



# Circuit breakers for power distribution

## Electrical characteristics

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			T1 1P	T1	T2	T3
Frame size	[A]		100	100	100	225
Numbers of poles	Nr		1	3-4	3-4	3-4
Rated voltage	(AC) 50-60Hz [V]		277	600Y/347	480	600Y/347
	(DC) [V]			500		500
Test voltage (1min) 50-60 Hz	[V]		3000	3000	3000	3000
Interrupting ratings	[kA rms]		<b>B</b>	<b>N</b>	<b>S</b> <b>H</b>	<b>N</b> <b>S</b>
	240 V AC [kA rms]			50 <sup>(2)</sup>	65 150	50 65
	277 V AC [kA rms]		18 <sup>(1)</sup>			
	480 V AC [kA rms]			22 <sup>(2)</sup>	35 65	25 35
	600Y/347 V AC [kA rms]		14 <sup>(1)</sup>	10		10 10
	600 V AC [kA rms]					
	250 V DC (2 poles in series) [kA rms]			25		25 35
	500 V DC (3 poles in series) [kA rms]			25		25 35
	500 V DC (2 poles in series) [kA rms]					
	600 V DC (3 poles in series) [kA rms]					
Trip units	Thermomagnetic		■	■	■	■
	Electronic				■	
Dimensions fixed version (3p)	H [in-mm]		5.12-130	5.12-130	5.12-130	5.9-150
	W [in-mm]		1-25.4	3-76	3.54-90	4.13-105
	D [in-mm]		2.76-70	2.76-70	2.76-70	2.76-70
Mechanical life	[operations]		25000	25000	25000	25000
Weights (fixed 3p)	[lbs]		1.06	2.34	2.86	5.45

Note: for S6 4 poles only for N versions

<sup>(1)</sup> In 15A = 10 kA @ 277 V AC, 10 kA @ 600Y/347 V AC

<sup>(2)</sup> In 15A = 35 kA @ 240 V AC 14 kA @ 480Y/277 V AC

<sup>(3)</sup> T5 600 with electronic trip unit only

<sup>(4)</sup> 2p breakers: available only in interrupting rating



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T4					T5					S6			S7	S8
250					400-600 <sup>(3)</sup>					800			1200	1600-2000-2500
2-3-4 <sup>(4)</sup>					2-3-4 <sup>(4)</sup>					2-3-4			2-3-4	3
600					600					600			600	600
600					600					600				
3500					3500					3000			3000	3000
N	S	H	L	V	N	S	H	L	V	N	H	L	H	V
65	100	150	200	200	65	100	150	200	200	65	150	200	100	125
25	35	65	100	150	25	35	65	100	150	50	65	100	65	100
18	25	35	65	100	18	25	35	65	100	25	35	42	50	85
25	35	50	65	100	25	35	50	65	100	35	50	65		
16	25	35	50	65	16	25	35	50	65	20	35	50		
■					■					■				
■					■					■			■	■
8.07/205					8.07/205					10.55-268			16-406	15.75-400
4.13/105					5.51/140					8.27-210			8.27-210	15.98-406
4.07/103.5					4.07-103.5					4.07-103.5			5.45-138.5	9.25-235
20000					20000					20000			10000	10000
6.18					8.55					22			37.5	135



# Circuit breakers for power distribution

## General characteristics

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### General characteristics

The ABB family of molded case circuit breakers, complying with the UL 489 and CSA C22.2 No. 5.1 Standards, is divided into different sizes, with an application range from 15 to 2500 A and interrupting ratings up to 150 kA at 480 V AC.

Selection of the size allows the basic electrical characteristics to be identified simply and immediately, whereas selection of the overcurrent trip unit is made according to the type of application required.

Furthermore, for the first time ABB has also developed a molded case circuit breaker with a single-pole construction characteristic: T1B 1p. This is a 100 A frame size circuit breaker, able to operate at rated voltages up to 277 V AC.

For protection of alternating current networks, the following are available:

- Tmax T1B 1p, T1, T2, T3 and T4 (15 A, 20 A) circuit breakers, equipped with TMF thermomagnetic trip units, with fixed thermal and magnetic threshold ( $I_3 = 10 \times I_n$ );
- Tmax T4 (up to 50 A) circuit breaker equipped with TMD thermomagnetic trip units with adjustable thermal threshold ( $I_1 = 0.7 \dots 1 \times I_n$ ) and fixed magnetic threshold ( $I_3 = 10 \times I_n$ ).
- T4, T5 and Isomax S6 circuit breakers with TMA thermomagnetic trip units, with adjustable thermal threshold ( $I_1 = 0.7 \dots 1 \times I_n$ ) and adjustable magnetic threshold ( $I_3 = 5 \dots 10 \times I_n$ ).
- T2 with PR221DS electronic trip unit
- T4 and T5 with PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit
- Isomax S6, S7 and S8 with PR211/P and PR212/P electronic trip unit.

### Interchangeability

Tmax T4 and T5 circuit breakers can be equipped either with TMD or TMA thermomagnetic trip units, PR221DS,

PR222DS/P and PR222DS/PD-A electronic trip units. Thanks to their simplicity of assembly, the end customer can,

in fact, change the type of trip unit extremely rapidly, according to their own requirements and needs: in this case, correct

	Trip unit													
	TMF		TMD				TMA							
Circuit breakers														
In [A]	15	20	30	40	50	80	100	125	150	200	250	300	400	
T4 250	■	■	■	■	■	■	■	■	■	■	■			
T5 400												■	■	
T5 600														
■ = complete circuit breaker already coded														
▲ = circuit breaker to be assembled (separate codes of the circuit breaker part plus trip unit)														

**Range of application of the alternating and direct current circuit breakers**

	Trip unit	Range [A]
<b>AC</b>		
<b>T1B 1p</b>	TMF	15...100
<b>T1</b>	TMF	15...100
<b>T2</b>	TMF	15...100
	PR221DS	25...100
<b>T3</b>	TMF	60...225
<b>T4</b>	TMF/TMD/TMA	15...250
	PR221DS	100...250
	PR222DS/P	100...250
	PR222DS/PD-A	100...250
<b>T5</b>	TMA	300-400
	PR221DS	300-400-600
	PR222DS/P	300-400-600
	PR222DS/PD-A	300-400-600
<b>S6</b>	TMA	600-800
	PR211/P	400...800
	PR212/P	400...800
<b>S7</b>	PR211/P	1000-1200
	PR212/P	1000-1200
<b>S8</b>	PR212/P	1600...2500
<b>DC</b>		
<b>T1</b>	TMF	15...100
<b>T3</b>	TMF	60...225
<b>T4</b>	TMF/TMD/TMA	15...250
<b>T5</b>	TMA	300-400
<b>S6</b>	TMA	800

TMF = Fixed thermomagnetic trip unit

TMD = Thermomagnetic trip unit with adjustable thermal and fixed magnetic threshold

TMA = Thermomagnetic trip unit with adjustable thermal and adjustable magnetic threshold

ELT = Electronic trip unit

Tmax T2 and T3 offer a magnetic-only trip unit:  $I_3 = 6...12 \times I_n$ .

Finally, Tmax T1, T2, T3, T4 and T5 and Isomax S6 circuit breakers fitted with thermomagnetic trip units can also be used in direct current plants, with an application range from 15 to 800 A and a minimum operating voltage of 24 V DC.

assembly is under the customer's responsibility. Above all, this means into increased flexibility of use of the circuit breakers

with considerable savings in terms of costs thanks to better rationalisation of stock management.

PR221DS-LS/I or I						PR222DS/P-LSI or LSI G						PR222DS/PD-A-LSI or LSI G					
100	150	250	300	400	600	100	150	250	300	400	600	100	150	250	300	400	600
■	■	■				■	■	■				▲	▲	▲			
			■	■					■	■					▲	▲	
					■						■						▲



# Circuit breakers for power distribution

## Thermomagnetic trip units

### Thermomagnetic trip units

Tmax T1B 1p, T1, T2, T3, T4 and T5, and Isomax S6 circuit breakers can be fitted with thermomagnetic trip unit and are used in protection of alternating current networks or direct current networks with a range of application from 15 A to 800 A. They allow protection against overloads with a thermal device (fixed threshold for T1B 1P, T1, T2, T3, T4 up to 20 A; adjustable threshold between  $0.7 \div 1 \times I_n$  for T4, T5 and S6), made using the bimetal technique, and protection against

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### Thermomagnetic trip unit TMF, TMD and TMA

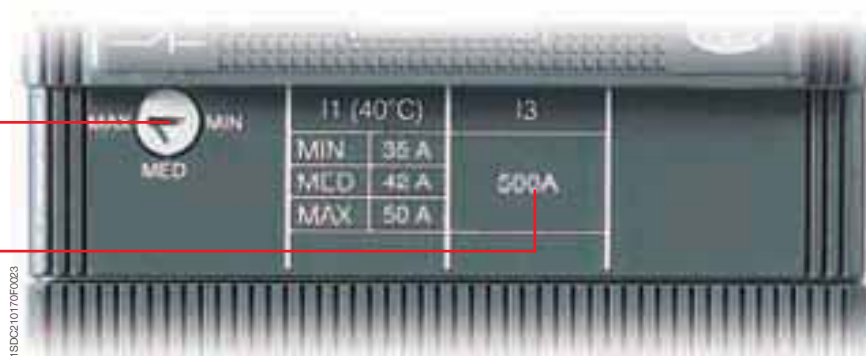
#### TMD

##### Thermal threshold

Adjustable from  $0.7$  to  $1 \times I_n$

##### Magnetic threshold

Fixed ( $I_s = 10 \times I_n$ )



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#### TMA

##### Thermal threshold

Adjustable from  $0.7$  to  $1 \times I_n$

##### Magnetic threshold

Adjustable from  $5$  to  $10 \times I_n$



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- TMF = thermomagnetic trip unit with fixed thermal threshold ( $I_1 = I_n$ ) and fixed magnetic threshold ( $I_s = 10 \times I_n$ ).
- TMD = thermomagnetic trip unit with adjustable thermal threshold ( $I_1 = 0.7 \dots 1 \times I_n$ ) and fixed magnetic threshold ( $I_s = 10 \times I_n$ ).
- TMA = thermomagnetic trip unit with adjustable thermal threshold ( $I_1 = 0.7 \dots 1 \times I_n$ ) and adjustable magnetic threshold ( $I_s = 5 \dots 10 \times I_n$ ).

short-circuit with a magnetic device (fixed threshold for T1 1P, T1, T2, T3 and T4 up to 50 A, adjustable threshold between 5÷10 x In for T4, T5 and S6; Isomax S6 can also offer a fixed magnetic threshold of 2.5 x In).

The four-pole circuit breakers are always supplied with the neutral protected by the trip unit and protection of the neutral at 100% of the phase setting.

### Thermomagnetic trip units

In [A]	15	20	25	30	35	40	50	60	70	80	90	100	125	150	175	200	225	250	300	400	600	800						
Neutral [A]	15	20	25	30	35	40	50	60	70	80	90	100	125	150	175	200	225	250	300	400	600	800						
T1 (I <sub>i</sub> =In)	■	■	■	■		■	■	■	■	■	■	■																
T2 (I <sub>i</sub> =In)	■	■	■	■	■	■	■	■	■	■	■	■																
T3 (I <sub>i</sub> =In)								■	■	■	■	■	■	■	■	■	■											
T4 (I <sub>i</sub> =In)	■	■																										
T4 (I <sub>i</sub> =0.7...1xIn)					■			■	■				■				■	■	■									
T5 400 (I <sub>i</sub> =0.7...1xIn)																						■			■			
S6 (I <sub>i</sub> =0.7...1 x In)																									■			■
T1																												
I <sub>3</sub> [A]	1000	1000	1000	1000			1000	1500	1500	1500	1500	1500	1500															
Neutral [A]	1000	1000	1000	1000			1000	1500	1500	1500	1500	1500	1500															
T2, T3																												
I <sub>3</sub> [A]	500	500	500	500	500	500	500	500	600	700	800	900	1000	1250	1500	1750	2000	2250										
Neutral [A]	500	500	500	500	500	500	500	500	600	700	800	900	1000	1250	1500	1750	2000	2250										
T4, T5, S6																												
I <sub>3</sub> [A]	500	500			500			500	500				400			500	625	750			1000			1250	1500	2000	3000	4000
											800			1000	1250	1500			2000			2500	3000	4000	6000	8000		
Neutral [A]	500	500			500			500	500				400			500	625	750			1000			1250	1500	2000	3000	4000
											800			1000	1250	1500			2000			2500	3000	4000	6000	8000		
S6																												
I <sub>3</sub> = 2.5 x In [A]																						1500	2000					



# Circuit breakers for power distribution

## Electronic trip units

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### General characteristics

Tmax T2, T4 and T5 circuit breakers for uses in alternating current can be equipped with PR221DS, the new PR222DS/P and PR222DS/PD-A electronic trip units. On the other hand, Isomax S6, S7 and S8 can be fitted with PR211/P and PR212/P. The electronic technology used to realise these trip units guarantees great reliability, trip precision and immunity to electromagnetic components in compliance with the standards on the matter. The power supply required for correct operation is supplied directly by the trip units current transformers and tripping is always guaranteed, even under single-phase load conditions and in correspondence with the minimum setting.

The protection trip units are made up of the current transformers (three or four depending on the number of conductors to be protected), the protection unit (PR221DS, PR222DS/P, PR222DS/PD-A, PR211/P or PR212/P), and of a trip coil with demagnetisation, which acts directly on the circuit breaker operating mechanism unit. It is possible to test the trip coil by means of the TT1 device. A positive test will trip the breaker.

The current transformers are housed inside the trip unit box and supply the energy required for correct operation of the protection and the signal needed to detect the current. They are available with primary rated current as indicated in the table.

Characteristics of PR221DS, PR222DS/P, PR222DS/PD-A, PR211/P, PR212/P electronic trip units	
Operating temperature	-13 °F...+158 °F (-25 °C...+70 °C)
Relative humidity	90%
Service Frequency	45...66 Hz able to measure harmonics up to 550 Hz
Electromagnetic compatibility (LF and HF)	IEC 60947-2 Annex F

## Current transformers

PR221DS	In [A]	25	60	100	150	250	300	400	600
T2		■	■	■					
T4				■	■	■			
T5 400							■	■	
T5 600									■
L	10...25	24...60	40...100	60...150	100...250	120...300	160...400	240...600	
S	25...250	60...600	100...1000	150...1500	250...2500	300...3000	400...4000	600...6000	
I	25...250	60...600	100...1000	150...1500	250...2500	300...3000	400...4000	600...6000	

PR222DS/P or PR222DS/PD-A	In [A]	100	150	250	300	400	600
T4		■	■	■			
T5 400					■	■	
T5 600							■
L	40...100	60...150	100...250	120...300	160...400	240...600	
S	60...1000	90...1500	150...2500	180...3000	240...4000	360...6000	
I	150...1200	225...1800	375...3000	450...3600	600...4800	900...7200	
G	20...100	30...150	50...250	60...300	80...400	120...600	

PR211/P	In [A]	400	600	800	1000	1200
S6		■	■	■		
S7					■	■
L	160...400	240...600	320...800	400...1000	480...1200	
I	600...4800	900...7200	1200...9600	1500...12000	1800...14400	

PR212/P	In [A]	400	600	800	1000	1200	1600	2000	2500
S6		■	■	■					
S7				■	■				
S8							■	■	■
L	160...400	240...600	320...800	400...1000	480...1200	640...1600	800...2000	1000...2500	
S	400...4000	600...6000	800...8000	1000...10000	1200...12000	1600...16000	2000...20000	2500...25000	
I	600...4800	900...7200	1200...9600	1500...12000	1800...14400	2400...19200	3000...24000	3750...30000	
G	80...400	120...600	160...800	200...1000	240...1200	320...1600	400...2000	500...2500	





## Circuit breakers for power distribution

### Electronic trip units

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#### PR221DS - Tmax T2, T4 and T5

The PR221DS trip unit, available for T2, T4 and T5, provides protection functions against overload L, and short-circuit S or I (version PR221DS-LS/I): with this version, you can choose between protection S or I simply by moving the dip-switch. Alternatively, the version with only the function of protection against instantaneous short-circuit I is available (version PR221DS-I).

The PR221DS for Tmax T2 has some differences if compared with the one used with T4 and T5. With Tmax T2, the trip unit is not interchangeable, protection against overload L can be set manually at  $I_1 = 0.4 \dots 1 \times I_n$ , with 16 thresholds by means of a dip switch on the front of the circuit breaker, and it is possible to select between 2 trip curves 3s at  $6 \times I_1$  and 6s at  $6 \times I_1$ .

On the other side, with Tmax T4 and T5, the trip unit is interchangeable; furthermore, protection L can be set manually at  $I_1 = 0.4 \dots 1 \times I_n$  with 16 thresholds by means of a dip switch and it is possible to select between 2 different trip curves 3s at  $6 \times I_1$  and 12s at  $6 \times I_1$ .

#### PR221DS-LS/I

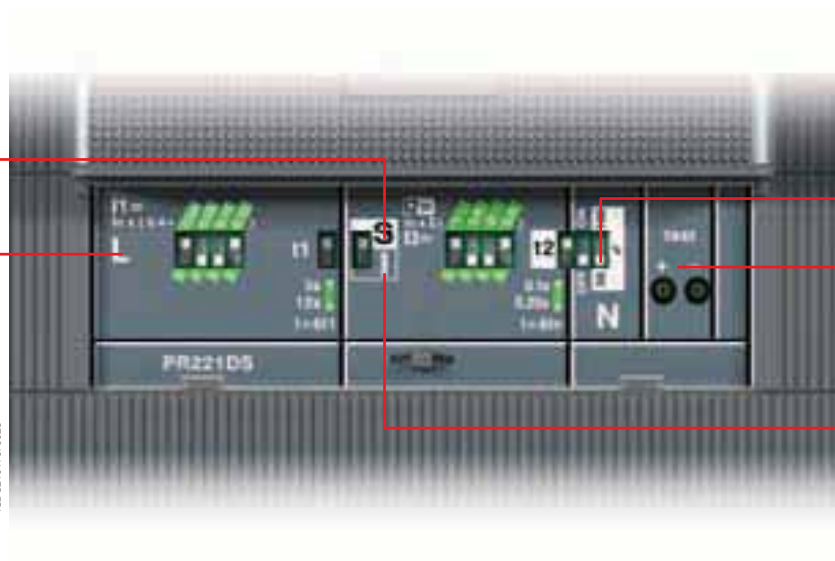
##### Protection S

Against short-circuit with delayed trip

##### Protection L

Against overload

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Dip-switches for setting the neutral (only for T4 and T5)

Socket for TT1 test unit

##### Protection I







Against short-circuit with instantaneous trip

The protection function against short-circuit with delayed trip S, with inverse short time delay and trip characteristic with inverse time ( $I^2t = \text{const}$ ), can be set to  $I_2 = 1 \dots 10 \times I_n$  with 15 thresholds. This protection is selectable as an alternative to protection function I. The protection time delay can be selected by adjusting the dip switches on one of the two available curves (0.1s at  $8 \times I_n$ , 0.25s at  $8 \times I_n$ ).

The protection function against instantaneous short-circuit I can be adjusted to  $I_3 = 1 \dots 10 \times I_n$  with 15 thresholds.

Concerning to neutral protection, for Tmax T2 the protection of the neutral is set to 100% of the phase protection setting, whereas for T4 and T5 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.

## PR221DS - Protection functions and settings

Protection functions	Trip threshold	Trip curves <sup>(1)</sup>		
 CANNOT BE EXCLUDED	Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve ( $I^2t = \text{constant}$ )  $I_1 = 0.40 - 0.44 - 0.48 - 0.52 - 0.56 - 0.60 - 0.64 - 0.68 - 0.72 - 0.76 - 0.80 - 0.84 - 0.88 - 0.92 - 0.96 - 1 \times I_n$ Release between $1.1 \dots 1.3 \times I_1$ (IEC 60947-2 and UL 489)	at $6 \times I_1$ $t_1 = 3s$	at $6 \times I_1$ $t_1 = 6s$ <b>only for T2</b>	at $6 \times I_1$ $t_1 = 12s$ <b>only for T4, T5</b>
 CAN BE EXCLUDED	Against short-circuit with inverse short time delay trip and trip characteristic with inverse time ( $I^2t = \text{constant}$ ) (selectable as an alternative to protection function I)  $I_2 = 1 - 1,5 - 2 - 2,5 - 3 - 3,5 - 4,5 - 5,5 - 6,5 - 7 - 7,5 - 8 - 8,5 - 9 - 10 \times I_n$ <sup>(2)</sup> Tolerance: $\pm 10\%$ (T4-T5) $\pm 10\%$ up to $2 \times I_n$ (T2) $\pm 20\%$ above $2 \times I_n$ (T2)	at $8 \times I_n$ $t_2 = 0,1s$	at $8 \times I_n$ $t_2 = 0,25s$	Tolerance: $\pm 10\%$ up to $6 \times I_n$ (T4-T5) $\pm 20\%$ above $6 \times I_n$ (T4-T5) $\pm 20\%$ (T2)
 CAN BE EXCLUDED	Against short-circuit with instantaneous trip (selectable as an alternative to protection function S)  $I_3 = 1 - 1,5 - 2 - 2,5 - 3 - 3,5 - 4,5 - 5,5 - 6,5 - 7 - 7,5 - 8 - 8,5 - 9 - 10 \times I_n$ <sup>(3)</sup> Tolerance: $\pm 10\%$ (T4-T5) $\pm 20\%$ (T2)	instantaneous		

<sup>(1)</sup> These tolerances hold in the following conditions:  
 – self-powered relay at full power and/or auxiliary supply;  
 – two or three-phase power supply.

In conditions other than those considered, the following tolerances hold:

Trip time	
<b>S</b>	$\pm 20\%$
<b>I</b>	$\leq 40ms$

<sup>(2)</sup> For T5  $I_n = 600 A \Rightarrow I_2 \text{ max} = 9,5 \times I_n$

<sup>(3)</sup> For T5  $I_n = 600 A \Rightarrow I_3 \text{ max} = 9,5 \times I_n$



# Circuit breakers for power distribution

## Electronic trip units

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### PR222DS/P - Tmax T4 and T5

The PR222DS/P trip unit, available for T4 and T5, has protection functions against overload L, delayed S and instantaneous I short-circuit (version PR222DS/P-LSI) and, alternatively, as well as the functions L, S, I also has protection against earth fault G (version PR222DS/P-LSIG).

Function L, which cannot be excluded, can be set manually to  $I_1 = 0.4 \dots 1 \times I_n$  with 32 thresholds by means of the dip switches or electronically by means of the PR010T test and configuration unit: in this case the thresholds are 61 (steps of  $0.01 I_n$ ). Furthermore, it is possible to select among 4 different trip curves: 3s at  $6 \times I_1$ , 6s at  $6 \times I_1$ , 9s at  $6 \times I_1$ , 12s at  $6 \times I_1$  for T4  $I_n = 250 \text{ A}$  and T5 = 600 A, and 18s at  $6 \times I_1$  for all the other settings.

The protection function against short-circuit with delayed trip S, with inverse short time delay and trip characteristic with inverse time ( $I^2t = \text{const}$ ) can be set to  $I_2 = 0.6 \dots 10 \times I_n$  with 15 thresholds by means of the dip switches or electronically by means of the PR010T test and configuration unit, with 95 thresholds (steps of  $0.1 \times I_n$ ). The time delay of the protection can be selected either manually by adjusting the dip switch to one of the 4 curves available (with delay of 0.05s at  $8 \times I_n$ , 0.1s at  $8 \times I_n$ , 0.25s at  $8 \times I_n$  or 0.5s at  $8 \times I_n$ ) or electronically by means of PR010T between 0.05 and 0.5s at  $8 \times I_n$  with 46 thresholds (steps of 0.01s).

The protection function against instantaneous short-circuit I can be adjusted to  $I_3^{(1)} = 1.5 \dots 12 \times I_n$  with 15 thresholds, by means of the dip switches or electronically by means of the PR010T test and configuration unit, with 86 thresholds (steps of  $0.1 \times I_n$ ).

The function of protection against earth fault G is adjustable either manually, by means of dip switches, to  $I_4 = 0.2 \dots 1 \times I_n$ , with 7 thresholds or electronically with PR010T, with 81 thresholds (steps of  $0.01 I_n$ ). It is also possible to select among 4 different trip curves: 0.1 s at  $3.25 \times I_4$ , 0.2s at  $2.25 \times I_4$ , 0.4s at  $1.6 \times I_4$  and 0.8s at  $1.25 \times I_4$ , or to set the trip time electronically between 0.1 and 0.8s with 71 thresholds (steps of 0.01s).

Concerning to neutral protection, it is possible to select the protection threshold OFF, 50% or 100% directly from the front of the release by means of the specific dip switch.

Furthermore, on the front of the trip unit, signalling of pre-alarm and alarm of protection L is available. The pre-alarm threshold value is equal to  $0.9 \times I_1$  (cannot be modified or excluded).

<sup>(1)</sup> For T5  $I_n = 600 \text{ A} \Rightarrow I_{3\text{max}} = 10 \times I_n$

## PR222DS/PD-A

Apart from the protection functions against overload L, delayed S and instantaneous I short-circuit (version PR222DS/PD-A-LSI) or, alternatively,

plus the extra protection G (version PR222/PD-A-LSIG), the PR222DS/PD-A trip unit, available for T4 and T5, also has the dialogue unit integrated with

Modbus RTU protocol.

PR222PD allows Tmax T4 and T5 circuit breakers to be integrated in a communication network based on the Modbus RTU protocol. The devices use the EIA RS485 standard as the physical means for data transmission at a maximum transmission speed of 19200 bit/sec. If the power for protection function is supplied directly by the current transformers of the release, communication is only possible with an auxiliary power supply of 24 V DC.

All the information provided by the trip unit (measurement functions, alarms, maintenance data, state of the circuit breaker) can be consulted both locally, directly on the front of the circuit breaker, and remotely by means of supervision and control systems.

The PR222DS/PD-A trip unit can be associated with the AUX-E auxiliary contacts in electronic version, to know the state of the circuit breaker (open/closed).

Communication functions	PR222DS/P	PR222DS/PD-A
Protocol		Modbus RTU standard
Physical medium		EIA RS485
Speed (maximum)		19200bps
<b>Measurement functions</b>		
Phase currents	■	■
Neutral	■	■
Earth	■	■
<b>Signalling functions</b>		
L pre-alarm and alarm LED	■	■
L alarm output contact <sup>(1)</sup>	■	■
<b>Data available</b>		
State of the circuit-breaker (open, closed)		■
Mode (local, remote)		■
Protection parameters set	■	■
<b>Alarms</b>		
Protections: L, S, I, G	■	■
Release control for failed fault	■	■
<b>Maintenance</b>		
Total number of operations		■
Total number of trips		■
Number of trip tests		■
Number of manual operations		■
Number of trips for each individual protection function		■
Record of last trip data		■
<b>Safety function</b>		
Automatic opening in the case of failed release for fault (with motor operator)		■
<b>Events</b>		
Changes in circuit breaker state, in the protections and all the alarms		■

<sup>(1)</sup> Typical contact: MOS photo Vmax: 48 V DC/30 V AC  
Imax: 50 mA DC/35 mA AC

### Auxiliary power supply - Electrical characteristics

	PR222DS/PD-A
Auxiliary power supply (galvanically insulated)	24 V DC $\pm$ 20%
Maximum ripple	5%
Inrush current @ 24 V	1 A for 30 ms
Rated current @ 24 V	100 mA
Rated power @ 24 V	2.5 W



## Circuit breakers for power distribution

### Electronic trip units

2

#### PR222DS/P

##### Protection S

Against short-circuit  
with delayed trip

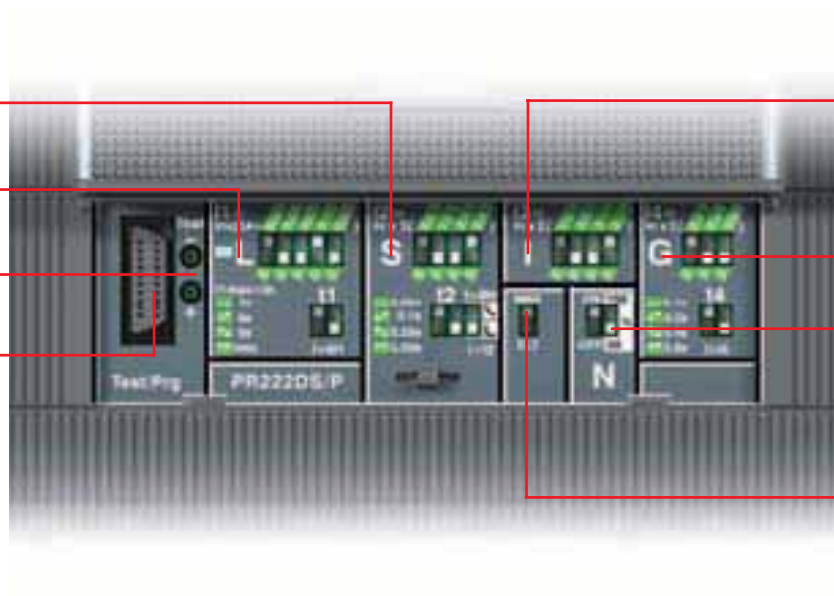
##### Protection L

Against overload

Socket for test  
TT1 test unit

Socket for connection of  
PR010/T test unit

1SD2210174F0023



##### Protection I

Against short-circuit  
with instantaneous trip

##### Protection G

Against earth fault

Dip-switches for  
setting the neutral

Selection for electronic  
or manual setting

#### PR222DS/PD-A

##### Protection S

Against short-circuit  
with delayed trip

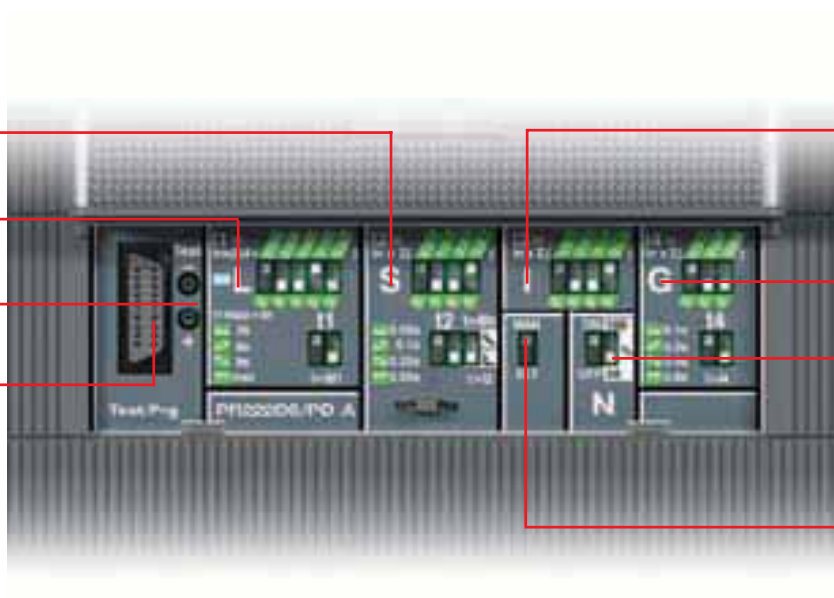
##### Protection L

Against overload

Socket for test  
TT1 test unit

Socket for connection of  
PR010/T test unit

1SD2210180F0023



##### Protection I

Against short-circuit  
with instantaneous trip










##### Protection G

Against earth fault

Dip-switches for  
setting the neutral

Selection for electronic  
or manual setting

## PR222DS/P and PR222DS/PD-A - Protection functions and settings

Protection functions		Trip threshold	Trip curves <sup>(1)</sup>
 CANNOT BE EXCLUDED	Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve ( $I^2t = \text{constant}$ )	 <b>Manual setting</b> $I_1 = 0.40 - 0.42 - 0.44 - 0.46 - 0.48 - 0.50 - 0.52 - 0.54 - 0.56 - 0.58 - 0.60 - 0.62 - 0.64 - 0.66 - 0.68 - 0.70 - 0.72 - 0.74 - 0.76 - 0.78 - 0.80 - 0.82 - 0.84 - 0.86 - 0.88 - 0.90 - 0.92 - 0.94 - 0.96 - 0.98 - 1 \times I_n$ <b>Electronic setting</b> $I_1 = 0.40 \dots 1 \times I_n$ (step $0.01 \times I_n$ ) Release between $1.1 \dots 1.3 \times I_1$ (IEC 60947-2 and UL 489)	<b>Manual setting</b> at $6 \times I_1$ $t_1 = 3s$ at $6 \times I_1$ $t_1 = 6s$ at $6 \times I_1$ $t_1 = 9s$ at $6 \times I_1$ $t_1 = 18s^{(2)}$
			<b>Electronic setting</b> at $6 \times I_1$ $t_1 = 3 \dots 18s$ (step $0.5s$ ) <sup>(2)</sup> Tolerance: $\pm 10\%$
 CAN BE EXCLUDED	Against short-circuit with inverse short time delay trip and trip characteristic with inverse time ( $I^2t = \text{constant}$ ) or definite time	 <b>Manual setting</b> $I_2 = 0.6 - 1.2 - 1.8 - 2.4 - 3.0 - 3.6 - 4.2 - 5.8 - 6.4 - 7.0 - 7.6 - 8.2 - 8.8 - 9.4 - 10 \times I_n^{(3)}$ <b>Electronic setting</b> $I_2 = 0.60 \dots 10 \times I_n$ (step $0.1 \times I_n$ ) <sup>(3)</sup> Tolerance: $\pm 10\%$	<b>Manual setting</b> at $8 \times I_n$ $t_2 = 0.05s$ at $8 \times I_n$ $t_2 = 0.1s$ at $8 \times I_n$ $t_2 = 0.25s$ at $8 \times I_n$ $t_2 = 0.5s$
			<b>Electronic setting</b> at $8 \times I_n$ $t_2 = 0.05 \dots 0.5s$ (step $0.01s$ ) Tolerance: $\pm 10\%$ <sup>(4)</sup>
		 <b>Manual setting</b> $I_2 = 0.6 - 1.2 - 1.8 - 2.4 - 3.0 - 3.6 - 4.2 - 5.8 - 6.4 - 7.0 - 7.6 - 8.2 - 8.8 - 9.4 - 10 \times I_n^{(3)}$ <b>Electronic setting</b> $I_2 = 0.60 \dots 10 \times I_n$ (step $0.1 \times I_n$ ) <sup>(3)</sup> Tolerance: $\pm 10\%$	<b>Manual setting</b> $t_2 = 0.05s$ $t_2 = 0.1s$ $t_2 = 0.25s$ $t_2 = 0.5s$
			<b>Electronic setting</b> $t_2 = 0.05 \dots 0.5s$ (step $0.01s$ ) Tolerance: $\pm 10\%$ <sup>(4)</sup>
 CAN BE EXCLUDED	Against short-circuit with instantaneous trip	 <b>Manual setting</b> $I_3 = 1.5 - 2.5 - 3 - 4 - 4.5 - 5 - 5.5 - 6.5 - 7 - 7.5 - 8 - 9 - 9.5 - 10.5 - 12 \times I_n^{(3)}$ <b>Electronic setting</b> $I_3 = 1.5 \dots 12 \times I_n$ (step $0.1 \times I_n$ ) <sup>(3)</sup> Tolerance: $\pm 10\%$	instantaneous
 CAN BE EXCLUDED	Against earth fault with inverse short time delay trip and trip characteristic according to an inverse time curve ( $I^2t = \text{constant}$ )	 <b>Manual setting</b> $I_4 = 0.2 - 0.25 - 0.45 - 0.55 - 0.75 - 0.8 - 1 \times I_n$ <b>Electronic setting</b> $I_4 = 0.2 \dots 1 \times I_n$ (step $0.01 \times I_n$ ) Tolerance: $\pm 10\%$	<b>Manual setting</b> up to $3.15 \times I_4$ $t_4 = 0.1s$ up to $2.25 \times I_4$ $t_4 = 0.2s$ up to $1.6 \times I_4$ $t_4 = 0.4s$ up to $1.10 \times I_4$ $t_4 = 0.8s$
			<b>Electronic setting</b> $t_4 = 0.1 \dots 0.8 \times I_n$ (step $0.01s$ ) Tolerance: $\pm 20\%$

<sup>(1)</sup> These tolerances hold in the following conditions:  
 – self-powered relay at full power and/or auxiliary supply;  
 – two or three-phase power supply

In conditions other than those considered, the following tolerances hold:

	Trip time
S	$\pm 20\%$
G	$\pm 20\%$

<sup>(2)</sup> for  $T5 I_n = 600 A \Rightarrow t_1 = 10.5s$   
<sup>(3)</sup> for  $T5 I_n = 600 A \Rightarrow I_{2max} = 9.5 \times I_n$   
<sup>(4)</sup> tolerance:  $\pm 10 ms$  up to  $t_2 = 0.1s$





# Circuit breakers for power distribution

## Electronic trip units

2

### PR211/P - Isomax S6 and S7

PR211/P trip unit (available for Isomax S6 and S7) provides protection functions against overload L and instantaneous short-circuit I, and is available in the versions with functions I and LI.

Function L, which cannot be excluded, can be set manually to  $I_1 = 0.4 \dots 1 \times I_n$  by means of the dip switches on the front of the circuit-breaker. Furthermore, it is possible to select among 4 different trip curves: 3s at  $6 \times I_1$ , 6s at  $6 \times I_1$ , 12s at  $6 \times I_1$  and 18s at  $6 \times I_1$ .

The protection function against instantaneous short-circuit I can be adjusted to  $I_3 = 1.5 \dots 12 \times I_n$  by means of the dip switches.

Neutral protection is set to 50% of the phase protection. Ask ABB for the 100% version.

### PR212/P - Isomax S6, S7 and S8

PR212/P trip unit (available from Isomax S6 to S8) provides protection functions against overload L, delayed short-circuit S and instantaneous short-circuit I, and against earth fault G. It is available in the versions PR212/P with functions LSI and LSIG.

#### PR211/P

##### Protection L

Against overload

##### Protection I

Against short-circuit with instantaneous trip



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#### PR212/P

##### Protection I

Against short-circuit with instantaneous trip

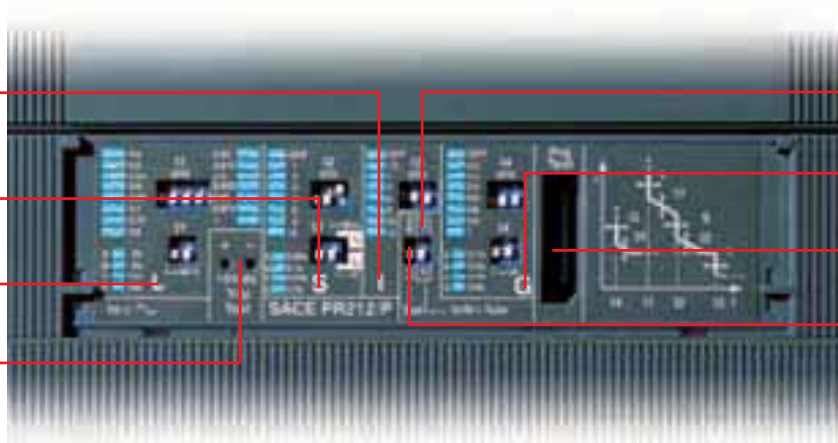
##### Protection S

Against short-circuit with delayed trip

##### Protection L

Against overload

Socket for TT1 test unit



1SD021046R0003










Function L, which cannot be excluded, can be set manually to  $I_1 = 0.4 \dots 1 \times I_n$  by means of the dip switches on the front of the circuit-breaker. Furthermore, it is possible to select among 4 different trip curves: 3s at  $6 \times I_1$ , 6s at  $6 \times I_1$ , 12s at  $6 \times I_1$  and 18s at  $6 \times I_1$ .

The protection function against short-circuit with delayed trip S, with inverse short time delay and trip characteristic with inverse time ( $I^2t = \text{const}$ ), can be set to  $I_2 = 1 \dots 10 \times I_n$  by means of the dip switches or electronically by means of the PR010T test and configuration unit. The time delay of the protection can be selected either manually by adjusting the dip switch to one of the 4 curves available (with delay of 0.05s at  $8 \times I_n$ , 0.1s at  $8 \times I_n$ , 0.25s at  $8 \times I_n$  or 0.5s at  $8 \times I_n$ ) or electronically by means of PR010T between 0.05 and 0.5s at  $8 \times I_n$ . The protection functions against instantaneous short-circuit I and earth fault G can be adjusted respectively to  $I_3 = 1.5 \dots 12 \times I_n$  and  $I_4 = 0.2 \dots 1 \times I_n$ , by means of the dip switches or electronically by means of the PR010T.

For four-pole circuit breakers, protection of the neutral can be set to 50% or 100% of the phase protection setting, by means of dip-switches on the front of the trip unit.

Setting the adjustment parameters of the protection functions is carried out directly from the front of the trip unit or remotely, thanks to the use of the PR212/D (IEC only) dialogue unit, available with Modbus or LON communication protocols.

## PR211/P and PR212/P - Protection functions and settings

Protection function		Trip threshold		Trip curves			
				A	B	C	D
 <b>CANNOT BE EXCLUDED</b>	Against overload with inverse long time delay and trip characteristic according to a time dependent curve ( $I^2t = \text{constant}$ )		$I_1 = 0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.95 - 1 \times I_n$ - <b>PR211/P</b>	at $6 \times I_1$ $t_1 = 3s$	at $6 \times I_1$ $t_1 = 6s$	at $6 \times I_1$ $t_1 = 12s$	at $6 \times I_1$ $t_1 = 18s$
			$0.4 - 0.5 - 0.55 - 0.6 - 0.65 - 0.7 - 0.75 - 0.8 - 0.85 - 0.875 - 0.9 - 0.925 - 0.95 - 0.975 - 1 \times I_n$ - <b>PR212/P</b> Release between $1.05 \dots 1.30 \times I_1$ (IEC 60947-2 and UL 489)	(tolerance: $\pm 10\%$ up to $2 \times I_n$ ; $\pm 20\%$ above $2 \times I_n$ )			
 <b>CAN BE EXCLUDED</b>	Against short-circuit with inverse short time delay and trip characteristic with dependent time ( $I^2t = \text{constant}$ ) or independent time		$I_2 = 1 - 2 - 3 - 4 - 6 - 8 - 10 \times I_n$ Tolerance $\pm 10\%$	at $8 \times I_n$ $t_2 = 0.05s$	at $8 \times I_n$ $t_2 = 0.1s$	at $8 \times I_n$ $t_2 = 0.25s$	at $8 \times I_n$ $t_2 = 0.5s$
			$I_2 = 1 - 2 - 3 - 4 - 6 - 8 - 10 \times I_n$ Tolerance $\pm 10\%$	$t_2 = 0.05s$	$t_2 = 0.1s$	$t_2 = 0.25s$	$t_2 = 0.5s$
 <b>CAN BE EXCLUDED</b>	Against short-circuit with adjustable instantaneous trip		$I_3 = 1.5 - 2 - 4 - 6 - 8 - 10 - 12 \times I_n$ Tolerance $\pm 20\%$	instantaneous			
 <b>CAN BE EXCLUDED</b>	Against earth fault with short inverse time delay and trip characteristic according to a dependent time curve ( $I^2t = \text{constant}$ )		$I_4 = 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 0.9 - 1 \times I_n$ Tolerance $\pm 20\%$	up to $3.25 \times I_4$ $t_4 = 100ms$	up to $2.25 \times I_4$ $t_4 = 200ms$	up to $1.6 \times I_4$ $t_4 = 400ms$	up to $1.25 \times I_4$ $t_4 = 800ms$
				(tolerance: $\pm 20\%$ )			





# Motor control protection circuit breakers: MCP

## Magnetic and electronic trip units

2

### General characteristics

MCP circuit breakers are used to protect three phase asynchronous motors.

The traditional system used for this purpose is based on three different devices: a circuit breaker for protection against short-circuit, a thermal relay for protection against overload and phase loss or unbalance of phase, and a contactor for motor switching. All this has to take into account the problems that arise at the moment of the motor starting.

In particular, when selecting these devices, different factors must be taken into consideration, such as:

- the motor power
- the diagram and type of starting
- the type of motor: with cage rotor or with wound rotor
- the fault current at the point of the network where the motor is installed.





MCP	T2		T3	T4				T5				S6			S7	S8
Frame size	100		225	250				400-600				800			1200	1600-2000-2500
Poles	3		3	3				3				3			3	3
Ratings	20...100		100...200	100-150-250				300-400-600				800			1000-1200	1600-2000-2500
Interrupting ratings	S	H	S	N	S	H	L	N	S	H	L	N	H	L	H	V
240 V AC	65	150	65	65	100	150	200	65	100	150	200	65	150	200	100	120
480 V AC	35	65	35	25	35	65	100	25	35	65	100	50	65	100	65	100
600Y/347 V AC			10													
600 V AC				18	25	35	65	18	25	35	65	25	35	42	50	85
500 V DC			35													
600 V DC																
Trip unit																
Adjustable magnetic only (6...12 x I <sub>n</sub> )	■	■	■													
Electronic PR221DS-I	■	■		■	■	■	■	■	■	■	■					
PR211/P-I												■	■	■	■	■

ABB offers two different protection types:



- a magnetic only trip unit (MA) for Tmax T2 and T3, with adjustable threshold between  $6...12 \times I_n$
- an electronic trip unit with only an instantaneous short-circuit protection function I, PR221DS-I for Tmax T2, T4 and T5, and PR211/P-I for Isomax S6, S7 and S8. For PR221DS-I, protection I is adjustable between  $1...10 \times I_n$ , whereas the range for PR211/P is  $1.5...12 \times I_n$ .


Electronic trip units														
In [A]	25	60	100	150	250	300	400	600	800	1000	1200	1600	2000	2500
T2	■	■	■											
T4			■	■	■									
T5						■	■	■						
S6								■	■					
S7										■	■			
S8												■	■	■
Trip current function I														
I <sub>3</sub> [A]	25 ÷ 250	60 ÷ 600	100 ÷ 1000	150 ÷ 1500	250 ÷ 2500	300 ÷ 3000	400 ÷ 4000	600 ÷ 6000	1200 ÷ 1600	1500 ÷ 12000	1800 ÷ 14400	2400 ÷ 19200	3000 ÷ 24000	3750 ÷ 30000

### PR221DS-I (Tmax T2, T4 and T5) - Protection functions and settings

Protection function	Trip threshold
 Against short-circuit with adjustable instantaneous trip	 $I_3 = 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4.5 - 5.5 - 6.5 - 7 - 7.5 - 8 - 8.5 - 9 - 10 \times I_n$ Tolerance $\pm 20\%$

### PR211/P (Isomax S6...S8) - Protection functions and settings

Protection function	Trip threshold
 Against short-circuit with adjustable instantaneous trip	 $I_3 = 1.5 - 2 - 4 - 6 - 8 - 10 - 12 \times I_n$ Tolerance $\pm 20\%$

MA - Magnetic only trip unit							
 $I_3 = 6...12 \times I_n$	$I_n$ [A]	20	50	100	125	150	200
	T2	■	■	■			
	T3			■	■	■	■
	$I_3$ [A]	120...240	300...600	600...1200	750...1500	900...1800	1200...2400



# Molded case switches: MCS

## Electrical characteristics

### General characteristics

The MCS can be used as general circuit breakers in sub-switchboards, as switching and isolation parts for lines, busbars or groups of apparatus, or as bus-ties. They can be part of general isolation devices of groups of machines or of complexes for motor operation and protection.

The MCS are derived from the corresponding circuit breakers, of which they keep the overall dimensions, versions, fixing systems and the possibility of mounting accessories.

The MCS up to 1200 A are available in three-pole and four-pole versions, whereas the 2500 A size is only available in the three-pole version.

All the molded case switches in accordance with UL 489 and CSA C22.2 Standards are self protected.

2



MCS		T1N-D	T3S-D	T3S-D	T4N-S-H-L-V-D	T5N-S-H-L-V-D		S6H-D		S7H-D	S8V-D
Rating	[A]	100	150	225	250	400	600	600	800	1200	2500
Poles	[No]	3-4	3-4	3-4	3-4	3-4		3-4		3-4	3
Magnetic override	[A]	1000	1500	2250	3000	5000	6000	8000	10000	20000	35000
Rated Voltage											
	AC (50-60 Hz) [V]	600Y/347	600Y/347	600Y/347	600	600		600		600	600
	DC [V]	500	500	500	600	600		600		600	600



## Accessories

### Versions and types



#### Fixed

Fixed ABB molded case circuit breakers, in accordance with UL/CSA standards up to 2500 A, are available in the two-pole, three-pole and four-pole version up to 1200 A and only in the three-pole version from 1600 A up to 2500 A.

The circuit breakers have:

- single depth of 2.76" (70 mm) up to 225 A and 4.07" (103.5 mm) from 150 to 800 A
- standardized front 1.77" (45 mm) up to 225 A
- possibility of assembly on back plate or on DIN rail up to 225 A (except T1B 1p)
- thermomagnetic or electronic trip units
- UL file: E93565 for circuit breakers and MCP; CSA file: LR54280
- UL file: E116595 for MCS; CSA file: LR54280.



#### Plug-in

The plug-in version circuit breaker consists of:

- fixed part to be installed directly on the back plate of the cubicle
- moving part, obtained from the fixed circuit breaker with addition of the isolating contacts (in correspondence with the connection terminals), of the rear frame (for fixing the fixed part), and of the terminal covers.

Circuit breaker removal is carried out by unscrewing the top and bottom fixing screws. A special lock prevents circuit breaker racking in and racking out with the contacts in the closed position.

Tmax T2 T3, T4 and T5 circuit breakers, starting from the fixed version, can be changed into the various types using the conversion kits.

When the circuit breaker has electrical accessories mounted (SOR, UVR, MOS, MOE, AUX, AUX-E, AUE and RC222), the socket-plug connectors or the adapters for isolation of the relative auxiliary circuits must also be ordered.



## Accessories

### Versions and types

#### Draw out

The draw out version circuit breaker consists of:

- fixed part to be installed directly on the back plate of the cubicle with the side group mounted on the fixed part to allow the racking-out/racking-in movement
- moving part, obtained from the fixed circuit breaker with addition of the isolating contacts (in correspondence with the connection terminals), of the rear frame (for fixing the fixed part), and of the terminal covers
- accessory to be mounted on the front of the circuit breaker, with selection between front flange for lever operating mechanism, motor operator and rotary handle operating mechanism; application of one of these accessories allows the circuit breaker lock to be made in the withdrawn position.

Racking-in/racking-out of the moving part is carried out by means of the special crank supplied with the conversion kit of the fixed circuit breaker into moving part of draw out circuit breaker. The special mechanism allows the circuit breaker to be racked out in the isolated position (with power and auxiliary circuits disconnected) with the compartment door closed, increasing the safety of the operation.

Once racked out or removed, the circuit breaker can be operated in open or closed position and, by means of the special connectors, blank operating tests of the auxiliary control circuits can be carried out.

The draw out version T4 and T5 circuit breaker can only be fitted with pre-cabled electrical accessories, provided with ADP adapters suitable for isolation of the relative auxiliary circuits.

Versions available			
	F Fixed	P Plug-in	W Draw out
T1B 1p	■	–	–
T1	■	–	–
T2	■	■	–
T3	■	■	–
T4	■	■	■
T5	■	■	■
S6	■	–	■
S7	■	–	■
S8	■	–	–

## Conversion kit into part of plug-in for T2, T3, T4 and T5

(UL file: E116596)

Allows conversion of a fixed circuit breaker with front terminals into the moving part of a plug-in circuit breaker. The kit consists of:

- isolating contacts
- anti-racking out safety device
- assembly nuts and screws
- terminals covers.

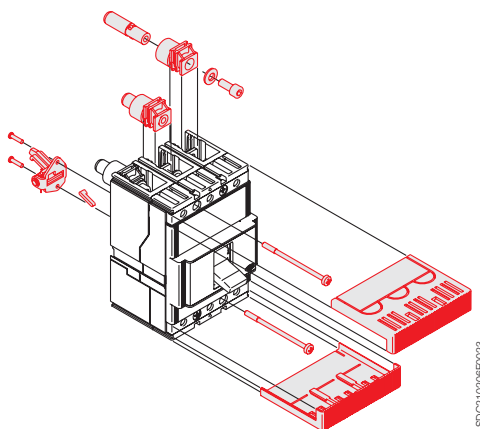
The circuit breaker is completed with the fixed part.



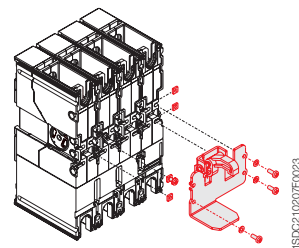
T2-T3



T4-T5



T2-T3



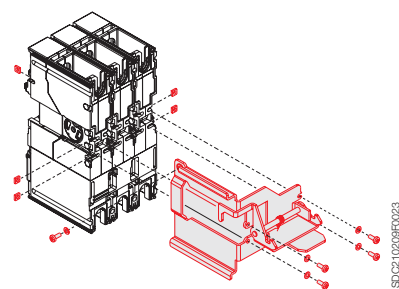
T4-T5

## Conversion kit into moving part of draw out circuit breaker for Tmax T4, T5 and Isomax S6 and S7 (UL file: E116596 for Tmax)

This allows the fixed circuit breaker with front terminals to be converted into the moving part of a draw out circuit breaker. The kit consists of isolating contacts, frame, and assembly nuts and screws. The circuit breakers in the draw out version must be completed, alternatively, with one of the following accessories:

- front for lever operating mechanism
- rotary handle operating mechanism
- motor operator
- terminal covers

in order to prevent the racking-out operation with the circuit breaker closed. The circuit breaker is completed with the fixed part.





## Accessories

### Versions and types

3



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#### Fixed part

(UL file: E116596 for Tmax)

The fixed part completes the circuit breaker in the plug-in or draw out version. For plug-in or draw out version circuit breakers, different positions are available:

- plug-in: plugged-in, unplugged
- draw out version: racked-in/racked-out, removed.

The fixed part for draw out version is fitted with a guide for supporting the moving part during the isolation or withdrawal operations. For Isomax S6 and S7 circuit breakers, there are two guides. For Tmax T2 and T3 circuit breakers, the fixed parts are available, in the standard version, with front terminals (F): a distinguishing characteristic of these two sizes of circuit breakers is the possibility of equipping the fixed parts with the same kit of terminals, terminal covers and phase separators, used for the fixed circuit breakers. With Tmax T4 and T5, codes of fixed parts are available with different types of terminals (EF, HR, VR). The fixed parts with EF terminals, moreover, can be also equipped with ES, FC Cu and FC CuAl terminals.

#### Conversion kit for fixed part of plug-in into fixed part of draw out for Tmax T4 and T5 (UL file: E116596)



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A guide for converting the fixed part of a plug-in version circuit breaker into the fixed part of a draw out version circuit breaker is available for Tmax T4 and T5 circuit breakers.

#### Racking out crank



1SD021021F0023

This allows racking out and racking in of the circuit breaker in the draw out version into the fixed part, with the door closed. The crank handle is the same for the whole range of circuit breakers and is automatically supplied with the fixed part of draw out circuit breakers or with the conversion kit for fixed part of plug-in into fixed part of draw out.





## Accessories

### Connection terminals

The basic version of the circuit breakers is supplied with:

- lugs for copper and aluminium cables (FC CuAl) or lugs for copper cables (FC Cu) for the Tmax T1 circuit breaker
- front terminals (F) for Tmax T2, T3, T4, T5 and Isomax S6, S7 and S8 circuit breakers.

Different types of terminals are also available and these can be combined in various ways (top of one type, bottom of a different type), allowing the circuit breaker to be connected to the plant in the most suitable way for the installation requirements.

The following distinctions can be made between:

- **front terminals**, which allow connection of cables or busbars by acting directly from the front of the circuit breaker
- **rear terminals**, which allow installation in switchboards with rear access to both cable and busbar connections. For Tmax T2, T3, T4 and T5 the rear terminals are adjustable.

Terminals are available for direct connection of bare copper or aluminium cables (UL listed) and terminals for connection of busbars or cables terminated with cable terminals.

An important feature of the Tmax T2 and T3 circuit breakers is that all the different types of terminals can be mounted either on the fixed version circuit breaker or on the fixed part of the plug-in circuit breaker. On the other hand, T4 and T5 fixed part can mount EF, HR or VR terminals, and, moreover, fixed part with EF terminals can be equipped also with ES, FC Cu and FC CuAl terminals.

The information needed to make the connections is given for each type of terminal on page 3/9 and following. The minimum and maximum cross-section of the cables, which can be tightened in the terminals and the diameter of the terminal, are indicated for connection with bare cables. Flat bars of different size and composition are recommended for connections with busbars. The required minimum depth is also indicated, if it is different to the one recommended.

The torque values to be applied to the tightening screws for cable terminals and to the screws used to connect the busbars to the flat bar terminals are given.

3



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### Insulating terminal covers

The terminal covers are applied to the terminals of the circuit breaker to prevent accidental contact with live parts.

The following are available:

- low terminal covers (LTC), which guarantee IP40 degree of protection for fixed circuit breakers with rear terminals and for moving parts of plug-in or draw out circuit breakers
- high terminal covers (HTC), for fixed circuit breakers with front, front extended, front for cables and rear terminals; guarantee IP40 degree of protection
- terminal covers for fixed parts, of plug-in or draw out circuit breakers for T4, T5, S6 and S7 circuit breakers, guarantee IP40 degree of protection on the front with moving part connected. They are available in a single version. The fixed parts of plug-in T2 and T3 circuit breakers can use the same terminal covers as the corresponding fixed circuit breakers. For fixed parts of T4 and T5 400, the proper terminal covers (TC-FP) are available.

The degrees of protection indicated are valid for circuit breaker installed in switchboards.



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## Accessories

### Connection terminals

3



#### Phase separating partitions

These allow the insulation characteristics between the phases at the connections to be increased. They are mounted from the front, even with the circuit breaker already installed.

Two versions are available for Tmax circuit breakers:

- 3.94" (100 mm) high
- 7.87" (200 mm) high.

The H = 3.94" (100 mm) phase separators are supplied as standard with front extended type terminals (EF), whereas those with H = 7.87" (200 mm) are standard with the front extended spread type of terminals (ES).

They are incompatible with both the high and low insulating terminal covers.

The fixed parts of plug-in Tmax circuit breakers can use the same phase separating partitions as the corresponding fixed circuit breakers. With the phase separating partitions mounted, a special kit is available on request to reach IP40 degree of protection from the front of the circuit breaker.

Moreover, it is possible to mount the phase separating partitions between two circuit breakers or fixed parts side by side.

Phase separating partitions must always be requested for Isomax S6 and S7 circuit breakers. They are always an alternative to the high or low terminal covers.



#### Screws for sealing the terminal covers

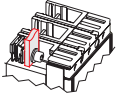
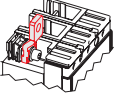
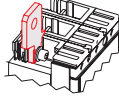
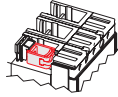
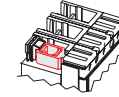
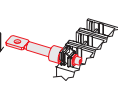
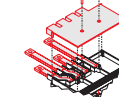
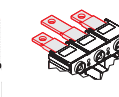

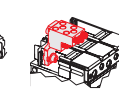
These are applied to the terminal covers of fixed circuit breakers or to the moving parts of plug-in or draw out circuit breakers. They prevent removal of both the high and low terminal covers and can be locked with a wire and lead seal.



#### Kit for taking up the auxiliary power supply

Special kits are available with the Tmax T2, T3, T4 and T5 circuit breakers for taking up the auxiliary power supply directly from the connection terminals. They can only be combined with the front terminals for copper cables (FC Cu) or with the front terminals (F) for T3, T4 and T5.




## Connection terminals

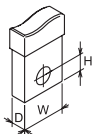
	F	EF	ES	FC Cu	FC CuAl <sup>(1)</sup>	R	RC	HR	VR	MC
										
	Front	Extended front	Front extended spread	Front for copper cables	Front for copper and aluminium cables <sup>(3)</sup>	Rear <sup>(4)</sup>	Rear for Cu/Al cables	Rear flat horizontal	Rear flat vertical	Multi-cable terminals
<b>T1</b>	F			F <sup>(2)</sup>	F <sup>(2)</sup>			F		
<b>T2</b>	F - P <sup>(2)</sup>	F-P	F-P	F-P	F-P	F-P				
<b>T3</b>	F - P <sup>(2)</sup>	F-P	F-P	F-P	F-P	F-P				
<b>T4</b>	F <sup>(2)</sup>	F-P-W	F-P-W	F-P-W	F-P-W	F		P-W	P-W	F
<b>T5</b>	F <sup>(2)</sup>	F-P-W	F-P <sup>(5)</sup> -W <sup>(5)</sup>	F-P-W	F-P-W	F		P-W	P-W	
<b>S6</b>	F <sup>(2)</sup>	F-W	F		F	F	F	W	W	
<b>S7</b>	F <sup>(2)</sup>	F-W	F		F			F-W	F-W	
<b>S8</b>	F <sup>(2)</sup>								F	

<sup>(1)</sup> UL listed  
<sup>(2)</sup> Standard supply  
<sup>(3)</sup> External and standard versions  
<sup>(4)</sup> Orientated for Tmax and threaded for Isomax  
<sup>(5)</sup> Only for T5 600

F = Fixed  
 P = Plug-in  
 W = Draw-out

3

Front terminals - F											
			<b>T1-T5</b>	<b>S6</b>	<b>S7</b>						
											
			1SDC21023F0023	1SDC21023F0023	1SDC21023F0023						
Allow connection of busbars or cables terminated with cable terminals											
Type	Version	Pieces	Busbars/cable terminals [in-mm]				Tightening [lbin-Nm]	Terminal covers			Phase separators
			W	H	D	Ø		high	low	fixed part	
<b>T2</b>	F - P	1	0.79-20	0.3-7.5	0.2-5	0.26-6.5	54-6	R	R	–	R
<b>T3</b>	F - P	1	0.94-24	0.37-9.5	0.31-8	0.33-8.5	71-8	R	R	–	R
<b>T4</b>	F	1	0.98-25	0.37-9.5	0.31-8	0.33-8.5	161-18	R	R	–	R
<b>T5</b>	F	1	1.38-35	0.43-11	0.40-10	0.41-10.5	250-28	R	R	–	R
<b>S6</b>	F	2	1.97-50	0.47-12	0.20-5	2 x 0.27-7	80-9	R	R	–	R
<b>S7</b>	F	2	1.97-50	0.79-20	0.31-8	2 x 0.43-11	161-18	–	R	–	R
<b>S8 2000</b>	F	3	3.94-100	–	0.20-5	4 x 0.59-15	625-70	–	R	–	–
<b>S8 2500</b>	F	4	3.94-100	–	0.20-5	4 x 0.59-15	625-70	–	R	–	–



A = Tightening the terminal onto the circuit breaker  
 B = Tightening of the cable/busbar onto the terminal  
 R = On request  
 S = Standard



## Accessories

### Connection terminals

#### Front extended terminals - EF

T1-T5

S6 800

S7

PF S6

PF S7



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1SDC210230F0023



1SDC210230F0023



1SDC210230F0023



1SDC210230F0023

Allow connection of busbars or cables terminated with cable terminals

Type	Version	Pieces	Busbars [in-mm]			Cable terminals [in-mm]		Tightening [lbin-Nm]		Terminal covers			Phase separators
			W	D	Ø	L	Ø	A	B <sup>(1)</sup>	high	low	fixed part	
T1	F	1	0.59-15	0.20-5	0.33-8.5	0.59-15	0.33-8.5	63-7	80-9	R	-	-	S
T2	F-P	1	0.79-20	0.16-4	0.33-8.5	0.79-20	0.33-8.5	54-6	80-9	R	-	-	S
T3	F-P	1	0.79-20	0.24-6	0.39-10	0.79-20	0.39-10	71-8	161-18	R	-	-	S
T4	F	1	0.79-20	0.39-10	0.39-10	0.79-20	0.39-10	161-18	161-18	R	-	-	S
	P-W	1	0.79-20	0.39-10	0.31-8	0.79-20	0.31-8	-	80-9	-	-	R	R
T5	F	2	1.18-30	0.27-7	0.43-11	1.18-30	0.43-11	252-28	161-18	R	-	-	S
	P-W	2	1.18-30	0.59-15	0.39-10	1.18-30	0.39-10	-	161-18	-	-	-	S
S6	F-W	2	1.97-50	0.20-5	0.55-14	1.97-50	0.55-14	80-9	268-30	R	R	-	R
S7	F-W	2	1.97-50	0.31-8	4 x 0.43-11	1.97-50	4 x 0.43-11	402-45	161-18	-	R	-	R

#### Front extended spread terminals - ES

T1-T5

S6

S7



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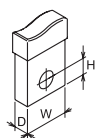


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Allow connection of busbars or cables terminated with cable terminals

Type	Version	Pieces	Busbars [in-mm]			Cable terminals [in-mm]		Tightening [lbin-Nm]		Terminal covers			Phase separators
			W	D	Ø	L	Ø	A	B	high	low	fixed part	
T2	F-P	1	1.18-30	0.16-4	0.41-10.5	1.18-30	0.41-10.5	54-6	161-18	-	-	-	S
T3	F-P	1	1.18-30	0.16-4	0.41-10.5	1.18-30	0.41-10.5	71-8	161-18	-	-	-	S
T4	F-P-W	1	1.18-30	0.24-6	0.41-10.5	1.18-30	0.41-10.5	161-18	161-18	-	-	-	S
T5	F-P <sup>(1)</sup> -W <sup>(1)</sup>	1	1.57-40	0.39-10	0.43-11	0.43-11	0.43-11	252-28	161-18	-	-	-	S
S6	F	1	3.54-90	0.31-8	3 x 0.51-13	4x1.77-45	0.51-13	80-9	268-30	-	-	-	-
S7	F	1	3.54-90	0.59-15	3 x 0.51-13	4x1.77-45	0.51-13	402-45	179-30	-	-	-	-

<sup>(1)</sup> Only for T5 600



A = Tightening the terminal onto the circuit breaker  
 B = Tightening of the cable/busbar onto the terminal  
 R = On request  
 S = Standard

### Front terminals for copper cables - FC Cu<sup>(1)</sup>



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Allow connection of bare copper cables directly to the circuit breaker

Type	Version	Pieces	Cable [AWG or Kcmil-mm²]		Tightening [lbin-Nm]		Ø [in-mm]	Terminal covers			Phase separators
			rigid	flexible	A	B		high	low	fixed part	
<b>T1/T1P</b>	F	1	14...2/0-2.5...70	14...1-2.5...50	–	62-7	0.47-12	R	R	–	R
	F	2	–	14...1-2.5...50	–	62-7	0.47-12	R	R	–	R
<b>T2</b>	F-P	1	18...3/0-1...95	18...2/0-1...70	–	62-7	0.55-14	R	R	R	R
	F-P	2	–	18...0-1...50	–	62-7	0.55-14	R	R	R	R
<b>T3</b>	F-P	1	10...350-6...185	10...300-6...150	–	89-10	0.71-18	R	R	R	R
	F-P	2	–	10...2/0-6...70	–	89-10	0.71-18	R	R	R	R
<b>T4</b>	F-P-W	1	14...350-2.5...185	14...300-2.5...150	–	89-10	0.71-18	R	R	S	R
	F-P-W	2	–	14...3/0-2.5...95	–	89-10	0.71-18	R	R	S	R
<b>T5</b>	F-P-W	1	6...500-16...240	6...500-16...300	–	222-25	1.1-28	R	R	S	R
	F-P-W	2	–	6...300-16...150	–	222-25	1.1-28	R	R	S	R
	F	2	–	1...350-50...185	161-18	279-31	0.85-21.5	S	–	–	–

<sup>(1)</sup> UL listed for Tmax T1

### Front terminals for copper/aluminium cables - FC CuAl (UL listed)

T2-T5 Standard

T4-T5 External

S6 800

S7



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1SDC210235F0023



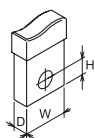
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Allow connection of bare copper or aluminium cables directly to the circuit breaker (solid aluminium cables cannot be used)

Type	Assembly	Version	Pieces	Cable [AWG or Kcmil-mm²]	Tightening [lbin-Nm]		Ø [in-mm]	Terminal covers			Phase separators
					A	B		high	low	fixed part	
<b>T1 1P/T1</b>	standard	F	1	14...10-2.5...6	20-2.5		0.37-9.5	R	R		R
				8.0-10	40-4.5						
				6...1/0-16...50	45-5						
<b>T2</b>	standard	F-P	1	14...1/0-2.5...50	80-9	50-5.6		R	R	R	R
<b>T3</b>	standard	F-P	1	14...1/0-2.5...50	80-9	50-5.6	0.39-10	R	R	R	R
	standard	F-P	1	4...300-25...150	80-9	200-22.6					
<b>T4</b>	standard	F-P-W	1	6...350-6...185	274-31	80-9	0.7-18	R	R	S	R
	standard	F	1	14...1/0-2.5...50	50-5.6	80-9					
<b>T5 400</b>	external	F	2	3/0...250-95...120	274-31	159-18	0.61-15.5	S			R
	external	F	2	3/0...500-95...240	274-31	159-18					
<b>T5</b>	standard	F-P-W	1	250...500-120...240	380-43	159-18	0.84-21.5	R	R	S	R
	standard	F	2	250...500-120...240	44-5	276-31					
<b>S6</b>	standard	F	3	2/0...400-70...185	80-9	383-43	0.75-9	S			
	standard	F	2	250...500-120...240	44-5	276-31					
<b>S7</b>	standard	F	4	4/0...500-95...240	311-35	383-43	0.85-21.5	S			



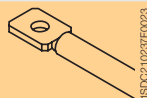
A = Tightening the terminal onto the circuit breaker  
 B = Tightening of the cable/busbar onto the terminal  
 R = On request  
 S = Standard



## Accessories

### Connection terminals

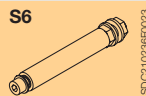
#### Rear orientated terminals for Tmax - R



Allow connection of busbars or cable terminal at the rear

Type	Version	Pieces	Busbars [in-mm]			Tightening [lbin-Nm]		Terminal covers		Phase separators
			W	D	Ø	A	B	high	low	
T2	F-P	1	0.79-20	0.16-4	0.33-8.5	54-6	80-9	–	S	–
T3	F-P	1	0.79-20	0.24-6	0.33-8.5	54-6	80-9	–	S	–
T4	F	1	0.79-20	0.39-10	0.33-8.5	54-6	80-9	–	S	–
T5	F	2	1.18-30	0.27-7	0.43-11	161-18	161-18	–	S	–

#### Threaded rear terminals for Isomax - R



Allow connection of busbars at the rear

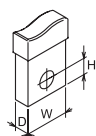
Type	Version	Pieces	Busbars [in-mm]			Cable terminals [in-mm]		Tightening [lbin-Nm]		Terminal covers			Phase separators
			W	D	Ø	L	Ø	A	B	high	low	fixed part	
S6	F	2	1.97-50	0.20-5	0.98-25	1.97-50	0.98-25	161-18	890-100	–	S	–	–

#### Rear terminals for copper/aluminium cables for Isomax - RC



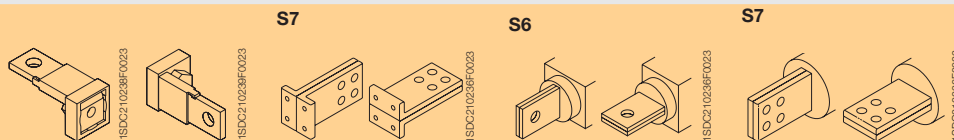
Allow connection of copper or aluminium cables directly to the circuit breaker

Type	Version	Pieces	Cable terminals [AWG or Kcmil-mm²]	Tightening [lbin-Nm]		Ø [in-mm]	Terminal covers			Phase separators
				A	B		high	low	fixed part	
S6	F	3	2/0...300-70...150	80-9	276-31	0.689-17.5	S	–	–	–



A = Tightening the terminal onto the circuit breaker  
 B = Tightening of the cable/busbar onto the terminal  
 R = On request  
 S = Standard

### Rear flat horizontal and vertical terminals - HR/VR

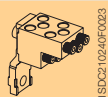


Allow connection of busbars at the rear.

Type	Version	Pieces	Busbars [in-mm]			Cable terminal [in-mm]		Tightening [lbin-Nm]		Terminal covers			Phase separators
			W	D	Ø	L	Ø	A	B	high	low	fixed part	
T1	F	1	0.55-14	0.20-5	0.24-6.2	0.55-14	0.24-6.2	63-7	45-5	-	S	-	-
T4	P-W	1	0.79-20	0.39-10	0.39-10	0.79-20	0.39-10	161-18	-	-	-	-	-
T5 400	P-W	1	0.98-25	0.39-10	0.47-12	0.98-25	0.47-12	161-18	-	-	-	-	-
T5 600	P-W	2	1.57-40	0.59-15	0.43-11	1.57-40	0.43-11	161-18	-	-	-	-	-
S6	W	2	1.97-50	0.20-5	0.55-14	1.97-50	0.55-14	-	267-30	-	-	-	-
S7	F-W	2	1.97-50	0.31-8	4 x 0.43-11	-	-	-	179-20	-	S	-	-
S8 2000	F	3	3.94-100	0.20-5	4 x 0.59-15	-	-	-	625-70	-	-	-	-
S8 2500	F	4	3.94-100	0.20-5	4 x 0.59-15	-	-	-	625-70	-	-	-	-

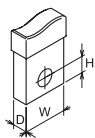
Note: for T1 and S8 only the terminals are available.

### Multi-cable terminals for Tmax - MC



Allow connection of cables directly to the circuit breaker

Type	Version	Pieces	Cable [AWG or Kcmil-mm²]		Tightening [lbin-Nm]		Terminal covers			Phase separators
			max	flexible rigid	A	B	high	low	fixed part	
T4	F	6	14...4-2.5...25	14...4-2.5...35	161-18	62-7	S	-	-	-



A = Tightening the terminal onto the circuit breaker  
 B = Tightening of the cable/busbar onto the terminal  
 R = On request  
 S = Standard



## Accessories

### Service releases

The shunt trip and undervoltage releases, housed and fixed in a slot on the left-hand side of the circuit breaker, are always alternative to each other. They are supplied in the pre-cabled version with 39.4" (1 m) long cables for Tmax T1, T2 and T3 circuit breakers, or socket-plug connectors, still with 39.4" (1 m) long cables, for T4 and T5. For Isomax S6 and S7, the power supply is made by means of special connectors.

Assembly is carried out by pressure into the appropriate seat located in the left-hand part of the circuit breaker and fixing with the screw provided.



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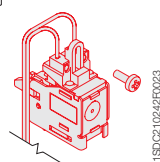
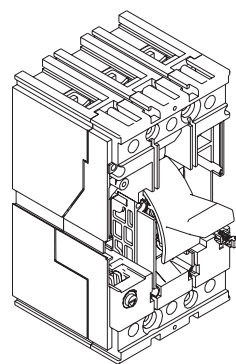
### SOR - Shunt trip

(UL file: E116596)

This allows circuit breaker opening by means of an electrical command. Operation of the release is guaranteed for a voltage between 75% and 110% of the value of the rated power supply voltage  $U_n$ , both in AC and DC. It is always fitted with an auxiliary limit contact.

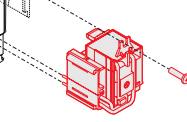
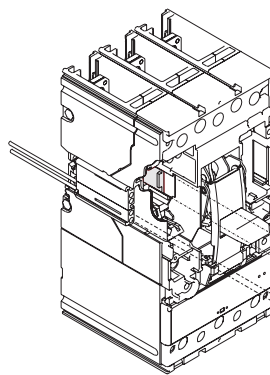
Furthermore, PS-SOR opening coils with permanent operation are also available for T4 and T5, with a much lower power consumption and these can be continuously supplied: in this case they are not, in fact, fitted with an auxiliary limit contact. Again for these coils, either the pre-cabled or uncabled version can be selected.

#### T1-T2-T3



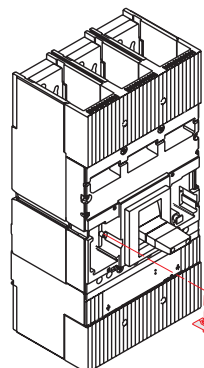
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#### T4-T5



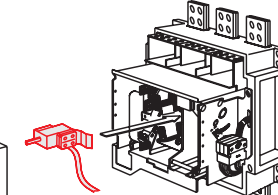
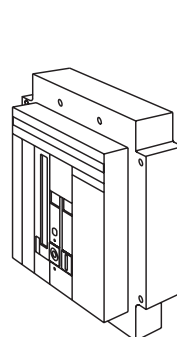
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#### S6-S7



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#### S8



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**SOR - Electrical characteristics**

Absorbed power on inrush				
Version	Tmax T1, T2, T3		Tmax T4 and T5	
	AC [VA]	DC [W]	AC [VA]	DC [W]
12 V DC	–	50	–	150
24...30 V AC/DC	50	50	150	150
48...60 V AC/DC	60	60	150	150
110...127 V AC-110...125 V DC	50	50	150	150
220...240 V AC-220...250 V DC	50	50	150	150
380...440 V AC	55	–	150	–
480...500 V AC	55	–	150	–
Opening times [ms]	15	15	15	15

Absorbed power on inrush				
Version	Isomax S6, S7		Isomax S8	
	AC [VA]	DC [W]	AC [VA]	DC [W]
12 V DC	–	150	–	–
24 V AC/DC	150	150	–	150
30 V DC	–	–	–	150
48 V AC/DC	150	150	200	150
60 V DC	–	–	–	150
100...127 V AC/DC	–	–	200	150
110...120 V AC-110...125 V DC	150	150	–	–
127...150 V AC	–	–	200	–
160 V DC-150...180 V AC	–	–	200	150
200...250 V AC/DC	–	–	200	150
220...240 V AC-220...250 V DC	150	150	–	–
480 V AC	150	–	–	–
380...500 V AC	–	–	200	–
Opening times [ms]	15	–	–	–

**PS-SOR - Electrical characteristics**

Absorbed power on inrush				
Version	Tmax T4 and T5		Isomax S6 and S7	
	AC [VA]	DC [W]	AC [VA]	DC [W]
24-30 V DC	–	4	–	–
110...120 V AC	4	–	–	–
24 V AC/DC	–	–	3.9	4.2





## Accessories

### Service releases



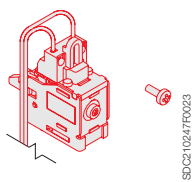
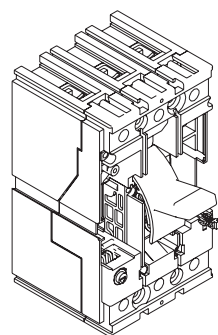
#### UVR - Undervoltage release

(UL file: E116596)

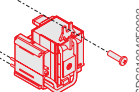
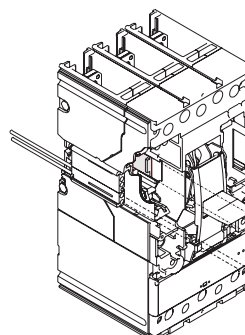
This opens the circuit breaker due to a power supply failure of the release or to voltage drops to values of less than  $0.7 \times U_n$  with a trip range from  $0.69$  to  $0.35 \times U_n$ .

After tripping, the circuit breaker can be closed again starting from a voltage higher than  $0.85 \times U_n$ . With the undervoltage release de-energized, it is not possible to close the circuit breaker.

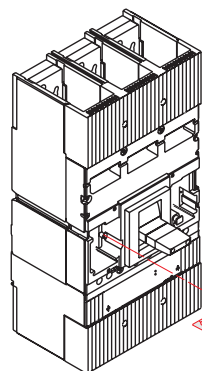
#### T1-T2-T3



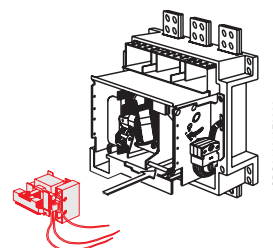
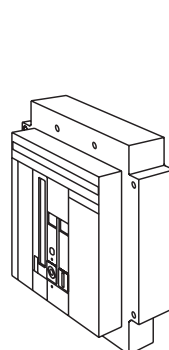
#### T4-T5



#### S6-S7



#### S8



## UVR - Electrical characteristics

Power consumption during permanent operation				
Version	Tmax T1, T2, T3		Tmax T4 and T5	
	AC [VA]	DC [W]	AC [VA]	DC [W]
24...30 V AC/DC	1.5	1.5	6	3
48 V AC/DC	1	1	6	3
60 V AC/DC	1	1	6	3
110...127 V AC-110...125 V DC	2	2	6	3
220...240 V AC-220...250 V DC	2.5	2.5	6	3
380...440 V AC	3	–	6	–
480...500 V AC	4	–	6	–
Opening times [ms]	15	15	25	25

Power consumption during permanent operation				
Version	Isomax S6, S7		Isomax S8	
	AC [VA]	DC [W]	AC [VA]	DC [W]
24 V DC	–	4	–	15
24 V AC	10	–	30 (50 Hz)	–
30 V DC	–	–	–	15
30 V AC	–	–	30 (50 Hz)	–
48 V AC	10	–	30 (50 Hz)	–
48 V DC	–	4	–	15
60 V DC	–	–	–	15
60 V AC	–	–	30 (50 Hz)	–
100 V AC	–	–	30 (50 Hz)	–
110...115 V AC	–	–	30 (60 Hz)	–
110...115 V AC	–	–	30 (50 Hz)	–
110...127 V AC	10	–	30 (50 Hz)	–
125...127 V AC	–	–	30 (60 Hz)	–
110...125 V DC	–	–	–	15
120 V AC	–	–	30 (60 Hz)	–
127...130 V AC	–	–	30 (50 Hz)	–
125 V DC	–	4	–	–
240 V AC	10	–	30 (60 Hz)	–
250 V DC	–	4	–	–
480 V AC	10	–	–	–
208...220 V AC	–	–	30 (60 Hz)	–
220 V AC	–	–	30 (50 Hz)	–
220...250 V DC	–	–	–	15
230...240 V AC	–	–	30 (50 Hz)	–
277 V AC	–	–	30 (60 Hz)	–
380 V AC	–	–	30 (60 Hz)	–
380...400 V AC	–	–	30 (50 Hz)	–
440 V AC	–	–	30 (60 Hz)	–
480 V AC	–	–	30 (60 Hz)	–
500 V AC	–	–	30 (50 Hz)	–
Opening times [ms]	25	25	25	25



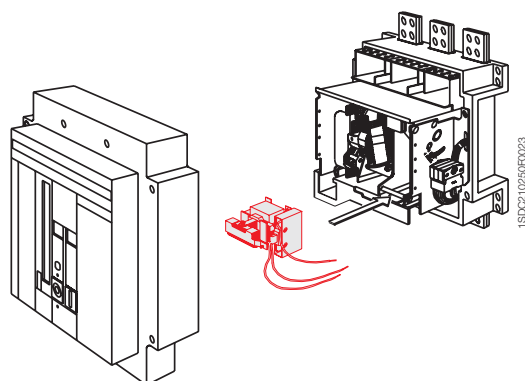
## Accessories

### Service releases



#### Closing coil

Used with Isomax S8 circuit breaker, this allows circuit breaker closing by means of an electrical contact. Operation of the release is guaranteed for a voltage between 80% and 110% of the value of the rated power supply voltage  $U_n$ , both in AC and in DC.



#### Closing coil

##### Isomax S8

Version	Absorbed power on inrush	
	AC [VA]	DC [W]
24 V DC		220
24 V AC (60Hz)	200	
48 V DC		220
110...125 V DC		220
120 V AC (60Hz)	200	
208...220 V AC (60Hz)	200	
220...250 V DC		220
240 V AC (60Hz)	200	
415...440 V AC-480 V AC (60Hz)	200	
Opening times [ms]	25	25



## UVD - Time delay device for undervoltage release

The undervoltage release can be combined with an external electronic power supply time delay device, which allows circuit breaker opening to be delayed in the case of a drop or failure in the power supply voltage of the release itself, according to preset and adjustable delays, in order to prevent unwarranted trips caused by temporary malfunctions. The delay device must be combined with an undervoltage release with the same corresponding voltage. This time delay device can also be combined either with the Tmax T1...T5 or Isomax circuit breakers.



## Extension for testing releases

Available for Tmax T4 and T5 and Isomax S6 and S7 circuit breakers, this allows supply to the service releases with the circuit breaker in the racked out position. It is therefore possible to carry out blank operating tests of the circuit breaker in safe conditions, i.e. isolated in relation to the power circuits.



## Connectors for service releases for Isomax

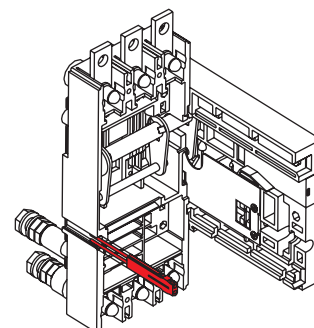
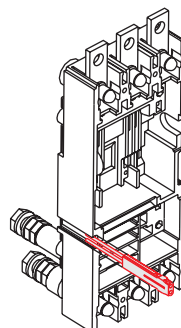
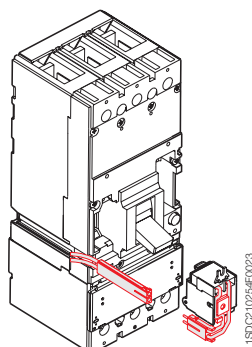
These allow the shunt trip or undervoltage release to be connected to the power supply circuit. They are available in the following versions:

- for Isomax S6 and S7 fixed circuit breakers
- for Isomax S6 and S7 draw out circuit breakers.

Assembly is by means of pressure into special slots in the left side of the circuit breaker.

Cables of different lengths (UL/CSA) are available.

Socket-plugs with 3, 6 or 12 poles and cable kit (UL/CSA) with a length of 78.8' (2 meters) are available for Tmax: the socket-plugs are necessary only for plug-in version.



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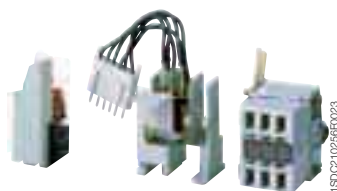


## Accessories

### Electrical signals

These allow information relative to the circuit breaker status to be taken outside the circuit breaker. Installation of these accessories takes place directly from the front of the circuit breaker, in special slots on the right-hand side of the circuit breaker, completely segregated from the live parts, with increased operator safety.

They are supplied in the pre-cabled version with 39.4" (1 m) long cables for the T1, T2 and T3 circuit breakers, or socket-plug connectors, still with 39.4" (1 m) long cables, for T4 and T5. For Isomax S6 and S7, the power supply is made by means of special connectors.



### AUX - Auxiliary contacts and bell alarm

(UL file: E116596)

These carry out electrical signalling of the operating state of the circuit breaker:

- **open/closed**, which indicates the position of the main contacts
- **bell alarm**, which signals the circuit breaker open due to one of the following reasons:
  - overload or short circuit
  - shunt trip
  - UVR
  - residual current release
  - emergency opening pushbutton of the motor operator
  - operation of the circuit breakers test pushbutton.

Auxiliary contacts can be supplied (according to the type) in the pre-cabled version with 1 m long cables for T1, T2 and T3 or with connectors, still with 1m long cables, for T4, T5, S6 and S7.

#### AUX - Electrical characteristics

AUX 250 V - T1, T2, T3, T4 and T5		
Power supply voltage [V]	Service current [A]	
	AC	DC
125	6	0.3
250	5	0.15

AUX 400V - T4, T5		
Power supply voltage [V]	Service current [A]	
	AC	DC
125	–	0.5
250	12	0.3
400	3	–

AUX 24 V - T1, T2, T3, T4 and T5		
Power supply voltage [V]	Service current [A]	
	AC	DC
24	0.3	0.75 mA
5	–	1 mA

AUX 400V - S6, S7		
Power supply voltage [V]	Service current [A]	
	AC	DC
125	–	0.3
250	6	0.15
400	3	–

AUX 500 V - S8		
Power supply voltage [V]	Service current [A]	
	AC	DC
220	–	1
380	6	–
500	3	–

The auxiliary contacts are available for use with different voltages either in direct or alternating current:

#### **T1, T2, T3, T4 and T5 (AUX) – 250 V AC/DC (UL file: E116596)**

In the pre-cabled version:

- 1 contact for signalling (on changeover) open/closed plus 1 contact (on changeover) for bell alarm
- 3 contacts for signalling (on changeover) open/closed plus 1 contact (on changeover) for bell alarm.

#### **T4 and T5 (AUX) – 400 V AC (UL file: E116596)**

Only in the pre-cabled version:

- 1 contact for signalling (on changeover) open/closed plus 1 contact (on changeover) for bell alarm
- 2 contacts for signalling (on changeover) open/closed.

#### **T1, T2, T3, T4 and T5 (AUX) – 24 V DC**

Gold-plated in the pre-cabled and uncabled version for T4 and T5 and only in the uncabled version for T1, T2 and T3:

- 3 contacts for signalling (on changeover) open/closed plus 1 contact (on changeover) for bell alarm.

#### **T2 with PR221DS electronic trip unit - 250 V AC/DC**

In the pre-cabled version:

- a contact for signalling alarm which signals intervention of one of the protection functions of electronic trip unit plus a contact for signalling (on changeover) open/closed plus a contact for signalling (on changeover) release tripped
- two open/closed signalling contacts (on changeover) plus one release tripped signalling contact (on changeover).

#### **T4 and T5 with PR221DS, PR222DS/P and PR222DS/PD-A (AUX-SA) – 250 V AC**

Only in the pre-cabled version:

- 1 contact for bell alarm.

#### **T4 and T5 (AUX-MO)**

Only in the uncabled version, to be combined with the MOE or MOE-E motor operator:

- 1 contact for signalling the operating mode of the circuit breaker with the motor operator: manual or remote.

#### **T4 and T5 with PR222DS/PD-A electronic trip unit (AUX-E)**

Only in the uncabled version and only combined with the PR222DS/PD-A, they communicate the state of the circuit breaker to the electronic trip unit.

- 1 contact for signalling (on changeover) open/closed + 1 contact (on changeover) for bell alarm.

#### **S6 and S7 (AUX) – 400 V AC/250 V DC (UL file: E116596)**

In the pre-cabled and uncabled version:

- 1 contact during open/closed changeover + 1 bell alarm
- 2 contacts for signalling (on changeover) open/closed
- 1 open signal +1 closed signal +1 bell alarm.

#### **S8 (AUX) – 500 V AC/220 V DC (UL file: E116596)**

In the pre-cabled version:

- 3 contacts during open/closed changeover
- 1 bell alarm.

Signals			T1	T2	TMF	T2 PR221DS	T3	T4	T5	S6	S7	S8
AUX 250 V AC/DC	1 open/closed changeover contact + 1 bell alarm contact		■	■			■	■	■			
AUX 250 V AC/DC	3 open/closed changeover contacts + 1 bell alarm contact		■	■			■	■	■			
AUX 250 V AC/DC	1 contact signalling coil tripped + 1 open/closed changeover contact + 1 bell alarm contact					■						
AUX 250 V AC/DC	2 open/closed changeover contacts + 1 bell alarm contact					■						
AUX 400 V AC	1 open/closed changeover contact + 1 bell alarm contact							■	■	■	■	
AUX 400 V AC	2 open/closed changeover contacts							■	■	■	■	
AUX 400 V AC/250 V DC	1 contact signalling coil tripped + 1 open/closed changeover contact + 1 bell alarm contact									■	■	
AUX 24 V AC/DC	3 open/closed changeover contacts + 1 bell alarm contact		■	■			■	■	■			
AUX-SA	1 contact signalling coil tripped							■	■			
AUX-MO	1 contact signalling manual/remote							■	■			
AUX 500 V AC/220 V DC	3 open/closed changeover contacts											■
AUX 500 V AC/220 V DC	1 bell alarm contact											■

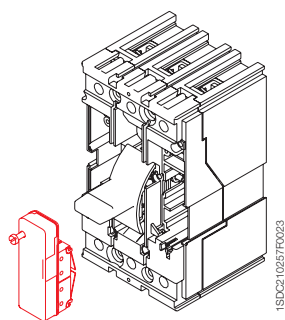


## Accessories

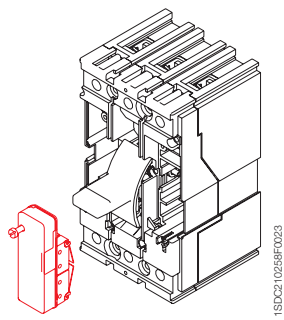
### Electrical signals

A change-over contact signalling residual current protection trip is always supplied for the Tmax circuit breakers combined with the RC221 and RC222 residual current releases (in accordance with IEC 60947-2 Standard). Two change-over contacts for signalling pre-alarm and alarm are also available with RC222.

**T1-T2-T3**

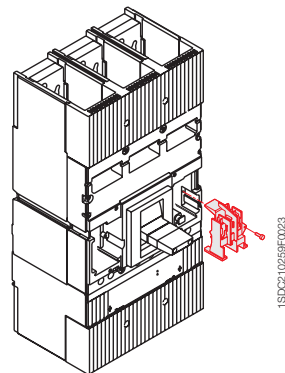


**T4**



**AUX-C 250 V AC/DC**

**S6-S7**





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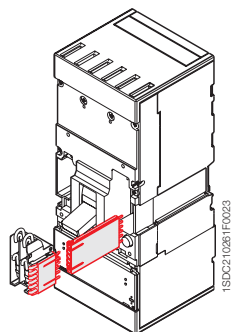
## Connectors for auxiliary contacts for Isomax

These allow the auxiliary contacts to be connected to the relative power supply circuit.

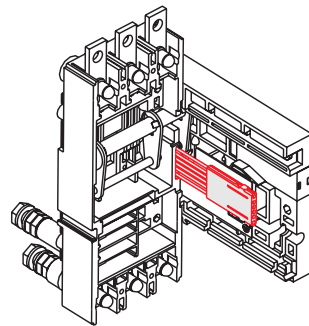
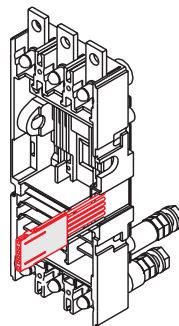
For Isomax S6 and S7 circuit breakers, the auxiliary contacts (fitted with plug connector) can only be supplied by means of the specific connectors to be ordered specifying the size and version of the circuit breaker (fixed or plug-in/draw out).

Assembly is carried out by mounting into special slots on the right side of the circuit breaker.

Socket-plugs with 3, 6 or 12 poles and cable kit (UL/CSA) with a length of 78.8" (2 m) are available. For Tmax: the socket-plugs are necessary only for plug-in version.



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## Extension for testing auxiliary contacts



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Available for Tmax T4 and T5, and Isomax S6 and S7 circuit breakers, this allows the auxiliary contacts to be connected to the relative power supply circuit with the circuit breaker in the withdrawn position. With the circuit breaker in safe conditions, i.e. isolated in relation to the power circuits, blank tests of circuit breaker operation can be carried out.





## Accessories

### Electrical signals



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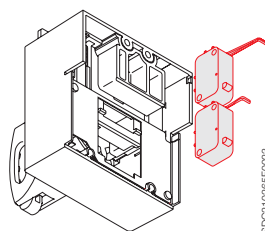
#### AUE - Early auxiliary contacts

One auxiliary contact for Isomax S6 and S7 and two contacts for Tmax T1, T2, T3, T4 and T5 allow the undervoltage release or a control device to be supplied in advance, in relation to closing of the main contacts, in compliance with the IEC 60204-1, and VDE 0113 Standards. They are mounted inside the direct rotary handle operating mechanism.

For Isomax S6 and S7, the contact is supplied complete with a socket connector with double slide for simultaneous connection of the undervoltage release and of the consent contact itself. With Tmax T1, T2 and T3, the early contacts are supplied in the cabled version with cables 39.4" (1 m) long, complete with socket-plug with 6 poles, whereas for T4 and T5 early contacts are provided with socket-plug connectors with 39.4" (1 m) cables.

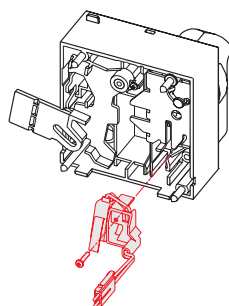
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#### T1-T5

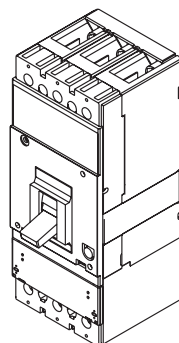
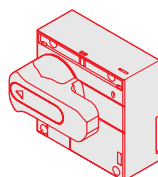


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#### S6...S7



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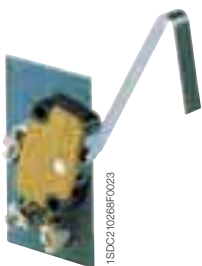
## AUP - Auxiliary position contacts

For the fixed part of circuit breakers Tmax T2, T3, T4 and T5, and Isomax S6 and S7 they provide electrical signalling of the circuit breaker position in relation to the fixed part: racked-in, drawn out and removed. They can only be connected by means of free wires and are available in the following versions:

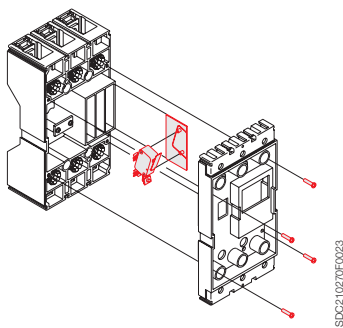
- contacts signalling circuit breaker racked-in for Tmax and Isomax circuit breakers
- contacts signalling circuit breaker racked-out for Tmax T4 and T5 for the draw-out version
- contacts signalling circuit breaker racked-in for Tmax T4 and T5 in 24 V DC
- contacts signalling circuit breaker racked-out for Tmax T4 and T5 in 24 V DC for the draw-out version.

A maximum of three contacts for Tmax and a maximum of five contacts for S6 and S7, in any combination, can be installed on the fixed part.

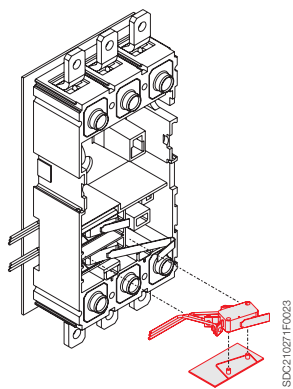
The circuit breaker position contacts are also available in the gold-plated version for digital signals, also suitable for use for  $U_n < 24$  V voltages with the same type of signaling and versions (for Isomax).



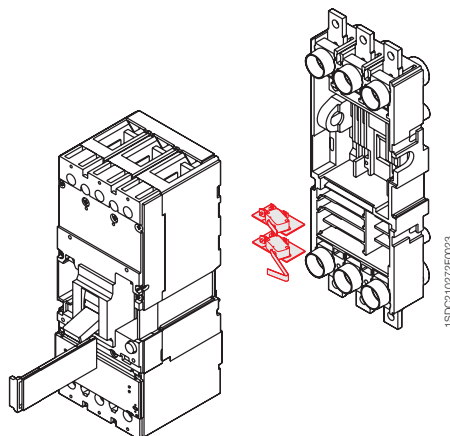
**T2-T3**



**T4-T5**



**S6-S7**





## Accessories

### Remote controls

These allow remote control of circuit breaker opening and closing and are particularly suitable for use in electrical network supervision and control systems.

A selector allows changeover from automatic to manual operation. They are always fitted with a padlock in the open position.

### MOS - Solenoid operating mechanism for Tmax T1, T2 and T3

(UL file: E116596)



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This operates both opening and closing of the circuit breaker, acting directly on its lever. It is proposed in two versions, one "side-by-side" (IEC only), with T1 and T2, for installation on a panel or DIN rail, the other on the front of the circuit breaker (UL file: E116596), with T1, T2 and T3. The latter is complete with operating handle. The front version can also be used with plug-in circuit breakers.

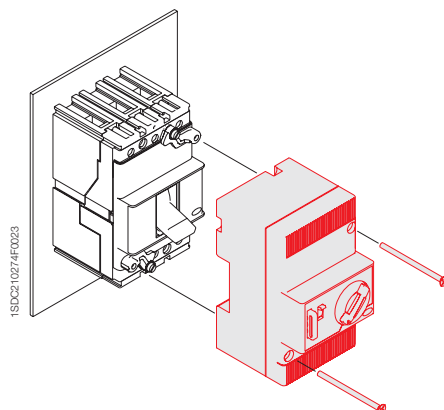
Coupling with the residual current release is only allowed for a circuit breaker with solenoid operator side-by-side, to allow access to the user interface of the residual current release from the front of the switchgear. In fact, using the solenoid operator superimposed would imply the circuit breaker position on the rear of the door and its residual current release and the interface would no longer be ac-

cessible. This combination can only be installed directly on the back plate of the switchboard. Both versions can be used either in the three-pole or four-pole version.

The solenoid operator is supplied complete with free cables 39.4" (1 m) long and socket-plug connector with 3 poles just for the superimposed version. The table gives the power supply voltage values  $U_n$  [V].

Rated voltage, $U_n$		
AC	[V]	110...250
DC	[V]	48...60 / 110...250
Operating voltage		85...110% $U_n$
Inrush power consumption		1800 [VA] / 1000 [W]
Time	opening [s]	< 0.1
	closing [s]	< 0.1
Mechanical life	[no. Operations]	25000
	[no. Operations/h]	240 (T1 and T2); 120 (T3)
Degree of protection, on the front		IP30
Minimum control impulse time on opening and closing		[ms] >100

Note: with the MOS in the 110...250 V AC/DC version, it is necessary to use the MOS-A adapter (supplied) for 220 V  $U_n$  250 V service voltage



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## Stored energy motor operator for Tmax T4 and T5 – MOE

(MOE: UL file: E116596)



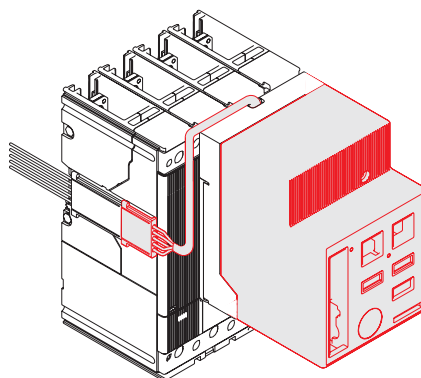
1SD/C21/027/5F0023

With the stored energy motor operator, it is possible to control both opening and closing of the circuit breaker on which it is installed. During opening of the circuit breaker, the spring system is recharged automatically: the stored energy is exploited in this way to close the circuit breaker. The motor operator is always supplied complete with socket-plug connectors with 39.4" (1m) long cables and is always fitted with a padlock. The connectors, once inserted in the special slot on the right-hand side of the circuit breaker, extend in relation to the outline of the circuit breaker itself.

The device can be fitted both with a key lock in the open position (with the same MOL-S keys for groups of circuit breakers or different MOL-D keys) and with a MOL-M key lock against manual operation: in the former case, the lock in the open position is both of electrical and mechanical type, in the latter case, only of mechanical type, i.e. only closing from the front of the circuit breaker (remote closing is allowed).

The motor operator is always fitted with an auxiliary contact to signal "auto" or "manual (not on changeover)". On request, it can also be fitted with an AUX-MO auxiliary contact (on changeover), which provides a signal of its service state: "auto" (remote control of the circuit breaker) or "manual".

MOE		Tmax T4 and T5	
Rated voltage, Un		AC [V]	DC [V]
		–	24
		–	48...60
		110...125	110...125
		220...250	220...250
		380	–
Operating voltage		85...110% Un 85...110% Un	
Power consumption on inrush Ps		300 V A	300 W
Power consumption in service Pc		150 V A	150 W
Time	opening [s]	1.5	
	closing [s]	< 0.1	
	resetting [s]	3	
Mechanical life [no. operations]		20000	
Degree of protection, on the front		IP30	
Minimum opening and closing control time [ms]		150	



1SD/C21/027/5F0023



## Accessories

### Remote controls

#### Adapters - ADP

For the pre-cabled electrical accessories, it is necessary to use the adapters to be coupled with the plug, which will then be connected to the socket located on the cradle for the moving parts of the plug-in or draw out version of Tmax T4 and T5.

Depending on the electrical accessories required, it will be necessary to ask for one or two adapters to be mounted on the left side and/or on the right side of the moving part

There are four types of adapters available:

- 5-way adapters
- 6-way adapters
- 10-way adapters
- 12-way adapters.

The table below indicates the adapters which must be used for the various possible configurations of electrical accessories:

ADP adapters for T4 and T5 cabled accessories				
	5-way	6-way	10-way	12-way
<b>left side</b>				
SOR	■			
UVR	■			
SA for residual current RC222	■			
SOR o UVR + SA for residual current RC222	■			
MOE			■	
MOE + SOR or UVR			■	
MOE + SOR or UVR + SA for residual current RC222			■	
AUE			■	
AUE + SOR or UVR			■	
AUE + SOR or UVR + SA for residual current RC222			■	
<b>right side</b>				
AUX 1Q + 1SY 1 open/closed changeover contact + 1 release tripped changeover contact		■		
AUX 2Q 2 open/closed changeover contacts		■		
AUX 3Q + 1SY 3 open/closed changeover contacts + 1 release tripped changeover contact				■



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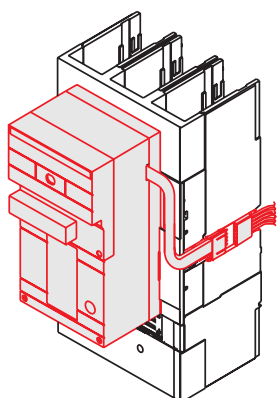
## Stored energy motor operator for Isomax S6 and S7 circuit breakers

(UL file: E116596)

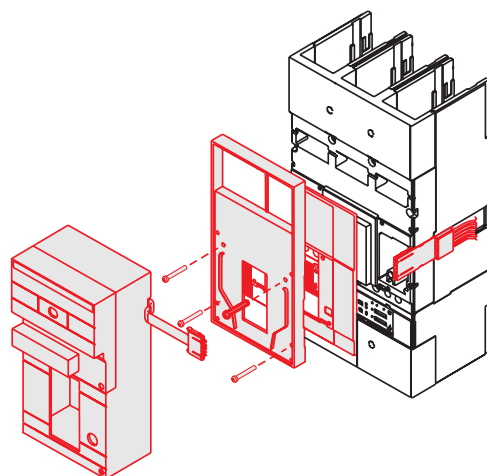
With the stored energy operating mechanism, during circuit breaker opening the release mechanism automatically pre-charges a system of springs: the stored energy is used for closing the circuit breaker. It is supplied complete with shunt opening release ( $P_s=100\text{VA}/100\text{W}$ ) and flange for the compartment door. The table shows the power supply voltages values  $U_n$  [V].

In case of interlocked circuit breakers, the key lock against manual operation is necessary.

Motor operator for S6, S7			
		AC	DC
Rated voltage, $U_n$	[V]		24
	[V]		48
	[V]	120	125
	[V]	240	250
Operating frequency		50...60	
Operating voltage		85...110% $U_n$	85...110% $U_n$
Power consumption on inrush $P_s$		660 VA	600 W
Power consumption in service $P_c$		180 VA	180 W
Time constant [ms]		22	
Duration	opening [s]	1.2	
	closing [s]	0.09	
Mechanical life [no. operations]		10000 (S6) - 5000 (S7)	
Degree of protection, on the front		IP30	
Minimum duration of the opening and closing command impulse [ms]		100	



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## Accessories

### Remote controls



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#### Geared motor for Isomax S8 circuit breaker

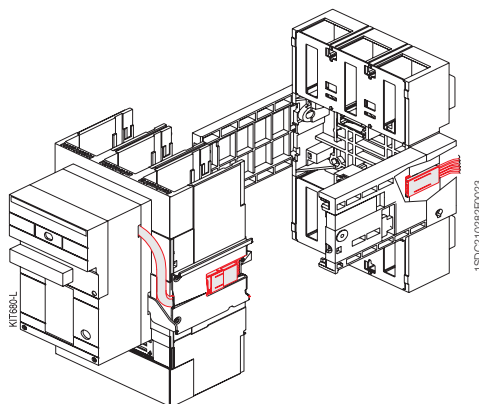
This allows the springs of the circuit breaker closing mechanism to be charged automatically, immediately following a closing operation. It includes a limit microswitch for electrical signalling of closing springs charged.



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#### Connectors for Isomax S6 and S7 motor operators

The motor operators for S6 and S7 can only be supplied by means of the specific connectors. They are of the slide type and allow simultaneous connection of both the motor operator and the auxiliary contacts to the relative power supply circuit. They are an alternative to the corresponding connectors for the auxiliary contacts only since they are housed in the same seat. They must be ordered specifying the size and version of the circuit breaker (fixed or plug-in/draw out).



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#### Extension for testing motor operators

For Tmax T4 and T5 and Isomax S6 and S7 circuit breakers, this allows both motor operators and the auxiliary contacts to be connected to the relative power supply circuit with the circuit breaker in the racked-out position. With the circuit breaker in safe conditions, i.e. isolated in relation to the power circuits, blank operating tests of the circuit breaker can be carried out. It must be ordered specifying the size and version of the circuit breaker (fixed or plug-in/draw out) and automatically excludes the corresponding extension for testing the auxiliary contacts.



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## Accessories

### Operating mechanisms with locks

#### Rotary handle operating mechanism – RHD/RHE

(UL file: E116596 for Tmax)



The rotary handle operating mechanism facilitates operation thanks to its ergonomic handle. It is always fitted with a padlock in the open position, which prevents the circuit breaker being closed. The padlock slot can take up to three padlocks – stem Ø 0.27" (7 mm) for T1, T2, T3 T4 and T5, and 0.24" (6 mm) for S6 and S7 (not supplied).

The rotary handle operating mechanism for Tmax is always fitted with a compartment door lock and, on request, can be supplied with a key lock in the open position; for S6 and S7, on request, it can be supplied with a compartment door lock or key lock in the open position.

Application of the rotary handle operating mechanism is an alternative to the motor operator and to the front interlocking plate for Tmax T1, T2, T3 and to the front flange for the lever operating mechanism for Tmax T4, T5 and Isomax S6 and S7.

The rotary handle operating mechanism is available in either the direct version and in the transmitted version on the compartment door. The trip unit settings and the nameplate data remain accessible to the user.

For Isomax S6 and S7 circuit breakers, the direct rotary handle operating mechanism on the circuit breaker is always supplied complete with flange for the compartment door.

The rotary handle operating mechanism in the emergency version, complete with red-yellow handle and yellow plate, suitable for machine tool control, is also available for all the circuit breakers. For Tmax circuit breakers, the rotary handle operating mechanisms can be ordered by building up by ordering the following three devices:

- rotary handle on the compartment door
- transmission rod (19.68" / 500 mm)
- base for circuit breaker

or, alternatively, by using the code of the ready-configured version.

3

Type of RH operating mechanism		T1, T2, T3		T4, T5		S6, S7	
		F/P		F/P	W	F	W
RHD	Direct	■		■	■	■	■
RHD_EM	Emergency direct	■		■	–	■	■
RHE	Transmitted with adjustable distance	19.68" - 500 mm		■	■	19.68" - 500 mm	19.68" - 500 mm
RHE_EM	Emergency transmitted with adjustable distance	19.68" - 500 mm		■	■	19.68" - 500 mm	–
RHE_S	Rod for transmitted adjustable handle	19.68" - 500 mm		■	–	–	–
RHE_B	Base for circuit breaker	■		■	■	–	–
RHE_H	Handle for transmitted RH with adjustable distance	■		■	■	–	–
RHE_H_EM	Emergency handle for transmitted RH with adjustable distance	■		■	■	–	–

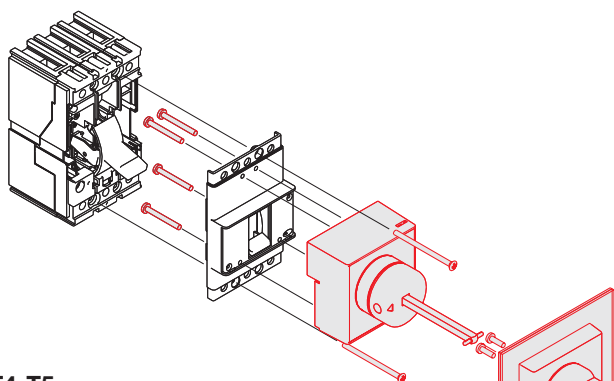




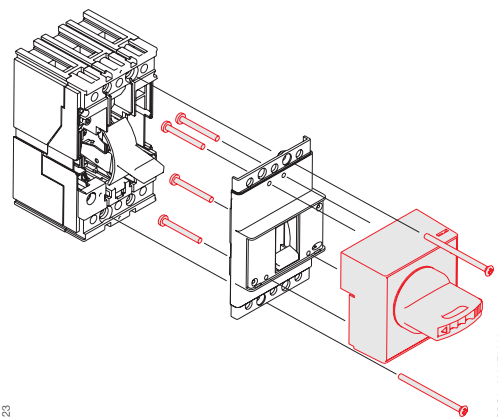
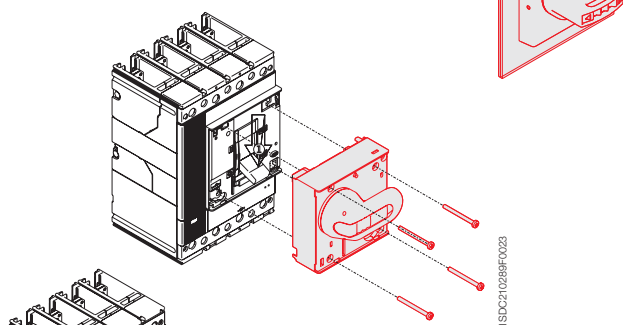
## Accessories

### Operating mechanisms with locks

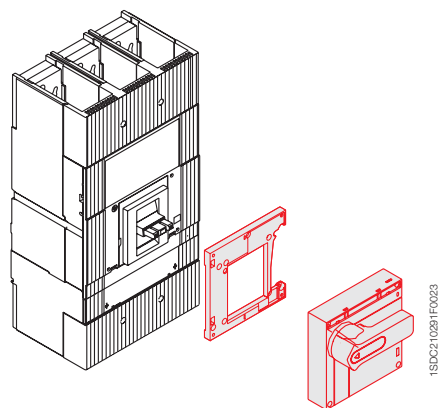
T2-T3



T4-T5



S6-S7



3

### IP54 protection for rotary handle

(UL file: E116596 for Tmax T4-T5)

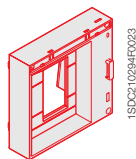
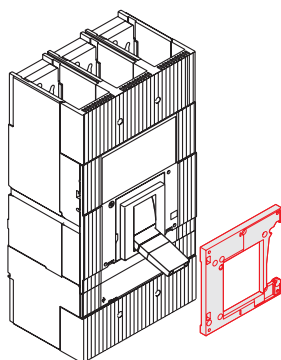
Allows IP54 degree of protection to be obtained. It is available for the transmitted rotary handle operating mechanism on the compartment door (RHE) for the Tmax and Isomax circuit breakers.





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#### S6-S7



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### Front flange for lever operating mechanism – FLD (UL file: E116596 for Tmax)

This can be installed on Tmax T4 and T5, and on Isomax S6 and S7 fixed, plug-in or draw out circuit breakers. In case of draw out circuit breakers installed in compartments, it allows higher degree of protection to be maintained for the whole isolation run of the circuit breaker.

It is always fitted with a padlock in the open position (stem  $\varnothing 0.24''$  - 6 mm up to three padlocks - not supplied) which prevents closing of the circuit breaker.

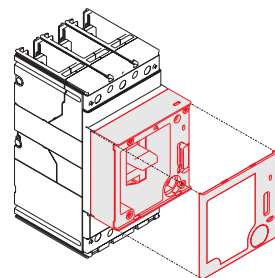
On request, it can be fitted with a key lock in the open position for one or more circuit breakers and with the compartment door lock.

It is available in the following versions:

- for fixed or plug-in circuit breaker
- for draw out circuit breaker.

The front flange for lever operating mechanism is always an alternative to the motor operator, to the rotary handle and, for T4 and T5, to the front display unit FDU.

For Isomax S6 and S7 circuit breakers, it is always supplied complete with flange for the compartment door.



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### Key lock in open position

This allows the mechanical closing operation of the circuit breaker to be locked.

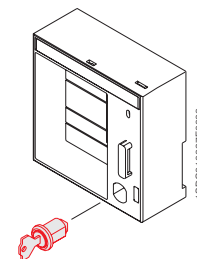
The following versions are available:

- lock with different key for each circuit breaker
- lock with the same key for groups of circuit breakers.

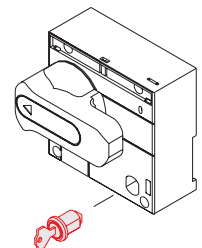
For Isomax S6 and S7 circuit breakers, different locks are supplied, for stored energy motor operator, for rotary handle or front for lever operating mechanism.

For Tmax T1, T2 and T3, the key lock is available for the rotary handle operating mechanism (RHL). Furthermore, it is also available in the version which allows the lock both in the open and in the closed position: the lock in the closed position does not prevent tripping of the mechanism following a fault or a remote control command.

For T4 and T5 key locks in the open position are available either with different keys (KLF-D) or with the same keys (KLF-S): in this case, up to four different key numbering codes are available.



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## Accessories

### Operating mechanisms with locks



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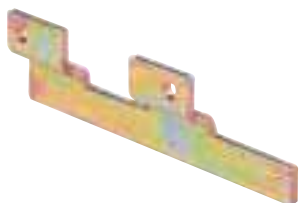
#### KLC - Key lock on the circuit breaker

Available for Tmax T1, T2 and T3, the key lock on the circuit breaker allows the mechanical closing operation of the circuit breaker to be locked and is installed directly on the front inside the slot in correspondence with the left pole. It cannot be mounted with a front operating mechanism, a rotary handle operating mechanism, a motor operator, or RC221/RC222 residual current releases and, only in the case of three-pole circuit breakers, with service releases (UVR, SOR).

The key lock is the Ronis 622 type and is available in two versions:

- standard type, with key only removable with the circuit breaker locked (KLC)
- special type, with key removable in both positions (KLC-S).

3

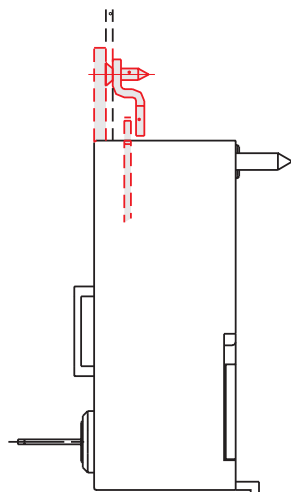


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#### Compartment door lock

This prevents the compartment door being opened with the circuit breaker closed. It can be used with Isomax S6 and S7 circuit breakers in the fixed, plug-in or draw out version and fitted with rotary handle operating mechanism or front for lever operating mechanism. It consists of two elements: one applied to the rotary handle operating mechanism or to the front for the lever operating mechanism, the other, consisting of a metal striker, to be applied onto the compartment door.

For Tmax circuit breakers, the door lock is always supplied with the rotary handle operating mechanism.



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## Lock for fixed part of draw out circuit breakers - Tmax T4, T5 and Isomax S6, S7



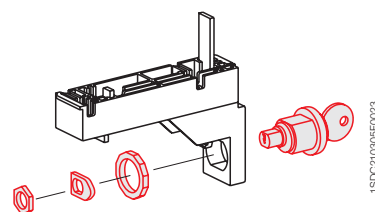
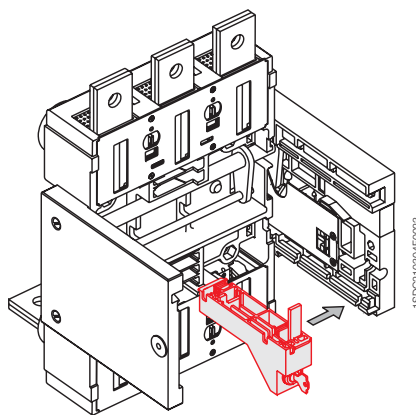
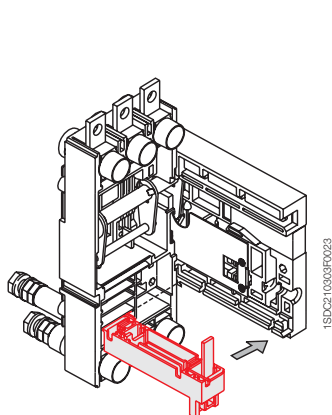
Key locks or padlocks are available to be applied to the guide of the fixed part of a draw out circuit breaker to prevent the moving part from being racked-in. The following different versions are available:

- padlock, which can take up to three padlocks with stem  $\varnothing 0.24"$  - 6 mm (not supplied);
- key lock in the open position with different key for each circuit breaker;
- key lock in the open position between two or more circuit breakers with the same key for groups of circuit breakers;
- key lock of Ronis type (without key).

For T4 and T5 draw out circuit breakers, key or padlocks-locks are available to be applied onto the rail of the fixed part, to prevent racking-in of the withdrawable part.

Selection can be made among the following:

- key lock with different keys (KLF-D FP)
- key lock with the same keys for groups of circuit breakers (KLF-S FP)
- padlock, which can take up to three padlocks with 6 mm stem  $\varnothing$ , not supplied (PLL FP).





## Accessories

### Operating mechanisms with locks



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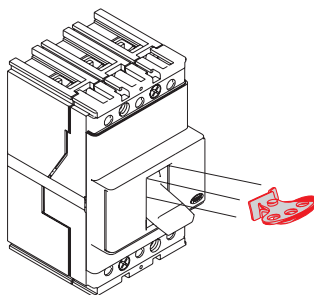
\* UL file E116596

#### PLL - Padlock for operating lever for Tmax T1, T2, T3

This is applied to the Tmax T1, T2 and T3 covers to prevent the lever closing or opening operations. It allows installation of up to a maximum of three padlocks Ø 0.24" - 7 mm (not supplied).

It is available in the following versions:

- locking device only of the closing operation (it is applied with circuit breaker ON/OFF)
- locking device on the closing and opening operation according to its assembly position. The lock on the opening operation does not prevent release of the mechanism following a fault or remote control command.



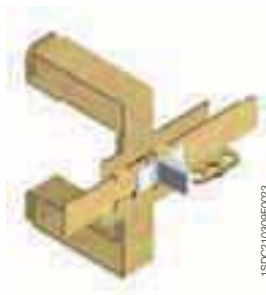
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#### Operating mechanisms with locks

	T1	T2	T3	T4	T5	S6	S7
Sealable lock of thermal adjustment	■	■	■				
FDL_Key lock for fornt for lever operating mechanism				■	■	■	■
RHL_Key lock for rotary handle operating mechanism	■	■	■			■	■
KLC_Key lock on the circuit breaker	■	■	■				
Compartment door lock	■	■	■	■	■	■	■
KLF-FP and PLL-FP_locks in open position for fixed parts				■	■	■	■
PLL_Padlock for operating lever	■	■	■				
MOL-D and MOL-S_Key lock in open position for MOE				■	■		
MOL-M_Key lock against manual operation for MOE				■	■		

## Mechanical interlock between circuit breakers (for Tmax UL file E116596)

### Tmax T1, T2, T3



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For Tmax T1, T2 and T3 circuit breakers a front mechanical interlock (MIF) is available, which can be applied on the front of two (UL file E116596) both three-pole and four-pole fixed version circuit breakers, preventing simultaneous closing of the two circuit breakers. Fixing is carried out directly on the back plate of the switchboard. The front interlocking plate allows installation of a padlock in order to fix the position (possibility of fixing the O-O position as well). It is also possible to interlock three circuit breakers, even of different sizes, by using a special plate, making the following interlocking combinations: IOO-OIO-OOI-OOO. For Tmax T3 is now available also rear interlock both vertical and horizontal.

### Tmax T4, T5

The mechanical interlock for Tmax T4 and T5 allows installation of two circuit breakers on a single support and, by means of special lever mechanism, makes them mechanically interdependent. Unlike the interlock used with T1, T2 and T3 which is frontal, this is a rear interlock consisting of a vertical or horizontal frame group (MIR-HB or MIR-VB), made up of a metal frame and of the leverisms to interlock, and of two plates (MIR-P) on which the circuit breakers are housed. Types of back plates:

#### Interlock

Type		
<b>A</b>	T4 (F-P-W)	+ T4 (F-P-W)
<b>B</b>	T4 (F-P-W)	+ T5 400 (F-P-W) or T5 630 (F)
<b>C</b>	T4 (F-P-W)	+ T5 630 (P-W)
<b>D</b>	T5 400 (F-P-W) or T5 630 (F)	+ T5 400 (F-P-W) or T5 630 (F)
<b>E</b>	T5 400 (F-P-W) or T5 630 (F)	+ T5 630 (P-W)
<b>F</b>	T5 630 (P-W)	+ T5 630 (P-W)

### S6-S7



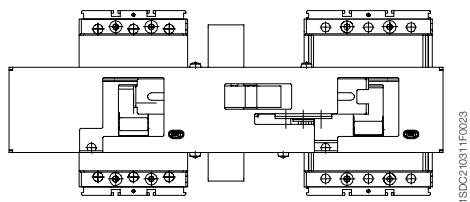
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### Isomax S6, S7

For Isomax S6 and S7 circuit breakers, the rear mechanical interlock allows installation of two circuit breakers on a single support and, by means of a walking beam mechanism, makes them mechanically inter-dependent. It prevents operation in parallel of two power supply sources (e.g.: normal - emergency). It consists of a kit with levers and assembly accessories and a metallic support.

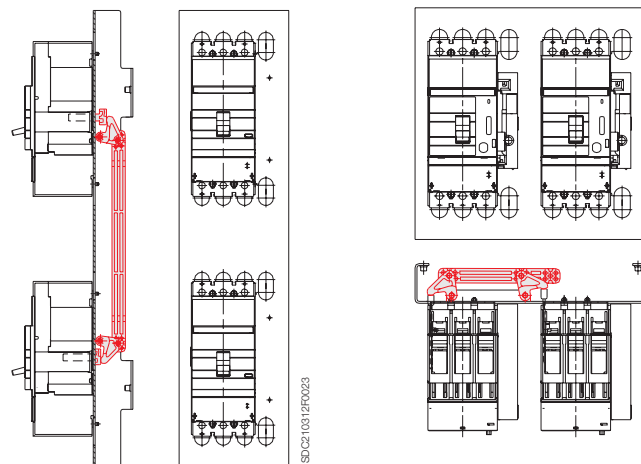
The mechanical interlock is available in the version for side-by-side circuit breakers and for superimposed circuit breakers. Only circuit breakers of the same size and in the same version can be interlocked.

### T1-T2-T3



1SDC210311F0023

### S6-S7



1SDC210312F0023

1SDC210313F0023

#### Mechanical interlocks

	T1	T2	T3	T4	T5	S6	S7
Front interlock between two fixed circuit breakers	■	■	■				
Front interlock among three fixed circuit breakers	■	■	■				
Rear interlock between two fixed or plug-in or draw out circuit breakers side by side				■	■	■	■
Rear interlock between two fixed or plug-in or draw out circuit breakers superimposed				■	■	■	■





## Accessories

### Residual current releases - IEC only

All the Tmax series of circuit-breakers are preset for combined assembly with residual current releases. In particular, the Tmax T1, T2 and T3 circuit-breakers can be combined with the new version of the SACE RC221 or RC222 series of residual current releases and four-pole T4 and T5 with RC222 or RC223 to be installed below the circuit-breaker.

Apart from the protection against overloads and short-circuits typical of automatic circuit-breakers, the residual current circuit-breakers derived from them also guarantee protection of people and protection against earth fault currents, thereby ensuring protection against direct contacts, indirect contacts and fire hazards. The residual current releases can also be mounted on the Tmax T1D, T3D, T4D and T5D switch-disconnectors. In that case, the derived apparatus is a "pure" residual current circuit-breaker, i.e. one which only guarantees residual current protection and not the protections typical of circuit-breakers. "Pure" residual current circuit-breakers are only sensitive to the earth fault current and are generally applied as main switch-disconnectors in small distribution switchboards towards end users.

The use of "pure" and "impure" residual current circuit-breakers allows continual monitoring of the state of plant insulation, ensuring efficient protection against fire and explosion hazards and, when the devices have  $I_n \geq 30$  mA, ensure protection of people against indirect and direct earth contacts to fulfil the compulsory measures foreseen by the accident prevention regulations and prescriptions. The residual current releases are constructed in compliance with the following Standards:

- IEC 60947-2 appendix B
- IEC 60255-3 (SACE RCQ and RC223) and IEC 61000: for protection against unwarranted release
- IEC 60755 (SACE RCQ): for insensitivity to direct current components.

### RC221 and RC222 residual current releases for T1, T2 and T3

The RC221 and RC222 residual current releases can be installed either on the Tmax T1, T2 and T3 circuit-breakers, or on the T1D and T3D switch-disconnectors. The versions available make their use possible both with three-pole and four-pole circuit-breakers, in the fixed version.

They are constructed using electronic technology and act directly on the circuit-breaker by means of a trip coil, supplied with the residual current release, to be housed in the special slot made in the left-hand pole area. They do not require an auxiliary power supply as they are supplied directly by the network and their operation is guaranteed

even with only a single phase plus neutral or only two phases supplied with voltage and in the presence of unidirectional pulsating currents with direct components.

All the possible connection combinations are allowed, except for guaranteeing, in the four-pole version, connection of the neutral to the first pole on the left.

The RC221 and RC222 residual current releases can either be supplied from above or from below.

The operating conditions of the apparatus can be continually controlled by means of the electronic circuit test pushbutton and the magnetic indicator of

residual current trip.

A disconnection device of the power supply during the insulation test is available.

The four-pole circuit-breaker complete with residual current release can be fitted with the electrical accessories normally available for the circuit-breaker. The shunt opening and under-voltage releases are housed in the special slot made in the neutral pole for the four-pole circuit-breakers, whereas they are incompatible with the three-pole circuit-breakers.



1SDC21031-4FV023



1SDC21031-5FV023



1SDC210316F0023



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The residual current releases are supplied complete with:

- a trip coil to be housed in the area of the third pole, complete with an auxiliary contact signalling residual current release trip
- dedicated flange.

The bracket for fixing onto DIN 50022 rail is available on request.

The configuration foresees insertion of the circuit-breaker on the structure of the corresponding residual current release, making access to the adjustments on the left-hand side of the circuit-breaker available, whilst the toroid is in the underneath position.

A distinguishing characteristic is provided by the type of cable connection which is made directly on the circuit-breaker, once the residual current release has been mounted, thereby ensuring simplification and rationalisation of the installation procedure.

With Tmax T2 and T3, only front terminals for copper cables (FC Cu) at the bottom are mounted on the residual current releases. For this reason, when the residual current release is ordered, the FC Cu terminal semi-kit is always supplied (consult the code section on page 7/36). On the other hand, for four-pole Tmax T1, it is also possible to

mount the rear horizontal flat terminal kit below (HR for RC221/RC222).

Furthermore, still for four-pole T1, a version of the RC222 residual current release is available in 200 mm modules. This release keeps the same technical characteristics as the normal RC222 for T1, T2 and T3 but, thanks to its reduced height, allows installation in 200 mm modules. Its special shape also allows a reduction in the overall dimensions when two or more units are placed side by side.

## RC222 residual current release for T4 and T5

With T4 and T5, in the four-pole version, it is possible to use an RC222 residual current release below the circuit-breaker.

This RC222 residual current release, in the fixed version, can easily be converted into plug-in by adding the special conversion kit.

The RC222 release is constructed using electronic technology and acts directly on the circuit-breaker by means of a trip coil, supplied with the residual current release, to be housed in the special slot made in the left-hand pole area.

It does not require an auxiliary power supply as they are supplied directly by the network and their operation is guaranteed even with only a single phase

plus neutral or only two phases supplied with voltage and in the presence of unidirectional pulsating currents with direct components.

All the possible connection combinations are allowed as long as there is that of the neutral to the first pole on the left.

The RC222 residual current release can either be supplied from above or from below.

The operating conditions of the apparatus can be continually controlled by means of the electronic circuit test pushbutton and the magnetic indicator of residual current trip.

A disconnection device of the power supply during the insulation test is available.

The four-pole circuit-breaker

complete with residual current release can be fitted with the electrical accessories normally available for the circuit-breaker. The shunt opening and under-voltage releases are housed in the special slot made in the neutral pole for the four-pole circuit-breakers.

The residual current release is supplied complete with:

- a trip coil to be housed in the area of the third pole, complete with an auxiliary contact signalling residual current release trip
- dedicated flange.

The release is supplied with standard front terminals, but it can also be combined with all the terminals available for the corresponding circuit-breaker.



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## Accessories

### Residual current releases - IEC only

		RC221	RC222		RC223
Circuit-breakers size		T1-T2-T3	T1-T2-T3	T4 and T5	T4 4p
Type		"L" shaped	"L" shaped	Placed below	Placed below
Technology		microprocessor-based	microprocessor-based	microprocessor-based	microprocessor-based
Action		with solenoid	with solenoid	with solenoid	with solenoid
Primary service voltage <sup>(1)</sup>	[V]	85...500	85...500	85...500	110...500
Operating frequency	[Hz]	45...66	45...66	45...66	0-1000
Self-supply		■	■	■	■
Test operation range <sup>(1)</sup>		85...500	85...500	85...500	110...500
Rated service current	[A]	up to 250 A	up to 250 A	up to 630 A	up to 250 A
Rated residual current trip	[A]	0.03 - 0.1 - 0.3 - 0.5 - 1 - 3	0.03 - 0.05 - 0.1 - 0.3 - 0.5 - 1 - 3 - 5 - 10	0.03 - 0.05 - 0.1 - 0.3 - 0.5 - 1 - 3 - 5 - 10	0.03 - 0.05 - 0.1 0.3 - 0.5 - 1
Time limit for non-trip	[s]	instantaneous	instantaneous - 0.1 - 0.2 - 0.3 - 0.5 - 1 - 2 - 3	instantaneous - 0.1 - 0.2 - 0.3 - 0.5 - 1 - 2 - 3	instantaneous - 0 - 0.1 - 0.2 - 0.3 - 0.5 - 1 - 2 - 3
Tolerance over trip times			± 20%	± 20%	± 20%
Local trip signalling		■	■	■	■
Trip coil with changeover contact for trip signalling		■	■	■	■
Input for remote opening			■	■	■
NO contact for pre-alarm signalling			■	■	■
NO contact for alarm signalling			■	■	■
Indication of pre-alarm from 25% I <sub>n</sub> (tolerance ±3%)				■	■
Indication of alarm timing at 75% I <sub>n</sub> (tolerance ±3%)				■	■
Automatic residual current reset		■	■	■	■
"A" type for pulsating alternating current, AC for alternating current		■	■	■	■
"AE" type for remote release device			■	■	■
Selective "S" type			■	■	■
Button for insulation test		■	■	■	■
Power supply from above and below		■	■	■	■
Assembly with three-pole circuit-breakers		■	■		
Assembly with four-pole circuit-breakers		■	■	■	■
Kit for conversion of circuit-breaker with residual current release from fixed to plug-in				■	■

<sup>(1)</sup> Operation up to 50 V Phase-Neutral

### RC223 (B type) residual current release for T4



Along with the family of residual current releases illustrated previously, ABB SACE is developing the RC223 (B type) residual current release, which can only be combined with the Tmax T4 four-pole circuit-breaker in the fixed or plug-in version. The range of operation of the primary line-to-line voltage of this residual current release varies between 110 V and 440 V, with operation starting from 55 V phase-neutral. It is characterised by the same types of reference as the RC222 (S and AE type) release, but can also boast conformity with type B opera-

tion, which guarantees sensitivity to residual fault currents with alternating, alternating pulsating and direct current components. The reference Standards are: IEC 60947-1, IEC 60947-2 Appendix B, and IEC 60755. Apart from the signals and settings typical of the RC222 residual current release, the RC223 also allows selection of the maximum threshold of sensitivity to the residual fault frequency (3 steps: 400 – 700 – 1000 Hz). It is therefore possible to adapt the residual current device to the different requirements of the industrial plant ac-

cording to the prospective fault frequencies generated on the load side of the release. Typical installations which may require frequency thresholds different from the standard ones (50 – 60 Hz) are the welding plants for the automobile industry (1000 Hz), the textile industry (700 Hz), airports and three-phase drives (400 Hz). All the functions of the apparatus - even the most advanced ones - can be checked by the user by means of a careful watchdog test which is carried out by a series of simple successive steps.



## SACE RCQ residual current relay

The Tmax T1, T2, T3 T4 and T5, and Isomax S6 and S7 circuit breakers can be combined with the RCQ relay with separate toroid (to be installed externally on the line conductors) and these fulfill requirements with thresholds up to 30 A trips and times up to 5 s or when the installation conditions are particularly restrictive, such as with circuit breakers already installed, or limited space in the circuit breaker compartment.

Thanks to the wide range of settings, the RCQ relay is suitable for applications where a system of residual current protection coordinated with the various distribution levels. It is particularly recommended when low sensitivity residual current protection is required, such as in partial (current) or total (chronometric) selective chains, and for high sensitivity applications (physiological sensitivity). In case of drops in the auxiliary power supply voltage, the opening control intervenes after a minimum time of 100 ms and after the time set plus 100 ms.

The RCQ relay is suitable for use in the presence of alternating currents only (Type AC), for alternating and/or pulsating current with direct components (Type A) and allows residual current selectivity to be set up.

The RCQ relay is of the type with indirect action and acts on the circuit breaker release mechanism by means of the shunt trip of the circuit breaker itself (to be ordered by the user), to be housed in the special slot made on the left-hand pole of the circuit breaker.

Residual current relay		RCQ
Power supply voltage	AC [V]	80...500
	DC [V]	48...125
Operating frequency	[Hz]	50 ÷ 60 Hz ± 10%
Trip threshold adjustment $I_n$		
1st range of adjustments	[A]	0.03-0.05-0.1-0.3-0.5
2nd range of adjustments	[A]	1-3-5-10-30
Trip time adjustment	[s]	0-0.1-0.2-0.3-0.5-0.7-1-2-3-5
Pre-alarm threshold adjustment	[%] x $I_n$	25...75% x $I_n$
Range of use of closed transformers		
Toroidal transformer Ø 2.36" [60 mm]	[A]	0.03...30
Toroidal transformer Ø 4.33" [110 mm]	[A]	0.03...30
Toroidal transformer Ø 7.28" [185 mm]	[A]	0.1...30
Range of use of transformers which can be opened		
Toroidal transformer Ø 4.33" [110 mm]	[A]	0.03...30
Toroidal transformer Ø 7.09" [180 mm]	[A]	0.03...30
Toroidal transformer Ø 9.06" [230 mm]	[A]	1...30
Signalling for alarm pre-threshold	Yellow flashing LED 1 N.O. change-over contact 6 A - 250 V AC 50/60 Hz	
Residual current relay trip signalling	Yellow magnetic flag change-over contacts (N.O. N.C.; N.O.) 6 A - 250 V AC 50/60 Hz	
Remote opening control	N.O. contact	
	Trip time 15 ms	
Connection to the toroidal transformer	By means of 4 twisted conductors. Maximum length: 1270 in	
Dimensions L x H x D	[in]	3.78 x 3.78 x 5.18
Drilling for assembly on door	[in]	3.62 x 3.62



## Accessories

### Accessories for electronic trip units

#### **SACE PR212/D-M Modbus and PR212/D-L Lon dialogue unit for S6 and S7- (IEC only)**

The dialogue unit is a device which allows two-way communication from the circuit breaker to the outside and vice versa. ABB has built two distinct dialogue units able to support two different communication protocols: PR212/D-M (Modbus RTU protocol) and PR212/D-L (LonTalk protocol by Echelon). Both units are housed in external modules, which can be installed on DIN rails, and can be used with the Isomax S6 and S7 circuit breakers fitted with PR212/P electronic trip unit, both in the LSI and LSIG versions. They must be supplied with a stabilized voltage of 24 V DC ( $\pm 20\%$  with maximum ripple  $\pm 5\%$ ) and be earthed. Communication towards the outside is generally addressed to a supervision and control unit, which has the task of collecting and storing the information regarding the part of the plant controlled.

In the case of an error in the serial communication due to a fault in the dialogue unit or lack of auxiliary power supply, the PR212/P protection unit works according to the last parameters set and, in any case, in accordance with what has been set manually. The PR212/D-M and PR212/D-L dialogue units are always fitted in combination with the PR212/T actuator unit, which allows remote closing or opening operation of the circuit breaker (Remote Control) by means of two digital outputs which can be disabled thanks to the dip-switch (LOC/REM) positioned on LOC.

#### **Information available**

- State of the circuit breaker: open; closed; tripped
- installation alarms: pre-alarm L; tripped L-S-I-G-R-V-PTC
- measurements: currents; N° operations; N° trips
- reading and writing curves and trip thresholds: only manual reading (MAN), electronic or remote reading and writing (ELT)
- circuit breaker commands: opening; closing; reset.



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### SACE PR212/T actuator unit for S6 and S7

The PR212/T actuator unit allows circuit breaker opening and closing by means of the motor operator mounted on the circuit breaker. It is always supplied in combination with the PR212/D dialogue unit for Isomax S6 and S7. An auxiliary power supply with a stabilized voltage of 24 V DC ( $\pm 20\%$ , with maximum ripple  $\pm 5\%$ ) and earthed is required for operation of the unit.

The PR212/D dialogue unit sends the digital opening and closing commands, received from the supervision and control system, to the inputs of the PR212/T actuator unit, which carries out circuit breaker closing and opening by means of a power relay. The motor operator of the circuit breaker (use the versions with power supply voltage at 110 V AC/DC or 220 V AC) must be connected to these relays.



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### SACE TT1 Test unit

This allows control of tripping of the PR211/P, PR212/P, PR221DS, PR222DS/P and PR222DS/PD-A electronic trip unit and the trip test of the trip coil. The device is supplied by means of a 12 V replaceable battery and is fitted with a two-pole polarized connector-tracer point housed on the bottom of the box, which allows connection of the device to the test input bushings located on the bottom of the electronic trip unit.

The limited dimensions of the accessory make it practically pocket-type.



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### SACE PR212/K signalling unit for S8

The PR212/K signalling unit, only available for Isomax S8, is able to convert the digital signals supplied by the PR212/P - (LSIG) protection unit into electric signals by means of normally open electrical contacts. An auxiliary power supply is needed to operate the unit. It is connected to the internal bus of the protection unit by means of a dedicated serial line over which the information regarding the state of activation of the protection functions passes, on the basis of which the relative power contacts are closed to signal:

- pre-alarm for protection function L ( $I > 0.9 \times I_1$ )
- protection function L, S, I, G trip
- trip indication
- communication error with protection unit.



# Accessories

## Accessories for electronic trip units

### SACE PR021/K signalling unit

The SACE PR021/K signalling unit can convert the digital signals supplied by the PR222DS/PD-A (LSI or LSIG) protection unit into electrical signals, via normally open electrical contacts.

The unit is connected to the protection release by means of the Modbus RTU standard serial changeover line, on which all the information about the activation status of the protection functions flows. The corresponding power contacts are closed based on this information.

In particular, the following signals are available:

- the alarm signal remains active throughout the overload, until the release is tripped
- the trip signals of the protections remain active during the timing phase, and even after the release is tripped.

#### PR021/K (PR222DS/PD-A)

Maximum changeover power (resistive load)	100W / 1250 VA (resistive load)
Maximum changeover voltage	130 V DC / 250 V AC
Maximum changeover current	5 A
Breaking capacity (resistive load) @ 30 V DC	3.3 A
Breaking capacity (resistive load) @ 250 V AC	5 A
Contact/coil insulation	2000 V eff (1 min @ 50 Hz)

Note: the PR021/K unit is an alternative to any supervision and control systems.

A reset pushbutton allows the state of all the signals to be reset.

The unit also has ten LEDs to visually signal the following information:

- “Power ON”: auxiliary power supply present
- “TX (Int Bus)”: flashing synchronised with dialogue with the internal Bus
- eight LEDs associated with the internal contacts.

The table indicates the characteristics of the signalling relays available in the SACE PR021/K unit.

#### Available signals

K51	PR222MP
1	Protection L alarm
2	Protection R alarm
3	Protection I alarm
4	Protection U alarm Welded contactor alarm contacts (*)
5	Bus K.O.
6	PTC alarm (temperature sensor on motor) Generic input 0/1(*)
7	Release trip
8	Protection L pre-alarm Back-up protection alarm (*)
(*) alternatively by means of dip-switch.	

K51	PR222DS
1	Protection L alarm
2	Protection S alarm
3	Protection I alarm
4	Protection G alarm
5	Bus K.O.
6-7	Release trip
8	Protection L pre-alarm



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## SACE PR010/T Test and Configuration Unit

The PR010/T unit is an instrument able to carry out the Test, programming and parameter readout functions for the protection units which equip the Tmax, the Isomax S molded case circuit breakers and the Emax air circuit breakers.

In particular, for circuit breakers fitted with PR212/P and PR222DS/P trip units, the test, programming and readout parameter functions are available. All the functions mentioned can be carried out ON BOARD by connection of the PR010/T unit to the multipin front flange connector on the protection unit; connection is guaranteed by means of special interfacing cables supplied as standard with the unit.

The human-machine interface is guaranteed by using a membrane keyboard and a multi-line alphanumeric display.

There are also two LEDs on the unit which signal the following respectively:

- POWER-ON and STAND BY situation
- situation of the battery charging state.

Two different types of Test are provided: automatic and manual.

By means of connection to the PC (software provided), it is also possible to upgrade the SW of the PR010/T unit to allow adaptation of the Test unit to evolution of new products.

The most relevant test results can also be stored in the unit itself and sent to the Personal Computer on explicit request for "issue of report".

Both in automatic and manual mode, the PR010/T unit is able to test the following:

- protection functions L, S, I, G
- monitoring of correct operation of the microprocessor.

The same Tests can also be repeated using the manual method.

The PR010/T unit is of the portable type and operates with re-

chargeable batteries and/or with an external power supply.

In its standard supply, the unit includes:

- PR010/T Test unit complete with rechargeable batteries
- TT1 Test unit;
- 100...240 V AC/12 V DC external power supply
- connection cables between the unit and the multipin connector present on the ranges of releases which equip the Isomax S and the Emax series
- connection cable between the unit and the PC (serial RS232)
- power supply cable
- instruction manual and software
- plastic case.

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## EP 010 - FBP

It is the "e-plug" interface which can connect T4 and T5, equipped with the PR222DS/PD-A electronic trip unit, to the field bus plug system, allowing user to choose among several field bus system (ASI, Device Net, Profibus).

It must be connected to the trip unit by means of the specific X3 connector.



## Accessories

### Accessories for electronic trip units



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#### Front display unit - FDU

The front display is a display unit of the setting currents, alarms and parameters of the PR222DS/P and PR222DS/PD-A electronic trip units of T4 and T5. The display unit can operate correctly with self-supply with  $I_n \geq 0.35 \times I_n$  on at least one phase. If the display is used in combination with the PR222DS/PD-A trip unit, and therefore with an auxiliary power supply, it is also possible to detect the protection, which has caused the trip unit intervention and the fault current. It is not compatible with the front accessories: rotary handle operating mechanism, motor operator and front for lever operating mechanism.

#### CT for external neutral (UL file: E116596)

This is mounted onto the external neutral conductor and allows protection against earth faults with three-pole circuit breakers. The circuit breaker must be fitted with PR212/P – LSIG, PR222DS/P or PR222DS/PD-A trip units. The transformer must be connected to the trip unit by means of the specific X3-X4 connectors, selected according to the version of the circuit breaker and the type of protection trip unit used.

##### CT ext

T4	T5	S6	S7	S8
100	300	600	1000	1600
150	400	800	1200	2000
250	600			2500

## Connectors

Connectors X3 and X4 allow connection of the electronic trip unit with external plant units or components. In fact, they are used to make the L alarm signal available outside or to realise connection to the PR021/K signalling unit. Both connectors are available for fixed and plug-in or draw out version circuit breakers.

Connector	Function	Trip unit
X3	PR021/K	PR222DS/PD-A and PR211/P, PR212/P
	L alarm signal	PR222DS/P, PR222DS/PD-A, PR211/P, PR212/P
	Dialogue	PR222DS/PD-A, PR212/D
	Auxiliary supply	PR222DS/P, PR222DS/PD-A
	EP 010	PR222DS/PD-A
X4	External neutral	PR222DS/P, PR222DS/PD-A, PR212/P





## Accessories

### Installation and testing accessories

#### Bracket for fixing on DIN rail

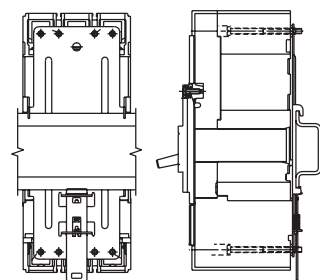
This is applied to the fixed circuit breaker and allows installation on DIN rails (1.38"/35 mm).

It simplifies assembly of circuit breakers up to 225 A (Tmax T1, T2 and T3, except for T1B 1p) in standard switchboards.

The bracket for fixing onto DIN rails is also available for Tmax circuit breakers combined with RC221 and RC222 residual current releases or with the solenoid operating mechanism of the side-by-side type.



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#### Flange for compartment door

For Isomax S6 and S7 circuit breakers with the rotary handle operating mechanism, front for lever operating mechanism and motor operator, a special flange is supplied for the purpose.

All the flanges of the Tmax series (to be ordered) are of new conception and do not require the use of screws for their installation: fixing is greatly simplified by means of a simple dove-tailing operation.

In the case of use of a rotary handle operating mechanism, solenoid operating mechanism or residual current releases, a special dedicated flange is supplied.

For T4 and T5 draw out circuit breakers, the flange supplied with the conversion kit must be used instead of the one supplied with the fixed circuit breaker.

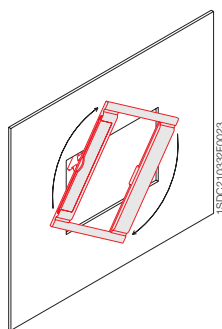


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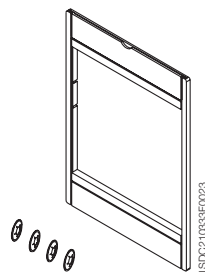
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##### T1-T5



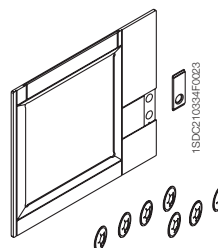
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##### S6-S7 fixed



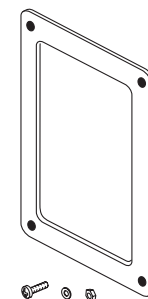
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##### S6-S7 draw out



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##### S8



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## Accessories

### Spare parts

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#### Spare parts

With Tmax series, the following spare parts are available:

- opening solenoid for the RC221 and RC222 residual current releases
- opening solenoid for PR221DS electronic trip unit
- kit with washers, screws and plugs for assembly of the front terminals (F)
- flange for compartment door.

For further details, please ask the Service Division of ABB for the spare parts catalogue.



## Accessories

### Controller for automatic transfer switch - ATS010



#### Control for automatic transfer switch - ATS010 (IEC only)

The ATS010 controller is the new network-group switching device offered by ABB. It is based on microprocessor technology in compliance with the leading electromagnetic compatibility and environmental standards (EN 50178, EN 50081-2, EN 50082-2, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-3).

The device is able to manage the entire switching procedure between the normal line and emergency line circuit breakers automatically, allowing great flexibility of settings.

In case of fault in the normal line voltage, in accordance with the delays set, the normal line circuit breaker is opened, the generator started and the emergency line circuit breaker closed. Similarly, when the normal line returns to range, the reverse switching procedure is automatically controlled. It is especially suited for use in all emergency power supply systems requiring a solution that is ready to install, easy to use and reliable.

Some of the main applications include: power supply for UPS (Uninterrupted Power Supply) units, operating rooms and primary hospital services, emergency power supply for civilian buildings, airports, hotels, data banks and telecommunications systems, power supply of industrial lines for continuous processes.

The switching system consists of the ATS010 unit connected to two motor-driven and mechanically interlocked circuit breakers. Tmax T4 and T5, and Isomax S6 and S7 circuit breakers can be used. The built-in main sensor of the ATS010 device makes it possible to detect faults in the mains voltage. The three inputs may be directly connected to the three phases of the normal power supply line for networks with rated voltage up to 500 V AC. Networks with a higher voltage require the insertion of potential transformers (PT), setting a rated voltage for the device that matches their secondary voltage (typically 100 V).

Two change-over contacts for each circuit breaker connect directly to the motor operator. The circuit breaker connection is completed by wiring the status contacts: Open/Closed, Relay tripped, Racked-in (for draw out/plug-in circuit breakers).

That is why on every circuit breaker connected to the ATS010 unit, the following are included in addition to the mechanical interlock accessories:

- motor operator from 48 V to 110 V DC or up to 250 V AC
- open/closed contact
- relay tripped contact
- racked-in contact (for draw out versions)
- signal and mechanical lock for protection relay tripped.

On the motor operator for S6 and S7, the key lock is needed.

The ATS010 device is designed to ensure extremely high reliability for the system it controls. It contains various safety systems intrinsically related to software and hardware operation.

For software safety, a special logic prevents undesired operations, while a constantly operative watchdog system points out any microprocessor malfunctions via a LED on the front of the device.

Hardware safety allows integration of an electrical interlock via power relay, so that there is no need to use an external electrical interlock system. The manual selector on the front of the device can also control the entire switching procedure, even in the event of a microprocessor fault, by working electromechanically on the control relays.



## Accessories

### Controller for automatic transfer switch - ATS010

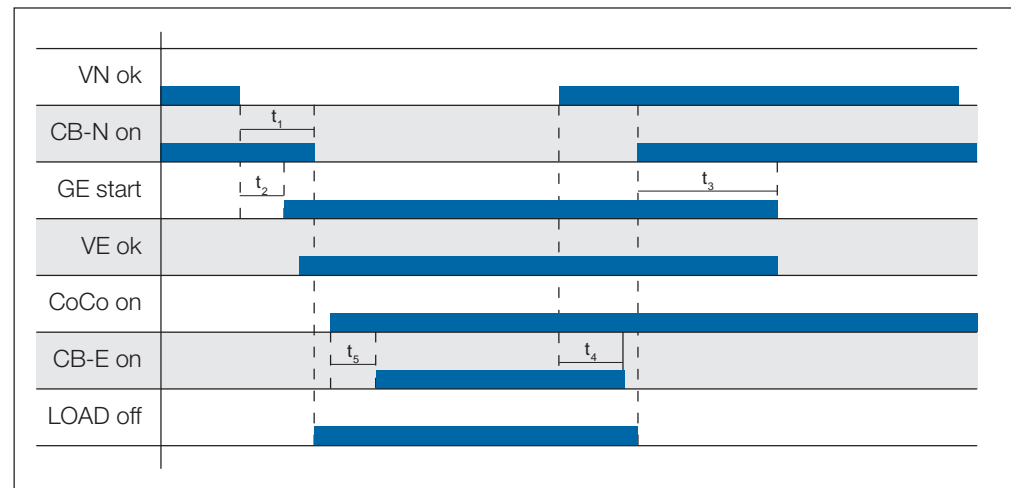
#### General specifications

Rated supply voltage (galvanically insulated from earth)	24 V DC $\pm 20\%$ 48 V DC $\pm 10\%$ (maximum ripple $\pm 5\%$ )
Maximum absorbed power	5 W @ 24 V DC 10 W @ 48 V DC
Rated power (mains present and circuit breakers not controlled)	1.8 W @ 24 V DC 4.5 W @ 48 V DC
Operating temperature	-25 °C...+70 °C
Maximum humidity	90% without condensation
Storage temperature	-25 °C...+80 °C
Protection rating	IP54 (front panel)
Protection rating	[mm] 144 x 144 x 85
Weight	[kg] 0.8

#### Setting range for thresholds and times

Minimum voltage	Un Min	-5%...-30% Un
Maximum voltage	Un Max	+5%...+30% Un
Fixed frequency thresholds		10%...+10% fn
$t_1$ : opening delay of the normal line circuit breaker due to network error	(CB-N)	0...32s
$t_2$ : generator start-up delay due to network error		0...32s
$t_3$ : stopping delay of the generator		0...254s
$t_4$ : switching delay due to network stop		0...254s
$t_5$ : closing delay of the emergency line circuit breaker after detecting the generator voltage	(CB-E)	0...32s

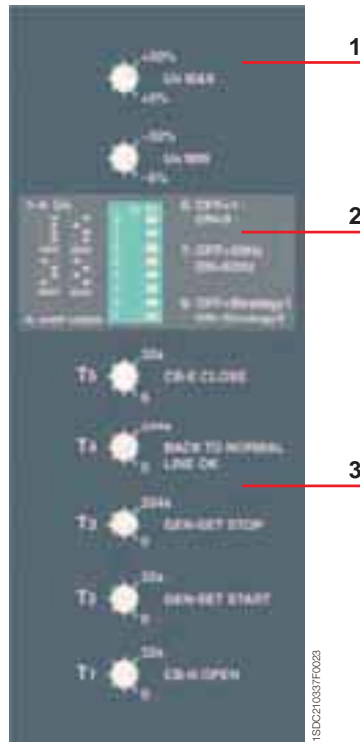
#### Operating sequence



#### Caption

<b>VN</b>	Main voltage
<b>CB-N</b>	Normal line circuit breaker closed
<b>GE</b>	Generator
<b>VE</b>	Emergency line voltage
<b>CoCo</b>	Enable switching to emergency line
<b>CB-E</b>	Emergency line circuit breaker closed
<b>LOAD</b>	Disconnection of lower priority connected loads

## Side panel settings



### Caption

- 1 Selectors to set the under- and over-voltage thresholds
- 2 Dip-switches to set:
  - rated voltage
  - normal single-phase or three-phase line
  - mains frequency
  - switching strategy
- 3 Switching delay time settings for T1...T5

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## Front panel



### Caption

- 1 Status of the ATS010 unit and logic
- 2 Operating mode selector
- 3 Normal line check
- 4 Normal line circuit breaker status
- 5 Voltage on the emergency line
- 6 Emergency line circuit breaker status
- 7 Generator status