DOC. N° 1SDH001330R0002 - ECN000086018 - Rev. B

SACE Emax 2

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

Operating instructions for the design engineer

Power and productivity
for a better world™

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

1 - 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.

2 - Contents

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.

3 - Standards

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)

Guide to the product choice

1 - List for Emax 2 selection

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
N° poles	
	3
	4
Installation version	
	Fixed
	Withdrawable
Terminals	
	Horizontal/Vertical
	Spread
	Front
	Extended front
	Spread front
	Floor
	For 4x240 FcCuAl cable

NOTE: *details of the terminals are given in Emax 2 catalogue available on the website http://new.abb.com/low-voltage/products/circuit-breakers/emax2.*

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. For further details, consult Emax 2 catalogue available on the website http://new.abb.com/low-voltage/products/circuit-breakers/emax2.*

Protection functions of the electronic trip units

Basic protections that can be configured with Ekip DIP, Ekip Touch and Ekip LCD protection trip units	
	Overload (L - ANSI 49)
	Time-delayed overcurrent
	Instantaneous overcurrent (I - ANSI 50)
	Earth fault (G - ANSI 51N & 50N TD)
Additional protections available with Ekip Touch and Ekip LCD protection trip units (all versions)	
	Programmable instantaneous overcurrent (2I - ANSI 50)
	Earth fault with external toroid (Gext - ANSI 51G & 50GTD)
	Current unbalance (IU – ANSI 46)
	Zone Selectivity for S and G protections (ANSI 68)
	Undervoltage (UV - ANSI 27)
	Overvoltage (OV - ANSI 59)
	Underfrequency (UF - ANSI 81L)
	Overfrequency (OF - ANSI 81H)
	Voltage unbalance (VU – ANSI 47)
	Residual current (Rc – ANSI 64 & 50 NTD)
	Reverse active power (RP - ANSI 32R)
	Synchrocheck (SC - ANSI 25)
	Cyclical direction of the phases (ANSI 47)
	Power factor (ANSI 78)
Additional protections available with Ekip Touch and Ekip LCD protection trip units (in all Hi- versions)	
	Second time-delayed overcurrent (S2 – ANSI 50TD)
	Second earth fault (G2 – ANSI 50GTD/51G & 64REF)
	Directional overcurrent (D – ANSI 67)
	Zone Selectivity for D protection (ANSI 68).
	Second undervoltage and overvoltage (UV2 and OV2 – ANSI 27 and 59)
	Second underfrequency and overfrequency (UF2 and OF2 – ANSI 87L and 87H)
Additional protections available with Ekip Touch and Ekip LCD protection trip units (in all G versions)	
	Residual current earth fault (Rc - ANSI 87N)
	Voltage controlled overcurrent (S(V) - ANSI 51V)
	Residual overvoltage (RV – ANSI 59N)
	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)
Additional protections available with Ekip Touch and Ekip LCD protection trip units (all G Hi- versions)	
	Rate of change of frequency (ROCOF – ANSI 81R)
	Second voltage controlled overpower (S2(V) - ANSI 51V)
	Second protection against loss of field or reverse reactive power (RQ – ANSI 40 or 32R)

NOTE: *for full details on the operation of the electronic protections, see the relevant chapters* **Ekip Dip protection trip unit** *(starting on page* **18***) and* **Ekip Touch protection trip unit** *(starting on page* **37***).*

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* **292.**

Electronic accessories

Electronic accessories	
	Ekip Measuring - 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 "* **Electronic accessories** *" starting on page* **207.**

2 - 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 “Specific applications" starting on page 156.

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".

Documents and Tools for the design engineer

1 - Foreword

Various software programs and documents are available that allow optimization of the performance and installation of Emax 2. Most of them are available free on the internet.

2 - Software list

The following software programs are available for Emax 2.

e-Design ABB software suite that includes the following tools: DOC, CAT, Curves, DOCSolar, OTC and UniSec (for the configuration of medium voltage switchgear).

Further information is available on the website abb.com (OVERVIEW) which is the direct link to download the software (E-DESIGN).

DOC ABB SACE software for designing and calculating single-line diagrams for low and medium voltage electrical installations, for choosing protection and operating devices, and for checking and coordinating the protections.

DOC is available with the e-Design software suite.

CAT ABB SACE software for preparing technical/commercial estimates for ABB SACE products, and to facilitate the creation of quotations and offers.

CAT is available with the e-Design software suite.

Curves Software for designing, calibrating and to printing the trip curves of the protection devices.

Curves is available with the e-Design software suite.

OTC Thermal calculation software that allows you to check the thermal behavior of switchgear and to size fans and air conditioners to be installed in the switchgear

OTC is available with the e-Design software suite.

Front CAD

Software that provides libraries of graphical blocks for the products for ABB switchgear design to be used in the context of the latest available versions of AutoCAD, AutoCAD LT and IntelliCAD.

Further information is available on the website abb.com (Front CAD) which is the direct link to download the software (Front CAD).

NOTE: *the link launches the software package download, which requires about 190 Mb of space.*

Trip Unit simulator

It allows you to simulate the operation and the various programming options of the protection trip units.

Further information on the documentation is available on the website abb.com, in particular: Trip unit simulator.

Ekip Connect

ABB SACE software for interfacing with the low voltage circuit-breakers equipped with a compatible protection trip unit.

Further information on the documentation is available on the ABB library website, in particular: Ekip Connect, and on Android market, in particular: App Ekip Connect.

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.

Ekip View

It supervises the communication network. It analyzes changes in electrical values and the monitoring of the installation conditions. The application is only available in English.

Further information is available on the website abb.com (Ekip View) which is the direct link to download the software (Ekip View).

NOTE: *the link starts the download of the software package, which requires approximately 1.3 Gb of space.*

3 - Documentation list

The documentation (brochures, flyers, White Papers, etc.) is listed below.

Brochure: introductory overview

Main features of SACE Emax 2 circuit-breakers.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200023B0201.

Brochure: History of air circuit-breakers

Presentation of the origin and evolution of ABB air circuit-breakers ABB for low voltage applications.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200024B0201.

Brochure: retrofitting kit

Overview of retrofitting kits for New Emax circuit-breakers.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200034L0202.

Product notes for consultants

General overview of the features of Emax 2 circuit-breakers, specifically for consultants.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200032L0201.

Product notes for switchgear engineers

General overview of the features of Emax 2 circuit-breakers, specifically for switchgear engineers

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200028L0201.

Product notes the Ekip Link system

Introduction to the new Ekip Link switchgear control system

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200031L0202.

Product notes for Power Controller

Introduction to the new Power Controller load management system.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200030L0202.

Product notes for generator protections

General features for the new generator protections available with Emax 2 protection trip units.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200035L0202.

Product notes: migration to Emax 2

Advantages and details of migration from New Emax to Emax 2 circuit-breakers.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200036L0201.

White Paper for generator protections

White Paper on generator protections.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC007409G0202.

White Paper for Ekip Power Controller

White Paper on the Power Controller function.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC007410G0202.

White Paper for communication

White paper of communication modules for Emax2.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC007412G0201.

Product Notes for IEC 61850

Overview of the new IEC 61850 communication modules.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200038L0201.

Product notes for Network Analyzer

Introduction to the new Network Analyzer measurement and analysis system.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200037L0202.

Catalogue

Emax 2 general catalogue.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC200023D0204.

Handbook

The scope of this manual for electrical installations is to provide the design engineer and the user of electrical installations with a rapid access work tool.

Further information on the documentation is available on the ABB library website, in particular in the document 1SDC010002D0206.

Introduction to Ekip trip units

1 - Presentation

Families and functionality

SACE Emax 2 can be configured with five different types of protection trip unit, distinguished by type of interface and functionality. One trip unit has a dip-switch interface (Ekip Dip) while the others are equipped with a touchscreen display (Ekip Touch).

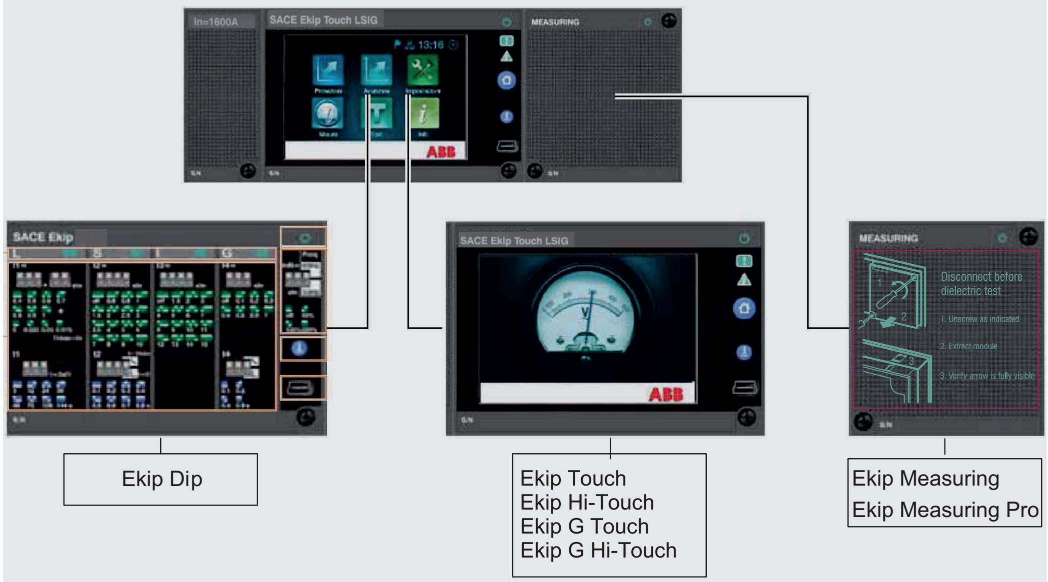


Figure 1

All trip units have protection and measuring functions that refer to the primary currents of the installation and are available in the following versions:

- **Ekip DIP:** LI, LSI, LSIG
- **Ekip Touch:** LI, LSI, LSIG
- **Ekip Hi-Touch:** LSI, LSIG
- **Ekip G Touch:** LSIG
- **Ekip G Hi-Touch:** LSIG

The Ekip Touch trip unit can be equipped with the Ekip Measuring module to extend the measurement functions, or the protection and measurement functions (with the Ekip Measuring Pro module), to voltage, power and energy.

NOTE: *Ekip Hi-Touch, Ekip G Touch and Ekip G Hi-Touch trip units have the Ekip Measuring Pro module mounted as standard.*

The corresponding LCD model (Ekip LCD, Ekip Hi-LCD, Ekip G LCD, Ekip G Hi-LCD) is available for all Ekip Touch versions if the installation must operate under particularly aggressive environmental conditions.

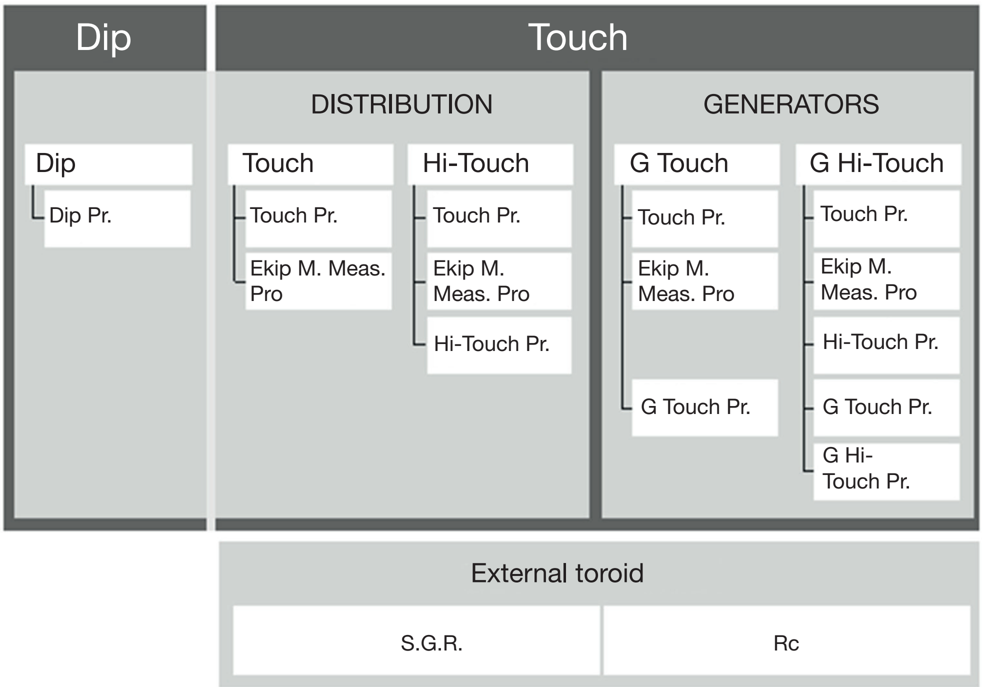
The following chapters describe all the functional and usage specifications of the Ekip Dip and Ekip Touch trip units, organised by topic:

- **User interface:** for correct use of the interface.
- **Protections:** description of the protections available with each model of the trip unit.
- **Measurements:** description of the measurements available for each trip unit.
- **Test:** to allow the operator to perform tests on the unit.
- **Self-diagnosis:** description of the integrated self-checking function on the trip unit.
- **Accessories:** presentation of all the accessory modules by trip unit and the related additional functions.

All characteristics are described for each protection trip unit:

Trip units	Page
Ekip Dip	18
Ekip Touch	37

Protections Numerous protection functions are available to protect the circuit-breaker in abnormal conditions of the installation. The combination of the protection functions varies depending on the type of trip unit, as shown in the following table:

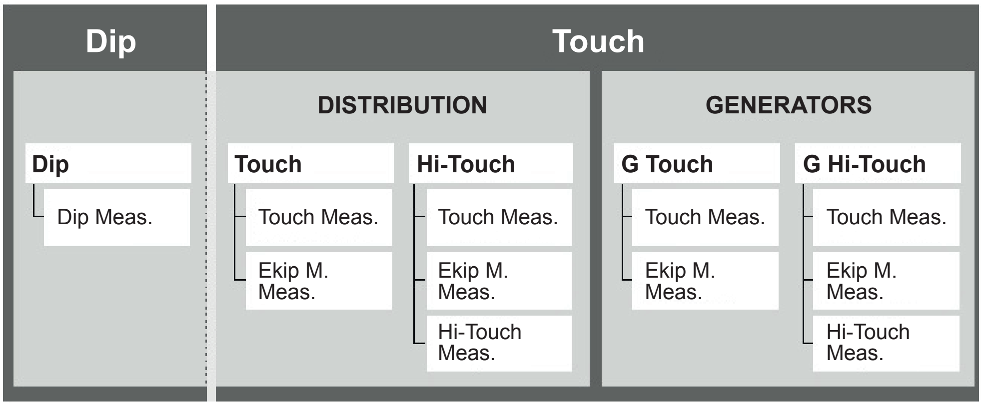


All the protections are described by type:

Type	Available protections	Page
DIP protections	L (+ functions), S (+ functions), I, G	20
Touch protections	L (+ functions), S (+ functions), I (+ functions), G (+ functions), 2I, MCR, IU	61
Measuring Pro protections	UV, OV, UF, OF, VU, RP and SC (if the Ekip Synchrocheck module is also present)	75
Hi-Touch protections	S2, D (+ functions), UV2, OV2, UF2, OF2, Set A-B	81
G Touch protections	S(V), RQ, OQ, OP, UP	90
G Hi-Touch protections	ROCOF, S2(V), RQ2	96

Touch trip units can be connected to an SGR or RC toroid, which allow activation, respectively, of the **Gext** protections (page 287) and **Rc** protections to be activated (page 101).

Measurements The trip units include a huge range of measurements. As for the protections, availability and combinations vary for each version of the trip unit:



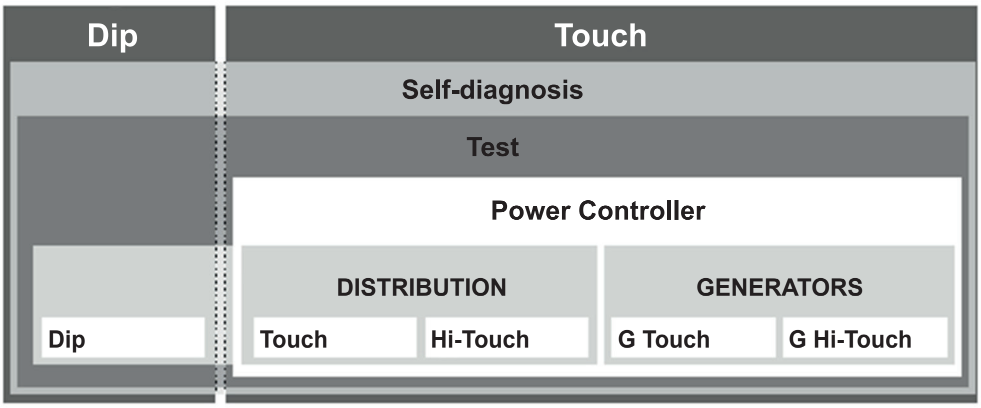
All the measurements are described by type:

Type	Available measurements	Page
Dip measurements	Currents, Trip History, Measurement History, Total Operations of the circuit-breaker, Contact Wear	27
Touch measurements	Currents, Trip History, Measurement History, Peak Factor, Datalogger, Total Operations of the circuit-breaker, Contact Wear	105
Ekip Measuring Measurements	Voltages, Powers, Energies, Frequencies, Measurement History, Power factor	110
Hi-Touch measurements	Waveforms, Harmonics, Network analyzer	114

Integrated functions: Self-diagnosis, Test and Power Controller All the protection trip units for Emax 2 integrate:

- Self-diagnosis: continuous monitoring of the state of the internal and external connections, with signalling of any faults that may occur.
- Test: checking of the protections and of the other functionalities.

In addition, trip units of the Ekip Touch series can be supplied equipped with Power Controller to manage the energy demand.



The additional functions are described for each protection trip unit:

Trip units	Available functions	Page
Ekip Dip	Test, self-diagnosis	28, 29
Ekip Touch	Test, self-diagnosis, Power Controller	118, 120, 131

Accessorizing modules

The Emax 2 circuit-breakers and Ekip trip units can be equipped as indicated in the combination tables on page 195.

Various types of modules are available, differing in functionality and in their position on the circuit-breaker.

The modules that can be connected directly to the electronic trip unit are:

Name	Description	Page
Ekip Measuring Ekip Measuring Pro	Power supply, protection and measurement modules.	210
Ekip Signalling 4K	Signalling module	224

NOTE: *the Ekip Signalling 4K module is not available for E1.2 circuit-breakers.*

The modules available for the terminal box of the circuit-breaker are:

Name	Description	Page
Ekip Supply	Power supply module	208
Ekip Signalling 2K	Signalling module	231
Ekip Signalling 3T	Signalling module	239
Ekip Synchrocheck	Module for measuring voltage and synchronism between two power sources	216
Ekip Com Modbus RTU Ekip Com Profibus DP Ekip Com DeviceNet™ Ekip Com Modbus TCP Ekip Com Profinet Ekip Com EtherNet/IP™ Ekip Com IEC 61850 Ekip Com Hub	Communication module	243
Link	Communication module	275

The modules external to the circuit-breaker are:

Name	Description	Page
Ekip Multimeter	Power supply and measurement module	289
Ekip Signalling 10K	Signalling module	290
Ekip Signalling Modbus TCP	Remote control and monitoring module	290

The supervision, configuration and reporting functions are, in addition, guaranteed by further modules for temporary power supply and communication (test modules):

Name	Description	Page
Ekip TT	Power supply and test module	289
Ekip T&P	Power supply, communication and test module	289
Ekip Programming	Power supply, communication and programming module	289
Ekip Bluetooth	Power supply and communication module	288

Information about the LCD version of the trip units is available from page 287.

Ekip Dip protection trip unit

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:

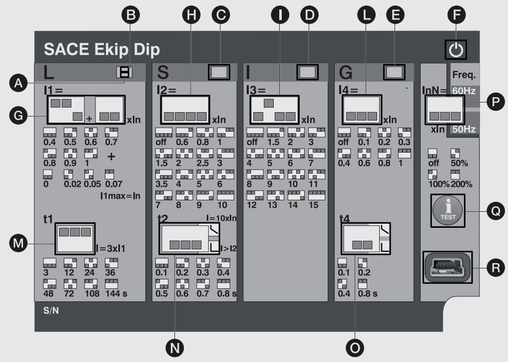


Figure 2

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)
Or		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 or by Ekip Bluetooth) 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).

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

Continued on the next page

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 and Ekip Bluetooth modules 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 of the trip unit defined by the Rating Plug.

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

Protections: times

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

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

Settings

Two further settings are available:
- **Neutral** allows activation and adjustment of the protections on the neutral pole.
- **Frequency** allows the selection of the installation frequency.

iTest pushbutton

The iTest pushbutton is useful for three operations:
- Perform tests (circuit-breaker opening test and LED test). Consult chapter 4 - Test18 - Test on page 28118.
- 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

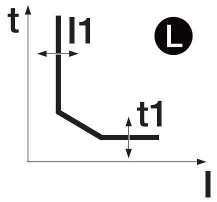
The test connector allows the connection of Ekip TT, Ekip T&P and Ekip Bluetooth modules, in order to perform the following operations:
- Temporary energizing of the trip unit to check the status, and perform the trip test (option possible with all the front interface modules).
- Analysis, supervision and setting of additional parameters through external communication test units (Ekip T&P, Ekip Bluetooth).

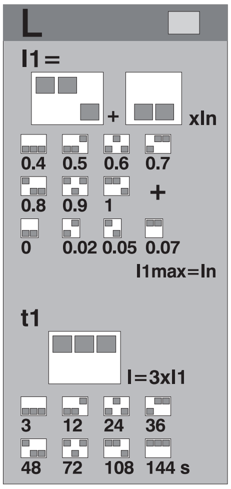
2 - Protections

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.**

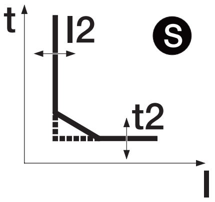
[(1)] *Example (with I1 set to 400 A): the protection is activated for currents between 420 A and 480 A.*

With the modules Ekip T&P or Ekip Bluetooth and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**, and adjust the threshold of **Pre-alarm**. See page 25.

S Protection

S protection protects against selective short circuit.

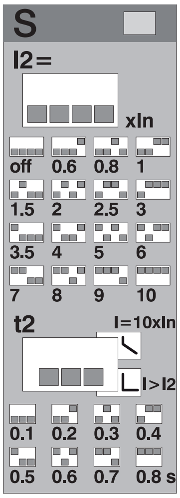
NOTE: *the protection is available for LSI and LSIG versions of the trip unit.*



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.



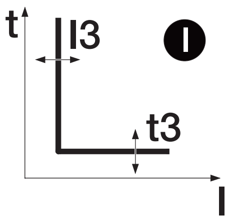
Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Type of curve	It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: **NOTE:** calculation of the tripping time of the inverse time curve 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 by the trip unit is 0.4 s. If a higher value is set, the trip unit signals the error and forces the parameter to 0.4 s.**

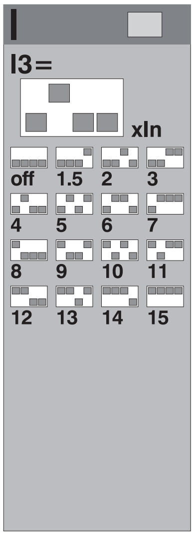
With the modules Ekip T&P or Ekip Bluetooth and with the Ekip Connect software, it is possible to activate the function **Thermal Memory**. See page 25.

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

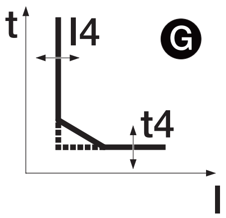
The user can set the intervention threshold.

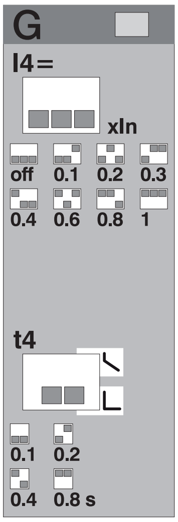
Parameter	Description
Enable	By setting the threshold dip-switches to the Off position, the protection is disabled.
Threshold I3	It defines the current value that activates the protection when exceeded (with reference to the curve, it is the part parallel to the y-axis). **IMPORTANT: The I3 threshold 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).

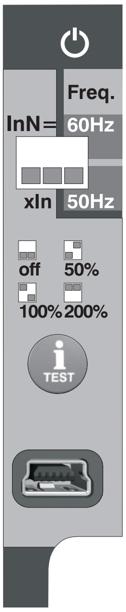
Parameters

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 or Ekip Bluetooth modules and with the Ekip Connect software, it is possible to adjust the threshold of **Pre-alarm**. See page 25.

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	Represented as a percentage; it defines the multiplication factor applied to the tripping 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: $(I1 * InN) \leq Iu$.

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

Additional protections

The Ekip T&P and Ekip Bluetooth modules, 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

This function, available for protections L and S, reduces the tripping time of the protection based on the time elapsed between multiple trips caused by heating of the cables.

NOTE: *for correct calculation of the time between the various trips, the trip unit must have been powered for at least one 1 second.*

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

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 < -25 °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

Hardware Trip protection protects against internal disconnections of the circuit-breaker. Via Ekip Connect it is possible to enable the trip command, which is sent if one or more of the following events is detected:

- Current sensors disconnected (internal or external if enabled).
- Rating Plug disconnected.
- Trip Coil disconnected.
- Internal problems with the protection trip unit.

IMPORTANT: the protection trips if the error conditions persist for more than 1 second.

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 %

3 - Measurements

Introduction Measurements

The Ekip Dip trip unit records various items of information, useful for analysis and consultation:
- Instantaneous measurements of phase currents
- Measurement of the maximum and minimum currents recorded with an adjustable interval
- Trip Log
- List of events, changes of state and alarms recorded by the trip unit
- Contact Wear value
- Number of mechanical and electrical operations.

NOTE: *all the information is available with Ekip T&P and Ekip Bluetooth modules and with the Ekip Connect software. The instantaneous measurements are also available with the Ekip Multimeter switchgear unit.*

Instantaneous currents

The following table summarises the measurements of the instantaneous currents:

Type of Measurement	Range	Standard operation range	Accuracy
Phase currents (I1, I2, I3, INe)	0.03…16 In	0.2…1.2 In	1 %

NOTE: *the precisions specified in the table refer to the range of normal operation*

Maximum and minimum currents

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

Every measurement recorded is accompanied by the following information:
- Recording interval.
- Phase and value of maximum and minimum current measured.
- Date and time of the recording (referring to the internal clock).

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

Trips

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

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

Contact Wear

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

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

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

Number of operations

In the presence of auxiliary power, the trip unit records a series information relating to the openings of the circuit-breaker:
- Number of manual operations
- Total number of operations (manual + trips)

4 - Test

Presentation

The Ekip TT, Ekip T&P and Ekip Bluetooth modules connected to the Ekip Dip trip unit 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 or Ekip Bluetooth 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.

Further information on Ekip Connect is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular with the manual 1SDH000891R0002.

Opening test

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

To perform the test from the trip unit:

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:

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

Further information on Ekip Connect is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular with the manual 1SDH000891R0002.

5 - List of alarms and signals

LED view

The Ekip Dip trip unit 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.

Figure 3

NOTE: *the number of LEDs depends on the version of the trip unit (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 • $I1 \geq I2$ or $I2 \geq I3$. • 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	Carry out installation.
F	Connect via Ekip Connect in order to set the Local Bus or to confirm maintenance.
G	Contact ABB to restore software compatibility between Ekip Dip and Mainboard.
H	Replace the battery.

6 - Ekip Dip: additional functions

Presentation

Ekip T&P, Ekip Programming and Ekip Bluetooth 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.

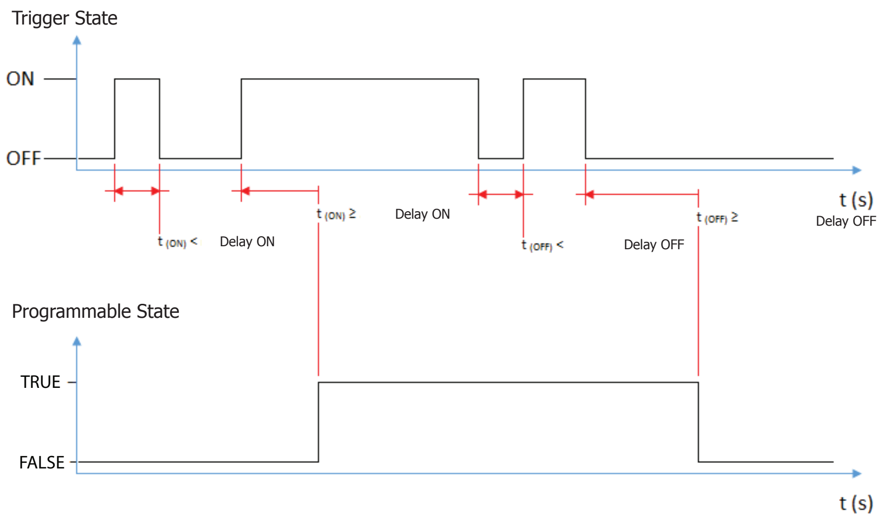
Programmable States

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* **118).**

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.

Info Page

Additional information page that can be activated and customized by the user. If activated, it can be accessed on the display by pressing the iTest button twice from the main page.

NOTE: *the pages can be configured with all the trip units for SACE Emax 2 circuit-breakers, but they can only be displayed via Ekip Touch.*

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.

Energy Store Time

The counter indicates the time that has elapsed since the last energy metering reset.

It is active and updated in the presence of at least one of the following: auxiliary supply, supply by Ekip T&P or supply by Ekip Measuring.

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.

Open/Close Remote Direct Command

The parameter controls two different command packages for remote circuit-breaker opening and closing:

- **Enabled**: commands 7 and 8 are valid (direct commands for **CB Open** and **CB Close**).
- **Disabled**: commands 7 and 8 are not valid.

IMPORTANT: in this case, remote circuit-breaker opening and closing can still be obtained using the programmable YC COMMAND and YO COMMAND functions and the Request circuit-breaker opening (28) and Request circuit-breaker closing (29) commands.

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.

7 - Operating features

Primary operating currents

The Ekip Dip trip unit can be powered directly by the internal current sensors, with clearly defined primary currents.

The operating conditions for proper operation are listed below:

Parameter	Operating limits
Minimum three-phase turn-on current	> 80 A (E1.2-E2.2-E4.2) > 160 A (E6.2)
Rated frequency	50 / 60 Hz ± 10 %
Harmonic distortion	Conforming to 60947-2

Auxiliary power supply

The Ekip Dip trip unit can be connected to an external auxiliary power source, useful for activating some functions such as communication on the Local Bus or recording of manual operations.

The auxiliary power can be supplied by the modules of the Ekip Supply range (for further functional details, see page 208), or with direct connection to a terminal box.

The direct connection must be made guaranteeing 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 a two-pole shielded cable (Belden 3105A type or equivalent)

IMPORTANT: in case of direct connection, the power supply must be galvanically insulated and provide the insulation characteristics established by the Standard IEC 60950 (UL 1950) or equivalent.

8 - 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
Monitor time	5 minutes
Local Bus	Disabled
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 protection trip unit

1 - Layout of the interface

Functions of the interface

The operator interface for Ekip Touch trip units allows to:
- Dislpay signals and measurements related to the functions in progress, or recorded events.
- Configure the circuit-breaker, and the installation parameters.
- Set the parameters for available protections and for other functions of the trip unit.
- Set parameters for the connected accessory modules.
- Perform tests.
- Display information on the circuit-breaker, trip unit, and connected accessory modules.

Components of the interface

The operator interface for the Ekip Touch trip units appears as follows:

Figure 4

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

Pos.	Description
A	Touchscreen display.
B	Power LED, green.
C	LED Warning, yellow.
D	LED Alarm, red.
E	The **HOME** key accesses the main page, or the **initial page**.
F	**iTEST** key. If the main page or a level 2 page is displayed (see below), whenever you press on it the following pages are displayed in succession: • **List of Alarms**, if there are any messages. • **Protection unit**, with information on Mainboard and trip unit. • **Circuit-breaker**, with information on the circuit-breaker. • **Last opening**, with information on the last opening. If the **Trip Test** item has been selected in the **Test** menu, it will execute the opening command when pressed and held for at least 7 seconds.
G	Test connector.

Signallings The following table provides a description of the signals of the interface:

LEDs	Description
Green	The possible states are: • Off: power supply absent. • On, fixed or flashing: power supply present, and trip unit on. **NOTE**: if the trip unit is off and no opening has taken place, if you press the **iTEST** key the LED comes on for 6 s.
Yellow	The possible states are: • Off: no warning or error. • On, blinking rapidly: absence of communication between trip unit and Mainboard, or installation error (of the Rating Plug, or the Ekip Measuring module, or Ekip Measuring Pro). • On, flashing slowly: internal error. • On, with two quick flashes every 0.5 s: parametrization error. • On, fixed: prealarm of protection L, or circuit-breaker state error.
Red	The possible states are: • Off: no alarm or error. • On, blinking rapidly: absence of communication between trip unit and Mainboard, or trip coil disconnected, or current sensor disconnected, or delay active. • On, with two quick flashes every 2 s: rating plug error. • On, flashing slowly: internal error. • On, fixed: tripping signal.

Structure of the pages The following table shows how the pages shown on the display are structured:

Level 1	Level 2	Level 3
Diagnosis bar	**Alarm list** page	
Main page	**Histograms** page	
	Menu page	**Protections** menu
		Advanced menu
		Measurements menu
		Settings menu
		Test menu
		About menu
	Measuring instruments pages	
	Measurements pages	

NOTE: *the level 3 pages are not graphical pages, and are dealt with in chapter "***6 - Menu" on page 46.**

Diagnosis bar The diagnosis bar is present on the main page and on level 2 pages, along the lower side of the display.

The bar appears as follows:

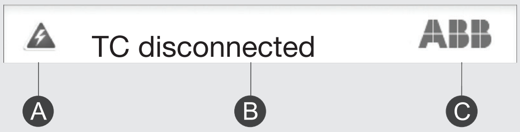


Figure 5

The following table provides a description of the various areas of the bar:

Pos.	Description
A	It shows the type of message: •  Alarm •  Warning, error, or prealarm •  Information •  Active timing
B	It displays the active messages one by one in a loop.
C	ABB logo.

The complete list of messages is given on page 120.

Main page To open the page, press the key **HOME**.

The page appears as follow:

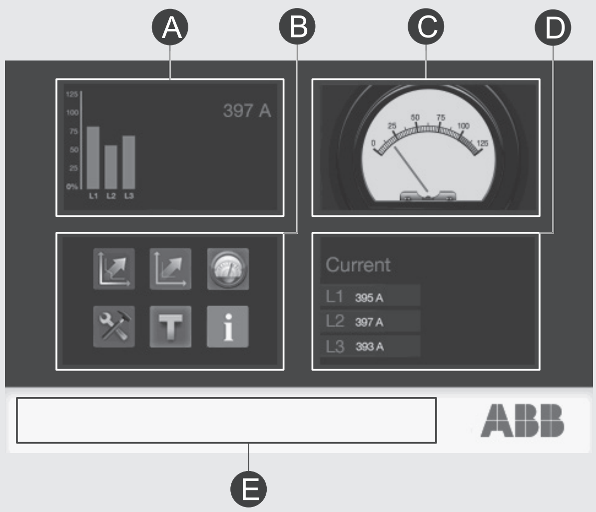


Figure 6

The following table provides a description of the various areas of the page:

Pos.	Function
A	It opens the **Histograms** page.
B	It opens the **Menu** page.
C	It opens the **Measuring instruments** page.
D	It opens the **Measurements** page.
E	In the presence of messages, it opens the **Alarm List** page.

Start page

To open the page, press the **HOME** key until the page is displayed.

The system returns automatically to this page after some minute of inactivity.

The default **start page** is the **Histograms** page.

Any graphical level 2 page (accessible from the main page) can be set as the **start page**, except for the pages **Alarm List** and **Menu**.

To set a page as the start page, you need to:

1. Open the page
2. Keep the **HOME** key pressed for at least 5 seconds.
3. Select **Yes** in the confirmation window that appears on the display.

Navigation

The following table shows how to access the pages through the keys:

To open...	Perform these operations...
The main page	Press the **HOME** key.
The start page	Press the **HOME** key, until the **start page** appears.
The **Alarm List** page	If there are messages present, if the diagnostics bar is displayed: • Touch the display in the message display area, or • Press the **iTEST** button.
The **Info** page	Press the **iTEST** key, until the **Info** (1) page appears.

(1) The Info page displays five lines of twenty characters each containing alphanumeric data that the customer can insert through the Ekip Connect software (see the chapter "17 - Other accessories", and the paragraph " Ekip Connect software" on page 288). To be displayed, it must be enabled (see the chapter "6 - Menu", and the paragraph "Settings Menu" on page 49).

2 - Alarm List Page

Description

The page **Alarm List** shows the list of messages present.

The Alarm page is available:

- By touching the diagnosis bar, in the message display area.
- By pressing the key **iTEST**.

NOTE: *when the menus, or the pages that can be accessed from them are displayed, the key* **iTEST** *doesn't open the page* **Alarm List**.

The page orientation (horizontal by default) can be changed from the **Settings** menu, by selecting *System - View* (see the chapter "6 - Menu", and the paragraph "Settings Menu" on page 49).

Components of the page

The page appears as follow:

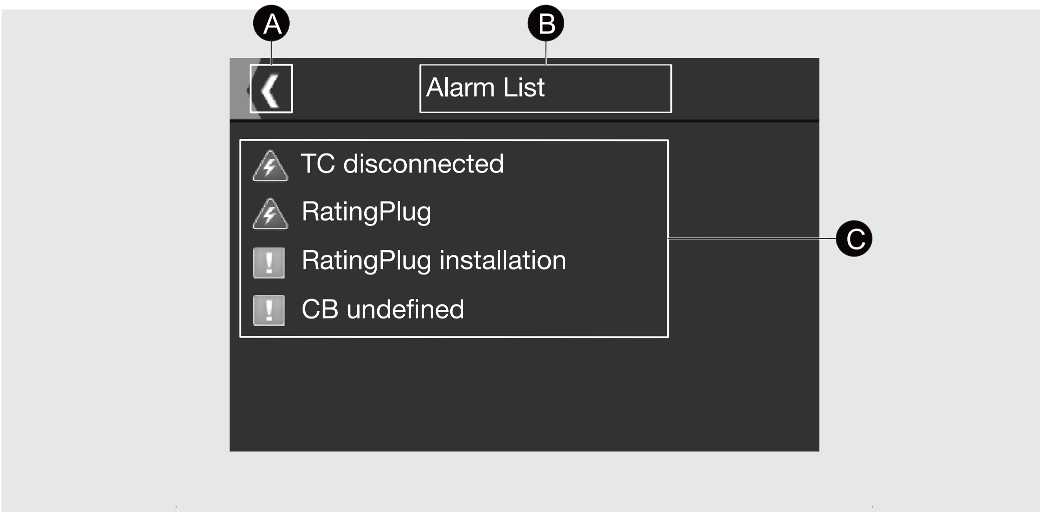


Figure 7

The following table provides a description of the various areas of the page:

Pos.	Function
A	It opens the page displayed previously
B	It shows the name of the page
C	It shows the list of messages of: • Alarm • Warning, error, or prealarm • Information • Active timing

3 - Histograms Page

Description

The **Histogram** page:

- This is the default **initial page** (accessed upon powering).
- It shows the histograms of the voltage and current measurements, acquired in real time by the trip unit.

Components of the page

The page appears as follow:

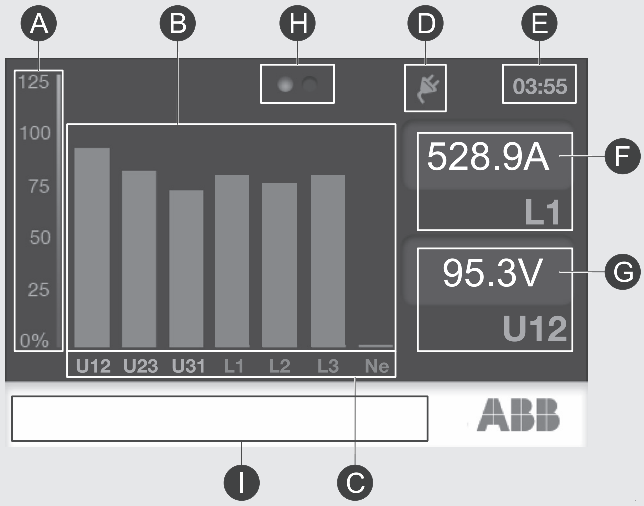


Figure 8

The following table provides a description of the various areas of the page:

Pos.	Description
A	Y-axis of the histogram, with the measurements expressed as percentage of the nominal values set.
B	Bars that represent the measurements of phase-to-phase voltages U12 U23 U31, and of the phase currents L1 L2 L3 and of the neutral Ne: • In blue: no alarm. • In yellow: voltage or current in prealarm, compared with the thresholds set (see the chapter "9 - Touch protections" from page 61, and the chapter "10 - Measuring Pro protections" from page 75). • In red: voltage or current in alarm, compared with the thresholds set (see the chapter "9 - Touch protections" from page 61, and the chapter "10 - Measuring Pro protections" from page 75).
C	X-axis of the histogram. **NOTE:** • *The voltage histograms are shown with the Ekip Measuring accessory module.* • *The Ne current histogram is shown with circuit-breaker configured with neutral.*

Continued on the next page

Pos.	Description
D	Signalling and functions in progress: • Remote connection, visible with auxiliary voltage and Ekip Com accessory modules. • o Auxiliary voltage or Test connection. • or If the **Dual Set** function is enabled (see **Settings** menu), the letter identifies the activated configuration.
E	Current time.
F	• Measurement of the maximum phase current, as an absolute value (Ampere). • Phase to which the measurement refers.
G	Displayed with the Ekip Measuring module: • Measurement of the maximum phase-to-phase voltage, as an absolute value (Volt). • Concatenated to which the measurement refers.
H	Viewed with the Ekip Measuring module, it indicates the presence of several pages, that you can scroll through by touching the sides of the display, and in which of these pages you are.
I	Diagnosis bar.

Possible operations

If Ekip Measuring or Ekip Measuring Pro are installed, access the histogram page and press the sides of the display to access a page containing a summary of the main measurements (maximum phase current, line-to-line overvoltage, power factor, active, reactive and apparent power). If Ekip Synchrocheck is also available, there is a further page with a summary of the main measurements associated with the module (Int and Ext voltages and frequencies, phase difference, synchronism state).

Both pages can be set as main page by pressing and holding down the HOME key.

4 - Measuring instruments pages

Description

The **Measuring instruments** pages show an indicator of the maximum phase current, or the maximum line-to-line voltage, or the active, reactive or apparent power.

The page orientation (horizontal by default) can be changed from the **Settings** menu, by selecting *System - View* (see the chapter "6 - Menu", and the paragraph "Settings Menu" on page 49).

Components of the pages

The pages appear as follows:

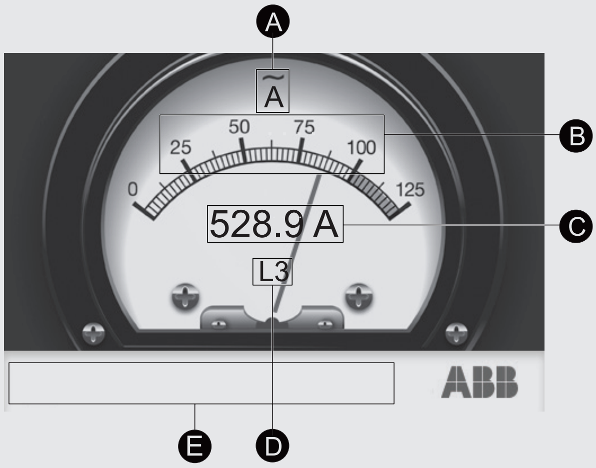


Figure 9

The following table provides a description of the various areas of the pages:

Pos.	Description
A	Type of indicator: • A: ammeter, with measurement of the maximum phase current. • V: ammeter, with measurement of the maximum phase-to-phase voltage. • kW: measurement of the active power. • kVAR: measurement of the reactive power. • kVA: measurement of the apparent power. **NOTE**: *all the indicators except the ammeter are available with the Ekip Measuring module.*
B	Measurement expressed as a percentage of the nominal value set.
C	Measurement as an absolute value (A, V, kW, kVA).
D	Phase current or phase-to-phase voltage, to which the measurement refers.
E	Diagnosis bar.

Possible operations

In these pages, the following operations are possible:

- By touching the sides of the display, scroll through the available indicators.
- Open the page **Alarm List**.

5 - Measurements pages

Description

The pages **Measurements** display a list of real-time measurements of currents, voltages, active/reactive/apparent power, or relavant to the energy counters, or to the Power Controller function.

NOTE: *the voltage and power measurements, and the measurements related to the energy counters and the Power Controller function, are available with the Ekip Measuring module.*

Components of the pages

The pages appear as follows:

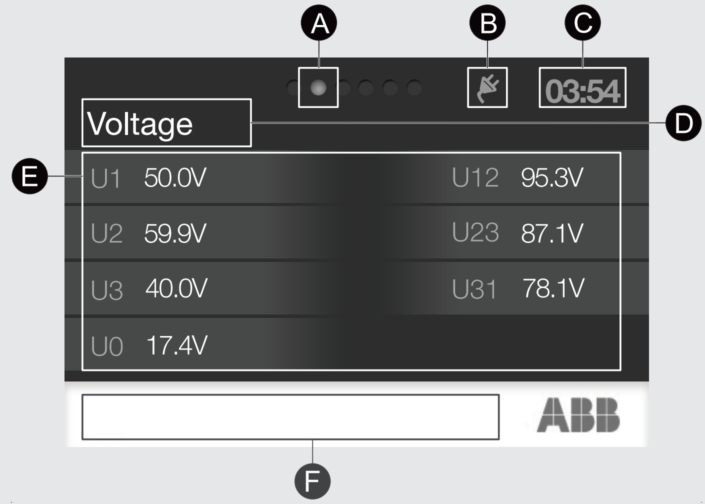


Figure 10

The following table provides a description of the various areas of the pages:

Pos.	Description
A	Viewed with the Ekip Measuring module, it indicates the presence of several pages, that you can scroll through by touching the sides of the display, and in which of these pages you are.
B	Signalling and functions in progress (see the **Histograms** page)
C	Current time.
D	Unit in which the measurements are displayed.
E	Real time measurements.
F	Diagnosis bar.

Possible operations

In these pages, the following operations are possible:

- By touching the sides of the display, scroll through the pages with the available measurements.
- Open the page **Alarm List**.

6 - Menu

Introduction

This paragraph illustrates:
- **Menu** page.
- The structure of the menus.
- How to navigate among the menus

The **Menu** page is the menu access page.

The menus are the level 3 pages that can be displayed on display (see the chapter “1 - Layout of the interface" and the paragraph "Structure of the pages" on page 38), and they include lists of:
- Submenus.
- Parameters that can be set.
- Commands that can be performed.

Selecting a menu item can:
- Open a submenu.
- Open the page **Modify Parameter** to set a parameter.
- Display scrollable lists of information (example: on circuit-breaker, trip unit, connected electronic accessories), real-time measurements, recorded events.
- Open a graphical page (secondary).
- Perform a command (example: reset or test).

Components of the page

The page appears as follow:

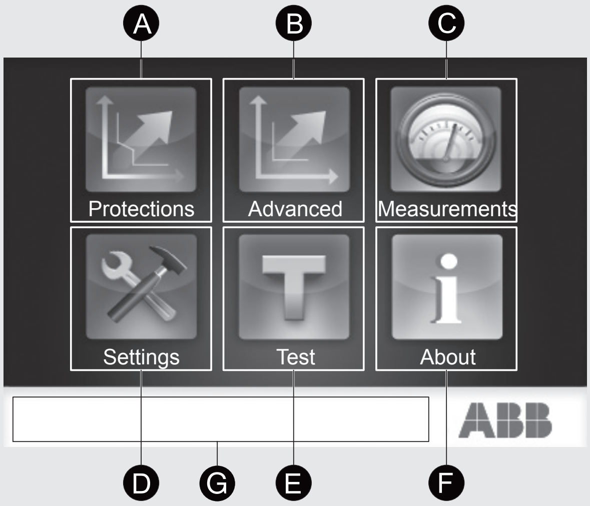


Figure 11

The following table provides a description of the various areas of the page:

Pos.	Function
A	It opens the **Protections** menu.
B	It opens the **Advanced** menu.
C	It opens the **Measurements** menu.
D	It opens the **Settings** menu.
E	It opens the **Test** menu.
F	It opens the **About** menu.
G	In the presence of messages, it opens the **Alarm List** page.

Components of the menus

The menus appear as follows:

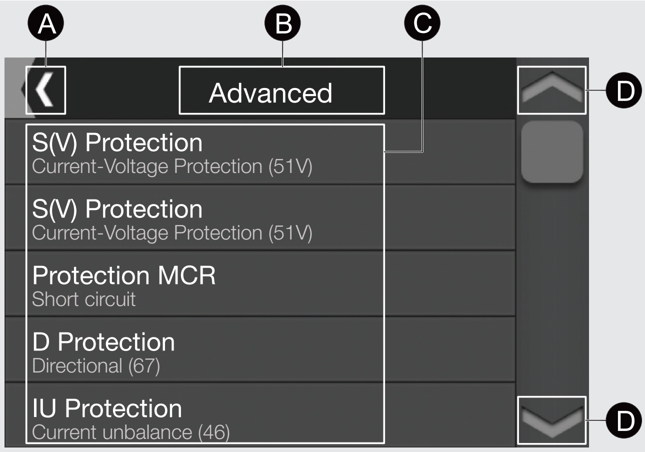


Figure 12

The following table provides a description of the various areas of the menus:

Pos.	Function
A	It opens the higher level menu, or if there is no higher level, the **Menu** page.
B	It displays the name of the menu.
C	• It displays a list of the available submenus, the parameters that can be set, and the commands that can be performed • Depending on the selection, it opens a submenu, the **Modify Parameters** page, or an information page, or performs a command.
D	Scroll the list

NOTE: *in the menus, the description and the ANSI code are indicated under each protection, and the current value is shown under each parameter.*

Protections Menu

The following table shows the submenus and the protections associated to the menu **Protections**, and the relevant Ekip Touch trip units.

IMPORTANT:

• Selecting a protection opens the list of the parameters that can be set for the selected protection.

• With Hi-Touch and G Hi-Touch trip units, and the Dual Set function enabled (see the Settings menu), the protections can be set according to two configurations (Set A and Set B), of which the default configuration can be selected.

Protections		Trip units			
• Set A (1) **• Set B** (1)	**L Protection**	Touch	Hi-Touch	G-Touch	G Hi-Touch
	S Protection				
	S2 Protection	-		-	
	I Protection	Touch		G-Touch	
	2I Protection				
	G Protection	Touch (2)		G-Touch (2)	
	Gext Protection (3)	Touch		G-Touch	

(1) Submenus available with Hi-Touch and G Hi-Touch trip units, and the Dual Set function enabled (see the Settings menu).
(2) With Touch and G Touch trip units, alternative protection to Gext, therefore available only without S.G.R. toroid (see the menu Settings, Circuit Breaker, Ground protection).
(3) Protection available with S.G.R. toroid (see the menu Settings, Circuit Breaker, Ground protection), and alternative to RC protection (see the Advanced menu).

Advanced menus

The following table shows the submenus and the protections associated to the menu **Advanced**, and the relevant Ekip Touch trip units.

IMPORTANT:

• Selecting a protection opens the list of the parameters that can be set for the selected protection.

• With Hi-Touch and G Hi-Touch trip units, and the Dual Set function enabled (see the Settings menu), the protections can be set according to two configurations (Set A and Set B), from which the default configuration can be selected.

<table>
<tr><th colspan="2">Advanced</th><th colspan="4">Trip units</th></tr>
<tr><td rowspan="25">• Set A [1]
• Set B [1]</td><td>S(V) Protection</td><td>-</td><td>-</td><td>G-Touch</td><td rowspan="28">G Hi-Touch</td></tr>
<tr><td>S2(V) Protection</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>MCR Protection</td><td>Touch</td><td rowspan="8">Hi-Touch</td><td>G-Touch</td></tr>
<tr><td>D Protection</td><td>-</td><td>-</td></tr>
<tr><td>IU Protection</td><td rowspan="2">Touch</td><td rowspan="3">G-Touch</td></tr>
<tr><td>Rc Protection [2]</td></tr>
<tr><td>UV Protection</td><td>Touch [3]</td></tr>
<tr><td>UV2 Protection</td><td>-</td><td>-</td></tr>
<tr><td>OV Protection</td><td>Touch [3]</td><td>G-Touch</td></tr>
<tr><td>OV2 Protection</td><td>-</td><td>-</td></tr>
<tr><td>RV Protection</td><td>-</td><td>-</td><td rowspan="3">G-Touch</td></tr>
<tr><td>VU Protection</td><td>Touch [3]</td><td rowspan="5">Hi-Touch</td></tr>
<tr><td>UF Protection</td><td>Touch [3]</td></tr>
<tr><td>UF2 Protection</td><td>-</td><td>-</td></tr>
<tr><td>OF Protection</td><td>Touch [3]</td><td>G-Touch</td></tr>
<tr><td>OF2 Protection</td><td>-</td><td>-</td></tr>
<tr><td>ROCOF Protection</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>RP Protection</td><td>Touch [3]</td><td>Hi-Touch</td><td rowspan="11">G-Touch</td></tr>
<tr><td>RQ ProtectioN</td><td>-</td><td>-</td></tr>
<tr><td>OP Protection</td><td>-</td><td>-</td></tr>
<tr><td>OQ Protection</td><td>-</td><td>-</td></tr>
<tr><td>UP Protection</td><td>-</td><td>-</td></tr>
<tr><td>Synchrocheck [4]</td><td>Touch [3]</td><td rowspan="6">Hi-Touch</td></tr>
<tr><td>Alarms</td><td>Touch [3]</td></tr>
<tr><td>Current thresholds</td><td rowspan="4">Touch</td></tr>
<tr><td rowspan="3">• Functions</td><td>External Trip [5]</td></tr>
<tr><td>Trip RESET [6]</td></tr>
<tr><td>Switch On SET B [7]</td></tr>
</table>

[1] Submenus available with Hi-Touch and G Hi-Touch trip units, and the Dual Set function enabled (see the Settings menu).
[2] Protection available with Rating Plug Rc and Ekip Measuring Pro modules, and toroid Rc (see the menu Settings, Circuit Breaker, Ground protection), and alternative to the Gext protection (see the Protections menu).
[3] Protection available with Ekip Measuring Pro module.
[4] Protection available with the Ekip Synchrocheck module.
[5] It opens a list of the parameters that can be set for programming the opening of the circuit-breaker.
[6] It opens a list of the parameters that can be set for programming the reset of the tripping signal.
[7] It opens a list of the parameters that can be set for programming the switching of the protection configuration from A to B.

Settings Menu

This menu allows you to configure more settings in addition to those of the protections and of the advanced protections and functions.

The following table shows the submenus and the parameters associated to the menu **Settings**, up to Level 3 (if present). The options corresponding to parameters and commands are underlined, to distinguish from those corresponding to submenus.

Settings	Options
Circuit Breaker	• **Configuration**: available with a three-pole circuit-breaker, it opens a list of the possible configurations of the circuit-breaker neutral. • Hardware Trip: it opens the **Modify Parameters** page, to enable/disable tripping in the case of hardware problem of the trip unit. • **T Protection**: it opens a list of the parameters that can be set for the overtemperature protection. • **Neutral Protection**: available with a configuration with neutral, it opens a list of the parameters that can be set. • **Ground protection**: it opens a list of the parameters that can be set. • **Installation**: displayed if a Rating Plug or Ekip Measuring or Ekip Measuring Pro module is not installed. It opens a list of the modules to be installed.
Main frequency	It opens the **Modify Parameters** page, to set the Line frequency.
Phase Sequence	It opens the **Modify Parameters** page, to set the phase sequence.
Modules (1)	• Local/Remote: it opens the **Modify Parameters** page, to set the local or remote connection. • Local Bus: it opens the **Modify Parameters** page, to enable/disable the Local Bus • **Ekip Measuring**, **Ekip Synchrocheck**, etc: these open a list of the parameters that can be the set for the electronic accessories. • **Functions**: it allows the access to the menus in order to program **Switch On LOCAL**, **Signalling RESET**, **YO Command**, and **YC Command** actions (see the chapter "20 - Operating features", and the paragraph "Functional characteristics", on page 124).
Monitor time	It opens the **Modify Parameters** page, to set the waiting time between the acquisition of one measurement and the next.
Power Controller	• Enable: it opens the **Modify Parameters** page, to enable/disable the function. • **Load Operating Mode**: available with Power Controller enabled, it opens a list of the loads, to be enabled/disabled. • **Power Limits**: available with Power Controller enabled, it opens a list of the power thresholds to be set.
Network Analyzer	• Enable: it opens the **Modify Parameters** page, to enable/disable the function. • I Harm Analysis: available with Network Analyzer enabled, it opens the **Modify Parameters** page to enable/disable the calculation of the harmonics for currents. • V Harm Analysis: available with Network Analyzer enabled, it opens the **Modify Parameters** page to enable/disable the calculation of the harmonics for voltages. • V Threshold Low, V Threshold High, Umbalance Th, V microinterr. Th, V Spike Threshold: available with Network Analyzer enabled, they open the **Modify Parameters** page, to set the parameters (for details on the parameters, see the chapter "17 - Hi-Touch measurements", and the paragraph "Network Analyzer", on page 114). • **Sags**: available with Network Analyzer enabled, it opens a list of the parameters that can be set for monitoring voltage drops. • **Swells**: available with Network Analyzer enabled, it opens a list of the parameters that can be set for monitoring voltage swells.
Datalogger (2)	• Enable: available if the function is not running, it opens the **Modify Parameters** page to enable/disable the function. • Num. of Datalogger: available with Datalogger enabled, it opens the **Modify Parameters** page, in order to set the number of records. • Sampling frequency: available with Datalogger enabled, it opens the **Modify Parameters** page, to set the frequency of data logging. • **Datalogger 1**: available with Datalogger enabled, opens a list of the parameters that can be set and the commands of the function. • **Datalogger 2**: available with the second Datalogger enabled, it opens a list of the parameters that can be set and the commands of the function. • Restart all: available with the second Datalogger enabled, it starts both recordings. • Stop all: available with the second Datalogger enabled, it stops both recordings.

Continued on the next page

Settings	Options
Dual Set	• Enable: it opens the **Modify Parameters** page, to enable/disable dual configuration of the protections. • Default Set: available with Dual Set enabled, it opens the **Modify Parameters** page, to set the default configuration.
System	• Date: it opens the **Modify Parameters** page, to set the date. • Time: it opens the **Modify Parameters** page, to set the time • Language: it opens the **Modify Parameters** page, to set the language. • New Password: it opens the page for insertion of the password.
View	• TFT orientation: it opens the **Modify Parameters** page to set the orientation of the **Alarm List** and **Measuring instruments** pages, and with a summary of the measurements accessible from the **Histograms** page. • Ammeter Phase: it opens the **Modify Parameters** page to set the current the measurement of which is to be displayed in the **Measuring instruments** page. • Voltmeter phase: it opens the **Modify Parameters** page to set the phase-to-phase voltage the measurement of which is to be displayed in the **Measuring instruments** page. • Clients page: it opens the **Modify Parameters** page, to enable the **Info** [4] page.
Functions	• **YO Command**: opens the list of parameters that can be set for programming the coil opening command. • **YC Command**: opens the list of parameters that can be set for programming the coil closing command.
Maintenance	• Signals: it opens the **Modify Parameters** page, in order to enable/disable the maintenance required signal, after a year from the last maintenance, or with contact wear of at least 20 % and an increase of 10 % compared to the last maintenance.

(1) The options in the Modules submenu change according to the electronic accessories connected.
(2) Function available with the trip unit energized with auxiliary voltage.
(3) Setting available with Hi-Touch and G Hi-Touch trip units.
(4) If enabled, the Info page can be accessed by pressing the iTEST key until it appears; it displays five lines of twenty characters each containing alphanumeric data that the customer can insert through the Ekip Connect software (see the chapter "17 - Other accessories", and the paragraph "Ekip Connect software" on page 288).

Test Menu

This menu allows you to access the commands in order to perform the tests.

The following table shows the submenus and the commands associated to the menus **Test**, up to Level 3 (if present). The options corresponding to commands are underlined, to distinguish them from those corresponding to submenus.

Test	Option
Rc Test [1]	Test protection Rc.
Auto Test	It performs a test on the display and LEDs of the interface.
Trip Test	it enables the opening command.
Test CB	• Close CB: it commands the closing of the circuit-breaker. • Open CB: it commands the opening of the circuit-breaker.
Ekip Signalling 2K [2]	• Auto Test
Ekip Signalling 4K [2]	• Auto Test
Zone selectivity (68)	• **S Protection**: opens a list of the test commands of the Zone Selectivity function for S protection. • **G Protection**: it opens a list of the test commands of the Zone Selectivity function for G protection.

(1) Test available with Rating Plug Rc and Ekip Measuring Pro modules, and toroid Rc (see Settings - Circuit Breaker - Earth protection menu).
(2) These menus are available if the relevant modules are connected.

About Menu

This menu allows you to view information on:

- Mainboard and trip unit (serial number, model, software version, etc.).
- The circuit-breaker (serial number, rated current, configuration with or without neutral, number of poles, fixed or withdrawable version, state, etc).
- The connected electronic accessories (serial number, model if present, software version if present, information on state if present, etc).
- Date and time.

Information	**Function**
Protection unit	It displays: • Information on Mainboard and trip unit. • Date and time.
Circuit Breaker	Displays information on the circuit-breaker.
Modules	It displays a list of the electronic accessories connected.
Power Controller (1)	• **Load input status**: shows the Open/Closed state of the loads • **Load Active**: shows the Active/Inactive state of the loads.

(1) Menus available with the Power Controller function enabled (see the Settings Menu- Power Controller).

Measurements Menu

This menu allows you to:

- It open lists of recorded events.
- It display measurements in graphical or numerical form.
- It reset measurements.

The following table shows the submenus and the parameters associated to the menu **Measurements** up to Level 3 (if present), and the Ekip Touch trip units where they can be found. The options corresponding to parameters and commands are underlined, to distinguish them from those corresponding to submenus.

Measurements	**Options**	**Trip units**
Historicals	• **Trip**: it opens a list of the trip performed. • **Events**: it opens a list of the recorded events. • **Measurements**: it opens a list of the dimensions whose history can be displayed.	Touch G-Touch Hi-Touch G Hi-Touch
Power factor	It displays the power factor measured.	Touch (1) G-Touch Hi-Touch G Hi-Touch
Frequency	It shows the frequency measured for the voltages.	
Energy	• **Energy counters**: it displays the active, reactive and apparent energies measured. • <u>Reset counters</u>: it resets the energy counters. • **Energy RESET**: opens a list of the parameters for programming the reset of the energy counters (see the chapter "20 - Operating features", and the paragraph "Functional characteristics", on page 124).	
Peak factor	It shows the peak factors measured for the phase currents and the neutral currents.	Touch G-Touch Hi-Touch G Hi-Touch
<u>Harmonic Distortion</u>	It opens the **Modify Parameters** page, to enable/disable the alarm with a peak factor greater than 2.1.	
Ekip Synchrocheck (2)	It opens a list of the measurements related to the synchronism function.	Touch (1) G-Touch Hi-Touch G Hi-Touch
Network Analyzer (3)	• **V Sequences**: it shows the last and penultimate positive and negative voltage sequences measured. • **V 3s Sequences**: it shows the voltage sequences and unbalance measured in last the 3 seconds. • **THD Current**: it shows the measurements of the harmonic distortion of currents. • **THD Voltages**: it shows the measurements of the harmonic distortion of line-to-line voltages. • **Counters**: it allows you to display the number of events monitored by the function in the last twenty-four hours and the totals. • **Waveforms**: it opens a list of the currents and voltages for which an instantaneous wave form can be displayed.	Hi-Touch G Hi-Touch

Continued on the next page

 Measurements	Options	Trip units
Maintenance	• **Contact Wear**: it shows the estimated percentage of wear on the contacts • **Last Service Contact Wear**: it shows the percentage of contact wear at the last maintenance • **Installation**: it shows the installation date of the circuit-breaker. • **Last Maintenance**: it shows the date of the last maintenance. • Service RESET: it updates the values of the parameters **Last Service Contact Wear** and **Last Maintenance**, with the percentage of contact wear and the date set on the trip unit at the moment of the command selection.	Touch G-Touch Hi-Touch G Hi-Touch

(1) Measurements available with Ekip Measuring or Ekip Measuring Pro modules.
(2) Measurements available with Ekip Synchrocheck module.
(3) Measurements available with the Network Analyzer function enabled (see the menu Settings - Network Analyzer).

Last Trip measurements

To open the page, from the menu **Measurements**, you need to select *Historicals - Tripping*, and a trip from the list.

Alternatively, if the main page or a level 2 page is displayed (see the chapter "1 - Layout of the interface", and the paragraph "Structure of the pages", on page 38), you can open the page relating to the last opening by pressing the **iTEST** key until the page is displayed.

NOTE: *when a trip occurs, the page relating to the last trip is opened automatically.*

The page shows details related to the selected opening.

To exit the page, press the **iTEST** key. Now the page is open.

The page appears as follow:

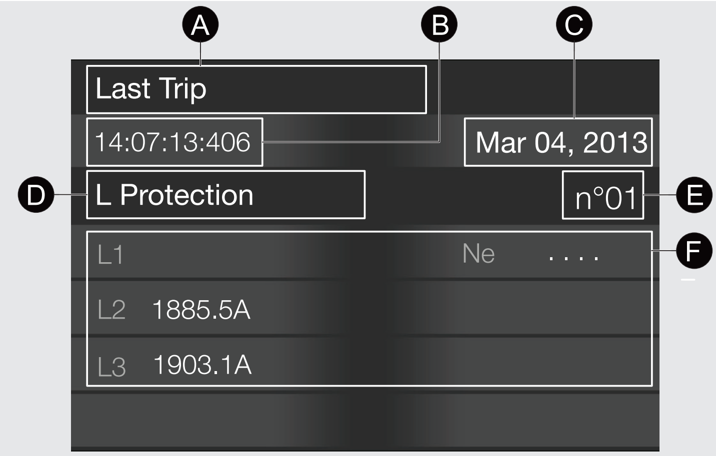


Figure 13

The following table provides a description of the various areas of the page:

Pos.	Description
A	Name of the page.
B	Time at which the selected trip occurred (time set on the trip unit at the moment of the trip)
C	Date at which the selected trip occurred (date set on the trip unit at the moment of the trip)
D	The protection that tripped.
E	Number of the selected trip. **NOTE**: *every new trip is associated to an incremental number*
F	Measurements recorded at tripping.

Measurements history

To open the page, from the menu **Measurements**, you need to select *Historicals - Measurements*, and an item in the list.

The page appears as follow:

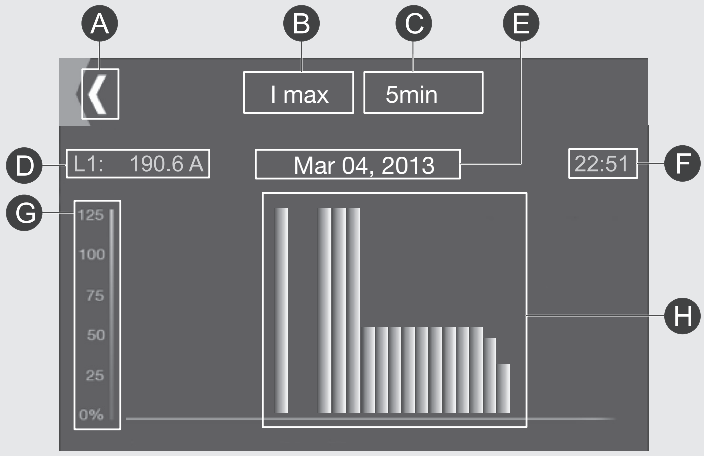


Figure 14

The following table provides a description of the various areas of the page:

Pos.	Description
A	It cancels the operation, and opens the **Measurements** list.
B	Item selected in the **Measurements** list.
C	Time interval between the selected measurement (see flashing bar) and the previous one. Value 0 indicates the first measurement after a unit shutdown.
D	Measurement of the bar that is flashing in the histogram.
E	Date of the selected measurement.
F	Time of the selected measurement (see flashing bar).
G	Histogram y-axis, with the measurements expressed as percentages of the nominal value set.
H	Bars that represent the measurements of the dimension in position D.

In this page, you can do the following:

- Touch the sides of the display to scroll along the time axis, and select the bar before or after the flashing bar.
- Return to the list **Measurements**.

Waveforms To open the page, from the menu **Measurements**, you need to select *Network Analyzer - Waveforms*, and an item from the list.

The page appears as follow:

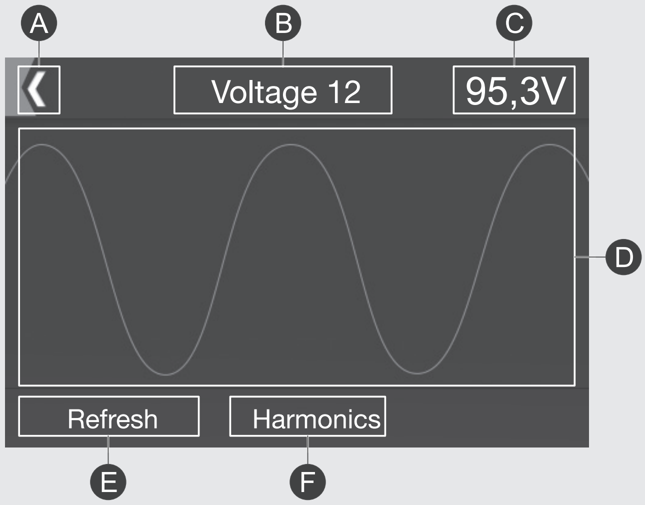


Figure 15

The following table provides a description of the various areas of the page:

Pos.	Description
A	It cancels the operation, and opens the **Waveforms** list.
B	Item (measurement) selected in the **Waveforms** list.
C	Measurement value at the moment of selection.
D	Waveform at the time of selection.
E	**Refresh** key: performs a new acquisition.
F	**Harmonics** key: available if the measurement of harmonics is enabled (see the menu **Settings**, **Network Analyzer**), open the **Harmonic Measurements** page.

Harmonics Measurement

To open the page, from the page with the waveform, press the key **Harmonics**.

The page shows the measurements performed for the harmonics of the selected item, in the form of a histogram.

NOTE: *to view measurement of the harmonics, measuring must be enabled from the Settings - Network Analyzer menu, selecting I Harm Analysis to enable measurement of the harmonics of the currents, and V Harm Analysis to enable measurement of voltage harmonics.*

The page appears as follow:

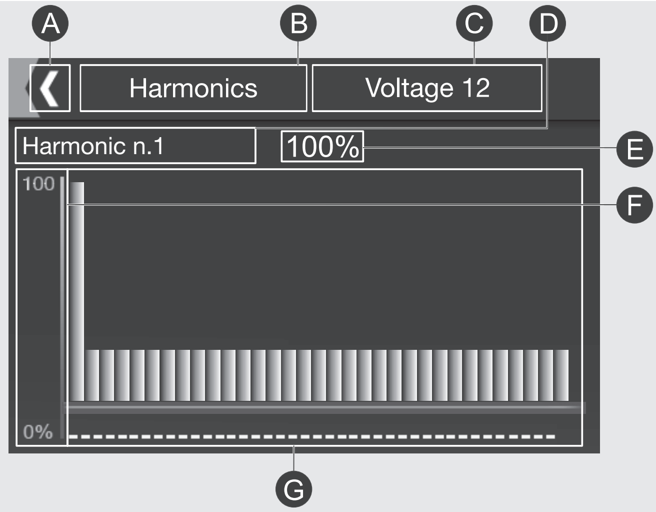


Figure 16

The following table provides a description of the various areas of the page:

Pos.	Description
A	It cancels the operation, and opens the **Waveforms** list.
B	Name of the page.
C	Quantity of which the harmonics are displayed.
D	The harmonic to which the flashing bar in the histogram corresponds.
E	Measurement of the flashing bar in the histogram in numerical form.
F	Histogram y-axis, with the measurements expressed as a percentage of the fundamental component.
G	Bars that represent the measurements of the harmonics of dimension in position C.

In this page, you can do the following:

- Touch the sides of the display to scroll through the harmonics, and select the bar before or after the flashing bar.
- Return to the list **Waveforms**.

7 - Insertion of the password

Function

The purpose of the password of Ekip Touch is to prevent unintentional parameter settings made via the display.

However, the parameters can still be changed using Ekip Connect via the front connector to Ekip T&P, Ekip Programming or Ekip Bluetooth.

If the trip unit is connected to Ekip Com modules and configured as Remote, the parameters can also be changed via the relative bus.

WARNING! the user is responsible for security against unauthorized access and modifications in all the cases mentioned above.

Description

The page where the password is entered is open, if a parameter to be entered, or the **Test** menu have been selected, or if the password must be changed.

NOTE: *insertion of the password is requested, if:*

- *The password has never been inserted.*
- *After programming has been cancelled.*
- *After a few minutes of inactivity.*

The password is composed of five digits, each of which can have a value from 0 to 9.

The default value is “00001”, and it must be modified after the first switch-on in order to prevent access by unauthorized personnel.

In order to modify the password, from the menu **Settings**, you need to select *System - New Password.*

It is possible to disable the password by inserting "00000" as new password .

Components of the page The page appears as follow:

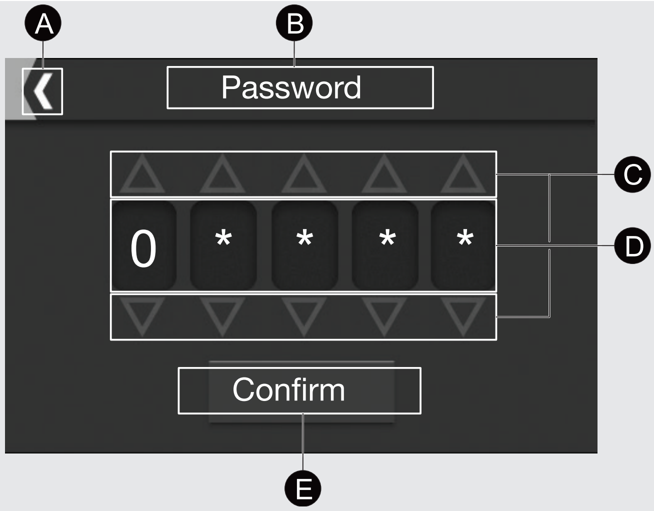


Figure 17

The following table provides a description of the various areas of the page:

Pos.	Function
A	Cancels the operation, and opens the start menu.
B	It shows the name of the page
C	Keys to increase and decrease the corresponding digit.
D	It displays the digits of the password.
E	**Confirm** key: • Confirmation after inserting a digit in a position from 1 to 4 will automatically bring you to the next digit. • When the fifth digit is confirmed, the entire password is confirmed and the selected page is opened.

NOTE:

- *If you are changing the password, after the first confirmation of the new password, the page opens again for the reconfirmation.*
- *In the case of an incorrect password, the message "Wrong Password" appears for approximately 3 seconds, and the page for insertion of the password opens again.*
- *There is no limit to the number of incorrect passwords that you can insert.*
- *If the password is lost, see the document* **1SDH001501R0002** or contact ABB

8 - Setting the parameters

Modifying a parameter

To set a parameter, you need to select it. Selecting a parameter opens the page **Modify Parameter**.

There are two possible types of **Modify Parameter** page:

- By option: it consists of a list of the values that can be assigned to the parameter (see page 59).
- By value: graphical page with a bar for assigning the parameter a numerical value within a range. (see page 59).

In both the cases, in order to set the parameter, you need to select the desired value.

Programming the trip unit

When a parameter is modified, the new value is indicated in the Start menu, and the parameter is associated to a tick symbol.

If available, when going up to the higher level menus, the submenus of which parameters have been modified are also associated to a tick symbol.

The menu with submenus and parameters with ticks appears as follows:

Figure 18

The following table provides a description of the changes made to the menu:

Pos.	Description
A	Modified submenu or parameter. If it is a parameter, the new value assigned is shown.
B	Tick symbol, that indicates the submenus and parameters modified.

The ticks indicate that the changes are not effective. In order make a change effective, the trip unit must be programmed. To program the trip unit, you need to press the key **HOME**, that opens the page **Programming**. Alternatively, you can go up to the higher level menus until the page is displayed.

In the page **Programming**:

- A list of the changes made is displayed.
- You are asked to confirm, cancel, or modify the settings.

NOTE: *before confirming a change in the page* **Programming***, other changes can be made both in the same menu and in higher or lower level menus. In fact, the changes are stored unless they are cancelled in the page* **Programming***, and the confirmation or the cancellation refers to all the changes made up to that moment but still not confirmed.*

Edit Parameters page by option

NOTE: *In the case of Edit Parameters by option, the selection of a value brings you automatically back to the previous Menu.*

The page appears as follow:

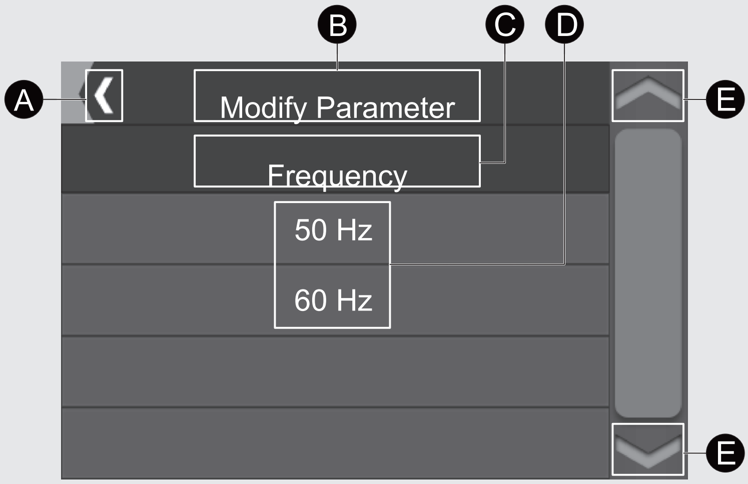


Figure 19

The following table provides a description of the various areas of the page:

Pos.	Description
A	Cancels the operation, and opens the start menu.
B	Name of the page.
C	Name of the parameter to be set.
D	List of the selectable values.
E	Scroll the list

Edit Parameters page by value

NOTE: *In the case of Edit Parameters by value, in order to complete the setting and return to the previous menu, you need to confirm the selected value.*

The page appears as follow:

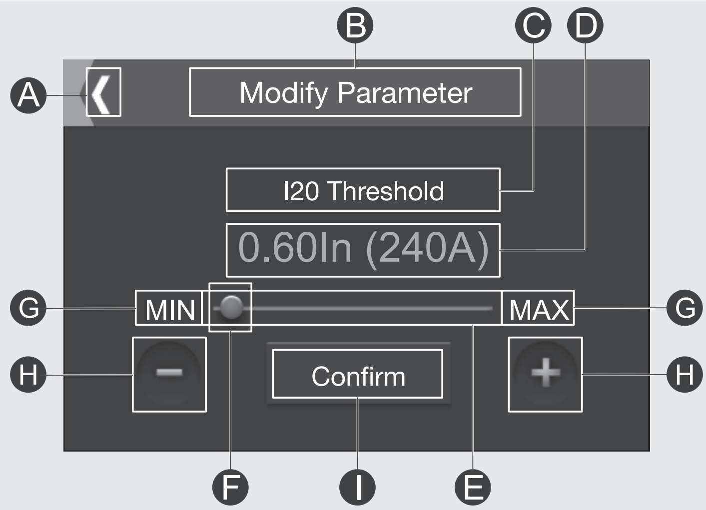


Figure 20

Continued on the next page

The following table provides a description of the various areas of the page:

Pos.	Description
A	Cancels the operation, and opens the start menu.
B	Name of the page.
C	Name of the parameter to be set.
D	Value selected for the parameter.
E	Bar: graphic representation of the range of selectable values.
F	Cursor: graphic representation of the selected value.
G	• **MIN** key: selects the minimum value. • **MAX** key: selects the maximum value.
H	**-** and **+** keys: allow you to increase and decrease the value selected.
I	**Confirm** key: confirms the selected value.

Programming Page

The page appears as follow:

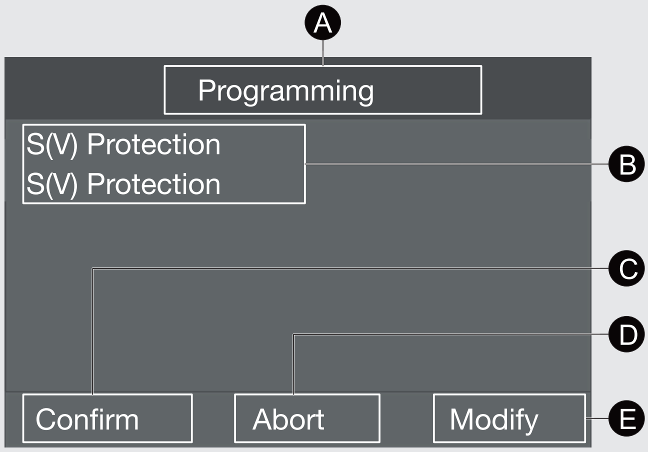


Figure 21

The following table provides a description of the various areas of the page:

Pos.	Description
A	Name of the page.
B	List of changes made.
C	**Confirm** key: confirms the changes (programs the trip unit), and opens the **Menus** page.
D	**Cancel** key: cancels the changes, and opens the **Menus** page.
E	**Modify** key: it keeps the changes and opens the menu with ticks, for further modifications.

NOTE: *if the changes are confirmed:*

- The **Menu** *page is opened.*
- *For approximately 3 seconds, the message "Parameters updated" appears.*

9 - Touch protections

Presentation

Touch protections are available in all models of trip units of the Ekip Touch range.

The presence of each single protection depends on the version of the trip unit, as specified in the following paragraphs.

List of protections

Touch protections:

Symbol	Protection against
L	Overload with inverse long-time delay
S	Selective short-circuit
I	Instantaneous short-circuit
G	Earth fault with adjustable delay
2I	Programmable instantaneous short-circuit
MCR	Instantaneous short-circuit on closing of the circuit-breaker
IU	Current unbalance
Hardware Trip	Circuit-breaker internal connection error
Harmonic Distortion	Distorted waveforms
Current thresholds	Programmable signal thresholds
T	Temperature outside range
Neutral	Neutral protection

The trip units of SACE Emax 2 series also guarantee a non-adjustable fixed protection against instantaneous short-circuit at high currents, called **Iinst**.

Operating principle

The protections have a series of parameters available allowing the user to adjust the activation thresholds and the opening times of the circuit-breaker.

The operating principle of all the protections is similar: if the current exceeds the set protection threshold, the specific protection will enter the alarm condition and will begin to delay.

The duration of the delay depends on the threshold and time parameters set, and depending on the dynamic of the current two behavoiurs are possible:

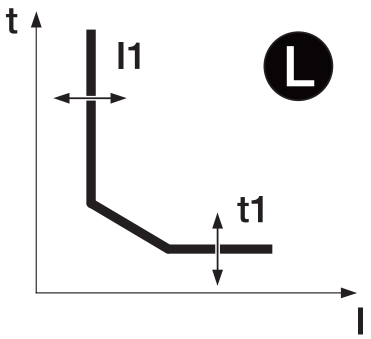
- If the alarm condition persists, the trip unit opens the circuit-breaker.
- If the current drops below the protection threshold, the trip unit exits from the alarm condition, interrupts the delay and does not make the circuit-breaker open.

The protection thresholds refer to the rated current of the Rating Plug (In).

IMPORTANT:

- **To manage the circuit-breaker tripping with a specific protection, the protection itself must be enabled and, if supported, must have the Trip Enable parameter activated.**
- **All the protections have a default configuration: if enabled, check the parameters and make the necessary changes according to the requirements of your installation.**

L Protection



Path

Main page - Menus - Protections

Function

L protection protects against overloads

NOTE: *the protection is available and active for all the versions of the trip unit. You can disable the protection by configuring the trip unit with Rating Plug L = Off.*

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

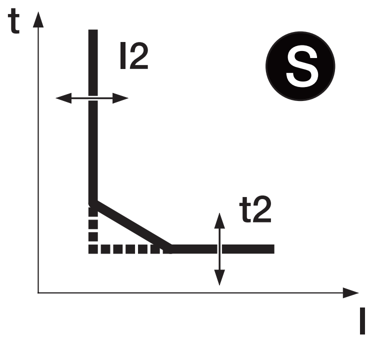
Parameters

Here is a list of the available parameters:

Parameter	Description
Curve	It determines the dynamic of the curve and the calculation of the tripping time, conforming to various reference standards: • $t = k / I^2$ according to IEC 60947-2. • IEC 60255-151 SI • IEC 60255-151 VI • IEC 60255-151 EI • $t = k / I^4$ according to IEC 60255-151 Each function corresponds to a mathematical expression that allows the tripping time to be calculated. The details of the expressions are provided in the table on page 73. **IMPORTANT: if from the calculation the tripping time turns out to be less than 1 second, it is automatically limited to 1 second.**
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). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug). **IMPORTANT: the protection is activated and starts timing for currents between 1.05 and 1.2 of the I1 threshold set. Example (with I1 set = 400 A): the protection is activated for currents read between 420 A and 480 A.**
Time t1	The value T1 contributes to calculate the tripping time (with reference to the curve, T1 affects the entire curve shifting it along the vertical 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.**
I1 Prealarm	The prealarm of L allows notification that the measured current is near the activation threshold of the protection. The prealarm state is activated for currents higher than a threshold that can be set by the user, and is deactivated in two cases: • Current lower than the prealarm threshold. • Current higher than the protection activation threshold. A value within the 50 % ... 90 % range can be entered, with 1 % steps.

L protection has **Thermal Memory**, see page 71.

S Protection



Path

Main page - Menus - Protections

Function

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

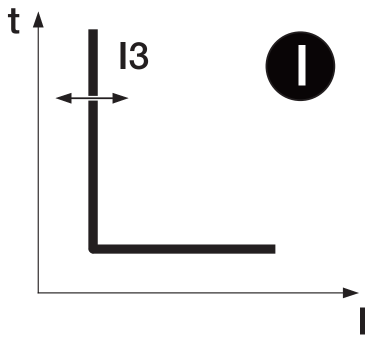
Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Curve	It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: • t = k (ANSI 50TD): fixed time trip. • $t = k / I^2$ (ANSI 51): inverse time dynamic tripping. The 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 73.
Threshold I2	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug). **IMPORTANT: The I2 threshold set must be higher than the I1 threshold. An incorrect configuration gives an error on the display and the programming session doesn't conclude, with consequent rejection of the changes made to the parameters.**
Time t2	The selected function determines the contribution of t2: • t = k: t2 is the delay time between the exceeding of the I2 threshold and the sending of the opening command. • $t = k / I^2$: t2 contributes in calculating the tripping time (with reference to the above curve, t2 affects the curve, shifting it along the vertical axis). **IMPORTANT: the minimum tripping time for the protection is t2. If according to the calculation the tripping time is less, it is automatically limited to t2.**

S protection has **Trip Enable, Thermal Memory, Zone Selectivity, Startup Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

I Protection



Path

Main page - Menus - Protections

Function

I protection protects against instantaneous short circuit.

When the activation threshold is exceeded, the protection trips within a fixed time. The user can set the intervention threshold.

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection. **IMPORTANT: it can be only activated if the MCR protection is Off.**
Threshold I3	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug). **IMPORTANT: The I3 threshold set must be higher than the I2 threshold. An incorrect configuration gives an error on the display and the programming session doesn't conclude, with consequent rejection of the changes made to the parameters.**

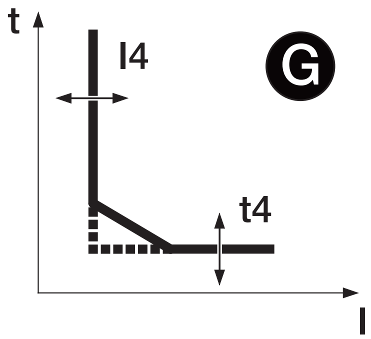
I protection has **Startup Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

G Protection

Path

Main page - Menus - Protections



Function

G protection protects against a ground fault.

NOTE:

- *The protection is available for the LSIG version of the trip unit.*
- *With toroid S.G.R. enabled and Ekip Touch and Ekip G Touch trip units, protection G is replaced by Gext. Both protections, G and Gext, are available with Ekip Hi-Touch and G Hi-Touch trip units.*

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

Parameters

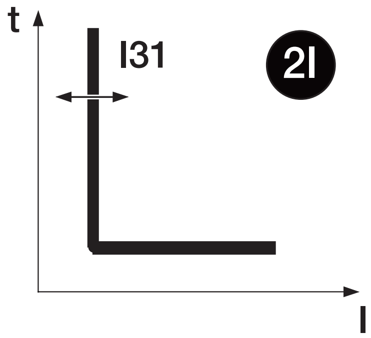
Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection. 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)**
Curve	It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: • t = k (ANSI 50NTD): fixed time trip. • $t = k / I^2$ (ANSI 51N): inverse time dynamic tripping. The 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 73.
Threshold I4	The value I4 contributes in calculating the tripping time, and also defines the current value that, if exceeded, activates the protection (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug).
Time t4	The selected function determines the contribution of t4: • t = k: t4 is the delay time between the exceeding of the I4 threshold and the sending of the opening command. • $t = k / I^2$: t4 contributes in calculating the tripping time (with reference to the above curve, t4 affects the curve, shifting it along the vertical axis). **IMPORTANT: the minimum tripping time for the protection is t4. If according to the calculation the tripping time is less, it is automatically limited to t4.**
I4 Prealarm Threshold	The pre-alarm of G protection indicates that the measured current is near to the trip threshold of the protection. The prealarm state is activated for currents higher than a threshold that can be set by the user, and is deactivated in two cases: • Detected current lower than the prealarm threshold. • Detected current higher than the protection activation threshold. A value within the 50 % ... 90 % range can be entered, with 1 % steps.

G protection has **Trip Enable, Zone Selectivity, Startup Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

2I Protection



Path

Main page - Menu - Advanced

Function

2I protection, like I protection, protects against instantaneous short circuit.

The main difference between the two protections is that 2I requires an activation event (or command), that can be programmed by the user.

If 2I protection is active and the set threshold is exceeded, the protection trips within a fixed time. The user can set the threshold and select three different activation modes.

Parameters

The following is a description of the protection parameters:

Parameter	Description
Enable	To enable/disable the protection and access the programmable parameters.
Threshold I31	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug).

Protection enabling allows access to menu **2I Menu** (available following the path *Advanced - Functions*), to program the protection activation event.

Parameter	Description
Activation	Two alternative modes are available: • **Dependent function**: the protection is active if the programmed activation event occurs. • **Active**: the protection is always active. **NOTE**: *if you select Dependent function the access to the Function and Delay parameters is activated in order to program the activation event*.
Function	Protection activation event: • On the display, it is possible to choose between the state of the input contacts of the Ekip Signalling 4K and Ekip Signalling 2K modules, the states of the circuit-breaker, and the Custom function. • Via Ekip Connect, it is possible to customize the Custom function, that allows up to eight states to be combined with the activation event configured using AND or OR logical operators.
Delay	Protection activation delay, calculated according to the presence of the activation event. **NOTE**: *the protection is active if the event is present for a time greater than the set delay*.

Remote activation

Two remote commands are available for the temporary activation/deactivation of the protection:

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

NOTE: if the protection has been activated by the 2I Mode ON *command, it will be deactivated automatically when the solid-state trip unit is turned off.*

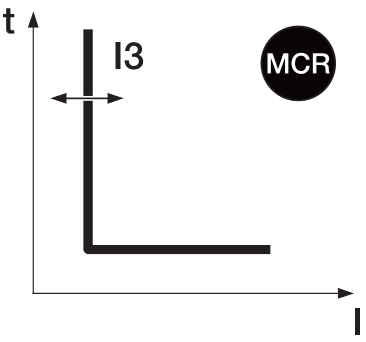
Signallings

With 2I protection active, the message “2I active” appears in the diagnosis bar and in the **Alarm List** page, and the alarm LED remains lit (red).

Protection MCR

Path

Main page - Menu - Advanced



Function

MCR protection has the same characteristics as I protection, with some variations:

- It acts only within an interval that starts from the closing of the circuit-breaker.
- It only works with auxiliary power supply or Ekip Measuring Pro module (with voltage sockets energized).

When the activation threshold is exceeded, the protection trips within a fixed non-adjustable time. The user can set the tripping threshold.

Parameters

Here is a list of the available parameters:

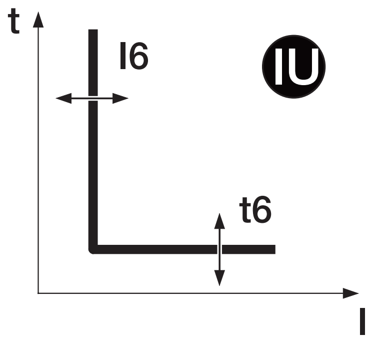
Parameter	Description
Enable	To activate/deactivate the protection. **IMPORTANT: it can be only activated if the protection is deactivated.**
Threshold I3	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug).
Monitor time	It defines the time interval during which the protection is active, starting from the closing of the circuit-breaker.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

IU Protection

Path

Main page - Menu - Advanced



Function

IU protection protects against an unbalance between the currents of the individual phases protected by the circuit-breaker.

When the activation threshold is exceeded, the protection trips within a fixed time.

Unbalance, expressed in percentage value, is calculated in the following way: % Sbil = 100 * (I_{max}-I_{min}) / I_{max}, where I_{max} is the maximum and I_{min} the minimum.

NOTE: *The protection is automatically self-excluding in two cases:*

- *when at least one phase current exceeds 6 * In.*
- *when the maximum phase current is less than 0.3 * In.*

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold I6	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented as a percentage value of 1 In.
Time t6	The delay time between the exceeding of the I6 threshold and the sending of the opening command (with reference to the curve, it affects the entire curve, shifting it along the vertical axis).

IU protection has **Trip Enable**, see page 71.

Hardware Trip

Path

Main page - Menus - Settings - Circuit-breaker

Function

Hardware Trip protection protects against internal disconnections of the circuit-breaker.

If enabled, the fault is signalled and an opening command is sent when one or more of the following events is detected:

- Current sensors disconnected (phase or external if enabled).
- Rating Plug disconnected.
- Trip coil disconnected (only signalling).
- Incompatibility between protection trip unit and mainboard.
- Internal problems with the trip unit.

IMPORTANT: the protection trips if the error conditions persist for more than 1 second.

Harmonic distortion

Path

Main page - Menus - Measurements

Function

The Harmonic Distortion protection allows a control alarm to be activated for a distorted waveforms.

If enabled, an alarm is activated for peak factors higher than 2.1.

Current thresholds

Path

Main page - Menu - Advanced

Function

The Current Thresholds allow controls to be set on the current lines, to be connected to the programmable contacts of the Ekip Signalling modules (in all versions). Two pairs of contacts are available:

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

IMPORTANT:

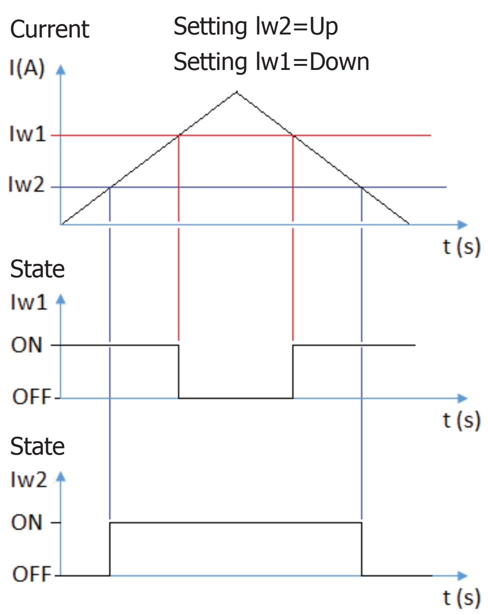
- **The current thresholds do not manage the trip, but only the signal.**
- **The function is active if the trip unit is energized by an auxiliary power supply or Ekip Measuring Pro.**

Parameters

Here is a list of the available parameters:

Parameter	Description
Threshold 1 I1	It is possible to do the following: • Enable the function. • Set the activation percentage value
Threshold 2 I1	It is possible to do the following: • Enable the function. • Set the activation percentage value
Threshold Iw1	It is possible to do the following: • Enable the function. • Set the threshold. • Set activation to obtain the signal when current is higher (up) or lower (down) than the threshold value. See the following graph.
Threshold Iw2	It is possible to do the following: • Enable the function. • Set the threshold. • Set activation to obtain the signal when current is higher (up) or lower (down) than the threshold value. See the following graph.

NOTE: *the thresholds Iw1 and Iw2 are expressed both as an absolute value (Ampere) and a relative value (In, nominal value defined by Rating Plug).*



T Protection

Path

Main page - Menus - Settings - Circuit-breaker

Function

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

It is always active, and has two states, according to the temperature read:

State	Temperature Range	Trip unit actions
Warning	-25 < t < -20 or 70 < t < 85	Display off; Warning LED on @ 0.5Hz.
Alarm	t < -25 o t > 85	Display off; Alarm and Warning LEDs on @2Hz; Circuit beaker opening command.

IMPORTANT: the opening command is sent only if the parameter Trip Enable is ON.

T protection has **Trip Enable**, see page 71.

Neutral

Path

Main page - Menus - Settings - Circuit-breaker

Function

The purpose of the neutral protection is to characterize the protections L, S and I on the Neutral pole with a control factor different from the other phases.

IMPORTANT: the protection is available with four-pole circuit-breakers or three-pole circuit-breakers with external neutral.

Parameters

Here is a list of the available parameters:

Parameter	Description
Configuration	This parameter is available with three-pole circuit-breakers and makes it possible to activate (3 P + N setting) or deactivate (3 P setting) the presence of the external neutral.
Enable	To activate/deactivate the protection. **NOTE:** *with neutral present (four-pole or three-pole circuit-breakers configured with external neutral), the neutral current measurement is available even when the protection is deactivated.*
Neutral threshold	Represented as a percentage; it defines the multiplication factor applied to the tripping thresholds of the protections: • 50%: trip threshold of the neutral current lower than other phases. • 100%: same trip thresholds for all poles. • 150%: trip threshold of the neutral current higher than other phases. • 200%: trip threshold of the neutral current higher than other phases.

Limitations

The adjustment of the neutral threshold to values of 200% and 150% must be performed considering the following formula: (I1 x 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).

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

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

Additional functions

Functions

For some protections there are functions available that extend the functionality:

Protection	L	S	I	G	MCR	IU	T
Thermal memory	x	x					
Trip Enable		x		x		x	x
Zone Selectivity		x		x			
StartUp enable		x	x	x			
Blocks		x	x	x	x		

Thermal Memory

This function reduces the tripping time of the protection based on the time elapsed between multiple trips caused by heating of the cables.

IMPORTANT: the parameter can be activated if the function of the selected protection is $t = k / I^2$.

Trip enable

It disables the opening command in order to use the protection as an alarm signal, without opening commands.

Zone Selectivity

The function allows multiple circuit-breakers in the same installation to be connected together, in order to coordinate the trip units and to reduce the tripping times in the case of S and G protections.

The function allows circuit-breakers to be coordinated so that, in the event of a failure:
- The circuit-breaker closest to the fault trips.
- The other circuit-breakers are locked for a programmable time.

For further information see the chapter "1 - Zone Selectivity" on page 156.

StartUp enable

The function allows you to modify the threshold of the protection for a period that can be set by the user. The period is activated when a threshold is exceeded (startup threshold), which can be programmed by the user via Ekip Connect software.

IMPORTANT:

- **Startup can be activated with a fixed time protection function (t = k).**
- **The I3 startup threshold must be higher than the I2 startup threshold.**

Continued on the next page

Protection blocks

With Ekip Connect software six blocks are available for some protections, useful for deactivating the protection based on programmable events.

In particular, four blocks are associated with the programmable states A, B, C and D:

- BlockOnProgStatusA
- BlockOnProgStatusB
- BlockOnProgStatusC
- BlockOnProgStatusD

One block is associated to the startup (present for protections that have a StartUp function):

- BlockOnStartUp

and one block, not present for frequency protections, is associated with the checking of the measured frequency:

- BlockOnOutOfFrequency

Each block is independent and has its own activation command (Block On).

The protection is deactivated for a time equal to the duration of the event itself:

- If the programmed event occurs (true), in the case of state-based blocks.
- If the StartUp function is active and the startup threshold is exceeded (block active for the startup time that has been set), in the case of blocking from StartUp.
- If at least one frequency measured is outside the range 30…80 Hz, in the case of a frequency-based block.

IMPORTANT: the blocks can cause:

- **Increase of the tripping times of the protections (max: + 30 ms), due to the occurrence of the event in question (example: frequency check).**
- **undesired deactivation of the protection, if the block is associated to states or signals from modules on the local bus and the auxiliary power supply is absent. In this case, it can be useful to program the event also taking account of the state of the auxiliary power supply (Supply from Vaux).**
- **undesired deactivation of the protection, if the block is associated to frequency measurements, and the voltage is less than the minimum calculation threshold (30 or 60 V, see page 288).**

IMPORTANT: during startup, if the function is activated, the blocks are deactivated.

Summary table of basic protections

ABB	ANSI (1)	Threshold	Threshold tolerance (3)	Time	Calculation formula t_t (2)	Calculation example t_t (2)	Tolerance t_t (3)
L (60947-2)	49	I1 = 0.4…1 In step = 0.001 In	Activation for If in the range (1.05...1.2) x I1	t1 = 3…144 s step = 1 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
L (60255-151) (9)	49	I1 = 0.4…1 In step = 0.001 In	Activation for If in the range (1.05...1.2) x I1	t1 = 3…144 s step = 1 s	t_t = (t1 x a x b) / ((If / I1) ^{k}-1)	See the table below	± 10 % with If ≤ 6 In ± 20 % with If > 6 In
S (t = k)	50 TD	I2 = 0.6...10 In step = 0.1 In	± 7 % with If ≤ 6 In ± 10 % with If > 6 In	t2 = 0.05…0.8 s step = 0.01 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 step = 0.1 In	± 7 % with If ≤ 6 In ± 10 % with If > 6 In	t2 = 0.05…0.8 s step = 0.01 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 step = 0.1 In	± 10 %	Not adjustable	t_t ≤ 30 ms	-	-
G (t = k)	50N TD	I4 (4)= 0.1…1 In step = 0.001 In	± 7 %	t4 = Instantaneous…1 s, 0.1...1s step = 0.05 s	t_t = t4	-	The better of the two values: ± 10 % or ± 40 ms (8)
G (t = k / I ^{2})	51N	I4 (4)= 0.1…1 In step = 0.001 In	± 7 %	t4 = 0.1…1 s step = 0.05 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 %
2I	50	I31 = 1.5...15 In step = 0.1 In	± 10 %	Not adjustable	t_t ≤ 30 ms	-	-
MCR	-	I3 = 1.5...15 In step = 0.1 In	± 10 %	40…500 ms (5) step = 0.01 s	t_t ≤ 30 ms	-	-
IU	46	I6 = 2…90 % step = 1 %	± 10 %	t6 = 0.5…60 s step = 0.5 s	t_t = t6	-	the better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
Iinst	-	Defined by ABB	-	Instantaneous	-	-	-
Current thresholds (1 and 2)	-	50…100 % I1 step = 1 %	-	-	-	-	-
Current thresholds (Iw1 and Iw2)	-	0.1…10 In step = 0.01 In	-	-	-	-	-

Continued on the next page

The following are the details of the protections according to standard IEC 60255-151:

Protection	Curve parameters	Calculation formula t_t (3)	Calculation example t_t (3)
L (60255-151 SI)	a = 0.02; b = 0.15873; k = 0.16	t_t = (t1 x k x b) / ((If / I1) ^{a} -1)	t_t = 4.78 s with: I1 = 0.4 In; t1 = 3 s; If = 0.8 In
L (60255-151 VI)	a = 1; b = 0.148148; k = 13.7	t_t = (t1 x k x b) / ((If / I1) ^{a} -1)	t_t = 6 s with: I1 = 0.4 In; t1 = 3 s; If = 0.8 In
L (60255-151 EI)	a = 2; b = 0.1; k = 82	t_t = (t1 x k x b) / ((If / I1) ^{a} -1)	t_t = 8 s with: I1 = 0.4 In; t1 = 3 s; If = 0.8 In
L (60255-151 I4)	a = 4; b = 1; k = 82	t_t = (t1 x k x b) / ((If / I1) ^{a} -1)	t_t = 16 s with: I1 = 0.4 In; t1 = 3 s; If = 0.8 In

Table of Additional Functions of the protections

The following table summarises the additional functions combined with protections S, I, G:

ABB	ANSI (1)	Threshold	Threshold tolerance (3)	Time (7)	Calculation formula t_t (3)	Tolerance t_t (3)
S (Startup) (6)	-	If $_{startup}$= 0.6...10 In step = 0.1 In	± 7 % with If ≤ 6 In ± 10 % with If > 6 In	t2 $_{startup}$= 0.1…30 s step = 0.01 s	t_t = t2	The better of the two values: ± 10 % or ± 40 ms
I (Startup)	-	I3 $_{startup}$= 1.5...15 In step = 0.1 In	± 10 %	t3 $_{startup}$= 0.1…30 s step = 0.01 s	t_t ≤ 30 ms	-
G (Startup) (6)	-	I4 $_{startup}$= 0.2...1 In step = 0.02 In	± 7 %	t4 $_{startup}$= 0.1…30 s step = 0.01 s	t_t = t4	The better of the two values: ± 10 % or ± 40 ms
S (SdZ)	68	-	-	t2 $_{SdZ}$ = 0.04…0.2 s step = 0.01 s	-	-
G (SdZ)	68	-	-	t4 $_{SdZ}$ = 0.04…0.2 s step = 0.01 s	-	-

NOTES

(1) ANSI / IEEE C37-2 encoding.
(2) t_t calculation is valid for If values exceeding 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) Valid tolerances with steady-state energized trip unit or trip unit energized by auxiliary power supply, tripping time ≥ 100 ms, temperature and currents within operating limits. If these conditions are not guaranteed, the tolerances in the table that following these notes are valid.
(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) The MCR time is the time for which the protection remains active after circuit-breaker closing. Tripping time, not adjustable, as for protection I.
(6) Startup can be activated only with the function set to fixed time.
(7) For the startup functions, the specified time is the period during which the protection with the different threshold remains active, calculated from the moment the startup threshold is exceeded.
(8) With t4 = Instantaneous, the maximum tolerance is 50 ms.

Protection	Tolerance threshold	Tolerance t_t
L	Activation for If in the range 1.05...1.2 I1	± 20 %
S	± 10 %	± 20 %
I	± 15 %	≤ 60 ms
G	± 15 %	± 20 % (60 ms with t4 = instantaneous)
2I	± 15 %	≤ 60 ms
Other	-	± 20 %

10 - Measuring Pro protections

Presentation

The Measuring Pro protections are available in all versions of trip units of the Touch range equipped with Ekip Measuring Pro module.

List of protections

The following is a list of the Measuring Pro protections:

Symbol	Protection against
UV	Minimum voltage
OV	Maximum voltage
VU	Voltage unbalance
UF	Minimum frequency
OF	Maximum frequency
RP	Reverse active power
Phase Sequence	Phase sequence error
Cos φ	Power factor error

If the Ekip Measuring Pro module and the Ekip Synchrocheck module are present, a further selection is activated:

Symbol	Function
Synchrocheck	Synchronism between two independent power supply systems

Operating principle

The protections have a series of parameters available allowing the user to adjust the activation thresholds and the opening times of the circuit-breaker.

The operating principle of all the protections is similar: if the voltage, frequency or power signal exceeds the set protection threshold, the specific protection will enter the alarm condition and will begin to delay.

The duration of the delay depends on the threshold and time parameters set, and depending on the dynamic of the signal we can have two behaviours:

- If the alarm condition persists, the trip unit opens the circuit-breaker.
- If the signal drops below the protection threshold, the trip unit exits from the alarm condition, interrupts the delay and doesn't open the circuit-breaker.

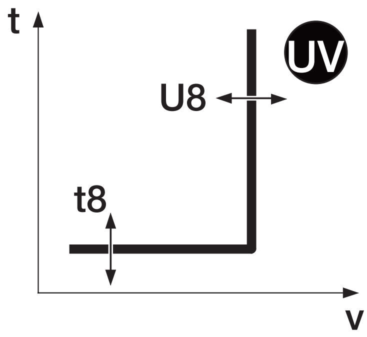
The protection thresholds are distinguished by type:

- The voltage protections are related to the rated size of the voltage line-to-line set on the trip unit (Un).
- The frequency protections are related to the frequency set on the trip unit (fn).
- The power protections refer to the product of current and rated voltage ($Sn = \sqrt{3} * In * Un$).

IMPORTANT:

- **To manage the circuit-breaker tripping with a specific protection, the protection itself must be enabled and, if supported, must have the Trip Enable parameter activated.**
- **All the protections have a default configuration: if enabled, check the parameters and make the necessary changes according to the requirements of your installation.**

UV Protection



Path

Main page - Menu - Advanced

Function

UV protection trips when the phase-to-phase voltage drops below the set threshold.

If at least one line-to-line voltage drops below the activation threshold, the protection trips within a fixed time set by the user.

Parameters

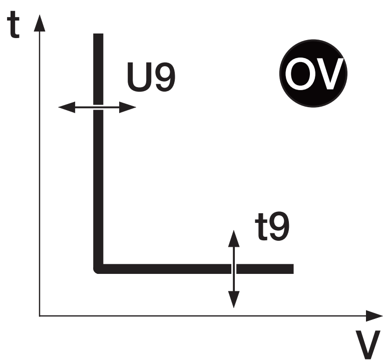
Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold U8	It defines the voltage value below which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Volts) and a relative value (Un, nominal value defined on the trip unit).
Time t8	The delay time between the exceeding of the U8 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

UV protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

OV Protection



Path

Main page - Menu - Advanced

Function

OV protection trips when the phase-to-phase voltage rises above the set threshold.

If at least one line-to-line voltage rises above the activation threshold, the protection trips within a fixed time set by the user.

Parameters

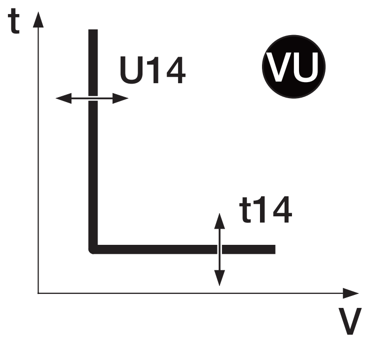
Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold U9	It defines the voltage value above which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Volts) and a relative value (Un, nominal value defined on the trip unit).
Time t9	The delay time between the exceeding of the U9 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

OV protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

VU Protection



Path

Main page - Menu - Advanced

Function

VU protection protects against an unbalance between the phase-to-phase voltages protected by the circuit-breaker.

The unbalance, expressed as a percentage, is calculated as follows: *% Sbil = 100 * dmax Umi / Umi*, where dmax Umi is the maximum deviation of the three of calculated by comparing each line-to-line voltage with the average value, and Umi is the average value of the line-to-line voltages.

When the activation threshold is exceeded, the protection trips within a fixed time, set by the user.

NOTE: *the protection is not active if the highest of the voltages measured is in any case less than 30% of the Un.*

Parameters

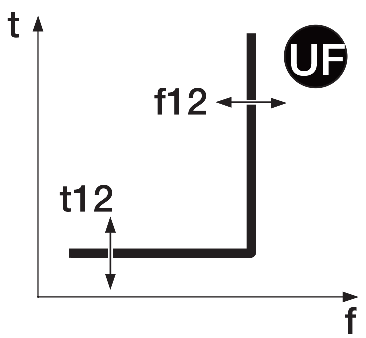
Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold U14	It defines the voltage value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented as a percentage value of Un.
Time t14	The delay time between the exceeding of the U14 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

VU protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

UF Protection



Path

Main page - Menu - Advanced

Function

UF protection trips when line frequency drops below the set threshold.

If the line frequency drops below the activation threshold, the protection trips within a fixed time set by the user.

NOTE: *the protection is not active for voltages <30V.*

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold f12	It defines the frequency value below which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Hertz) and a relative value (fn, nominal value defined on the trip unit).
Time t12	The delay time between the exceeding of the f12 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

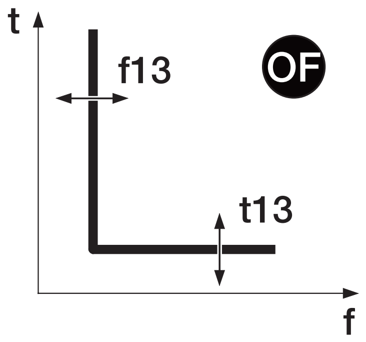
UF protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

OF Protection

Path

Main page - Menu - Advanced



Function

OF protection trips when the line frequency rises above the set threshold.

If the line frequency rises above the activation threshold, the protection trips within a fixed time set by the user.

NOTE: *the protection is not active for voltages <30V.*

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold f13	It defines the frequency value above which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Hertz) and a relative value (fn, nominal value defined on the trip unit).
Time t13	The delay time between the exceeding of the f13 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

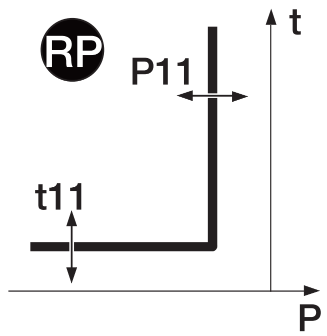
OF protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

RP Protection

Path

Main page - Menu - Advanced



Function

RP protection trips when the total reverse active power exceeds the reverse active power threshold set.

When the total reverse active power rises above the set threshold, the protection delays for the set time t11 and then opens.

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold P11	It defines the power value for which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (KW) and a relative value (Sn, referring to the rated voltage set on the trip unit). **NOTE:** *the threshold expressed in Sn is preceded by the sign "- " in order to indicate that it refers to reverse power.*
Time t11	The delay time between the exceeding of the p11 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

RP protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

Phase Sequence

Path

Main page - Menu - Settings (Threshold)

Main page - Menus - Advanced - Alarms (enabling)

Function

The phase Sequence protection trips when the sequence of the voltages is not aligned with the sequence set by the user.

Parameters

The following is a description of the parameters in the various menus:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold	It defines the voltage control sequence.

Cos φ

Path

Main page - Menus - Advanced - Alarms

Function

The protection Cos φ trips when the total cos φ value drops below the threshold set.

NOTE: total cos φ *is calculated as the ratio between Total active power and Total apparent power.*

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold	It defines the value of cos φ below which the protection is activated.

Synchrocheck

Path

Main page - Menu - Advanced

Function

The Synchrocheck module recognizes and signals if the synchronism conditions exist between two independent voltage sources (example: generator + network) for closing of the interconnection circuit-breaker.

NOTE:

- *Synchrocheck functions are activated only if the Ekip Synchrocheck module is present.*
- *All the operating specifications are described in the paragraph that describes the Synchrocheck module, on page* 216.

Summary table of Measuring Pro protections

ABB	ANSI [3]	Threshold	Tolerance threshold	Time	Calculation formula t_t [1]	Tolerance t_t [2]
UV	27	U8 = 0,05….0,98 Un step = 0.001 Un	± 2 %	t8 = 0.05…120 s step = 0.01 s	t_t = t8	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
OV	59	U9 = 1….1,5 Un step = 0.001 Un	± 2 %	t9 = 0.05…120 s step = 0.01 s	t_t = t9	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
VU	47	U14 = 2…90 % step = 1 %	± 5 %	t14 = 0.5…60 s step = 0.5 s	t_t = t14	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
UF	81L	f12 = 0,9….1 fn step = 0.001 fn	± 1 % [4]	t12 = 0,06…300 s step = 0.01 s	t_t = t12	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
OF	81H	f13 = 1….1,1 fn step = 0.001 fn	± 1 % [4]	t13 = 0,06…300 s step = 0.01 s	t_t = t13	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
RP	32R	P11 = -1…-0.05 Sn step = 0.001 Sn	± 10 %	t11 = 0.5…100 s step = 0.1 s	t_t = t11	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set ≥ 5 s)
Synchrocheck	25	Ulive = 0.5…1.1 Un; step = 0.001 Un ΔU = 0.02…0.12 Un; step = 0.001 Un Δf = 0.1…1 Hz; step = 0.1 Hz ΔCos φ = 5…50° elt; step = 5° elt tsyn = 0.1…3 s; step = 0.1 s	± 10 %	tref = 0.1…30 s step = 1 ms	-	-
Cyclic direction of the phases	47	1-2-3 or 3-2-1	-	-	-	-
Cos φ	78	Cos φ = 0.5…0.95 step = 0.01	-	-	-	-

[1] Calculation of t_t is valid for values exceeding the tripping threshold of the protection.
[2] Valid tolerances with steady-state energized trip unit or trip unit energized by auxiliary power supply, tripping time ≥ 100 ms, temperature and currents within operating limits. If these conditions are not guaranteed, the tripping time tolerance of ± 10 % will become ± 20%.
[3] ANSI / IEEE C37-2 encoding.
[4] Valid tolerance for frequencies in the range: fn ± 2 %. For frequency outside the range a tolerance of ± 5 % applies.

11 - Hi-Touch protections

Presentation

Hi-Touch protections are available for Ekip Hi-Touch and Ekip G Hi-Touch trip units.

List of protections

The following is a list of the Hi-Touch protections:

Symbol	Protection against
S2	Short-circuit with adjustable delay
D	Directional short-circuit with adjustable delay
UV2	Minimum voltage
OV2	Maximum voltage
UF2	Minimum frequency
OF2	Maximum frequency
Set A-B	Double configuration of the protections

Operating principle

The protections have a series of parameters available allowing the user to adjust the activation thresholds and the opening times of the circuit-breaker.

The operating principle of all the protections is similar: if the current, voltage or frequency signal exceeds the set protection threshold, the specific protection will enter the alarm condition and will begin to delay.

The duration of the delay depends on the threshold and time parameters set, and depending on the dynamic of the signal we can have two behaviours:

- If the alarm condition persists, the trip unit opens the circuit-breaker.
- If the signal drops below the protection threshold, the trip unit exits from the alarm condition, interrupts the delay and doesn't open the circuit-breaker.

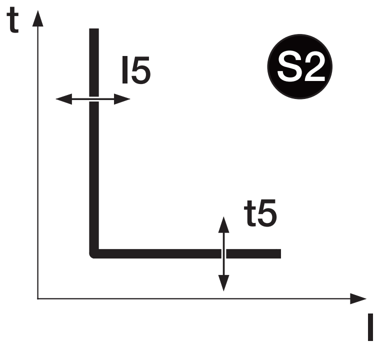
The protection thresholds are distinguished by type:

- The current protections are related to the rated size of the Rating Plug (In).
- The voltage protections are related to the rated size of the voltage line-to-line set on the trip unit (Un).
- The frequency protections are related to the frequency set on the trip unit (fn).

IMPORTANT:

- **To manage the circuit-breaker tripping with a specific protection, the protection itself must be enabled and, if supported, must have the Trip Enable parameter activated.**
- **All the protections have a default configuration: if enabled, check the parameters and make the necessary changes according to the requirements of your installation.**

S2 Protection



Path

Main page - Menus - Protections

Function

S2 protection:

- It protects against a selective short circuit, as the S function.
- It is independent from S protection: it is therefore possible to program thresholds and functions of the two protections in order to have different installation solutions (for example: signalling with S and trip with S2, or vice versa, or S and S2 both for signalling or trip).

When the activation threshold is exceeded, the protection trips within a fixed time. The user can set the threshold and the tripping time.

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold I5	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug). **IMPORTANT: The I5 threshold set must be higher than the I1 threshold. An incorrect configuration gives an error on the display and the programming session doesn't conclude, with consequent rejection of the changes made to the parameters.**
Time t5	This is the delay time between the exceeding of the I5 threshold and the sending of the opening command.

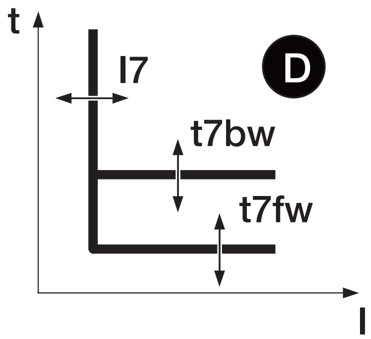
S2 protection has **Trip Enable, Zone Selectivity, Startup Enable**, see page 88.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

D Protection

Path

Main page - Menu - Advanced



Function

D protection protects against selective directional short circuit.

Once the activation threshold has been exceeded, the protection trips within a fixed time determined by the direction of the fault, t7fw in the case of forward direction and T7bw in the case of backward direction.

NOTE: *the protection does not detect the direction of fault current for < 5 V voltages.*

Operating principle

The **direction of the fault current** detected is compared with the **reference direction for the fault current** (forward direction).

This reference direction matches the set **power flow** value in nominal conditions, provided that the **phase sequence** has been set correctly (cyclic direction of the phases).

Cyclic direction of the phases (Set)	Power flow	Cyclic direction of the phases (Real)	Reference direction for the fault current (forward direction).
123	Top -> Bottom	123	Top -> Bottom
123	Bottom -> Top	123	Bottom -> Top
123	Top -> Bottom	321	Bottom -> Top
123	Bottom -> Top	321	Top -> Bottom
321	Top -> Bottom	123	Bottom -> Top
321	Bottom -> Top	123	Top -> Bottom
321	Top -> Bottom	321	Top -> Bottom
321	Bottom -> Top	321	Bottom -> Top

NOTE: *The flow of power parameter is described under the Ekip Measuring Pro module, on page* **210***, while the phase sequence on page* **79***.*

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold I7 Bw	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis), in the case of forward direction. It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug)
Threshold I7 Fw	It defines the current value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis), in the case of backward direction. It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug)
Time t7 Fw	This is the delay time between the exceeding of the I7 threshold and the sending of the opening command, in the case of forward direction.
Time t7 Bw	This is the delay time between the exceeding of the I7 threshold and the sending of the opening command, in the case of backward direction.
Direction Min Angle	The direction of the fault is calculated by the trip unit according to the phase difference angle between the reactive and apparent powers measured: when the phase-difference becomes greater than the parameter **Min Angle Direction** set, the trip unit considers the direction of the fault to have been identified. **NOTE:** *There are 15 preset values available, in a range from 3.6° to 69.6°.*

Continued on the next page

D protection has **Trip Enable, Directional Zone Selectivity, Startup Enable**, see page 88.

Via Ekip Connect it is possible to access further parameters:

- **Blocking** functions, see page 72 for operation details.
- **Trip only Forward**: if it is activated, protection D manages opening commands only if forward direction is detected
- **Trip only Backward**: if it is activated, protection D manages opening commands only if backward direction is detected

Notes

By activating the directional D protection, the alarm that checks the phase sequence is automatically set (it can however also be bypassed and activated manually): note that in the event of a cyclical sequence of phases different from the set value, the directional protection inverts the reference direction in the case of a fault whenever different from the expected one.

NOTE: *the details of the phase sequence protection are available on page* **79***.*

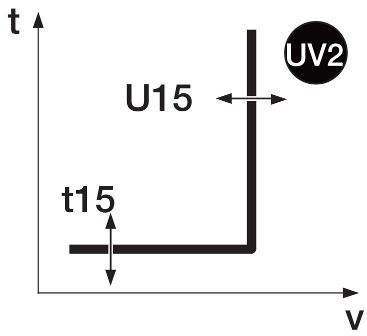
The behavior of the directional protection is influenced in the case of small overloads by the load type: in the case of a capacitive load, to avoid the possibility of incorrect identification of the fault current direction, this protection should be adjusted in relation to real fault conditions and not to overloads.

WARNING! Parameters and application notes are valid with protection trip units updated to SW version 2.00 (or later versions).

UV2 Protection

Path

Main page - Menu - Advanced



Function

UV2 protection:

- It trips when the line-to-line voltage drops below the set threshold, like the UV protection.
- It is independent from UV protection: it is therefore possible to program thresholds and functions of the two protections in order to have different installation solutions (for example: signalling with UV and trip with UV2, or vice versa, or UV and UV2 both for signalling or trip).

If at least one line-to-line voltage drops below the activation threshold, the protection trips within a fixed time set by the user.

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold U15	It defines the voltage value below which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Volts) and a relative value (Un, nominal value defined on the trip unit).
Time t15	The delay time between the exceeding of the U15 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

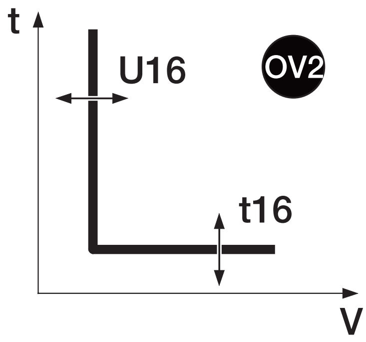
UV2 protection has **Trip Enable**, see page 88.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

OV2 Protection

Path

Main page - Menu - Advanced



Function

OV2 protection:

- It trips when the line-to-line voltage rises above the set threshold, like the OV protection.
- It is independent from OV protection: it is therefore possible to program thresholds and functions of the two protections in order to have different installation solutions (for example: signalling with OV and trip with OV2, or vice versa, or OV and OV2 both for signalling or trip).

If at least one line-to-line voltage rises above the activation threshold, the protection trips within a fixed time set by the user.

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold U16	It defines the voltage value above which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Volts) and a relative value (Un, nominal value defined on the trip unit).
Time t16	The delay time between the exceeding of the U16 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

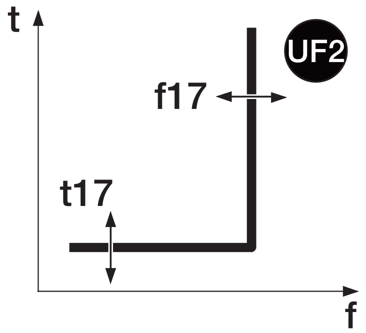
OV2 protection has **Trip Enable**, see page 88.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

UF2 Protection

Path

Main page - Menu - Advanced



Function

UF protection:

- It trips when the line frequency drops below the set threshold, like UF protection.
- It is independent from UF protection: it is therefore possible to program thresholds and functions of the two protections in order to have different installation solutions (for example: signalling with UF and trip with UF2, or vice versa, or UF and UF2 both for signalling or trip).

If the line frequency drops below the activation threshold, the protection trips within a fixed time set by the user.

NOTE: *the protection is not active for voltages <30V.*

Parameters

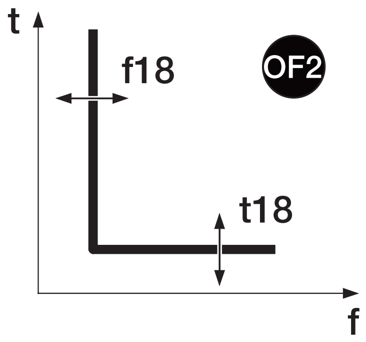
Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold f17	It defines the frequency value below which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Hertz) and a relative value (fn, nominal value defined on the trip unit).
Time t17	The delay time between the exceeding of the f17 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

UF2 protection has **Trip Enable**, see page 88.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

OF2 Protection



Path

Main page - Menu - Advanced

Function

OF2 protection:

- It trips when the line frequency rises above the set threshold, like the OF protection.
- It is independent from OF protection: it is therefore possible to program thresholds and functions of the two protections in order to have different installation solutions (for example: signalling with OF and trip with OF2, or vice versa, or OF and OF2 both for signalling or trip).

If the line frequency rises above the activation threshold, the protection trips within a fixed time set by the user.

NOTE: *the protection is not active for voltages <30V.*

Parameters

Here is a list of the available parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold f18	It defines the frequency value above which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Hertz) and a relative value (fn, nominal value defined on the trip unit).
Time t18	The delay time between the exceeding of the f18 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

OF2 protection has **Trip Enable**, see page 88.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

Set A-B

Path

Main page - Menu - Settings - Double Set (Enabling)

Main page - Menus - Protections - Advanced - Functions - Turn on SET B (Activation event)

Function

Enabling the function Set A-B makes it possible to activate two different protection configurations, alternatives to each other, on the basis of certain programmable events.

Enabling

The following parameters are available:

Parameter	Description
Enable	To activate/deactivate the protection. **NOTE:** *The parameter Enable changes the structure of the Protections and Advanced Protections menus: after it is accessed, an intermediate page appears for selecting the reference set (Set A and Set B). Enabling activates an icon in the Histograms page, representing the Set in use.*
Default Set	It defines the main and secondary protection sets.

Activation events

The following parameters are available:

Parameter	Description
Function	It allows you to choose the event or the state that activates the secondary protection set. **NOTE:** *with SW Ekip Connect it is possible to program the "Custom" setting (for further details see the Ekip Connect User Manual)*.
Delay	This is the minimum time of presence of an event/state necessary to activate the parameter change.

Hi- versions: additional functions

Functions

For some protections there are functions available that extend the functionality:

Protection	S2	D	UV2	OV2	UF2	OF2
Trip Enable	x		x	x	x	x
Zone Selectivity	x					
StartUp enable	x	x				
Directional Zone Selectivity		x				
Blocks	x		x	x	x	x

Trip enable

It disables the opening command in order to use the protection as an alarm signal, without opening commands.

Zone Selectivity

The function allows multiple circuit-breakers in the same installation to be connected together, in order to coordinate the trip units and to reduce the tripping times in the case of S2 protection.

The function allows circuit-breakers to be coordinated so that, in the event of a failure:

- The circuit-breaker closest to the fault trips.
- The other circuit-breakers are locked for a programmable time.

For further details see the chapter "Specific applications" on page 156.

Startup enable

The function allows you to modify the threshold of the protection for a period that can be set by the user. The period is activated when a threshold is exceeded (startup threshold), which can be programmed by the user via Ekip Connect software.

NOTE: *for protection D the startup thresholds are available for both forward and backward direction.*

Directional Zone Selectivity

The function allows, as with Zone Selectivity, multiple circuit-breakers in the same installation to be connected together, in order to coordinate the trip units and reduce tripping times, but with some important differences:

- It is to be used in installations with loop circuit.
- It allows tripping to be managed and coordinated according to the power flows (determined by the direction of the current), in order to minimize dispersion of energy.

NOTE: *Directional Zone Selectivity works as an alternative to S and G Zone Selectivity.*

Summary table of Hi-Touch protections

ABB	ANSI [4]	Threshold	Tolerance threshold	Time	Calculation formula t_t [1]	Tolerance t_t [2]
S2	50 TD	I5 = 0.6...10 In step = 0.1 In	± 7 % If ≤ 6 In ± 10 % If > 6 In	t5 = 0.05...0.8 s step = 0.01 s	t_t = t5	The better of the two values: ± 10 % or ± 40 ms
D	67	I7 Fw/Bw = 0.6...10 In step = 0.1 In	± 7 % If ≤ 6 In ± 10 % If > 6 In	t7 Fw/Bw = 0.1...0.8 s step = 0.01 s	t_t = t7	The better of the two values: ± 10 % or ± 40 ms
UV2	27	U15= 0,05….0,98 Un step = 0.001 Un	± 2 %	t15 = 0.05…120 s step = 0.01 s	t_t = t15	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
OV2	59	U16= 1….1,5 Un step = 0.001 Un	± 2 %	t16 = 0.05…120 s step = 0.01 s	t_t = t16	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
UF2	81L	f17= 0,9….1 fn step = 0.001 fn	± 1 % [5]	t17 = 0,06…300 s step = 0.01 s	t_t = t17	The better of the two values: ± 10 % (min=30ms) or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
OF2	81H	f18= 1….1,1 fn step = 0.001 fn	± 1 % [5]	t18 = 0,06…300 s step = 0.01 s	t_t = t18	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)

Table of Additional functions of the protections

The following table summarises the additional functions combined with protections S2 and D:

ABB	ANSI [4]	Threshold	Threshold tolerance [2]	Time [3]	Calculation formula t_t [1]	Tolerance t_t [2]
S2 (Startup)	-	$I5_{startup}$= 0.6...10 In step = 0.1 In	± 7 % with If ≤ 6 In ± 10 % with If > 6 In	$t5_{startup}$= 0.1…30 s step = 0.01 s	$t_t = t5_{startup}$	The better of the two values: ± 10 % or ± 40 ms
S2 (Sdz)	68	-	-	$t2_{sdz}$= 0.04…0.2 s step = 0.01 s	-	-
D (Startup)	-	$I7_{startup}$= 0.6...10 In step = 0.1 In	± 10 %	$t7_{startup}$= 0.1…30 s step = 0.01 s	$t_t = t7_{startup}$	The better of the two values: ± 10 % or ± 40 ms
D (SdZ)	68	-	-	$t7_{SdZ}$ = 0.1…0.8 s step = 0.01 s	-	-

(1) Calculation of t_t is valid for values exceeding the tripping threshold of the protection.
(2) Valid tolerances with steady-state energized trip unit or trip unit energized by auxiliary power supply, tripping time ≥ 100 ms, temperature and currents within operating limits. If these conditions are not guaranteed, the tripping time tolerance of ± 10 % will become ± 20%.
(3) For the startup functions, the specified time is the period during which the protection with the different threshold remains active, calculated from the moment the startup threshold is exceeded.
(4) ANSI / IEEE C37-2 encoding.
(5) Valid tolerance for frequencies in the range: fn ± 2 %. For frequency outside the range a tolerance of ± 5 % applies.

12 - G Touch protections

Presentation G Touch protections are available in all the versions of trip units of the Generators range (Ekip G Touch and Ekip G Hi-Touch).

List of protections

The following is a list of the G Touch protections:

Symbol	Protection against
S(V)	Voltage control short-circuit
RV	Residual voltage
RQ	Reverse reactive power
OQ	Maximum reactive power
OP	Maximum active power
UP	Minimum active power

Operating principle

The protections have a series of parameters available allowing the user to adjust the activation thresholds and the opening times of the circuit-breaker.

The operating principle of all the protections is similar: if the voltage or power signal exceeds the set protection threshold, the specific protection will enter the alarm condition and will begin to delay.

The duration of the delay depends on the threshold and time parameters set, and depending on the dynamic of the signal we can have two behaviours:

- If the alarm condition persists, the trip unit opens the circuit-breaker.
- If the signal drops below the protection threshold, the trip unit exits from the alarm condition, interrupts the delay and doesn't open the circuit-breaker.

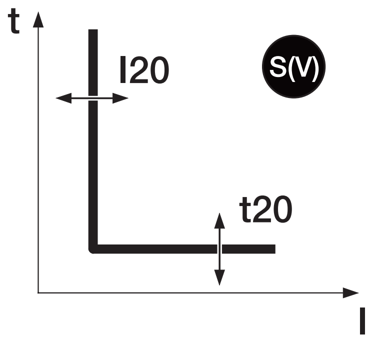
The protection thresholds are distinguished by type:

- The voltage protections are related to the rated size of the voltage line-to-line set on the trip unit (Un).
- The power protections refer to the product of current and rated voltage (Sn = √3 * In * Un).

IMPORTANT:

- **To manage the circuit-breaker tripping with a specific protection, the protection itself must be enabled and, if supported, must have the Trip Enable parameter activated.**
- **All the protections have a default configuration: if enabled, check the parameters and make the necessary changes according to the requirements of your installation.**

S(V) Protection



Path

Main page - Menu - Advanced

Function

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

Following a voltage drop, the I20 threshold varies according to two different modes:
- Step Mode provides for variation in steps according to the Ul parameter.
- Linear Mode provides for dynamic variation base on Ul and Uh parameters.

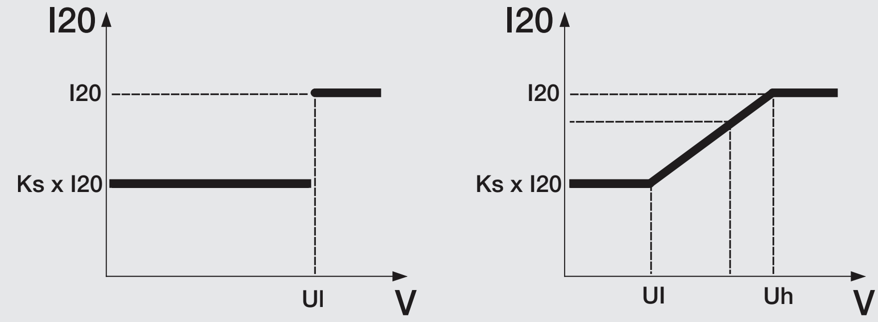


Figure 22

Parameters

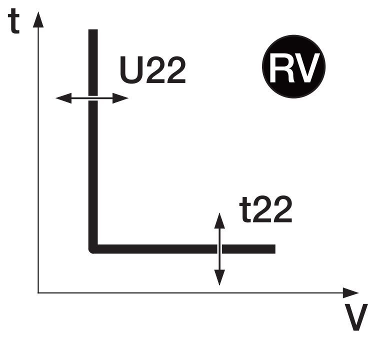
It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Curve	Allows you to choose the variation dynamic of the current threshold, as represented in the two diagrams above.
Threshold I20	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). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug).
Ul Threshold (Step)	With the curve in step mode, it is the threshold that determines the variation in the level of I20: • With voltage ≥ Ul, the tripping threshold is I20. • With voltage < Ul, the tripping threshold is Ks * I20. It is represented both as an absolute value (Volts) and as a percentage (%Un, with Un nominal value defined on the trip unit).
Threshold Uh e Ul (Linear)	With the curve in linear mode, it is the threshold that determines the variation in the level of I20: • With voltage ≥ Uh, the tripping threshold is I20. • With voltage < Uh and > Ul, the tripping threshold changes gradually. • With voltage ≤ Ul, the tripping threshold is Ks * I20 It is represented both as an absolute value (Volts) and as a percentage (%Un, with Un nominal value defined on the trip unit).
Ks threshold	Constant for calculation of the variation of the I20 threshold. To be applied in different ways according to the type curve selected.
Time t20	This is the delay time between the exceeding of the I20 threshold (determined by the voltage value read) and the sending of the opening command (with reference to the curve, t20 affects the entire curve, shifting it along the y-axis).

S(V) protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

RV Protection



Path

Main page - Menu - Advanced

Function

RV protection protects against loss of insulation (residual voltage). The residual voltage U_0 is calculated by the vectorial sum of the phase voltages.

NOTE: *the protection is activated and available for:*

- Four-pole circuit-breakers
- Three-pole circuit-breakers configured with external neutral voltage (parameter *Neutral connection= Present*, available in the menu of the Ekip Measuring module).

When the residual voltage exceeds the activation threshold U22, the protection trips within a fixed time t22.

Parameters

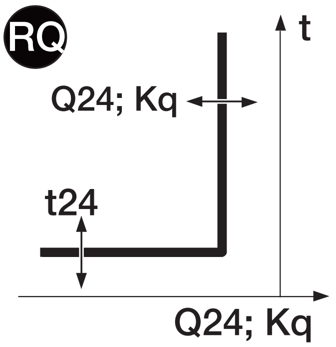
It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold U22	It defines the voltage value that activates the protection when exceeded (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (Volts) and a relative value (Un, nominal value defined on the trip unit).
Time t22	This is the delay time between the exceeding of the U22 threshold (determined by the voltage value read) and the sending of the opening command (in reference to the curve, t22 affects the entire curve, shifting it along the y-axis).

RV protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

RQ Protection



Path

Main page - Menu - Advanced

Function

RQ protection protects against reversal of reactive power, with an adjustable threshold according to the parameter Sn (= √3 x Un x In).

When the reverse reactive power drops below the activation threshold Q24, the protection trips within a fixed time t24.

Adjustment of the constant Kq allows you to vary the tripping threshold of the protection: with Kq = 0 the threshold is constant, while with Kq different from 0 the threshold has a slope, as illustrated in the following figure.

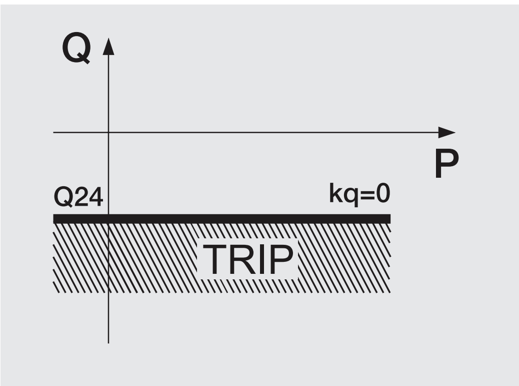


Figure 23

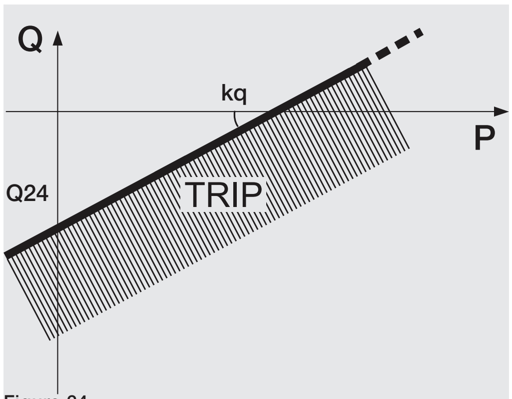


Figure 24

Continued on the next page

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold Kq	It defines the slope of the protection function.
Threshold Q24	It defines the starting point on the Q axis of the protection curve. It is represented both as an absolute value (kVAR) and a relative value (Sn, referring to the rated voltage set on the trip unit). **NOTES:** the threshold expressed in Sn is preceded by the sign "- " in order to indicate that it refers to reverse power.
Time t24	This is the delay time between the exceeding of the tripping threshold and the sending of the opening command
Threshold Vmin	It is the minimum voltage for activation of the protection. If a there is at least one line-to-line voltage present below the Vmin threshold, the protection is not active.

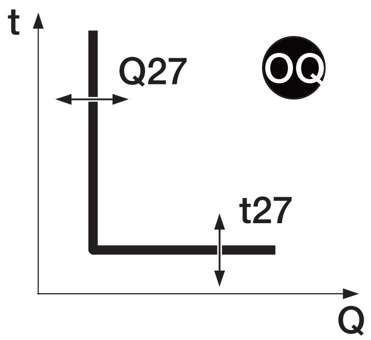
RQ protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

OQ Protection

Path

Main page - Menu - Advanced



Function

OQ protection trips when the power supplied rises above the set threshold.

If the reactive power rises above the activation threshold, the protection trips within a fixed time set by the user.

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold Q27	It defines the reactive power value above which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (kVAR) and a relative value (Sn, referring to the rated voltage set on the trip unit).
Time t27	The delay time between the exceeding of the Q27 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

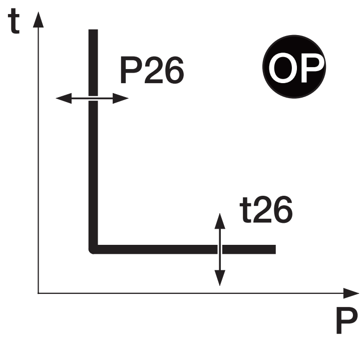
OQ protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

OP Protection

Path

Main page - Menu - Advanced



Function

OP protection trips when the active supplied rises above the set threshold.

If the active power rises above the activation threshold, the protection trips within a fixed time set by the user.

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold P26	It defines the active power value above which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (kW) and a relative value (Sn, referring to the rated voltage set on the trip unit).
Time t26	The delay time between the exceeding of the P26 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

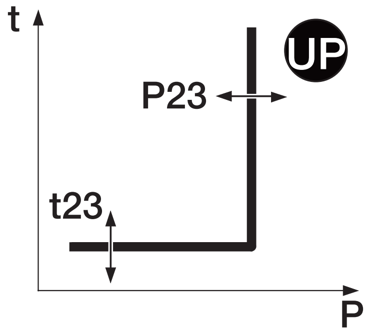
OP protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

UP Protection

Path

Main page - Menu - Advanced



Function

UP protection trips when the power supplied drops below the set threshold.

If the active power drops below the activation threshold, the protection trips within a fixed time set by the user.

NOTE:

- *The protection is not active for voltages <30V and if the circuit-breaker is open.*
- *The protection is active also for negative (reverse) active power, but is independent from the RP protection (protection against reverse active power).*

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold P23	It defines the active power value below which the protection is activated (with reference to the figure above, the threshold is the part of the curve parallel to the y-axis). It is represented both as an absolute value (kW) and a relative value (Sn, nominal value defined on the trip unit).
Time t23	The delay time between the exceeding of the P23 threshold and the sending of the opening command (with reference to the figure above, the threshold is the part of the curve parallel to the x-axis).

UP protection has **Trip Enable** and **Startup Enable** , see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

Summary table for G Touch protections

ABB	ANSI [5]	Threshold	Tolerance threshold	Tripping time	Calculation formula t_t [1]	Tolerance t_t [2]
S(V) (Step)	51V	I20 = 0.6...10 In; step = 0.1 In [6] Ul = 0.2…1 Un; step = 0.01 Un Ks = 0.1…1; step = 0.01 [6]	± 10 %	t20 = 0.05…30 s step = 0.01 s	t_t = t20	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
S(V) [3] (Linear)	51V	I20 = 0.6...10 In; step = 0.1 In [6] Ul = 0.2…1 Un; step = 0.01 Un [7] Uh = 0.2…1 Un; step = 0.01 Un [7] Ks = 0.1…1; step = 0.01 [6]	± 10 %	t20 = 0.05…30 s step = 0.01 s	t_t = t20	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
RV	59N	U22 = 0.05….0.5 Un step = 0.001 Un	± 5 %	t22 = 0.05…120 s step = 0.01 s	t_t = t22	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
RQ	40/32R	Q24 = -1…-0.1 Sn; step = 0.001 Sn Kq = -2…2; step = 0.01 Vmin = 0.5...1.2 Un; step = 0.01	± 10 %	t24 = 0.5…100 s step = 0.1 s	t_t = t24	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
OP	32OF	P26 = 0.4…2 Sn step = 0.001 Sn	± 10 %	t26 = 0.5…100 s step = 0.5 s	t_t = t26	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
OQ	32OF	Q27 = 0.4…2 Sn step = 0.001 Sn	± 10 %	t27 = 0.5…100 s step = 0.5 s	t_t = t27	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
UP	32LF	P23 = 0.1...1 Sn step = 0.001 Sn	± 10 %	t23 = 0.5…100 s step = 0.5 s	t_t = t23	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)

Table of Additional functions of the protections

UP protection has Startup Enable:

ABB	Time [4]
UP (Startup)	$t23_{startup}$ = 0.1…30 s step = 0.01 s

[1] Calculation of t_t is valid for values exceeding the tripping threshold of the protection.
[2] Valid tolerances with steady-state energized trip unit or trip unit energized by auxiliary power supply, tripping time ≥ 100 ms, temperature and currents within operating limits. If these conditions are not guaranteed, the tripping time tolerance of ± 10 % will become ± 20%.
[3] The tripping threshold of the current for voltage values between Ul and Uh is calculated by performing the linear interpolation between the thresholds Uh and I20 (first point on the line) and Ul and Ks * I20 (second point on the line). $I_{threshold}$ = [I20 * (1 - ks) * ($U_{measured}$ - Uh)] / (Uh - Ul) + I20.
[4] The startup of protection UP is to be considered as the temporary deactivation time of the protection, starting from the exceeding of the startup threshold.
[5] ANSI / IEEE C37-2 encoding.
[6] The setting of the Ks threshold must guarantee the following constraint: Ks * I20 ≥ 0.6 In.
[7] The setting of thresholds Uh and Ul must guarantee the following constraint: Uh > Ul.

13 - G Hi-Touch protections

Presentation The G Hi-Touch protections are available with the Ekip G Hi-Touch trip unit.

List of protections

The following is a list of the G Hi-Touch protections:

Symbol	Protection against
ROCOF	Rate of change of frequency
S2(V)	Voltage control short-circuit
RQ2	Reverse reactive power

Operating principle

The protections have a series of parameters available allowing the user to adjust the activation thresholds and the opening times of the circuit-breaker.

The operating principle of all the protections is similar: if the frequency or power signal exceeds the set protection threshold, the specific protection will enter the alarm condition and will begin to delay.

The duration of the delay depends on the threshold and time parameters set, and depending on the dynamic of the signal we can have two behaviours:

- If the alarm condition persists, the trip unit opens the circuit-breaker.
- If the signal drops below the protection threshold, the trip unit exits from the alarm condition, interrupts the delay and doesn't open the circuit-breaker.

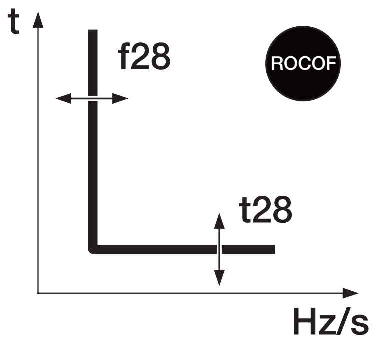
The protection thresholds are distinguished by type:

- The frequency protections are related to the rated size of the frequency set on the trip unit (Un).
- The power protections refer to the product of current and rated voltage (Sn = √3 * In * Un).

IMPORTANT:

- **To manage the circuit-breaker tripping with a specific protection, the protection itself must be enabled and, if supported, must have the Trip Enable parameter activated.**
- **All the protections have a default configuration: if enabled, check the parameters and make the necessary changes according to the requirements of your installation.**

ROCOF Protection



Path

Main page - Menu - Advanced

Function

ROCOF protection protects against rapid frequency variations.

When the frequency change exceeds the control threshold f28 over time, the protection trips within a fixed time t28.

It is also possible to characterize the protection according to the way in which frequency varies (increase or decrease), or to consider both conditions.

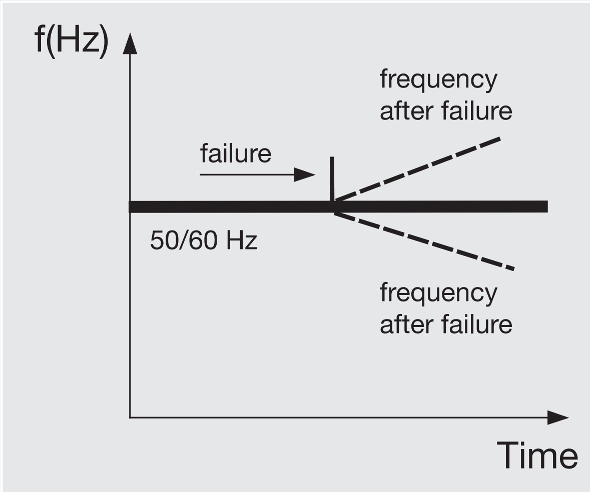


Figure 25

NOTE: *the protection is not active for voltages <30V.*

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold f28	It defines the maximum allowed frequency variation rate over time, above which the protection will be activated. It is represented as an absolute value (Hertz / second).
Trip Direction	It defines whether the protection monitors increases, decreases, or both variations.
Time t28	This is the delay time between the exceeding of the f28 threshold and the sending of the opening command

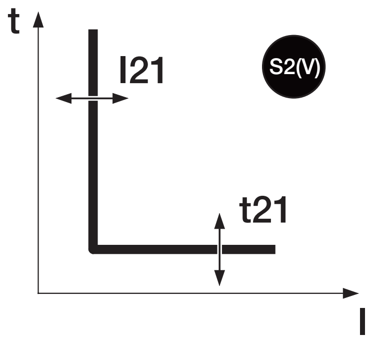
ROCOF protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

S(V) Protection

Path

Main page - Menu - Advanced



Function

S2(V) protection:

- It protects against short circuits, with a threshold sensitive to the value of the voltage.
- It is independent from S(V) protection: it is therefore possible to program thresholds and functions of the two protections in order to have different installation solutions (for example: signalling with S(V) and trip with S(V)2, or vice versa, or S(V) and S(V)2 both for signalling or trip).

When the activation threshold I21 is exceeded, the protection trips within a fixed time t21.

Following a voltage drop, the I21 threshold varies according to two different modes:

- Step Mode provides for variation in steps according to the Ul2 parameter.
- Linear Mode provides for dynamic variation base on the parameters Ul2 and Uh2.

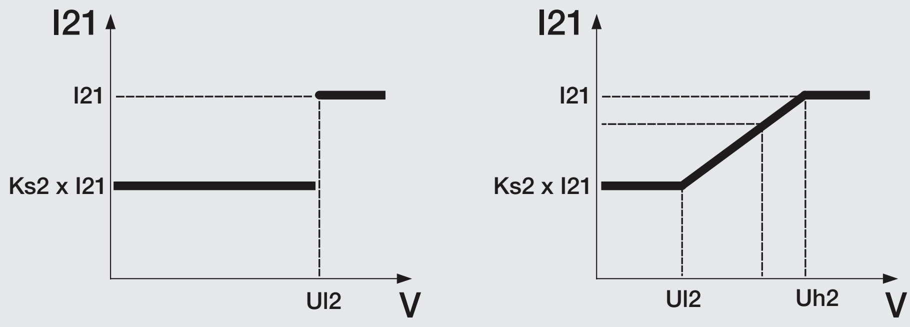


Figure 26

Parameters

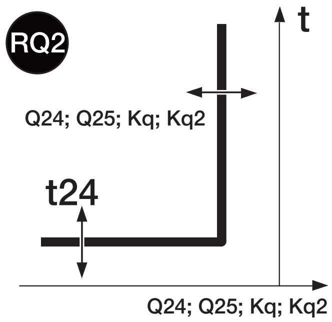
It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Curve	It defines the variation dynamic of the current threshold, as represented in the two diagrams above.
Threshold I21	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). It is represented both as an absolute value (Ampere) and as a relative value (In, nominal value defined by the Rating Plug).
Threshold Ul2 (Step)	With the curve in step mode, it is the threshold that determines the variation of the level of I21: • With voltage ≥ Ul2, the tripping threshold is I21. • With voltage < Ul2, the tripping threshold is Ks2 * I21. It is represented both as an absolute value (Volts) and as a percentage (of Un, nominal value defined on the trip unit).
Threshold Uh2 e Ul2 (Linear)	With the curve in linear mode, it is the threshold that determines the variation of the level of I21: • With voltage ≥ Uh2, the tripping threshold is I21. • With voltage < Uh2 and > Ul2, the tripping threshold changes gradually. • With voltage ≤ Ul2, the tripping threshold is Ks2 * I21. It is represented both as an absolute value (Volts) and as a percentage (of Un, nominal value defined on the trip unit).
Threshold Ks2	Constant for calculation of the variation of the I21 threshold. To be applied in different ways according to the type curve selected.
Time t21	This is the delay time between the exceeding of the I21 threshold (determined by the voltage value read) and the sending of the opening command (in reference to the curve, t21 affects the entire curve, shifting it along the y-axis).

S2(V) protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

RQ2 Protection



Path

Main page - Menu - Advanced

Function

RQ2 protection:

- It protects against the reversal of reactive power, with an adjustable threshold according to the active power value.
- It is a variant of the RQ protection available with Ekip G Hi-Touch trip units.

When the reverse reactive power drops below activation threshold, the protection trips within a fixed time t24.

The parameters Q24 and Q25, with the respective constants Kq and Kq2, allow you to characterize the response curve with a dynamic behavior.

In particular, the adjustment of the constants Kq and Kq2 allows you to vary the tripping threshold of the protection: with Kq and Kq2 = 0 the threshold is constant, while with Kq and Kq2 different to 0 the threshold has a slope, as illustrated in the following image.

NOTE: *The trip unit accepts parameters in accordance with the following limitations: Q24 < Q25 e Kq < Kq2 (slope).*

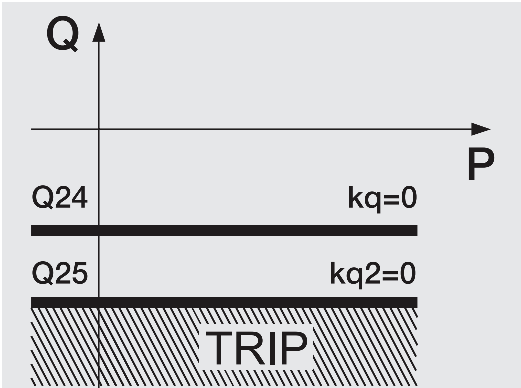


Figure 27

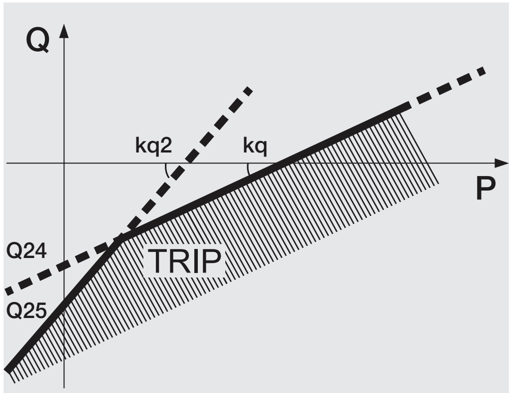


Figure 28

Parameters

It is possible to modify various parameters:

Parameter	Description
Enable	To activate/deactivate the protection.
Threshold Kq	It defines the slope of the protection function.
Threshold Kq2	It defines the slope of the protection function.
Threshold Q24	It defines the reactive power value for which the protection is activated. It is represented both as an absolute value (kVAR) and a relative value (Sn, referring to the rated voltage set on the trip unit). **NOTE:** *the threshold expressed in Sn is preceded by the sign "- " in order to indicate that it refers to reverse power.*
Threshold Q25	It defines the reactive power value for which the protection is activated. It is represented both as an absolute value (kVAR) and a relative value (Sn, referring to the rated voltage set on the trip unit). **NOTE:** *the threshold expressed in Sn is preceded by the sign "- " in order to indicate that it refers to reverse power.*
Time t24	This is the delay time between the exceeding of the tripping threshold and the sending of the opening command
Threshold Vmin	It is the minimum voltage for activation of the protection. If a there is at least one line-to-line voltage present below the Vmin threshold, the protection is not active.

RQ2 protection has **Trip Enable**, see page 71.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

Summary table of G Hi-Touch protections

ABB	ANSI (1)	Threshold	Tolerance threshold	Tripping time	Calculation formula t_t (2)	Tolerance t_t (3)
S2(V) (Step)	51V	I21 = 0.6...10 In; step = 0.1 In (4) Ul2 = 0.2…1 Un; step = 0.01 Un Ks2 = 0.1…1; step = 0.01 (4)	± 10 %	t21 = 0.05…30 s step = 0.01 s	t_t = t21	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
S2(V) (Linear) (5)	51V	I21 = 0.6...10 In; step = 0.1 In (4) Ul2 = 0.2…1 Un; step = 0.01 Un (7) Uh2 = 0.2…1 Un; step = 0.01 Un (7) Ks2 = 0.1…1; step = 0.01 (4)	± 10 %	t21 = 0.05…30 s step = 0.01 s	t_t = t21	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
RQ2 (6)	40/32R	Q24 = -1…-0.1 Sn; step = 0.001 Sn Q25 = -1…-0.1 Sn; step = 0.001 Sn Kq = -2…2; step = 0.01; Kq2 = -2…2; step = 0.01 Vmin = 0.5...1.2 Un; step = 0.01	± 10 %	t24 = 0.5…100s step = 0.1 s	t_t = t24	The better of the two values: ± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s)
ROCOF	81R	f28 = 0.4…10 Hz / s step = 0.2 Hz / s	± 10 % (8)	t28 = 0.5...10 s step = 0.01 s	t_t = t28	The better of the two values: ± 20 % o 200 ms

(1) ANSI / IEEE C37-2 encoding.
(2) Calculation of t_t is valid for values exceeding the tripping threshold of the protection.
(3) Valid tolerances with steady-state energized trip unit or trip unit energized by auxiliary power supply, tripping time ≥ 100 ms, temperature and currents within operating limits. If these conditions are not guaranteed, the tripping time tolerance of ± 10 % will become ± 20%.
(4) The trip unit accepts the I21 and Ks2 parameters provided that their product is greater than or equal to 0.6 Hz / s: Ks2 * I21 >= 0.6 Hz / s.
(5) The tripping threshold of the current for voltage values between Ul2 and Uh2 is calculated by performing the linear interpolation between the thresholds Uh2 and I21 (first point on the line) and Ul2 and Ks2 * I20 (second point on the line). $I_{threshold}$ = [I10 * (1 - ks2) * ($U_{measured}$ - Uh2)] / (Uh2 - Ul2) + I21.
(6) The tripping threshold of protection RQ2 is calculated by the intersection of the 2 straight lines formed by Q24 and Kq ($P_{threshold} = Q_{measured}$ * Kq + Q24) and from Q25 and Kq2 ($P_{threshold} = Q_{measured}$ * Kq2 + Q25). If the constants Kq and Kq2 are set to 0, the highest threshold will apply (see the sample graph in the chapter on the RQ protection).
(7) The setting of thresholds Uh2 and Ul2 must guarantee the following constraint: Uh2 > Ul2.
(8) ± 20 % for the threshold 0.4 Hz / s.

14 - External toroid protections

Presentation

The presence of SGR external toroids and Rc allows the use of Gext and Rc protections respectively.

External toroids can be connected to all versions of the protection trip units of the Touch range.

NOTE: *the Rc protection RC requires the presence of an Rc Rating Plug and an Ekip Measuring Pro module.*

List of protections

Symbol	Protection against
Gext	Earth fault on external toroid with adjustable delay
Rc	Residual current

Operating principle

The protections have a series of parameters available allowing the user to adjust the activation thresholds and the opening times of the circuit-breaker.

The operating principle of all the protections is similar: if the current exceeds the protection threshold that has been set, the specific protection enters the alarm condition and starts timing.

The duration of the delay depends on the threshold and time parameters set, and two cases can be distinguished according to the dynamics of the current:

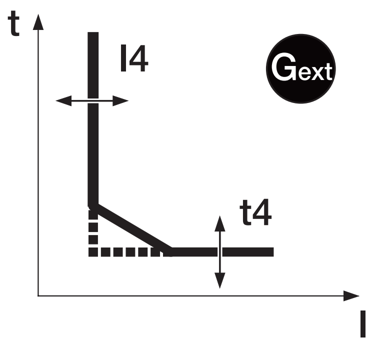
- If the alarm condition persists, the trip unit opens the circuit-breaker.
- If the current drops below the protection threshold, the trip unit exits from the alarm condition, interrupts the delay and does not make the circuit-breaker open.

For the Gext protection the protection threshold is related to the size of the current of the of the SGR external toroid and, for the Rc protection, to of preset current values.

IMPORTANT:

- **To manage the circuit-breaker tripping with a specific protection, the protection itself must be enabled and, if supported, must have the Trip Enable parameter activated.**
- **All the protections have a default configuration: in the event of activation, check the parameters and make changes according to the requirements of your installation.**

Gext Protection



Path

Main page - Menus - Settings - Circuit Breaker - Ground protection (enabling the presence of the external toroid)

Main page - Menus - Protections (protection parameters)

NOTE: *the menu containing the Gext protection parameters is activated if the presence of the SGR external toroid was previously enabled in the appropriate menu.*

Function

Gext protection protects against external earth faults, detecting the fault current with the appropriate SGR external toroid

NOTE:

- *The protection is available for LSIG version protection trip units.*
- *For the Gext protection to function correctly also in conditions of low installation currents, it is recommended to connect the protection trip unit to an auxiliary power supply.*

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

Continued on the next page

Availability

Protection G is an alternative to protection Gext on Ekip Touch and Ekip G Touch type releases (by enabling the presence of external toroid S.G.R. so as to display the Gext protection), while both protections are available with trip units Ekip Hi-Touch and Ekip G Hi-Touch.

Enabling parameters

Parameters to enable the external toroid presence in the relevant menu:

Parameter	Description
External Toroid	It allows the presence of the SGR external toroid to be activated
Toroid size	It allows you to select the reference current of the protection among four available sizes. **NOTE**: *the menu is available after the presence of the SGR external toroid has been enabled* **IMPORTANT: the current selected from the menu must be consistent with the size of the SGR external toroid connected to the protection trip unit.**

Protection parameters

The following is a description of the protection parameters:

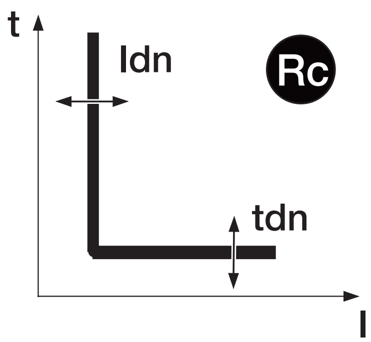
Parameter	Description
Enable	To activate/deactivate the protection. **IMPORTANT: the protection is inhibited automatically by the protection trip unit if the absence of the SGR external toroid is detected**
Curve	It determines the dynamic of the curve and the tripping time, fixed or dynamic according to the selection: • t = k (ANSI 50GTD): fixed time trip. • $t = k / I^2$ (ANSI 51G): inverse time tripping. The calculation of the tripping time of the inverse time curve is based on a mathematical expression. The details provided in the table on page 104.
Threshold I41	The value I41 contributes to calculate the tripping time, and also defines the current value that, if exceeded, activates the protection. It is represented both as an absolute value (Amperes) and as a relative value (In, nominal value defined by the size of the SGR external toroid).
Time t41	The selected function determines the contribution of t41: • t = k: t41 is the delay time between the exceeding of the I41 threshold and the sending of the opening command. • $t = k / I^2$: t41 contributes to calculate the tripping time.
I41 Prealarm Threshold	The prealarm of the Gext protection indicates that the current measured is close to the tripping threshold of the protection. The prealarm state is activated for currents higher than a threshold that can be set by the user, and is deactivated in two cases: • Detected current lower than the prealarm threshold. • Detected current higher than the protection tripping threshold. A value within the 50 % ... 90 % range can be entered, with 1 % steps.

Additional functions

Gext protection has **Trip Enable**, **Zone Selectivity**, **StartUp Enable**, see page 72.

Via Ekip Connect it is also possible to access the **blocking functions**, see page 72.

RC Protection



Path

Main page - Menus - Settings - Circuit Breaker - Ground protection (reading of the external toroid setting)

Main page - Menus - Advanced (protection parameters)

NOTE: *the menu with the parameters of Rc protection is activated if Rc type Rating Plug and Ekip Measuring Pro modules are present and correctly installed.*

Function

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

When the activation threshold is exceeded, the protection trips within a fixed time. The user can set the threshold and the tripping time of the protection.

Availability

protection G is an alternative to protection Rc on Ekip Touch and Ekip G Touch type releases (by enabling the presence of external toroid Rc so as to display the Rc protection), while both protections are available with trip units Ekip Hi-Touch and Ekip G Hi-Touch.

Parameters

Here is a list of the available parameters:

Parameter	Description
Threshold Idn	It defines the current value that activates the protection when exceeded. It is represented as an absolute value (Ampere).
Time tdN	This is the delay time between the exceeding of the Idn threshold and the sending of the opening command

Continued from the previous page

Summary table of external toroid protections

ABB	ANSI [1]	Threshold	Threshold toleran-ce [3]	Time	Calculation formula t_t [2]	Calculation example t_t [2]	Tolerance t_t [3]
Gext (t = k)	50GTD	I41 = 0.1...1 In toroid step = 0.001 In	± 7 %	t41 = 0.1…1 s step = 0.05 s [6]	t_t = t41	-	The better of the two values: ± 10 % or ± 40 ms
Gext (t = k / I²)	51G	I41 = 0.1...1 In toroid step = 0.001 In	± 7 %	t41 = 0.1…1 s step = 0.05 s [6]	$t_t = 2 / (If / I41)^2$	t_t = 0.32 s with: I41 = 0.8 In; t41 = 0.2 s; If = 2 In	± 15 %
Rc	64 50NTD	Idn = 3 - 5 - 7 - 10 - 20 - 30 A	-20 % ÷ 0	tdn = 0.06 - 01 - 0.2 - 0.3 - 0.4 - 0.5 - 0.8 s	t_t = tdn	-	140 ms @ 0.06 s [7] 950 ms @ 0.8 s [7]

Table of additional function of the Gext protection

ABB	ANSI [1]	Threshold	Threshold tolerance [3]	Time [5]	Calculation formula t_t [3]	Tolerance t_t [3]
Gext (Startup) [4]	-	I41 startup = 0.1...1 In toroid step = 0.02 In toroid	± 7 %	t41 startup = 0.1…30 s step = 0.01 s	t_t = t41	The better of the two values: ± 10 % or ± 40 ms
Gext (SdZ)	68		± 7 %	t41 sdz= 0.04…0.2 s step = 0.01 s	$t_t = 2 / (If / I41)^2$	-

(1) ANSI / IEEE C37-2 encoding.
(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 auxiliary power supply, tripping time ≥ 100 ms, temperature and currents within operating limits. If these conditions are not guaranteed, the threshold tolerance becomes: ± 15 % and tolerance tt becomes: ± 20 %.
(4) Startup can be activated only with the function set to fixed time.
(5) For the startup functions, the specified time is the period during which the protection with the different threshold remains active, calculated from the moment the startup threshold is exceeded.
(6) The maximum time permitted by the trip unit for type UL circuit-breakers is 0.4 s. If a higher value is entered, the protection trip unit will signal error and force the parameter to 0.4 s.
(7) Maximum tripping time.

15 - Touch measurements

Presentation

Touch measurements are available in all the models of trip units of the Ekip Touch range.

The following is a list of the available measurements:

Measurements	Description
Instantaneous currents	Real Time measurements of the currents
Trip	List of the trip for basic protections
Events	List of events, changes of state, alarms recorded by the trip unit
Maximum current	History of the maximum currents recorded with an interval that can be set
Minimum current	History of the minimum currents recorded with an interval that can be set
Peak factor	Real time measurement of the peak factor of the currents
Contact Wear	Calculation of the wear of the contacts
Datalogger	Recording of the waveform of the currents and the digital states
Operation counters	Number of mechanical and electrical operations

Instantaneous currents

Description

Instantaneous currents are real time measurements of earth fault and phase currents, expressed as r.m.s. value.

Representations and access pages

The current measurements are available in different forms, accessible from the following pages:
- **Histograms** page: graphical representation in the form of a histogram of the phase currents, and measurement in Amperes of the highest current.
- **Measuring instruments** page: graphical representation in the form of an ammeter and measurement in Amperes of the highest current.
- **Measurements** page: measurements in Amperes of all the phase currents and earth fault current.

NOTE:

- *The measurement of the earth fault current is available only with LSIG versions of trip units.*
- *The measurements in Amperes are available from a minimum value of 0.03 In for the phase currents, and 0.08 In the for earth fault current. For lower currents "…" is displayed.*
- In the **Histograms** *page, the graphical representation of the currents is in relation to 1 In, with a maximum value of 1.25 In*

Tripping

Path

Main page - Menu - Measurements - Historicals

Description

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

The trips are associated to the following information:
- The protection that tripped.
- The progressive number.
- The date and time of the opening (referring to the internal clock)
- The measurements associated to the trip protection.

NOTE:

- *Each trip is associated to a progressive number that is increased with every trip.*
- *If the trip unit has exceeded the threshold of the 30 openings, the oldest ones are progressively overwritten.*

Continued on the next page

Continued from the previous page

Correlated measurements

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

Protection against	Measurements recorded at the moment of the tripping
Current	Phase currents L1, L2, L3, Ne, Ig, Ige, Irc. **NOTE:** *• Ne is available with four-pole or three-pole circuit brakers with external Neutral* *• Ig is available with a trip unit in the LSIG version, in the case of trip due G protection.* *• Ige is available with a trip unit with a SGR toroid, in the case of trip due Gext protection.* *• Irc is available with a trip unit with a Rc toroid.*
Temperature	Phase currents L1, L2, L3, Ne. **NOTE:** *the temperature cannot be viewed from the display.*

Access to the last trip

The information on the most recent opening, as well as in the **Historicals** menu, is accessible in three different ways, according to the conditions of the trip unit:

Condition	Access mode
1) Opening just happened. 2) Trip unit with auxiliary power supply (always on).	The main page is temporarily replaced by the information page on the opening just occurred. The page is available until the reset of the trip unit (through the **iTest** key).
1) Opening just happened. 2) Trip unit without auxiliary power supply or Ekip Measuring Pro connected (off with circuit-breaker open).	Pressing the **iTest** key displays (for few seconds) the information page on the last trip.
1) Fast reading with trip unit on	From any page that is not a menu or a page opened from a menu, press the **iTest** button four times.

Events

Path

Main page - Menu - Measurements - Historicals

Description

The trip unit can record the last 200 events, referring mainly to variations in state and operation.

Specifically, the recorded events can supply information on:

- Trip unit: configuration status of the bus, operating mode, active set, auxiliary power supply.
- Protections: delay in action or alarm.
- Connection states and connection alarms: circuit-breaker, current sensors, trip coil, Rating Plug.
- Tripping: state of the opening command, or signal of tripping due to protection.

NOTE: *in the list of the events, the first available is the most recent one. If the trip unit has exceeded the threshold of 200 events, the oldest ones are progressively overwritten.*

Continued on the next page

Correlated information

All events are correlated with the following information:

- Icon that identifies the type.
- Name
- Date and time.

There are 4 icons that identify the type of event:

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

Maximum and minimum currents

Path

Main page - Menus - Measurements - Historicals - Measurements

NOTE: for details on the pages, see the chapter Menu pages and menus*, and the paragraph* **Measurement history***, beginning from page* **46.**

Description

The maximum and minimum currents are the recordings of the measurements of the maximum and minimum phase currents performed by the trip unit, and that can be displayed by selecting **I Max** and **I Min** in the menu *Historicals - Measurements*.

The interval between one measurement and the other can be set through the parameter **Monitor time**, available in the menu **Settings**.

The recordings can be reset through the command **Reset measurements**, available in the menu *Historicals - Measurements*.

Correlated information

Al measurements are correlated with the following information:

- The time interval since the previous measurement.
- The phase to which it refers, and value in Amperes.
- The date and time (referring to the internal clock).
- Graphical representation in the form of a histogram on a time axis.

NOTE:

- *If the value is less than 0,03 In, "…" is shown instead of the value in Amperes.*
- *The graphical representation is referred to 1 In, with a maximum value of 1.25 In*
- *When the parameter "Monitor time" is modified, the trip unit performs an immediate recording.*

Peak factor

Path

Main page - Menus - Measurements

Description

The selection of **Peak factor** in the menu **Measurements** allows you to display real time measurements of the peak factors of the phase currents.

The measurements are expressed as a ratio between the peak values and RMS values, for each individual phase.

Contact Wear

Path

Main page - Menu - Measurement - Maintenance

Description

Contact wear gives an estimation of the conditions of the circuit-breaker's main contacts.

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.

NOTE:

- *On reaching 100%, the percentage is not increased any further.*
- *Reaching of 80% is signalled with a prealarm, while reaching of 100% is signalled with an alarm.*

IMPORTANT: 100% wear doesn't involve any functional limit for the trip unit, but the condition of the circuit-breaker must be checked as soon as possible.

Datalogger

Path

Main page - Menus - Settings

Description

The datalogger it is a function that allows the recording of data associated to a trigger event.

The data recorded are:

- Analog measurements: phase currents and line-to-line voltages (if the Ekip Measuring or Ekip Measuring Pro module is present).
- Digital events: protection alarms, circuit-breaker state signals, tripping of protections.

When the datalogger is activated, the protection trip unit continuously acquires data, by filling and emptying an internal buffer. If a trigger event occurs, the trip unit inhibits acquisition (either immediately or with a time-lag that can be adjusted by the user) and stores the data, which can then be downloaded to a PC for reading and analysis.

IMPORTANT: the function is available with trip unit energized with auxiliary voltage.

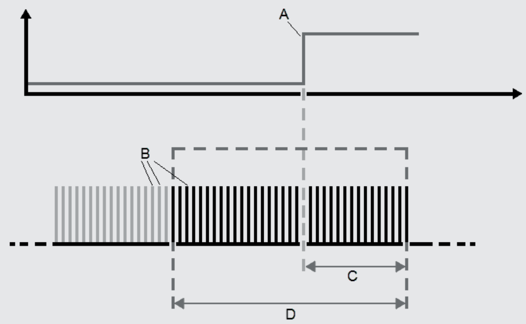


Figure 29

Pos.	Description
A	Trigger event
B	Data samples **NOTE:** *the set sampling frequency establishes the number of samples acquired per second.*
C	Time delay before stopping of recording
D	Recording window **NOTE:** *the window changes, depending on the set sampling frequency.*

Continued on the next page

Parameters that can be the set and the commands of the function are:

Parameter	Description
Number of dataloggers	It selects the number of recordings (1 or 2). **NOTE:** *the recordings are independent, but they share the sampling frequency and the type of memory.*
Sampling frequency	It determines the number of data logs recorded. There are four options available: 1200, 2400, 4800, 9600 Hz. **IMPORTANT:** **• A high frequency allows a more accurate analysis of the data.** **• The higher the frequency, the shorter the recording.**
Datalogger 1	It allows the user to set the parameters and to manually command recording number 1. • Stop Source: it selects the trigger event, on the occurrence of which the recording is to be stopped. • Stop Delay: it sets the delay after the trigger event after which recording is to be stopped • Restart command: it starts recording. • Stop command: it stops the recording and saves it in memory. **IMPORTANT: the recording can only be downloaded with the Ekip Connect application.**

The selection of two recordings activates additional parameters and commands:

Parameter	Description
Datalogger 2	Like Datalogger 1, but relevant to recording number 2.
Restart all	It starts both the recordings.
Stop All	It stops both the recordings and saves them in memory.

With Ekip Connect software it is possible to select the parameter *Memory Type*, not available on the display. Such parameter allows to choose whether to keep the recording also with the trip unit off (non-volatile) or to delete it if the auxiliary power disappears (volatile).

NOTE: *the parameter is configured by default as non-volatile.*

- *If Memory Type = Non volatile, the life of the internal battery of Ekip Touch may be sensibly lower than the declared value in case a recording is stored but auxiliary power supply is not present.*
- *If the Memory Type is Volatile and the auxiliary supply is lost, the datalogger will rerun the recording when re-powered and the previously memorized data will be lost.*

Operation counters

Path

Main page - Menu - About - Circuit-breaker

Description

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

- The number of manual openings.
- The total number of operations (manual + trips).

By activating the communication with the trip unit, the following counters are also available:

- The number of openings due to tripping of protections.
- The number of openings due tripping of failed protections.
- The number of opening tests performed.

Summary table of basic measurements

The following table summarises the basic measurements:

Quantities measured	Monitor time	Normal operating range	Accuracy
Phase currents (I1, I2, I3, Ine)	0.03…16 In	0.2…1.2 In	1 %
Earth fault current (Ig)	0.08…4 In	0.2…1.2 In	2 %

NOTE: *the accuracies refer to normal operating ranges, as established by IEC 61557-12.*

16 - Ekip Measuring Measurements

Presentation

These measurements are available in all the models of trip units of the Ekip TOUCH range supplied with Ekip Measuring module or Ekip Measuring Pro.

The following is a list of the available measurements:

Measurements	Description
Instantaneous voltages	Real Time measurements of the voltages
Instantaneous power	Real Time measurements of the active, reactive, apparent power
Trips	List of the trips due to voltage, frequency, power
Maximum voltage	History of the maximum voltages recorded with an interval that can be set
Minimum voltage	History of the minimum voltages recorded with an interval that can be set
Maximum power	History of the maximum active powers recorded with an interval that can be set
Average power	History of the average active powers recorded with an interval that can be set
Power factor	Real time measurement of the power factor
Instantaneous frequency	Measurement of the line frequency
Energy counters	Measurement of active, reactive, apparent energy

With the Ekip Measuring Pro module and Ekip Synchrocheck, a further set of measurements is activated:

Measurements	Description
Synchrocheck	Measurements related to the function of synchronism between two independent power supply systems

Power references

Displayed operating ranges and maximum values of power described in this chapter are given in absolute value or in relation to:

- Pn for the total power (Sn = In * Un * √3).
- Pn for the phase power (Pn = In * Un / √3).

Instantaneous voltages

Description

Instantaneous voltages are measurements in real time of the line-to-line and phase voltages.

NOTE: *the measurements of the phase voltages are available with four-pole or three-pole circuit-breakers configured with external neutral.*

Representations and access pages

Voltage measurements are available in different representations, accessible from the following pages:

- In the **Histograms page** there is a graphical representation in the form of a histogram of the line-to-line voltages, and the measurement in Volts of the highest voltage.
- In the **Measurements Synthesis** page, accessible from the **Histograms** page, there is the measurement in Volts of the highest line-to-line voltage.
- In the **Measuring instruments page** there is a graphical representation in the form of a voltmeter and measurement in Volts of the highest line-to-line voltage.
- In the **Measurements page** there are measurements in Volts of all the line-to-line voltages and phase voltages.

The measurements in Volts are available from a minimum value of 5 V to a maximum value of 1.25 Un.

NOTE:

- *"..." is displayed, for voltage values lower than 5 V, "> 1.25 Un" is displayed for voltage values greater than 1.25Un (example: with Un = 100 V, "> 125 V" is displayed).*
- *In the Histograms page, the graphical representation of the voltages relates to 1 Un, with a maximum value of 1.25*

Instantaneous power

Description

Instantaneous power values are real time measurements of the total and phase power

NOTE: *phase power measurements are available with four-pole circuit-breakers or three-pole circuit-breakers with external neutral.*

Representations and access pages

The power measurements are available in different forms, accessible from the following pages:

- In the **Measurements synthesis** page, accessible from the **Histograms** page, there are the measurements in kW or kVAR of the active, reactive and apparent total power.
- In the **Measuring instruments** page there is a graphical representation in the form of analog meters in kW or kVAR, for active, reactive and apparent total power.
- In the **Measurements** page there are measurements in kW or to kVAR of the active, reactive and apparent total power and of phase power (if any).

NOTE: with three-pole circuit-breakers only one Measurements *page is available. With four-pole circuit-breakers or three-pole + neutral voltage circuit-breakers, there are three* **Measurements** *pages available that contain all power measurements (one for each phase).*

The measurements in kW or kVAR are available with minimum voltages of 5 V and minimum currents of 0.03 In The maximum measurable power value is 1.25 Pn (phase power) / 1,25 Sn (total power).

NOTE: *with voltages or currents lower than the minimum values, or power higher than 1.25 Pn / 1,25 Sn, the indication "…" is shown.*

Tripping

Path

Main page - Menu - Measurements - Historicals

Description

The presence of the Ekip Measuring Pro module introduces other types of trips, relating to the protections active with Measuring Pro.

The ways to access theses pages and the information contained are similar to those for the trips of the Basic protections.

Correlated measurements

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

Protection against	Measurements recorded at the moment of the tripping
Voltage	Phase currents (L1, L2, L3, Of), and line-to-line voltages (U12, U23, U31). **NOTE:** *if protection RV trips, U0 is also recorded.*
Frequency	Phase currents (L1, L2, L3, Of), and line frequency.
Power	Phase currents (L1, L2, L3, Of), and total power (active or apparent depending on the protection tripped).

Maximum and Minimum voltage

Path

Main page - Menus - Measurements - Historicals - Measurements

NOTE: for details on the pages, see the chapter Menu pages and menus*, and the paragraph* **Measurement history***, beginning from page* **46.**

Description

The Maximum and Minimum Voltages are recordings of the measurements of maximum and minimum phase-to-phase voltages made by the trip unit, and that can be displayed by selecting **U Max** and **U Min** in the menu *Historicals - Measurements*.

The interval between one measurement and the other can be set through the parameter **Monitor time**, available in the menu **Historicals**.

The recordings can be reset through the command **Reset measurements**, available in the menu *Historicals - Measurements*.

Correlated information

Al measurements are correlated with the following information:

- The time interval since the previous measurement.
- The phase-to-phase voltage to which it refers, and value in Volt.
- The date and time (of the internal clock).
- Graphical representation in the form of a histogram on a time axis.

NOTE:

- *If the value is less than 5 V, "…" is shown instead of the Volt values.*
- *The graphical representation is in reference to 1 Un, with a maximum value of 1.25 Un*
- When the parameter **Monitor time** *is modified , the trip unit performs an immediate recording.*

Maximum and minimum power

Path

Main page - Menus - Measurements - Historicals - Measurements

NOTE: for details on the pages, see the chapter Menu pages and menus*, and the paragraph* **Measurement history***, beginning from page* **46.**

Description

The maximum and minumun power are the recordings of the measurements of total maximum and minumun active power made by the trip unit, and that can be displayed by selecting **P Max** and **P Min** in the menu *Historicals - Measurements*.

The interval between one measurement and the other can be set through the parameter **Monitor time**, available in the menu **Historicals**.

The recordings can be reset through the command **Reset measurements**, available in the menu *Historicals - Measurements*.

NOTE: *with external communication, recordings of total, maximum and average reactive and apparent power measurements are also available.*

Correlated information

Al measurements are correlated with the following information:

- The time interval since the previous measurement.
- The value in kW.
- The date and time (referring to the internal clock).
- Graphical representation in the form of a histogram on a time axis.

NOTE:

- *If current and voltage are lower than the minimum measurable values, the power measurement indicates "…" instead of the value in kW.*
- *The graphical representation is related to 1 Sn, with maximum value of 1.25 Sn.*
- *If the value is negative, the corresponding bar is represented with different color from those with positive value.*
- When the parameter **Monitor time** *is modified , the trip unit performs an immediate recording.*

Power factor

Path

Main page - Menus - Measurements

Description

The power factor is the real time measurement of the ratio of total active power and total apparent power, expressed as Cos φ.

The trip unit signals with an alarm if Cos φ drops below a control threshold, preset to 0.95. The threshold can be modified via Ekip Connect software (from 0.5 to 0.95).

Energy counters

Path

Main page - Menus - Measurements - Energy - Energy counters

NOTE: for details on the pages, see the chapter Menu pages and menus*, and the paragraph* **Measurement history***, beginning from page* **45.**

Description

The energy counters are the measurements of the total reactive and apparent active energy, updated every minute.

The measurements can be reset through the command **Reset counters**, available in the menu **Energy**.

Instantaneous frequency

Path

Main page - Menus - Measurements

Description

The Instantaneous frequency is the real-time measurement of the line frequency, expressed in Hertz.

NOTE: *measurement of the line frequency is available for voltages greater than 30 V (with Un < 277 V) or 60 V (with Un > 277 V), and if the installation frequency is in the range 30...80 Hz.*

Synchrocheck

Path

Main page - Menus - Measurements - Ekip Synchrocheck

Description

The Synchrocheck measurements relating to the function of synchronism between two independent power source, are described in the dedicated section on accessories, in the paragraph dedicated to the Ekip Synchrocheck module.

Summary table of Ekip Measuring measurements

The following table summarises the basic measurements:

Quantities measured	Monitor time	Normal operating range	Accuracy
Line-to-line and phase voltages	5 V…1.25 Un	50…400 V (phase) 100…690 V (phase-to-phase)	0.5 %
Line frequency	30…80 Hz	45…55 Hz (Frequency set = 50 Hz) 54…66 Hz (Frequency set = 60 Hz)	0.1 %
Active, reactive, and apparent power (total and phase)	-(16 In * 1.25 Un)… (16 In * 1.25 Un)	-1.2…-0.3 Sn / 0.3…1.2 Sn (total) -1.2…-0.3 Pn / 0.3…1.2 Pn (phase)	2 %
Power factor	-1…1	-	2 %
Total apparent active, reactive, and apparent energy	1 kWh … 2 TWh 1 kVAh … 2 TVARh 1 kVARh … 2 TVAh	-	2 %

NOTE:

- The accuracies refer to normal operating ranges, as established by IEC 61557-12.
- Load Profile Timers and Energy Store time measurements are also available with communication activated via Ekip Com or front connector (see page 127).

17 - Hi-Touch measurements

Presentation

Hi-Touch measurements are available for Ekip Hi-Touch and Ekip G Hi-Touch trip units.

IMPORTANT: the measurements are available with trip units equipped with auxiliary power supply.

The following is a list of the available measurements:

Measurements	Description
Waveforms	Display of the waveforms of the voltage and current signals and current
Harmonics	Display of the harmonic component of the voltage and current signals
Network Analyzer	Statistical analysis of voltages and currents

Waveforms

Path

Main page - Menu - Measurement - Network Analyzer - Waveforms

Description

The selection of one of the listed quantities opens the representation of the waveform of the selected quantity acquired at the moment of selection.

The quantities with which the waveform can be displayed are:
- Phase currents L1, L2, L3, Of.
- Line-to-line voltages V12, V23, V31.

NOTE:

- *The Ne phase current is available with four-pole or three-pole circuit-breakers with external neutral.*
- *For details on the pages, see the chapter "Menu Page and menus", and the paragraph "Measurements Menu", on page* 51.

Harmonics

Path

Main page - Menu - Measurement - Network Analyzer - Waveforms

Description

In the above mentioned page, the **Harmonics** key opens a representation in the form of a histogram of the measurements of the harmonics constituting the waveform, and related to the frequency set in the menu **Settings**.

In order to display the harmonics, you need to enable the calculation of the harmonics through the parameter **Harmonic**, available in the menu **Measurements**.

NOTE: *For details on the pages, see the chapter "Menu Page and menus", and the paragraph "Measurements Menu", on page* **51.**

Network Analyzer

Path

Main page - Menu - Measurements - Network Analyzer (for the measurements and the counters)

Main page - Menu - Settings - Network Analyzer (for the control parameters)

Description

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.
- Short voltage sags or interruptions.
- Short voltage increases.
- Slow voltage sags.
- Slow voltage increases.
- Unbalances between the voltages.
- Harmonic distortion of voltages and currents.

Continued on the next page

Each monitoring is associated with control parameters set by the user and updated each time the set control conditions occur.

NOTE:

- *On the display the cumulative counter and the counter relevant to the last 24 hours of activity (two counters for each monitoring operation) are available.*
- *With external communication, the cumulative counter and the counters relevant to the last seven days of activity (eight counters for each monitoring) are available.*

The general parameters available on the display are:

- **Enable:** to activate the Network Analyzer function and to modify the control parameters
- **I Harm Analysis**: to activate the analysis of the current harmonics.
- **V Harm Analysis**: to activate the analysis of the voltage harmonics.

Voltage sequences

There are three alarm counters:

- **Over voltages**: it records the number of times that the average value of the positive sequence (with the rotation direction of the phases set: 1-2-3) or negative sequence (with the rotation direction of the phases set: 3-2-1) calculated in the set interval exceeds a certain threshold.
- **Under voltages**: it records the number of times that the average value of the positive sequence (with the rotation direction of the phases set: 1-2-3) or negative sequence (with the rotation direction of the phases set: 3-2-1) calculated in the set interval drops below a threshold.
- **Unbalance**: it counts the number of times that the average value of the ratio between positive on negative sequence (with the rotation direction 3-2-1) and negative on positive sequence (1-2-3) calculated in the set interval rises above a certain threshold.

Parameters that can be set for the check are:

Parameter	Description
V Threshold High	It defines the upper alarm threshold for the Overvoltage counter. It is expressed as % Un.
V Threshold Low	It defines the lower alarm threshold for the Undervoltage counter. It is expressed as % Un.
Unbalance Th	It defines the alarm threshold for the Unbalance counter, expressed as a % (0 % = symmetric and balanced system).

In the settings menu you can set the **Monitor time** parameter, which defines the time interval between subsequent measurements.

NOTE: *the monitor time is the same parameter available for the maximum current and voltage measurements.*

The positive and negative sequence counters are available on the display.

The checking is completed by these available measurements:

- Positive sequence relating to the period in progress (V pos seq).
- Negative sequence relating to the period in progress (V neg seq).
- Positive sequence calculated on the last period (Last V pos seq).
- Negative sequence calculated on the last period (Last V neg seq).
- Positive sequence calculated in last the 3 seconds (V pos seq).
- Negative sequence calculated in last the 3 seconds (V neg seq).
- Unbalance.

NOTE: *The measurements of the sequences are available following the path: Main page - Menus - Measurements - Network Analyzer- V Sequences - V 3s Sequences.*

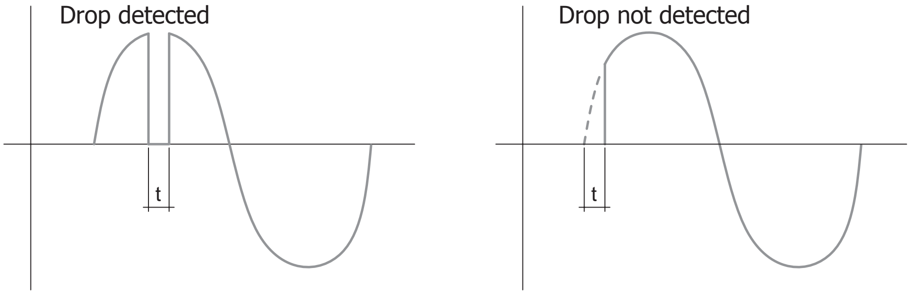
NOTE: *the unbalance value measured by the protection trip unit stops when it reaches 200 %.*

Continued on the next page

Short voltage interruption

The short duration voltage drop is to be understood as a decrease in the RMS value of the line-to-line voltage below the set threshold, for a duration less than 40 ms.

NOTE: *Since the counter is based on the calculation of the RMS value, two sudden drops in voltage of equal duration may be evaluated differently depending on when they occur (see the attached example).*



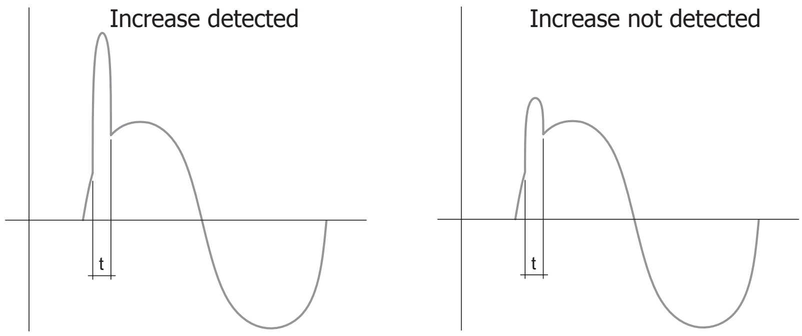
The alarm threshold available in the menu, **V microinterr. Th**, is expressed as %Un.

The cumulative (**V microinterr.**) and last day counters are available in the corresponding menus.

Short duration voltage increases

The short duration voltage increase is to be understood as an increase in the RMS value of the line-to-line voltage above the set threshold, for a duration less than 40 ms.

NOTE: *Since the counter is based on the calculation of the RMS value, two rapid increases in voltage of equal duration may be evaluated differently depending on their amplitude (see the attached example).*



The alarm threshold available in the menu, **V Spike Threshold**, is expressed as %Un.

The cumulative (**Peaks**) and last-day counters are available in the corresponding menus.

Slow voltage drops

Slow voltage drops are the lowering of any line-to-line voltage, under one of the set thresholds, for a duration greater than the set time.

The parameters that can be set for the control are available in the **Sags** submenu:

Parameter	Description
V sag Th Short	It defines the first alarm threshold. It is expressed as %Un.
V sag dur short	In the event of dropping under the first alarm threshold, it defines the time beyond which the alarm counter is increased.
V sag Th Middle	It defines the second alarm threshold. It is expressed as %Un.
V sag dur middle	In the event of dropping under the second alarm threshold, it defines the time beyond which the alarm counter is increased.
V sag Th Long	It defines the third alarm threshold. It is expressed as %Un.
V sag dur long	In the event of dropping under the third alarm threshold, it defines the time beyond which the alarm counter is increased.

Continued on the next page

NOTE:

- *The trip unit accepts the parameters in accordance with the following limitation: V dur short <= V dur middle <= V dur long.*
- *Since an event may belong to more typologies, only the counter corresponding to the longest duration is incremented (long > middle > short).*

Cumulative counters (Short sags, Medium sags, Long sags) and those of the last-day counters are available in the respective menus.

Slow voltage increases

The slow voltage increase is the rise of any line-to-line voltage above one of the set thresholds, for a duration longer than the set time.

The parameters that can be set for the control are available in the **Swells** submenu:

Parameter	Description
V swell Th Short	It defines the first alarm threshold. It is expressed as %Un.
V swell dur short	In the event of rising above the first alarm threshold, it defines the time beyond which incremented.
V swell Th Long	It defines the second alarm threshold. It is expressed as %Un.
V swell dur long	In the event of rising above the second alarm threshold, it defines the time beyond which incremented.

NOTE:

- *The trip unit accepts the parameters in accordance with the following limitation: V dur short <= V dur long.*
- *Since an event may belong to more typologies, only the counter corresponding to the longest duration is incremented (long > short).*

Cumulative counters (Short sags, Long sags) and those of the last-day counters are available in the respective menus.

Harmonic distortion

The Harmonic Distortion check regards line-to-line voltages and the phase currents, and is of two types:

- If the single harmonic components (different from the fundamental ones) have an amplitude greater than the set value, an alarm is activated and displayed (**Harmonic V Over Th** / **Harmonic I Over Th**).
- If the total distortion is greater than the set value an alarm is activated and displayed (**THD V Over Th** / **THD I Over Th**), and the THD meter is incremented by the total minutes during which the threshold was exceeded.

NOTE: *The counter stops at 65535 minutes.*

Parameters that can be set for the check are:

Parameter	Description
I Harm Analysis	It allows monitoring of the harmonic distortion of currents to be activated, and the specific menu for setting the parameters (Network Analyser - Harmonics - Current).
V Harm Analysis	It allows monitoring of the harmonic distortion of voltages to be activated, and the specific menu for setting the parameters (Network Analyser - Harmonics - Voltage).
THD Threshold (Voltages)	It defines the alarm threshold for the total distortion of the voltages. It is expressed as a percentual value.
THD Threshold (Currents)	It defines the alarm threshold for the total distortion of the currents. It is expressed as a percentual value.
Individual harmonic Th (Voltages)	It defines the alarm threshold for the individual harmonics of the voltages. It is expressed as a percentual value.
Individual harmonic Th (Currents)	It defines the alarm threshold for the individual harmonics of the currents. It is expressed as a percentual value.

The cumulative and last-day counters (THD Voltage and THD Current) are available in the corresponding menus.

18 - Test

Path *Main page - Menu - Test*

Presentation All the trip units of the Ekip Touch range allow you to carry out various checks directly from the display:

- **Autotest**, for the check on the display and the LEDs.
- **Trip Test**, for the check on the circuit breaker opening command.
- **Test CB**, for the check on the controls of the circuit-breaker opening and closing coils
- **Zone Selectivity**, for the check on Zone Selectivity inputs and outputs.

In the presence of auxiliary power supply and contact type modules, the dedicated sections are enabled:

- **Ekip Signalling 4K** allows module contacts and leds to be checked.
- **Ekip Signalling 2K-1, 2K-2, 2K-3** allows module contacts and leds to be checked.
- **Ekip Signalling 10K-1, 10K-2, 10K-3** allows leds to be checked and contact closing commands to be sent.

In the presence of an Rc type trip unit and auxiliary power supply, the dedicated test section is enabled:

- **Rc Test** allows the connection and correct operation of the Rc toroid to be checked.

NOTE: *access to the Test Menu requires the insertion of the password.*

Using the Ekip T&P and Ekip Bluetooth test accessories it is also possible to check the operation of the electronic protections from a PC, by simulating various installation conditions.

Autotest The automatic sequence of the display and the LED is activated by selecting the command **Autotest.**

The sequence includes the following test phases:

Phase	Operation
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	Warning and Alarm LEDs switched on for 1 second

Trip Test Selecting the command **Trip test** opens a dedicated page that requests confirmation for performing the test by pressing the iTest key.

An opening command is transmitted to the trip coil when the key is released.

IMPORTANT: the opening command is performed with circuit-breaker closed and absence of circulating currents.

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 Selecting the command **Test CB** opens a submenu containing the commands **Open CB** and **Close CB.**

The commands allow you to activate coil opening and closing respectively: the correct sending of the command is confirmed by a window with the message “Test Executed”.

The correct operation of the entire command system (trip unit, Ekip Com Actuator and opening and closing coils) is verified through the opening and/or the closing of the circuit-breaker.

Continued on the next page

IMPORTANT:

- **The coil opening and closing commands work only with the trip unit powered by auxiliary power supply.**
- **Make sure that the coils are connected to the power supply source.**
- **The commands verify the operation of the trip unit: any possible faults on Ekip COM Actuator or the coils are not found by the test.**

Zone Selectivity

The command **Zone Selectivity** allows you to select the line you want to check: **S Protection** or **G Protection.**

The following are available for each command:

- **Input**, to check the state of the Zone Selectivity input.
- **Force output**, in order to force the state of the Zone Selectivity output to high.
- **Force Output**, to trip unit the override on the Zone Selectivity output.

IMPORTANT: the Zone Selectivity commands work with:

- **Auxiliary power supply present.**
- **Circuit-breaker open and, in the case of the withdrawable version, in CONNECTED or TEST POSITION.**

Ekip Signalling

The submenus for testing the Ekip Signalling modules in the various versions 4K, 2K-1, 2K-2, 2K-3 allow you to send the command **Autotest.**

The command activates an automatic sequence of test for the LEDs and contacts:

Phase	Operation
1	Reset LEDs and output contacts
2	Switch-on in sequence of all LEDs and closing in sequence of all the associated output contacts
3	Reset initial conditions

NOTE: *with Ekip Signalling modules 2K-1, 2K-2, 2K-3, the sequence includes testing of the LEDs of the inputs.*

IMPORTANT: the autotest sequence involves the closing of the output contacts: the check on the correct closing is the user's responsibility.

Rc Test

Submenus for the test of the Rc toroid involve the command **Autotest** that allows you to send the command to the toroid to check correct operation.

NOTE: *the test is available only with the toroid correctly connected, the trip unit in Rc configuration, auxiliary power supply present.*

Protection test

To perform the protection command test, follow this procedure:

Phase	Operation
1	Make sure that the circuit-breaker is closed and that there are no currents circulating
2	Connect Ekip T&P or Ekip Bluetooth
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

19 - 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 37.
- 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.

Self-diagnosis

Ekip Touch continuously monitors its own operating state and that of all connected devices.

In the event of an error, the detected fault is reported:

Signal	Description
Local Bus	With Vaux present and local Bus enabled: no module detected on terminal box by trip unit (with alarm icon) or loss of communication for more than 5 seconds between trip unit and previously detected module (with prealarm icon)
TC disconnected	Trip coil not connected
L1 Sensor	Current sensor not connected
L2 Sensor	
L3 Sensor	
Ne Sensor	
Gext Sensor	Toroid S.G.R. not connected
Rating Plug	Make sure that one of the following conditions is present: • Rating plug not connected • Invalid value • Rating Plug Rc inserted but Ekip Measuring not present • Upon replacing the rating plug I4 becomes > 1200 A (in the case of UL circuit-breaker)
Internal Error	Internal error
Invalid Date	Date not set
CB status	CB state incorrect (esample: current present but CB in open state)
Rating Plug Installation	Rating Plug not installed
Battery low	Battery low or absent
Measuring Installation	Ekip Measuring module not installed
Measuring Error	Ekip Measuring module in error
Software Not Compatible	The Mainboard and Ekip Touch software versions are not compatible with each other: editing of all parameters is inhibited by the display. The protections L, I and Iinst are active and working with the parameters set in the previous protection trip unit. To restore compatibility please contact ABB.
Configuration	Make sure that one of the following conditions is present: • 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 • Iu < (2 * In * I1) if InN = 200 % • t2 or t4 or t5 or t41 > 0.4 s (in case of UL circuit-breaker) • I4 > 1200 A (in case of UL circuit-breaker) • Protection curve L different from $t=k/i^2$ (in case of UL circuit-breaker)
Ekip Link Bus	Loss of connection with one or more actors
PC Power exceed	The average power limit setting of the Power Controller has been exceeded
IEEE1588 synch	Synchronization problem of IEEE 1588 synchronization reference module
Maintenance	Maintenane alarm
Zone Selectivity Diag	Error in zone selectivity connections (Hardware Selectivity)
CB undefined	CB state contacts error
SNTP error	Synchronization problem of SNTP synchronization reference module

Signal	Description
Ethernet disconnected	no external cable on one or more modules without Ethernet connection
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
Configuration Session	TFTP server enabled / configuration session open in one or more modules between: Ekip Com IEC 61850 or Ekip Hub
Ekip Signalling 3T	Alarm for connection of one or more analog inputs to the Ekip Signalling 3T module
Ekip Installattion	Installation error between HMI and mainboard. Contact ABB
MAC Address	Module detected with incorrect / not allowed MAC address
Numeric alarm (e.g. 30002)	Internal error. Contact ABB

NOTE: *for resolution of the signals see section* **Fault resolution** *on page* **312.**

Protections and Measurements

In the event of protection or measurement alarms, the associated signals are reported:

Signal	Alarm type
Protection timer (example: Timer L)	Specific protection in time delay mode
Protection prealarm (example: Prealarm G)	Specific protection in prealarm
Protection (Trip off) [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 protection. Current threshold 1 I1 / 2 I1 exceeded and in alarm state
Iw1 Warning / Iw2 Warning	Current threshold protection. Current threshold Iw1 / Iw2 exceeded and in alarm state
Contact Wear	> 80% contact wear (with prealarm icon) or 100% contact wear (alarm icon)
Harmonic dist.	Harmonic Distortion protection in alarm state
Power factor	Power factor measurement below the set threshold
Phase cycle	Phase sequence protection in alarm state
Frequency	Frequency measured off range (<30 Hz or >80 Hz)
Harmonic V Over Th	Harmonics measurement
Harmonic I Over Th	Harmonics measurement
THD I Over Th	Harmonics measurement
THD V Over Th	Harmonics measurement
Trip Test	Trip test performed signal. Press iTEST to reset the message

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
L Th ≥ S Th	Errors in the adjustment of the protection thresholds
S Th ≥ I Th	Errors in the adjustment of the protection thresholds
L Th ≥ S2 Th	Errors in the adjustment of the protection thresholds
S2 Th ≥ I Th	Errors in the adjustment of the protection thresholds
L Th ≥ D Th	Errors in the adjustment of the protection thresholds
D Th ≥ I Th	Errors in the adjustment of the protection thresholds
D Zone Sel = On while S / S2/ G / Rc = On	Activation of Zone Selectivity with protections S, S2, G or Rc enabled
S(V) t20 and S(V) I20 error	Incorrect configuration of S(V) protection
RQ Q24 > Q25	Incorrect configuration of RQ protection
SYNCHRO parameters error	Error in the parameters of the Ekip Synchrocheck module
ROCOF t28 error	Incorrect configuration of ROCOF protection
And the MCR enabled together	Simultaneous enabling of the protections I and MCR
High priority alarm	Protection and delay alarms present during programming
Rc toroid error	Attempt to activate the Rc toroid without Ekip Measuring or Rating Plug of the Rc type
Internal neutral config error	It tries to set the internal neutral setting with a value that is not allowed
Change of datalogger number with datalogger not stopped	Change datalogger parameters with datalogger active
Error Reverse pole order	Change of the parameter "pole order" with a half size circuit-breaker.
Programming Session Timeout	Timeout for saving data

20 - Operating features

Electrical characteristics

Operating currents and voltages

The correct operation of Ekip Touch trip unit is guaranteed with primary currents with clearly defined characteristics.

In addition, Ekip Touch trip unit can be powered directly by the internal current sensors or, in the presence of the Ekip Measuring Pro module, by the installation voltage.

The following are the specifications:

Parameter	Operating limits
Minimum three-phase turn-on current	> 80 A (E1.2-E2.2-E4.2) > 160 A (E6.2)
Rated frequency	50 / 60 Hz ± 10 %
Peak factor	Complying with standard IEC 60947-2
Minimum three-phase turn-on voltage	> 80 V

Auxiliary power supply

All the trip units of the Ekip Touch range can be connected to an external auxiliary power supply source, useful to activate certain functions such as communication on a Local Bus, recording of manual operations, measurements and the datalogger.

The auxiliary power can be supplied by the modules of the Ekip Supply range (for further functional details, see page 208), or with direct connection to a terminal box.

The direct connection must be made guaranteeing 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: in case of direct connection, the power supply must be galvanically insulated and provide the insulation characteristics established by the Standard IEC 60950 (UL 1950) or equivalent.

21 - Additional Ekip Touch functions

Functional characteristics

The Ekip Touch trip unit, in addition to the protection and measurement menus, also allows various operating and configuration parameters to be set on the screen:

- **Line frequency**, to set the installation frequency.
- **Remote / Local Mode**, to set the operating mode and enable editing of parameters and sending remote commands.
- **Local Bus**, to enable communication with the terminal modules and communication on the Local Bus.
- **Harmonics**, to enable the calculation of current and voltage harmonics.
- **Power controller**, to enable the function Ekip Power Controller.
- **Programmable functions**, to combine the modification of parameters and configurations to the programmable inputs of Ekip Signalling modules.
- **System**, to modify system data such as date, time, language and password.
- **Maintenance**, to optimize maintenance operations on the circuit-breaker.

Line frequency

The adjustment of the frequency setting is used to set the installation frequency.

In the menu *Settings - Main frequency* two configurations are available: 50 and 60 Hz.

NOTE: *the measurements of voltages and currents are performed according to the grid frequency set. A wrong setting could cause protection and measurement anomalies.*

Local/Remote

In the menu *Settings - Modules - Local/Remote* you can enable the modification of the parameters and sending of certain commands remotely, via Ekip Com communication modules.

Enabling Remote Configuration inhibits changing of parameters from display, with the exception of the parameter Local / Remote.

NOTE: *in Remote configuration the inhibition of changes is active if:*

- *The trip unit is connected to one auxiliary power supply.*
- *Ekip Com modules are present.*

Local Bus

In the menu *Settings - Modules - Local Bus* you can enable the Local Bus line to allow communication with all modules mounted on the terminal block or switchgear.

NOTE: *the Local Bus alarm is signalled if the trip unit is powered by Ekip Supply, but no module is connected and the Local Bus parameter is enabled.*

Harmonics

Hi-Touch and G Hi-Touch trip unit versions, in the menu *Measurements - Harmonic* allow you to enable the check on the current and voltage harmonics.

The harmonics are essential for:

- Network Analyzer function.
- Waveform measurement.

Power Controller

The description of Ekip Power Controller function is available beginning from page 131.

Programmable functions

It is possible to program eight commands, with automatic activation based on signals or events.

The commands are:

Command type	Path
Trip	Advanced - Functions
Change protection set (from Set A to Set B)	Advanced - Functions
Change configuration (from Remote to Local)	Settings - Modules - Functions
Reset the contacts of the signalling modules	Settings - Modules - Functions
Opening coil command (YO).	Settings - Functions
Closing coil command (YC).	Settings - Functions
Reset energy counters	Measurements - Energies - Function
Reset of the trip signal	Advanced - Functions

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 are present and if all the operating conditions exist (circuit-breaker open).*

System

In the menu *Settings - System* some system parameters are available:

Date, to set the current date.

Time, to set the current time

Language, to set the language of the menus.

Password, in order to reconfigure the password.

NOTE: *the date and time are maintained thanks to an internal battery in the trip unit. In the event of date and time fault, you are advised to follow the procedure for replacement of the battery.*

Maintenance

The Maintenance function allows the user to be alerted by a Warning alarm 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.

There are two areas available on the display:

- Activation area (*Main page - Menus - Settings - Maintenance*): it allows the maintenance function to be activated.
- Measurements and reset area (*Main page - Menus - Measurements - Maintenance*): it appears only if the maintenance function is activated; it provides information related to maintenance (contact wear and dates) and the command for confirming that maintenance has been carried out (by confirming, the current date and contact wear values are recorded, and the alarm 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 %.*

Additional options via remote / front control

Ekip T&P, Ekip Programming and Ekip Bluetooth 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.

Parameters, measurements and commands are also available when communication is activated via Ekip Com modules.

A description of the different functions is given below.

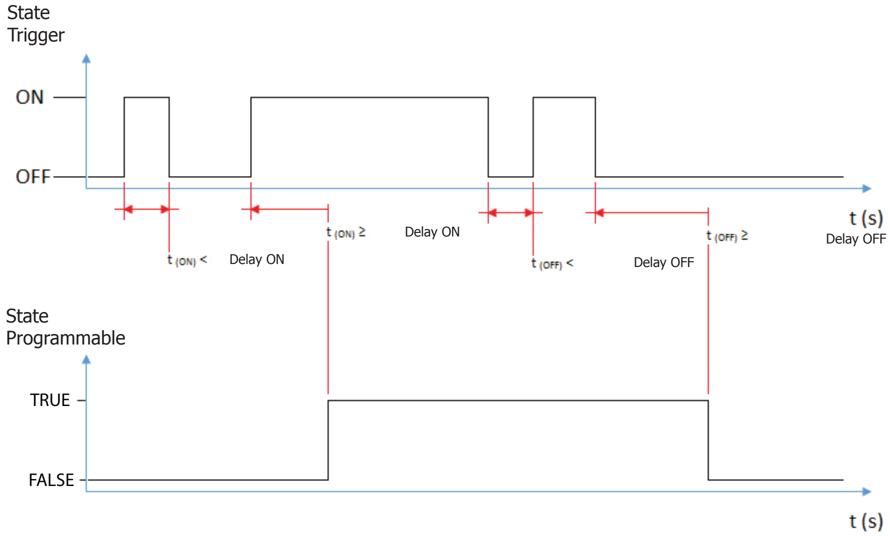
Programmable States

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.

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.

Filters

Measuring filters can be activated on channels G / S.G.R. / Rc and V0:

- GTE filter: available if the trip unit is the LSIG version, or if there is an external toroid (SGR or Rc).
- V0 filter: available in the presence of Ekip Measuring Pro and active neutral connection (see paragraph " Access from the display" on page 215).

If the filter is activated, the specific measurements and protections (G, Gext and Rc for GTE filter, and V0 for V0 filter) are treated differently: the trip unit applies a bandpass filter to the signal in order to measure only the fundamental component (50 or 60 Hz).

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.

Info Page

Additional information page that can be activated and customized by the user. If activated, it can be accessed on the display by pressing the iTest button twice from the main page.

NOTE: *the pages can be configured with all the trip units for SACE Emax 2 circuit-breakers, but they can only be displayed via Ekip Touch.*

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.

Energy Store Time

The counter indicates the time that has elapsed since the last energy metering reset.

It is active and updated in the presence of at least one of the following: auxiliary supply, supply by Ekip T&P or supply by Ekip Measuring.

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.

Open/Close Remote Direct Command

The parameter controls two different command packages for remote circuit-breaker opening and closing:

- **Enabled**: commands 7 and 8 are valid (direct commands for **CB Open** and **CB Close**).
- **Disabled**: commands 7 and 8 are not valid.

IMPORTANT: in this case, remote circuit-breaker opening and closing can still be obtained using the programmable YC COMMAND and YO COMMAND functions and the Request circuit-breaker opening (28) and Request circuit-breaker closing (29) commands.

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**.

Change Double Set of parameters always

If activated, it allows the modification of the parameter set even when delay alarms are in progress. **Disabled** by default.

Repeat zone selectivity S/G HW

If **Enabled**, the propagation logic of HW signals for zone selectivity applies in accordance with the table in the Technical Application Paper QT1. 1SDC007100G0205; IF **Disabled** the HW selectivity signal is not propagated by the protection trip unit.

Zone selectivity input functions

The zone selectivity inputs and some outputs can be configured in this section:

- **Standard**: input or output operation as per standard zone selectivity logic (see 1SDC007100G0205 or 1SDC007401G0201); ALL SELECTIVITY FUNCTIONS HAVE THE **Standard** setting.
- **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 therefore standard selectivity operation is not active (modification should only be performed by expert technical personnel).

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.

Wizard Reset

Reset **Wizard**: the **Wizard** window appears the first time the trip unit comes on and can be used to enter some of the trip unit and circuit-breaker parameters.

22 - Default parameters

Ekip Touch default parameters

The Ekip Touch trip units are supplied with the following default parameters:

Protection/Parameter	Value [1]
L	1 In; 144 s; pre-alarm: 90 %
S [2]	Off; 2 In; 50 ms; Curve: t = k
I	4 In
G [2]	Off; 0.2 In; 400 ms; Curve: t = k
2I	Off; 1.5 In
MCR	Off; 6 In; 40 ms
IU	Off; 50%; 5 s
OT	Off
I1 current thresholds	Off; 1: 50 %; 2: 75 %
Current thresholds	Off; Iw1: 3 In; Iw2: 3 In
Harmonic Distortion	On
Gext [2] [3]	Off; 0.2 In; 400 ms; Curve: t = k
Rc [3]	Off; 3 A; 60 ms
Frequency	50 Hz (IEC) / 60 Hz (UL)
Neutral	Off (for circuit breakers three-pole) 50 % (for four-pole circuit-breaker)
Datalogger	Off
Power Controller	See note [4]
Hardware Trip	Disabled
Monitor time	5 minutes
Local Bus	Disabled
Alive LED	Disabled
Language	English
Password	00001
Mode	Local
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
Maintenance	Off

(1) Thermal memory, startup, Zone Selectivity set to Off.
(2) S Protection available with LSI and LSIG versions of the trip unit. G Protection available with LSIG version.
(3) Protections available if the respective toroids (S.G.R. or Rc) are present.
(4) Protection activated on request when purchasing the trip unit.

The protections activated by the presence of the Ekip Measuring Pro module, have the following default parameters:

Protection/Parameter	Value
VU	Off; 50%; 5 s
UV	Off; 0.9 Un; 5 s
OV	Off; 1.05 Un; 5 s
UF	Off; 0.9 fn; 3 s
OF	Off; 1.1 fn; 3 s
RP	Off; 0.1 Sn; 10 s
Phase Sequence	1-2-3
Cos φ	Off; 0.95

Continued on the next page

The Ekip Hi-Touch and Ekip G Hi-Touch trip units have additional protections, provided with the following default parameters:

Protection/Parameter	Value (1)
S2	Off; 2 In; 50 ms; Curve: t = k
D	Off; 2 In; 200 ms
UV2	Off; 0.9 Un; 5 s
OV2	Off; 1.05 Un; 5 s
UF2	Off; 0.9 fn; 3 s
OF2	Off; 1.1 fn; 3 s
Network Analyzer	Off
Harmonic calculation	Off
Set A-B	Off

The Ekip G Touch and Ekip G Hi-Touch trip units have additional protections, provided with the following default parameters:

Protection/Parameter	Value (1)
S(V)	Off; type = step; 1 In; Ul = 1 Un; Ks = 0.6; t20 = 1 s
RV	Off; 0.15 Un; 15 s
RQ	Off; Kq = -2; Q24 = 0.1 An
OQ	Off; 1 Sn; 1 s
OP	Off; 1 Sn; 1 s
UP	Off; 1 Sn; 1 s

The Ekip G Hi-Touch trip units has additional protections, provided with the following default parameters:

Protection/Parameter	Value
ROCOF	Off; 0.6 Hz; 500 ms
S2(V)	Off; type = step; 1 In; Ul2 = 1 Un; Ks2 = 0.6; t21 = 1 s
RQ2	Off; Kq = -2; Kq2 = 2; Q24 = 0.1 Sn; Q25 = 0.11 Sn; Vmin = 0.5 Un; 100 s

23 - Ekip Power Controller

Presentation

The Ekip Power Controller function allows you to manage the load of an installation according to the power input, in order to contain consumption and to optimize energy efficiency.

The various parameters related to this function can be configured using a dedicated tool in the Ekip Connect software.

For further information see the chapter "2 - Load control" *on page* 159.

trip units

The function Power Controller can be activated for all the trip units of the Ekip TOUCH range, and allows you to do the following via display:

- Modify some parameters of the function.
- Display some measurements of the function.
- View the state of the loads.

NOTE: *the Power Controller function is available if requested when ordering the CB or the protection trip unit.*

Parameters on the display

The parameters available following the path *Main page - Menu page - Settings - Power Controller* are:

Parameter	Description
Enable	It allows you to enable/disable the Power Controller function.
Load Operating Mode	It allows you to set the configuration of each of the 15 programmable loads Automatic or Manual configurations available.
Power limits	It allows you to set the four power limits (from 0 to 10000 kW, step 10kW).

NOTE: *for the characterization of all the parameters of the function you are advised to configure the parameters via Ekip Connect first, and only subsequently to operate on the trip unit in order to enable or to modify loads and power limits.*

Measurements on the display

The measurements are available by following the path *Main page - Measurements page - Power Controller page*, they are:

Measurement	Description
Ea	Expected energy
DT	Time elapsed inside of the evaluation range
LOADS	Number of loads monitored
LOADS Shed	Number of shed loads
Sp	Shed priority set
T	Evaluation window

Information displayed

Information about the state of the loads is available by following the path *Main page - Menu page - Information - Power Controller*.

Protection curves

1 - Introduction

This chapter illustrates the 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:

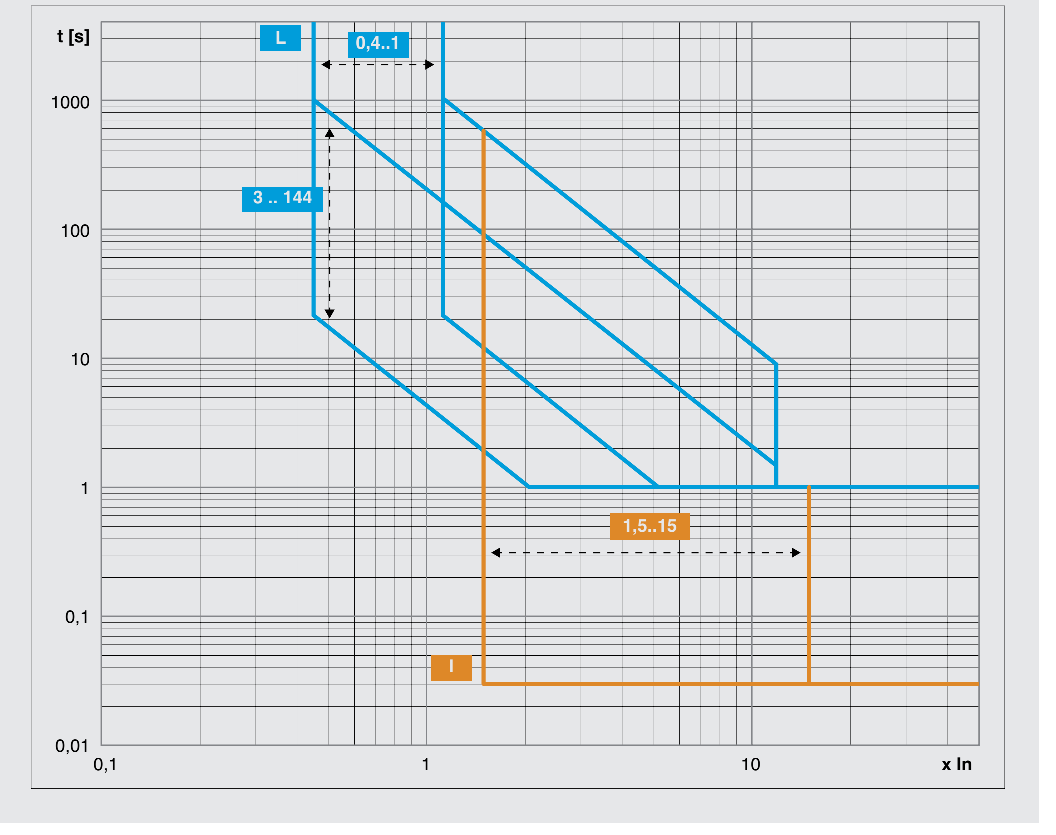
- The curves are illustrated considering the minimum and maximum values and of the parameters of each protection.
- Protections that have multiple functions (for example: G protection), are represented with multiple diagrams.
- The curves do not take account of the effects of special parameters such as thermal memory, startup or presence of the Rating Plug L=OFF.
- Where not present, the curves are valid for both the IEC version and the UL version.

NOTE: *for calculation of the tripping time, it is recommended to always use the mathematical function provided in the protection summary table.*

2 - DIP protections

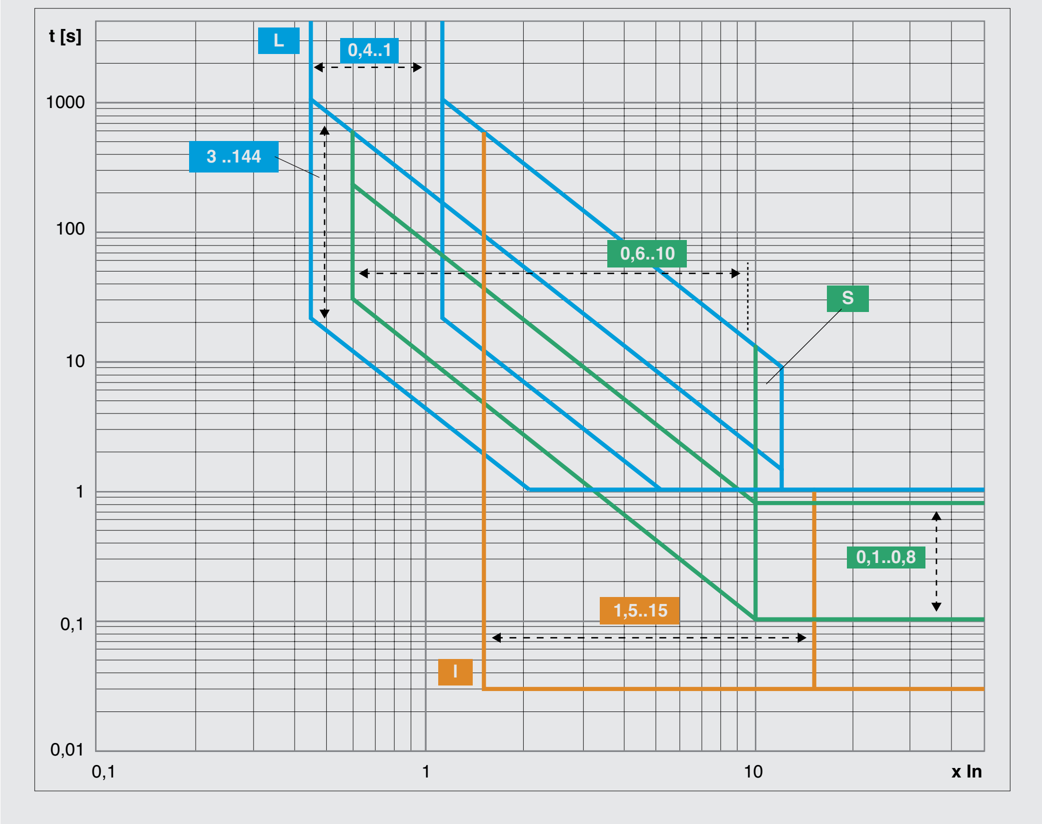
The following are the trip curves of the protections available with Ekip Dip trip units.

Tripping curve for L-I protections

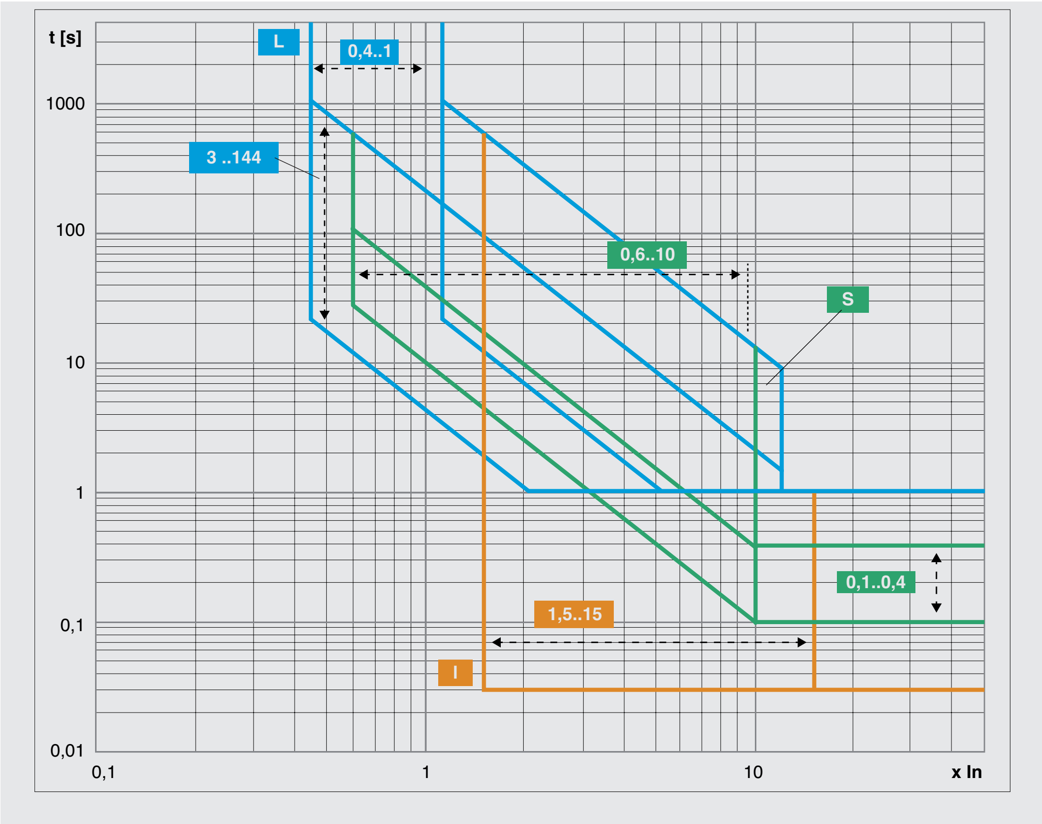


Tripping curve for L-S(t = k / I ^{2})-I protections

Version IEC

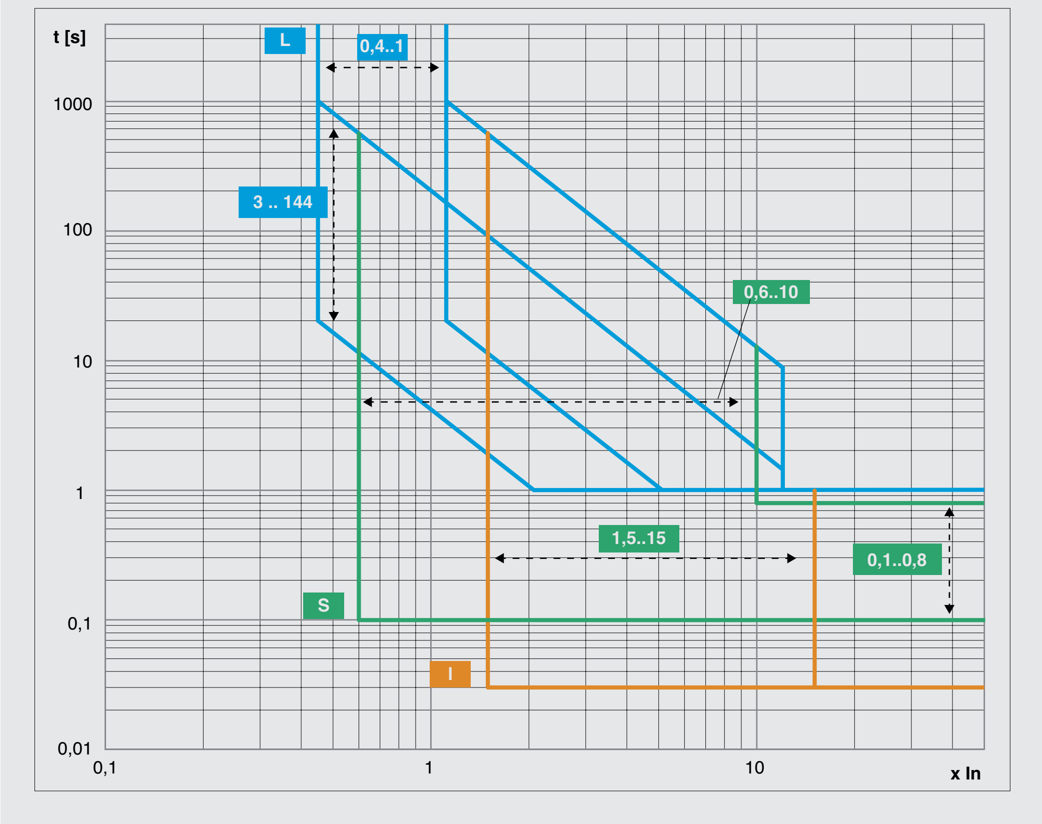


Version UL

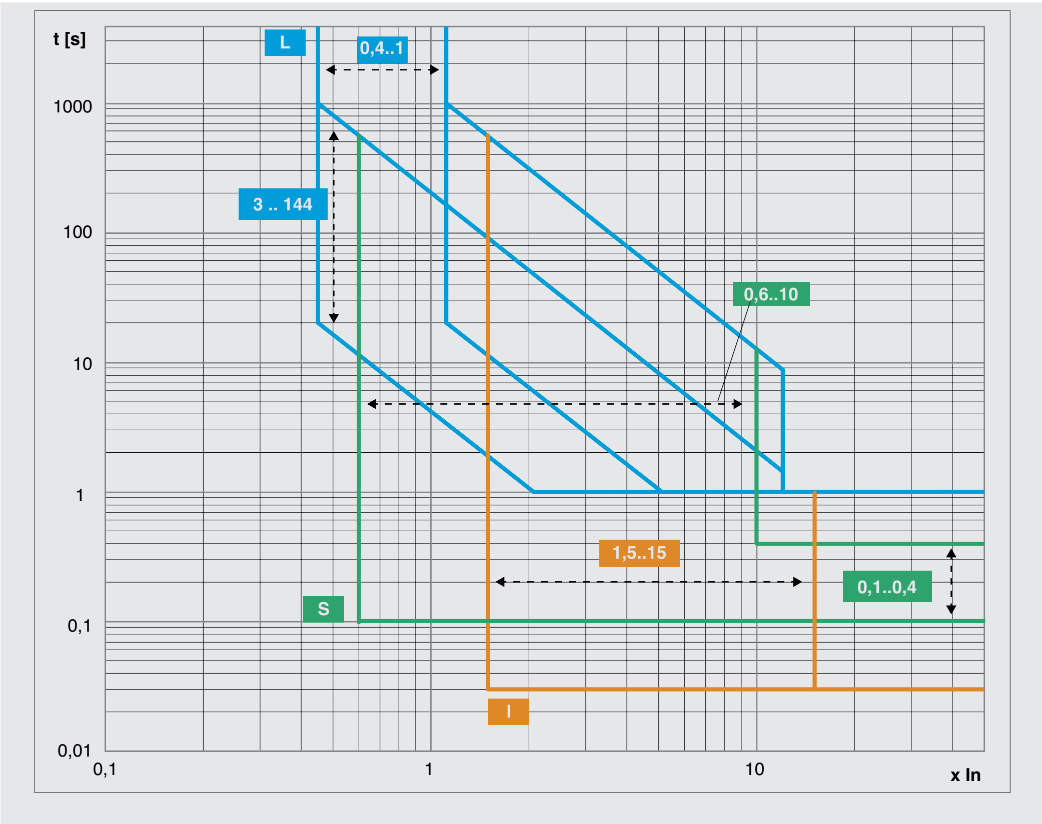


Tripping curve for L-S(t = k)-I protections

Version IEC

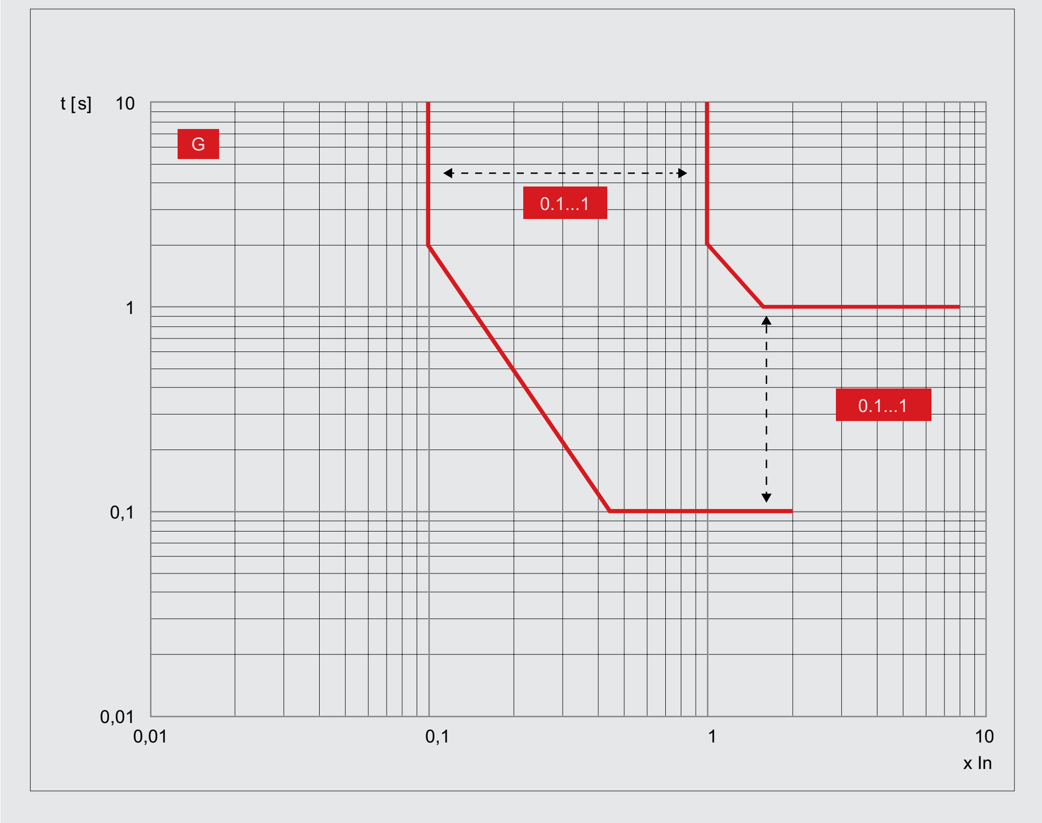


Version UL

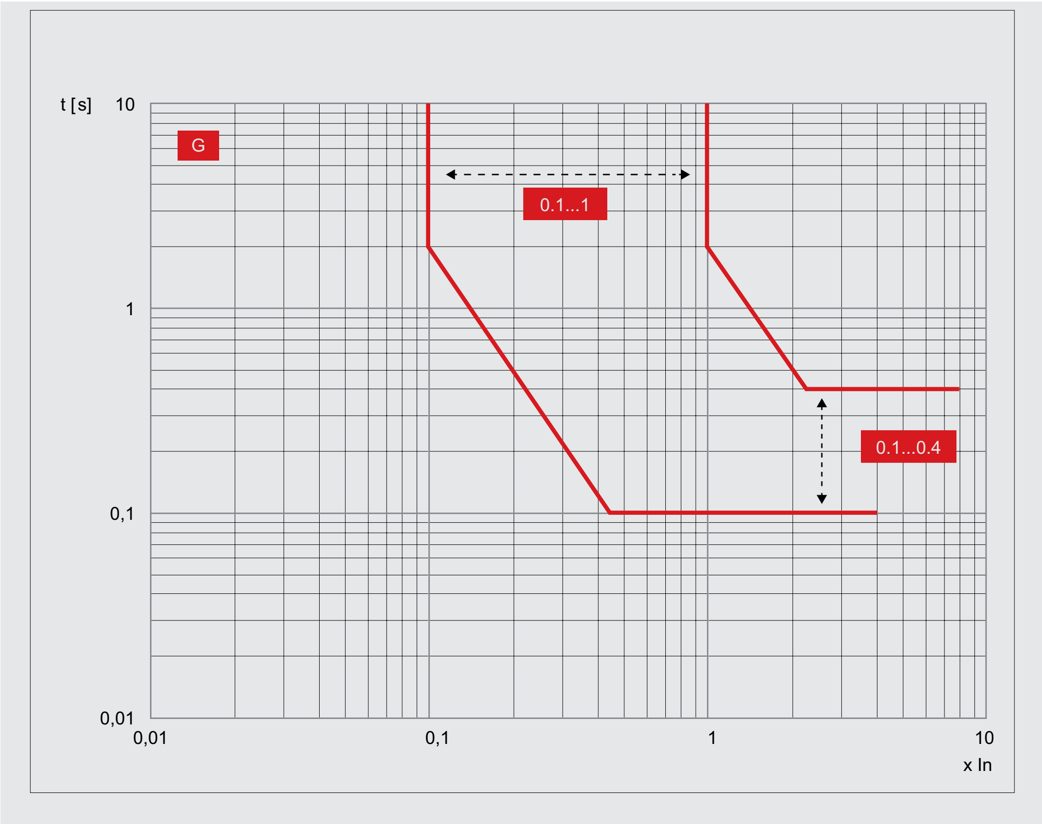


Tripping curves for G protection (t = k / I²)

Version IEC

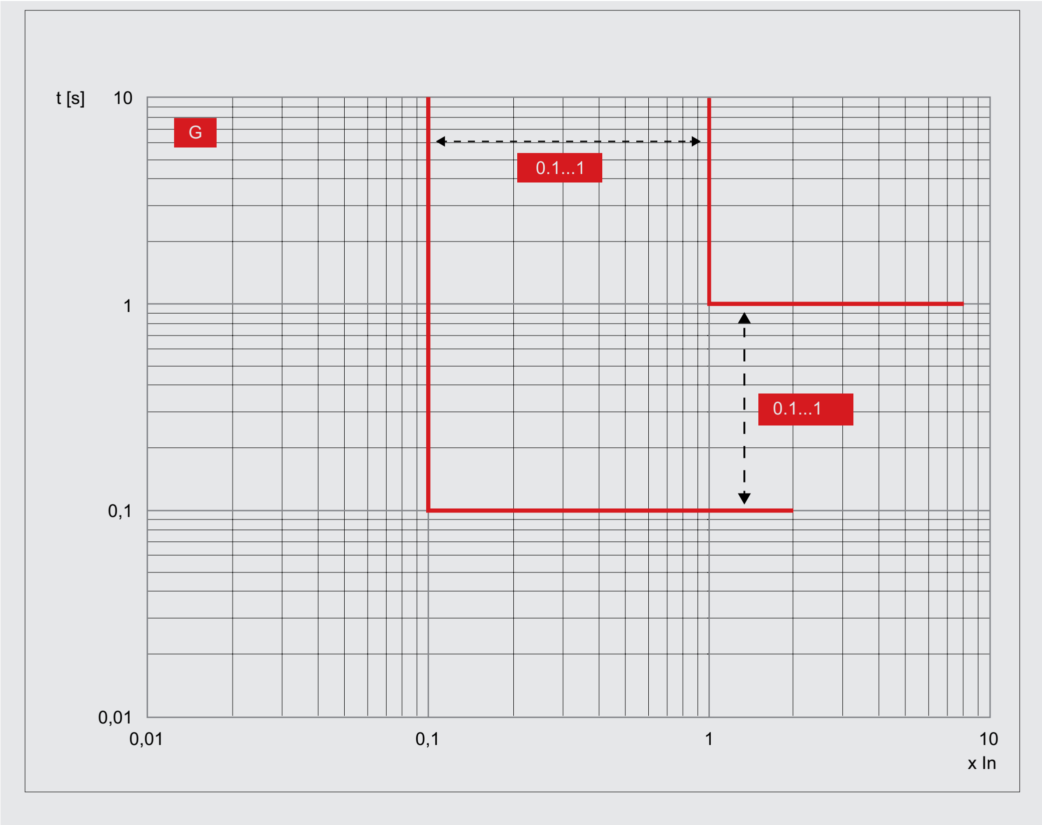


Version UL

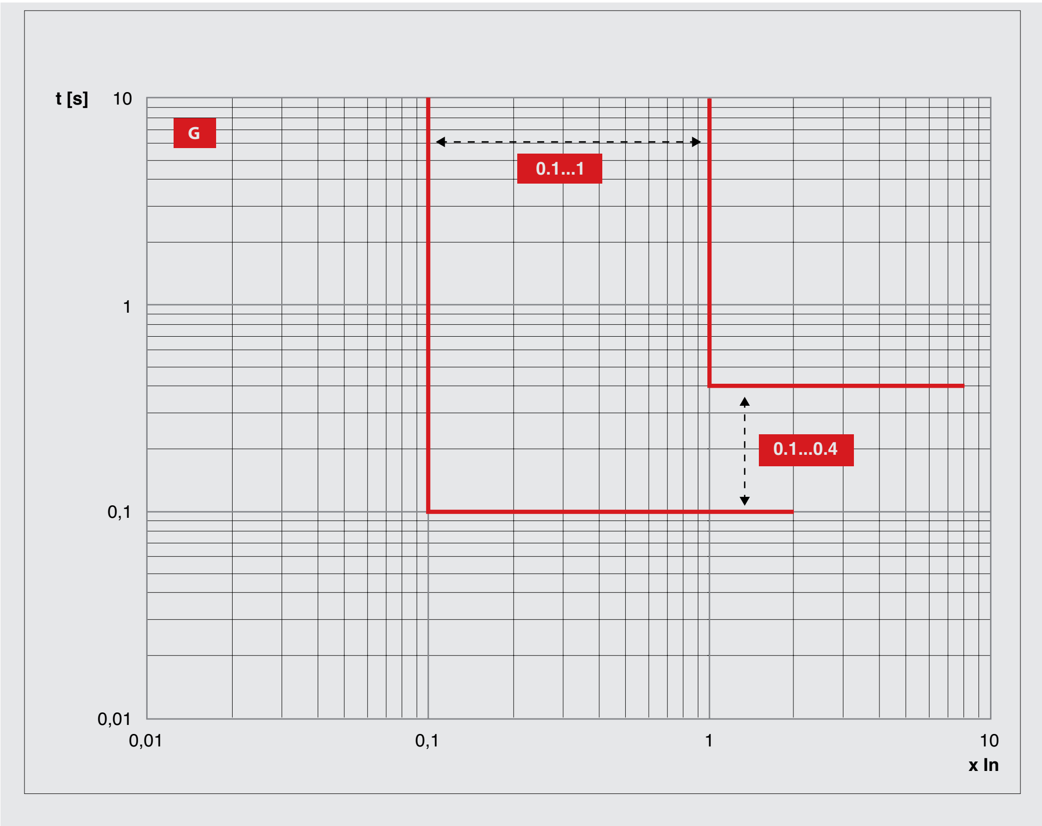


Tripping curves for G protection (t = k)

Version IEC



Version UL

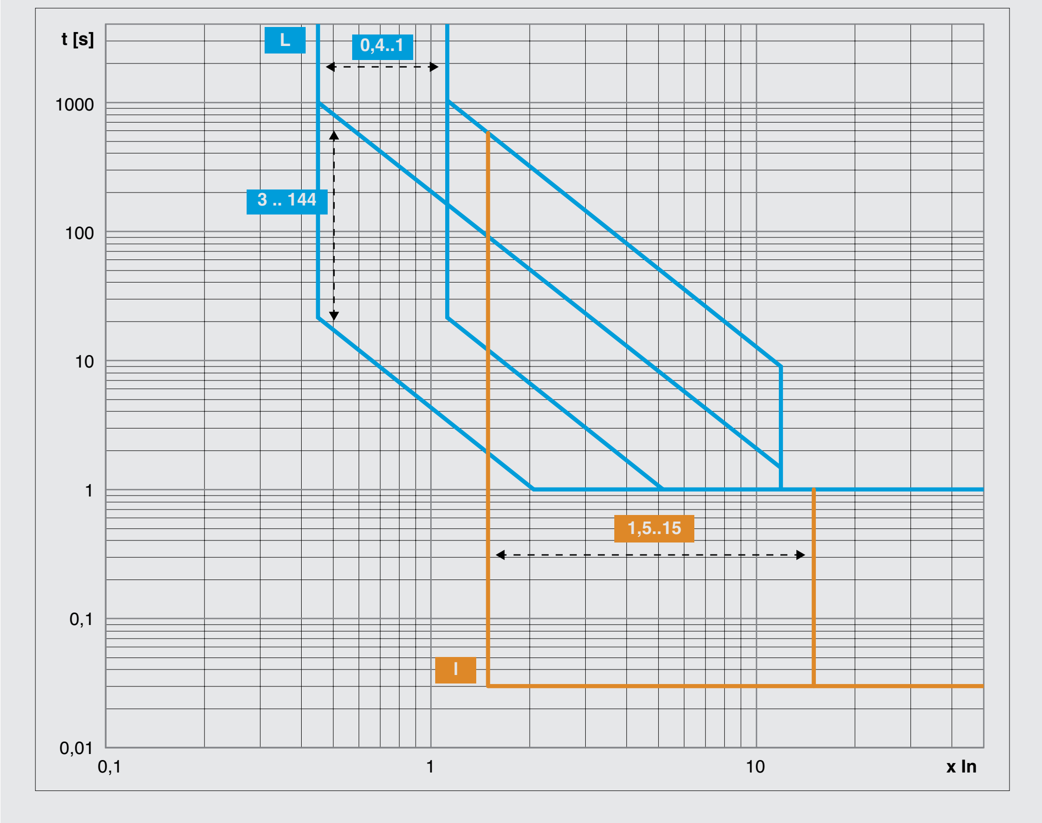


3 - Touch protections

The following are the trip curves of the protections available with Ekip Touch trip units.

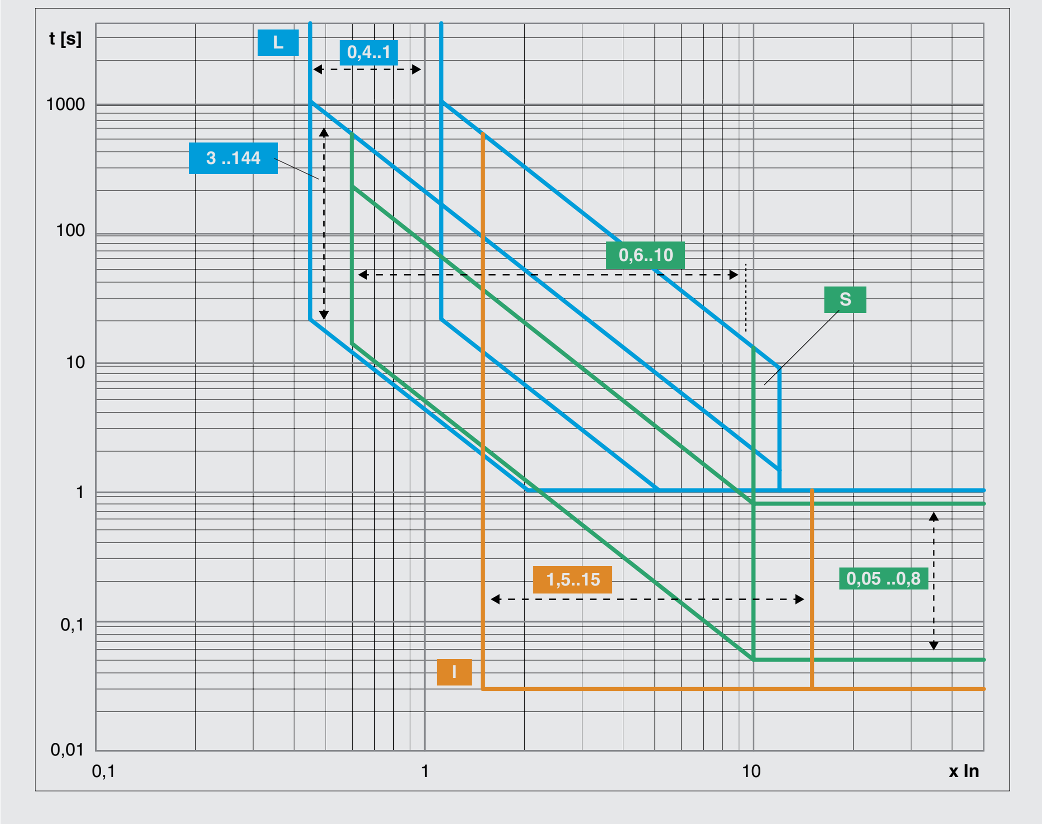
NOTE: *protections I, MCR and 2I share the same curve. For graphical convenience only protection I is included.*

Tripping curve for L-I protections

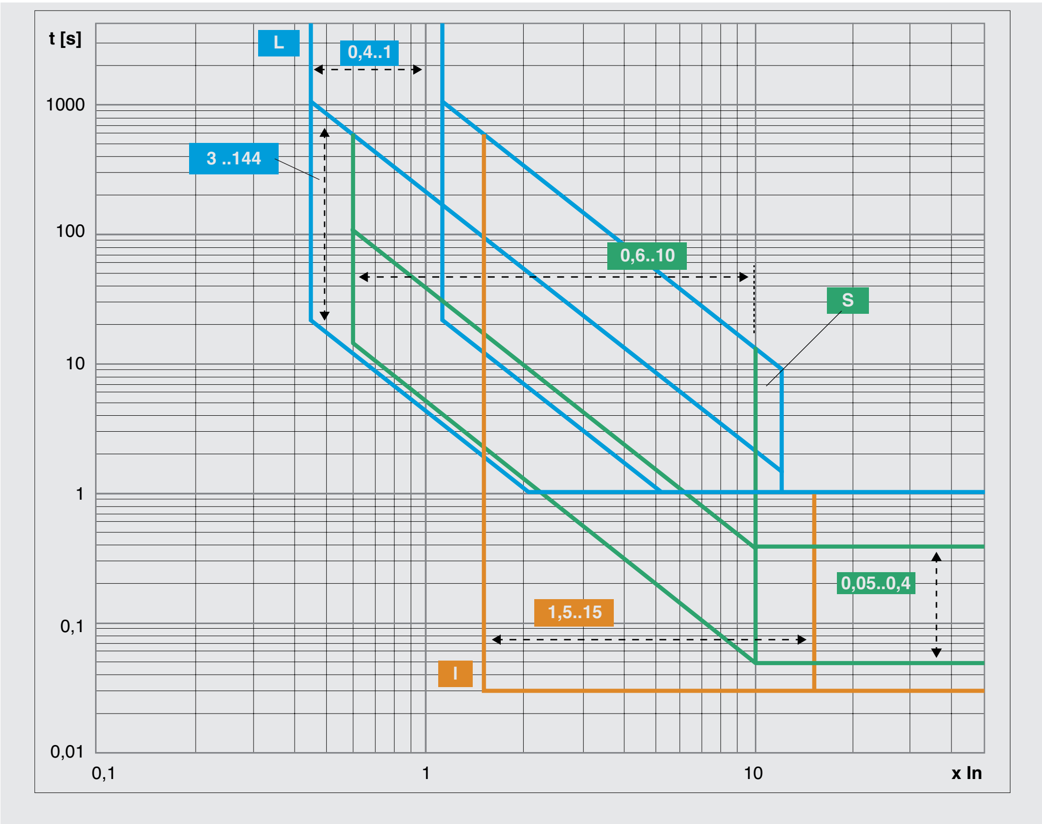


Tripping curve for L-S(t = k / I [2])-I protections

Version IEC

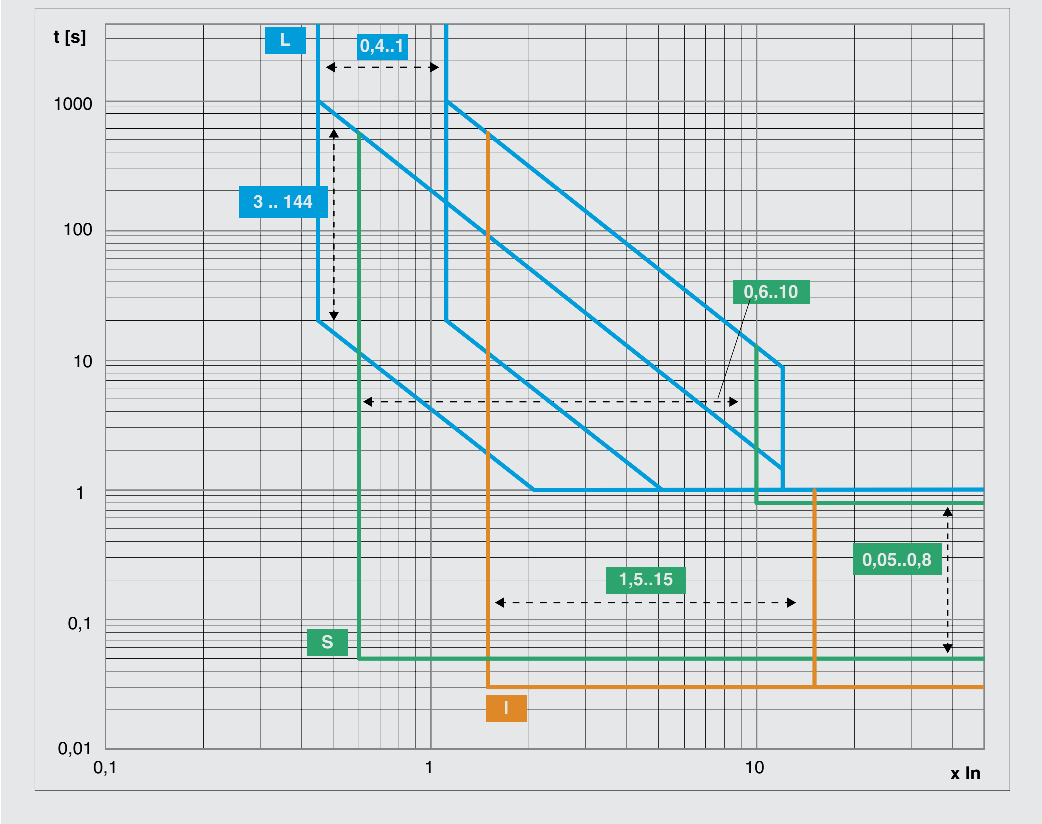


Version UL

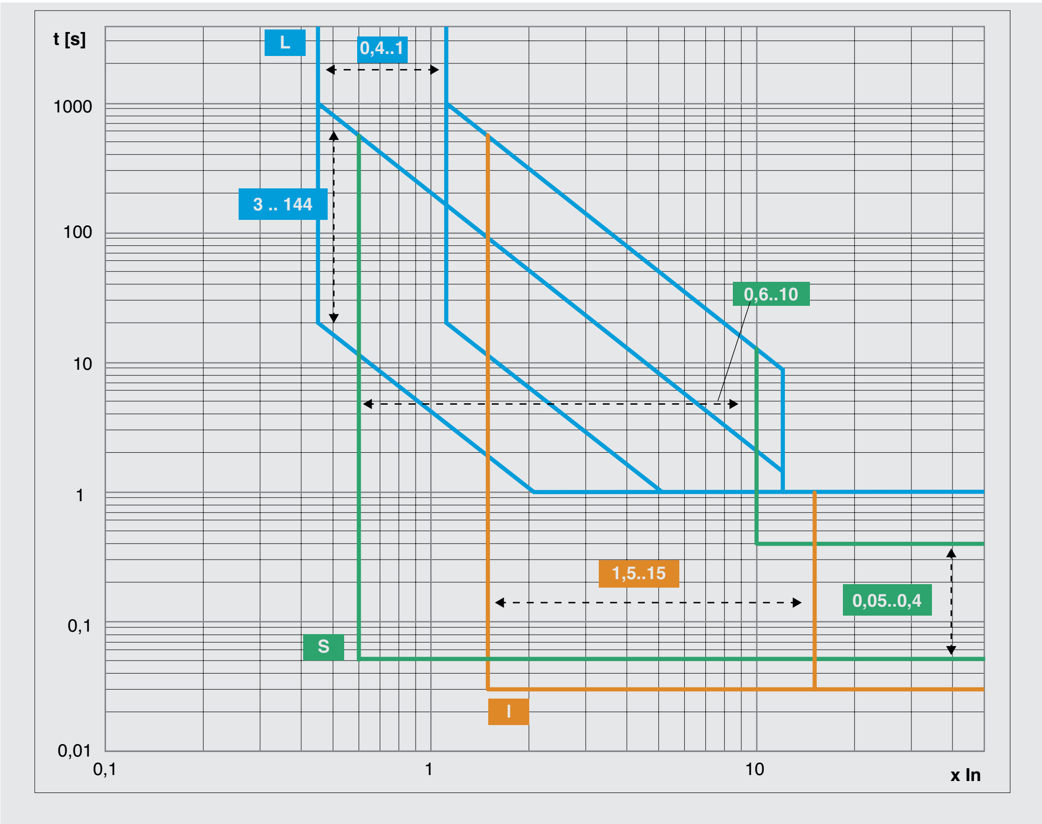


Tripping curve for L-S(t = k)-I protections

Version IEC

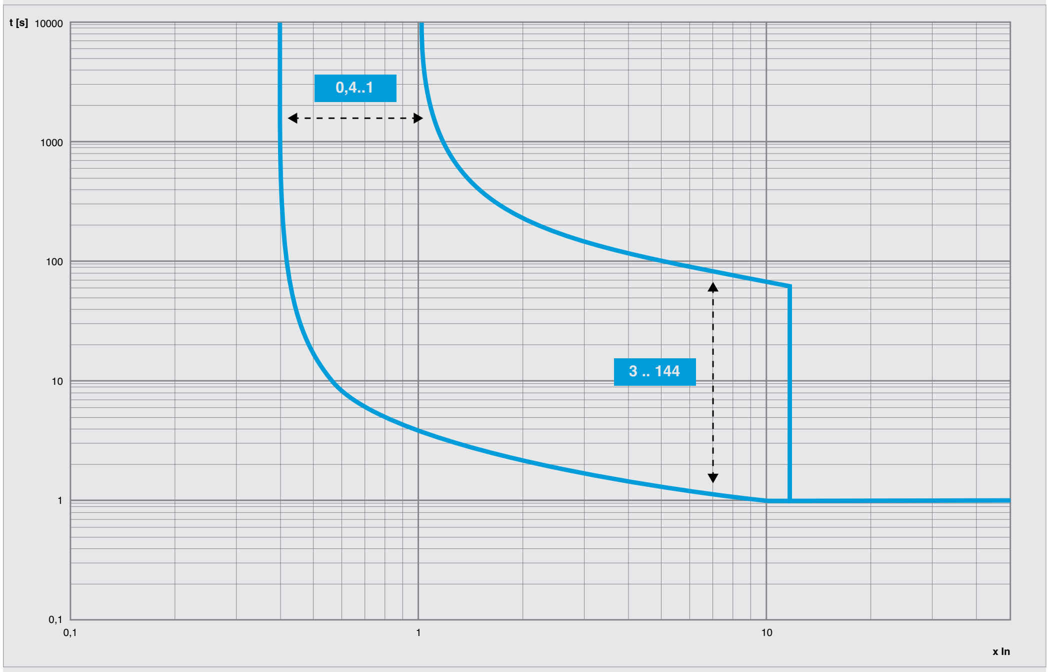


Version UL

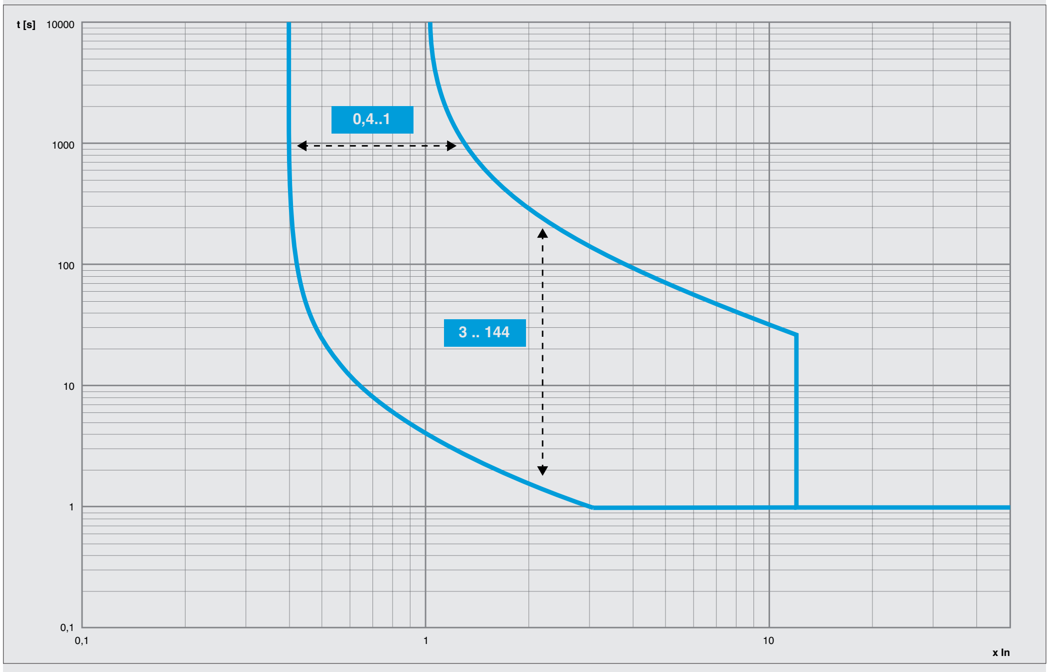


Tripping curves for protection L according to IEC 60255

Version SI

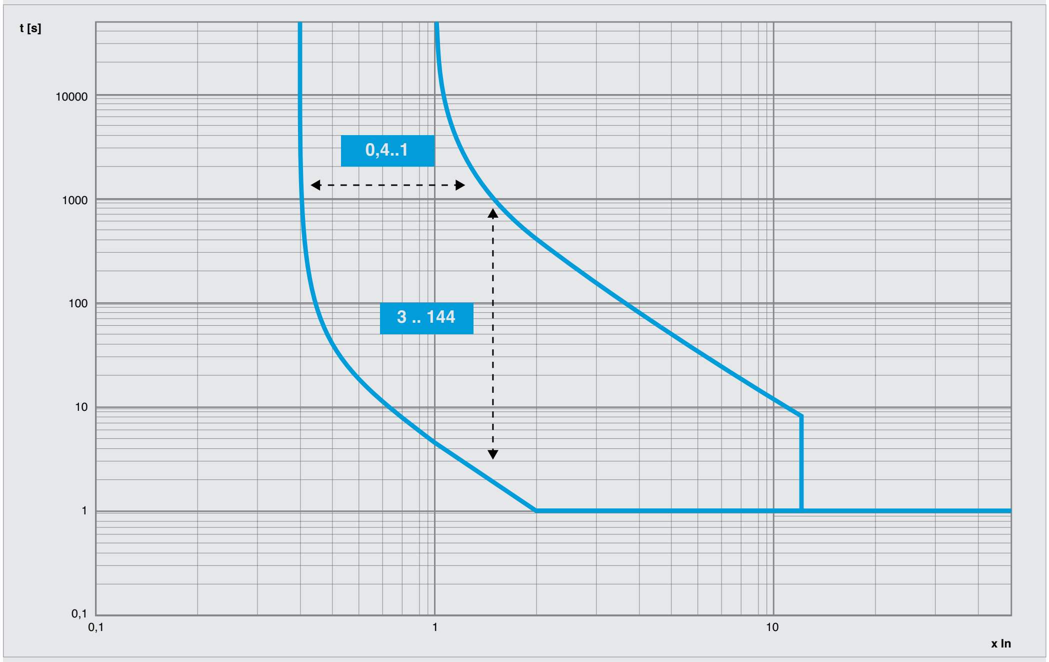


Version VI

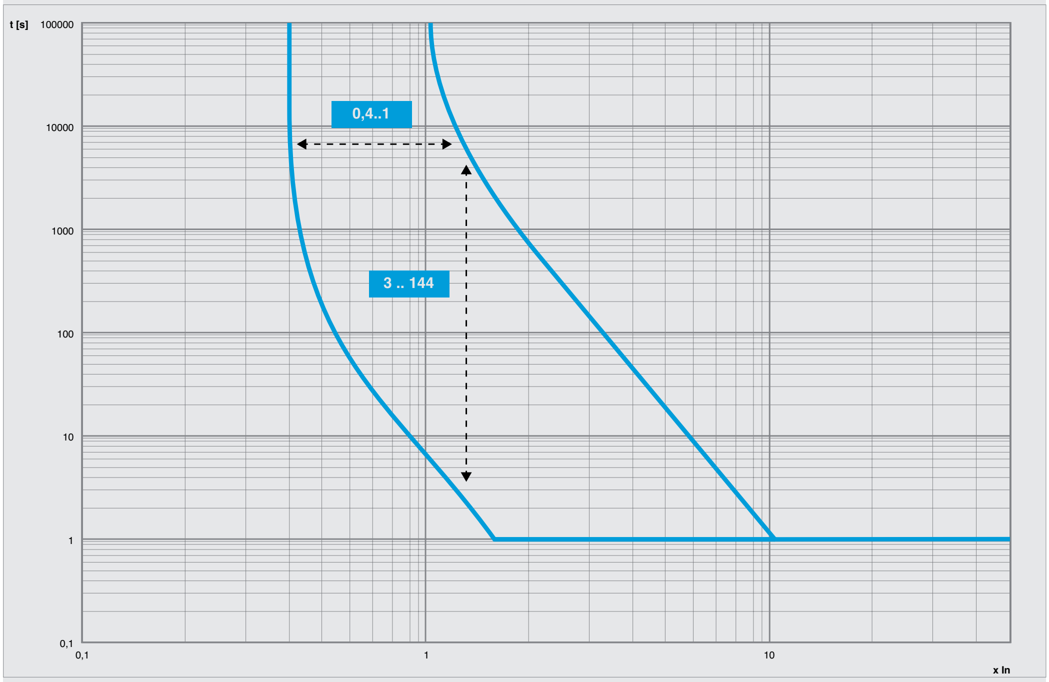


Continued on the next page

Version EI

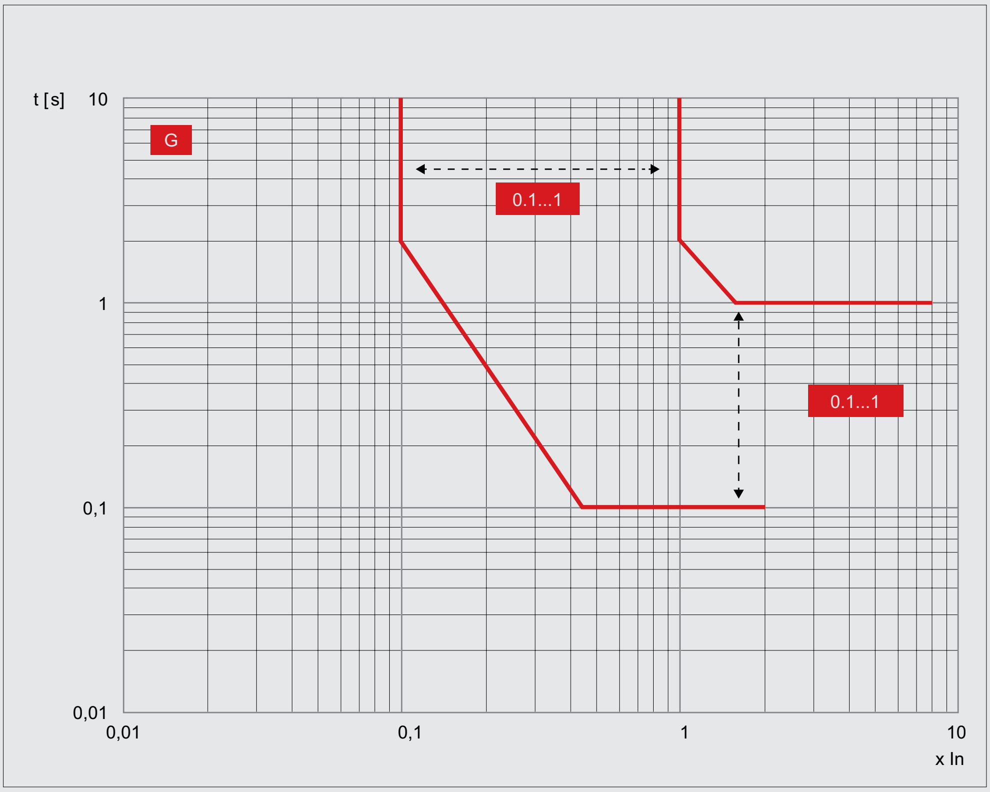


Version I4

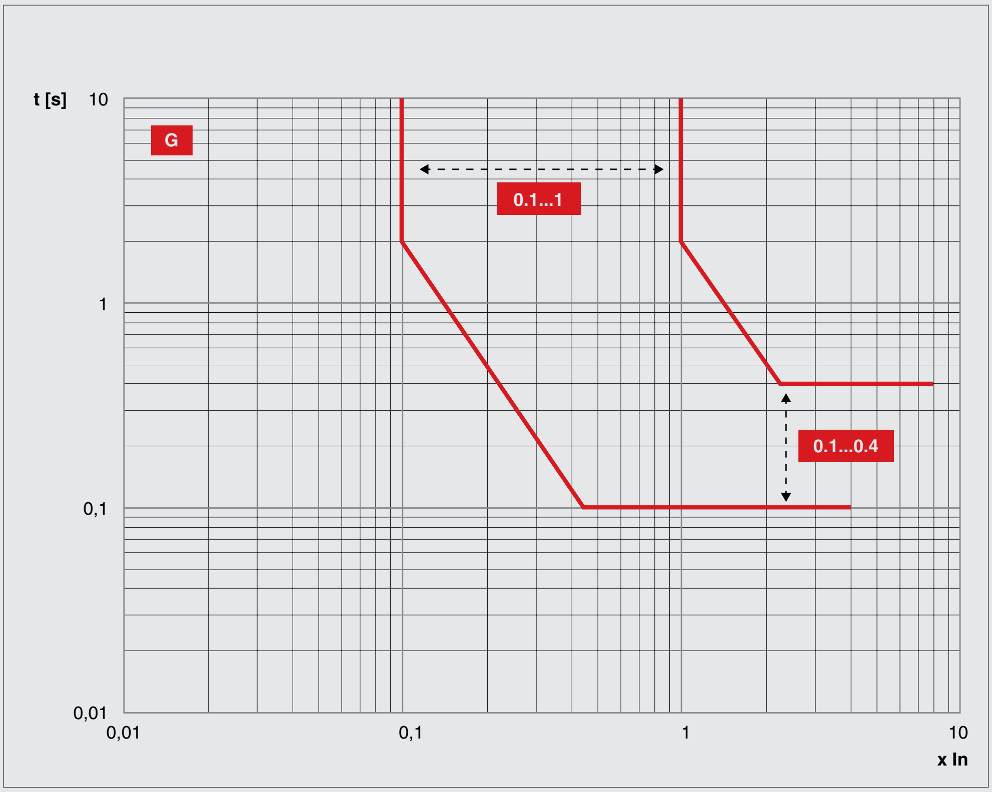


Tripping curves for G protection
($t = k / I^2$)

Version IEC

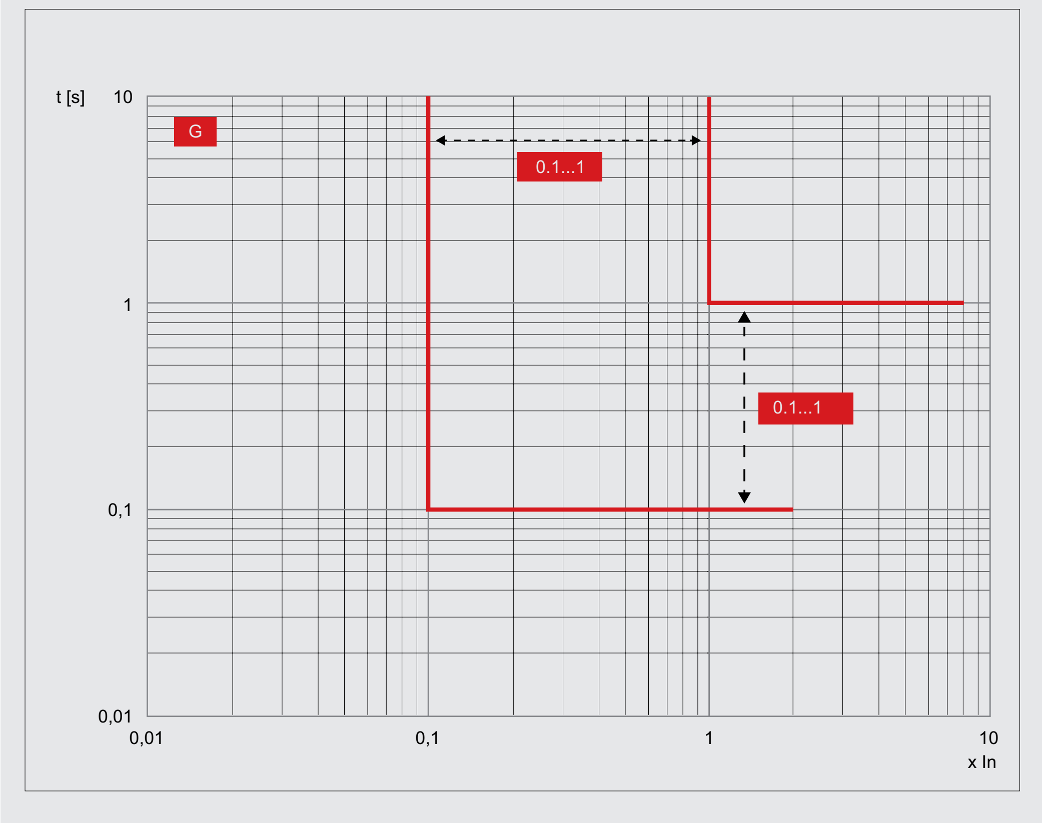


Version UL

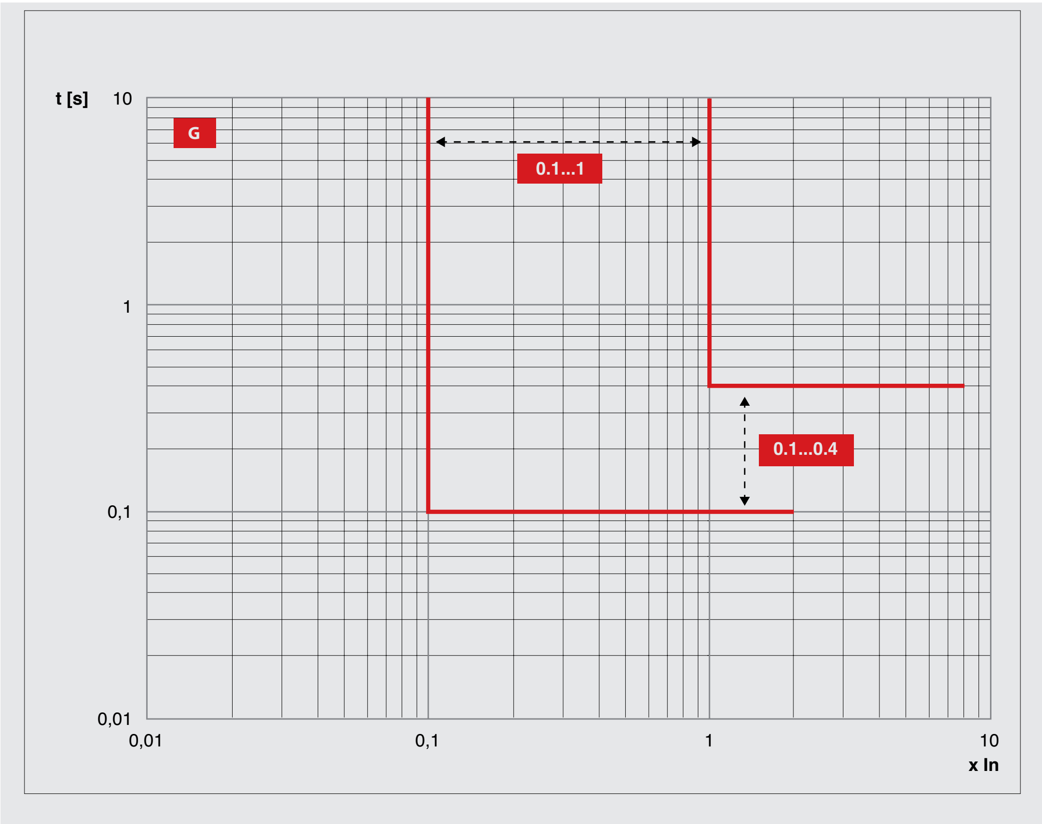


Tripping curves for G protection (t = k)

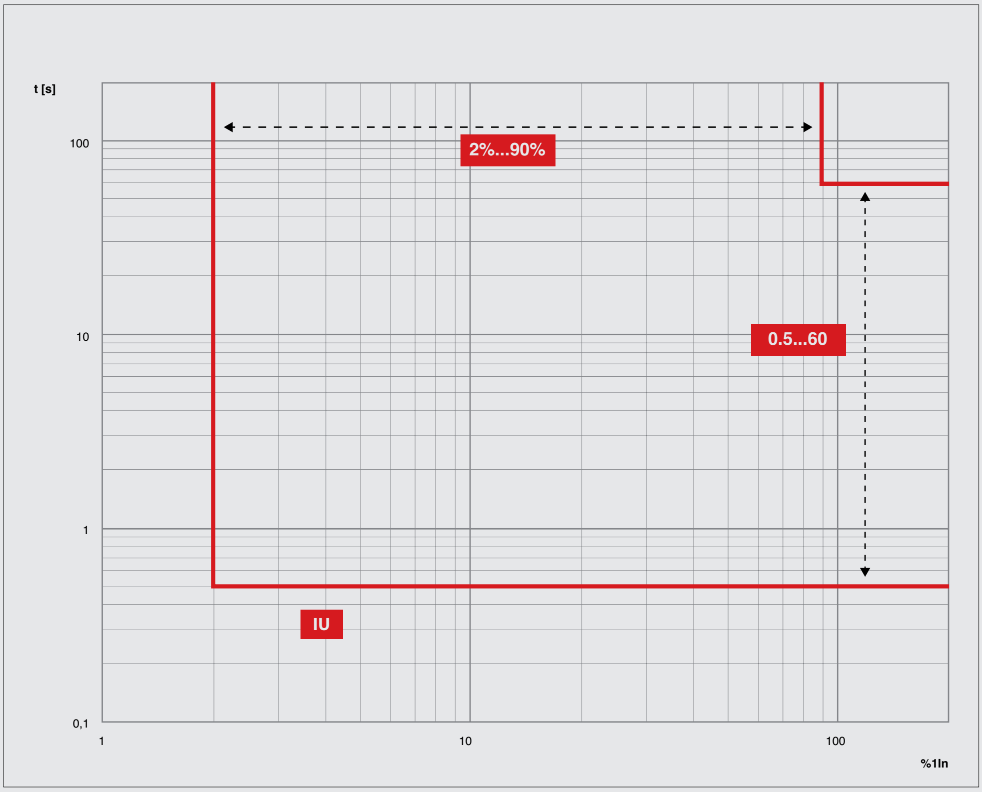
Version IEC



Version UL



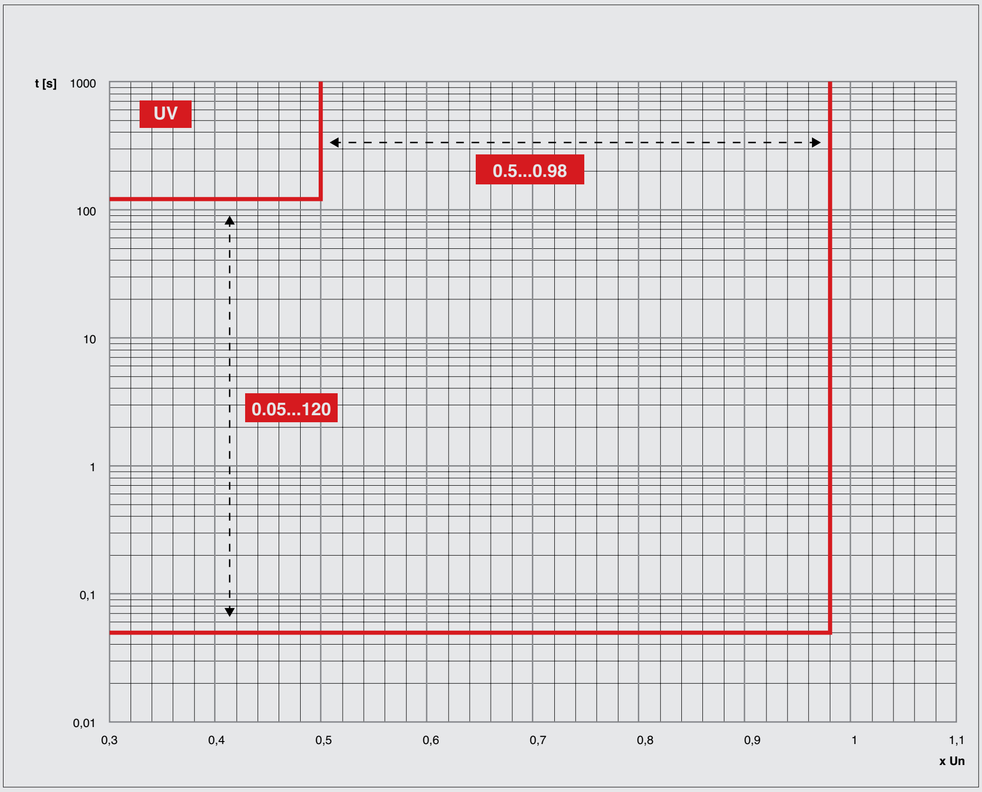
Tripping curves for IU protection



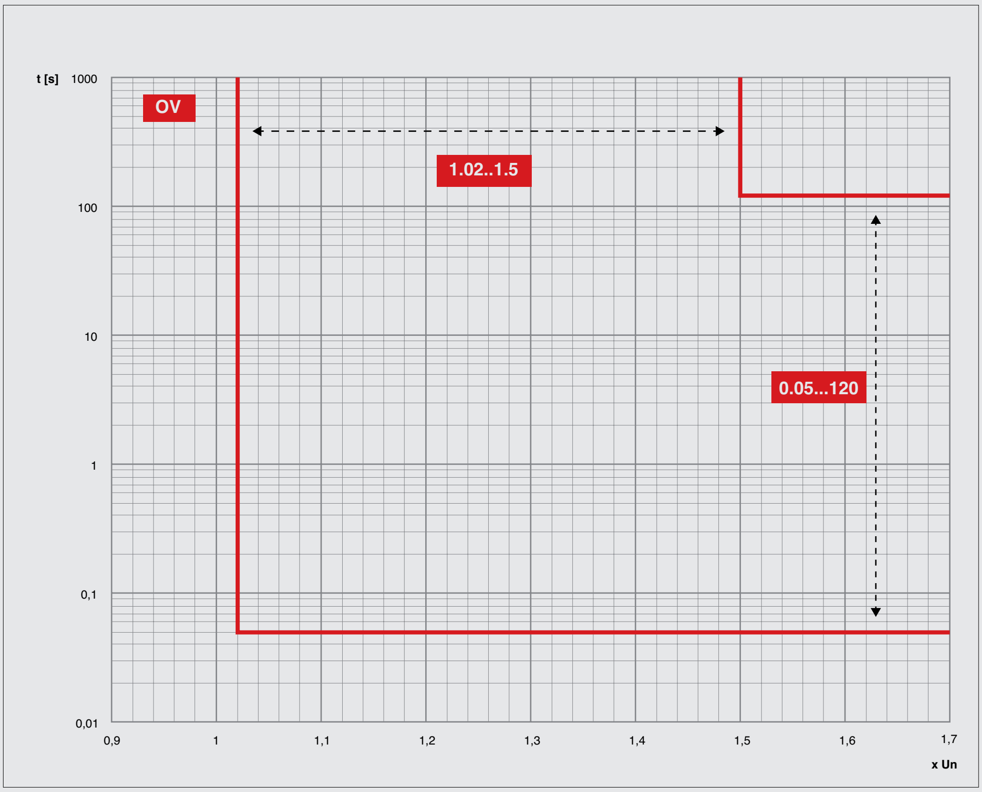
4 - Measuring Pro protections

The following are the trip curves of the protections available for all the Ekip Touch trip units equipped with an Ekip Measuring Pro module.

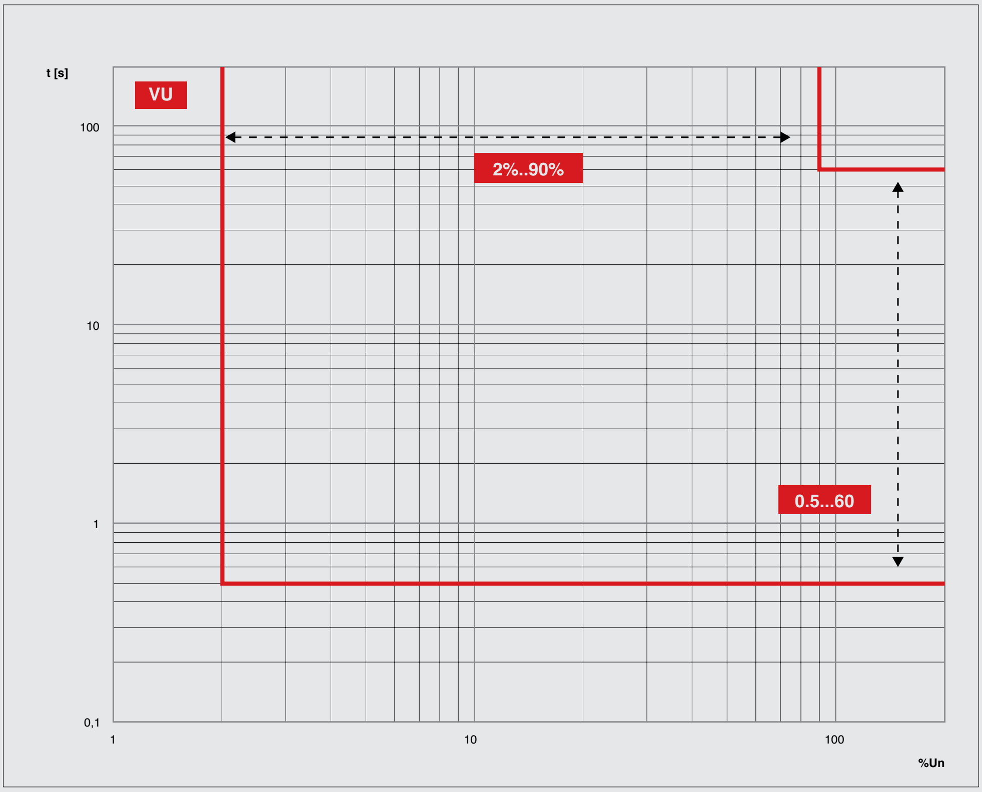
Tripping curves for UV protection



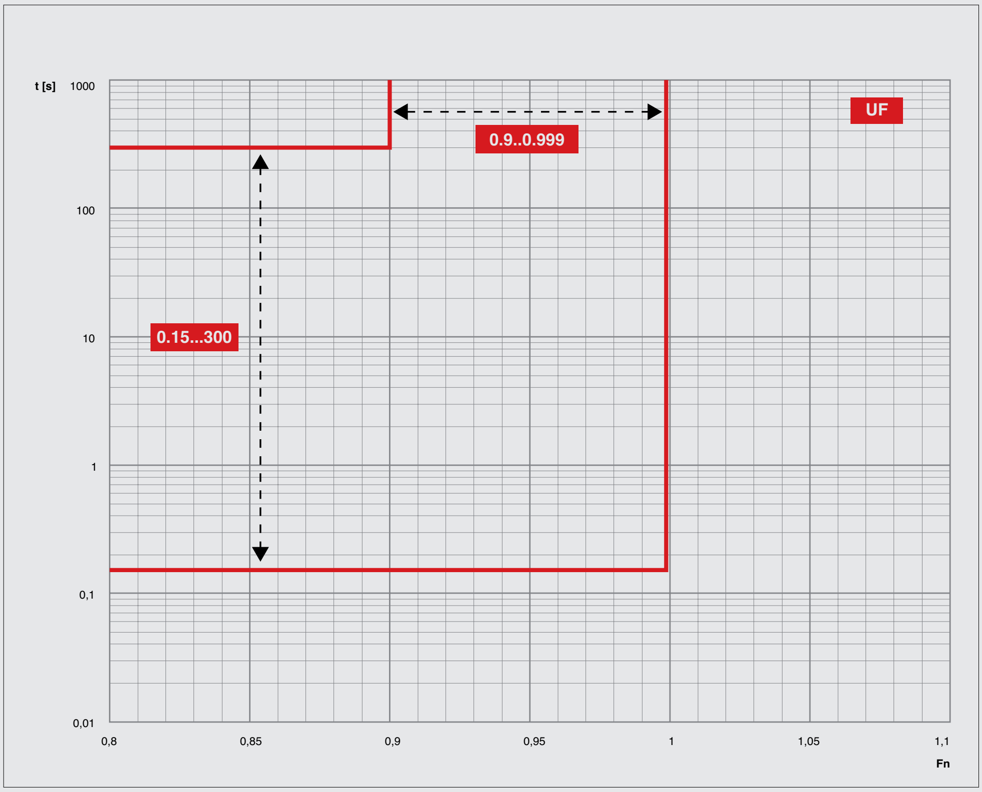
Tripping curves for protection OV



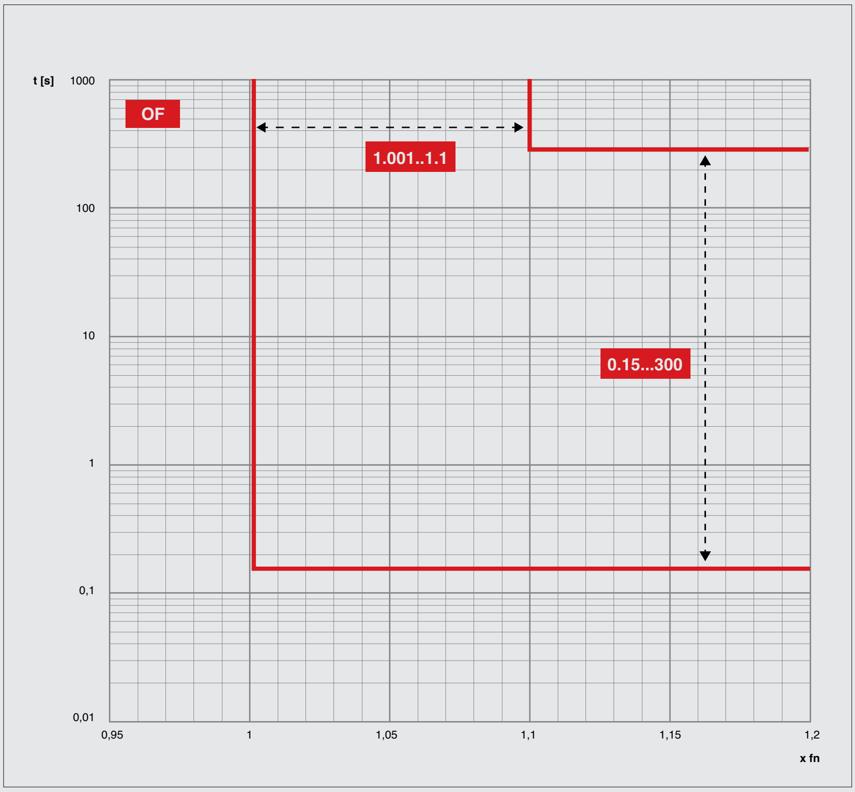
Tripping curves for VU protection



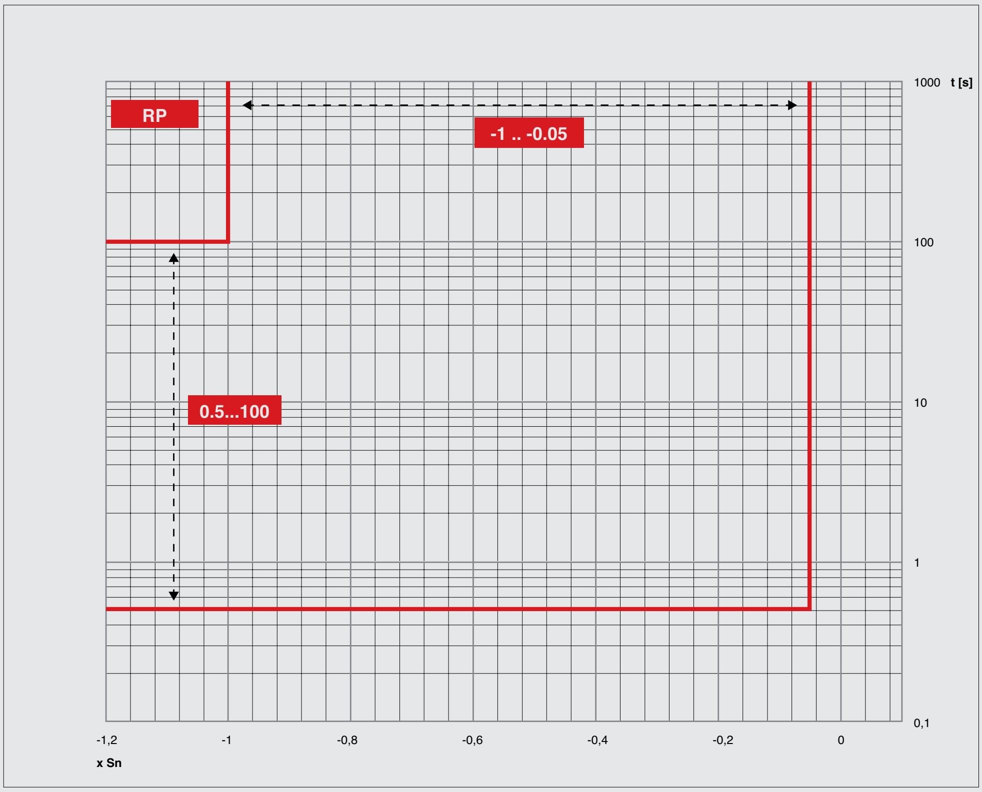
Tripping curves for protection UF



Tripping curves for protection OF



Tripping curves for RP protection

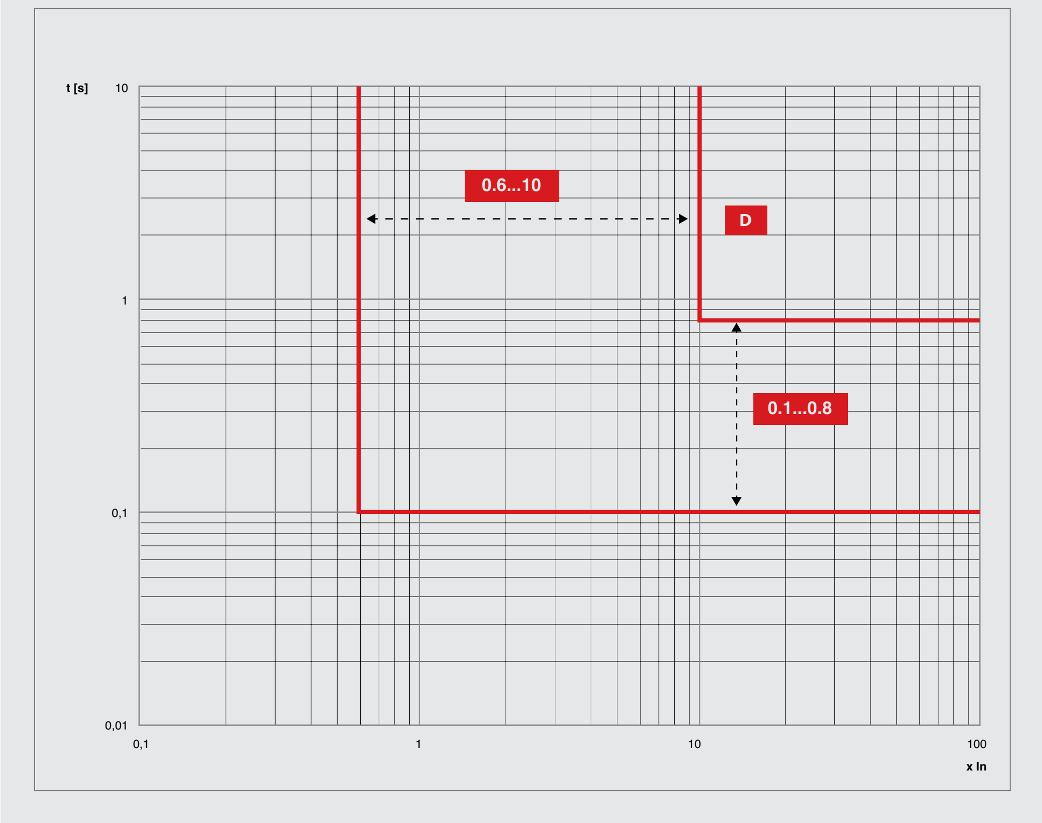


5 - Hi-Touch protections

The following are the trip curves of the protections available with Ekip Hi-Touch and Ekip G Hi-Touch trip units.

NOTE: *the protections S with S2, OV with OV2, UV with UV2, UF with UF2 and OF with OF2 share the same calculation algorithm. For graphical convenience only one curve is shown for each protection (S, OV, UV, UF, OF in the previous chapters).*

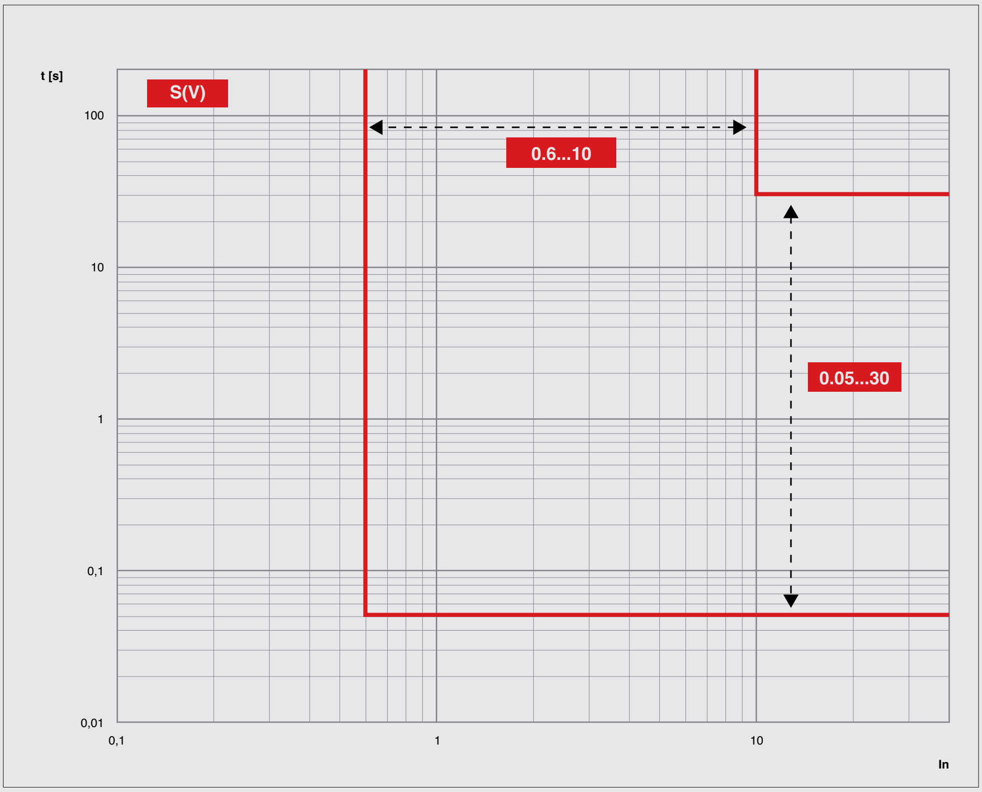
Tripping curves for protection D



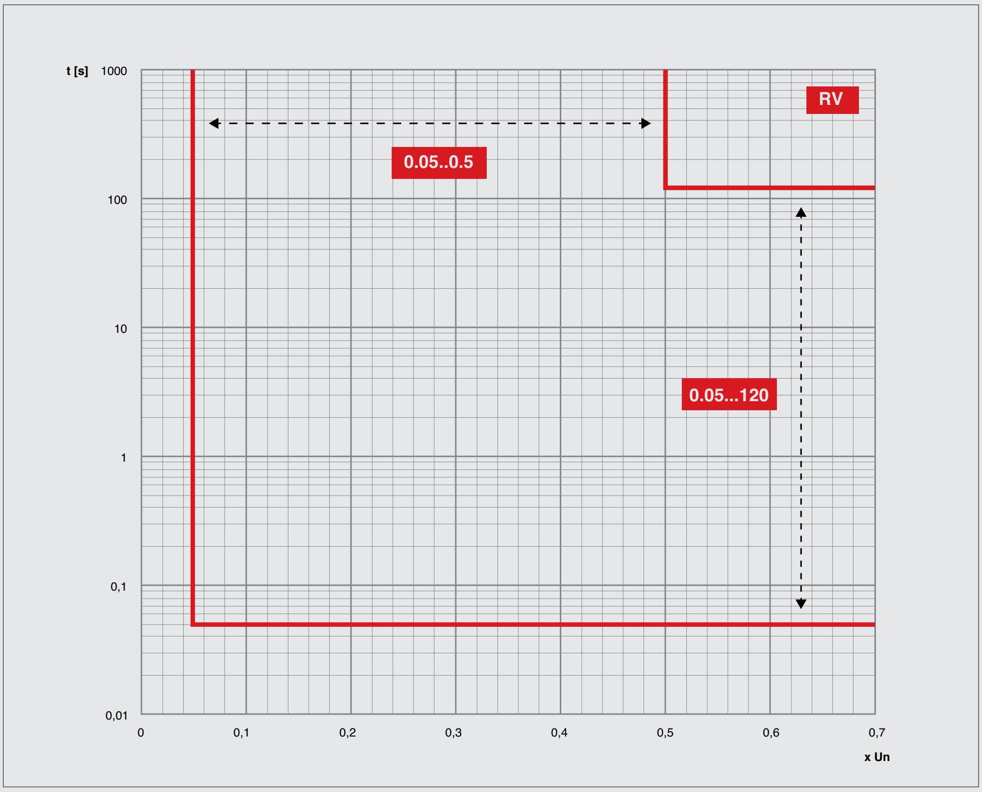
6 - G Touch protections

The following are the trip curves of the protections available with Ekip G-Touch and Ekip G Hi-Touch trip units.

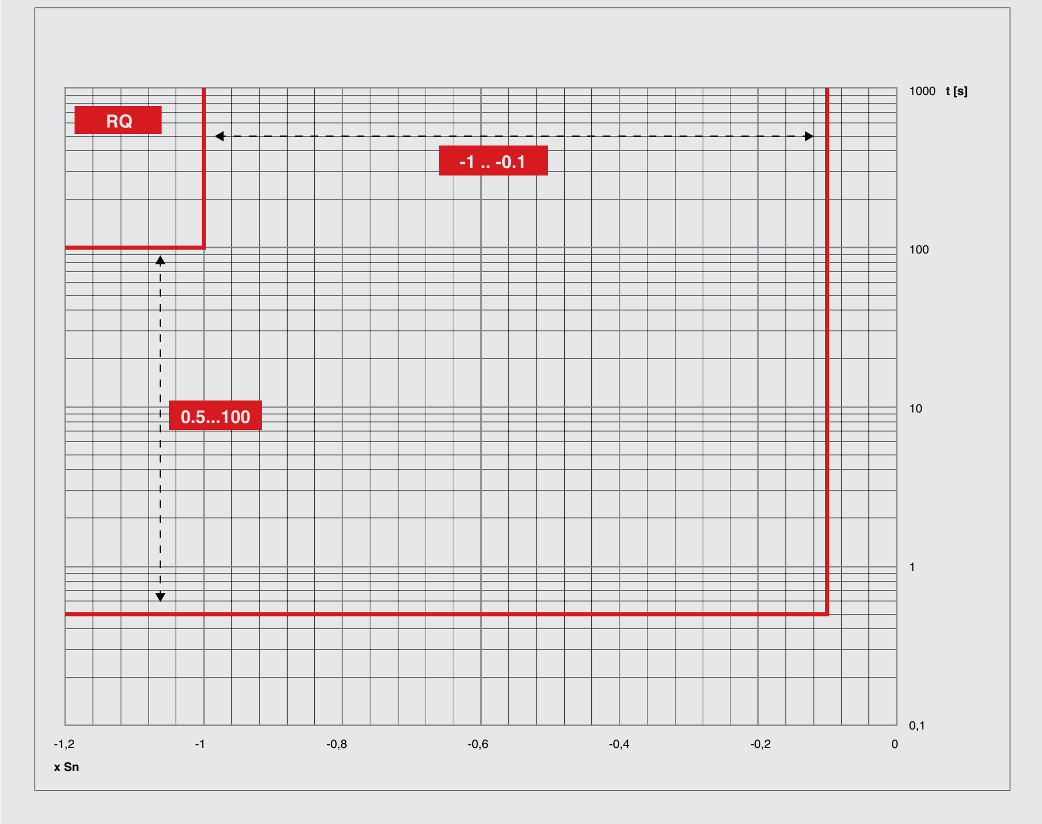
Tripping curves for S(V) protection



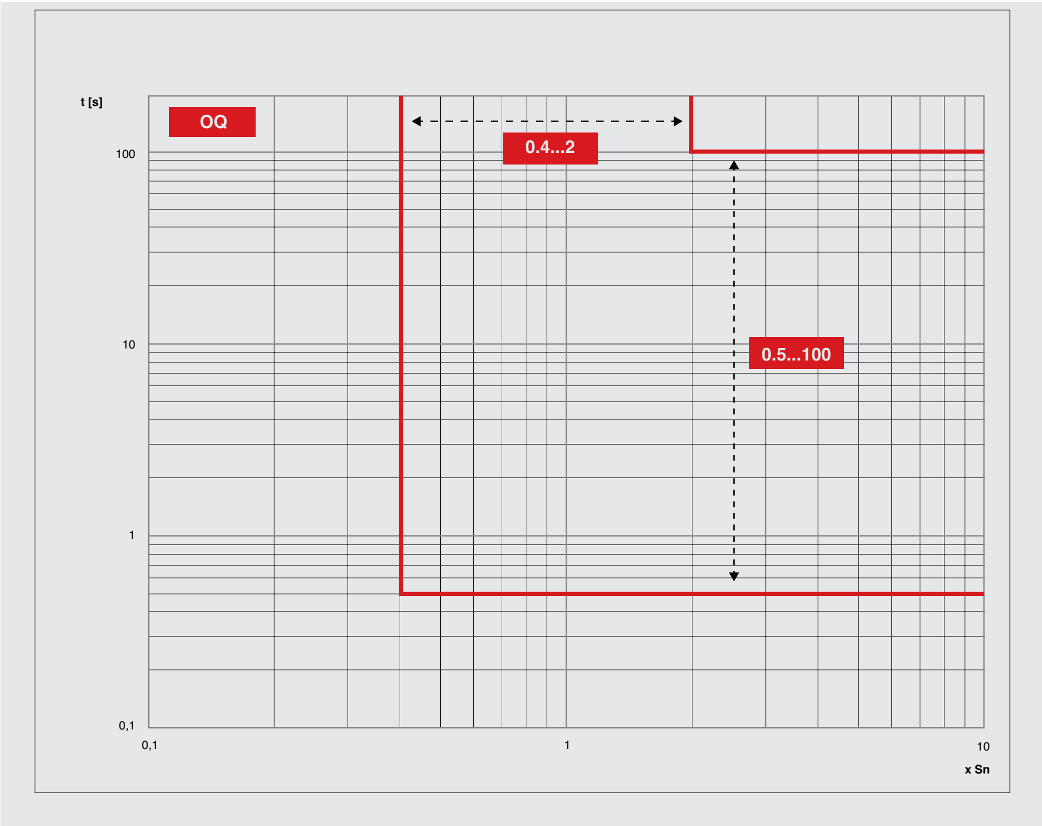
Tripping curves for protection RV



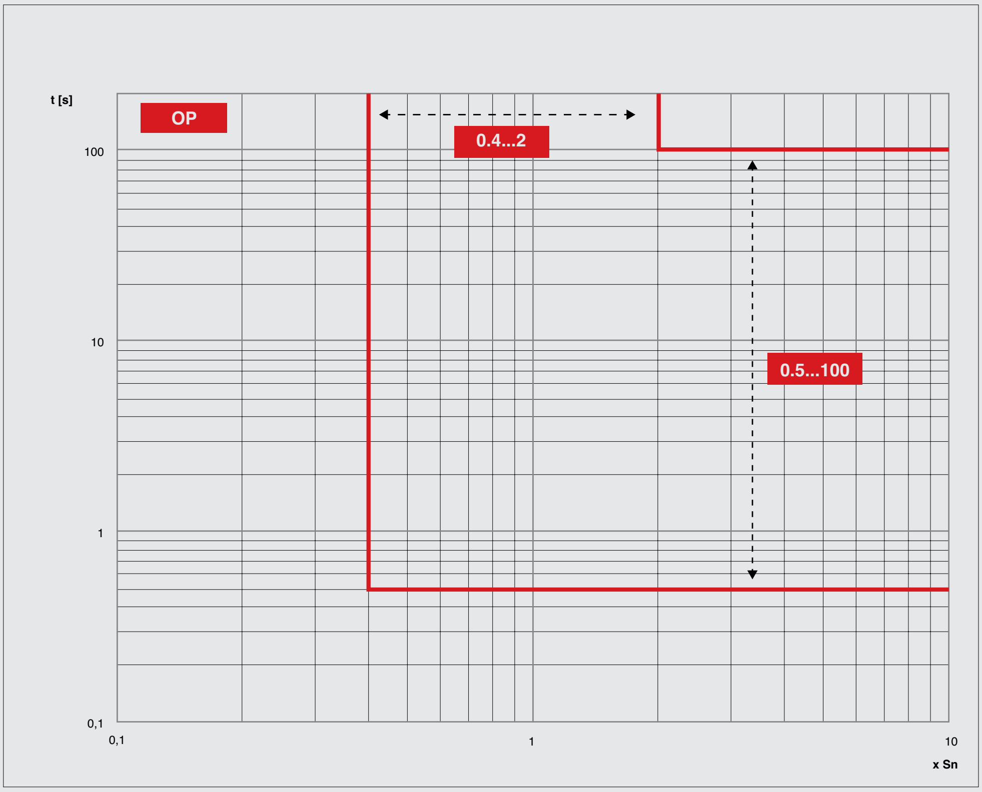
Tripping curves for RQ protection



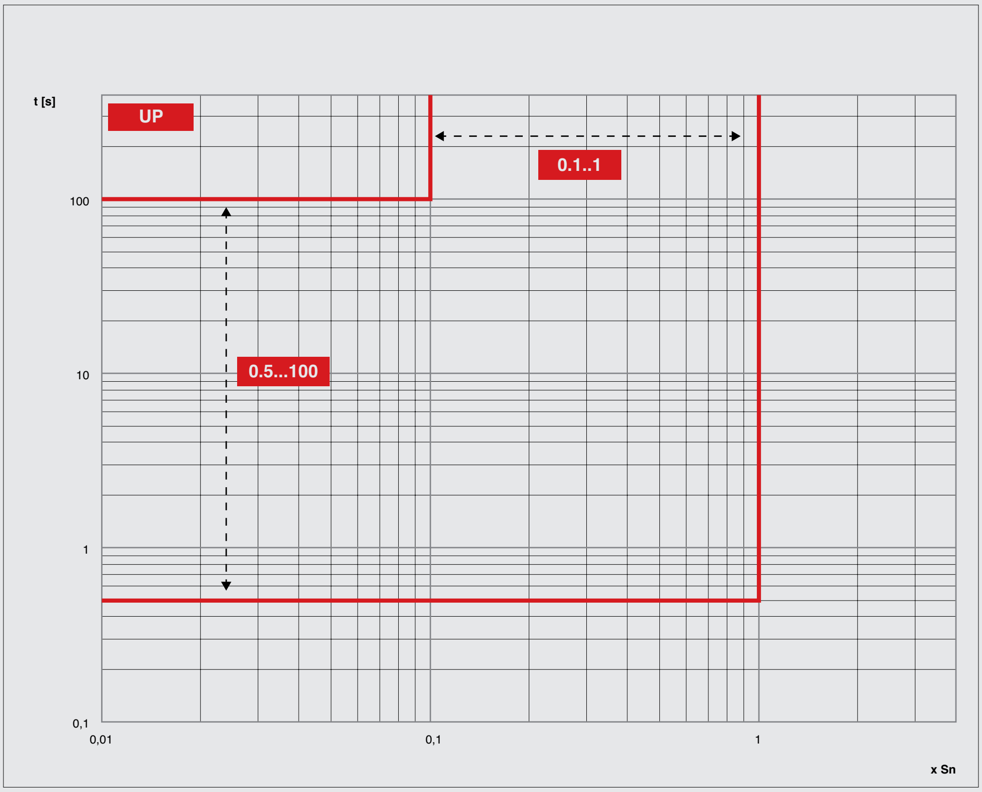
Tripping curves for OQ protection



Tripping curves for OP protection



Tripping curves for UP protection

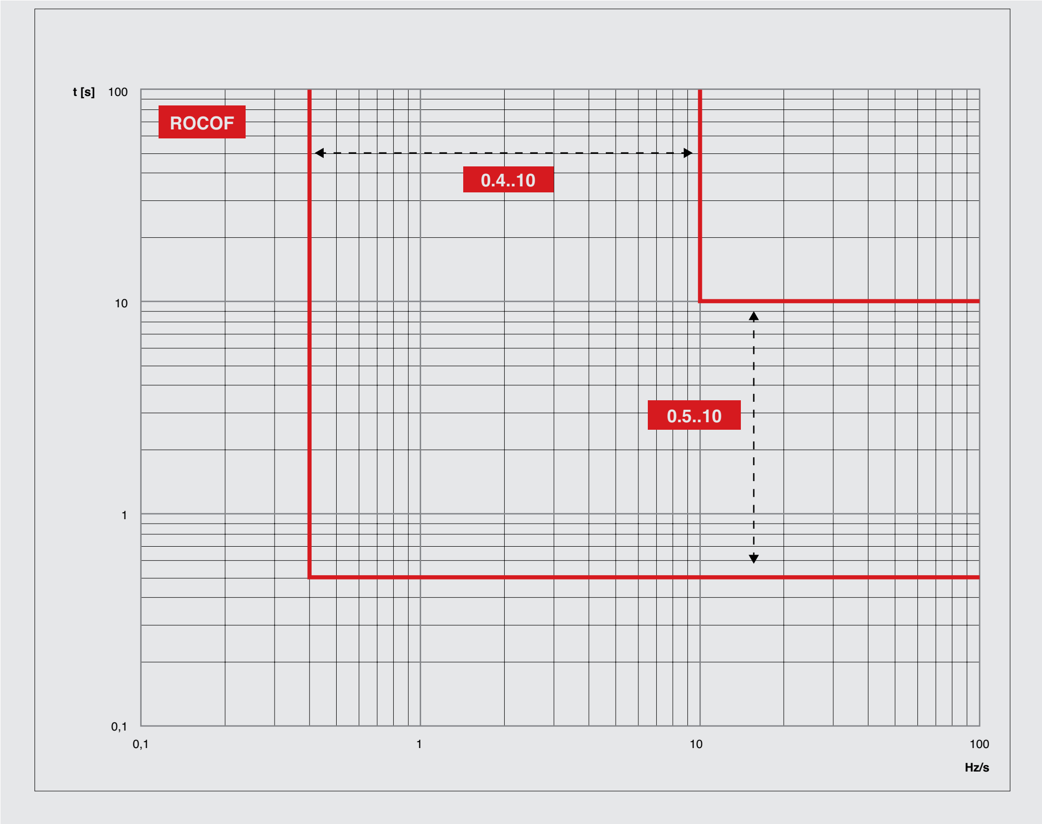


7 - G Hi-Touch protections

The following are the trip curves of the protections available with Ekip G Hi-Touch trip units.

NOTE: *the protections S(V) with S2(V), and RQ with RQ2, share the same calculation algorithm. For graphical convenience only one curve is shown for each protection (S(V) and RQ in the previous chapters).*

Tripping curves for protection ROCOF

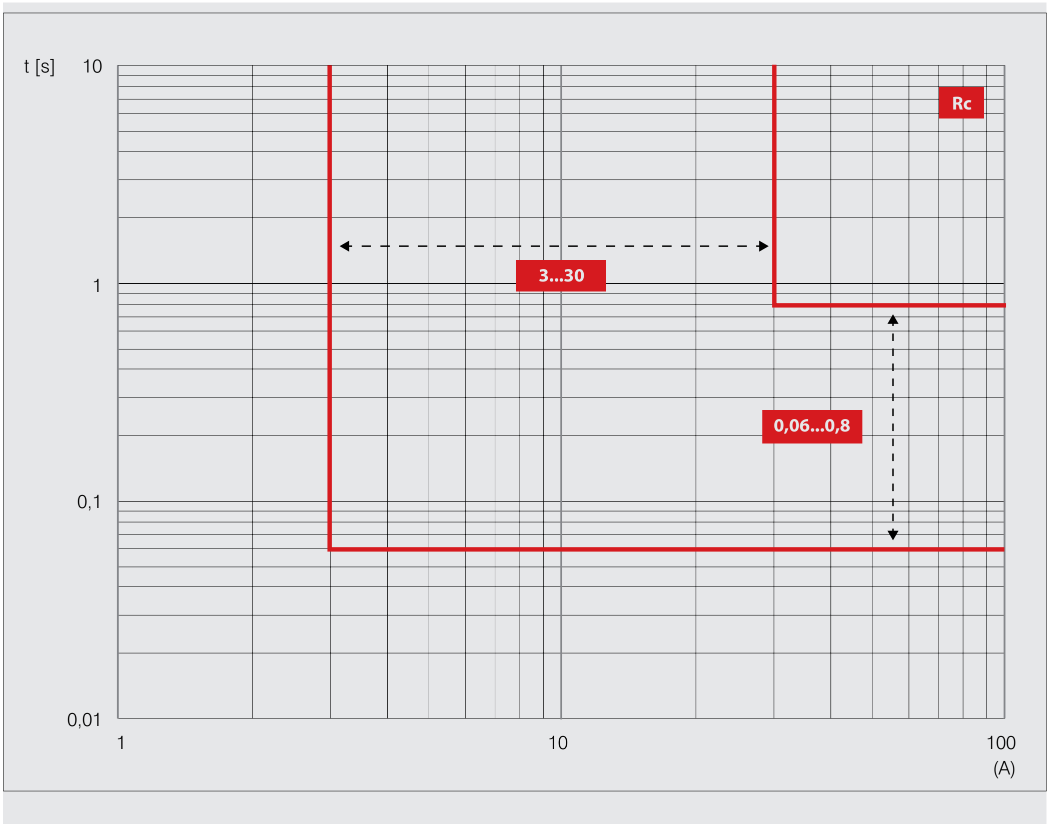


8 - External toroid protections

The following are the curves available with Rc protection, which is available for all the protection trip units of the Touch range connected to an Rc toroid.

For the curve of the Gext protection, refer to the curve of G protection, in the chapter "3 - Touch protections" on page 143.

Tripping curves for protection Rc



System Interface

Documents

For correct use of Ekip Com communication modules, two documents are available in the ABB library:

Document	Description
1SDH001140R0001	Guidelines with details for putting communication modules into service.
1SDH001140R0001_CSI_Emax2	Table with the references of all the registers for the parameters, commands, measurements, etc.

The documents are available in a single .zip file (**1SDH001140R0001**).

The .zip file contains the files for integrating Emax 2 in the available communication networks. The specific Ekip Com module contains an IMPORTANT file with notes on how to use the files.

File	Protocol / Ekip Com module
ABBS0E7F.gsd	.gsd file for the configuration of the Ekip Com Profibus DP module
Ekip COM EtherNetIPTM_v02.eds	.eds file for the configuration of the Ekip Com EtherNet/IP™ module
Ekip_COM_DeviceNetTM_v02.eds	.eds file for the configuration of the Ekip Com DeviceNet™ module
emax2_v02_00_2003.icd	.icd file for the configuration of the Ekip Com IEC 61850 module
emax2_v02_00_2003_Citect.icd	.icd file for the configuration of the Ekip Com IEC 61850 module
GSDML-V2.3-ABB S.p.A.-SACE Emax 2-20130924.xml	.xml for the configuration of the Ekip Com Profinet module

NOTE: *consult the ABB library for the most recent version of the .zip file.*

Specific applications

1 - Zone Selectivity

Description

Zone Selectivity is an evolution of time selectivity (see chapter "2 - 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 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 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 and G and Directional Zone Selectivity are mutually excluding (to implement Directional Zone Selectivity, the S 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.
- 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.
- 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, G, D, S2, Gext (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 and Gext in the list of protections supported.

NOTE: *S2 and Gext share the same selectivity inputs/outputs of S and G, 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* "**14 - Ekip Link module**"*.*

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 (see the chapter "17 - Other accessories", and the paragraph "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 "14 - Ekip Link module").
- 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 "2 - Load control").
- 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) that activate the selectivity input of the trip unit (example: actor 1, protection mask S= S2 and Gext: selectivity S of the trip unit will be active in the presence of signals S2 or Gext 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 "14 - Ekip Link module".

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 "14 - Ekip Link module") while it is not necessary (it is not necessary for the value “True” to be assigned to the Selectivity Actor parameter).

2 - Load control

General description

Load control is possible through the Ekip Power Controller, which is a new patented ABB function, available only on SACE Emax 2 circuit-breakers equipped with any Ekip LCD or Touch (including Hi-, G, and G Hi- trip units).

The purpose of the function is to to prevent a defined limit of power absorption from being exceeded in the installation, through:

- The cumulative measurement of the energy consumed by the installation over time.
- An estimate of the energy consumed at the end of the monitoring periods in which the electrical energy billing cycle is divided.
- Automatic load control, that is to say the temporary disconnection of lower priority loads if the estimate of the energy exceeds the product of the power limit set and the duration of the monitoring periods.
- Recognition of the instant the monitoring periods start with reset and restart of energy meters at the beginning of each period on the basis of the internal clock of the release or of an external synchronization signal.

NOTE: *if the trip unit where the function resides is equipped with an Ekip Link module and the clock and synchronization signals in accordance with the IEEE 1588 protocol are available on the Link Bus, synchronization can be performed by the trip unit on the basis of this signal. For details, see the chapter "***14 - Ekip Link module***".*

Ekip Power Controller enables you to:

- do not exceed the contracted power limits established with the users and increase the contracted power and fixed costs without incurring penalties in the case of peaks in energy consumption.
- oversize the installation to prevent overload protections from tripping.
- ensure smart real time management of the loads on the basis of real plant consumption needs at any instant.

NOTE: *load control based on measuring the energy rather than the instantaneous power allows power peaks above the contractual limit to be tolerated if the duration of the peaks is such that the average power during the monitoring period does not exceed the contractual limit. This is useful, because billing and any penalties from the public utility company are calculated on the basis of the average power measured in predefined time intervals, specifically on the basis of the average highest power reached during the billing period.*

Further information on the potential of the function is available in the White Paper **1SDC007410G0202** "Load management with Ekip Power Controller for SACE Emax 2".

Operating details

To enable the function, this just needs to be available on an Ekip LCD or Ekip Touch trip unit equipped with an auxiliary power supply, and with the possibility to measure the total energy consumed (for example: installed on the main circuit-breaker of the system). Therefore, the energy can be measured if the trip unit is equipped with an Ekip Measuring module (see the chapter "2 - Ekip Measuring modules").

NOTE: *Ekip Measuring module is supplied as standard with Ekip Hi-, G, G Hi-Touch and Ekip Hi-, G, G Hi-LCD trip units, whereas it has to be ordered in case an Ekip LCD or Touch are used.*

The circuit-breaker performing the function is indicated as the **master**, while the devices located upstream the power supply circuits and controlled by the master are indicated as **slaves**.

The slaves can be real loads, or they can be generators. The generators are controlled in the opposite way to loads, that is, they are connected in the event of high consumption (to activate additional energy sources) and disconnected in the event of reduced consumption.

Continued on the next page

Within the monitoring period, the estimate of the energy consumed at the end of the period is performed by the master at regular intervals. Then, after every interval:

- If the estimate is in the high consumption range, a load is disconnected (or a generator is connected)
- If the estimate is in the low consumption range, a load is connected (or a generator is disconnected)
- If the estimate is in the acceptable consumption range, no loads or generators are disconnected or connected.

Load monitoring is still performed by the master, in accordance with these rules:

- The maximum number of loads that can be controlled is 15 (including the generators).
- The order in which the loads are disconnected and connected depends on the priority level assigned: the lower the priority level, the less important the load. Therefore a load with lower priority will be disconnected before and connected after the one with higher priority.
- It is possible to assign the same priority level to different loads.
- If the same level of priority is assigned to more loads, the master will disconnect (connect) the load that has been connected (disconnected) for the longest time.
- To avoid damage or due to operating requirements, it is possible that once a load has been disconnected (connected) it can only be reconnected (disconnected) only after a certain minimum time (the minimum times for which a load must remain disconnected and connected can be different). Furthermore, a load cannot remain disconnected beyond a certain maximum time. This information can be inserted in the master (separately for each load), and the master will disconnect (connect) each load only after its minimum time has elapsed, and will reconnect before its maximum time has elapsed, regardless of its priority level.
- If a load to be disconnected is already disconnected (for example: due to tripping of a protection of a supply-side trip unit, or manual opening), the load is classified as not available and is excluded by the function until it becomes available again.

Connections and equipment

Types of connection and compatibility

NOTE: *in the text that follows, the term "load" is used for both real loads and generators.*

The master monitors the loads, controlling the slaves remotely:

- Through wiring, and controlling also opening/closing coils or motor operators if the slaves are circuit-breakers.
- Using communication via Link Bus between Emax 2 trip units, or with Ekip Signalling 10K modules.

NOTE:

- *Communication via Link Bus is possible only with Ekip Dip, LCD, and Touch trip units equipped with an Ekip Link module. Then the circuit-breakers equipped with Ekip Dip trip units can only act as slaves, while the circuit-breakers equipped with LCD or Touch trip units can act both as masters and as slaves.*
- *For details on how to associate trip units connected to the same Link Bus with each other, see the chapter* "14 - Ekip Link module". *For details on how to associate a trip unit and a 10K module connected to the same Link Bus, see the manual* **1SDH001318R0002** *of the 10K modules.*

Continued on the next page

Load control via wiring

For load control via wiring, for each load the master requires at least:

- An input, to get information on the open/closed state of the slave on the supply side of the load.
- Either one or two outputs, depending on the type of slave, to control its opening/closing (two outputs if the slave is a circuit-breaker, for example one output to control the opening coil and one output to control the closing coil).

For these signals, the inputs and outputs of the signalling modules connected to the master can be used (Ekip Signalling 4K mounted on the trip unit, or 2K or 10K modules connected to the trip unit via Local Bus, see the chapters “4 - Ekip Signalling 4K module" and "5 - Ekip Signalling 2K modules“ and the manual 1SDH001318R0002 for 10K modules). Thus, if the slaves are circuit-breakers, the maximum number of loads that can be controlled through wiring is:

- Two, if the master is an E1.2 and 2K modules are used (4k modules cannot be installed on E1.2 circuit breakers, and a maximum of two 2k modules can be connected).
- Five, if the master is an E2.2, an E4.2 or an E6.2, and 4K and 2K modules are used.
- 15, if 10K modules are used.

More information on the connections, the equipment of the master and of every type of slave (for example: air , molded-case, miniature circuit-breakers), and examples of applications are provided in the White Paper 1SDC007410G0202 “Load management with Ekip Power Controller for SACE Emax 2”.

Load control via Link Bus

Load control via Link Bus offers the advantage of reducing the number of cables. In fact, the information on the state of the circuit-breakers and the opening/closing controls is shared by the trip units on the Link Bus, and each connected trip unit can be set so as to select the shared information required to perform its own function.

Furthermore, load control via Link Bus is possible even if the slaves are not SACE Emax 2 circuit-breakers, by using the inputs and outputs of Ekip Signalling 10K modules configured to communicate via Link Bus and associated to the trip unit mounted on the master.

NOTE: *unlike the 10K modules connected to the trip unit via Local Bus (with which the programming of inputs and outputs must be performed via Ekip Connect, by connecting to the trip unit), the programming of the inputs and outputs of 10K modules configured to communicate via Link Bus must be performed via Ekip Connect, connecting the module. For details, see the manual* **1SDH001318R0002** *of the 10K modules.*

Load control via Link Bus is useful if the loads are located in different switchboards and the connection distances are long. And it is possible by setting up one or more Ethernet switches, with an adequate number of outputs for the connection of all the trip units equipped with Ekip Link modules and Ekip Signalling 10K modules configured to communicate via the Link Bus of the installation.

More information on the connections, the equipment of the master and of every type of slave (for example: air , molded-case, miniature circuit-breakers), and examples of applications are provided in the White Paper 1SDC007410G0202 “Load management with Ekip Power Controller for SACE Emax 2”.

Access from the Ekip Connect

Setting the function

Apart from few parameters, the function can only be set via the Ekip Connect software (see the chapter " 17 - Other accessories", and the paragraph "Ekip Connect software").

NOTE: *the parameters for setting the function are available only if the trip unit is equipped with an Ekip Measuring module. In this case, the Advanced Power Controller menu on Ekip Connect is activated, under which the following pages can be selected.*

The function must be enabled in the **Basic settings and information** page of the master.

The following items must be entered in the **Advanced settings and information** page of the master:
- If, on start up, the loads must be considered available, they can be both closed and open, or must be closed, or if they must in any case be considered unavailable until the manual alarm deletion command has been selected in the **Basic settings and information** page.
- During the monitoring period (5 minutes by default. Can be set in the **Unit configuration** page of the general configuration of the release and installation), after how much time the function must be executed (energy at end of period must be estimated and loads must be controlled).
- In relation to this time, the percentage of delay with which loads can be disconnected and connected.
- In the presence of an external time synchronization signal, the master signalling input to which it is connected (input of the Ekip Signalling 4K module installed on the trip unit, or the 2K or 10K modules connected to the trip unit via Local Bus). For more information on synchronization, see the White Paper 1SDC007410G0202 "Load management with Ekip Power Controller for SACE Emax 2".
- Up to ten power limits, of which at least the first one must be set.
- For each day of the week, up to a maximum of four time bands (which must cover a total twenty four hours), and for each time band one of the above-mentioned ten power limits.

The load parameters are set in the **Load parameters** pages of the master (separately for each load):
- If the load has to be disconnected and connected manually, or automatically by the master.
- The priority level, from 1 to 15 (the higher the level, for example 15, the more important the load. The lower the level, for example 1, the less important the load).
- The load type, in other words whether it is a real load or a generator.
- The number (from 0 to 2) and type of information on the state of the slaves on the supply side of the load (open/closed, not available, in tripped position).
- The type of inputs, in other words, how the above state information is supplied (through physical connection of inputs, or via Link Bus using one of the 15 Ekip Link modules that can be associated with the master).
- In case of physical inputs, to which signalling inputs of the master the above state signals are connected.
- The minimum time for which the load must remain connected.
- The minimum time for which the load must remain disconnected.
- The maximum time for which the load can remain disconnected.
- The start time and end time of a possible time slot in the day during which the load cannot be disconnected.

NOTE: *if the non-availability signal of a load is active, the load cannot be disconnected and connected, and therefore it cannot be used for the function until it becomes available again.*

Continued on the next page

Information on the loads

Information about the state of the loads is also available in the **Power Controller advanced settings** page of the master:

- Under Load Requested Status, the desired state of the loads (connected or not) is indicated.
- Under Load Input Status, the actual state of the loads is indicated.
- Under Load Alarm, any non-correspondence between desired state and actual state of the loads is indicated.
- Under Load Active Flags, any non-availability of the loads is indicated.

Setting the Ekip Link module

The Ekip Link modules of both the master and slave must be set correctly in order to control the loads via Link Bus. In detail, in the **Ekip Link configuration** page activated by the Ekip Link module:

- On the master, the IP addresses of the slaves must be inserted.
- On the slaves, the IP address of the master must be inserted.

Setting of the IP address of each actor enables the associated parameters:

- The value "True" must be assigned to the **Power Controller Master** parameter if the actor is to act as a master. Otherwise, the value "False" shall be assigned.
- The value "True" must be assigned to the **Power Controller Energy Meter** parameter if the actor musts end information to the trip unit regarding its own energy consumed (for calculating the total energy of the installation). Otherwise, the value "False" shall be assigned.
- **Selectivity actor**, for which the selectivity function can be enabled for that actor
- **Selectivity Input Selection** in page **Ekip Link diagnosis configuration**, to configure the diagnosis of each active actor.
- **Selectivity selection masks** in page **Ekip Link advanced selectivity**, to configure the protections that must act as locks, specific for each active actor.

NOTE: *by default, all the actors are set as slaves, therefore the trip unit for which the Ekip Link is being set is the master of the function (which is, however, not activate unless it is enabled on the Advanced Information and Settings page).*

Setting the signalling modules

The inputs and the outputs of the signalling modules must be configured appropriately. For details, see chapters “4 - Ekip Signalling 4K module” and “5 - Ekip Signalling 2K modules”, and the manual **1SDH001318R0002** of the Ekip Signalling 10K modules.

In particular, the outputs must be configured:

- By selecting the value “Custom” for the Signal Source parameter and the load to which the output is to be bound from the PC Load Output Status lists: the output will be enabled in order to connect the load or the generator, and disabled in order to disconnect it.
- By setting an activation delay of at least 1 second.
- By selecting the value “Power Controller” for the min activation time parameter, if you wish the closing command to be impulsive.

Wizard

To facilitate the setting of the function, under the heading "Tools" in the menu, the Ekip Connect software provides the Power Controller wizard, which guides the user step by step and automatically creates configurations based on the choices made by the operator.

Access from the display

For the parameters to be set and the information regarding the function available on the display, see the chapter “23 - Ekip Power Controller".

3 - 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 Ekip Measuring Pro 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 "3 - Ekip Synchrocheck module"), 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 chapters "9 - Touch protections" "10 - Measuring Pro protections" "12 - G Touch protections" and " 13 - G Hi-Touch protections".

Compatibility

The protections may already be available in Ekip LCD and Ekip Touch trip units (with Ekip Measuring Pro module, see the chapter "2 - Ekip Measuring modules") or Ekip Hi- (LCD and Touch) trip units, or only Ekip G or G Hi- trip units (LCD and Touch). To identify the trip units in which the protections are available, see the chapter "1 - Presentation" and the paragraph "Families and functionality", and the chapter "6 - Menu" and the paragraph "Advanced menus".

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 30) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 31 for IEC and Figure 32 for UL) and of a fixed part (see Figure 33 for IEC and Figure 34 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.

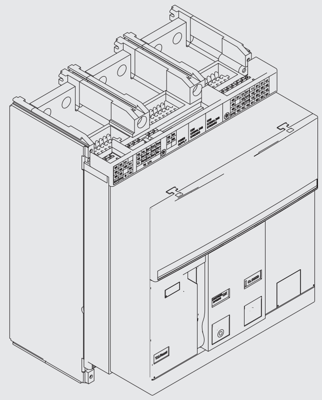


Figure 30

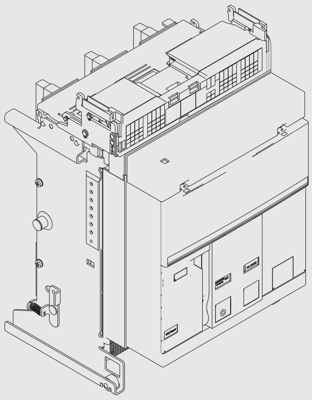


Figure 31

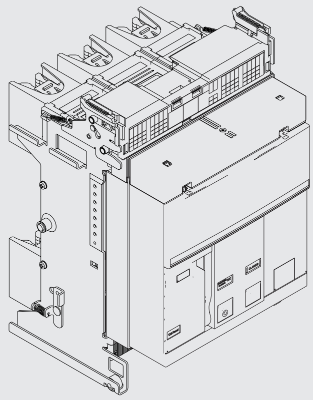


Figure 32

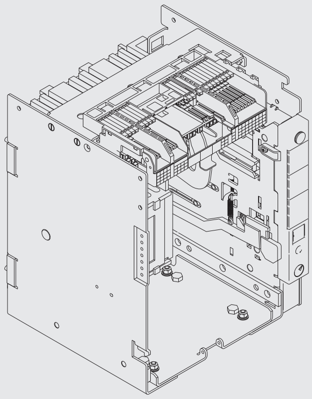


Figure 33

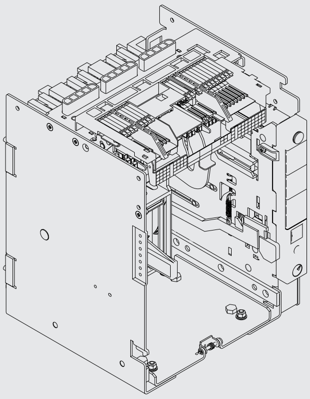


Figure 34

Description of the circuit-breaker front panel

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

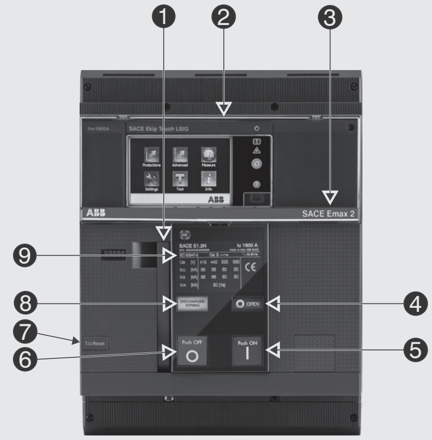


Figure 35

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

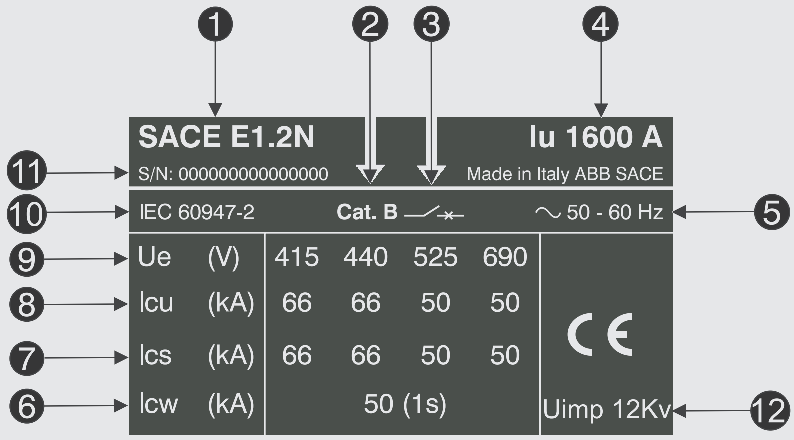


Figure 36

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 37

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 38.
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 39.

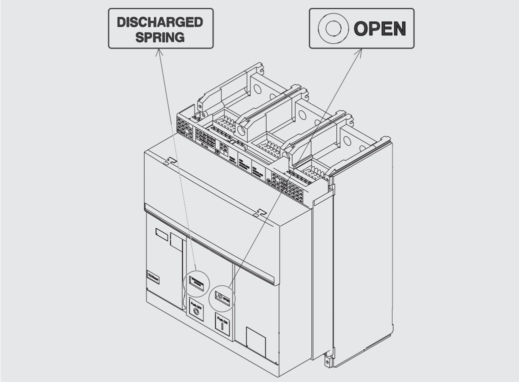


Figure 38

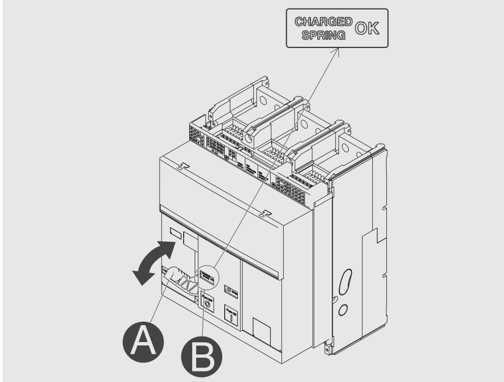


Figure 39

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 40.
4. Closing - Press the closing pushbutton "I - Push ON" as indicated in Figure 41.

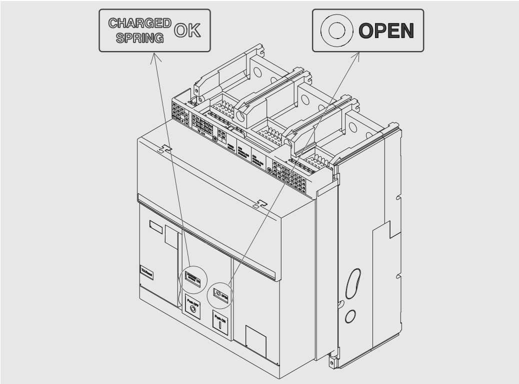


Figure 40

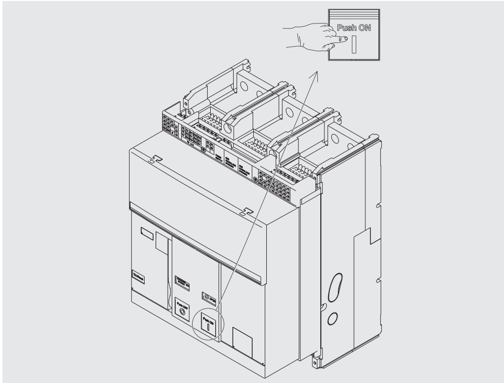


Figure 41

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 42.
6. Opening - Press the opening pushbutton "O - Push OFF" as indicated in Figure 43.

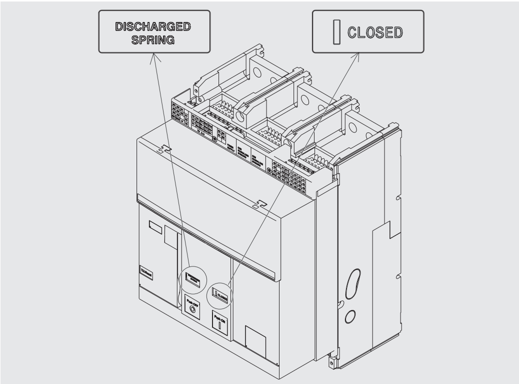


Figure 42

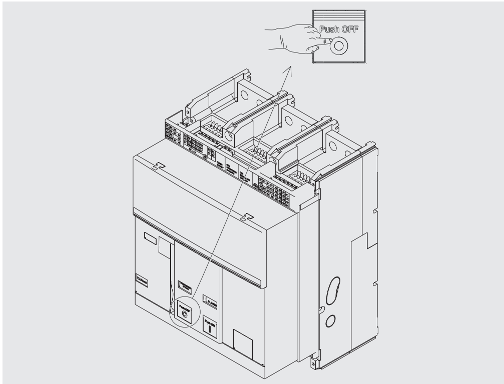


Figure 43

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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 44.

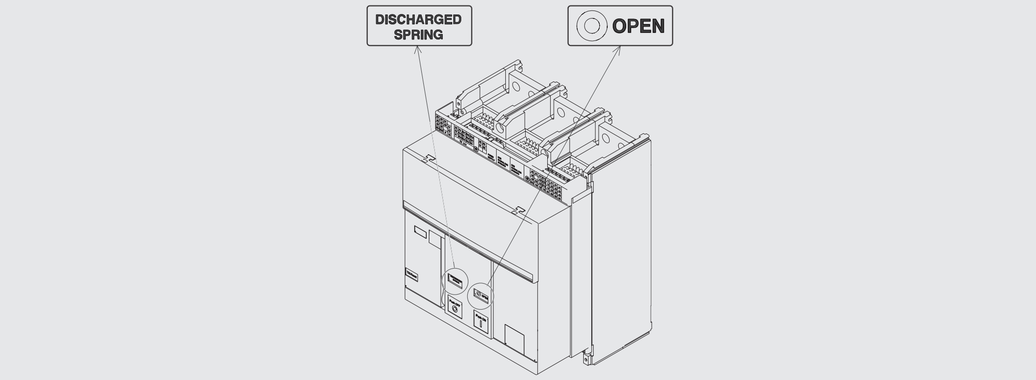

Figure 44

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 45).
2. Circuit-breaker open with springs charged (see Figure 46).
3. Circuit-breaker closed with springs discharged (see Figure 47).
4. Circuit-breaker closed with springs charged (see Figure 48). This state occurs when after closing (see step 4 - Figure 48) the springs are recharged manually or automatically by the gearmotor (if provided).

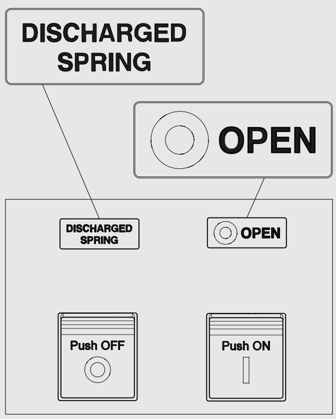

Figure 45

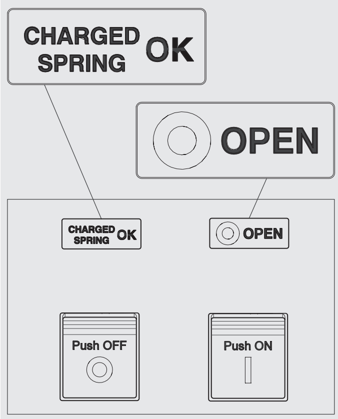

Figure 46

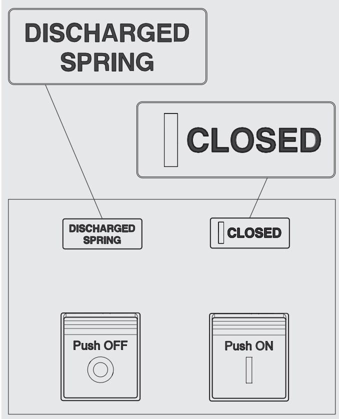

Figure 47

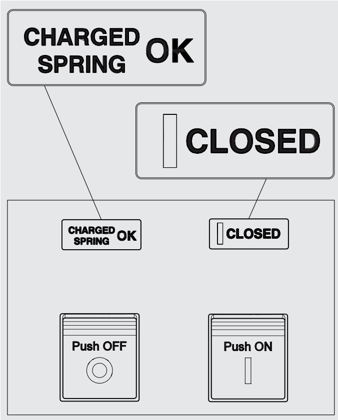

Figure 48

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.

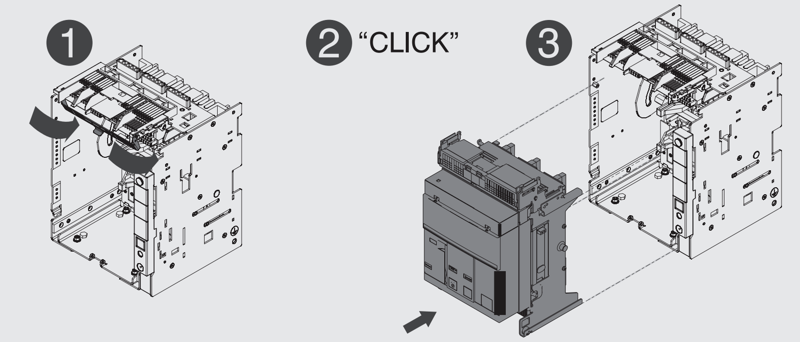

Figure 49

2. Make sure that signalling device on the fixed part indicates the **DISCONNECT** position. See Figure 50.

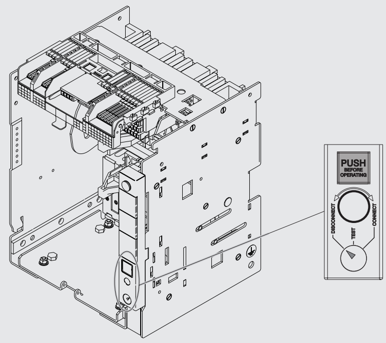

Figure 50

3. Position the moving part in the fixed part and push until it comes to a stop. See Figure 51 and Figure 52.

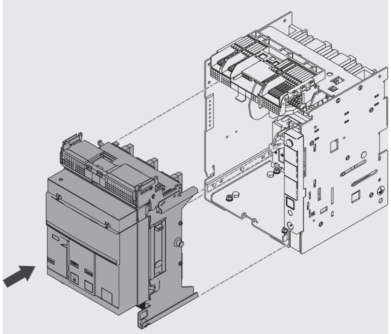

Figure 51

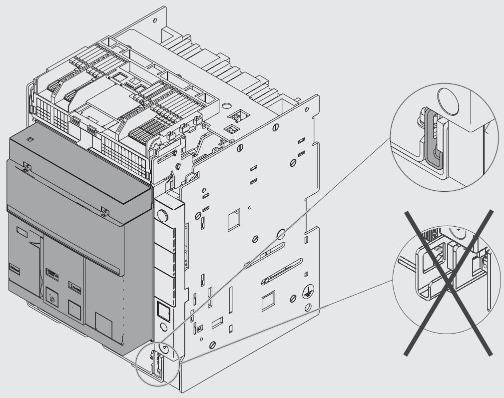

Figure 52

Continued on the next page

4. Extract the disconnection crank from its housing See Figure 53.
5. Press the lock pushbutton and insert the crank in the moving part. In this phase the moving part is still in **DISCONNECT** position. See Figure 54.

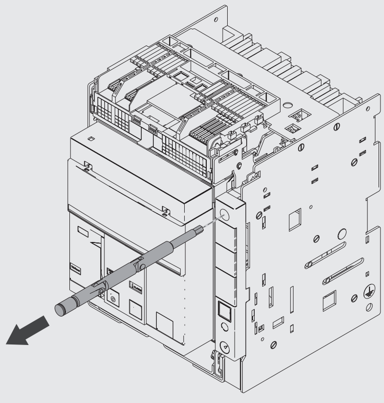

Figure 53

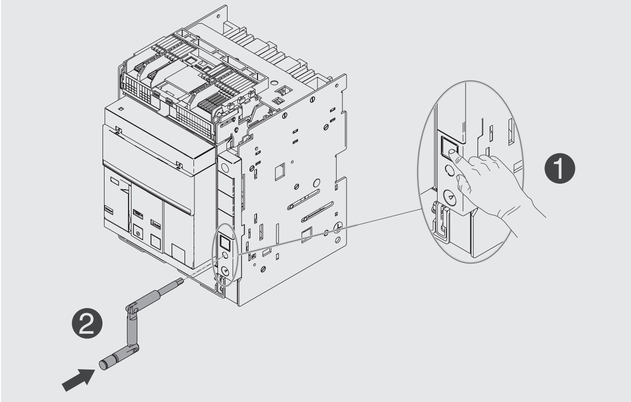

Figure 54

6. Turn the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **TEST** position. See Figure 55.

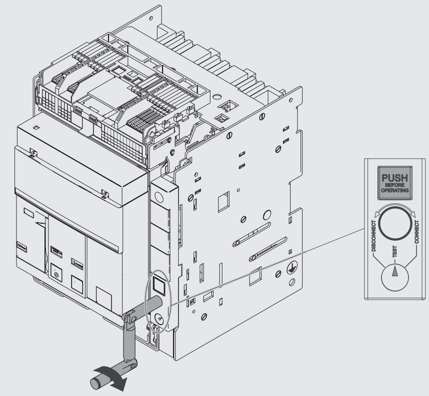

Figure 55

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 56.

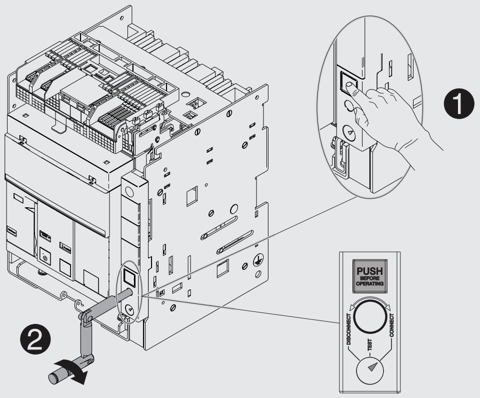

Figure 56

Continued on the next page

8. Extract the crank. See Figure 57.
9. Replace the crank in its housing See Figure 58.

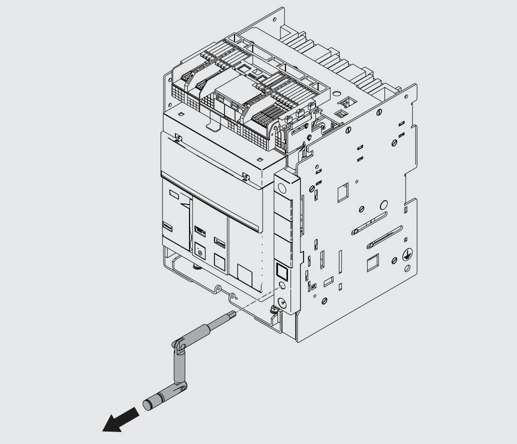

Figure 57

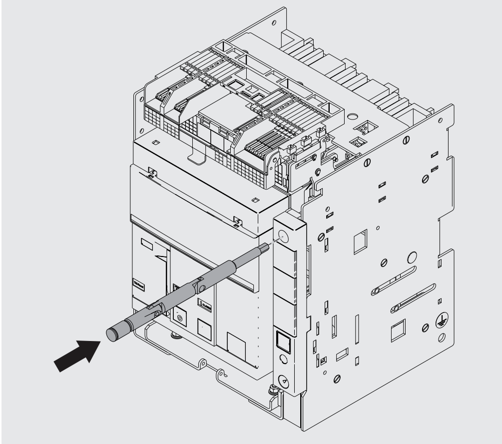

Figure 58

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 59.

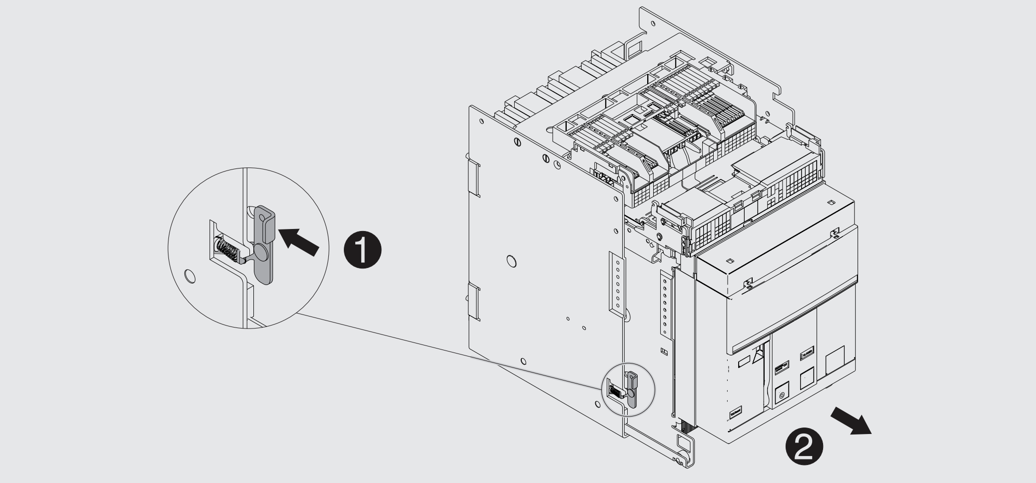

Figure 59

WARNING! The inserted circuit-breaker must be opened in order to be able to reach the test position Discharge the springs before removing the circuit-breaker from the fixed part. On the UL version, the fail safe prevents the removal of the circuit-breaker from the fixed part with springs charged. For further information see chapter "2 - Mechanical safety accessories" on page 306.

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 60).
- circuit-breaker in test position (see Figure 61).
- circuit-breaker in CONNECT position (see Figure 62).

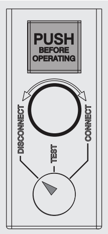

Figure 60

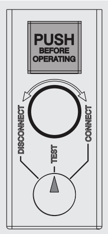

Figure 61

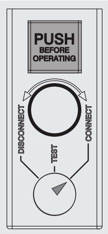

Figure 62

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 63) has its own terminals for connection to the power circuit.

The withdrawable circuit breaker consists of a mobile part (see Figure 64) and of a fixed part (see Figure 65 for IEC and Figure 66 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.

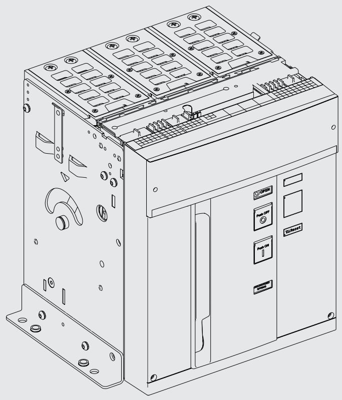

Figure 63

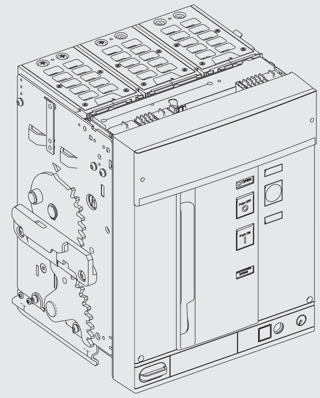

Figure 64

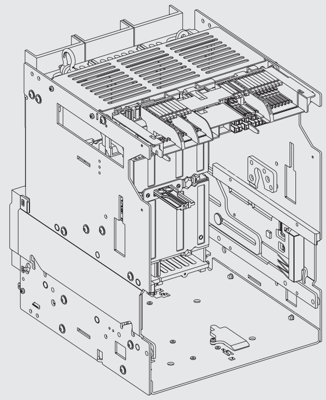

Figure 65

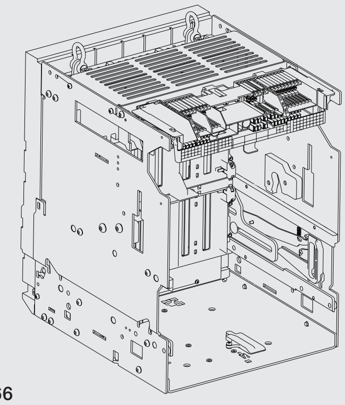

Figure 66

Description of the circuit-breaker front panel

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

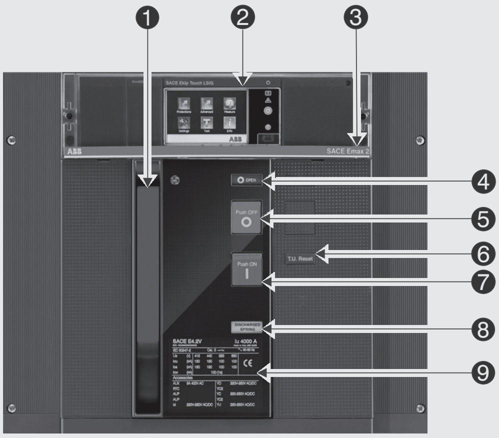

Figure 67

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

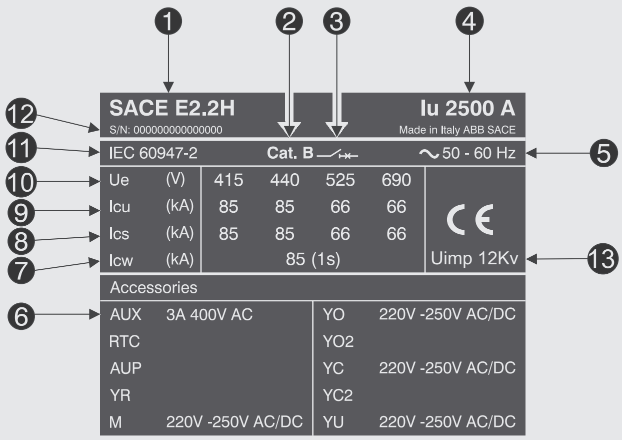

Figure 68

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

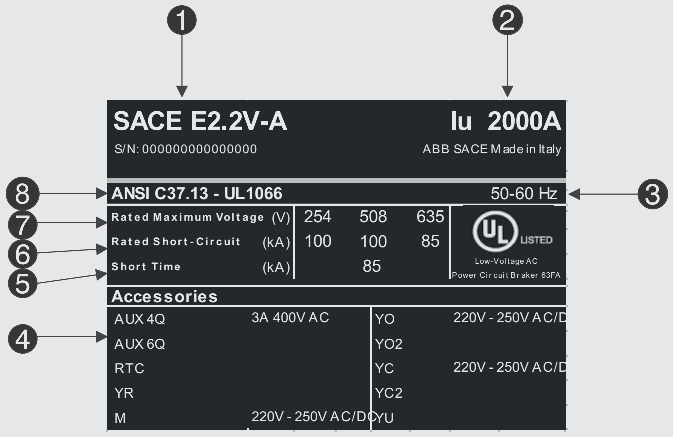

Figure 69

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 70.
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 71.

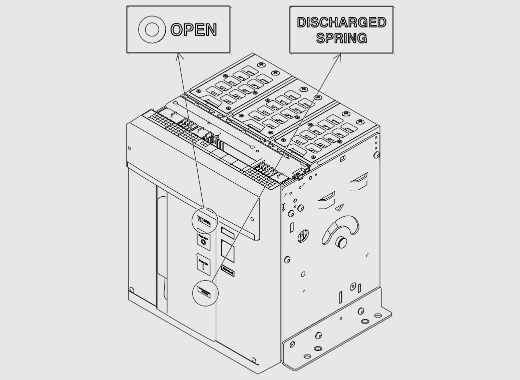

Figure 70

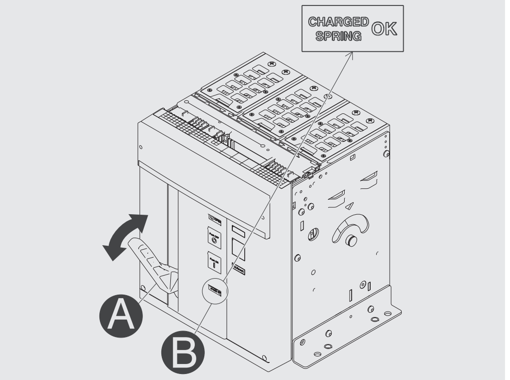

Figure 71

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 72.
4. Closing - Press the closing pushbutton “I - Push ON” as indicated in Figure 73.

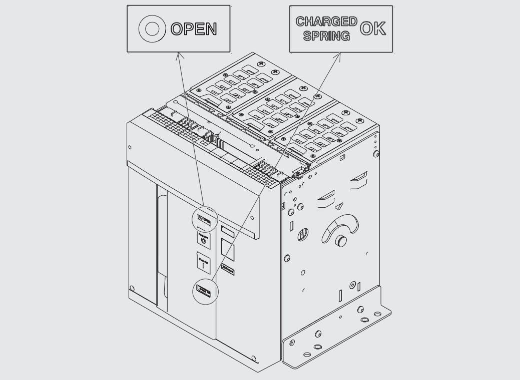

Figure 72

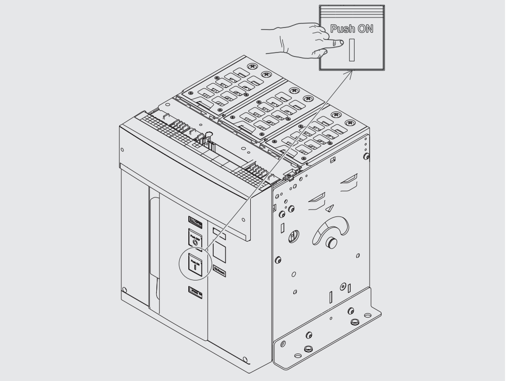

Figure 73

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 74.
6. Opening - Press the opening pushbutton “O - Push OFF” as indicated in Figure 75.

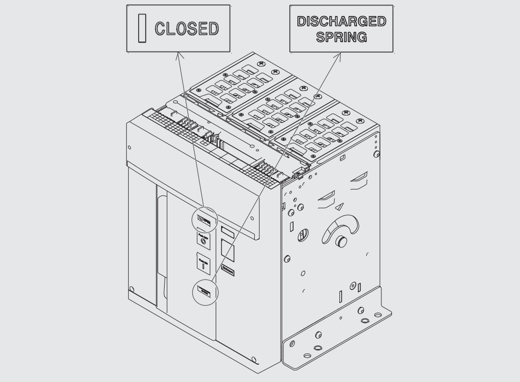

Figure 74

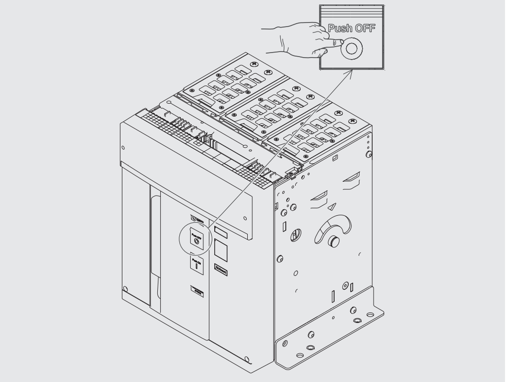

Figure 75

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 76.

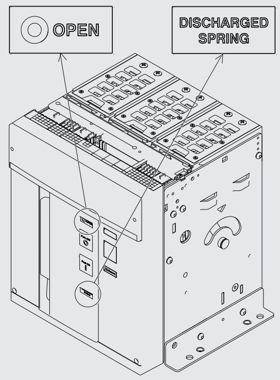

Figure 76

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 77).
2. Circuit-breaker open with springs charged (see Figure 78).
3. Circuit-breaker closed with springs discharged (see Figure 79).
4. Circuit-breaker closed with springs charged and not ready to close (see Figure 80). 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 81). 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.*

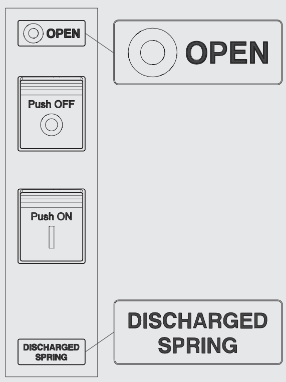

Figure 77

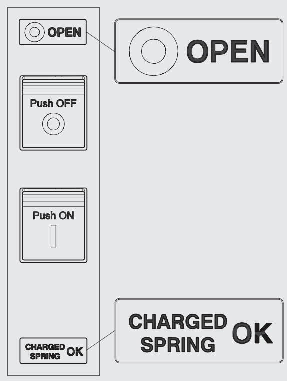

Figure 78

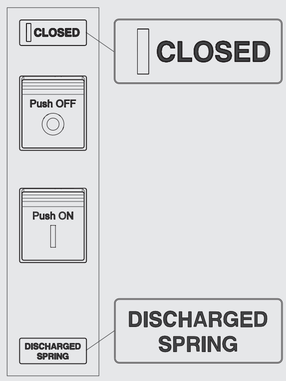

Figure 79

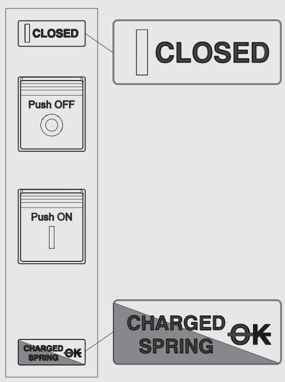

Figure 80

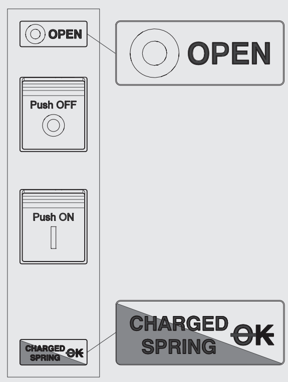

Figure 81

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.

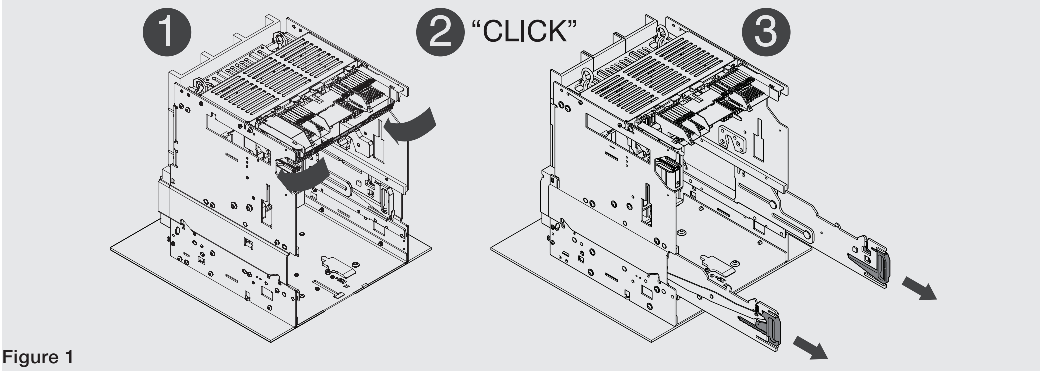

Figure 1

2. Position the lifting plates on the mobile part making sure that the tongue of the plates is latched properly. See Figure 82.

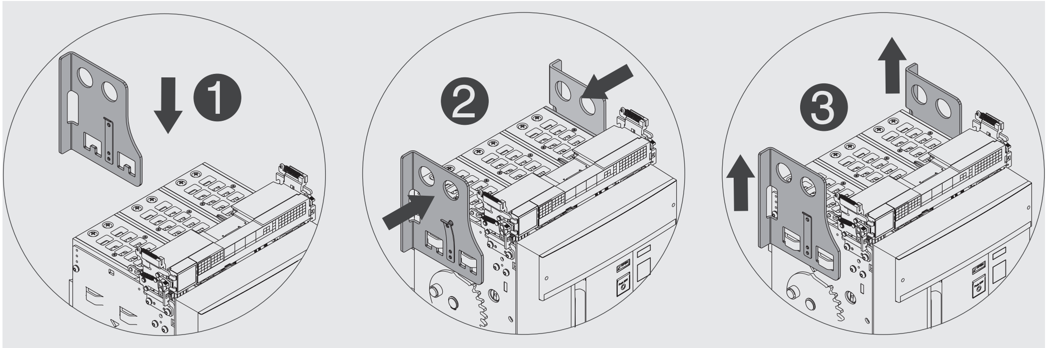

Figure 82

3. Extract the guides of the fixed part using the appropriate levers. See Figure 83.
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 84.

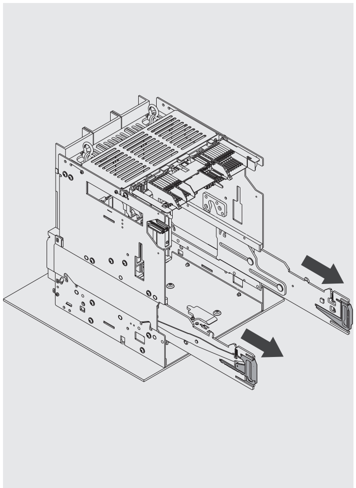

Figure 83

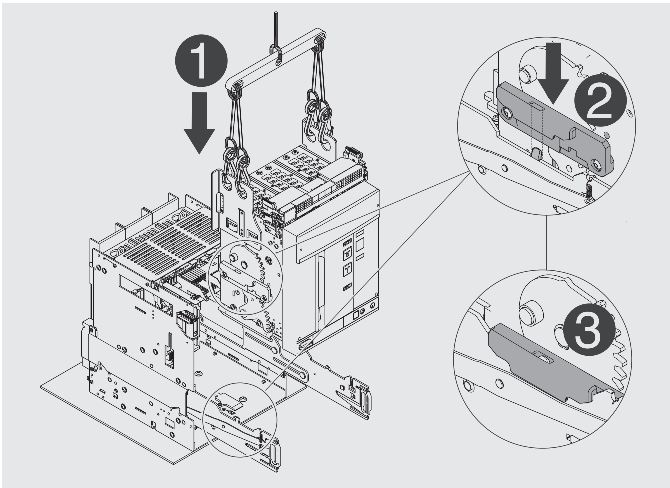

Figure 84

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5. Unlatch the tongue and remove the lifting plates from the moving part. See Figure 85.

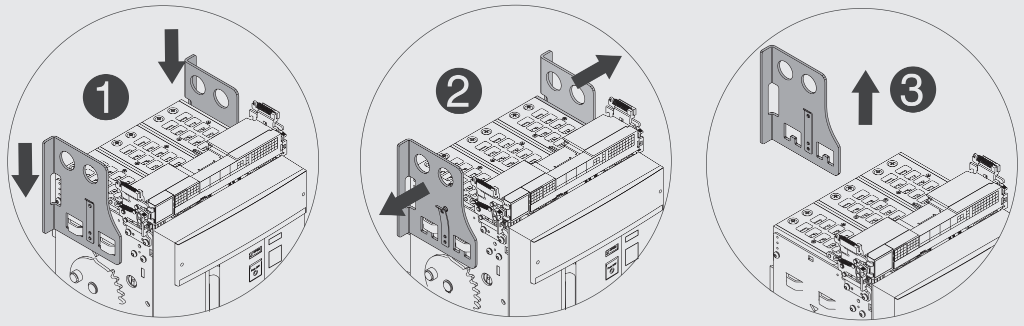

Figure 85

6. Make sure that the signalling device indicates the **DISCONNECT** position. See Figure 86.

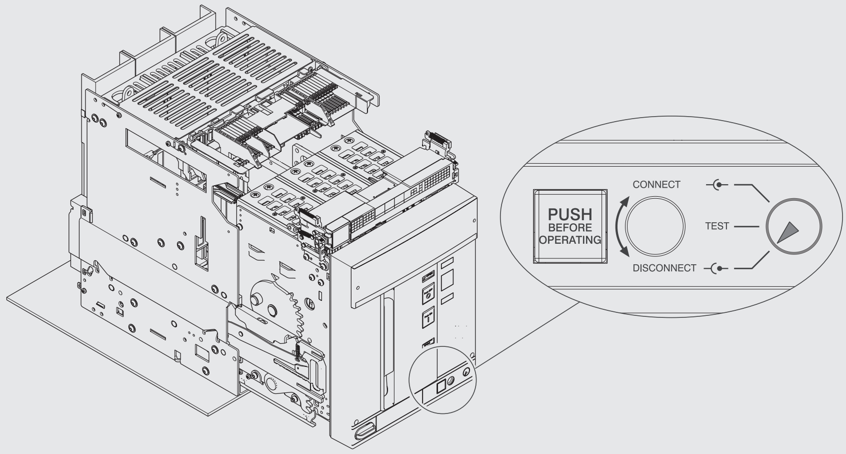

Figure 86

7. Grip the guide levers of the fixed part and push them until the moving part stops. See Figure 87.

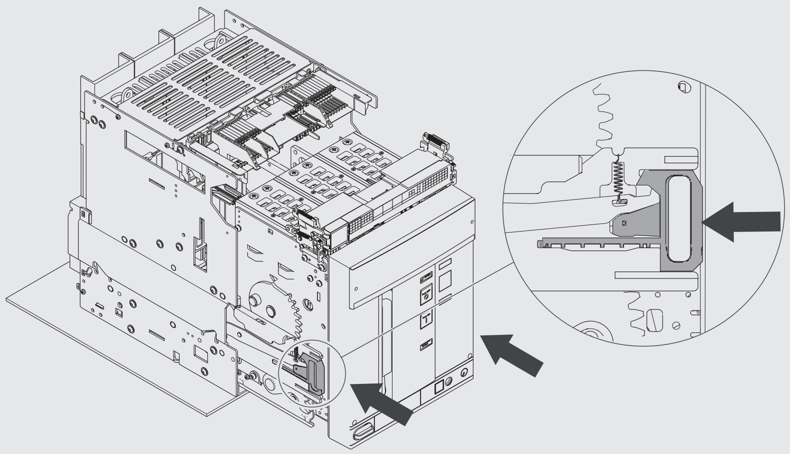

Figure 87

Continued on the next page

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8. Extract the disconnection crank from its housing See Figure 88.
9. Press the lock pushbutton and insert the crank in the moving part. In this phase the moving part is still in **DISCONNECT** position. See Figure 89.

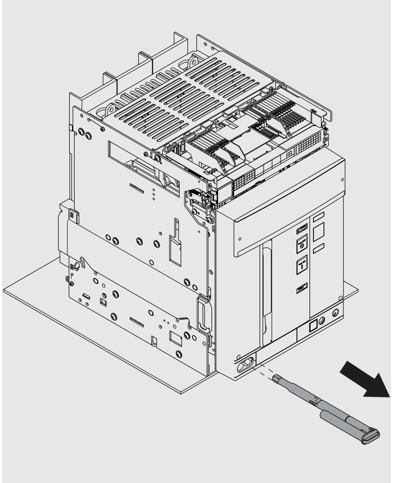


Figure 88

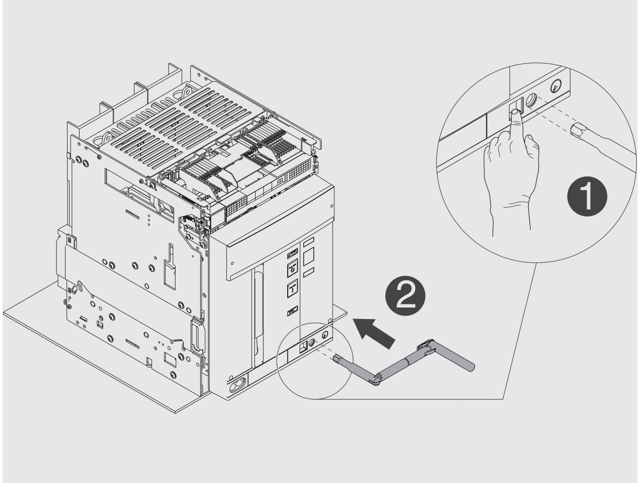


Figure 89

10. Turn the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **TEST** position. See Figure 90.

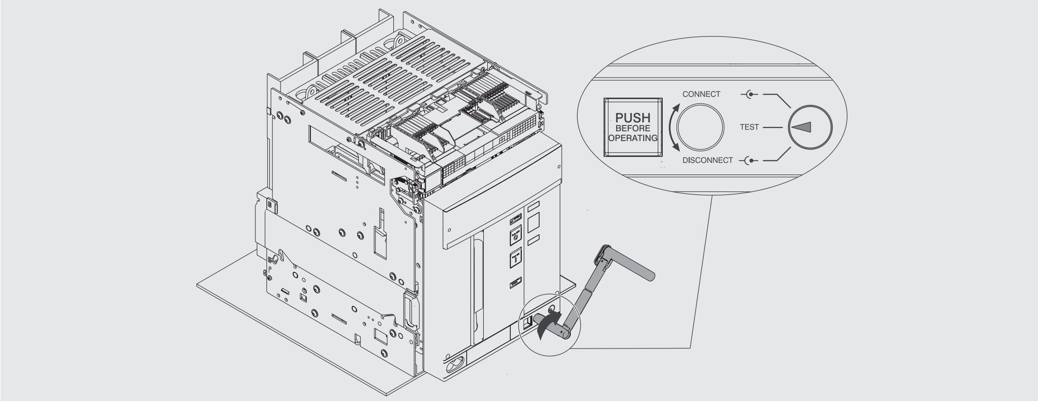


Figure 90

11. Press the lock button and rotate the crank clockwise until it comes out and the indicator shows that the circuit-breaker is in **CONNECT** position. See Figure 91.

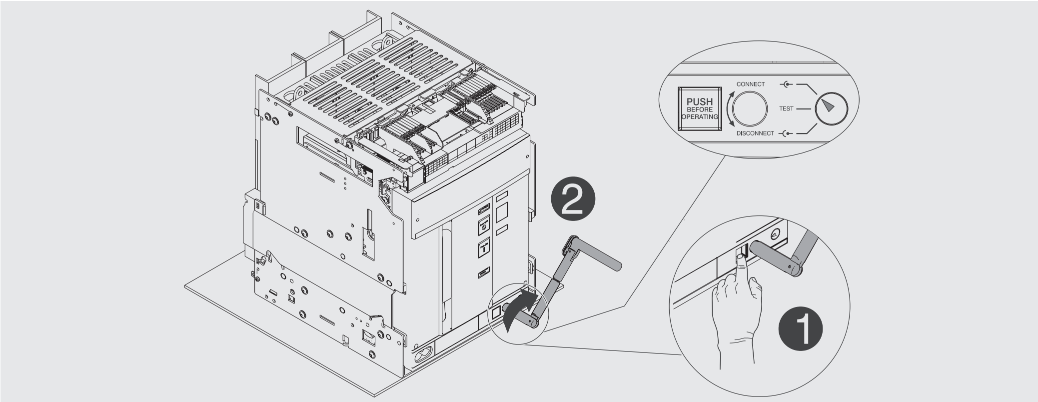


Figure 91

Continued on the next page

12. Extract the crank. See Figure 92.
13. Replace the crank in its housing See Figure 93.

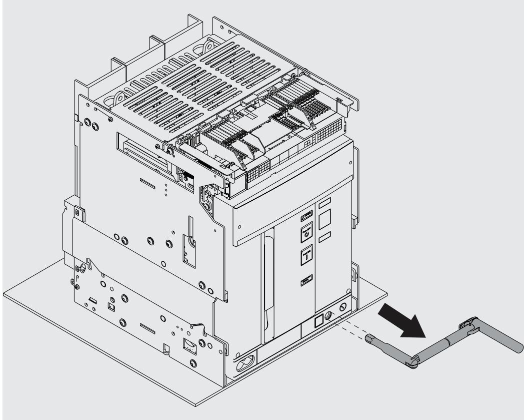


Figure 92

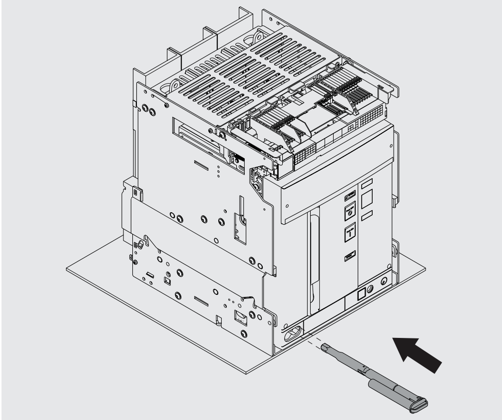


Figure 93

WARNING! The inserted circuit-breaker must be opened in order to be able to reach the test position Discharge the springs before removing the circuit-breaker from the fixed part. On the UL version, the fail safe prevents the removal of the circuit-breaker from the fixed part with springs charged. For further information see chapter "2 - Mechanical safety accessories" on page 306.

WARNING! The inserted circuit-breaker must be opened in order to be able to reach the test position Discharge the springs before removing the circuit-breaker from the fixed part.

To extract the moving part from the fixed part, perform the same steps indicated for insertion in reverse order.

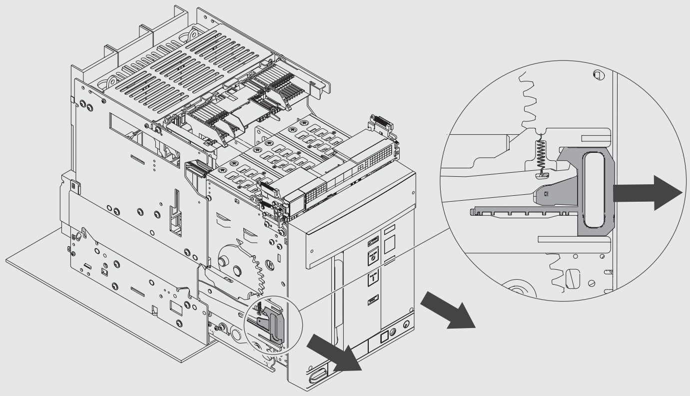


Figure 94

Continued on the next page

Always use both levers of the guides on the fixed part when racking out the circuit-breaker. See Figure 94.

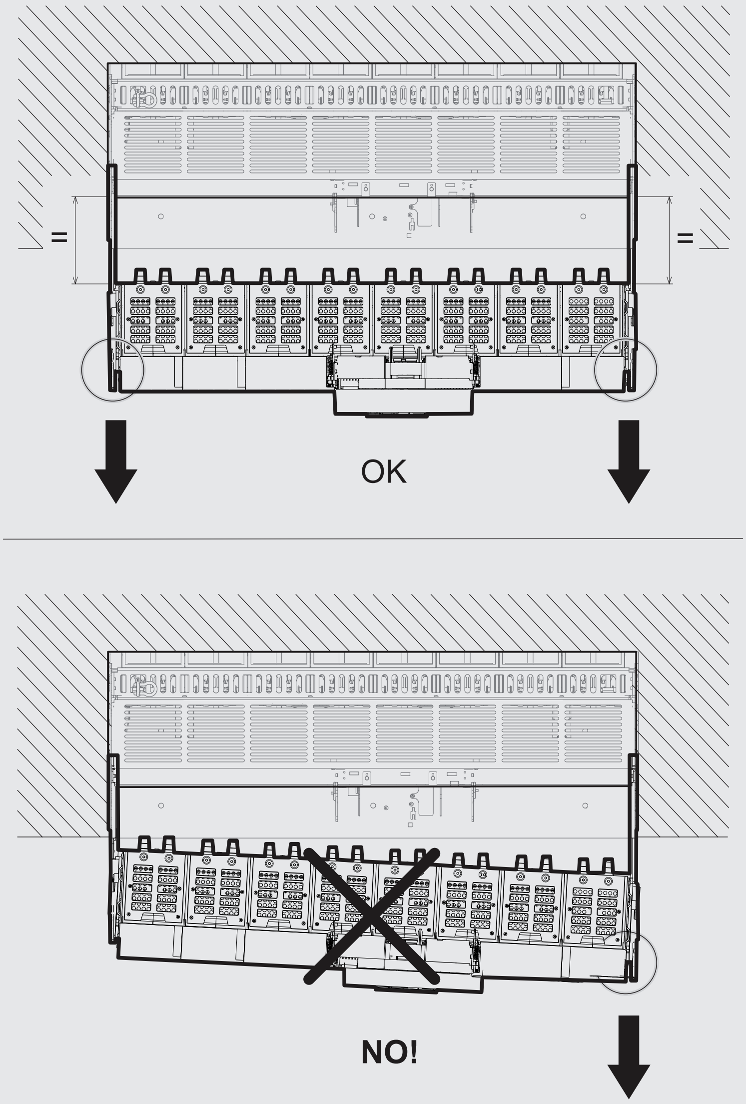


Figure 95

⚠ **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 95.**

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 96)
- circuit-breaker in test position (see Figure 97)
- circuit-breaker in CONNECT position (see Figure 98)

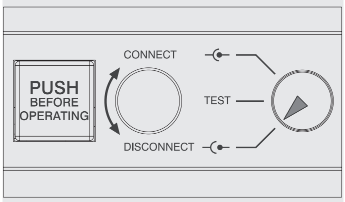


Figure 96

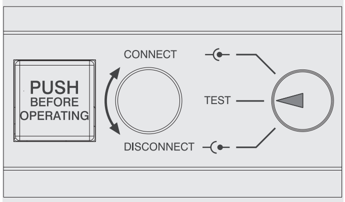


Figure 97

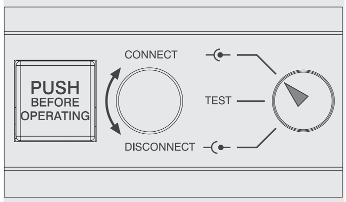


Figure 98

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 185 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

E1.2 Dimensions

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:

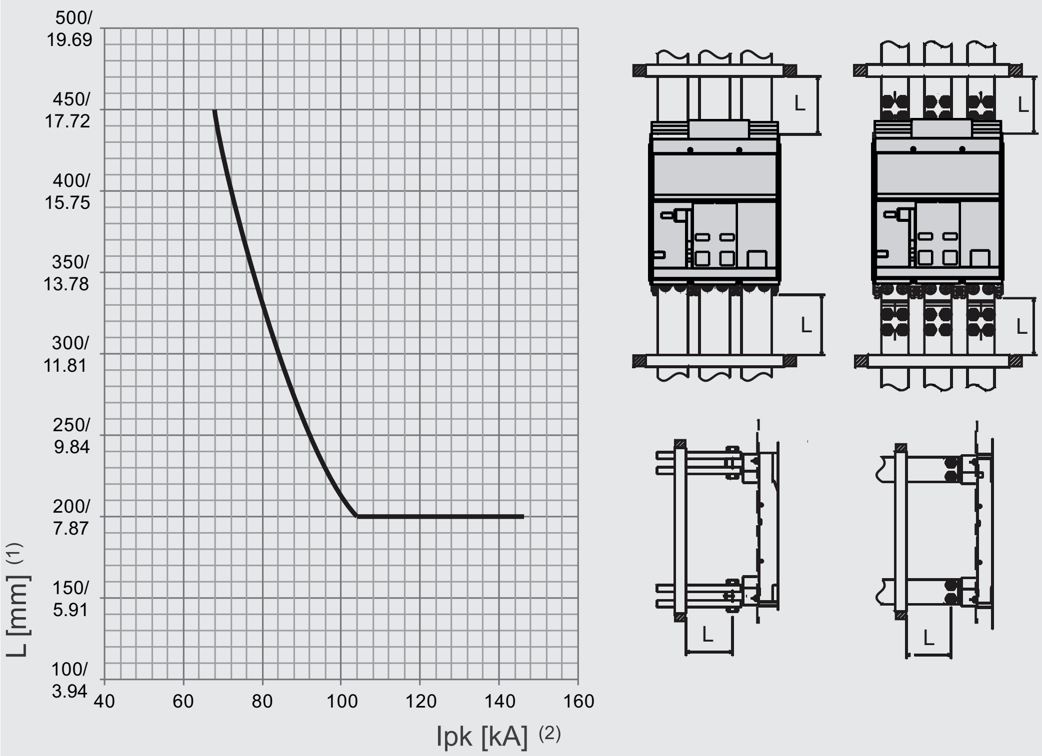


Figure 99

(1): distance of the first anchor plate from the circuit-breaker terminals
(2): peak current

E2.2-E4.2-E6.2 Dimensions

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:

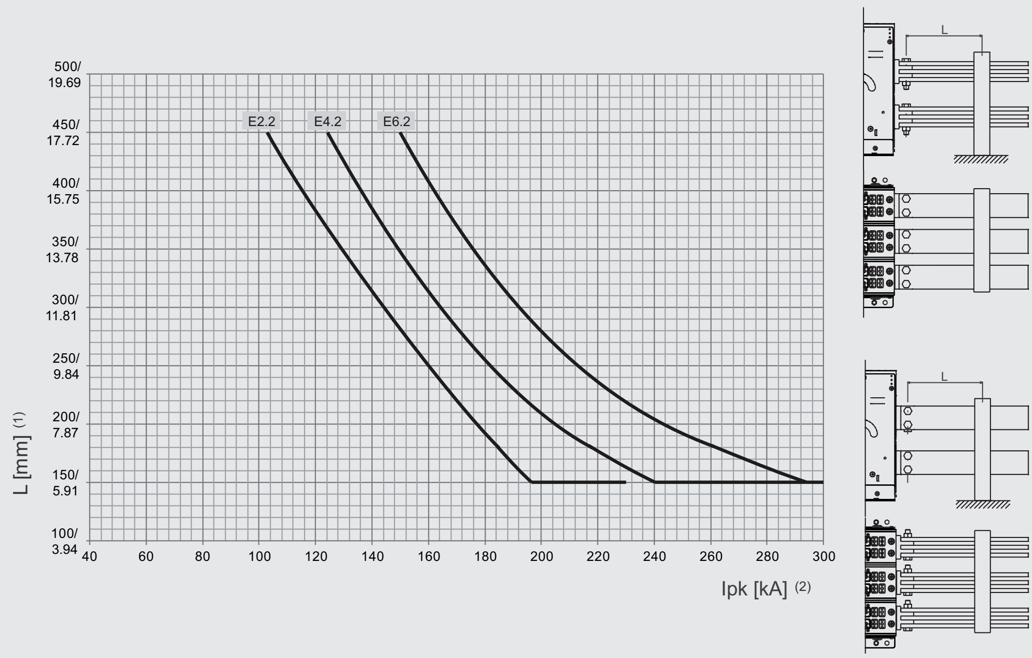


Figure 100

(1): distance of the first anchor plate from the circuit-breaker terminals
(2): peak current

Positioning anchor plates E4.2 3600A

The anchor plates for E4.2 3600A circuit-breakers must be positioned as indicated in the figure.

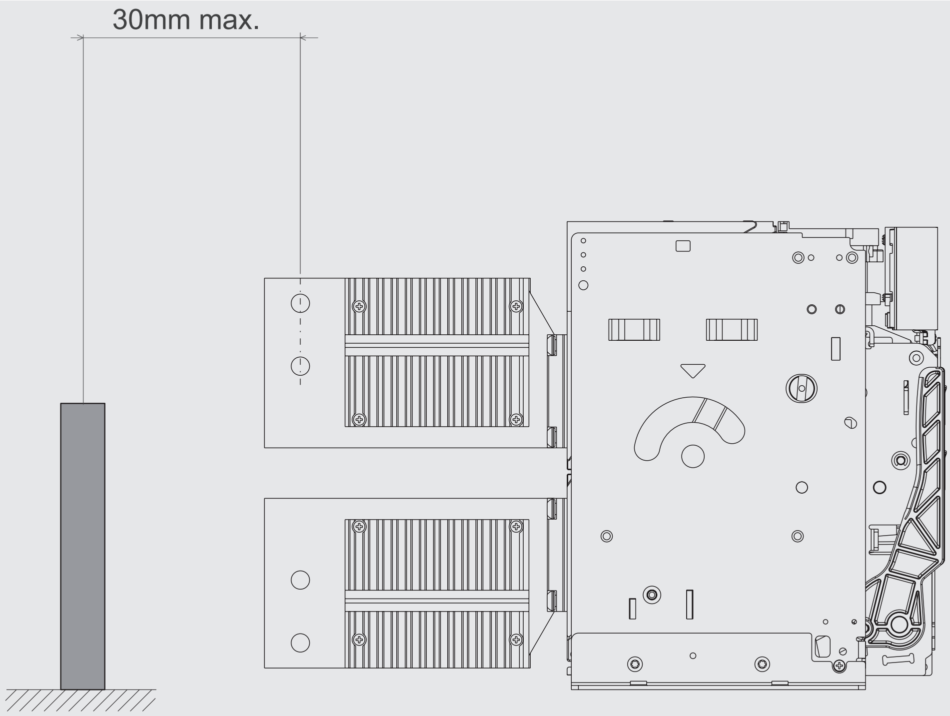


Figure 101

>690V version circuit-breakers

Insulating protections must be assembled for >690V circuit-breakers as indicated in the figure.

Circuit-breaker	Voltage	Version	Fixed protection	Withdrawable protection
E2.2/E9	800V/900V	F	X	-
		W	-	-
E2.2/E	1000V/1150V	F	X	-
		W	-	X
E4.2/E9	800V/900V	F	X	-
		W	-	-
E4.2/E	1000V/1150V	F	X	-
		W	-	X
E6.2/E9	800V/900V	F	X	-
		W	-	-
E6.2/E	1000V/1150V	F	X	-
		W	-	X

Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0746 for fixed circuit-breakers and in the kit sheet 1SDH001000R0747 for withdrawable circuit breakers.

Earthing (solo E2.2-E4.2-E6.2)

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 Nm - 17.7 lb in.

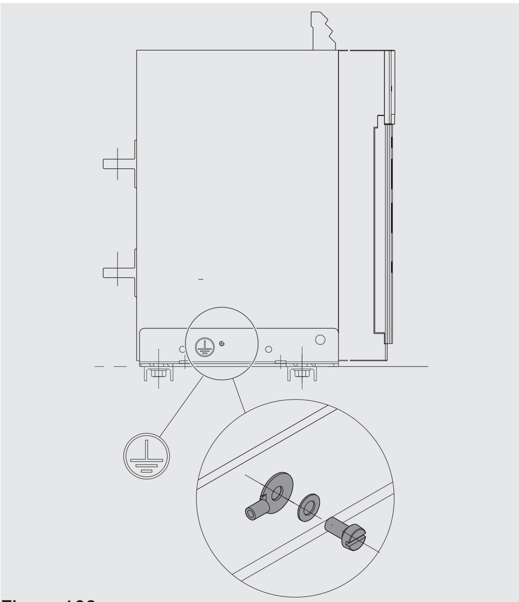


Figure 102

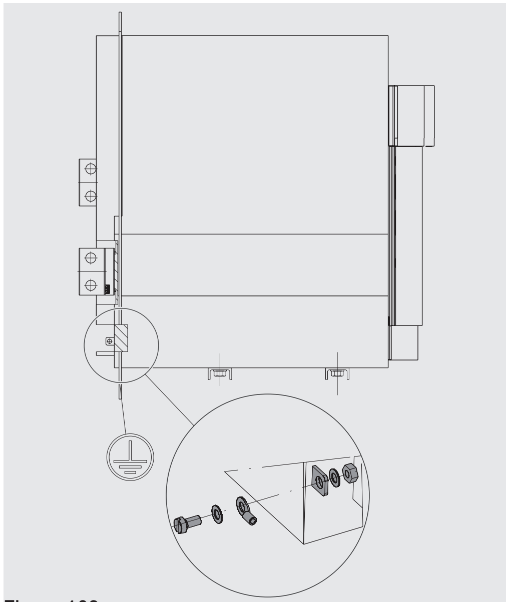


Figure 103

Clearances

Information on clearances is available on the website:

http://www.abb.com/abblibrary/DownloadCenter/.

The following drawing is also available in .dxf format: 1SDH001301R0001 - Cubicle E1.2-E2.2-E4.2-E6.2

Phase separators (for E2.2-E4.2-E6.2 only)

Phase separators are available on request. Alternatively, it is possible to position the insulation barriers to segregate 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 >690V.

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:

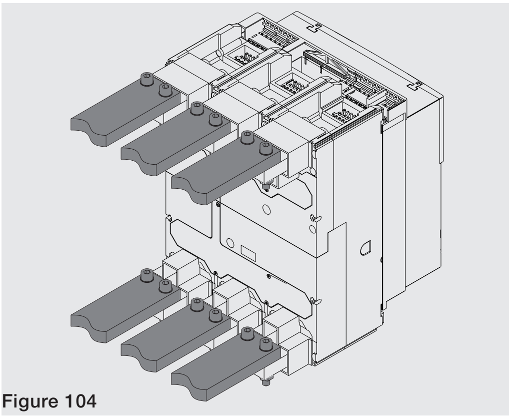


Figure 104

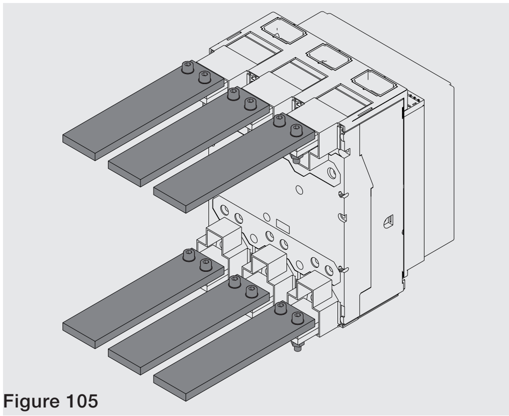


Figure 105

circuit-breaker IEC 60947	Iu (A)	Dimension of busbars (mm)	Horizontal terminals	Vertical terminals
E1.2	630	2x40x5	yes	yes
E1.2	800	2x50x5	yes	yes
E1.2	1000	2x50x10	yes	-
		2x50x8	-	yes
E1.2	1250	2x50x10	yes	-
		2x50x8	-	yes
E1.2	1600	3x50x8	yes	-
		2x50x10	-	yes

circuit-breaker UL 1066	Iu (A)	Dimension of busbars (inches)	Horizontal terminals	Vertical terminals
E1.2-A	800	1x1/4x3	-	yes
		2x1/4x2	yes	-
E1.2-A	1200	2x1/4x2	-	yes
		3x1/4x2	yes	-

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:

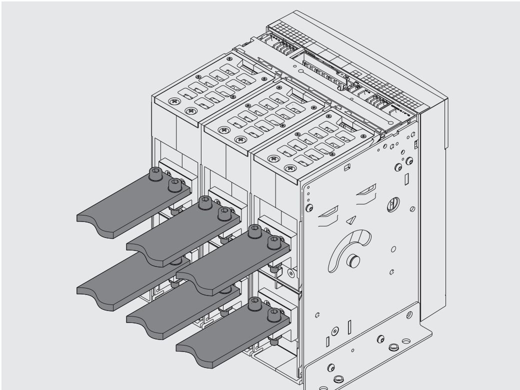


Figure 106 IEC

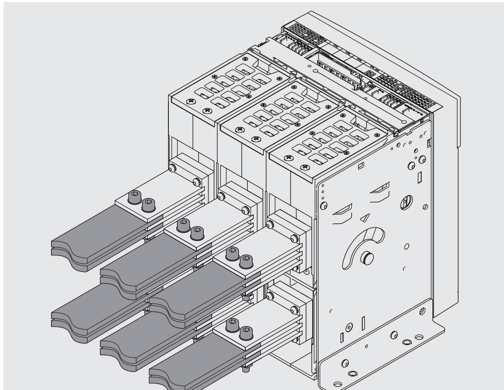


Figure 107 UL

circuit-breaker IEC 60947	Iu (A)	Dimension of busbars	Horizontal terminals	Vertical terminals
E2.2	800	1x50x10	yes	yes
	1000	2x50x5	yes	yes
	1250	2x50x10	yes	yes
	1600	2x60x10	yes	-
		1x100x10	-	yes
	2000	3x60x10	yes	-
		2x80x10	-	yes
		3x60x10 (1)	yes	-
		2x80x10 (1)	-	yes
	2500	3x60x10	yes	-
		4x100x5	-	yes
		3x60x10 (1)	yes	-
		4x100x5 (1)	-	yes
E4.2	2000	2x80x10	yes	yes
	2500	2x100x10	yes	yes
	3200	3x100x10	yes	yes
	4000	4x100x10	yes	yes
E6.2	4000	4x100x10	yes	yes
	5000	5x100x10	yes	yes
	6300	6x100x10	yes	yes

(1) values for spread terminals

circuit-breaker UL 1066	Iu (A)	Dimension of busbars	Horizontal terminals	Vertical terminals
E2.2-A	1600	3x1/4x2	-	yes
		4x1/4x2	yes	-
		3x1/4x2.5	yes	-
		2x1/4x3	-	yes
	2000	4x1/4x2	-	yes
		4x1/4x2.5	yes	-
E4.2-A	2000	4x1/4x2	-	yes
		4x1/4x2.5	yes	-
	2500	3x1/4x4	-	yes
		4x1/4x4	yes	-
	3200	4x1/4x4	-	yes
E6.2-A	4000	4x1/4x5	yes	yes
	5000	6x1/4x5	-	yes
		8x1/4x5	yes	-

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 108.
- Guarantee the maximum use of the surface of the terminal. See the example Figure 109.
- 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 110.
- 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 111.

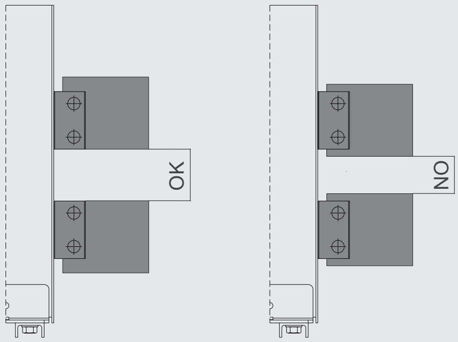


Figure 108

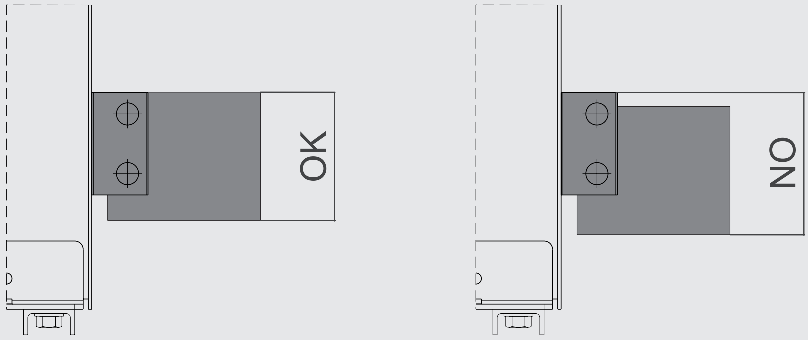


Figure 109

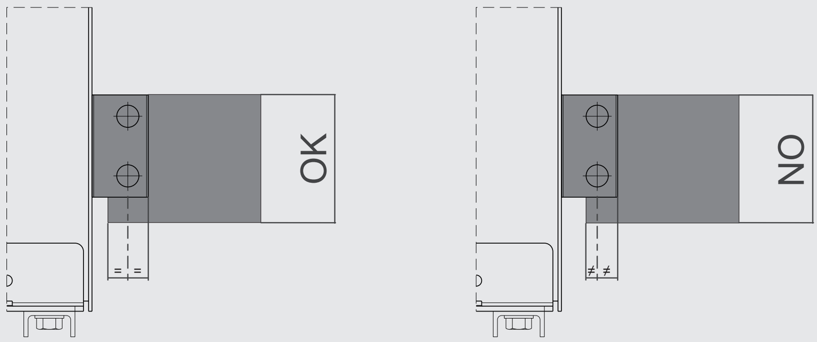


Figure 110

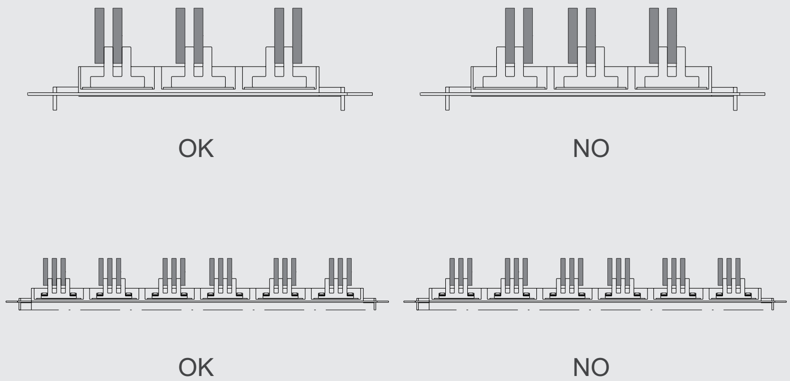


Figure 111

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											395	536		
4000A											476	646	476	646
5000A											700	950	700	950

(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%

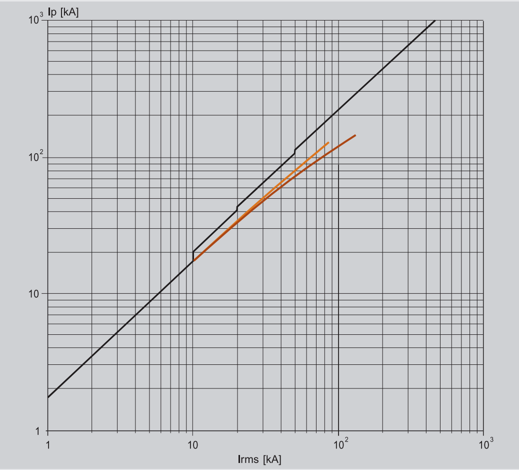
Emax 2 E6.2	Temperature [°C]						
	< 40	45	50	55	60	65	70
E6.2 4000	100%	100%	100%	100%	100%	100%	100%
E6.2 5000	100%	100%	100%	100%	100%	98%	95%
E6.2 6300	100%	100%	95%	91%	87%	84%	81%

Current limiting curve

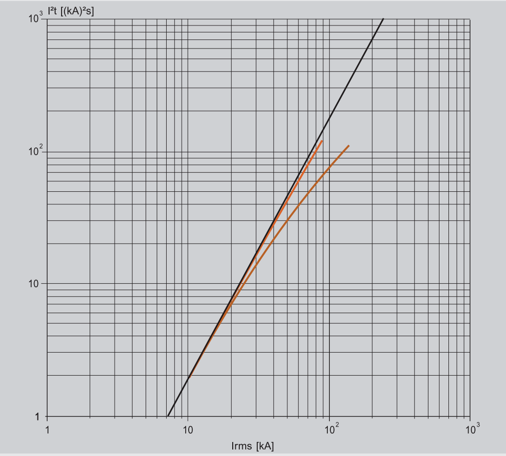
SACE Emax 2 series offer current-limiting circuit-breakers in E1.2 size up to 1600 A. These circuit-breakers are characterized from the constructional point of view by the following features:

- 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 - Preliminary considerations

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.

Accessory combination tables

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.

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	-	-	-
Interlocks	MI (5)	R	R	-	-	R

Continued on the next page

Type of accessory	Accessory	Circuit-breakers	Switch-disconnectors	Derived versions		
				CS	MV	MTP
Electrical control	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

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 Bluetooth	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	Ekip Measuring	-	R	-	-	-
	Ekip Measuring Pro	-	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.*

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).

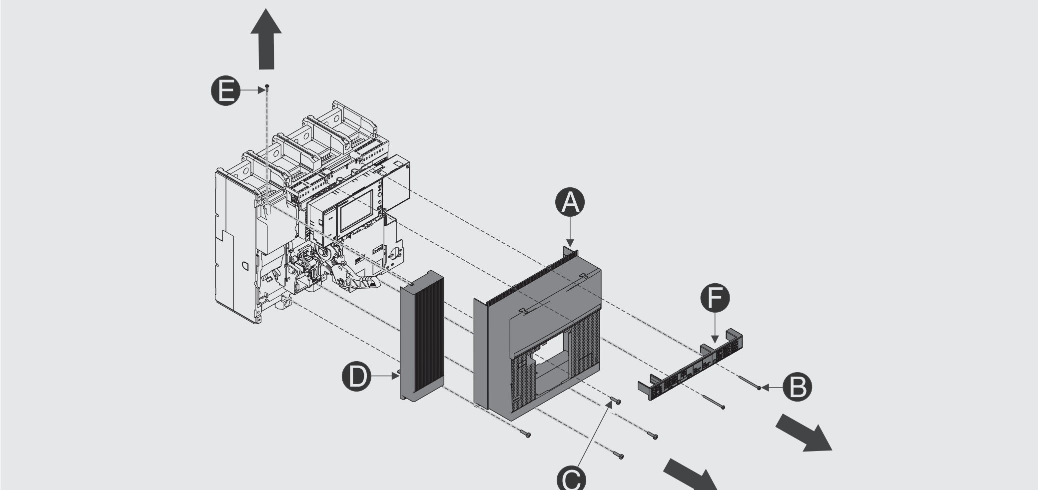


Figure 112 - Removing the front cover and protections

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.

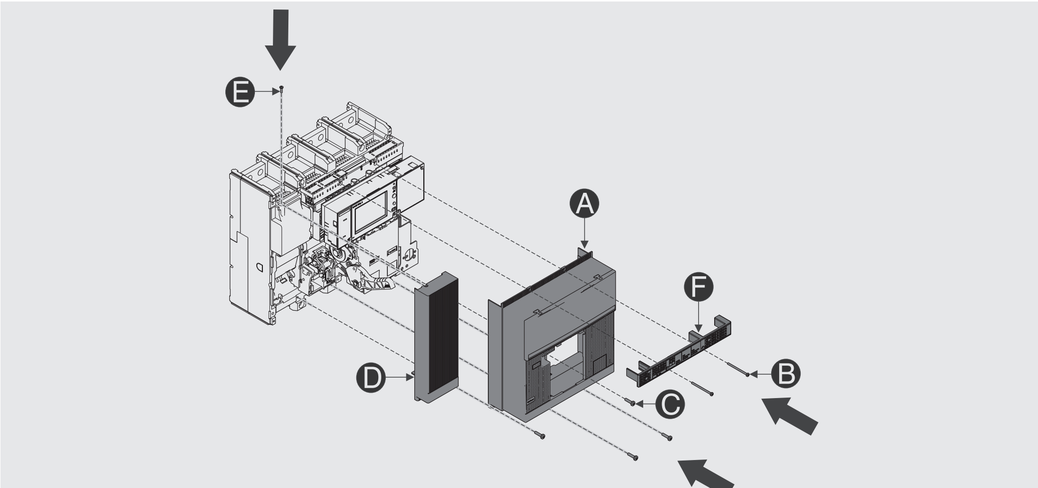


Figure 113 - Assembly of front cover and protections

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).

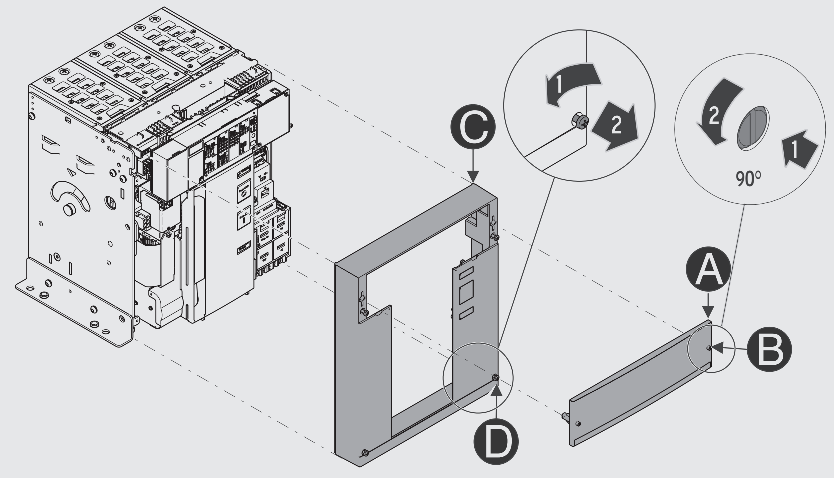


Figure 114 - Removing the flange and front cover

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).

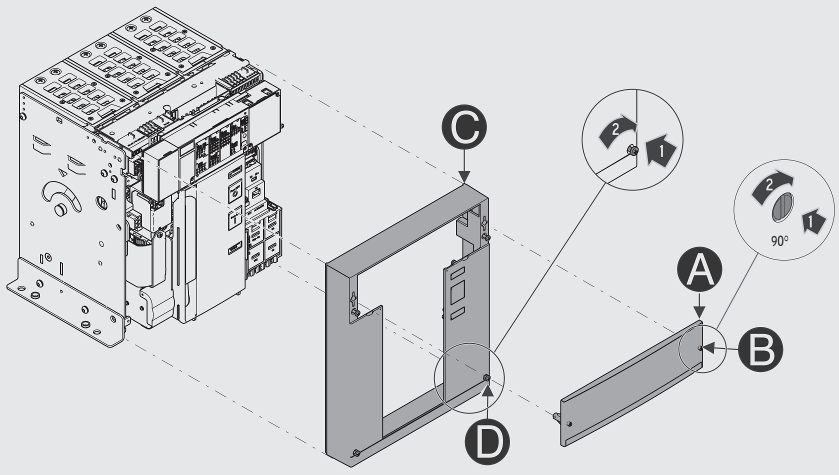


Figure 115 - Assembly of flange and front cover

2 - Wiring diagrams

General wiring diagrams

The following is the wiring diagram of the circuit-breaker **1SDM000091R0001**, also available on the website http://www.abb.com/abblibrary/DownloadCenter/.

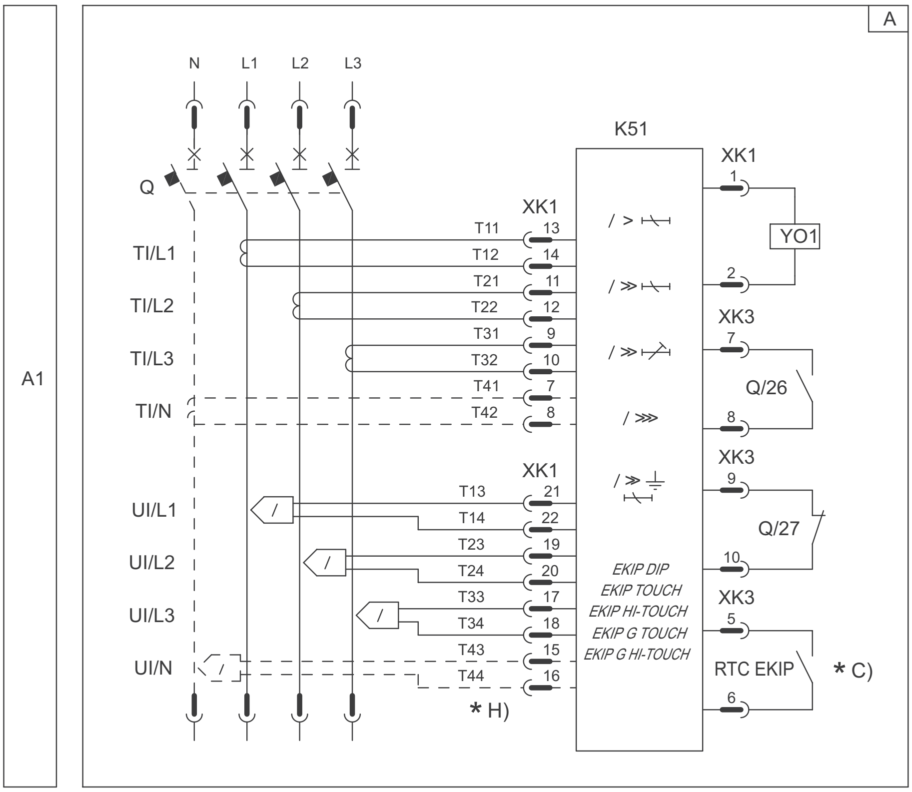


Diagram A - General diagram of the circuit-breaker

NOTE: *The diagram is shown in the following conditions:*

- *Circuit-breaker in withdrawable version (also valid for fixed version), open and connected.*
- *Circuits de-energized.*
- *Trip units not tripped.*
- *Motor operator with discharged springs.*

The following is the wiring diagram of the switch-disconnector:

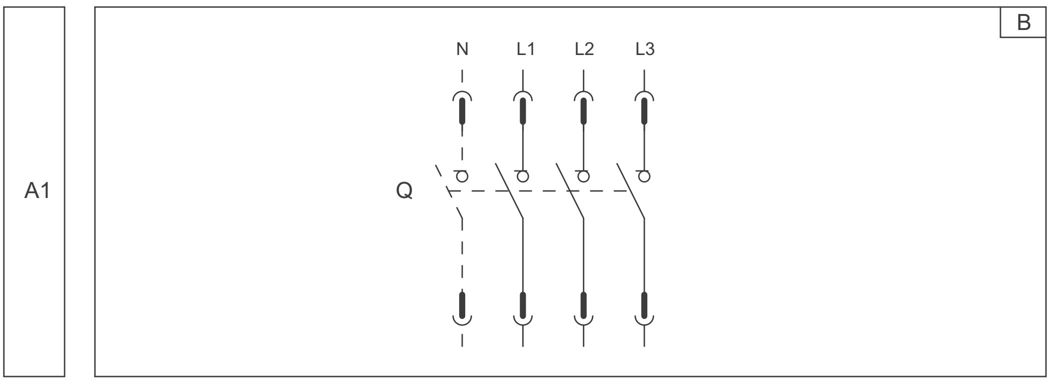


Diagram B - General diagram of the switch-disconnector

Continued on the next page

The wiring diagram of the circuit breaker is illustrated without any indication of the auxiliary power supply of the Ekip trip unit. If the circuit-breaker is equipped with the Ekip Supply module, for information see page 208.

If the circuit-breaker is not equipped with the Ekip Supply module, for the connection of the auxiliary power supply of the Ekip trip unit see the direct power supply diagram below:

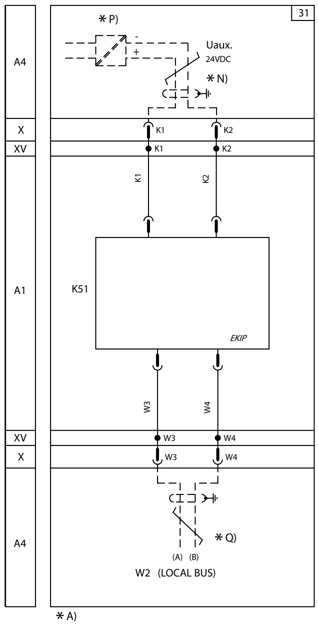


Diagram 31 - Direct auxiliary power supply

Circuit-breaker terminal box

The circuit-breaker is equipped with a terminal box for the wiring of the accessories, different according to the type of circuit-breaker:

- Terminal box for circuit-breakers in fixed version.
- Terminal box for circuit-breakers in withdrawable version.

The following is a view of the terminal box of E1.2 circuit-breakers in both fixed and withdrawable versions with the differences highlighted:

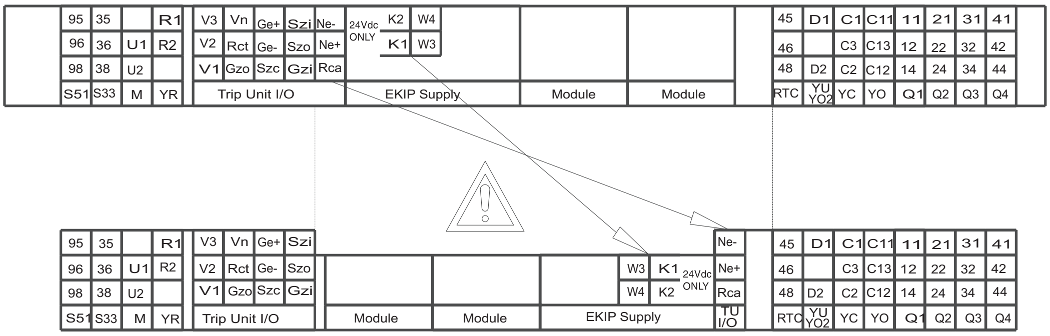


Figure 116

The following is a view of the terminal box of E2.2-E4.2-E6.2 circuit-breakers in both fixed and withdrawable versions with the differences highlighted:

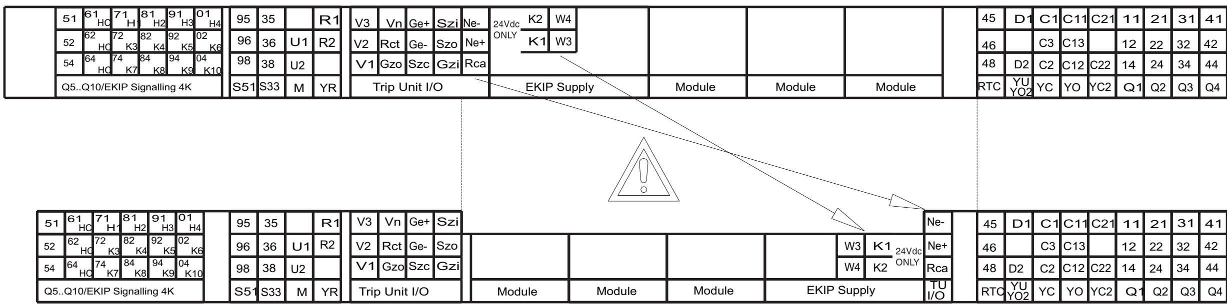


Figure 117

NOTE: *for the details of the wiring diagram of each single accessory, please refer to the pages describing that specific accessory.*

In addition, the terminal box of the Emax E1.2 circuit-breaker has two differences compared to the terminal box for Emax E2.2-E4.2-E6.2 circuit-breakers:

- Module compartments: Emax E1.2 can house three modules (one Ekip Supply + two other modules), whereas E2.2-E4.2-E6.2 can house four modules (one Ekip Supply + three other odules).
- Ekip Signalling 4K: Emax E1.2 does not have the connections for Q5...Q10 / Ekip Signalling 4K.

In the following chapters, the terminal box considered is always that one of E2.2-E4.2-E6.2 circuit-breakers.

Continued on the next page

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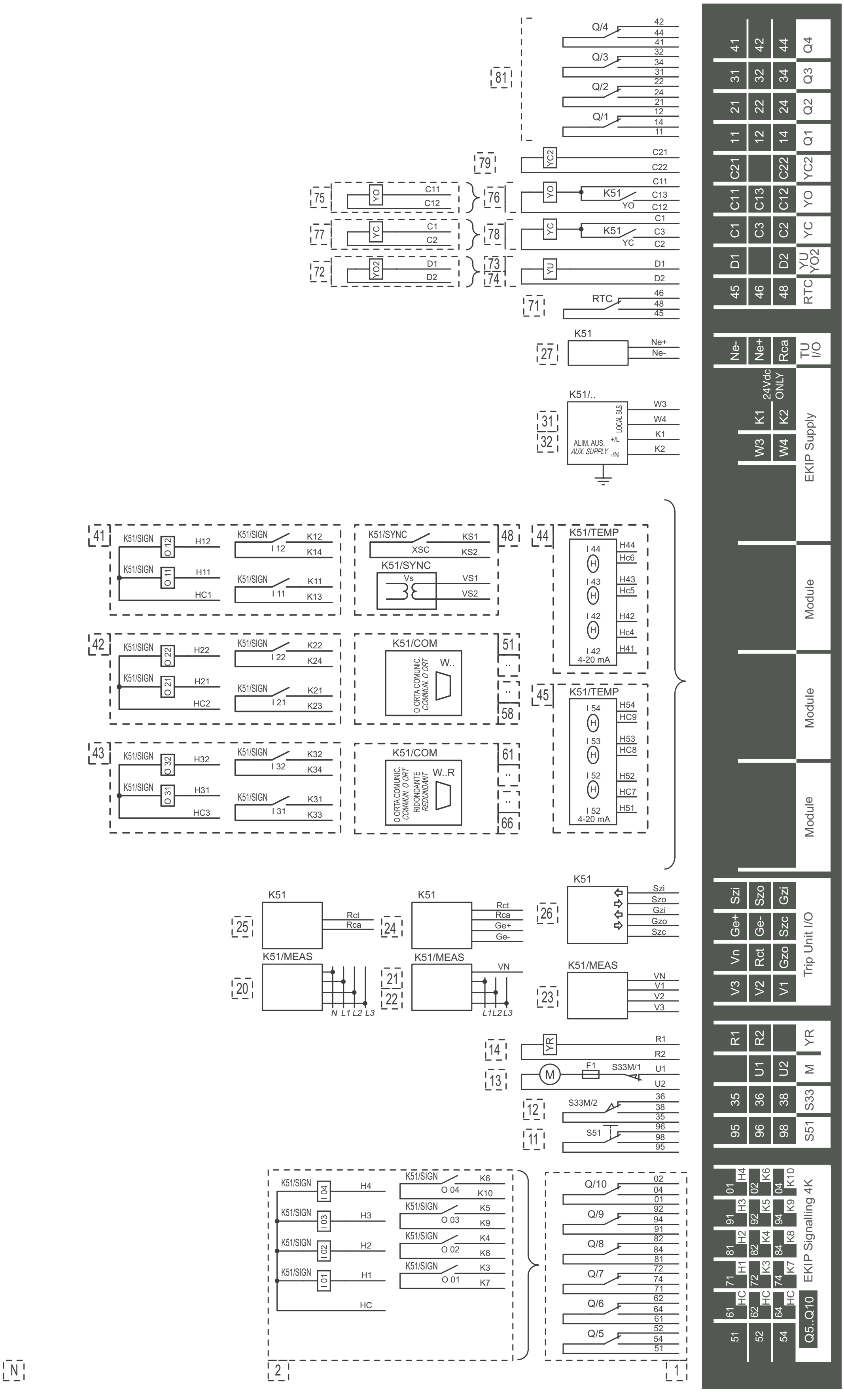
Terminal box for a circuit-breaker in fixed version:



Number of the diagram

Continued on the next page

Symbol	Description
*	See the note indicated by the letter
A1	Applications located on the mobile part of the circuit-breaker
A3	Applications located on the fixed part of the circuit-breaker
A4	Indicative device and connections for control and signalling, outside the circuit-breaker
BUS1	Serial interface with external bus
D	Electronic time-lag device of YU undervoltage coil, outside the circuit-breaker
F1	Time-delayed trip fuse
GZi(DBi)	Zone Selectivity input for G protection or input in “reverse” direction for D protection
GZo(DBo)	Zone Selectivity output for G protection or output in “reverse” direction for D protection
I 01…32	Up to 10 programmable digital inputs of the Ekip trip unit
K51	Overcurrent protection solid-state trip unit
K51 / COM	Communication module
K51 / MEAS	Measurement module
K51 / SIGN	Signalling module
K51 / SUPPLY	Optional auxiliary power supply module (24-48Vdc and 110-220Vac / dc)
K51 / SYNC	Synchronization module
K51 / YC	Closing control from the Ekip protection trip unit
K51 / YO	Opening control from the Ekip protection trip unit
M	Motor for loading closing springs
O 01...32	Up to 10 programmable digital inputs of the Ekip trip unit
O SC	Contact for synchronism control
Q	Circuit-breaker
Q / 1...Q / 27	Auxiliary open/closed contacts of the circuit-breaker
Rc	Rc Toroid
RTC EKIP	Auxiliary ready to close contact of the circuit-breaker, used internally by the trip unit
RTC	Contact for signalling circuit-breaker is ready to close
S33M / 1…2	Limit contacts of spring loading motor
S43	Switch for setting remote/local control
S51	Trip signalling contact
S51/2	Trip signalling contact
S75E / 1…4 (1)	Contacts for signalling circuit-breaker in disconnected position (only with withdrawable circuit-breakers)
S75I / 1…4 (1)	Contacts for signalling circuit-breaker in connected position (only with withdrawable circuit-breakers)
S75T / 1…4 (1)	Contacts for signalling circuit-breaker in test position (only with withdrawable circuit-breakers)
SC	Pushbutton or contact for closing the circuit-breaker
SO	Pushbutton or contact for immediate opening of the circuit-breaker
SO1	Pushbutton or contact for opening the circuit-breaker with time-delayed trip
SR	Push-button or contact for electrical restting of opening contacts S51 and S51/2
SZi(DFi)	Input for Zone Selectivity for S protection or input in “direct” direction for D protection
SZo(DFo)	Output for Zone Selectivity for S protection or output in “direct” direction for D protection
TI / L1	Current transformer phase L1
TI / L2	Current transformer phase L2
TI / L3	Current transformer phase L3
TI / N	Current transformer on neutral
TU1…TU2	Insulation voltage transformer (outside circuit-breaker)
Uaux	Auxiliary supply voltage
UI / L1	Current sensor phase L1
YU2 (2)	Second undervoltage coil

Continued on the next page

The following is a key to the symbols used in the wiring diagrams:

Symbol	Description
UI / L2	Current sensor phase L2
UI / L3	Current sensor phase L3
UI / N	Current sensor on neutral
UI / O	Toroid S.G.R.
W2	Serial interface with internal bus (Local Bus)
W9…W13	RJ45 connector for communication modules
W9R...W11R	RJ45 connector for redundant communication modules
X	Delivery connector for auxiliary circuits for withdrawable version of circuit-breaker
XB1...XB7	Connectors for circuit-breaker applications
XF	Delivery terminal board for position contacts of withdrawable version of circuit-breaker
XK1…XK3	Connectors for auxiliary circuits of the Ekip protection trip unit
XK7	Connector for auxiliary circuits of communication modules
XV	Delivery terminal board for auxiliary circuits of fixed version circuit-breaker
YC	Closing coil
YC2 (2)	Second closing coil
YO	Opening coil
YO1	Opening coil for overcurrent
YO2	Second opening coil
YR	Coil for electrical restting of opening contacts S51 and S51/2
YU	Undervoltage coil
YU2 (2)	Second undervoltage coil

(1) There are up to 6 S75 contacts for E1.2 and 10 for E2.2-E4.2-E6.2.
(2) Only for E2.2-E4.2-E6.2.

The explanatory key to the numbering used in the circuit diagrams is given below:

Symbol	Description
[81]	Open/close auxiliary contacts of the circuit-breaker (first set)
[79]	Second closing coil
[75][76]	First opening coil
[77][78]	First closing coil
[72]	Second opening coil
[73][74]	Undervoltage coil
[71]	Contact ready to close
[27]	Input of current sensor on the external neutral
[31][32]	Auxiliary power supply and Local Bus
[41][42][43]	Signalling modules
[44][45]	Temperature monitoring modules
[48]	Ekip Synchrocheck
[51][...][...][58]	Communication modules
[61][...][...][66]	Redundant communication modules
[26]	Zone selectivity
[25]	Input of the TRAFO star centre sensor
[24]	Input of the residual-current protection RC sensor
[20][21][22][23]	Ekip Measuring voltage sockets
[14]	Trip reset coil YR
[13]	Closing springs loading motor
[12]	Springs charged position signalling contact
[11]	Trip signalling contact
[2]	Ekip Signalling 4K
[1]	Supplementary auxiliary contacts of circuit-breaker (second set)

Continued on the next page

Note	Description
A)	For the zone selectivity and Local bus functions an auxiliary power supply is required (see diagram 1SDM000091R0001, figures 31-32).
B)	When there are mixed auxiliary contacts, Q1 and Q2 are 400V, while Q3 and Q4 are 24V. Then Q5, Q6 and Q7 are 400V while Q8, Q9 and Q10 are 24V.
C)	Always supplied with Ekip Com module.
D)	Always supplied with the motor for loading the closing springs in Figure 13.
E)	Voltage transformer, mandatory in the case of external outlet sockets. External outlet sockets, mandatory for systems with rated voltage greater than 690 V. The maximum secondary rated voltage admitted is 230V.
F)	The connections between the residual-current protection RC sensor and the poles of connector X (or XV) of the circuit-breaker must be implemented with a screened four-pole cable with paired braided conductors (BELDEN 9696 paired type or equivalent), no more than 10m in length.
G)	With all the electronic protection trip units equipped with a display interface with LSIG protections, protection against ground faults (Gext) is available through a current sensor positioned on the star centre of the MV/LV transformer. The connection between terminals 1 and 2 of the UI/O current transformer and the Ge+ and Ge- poles of connector X (or XV) must be implemented with two-pole shielded stranded cable (BELDEN 9841 type or equivalent) no more than 15 m in length.
H)	Make the connection using the ABB cable supplied. There must be no break in the cable. Use of other cables or extensions using intermediate terminal boxes is not allowed. With a three-pole circuit-breaker, poles Ne+ and Ne- of connector X (or XV) are short-circuited (unless the external neutral is present): realize short-circuit connection if absent.
I)	Obligatory in the case of presence of any Ekip module.
L)	In the presence of Fig. 32, for circuit-breakers E2.2, E4.2 and E6.2, up to three applications can be supplied between Fig. 41…58 taken only one; for E1.2 circuit-breakers, instead, up to two applications can be supplied between Fig. 41…58 taken only once. In addition it is possible to duplicate an Ekip Com module that may be selected choosing between Fig. 61…66.
M)	Opening and closing commands via the Ekip Actuator module can be obtained with coils YC and YO, with 110-120VDC and 240-250VAC maximum voltage values.
N)	Use cable type Belden 3105A or equivalent.
O)	In the presence of several Ekip Com modules with withdrawable version circuit-breakers, the contact S75I/5 should be connected only once to a single module.
P)	The auxiliary voltage Uaux allows all the functions of the Ekip electronic protection trip units to be activated "Galvanically separated converters" conforming to standard IEC 60950 (UL 1950) or the equivalent standards.
Q)	Belden type 3105A or equivalent cables must be used, with a maximum length of 15m.
R)	Suggested RJ45 cable: CAT6 STP
S)	For the EIA RS485 serial interface connection, see the "Technical Application Handbook - vol. 9: Communication with ABB circuit-breakers via BUS”
T)	Short circuit the 120 Ω on terminals if you wish to insert a terminating resistor on the Local Bus.
U)	Use Belden type 3105A or equivalent cables. For further details see the White Paper 1SDC007412G0201 "Communication with SACE Emax 2 circuit-breakers".
V)	Use Belden type 3084A or equivalent cables. For further details see the White Paper 1SDC007412G0201 "Communication with SACE Emax 2 circuit-breakers".
Z)	Ekip Supply cannot be used to supply the electronic trip unit via terminals K1 and K2.
AA)	For W3 and W4 connection see figure 31 or 32
AB)	Use a twisted pair shielded and stranded cable type BELDEN 8762/8772 or equivalent. The shield must be earthed on the selectivity input side (for zone selectivity) or on both sides (for others applications).
AC)	The maximum secondary rated voltage admitted is 120V.
AD)	Use insulated cables for thermcouples such as PENTRONIC TEC/SITW-24F (Type TX) or similar. Maximum length 3 meters.
AE)	Use suitable cables up to 3 meters in length compatible with the workplace in which the 4-20mA current sensor is used.

(1) Only for E2.2-E4.2-E6.2.

3 - 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

Electronic accessories

1 - Introduction

Operating conditions

The Ekip Synchrocheck, Ekip Com and Ekip Signalling modules function correctly:

- In the presence of auxiliary power supply.
- With the circuit-breaker in racked-in position (if the model 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 DISCONNECTED position, the connection between trip unit and modules is interrupted.
(4) Owing to internal voltage not connected to the Ekip Measuring Pro module.
(5) See the document **1SDH001140R0001** (Communication System Interface Emax 2), section INFORMATION WITH PROTECTION TRIP UNIT DISCONNECTED.
(6) Outputs only function correctly if configured as: input state (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).

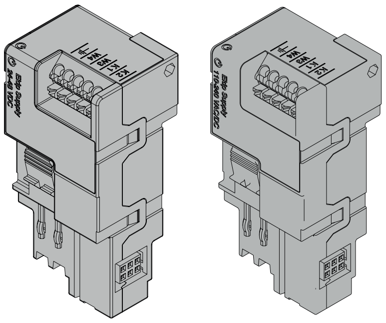
1 - Ekip Supply modules

Description

Ekip Supply is a power supply accessory module.

There are two types, depending on the input voltages:

- Ekip Supply 24-48Vdc.
- Ekip Supply 110-240Vac/dc.



It performs three functions:

- Supply insulated 24 V DC auxiliary power to the trip unit.
- Supply 24 V DC non-insulated power to the electronic accessories mounted on the terminal box.
- Act as a bridge for the Local Bus, between the trip unit and the electronic accessories mounted on the terminal box.

Compatibility

The modules can be installed combined with Ekip Dip, Ekip Touch, Ekip Hi-Touch, Ekip G Touch, and Ekip G Hi-Touch trip units.

Electrical characteristics

The following table lists the electrical characteristics of the modules:

Module	Ekip Supply 24-48Vdc	Ekip Supply 110-240Vac/dc
Power supply voltages	21.5…53 V DC	105…265 V AC/DC
Frequency	-	45…66 Hz
Maximum power consumption without modules (1)	3 W	3 VA/W
Maximum power consumption with modules	10 W	10 VA/W
Maximum inrush current	2 A for 20 ms	2 A for 20 ms

(1) Trip unit with Ekip Supply only

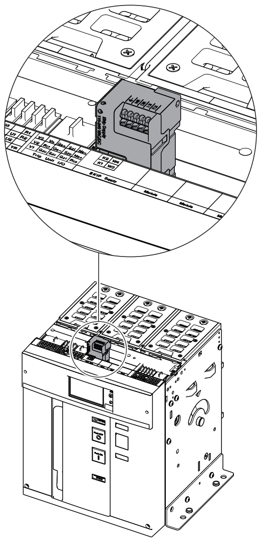
Connections

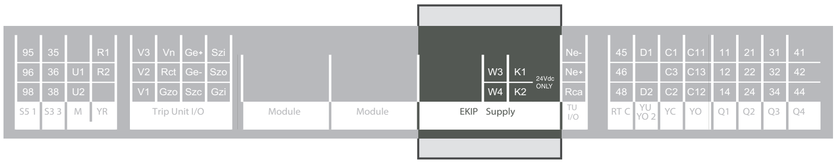
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot.

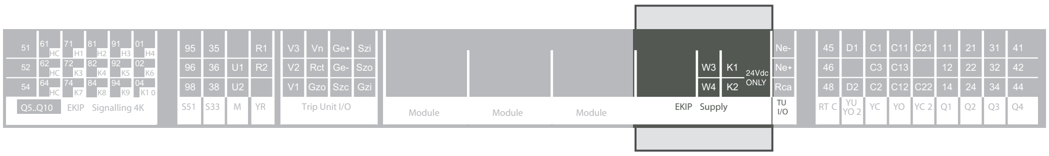
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0511**.

An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:







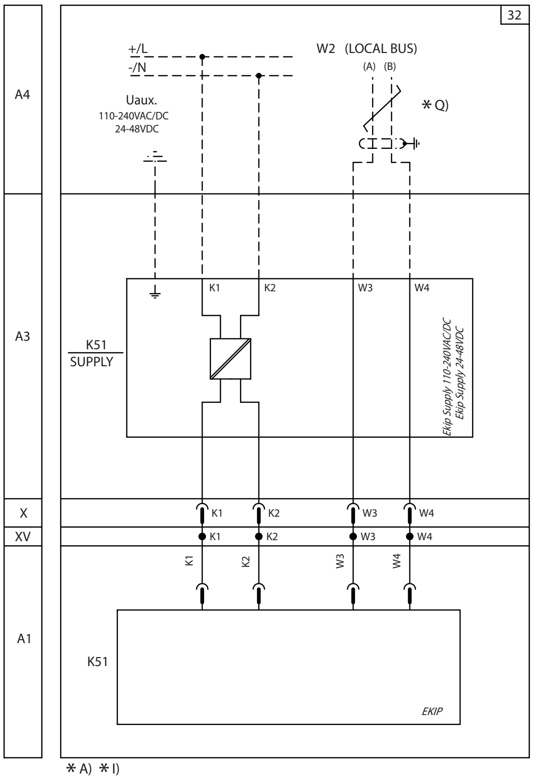
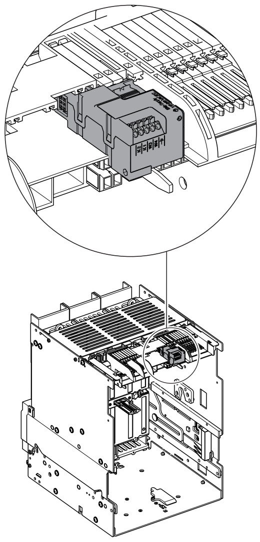


Diagram 32

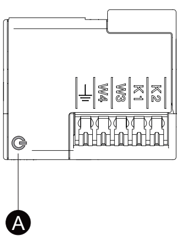


For external wiring, AWG 22-16 cables with a maximum external diameter of 1.4 mm must be used.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Signallings

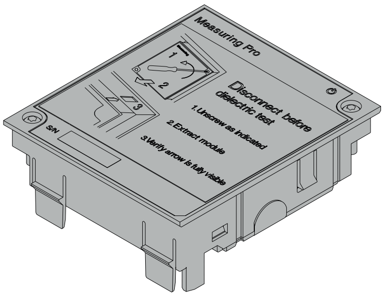
The following table shows the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply present.

2 - Ekip Measuring modules

Description



The Ekip Measuring is an accessory module for measurement of voltage, power and energy.

Specifically:

- It measures the r.m.s. value and frequency of the voltages of the three-phase system on the internal contacts of the circuit-breaker, or on the external sockets. From these measurements, the trip unit obtains the power and energy ones, which therefore become available.
- Combined with the Ekip Synchrocheck module, Ekip Measuring makes it possible to recognise whether the synchronism conditions exist between the internal contacts (or external sockets) and external contacts necessary for closing the circuit-breaker.

Two types are available:

- Ekip Measuring, equipped with the measuring function only.
- Ekip Measuring Pro, with a measuring function, possibility of powering the trip unit, and activation of the Measuring protections.

With the Ekip Measuring Pro module, the power supply of the trip unit is guaranteed, if at least one value of the line-to-line voltages is greater than or equal to 80 V AC.

Compatibility and power supply

The Ekip Touch trip unit can be equipped with the Ekip Measuring and the Ekip Measuring Pro modules, the former if you only wish to implement the measurement function and the latter if you also wish to implement the power supply function and activate the Measuring protections. With Ekip Hi-Touch, G Touch, and G Hi-Touch trip units, Ekip Measuring Pro is provided as standard.

Ekip Measuring requires the trip unit to be also supplied with auxiliary voltage (example: provided by an Ekip Supply module). Auxiliary supply is not necessary with Ekip Measuring Pro.

Electrical characteristics

The following table lists the electrical characteristics of the modules:

Component	Characteristics
Phase-to-phase input voltage	0…760 V AC
Input frequency	30…80 Hz

Isolation transformer

If the input phase-to-phase voltage supplied to the modules is greater than 690 V AC rated voltage (maximum 760 V AC), external sockets must be used.

In the presence of external sockets, the use of an isolation transformer is mandatory.

IMPORTANT: the maximum secondary rated voltage admitted in the case of external outlet sockets is 230V.

The following table lists the characteristics of the transformer:

Characteristics	Description
Mechanical	• Mounting: EN 50022 DIN43880 guide. • Material: self-extinguishing thermoplastic. • Protection degree: IP30. • Electrostatic protection: with shield to be connected to ground.
Electrical	• Accuracy class: ≤ 0.5. • Performance: ≥ 10 VA. • Overload: 20 % permanent. • Insulation: 4 kV between inputs and outputs, 4 kV between shield and outputs, 4 kV between shield and inputs. • Frequency: 45…66 Hz.

NOTE: *for the primary and secondary voltages of the transformer, see the configuration parameters of the module, paragraph* "**Access from the display**".

Measurements

The following table lists the measurement accuracy for the modules:

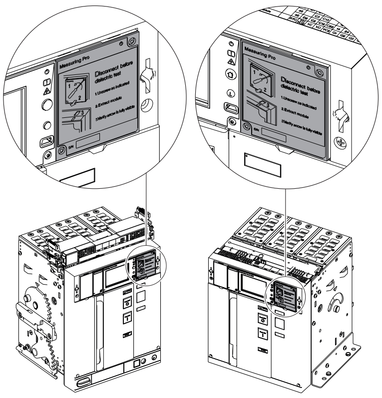
Quantity	Range	Accuracy
Phase-to-phase voltage (1)	100…1150 V AC	± 0.5 % @ 45…66 Hz
Frequency (2)	30…80 Hz	± 0.1 % (3)

(1) With phase-to-phase voltage V greater than 690 V AC rated voltage (maximum 760 V AC), in the presence of external sockets and an isolation transformer.
(2) The measurement of the frequency is available with a a phase-to-phase voltage value ≥ 36 V AC, and is unavailable with a phase-to-phase voltage value ≤ 32 V AC.
(3) In the absence of harmonic distortion.

Connections

The modules must be mounted directly on the Mainboard, to the right of the trip unit. In parallel they are connected to a connector, to which the phase and neutral voltages arrive either on the internal contacts of the circuit-breaker, or on the external sockets.

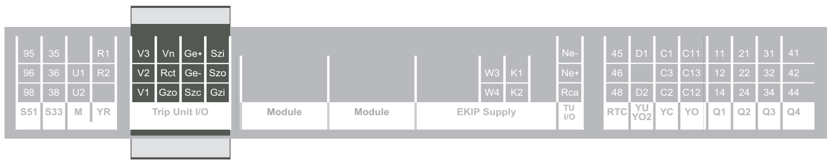
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0505.

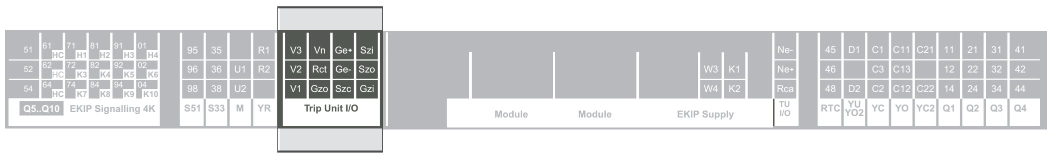


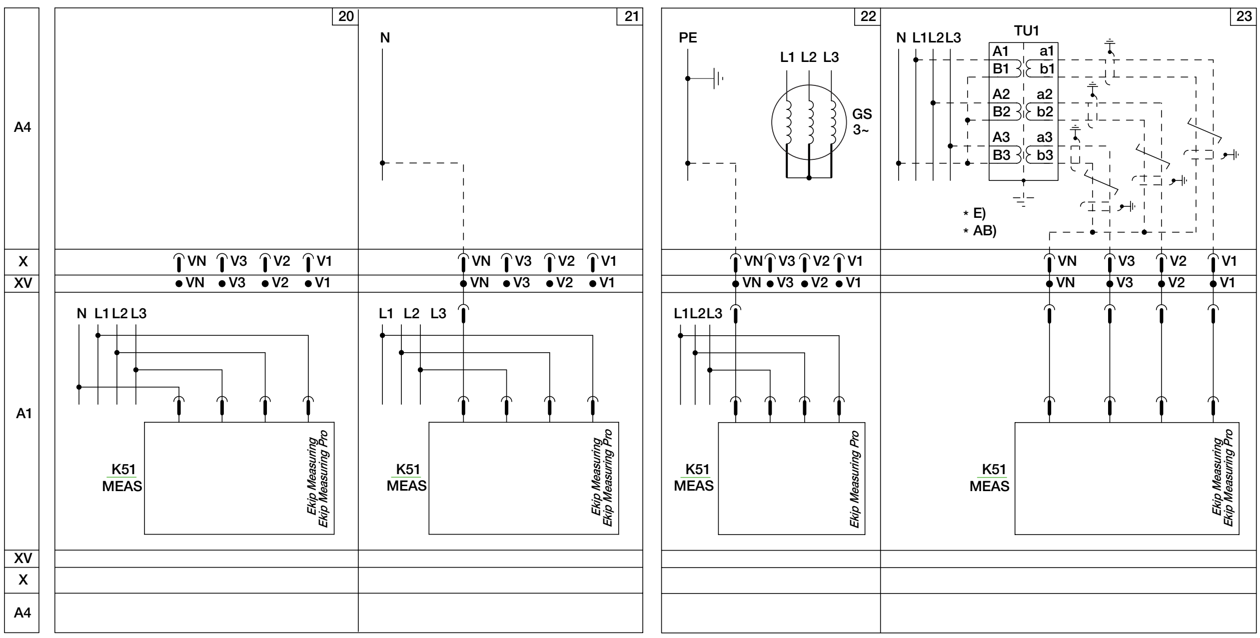
IMPORTANT: in the case of dielectric tests, you need to disconnect the modules as illustrated in the assembly diagram, and to disconnect the external sockets from the terminal box. It is not necessary to remove the modules.

An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:







Diagrams 20 - 21 - 22 - 23

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

With the trip unit energized, the presence of the modules activates the following on the display:
- Additional graphical pages, that display measurements.
- Additional menus.

The additional graphical pages are:
- A summary of the measurements in progress (maximum phase current, maximum phase-to-phase voltage, power factor, and the active, reactive and apparent power), accessible from the page **Histograms** (see page 42).
- The indicators of the maximum phase-to-phase voltage, and of the active, reactive and apparent power, accessible by selecting the pages **Measuring instruments** (see page 44).
- The measurements of the phase and phase-to-phase voltages, and of the active, reactive and apparent power, as well as the energy counters, accessible by selecting the pages **Measurements** (see page 45).
- The historicals of the minimum and maximum phase-to-phase voltages and maximum and mean power, accessible from the menu **Measurements**.
- The waveforms and the harmonics of the phase-to-phase voltages, accessible from the menu **Measurements**.

The additional menus allow you to:
- Configure the protections activated by Ekip Measuring Pro.
- Configure the modules.
- Display the measurements associated to the modules (in addition to those displayed in the graphical pages).
- Display information on the modules.

The following table shows the path from the display to access the configuration parameters of the protections activated by the Ekip Measuring Pro module:

Advanced 	...	
	IU Protection	
	Rc Protection [1]	
	UV Protection	
	UV2 Protection	
	OV Protection	
	OV2 Protection	
	RV Protection	
	VU Protection	
	UF Protection	
	UF2 Protection	
	OF Protection	
	OF2 Protection	
	ROCOF Protection	
	RP Protection	
	RQ Protection	
	OP Protection	
	OQ Protection	
	UP Protection	
	Synchrocheck	
	Signallings	Phase Sequence
		Cos φ
	Current thresholds	
	...	

[1] Protection available with Rating Plug Rc and Ekip Measuring Pro, and toroid Rc (see the menu Settings - Circuit Breaker - Ground protection), and alternative to the Gext protection (see the Protections menu).

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NOTE: *selecting a protection opens the list of parameters that can be set for the selected protection. For details on the protections, see chapters "***10 - Measuring Pro protections***" on page* **75***, and the chapter "***11 - Hi-Touch protections***" on page* **81.**

The following table shows the path from the display for viewing the measurements and commands activated by the modules and accessible from the menus:

 Measurement	Historicals	...	
		Events	
		Measurements	...
			I Max
			U Min
			U Max
			P Max
			P Mean
			Q Max
			Q Mean
			S Max
			S Mean
			Reset measures
	Power factor		
	Frequency		
	Energy	Energy counters	
		Reset counters	
		RESET Energy	
	Peak factor		
	Harmonic dist.		
	Ekip Synchrocheck		
	Network Analyzer	...	
		Counters	
		Waveforms	...
			Ne
			Voltage 12
			Voltage 23
			Voltage 31
	Maintenance		

Continued on the next page

The following table shows the measurements and commands accessible from the menus:

Measurement or control	**Description**
U Min	It shows the history of the minimum line-to-line voltage measurements in the form of a histogram (see page 53).
U Max	It shows the history of the maximum line-to-line voltage measurements in the form of a histogram (see page 53).
P Max	It shows the history of the maximum active power measurements in the form of a histogram (see page 53).
P Mean	It shows the history of the mean active power measurements in the form of a histogram (see page 53).
Q Max	It shows the history of the maximum reactive power measurements in the form of a histogram (see page 53).
Q Mean	It shows the history of the mean active power measurements in the form of a histogram (see page 53).
S Max	It shows the history of the maximum apparent power measurements in the form of a histogram (see page 53).
S Mean	It shows the history of the mean apparent power measurements in the form of a histogram (see page 53).
Power factor	Shows the value of the power factor.
Energy counters	Shows the values of active, reactive and apparent energy.
Reset counters	It resets the energy counters.
RESET Energy	It opens a list of the parameters for programming the resetting of the energy counters (see page 51).
Voltage 12	Shows the waveform of the phase-to-phase voltage U12, acquired at the moment of selection (see page 54).
Voltage 23	Shows the waveform of the phase-to-phase voltage U23, acquired at the moment of selection (see page 54).
Voltage 31	Shows the waveform of the phase-to-phase voltage U31, acquired at the moment of selection (see page 54).

The following table shows the path for accessing the configuration parameters of the modules from the display:

Settings	…		
	Main frequency		
	Phase Sequence		
	Modules	Local/Remote	
		Local bus	
		…	
		Ekip Measuring	Voltage Transf.
			Rated voltage
			Primary voltage
			Secondary voltage
			Power flow
			Neutral connection
		…	
		Functions	
	Monitor time		
	Power Controller		
	…		

Continued on the next page

The following table shows the configuration parameters of the modules:

Parameter	Values	Default	Description
Voltage Transf.	Absent, Present	Absent	• Absent = Isolation transformer on the supply side of the inputs of the module is absent. • Present = Isolation transformer on the supply side of the inputs of the module is present.
Rated voltage	100 V, 115 V, 120 V, 190 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V, 415 V, 440 V, 480 V, 500 V, 550 V, 600 V, 660 V, 690 V	400 V	Displayed with "Voltage Transf." set as absent: the rated voltage of the installation.
Primary voltage	100 V, 115 V, 120 V, 190 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V, 415 V, 440 V, 480 V, 500 V, 550 V, 600 V, 660 V, 690 V, 910 V, 950 V, 1000 V, 1150 V	400 V	Displayed with "Voltage Transf." set as present: the primary voltage of the isolation transformer.
Secondary voltage	100 V, 110 V, 115 V, 120 V, 200 V, 230 V	100 V	Displayed with "Voltage Transf." set as present: the secondary voltage of the isolation transformer.
Power flow	Bottom->Top, Top->Bottom	Low->High	• Bottom->Top = Flow of power from the low terminals to the high terminals of the circuit-breaker (load connected to top). • Top->Bottom = Flow of power from the high terminals to the low terminals the circuit-breaker (load connected to bottom).
Neutral connection (1)	Absent, Present	Present	• Present = It enables measurement of the phase voltages. • Absent = It disables measurement of the phase voltages (only it enables measurement of line-to-line voltages).

(1) Available with 3P configuration.

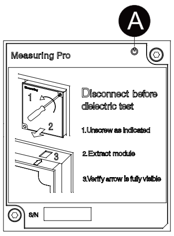
The following table shows the path from the display to get information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Measuring
		...
	Power Controller	

The items of information on the modules that can be displayed are the serial number and the version ("Basic" in the case of Ekip Measuring, "Pro" in the case of Ekip Measuring Pro).

Signallings

The following table shows the possible signals, and their meaning:

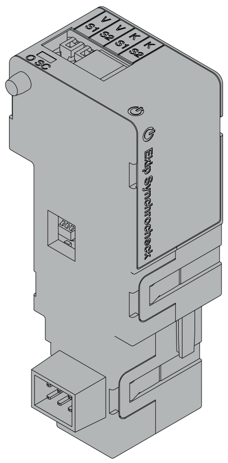


Pos.	Description
A	Power status LED, green; present only on the Ekip Measuring Pro. The possible states are: • Off: the power supplied by the Ekip Measuring Pro to the trip unit is absent. • On fixed: the power supplied by the Ekip Measuring Pro to the trip unit is present.

3 - Ekip Synchrocheck module

Description

The Ekip Synchrocheck is an accessory module that, combined with the Ekip Measuring or Ekip Measuring Pro module serves to recognize whether the synchronism conditions exist between the internal and external contacts of the circuit-breaker, necessary for closing the circuit-breaker.



Ekip Synchrocheck measures the voltage on the external contacts (external voltage) while Ekip Measuring or Ekip Measuring Pro measures it on the internal contacts (internal voltage). With a generator, and the circuit-breaker in "Standard" configuration, the external voltage is that of the grid while the internal voltage is that of the generator.

There are two types of operation:
- With busbar live, if the external voltage is other than zero.
- With a dead bus, if one of the voltages is nil (external with "Standard" configuration, internal with "Reverse" configuration).

With live busbar:
- The search for the synchronism is started if the external voltage is greater than or equal to a minimum (0.5 Un by default), for a minimum time (1 s by default).
- Synchronism is considered to be reached if the differences between the RMS values of the frequency and the voltage phases are less than or equal to a maximum (0.12 Un, 0.1 Hz and 50 ° by default).

Instead, with a dead bus and "Normal" configuration:
- The search for the synchronism is started if the internal voltage is greater than or equal to a minimum (0.5 Un by default), for a minimum time (1 s by default).
- The synchronism is considered to be achieved if the external voltage is less than or equal to a maximum (0.2 by default) for a minimum time (1 s by default).

With a dead bus and "Reverse" configuration, the roles of the internal and external voltages are reversed.

To the above-mentioned synchronism conditions, we can add that of circuit-breaker open (by enabling the condition “Evaluate CB status”, disabled by default).

The frequency and phase controls can be disabled.

IMPORTANT: to disable frequency and phase controls, make sure that the correspondence of the desired frequency and phase already exists between external and internal contacts.

The synchronism signal is activated when the synchronism is achieved and is kept active for at least 200 ms. After 200 ms, it is kept active while the synchronism is present, and deactivated when the synchronism falls, or the circuit-breaker is open (with condition "Evaluate CB status" enabled), or the communication with the trip unit is interrupted.

Lastly, the Ekip Synchrocheck module makes the pins of a contact (K S1 and K S2) available on the terminal box. Depending on how the module is configured, this contact is either normally open or closed, and changes status when the synchronism is achieved.

IMPORTANT: only one Ekip Synchrocheck can be installed on each circuit-breaker.

Functionality is guaranteed with the circuit-breaker in the racked-in position.

Compatibility and power supply

The module can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and requires the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

Electrical characteristics

The following table lists the electrical characteristics of the module:

Component	Characteristics
Input voltage	0...120 V AC rated
Input frequency	30…80 Hz
Output contact	• Maximum switching voltage [1]: 150 V DC / 250 V AC. • Breaking capacity [1]: 2 A @ 30 V DC, 0.8 A @ 50 V DC, 0.2 A @ 150 V DC, 4A @ 250 V AC. • 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 related to a resistive load.

Isolation transformer

Between the external contacts of the circuit-breaker and the inputs of the module, an isolation transformer must always be installed having the following characteristics:

Characteristics	Description
Mechanical	• Mounting: EN 50022 DIN43880 guide. • Material: self-extinguishing thermoplastic. • Protection degree: IP30. • Electrostatic protection: with shield to be connected to ground.
Electrical	• Accuracy class: ≤ 0.5. • Performance: ≥ 5 VA. • Overload: 20 % permanent. • Insulation: 4 kV between inputs and outputs, 4 kV between shield and outputs, 4 kV between shield and inputs. • Frequency: 45…66 Hz.

NOTE: *for the primary and secondary voltages of the transformer, see the configuration parameters of the module, paragraph* "**Access from the display**" *on page* **220**).

Measurements

The following table lists the measurement accuracy for the module:

Quantity	Range	Accuracy
Voltage	10…120 V AC	± 1 % [1]
Frequency [2]	30…80 Hz	± 0.1 % [3]
Phase [4]	-180...+180 °	± 1 °

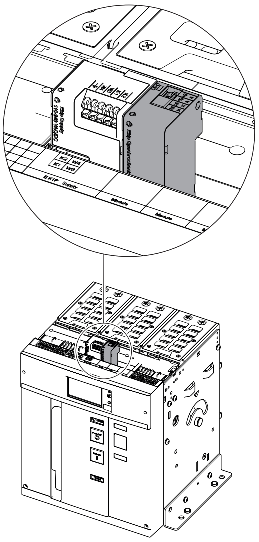
[1] With live busbar.
[2] With a live busbar, the frequency measurement is available with a voltage measured ≥ 36 V AC, and is unavailable with a voltage measured ≤ 32 V AC.
[3] In the absence of harmonic distortion.
[4] The phase measurement refers to the phase difference between internal and external voltage.

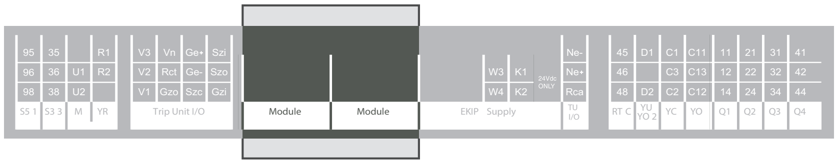
Connections The module must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

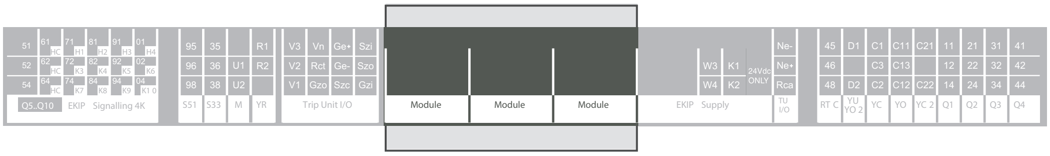
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0513**.

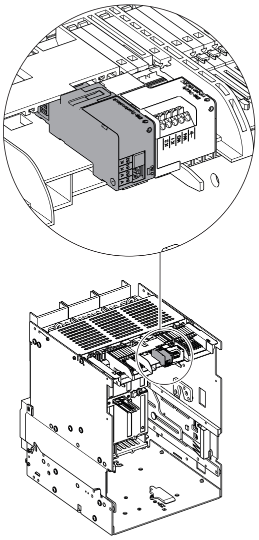
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:









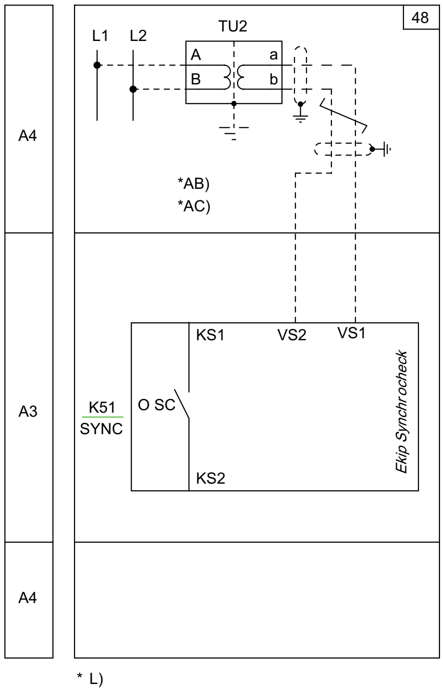
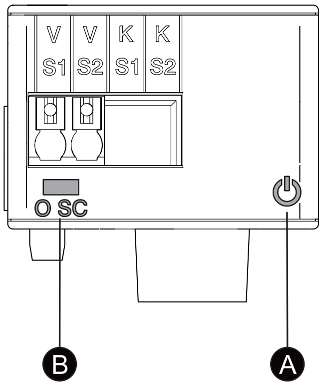


Diagram 48

For external wiring, AWG 22-16 cables with a maximum external diameter of 1.4 mm must be used.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Signallings The following table shows the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	LED O SC, green. The possible states are: • Off: contact K open (with contact normally open, synchronization KO; with contact normally closed, synchronization OK) (1). • On fixed: contact K closed (with contact normally open, synchronization OK; with contact normally closed, synchronization KO) (1).

(1) Consult the Settings menu of the module in order to configure the contact.

Access from the display

With the module energized, and the Local Bus enabled, the presence of the module itself on the terminal box activates additional menus on the display:

- To configure the synchronism function.
- To display the measurements related to the function (voltage, frequency, and phase).
- To configure the module.
- To display information on the module and synchronism status.

The presence of the module also activates a graphic summary page with the measurements of the synchronism function and synchronism state. This page can be accessed from the Main page by touching the sides of the display until it appears. Further information is available on page 222.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The configuration parameters of the synchronism function are different depending on whether the dead busbar option is enabled or not.

The following table shows the path from the display to access the configuration parameters of the function, and the parameters available with dead busbar disabled:

Advanced	...	
	UP Protection	
	Synchrocheck	Activate
		Dead busbar option (Off)
		Ulive Threshold
		Stability Time
		Delta Voltage
		Delta Frequency
		Delta Phase
		Auto Live-dead detect
		Auto Deadbar detect
		Primary voltage
		Secondary voltage
		Concatenated Ref
		Contact type
	Signallings	
	...	

The following table shows the path from the display to access the configuration parameters of the function, and the parameters available with dead busbar enabled:

Advanced	...	
	UP Protection	
	Synchrocheck	Activate
		Dead busbar option (On)
		Udead Threshold
		Ulive Threshold
		Stability Time
		Contact Delay
		Dead bar configuration
		Auto Live-dead detect
		Auto Deadbar detect
		Primary voltage
		Secondary voltage
		Concatenated Ref
		Contact type
	Signallings	
	...	

NOTE: *the module can also be configured through the Ekip Connect software (see the chapter* "**17 - Other accessories**"*, and the paragraph* "**Ekip Connect software**" *on page* **288**).

Continued on the next page

The following table shows the configuration parameters of the synchronism function:

Parameter	Values	Default	Description
Activate	Off, On	Off	• Off = Function disabled. • On = Function enabled
Dead busbar option	Off, On	Off	• Off = busbar live. • On = busbar dead.
Udead Threshold	0,02...0,20 Un steps of 0.001 Un	0.2 Un	With a dead bus and "Standard" configuration, 1 st synchronism condition: maximum external voltage (2).
Ulive Threshold	0.5...1.1 Un steps of 0.001 Un	0.5 Un	Minimum voltage in order to start up monitoring of the voltages (3): • With busbar live, external undervoltage. • With a dead bus and "Standard" configuration, minimum internal voltage (2).
Stability Time	100...30000 ms steps of 1 ms	1000 ms	With live bus, minimum time during which the “Ulive Threshold” condition must be obtained in order to activate voltage monitoring
Dead bar configuration	Reversed, Standard	Standard	With busbar dead, and generator: • Reversed = Ekip Synchrocheck/external contacts connected to the generator (1). • Standard = Ekip Synchrocheck/external contacts connected to the network.
Delta Voltage	0.02...0,12 Un steps of 0.001 Un	0.12 Un	With live busbar, 1 st synchronism condition: maximum difference between internal and external voltage (1).
Delta Frequency	0.1...1.0 Hz steps of 0.1 Hz	0.1 Hz	With live busbar, 2 nd synchronism condition: maximum difference between internal and external frequency.
Delta Phase	5…50 ° steps of 5 °	50 °	With live busbar, 3 rd synchronism condition: maximum difference between internal and external phase.
Primary voltage	100 V, 115 V, 120 V, 190 V, 208 V, 220 V, 230 V, 240 V, 277 V, 347 V, 380 V, 400 V, 415 V, 440 V, 480 V, 500 V, 550 V, 600 V, 660 V, 690 V, 910 V, 950 V, 1000 V, 1150 V	400 V	Primary voltage of the isolation transformer.
Secondary voltage	100 V, 110 V, 115 V, 120 V	100 V	Secondary voltage of the isolation transformer.
Concatenated Ref	V12, V23, V31	V12	Input line-to-line voltage to the module.
Contact type	NC, NO	NO	Status of the contact: • NC = Normally closed. • NO = Normally open.
Frequency check (4) (5)	ON, OFF	ON	With busbar live, “Delta Frequency” condition: • OFF = Disabled. • ON = Enabled.
Phase check (4) (5)	ON, OFF	ON	With busbar live, “Delta Phase” condition: • OFF = Disabled. • ON = Enabled.
Evaluate CB status (4)	NO, YES	NO	Circuit-breaker open condition (with live busbar 4 th synchronism condition, With dead busbar 2 nd synchronism condition): • NO = Disabled. • YES = Enabled.
Auto Live-dead detect (4)	Manual, Automatic	Manual	• Manual = with dead bus, manual selection of the "Standard" or "Reverse" configuration by means of the "Dead bus configuration" parameter. • Automatic = with dead bus, automatic selection of the "Standard" or "Reverse" configuration on the basis of the voltages measured (the "Dead bus configuration" paremeter is ignored).
Auto Deadbar detect (4)	Manual, Automatic	Manual	• Manual = with dead bus, manual selection of the "Standard" or "Reverse" configuration by means of the "Dead bus configuration" parameter. • Automatic = with dead bus, automatic selection of the "Standard" or "Reverse" configuration on the basis of the voltages measured (the "Dead bus configuration" paremeter is ignored).
Minimum matching time (4)	100...3000 ms steps of 10 ms	100 ms	With live bus, minimum time in which the “Phase Delta” condition must be met: it is not a synchronism function but a parameter allowing a discrimination to be made between correct and incorrect combinations of the “Frequency Delta” and “Phase Delta” conditions. Owing to latencies in the worst case, the time that effectively elapses before synchronism is recognized may be longer than the set time (approx. 20 ms).

Continued on the next page

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(1) The precision of measurement of the voltage difference is ± 10%, except with the value of parameter equal to 0.02 Un, with which the precision is ± 20%.
(2) With a dead bus and "Reverse" configuration, the roles of the internal and external voltages are reversed.
(3) On the condition of minimum voltage, a hysteresis of 10 % is applied: once reached, the condition is lost if the voltage drops below 90 % of the set limit.
(4) Parameter available only with the Ekip Connect.
(5) If the Frequency Check is disabled (OFF), the Phase Check is also Off, but not vice versa.

The following table shows the path from the display get the measurements related to the synchronism function:

Measurements 	…
	Harmonic dist.
	Ekip Synchrocheck
	Network Analyzer
	…

The page containing a summary of the measurements of the Ekip Synchrocheck module can also be accessed from the Histograms page. The measurements in this page are:

- Green if the relative synchronism condition has been achieved.
- Red if the relative synchronism condition has not been achieved or the function is disabled.
- White if the measurements are not available.

The measurement summary page can be set as HOME.

The following table shows the measurements related to the synchronism function:

Measurement	Description
Module	• Ok = Synchronism conditions met. • Not Ok = Synchronism conditions not met or synchronism function disabled.
Frequency	• Ok = Synchronism condition regarding frequencies met. • Not Ok = Synchronism condition regarding frequencies not met, or synchronism function disabled, or frequencies out of the measuring range limits. • --- = Synchronism condition regarding frequencies not available (example: owing to operation with dead bus).
Voltage	• Ok = Synchronism condition regarding voltages met. • Not Ok = Synchronism conditions regarding voltages not met or synchronism function disabled.
Phase	• Ok = Synchronism condition regarding phase difference met. • Not Ok = Synchronism condition regarding phase difference not met, or synchronism function disabled, or frequencies out of the measuring range limits. • --- = Synchronism condition regarding phase difference not available (example: owing to operation with dead bus).

Continued on the next page

Measurement	Description
Ext Side Voltage	Voltage measured by Ekip Synchrocheck [1]. The dots "...." indicate that the measurement is continuous or less than 1 V, while the dashes "---" indicate that the measurement is not available (example: because the synchronism function is disabled).
Int Side Voltage	Voltage measured by Ekip Measuring [2]. The dots "...." indicate that the measurement is continuous or less than 1 V.
Ext Side Frequency	Frequency measured by Ekip Synchrocheck [1]. The dots "...." indicate that the measurement is not available (example: owing to synchronism function disabled, or operation with dead bus, or frequencies out of the measuring range limits).
Int Side Frequency	Frequency measured by Ekip Measuring [2]. The dots "...." indicate that the measurement is not available (example: owing to operation with dead bus, or frequencies out of the measuring range limits).
Phase difference	Phase difference among voltages [1]. The dots "...." indicate that the measurement is not available (example: owing to synchronism function disabled, or operation with dead bus, or frequencies out of the measuring range limits).
Auto detection	• Live bar = With automatic detection of operating mode, operation with live bus or synchronism function not enabled. • Dead bar = With automatic detection of operating mode, operation with dead bus. • --- = Measurement not available (example: owing to manual detection of operation mode).
Voltage relation	• Vint<=Vext = Internal voltage lower than or equal to external voltage. • Vin>Vext = Internal voltage higher than external voltage. • --- = Measurement not available (example: because the synchronism function is disabled, or voltages less than 1 V or continuous).
Frequency relation	• fint<=fext = Internal frequency lower than or equal to external frequency. • fin>fext = Internal frequency higher than external frequency. • --- = Measurement not available (example: owing to synchronism function disabled, or operation with dead bus, or frequencies out of the measuring range limits).

[2] For the characteristics of the voltage and frequency (internal) measurements of Ekip Measuring, refer to those of the Ekip Measuring module (see page 211).

The following table shows the path from the display to view information on the module and synchronism status:

About	Protection Unit	
	Circuit-breaker	
	Modules	…
		Ekip Synchrocheck
		…
	Power Controller	

The information on the modules that can be displayed includes the serial number and the software version.

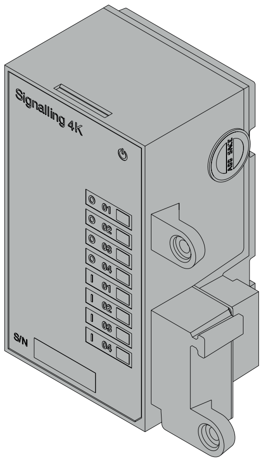
4 - Ekip Signalling 4K module

Description

Ekip Signalling 4K is a signalling accessory module.

This module has:

- Four contacts for output signals.
- Four digital inputs.
- A power state LED, and eight signalling LEDs (one LED for every output/input).



NOTE: *for the access to outputs and inputs, see the paragraph* "**Connections**" *on page* **225***. For the location of the LEDs, see the paragraph "***Signallings***", on page* **230.**

To switch the state of an input, a short circuit must be created between the input, and a reference available on the same terminal box. In parallel, the information on the state of the inputs is transmitted by the module to the trip unit, that can be programmed so that the activation of an input corresponds to an action on the part of the trip unit.

The closing or the opening of the contacts is commanded by the trip unit, which can be programmed so that the closing/opening corresponds to the occurrence of a desired event or combination of events.

The signalling LEDs light up in the presence of the short circuit for the inputs, or by closing the contact for the outputs.

Compatibility and power supply

The module can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and requires the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

NOTE: *the Ekip Signalling 4K module can be ordered only if the circuit-breaker is not equipped with AUX 6Q contacts.*

Electrical characteristics

The following table lists the electrical characteristics of the outputs of the module:

Component	Characteristics
Output contacts	• Maximum switching voltage [1]: 150 V DC / 250 V AC. • Breaking capacity [1]: 2 A @ 30 V DC, 0.8 A @ 50 V DC, 0.2 A @ 150 V DC, 4A @ 250 V AC. • 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.

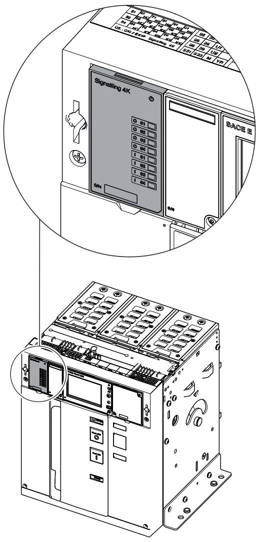
Connections

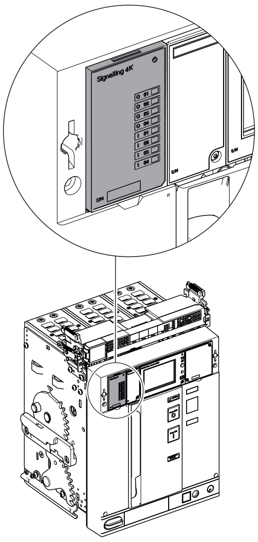
The module must be mounted directly on the Mainboard, to the left of the trip unit. The outputs and inputs of the module are therefore accessible from the terminal box of the circuit-breaker.

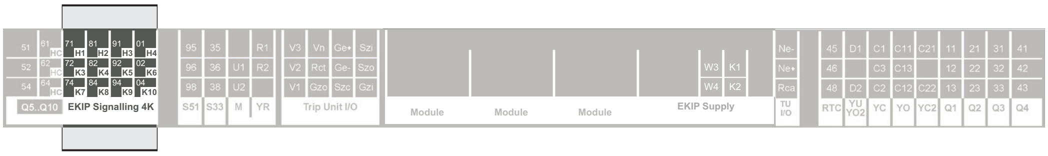
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0516**.

An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The wiring diagram for the module is shown below:







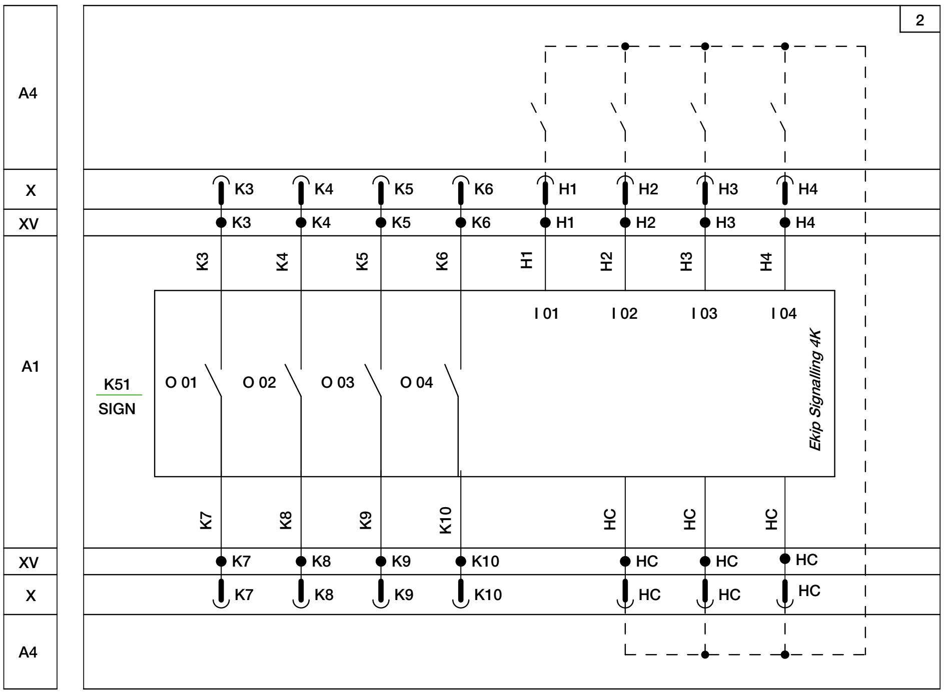


Diagram 2

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Access from the display

To configure the module the trip unit must be on.

Then, the presence of the module activates the additional menus on the display:

- In order to configure the input and output contacts.
- To display information on the module and the state of inputs and outputs.

The following table shows the path for accessing the configuration parameters of the module from the display:

Settings	…			
	Main frequency			
	Modules	Local/Remote		
		Local Bus		
		…		
		Ekip Signalling 4K	I 01	Polarity
				Delay
			I 02	(1)
			I 03	(1)
			I 04	(1)
			O 01	Signal source
				Delay
				Contact type
				Self-latching
				Min activation time
			O 02	(2)
			O 03	(2)
			O 04	(2)
		…		
		Functions		
	Power Controller			
	…			

(1) As the menu I 01.
(2) As the menu O 01.

NOTE: *the module can also be configured through the Ekip Connect software (see the chapter* "**17 - Other accessories**"*, and the paragraph* "**Ekip Connect software**" *on page* **288).**

The following table shows the configuration parameters of the inputs:

Parameter	Selectable values	Default	Description
Polarity	Active open, Active closed	Active closed	• Active open = To be considered active, the input must be floating. • Active closed = To be considered active, the input must be connected to its reference.
Delay	0.00…100.00 s steps of 0.01 s	0.1 s	Delay time after the input is activated before the change of state is recognized (if the input is reset before a time equal to the delay has elapsed, the change of state is not recognized). If 0.00 s is selected, the value 300 μs is assigned to the parameter.

Continued on the next page

The following table shows the configuration parameters of the outputs:

Parameter	Selectable values	Default	Description
Signal source	• None • Prealarm L • Delay L • Delay S • Opening L • Opening S • Opening G • Opening I • Every opening • Every delay • Threshold1 I1 (1) • Threshold2 I1 (1) • CB Open • CB Close • Local Bus Not Active • Custom (2)	None	The event that activates the outputs, so as to make the contact: • Closed, if set as NO. • Open, if set as NC.
Delay	0.00…100.00 s steps of 0.01 s	0.00 s	Standby time after the selected event has occurred, and before the output is activated (if the event disappears before a time equal to the delay elapsed, the output is not activated). If 0.00 s is selected, the value 300 μs is assigned to the parameter.
Contact type (3)	NO, NC	NO	• NO = Contact normally open. • NC = Contact normally closed.
Self-latching (3)	Off, On	Off	• Off = The output is deactivated when the event disappears. • On = When the event disappears, the output is kept active for the minimum time selected. **IMPORTANT: if the output is used for the Power Controller function, self-latching must not be enabled.**
Min activation time	0 ms, 100 ms, 200 ms, Pulse Mode	0 ms	The "Pulse Mode" value can only be selected if the output is used for the Power Controller function (see chapter "23 - Ekip Power Controller", on page 131). Then 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. On the contrary, with self-latching enabled, the minimum time in which the output is kept active (once the selected time has elapsed, the output is kept active as long as the event that activated it persists). **IMPORTANT: if the output is not used for the Power Controller function, the "Pulse Mode" value must not be selected.**

(1) For the sources Threshold1 I1 and Threshold2 I1, see the chapter "9 - Touch protections", and the paragraph "Current thresholds", on page 69.
(2) The Custom source is a combination of default events that can be modified using the Ekip Connect software so as to make the closing/opening of the contact correspond to a wide range of combinations of the status bits of the trip unit.
(3) If self-latching is configured as On and the contact Type must be changed (e.g. from NO to NC), after the parameters have been changed a signaling reset command must be transmitted (by pressing and holding the *iTEST* push-button for at least 4 s or by transmitting the *Reset signals* command from Ekip Connect.

Continued on the next page

The following table shows the path from the display for accessing information on the module:

About	Protection Unit	
	Circuit-breaker	
	Modules	…
		Ekip Signalling 4K
		…
	Power Controller	

Information that can be displayed on the module:

- The logical state of the inputs (“Off” if not active, “On” if active).
- The state of the output contacts (“Open” if open, “Closed” if closed).

The following tables illustrate the paths from the display to access the pages for programming the actions you wish the trip unit to perform in the event of an input being activated.

NOTE: *the selection of an action opens a list of the programming parameters, that is, a list of the events for which the action can be performed, and the related delay. For details on the parameters, see the chapter “***20 - Operating features***", and the paragraph* "**Functional characteristics**" *on page* **124.**

Advanced	…	
	Current thresholds	
	Functions [1]	External Trip
		Trip RESET

[1] Menus available with the Double Set function disabled (see the chapter "6 - Menu", and the paragraph " Settings Menu" on page 49.

Advanced	Set A	
	Set B	
	Functions [1]	External Trip
		Trip RESET
		Turn on SET B

[1] Menus available with the Double Set function enabled (see the chapter "6 - Menu", and the paragraph " Settings Menu" on page 49.

Measurements	…	
	Frequency	
	Energy [1]	Energy counters
		Reset counters
		RESET Energy
	Peak factor	
	…	

[1] Menu available with Ekip Measuring or Ekip Measuring Pro modules.

Continued on the next page

Settings	Circuit-breaker	…	
		Ground protection	
		Installation	
	Main frequency		
	Modules	…	
		Functions	Switch On LOCAL
			Signalling RESET
	Power Controller		
	…		
	System		
	Functions	YO Command	
		YC Command	
	Maintenance		

The following table describes the programmable actions on the trip unit:

Action	Description
Trip RESET	Resetting of the trip signal.
RESET Energy	Resetting of the energy counters (see the chapter "16 - Ekip Measuring Measurements", and the paragraph "Energy counters", on page 113).
External Trip	Opening of the circuit-breaker (see the chapter "6 - Menu", and the paragraph "Advanced menus", on page 48).
Switch On LOCAL	Switching of the connection from remote to local (see the chapter "6 - Menu", and the paragraph "Settings Menu", on page 49).
Signalling RESET	Resetting of the signals.
YO Command	Opening coil command (see the chapter "6 - Menu", and the paragraph " Settings Menu", on page 49).
YC Command	Closing coil command (see the chapter "6 - Menu", and the paragraph " Settings Menu", on page 49).
Turn on SET B	Switching the protections from configuration A to configuration B (see the chapter "11 - Hi-Touch protections", and the paragraph "Set A-B", on page 87).

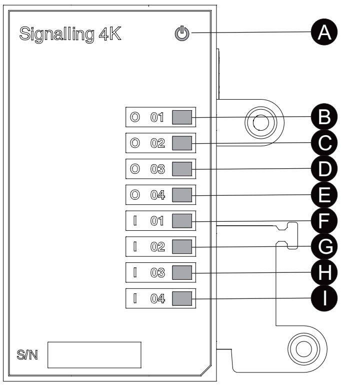
The following table shows the path for accessing the Test command of the module:

Test	…	
	Test CB	
	Ekip Signalling 2K (1)	
	Ekip Signalling 4K	Auto Test
	Zone selectivity (68)	

(1) Menu available with module Ekip signalling 2K.

Signallings The following table shows the possible signals, and their meaning:

NOTE: *for the references of contacts and inputs, see the paragraph "***Connections***", on page* **225.**



Pos.	Name	Description
A	-	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply present.
B	O 01	LED for signalling the state of contact the K3 - K7, green. The possible states are: • Off: contact open. • On fixed: contact closed.
C	O 02	LED for signalling the state of contact the K4 - K8, green. The possible states are: • Off: contact open. • On fixed: contact closed.
D	O 03	LED for signalling the state of the contact K5 - K9, green. The possible states are: • Off: contact open. • On fixed: contact closed.
E	O 04	LED for signalling the state of the contact K6 - K10, green. The possible states are: • Off: contact open. • On fixed: contact closed.
F	I 01	LED for signalling the physical state of the input H1, green [1]. The possible states are: • Off: floating input. • On fixed: input short-circuited on HC.
H	I 02	LED for signalling the physical state of the input H2, green [1]. The possible states are: • Off: floating input. • On fixed: input short-circuited on HC.
G	I 03	LED for signalling the physical state of the input H3, green [1]. The possible states are: • Off: floating input. • On fixed: input short-circuited on HC.
I	I 04	LED for signalling the physical state of the input H4, green [1]. The possible states are: • Off: floating input. • On fixed: input short-circuited on HC.

[1] The LED turns on and off according to the physical state of the input, without taking any account of how the Delay parameter is set.

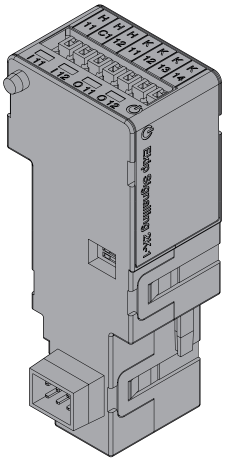
5 - Ekip Signalling 2K modules

Description

Ekip Signalling 2K is a signalling accessory module.

This module has:

- Two digital inputs, and two contacts for output signals.
- A power status LED, and four signalling LEDs (one LED for every input/output).



NOTE: *for the positioning of inputs, outputs and LEDs, see the paragraph "***Signals and inputs/outputs***", on page* **238.**

To switch the state of an input, a short circuit must be created between the input and a reference available on the same connector. In parallel, the information on the state of the inputs is transmitted by the module to the trip unit, that can be programmed so that the activation of an input corresponds to an action of the trip unit.

The closing or the opening of the contacts is commanded by the trip unit, which can be programmed so that the closing/opening corresponds to the occurrence of a desired event or combination of events.

The signalling LEDs light up in the presence of the short circuit for the inputs, or by closing the contact for the outputs.

IMPORTANT: on each circuit-breaker, a maximum of two (for E1.2 circuit-breakers) or three (for E2.2-E4.2-E6.2 circuit breakers) Ekip Signalling 2K modules can be installed: one 2K-1, one 2K-2, and one 2K-3 (for E2.2-E4.2-E6.2 circuit breakers only). These modules differ in name and label, and have distinct wirings, but they are identical as regards their characteristics and installation.

Functionality is guaranteed with the circuit-breaker in the racked-in position.

IMPORTANT:

- **when the circuit-breaker is in the disconnected position, the module overrides the outputs as per the configuration of the Type of Contact parameters (NO, NC); this override is not performed if output configuration is: input state of the module itself, communication with trip unit failed.**
- **In the absence of power supply the contacts are always in the open position.**

Compatibility and power supply

The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

Electrical characteristics

The following table lists the electrical characteristics of the modules:

Component	Characteristics
Output contacts	• Maximum switching voltage [1]: 150 V DC / 250 V AC. • Breaking capacity [1]: 2 A @ 30 V DC, 0.8 A @ 50 V DC, 0.2 A @ 150 V DC, 4A @ 250 V AC. • 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.

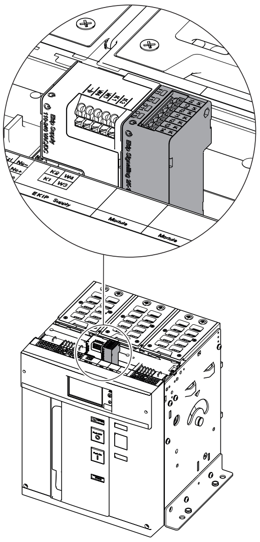
Connections

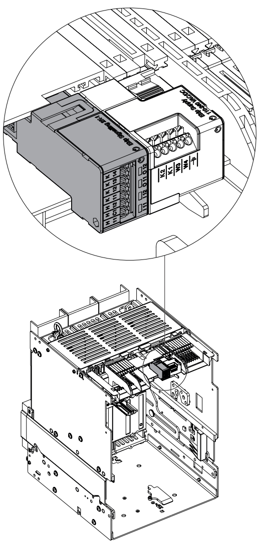
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

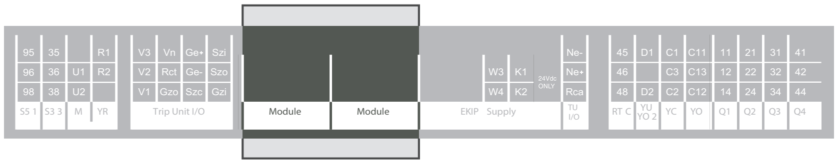
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0524.

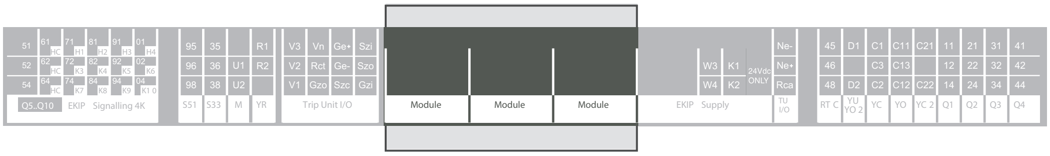
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

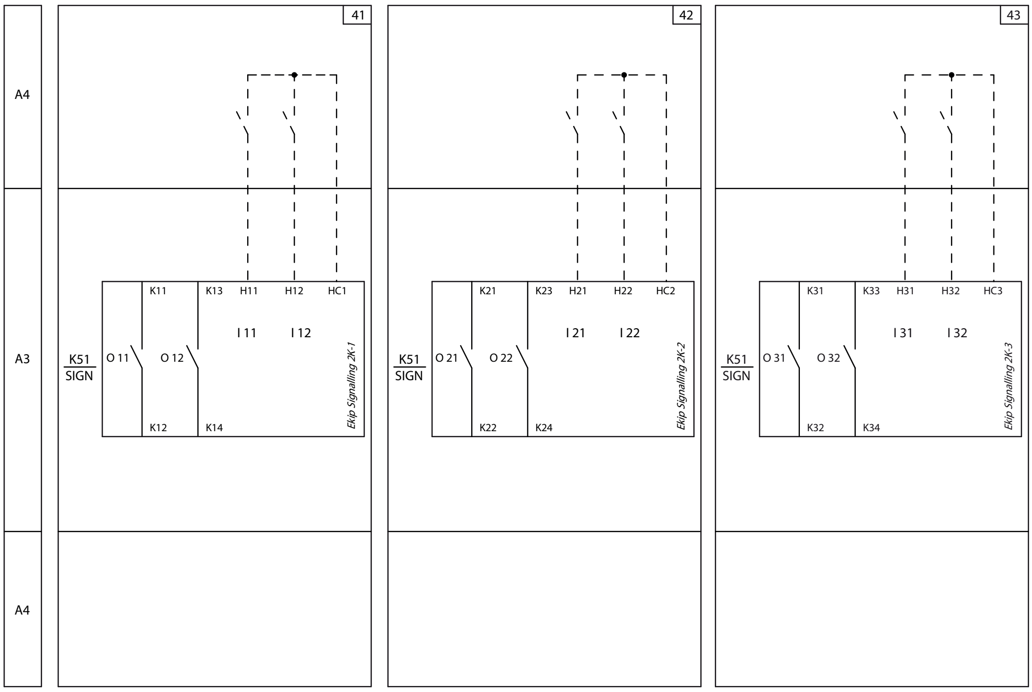
The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:











Diagrams 41 - 42 - 43

For external wiring, AWG 22-16 cables with a maximum external diameter of 1.4 mm must be used.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display:

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display.

- In order to configure the input and output contacts.
- To display information on the modules and the state of inputs and outputs.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path for accessing the configuration parameters of the modules from the display:

Settings	...			
	Main frequency			
	Modules	Local/Remote		
		Local Bus		
		...		
		Ekip Signalling 2K-1	I 01	Signal source
				Delay
			I 02	(1)
			O 01	Signal source
				Delay
				Contact type
				Self-latching
				Min activation time
			O 02	(2)
		Ekip Signalling 2K-2	(3)	
		Ekip Signalling 2K-3	(3)	
		...		
		Functions		
	Power Controller			
	...			

(1) As menu I 01.
(2) As menu O 01.
(3) As menu Signalling 2K-1.

NOTE: *the modules can also be configured with the Ekip Connect software (see the chapter "***17 - Other accessories***", and the paragraph "***Ekip Connect software***" on page* **288).**

NOTE: *Ekip Signalling 2K-3 module menu available with E2.2-E4.2-E6.2 circuit-breakers.*

Continued on the next page

The following table shows the configuration parameters of the outputs:

Parameter	Selectable values	Default	Description
Signal source	• None • Prealarm L • Delay L • Delay S • Opening L • Opening S • Opening G • Opening I • Every opening • Every delay • Threshold1 I1 (1) • Threshold2 I1 (1) • CB Open • CB Close • Local Bus Not Active • Custom (2)	None	The event that activates the outputs, so as to make the contact: • Closed, if set as NO. • Open, if set as NC.
Delay	0.00…100.00 s steps of 0.01 s	0.00 s	Standby time after the selected event has occurred, and before the output is activated (if the event disappears before a time equal to the delay elapsed, the output is not activated). If 0.00 s is selected, the value 300 μs is assigned to the parameter.
Contact type (3)	NO, NC	NO	• NO = Contact normally open. • NC = Contact normally closed.
Self-latching (3)	Off, On	Off	• Off = The output is deactivated when the event disappears. • On = When the event disappears, the output is kept active for the minimum time selected. **IMPORTANT: if the output is used for the Power Controller function, self-latching must not be enabled.**
Min activation time	0 ms, 100 ms, 200 ms, Pulse Mode	0 ms	The "Pulse Mode" value can only be selected if the output is used for the Power Controller function (see chapter "23 - Ekip Power Controller", on page 131). Then 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. On the contrary, with self-latching enabled, the minimum time in which the output is kept active (once the selected time has elapsed, the output is kept active as long as the event that activated it persists). **IMPORTANT: if the output is not used for the Power Controller function, the "Pulse Mode" value must not be selected.**

(1) For the sources Threshold1 I1 and Threshold2 I1, see the chapter "9 - Touch protections", and the paragraph "Current thresholds", on page 69.
(2) The Custom source is a combination of default events that can be modified using the Ekip Connect software so as to make the closing/opening of the contact correspond to a wide range of combinations of the status bits of the trip unit.
(3) If self-latching is configured as On and the contact Type must be changed (e.g. from NO to NC), after the parameters have been changed a signaling reset command must be transmitted (by pressing and holding the *iTEST* push-button for at least 4 s or by transmitting the *Reset signals* command from Ekip Connect.

Continued on the next page

The following table shows the configuration parameters of the inputs:

Parameter	Selectable values	Default	Description
Polarity	Active open, Active closed	Active closed	• Active open = To be considered active, the input must be floating. • Active closed = To be considered active, the input must be connected to its reference.
Delay	0.00…100.00 s steps of 0.01 s	0.1 s	Delay time after the input is activated before the change of state is recognized (if the input is reset before a time equal to the delay has elapsed, the change of state is not recognized). If 0.00 s is selected, the value 300 μs is assigned to the parameter.

IMPORTANT: if the trip unit is disconnected for at least 8 s, the outputs are deactivated, except those programmed to be activated in case of disconnection. Normal operation is restored at reconnection.

The following table shows the path from the display for accessing information on the modules:

<table>
<tr><td rowspan="7">About</td><td>Protection Unit</td><td></td></tr>
<tr><td>Circuit-breaker</td><td></td></tr>
<tr><td rowspan="5">Modules</td><td>…</td></tr>
<tr><td>Ekip Signalling 2K-1</td></tr>
<tr><td>Ekip Signalling 2K-2</td></tr>
<tr><td>Ekip Signalling 2K-3</td></tr>
<tr><td>…</td></tr>
<tr><td></td><td>Power Controller</td><td></td></tr>
</table>

Information that can be displayed on the modules:

- The serial number and the software version.
- The logical state of the inputs (“Off” if not active, “On” if active).
- The state of the output contacts (“Open” if open, “Closed” if closed).

Continued on the next page

The following tables illustrate the paths from the display to access the pages for programming the actions you wish the trip unit to perform in the event of an input being activated.

NOTE: *the selection of an action opens a list of the programming parameters, that is, a list of the events for which the action can be performed, and the related delay. For details on the parameters, see the chapter "***20 - Operating features***", and the paragraph "***Functional characteristics***" on page* **124.**

Advanced	…	
	Current thresholds	
	Functions [(1)]	External Trip
		Trip RESET

[(1)] Menus available with the Double Set function disabled (see the chapter "6 - Menu", and the paragraph " Settings Menu" on page 49.

Advanced	Set A	
	Set B	
	Functions [(1)]	External Trip
		Trip RESET
		Turn on SET B

[(1)] Menus available with the Double Set function enabled (see the chapter "6 - Menu", and the paragraph " Settings Menu" on page 49.

Measurements	…	
	Frequency	
	Energy [(1)]	Energy counters
		Reset counters
		RESET Energy
	Peak factor	
	…	

[(1)] Menu available with Ekip Measuring or Ekip Measuring Pro modules.

Settings	Circuit-breaker	…	
		Ground protection	
		Installation	
	Main frequency		
	Modules	…	
		Functions	Switch On LOCAL
			Signalling RESET
	Power Controller		
	…		
	System		
	Functions	YO Command	
		YC Command	
	Maintenance		

Continued on the next page

The following table describes the programmable actions on the trip unit:

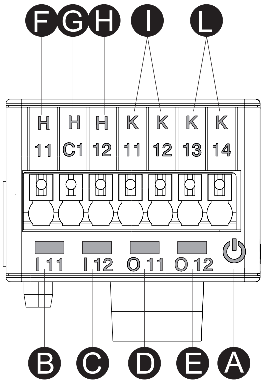
Action	Description
Trip RESET	Resetting of the trip signal.
RESET Energy	Resetting of the energy counters (see the chapter "16 - Ekip Measuring Measurements", and the paragraph "Energy counters", on page 113).
External Trip	Opening of the circuit-breaker (see the chapter "6 - Menu", and the paragraph "Advanced menus", on page 48).
Switch On LOCAL	Switching of the connection from remote to local (see the chapter "6 - Menu", and the paragraph "Settings Menu", on page 49).
Signalling RESET	Resetting of the signals.
YO Command	Opening coil command (see the chapter "6 - Menu", and the paragraph " Settings Menu", on page 49).
YC Command	Closing coil command (see the chapter "6 - Menu", and the paragraph " Settings Menu", on page 49).
Turn on SET B	Switching the protections from configuration A to configuration B (see the chapter "11 - Hi-Touch protections", and the paragraph "Set A-B", on page 87).

The following table shows the path for accessing the Test command of the module:

Test	...	
	Test CB	
	Ekip Signalling 2K	Auto Test
	Ekip Signalling 4K (1)	
	Zone selectivity (68)	

(1) Menu available with module Ekip signalling 4K.

Signals and inputs/outputs The following table shows all the signals, inputs and outputs of the module:



Pos.	Name	Description
A	-	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled) (1).
B	I x1 (2)	LED for signalling the physical state of the input H x1 (2), green (3). The possible states are: • Off: floating input. • On fixed: input short-circuited on H Cx (2).
C	I x2 (2)	LED for signalling the physical state of the input H x2 (2), green (3). The possible states are: • Off: floating input. • On fixed: input short-circuited on H Cx (2).
D	O x1 (2)	LED for signalling contact K x1 - K x2 (2), green. The possible states are: • Off: contact open. • On fixed: contact closed.
E	O x2 (2)	LED for signalling the state of the contact K x3 - K x4 (2), green. The possible states are: • Off: contact open. • On fixed: contact closed.
F	H x1 (2)	Input I x1.
G	H Cx (2)	Conductive part of the inputs H x1 and H x2 (2).
H	H x2 (2)	Input I x2 (2).
I	K x1, K x2 (2)	Output contact pin O x1 (2).
L	K x3, K x4 (2)	Output contact pin O x2 (2).

(1) The absence of communication is signalled immediately by the power LED, unlike the outputs which (except for those programmed to be activated in the case of disconnection) are deactivated if the condition persists for at least 8 s.
(2) With x = 1, 2, or 3.
(3) The LED turns on and off according to the physical state of the input, without taking any account of how the Delay parameter is set.

6 - Ekip Signalling 3T modules

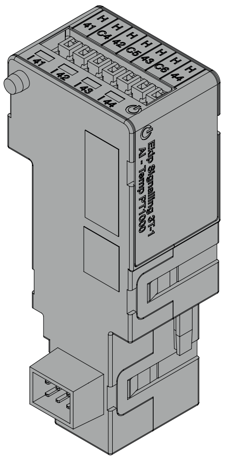
Description

Ekip Signalling 3T is a signaling accessory which enables the connection of:

- 3 analog inputs for PT1000 temperature sensors (2 wires).
- 1 analog input for 4-20mA current loop.

The measurements supplied by the module can be associated with different control threshold, useful for configuring alarm signals, states and programmable commands.

The module can be installed on all Emax 2 circuit-breakers in the presence of trip units Ekip Touch, Hi-Touch, G Touch, G Hi-Touch (of the equivalent Ekip LCD models) with firmware version 2.23 or higher.



Models

Emax 2 can be configured with 2 different 3T modules: *Ekip Signalling 3T-1* and *Ekip Signalling 3T-2*.

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 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. The configuration with two modules of the same model is not allowed (example: two Ekip Signalling 3T-1 modules).

Input

The module enables the following quantities to be measured

Input	Measurement	Range	Auflösung	Accuracy (1)
PT1000	Temperature	-50 ÷ 250 °C	0,01 °C	± 0,25 °C (2)
Current loop 4-20 mA	DC current	0 ÷ 100 % (3)	0.1 %	± 0,5 % (4)

(1) Accuracy values refer to 3T module without sensors. For complete accuracy, consider the characteristics of the sensors and cabling used.
(2) Accuracy valid in -25 to 250°C range; in complete range it is: ± 0.5°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.

Power supply

Ekip Signalling 3T is supplied directly by the *Ekip Supply* module to which it is connected.

NOTE: *in the following cases:*

- *no auxiliary supply*
- *withdrawable circuit-breaker momentarily in withdrawn position.*

communication between trip unit and module is interrupted and the information supplied (state and measurement of the inputs) is not valid.

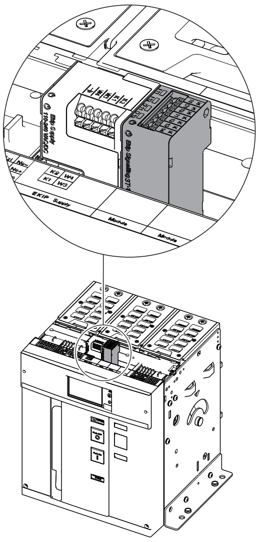
Connections - Module

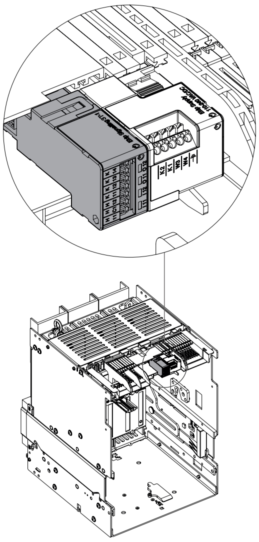
The module must be installed on the terminal box of the circuit-breaker (in the fixed version), or on the fixed part (in the withdrawable version), in the first slot after the Ekip Supply module.

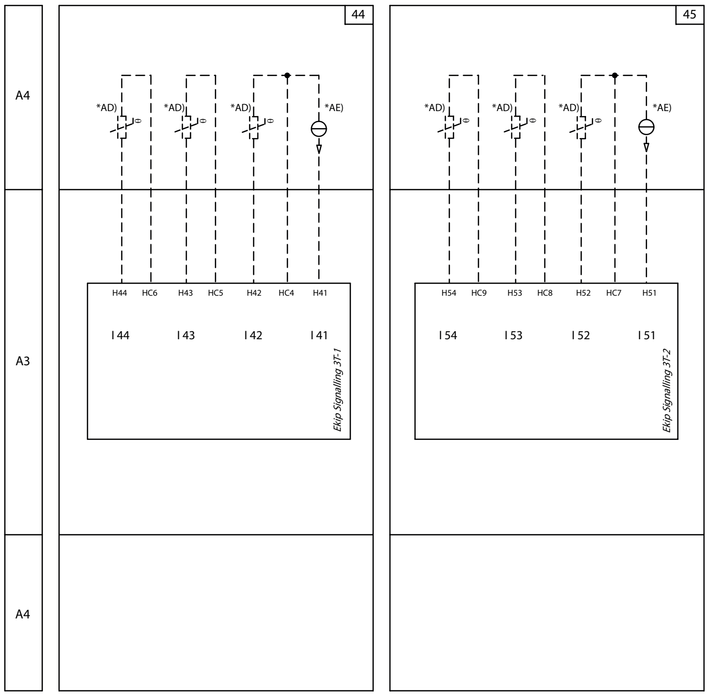
Further details about assembly of module 3T on Emax 2 circuit-breakers are available at http://www.abb.com/abblibrary/DownloadCenter/, especially in the kit sheet 1SDH001000R0527.

There are two examples alongside, with circuit-breaker E2.2 in the fixed and withdrawable versions.

Connection of each input (H41, H42, H43, H44 for model 3T-1, H51, H52, H53, H54 for model 3T-2) must be performed with reference to the respective common contacts (HC), as indicated in the circuit diagram:







Diagrams 44 - 45

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Connections - Inputs

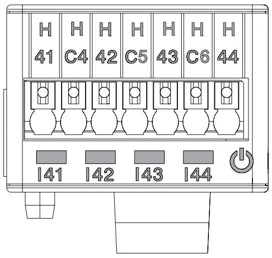
For PT1000 sensors, use insulated cables for thermistors such as PENTRONIC TEC/SITW-24F (Type TX) or similar. Maximum length 3 meters

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 dedicated isolated external sensor PT1000, which can be ordered by code 1SDA085695R1, 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).

Interface

Five signalling leds are available:



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 (2 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 measurement not valid.

Access from the display

Local bus activation, which is essential for starting the communication between module and trip unit, is available in the Settings Menuon page 49.

The following areas are activated on the trip unit if the *Ekip Signalling 3T* is detected correctly:

- *Measurements* page, accessible from the Home page by pressing at the sides of the display, containing the measurements of all the PT1000 and Current Loop 4-20mA inputs of both modules 3T-1 and 3T-2.
- Information submenus in the *Information-Modules* menu containing: serial number, module version and state of sensors (Present/Alarm).

IMPORTANT:

- If one or more sensors are in the alarm state, the signal on the diagnosis bar will be: Ekip Signalling 3T.
- If a sensor is not enabled, the state indicated is: Present

Remote configurations

The configuration of the module is available:

- Via Ekip Connect, with communication accessories from service connector or with communication from system bus.
- With own communication system and Ekip Com modules installed on circuit-breaker, in the conditions required by the trip unit (use the 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 2 are given in the tables.*

Enabling and measurements

The individual inputs of the module: PT1000 1, PT1000 2, PT1000 3 and Current Loop 4-20mA can be enabled in the *Ekip Signalling 3T* page.

Parameter	Description	Default
Enable	Enables the specific input and relative alarm state and signaling controls to be activated	Enabled

The state alarms and the measurement detected for each input are also available in the page.

Alarm signals

In the *Protection parameters - Other parameters A* (and *B*, if dual set is activated) page, up to three alarm thresholds, independent of each other: THR 1, THR2, TH3, can be activated and configured for each input.

Each alarm threshold has the following configuration parameters:

NOTE: *the table lists the parameters of threshold 1 of input PT1000 1; the names and references of all the other thresholds and inputs change.*

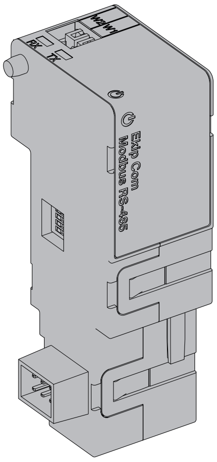
Parameter	Description	Default
PT1000 1 THR 1 Protection	Activates verification of input PT1000 1 with alarm threshold THR 1.	Disabled
PT1000 1 THR 1 Config	Defines whether the alarm must activate when measurement is above (Up) or below (Down), with reference to the THR 1 threshold setting.	Down
PT1000 1 THR 1	THR 1 alarm threshold of input PT1000 1. The value is expressed in degrees Celsius (°C) and can be set within the range: -40 °C to 240 °C with 0.1°C steps. **IMPORTANT:**: the thresholds of the 4-20 mA Current Loop input are given in percentage form, settable within the 0% to 100 % range in 0.1% steps (each step equivalent to 0.016 μA).	200 °C (PT1000) / 50% (4-20mA)
PT1000 1 THR 1 hysteresis	Hysteresis value, valid for quitting the alarm condition if the set THR 1 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 Config parameter, example: • Config = Up, THR 1 = 200°C, hysteresis = 10°C alarm activates over 200°C and de-activated 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. **IMPORTANT:**: the thresholds associated with the 4-20 mA Current Loop input are given in percentage form, settable within the 0% to 30% range in 0.1% steps (each step equivalent to 0.016 μA).	1 °C (PT1000) / 1% (4-20mA)

States and alarms

The state of all control thresholds can be checked in the *Warnings/Alarms* page.

7 - Ekip Com Modbus RTU modules

Description



Ekip Com Modbus RTU is a communication accessory module which integrates the circuit-breaker into a remote industrial supervision and monitoring network in two different modes, master and slave.

It can be connected to a RS-485 network with a Modbus RTU communication protocol, and allows you to:

- Connect the trip units to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.

For more details about how to access information and transmit commands to the trip unit via the module, consult chapter "System Interface" on page 155.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com Modbus RTU, and only one Ekip Com Modbus RTU Redundant can be installed.

IMPORTANT: functionality is guaranteed with the circuit-breaker in the Racked-in and Test positions. When the circuit-breaker is in the Withdrawn position, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Compatibility and power supply

The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

Termination resistor

A 120 Ω termination resistance can be linked to bus RS-485, thereby configuring the dip-switches **Rterm** located on the side of the modules in the **on** position. In the case of bus termination, a 220 Ω pull-up or pull-down resistor must also be installed on the lines by setting dip-switches **Rpoll** to the **on** position. These options must be selected before the installation of the modules.

Consult the next figure for the **on** and **off** positions of the dip-switches.

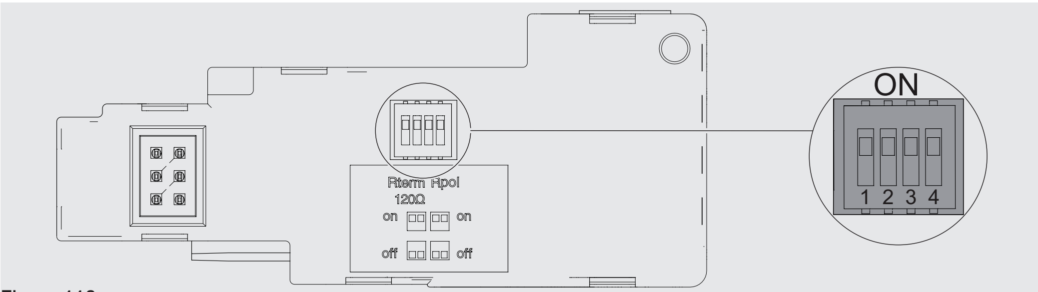


Figure 118

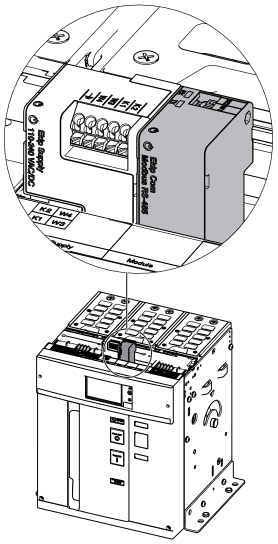
Connections

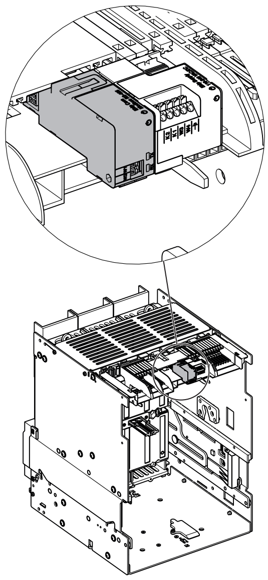
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

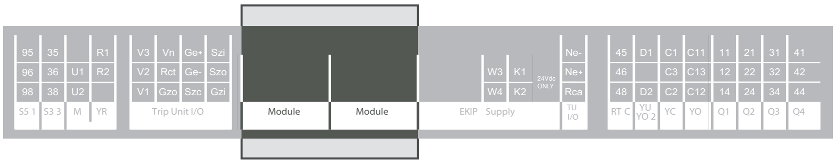
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0512**.

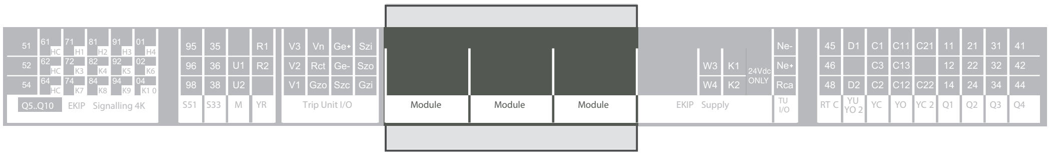
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

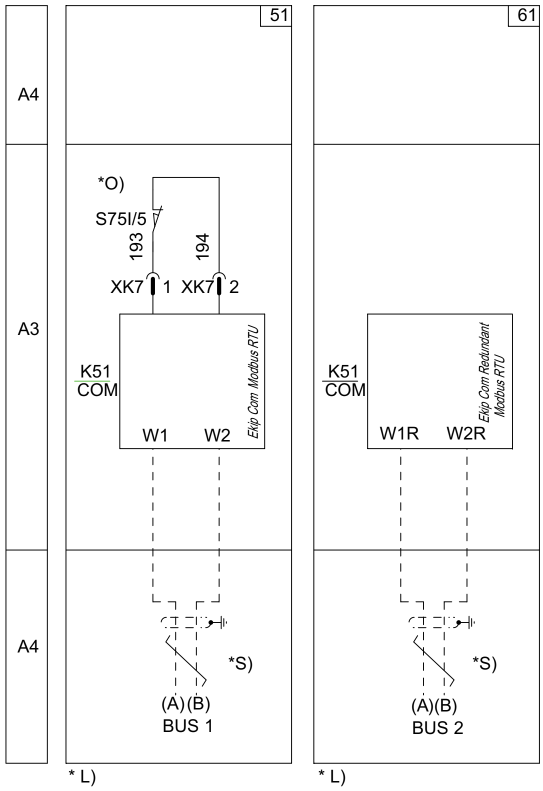
The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:











Diagrams 51 - 61

For the communication lines (A) and (B), Belden type 3105A or equivalent cables must be used.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path for accessing the configuration parameters of the modules from the display:

Settings	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Com Modbus RTU	Serial address
			Baudrate
			Physical protocol
		Ekip Com Modbus RTU *R	(1)
		...	
		Functions	
	Power Controller		
	...		

(1) As Ekip Com Modbus RTU.

The following table shows the configuration parameters of the modules:

Parameter	Values	Default	Description
Serial address	1… 247	• Ekip Com Modbus RTU: 247 • Ekip Com Modbus RTU Redundant: 246	Address to be assigned to the modules. **IMPORTANT: devices connected to the same network must have different addresses.**
Baudrate	9600 bit/s, 19200 bit/s, 38400 bit/s	19200 bit/s	Data transmission speed
Physical protocol	8.E,1, 8.O,1, 8.N,2, 8.N,1	8,E,1	• 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.

NOTE: *the modules can also be configured with the Ekip Connect software (see the chapter "***17 - Other accessories***", and the paragraph "***Ekip Connect software***" on page* **288***).*

The following table shows the path from the display for accessing information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Com Modbus RTU
		Ekip Com Modbus RTU *R
		...
	Power Controller	

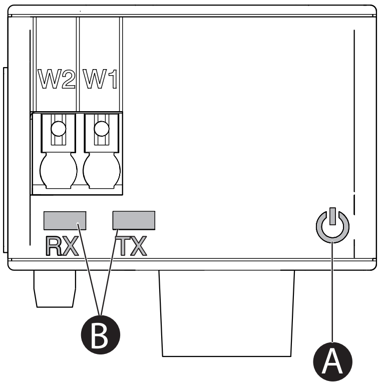
The information on the modules that can be displayed includes the serial number and the software version.

Remote configurations The operating configuration can be changed from slave to master via the service connector (via Ekip Connect) or via a system bus communication as as to integrate the module into an interactive data exchange network (see description of *Ekip Com Hub*).

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.**

Signallings The following table shows the possible signals, and their meaning:

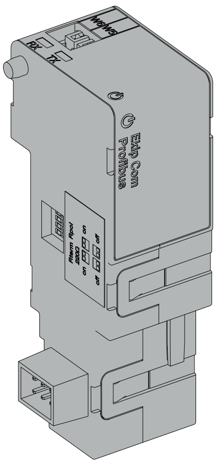


Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	RX and TX LEDs, green. The possible states are: • Off: Modbus RTU communication not active. • On, flashing rapidly: Modbus RTU communication active.

8 - Ekip Com Profibus DP modules

Description

The Ekip Com Profibus DB is a communication accessory module that integrates the circuit-breaker in an industrial remote supervision and control network.



It can be connected to a RS-485 network with a Profibus communication protocol, and allows of:

- Connect the trip units as slaves to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.

For more details about how to access information and transmit commands to the trip unit via the module, consult chapter "System Interface" on page 155.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com Profibus DP, and only one Ekip Com Profibus DP Redundant can be installed.

IMPORTANT: when the circuit-breaker is in the disconnected position, the trip unit is disconnected from the module: in this condition, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Compatibility and power supply

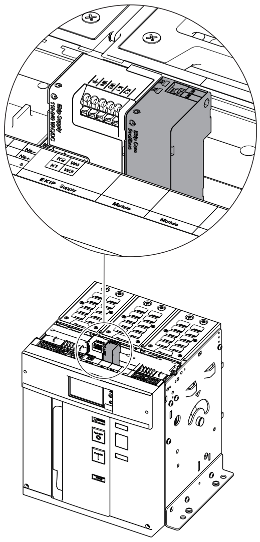
The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

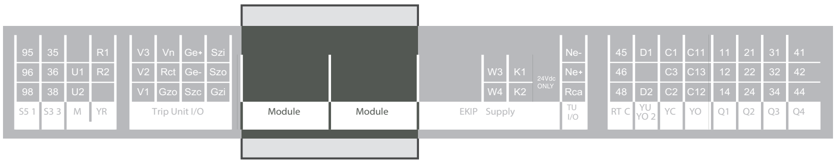
Connections The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

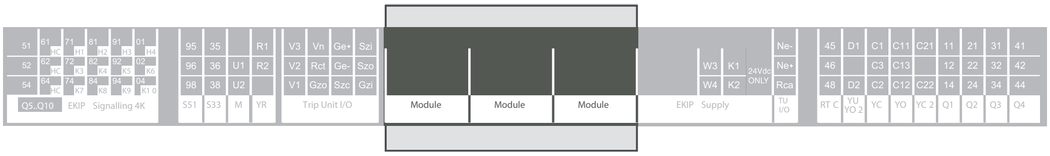
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0512.

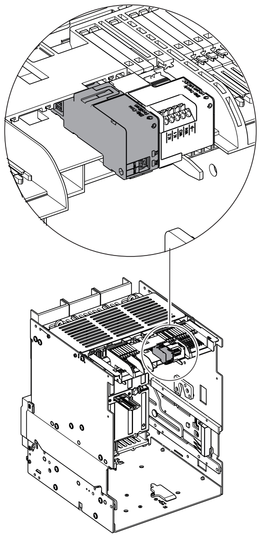
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

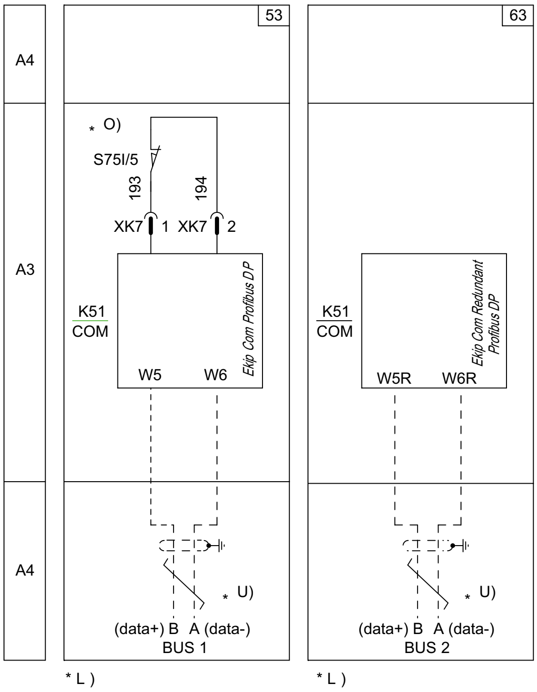
The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:











Diagrams 53 - 63

For the communication lines (A) and (B), Belden type 3079A or equivalent cables must be used.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Termination resistors

The modules provide the possibility to insert a 220 Ω termination resistor on the RS-485 bus, by setting the dip-switches **Rterm** on the side of the modules, in position **on**.

In the event of termination of the bus, a 390 Ω pull-up or pull-down resistor must also be inserted on the lines, by setting the dip-switches **Rpoll**, in position **on**.

These options must be selected before the installation of the modules.

For the positions **on** and **off** of the dip-switches, see the following figure.

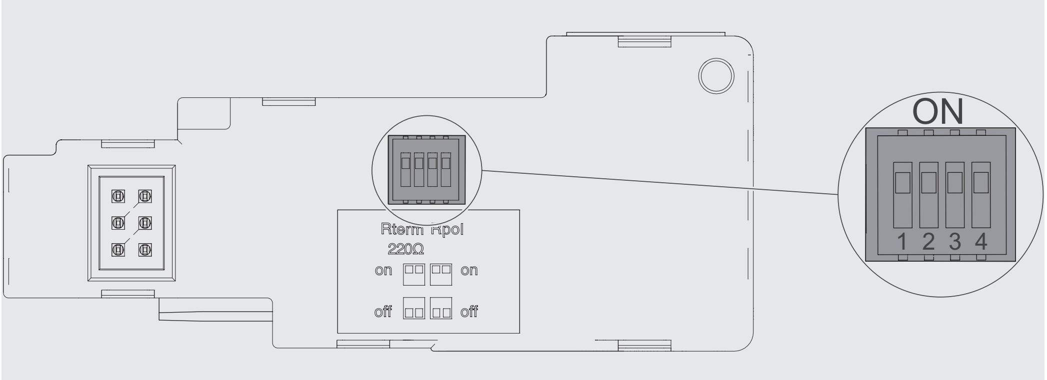


Figure 119

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path for accessing the configuration parameters of the modules from the display:

Settings 	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Com Profibus DP	Serial address
		Ekip Com Profibus DP *R	Serial address
		...	
		Functions	
	Power Controller		
	...		

NOTE: *the modules can also be configured with the Ekip Connect software (see the chapter "***17 - Other accessories***", and the paragraph* "**Ekip Connect software**" *on page* **288).**

The default serial address is 125 for Ekip Com Profibus DP, and 124 for Ekip Com Profibus DP Redundant, and can be changed to a value between 1 and 125.

IMPORTANT: devices connected to the same network must have different addresses.

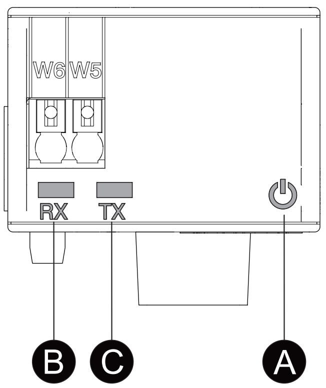
Continued on the next page

The following table shows the path from the display for accessing information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Com Profibus DP
		Ekip Com Profibus DP *R
		...
	Power Controller	

The information on the modules that can be displayed includes the serial number and the software version.

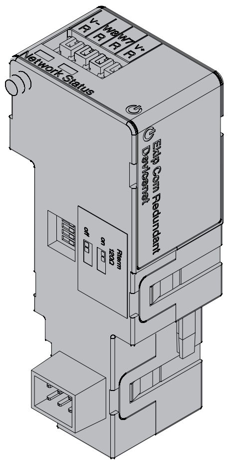
Signallings The following table shows the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	RX LED, green. The possible states are: • Off: communication between master and trip unit not active. • On fixed: communication between master and trip unit active.
C	TX LED, green. The possible states are: • Off: communication between master and trip unit not active. • On flashing: communication between master and trip unit active.

9 - Ekip Com DeviceNet modules™

Description



The Ekip Com DeviceNet™ is a communication accessory module that integrates the circuit-breaker in an industrial remote supervision and control network.

It can be connected to a CAN network with a DeviceNet™ communication protocol, and allows you to:

- Connect the trip units as slaves to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.

For more details about how to access information and transmit commands to the trip unit via the module, consult chapter "System Interface" on page 155.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com DeviceNet™, and only one Ekip Com Redundant DeviceNet™ can be installed.

IMPORTANT: when the circuit-breaker is in the disconnected position, the trip unit is disconnected from the module: in this condition, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

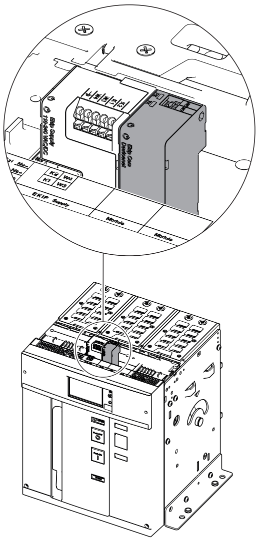
Compatibility and power supply

The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

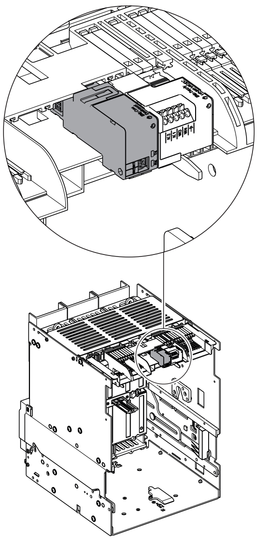
Connections

The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

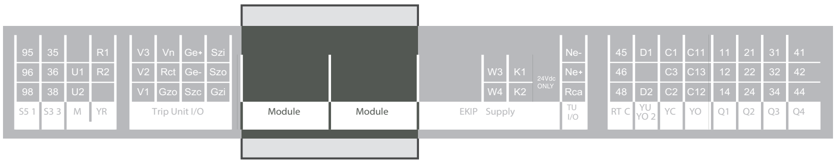
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0512**.

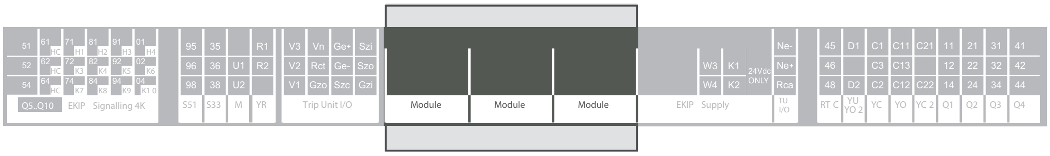


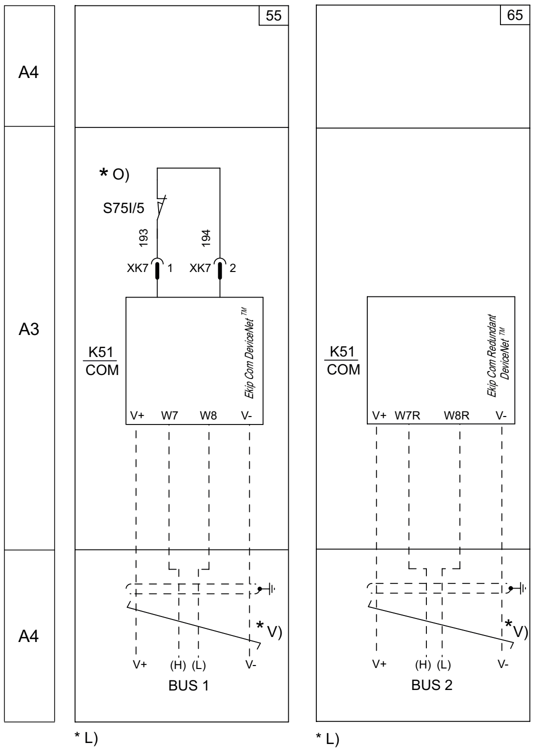
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.



The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:







Diagrams 55 - 65

For the communication buses BUS1 and BUS2, Belden type 3084A or equivalent cables must be used.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Termination resistor

The modules provide the possibility to insert a 120 Ω termination resistor on the CAN bus, by setting the dip-switches **Rterm** on the side of the modules, in position **on**. This option must be selected before the modules are installed.

For the positions **on** and **off** of the dip-switches **Rterm**, see the following figure (on DeviceNet™ communication modules, the remaining dip-switches are not used).

IMPORTANT:

- **The termination resistors must never be included in the nodes. The inclusion of this capability could easily lead to a network with improper termination (impedance too high or too low), potentially causing a failure. For example, the removal of a node, which includes a termination resistor, could result in a network failure.**
- **The termination resistors must not be installed at the end of a branch (drop line), but only at the two ends of the main backbone (trunk line).**

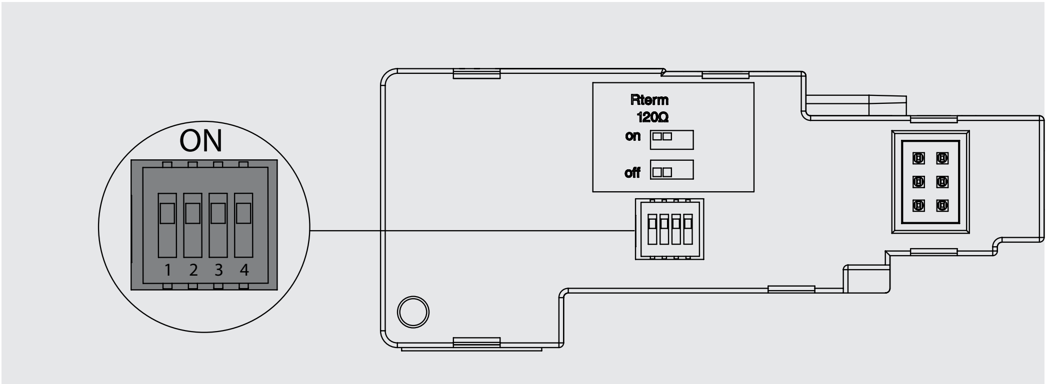


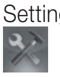
Figure 120

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display.

To enable the Local Bus, you need to select "On" in the menu **Settings**, **Modules**, **Local Bus**.

The following table shows the path for accessing the configuration parameters of the modules from the display:

Settings 	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Com DeviceNet™	MAC Address
			Baudrate
		Ekip Com DeviceNet™*R	MAC Address
			Baudrate
		...	
		Functions	
	Power Controller		
	...		

Continued on the next page

The following table shows the configuration parameters of the modules:

Parameter	Values	Default	Description
MAC Address	1…63	• Ekip Com DeviceNet™: 65 • Ekip Com Redundant DeviceNet™: 64	Address to be assigned to the modules. **IMPORTANT: devices connected to the same network must have different addresses.**
Baudrate	125 kbit/s, 250 kbit/s, 500 kbit/s	125 kbit/s	Data transmission speed

NOTE: *the modules can also be configured with the Ekip Connect software (see the chapter "***17 - Other accessories***", and the paragraph "***Ekip Connect software***" on page* **288).**

The following table shows the path from the display for accessing information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	…
		Ekip DeviceNet™
		Ekip DeviceNet™ *R
		…
	Power Controller	

The information on the modules that can be displayed includes the serial number and the software version.

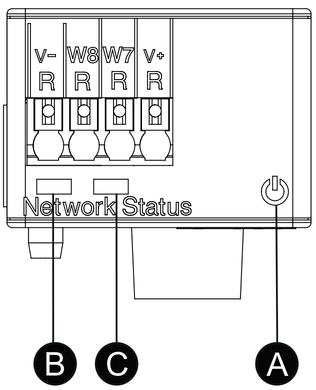
Remote configurations

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 and detects the error state).	DeviceNet standard

Signallings

The following table shows the possible signals, and their meaning:



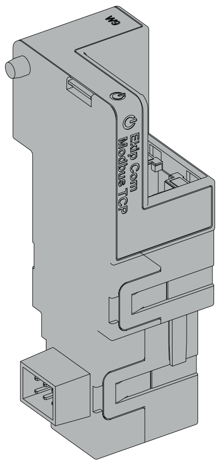
Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	LED, green. The possible states are: • Off: device off line (with red LED off) [1], or in error conditions (with red LED on). • On fixed: device on line, and allocated on a master (operating condition). • On flashing: device on line, but not allocated on a master (device ready for communication).
C	LED, red. The possible states are: • 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 Duplicate ID sequence on line.

10 - Ekip Com Modbus TCP modules

Description

Ekip Com Modbus TCP is an accessory module that can function as a communication module integrating the circuit-breaker in an industrial remote supervision and control network or as an HTTP Server.



As communication module, it can be connected to an Ethernet network with Modbus TCP communication, and allows to:

- Connect the trip units to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.

For more details about how to access information and transmit commands to the trip unit via the module, consult chapter "System Interface" on page 155.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

As HTTP Server, connected to an Ethernet network, this module allows read-only access to the information of the trip unit. This access is possible through a browser, inserting the IP address of the module. Once the trip unit has been found, a login page is opened that asks for the user password to be inserted, which is the same password to be inserted in the display to modify the parameters.

The following table shows the ports used by the module:

Port	Service	Notes
502/tcp	Modbus TCP	When the module is used as Modbus TCP/IP communication module.
80/tcp	Server HTTP	When the module is used as Server HTTP.
319/udp 320/udp	IEEE 1588	When IEEE protocol 1588 is enabled (see paragraph "Remote configurations", on page 260).
68/udp	DHCP client	DHCP Client enabled as an alternative to “Static Address = On”

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com Modbus TCP, and only one Ekip Com Modbus TCP Redundant can be installed.

IMPORTANT: when the circuit-breaker is in the disconnected position, the trip unit is disconnected from the module: in this condition, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Safety and cyber security

Since the module allows the circuit-breaker and access to the data in the trip unit to be checked, it can only be connected to networks equipped with all the necessary safety 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 Ekip Com Modbus TCP 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.**
- **The module cannot be connected directly to the Internet. Only connect to dedicated Ethernet networks with Modbus TCP communication protocol.**

Compatibility and power supply

The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

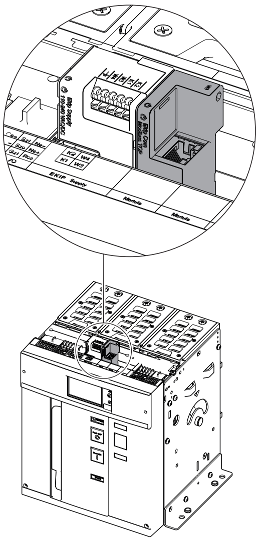
Connections

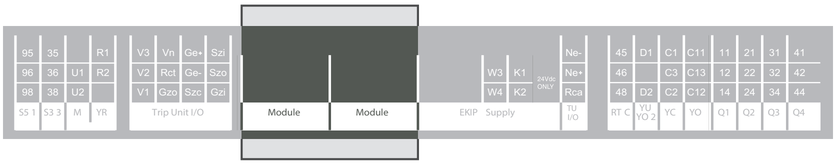
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

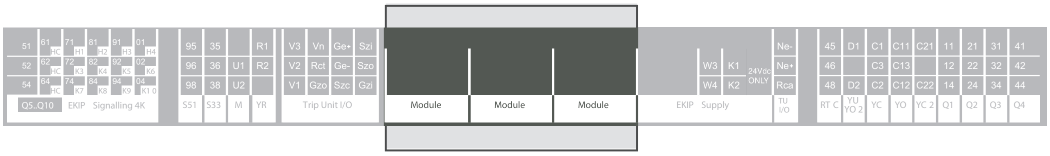
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0514.

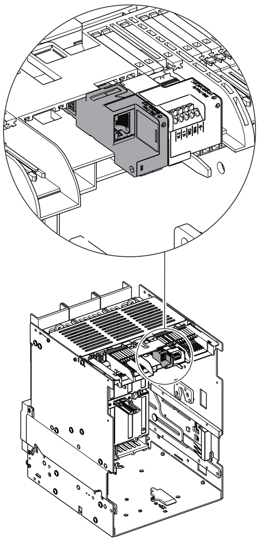
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

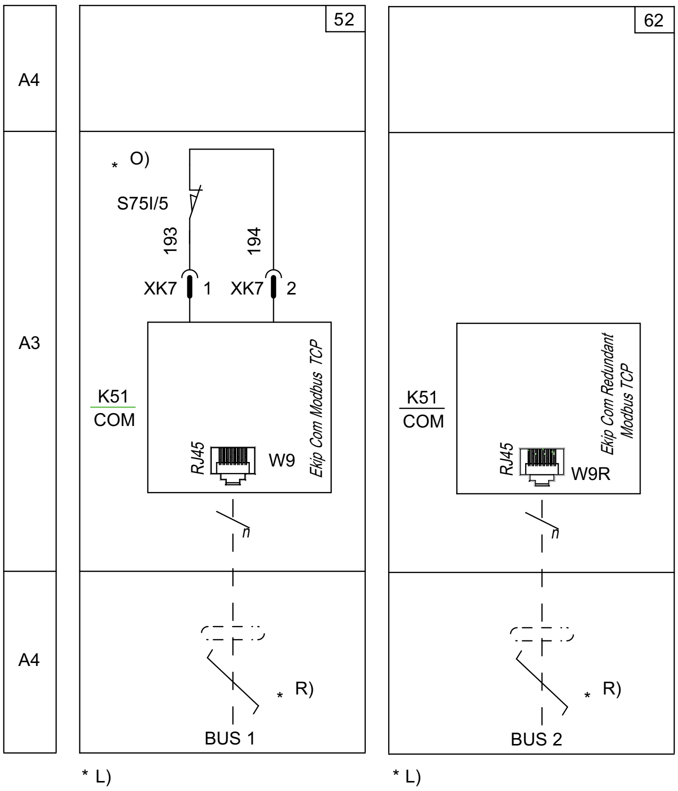
The following is a view of the terminal box of E1.2 and E2.2/E4.2/E6.2 circuit-breakers with the relevant wiring diagram:











Diagrams 52 - 62

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

If the circuit-breaker is in withdrawable version, the use of cables fitted with a RJ45 socket with output at 90° is recommended.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display:

- For setting the function and addressing of the modules.
- In order to display information on the modules.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path from the display, for setting the function and addressing of the modules:

Settings	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Com Modbus TCP	Function
			Force Static IP address
			Static IP Address
			Static Network Mask
			Static Gateway addr
		Ekip Com Modbus TCP *R	[1]
		...	
		Functions	
	Power Controller		
	...		

[1] As Ekip Com Modbus TCP menu.

The following table shows the parameters for setting the function and the addressing of the modules. For further information, see the table on page 259.

Parameter	Selectable values	Default	Description
Function	HTTP Server, Modbus TCP	Modbus TCP	• HTTP Server = HTTP Server operating mode. • Modbus TCP = Communication module operating mode.
Force Static IP address	Off, On	Off	• Off = Dynamic IP address. • On = Static IP address.
Static IP Address	Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.		
Static Network Mask	Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.		
Static Gateway addr	Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.		

Continued on the next page

The following table shows the path from the display for accessing information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Com Modbus TCP
		Ekip Com Modbus TCP *R
		...
	Power Controller	

Information that can be displayed on the modules:
- The serial number and the software version.
- The IP address, the Network Mask, and the Gateway Address.
- TCP Clients.
- The MAC Address.

The following table shows the information on the modules:

Information	Description
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have a value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. As an alternative, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different from that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enable the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	It is the IP address of the node to which the modules are connected, in case of multiple subnets. If you enable the Static IP Address option, you must also enter the correct Gateway Address.
TCP Client	There are three IP Addresses of the client devices connected to the modules.
MAC Address	It is the address assigned by ABB, having an OUI equal to ac:d3:64 (1).

(1) Organizationally Unique Identifier, formed by the first three bytes of a MAC address, and 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:

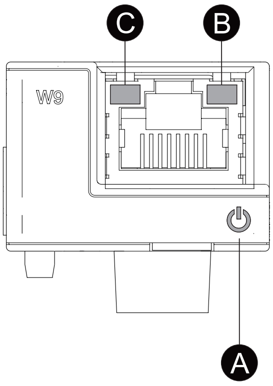
Parameter	Description	Default
Client/Server	Parameter for changing the configuration of the module from Server Only to Client and Server and for integrating it into an interactive data exchange network (see chapter "15 - Ekip Com Hub modules" on page 282). **IMPORTANT:**: if Client/Server, the module allows data exchange like a normal Server function.	Server only
IEEE 1558 enable	Enables 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	Enables the data exchange mode between module and master, between Peer-to-Peer and End-to-End to be selected.	End-to-End
SNTP Client enable	Enables the SNTP protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
Force Static IP Address	Enables 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 by the network to be protected by a password (Password request).	Standard mode
Password Modbus TCP	With access protected by enabled password, is the password to use before each writing session (2).	Local access

(1) Enable IEEE 1558 and Enable SNTP client must not be enabled at the same time.
(2) The parameter can only be changed by 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 1558 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

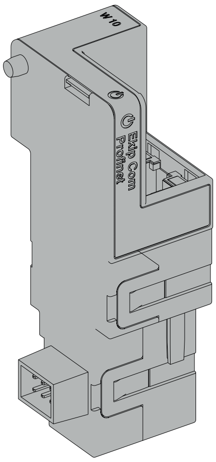
Signallings The following table shows the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	Link LED, green. The possible states are: • Off: connection error (signal absent). • On fixed: correct connection.
C	Activity LED, yellow. The possible states are: • Off: no activity on the line. • On flashing: activity on the line (in reception and/or transmission).

11 - Ekip Com Profinet modules

Description



The Ekip Com Profinet is a communication accessory module, that integrates the circuit-breaker in an industrial remote supervision and control network.

It can be connected to an Ethernet network with a Profinet communication protocol, and allows you to:

- Connect the trip units to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.

For more details about how to access information and transmit commands to the trip unit via the module, consult chapter "System Interface" on page 155.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

The following table shows the ports used by the module:

Ethertype	Port	Service	Notes
0x88CC.	-	LLDP	Link Layer Discovery Protocol
0x8892 (Profinet).	-	Profinet IO	Specific for real time communications (RT)
0x0800.	34964/udp	Profinet-cm (Context Manager)	DCE/RPC

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com Profinet, and only one Ekip Com Profinet Redundant can be installed.

IMPORTANT: when the circuit-breaker is in the disconnected position, the trip unit is disconnected from the module: in this condition, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Safety and cyber security

Since the module allows the circuit-breaker and access to the data in the trip unit to be checked, it can only be connected to networks equipped with all the necessary safety 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 Ekip Com Profinet 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**

Compatibility and power supply

The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

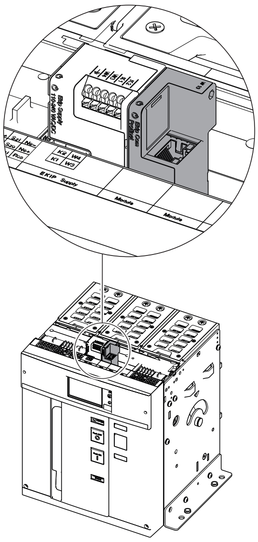
Connections

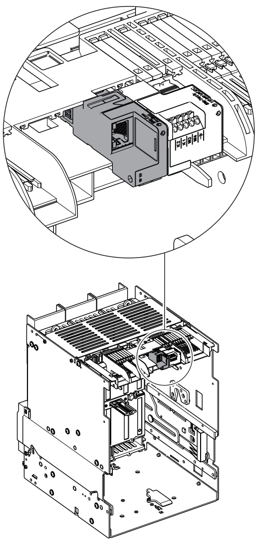
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

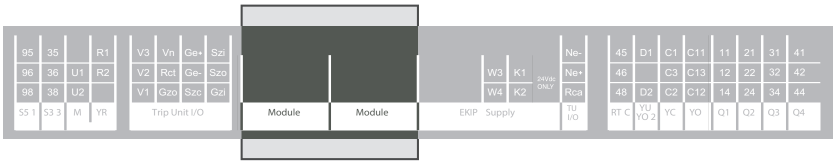
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0514**.

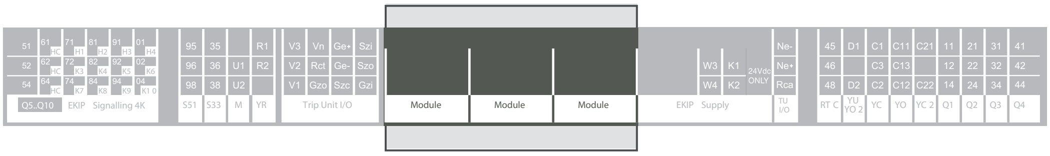
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

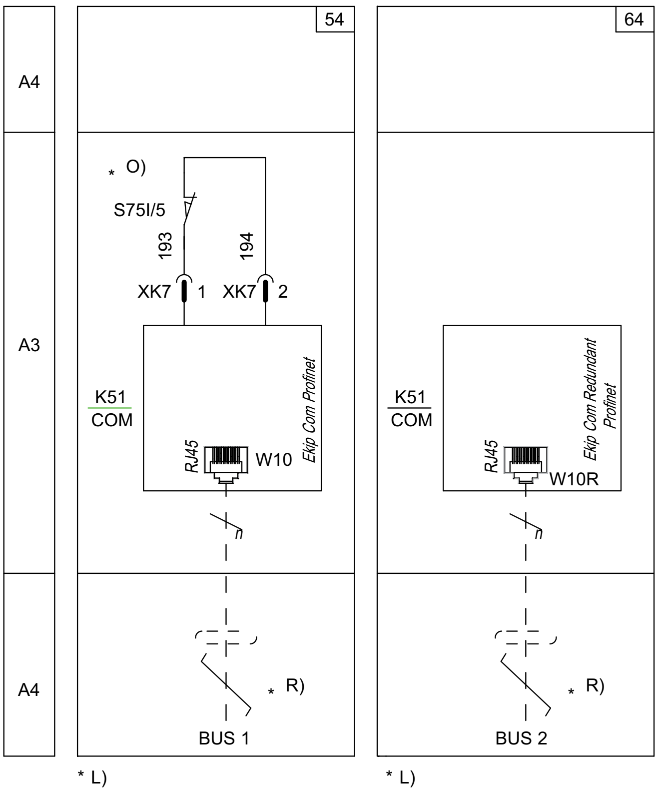
The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:











Diagrams 54 - 64

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

If the circuit-breaker is in withdrawable version, the use of cables fitted with a RJ45 socket with output at 90° is recommended.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Access from the display

With the modules energized and Local Bus enabled, the modules can be viewed on the display.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path from the display for accessing information on the modules:

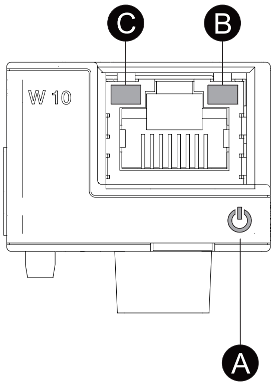
About	Protection Unit	
	Circuit-breaker	
	Modules	…
		Ekip Com Profinet
		Ekip Com Profinet *R
		…
	Power Controller	

Information that can be displayed on the modules:

- The serial number and the software version.
- The MAC address, assigned by ABB and with an OUI equal to ac:d3:64 (Organizationally Unique Identifier, formed of the first three bytes of a MAC address; the OUI uniquely identifies the manufacturer of an Ethernet device).

Signallings

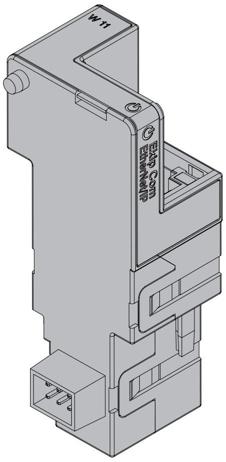
The following table shows the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	Link LED, green. The possible states are: • Off: connection error (signal absent). • On fixed: correct connection.
C	Activity LED, yellow. The possible states are: • Off: no activity on the line. • On flashing: activity on the line (in reception and/or transmission).

12 - Ekip Com EtherNet/IP™ modules

Description



Ekip Com EtherNet/IP™ is an accessory module that can act as a communication module integrating the circuit-breaker in an industrial remote supervision and control network.

It can be connected to an Ethernet network with EtherNet/IP™ communication protocol, and allows you to:

- Connect the trip units to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.

For more details about how to access information and transmit commands to the trip unit via the module, consult chapter "System Interface" on page 155.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

The following table shows the ports used by the module:

Port	Protocol	Notes
44818	TCP	Encapsulation Protocol (example: ListIdentity, UCMM, CIP Transport Class 3)
44818	UDP	Encapsulation Protocol (example: ListIdentity)
2222	UDP	CIP Transport Class 0 or 1
68/udp	DHCP Client	DHCP Client enabled as an alternative to “Static Address = On”

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com EtherNet/IP™, and only one Ekip Com Redundant EtherNet/IP™ can be installed.

IMPORTANT: when the circuit-breaker is in the disconnected position, the trip unit is disconnected from the module: in this condition, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Safety and cyber security

Since the module allows the circuit-breaker and access to the data in the trip unit to be checked, it can only be connected to networks equipped with all the necessary safety and prevention measures against unauthorized access (for example, the network of the control system of an installation).

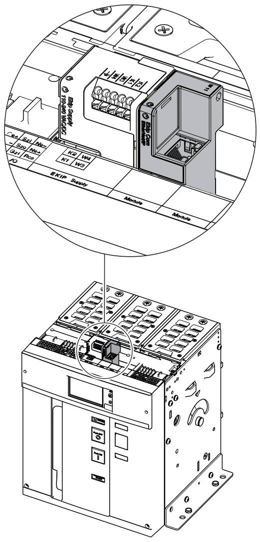
IMPORTANT:

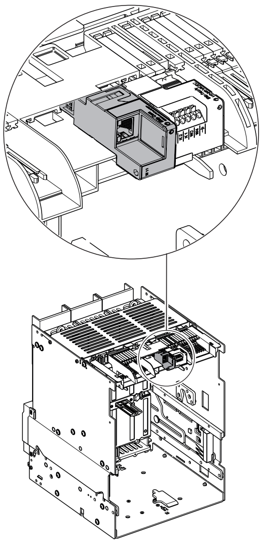
- **it is the customer's sole responsibility to provide and continuously ensure a secure connection between Ekip ComEtherNet/IP™ and customer network or any other network (as the case may be). The plant manager must establish and maintain appropriate measures (such as but not limited to the installation 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.**

Compatibility and power supply

The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

Connections



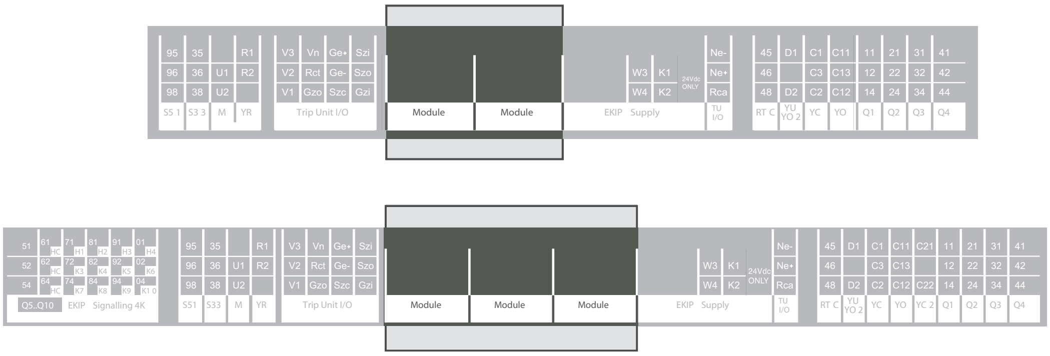


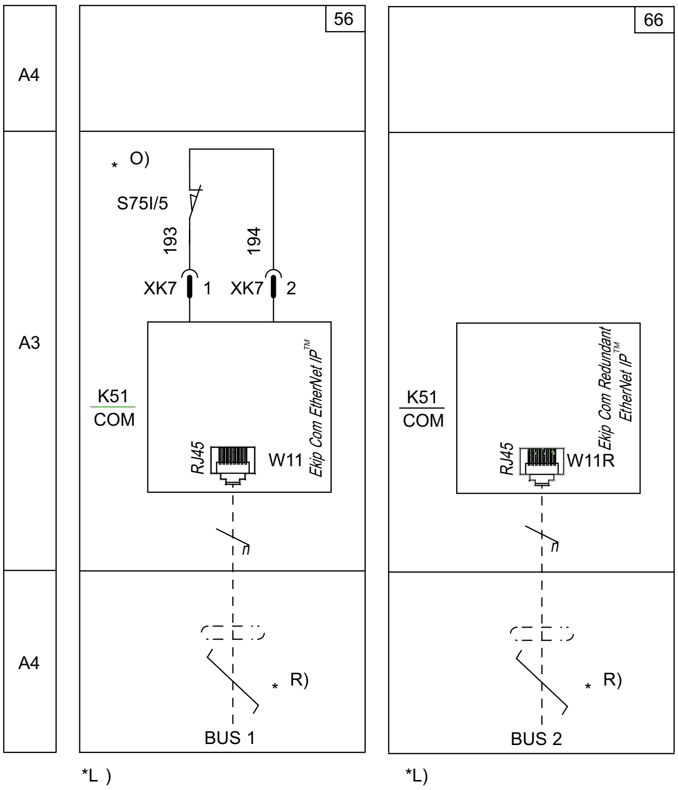
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0514.

An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:





Diagrams 56 - 66

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

If the circuit-breaker is in withdrawable version, the use of cables fitted with a RJ45 socket with output at 90° is recommended.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display:

- To set the addressing of the modules.
- In order to display information on the modules.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path from the display, for setting the function and addressing of the modules:

Settings	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Com EtherNet/IP™	Force Static IP address
			Static IP Address
			Static Network Mask
			Static Gateway addr
		Ekip Com EtherNet/IP™ *R	(1)
		...	
		Functions	
	Power Controller		
	...		

(1) As Ekip Com EtherNet/IP™.

The following table shows the parameters for setting the function and the addressing of the modules. For further information, see the table on page 259.

Parameter	Selectable values	Default	Description
Force Static IP address	Off, On	Off	• Off = Dynamic IP address. • On = Static IP address.
Static IP Address	Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.		
Static Network Mask	Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.		
Static Gateway addr	Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.		

The following table shows the path from the display for accessing information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Com EtherNet/IP™
		Ekip Com EtherNet/IP™ *R
		...
	Power Controller	

Information that can be displayed on the modules:

- The serial number and the software version.
- The IP address, the Network Mask, and the Gateway Address.
- The MAC Address.

Continued on the next page

The following table shows the information on the modules:

Information	Description
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have a value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. As an alternative, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different from that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enable the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	It is the IP address of the node to which the modules are connected, in case of multiple subnets. If you enable the Static IP Address option, you must also enter the correct Gateway Address.
MAC Address	It is the address assigned by ABB, having an OUI equal to ac:d3:64 (1).

(1) Organizationally Unique Identifier, formed by the first three bytes of a MAC address, and 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:

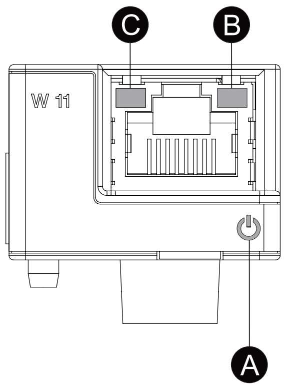
Parameter	Description	Default
IEEE 1558 enable	Enables the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
Master IEEE 1588	Enables the module to be set up as a master in the the network segment to which it belongs (synchronization clock).	OFF
IEEE 1588 delay mechanism	Enables the data exchange mode between module and master, between Peer-to-Peer and End-to-End to be selected.	End-to-End
SNTP Client enable	Enables the SNTP protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
Force Static IP Address	Enables 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 1558 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
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 1558 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

Signallings The following table shows the possible signals, and their meaning:

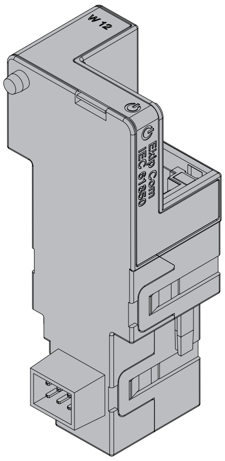


Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	Link LED, green. The possible states are: • Off: connection error (signal absent). • On fixed: correct connection.
C	Activity LED, yellow. The possible states are: • Off: no activity on the line. • On flashing: activity on the line (in reception and/or transmission).

13 - Ekip Com IEC 61850 modules

Description

Ekip Com IEC 61850 is an accessory module that can function as a communication module by integrating the circuit-breaker in an industrial remote supervision and control network.



It can be connected to an Ethernet network with an IEC 61850 communication protocol, and allows you to:

- Connect the trip units to the network, with dialog functionality.
- Command opening and closing of the circuit-breaker from remote.
- Provide information on the state of the circuit-breaker (open, closed, tripped).
- If mounted on a circuit-breaker in withdrawable version, detect the connected/disconnected position.
- Provide vertical communication (report) towards higher-level supervision systems (SCADA) with states and measurements (re-transmitted whenever, and only if, they change with respect to the previous report).
- Provide horizontal communication (GOOSE output) towards other circuit-breakers (non-Emax 2, e.g. medium voltage circuit-breakers), with all the information about state and measurements normally shared by Emax 2 communication modules on busbars.

Remote opening and closing of the circuit-breaker can be performed only if the circuit-breaker is equipped with an Ekip Com Actuator module (see page 286).

The configuration for the IEC 61850 protocol to assign the Technical Name, and, where necessary, to enable the GOOSE (by setting the corresponding MAC addresses), is carried out by loading a configuration file in the module. For further information, see the chapter "System Interface" on page 155, and in particular the document 1SDH001140R0001 referenced in the chapter

The following table shows the ports used by the module:

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

For applications in which a high network reliability is necessary, the module can be installed along with the corresponding Redundant module.

The Redundant module is identical in terms of characteristics and installation, but its wiring is different from the non-Redundant model.

IMPORTANT: on each circuit-breaker, only one Ekip Com IEC 61850, and only one Ekip Com IEC 61850 Redundant can be installed.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Safety and cyber security

Since the module allows the circuit-breaker and access to the data in the trip unit to be checked, it can only be connected to networks equipped with all the necessary safety 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 Ekip Com IEC 61850 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.**

Compatibility and power supply

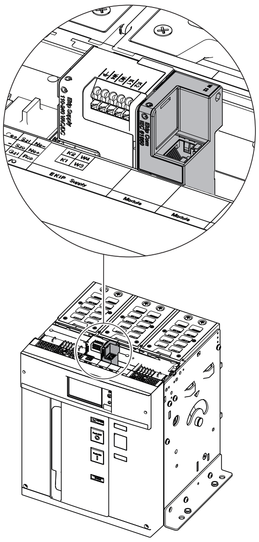
The modules can be installed combined with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip unit since version 2.0 software, and require the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

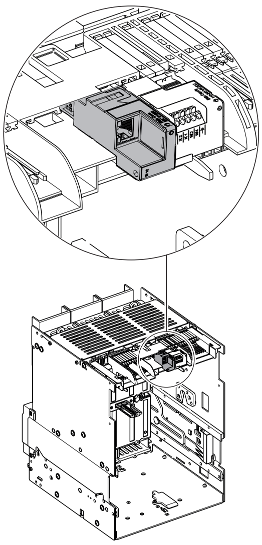
Connections

The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

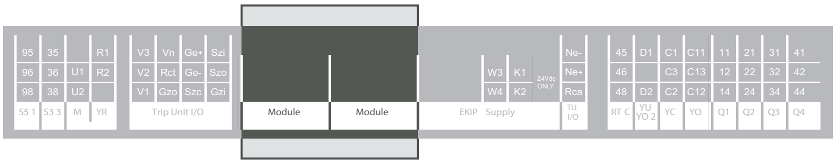
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0514.

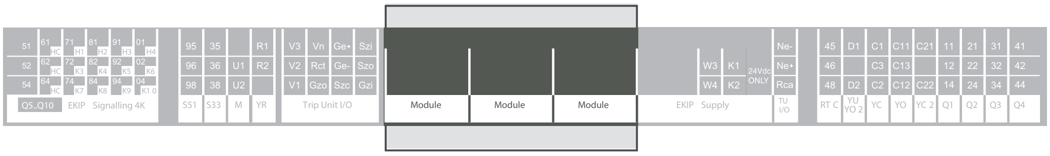
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

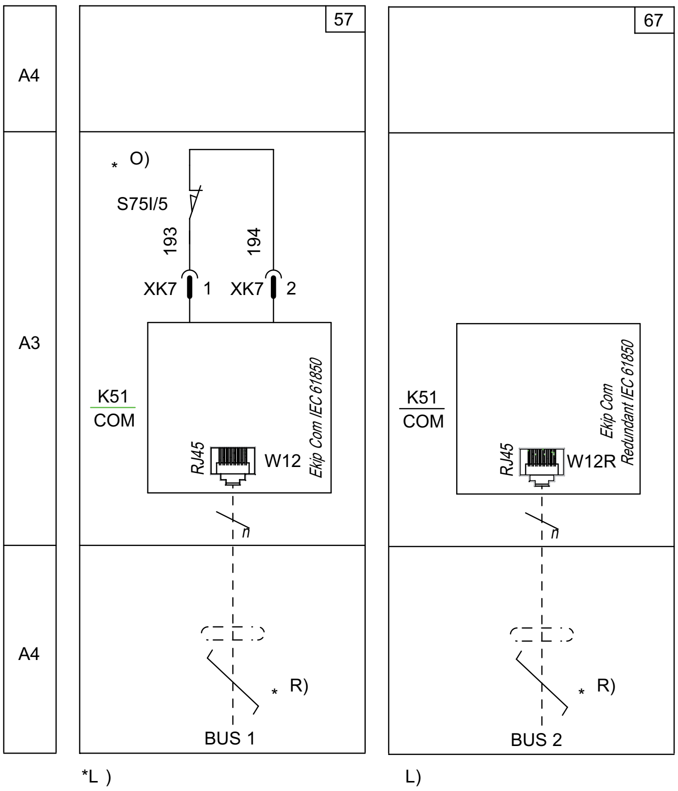




The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:







Diagrams 57 - 67

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

If the circuit-breaker is in withdrawable version, the use of cables fitted with a RJ45 socket with output at 90° is recommended.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

With the modules energized, and the Local Bus enabled, the presence of the modules on the terminal box activates additional menus on the display:

- To set the modules.
- In order to display information on the modules.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

The following table shows the path from the display, for setting the function and addressing of the modules:

Settings	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Com IEC 61850	Force Static IP address
			SNTP Client Enabled
			Static IP Address
			Static Network Mask
			Static Gateway addr
			SNTP Server Address
		Ekip Com IEC 61850 *R	(1)
		...	
		Functions	
	Power Controller		
	...		

(1) As Ekip Com IEC 61850.

The following table shows the parameters for setting the modules. For further information, see the table on page 273.

Parameter	Selectable values	Default	Description
Force Static IP address	Off, On	Off	• Off = Dynamic IP address. • On = Static IP address.
SNTP Client Enabled	Off, On	Off	• Off = Synchronism with the SNTP clock signal disabled. • On = Synchronism with the SNTP clock signal enabled.
Static IP Address	Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the modules.		
Static Network Mask	Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the modules.		
Static Gateway addr	Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the modules are connected.		
SNTP Server Address	Displayed with SNTP client enabled. "On" has to be selected to insert the IP address of the server with whose SNTP clock signal the modules are to be synchronised.		

The following table shows the path from the display for accessing information on the modules:

About	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Com IEC 61850
		Ekip Com IEC 61850 *R
		...
	Power Controller	

Continued on the next page

Information that can be displayed on the modules:

- The serial number and the software version.
- The IP address, the Network Mask, and the Gateway Address.
- The MAC Address.
- The name of the configuration file loaded in the modules.
- The error code relating to the configuration file (where "0" means no error).

The following table shows the information on the modules:

Information	Description
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have a value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. As an alternative, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different from that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enable the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	It is the IP address of the node to which the modules are connected, in case of multiple subnets. If you enable the Static IP Address option, you must also enter the correct Gateway Address.
MAC Address	It is the address assigned by ABB, having an OUI equal to ac:d3:64 (1).

(1) Organizationally Unique Identifier, formed by the first three bytes of a MAC address, and 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:

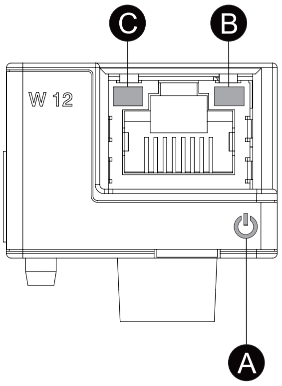
Parameter	Description	Default
Preferred configuration file	If several configuration files are present, allows file hierarchy between .cid and .iid to be defined	.cid
IEEE 1558 enable	Enables the IEEE 1588 protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
Master 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	Enables the data exchange mode between module and master, between Peer-to-Peer and 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 the 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 opening (28) and Request breaker closing (29) commands.	Standard commands
Flag word hex	Sets a filter on the selectivity states.	0

(1) Enable IEEE 1558 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
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 1558 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
Missing GOOSE	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 states (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
Remote inputs of zone selectivity	

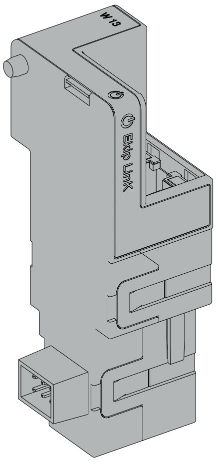
Signallings The following table shows the possible signals, and their meaning:



Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	Link LED, green. The possible states are: • Off: connection error (signal absent). • On fixed: correct connection.
C	Activity LED, yellow. The possible states are: • Off: no activity on the line. • On flashing: activity on the line (in reception and/or transmission).

14 - Ekip Link module

Description



Ekip Link is a communication accessory module that integrates the circuit-breaker in an internal Ethernet network with an ABB proprietary protocol.

The network to which the module is to be connected must be dedicated and comprising only Ekip Link and Ethernet switches that declare support for level L2 multicast on the datasheet. In this case the Ethernet switches do not require any configuration. If, instead, the network also includes routers, multicast must be enabled and configured on all L3 Layer VLAN interfaces.

IMPORTANT: the module can be connected only to Ethernet networks inside one or more switchboards, to which trip units or ABB Emax 2 accessories are connected. It is the installer's responsibility to ensure that all the necessary security measures are adopted for all the connected devices (for example, the necessary access authorizations, and so on). The module cannot be connected to other Ethernet networks (for example, with the purpose of monitoring the system, or the office), or to the Internet.

The module is necessary if you wish to implement the following functions:

- Power Controller
- Zone Selectivity
- Programmable Logic

For these functions, the trip units of the system that are involved must be equipped with an Ekip Link, and for each of them the IP addresses of the Ekip Link modules of the other trip units must be inserted.

The Ekip Link modules must be connected to a dedicated network that includes only Ekip Link modules and Ethernet switches that declare support for level L2 multicast in their data sheets. In this case, the Ethernet switches do not require any configuration. If instead the network also includes routers, multicast must be enabled and configured on all L3 Layer VLAN interfaces.

For each Ekip Link, every other trip unit connected to the network is considered as an actor. In addition, each Ekip Link can be interfaced with a maximum of 15 actors, of which a maximum of 12 for the Zone Selectivity function.

With the Power Controller function, every trip unit can:

- Acquire the state of the loads from remote and monitor them.
- Play the role of Master, and collect the energy measurements of the trip units selected as Energy Meter.
- Supply energy measurements to the trip units inserted as master.

The state of the loads can be acquired by checking the state of the inputs of the signalling modules connected to the trip units whose IP address has been entered, while the loads can be monitored by programming their outputs.

Remote acquisition of the state of the loads and monitoring of the loads can also be implemented with Ekip Signalling 10K modules connected to the network.

For further information about the Power Controller function see the chapter "23 - Ekip Power Controller" on page 131, and "2 - Load control" on page 159.

With the Zone Selectivity function:

- The IP addresses inserted refer to the trip units with the role of interlock.
- For every interlock trip unit inserted, the protections for which selectivity is to be implemented must be selected by setting a mask. The function set in this way is indicated hereafter as logical, in order to distinguish it from the standard function, hereafter referred to as hardware.
- The protections selected in this manner are added to the hardware protections S G D-Backward and D-Forward.
- It is possible to choose between hardware-only selectivity and both hardware and logical selectivity.
- It is possible to set diagnostics to check for each interlock trip unit whether there is consistency between the hardware and logical selectivity information.
- It is possible to set a mask that identifies the protections from which the received information about selectivity is to be retransmitted, regardless of whether the trip unit is in alarm conditions. The information to which the mask is applicable regards only logical selectivity.

For further information about Zone Selectivity function see the chapter "1 - Zone Selectivity" on page 156.

Continued on the next page

With the Programmable Logic function, it is possible to program the activation of the Ekip Link up to 4 bits, each bit according to any combination of the status bits of a trip unit whose IP Address has been inserted.

These four bits are indicated as states A, B, C and D remotely programmable, and their value is transmitted to the trip unit to which the Ekip Link module is connected.

Exclusively with Ekip Dip trip units: the module can also be used with a function similar to that of the Ekip Com Modbus TCP module, but only with the possibility to communicate with the ABB master (e.g.: Ekip Connect, or Ekip Control Panel).

The following table shows the ports used by the module:

Port	Service	Notes
502/tcp	Modbus TCP	When the module is used as a Modbus TCP communication module.
18/udp	ABB proprietary	In case of exchange of fast information between ABB devices.
319/udp	IEEE 1588	When IEEE protocol 1588 is enabled (see paragraph "Remote configurations", on page 279).
320/udp		
68/udp	DHCP Client	DHCP Client enabled as an alternative to “Static Address = On”

IMPORTANT: only one Ekip Link can be installed on each circuit-breaker.

If connected to a withdrawable version of the circuit-breaker, the module allows the connected/disconnected position to be detected.

IMPORTANT: when the circuit-breaker is in the disconnected position, the trip unit is disconnected from the module: in this condition, the only valid information transmitted is:

- **Connection of trip unit to Com module (Trip unit disconnected = disconnected).**
- **CB position (CB isolated / CB connected = CB isolated).**
- **Presence of com module (= present; only valid for the module to which it is connected).**

Further details are given in document 1SDH001140R0001 (Communication System Interface for Emax 2), sections Status Global 1 [dlog], Status Accessories 1 and Status Accessories 2.

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

Compatibility and power supply

The module can be installed combined with Ekip Dip, Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, and requires the presence of an Ekip Supply module in the first slot of the circuit-breaker terminal box.

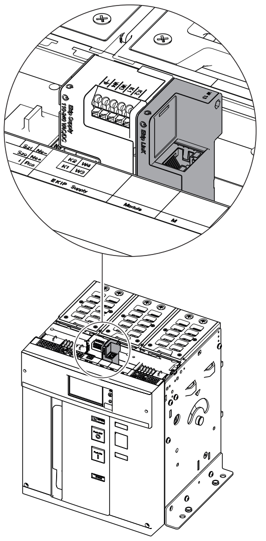
Connections

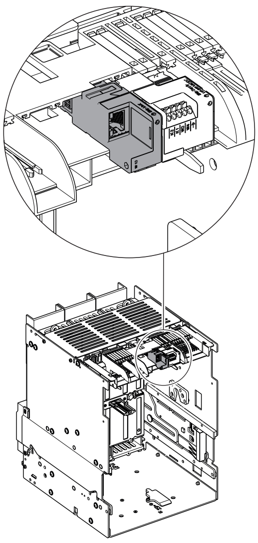
The modules must be mounted on the terminal box of the circuit-breaker or of the fixed part of the withdrawable circuit-breaker, in the first free slot after the Ekip Supply module.

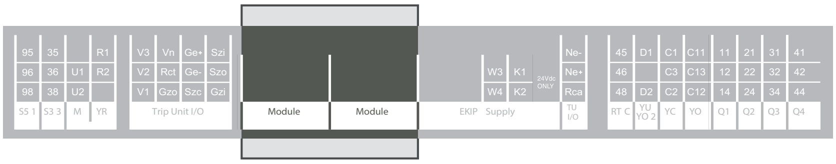
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0514.

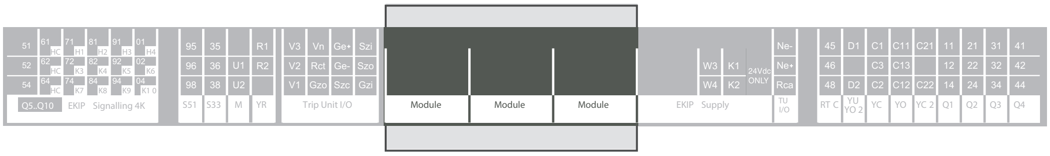
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E1.2 and E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:









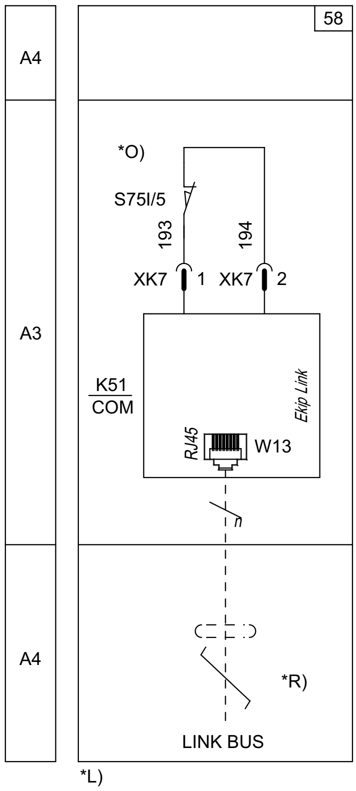


Diagram 58

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

If the circuit-breaker is in withdrawable version, the use of cables fitted with a RJ45 socket with output at 90° is recommended.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

With the module energized, and the Local Bus enabled, the presence of the module itself on the terminal box activates additional menus on the display:

- To set the addressing of the module.
- To display information on the module.

To enable the Local Bus, you need to select "On" in the menu *Settings - Modules - Local Bus*.

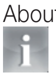
The following table shows the path from the display to set the addressing of the module:

Settings 	...		
	Main frequency		
	Modules	Local/Remote	
		Local Bus	
		...	
		Ekip Link	Force Static IP address
			Static IP Address
			Static Network Mask
			Static Gateway addr
		...	
		Functions	
	Power Controller		
	...		

The following table shows the configuration parameters for the addressing of the module: For further information, see the table on page 279.

Parameter	Selectable values	Default	Description
Force Static IP address	Off, On	Off	• Off = Dynamic IP address. • On = Static IP address.
Static IP Address	Displayed with static IP Address enabled, it must be selected in order to insert the IP Address of the module.		
Static Network Mask	Displayed with static IP Address enabled, it must be selected in order to insert the subnet mask of the module.		
Static Gateway addr	Displayed with static IP Address enabled, it must be selected in the presence of multiple subnets, in order to insert the IP Address of the node to which the module is connected.		

The following table shows the path from the display for accessing information on the module:

About 	Protection Unit	
	Circuit-breaker	
	Modules	...
		Ekip Link
		...
	Power Controller	

Information that can be displayed on the modules:

- The serial number and the software version.
- The IP address, the Network Mask, and the Gateway Address.
- The MAC Address.

Continued on the next page

The following table shows all the information on the module:

Information	Description
IP Address	This is the address assigned to the modules at the moment of connection to the network. It consists of four bytes (for a total of 32 bits), each of which can have a value from 0 to 255. By default, allocation is dynamic. With dynamic allocation, the modules wait to receive the IP address from a DHCP server. Without a DHCP server, the modules adopt an Autoconfiguration IP Address in the range 169.254.xxx.xxx, calculated in a pseudo random manner so as to be the same at every switch-on. As an alternative, you can enable the static IP address option, which allows the IP address to be forced. In this case, you must make sure that the IP Address inserted is different from that of the other devices connected to the same network.
Network Mask	This is the subnet mask, and identifies the method to recognize the subnet to which the modules belong, with the possibility of searching for the modules within a defined set of recipients. If you enable the option Static IP Address, you must also enter the correct Network Mask.
Gateway Address	It is the IP address of the node to which the modules are connected, in case of multiple subnets. If you enable the Static IP Address option, you must also enter the correct Gateway Address.
MAC Address	It is the address assigned by ABB, having an OUI equal to ac:d3:64 (1).

(1) Organizationally Unique Identifier, formed by the first three bytes of a MAC address, and 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 154). **IMPORTANT:**: if Client/Server, the module allows data exchange like a normal Server function.	Server only
IEEE 1558 enable	Enables 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	Enables the data exchange mode between module and master, between Peer-to-Peer and End-to-End to be selected.	End-to-End
SNTP Client enable	Enables the SNTP protocol for distribution of the clock and synchronization signal to be enabled (1).	OFF
Force Static IP Address	Enables 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 by the network to be protected by a password (Password request).	Standard mode
Password Modbus TCP	With access protected by enabled password, is the password to use before each writing session (2).	Local access

(1) Enable IEEE 1558 and Enable SNTP client must not be enabled at the same time.
(2) The parameter can only be changed by 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 state (A to D)	Configuration parameters of the configurable states: • Selection of actor (actor from 1 to 15) which activates the programmable state. • Actor event that determines programmable change of state.	Actor 1 Nobody
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:

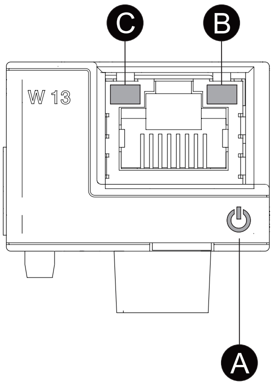
Information	Description
Boot and HW version	General module information
Flash CRC status e result	Information about the correctness of the SW in the module
Stato Ekip Link	Signals Ethernet cable connection errors
SNTP Server Error	Error in communication with SNTP server
SNTP Server Synchronisation	State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

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 states	state (true/false) of remote programmable states A, B, C and D
Remote programmable Word state	value of remote programmable Words A, B, C, D
Zone logic selectivity	Logic selectivity states (inputs and outputs)

Signallings The following table shows the possible signals, and their meaning:

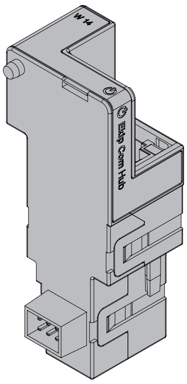


Pos.	Description
A	Power LED, green. The possible states are: • Off: power supply absent. • On fixed: power supply and communication with the trip unit present (with a trip unit with the Alive LED option disabled). • On, with one flash per second (synchronized with that of the green LED on the trip unit): power supply and communication with trip unit present (with a trip unit with the Alive LED option enabled). • On, with two quick flashes per second (not synchronized with those of the green LED on the trip unit): power supply present, and communication with trip unit absent (for example: because of Local Bus disabled).
B	Link LED, green. The possible states are: • Off: connection error (signal absent). • On fixed: correct connection.
C	Activity LED, yellow. The possible states are: • Off: no activity on the line. • On, fixed or flashing: activity present on the line (in reception and/or transmission). When it is on, it may be fixed or flashing (communication is active in both cases).

15 - Ekip Com Hub modules

Description

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.

The ports used by the module are:

Port	Service	Notes
67/udp 68/udp	DHCP client	Client DHCP enabled as an alternative to 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

The modules are always supplied with Ekip AUP and Ekip RTC contacts (see the chapter "17 - Other accessories" on page 287).

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 Ekip Com Hub 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.

Compatibility and power supply

The modules can be installed on Emax 2 circuit-breakers configured with trip units Ekip Touch, Hi-Touch, G Touch, G Hi-Touch (firmware version 2.20 or higher) and Ekip Supply module fitted into the first slot of the terminal box of the circuit-breaker.

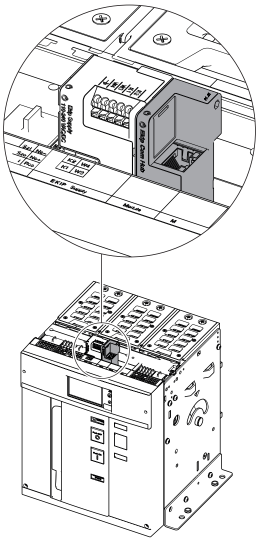
NOTE: *the communication is interrupted in the absence of auxiliary power supply.*

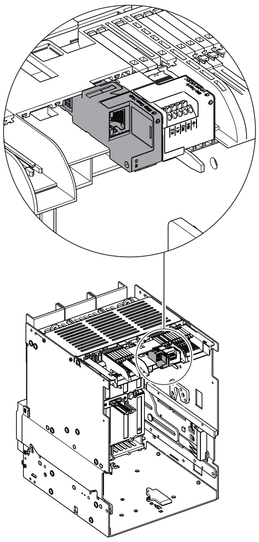
Connections The module must be installed on the terminal box of the circuit-breaker, or on the fixed part of withdrawable circuit-breakers, in the first slot after the Ekip Supply module.

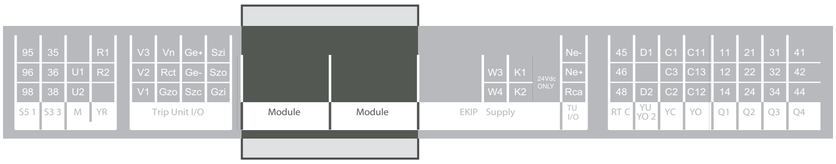
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0514.

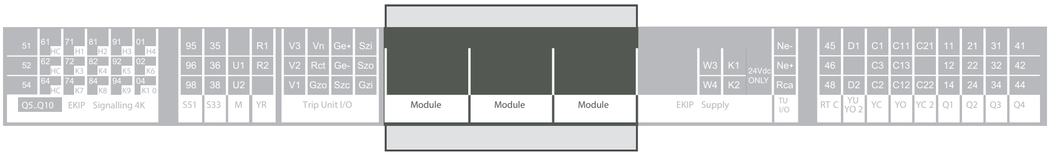
An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.

The following is a view of the terminal box of E2.2-E4.2-E6.2 circuit-breakers with the relevant wiring diagram:









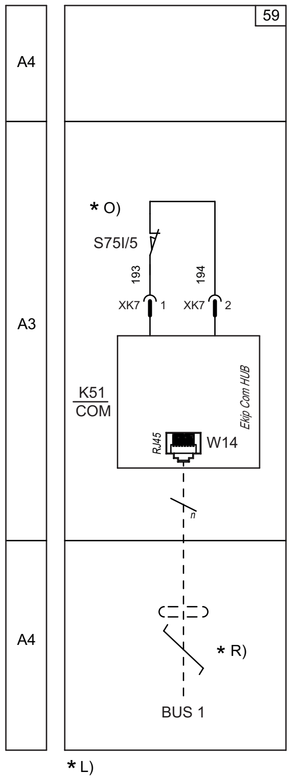


Diagram 69

For the communication bus, a cable of type Cat.6 S/FTP must be used (Cat.6 with S/FTP double shielding).

If the circuit-breaker is in withdrawable version, the use of cables fitted with a RJ45 socket with output at 90° is recommended.

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Access from the display

Local bus activation, which is essential for starting the communication between module and trip unit, is available in the menu Settings Menu on page 49

The following communication parameters can be configured if the module has been correctly detected by the trip unit in the *Settings-Modules* menu:

Parameter	Description	Default
Enable	Switch communication between module and server on/off.	
Force Static IP Address	Defines whether the module has the dynamic (Off) or static (On) IP address. Se = On all the associated parameters are enabled.	OFF
Static IP Address	Enables the static IP to be selected.	0.0.0.0
Network Mask Static	Enables the subnet mask to be selected.	0.0.0.0
Static Gateway addr	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
SNTP Client Enabled	Enables the SNTP protocol for distribution of the clock and synchronization signal to be enabled.	OFF
SNTP Server Address	Enables 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. Two parameters are available: • Enable, to configure firmware download. • Automatic, to automate module update.	OFF Automatic

The following information will be available if the module is detected correctly by Ekip UP in the *Information-Modules* menu:

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 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.
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

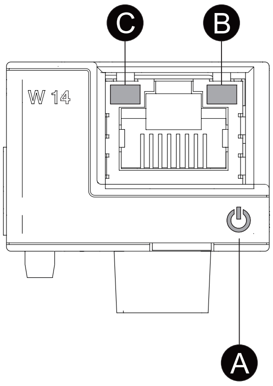
Additional parameters can be accessed via the service connector (via Ekip Connect) or via a system bus communication:

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
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

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
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	Address of modbus TCP client 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 state, flash, cable connection, FW availability, file errors, etc.

Signallings The following table shows the possible signals, and their meaning:



Pos.	Description
A	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 (2 fast flashes per second): module on and communication with trip unit absent.
B	Indicates the communication state: • Off: incorrect connection, signal absent. • On fixed: correct connection.
C	Indicates the communication state: • Off: no activity on the line. • Flashing: activity on line present (receiving and/or transmitting).

16 - Ekip Com Actuator module

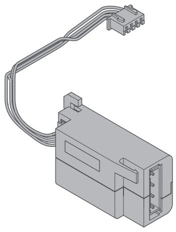
Description Ekip Com Actuator is an accessory module that allows SACE Emax 2 circuit-breakers to be opened and closed from remote.

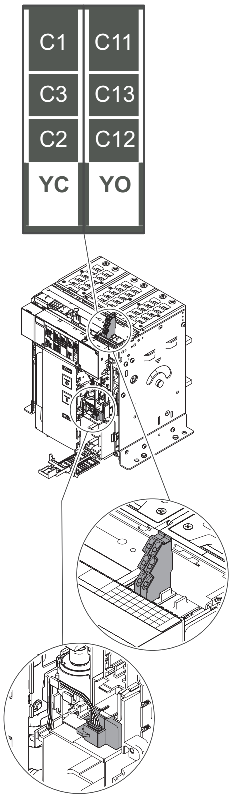
Connections Ekip Com Actuator is installed on the front of the circuit-breaker in the accessories area.

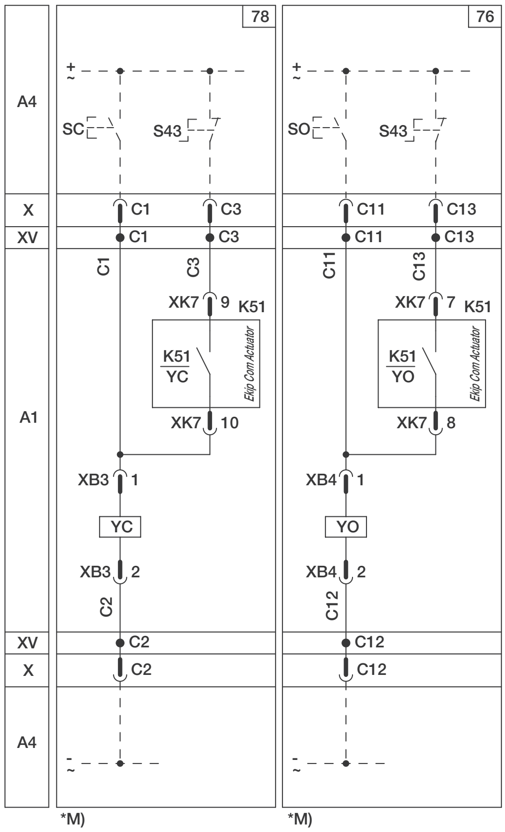
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH000999R0501 and 1SDH001000R0501.

Wiring diagrams of the module are provided below:

An example with an E2.2 circuit-breaker in fixed and withdrawable versions is provided to the side.







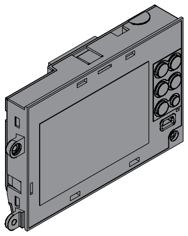
Diagrams 78 - 76

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

Compatibility Ekip Com Actuator module is supplied on request and is compatible with all Ekip trip units equipped with Ekip Com or Ekip Link modules.

17 - Other accessories

Ekip LCD

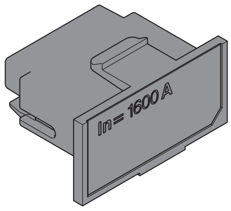


The LCD version of the protection trip unit can be requested for installations in particularly aggressive environments (low temperatures, high degree of humidity, dust or chemical substances). The LCD version differs from the version with touchscreen display in:

- 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.

Rating Plug



The Rating Plug defines the rated current In necessary to set the current protections on the trip unit, since these refer to In.

It is supplied with all Ekip trip units, mounted on a front connector dedicated and accessible to the user, and can be replaced with trip unit off and circuit breaker open.

IMPORTANT: the replacement of the Rating Plug with trip unit on or circuit breaker closed may cause malfunction of the trip unit, or unwanted opening of the circuit-breaker.

NOTE: *a trip unit can be equipped with any Rating Plug with a maximum rated current equal to Iu, i.e. the rated uninterrupted current of the circuit-breaker (indicated on the rating plate of the circuit-breaker).*

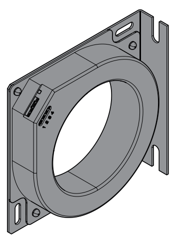
The trip unit continuously checks for the presence of the Rating Plug, signalling its absence or any assembly or installation errors.

Once mounted, when the trip unit is energized, its installation is requested.

To activate the residual current protection on the Touch, Hi-Touch, G Touch and G Hi-Touch trip units, it is necessary to mount a Rating Plug Rc. Rating Plug L = OFF, which allow you to deactivate the protection L are also available.

Further details about assembly and the Rating Plug installation procedure are available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0510.

Toroid S.G.R.



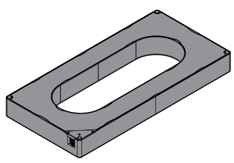
S.G.R., or Source Ground Return, is the external homopolar current sensor that can be installed with the following trip units: Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch, LSIG version.

Its presence should be selected when the release is programmed (see menu **Settings** - **Circuit-breaker** - **Earth protection**), which activates earth fault protection Gext (see **Advanced** menu) .

IMPORTANT: the S.G.R. Toroid can be selected as an alternative to the Rc type. Therefore Gext and Rc protections are alternatives.

Further information on the connection of the S.G.R. toroid is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in kit sheet 1SDH001000R0507.

Rc Toroid



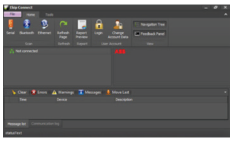
Rc is the external residual current sensor, that can be installed with Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units equipped with Rating Plug Rc, Ekip Measuring Pro and Ekip Supply modules.

Its presence should be selected when the release is programmed (see menu **Settings** - **Circuit-breaker** - **Earth protection**), which activates residual current Rc protection Gext (see **Advanced** menu) .

IMPORTANT: the Rc toroid can be selected as an alternative to the S.G.R type. Therefore the Rc and Gext protections are alternatives.

Further information on the connection of the Rc toroid is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in kit sheet 1SDH001000R0521.

Ekip Connect software



Ekip Connect is the free software for communication and testing of ABB low voltage circuit-breakers equipped with compatible trip units, in particular of Ekip series.

Ekip Connect must be installed on PCs equipped with the Microsoft Windows® operating system by downloading it from the site http://www.abb.com/abblibrary/DownloadCenter.

Through its communication function, it allows you to:

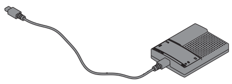
- Monitor the state of the connected circuit-breakers and record information.
- Execute the switching, reset, signalling commands, etc…
- Configure the protection trip units with customized parameters.
- Configure the electronic accessories, connected to the trip unit via Local Bus.
- Download information from the trip units equipped with Datalogger.
- Create communication reports.
- Reset configurations.

Through the test function, and Ekip T&P module (see page 289), it allows you to:

- Simulate fault conditions by performing manual or automatic tests.
- Perform trip tests.
- Create test reports.

Further information on the Ekip Connect application is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the manual 1SDH000891R0002.

Ekip Bluetooth module



The Ekip Bluetooth allows connection via Bluetooth between the Ekip trip units, and a support (PC, tablet, or smart phone) with the Ekip Connect software installed (see previous paragraph).

IMPORTANT: the Ekip Bluetooth module can be connected to the trip units also when in service.

NOTE: *Ekip Bluetooth powers the trip unit only. Therefore, in order to set and to display information on any electronic accessories connected to the terminal box, these must be powered by an Ekip Supply module (see page* **208***).*

It draws its power from a rechargeable lithium-polymer battery delivered with the unit. It is connected directly to the front test connector of the trip unit, and allows a trip unit without auxiliary voltage to be powered.

It is switched on by pressing the power button on the side, and is equipped with two LEDs:

- The first LED in green when the device is on and the battery charged, red with the device turned on and low battery.
- The second LED flashing blue with active Bluetooth communication.

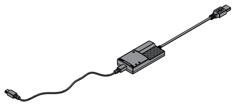
NOTE: *the red flashing LED indicates that the battery is completely drained, an error condition, or malfunction of the module.*

The battery charging is performed by connecting the module to the USB ports of a PC with the supplied cable. Connection to a PC automatically switches the module on, and charging in progress is indicated by the flashing green LED, with increasing frequency as the level of charging rises. Completion of charging is indicated by the green LED on (fixed).

NOTE: *during recharging, the module must be kept energized.*

Further information on Ekip Bluetooth is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0518, and in the Ekip Connect software manual 1SDH000891R0002.

Ekip T&P module



The Ekip T&P module is part of the Ekip T&P programming and test kit for Ekip trip units, and allows you to:

- Supply the trip unit in the absence of auxiliary voltage.
- Access the information, the pages for programming the trip unit and activate the test pages, through the Ekip Connect software (see page 288).

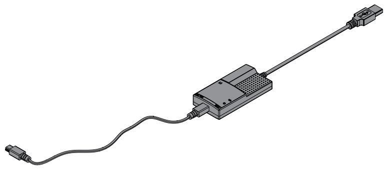
IMPORTANT: Ekip T&P can also be connected to the trip units when in service. In case of connection to trip units in service, it is not possible to perform a trip test.

NOTE: *Ekip T&P only powers the trip unit. Therefore, in order to set and to display information on any electronic accessories connected to the terminal box, these must be powered with an Ekip Supply module (see page* **208***).*

It draws its power from the PC, and connects one side directly to the test connector at the front of the trip unit, and on the other to the USB ports of the PC through the cable supplied.

It turns on after connecting to the PC, and is equipped with two LEDs, a green one indicating that the module is on, and a yellow one indicating active communication.

Module Ekip Programming



Ekip Programming allows you to:

- Supply the trip unit in the absence of auxiliary voltage.
- Access the information and programming pages of the release with Ekip Connect software (see page 288).

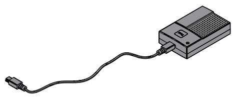
IMPORTANT: Ekip Programming can be connected the trip units when they are in service.

NOTE: *Ekip Programming powers the trip unit only. Therefore, to set and display the information for any electronic accessories connected to the terminal box, those accessories must be powered with an Ekip Supply module (see page* **208***).*

It draws its power from the PC, and connects one side directly to the test connector at the front of the trip unit, and on the other to the USB ports of the PC through the cable supplied.

It turns on after connecting to the PC, and is equipped with two LEDs, a green one indicating that the module is on, and a yellow one indicating active communication.

Ekip TT module



Ekip TT is supplied as standard with Emax 2 circuit-breakers if they are equipped with an Ekip Touch, Ekip Hi-Touch, Ekip G Touch or Ekip G Hi-Touch protection trip unit, and with all loose trip units (ordered as spare parts). Ekip TT allows you to:

- Check that the opening mechanism of the circuit-breaker functions properly by commanding an opening according to the test procedure (see page 28)
- Power the trip unit so that you can see which protection tripped either on the display or through the lighting of the corresponding LEDs in the absence of auxiliary voltage and where the circuit breaker is open due to a protection tripping
- Power the Ekip Touch, Hi-Touch, G Touch, and G Hi-Touch trip units in order to set the protections in the absence of auxiliary voltage

IMPORTANT: Ekip TT can be connected to the trip units also when in service. In case of connection to trip units in service, it is not possible to perform a trip test.

NOTE: *Ekip TT powers the trip unit only. Therefore, in order to set and to display information on any electronic accessories connected to the terminal box, these must be powered through an Ekip Supply module (see page* **208***).*

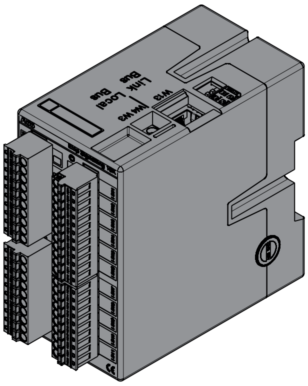
Ekip TT draws its power from three AA alkaline batteries 1.5V, connects to the test connector at the front of the trip unit through the supplied cable, and is turned on by setting the side switch to ON.

It includes a LED that is green when the device is energized and the batteries are charged, and red when the batteries are drained and need to be replaced.

Further information on Ekip TT is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0519**, and in the Ekip Connect software manual **1SDH000891R0002**.

Ekip Signalling 10K modules

The Ekip Signalling 10K is an accessory module for external signaling that 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.
- A power-on LED, and twenty or twenty-one signalling LEDs (one for each output/input).

The module can be set-up 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).

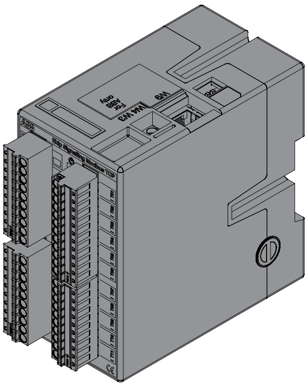
The module can be supplied by 110...240 V AC / DC or 24...48 V DC.

Further information on Ekip Signalling 10K is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the manual 1SDH001318R0002.

IMPORTANT: make sure that you have read the recommendations concerning security and prevention from unauthorized access.

Ekip Signalling Modbus TCP

The Ekip Signalling Modbus TCP is an external accessory module that can be installed on a standard 35 mm DIN rail (DIN EN 50022 type TS 35 x 15 mm).



Its function is to share, via an Ethernet network with Modbus TCP communication protocol, information about the state of circuit-breakers that may even be without the capability to provide such information via Ethernet, and to allow these circuit-breakers to be operated via remote control.

The module has 11 digital inputs and 10 output contacts:
- The inputs allow the state of the circuit-breakers and other information to be monitored.
- The outputs allow the circuit-breakers to be operated.

Each input and output is associated with a state LED.

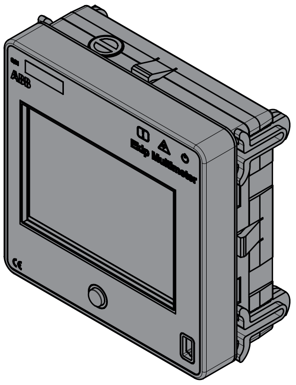
The module can operate in three modes:

Mode	Characteristics
CB Supervisor	The module can be associated with a single circuit-breaker, which can be selected from a list. Configuration of the inputs and output is pre-defined.
Multi MCCB Supervisor	The module can be associated with up to five circuit-breakers. Configuration of the inputs and output is pre-defined. **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 on the website http://www.abb.com/abblibrary/ DownloadCenter/, in particular in the manual 1SDH001456R0002.

Ekip Multimeter module



The Ekip Multimeter is a remote displaying unit on the front of the switchgear and is equipped with a touchscreen display.

It can be installed in combination with Ekip Dip, Touch, Hi-Touch, G Touch, and G Hi-Touch trip units, with which it communicates via Local Bus. It must be powered independently of the trip units to which it is connected and can be powered in AC at 105...265 V AC/DC, or DC at 21.5...53 V DC.

IMPORTANT: AC and DC power supplies cannot be present at the same time.

The following table lists the electrical characteristics of the module:

Power supply voltage	Frequency	Power input	Inrush current
21.5...53 V DC	-	Maximum 10W	Maximum 2 A for 20 ms
105...265 V AC/DC	45…66 Hz	Maximum 10 VA/W	Maximum 2 A for 20 ms

One trip unit can communicate with a maximum of four Ekip Multimeters. On the other hand, the module can be connected to only one trip unit.

In addition, the module makes available an auxiliary voltage of 24 V DC, which can be used to power the trip unit. If the trip unit is powered through Ekip Multimeter, the power supply must be applied directly on the terminal box of the circuit-breaker: in fact the Ekip Multimeter is sized in order to supply only the trip unit, and therefore it is may be unable to deliver enough power to supply an Ekip Supply module and any other electronic accessories connected to the terminal box.

In case of connection to an Ekip Touch, Hi-Touch, G-Touch, and G Hi-Touch trip unit, as well as displaying the measurements, the module also allows you to set parameters and protection thresholds.

For the Local Bus (communication lines W3 and W4) and the auxiliary output power (24Vout L+ and - signals), Belden 3105A or equivalent cables must be used with a maximum length of 15 m. The shield of the cables must be connected to ground on both sides of the connection.

Further information on Ekip Multimeter is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet 1SDH001000R0520.

External neutral

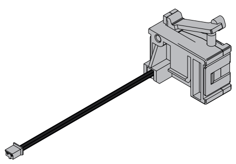
This is a current sensor for the neutral pole outside the circuit-breaker.

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.

Contacts Ekip AUP



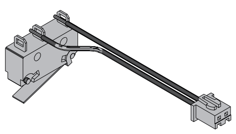
The communication modules are always supplied with dedicated Ekip AUP auxiliary position contacts. In case of a withdrawable circuit-breaker, the Ekip AUP contacts give the signal of moving part racked-in/out from the fixed part.

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.

Ekip RTC contact



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 website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheets:

- 1SDH000999R0604 for circuit breakers E1.2.
- 1SDH001000R0604 for circuit breakers E2.2, E4.2 and E6.2.

Electrical accessories

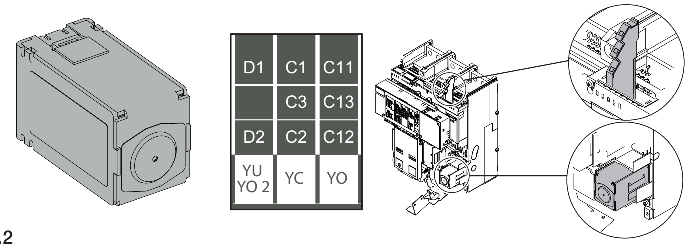
1 - Electrical control accessories

YO-YC-YO2-YC2 [1]: Opening and closing coil

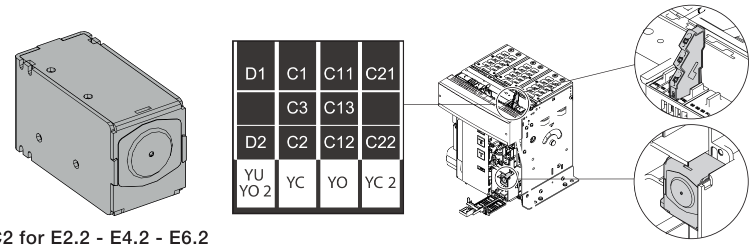
The opening coils, YO and YO2, and the closing coil, YC and YC2 [1], allow the circuit-breaker to be controlled remotely.

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***

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 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:

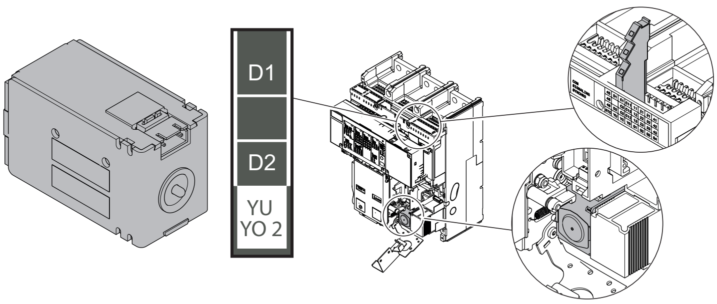
- Trip unit the circuit-breaker remotely using pushbuttons of the normally closed type.
- Activate the lock when the circuit-breaker is closed (the closing of the circuit-breaker is allowed only with the undervoltage coil energized).

IMPORTANT:

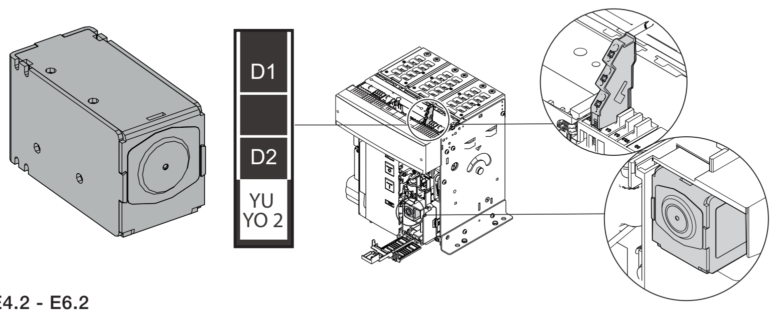
- **The undervoltage coil YU is incompatible with the presence of the Fail Safe device (UL circuit-breakers).**
- **The undervoltage coil YU is a emergency trip unit. For service operations use the opening coil.**

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

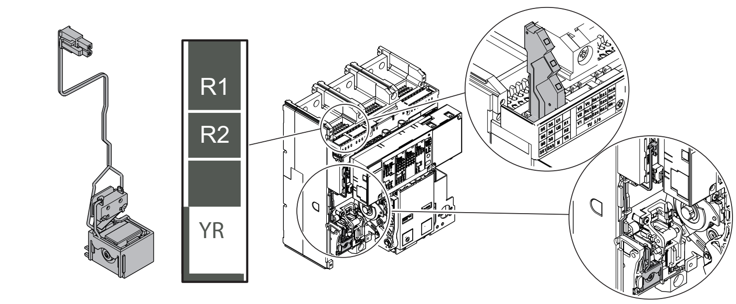
YU: Connections

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

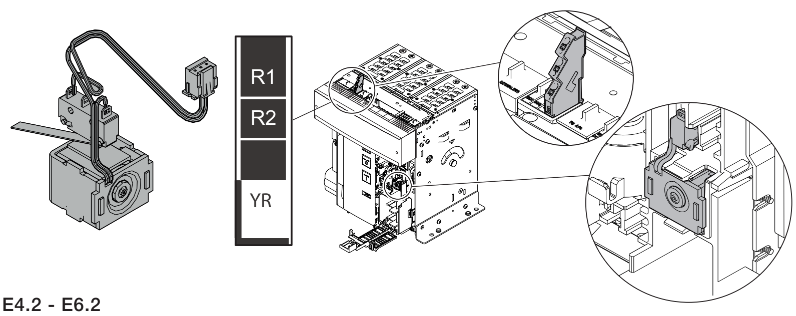
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0504 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0504.

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

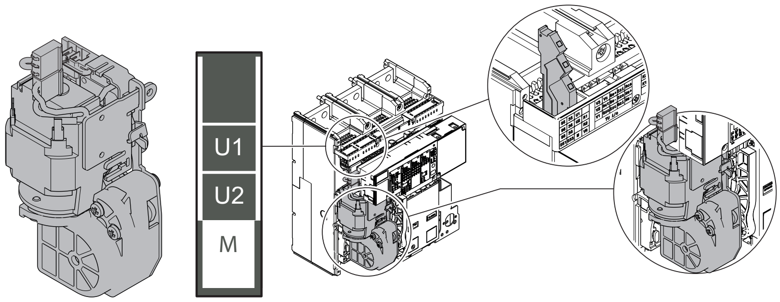
Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 1SDM000091R0001.

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.

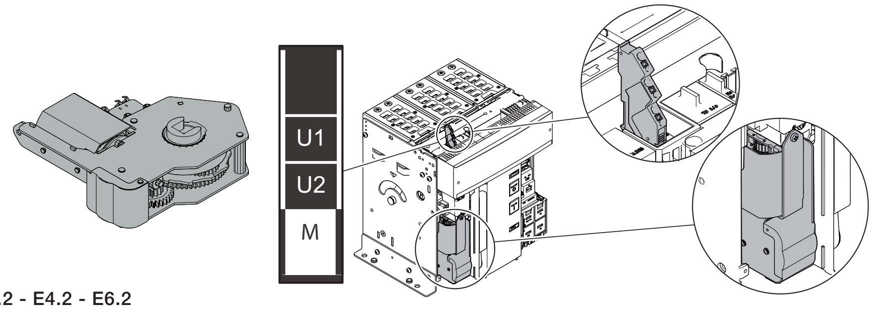
M: Motor The motor automatically recharges the closing springs of the circuit-breaker when these are discharged.

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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 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

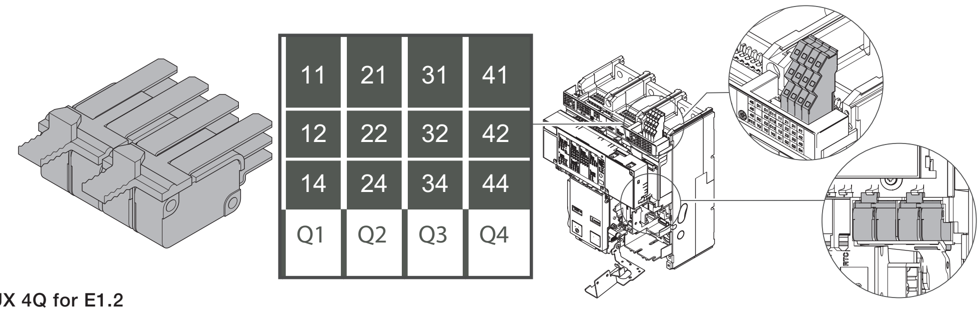
AUX 4Q: auxiliary open-closed contacts

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

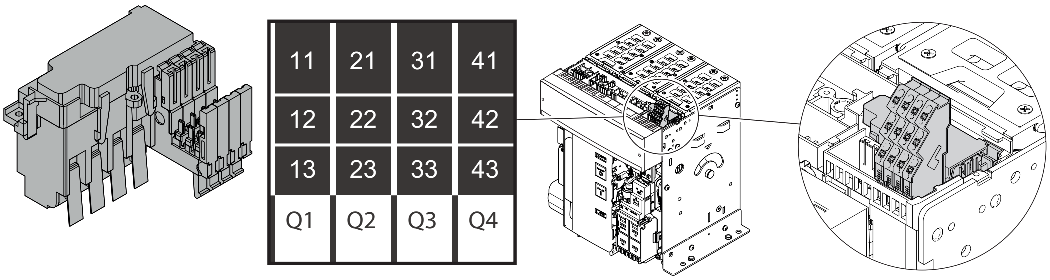
These are "switching" contacts and are available in three types:

- 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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

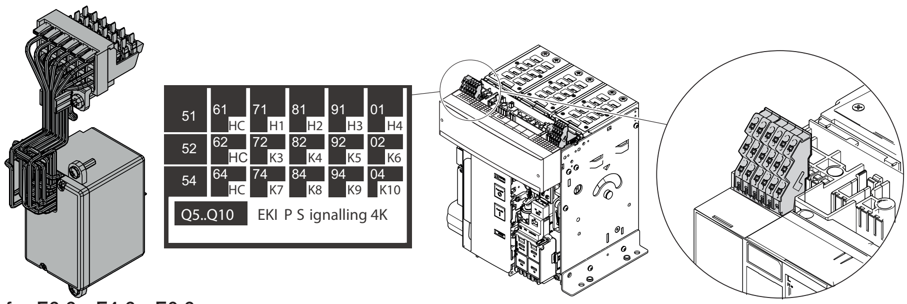
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet **1SDH000999R0601** and for E2.2-E4.2-E6.2 in the kit sheet **1SDH001000R0601**.

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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

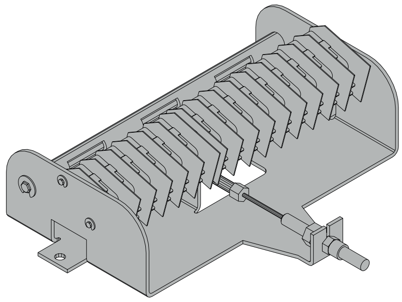
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular with the kit sheet **1SDH001000R0601**.

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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **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.

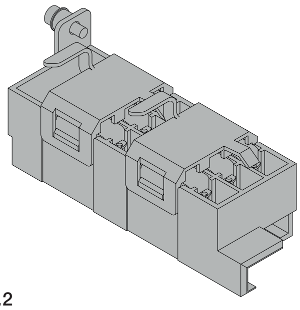
These are "switching" contacts and are available in the following configurations:

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

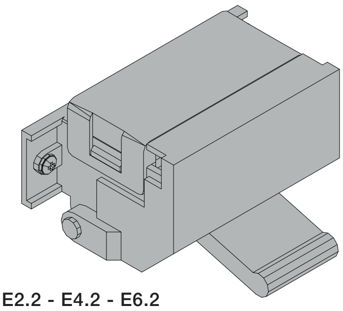
- six standard contacts
- six digital signals

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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **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

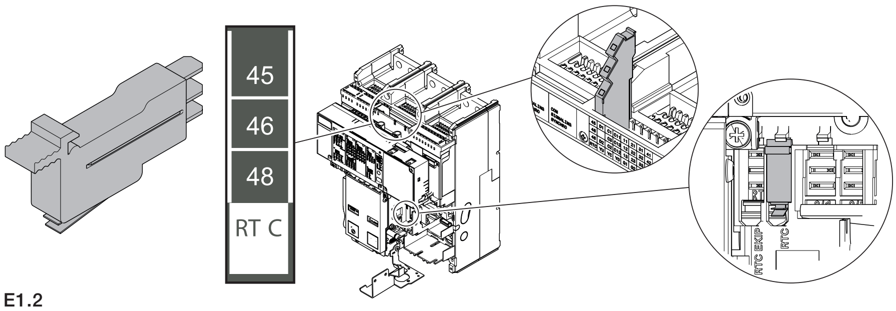
The RTC contact indicates that the circuit-breaker is ready to receive a closing command.

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

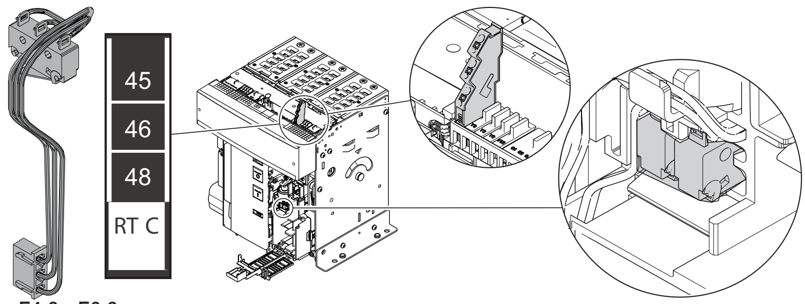
- circuit-breaker open
- springs charged
- absence of an opening command or of a lock in opening

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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 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.

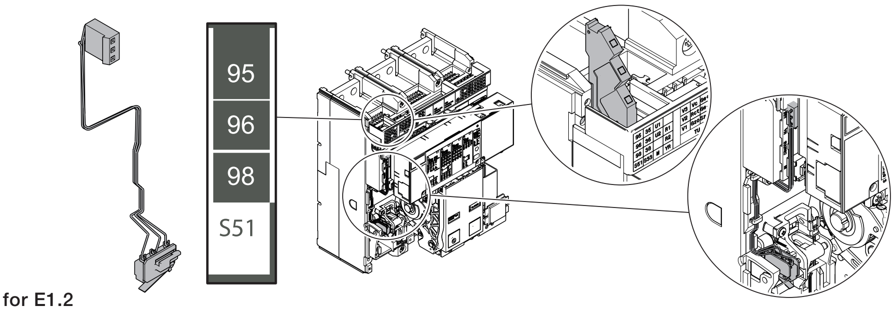
S51: trip unit tripping signalling contact

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

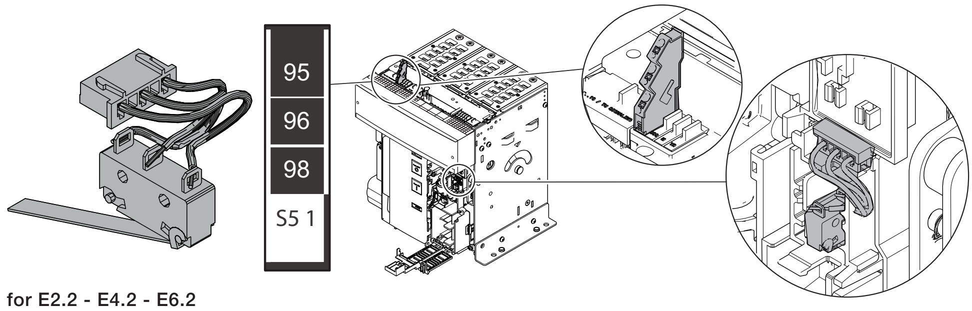
It is available in two different types:

- 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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **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

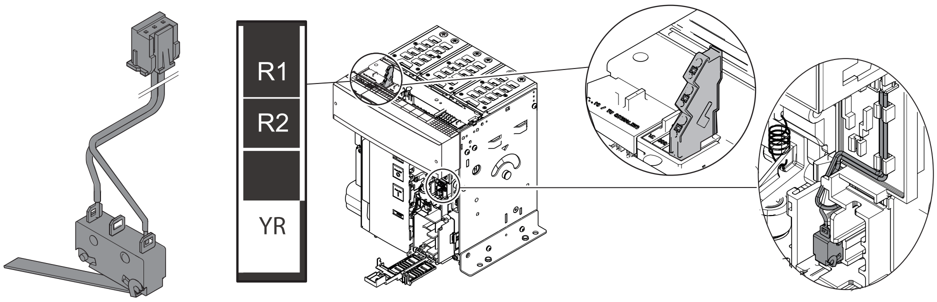
Contact S51/2 signals circuit-breaker opening after the protection release Ekip has tripped.

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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available **1SDM000091R0001**.

Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular in the kit sheet **1SDH001000R0614**.

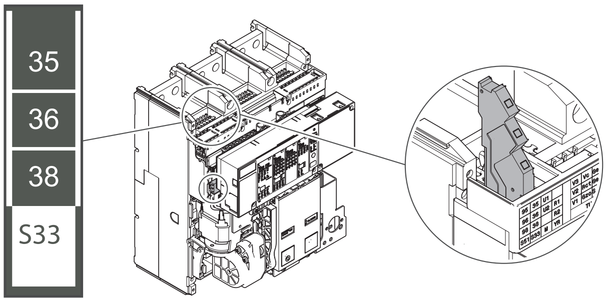
S33 M/2: springs charged signalling contact

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

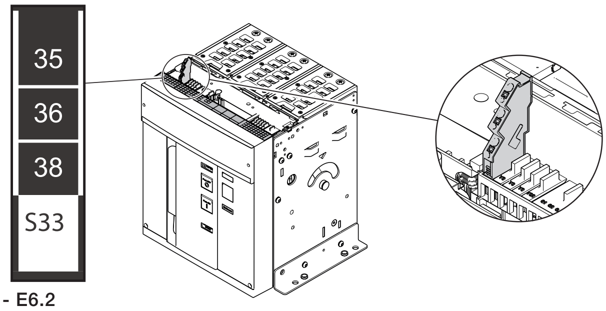
It is available in two types:

- 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

Further information is available on page 204, or on the website http://www.abb.com/abblibrary/DownloadCenter/, where the wiring diagram is available 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

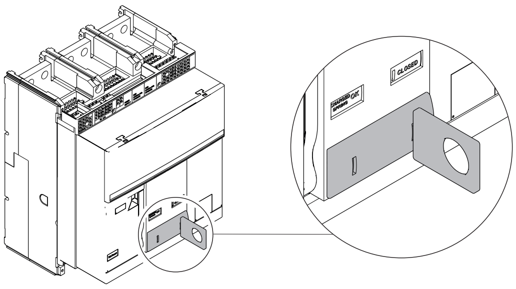
1 - Mechanical Protection accessories

PBC: opening and closing pushbutton protection

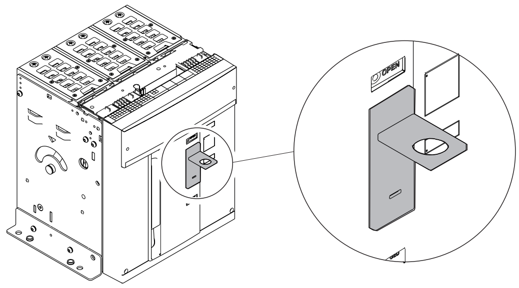
The pushbutton protection inhibits the use of the opening and closing pushbuttons.

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

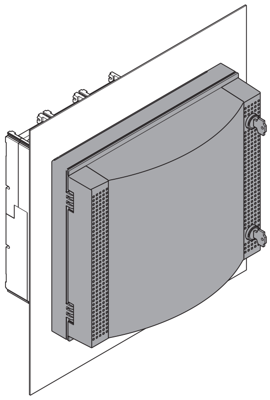
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0715 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0715.

IP54 protection

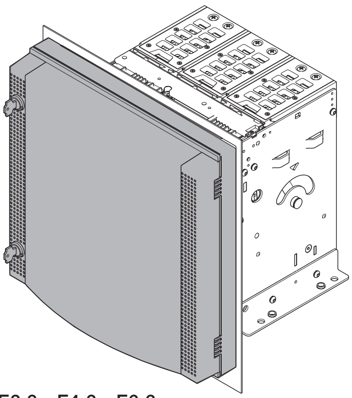
IP54 protection completely protects the front of the circuit-breaker, to achieve protection class IP54.

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



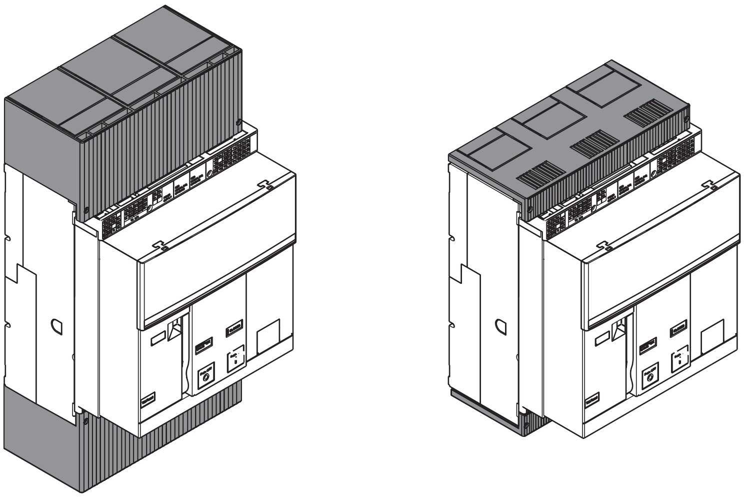
IP54 for E2.2 - E4.2 - E6.2

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



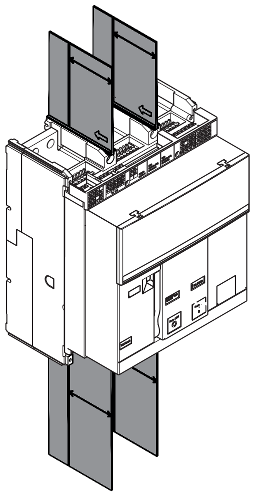
[1] Only for E1.2

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.

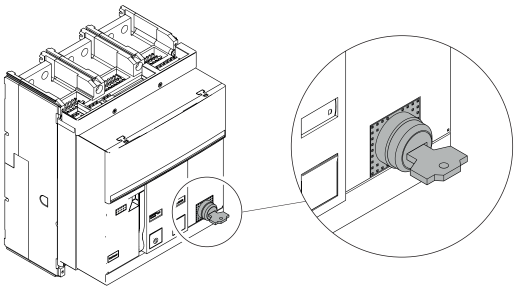
The KLC lock is available with two types of locking:

- 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.

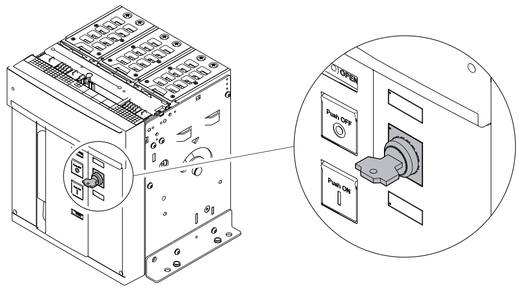
If set up appropriately, the KLC-A lock can work with four other types of locks:

- 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

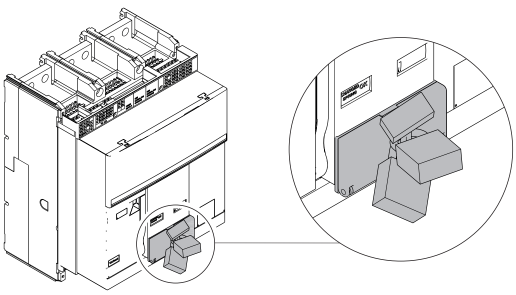
PLC: padlock

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

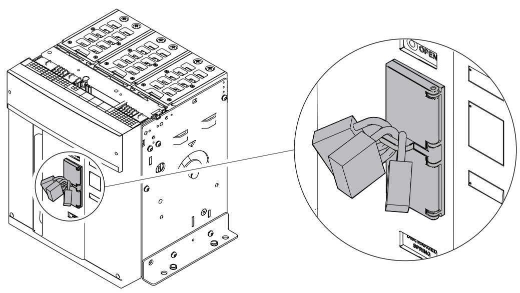
It is available in two types:

- 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



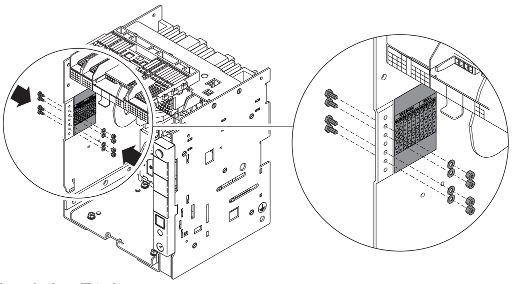
PLC for E2.2 - E4.2 - E6.2

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.

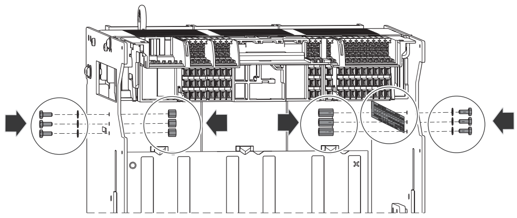
Anti-insertion lock

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

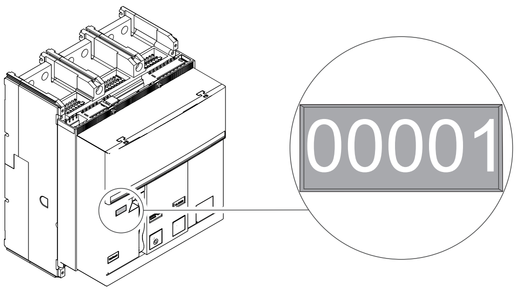


Lock for E2.2 - E4.2 - E6.2

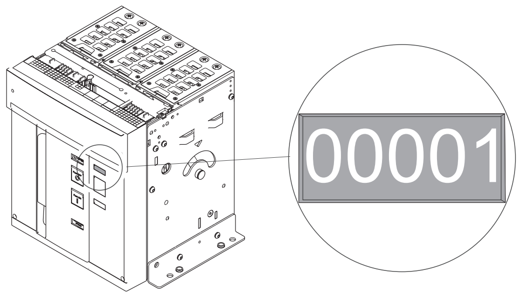
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0701 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0701.

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.

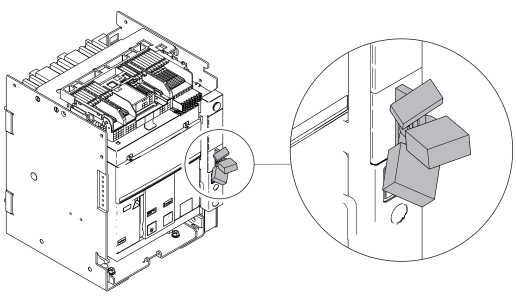
PLP: padlock in connected/ test/disconnected positions

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

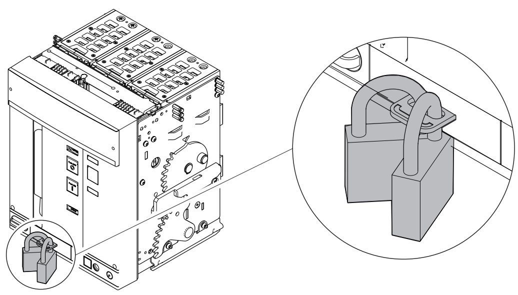
- connected
- test
- disconnected

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.

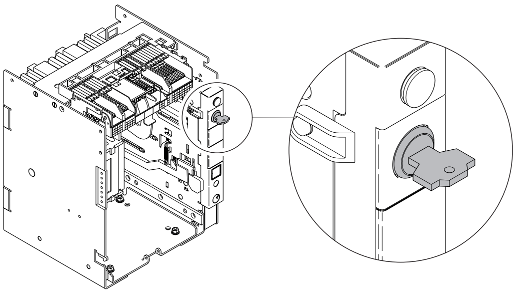
Through an appropriate setup, the KLP lock for connected/test/disconnected positions can work with three other types of lock:

- Ronis
- Profalux
- Kirk
- Castell

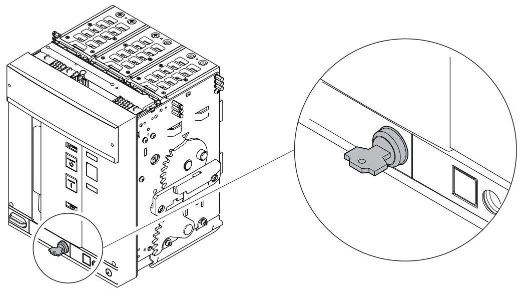
The maximum number of locks that can be installed per circuit-breaker is the two, for all types of lock.

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

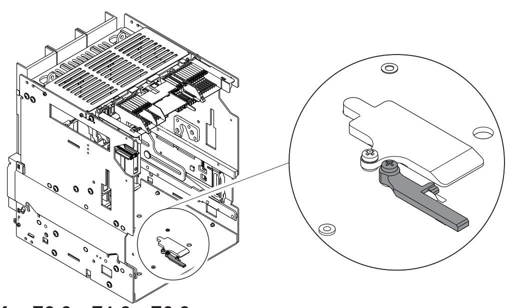
- 1SDH000999R0704 and 1SDH000999R0726 for key locks with lock supplied by ABB
- 1SDH000999R0705 for the key locks with pre-engineering for Ronis - Profalux - Kirk locks
- 1SDH000999R0719 for the key locks with pre-engineering for Castell locks

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.

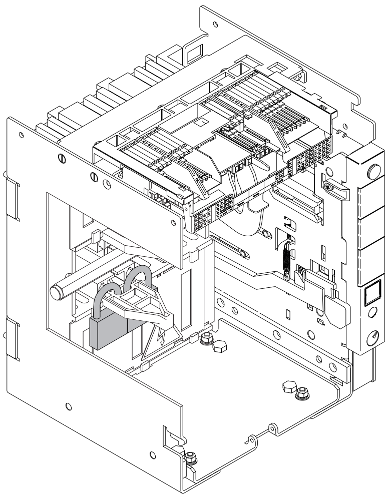
SL: shutter lock

The SL shutter locks the shutters of the fixed part.

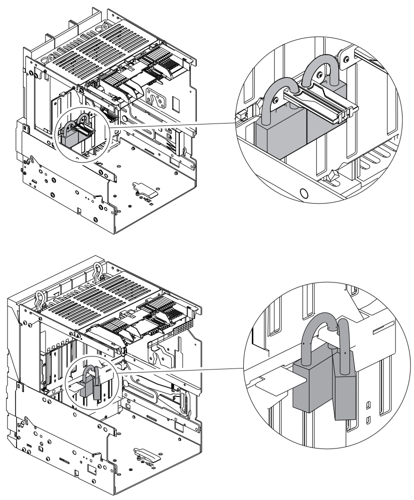
It is possible to lock the upper and lower shutters independently.

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

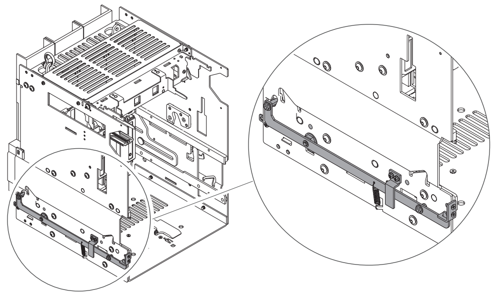
Information on the assembly is available on the website http://www.abb.com/abblibrary/DownloadCenter/, in particular for E1.2 in the kit sheet 1SDH000999R0712 and for E2.2-E4.2-E6.2 in the kit sheet 1SDH001000R0712.

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

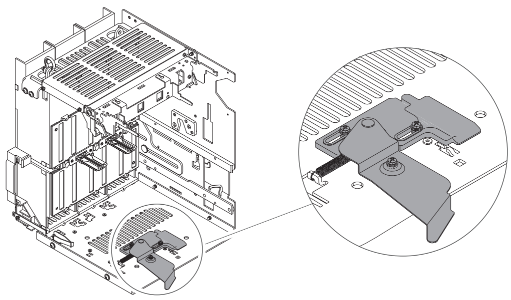
(1) Not available for E1.2

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.

Alarms or failures

1 - Identification of alarms or failures

Introduction

The protection trip unit is able to identify some faults and to signal them through LEDs or display; you need to identify the cause and eliminate it before re-closing the circuit-breaker, both locally and remotely.

WARNING! identification of the faults must be managed only by Skilled Persons in the electrical field (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. Indeed, it may be necessary to perform insulation and dielectric tests on part or all of the installation.

Some failures involve partial operation of the circuit-breaker. Consult the paragraphs "Faults, causes and remedies" on page 313 and "Faults signalled on the display" on page 316 where the possible causes of the main faults are listed.

Further information on the Ekip Touch trip unit and on the accessories mentioned in this chapter and which are not covered in this manual are available on the website http://www.abb.com/abblibrary/DownloadCenter/, with the Ekip Touch manual 1SDH001316R0002.

Faults, causes and remedies The following is a list of possible fault situations, their possible causes and suggestions for resolving them.

NOTE: *Before consulting the table, check the error messages on the display. If the suggestions indicated fail to resolve the problem, contact the ABB Assistance Service supplying, if possible supplying the report produced by the Ekip Connect software.*

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 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 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 170 178
	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	The opening solenoid is not inserted correctly	Check the connection of the opening solenoid and check the messages on the display
	The trip signal of the protection trip unit has not been reset	Press the reset pushbutton
	The busbar current is greater than zero	Correct operating condition.
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
It is not possible to remove the circuit-breaker from the disconnected position	Fail Safe lock active	Discharge the closing springs of the command
Tripping times shorter than expected	Selected threshold too low	Modify the threshold
	Wrong curve selected	Modify the curve
	Thermal memory enabled	Disable it if it is not necessary
	Incorrect neutral selection	Modify the neutral selection
	Zone Selectivity enabled	Disable it if it is not necessary
Tripping times longer than expected	Threshold too high	Modify the threshold
	Curve too high	Modify the curve
	Wrong curve selected	Modify the curve type
	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 (if present)	No auxiliary power supply and the current and/or voltage is less than minimum value	Correct operating condition.
	Temperature outside range	Correct operating condition.
The display is not backlit (if present)	Current and/or voltages below the display switch-on limit	Correct operating condition.
Incorrect current reading	Current below the minimum threshold that can be displayed	Correct operating condition.
Incorrect voltage, power and cos φ reading	Incorrect connection between isolation transformer and Ekip Measuring	Check the connections between the isolation transformer and Ekip Measuring
	Voltage parameter setting error	Set the correct parameters
The expected trip does not occur	Trip excluded	Correct operating condition. Enable trip if necessary
No activation of the Voltage unbalance protection (VU)	Values outside range	Correct operating condition.
Opening data not displayed	No auxiliary power supply and/or battery low	Correct operating condition.
The password is not requested	The password was disabled or already inserted recently	Correct operating condition, reset the password with a value other than “00000”
Impossible to change any of the parameters	Trip unit in alarm condition	Correct operating condition.
The language cannot be changed	The trip unit is set in remote mode	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
Password error	Password wrong or lost	See the document 1SDH001501R0002 or contact ABB
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

Faults signalled on the display

The following is a list of faults that can be detected from the display and the suggestions for resolving them:

Signal	Suggestions
No Com on Local Bus warning	Local bus enabled bus but no module present: check connection to terminal box modules (example: Ekip Supply, Com, Contact, ecc...)
Trip coil disconnected	Check the connection of the opening solenoid
Contact Wear PreAlarm/ Alarm	Make sure that the contacts/poles are in good condition.
L1/L2/L3/Ne sensor disconnected	Check the connection of the current sensor
Gext sensor Disconnected	Check the connection of the current sensor
Rating Plug Error	Check the connection of the Rating Plug on the front of the trip unit and verify that the protections do not cause parameter configuration conflicts
Internal Error	Contact ABB
Invalid Date	Set the date
CB Status Error	Check the circuit-breaker status signal contacts
Rating Plug Installation Warning	Install Rating Plug, and in the case of faults check its connection
Switchboard Actors Communication Error	Check the configuration and connection of the Ekip Link modules
Battery Low	Change the battery on the trip unit [1]
Voltage module Installation warning	Install the module
Voltage Module Error	Error reading the module parameters. Contact ABB
Software Not Compatible	The Mainboard and Ekip Touch software versions are not compatible with each other: editing of all parameters is inhibited by the display. The protections L, I and Iinst are active and working with the parameters set in the previous protection trip unit. To restore compatibility please contact ABB.

[1] Further information is available on the website http://www.abb.com/abblibrary/DownloadCenter/, where the procedure is available **1SDH001000R0509**.

Consult the individual chapters describing the modules for fault finding and resolving with regard to Ekip Com modules.

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 *Predictive Maintenance* in *ABB Ability 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

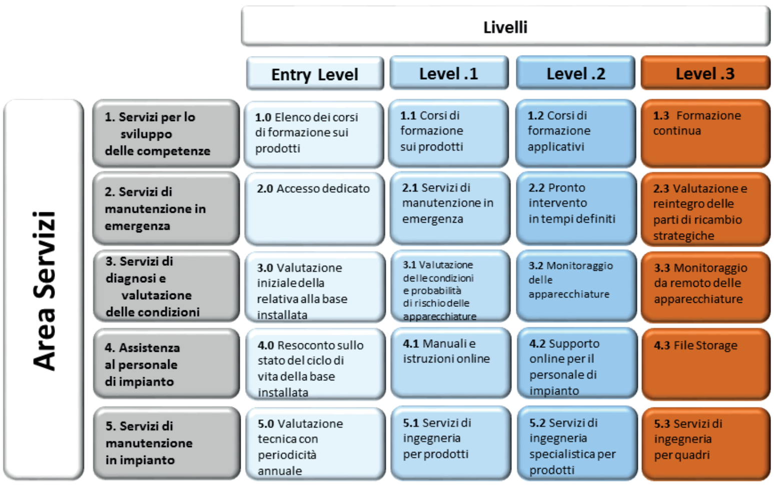
Foreword The number of devices that make up an electrical installation varies so greatly that it can be difficult to manage them, even for a very expert installation manager.

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.

1SDH001330R0002 - ECN000086018 - Rev. B

Power and productivity
for a better world™