DOC. N° 1SDH001316R0002 - ECN000086018 - Rev. C

# SACE Emax 2

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

**Instructions for using Ekip Touch protection trip units and Accessories.**

Power and productivity for a better world™

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

## 1 - Contents

**Organization of this handbook**

This manual contains the characteristics and instructions for using Ekip Touch trip units, compatible with SACE Emax 2 circuit-breakers, and completes the information in manuals 1SDH000999R0002 (for E1.2) or 1SDH001000R0002 (for E2.2-E4.2-E6.2).

**Intended readership**

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

- Electrically Skilled Person (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.
- Trained Persons in the electrical field (IEV 195-04-02): person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid danger which electricity can create.

**NOTE:** *This manual specifically indicates what operations can be performed by people trained in the field of electricity. All the remaining operations described in the handbook must be performed by skilled persons, in the electrical field. ABB declines all liability for damage to persons or property caused by failure to comply with the instructions in this document.*

**Instructions**

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

**Integrated informations**

Further details about functionality, parameters and supporting documentation are available in the manual 1SDH001330R0002 (Emax 2 engineering manual) available on the website ABB library.

# 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).

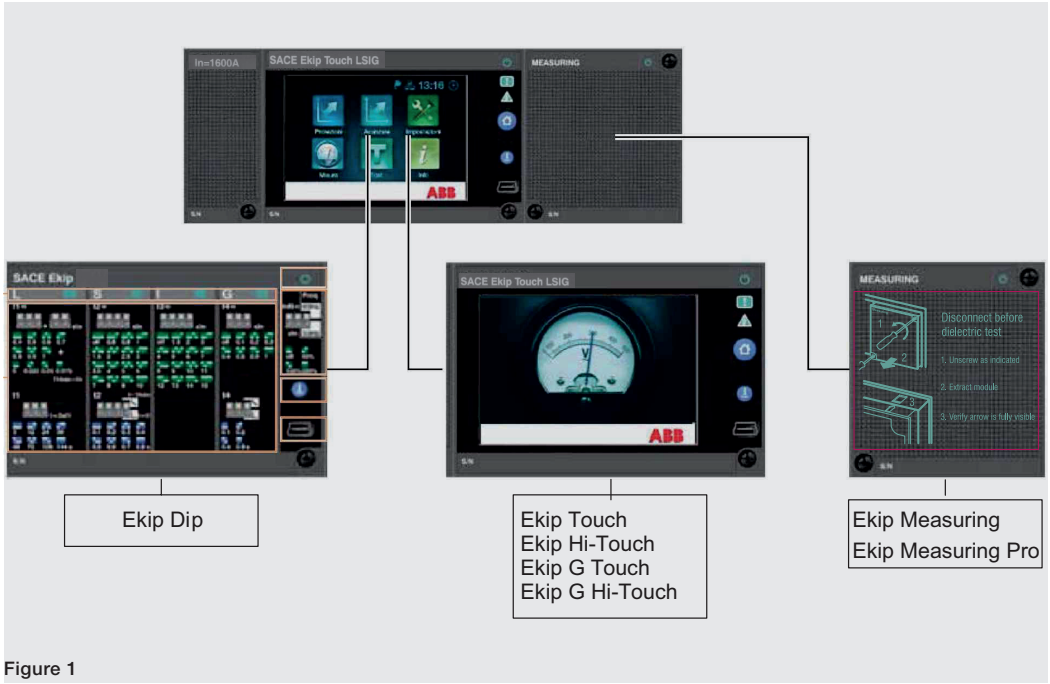


**Figure 1**

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.

Ekip Touch is described starting from page 6.

The description of Ekip DIP is available on the website http://www.abb.com/abblibrary/DownloadCenter/ in the installation manuals 1SDH000999R0002 (for circuit breakers E1.2) and 1SDH001000R0002 (for circuit breakers E2.2-E4.2-E6.2).

## Accessorizing modules

The Emax 2 circuit-breakers and Ekip trip units can be equipped as indicated in the combination tables on page 27.

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 |
|---|---|
| Ekip Measuring<br>Ekip Measuring Pro | Power supply, protection and measurement modules. |
| Ekip Signalling 4K | Signalling module |

**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 |
|---|---|
| Ekip Supply | Power supply module |
| Ekip Signalling 2K | Signalling module |
| Ekip Signalling 3T | Signalling module |
| Ekip Synchrocheck | Module for measuring voltage and synchronism between two power sources |
| Ekip Com Modbus RTU<br>Ekip Com Profibus DP<br>Ekip Com DeviceNet™<br>Ekip Com Modbus TCP<br>Ekip Com Profinet<br>Ekip Com EtherNet/IP™<br>Ekip Com IEC 61850<br>Ekip Com Hub | Communication module |
| Link | Communication module |

The modules external to the circuit-breaker are:

| Name | Description |
|---|---|
| Ekip Multimeter | Power supply and measurement module |
| Ekip Signalling 10K | Signalling module |
| Ekip Signalling Modbus TCP | Remote control and monitoring module |

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

| Name | Description |
|---|---|
| Ekip TT | Power supply and test module |
| Ekip T&P | Power supply, communication and test module |
| Ekip Programming | Power supply, communication and programming module |
| Ekip Bluetooth | Power supply and communication module |

Other accessories:

| Name | Description |
|---|---|
| Ekip LCD | LCD interface for aggressive environments |
| Rating plug | Module which defines the rated current In |
| Toroid S.G.R. | External homopolar current sensor |
| Rc Toroid | External differential current sensor |
| External neutral | Current sensor on the external neutral |
| Ekip AUP | Connected/isolated position contacts |
| Ekip RTC | Contact for signalling circuit-breaker is ready to close |

# Ekip Touch protection trip unit

## 1 - Layout of the interface

**Components of the interface**

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


Figure 2

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:<br>• **List of Alarms**, if there are any messages.<br>• **Protection unit**, with information on Mainboard and trip unit.<br>• **Circuit-breaker**, with information on the circuit-breaker.<br>• **Last opening**, with information on the last opening.<br>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:<br>• Off: power supply absent.<br>• On, fixed or flashing: power supply present, and trip unit on.<br>**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:<br>• Off: no warning or error.<br>• 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).<br>• On, flashing slowly: internal error.<br>• On, with two quick flashes every 0.5 s: parametrization error.<br>• On, fixed: prealarm of protection L, or circuit-breaker state error. |
| Red | The possible states are:<br>• Off: no alarm or error.<br>• On, blinking rapidly: absence of communication between trip unit and Mainboard, or trip coil disconnected, or current sensor disconnected, or delay active.<br>• On, with two quick flashes every 2 s: rating plug error.<br>• On, flashing slowly: internal error.<br>• 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 | |

## Diagnosis bar

The diagnostics bar is present in the main page and level 2 pages, along the lower side of the display, and its function is to display the messages.

The bar appears as follows:


Figure 3

Continued on the next page

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

| Pos. | Description |
|---|---|
| A | It shows the type of message:<br>• Alarm<br>• Warning, error, or prealarm<br>• Information<br>• 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 22.

## Main page

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

The page appears as follow:

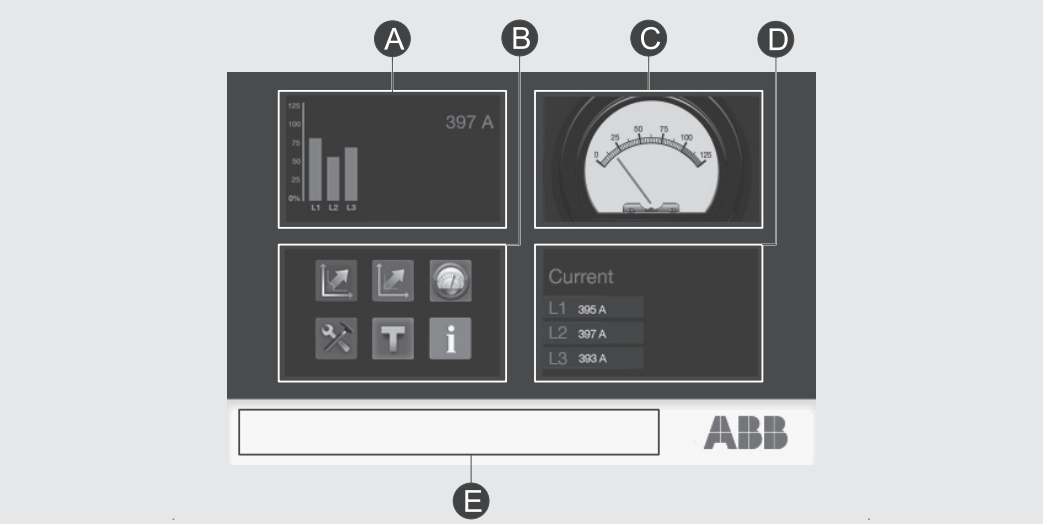


Figure 4

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 page **Histograms**.

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.

# 2 - Pages details

Details related to this chapter are available in the manual 1SDH001330R0002 (Emax 2 engineering manual) available on the website ABB library.

# 3 - Insertion of the password

## 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:

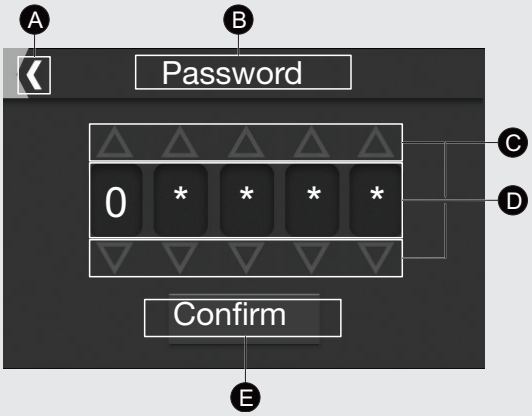


Figure 5

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:<br>• Confirmation after inserting a digit in a position from 1 to 4 will automatically bring you to the next digit.<br>• 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

# 4 - 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.
- By value: graphical page with a bar for assigning the parameter a numerical value within a range..

## 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.

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


Figure 6

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.

# 5 - Protections

## Operating principle

All the protections present in the electronic trip units with a display (Ekip Touch, Ekip Hi-Touch, Ekip G Touch, Ekip G Hi-Touch) have a delay time before entering alarm state and tripping the circuit-breaker.

The duration of the delay depends on the parameters set: threshold, time, curve. Depending on the current read by the trip unit, there are two possible behaviours:

- Current above the protection threshold, persistent alarm condition, the trip unit will open the circuit-breaker.
- Current below the protection threshold, alarm condition and delay interrupted.

The protection threshold relates to different parameters, according to the type:

| Type | Reference |
|---|---|
| Current | Nominal current of the rating plug (In). |
| Voltage | Rated voltage set (Un) |
| Frequency | Frequency set (fn) |
| Power | Current multiplied by rated voltage ($Sn = \sqrt{3} * In * Un$) |

**IMPORTANT:**

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

# 6 - Touch protections

**Availability (Performance)**

The following is a complete list of the protections (and related parameters) available with all the trip units equipped with a display, in the Protections and Advanced menus:

| Name | Protection against | Threshold | Time | Function | Auxiliary functions [5] [8] |
|---|---|---|---|---|---|
| L [1] | Overload with long-time delay | X | X | X | Thermal memory, Pre-alarm threshold |
| S [9] | Selective short-circuit | X | X | X | Trip enable, Zone Selectivity, Thermal Memory, Startup enable, Lock |
| I [2] | Instantaneous short-circuit | X | -- | -- | Startup enable, Lock |
| G [4][6][9][10] | Earth fault | X | X | X | Trip enable, Zone Selectivity, Startup enable, Locking, Pre-alarm threshold |
| 2I | Instantaneous short-circuit programmable | X | -- | -- | -- |
| MCR [3] | Instantaneous short circuit on closing | X | -- | -- | Monitoring period, Locking |
| IU | Current unbalance | X | X | -- | Trip enable |
| OT [7] | Temperature outside range | -- | -- | -- | Trip enable |
| IInst | Instantaneous short-circuit | -- | -- | -- | -- |
| Hardware Trip | Circuit-breaker internal connection error | -- | -- | -- | -- |
| Harmonic Distortion | Distorted waveforms | -- | -- | -- | -- |
| Current thresholds [11] | Programmable signal thresholds | X | -- | -- | Direction of current flow |
| Neutral | Neutral protection | X | -- | -- | -- |

[1] The protection forces 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.

[2] Activatable with protection MCR= Off.

[3] Activatable with protection I= Off.

[4] The protection automatically deactivates in the event of a connection error of 1 or more sensors, or if the measured current is higher than a maximum value:
- 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)

[5] Detailed description in the Design Engineer's manual.

[6] If the presence of sensor S.G.R. is activated, G protection adjustment is replaced by the Gext item in the Advanced section. Both the G and Gext items are available with Ekip Hi-Touch and Ekip G Hi-Touch.

[7] Available in the Circuit-Breaker Settings menu.

[8] Locking Function available via Ekip Connect.

[9] For all the UL versions the maximum time allowed by the trip unit is 0.4 seconds. If a higher value is set, the trip unit signals the error and forces the parameter to 0.4 seconds.

[10] 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.

[11] The current thresholds do not manage the trip, but only the signal.

**Neutral**

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.

Represented as a percentage, it defines the multiplication factor applied to the tripping thresholds of the protections (example: 50%= the tripping threshold of the neutral is half the phase threshold).

**NOTE:** *adjust the neutral setting only with four-pole or three-pole circuit-breakers with external neutral.*

## 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<br>± 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<br>± 20 % with If > 6 In |
| **S** (t = k) | 50 TD | I2 = 0.6...10 In step = 0.1 In | ± 7 % with If ≤ 6 In<br>± 10 % with If > 6 In | t2 = 0.05…0.8 s step = 0.01 s | $t_t$ = t2 | - | The better of the two values:<br>± 10 % or ± 40 ms |
| **S** (t = k / I$^2$) | 51 | I2 = 0.6...10 In step = 0.1 In | ± 7 % with If ≤ 6 In<br>± 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<br>± 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:<br>± 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:<br>± 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 I [4]) | 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<br>± 10 % with If > 6 In | $t2_{startup}$= 0.1…30 s step = 0.01 s | $t_t$ = t2 | The better of the two values:<br>± 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:<br>± 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 | - | - |

(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 % |

# 7 - Measuring Pro protections

### Availability (Performance)

The following is a complete list of the protections (and related parameters) available with all the trip units of the Touch range equipped with an Ekip Measuring Pro module, in the Protections and Advanced menus:

| Name | Protection against | Threshold | Time | Auxiliary functions (3) (4) |
|---|---|---|---|---|
| UV | Minimum voltage | X | X | Trip Enable, Lock |
| OV | Maximum voltage | X | X | Trip Enable, Lock |
| VU (1) | Voltage unbalance | X | X | Trip Enable, Lock |
| UF (2) | Minimum frequency | X | X | Trip Enable, Lock |
| OF (2) | Maximum frequency | X | X | Trip Enable, Lock |
| RP | Reverse active power | X | X | Trip Enable, Lock |
| Phase Sequence | Phase sequence error | X | -- | |
| Cosφ | Power factor error | X | -- | |

(1) Protection not active if the highest of the voltages measured is in any case less than 30% of Un.
(2) Protection not active for voltages <30V.
(3) Detailed description in the Design Engineer's manual
(4) Locking Function available via Ekip Connect.

### 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<br>step = 0.001 Un | ± 2 % | t8 = 0.05…120 s<br>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<br>step = 0.001 Un | ± 2 % | t9 = 0.05…120 s<br>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 %<br>step = 1 % | ± 5 % | t14 = 0.5…60 s<br>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<br>step = 0.001 fn | ± 1 % (4) | t12 = 0,06…300 s<br>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<br>step = 0.001 fn | ± 1 % (4) | t13 = 0,06…300 s<br>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<br>step = 0.001 Sn | ± 10 % | t11 = 0.5…100 s<br>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) |
| **Synchro-check** | 25 | Ulive = 0.5…1.1 Un; step = 0.001 Un<br>ΔU = 0.02…0.12 Un; step = 0.001 Un<br>Δf = 0.1…1 Hz; step = 0.1 Hz<br>ΔCos φ = 5…50° elt; step = 5° elt<br>tsyn = 0.1…3 s; step = 0.1 s | ± 10 % | tref = 0.1…30 s<br>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<br>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.

# 8 - Hi-Touch protections

### Availability (Performance)

The following is a complete list of the protections (and related parameters) available with all the Ekip Hi-Touch and Ekip G Hi-Touch trip units, in the Protections and Advanced menus:

| Name | Protection against | Threshold | Time | Auxiliary functions (1) (2) |
|---|---|---|---|---|
| S2 (3) | Selective short-circuit | X | X | Trip enable, Zone Selectivity, Startup enable, lock |
| D (6) | Directional short circuit | X | X | Trip Enable, Directional Zone Selectivity (4), Startup enable, Locki, Min Angle Direction |
| UV2 | Minimum voltage | X | X | Trip Enable, Lock |
| OV2 | Maximum voltage | X | X | Trip Enable, Lock |
| UF2 (5) | Minimum frequency | X | X | Trip Enable, Lock |
| OF2 (5) | Maximum frequency | X | X | Trip Enable, Lock |
| Set A-B | Double configuration of the protections | X | X | Default set, Activation event, Activation delay |

(1) Detailed description in the Design Engineer's manual.
(2) Locking Function available via Ekip Connect.
(3) For all the UL versions the maximum time allowed by the trip unit is 0.4 seconds. If a higher value is set, the trip unit signals the error and forces the parameter to 0.4 seconds.
(4) Directional Zone Selectivity works as an alternative to S and G Zone Selectivity.
(5) Protection not active for voltages <30V.
(6) The protection does not detect the direction of fault current for voltages < 5V.

### 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<br>step = 0.1 In | ± 7 % If ≤ 6 In<br>± 10 % If > 6 In | t5 = 0.05...0.8 s<br>step = 0.01 s | $t_t$ = t5 | The better of the two values:<br>± 10 % or ± 40 ms |
| **D** | 67 | I7 Fw/Bw = 0.6...10 In<br>step = 0.1 In | ± 7 % If ≤ 6 In<br>± 10 % If > 6 In | t7 Fw/Bw =<br>0.1...0.8 s<br>step = 0.01 s | $t_t$ = t7 | The better of the two values:<br>± 10 % or ± 40 ms |
| **UV2** | 27 | U15= 0,05….0,98 Un<br>step = 0.001 Un | ± 2 % | t15 = 0.05…120 s<br>step = 0.01 s | $t_t$ = t15 | The better of the two values:<br>± 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<br>step = 0.001 Un | ± 2 % | t16 = 0.05…120 s<br>step = 0.01 s | $t_t$ = t16 | The better of the two values:<br>± 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<br>step = 0.001 fn | ± 1 % (5) | t17 = 0,06…300 s<br>step = 0.01 s | $t_t$ = t17 | The better of the two values:<br>± 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<br>step = 0.001 fn | ± 1 % (5) | t18 = 0,06…300 s<br>step = 0.01 s | $t_t$ = t18 | The better of the two values:<br>± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s) |

Continued on the next page

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<br>± 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:<br>± 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:<br>± 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.

# 9 - G Touch protections

### Availability (Performance)

The following is a complete list of the protections (and related parameters) available with all the Ekip G Touch and Ekip G Hi-Touch trip units, in the Protections and Advanced menus:

| Name | Protection against | Th-reshold | Time | Additional parameters [2] | Auxiliary functions [2] [3] |
|---|---|---|---|---|---|
| S(V) | Voltage control short-circuit | X | X | X | Trip enable, lock |
| RV [1] | Residual voltage | X | X | | Trip enable, lock |
| RQ | Reverse reactive power | X | X | X | Trip Enable, Lock |
| OQ | Maximum reactive power | X | X | | Trip Enable, Lock |
| OP | Maximum active power | X | X | | Trip Enable, Lock |
| UP [4] | Minimum active power | X | X | | Trip Enable, Lock, Startup enable |

[1] Available for four-pole or three-pole circuit-breakers configured with external neutral voltage.
[2] Detailed description in the Design Engineer's manual.
[3] Locking Function available via Ekip Connect.
[4] Not active for voltages <30V and if the circuit-breaker is open. The protection is also active for negative (reverse) active power, but it is independent of the RP protection (Protection against reverse active power).

### 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]<br>Ul = 0.2...1 Un; step = 0.01 Un<br>Ks = 0.1...1; step = 0.01 [6] | ± 10 % | t20 = 0.05...30 s<br>step = 0.01 s | $t_t$ = t20 | The better of the two values:<br>± 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]<br>Ul = 0.2...1 Un; step = 0.01 Un [7]<br>Uh = 0.2...1 Un; step = 0.01 Un [7]<br>Ks = 0.1...1; step = 0.01 [6] | ± 10 % | t20 = 0.05...30 s<br>step = 0.01 s | $t_t$ = t20 | The better of the two values:<br>± 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<br>step = 0.001 Un | ± 5 % | t22 = 0.05...120 s<br>step = 0.01 s | $t_t$ = t22 | The better of the two values:<br>± 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<br>Kq = -2...2; step = 0.01<br>Vmin = 0.5...1.2 Un; step = 0.01 | ± 10 % | t24 = 0.5...100 s<br>step = 0.1 s | $t_t$ = t24 | The better of the two values:<br>± 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<br>step = 0.001 Sn | ± 10 % | t26 = 0.5...100 s<br>step = 0.5 s | $t_t$ = t26 | The better of the two values:<br>± 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<br>step = 0.001 Sn | ± 10 % | t27 = 0.5...100 s<br>step = 0.5 s | $t_t$ = t27 | The better of the two values:<br>± 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<br>step = 0.001 Sn | ± 10 % | t23 = 0.5...100 s<br>step = 0.5 s | $t_t$ = t23 | The better of the two values:<br>± 10 % or ± 40 ms (for a time set < 5 s) / ± 100 ms (for a time set > 5 s) |

Continued on the next page

UP protection has Startup Enable:

| ABB | Time [4] |
|---|---|
| **UP** (Startup) | $t23_{startup}$ = 0.1…30 s<br>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.

# 10 - G Hi-Touch protections

### Availability (Performance)

The following is a complete list of the protections (and related parameters) available with all the Ekip G Touch and Ekip G Hi-Touch trip units, in the Protections and Advanced menus:

| Name | Protection against | Threshold | Time | Additional parameters (2) | Auxiliary functions (2) (3) |
|---|---|---|---|---|---|
| ROCOF (1) | Rate of change of frequency | X | X | X | Trip Enable, Lock |
| S2(V) | Voltage control short-circuit | X | X | X | Trip Enable, Lock |
| RQ2 | Reverse reactive power | X | X | X | Trip Enable, Lock |

(1) Not active for voltages <30V.
(2) Detailed description in the Design Engineer's manual.
(3) Locking Function available via Ekip Connect.

### 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)<br>UI2 = 0.2…1 Un; step = 0.01 Un<br>Ks2 = 0.1…1; step = 0.01 (4) | ± 10 % | t21 = 0.05…30 s<br>step = 0.01 s | $t_t$ = t21 | The better of the two values:<br>± 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)<br>UI2 = 0.2…1 Un; step = 0.01 Un (7)<br>Uh2 = 0.2…1 Un; step = 0.01 Un (7)<br>Ks2 = 0.1…1; step = 0.01 (4) | ± 10 % | t21 = 0.05…30 s<br>step = 0.01 s | $t_t$ = t21 | The better of the two values:<br>± 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<br>Q25 = -1…-0.1 Sn; step = 0.001 Sn<br>Kq = -2…2; step = 0.01;<br>Kq2 = -2…2; step = 0.01<br>Vmin = 0.5...1.2 Un; step = 0.01 | ± 10 % | t24 = 0.5…100s<br>step = 0.1 s | $t_t$ = t24 | The better of the two values:<br>± 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<br>step = 0.2 Hz / s | ± 10 % (8) | t28 = 0.5...10 s<br>step = 0.01 s | $t_t$ = t28 | The better of the two values:<br>± 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 UI2 and Uh2 is calculated by performing the linear interpolation between the thresholds Uh2 and I21 (first point on the line) and UI2 and Ks2 * I20 (second point on the line). $I_{threshold}$ = [I10 * (1 - ks2) * ($U_{measured}$ - Uh2)] / (Uh2 - UI2) + 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 UI2 must guarantee the following constraint: Uh2 > UI2.
(8) ± 20 % for the threshold 0.4 Hz / s.

## 11 - External toroid protections

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 12 - Touch measurements

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 13 - Ekip Measuring Measurements

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 14 - Hi-Touch measurements

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 15 - Test

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

# 16 - 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 6.
- 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:<br>• Rating plug not connected<br>• Invalid value<br>• Rating Plug Rc inserted but Ekip Measuring not present<br>• 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.<br>The protections L, I and linst are active and working with the parameters set in the previous protection trip unit.<br>To restore compatibility please contact ABB. |
| **Configuration** | Make sure that one of the following conditions is present:<br>• 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<br>• Iu < (2 * In * I1) if InN = 200 %<br>• t2 or t4 or t5 or t41 > 0.4 s (in case of UL circuit-breaker)<br>• I4 > 1200 A (in case of UL circuit-breaker)<br>• 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 |

Continued on the next page

| Signal | Description |
|---|---|
| **SNTP error** | Synchronization problem of SNTP synchronization reference module |
| **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 information about how to resolve error signaling, see the Fault Resolution section in the manuals* **1SDH000999R0002** *for Emax E1.2 and* **1SDH001000R0002** *for Emax E2.2, E4.2 and E6.2.*

## 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 |

# 17 - 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)<br>> 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 rangeor 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.**

**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.

**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 and commands that identify the CB (**CB label**, **User data**, **Additional pages**, **Installation data**, **Alive Led**, **Wink** command).
- Additional measurements (**Load Profile Timers**).
- Additional commands (management of **Open CB** / **Close CB** commands, additional zone selectivity functions, **Glitch** commands),
- Additional parameters (**programmable states**, **protection locks**, **filters**, management of communication data, options **double set A-B**, **Wizard**).

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

Further details about the single options are available in the Design Engineering manual 1SDH001330R0002.

## 18 - Default parameters

Details related to this chapter are available in the manual 1SDH001330R0002 (Emax 2 engineering manual) available on the website ABB library.

## 19 - Ekip Power Controller

Details related to this chapter are available in the manual 1SDH001330R0002 (Emax 2 engineering manual) available on the website ABB library.

# 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 | - | - | - |
| | YR | R | - | - | - | - |

Continued on the next page

| Type of accessory | Accessory | Circuit-breakers | Switch-disconnectors | Derived versions | | |
|---|---|---|---|---|---|---|
| | | | | CS | MV | MTP |
| 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.

## 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).

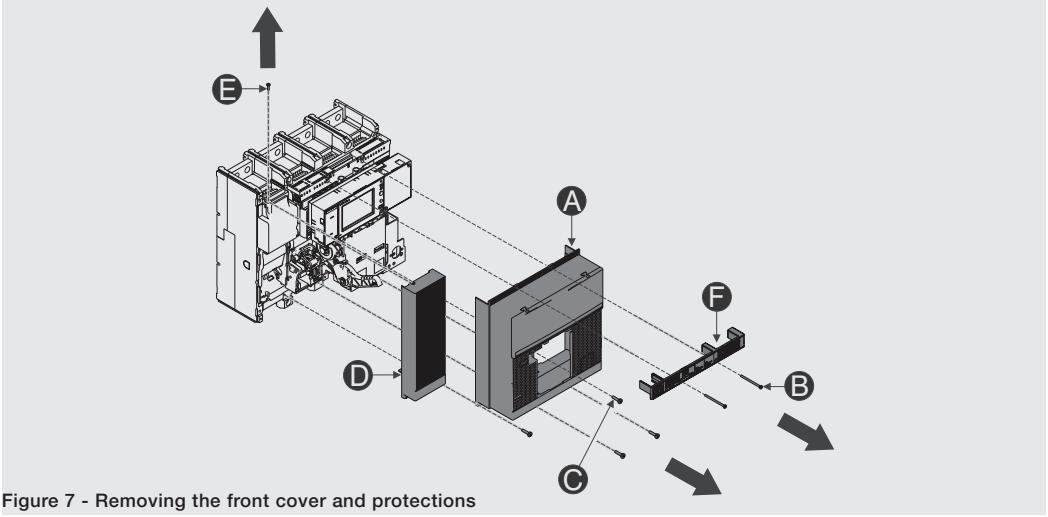


**Figure 7 - Removing the front cover and protections**

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.

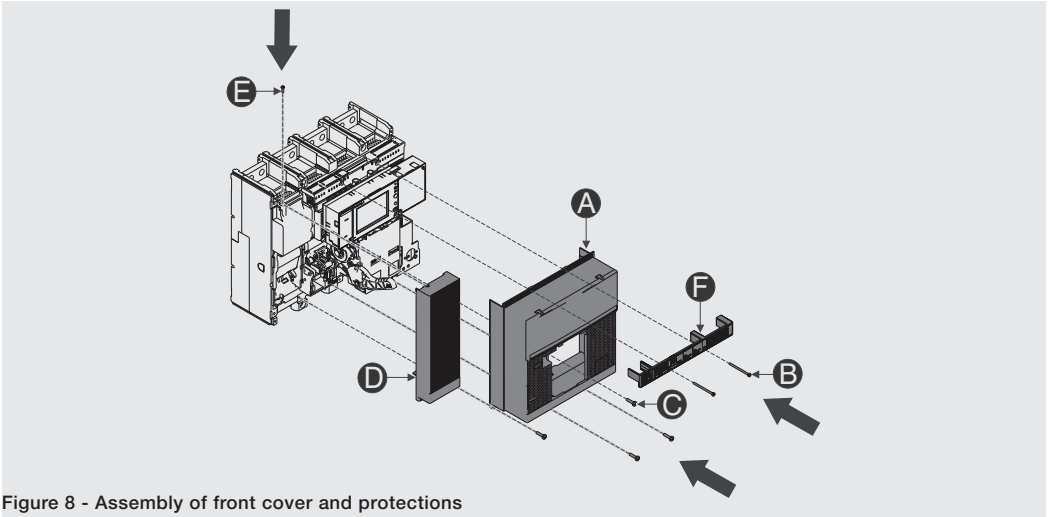


**Figure 8 - Assembly of front cover and protections**

**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).

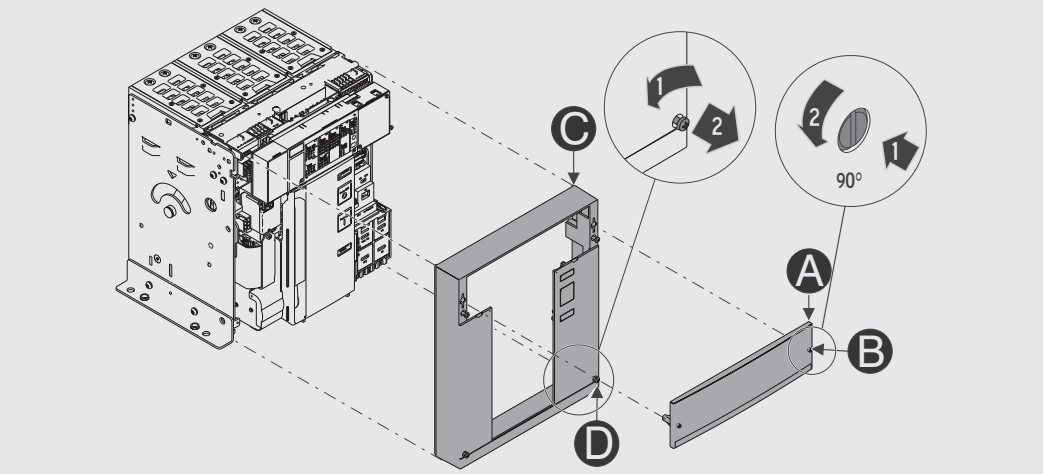


**Figure 9 - Removing the flange and front cover**

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).

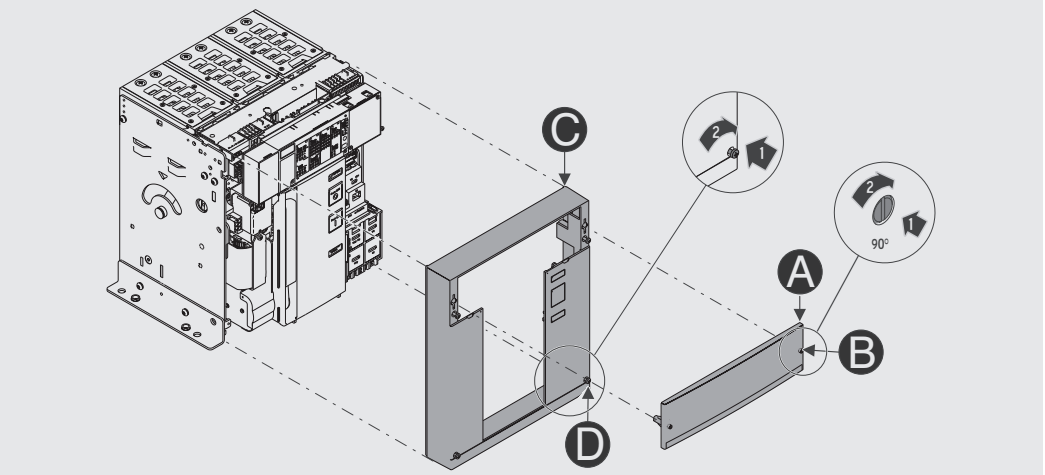


**Figure 10 - Assembly of flange and front cover**

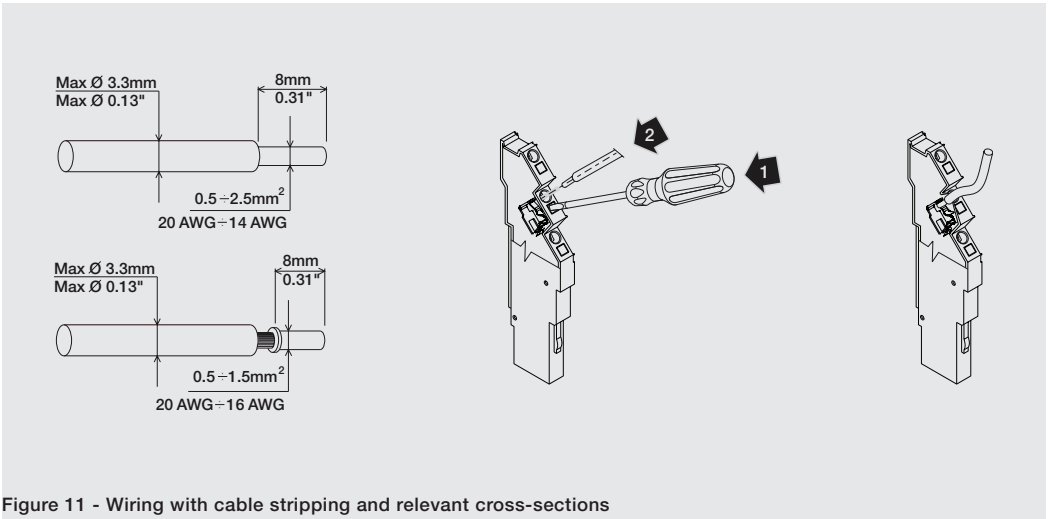


**Figure 11 - Wiring with cable stripping and relevant cross-sections**

## 2 - Wiring diagrams

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

# Electronic accessories

## 1 - Introduction

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 2 - Ekip Measuring modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 3 - Ekip Synchrocheck module

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 4 - Ekip Signalling 4K module

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 5 - Ekip Signalling 2K modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 6 - Ekip Signalling 3T modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 7 - Ekip Com Modbus RTU modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 8 - Ekip Com Profibus DP modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 9 - Ekip Com DeviceNet modules™

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 10 - Ekip Com Modbus TCP modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 11 - Ekip Com Profinet modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 12 - Ekip Com EtherNet/IP™ modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 13 - Ekip Com IEC 61850 modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 14 - Ekip Link module

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 15 - Ekip Com Hub modules

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 16 - Ekip Com Actuator module

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

## 17 - Other accessories

Details related to this chapter are available in the manual **1SDH001330R0002** (Emax 2 engineering manual) available on the website ABB library.

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