New SACE Tmax XT.
XTraordinary completeness of range.

Here are the 4 new SACE Tmax XT frames for you:
- the small XT1 up to 160A;
- the high-performing XT2 up to 160A;
- the reliable XT3 up to 250A;
- the powerful XT4 up to 250A.

Construction characteristics

				XT1				
Size(G2.1)			[A]	160				
Poles			[No.]	3, 4				
Rated service voltage, **Ue**(G2.4)		(AC) 50-60Hz	[V]	690				
		(DC)	[V]	500				
Rated insulation voltage, **Ui**(G2.5)			[V]	800				
Rated impulse withstand voltage, **Uimp**(G2.6)			[kV]	8				
Versions				Fixed, Plug-in(2)				
Breaking capacities according to IEC 60947-2				**B**	**C**	**N**	**S**	**H**
Rated ultimate short-circuit breaking capacity, Icu(G2.7)								
Icu @ 220-230-240V 50-60Hz (AC)			[kA]	25	40	65	85	100
Icu @ 380V 50-60Hz (AC)			[kA]	18	25	36	50	70
Icu @ 415V 50-60Hz (AC)			[kA]	18	25	36	50	70
Icu @ 440V 50-60Hz (AC)			[kA]	15	25	36	50	65
Icu @ 500V 50-60Hz (AC)			[kA]	8	18	30	36	50
Icu @ 525V 50-60Hz (AC)			[kA]	6	8	22	35	35
Icu @ 690V 50-60Hz (AC)			[kA]	3	4	6	8	10
Icu @ 250V (DC) 2 poles in series			[kA]	18	25	36	50	70
Icu @ 500V (DC) 2 poles in series			[kA]	–	–	–	–	–
Icu @ 500V (DC) 3 poles in series(3)			[kA]	18	25	36	50	70
Rated service short-circuit breaking capacity, Ics(G2.8)								
Ics @ 220-230-240V 50-60Hz (AC)			[kA]	100%	100%	75% (50)	75%	75%
Ics @ 380V 50-60Hz (AC)			[kA]	100%	100%	100%	100%	75%
Ics @ 415V 50-60Hz (AC)			[kA]	100%	100%	100%	75%	50% (37.5)
Ics @ 440V 50-60Hz (AC)			[kA]	75%	50%	50%	50%	50%
Ics @ 500V 50-60Hz (AC)			[kA]	100%	50%	50%	50%	50%
Ics @ 525V 50-60Hz (AC)			[kA]	100%	100%	50%	50%	50%
Ics @ 690V 50-60Hz (AC)			[kA]	100%	100%	75%	50%	50%
Ics @ 250V (DC) 2 poles in series			[kA]	100%	100%	100%	100%	75%
Ics @ 500V (DC) 2 poles in series			[kA]	–	–	–	–	–
Ics @ 500V (DC) 3 poles in series(3)			[kA]	100%	100%	100%	100%	75%
Rated short-circuit making capacity, Icm(G2.10)								
Icm @ 220-230-240V 50-60Hz (AC)			[kA]	52.5	84	143	187	220
Icm @ 380V 50-60Hz (AC)			[kA]	36	52.5	75.6	105	154
Icm @ 415V 50-60Hz (AC)			[kA]	36	52.5	75.6	105	154
Icm @ 440V 50-60Hz (AC)			[kA]	30	52.5	75.6	105	143
Icm @ 500V 50-60Hz (AC)			[kA]	13.6	36	63	75,6	105
Icm @ 525V 50-60Hz (AC)			[kA]	9.18	13.6	46.2	73.5	73.5
Icm @ 690V 50-60Hz (AC)			[kA]	4.26	5.88	9.18	13.6	17
Breaking capacities according to NEMA-AB1								
@ 240V 50-60Hz (AC)			[kA]	25	40	65	85	100
@ 480V 50-60Hz (AC)			[kA]	8	18	30	36	65
Utilisation Category (IEC 60947-2)				A				
Reference Standard				IEC 60947-2				
Isolation behaviour				✔				
Mounted on DIN rail				DIN EN 50022				
Mechanical life(G2.14)			[No. Operations]	25000				
			[No. Hourly operations]	240				
Electrical life @ 415 V (AC)(G2.13)			[No. Operations]	8000				
			[No. Hourly operations]	120				
Dimensions - Fixed (Width x Depth x Height)		3 poles	[mm]	76.2 x 70 x 130				
		4 poles	[mm]	101.6 x 70 x 130				
Total opening time								
Circuit-breaker with shunt opening release			[ms]	15				
Circuit-breaker with undervoltage release			[ms]	15				
Trip units for power distribution								
TMD/TMA								
TMD						■		
Ekip LS/I								
Ekip I								
Ekip LSI								
Ekip LSIG								
Ekip E								
Trip units for motor protection								
MF/MA								
Ekip M-I								
Ekip M-LIU								
Ekip M-LRIU								
Trip units for generator protection								
TMG								
Ekip G-LS/I								
Trip units for oversized Neutral Protection								
Ekip N-LS/I								
Interchangeable protection trip units								
Weight Fixed		3/4 poles	[kg]	1.1 / 1.4				
Plug in (EF terminals)		3/4 poles	[kg]	2.21 / 2.82				
Withdrawable (EF terminals)		3/4 poles	[kg]					

(1) 90kA@690V only for XT4 160. Available shortly, please ask ABB SACE
(2) XT1 plug-in In max=125A
(3) XT1 500V DC 4 poles in series
(4) XT4 750V DC please ask ABB SACE for availability

■ Complete circuit-breaker
▲ Loose trip unit

	XT2					XT3		XT4				
	160					250		160 / 250				
	3, 4					3, 4		3, 4				
	690					690		690				
	500					500		500[4]				
	1000					800		1000				
	8					8		8				
	Fixed, Withdrawable, Plug-in					Fixed, Plug-in		Fixed, Withdrawable, Plug-in				
	N	S	H	L	V	N	S	N	S	H	L	V
	65	85	100	150	200	50	85	65	85	100	150	200
	36	50	70	120	150	36	50	36	50	70	120	150
	36	50	70	120	150	36	50	36	50	70	120	150
	36	50	65	100	150	25	40	36	50	65	100	150
	30	36	50	60	70	20	30	30	36	50	60	70
	20	25	30	36	50	13	20	20	25	45	50	50
	10	12	15	18	20	5	6	10	12	15	20	25 (90[11])
	36	50	70	85	100	36	50	36	50	70	85	100
	–	–	–	–	–	–	–	36	50	70	85	100
	36	50	70	85	100	36	50	36	50	70	85	100
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50% (27)	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50% (27)	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
	100%	100%	100%	100%	75%	75%	50%	100%	100%	100%	100%	75% (20)
	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%	100%
	–	–	–	–	–	–	–	100%	100%	100%	100%	100%
	100%	100%	100%	100%	100%	100%	75%	100%	100%	100%	100%	100%
	143	187	220	330	440	105	187	143	187	220	330	440
	75.6	105	154	264	330	75.6	105	75.6	105	154	264	330
	75.6	105	154	264	330	75.6	105	75.6	105	154	264	330
	75.6	105	143	220	330	52.5	84	75.6	105	143	220	330
	63	75.6	105	132	154	40	63	63	75.6	105	132	154
	40	52.5	63	75.6	105	26	40	40	52.5	94.5	105	105
	17	24	30	36	40	7.65	13.6	17	24	30	40	52.5
	65	85	100	150	200	50	85	65	85	100	150	200
	30	36	65	100	150	25	35	30	36	65	100	150
	A					A		A				
	IEC 60947-2					IEC 60947-2		IEC 60947-2				
	✔					✔		✔				
	DIN EN 50022					DIN EN 50022		DIN EN 50022				
	25000					25000		25000				
	240					240		240				
	8000					8000		8000				
	120					120		120				
	90 x 82.5 x 130					105 x 70 x 150		105 x 82.5 x 160				
	120 x 82.5 x 130					140 x 70 x 150		140 x 82.5 x 160				
	15					15		15				
	15					15		15				
	■							■				
						■						
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	■					■						
	▲							▲				
	▲							▲				
	✔							✔				
	1.2 / 1.6					1.7 / 2.1		2.5 / 3.5				
	2.54 / 3.27					3.24 / 4.1		4.19 / 5.52				
	3.32 / 4.04							5 / 6.76				

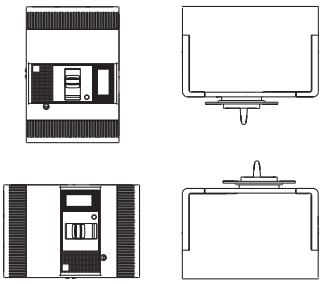
Construction characteristics

The references in round brackets (Gx.x) in the technical catalogue refer to the Glossary in the final charter of the technical catalogue.

Positive operation

All the moulded-case circuit-breakers in the SACE Tmax XT family are realized in accordance with the following construction characteristics:

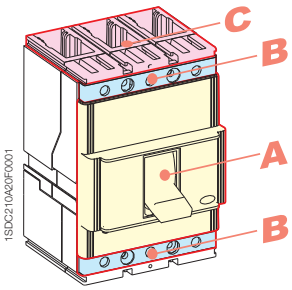
- double insulation(G1.5);
- positive operation(G1.6);
- isolation behaviour(G1.7);
- electromagnetic compatibility(G1.8);
- tropicalization(G1.9);
- impact and vibration resistance(G1.10);
- power supply from the top towards the bottom or vice versa;
- versatility of the installation. It is possible to mount the circuit-breaker in horizontal, vertical, or lying down position without any derating of the rated characteristics;
- no nominal performance derating for use up to an altitude of 2000m. Above 2000m, the properties of the atmosphere (composition of the air, dielectric strength, cooling power and pressure) change, having an impact on the main parameters which define the circuit-breaker. The table below gives the changes to the main performance parameters;



Installation positions

Altitude		2000m	3000m	4000m	5000m
Rated employ voltage, Ue	[V]	690	600	540	470
Rated uninterrupted current	%	100	98	93	90

- the SACE Tmax XT circuit-breakers can be used in environments where the temperature is between -25°C and +70°C and stored in environments where the temperature is between -40°C and +70°C. To use temperatures other than 40°C, see the “Temperature Performances” paragraph of the Characteristic Curves and the technical information chapter;
- different degrees of protection IP (International Protection)(G 1.11);



Protection degrees

Circuit-breaker

	With front	Without front(1)	With Front for lever -FLD-	With rotary Handles	With transmitted rotary handle and accessory IP54	With high terminal covers HTC	With low terminal covers LTC
A	IP40	IP20	IP40	IP40	IP54	IP40	IP40
B	IP20	IP20	IP20	IP20	IP20	IP40	IP40
C	NC	NC	NC	NC	NC	IP40	IP30

(1) During the installation of electrical accessories
NC Not classifiable

Test pushbutton

Accessories

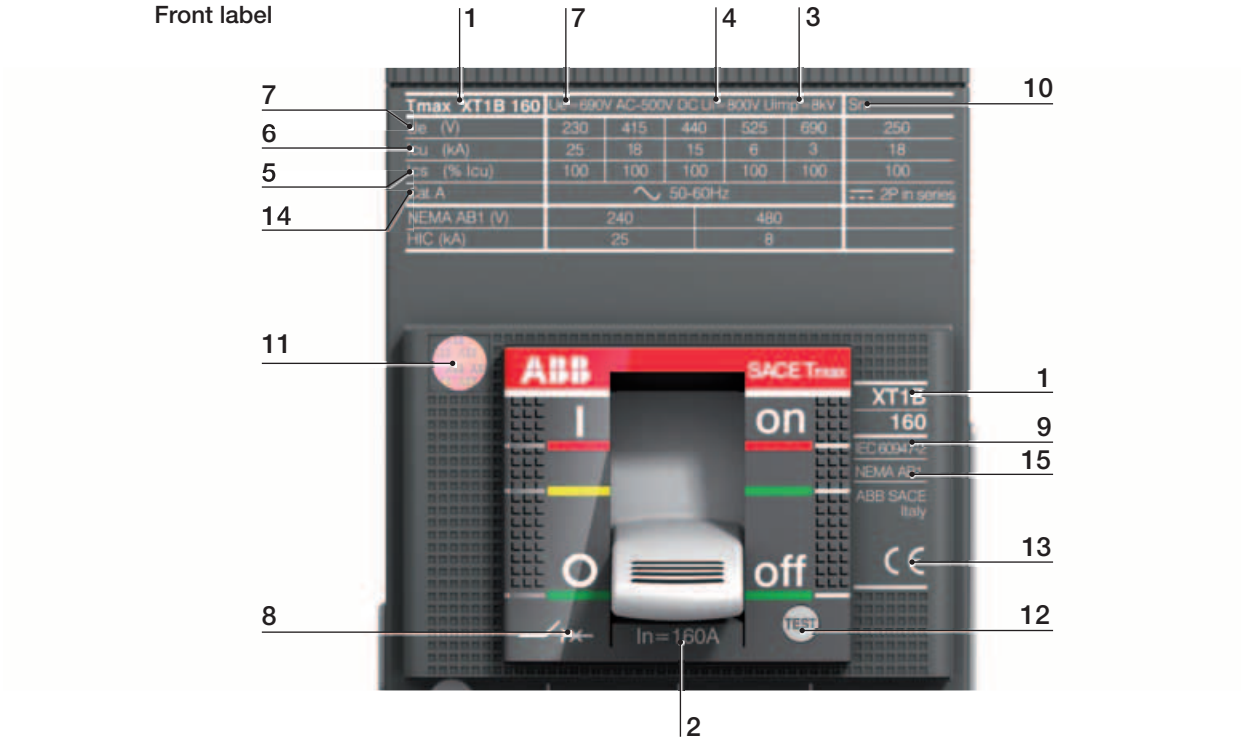
	Motor operator MOD, MOE or MOE-E	Residual current devices	Residual current from switchboard RCQ020	Automatic Transfer Switch ATS021 and ATS022
On Front	IP30	IP40	IP41	IP40

- all the circuit-breakers in the XT family are fitted with a test pushbutton which allows the release test to be done. This test must be carried out with the circuit-breaker closed and with no current.

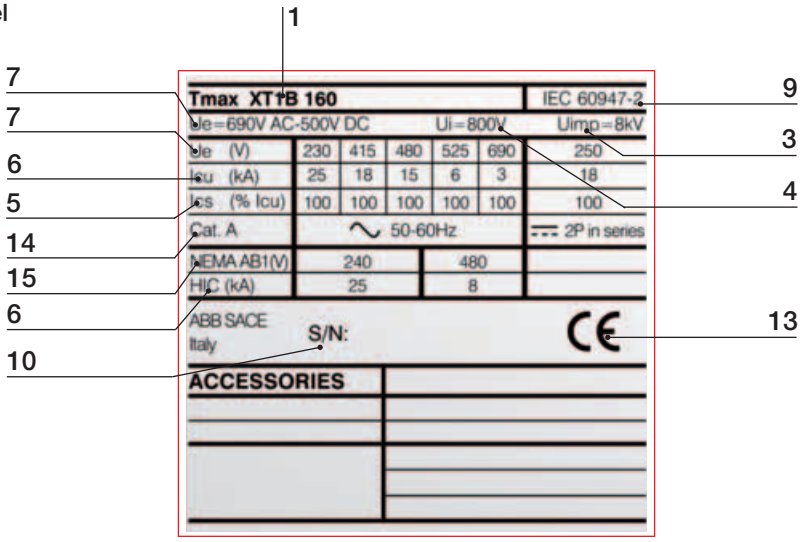
Identification of the SACE Tmax XT circuit-breakers

The characteristics of the circuit-breaker are given on the rating nameplate on the front of the circuit-breaker, and on the side rating plate.

Front label



Side label



1 Name of the circuit-breaker and performance level(*)
2 In: rated current of the circuit-breaker(*)
3 Uimp: rated impulse withstand voltage(*)
4 Ui: insulation voltage(*)
5 Ics rated short-circuit duty breaking capacity(*)
6 Icu: rated ultimate short-circuit breaking capacity(*)
7 Ue: rated service voltage(*)
8 Symbol of isolation behaviour(*)
9 Reference Standard IEC 60947-2(*)
10 Serial number
11 Anti-forgery logo
12 Test pushbutton
13 CE marking
14 Utilisation Category
15 Reference Standard NEMA-AB1

(*) In compliance with the IEC 60947-2 Standard

The SACE Tmax XT family ranges

The SACE Tmax XT moulded-case circuit-breaker family complies with different installation requirements. Circuit-breakers are available with trip units dedicated to different applications, such as power distribution, generator protection, motor protection and oversized neutral protection. Some of these circuit-breakers can also be used in communication systems and plants that function at 400Hz. Switch-disconnectors are also available.

In = Rated uninterrupted current[G2.2]	XT1 160	XT2 160	XT3 250	XT4 250
Power distribution				
Thermomagnetic trip units				
TMD	16…160		63…250	
TMD/TMA		1.6…160		16…250
Electronic trip units				
Ekip LS/I		10…160		40…250
Ekip I		10…160		40…250
Ekip LSI		10…160		40…250
Ekip LSIG		10…160		40…250
Ekip E-LSIG				40…250
Motor protection				
Magnetic trip units				
MF/MA		1…100[1]	100…200[1]	10…200[1]
Electronic trip units				
Ekip M-I		20…100[1]		
Ekip M-LIU		25…100[1]		40…160[1]
Ekip M-LRIU		25…100[1]		40…200[1]
Generator Protection				
Thermomagnetic trip units				
TMG		16…160	63…250	
Electronic trip units				
Ekip G-LSI		10…160		40…250
Oversized Neutral Protection 160%				
Electronic trip units				
Ekip N-LS/I		10…100[2]		40…160[2]
Switch-disconnectors	■		■	■
Special applications				
400Hz	■	■	■	■
Communication		■		■

[1] Only 3 poles version
[2] Only 4 poles version

Circuit-breakers for power distribution

Main characteristics

SACE Tmax XT moulded-case circuit-breakers are the ideal solution for all distribution levels, from the main low voltage switchboard to the subswitchboards in the installation. They feature high specific let-through current peak and energy limiting characteristics that allow the circuits and equipment on the load side to be sized in an optimum way. SACE Tmax XT circuit-breakers with thermomagnetic and electronic trip units protect against overloads, short-circuits, earth faults and indirect contacts in low voltage distribution networks.

The SACE Tmax XT family of moulded-case circuit-breakers can be equipped with:

- thermomagnetic trip units(G3.2), for direct and alternating current network protection, using the physical properties of a bimetal and an electromagnet to detect the overloads and short-circuits;
- electronic trip units(G3.4), for alternating current network protection. Releases with microprocessor technology obtain protection functions that make the operations extremely reliable and accurate. The power required for operating them correctly is supplied straight from the current sensors of the releases. This ensures that they trip even in single-phase conditions and on a level with the minimum setting.
  The electronic protection trip unit consists of:
  - 3 or 4 current sensors (current transformers);
  - a protection unit;
  - an opening solenoid (built into the electronic trip unit).

Characteristics of Electronic trip units SACE Tmax XT	
Operating temperature	-25°C…+70°C
Relative humidity	98%
Self-supplied	0.2xIn (single phase)(1) (2)
Auxiliary supply (where applicable)	24V DC ± 20%
Operating frequency	45…66Hz or 360…440Hz
Electromagnetic compatibility	IEC 60947-2 Annex F

(1) 0.32 x In for Ekip N-LS/I
(2) For 10A: 0.4In

Circuit-breakers for power distribution

Main characteristics

Characteristics of circuit-breakers for power distribution

			XT1	XT2	XT3	XT4
Size(G2.1)		[A]	160	160	250	160/250
Poles		[Nr.]	3, 4	3, 4	3, 4	3, 4
Rated service voltage, **Ue**(G2.4)	(AC) 50-60Hz	[V]	690	690	690	690
	(DC)	[V]	500	500	500	500
Rated insulation voltage, **Ui**(G2.5)		[V]	800	1000	800	1000
Rated impulse withstand voltage, **Uimp**(G2.6)		[kV]	8	8	8	8
Versions			Fixed, Plug-in	Fixed, Withdrawable, Plug-in	Fixed, Plug-in	Fixed, Withdrawable, Plug-in
Breaking capacities			**B C N S H**	**N S H L V**	**N S**	**N S H L V**
Trip units			Thermomagnetic	Thermomagnetic, Electronic	Thermomagnetic	Thermomagnetic, Electronic
TMD/TMA				■		■
TMD			■		■	
Ekip LS/I				■ In = 10A, 25A, 63A, 100A, 160A		■ In = 40A, 63A, 100A, 160A, 250A
Ekip I				■ In = 10A, 25A, 63A, 100A, 160A		■ In = 40A, 63A, 100A, 160A, 250A
Ekip LSI				■ In = 10A, 25A, 63A, 100A, 160A		■ In = 40A, 63A, 100A, 160A, 250A
Ekip LSIG				■ In = 10A, 25A, 63A, 100A, 160A		■ In = 40A, 63A, 100A, 160A, 250A
Ekip E-LSIG						■ In = 40A, 63A, 100A, 160A, 250A
Interchangeability				■		■

■ Complete circuit-breaker

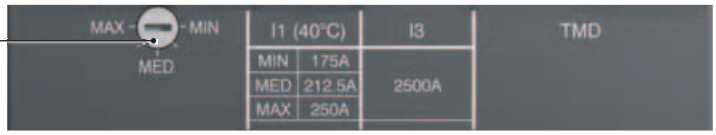
TMD

Main characteristics:

- available for XT1 and XT3 in the three-pole and four-pole versions;
- protections:
  - against overload (L): adjustable protection threshold from 0.7...1xIn, with inverse long-time trip curve;
  - against instantaneous short-circuits (I): fixed 10xIn protection threshold, with instantaneous trip curve;
- 100% neutral protection in four-pole circuit-breakers. 50% neutral protection is only available for In≥125A;
- the thermal protection setting is made by turning the relative cursor on the front of the release.

Example with XT3 250A

Rotary switch for thermal protection setting



XT1

TMD

Breaking capacity		B	B	B,C	B,C,N	B,C,N	ALL	ALL	ALL	ALL	ALL	ALL
L	In [A]	16	20	25	32	40	50	63	80	100	125	160
	Neutral [A] - 100%	16	20	25	32	40	50	63	80	100	125	160
I_1 = 0.7...1xIn	Neutral [A] - 50%	–	–	–	–	–	–	–	–	–	80	100
I	I_3 [A]	450	450	450	450	450	500	630	800	1000	1250	1600
	Neutral [A] - 100%	450	450	450	450	450	500	630	800	1000	1250	1600
I_3 = 10xIn	Neutral [A] - 50%	–	–	–	–	–	–	–	–	–	800	1000

XT3

TMD

L	In [A]	63	80	100	125	160	200	250
	Neutral [A] - 100%	63	80	100	125	160	200	250
I_1 = 0.7...1xIn	Neutral [A] - 50%	–	–	–	80	100	125	160
I	I_3 [A]	630	800	1000	1250	1600	2000	2500
	Neutral [A] - 100%	630	800	1000	1250	1600	2000	2500
I_3 = 10xIn	Neutral [A] - 50%	–	–	–	800	1000	1250	1600

TMD/TMA

Main characteristics:

- available for XT2 and XT4 in the three-pole and four-pole versions;
- protections:
  - against overload (L): adjustable protection threshold from 0.7...1xIn, with inverse long time trip curve;
  - against instantaneous short-circuit (I):
    - fixed protection threshold for In≤32A,
    - adjustable threshold beteewn 8…10xIn for 40A,
    - adjustable threshold beteewn 6…10xIn for 50A,
    - adjustable threshold beteewn 5…10xIn for In≥63A;
- 100% neutral protection in four-pole circuit-breakers. 50% neutral protection is only available for In≥125A;
- the thermal and magnetic protection settings are made by turning the relative cursors on the front of the release.

Example with XT4 250A

Rotary switch for magnetic protection setting

Rotary switch for thermal protection setting

XT2

TMD/TMA

L	In [A]	1.6(1)	2(1)	2.5(1)	3.2(1)	4(1)	5(1)	6.3(1)	8(1)	10(1)	12.5(1)	16	20	25	32	40	50	63	80	100	125	160
	Neutral [A] - 100%	1.6	2	2.5	3.2	4	5	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160
I_1 = 0.7…1xIn	Neutral [A] - 50%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	80	100
	TMD	16	20	25	32	40	50	63	80	100	125	300	300	300	320							
	TMA															300…400	300…500	300…630	400…800	500…1000	625…1250	800…1600
I	Neutral [A] - 100%	16	20	25	32	40	50	63	80	100	125	300	300	300	320	300…400	300…500	300…630	400…800	500…1000	625…1250	800…1600
	Neutral [A] - 50%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	400…800	1000…2000

(1) Available only as complete circuit-breaker

XT4

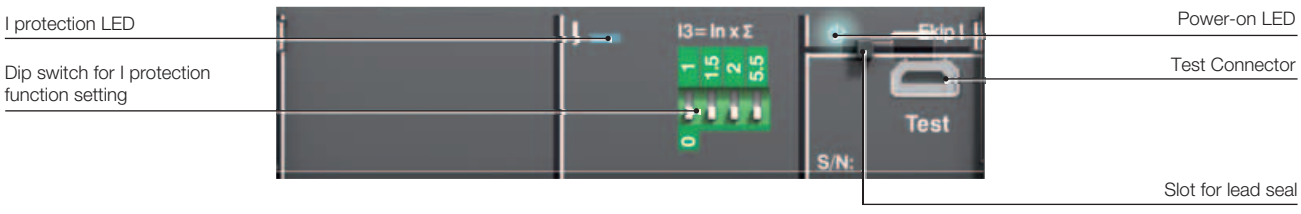
TMD/TMA

L	In [A]	16	20	25	32	40	50	63	80	100	125	160	200	225	250
	Neutral [A] - 100%	16	20	25	32	40	50	63	80	100	125	160	200	225	250
I_1 = 0.7…1xIn	Neutral [A] - 50%	–	–	–	–	–	–	–	–	–	80	100	125	125	160
	TMD	300	300	300	320										
	TMA					300…400	300…500	315…630	400…800	500…1000	625…1250	800…1600	1000…2000	1125…2250	1250…2500
I	Neutral [A] - 100%	300	300	300	320	300…400	300…500	315…630	400…800	500…1000	625…1250	800…1600	1000…2000	1125…2250	1250…2500
	Neutral [A] - 50%	–	–	–	–	–	–	–	–	–	315…630	500…1000	625…1250	625…1250	500…1000

Ekip I

Main characteristics:

- usable with the XT2 and XT4 circuit-breaker in the three-pole and four-pole versions;
- protections:
  - against instantaneous short-circuit (I): adjustable protection threshold from 1...10xIn, with instantaneous trip curve;
  - of the neutral in four-pole circuit-breakers:
    - for In≥100A in the OFF or ON positions, 50% and 100% of the phases can be selected;
    - for In<100A, neutral protection is fixed at 100% of the phases and disableded by user;
- manual setting using the relative dip-switches, which allow the settings to be made even when the trip unit is off;
- LED:
  - LED lit with a steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - LED with a steady red light, indicating that protection I has tripped; red LED light on connecting Ekip TT or Ekip T&P accessories after circuit-breaker opening for “I protection” intervention;
  - Ekip I is equipped with a trip coil disconnection protection device that detects whether the opening solenoid has disconnected. Signalling is made by the red LED flashing;
- test connector on the front of the trip unit;
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about latest trip happened;
  - to connect the Ekip T&P unit, which allows the measurements to be read, the trip test to be conducted and the I protection function test to be carried out;
- self-supply from a minimum current of 0.2xIn up.



Ekip I

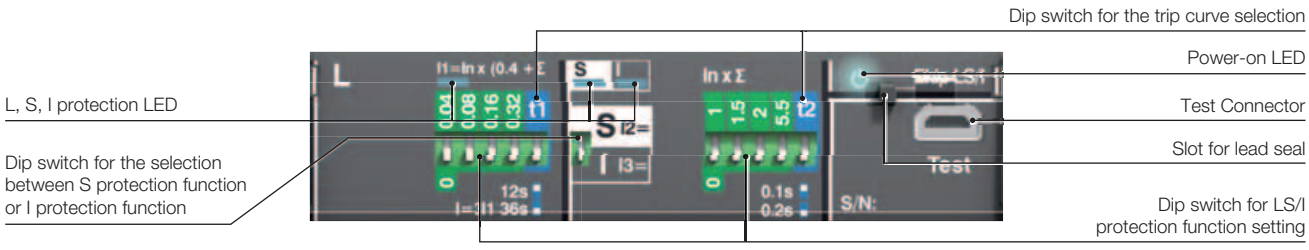
Protection function		Trip threshold	Trip curve[1]	Excludability	Relation
I	Against short-circuits with adjustable treshold and instantaneous trip time	Manual setting: I_3= 1, 1.5, 2, 2.5, 3, 3.5, 4.5, 5.5, 6.5, 7, 7.5, 8, 8.5, 9, 10xIn Tolerance: ±20% I>4In ±10% I≤4In	≤20ms	Yes	t = k

[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the trip time is ≤60ms.

Ekip LS/I

Main characteristics:

- available for XT2 and XT4 in the three-pole and four-pole versions;
- protections:
  - against overload (L): 0.4...1xIn adjustable protection threshold, with adjustable time trip curve;
  - against short-circuit with delay (S): 1...10xIn adjustable protection threshold, with adjustable time trip curve (as an alternative to I protection);
  - against instantaneous short-circuit (I): 1...10xIn adjustable protection threshold, with instantaneous trip curve (as an alternative to S protection);
  - of the neutral in four-pole circuit-breakers:
    - for In ≥100A can be selected in the OFF or ON positions, 50%, 100% of the phases;
    - for In <100A, neutral protection is fixed at 100% of the phases and disabled by user;
- manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off;
- LED:
  - LED with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding 0.9xI_1;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - LS/I: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - Ekip LS/I is equipped with a trip coil disconnection detection device that detects whether the opening solenoid has disconnected. Signalling is made by all the red LEDs flashing simultaneously;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about latest trip happened;
  - to connect the Ekip T&P unit, which allows the measurements to be read, the trip test to be conducted and the protection functions test to be carried out;
- thermal memory which can be activated by Ekip T&P;
- self-supply from 0.2xIn minimum current up.



Ekip LS/I

Protection function		Trip threshold	Trip curve[1]	Excludability	Relation	Thermal memory
L	Against overloads with long inverse time delay trip according to IEC 60947-2 Standard	Manual setting: I_1= 0.4...1xIn step 0.04 Tolerance: trip between 1.05…1.3 I_1 (IEC 60947-2)	Manual setting: t_1= 12-36s at I=3xI_1 Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	$t = k/I^2$	Yes
S	Against short-circuits with indipendend time delay (t=k)	Manual setting: I_2= 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	t_2= 0.1-0.2s Tolerance: ±15%	Yes	t = k	–
I	Against short-circuits with adjustable treshold and instantaneous trip time	Manual setting: I_3= 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	≤20ms	Yes	t = k	–

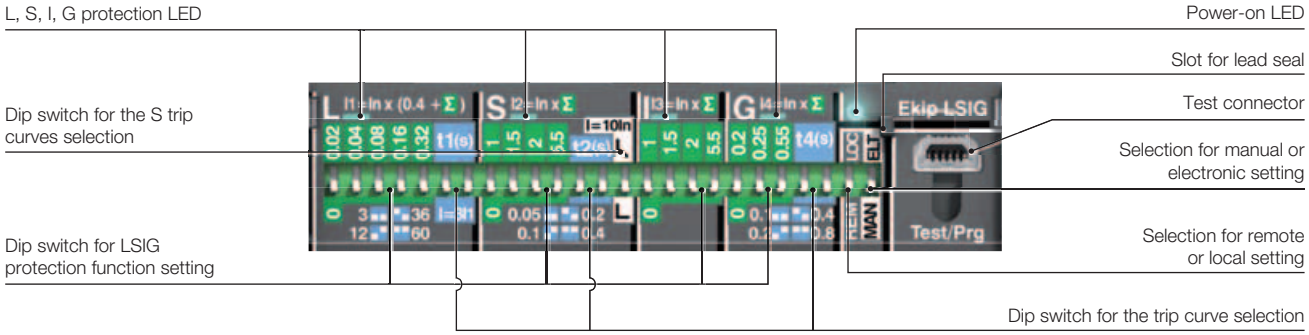
[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

Protection	Trip threshold	Trip time
L	release between 1.05 and 1.3 x I_1	±20%
S	±10%	±20%
I	±15%	≤60ms

Ekip LSI and Ekip LSIG

Main characteristics:

- available for XT2 and XT4 in three-pole and four-pole versions;
- protections:
  - against overloads (L): 0.4...1xIn adjustable protection threshold, with adjustable time trip curve;
  - against short-circuits with delay (S): 1...10xIn adjustable protection threshold, with adjustable time trip curve (short inverse time ($t=k^2$) or indipendent time (t=k));
  - against instantaneous short-circuits (I): 1...10xIn adjustable protection threshold, with instantaneous trip curve;
  - against earth faults (G): 0.2...1xIn adjustable protection threshold, with indipendent time trip curve;
  - of the neutral in four-pole circuit-breakers:
    - for In≥100A can be selected in OFF or ON, 50%, 100% of phases;
    - for In<100A neutral protection is fixed on 100% of phases and disableded by user;
- setting:
  - manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off;
  - electronic setting, made both locally using the Ekip T&P or Ekip Display accessory and via remote control, by means of the Ekip Com unit;
- LED:
  - LED on with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding $0.9xI_1$;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - LSIG: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - the trip unit is equipped with a device that detects the eventual opening solenoid disconnection thanks to the simultaneous blinking of all the LED;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about the latest trip happened;
  - to connect the Ekip T&P unit, which allows the measurements to be read, the trip test to be conducted, the protection functions test to be carried out, electronic setting of the protection functions of the trip unit and of the communication parameters;
- thermal memory which can be activated by Ekip T&P or Ekip Display;
- self-supply from a minimum current of 0.2xIn up;
- the three-pole version can be accessorized with external neutral;
- with the addition of the Ekip Com in the circuit-breaker, you can:
  - acquire and transmit a wide range of information via remote control;
  - accomplish the circuit-breaker opening and closing commands by means of the motor operator in the electronic version (MOE-E);
  - know the state of the circuit-breaker (open/closed/trip) via remote control;
  - setting the configuration and programming the unit, such as the current thresholds and the protection function curves.



Ekip LSI – Ekip LSIG

Protection function		Trip threshold	Trip curve[1]	Excludability	Relation	Thermal memory
L	Against overloads with long inverse time delay trip according to IEC 60947-2 Standard	Manual setting: I_1= 0.4...1xIn step 0.02 Tolerance: trip between 1.05…1.3 I_1 (IEC 60947-2)	Manual setting: t_1 = 3-12-36-60s at I=3xI_1 Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	t = k/I²	Yes
		Electronic setting: I_1= 0.4...1xIn step 0.01 Tolerance: trip between 1.05…1.3 I_1 (IEC 60947-2)	Electronic setting: t_1 = 3...60s at I=3xI_1 step 0.5 Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	t = k/I²	Yes
S	Against short-circuits with inverse short (t=k/I²) or indipendent (t=k) time delay trip	Manual setting: I_2= 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	Manual setting: t_2= 0.05-0.10-0.20-0.40s at 10xIn Tolerance: ±10% up to 4xIn ±20% from 4xIn	Yes	t = k/I²	–
		Electronic setting: I_2= 1...10xIn step 0.1 Tolerance: ±10%	Electronic setting: t_2= 0.05...0.40s at 10xIn step 0.01 Tolerance: ±10% up to 4xIn ±20% from 4xIn	Yes	t = k/I²	–
		Manual setting: I_2= 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	Manual setting: t_2= 0.05-0.1-0.2-0.4s Tolerance: ±15% t_2>100ms ±20% t_2≤100ms	Yes	t = k	–
		Electronic setting: I_2= 1...10xIn step 0.1 Tolerance: ±10%	Electronic setting: t_2= 0.05...0.4s step 0.01 Tolerance: ±15% t_2>100ms ±20% t_2≤100ms	Yes	t = k	–
I	Against short-circuits with adjustable threshold and instantaneous trip time	Manual setting: I_3= 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±20%	≤40ms	Yes	t = k	–
		Electronic setting: I_3= 1...10xIn step 0.1 Tolerance: ±10%	≤40ms	Yes	t = k	–
G	Against earth fault with independent time delay trip[2]	Manual setting: I_4 = 0.2-0.25-0.45-0.55-0.75-0.8-1xIn Tolerance: ±10%	Manual setting: t_4 = 0.1-0.2-0.4-0.8s Tolerance: ±15%	Yes	I²t = k	–
		Electronic setting: I_4 = 0.2...1xIn step 0.02 Tolerance: ±10%	Electronic setting: t_4 = 0.1...0.8s step 0.05 Tolerance: ±15%	Yes	I²t = k	–

[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

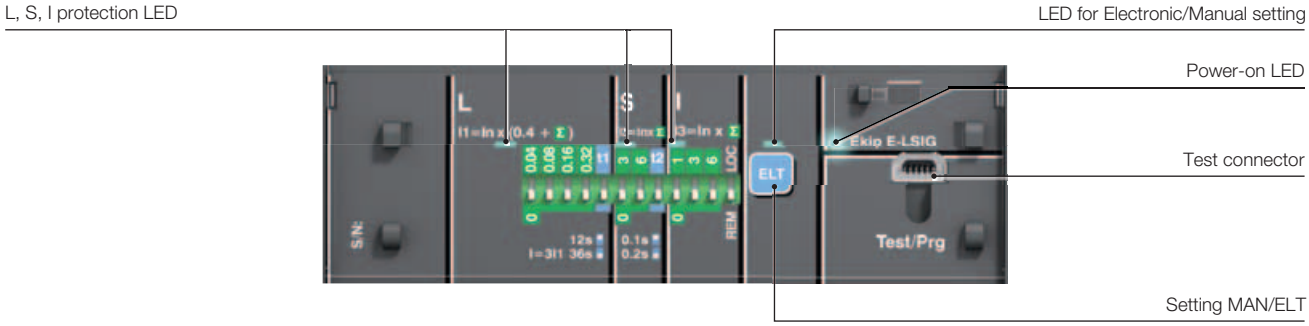
Protection	Trip threshold	Trip time
L	release between 1.05 and 1.3 x I_1	±20%
S	±10%	±20%
I	±15%	≤60ms
G	±15%	±20%

[2] Protection G is inhibited for currents higher than 2 In.

Ekip E-LSIG

Main characteristics:

- available for XT4 in three-pole and four-pole versions;
- protections:
  - against overloads (L): 0.4...1xIn adjustable protection threshold, with adjustable time trip curve;
  - against short-circuits with delay (S): 1...10xIn adjustable protection threshold, with adjustable time trip curve;
  - against instantaneous short-circuits (I): 1...10xIn adjustable protection threshold, with instantaneous trip curve;
  - of the neutral in four-pole circuit-breakers;
- measurements:
  - available from 0.2xIn in Vaux mode and starting from 0.5xIn in self supply mode; external current or voltage transformers are not required. See table for ranges and accuracy;
  - Currents: three phases (L_1, L_2, L_3), neutral (Ne) and earth fault;
  - Voltage: phase-phase, phase-neutral;
  - Power: active, reactive and apparent;
  - Power factor;
  - Frequency and peak factor;
  - Energy: active, reactive, apparent, counter;
- setting:
  - manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off;
  - electronic setting, made both locally using Ekip T&P or Ekip Display accessory and via remote control, by means of the dialogue unit Ekip Com. The electronic setting have a wider range and a thicker regulation step.
    Use of electronic setting allows other functions to be activated:
    - function for protection against earth faults (G): 0.2..1xIn adjustable protection threshold, with a time constant trip curve;
    - over voltage protection 0.5…0.95 Un with a time constant trip curve;
    - under voltage protection 1.05…1.2 Un with a time constant trip curve;
- LED:
  - LED on with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding 0.9xI_1;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - fixed LED MAN/ELT show the kind of active parameters;
    - LSIG: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - the trip unit is equipped with a device that detects the eventual opening solenoid disconnection thanks to the simultaneous blinking of all the LED;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about the latest trip happened;
  - to connect the Ekip T&P unit, which allows the measurements to be read, the trip test to be conducted, the protection functions test to be carried out, electronic setting of the protection functions of the trip unit and of the communication parameters;
- self-supply from a minimum current of 0.2xIn up; measurements starting from 0.5xIn;
- the three-pole version can be accessorized with external neutral current transformer and external neutral voltage connection kit;
- with the addition of the Ekip Com in the circuit-breaker, you can:
  - acquire and transmit a wide range of information via remote control;
  - accomplish the circuit-breaker opening and closing commands by means of the motor operator in the electronic version (MOE-E);
  - know the state of the circuit-breaker (open/closed/trip) via remote control;
  - setting the configuration and programming the unit, such as the current thresholds and the protection function curves.



Ekip E-LSIG

Protection function		Trip threshold	Trip curve[1]	Excludability	Relation	Thermal memory
L	Against overloads with long inverse time delay trip according to IEC 60947-2	Manual setting: I_1= 0.4...1xIn step 0.04 Tolerance: trip between 1.05…1.3 I_1 (IEC 60947-2)	Manual setting: t_1 = 12-36s at I=3xI_1 Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	t = k/I^2	–
		Electronic setting: I_1= 0.4...1xIn step 0.01 Tolerance: trip between 1.05…1.3 I_1 (IEC 60947-2)	Electronic setting: t_1 = 3...60s at I=3xI_1 step 0.5 Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	t = k/I^2	Yes
S	Against short-circuits with inverse short (t=k/I^2) or indipendent (t=k) time delay trip	Manual setting: I_2= OFF 3-6-9 Tolerance: ±10%	Manual setting: t_2= 0.10-0.20s at 10xIn Tolerance: ±15% t_2>100ms ±20% t_2≤100ms	Yes	t = k	–
		Electronic setting: I_2= 1...10xIn step 0.1 Tolerance: ±10%	Electronic setting: t_2= 0.05...1s at 10xIn step 0.01 Tolerance: ±10% up to 4xIn ±20% from 4xIn	Yes	t = k/I^2	–
		Electronic setting: I_2= 1...10xIn step 0.1 Tolerance: ±10%	Electronic setting: t_2= 0.05...0.4s step 0.01 Tolerance: ±10% up to 4xIn ±20% from 4xIn	Yes	t = k/I^2	–
I	Against short-circuits with adjustable threshold and instantaneous trip time	Manual setting: I_3= OFF 1-3-4-7-9-10 Tolerance: ±20%	≤40ms	Yes	t = k	–
		Electronic setting: I_3= 1...10xIn step 0.1 Tolerance: ±10%	≤40ms	Yes	t = k	–
G	Against earth fault with independent time delay trip[2]	Electronic setting: I_4 = 0.2...1xIn step 0.02 Tolerance: ±10%	Electronic setting: t_4 = 0.1...0.8s step 0.05s Tolerance: ±15%	Yes	t = k/I^2	–
UV	Standard adjustable constant time	Electronic setting: U_8 = 0.5...0.95xUn step=0.01xUn Tolerance: ±5%	Electronic setting: t_8 = 0.1...5s step 0.1s Tolerance: min (±20% ±100ms)	Yes	t = k	–
OV	Against overvoltage with adjustable constant time	Electronic setting: U_9 = 1.05...1.2xUn step=0.01xUn Tolerance: ±5%	Electronic setting: t_9 = 0.1...5s step 0.1s Tolerance: min (±20% ±100ms)	Yes	t = k	–

[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

Protection	Trip threshold	Trip time
L	release between 1.05 and 1.3 x I_1	±20%
S	±10%	±20%
I	±15%	≤60ms
G	±15%	±20%

[2] Protection G is inhibited for currents higher than 2 In.

		Value	Range	Accuracy	Specified measuring range
Current		Phase current (I1, I2, I3, IN)	0 … 12 In	Cl 1	0.2 … 1.2 In
		Phase current minimum value			
		Phase current maximum value			
		Ground current (Ig)	0 … 4 In	–	–
Voltage		Phase voltage runtime, max and min (V1N, V2N, V3N) (1)	0 … 828 V	±0.5%	100 … 400 V
		Line voltage runtime, max and min (U12, U23, U31)	0 … 828 V	±0.5%	100 … 690 V
Power	**Active**	Phase power runtime, max and min (P1, P2, P3) (1)	-207 kW … 207 kW	Cl 2	-207 kW … -1 kW 1 kW … 207 kW
		Total power runtime, max and min	-1 MW … 1 MW	Cl2	-1 MW … -3 kW 3 kW … 1 MW
	Reactive	Phase power runtime, max and min (Q1, Q2, Q3) (1)	-207 kvar … 207 kvar	Cl 2	-207 kvar … -1 kvar 1 kvar … 207 kvar
		Total power runtime, max and min	-1 Mvar … 1 Mvar	Cl 2	-1 Mvar … -3 kvar 3 kvar … 1 Mvar
	Apparent	Phase power runtime, max and min (S1, S2, S3) (1)	0 … 207 kVA	Cl 2	1 kVA … 207 kVA
		Total power runtime, max and min	0 … 1 MVA	Cl 2	3 kVA … 1 MVA
Energy	**Active**	Total energy	1 kWh … 2 TWh	Cl 2	1 kWh … 2 TWh
		Incoming energy			
		Outgoing energy			
	Reactive	Total energy	1 kvarh … 2 Tvarh	Cl 2	1 kvarh … 2 Tvarh
		Incoming energy			
		Outgoing energy			
	Apparent	Total energy	1 kVAh … 2 TVAh	Cl 2	1 kVAh … 2 TVAh
Power quality		Harmonic analisys (2)	11th (50 - 60Hz)	–	–
		THD of phase L1, L2, L3 (2)	0 … 1000%	±10%	0 … 500%
		Frequency runtime, max, min	45 … 66 Hz	±0.5%	45 … 66 Hz
		PF of phase L1, L2, L3 (1)	-1 … 1	±2%	-1 … -0.5 0.5 … 1

(1) Not available if Neutral is not connected
(2) Available on demand by sending a Modbus command

Circuit-breakers for motors protection

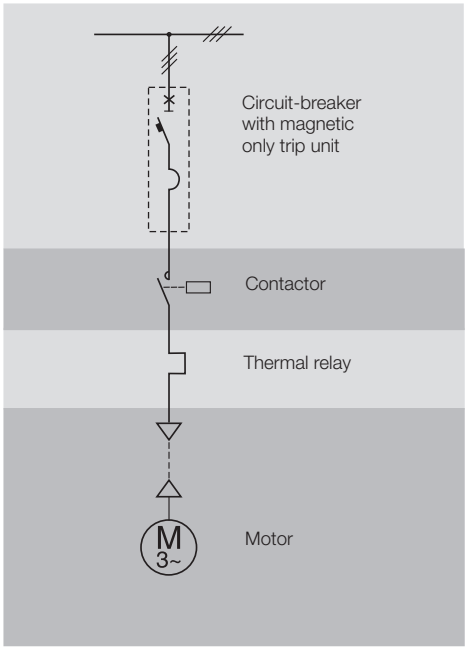
Main characteristics

The safety and reliability of the solution are important aspects that must be considered when choosing and manufacturing the system for starting(G4.3 and G4.4) and monitoring motors.
Start-up is a particularly critical phase for the motor itself and for the installation powering it. Even rated service needs to be adequately monitored and protected so as to deal with any faults that might occur.
When it comes to direct starting, ABB SACE proposes two different solutions:

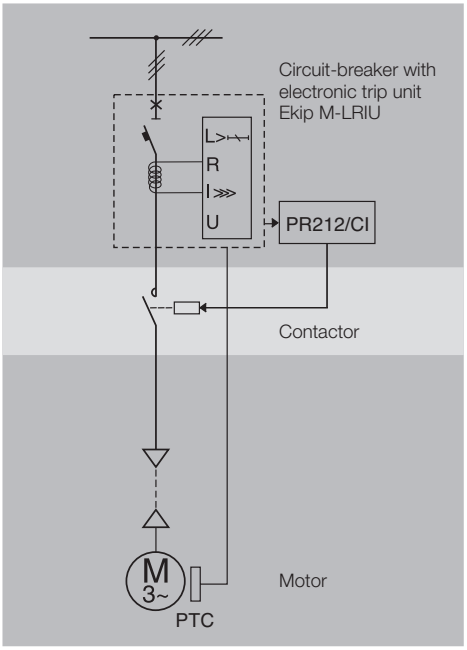
- **a conventional system** with three poles a circuit-breaker equipped with a magnetic only trip unit for protection against short-circuits, a thermal relay for protection against overloads and phase failure or imbalance, and a contactor to operate the motor;
- **an advanced protection system** which integrates all the protection and monitoring functions, and a contactor for operating the motor, in the circuit-breaker itself.

Several different factors must be considered when choosing and coordinating the protection and operating devices, e.g.:

- the electrical specifications of the motor (type, power rating, efficiency, cosφ);
- the starting type and diagram;
- the fault current and voltage in the part of the network where the motor is installed.



Conventional system



Advanced protection system

Consult the QT7 Technical Application Paper: “The asynchronous three-phase motor: general information and ABB’s offer for coordinating the protections” for further details.
The motor protection and operating devices must be chosen in accordance with the coordination tables provided by ABB either through documentation “Coordination tables” or on the web site: http://www.abbcontrol.fr/coordination_tables/.

Characteristics of circuit-breakers for protecting motors

			XT2					XT3		XT4				
Size(G2.1)		[A]	160					250		160/250				
Poles		[Nr.]	3					3		3				
Rated service voltage, **Ue**(G2.4)	(AC) 50-60Hz	[V]	690					690		690				
	(DC)	[V]	500					500		500				
Rated insulation voltage, **Ui**(G2.5)		[V]	1000					800		1000				
Rated impulse withstand voltage, **Uimp**(G2.6)		[kV]	8					8		8				
Versions			Fixed, Withdrawable, Plug-in					Fixed, Plug-in		Fixed, Withdrawable, Plug-in				
Breaking capacities			**N**	**S**	**H**	**L**	**V**	**N**	**S**	**N**	**S**	**H**	**L**	**V**
Trip Units			Magnetic, Electronic					Magnetic		Magnetic, Electronic				
MF/MA			■					■		■				
Ekip M-I			■ In = 20A, 32A, 52A, 100A											
Ekip M-LIU			▲ In = 25A, 63A, 100A							▲ In = 40A, 63A, 100A, 160A				
Ekip M-LRIU			▲ In = 25A, 63A, 100A							▲ In = 40A, 63A, 100A, 160A				
Interchangeability			■							■				

■ Complete circuit-breaker
▲ Loose trip unit

Circuit-breakers for motors protection

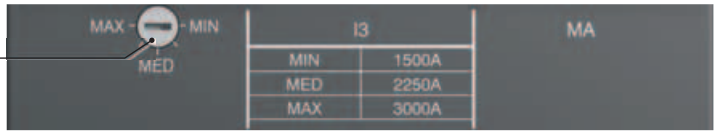
Magnetic trip units

MF/MA

Main characteristics:

- available for XT2, XT3 and XT4 in the three-pole version only, these trip units are mainly used for protecting motors, in conjunction with a thermal relay and a contactor;
- protections:
  - against instantaneous short-circuit (I) for XT2: for In≤12.5A the protection threshold I is fixed at 14xIn, whereas for In>12.5A the protection threshold I is adjustable from 6..14xIn;
  - against instantaneous short-circuit (I) for XT3: the protection threshold I is adjustable from 6..12xIn;
  - against instantaneous short-circuit (I) for XT4: the protection threshold I is adjustable from 5..10xIn;
- the magnetic protection setting is made by turning the relative cursor on the front of the release.

Rotary switch for magnetic protection setting



XT2

MF/MA

	In [A]	1(1)	2(1)	4(1)	8.5(1)	12.5(1)	20	32	52	80	100
I_3 = 14xIn [A]	I_3 = MF	14	28	56	120	175					
I_3 = 6..14xIn [A]	I_3 = MA						120...280	192…448	314…728	480…1120	600...1400

(1) Available only as complete circuit-breaker

XT3

MA

	In [A]	100	125	160	200
I_3 = 6..12xIn	I_3 [A]	600…1200	750…1500	960…1920	1200…2400

XT4

MA

	In [A]	10(1)	12.5(1)	20	32	52	80	100	125	160	200
I_3 = 5..10xIn	I_3 [A]	50…100	62.5…125	100…200	160…320	260…520	400…800	500…1000	625…1250	800…1600	1000…2000

(1) Available only as complete circuit-breaker

Ekip M-I

Main characteristics:

- only available for XT2 in three-pole version. It is normally used in combination with a thermal relay and a contactor for motor protection;
- protections:
  - against instantaneous short-circuit (I): protection threshold adjustable from 6...14xIn, with instantaneous trip curve;
- manual setting by means of the special dip-switches positioned on the front of the trip unit, which allow its adjustment even with the trip unit off;
- LED:
  - fixed green LED which indicates correct operation of the trip unit; the LED lights up for a current over 0.2xIn;
- Test connector positioned on the front of the trip unit:
  - for connection of the Ekip TT test unit, which allows the trip test and the LED test;
  - for connection of the Ekip T&P unit, which allows the measurements to be read, to carry out the trip test and to carry out the protection function test;
  - self-supply starting from a minimum current of 0.2 x In.

Ekip M-I

Protection function	Trip threshold	Trip curve[1]	Excludability	Relation	Thermal memory
Against short-circuits with adjustable threshold and instantaneous trip time	Manual setting: I_3 = 6-6,5-7-7,5-8-8,5-9-9,5-10-10,5-11-11,5-12,5-13-13,5-14xIn Tolerance: ±10%	≤15ms	–	t = k	–

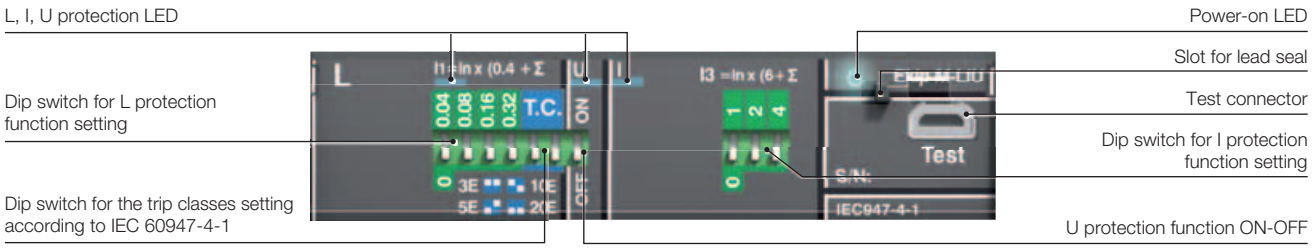
[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

Protection	Trip threshold	Trip time
I	±15%	≤60ms

Ekip M-LIU

Main characteristics:

- available for XT2 and XT4 in the three-pole version, this device protects motors. The L protection function protects the motor against overloads, in accordance with the indications and classes defined by standard IEC 60947-4-1;
- protections:
  - against overloads (L): 0.4...1xIn adjustable threshold. The operating time is established by choosing the operating class defined by Standard IEC 60947-4-1: Class 3E, 5E, 10E, 20E;
  - against short-circuits (I): 6...13xIn adjustable threshold with instantaneous operating time;
  - against phase loss (U): the protection can be selected either in the ON or OFF position. When the selector is in the ON position, the threshold is 50% I_1, with fixed operating time;
- manual setting using the relative dip-switches on the front of the release;
- LED:
  - LED on with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding 0.9xI_1;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - LIU: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - release Ekip M-LIU is equipped with a trip coil disconnection detection device that detects whether the opening solenoid has disconnected. Signalling is made by all the red LEDs flashing simultaneously;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about the latest trip happened;
  - to connect the Ekip T&P unit, which allows the measurements to be read, the trip test to be conducted and the protection function test to be carried out;
- thermal memory always active;
- self-supply starting from a minimum current of 0.2xIn.



Ekip M-LIU

Protection function		Trip threshold	Trip curve(1)	Excludability	Relation	Thermal memory
L	Against overloads with long inverse time delay according to IEC 60947-4-1 Standard	Manual setting: I_1= 0.4...1xIn step 0.04 Tolerance: trip between 1.05...1.2xI_1	Manual setting: Operating class: 3E, 5E, 10E, 20E Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	$t = k/I^2$	Yes
I	Against short-circuits with adjustable threshold and instantaneous trip time	Manual setting: I_3 = 6...13xIn step 1 Tolerance: ±10%	≤20ms	–	$t = k$	–
U	Aganist phase loss with indipendend time delay (IEC 60947-4-1)	Manual setting: I_6 = ON / OFF When ON, I_6=50% I_1 Tolerance: ±15%	Manual setting: When ON, t_6= 2s Tolerance: ±10%	Yes	$t = k$	–

(1) Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

Protection	Trip threshold	Trip time
L	release between 1.05 and 1.2 x I_1	±20%
I	±15%	≤60ms
U	±20%	±20%

Ekip M-LRIU

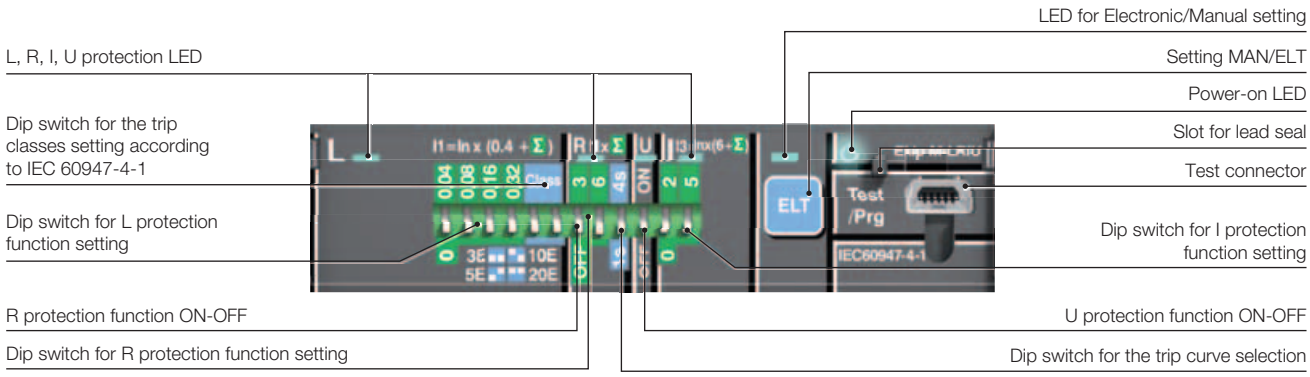
Main characteristics:

- available for XT2 and XT4 in the three-pole version, this device is generally used for protecting integrated motors;
- protections:
  - against overloads (L): 0.4...1xIn adjustable threshold. The operating time is established by choosing the operating class defined by standard IEC 60947-4-1;
  - rotor locking (R): with adjustable threshold in the OFF position or from 3...9xI_1, with settable operating time;
  - against instantaneous short-circuits (I): with adjustable threshold from 6...13xIn and instantaneous operating time;
  - against phase loss (U): with adjustable threshold in the ON or OFF positions;
- setting:
  - manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off;
  - electronic setting, made both locally using Ekip T&P or Ekip Display accessory and via remote control, by means of the dialogue unit Ekip Com. Use of electronic setting allows other functions to be activated:
    - function for protection against earth faults (G): 0.2..1xIn adjustable protection threshold, with a time constant trip curve;
    - duty mode setting (Normal/Heavy):
      - the Normal duty mode requires use of a circuit-breaker and a contactor. In the case of tripping, the Ekip M-LRIU release commands the opening of the contactor via PR212/CI;
      - the Heavy duty mode foresees circuit-breaker opening for all overcurrent conditions, and just the function of motor operation is entrusted to the contactor;
    - BACK UP function:
      - this protection is designed to handle the situation whereby, in the Normal duty mode, the opening command transmitted to the contactor via PR212/CI has not been implemented, i.e. the contactor has not tripped. If this happens, the Ekip M-LRIU release transmits a trip command directly to the circuit-breaker after having waited a time defined. A waiting time between the command transmitted to the contactor and the back-up command transmitted to the circuit-breaker is required so as to take the contactor opening time into account;
    - PTC protection setting:
      - PTC: this protection, monitors the temperature inside the protected motor by means of a PTC sensor. If the temperature is too high, the Ekip M-LRIU release will command contactor opening (if the mode is “Normal”) or circuit-breaker opening (if the mode is “Heavy”). To realize this protection is necessary to order the connector available for PTC;
- LED:
  - LED on with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding 0.9xI_1;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - fixed LED ELT show the kind of active parameters;
    - LRIU: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - Ekip M-LRIU is equipped with a trip coil disconnection detection device that detects whether the opening solenoid has disconnected. Signalling is made by all the LEDs flashing simultaneously;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about the latest trip happened;
  - to connect the Ekip T&P unit, which allows the measurements to be read, the trip test to be conducted, the protection function test to be carried out, and electronic setting of the protection function of the release and of the communication parameters;
- thermal memory always active;
- self-supply from a minimum current of 0.2xIn up;

Circuit-breakers for motors protection

Electronic trip units

- with the addition of the Ekip Com in the circuit-breaker, you can:
  - acquire and transmit a wide range of information via remote control;
  - accomplish the circuit-breaker opening and closing commands by means of the motor operator in the electronic version (MOE-E);
  - know the state of the circuit-breaker (open/closed/trip) via remote control;
  - setting the configuration and programming parameters of the unit, such as the current thresholds and the protection function curves.



Ekip M-LRIU

Protection function		Trip threshold	Trip curve[1]	Excludability	Relation	Thermal memory
L	Against overloads with long inverse time delay trip according to IEC 60947-4-1	Manual setting: I_1 = 0.4...1xIn step 0.04 Tolerance: trip between 1.05...1.2xI_1	Manual setting: Trip class: 3E, 5E, 10E, 20E Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	$t = k/I^2$	Yes
		Electronic setting: I_1 = 0.4...1xIn step 0.01 Tolerance: trip between 1.05...1.2xI_1	Electronic setting: Trip class: 3E, 5E, 10E, 20E Tolerance: ±10% up to 4xIn ±20% from 4xIn	–	$t = k/I^2$	Yes
R	Against rotor block with delayed trip and with an indipendent time delay trip (IEC 60947-4-1)	Manual setting: I_5 = OFF, 3, 6, 9xI_1 Tolerance: ±10%	Manual setting: t_5 = 1, 4s Tolerance: ±10% up to 4xIn ±20% from 4xIn	Yes	t = k	–
		Electronic setting: I_5 = OFF, 3...9xI_1 step 0.1I_1 Tolerance: ±10%	Electronic setting: t_5 =1...4s step 0.5 Tolerance: ±10% up to 4xIn ±20% from 4xIn	Yes	t = k	–
I	Against short-circuits threshold with adjustable threshold and istantaneous trip time	Manual setting: I_3 = 6-8-11-13xIn Tolerance: ±10%	≤40ms	–	t = k	–
		Electronic setting: I_3 = 1...13xIn Tolerance: ±10%	≤40ms	–	t = k	–
U	Aganist phase current unbalanced or loss of phase with tripping at indipendent time (IEC 60947-4-1)	Manual setting: I_6 = On / Off When ON, I_6 = 50% I_1 Tolerance: ±15%	Manual setting: t_6 = 2s Tolerance: ±20%	Yes	t = k	–
		Electronic setting: I_6 = On / Off When ON, I_6 = 10%..50% I_1 step 10% I_1 Tolerance: ±15%	Electronic setting: t_6 = 0...5s step 0.5 Tolerance: ±20%	Yes	t = k	–
G	Against earth fault with indipendent time delay trip[2]	Electronic setting: I_4 = 0.2...1xIn step 0.1In Tolerance: ±10%	Electronic setting: t_4 = 0.1...0.8s step 0.01 Tolerance: ±15%	Yes	t = k	–

[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

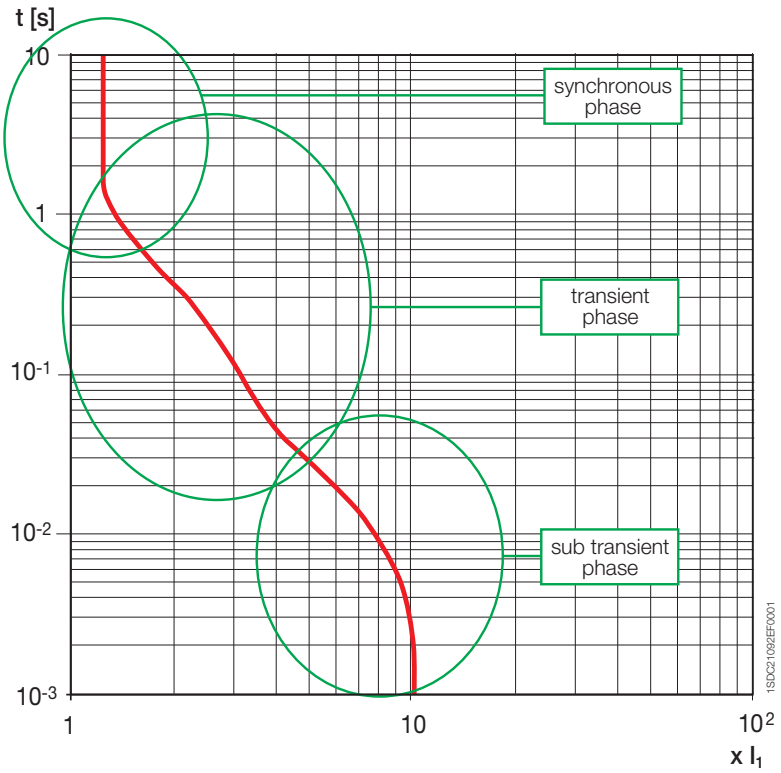
Protection	Trip threshold	Trip time
L	release between 1.05 and 1.2 x I_1	±20%
R	±20%	±20%
I	±20%	≤60ms
U	±20%	±20%
G	±15%	±20%

[2] Protection G is inhibited for currents higher than 2 In.

Circuit-breakers for generator protection

Main characteristics

SACE Tmax XT circuit-breakers can be equipped with thermomagnetic trip units with a low magnetic threshold.
This type of release can been designed and made so as to provide a solution for protecting small generators and distribution networks with very long cables (slight end of line fault current owing to the high cable impedance).
Generator protection requires a low magnetic threshold, typically about three times circuit-breaker's rated current, so as to "cut" the short-circuit current in the "transient" zone of the decrement curve of the generator fault current. Consult the "Electrical installation handbook" ABB SACE guide vol. 2 for further details.



Characteristics of circuit-breakers for protecting generators

			XT2		XT3		XT4	
Size(G2.1)		[A]	160		250		160/250	
Poles		[Nr.]	3, 4		3, 4		3, 4	
Rated service voltage, **Ue**(G2.4)	(AC) 50-60Hz	[V]	690		690		690	
	(DC)	[V]	500		500		500	
Rated insulation voltage, **Ui**(G2.5)		[V]	1000		800		1000	
Rated impulse withstand voltage, **Uimp**(G2.6)		[kV]	8		8		8	
Versions			Fixed, Withdrawable, Plug-in		Fixed, Plug-in		Fixed, Withdrawable, Plug-in	
Breaking capacities			**N**	**S**	**N**	**S**	**N**	**S**
Trip units			Thermomagnetic, Electronic		Thermomagnetic		Electronic	
TMG			■		■			
Ekip G-LS/I			▲ In = 10A, 25A, 63A, 100A, 160A				▲ In = 40A, 63A, 100A, 160A, 250A	
Interchangeability			■				■	

■ Complete circuit-breaker
▲ Loose trip unit

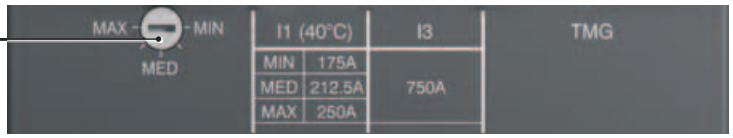
TMG

Main characteristics:

- available for XT2 and XT3 in the three-pole and four-pole versions;
- protections:
  - against overloads (L): adjustable 0.7...1xIn protection threshold, with inverse long-time trip curve;
  - against instantaneous short-circuits (I): fixed 3xIn protection threshold, with instantaneous trip curve;
  - 100% neutral protection in four-pole circuit-breakers;
- the thermal protection setting is made by turning the relative cursor on the front of the release.

Example with XT3 250A

Rotary switch for thermal protection setting



XT2

TMG

L	In [A]	16(1)	20(1)	25(1)	32(1)	40(1)	50(1)	63(1)	80	100	125	160
	Neutral [A] - 100%	16	20	25	32	40	50	63	80	100	125	160
I_1 = 0.7...1xIn												
I	I_3 [A]	160	160	160	160	200	200	200	240	300	375	480
	Neutral [A] - 100%	160	160	160	160	200	200	200	240	300	375	480
I_3 = 3xIn												

(1) Available only as complete circuit-breaker

XT3

TMG

L	In [A]	63	80	100	125	160	200	250
	Neutral [A] - 100%	63	80	100	125	160	200	250
I_1 = 0.7...1xIn								
I	I_3 [A]	400	400	400	400	480	600	750
	Neutral [A] - 100%	400	400	400	400	480	600	750
I_3 = 3xIn								

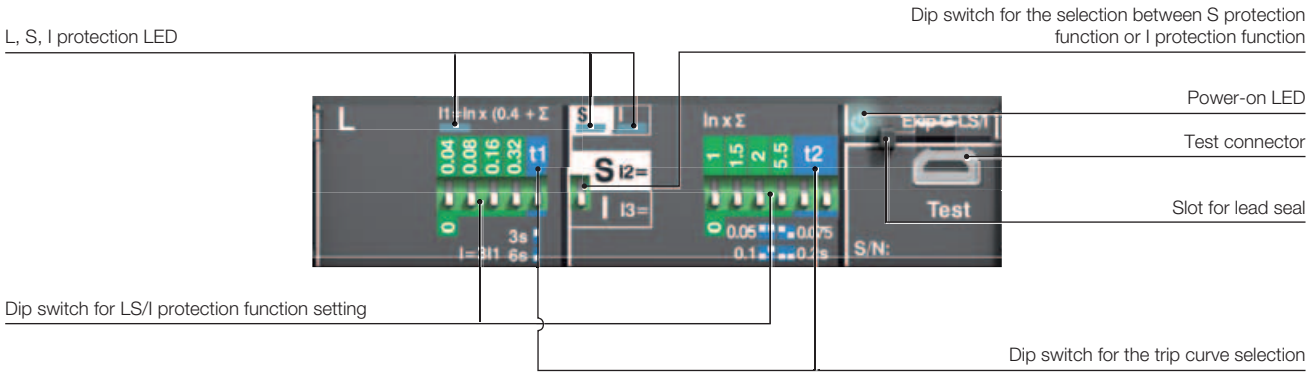
Ekip G-LS/I

Main characteristics:

- available for XT2 and XT4 in the three-pole and four-pole versions. Allows the protection against overloads to be extensively adjusted;
- protections:
  - against overloads (L): I_1=0.4...1xIn adjustable protection threshold, with inverse long-time trip curve;
  - against delayed short-circuits (S): 1...10xIn adjustable protection threshold, with adjustable trip curve (as an alternative to I protection);
  - against instantaneous short-circuits (I): 1...10xIn adjustable protection threshold, with instantaneous operating time (as an alternative to S protection);
  - neutral, in four-pole circuit-breakers, can be set in the OFF, ON positions at 50% or 100% of the phases;
- manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off;
- LED:
  - LED on with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.2xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding setted threshold;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - LS/I: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - Ekip G-LS/I is equipped with a trip coil disconnection detection device that detects whether the opening solenoid has disconnected. Signalling is made by all the LEDs flashing simultaneously;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit, which allows trip test, LED test and signalling about the latest trip happened;
  - for connecting the Ekip T&P unit which allows the measurements to be read and the trip test to be carried out;
- thermal memory which can be activated by Ekip T&P;
- self-supply from 0.2xIn up.

Circuit-breakers for generator protection

Main characteristics



Ekip G-LS/I

Protection function	Trip threshold	Trip curve[1]	Excludability	Relation	Thermal memory
L — Against overloads with inverse long-time delayed tripping according to IEC 60947-2 standard	Manual setting: I_1 = 0.4...1xIn step 0.04 Tolerance: trip between 1.05…1.3xI_1 (IEC 60947-2)	Manual setting: t_1 = 3-6s at I = 3xI_1 Tolerance: ±10% up to 4xIn ±15% from 4xIn	–	$t = k/I^2$	Yes
S — Against short-circuit with indipendent time delay trip	Manual setting: I_2 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10% up to 2xIn ±20% from 2xIn	t_2 = 0.05-0.075-0.1-0.2s Tolerance: ±10% t_2>0.075 ±20% t_2≤0.075	Yes	t = k	–
I — Against short-circuits with adjustable threshold and istantaneous trip time	Manual setting: I_3 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	≤20ms	Yes	t = k	–

(1) Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

Protection	Trip threshold	Trip time
L	release between 1.05 and 1.3 x I_1	±20%
S	±10%	±20%
I	±15%	≤60ms

Circuit-breakers for oversized neutral protection

Main characteristics

The SACE Tmax XT range of circuit-breakers with oversized neutral is used in certain applications where harmonics or unbalance loads or single phase create an overload on the neutral conductor. Under these conditions, a current of a considerable value could travel along the neutral conductor. In particular, third-order harmonics and relative multiples add together on the neutral and give rise to a current value that could be higher than the one which travels along the phase conductors.
For this reason, circuit-breakers with oversized neutral provide adequate protection in installations where the neutral conductor is sized with a larger section than the phase conductors.
The main types of equipment that generate harmonics are given below by way of example:

- personal computers;
- fluorescent lamps;
- static converters;
- no-break power units;
- variable speed drives;
- welding machines.

By and large, the wave shape is distorted owing to the presence of semiconductor devices able to conduct for a fraction of the entire cycle, creating discontinuous trends and consequently introducing numerous harmonics.
Consult the “Electrical installation handbook” ABB SACE guide vol. 2 for further details.

Characteristics of circuit-breakers for oversized neutral protection

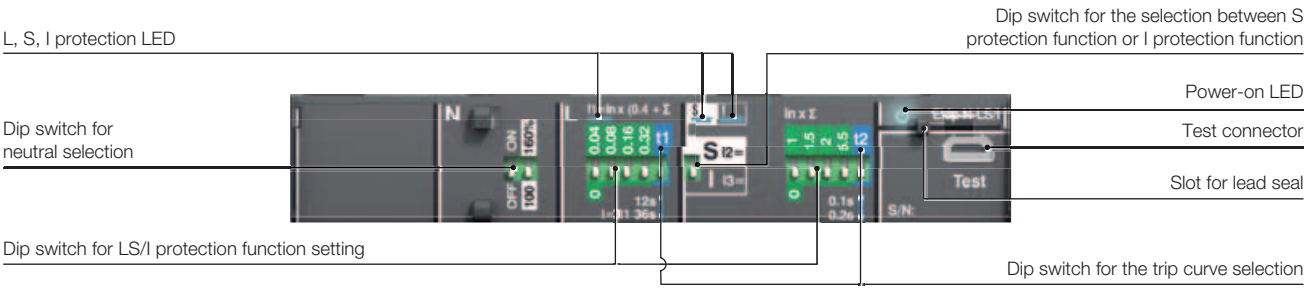
			XT2					XT4				
Size(G2.1)		[A]	160					160/250				
Uninterrupted nominal current, **In**		[A]	10, 63, 100					40, 63, 100, 160				
Poles		[Nr.]	4					4				
Rated service voltage, **Ue**(G2.4)	(AC) 50-60Hz	[V]	690					690				
Rated insulation voltage, **Ui**(G2.5)		[V]	1000					1000				
Rated impulse withstand voltage, **Uimp**(G2.6)		[kV]	8					8				
Versions			Fixed, Withdrawable, Plug-in					Fixed, Withdrawable, Plug-in				
Breaking capacity			**N**	**S**	**H**	**L**	**V**	**N**	**S**	**H**	**L**	**V**
Trip units			Electronic					Electronic				
Ekip N-LS/I			▲					▲				
Interchangeability			■					■				

■ Complete circuit-breaker
▲ Loose trip unit

Ekip N-LS/I

Main characteristics:

- available for XT2 and XT4 in the four-pole version;
- protections:
  - against overload (L): I_1=0.4...1xIn adjustable protection threshold, with inverse long-time trip curve;
  - against delayed short-circuits (S): 1...10xIn adjustable protection threshold, with adjustable trip curve (as an alternative to I protection);
  - against instantaneous short-circuit (I): 1...10xIn adjustable protection threshold, with instantaneous operating time (as an alternative to S protection);
  - neutral can be set in the OFF or ON positions, at 100% or at 160% of the phases;
- manual setting using the relative dip-switches on the front of the trip unit, which allow the settings to be made even when the trip unit is off;
- LED:
  - LED on with steady green light indicating that the trip unit is supplied correctly. The LED comes on when the current exceeds 0.32xIn;
  - red LED for each protection:
    - L: LED with steady red light, indicates pre-alarm for current exceeding 0.9xI_1;
    - L: LED with flashing red light, indicates alarm for current exceeding setted threshold;
    - LS/I: LED with steady red light, shows that the protection has tripped. After the circuit-breaker has opened, connect the Ekip TT or Ekip T&P accessory to find out which protection function tripped the trip unit;
  - Ekip N-LS/I is equipped with a device that detects whether the opening solenoid has disconnected. Signalling is made by all the LEDs flashing simultaneously;
- test connector on the front of the release:
  - to connect the Ekip TT trip test unit which allows trip test, LED test and signalling about the latest trip happened;
  - for connecting the Ekip T&P unit, which allows the measurements to be read and the trip test to be carried out;
- thermal memory which can be activated by Ekip T&P;
- self-supply from 0.32xIn.



Ekip N-LS/I

Protection function		Trip threshold	Time-current curve[1]	Excludability	Relation	Thermal memory
L	Against overloads with inverse long-time delayed tripping. According to IEC 60947-2 Standard	Manual setting: I_1 = 0.4...1xIn step 0.04 Tolerance: trip between 1.05…1.3xI_1 (IEC 60947-2)	Manual setting: t_1 = 12-36s at I= 3xI_1 Tolerance: ±10% up to 4xIn ±15% from 4xIn	–	t = k/I^2	Yes
S	Against short-circuits with inverse short indipendent time delay trip (t=k)	Manual setting: I_2 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	t_2 = 0.1-0.2s Tolerance: ±15%	Yes	t = k	–
I	Against short-circuits with istantaneous trip time	Manual setting: I_3 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10xIn Tolerance: ±10%	≤20ms	Yes	t = k	–

[1] Tollerances in case of:
– self-powered trip unit at full power;
– 2 or 3 phase power supply.
In conditions other than those considered, the following tollerance hold:

Protection	Trip threshold	Trip time
L	release between 1.05 and 1.3 x I_1	±20%
S	±10%	±20%
I	±15%	≤60ms