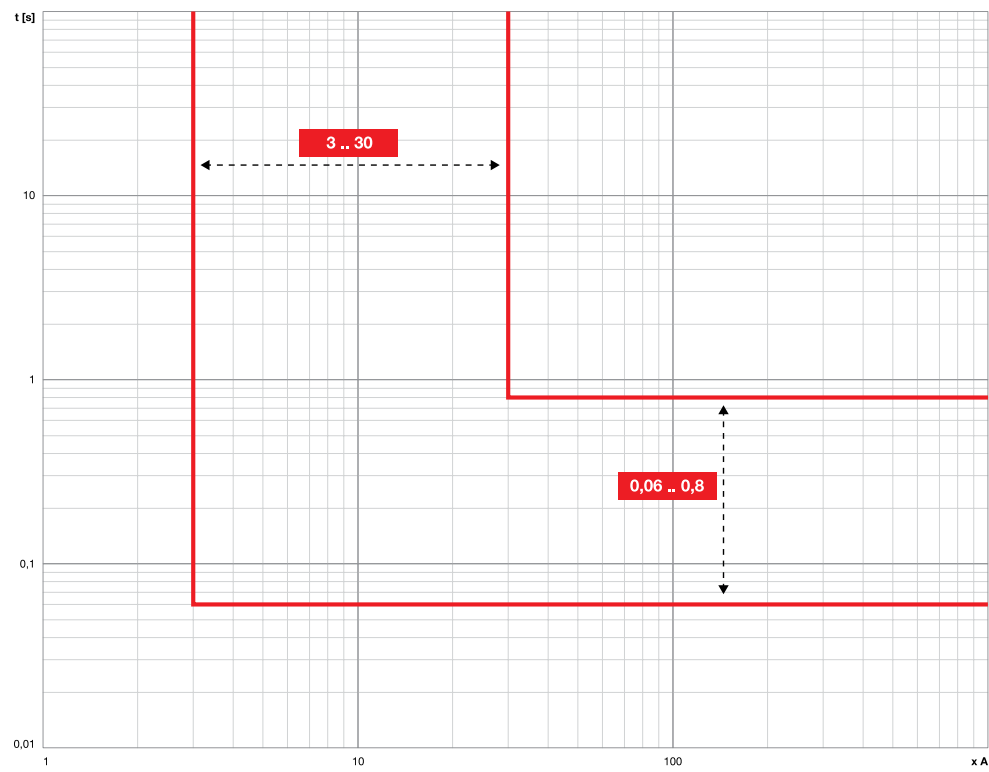
Function RQ



Function ROCOF



Function RC



Ekip Touch - Measurements

1 - Standard Measurements

List The Standard measurements are:

Parameter	Description	Page
<i>Instantaneous currents</i>	Phase current and earth fault measurements in real time	113
<i>Events</i>	List of events, status changes, alarms, recorded by the Trip unit	113
<i>Trip</i>	List of current protection trips (TRIP)	113
<i>Min-Max measurements</i>	History of minimum and maximum currents, recorded at a settable interval	115
<i>Maintenance</i>	CB status: contact wear and last maintenance	116
<i>Operation counters</i>	Number of mechanical and electrical operations	116

Instantaneous currents The instantaneous currents, available in the *Measurements* pages, are real time measurements of the phase and earth fault currents expressed in root mean square value; the monitor time and performance depend on the rated current defined by the Rating plug (In):

Measurement	Monitor time (min-max)	Normal operating range	Accuracy of value read ⁽¹⁾
<i>Phase currents</i> ⁽⁴⁾	0,004 ÷ 64 In	0,2 ÷ 1,2 In	1% ⁽³⁾
<i>Internal earth fault current</i> ⁽²⁾	0,08 ÷ 64 In	0,2 ÷ 1,2 In	2 % ⁽³⁾
<i>External earth fault current</i> ^{(2) (4)}	0,08 ÷ 4 In	0,2 ÷ 1,2 In	2 %
<i>Residual current</i> ^{(2) (5)}	2 ÷ 32 A		5 %

⁽¹⁾ the accuracies refer to normal operating ranges, as established by IEC 61557-12

⁽²⁾ available with LSIG versions

⁽³⁾ accuracies based on Ekip Touch without Class 1 Power & Energy Metering package; if the Class 1 Power & Energy Metering package is present and for all other trip unit models, check the indicated performance values from page 120

⁽⁴⁾ the higher phase currents are also available in the *Histograms*, *Measuring instruments* and *Measurement summary* pages

⁽⁵⁾ available by activating the presence of toroid S.G.R or Rc

Special representations

Type of measurement	Measurement < min value	Measurement > max value	"_ _ _" displayed: (not available) due to
Internal earth fault and phase currents	...	[64 In] ⁽¹⁾	Sensors disconnected
External earth fault current	...	> [4 In toroid]	Toroid not activated and/or disconnected
Residual current	...	> 32 A	Toroid not activated and/or disconnected

Events Ekip Touch can record the last 200 events, mainly concerning variations in the status and operation of the unit; in particular:

- configuration status of the bus, operating mode, active set, auxiliary supply
- connection statuses or alarms: current sensors, *Trip Coil*
- connection statuses or alarms: current sensors, *Rating Plug*, *Trip unit*, *Trip Coil*
- protections: delay in action or alarm
- trip: status of open command, signaling of trips due to protection



NOTE: the first event available in the list is the most recent one; having reached the 200-events threshold, the oldest events will be progressively overwritten



NOTE: if a numerical alarm is displayed (e.g.: 30002), consult the Events page of the System Interface to identify the error. Contact ABB if the code is not included in the list.

The complete list is available in the *Measurements - Historicals - Events* menu, where a set of information is given for each event: icon of the type of event, name of event, date and time recorded.

There are 4 icons that identify the type of event:

Icon	Description
	Event reported for information purposes
	Timing of a protection in progress, trip expected
	Alarm referring to a non-dangerous condition
	Alarm concerning operation, a fault or connection failure

Tripping Ekip Touch is able to record the last 30 TRIPs.

The complete list is available in the *Measurements - Historicals - Trips* menu, where useful information is given for each TRIP:

- the protection that caused the trip
- the consecutive number of the trip
- the date and time of the trip (with reference to the internal clock)
- the measurements associated with the tripped protection



NOTE: once the 30-TRIP threshold has been exceeded, the oldest trips are progressively overwritten

Correlated measurements

The type of protection involved determines the measurements recorded at the moment of tripping:

Protection	Measurements recorded	Notes
Current	L1, L2, L3, Ne, Ig Currents	Ne is available with CBs type 4P and 3P + N; Ig is available in the case of trips due to G protection
Temperature	L1, L2, L3, Ne Currents	The temperature cannot be displayed

Access to most recent trips

Besides being available in the *Historicals* menu, information about the most recent trips can be accessed in three different ways, depending on the conditions of Ekip Touch:

Condition	Access
Trips that have just occurred with Ekip Touch on	The main page is temporarily replaced by a trip information page; press the ITEST button to reset and go back to the normal screen page
Trips that have just occurred with Ekip Touch off	Press the ITEST button to display the trip information page for a few seconds
Rapid consultation in all the other conditions	Press the ITEST button four times from any page other than a menu, or a page accessed via a menu

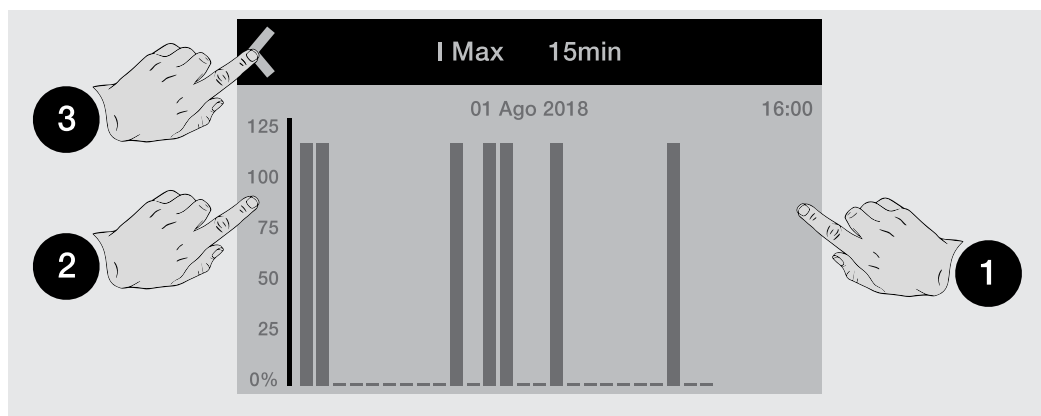
Min-Max measurements

Ekip Touch records the maximum and minimum phase currents in the *Measurements - Historicals - Measurements* menu

The recording interval between one measurement and the next can be set via the Monitor time parameter, available in the *Settings* menu (page 49).

Representation

Select one of the measurements to access the graph page containing the records



Each measurement allows up to 25 recordings, each shown in a bar chart (graphic full scale equal to 125% of the rated value).

The selected recording flashes, to distinguish it from the others.

Touch the sides of the display to select the recordings after **(1)** and before **(2)** the selected recording. The command for quitting the page **(3)** is in the top left corner.

Use the **Enter**, **ESC**, **Right/Up** and **Left/Down** to scroll all the recorded measurements.

The selected recording flashes, to distinguish it from the others.

- phase and value of measurement
- date and time of recording



NOTES:

- if the value is less than the minimum viewable threshold, “...” is indicated instead of the value
- graphic representation is in relation to 1 In, with 1.25 In as maximum value
- the trip unit immediately makes a recording when the “Monitor time” parameter is changed

Reset measurements

The Reset measurements command is available in the *Measurements - Historicals - Measurements* menu, for the purpose of resetting all the recordings

Maintenance Certain information about the status of the CB is available in the *Measurements-Maintenance* menu.

Contact Wear

Contact wear provides an estimation of the state of wear of the main contacts of the circuit-breaker. The value is given in percentage form and is 0% if there is no wear and 100% if the contacts are completely worn

It is calculated automatically by the Trip unit whenever a trip is caused by a protection or, in the presence of auxiliary power supply, whenever the circuit-breaker is opened in the manual mode.



NOTES:

- the percentage is no longer increased once 100% has been reached
- a prealarm signals when 80% is reached,, while an alarm signals when 100% is reached



IMPORTANT: 100% wear does not impose any functional limit on the Trip unit; however, the state of the circuit-breaker must be checked as soon as possible

Maintenance

The *Maintenance* function allows the user to be alerted by a Warning that:

one year has elapsed since maintenance was last performed

contact wear has increased by over 10% with respect to the last maintenance value

Two areas are available in the Trip unit menu:

- Activation area (*Settings - Maintenance* menu), allows the *Maintenance* function to be activated
- Measurement and reset area (*Measurements - Maintenance* menu): only appears if the *Maintenance* function is activated; provides information about maintenance (contact wear and dates) and the command for confirming that maintenance has been performed (confirming records the actual date and contact wear values, and resets the alarm signal).

The reference date is that of the internal clock and the time elapsed is calculated with the trip unit both on and off (so long as the internal battery functions).



NOTE: manual modification of the date may cause variations to the elapsed time calculation, thus to the next maintenance date



NOTE: the maintenance signal due to increased contact wear is given for values exceeding 20%

Operation counters The CB operations (total manual operations and TRIPs) are recorded by the Trip unit in the presence of auxiliary power supply and are available in the *About-Circuit breaker* menu.

The following counters are also available when communication with the Trip unit is activated:

- number of mechanical operations
 - number of trips due to protection trips (TRIP)
 - number of trips due to failed protection trips (TRIP)
 - number of trip tests performed
-

2 - Measuring Measurements

List The Measuring measurements are

Condition	Access	Page
<i>Instantaneous voltages</i>	Phase and line-to-line voltage measurements in real time	117
<i>Instantaneous powers</i>	Real time measurements of the active, reactive, apparent phase and total powers	117
<i>Instantaneous frequency</i>	Measurement of the line frequency	117
<i>Trip</i>	List of trips (TRIP) due to voltage, frequency, power protections	118
<i>Min-Max-Med measurements</i>	History of minimum, maximum and mean voltages and powers recorded within a settable range	118
<i>Peak factor</i>	Real time measurement of the peak factor of the currents	118
<i>Power factor</i>	Real time measurement of the power factor	118
<i>Energy counters</i>	Measurement of active, reactive, apparent energy	118

The relative associated measurements are activated by means of the *Ekip Synchrocheck* module (page 247).

Instantaneous measurements

Instantaneous currents, available in the *Summary pages*, are real time measurements of the line-to-line and phase voltages expressed in root-mean-square value.

Representation, measuring range and performance depend on the set rated voltage (U_n).

Available in the *Summary pages*, the instantaneous powers are real time measurements of the phase and total active powers.

Representation, measuring range and performance depend on the set rated voltage (U_n) and on the rated current defined by the rated size of the Trip unit (I_n); in addition, the reference changes on the basis of the type of measurement:

- S_n for total powers ($S_n = I_n \cdot U_n \cdot \sqrt{3}$).
- P_n for phase powers ($P_n = I_n \cdot U_n / \sqrt{3}$).



NOTE: the phase powers and voltages are available with 4P and 3P + N CBs

Measurement	Monitor time (min-max)	Normal operating range	Accuracy of value read ⁽¹⁾
Line-to-line voltages ⁽⁶⁾	5 V ÷ 900 V ⁽⁹⁾	100 ÷ 690 V	0.5 % ⁽⁸⁾
Phase voltages	5 V ÷ 900 V ⁽⁹⁾	50 ÷ 400 V	0.5 % ⁽⁸⁾
Line frequency	30 ÷ 80 Hz ⁽²⁾	f -10 % ÷ f +10 % ⁽⁴⁾	0,1 % ⁽³⁾
Total active, reactive and apparent power ⁽⁷⁾	Pmin ÷ Pmax ⁽⁵⁾	0,3 ÷ 1,2 S_n	2 % ⁽³⁾
Active, reactive and apparent phase power	Pmin ÷ Pmax ⁽⁵⁾	0,3 ÷ 1,2 P_n	2 % ⁽³⁾

⁽¹⁾ the accuracies refer to normal operating ranges, as established by IEC 61557-12

⁽²⁾ available for voltage values of over 30 V (with $U_n < 277$ V) or 60 V (with $U_n > 277$ V)

⁽³⁾ accuracies based on Ekip Touch without Class 1 Power & Energy Metering package; if the Class 1 Power & Energy Metering package is present and for all other trip unit models, check the indicated performance values from page 120

⁽⁴⁾ 45 to 55 Hz with set frequency = 50 Hz; 54 to 66 Hz with f = 60 Hz

⁽⁵⁾ $P_{min} = 0,0625 I_n \times 5$ V; $P_{max} = 3 \times 16 I_n \times 900$ V

⁽⁶⁾ the higher line-to-line voltages are also available in the *Histograms*, *Measuring instruments* and *Measurement summary pages*

⁽⁷⁾ the higher total powers are also available in the *Measuring instruments* and *Measurement summary pages*

⁽⁸⁾ without transformers; 0.7 % with class 0.2 external transformers

⁽⁹⁾ without transformers; with transformers, multiply the min and max values for the transformer ratio between primary and secondary voltages

Continued on the next page

Special representations

Type of measurement	Measurement < min value	Measurement > max value	"_ _ _" displayed: (not available) due to
Line-to-line and phase voltages	899,97 V ⁽¹⁾	Measurement module not detected
Line frequency	30 Hz	80 Hz	Measurement module not present, $V < 5\text{ V}$
Active, reactive and apparent total and phase power	> [Pn x 1,25]	Sensors disconnected, Measurement module not present, $V < 5\text{ V}$, $I < 0.03\text{ In}$
Voltage U0		> [Un x 1,25]	

Tripping The *Measuring Measurements* page adds to the range of TRIPs that Ekip Touch is able to record (page 118).

The voltage, frequency or power protection that trips determines the measurements recorded the moment the trip occurs

Protection	Measurements re-recorded	Notes
Voltage	Currents L1, L2, L3, Ne, voltages U12, U23, U31, U0	Ne is available with CBs type 4P and 3P + N; U0 is available in the case of trips due to RV protection
Frequency	Currents L1, L2, L3, Ne and grid frequency	Ne is available with CBs type 4P and 3P + N
Power	Currents L1, L2, L3, Ne and total power	Ne is available with CBs type 4P and 3P + N; Active or apparent total power depending on which protection tripped

Min-Max-Med measurements The *Measuring Measurements* package adds to the range of measurements that Ekip Touch is able to record (page 114):

- Maximum and medium voltage
- Active, reactive and apparent maximum and medium powers

The type of information given, the available commands and notes are the same as those described for the current measurements.

**NOTES:**

- compared to the current measurements, graphic representation is with respect to 1 Un (with maximum value 1.25 Un) for the voltage recordings and with respect to 1 Sn (with maximum value 1.25 Sn) for the power recordings
- if the power measurement is negative, the color of the corresponding bar is different from those with a positive value

Peak factor The peak factors are real time measurements of the ratio between the peak and RMS values of the phase current; the measurement is supported by the *Harmonic distortion* protection function (page 64).

Measurement	Monitor time	Accuracy	Notes
Peak factor	0,3 ÷ 6In	1,5%	"_ _ _" (not available) is indicated for currents outside the range and disconnected sensors

Power factor The power factor is the real time measurement of the ratio of total active power and total apparent power, expressed as $\cos\phi$.

Measurement	Monitor time	Accuracy	Notes
Power factor	0,5 ÷ 1	2,5% ⁽¹⁾	"_ _ _" (not available) is indicated for: active and/or reactive power not available or outside the admissible ranges

⁽¹⁾ accuracy based on Ekip Touch without Class 1 Power & Energy Metering package; if the Class 1 Power & Energy Metering package is present and for all other Trip unit models, check the indicated performance values from page 120

Energy counters The energy counters are the measurements of the total reactive and apparent active energy, updated every minute.

Measurement	Monitor time	Accuracy
Total active, reactive and apparent energy	1 kWh ÷ 2 TWh; 1 kVARh ÷ 2 TVARh; 1 kVAh ÷ 2 TVAh	2 % ⁽¹⁾

⁽¹⁾ accuracy based on Ekip Touch without Class 1 Power & Energy Metering package; if the Class 1 Power & Energy Metering package is present and for all other Trip unit models, check the indicated performance values from page 120

Reset measurements

The *Energy RESET* command is available in the *Energy* menu for the purpose of resetting the energy counters (page 48).

3 - Class 1 Power & Energy Metering

List and performance Presence of the *Class 1 Power & Energy Metering* package allows higher measuring accuracy to be obtained for the following quantities:

Measurement	Monitor time (min-max)	Normal operating range	Accuracy of read value
Phase currents ^{(6) (8)}	0,004 ÷ 64 In	Standard IEC 61557-12, tables 20-22	0,5 % ⁽¹⁾
Internal earth fault current ⁽²⁾	0,08 ÷ 64 In	Standard IEC 61557-12, table 20	0,5 % ⁽¹⁾
Line frequency	30 ÷ 80 Hz ⁽³⁾	$f_n \pm 10\%$ ⁽⁴⁾	$\pm 0,02$ Hz
Total active and apparent power ⁽⁷⁾	$ P_{min} \div P_{max} $ ⁽⁵⁾	Standard IEC 61557-12, tables 8-11-14	1 % ⁽¹⁾
Active and apparent phase power	$ P_{min} \div P_{max} $ ⁽⁵⁾	Standard IEC 61557-12, tables 8-11-14	1 % ⁽¹⁾
Total active and apparent energy	1 kWh ÷ 2 TWh; 1 kVARh ÷ 2 TVARh; 1 kVAh ÷ 2 TVAWh	Standard IEC 61557-12, tables 8-11-14	1 % ⁽¹⁾
Power factor	0,5 ÷ 1	Standard IEC 61557-12, table 27	1% ⁽¹⁾

⁽¹⁾ the accuracy values refer to the normal operating intervals and conditions established by IEC 61557-12, for each quantity and class declared

⁽²⁾ available with LSiG versions

⁽³⁾ available for voltage values of over 30 V (with $U_n < 277$ V) or 60 V (with $U_n \geq 277$ V)

⁽⁴⁾ 47 ÷ 55 Hz with $f_n = 50$ Hz; 54 ÷ 66 Hz with $f_n = 60$ Hz

⁽⁵⁾ $P_{min} = 0,0625 I_n \times 5$ V; $P_{max} = 3 \times 16 I_n \times 900$ V

⁽⁶⁾ the higher phase currents are also available in the Histograms, Measuring instruments and Measurement summary pages

⁽⁷⁾ the higher total powers are also available in the Measuring instruments and Measurement summary pages

⁽⁸⁾ internal phase current; in the presence of an external Neutral, the accuracy of current I_n is 1%

Functional characteristics The measuring performance of the *Class 1 Power & Energy Metering* package is guaranteed in the following conditions (from table 43 of standard IEC 61557-12):

Characteristic	Value
Power supply	Vaux auxiliary power supply
Classification of performance measuring and monitoring device (PMD) in accordance with chapter 4.3 of the standard	PMD-DD
Temperature	Operating: $T = -25^\circ\text{C}$ to $+70^\circ\text{C}$; Storage: $T = -30^\circ\text{C}$ to $+70^\circ\text{C}$; Class: K70
humidity and altitude	Up to 90% relative humidity without condensation; From 0 to 2000 meters
Performance class for active energy and power	1

Information page Presence of the *Class 1 Power & Energy Metering* package activates the IEC 61557-12 information page, which can be consulted in the *About* menu



Figure 29

The page shows the activation state of the *Class 1 Power & Energy Metering* package (*Activated/Deactivated*) and the serial numbers of certain accessories installed on the CB for the specific purpose of conforming to the characteristics of the package (electronic units and internal current sensors)

4 - Datalogger

Presentation



The datalogger is a function which allows data associated with a trigger event to be recorded. The following data are recorded:

- Analog measurements: line-to-line voltages and phase currents
- Digital events: protection events or alarms, circuit-breaker status signals, protection trips.

One or two independent recordings can be configured and, via Ekip Connect, all the associated information can be downloaded, displayed and saved.

Function

When the datalogger is enabled and activated (**RESTART**), Ekip Touch continuously acquires data by filling and emptying an internal buffer (**B**).

If a trigger event (**A**) occurs, Ekip Touch interrupts acquisition (**STOP**) immediately or after a time that can be set by the user (**C**) and stores all the data of the window (**D**), which can then be downloaded to a PC for reading and analysis.



IMPORTANT: the function requires an auxiliary voltage supply

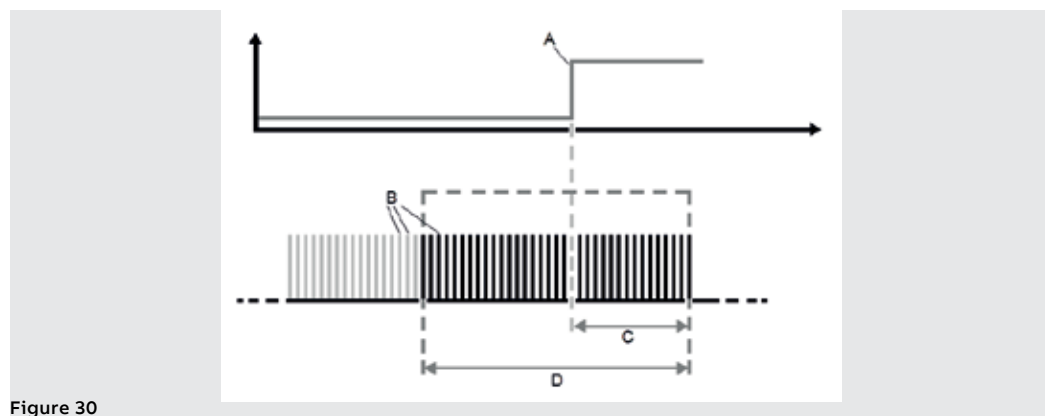


Figure 30

Parameters 1

The parameters and commands of the function are available in the *Settings* menu (page 49).

Parameter	Description	Default
Enable	Activates/deactivates the function and its availability in the parameters menu i NOTE: <i>if the enable command is hidden when at least one datalogger is activated</i>	Off
Num. of Datalogger	Determines the number of recordings (1 or 2) i NOTE: <i>the recordings share the settings of the sampling frequency and type of memory</i> ! IMPORTANT: Change the parameter with interrupted or not started recording	1
Sampling frequency	Establishes the number of samples acquired per second and the recording window. Four options are available: 1200 Hz (window= 13.6 s), 2400 Hz (6.8 s), 4800 Hz (3.4 s), 9600 Hz (1.7 s) i NOTE: • A high frequency allows the data to be analyzed more accurately • if there are two dataloggers, the recording window of each recording is halved	9600 Hz
Datalogger 1 and 2	Menu with the parameters of each Datalogger: trigger event, recording delay and Restart/Stop commands	
Restart and Stop Both	Synchronized start and stop commands of the two dataloggers, valid and available with Num. of Datalogger = 2	

Parameters 2 The *Datalogger 1* and *Datalogger 2* submenus (available if the number of dataloggers selected is: 2) contain the following options:

Parameter	Description	Default
Stop Event	Trigger event at which the recording is to be interrupted; the main protection options (trips, timings, alarms) and the actuator status (open/closed) are displayed. The Custom option can be configured via Ekip Connect	None
Stop delay	Recording interruption delay, calculated from the trigger; the value is given in seconds and can be set within a range: 0 s to 10 s, in 0.01 s steps	0.01 s
Restart	Recording start command	
Stop	Manual recording stop command	

Memory Type

Ekip Connect enables the *Memory Type* (Non volatile/Volatile) to be selected:

- *Non volatile*: Ekip Touch maintains the registration even when off; the life of the internal battery of the unit can be sensibly less than the declared value in the absence of auxiliary power supply.
- *Volatile*: Ekip Touch loses the recording if it is switched off; when the unit is switched on again, the datalogger automatically restarts, losing the previously stored data.

The parameter is configured by default as Non volatile.

Signallings If there is a recording present, Ekip Touch provides the information on the diagnosis bar (DLog1 available).



NOTE: *In the configuration with two dataloggers, the specific indication of the available recording is shown (DLog1 available or DLog2 available)*

Ekip Connect Ekip Connect 3 has two specific areas for the Datalogger function:

- **Datalogger** for configuring the recording parameters with a user-friendly interface, and for downloading the recordings
- **Data Viewer** for opening and consulting the recordings

Both areas are available in the Tools menu of Ekip Connect.

5 - Network Analyzer

Presentation The Network Analyzer function allows you to set voltage and current controls over a long period, in order to analyze your system.

To this purpose, voltages and currents are monitored, so as to find:

- voltage sequences (Over, Under, Pos and neg)
- unbalance between voltages (Unbalance)
- short voltage drops (Interruption) and slow sags (Sag)
- short voltage increases (Spikes) and slow swells (Swell)
- harmonic distortion of voltages and currents (THD)

Each monitoring is associated with control parameters set by the user and updated each time the set control conditions occur.

Parameters The configuration parameters of the counters are available in the *Settings - Network Analyzer* menu (page 49).

The Monitor time parameter, which defines the length of each monitoring session, can also be set in the *Settings* menu.



NOTE: the parameter is the one used for measuring the maximum currents and voltages

Main Menu

Parameter	Description	Default
Enable	Activates/deactivates the function and its availability in the parameters menu	Off
I Harmonic Analysis	Activates harmonic analysis of the currents	Off
V Harmonic Analysis	Activates harmonic analysis of the voltages	Off
V Threshold Low	Control threshold of the <i>Under V Th</i> counter The value is given as a percentage of rated voltage U_n and can be set within the range: 75% to 95%, in 5% steps.	85 % U_n
V Threshold High	Control threshold of the <i>Over V Th</i> counter The value is given as a percentage of rated voltage U_n and can be set within the range: 105, 110, 115 % U_n	110 % U_n
Unbalance V Th	Alarm threshold for the <i>Unbalance</i> counter. The value is given as a percentage of rated voltage U_n and can be set within the range: 2% to 10% U_n , in 1% steps. NOTE: 0% =symmetrical and balanced system	3 % U_n
V microinterr. Th	Control threshold of the <i>V microinterr</i> counter. The value is given as a percentage of rated voltage U_n and can be set within the range: 10% to 95% U_n , in 5% steps	95 % U_n
V Spike Threshold	Control threshold of the <i>Spike</i> counter. The value is given as a percentage of U_n and can be set within the range: 105% to 125% U_n , in 5% steps	105 % U_n
Sags	Menu with the control parameters of the voltage sags	
Swells	Menu with the control parameters of the voltage swells	
Harmonics	The submenu, which becomes available by enabling the harmonic current and/or voltage analysis, allows the harmonic control parameters to be configured	

Continued on the next page

Sags Menu

All the thresholds are given as a percentage of rated voltage U_n and can be set from 10% to 95% U_n , in 5% steps.

All the times are given in seconds and can be set within the range: 0.04 s to 60 s, in variable steps

Parameter	Description	Default
V sag Th Short	Control threshold of <i>Sags Short</i> counter	10 % U_n
V sag dur Short	Minimum duration of sag below the Short threshold to validate the count of the <i>Sags Short</i> counter	0,8 s
V sag Th Middle	Control threshold of <i>Sags Middle</i> counter	45 % U_n
V sag dur Middle	Minimum duration of sag below the <i>Middle</i> threshold to validate the count of the <i>Sags Middle</i> counter	0,8 s
V sag Th Long	Control threshold of <i>Sags Long</i> counter	95 % U_n
V sag dur Long	Minimum duration of sag below the Long threshold to validate the count of the <i>Sags Long</i> counter	0,8 s



NOTE: *Ekip Touch* accepts changes to the parameters subject to compliance with the following limitations: $V \text{ sag dur Long} \geq V \text{ sag dur Middle} \geq V \text{ sag dur Short}$

Swells Menu (Swell)

All the thresholds are given as a percentage of rated voltage U_n and can be set from 105% to 125% U_n , in 5% steps.

All the times are given in seconds and can be set within the range: 0.04 s to 60 s, in variable steps

Parameter	Description	Default
V swell Th Short	Control threshold of the <i>Swell Short</i> counter	125 % U_n
V swell dur Short	Minimum duration of swell above the <i>Short</i> threshold to validate the count of the <i>Swell Short</i> counter	0,8 s
V swell Th Long	Control threshold of the <i>Swells Long</i> counter	105 % U_n
V swell dur Long	Minimum duration of swell above the Long threshold to validate the count of the <i>Swells Long</i> counter	0,8 s



NOTE: *Ekip Touch* accepts changes to the parameters subject to compliance with the following limitations: $V \text{ sag dur Long} \geq V \text{ sag dur Middle} \geq V \text{ sag dur Short}$

Harmonics (Current and Voltage)

All the thresholds are given as a percentage and can be set within the range: 5% to 20% (total THD) or: 3% to 10% (single harmonics) in 1% steps.

Menu	Parameter	Description	Default
Current	THD Threshold	Control threshold of the <i>THD Voltages</i> counter	5 %
	Single harmonic th	Control threshold of the single harmonics counters of the voltages	5 %
Voltage	THD Threshold	Control threshold of the <i>THD Current</i> counter	5 %
	Single harmonic th	Control threshold of the single harmonics counters of the currents	5 %

Counters - introduction

The main counters of the function are available in the *Measurements – Network Analyzer* menu, distributed among several sections (page 48).

The extended list of all the measurements is available via Ekip Connect or by connecting to the bus system



NOTE: the *Additional List* item in the following paragraphs contains the additional counters that are only present via Ekip Connect; the type of reference counter is given in the heading of the additional tables

V Sequences and V 3s Sequences

Submenus **V Sequences** and **V 3s Sequences** have the following counters:

Menu	Parameter	Description
V Sequences	V seq pos	Positive sequence of period in progress [V]
	V seq neg	Negative sequence of period in progress [V]
	Last V pos seq	Positive sequence of period preceding the one in progress [V]
	Last V neg seq	Negative sequence of period preceding the one in progress [V]
V 3s Sequence	V seq pos	Positive sequence calculated during the last three seconds [V]
	V seq neg	Negative sequence calculated during the last three seconds [V]
	Unbalance	Voltage unbalance calculated during the last three seconds [%]

Additional List

Counters (Sequences)	Description
Last time stamp	Date and time of last recording of the sequences
Counters (Sequences)	Description
Last value	Voltage unbalance relating to the period in progress [%]
Actual unbalance value	Voltage unbalance relating to the period preceding the one in progress [%]
Last time stamp	Date and time of last recording of the unbalances
Actual number of U.	Counts the number of times that the average value of the ratio between the positive on negative sequence (with direction of rotation 3-2-1) and negative on positive sequence (1-2-3) exceeds the <i>Unbalance V Th</i> threshold; the count refers to the actual day
Actual [day -1 ... day -7] number of U.	Counters relating to the number of unbalances detected in the last seven days of activity, calculated using the internal clock of the unit
Cumulative number of U.	Cumulative counter of all the unbalances detected by the unit (sum of the other counters or to be increased also for the previous days?)



NOTE: all measurements of unbalances (*Not balanced* and *Unbalance value*) saturate at 200%

THD Current and THD Voltages

The *THD Current* and *THD Voltages* submenus have the following counters:

Menu	Counters	Description
THD Current	L1, L2, L3, Ne	Instantaneous harmonic distortion value of each current phase
THD Voltages	U12, U23, U31	Instantaneous harmonic distortion value of each line-to-line voltage

Over V Th and Under V Th

Certain counters relating to the sequence measurements are available in the *Counters - Day -1* and *Counters - Cumulative* submenus:

Counters	Description
Over V Th	Counts the number of times that the average value of the positive sequence (in the set direction of rotation of the phases: 1-2-3) or negative sequence (in the set direction of rotation of the phases: 3-2-1) exceeds the <i>V Threshold High</i> threshold. The count refers to the reference menu interval (previous day or cumulative)
Under V Th	Counts the number of times that the average value of the positive sequence (in the set direction of rotation of the phases: 1-2-3) or negative sequence (in the set direction of rotation of the phases: 3-2-1) falls below the <i>V Threshold Low</i> threshold. The count refers to the reference menu interval (previous day or cumulative)

Additional List

Counters (Over Voltage)	Description
Last time stamp	Date and time of last recording of the <i>Over V Th</i> counter
Last value	Value of the last swell above the <i>Over V Th</i> [V] threshold
Actual number of O.	<i>Over V Th</i> count for the current day
Actual [day -2 ... day -7] number of O.	<i>Over V Th</i> count of the last seven days of activity, calculated using the internal clock of the unit

Counters (Under Voltage)	Description
Last time stamp	Date and time of last recording of the <i>Under V Th</i> counter
Last value	Value of the last sag below the <i>Under V Th</i> [V] threshold
Actual number of O.	<i>Under V Th</i> count for the current day
Actual [day -2 ... day -7] number of O.	<i>Under V Th</i> count of the last seven days of activity, calculated using the internal clock of the unit

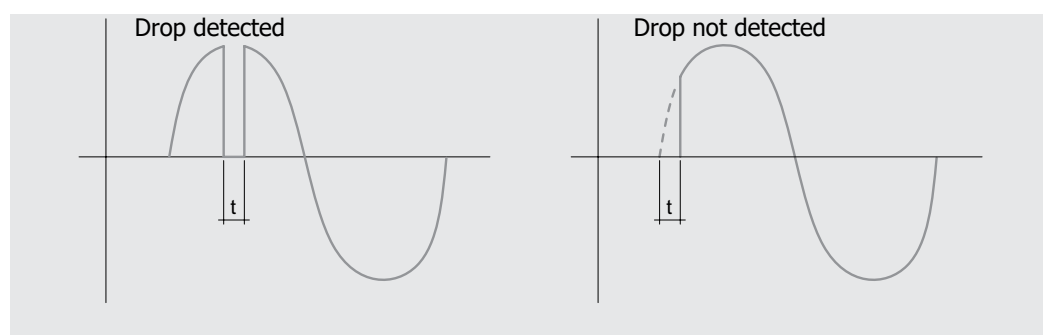
V microinterr. (Interruption)

The *V microinterr* counter should be understood as reduction of the RMS value of the line-to-line voltage below the *V microinterr. Th* set threshold for less than 40 ms (short time voltage sag).

The counter is available in the two submenus *Counters - Day -1* and *Counters - Cumulative* (previous day or cumulative)



NOTE: Since the counter is based on the RMS value calculation, two rapid voltage sags of equal duration may be evaluated differently, depending on when they occur:

**Additional List**

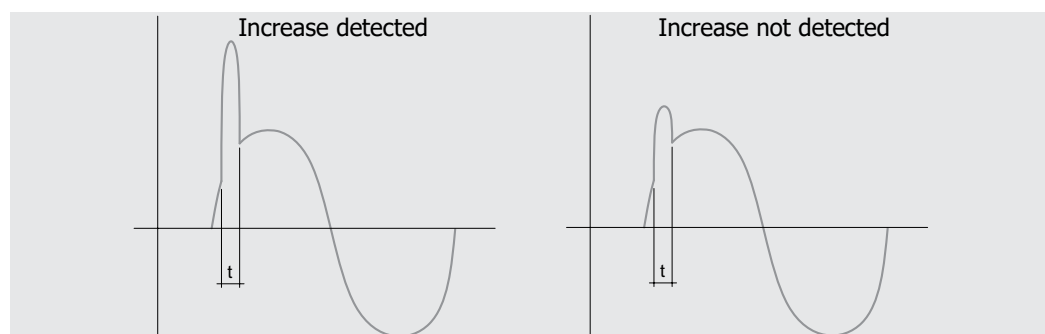
Counters (Interruptions)	Description
Last instant	Date and time of last recording of the <i>V microinterr</i> counter
Last value	Value of last sag below the <i>V microinterr</i> [V] threshold
Last duration	Value of last sag below the <i>V microinterr</i> [ms] threshold
Actual number of I.	<i>V microinterr</i> count for the current day
Actual [day -2 ... day -7] number of I.	<i>V microinterr</i> count of the last seven days of activity, calculated using the internal clock of the unit

Spikes The *Spikes* counter should be understood as increase of the RMS value of the line-to-line voltage above the set *V Spike Threshold* threshold for less than 40 ms (short time voltage spike).

The counter is available in the two submenus *Counters - Day -1* and *Counters - Cumulative* (previous day or cumulative)



NOTE: Since the counter is based on the RMS value calculation, two rapid voltage spikes of equal duration may be evaluated differently, depending on their amplitude:



Additional List

Counters (Interruptions)	Description
Last time stamp	Date and time of last recording of the <i>Spikes</i> counter
Last value	Value of last swell above <i>Spikes</i> [V] threshold
Last duration	Duration of last swell above <i>Spikes</i> [ms] threshold
Actual number of S.	<i>Spikes</i> count for the current day
Actual [day -2 ... day -7] number of S.	<i>Spikes</i> count of the last seven days of activity, calculated using the internal clock of the unit

Sags Certain counters relating to sags are available in the *Counters - Day -1* and *Counters - Cumulative* submenus:

Counters (Interruptions)	Description
Sags Short	Counts the number of times that any line-to-line voltage falls below the <i>V sag Th Short</i> threshold for longer than <i>V sag dur Short</i>
Sags Middle	Counts the number of times that any line-to-line voltage falls below the <i>V sag Th Middle</i> threshold for longer than <i>V sag dur Middle</i>
Sags Long	Counts the number of times that any line-to-line voltage falls below the <i>V sag Th Long</i> threshold for longer than <i>V sag dur Long</i>

The count refers to the reference menu interval (previous day or cumulative)



NOTE: since an event may fall under more than one category, only the counter of the main type (*Long > Middle > Short*) is increased

Additional List

Counters (Interruptions)	Description
Last time stamp	Date and time of last recording of the <i>Sags Short</i> counter
Sags Middle	Value of last sag below the <i>Sags Short</i> [V] threshold
Sags Long	Duration of last sag below the <i>Sags Short</i> [ms] threshold
Actual number of S.	<i>Sags Short</i> count for the current day
Actual [day -2 ... day -7] number of S.	<i>Sags Short</i> count of the last seven days of activity, calculated using the internal clock of the unit

Continued on the next page

Counters (Sags Middle)	Description
Last time stamp	Date and time of last recording of the <i>Sags Middle</i> counter
Sags Middle	Value of last sag below the <i>Sags Middle [V]</i> threshold
Sags Long	Duration of last sag below the <i>Sags Middle [ms]</i> threshold
Actual number of S.	<i>Sags Middle</i> count of the current day
Actual [day -2 ... day -7] number of S.	<i>Sags Middle</i> count of the last seven days of activity, calculated using the internal clock of the unit

Counters (Sags Middle)	Description
Last time stamp	Date and time of last recording of the <i>Sags Long</i> counter
Sags Middle	Value of last sag below the <i>Sags Long[V]</i> threshold
Sags Long	Duration of last sag below the <i>Sags Long[ms]</i> threshold
Actual number of S.	<i>Sags Long</i> count of the current day
Actual [day -2 ... day -7] number of S.	<i>Sags Long</i> count of the last seven days of activity, calculated using the internal clock of the unit

Swells Certain counters relating to swells are available in the *Counters - Day -1* and *Counters - Cumulative* submenus:

Counters (Sags Middle)	Description
Swells Short	Counts the number of times that any line-to-line voltage exceeds the <i>V swell Th Short</i> threshold for longer than <i>V swell dur Short</i>
Swells Long	Counts the number of times that any line-to-line voltage exceeds the <i>V swell Th Long</i> threshold for longer than <i>V swell dur Long</i>

The count refers to the reference menu interval (previous day or cumulative)



NOTE: since an event may fall under more than one category, only the counter of the main type (long > short) is increased

Additional List

Counters (Swells Short)	Description
Last time stamp	Date and time of last recording of the <i>Swells Short</i> counter
Last value	Value of last swell above <i>Swells Short [V]</i> threshold
Last duration	Duration of last swell above <i>Swells Short [ms]</i> threshold
Actual number of S.	<i>Swells Short</i> count for the current day
Actual [day -2 ... day -7] number of S.	<i>Swells Short</i> count of the last seven days of activity, calculated using the internal clock of the unit

Counters (Swells Long)	Description
Last time stamp	Date and time of last recording of the <i>Swells Long</i> counter
Last value	Value of last swell above <i>Swells Long[V]</i> threshold
Last duration	Duration of last swell above <i>Spikes[ms]</i> threshold
Actual number of S.	<i>Swells Long</i> count for the current day
Actual [day -2 ... day -7] number of S.	<i>Swells Long</i> count of the last seven days of activity, calculated using the internal clock of the unit

THD Voltages and Currents

Certain counters relating to harmonic distortion are available in the *Counters - Day -1 and Counters - Cumulative* submenus:

Counters (Swells Long)	Description
THD Voltages	Counts the total number of minutes in which total distortion exceeds current threshold <i>THD Threshold</i>
THD Current	Counts the total number of minutes in which total distortion exceeds voltage threshold <i>THD Threshold</i>



NOTE: the counters saturate at 65535 minutes (45 days); they can be reset by a service connector command (via Ekip Connect) or via communication from the system bus

Additional List

Counters (Swells Long)	Description
Actual minutes	<i>THD Current</i> count for the current day [min]
Actual [day -2 ... day -7] number of THD C.	<i>THD Current</i> count of the last seven days of activity, calculated using the internal clock of the unit
Counters (Swells Long)	Description
Actual minutes	<i>THD Voltages</i> count for the current day [min]
Actual [day -2 ... day -7] number of THD C.	<i>THD Voltages</i> count of the last seven days of activity, calculated using the internal clock of the unit

Waveforms

The *Network Analyzer - Waveforms* menu provides graphic representations of:

- phase currents L1, L2, L3, Ne (for units configured with 4 phases)
- line-to-line voltages V12, V23, V31

When one of the available quantities is selected, Ekip Touch acquires and displays the waveform

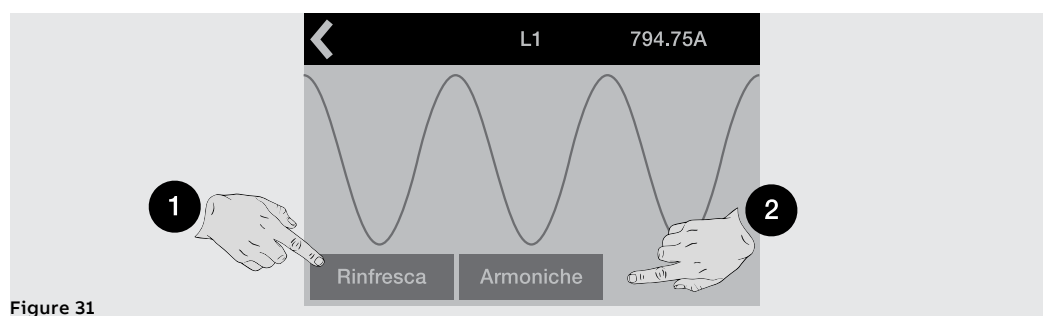


Figure 31

The detected waveform and the value at the time of selection are displayed in the window that appears. A new waveform and the relative measurement can be acquired with the Refresh command (1).

Harmonics

The waveform window will propose the *Harmonics* (2) command if harmonic analysis of currents and/or voltages has been selected. This command accesses the histogram of the harmonics (relating to the grid frequency set in the menu) that make up the waveform.



Figure 32

Touch the sides of the display to scroll the harmonics after (3) and before (4) the selected harmonic, displayed on a flashing graph with value shown in the center of the page. The command for exiting the page is at the top left (5).

Ekip Touch - Settings

1 - Main settings

Foreword All the following parameters are available either directly, or from the *Settings* menu, in the conditions established by Ekip Touch on the basis of the version and configuration described.

To correctly address parameters which are present in the menu but not described below:

- Circuit-breaker: Hardware Trip, T Protection, Neutral Protection
- Phase Sequence
- Monitor time
- Power Controller
- Load Shedding
- Network Analyzer
- Datalogger
- Dual Set
- Functions

please consult the *Settings* menu overview (page 49).



WARNING! changes to the settings must be made in the absence of protection alarms

Bluetooth Low Energy - Connection security

The Bluetooth antenna on the Trip unit can be activated in the *Bluetooth Low Energy* menu. This is useful for launching a communication with an external device (tablet, smartphone) according to the Bluetooth Low Energy protocol, via the *EPiC* APP (page 14).

Activation of Bluetooth Low Energy communication requires the Trip unit to be pre-engineered for a wireless connection: security of the data and Bluetooth Low Energy connection between the Trip unit and its device is guaranteed thanks to the *ABB EPiC* application and the pairing configuration described in the next paragraph.



WARNING! It is the customer's sole responsibility to provide and continuously ensure a secure connection between his device and the Trip unit. The plant manager must establish and maintain appropriate measures (such as but not limited to the installation of malware prevention systems, application of authentication measures, his own system and interface against any kind of security breach, unauthorized access, interference, intrusion, loss and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized accesses, interference, intrusion, loss and/or theft of data or information, use of APPs other than those allowed.

ABB recommends a few general configurations to strengthen the access of data into the Trip unit:

- activate the access PIN code in the Trip unit configure it with a value differing from the default value
- if parameters need not be written, configure the Trip unit only for parameter readout via bus (*Test bus* parameter = *Off*)
- switch off the Bluetooth Low Energy antenna (*Bluetooth Low Energy-Enable* parameter = *Off*) after use



IMPORTANT: communications via wireless and via service connector function alternatively: if Bluetooth Low Energy is activated there can be no communication with other accessories via the service connector

Bluetooth Low Energy - Parameters

The following parameters are available

Parameter	Description	Default
<i>Enable</i>	Enables/disables Bluetooth Low Energy antenna switch-on and availability of the other parameters in the menu: <ul style="list-style-type: none"> • if <i>On</i>, the antenna comes on, on the basis of the <i>Battery Mode</i> parameter configuration • if <i>Off</i>, the antenna is off 	Off
<i>Battery mode</i>	Defines the switch-on mode of the Bluetooth Low Energy antenna, based on the presence of the devices on the service connector (Ekip T&P, Ekip Programming, Ekip TT); can have two values: <ul style="list-style-type: none"> • --- ; with this option, the state of the antenna depends exclusively on the presence of devices: on if not present; off if present • ON; with this option, the antenna is switched off for 15 seconds when a device is connected, after which it remains off if communication with the device has been activated; it comes on if no communication has been activated <p>! IMPORTANT: the typical scenario in which Battery mode should be configured = On is: Ekip Touch + Ekip TT + communication with smartphone activated; in all other cases, including System Update, configure Battery mode = ---</p>	---
<i>Start Pairing</i>	Command which starts Pairing between Trip unit and external device. To perform the operation correctly: <ol style="list-style-type: none"> 1. Press Connect on EPiC APP, select the Trip Unit from among the units in the list and then select Connect again 2. Press Start Pairing in the Trip unit menu, enter the PIN, then press Start Pairing again 3. Press Start Pairing on EPiC APP and confirm the operations until the code request appears 4. Check that the pop up with the Passkey appears on the display of the Trip unit (about 20 seconds) and enter it in EPiC APP 5. The Trip unit will be connected to the external device from this moment on; for the successive re-connections, it will be sufficient to just repeat point 1 <p>i NOTES:</p> <ul style="list-style-type: none"> • execute the procedure within 120 seconds • the command is not available if communication with a device is activated 	---
<i>Decouple devices</i>	Command that deletes the list of devices coupled to the Trip unit <p>i NOTE: the command is not available if communication with a device is activated</p>	---
<i>Version</i>	FW version of the Bluetooth Low Energy module installed on board	---



IMPORTANT: when Bluetooth Low Energy antenna is on, communication on the service connector is not available



IMPORTANT: if Bluetooth is disabled during the order (with the extracode) or disabled by a Service L3 authorized person, the dedicated menu will neither be present, nor visible nor usable. The icons will not be shown on the screen if Bluetooth is disabled

Configuration The *Circuit breaker-Configuration* menu, allowing the presence of the *External neutral* sensor to be activated, is available for the 3P CB (page 258).

Activation of the configuration with *External neutral* (3P + N) enables:

- histograms of phase Ne in the *Histograms* page
- neutral current measurements
- submenu for configuring the Neutral protection (*Neutral Protection*)
- neutral current recording in the case of TRIP

With 3P CB, the parameter is set by default as: 3P.

Ground protection In the earth *Circuit-breaker-Protections* menu of the LSIG version of Ekip Touch you can:

- activate/deactivate the presence of external toroid S.G.R and relative Gext protection (page 257, 87).
- activate the presence of Rc Toroid and relative protection (page 257, 90).
- activate/deactivate the MDGF transformer presence and relative MDGF protection.



NOTE: Rc Toroid can be activated if the Measuring Measurements package and Rc version Rating plug are present; Toroid presence in the menu can only be deactivated afterwards by replacing the installed Rating plug

With Ekip Touch LSIG, the parameter is set by default as: Absent.

Line frequency Frequency adjustment is performed to set the installation frequency; the choice is between 50 Hz and 60 Hz.



NOTE: the measurements are taken on the basis of the set grid frequency: incorrect configuration of the parameter may lead to abnormal measurements and protection

Ekip Touch is supplied with the parameter setting that suits the ordered configuration.

Modules The *Modules* menu provides various options:

Parameter	Description	Default
Local/Remote	<p>The parameter defines the mode in which the parameters are written in the unit:</p> <ul style="list-style-type: none"> • <i>Local</i>, parameter editing only via the display or service connector • <i>Remote</i>, parameter editing only remotely (Ekip Com modules) <p>NOTES:</p> <ul style="list-style-type: none"> • the Remote mode requires the presence of auxiliary power supply and Ekip Com modules, otherwise it disables automatically • however, the Local/Remote parameter can still be edited in the Remote mode 	Local
Local bus	<p>The parameter enables communication between the Trip unit and modules installed via terminal box or outside the unit to be activated. Correct communication between unit and modules is confirmed by:</p> <ul style="list-style-type: none"> • population of the <i>Modules</i> menu with all the modules connected • Power Leds of the modules on and synchronized like the power led of Ekip Touch • absence of Local Bus alarm in the diagnosis bar 	Off
Ekip Signalling 4K	Menu with the parameters of the Ekip Signalling 4K module, if present	
Ekip Measuring	Menu with the parameters of the module <i>Measurement</i> (page 205)	
-	Menu of every module connected and detected (from page 213)	
Functions	Access to the <i>LOCAL Switch On</i> and <i>RESET signaling</i> functions (from page 92)	

Test Bus The parameter allows parameter editing via the service connector to be enabled/disabled, thereby limiting the possibility of configuring all the options on the display (in the Local mode) or via modules *Ekip Com* (in the Remote mode).

Disabling the parameter, Local mode and using the PIN allow security against undesired modification by unauthorized persons to be increased.



NOTE: with *Test Bus*= Off, communication via service connector is still guaranteed (reading enabled)

Ekip Touch is supplied with the parameter set to: On.

System The *System* menu provides various options:

Parameter	Description	Default
Date	Setting the current date	
Time	Setting the current time	
Language	Setting the language in display menus	English
PIN	PIN setting (page#s#53)	00001



IMPORTANT: setting and checking Date and Time is important for all the recording functions (trips or measurements); in the event of date and time glitches, reset and if necessary replace the battery inside Ekip Touch (page 291).

View The *View* menu provides various options:

Parameter	Description	Default
<i>TFT orientation</i>	Enables the orientation of the <i>Alarms List</i> , <i>Measuring Instruments</i> and <i>Main Measurements</i> pages to be set. The options are: Horizontal, Vertical clockwise, Vertical counter-clockwise	Horizontal
<i>Customer page</i>	Allows you to activate a supplementary information page, which can be accessed by pressing the iTEST button twice from any page with a diagnosis bar. The information on the new page can be configured via Ekip Connect (page#s#135)	Off
<i>Ammeter Phase</i>	Allows the current to be displayed in the <i>Measuring instruments</i> page to be set from among the following options: I _{max} , I ₁ , I ₂ , I ₃ , N _e (only in the 4P or 3P + N configuration)	I _{max}
<i>Voltmeter Phase</i>	Allows the voltage to be displayed in the <i>Measuring instruments</i> page to be set from among the following options: V _{max} , V ₁₂ , V ₂₃ , V ₃₁	V _{max}

Maintenance The parameter allows an alarm, concerning maintenance of the unit, to be enabled/disabled. (page 116).
Ekip Touch is supplied with the parameter set to: On.

2 - Additional settings

Presentation Via the service connector (via Ekip Connect) or system bus communication, you can:
A description of the different functions is given below.

Programmable States There are sixteen independent programmable states identified by the letters A, B, C, D, E, F, G, H, I, L, M, N, O, P, Q, R, offering different solutions for event control.

Each programmable status can have two values: True or False. There are also various configuration parameters available:

- *Trigger*, event or combination of several status activation events (up to 24, in AND or OR logic configuration)
- *On Delay*: status activation delay calculated from trigger presence onwards
- *Off Delay*: status de-activation delay calculated from trigger absence onwards



NOTE: the status activates if the trigger is present for longer than the On delay setting and de-activates if the trigger is absent for longer than the Off delay setting

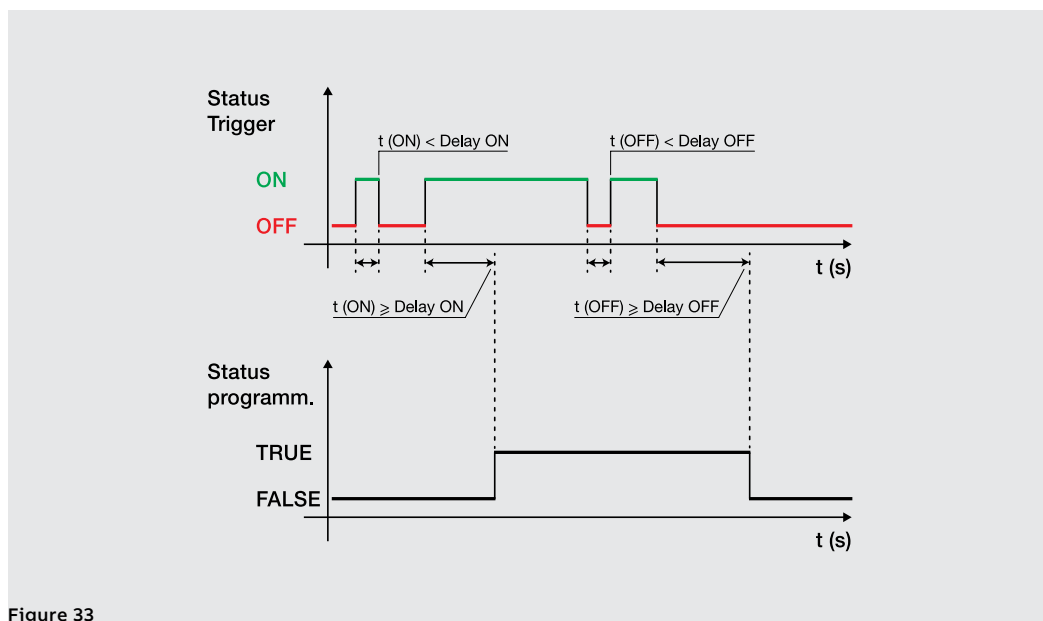


Figure 33

The statuses can be used with external module *Ekip Signalling 10K*, on Link Bus or with the programmable functions, so as to convey the required signaling combination to the contacts.

Filters Measuring filters can be activated on channels S.G.R., MDGF, Rc and V0:


- *GTE filter*: available if the external toroid is present (S.G.R., MDGF or Rc).
- *V0 filter* available with neutral connection activated

If the filter is activated, the measurements and specific protections (Gext, MDGF or Rc for GTE filter, and V0 for V0 filter) are dealt with differently: Ekip Touch applies a pass-band filter to the signal so as to measure the fundamental component only (50 or 60 Hz).

TAG Name, User data Tags that can be programmed by the user to facilitate remote identification of units.



NOTE: the Name TAG and communication address form the identification used by Ekip Connect for the connected devices

Customers Page	Enabling and fields for editing the Customers page (5 information lines) that can be viewed on the display of the unit (page 133).
Installation	Date of installation of unit
Load Profile Time	The counter indicates the time that has elapsed since the last reset of the energy measurements. It is active and updated in the presence of at least one of the following: auxiliary supply or supply by Ekip T&P.
LED Alive	<p>The parameter enables the behavior of the Power led of the Trip unit and of all the connected modules to be modified; if activated (<i>Alive Mode on</i>), the Power leds act in the following way:</p> <ul style="list-style-type: none"> • <i>Ekip Touch</i>: flashes at 0.5 Hz frequency • <i>Modules</i>: if there are no communication errors, they synchronize with the led of Ekip Touch <p>If deactivated, the Power leds on the respective devices come on with a steady light.</p>
Open/Close Remote Direct Command	<p>The parameter controls 2 different command packages for remote opening and closing:</p> <ul style="list-style-type: none"> • <i>Enabled</i>: command 7 and 8 valid (direct Open and Close commands). • <i>Disabled</i>: commands 7 and 8 not valid: in this case, remote opening and closing can still be obtained using the programmable YC COMMAND and YO COMMAND functions and the <i>Request circuit-breaker opening</i> and <i>Request circuit-breaker closing</i> commands
Change Double Set of parameters always	<p>If activated, enables the set of parameters (<i>Adaptive Protections</i>) to be changed even when timing alarms are in progress.</p> <p>Disabled by default.</p>
Repeat zone selectivity S/I/2I/MCR/G HW	<p>If Enabled, zone selectivity HW signals propagation logic applies in accordance with the table in the QT1 technical application notes. 1SDC007100G0205</p> <p>If Disabled, the HW selectivity signal is not propagated by Ekip Touch</p>
Zone selectivity input functions	<p>The zone selectivity inputs and certain of the outputs can be configured in this section:</p> <ul style="list-style-type: none"> • <i>Standard</i>: input or output operation as per standard zone selectivity logic; all selectivity functions are set as Standard. (1SDC007100G0205 or 1SDC007401G0201) • <i>Customized</i>: the event that activates the zone selectivity input or output can be selected. <p> IMPORTANT: in the Customized configuration, the only zone selectivity activation event is the one set and standard selectivity operation is therefore not active (changes should only be made by expert technical personnel)</p>
Glitch	The commands of Glitches 16 to 23 activate the respective glitch registers, which can be used for customizing programmable functions or output contacts.
Wizard Reset	Reset Wizard: the Wizard window appears on Ekip Touch when powered-up the next time and allows some of the parameters of the unit to be entered.

Ekip Touch - Test

1 - Test

Presentation The test area can be accessed on the display; the commands available in this area allow certain functions of the Trip unit to be checked; details of all the commands available in the Test menu are given below (page 50).

Ekip T&P with Ekip Connect has a *Test Protections* section where the presence of current or voltage alarm signals can be simulated and times and trips can be checked.

Autotest The Autotest command starts an automatic sequence of the display and leds so as to enable their operation to be checked.

The sequence comprises the following test phases:

1. Screen with message "www.abb.com".
2. Darkening of the display.
3. Color sequence with red, green, blue bands, with gradual increase of backlighting.
4. Lighting up, for one second, of the Warning and Alarm leds.



NOTE: auxiliary power supply must be present in order to check the gradual increase of backlighting

Trip Test Selection of the *Trip test* command accesses the dedicated page where the operator is asked to press the **iTEST** key to confirm the test operation.

An open command is transmitted to the Trip coil of the CB when the key is released.



IMPORTANT:

- the open command is sent with the circuit-breaker closed and in the absence of current
- following a command, the user is responsible for checking the effective change in status of the actuator and the information displayed, make sure that there are no alarms on the diagnosis bar before performing the test



NOTE: to reset the TRIP signal, go back to the HOME page and press the **iTEST** key or transmit a TRIP RESET command (via Ekip Connect or remotely)

Test CB Selection of the *Test CB* command accesses a submenu with the *Open CB* and *Close CB* commands allowing the CB to be opened and closed via MOE-E. Selection of the *Test CB* command accesses a submenu with the *Open CB* and *Close CB* commands. The commands allow opening coil YO and closing coil YC to be activated, respectively: a window with the message "Test Executed" confirms that the command has been transmitted correctly.



IMPORTANT:

- the open and close commands only function when the Trip unit is on and powered by an auxiliary supply
- the open and close commands of the coils only function when the Trip unit is on and powered by an auxiliary supply
- make sure that the coils are connected to the supply source
- release operation is checked by the commands: coil faults are not detected by the test
- faults in Ekip Com Actuator or the coils are not detected by the test

Ekip Signalling 4K

The menu activates in the presence of module *Ekip Signalling 2K* and auxiliary power supply.

The *Autotest* command is available in the menu; it activates the automatic output test sequence (contacts and leds) and provides for the following operations:

- Opening of the output contacts and switching off of output leds
- Closing in sequence of the four output contacts and switching on of the relative leds
- Reset initial conditions



IMPORTANT: the Autotest command closes the contacts regardless of the configuration set by the user: the user is responsible for making the devices connected to the modules secure, checking that the contacts have closed properly and that the leds have come on

Ekip Signalling 2K

The menu activates in the presence of module *Ekip Signalling 2K*, auxiliary power supply and local bus enabled.



NOTE: a menu is available for each *Ekip Signalling 2K* module present, up to a maximum of three

The *Autotest* command is available in each submenu; it activates the automatic output test (Contacts and leds), input test (leds) and provides for the following operations:

1. Resetting of output contacts (= open) and leds (= off).
2. Lighting up of all leds in sequence (output and input)
3. Closing and switch-off in sequence of the two output contacts while the relative leds come on.
4. Reset initial conditions



IMPORTANT: the Autotest command closes the contacts regardless of the configuration set by the user: the user is responsible for making the devices connected to the Ekip Signalling 2K modules secure, checking that the contacts have closed properly and that the leds have come on

ZoneSelectivity

The menu has one or two sections, visibility of which depends on the protections available and enabled:

Submenus	Reference selectivity	Outputs/Inputs managed
S Selectivity	S, S2, D (Forward)	SZi (DFi), SZo (DFo)
G Selectivity	G, Gext, MDGF, D (Backward)	GZi (DBi), GZo (DBo)

Each submenu has three fields for checking selectivity inputs and outputs:

Field	Description
Input	Provides the status of the selectivity input (On/Off)
Force output	Selectivity output activated
Force Output	Selectivity output deactivated

Consult the description of the putting into service procedure when checking the selectivity contacts in the manuals [1SDH000999R0002](#) and [1SDH001000R0002](#).

RC test

The command is available in the presence of *Rating plug Rc* and *Rc toroid*.

Selection of the command accesses a window containing the protection settings and test instructions:

1. Press the **iTEST** button to send a test signal to the toroid.
2. The toroid sends Ekip Touch a signal as though it had measured an alarm current.
3. Ekip Touch sends a TRIP command.



IMPORTANT: the command sends a signal to the Rc toroid and concludes with a TRIP command: the user is responsible for checking that the initial connections are correct (of the toroid and power supplies of the unit) and that TRIP is accomplished

Ekip Touch - Additional functions

1 - Zone Selectivity

Description Zone Selectivity is an evolution of time selectivity (see chapter "5 - Selectivity between ABB SACE circuit-breakers"), in which a dialog is created between the trip units through input and output blocking signals: an active input blocking signal means that the circuit-breaker must remain closed.

In detail. If a release with the function enabled detects a higher fault current than the threshold set for a certain protection, it activates the lock signal relating to that protection on the output and, before opening, makes sure that the corresponding lock signal is present on the input:

- If the input is not active, the release opens with a delay equal to the selectivity time set for the protection (which must be less than that of the protection trip).
- If the input is active, it opens only if the fault persists and with a delay equal to the tripping time of the protection.

Zone Selectivity can be enabled via cabling (**Hardware Selectivity**) with ABB SACE circuit-breakers, not Emax 2, where available.

Besides Hardware Selectivity, SACE Emax 2 circuit-breakers allow **Logic Selectivity** to be configured using the communication via Link Bus between releases equipped with Ekip Link module. For further details, consult paragraph "Zone Selectivity with SACE Emax 2 circuit-breakers".

Zone Selectivity with ABB SACE circuit-breakers

With electronic trip units not for ABB SACE Emax 2:

- Zone selectivity can be implemented only for protections S I G and D (Directional).
- If the function is available, the circuit-breaker is equipped with two blocking outputs and two blocking inputs that is, one output and one input for each S, I and G protection), or as an alternative two outputs and two inputs for protection D (one output and one input per direction).
- Since only two blocking outputs and two blocking inputs are available, Zone Selectivity for protections S, I and G and Directional Zone Selectivity are mutually excluding (to implement Directional Zone Selectivity, the S, I and G protections must be disabled, and vice versa).
- To actuate Zone Selectivity, the releases must be equipped with auxiliary voltage to activate the outputs.
- Zone selectivity for S and I protection share the same restrain signal
- Each S G and D protection has two selectivity parameters: the function enabling parameter and selectivity time, meaning the opening time of the circuit-breaker if the selectivity input is not active.
- For I protection the selectivity time is fixed (without possibility to modify the value).
- The blocking outputs and inputs are considered active if the level is high (equal to the auxiliary voltage).
- For protection D, the selectivity time to be set is the same for both directions.

To obtain Zone Selectivity, the protections must be set, and the blocking outputs and must be wired, so that only those circuit-breakers capable of isolating the overload or fault without the rest of the installation being de-energized open. Regarding this:

- For each type of selectivity, definitions, operating principles, application fields, advantages and disadvantages, requirements, indications for setting the protections and examples are provided in the Technical Application Paper QT1 [1SDC007100G0205](#) Low voltage selectivity with ABB circuit-breakers
- For Directional Selectivity, application examples are available in the White Paper [1SDC007401G0201](#) "Directional protection and directional zone selectivity".

Zone Selectivity with SACE Emax 2 circuit-breakers

With SACE Emax 2 circuit-breakers, Zone Selectivity can be implemented:

- If the circuit-breakers are equipped with Ekip LCD or Touch trip units (including Hi-, G, and G Hi-trip units).
- For protections S, I, G, D, 2I, MCR, S2, Gext, MDGF (availability depends on the trip unit model).

Hardware Selectivity operation is the same as that described in the previous section for SACE circuit-breakers other than Emax2, except for the addition of S2, Gext and MDGF in the list of protections supported.



NOTE: S2, Gext and MDGF share the same selectivity inputs/outputs of S (S2) and G (Gext and MDGF), respectively. If several protections are active with the same channels (e.g.: S and S2) the trip unit controls the inputs and outputs with OR logic: configure the parameters with care to avoid undesired signals or actions.

Logic Selectivity, which is available in the presence of Ekip Link modules, has different advantages:

- Each protection is independent. There are no cases of shared or exclusive channels/bits (example: selectivity D can be actuated without disabling protections S and G).
- Each device connected to Link Bus can be customized with many propagation parameters, mask, diagnosis.

Use of both types of selectivity or just logic selectivity can be selected on trip unit for each protection.



NOTE: for details on how to associate trip units connected to the same Link Bus, see the chapter "9 - Ekip Link".

Logic selectivity: setting

For each protection for which you wish to implement Zone Selectivity, you must set the function enabling among the available parameters. Then, in addition to these parameters, the selectivity time is also activated for the setting.

Otherwise, Zone Selectivity can only be set up via the Ekip Connect software. Specifically:

- Logic selectivity can be implemented for a maximum of 12 of the 15 actors (trip units) that can be associated to the trip unit via Link Bus (see the chapter "9 - Ekip Link").
- Only hardware selectivity or mixed selectivity (hardware and logic) must be selected in the **Ekip Link advanced selectivity** page.
- The IP address of each actor present must be entered in the **Ekip Link configuration**. Entry of the address enables the configuration parameters and state indicators to be displayed in the various pages (see the chapter "3 - Power Controller").
- For each actor associated to the trip unit via Link Bus and for which you want to enable Logic Selectivity, the function must be enabled (the value "True" must be assigned to the Selectivity Actor parameter).
- **Selectivity masks** are available for each actor present in the **Ekip Link advanced selectivity** page: the mask enables selection of the protections of the actors (S, G, D-Forward, D-Backward, S2, Gext, MDGF) that activate the selectivity input of the trip unit (example: actor 1, protection mask S = S2: selectivity S of the trip unit will be active in the presence of signals S2 of actor 1).
- If selectivity has been enabled for protection S and the protection itself is in the alarm state, the following are activated on the output: the S/D-Forward hardware signal and logic selectivity bit S.

In addition, with reference to the example, the circuit-breaker opening time varies on the basis of the state of the selectivity inputs and/or state bits:

- if hardware signal S/D-Forward (SZi) and logic selectivity bits S2 and Gext of actor 1 are not active: the circuit-breaker is open during the selectivity time for protection S.
- if hardware signal S/D-Forward (SZi) or, with mixed selectivity, logic selectivity bits S2 or Gext of actor 1 are active: the circuit-breaker is open during S protection time (if S protection is still in the alarm state once this time has elapsed).



IMPORTANT: if hardware-only selectivity is selected, the logical selectivity bits are ignored in input, but they are however activated in output.



NOTE: the S/D-Forward (G/D-Backward) hardware output is activated only if the protections S or D-Forward (G or D-Backward) are in alarm, and the S/D-Forward (G/D-Backward) hardware input acts as a block only for the protections S and D-Forward (G and D-Backward), regardless of whether hardware-only or mixed selectivity is selected.

Continued on the next page

- Remote Programmable States A and B are also included in the **selectivity masks**: these 2 parameters, which are available in the **Ekip Link configuration** page, enable the event (or combination of several events) and reference actor that activate the selectivity input of the trip unit to be selected. 2 further states are available, C and D, but they cannot be configured for Zone Selectivity. All 4 programmable states are used for the *Programmable Logic* function described in chapter "9 - Ekip Link".



NOTE: *The Programmable Logic function is different from that of Zone Selectivity.*

Additional functions: repetition of selectivity information

The **Repeat Configuration mask** parameter is available in the **Ekip Link advanced selectivity** page. It enables the selection of protections whose logic selectivity bit, if present on the input, must be propagated regardless of the state of the protection on the current trip unit.



NOTE: *the parameter only acts on the selectivity bits. It does not involve the hardware outputs.*

Additional functions: diagnostics

In the presence of both hardware and logic selectivity, the **diagnosis** highlights any errors in the hardware selectivity cabling by checking its continuity.

In the **Ekip Link diagnosis configuration** page it is possible to: enable diagnosis, configure the interval of time between one inspection and the next, select the inputs to be checked for each active actor (S/D_Foward, G/D_Backward).

Then:

- A check is performed on the hardware inputs at regular intervals.
- If, on the trip unit, the input of an actor is configured for diagnosis (e.g. input S of actor 3) and this input is not active when the test is performed, the actor stimulates its output (e.g. actor 3 activates output S) for a short time: the trip unit considers the test result to be positive if it receives the signal correctly at its input, otherwise it will signal error.
- the diagnosis check will not be performed if the hw input is active.
- if the input configured for diagnosis is active when the test is performed, diagnosis check will not be performed and the **Detection state** in the **Ekip Link state** page will indicate: **Unknown**.

Error signals (inconsistency)

- Regardless of the diagnosis, if a hardware input is active and none of the logic selectivity bits of the associated actors is active, a **line inconsistency** for this input is reported in the **Ekip Link state** page.



NOTE: *line inconsistency is ascertained by checking all the actors associated with the release, even those for which the function has not been enabled (the Selectivity Actor parameter has not been assigned the "True" value).*

- A line inconsistency (independently of diagnostics) is indicative of a possible configuration error (for example: a hardware input of the trip unit is connected to the hardware output of a trip unit not associated via Link Bus, or to an actor for which the function has not been enabled).
- Therefore, to avoid a line inconsistency being reported, the trip units whose hardware outputs are connected to the hardware inputs of the trip unit must also be connected to the Link Bus and associated to the trip unit (see the chapter "9 - Ekip Link") while it is not necessary (it is not necessary for the value "True" to be assigned to the Selectivity Actor parameter).

2 - Generator protection

Description

Specific protections and functions have been integrated into SACE Emax 2 circuit-breakers equipped with Ekip LCD or Touch trip units (with Measurement enabler with voltage socket module), or Ekip Hi- or G or G Hi- (LCD or Touch) trip units to protect low voltage synchronous generators against typical fault conditions and to connect the generators to the installation. This ensures solutions that are compact and simple to install, with no need to turn to indirect solutions.

Available information

More information is available in the White Paper [1SDC007409G0202](#) "Generator protections: Ekip G trip unit for SACE Emax 2", which provides:

- A list of the available protections and functions giving both the ABB name and the ANSI codes (example: protection RQ, with ANSI codes 40 and 32R).
- For each protection, the fault conditions to which it is applied (example: for protection RQ, the inversion of the sign of the reactive power, positive if outgoing from the generator).
- A description of the malfunctions that can lead to the above fault conditions (example: for reactive power reversal, the loss of excitation and the consequent loss of the electromotive force, with reactive power absorption from the network by the generator).
- The types of generator or installation in which such malfunctions are most likely to take place (for example: reversal of reactive power, smooth rotor generators).
- The consequences to which they may lead if the trip unit does not trip (example: for reversal of reactive power, a voltage drop, if the network is not able to supply the required reactive power with the consequent loss of system stability, and in any case an increase in temperature on the generator windings).
- If the protection can be duplicated using the Hi- version of the trip unit, with the possibility of setting the two protections independently, and therefore with the possibility of adding redundancy to increase reliability, or to fine tune the adjustment of the protection.
- For each protection, the parameters to be set, the trip curves and the criteria for the setting of parameters.
- For each of the above parameters, the values that can be assigned.
- For each protection, an application example.
- The description of the synchronism function, which can be implemented with the Ekip Synchrocheck module (see the chapter "12 - Ekip Synchrocheck"), that permits the parallel connection of two independent power supply systems.

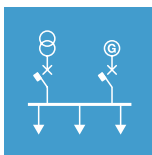
For a summary of the fault conditions to which the protections are applied and of the parameters to be set, see the chapter "Ekip Touch - Protections" starting on page 54.

Compatibility

To identify the trip units in which the protections are available, see the chapter "1 - Overview", and the chapter "4 - Menu" and the paragraph "Advanced menus".

3 - Power Controller

Description



The *Power Controller* function allows the loads of an installation to be managed according to power consumption, for the purpose of reducing consumption and optimizing energy efficiency.

All the parameters and measurements of the function are available via Ekip Connect; however, the Trip unit allows certain of them to be set and displayed, as described below.



IMPORTANT: consult the Technical catalog or White paper of the function for full details (page 15, 19).

Ekip Touch Parameter

Certain configuration parameters of the function are available in the *Settings - Power Controller* menu 49).

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the function and its availability in the parameters menu	OFF
<i>Load Operating Mode</i>	Enables the configuration of each of the 15 programmable loads to be set (from Load 1 to Load 15); either Automatic or Manual configuration can be selected	Manual
<i>Power Limits</i>	Enables 10 power limits to be set (from Power Limit 1 to Power Limit 10); the value is given in kW and can be set within range: 10 kW to 10000 kW, in 10 kW steps	10 kW



NOTE: to characterize the parameters of the function, it is advisable to first configure them via Ekip Connect and only then use the Trip unit to enable or modify the power limits and loads

Ekip Touch Measure

A specific page containing the main measurements is available in the *Measurements* pages, with *Power Controller* activated:

Measurement	Description
<i>Ea</i>	Expected energy
ΔT	Time elapsed in the evaluation window
<i>LOADS</i>	Number of loads monitored
<i>LOADS Shed</i>	Number of shed loads
<i>Sp</i>	Load shedding priority setting
<i>T</i>	Evaluation window

The *Power Controller* menu, with information concerning the 15 loads in two submenus, is available in the *About* page when *Power Controller* is activated (page 50):

Submenus	Information provided
<i>Load Input Status</i>	Status of the loads (from Load 1 to Load 15): open or closed
<i>Load Active</i>	Load configuration (from Load 1 to Load 15): active or inactive

4 - Load Shedding

Description



The *Load Shedding* function allows faults to be managed in installations which are able to function thanks to the energy produced by renewable and local energy sources, especially the absence of power supply caused, for example, by a fault on the MV voltage side.

This function is available in two versions:

- *Basic*, supplied with all the Ekip Touch Trip units
- *Adaptive*; can be purchased by means of the relative additional package and is available for all Trip units with the *Measuring Measurements* package

All the parameters and measurements of the function are available via Ekip Connect; however, the Trip unit allows certain of them to be set and displayed, as described below.




IMPORTANT: consult the Technical catalog or White paper of the function for full details (page 15, 19).

Ekip Touch Parameter

Certain configuration parameters of the function are available in the *Settings - Load Shedding* menu (page 49).



NOTE: it is advisable to first configure the parameters via Ekip Connect, and only then operate on the Trip unit

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the function and its availability in the parameters menu	Off
<i>Version</i>	Display of the version of the function, Basic or Adaptive  NOTE: with the Basic version, the only parameter available is <i>Reconnection Timeout</i>	--
<i>Solar Plant present</i>	Establishes whether the microgrid includes a solar energy system (Off/On)	Off
<i>SolarPlantNominalPower</i>	Available with Solar Energy System Present = On, defines the rated power of its solar energy system. The value is given in kW and can be set within the range: 100 kW to 65535 kW, in 1 kW steps	100 kW
<i>ATS</i>	Establishes whether the installation has an ATS system (Off/On)	Off
<i>Generator Power</i>	Available with ATS=On, defines the power received from the ATS branch; can be set within the range: 0 kW (. . .) to 10000 kW, in 1 kW steps
<i>Frequency slope</i>	Defines the instantaneous frequency variation that activates <i>Load shedding</i> The value is given as absolute value (Hz/s) and can be set within the range: 0.6 Hz/s to 10 Hz/s in 0.2 Hz/s steps	0,6 Hz/s
<i>F W Warning ⁽¹⁾</i>	Control threshold of the minimum frequency that activates Load shedding The value is given as absolute value (Hertz) and can be set within the range: 0.9 Fn to 1.1 Fn in 0.001 Fn steps	3 Fn
<i>Reconnection Timeout</i>	Defines the time employed by the Trip unit between reconnection of one load and the next, after the main CB has reclosed. The value is given as absolute value (s) and can be set within the range: 1 s ÷ 1800 s, in 1 s steps	10 s



NOTE: Load shedding activates if the monitoring conditions defined by the *Frequency slope* and *F W Warning* parameters are present at the same time

Ekip Touch Measure

A specific page containing the main measurements is available in the *Measurements* pages, with *Power Controller* activated:

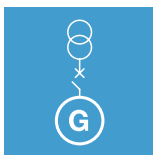
Measurement	Description
<i>F</i>	Frequency measured
<i>F_n</i>	Nominal frequency of the Trip unit
<i>LOADS</i>	Number of loads monitored
<i>LOADS Shed</i>	Number of shed loads

The *Load Shedding* menu, with information concerning the 15 loads in two submenus, is available in the *About* page when *Load Shedding* is activated (page 50).

Submenus	Information provided
<i>Load Input Status</i>	Status of the loads (from Load 1 to Load 15): open or closed
<i>Load Active</i>	Load configuration (from Load 1 to Load 15): active or inactive

5 - IPS Interface protections

Description



The *IPS Interface protection* function allows faults to be managed in installations which are able to function thanks to the energy produced by renewable and local energy sources, especially the absence of power supply, e.g. caused by a fault on the MV voltage side.

The function is available for all the Ekip Hi-Touch Trip units.

All the parameters and measurements of the function are available via Ekip Connect; however, the Trip unit allows protection *59 S1*, *V DIR*, *V INV* and control thresholds *Voltage stability*, *Frequency stability* and *F WI* to be set, as described below.



IMPORTANT: consult the Technical catalog or White paper of the function for full details (page 15, 19).

Protection 59.S1 [ANSI 59S1]

The protection sends a TRIP command if the maximum mean value of the three line-to-line voltages, calculated in a 10-minute floating menu, exceeds the threshold for longer than the set time.

The *Protections-Advanced* menu includes the protection submenu in which the parameters can be entered:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	Off
<i>Trip Enable</i>	Activates/deactivates transmission of the open command: if disabled, the alarm and exceedance of protection time are only managed as information	Off
<i>Threshold</i>	Establishes the value that activates the protection. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 1 Un to 1.3 Un in 0.05 Un steps	1,1 Un
<i>Time</i>	This is the trip time of the protection; the value is given in seconds and can be set within a range: 3 s to 999 s, in 3 s steps	3 s

Limitations and additional functions

The block functions can also be accessed by means of the service connector (via Ekip Connect) or communication via system bus (page 86).

Protection V DIR [ANSI 27VD]

If the positive sequence measured by the Trip unit exceeds or falls below threshold *Up_{os}* (depending on the direction set), the corresponding alarm will be activated (no TRIP). The *Protections-Advanced* menu includes the protection submenu in which the parameters can be entered:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the control threshold of the parameters and their availability in the menu	Off
<i>Direction</i>	Defines whether sequence monitoring is performed after the measured sequence has dropped (Down) or been exceeded (Up)	Down
<i>Threshold</i>	Establishes the value that activates the alarm. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.1 Un to 1.5 Un in 0.05 Un steps	0,8 Un

Protection V INV [ANSI 59VI]


If the negative sequence measured by the Trip unit exceeds or falls below threshold *Uneg*, the corresponding alarm will be activated (no TRIP).

The *Protections-Advanced* menu includes the protection submenu in which the parameters can be entered:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates monitoring of the parameters and their availability in the menu	Off
<i>Threshold</i>	Establishes the value that activates the alarm. The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.05 Un to 0.5 Un in 0.05 Un steps	0,05 Un


VS Warning A warning signal is activated if all three of the line-to-line voltages measured by the Trip unit are within the window defined by the control thresholds for the set time.

The *Protections-Advanced-Warnings* menu includes the control threshold submenu in which the parameters can be entered:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates monitoring of the parameters and their availability in the menu	Off
<i>Signal source</i>	Defines whether the line-to-line voltages to be verified are those from the internal sockets (<i>Measurement</i> module) or from <i>Ekip Synchrocheck</i> , if present.  NOTE: if <i>Ekip Synchrocheck</i> is set, monitoring will refer to one single voltage	Meas.
<i>Threshold DOWN</i>	Establishes the lower value of the control band, given as both absolute value (V) and relative value (Un), which can be set within the range: 0.5 Un to 1 Un in 0.001 Un steps	0,9 Un
<i>Threshold UP</i>	Establishes the upper value of the control band, given as both absolute value (V) and relative value (Un), which can be set within the range: 1 Un to 1.5 Un in 0.001 Un steps	1,1 Un
<i>Time</i>	This is the monitoring time that activates the signal; the value is given in seconds and can be set within a range: 0.1 s to 900 s, in 0.1 s steps	30 s

FS Warning A warning signal is activated if the frequency measured by the Trip unit is within the window defined by the control thresholds for the set time.

The *Protections-Advanced-Warnings* menu includes the control threshold submenu in which the parameters can be entered:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates monitoring of the parameters and their availability in the menu	Off
<i>Signal source</i>	Defines whether the frequencies of the line-to-line voltages to be verified are those from the internal sockets (<i>Measurement</i> module) or <i>Ekip Synchrocheck</i> , if present.  NOTE: if <i>Ekip Synchrocheck</i> is set, monitoring will refer to one single voltage	Meas.
<i>Threshold DOWN</i>	Establishes the lower limit value of the control band, given as both absolute value (Hertz) and relative value (Fn), which can be set within the range: 0.9 Fn to 1 Fn in 0.001 Fn steps	0,998 Fn
<i>Threshold UP</i>	Establishes the lower limit value of the control band, given as both absolute value (Hertz) and relative value (Fn), which can be set within the range: 1 Fn to 1.1 Fn in 0.001 Fn steps	1,002 Fn
<i>Time</i>	This is the monitoring time that activates the signal; the value is given in seconds and can be set within the range: 0.1 s to 900 s, in 0.1 s steps	30 s

F W1 Warning The *F W1 Warning* function activates the alarm (without commanding TRIP) if the frequency measured by Ekip Touch exceeds or drops below the set threshold value (depending on the direction set).

The *Protections-Advanced* menu includes the *F W1 Warning* submenu via which the following parameters can be configured:

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the control threshold of the parameters and their availability in the menu	Off
<i>Direction</i>	Defines whether frequency monitoring is performed after the measured sequence has dropped (Down) or been exceeded (Up)	Down
<i>Threshold</i>	Establishes the value that activates the alarm. The value is given as both absolute value (Hertz) and relative value (Fn) and can be set within the range: 0.9 Fn to 1.1 Fn in 0.001 Fn steps	3 Fn

Ekip Touch - Default

1 - Ekip TOUCH default parameters

Foreword Given the number of parameters available with Ekip Touch, each chapter describing their characteristics also includes their default value settings.

The configurations of the main parameters are given below.

Protections All Ekip Touch models are supplied with the protections (and relative correlated functions) off, with the exception of the protections listed below:

Protection	Configuration
L (excluding Ekip M Touch)	I1= 1 In; t1= 12 s; curve= t= k/I ² ; prealarm: 90% I1 I1I1= 1 In; t1= 48 s; curve= t= k/I ² ; prealarm: 90% I1
L (only Ekip M Touch)	I1= 1 In; t1= 22 s (Class= 10E); Thermal Memory= On; Prealarm: 90 % I1 I1I1= 0,4 In; t1= 45 s (Class= 20E); Thermal Memory= On; Prealarm: 90 % I1
L ⁽¹⁾	I1= 1 In; t1= 144 s; curve= t= k/I ² ; prealarm: 90% I1
I	I3= 5.5 In (all except Ekip M Touch) / 6 In (Ekip M Touch); startup= OFF
I	I3= 4 In; startup= OFF
Harmonic distortion	On
Rc ⁽¹⁾	I _{dn} = 3 A; T _{dn} = 0,06 s
Rc ⁽²⁾	I _{dn} = 3 A; T _{dn} = 0,06 s

⁽¹⁾ protection always active; a model L Disable rating Plug must be used to disable it

^(1/2) protection available and active if model Rc Rating Plus is present

Parameters Unless different specifications are requested when ordering, all Ekip Touch models are supplied with the following configurations:

Parameters	Configuration
Frequency	50 Hz (IEC) / 60 Hz (UL)
Configuration	3P (3P circuit-breaker) / 4P (4P circuit-breaker)
Neutral	Off (3P circuit-breaker) / 50% (4P circuit-breaker)
Rated voltage	400 V
Power flow	Bottom → Top
Phase Sequence	1-2-3
Local bus	Off
Mode	Local
Language	English
Bluetooth Low Energy	Off
Password	00001
Home page	Histograms
LED Alive	Disabled
View	Horizontal
Maintenance	On
Test Bus	On
Modbus RTU par	Address: 247; baudrate: 19.2 kbit/s
Profibus	Address: 125
DeviceNet™	MAC ID: 63; baudrate: 125 kbit/s
Modbus TCP/IP	Static IP: 0.0.0.0

Mechanical characteristics

1 - E1.2 description

Description of circuit-breaker

Emax E1.2 circuit-breakers consist of a structure containing the poles, the operating mechanism and the auxiliary parts. Each pole, enclosed in a plastic box, consists of a breaking part and a current transformer.

The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 34) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 35 for IEC and Figure 36 for UL) and of a fixed part (see Figure 37 for IEC and Figure 38 for UL) for connection through its own terminals to the power circuit.

The coupling between the mobile part and the fixed part is via disconnection contacts mounted on the fixed part.

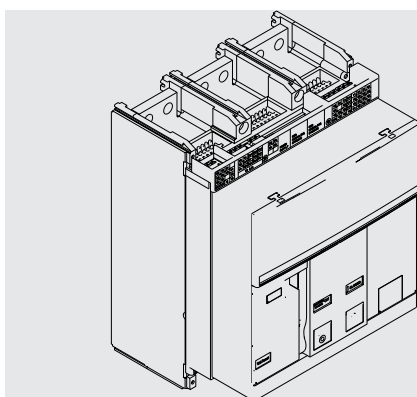


Figure 34

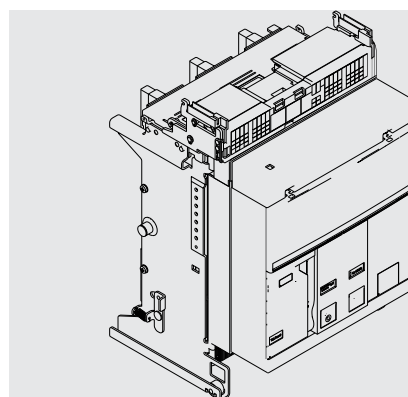


Figure 35

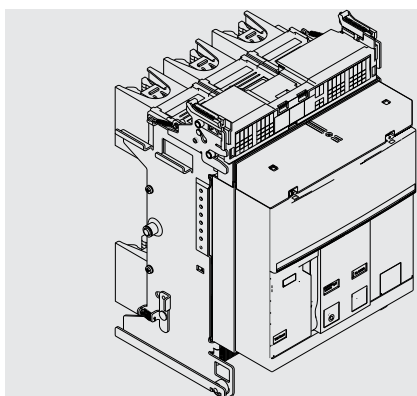


Figure 36

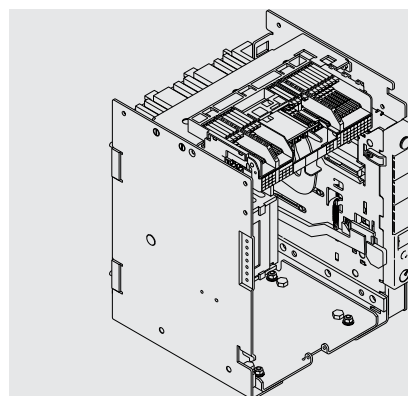


Figure 37

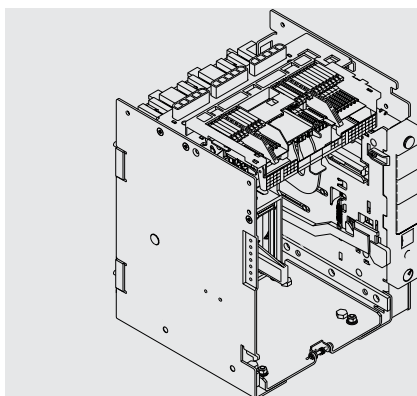


Figure 38

Description of the circuit-breaker front panel

The following are the main components of the circuit-breaker:

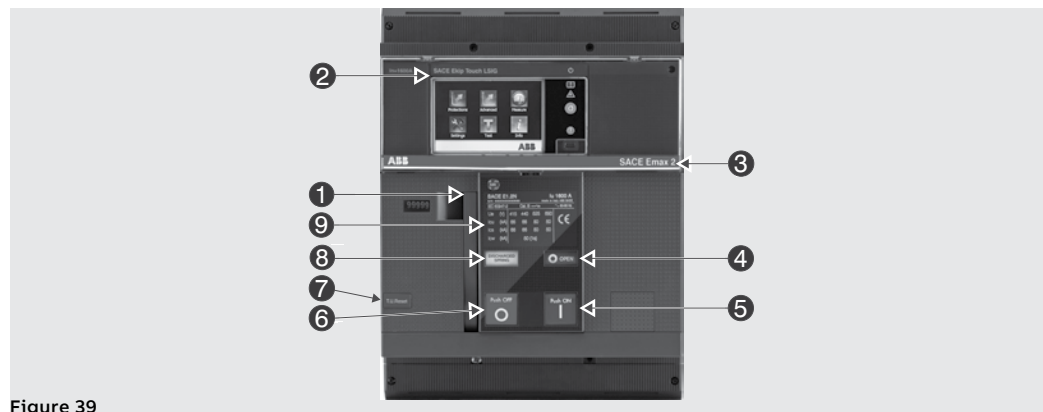


Figure 39

Pos.	Description
1	Lever for manually charging the closing springs
2	SACE Ekip protection trip unit
3	Name of the circuit-breaker
4	CB open (O) / closed (I) indicator
5	Closing pushbutton
6	Opening pushbutton
7	Mechanical signalling of tripped TU
8	Springs charged-discharged signalling device
9	Electrical data plate

Description of electrical data plate IEC

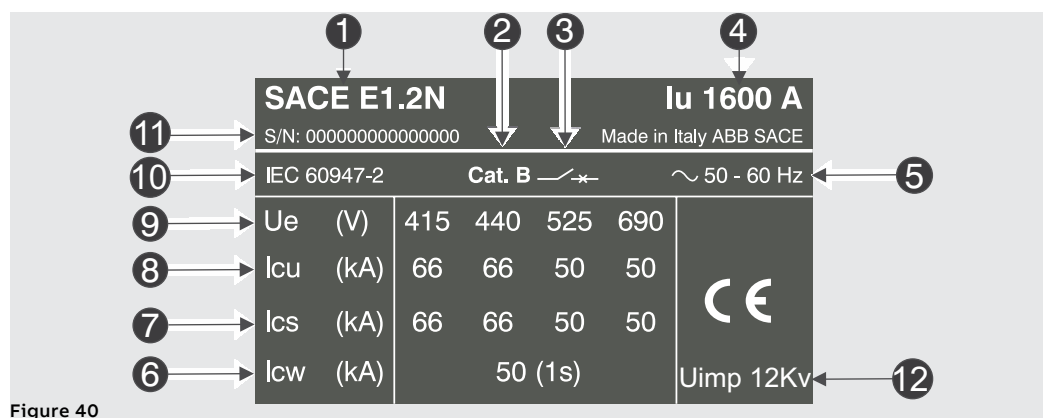


Figure 40

Pos.	Description
1	Type of circuit-breaker
2	Utilization category
3	Device type: Circuit-breaker or switch-disconnector
4	Rated current
5	Rated operating frequency
6	Admissible rated short-time current
7	Rated duty short-circuit breaking capacity
8	Rated ultimate short-circuit breaking capacity
9	Rated service voltage
10	Standards
11	Circuit-breaker serial number
12	Impulse voltage

Continued on the next page

Description of electrical data
plate UL

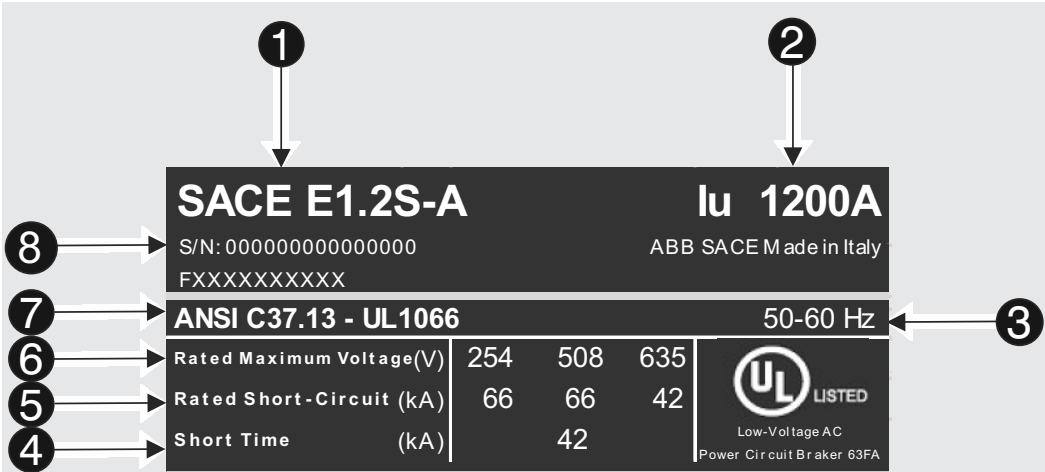


Figure 41

Pos.	Description
1	Type of circuit-breaker
2	Rated current
3	Rated operating frequency
4	Admissible rated short-time current
5	Rated short-circuit breaking capacity
6	Rated service voltage
7	Standards
8	Circuit-breaker serial number

Manual operations for opening and closing the circuit-breaker

The following is the sequence of steps for closing and opening the circuit-breaker:

1. Check that the circuit-breaker is open (open / closed indicator "O - OPEN"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 42.
2. Charging the springs - Pull the lever [A] downwards several times until the springs charged signalling device [B] is "yellow - CHARGED SPRING" as indicated in Figure 43.

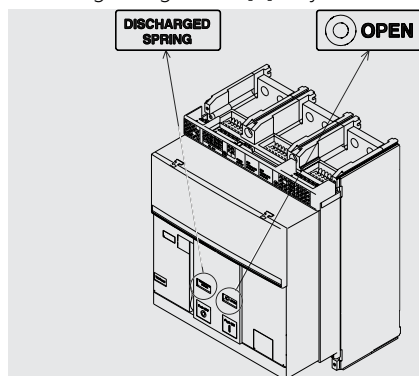


Figure 42

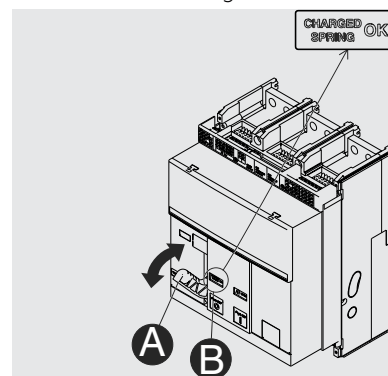


Figure 43

3. Check that the circuit-breaker is open (open/closed signalling device "O - OPEN"), and check that the springs are charged (springs signalling device "yellow - CHARGED SPRING") as indicated in Figure 44.
4. Closing - Press the closing pushbutton "I - Push ON" as indicated in Figure 45.

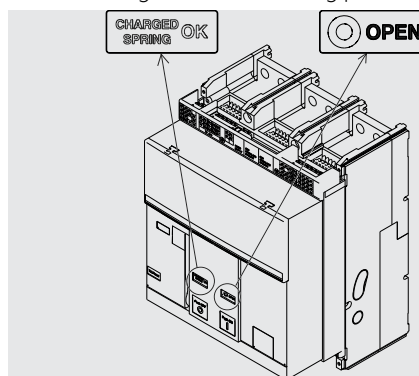


Figure 44

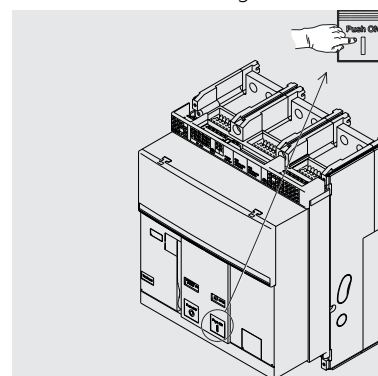


Figure 45

5. Check that the circuit-breaker is closed (open/closed indicator "I - CLOSED"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 46.
6. Opening - Press the opening pushbutton "O - Push OFF" as indicated in Figure 47.

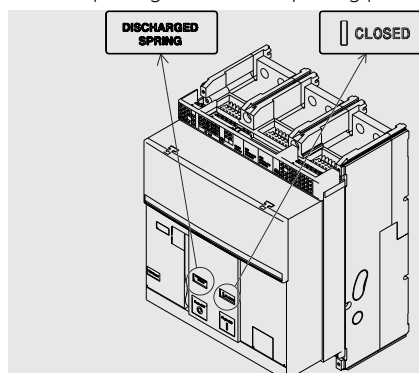


Figure 46

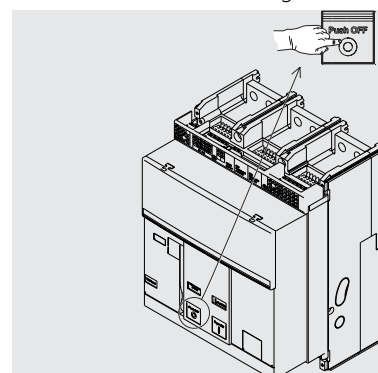


Figure 47

Continued on the next page

7. Check that the circuit-breaker is open (open / closed indicator "O - OPEN"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 48.

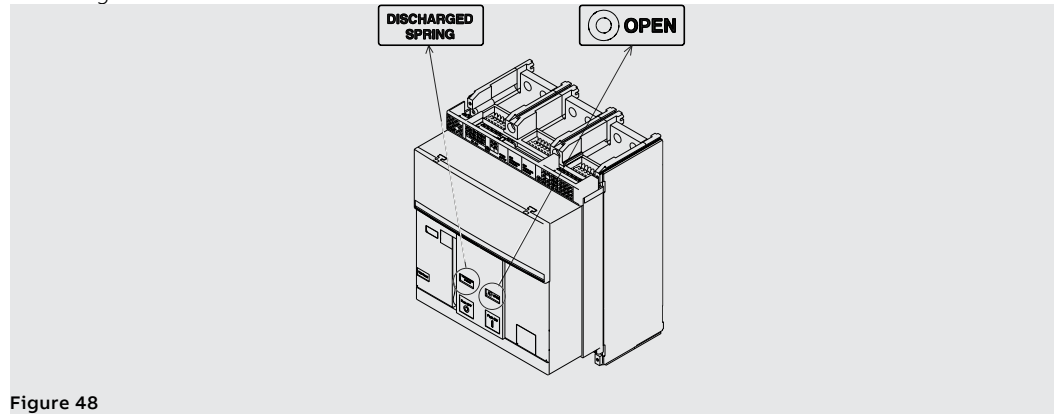


Figure 48

Mechanical status indicators

The following are the possible states in which you can find the circuit-breaker:

1. Circuit-breaker open with springs discharged (see Figure 49).
2. Circuit-breaker open with springs charged (see Figure 50).
3. Circuit-breaker closed with springs discharged (see Figure 51).
4. Circuit-breaker closed with springs charged (see Figure 52). This state occurs when after closing (see step 4 - Figure 52) the springs are recharged manually or automatically by the gearmotor (if provided).

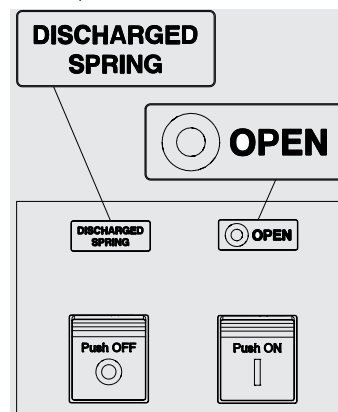


Figure 49

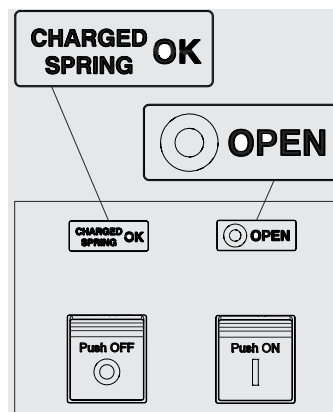


Figure 50

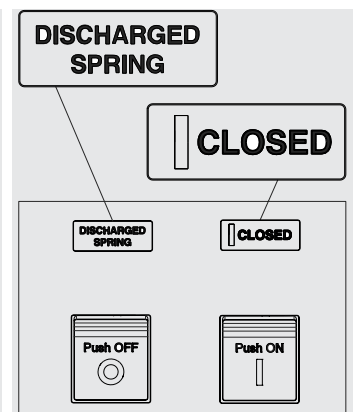


Figure 51

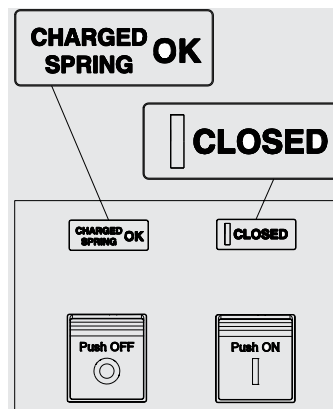


Figure 52

Circuit breaker racking-in/ racking-out operations

The following is the procedure for the insertion of the moving part in the fixed part:



WARNING!

- Make sure the circuit-breaker is disconnected from all sources of energy.
- Switch the circuit-breaker to the open position with springs discharged.



WARNING! Before proceeding, remove all equipment used during the work and remove processing waste and materials used.

1. Turn plate through 90° before inserting the moving part.

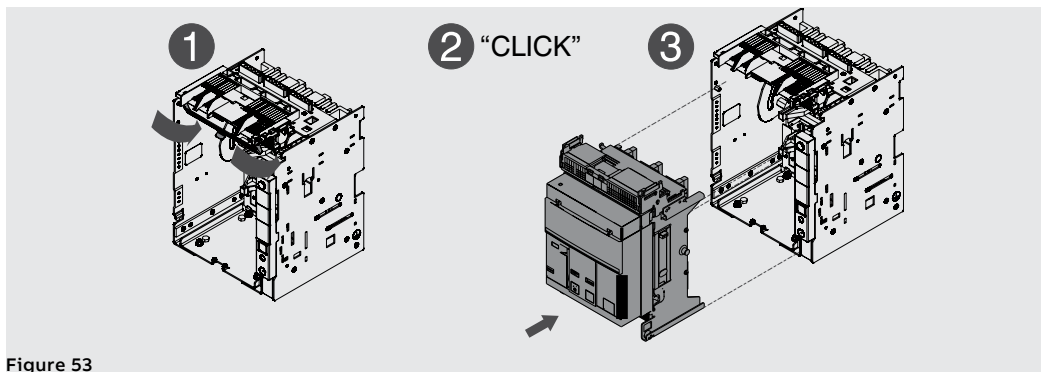


Figure 53

2. Make sure that signalling device on the fixed part indicates the **DISCONNECT** position. See Figure 54.

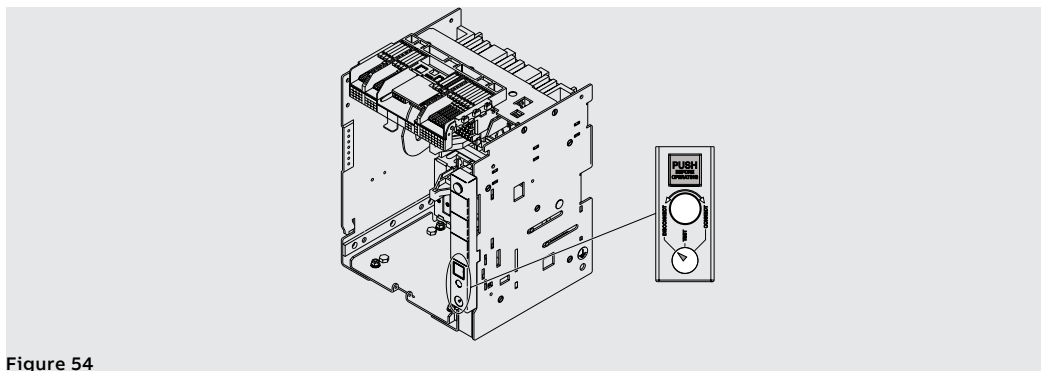


Figure 54

3. Position the moving part in the fixed part and push until it comes to a stop. See Figure 55 and Figure 56.

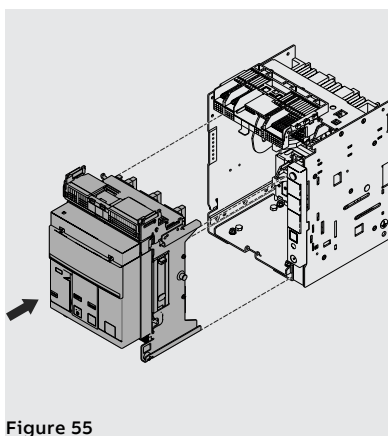


Figure 55

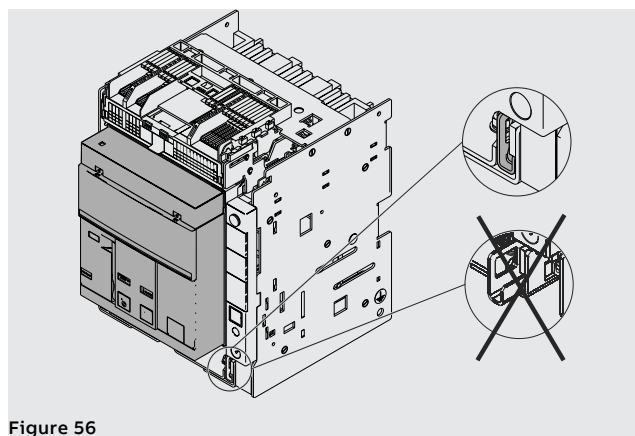


Figure 56

Continued on the next page

4. Extract the disconnection crank from its housing See Figure 57.
5. Press the lock pushbutton and fit the handle into the moving part. In this phase, the moving part will still be in the **DISCONNECT** position. See Figure 58.

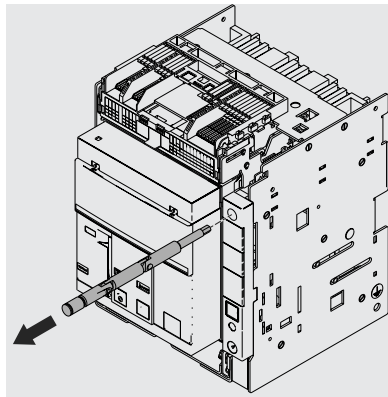


Figure 57

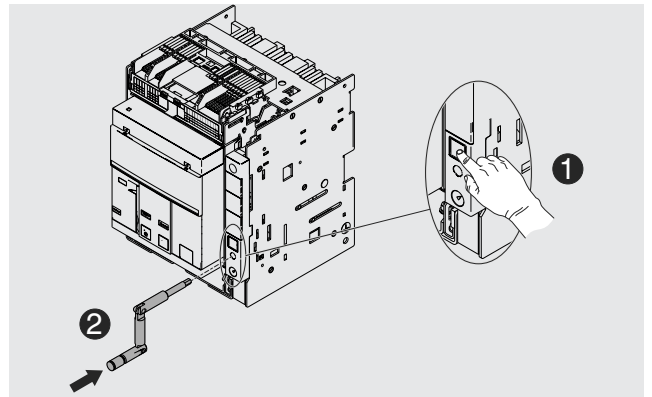


Figure 58

6. Keep breaker pushed. Turn the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **TEST** position. See Figure 59.

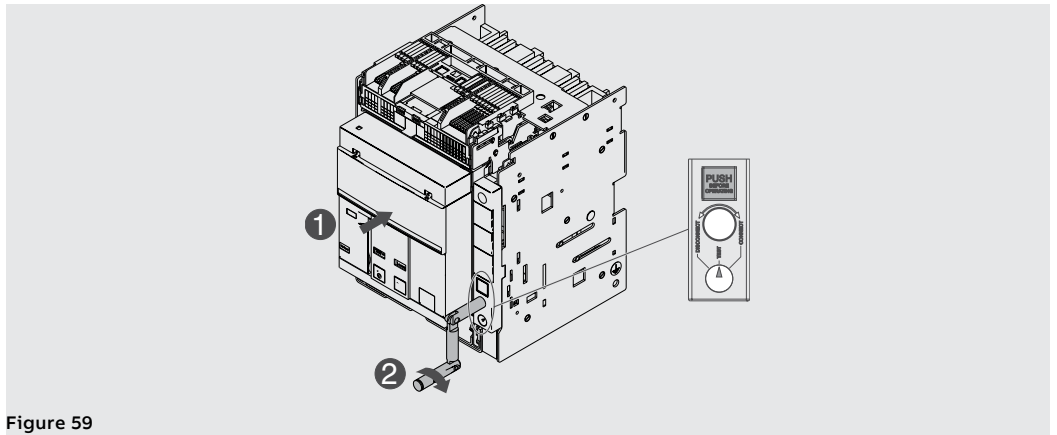


Figure 59

7. Press the lock button and then rotate the crank clockwise until the button comes out and the indicator shows that the circuit-breaker is in the **CONNECT** position. See Figure 60.

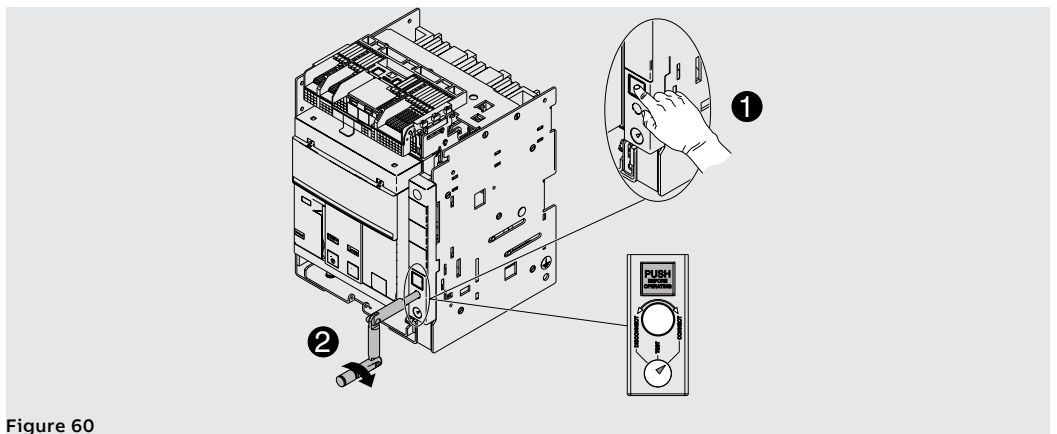


Figure 60

Continued on the next page

8. Extract the crank. See Figure 61.
9. Replace the crank in its housing See Figure 62.

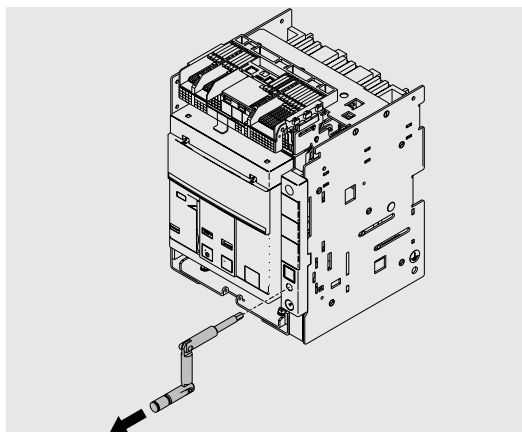


Figure 61

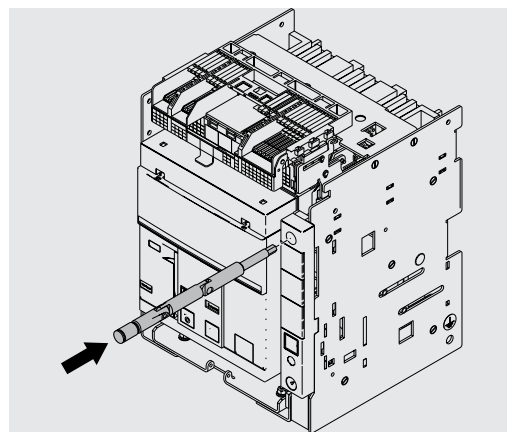


Figure 62

To extract the moving part from the fixed part, perform the same steps indicated for insertion in reverse order.

After extraction, in order to remove the moving part, unlock the safety lock. See Figure 63.

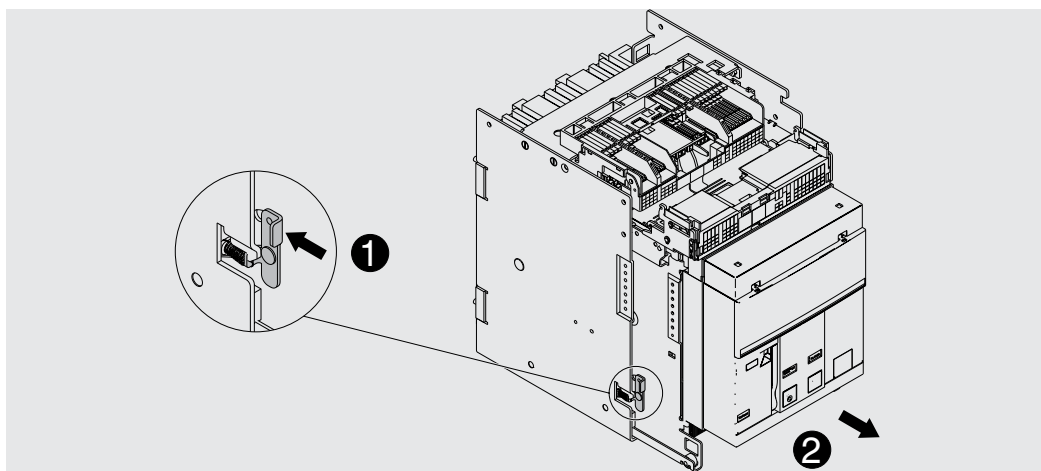


Figure 63



WARNING! The inserted circuit-breaker must be opened in order to be able to reach the test position. On the UL version, the fail safe prevents the removal of the circuit-breaker from the fixed part with springs charged. Discharge the springs before removing the circuit-breaker from the fixed part. For further details, consult the Mechanical safety accessories chapter.

Mechanical position indicators

The following are the possible positions where you can find the mobile part of a withdrawable circuit-breaker during its use:

- circuit breaker in DISCONNECT position (see Figure 64).
- circuit-breaker in test position (see Figure 65).
- circuit-breaker in CONNECT position (see Figure 66).

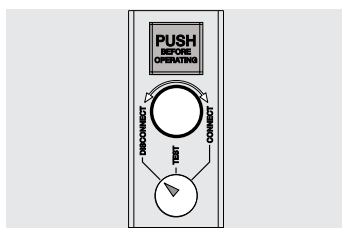


Figure 64

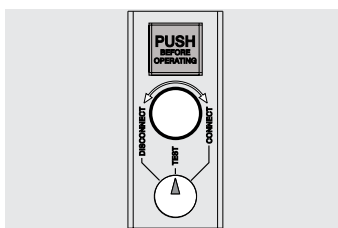


Figure 65

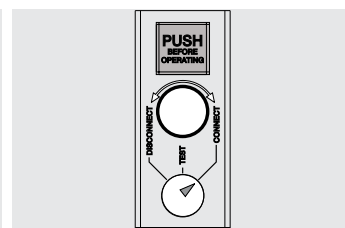


Figure 66

2 - E2.2-E4.2-E6.2 description

Description of circuit-breaker

The Emax E2.2-E4.2-E6.2 circuit-breakers consist of a steel structure in which the operating mechanism, the poles and the auxiliary parts are located.

Each pole, isolated from the others, contains the breaking parts and the current transformer of its own phase.

The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 67) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 68) and of a fixed part (see Figure 69 for IEC and Figure 70 for UL) for connection through its own terminals to the power circuit.

The coupling between the mobile part and the fixed part is via disconnection contacts mounted on the fixed part.

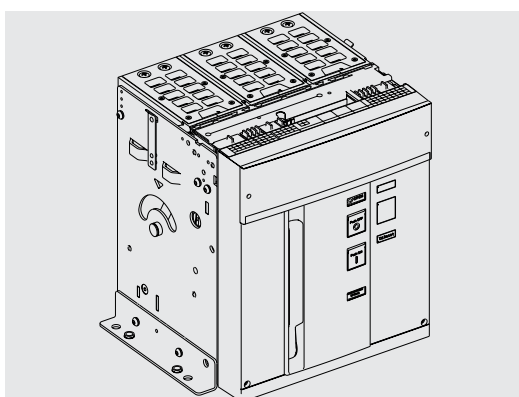


Figure 67

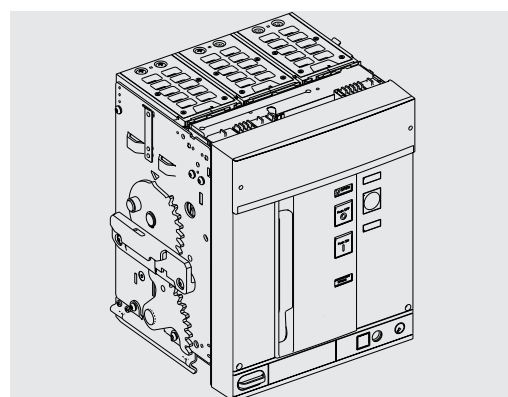


Figure 68

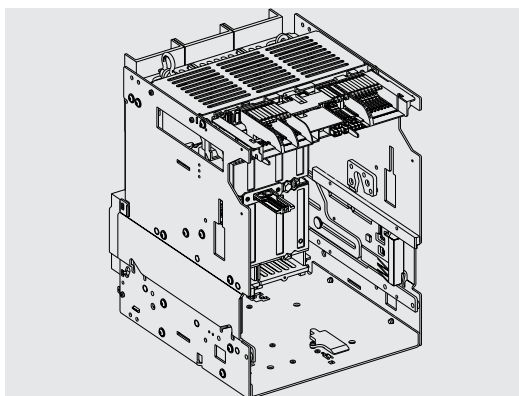


Figure 69

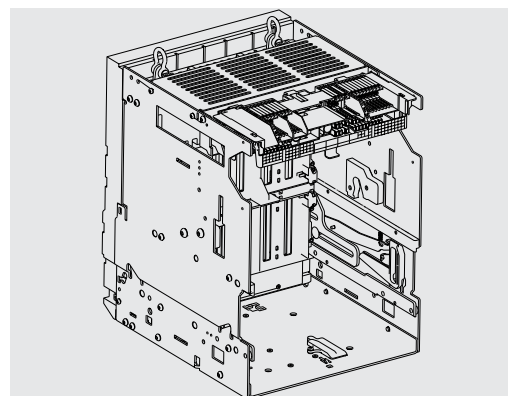


Figure 70

Description of the circuit-breaker front panel

The following are the main components of the circuit-breaker:

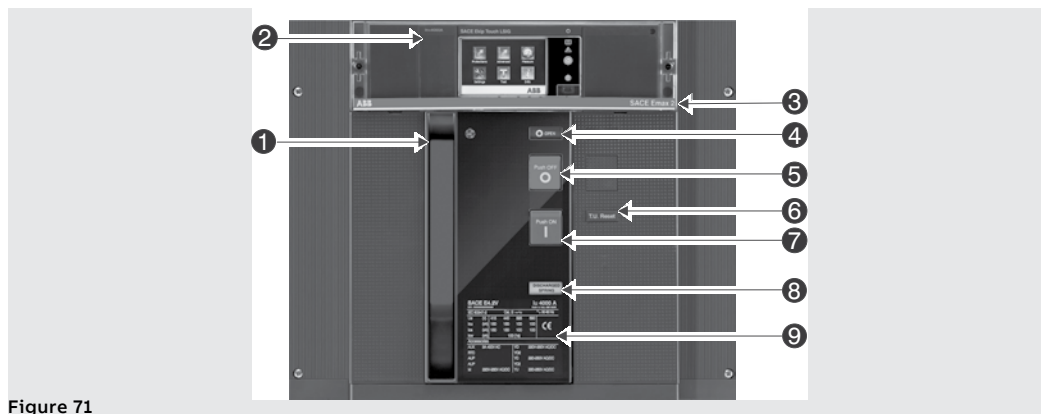


Figure 71

Pos.	Description
1	Lever for manually charging the closing springs
2	Ekip protection trip unit
3	Name of the circuit-breaker
4	CB open (O) / closed (I) indicator
5	Opening pushbutton
6	Mechanical signalling of tripped TU
7	Closing pushbutton
8	Springs charged-discharged signalling device
9	Electrical data plate

Description of electrical data plate IEC

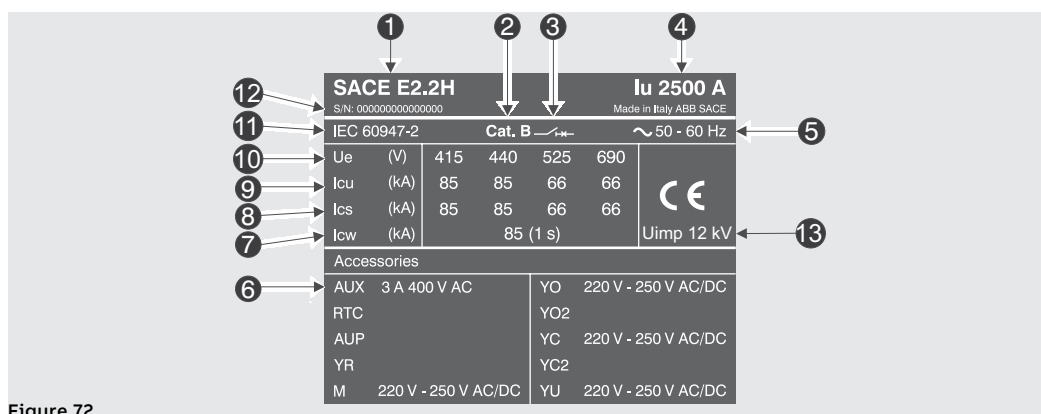


Figure 72

Pos.	Description
1	Type of circuit-breaker
2	Utilization category
3	Device type: Circuit-breaker or switch-disconnector
4	Rated current
5	Rated operating frequency
6	Rated voltage of accessories
7	Admissible rated short-time current
8	Rated duty short-circuit breaking capacity
9	Rated ultimate short-circuit breaking capacity
10	Rated service voltage
11	Standards
12	Circuit-breaker serial number
13	Impulse voltage

Continued on the next page

Description of electrical data plate UL

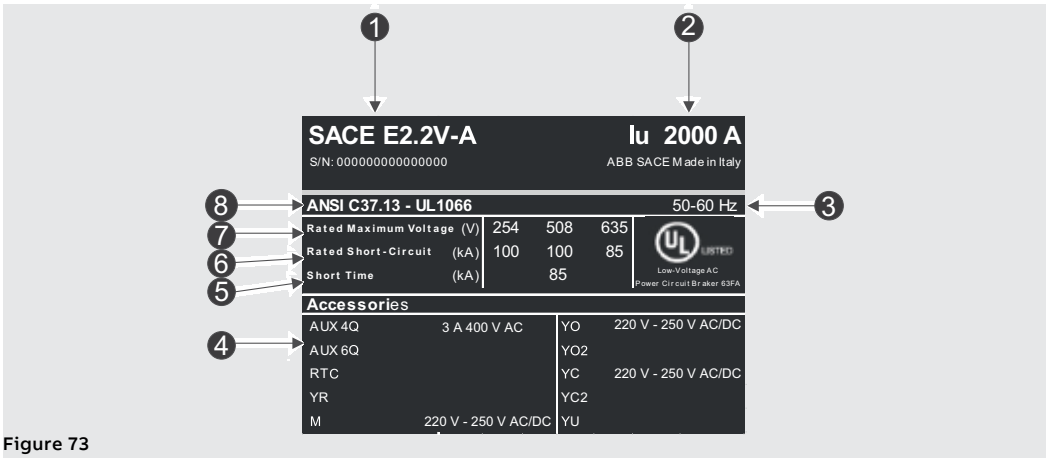


Figure 73

Pos.	Description
1	Type of circuit-breaker
2	Rated current
3	Rated operating frequency
4	Rated voltage of accessories
5	Rated short-circuit breaking capacity
6	Rated service voltage
7	Standards
8	Circuit-breaker serial number

Manual operations for opening and closing the circuit-breaker

The following is the sequence of steps for closing and opening the circuit-breaker:

1. Check that the circuit-breaker is open (open / closed indicator "O - OPEN"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 74.
2. Charging the springs - Pull the lever [A] downwards several times until the springs charged signalling device [B] is "yellow - CHARGED SPRING" as indicated in Figure 75.

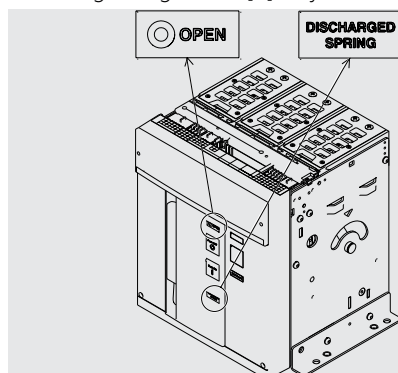


Figure 74

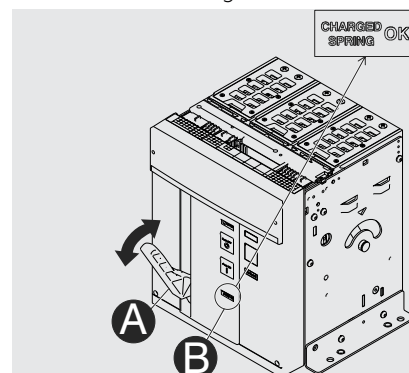


Figure 75

3. Check that the circuit-breaker is open (open/closed signalling device "O - OPEN"), and check that the springs are charged (springs signalling device "yellow - CHARGED SPRING") as indicated in Figure 76.
4. Closing - Press the closing pushbutton "I - Push ON" as indicated in Figure 77.

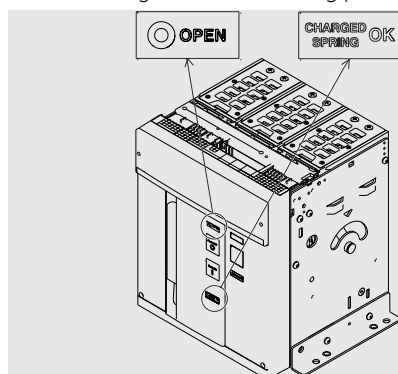


Figure 76

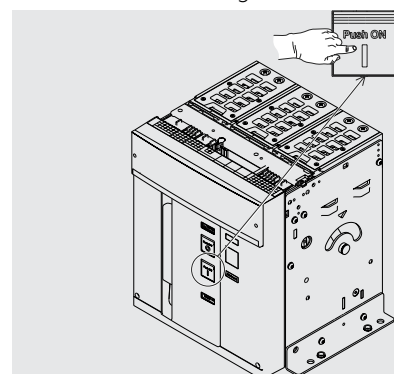


Figure 77

5. Check that the circuit-breaker is closed (open/closed indicator "I - CLOSED"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 78.
6. Opening - Press the opening pushbutton "O - Push OFF" as indicated in Figure 79.

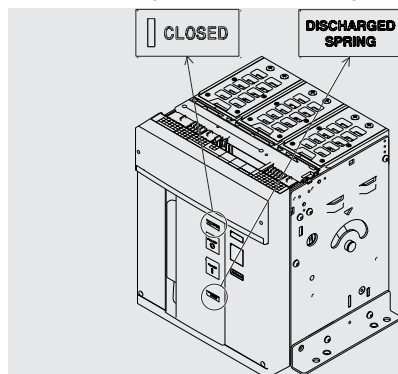


Figure 78

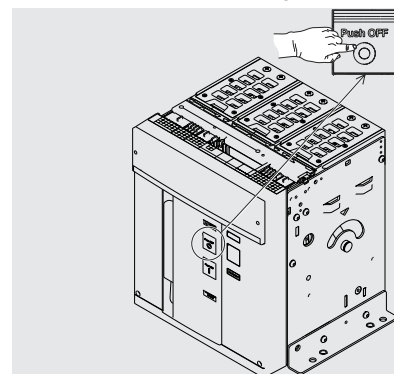


Figure 79

Continued on the next page

7. Check that the circuit-breaker is open (open / closed indicator "O - OPEN"), and check that the springs are discharged (spring signalling device "white - DISCHARGED SPRING") as indicated in Figure 80.

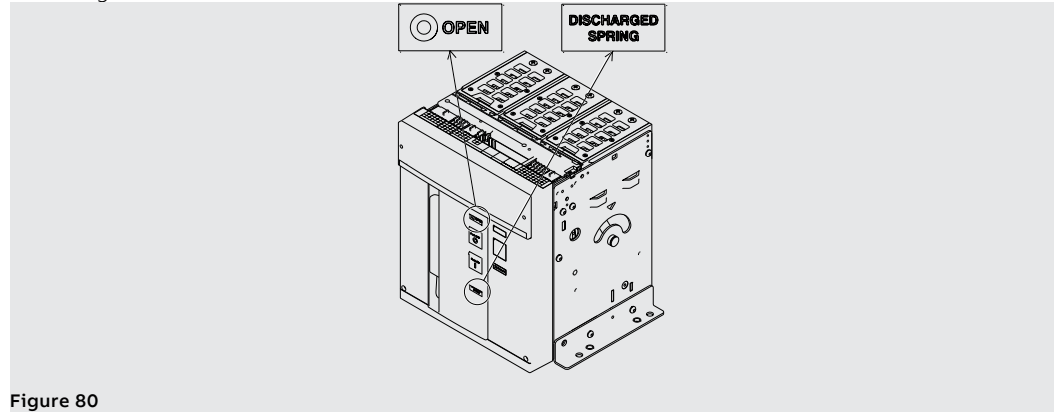


Figure 80

Mechanical status indicators

The following are the possible states in which you can find the circuit-breaker:

1. Circuit-breaker open with springs discharged (see Figure 81).
2. Circuit-breaker open with springs charged (see Figure 82).
3. Circuit-breaker closed with springs discharged (see Figure 83).
4. Circuit-breaker closed with springs charged and not ready to close (see Figure 84). This state occurs when after closing (see step 4 - Manual operations for opening and closing the circuit-breaker) the springs are recharged manually or automatically by the gearmotor (if provided).
5. Circuit-breaker open with springs charged and not ready to close (see Figure 85). This state occurs in the following cases:
 - The circuit-breaker is open due to tripping of protection trip units and the Reset signal has not been reset. To close the circuit-breaker press the TU Reset pushbutton on the front of the circuit-breaker.
 - The key lock or padlock is active in the open position.
 - The undervoltage coil is de-energized.
 - The opening coil is permanently energized.
 - The closing coil is permanently energized.
 - The pushbutton for enabling the insertion/extraction crank of a withdrawable circuit-breaker is pressed.

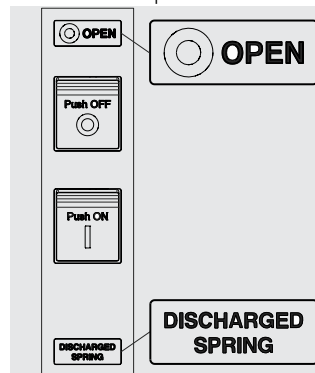


Figure 81

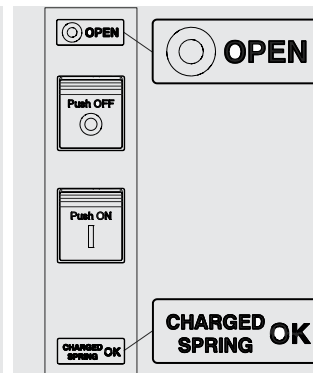


Figure 82

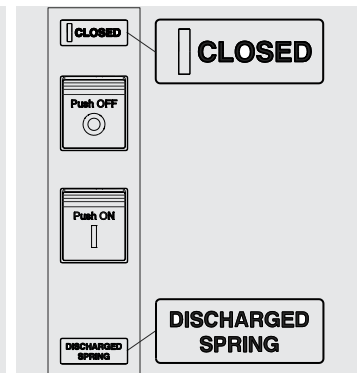


Figure 83

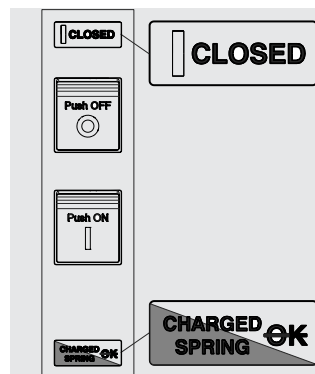


Figure 84

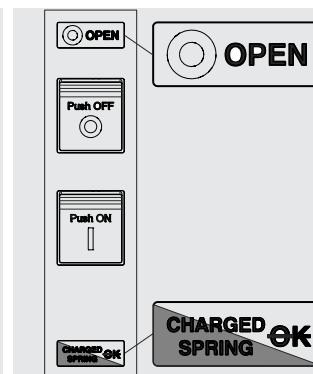


Figure 85

Circuit breaker racking-in/ racking-out operations

The following is the procedure for the insertion of the moving part in the fixed part:



WARNING!

- Make sure the circuit-breaker is disconnected from all sources of energy.
- Switch the circuit-breaker to the open position with springs discharged.



WARNING! Before proceeding, remove all equipment used during the work and remove processing waste and materials used.

1. Turn plate through 90° before inserting the moving part.

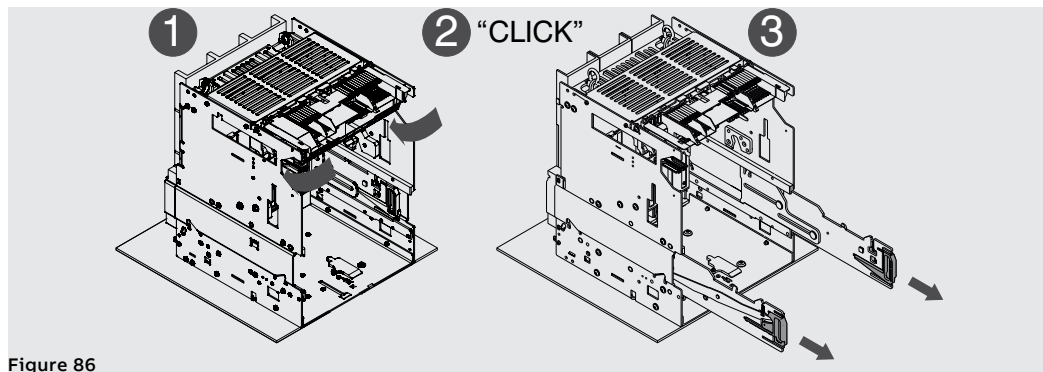


Figure 86

2. Position the lifting plates on the mobile part making sure that the tongue of the plates is latched properly. See Figure 87.

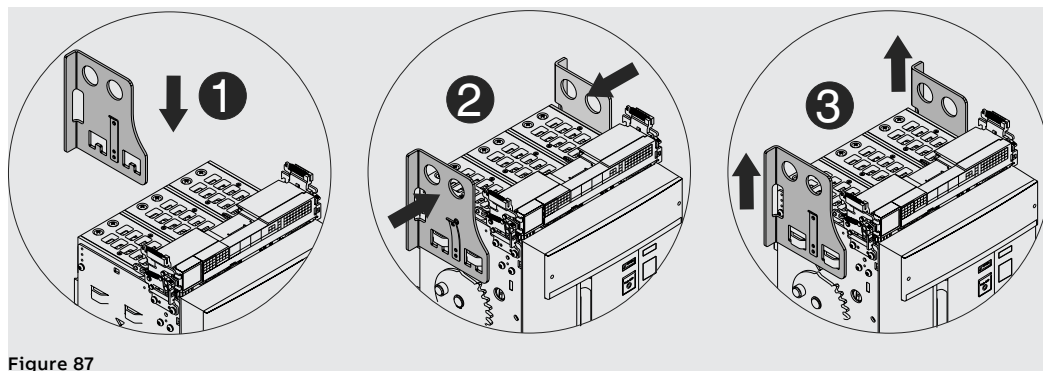


Figure 87

3. Extract the guides of the fixed part using the appropriate levers. See Figure 88.
4. Position the moving part on the guides of the fixed part. Latch by inserting the hollow part of the side in the latch of the guide of the fixed part See Figure 89.

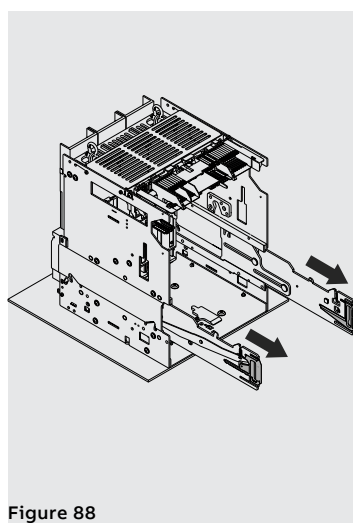


Figure 88

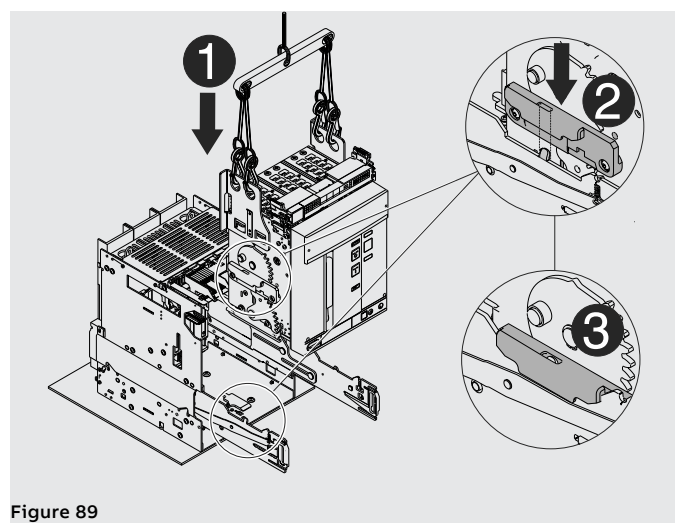


Figure 89

Continued on the next page

5. Unlatch the tongue and remove the lifting plates from the moving part. See Figure 90.

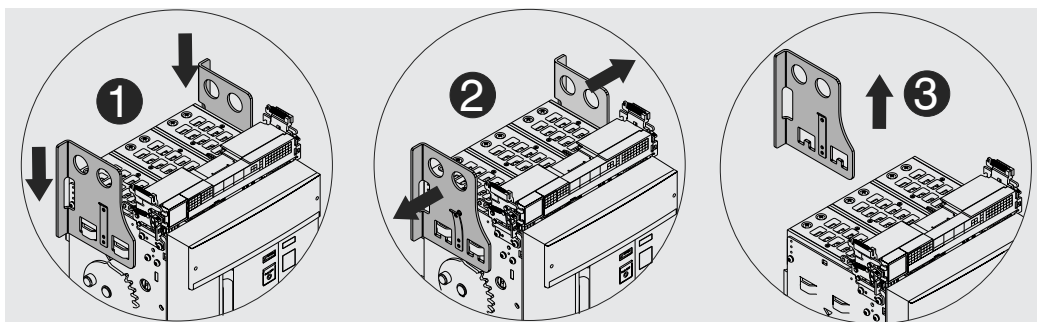


Figure 90

6. Make sure that the signalling device indicates the **DISCONNECT** position. See Figure 91.

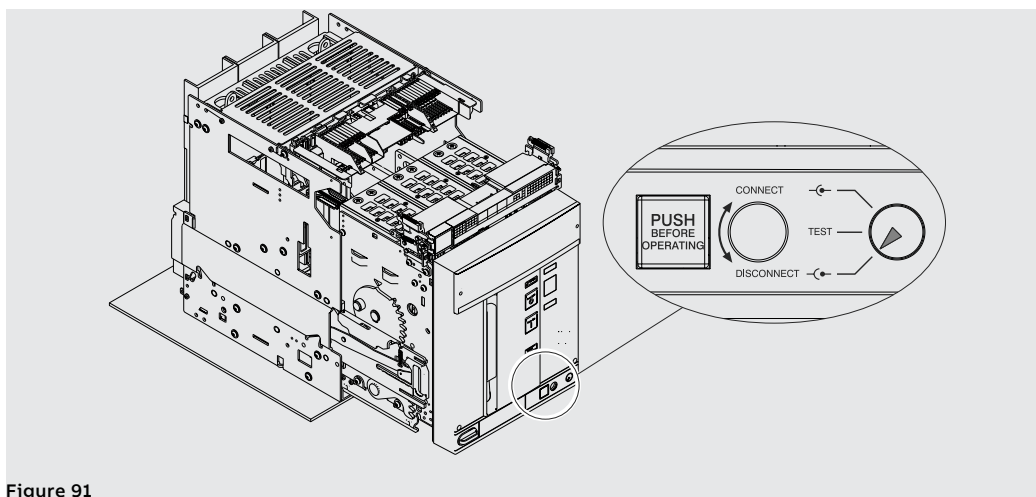


Figure 91

7. Grip the guide levers of the fixed part and push them until the moving part stops. See Figure 92.

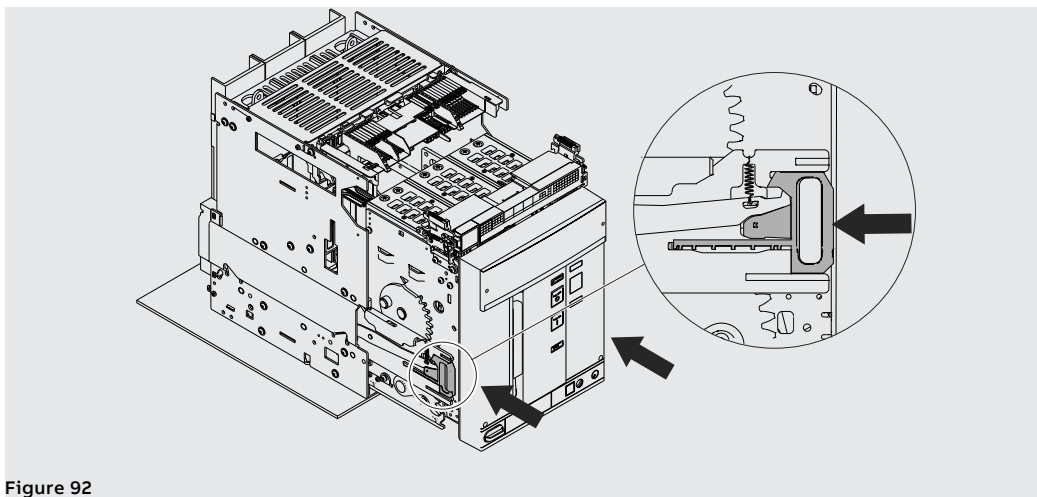


Figure 92

Continued on the next page

8. Extract the disconnection crank from its housing See Figure 93.
9. Press the lock pushbutton and fit the handle into the moving part. In this phase, the moving part will still be in the **DISCONNECT** position. See Figure 94.

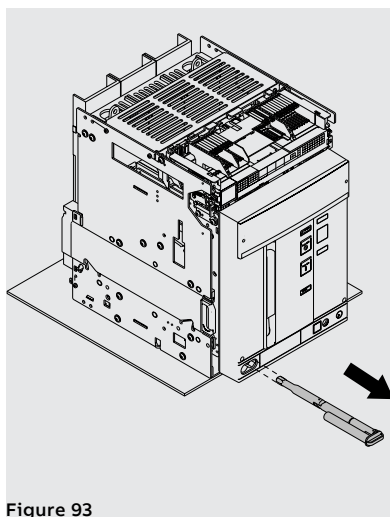


Figure 93

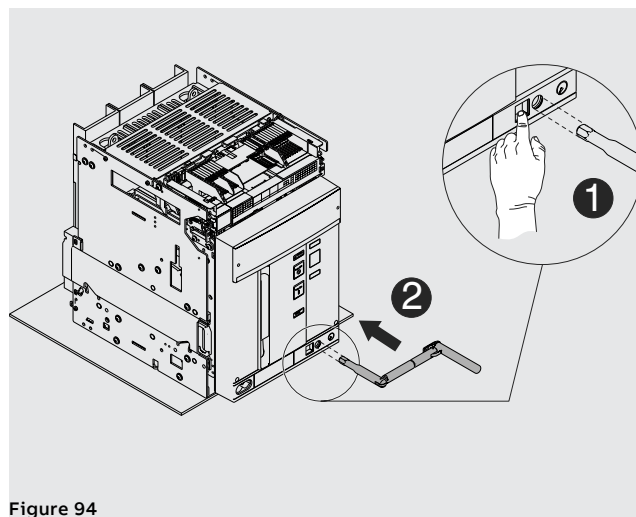


Figure 94

10. Turn the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **TEST** position. See Figure 95.

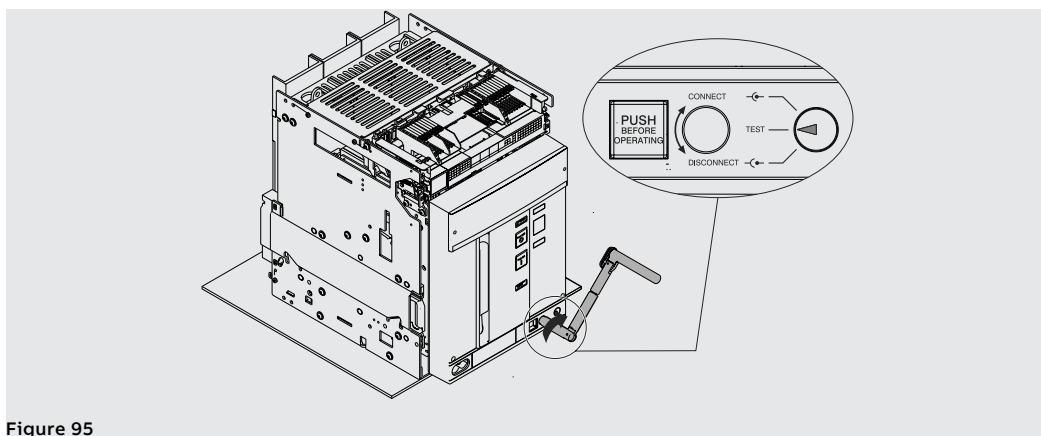


Figure 95

11. Press lock pushbutton and turn handle clockwise until pushbutton projects and signaling device indicates that circuit-breaker is in position **CONNECT**. See Figure 96.

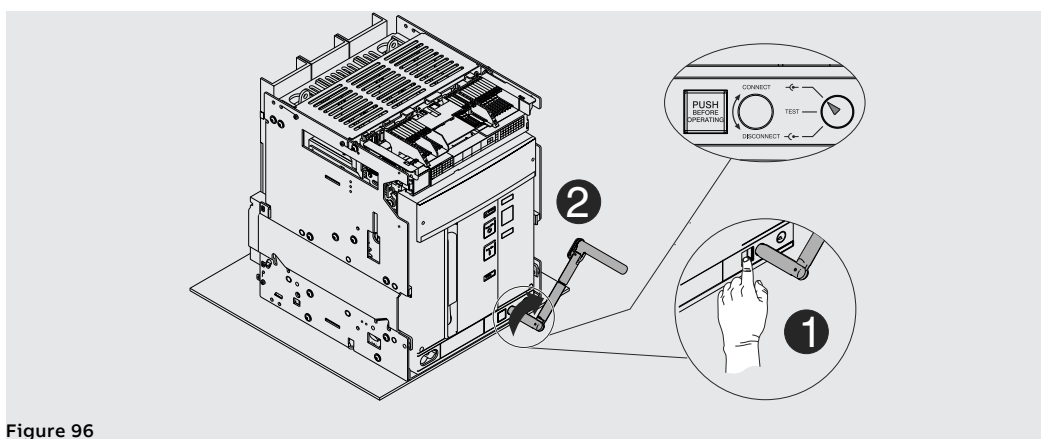


Figure 96

Continued on the next page

12. Extract the crank. See Figure 97.
13. Replace the crank in its housing See Figure 98.

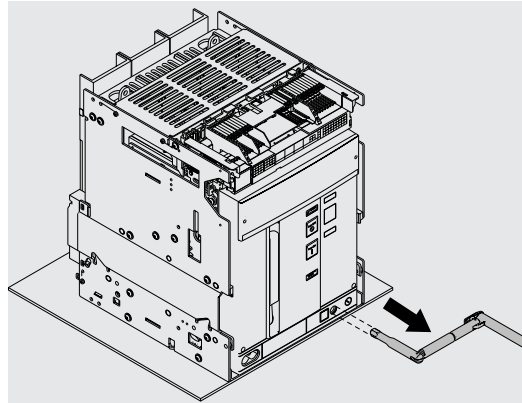


Figure 97

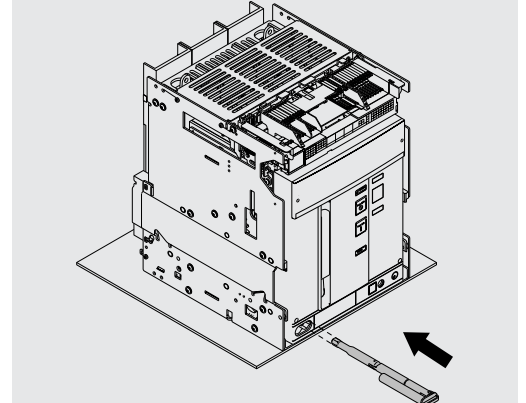


Figure 98



WARNING! The inserted circuit-breaker must be opened in order to be able to reach the test position. On the UL version, the fail safe prevents the removal of the circuit-breaker from the fixed part with springs charged. Discharge the springs before removing the circuit-breaker from the fixed part. For further details, consult the Mechanical safety accessories chapter.

To extract the moving part from the fixed part, perform the same steps indicated for insertion in reverse order.

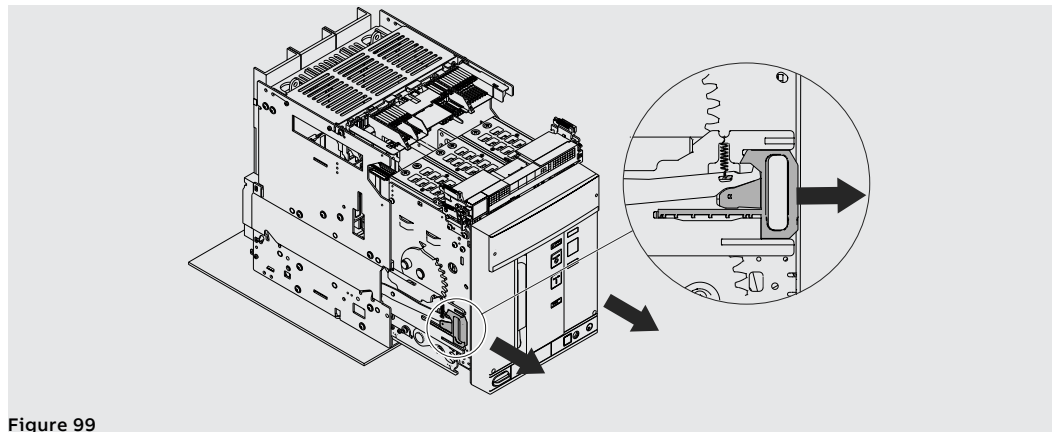


Figure 99

Continued on the next page

Always use both levers of the guides on the fixed part when racking out the circuit-breaker. See Figure 99.

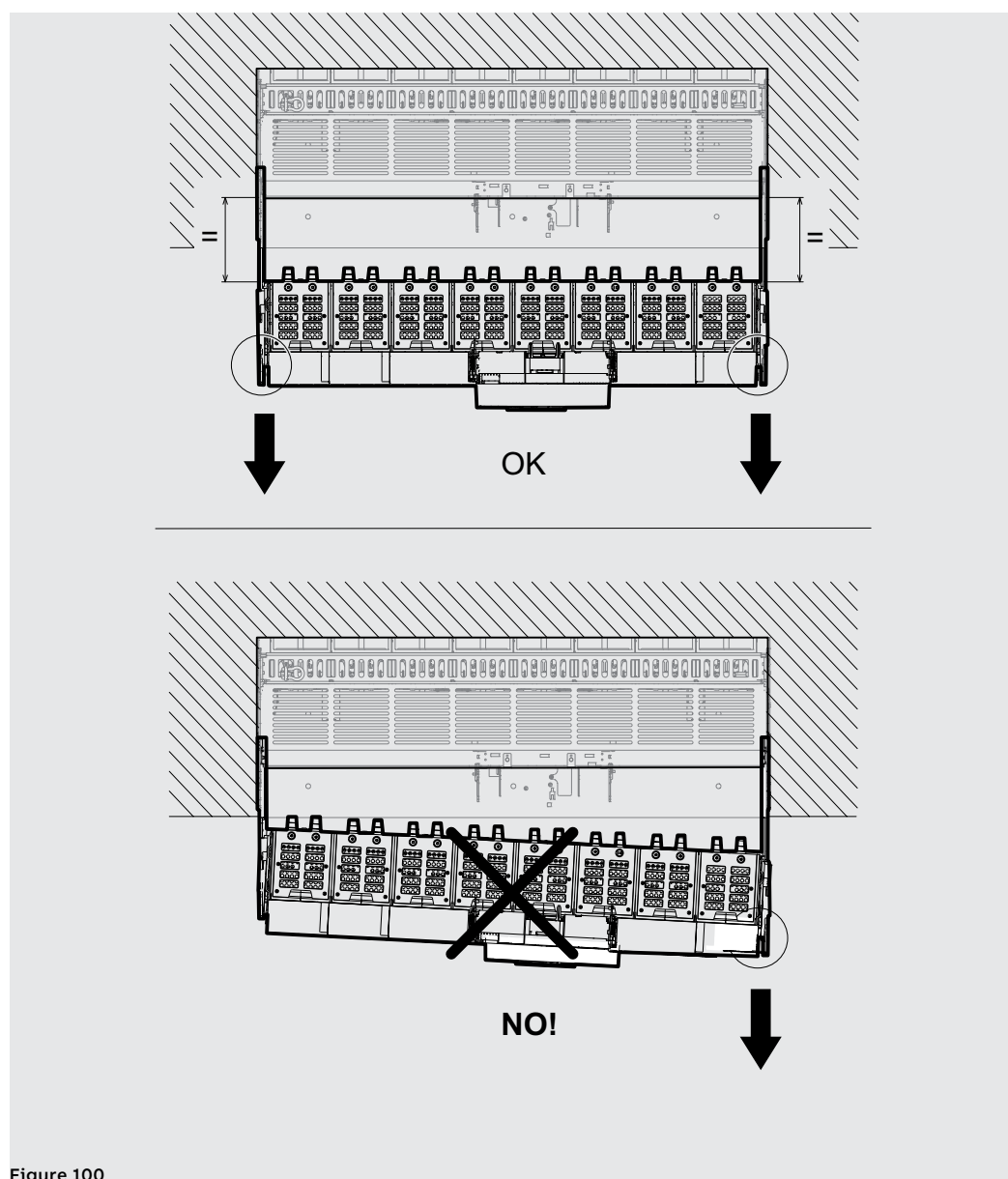


Figure 100



WARNING! When withdrawing the moving part, make sure that both guides on the fixed part travel to the same extent, thereby keeping the moving part parallel to the fixed part. See Figure 100.

Mechanical position indicators

The following are the possible positions where you can find the mobile part of a withdrawable circuit-breaker during its use:

- circuit breaker in DISCONNECT position (see Figure 101)
- circuit-breaker in test position (see Figure 102)
- circuit-breaker in CONNECT position (see Figure 103)

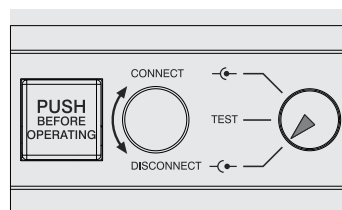


Figure 101

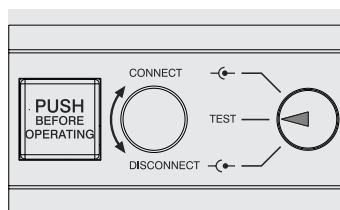


Figure 102

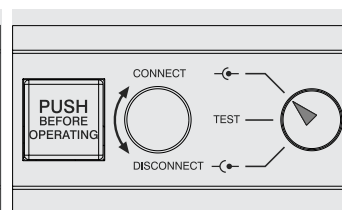


Figure 103

3 - Installation

Overall dimensions E1.2

Information on the overall dimensions is available on the website:

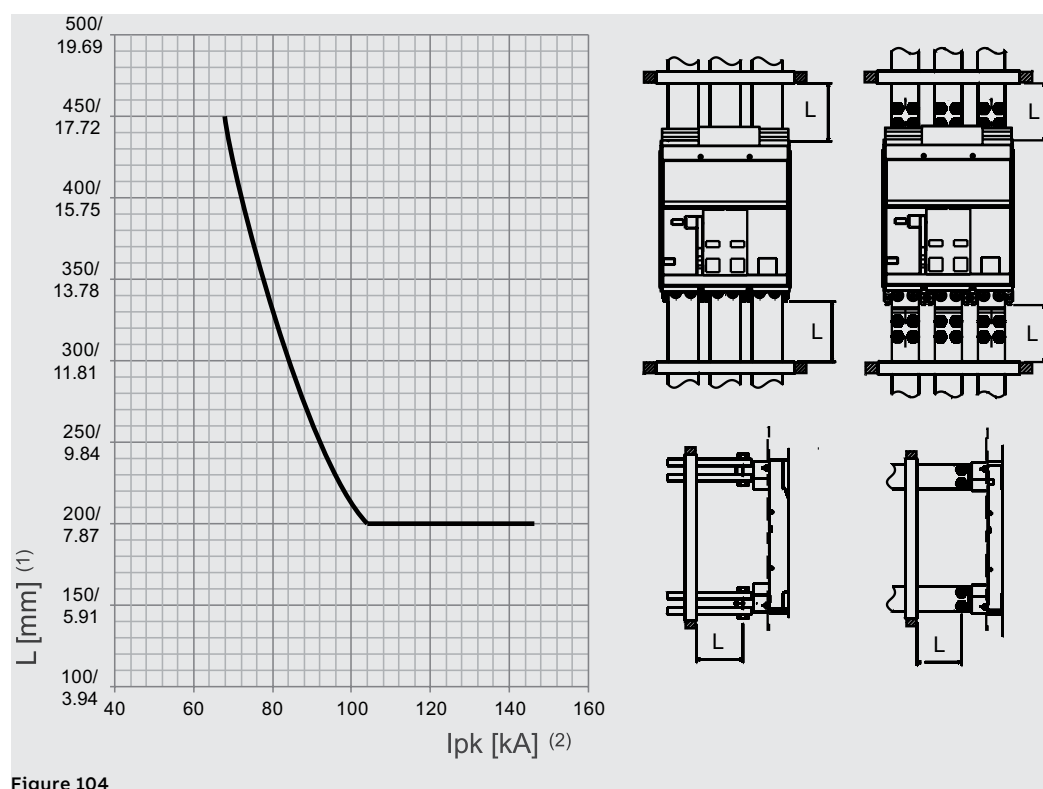
<http://www.abb.com/abblibrary/DownloadCenter/>.

The following drawings are also available in .dxf format:

- [1SDH000999R0101](#) - E1.2 III-IV Fixed F EF IEC-UL
- [1SDH000999R0102](#) - E1.2 III-IV Fixed FC IEC-UL
- [1SDH000999R0103](#) - E1.2 III-IV Withdrawable EF IEC-UL
- [1SDH000999R0104](#) - E1.2 III-IV Withdrawable ES IEC-UL
- [1SDH000999R0105](#) - E1.2 III-IV Withdrawable SHR IEC
- [1SDH000999R0106](#) - E1.2 III-IV Withdrawable FC IEC
- [1SDH000999R0107](#) - E1.2 III-IV Fixed HR-VR Positionable IEC
- [1SDH000999R0108](#) - E1.2 III-IV Fixed ES IEC-UL
- [1SDH000999R0109](#) - E1.2 III-IV Withdrawable HR-VR IEC
- [1SDH000999R0120](#) - E1.2 Flange Fixed Withdrawable IEC-UL
- [1SDH000999R0121](#) - E1.2 Floor mounting IEC-UL
- [1SDH000999R0303](#) - E1.2 III-IV Withdrawable Rear Terminals HR-VR UL
- [1SDH000999R0307](#) - E1.2 III-IV Fixed Rear Terminals HR-VR UL

Positioning anchor plates E1.2

The following diagram shows the distance for positioning the first anchor plate for E1.2 circuit-breakers according to the peak current:



(1): distance of the first anchor plate from the circuit-breaker terminals

(2): peak current

Overall dimensions E2.2- E4.2-E6.2

Information on the overall dimensions is available on the website:

<http://www.abb.com/abblibrary/DownloadCenter/>.

The following drawings are also available in .dxf format:

- [1SDH001000R0100](#) - E2.2 III-IV Fixed HR VR IEC
- [1SDH001000R0101](#) - E2.2 III-IV Fixed F IEC-UL
- [1SDH001000R0102](#) - E2.2 III-IV Withdrawable HR-VR IEC
- [1SDH001000R0103](#) - E2.2 III-IV Withdrawable F IEC
- [1SDH001000R0104](#) - E2.2 III-IV Fixed SHR IEC
- [1SDH001000R0105](#) - E2.2 III-IV Withdrawable SHR IEC
- [1SDH001000R0106](#) - E2.2 III-IV Fixed SVR IEC
- [1SDH001000R0107](#) - E2.2 III-IV Withdrawable SVR IEC
- [1SDH001000R0110](#) - E2.2 2000 III-IV Withdrawable FL IEC
- [1SDH001000R0111](#) - E2.2 2500 III-IV Withdrawable FL IEC
- [1SDH001001R0100](#) - E4.2 III-IV Fixed HR VR IEC
- [1SDH001001R0101](#) - E4.2 III-IV Fixed F IEC
- [1SDH001001R0102](#) - E4.2 III-IV Withdrawable HR-VR IEC
- [1SDH001001R0103](#) - E4.2 III-IV Withdrawable F IEC
- [1SDH001001R0104](#) - E4.2/E-E9-E10-E12 III-IV Fixed SHR IEC
- [1SDH001001R0105](#) - E4.2/E-E9-E10-E12 III-IV Withdrawable SHR IEC
- [1SDH001001R0106](#) - E4.2/E-E9-E10-E12 III-IV Fixed SVR IEC
- [1SDH001001R0107](#) - E4.2/E-E9-E10-E12 III-IV Withdrawable SVR IEC
- [1SDH001001R0110](#) - E4.2 3200 III-IV Withdrawable FL IEC
- [1SDH001001R0111](#) - E4.2 4000 III-IV Withdrawable FL IEC
- [1SDH001060R0100](#) - E6.2 III-IV Fixed HR IEC
- [1SDH001060R0101](#) - E6.2 III-IV Fixed VR IEC
- [1SDH001060R0102](#) - E6.2 IV FS Fixed HR-VR IEC
- [1SDH001060R0104](#) - E6.2 III-IV Fixed F IEC
- [1SDH001060R0105](#) - E6.2 III-IV Withdrawable HR IEC
- [1SDH001060R0106](#) - E6.2 III-IV Withdrawable VR IEC
- [1SDH001060R0107](#) - E6.2 IV FS Withdrawable HR-VR IEC
- [1SDH001060R0108](#) - E6.2 III-IV Withdrawable F IEC
- [1SDH001060R0110](#) - E6.2 6300 III-IV Withdrawable FL IEC
- [1SDH001000R0120](#) - E2.2-E4.2-E6.2 Fixed Withdrawable Flange IEC-UL
- [1SDH001000R0121](#) - E2.2-E4.2-E6.2 Fixed internal mounting IEC-UL
- [1SDH001000R0300](#) - E2.2 III-IV Fixed HR-VR UL
- [1SDH001000R0302](#) - E2.2 III-IV Withdrawable HR-VR UL
- [1SDH001000R0303](#) - E2.2 III-IV Withdrawable F UL
- [1SDH001001R0300](#) - E4.2 III-IV Fixed HR-VR UL
- [1SDH001001R0302](#) - E4.2 III-IV Withdrawable HR-VR UL
- [1SDH001001R0303](#) - E4.2 III-IV Withdrawable F UL
- [1SDH001001R0304](#) - E4.2 III-IV Fixed HR-VR UL
- [1SDH001001R0305](#) - E4.2 III-IV Withdrawable HR-VR UL
- [1SDH001001R0306](#) - E4.2 3600 III-IV Fixed UL
- [1SDH001060R0300](#) - E6.2 III-IV Fixed HR UL
- [1SDH001060R0301](#) - E6.2 III-IV Fixed VR UL
- [1SDH001060R0302](#) - E6.2 IV FS Fixed HR-VR UL
- [1SDH001060R0305](#) - E6.2 III-IV Withdrawable HR UL
- [1SDH001060R0306](#) - E6.2 III-IV Withdrawable VR UL
- [1SDH001060R0307](#) - E6.2 IV FS Withdrawable HR-VR UL
- [1SDH001060R0308](#) - E6.2 III-IV-IV FS Withdrawable F UL
- [1SDH001060R0309](#) - E6.2 III-IV Fixed VR UL
- [1SDH001060R0310](#) - E6.2 IV FS Fixed VR UL
- [1SDH001060R0311](#) - E6.2 III-IV Withdrawable VR UL
- [1SDH001060R0312](#) - E6.2 IV FS Withdrawable VR UL
- [1SDH001060R0313](#) - E6.2 6000 III Withdrawable VR UL

Positioning anchor plates E2.2-E4.2-E6.2

The following diagram shows the distance for positioning the first anchor plate for E2.2-E4.2-E6.2 circuit-breakers according to the peak current:

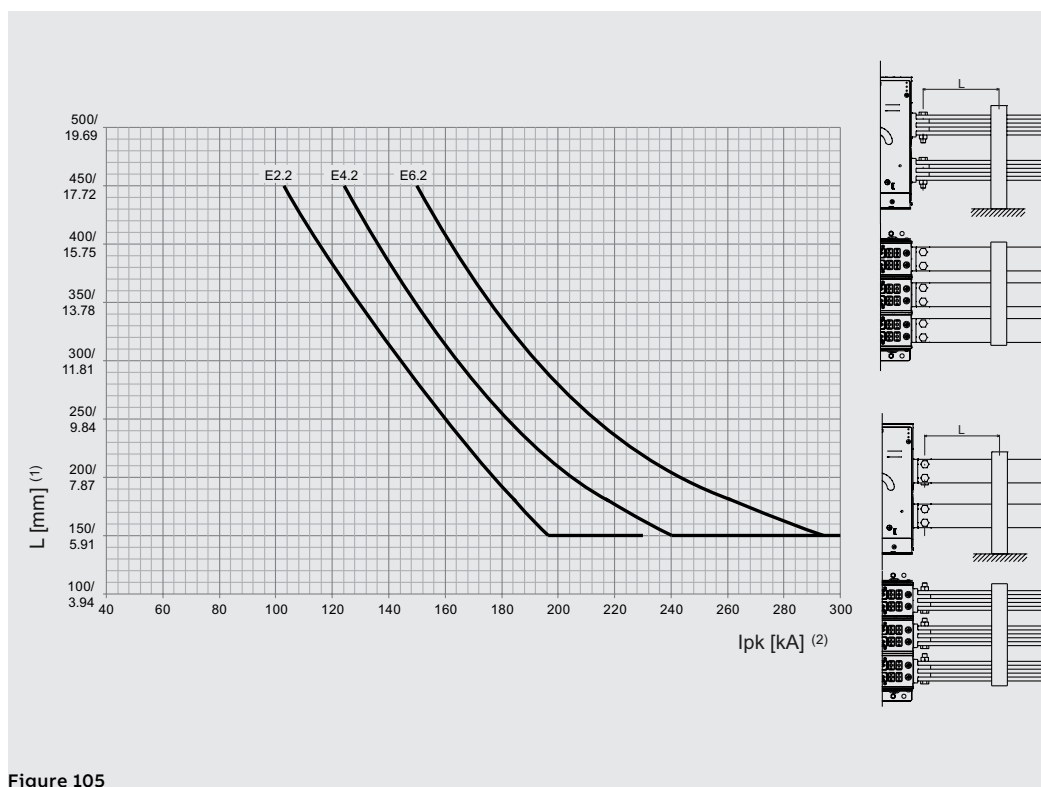


Figure 105

(1): distance of the first anchor plate from the circuit-breaker terminals
(2): peak current

Positioning anchor plates E4.2-A 3200A / 3600A Fixed

The anchor plates must be positioned as indicated in the figure.

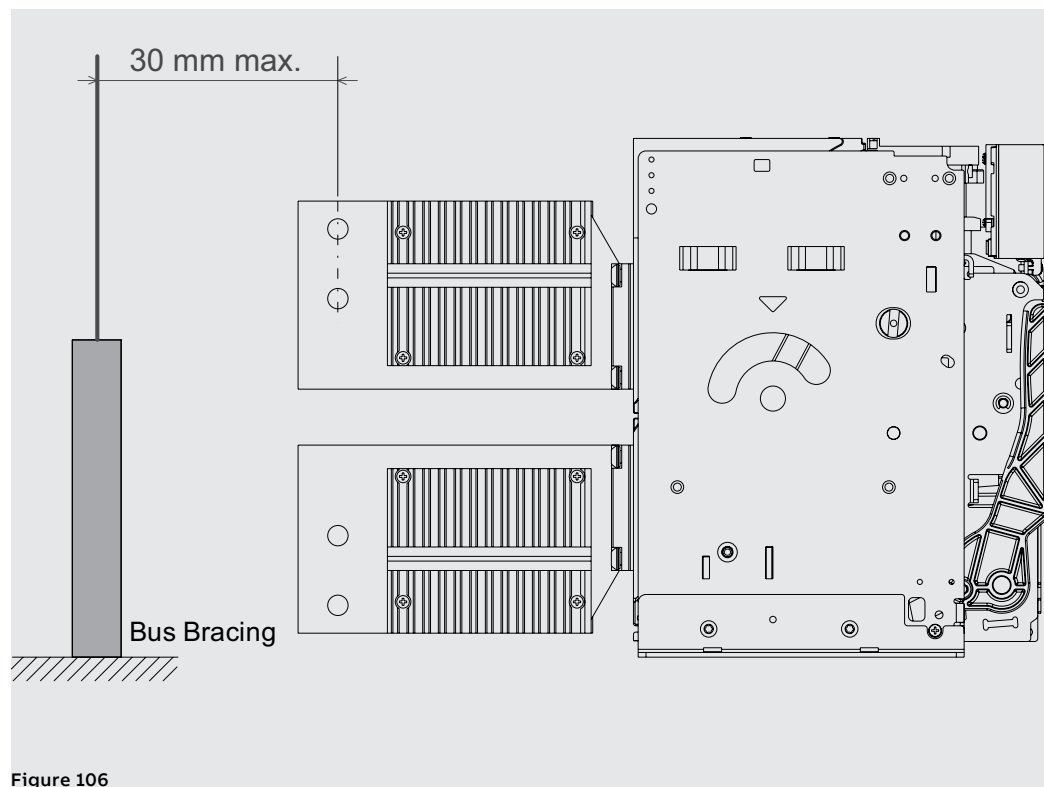


Figure 106

Continued on the next page

Positioning of anchor plates for Terminals FL

The anchor plates must be positioned as indicated in the figure.

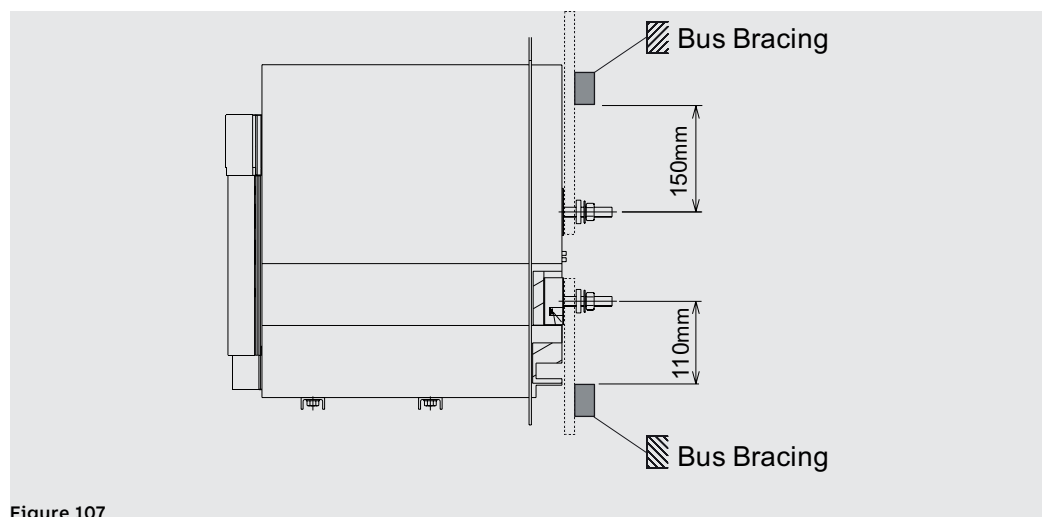


Figure 107

>690V version IEC circuit-breakers

>690V disconnectors and circuit-breakers are available in the following configurations:

Circuit-breaker	Voltage	Version
E1.2/E9	800 V	F ⁽¹⁾ - W ⁽²⁾
E2.2/E9/E10	800/900/1000 V	F ⁽³⁾ - W
E4.2/E9/E10/E12	800/900/1000/1150/1200 V	F ⁽³⁾ - W
E6.2/E9	800/900 V	F ⁽³⁾ - W

⁽¹⁾ Mandatory provision with front terminals (F) and high terminal covers (HTC)

⁽²⁾ Mandatory provision with positionable rear terminals (HR/VR) and phase separators (PB)

⁽³⁾ Insulating protections are mandatory for >690 V fixed versions of E2.2, E4.2 and E6.2.

Details about assembling insulating protections are available at <http://www.abb.com/abblibrary/DownloadCenter/>, especially in the kit sheet [1SDH001000R0746](#).

>635V version UL circuit-breakers

>635V disconnectors and circuit-breakers are available in the following configurations:

Circuit-breaker	Voltage	Version
E4.2H-A/E	730V	F ⁽¹⁾

⁽¹⁾ With insulating protections

Details about assembling insulating protections are available at <http://www.abb.com/abblibrary/DownloadCenter/>, especially in the kit sheet [1SDH001000R0746](#).

Earthing (for E2.2-E4.2-E6.2 only)

The circuit-breakers in fixed version and the fixed part of withdrawable circuit-breakers are equipped with a screw for the ground connection.

The connection must be implemented by means of a conductor of suitable cross-section according to the IEC 61439-1 Standard.

Clean and degrease the area around the screw before making the connection.

After assembly of the conductor, tighten the screw with a torque of 2 N m - 17.7 lb in.

Alternatively, no connection will be required if circuit-breaker frame continuity with the switchgear earthing is provided by the metal contact (support) between the circuit-breaker and the metal structure of the switchgear (or a part of the protection circuit) (as long as there are no insulating panels between the circuit-breaker and the metal frame of the switchgear).

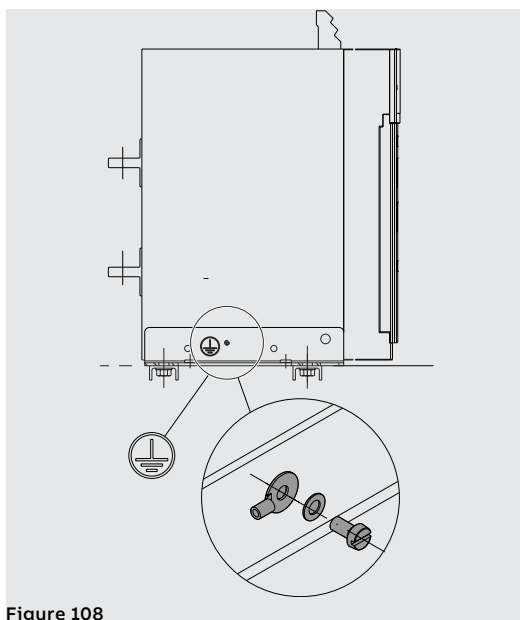


Figure 108

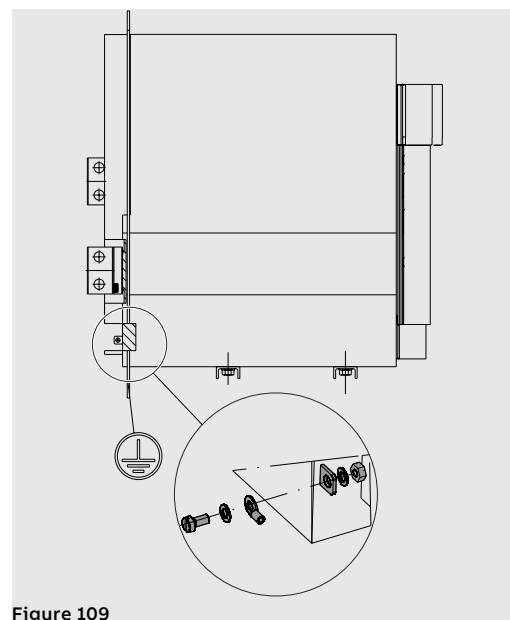


Figure 109

Clearances

Information on clearances is available on the website:

<http://www.abb.com/abblibrary/DownloadCenter/>

The following layout is also available [1SDH001301R0001](#) - Cubicle E1.2-E2.2-E4.2-E6.2

Phase separators (for E2.2-E4.2-E6.2 only)

Phase barriers are mandatory for 2ps configuration. For the 4ps configuration it is possible to place isolation barriers for the segregation of live parts. In addition, the phase separators are mandatory:

- If, between two phases, the minimum distance between the screws that fix the circuit-breaker terminals to the connection bars is less than 14 mm - 0.55".
- For circuit breakers version IEC >690V and UL >635V.

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0810](#).

Connection to the power circuit

A circuit-breaker is connected to the power circuit using the connection busbars of the switchboard fixed to the circuit-breaker terminals.

Emax 2 circuit-breakers are tested in accordance with standards IEC 60947.2-3 and UL 1066.

The switchboard designer is responsible for busbar sizing, which must be validated by application of the tests provided for by the pertinent standards.



IMPORTANT: before proceeding with the connection between terminals and connection busbars:

- Make sure that the contact surfaces of the busbars are free of burrs, dents, traces of rusting, dust or traces of grease.
- Make sure, if aluminium busbars are used, than they are tin plated in the contact areas.
- Make sure that the busbars do not exert forces in any direction on the terminal.
- Tightening: for E1.2 use M10 screws with resistance class 8.8 equipped with spring washers and lock them with a torque of 45 Nm - 398.3 lb in
- Tightening: for E2.2-E4.2-E6.2 use M12 screws with resistance class 8.8 equipped with spring washers and lock them with a torque of 70 Nm - 619.5 lb in



IMPORTANT: it is possible to obtain different capacities for the connections by altering the thickness and number of busbars in parallel.



NOTE: the information on the performances of the circuit-breakers in switchboards is available on the website:

<http://new.abb.com/low-voltage/products/circuit-breakers/emax2>.

The connection for the E1.2 circuit-breaker is shown below as well as the tables with some examples of the amount and sizes of the connections that can be used for each type of circuit-breaker:

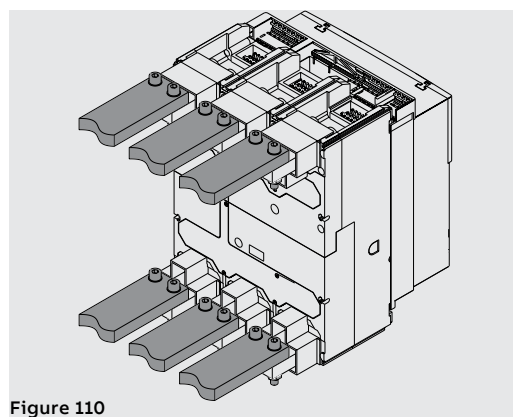


Figure 110

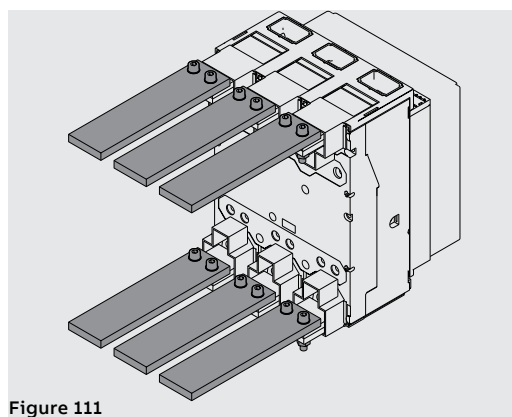


Figure 111

circuit-breaker IEC 60947	Iu (A)	Dimension of busbars (mm)	
		Horizontal terminals	Vertical terminals
E1.2	630	2x40x5	2x40x5
E1.2	800	2x50x5	2x50x5
E1.2	1000	2x50x10	2x50x8
E1.2	1250	2x50x10	2x50x8
E1.2	1600	3x50x8	2x50x10

circuit-breaker UL 1066	Iu (A)	Dimension of busbars (inches)	
		Horizontal terminals	Vertical terminals
E1.2-A	800	2x1/4x2	1x1/4x3
E1.2-A	1200	3x1/4x2	2x1/4x2

Continued on the next page

The connection for the E2.2-E4.2-E6.2 circuit-breakers is shown below as well as the tables with some examples of the amount and sizes of the connections that can be used for each type of circuit-breaker:

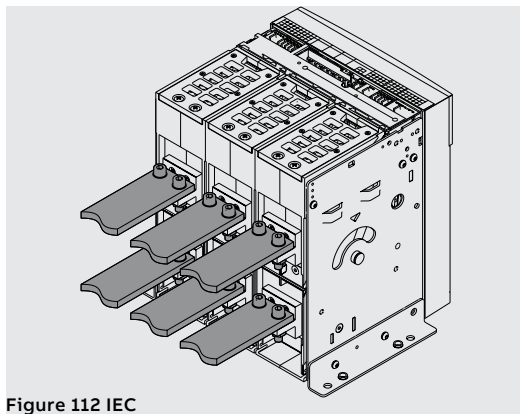


Figure 112 IEC

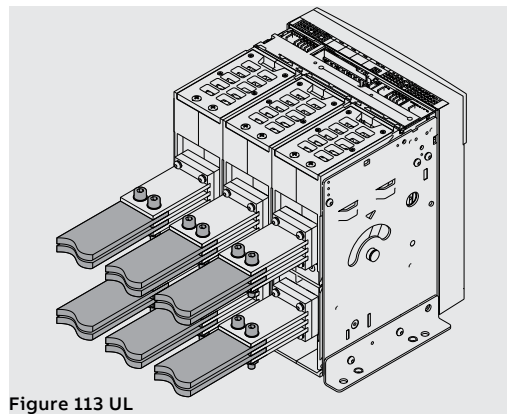


Figure 113 UL

circuit-breaker IEC 60947	I _u (A)	Dimension of busbars (mm)	
		Horizontal terminals	Vertical terminals
E2.2	800	1x50x10	1x50x10
	1000	2x50x5	2x50x5
	1250	2x50x10	2x50x10
	1600	2x60x10	1x100x10
	2000	3x60x10	2x80x10
		3x60x10 ⁽¹⁾	2x80x10 ⁽¹⁾
	2500	3x60x10	4x100x5
		3x60x10 ⁽¹⁾	4x100x5 ⁽¹⁾
E4.2	2000	2x80x10	2x80x10
	2500	2x100x10	2x100x10
	3200	3x100x10	3x100x10
	4000	4x100x10	4x100x10
E6.2	4000	4x100x10	4x100x10
	5000	5x100x10	5x100x10
	6300	6x100x10	6x100x10

⁽¹⁾ values for spread terminals

circuit-breaker UL 1066	I _u (A)	Dimension of busbars (inches)	
		Horizontal terminals	Vertical terminals
E2.2-A	1600	4x1/4x2	3x1/4x2
		3x1/4x2.5	2x1/4x3
	2000	4x1/4x2.5	4x1/4x2
E4.2-A	2000	4x1/4x2.5	4x1/4x2
	2500	4x1/4x4	3x1/4x4
	3200	-	4x1/4x4
	3600	-	4x1/4x5
E6.2-A	4000	4x1/4x5	4x1/4x5
	5000	8x1/4x5	6x1/4x5
	6000	-	6x1/4x6

Continued on the next page

To optimize the thermal efficiency, it is recommended to adhere to the following installation guidelines:

- Guarantee the maximum possible distance between the input and output busbars. See the example Figure 114.
- Guarantee the maximum use of the surface of the terminal. See the example Figure 115.
- Make sure that the distance between the holes and the end of the terminal and between the holes and extremity of the busbar is the same. See the example Figure 116.
- Make sure that, accordingly to the number of busbars and terminal tangs, the busbars of the lateral phases are as distant as possible from the busbars of the central phase. See the example Figure 117.

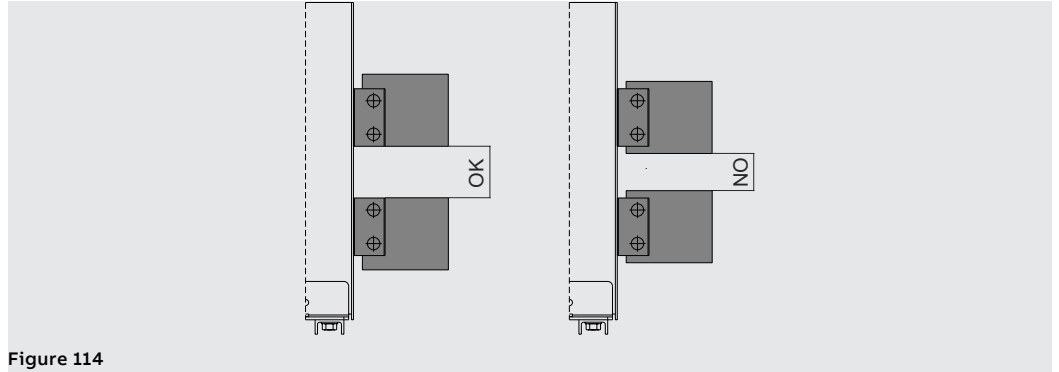


Figure 114

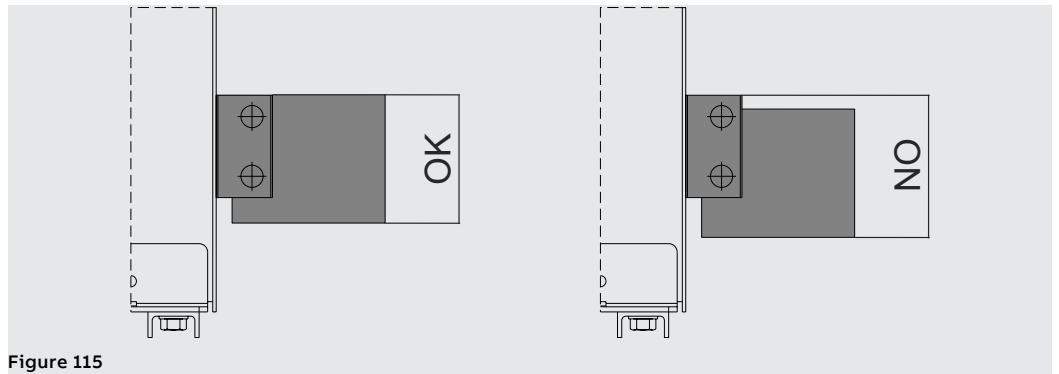


Figure 115

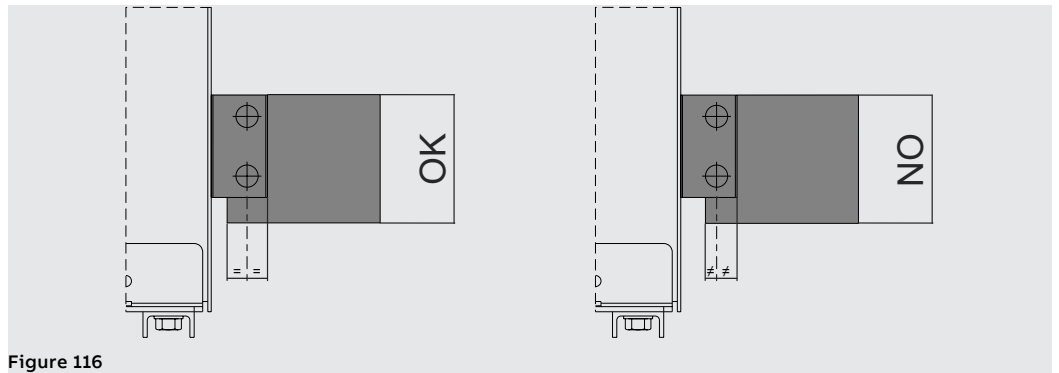


Figure 116

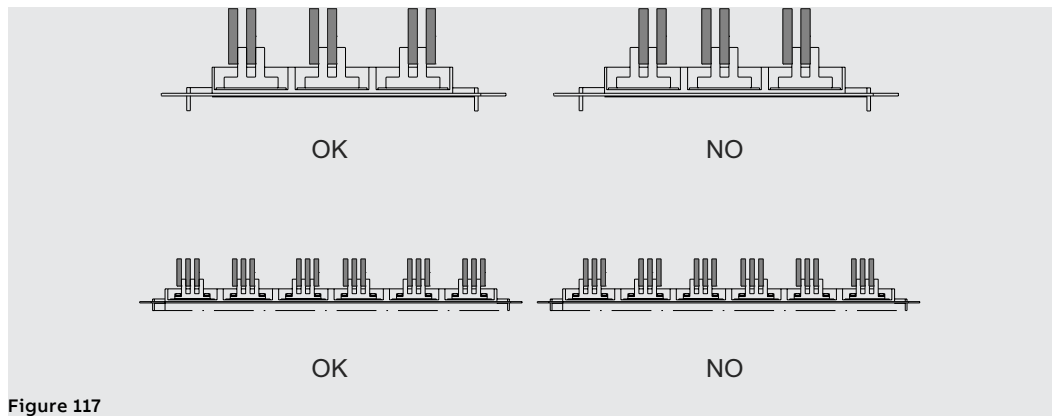


Figure 117

4 - Technical characteristics

- Protection degree** SACE Emax 2 circuit-breakers guarantee the following protection degrees:
- IP20 for circuit-breakers in fixed or withdrawable versions, excluding the terminals
 - IP30 for the front parts of the circuit-breaker when it is installed in a switchboard with IP30 flange mounted on the door
 - IP54 in circuit-breakers equipped with an optional IP54 transparent flange fitted to the front door of the switchboard

Dissipated power To guarantee the performance of the switchgear in terms of uninterrupted rated capacity, the design of the switchgear must take into account the power dissipated by switchgear and controlgear and by the installed live parts. Dissipated powers are calculated according to the standard IEC 60947. The values indicated in the table refer to the total power for each three-phase circuit-breaker with balanced loads with a current flow equal to the rated uninterrupted current I_u . These power dissipations are measured according to the standard IEC 60947. The values indicated in the table refer to the total power of the circuit-breakers in three-pole and four-pole versions with balanced loads and a current flow equal to the rated uninterrupted current I_u at 50/60 Hz.

I_u	Dissipated power [W]							
	E1.2 B/C/N		E2.2 B/N/S/H		E4.2 N/S/H/V		E6.2 H/V/X	
	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾
630A	31	62						
800A	50	100	34	72				
1000A	78	156	53	113				
1250A	122	244	83	176				
1600A	201	400	136	288				
2000A			212	450				
2500A			267	550				
3200A					425	743		
4000A					465	900	309	544
5000A							483	850
6300A							767	1350

I_u	Dissipated power [W]													
	E1.2 B/N/S - A		E2.2 B/N/S - A		E2.2 H/V - A E2.2 2000A B/N/S - A		E4.2 S/H/V - A		E4.2 L - A E4.2 3200A S/H/V - A		E6.2 H/V - A		E6.2 L - A	
	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾	F ⁽¹⁾	W ⁽²⁾
250A	7	14												
400A	17	35	15	22	15	22								
800A	59	118	48	73	48	68	44	58	42	49				
1200A	125	250	100	152	99	138	86	114	81	111				
1600A			170	260	167	233	143	189	132	181				
2000A					250	350	211	279	193	264				
2500A							310	410	280	384				
3200A									445	610	323	438		
3600A									578		395	536		
4000A											476	646	476	646
5000A											700	950	700	950
6000A											1484			

⁽¹⁾ Fisso - Fixed - Fest - Fixe - Fijo

⁽²⁾ Estraibile - Withdrawable - Ausfahrbarer - Débrochable - Extraíble

Derating due to temperature

In certain installations, the circuit-breakers could end up operating at a temperature above the reference temperature (40 °C). In such cases the rated capacity of the circuit-breaker may be reduced. To find out the percentage of reduction to be applied to the capacity consult the following table:

Emax 2 E1.2	Temperature [°C]						
	< 40	45	50	55	60	65	70
E1.2 250	100%	100%	100%	100%	100%	100%	100%
E1.2 630	100%	100%	100%	100%	100%	100%	100%
E1.2 800	100%	100%	100%	100%	100%	100%	100%
E1.2 1000	100%	100%	100%	100%	100%	100%	100%
E1.2 1250	100%	100%	100%	100%	100%	100%	100%
E1.2 1600	100%	100%	100%	98%	95%	93%	90%

Emax 2 E2.2	Temperature [°C]						
	< 40	45	50	55	60	65	70
E2.2 250	100%	100%	100%	100%	100%	100%	100%
E2.2 630	100%	100%	100%	100%	100%	100%	100%
E2.2 800	100%	100%	100%	100%	100%	100%	100%
E2.2 1000	100%	100%	100%	100%	100%	100%	100%
E2.2 1250	100%	100%	100%	100%	100%	100%	100%
E2.2 1600	100%	100%	100%	100%	100%	100%	98%
E2.2 2000	100%	100%	100%	100%	95%	91%	87%
E2.2 2500	100%	100%	100%	100%	98%	94%	90%

Emax 2 E4.2	Temperature [°C]						
	< 40	45	50	55	60	65	70
E4.2 2000	100%	100%	100%	100%	100%	100%	100%
E4.2 2500	100%	100%	100%	100%	100%	100%	100%
E4.2 3200	100%	100%	97%	93%	89%	86%	82%
E4.2 4000	100%	100%	94%	90%	86%	83%	80%

Emax 2 E6.2	Temperature [°C]						
	< 40	45	50	55	60	65	70
E6.2 4000	100%	100%	100%	100%	100%	100%	100%
E6.2 5000	100%	100%	100%	100%	100%	98%	95%
E6.2 6300	100%	100%	95%	91%	87%	84%	81%

Accessories

1 - Overview

Introduction All circuit-breakers have a set of electrical and mechanical accessories (application of which depends on the type of circuit-breaker) and a set of electronic accessories (application of which depends on the type of Ekip release with which the circuit-breaker is equipped).

Mechanical and electrical accessories The following table shows the possible combinations of the electrical and mechanical accessories for E1.2:

Type of accessory	Accessory	Circuit-breakers	Switch-disconnectors
Electrical signalling	AUX 4Q	S	R
	AUX 15Q	R	R
	Ekip AUP ⁽¹⁾	R	R
	Ekip RTC	R	R
	S51	S	-
	S33 M/2	R	R
Electrical control	YO ⁽⁴⁾ - YC	R	R
	YO2 ⁽⁴⁾	R	R
	YU ⁽²⁾⁽⁴⁾	R	R
	M	R	R
	YR	R	-
Security mechanical	KLC - PLC	R	R
	KLP - PLP ⁽¹⁾	R	R
	SL ⁽¹⁾	S	S
	DLC	R	R
	Anti-insertion lock	S	S
	MOC	R	R
	FAIL SAFE ⁽³⁾	R	R
Protection mechanical	PBC	R	R
	IP54	R	R
	HTC-LTC	R	R
	PB	R	R
Interlocks	MI	R	R

S: Standard. R: on request.

⁽¹⁾ For withdrawable version only.

⁽²⁾ Incompatible with FAIL SAFE. Can be ordered for UL on request

⁽³⁾ Incompatible with YU; standard for UL version.

⁽⁴⁾ A maximum of two accessories are available for YO and YU.

Continued on the next page

The following table shows the possible combinations of the electrical and mechanical accessories for E2.2-E4.2-E6.2:

Type of accessory	Accessory	Circuit-breakers	Switch-disconnectors	Derived versions		
				CS	MV	MTP
Electrical signalling	AUX 4Q	S	R	-	-	-
	AUX 6Q	R	R	-	-	-
	AUX 15Q ⁽⁵⁾	R	R	-	-	-
	Ekip AUP ⁽¹⁾	R	R	R	R	R
	Ekip RTC	R	R	-	-	-
	S51	S	-	-	-	-
	S51/2 ⁽⁶⁾	R	-	-	-	-
	S33 M/2	R	R	-	-	-
Electrical control	YO ⁽⁴⁾ - YC	R	R	-	-	-
	YO2 ⁽⁴⁾ - YC2	R	R	-	-	-
	YU ⁽²⁾⁽⁴⁾	R	R	-	-	-
	YU2 ⁽²⁾⁽⁴⁾	R	R	-	-	-
	M	R	R	-	-	-
	YR	R	-	-	-	-
Security mechanical	KLC - PLC	R	R	-	-	-
	KLP - PLP ⁽¹⁾	R	R	-	-	R
	SL ⁽¹⁾	S	S	-	-	S
	DLR ⁽¹⁾	R	R	-	-	R
	DLP ⁽¹⁾	R	R	-	-	R
	DLC ⁽⁵⁾	R	R	-	-	R
	Anti-insertion lock	S	S	-	-	S
	MOC	R	R	-	-	R
	FAIL SAFE ⁽³⁾	R	R	-	-	R
Protection mechanical	PBC	R	R	-	-	R
	IP54	R	R	-	-	R
Interlocks	MI ⁽⁵⁾	R	R	-	-	R
Lifting plates	-	R	R	-	-	-

S: Standard. R: on request.

⁽¹⁾ For withdrawable version only.

⁽²⁾ Incompatible with FAIL SAFE. Can be ordered for UL on request

⁽³⁾ Incompatible with YU; standard for UL version.

⁽⁴⁾ A maximum of two accessories are available for YO and YU.

⁽⁵⁾ Not available for withdrawable circuit-breakers with lateral fastening.

⁽⁶⁾ Incompatible with YR

Electronic accessories

The following table shows the possible combinations of the electronic accessories:

Type of accessory	Accessory	Trip units				
		Ekip Dip	Ekip Touch	Ekip Hi-Touch	Ekip G Touch	Ekip G Hi-Touch
Power supply	Ekip Supply	R	R	R	R	R
Connectivity	Ekip Com	-	R	R	R	R
	Ekip Com Redundant	-	R	R	R	R
	Ekip Com Actuator	R	R	R	R	R
	Ekip Link	R	R	R	R	R
	Ekip Signalling Modbus TCP	R	R	R	R	R
Signal	Ekip Signalling 2K	-	R	R	R	R
	Ekip Signalling 3T	-	R	R	R	R
	Ekip Signalling 4K	-	R	R	R	R
	Ekip Signalling 10K	R	R	R	R	R
Measurement and Protection	Measurement enabler	-	R	-	-	-
	Measurement enabler with voltage socket	-	R	S	S	S
	Ekip Synchrocheck	-	R	R	R	R
	Rating Plug	R	R	R	R	R
	S.G.R. Toroid	-	R	R	R	R
	Rc Toroid	-	R	R	R	R
	External neutral sensor	R	R	R	R	R
Display and Supervision	Ekip Multimeter	R	R	R	R	R
	Ekip Control Panel	R	R	R	R	R
Testing and Programming	Ekip TT	R	S	S	S	S
	Ekip T&P	R	R	R	R	R
	Ekip Programming	R	R	R	R	R

S: Standard. R: on request.



NOTE: Ekip Signalling 4K module available for E2.2-E4.2-E6.2 circuit-breakers.

Wiring diagrams

The internal connections of the circuit-breaker, the connections to the external terminal box of all accessories and all related notes are indicated on the wiring diagrams.

There is one document and it is valid for all SACE Emax 2 CBs, with certain considerations distinguishing the various models/versions also described on the actual diagrams:

- access to certain connections and accessories in the terminal box differs, depending on whether the version is fixed or withdrawable
- Emax E1.2 can be fitted with three modules (one Ekip Supply + two other modules); E2.2-E4.2-E6.2 can be fitted with up to four modules (one Ekip Supply + three other modules)
- Ekip Signalling 4K module: Emax E1.2 does not have the connections for Q5...Q10 / Ekip Signalling 4K

Information about the wiring diagram is available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, especially in document [1SDM000091R0001](#).

Operating conditions

Ekip Synchrocheck, *Ekip Com* and *Ekip Signalling* function correctly:

- In the presence of auxiliary supply voltage
- With the circuit-breaker in the Racked-in position (if the CB version is withdrawable)

The limitations listed below apply in all the other cases:

Module\ Condition	Ekip Synchro-check	Ekip Com	Ekip Signalling 2K Ekip Signalling 3T Ekip Signalling 10K	Ekip Signalling 4K
Module power supply absent	Synchronism contact open	Communication: absent	Output contacts: open	Output contacts: open
CB in Test ⁽¹⁾⁽²⁾ position	Synchronism: not available ⁽⁴⁾	Communication: active	Inputs and output contacts: available	Inputs and output contacts: available
CB in DISCONNECTED ⁽¹⁾ ⁽³⁾ position	Synchronism: not available ⁽⁴⁾	Communication: partially active ⁽⁵⁾	Inputs and output contacts: partial available ⁽⁶⁾	Module power supply off (Output contacts: open)

⁽¹⁾ the description refers to the module when correctly on and with the CB in the indicated position

⁽²⁾ in the Test position, the Trip unit is connected to the modules and all information is available on the display or via external communication

⁽³⁾ in the Racked-out position, connection and communication between Trip unit and modules is interrupted. Information is not available/valid

⁽⁴⁾ due to voltage not connected to the internal sockets

⁽⁵⁾ see System Interface, INFORMATION WITH PROTECTION TRIP UNIT DISCONNECTED section (next page)

⁽⁶⁾ the outputs only function correctly if configured as: input status (of module itself) or non-communication with Trip unit. For all other configurations, the module forces the Outputs as per Contact Type parameter (NO, NC).

System Interface

Document 1SDH001140R0001.zip, describing how to use the Ekip Com communication modules correctly, is available in ABB library; the file contains:

Document	Description
1SDH001140R0001.pdf	Guidelines with details about how to put the communication modules into service, with reference to the protocols and supporting documents
1SDH001140R0001.xlsx	Table with the references of all the registers for parameters, controls, measurements, etc.

The .zip file contains the files for supplementing Ekip Touch in the available communication networks, with the specific Ekip Com module and an IMPORTANT file with notes on how to use the files:

File ⁽¹⁾⁽²⁾	Protocol / Ekip Com module
ABBS0E7F.gsd + EkiDPB.bmp	File .gsd and module image for configuring <i>Ekip Com Profibus DP</i>
Ekip_COM_EtherNetIP_M4_vx_xx.eds	File .eds for configuring <i>Ekip Com EtherNet/IP™</i>
Ekip_COM_DeviceNet_vx_xx.eds	File .eds for configuring <i>Ekip Com DeviceNet™</i>
ABBECxxxx_Ed1.icd ABBECxxxx_Ed2.icd	File .icd for configuring <i>Ekip Com IEC 61850</i>
GSDML-Vx.xx.xml	File .xml for configuring <i>Ekip Com Profinet</i>

⁽¹⁾ The files are also valid for the respective Redundant versions.

⁽²⁾ Check the Firmware version of your module so as to choose the file with the correct configuration.

2 - Standard accessories

Accessories for fixed circuit-breakers

Fixed version SACE Emax 2 circuit-breakers and switch-disconnectors are always supplied with the following accessories as standard:

- IP30 protection for the switchgear door
- front terminals for E1.2 circuit-breakers
- orientable rear terminals for E2.2-E4.2-E6.2 circuit-breakers, mounted in HR – HR position
- screws for mounting in switchboards

In addition, for automatic circuit-breakers only, the following accessories are always supplied:

- four standard open/closed auxiliary contacts - AUX 4Q
- four terminals for the auxiliary connections
- mechanical signalling for protection trip unit tripping - Ekip TU Reset
- Ekip TT power supply and test unit, when a protection unit is present on display
- Ekip protection trip unit tripping signalling contact S51

Accessories for withdrawable circuit-breakers

Withdrawable version SACE Emax 2 circuit-breakers and switch-disconnectors are always supplied with the following accessories as standard:

- anti-extraction locking mechanism with the circuit-breaker closed
- racking-in/racking-out lever
- anti-insertion lock

In addition, for automatic circuit-breakers only, the following accessories are always supplied:

- four standard open/closed auxiliary contacts - AUX 4Q
- four terminals for the auxiliary connections
- mechanical signalling for protection trip unit tripping - Ekip TU Reset
- Ekip TT power supply and test unit, when a protection unit is present on display

The fixed parts of the withdrawable versions are always supplied with:

- IP30 protection for the switchgear door
- anti-insertion lock
- standard shutter lock - SL
- screws for floor mounting
- orientable rear terminals

Terminal wiring

Indication of cable size for wiring terminals:

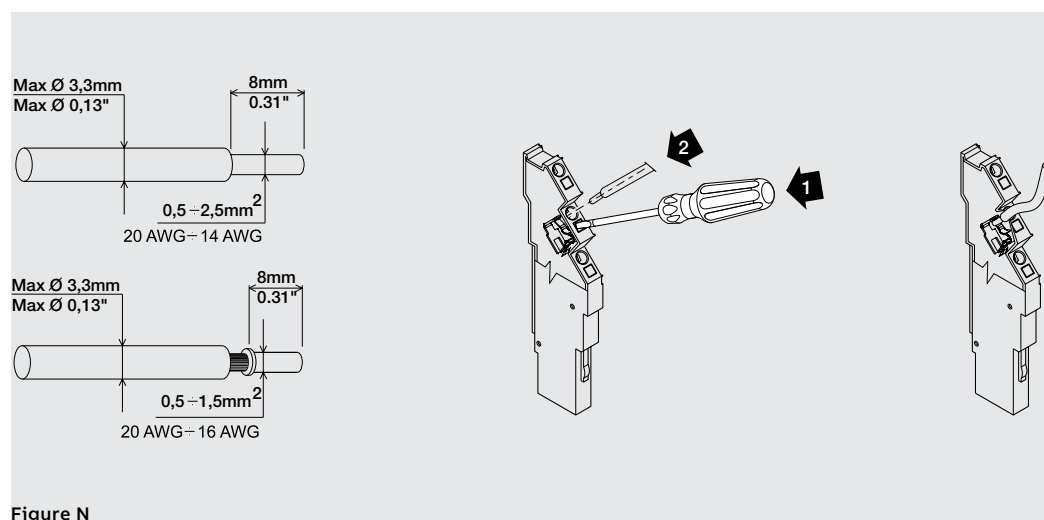


Figure N

3 - Assembly and disassembly

Mounting The circuit-breaker is supplied with the ordered accessories already assembled. If ordered individually and separately from the job order of the circuit-breaker, the accessories are supplied with a Kit Sheet describing all the assembly operations.

Disassembly operations for circuit breakers E1.2

To dismantle the accessories, the following parts must be removed from the circuit-breaker:

- Front cover (A) and protection (F) by removing the screws (B and C).
- For 4-p circuit-breakers, the lateral protection (D) by fixing the screws (C and E).

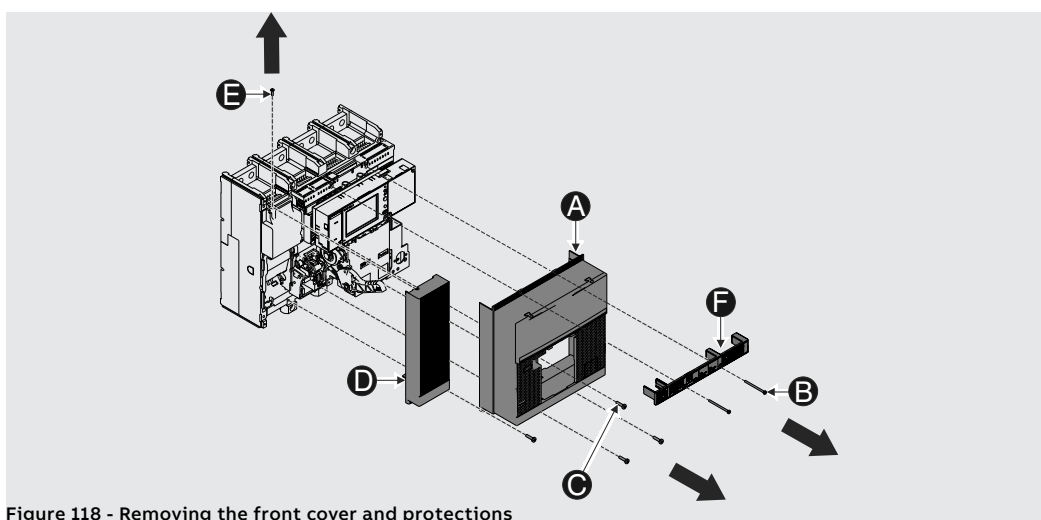


Figure 118 - Removing the front cover and protections

After reassembling the accessories, the parts previously dismantled must be reassembled as indicated:

- Front cover (A) and protection (F) by screwing the fixing screws (B and C) with tightening torque 0.8 Nm - 7 lb in (B) and 1.5 Nm - 13 lb in (C).
- For 4-p circuit-breakers, the lateral protection (D) by fixing the screws (C and E) with tightening torque 1.5 Nm - 13 lb in.

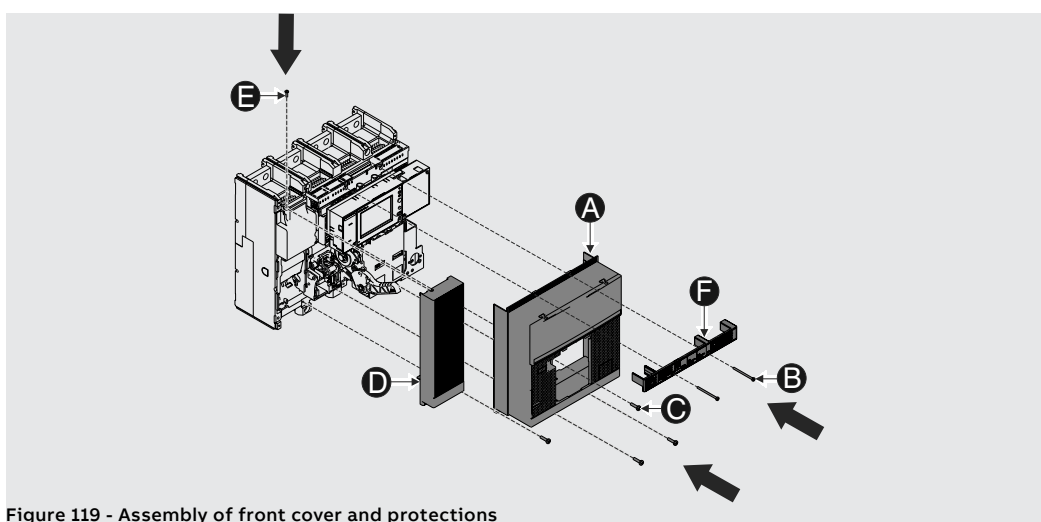


Figure 119 - Assembly of front cover and protections

Disassembly operations for circuit breakers E2.2-E4.2-E6.2

To dismantle the accessories, the following parts must be removed from the circuit-breaker:

- Transparent flange (A) of the trip unit, by turning the screws (B).
- Front cover of the circuit-breaker (C), by removing the mounting screws (D).

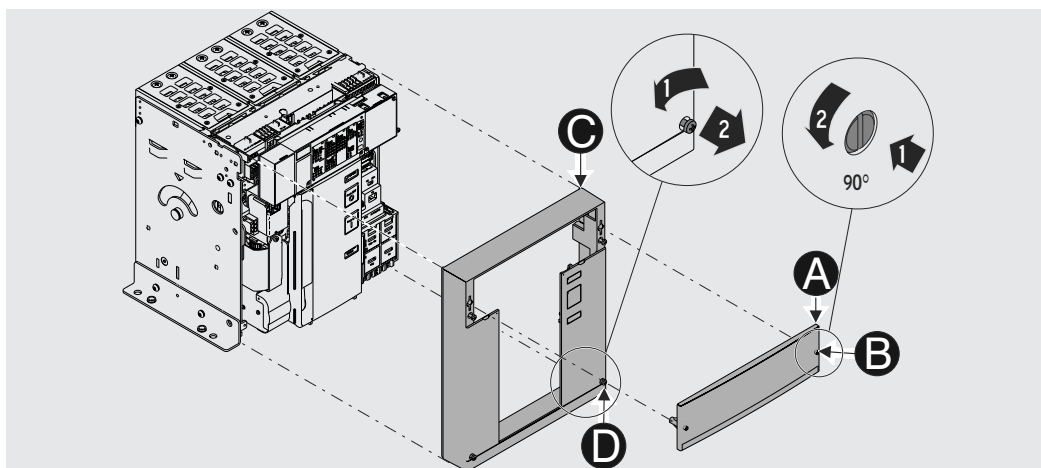


Figure 120 - Removing the flange and front cover

After reassembling the accessories, the parts previously dismantled must be reassembled as indicated:

- Front cover of the circuit-breaker (C), by screwing in the mounting screws (D) with tightening torque 1.1 Nm - 9.74 lb in.
- Transparent flange (A) of the trip unit, by turning the screws (B).

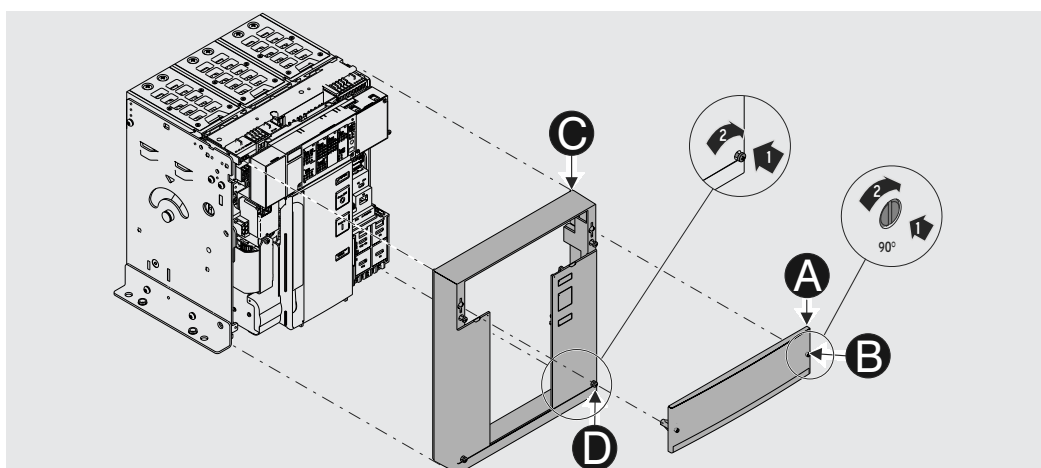


Figure 121 - Assembly of flange and front cover

Mechanical accessories

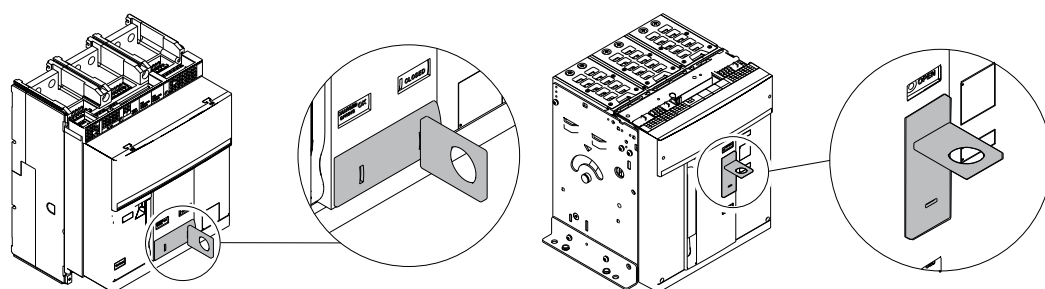
1 - Mechanical Protection accessories

PBC: opening and closing pushbutton protection

The pushbutton protection inhibits the use of the opening and closing pushbuttons.

It is available in two types:

- Protection that simultaneously inhibits the use of both pushbuttons. The use of the pushbuttons is only allowed with the aid of an appropriate key.
- Padlockable protection that inhibits the use of one or both pushbuttons with the aid of a padlock.



PBC for E1.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0715](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0715](#).

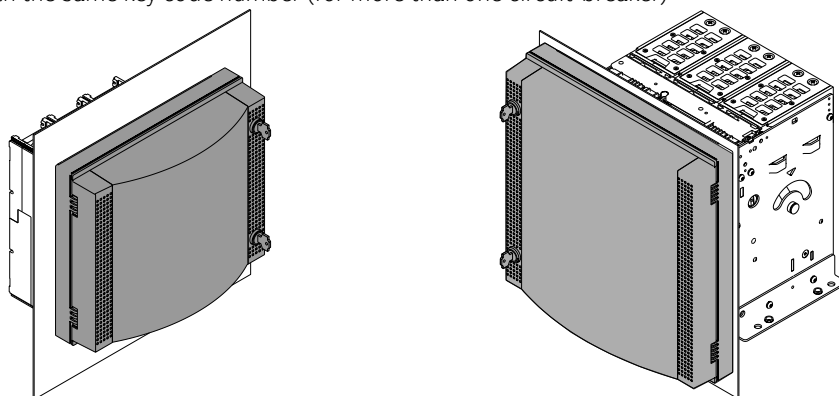
PBC for E2.2 - E4.2 - E6.2

IP54 protection

IP54 protection completely protects the front of the circuit-breaker, to achieve protection class IP54.

It is always equipped with two locks for closing, available in two types:

- lock with different key code numbers (for an individual circuit-breaker)
- lock with the same key code number (for more than one circuit-breaker)



IP54 for E1.2

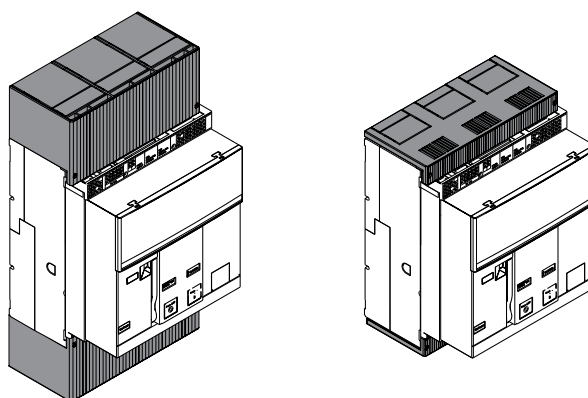
Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0714](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0714](#).

IP54 for E2.2 - E4.2 - E6.2

HTC / LTC ⁽¹⁾: Terminal-cover

Terminal-covers are applied in order to reduce the risk of direct contact with live parts. They are available in two types:

- HTC - High terminal-covers
- LTC - Low terminal-covers



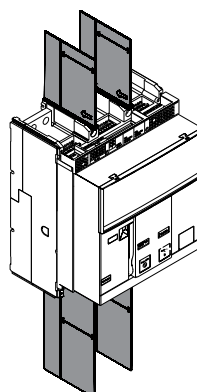
⁽¹⁾ Only for E1.2

Information on assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheets:

- [1SDH000999R0612](#) for the high terminal-covers
- [1SDH000999R0613](#) for the low terminal-covers

PB ⁽¹⁾: Phase separators

The phase separators are applied in order to increase the insulation clearance between two adjacent phases.



⁽¹⁾ Only for E1.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH000999R0608](#).

2 - Mechanical safety accessories

KLC: open position key lock

The KLC locks the circuit-breaker in the open position.

It can also be used during maintenance activities on the circuit-breaker after removal of the cover of the accessory area.

The KLC lock is available with two types of locking:

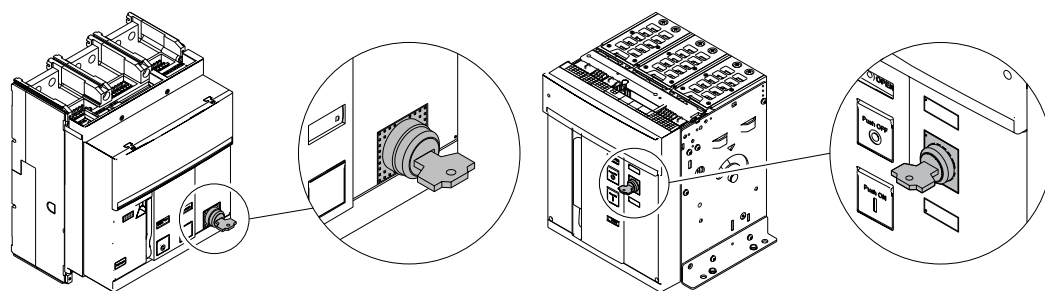
- lock with different key code numbers (for a single circuit-breaker)
- lock with the same key code number (for more than one circuit-breaker). The maximum number of key code numbers available is five.

If set up appropriately, the KLC-A lock can work with four other types of locks:

- Ronis
- Profalux
- Kirk
- Castell



NOTE: the supply of Ronis - Profalux - Kirk - Castell locks is at customer's expense.



KLC for E1.2

KLC for E2.2 - E4.2 - E6.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheets

- [1SDH000999R0702](#) for key locks with lock supplied by ABB
- [1SDH000999R0703](#) for the key locks with pre-engineering for Ronis - Profalux - Kirk locks
- [1SDH000999R0718](#) for the key locks with pre-engineering for Castell locks

and for E2.2-E4.2-E6.2 in the kit sheets:

- [1SDH001000R0702](#) for key locks with lock supplied by ABB
- [1SDH001000R0703](#) for the key locks with pre-engineering for Ronis - Profalux - Kirk locks
- [1SDH001000R0718](#) for the key locks with pre-engineering for Castell locks

PLC: padlock

The PLC locks the circuit-breaker in the open position.

It is available in two types:

- lock usable with a maximum number of three padlocks with a diameter of 4 mm - 5/32"
- lock usable with a maximum number of two padlocks with a diameter of 8 mm - 5/16"
- lock for a padlock with a diameter of 7 mm - 1/4"-17/64"



WARNING!

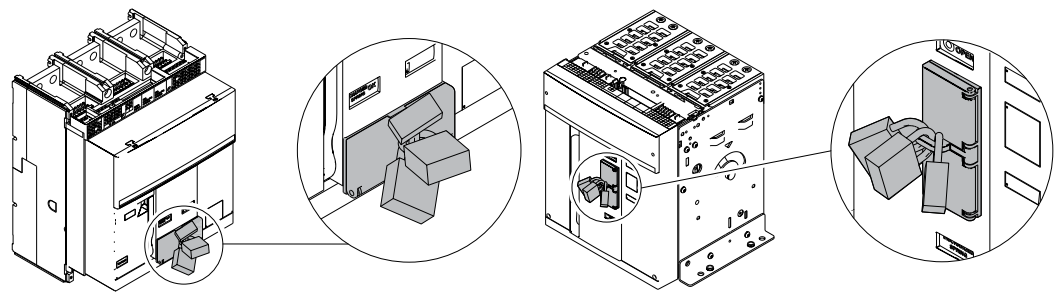
The padlock diameter must be respected for safe operation. Smaller diameters than indicated can result in undesired and unsafe operation. This accessory is meant to be used for regular lock devices with specific shackle diameters. The use of a hasp is not allowed.

Please contact ABB for further information on different dimensions needs.



NOTE: The padlocks are at customer's expenses.

Continued on the next page

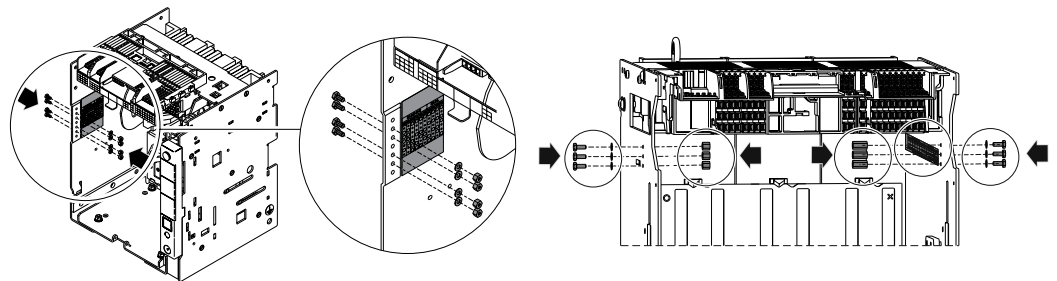
**PLC for E1.2****PLC for E2.2 - E4.2 - E6.2**

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0706](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0706](#).

Anti-insertion lock

The anti-insertion lock allows the moving part of the circuit-breaker to be inserted only into the corresponding fixed part.

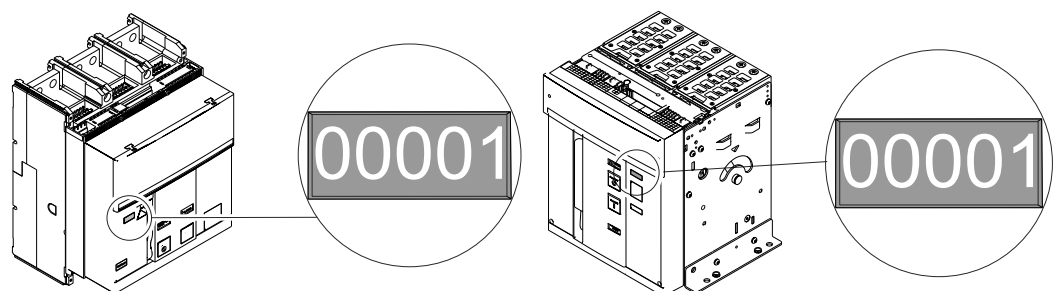
It is intended for all withdrawable circuit breakers.

**Lock for E1.2****Lock for E2.2 - E4.2 - E6.2**

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0701](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0701](#).

MOC: Operation counter

The mechanical operation counter displays the number of mechanical operations performed by the circuit-breaker.

**MOC for E1.2****MOC for E2.2 - E4.2 - E6.2**

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0710](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0710](#).

**PLP: padlock in connected/
test/disconnected positions**

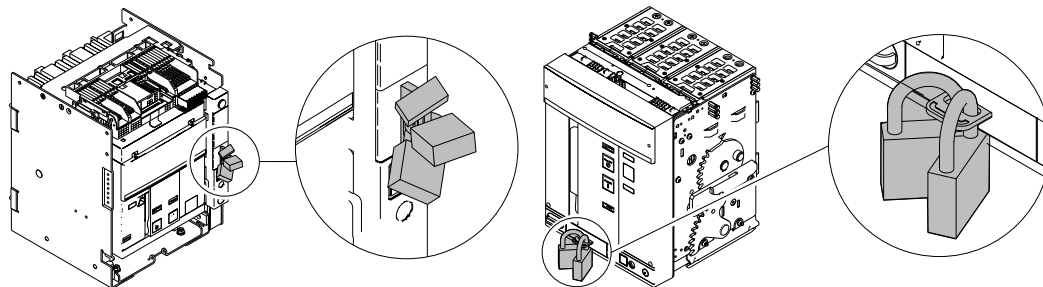
The PLP locks the moving part of a withdrawable circuit-breaker in the fixed part, in one of the following positions:

- connected
- test
- disconnected

Only one type is available that allows you to mount up to three padlocks with a diameter of 8 mm.



NOTE: the PLP lock can also be supplied in the presence of a KLP lock.



PLP for E1.2

PLP for E2.2 - E4.2 - E6.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0707](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0707](#).

**KLP: key lock for connected/
test/disconnected positions**

The KLP lock for connected/test/disconnected position locks the moving part of a withdrawable circuit-breaker in the fixed part, in one of the following positions:

- connected
- test
- disconnected



NOTE: it is possible to lock the moving part in the disconnected position only by using the additional accessory KLP lock.

The KLP lock for connected/test/disconnected positions is available with two types of lock:

- lock with different key code numbers (for a single circuit-breaker)
- lock with the same key code number (for more than one circuit-breaker). The maximum number of key code numbers available is five.

Through an appropriate setup, the KLP lock for connected/test/disconnected positions can work with three other types of lock:

- Ronis
- Profalux
- Kirk
- Castell

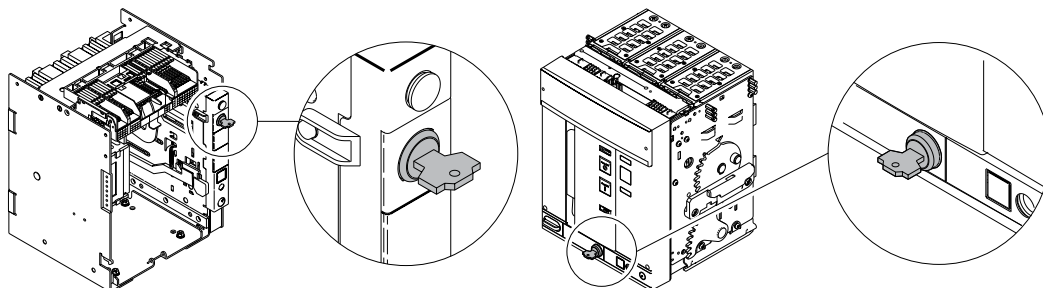
The maximum number of locks that can be installed per circuit-breaker is the two, for all types of lock.



NOTE: the supply of Ronis - Profalux - Kirk locks is at customer's expense.



NOTE: the KLP lock can also be supplied in the presence of a PLP lock.



KLP for E1.2

KLP for E2.2 - E4.2 - E6.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheets

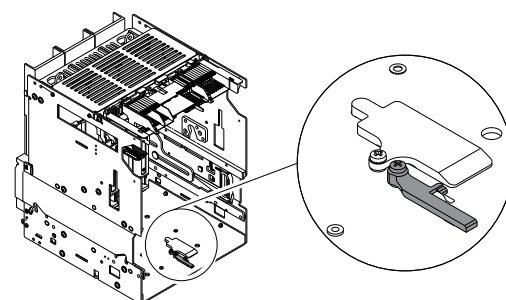
- [1SDH000999R0704](#) and [1SDH000999R0726](#) for key locks with lock supplied by ABB
- [1SDH000999R0705](#) for the key locks with pre-engineering for Ronis - Profalux - Kirk locks
- [1SDH000999R0719](#) for the key locks with pre-engineering for Castell locks

and for E2.2-E4.2-E6.2 in the kit sheets:

- [1SDH001000R0704](#) for key locks with lock supplied by ABB
- [1SDH001000R0705](#) for the key locks with pre-engineering for Ronis - Profalux - Kirk locks
- [1SDH001000R0719](#) for the key locks with pre-engineering for Castell locks

KLP lock additional accessory

This additional accessory limits the blocking function to the disconnected position only.



for E2.2 - E4.2 - E6.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0727](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0727](#).

SL: shutter lock

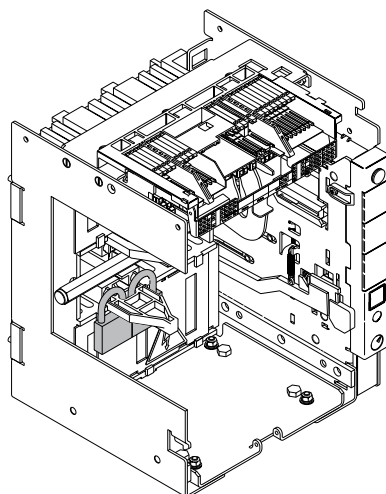
The SL shutter locks the shutters of the fixed part.

It is possible to lock the upper and lower shutters independently.

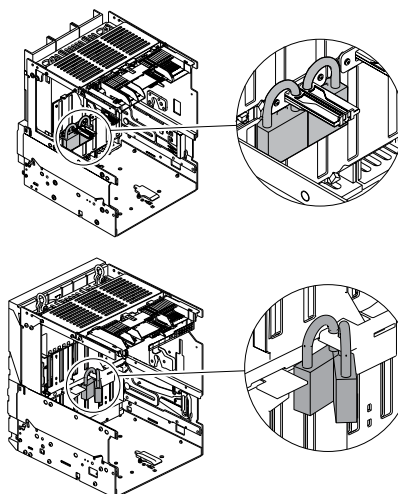
This is an accessory available on all the fixed parts and can work with the aid of padlocks with diameters of 4 mm - 5/32", 6 mm - 1/4", 8 mm - 5/16", with a maximum of four padlocks per fixed part (two for the upper shutters and two for the lower shutters).



NOTE: The padlocks are at customer's expenses.



SL for E1.2



SL for E2.2 - E4.2 - E6.2

DLC: Door opening lock with the circuit-breaker in closed position

The DLC prevents the following operations from being carried out:

- opening the switchgear door with the circuit-breaker closed if the circuit-breaker is in fixed version
- opening the switchgear door with the circuit-breaker closed and in connected position if the circuit-breaker is in fixed version
- closing of the circuit-breaker when the switchgear door is open

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0712](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0712](#).

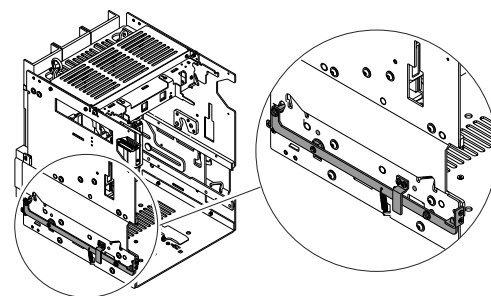
DLP ⁽¹⁾: door opening lock with the circuit-breaker in connected/test position

The DLP lock prevents the switchgear door from being opened when the moving part of the circuit-breaker is in the connected or test position.

It can be installed alternatively on the right side or the left side of the fixed part.



NOTE: The DLP lock is used as an alternative to the mechanical interlock.



DLP for E2.2 - E4.2 - E6.2

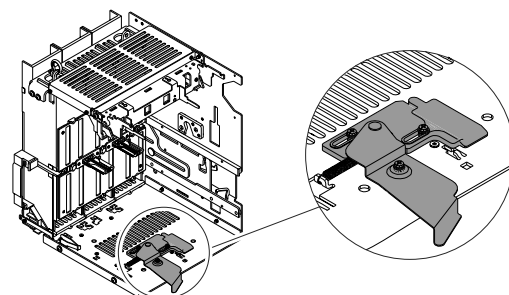
⁽¹⁾ Not available for E1.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0709](#).

DLR ⁽¹⁾: lock on racking-in/ racking-out of the moving part with the door open

The DLR lock prevents the moving part from being racked in/out from the fixed part when the switchgear door is open.

It is available on request on all fixed parts.



DLR for E2.2 - E4.2 - E6.2

⁽¹⁾ Not available for E1.2

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0725](#).

Fail safe

The fail safe is a device that prevents the removal of the mobile part of a withdrawable circuit-breaker from the fixed part if the springs are charged.

It is always supplied with UL circuit-breakers.



IMPORTANT:

- The fail safe device makes undervoltage coil YU unavailable.
- It is, however, possible not to install the fail safe device, in which case the undervoltage coil YU must be used.

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheets

- [1SDH000999R0708](#) for the Fail Safe, movable part
- [1SDH000999R0711](#) for the Fail Safe, fixed part

and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001400R0821](#).

3 - Mechanical Interlocks

Mechanical interlocks determine the opening/closing logic between two or three circuit-breakers.

Four types of interlocks are available, usable in both fixed and withdrawable versions.

Mechanical interlock of type A - Two Circuit-breakers

1	2
O	O
I	O
O	I

The Type A interlock is applicable to two circuit-breakers (normal power supply + emergency power supply).

It allows you never to have two circuit-breakers in the closed position at the same time.

Information on assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheets:

- [1SDH000999R0720](#) for interlock between E1.2 circuit-breakers
- [1SDH001000R0720](#) for interlock between E2.2-E4.2-E6.2 circuit-breakers
- [1SDH000999R0721](#) for interlock between one E1.2 circuit-breaker and one E2.2-E4.2-E6.2 circuit-breaker

Mechanical interlock of type B - Three Circuit-breakers

1	2	3
O	O	O
I	O	O
O	O	I
I	O	I
O	I	O

The Type B interlock is applicable to three circuit-breakers (two normal power supplies + emergency power supply).

It only allows the closing of the two circuit-breakers of the normal power supply if the circuit-breaker of the emergency power supply is open. The circuit-breaker of the emergency power supply can be closed only if the others two are open.

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0721](#).

Mechanical interlock of type C - Three Circuit-breakers

1	2	3
O	O	O
I	O	O
O	I	O
O	O	I
O	I	I
I	I	O
I	O	I

The Type C interlock is applicable to three circuit-breakers (two normal power supplies + a bus tie).

It allows the simultaneous closing of one or two circuit-breakers, resulting in two possible types of power supply of the half busbars:

- power supply from a single transformer (bus tie closed)
- power supply from both transformers (bus tie open)

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0722](#).

Mechanical interlock of type D - Three Circuit-breakers

1	2	3
O	O	O
I	O	O
O	I	O
O	O	I

The Type D interlock is applicable to three circuit-breakers (three power supplies on the same bar that must not operate in parallel)

It allows only one of the three circuit-breakers to be closed.

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0723](#).

Operating coil trip time setting on interlocked circuit- breakers

Before the trip command of a YC release on the circuit-breaker (B) which activates an interlock, make sure that at least 60ms have passed since the energizing of release YU or from the de-energizing of release YO - YO2 on the circuit-breaker to be interlocked (A).

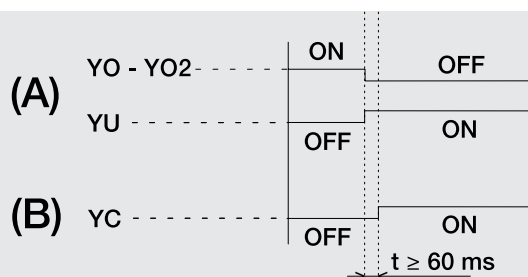


Figure 122

4 - Lifting plates

Lifting plates are applied to the circuit-breaker so that it can be handled when unpacked and for the racking-in/racking-out operations.



NOTE: *Lifting plates are only required for E2.2, E4.2 and E6.2.*

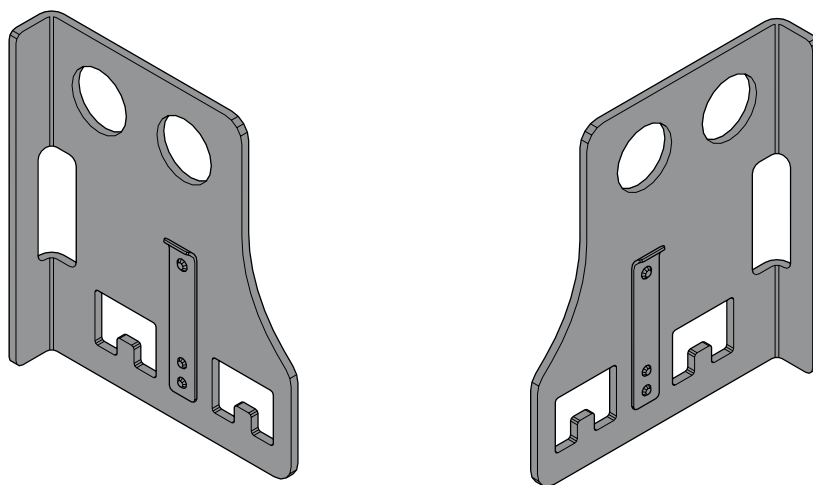


Figure 123

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001400R0912](#).

Electrical accessories

1 - Electrical control accessories

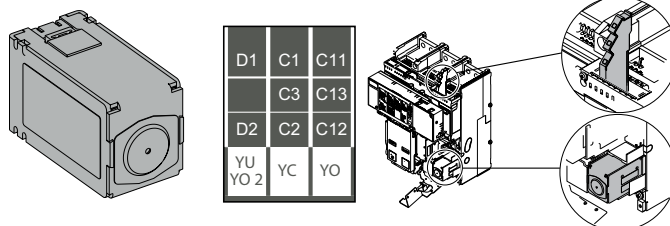
YO-YC-YO2-YC2 ⁽¹⁾: Opening and closing coil

The opening coils, YO and YO2, and the closing coil, YC and YC2 ⁽¹⁾, allow the circuit-breaker to be controlled remotely.

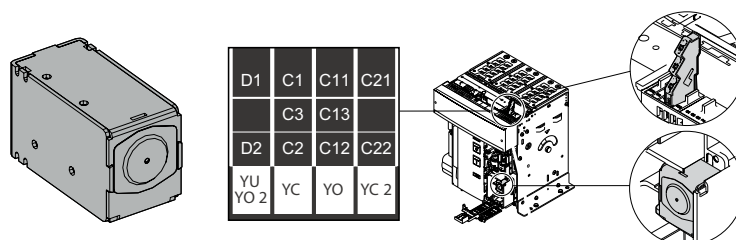
The opening of the circuit-breaker is always possible with the circuit-breaker closed, while closing is possible with the circuit-breaker open and the closing springs charged.

The opening and closing coils can operate in two different modes:

- instantaneous service (the minimum duration of the command impulse must be 100 ms).
- service with permanent power supply.



YO-YC-YO2 for E1.2



YO-YC-YO2-YC2 for E2.2 - E4.2 - E6.2



NOTE: the second opening coil YO2 is alternative to the undervoltage coil YU.

IMPORTANT:

- If the closing coil is permanently energized and the opening coil trips, after opening, the closing coil must be momentarily de-energized so that it can be reused for the next closing operation.
- If instead the opening coil trips, it is necessary, after having de-energized it, to wait at least 100 ms before operating the closing coil.

Available voltages and characteristics

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)	General characteristics	YO-YO2	YC-YC2 ⁽¹⁾
24 V AC/DC	Operating limits	70...110 %Un	85...110 %Un
30 V AC/DC	Inrush power (Ps)	300 VA/W	
48 V AC/DC	Continuous power (Pc)	3.5 VA/W	
60 V AC/DC	Maximum opening time	35 ms	-
110...120 V AC/DC	Maximum closing time	-	70 ms
220...240 V AC/DC			
240...250 V AC/DC			
277 V AC/DC			
380...400 V AC			
415...440 V AC			
480...500 V AC			
500...550 V AC			

⁽¹⁾ YC2 not available for E1.2

Continued on the next page

YO-YC-YO2-YC2⁽¹⁾: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular,

for E1.2 in the kit sheets:

- [1SDH000999R0502](#) for YO and YO2 coils
- [1SDH000999R0503](#) for coils YC

and for E2.2-E4.2-E6.2 in the kit sheets:

- [1SDH001000R0502](#) for YO and YO2 coils
- [1SDH001000R0503](#) for YC and YC2 coils

⁽¹⁾ YC2 not available for E1.2

YU: Undervoltage coil

The undervoltage coil YU controls the value of the voltage in the circuit to which it is connected.

The coil opens the circuit-breaker when its energizing voltage drops below a value between 35...70%Un

The circuit-breaker can be reclosed when the coil energizing voltage is between 85...110% Un.

The undervoltage coil YU can in addition be used for the following purposes:

- Trip unit the circuit-breaker remotely using pushbuttons of the normally closed type.
- Activate the lock when the circuit-breaker is closed (the closing of the circuit-breaker is allowed only with the undervoltage coil energized).

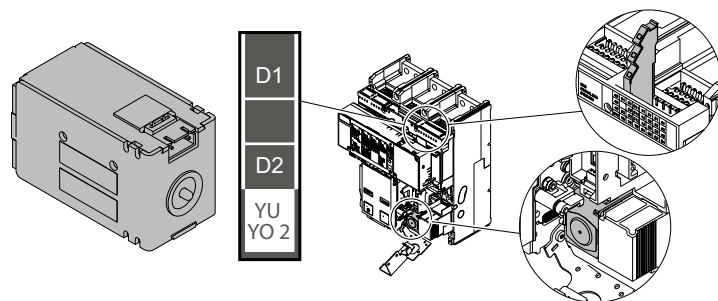
**IMPORTANT:**

- The undervoltage coil YU is incompatible with the presence of the Fail Safe device (UL circuit-breakers).
- The undervoltage coil YU is a emergency trip unit. For service operations use the opening coil.

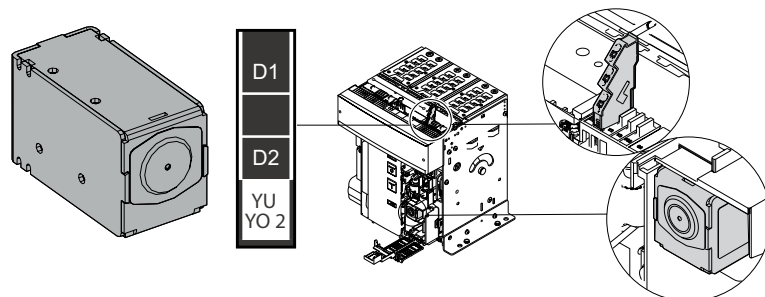


NOTE: the power supply of the coil must be drawn on the supply side of the circuit-breaker or from an independent source.

If the undervoltage coil trips, it is necessary, after having reset it, to wait at least 100 ms before operating the closing coil.



YU for E1.2



YU for E2.2 - E4.2 - E6.2

Continued on the next page

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)	General characteristics	YU
24 V AC/DC	Inrush power (Ps)	300 VA/W
30 V AC/DC	Continuous power (Pc)	3.5 VA/W
48 V AC/DC	Opening time	50 ms
60 V AC/DC		
110...120 V AC/DC		
220...240 V AC/DC		
240...250 V AC/DC		
277 V AC/DC		
380...400 V AC		
415...440 V AC		
480...500 V AC		

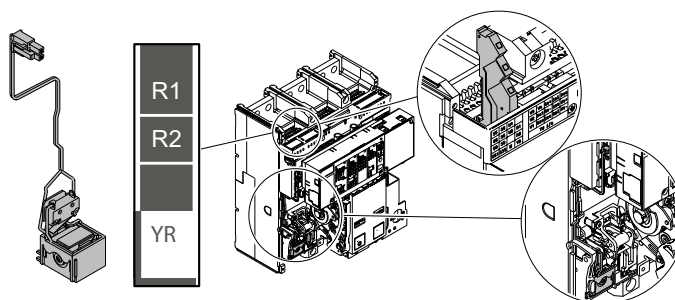
YU: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

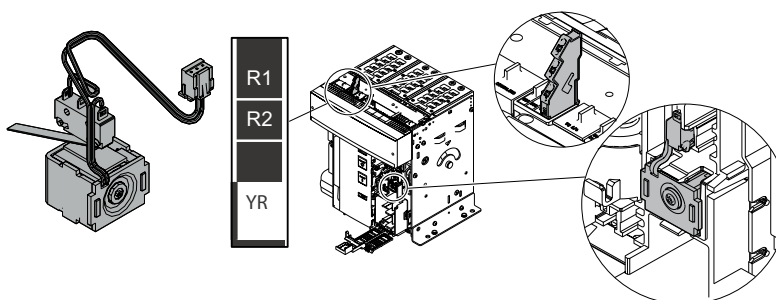
Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0504](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0504](#).

YR: Remote resetting coil

The remote resetting coil deactivates the lock at the closing of the circuit-breaker, generated by the opening of the circuit-breaker caused by tripping of the Ekip protection trip unit.



YR for E1.2



YR for E2.2 - E4.2 - E6.2

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)		General characteristics	
24 V AC ⁽¹⁾	24 V DC ⁽¹⁾	Operating limits	90...110 %Un
110 V AC ⁽¹⁾	110 V DC ^{(1) (2)}		
220 V AC ⁽¹⁾	220 V DC ^{(1) (2)}		

⁽¹⁾ The coil must be activated by a pulse lasting at least 20ms.

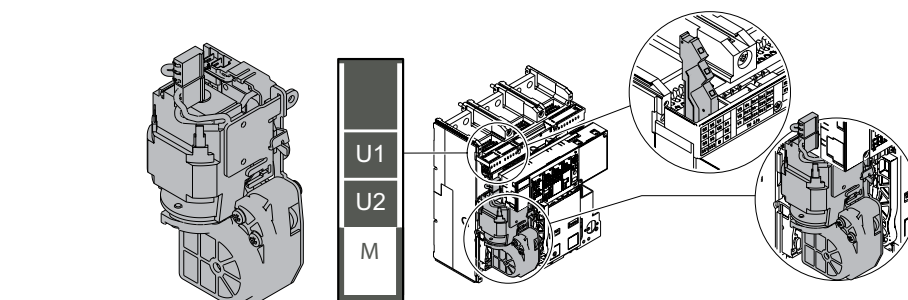
⁽²⁾ The coil must be activated by a pulse lasting max 50ms.

YR: Connections

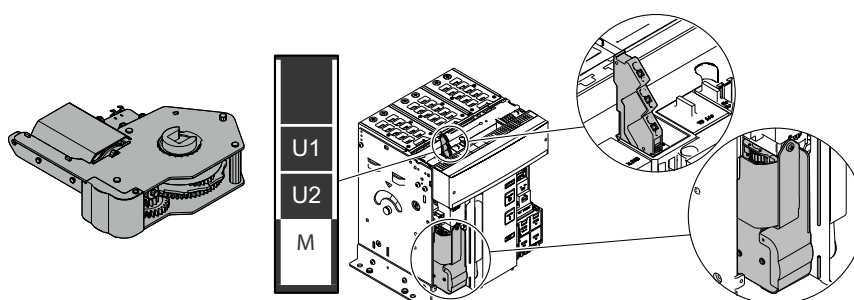
More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0606](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0606](#).

- M: Motor** The motor automatically recharges the closing springs of the circuit-breaker when these are discharged. The motor is equipped with a limit contact S33 M/1 that interrupts the power supply of the motor after charging of the springs is completed.
- The motor is equipped with a limit contact S33 M/2 that signals the state of the charged springs. For information on the S33 M/2 limit contact refer to the dedicated paragraph "S33 M/2: springs charged signalling contact" in this chapter.



M for E1.2



M for E2.2 - E4.2 - E6.2



NOTE: The closing springs can in any case be charged manually through the appropriate front control lever.

The tables listing the available voltages and the electrical characteristics are provided below:

Available voltages (Un)	General characteristics	
24...30 V AC/DC	Operating limits	85...110 %Un
48...60 V AC/DC	Inrush power (Ps)	500 VA/W
100...130 V AC/DC	Power during charge (Pc):	100 VA/W
220...250 V AC/DC	Charging time	Min 5 s, max 10 s
Available voltages (Un) ⁽¹⁾		
380...415 V AC		
Available voltages (Un) ⁽²⁾		
277 V AC/DC		
380...400 V AC		
440...480 V AC		

⁽¹⁾ for E1.2

⁽²⁾ for E2.2 - E4.2 - E6.2

M: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0609](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0609](#).

2 - Electrical signalling accessories

AUX 4Q: auxiliary open-closed contacts

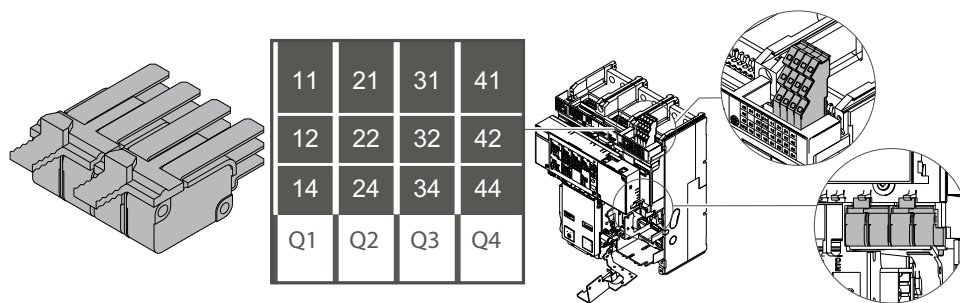
The AUX 4Q contacts signal the open/closed state of the circuit-breaker.

These are "switching" contacts and are available in three types:

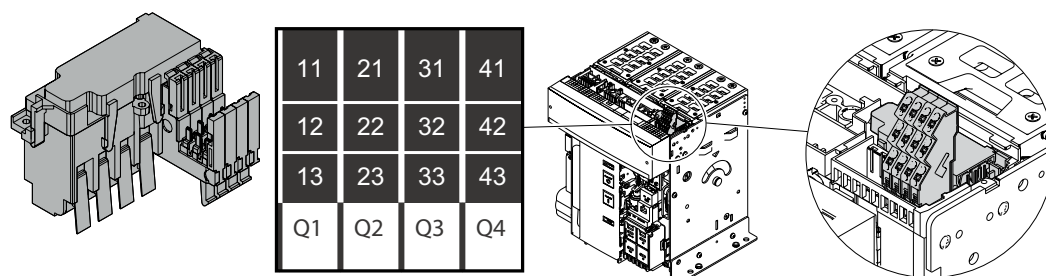
- four standard contacts
- four digital signals (low power)
- two standard contacts (Q1-Q2) + two digital signals (Q3-Q4)



NOTE: The standard AUX 4Q contacts are always included in the circuit-breakers



AUX 4Q for E1.2



AUX 4Q for E2.2 - E4.2 - E6.2

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cosϕ 0,3	-
			5A cosϕ 0,7	-
			5A cosϕ 1	-
		400V	3A cosϕ 1	-
			2A cosϕ 0,7	-
			1A cosϕ 0,3	-
Minimum load			100mA @ 24V	1mA @ 5V

AUX 4Q: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

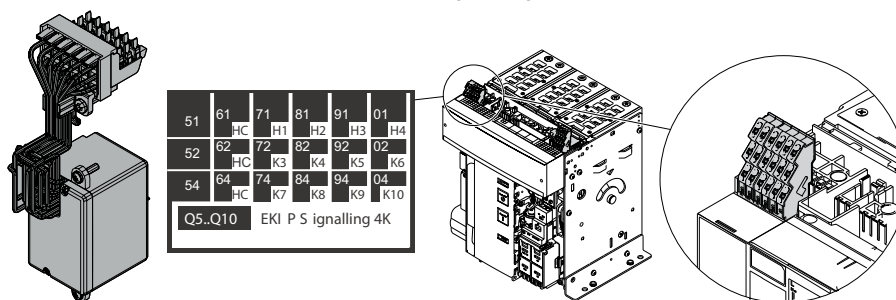
Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0601](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0601](#).

**AUX 6Q ⁽¹⁾: Additional open/
closed auxiliary contacts**

The additional AUX 6Q contacts signal the open/closed state of the circuit-breaker.

These are "switching" contacts and are available in three types:

- six standard contacts
- six digital signals (low power)
- three standard contacts (Q1-Q2-Q3) + three digital signals (Q4-Q5-Q6)



⁽¹⁾ Only for E2.2 - E4.2 - E6.2



NOTE: it is possible to order the AUX 6 Q contacts only if the circuit-breaker is not equipped with a protection trip unit with the Ekip Signalling 4K module.

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cosϕ 0,3	-
			5A cosϕ 0,7	-
			5A cosϕ 1	-
		400V	3A cosϕ 1	-
			2A cosϕ 0,7	-
			1A cosϕ 0,3	-
Minimum load			100mA @ 24V	1mA @ 5V

AUX 6Q: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

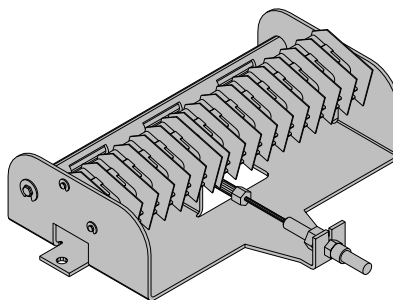
Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular with the kit sheet [1SDH001000R0601](#).

AUX 15Q: External additional open/closed auxiliary contacts

The additional AUX 6Q contacts signal the open/closed state of the circuit-breaker.

These are "switching" contacts and are available in two types:

- 15 standard contacts
- 15 digital signals (low power)



The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cosϕ 0,3	-
			5A cosϕ 0,7	-
			5A cosϕ 1	-
		400V	3A cosϕ 1	-
			2A cosϕ 0,7	-
			1A cosϕ 0,3	-
Minimum load			100mA @ 24V	1mA @ 5V

AUX 15Q Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0607](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0607](#).

AUP: auxiliary position contacts

The AUP contacts are intended for circuit-breakers in withdrawable version.

They electrically signal the position of a moving part (inserted/test/withdrawn) in relation to the fixed part in which they are inserted.

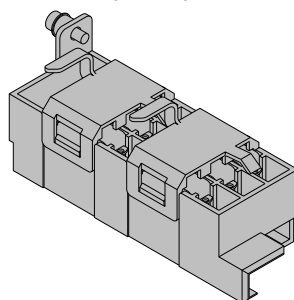
These are "switching" contacts and are available in the following configurations:

Up to a maximum of six contacts for E1.2:

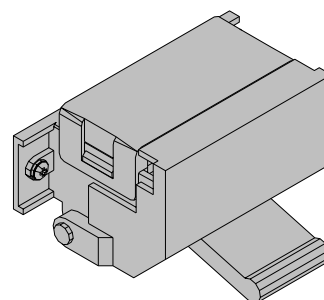
- six standard contacts
- six digital signals

Up to a maximum of ten contacts for E2.2-E4.2-E6.2:

- five standard contacts
- five digital signals
- five additional standard contacts
- five additional digital signals



AUP for E1.2



AUP for E2.2 - E4.2 - E6.2

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cosϕ 0,3	-
			5A cosϕ 0,7	-
			5A cosϕ 1	-
		400V	3A cosϕ 1	-
			2A cosϕ 0,7	-
			1A cosϕ 0,3	-
Minimum load			100mA @ 24V	1mA @ 5V

AUP: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0603](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0603](#).

RTC: ready to close signalling contact

The RTC contact indicates that the circuit-breaker is ready to receive a closing command.

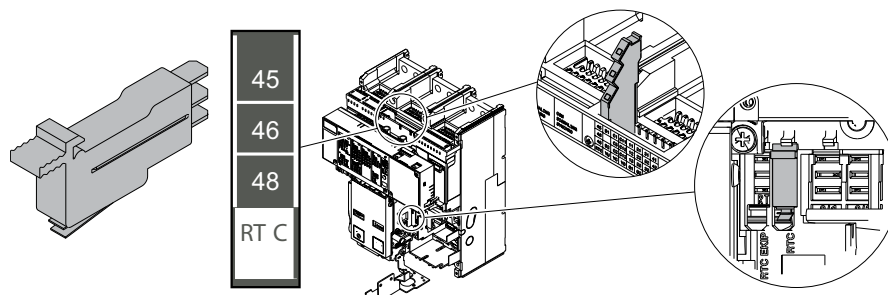
The conditions necessary to allow the closing of the circuit-breaker are:

- circuit-breaker open
- springs charged
- absence of an opening command or of a lock in opening

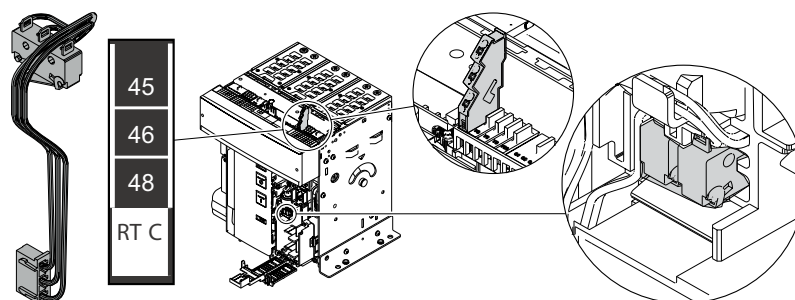


NOTE: if the circuit-breaker is opened due to the tripping of the Ekip protection trip unit, in order to allow closing, the Reset signal of the circuit-breaker must have been reset (press the TU Reset pushbutton on the front panel).

The RTC is a "switching" contact type and is available in the standard version or in the versions for digital signals.



RTC for E1.2



RTC for E2.2 - E4.2 - E6.2

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.3A @ 0ms	-
			0.15A @ 10ms	-
		250V	0.3A @ 0ms	-
			0.15A @ 10ms	-
	AC	125V - 250V	1A cosϕ 0,3	-
			2A cosϕ 0,7	-
			3A cosϕ 1	-
Minimum load			100mA @ 24V	1mA @ 5V

RTC: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0604](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0604](#).

**S51: trip unit tripping
signalling contact**

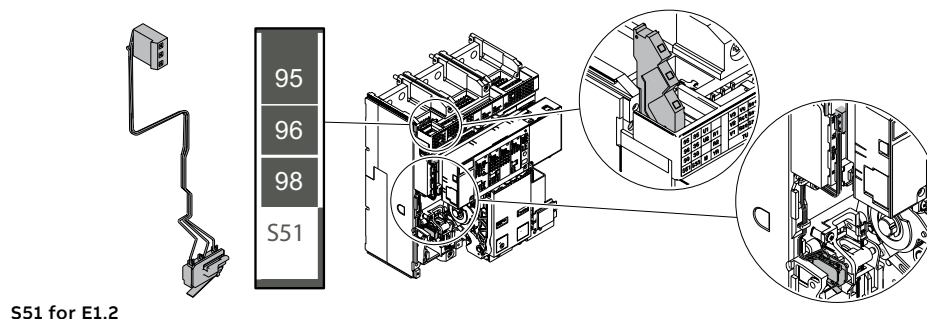
The S51 contact signals the opening of the circuit-breaker due to tripping of the Ekip protection trip unit.

It is available in two different types:

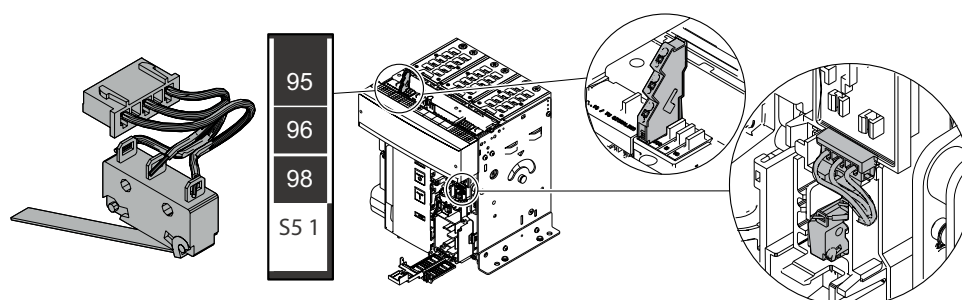
- standard contact
- contact for digital signals



NOTE: The standard S51 contact is always included in automatic circuit-breakers, and is associated with the TU Reset mechanical signalling.



S51 for E1.2



S51 for E2.2 - E4.2 - E6.2

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.3A @ 0ms	-
			0.15A @ 10ms	-
		250V	0.3A @ 0ms	-
			0.15A @ 10ms	-
	AC	125V - 250V	1,5A cosϕ 0,3	-
			3A cosϕ 0,7	-
			5A cosϕ 1	-
Minimum load			100mA @ 24V	1mA @ 5V

S51: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0605](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0605](#).

S51/2: releases tripped signaling contact

Contact S51/2 signals circuit-breaker opening after the protection release Ekip has tripped.

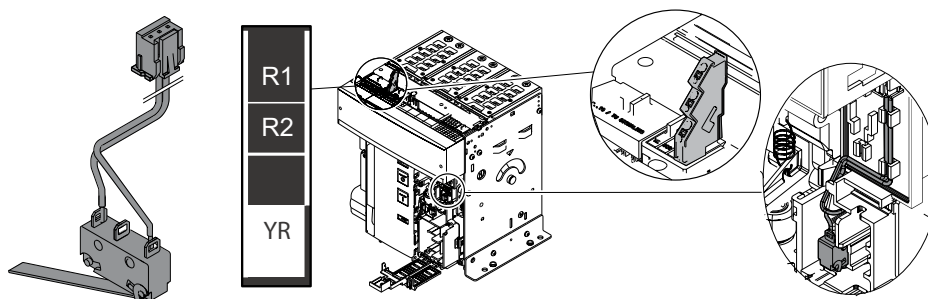
Only available with circuit-breakers Emax E2.2-E4.2-E6.2

It is available in two different types:

- standard contact
- contact for digital signals



NOTE: Contact S51/2 can be used as an alternative to YR and at the same time as S51.



The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.3A @ 0ms	-
			0.15A @ 10ms	-
		250V	0.3A @ 0ms	-
			0.15A @ 10ms	-
	AC	125V - 250V	1,5A cosϕ 0,3	-
			3A cosϕ 0,7	-
			5A cosϕ 1	-
Minimum load			100mA @ 24V	1mA @ 5V

S51: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0614](#).

S33 M/2: springs charged signalling contact

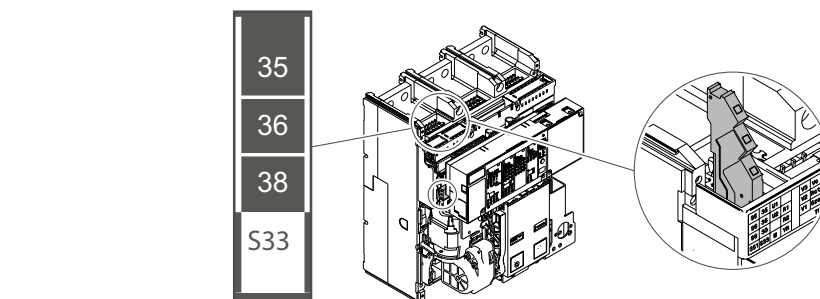
The S33 M/2 contact signals the state of the closing springs of the circuit-breaker control (charged or discharged).

It is available in two types:

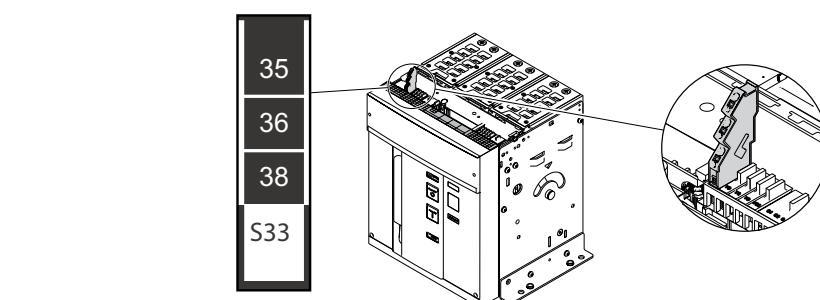
- standard contact
- contact for digital signals



NOTE: the S33_M/2 contact is always included in the gearmotor for automatic charging of the springs in the standard version. The version for digital signals must be requested with the order for the motor.



S33 M/2 for E1.2



S33 M/2 for E2.2 - E4.2 - E6.2

The following table provides information on the electrical characteristics:

Characteristics			Standard	Digital signals
Breaking capacity	DC	24V	-	0.1 A
		125V	0.5A @ 0ms / 0.3A @ 10ms	-
		250V	0.3A @ 0ms / 0.15A @ 10ms	-
	AC	250V	3A cosϕ 0,3	-
			5A cosϕ 0,7	-
			5A cosϕ 1	-
		400V	3A cosϕ 1	-
			2A cosϕ 0,7	-
			1A cosϕ 0,3	-
Minimum load			100mA @ 24V	1mA @ 5V

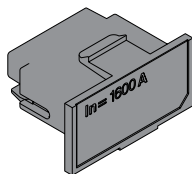
S33/M2: Connections

More details are available in the website <http://www.abb.com/abblibrary/DownloadCenter/>, which also includes the entire circuit diagram [1SDM000091R0001](#).

Information on the assembly is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular for E1.2 in the kit sheet [1SDH000999R0609](#) and for E2.2-E4.2-E6.2 in the kit sheet [1SDH001000R0609](#).

Internal electronic accessories

1 - Rating Plug



The *Rating Plug*, supplied with the trip unit establishes the rated current I_n required by the measuring range and for setting the current protections (with reference to I_n).

It is installed on a dedicated front connector which can be accessed by the user.

The trip unit continuously checks for the presence of the *Rating Plug* and signals its absence or any assembly or installation errors.

If a new model is installed, the Trip unit displays the request for installation when first powered.

In Ekip Touch, field *Nom.Curr* in the *About-Circuit breaker* menu displays the I_n quantity read by the unit.

Versions Various models of different sizes are available and can be ordered in three versions: a classic version, a version which activates Rc protection and one that deactivates L protection; the three versions have different labels:

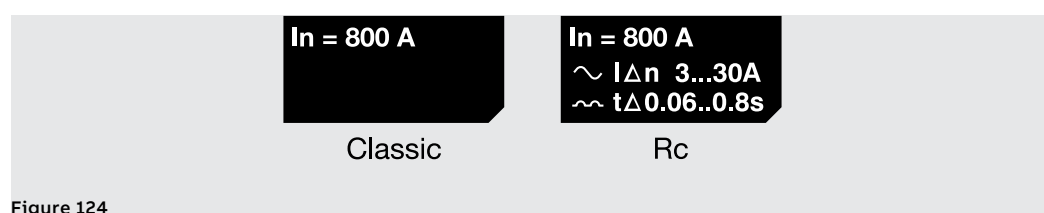


Figure 124



IMPORTANT: the Rating plug labels have a black background; if the colour is different, they may be incompatible with the trip units described in this document: consult ABB for assistance

Replacement The module can be replaced by the user; any *Rating Plug* with maximum rated current equal to the current of the sensor in the unit can be installed.



WARNING!

- with $I_u \leq 400$ A size circuit-breakers, Rating Plugs from 100 A to the I_u size of the CB can be installed
- with $I_u > 400$ A size circuit-breakers, Rating Plugs from 400 A to the I_u size of the CB can be installed



IMPORTANT: to avoid alarms or undesired trips, the Rating Plug must be replaced when Ekip Touch is off, and in the absence of primary currents.

2 - Measurement

- Presentation** Two *Measurement* modules are available:
- *Measurement enabler* installed by default on Ekip Touch and enabled in the presence of the Measuring Measurements package (enabling can be obtained both at the time the circuit-breaker is ordered or at a later date, via Market Place)
 - *Measurement enabler with voltage socket* is installed by default on Ekip Hi-Touch, Ekip G Touch and Ekip G Hi-Touch; can be installed in conjunction with Ekip Touch if requested when circuit-breaker is ordered
- Both modules measure voltages, frequencies, power and energy values; in addition, the *Measurement enabler with voltage socket* module allows:
- the Trip unit to be supplied directly by the voltage sockets to which it is connected
 - management of the synchronism function when the *Ekip Synchrocheck* module is installed (see chapter dedicated to *Ekip Synchrocheck* from page 247).

Measurement performance The measurement performance provided when the *Measurement* modules are installed (described on page 117), are more accurate when the *Class 1 Power & Energy Metering* package is present (described on page 120).

Configurations available Both modules can be ordered with different connection configurations:

- connections to internal terminals or in an external terminal box
- connections to the upper or lower terminals of the poles on the basis of the expected power flow
- with normal or reverse pole order

For full details about ordering and the connections, consult technical catalog [1SDC200023D0906](#) and the wiring diagrams [1SDM000091R0001](#).

Electrical characteristics The *Measurement* modules function correctly in the electrical conditions described on page 20.


Installations with up to 1200 VAC line-to-line voltage can be connected and configured in the presence of connections to external sockets and an isolation transformer.

Isolation transformer The isolation transformer must conform to standard IEC 60255-27 and possess the following characteristics:

Characteristics	Description
Electrical	<ul style="list-style-type: none"> • Accuracy class: $\leq 0,2$ • Performance: ≥ 10 VA • Overload: 20 % permanent • Insulations: 4 kV between inputs and outputs, 4 kV between shield and outputs, 4 kV between shield and inputs • Frequency: $F_n \pm 10\%$ • Primary voltage: 100 to 1200 V (nominal, to be configured via menu) • Secondary voltage: 100 to 230 V (nominal, to be configured via menu)

Menu The specific configuration area will activate in the *Settings - Modules - Ekip Measuring* menu if the *Measurement* module is detected correctly by Ekip Touch.

The following parameters can be configured in this menu:

Parameter	Description	Default
<i>Voltage Transf.</i>	Selects the presence or absence of the external transformer	Absent
<i>Un Setting Mode</i>	Selects the rated voltage value selection mode: • Table: value editable in preset steps • Volt: value editable within the range in 1 V steps	Table
<i>Rated voltage</i>	Defines rated voltage Un. Available in the absence of a transformer; defines rated voltage Un. The value is given in absolute value (Volts), editable within the 100 V to 690 V range in steps which depend on the Un Setting Mode parameter setting.	400 V
<i>Primary voltage</i>	Available in the presence of a transformer; defines rated voltage Un of the installation. The value is expressed in absolute value (volt) and can be set within the 100 V to 1150 V range, in steps that depend on the Un Setting Mode parameter setting.	400 V
<i>Secondary voltage</i>	Available in the presence of a transformer; defines the secondary voltage of the transformer. The value is expressed in absolute value (volt) and can be set within the 100 V to 230 V range, in steps that depend on the Un Setting Mode parameter setting.	100 V
<i>Positive Power flow</i>	Defines the power flow required for D protection; there are 2 options available (page#s#76): • High → Low: power flows from high terminals to low terminals (load connected low) • Low → High, power flows from low terminals to high terminals (load connected high).	Bottom → Top
<i>Neutral connection</i>	Available with 3P CB; allows the presence of the external Neutral to be enabled.  NOTE: <i>presence of the neutral activates phase voltage measurement</i>	Absent

When Un Setting Mode is set according to Table the voltage parameters can have the following values:

Parameter	Voltage values with adjustment in steps
<i>Rated voltage</i>	100 V, 115 V, 120 V, 190 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V, 415 V, 440 V, 480 V, 500 V, 550 V, 600 V, 660 V, 690 V
<i>Primary voltage</i>	100 V, 115 V, 120 V, 190 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V, 415 V, 440 V, 480 V, 500 V, 550 V, 600 V, 660 V, 690 V, 910 V, 950 V, 1000 V, 1150 V
<i>Secondary voltage</i>	100 V, 110 V, 115 V, 120 V, 200 V, 230 V

About The *About-Modules* menu contains the specific menu of the module with the serial number and version of the module itself.

Test The Measurement module must be disconnected from Ekip Touch (according to the procedure available on the front label) and the external sockets must be disconnected from the terminal box in the following cases:

Test	Module Measurement enabler ⁽¹⁾	Module Measurement enabler with voltage sockets
Dielectric test		x
Isolation between phases	x	x

⁽¹⁾ disconnection to be performed also in the presence of Ekip Touch without Measuring package

Replacement The *Measurement* module can be replaced on its Trip unit, for details consult document [1SDH001000R0528](#). If the *Measurement* module is replaced, module change is indicated on the display by an alarm in the diagnosis bar when the apparatus is powered for the first time.

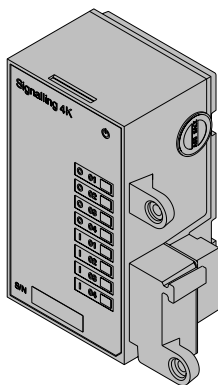
To install the new module:

- Confirm the installation module which appears automatically on the display
- Execute manual control, available in the *Settings* menu (page 49)



WARNING! if the Class 1 Power & Energy Metering package is present, module replacement could impair the performance values indicated on page 120; consult ABB to assess solutions able to comply with your requirements

3 - Ekip Signalling 4K



Ekip Signalling 4K is an accessory signaling module allowing programmable inputs/outputs to be managed.

This module has:

- four outputs and relative state led: O 01, O 02, O 03, O 04;
- four digital inputs and relative state led: I 01, I 02, I 03, I 04;
- a Power led with the startup status of the module

The module can be installed on Emax 2 E2.2-E4.2-E6.2 circuit-breakers equipped with Ekip Touch trip unit.



NOTE: *Ekip Signalling 4K* can be installed on circuit-breakers in which AUX 6Q contacts are not present

Connections

The module connects directly to the Mainboard, in the dedicated slot on the left-hand side of the display; the outputs and inputs of the module can be accessed from the upper terminal box of the circuit-breaker.

To connect the module to Ekip Touch, please consult document [1SDH001000R0516](#).

For references about the connection and terminals, please consult document [1SDM000091R0001](#).

Power supply

Ekip Signalling 4K functions with Ekip Touch energized by auxiliary supply, with *Ekip Supply* or direct power supply, or via the *Measurement enabler with voltage sockets* module.

The Power led comes on when the module is activated and functioning.



NOTE: *when the module is off, the output contacts are always in the open position and the state of the inputs is not valid*

Output

Each output consists of two contacts (O 01: K3-K7; O 02: K4-K8; O 03: K5-K9; O 04: K6-K10), isolated from the trip unit and other outputs, which have two physical states (contacts open or closed) and provide the following electrical characteristics:

Characteristics	Maximum limit ⁽¹⁾
Maximum switchable voltage	150 VDC / 250 VAC.
Breaking capacity	2 A @ 30 VDC, 0,8 A @ 50 VDC, 0,2 A @ 150 VDC, 4A @ 250 VAC
Dielectric strength between open contacts	1000 VAC (1 minutE @ 50 Hz)
Dielectric strength between each contact and coil	1000 VAC (1 minutE @ 50 Hz)

⁽¹⁾ data relating to a resistive load

All the outputs are independent and can be programmed so as to activate when one or more events occur (see Menu on page 209).

Input

Ekip Touch can be configured so that the state of the inputs corresponds to actions or signals, (page 210).

Each input consists of two contacts (I 01: H1-HC; I 02: H2-HC; I 03: H3-HC; I 04: H4-HC).

The module permits two logic statuses, interpreted differently by Ekip Touch depending on the configuration selected for each contact:

State	Electrical condition	Contact configuration	Status detected by Trip unit
Open	Circuit open ⁽¹⁾	Active open	ON
		Active closed	OFF
Closed	Short-circuit ⁽²⁾	Active open	OFF
		Active closed	ON

(1) $R > 100 \text{ k}\Omega$

(2) $R \text{ (wiring + short circuit contact)} < 25 \text{ }\Omega$

Interface The module has nine signaling leds:

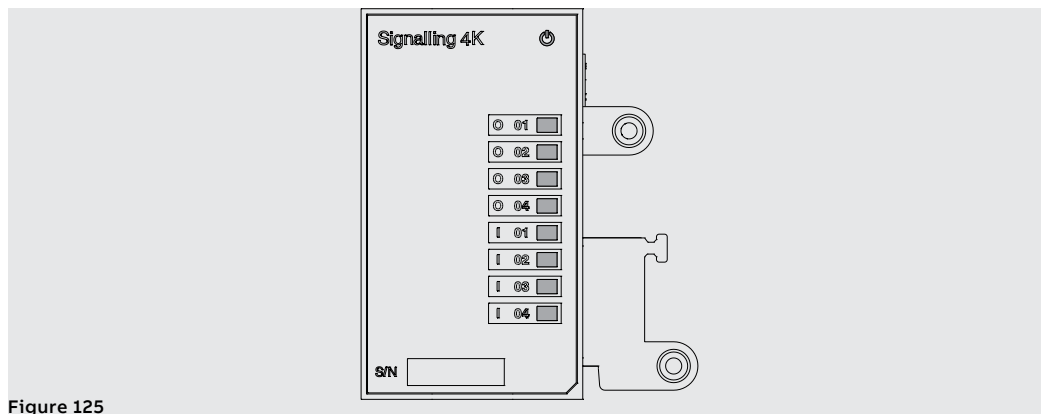


Figure 125

LED	Description
Power	Signals the state of the module (on or off)
O 01, O 02, O 03, O 04	Indicate the physical state of the contacts of each output: <ul style="list-style-type: none"> • off (contact open); • on (contact closed).
I 01, I 02, I 03, I 04	Indicate the physical state of the contacts of each input: <ul style="list-style-type: none"> • off (circuit open); • on (short circuit).

Menu The specific configuration area will activate in the *Settings-Modules* menu if the *Ekip Signalling 4K* module is connected correctly to Ekip Touch.

The programming submenus of the inputs and outputs are present inside.

Output parameters All the available outputs enable the following parameters to be configured:

Parameter	Description	Default
<i>Signal source</i>	Event which activates the output and changes the state of the contacts. Different protection proposals, statuses and thresholds are available in the menu; the Custom mode can be configured via Ekip Connect so as to extend the solutions and combine several events.	None
<i>Delay</i>	Minimum presence of Source for output activation; the Delay is given in seconds and can be set within a range between 0 s and 100 s, in 0.01 s steps. i NOTES: <ul style="list-style-type: none"> • output will not activate if Source deactivates before Delay has elapsed • if delay = 0 s Source must still be present for longer than 300 mS 	0 s
<i>Contact Type</i>	Defines the rest status of the contact with Source not present between either: normally open (NO) and closed (NC). Output activation coincides with the change in state with respect to that of rest.	NO
<i>Latched⁽¹⁾</i>	Allows the output to be managed differently when Source disappears: either keep contact activated (On) or deactivate it (Off). i NOTE: if Self-latching = On, the output resets if the module switches off, or in the case of a module auto test or signal reset command	Off


Continued on the next page

Parameter	Description	Default
<i>min Activation Time</i> ⁽²⁾	If Self-latching = Off, defines the minimum activation time of the output in the presence of rapid Sources: <ul style="list-style-type: none"> • Source duration < Min activ. time = the output remains activated for the duration of the Min activ. time • Source duration < Min activ. time = the output remains activated for as long as the Source persists Choose between: 0 ms, 100 ms, 200 ms	0 ms

⁽¹⁾ deactivate the self-latchings of the outputs used for Power Controller if the module is used for the Power Controller function

⁽²⁾ the Pulse Mode option will be available as well as those described if the module is used for the Power Controller function. If selected, the output is maintained active for a fixed time pertaining to the function itself, regardless of whether the event that activated it persists or not.

Input parameters All the inputs enable the following parameters to be configured:

Parameter	Description	Default
<i>Polarity</i>	Defines whether the state of the input is ON when the contacts are open (Active open) or short-circuited (Active Closed)	Active closed
<i>Delay</i>	Minimum activation and deactivation time of an input enabling a change of state to be recognized by the trip unit; the Delay is given in seconds and can be set within a range between 0 s and 100 s, in 0.01 s steps.  NOTES: <ul style="list-style-type: none"> • the trip unit will not detect a change of state if it is present for less than the set Delay • if Delay = 0 s, the change of state must still be more than 300 ms 	0.1 s

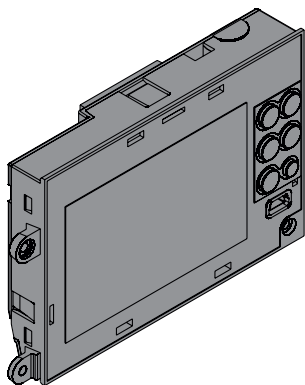
About The *About-Modules* menu contains the specific area for *Ekip Signalling 4K*, in which the states of the inputs (*On/Off*) and outputs (*Open/Closed*) are present.

Test The dedicated area in the *Test* menu is activated if *Ekip Signalling 4K* is detected correctly by the trip unit. For details of the test characteristics, please consult page 137.

Commands and functions If Self-latching = On, the activated output contacts can be reset with:

- automatic command *RESET signaling*, which can be programmed in the *Settings-Modules-Functions* menu of Ekip Touch or via Ekip Connect (see page xx)
- manual command via the service connector (via Ekip Connect) or via system bus communication

4 - Ekip LCD



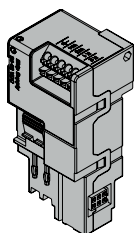
The LCD version of the protection trip unit can be requested for installations in particularly aggressive environments (low temperatures, high degree of humidity, dust or chemical substances). The LCD version differs from the version with touchscreen display in:

- Black and white LCD display.
- Menu navigation by buttons.
- The HOME button provides direct access to the page **Menu**. The **Measurements** pages can be accessed using the ARROW UP and ARROW DOWN buttons from the page **Histograms**. (**Main Page** and **Measuring Instruments** area are not available).

All the protection, measurement and accessory options are the same as those of the touchscreen version.

External electronic accessories

1 - Ekip Supply



Ekip Supply is an accessory supply module. It is available in two models, depending on the incoming voltage to be provided.

It performs three functions:

- supplies auxiliary power to Ekip Touch
- allows the terminal box modules to be supplied and connected to Ekip Touch
- acts as a bridge for the Local Bus between Ekip Touch and the external electronic accessories (e.g. *Ekip Signalling 10K* and *Ekip Multimeter*)

The module has a Power led to signal the presence of incoming power supply:

- off: power supply absent
- on (steady): power supply present

Electrical characteristics

Model	Ekip Supply 24-48VDC	Ekip Supply 110-240 VAC/DC
Power supply voltages	21,5 ÷ 53 VDC	105 ÷ 265 VAC/DC
Frequency	--	45 ÷ 66Hz
Maximum power consumption without modules ⁽¹⁾	3 W	3 VA/W
Maximum power consumption with modules ⁽²⁾	10 W	10 VA/W
Maximum inrush current	2 A for 20 ms	2 A for 20 ms

⁽¹⁾ *Ekip Touch* with just *Ekip Supply*

⁽²⁾ *Ekip Touch* with three modules connected

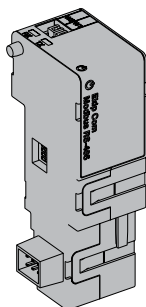
Connections

The module must be assembled in the first slot of the terminal box on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); use AWG 22-16 cables with 1.4 mm maximum outer diameter for the external cabling.

To connect the module to Ekip Touch, please consult document [1SDH001000R0511](#).

2 - Ekip Com Modbus RTU



Ekip Com Modbus RTU is a communication accessory which allows Ekip Touch to be integrated into an RS-485 network with Modbus RTU communication protocol, remote supervision and monitoring functions, in two different modes, master and slave.

You can perform the following operations remotely:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator
- access information and parameters not available on the display
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: the remote open and close commands of the circuit-breaker can only be executed if Ekip Touch is in the Remote configuration and the circuit-breaker is equipped with the Ekip Com Actuator module (page 258)

Ekip Com Modbus RTU is always supplied with contacts Ekip AUP and Ekip RTC (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

Models Two different modules compatible with the Modbus RTU protocol are available: *Ekip Com Modbus RTU* and *Ekip Com Modbus RTU Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: if different indications are not given, the information in the next chapter is valid for both models

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).



IMPORTANT: each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com Modbus RTU Redundant)

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

To connect the module to its communication network and for references about the terminals, please consult document [1SDM000091R0001](#); use Belden 3105A type cables or equivalent for the external cabling.

To connect the module to Ekip Touch, please consult document [1SDH001000R0512](#).

Power supply *Ekip Com Modbus RTU* is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: communication between Ekip Touch and the module is interrupted in the absence of auxiliary power supply

Interface the module has three signaling leds:

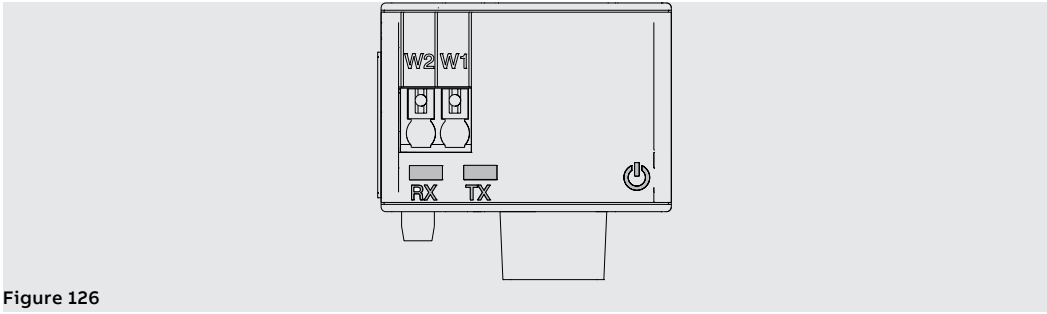


Figure 126

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none">• Off: module off• on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present.• flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Rx	Indicates the status of the communication between network master and module (slave): <ul style="list-style-type: none">• off: Modbus RTU communication not activated• on with fast flashes: Modbus RTU communication activated
Tx	Indicates the status of the communication between network master and module (slave): <ul style="list-style-type: none">• off: communication between Modbus RTU not activated• on with fast flashes: Modbus RTU communication activated

Configurations

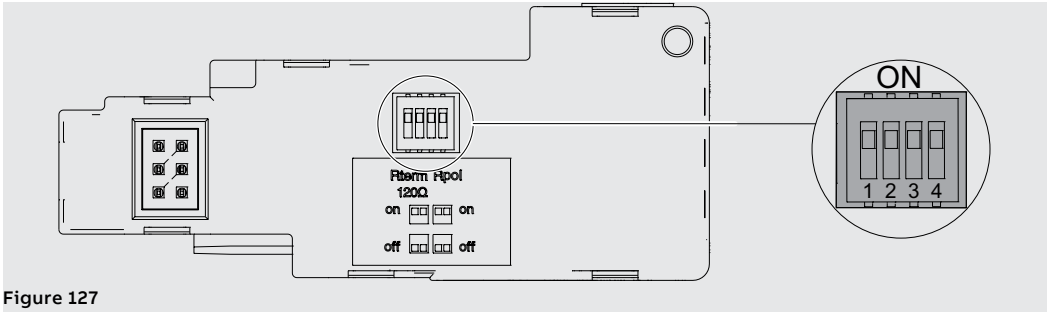


Figure 127

Resistor	Dip	Description	Default
Rterm	1 and 2	120 Ω termination resistor Move dip-switches 1 and 2 to the ON position to connect Rterm	Off
Rpol	3 and 4	220 Ω pull-up or pull-down resistor Move dip-switches 3 and 4 to the ON position to connect Rpol	Off


! IMPORTANT: move the dip-switches before connecting the module to Ekip Supply and the communication network

Configurations via menu

Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 133).

Two areas are activated if Ekip Touch detects the module correctly:

- information area in the About-Modules menu, containing the software version and serial number of the module
- specific configuration area in the Settings-Modules menu, where the following communication parameters can be configured

Parameter	Description	Default
<i>Serial address</i>	Module address; 1 to 247 range available  IMPORTANT: devices connected to the same network must have different addresses	247 / 246 ⁽¹⁾
<i>Baudrate</i>	Data transmission speed; 3 options are available: 9600 bit/s, 19200 bit/s, 38400 bit/s	19200 bit/s
<i>Physical protocol</i>	Defines the stop and parity bit; 4 options are available: • 8,E,1 = 8 data bits, 1 EVEN parity bit, 1 STOP bit • 8,O,1 = 8 data bits, 1 ODD parity bit, 1 STOP bit • 8,N,2 = 8 data bits, no parity bit, 2 STOP bits • 8,N,1 = 8 data bits, no parity bit, 1 STOP bit	8,E,1

⁽¹⁾ 247 default of the Ekip Com Modbus RTU module; 246 default of the Ekip Com Modbus RTU Redundant module

Remote configurations

The operating configuration can be changed from slave to master via the service connector (via Ekip Connect) or via system bus communication so as to integrate the module into an interactive data exchange network (see description of Ekip Com Hub, page 240).



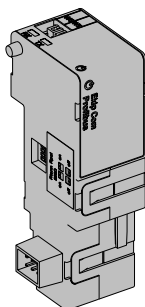
IMPORTANT:

- **In the Master configuration, the module does not allow data exchange as in the normal Slave function**
- **the presence of several masters in the same network can cause faulty operation**

Remote information

Certain additional information concerning the version and status of the module is available via the service connector (via Ekip Connect) or by communication via system bus; the information includes: HW and Boot version, CRC status (correctness of the SW in the module).

3 - Ekip Com Profibus DP



Ekip Com Profibus DP is a communication accessory which allows Ekip Touch to be integrated into an RS-485 network with Profibus communication protocol, with remote supervision and monitoring functions.

The module is configured as a Slave and remotely, you can:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator (MOE-E)
- access information not available on the display
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: the remote open and close commands of the circuit-breaker can only be executed if *Ekip Touch* is in the Remote configuration and the circuit-breaker is equipped with the *Ekip Com Actuator* module (page 258)

Ekip Com Profibus DP is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

Models Two different modules compatible with the Profibus protocol are available: *Ekip Com Profibus DP* and *Ekip Com Profibus DP Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: if different indications are not given, the information in the next chapter is valid for both models

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).



IMPORTANT: each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com Profibus DP Redundant)

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); use Belden 3079A type cables or equivalent for the external cabling.

To connect the module to Ekip Touch, please consult document [1SDH001000R0512](#).

Power supply *Ekip Com Profibus DP* is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

Interface the module has three signaling leds:

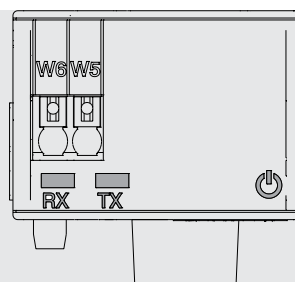


Figure 128

Continued on the next page

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> Off: module off on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present. flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Rx	Indicates the status of the communication between network master and module (slave): <ul style="list-style-type: none"> off: communication between master and module not activated on steady: communication between master and module activated
Tx	Indicates the status of the communication between network master and module (slave): <ul style="list-style-type: none"> off: communication between master and module not activated on flashing: communication between master and module activated

Configurations Resistors can be connected to the RS-485 bus by configuring the dip-switches at the side of the module:

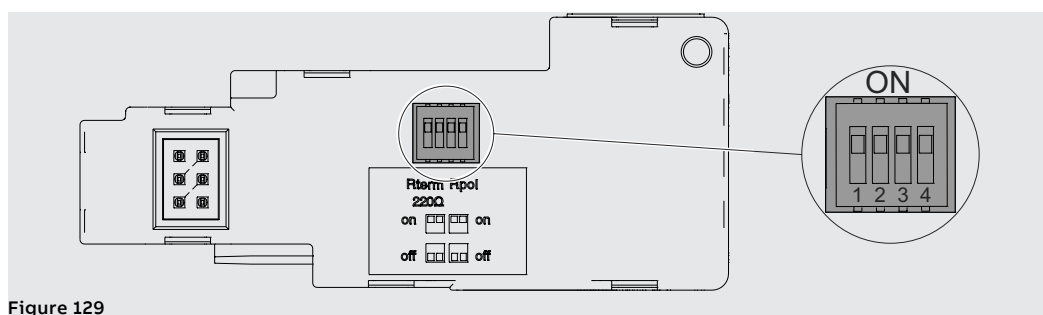


Figure 129

Resistor	Dip	Description	Default
Rterm	1 and 2	220 Ω termination resistor Move dip-switches 1 and 2 to the ON position to connect Rterm	Off
Rpol	3 and 4	390 Ω pull-up or pull-down resistor Move dip-switches 3 and 4 to the ON position to connect Rpol	Off



IMPORTANT: move the dip-switches before connecting the module to Ekip Supply and the communication network

Configurations via menu Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

Two areas are activated if Ekip Touch detects the module correctly:

- information area in the *About - Modules* menu, containing the software version and serial number of the module
- specific configuration area in the *Settings - Modules* menu, where the following communication parameters can be configured:

Parameter	Description	Default
Serial address	Module address; 1 to 126 range available IMPORTANT: devices connected to the same network must have different addresses	125 / 124 ⁽¹⁾

⁽¹⁾ 125 default of the Ekip Com Profibus DP module; 124 default of the Ekip Com Profibus DP Redundant module

Remote configurations

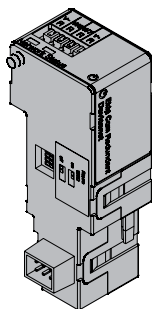
Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
<i>Data access mode</i>	Defines Dataset (acyclic data) access mode <ul style="list-style-type: none">• each individual acyclic register can be accessed in the Legacy mode using the Slot, Subslot and Index fields (with Slot fixed at 3)• only complete blocks can be accessed in the Dataset mode; Slot is fixed at 0, Subslot at 1 and Index defines the block reference See System Interface for details.	Legacy
<i>Cyclic data endianness</i>	Establishes whether the register of the cyclic data item is configured in Big endian or Little endian.	Little endian
<i>Acyclic data endianness</i>	Establishes whether the register of the acyclic data item is configured in Big endian or Little endian.	Big endian

Remote information

Certain additional information concerning the version and status of the module is available via the service connector (via Ekip Connect) or by communication via system bus; the information includes: HW and Boot version, CRC status (correctness of the SW in the module).

4 - Ekip Com DeviceNet™



Ekip Com DeviceNet™ is a communication accessory which allows Ekip Touch to be integrated into a CAN network with DeviceNet™ communication protocol, with remote supervision and monitoring functions.

The module is configured as a Slave and remotely, you can:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator (MOE-E)
- access information and parameters not available on the display
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: the remote open and close commands of the circuit-breaker can only be executed if Ekip Touch is in the Remote configuration and the circuit-breaker is equipped with the Ekip Com Actuator module (page 258)

Ekip Com DeviceNet™ is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

Models Two different modules compatible with the DeviceNet™ protocol are available: *Ekip Com DeviceNet™* and *Ekip Com DeviceNet™ Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: if different indications are not given, the information in the next chapter is valid for both models

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).



IMPORTANT: each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com DeviceNet™ Redundant)

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); use Belden 3084A type cables or equivalent for the external cabling.

To connect the module to Ekip Touch, please consult document [1SDH001000R0512](#).

Power supply *Ekip Com DeviceNet™* is supplied directly by the *Ekip Supply* module to which it is connected.

To function correctly, the DeviceNet™ bus must be supplied on terminals V+ and V- with a signal of over 12 VDC.



NOTE:

- the ABB PLC with DeviceNet (CM575-DN) communication module provides V+ V- supply
- communication between Ekip Touch and the module is interrupted in the absence of power supplies from Ekip Supply and on the supply terminals of the bus

Interface the module has three signaling leds:

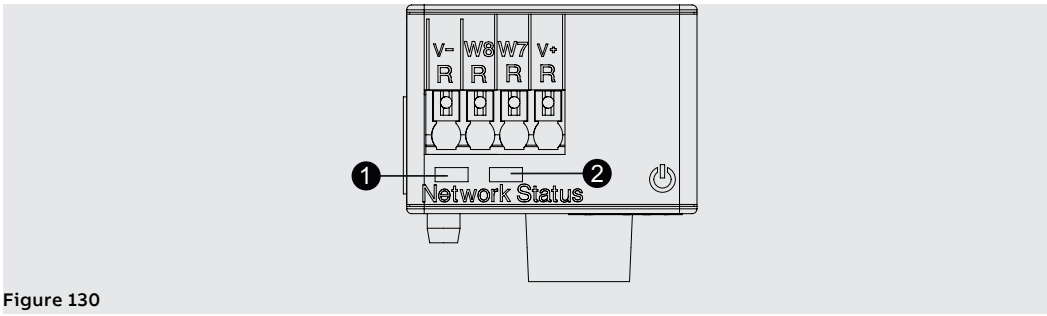


Figure 130

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none">• Off: module off• on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present.• flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Network Status (1)	Indicates the communication status on the bus: <ul style="list-style-type: none">• off: device off line (with Status led off) ⁽¹⁾, or in the error condition (with Status led on)• on steady: device on line, and assigned to a master (operating condition)• on flashing: device on line, but not assigned to a master (device ready to communicate)
Network Status (2)	Indicates the communication status on the bus: <ul style="list-style-type: none">• Off: no error.• On fixed: device in bus off, or Network Power absent.• On flashing: I/O connection (cyclic data) in timeout

⁽¹⁾ the device has not yet sent the Duplicate ID sequence in line

Configurations Resistors can be connected to the CAN bus by configuring the dip-switches at the side of the module:

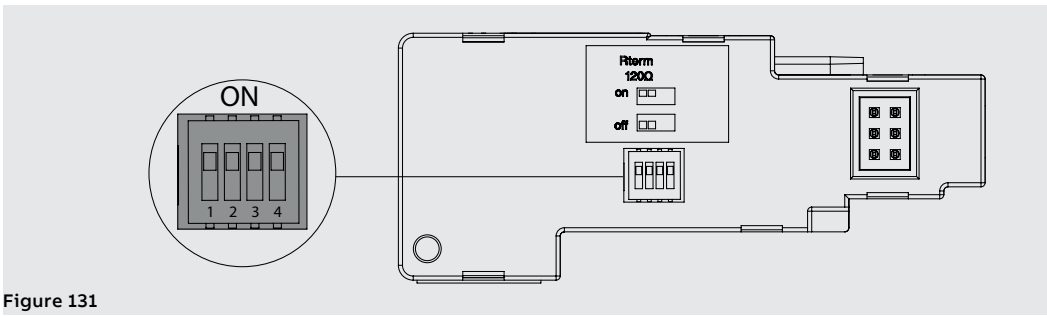


Figure 131

Resistor	Dip	Description	Default
Rterm	1 and 2	120 Ω termination resistor Move dip-switches 1 and 2 to the ON position to connect Rterm	Off



IMPORTANT:


- move the dip-switches before connecting the module to Ekip Supply and the network
- the termination resistors must never be included in the nodes; inclusion of this capacitance could lead to a network with improper termination (impedance too high or too low), which could potentially cause a failure. For example, removal of a node comprising a termination resistor could lead to network failure
- the termination resistors must never be installed at the end of a drop line but only at the ends of the main trunk line

Configurations via menu

Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

Two areas are activated if Ekip Touch detects the module correctly:

- information area in the *About - Modules* menu, containing the software version and serial number of the module
- specific configuration area in the *Settings - Modules* menu, where the following communication parameters can be configured:

Parameter	Description	Default
MAC Address	Module address; 1 to 63 range available  IMPORTANT: devices connected to the same network must have different addresses	63 / 62 ⁽¹⁾
Baudrate	Data transmission speed; 3 options are available: 125 kbit/s, 250 kbit/s, 500 kbit/s	125 kbit/s

⁽¹⁾ 63 default of the Ekip Com DeviceNet™ module; 62 default of the Ekip Com DeviceNet™ Redundant module

Remote configurations

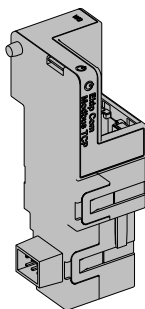
Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
Class ID	Defines the addressing class of the module, either 8 or 16 bits.	8-bit Class ID
Bus-Off Behavior	Defines the behavior of the module following loss of communication (Bus-Off), with a choice between Standard (supply reset is awaited if the communication is lost) and Advanced (the module attempts to reset itself if it detects the error status).	DeviceNet standard

Remote information

Certain additional information concerning the version and status of the module is available via the service connector (via Ekip Connect) or by communication via system bus; the information includes: HW and Boot version, CRC status (correctness of the SW in the module).

5 - Ekip Com Modbus TCP



Ekip Com Modbus TCP is a communication accessory which allows Ekip Touch to be integrated into an Ethernet network with Modbus TCP communication protocol, with remote supervision and monitoring functions.

The module is configured as master and remotely, you can:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator (MOE-E)
- access information and parameters not available on the display
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: *the remote open and close commands of the circuit-breaker can only be executed if Ekip Touch is in the Remote configuration and the circuit-breaker is equipped with the Ekip Com Actuator module (page 258)*

Ekip Com Modbus TCP is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

Depending on the parameter settings, described in the next pages, the ports used by the module are:

Port	Service	Notes
502/tcp	Modbus TCP	Valid for the Modbus TCP mode
319/udp	IEEE 1588	Valid with IEEE 1588 protocol enabled
320/udp		
68/udp	DHCP client	DHCP client enabled alternatively as: <i>Static address = On</i>

Safety and cyber security

Since the module allows the actuator connected to Ekip Touch and access to the data in the unit to be checked, it can only be connected to networks equipped with all the necessary security and prevention measures against unauthorized access (for example, the network of the control system of an installation).



IMPORTANT:

- **it is the customer's sole responsibility to provide and continuously ensure a secure connection between the module and customer network or any other network (as the case may be). The plant manager must establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, the customer system and interface against any kind of security breaches, unauthorized access, interference, intrusion, loss and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized accesses, interference, intrusion, loss and/or theft of data or information.**
- **The module cannot be connected directly to the Internet. Only connect to dedicated Ethernet networks with Modbus TCP communication protocol**

Models

Two different modules compatible with the Modbus TCP protocol are available: *Ekip Com Modbus TCP* and *Ekip Com Modbus TCP Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: *if different indications are not given, the information in the next chapter is valid for both models*

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).




IMPORTANT: **each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com Modbus TCP Redundant)**

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

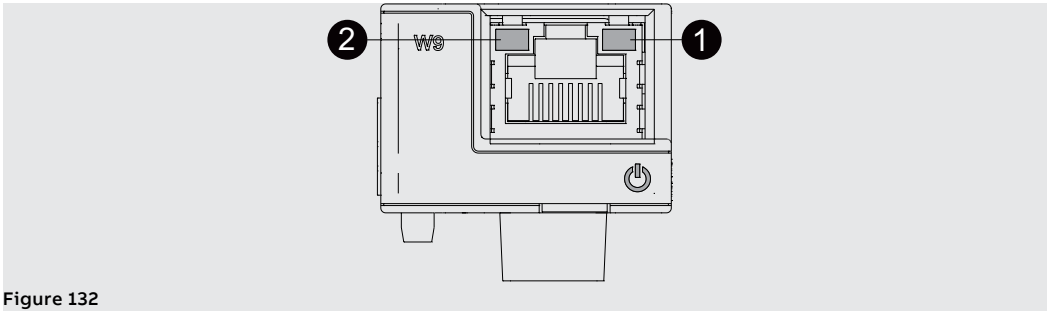
For references about the connection and terminals, please consult document [1SDM000091R0001](#); a cable of the Class 6 S/FTP type (Class 6 with double screening S/FTP) must be used for the communication bus.

To connect the module to Ekip Touch, please consult document [1SDH001000R0514](#).

Power supply *Ekip Com Modbus TCP* is supplied directly by the *Ekip Supply* module to which it is connected.

 **NOTE:** communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

Interface the module has three signaling leds:



LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none">• Off: module off• on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present.• flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Link (1)	Indicates the communication state: <ul style="list-style-type: none">• Off: incorrect connection, signal absent• on fixed: correct connection
Activity (2)	Indicates the communication state: <ul style="list-style-type: none">• off: no activity on the line• flashing (activity on line present receiving and/or transmitting)

Configurations via menu


Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 130).

The following communication parameters can be configured if the module has been correctly detected by Ekip Touch in the *Settings-Modules* menu:

Parameter	Description	Default
<i>Static IP address ON</i>	Defines whether the module has the dynamic (Off) or static (On) IP address. Se = On all the associated parameters are enabled	Off
<i>Static address IP address</i>	Enables the static IP to be selected	0.0.0.0
<i>Static Network Mask</i>	Enables the subnet mask to be selected	0.0.0.0
<i>Static Gateway address</i>	When there are several subnets, enables the IP address of the node to which the module is connected to be selected	0.0.0.0


Information in menu

The following information will be available in the About-Modules menu if Ekip Touch has detected the module correctly:

Information	Description
<i>SN and version</i>	Identifier and SW version of the module
<i>IP address</i>	Address of the module, assigned to the module by a DHCP server at the time of connection to the network in the case of configuration with a dynamic IP, or can be set via the menu in the event of a static IP.  NOTE: without a DHCP server, the module automatically adopts a random IP address within the 169.254.xxx.xxx range
<i>Network Mask</i>	Subnet mask; identifies the method for recognizing the subnet to which the modules belong and enables modules to be searched for within a defined set of recipients.
<i>Gateway address</i>	IP address of the node to which the module is connected, in the presence of several subnets
<i>TCP Client 1, 2, 3</i>	IP addresses of the client devices connected to the module (in the Server mode)
<i>MAC address</i>	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device

Remote configurations

Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
Client/Server	Parameter for changing the configuration of the module from Server Only to Client and Server and for integrating it into an interactive data exchange network (see Ekip Com Hub on page 240)  IMPORTANT: if Client/Server, the module allows data exchange like a normal Server function	Server only
IEEE 1588 enable	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾ .	OFF
Master IEEE 1588	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
IEEE 1588 delay mechanism	Allows the data exchange mode between module and master, either Peer-to-Peer or End-to-End, to be selected.	End-to-End
SNTP Client enable	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾	OFF
Force Static IP Address	Allows the network server that supplies the SNTP to be set.	0.0.0.0
Time zone	Defines the time zone to be used for synchronism	+00:00
Daylight Saving Time	Used to select whether daylight saving time is present (ON) or not (OFF) in the country to which the synchronization time refers	OFF
Disable Gratuitous ARP	Permits (Enabled ARP) the periodic generation of a Gratuitous ARP message, used by Ekip Connect to rapidly find the modules via Ethernet scan without knowing the IP address beforehand	ARP Enabled
Access protected by password	Enables the writing operations performed via the network to be protected by a password (Request password)	Standard mode
IEEE 1588 Boundary clock	Parameter useful if an IEEE 1588 GrandMaster clock is not available: • If enabled (ON), the module is seen as an IEEE1588 master clock by all the slaves/devices in the same local network, even when the source of external synchronism is different from IEEE 1588 (SNTP for example) • If disabled (OFF) the module benefits from the synchronism of the master in its own network)	OFF
Enable package Limitation	Enables the Rate limiter function, which limits the number of packages entering the module from the network, to be activated/deactivated	Disable

⁽¹⁾ Enable IEEE 1588 and Enable SNTP client must not be enabled at the same time

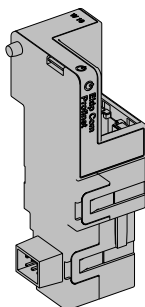
⁽²⁾ the parameter can only be changed via system bus in the remote configuration

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
Boot and HW version	General module information
Flash CRC status e result	Information about the correctness of the SW in the module
Stato Ekip Link	Signals Ethernet cable connection errors
SNTP Server Error	Error in communication with SNTP server
SNTP Server Synchronisation	State of synchronism with SNTP server
IEEE 1588 status	Valid with Master IEEE 1588= ON, notifies the presence (Slave or PTP Master Active) or absence (PTP Master but Passive) of the higher level master

6 - Ekip Com Profinet



Ekip Com Profinet is a communication accessory which allows Ekip Touch to be integrated into an Ethernet network with Profinet communication protocol, with remote supervision and monitoring functions.

The module is configured as master and remotely, you can:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator
- access information not available on the display
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: the remote open and close commands of the circuit-breaker can only be executed if Ekip Touch is in the Remote configuration and the circuit-breaker is equipped with the Ekip Com Actuator module (page 258)

Ekip Com Profinet is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

The ports used by the module are:

Ethertype	Port	Service	Notes
0x88CC	-	LLDP	Link Layer Discovery Protocol
0x8892 (Profinet)	-	Profinet IO	Specific for real time communications (RT)
0x0800	34964/udp	Profinet-cm (Context manager)	DCE/RPC

Safety and cyber security

Since the module allows the actuator connected to Ekip Touch and access to the data in the unit to be checked, it can only be connected to networks equipped with all the necessary security and prevention measures against unauthorized access (for example, the network of the control system of an installation).



IMPORTANT:

- **it is the customer's sole responsibility to provide and continuously ensure a secure connection between the module and customer network or any other network (as the case may be). The plant manager must establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, the customer system and interface against any kind of security breaches, unauthorized access, interference, intrusion, loss and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized accesses, interference, intrusion, loss and/or theft of data or information.**
- **The module cannot be connected directly to the Internet. Only connect to dedicated Ethernet networks with Profinet communication protocol**

Models

Two different modules compatible with the Profinet protocol are available: *Ekip Com Profinet* and *Ekip Com Profinet Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: if different indications are not given, the information in the next chapter is valid for both models

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).



IMPORTANT: each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com Profinet Redundant)

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); a cable of the Class 6 S/FTP type (Class 6 with double screening S/FTP) must be used for the communication bus.

To connect the module to Ekip Touch, please consult document [1SDH001000R0514](#).

Power supply *Ekip Com Profinet* is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

Interface the module has three signaling leds:

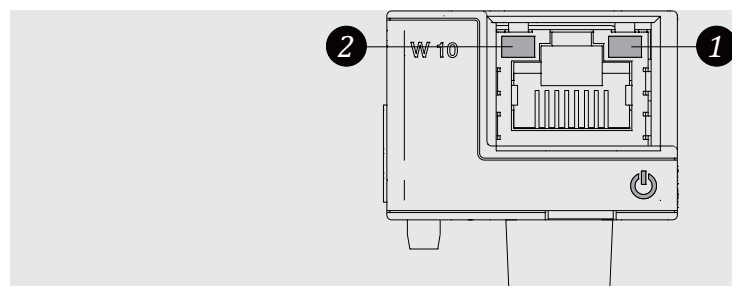


Figure 133

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> • Off: module off • on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present • flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent.
Link (1)	Indicates the communication state: <ul style="list-style-type: none"> • Off: incorrect connection, signal absent • on fixed: correct connection
Activity (2)	Indicates the communication state: <ul style="list-style-type: none"> • off: no activity on the line • flashing (activity on line present receiving and/or transmitting)

Configurations via menu Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
<i>SN and version</i>	Identifier and SW version of the module
<i>MAC address</i>	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device

Remote configurations

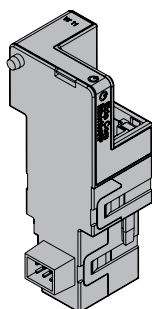
Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
<i>Data access mode</i>	Defines Dataset (acyclic data) access mode <ul style="list-style-type: none"> • each individual acyclic register can be accessed in the Legacy mode using the Slot, Subslot and Index fields (with Slot fixed at 3) • only complete blocks can be accessed in the Dataset mode; Slot is fixed at 0, Subslot at 1 and Index defines the block reference See System Interface for details.	Legacy
<i>Cyclic data endianness</i>	Establishes whether the register of the cyclic data item is configured in Big endian or Little endian.	Little endian
<i>Acyclic data endianness</i>	Establishes whether the register of the acyclic data item is configured in Big endian or Little endian.	Big endian

Remote information

Certain integrative information concerning the version and state of the module is available via service connector (via Ekip Connect) or through communication via system bus, i.e., HW and Boot version, CRC state (correctness of SW in module), DCP Name, network settings (IP address, Network Mask, Gateway address)

7 - Ekip Com EtherNet/IP™



Ekip Com EtherNet/IP™ is a communication accessory which allows Ekip Touch to be integrated into an Ethernet network with EtherNet/IP™ communication protocol, with remote supervision and monitoring functions.

The module is configured as master and remotely, you can:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator
- access information and parameters not available on the display
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: *the remote open and close commands of the circuit-breaker can only be executed if Ekip Touch is in the Remote configuration and the circuit-breaker is equipped with the Ekip Com Actuator module (page 258)*

Ekip Com EtherNet/IP™ is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

Depending on the parameter settings, described in the next pages, the ports used by the module are:

Port	Protocol	Notes
44818	TCP	Encapsulation Protocol (example: ListIdentity, UCMM, CIP Transport Class 3)
44818	UDP	44818 UDP Encapsulation Protocol (example: ListIdentity)
2222	UDP	2222 UDP CIP Transport Class 0 or 1
68/udp	DHCP Client	DHCP client enabled alternatively as <i>Static address = On</i>

Safety and cyber security

Since the module allows the actuator connected to Ekip Touch and access to the data in the unit to be checked, it can only be connected to networks equipped with all the necessary security and prevention measures against unauthorized access (for example, the network of the control system of an installation).



IMPORTANT:

- **it is the customer's sole responsibility to provide and continuously ensure a secure connection between the module and customer network or any other network (as the case may be). The plant manager must establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, the customer system and interface against any kind of security breaches, unauthorized access, interference, intrusion, loss and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized accesses, interference, intrusion, loss and/or theft of data or information.**
- **The module cannot be connected directly to the Internet. Only connect to dedicated Ethernet networks with EtherNet/IP™ communication protocol**

Models

Two different modules compatible with the EtherNet/IP™ protocol are available: *Ekip Com EtherNet/IP™* and *Ekip Com EtherNet/IP™ Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: *if different indications are not given, the information in the next chapter is valid for both models*

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).



IMPORTANT: *each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com EtherNet/IP™ Redundant)*

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); a cable of the Class 6 S/FTP type (Class 6 with double screening S/FTP) must be used for the communication bus.

To connect the module to Ekip Touch, please consult document [1SDH001000R0514](#).

Power supply *Ekip Com EtherNet/IP™* is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

Interface the module has three signaling leds:

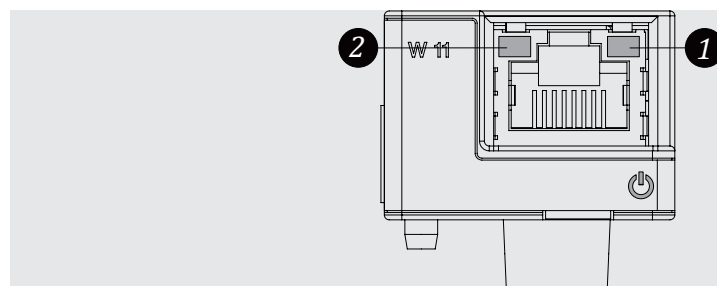


Figure 134

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> Off: module off on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present. flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Link (1)	Indicates the communication state: <ul style="list-style-type: none"> Off: incorrect connection, signal absent on fixed: correct connection
Activity (2)	Indicates the communication state: <ul style="list-style-type: none"> off: no activity on the line flashing (activity on line present receiving and/or transmitting)


Configurations via menu Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

The following communication parameters can be configured if the module has been correctly detected by Ekip Touch in the *Settings-Modules* menu:

Parameter	Description	Default
<i>Static IP address ON</i>	Defines whether the module has the dynamic (Off) or static (On) IP address. Se = On all the associated parameters are enabled	OFF
<i>Static address IP address</i>	Enables the static IP to be selected	0.0.0.0
<i>Static Network Mask</i>	Enables the subnet mask to be selected	0.0.0.0
<i>Static Gateway address</i>	When there are several subnets, enables the IP address of the node to which the module is connected to be selected	0.0.0.0

Information in menu

The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
<i>SN and version</i>	Identifier and SW version of the module
<i>IP address</i>	Address of the module, assigned to the module by a DHCP server at the time of connection to the network in the case of configuration with a dynamic IP, or can be set via the menu in the event of a static IP  NOTE: without a DHCP server, the module automatically adopts a random IP address within the 169.254.xxx.xxx range
<i>Network Mask</i>	Subnet mask; identifies the method for recognizing the subnet to which the modules belong and enables modules to be searched for within a defined set of recipients.
<i>Gateway address</i>	IP address of the node to which the module is connected, in the presence of several subnets
<i>MAC address</i>	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device

Remote configurations

Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
<i>Enable IEEE 1558</i>	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾ .	OFF
<i>IEEE 1558 Master</i>	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
<i>IEEE 1558 Delay mechanism</i>	Allows the data exchange mode between module and master, either Peer-to-Peer or End-to-End, to be selected.	End-to-End
<i>Enable client SNTP</i>	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾	OFF
<i>ANTP Server address</i>	Allows the network server that supplies the SNTP to be set.	0.0.0.0
<i>Time zone</i>	Defines the time zone to be used for synchronism	+00:00
<i>Daylight Saving Time</i>	Used to select whether daylight saving time is present (ON) or not (OFF) in the country to which the synchronization time refers	OFF
<i>IEEE 1588 Boundary clock</i>	Parameter useful if an IEEE 1588 GrandMaster clock is not available: • If enabled (ON), the module is seen as an IEEE1588 master clock by all the slaves/devices in the same local network, even when the source of external synchronism is different from IEEE 1588 (SNTP for example) • If disabled (OFF) the module benefits from the synchronism of the master in its own network	OFF
<i>Enable package Limitation</i>	Enables the Rate limiter function, which limits the number of packages entering the module from the network, to be activated/deactivated	Disable

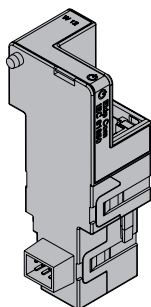
⁽¹⁾ *Enable IEEE 1588 and Enable SNTP client must not be enabled at the same time*

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
<i>HW and Boot version</i>	General module information
<i>Flash CRC status and result</i>	Information about the correctness of the SW in the module
<i>Ekip Link status</i>	Signals Ethernet cable connection errors
<i>SNTP Server Error</i>	Error in communication with SNTP server
<i>SNTP Server Synchronization</i>	State of synchronism with SNTP server
<i>IEEE 1558 status</i>	Valid with Master IEEE 1588= ON , notifies the presence (Slave or PTP Master Active) or absence (PTP Master but Passive) of a higher level master

8 - Ekip Com IEC 61850



Ekip Com IEC 61850 is a communication accessory which allows Ekip Touch to be integrated into an Ethernet network with IEC 61850 communication protocol, with remote supervision and monitoring functions.

The module is configured as master and remotely, you can:

- read Ekip Touch measurements and information
- manage certain controls, including opening and closing the actuator
- access information and parameters not available on the display
- transmit vertical communication (report) to superior supervision systems (SCADA), with statuses and measurements (re-transmitted whenever and only if they change with respect to the previous report)
- transmit horizontal communication (GOOSE) to other actuator devices (example: medium voltage circuit-breakers), with all the information about status and measurements normally shared by Ekip Com communication modules via bus.
- If connected to a withdrawable version of the circuit-breaker, the allows the racked-in/racked-out status to be detected



NOTE: *the remote open and close commands of the circuit-breaker can only be executed if Ekip Touch is in the Remote configuration the circuit-breaker is equipped with the Ekip Com Actuator module (page 258)*

Ekip Com IEC 61850 is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

The System Interface document is available for mapping the module in its communication network. All the required communication and command details are listed in the document (page 179).

The document also describes the configuration files for the IEC 61850 protocol and relative uploading procedure for assigning the Technical Name and enabling GOOSE messages if required (by setting the relative MAC Addresses)

Depending on the parameter settings, described in the next pages, the ports used by the module are:

Ethertype	Port	Protocol
0x0800-IP	102	ISO Transport Service on top of the TCP (RFC 1006)
0x88B8	-	GOOSE Messages
0x0800-IP	123 UDP	NTP - Network Time Protocol
0x0800-IP	69 UDP	TFTP - Trivial File Transfer Protocol

Safety and cyber security

The module uses the HTTPS protocol and can be connected to the Internet

Since the module allows the actuator connected to Ekip Touch and access to the data in the unit to be checked, it can only be connected to networks equipped with all the necessary security and prevention measures against unauthorized access (for example, the network of the control system of an installation).



IMPORTANT:

- **it is the customer's sole responsibility to provide and continuously ensure a secure connection between the module and customer network or any other network (as the case may be). The plant manager must establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, the customer system and interface against any kind of security breaches, unauthorized access, interference, intrusion, loss and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized accesses, interference, intrusion, loss and/or theft of data or information.**
- **The module cannot be connected directly to the Internet. Only connect to dedicated Ethernet networks with IEC 61850 communication protocol**

Models Two different modules compatible with the IEC 61850 protocol are available: *Ekip Com IEC 61850* and *Ekip Com IEC 61850 Redundant*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: if different indications are not given, the information in the next chapter is valid for both models

The two modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. for applications where high grid reliability is required).



IMPORTANT: each Ekip Touch can be fitted with only one module per type. The configuration with two modules of the same model is not allowed (example: two Ekip Com IEC 61850 Redundant)

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); a cable of the Class 6 S/FTP type (Class 6 with double screening S/FTP) must be used for the communication bus.

To connect the module to Ekip Touch, please consult document [1SDH001000R0514](#).

Power supply *Ekip Com IEC 61850* is supplied directly by the *Ekip Supply* module to which it is connected..



NOTE: communication between Ekip Touch and the module is interrupted in the absence of auxiliary power supply

Interface the module has three signaling leds:

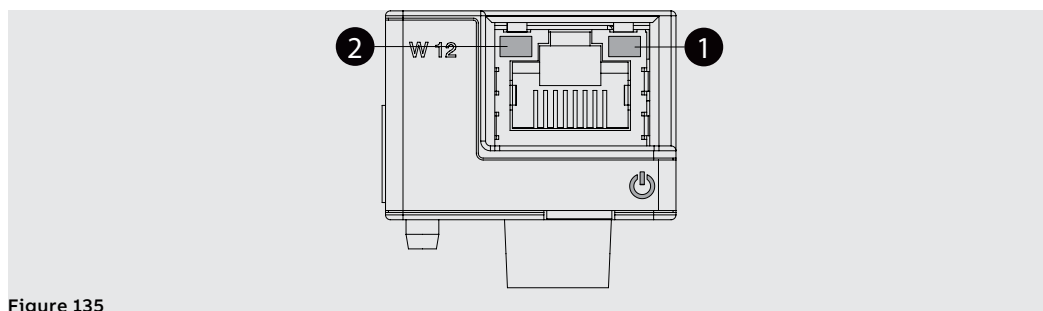


Figure 135

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> Off: module off on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present. flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Link (1)	Indicates the communication state: <ul style="list-style-type: none"> Off: incorrect connection, signal absent on fixed: correct connection
Activity (2)	Indicates the communication state: <ul style="list-style-type: none"> off: no activity on the line flashing (activity on line present receiving and/or transmitting)

Configurations via menu


Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

The following communication parameters can be configured if the module has been correctly detected by Ekip Touch in the *Settings-Modules* menu:

Parameter	Description	Default
<i>Static IP address ON</i>	Defines whether the module has the dynamic (Off) or static (On) IP address. Se = On all the associated parameters are enabled	OFF
<i>Static address IP address</i>	Enables the static IP to be selected	0.0.0.0
<i>Static Network Mask</i>	Enables the subnet mask to be selected	0.0.0.0
<i>Static Gateway address</i>	When there are several subnets, enables the IP address of the node to which the module is connected to be selected	0.0.0.0
<i>Enable SNTP client</i>	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled.	OFF
<i>SNTP Server Addr.</i>	Allows the network server that supplies the SNTP to be set.	0.0.0.0
<i>Configuration Session</i>	Defines the write mode of the configuration file in the module via the TFTP port; two options are available: • Always ON: the TFTP port is always open and write is always enabled • Activation requested: the TFTP is opened by a specific command, which enables write for a limited time (or for a finite number of data packages)	Always ON
<i>Start Configuration</i>	Write enable command on TFTP port in Activation mode requested	---

Information in menu

The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
<i>SN and version</i>	Identifier and SW version of the module
<i>IP address</i>	Address of the module, assigned to the module by a DHCP server at the time of connection to the network in the case of configuration with a dynamic IP, or can be set via the menu in the event of a static IP  NOTE: without a DHCP server, the module automatically adopts a random IP address within the 169.254.xxx.xxx range
<i>Network Mask</i>	Subnet mask; identifies the method for recognizing the subnet to which the modules belong and enables modules to be searched for within a defined set of recipients.
<i>Gateway address</i>	IP address of the node to which the module is connected, in the presence of several subnets
<i>MAC address</i>	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device
<i>Cfg file</i>	Name of the configuration file uploaded to the modules
<i>Cfg file error</i>	Code of the error concerning the configuration file (0 = no error)

Remote configurations

Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
<i>Preferred configuration file</i>	If several configuration files are present, allows file hierarchy between .cid and .iid to be defined	.cid
<i>Enable IEEE 1588</i>	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾ .	OFF
<i>IEEE 1588 Master</i>	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
<i>IEEE 1588 Delay mechanism</i>	Allows the data exchange mode between module and master, either Peer-to-Peer or End-to-End, to be selected.	End-to-End
<i>Time zone</i>	Defines the time zone to be used for synchronism	+00:00
<i>Daylight Saving Time</i>	Used to select whether daylight saving time is present (ON) or not (OFF) in the country to which the synchronization time refers	OFF
<i>TFTP Security level</i>	Defines the file loading procedure: <ul style="list-style-type: none">• <i>TFTP always On</i> = port open, loading always possible• <i>TFTP enable required</i> = port normally closed. To start loading, <i>Enable TFTP</i> must be run at the start of the procedure and <i>Disable TFTP</i> must be run at the end of the procedure (disable not necessary, security command).	TFTP always On
<i>CB Open/CB Close command</i>	Defines the limitations to remote opening and closing command execution: <ul style="list-style-type: none">• <i>Standard commands</i> = standard commands (unrestricted) activated• <i>CB operate request</i> = standard commands not activated. Use programmable functions YC COMMAND and YO COMMAND, and Request breaker open (28) and Request breaker close (29) commands	Standard commands
<i>Zone Selectivity Analysis</i>	Analysis of selectivity input from IEC 61850 module can be enabled/disabled for each of protections S, S2, G, Gext, D, D(BW), D(FW)	Disabled (all)
<i>IEEE 1588 Boundary clock</i>	Parameter useful if an IEEE 1588 GrandMaster clock is not available: <ul style="list-style-type: none">• If enabled (ON), the module is seen as an IEEE1588 master clock by all the slaves/devices in the same local network, even when the source of external synchronism is different from IEEE 1588 (SNTP for example)• If disabled (OFF) the module benefits from the synchronism of the master in its own network	OFF
<i>Enable package Limitation</i>	Enables the Rate limiter function, which limits the number of packages entering the module from the network, to be activated/deactivated	Disable

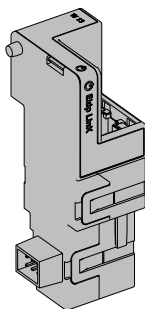
⁽¹⁾ Enable IEEE 1588 and Enable SNTP client must not be enabled at the same time

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
<i>HW and Boot version</i>	General module information
<i>Flash CRC status and result</i>	Information about the correctness of the SW in the module
<i>Ekip Link status</i>	Signals Ethernet cable connection errors
<i>SNTP Server Error</i>	Error in communication with SNTP server
<i>SNTP Server Synchronization</i>	State of synchronism with SNTP server
<i>IEEE 1588 status</i>	Valid with Master IEEE 1588= ON , notifies the presence (Slave or PTP Master Active) or absence (PTP Master but Passive) of a higher level master
<i>GOOSE Missing</i>	Signals that an expected GOOSE has not been received
<i>Configure Mismatch</i>	A GOOSE received does not conform to the expected structure
<i>Decode Error</i>	
<i>Sequence number error</i>	
<i>Remote programmable statuses (from E to R)</i>	Condition (true/false) of the programmable states and information on selectivity arising from logic defined in the configuration files loaded in module IEC 61850
<i>Zone selectivity remote inputs</i>	

9 - Ekip Link



Ekip Link is a communication accessory which allows Ekip Touch to be integrated into an internal Ethernet network with ABB proprietary protocol.

The following functions can be performed with the remote module:

- Programmable Logic
- Power Controller
- Zone Selectivity

To perform these functions, the system units involved must be equipped with their own *Ekip Link* and for each of these, the IP addresses of all the other *Ekip Link* connected must have been entered.

Each device is defined as an Actor in the Link network.

Each *Ekip Link* can interface with up to 15 actors, of which up to 12 for the *Zone Selectivity* function.

The ports used by the module are:

Port	Service	Notes
18/udp	ABB proprietary	In the case of rapid exchanges of information among ABB devices
319/udp	IEEE 1588	Valid with IEEE 1588 protocol enabled
320/udp		
68/udp	DHCP client	DHCP client enabled alternatively as <i>Static address = On</i>

Ekip Link is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

If connected to a withdrawable version of the circuit-breaker, it is possible to detect the racked-in/racked-out status

Network

The *Ekip Link* modules must be connected to a dedicated network that includes only *Ekip Link* and Ethernet switches for which support for level L2 multicast is declared in the datasheet.

If the network also includes routers, multicast must be enabled and configured in all the level L3 VLAN interfaces.

Programmable Logic

Activation of up to four bits of the *Ekip Link* can be programmed via the Programmable Logic function, each bit according to any combination of the status bits of an actor of which the IP address has been entered.

These four bits are indicated as Statuses A B C and D; they are remotely programmable and their value is transmitted to the device to which *Ekip Link* is connected

Power Controller

Using the *Power Controller* function, each actor can:

- Acquire the status and control the loads
- Act as master and collect the energy measurements of actors entered as Energy Meters
- Supply energy measurements to actors entered as masters

The state of the loads can be acquired by checking the status of the inputs of the signaling modules connected to the actors of which the IP Addresses have been entered, while load control can be performed by programming the outputs.

Remote acquisition of the statuses of the loads and their control can also be performed with *Ekip Signalling 10K* connected to the network.

Further information on the potential of the function is available in the White Paper [1SDC007410G0201](#) "Load management with Ekip Power Controller for SACE Emax 2".

Zone selectivity With the Zone Selectivity function:

- the IP addresses entered refer to actors with the role of interlock with respect to the current role
- the protections for which selectivity must be actuated by setting a mask, must be selected for each interlock actor entered. Thus set, the function will now be indicated as logic in the following text so as to distinguish it from the standard function, now also indicated as hardware in the following text
- thus selected, the protections add to those of the hardware S, I, 2I, MCR, G, D-Backward and D-Forward
- hardware selectivity only, or both hardware and logic selectivity can be selected
- diagnosis can be set, for each interlock release, to ascertain whether there is consistency between the hardware and logic selectivity information
- a mask can be set for the purpose of identifying those protections whose received selectivity information must be re-transmitted, regardless of whether the actor is in the alarm status. The mask is only applicable to logic selectivity information

For further details about the *Zone Selectivity* function with *Ekip Link*, please consult page 93.

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); a cable of the Class 6 S/FTP type (Class 6 with double screening S/FTP) must be used for the communication bus.

To connect the module to Ekip Touch, please consult document [1SDH001000R0514](#).

Power supply *Ekip Link* is supplied directly by the Ekip Supply module to which it is connected.

NOTE: communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

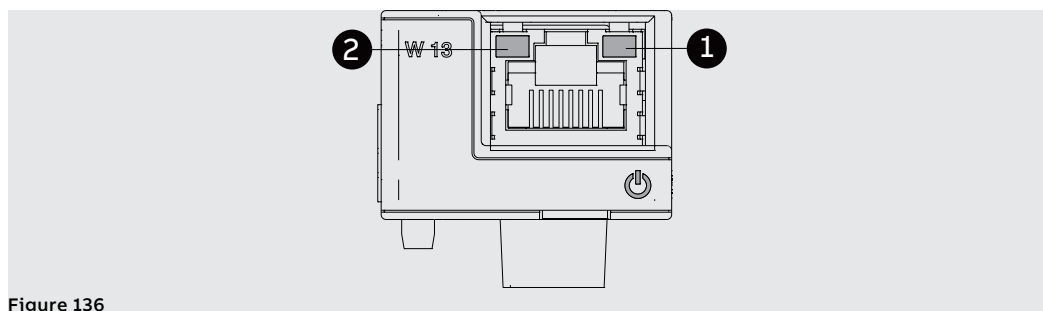
Interface the module has three signaling leds:

Figure 136

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> • Off: module off • on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present. • flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Link (1)	Indicates the communication state: <ul style="list-style-type: none"> • Off: incorrect connection, signal absent • on fixed: correct connection
Activity (2)	Indicates the communication state: <ul style="list-style-type: none"> • off: no activity on the line • flashing (activity on line present receiving and/or transmitting)

Configurations via menu


Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

The following communication parameters can be configured if the module has been correctly detected by Ekip Touch in the *Settings-Modules* menu:

Parameter	Description	Default
<i>Static IP address ON</i>	Defines whether the module has the dynamic (Off) or static (On) IP address. Se = On all the associated parameters are enabled	OFF
<i>Static address IP address</i>	Enables the static IP to be selected	0.0.0.0
<i>Static Network Mask</i>	Enables the subnet mask to be selected	0.0.0.0
<i>Static Gateway address</i>	When there are several subnets, enables the IP address of the node to which the module is connected to be selected	0.0.0.0


Information in menu

The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
<i>SN and version</i>	Identifier and SW version of the module
<i>IP address</i>	Address of the module, assigned to the module by a DHCP server at the time of connection to the network in the case of configuration with a dynamic IP, or can be set via the menu in the event of a static IP  NOTE: without a DHCP server, the module automatically adopts a random IP address within the 169.254.xxx.xxx range
<i>Network Mask</i>	Subnet mask; identifies the method for recognizing the subnet to which the modules belong and enables modules to be searched for within a defined set of recipients.
<i>Gateway address</i>	IP address of the node to which the module is connected, in the presence of several subnets
<i>MAC address</i>	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device

Remote configurations

Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
<i>Client/Server</i>	Parameter for changing the configuration of the module from Server Only to Client and Server and for integrating it into an interactive data exchange network (see Ekip Com Hub on page 240).  IMPORTANT: if Client/Server, the module allows data exchange like a normal Server function	Server only
<i>Enable IEEE 1588</i>	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾ .	OFF
<i>IEEE 1588 Master</i>	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
<i>IEEE 1588 Delay mechanism</i>	Allows the data exchange mode between module and master, either Peer-to-Peer or End-to-End, to be selected.	End-to-End
<i>Enable client SNTP</i>	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled ⁽¹⁾	Off
<i>ANTP Server address</i>	Allows the network server that supplies the SNTP to be set.	0.0.0.0
<i>Time zone</i>	Defines the time zone to be used for synchronism	+00:00
<i>Daylight Saving Time</i>	Used to select whether daylight saving time is present (ON) or not (OFF) in the country to which the synchronization time refers	OFF

Continued on the next page

Parameter	Description	Default
<i>Disable Gratuitous ARP</i>	Permits (Enabled ARP) the periodic generation of a Gratuitous ARP message, used by Ekip Connect to rapidly find the modules via Ethernet scan without knowing the IP address beforehand	ARP Enabled
<i>Password protected access</i>	Enables the writing operations performed via the network to be protected by a password (Request password)	Standard mode
<i>Password Modbus TCP</i>	With access protected by enabled password, this is the password to use before each writing session ⁽²⁾ .	Local access

⁽¹⁾ Enable IEEE 1588 and Enable SNTP client must not be enabled at the same time

⁽²⁾ the parameter can only be changed via system bus in the remote configuration

Remote Link configurations

Regarding the Link functions, the following further parameters are available:

Parameter	Description	Default
<i>Link Actor (1÷15)</i>	IP address of each actor (from 1 to 15)	0.0.0.0
<i>Remote Programmable Status (A÷D)</i>	Configuration parameters of the configurable states: <ul style="list-style-type: none"> • selection of actor (actor from 1 to 15) which activates the programmable status • event of the actor that determines change of programmable status 	Actor 1 None
<i>Remote Status word (A÷D)</i>	Configuration parameters of the words: <ul style="list-style-type: none"> • selection of actor (actor from 1 to 15) from which the word status is taken • selection of the taken word 	None 1 global
<i>Diagnostic</i>	Active (Passive diagnosis) or deactivated (No diagnosis) cabled selectivity diagnosis	No Diagnostic
<i>Diagnostic check timeout</i>	30 s, 1 min, 10 min, 60 min diagnosis frequency intervals available, if activated	30 seconds
<i>Zone Selectivity Type</i>	Configuration of hardware selectivity (Only HW) or hardware and logic (Mixed)	HW only
<i>Repeat Configuration mask</i>	Interactive mask for selecting selectivity to be sent also to the upper levels (even if not active in the programmed device)	0x0000

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

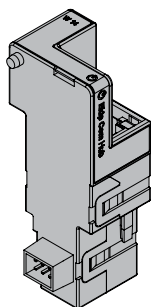
Information	Description
<i>HW and Boot version</i>	General module information
<i>Flash CRC status and result</i>	Information about the correctness of the SW in the module
<i>Ekip Link status</i>	Signals Ethernet cable connection errors
<i>SNTP Server Error</i>	Error in communication with SNTP server
<i>SNTP Server Synchronization</i>	State of synchronism with SNTP server
<i>IEEE 1588 status</i>	Valid with Master IEEE 1588= ON , notifies the presence (Slave or PTP Master Active) or absence (PTP Master but Passive) of a higher level master

Remote Link information

Regarding the Link functions, the following further parameters are available:

Information	Description
<i>Line Congruency detection</i>	Information about the state and inconsistency of HW and logic selectivity (state and type of selectivity inconsistent)
<i>Remote Programmable Status</i>	Status (true/false) of remote programmable statuses A, B, C and D
<i>Remote Status Word</i>	Value of remote programmable Words A, B, C, D
<i>Logic Zone Selectivity</i>	Logic selectivity states (inputs and outputs)

10 - Ekip Com Hub



Ekip Com Hub is a communication accessory that enables the data and measurements of *Ekip Touch* and other devices connected to the same installation to be gathered and then made available on the server through an Ethernet network.

The configuration of the module is available via *Ekip Connect* or with the *System Interface* document, which contains all the details. (page 179).

The ports used by the module are:

Port	Service	Notes
67/udp 68/udp	DHCP client	DHCP client enabled alternatively as <i>Static address = On</i>
443/tcp	HTTPS	Always active when module is enabled
123/udp	SNTP	Active with SNTP client enabled
53/udp	DNS	Always active

The *Ekip Com Modbus RTU* and *Ekip Com Modbus TCP* modules can be configured to support *Ekip Com Hub* in the collection of data to send to Cloud. See Getting Started [1SDC200063B0201](#).

Ekip Com Hub is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 258).

If connected to a withdrawable version of the circuit-breaker, it is possible to detect the racked-in/racked-out status

Safety and cyber security

The module uses the HTTPS protocol and can be connected to the Internet



IMPORTANT:

- **it is the customer's sole responsibility to provide and continuously ensure a secure connection between the module and customer network or any other network (as the case may be). The plant manager must establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, the customer system and interface against any kind of security breaches, unauthorized access, interference, intrusion, loss and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized accesses, interference, intrusion, loss and/or theft of data or information.**

Connections

The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); a cable of the Class 6 S/FTP type (Class 6 with double screening S/FTP) must be used for the communication bus.

To connect the module to *Ekip Touch*, please consult document [1SDH001000R0514](#).

Power supply

Ekip Com Hub is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: *communication between Ekip Touch and the module is interrupted in the absence of auxiliary power supply*

Interface the module has three signaling leds:

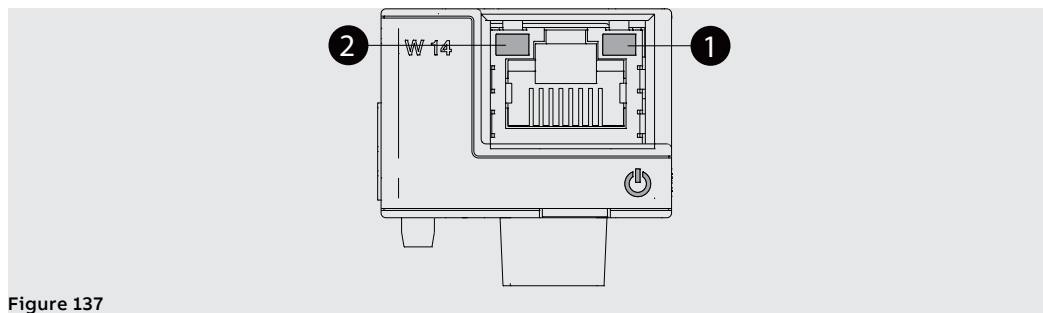


Figure 137

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> • Off: module off • on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present. • flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
Link (1)	Indicates the communication state: <ul style="list-style-type: none"> • Off: incorrect connection, signal absent • on fixed: correct connection
Activity (2)	Indicates the communication state: <ul style="list-style-type: none"> • off: no activity on the line • flashing (activity on line present receiving and/or transmitting)

Configurations via menu Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 49).

The following communication parameters can be configured if the module has been correctly detected by Ekip Touch in the *Settings-Modules* menu:


Parameter	Description	Default
<i>Enable</i>	Switches communication between module and server on/off.	Off
<i>Static IP address ON</i>	Defines whether the module has the dynamic (Off) or static (On) IP address. If = On all the associated parameters are enabled	Off
<i>Static address IP address</i>	Enables the static IP to be selected	0.0.0.0
<i>Static Network Mask</i>	Enables the subnet mask to be selected	0.0.0.0
<i>Static Gateway address</i>	When there are several subnets, enables the IP address of the node to which the module is connected to be selected	0.0.0.0
<i>Enable SNTP client</i>	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled.	Off
<i>SNTP Server Addr.</i>	Allows the network server that supplies the SNTP to be set.	0.0.0.0
<i>Password</i>	Code required to register module on Cloud	---

The Remote FW update submenu enables the Firmware update function of the module to be managed; the following parameters are available:

Parameter	Description	Default
<i>Enable</i>	Enables firmware update function of module to be remotely activated/deactivated	OFF
<i>Automatic</i>	The parameter is available when Enable = On and allows the automatic update mode to be activated (On): in the presence of new Firmware, this latter is updated automatically. If the parameter is Off, updating must be performed in the Manual mode: in the presence of new Firmware, the message Ekip Com Hub FW Update appears in the status bar and updating is performed via the Manual command.	OFF (manual)
<i>Start FW update</i>	This parameter is available when Enable= On, with Automatic= Off configuration and when new Firmware is present (see description above); allows the Firmware update of the module to run	

Information in menu

The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
<i>SN and version</i>	Identifier and SW version of the module
<i>IP address</i>	Address of the module, assigned to the module by a DHCP server at the time of connection to the network in the case of configuration with a dynamic IP, or can be set via the menu in the event of a static IP  NOTE: without a DHCP server, the module automatically adopts a random IP address within the 169.254.xxx.xxx range
<i>Network Mask</i>	Subnet mask; identifies the method for recognizing the subnet to which the modules belong and enables modules to be searched for within a defined set of recipients.
<i>Gateway address</i>	IP address of the node to which the module is connected, in the presence of several subnets
<i>MAC address</i>	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device

Remote configurations

Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

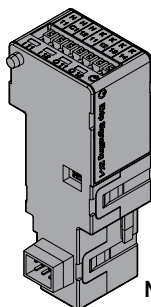
Parameter	Description	Default
<i>CRL Enable</i>	Allows the CRL (Certificate Revocation List) to be used to ascertain whether the server certificate is valid	
<i>Clock update hardening enable</i>	Enables control of the time reference transmitted by the SNTP server	
<i>SNTP Server Location</i>	Enables the position of the SNTP server to be set in relation to the network in which the module is installed	
<i>SNTP Time zone</i>	Defines the time zone to be used for synchronism	+00:00
<i>SNTP Daylight Saving Time</i>	Used to select whether daylight saving time is present (ON) or not (OFF) in the country to which the synchronization time refers	OFF
<i>Disable Gratuitous ARP</i>	Permits (Enabled ARP) the periodic generation of a Gratuitous ARP message, used by Ekip Connect to rapidly find the modules via Ethernet scan without knowing the IP address beforehand	ARP Enabled
<i>Cloud data send enable</i>	Enables/disables the function that collects and transmits the module data	OFF
<i>JSON data compression</i>	Allows the compressed format of the JSON file sent to Cloud to be selected (enable)	Disabled

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
<i>HW and Boot version</i>	General module information
<i>Flash CRC status and result</i>	Information about the correctness of the SW in the module
<i>Publish enable configuration</i>	State of enabling in Security File
<i>Configuration file</i>	Name of the file dedicated to the information to transmit (measurements, etc.)
<i>Security file</i>	Name of the file dedicated to the information requested by the module for transmission purposes (addresses, certificates, etc.)
<i>Certificate Revocation List</i>	Name of the file containing the revoked certificates
<i>Executable file</i>	Name of the executable firmware update file
<i>Configuration error</i>	Module configuration error state
<i>Sample time</i>	Period of data acquisition from the connected devices
<i>Log time</i>	Period within which the acquired data are saved in the log
<i>Upload time</i>	Period (calculated by the module) between each data transmission
<i>Configured device</i>	Number of modules involved in the network with Hub module
<i>Polling period API events</i>	Period in which the module communicates with the API device
<i>Connection client 1, 2, 3</i>	Address of TCP Modbus clients connected to the module
<i>Statistics</i>	Recordings of the latest saving operations and percentage of resources being used
<i>Status plant side</i>	Information about the quality of the communication with the other devices
<i>Status Cloud side</i>	State of the errors concerning the TLS session established between module and server
<i>Application status</i>	Operation progress indicators
<i>Status</i>	General indicators of the module: SNTP state, flash, cable connection, FW availability, file errors, etc.

11 - Ekip Signalling 2K



Models

Ekip Signalling 2K is an accessory signaling module allowing programmable inputs/outputs to be managed.

This module has:

- two contacts for output signals and relative status led
- two digital inputs and relative status led
- a Power led with the startup status of the module

Three different Signalling 2K modules are available: *Ekip Signalling 2K-1*, *Ekip Signalling 2K-2* and *RELT - Ekip Signalling 2K-3*.

The modules are identical in terms of characteristics and installation methods, except for: display menus, cabling and addresses for system communication, which are specific for each module.



NOTE: if different indications are not given, the information in the next chapter is valid for all three models

The three modules can be connected at the same time to Ekip Touch so as to expand the potential of the unit (e.g. to increase the number of control outputs and inputs).



IMPORTANT: each Ekip Touch can be fitted with only one module per type. The configuration with two or three modules of the same model is not allowed (example: two Ekip Signalling 2K-1 modules)

RELT - Ekip Signalling 2K-3

The RELT - Ekip Signalling 2k-3 module has a dedicated command (RELT Wizard) for auto-programming a set of trip unit parameters; The wizard ensures the activation of the 2I protection when the input of the RELT – Ekip Signalling 2k-3 module active. In addition, the 2I is placed in local model and the RELT module's outputs are activated.

Below is a complete list of the parameters configured by the command:

Parameter	Configuration from RELT Wizard command	Page
2I Protection ⁽¹⁾	On; Threshold I31 = 1,5 In	62
2I Protection Function	Delay ON=100 ms; Delay OFF=15s; Activation = dependent function; Function = RELT - Ekip Signalling 2K-3 Input 1 (I31)	62, 92
Input I31 (RELT - Ekip Signalling 2K-3)	Polarity = active closed; Delay = 0,1 s	245, 246
Output O31 and O32 (RELT - Ekip Signalling 2K-3)	Signal source = 2I protection active; Delay = 0 s; Contact type = NO; Self-latching = OFF; min Activation Time = 0 ms	246
SwitchOnLocal Function	Function = 2I protection active; Delay = 0 s	92

⁽¹⁾ if Dual set is present, programming performed for both Set A and Set B

The RELT setup Wizard can be found in the 2I protection menu. The RELT setup Wizard can be found in the 2I protection menu and also the first time the trip unit is switched ON.

In the case that the wizard is not executed (or is rejected during the initial trip unit start up), the functionality and the characteristic of the RELT – Ekip Signalling 2k-3 module will be as described in the following pages.



NOTE: The input is able to operate with a maximum input resistance of 25 Ohm. Wiring distance limitation have to be calculated from this value. As example: considering an AWG20 cable with 29.5 Ohm/km and a microswitch with a resistance of few milliohm (negligible for the calculation) the limitation is: $25 \text{ (Ohm)} / 29.5 \text{ (Ohm/km)} / 2 \text{ wires} = 0.423 \text{ km} = 423 \text{ m}$

Connections

The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#) and [1SDM000019A1002](#); use AWG 22-16 cables with 1.4 mm maximum outer diameter for the external cabling.

To connect the module to Ekip Touch, please consult document [1SDH001000R0524](#).

Power supply

Ekip Com Signalling 2K is supplied directly by the Ekip Supply module to which it is connected.



NOTE: communication between Ekip Touch and the module is interrupted in the absence of auxiliary power supply

Input

Ekip Touch can be configured so that the status of the inputs corresponds to actions or signals, with different programming options (page 246).

The connection of each input (H11 and H12 for model 2K-1, H21 and H22 for model 2K-2, H31 and H32 for model 2K-3) must be made with reference to the common contacts (HC).

The module permits two logic statuses, interpreted differently by Ekip Touch depending on the configuration selected for each contact:

State	Electrical condition	Contact configuration	Status detected by Trip unit
Open	Circuit open ⁽¹⁾	Active open	ON
		Active closed	OFF
Closed	Short-circuit ⁽²⁾	Active open	OFF
		Active closed	ON

⁽¹⁾ $R > 100 \text{ k}\Omega$

⁽²⁾ $R \text{ (wiring + short circuit contact)} < 25 \Omega$

Output

Ekip Touch can be configured so that the contacts of each output are closed or opened upon the occurrence of one or more events, with different programming options (page 246).

The output of each module consists of 2 contacts (K11-K12 and K13-K14 for model 2K-1; K21-K22 and K23-K24 for model 2K-2; K31-K32 and K33-K34 for model 2K-3), which are isolated from the unit and from the other outputs, and have the following electrical characteristics:

Characteristics	Maximum limit ⁽¹⁾
Maximum switchable voltage	150 VDC / 250 VAC
Breaking capacity	2 A @ 30 VDC, 0,8 A @ 50 VDC, 0,2 A @ 150 VDC, 4 A @ 250 VAC
Dielectric strength between open contacts	1000 VAC (1 minutE @ 50 Hz)
Dielectric strength between each contact and coil	1000 VAC (1 minutE @ 50 Hz)

⁽¹⁾ data relating to a resistive load

Interface

the module has three signaling leds:

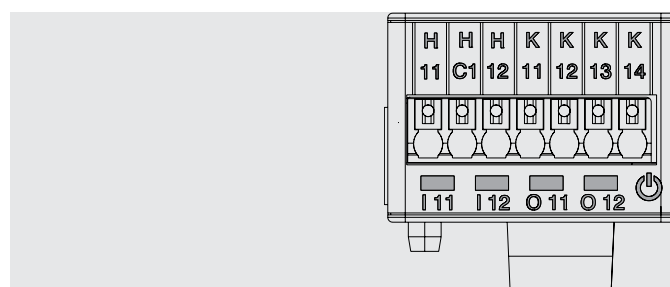



Figure 138

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> Off: module off on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present. flashing not synchronized with the Power led of Ekip Touch (2 fast flashes per second): module on and communication with Trip unit absent
I 11, I 12	Indicate the status of the contacts of each output: <ul style="list-style-type: none"> off: contact open on: contact closed
O 11, O 12	Indicate the status of the contacts of each input: <ul style="list-style-type: none"> off: circuit open on: short circuit


Menu The specific configuration area will activate in the *Settings - Modules* menu if the *Ekip Signalling 2K* module is detected correctly by Ekip Touch.

A specific menu containing the submenus of all the available and configurable inputs and outputs is available for each *Ekip Signalling 2K* module detected by Ekip Touch.

Input parameters All the available inputs enable the following parameters to be configured:

Parameter	Description	Default
<i>Polarity</i>	Defines whether the input is interpreted as ON by Ekip Touch when it is open (<i>Active open</i>) or when it is closed (<i>Active Closed</i>)	Active closed
<i>Delay</i>	Minimum activation time of the input before status change is recognized; the delay is given in seconds and can be set within range: 0 s to 100 s, in 0.01 s steps  NOTES: • if the input is deactivated before this time has elapsed the status change is not recognized • if delay = 0 s status change must still be more than 300 µS	0.1 s

Output parameters All the available inputs enable the following parameters to be configured:

Parameter	Description	Default
<i>Signal source</i>	Event which activates the output and switches the contacts. Different protection proposals, statuses and thresholds are available on the display; the Custom mode can be configured via Ekip Connect so as to extend the solutions and combine several events	None
<i>Delay</i>	Minimum duration of the presence of the source before the output is activated; the delay is given in seconds and can be set within range: 0 s to 100 s, in 0.01 s steps  NOTES: • the output will not be switched if the source is deactivated before this time has elapsed • if delay = 0 s the source must still be present for longer than 300 µS	0 s
<i>Contact Type</i>	Defines the rest status of the contact with source not present between: open (NO) and closed (NC)	NO
<i>Latched⁽¹⁾</i>	Allows the output (and relative status led) to be kept activated (On) or deactivated (Off) when the event disappears	OFF
<i>min Activation Time⁽²⁾</i>	Defines the minimum closing time of the contact following the rapid presence of sources: • Source duration < min. activation = contact is activated for the minimum activation time • Source duration ≥ min. activation = contact is activated for as long as the source persists Choose between: 0 ms, 100 ms, 200 ms	0 ms

⁽¹⁾ deactivate the latching of the outputs used if the Measurement module is used for the Power Controller function

⁽²⁾ if the Measurement module is used for the Power Controller function, the Power Controller option will also be available; if selected, the output is kept activated for a set time that depends on the function, regardless of whether the event that activated it persists

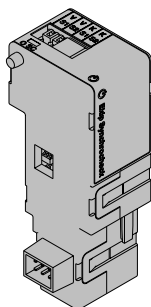
About The specific menu of the module available in the *About - Modules* menu contains:

- the serial number and version of the module
- the statuses of the inputs (On/Off) and outputs (Open/Closed)

Test The test area in the *Test* menu is activated if the *Ekip Signalling 2K* module is detected correctly. For details of the test characteristics, please consult page 137.

Remote information Certain additional information concerning the version and status of the module is available via the service connector (via Ekip Connect) or by communication via system bus; the information includes: HW and Boot version, CRC status (correctness of the SW in the module).

12 - Ekip Synchrocheck



Ekip Synchrocheck is an accessory module that is used to control closing of an actuator when synchronism conditions, programmable by the user, exist.

To actuate synchronism:

- *Ekip Synchrocheck* and the internal sockets measure, respectively, the voltage on the external contacts (external voltage) and on the internal contacts (internal voltage) of the actuator
- *Ekip Synchrocheck* manages a closing contact



NOTES:

- *the actuator is described as a circuit-breaker in the following description and in the menus*
- *with a generator and the actuator being configured: Normally, the external voltage is that of the grid and the internal voltage is that of the generator*



IMPORTANT: only one Ekip Synchrocheck can be installed on each CB

Mode The module operates in two modes, configurable by the user (manual-mode configuration) or managed automatically by the unit (automatic-mode configuration).

Conditions	Description
Busbar active	Operation with external voltage other than zero: <ul style="list-style-type: none"> • synchronism search starts if the external voltage is (0.5 U_n by default) or more, for at least (1 s by default) • synchronism is considered to have been reached if the differences between RMS values and frequencies and the voltage phases are (0.12 U_n, 0.1 Hz, and 50° by default) or less
Dead busbar and configuration: <i>Normal</i>	Operation with one of the voltages nil: <ul style="list-style-type: none"> • synchronism search starts if the internal voltage is (0.5 U_n by default) or more, for at least (1 s by default) • synchronism is considered to have been reached if the external voltage is (0.2 U_n by default) or less, for at least (1 s by default)



NOTE: with dead busbar and configuration: *Reversed*, the roles of the internal and external voltages are reversed

Synchronism signal:

- is activated and maintained, after synchronism has been reached, for at least 0.2 s
- is deactivated when synchronism ends or the circuit-breaker is opened (with condition: *Evaluate CB status* = enabled) or communication with Ekip Touch is interrupted

Additional functions

Certain options can be remotely configured in the synchronism conditions described above:

- the open circuit-breaker condition can be added (disabled by default)
- removal of the frequency and phase controls can be disabled



IMPORTANT: to be able to disable the frequency and phase controls, first make sure that the required frequency and phase correspondence between external and internal contacts already exists

Connections The module must be assembled in the first vacant slot of the terminal box after *Ekip Supply*, either on the circuit-breaker (fixed version) or on the fixed part (withdrawable version).

For references about the connection and terminals, please consult document [1SDM000091R0001](#); use AWG 22-16 cables with 1.4 mm maximum outer diameter for the external cabling.

To connect the module to Ekip Touch, please consult document [1SDH001000R0513](#).

Power supply *Ekip Com Synchrocheck* is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

Input *Ekip Synchrocheck* has an input (V S1 - V S2) for reading voltage, operation of which is ensured within the ranges and with the performance given below:

Component	Operating range	Normal operating range	Accuracy ⁽¹⁾
Voltage	0÷120 VAC	10 ÷ 120 VAC	1 % ⁽²⁾
Frequency ⁽³⁾	30÷80 Hz	30 ÷ 80 Hz	0,1 % ⁽⁴⁾
Phase ⁽⁵⁾	-	-180 ÷ +180 °	1 °

⁽¹⁾ the accuracy values refer to normal operating ranges, as established by IEC 61557-12

⁽²⁾ with busbar activated

⁽³⁾ with the busbar activated, frequency measurement starts at ≥ 36 V AC and ends at ≤ 32 V AC measured voltage

⁽⁴⁾ in the absence of harmonic distortion

⁽⁵⁾ phase measurement refers to the phase difference between internal and external voltage

Isolation transformer

An isolating transformer with the characteristics given below must always be installed between the external contacts of the circuit-breaker and the input of the module:

Characteristics	Description
Mechanical	<ul style="list-style-type: none"> fixing: EN 50022 DIN 43880 rail material: self-extinguishing thermoplastic protection class: IP30 electrostatic protection: with earth connector shield
Electrical	<ul style="list-style-type: none"> accuracy class: $\leq 0,2$ performance: ≥ 4 VA overload: 20% permanent insulations: 4 kV between inputs and outputs, 4 kV between screen and outputs, 4 kV between screen and inputs frequency: 45 to 66 Hz

Output *Ekip Synchrocheck* has an output (K S1 - K S2) used as synchronism contact.

The output is insulated from the unit and input, and has the following electrical characteristics:

Characteristics	Maximum limit ⁽¹⁾
Maximum switchable voltage	150 VDC / 250 VAC.
Breaking capacity	2 A @ 30 VDC, 0,8 A @ 50 VDC, 0,2 A @ 150 VDC, 4 A @ 250 VAC
Dielectric strength between open contacts	1000 VAC (1 minutE @ 50 Hz)
Dielectric strength between each contact and coil	1000 VAC (1 minutE @ 50 Hz)

⁽¹⁾ data relating to a resistive load

Interface the module has three signaling leds:

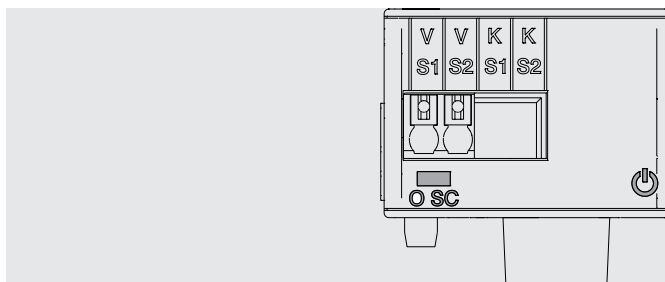


Figure 139

LED	Description
Power	Signals the on status and correct communication with Ekip Touch: <ul style="list-style-type: none"> Off: module off on steady or flashing synchronized with the Power led of Ekip Touch: module on and communication with Trip unit present, flashing not synchronized with the Power led of Ekip Touch (two fast flashes per second): module on and communication with Trip unit absent
O SC	Indicate the status of the contacts of each output: <ul style="list-style-type: none"> off: contact open on: contact closed <p>NOTE: The LED displays the state of the output: it can indicate synchronization OK or KO, depending on the contact rest configuration (normally open or closed)</p>

Configurations via menu The specific configuration area will activate in the *Advanced - Synchrocheck* menu if the *Ekip Synchrocheck* module is detected correctly by Ekip Touch.

Parameter	Description	Default
<i>Enable</i>	Activates/deactivates the protection and its availability in the parameters menu	Off
<i>Dead bar option</i>	On = busbar activated; Off = dead busbar present	Off
<i>Udead Threshold</i> ⁽¹⁾⁽²⁾	Maximum external voltage (with dead busbar and configuration: <i>Normal</i> ⁽²⁾ is the first synchronism condition) The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.02 Un to 2 Un, in 0.001 Un steps	0.2 Un
<i>Ulive Threshold</i> ⁽²⁾⁽³⁾	Minimum voltage for starting monitoring of external voltage (with busbar activated) or internal voltage (with dead busbar and <i>Normal</i> configuration) The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.5 Un to 1.1 Un, in 0.001 Un steps	0.5 Un
<i>Stability Time</i>	Minimum time within which the <i>Ulive Threshold</i> condition must be obtained in order to activate voltage monitoring The value is given in seconds and can be set within the range: 100 ms to 30 s, in 1 ms steps	1 s
<i>Delta Voltage</i>	Maximum difference between internal and external voltage (first synchronism condition) The value is given as both absolute value (V) and relative value (Un) and can be set within the range: 0.02 Un to 0.12 Un, in 0.001 Un steps	0.12 Un
<i>Delta frequency</i> ⁽⁴⁾	Maximum difference between internal and external frequency (second synchronism condition) The value is given in Hertz and can be set within the range: 0.1 Hz to 1 Hz in 0.1 Hz steps	0.1 Hz
<i>Delta phase</i> ⁽⁴⁾	Maximum difference between internal and external phase (third synchronism condition) The value is given in degrees and can be set within the range: 5° to 50° in 5° steps	50 °

Continued on the next page

Parameter	Description	Default
<i>Dead bar configuration</i>	With dead busbar and generator: • Reversed = <i>Ekip Synchrocheck</i> /external contacts connected to the generator • Normal = <i>Ekip Synchrocheck</i> /external contacts connected to the grid	Standard
<i>Auto Live-dead detect</i>	Enables automatic synchronism control to be activated: • Manual = Ekip Touch considers the <i>Dead bar option</i> parameter • Automatic = Ekip Touch automatically assesses the configuration to be actuated between the dead busbar and active busbar	Manual
<i>Auto Deadbar detect</i>	Configuration for detecting dead busbar: • Manual = Ekip Touch considers the <i>Dead bar configuration</i> parameter • Automatic = Ekip Touch automatically assesses the configuration to be actuated between: <i>Reversed</i> and <i>Normal</i>	Manual
<i>Primary voltage</i>	Rated voltage U_n of installation; the value is given as absolute value (V) and can be set within the range: 100 V to 1150 V in variable steps.	100 V
<i>Secondary voltage</i>	Secondary voltage of the transformer; the value is given as absolute value (V) and can be set within the range: 100 V to 120 V in variable steps.	100 V
<i>Concatenated Ref</i>	Line-to-line voltage entering the module among the 3 installation voltages	U12
<i>Contact Type</i>	Defines the rest status of the contact with synchronism not present between: open (NO) and closed (NC)	NO

⁽¹⁾ parameter not available with busbar active and Auto deadbar detect= Manual

⁽²⁾ with dead busbar and configuration: Reversed, the roles of the internal and external voltages are reversed

⁽³⁾ 10% hysteresis is applied to the minimum voltage condition: once reached, the condition is lost if the voltage drops below 90% of the set limit

⁽⁴⁾ parameter not available with dead busbar and Auto deadbar detect= Manual





NOTE: all the thresholds have $\pm 10\%$ tolerance with the exception of:

- Voltage Delta; the tolerance is the higher value between: $\pm 10\%$ of the set threshold and 0.5% U_n (with $U_n > 220$ V) or 1% U_n (with $U_n \leq 220$ V)
- Frequency Delta; the tolerance is the higher value between $\pm 10\%$ of the set threshold and 0.02 Hz

Remote configurations

Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Parameter	Description	Default
<i>Frequency check</i>	Activates (ON) or deactivates (OFF) frequency control for synchronism assessment	ON
<i>Phase check</i>	Activates (ON) or deactivates (OFF) phase control for synchronism assessment	ON
<i>Evaluate CB status</i>	Activates (YES) or deactivates (NO) circuit-breaker open status control for synchronism assessment  NOTE: fourth synchronism condition with busbar active; second synchronism condition with dead busbar	NO
<i>Minimum matching time</i>	With active busbar, minimum time within which the <i>Delta Phase</i> condition must be obtained The value is given in seconds and can be set within the range: 100 ms to 3 s, in 10 ms steps  NOTE: this is not a synchronism condition, but a parameter allowing a discrimination to be made between correct and incorrect combinations of the <i>Delta Frequency</i> and <i>Delta Phase</i> conditions. Owing to worst case latencies, the time that effectively elapses before synchronism is recognized may be longer than the set time (approx. 20 ms)	100 ms

Measurements

The specific measurement area will activate in the *Measurements - Synchrocheck* menu if the *Ekip Synchrocheck* module is detected correctly by Ekip Touch.

Measurement	Description
<i>Module</i>	<ul style="list-style-type: none"> • Ok = Synchronism conditions fulfilled • Not Ok = Synchronism conditions not fulfilled or function disabled
<i>Frequency</i>	<ul style="list-style-type: none"> • Ok = Synchronism condition regarding frequencies fulfilled • Not Ok = Synchronism condition regarding frequencies not fulfilled or synchronism function disabled, or frequencies outside measuring range limits. • --- = Synchronism condition regarding frequencies not available (example: for operation with dead busbar)
<i>Voltage</i>	<ul style="list-style-type: none"> • Ok = Synchronism conditions regarding voltages fulfilled. • Not Ok = Synchronism conditions regarding voltages not fulfilled or synchronism function disabled
<i>Phase</i>	<ul style="list-style-type: none"> • Ok = Synchronism condition regarding phase difference fulfilled • Not Ok = Synchronism condition regarding phase difference not fulfilled or synchronism function disabled, or frequencies outside measuring range limits • --- = Synchronism condition regarding phase difference not available (example: for operation with dead busbar)
<i>Ext Side Voltage</i> ⁽¹⁾	<ul style="list-style-type: none"> • Voltage measured by <i>Ekip Synchrocheck</i> given in Volts • = measurement DC or less than 1 VAC • --- = measurement not available (example: because synchronism function is disabled)
<i>Int Side Voltage</i> ⁽²⁾	<ul style="list-style-type: none"> • Voltage measured on internal sockets, given in Volts. • = measurement less than 1 VAC
<i>Ext Side Frequency</i> ⁽¹⁾	<ul style="list-style-type: none"> • Frequency measured by <i>Ekip Synchrocheck</i> • --- = measurement not available (example: because synchronism function is disabled, or operation with dead busbar, or frequencies outside measuring range limits)
<i>Int Side Frequency</i> ⁽²⁾	<ul style="list-style-type: none"> • Frequency measured on internal sockets • --- = measurement not available (example: because synchronism function is disabled, or operation with dead busbar, or frequencies outside measuring range limits)
<i>Phase Difference</i> ⁽¹⁾	<ul style="list-style-type: none"> • Phase difference between voltages, given in degrees • --- = measurement not available (example: because synchronism function is disabled, or operation with dead busbar, or frequencies outside measuring range limits)
<i>Auto detection</i>	<ul style="list-style-type: none"> • Busbar active = with automatic detection of operating mode and operation with active busbar, or with synchronism function not enabled • Dead bar = with automatic detection of operating mode and operation with dead busbar • --- = Measurement not available (example: owing to manual detection of operating mode)
<i>Voltage relation</i>	<ul style="list-style-type: none"> • $V_{int} \leq V_{ext}$ = Internal voltage the same as external voltage or lower • $V_{in} > V_{ext}$ = Internal voltage higher than external voltage • --- = Measurement not available (example: because the synchronism function is disabled, or direct voltages or voltages lower than 1 V).
<i>Frequency relation</i>	<ul style="list-style-type: none"> • $f_{int} \leq f_{ext}$ = Internal frequency the same as external frequency or lower • $f_{in} > f_{ext}$ = Internal frequency higher than external frequency • --- = Measurement not available (example: because synchronism function is disabled, or operation with dead busbar, or frequencies outside measuring range limits)

⁽¹⁾ voltage difference measurement accuracy is $\pm 10\%$ unless the parameter value is $0.02 U_n$, in which case accuracy is $\pm 20\%$

⁽²⁾ the characteristics of the voltage and frequency measurements coincide with those given on the internal sockets (page 113)

Summary page The summary page is activated in the presence of the *Ekip Synchrocheck* module; access is obtained in the same way as the other summary pages (page).

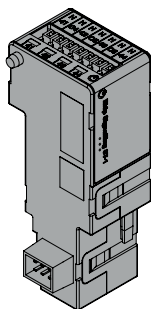
The measurements in this page are:

- V int: voltage read by Ekip Touch
- f int: frequency read by Ekip Touch
- $\Delta\phi$: phase difference
- SYNC: status of synchronism

About The *About - Modules* menu contains the specific menu of the module with the serial number and version of the module itself.

Remote information Certain additional information concerning the version and status of the module is available via the service connector (via Ekip Connect) or by communication via system bus; the information includes: HW and Boot version, CRC status (correctness of the SW in the module).

13 - Ekip Signalling 3T



Ekip Signalling 3T is a signaling accessory which enables the connection of:

- three analog inputs for PT100/PT1000 temperature sensors (2 wires): I42, I43, I44
- an analog input for 4-20 mA current loop: I41

The measurements supplied by the module can be associated with different control threshold, useful for configuring alarm signals, states and programmable commands.



NOTE: PT100 temperature sensors are compatible only with *Ekip Signalling 3T* module installed on *Emax 2* with black platform.

Models

Ekip Touch can be configured with two different 3T modules: *Ekip Signalling 3T-1* and *Ekip Signalling 3T-2*.



NOTE: if different indications are not given, the information in the next chapter is valid for both models; on the second module the inputs are called I51 (loop 4-20 mA), I52, I53, I54 (PT100/PT1000)

The two modules can be installed at the same time on the same circuit-breaker so as to extend the opportunities for measuring and monitoring the installation.



IMPORTANT: each circuit-breaker can only be fitted with one module per type. Configuration with two modules of the same model is not allowed (example: two *Ekip Signalling 3T-1* modules)

Connections

For references about the connection and terminals, please consult document [1SDM000091R0001](#)

To connect the module to *Ekip Touch*, please consult document [1SDH001000R0527](#).

For PT100/PT1000 sensors, use insulated cables for resistance thermometers such as PENTRONIC TEC/SITW-24F (Type TX) or similar. Maximum length 3 meters.

For the 4-20 mA Current Loop sensor, use suitable cables up to 3 meters in length compatible with the workplace in which the 4-20 mA current sensor is used.



IMPORTANT: the inputs are not insulated: regardless of plant voltage, the customer must ensure there is insulation between each input and between the inputs and power supply of the *Ekip Supply* module on the basis of the customer's own application and network.

For applications in low voltage installations ABB suggests use of the external probe PT1000 3mt, is equipped with a nut and screw for use on busbars and is compatible with the dielectric withstand and insulation levels established by standard IEC 60947-2 ($U_i = 1000 \text{ V}$, $U_{imp} = 12 \text{ kV}$).

Power supply

Ekip Signalling 3T is supplied directly by the *Ekip Supply* module to which it is connected.



NOTE: communication between *Ekip Touch* and the module is interrupted in the absence of auxiliary power supply

Input The module enables the following quantities to be measured

Input	Measurement	Range	Resolution	Accuracy ⁽¹⁾
PT100/PT1000	Temperature	-50 ÷ 250 °C ⁽²⁾	0,01 °C	± 1 °C ⁽⁵⁾
Current loop 4-20 mA	DC current	0 ÷ 100 % ⁽³⁾	0.1 %	± 0,5 % ⁽⁴⁾

⁽¹⁾ accuracy values refer to 3T module without sensors. For complete accuracy, consider the characteristics of the sensors and cabling used; accuracy increases by 0.5 °C with the ABB sensor

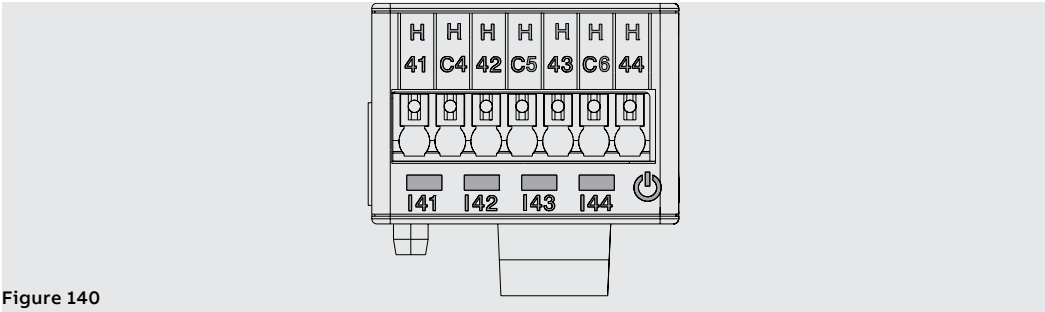
⁽²⁾ with ABB PT1000 sensor, the range is -25 ÷ 150 °C

⁽³⁾ the measurement is expressed as a percentage, where: 0% = 4 mA and 100% = 20 mA

⁽⁴⁾ accuracy values refer to full scale: 0.5%= 0.1 mA

⁽⁵⁾ Accuracy valid within the 0 to 130 °C range with module at 25 °C ambient temperature. The accuracy value is ± 2 °C over the whole range, with module at 25 °C ambient temperature

Interface Five signalling leds are available:



LED	Description
Power	Signals the on state and correct communication with the trip unit: <ul style="list-style-type: none">• Off: module off• on steady or flashing synchronized with the trip unit Power led: module on and communication with trip unit present• flashing not synchronized with trip unit Power led (two fast flashes per second): module on and communication with trip unit absent
I 41, I 42, I 43, I 44	Indicate the state of the input contacts: <ul style="list-style-type: none">• off: input disabled• on steady: input enabled, sensor connected and measurement valid• flashing: input enabled, sensor not connected and/or measurement not valid

Access from the display The following areas are activated on Ekip Touch if the Ekip Signalling 3T module is detected correctly:

- *Measurements* page, accessible from the Home page, containing the measurements of all the PT100/PT1000 and 4-20 mA Current Loop inputs of both modules 3T-1 and 3T-2
- information submenus in the *About-Modules* menu containing: serial number, module version and statuses of sensors (Present/Alarm)

! IMPORTANT:

- **if one or more sensors are in the alarm status, the signal on the diagnosis bar will be: Ekip Signalling 3T**
- **if a sensor is not enabled, the status indicated is: Present**

Remote configurations The configuration of the module is available:

- via Ekip Connect, with communication accessories via service connector or with communication via system bus
- via own communication system and *Ekip Com* modules installed on circuit-breaker, in the conditions required by the trip unit (use System Interface for details)

All the measurements, states and alarms of the module are available in both conditions.

i NOTE: *parameters and measurements are distributed in Ekip Connect pages and communication addresses sometimes nonsequential; references to the pages in Ekip Connect 3 are given in the tables below*

Enabling and measurements

The individual inputs of the module can be enabled in the *Ekip Signalling 3T* page: I42 Temperatures, I43 Temperatures, I44 Temperatures, I41 Current 4-20 mA (per 3T-1), I52 Temperatures, I53 Temperatures, I54 temperatures, I51 Current 4-20 mA (for 3T-2).

Parameter	Description	Default
<i>Enable</i>	Enables the specific input and relative alarm state and signaling controls to be activated	Enabled

Alarm signals

Up to three alarm thresholds (independent of each other), Threshold A, Threshold B, Threshold C, can be activated and configured for each input in the *Protection parameters - Other parameters A* (and B if dual set is activated) page

Each alarm threshold has the following configuration parameters:



NOTE: the table lists the parameters of threshold A of input I42; the names and references of all the other thresholds and inputs change

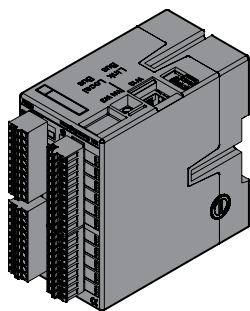
Parameter	Description	Default
<i>Threshold A enable</i>	Activates verification of input I42 with alarm Threshold A	Off
<i>Threshold A hysteresis direction</i>	Defines whether the alarm must activate when measurement is above (<i>Up</i>) or below (<i>Down</i>) the set value, with reference to the Threshold A setting	Up
<i>Threshold A value</i>	Alarm threshold A of input I42. The value is given in degrees Celsius (°C) and can be set within the range: -40°C to 240°C, in 0.1°C steps. NOTE: the thresholds of the 4-20 mA (I41 and I51) Current Loop input are given in percentage form and can be set within the range: 0% to 100 %, in 0.1% steps (each step equivalent to 0.016 µA)	200 °C (I42, I43, I44, I52, I53, I54) / 50 % (I41, I51)
<i>Threshold A hysteresis</i>	Hysteresis value, valid for quitting the alarm condition if the set Threshold A alarm threshold has been exceeded. The hysteresis parameter only allows positive values. The trip unit decides whether to add or subtract this value to or from the alarm threshold on the basis of the direction parameter, example: • <i>Direction</i> = Up, <i>Value</i> = 200°C, <i>hysteresis</i> = 10°C, the alarm activates over 200° and de-activates below 190°C The value is expressed in degrees Celsius (°C) and can be set within the range: 0°C to 50°C with 0.1°C steps. NOTE: the thresholds associated with the 4-20 mA (I41 and I51) Current Loop input are given in percentage form and can be set within the range 0% to 30 %, in 0.1% steps (each step equivalent to 0.016 µA)	1 °C (I42, I43, I44, I52, I53, I54) / 1 % (I41, I51)

States and alarms

The state of all control thresholds can be checked in the *Warnings/Alarms* page

Other electronic accessories

1 - Ekip Signalling 10K



Ekip Signalling 10K is an external accessory signaling module. It can be installed on a standard 35 mm DIN rail (DIN EN 50022 type TS 35x15 mm).

This module has:

- Ten programmable output contacts
- Ten or eleven programmable digital inputs
- One power led and twenty or twenty-one signaling leds (one for each input/output)

The module can be set in four different configurations

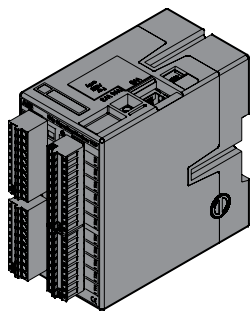
- One in case of connection to a Link bus network
- Three configurations in case of connection via Local Bus (to allow up to three modules to be connected to the same trip unit)

The module can be supplied by 110...240 V AC / DC or 24...48 V DC.

Further details about *Ekip Signalling 10K* are available in ABB Library, especially in document [1SDH001318R0002](#).

! IMPORTANT: make sure that you have read the recommendations concerning safety and prevention of unauthorized access.

2 - Ekip Signalling Modbus TCP



Ekip Signalling Modbus TCP is an external accessory module. It can be installed on a standard 35 mm DIN rail (DIN EN 50022 type TS 35 x 15 mm).

Its function is to share on another Ethernet network with communication protocol.

The module has 11 digital inputs and 10 output contacts:

- The inputs allow the state of the devices and other information to be monitored
- The outputs allow the circuit-breakers to be operated.

Each input and output is associated with a state LED.

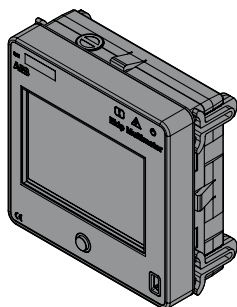
The module can operate in three modes:

Mode	Characteristics
CB Supervisor	The module can be associated with a single circuit-breaker, which can be selected from a list. Configuration of the inputs and output is pre-defined
Multi MCCB Supervisor	The module can be associated with up to five circuit-breakers. Configuration of the inputs and output is pre-defined. i NOTE: mode available with moulded-case circuit-breakers
Free I/O	The inputs and outputs can be fully configured by the user

The module can be supplied by 110...240 V AC / DC or 24...48 V DC.

Further details about *Ekip Signalling Modbus TCP* are available in ABB Library, especially in document [1SDH001456R0002](#).

3 - Ekip Multimeter



Ekip Multimeter is a remote display panel-front module with touchscreen display allowing the parameters of the Trip unit to which it is connected via local bus to be displayed and edited.

Up to four *Ekip Multimeter* modules can be connected to the same Trip unit. On the other hand, the module can only be connected to one Trip unit.

The rear connector allows the unit to be supplied in two different ways:

Terminals / supply voltage	Frequency	Power input	Inrush current
21,5 ÷ 53 VDC	-	Maximum 10W	Maximum 2 A for 20 ms
105 ÷ 265 VAC/DC	45 ÷ 66 Hz	Maximum 10 VA/W	Maximum 2 A for 20 ms



IMPORTANT: AC and DC supplies cannot be present at the same time

The module provides for 24 VDC auxiliary voltage (terminals 24 Vout L+ and L-), which can be used to directly supply the Trip unit.



WARNING! Ekip Multimeter is sized to supply the Trip unit alone, without additional modules: if auxiliary voltage is used via module, it must be connected directly to the terminal box of the CB without the possibility of using Ekip Supply or other modules

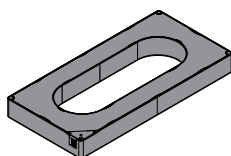
Connections

Belden 3105A cables or equivalent, up to 15 m in length, must be used for the local bus and auxiliary supply. The cable shield must be earthed on both sides of the connection.

Documents

Further details are available in ABB Library, especially in document [1SDH001000R0520](#).

4 - Rc Toroid



Rc is an external differential current sensor which can be installed on Ekip Touch Trip units equipped with *Rc Rating Plug*.

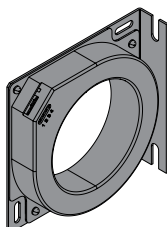
When Ekip Touch is being programmed, check in the *Settings-Circuit breaker-Ground protection* menu to make sure that the toroid is present (page 49, the configuration menu of the Rc protection parameters must be activated in the *Advanced* menu (page 47).



IMPORTANT: the toroid can be chosen as an alternative to the S.G.R. one: protections Gext, MDGF and Rc are alternatives to each other

Further details about the *Rc toroid* connection are available in ABB Library, especially in document [1SDH001000R0521](#).

5 - S.G.R. Toroid



|i|S.G.R. or *Source Ground Return* is an external single-pole current sensor available for LSIG version Ekip Touch Trip units

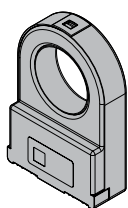
When Ekip Touch is being programmed, check in the *Settings-Circuit breaker-Ground protection* menu to make sure that the toroid is present (page 49, the configuration menu of the Gext protection parameters must be activated in the *Advanced* menu (page 47).



IMPORTANT: the toroid can be chosen as an alternative to the Rc one; protections Gext, MDGF and Rc are alternatives to each other

Further details about the *S.G.R. toroid* connection are available in ABB Library, especially in document [1SDH001000R0507](#).

6 - External neutral



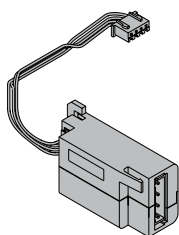
This is a current sensor for the neutral pole outside the circuit-breaker.

It is provided only for three-pole circuit breakers. It allows protection of the neutral to be implemented through the connection to the Ekip trip unit. It is supplied on request.

Further information on the connection of the external neutral is available on the website <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheets:

- [1SDH001000R0506](#) for circuit breakers E2.2.
- [1SDH001000R0515](#) for circuit breakers E4.2 and E6.2.

7 - Ekip Com Actuator



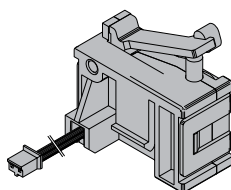
Ekip Com Actuator is an accessory module which allows SACE Emax 2 circuit-breakers to be opened and closed remotely.

The module is installed on the front of the circuit-breaker, in the accessories area.

For references about the connection and terminals, please consult document [1SDH000999R0501](#) and [1SDH001000R0501](#)

The *Ekip Com Actuator* module is supplied on request and is compatible with all Ekip Touch Trip units when the *Ekip Com* or *Ekip Link* modules are installed.

8 - Ekip AUP



The communication modules are always supplied with dedicated Ekip AUP auxiliary position contacts. In case of a withdrawable circuit-breaker, the Ekip AUP contacts give the signal of moving part racked-in/out from the fixed part.

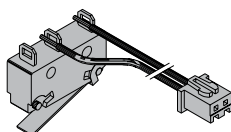
The assembly assures that the position signalling is given also with the moving part withdrawn.



IMPORTANT: in case of multiple communication modules, only one can be connected to the Ekip AUP contacts.

Further information on assembling Ekip AUP modules and contacts is available on the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH001000R0811](#).

9 - Ekip RTC

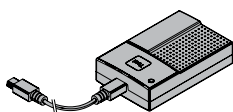


The communication modules are always supplied with an Ekip RTC auxiliary contact, which gives to the trip unit the signal indicating that the circuit-breaker is ready to receive a close command.

Further information on the assembly of the Ekip RTC contact is available on the web site <http://www.abb.com/abblibrary/DownloadCenter/>, in particular in the kit sheet [1SDH000999R0614](#).

10 - Testing and Programming

Ekip TT



Ekip TT is a supply accessory and is useful for powering Ekip Touch in the absence of auxiliary power supply; the unit allows:

- Ekip Touch to be supplied and the tripped protection to be displayed, in the event of a TRIP and absence of auxiliary voltage
- the protections and certain parameters to be set before installation in the system



IMPORTANT:

- **Ekip TT can also be connected to Ekip Touch when in service.**
- **Ekip TT only supplies the Trip unit: the presence of an auxiliary supply is required in order to set and display the information about the electronic accessories**

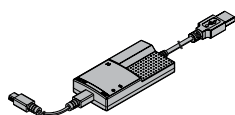
Ekip TT is connected to the service connector of Ekip Touch by means of the supplied cable.

To switch on the module, set the side switch to the ON position and check the status of the led:

- if green, proceed with the required reading and configuring operations
- if red, replace the batteries of the device (three 1.5 V AA batteries)

Further details are available in ABB Library, especially in document [1SDH001000R0519](#)

Ekip Programming and Ekip T&P



Ekip Programming is a supply and communication accessory that is useful for:

- Ekip Touch to be supplied and the tripped protection to be displayed, in the event of a TRIP and absence of auxiliary voltage
- the protections and certain parameters to be set before installation in the system
- with Ekip Connect software, accessing the programming, measuring pages and other exclusive functions (Datalogger, Dataviewer, Power Controller, Load Shedding, IPS, IEC 61850)
- with Ekip Connect software, accessing the programming, measuring pages and other exclusive functions (Datalogger, Dataviewer, IEC 61850)



IMPORTANT:

- **Ekip Programming can also be connected to Ekip Touch when in service.**
- **Ekip Programming only supplies the Trip unit: the presence of an auxiliary supply is required in order to set and display the information about the electronic accessories**

Ekip Programming connects to the USB port of the PC, from which it receives the power required to switch on and also supply Ekip Touch; connection to the service connector of Ekip Touch must be made with the supplied cable.

Ekip Programming has two leds, one green to indicate when the module is on, the other yellow to indicate when communication is activated.

Ekip T&P is a supply and communication accessory with the same characteristics as *Ekip Programming*, plus a further function:

- with Ekip Connect software, it enables access to the test pages

Putting into service and maintenance

1 - Putting into service

Introduction

The general check is necessary:

- when the circuit-breaker is put into service for the first time
- after prolonged inactivity of the circuit-breaker



HAZARD! RISK OF ELECTRIC SHOCK! Test the circuit-breaker with all switchgear apparatus de-energized.



IMPORTANT: The verifications involve procedures which must only be performed by persons skilled in the electrical field (IEV 195-04-01): person with sufficient training and experience to enable him or her to perceive risks and avoid the dangers potentially created by electricity).

Terminal wiring

Indication of cable size for wiring terminals:

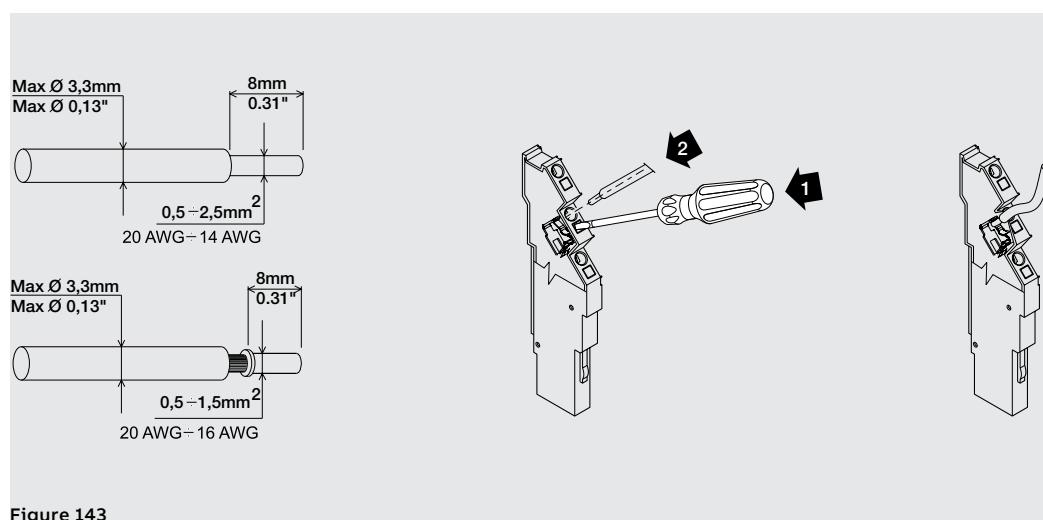



Figure 143

General checks

Before putting it into service for the first time or after a prolonged period of inactivity, some checks must be carried out on the circuit-breaker and the environment in which it is installed:

Points to be checked	Checks
Switchgear	1. Sufficient change of air to avoid overtemperatures
	2. Clean location, free of all installation refuse (e.g.: cables, tools, metal splinters)
	3. Circuit-breaker mounted correctly (tightening torques, clearances respected)
	4. The installation environmental conditions must be consistent with the "Environmental conditions" specifications on page#s#7
Connections	1. Power connections tightened to the terminals of the circuit-breaker
	2. Cables and busbars with adequate cross-section
	2. Busbars with adequate cross-section
	3. Correct ground connections
Operations	4. Maximum distances of separators respected
	Perform some opening and closing operations (See chapter "Description of the product - circuit-breaker opening/closing operations on page#s#151 #s#159). The spring loading lever must move with regularly
	 WARNING! in the presence of an undervoltage coil the circuit-breaker can be closed only after the trip unit is energized
Trip unit alarm	Connect the protection device Ekip TT to the trip unit and verify that there are no alarms present
State of the circuit-breaker with Ekip Dip	With Ekip Dip, the circuit-breaker state must not be in error (see table on page#s#32). Perform a circuit-breaker closing/opening operation and make sure that there are no alarms (see table on page#s#32)
State of the circuit-breaker with Ekip Touch	With Ekip Touch, the circuit-breaker state must be read correctly (see table on page#s#286). Perform a circuit-breaker closing/opening operation and make sure that change of state is read correctly
Trip Test	With circuit-breaker closed and in conditions of rest (without circulating currents), carry out a Trip test, and verify the opening of the circuit-breaker
Ekip Dip parameters	Check and modify the protection dip switches, presence of external neutral and frequency to suit your installation requirements
Ekip Touch parameters	Connect the Ekip TT device. Check and make the necessary changes to: protection parameters, circuit-breaker configuration, frequency, PIN, date and language






NOTE: for security reasons, ABB strongly advises you to change the PIN right from the first access and to keep it with care.

Wizard When powered, the Ekip Touch shows the Wizard window, a user-friendly procedure for immediate adjustment of certain parameters: language, date, time, voltage of the installation (if Measurement enabler is present) and PIN.

After the procedure has terminated, the window will no longer appear unless it is reset by Ekip Connect (Reset Wizard command): in this case, it will appear the first time the apparatus is powered after the command has been sent.


Check accessories The following procedures for checking the accessories are to be performed before they are put into service:

Accessories ^(*) to be checked	Procedure
Gearmotor	1. Power the gearmotor to charge the springs at the relevant rated voltage.
	Result: The springs are charged correctly. The signals are normal. When the springs are charged the gearmotor stops.
	2. Perform some closing and opening operations.
	Result: The gearmotor recharges the springs after every closing operation.
	 NOTE: If present, power the undervoltage coil in advance.
Undervoltage coil	1. Power the undervoltage coil at the relevant rated voltage and perform the closing operation on the circuit-breaker.
	Result: The circuit-breaker closes correctly; the signals are normal.
	2. Turn off the voltage supply to the trip unit. The circuit-breaker opens.
	3. Power the undervoltage coil at the relevant rated voltage and perform the closing operation on the circuit-breaker.
	Result: The circuit-breaker closes; the signal switches over.
	 WARNING! If the undervoltage coil has been tripped by a power failure, the circuit-breaker can be closed only after the coil has been energized electrically. Make sure that the coil has effectively been tripped due to a power failure. Otherwise, examine the circuit-breaker and the associated equipment to make sure that they are in a good condition.
Opening coil	1. Close the circuit-breaker.
	2. Power the opening coil at the relevant rated voltage.
	Result: The circuit-breaker opens correctly; the signals are normal.
Closing coil	1. Open the circuit-breaker.
	2. Charge the springs manually or electrically.
	3. Power the closing coil at its rated voltage.
	Result: The circuit-breaker closes correctly; the signals are normal.
Opening coil with Ekip Com Actuator	1. Power the protection trip unit with the Vaux auxiliary power supply.
	2. Power the Ekip Com Actuator contacts.
	3. Close the circuit-breaker
	4. Select "open CB" from the Ekip Touch menu
	Result: The circuit-breaker opens correctly; the signals are normal.
	 NOTE: The test can be performed if the trip unit and the coils are energized.

^(*) If present.

^(**) Withdrawable versions only.


Continued on the next page

Accessories ^(*) to be checked	Procedure
Closing coil with Ekip Com Actuator	1. Power the protection trip unit with the Vaux auxiliary power supply.
	2. Power the Ekip Com Actuator contacts.
	3. Charge the springs.
	4. Select "close CB" from the Ekip Touch menu
	Result: The circuit-breaker closes correctly; the signals are normal.
	 NOTE: The test can be performed if the protection trip unit and the coils are energized.
Lock for circuit-breaker in open position (key or padlock)	1. Open the circuit-breaker
	2. Keep the opening pushbutton pressed
	3. Turn the key and remove it
	4. Attempt the circuit-breaker closing operation.
	Result: Both manual and electrical closing is prevented.
Auxiliary open/closed contacts of the circuit-breaker	1. Connect the auxiliary contacts to appropriate signalling circuits or to the multimeter.
	2. perform some closing and opening operations on the circuit-breaker.
	Result: signalling occurs normally.
Circuit-breaker connected, isolated for test, disconnected auxiliary contacts	1. Connect the auxiliary contacts to appropriate signalling circuits.
	2. bring the circuit-breaker to the connected, isolated for test and disconnected position.
	Result: the signals due to the relative operations are normal.
Locking devices for connected/test/disconnected positions ^(**)	1. Perform operating tests.
	Result: the interlocks function correctly.
Interlocks between circuit breakers assembled side by side and stacked	1. Perform operating tests.
	Result: the interlocks function correctly.
Racking-in/out device ^(**)	1. Perform a few racking-in and racking-out operations.
	Result: in the rack-in operation the circuit-breaker is connected correctly. There is no particular resistance during the first turns of the handle.
Auxiliary accessories and auxiliary voltage	Verify the proper installation. The supply voltage of the auxiliary accessories must be between 85% and 110% of the rated voltage for the auxiliary accessories.
External modules	1. For all modules with terminal box: check connection to <i>Ekip Supply</i> in mechanical seat of terminal box For <i>Ekip Signalling 10K</i> and <i>Ekip Multimeter</i> : check connection of the bus of module (W3-W4) to the respective sockets of <i>Ekip supply</i> or terminal box
	2. Power up the Trip unit (and external modules if there is a separate supply) and make sure they are on
	3. Check on menu or via Ekip Connect that the local bus on the Trip unit is enabled
	4. Check that the Power LED on each module is on in the same way as the Power LED of Ekip Touch (steady or synchronous flash)
	5. Check on menu or via Ekip Connect to make sure that all installed modules are present and that there are no alarms
External neutral, single-pole sensor (SGR), residual current sensor (Rc)	1. Make sure that the sensor is connected to the terminal box
	2. Power up the Trip unit and make sure it is on
	3. For <i>External neutral</i> : check in the <i>Settings - Circuit-breaker</i> menu that <i>Configuration</i> = 3P + N; otherwise change the parameter For single-pole and residual current sensors: set presence and size in the <i>Settings - Circuit-breaker - Earth protection</i> menu; protection parameters in the <i>Protections</i> or <i>Advanced</i> menus
	4. Make sure there are no alarms

^(*) if present.

^(**) withdrawable versions only.

Continued on the next page

Accessories ^(*) to be checked	Procedure
Zone selectivity	1. Check selectivity connections (between Ekip Touch and the other units) as shown in circuit diagrams
	2. Provide Ekip Touch with auxiliary power and make sure that CB status is: Open
	3. Check that the protection of the selectivity concerned has been enabled (example: S protection)
	4. Select the <i>Test - Zone Selectivity</i> menu and the submenu of the protection concerned; repeat points 5, 6, 7 and 8 for each protection activated
	 NOTE: for selectivity D, consider submenu S for the Forward connections and G for the Backward connections
	Check Output: 5. Select the <i>Force Output</i> command and check, on the unit connected to the Ekip Touch output, that the state of its <i>Input</i> = ON 6. Select <i>Release Output</i> and check on the unit that <i>Input</i> = OFF
	Check Input: 7. Select the <i>Force Output</i> command in the unit connected to the Ekip Touch input; check on Trip unit: <i>Input</i> = ON 8. Select <i>Release Output</i> and check on Trip unit: <i>Input</i> = OFF

Final check list Perform the operations described below after having completed the general inspection procedures and checked the accessories. Print this sheet and use it to make an inspection report in the "Checks" column.

Operation	Description	Check
1	Circuit-breaker OFF	Open the circuit-breaker
2	Circuit-breaker connected	Switch the circuit-breaker in withdrawable version to the connected position and reposition the crank in its seat
3	Trip unit Parameters	Adjust the protection trip unit in accordance with the design specifications of the installation (drawn up by design engineer of the installation). If necessary, power the protection trip unit with an Ekip TT unit
4	Removal of the Ekip TT	If present, remove the Ekip TT unit
5	Connecting the voltage	Connect the auxiliary voltage
6	Closing the switchgear	Close the switchgear door
7	Charging the springs	Charge the closing springs
8	Undervoltage coil	Make sure that undervoltage coil is energized
9	Opening and closing coils	Make sure that opening and closing coils are NOT energized
10	Mechanical interlock of the circuit-breaker	If present, make sure that the mechanical interlock of the circuit-breaker is not active
11	Locking devices	If present, make sure that the locking devices of the circuit-breaker are not active
12	Status signals	Make sure that the signalling devices on the front of the circuit-breaker indicate: circuit-breaker open - springs discharged O - OPEN and white spring signalling device DISCHARGED SPRING

2 - Maintenance

Safety standards Comply with the following mandatory recommendations during maintenance work.



HAZARD! RISK OF ELECTRIC SHOCK! Risk of electric shock or accident.



WARNING! before proceeding with any maintenance operation, it is mandatory to:

- Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.
- In the case of a withdrawable circuit-breaker, extract the circuit-breaker from the fixed part (see the indication **DISCONNECTED**)
- If work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly ground the terminals on both the supply side and load side.
- Use adequate personal protection equipment, ensure that the apparatus is in a safe condition and proceed in accordance with the Laws in force.

Skilled personnel The maintenance operations must be carried out by Skilled Personnel:

skilled person, in the electrical field (IEV 195-04-01): person with sufficient training and experience to enable him or her to perceive risks and avoid the dangers potentially created by electricity).

ABB declines all liability for damage to persons or property caused by failure to comply with the instructions in this document.

Circuit-breaker life The circuit-breakers SACE Emax 2, with or without opening or closing coils, can withstand the following operating cycles if regularly serviced. For further information see chapter 3 - Environmental conditions on page 7.

circuit-breaker IEC 60947	Inter- rupted rated current	Mechanical life with regular main- tenance		Electrical life					
		No. of operations (x 1000)	Frequency of operations/ hour	440 V	690 V	900 V	1000 V	1150 V / 1200 V	Frequency of operations/ hour
	I _u (40°C) [A]			No. of operations (x 1000)					
E1.2	<= 1000	20	60	8	8	-	-	-	30
	1250	20	60	8	6,5	-	-	-	30
	1600	20	60	8	6,5	-	-	-	30
	1250L	20	60	3	1	-	-	-	30
E2.2	< 1250	25	60	15	15	2	0,5	-	30
	1600	25	60	12	10	2	0,5	-	30
	2000	25	60	10	8	2	0,5	-	30
	2500	20	60	8	7	2	0,5	-	30
E4.2	< 2500	20	60	10	10	0,5	1	1	20 ⁽¹⁾
	2500	20	60	8	8	0,5	1	1	20 ⁽¹⁾
	3200	20	60	7	7	0,5	1	1	20 ⁽¹⁾
	4000	15	60	5	4	0,5	1	1	20 ⁽¹⁾
E6.2	4000	12	60	4	4	1	-	-	10
	5000	12	60	3	2	1	-	-	10
	6300	12	60	2	2	1	-	-	10

⁽¹⁾ Only for 900V and 1150V circuit-breakers Operating sequences/hour = 10.

Continued on the next page

circuit-breaker UL 1066	Interrupted rated current	Mechanical life with regular maintenance		Electrical life		
	I _u (40°C) [A]	No. of operations (x 1000)	Frequency of operations/hour	508V AC No. of operations (x 1000)	635V AC No. of operations (x 1000)	Frequency of operations/hour
E1.2-A	</= 800	20	60	8	8	30
	1200	20	60	7	6,5	30
E2.2-A	< 1600	25	60	15	15	30
	1600	25	60	12	10	30
	2000	25	60	10	8	30
E4.2-A	< 2500	20	60	10	10	20
	2500	20	60	8	8	20
	3200	20	60	7	7	20
E6.2-A	4000	12	60	4	4	10
	5000	12	60	3	2	10
	6000	12	60	2	2	10

Maintenance schedule

Proper maintenance of the equipment allows good electromechanical operation to be maintained over time.

The maintenance plan for SACE Emax 2 circuit-breakers specifies two periodic levels of maintenance for the different types of site conditions.

The following is a table of maintenance frequency with the periodic intervals and the routine maintenance operations.

Activity	Frequency in standard environments ⁽¹⁾	Frequency in dusty environments (dust level measured > 1mg/m ³)
E1.2 maintenance	One year or 2000 operations or after tripping due to short circuit	6 months or 1000 operations or after tripping due to short circuit
E2.2, E4.2 and E6.2 first level maintenance	One year or 20% of mechanical life or 20% of electrical life	6 months or 10% of mechanical life or 10% of electrical life
E2.2, E4.2 and E6.2 second level maintenance	Three years or 50% of mechanical life or 50% of electrical life or after a trip due to short-circuit	18 months or 25% of mechanical life or 25% of electrical life or after a trip due to short-circuit
Lubrication of jaw-type isolating contacts of withdrawable circuit-breaker	100 racking-in and racking-out operations ⁽²⁾ or three years	50 racking-in and racking-out operations ⁽²⁾ or 18 months

⁽¹⁾ Only for 900V and 1150V circuit-breakers Operating sequences/hour = 10.

⁽²⁾ Keep track of the number of racking in and out operations or make an estimate on the basis of the average number of racking out operations to ensure that the jaw-type isolating contacts are cleaned and lubricated correctly.

Compliance with the following rules is also recommended:

- even circuit-breakers that operate infrequently or that remain closed or open for long periods of time must be subjected to programmed maintenance
- All the circuit-breakers provide information on the number of operations performed in the presence of auxiliary power supply of the Trip Unit. With Ekip Dip trip units, the information can be obtained with the aid of Ekip T&P and a PC on which the Ekip Connect software is installed. With Ekip Touch trip units, the information is available at any time on the appropriate display. With Ekip Dip trip units, installation of the mechanical operation counter is recommended (supplied on request).
- During the service, visually inspect the circuit-breaker from the outside to check for the presence of dust, dirt or damage.

3 - E1.2 maintenance and E2.2, E4.2 and E6.2 first level maintenance

First level maintenance should be carried out in accordance with the maintenance schedule shown on page 267.

Preliminary operations



WARNING! before proceeding with any maintenance operation, it is mandatory to:

- **Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.**
- **In the case of a withdrawable circuit-breaker, extract the circuit-breaker from the fixed part (see the indication DISCONNECTED)**
- **If work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly ground the terminals on both the supply side and load side.**

Inspections and general cleaning

Perform the following checks:

1. Make sure that the circuit-breaker is clean. Remove dust and oily substances or excess grease with a clean, dry cloth and mild detergent if necessary. If there is a thick build-up of dirt, use a thinner from the greasing kit or ask for assistance from the service staff.
2. Check that the rating plates with the technical specifications of the apparatus are present.
3. Clean the rating plates with clean, dry rags.
4. Make sure that there are no foreign bodies in the circuit-breaker compartment.

Circuit-breaker connections and connections between circuit-breaker and switchboard

Perform the following checks on the connections:

1. With dry paint-brushes and rags remove dust or soil, if present (use a non- aggressive detergent if necessary. Use a cleaning product such as Chemma 18 or equivalent if there is a heavy coating of dirt).
2. Make sure there are no traces of overheating on the terminals. Overheating is detected by a different coloration of the parts in contact; the contact parts are usually silvery white in colour.
3. Check the tightness of fastening bolts for all connections to the terminals



WARNING! if work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.

Disassembly operations for circuit breakers E1.2

To disassemble the parts of the circuit-breaker:

1. Remove the front cover (A) by removing the mounting screws (B and C).
2. With a four-pole circuit-breaker (Figure 144 - Four-pole fixed circuit-breaker), remove the lateral shield (D) by removing the fixing screws (E).
3. With circuit-breaker in the withdrawable version (Figure 145 - Three-pole withdrawable circuit-breaker), remove the protection (F) and the terminal-cover (G) by removing the screws (H)

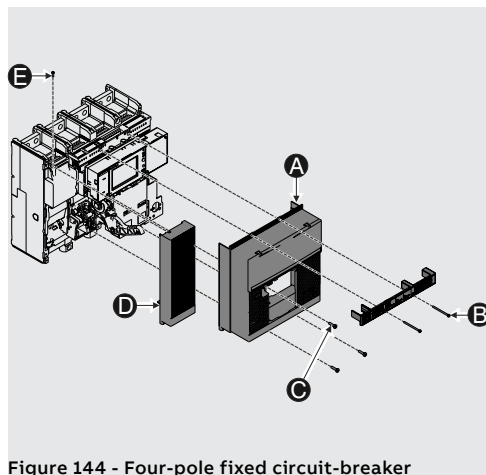


Figure 144 - Four-pole fixed circuit-breaker

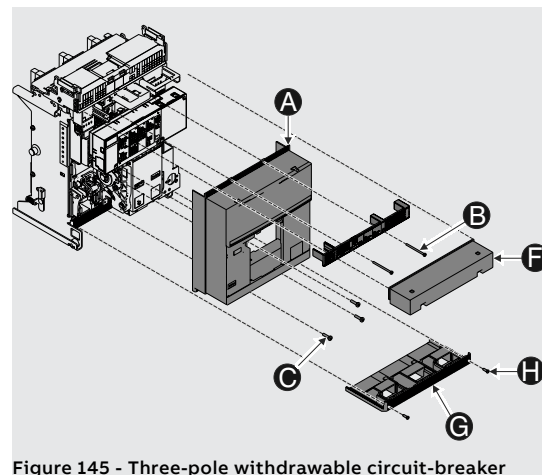


Figure 145 - Three-pole withdrawable circuit-breaker

4. Remove the gearmotor (I) by removing the screw (L).

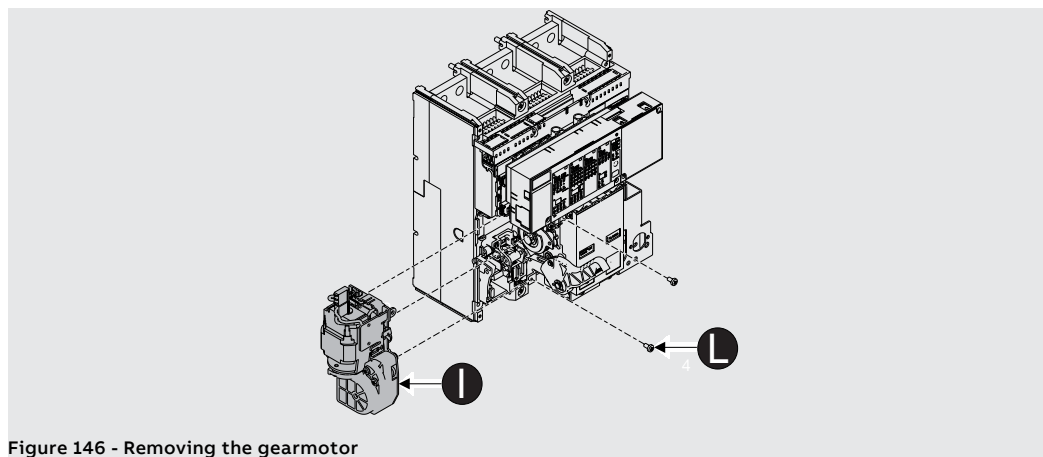


Figure 146 - Removing the gearmotor

5. If there is a undervoltage coil (M), remove it, and discharge the springs of the operating mechanism for closing and opening the circuit breaker.

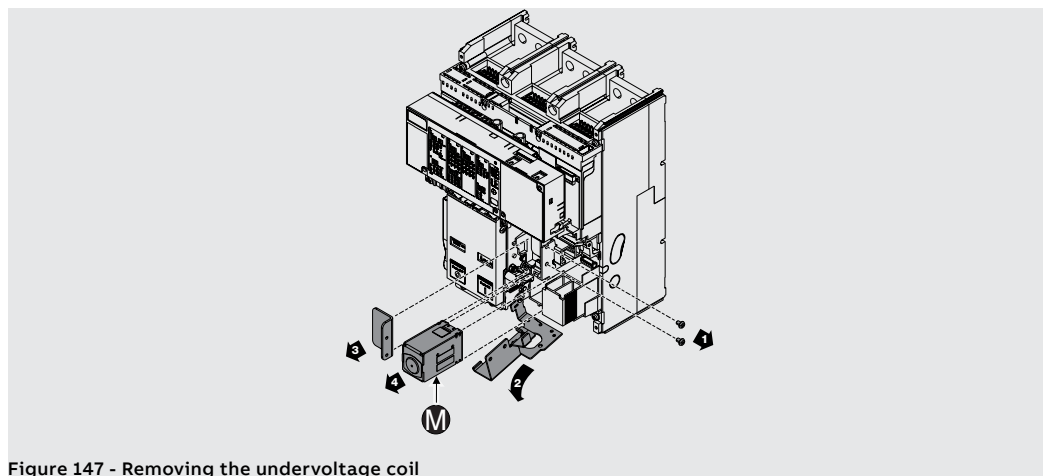


Figure 147 - Removing the undervoltage coil

Disassembly operations for circuit breakers E2.2, E4.2 and E6.2

To disassemble the parts of the circuit-breaker:

1. Remove the transparent flange (A) of the trip unit, by turning the screws (B).
2. Remove the front cover of the circuit-breaker (C), by removing the mounting screws (D).

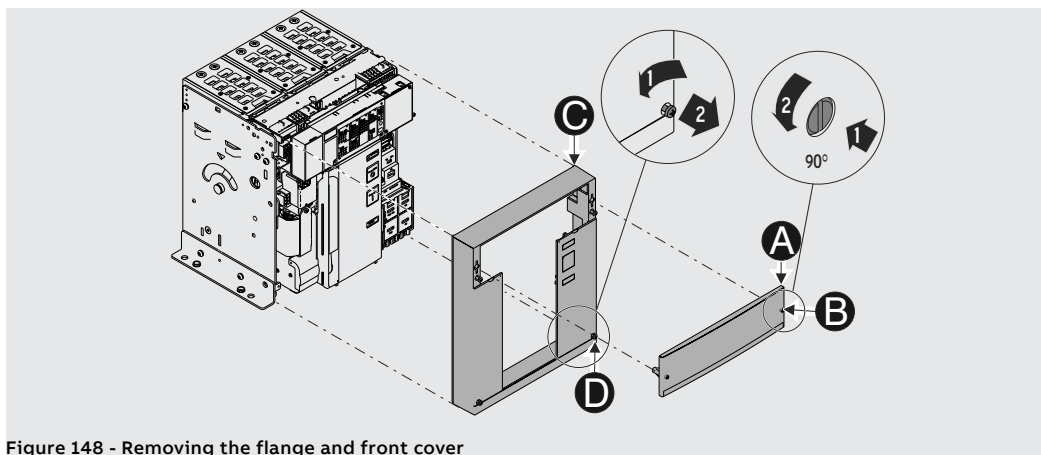


Figure 148 - Removing the flange and front cover

3. Remove the gearmotor (E) by removing the screw (F) and the connector.

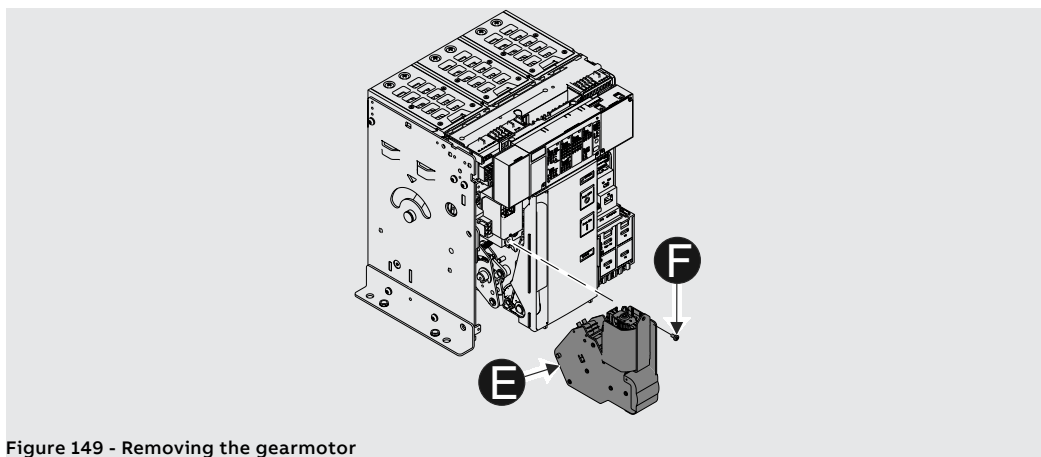


Figure 149 - Removing the gearmotor

4. If there is an undervoltage coil (G), remove it, and discharge the springs of the operating mechanism for closing and opening the circuit breaker.

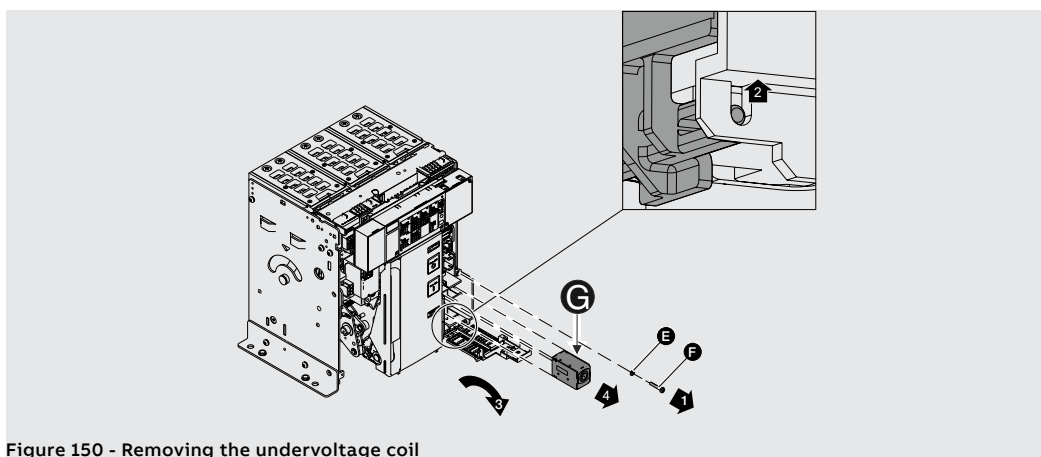


Figure 150 - Removing the undervoltage coil

Cleaning and lubrication of the operating mechanism

To clean and lubricate (E1.2 Figure 151 - Lubrication of the shafts and closing and opening latches; E2.2, E4.2 and E6.2 Figure 152 - Lubricating the shaft and closing hook):

1. Clean the closing shaft and closing hook at the point indicated. In the case of excessive deposits you can use a laminate thinner such as Chemma 18 or equivalent.
2. Lubricate the closing shaft and closing latches in the indicated points using Mobilgrease 28 (EXXON MOBIL).
3. Make sure that the closing shaft is free to rotate.

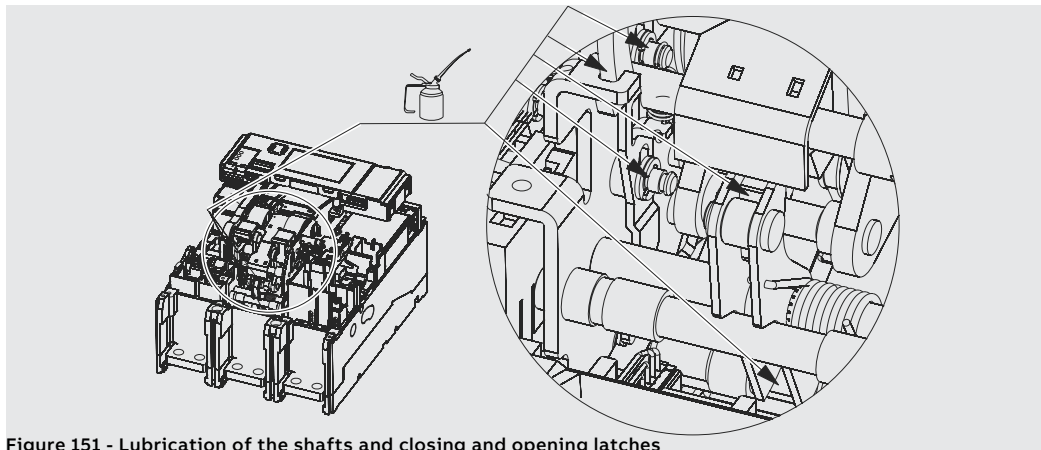


Figure 151 - Lubrication of the shafts and closing and opening latches

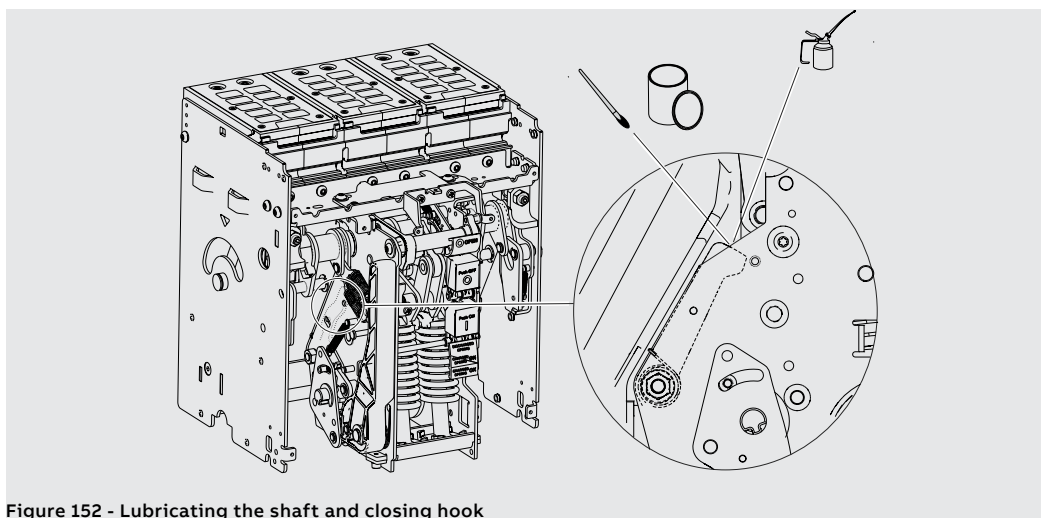


Figure 152 - Lubricating the shaft and closing hook

Inspection of electrical and mechanical accessories

Check the accessories:

1. Check that the accessories are securely fixed to the circuit-breaker.
2. Check that the accessories are connected correctly to the circuit-breaker.
3. Make sure that the coils (YU-YO-YC), if present, are in good condition (no excessive wear and tear, overheating, rupture).
4. Make sure that the mechanical operation counter functions correctly (if present) by operating the circuit-breaker.
5. Check the wear on the brushes of the gearmotor and if necessary replace them.



NOTE: it is advisable to replace the gear motor if it has performed more than 10000 spring charging operations or reached 50% of the declared mechanical life of the circuit-breaker.

Inspection of the protection trip unit

Check that the trip unit is in good condition:

1. Power the protection trip unit with an Ekip TT battery unit.
2. Check the correct operation of the protection trip unit: tripping test with "Trip Test" and "Autotest".
3. With a Ekip Dip verify the absence of alarms through frontal LEDs.
4. With a Ekip Touch, verify the absence of alarms via the display and the front LEDs.
5. Make sure that the cables are correctly connected to the modules and to the trip unit (if applicable).
6. On a Ekip Touch check the percentage of wear on the contacts of the circuit-breaker.
7. Finally, remove the Ekip TT battery unit.

Test with Ekip Connect


Test the trip unit:

1. Connect the Ekip Bluetooth or Ekip T & P unit to the trip unit.
 2. Connect the computer where the program is installed by means of a Bluetooth or USB connection.
 3. After connecting the computer and trip unit, check that there are no alarm signals. Otherwise, refer to the paragraph "1 - Identification of alarms or failures" on page 285.
 4. In the absence of alarms you can proceed to the trip test and self test (depending on the type of trip unit). For future checks it is recommended to insert the current date in the area called "Information". These data will be stored within the trip unit itself.
 5. Remove the Ekip Bluetooth or Ekip T & P unit from the trip unit.
-

Final checks Reassemble and check the circuit-breaker:

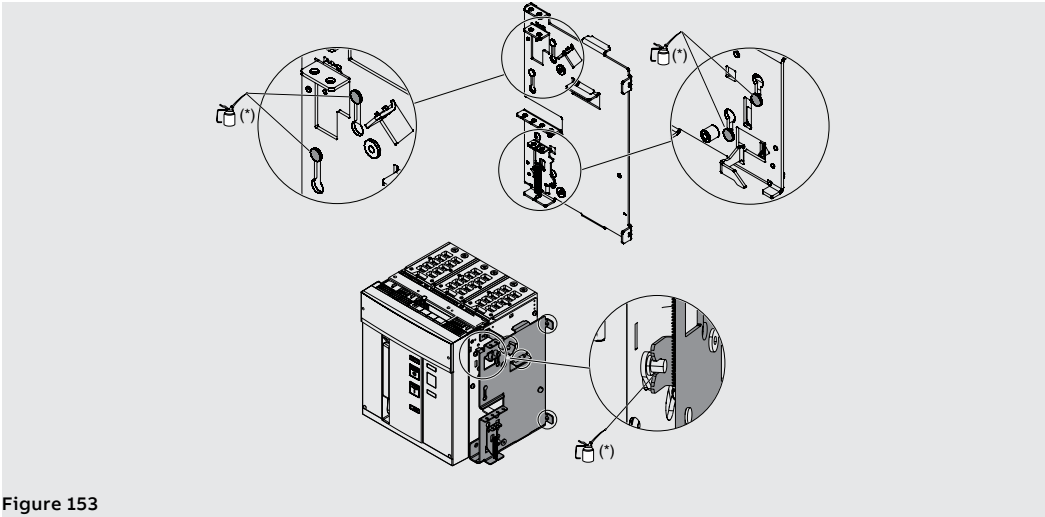
1. Reassemble all the parts by performing all the operations indicated in the paragraph “Disassembly Operations” in reverse order and, if necessary, reconnect the auxiliary power supply.
2. Put the movable part (breakers) in the test position (see indication TEST).
3. Perform the following operations 10 times:
 - Opening (in both local and remote modes, if applicable)
 - Closing (in both local and remote modes, if applicable)
 - Tripping via Trip Test
4. Perform the operations in the following sequence:
 - Open - Springs discharged
 - Open - Springs charged
 - Closed - Springs discharged
 - Closed - Springs charged
5. Check that the following operate correctly:
 - accessories, if provided.
 - gearmotor, if provided.
 - undervoltage coil, if provided.
 - opening coil, if provided.
 - closing coil, if provided.
 - auxiliary contacts of the circuit-breaker, if provided.
 - lock for circuit-breaker in open position (key or padlock), if provided

Interlock check Check that the vertical or horizontal interlocking devices (if provided) are installed and that they operate correctly.

 **WARNING! the interlocks cannot be tested in the Test or Disconnected positions.**

Perform maintenance periodically as indicated in the table below.

Activity	Frequency	Maintenance operations
Functionality	1 year or	See kit sheet
Check tightness	20% of mechanical life or	
Lubrication	20% of electrical life	As shown in the figure
Cables	Three years or 50% of the mechanical life or 50% of the electrical life of the largest circuit-breaker involved in the interlock. After a trip due to a short-circuit.	Replacement is advisable



(*) Use Mobilgrease 28, also available in the ABB greasing kit.

4 - E2.2, E4.2 and E6.2 second level maintenance

Preliminary operations

The second level maintenance must be performed in accordance with the maintenance schedule shown on page 267.



WARNING! before proceeding with any maintenance operation, it is mandatory to:

- Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.
- In the case of a withdrawable circuit-breaker work with it withdrawn from the fixed part. For removal of the fixed part see paragraph "Circuit breaker racking-in/racking-out operations" in the document [1SDH001000R0002](#).

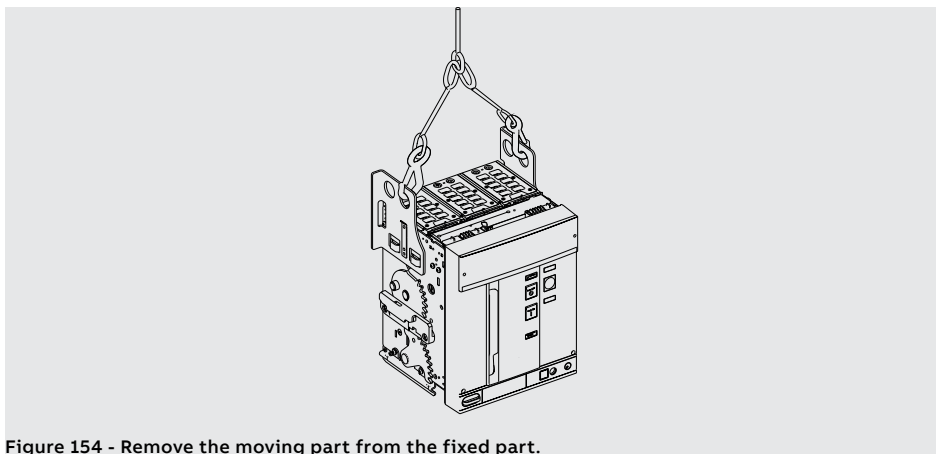


Figure 154 - Remove the moving part from the fixed part.

- If work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly ground the terminals on both the supply side and load side.

Inspections and general cleaning

Perform the following checks:

1. Make sure that the circuit-breaker is clean. Remove dust and oily substances or excess grease with a clean, dry cloth (use a mild detergent if necessary. If there is a thick build-up of dirt, use a thinner from the greasing kit or ask for assistance from the service staff).
2. Check that the rating plates with the technical specifications of the apparatus are present.
3. Clean the rating plates with clean, dry rags.
4. If the circuit-breaker is in the withdrawable version, remove all traces of dust, mould, condensation and oxidation inside the fixed part.
5. Make sure that there are no traces of overheating or cracks, which could impair the insulating parts of the circuit-breaker
6. Check the integrity of the separation pliers (for withdrawable circuit-breaker).
7. The jaw contacts must be silvery in colour with no traces of erosion or discoloration.
8. Make sure that there are no foreign bodies in the circuit-breaker compartment.
9. Check for loose screws of the fixed part of the framework (M8 - 25Nm).

Circuit-breaker connections and connections between circuit-breaker and switchboard

Perform the following checks on the connections:

1. Remove any dust or dirt with a brush and dry cloth (use a mild detergent if necessary. If there is a thick build-up of dirt, use a thinner from the greasing kit or ask for assistance from the service staff).
2. Make sure there are no traces of overheating on the terminals. Overheating is detected by a different coloration of the parts in contact; the contact parts are usually silvery white in colour.
3. Make sure that the bolts of the terminal connections are well tightened.



WARNING! if work must be performed on fixed circuit-breakers or on fixed parts, disconnect the power supply to the power circuit and auxiliary circuits and visibly earth the terminals on both the supply side and load side.

Disassembly operations

To disassemble the parts of the circuit-breaker:

1. Remove the transparent flange (A) of the trip unit, by turning the screws (B).
2. Remove the front cover of the circuit-breaker (C), by removing the mounting screws (D).

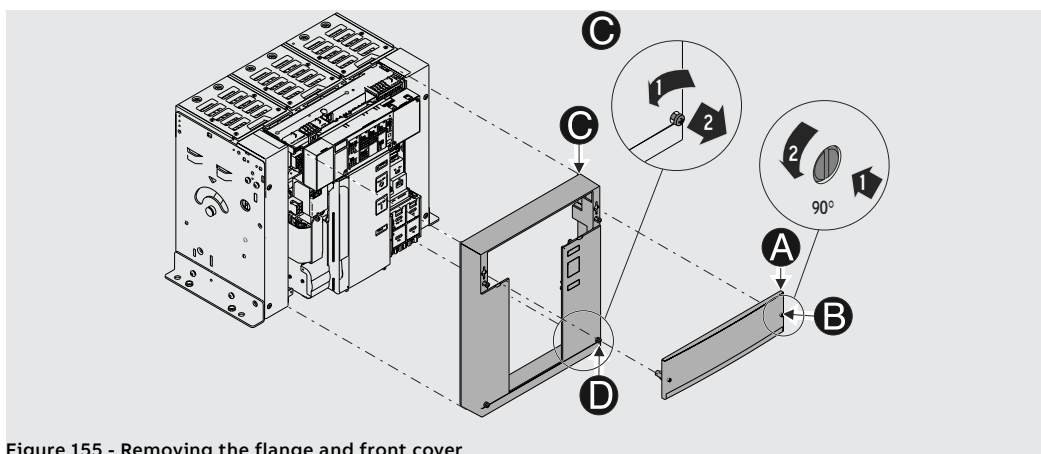


Figure 155 - Removing the flange and front cover

3. Remove one or both of the side guards (E) (if installed) by removing the front screws (F).
4. Remove the gearmotor (G) by removing the screw (H) and the connector.

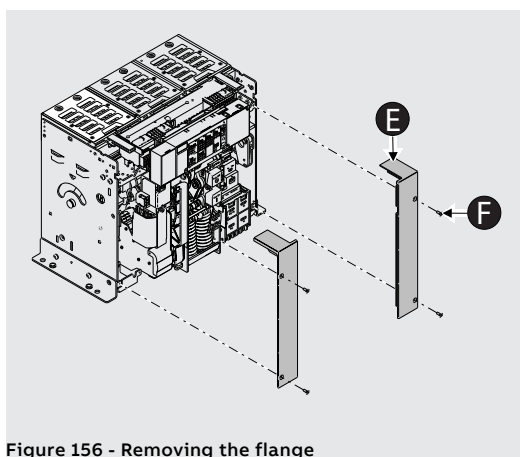


Figure 156 - Removing the flange

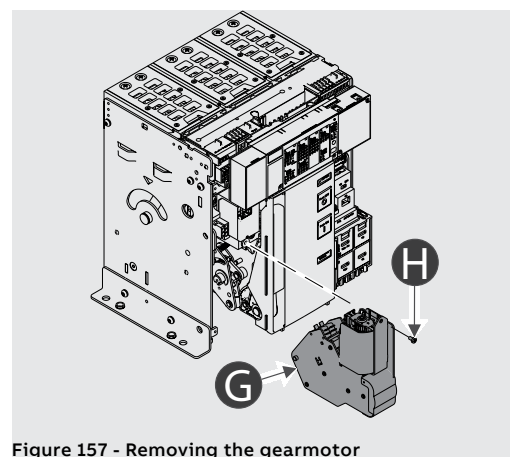


Figure 157 - Removing the gearmotor

5. If there is an undervoltage coil (I), remove it, and discharge the springs of the operating mechanism for closing and opening the circuit breaker.

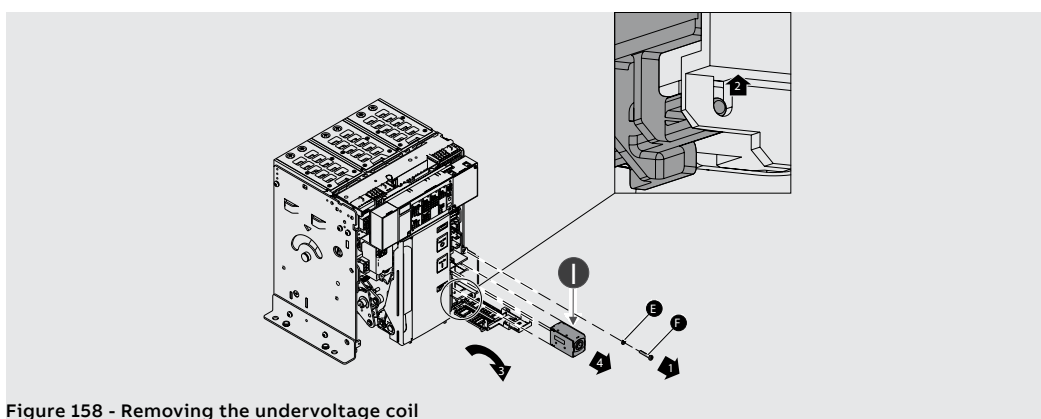


Figure 158 - Removing the undervoltage coil

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6. Remove the front cover of the circuit-breaker (L) by removing the screws (M) and the protection plate (N) by removing the screw (O).

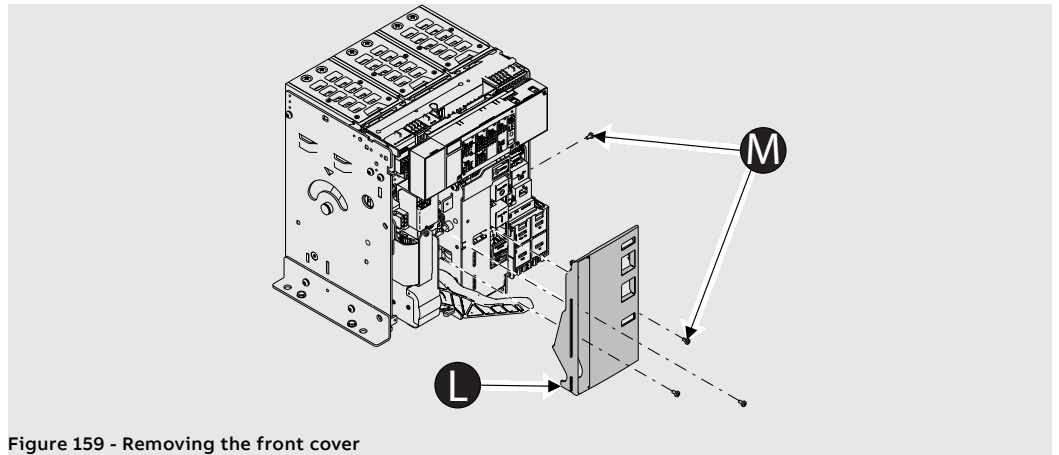


Figure 159 - Removing the front cover

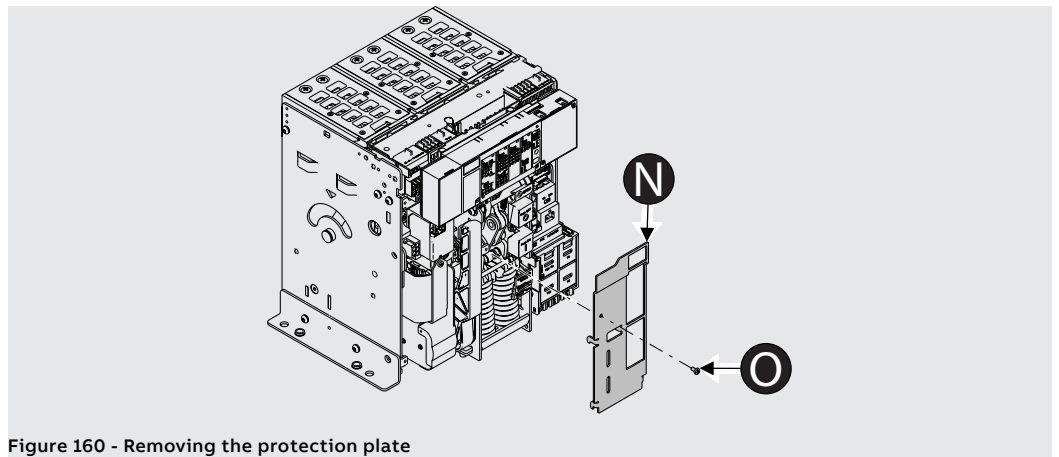


Figure 160 - Removing the protection plate

Before cleaning and lubrication of the operating mechanism, you must remove the protection trip unit. For information about removal, see the document [1SDH001000R0523](#), or request the intervention of a technician ABB.

Cleaning and lubrication of the operating mechanism

To clean and lubricate:

1. Clean the closing clip, the closing rod and opening rod in the points shown in the illustrations. If there is a thick build-up of dirt, use a thinner from the greasing kit or ask for assistance from the service staff.
2. Lubricate closing hook, the closing shaft, opening hook and opening shaft in the points indicated by the illustrations with Mobilgrease 28 grease (EXXON MOBIL).
3. Make sure that the opening and closing shafts are free to turn.

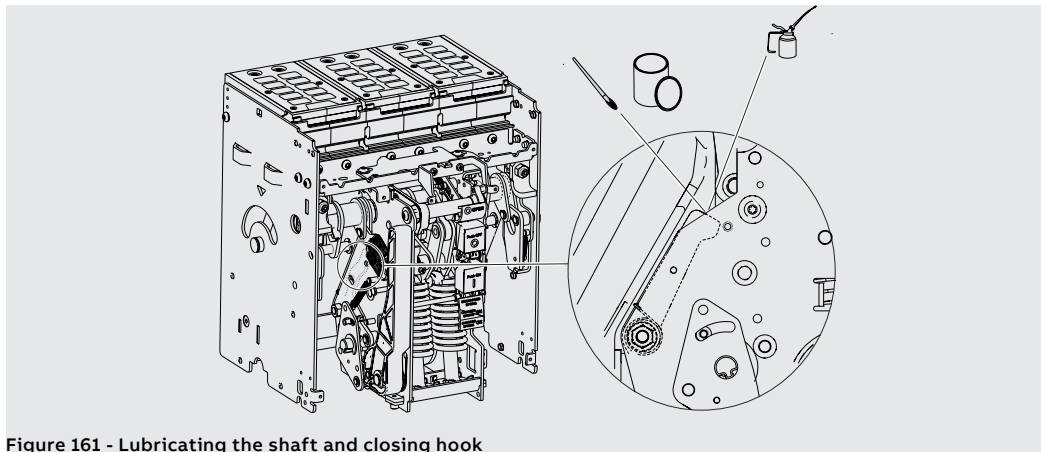


Figure 161 - Lubricating the shaft and closing hook

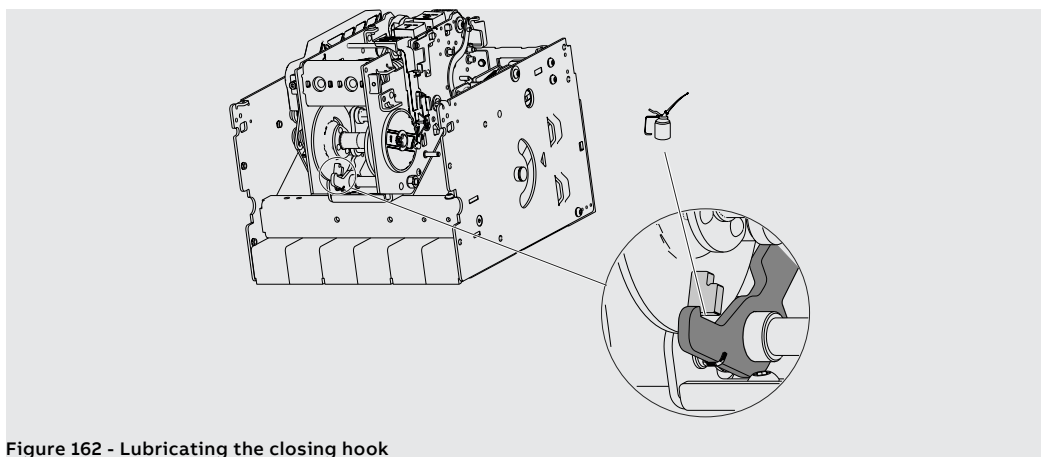


Figure 162 - Lubricating the closing hook

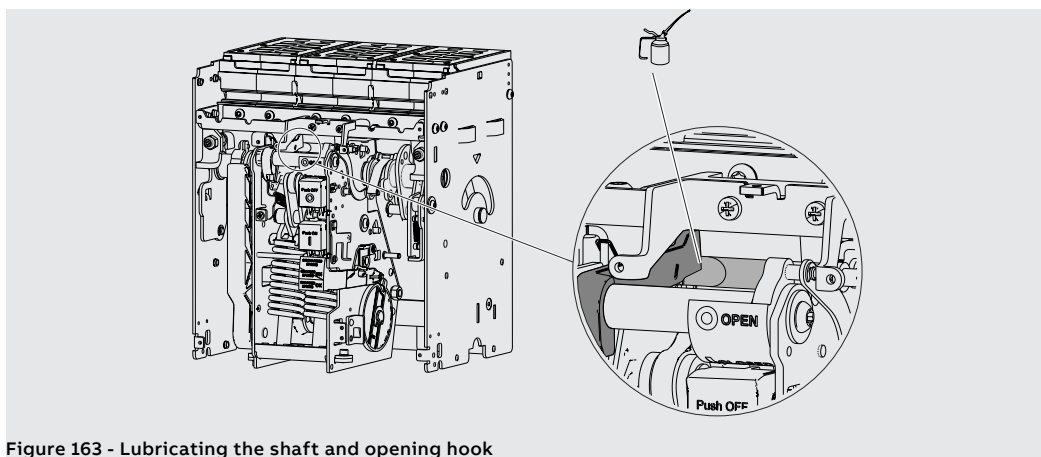


Figure 163 - Lubricating the shaft and opening hook

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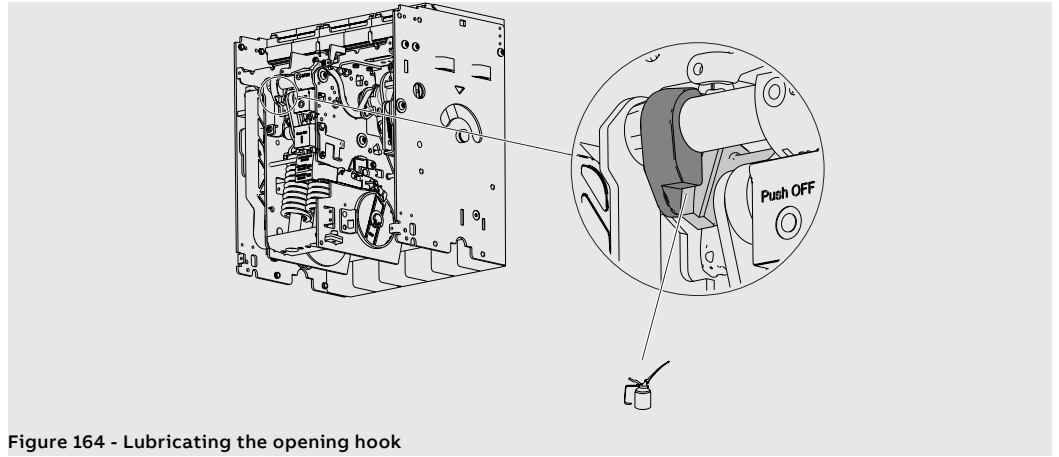


Figure 164 - Lubricating the opening hook

- In the case of deformed or rusty springs, rings missing or severe wear of the operating device, contact ABB Sace.

Inspection of electrical and mechanical accessories

Check the accessories:

1. Check that the accessories are securely fixed to the circuit-breaker.
2. Check that the accessories are connected correctly to the circuit-breaker.
3. Make sure that the coils (YU-YO-YC) are in good condition (no excessive wear and tear, overheating, rupture).
4. Make sure that the mechanical operation counter functions correctly (if present) by operating the circuit-breaker.
5. Check the wear on the brushes of the gearmotor and if necessary replace them.



NOTE: it is advisable to replace the gear motor if it has performed more than 10000 spring charging operations or reached 50% of the declared mechanical life of the circuit-breaker.

Check for wear on the contacts

With the circuit-breaker open and springs discharged:

1. Remove the arc chutes

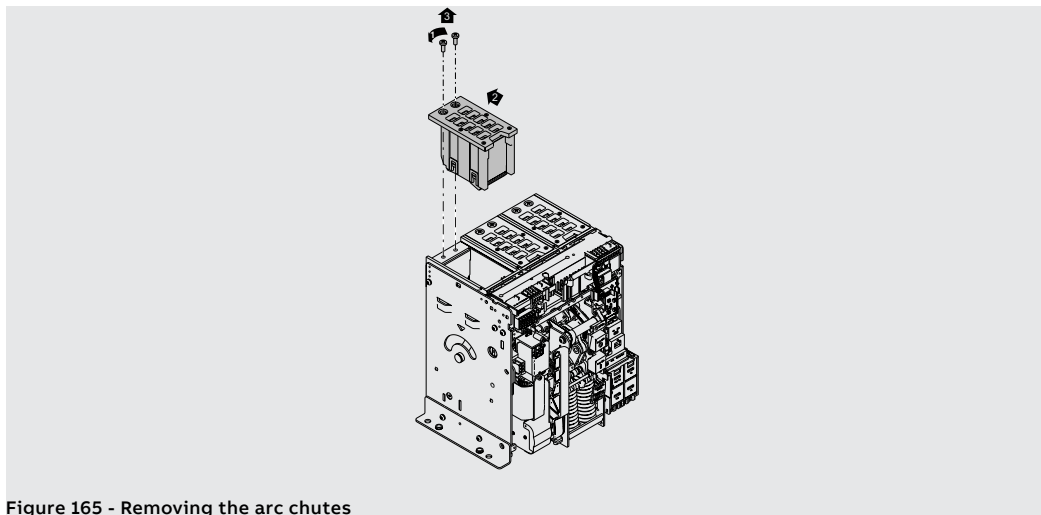


Figure 165 - Removing the arc chutes

2. Check the condition of the arc-breaking chutes: the base of the chute must be undamaged and the plates must be neither corroded nor indented.
3. Remove the dust with compressed air, then clean off all traces of fumes and slags with a brush.
4. Make sure that the contacts are in good condition.
5. Visually check to make sure that the main and arc-breaking plates are in place.
6. Check for tarnishing or beading. If such defects are discovered, ask for assistance from a qualified ABB Technician (*).
7. Check the arc-breaking gaps (distance A).

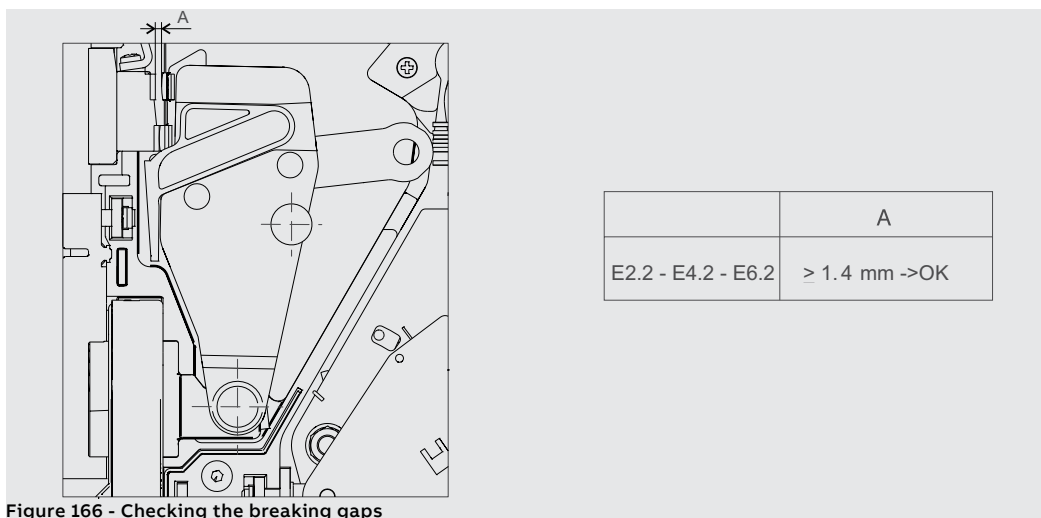


Figure 166 - Checking the breaking gaps

8. Close the circuit-breaker and check dimension A. Contact ABB Sace (*) if dimension A is incorrect. If dimension A is correct, open the circuit-breaker again and re-assemble the arc chutes.



NOTE: (*) After approval from the customer, ABB can proceed with replacement of the worn parts.

Inspection of the protection trip unit

Check that the trip unit is in good condition:

1. Power the protection trip unit with an Ekip TT battery unit.
2. Check the correct operation of the protection trip unit: tripping test with "Trip Test" and "Autotest".
3. With a Ekip Dip verify the absence of alarms through frontal LEDs.
4. With a Ekip Touch, verify the absence of alarms via the display and the front LEDs.
5. Make sure that the cables are correctly connected to the modules and to the trip unit (if applicable).
6. On a Ekip Touch check the percentage of wear on the contacts of the circuit-breaker.
7. Finally, remove the Ekip TT battery unit.

Test with Ekip Connect

Test the trip unit:

1. Connect the Ekip Bluetooth or Ekip T & P unit to the trip unit.
2. Connect the computer where the program is installed by means of a Bluetooth or USB connection.
3. After connecting the computer and trip unit, check that there are no alarm signals. Otherwise, refer to the paragraph "1 - Identification of alarms or failures" on page 285.
4. In the absence of alarms you can proceed to the trip test and self test (depending on the type of trip unit). For future checks it is recommended to insert the current date in the area called "Information". These data will be stored within the trip unit itself.
5. Remove the Ekip Bluetooth or Ekip T & P unit from the trip unit.

Final checks

Reassemble and check the circuit-breaker:

1. Reassemble all the parts by performing all the operations indicated in the paragraph "Disassembly Operations" in reverse order and, if necessary, reconnect the auxiliary power supply.
2. Put the movable part (breakers) in the test position (see indication TEST).
3. Perform the following operations 10 times:
 - Opening (in both local and remote modes, if applicable)
 - Closing (in both local and remote modes, if applicable)
 - Tripping via Trip Test
4. Perform the operations in the following sequence:
 - Open - Springs discharged
 - Open - Springs charged
 - Closed - Springs discharged
 - Closed - Springs charged
5. Check that the following operate correctly:
 - accessories, if provided.
 - gearmotor, if provided.
 - undervoltage coil, if provided.
 - opening coil, if provided.
 - closing coil, if provided.
 - auxiliary contacts of the circuit-breaker, if provided.
 - lock for circuit-breaker in open position (key or padlock), if provided

Interlock check Check that the vertical or horizontal interlocking devices (if provided) are installed and that they operate correctly.

 **WARNING! the interlocks cannot be tested in the Test or Disconnected positions.**

Perform maintenance periodically as indicated in the table below.

Activity	Frequency	Maintenance operations
Functionality	1 year or	See kit sheet
Check tightness	20% of mechanical life or	As shown in the figure
Lubrication	20% of electrical life	
Cables	Three years or 50% of the mechanical life or 50% of the electrical life of the largest circuit-breaker involved in the interlock. After a trip due to a short-circuit.	Replacement is advisable

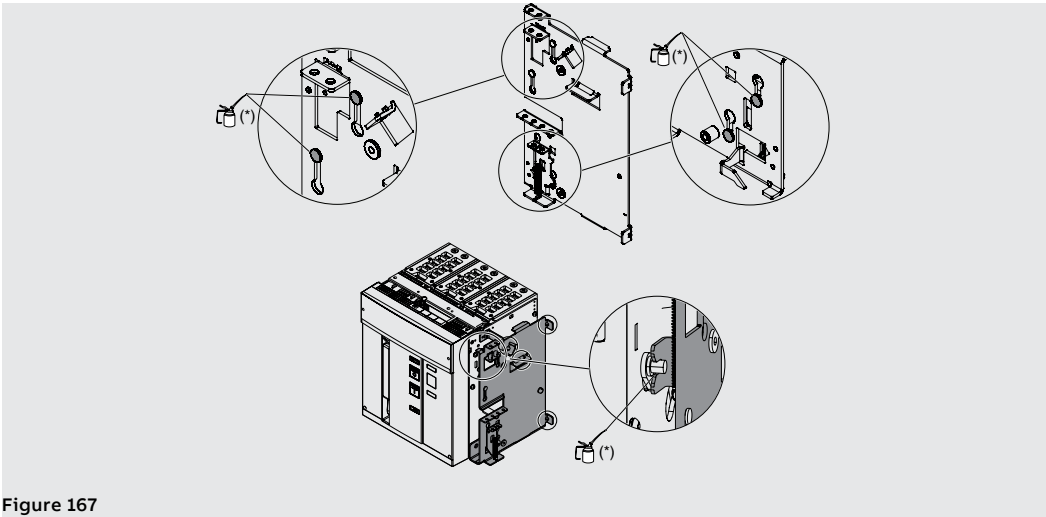


Figure 167

^(*) Use Mobilgrease 28, also available in the ABB greasing kit.

5 - Lubrication of jaw-type isolating contacts of withdrawable circuit-breaker

Lubrication operations must be performed as indicated in the maintenance schedule on page 267.

Preliminary operations



WARNING! before proceeding with any maintenance operation, it is mandatory to:

- Set the circuit-breaker to the open position and make sure that the springs of the operating mechanism are discharged.
- Work with the circuit-breaker removed from the fixed part. For removal of the fixed part see paragraph "Circuit breaker racking-in/racking-out operations" in the document [1SDH000999R0002](#) for circuit breakers E1.2 or in the document [1SDH001000R0002](#) for circuit breakers E2.2, E4.2 and E6.2.
- Disconnect the power circuit and auxiliary circuits and earth the terminals in a visible way, on both the supply side and load side.

Clean and lubricate the jaw-type isolating contacts

Perform maintenance periodically where grease is already present and if its properties have been impaired due to the environment.

The safety shutters must be disassembled (only IEC) before cleaning and lubricating the jaw-type isolating contacts. Information about disassembly is given in document [1SDH000999R0717](#) for circuit breakers E1.2 or the document [1SDH001000R0717](#) for circuit breakers E2.2, E4.2 and E6.2, or request the intervention of a technician ABB.

1. Clean the jaw-type isolating contacts in the indicated points. Use a laminate thinner such as Chemma 18 or equivalent if there is a heavy coating of dirt (Figure 168 - IEC for E1.2; Figure 169 - IEC for E2.2, E4.2 and E6.2).

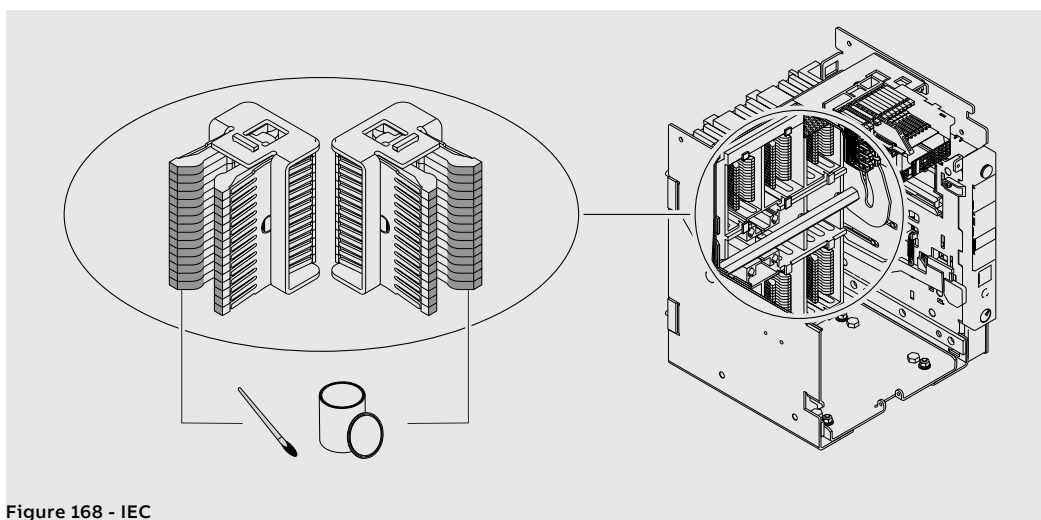


Figure 168 - IEC

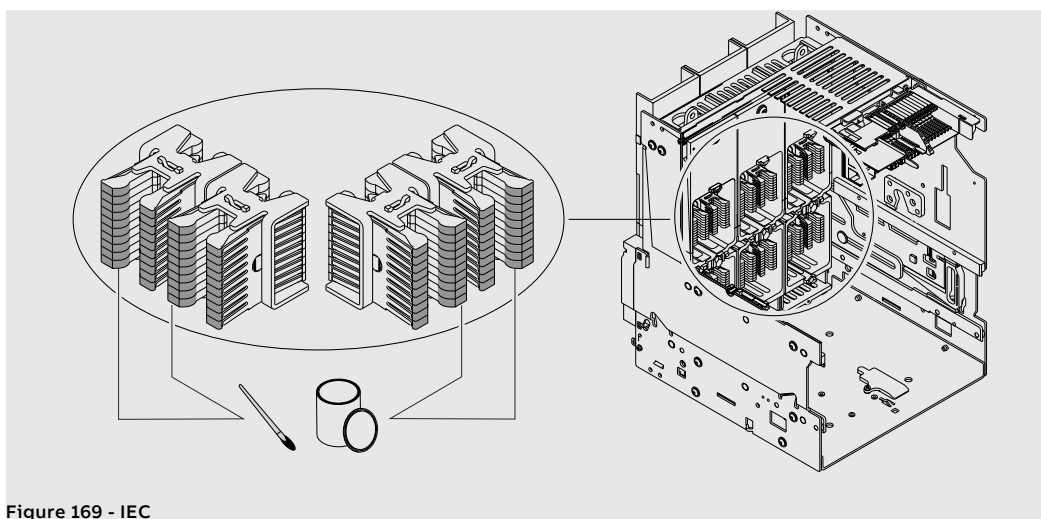


Figure 169 - IEC

Continued on the next page

2. Lubricate the jaw-type isolating contacts with Mobilgrease 28 in the indicated points (EXXON MOBIL) (Figure 170 - UL for E1.2; Figure 171 - UL for E2.2, E4.2 and E6.2).

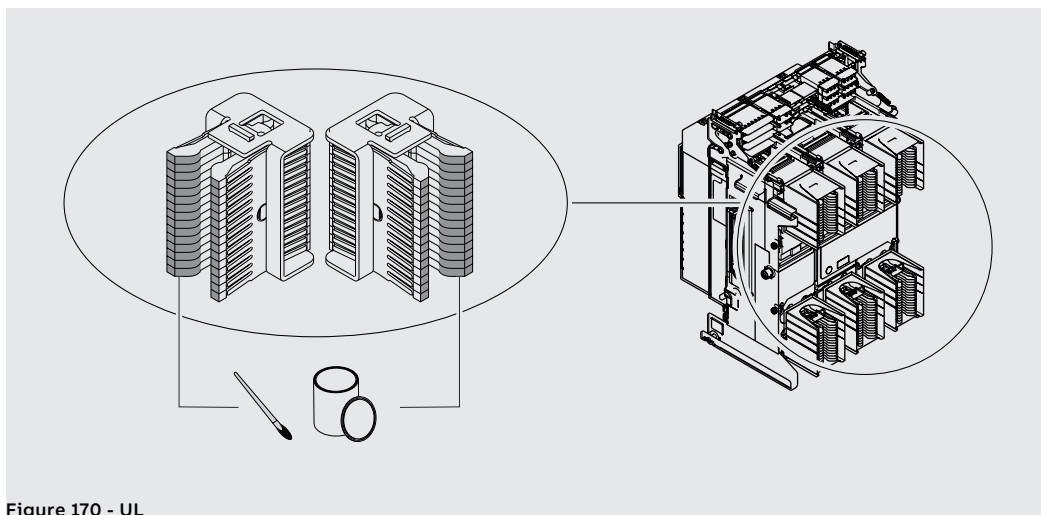


Figure 170 - UL

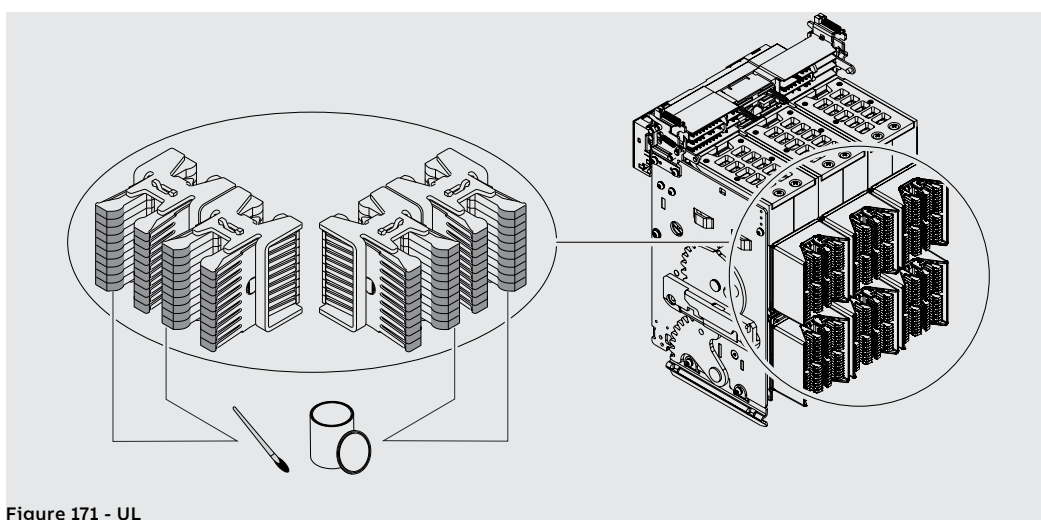


Figure 171 - UL

Alarms or failures

1 - Identification of alarms or failures

Introduction

Correct maintenance of the unit and connected devices ensures they operate correctly over time.

The maintenance operations must be performed by expert personnel, as required by the safety regulations and maintenance schedule described in this document.

If faults are discovered, find out what is causing them and eliminate them before putting the unit back into service.



WARNING! Detecting faults must only be managed by (electrically) skilled persons (IEV 195-04-01: person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create), as it may be necessary to perform insulation and dielectric tests on part or all the installation

Faults, causes and remedies

The following is a list of possible fault situations, their possible causes and suggestions for resolving them.

Faults	Possible causes	Suggestions
The circuit-breaker doesn't close when the closing pushbutton is pressed	The trip signal of the protection trip unit has not been reset	Press the TU mechanical reset pushbutton or operate the electrical reset remotely.
	The open-position key lock or padlock is activated	Unlock the lock in open position using the relevant key
	The circuit-breaker is in an intermediate position between connected and isolated for test or between isolated for test and disconnected	Complete the rack-in operation
	The undervoltage coil is not energized	Check the power supply circuit and the power supply voltage
	The opening coil is permanently energized	Correct operating condition.
	The trip unit pushbutton is pressed (withdrawable version)	Rotate the crank to complete
The circuit-breaker doesn't close when the closing coil is powered	The trip signal of the protection trip unit has not been reset	Press the TU Reset button
	The power supply voltage of the auxiliary circuits is too low	Measure the voltage: it should not be lower than 70% of the rated voltage of the coil
	The power supply voltage is different from that indicated on the rating plate	Check the voltage on the rating plate
	The cables of the coil are not inserted correctly in the terminals	Make sure there is continuity between cable and terminal and if necessary reconnect the cables of the coil to the terminals
	The connections in the power supply circuit are wrong	Check the connections using the relevant wiring diagram
	The closing coil is damaged	Replace the coil
	The operating mechanism is blocked	Perform the closing operation manually; if the fault persists contact ABB
	The open position key lock is activated	Unlock the lock in open position using the relevant key
	The circuit-breaker is in an intermediate position between connected and test or the trip unit pushbutton is pressed (withdrawable version)	Complete the rack-in operation
	The undervoltage coil is not energized	Make sure that undervoltage coil is energized properly
	The opening coil is permanently energized	Correct operating condition. If necessary, disconnect the power from the opening coil
	The racking out crank handle is inserted (withdrawable version)	Remove the crank
The circuit-breaker doesn't open when the opening pushbutton is pressed	The operating mechanism is blocked	Contact ABB

Continued on the next page

Faults	Possible causes	Suggestions
The circuit-breaker doesn't open when the opening coil is powered	The operating mechanism is blocked	Contact ABB
	The power supply voltage of the auxiliary circuits is too low	Measure the voltage: it should not be lower than 85 % of the rated voltage of the coil
	The power supply voltage is different from that indicated on the rating plate	Use the correct voltage
	The cables of the coil are not inserted correctly in the terminals	Make sure there is continuity between cable and terminal and if necessary reconnect the cables of the coil to the terminals
	The connections of the power supply circuit are wrong	Check the connections using the relevant wiring diagram
	The opening coil is damaged	Replace the coil
The circuit-breaker doesn't open despite the command of the undervoltage coil	The operating mechanism is blocked	Perform the opening operation manually; if the fault persists contact ABB
It is not possible to charge the closing springs by means of the manual charging lever	The operating mechanism is blocked	Contact ABB
It is not possible to charge the closing springs by means of the gearmotor	The cables of the gearmotor are not inserted correctly in the terminals	Make sure there is continuity between cable and terminal and if necessary reconnect the cables of the gearmotor to the terminals
	The connections of the power supply circuit are wrong	Check the connections using the relevant wiring diagram
	The circuit-breaker is in disconnected position	Switch the circuit-breaker to the test or connected position
	The gearmotor protection internal fuse has tripped	Replace the fuse
	The gearmotor is damaged	Replace the gearmotor
It is not possible to press the button in order to insert the racking out crank handle	The circuit-breaker is closed	Press the opening pushbutton in order to allow the insertion of the crank with the circuit-breaker open
It is not possible to insert the moving part in the fixed part	The racking-in/racking-out operation is not performed correctly	See chapters "Circuit breaker racking-in/racking-out operations" on pages#s#153#s#161 See the document 1SDH002013A1001
	The moving part is incompatible with the fixed part	Check the compatibility between the moving part and the fixed part
It is not possible to lock the circuit-breaker in the open position	The opening pushbutton is not being pressed	Press the opening pushbutton and activate the lock
	The lock in open position is defective	Contact ABB
It is not possible to perform the trip test	Trip coil is not connected properly	Check Trip coil connection and messages on display
	CB trip signal has not been reset	Press the reset pushbutton
	The busbar current is greater than zero	Correct operating condition.

Continued on the next page

Faults	Possible causes	Suggestions
It is not possible to remove the circuit-breaker from the disconnected position	Fail Safe lock active	Discharge the closing springs of the command
Trip times different than expected	Wrong threshold/time/curve selected	Correct parameters
	Thermal memory enabled	Disable it if it is not necessary
	Zone selectivity enabled	Disable it if it is not necessary
	Incorrect neutral selection	Modify the neutral selection
Rapid trip with I3 = Off	Inst trip	Correct operating condition with short circuit at high current
High ground-fault current, but no trip occurs	Incorrect selection of the sensor	Set internal or external sensor
	Function G inhibited owing to high current	Correct operating condition (see use cases in the chapter that describes the protection)
Display off and/or not backlit	No auxiliary supply or currents lower than minimum turn-on values	Correct operating condition.
	Temperature outside range	Correct operating condition.
Measurements incorrect or absent (current, voltage, etc)	Current below the minimum threshold that can be displayed	Correct operating condition.
	Incorrect frequency setting	Set frequency
	Harmonic distortion and/or crest factor off range	Correct operating condition.
	Incorrect connection between isolation transformer and <i>Measurement</i> module	Check connections between isolation transformer and Measurement module
	Rated voltage parameter setting Error	Set the correct parameters
The expected trip does not occur	Trip excluded	Correct operating condition. Enable trip if necessary
Opening data not displayed	No auxiliary power supply and/or battery low	Correct operating condition.
The PIN is not required	The PIN has been disabled or has already been entered in the same programming session	Operating condition correct; consult chapter relating to the PIN
Impossible to change any of the parameters	Trip unit in alarm condition	Correct operating condition.
The language cannot be changed	Trip unit set remotely	Set it in local mode
	The circuit-breaker is not open	Open the circuit-breaker
	One of the possible power supplies is not present	Power the trip unit with Vaux, Ekip T&P or Ekip TT
PIN error	PIN wrong or lost	Contact ABB or consult document 1SDH001501R0001
Communication problems with Ekip Com, Ekip Link, Ekip Signalling or Ekip CI	Circuit-breaker in withdrawn position, Vaux absent or modules not inserted properly	Insert modules, set circuit-breaker to Connected position, connect Vaux
State of CB Position field not aligned with circuit-breaker position	Absence of Ekip Com or Ekip Link modules, or contact S75I	Check for presence of Ekip Com or Ekip Link modules and connect contact S75/I

Continued on the next page

Faults	Possible causes	Suggestions
Circuit-breaker fails to react to opening/closing command from Ekip Touch	The connections or supplies of the opening/closing actuators are not correct	Check connections and supplies
	Absence of auxiliary power supply to Ekip Touch	Check supplies and status of Power LEDs
	Circuit-breaker is in a condition which fails to enable the selected command	Check circuit-breaker documentation and cases that fail to enable command
TRIP fail signaling: <i>Trip Fail command (BF)</i>	One or more of the following conditions: <ul style="list-style-type: none"> • Trip coil not working • status contacts not working • faulty internal wiring 	1. If closed, open CB in the manual mode and check changed status. 2. Press iTest, check that the signal has disappeared from the display and the general status of the alarms. 3. Check the conditions of the wiring and internal contacts 4. Working in safety conditions, close the CB and perform a trip test via the trip unit Contact ABB if problems persist

Programming errors

If during the programming of the parameters an attempt is made to violate certain limitations, the trip unit blocks the saving procedure and signals the error:

Type of error	Error description
2I Th > 15 kA	Threshold I31 (protection 2I) > 15 kA
30006	Parameter change not completed on display within five minutes
30007	Attempt at remote control with Trip unit configuration in the local mode
30008	Attempt at local control with Trip unit configuration in the remote mode
30011	Error in Ekip Link list of actors
30012	More than one Time Sync source (IEEE 1588 or SNTP) on one single module or between different modules
30013	Network Analyzer parameter control unsuccessful
Active Power Fail	Threshold P23 (protection UP) \geq Threshold P26 (protection OP)
DLog not stopped	Modification of datalogger parameters not allowed with datalogger function not stopped
D Th \geq I Th	Threshold I7 (protection D) \geq Threshold I3 (protection I)
Zone Sel Config = On while S / S2 / I / G / Gext / MDGF = On	Zone selectivity enabling of protection D not allowed with zone selectivity already active for one among protections S, S2, I, G, Gext or MDGF
G Th > 1200 A	Threshold I4 (protection G) > 1200 A with CB in standard configuration UL Threshold I4 (protection G) or Threshold I41 (protection Gext or MDGF) > 1200 A with CB in standard configuration UL
G Startup Th > 1200 A	G > 1200 A protection threshold start up with CB in standard configuration UL G or Gext or MDGF > 1200 A protection threshold start up with CB in standard configuration UL
In MDGF > CB Nominal Current	Set size of sensor MDGF exceeds I _u size of circuit-breaker
G FT time = 50 ms is not valid	Trip time I4 (protection G) = 50 ms
G Time > 400 ms	Trip time t4 (protection G) > 400 ms with CB in standard configuration UL
Gext Time > 400 ms	Trip time t41 (protection Gext or MDGF) > 400 ms with CB in standard configuration UL
Gext FT time = 50 ms isn't valid	Trip time I41 (protection G) = 50 ms
High priority alarm	Modification of parameters not allowed during protection times
I and MCR enabled together	Protections I and MCR are mutually exclusive
L Th \geq S Th	Threshold I1 (protection L) \geq Threshold I2 (protection S)
L Th \geq S2 Th	Threshold I1 (protection L) \geq Threshold I5 (protection S2)
L curve different to I ² t=k	Protection curve L different from t=k/I ² with CB in standard configuration UL
L Th > 980 A	Threshold I1 (protection I) > 980 A with CB in standard configuration UL
Neutral configuration error	Configuration of neutral protection must conform to formula: I1 (A) \geq I _u (A) x Ne config / 100
OV Threshold > 828 V	Threshold U9 (Protection OV) > 828 V (690 x1.2)
OV2 Threshold > 828 V	Threshold U16 (Protection OV2) > 828 V (690 x1.2)
RC toroid error	Activation of toroid Rc is not allowed without the presence of a model Rc rating plug
RQ Q24 \geq Q25	Threshold Q24 \geq Threshold Q25 (Protection RQ)
S Th \geq I Th	Threshold I2 (Protection S) \geq Threshold I3 (Protection I)
S2 Th \geq I Th	Threshold I5 (Protection S2) \geq Threshold I3 (Protection I)
S Time > 400 ms	Trip time t2 (protection S) > 400 ms with CB in standard configuration UL
S2 Time > 400 ms	Trip time t5 (protection S2) > 400 ms with CB in standard configuration UL
S(V) or S2(V) parameters	Error in configuration of parameters of protection S (V) or S2 (V); consult user manual of Trip unit for the limits
SYNCHRO parameters error	Inconsistency of Synchrocheck protection parameters: Delta phase \geq 180 x Delta freq x [minimum correspondence time + 0.0023]
V DIR Th > 690*1.2	Protection threshold VDIR > 828 V (690 x1.2)
VS Th > 690*1.2	One of the two thresholds of protection VS Warning > 828 V (690 x1.2)

2 - Self-diagnosis

Alarms and signals

Alarm Tests

Ekip Touch provides a series of signals that indicate its operating state, alarms present, or configuration errors in progress.


The signals are provided:

- by LEDs, as described on page 39;
- by messages on the diagnosis bar.




The messages on the diagnostics bar can be divided into three categories: self-diagnosis, protection or measurement alarms, and programming error.

Alarms displayed and suggestions

A list of faults that may appear on the Ekip Touch display is given below along with suggestions on how to resolve them:

Signal	Suggestions
Numerical alarm (e.g. 30002)	Consult the Events page of the System Interface to identify the error. Contact ABB if the code is not included in the list.
Battery low	Change the battery (See 1SDH001000R0509 kit sheet)  WARNING! The battery may explode unless it is handled correctly: do not charge, disassemble or burn. Replace battery with CR2450HR; use of another battery could lead to the risk of fire or explosion.
Local bus	Unit on with auxiliary supply, Local Bus parameter enabled but connection to modules not present, incorrect or communication lost (for more than five seconds); check: <ul style="list-style-type: none"> • connection and powering of modules in terminal box or external • that the modules connected are compatible with Ekip Touch
CB undefined	Check the circuit-breaker status signal contacts
Trip fail command (BF)	CB has failed to open and/or current still present after a TRIP command: comply with the procedure proposed in the next chapter 'Faults, causes and remedies'
Configuration	Protection parameter configuration error: make sure that threshold I4 and time t4 are compatible with the minimum values required for self-supply Check: <ul style="list-style-type: none"> • <i>Rating plug</i> of model compatible with Ekip Touch and CB size • If present, protection parameters do not conflict with size of current of unit details on page ,54) • In the absence of <i>Vaux</i> threshold I4 and/or I41 > 100 A • In the absence of <i>Vaux</i> time t4 and/or t41 > 100 ms • RC protection active and <i>Rating Plug</i> not RC
Invalid Date	Wrong date and time: set in <i>Settings-System-Date</i> and <i>Settings-System-Time</i>
Ekip CI	Ekip CI module not detected or absent, with Ekip M Touch and Open Mode configuration = Normal
Ekip Com Hub	Problem of Ekip Com Hub module with: certificates, connected devices, missing Com modules (RTU or with Ethernet connection), API TLS device, Hub events, parsar configuration
Ekip Link Bus	Fault in <i>Ekip Link</i> module: check for loss of connection with one or more actors (modules) connected to Link Bus
Ekip Sign 3T connection	Alarm for connection of one or more analog inputs to <i>Ekip Signalling 3T</i> module
Ekip Sign 3T threshold	One or more thresholds of the <i>Ekip Signalling 3T</i> module has/have been exceeded
Internal error	Internal error; contact ABB if this type of error occurs
SNTP error	Fault with <i>Ekip Com</i> modules: synchronization problem of SNTP synchronization reference module
Measuring Error	<i>Measurement</i> module parameter reading error, contact ABB
Ethernet disconnected	No external cable on one or more <i>Ekip Com</i> modules with Ethernet connection

Continued on the next page

IEEE 1588 synch	Synchronization problem of IEEE 1588 synchronization reference module
MAC Address	<i>Ekip Com</i> module detected with incorrect / not allowed MAC address, contact ABB.
Ekip Installation	Installation error between HMI and Mainboard, contact ABB
Measuring installation	Install <i>Measurement</i> module (<i>Settings-Circuit breaker-Installation-Measuring-Install</i>) menu
RatingPlugInstallation	Install Rating Plug (<i>Settings-Circuit breaker-Rating Plug-Install</i> menu) and check connection if there are further faults
Maintenance	Maintenance alarm: carry out maintenance and then reset the alarm via <i>Ekip Connect</i> (see 1SDH001330R1002)(see page116)
PC Power exceed	The average power limit setting of the Power Controller has been exceeded
Rating plug	<i>Rating plug</i> not present, value or size incompatible with <i>Ekip Touch</i> parameters
Zone Selectivity Diag	Error in zone selectivity connections (Hardware Selectivity)
S.G.R. Toroid	Check connection and state of toroid
Sensor L1/L2/L3/Ne	Fault in connection of sensors to Trip unit; check status of sensors, including external Neutral, or call ABB
	Check current sensors, status of terminal and cables connecting to <i>Ekip Touch</i>
Configuration Session	TFTP server enabled and/or configuration session open on module <i>Ekip Com IEC 61850</i> or <i>Ekip Hub</i>
Software Not Compatible	<p> IMPORTANT! Ignore the message if all the following conditions are present at the same time:</p> <ul style="list-style-type: none"> • Vaux absence • Absence of <i>Ekip TT/Ekip T&P/Ekip Programming</i> • Presence of primary current near to self supply powering minimum value (condition in which the Power LED flashes) • After having pressed and held the Trip unit test button for at least three seconds <p> NOTE: If for further confirmation that the alarm is unwarranted and must therefore be ignored, temporarily power even only in one of these sources and check that the alarm is no longer changed:</p> <ul style="list-style-type: none"> • Vaux (24 VDC) -> K1 K2. For further details, consult page#s#20 • <i>Ekip TT/Ekip T&P/EKIP Programming</i> <p>If the conditions indicated above are not present, the software versions between Mainboard and display (<i>Ekip Touch</i>) are not compatible with each other: to restore compatibility, please contact ABB</p> <p> NOTE: modification of all parameters is inhibited via display; if present, protections L, I and linst are active and function with the parameters prior to the alarm (parameters of previous unit are active if display has been replaced)</p>
CB status	CB state incorrect (esample: current present but CB in open state)
Switchboard Actor communication Error	Check configuration and connection of <i>Ekip Link</i> module
TC disconnected	Disconnection of Trip coil detected, check functionality
	Check Trip coil, status of the terminal and cables connecting to <i>Ekip Touch</i>
Contact Wear	Make sure that the contacts/poles are in good condition.

Continued on the next page

Protections

In the event of protection or measurement alarms, the associated signals are reported:

Signal	Type of alarm
Trip Test	Trip test performed signal. Press iTEST to reset the message
Protection timing (for example: L timing)	Specific protection in time delay mode
Protection prealarm (for example: Prealarm G)	Specific protection in prealarm
Protection (Trip off) [for example: S (Trip off)]	Specific protection, configured with trip disabled, in alarm state
2I Protection Active	2I Protection active
Load LC1 / Load LC2	Current threshold 1 I1 / 2 I1 exceeded and in alarm state
Iw1 Warning / Iw2 Warning	Current threshold Iw1 / Iw2 exceeded and in alarm state
Harmonic dist.	Harmonic Distortion protection in alarm state
Power factor	Power factor measurement ($\cos\phi$) less than set threshold
Phase cycle	Phase sequence protection in alarm state
Frequency	Frequency measured off range (<30 Hz or >80 Hz)
5th harmonic above Th / I sopra Th / THD I above Th / THD V above Th	Single or total harmonic measurement above threshold

Predictive analysis program

1 - Presentation

Objectives Routine maintenance has always been considered a good way to maintain a high level of efficiency in the installation, but it is also a cost item linked to the frequency with which it is performed.

Maintenance work can be promptly organized thanks to application of the new digital technologies and constant monitoring of the vital parameters of the circuit-breaker during normal daily operation.

The ability to estimate the exact time that maintenance must be performed optimizes all aspects concerning maintenance itself: plant efficiency, management of costs and investments, continuity of service.

This condition is known as **predictive maintenance**.

Proposal In ABB low voltage air circuit-breakers, the system that monitors and identifies the moment in which maintenance is required is made available thanks to the *Predict* function in the *ABB Ability Electrical Distribution Control System (EDCS)*.

When it is connected to Cloud, the circuit-breaker continuously transmits a set of data which, once organized and analyzed by algorithms, supply a trend with the state of aging of the circuit-breaker.

Operating principle The main factors that influence circuit-breaker aging are:

- The number of electrical and mechanical openings (switches).
- The interrupted current (%In, short-circuit, overload, etc...).
- Environmental factors such as temperature, humidity, dust, corrosion, ...

Constant evolution of these data and their combination affect circuit-breaker aging, which can be more or less rapid.

An indication of the condition of the circuit-breaker and, above all, of the date when maintenance should next be performed can be obtained by monitoring these data by means of *Predictive Maintenance* in *ABB Ability EDCS*.

If something happens to the circuit-breaker during its normal operation, this data item is updated as a consequence.



Advantages Any prompt identification of potential problems allows action to be taken:

- So as to optimize the way that the required resources are managed (organization of personnel, shorter lead times for support - thus shorter downtimes,...) .
- On the quality processes and supply of replacement parts.
- So as to enhance customer satisfaction by ensuring that the installations are increasingly efficient.

2 - Service offers

Analysis programs

Two preventive analysis programs are available:

Name	LEAP Easy Audit	Predictive maintenance in ABB Ability EDCS
User	Customer	ABB Service
Circuit-breaker state of aging [on statistical basis]	X	
Circuit-breaker state of aging [analysis]		X
Maintenance		X

LEAP Easy Audit

On the basis of the environmental and specific operating conditions of the circuit-breaker in different types of installation, LEAP AUDIT EASY provides a simple analysis using statistical data for the purpose of obtaining an estimation of the conditions of the circuit-breaker itself.

LEAP EASY AUDIT can be performed by the actual client, free of charge, after registration in the dedicated WEB page [\(LINK\)](#).

Procedure

1. The client registers in the dedicated WEB page (link). [\(LINK\)](#).
2. Waiting for mail with credentials to access software online and directly enter certain data concerning use of the circuit-breaker (serial number of circuit-breaker, application, average annual environmental conditions and number of operations (opening sequences) since installation).
3. Once this general information has been entered, the customer received a report via mail describing the condition of his circuit-breaker.

The result is an analysis purely based on statistical data in the absence of access to the complete operating data of the circuit-breaker.

Predictive maintenance in ABB Ability EDCS

A section dedicated to predictive maintenance can be activated in ABB Ability EDCS and used to supervise the conditions of the ABB air circuit-breakers connected in ABB Ability EDCS.

If a maintenance contract has been drawn up with ABB service, evidence of maintenance efficacy will also be apparent in ABB Ability EDCS.

Decommissioning and treatment at end of life

1 - Decommissioning and treatment at end of life

Safety standards During the early stages of the process of decommissioning and end of life treatment of SACE Emax 2 circuit-breakers, observe the following safety rules:

- the closing springs, even if discharged, must never to be taken apart.
- instructions for handling and lifting the circuit-breakers are given in the “Unpacking and handling” chapter of document [1SDH000999R0002](#) for E1.2 or in the document [1SDH001000R0002](#) for E2.2, E4.2 and E6.2.



HAZARD! RISK OF ELECTRIC SHOCK! Unplug or disconnect any power supply, to avoid any potential risk of shock during removal of the circuit-breaker from the service.



WARNING! After dismantling the switchgear, the circuit-breaker must be stored in the open position with the closing springs discharged and with the front cover mounted.

Trained personnel The operations for decommissioning SACE Emax 2 circuit-breakers involve performing procedures that can be performed by Trained Persons in the electrical field (IEV 195-04-02: person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid danger which electricity can create).

End of life treatment for circuit-breaker materials The materials used in the production of SACE Emax 2 circuit-breakers are recyclable and should be treated separately as shown in the following table:

TYPE	MATERIAL
A	Plastic parts ⁽¹⁾
B	Metal parts
C	Printed circuits
D	Current sensors, cables, motors, electrical windings

⁽¹⁾ All the components of significant dimensions bear a mark specifying the type of material.



NOTE: refer to the national legislation in force at the time of decommissioning of the product, in the case where it specifies end of life treatment procedures different from those indicated.

Disposal of packing materials The materials used for the packaging of SACE Emax 2 circuit-breakers are recyclable and should be treated separately as shown in the following table:

TYPE	MATERIAL
A	Plastic parts
B	Cardboard parts
C	Wooden parts
D	Metal parts



NOTE: refer to the national legislation in force at the time of decommissioning of the product, if it provides for disposal procedures other than those specified.

Service

1 - Power Care

Foreword The number of devices that make up an electrical installation varies so greatly that it can be difficult to manage them, even for a very expert installation manager.

To ensure the availability and reliability of electrification systems, ABB offers PowerCare, a wide range of service packages tailored to the type of company, with custom support solutions based on customer requirements.

Description The PowerCare platform is based on a matrix of services that the customer selects, according to his own needs, when the service contract is activated. The proposed services range from the possibility of having dedicated access, through a portal [POWERCARE](#), to a complete range of support services for each type switchgear and controlgear.

All the services are supplied by qualified and certified ABB personnel.

Services The PowerCare matrix consists of 20 products subdivided into five service areas and four levels:



Service Area Each service area represents a service offered by ABB technical support:

Area	Offered service
Skill Development Services	Training on the maintenance to be carried out on ABB products installed at the customer site.
Emergency Maintenance Service	Rapid support for any emergency situation.
Diagnosis & Condition Assessment	An indication of the state of health of the various products installed with any restoration actions necessary to reduce fault risks.
Self-Maintenance Services	Assistance for implementing an internal maintenance strategy for the customer's organization for carrying out specific tasks. The customer's maintenance staff can access the product documentation by contacting ABB experts, online or by accessing private folders directly.
Delivered maintenance Services	Maintenance of the products installed in order to maintain their good state of health through preventive maintenance plans.

Levels The levels represent the extent of the service offered: the higher the level the greater the expertise of the service and of the ABB design engineers put at the disposal of the customer to support him.



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