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SACE Tmax. T Generation
Low voltage moulded-case circuit-breakers up to 1600 A

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A single family of moulded-case circuit-breakers up to 3200 A

Certifications and Shipping Registers

The moulded-case circuit-breakers and their accessories comply with IEC60947-2 international standards and conform to EC directive “Low Voltage Directives (LVD) N° 73/23 EEC” and “Electromagnetic Compatibilities Directives (EMC) N° 89/ 336 EEC”.

Certification of conformity with the product Standards is carried out in the ABB SACE tests laboratory (accredited by SINAL) in respect of the EN 45011 European Standard, by the Italian certification body ACAE (Association for Certification of Electrical Apparatus), member of the European LOVAG organisation (Low Voltage Agreement Group) and by the Swedish certification body SEMKO belonging to the international IECEE organisation.

The SACE Tmax XT series has a hologram on the front, obtained using special anti-forgery techniques,a guarantee of the quality and genuineness of the circuit-breaker as an ABB SACE product.

There is also an entire range of moulded-case circuit-breakers conforming to UL/CSA standards, with rated current values ranging from 1 to 3000A and breaking capacities, at 600V AC, that can reach 100kA.

All the equipment also conforms to the specifications for installations on board and to those of RINA, DNV, BV, ABS, GL, LRs, PRS, RMRS, NKK type-approvals.

Corporate Quality System

The ABB SACE Quality System conforms with the following Standards:

- ISO 9001 international Standard;
- EN ISO 9001 (equivalent) European Standards;
- UNI EN ISO 9001 (equivalent) Italian Standards;
- IRIS International Railway Industry Standard

The ABB SACE Quality System attained its first certification with the RINA certification body in 1990.

Tmax - Moulded - Case Circuit - Breakers (MCCB)

A single family of moulded-case circuit-breakers up to 3200 A

Tmax moulded-case circuit-breakers guarantee an extremely high performance level while being progressively smaller in size, simple to install and able to provide increasingly better safety guarantees for the operator.
In addition to being ideal for the secondary distribution of alternmate and direct current, they feature dedicated solutions for all application requirements.

Moulded-case circuit-breakers can be used in low voltage civil and industrial installations with 1 to 3200 A operating current. The Tmax family includes 9 circuit-breaker sizes in three- or four-pole versions:
- XT1, XT2, XT3 and XT4 up to 250A;
- T4, T5 and T6 up to 1000A;
- T7 and T8 up to 3200A.

Tmax circuit-breakers can be equipped with thermomagnetic, solely magnetic or electronic trip units;, all of which are interchangeable.
Since assembly instructions are simple, trip units can quickly and easily be replaced; even in the field.

The ultimate short-circuit breaking capacity (Icu) at 415V ranges from 18kA to 200kA, or up to 100kA for 690V.

The following ranges are available:
- Circuit-breakers for AC and DC power distribution;
- Circuit-breakers for zone selectivity;
- Circuit-breakers for motor protection;
- Circuit-breakers for up to 1150V AC and 1000V DC applications;
- Switch-disconnectors.

All Tmax circuit breakers can be enhanced with a vast range of standardized accessories. This convenience not only cuts down on inventory, but creates an extremely flexible and easily managed solution.

All this makes the circuit-breakers very easy to operate with considerable savings due to rationalized stock management.

Accessories


Direct handle

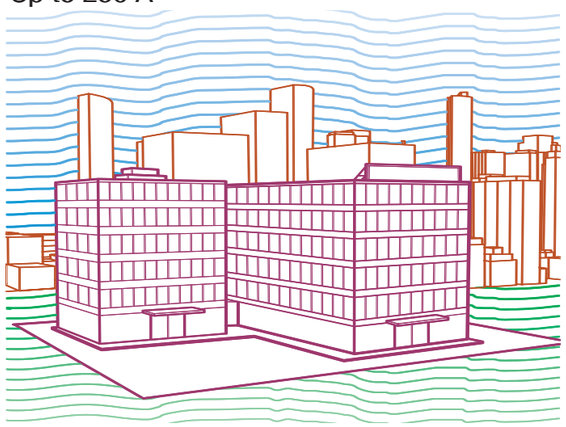

Transmitted handle


MOE - Motor operator


UVR uncabled

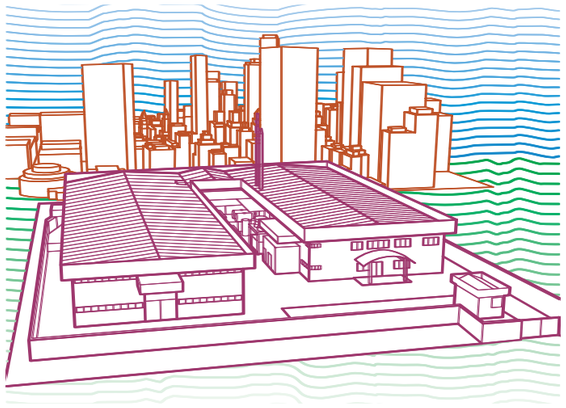
A single family of moulded-case circuit-breakers up to 3200 A
Construction characteristics

Up to 250 A



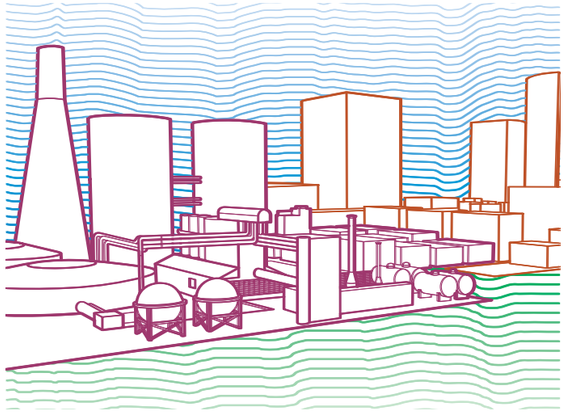
SACE Tmax		XT1					XT2					XT3		XT4				
Size	[A]	160					160					250		160/250				
Rated service voltage, Ue	(AC) 50-60Hz [V]	690					690					690		690				
	DC [V]	500					500					500		500 [4]				
Versions		Fixed, Plug-in [1]					Fixed, Plug-in, Withdrawable					Fixed, Plug-in		Fixed, Plug-in, Withdrawable				
Breaking capacity according to IEC 60947-2		B	C	N	S	H	N	S	H	L	V	N	S	N	S	L	H	V
Rated ultimate short-circuit breaking capacity, Icu																		
Icu @ 220-230-240V 50-60Hz (AC)	[kA]	25	40	65	85	100	65	85	100	150	200	50	85	65	85	100	150	200
Icu @ 415V 50-60Hz (AC)	[kA]	18	25	36	50	70	36	50	70	120	150	36	50	36	50	70	120	150
Icu @ 690V 50-60Hz (AC)	[kA]	3	4	6	8	10	10	12	15	18	20	5	6	10	12	15	20	25/100 [2]
(DC) 500V - 2 poles in series	[kA]	-	-	-	-	-	-	-	-	-	-	-	-	36	50	70	85	100
(DC) 500V - 3 poles in series	[kA]	18 [3]	25 [3]	36 [3]	50 [3]	70 [3]	36	50	70	85	100	36	50	36	50	70	85	100
(DC) 750V - 3 poles in series	[kA]	-	-	-	-	-	-	-	-	-	-	-	-	[4]	[4]	[4]	[4]	[4]
Rated service short-circuit breaking capacity, Ics																		
Ics @ 220-230-240V 50-60Hz (AC)	[kA]	100%	100%	75%(50)	75%	75%	100%	100%	100%	100%	100%	75%	50%	100%	100%	100%	100%	100%
Ics @ 415V 50-60Hz (AC)	[kA]	100%	100%	100%	75%	50% (37,5)	100%	100%	100%	100%	100%	75%	50% (27)	100%	100%	100%	100%	100%
Ics @ 690V 50-60Hz (AC)	[kA]	100%	100%	100%	75%	50%	100%	100%	100%	75% (15)	75% (15)	75%	50%	100%	100%	100%	100%	75% (20)
Mechanical life	[N° Operations]	25000					25000					25000		25000				
	[N° Hourly opertions]	240					240					240		240				
Electrical life @ 415V (AC)	[N° Operations]	8000					8000					8000		8000				
	[N° Hourly opertions]	120					120					120		120				
Dimensions	3 poles [mm]	76,2x70x130					90x82,5x130					105x70x150		105x82,5x160				
(Width/Depth/Height)	4 poles [mm]	101,6x70x130					120x82,5x130					140x70x150		140x82,5x160				

Up to 1000 A



SACE Tmax		T4					T5					T6				
Size	[A]	320					400/630					630/800/1000				
Rated service voltage, Ue	(AC) 50-60Hz [V]	690					690					690				
	(DC) [V]	750					750					750				
Versions		Fixed, Plug-in, Withdrawable					Fixed, Plug-in, Withdrawable					Fixed, Withdrawable [5]				
Breaking capacity according to IEC 60947-2		N	S	H	L	V	N	S	H	L	V	N	S	H	L	V [6]
Rated ultimate short-circuit breaking capacity, Icu																
Icu @ 220-230-240V 50-60Hz (AC)	[kA]	70	85	100	200	200	70	85	100	200	200	70	85	100	200	200
Icu @ 415V 50-60Hz (AC)	[kA]	36	50	70	120	200	36	50	70	120	200	36	50	70	100	150
Icu @ 690V 50-60Hz (AC)	[kA]	20	25	40	70	80	20	25	40	70	80	20	22	25	30	40
(DC) 500V - 2 poles in series	[kA]	25	36	50	70	100	25	36	50	70	100	20	35	50	65	70
(DC) 500V - 3 poles in series	[kA]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	-
(DC) 750V - 3 poles in series		16	25	36	50	70	16	25	36	50	70	16	20	36	50	50
Rated service short-circuit breaking capacity, Ics																
Ics @ 220-230-240V 50-60Hz (AC)	[kA]	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	100%
Ics @ 415V 50-60Hz (AC)	[kA]	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%	75%
Ics @ 690V 50-60Hz (AC)	[kA]	100%	100%	100%	100%	100%	100%	100%	100% [7]	100% [8]	100% [8]	75%	75%	75%	75%	75%
Mechanical life	[N° Operations]	20000					20000					20000				
	[N° Hourly opertions]	240					120					120				
Electrical life @ 415V (AC)	[N° Operations]	6000					7000 (400 A) - 5000 (630 A)					7000 (630A) - 5000 (800A) - 4000 (1000A)				
	[N° Hourly opertions]	120					60					60				
Dimensions	3 poles [mm]	105 x 103.5 x 205					140 x 103.5 x 205					210 x 103.5 x 268				
(Width/Depth/Height)	4 poles [mm]	140 x 103.5 x 205					186 x 103.5 x 205					280 x 103.5 x 268				

Up to 3200 A



SACE Tmax		T7					T8	
Size	[A]	800/1000/1250/1600					2000/2500/3200	
Rated service voltage, Ue	(AC) 50-60Hz [V]	690					690	
	(DC) [V]	-					–	
Versions		Fixed, Withdrawable					Fixed	
Breaking capacity according to IEC 60947-2		S	H	L	V [9]	X [10]	L	V
Rated ultimate short-circuit breaking capacity, Icu								
Icu @ 220-230-240V 50-60Hz (AC)	[kA]	85	100	200	200	170	85	130
Icu @ 415V 50-60Hz (AC)	[kA]	50	70	120	150	170	85	130
Icu @ 690V 50-60Hz (AC)	[kA]	30	42	50	60	75	50	80
(DC) 500V - 2 poles in series	[kA]	–	–	–	–	–	–	–
(DC) 500V - 3 poles in series	[kA]	–	–	–	–	–	–	–
(DC) 750V - 3 poles in series		–	–	–	–	–	–	–
Rated service short-circuit breaking capacity, Ics								
Ics @ 220-230-240V 50-60Hz (AC)	[kA]	100%	100%	100%	100%	100%	100%	75%
Ics @ 415V 50-60Hz (AC)	[kA]	100%	100%	100%	100%	100%	100%	75%
Ics @ 690V 50-60Hz (AC)	[kA]	100%	75%	75%	75%	100%	100%	75%
Mechanical life	[N° Operations]	10000					15000	
	[N° Hourly opertions]	60					60	
Electrical life @ 415V (AC)	[N° Operations]	2000 (versioni S, H, L) / 3000 (versione V)					4500(2000A);4000 (2500A);3000 (3200A)	
	[N° Hourly opertions]	60					20	
Dimensions	3 poles [mm]	210 x 154 (leva) /178 (motorizzabile) x 268					427 x 282 x 382	
(Width/Depth/Height)	4 poles [mm]	280 x 154 (leva) /178 (motorizzabile) x 268					553 x 282 x 382	

[1] XT1 plug-in In max=125A
[2] 25kA@690V available for XT4 250; 100kA@690V available for XT4 160
[3] XT1 500V DC 4 poles in series
[4] XT4 750V DC ask ABB SACE whether available
[5] Withdrawable not available for T6 1000A
[6] V version only available for frame 630A/800A
[7] 75% for T5 630
[8] 50% for T5 630
[9] Only for T7 800/1000/1250
[10] Only for T7 800

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.

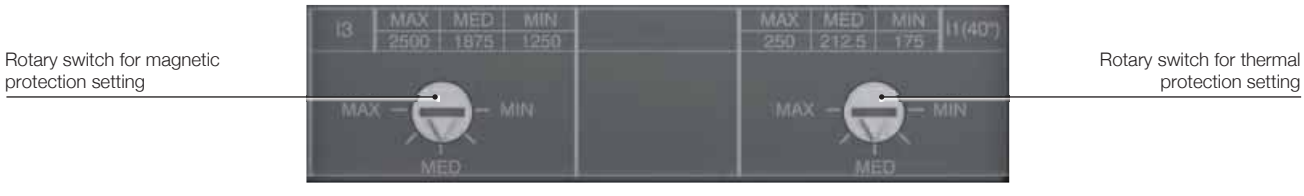
Example with XT3 250A

TMD/TMA

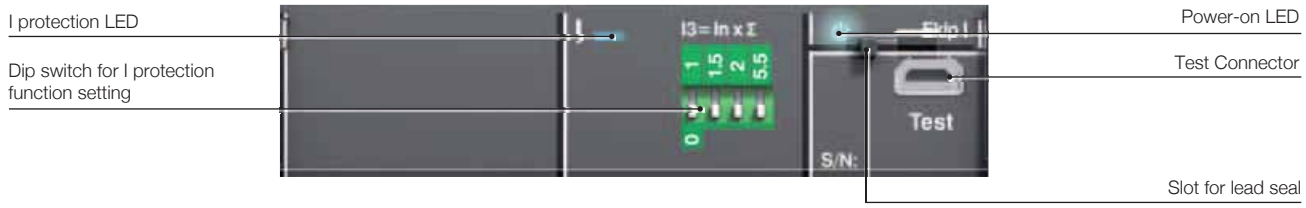
Main characteristics:

- 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



Ekip I

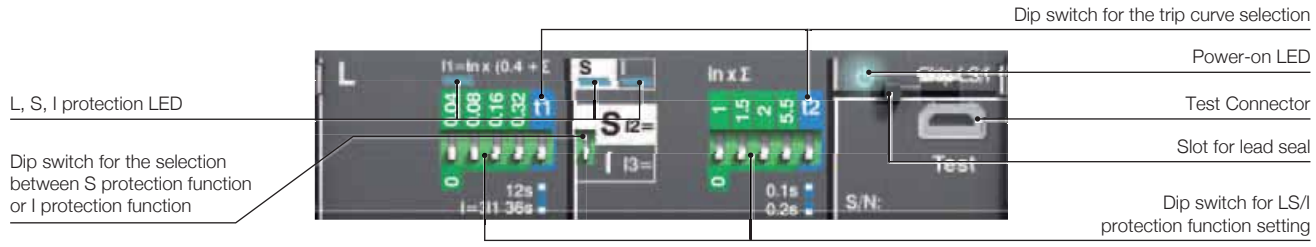


Ekip I

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



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

Circuit-breakers for power distribution

Electronic trip units

The Tmax T2, T4, T5, T6 and T7 circuit-breakers, for use in alternating current, can be equipped with overcurrent releases constructed using electronic technology. This allows protection functions to be obtained which guarantee high reliability, tripping precision and insensitivity to temperature and to the electromagnetic components in conformity with the standards on the matter.

The power supply needed for correct operation is supplied directly by the current sensors of the release, and tripping is always guaranteed, even under single-phase load conditions and in correspondence with the minimum setting.

Basic protection functions

(L) Protection against overload
This protection function trips when there is an overload with inverse long-time delay trip according to the IEC 60947-2 Standard ($I^2t=k$). The protection cannot be excluded.

(S) Protection against short-circuit with time delay
This protection function trips when there is a short-circuit, with long inverse time-delay trip ($I^2t=k$ ON) or a constant trip time ($I^2t=k$ OFF). The protection can be excluded.

(I) Instantaneous protection against short-circuit
This protection function trips instantaneously in case of a short-circuit. The protection can be excluded.

(G) Protection against earth fault
The protection against earth fault trips when the vectorial sum of the currents passing through the current sensors exceeds the set threshold value, with long inverse time-delay trip ($I^2t=k$ ON) or a constant trip time ($I^2t=k$ OFF). The protection can be excluded.

Advanced protection functions

The PR332/P trip unit makes it possible to carry out highly developed protection against the most varied types of fault.

In fact, it adds the following advanced protection functions to the basic protection functions.

(L) Protection against overload (IEC 60255-3)
This protection trips in case of an overload with inverse long-time delay according to IEC 60255-3 Standard, for the coordination with fuses and MV protections. The protection can be excluded.

IEC 60255-3

(U) Protection against unbalanced phase
The protection function against unbalanced phase U can be used in those cases where a particularly precise control is needed regarding missing and/or unbalance of the phase currents. The trip time is instantaneous. The protection can be excluded.

(OT) Protection against overtemperature
The protection against overtemperature trips instantaneously when the temperature inside the trip unit exceeds 85 °C, in order to prevent any temporary or continual malfunction of the microprocessor. The protection cannot be excluded.

(Rc) Protection against residual current [1]
This integrated protection is based on current measurements made by an external toroid and is alternative to protection against earth fault G. The protection can be excluded.

(ZS) Zone selectivity [2]
ZS zone selectivity is an advanced method for carrying out coordination of the protections in order to reduce the trip times of the protection closest to the fault in relation to the time foreseen by time selectivity. Zone selectivity can be applied to the protection functions S and G, with constant time-delay trip. The protection can be excluded.

(UV, OV, RV) Protections against voltage
The three protections trip with a constant time-delay in the case of undervoltage, overvoltage and residual voltage respectively. The latter allows to detect interruptions of the neutral (or of the earthing conductor in systems with earthed neutral) and faults which cause movement of the star centre in systems with isolated neutral (e.g. large earth faults) to be identified. Movement of the star centre is calculated by vectorially summing the phase voltages. The protections can be excluded.

(RP) Protection against reversal of power
The protection against reversal power causes tripping of the breaker, with constant time-delay trip, when the flow of power reverses sign and exceeds, as an absolute value, the set threshold. It is particularly suitable for protection of large machines such as generators. The protection can be excluded.

(UF, OF) Protections of frequency
The two protections detect the variation in network frequency above or below the adjustable thresholds, opening the circuit-breaker, with constant time-delay trip. The protection can be excluded.

[1] It is not suitable for human protection.
[2] For further information about zone selectivity, please see the section: “Circuit-breakers for zone selectivity”.

Electronic trip units for power distribution

SACE PR221DS

	PR221DS	PR221DS	PR221GP
Protection functions	L S / I	I	L S I

SACE PR231/P

	PR231/P	PR231/P
Protection functions	L S / I	I

SACE PR331/P

	PR331/P
Protection functions	L S I G

SACE PR332/P

	PR332/P	PR332/P	PR332/P	PR332/P
Protection functions	L I	L S I	L S I G(1)	L S I Rc
Advanced protection function(*)	L(**) U OT	L(**) U OT	L(**) U OT	L(**) U OT
Opt.(**)	UV OV RV RP UF OF	UV OV RV RP UF OF	UV OV RV RP UF OF	UV OV RV RP UF OF

(1) In alternative to Rc (with external toroid).
(*) For all versions.
(**) Available with PR330/V. Measurement module.
(***) According to IEC 60255-3.

PR221DS

The PR221DS trip unit, available for T2, T4, T5 and T6, provides protection functions against overload L and short-circuit S/I (version PR221DS-LS/I): with this version, by moving the dedicated dip-switch, you can choose whether to have inverse time-delay S or instantaneous I protection against short-circuit. Alternatively, the version with only the protection function against instantaneous short-circuit I is available (version PR221DS-I, also see page 2/40 and following).
There is a single adjustment for the phases and the neutral. However, for the neutral it can be decided whether to request the protection threshold of the functions at 50 - 100% of that of the phases for Tmax T2 In = 160 A (T2 In<160 A, N = 100%), whereas for T4, T5 and T6 it is possible to select the protection threshold OFF, 50% or 100% directly from the front of the trip unit by means of the specific dip switch.
The trip coil is always supplied with the PR221DS trip unit for Tmax T2 and is housed in the right-hand slot of the circuit-breaker. Dedicated auxiliary contacts are available for T2 with electronic trip unit (see page 3/24).
For Tmax T4, T5 and T6, the opening solenoid is housed internally and therefore, by not using the right-hand slot of the circuit-breaker, all the auxiliary contacts available can be used.

PR221DS-LS/I

Protection functions and parameterisations

Protection functions [1]		Trip threshold	Trip curves	Excludability	Relation t=f(I)
L	Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve ($I^2t=k$) according to IEC 60947-2 Standard	I_1 = 0.40 - 1 x In step = 0.04 x In Trip between 1.1...1.30 x I_1 (T4,T5,T6) Trip between 1.05...1.30 x I_1 (T2)	at 6 x I_1 t_1 = 3-6 **(only for T2)** 12s **(only for T4,T5,T6)** Tolerance: ± 10% up to 6 x In (T4,T5,T6) ± 10% up to 2 x In (T2) ± 20% above 6 x In (T4,T5,T6) ± 20% above 2 x In (T2)	–	$t = k/I^2$
S	Against short-circuit with inverse short time delay trip and trip characteristic with inverse time ($I^2t=k$) (selectable as an alternative to protection function I)	I_2 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10 x In[2] Tolerance: ± 10% (T4,T5,T6) ± 10% up to 2 x In (T2) ± 20% above 2 x In (T2)	at 8 x In t_2 = 0.1 - 0.25s Tolerance: ± 10% up to 6 x In (T4,T5,T6) ± 20% above 6 x In (T4,T5,T6) ± 20% (T2)	■	$t = k/I^2$
I	Against short-circuit with instantaneous trip (selectable as an alternative to protection function S)	I_3 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10 x In[2] Tolerance: ± 10% (T4,T5,T6) ± 20% (T2)	instantaneous	■	t = k

[1] These tolerances hold in the following conditions:
– self-powered trip unit at full power (without start-up)
– two or three-phase power supply
In conditions other than those considered, the following tollerances hold:

	Trip threshold	Trip time
S	± 20%	± 20%
I	± 20%	≤ 40ms

[2] For T4 In = 320 A. T5 In = 630 A and T6 In = 1000 A ⇒ I_2max = 9.5 x In, I_3max = 9.5 x In.
The setting at 10 x In corresponds to 9.5 x In.

PR231/P

The PR231/P trip unit is the basic trip unit for Tmax T7. It provides protection functions against overload L and short-circuit S/I (version PR231/P-LS/I): with this version, by moving the dedicated dip-switch, you can choose whether to have protection S or protection I. Alternatively the version with only the protection function against instantaneous short-circuit I is available (version PR231/P-I see also page 2/45 and following).
Setting the trip parameters of the PR231/P trip unit is made directly on the front of the circuit-breaker by means of dip switches, and there is only one for the phases and the neutral, so it is possible to set the protection threshold, at 50% or at 100% of the phase protection.
To guarantee protection of the installation by means of the PR231/P protection trip unit, it is necessary to select the rated network frequency (50/60 Hz), by means of the special dip-switch.
Interchangeability of PR231/P can be requested by means of the dedicated ordering code 1SDA063140R1.

Protection functions and parameterisations

Protection function		Trip threshold	Trip curves (1)	Excludability	Relation t=f(I)
L	Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve (I^2t=k) according to IEC 60947-2 Standard	I_1 = 0.40...1 x In step = 0.04 x In Trip between 1.1...1.3 x I_1	at 6 x I_1 at 6 x I_1 t_1 = 3 - 12s Tolerance: ±10%	–	$t = k/I^2$
S	Against short-circuit with long inverse time delay trip and trip characteristic with inverse time (I^2t= k) (selectable as an alternative to protection function I)	I_2 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10 x In Tolerance: ±10%	at 10 x In at 10 x In t_2 = 0.1 - 0.25s Tolerance: ±10%	■	$t = k/I^2$
I	Against short-circuit with istantaneous trip (selectable as an alternative to protection function S)	I_3 = 1-1.5-2-2.5-3-3.5-4.5-5.5-6.5-7-7.5-8-8.5-9-10 x In Tolerance: ±10%	instantaneous	–	t = k

(1) These tolerances hold in the following conditions:
– self-powered trip unit at full power
– two or three-phase power supply
In conditions other than those considered, the following tollerances hold:

	Trip threshold	Trip time
S	± 10%	± 20%
I	± 15%	≤ 60ms

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