Schneider Electric spectre

9 Series

Final level of protection in electrical distribution

M9/Multi 9

Multistandard protection for OEMs,
residential and industry

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Content

M9/Multi9

Modular protection for OEMs, residential and industry

M9 (the same legendary Multi9™ by Schneider Electric) is a range of DIN rail modular devices, a solution offering great performance, M9 (Multi9) is a Spectre Electric offer dedicated to OEMs and all residential and industrial sectors, meeting the major standards for industry applications.
Designed to meet your needs for most types of panels and machines, offering a wide range of modular devices, it provides protection, signaling functions and accessories.

Miniature circuit breakers

IEC/EN 60947-2: 10 kA, IEC 60898: 6000 A
C60N - B and C curves

IEC CE

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C60N 1P

C60N 2P

C60N 3P

C60N 4P

Function

■ The circuit-breakers combine the following functions:
□ protection of circuits against short-circuit currents
□ protection of circuit against overload currents
□ control
□ isolation
C60N circuit breaker are used in the tertiary and industrial sectors.

Tripping curves

B curve

When the short-circuit currents are weak (generators, long cables).
■ Power circuit:
□ ratings: 2 to 63 A set at 30 °C
□ tripping curve: the magnetic trip units operate between 3 and 5 In.

C curve

Cables feeding conventional loads.
■ Power circuit:
□ ratings: 2 to 63 A set at 30 °C
□ tripping curve: the magnetic trip units operate between 5 and 10 In.

Technical data according to IEC 60898

■ Power circuit:
□ voltage rating (Ue): 230...400 V AC
□ breaking capacity:
- according to IEC 60898, Icn rated short-circuit capacity (O-CO cycle):

Rating (A)	Type	Voltage	Breaking capacity Icn (A)	Service breaking capacity (Ics)
2...63	1P	230/400	6000	100% of Icn
	2P, 3P, 4P	400	6000	100% of Icn

□ limitation class: 3.

Technical data according to IEC 60947-2

■ Power circuit:
□ voltage rating (Ue): 240...440 V AC / 12...240 V DC
□ impulse voltage (Uimp): 6 kV
□ insulation voltage (Ui): 500 V AC
□ breaking capacity:
- according to IEC 60947-2, Icu ultimate breaking capacity (O-CO cycle):

Alternating current (AC) 50/60 Hz					
Ultimate breaking capacity (Icu) according to IEC/EN 60947-2					Service breaking capacity (Ics)
	Voltage (Ue)				
Ph/Ph (2P, 3P, 4P)	240 V	415 V	-	440 V	
Ph/N (1P)	-	240 V	415 V	-	
Rating (In) 1 to 63 A	20 kA	10 kA	3 kA(*)	6 kA	75% of Icu
i_{IT}	1.2 x 12 In				

(*) Breaking capacity under 1 pole with IT isolated neutral system (case of double fault).

Direct current (DC)					
Ultimate breaking capacity (Icu) according to IEC/EN 60947-2					Service breaking capacity (Ics)
	Voltage (Ue)				
Between +/-	≤60 V	≤125 V	≤125 V	≤250 V	
Number of poles	1P	2P	3P	4P	
Rating (In) 1 to 63 A	15 kA	20 kA	30 kA	40 kA	100% of Icu

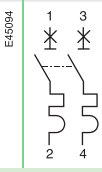
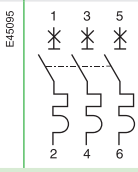
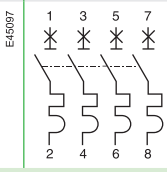
General technical data

■ Fast closing: allows the high inrush currents of some loads to be better held.
■ Isolation with positive break indication: opening is indicated by a green strip on the device operating handle. This indicator shows opening contacts of all the poles.

IEC/EN 60947-2: 10 kA, IEC 60898: 6000 A
C60N - B and C curves (cont.)

Catalog numbers

spectre

C60N circuit breaker								Spectre Electric
Type	**1P**		**2P**		**3P**		**4P**	
								
Rating (In)	**Curve**		**Curve**		**Curve**		**Curve**	
	B	**C**	**B**	**C**	**B**	**C**	**B**	**C**
2 A	**24046-SE** M9F10102	**24396-SE** M9F11102	**24072-SE** M9F10202	**24332-SE** M9F11202	**24085-SE** M9F10302	**24345-SE** M9F11302	**24098-SE** M9F10402	**24358-SE** M9F11402
4 A	**24048-SE** M9F10104	**24398-SE** M9F11104	**24074-SE** M9F10204	**24334-SE** M9F11204	**24087-SE** M9F10304	**24347-SE** M9F11304	**24100-SE** M9F10404	**24360-SE** M9F11404
6 A	**24049-SE** M9F10106	**24399-SE** M9F11106	**24075-SE** M9F10206	**24335-SE** M9F11206	**24088-SE** M9F10306	**24348-SE** M9F11306	**24101-SE** M9F10406	**24361-SE** M9F11406
10 A	**24050-SE** M9F10110	**24401-SE** M9F11110	**24076-SE** M9F10210	**24336-SE** M9F11210	**24089-SE** M9F10310	**24349-SE** M9F11310	**24102-SE** M9F10410	**24362-SE** M9F11410
16 A	**24051-SE** M9F10116	**24403-SE** M9F11116	**24077-SE** M9F10216	**24337-SE** M9F11216	**24090-SE** M9F10316	**24350-SE** M9F11316	**24103-SE** M9F10416	**24363-SE** M9F11416
20 A	**24052-SE** M9F10120	**24404-SE** M9F11120	**24078-SE** M9F10220	**24338-SE** M9F11220	**24091-SE** M9F10320	**24351-SE** M9F11320	**24104-SE** M9F10420	**24364-SE** M9F11420
25 A	**24053-SE** M9F10125	**24405-SE** M9F11125	**24079-SE** M9F10225	**24339-SE** M9F11225	**24092-SE** M9F10325	**24352-SE** M9F11325	**24105-SE** M9F10425	**24365-SE** M9F11425
32 A	**24054-SE** M9F10132	**24406-SE** M9F11132	**24080-SE** M9F10232	**24340-SE** M9F11232	**24093-SE** M9F10332	**24353-SE** M9F11332	**24106-SE** M9F10432	**24366-SE** M9F11432
40 A	**24055-SE** M9F10140	**24407-SE** M9F11140	**24081-SE** M9F10240	**24341-SE** M9F11240	**24094-SE** M9F10340	**24354-SE** M9F11340	**24107-SE** M9F10440	**24367-SE** M9F11440
50 A	**24056-SE** M9F10150	**24408-SE** M9F11150	**24082-SE** M9F10250	**24342-SE** M9F11250	**24095-SE** M9F10350	**24355-SE** M9F11350	**24108-SE** M9F10450	**24368-SE** M9F11450
63 A	**24057-SE** M9F10163	**24409-SE** M9F11163	**24083-SE** M9F10263	**24343-SE** M9F11263	**24096-SE** M9F10363	**24356-SE** M9F11363	**24109-SE** M9F10463	**24369-SE** M9F11463

Schneider Electric

							Schneider Electric	
Rating (In)	**Curve**		**Curve**		**Curve**		**Curve**	
	B	**C**	**B**	**C**	**B**	**C**	**B**	**C**
2 A	**24046**	**24396**	**24072**	**24332**	**24085**	**24345**	**24098**	**24358**
4 A	**24048**	**24398**	**24074**	**24334**	**24087**	**24347**	**24100**	**24360**
6 A	**24049**	**24399**	**24075**	**24335**	**24088**	**24348**	**24101**	**24361**
10 A	**24050**	**24401**	**24076**	**24336**	**24089**	**24349**	**24102**	**24362**
16 A	**24051**	**24403**	**24077**	**24337**	**24090**	**24350**	**24103**	**24363**
20 A	**24052**	**24404**	**24078**	**24338**	**24091**	**24351**	**24104**	**24364**
25 A	**24053**	**24405**	**24079**	**24339**	**24092**	**24352**	**24105**	**24365**
32 A	**24054**	**24406**	**24080**	**24340**	**24093**	**24353**	**24106**	**24366**
40 A	**24055**	**24407**	**24081**	**24341**	**24094**	**24354**	**24107**	**24367**
50 A	**24056**	**24408**	**24082**	**24342**	**24095**	**24355**	**24108**	**24368**
63 A	**24057**	**24409**	**24083**	**24343**	**24096**	**24356**	**24109**	**24369**
width in 9-mm modules	2		4		6		8	

Miniature circuit breakers

IEC/EN 60947-2: 15 kA, IEC 60898: 10000 A
C60H - B and C curves

IEC CE

Schneider Electric | spectre

C60H 1P

C60H 2P

C60H 3P

C60H 4P

Function

■ The circuit-breakers combine the following functions:
□ protection of circuits against short-circuit currents
□ protection of circuit against overload currents
□ control
□ isolation
C60H circuit breaker are used in the tertiary and industrial sectors.

Tripping curves

B curve

When the short-circuit currents are weak (generators, long cables).
■ Power circuit:
□ ratings: 2 to 63 A set at 30 °C
□ tripping curve: the magnetic trip units operate between 3 and 5 In.

C curve

Cables feeding conventional loads.
■ Power circuit:
□ ratings: 2 to 63 A set at 30 °C
□ tripping curve: the magnetic trip units operate between 5 and 10 In.

Technical data according to IEC 60898

■ Power circuit:
□ voltage rating (Ue): 230...400 V AC
□ breaking capacity:
- according to IEC 60898, Icn rated short-circuit capacity (O-CO cycle):

Rating (A)	Type	Voltage	Breaking capacity Icn (A)	Service breaking capacity (Ics)
2...63	1P	230/400	10000	75% of Icn
	2P, 3P, 4P	400	10000	75% of Icn

□ limitation class: 3.

Technical data according to IEC 60947-2

■ Power circuit:
□ voltage rating (Ue): 240...440 V AC / 12...240 V DC
□ impulse voltage (Uimp): 6 kV
□ insulation voltage (Ui): 500 V AC
□ breaking capacity:
- according to IEC 60947-2, Icu ultimate breaking capacity (O-CO cycle):

Alternating current (AC) 50/60 Hz					
Ultimate breaking capacity (Icu) according to IEC/EN 60947-2					Service breaking capacity (Ics)
	Voltage (Ue)				
Ph/Ph (2P, 3P, 4P)	240 V	415 V	-	440 V	
Ph/N (1P)	-	240 V	415 V	-	
Rating (In) 1 to 63 A	30 kA	15 kA	3 kA(*)	10 kA	50% of Icu
i_{IT}	1.2 x 12 In				

(*) Breaking capacity under 1 pole with IT isolated neutral system (case of double fault).

Direct current (DC)					
Ultimate breaking capacity (Icu) according to IEC/EN 60947-2					Service breaking capacity (Ics)
	Voltage (Ue)				
Between +/-	≤60 V	≤125 V	≤125 V	≤250 V	
Number of poles	1P	2P	3P	4P	
Rating (In) 1 to 63 A	20 kA	25 kA	40 kA	50 kA	100% of Icu

General technical data

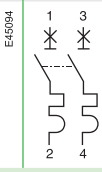
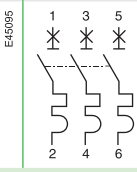
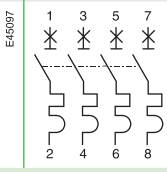
■ Fast closing: allows the high inrush currents of some loads to be better held.
■ Isolation with positive break indication: opening is indicated by a green strip on the device operating handle. This indicator shows opening contacts of all the poles.

IEC/EN 60947-2: 15 kA, IEC 60898: 10000 A
C60H - B and C curves (cont.)

Catalog numbers

spectre

C60H circuit breaker — **Spectre Electric**

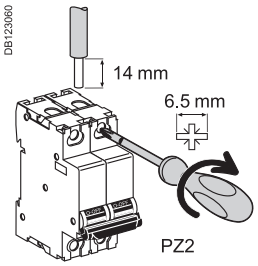
Type	1P		2P		3P		4P	
								
Rating (In)	**Curve B**	**C**	**Curve B**	**C**	**Curve B**	**C**	**Curve B**	**C**
2 A	**24640-SE** M9F13102	**24969-SE** M9F14102	**24722-SE** M9F13202	**24982-SE** M9F14202	**24735-SE** M9F13302	**24995-SE** M9F14302	**24748-SE** M9F13402	**25008-SE** M9F14402
4 A	**24642-SE** M9F13104	**24971-SE** M9F14104	**24724-SE** M9F13204	**24984-SE** M9F14204	**24737-SE** M9F13304	**24997-SE** M9F14304	**24750-SE** M9F13404	**25010-SE** M9F14404
6 A	**24643-SE** M9F13106	**24972-SE** M9F14106	**24725-SE** M9F13206	**24985-SE** M9F14206	**24738-SE** M9F13306	**24998-SE** M9F14306	**24751-SE** M9F13406	**25011-SE** M9F14406
10 A	**24644-SE** M9F13110	**24973-SE** M9F14110	**24726-SE** M9F13210	**24986-SE** M9F14210	**24739-SE** M9F13310	**24999-SE** M9F14310	**24752-SE** M9F13410	**25012-SE** M9F14410
16 A	**24646-SE** M9F13116	**24974-SE** M9F14116	**24727-SE** M9F13216	**24987-SE** M9F14216	**24740-SE** M9F13316	**25000-SE** M9F14316	**24753-SE** M9F13416	**25013-SE** M9F14416
20 A	**24647-SE** M9F13120	**24975-SE** M9F14120	**24728-SE** M9F13220	**24988-SE** M9F14220	**24741-SE** M9F13320	**25001-SE** M9F14320	**24754-SE** M9F13420	**25014-SE** M9F14420
25 A	**24648-SE** M9F13125	**24976-SE** M9F14125	**24729-SE** M9F13225	**24989-SE** M9F14225	**24742-SE** M9F13325	**25002-SE** M9F14325	**24755-SE** M9F13425	**25015-SE** M9F14425
32 A	**24649-SE** M9F13132	**24977-SE** M9F14132	**24730-SE** M9F13232	**24990-SE** M9F14232	**24743-SE** M9F13332	**25003-SE** M9F14332	**24756-SE** M9F13432	**25016-SE** M9F14432
40 A	**24650-SE** M9F13140	**24978-SE** M9F14140	**24731-SE** M9F13240	**24991-SE** M9F14240	**24744-SE** M9F13340	**25004-SE** M9F14340	**24757-SE** M9F13440	**25017-SE** M9F14440
50 A	**24651-SE** M9F13150	**24979-SE** M9F14150	**24732-SE** M9F13250	**24992-SE** M9F14250	**24745-SE** M9F13350	**25005-SE** M9F14350	**24758-SE** M9F13450	**25018-SE** M9F14450
63 A	**24652-SE** M9F13163	**24980-SE** M9F14163	**24733-SE** M9F13263	**24993-SE** M9F14263	**24746-SE** M9F13363	**25006-SE** M9F14363	**24759-SE** M9F13463	**25019-SE** M9F14463
width in 9-mm modules	2		4		6		8	

Miniature circuit breakers

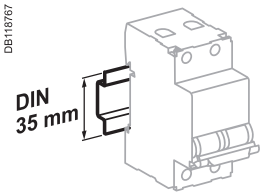
IEC/EN 60947-2: 10 kA, IEC 60898: 6000 A
C60N - B and C curves

IEC/EN 60947-2: 15 kA, IEC 60898: 10000 A
C60H - B and C curves

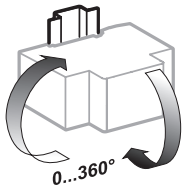
Connection



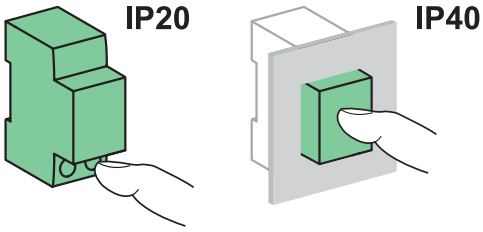
Rating	Tightening torque	Without accessory	
		Copper cables	
		Rigid, flexible or with ferrule	
		DB122945	DB122946
2 to 25 A	2.5 N.m (22 lb.in)	1 to 25 mm²	AWG #18 to #3
32 to 63 A	3.5 N.m (31 lb.in)	1.5 to 35 mm²	AWG #16 to #2



Clip on DIN rail 35 mm



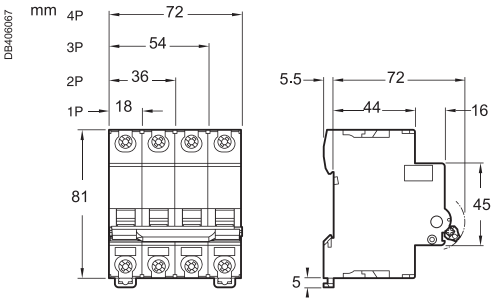
Indifferent position of installation



Technical data

According to IEC/EN 60947-2			
Insulation voltage (Ui)			500 V AC
Pollution degree			3
Rated impulse withstand voltage (Uimp)			6 kV
Thermal tripping	Reference temperature		50°C / 122°F
Magnetic tripping (Ii)	B curve	in alternative current	4 In ± 20%
		in direct current	5.7 In (± 20%)
	C curve	in alternative current	8.5 In ± 20%
		in direct current	12 In (± 20%)
	According to current frequency		50/60 Hz
Utilization category			A
Additional characteristics			
Degree of protection (IEC 60529)	Device only		IP20
	Device in modular enclosure		IP40 Insulation class II
Endurance (O-C)	Electrical		10,000 cycles
	Mechanical		20,000 cycles
Serving temperature			-30°C to +70°C / -22°F to 158°F
Storage temperature			-40°C to +80°C / -40°F to 176°F
Tropicalization (IEC 60068-1)			Treatment 2 (relative humidity 95% at 55°C / 131°F)

Dimensions (mm)



Weight (g)

Circuit-breaker	
Type	**C60N , C60H**
1P	120 g
2P	240 g
3P	360 g
4P	480 g

Residual current devices
IEC/EN 61008-1, IEC/EN 62423-2
RCCB ID – Residual Current Circuit Breakers – AC, A, A-SI, F & B types

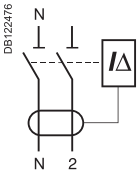
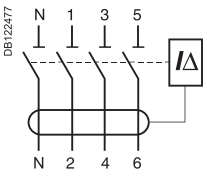
IEC/EN 61008-1, IEC/EN 62423-2

According to the above standard:

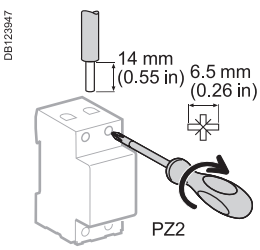
- ■ RCCB-ID residual current circuit breakers offer the following functions:
- □ protection of persons against electric shock by direct contact (30 mA),
- □ protection of persons against electric shock by indirect contact (100, 300 mA),
- □ protection of installations against fire risks (300 mA).

Catalog numbers

RCCB-ID residual current circuit breakers

Type			AC			A		
2P		Sensitivity	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA
	Rating	25 A	M9R11225-S	M9R12225-S	M9R14225-S	M9R21225-S	M9R22225-S	M9R24225-S
		32 A	M9R11232-S	M9R12232-S	M9R14232-S	M9R21232-S	M9R22232-S	M9R24232-S
		40 A	M9R11240-S	M9R12240-S	M9R14240-S	M9R21240-S	M9R22240-S	M9R24240-S
		63 A	M9R11263-S	M9R12263-S	M9R14263-S	M9R21263-S	M9R22263-S	M9R24263-S
4P		Sensitivity	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA
	Rating	25 A	M9R11425-S	M9R12425-S	M9R14425-S	M9R21425-S	M9R22425-S	M9R24425-S
		32 A	M9R11432-S	M9R12432-S	M9R14432-S	M9R21432-S	M9R22432-S	M9R24432-S
		40 A	M9R11440-S	M9R12440-S	M9R14440-S	M9R21440-S	M9R22440-S	M9R24440-S
		63 A	M9R11463-S	M9R12463-S	M9R14463-S	M9R21463-S	M9R22463-S	M9R24463-S
Voltage rating (Ue)		2P	230 - 240 V					
		4P	400 - 415 V					
Operating frequency			50 Hz					

Connection



Rating	Tightening torque	Copper cables			
		Rigid		Flexible or with ferrule	
					
25 to 63 A	3.5 N.m / 31 lb.in	1 to 16 mm²	AWG #18 to #6	1 to 10 mm²	AWG #18 to #8

Residual current devices
IEC/EN 61008-1, IEC/EN 62423-2
RCCB ID – Residual Current Circuit Breakers – AC, A, A-SI, F & B types (cont.)

- Test button
- Clip-on terminal markers
- Clip allowing dismounting with comb busbar in place

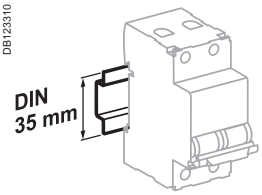
Window
- Tripping upon electrical fault is indicated by a red mechanical status indicator on the front panel

Positive contact indication
- Suitability for isolation in industrial sector
- A green strip on the toggle indicates full opening of all the poles
- Downstream maintenance operations can be carried out in better safety conditions

	A-SI			F			B			Width in 9-mm modules
	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	
	M9R31225-S	M9R32225-S	M9R34225-S	M9R41225-S	M9R42225-S	M9R44225-S	M9R61225-S	M9R62225-S	M9R64225-S	4
	M9R31232-S	M9R32232-S	M9R34232-S	M9R41232-S	M9R42232-S	M9R44232-S	M9R61232-S	M9R62232-S	M9R64232-S	
	M9R31240-S	M9R32240-S	M9R34240-S	M9R41240-S	M9R42240-S	M9R44240-S	M9R61240-S	M9R62240-S	M9R64240-S	
	M9R31263-S	M9R32263-S	M9R34263-S	M9R41263-S	M9R42263-S	M9R44263-S	M9R61263-S	M9R62263-S	M9R64263-S	
	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	
	M9R31425-S	M9R32425-S	M9R34425-S	M9R41425-S	M9R42425-S	M9R44425-S	M9R61425-S	M9R62425-S	M9R64425-S	8
	M9R31432-S	M9R32432-S	M9R34432-S	M9R41432-S	M9R42432-S	M9R44432-S	M9R61432-S	M9R62432-S	M9R64432-S	
	M9R31440-S	M9R32440-S	M9R34440-S	M9R41440-S	M9R42440-S	M9R44440-S	M9R61440-S	M9R62440-S	M9R64440-S	
	M9R31463-S	M9R32463-S	M9R34463-S	M9R41463-S	M9R42463-S	M9R44463-S	M9R61463-S	M9R62463-S	M9R64463-S	

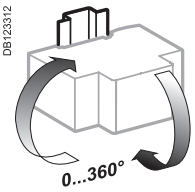
RCCB ID – Residual Current Circuit Breakers – AC, A, A-SI, F & B types (cont.)

DB123310



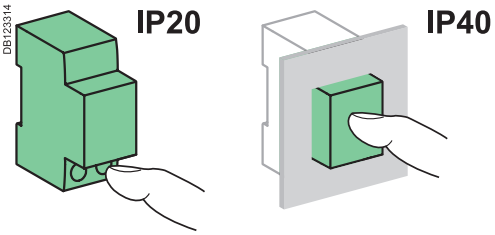
Clip on to 35 mm (1.38 in) DIN rail

DB123312



Any installation position

DB123314

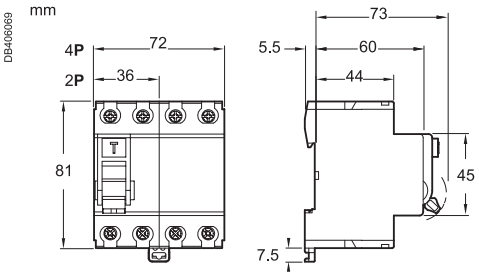


Technical data

According to IEC/EN 60947-2		
Insulation voltage (Ui)		440 V
Pollution degree		3
Rated impulse withstand voltage (Uimp)		6 kV
According to IEC/EN 61008-1		
Making and breaking capacity (Im/IΔm)	≤40 A	500 A
	63 A	630 A
Impulse current withstand (8/20 µs) without tripping	A, AC, F & B types	250 Â
	A-SI type	3 kÂ
Rated conditional short-circuit current (Inc/IΔc)	with fuse 100 A	10,000 A
Behaviour in case of voltage drop		Residual current protection down to 0 V according to IEC/EN 61008-1 § 3.3.4
Additional characteristics		
Degree of protection (IEC 60529)	Device only	IP20
	Device in modular enclosure	IP40 Insulation class II
Endurance (O-C)	Electrical	2,000 cycles
	Mechanical	20,000 cycles
Operating temperature	AC type	-5°C to +40°C
	A, A-SI, F & B types	-25°C to +40°C
Storage temperature		-40°C to +60°C
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity 95% at 55°C)

Dimensions (mm)

DB406069



Weight (g)

Residual current circuit breaker (RCCB)	
Type	**ID**
2P	192 g
4P	324 g

RCBO - IEC/EN 61009-1 - Residual Current Circuit Breakers with Over-current Protection– AC & A types

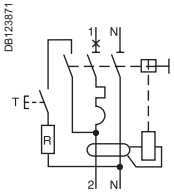
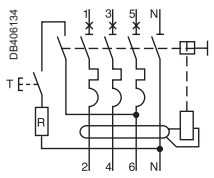
IEC CE

IEC/EN 61009-1

- The N60N residual current device provides complete protection for final circuits (against overcurrents and insulation faults):
  - protection for people against electric shocks by direct contacts (30 mA),
  - protection for people against electric shocks by indirect contacts (100, 300 mA),
  - protection of installations against risk of fire (300 mA).
- The N60N RCBOs are circuit breakers which combine the following functions:
  - circuit protection against short-circuit currents,
  - circuit protection against over-load currents,
  - breaking and industrial disconnections according to IEC/EN 60947-2.

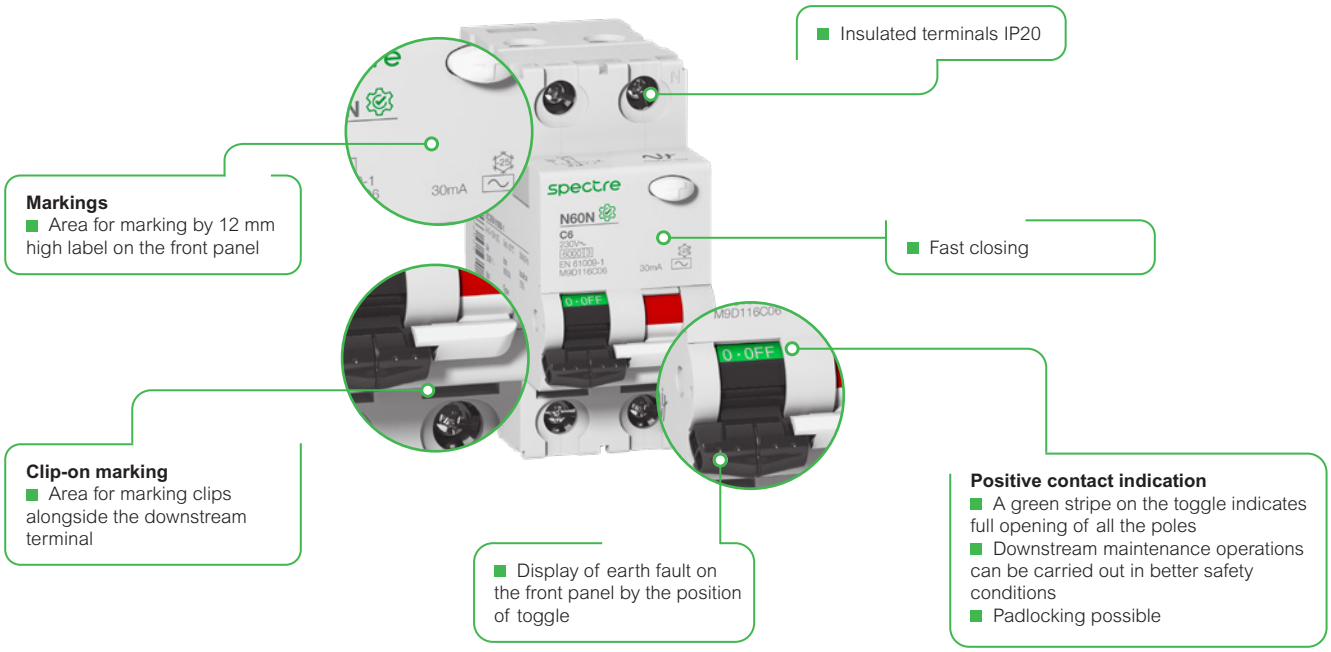
Catalog numbers

N60N 6000

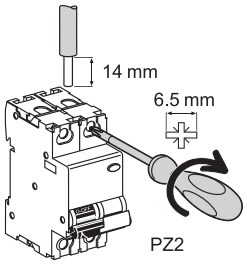
Type			AC			A			Width in 9-mm modules
1P+N	Sensitivity		30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	
	B curve	Rating (In) 6 A	M9D116B06	M9D126B06	M9D146B06	M9D216B06	M9D226B06	M9D246B06	4
		10 A	M9D116B10	M9D126B10	M9D146B10	M9D216B10	M9D226B10	M9D246B10	
		16 A	M9D116B16	M9D126B16	M9D146B16	M9D216B16	M9D226B16	M9D246B16	
		20 A	M9D116B20	M9D126B20	M9D146B20	M9D216B20	M9D226B20	M9D246B20	
		25 A	M9D116B25	M9D126B25	M9D146B25	M9D216B25	M9D226B25	M9D246B25	
		32 A	M9D116B32	M9D126B32	M9D146B32	M9D216B32	M9D226B32	M9D246B32	
		40 A	M9D116B40	M9D126B40	M9D146B40	M9D216B40	M9D226B40	M9D246B40	
		50 A	M9D116B50	M9D126B50	M9D146B50	M9D216B50	M9D226B50	M9D246B50	
		63 A	M9D116B63	M9D126B63	M9D146B63	M9D216B63	M9D226B63	M9D246B63	
	C curve	Rating (In) 6 A	M9D116C06	M9D126C06	M9D146C06	M9D216C06	M9D226C06	M9D246C06	4
		10 A	M9D116C10	M9D126C10	M9D146C10	M9D216C10	M9D226C10	M9D246C10	
		16 A	M9D116C16	M9D126C16	M9D146C16	M9D216C16	M9D226C16	M9D246C16	
		20 A	M9D116C20	M9D126C20	M9D146C20	M9D216C20	M9D226C20	M9D246C20	
		25 A	M9D116C25	M9D126C25	M9D146C25	M9D216C25	M9D226C25	M9D246C25	
		32 A	M9D116C32	M9D126C32	M9D146C32	M9D216C32	M9D226C32	M9D246C32	
		40 A	M9D116C40	M9D126C40	M9D146C40	M9D216C40	M9D226C40	M9D246C40	
		50 A	M9D116C50	M9D126C50	M9D146C50	M9D216C50	M9D226C50	M9D246C50	
		63 A	M9D116C63	M9D126C63	M9D146C63	M9D216C63	M9D226C63	M9D246C63	
3P+N	Sensitivity		30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	
	B curve	Rating (In) 6 A	M9D118B06	M9D128B06	M9D148B06	M9D218B06	M9D228B06	M9D248B06	8
		10 A	M9D118B10	M9D128B10	M9D148B10	M9D218B10	M9D228B10	M9D248B10	
		16 A	M9D118B16	M9D128B16	M9D148B16	M9D218B16	M9D228B16	M9D248B16	
		20 A	M9D118B20	M9D128B20	M9D148B20	M9D218B20	M9D228B20	M9D248B20	
		25 A	M9D118B25	M9D128B25	M9D148B25	M9D218B25	M9D228B25	M9D248B25	
		32 A	M9D118B32	M9D128B32	M9D148B32	M9D218B32	M9D228B32	M9D248B32	
		40 A	M9D118B40	M9D128B40	M9D148B40	M9D218B40	M9D228B40	M9D248B40	
	C curve	Rating (In) 6 A	M9D118C06	M9D128C06	M9D148C06	M9D218C06	M9D228C06	M9D248C06	8
		10 A	M9D118C10	M9D128C10	M9D148C10	M9D218C10	M9D228C10	M9D248C10	
		16 A	M9D118C16	M9D128C16	M9D148C16	M9D218C16	M9D228C16	M9D248C16	
		20 A	M9D118C20	M9D128C20	M9D148C20	M9D218C20	M9D228C20	M9D248C20	
		25 A	M9D118C25	M9D128C25	M9D148C25	M9D218C25	M9D228C25	M9D248C25	
		32 A	M9D118C32	M9D128C32	M9D148C32	M9D218C32	M9D228C32	M9D248C32	
		40 A	M9D118C40	M9D128C40	M9D148C40	M9D218C40	M9D228C40	M9D248C40	

Voltage rating (Ue)	1P+N	230 - 240 V
	3P+N	400 - 415 V
Operating frequency		50/60 Hz

RCBO - IEC/EN 61009-1 - Residual Current Circuit Breakers with Over-current Protection– AC & A types (cont.)

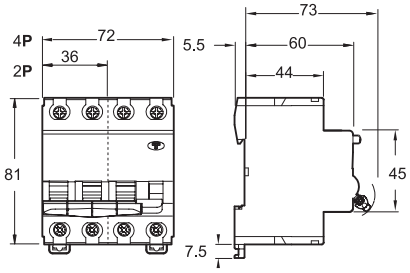


Connection



Type	Connection	Tightening torque	Comb busbar	Copper cables	
				Rigid	Flexible or with ferrule
					
M9 N60N	Top	2N.m	■	1 to 25 mm² AWG #18 to #3	1 to 16 mm² AWG #18 to #6
	Bottom		■		

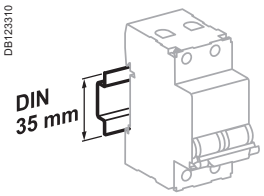
Dimensions (mm)



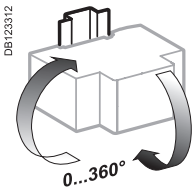
Weight (g)

Residual current device with over-current protection	
Type	N60N
1P+N	220 g
3P+N	460 g

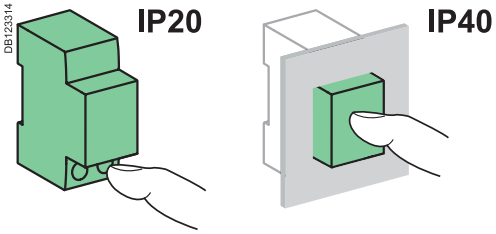
RCBO - IEC/EN 61009-1 - Residual Current Circuit Breakers with Over-current Protection– AC & A types (cont.)



Clip on to 35 mm (1.38 in) DIN rail



Any installation position



Technical data

According to IEC/EN 60947-2			
Type			N60N
Insulation voltage (Ui)			440 V
Pollution degree			3
Rated impulse withstand voltage (Uimp)			6 kV
Setting temperature for ratings			4 kV
Earth leakage protection with instantaneous tripping			30, 100, 300 mA
magnetic tripping	B curve		Between 3 and 5 In
	C curve		Between 5 and 10 In
Utilization category			A
Insulation class			2
8/20 µs impulse withstand current		AC type	250 Â
		A type	250 Â
According to IEC/EN 61008-1			
Limitation class			3
Rated breaking capacity (Icn)			6000 A
Rated residual breaking and making capacity (IΔm)			6000 A
Behaviour in case of voltage drop			Residual current protection down to 0 V according to IEC/EN 61009-1 § 3.3.8
Additional characteristics			
Degree of protection (IEC 60529)	Device only		IP20
	Device in modular enclosure		IP40 Insulation class II
Endurance (O-C)	Electrical	≤20 A	20,000 cycles
		≥25 A	10,000 cycles
	Mechanical		20,000 cycles
Overvoltage category (IEC 60364)			IV
Operating temperature	AC type		-5°C to +60°C
	A type	-25°C	-25°C to +60°C
Storage temperature			-30°C to +70°C
Tropicalization (IEC 60068-1)			Treatment 2 (relative humidity of 95% at 55°C / 131°F)

TL & TLi impulse relays

IEC/EN 60669-2-2

Impulse relays:

- Closing of the impulse relay pole(s) is triggered by an impulse on the coil.
- Having two stable mechanical positions, the pole(s) will be opened by the next impulse. Each impulse received by the coil reverses the position of the pole(s).
- Can be controlled by an unlimited number of pushbuttons.
- Zero energy consumption.

TL

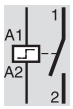
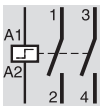
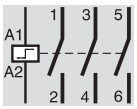
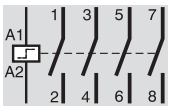
- The impulse relays are used to control, by means of pushbuttons, lighting circuits consisting of:
  - incandescent lamps, low-voltage halogen lamps, etc. (resistive loads)
  - fluorescent lamps, discharge lamps, etc. (inductive loads)

Changeover contact TLi

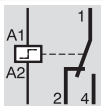
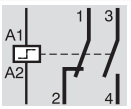
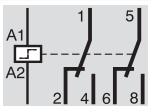
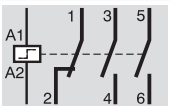
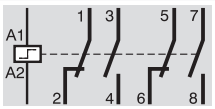
- This impulse relay has a changeover contact

Catalog numbers

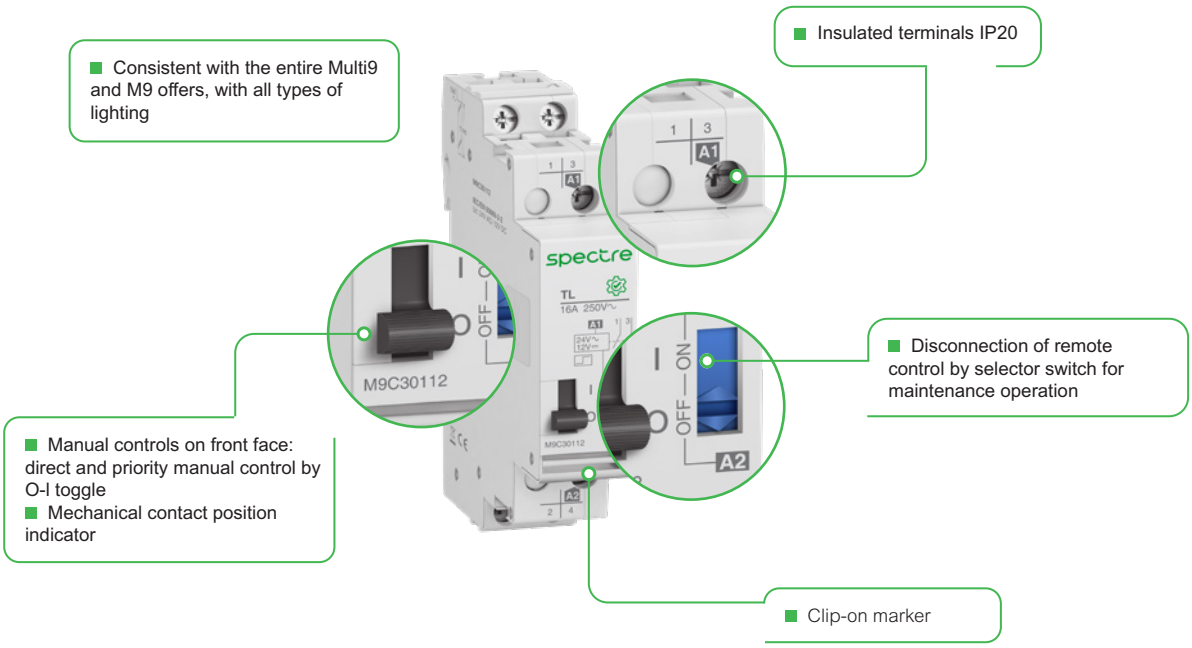
TL impulse relays

Type			1P	2P	3P	4P
			 1 NO	 2 NO	 3 NO	 4 NO
Rating (In)	**Control voltage (Uc) (V AC) (50/60 Hz)**	**(V DC)**				
16 A	12	6	M9C30011	M9C30012	M9C30013	M9C30014
	24	12	M9C30111	M9C30112	M9C30113	M9C30114
	48	24	M9C30211	M9C30212	M9C30213	M9C30214
	130	48	M9C30311	M9C30312	M9C30313	M9C30314
	230...240	110	M9C30811	M9C30812	M9C30813	M9C30814
32 A	12	6	M9C30031-S	-	-	-
	24	12	M9C30131-S	-	-	-
	48	24	M9C30231-S	-	-	-
	130	48	M9C30331-S	-	-	-
	230...240	110	M9C30831-S	-	-	-
Width in 9 mm modules			2	2	4	4

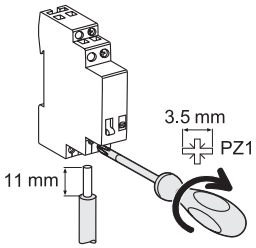
TLi impulse relays

Type			1P	2P		3P	4P
			 1CO	 1NO + 1NC	 2CO	 2NO +1NC	 2NO + 2NC
Rating (In)	**Control voltage (Uc) (V AC) (50/60 Hz)**	**(V DC)**					
16 A	12	6	M9C30021	M9C30015	M9C30022	M9C30016	M9C30017
	24	12	M9C30121	M9C30115	M9C30122	M9C30116	M9C30117
	48	24	M9C30221	M9C30215	M9C30222	M9C30216	M9C30217
	130	48	M9C30321	M9C30315	M9C30322	M9C30316	M9C30317
	230...240	110	M9C30821	M9C30815	M9C30822	M9C30816	M9C30817
Width in 9 mm modules			2	2	4	4	4

TL & TLi impulse relays (cont.)

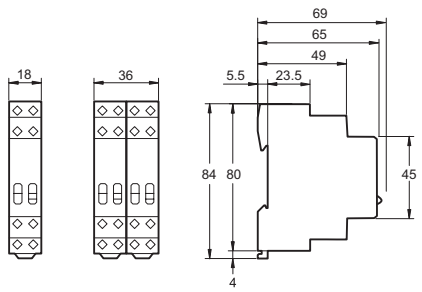


Connection



Type	Rating	Circuit	Tightening torque	Copper cables	
				Rigid	Flexible or with ferrule
				DB122945	DB123553
TL, TLi	16 A	Control	1 N.m	0.5 to 4 mm²	1 to 4 mm²
		Power		1.5 to 4 mm²	1.5 to 4 mm²
TL	32 A	Control		0.5 to 4 mm²	1 to 4 mm²
		Power	1.2 N.m	2.5 to 6 mm²	2.5 to 6 mm²

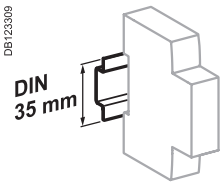
Dimensions (mm)



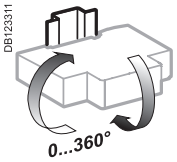
Weight (g)

Impulse relay	
Type	TL, TLi
1P	94 g
2P	102 g
3P	210 g
4P	218 g

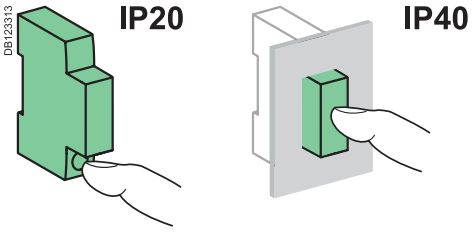
TL & TLi impulse relays (cont.)



Clip on DIN rail 35 mm (1.38 in)



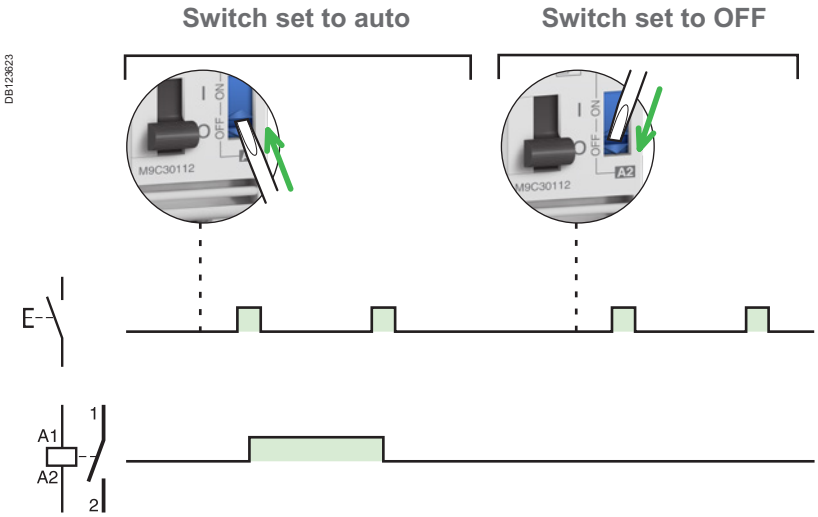
Indifferent position of installation



Technical data

Control circuit			
		TL and TLi 16 A	TL 32 A
Control voltage (Uc)	Tolerence at 50 Hz	+6 %, -15 %	
	Tolerence at 60 Hz	±6 %	
	Tolerence V DC	+6 %, -10 %	
Dissipated power (during the impulse)		1, 2, 3P: 19 VA	19 VA
		4P: 38 VA	
Illuminated PB control		Max. current 3 mA	
Operating threshold		Min. 85 % of Un in conformance with IEC/EN60669-2-2	
Duration of the control order		50 ms to 1 s (200 ms recommended)	
Response time		50 ms	
Power circuit			
Voltage rating (Ue)	1P, 2P	24 ...250 V AC	
	3P, 4P	24....415 V AC	
Frequency		50 Hz or 60 Hz	
Maximum number of operations per minute		5	
Maximum number of switching operation a day		100	
Additional characteristics			
Insulation voltage (Ui)		440 V AC	
Pollution degree		3	
Rated impulse withstand voltage (Uimp)		6 kV	
Overvoltage category		IV	
Endurance (O-C)			
Electrical		200,000 cycles (AC21)	50,000 cycles (AC21)
		100,000 cycles (AC22)	20,000 cycles (AC22)
Other characteristics			
Degree of protection (IEC 60529)	Device only	IP20	
	Device in modular enclosure	IP40 Insulation class II	
Operating temperature		-5°C to +60°C	
Storage temperature		-30°C to +70°C	
Tropicalization (IEC 60068-1)		Treatment 2 (relative humidity of 95% at 55°C / 131°F)	

Operation



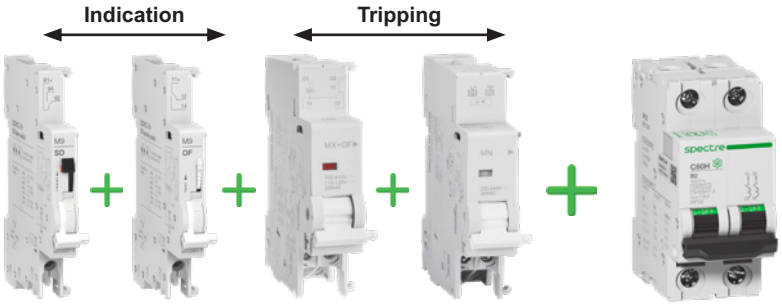
Auxiliaries
Electrical auxiliaries

DB105727 DB105730 DB105728 DB105729 IEC
DB405227_1

Compliance with electrical auxiliaries standards

- UL 489 Branch circuit protection File #E215117.
- CSA C22.2 No. 5 Branch circuit protection File #179014.
- UL 1077 Supplementary Protection File #E90509.
- CSA C22.2 No. 235 Supplementary Protection File #179014.
- IEC 60947-1 and IEC 60947-5-1 circuit breakers.
- CE Marked.

- The electrical auxiliaries provide the remote tripping or position (open/closed/tripped) indication functions of these devices in the event of an electrical fault.
- They clip on (no tool required) to the left-hand side of associated device.
- The SD+OF auxiliary is a two-in-one product consisting of SD and OF auxiliaries in a single device.

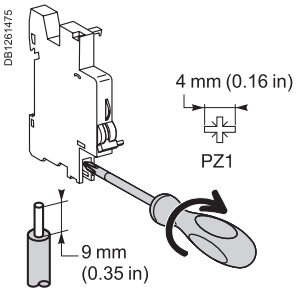


Combination table

Indication auxiliaries		Tripping auxiliaries	Devices
			 C60
1 SD+OF maxi	1 SD+OF maxi	1 maxi	
1 OF maxi	1 (SD+OF or SD or OF) maxi	2 maxi	 N60

Tripping devices must be installed first.
If two tripping devices are used: the MN under voltage release must be installed first
Indication auxiliaries: install the SD auxiliaries first

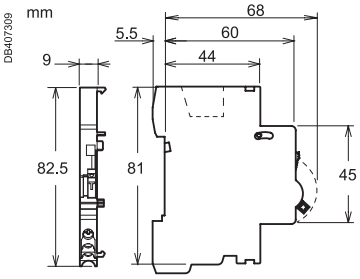
Electrical auxiliaries (cont.)



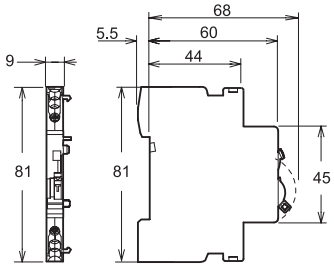
Connection

Type	Tightening torque	Copper cables Rigid
		DB122946 
Indication and tripping auxiliaries	1 N.m / 9 lb.in	DB405990 2 cables, 1.5 mm² / #16 AWG  or 1 cable, 2.5 mm² / #14 AWG 

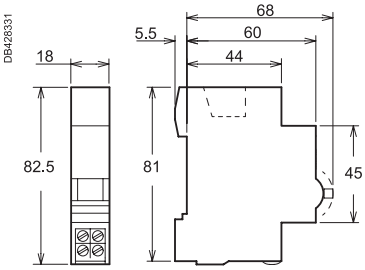
Dimensions (mm)



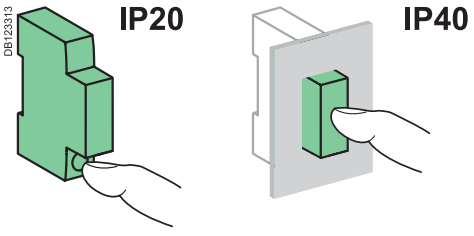
OF, SD

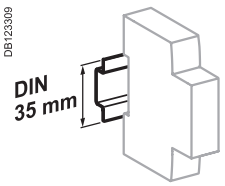


OF-SD

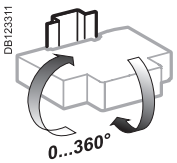


MX, MN, MN[S], MX+OF, MNx MNx





Clip on DIN rail 35 mm (1.38 in)

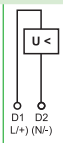
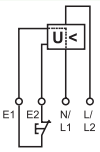


Indifferent position of installation

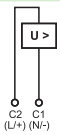
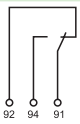
Weight (g)

Electrical auxiliary	
Type	
MN	66 g
MN[S]	66 g
MNx	73 g
MX	60 g
MX+OF	65 g
OF	30 g
SD	30 g
OF-SD	40 g

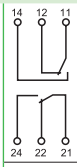
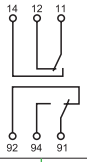
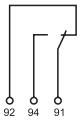
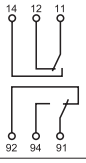
Electrical auxiliaries (cont.)

	Tripping							
Auxilliaries	**MN**					**MN[S]**	**MNx**	
Type	**Undervoltage release**							
	Instantaneous					Delayed	Independent of the supply voltage	
	PB100202_SE-30 					PB100203_SE-30 	PB100205_SE-30 	
Trademark	Schneider Electric					Schneider Electric	Schneider Electric	
Function								
	■ Causes the device with which it is associated to trip when its input voltage decreases (between 70% and 35% of Un). Prevents the device from closing until its input voltage has been restored						■ Tripping of the associated device by opening of the control circuit (e.g. push-button, dry contact)	
						■ No tripping in the event of transient voltage dips (up to 0.2 s)	■ A drop in the supply voltage does not trip the associated device ■ A locking push-button control allows the circuit protected (e.g. machine control) to be placed in safety configuration	
Wiring diagrams								
	DB118804 						DB406947 	
Utilization								
	■ Emergency stop via a normally-closed pushbutton ■ Improves the safety of the power supply circuits of several machines by preventing “uncontrolled” restarting						■ Fail-safe emergency stop ■ Insensitive to the variation in the control circuit voltage to improve continuity of service **Important: before any servicing operation switch off the main power supply (voltage presence terminals E1/E2)**	
Catalog numbers	**M9A27108**	**M9A27107**	**M9A26960**	**M9A26961**	**M9A26959**	**M9A26963**	**M9A26969**	**M9A26971**
Technical specifications								
Rated voltage (Ue) V AC	24	120	220...240	48	115	200...240	230	400
V DC	24			48		-	-	
Operating frequency Hz	50/60				400	50/60	50/60	
Pollution degree	3					3	3	
Mechanical state indicator light, red	On front face					On front face	On front face	
Test function	-					-	-	
Width in 9 mm (0.35 in) modules	2					2	2	
Operating current	-					-	-	
Number of contcts	-					-	-	
Operating temperature	-25... +50°C / -13...122°F					-25... +50°C / -13...122°F	-25... +50°C / -13...122°F	
Storage temperature	-40... +85°C / -40...185°F					-40... +85°C / -40...185°F	-40... +85°C / -40...185°F	
Standards								
IEC/EN 60947-1	■					■	■	
IEC/EN 60947-5-1	-					-	-	
EN 60947-2	■					■	-	
EN 62019-2	-					-	-	
UL	■					■	-	
CSA	■					■	-	
RU	■					■	-	
CCC	-					-	-	
EAC	■					■	■	

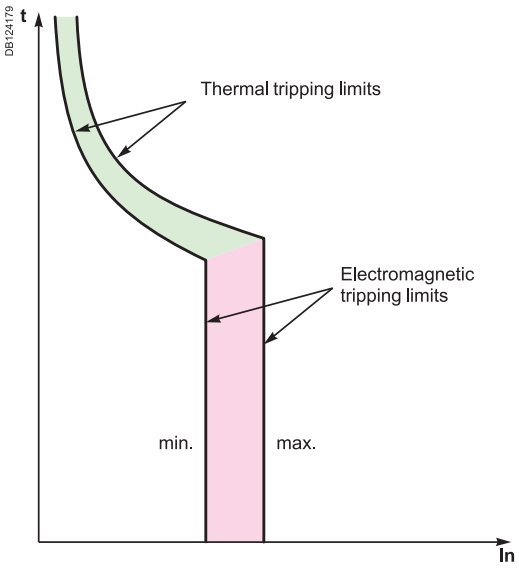
Auxiliaries
Electrical auxiliaries (cont.)

	Schneider Electric						Indication	
Auxilliaries	**MX**			**MX+OF**			**OF**	**SD**
Type	**Shunt release**						**open/closed auxilliary contact**	**Electrical fault indicating contact**
				With open/closed auxilliary contact				
	PB100199_SE-30 			PB100198_SE-30 			PB100626_SE-30 	PB100627_SE-30 
Trademark	Schneider Electric			Schneider Electric			Schneider Electric	Schneider Electric
Function								
	■ Tripping the associated device when it is powered on			■ Includes an open/closed contact (OF contact) to indicate the “open” or “closed” position of the associated device			■ Changeover contact indicating the “open” or “closed” position of the associated device	■ Changeover contact indicating the position of the associated device in the event of: □ electrical fault □ action on the tripping auxiliary
Wiring diagrams								
	DB123012 						DB118811 	DB118811 
Utilization								
	■ Emergency stop via a normally-open pushbutton			■ Emergency stop via a normally-open pushbutton Remote indication of the position of the associated device			■ Remote indication of the position of the associated device	■ Remote electrical fault tripping indication of the associated device
Catalog numbers	**M9A26476**	**M9A26477**	**M9A26478**	**M9A26946**	**M9A26947**	**M9A26948**	**M9A26924**	**M9A26927**
Technical specifications								
Rated voltage (Ue) V AC	100...415	48	12...24	100...415	48	12...24	240...415	240...415
V DC	110...130	48	12...24	110...130	48	12...24	24...130	24...130
Operating frequency Hz	50/60			50/60			50/60	50/60
Pollution degree	3			3			3	3
Mechanical state indicator light, red	On front face			On front face			-	On front face
Test function	-			-			On front face	On front face
Width in 9 mm (0.35 in) modules	2			2			1	1
Operating current	-			3 A / 415 V AC 6A / ⩽ 240 V AC			3 A / 415 V AC 6A / ⩽ 240 V AC	
Number of contcts	-			1 NO/NC			1 NO/NC	1 NO/NC
Operating temperature	-25... +50°C / -13...122°F			-25... +50°C / -13...122°F			-25... +50°C / -13...122°F	-25... +50°C / -13...122°F
Storage temperature	-40... +85°C / -40...185°F			-40... +85°C / -40...185°F			-40... +85°C / -40...185°F	-40... +85°C / -40...185°F
Standards								
IEC/EN 60947-1	■			■			-	-
IEC/EN 60947-5-1	-			-			■	■
EN 60947-2	-			-			-	-
EN 62019-2	-			-			■	■
UL	■			■			■	■
CSA	■			■			■	■
RU	■			■			■	■
CCC	-			■			■	■
EAC	■			■			■	■

Spectre

	OF+OF / OF+SD	OF	SD	OF-SD
	Double open/closed or fault indicating contact	**open/closed auxilliary contact**	**Electrical fault indicating contact**	**Double open/closed or fault indicating contact**
	PB100625_SE-30 	PB100626_SP-30 	PB100627_SP-30 	PB100625_SP-30 
	Schneider Electric	Spectre	Spectre	Spectre
	■ The OF+OF / OF+SD auxiliary is a two-in-one product: choice of OF or SD contact via the selector switch	■ Changeover contact indicating the “open” or “closed” position of the associated device	■ Changeover contact indicating the position of the associated device in the event of: □ electrical fault □ action on the tripping auxiliary	■ The OF-SD auxiliary is a two-in-one product
	DB118812  DB118813 	DB118809 	DB118811 	DB118813 
	OF position / SD position			
	■ Remote position and/or fault tripping indication of the associated device	■ Remote indication of the position of the associated device	■ Remote electrical fault tripping indication of the associated device	■ Remote position and/or fault tripping indication of the associated device
	M9A26929	**M9A26924-S**	**M9A26927-S**	**M9A26929-S**
	240...415	240...415	240...415	240...415
	24...130	24...130	24...130	24...130
	50/60	50/60	50/60	50/60
	3	3	3	3
	On front face	-	On front face	On front face
	On front face	On front face	On front face	On front face
	1	1	1	1
		3 A / 415 V AC 6A / ≤ 240 V AC		
	1 NO/NC + 1 NO/NC	1 NO/NC	1 NO/NC	1 NO/NC + 1 NO/NC
	-25... +50°C / -13...122°F	-25... +50°C / -13...122°F	-25... +50°C / -13...122°F	-25... +50°C / -13...122°F
	-40... +85°C / -40...185°F	-40... +85°C / -40...185°F	-40... +85°C / -40...185°F	-40... +85°C / -40...185°F
	-	-	-	-
	■	■	■	■
	-	-	-	-
	■	-	-	-
	■	-	-	-
	■	-	-	-
	■	-	-	-
	■	-	-	-
	■	-	-	-

Circuit breakers tripping curves



The following curves show the total fault current breaking time, depending on its amperage. For example: based on the curve on “Circuit breakers tripping curves”, page 20, a C60 circuit breaker of curve C, 20 A rating, will interrupt a current of 100 A (5 times the rated current In) in:

- 1 second at least
- 7 seconds at most.

The circuit breakers’ tripping curves consist of two parts:

- tripping of overload protection (thermal tripping device): the higher the current, the shorter the tripping time
- tripping of short-circuit protection (magnetic tripping device): if the current exceeds the threshold of this protection device, the breaking time is less than 10 milliseconds.

For short-circuit currents exceeding 20 times the rated current, the time-current curves do not give a sufficiently precise representation. The breaking of high short-circuit currents is characterized by the current limiting curves, in peak current and in energy. The total breaking time can be estimated at 5 times the value of the ratio $(I^2t)/(\hat{I})^2$.

Verification of the selectivity between two circuit breakers

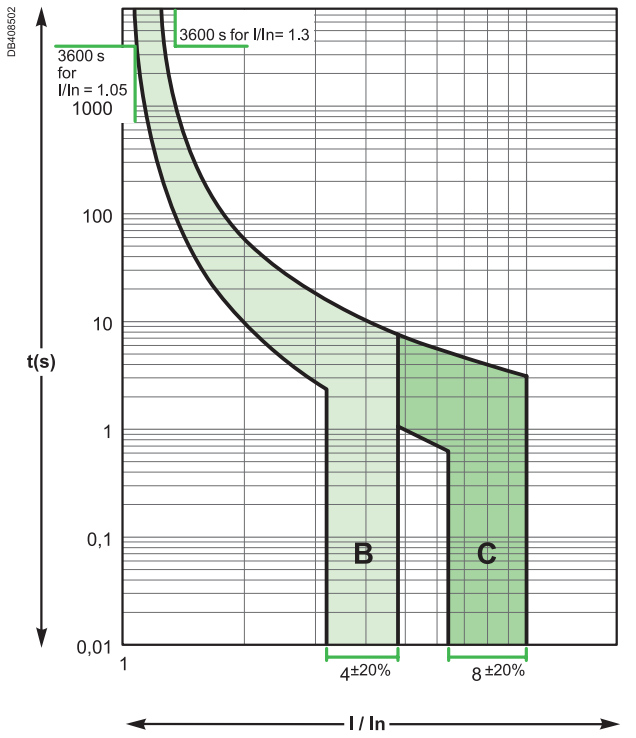
By superimposing the curve of a circuit breaker on that of the circuit breaker installed upstream, one can check whether this combination will be selective in cases of overload (selectivity for all current values, up to the magnetic threshold of the upstream circuit breaker). This verification is useful when one of the two circuit breakers has adjustable thresholds; for fixed-threshold devices, this information is provided directly by the selectivity tables.

To check selectivity on short circuit, the energy characteristics of the two devices must be compared.

Alternative current 50/60 Hz

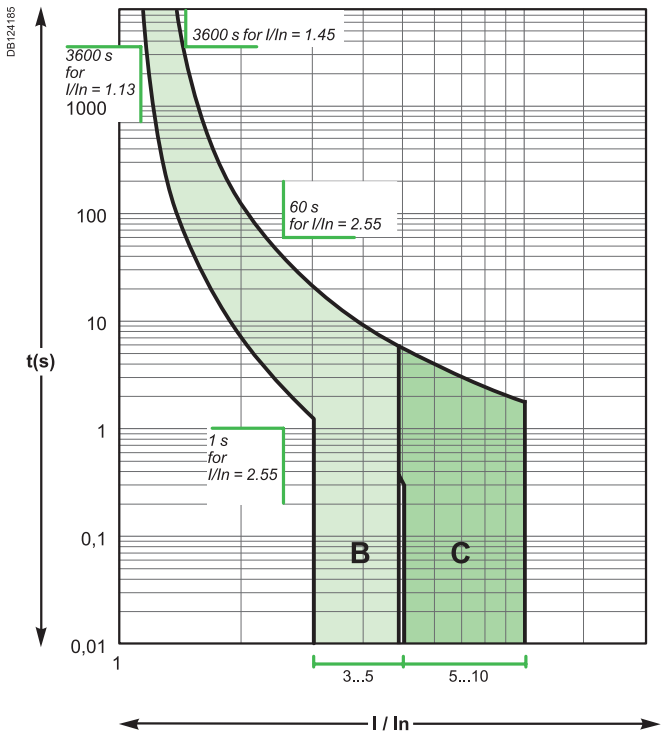
C60N, C60H

According to IEC/EN 60947-2 (reference temperature 50°C)
Curves B & C



C60N, C60H

According to IEC/EN 60898-1 (reference temperature 30°C)
Curves B & C

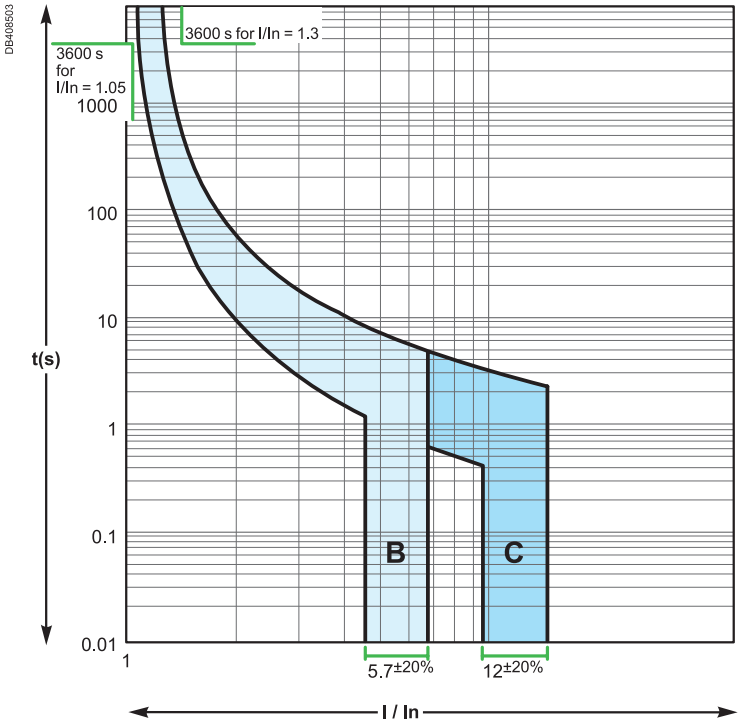


Circuit breakers tripping curves (cont.)

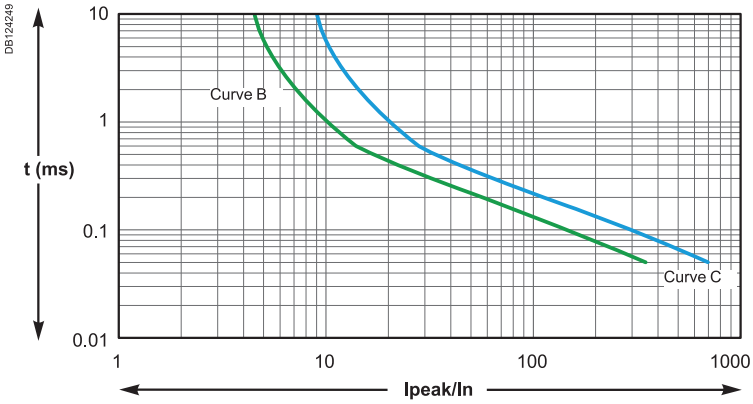
Direct current

C60N, C60H

According to IEC/EN 60947-2 (reference temperature 50°C)
Curves B & C



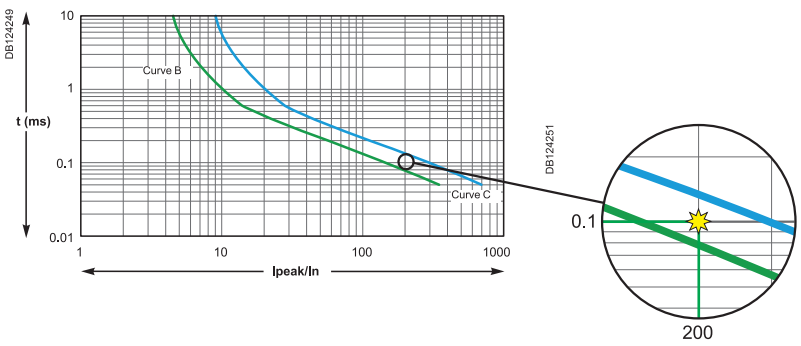
C60N, C60H



The circuit-breaker characteristics chosen depend on the type of load downstream of the installation.
The rating depends on the size of the cables to be protected and the curves depend on the load inrush current.

Product selection according to the load inrush current
When certain “capacitive” loads are switched on, very high inrush currents appear during the first milliseconds of operation. The left graphs show the average non-tripping curves of our products for this time range (50 µs to 10 ms).

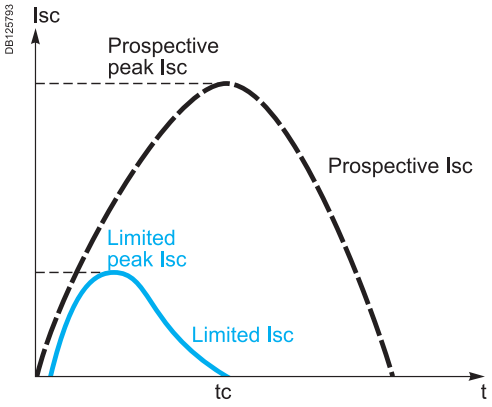
This information allows us to select the most appropriate product, according to the load specifications: curve and rating.



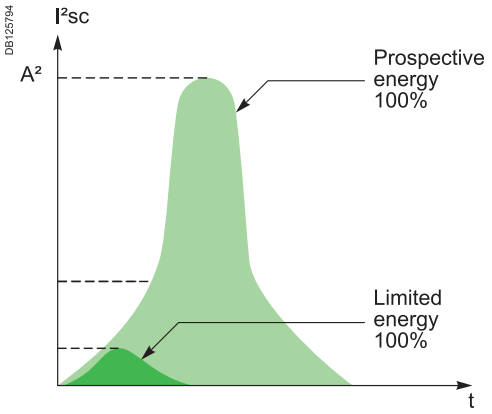
Example

When a C60 is used with a load with current peaks in the order of 200 In during the first 0.1 millisecond, a curve C product must be installed.

Short-circuit current limiting



Prospective current and real limit current.



Definition

The limiting capacity of a circuit breaker is its ability to lessen the effects of a short-circuit on an electrical installation by reducing the current amplitude and the dissipated power.

Benefits of limiting

Long installation service life

Thermal effects

Lower temperature rise at the conductor level, hence increased service life for cables and all components that are not self-protected (e.g. switches, contactors, etc.)

Mechanical effects

Lower electrodynamic repulsion forces, hence less risk of deformation or breakage of electrical contacts and busbars.

Electromagnetic effects

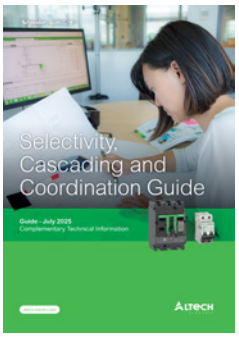
Less interference on sensitive equipment located in the vicinity of an electric circuit.

Savings through cascading

Cascading is a technique derived directly from current limiting: downstream of a current-limiting circuit breaker it is possible to use circuit breakers of breaking capacity lower than the prospective short-circuit current (in line with the cascading tables). The breaking capacity is heightened thanks to current limiting by the upstream device. Substantial savings can be achieved in this way on switchgear and enclosures.

Discrimination of protection devices

The circuit breakers' current limiting capacity improves discrimination with the protection devices located upstream: this is because the required energy passing through the upstream protection device is greatly reduced and can be not enough to cause it to trip. Discrimination can thus be natural without having to install a time-delayed protection device upstream.



Scan this QR code to download Selectivity, Cascading and Coordination Guide.

Short-circuit current limiting (cont.)

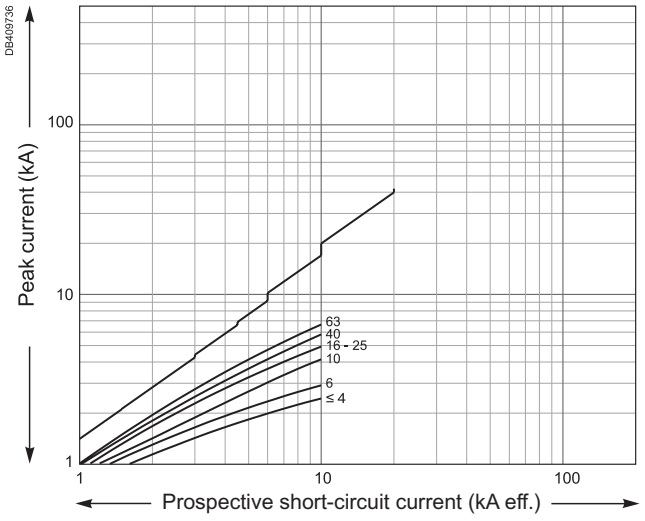
Ue: 380-415 V AC

Limitation curves for network
Ue: 380-415 V AC (Ph/N 220-240 V AC)

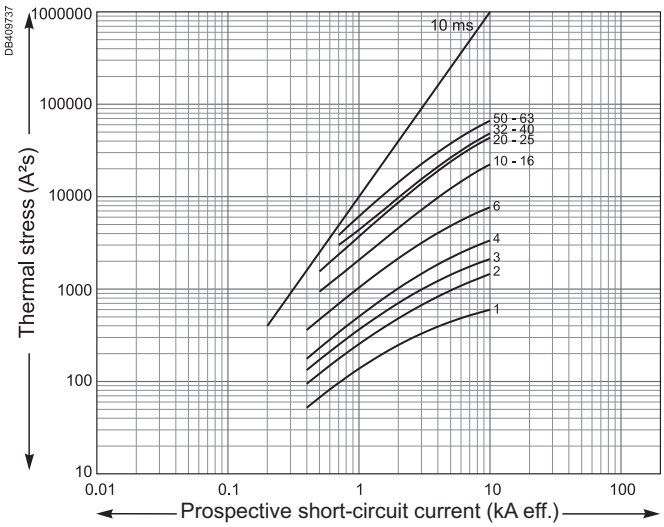
C60N

1P / 2P / 3P / 4P

Peak current



Thermal stress

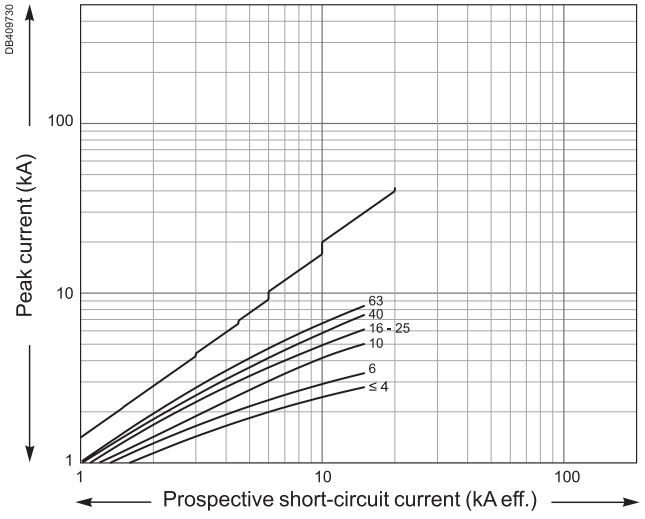


Limitation curves for network
Ue: 380-415 V AC (Ph/N 220-240 V AC)

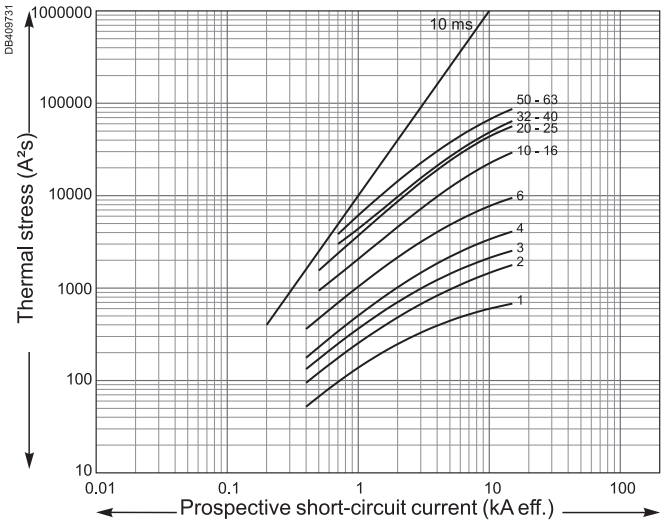
C60H

1P / 2P / 3P / 4P

Peak current



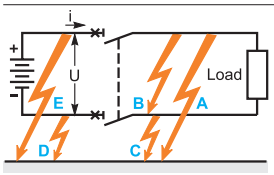
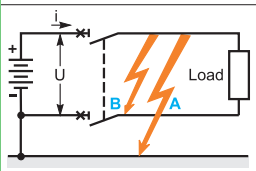
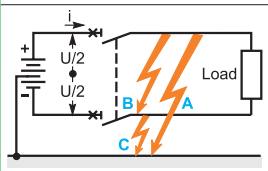
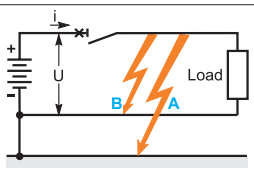
Thermal stress



Miniature circuit breakers for DC applications up to 240 V DC

This application sheet is inteded to provide guidance for selecting the best protection and control components for a given DC system. It covers DC systems supplied by rectifier (AC/DC or DC/DC converter) and/or battery, isolated from or connected to earth.
The main voltages are 24 V DC, 48 V DC, 110 V DC and 220 V DC.

Selection of devices in DC can be challenging due to the diversity of voltage levels and earthing system.
In this document we will consider the following systems.

IT	TN		
Isolated from earth	**- (or +) earthed**	**Midpoint earthed (not distributed)**	**- (or +) earthed**
+ and - conductors protected and disconnected	+ and - conductors protected and disconnected	+ and - conductors protected and disconnected	+ (or -) conductor only protected and disconnected
			

Disconnection of one or two polarities in TN ?

IEC 60364 Electrical Installation Rules (Chapter 42) can be applied to protect and break only the polarity that is not earthed in TN, but both + & - conductors are “active” conductors, so we recommend disconnecting both polarities.

Positive or negative polarity earthed in TN ?

According to IEC 60479-1 upward current is twice as dangerous as downward current so for protection against electric shock it is recommended to earth the negative pole. (In some DC applications the positive polarity can be earthed for galvanic corrosion reason).

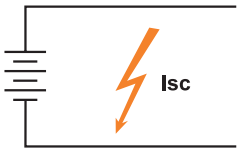
Calculation of the short-circuit current (Isc) at the terminals of a battery

When a short-circuit occurs at its terminals, a battery discharges a current given by ohm’s law:

$$Ic = \frac{Vb}{Ri}$$

where Vb = the maximum discharge voltage (battery 100% charged)
and Ri = the internal resistance equivalent to the sum of the cell resistances (figure generally given by the manufacturer in terms of Ampere-hour capacity of the battery).

example
What is the short-circuit current at the terminals of standing battery with the following characteristics:
capacity: 500 Ah
maximum discharge voltage:
240V (110 cells of 2.2 V)
discharge current: 300 A
autonomy: 30 mm
internal resistance: 0.5 mΩ per cell



$Ri = 110 \times 0.5 \times 10^{-3}$

$$Isc = \frac{240}{66 \times 10^{-3}} = 4.4kA$$

As the above calculation shows, the short-circuit current is relatively weak.

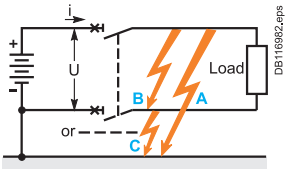
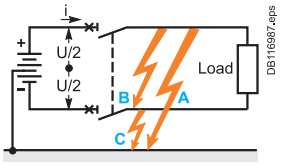
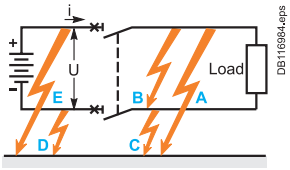
Note: If the internal resistance is not known, the following approximate formula can be used:
Isc= kC, where C is the capacity of the battery expressed in Ampere-hours, and k is a coefficient close to 10 but in any case always lower than 20.

Miniature circuit breakers for DC applications up to 240 V DC (cont.)

Circuit breaker selection

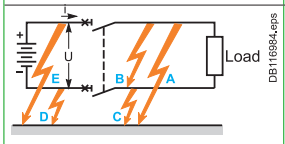
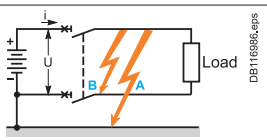
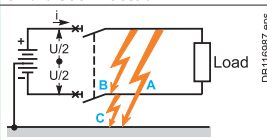
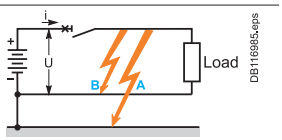
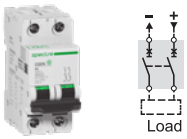
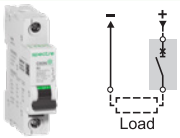
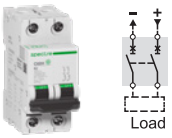
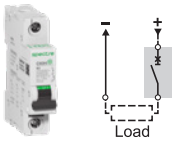
Selection of a circuit breaker depends essentially on the distribution-system parameters presented below which are used to determine the corresponding characteristics:

- Type of system - determines the type of product and the number of poles connected in series for each polarity.
- Rated voltage - determines the number of series poles taking part in current interruption.
- Nominal current - determines the rated current of the circuit breaker.
- Maximum short-circuit current at the point of installation - determines the breaking capacity.

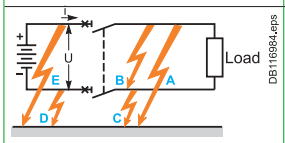
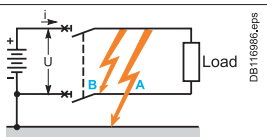
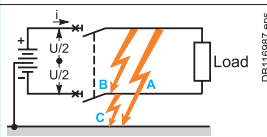
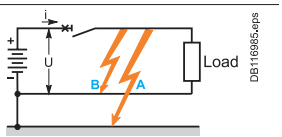
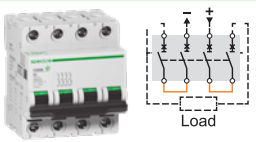
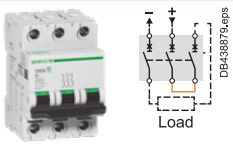
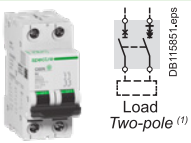
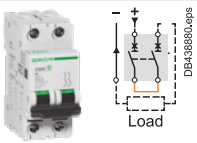
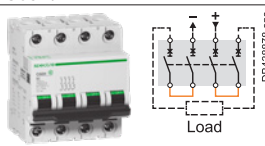
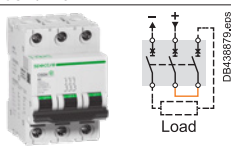
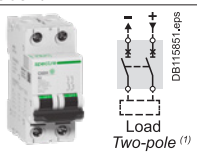
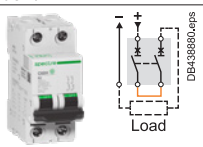
Types of system			
	Earthed systems		**Isolated systems**
	The source has one earthed polarity(1)	The source has an earthed mid-point	
Diagrams and various faults			
Fault analysis (neglecting resistance of earth electrodes)			
Fault **A**	■ Maximum Isc at U ■ Only protected polarity concerned ■ All poles of protected polarity must have breaking capacity ≥ Isc max. at U	■ Maximum Isc at U/2 ■ Only positive polarity concerned ■ All poles of positive polarity must have breaking capacity ≥ Isc max. at U/2	■ No consequences ■ The fault must be indicated by an IMD (insulation-monitoring device) and cleared (standard IEC/EN 60364)
Fault **B**	■ Maximum Isc at U ■ If only one polarity (the positive here) is protected, all poles of protected polarity must have breaking capacity ≥ Isc max. at U ■ If both polarities are protected, to enable disconnection, all poles of the two polarities must have breaking capacity ≥ Isc max. at U	■ Maximum Isc at U ■ Both polarities are concerned ■ All poles of the two polarities must have breaking capacity ≥ Isc max. at U	■ Maximum Isc at U ■ Both polarities are concerned ■ All poles of the two polarities must have breaking capacity ≥ Isc max. at U
Fault **C**	■ No consequences	■ Same as fault A ■ All poles of the ■ Negative polarity must have breaking capacity ≥ Isc max. at U/2	■ Same as fault A with the same obligations
Double fault **A** and **D** or **C** and **E**	■ Double fault not possible, system trips on first fault	■ Double fault not possible, system trips on first fault	■ Maximum Isc at U ■ Only positive polarity (cases A and D) or negative polarity (C and E) concerned ■ All poles of each polarity must have breaking capacity ≥ Isc max. at U
Most unfavorable cases			
	Fault **A** and fault **B** (if only one polarity is protected)	Fault **B**	Double fault **A** and **D** or **C** and **E**

Miniature circuit breakers for DC applications up to 240 V DC (cont.)

A. circuit breaker selection for 24/48 V DC according to method of earthing

Ue = 24/48 V DC					
Method of earthing		**IT**	**TN**		
		Isolated from earth + and - conductors protected and disconnected	**- (or +) earthed** + and - conductors protected and disconnected	**Midpoint earthed (not distributed)** + and - conductors protected and disconnected	**- (or +) earthed** + (or -) conductor protected and disconnected
					
Breaking capacity	**Rating**				
Isc ⩽ 10 kA	In ⩽ 63 A				
		C60N/H 2P			C60N/H 1P
Isc ⩽ 20 kA	In ⩽ 63 A				
		C60H 2P			C60H 1P

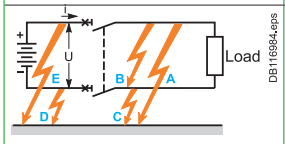
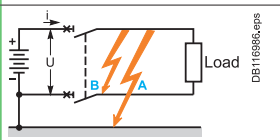
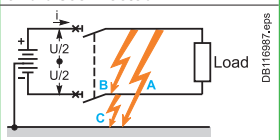
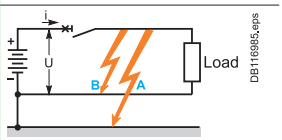
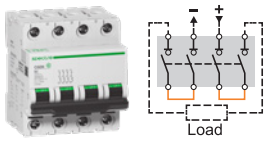
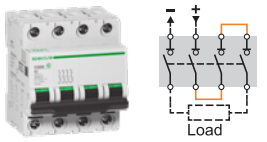
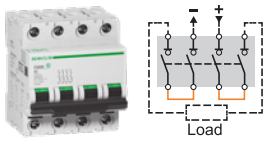
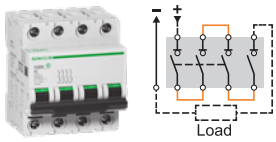
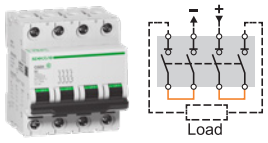
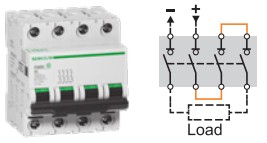
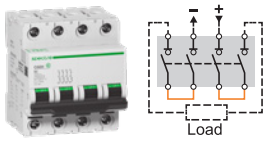
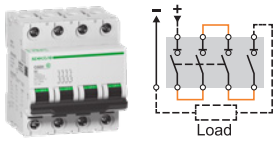
B. circuit breaker selection for 110 V DC according to method of earthing

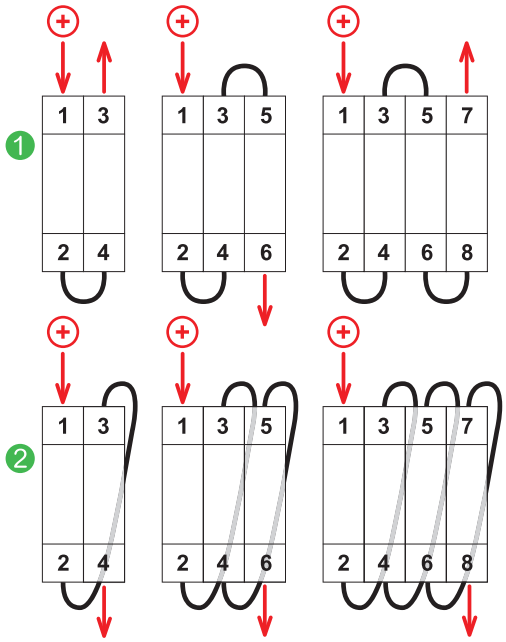
Ue = 110 V DC					
Method of earthing		**IT**	**TN**		
		Isolated from earth + and - conductors protected and disconnected	**- (or +) earthed** + and - conductors protected and disconnected	**Midpoint earthed (not distributed)** + and - conductors protected and disconnected	**- (or +) earthed** + (or -) conductor protected and disconnected
					
Breaking capacity	**Rating**				
Isc ⩽ 20 kA	In ⩽ 63 A				
		C60N/H 4P	C60N/H 3P	C60N/H 2P	C60N/H 2P
Isc ⩽ 25 kA	In ⩽ 63 A				
		C60H 4P	C60H 3P	C60H 2P	C60H 2P

Note: This table is applicable for 125 V DC floating battery voltage.

Miniature circuit breakers for DC applications up to 240 V DC (cont.)

C. circuit breaker selection for 240 V DC according to method of earthing

Ue = 240 V DC					
Method of earthing		**IT**	**TN**		
		Isolated from earth + and - conductors protected and disconnected	**- (or +) earthed** + and - conductors protected and disconnected	**Midpoint earthed (not distributed)** + and - conductors protected and disconnected	**- (or +) earthed** + (or -) conductor protected and disconnected
					
Breaking capacity	**Rating**				
Isc ⩽ 10 kA	In ⩽ 63 A				
		C60N/H 4P (2x2P serie)	C60N/H 4P (1P+3P serie)	C60N/H 4P (2x2P serie)	C60N/H 4P (4P serie)
Isc ⩽ 15 kA	In ⩽ 63 A				
		C60H 4P (2x2P serie)	C60H 4P (1P+3P serie)	C60H 4P (2x2P serie)	C60H 4P (4P serie)



Pole connection

Series connection

Series connection of the poles, by dividing the voltage per pole, optimizes the circuit breaking performance for high-voltage networks.
Series connection of the poles of a circuit breaker used in direct current therefore makes it possible to:

- Divide the network voltage by the number of poles
- Have the rated current for each pole
- Have the circuit breaker's breaking capacity for all the poles.

Direction of cabling and cable length

In the case of series connection, the direction of cabling has a major impact on the performance of the products.

Usually the first product cabling method 1 will be used.
For special applications where there is only a single possible current direction, the second cabling method 2 is preferable, especially for electrical endurance properties.
Subsequently the cable cross section and length combination should be optimized, depending on the loads. Generally, a greater length and cross section improves performance.

Rating (In)	Cross section (mm^2)	Min. shunt length (mm)
⩽ 63 A	⩽16	500
	25	200
	35	100

Note: this table gives the minimum cable (shunt) lengths optimizing the equipment's performance according to the cable cross sections.

Influence of ambient temperature

Influence of temperature on the operation

Devices	Characteristics influenced by temperature	Temperature	
		Mini	Maxi
C60N, C60H	Tripping on overload	-30°C	+70°C
N60N RCBOs	Tripping on overload	-25°C	+60°C
RCCB-ID	Maximum operating current	-25°C	+40°C

Note:the temperature considered is the temperature viewed through the device.

Circuit breakers

High temperatures

- A rise in temperature decreases the tripping current of the thermal protection.
- Protection is still ensured: the tripping threshold remains lower than the current acceptable by the cable (I_z)
- To prevent nuisance tripping, it should be checked that this threshold remains higher than the maximum operating current (I_B) of the circuit, defined by:
  - the rated load currents,
  - the coefficients of expansion and simultaneity of use.

If the temperature is sufficiently high for the tripping threshold to become lower than the operating current I_B, switchboard ventilation should be provided for.

Low temperatures

- A fall in temperature increases the tripping current of the thermal protection.
- There is no risk of nuisance tripping: the threshold remains higher than the maximum operating current of the circuit (I_B) demanded by the loads.
- It should be checked that the cable remains suitably protected, i.e. that its acceptable current (I_z) is higher than the values shown in the following tables (in amperes).

When the ambient temperature could vary within a broad range, both these aspects must be taken into account:

- the difference between the maximum operating current of the circuit (I_B) and the tripping threshold of the circuit breaker for the minimum ambient temperature,
- the difference between the strength of the cable (I_Z) and the maximum tripping threshold of the circuit breaker for the maximum ambient temperature.

Influence of ambient temperature (cont.)

Maximum permissible current

- The maximum current allowed to flow through the device depends on the ambient temperature in which it is placed.
- The ambient temperature is the temperature inside the enclosure or switchboard in which the devices are installed.
- The reference temperature is in a halftone colour for the different devices.
- When several devices operating simultaneously are mounted side by side in a small enclosure, a temperature rise in the enclosure results in a reduction in the operating current. A reduction coefficient of 0.8 will then have to be assigned to the rating (already derated, if applicable, depending on the ambient temperature).

- Example:

Depending on the ambient temperature and the method of installation, the table below shows how to determine, for a C60, the operating currents not to be exceeded for ratings 25 A, 32 A and 40 A (reference temperature 50°C).

Operating current not to be exceeded (A)							
Installation conditions (IEC 60947-2)		**C60 alone**			**Several C60 in the same enclosure** (calculate with the reduction coefficient indicated below)		
Ambient temperature (°C)		**35°C**	**50°C**	**65°C**	**35°C**	**50°C**	**65°C**
Type	**Nominal rating (A)**	**Actual rating (A)**					
C60	25	26.7	25	23.2	26.7 x 0.8 = 21.4	25 x 0.8 = 20	23.2 x 0.8 = 18.6
	32	34	32	29.9	34 x 0.8 = 27	32 x 0.8 = 25.6	29.9 x 0.8 = 24
	40	42.9	40	36.9	42.9 x 0.8 = 34.3	40 x 0.8 = 32	36.9 x 0.8 = 29.5

C60N, C60H derating table

C60N, C60H	Ambient temperature (°C)																				
Rating	**-30**	**-25**	**-20**	**-15**	**-10**	**-5**	**0**	**+5**	**+10**	**+15**	**+20**	**+25**	**+30**	**+35**	**+40**	**+45**	**+50**	**+55**	**+60**	**+65**	**+70**
2A	2.55	2.59	2.56	2.52	2.49	2.45	2.41	2.37	2.34	2.3	2.26	2.22	2.17	2.13	2.09	2.04	2	1.95	1.91	1.88	1.84
4A	4.9	4.86	4.81	4.76	4.7	4.65	4.59	4.54	4.48	4.42	4.37	4.31	4.25	4.19	4.13	4.06	4	3.94	3.87	3.81	3.74
6A	7.93	7.82	7.71	7.6	7.49	7.38	7.27	7.15	7.03	6.91	6.79	6.66	6.54	6.41	6.27	6.14	6	5.86	5.71	5.56	5.42
10A	13.3	13.2	13	12.8	12.6	12.4	12.2	12	11.8	11.6	11.4	11.2	10.9	10.7	10.5	10.2	10	9.8	9.5	9.2	9
16A	20	19.8	19.5	19.3	19.1	18.8	18.6	18.4	18.1	17.9	17.6	17.3	17.1	16.8	16.6	16.3	16	15.7	15.4	15.1	14.8
20A	26.9	26.6	26.2	25.8	25.4	25	24.6	24.2	23.7	23.3	22.9	22.4	22	21.5	21	20.5	20	19.5	18.9	18.4	17.9
25A	32.9	23.5	32.1	31.6	31.1	30.7	30.2	29.7	29.2	28.7	28.2	27.7	27.2	26.7	26.1	25.6	25	24.4	23.8	23.2	22.6
32A	41.5	41.1	40.5	40	39.4	38.9	38.3	37.7	37.1	36.5	35.9	35.3	34.7	34	33.4	32.7	32	31.3	30.6	29.9	29.1
40A	53.7	52.9	52.2	51.4	50.6	49.8	49	48.2	47.3	46.5	45.6	44.7	43.8	42.9	42	41	40	39	37.9	36.9	35.8
50A	65	64.3	63.5	62.6	61.7	60.8	59.9	59	58.1	57.1	56.2	55.2	54.2	53.2	52.1	51.1	50	48.9	47.8	46.7	45.5
63A	85.5	84.6	83.3	82	80.7	79.4	78	76.7	75.3	73.9	72.4	70.9	69.4	67.9	66.3	64.7	63	61.3	59.5	57.8	56

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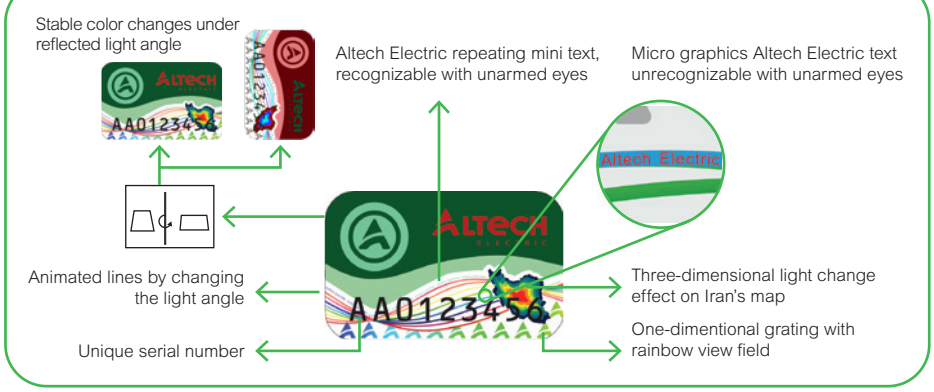

Previous design

New design

All Schneider Electric and Spectre products are valid with the two above hologram designs

Oct. 2025
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Office:
No. 2, Shahriar DE, Fayyazi (Fereshteh) St.,
Vali-e-Asr Ave.,1965938511,Tehran - Iran

+98(21)220 38385 +98(21)220 050742

Plant:
No. 76, Karafainan Sq., Simin Dasht Industrial
Town, Shahriar Road, Karaj 3165953175 - Iran

+98(26)366 70166 +98(26)366 70169

altech-electric.com

info@altech-electric.com