

7. Extract the disconnection crank from its housing See Figure 75.
8. Press the lock pushbutton and fit the handle into the moving part. In this phase, the moving part will still be in the **DISCONNECT** position. See Figure 76.

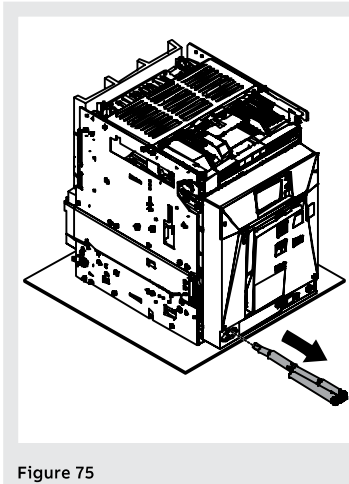


Figure 75

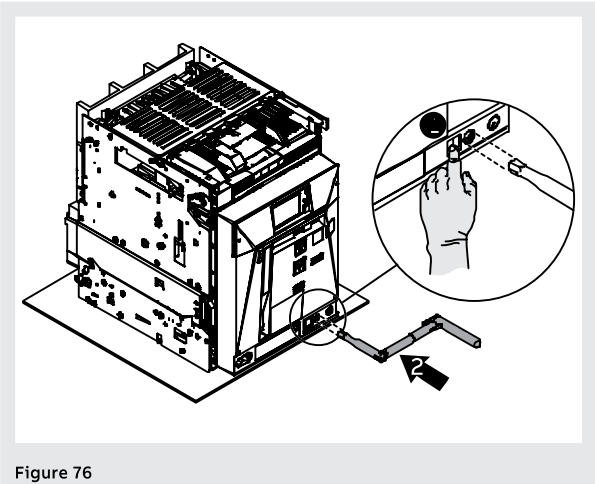


Figure 76

9. Turn the crank clockwise until the pushbutton comes out and the indicator shows that the circuit-breaker is in **TEST** position. See Figure 77.

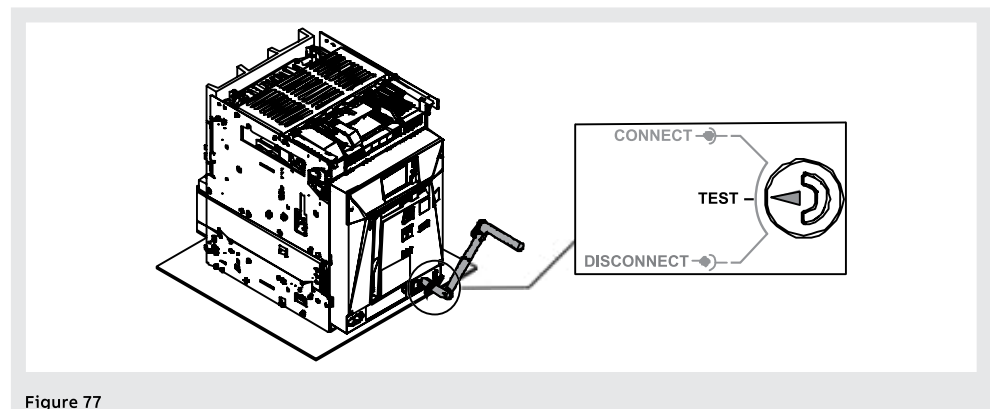


Figure 77

10. Press lock pushbutton and turn handle clockwise until pushbutton projects and signaling device indicates that circuit-breaker is in position **CONNECT**. See Figure 78.

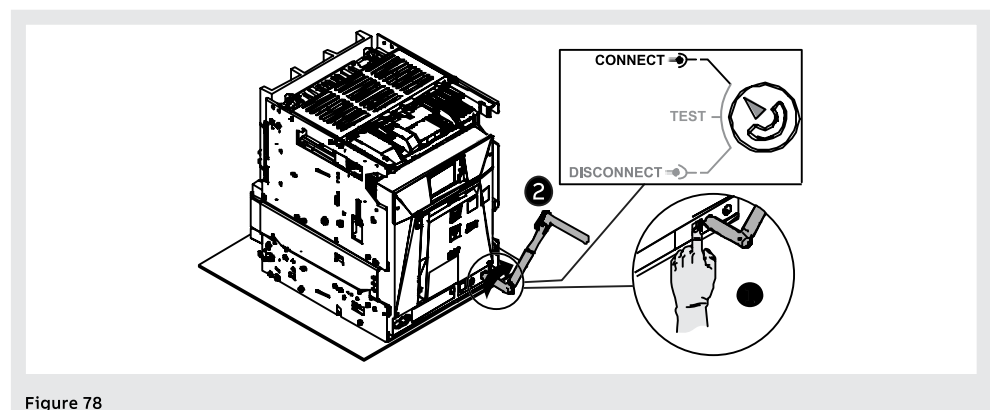


Figure 78

Continued on the next page

11. Extract the crank. See Figure 79.
12. Replace the crank in its housing See Figure 80.

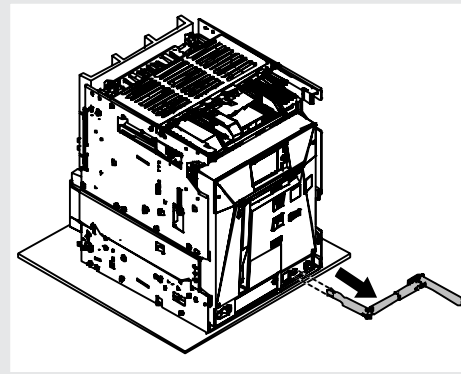


Figure 79

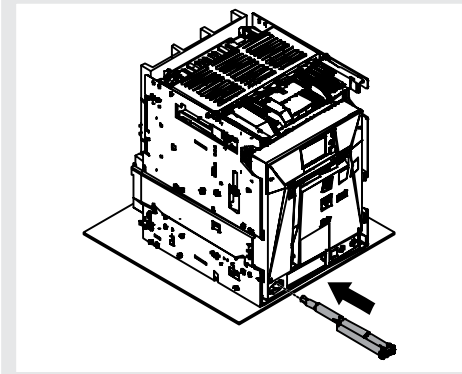


Figure 80

To extract the moving part from the fixed part, perform the same steps indicated for insertion in reverse order.

Always use both levers of the guides on the fixed part when racking out the circuit-breaker. See Figure 81.



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.

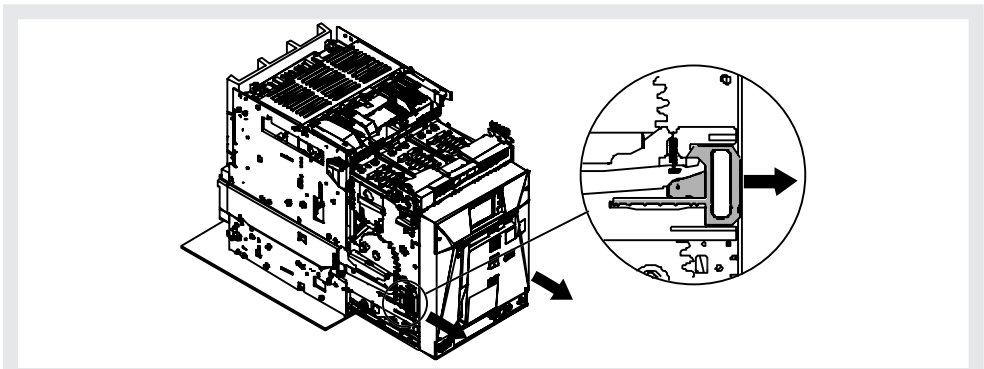


Figure 81

Continued on the next page

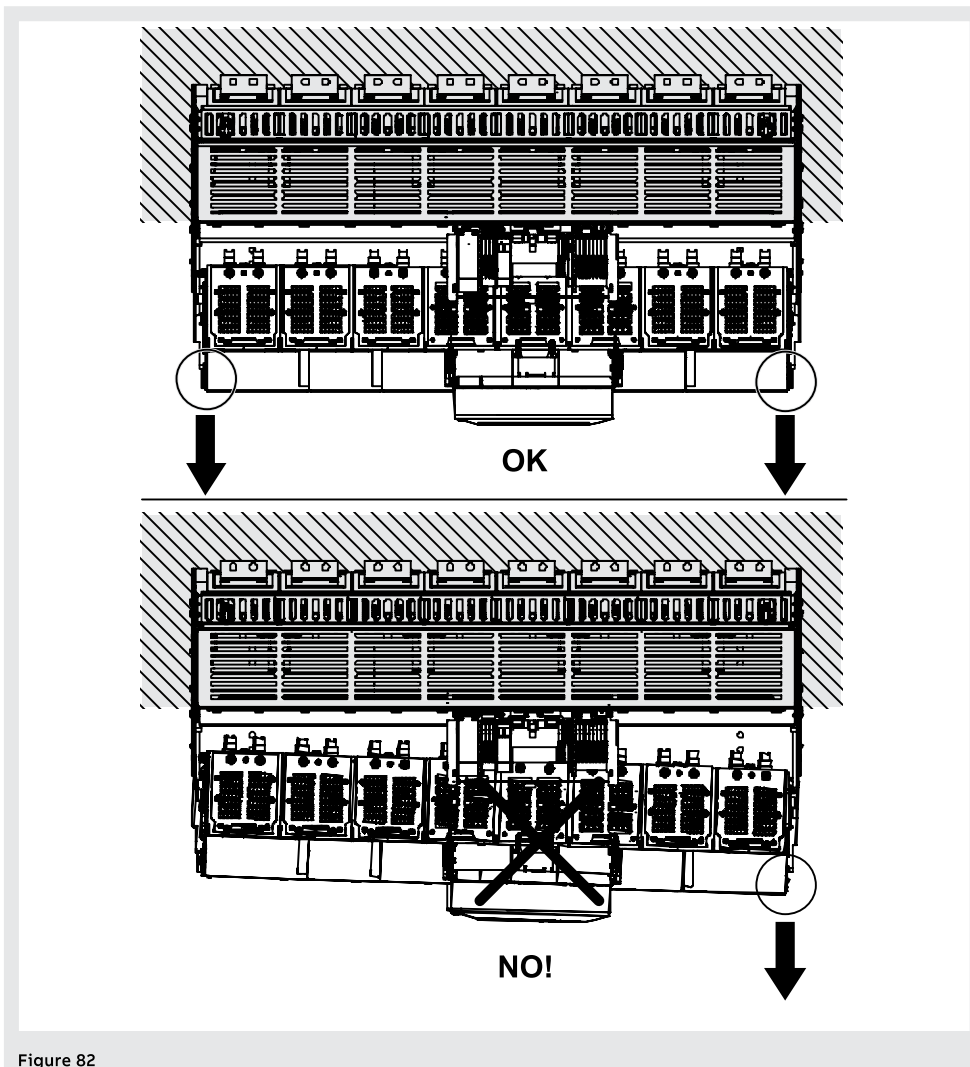


Figure 82



WARNING! Falling objects. Risk of serious injury to persons and damage to equipment. 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 82.

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 83)
- circuit-breaker in test position (see Figure 84)
- circuit-breaker in CONNECT position (see Figure 85)

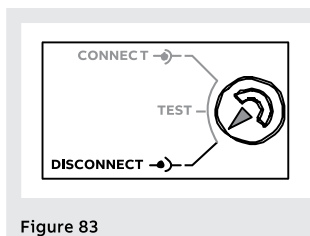


Figure 83

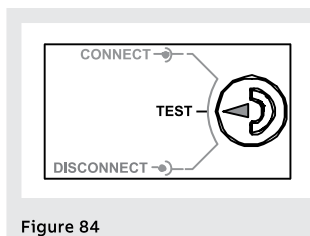


Figure 84

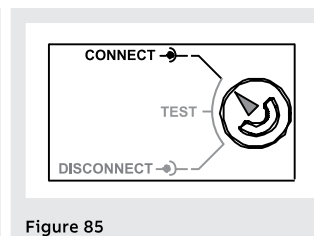


Figure 85

6 - Installation E1.3

Warnings and precautions before the installation

The following warnings and precautions must be respected before installing the circuit-breaker in the switchgear



DANGER! Dangerous voltage ACCIDENTAL CONTACT WITH LIVE POINTS CAN CAUSE SHOCK, BURNS AND RESULT IN DEATH.

- Disconnect the power from the circuit-breaker (power circuit and auxiliary circuits)
- Make sure the circuit-breaker is disconnected from all sources of energy
- Switch the circuit-breaker to the open position with springs discharged



WARNING! the qualified personnel tasked with handling and lifting work must use suitable safety equipment.

Mounting of the fixed circuit-breaker

Fix the circuit-breaker to a horizontal surface using four M5 x 25 screws (see Figure 86). Lock the screws with tightening torque 4 Nm - 35 lb in.

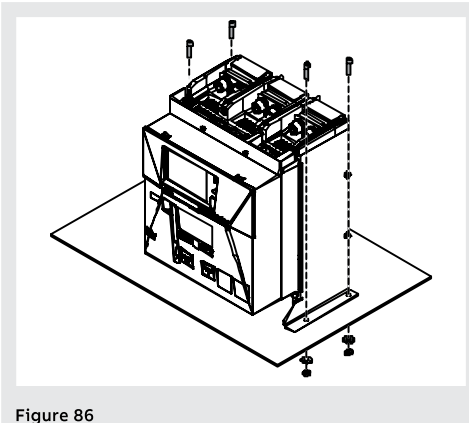


Figure 86

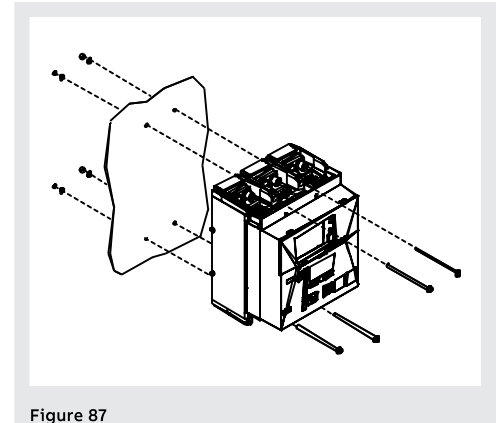


Figure 87

Mounting anti-insertion locks

Before installing the fixed part, assemble the lock that prevents circuit-breakers with different electrical characteristics from those of the fixed part itself from being racked-in (see Figure 88).

The anti-racking-in locks enable the movable part of the circuit-breaker to be only racked into the corresponding fixed part.

They are provided for all withdrawable circuit-breakers and are divided into two types:

- according to configuration, factory installed on both the fixed and movable parts (A)
- according to rating, factory installed on the movable part and supplied in the packaging for the fixed part (B)



WARNING! Incorrect assembly. Risk of serious injury to persons and damage to equipment. It is forbidden to change the position of the configuration blocks

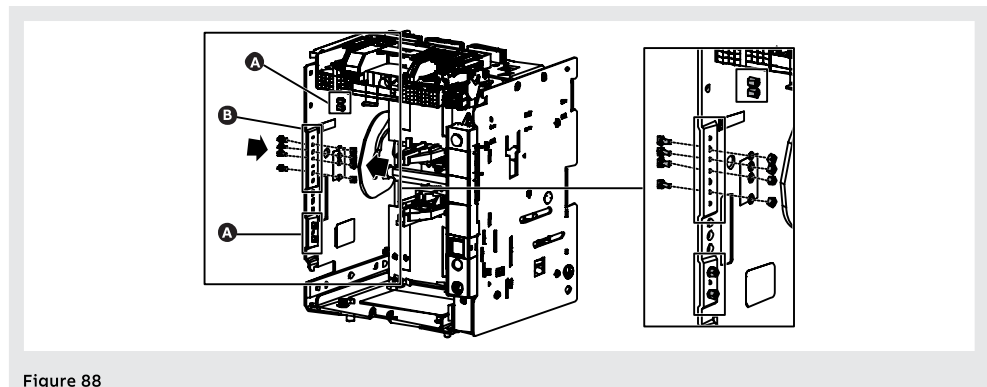


Figure 88

Information on the assembly is available on the website <https://library.abb.com> in particular in the kit sheet [1SDH002309A1701](#).

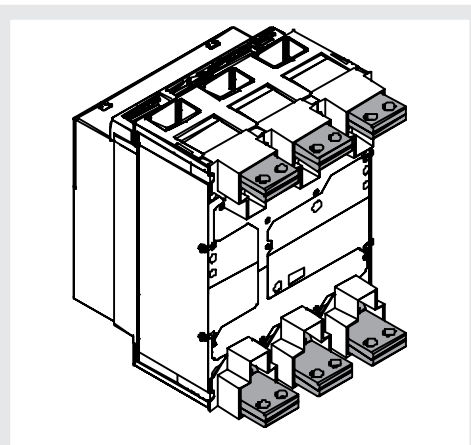
Types of terminal The following are the different types of terminal:

Figure 89 - F - HR - Horizontal rear IEC

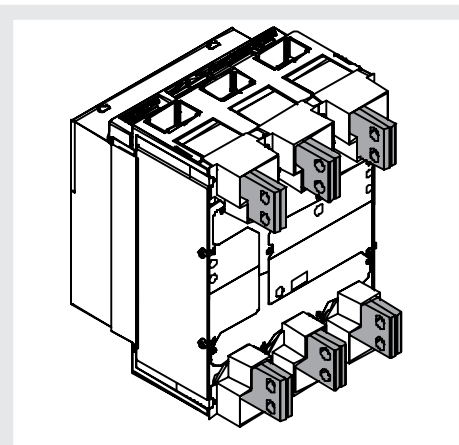


Figure 90 - F - VR - Vertical rear IEC

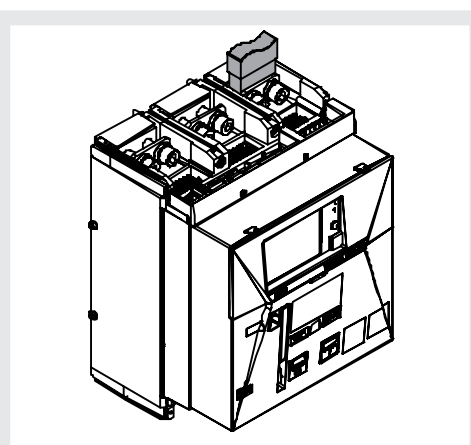


Figure 91 - F - F - Front IEC

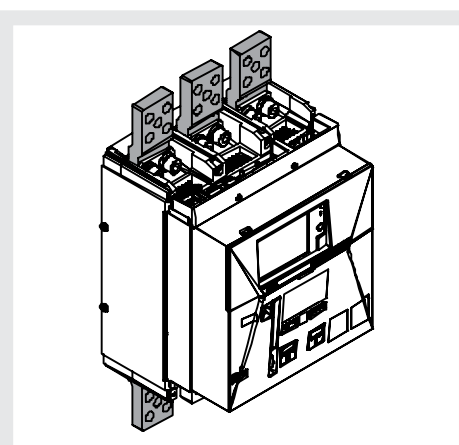


Figure 92 - F - EF - Extended front IEC

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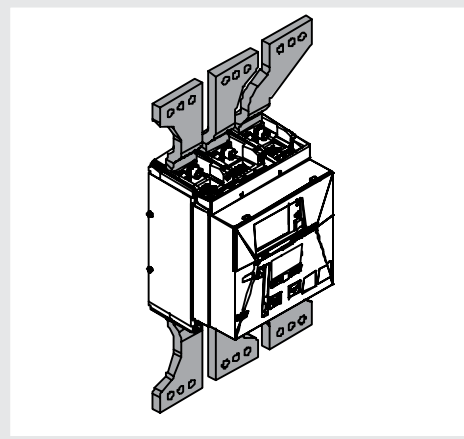


Figure 93 - F - ES - Spread front IEC

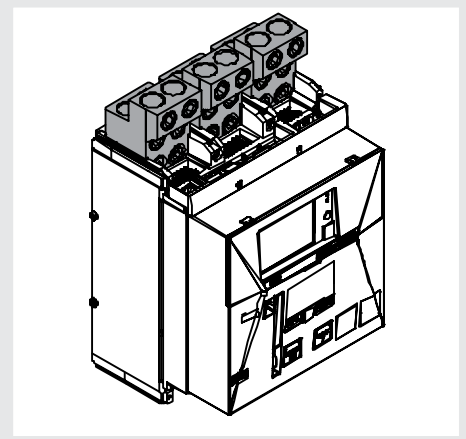


Figure 94 - F - FC - Terminals for cables IEC

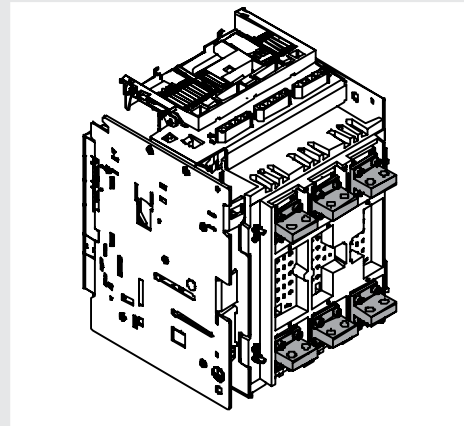


Figure 95 - W - HR - Horizontal rear IEC

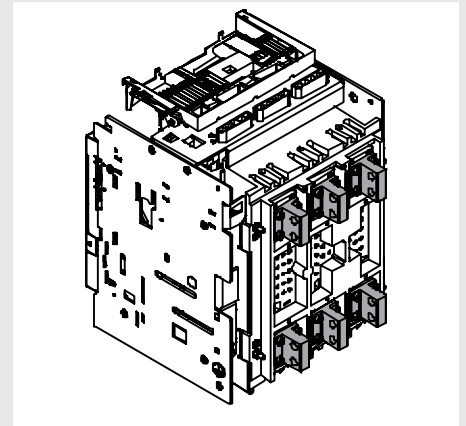


Figure 96 - W - VR - Vertical rear IEC

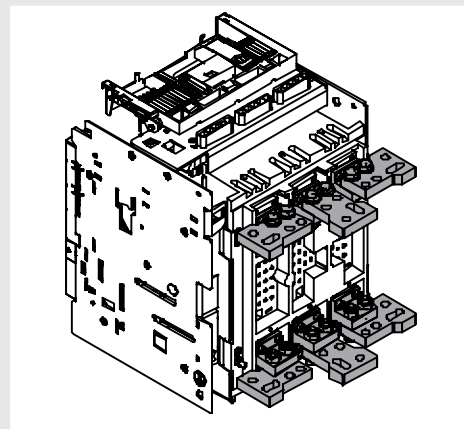


Figure 97 - W - SHR - Spread horizontal rear IEC

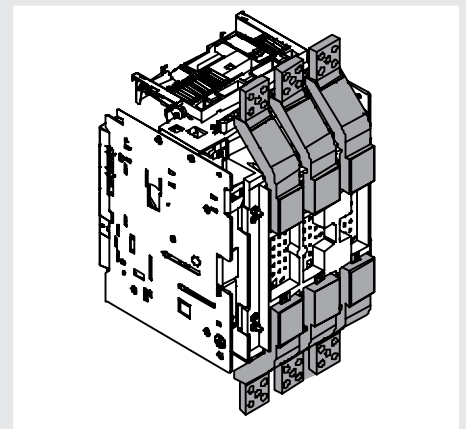


Figure 98 - W - EF - Extended front IEC

Continued on the next page

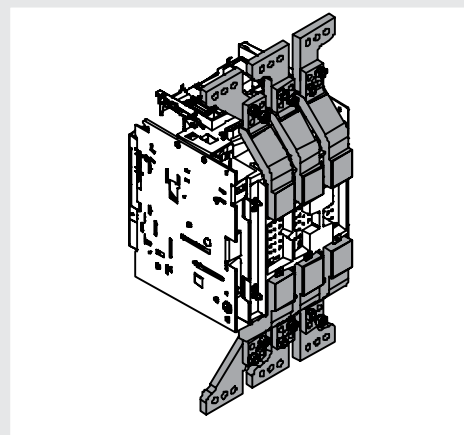


Figure 99 - W - ES - Spread front IEC

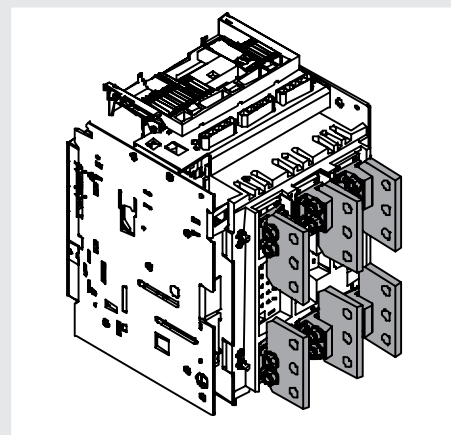


Figure 100 - F - FC CuAl - Terminals for IEC cables

Change of position of the vertical/horizontal terminals

If the circuit-breaker is supplied equipped with terminals of the horizontal/rear type, it is possible at any moment to switch from horizontal to vertical and vice versa. (see Figure 101 and Figure 102). Lock the screws with tightening torque 20 Nm - 177 lb in.

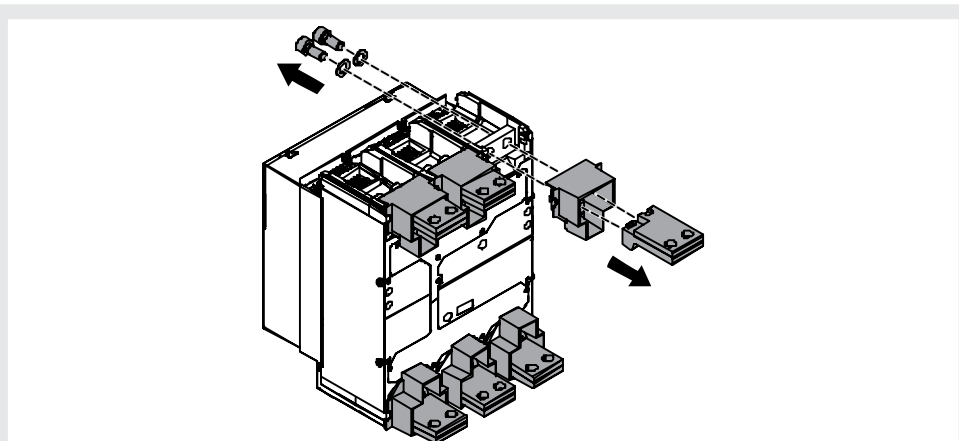


Figure 101

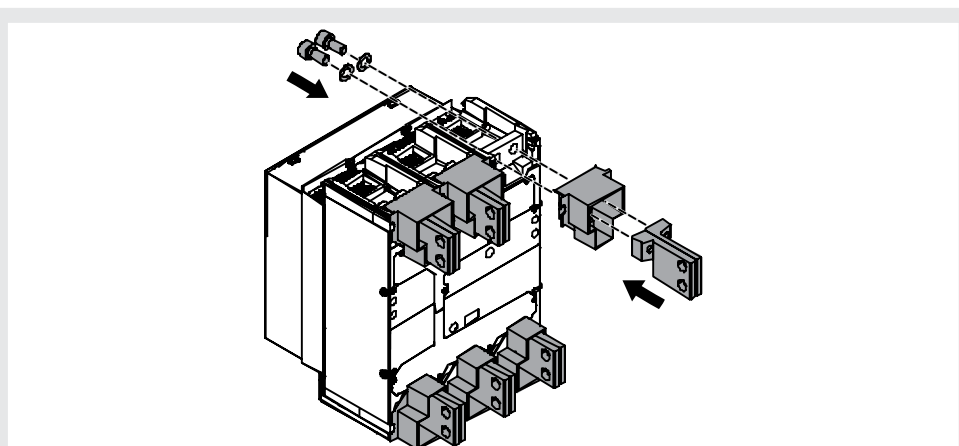


Figure 102

Phase separators

Phase separators are mandatory:

- If, between two phases, the minimum distance between the screws that fix the circuit-breaker terminals to the connection bars is less than 14 mm - 0.55".
- For circuit breakers version IEC >690V.

Details about assembly are available at <https://library.abb.com>, especially in the kit instruction sheet:

- fixed version [1SDH002309A1608](#)
- withdrawable version [1SDH002309A1814](#)

Connection to the power circuit

A circuit-breaker is connected to the power circuit using the connection busbars of the switchboard fixed to the circuit-breaker terminals.

Emax 3 circuit-breakers are tested in accordance with standards IEC-60947-2 and IEC 60947-3.

The switchboard designer is responsible for busbar sizing, which must be validated by application of the tests provided for by the pertinent standards.

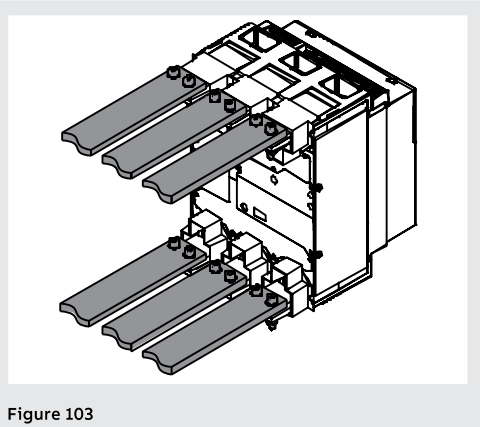


Figure 103

IMPORTANT: it is possible to obtain different capacities for the connections by altering the thickness and number of busbars in parallel.

The following tables provide some examples of the quantity and the sizes of the connections that can be used for each type of circuit-breaker:

circuit-breaker IEC 60947	Iu (A)	Dimension of busbars (mm)	
		Horizontal terminals	Vertical terminals
E1.3	630	2x40x5	2x40x5
E1.3	800	2x50x5	2x50x5
E1.3	1000	2x50x10	2x50x8
E1.3	1250	2x50x10	2x50x8
E1.3	1600	3x50x8	2x50x10

IMPORTANT: Before proceeding with the connection between terminals and connection busbars:

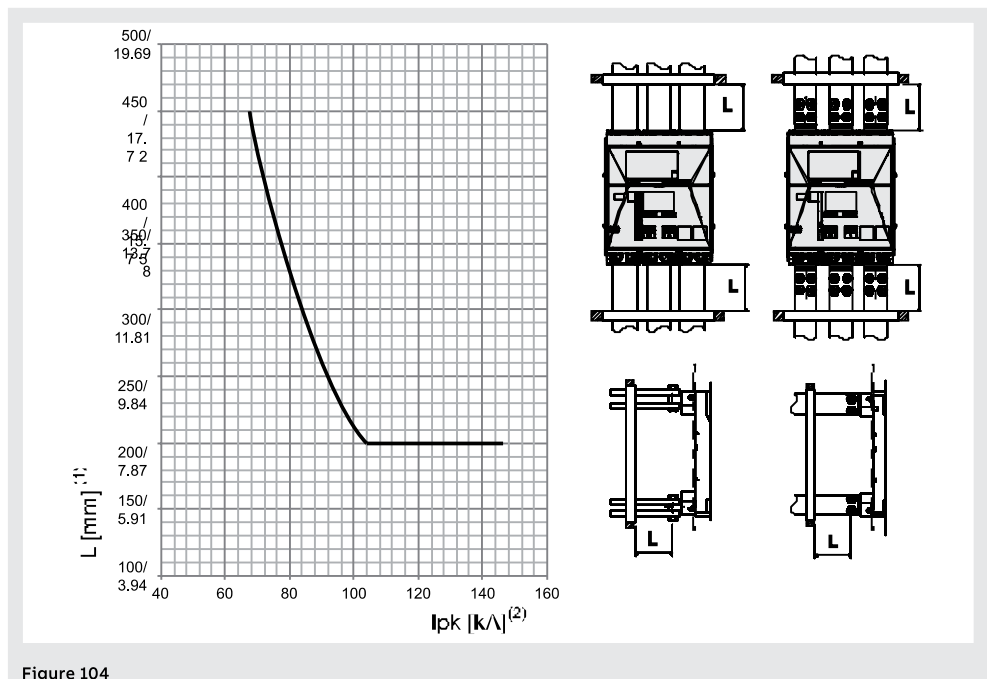
- make sure that the contact surfaces of the busbars are free of burrs, dents, traces of rusting, dust or traces of grease.
- make sure, if aluminium busbars are used, than they are tin plated in the contact areas.
- make sure that the busbars do not exert forces in any direction on the terminal.
- for tightening use M10 screws with resistance class 8.8 equipped with spring washers and lock them with a torque of 45 Nm - 400 lb in. Use M12 strength grade 8.8 screws or threaded bars equipped with spring washers for the ES terminals and tighten them to 70 N-m - 619.5 lb in.torque.

Overall dimensions Information on the overall dimensions is available on the website <https://library.abb.com>

The following drawings are also available in .dxf format:

- [1SDH002309A1101](#) - E1.3 III-IV Fixed F EF IEC
- [1SDH002309A1102](#) - E1.3 III-IV Fixed FC IEC
- [1SDH002309A1103](#) - E1.3 III-IV Withdrawable EF IEC
- [1SDH002309A1104](#) - E1.3 III-IV Withdrawable ES IEC
- [1SDH002309A1105](#) - E1.3 III-IV Withdrawable SHR IEC
- [1SDH002309A1106](#) - E1.3 III-IV Withdrawable FC IEC
- [1SDH002309A1107](#) - E1.3 III-IV Fixed HR-VR Orientabili IEC
- [1SDH002309A1108](#) - E1.3 III-IV Fixed ES IEC
- [1SDH002309A1109](#) - E1.3 III-IV Withdrawable HR-VR IEC
- [1SDH002309A1120](#) - E1.3 Fixed / Withdrawable - Flange IEC
- [1SDH002309A1121](#) - E1.3 Fixing to floor IEC

Positioning anchor plates The diagram below indicates the distance at which the first anchor plate is positioned, depending on the peak current:



(1): distance of the first anchor plate from the circuit-breaker terminals

(2): peak current

Grounding The fixed part of withdrawable circuit-breakers has a screw for the earth 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 the conductor has been assembled, tighten the screw to 3 N m - 26.5 lb in. torque.

No connection will be required if circuit-breaker frame continuity with switchgear earthing is guaranteed by the metal contact between the circuit-breaker and the metal structure of the switchgear or part of the protection circuit. This condition is valid as long as there are no insulating panels between the circuit-breaker and metal frame of the switchgear.

The fixed circuit-breaker version does not need an earth connection.

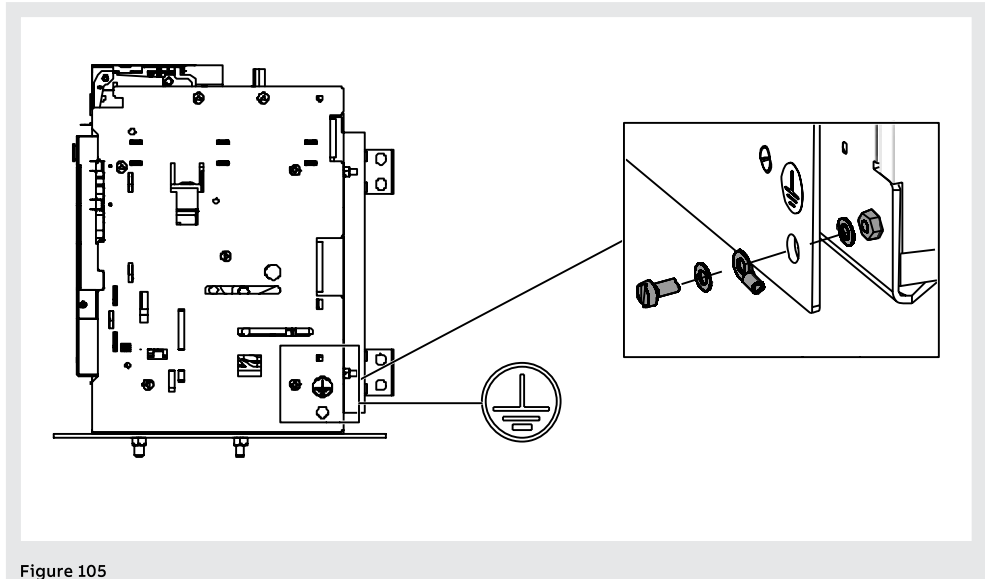


Figure 105

7 - Installation E2.3-E4.3-E6.3

Warnings and precautions before the installation

The following warnings and precautions must be respected before installing the circuit-breaker in the switchgear



DANGER! Dangerous voltage ACCIDENTAL CONTACT WITH LIVE POINTS CAN CAUSE SHOCK, BURNS AND RESULT IN DEATH.

- Disconnect the power from the circuit-breaker (power circuit and auxiliary circuits)
- Make sure the circuit-breaker is disconnected from all sources of energy
- Switch the circuit-breaker to the open position with springs discharged



WARNING! the qualified personnel tasked with handling and lifting work must use suitable safety equipment.

Mounting of the fixed circuit-breaker

Fix the circuit-breaker to a horizontal surface using 4 x M10 screws. Lock the screws with tightening torque 40 Nm - 354 lb in (see Figure 106).

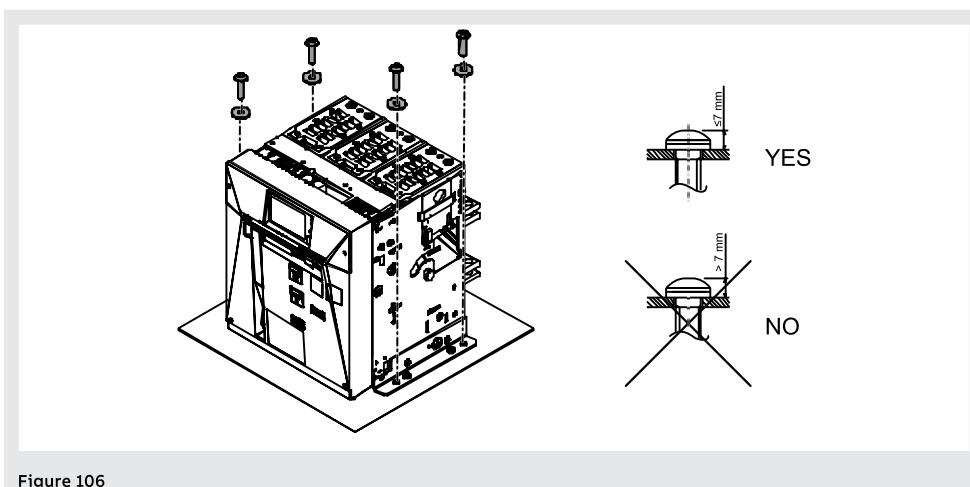


Figure 106



WARNING! Incorrect assembly. Risk of serious injury to persons and damage to equipment. Emax E2.3-E4.3-E6.3 circuit breakers can only be installed in vertical position

Mounting anti-insertion locks

Before installing the fixed part, it is necessary to fit the lock that prevents the insertion of circuit-breakers with different electrical characteristics from the fixed part. See Figure 107.

The anti-racking-in locks enable the movable part of the circuit-breaker to be only racked into the corresponding fixed part.

They are provided for all withdrawable circuit-breakers and are divided into two types:

- according to configuration, factory installed on both the fixed and movable parts (A)
- according to rating, factory installed on the movable part and supplied in the packaging for the fixed part (B)



WARNING! Incorrect assembly. Risk of serious injury to persons and damage to equipment. It is forbidden to change the position of the configuration blocks

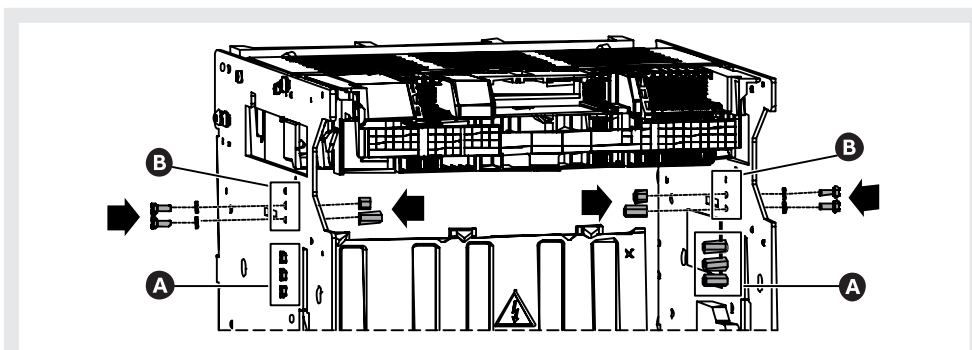


Figure 107

Information on the assembly is available on the website <https://library.abb.com> in particular in the kit sheet [1SDH002310A1701](https://library.abb.com).

Mounting the fixed part of the withdrawable circuit-breaker

Fasten the fixed part to a horizontal surface using four M8 x 25 screws for E2.3 and E4.3 fixed parts and six M8 x 25 screws for E6.3 fixed parts. The screws are supplied by ABB. See Figure 108. Tighten the screws with tightening torque = 21 Nm - 186 lb in

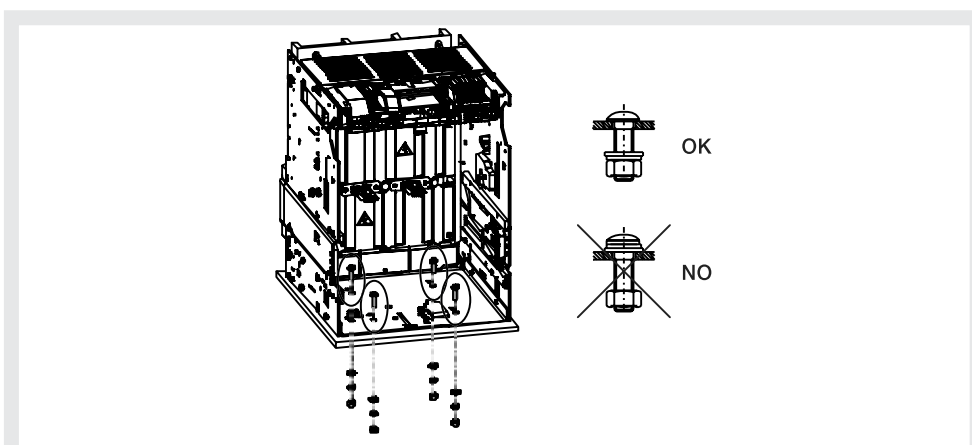


Figure 108



WARNING! Incorrect assembly. Risk of serious injury to persons and damage to equipment. Emax E2.3-E4.3-E6.3 circuit breakers can only be installed in vertical position

Lateral fixing (only for circuit-breakers to "IEC 60068-2-6 Test Fc" standards)

Further details about lateral fixing of fixed parts are available at <https://library.abb.com> especially in the kit sheet [1SDH002310A1821](https://library.abb.com).

Types of terminal SACE Emax 3 circuit-breakers can be equipped with different combinations of terminals for the upper and lower part. The following are the different types of terminal:

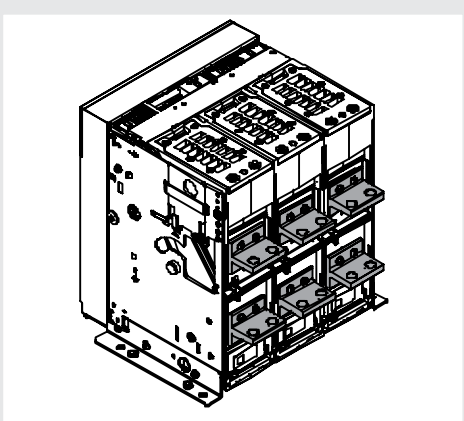


Figure 109 HR - Horizontal rear IEC

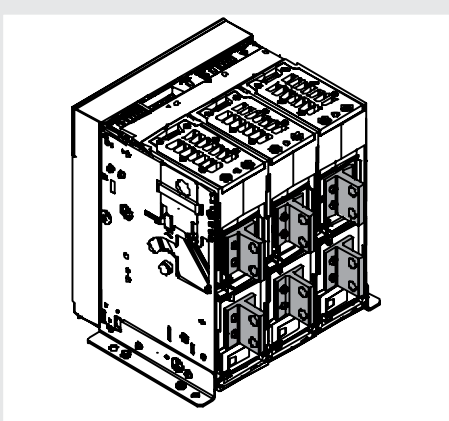


Figure 110 VR - Vertical rear IEC

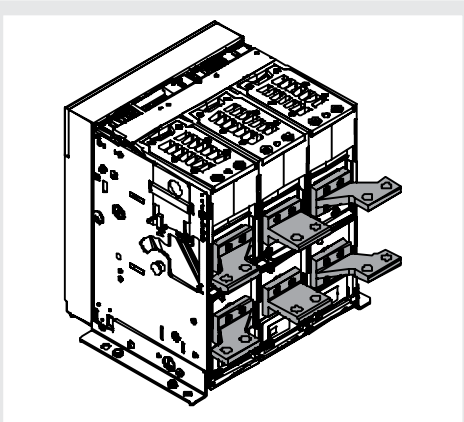


Figure 111 SHR - Horizontal spread rear IEC

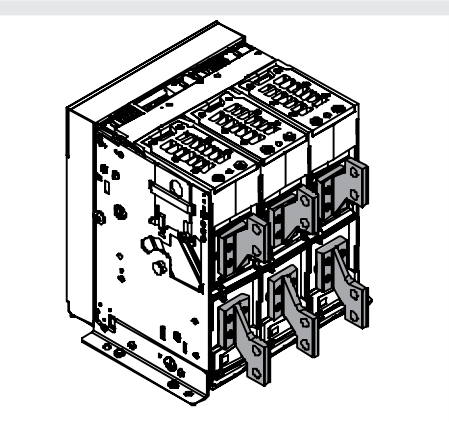


Figure 112 SVR - Vertical spread rear IEC

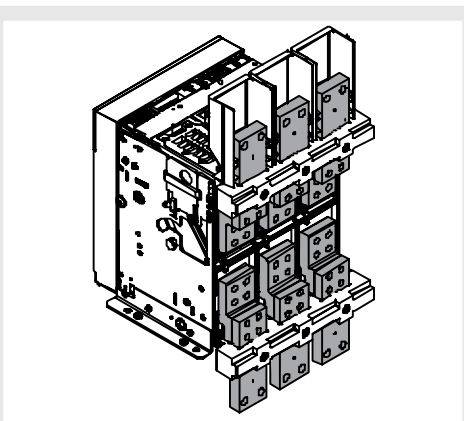


Figure 113 F - Frontal

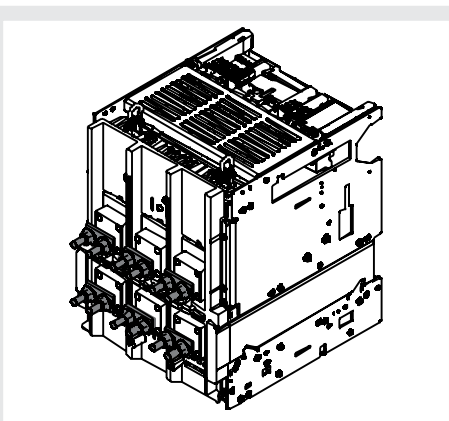


Figure 114 FL - Flat IEC

Terminal compatibility The table of terminals available for each circuit-breaker is given below.

				F	HR/VR	SHR	SVR	FL
E2.3	IEC	<=690 V	F-W	X	X	X	X	X ^(*)
E4.3	IEC	<=690 V		X	X	-	-	X ^(*)
E6.3	IEC	<=690 V		X	X	-	-	X ^(*)

^(*) For withdrawable version only (W).

Change of position of the vertical/horizontal terminals

If the circuit-breaker is equipped with horizontal/vertical rear terminals, switching from horizontal to vertical and vice versa is possible at any time. (see Figure 115 and Figure 116). Lock the screws with the following tightening torques:

- E2.3 - M6 screws - Tightening torque 8.6 Nm - 70.8 lb.in
- E4.3 and E6.2 - M8 screws - Tightening torque 20 Nm - 177 lb.in

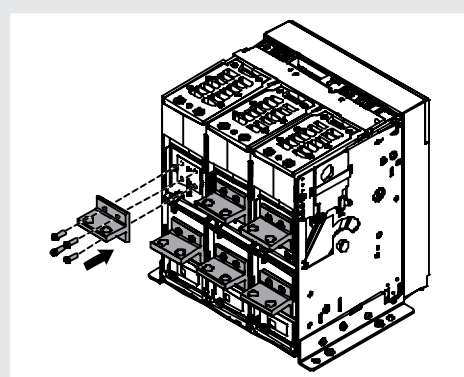


Figure 115

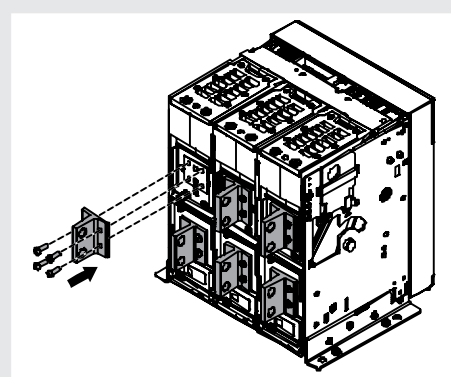


Figure 116

Clearances

Information about clearances is available at <https://library.abb.com>

The following layout is also available [1SDH002310A1233](#) - Cubicle E1.3-E2.3-E4.3-E6.3

Phase separators

Phase separators are mandatory:

- If the minimum distance between the fixing screws of the switch terminals and the connection bars between two phases is less than 14 mm - 0.55".
- For circuit breakers version IEC >690V.

Information on the assembly is available on the website <https://library.abb.com> in particular in the kit sheet [1SDH002310A1810](#).

Connection to the power circuit

A circuit-breaker is connected to the power circuit using the connection busbars of the switchboard fixed to the circuit-breaker terminals.

Emax 3 circuit-breakers are tested in accordance with standards IEC-60947-2 and IEC 60947-3.

The switchboard designer is responsible for busbar sizing, which must be validated by application of the tests provided for by the pertinent standards.

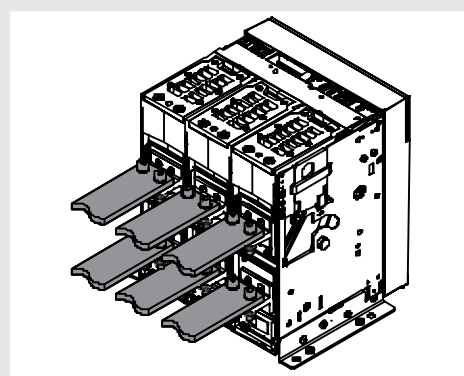


Figure 117

Continued on the next page



IMPORTANT: it is possible to obtain different capacities for the connections by altering the thickness and number of busbars in parallel.

The following tables provide some examples of the quantity and the sizes of the connections that can be used for each type of circuit-breaker:

circuit-breaker IEC 60947	I _n (A)	Horizontal terminals		Vertical terminals	
		Q.ty	Dimension of busbars (mm)	Q.ty	Dimension of busbars (mm)
E2.3	800	1	50x10	1	50x10
	1000	2	50x5	2	50x5
	1250	2	50x10	2	50x10
	1600	2	60x10	1	100x10
	2000	3	60x10	2	80x10
		3	60x10 ⁽¹⁾	2	80x10 ⁽¹⁾
	2500	3	60x10	4	100x5
		3	60x10 ⁽¹⁾	4	100x5 ⁽¹⁾
E4.3	2000	2	80x10	2	80x10
	2500	2	100x10	2	100x10
	3200	3	100x10	3	100x10
	4000	4	100x10	4	100x10
E6.3	4000	4	100x10	4	100x10
	5000	5	100x10	5	100x10
	6300	6	100x10	6	100x10

⁽¹⁾ values for spread terminals



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.
- for fastening purposes use strength class 8.8 M12 screws or threaded rods with spring washers and apply 70 Nm - 620 lb in tightening torque.



NOTE: the information on the performances of the circuit-breakers in switchboards is available on the website

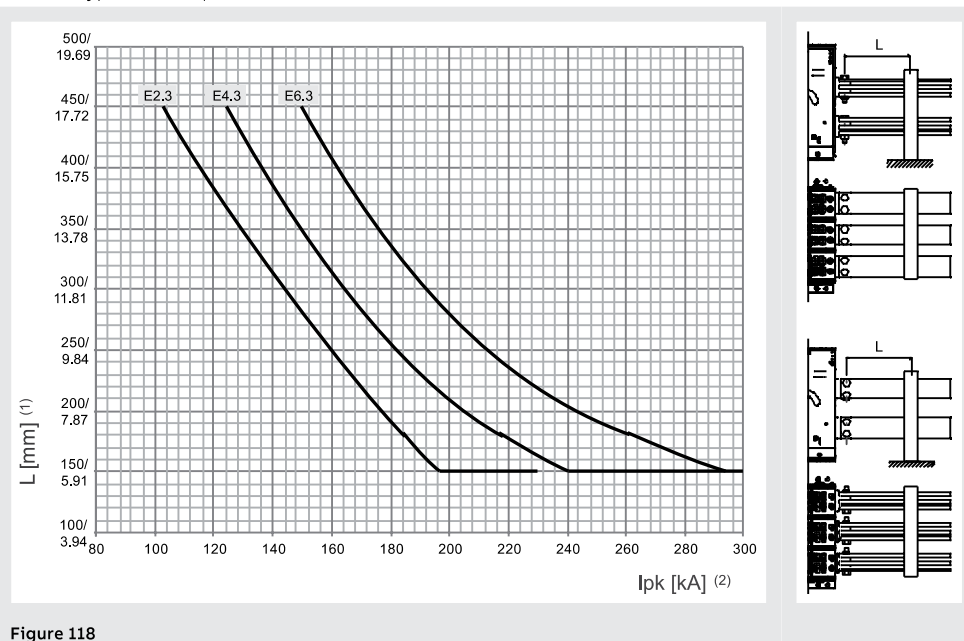
<https://new.abb.com/low-voltage/products/circuit-breakers/emax-3>

Overall dimensions Information on the overall dimensions is available on the website <https://library.abb.com>

The following drawings are also available in .dxf format:

- [1SDH002310A1100](#) - E2.3 III-IV Fixed HR VR IEC
- [1SDH002310A1101](#) - E2.3 III-IV Fixed F
- [1SDH002310A1102](#) - E2.3 III-IV Withdrawable HR-VR IEC
- [1SDH002310A1103](#) - E2.3 III-IV Withdrawable F IEC
- [1SDH002310A1104](#) - E2.3 III-IV Fixed SHR IEC
- [1SDH002310A1105](#) - E2.3 III-IV Withdrawable SHR IEC
- [1SDH002310A1106](#) - E2.3 III-IV Fixed SVR IEC
- [1SDH002310A1107](#) - E2.3 III-IV Withdrawable SVR IEC
- [1SDH002310A1110](#) - E2.3 2000 III-IV Withdrawable FL IEC
- [1SDH002310A1111](#) - E2.3 2500 III-IV Withdrawable FL IEC
- [1SDH002310A1200](#) - E4.3 III-IV Fixed HR VR IEC
- [1SDH002310A1201](#) - E4.3 III-IV Fixed F IEC
- [1SDH002310A1202](#) - E4.3 III-IV Withdrawable HR-VR IEC
- [1SDH002310A1203](#) - E4.3 III-IV Withdrawable F IEC
- [1SDH002310A1204](#) - E4.3/E-E9-E10-E12 III-IV Fixed SHR IEC
- [1SDH002310A1205](#) - E4.3/E-E9-E10-E12 III-IV Withdrawable SHR IEC
- [1SDH002310A1206](#) - E4.3/E-E9-E10-E12 III-IV Fixed SVR IEC
- [1SDH002310A1207](#) - E4.3/E-E9-E10-E12 III-IV Withdrawable SVR IEC
- [1SDH002310A1210](#) - E4.3 3200 III-IV Withdrawable FL IEC
- [1SDH002310A1211](#) - E4.3 4000 III-IV Withdrawable FL IEC
- [1SDH002310A1224](#) - E6.3 III-IV Fixed HR IEC
- [1SDH002310A1225](#) - E6.3 III-IV Fixed VR IEC
- [1SDH002310A1226](#) - E6.3 IV FS Fixed HR-VR IEC
- [1SDH002310A1227](#) - E6.3 III-IV Fixed F IEC
- [1SDH002310A1228](#) - E6.3 III-IV Withdrawable HR IEC
- [1SDH002310A1229](#) - E6.3 III-IV Withdrawable VR IEC
- [1SDH002310A1230](#) - E6.3 IV FS Withdrawable HR-VR IEC
- [1SDH002310A1231](#) - E6.3 III-IV Withdrawable F IEC
- [1SDH002310A1232](#) - E6.3 6300 III-IV Withdrawable FL IEC
- [1SDH002310A1120](#) - E2.3-E4.3-E6.3 Flange Fixed Withdrawable
- [1SDH002310A1121](#) - E2.3-E4.3-E6.3 Fixed internal mounting

Positioning anchor plates The diagram below indicates the distance for positioning the first anchor plate according to the circuit-breaker type and the peak current:



(1): distance of the first anchor plate from the circuit-breaker terminals

(2): peak current

Grounding 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 the conductor has been assembled, tighten the screw to 3 N m - 26.5 lb in. torque.

No connection will be required if circuit-breaker frame continuity with switchgear earthing is guaranteed by the metal contact between the circuit-breaker and the metal structure of the switchgear or part of the protection circuit. This condition is valid as long as there are no insulating panels between the circuit-breaker and metal frame of the switchgear.

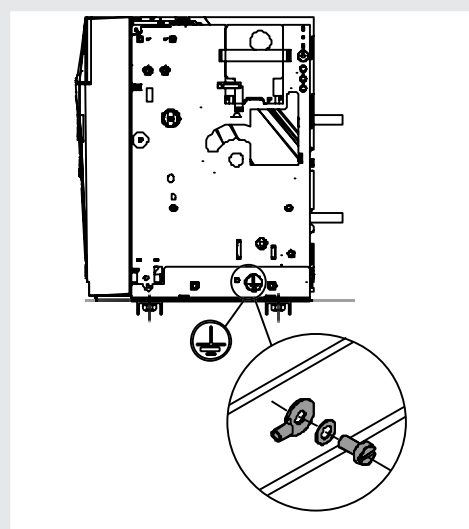


Figure 119

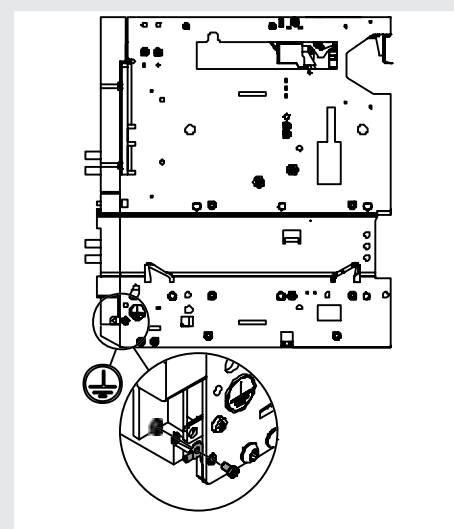


Figure 120

8 - Technical characteristics

Protection degree	SACE Emax 3 circuit-breakers guarantee the following protection ratings: • 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	Electric switchboard design considers the powers dissipated by the switchgears/controlgears and the live parts installed so as to guarantee switchboard performance in terms of interrupted rated power. Dissipated powers are calculated according to the standard IEC 60947. The values indicated in the table refer to the total power for each three-phase circuit-breaker with balanced loads with a current flow equal to the rated uninterrupted current I_u. These power dissipations are measured according to the standard IEC 60947. The values indicated in the table refer to the total power of the circuit-breakers in three-pole and four-pole versions with balanced loads and a current flow equal to the rated uninterrupted current I_u at 50/60 Hz.
-------------------------	---

I_u	Dissipated power [W]							
	E1.3 B/C/N		E2.3 B/N/S/H		E4.3 N/S/H/V		E6.3 H/V/X	
	F	W	F	W	F	W	F	W
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	1550

^(*) with fixed part E6.3H 4000-5000A, dissipated power is 950W

F = Fixed

W = Withdrawable

Overview of the protection release

1 - General characteristics

Warnings No changes shall be made to the equipment without the manufacturer's permission as this may void the user's authority to operate the equipment. This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This equipment complies with ICSED Canada radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Ekip Aware: versions Ekip Aware is available in three versions which differ, depending on the standard issue of protections and functions:

- LI
- LSI
- LSIG

The protections and functions of each Ekip Aware version can be expanded thanks to a broad range of optional packages.

Main functions Ekip Aware provides the following functions:

1. *Measurement*: measurement of different quantities among which currents (always available), voltages, power, energy (Ekip Aware with dedicated packages)
2. *Protection*: depending on the measurements made and the parameters configured by the user, the Trip unit checks for the presence of alarms and commands circuit-breaker opening if necessary
3. *Signalling*: management of contacts and communication networks to optimize plant efficiency, communication among different CB and other functions

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

SACE Emax 3 can be provided with mechanical, electronic and testing accessories, and is supported by different types of software and applications enabling the functions of the Trip unit and circuit-breaker to be expanded.

Presentation

Figure 121

Ekip Aware has a touchscreen display (1) for accessing the configuration menus and checking the main parameters, measurements and information (page 58).

The parameters and information about Ekip Aware can be accessed in different ways; one of these is by using a USB-C Frontal (2) port which enables temporary power supply and communication between the Trip unit and a PC.

For a complete overview of the access options, consult chapter Ekip Aware - Connectivity.

The rated current I_n setting can be checked from the front (page 278).

All the external connections, including the supply and communication modules, the external sensors and mechanical accessories, are available in the upper terminal box (3) (page 56 for an overview of the electronic accessories).

2 - Overview of protections and functions.

Protections and functions for Emax3.

The protections and functions developed for Emax3 are divided into three groups:

- standard protections and functions: these are those available by default in the different versions of Ekip Aware (consult Ekip Aware - Standard protections chapter).
- can only be ordered factory-configured: functions that can only be installed at the time Emax3 is purchased.
- digital updates: optional protections and functions which can also be purchased and installed after Emax3 has been purchased.

Can only be ordered factory-configured

Protection/Function	Description	Configuration notes
CB Internal Temperature Control (CB T)	Temperature protection	Factory-configurable only at the time of purchase
Predictive Maintenance on-premise	CB health status calculation function	Factory-configurable only at the time of purchase
Class 0,5 Power and Energy metering	Class 0.5 measurements, compliant with Standard IEC 61557-12	Factory-configurable only at the time of purchase
Class 1 Power and Energy metering	Class 1 measurements, compliant with Standard IEC 61557-12	Factory-configurable only at the time of purchase
Non Defeatable I Protection	Function that prevents deactivation of protection I	Factory-configurable only at the time of purchase

Digital Upgrade

Protection/Function	Description	Configuration notes
S – Time-Delayed Overcurrent Protection	S Protection	Can be ordered for Ekip Aware LI.
G – Earth Protections	Earth fault protections: G, Gext, MDGF	Can be ordered for Ekip Aware LI and LSI.
Current Protections	Current Protections: IU, S2 Load control alarm: LC1 / LC2 Current warning: Iw1 / Iw2	Needs S protection
Voltage Protections	Voltage Protections: OV, PS, UV, VU, S(V)	Requires digital update of Measuring functionality (Measuring)
Advanced Voltage Protections	Voltage Protections: OV2, UV2, RV, S2(V)	Requires digital update of Measuring functionality (Measuring) and Voltage protections
Power Protections	Power Protections: OP, OQ, RP, RQ, UP, cosfi	Requires digital update of Measuring functionality (Measuring)
Directional Current Protection	Current protection D	Requires digital update of Measuring functionality (Measuring)
Frequency Protections	Frequency Protections: OF, OF2, UF, UF2, ROCOF	Requires digital update of Measuring functionality (Measuring)

Continued on the next page

Protection/Function	Description	Configuration notes
Dual Setting Protections	Double configuration of all protections present	-
Triple Setting Protections	Triple configuration of all protections present	-
RC protection	Residual current/differential current protection	-
L OFF Protection	Function that enables protection L to deactivate	-
Advanced MDGF	MDGF protection for two or more protection releases connected to the same Link network	Needs the Supply Evo Modbus TCP module and the G, Gext and MDGF protections
Measuring	Voltage measurement (phase and phase-to-phase), phase sequence, frequency, power (active, reactive and apparent), cosφ, peak factor, energy (active, reactive and apparent)	-
Datalogger Pro	Data recording function in advanced version	-
Network Analyzer	Advanced long-term current and voltage measurement	Requires digital update of Measuring functionality (Measuring)
Custom Logics	Operating logic management	-
Power Controller	Function for managing loads depending on power consumption	Requires digital update of Measuring functionality (Measuring)
Adaptive Load Shedding	Function for managing loads from renewable energy sources	-
Flexible Digital Rating Plug	Function that enables Digital Rating Plug value to be changed	-

3 - Accessories

Internal and external accessories

The functions of Ekip Aware can be expanded by further internal and external accessories, which differ as to function and assembly position.

Internal modules:

Name	Function	Page
Ekip Busbars Supply	Power supply by installation voltages	279
Ekip Signalling 4K ⁽¹⁾⁽³⁾	Programmable digital inputs/outputs	280
M-Sense Enabler ⁽¹⁾	Monitoring of spring charging motor	283

External modules for assembly on upper terminal box:

Name	Description	Page
Ekip Supply Lite	Power supply of protection release and terminal box modules	286
Ekip Supply Evo Modbus TCP ⁽²⁾⁽⁴⁾	Power supply of protection release and terminal box modules, with support integrated with Modbus TCP (default) and Link protocols and advanced functions (optional).	287
Ekip Signalling 2K	Programmable digital inputs/outputs	311
Ekip RELT		314
Ekip Temperature 4T	Measurement from current loop and temperature sensors (PT100 o PT1000)	324
Ekip Synchrocheck	Measurement of an external voltage and management of synchronism between two supply sources	318
Ekip Arc-Flash 6F	Electric arc protection	327
Ekip Com moduls ⁽²⁾⁽⁴⁾	Communication between protection release and external buses (various protocols)	295
		298
		301
		304
		307

Other external modules and accessories:

Name	Description	Page
Ekip Signalling 10K Link	Programmable digital inputs/outputs	331
S.G.R. Toroid	Sensor for protection from earth fault currents	332
Rc Toroid	Sensor for protection from residual currents	332
External neutral	Sensor for protecting the external neutral line with 3P circuit-breaker	333
Sensor MDGF	Sensor for protection from earth fault currents	332
T-Sense	Modules with Wireless communication for temperature and humidity measuring	334

⁽¹⁾ Configurable with circuit-breakers E2.3, E4.3 and E6.3

⁽²⁾ Always supplied with contacts Ekip AUP and Ekip RTC

⁽³⁾ Needs one of the supply modules to be present (Lite, Evo Modbus TCP or Busbar)

⁽⁴⁾ Advanced functions available in the presence of Ekip Supply Evo Modbus TCP and certain Com modules; compatibility and details described in the chapters of each module.

4 - Operating features

Introduction Ekip Aware has been developed and certified to function in specific environmental, electrical and mechanical conditions; The following sections describe the electrical and power supply characteristics that enable Trip unit and the relative electronic accessories to operate correctly.

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

Parameter	Rated operating range
Primary current	$0,004 \div 16 I_n^{(1)}$
Primary voltage	$5 \div 690 \text{ V AC}^{(2)}$
Rated frequency	45 ... 55 Hz (with $f_n = 50 \text{ Hz}$) / 54 ... 66 Hz (with $f_n = 60 \text{ Hz}$)
Peak factor	Complying with standard IEC 60947-2

⁽¹⁾ range with reference to each phase; I_n and nominal size defined by the value set on Digital Rating Plug

⁽²⁾ for Ekip Aware maximum rated phase-to-phase voltage connected directly to the protection release, also by sockets inside the CB; use of external transformers is required for higher voltages

Self-supply The internal current sensors are able to energize Ekip Aware directly; in the presence of Ekip Busbars Supply, the protection release can be supplied by the installation voltages.

Parameter	Operating limits
Minimum three-phase turn-on current	> 30 A (E1.3-E2-3 with Digital Rating Plug < 400 A)
	> 80 A (E1.3-E2.3-E4.3 with Digital Rating Plug $\geq 400 \text{ A}$)
	> 160 A (E6.3)
Minimum three-phase turn-on voltage	> 80 V

Self-supply by Ekip Busbars Supply also ensures ignition and operation of Ekip Signalling 4K, if installed.

Auxiliary power supply Ekip Aware can be connected to an external auxiliary supply source, which is useful when certain functions such as communication via Local Bus, recording manual operations, certain measurements and the datalogger must if available.

The auxiliary supply can be provided by modules from the *Ekip Supply* range.

Ekip Aware - Interface and menus

1 - Presentation of interface

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

Components

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

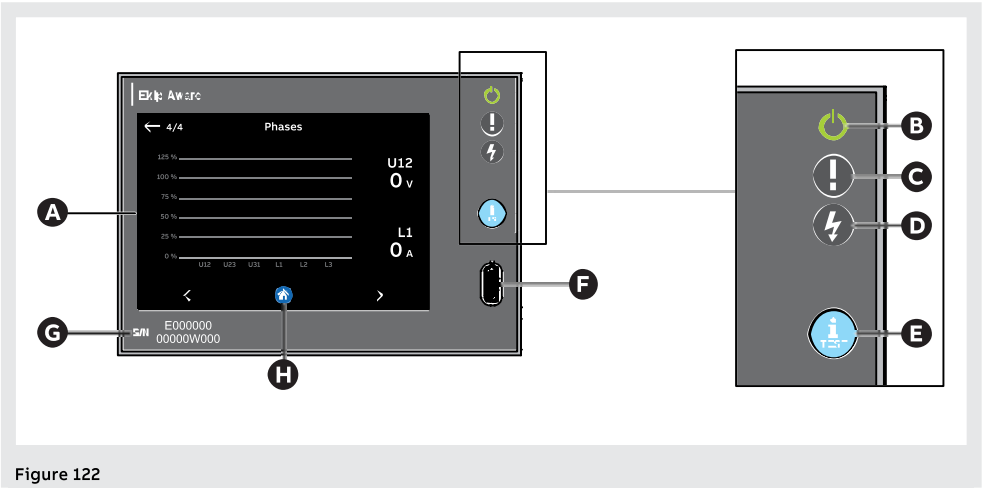
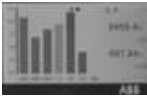


Figure 122

Pos.	Description
A	Display touchscreen
B	LED Power
C	LED Warning
D	LED Alarm
E	iTEST push-button
F	Service connector
G	Serial Number
H	Home Page

Display

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



LED



LED	Colour	Description
Power 	Green	Indicates the on status of Ekip Aware: • off: no power and unit off • on, steady (<i>Power mode</i>) or flashing (<i>Alive mode</i>): unit on and self-supplied by external <i>Vaux</i> or service connector You can select the <i>Power mode</i> or <i>Alive mode</i> via Ekip Connect: if the <i>Alive mode</i> is selected and external modules are connected, the Power LEDs of Ekip Aware and the modules flash in the synchronized mode
Warnings 	Yellow	Signals that certain alarms are present: • off: no alarm • on and steady: prealarm of an active protection or error of state contacts (CB not defined), error of the configuration parameters of the protection release and all the Warning signals (consult the “Alerts/Alarms” or System Interface page of Ekip Connect for a complete overview); check the diagnosis bar message to find out which of the cases is present
Alarm 	Red	Signals that an alarm is present: • off: no alarm • on and steady: TRIP signal for protection, internal error, trip coil disconnected, failed trip command and other alarm signals (consult the “Alerts/Alarms” or System Interface page of Ekip Connect for a complete overview); check the diagnosis bar message to find out which of the cases is present • fast flash: protection timing activated and/or disconnection of a current sensor

iTest button

The push button enables quick access to certain information pages on the unit.

Press the button and view the following pages:



- Alarm List, if messages are present
- Info, if Client Page option is active
- Protection unit, with information about Ekip Aware
- Circuit-breaker, con information about the CB
- Last opening, with information about the last opening, if available

Consultation is active from pages: HOME, Histograms, Measuring instruments, Measurements, Main measurements.



NOTE: with Ekip Aware off and the internal battery charged, press **iTEST** to temporarily turn on the Power LED and, if a trip has occurred, the Warning LED if L has tripped, the Alarm LED if other protections have tripped.

Service connector

The USB-C service connector enables Ekip Aware to be connected. The connector enables the unit to be temporarily energized, the parameters to be configured prior to commissioning, tests to be performed and the configuration functions to be expanded.



Signalling colours The bar of each signal is represented in scale 0 to 125 % with reference to the rated current and voltage values of the unit and can be of three colors:

- white: no protection in alarm state
- yellow: one of the active protections is in the prealarm state with respect to the set thresholds
- red: one of the active protections is in the alarm state with respect to the set thresholds

i **NOTE:** Histogram Ne is available with 4P or 3P + N configurations; the bars of the voltages are available if Measuring package is present.

These colours are used in the pages of the Measuring section (see page 66).

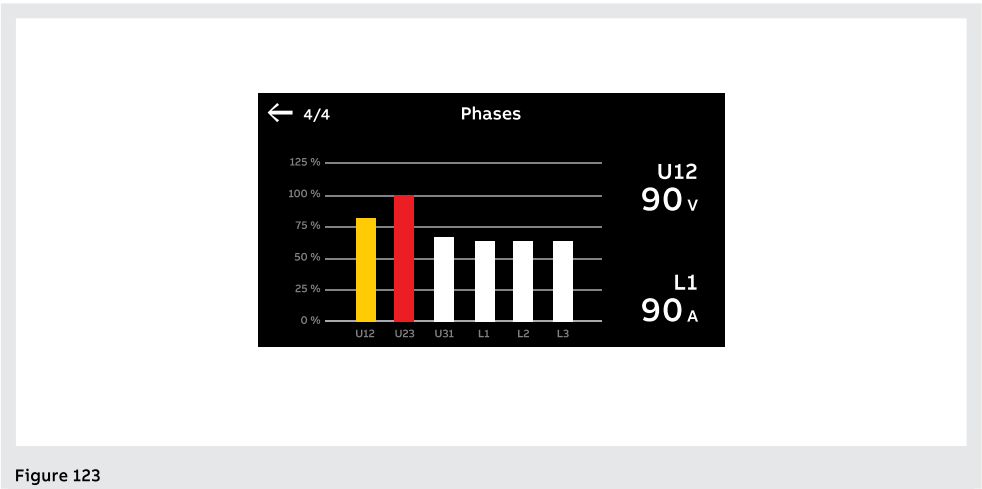


Figure 123

Diagnosis bar and event icons The diagnosis bar displays the faults detected by Ekip Aware by displaying the details of each alarm sequentially.

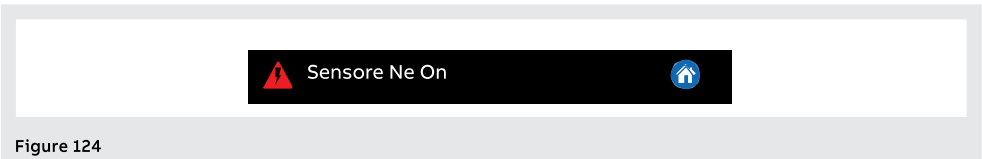


Figure 124

Select the diagnosis bar to access the Alarm List page with a list of all the alarms.



Figure 125

i **NOTE:** The Alarm List can be also be recalled by pressing the **iTEST** button (see page 59).

The type of alarm is indicated by the icon paired to the message:

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

Grid values and state icons

The following information is given at the top of the touchscreen display:

A - nominal values of main quantities:

- In: nominal current
 - F: line frequency
 - Ne: neutral protection threshold (available in the 4P or 3P+N configuration)
- B - indications about the state of certain of the main Ekip Aware functions

The icons on the right-hand side (B) indicate:

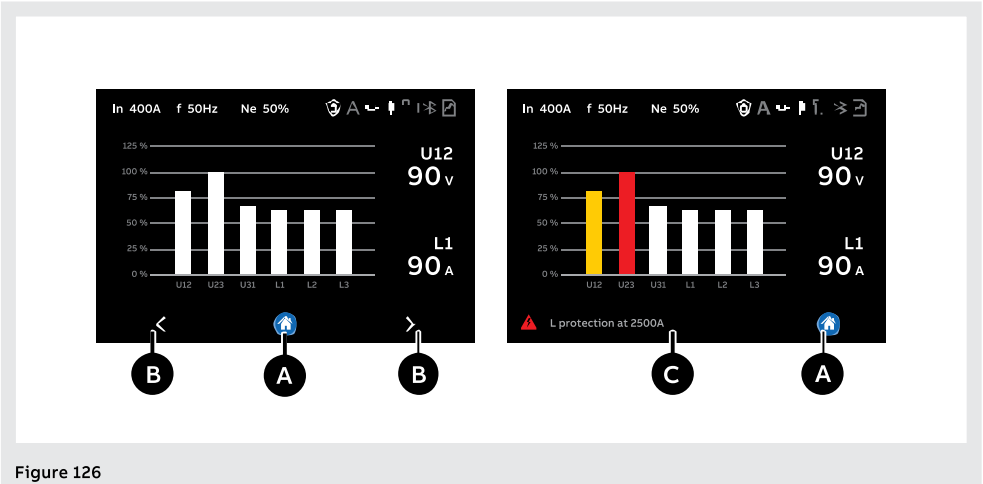
Icon	Description
	• Off: Cybersecurity deactivated • On: Cybersecurity activated • Absent: Cybersecurity not available
	The letter corresponding to the activated configuration appears when Double Set or Triple set packages are present
	Logic selectivity
	External power source present: • Vaux or • service connector
	• Off: remote connection absent • On: remote connection present
	Bluetooth antenna: • No icon: BLE not available in Ekip Aware • Off: BLE deactivated • White: activated but not connected • White with waves: pairing enabled, BLE available for pairing with new devices • Blue: connected to device
	• Off: Datalogger deactivated • On: Datalogger activated

2 - Navigation

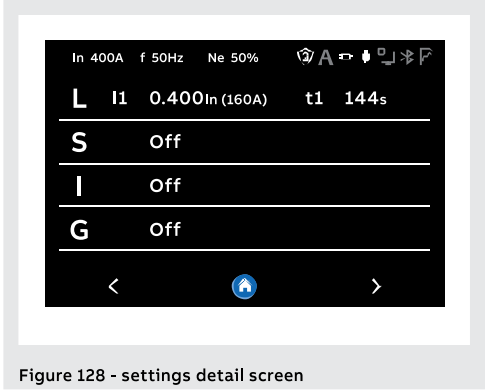
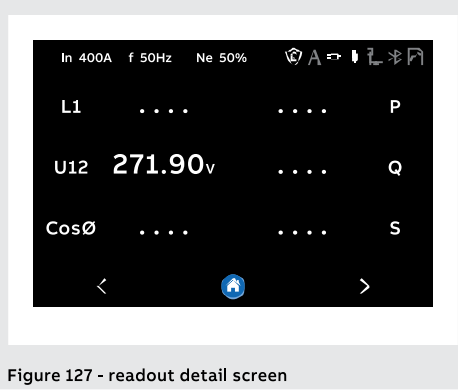
HOME page The Home page is the screen that Ekip Aware displays when booted and to which it returns automatically in the absence of commands transmitted via touchscreen (time setting 2 minutes).
Ekip Aware provided when the HOME page is set to histograms.
The HOME page can be changed as described on page 77.

From the HOME page you can:

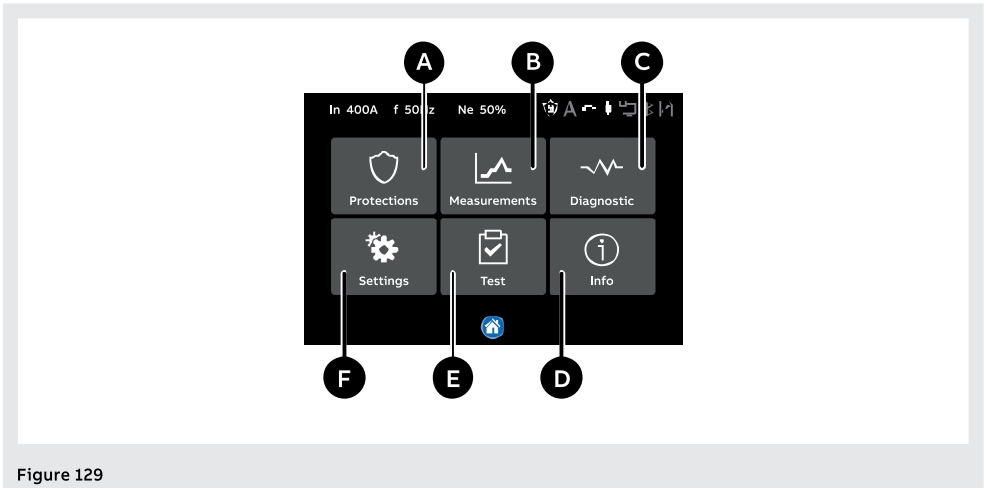
1. access the *Main menu* by selecting the **HOME** button (A);
2. access the *Alarm list* by selecting the diagnosis bar at the bottom, only in the presence of alarms (C) (see page 365);
3. scroll the *Summary pages* of certain measurements by selecting with the arrows (B) (always available in the absence of alarms; available by pressing on the center of the display when alarms are present).



By selecting the arrows at the bottom of the display, you can scroll the screens with the measurements of the main quantities in real time and the settings of protections L, S, I, G (S and G if present):



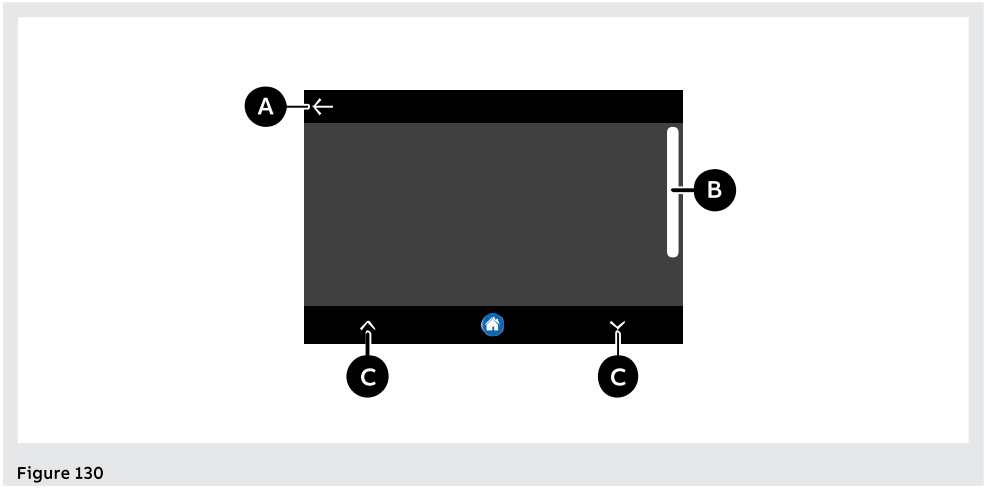
Main Menu All sections of the protection release that can be viewed on the display can be reached via the main Menu screen:



Pos.	Menu	Page
A	Protections	64
B	Measurements	66
C	Diagnostic	68
D	Info	71
E	Test	74
F	Settings	75

i **NOTE:** Select the Home button to go back to the HOME page

General navigation rules Elements enabling navigation are provided on the screens displayed.



Pos.	Menu
A	Command that returns to the previous screen
B	Vertical scrolling position
C	Vertical scrolling command

3 - Protections Menu

Menù Protections: level 1 The content of the Protections menu depends on the Ekip Aware version and optional packages enabled. Example:

- Figure 131: menu with Double set or Triple set disabled or deactivated, level 2 is accessed directly in this case;
- Figure 132: menu with Triple set activated.

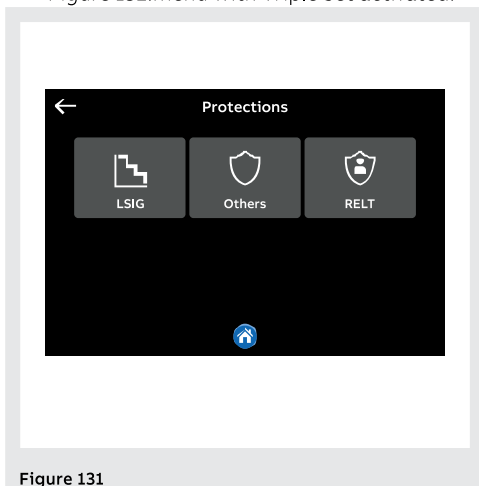


Figure 131

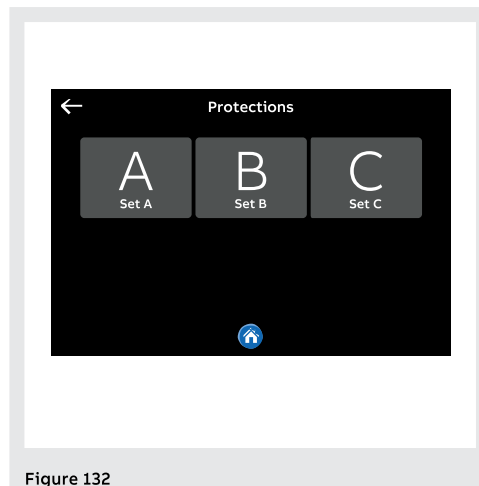


Figure 132

Menù Protections: level 2 The list of standard protections displayed is divided between:

- LSIG: includes the standard protections
- Others: contains certain of the advanced functions.
- RELT: enabling and configuration of RELT protection

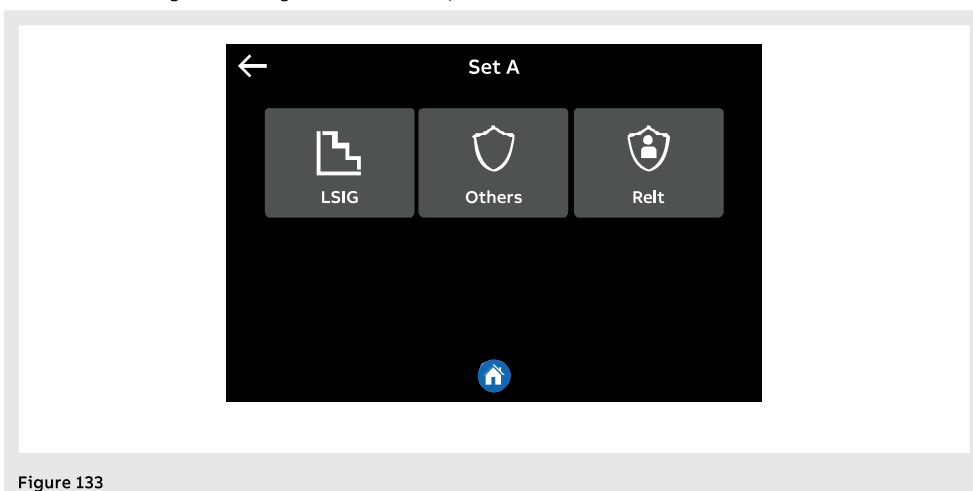


Figure 133

Menù Protections: level 3

Select one of the items in the level 2 menu to access the relevant screen:

- list of available protections/functions if several items are present (figure Figure 134).
- list of parameters, in the case of direct access to the protection/function.

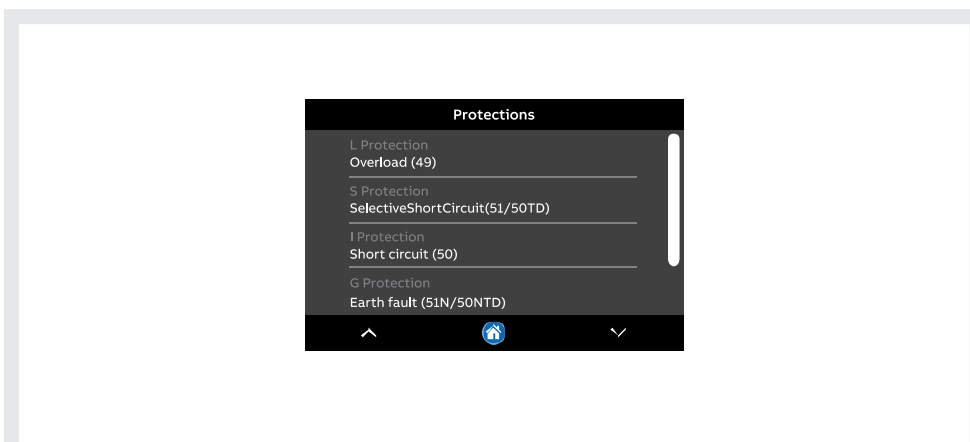


Figure 134

Select one of the items to access the relevant list of parameters.

Menù Protections: level 4

In the screen dedicated to the individual protection/function, you can enable the protection, view and edit certain parameters (paragraph 9 - Changing parameters and commands on page 76 and Ekip Aware - Standard Protections on page 96).

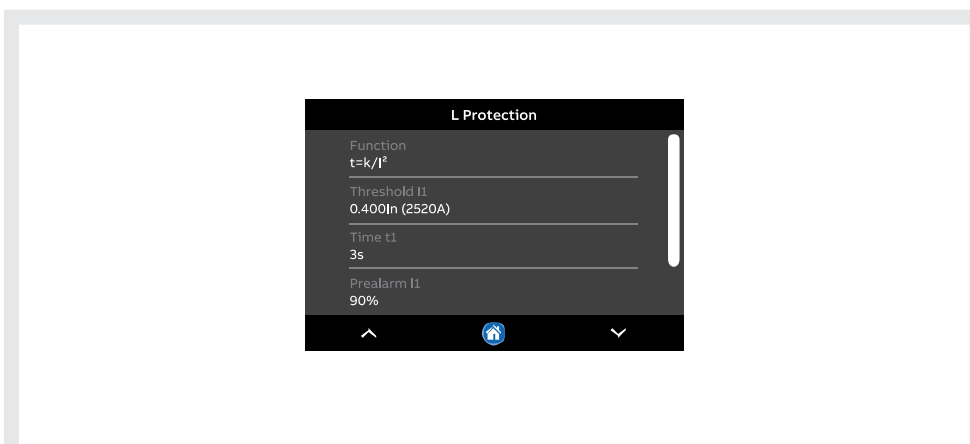


Figure 135

4 - Measurements Menu

Menù Measures: level 1 Select Measurements on the Home page to access the section containing information about the measurements taken by the protection release.
The content of the Measurements menu depends on the Ekip Aware version and optional packages enabled.

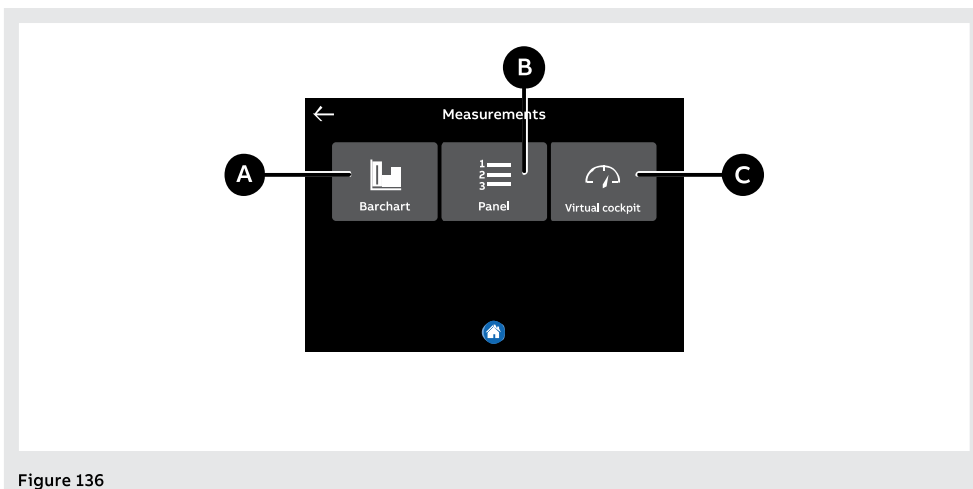


Figure 136

Pos.	Name	Description
A	Barchart	Representation by histograms
B	Panel	Indication of values
C	Virtual cockpit	Representation by virtual cockpit

Menù Measures: Barchart The values of the measured quantities are shown in histograms where the colour code is used to depict the state of the different quantities, see Signalling colours on page 60.

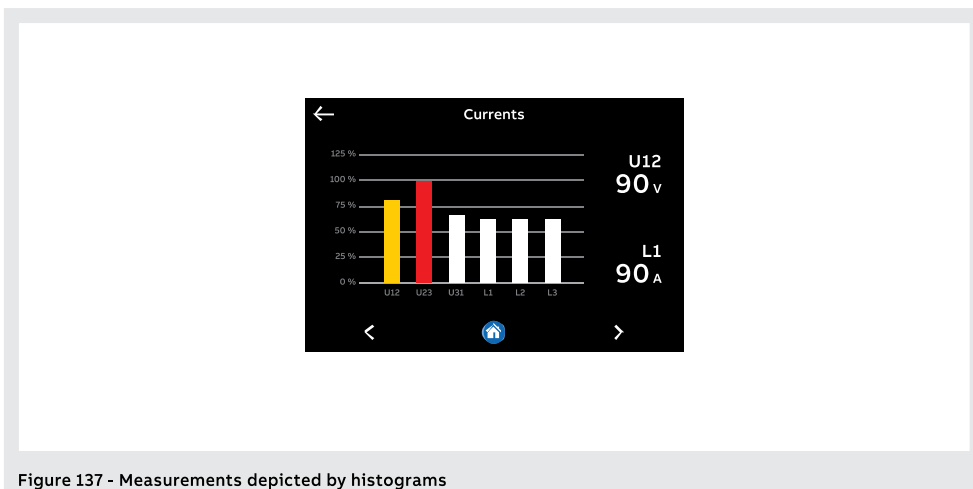


Figure 137 - Measurements depicted by histograms

Menù Measures: Panel Select one of the quantities displayed to view the measurements.

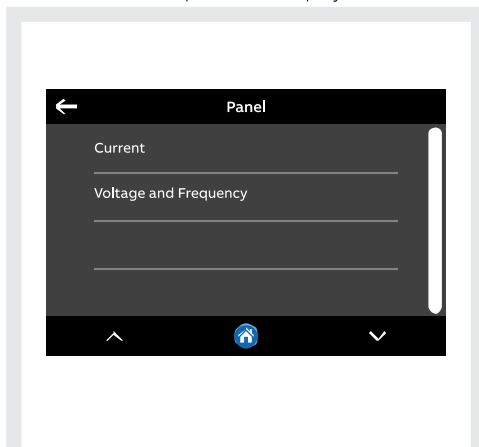


Figure 138

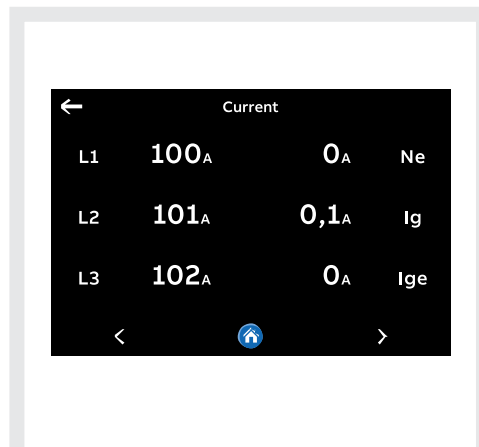


Figure 139 - Values measured in real time

Select the arrows at the bottom of the display to scroll the pages of the different quantities measured by the protection release.

Menù Measures: Virtual cockpit Select one of the quantities displayed to view the measurements.

The values of the measured quantities are depicted by the colour codes described in Signalling colours on page 60.

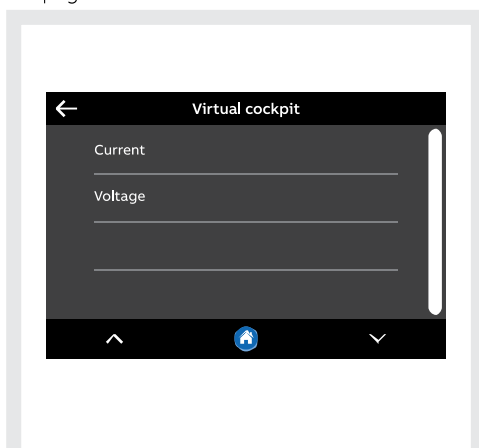


Figure 140

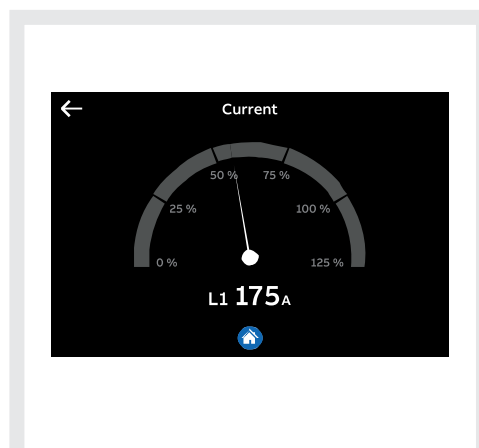


Figure 141

Select the arrows at the bottom of the display to scroll the pages of the different quantities measured by the protection release.

The current phase and voltage phase parameters allow the quantities given for the respective cockpits to be customized by choosing between the maximum value or the values of the individual phases (for Phase-to-Phase Voltmeter).

The parameters are available in the *Settings-Configuration* menu.

The arc illustrated in figure 67 can be:

- all grey, value measured is below the prealarm threshold
- all yellow, value measured has passed the prealarm threshold
- all red, value measured has passed the alarm threshold

5 - Menù Diagnostic

Menù Diagnostic: level 1 The content of the Diagnostic menu depends on the Ekip Aware version and optional packages enabled.

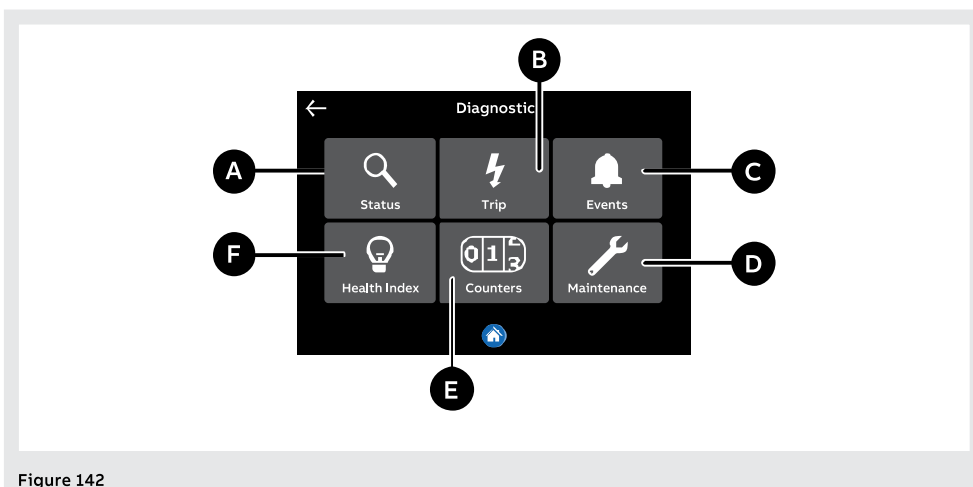


Figure 142

Pos.	Name	Description
A	State	Monitoring of CB state
B	Tripping	Displays the opening log of the CB. The push-button is not visible if the number of openings is zero.
C	Events	List of alarms and signals recorded by trip unit
D	Health Index	Information about the state of health of the CB and Sense accessories
E	Counters	CB operating statistics
F	Maintenance	Report on maintenance operations

Diagnostic menu: Openings The openings page provides the opening log of the CB, with an indication of what caused it to open, the date and time at which opening occurred. This page is only present if an opening event has occurred.

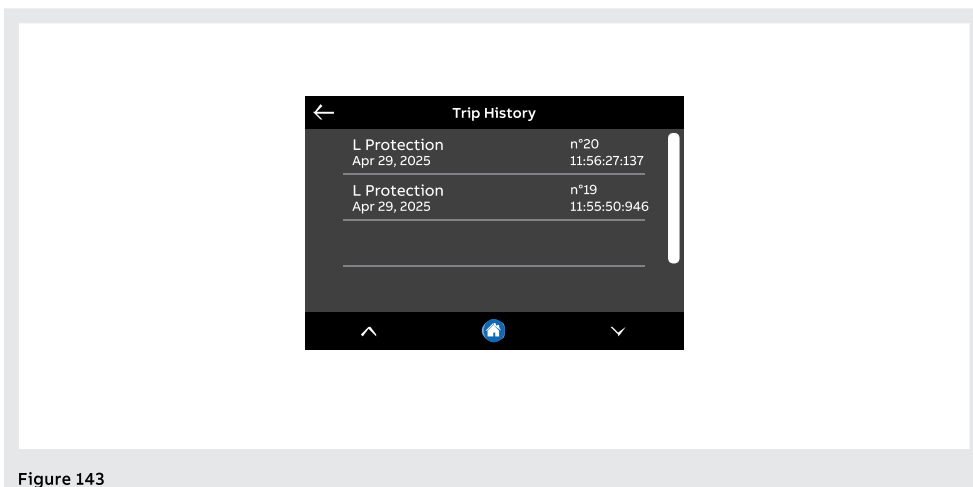


Figure 143



NOTE: after the factory tests, the list of openings is deleted and, upon initial installation, the Aperture Trip page is not visible.

Menù Diagnostic: State The state of the protection release can be checked from the Status page.
Select System Check to begin checking.
In correct operating conditions, the large push-button in the center of the page bears the words “View Status” in green, otherwise it will bear the words “System Check” in yellow if there are alerts, red if there are alarms.
Press the button to consult the details of the parameters checked for status monitoring.

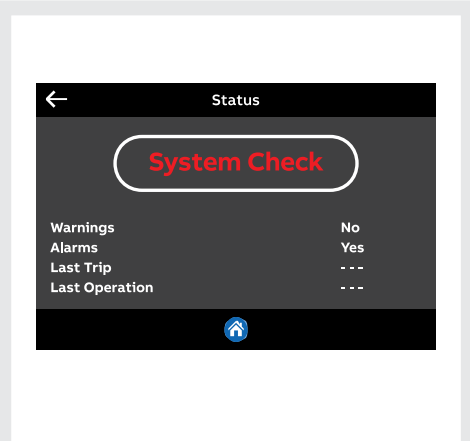


Figure 144

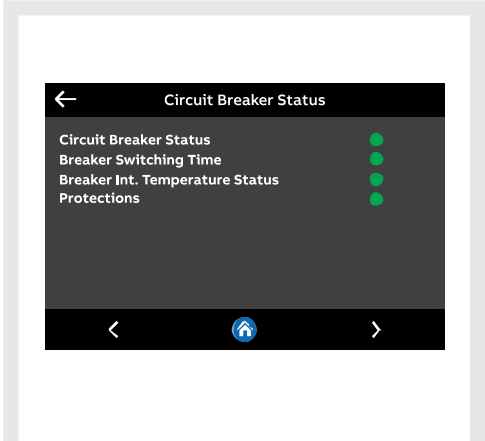


Figure 145

Further details can be obtained by connecting to the protection release from all remote connection systems; More specifically, the state information for Ekip Connect is available in the “Monitoring Status” page.

Menù Diagnostic: Events All the events signalled by the protection release are indicated in the Events page along with the date and time at which the events were generated.
The icons depicting the type of event are described in Diagnosis bar and event icons on page 60.

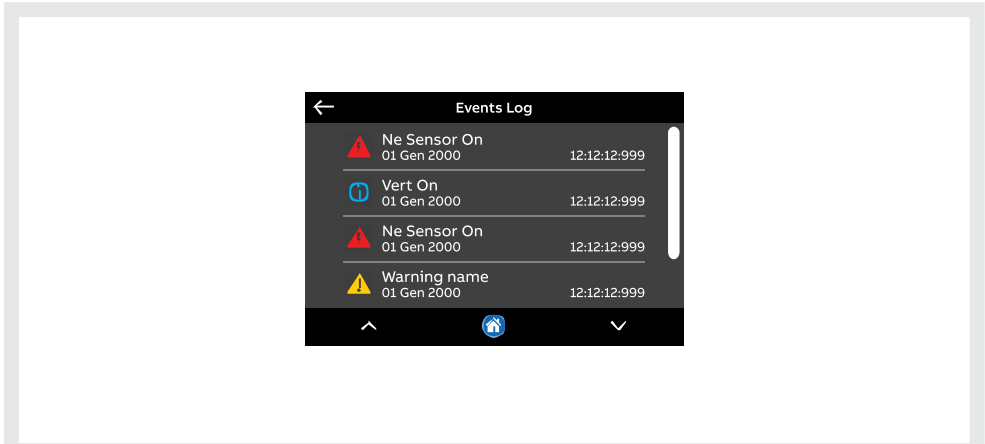


Figure 146

All the events recorded can be viewed by selecting the arrows at the bottom of the display.

Menù Diagnostic: Health Index The Health Index page is available if the CB has been configured with the Predictive Maintenance on Premise package or if Sense type accessories are present.

Inside, there are up to three pages available containing the state of health of the CB (on the Emax 3 page if the Predictive Maintenance on Premise package is present) or the Sense accessories (if present and configured in the Sense Accessories 1 and Sense Accessories 2 pages).

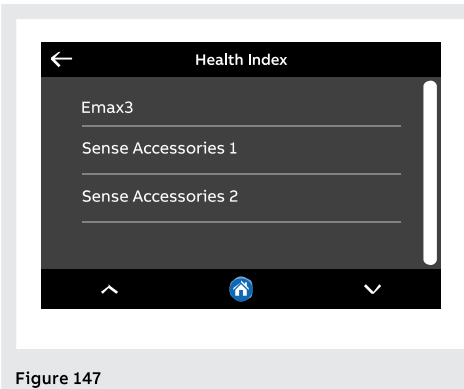


Figure 147

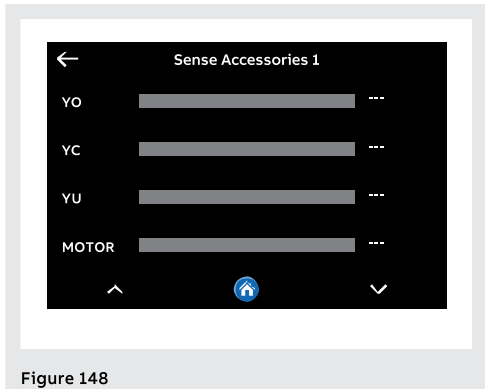


Figure 148

Menù Diagnostic: Counters The Counters menu provides time-related information about the load profiles and statistics of the circuit-breaker, such as contact wear and number of operations.

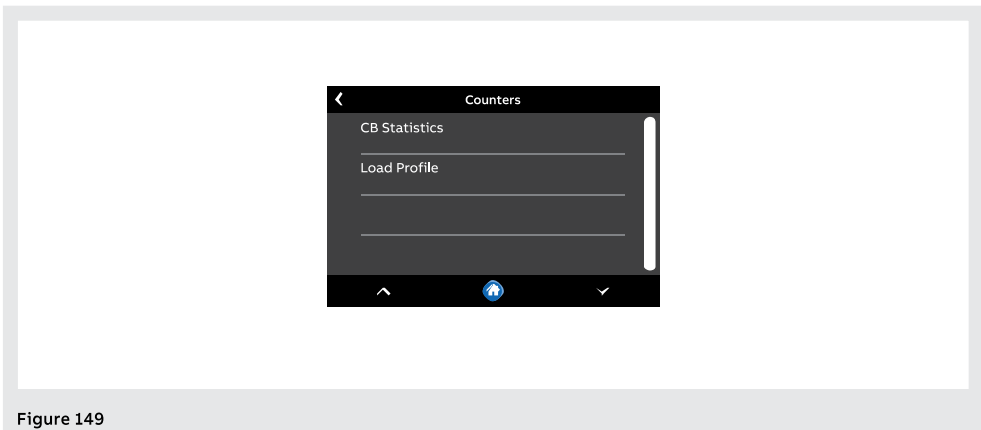


Figure 149

Menù Diagnostic: Maintenance Information about the maintenance operations recorded by the protection release.

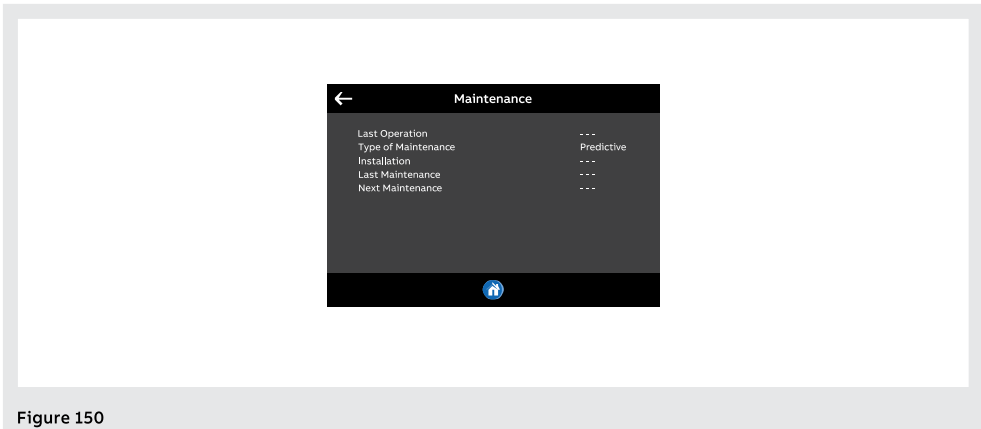


Figure 150

Further parameters are available if the Predictive Maintenance On Premise package is present, see dedicated chapter for details.