DOC. N° 1SDH001330R1002 - ECN000134959 - Rev. A

SACE Emax 2

Low voltage air circuit-breakers Emax E1.2-E2.2-E4.2-E6.2

Operating instructions for the design engineer

Glossary

Term	Description
SACE Emax 2	New series of ABB SACE air circuit-breakers
CB	Circuit-breaker
Trip unit / 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
Mainboard	Electronic board of the CB to which the Trip Unit and all the main accessories and electronic actuators connect
Ekip Dip	Trip unit SACE Emax 2 CBs, equipped with dip-switch type interface
Ekip Touch	Trip unit for SACE Emax 2 CBs, equipped with touchscreen display and available in four different versions
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 - Contents

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 relevant education, training, knowledge and experience to enable him or her to perceive risks and to avoid danger which electricity can create
- instructed person, in the electrical field (IEV 195-04-02): person adequately advised or supervised by electrically skilled persons to enjable 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

WARNING! carefully read the instructions for putting into service and maintenance given in the installation manuals 1SDH000999R0002 (for E1.2) or 1SDH001000R0002 (for E2.2-E4.2-E6.2).

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 - 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. Besisdes, 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
Nº 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* **236.**

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.**

3 - 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 135.

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".

4 - 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 (1SDH001276R0001)

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.

There are four Ekip Touch models available:

- Ekip Touch
- Ekip Hi-Touch
- Ekip G Touch
- Ekip G-Hi Touch

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

Main 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 1

Figure 2

Ekip Dip has a dip-switch (**1**) interface for configuring and verifying the protections and main parameters (page 18).

Ekip Touch has a touchscreen display (**1**) for accessing the configuration menus and checking parameters, measurements and information (page 35).

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 16 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

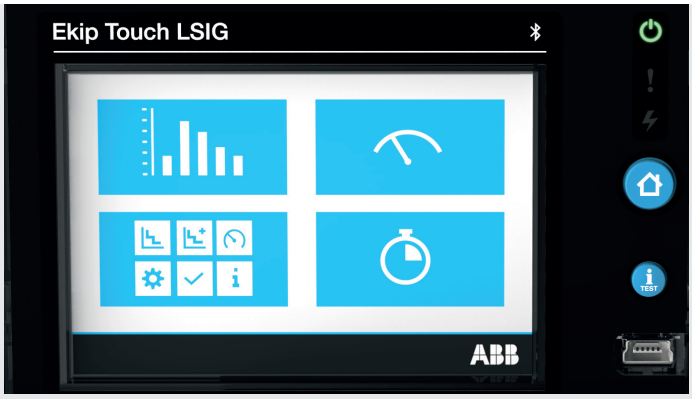


Figure 3

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	52
Voltage protections	O (1)	X	X (3)	X	62
Voltage advanced protections	O (1)	O	X (3)	X	65
Frequency protections	O (1)	X	X (3)	X	69
Power protections	O (1)	X (3)	X (3)	X	72
ROCOF protections	O (1)	O	O	X	78
Adaptive protections	O	X	O	X	79
Standard Measurements	X	X	X	X	110
Ekip Measuring Measurements	O	X	X	X	114
Class 1 Power & Energy Metering	O (2)	X	O	X	117
Datalogger	O (1)	X	X	X	118
Network Analyzer	O (1)	X	O	X	120

X = Available by default; O = Optional

(1) Configurable if Measuring Measurements package is present

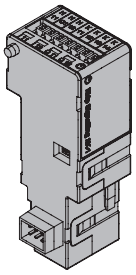
(2) Only available at the time circuit-breaker is ordered

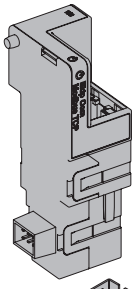
(3) Certain protections of the complete package are available by default; the remaining ones can be activated on request

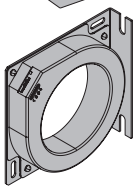
3 - Accessories and software

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	184
Ekip Signalling 4K (2)(5)	Programmable digital inputs/outputs	186
Ekip LCD	LCD interface for aggressive environments	189
Rating Plug (3)(6)	Defines rated current In	183

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	190
Ekip Com (4)	Communication between Trip unit and external buses (various protocols)	191
Ekip Link (4)(6)	Communication between Trip units via an intranet with ABB proprietary protocol	212
Ekip Signalling 2K	Programmable digital inputs/outputs	220
Ekip Signalling 3T	Measurement from current loop and temperature sensors	229
Ekip Synchrocheck	Measurement of an external voltage and management of synchronism between two supply sources	223

Other external modules and accessories:

Name	Description	Page
Ekip Signalling 10K (5)(6)	Programmable digital inputs/outputs	232
Ekip Multimeter (5)(6)	Panel front display	233
Toroid S.G.R.	Sensor for protection from earth fault currents	233
Toroid Rc	Sensor for protection from residual currents	233
External neutral (6)	Sensor for protecting the external neutral line with 3P circuit-breaker	234

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	235
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 11).

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 13).

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 trip unit 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:

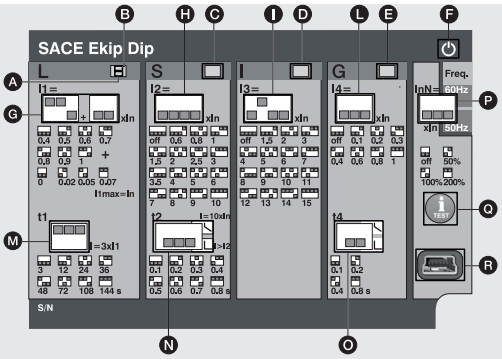


Figure 4

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.

LEDs

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* **29.**

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 In, 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 3 - Test on page 28.
- 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).

1 - 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**).
2. The **alarm** appears on the display and, after a period of time (timing t_t), depending on the protection parameters set, can convert into a **trip command (TRIP)** transmitted to the internal Trip coil of the CB.

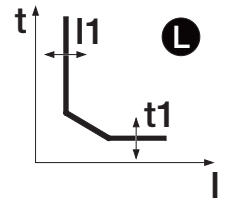
NOTE:

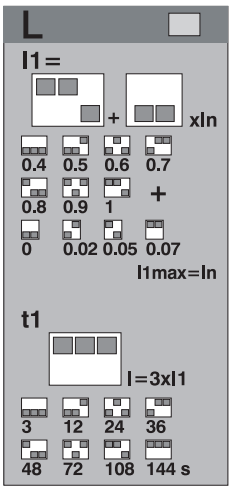
- if the signal measured drops below the set threshold before the trip time has elapsed, Ekip Dip quits the alarm and/or timing state and returns to the normal operating condition
- all protections have a default configuration: check the parameters and change to suit the installation requirements before 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	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). **IMPORTANT:** **• 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	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). **IMPORTANT:** **The protection limits the tripping time to 1 second in two cases:** **• if, according to the calculation, the time is less than 1 second.** **• If the fault current is greater than 12 In.**

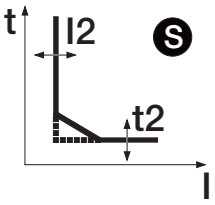
[1] *Example (with I1 set to 400 A): the protection is activated for currents between 420 A and 480 A.*

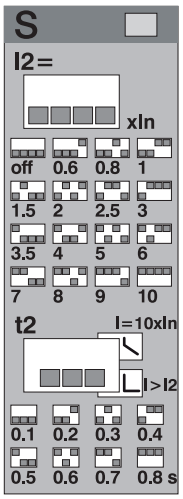
With the module Ekip T&P and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**, and adjust the threshold of **Pre-alarm**.

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.

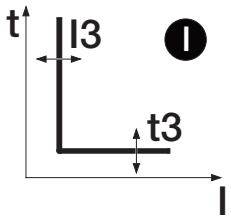
Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Type of curve	It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: **NOTE:** calculation of the tripping time of the inverse time curve is based on a mathematical expression. The details are provided in the table on page 26.
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:** **• 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: • 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:** **• 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.**

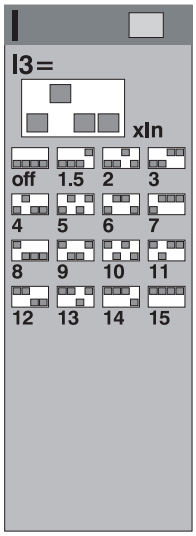
With the module Ekip T&P and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**.

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

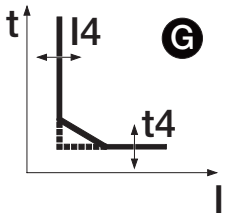
The user can set the intervention threshold.

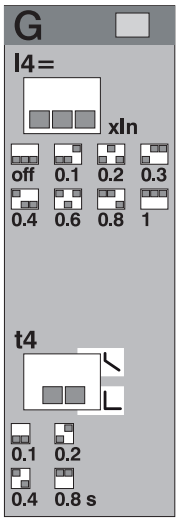
Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Threshold I3	It defines the current value that activates the protection when exceeded (with reference to the curve, it is the part parallel to the y-axis). **IMPORTANT: The I3 threshold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

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

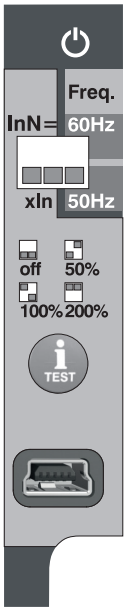
All the parameters that can be modified by the user affect the response curve, and related tripping times.

Parameter	Description
Enable	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: • Disconnection of one or more current sensors. • Current measured on one of the phases higher than a maximum value. **IMPORTANT: the maximum current value that deactivates G protection varies according to the threshold set:** **• 8 In (with I4 ≥ 0.8 In)** **• 6 In (with 0.5 In ≤ I4 < 0.8 In)** **• 4 In (with 0.2 In ≤ I4 < 0.5 In)** **• 2 In (with I4 < 0.2 In)**
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 26.
Threshold I4	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:** **• 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	The selected function determines the contribution of t4: • 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). **IMPORTANT:** **• 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: • 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) ≤ 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 °C or t > 85 °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 In and pre-alarm threshold L=50 %, the pre-alarm is activated for currents greater than 0.3 In

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.

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	I1 = 0.4…1 In	activation for If in the range (1.05...1.2) x I1	t1 = 3…144 s	t_t = (9 t1) / (If / I1) ^{2}	t_t = 6.75 s with: I1 = 0.4 In; t1 = 3 s; If = 0.8 In	± 10 % with If ≤ 6 In ± 20 % with If > 6 In
S (t = k)	50 TD	I2 = 0.6...10 In	± 7 % with If ≤ 6 In ± 10 % with If > 6 In	t2 = 0.1…0.8 s	t_t = t2	-	The better of the two values: ± 10 % or ± 40 ms
S (t = k / I ^{2})	51	I2 = 0.6...10 In	± 7 % with If ≤ 6 In ± 10 % with If > 6 In	t2 = 0.1…0.8 s	t_t = (100 t2) / (If) ^{2}	t_t = 5 s con: I2 = 1 In; t2 = 0.8 s; If = 4 In	± 15 % with If ≤ 6 In ± 20 % with If > 6 In
I	50	I3 = 1.5...15 In	± 10 %	Not adjustable	t_t ≤ 30 ms	-	-
G (t = k)	50N TD	I4 [4] = 0.1...1 In	± 7 %	t4 = 0.1…0.8 s	t_t = t4	-	The better of the two values: ± 10 % or ± 40 ms
G (t = k / I ^{2})	51N	I4 [4] = 0.1...1 In	± 7 %	t4 = 0.1…0.8 s	t_t = 2 / (If / I4) ^{2}	t_t = 0.32 s with: I4 = 0.8 In; t4 = 0.2 s; If = 2 In	± 15 %
Iinst	-	Defined by ABB	-	Instantaneous	-	-	-

[1] See the serigraph for the available combinations.
[2] t_t calculation is valid for If values that have exceeded the trip threshold of the protection. Use fault current and threshold values expressed in In 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 ≥ 100 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 In (with In = 100 A), 0.25 In (with In = 400 A) or 0.2 In (for all other sizes).
[5] ANSI / IEEE C37-2 encoding.

Key

- (t=k) - Fixed time curve
- *(t=k/I²)* - Dynamic time curve
- t_t - Tripping time
- *If* - 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 If in the range (1.05...1.2) x I1	± 20 %
S	± 10 %	± 20 %
I	± 15 %	≤ 60 ms
G	± 15 %	± 20 %

2 - Measurements

List

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

Parameter	Description
Instantaneous currents	Phase current and earth fault measurements in real time
Trip	List of current protection trips (TRIP)
Min Max Measurements	History of minimum and maximum currents, recorded at a settable interval
Operation counters	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]
Phase currents	0,004...64 In	0,2...1,2 In	1 %
Internal earth fault currents [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)

3 - 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: • 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.

4 - 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 19, indicates the power-on conditions of the trip unit.

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

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* **18.**

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: • All the dip-switches of L are in the ON position • I1 ≥ I2 or I2 ≥ I3. • Iu < (2 * In * I1) in the case where InN = 200 %. • I4 < 0.3 In (con In = 100 A), 0.25 In (con In = 400 A) or 0.2 In (for all other sizes), in the absence of auxiliary power supply. • t2 > 0.4s (in the case of UL circuit-breaker) • t4 > 0.4s (in the case of UL circuit-breaker) • I4 > 1200 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.

5 - 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 25.

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 to 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.

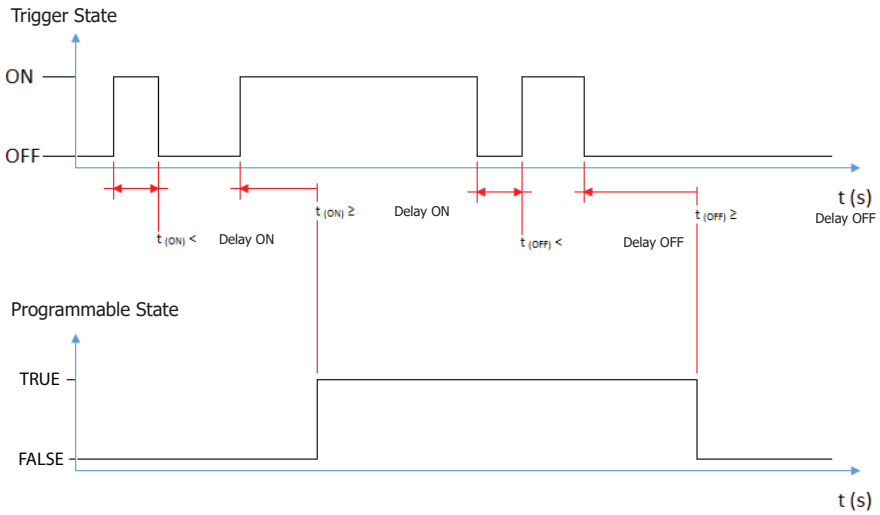
Programmable States

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* **133).**

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

SACE Emax 2 has 4 counters which display how long the maximum current measured has remained in each percentage band.

The counters are expressed in seconds and the bands are: 0-49%In, 50-79%In, 80-89%In, >90%In.

Led Alive

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:

- 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.

If deactivated, the power-on leds on the respective devices come on with a steady light.

Modules network settings retention

It allows the communication parameters of the circuit-breaker to be controlled if the trip unit is replaced:

- **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.

The trip units are supplied with the parameter set as **Overwrite**.

Wink

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.

3 Hz flashing is disabled by sending another **Wink** command or by switching off the trip unit.

Glitch

The commands of **Glitch** 16 to 23 activate the respective glitch registers, which can be used for customizing programmable functions or output contacts.

6 - 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
Alive LED	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 concerning the accessory modules connected
- perform tests

Components

The Ekip Touch interface includes a touchscreen, short-cut push-buttons, status leds and a service connector for certain external accessories:

Figure 5

Pos.	Description
A	Single-touch color touchscreen display
B	**Power** led
C	**Warning** led
D	**Alarm** led
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.

LEDs

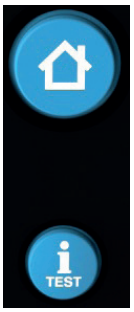
LEDs	Colour	Description
Power	Green	Indicates the on status of Ekip Touch: • off: no power and unit off • on, steady (*Power mode*) or flashing (*Alive mode*): unit on and self-supplied by external *Vaux* or service connector The *Power mode* or *Alive mode* can be selected via Ekip Connect: if the *Alive mode* 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: • off: no alarm • on steady: prealarm of an active protection or status contacts error • two flast flashes every 0.5 s: trip unit parameter configuration error • fast flash: *Rating Plug* or *Measurement* module installation error
Alarm	Red	Signals that an alarm is present: • off: no alarm • on steady: on steady signals a TRIP due to a protection • on flashing: protection timing tripped or alarm due to disconnection of a current sensor • two flast flashes every 2 seconds: *Rating Plug* error • on with fast flashing: protection timing tripped or alarm due to disconnection of a current sensor

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

- leds on with fast flashing: no communication between Trip unit and Mainboard
- leds on with slow flashing: internal error
- leds on and steady internal configuration error

These cases need assistance from ABB.

Push-buttons



Push-button	Description
HOME	Allows different areas of the menu to be accessed: • from pages: *HOME, Histograms, Measuring instruments, Measurements, Main measurements* -> open: *Main page* • from pages: *Main page, Alarm list*, at any point of the menu area -> open: *HOME* page
iTest	Allows certain pages of information about the unit to be rapidly consulted; press the button in successionj to display the following pages: • *Alarm list*, if messages are present • *Info*, if Customer Page option is active • *Protection unit*, with information about Ekip Touch • *Circuit breaker*, with information about the CB • *Last trip*, with information about the last trip, if available Consultation is active from pages: *HOME, Histograms, Measuring instruments, Measurements, Main measurements* **NOTE**: *with Ekip Touch 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 36; 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

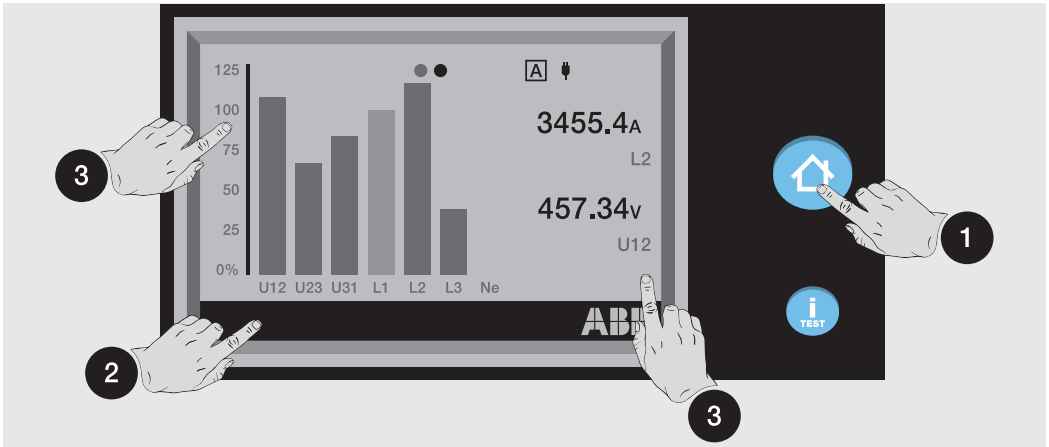


Figure 6

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 7

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*

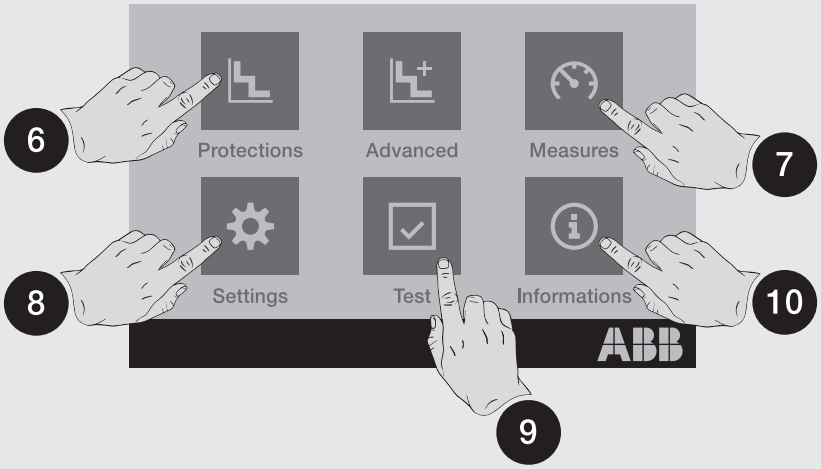


Figure 8

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.

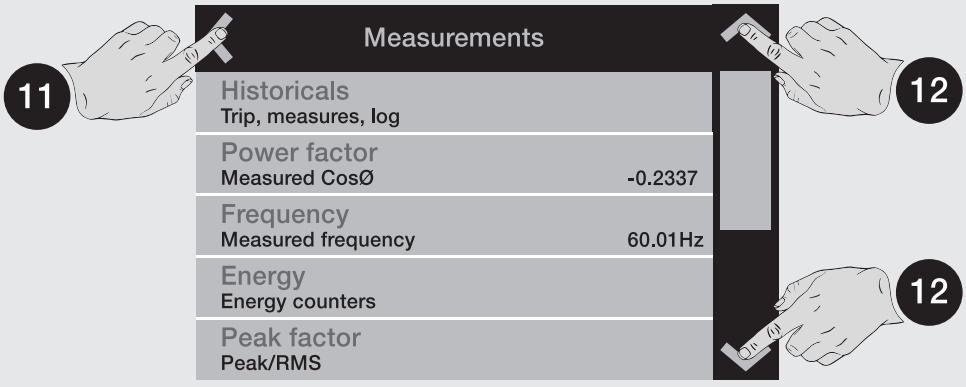


Figure 9

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 48).

3 - Graphic pages

Histograms

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

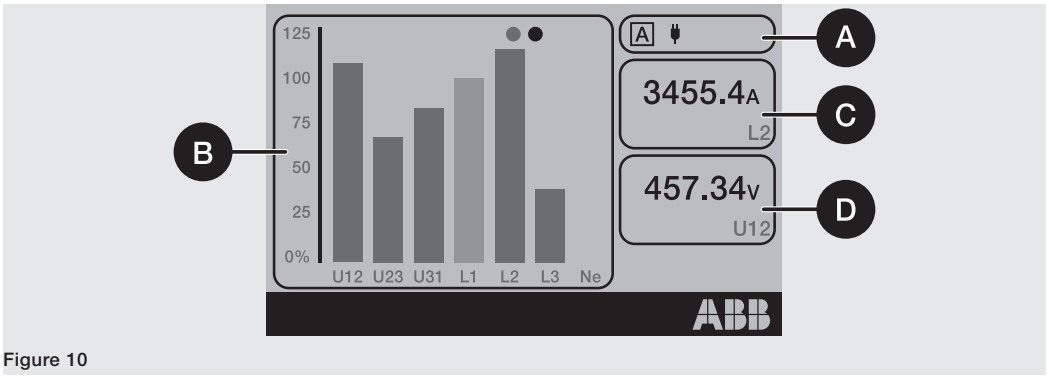


Figure 10

Pos.	Description	
A	Up to four information icons are available:	
	A or B	The letter corresponding to the active configuration is displayed if *Adaptive Protections* package is present and with *Dual Set enabled*;
	or	External power supply present (*Vaux* or through a service connector); the plug icon indicates *Vaux*
		Remote parameter writing configuration activre, modules *Ekip Com* connected, *Vaux* present
		Bluetooth antenna state; four options available, see next chapter for details
	D	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, and can be of three colors: • 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 Ne is available with 4P or 3P + N 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 45)

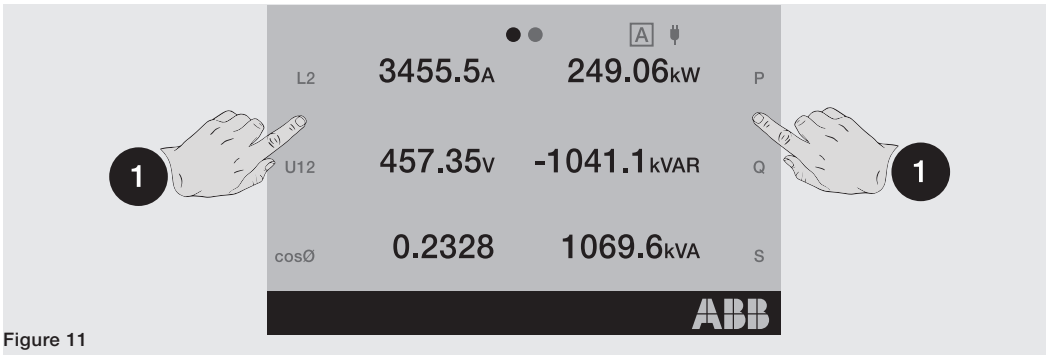


Figure 11

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

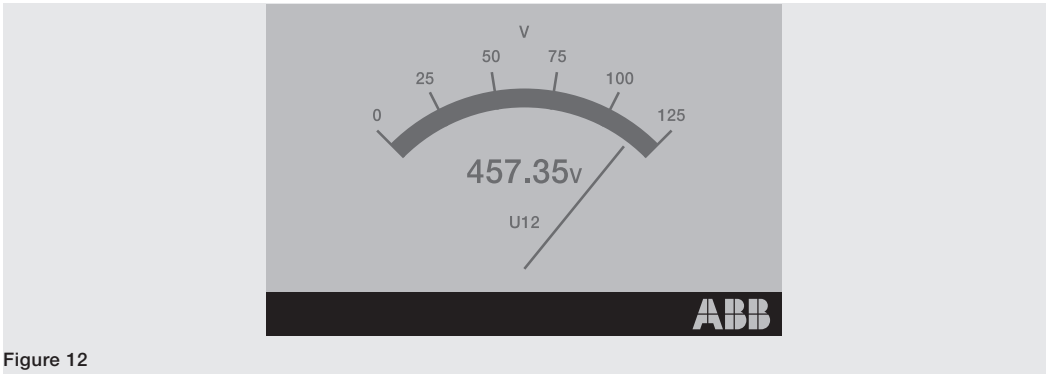


Figure 12

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 √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

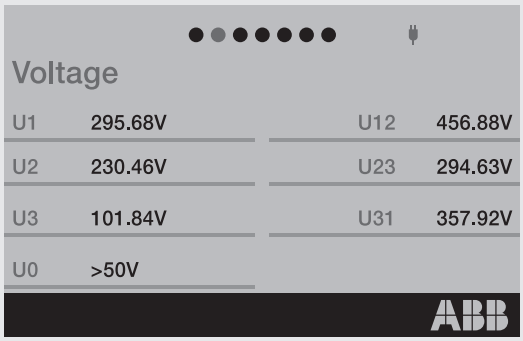


Figure 13

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/Rc earth fault
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 *Ekip Signalling 3T* module measurements, if present

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 sensor 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.

Figure 14

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

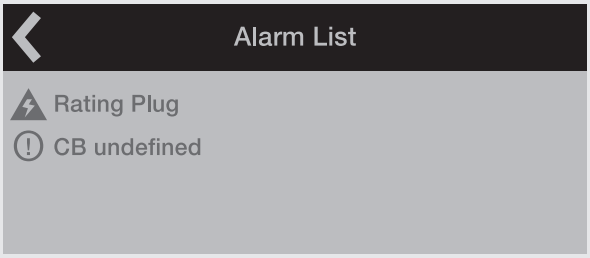


Figure 15

NOTE: *the Alarm List page also appears when the iTEST button is pressed in the cases provided for and described on page* **36**

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 262.

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 dislpayed 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)

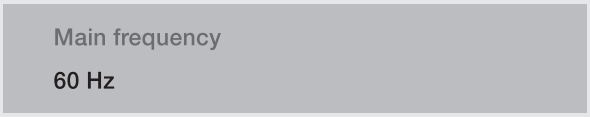


Figure 16

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	53
S	List and description in dedicated chapter		54
S2	List and description in dedicated chapter		55
I	List and description in dedicated chapter		56
G [2]	List and description in dedicated chapter		57
Gext [2]	List and description in dedicated chapter	[3]	84
MDGF [2]	List and description in dedicated chapter	[4]	85

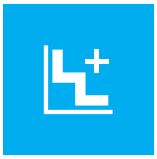
[1] if the *Adaptive Protections* package is available and *Dual set* has been activated, an intermediate menu where the set can be selected (Set A / Set B) will be available before the list of protections

[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	58
2I	List in dedicated chapter		59
IU	List in dedicated chapter		60
UV [2]	List in dedicated chapter	Voltage protections	62
OV [2]	List in dedicated chapter		63
UV2 [2]	List in dedicated chapter		63
OV2 [2]	List in dedicated chapter		64
VU [2]	List in dedicated chapter		64
S(V) [2]	List in dedicated chapter	Voltage Advanced protections	65
S2(V) [2]	List in dedicated chapter		66
RV [2]	List in dedicated chapter		68
UF [2]	List in dedicated chapter	Frequency protections	69
OF [2]	List in dedicated chapter		70
UF2 [2]	List in dedicated chapter		70
OF2 [2]	List in dedicated chapter		71
RP [2]	List in dedicated chapter	Power protections	72
D [2]	List in dedicated chapter		73
RQ [2]	List in dedicated chapter		76
OQ [2]	List in dedicated chapter		75
UP [2]	List in dedicated chapter		76
OP [2]	List in dedicated chapter		75
ROCOF [2]	List in dedicated chapter	ROCOF protections	78
V DIR, VINV [2]	List in dedicated chapter	Interface protections (IPS)	142
59 S1 [2]	List in dedicated chapter		142
Warnings	*VS Warning, FS Warning, FW1 Warning*		142
Signallings	*Threshold 1 I1, Threshold 2 I1, Threshold Iw1, Threshold Iw2, Phase Sequence* [2], *CosØ* [3]	Standard Protections	92
Functions	*External Trip, Trip Reset, Switch On SET B* [4]		92
Synchrocheck	List in dedicated chapter	[5]	89
RC	List in dedicated chapter	[6]	87

[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 14)

[3] CosØ 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
Historicals	*Trip*	Description in dedicated chapter	111
	Events	List of events recorded	111
	Measurements	List and description in dedicated chapter	111
Power factor (1)	-	Power factor measurement	114
Frequency (1)	-	Frequency measured	114
Energy (1)	*Energy counters*	Measurement of energies	114
	Reset counters	Meter reset command	
	Energy RESET	List and description in dedicated chapter	114
Peak factor (1)	-	Peak factor of each phase	114
Harmonic dist.	-	Activation command for current harmonic distortion monitoring	61
Ekip Synchrocheck (2)	-	Description in dedicated chapter	227
Network Analyzer (3)	*V Sequences*	Measurements associated with Network Analyzer function: list and description in dedicated chapter	120
	3s V Sequences		
	THD Current		
	THD Voltages		
	Counters		
	Waveforms		
Maintenance	*Contact Wear*	Installation and maintenance dates and commands	130
	LastServiceContactWear		
	Installation		
	Last Maintenance		
	Service RESET		

(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	128
	-		
Circuit Breaker	*Configuration*	Phase number selection	127
	Hardware Trip	Protection activation command	61
	T Protection	Protection activation command	
	Neutral Protection [2]	*Enable*, *Neutral threshold*	
	Earth protection [7]	External sensor configuration	129
	Installation	Installation of modules	47
Main Frequency	-	Grid frequency configuration	127
Phase Sequence	-	Phase sequence configuration	64
Modules	*Local/Remote*	Parameter writing configuration	128
	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	112
Test Bus	-	Test bus activation	130
Power Controller [4]	*Enable* [5]	Function enabling and parameters: see details in dedicated chapter	139
	-		
Load Shedding [4]	*Enable* [5]	Function enabling and parameters: see details in dedicated chapter	139
	-		
Network Analyzer [6]	*Enable* [5]	Function enabling and parameters: see details in dedicated chapter	120
	-		
Datalogger [6]	*Enable* [5]	Function enabling and parameters: see details in dedicated chapter	118
	-		
Dual Set [6]	*Enable* [5]	Function enabling and parameters: see details in dedicated chapter	79
	Default set		
System	Date	Configuration of unit date	130
	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	130
Functions	YO Command	*Function*, *Delay*	89
	YC Command		
Maintenance	*Alarms*	Activation of maintenance signals	113

[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 262) 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 Gext and/or MDGF and/or D protection enabled and curve t=k
(5) available with Rating Plug and Rc toroid present

About Menu

Menu	Submenus	Information provided
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
IEC61557-12 (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
(3) available if function has been installed and enabled in Trip 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:

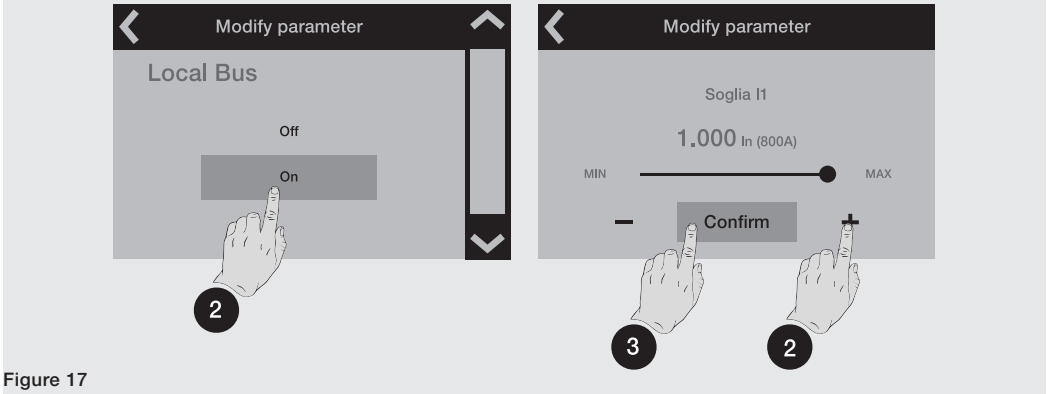


Figure 17

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:

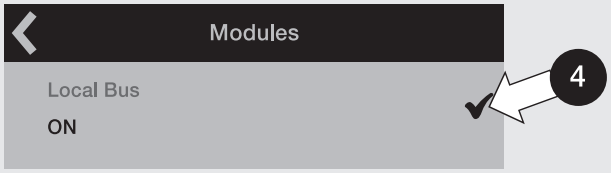


Figure 18

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

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

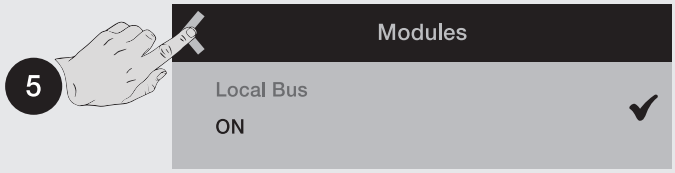


Figure 19

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

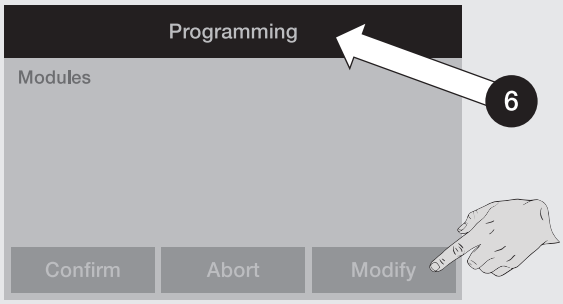


Figure 20

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 129).

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* **48***).*

Entry

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

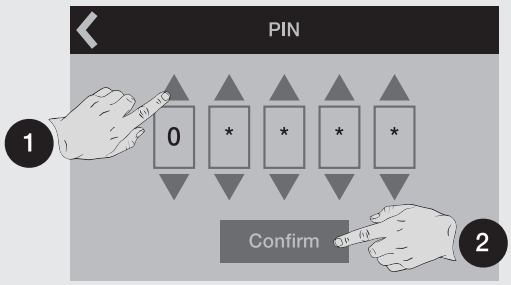


Figure 21

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

if the PIN code is lost, consult document 1SDH001501R0002, available in the ABB website, or contact ABB directly.

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**).
2. The **alarm** appears on the display and, after a period of time (timing t_t), 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	In	Nominal current of the *Rating plug*
Voltage	Un	Line-to-line voltage setting
Frequency	fn	Frequency setting
Power	Sn	√3 x In x Un

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	52
Voltage protections	62
Voltage Advanced protections	65
Frequency protections	69
Power protections	72
Adaptive protections	79

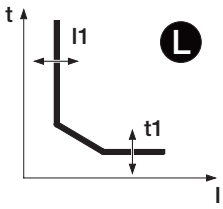
2 - Standard Protections

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

Name	Type of protection	Page
L	Overload with inverse long-time delay	53
S	Selective short-circuit	54
S2 (2)	Short-circuit with adjustable delay	55
I	Instantaneous short-circuit	56
G (1)	Earth fault with adjustable delay	57
MCR	Instantaneous short-circuit on circuit-breaker closing	58
2I	Instantaneous short-circuit programmable	59
IU	Current unbalance	60
Neutral	Different protection on neutral phase	60
Harmonic distortion	Distorted waveforms	61
T	Abnormal temperatures	61
Hardware Trip	Internal connection errors	61

(1) not available with LSI version of Ekip Touch
(2) not available with Ekip G Touch

L Protection



Function

If the current of one or more phases exceeds threshold I1, 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 92)
- the graph with trip curve (from page 95)

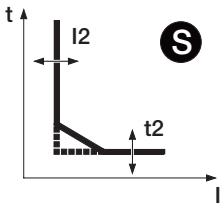
Parameters

Parameter	Description	Default
Curve	Establishes curve dynamics and trip time calculation: • $t = k / I^2$ 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	$t = k/I^2$
Threshold I1	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
Time t1	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
Thermal memory	Activates/deactivates the thermal memory function (page 80) **NOTE**:the function is available with curve $t=k/I^2$	OFF
Prealarm I1	Warns that the measured current is near to protection activation threshold I1. The value is given in percentage of threshold I1 and can be set within the range: 50% I1 to 90% I1, in 1% steps. **NOTE**: the prealarm condition deactivates in two cases: • current lower than prealarm threshold I1 • current higher than threshold I1	90 % I1

Limitations and additional functions

- threshold I1 must be lower than threshold I2 (if S protection is activated)
- the trip time of the protection is forcibly set at 1 s if the calculation results give a lower theoretical value and/or if the current reading is more than 12 In
- with CB in UL standard configuration, the only available curve is $t = k/I^2$

S Protection



Function

If the current of one or more phases exceeds threshold I2, 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 92)
- the graph with trip curve (page 98)

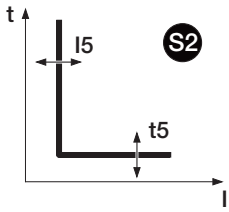
Parameters

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.	ON
Curve	Establishes curve dynamics and the threshold or trip time calculation: • t = k: fixed time trip • t = k/I²: inverse time-delay dynamic trip	t = k
Threshold I2	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	4 In
Time t2	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	0,05 s
Thermal memory	Activates/deactivates the thermal memory function (page 80) **NOTE**:the function is only available with curve t=k/I²	OFF
ZoneSelectivity	Activates/deactivates the function and selectivity time availability on the display (page 80) **NOTE**:the function is only available with curve t=k	OFF
Selectivity time	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present (page 80) 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 83)	OFF
StartUp Threshold	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 83) 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
StartUp Time	This is the time for which the StartUp threshold remains activated and is calculated from the moment the activation Threshold is exceeded (page 83) 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 I2 must be higher than threshold I1 (if S protection is activated)
- in the presence of curve t= k/I², the protection trip time is forced to t2 if the calculation results give a theoretical value lower than t2 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 80)
- with CB in UL standard configuration, the maximum value of t2 is 400 ms

S2 Protection



Function

S2 protection functions in the same way as S protection: if the current of one or more phases exceeds threshold I5 for longer than time t5, the protection activates and sends a TRIP command.

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:

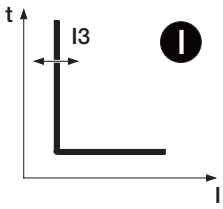
- the summary table of the protections with the calculation formulas (page 92)
- the graph with trip curve (page 98)

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 I5	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	4 In
Time t5	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 80) **NOTE**: if both S and S2 selectivities are activated, the input and output are shared with the OR function; to stimulate inputs and outputs, it is sufficient for even only one of the two to be activated	OFF
Selectivity time	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present (page 80) 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 83)	OFF
StartUp Threshold	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 83) 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	4 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 (page 83) 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 I5 must be higher than threshold I1 (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 82)
- with CB in UL standard configuration, the maximum value of t5 is 400 ms

I Protection



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 92)
- the graph with trip curve (page 99)

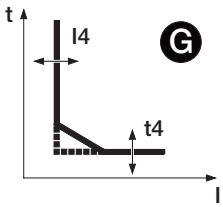
Parameters

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu.	ON
Threshold I3	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	4 In
ZoneSelectivity	Activates/deactivates the function	OFF
StartUp enable	Activates/deactivates the function and availability of the associated parameters on the display (page 82)	OFF
StartUp Threshold	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 82) 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
StartUp Time	This is the time for which the StartUp threshold remains activated and is calculated from the moment the activation Threshold is exceeded (page 82) 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 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 83)

G Protection



Function

Ekip Touch calculates the vector sum of the phase currents (L1, L2, L3, Ne) and obtains the internal earth fault current (Ig): if current Ig exceeds threshold I4, 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 92)
- the graph with trip curve (page 100)

Parameters

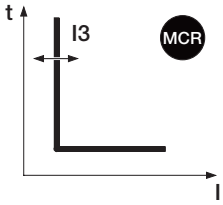
Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu.	OFF
Trip Enable	Activates/deactivates transmission of the open command. if disabled, the alarm and exceedance of protection time are only managed as information.	ON
Curve	Establishes 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
Threshold I4	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: 0.1 In to 1 In, in 0.001 In steps	0,2 In
Time t4	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, t4 can also be configured as: instantaneous; in this mode, the trip time is comparable to that given for I protection (page 92)	0,4 s
Prealarm I4	Warns that the measured current is near to the protection activation threshold. The value is given in percentage of threshold I1 and can be set within the range 50% I4 to 90% I4, in 1% steps. The prealarm condition deactivates in two cases: • current lower than prealarm threshold I4 • current higher than threshold I4	90 % I4
ZoneSelectivity	Activates/deactivates the function and selectivity time availability on the display (page 80) **NOTE**: the function is only available with curve t = k	OFF
Selectivity time	This is the trip time of the protection with the zone selectivity function activated and selectivity input not present (page 80) 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 83)	OFF
StartUp Threshold	Protection threshold valid during Startup time, in the conditions in which the function is activated (page 83) The value is given as both absolute value (A) and relative value (In) and can be set within the range: 0.2 In to 1 In, in 0.1 In steps	0,2 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 83) 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 t4 if the calculation results give a theoretical value lower than t4 itself
- in the absence of Vaux, the minimum threshold is 0.3 In (for In <= 100 A), 0,25 In (for In <= 400 A) or 0.2 In (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 I4 threshold setting, the protection deactivates for an Ig higher than: 8 In with threshold I4 ≥ 0.8 In; 6 In with 0.8 In > I4 ≥ 0.5 In; 4 In with 0,5 In > I4 ≥ 0,2 In; 2 In with I4 > 0.2 In
- with t4=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 80)
- with CB in UL standard configuration, some parameters have different maximum values: I4 maximum = 1200A, Startup maximum = 1200A, t4 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 I3, the protection transmits the TRIP command after a non-programmable fixed time.

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 92)
- the graph with trip curve (page 99)

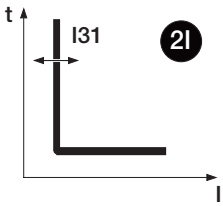
NOTE: *to activate MCR, protection I must be disabled*

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu.	OFF
Threshold I3	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	6 In
Monitor Time	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

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 80)

2I Protection



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 92)
- the graph with trip curve (page 99)

Parameter	Description	Default
Enable	Activates/deactivates the protection and its availability in the parameters menu.	OFF
Threshold I31	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	1,5 In

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

Parameter	Description	Default
Activation	Two alternative modes are available: • 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
Function	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 **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
Delay	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 to 100 s, in 0.1 s steps **NOTE**: the protection trips if the event is present for longer than the set time lag	0 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 220.

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

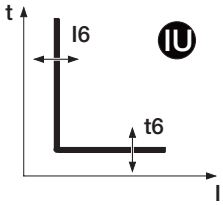
For further details consult the document 1SDH001140R0001.

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.

IU Protection



Function

The protection trips if the current readings are unbalanced; the protection sends a TRIP command if the detected unbalance exceeds threshold I6 for longer than t6.

The protection is automatically self-excluding in two cases:

- the measurement of at least one current exceeds 6 In
- the maximum current among all the phases is less than 0.3 In

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 92)
- the graph with trip curve (page 102)

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
Version	Allows the unbalance calculation mode to be selected: • Old: % Sbil = 100 x (I_{max} - I_{min}) / I_{max} • New: % Sbil = 100 x ($\Delta max\ I_{mi}$) / I_{mi} **NOTE**: $\Delta max\ I_{mi}$: maximum deviation among the measured currents, calculated by comparing each current with the mean value; I_{mi}: mean value of the current readings	Old
Threshold I6	Establishes the unbalance value that trips the protection. Unbalance is given in percentage value within the range: 2% to 90% with 1% steps.	50 %
Time t6	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 46).

Parameters

Parameter	Description	Default
Enable	Activates/deactivates the protection	OFF
Neutral threshold	Defines the multiplicative factor applied to the trip thresholds and curves of the protections for the current read on phase Ne: • 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 I1 and InN in the absence of the following limitation: (I1 x InN) ≤ Iu

- I1 is the threshold of L protection in Amperes (example: In= 400 A and I1= 0.6 becomes I1= 240 A)
- InN is the neutral threshold expressed as multiplicative factor (example: InN= 200% becomes InN= 2)
- Iu is the size of the CB

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

Harmonic Distortion Protection

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

The protection can be enabled in the *Measurements* menu; if enabled an alarm is activated (page 45).

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°C; with Ekip LCD, the display remains on within range: -30°C / +80°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 46).

Hardware Trip Protection

Hardware Trip protects against connection errors in Ekip Touch and is available in the *Settings - Circuit breaker - Hardware Trip* menu (page 45).

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)

3 - Voltage protections

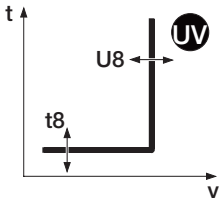
List

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	62
OV	Maximum voltage	63
UV2 (1)	Minimum voltage	63
OV2 (1)	Maximum voltage	64
Phase Sequence	Phase sequence error	64
VU	Voltage unbalance	64

(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

UV Protection



Function

The protection sends a TRIP command if one or more line-to-line voltages detected by the unit drop below threshold U8 for longer than t8.

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 93)
- the graph with trip curve (page 102)

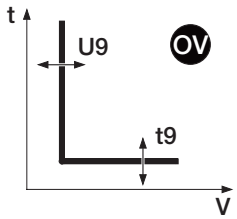
Parameters

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 U8	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
Time t8	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).

OV Protection



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 93)
- the graph with trip curve (page 103)

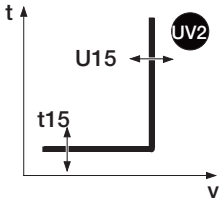
Parameters

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 U9	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
Time t9	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 80).

UV2 Protection



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 93)
- the graph with trip curve (page 102)

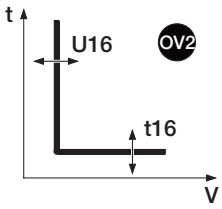
Parameters

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 U15	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
Time t15	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 80).

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 93)
- the graph with trip curve (page 103)

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 U16	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
Time t16	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

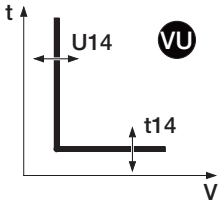
The block functions can also be accessed by means of the service connector (via Ekip Connect) or by connection to the system bus (page 83).

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 46 and page 44).

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 93)
- the graph with trip curve (page 103)

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 U14	Establishes the unbalance value that trips the protection. Unbalance is expressed in percentage value and is calculated in the following way: % Unba = 100 x (Δmax U_{mi}) / U_{mi} in range: 2% to 90% in 1% steps. **NOTE**: Δmax 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 %
Time t14	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 83).

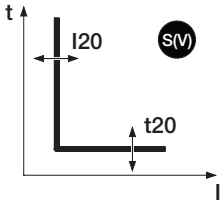
4 - Voltage Advanced protections

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	65
S2(V) (1)	Short-circuit with voltammetric control	66
RV	Residual voltage	68

(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 I20 for longer than time t20, the protection activates and sends a TRIP command.

Threshold I20, after a voltage drop, varies in two different modes:

- **Step** provides for a stepped variation, depending on parameters Ul and Ks.
- **Lin** (linear) provides for a dynamic variation, depending on parameters Ul, Uh and Ks.

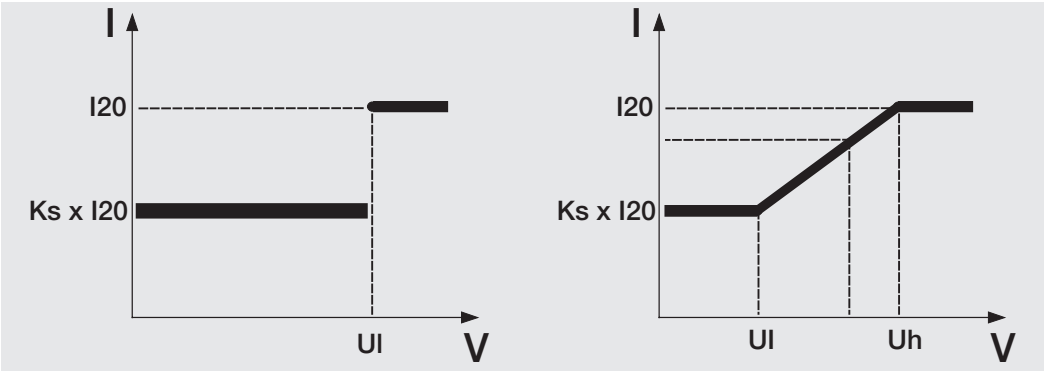


Figure 22

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 93)
- the graph with trip curve (page 104)

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
Curve	Allows the operating mode, Step or Lin, to be selected	Scal
Threshold I20	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

Continued on the next page

Parameter	Description	Default
Threshold Ul	This is the voltage that determines the change in trip threshold I20; the behavior differs, depending on the mode selected (1) The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
Threshold Uh	The parameter is shown by the Lin curve and contributes towards I20 trip threshold calculation: • with voltage reading < Uh (and ≥ Ul), the threshold changes gradually (1) • with voltage reading ≥ Uh, the threshold is I20 The value is given as both absolute value (Volts) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
Threshold Ks	I20 threshold calculation constant. The value is given as percentage of threshold I20 and can be set within the range: 0.1 I20 to 1 I20, in 0.01 steps	0,6 I20
Time t20	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

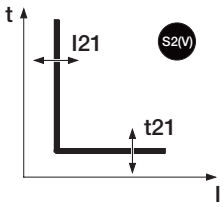
(1) Trip threshold (depending on the operating curve)

Mode	Voltage reading	Trip threshold
Scal	< Ul	Ks x I20
	≥ Ul	I20
Lin	< Ul	Ks x I20
	≥ Ul (e < Uh)	((I20 x (1 - Ks) x (U_{mis} - Uh)) / (Uh - Ul)) + I20

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).

S(V) Protection



Function

S2(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 S2(V) or vice versa, or both S(V) and S2(V) for signaling or tripping).

If the current of one or more phases exceeds threshold I21 for longer than time t21, the protection activates and sends a TRIP command.

Threshold I21, after a voltage drop, varies in two different modes:

- **Step** provides for a stepped variation, depending on parameters Ul2 and Ks2.
- **Lin** (linear) provides for a dynamic variation, depending on parameters Ul2, Uh2 and Ks2.

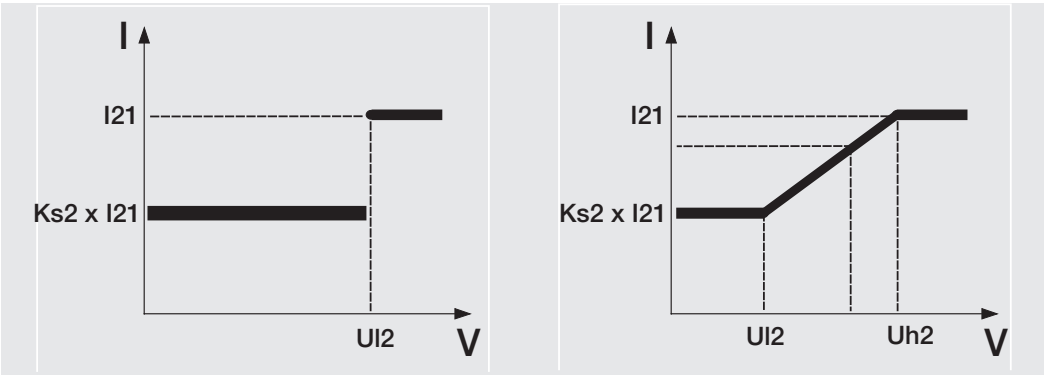


Figure 23

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 93)
- the graph with trip curve (page 104)

Continued on the next page

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
Curve	Allows the operating mode, Step or Lin, to be selected	Scal
Threshold I21	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
Threshold UI2	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 (Volts) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
Threshold Uh2	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 (Volts) and relative value (Un) and can be set within the range: 0.2 Un to 1 Un in 0.01 Un steps	1 Un
Threshold Ks2	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
Time t20	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

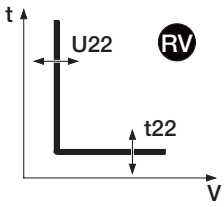
(1) Trip threshold (depending on the operating curve)

Mode	Voltage reading	Trip threshold
Scal	< UI2	Ks2 x I21
	≥ UI2	I21
Lin	< UIs	Ks2 x I21
	≥ UI2 (e < Uh2)	((I21 x (1 - Ks2) x (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 83).

RV Protection



Function

The protection trips if loss of insulation occurs (verification of residual voltage U0); the protection sends a TRIP command if voltage U0 exceeds threshold U22 for longer than t2.

The protection is always available in the 4P 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 93)
- the graph with trip curve (page 104)

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 U22	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 0.5 Un in 0.001 Un steps	0,15 Un
Time t22	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
Reset Time	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 83).

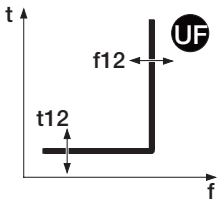
5 - Frequency protections

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	69
OF	Maximum frequency	70
UF2 (1)	Minimum frequency	70
OF2 (1)	Maximum frequency	71

(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 93)
- the graph with trip curve (page 105)

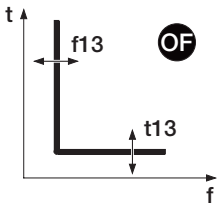
Parameters

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 83).

OF Protection



Function

The protection sends a TRIP command if the grid frequency read by the unit exceeds threshold f13 for longer than t13.

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 93)
- the graph with trip curve (page 105)

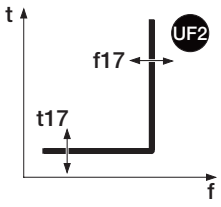
Parameters

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 f13	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
Time t13	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 83).

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 f17 for longer than t17.

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 93)
- the graph with trip curve (page 105)

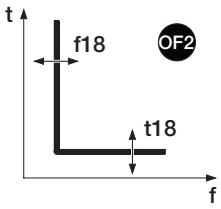
Parameters

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 f17	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 t17	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 83).

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 93)
- the graph with trip curve (page 105)

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 f18	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
Time t18	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 83).

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	72
D [2]	Directional short-circuit with adjustable delay	75
OQ [1]	Maximum reactive power	75
OP [1]	Active overpower	75
UP [1]	Active underpower	76
RQ [1][2]	Reverse reactive power	76
Cos φ	Minimum Cos φ	77

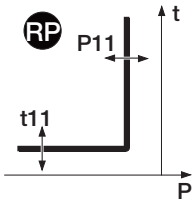
[1] the protection is not available by default with Ekip Hi-Touch. However, it can be integrated by requesting the relative SW package

[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 93)
- the graph with trip curve (page 106)

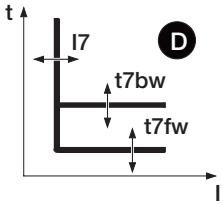
Parameters

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 f11	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 83).

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**.

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 93)
- the graph with trip curve (page 106)

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 I7 Fw	Establishes the value that activates the protection with forward 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	4 In
Threshold i7 Bw	Establishes the value that activates the protection with backward 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	4 In
Time t7 Fw	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
Time t7 Bw	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
ZoneSelectivity (1)	Activates/deactivates the function and selectivity time availability on the display. **NOTE**: configure selectivities S, S2 OFF to ensure that selectivity D functions correctly, G, Gext and MDGF	OFF
Selectivity time Fw (1)	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
Selectivity time Bw (1)	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
StartUp enable	Activates/deactivates the function and availability of the associated parameters on the display	OFF
StartUp Threshold Fw [2]	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	4 In
StartUp Threshold Bw [2]	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	4 In
StartUp Time [2]	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
Direction Min Angle	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 81
[2] details on page 83

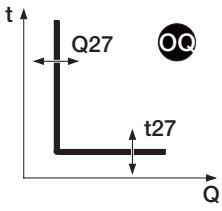
Limitations and additional functions

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 83).

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 64
- 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 93)
- the graph with trip curve (page 107)

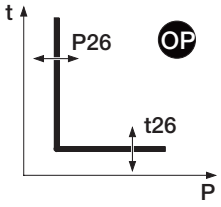
Parameters

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 Q27	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
Time t27	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 83).

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 93)
- the graph with trip curve (page 107)

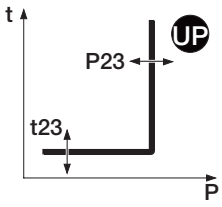
Parameters

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 P26	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
Time t26	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 83).

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:

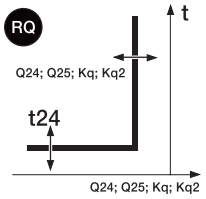
- summary table of the protections with the operating characteristics (page 93)
- the graph with trip curve (page 108)

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 P23	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
Time t23	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
StartUp enable	Activates/deactivates the function and availability of the StartUp Time parameter in the menu	OFF
StartUp Time	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 83).

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.

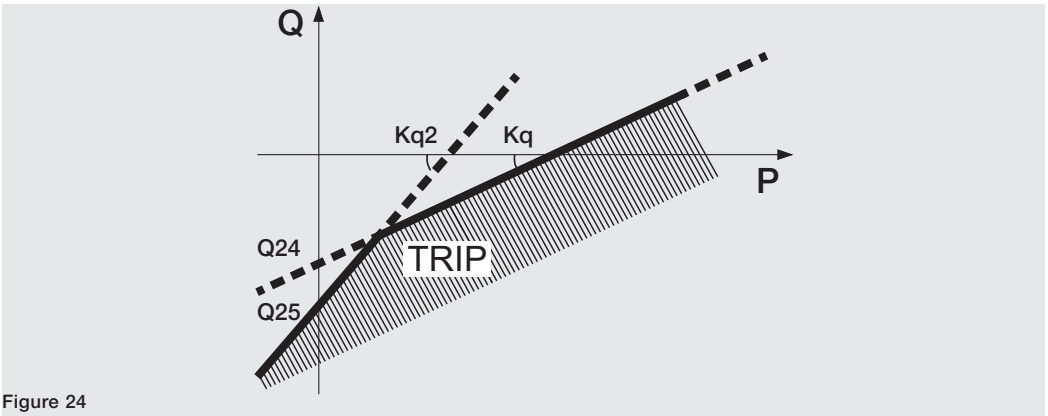


Figure 24

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 93)
- the graph with trip curve (page 108)

Continued on the next page

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 Kq	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
Threshold -Q24	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
Threshold Kq2	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
Threshold -Q25	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
Time t24	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
Threshold Vmin	This is the minimum activation voltage of the protection. The protection is not activated if at least one line-to-line voltage value is less than threshold Vmin. The value is given as both absolute value (Volts) 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 83).

Cos φ Protection

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

Total cos φ is calculated as ratio between total active Power and total apparent Power.

Parameters

The parameters are available in the *Advanced - Signaling menu* (page 44)

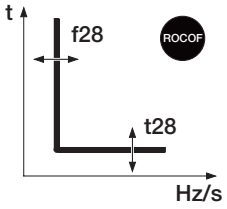
Parameter	Description	Default
Enable	Activates/deactivates the protection and availability of the threshold in the menu	OFF
Threshold	Defines the value that activates the protection; can be set within the range: 0.5 to 0.95 in 0.01 steps	0,95

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 f28 set in the unit for longer than t28.

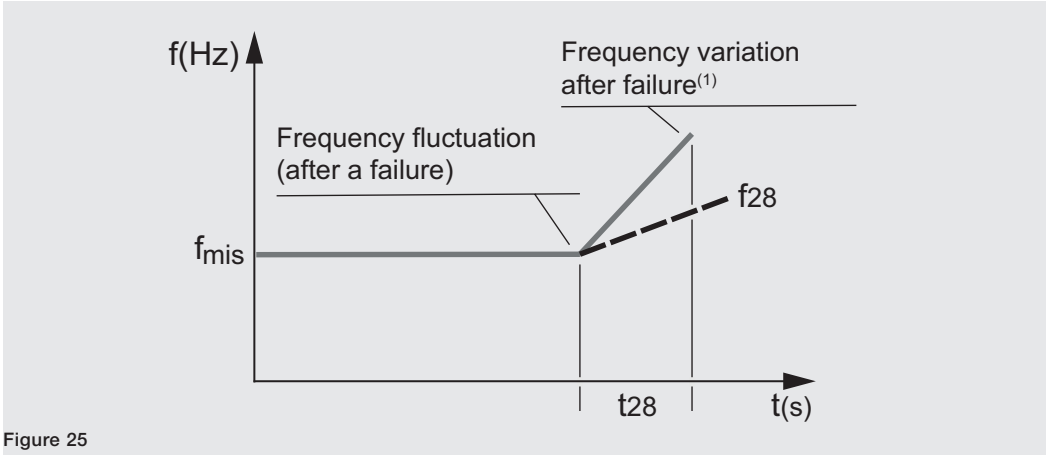


Figure 25

(1) example with positive linear variation of the higher frequency of the set f28 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 93)
- 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 f28	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) Fn) 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
Trip Direction	Establishes whether the protection monitors an increase (**Up**), a decrease (**Down**) or both variations (**Up** and **Down**)	Up or Down
Time f28	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 83).

8 - Protection Adaptive

The Adaptive Protection package is available by default for Ekip Hi-Touch and Ekip G Hi-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 46)

Parameter	Description	Default
Enable	Activates/deactivates the function	OFF
Default Set	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 89).

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	80
Zone selectivity	management of trip commands in a network of circuit-breakers	80
Blocks	blocking of protection on the basis of programmable events	83
Startup	different thresholds on the basis of monitoring thresholds	83
Current thresholds	Current control with programmable thresholds	88
Programmable Commands	Programmable commands with trip unit events or statuses	89

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

Name	Type of protection	Page
Gext	External earth fault with adjustable delay	84
Rc	Residual current	87
Synchrocheck	Synchronism between two independent voltage sources	89
MDGF	Modified differential ground fault	85

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 100ms)

S, S2, I, G zone selectivity Protection, Gext, MDGF

The function, which can be activated for S, S2, I, 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, 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 and I protection selecitivity input	From devices on the load side
Szo	Output	S, S2 and I protection selecitivity 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, 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 and I), 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 selecitivity 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, 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	Denomintion 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 73)

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 selecitivity 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, 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:

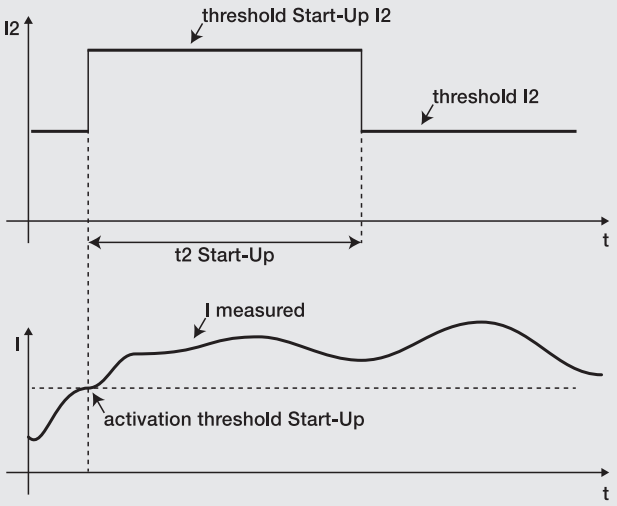


Figure 26

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).

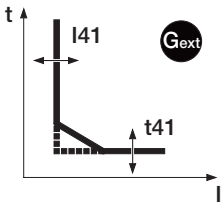
The protections which have blocks are: S, I, G, Gext, MDGF, MCR, S2, D, S(V), S2(V), UV, OV, VU, UV2, OV2, UP, OP, RP, RQ, OQ, RV, UF, OF, UF2, OF2, ROCOF, UC, U, R Jam, R Stall.

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 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 92)
- the graph with trip curve (page 100)

Parameters

Sensor configuration is available in the Settings menu (page 46)

Parameter	Description	Default
External Toroid	It allows the presence of *external toroid S.G.R.* to be activated	OFF
Toroid size	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

Protection configuration is available in the Advanced menu (page 44)

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
Curve	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
Threshold I41	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: 0.1 In to 1 In, in 0.001 In steps	0,2 In
Time t41	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
Threshold I41	Warns that the measured current is near to the protection activation threshold. The value is given in percentage of threshold I1 and can be set within the range 50% I41 to 90% I41, in 1% steps. The prealarm condition deactivates in two cases: • current lower than prealarm threshold I41 • current higher than threshold I41	90 % I41

Continued on the next page

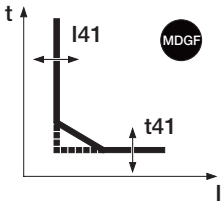
Parameter	Description	Default
ZoneSelectivity	Activates/deactivates the function and selectivity time availability on the display (1) **NOTES** : • the function is only available with curve t = k • if both selectivities G and Gext are activated, the input and output are shared with the OR function: it is sufficient for even only one of the two to be activated to stimulate the 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) The value is given as both absolute value (Amperes) and relative value (In) and can be set within the range: 0.2 In to 1 In, in 0.1 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 80
(2) details on page83

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 46);protection activation includes checking for the presence of toroide 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 82)
- with CB in UL standard configuration, some parameters have different maximum values: I41 maximum = 1200A, Startup maximum = 1200A, t41 maximum = 400ms

MDGF Protection



Function

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

if 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 92)
- the graph with trip curve (page 101)

Parameters

Sensor configuration is available in the Settings menu (page 46)

Parameter	Description	Default
External Toroid	It allows the presence of *toroid MDGF* to be activated	OFF

Continued on the next page

Protection configuration is available in the Advanced menu (page 44)

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
Curve	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
Threshold I41	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: 0.1 In to 1 In, in 0.001 In steps	0,2 In
Time t41	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} with CB in UL configuration, the maximum settable value of t41 is 0.4 s	0,4 s
Threshold I41	Warns that the measured current is near to the protection activation threshold. The value is given in percentage of threshold I1 and can be set within the range 50% I41 to 90% I41, in 1% steps. The prealarm condition deactivates in two cases: • current lower than prealarm threshold I41 • current higher than threshold I41	90 % I41
ZoneSelectivity	Activates/deactivates the function and selectivity time availability on the display (1) **NOTES** : • the function is only available with curve t = k • if both selectivities G and MDGF are activated, the input and output are shared with the OR function: it is sufficient for even only one of the two to be activated to stimulate the 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) The value is given as both absolute value (Amperes) and relative value (In) and can be set within the range: 0.2 In to 1 In, in 0.1 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

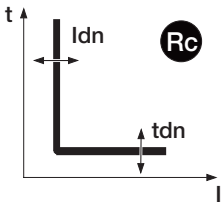
(1) details on page 80

(2) details on page 83

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 46);
- 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 82)
- with CB in UL standard configuration, some parameters have different maximum values: I41 maximum = 1200A, Startup maximum = 1200A, t41 maximum = 400ms

RC Protection



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 Idn for longer than Tdn.

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 92)
- the graph with trip curve (page 100)

Parameters

Parameter	Description	Default
Threshold Idn	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	5 A
Time Tdn	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 enabler with voltage socket* 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 relating 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 44).

IMPORTANT:

- the current thresholds do not handle the trip, just the signal
- the function is activated if the trip unit is powered by auxiliary voltage

Parameters

Threshold	Available parameters	Default
Threshold 1 I1	*Enable*: Activates the protection and availability of the threshold in the menu	OFF
	Threshold: 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	*Enable*: Activates the protection and availability of the threshold in the menu	OFF
	Threshold: 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	*Enable*: Activates the protection and availability of the threshold in the menu	OFF
	Direction: allows the user to choose whether to have the signal when the current is higher (**Up**) or lower (**Down**) than the threshold.	Down
	Threshold: 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	*Enable*: Activates the protection and availability of the threshold in the menu	OFF
	Direction: allows the user to choose whether to have the signal when the current is higher (**Up**) or lower (**Down**) than the threshold.	Up
	Threshold: 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

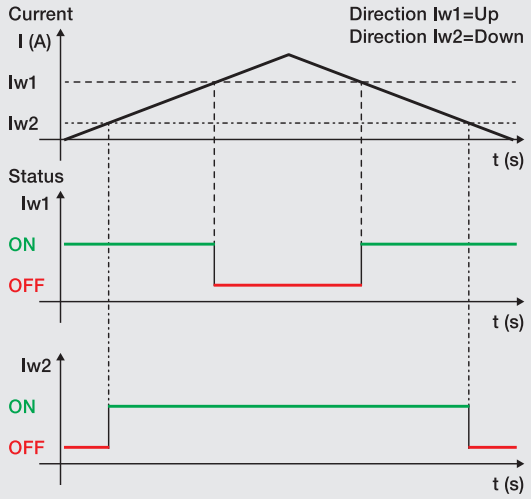


Figure 27

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 223).

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	*Advanced - Functions* (44)
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	*Advanced - Functions - 2I Menu* (59)
RESET Energy	Resets the energy meters	*Measurements - Energy* (45)
YO Command	Sends an open command to YO	*Settings - Functions* (46)
YC Command	Sends a close command to YC [1]	
LOCAL Switch On	Changes the configuration, from Remote to Local	*Settings - Modules -Functions* (46)
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
Function	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
Delay	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 212).

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 by means of 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:

- selection of selectivity type: hardware or mixed (hardware and logic)
- entry of the IP address of each actor present; entry of the address enables the configuration parameters and status indicators to be displayed in the various pages
- the function must be enabled for each actor associated with Ekip Touch via Link Bus and for which logic selectivity must be actuated (the *Actor Selectivity* parameter must be given value: *True*)

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, 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 and Gext/MDGF bits of actor 1 are not activated, the opening 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 or Gext/MDGF logic selectivity bits of actor 1 are activated (and the opening command is only sent if S protection is still in the alarm status once this time has elapsed)

NOTES:

- *the logic selectivity bits on the output and on the input are those in the data packages shared by the releases 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 212).

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 (regardless of the 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 Δ100 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
L [49]	$t_t = \frac{t1 \; x \; 9}{(\frac{If}{I1})^2}$ (with curve t = k / I^2)	Activation for If within range: (1.05 to 1.2) x I1	with If ≤ 6 In: ± 10 % / with If > 6 In: ± 20 %
	$t_t = \frac{t1 \; x \; a \; x \; b}{\left(\left(\frac{If}{I1}\right)^k - 1\right)}$ (with curves 60255-151)		
S [50TD / 51]	t_t = t2 (with curve t = k)	with If ≤ 6 In: ± 7 % / with If > 6 In: ± 10 %	The best between ± 10% and 40 ms
	$t_t = \frac{t2 \; x \; 100}{If^2}$ (with curve t = k / I^2)		with If ≤ 6 In: ± 15 % / with If > 6 In: ± 20 %
S2 [50TD]	t_t = t5	with If ≤ 6 In: ± 7 % / with If > 6 In: ± 10 %	The best between ± 10% and 40 ms
I [50]	t_t ≤ 30 ms	± 10 %	--
G [50N TD / 51N]	t_t = t4 (with curve t = k)	± 7 %	The best between ± 10% and 40 ms (2)
	$t_t = \frac{2}{\left(\frac{If}{I4}\right)^2}$ (with curve t = k / I^2)		± 15 %
MCR	t_t ≤ 30 ms	± 10 %	--
2I [50]	(10)	± 10 %	--
IU [46]	t_t = t6	± 10 %	with t6 ≥ 5 s: ± 100 ms / with t6 < 5 s the best between ± 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 ≤ 6 In: ± 7 % / with If > 6 In: ± 10 %	The best between ± 10% and 40 ms
I StartUp	t_t ≤ 30 ms	± 10 %	--
G StartUp	t_t = t4 startup	± 7 %	The best between ± 10% and 40 ms
S2 StartUp	t_t = t5 startup	with If ≤ 6 In: ± 7 % / with If > 6 In: ± 10 %	The best between ± 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)	± 2 % (4)	with t8 ≥ 5 s: ± 100 ms / with t8 < 5 s: the best between ± 10 % and ± 40 ms
OV [59] / OV2 [59]	t_t = t9 (t16)	± 2 % (4)	with t9 ≥ 5 s: ± 100 ms / with t9 < 5 s: the best between ± 10 % and ± 40 ms
VU [47]	t_t = t14	± 5 % (11)	with t14 ≥ 5 s: ± 100 ms / with t14 < 5 s: the best between ± 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)	± 10 %	with t20 ≥ 5 s: ± 100 ms / with t20 < 5 s: the best between ± 10 % and ± 40 ms
RV [59N]	t_t = t22	± 10 %	with t22 ≥ 5 s: ± 100 ms / with t22 < 5 s: the best between ± 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)	± 1 % (5)	with t12 ≤ 5 s: ± 100 ms / with t12 < 5 s: the best between ± 10 % (min = 30 ms) and ± 40 ms
OF [81H] / OF2 [87H]	t_t = t13 (t18)	± 1 % (5)	with t13 ≥ 5 s: ± 100 ms / with t13 < 5 s: the best between ± 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	± 10 %	with t23 ≥ 5 s: ± 100 ms / with t23 < 5 s: the best between ± 10 % and ± 40 ms
OP [320F]	t_t = t26	± 10 %	with t26 ≥ 5 s: ± 100 ms / with t26 < 5 s: the best between ± 10 % and ± 40 ms
RQ [40 o 32R]	t_t = t24	± 10 %	with t24 ≥ 5 s: ± 100 ms / with t24 < 5 s: the best between ± 10 % and ± 40 ms
OQ [320F]	t_t = t27	± 10 %	with t27 ≥ 5 s: ± 100 ms / with t27 < 5 s: the best between ± 10 % and ± 40 ms
D [67]	t_t = t7	with If ≤ 6 In: ± 7 % / with If > 6 In: ± 10 %	with t7 ≥ 400 ms: ± 40 ms / with t7 < 400 ms: ± 20 ms and ± 10%, whichever is the highest
RP [32R]	t_t = t11	± 10 %	with t11 ≥ 5 s: ± 100 ms / with t11 < 5 s: the best between ± 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	± 10 %	con t11 ≥ 5 s: ± 100 ms / con t11 < 5 s: il migliore tra ± 10 % e ± 40 ms
UP StartUp	t_t = t23 startup	± 10 %	with t23 ≥ 5 s: ± 100 ms / with t23 < 5 s: the best between ± 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	± 10 % (6)	the best between ± 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 = t41 (with curve t = k)	± 7 %	The best between ± 10% and 40 ms
	$t_t = \frac{2}{\left(\frac{If}{I41}\right)^2}$ (with curve t = k / I^2)		± 15 %
Rc [64 50N TD 87N]	t_t = tdn	-20 % ÷ 0	140 ms @ 0,06 s (9) 950 ms @ 0,8 s (9)
MDGF	t = k	± 7 %	The best between ± 10% and 40 ms
	t = k / I^2		± 15 %

Startup

Protection [ANSI code]	Trip time t_t (1)	Trip threshold tolerance (3)	Trip time tolerance
Gext StartUp	t_t = t41 startup	± 7 %	the best between: ± 10 % and ± 40 ms

Note on protections

(1) use trip and threshold current values expressed in In for calculating t_t (example: If = 0.8 In, I1= 0.6 In)
(2) with t4 = 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 a 3% hysteresis for clearing from the alarm condition
(5) tolerance valid for frequencies within range: fn ± 2 %. A ± 5% tolerance is applicable for off range frequencies
(6) ± 20% for threshold 0.4 Hz / s
(9) maximum trip time
(10) with If ≥ 18 kA, t_t ≤ 3 ms;
with 18 kA > If ≥ I31 * 3, t_t ≤ 7 ms (If three-phase) or t_t ≤ 9 ms (If single-phase);
with If < 18 kA and If < I31 * 3, t_t ≤ 15 ms.
(operating parameters guaranteed with Vaux auxiliary power supply)
(11) tolerance valid with threshold U14 > 10%; with U14 ≤ 10% (and >6%), the tolerance is 10%; with U14 < 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 I1	± 20 %
S	± 10 %	± 20 %
I / 2I	± 15 %	≤ 60 ms
G	± 15 %	± 20 % (60 ms with t4 = instantaneous)
Gext	± 15 %	± 20 %
MDGF	± 15 %	± 20 %
UF / UF2 / OF / OF2	± 2 %	± 20 %
RV	± 10 %	± 20 %; in the case of single-phase self-supply: the highest between ± 20 % and 30 ms
Other	--	± 20 %

12 - Functions

Introduction

This chapter includes the trip curves of the protections, which are shown in different point charts:

- The curves are illustrated considering the minimum and maximum values and of the parameters of each protection.
- 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.

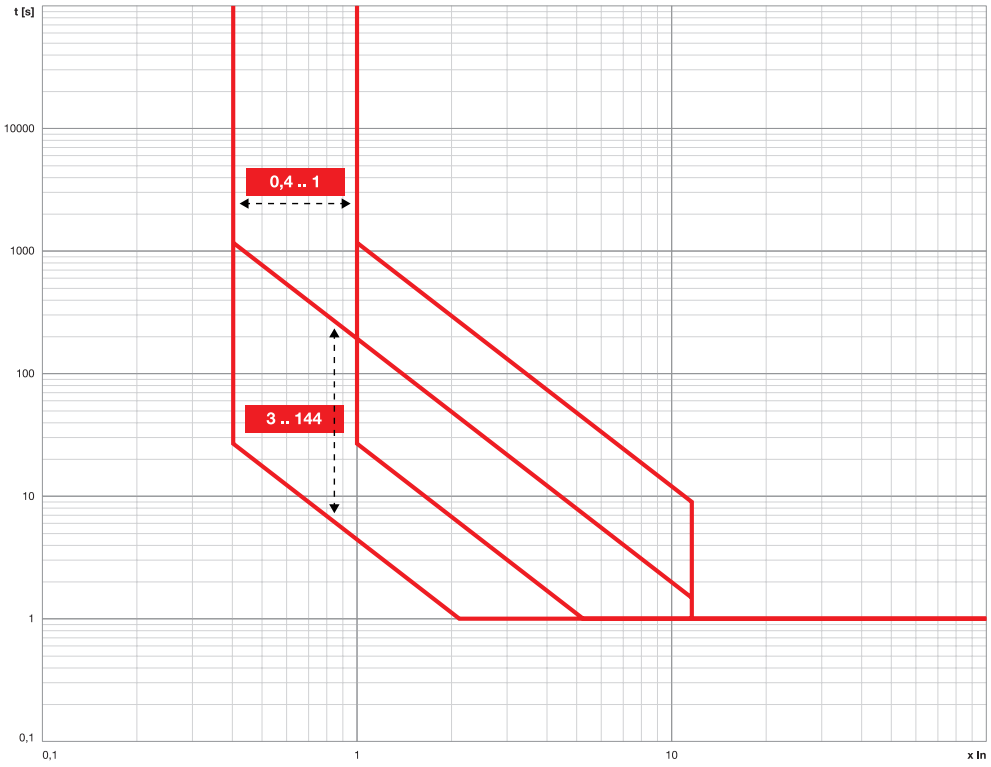
NOTE: *it is advisable to always use the mathematical function in the summary table of the protections to calculate the trip time (page* **92***)*

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:

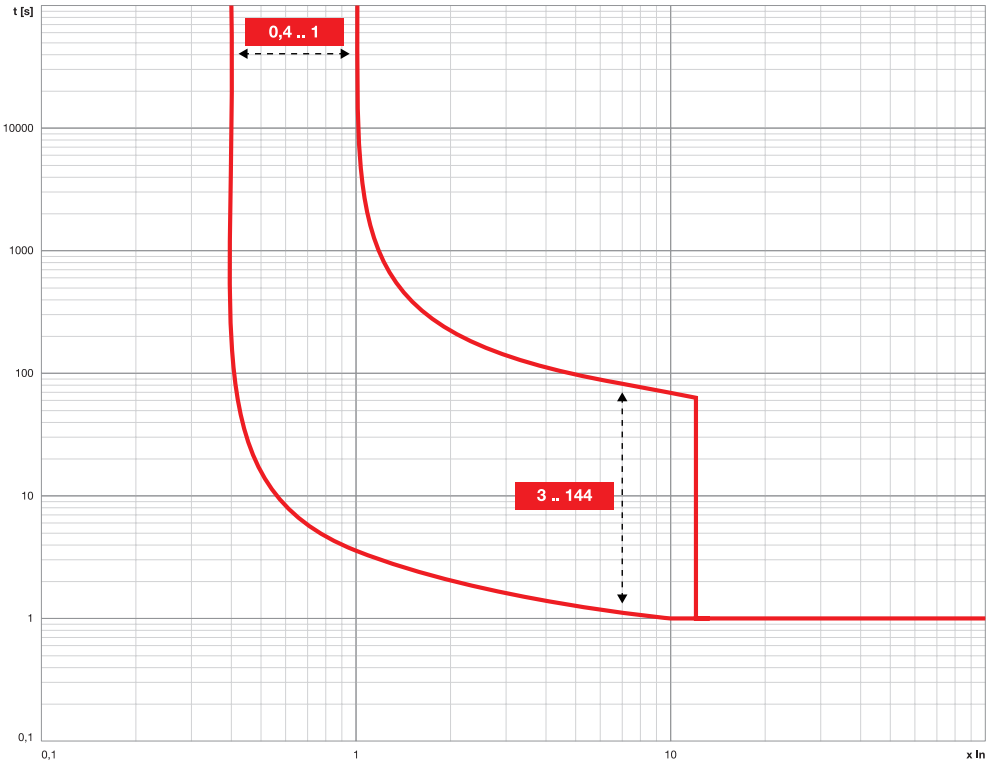
- The curves are illustrated considering the minimum and maximum values and of the parameters of each protection.
- The curves do not take account of the effects of special parameters such as thermal memory, startup, etc.
- Where version is not present, the curves are valid for both the IEC version and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

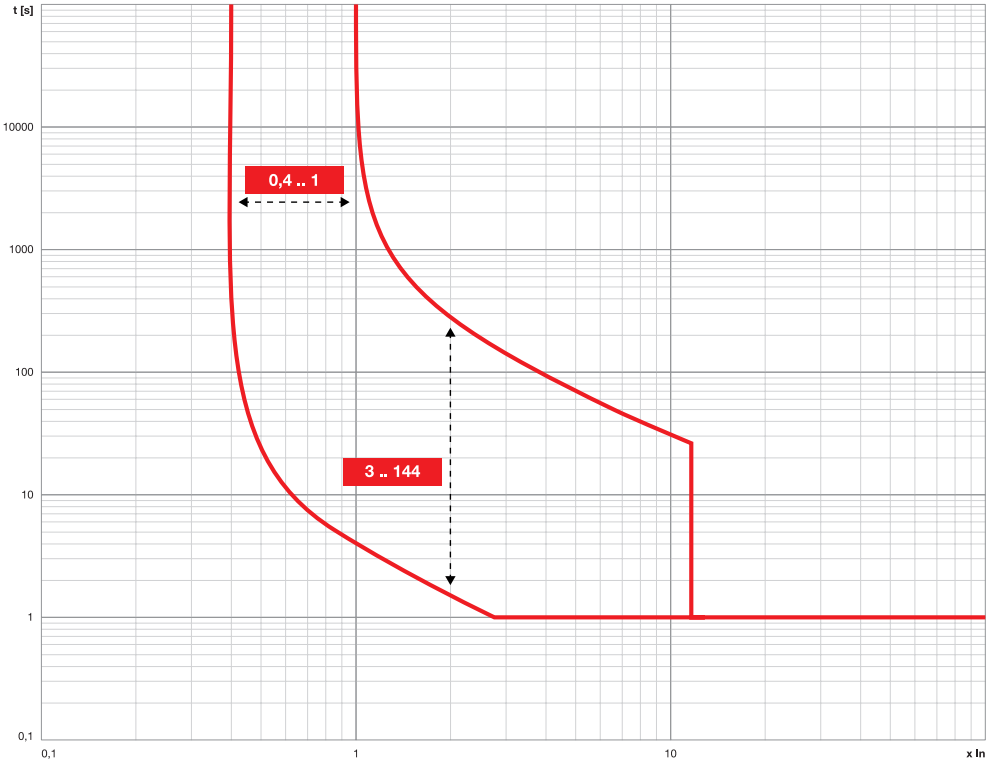
Function L ($t = k/I^2$)



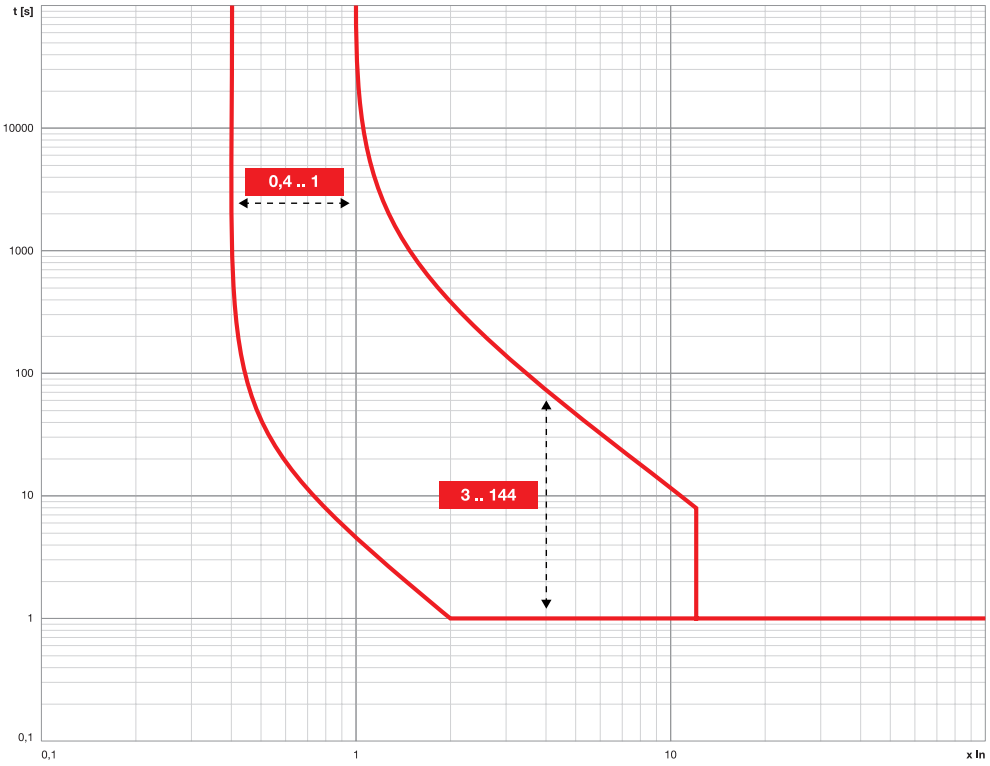
Function L (IEC 60255-151 SI)



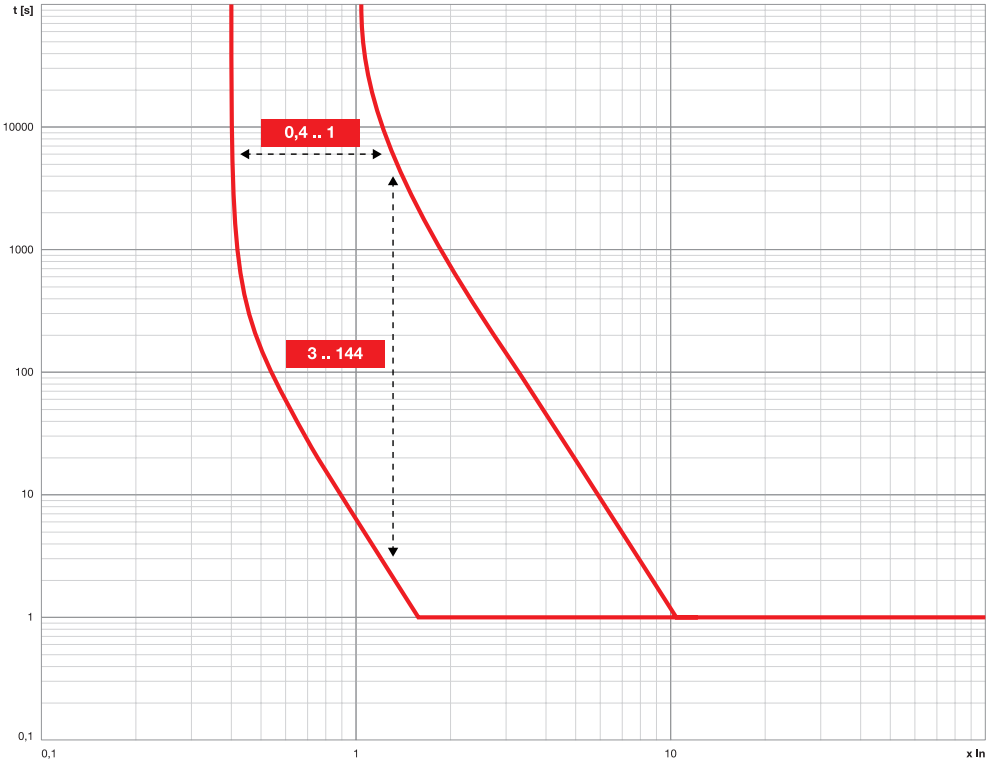
Function L (IEC 60255-151 VI)



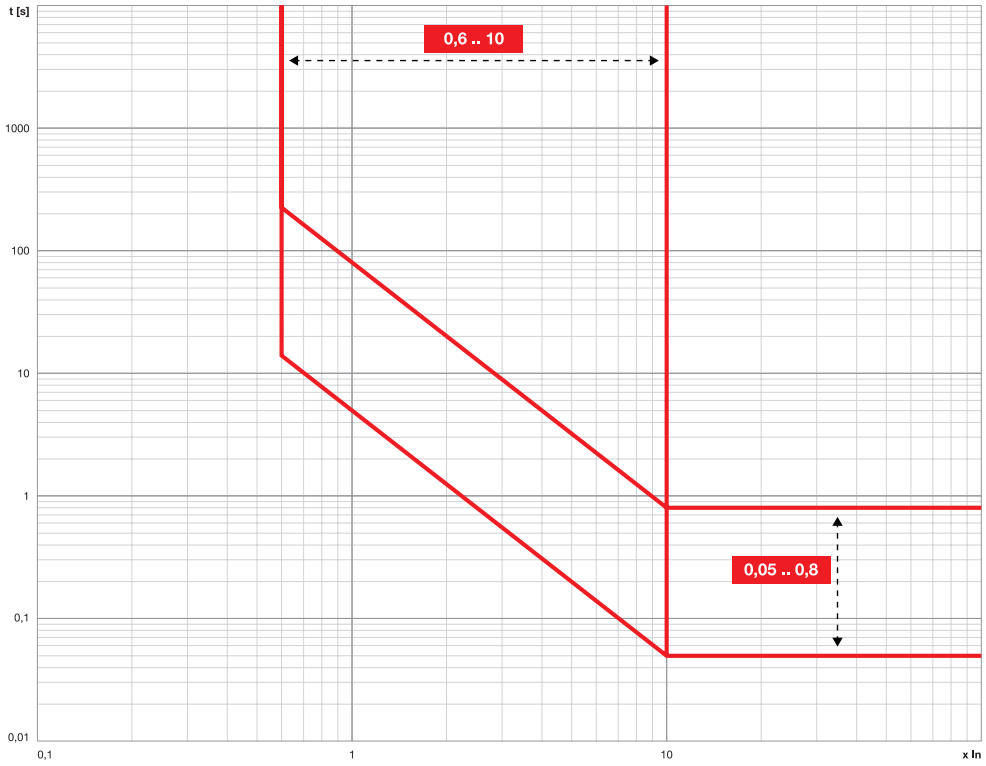
Function L (IEC 60255-151 EI)



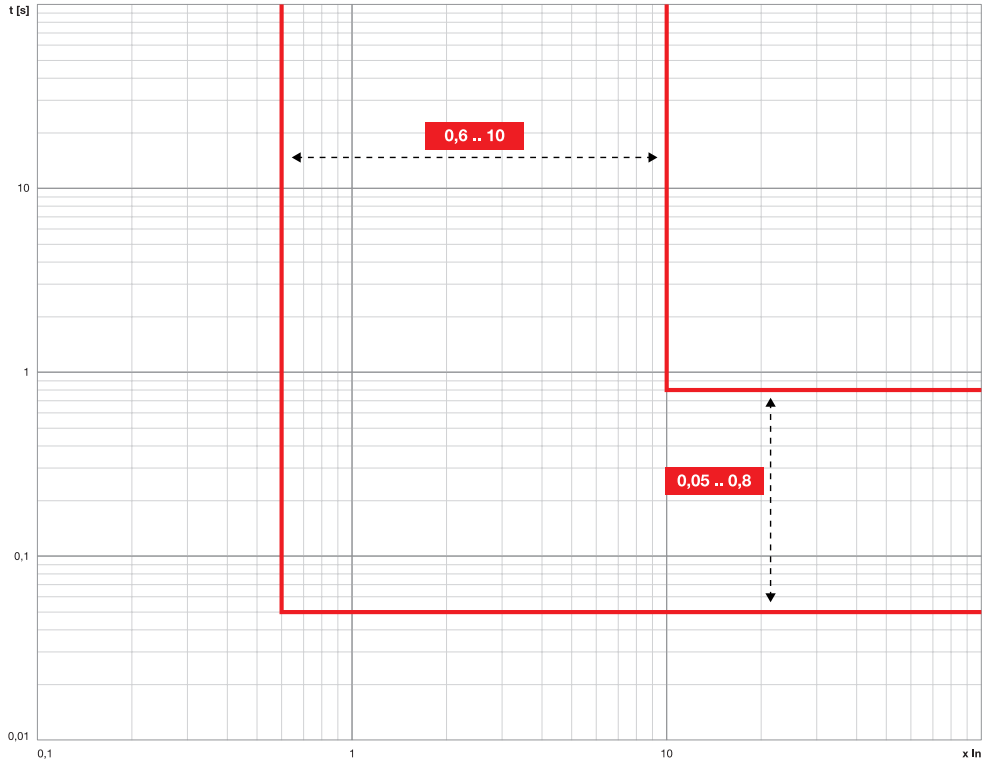
Function L (t = k/I [4])



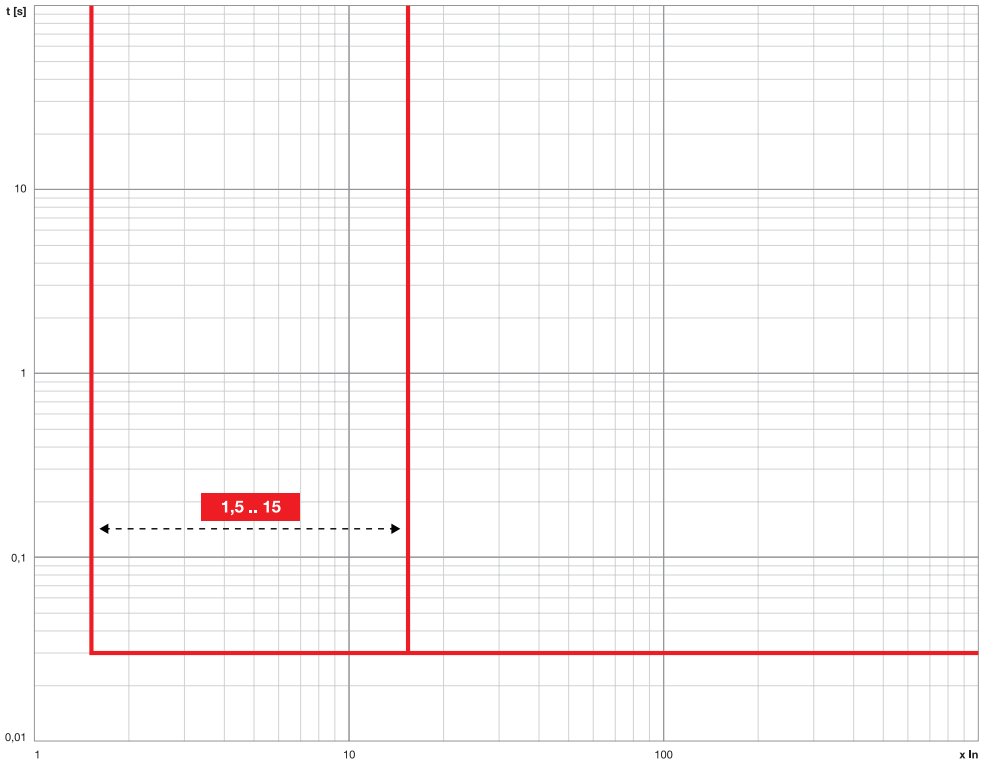
Function S (t = k/I ^{2})



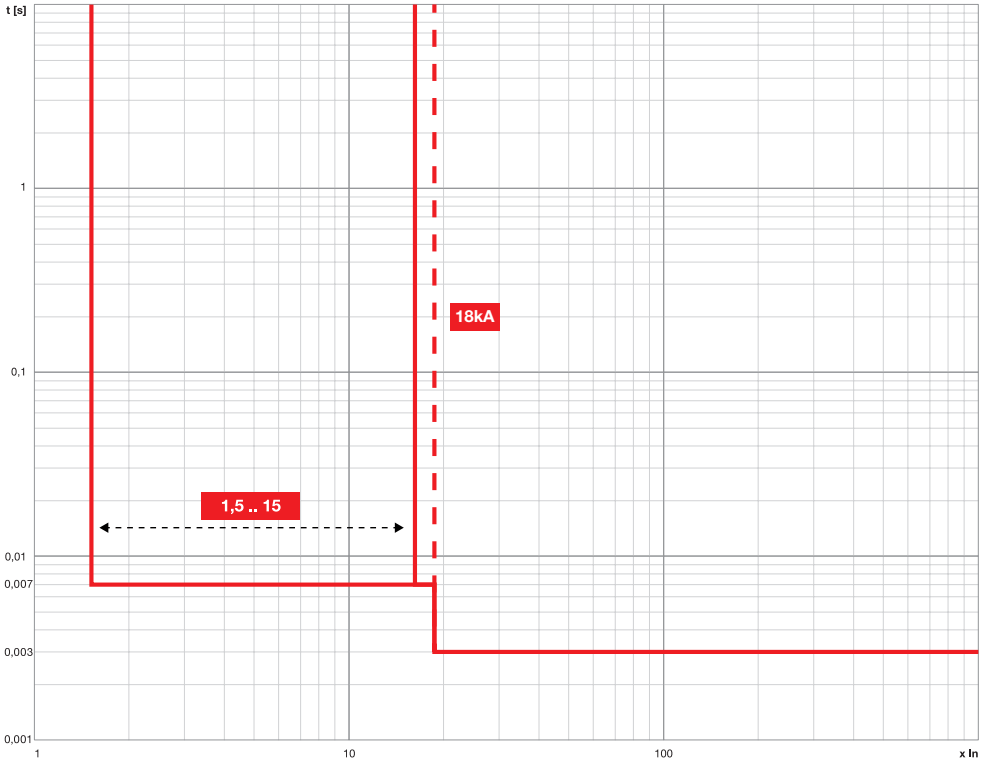
Function S (t = k) \ Function S2



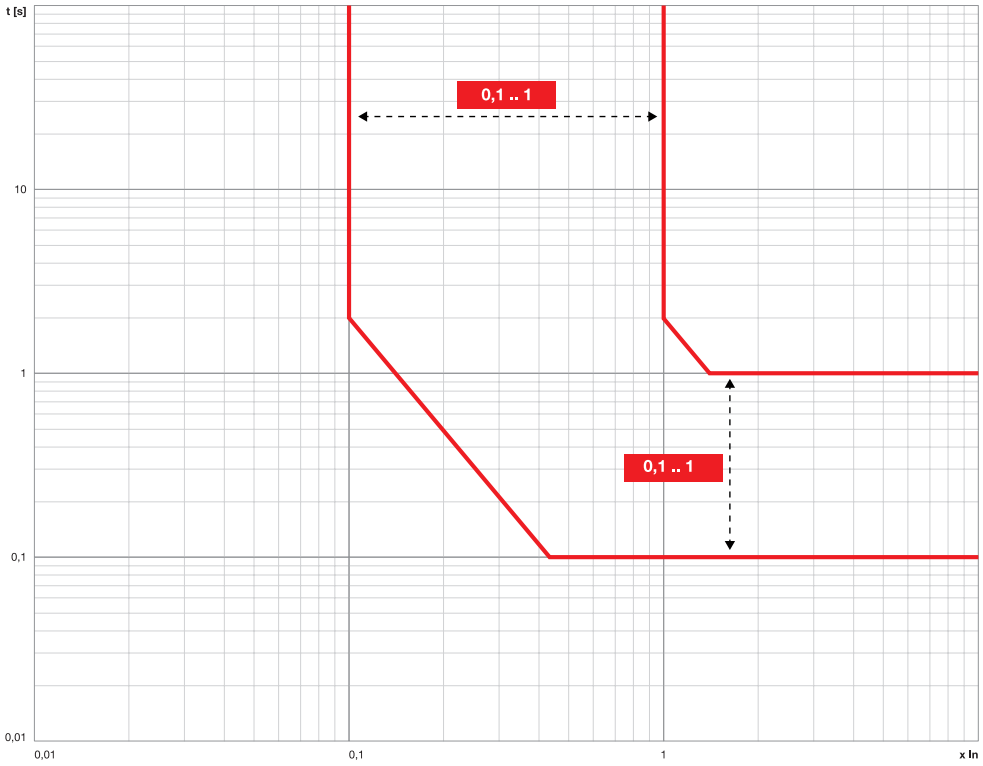
Function I \ Function MCR



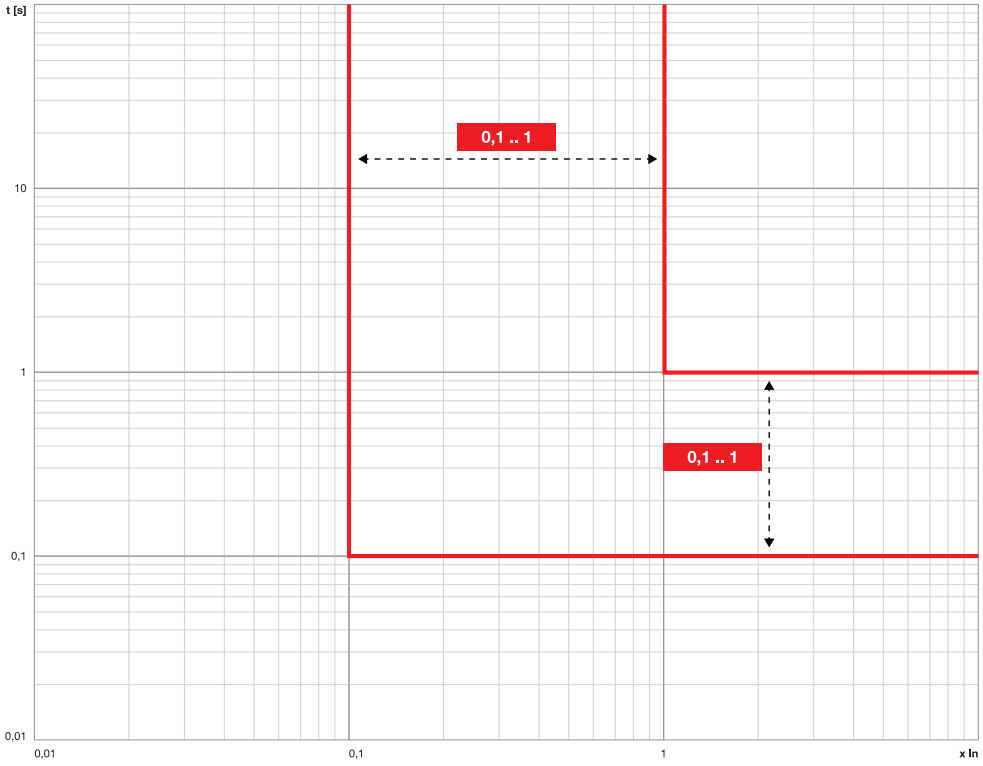
Function 2I



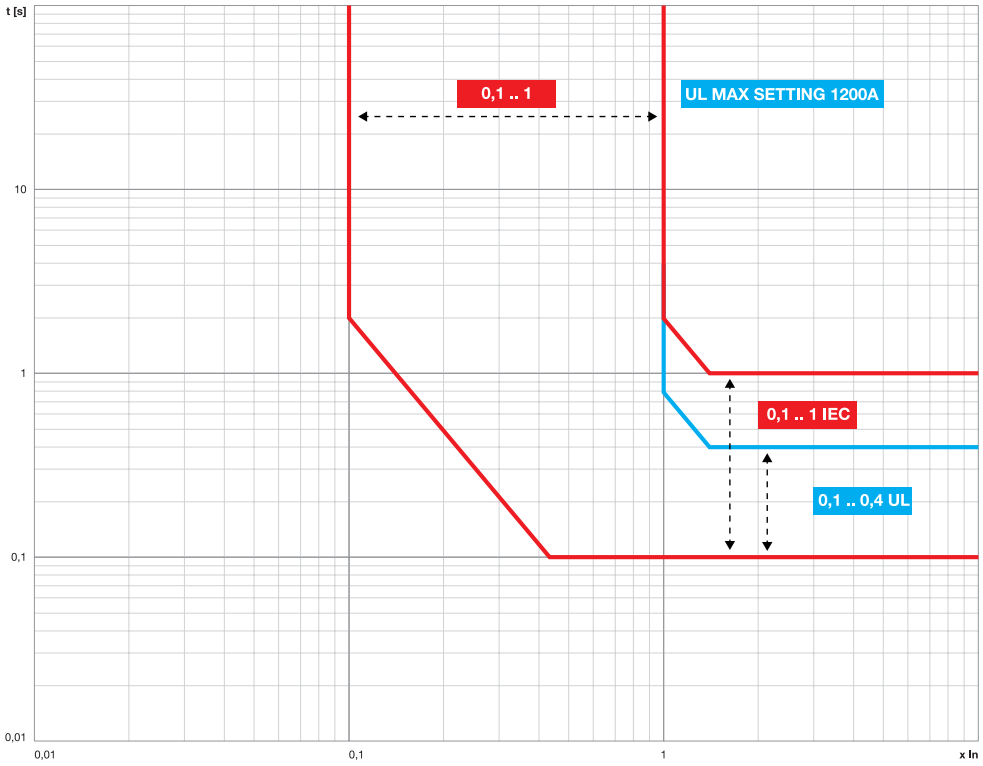
Function G (t = k/I ^{2}) \ Function Gext (t = k/I ^{2})



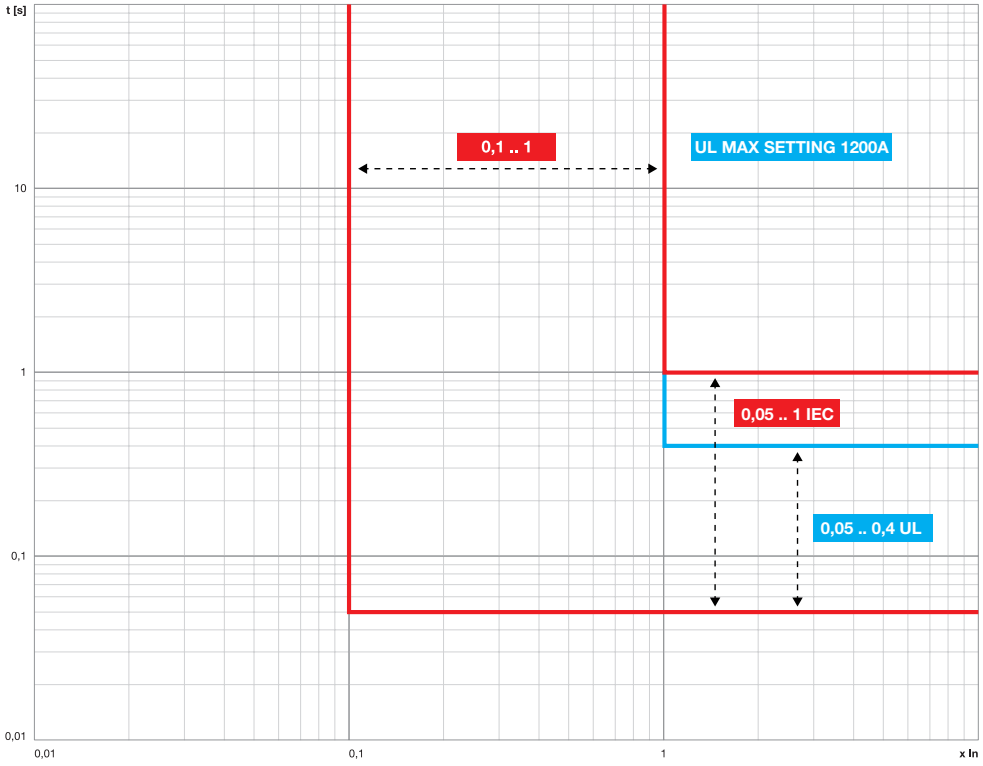
Function G (t = k) \Function Gext (t = k)



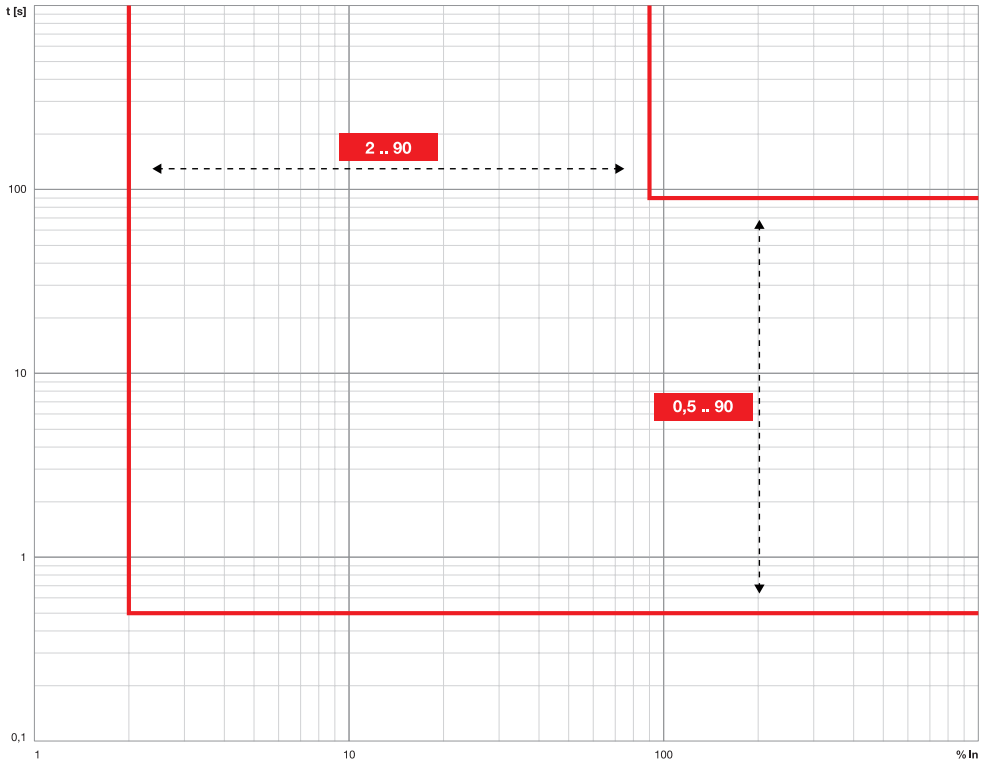
Function MDGF (t = k/I ^{2})



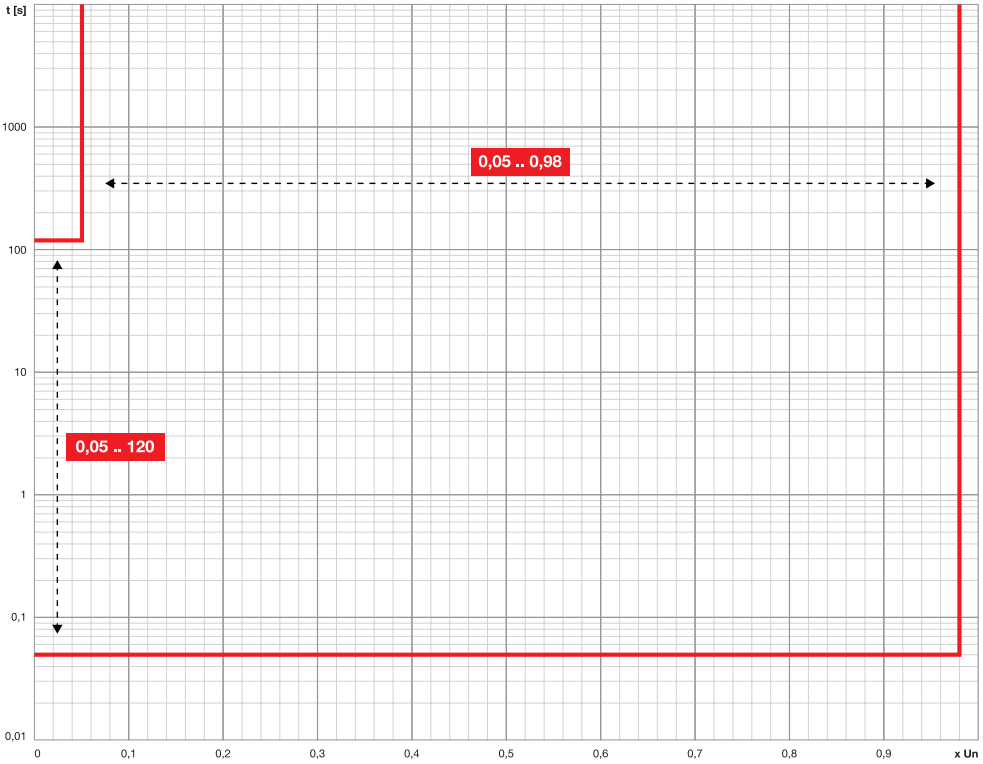
Function MDGF (t = k)



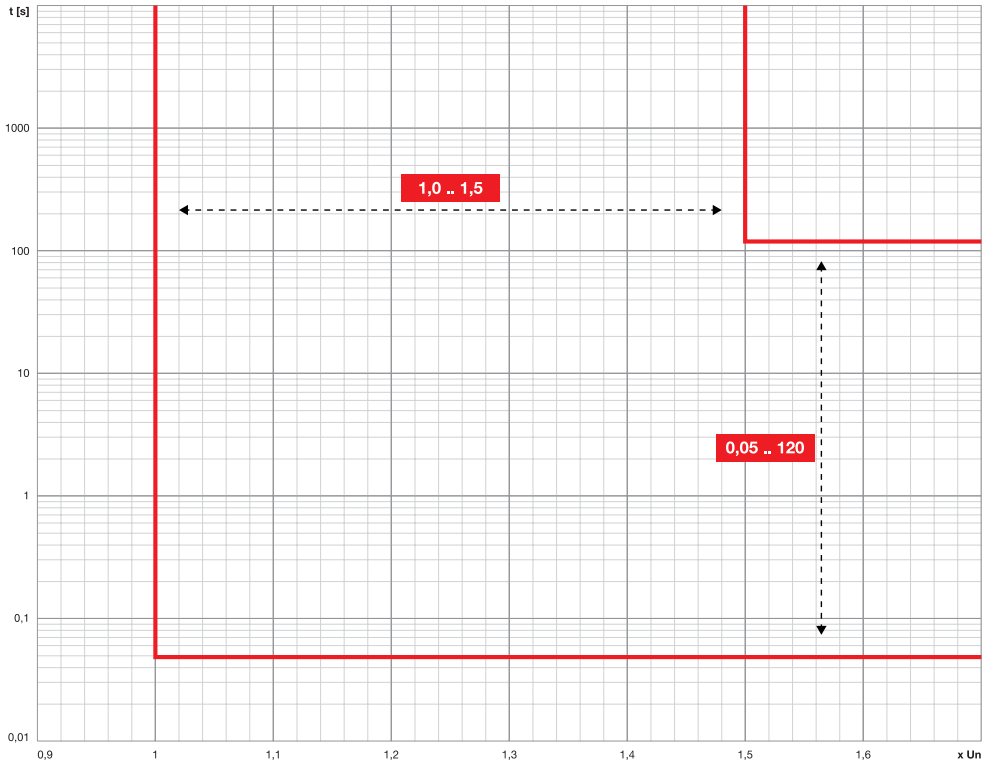
Function IU



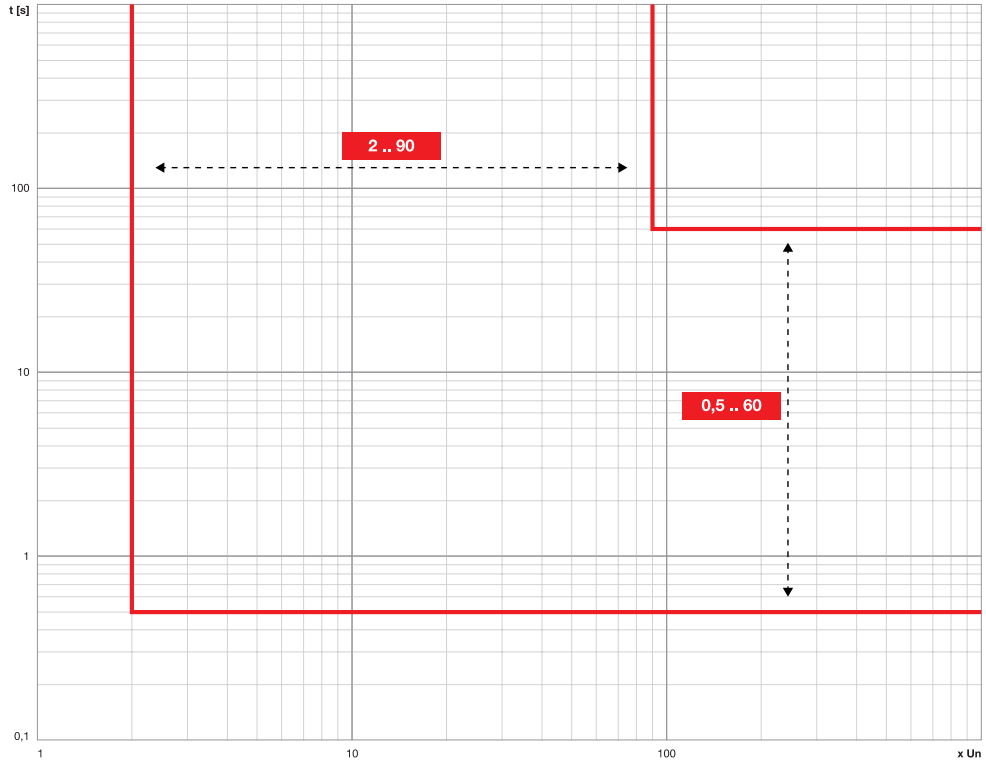
Function UV \ Function UV2



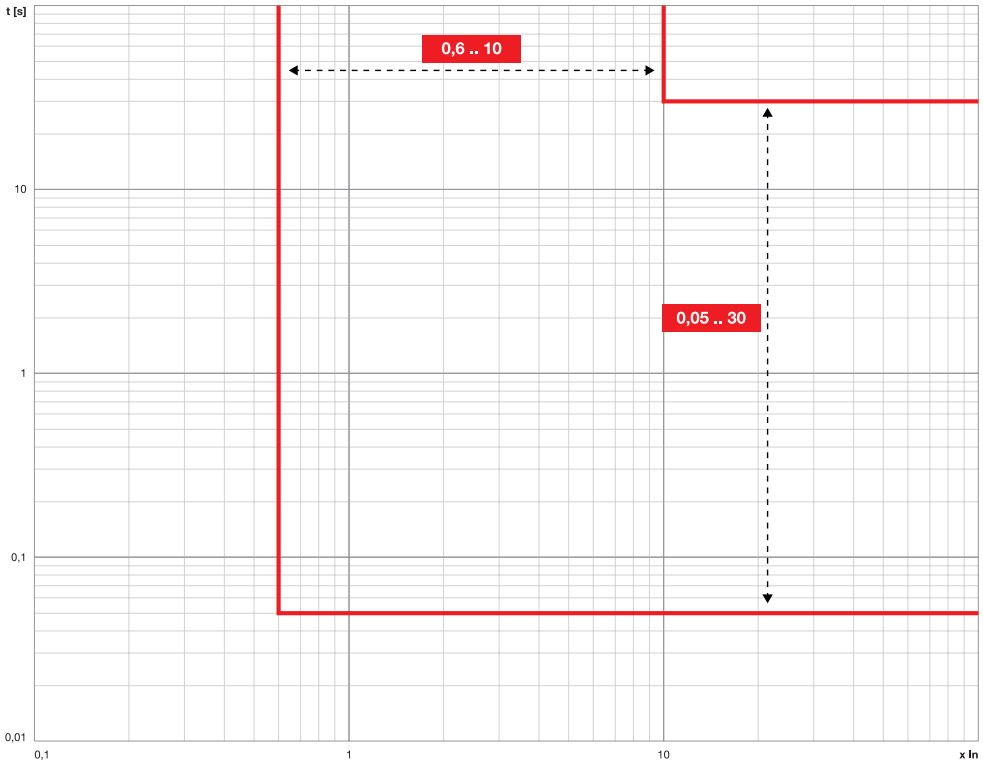
Function OV \ Function OV2



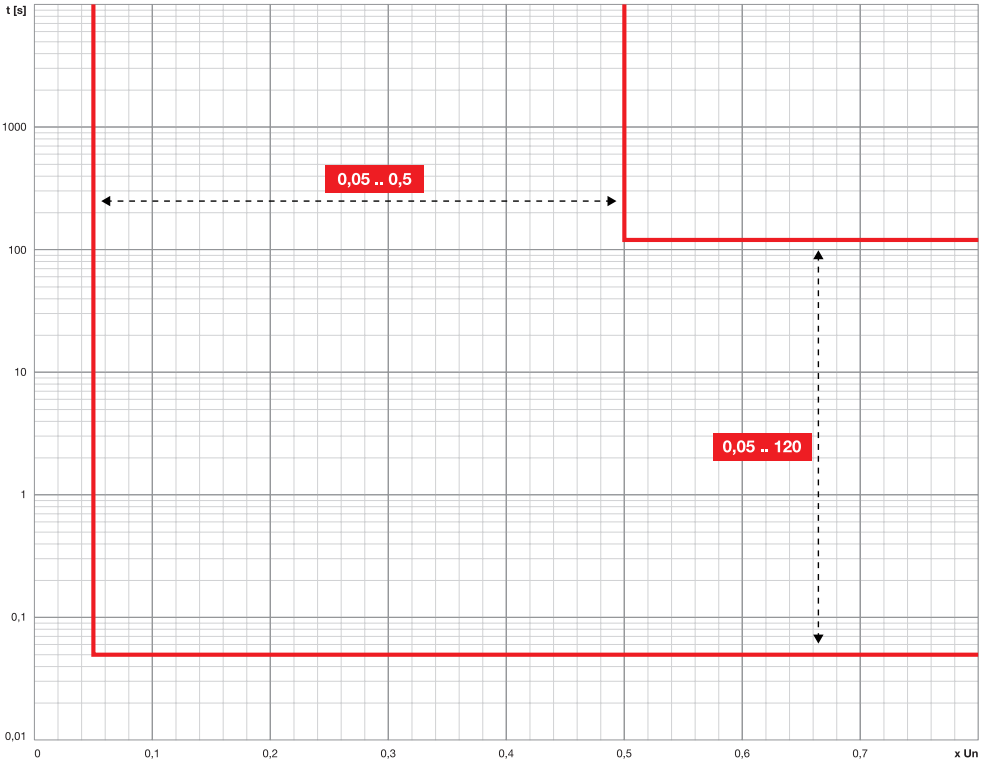
Function VU



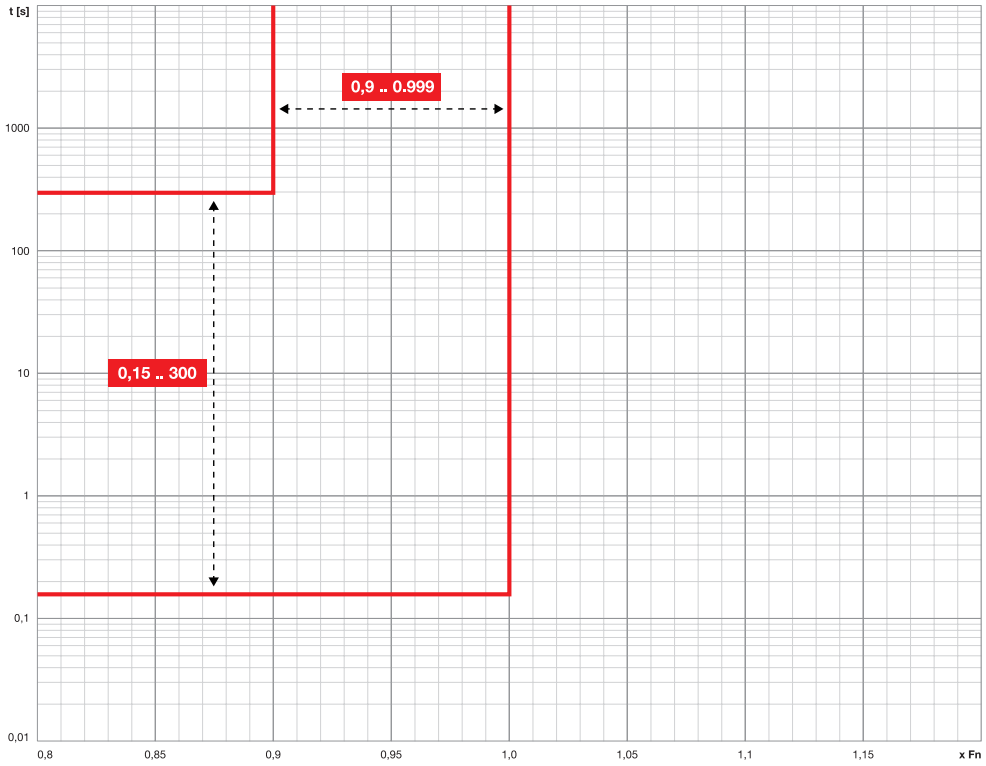
Function S(V) \ Function S2(V)



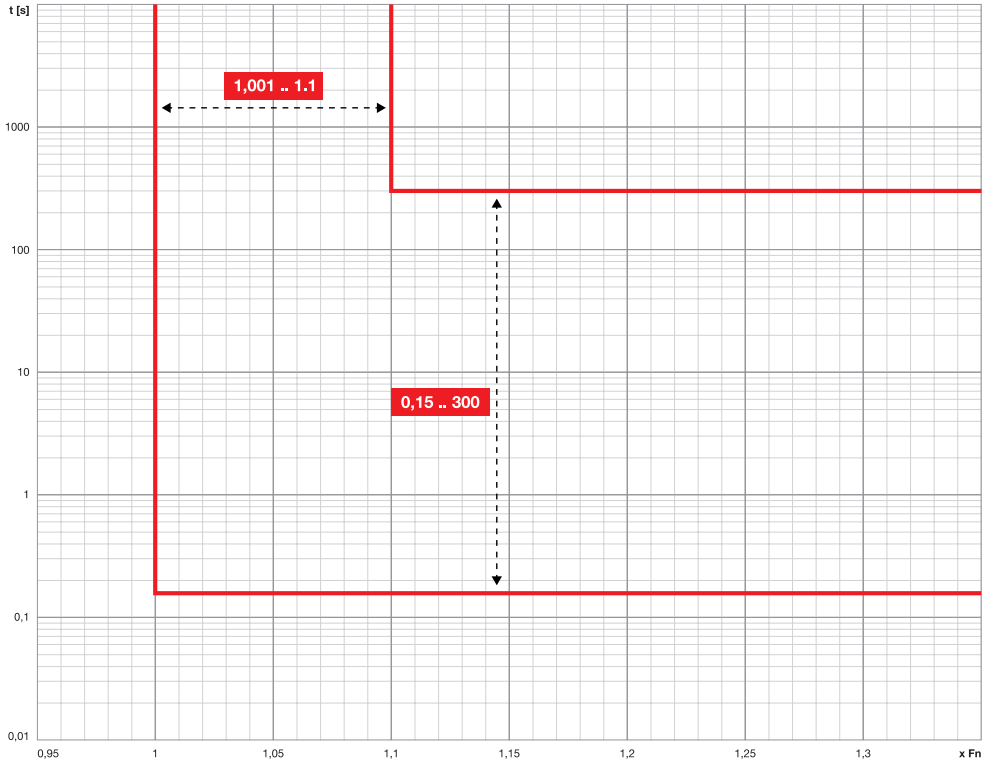
Function RV



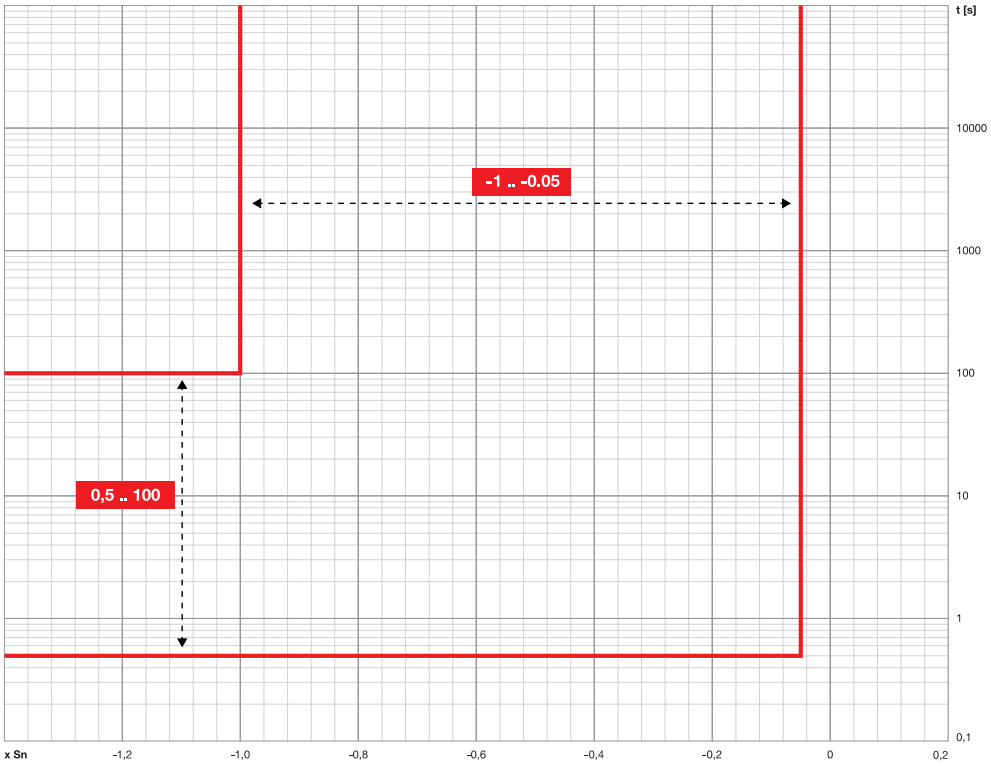
Function UF \ Function UF2



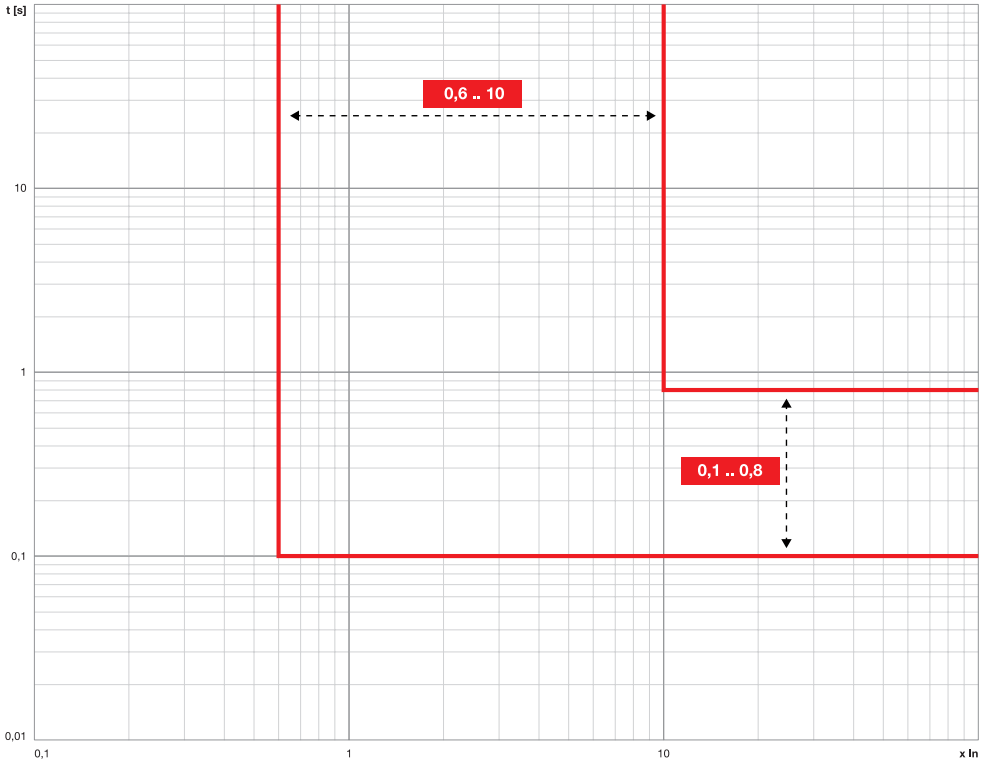
Function OF \ Function OF2



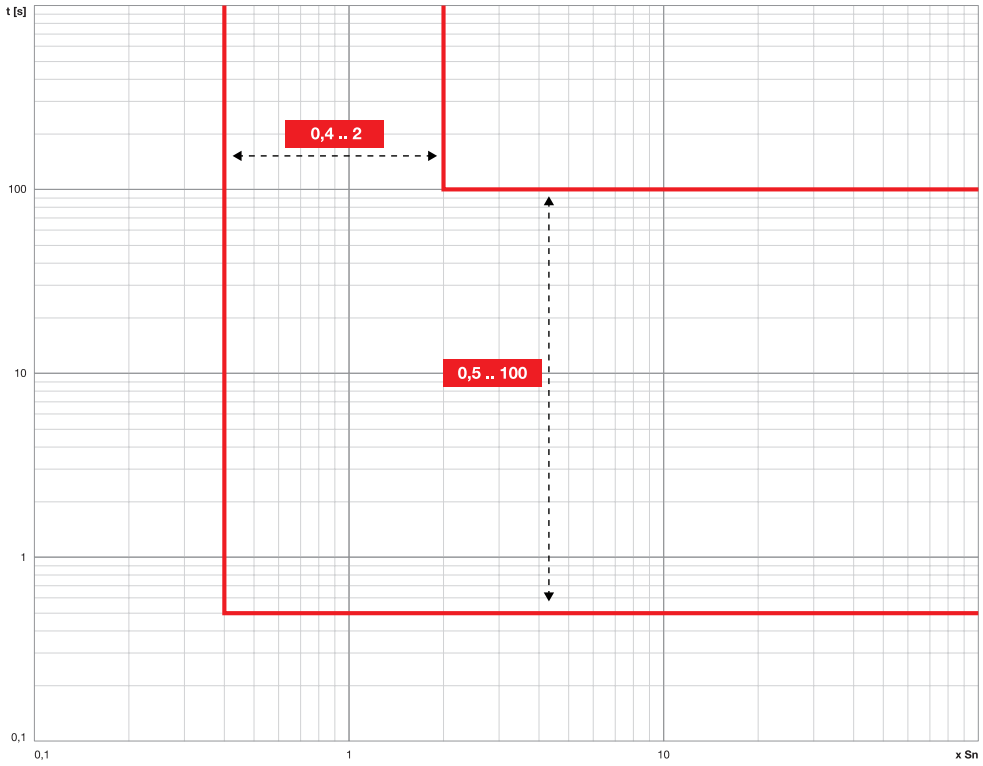
Function RP



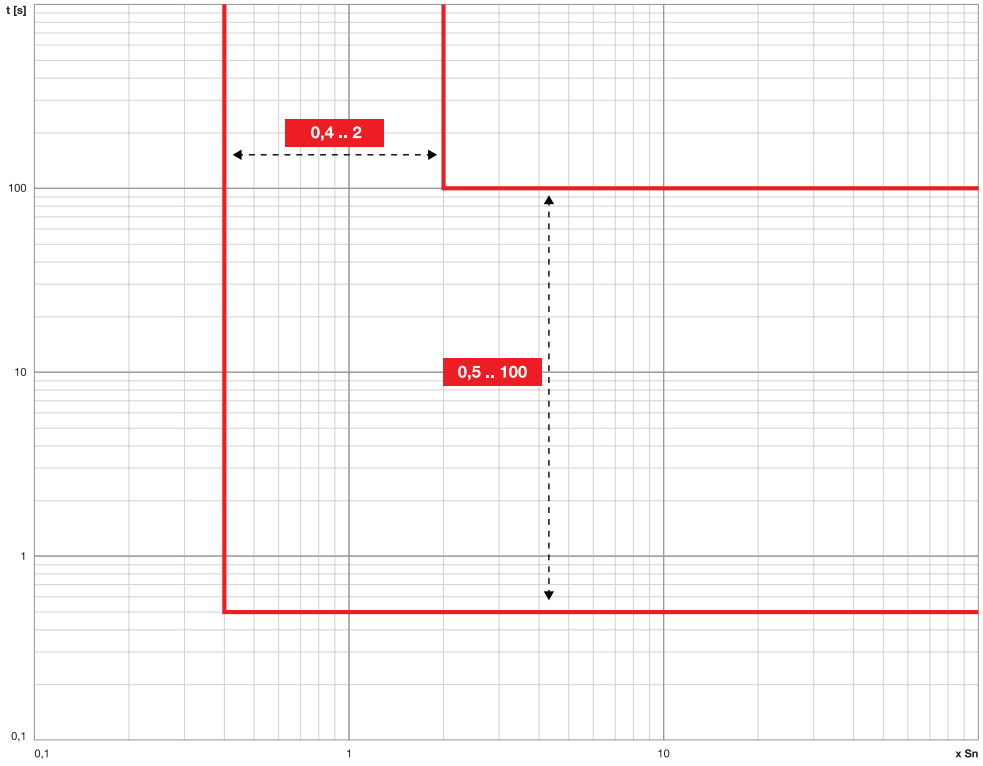
Function D



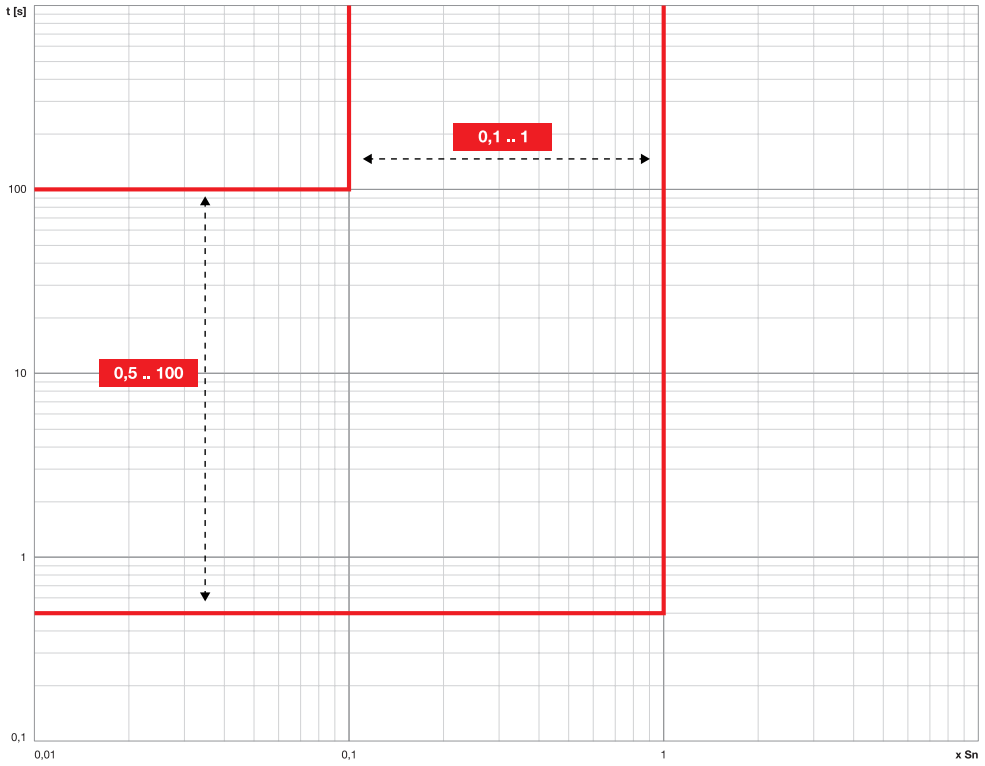
Function OQ



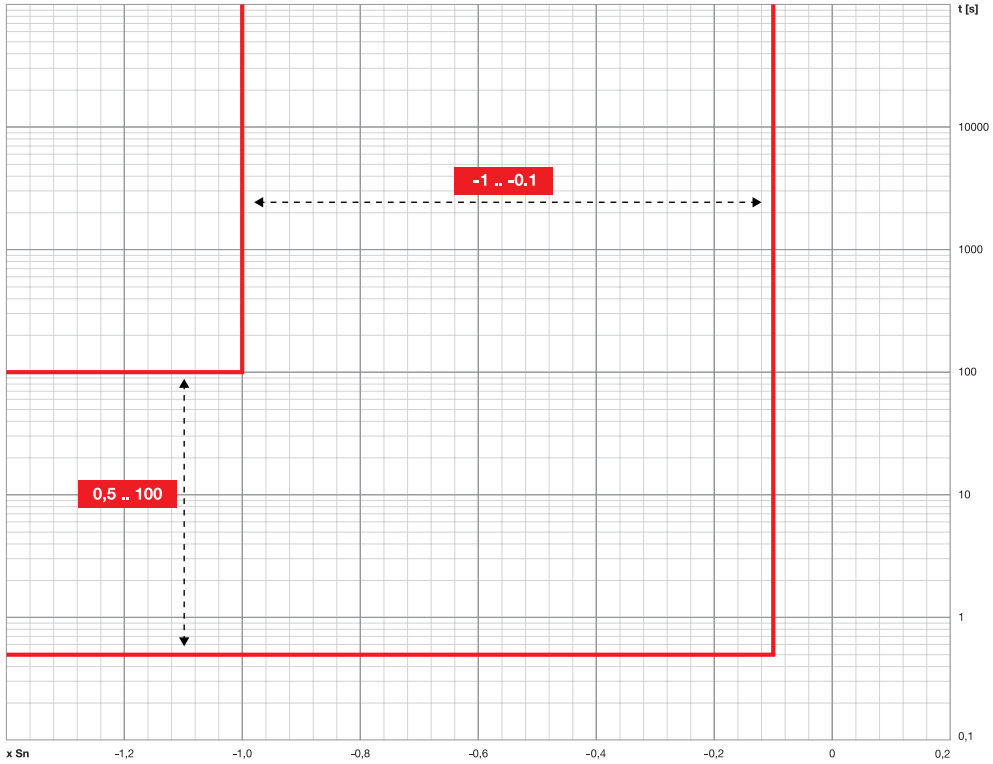
Function OP



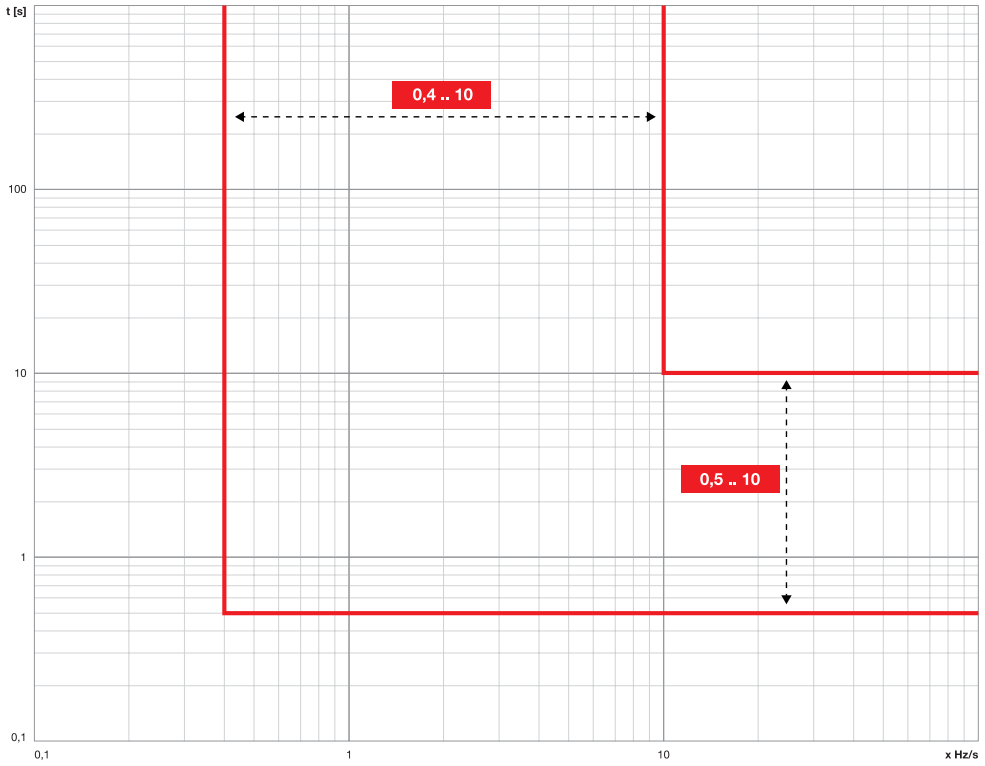
Function UP



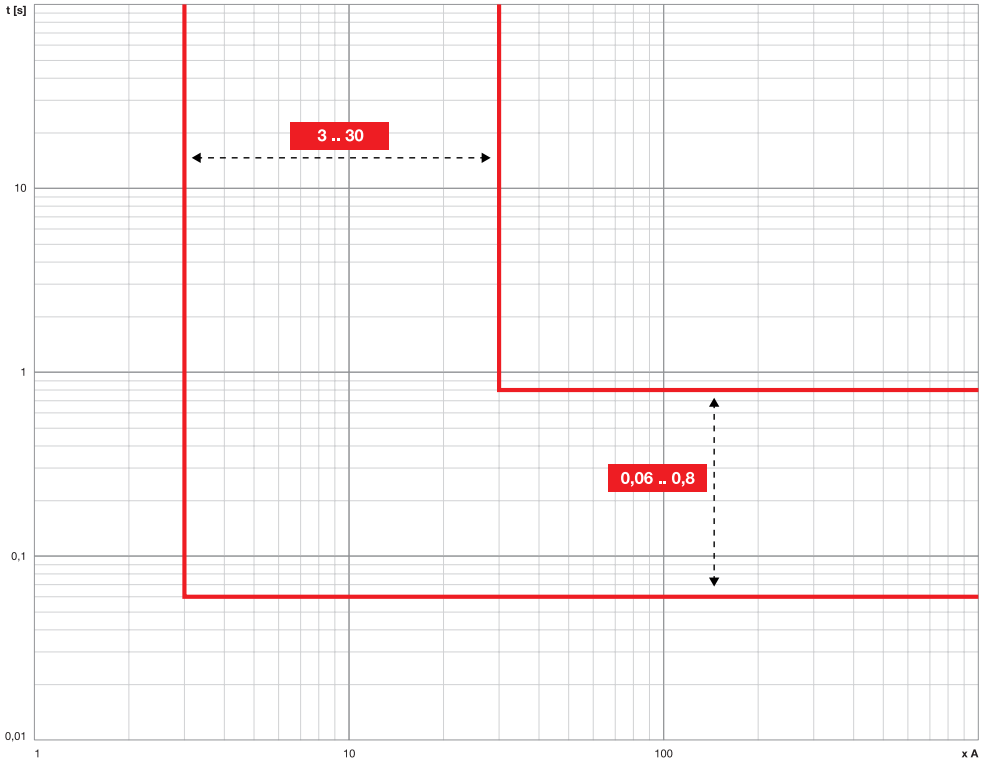
Function RQ



Function ROCOF



Function RC



Ekip Touch - Measurements

1 - Standard Measurements

List The Standard measurements are:

Parameter	Description	Page
Instantaneous currents	Phase current and earth fault measurements in real time	110
Events	List of events, status changes, alarms, recorded by the Trip unit	110
Trip	List of current protection trips (TRIP)	110
Min-Max measurements	History of minimum and maximum currents, recorded at a settable interval	112
Maintenance	CB status: contact wear and last maintenance	113
Operation counters	Number of mechanical and electrical operations	113

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)
Phase currents (4)	0,004 ÷ 64 In	0,2 ÷ 1,2 In	1% (3)
Internal earth fault current (2)	0,08 ÷ 64 In	0,2 ÷ 1,2 In	2 % (3)
External earth fault current (2) (5)	0,08 ÷ 4 In	0,2 ÷ 1,2 In	2 %
Residual current (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 117
(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]	Sensors disconnected
External earth fault current	. . . .	> [4 In sensor]	Sensor not activated and/or disconnected
Residual current	. . . .	> 32 A	Sensor 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: timing in progress 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*

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

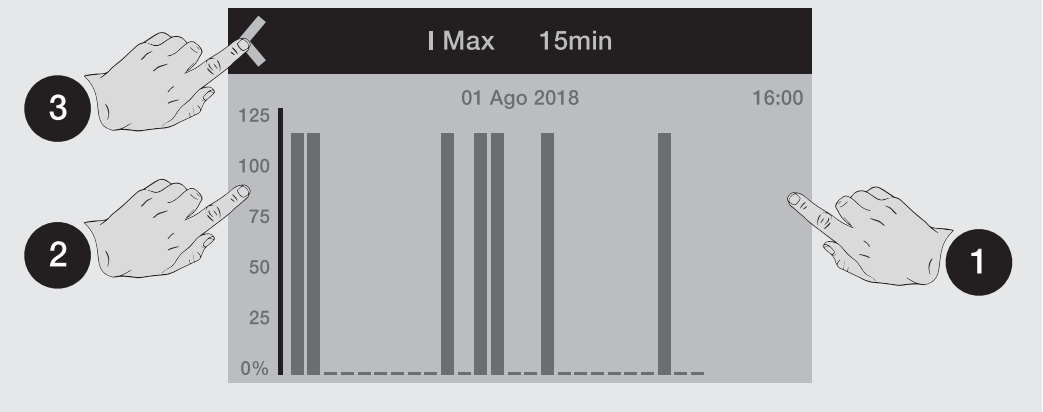
Min-Max measurements

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 46).

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.

The selected recording flashes, to distinguish it from the others.

- time elapsed from previous measurement
- 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*
- *80% wear is signaled by a prealarm, while 100% is signaled by an alarm*

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 - Ekip Measuring Measurements

List The Measuring measurements are

Condition	Access	Page
Instantaneous voltages	Phase and line-to-line voltage measurements in real time	114
Instantaneous powers	Real time measurements of the active, reactive, apparent phase and total powers	114
Instantaneous frequency	Measurement of the line frequency	114
Trip	List of trips (TRIP) due to voltage, frequency, power protections	115
Min-Max-Med measurements	History of minimum, maximum and mean voltages and powers recorded within a settable range	115
Peak factor	Real time measurement of the peak factor of the currents	115
Power factor	Real time measurement of the power factor	115
Energy counters	Measurement of active, reactive, apparent energy	115

The relative associated measurements are activated by means of the *Ekip Synchrocheck* module (page 223).

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 (Un).

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 current defined by the rated size of the Trip unit (In); in addition, the reference changes on the basis of the type of measurement:

- *Sn* for total powers (Sn = In * Un * √3).
- *Pn* for phase powers (Pn = In * Un / √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 Sn|	2 % (3)
Active, reactive and apparent phase power	|Pmin ÷ Pmax| (5)	|0,3 ÷ 1,2 Pn|	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 Un < 277 V) or 60 V (with Un > 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 117
(4) 45 to 55 Hz with set frequency = 50 Hz; 54 to 66 Hz with f = 60 Hz
(5) Pmin = 0,5 In x 5 V; Pmax= 3 x 16 In x 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	. . . .	> [Un x 1,25]	*Measurement* module not detected
Line frequency	30 Hz	80 Hz	*Measurement* module not present, V < 5 V
Active, reactive and apparent total and phase power	. . . .	> [Pn x 1,25]	Sensors disconnected, *Measurement* module not present, V < 5 V, I < 0.03 In

Tripping

The *Measuring Measurements* page adds to the range of TRIPs that Ekip Touch is able to record (page 115).

The voltage, frequency or power protection that trips determines the measurements recorded the moment the trip occurs

Protection	Measurements 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 111):

- 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
- and 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 61).

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 between total active power and total apparent power, expressed as cos φ.

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 117

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 117

Reset measurements

The *Energy RESET* command is available in the *Energy* menu for the purpose of resetting the energy counters (page 45).

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 IEC61557-12, tables 20-22	0,5 % [1]
Internal earth fault current [2]	0,08 ÷ 64 In	Standard IEC61557-12, table 20	0,5 % [1]
Line frequency	30 ÷ 80 Hz [3]	fn ± 10 % [4]	± 0,02 Hz
Total active and apparent power [7]	|Pmin ÷ Pmax| [5]	Standard IEC61557-12, tables 8-11-14	1 % [1]
Active and apparent phase power	|Pmin ÷ Pmax| [5]	Standard IEC61557-12, tables 8-11-14	1 % [1]
Total active and apparent energy	1 kWh ÷ 2 TWh; 1 kVARh ÷ 2 TVARh; 1 kVAh ÷ 2 TVAh	Standard IEC61557-12, tables 8-11-14	1 % [1]
Power factor	0,5 ÷ 1	Standard IEC61557-12, 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 Un < 277 V) or 60 V (with Un ≥ 277 V)
[4] 47 ÷ 55 Hz with fn = 50 Hz; 54 ÷ 66 Hz with fn = 60 Hz
[5] Pmin = 0,5 In x 5 V; Pmax= 3 x 16 In x 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 Ne 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 IEC61557-12):

Characteristic	Value
Classification of performance measuring and monitoring device (PMD) in accordance with chapter 4.3 of the standard	PMD-DD
Temperature	Operating: T= -25°C to +70°C; Storage: T = -30°C to +70°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 IEC61557 12 information page, which can be consulted in the *About* menu

Figure 28

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

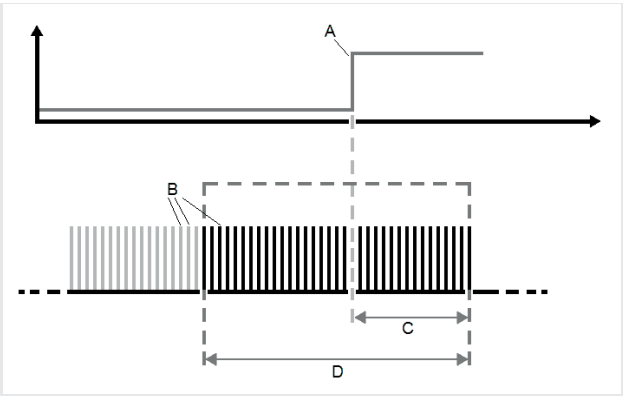


Figure 29

Parameters 1

The parameters and commands of the function are available in the *Settings* menu (page 46).

Parameter	Description	Default
Enable	Activates/deactivates the function and its availability in the parameters menu **NOTE**: *il the enable command is hidden when at least one datalogger is activated*	Off
Num. of Datalogger	Determines the number of recordings (1 or 2) **NOTE**: *the recordings share the settings of the sampling frequency and type of memory*	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) **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 (DataLog available).

NOTE: *Ekip Touch provides a general indication of recording availability in the configuration with 2 dataloggers: use Ekip Connect to identify which of the 2 recordings (or both) is 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 46).

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 *Under V Th* counter The value is given as a percentage of rated voltage Un and can be set within the range: 75% to 95%, in 5% steps.	85 % Un
V Threshold High	Control threshold of the *Over V Th* counter The value is given as a percentage of rated voltage Un and can be set within the range: 105, 110, 115 % Un	110 % Un
Unbalance V Th	Alarm threshold for the *Unbalance* counter. The value is given as a percentage of rated voltage Un and can be set within the range: 2% to 10% Un, in 1% steps. **NOTE**: *0% =symmetrical and balanced system*	3 % Un
V microinterr. Th	Control threshold of the *V microinterr* counter. The value is given as a percentage of rated voltage Un and can be set within the range: 10% to 95% Un, in 5% steps	95 % Un
V Spike Threshold	Control threshold of the *Spike* counter. The value is given as a percentage of Un and can be set within the range: 105% to 125% Un, in 5% steps	105 % Un
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 Un and can be set from 10% to 95% Un, 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 *Sags Short* counter	10 % Un
V sag dur Short	Minimum duration of sag below the Short threshold to validate the count of the *Sags Short* counter	0,8 s
V sag Th Middle	Control threshold of *Sags Middle* counter	45 % Un
V sag dur Middle	Minimum duration of sag below the *Middle* threshold to validate the count of the *Sags Middle* counter	0,8 s
V sag Th Long	Control threshold of *Sags Long* counter	95 % Un
V sag dur Long	Minimum duration of sag below the Long threshold to validate the count of the *Sags Long* counter	0,8 s

NOTE: *Ekip Touch accepts changes to the parameters subject to compliance with the following limitations: V sag dur Long ≥ V sag dur Middle ≥ V sag dur Short*

Swells Menu (Swell)

All the thresholds are given as a percentage of rated voltage Un and can be set from 105% to 125% Un, 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 Swell *Short* counter	125 % Un
V swell dur Short	Minimum duration of swell above the *Short* threshold to validate the count of the *Swell Short* counter	0,8 s
V swell Th Long	Control threshold of the *Swells Long* counter	105 % Un
V swell dur Long	Minimum duration of swell above the Long threshold to validate the count of the *Swells Long* counter	0,8 s

NOTE: *Ekip Touch accepts changes to the parameters subject to compliance with the following limitations: V sag dur Long ≥ V sag dur Middle ≥ V 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 *THD Voltages* counter	5 %
	Single harmonic th	Control threshold of the single harmonics counters of the voltages	5 %
Voltage	THD Threshold	Control threshold of the *THD Current* 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 45).

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 *Unbalance V Th* 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 *V Threshold High* 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 V Threshold Low 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 *Over V Th* counter
Last value	Value of the last swell above the *Over V Th* [V] threshold
Actual number of O.	*Over V Th* count for the current day
Actual [day -2 ... day -7] number of O.	*Over V Th* count of the last seven days of activity, calculated using the internal clock of the unit

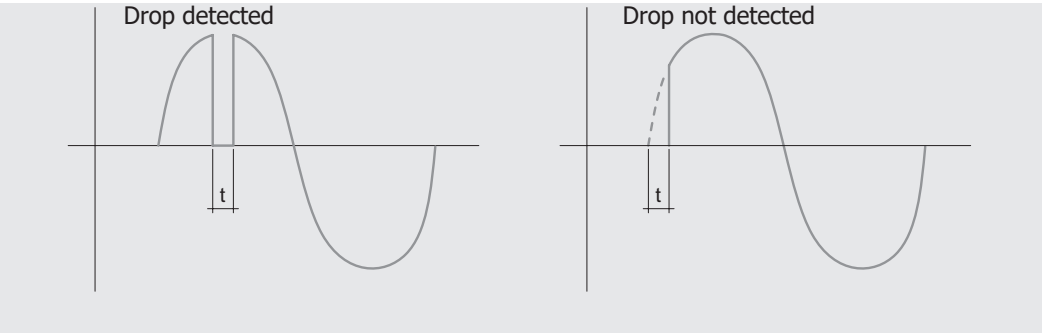
Counters (Under Voltage)	Description
Last time stamp	Date and time of last recording of the *Under V Th* counter
Last value	Value of the last sag below the *Under V Th* [V] threshold
Actual number of O.	*Under V Th* count for the current day
Actual [day -2 ... day -7] number of O.	*Under V Th* count 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

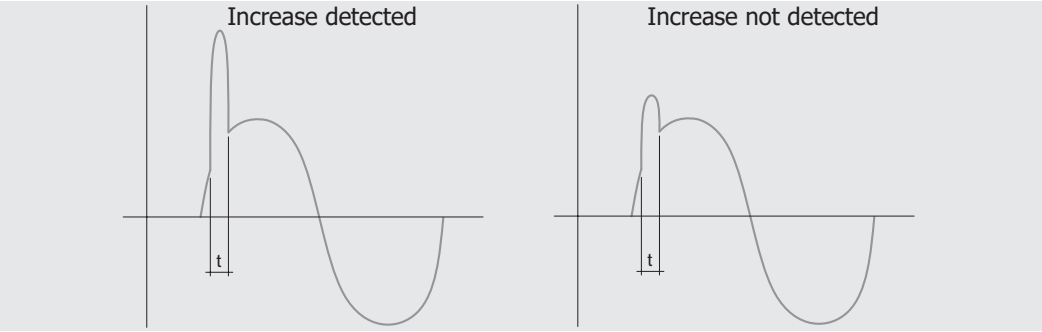
Counters (Interruptions)	Description
Last instant	Date and time of last recording of the *V microinterr* counter
Last value	Value of last sag below the *V microinterr* [V] threshold
Last duration	Value of last sag below the *V microinterr* [ms] threshold
Actual number of I.	*V microinterr* count for the current day
Actual [day -2 ... day -7] number of I.	*V microinterr* 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 *Spikes* counter
Last value	Value of last swell above *Spikes* [V] threshold
Last duration	Duration of last swell above *Spikes* [ms] threshold
Actual number of S.	*Spikes* count for the current day
Actual [day -2 ... day -7] number of S.	*Spikes* 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 *V sag Th Short* threshold for longer than *V sag dur Short*
Sags Middle	Counts the number of times that any line-to-line voltage falls below the *V sag Th Middle* threshold for longer than *V sag dur Middle*
Sags Long	Counts the number of times that any line-to-line voltage falls below the *V sag Th Long* threshold for longer than *V sag dur Long*

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 *Sags Short* counter
Sags Middle	Value of last sag below the *Sags Short* [V] threshold
Sags Long	Duration of last sag below the *Sags Short* [ms] threshold
Actual number of S.	*Sags Short* count for the current day
Actual [day -2 ... day -7] number of S.	*Sags Short* 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 *Sags Middle* counter
Sags Middle	Value of last sag below the *Sags Middle [V]* threshold
Sags Long	Duration of last sag below the *Sags Middle [ms]* threshold
Actual number of S.	*Sags Middle* count of the current day
Actual [day -2 ... day -7] number of S.	*Sags Middle* 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 *Sags Long* counter
Sags Middle	Value of last sag below the *Sags Long*[V] threshold
Sags Long	Duration of last sag below the *Sags Long*[ms] threshold
Actual number of S.	*Sags Long* count of the current day
Actual [day -2 ... day -7] number of S.	*Sags Long* 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 *V swell Th Short* threshold for longer than *V swell dur Short*
Swells Long	Counts the number of times that any line-to-line voltage exceeds the *V swell Th Long* threshold for longer than *V swell dur Long*

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 *Swells Short* counter
Last value	Value of last swell above *Swells Short* [V] threshold
Last duration	Duration of last swell above *Swells Short*[ms] threshold
Actual number of S.	*Swells Short* count for the current day
Actual [day -2 ... day -7] number of S.	*Swells Short* 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 *Swells Long* counter
Last value	Value of last swell above *Swells Long*[V] threshold
Last duration	Duration of last swell above *Spikes*[ms] threshold
Actual number of S.	*Swells Long* count for the current day
Actual [day -2 ... day -7] number of S.	*Swells Long* 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 *THD Threshold*
THD Current	Counts the total number of minutes in which total distortion exceeds voltage threshold *THD Threshold*

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	*THD Current* count for the current day [min]
Actual [day -2 ... day -7] number of THD C.	*THD Current* count of the last seven days of activity, calculated using the internal clock of the unit

Counters (Swells Long)	Description
Actual minutes	*THD Voltages* count for the current day [min]
Actual [day -2 ... day -7] number of THD C.	*THD Voltages* 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

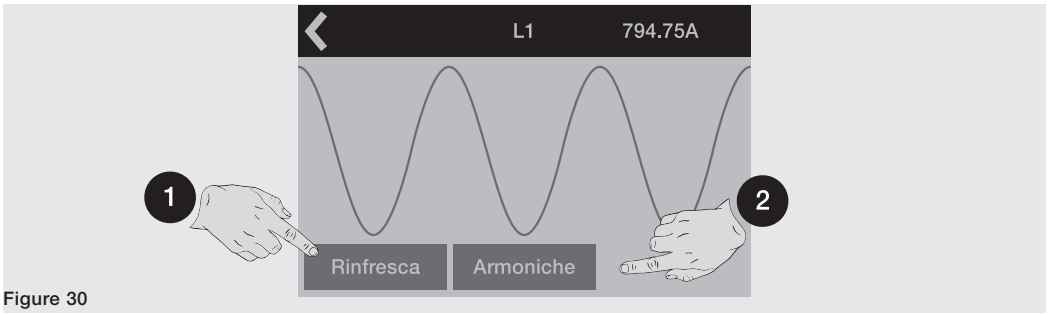


Figure 30

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.

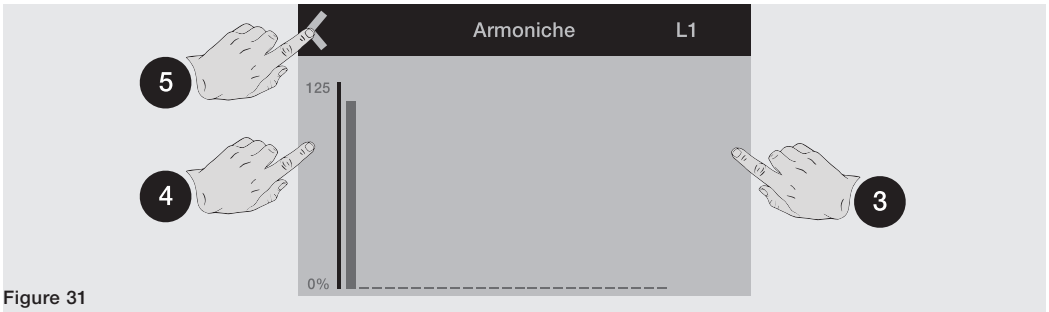


Figure 31

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 46).

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 11).

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
Enable	Enables/disables Bluetooth Low Energy antenna switch-on and availability of the other parameters in the menu: • if *On*, the antenna comes on, on the basis of the *Battery Mode* parameter configuration • if *Off*, the antenna is off	Off
Battery mode	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: • --- ; with this option, the state of the antenna depends esclusively 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 **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 = ---**	---
Start Pairing	Command which starts Pairing between Trip unit and external device. To perform the operation correctly: 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 **NOTES:** • *execute the procedure within 120 seconds* • *the command is not available if communication with a device is activated*	---
Decouple devices	Command that deletes the list of devices coupled to the Trip unit **NOTE:** *the command is not available if communication with a device is activated*	---
Version	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 234).

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 233, 84).
- activate the presence of Rc Toroid and relative protection (page 233, 87).
- 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; sensor 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	The parameter defines the mode in which the parameters are written in the unit: • *Local*: parameter editing only via the display or service connector • *Remote*: parameter editing only remotely (Ekip Com modules) **NOTES**: • *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	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: • population of the *Modules* 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 Measurement (page 184)	
-	Menu of every module connected and detected (from page 191)	
Functions	Access to the *LOCAL Switch On* and *RESET signaling* functions (from page 89)	

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 password 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
Password	Password setting (page 50)	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 256).

View

The *View* menu provides various options:

Parameter	Description	Default
TFT orientation	Enables the orientation of the *Alarms List*, *Measuring Instruments* and *Main Measurements* pages to be set. The options are: Horizontal, Vertical clockwise, Vertical counter-clockwise	Horizontal
Customer page	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 132)	Off
Ammeter Phase	Allows the current to be displayed in the *Measuring instruments* page to be set from among the following options: Imax, I1, I2, I3, Ne (only in the 4P or 3P + N configuration)	Imax
Voltmeter Phase	Allows the voltage to be displayed in the *Measuring instruments* page to be set from among the following options: Vmax, V12, V23, V31	Vmax

Maintenance

The parameter allows an alarm, concerning maintenance of the unit, to be enabled/disabled. (page 113).

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*

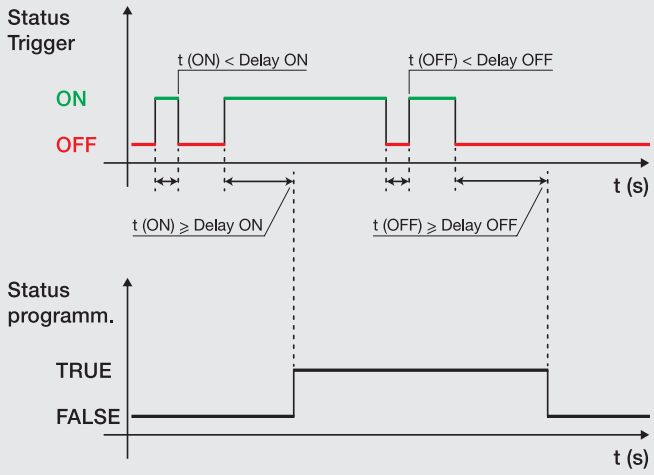


Figure 32

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. or MDGF and 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 or MDGF and 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 130).

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 The parameter enables the behavior of the Power led of the Trip unit and of all the connected modules to be modified; if activated (*Alive Mode on*), the Power leds act in the following way:

- *Ekip Touch*: flashes at 0.5Hz frequency
- *Modules*: if there are no communication errors, they synchronize with the led of Ekip Touch.

If deactivated, the Power leds on the respective devices come on with a steady light.

Open/Close Remote Direct Command The parameter controls 2 different command packages for remote opening and closing:

- *Enabled*: command 7 and 8 valid (direct Open and Close commands).
- *Disabled*: 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 *Request circuit-breaker opening* and *Request circuit-breaker closing* commands

Change Double Set of parameters always If activated, enables the set of parameters (*Adaptive Protections*) to be changed even when timing alarms are in progress.

Disabled by default.

Repeat zone selectivity S/I/G HW If Enabled, zone selectivity HW signals propagation logic applies in accordance with the table in the QT1 technical application notes. 1SDC007100G0205

If Disabled, the HW selectivity signal is not propagated by Ekip Touch

Zone selectivity input functions The zone selectivity inputs and certain of the outputs can be configured in this section:

- *Standard*: input or output operation as per standard zone selectivity logic; all selectivity functions are set as Standard. (1SDC007100G0205 or 1SDC007401G0201)
- *Customized*: the event that activates the zone selectivity input or output can be selected.

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).

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 at the first power-on and can be used to enter some of the parameters of the unit.

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 47).

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. 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.

Correct operation of the entire command system (Trip unit, Ekip Com Actuator and opening and closing coils) is checked by opening and closing the circuit-breaker.

IMPORTANT:

- **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: 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 1SDH000999R1002 and 1SDH001000R1002.

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 "3 - 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.

Specifically, if a trip unit with the function enabled detects a fault current higher than the threshold set for a particular protection, it activates the output blocking signal for the protection and, before opening, checks the corresponding input blocking signal:

- If the input is not active, the trip unit opens with a delay equal to the selectivity time set for the protection (which must be lower than the protection tripping time).
- 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 possibilty 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 "1 - 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 selecitivity 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_Forward, 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: *to check the line inconsistency, all the actors associated with the trip unit are checked, including those for which the function has not been enabled (i.e. the value “True” was not assigned to the Selectivity Actor parameter).*

- 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 mulfunctions 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.

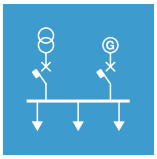
For a summary of the fault conditions to which the protections are applied and of the parameters to be set, see the chapter “Ekip Touch - Protections" starting on page 51.

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".

1 - 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 13, 16).

Ekip Touch Parameter

Certain configuration parameters of the function are available in the *Settings - Power Controller* menu 46).

Parameter	Description	Default
Enable	Activates/deactivates the function and its availability in the parameters menu	OFF
Load Operating Mode	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
Power Limits	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
Ea	Expected energy
ΔT	Time elapsed in the evaluation window
LOADS	Number of loads monitored
LOADS Shed	Number of shed loads
Sp	Load shedding priority setting
T	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 47):

Submenus	Information provided
Load Input Status	Status of the loads (from Load 1 to Load 15): open or closed
Load Active	Load configuration (from Load 1 to Load 15): active or inactive

2 - 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 13, 16).

Ekip Touch Parameter

Certain configuration parameters of the function are available in the *Settings - Load Shedding* menu (page46).

NOTE: *it is advisable to first configure the parameters via Ekip Connect, and only then operate on the Trip unit*

Parameter	Description	Default
Enable	Activates/deactivates the function and its availability in the parameters menu	Off
Version	Display of the version of the function, Basic or Adaptive **NOTE**: *with the Basic version, the only parameter available is Reconnection Timeout*	--
Solar Plant present	Establishes whether the microgrid includes a solar energy system (Off/On)	Off
SolarPlant NominalPower	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
ATS	Establishes whether the installation has an ATS system (Off/On)	Off
Generator Power	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	. . . .
Frequency slope	Defines the instantaneous frequency variation that activates *Load shedding* 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
F W Warning (1)	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
Reconnection Timeout	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
F	Frequency measured
Fn	Nominal frequency of the Trip unit
LOADS	Number of loads monitored
LOADS Shed	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 47).

Submenus	Information provided
Load Input Status	Status of the loads (from Load 1 to Load 15): open or closed
Load Active	Load configuration (from Load 1 to Load 15): active or inactive

3 - 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 W1* to be set, as described below.

IMPORTANT: consult the Technical catalog or White paper of the function for full details (page 13, 16).

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
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	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 1.3 Un, in 0.05 Un steps	1,1 Un
Time	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 83).

Protection V DIR [ANSI 27VD]

If the positive sequence measured by the Trip unit exceeds or falls below threshold Upos (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
Enable	Activates/deactivates the control threshold of the parameters and their availability in the menu	Off
Direction	Defines whether sequence monitoring is performed after the measured sequence has dropped (Down) or been exceeded (Up)	Down
Threshold	Establishes the value that activates the alarm. The value is given as both absolute value (Volts) 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
Enable	Activates/deactivates monitoring of the parameters and their availability in the menu	Off
Threshold	Establishes the value that activates the alarm. The value is given as both absolute value (Volts) 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
Enable	Activates/deactivates monitoring of the parameters and their availability in the menu	Off
Signal source	Defines whether the line-to-line voltages to be verified are those from the internal sockets (*Measurement* module) or from *Ekip Synchrocheck*, if present. **NOTE**: *if Ekip Synchrocheck is set, monitoring will refer to one single voltage*	Meas.
Threshold DOWN	Establishes the lower limit value of the control band, given as both absolute value (Volts) 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
Threshold UP	Establishes the upper limit value of the control band, given as both absolute value (Volts) 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
Time	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
Enable	Activates/deactivates monitoring of the parameters and their availability in the menu	Off
Signal source	Defines whether the line-to-line voltages to be verified are those from the internal sockets (*Measurement* module) or from *Ekip Synchrocheck*, if present. **NOTE**: *if Ekip Synchrocheck is set, monitoring will refer to one single voltage*	Meas.
Threshold DOWN	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
Threshold UP	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
Time	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

If the frequency measured by the Trip unit exceeds or falls below the threshold (depending on the direction set), the corresponding alarm will be activated (no TRIP).

The *Protections-Advanced-Warnings-F W Warnings* menu includes the control threshold submenu in which the parameters can be entered:

Parameter	Description	Default
Enable	Activates/deactivates the control threshold of the parameters and their availability in the menu	Off
Direction	Defines whether frequency monitoring is performed after the measured sequence has dropped (Down) or been exceeded (Up)	Down
Threshold	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 [(1)]	I1= 1 In; t1= 144 s; curve= t= k/I^2; prealarm: 90% I1
I	I3= 4 In; startup= OFF
Harmonic distortion	On
Rc [(2)]	Idn= 3 A; Tdn= 0,06 s

[(1)] protection always active; a model L Disable rating Plug must be used to disable it
[(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	Top → Bottom
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 structure of the breaking part differs between selective or current-limiting circuit-breaker.

The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 33) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 34 for IEC and Figure 35 for UL) and of a fixed part (see Figure 36 for IEC and Figure 37 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.

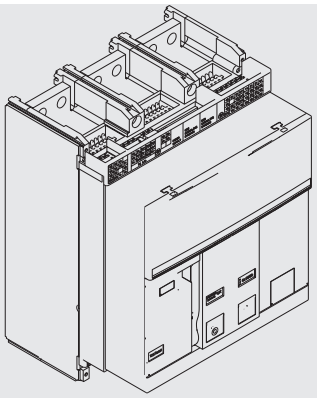


Figure 33

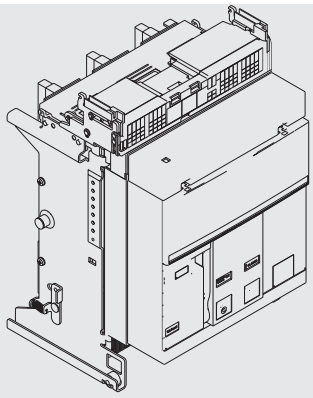


Figure 34

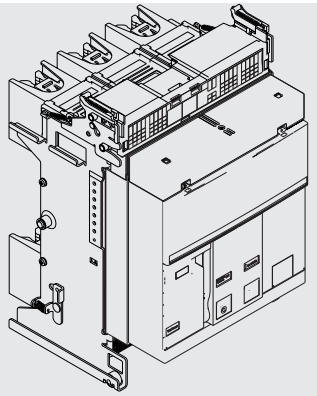


Figure 35

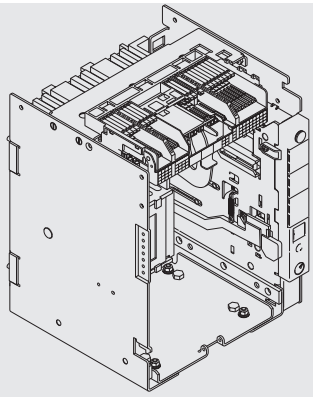


Figure 36

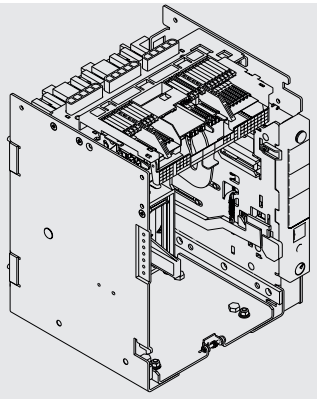


Figure 37

Description of the circuit-breaker front panel

The following are the main components of the circuit-breaker:

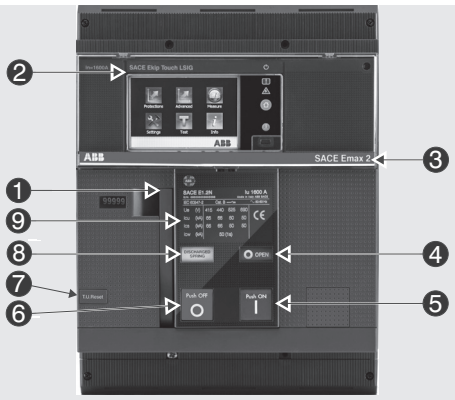


Figure 38

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

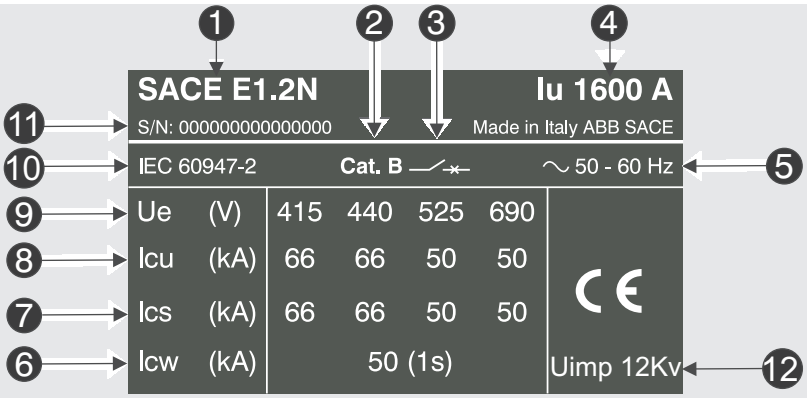


Figure 39

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

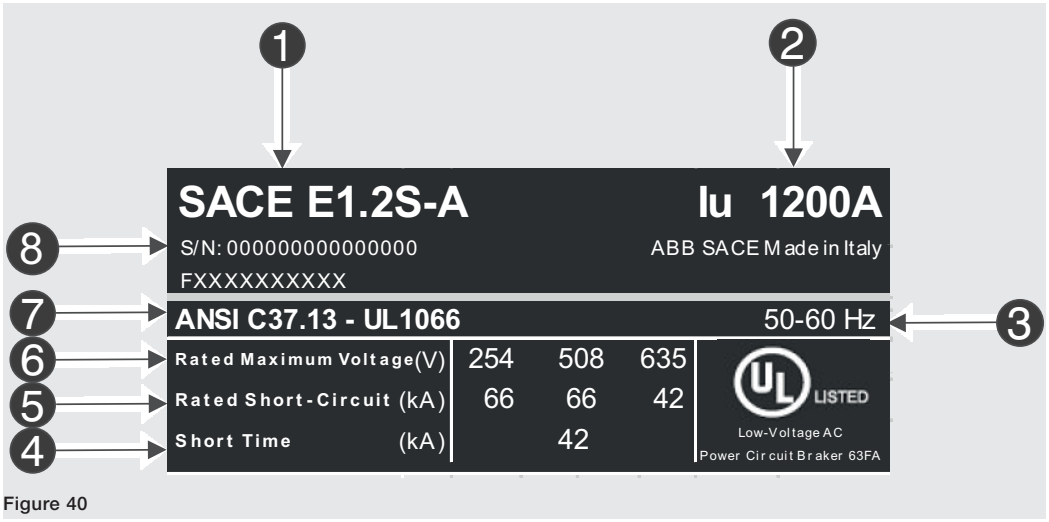


Figure 40

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 41.
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 42.

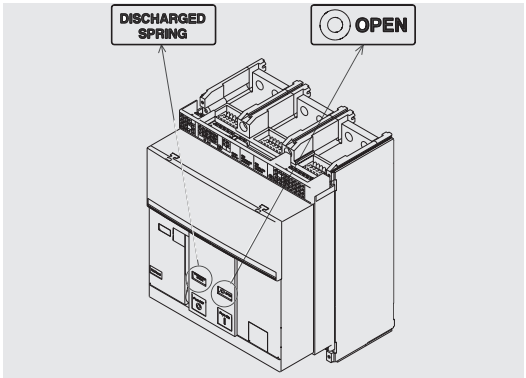


Figure 41

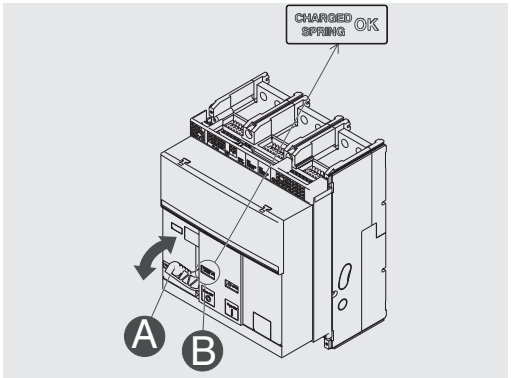


Figure 42

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 43.
4. Closing - Press the closing pushbutton “I - Push ON” as indicated in Figure 44.

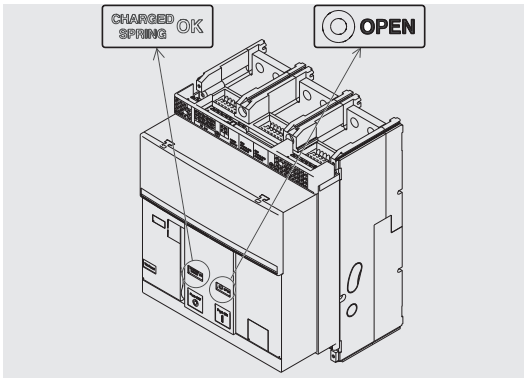


Figure 43

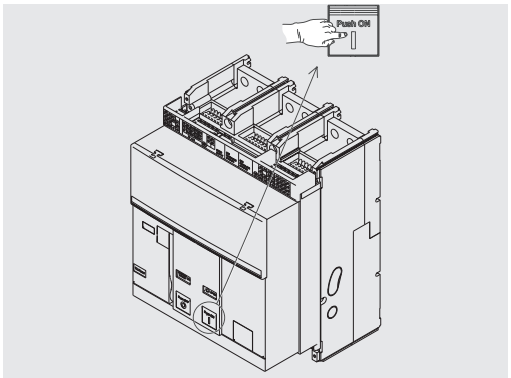


Figure 44

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 45.
6. Opening - Press the opening pushbutton “O - Push OFF” as indicated in Figure 46.

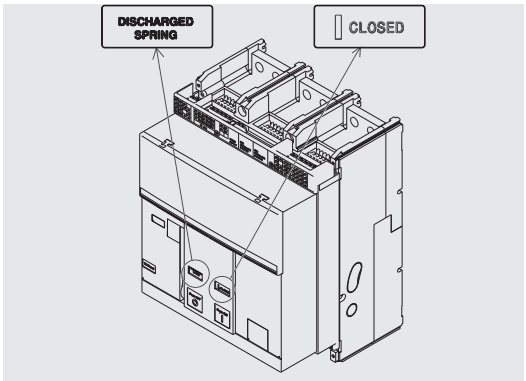


Figure 45

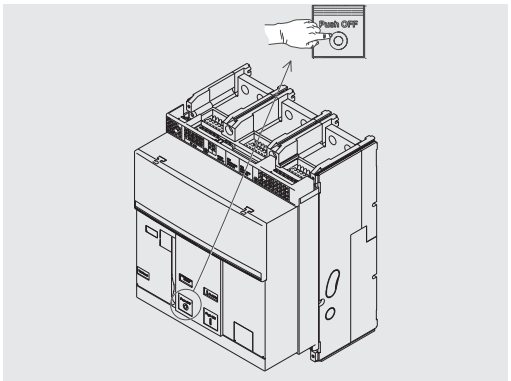


Figure 46

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 47.

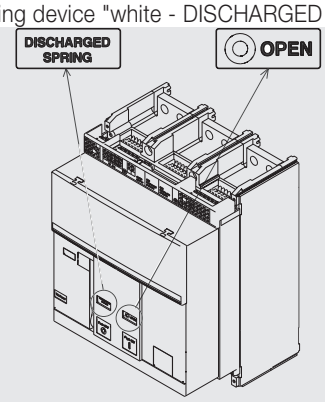


Figure 47

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 48).
2. Circuit-breaker open with springs charged (see Figure 49).
3. Circuit-breaker closed with springs discharged (see Figure 50).
4. Circuit-breaker closed with springs charged (see Figure 51). This state occurs when after closing (see step 4 - Figure 51) the springs are recharged manually or automatically by the gearmotor (if provided).

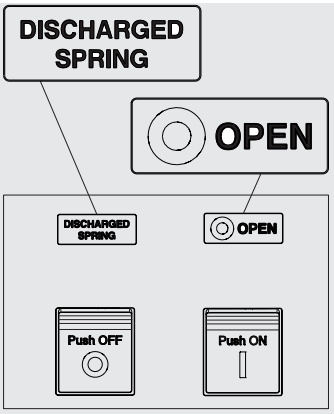


Figure 48

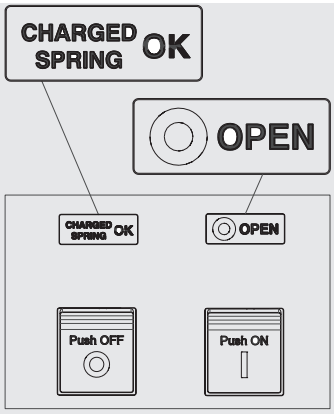


Figure 49

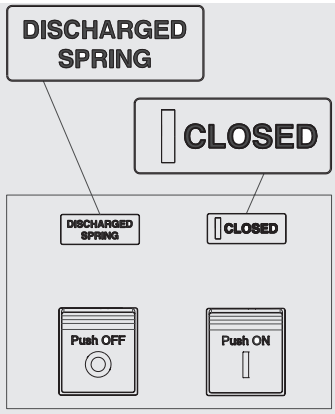


Figure 50

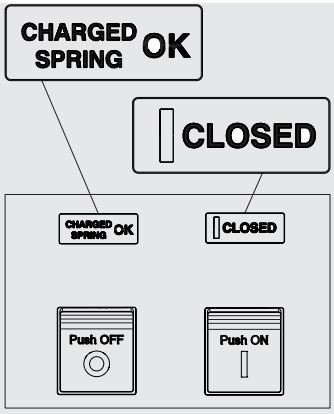


Figure 51

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.

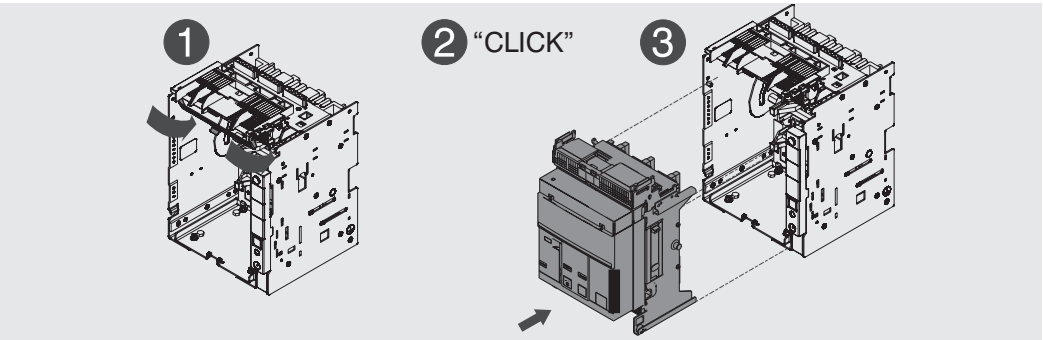


Figure 52

2. Make sure that signalling device on the fixed part indicates the **DISCONNECT** position. See Figure 53.

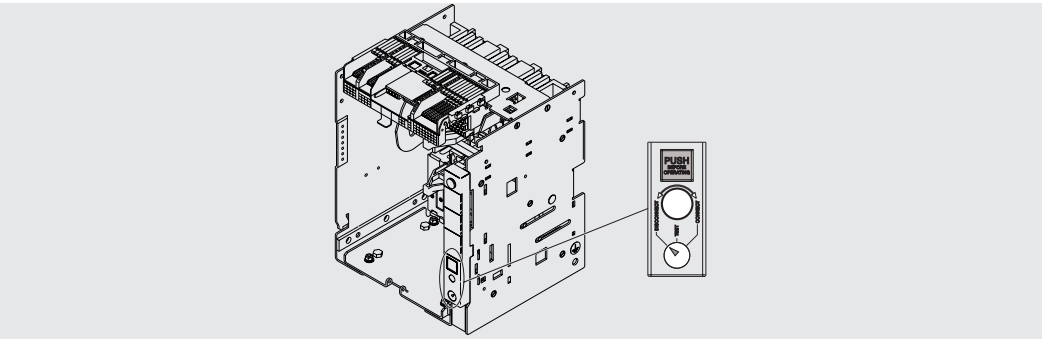


Figure 53

3. Position the moving part in the fixed part and push until it comes to a stop. See Figure 54 and Figure 55.

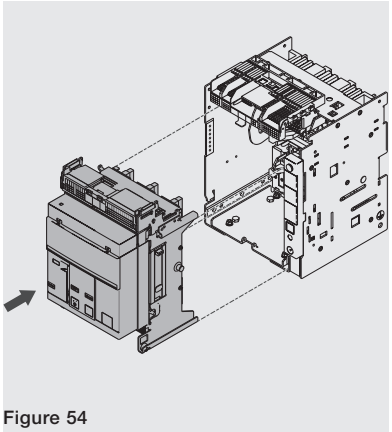


Figure 54

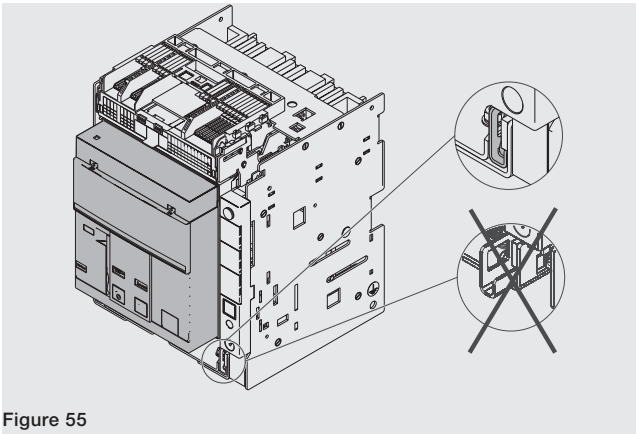


Figure 55

Continued on the next page

4. Extract the disconnection crank from its housing See Figure 56.
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 57.

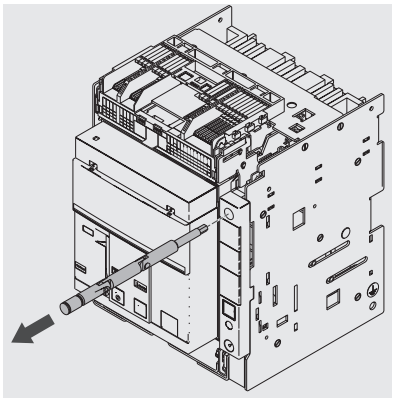


Figure 56

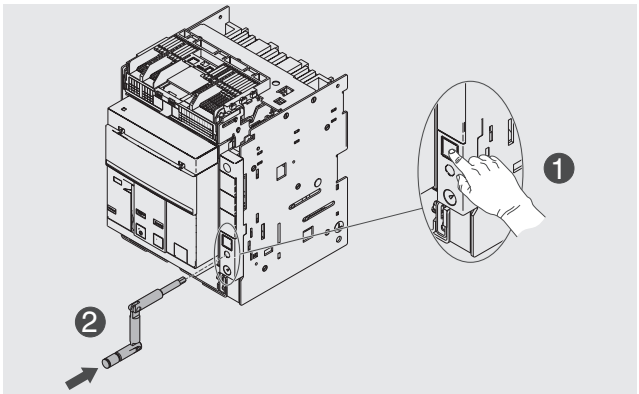


Figure 57

6. Keep breaker pushed. Turn handle clockwise until pushbutton projects and signaling device indicates that circuit-breaker is in position **TEST**. See Figure 58.

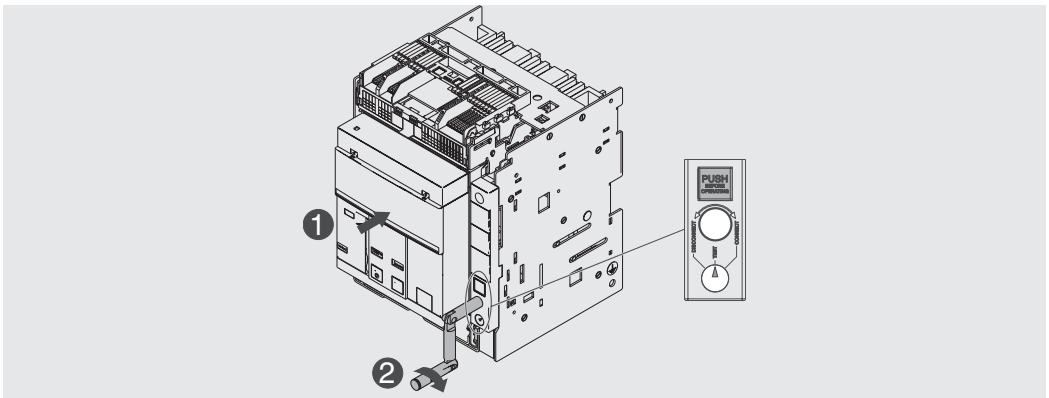


Figure 58

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 59.

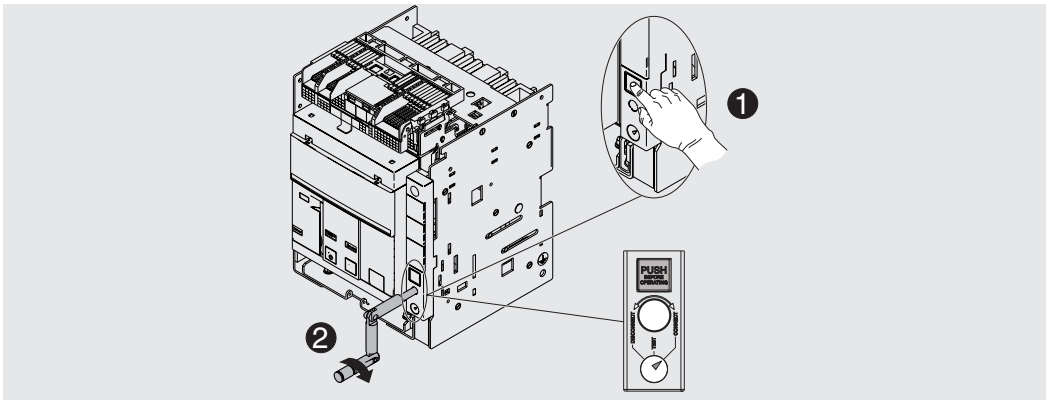


Figure 59

Continued on the next page

8. Extract the crank. See Figure 60.
9. Replace the crank in its housing See Figure 61.

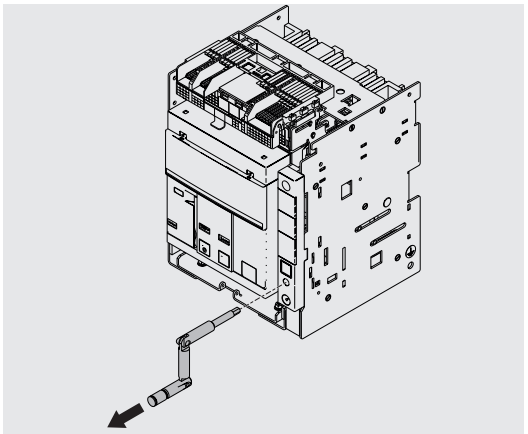


Figure 60

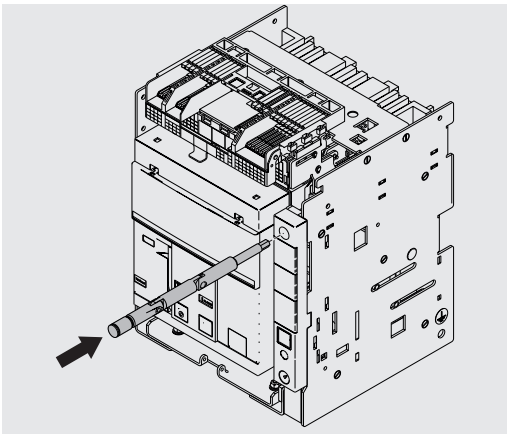


Figure 61

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 62.

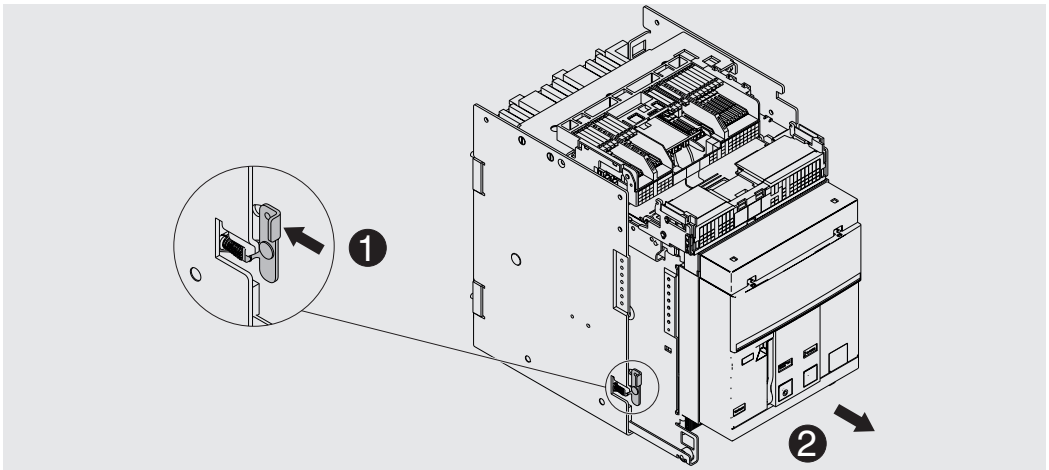


Figure 62

⚠ **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 63).
- circuit-breaker in test position (see Figure 64).
- circuit-breaker in CONNECT position (see Figure 65).

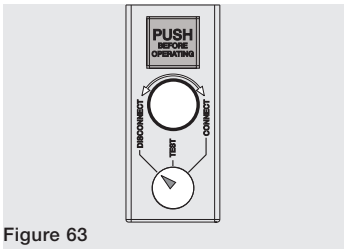


Figure 63

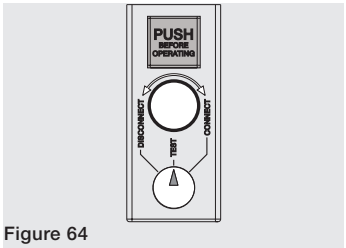


Figure 64

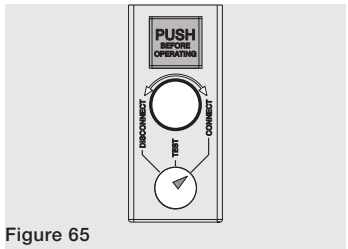


Figure 65

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 structure of the poles differs between selective or current-limiting circuit-breaker.

The circuit-breaker is available in two types:

- fixed version
- withdrawable

The circuit-breaker in fixed version (see Figure 66) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 67) and of a fixed part (see Figure 68 for IEC and Figure 69 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.

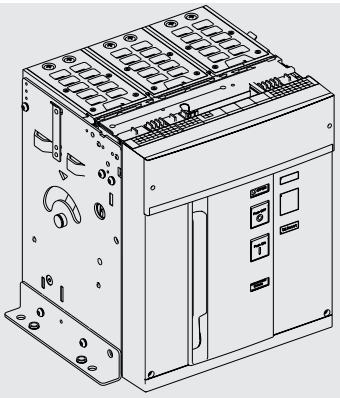


Figure 66

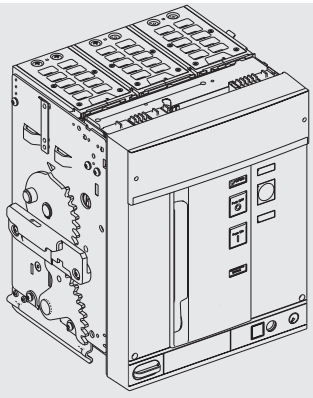


Figure 67

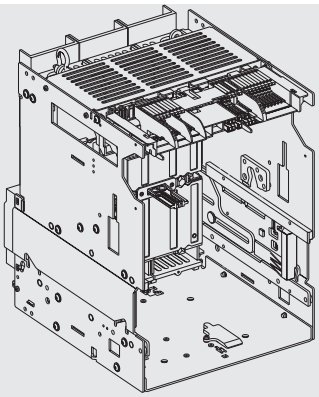


Figure 68

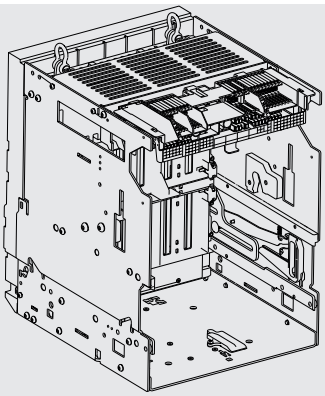


Figure 69

Description of the circuit-breaker front panel

The following are the main components of the circuit-breaker:

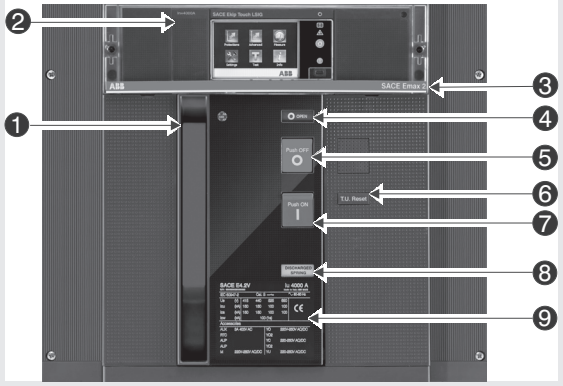


Figure 70

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

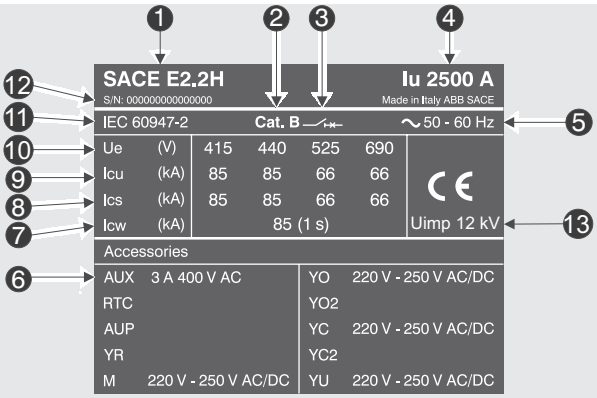


Figure 71

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

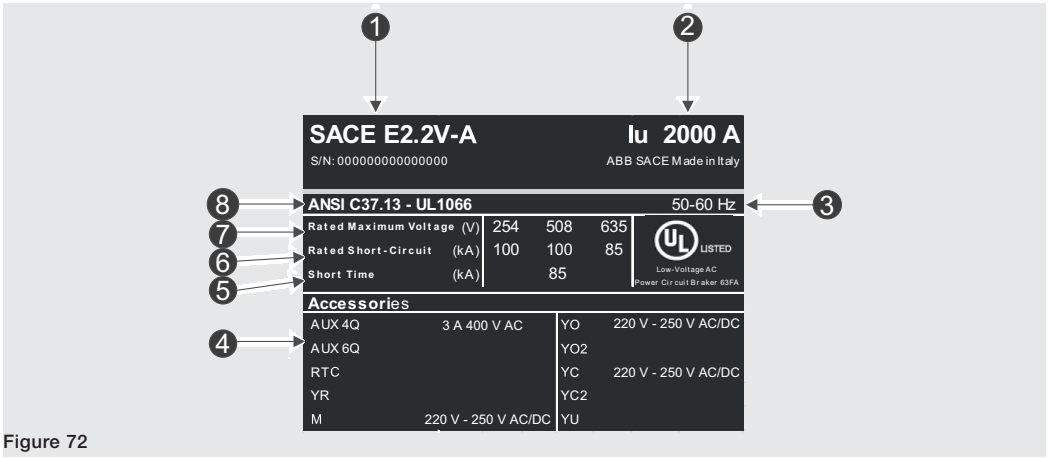


Figure 72

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 73.
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 74.

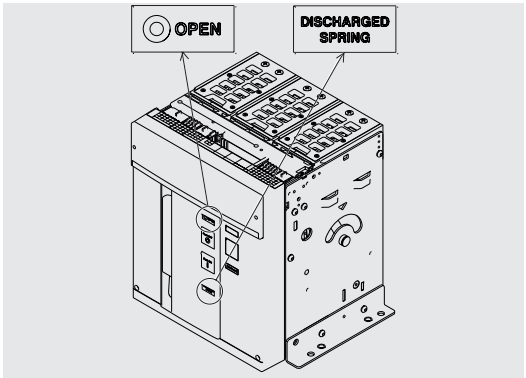


Figure 73

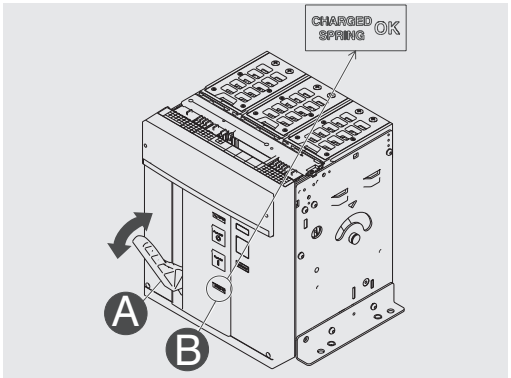


Figure 74

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 75.
4. Closing - Press the closing pushbutton “I - Push ON” as indicated in Figure 76.

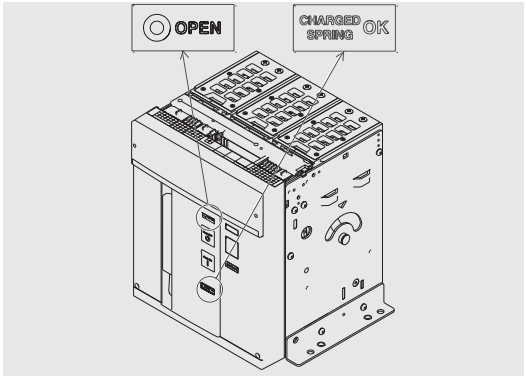


Figure 75

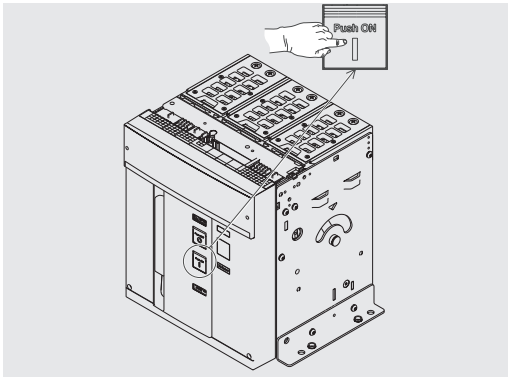


Figure 76

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 77.
6. Opening - Press the opening pushbutton “O - Push OFF” as indicated in Figure 78.

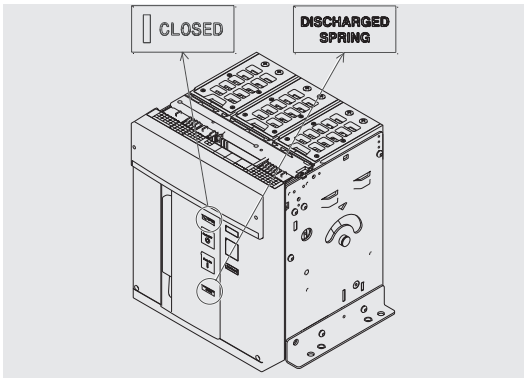


Figure 77

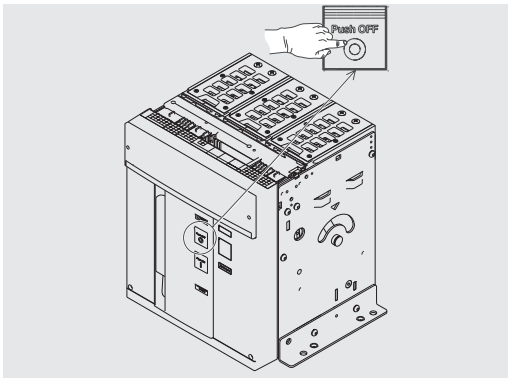


Figure 78

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 79.

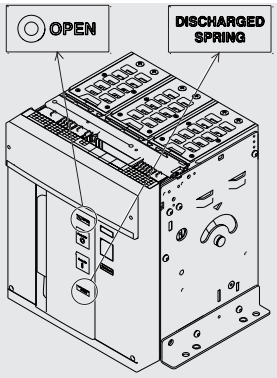


Figure 79

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 80).
2. Circuit-breaker open with springs charged (see Figure 81).
3. Circuit-breaker closed with springs discharged (see Figure 82).
4. Circuit-breaker closed with springs charged and not ready to close (see Figure 83). 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 84). 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.*

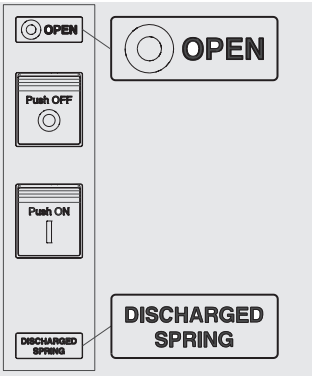


Figure 80

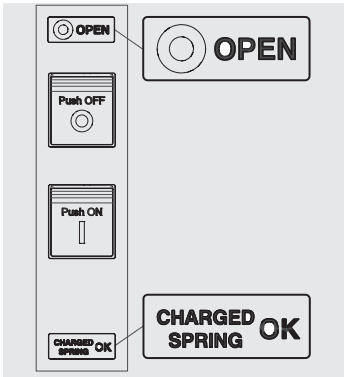


Figure 81

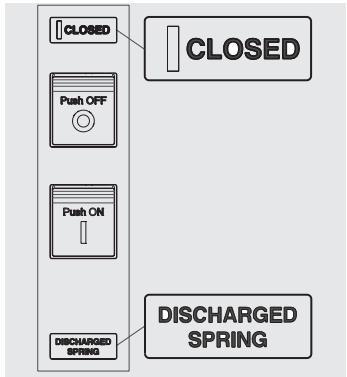


Figure 82

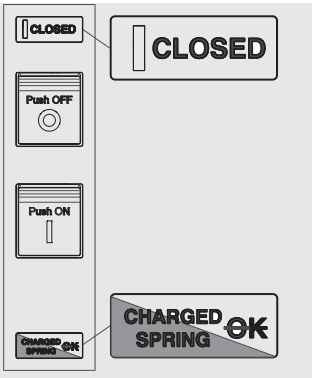


Figure 83

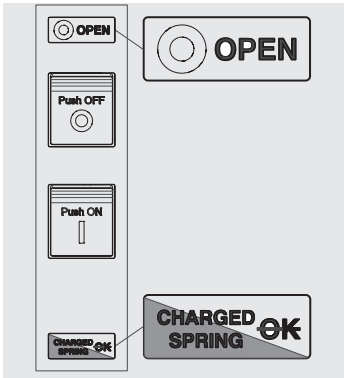


Figure 84

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.

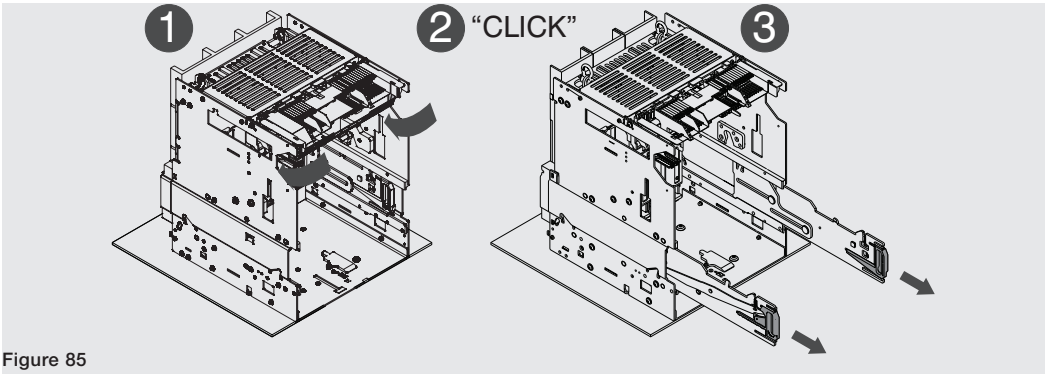


Figure 85

2. Position the lifting plates on the mobile part making sure that the tongue of the plates is latched properly. See Figure 86.

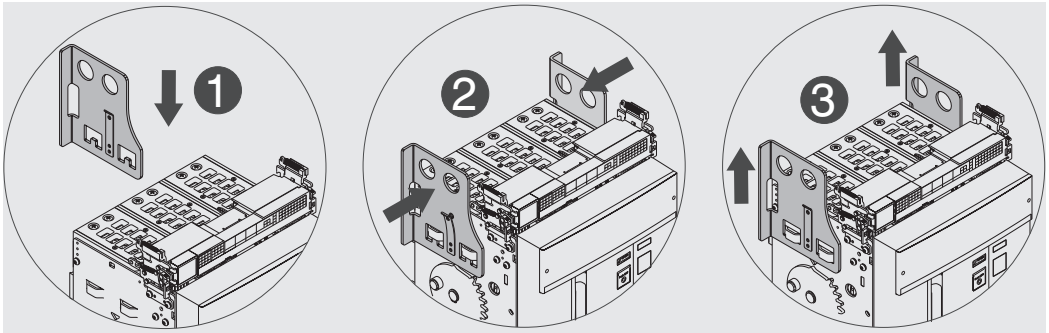


Figure 86

3. Extract the guides of the fixed part using the appropriate levers. See Figure 87.
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 88.

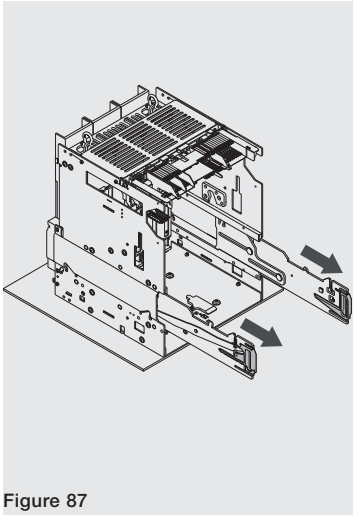


Figure 87

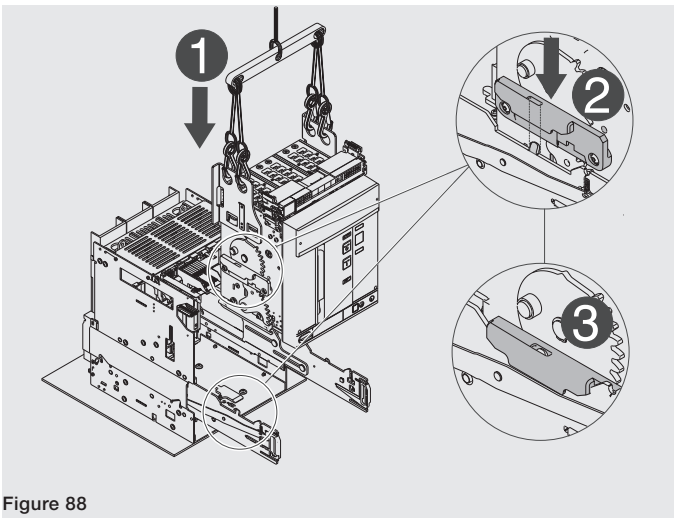


Figure 88

Continued on the next page

5. Unlatch the tongue and remove the lifting plates from the moving part. See Figure 89.

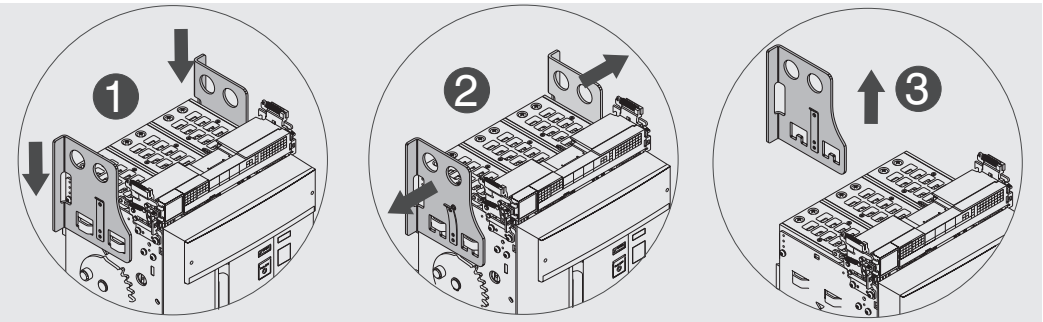


Figure 89

6. Make sure that the signalling device indicates the **DISCONNECT** position. See Figure 90.

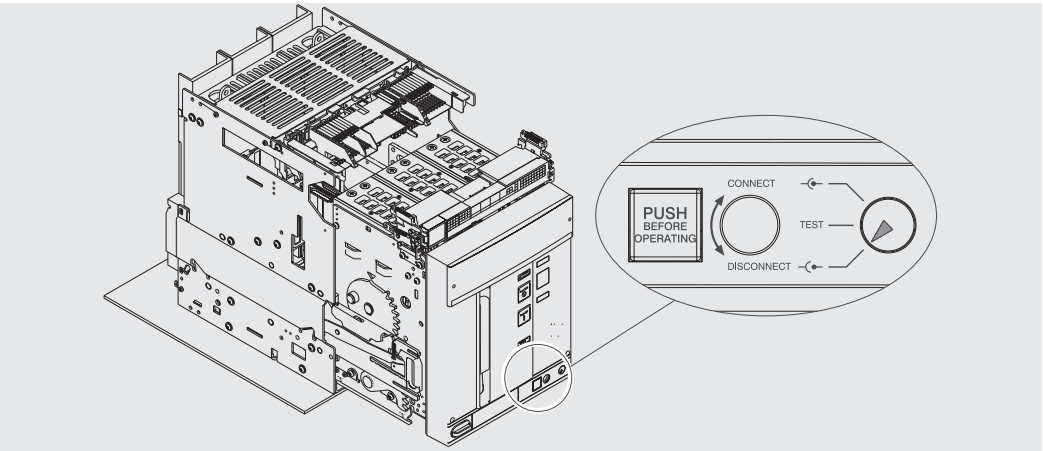


Figure 90

7. Grip the guide levers of the fixed part and push them until the moving part stops. See Figure 91.

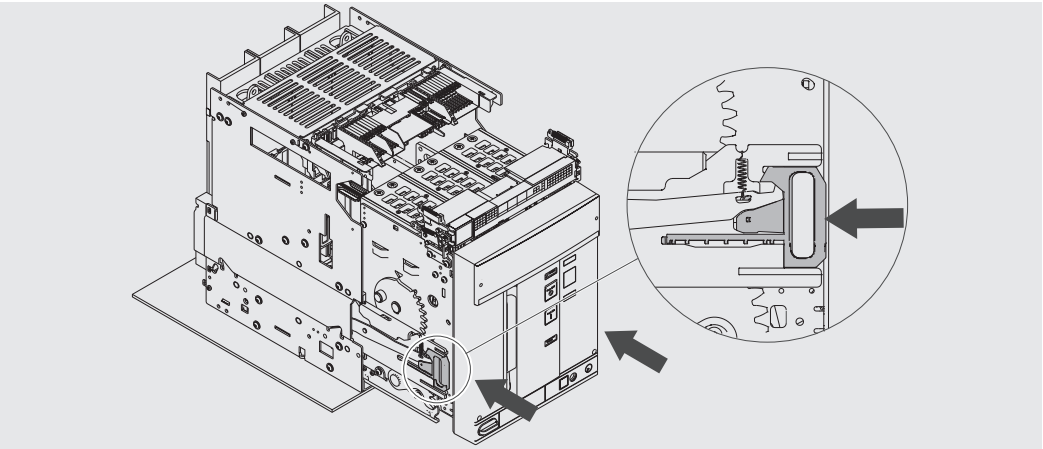


Figure 91

Continued on the next page

8. Extract the disconnection crank from its housing See Figure 92.
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 93.

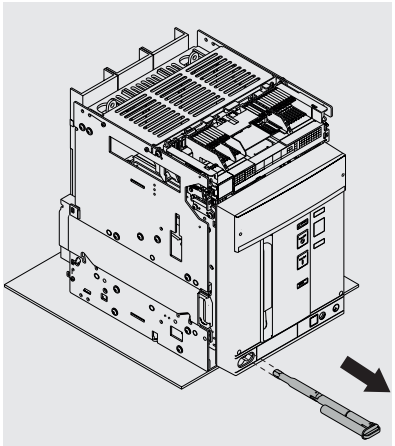


Figure 92

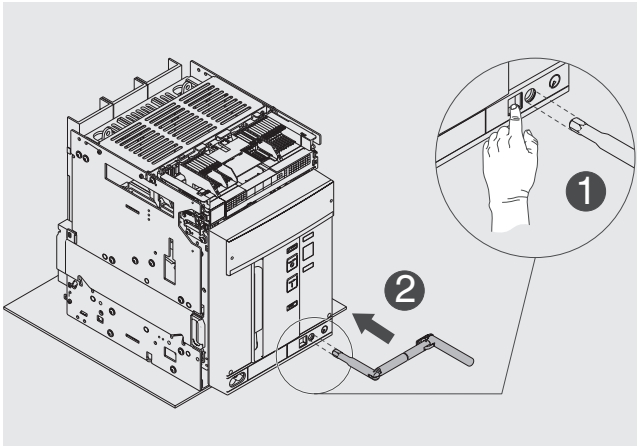


Figure 93

10. Turn handle clockwise until pushbutton projects and signaling device indicates that circuit-breaker is in position **TEST**. See Figure 94.

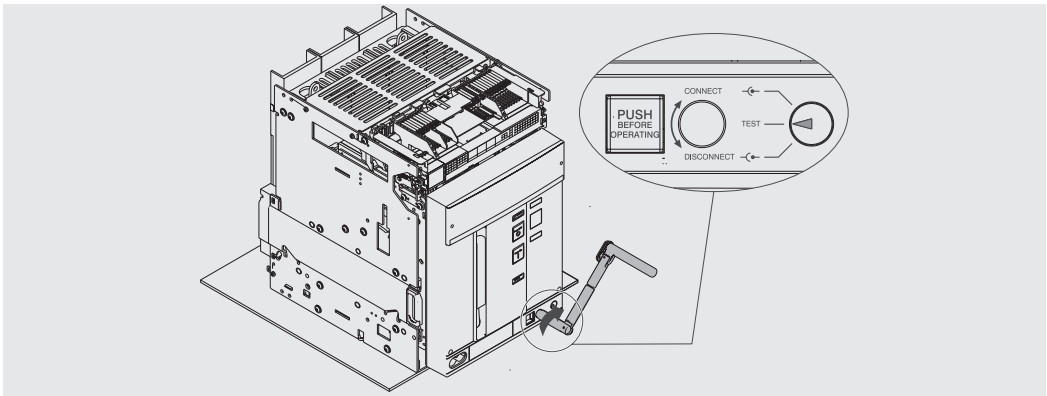


Figure 94

11. Press lock pushbutton and turn handle clockwise until pushbutton projects and signaling device indicates that circuit-breaker is in position **CONNECT**. See Figure 95.

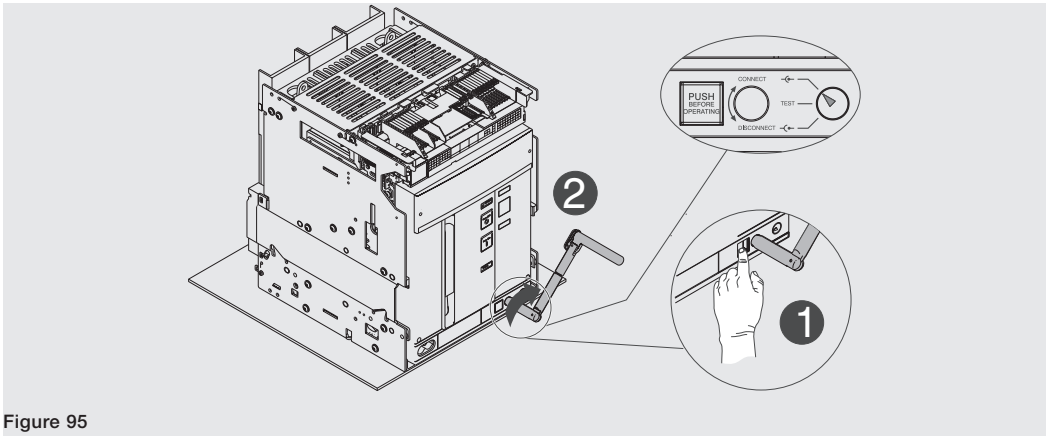


Figure 95

Continued on the next page

12. Extract the crank. See Figure 96.
13. Replace the crank in its housing See Figure 97.

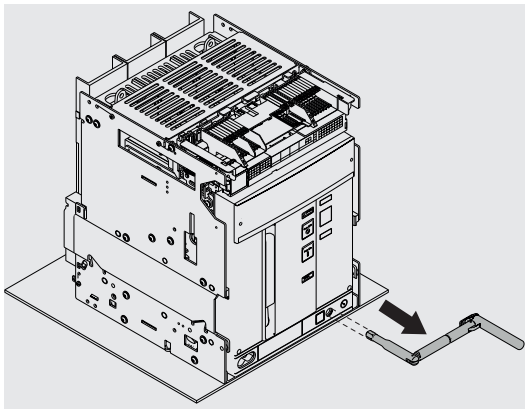


Figure 96

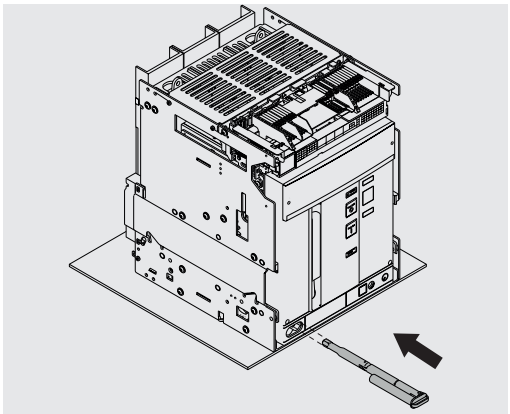


Figure 97

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.

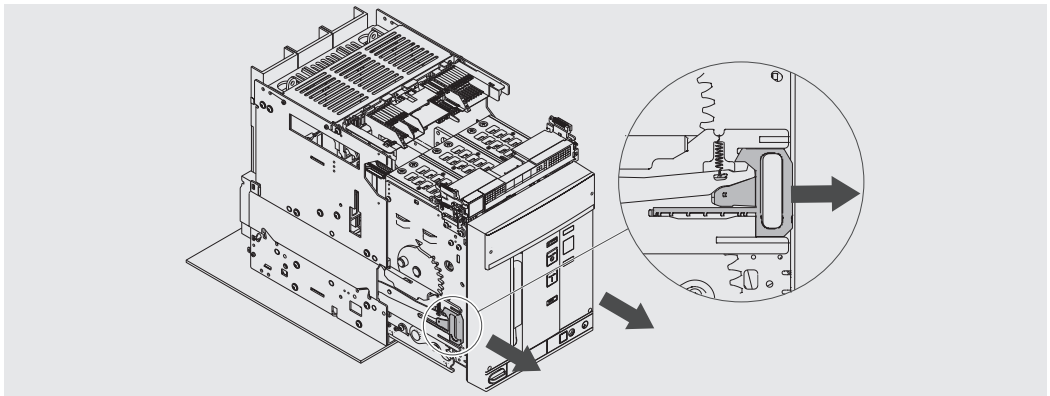


Figure 98

Continued on the next page

Always use both levers of the guides on the fixed part when racking out the circuit-breaker. See Figure 98.

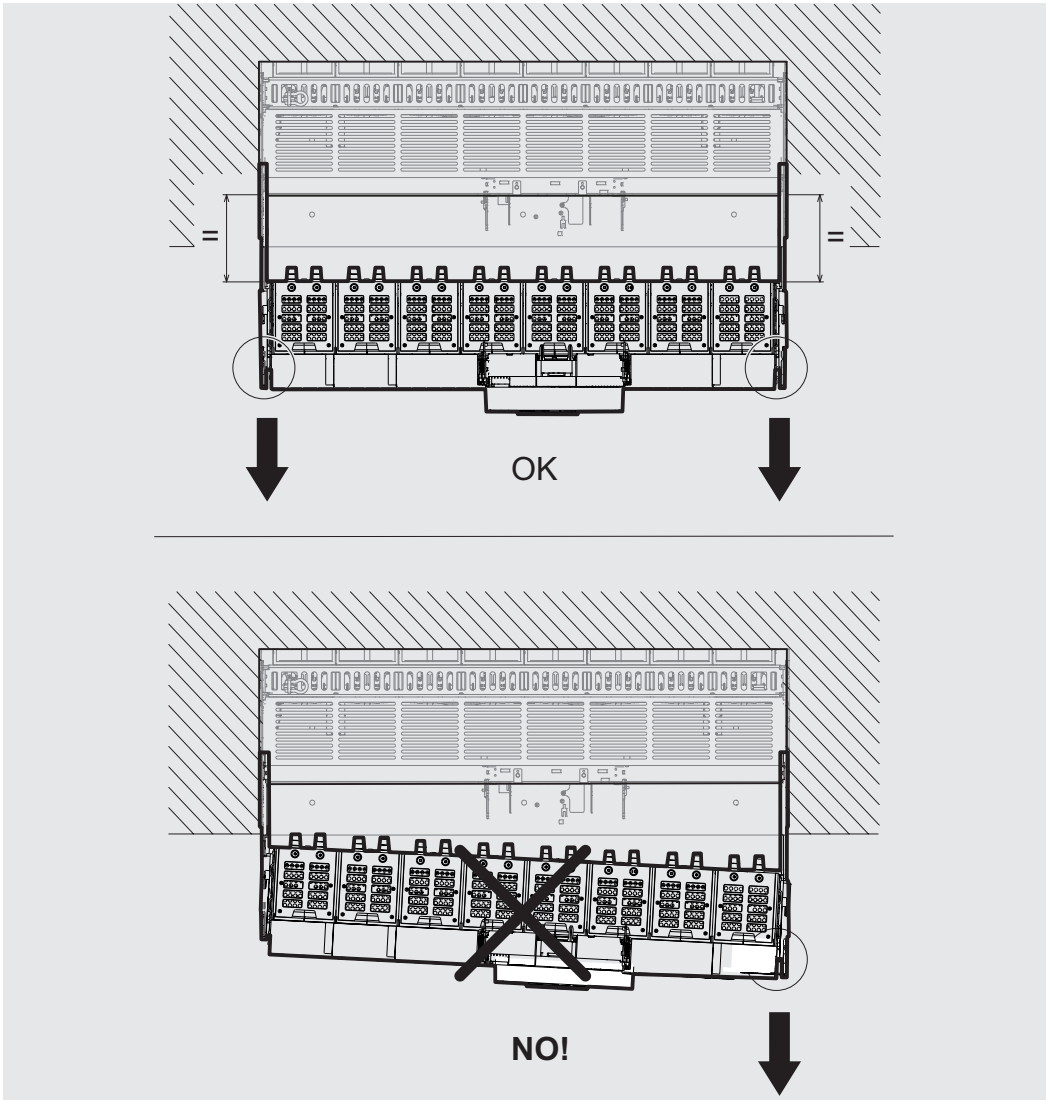


Figure 99

⚠ **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 99.**

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 100)
- circuit-breaker in test position (see Figure 101)
- circuit-breaker in CONNECT position (see Figure 102)

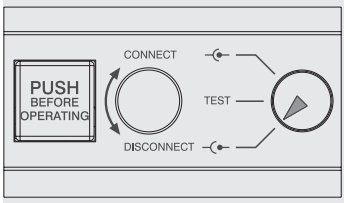


Figure 100

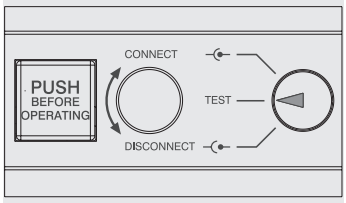


Figure 101

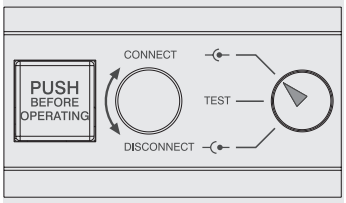


Figure 102

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 "4 - Installation" on page 165 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) Ue	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 - 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:

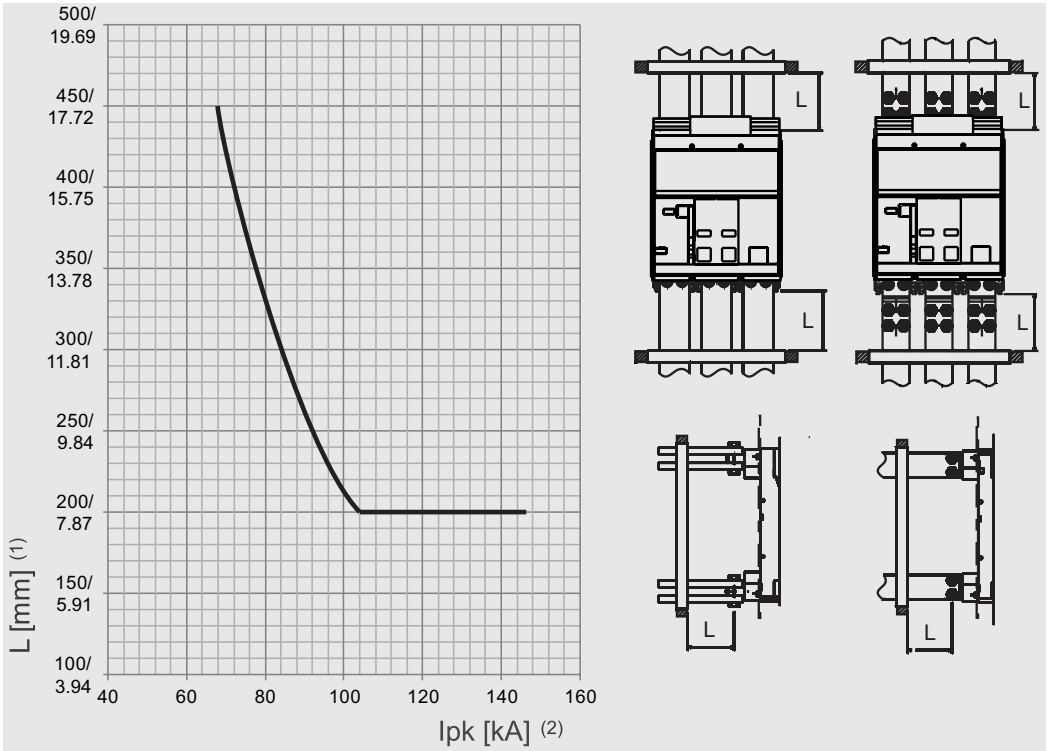


Figure 103

(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/E9, E4.2/E III-IV Fixed SHR IEC
- 1SDH001001R0105 - E4.2/E9, E4.2/E III-IV Withdrawable SHR IEC
- 1SDH001001R0106 - E4.2/E9, E4.2/E III-IV Fixed SVR IEC
- 1SDH001001R0107 - E4.2/E9, E4.2/E 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:

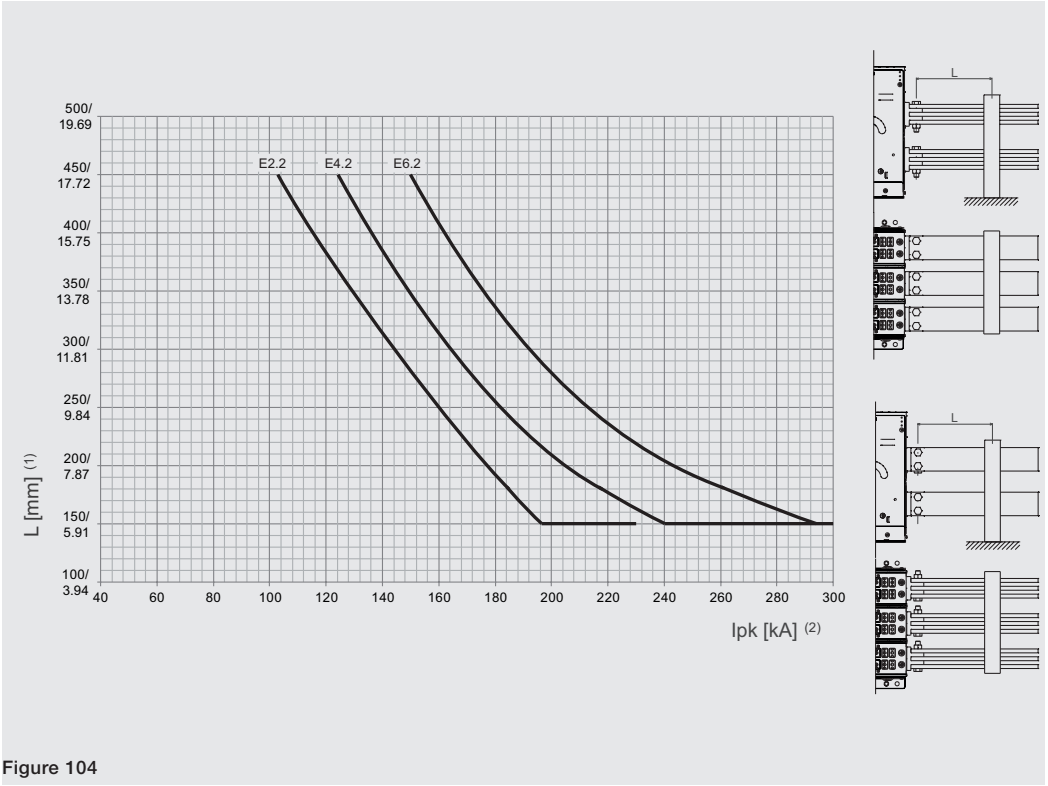


Figure 104

(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.

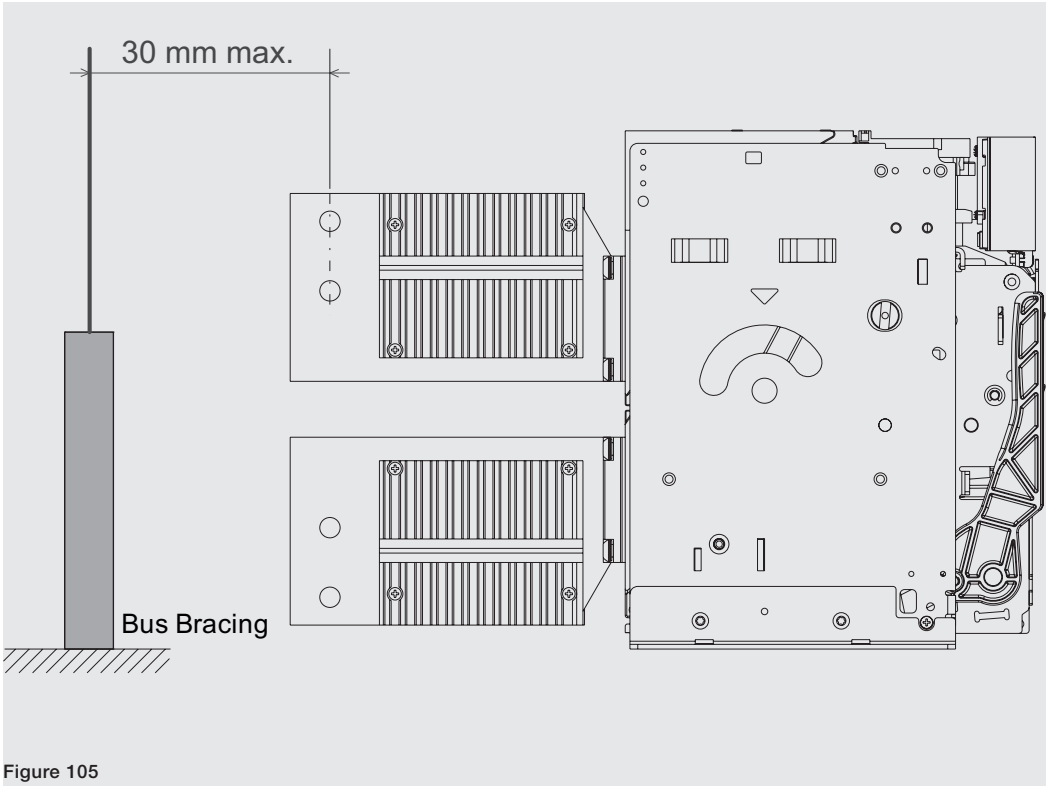


Figure 105

Continued on the next page

Positioning of anchor plates for Terminals FL

The anchor plates must be positioned as indicated in the figure.

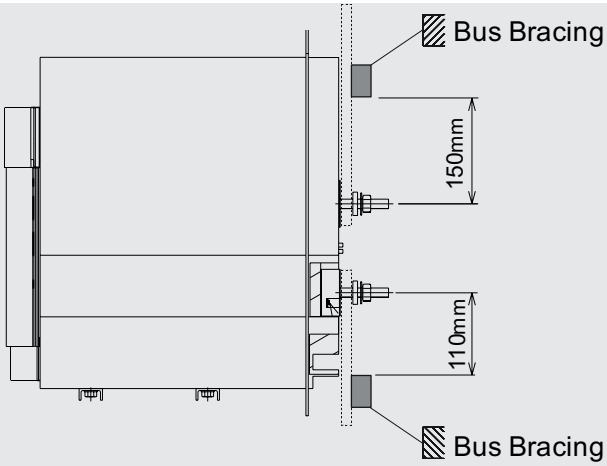


Figure 106

>690V version IEC circuit-breakers

>690V disconnectors and circuit-breakers are available in the following configurations:

Circuit-breaker	Voltage	Version
E1.2/E9	800V	F (1)
	800V	W (2)
E2.2/E9	800V/900V	F (3)
E4.2/E9	800V/900V	F (3)
E6.2/E9	800V/900V	F (3)

(1) With front terminals (F) and high terminal covers (HTC)
(2) With positionable rear terminals (HR/VR) and phase separators (PB)
(3) With insulating protections

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.

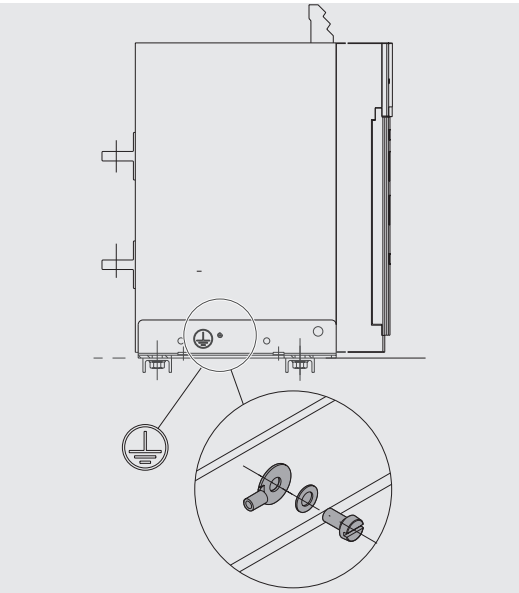


Figure 107

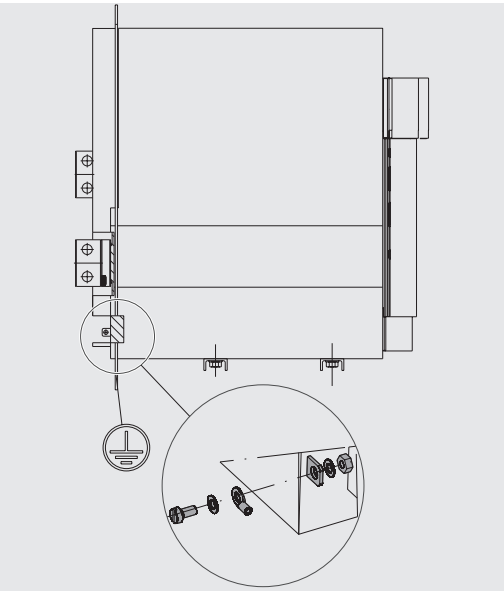


Figure 108

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

The connection of a circuit-breaker to the power circuit is performed using the connection busbars of the electric switchgear fixed to the terminals of the circuit-breaker. The sizing of the busbars is specified by the designer of the electrical switchgear.

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 swell as the tables with some examples of the amount and sizes of the connections that can be used for each type of circuit-breaker:

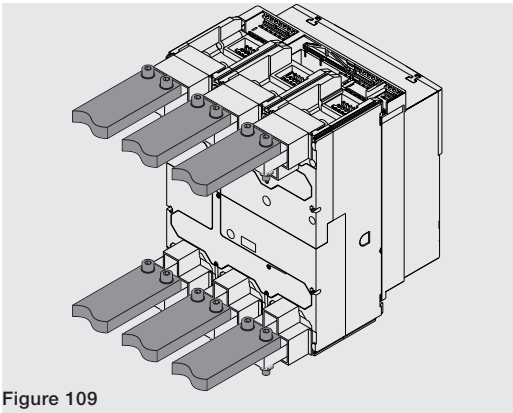


Figure 109

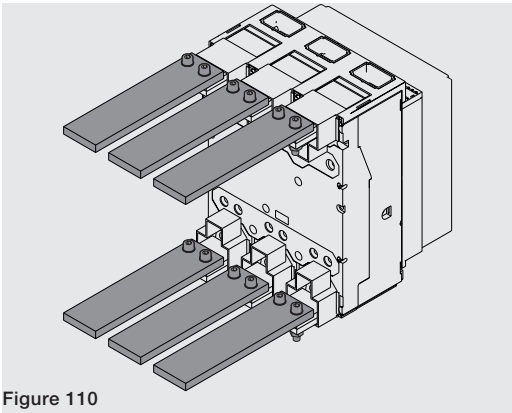


Figure 110

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 swell as the tables with some examples of the amount and sizes of the connections that can be used for each type of circuit-breaker:

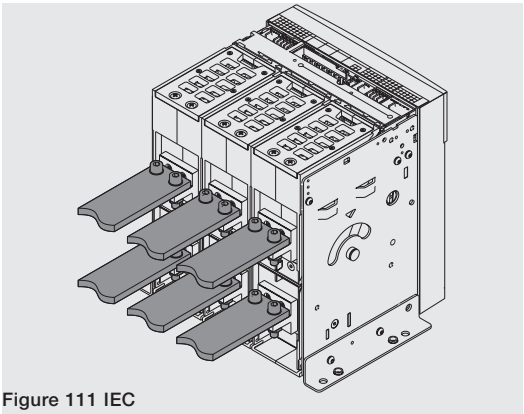


Figure 111 IEC

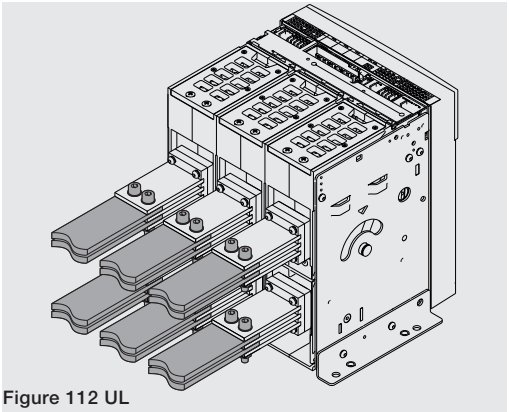


Figure 112 UL

circuit-breaker IEC 60947	Iu (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	Iu (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 113.
- Guarantee the maximum use of the surface of the terminal. See the example Figure 114.
- 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 115.
- 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 116.

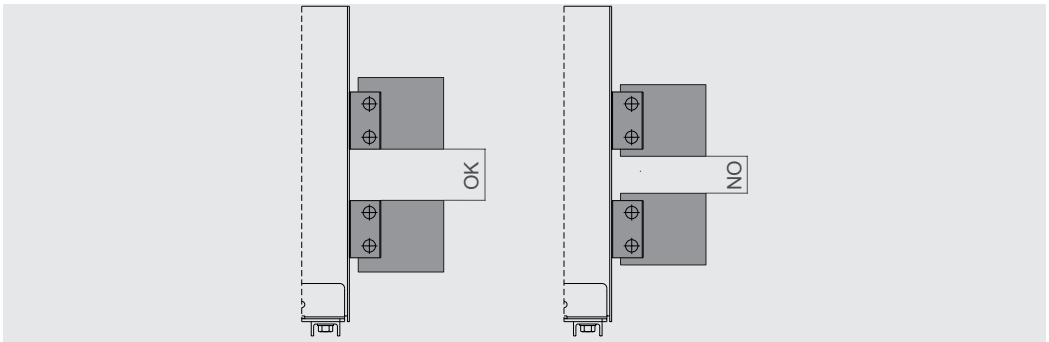


Figure 113

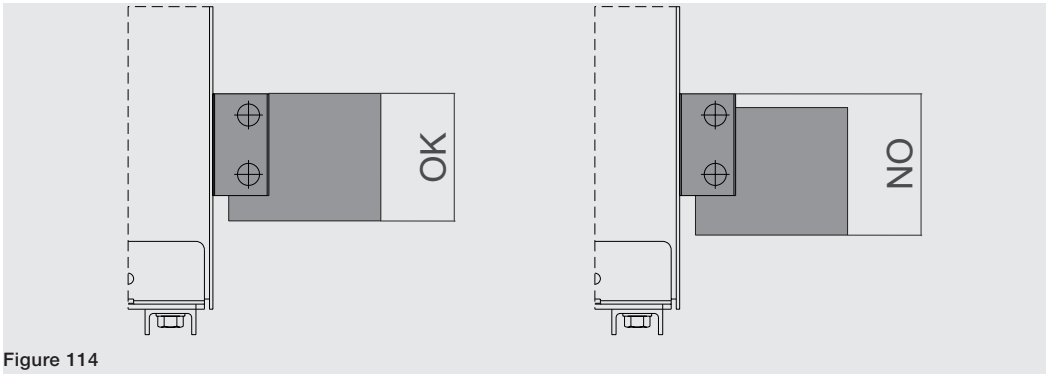


Figure 114

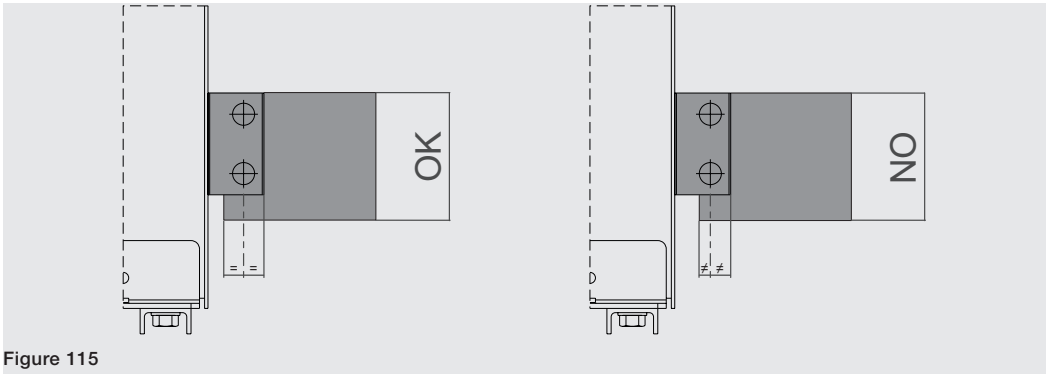


Figure 115

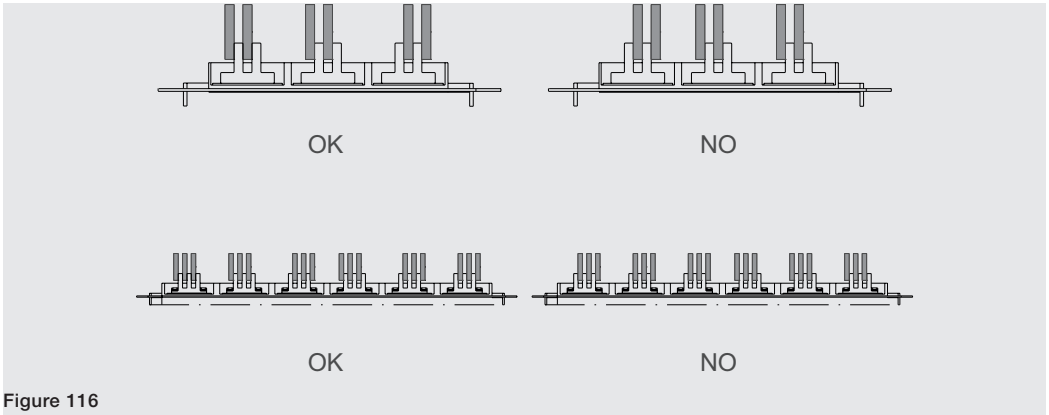


Figure 116

5 - 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 Iu. 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 Iu at 50/60 Hz.

Iu	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

Iu	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%

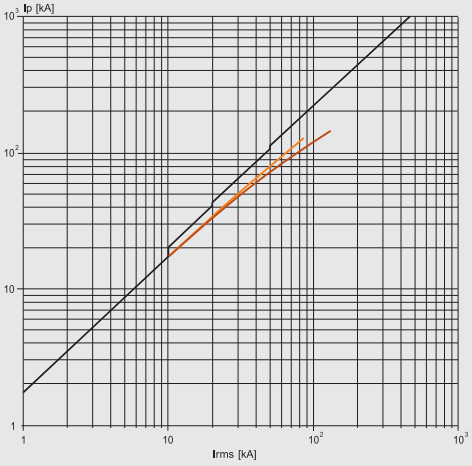
Emax 2 E6.2	Temperature [°C]						
	< 40	45	50	55	60	65	70
E6.2 4000	100%	100%	100%	100%	100%	100%	100%
E6.2 5000	100%	100%	100%	100%	100%	98%	95%
E6.2 6300	100%	100%	95%	91%	87%	84%	81%

Current limiting curve

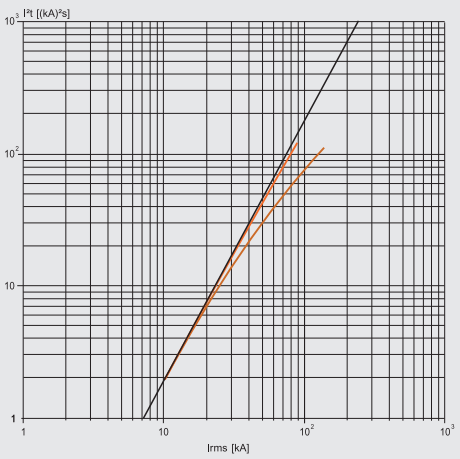
SACE Emax 2 series offer current-limiting circuit-breakers in E1.2 size up to 1600 A. These circuit-breakers are characterized from the constructional point of view by the following features:

- Dedicated stored energy operating mechanism that reduces opening times.
- Specific main contacts that, by exploiting the electrodynamic forces generated by the short-circuit, accelerate the opening of the main contacts.

These features enable rapid breaking and consequently reduce the electromechanical and thermal stress suffered by the installation during a short-circuit. The Current-limiting circuit-breakers are characterized by short-time withstand currents that are not particularly high and are therefore not suitable for applications where selectivity towards more downstream devices is required or in case of devices with high inrush currents in the start-up phase.



E1.2 L - Current-limiting curves



E1.2 L - Pass-through specific energy limitation curves

Accessories

1 - Overview

Introduction

All the circuit-breakers have a series of electrical and mechanical accessories that can be applied according to the circuit-breaker type, and a series of electronic accessories that can be applied according to the type of Ekip trip unit equipping the circuit-breaker.

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

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
	Toroid S.G.R.	-	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.

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
- lifting plates for E2.2-E4.2-E6.2 circuit-breakers
- 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
- lifting plates for E2.2-E4.2-E6.2 circuit-breakers
- 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

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).

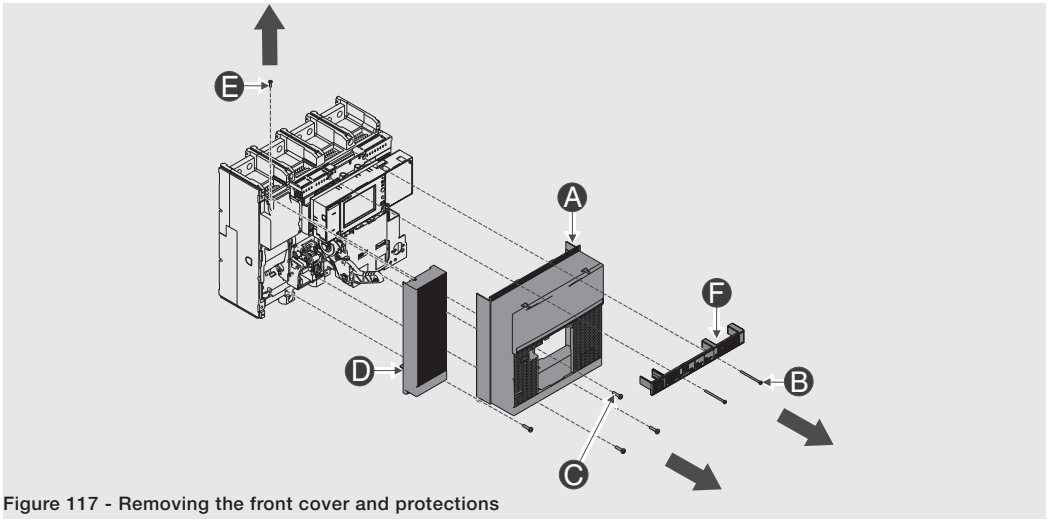


Figure 117 - Removing the front cover and protections

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.

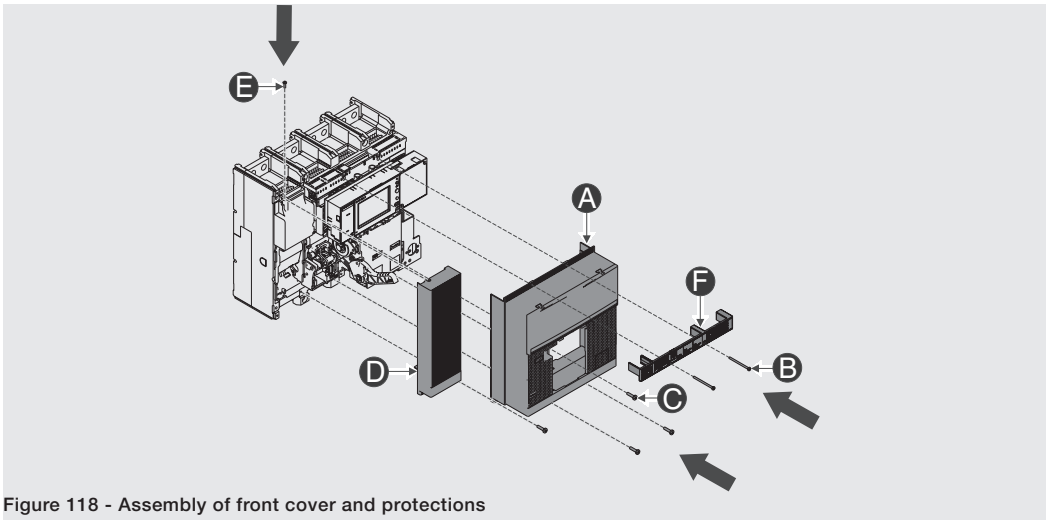


Figure 118 - Assembly of front cover and protections

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).

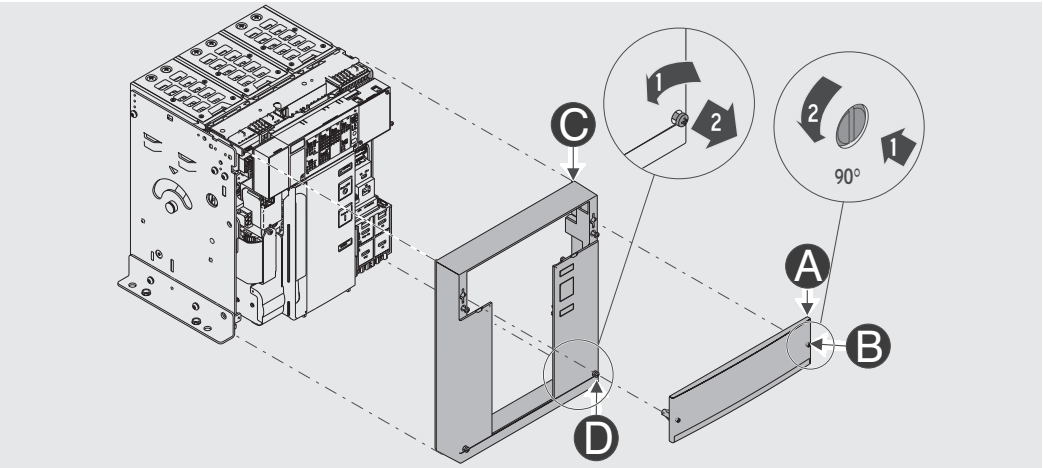


Figure 119 - Removing the flange and front cover

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).

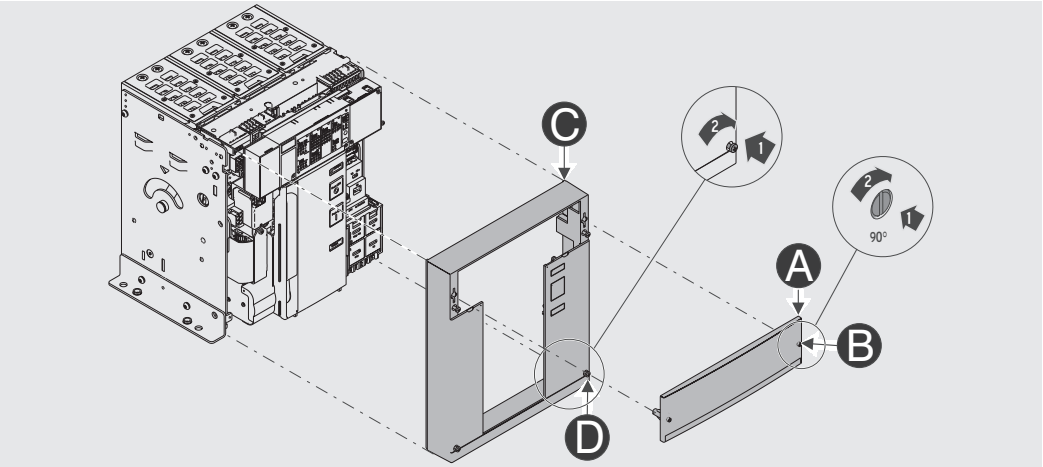


Figure 120 - Assembly of flange and front cover

4 - Introduction to the electronic accessories

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 Synchrocheck	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.

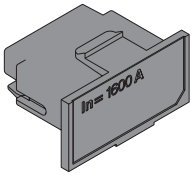
The .zip file contains the files for supplementing Ekip Touch in the available communication networks, with the specific Ekip Com module and an IMPORTANT file with notes on how to use the files:

File [1][2]	Protocol / Ekip Com module
ABBS0E7F.gsd + EkiDPB.bmp	File .gsd and module image for configuring *Ekip Com Profibus DP*
Ekip_COM_EtherNetIP_M4_v03_06.eds	File .eds for configuring *Ekip Com EtherNet/IP™*
Ekip_COM_DeviceNet_v02_08.eds	File .eds for configuring *Ekip Com DeviceNet™*
ABBEC0304_Ed1.icd ABBEC0304_Ed2.icd	File .icd for configuring *Ekip Com IEC 61850*
GSDML-V2.3-ABB S.p.A.-Ekip Com Profinet-20180823.xml	File .xml for configuring *Ekip Com Profinet*

[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.

Internal electronic accessories

1 - Rating Plug



The *Rating Plug*, supplied with the trip unit establishes the rated current In required by the measuring range and for setting the current protections (with reference to In).

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 In 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:

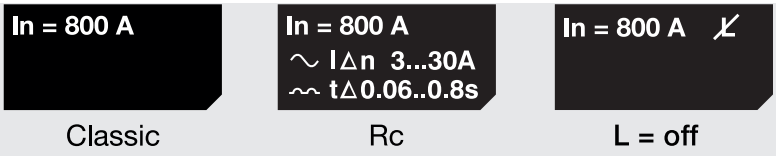


Figure 121

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 nominal size of the CB (Iu) can be installed.

WARNING!

- **with Iu ≤ 400 A size circuit-breakers, Rating Plugs from 100 A to the Iu size of the CB can be installed**
- **with Iu > 400 A size circuit-breakers, Rating Plugs from 400 A to the Iu size of the CB can be installed**

Further details about assembly and the Rating Plug installation procedure are available in ABB Library, particularly in document 1SDH001000R0510.

IMPORTANT: to avoid alarms or undesired trips, the Rating Plug must be replaced when Trip unit is off, the CB open and in the absence of primary currents and voltages

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 223).

Measurement performance

The measurement performance provided when the *Measurement* modules are installed (described on page 114), are more accurate when the *Class 1 Power & Energy Metering* package is present (described on page 117.

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 17.

Installations with up to 1150 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	• Accuracy class: ≤ 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: Fn +-10% • Primary voltage: 100 to 1150 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
Voltage Transf.	Selects the presence or absence of the external transformer	Absent
Rated voltage	Available in the absence of a transformer; defines rated voltage Un. The value is given as absolute value (Volts) and can be set within the range: 100 V to 690 V with variable steps.	400 V
Primary voltage	Available in the presence of a transformer; defines rated voltage Un of the installation. The value is given as absolute value (Volts) and can be set within the range: 100 V to 1150 V with variable steps.	400 V
Secondary voltage	Available in the presence of a transformer; defines the secondary voltage of the transformer. The value is given as absolute value (Volts) and can be set within the range: 100 V to 230 V with variable steps.	100 V
Positive Power flow	Defines the power flow required for D protection; there are 2 options available (page 73): • High → Low: the power flows from the low terminals to the high ones (load connected low) • Low → High: opposite power flow (load connected high)	High → Low
Neutral connection	Available with 3P CB; allows the presence of the external Neutral to be enabled. **NOTE**: *presence of the neutral activates phase voltage measurement*	Absent

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.

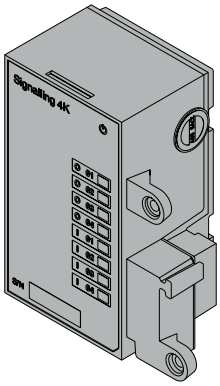
If the *Measurement* module is replaced, module change is indicated on the display by an alarm in the diagnosis bar when the apparatus is powered for the first time.

To install the new module:

- Confirm the installation module which appears automatically on the display
- Execute manual control, available in the *Settings* menu (page46)

WARNING! if the Class 1 Power & Energy Metering package is present, module replacement could impair the performance values indicated on page 117; 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 V AC (1 minute @ 50 Hz).
Dielectric strength between each contact and coil	1000 V AC (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 187).

Input

Each input consists of two contacts (I 01: H1-HC; I 02: H2-HC; I 03: H3-HC; I 04: H4-HC) and has two physical states: open circuit (> 100 kΩ) and short circuit (< 50 Ω)

All the inputs are independent and can be programmed so that an action or signaling are executed at the time of a specific change of state (see Menu on page 188).

Ekip Touch interprets the state of each input differently, on the basis of the electrical condition detected and the configuration of the contact programmed via the (*polarity*) menu:

Electrical condition	Contact configuration (polarity)	State detected
Circuit open	Active open	ON
	Active closed	OFF
Short-circuit	Active open	OFF
	Active closed	ON

Interface

The module has nine signaling leds:

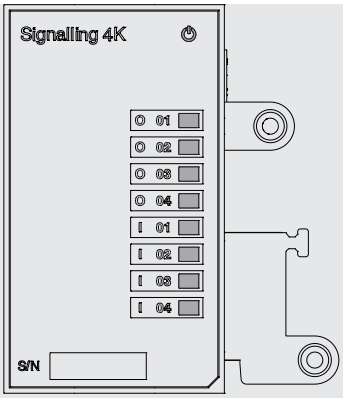


Figure 122

LEDs	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: • off: contact open • on: contact closed
I 01, I 02, I 03, I 04	Indicate the physical state of the contacts of each input: • 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
Signal source	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
Delay	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. **NOTES**: • *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
Contact Type	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
Latched (1)	Allows the output to be managed differently when Source disappears: either keep contact activated (On) or deactivate it (Off). **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
min Activation Time [2]	If Self-latching = Off, defines the minimum activation time of the output in the presence of rapid Sources: • 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
Polarity	Defines whether the state of the input is ON when the contacts are open (Active open) or short-circuited (Active Closed)	Active closed
Delay	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:** • *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|ii|	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.

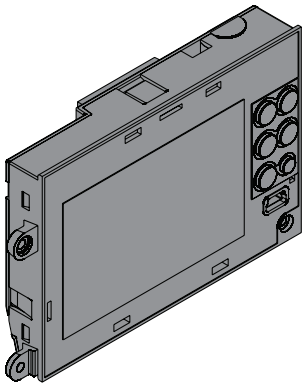
For details of the test characteristics, please consult page 134.

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
- manual command via the service connector (via Ekip Connect) or via system bus communication

4 - Ekip LCD



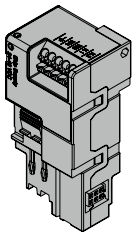
The LCD version of the protection trip unit can be requested for installations in particularly aggressive environments (low temperatures, high degree of humidity, dust or chemical substances). The LCD version differs from the version with touchscreen display in:

- 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: no supply
- on (steady): 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 with Ekip Cartridge

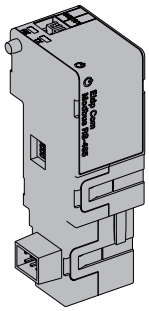
Connections

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 234)**

Ekip Com Modbus RTU is always supplied with contacts Ekip AUP and Ekip RTC (page 234.

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 182).

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:

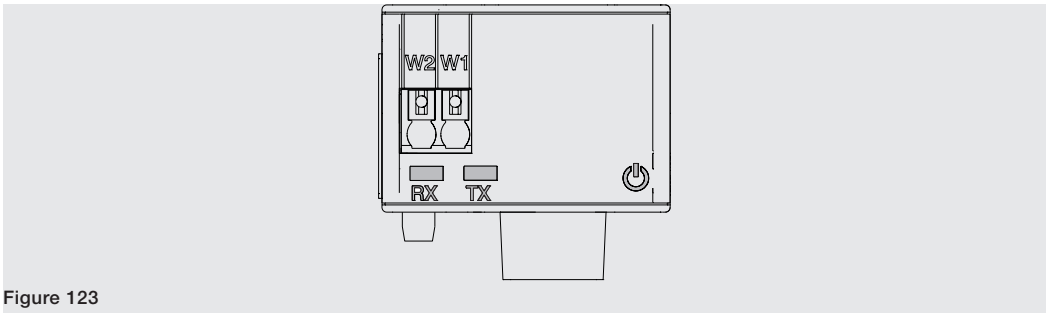


Figure 123

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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): • 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): • off: communication between Modbus RTU not activated • on with fast flashes: Modbus RTU communication activated

Configurations

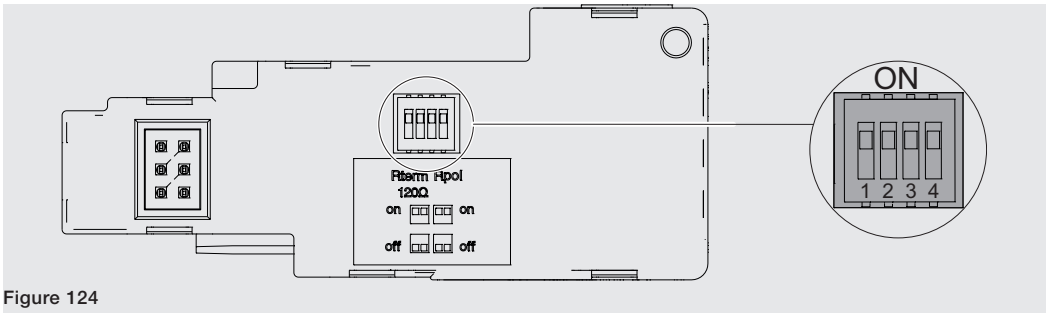


Figure 124

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

Menu

Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 130).

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 247 range available **IMPORTANT: devices connected to the same network must have different addresses**	247 / 246 (1)
Baudrate	Data transmission speed; 3 options are available: 9600 bit/s, 19200 bit/s, 38400 bit/s	19200 bit/s
Physical protocol	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 216).

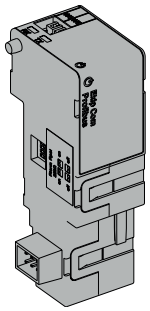
IMPORTANT:

- **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 234)**

Ekip Com Profibus DP is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 182).

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:

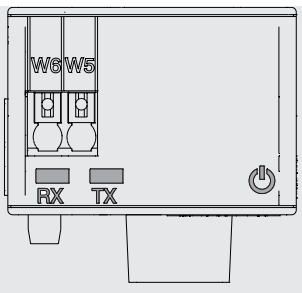


Figure 125

Continued on the next page

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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): • 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): • 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:

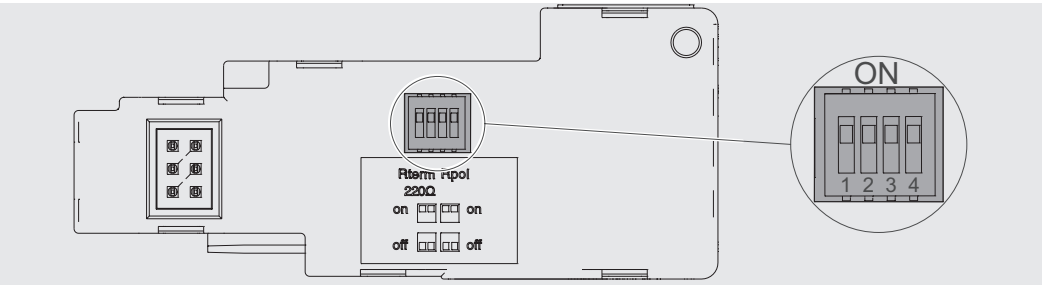


Figure 126

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

Menu

Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 46).

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:

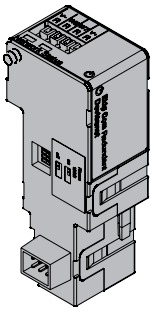
Parameter	Description	Default
Serial address	Module address; 1 to 126 range available **IMPORTANT: devices connected to the same network must have different addresses**	125 / 124 (1)

(1) *125 default of the Ekip Com Profibus DP module; 124 default of the Ekip Com Profibus DP Redundant module*

Remote 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 234)**

Ekip Com DeviceNet ™ is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 182).

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 DeviceNetTM 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:

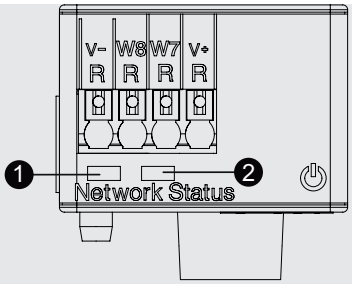


Figure 127

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • 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: • 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:

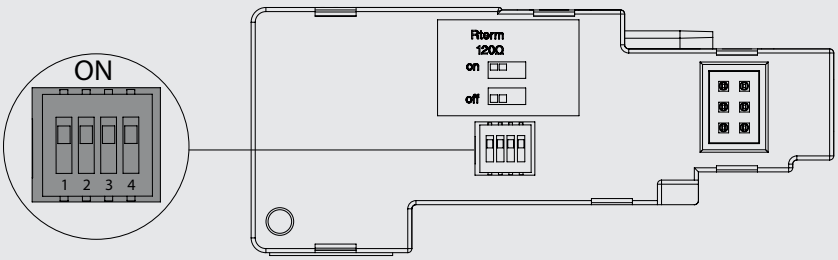


Figure 128

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

Menu

Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 46).

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

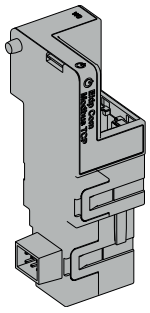
Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

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* **234***)*

Ekip Com Modbus TCP is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 182).

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
20/udp		
68/udp	DHCP client	DHCP client enabled alternatively as: *Static address = On*

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:

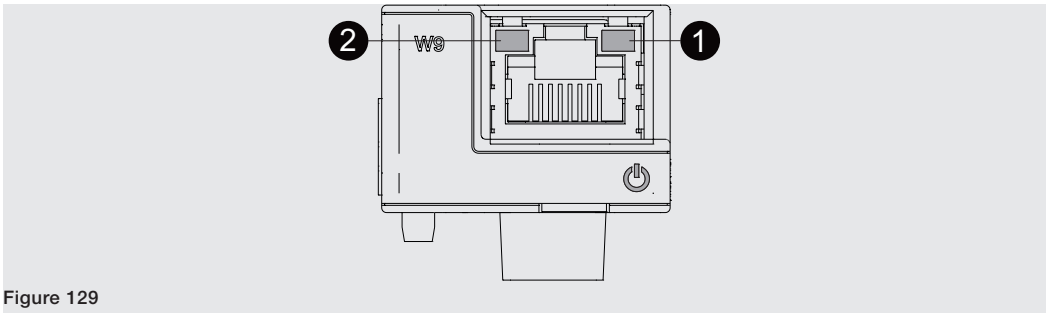


Figure 129

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: incorrect connection, signal absent. • on steady: connection correct
Activity (**2**)	Indicates the communication state: • off: no activity on 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 127).

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
Static IP address ON	Defines whether the module has the dynamic (**Off**) or static (**On**) IP address. Se = On all the associated parameters are enabled	Off
Static address IP address	Enables the static IP to be selected	0.0.0.0
Static Network Mask	Enables the subnet mask to be selected	0.0.0.0
Static Gateway address	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:

About	Description
SN and version	Identifier and SW version of the module
IP address	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 xset 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
Network Mask	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.
Gateway address	IP address of the node to which the module is connected, in the presence of several subnets
TCP Client 1, 2, 3	IP addresses of the client devices connected to the module (in the Server mode)
MAC address	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 216) **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
Disabilita Gratuitos ARP	Permits (Enabled ARP) the periodic generation of a Gratuituos 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
Password Modbus TCP	With access protected by enabled password, this is the password to use before each writing session (2).	Local access

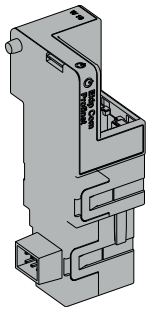
(1) Enable IEEE 1588 and Enable SNTP client must not be enabled at the same time
(2) the parameter can only be changed via system bus in the remote configuration

Remote 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 234)**

Ekip Com Profinet is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 182.

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)
0x0802	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:

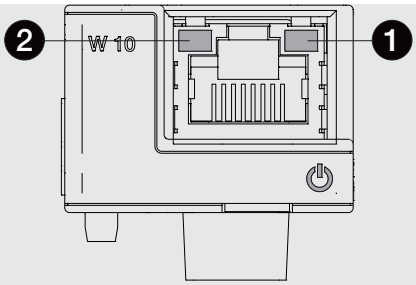


Figure 130

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: incorrect connection, signal absent. • on steady: connection correct
Activity (**2**)	Indicates the communication state: • off: no activity on line • flashing: activity on line present (receiving and/or transmitting)

Menu

Local bus activation, which is essential for starting the communication between module and Ekip Touch, is available in the *Settings* menu (page 46).

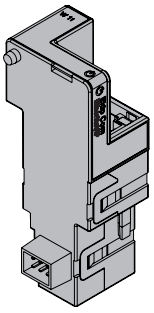
The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
SN and version	Identifier and SW version of the module
MAC address	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device

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).

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 234)**

Ekip Com EtherNet/IP™ is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 182.

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 *Static address = On*

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:

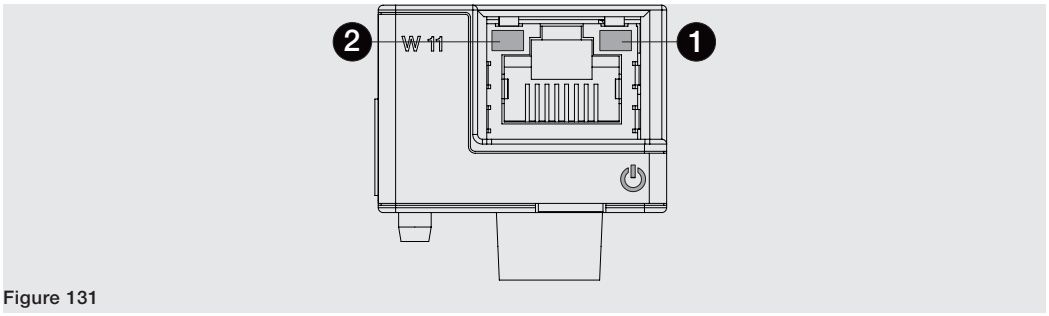


Figure 131

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: incorrect connection, signal absent. • on steady: connection correct
Activity (**2**)	Indicates the communication state: • off: no activity on 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 46).

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
Static IP address ON	Defines whether the module has the dynamic (**Off**) or static (**On**) IP address. Se = On all the associated parameters are enabled	OFF
Static address IP address	Enables the static IP to be selected	0.0.0.0
Static Network Mask	Enables the subnet mask to be selected	0.0.0.0
Static Gateway address	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
SN and version	Identifier and SW version of the module
IP address	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
Network Mask	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.
Gateway address	IP address of the node to which the module is connected, in the presence of several subnets
MAC address	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
Enable IEEE 1558	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
IEEE 1558 Master	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
IEEE 1558 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
Enable client SNTP	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled (1)	OFF
ANTP Server 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

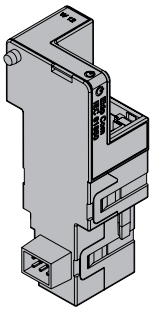
(1) Enable IEEE 1588 and Enable SNTP client must not be enabled at the same time

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
HW and Boot version	General module information
Flash CRC status and result	Information about the correctness of the SW in the module
Ekip Link status	Signals Ethernet cable connection errors
SNTP Server Error	Error in communication with SNTP server
SNTP Server Synchronization	State of synchronism with SNTP server
IEEE 1558 status	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 234)**

Ekip Com IEC 61850 is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 182).

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:

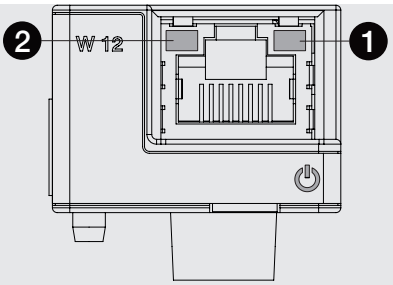


Figure 132

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: incorrect connection, signal absent. • on steady: connection correct
Activity (**2**)	Indicates the communication state: • off: no activity on 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 46).

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
Static IP address ON	Defines whether the module has the dynamic (**Off**) or static (**On**) IP address. Se = On all the associated parameters are enabled	OFF
Static address IP address	Enables the static IP to be selected	0.0.0.0
Static Network Mask	Enables the subnet mask to be selected	0.0.0.0
Static Gateway address	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
Enable SNTP client	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled.	OFF
SNTP Server Addr.	Allows the network server that supplies the SNTP to be set.	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
SN and version	Identifier and SW version of the module
IP address	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
Network Mask	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.
Gateway address	IP address of the node to which the module is connected, in the presence of several subnets
MAC address	Address assigned by ABB, with OUI (Organizationally Unique Identifier) equal to ac:d3:64, which uniquely identifies the manufacturer of an Ethernet device
Cfg file	Name of the configuration file uploaded to the modules
Cfg file error	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:

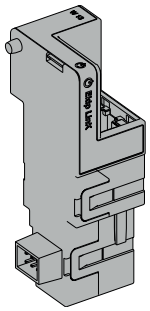
Parameter	Description	Default
Preferred configuration file	If several configuration files are present, allows file hierarchy between .cid and .iid to be defined	.cid
Enable IEEE 1558	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
IEEE 1558 Master	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
IEEE 1558 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
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
TFTP Security level	Defines the file loading procedure: • *TFTP always On* = port open, loading always possible • *TFTP enable required* = port normally closed. To start loading, *Enable TFTP* must be run at the start of the procedure and *Disable TFTP* must be run at the end of the procedure (disable not necessary, security command).	TFTP always On
CB Open/CB Close command	Defines the limitations to remote opening and closing command execution: • *Standard commands* = standard commands (unrestricted) activated • *CB operate request* = 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
Falg word hex	Sets a filter on the selectivity statuses	0

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
HW and Boot version	General module information
Flash CRC status and result	Information about the correctness of the SW in the module
Ekip Link status	Signals Ethernet cable connection errors
SNTP Server Error	Error in communication with SNTP server
SNTP Server Synchronization	State of synchronism with SNTP server
IEEE 1558 status	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
GOOSE Missing	Signals that an expected GOOSE has not been received
Configure Mismatch	A GOOSE received does not conform to the expected structure
Decode Error	
Sequence number error	
Remote programmable statuses (from E to R)	Condition (true/false) of the programmable states and information on selectivity arising from logic defined in the configuration files loaded in module IEC 61850
Zone selectivity remote inputs	

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 devices 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 *Static address = On*

Ekip Link is always supplied with contacts *Ekip AUP* and *Ekip RTC* (page 234).

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 details about the potential of the function are available in White Paper **1SDC007410G0201** “Load management with Ekip Power Controller for SACE Emax 2”.

Zone selectivity

With the Zone Selecitivity 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, 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 90.

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:

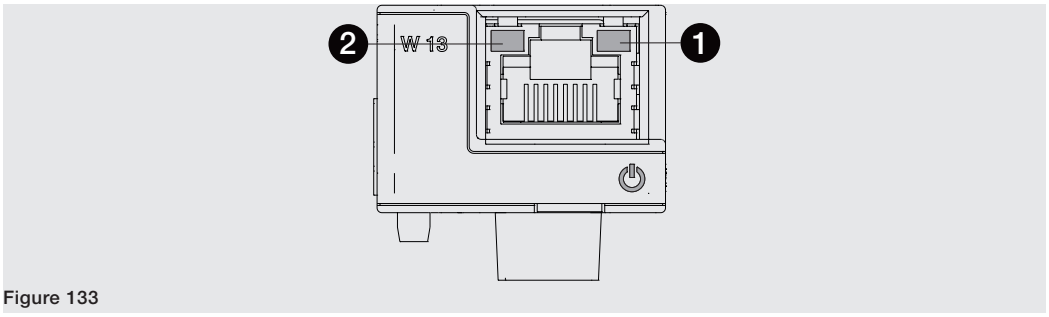


Figure 133

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: incorrect connection, signal absent. • on steady: connection correct
Activity (**2**)	Indicates the communication state: • off: no activity on 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 46).

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
Static IP address ON	Defines whether the module has the dynamic (**Off**) or static (**On**) IP address. Se = On all the associated parameters are enabled	OFF
Static address IP address	Enables the static IP to be selected	0.0.0.0
Static Network Mask	Enables the subnet mask to be selected	0.0.0.0
Static Gateway address	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
SN and version	Identifier and SW version of the module
IP address	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
Network Mask	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.
Gateway address	IP address of the node to which the module is connected, in the presence of several subnets
MAC address	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 page216). **IMPORTANT: if Client/Server, the module allows data exchange like a normal Server function**	Server only
Enable IEEE 1558	Allows the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
IEEE 1558 Master	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
IEEE 1558 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
Enable client SNTP	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled (1)	Off
ANTP Server 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

Continued on the next page

Parameter	Description	Default
Disable Gratuitous ARP	Permits (Enabled ARP) the periodic generation of a Gratuituos ARP message, used by Ekip Connect to rapidly find the modules via Ethernet scan without knowing the IP address beforehand	ARP Enabled
Password protected access	Enables the writing operations performed via the network to be protected by a password (Request password)	Standard mode
Password Modbus TCP	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
Link Actor (1÷15)	IP address of each actor (from 1 to 15)	0.0.0.0
Remote Programmable Status (A÷D)	Configuration parameters of the configurable states: • 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
Remote Status word (A÷D)	Configuration parameters of the words: • selection of actor (actor from 1 to 15) from which the word status is taken • selection of the taken word	None 1 global
Diagnostic	Active (Passive diagnosis) or deactivated (No diagnosis) cabled selectivity diagnosis	No Diagnostic
Diagnostic check timeout	30 s, 1 min, 10 min, 60 min diagnosis frequency intervals available, if activated	30 seconds
Zone Selectivity Type	Configuration of hardware selectivity (Only HW) or hardware and logic (Mixed)	HW only
Repeat Configuration mask	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:

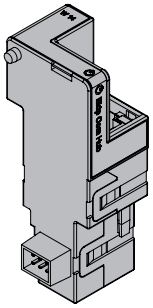
Information	Description
HW and Boot version	General module information
Flash CRC status and result	Information about the correctness of the SW in the module
Ekip Link status	Signals Ethernet cable connection errors
SNTP Server Error	Error in communication with SNTP server
SNTP Server Synchronization	State of synchronism with SNTP server
IEEE 1558 status	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
Line Congruency detection	Information about the state and inconsistency of HW and logic selectivity (state and type of selectivity inconsistent)
Remote Programmable Status	Status (true/false) of remote programmable statuses A, B, C and D
Remote Status Word	Value of remote programmable Words A, B, C, D
Logic Zone Selectivity	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 182).

The ports used by the module are:

Port	Service	Notes
67/udp 68/udp	DHCP client	DHCP client enabled alternatively as *Static address = On*
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 234).

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:

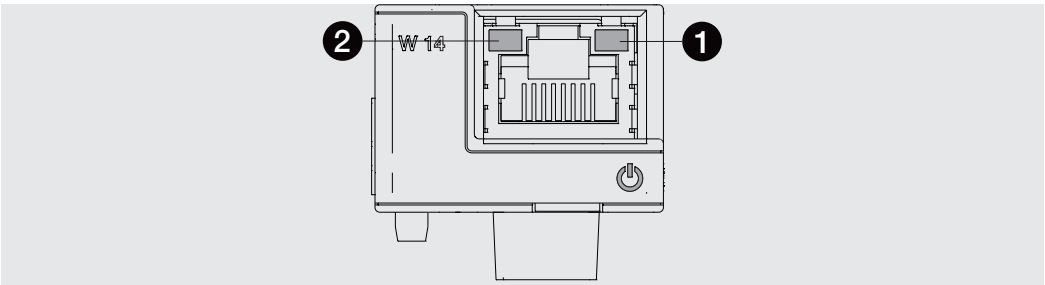


Figure 134

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: incorrect connection, signal absent. • on steady: connection correct
Activity (**2**)	Indicates the communication state: • off: no activity on 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 46).

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
Enable	Switches communication between module and server on/off.	
Static IP address ON	Defines whether the module has the dynamic (**Off**) or static (**On**) IP address. If = **On** all the associated parameters are enabled	Off
Static address IP address	Enables the static IP to be selected	0.0.0.0
Static Network Mask	Enables the subnet mask to be selected	0.0.0.0
Static Gateway address	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
Enable SNTP client	Allows the SNTP protocol for distribution of the clock and synchronization signal to be enabled.	Off
SNTP Server Addr.	Allows the network server that supplies the SNTP to be set.	0.0.0.0
Password	code required to register module on Cloud	---
Remote firmware update	Enables the firmware of the module to be updated. There are two parameters: • *Enable*, to configure firmware download • *Automatic*, to automate module updating	Off Automatic

Information in menu

The following information will be available in the *About-Modules* menu if Ekip Touch has detected the module correctly:

Information	Description
SN and version	Identifier and SW version of the module
IP address	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
Network Mask	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.
Gateway address	IP address of the node to which the module is connected, in the presence of several subnets
MAC address	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:

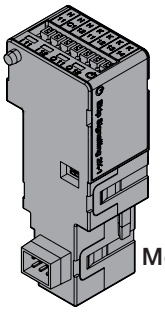
Parameter	Description	Default
CRL Enable	Allows the CRL (Certificate Revocation List) to be used to ascertain whether the server certificate is valid	
Clock update hardening enable	Enables control of the time reference transmitted by the SNTP server	
SNTP Server Location	Enables the position of the SNTP server to be set in relation to the network in which the module is installed	
SNTP Time zone	Defines the time zone to be used for synchronism	+00:00
SNTP 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 Gratuituos ARP message, used by Ekip Connect to rapidly find the modules via Ethernet scan without knowing the IP address beforehand	ARP Enabled

Remote information

Additional information can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

Information	Description
HW and Boot version	General module information
Flash CRC status and result	Information about the correctness of the SW in the module
Publish enable configuration	State of enabling in Security File
Configuration file	Name of the file dedicated to the information to transmit (measurements, etc.)
Security file	Name of the file dedicated to the information requested by the module for transmission purposes (addresses, certificates, etc.)
Certificate Revocation List	Name of the file containing the revoked certificates
Executable file	Name of the executable firmware update file
Configuration error	Module configuration error state
Sample time	Period of data acquisition from the connected devices
Log time	Period within which the acquired data are saved in the log
Upload time	Period (calculated by the module) between each data transmission
Configured device	Number of modules involved in the network with Hub module
Polling period API events	Period in which the module communicates with the API device
Connection client 1, 2, 3	Address of TCP modbus clients connected to the module
Statistics	Recordings of the latest saving operations and percentage of resources being used
Status plant side	Information about the quality of the communication with the other devices
Status Cloud side	State of the errors concerning the TLS session established between module and server
Application status	Operation progress indicators
Status	General indicators of the module: SNTP status, flash, cable connection, FW availability, file errors, etc.

11 - Ekip Signalling 2K



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

Models

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*

Two of 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	59
2I Protection Function	Delay = 100 ms; Activation = depentent function; Function = RELT - Ekip Signalling 2K-3 Input 1 (I31)	59, 89
Input I31 (RELT - Ekip Signalling 2K-3)	Polarity = active closed; Delay = 0,1 s	221, 222
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	222
SwitchOnLocal Function	Function = 2I protection active; Delay = 0 s	89

[(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 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 (Ohm)/29.5 (Ohm/km)/2wires=0.423 km=423mt*

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 222).

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	Active open	ON
		Active closed	OFF
Closed	Short-circuit	Active open	OFF
		Active closed	ON

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 222).

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, 4A @ 250 VAC
Dielectric strength between open contacts	1000 V AC (1 minute @ 50 Hz).
Dielectric strength between each contact and coil	1000 V AC (1 minute @ 50 Hz).

[1] data relating to a resistive load

Interface

the module has three signaling leds:

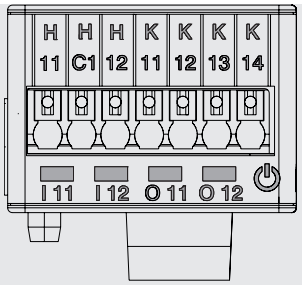


Figure 135

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: contact open • on: contact closed
O 11, O 12	Indicate the status of the contacts of each input: • 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
Polarity	Defines whether the input is interpreted as ON by Ekip Touch when it is open (*Active open*) or when it is closed (*Active Closed*)	Active closed
Delay	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
Signal source	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
Delay	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
Contact Type	Defines the rest status of the contact with source not present between: open (NO) and closed (NC)	NO
Latched (1)	Allows the output (and relative status led) to be kept activated (On) or deactivated (Off) when the event disappears	OFF
min Activation Time (2)	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 latchings 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

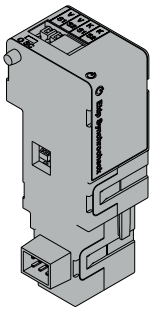
The test area in the *Test* menu is activated if the *Ekip Signalling 2K* module is detected correctly.

For details of the test characteristics, please consult page 134.

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: • synchronism search starts if the external voltage is (0.5 Un 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 Un, 0.1 Hz, and 50° by default) or less
Dead busbar and configuration: *Normal*	Operation with one of the voltages nil: • synchronism search starts if the internal voltage is (0.5 Un 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 Un 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	• fixing: EN 50022 DIN43880 rail • material: self-extinguishing thermoplastic • protection class: IP30 • electrostatic protection: with earth connector shield
Electrical	• accuracy class: ≤ 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, 4A @ 250 VAC
Dielectric strength between open contacts	1000 V AC (1 minute @ 50 Hz).
Dielectric strength between each contact and coil	1000 V AC (1 minute @ 50 Hz).

(1) data relating to a resistive load

Interface the module has three signaling leds:

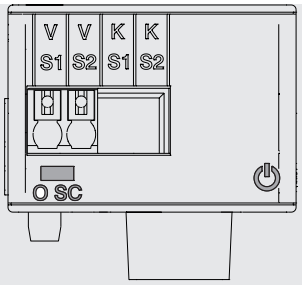


Figure 136

LEDs	Description
Power	Signals the on status and correct communication with Ekip Touch: • 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: • off: contact open • on: contact closed **NOTE**: *The LED shows the output status: it indicates synchronization OK or KO, depending on the contact rest configuration (normally open or closed)*

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
Enable	Activates/deactivates the protection and its availability in the parameters menu	Off
Dead bar option	On = busbar activated; Off = dead busbar present	Off
Udead T hreshold (1)(2)	Maximum external voltage (with dead busbar and configuration: *Normal* (2) is the first synchronism condition) The value is given as both absolute value (Volts) 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
Ulive Threshold (2)(3)	Minimum voltage for starting monitoring of external voltage (with busbar activated) or internal voltage (with dead busbar and *Normal* configuration) The value is given as both absolute value (Volts) 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
Stability Time	Minimum time within which the *Ulive Threshold* 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
Delta Voltage	Maximum difference between internal and external voltage (first synchronism condition) The value is given as both absolute value (Volts) 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
Delta frequency (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
Delta phase (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
Dead bar configuration	With dead busbar and generator: • Reversed = *Ekip Synchrocheck*/external contacts connected to the generator • Normal = *Ekip Synchrocheck*/external contacts connected to the grid	Standard
Auto Live-dead detect	Enables automatic synchronism control to be activated: • Manual = Ekip Touch considers the *Dead bar option* parameter • Automatic = Ekip Touch automatically assesses the configuration to be actuated between the dead busbar and active busbar	Manual
Auto Deadbar detect	Configuration for detecting dead busbar: • *Manual* = Ekip Touch considers the *Dead bar configuration* parameter • *Automatic* = Ekip Touch automatically assesses the configuration to be actuated between: *Reversed* and *Normal*	Manual
Primary voltage	Rated voltage Un of installation; the value is given as absolute value (Volts) and can be set within the range: 100 V to 1150 V in variable steps.	100 V
Secondary voltage	Secondary voltage of the transformer; the value is given as absolute value (Volts) and can be set within the range: 100 V to 120 V in variable steps.	100 V
Concatenated Ref	Line-to-line voltage entering the module among the 3 installation voltages	U12
Contact Type	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 ±10% tolerance with the exception of:*

- Voltage Delta; the tolerance is the higher value between: ±10% of the set threshold and 0.5% Un (with Un > 220 V) or 1% Un (with Un ≤ 220V)
- Frequency Delta; the tolerance is the higher value between ±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
Frequency check	Activates (ON) or deactivates (OFF) frequency control for synchronism assessment	ON
Phase check	Activates (ON) or deactivates (OFF) phase control for synchronism assessment	ON
Evaluate CB status	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
Minimum matching time	With active busbar, minimum time within which the *Delta Phase* 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 Delta Frequency and Delta Phase 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
Module	• Ok = Synchronism conditions fulfilled • Not Ok = Synchronism conditions not fulfilled or function disabled
Frequency	• 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)
Voltage	• Ok = Synchronism conditions regarding voltages fulfilled. • Not Ok = Synchronism conditions regarding voltages not fulfilled or synchronism function disabled
Phase	• 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)
Ext Side Voltage (1)	• Voltage measured by *Ekip Synchrocheck* given in Volts • .... = measurement DC or less than 1 VAC • --- = measurement not available (example: because synchronism function is disabled)
Int Side Voltage (2)	Voltage measured on internal sockets, given in Volts. • .... = measurement less than 1 VAC
Ext Side Frequency (1)	Frequency measured by *Ekip Synchrocheck* • --- = measurement not available (example: because synchronism function is disabled, or operation with dead busbar, or frequencies outside measuring range limits)
Int Side Frequency (2)	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)
Phase Difference (1)	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)
Auto detection	• 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)
Voltage relation	• Vint ≤ Vext = Internal voltage the same as external voltage or lower • Vin > Vext = 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).
Frequency relation	• fint ≤ fext = Internal frequency the same as external frequency or lower • fin > fext = 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 ± 10% unless the parameter value is 0.02 Un, in which case accuracy is ± 20%

(2) the characteristics of the voltage and frequency measurements coincide with those given on the internal sockets (page 110)

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 40).

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

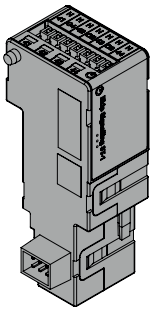
About

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 4-20mA 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 (Iopp 4-20mA), 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 4-20mA Current Loop sensor, use suitable cables up to 3 meters in length compatible with the workplace in which the 4-20mA 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 equippped 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 (Ui= 1000 V, Uimp= 12 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
4-20mA current loop	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

Interface Five signalling leds are available:

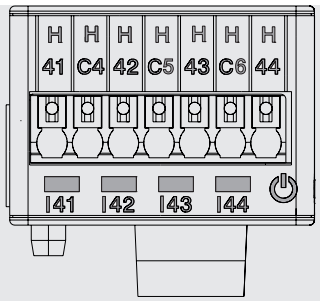


Figure 137

LEDs	Description
Power	Signals the on state and correct communication with the trip unit: • 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: • 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 4-20mA 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.

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 modulecan be enabled in the *Ekip Signalling 3T* page: I42 Temperatures, I43 Temperatures, I44 Temperatures, I41 Current 4-20mA (per 3T-1), I52 Temperatures, I53 Temperatures, I54 temperatures, I51 Current 4-20mA (for 3T-2).

Parameter	Description	Default
Enable	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*

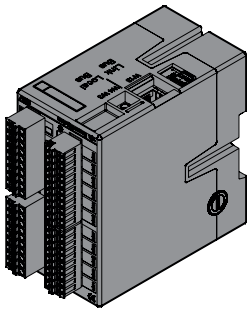
Parameter	Description	Default
Threshold A enable	Activates verification of input I42 with alarm Threshold A	Off
Threshold A hysteresis direction	Defines whether the alarm must activate when measurement is above (*Up*) or below (*Down*) the set value, with reference to the Threshold A setting	Up
Threshold A value	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 4-20mA (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 0.016µA)	200 °C (I42, I43, I44, I52, I53, I54) / 50 % (I41, I51)
Threshold A hysteresis	Hysteresis value, valid for quitting the alarm condition if the set Treshold 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: • *Direction* = Up, *Value* = 200°C, *hysteresis*= 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 4-20mA (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 0.016µA)	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

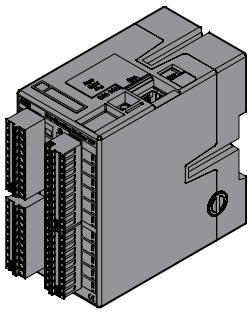
- One in case of connection to a Link bus network
- Three configurations in case of connection via Local Bus (to allow up to three modules to be connected to the same trip unit)

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.

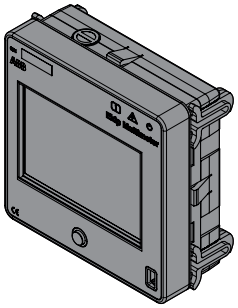
The module can function in three different modes:

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. **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 24Vout 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

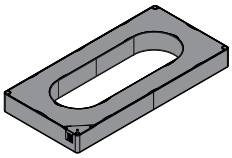
Connections

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



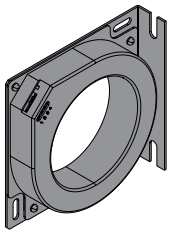
Rc is an external differential current sensor which can be installed on Ekip Touch Trip units equipped with *Rc Rating Plug*.

When Ekip Touch is being programmed, check in the *Settings-Circuit breaker-Ground protection* menu to make sure that the sensor is present (page 46, the configuration menu of the Rc protection parameters must be activated in the *Advanced* menu (page 44).

IMPORTANT: the toroid can be choosen 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 - Toroid S.G.R.



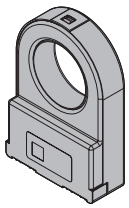
|i|S.G.R. or *Source Ground Return* is an external single-pole current sensor available for LSIG version Ekip Touch Trip units

When Ekip Touch is being programmed, check in the *Settings-Circuit breaker-Ground protection* menu to make sure that the sensor is present (page 46, the configuration menu of the Gext protection parameters must be activated in the *Advanced* menu (page 44).

IMPORTANT: the toroid can be choosen 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.

- External neutral



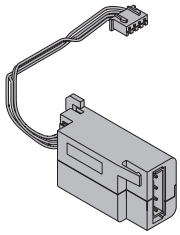
This is a current sensor for the neutral pole outside the circuit-breaker.

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.

6 - Ekip Com Actuator



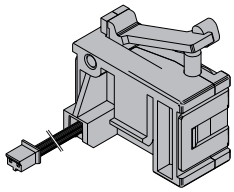
Ekip Com Actuator is an accessory module which allows SACE Emax 2 circuit-breakers to be opened and closed remotely.

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.

7 - Ekip AUP



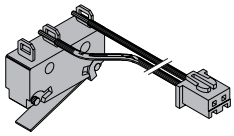
The communication modules are always supplied with dedicated Ekip AUP auxiliary position contacts. In case of a withdrawable circuit-breaker, the Ekip AUP contacts give the signal of moving part racked-in/out from the fixed part.

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.

8 - Ekip RTC

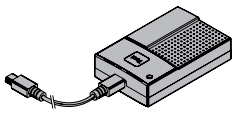


The communication modules are always supplied with an Ekip RTC auxiliary contact, which gives to the trip unit the signal indicating that the circuit-breaker is ready to receive a close command.

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.

9 - 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**

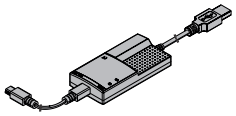
Ekip TT is connected to the service connector of Ekip Touch by means of the supplied cable.

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)

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

Electrical accessories

1 - Electrical control accessories

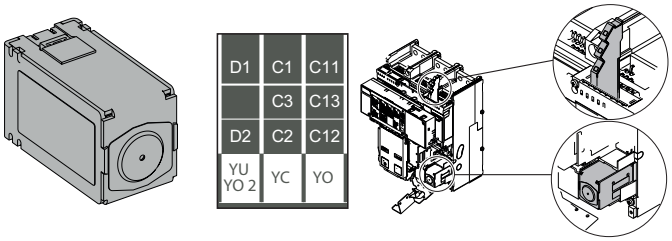
YO-YC-YO2-YC2 (1): Opening and closing coil

The opening coils, YO and YO2, and the closing coil, YC and YC2 (1), allow the circuit-breaker to be controlled remotely.

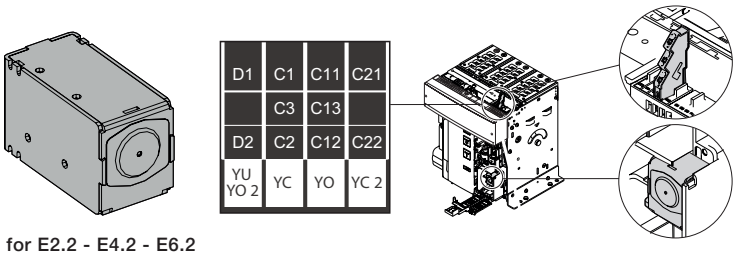
The opening of the circuit-breaker is always possible with the circuit-breaker closed, while closing is possible with the circuit-breaker open and the closing springs charged.

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)
24 V AC/DC
30 V AC/DC
48 V AC/DC
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
500…550 V AC

General characteristics	YO-YO2	YC-YC2 (1)
Operating limits	70...110 %Un	85...110 %Un
Inrush power (Ps)	300 VA/W	
Continuous power (Pc)	3.5 VA/W	
Maximum opening time	35 ms	-
Maximum closing time	-	50 ms

(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:

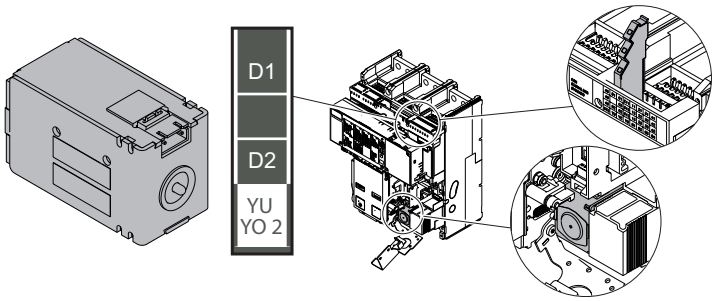
- Trip unit the circuit-breaker remotely using pushbuttons of the normally closed type.
- Activate the lock when the circuit-breaker is closed (the closing of the circuit-breaker is allowed only with the undervoltage coil energized).

IMPORTANT:

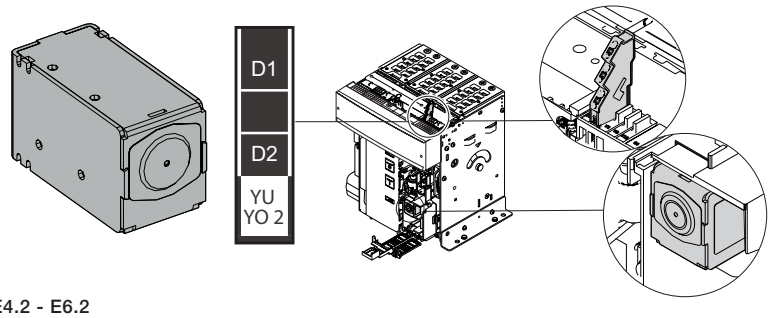
- **The undervoltage coil YU is incompatible with the presence of the Fail Safe device (UL circuit-breakers).**
- **The undervoltage coil YU is a emergency trip unit. For service operations use the opening coil.**

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)
24 V AC/DC
30 V AC/DC
48 V AC/DC
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

General characteristics	YU
Inrush power (Ps)	300 VA/W
Continuous power (Pc)	3.5 VA/W
Opening time	50 ms

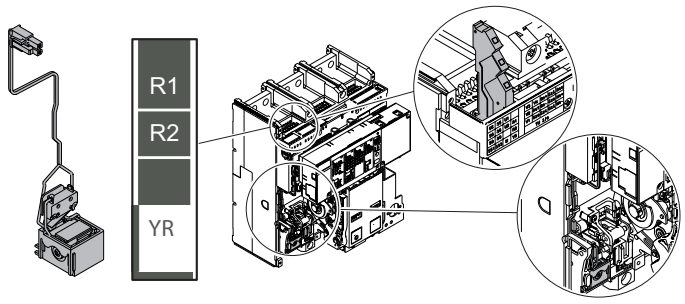
YU: Connections

More details are available in the website http://www.abb.com/abblibrary/DownloadCenter/, which also includes the entire circuit diagram 1SDM000091R0001.

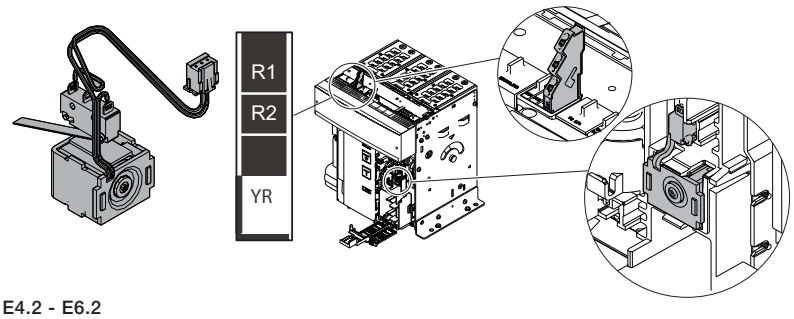
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0504 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0504.

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)	
24 V AC (1)	24 V DC (1)
110 V AC (1)	110 V DC (1) (2)
220 V AC (1)	220 V DC (1) (2)

General characteristics	
Operating limits	90...110 %Un

(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.

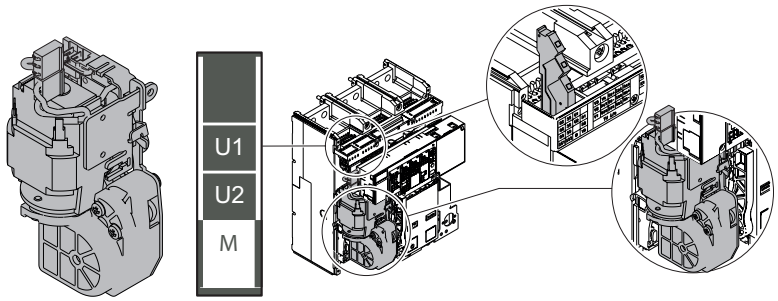
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0606 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0606.

M: Motor

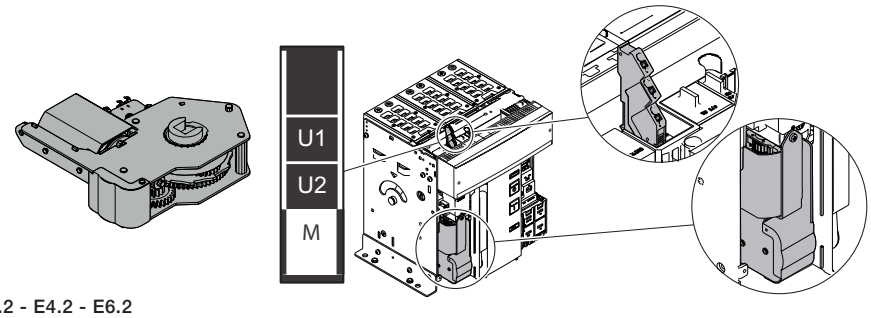
The motor automatically recharges the closing springs of the circuit-breaker when these are discharged.

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)
24…30 V AC/DC
48…60 V AC/DC
100…130 V AC/DC
220…250 V AC/DC
Available voltages (Un) [1]
380…415 V AC
Available voltages (Un) [2]
277 V AC/DC
380…400 V AC
440…480 V AC

General characteristics	
Operating limits	85...110 %Un
Inrush power (Ps)	500 VA/W
Power during charge (Pc):	100 VA/W
Charging time	Min 5 s, max 10 s

[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

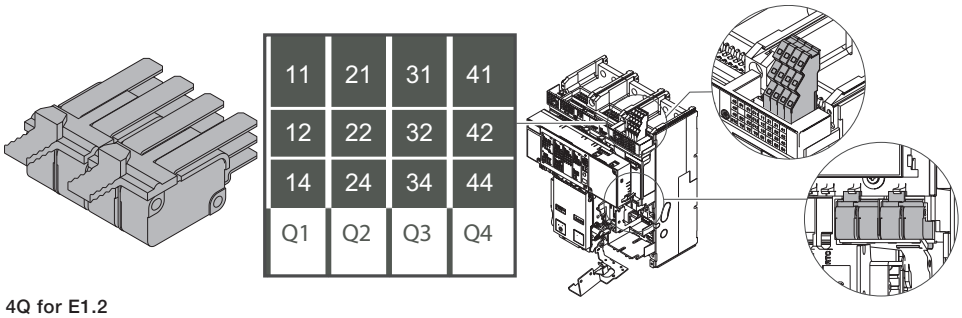
AUX 4Q: auxiliary open-closed contacts

The AUX 4Q contacts signal the open/closed state of the circuit-breaker.

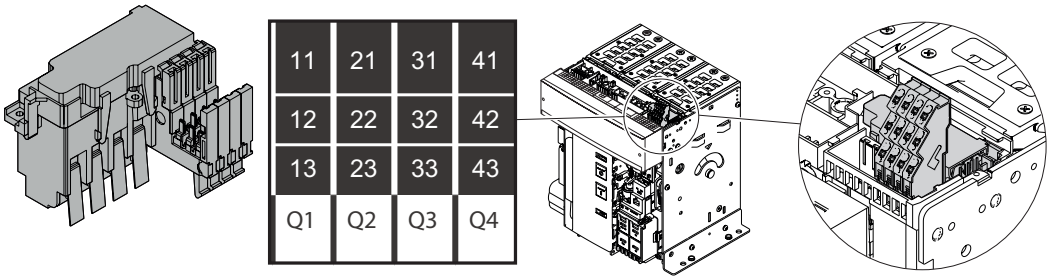
These are "switching" contacts and are available in three types:

- 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 cos φ 0.3	-
			5A cos φ 0.7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0.7	-
			1A cos φ 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.

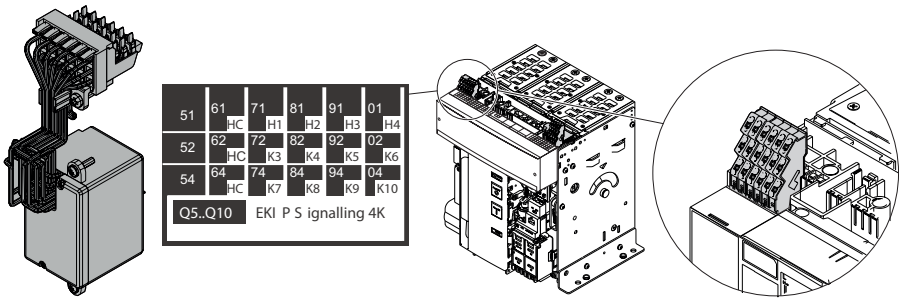
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0601 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0601.

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 cos φ 0.3	-
			5A cos φ 0.7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0.7	-
			1A cos φ 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**.

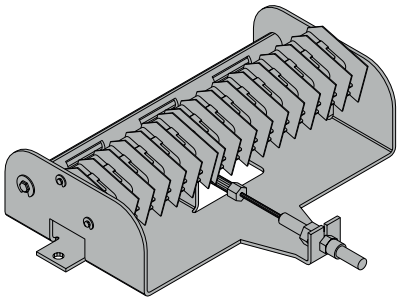
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular with the kit sheet **1SDH001000R0601**.

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 cos φ 0.3	-
			5A cos φ 0.7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0.7	-
			1A cos φ 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.

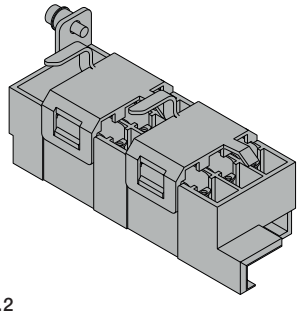
These are "switching" contacts and are available in the following configurations:

Up to a maximum of six contacts for E1.2:

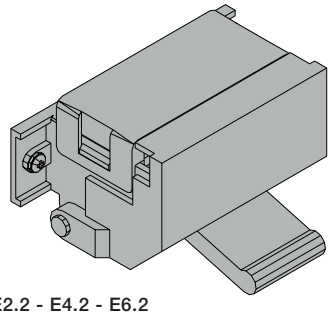
- six standard contacts
- six digital signals

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 cos φ 0.3	-
			5A cos φ 0.7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0.7	-
			1A cos φ 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

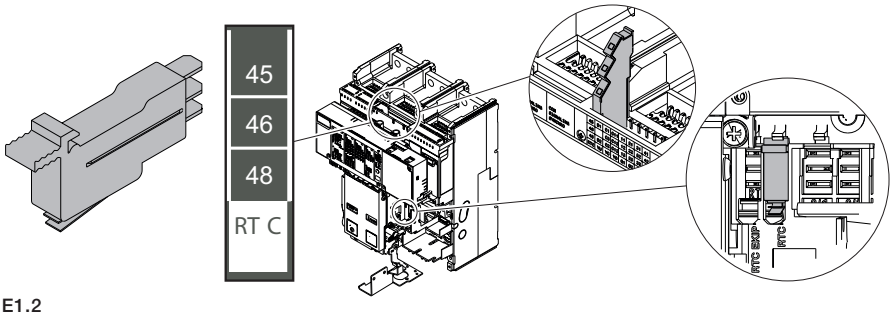
The RTC contact indicates that the circuit-breaker is ready to receive a closing command.

The conditions necessary to allow the closing of the circuit-breaker are:

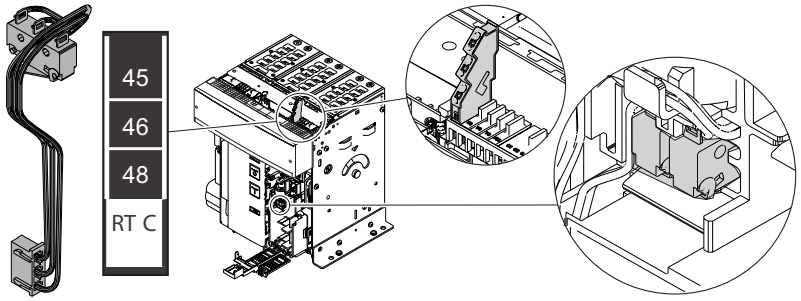
- circuit-breaker open
- springs charged
- absence of an opening command or of a lock in opening

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 cos φ 0.3	-
			2A cos φ 0.7	-
			3A cos φ 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.

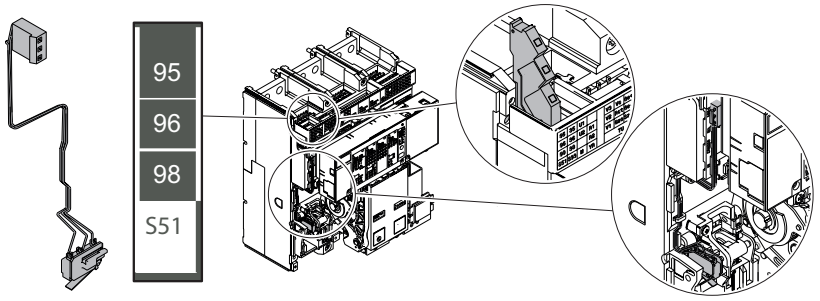
S51: trip unit tripping signalling contact

The S51 contact signals the opening of the circuit-breaker due to tripping of the Ekip protection trip unit.

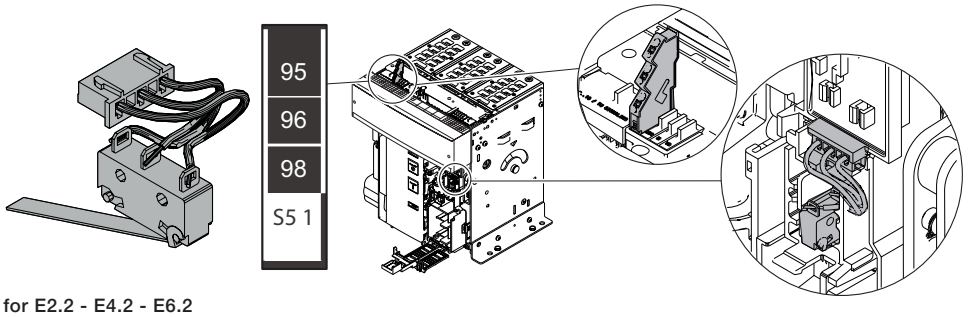
It is available in two different types:

- 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 cos φ 0.3	-
			3A cos φ 0.7	-
			5A cos φ 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

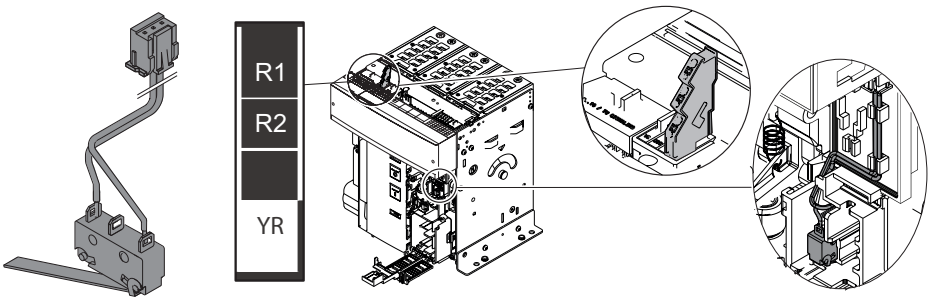
Contact S51/2 signals circuit-breaker opening after the protection release Ekip has tripped.

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 cos φ 0.3	-
			3A cos φ 0.7	-
			5A cos φ 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**.

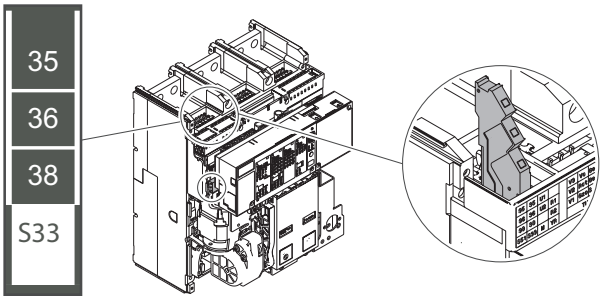
S33 M/2: springs charged signalling contact

The S33 M/2 contact signals the state of the closing springs of the circuit-breaker control (charged or discharged).

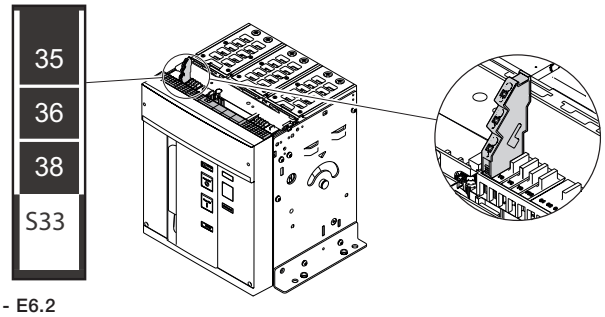
It is available in two types:

- 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 cos φ 0.3	-
			5A cos φ 0.7	-
			5A cos φ 1	-
		400V	3A cos φ 1	-
			2A cos φ 0.7	-
			1A cos φ 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.

Mechanical accessories

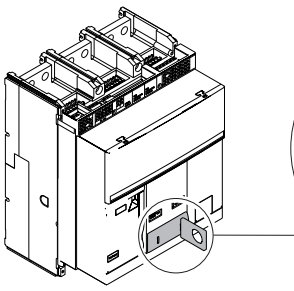
1 - Mechanical Protection accessories

PBC: opening and closing pushbutton protection

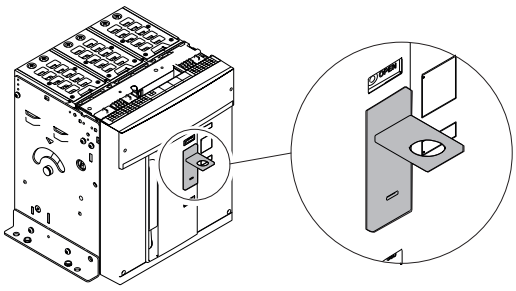
The pushbutton protection inhibits the use of the opening and closing pushbuttons.

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



PBC for E2.2 - E4.2 - E6.2

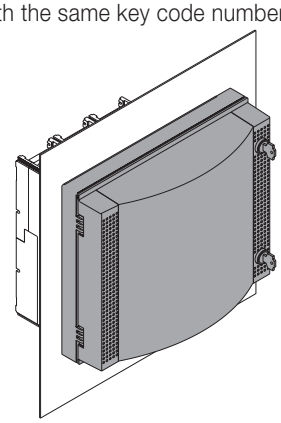
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0715 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0715.

IP54 protection

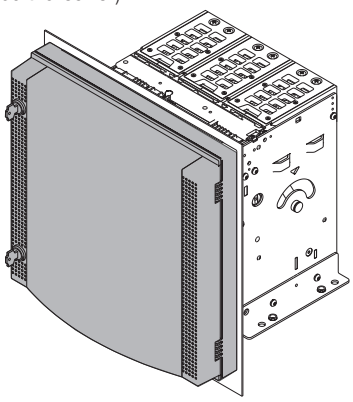
IP54 protection completely protects the front of the circuit-breaker, to achieve protection class IP54.

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



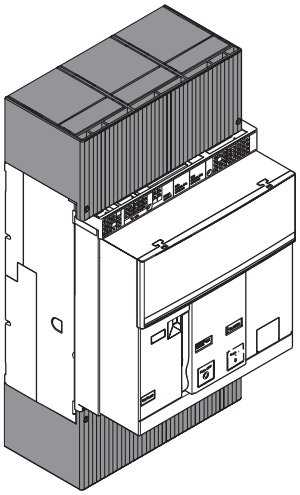
IP54 for E2.2 - E4.2 - E6.2

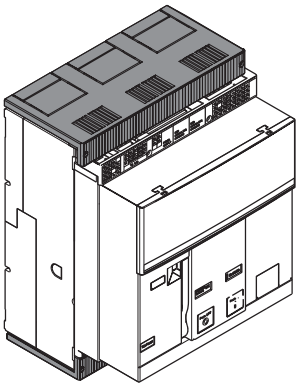
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0714 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0714.

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





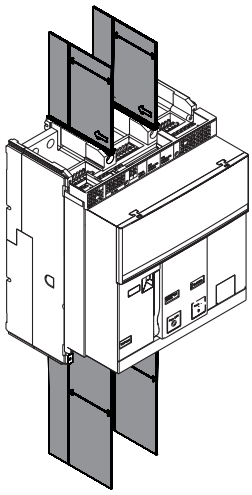
[1] Only for E1.2

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.

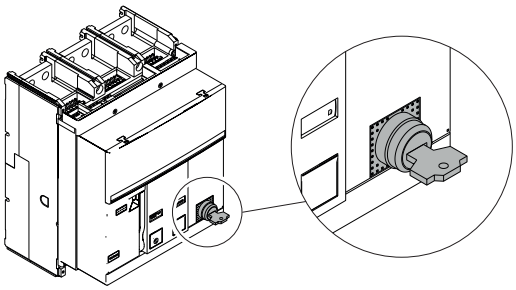
The KLC lock is available with two types of locking:

- 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.

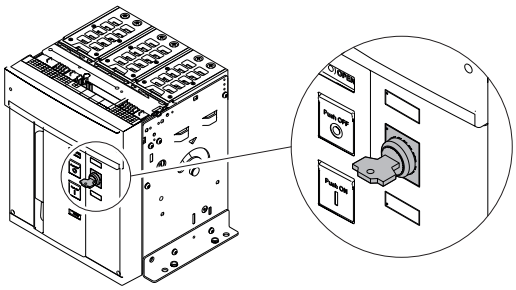
If set up appropriately, the KLC-A lock can work with four other types of locks:

- 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

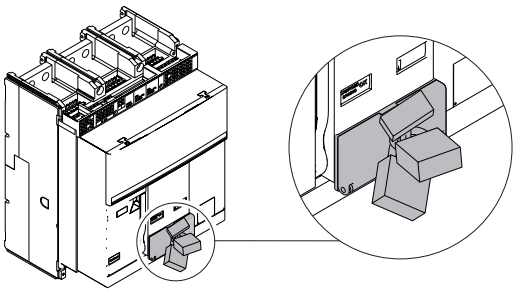
PLC: padlock

The PLC locks the circuit-breaker in the open position.

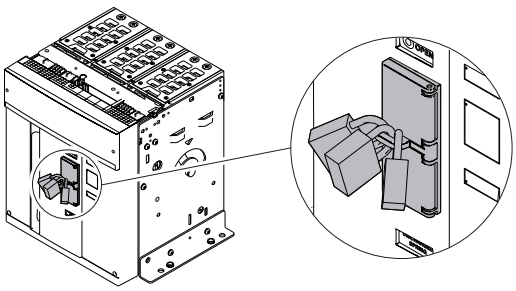
It is available in two types:

- lock usable with a maximum number of three padlocks with a diameter of 4 mm - 0.16"
- lock usable with a maximum number of two padlocks with a diameter of 8 mm - 0.32"
- lock for a padlock with a diameter of 7 mm - 0.28" or for a latch chain

NOTE: *The padlocks are at customer's expenses.*



PLC for E1.2



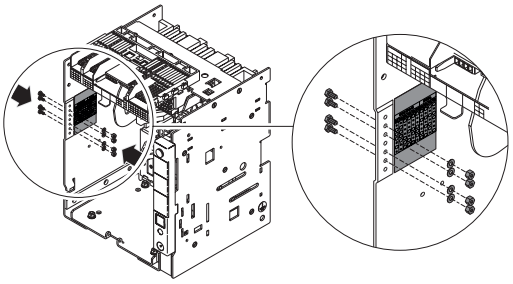
PLC for E2.2 - E4.2 - E6.2

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.

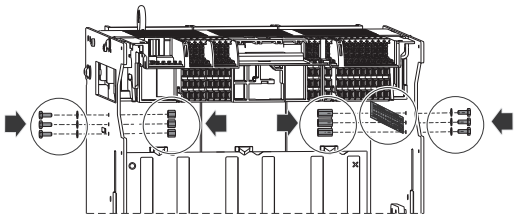
Anti-insertion lock

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

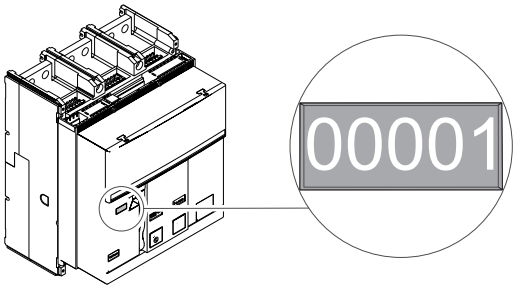


Lock for E2.2 - E4.2 - E6.2

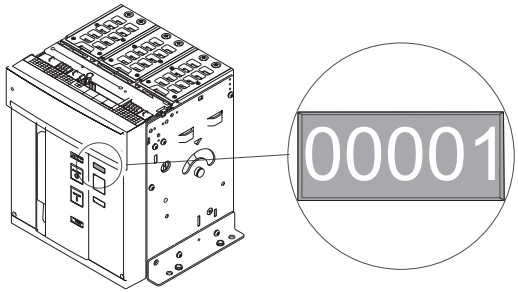
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0701 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0701.

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.

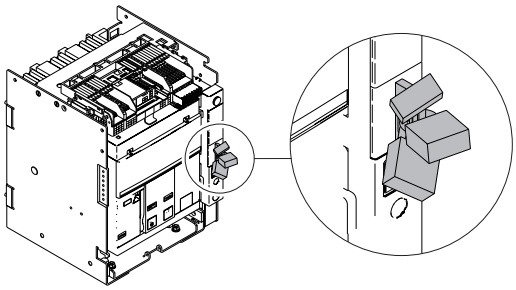
PLP: padlock in connected/ test/disconnected positions

The PLP locks the moving part of a withdrawable circuit-breaker in the fixed part, in one of the following positions:

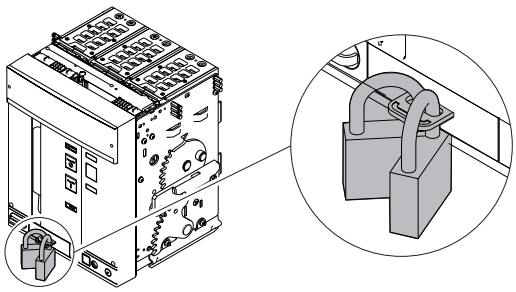
- connected
- test
- disconnected

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.

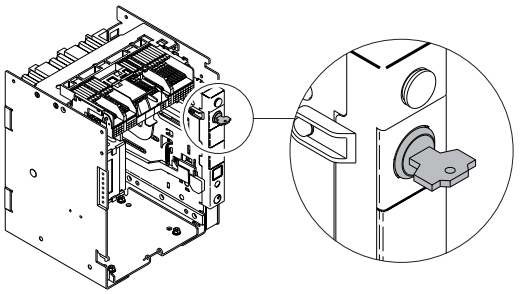
Through an appropriate setup, the KLP lock for connected/test/disconnected positions can work with three other types of lock:

- Ronis
- Profalux
- Kirk
- Castell

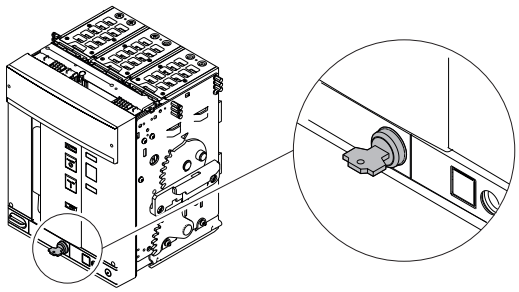
The maximum number of locks that can be installed per circuit-breaker is the two, for all types of lock.

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

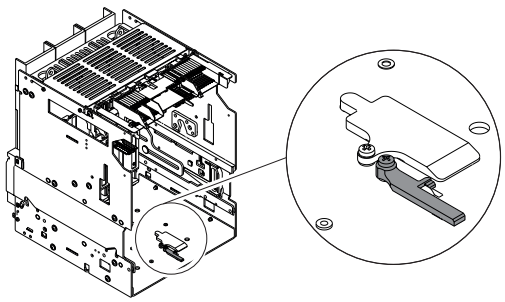
- 1SDH000999R0704 and 1SDH000999R0726 for key locks with lock supplied by ABB
- 1SDH000999R0705 for the key locks with pre-engineering for Ronis - Profalux - Kirk locks
- 1SDH000999R0719 for the key locks with pre-engineering for Castell locks

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.

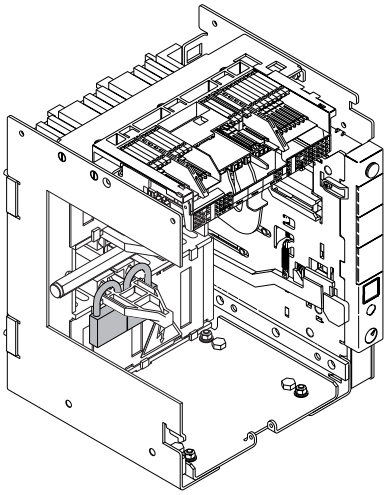
SL: shutter lock

The SL shutter locks the shutters of the fixed part.

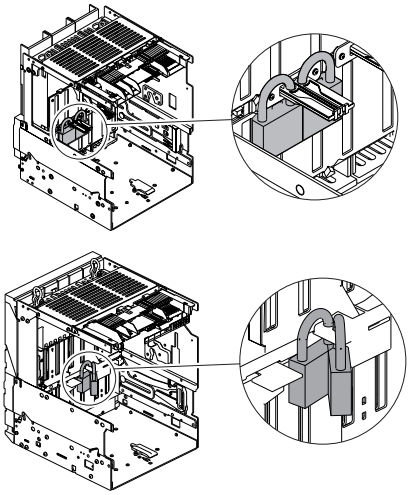
It is possible to lock the upper and lower shutters independently.

This is an accessory available on all the fixed parts and can work with the aid of padlocks with diameters of 4 mm - 0.16", 6 mm - 0.24", 8 mm - 0.32", 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

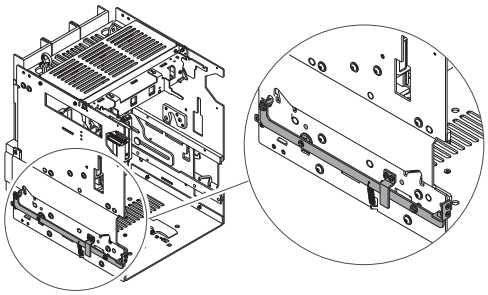
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0712 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0712.

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

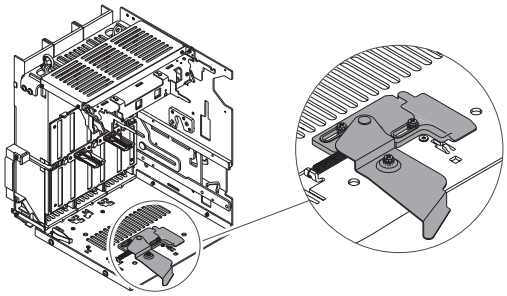
[1] Not available for E1.2

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 E1.2circuit-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 C 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).

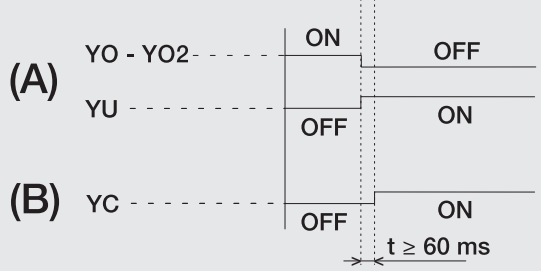


Figure 138

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 150 158
	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	Iinst 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 *Measurement* 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 or Ekip Signalling	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: *Trip Fail command (BF)*	One or more of the following conditions: • 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 > 15kA	Threshold I31 (protection 2I) > 15kA
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 (IEEE1588 or SNTP) on one single module or between different modules
30013	Network Analyzer parameter control unsuccessful
Active Power Fail	Threshold P23 (protection UP) ≥ Threshold P26 (protection OP)
DLog not stopped	Modification of datalogger parameters not allowed with datalogger function not stopped
D Th ≥ I Th	Threshold I7 (protection D) ≥ Threshold I3 (protection I)
D Zone Sel = 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 > 1200A	Threshold I4 (protection G) or Threshold I41 (protection Gext or MDGF) > 1200A with CB in standard configuration UL
G Startup Th > 1200A	G or Gext or MDGF > 1200A protection threshold start up with CB in standard configuration UL
G FT time = 50 ms is not valid	Trip time I4 (protection G) = 50 ms
G Time> 400 ms	Trip time t4 (protetion G) > 400ms with CB in standard configuration UL
Gext Time> 400 ms	Trip time t41 (protetion Gext or MDGF) > 400ms with CB in standard configuration UL
Gext FT time = 50ms 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 ≥ S Th	Threshold I1 (protection L) ≥ Threshold I2 (protection S)
L Th ≥ S2 Th	Threshold I1 (protection L) ≥ Threshold I5 (protection S2)
L curve different to $I^2t=k$	Protection curve L different from $t=k/I^2$ with CB in standard configuration UL
L Th >980A	Threshold I1 (protetion I)> 980A with CB in standard configuration UL
Neutral configuration error	Configuration of neutral protection must conform to formula: I1 (A) ≥ Iu (A) x Ne config / 100
OV Threshold > 828 V	Threshold U9 (Protection OV) > 828V (690 x1.2)
OV2 Threshold > 828 V	Threshold U16 (Protection OV2) > 828V (690 x1.2)
RC toroid error	Activation of toroid Rc is not allowed without the presence of a model Rc rating plug
RQ Q24 ≥ Q27	Threshold Q24 ≥ Threshold Q25 (Protection RQ)
S Th ≥ I Th	Threshold I2 (Protection S) ≥ Threshold I3 (Protection I)
S2 Th ≥ I Th	Threshold I5 (Protection S2) ≥ Threshold I3 (Protection I)
S Time > 400 ms	Trip time t2 (protetion S) > 400ms with CB in standard configuration UL
S2 Time> 400 ms	Trip time t5 (protetion S2) > 400ms 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 ≥ 180 x Delta freq x [minimum correspondence time + 0.0023]
V DIR Th > 690*1.4	Protection threshold VDIR > 828V (690 x1.2)
VS Th > 690*1.4	One of the two thresholds of protection VS Warning > 828V (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 36.
- 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)	Internal error; contact ABB if this typoe of error occurs
Battery low	Change the battery (See 1SDH001000R0509 kit sheet)
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: • connection and powering of modules in terminal box or external • that the moldules 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: • *Rating plug* 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 20 51) • In the absence of *Vaux* threshold I4 and/or I41 > 100 A • In the absence of *Vaux* time t4 and/or t41 > 100 ms • RC protection active and *Rating Plug* not RC
Invalid Date	Wrong date and time: set in *Settings-System-Date* and *Settings-System-Time*
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 *Ekip Link* 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 *Ekip Signalling 3T* module
Ekip Sign 3T threshold	One or more thresholds of the *Ekip Signalling 3T* module has/have been exceeded
Internal error	Internal error; contact ABB if this typoe of error occurs
SNTP error	Fault with *Ekip Com* modules: synchronization problem of SNTP synchronization reference module
Measuring Error	*Measurement* module parameter reading error, contact ABB
Ethernet disconnected	No external cable on one or more *Ekip Com* modules with Ethernet connection
IEEE1588 synch	Synchronization problem of IEEE 1588 synchronization reference module
MAC Address	*Ekip Com* module detected with incorrect / not allowed MAC address, contact ABB.

Continued on the next page

Signal	Suggestions
Ekip Installation	Installation error between HMI and Mainboard, contact ABB
Measuring installation	Install *Measurement* module (*Settings-Circuit breaker-Installation-Measuring-Install*) menu
RatingPlugInstallation	Install Rating Plug (*Settings-Circuit breaker-Rating Plug-Install* menu) and check connection if there are further faults
Maintenance	Maintenance alarm: perform maintenance and then reset the alarm via Ekip Connect (see 1SDH001330R1002)
PC Power exceed	The average power limit setting of the Power Controller has been exceeded
Rating plug	*Rating plug* not present, value or size incompatible with Ekip Touch parameters
Zone Selectivity Diag	Error in zone selectivity connections (Hardware Selectivity)
Toroid S.G.R.	Check connection and state of current sensor
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 Ekip Touch
Configuration Session	TFTP server enabled and/or configuration session open on module *Ekip Com IEC61850* or *Ekip Hub*
Software Not Compatible	The software versions between Mainboard and display (Ekip Touch) are not compatible with each other: To restore compatibility, please consult ABB. **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)*
CB status	CB state incorrect (esample: current present but CB in open state)
Switchboard Actor communication Error	Check configuration and connection of *Ekip Link* module
TC disconnected	Disconnection of Trip coil detected, check functionality
	Check Trip coil, status of the terminal and cables connecting to Ekip Touch
Contact Wear	Make sure that the contacts/poles are in good condition.

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 φ) 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.

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.

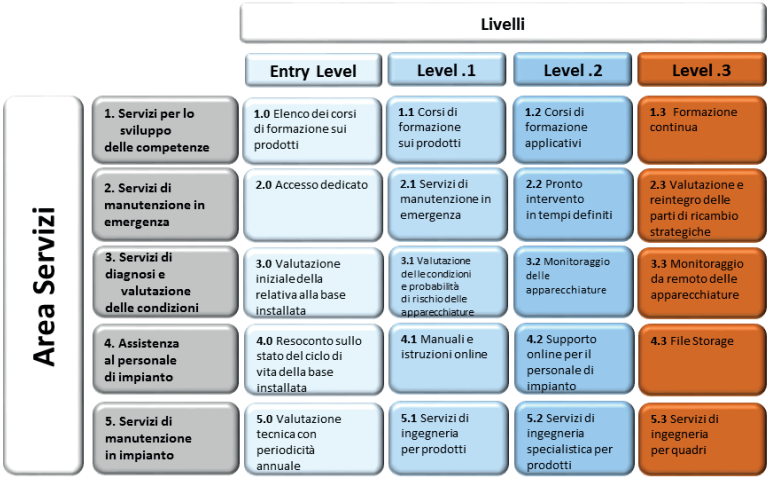
Description

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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