Technical data

Section 9

Miniature circuit breakers

Breaking capacities
Tripping characteristics

B type distribution board de-rating table

Board	Busbar rating	Integral MCCB	Integral isolator	Integral MCCB RCD
Standard	250A	0.9	1.0	0.9
MGB4N	200A	0.9	1.0	0.9
Split load	160A	0.9	1.0	0.9
Multi service	250A	0.9	1.0	0.9
Heavy duty	100A	N/A	N/A	N/A

The factors detailed above should be multiplied by the relevant busbar rating to give the operating current for each type of board when using a specified incomer.

Example:
If using an integral MCCB (typical Ref. **MCCB2503D4P**) in a standard board (typical Ref. **MGB12N**).

250A busbar rating x 0.9 = 225A board rating.

This represents the maximum operating current for an MGB12N with a **MCCB2503D4P**.

Miniature circuit breaker (magnetic trip setting)			BS EN 60898** Breaking capacity (A)		BS EN 60947-2* Breaking capacity (A)			
Type	Ratings (A)	Page	1 P 240V	2,3,4P 415V	1 P 220V/240V	2,3,4P 220V/240V	2,3,4P 380V/415V	2,3,4P 440V
C60HB MCB (type B: 3-5In)	1A to 63A	12/13	10,000	10,000	15,000	30,000	15,000	10,000
C60HC MCB (type C: 5-10In	1A to 63A	12/13	10,000	10,000	15,000	30,000	15,000	10,000
C60HD MCB (type D: 10-14In)	1A to 63A	12/13	10,000	10,000	15,000	30,000	15,000	10,000

* Breaking capacities quoted are Icu. Ics = 50% of Icu.
** Breaking capacities quoted are Icn. Ics = 75% of Icn.

Note: For UL/CSA approved MCB's consult us.

Maximum operating voltage 440V + 10%

Magnetic tripping characteristics (50/60Hz)

BS EN 60898			IEC 947-2			
Type	In min.	In max.	Type	In min.	In max.	Typical applications
B	3	5	**U**	5.5	8.8	Moderately inductive, e.g. commercial and general industrial
C	5	10	**C**	5	10	Highly inductive, e.g. heavy industrial
D	10	14	**D**	10	14	More highly inductive, e.g transformers, motors and certain lighting systems

Note: BS EN 60898 calibration temperature 30°C
BS EN 60947-2 calibration temperature 40°C

Temperature derating of MCB's

Miniature circuit beakers listed in the service current tables may be used at temperatures ranging from -30˚C to 60˚C. The tables show the maximum current to be employed as a function of certain ambient temperatures. Figures in bold type are the nominal current ratings at the calibration temperature.

Derating of MCB's grouped in enclosed installations.

When a number of circuit breakers or combined RCD/MCB's that operate simultaneously are mounted side by side in a small enclosure, the temperature rise inside the enclosure may cause a reduction in the service current. The reduction can be calculated by multiplying the maximum service current by a 'grouping factor'.

C60H B and C curves

	Temperature °C								
Rat. (A)	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
1	1.05	1.02	**1.00**	0.98	0.95	0.93	0.90	0.88	0.85
2	2.08	2.04	**2.00**	1.96	1.92	1.88	1.84	1.80	1.74
4	4.24	4.12	**4.00**	3.88	8.76	3.64	3.52	5.40	5.30
6	6.24	6.12	**6.00**	5.88	5.76	5.64	5.52	5.40	5.30
10	10.6	10.3	**10.0**	9.70	9.30	9.00	8.60	8.20	7.80
16	16.8	16.5	**16.0**	15.5	15.2	14.7	14.2	13.8	13.3
20	21.0	20.6	**20.0**	19.4	19.0	18.4	17.8	17.4	16.8
25	26.2	25.7	**25.0**	24.2	23.7	23.0	22.2	21.5	20.7
32	33.5	23.9	**32.0**	31.4	30.4	29.8	28.4	28.2	27.5
40	42.0	41.2	**40.0**	38.8	38.0	36.8	35.6	34.4	33.2
50	52.5	51.5	**50.0**	48.5	47.4	45.5	44.0	42.5	40.5
63	66.2	64.9	**63.0**	61.1	58.0	56.7	54.2	51.7	49.2

C60H D curve

	Temperature °C								
Rat. (A)	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**
1	1.10	1.08	1.05	1.03	**1.00**	0.97	0.95	0.92	0.89
2	2.18	2.14	2.08	2.04	**2.00**	1.96	1.90	1.86	1.80
4	4.52	4.40	4.24	4.12	**4.00**	3.88	3.72	3.56	3.44
6	6.48	6.36	6.24	6.12	**6.00**	5.88	5.76	5.58	5.46
10	11.4	11.1	10.7	10.4	**10.0**	9.60	9.20	8.80	8.40
16	17.9	17.4	16.9	16.4	**16.0**	15.5	15.0	14.4	13.9
20	22.2	21.6	21.2	20.6	**20.0**	19.4	18.8	18.2	17.6
25	27.7	27.0	26.5	25.7	**25.0**	24.2	23.5	22.7	21.7
32	35.2	34.2	3.6	32.9	**32.0**	31.0	30.4	29.4	28.4
40	44.4	43.6	42.4	41.2	**40.0**	38.8	37.6	36.4	34.8
50	56.0	54.5	53.0	51.5	**50.0**	48.5	46.5	45.0	43.0
63	71.8	69.9	67.4	65.5	**63.0**	60.4	57.9	55.4	52.9

■ Grouping factors

C60HB, C60HC, C60HD } 0.8

Table 1: fluorescent lighting

Depending on the power supply and the number and types of lighting units, the table gives the circuit breaker rating based on the following assumptions:

- Installation in an enclosure with an ambient temperature of 25°C (derating coefficient = 0.8).
- Power of ballast: 25% of tube power.
- Power factor: 0.6 for non-compensated fluorescent lighting. 0.86 for compensated fluorescent lighting.

Circuit breakers mounted in an enclosure with an ambient exterior temperature of 25°C: derating coefficient = 0.8.

Single phase system: 230V
Three phase + N system: 400V between phases

Types of lighting unit	**Power of tubes (W)**	**Number of lighting units per phase**												
Single phase non-compensated	**18**	4	9	29	49	78	98	122	157	196	245	309	392	490
	36	2	4	14	24	39	49	61	78	98	122	154	196	245
	58	1	3	9	15	24	30	38	48	60	76	95	121	152
Single phase compensated	**18**	7	14	42	70	112	140	175	225	281	351	443	562	703
	36	3	7	21	35	56	70	87	112	140	175	221	281	351
	58	2	4	13	21	34	43	54	69	87	109	137	174	218
Two phase 2x18 =	**36**	3	7	21	35	56	70	87	112	140	175	221	281	351
compensated 2x36 =	**72**	1	3	10	17	28	35	43	56	70	87	110	140	175
2x58 =	**118**	1	2	6	10	17	21	27	34	43	54	68	87	109
MCB rating		**1**	**2**	**6**	**10**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**

Calculation: non-compensated fluorescent lighting example (star connection)

$$\text{Number} = \frac{(\text{rating} \times 0.8)\ (U \times 0.6)}{(P \times 1.25)}$$

Table 2: high pressure discharge lamps

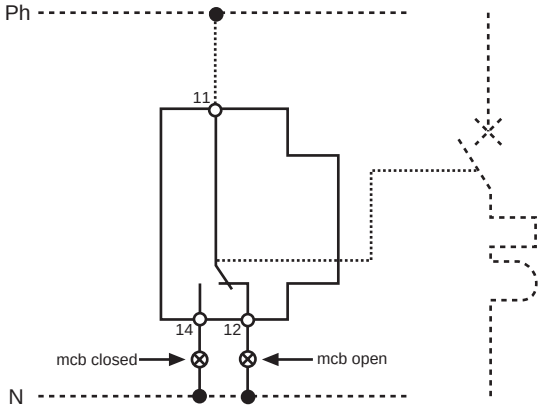
Table valid for 230V and 400V, with compensated or non-compensated ballast.

Mercury vapour + fluorescent substance	**Rat. (A)**
P(1) ≤ 700W	**6**
P(1) ≤ 1000W	**10**
P(1) ≤ 2000W	**16**
Mercury vapour + metal halides	
P(1) 375W	**6**
P(1) 1000W	**10**
P(1) 2000W	**16**
High pressure sodium vapour lamps	
P(1) 400W	**6**
P(1) 1000W	**10**

Auxiliary ON/OFF switch (OF) to indicate the 'open' or 'closed' position of a circuit breaker

Assembly
Clip on the left side of the circuit breaker.

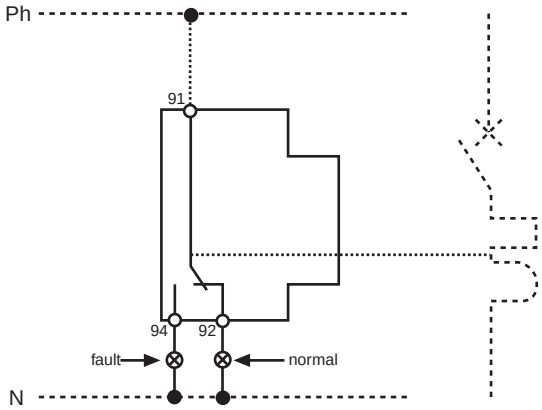
Applications
Audible or visual indication of the open or closed state of the circuit. The indication can be given on the front of a cubicle or enclosure or grouped on a control desk. Can be used in conjunction with an alarm switch.



Alarm switch (SD) to indicate circuit breaker opening on a fault (tripped)

Assembly
Clip on the left side of the circuit breaker.

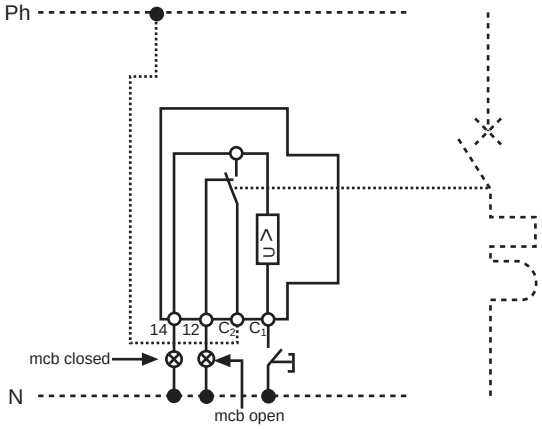
Applications
Audible or visual indication of a fault on an electrical circuit in air conditioned rooms, passenger and goods lifts, ventilation etc. May be used in conjunction with an auxiliary ON/OFF switch.



Shunt trip unit (MX) for remote tripping

Assembly
Clip on the left side of the circuit breaker.

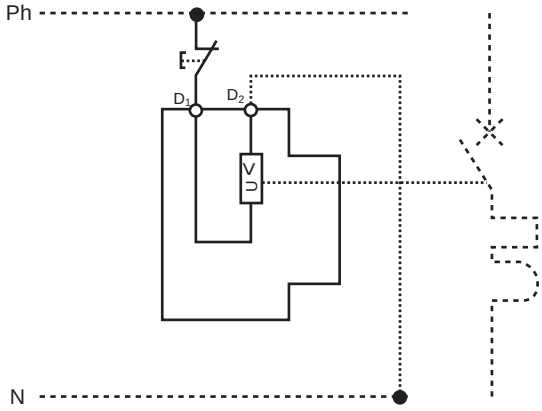
Applications
remote opening of electrical circuits.



Under voltage release unit (MN) to ensure automatic tripping in case of under voltage and for remote tripping by EMERGENCY STOP push button

Assembly
Clip on the left side of the circuit breaker.

Applications
Automatic tripping of a circuit breaker whenever the voltage drops sufficiently below its nominal rated voltage. Remote tripping of a circuit breaker by 'emergency stop' or other N.C. push button.

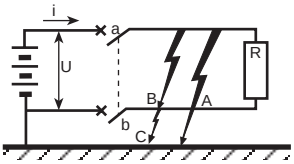
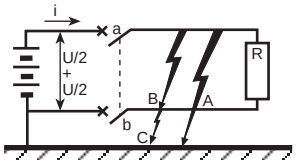
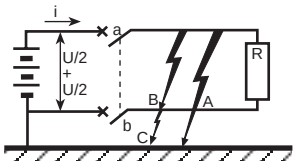


DC operation
Miniature circuit breakers

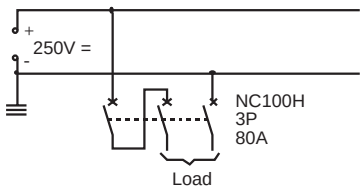
Selecting the circuit breaker
The selection of the type of circuit breaker most suitable for protection of a d.c. installation depends mainly on the following criteria:
- The rated current, which determines the rating of the equipment;
- The type of system (1,2 or 3), (see below);
- The rated voltage, which determines the number of poles to be involved in breaking;
- The maximum short-circuit current at the point of installation, which determines the breaking capacity. Magnetic trip threshold increases by 1.4.

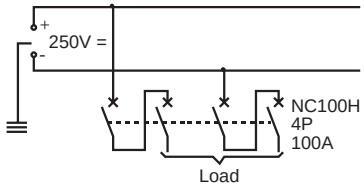
Breaking capacity of miniature circuit-breakers on d.c.
(in brackets, the number of poles involved in breaking)

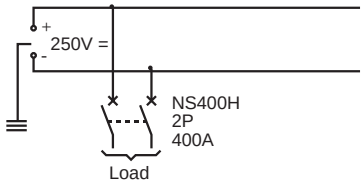
Type of circuit breaker	D.C. breaking capacity(kA)-L/R < 0.015s (IEC 947-2 ,Icu)			
Voltage	24/48V	125V	250V	500V
C60HB/HC	20 (1)	25 (2)	50 (4)	-
C60HD	20 (1)	25 (2)	50 (4)	-

Type of system		Earthed systems		Insulated systems
		One polarity of the DC supply is earthed	A centre point of the DC supply is earthed	
Diagrams and various cases of faults				
Fault effect	Fault **A**	Max. Isc the positive polarity is the only one involved	Isc close to max. Isc the positive polarity is the only one involved, voltage U/2	No effect
	Fault **B**	Max. Isc both polarities are involved	Max. Isc both polarities are involved	Max. Isc both polarities are involved
	Fault **C**	No effect	Same as fault A but this is the negative polarity which is involved	No effect
Most unfavourable case		Fault **A**	Faults **A** and **C**	Fault **B**
Distribution of the breaking poles		The poles required to perform the break are in series on the positive polarity (1),(2)	On each polarity there must be the number of poles required to perform the break of max. Isc at U/2	the poles required to perform the break are shared between the 2 polarities

(1) Or negative if the positive polarity is earthed.
(2) An extra pole will be needed on the earthed polarity to provide isolation







Calculation the short-circuit current (Isc) across the terminals of a battery
When a short-circuit occurs across its terminals, a battery discharges a current given by Ohm's law:

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

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 according to the capacity of the battery).

Example
What is the short-circuit current at the terminals of a standing battery with the following characteristics:
- Capacity: 500 Ah;
- Max. discharge voltage: 240 V (110 cells of 2.2 V);
- Discharge current: 300 A;
- Autonomy: 1/2 hour;
- Internal resistance: 0.5 mΩ per cell.

Ri = 110 x 0.5 10-3 = 55 x10-3

$$Isc = \frac{240}{55\ 10^{-3}} = 4.4kA$$

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.

240 V DC
300 A
500 Ah
Ri = 0.5 mΩ/cell

The greater part of multi 9 circuit breakers can be used on 400Hz networks. Short-circuit currents at 400Hz generator terminals do not, in general, exceed the nominal current by more than 4 times. Therefore, breaking capacity problems are very rare.

Multi 9 circuit breakers

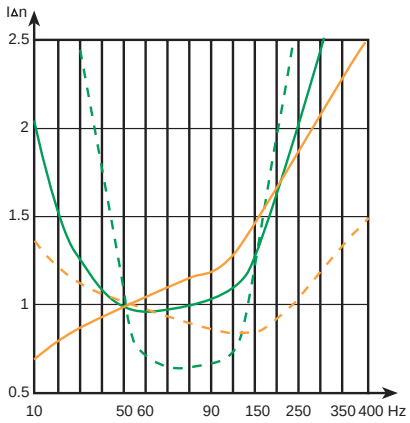
- ■ No thermal derating
- ■ Increase of magnetic thresholds:
- □ Coefficient 1.48 for C60
- ■ Residual current circuit-breakers from the multi 9 range can be used on 400Hz networks. It should be noted that the mA threshold varies depending on the network's frequency (see curves below).

Note:

In 400 Hz, the test circuit for residual current devices may present the risk of not functioning when actioning the test button because of threshold variation. According to international studies (IEC 60479-2), the human body is less sensitive to a 400Hz current that passes through the body; so well that, even though the residual current device has had its frequency desensitised, these devices still ensure the protection of persons. The method for choosing residual current devices in 400 Hz is thus the same as that for 50Hz.

RCCB

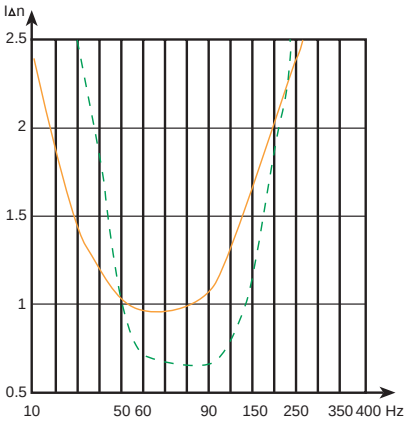
Operating residual current variation curves

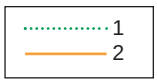


Class	Rating	Curve no. Sensitivity (mA)				
	(A)	10	30	100	300	500
AC	25	2	1	-	1	1
	25-40	-	1	1	1	1
	63-80-100	-	2	1	1	1
A	16-25-40-63	-	3	-	2	2
"si" type			4	-	4	-
Selective S (AC, A)		-	-	-	2	2

Vigi C60 2 and 4 pole, 220/415V - 50Hz

Operating residual current variation curves





Class	Rating	Curve N°. Sensitivity (mA)		
	(A)	10	30	100
AC	25	2	1	1
	40-63	-	2	1

Miniature circuit breakers

For use in conjunction with motor starters and transformers

Motor starters

In general miniature circuit breakers can give only short circuit protection to motor loads due to the high starting currents which may be encountered; typically 3 to 12 times full load current (FLC).

Assumptions

The tables give recommended mcb ratings for motors up to 37kW based on the following assumptions:

- **Direct-on-line starting**
  starting current = 7 x FLC
  run-up time =
  6seconds, motors <3kW
  10 seconds, motors < 22kW
  running currents = average values only (individual manufacturer's figures will vary). four-pole motors, i.e. speed approx. 1500 rev/min.

For higher inertia loads, i.e. hoists or fans, run-up times may be considerably longer than those assumed above. The rating of the mcb must take account of the greater run-up time and starting current. The required mcb rating can be determined by reference to time/current curves (consult us).

- **Star/delta starting**
  Since, during the changeover from star to delta, a high current surge in the order of DOL values may be met, the mcb rating selected should be the same as that recommended for DOL starting.

Table 1 - 3 phase 415V AC D.O.L. starting

			Recommended MCB		
kW	hHp	Running I	**C60HB**	**C60HC**	**C60HD**
0.12	0.166	0.65	2	2	1
0.18	0.25	0.7	2	2	1
0.25	0.33	0.87	4	2	1
0.37	0.5	1.35	4	4	2
0.55	0.75	1.55	4	4	2
0.75	1.0	1.93	6	4	4
1.1	1.5	2.5	6	6	4
1.5	2	3.5	10	10	6
2.2	3	4.8	16	10	10
3	4	6.4	20	20	10
3.75	5	7.8	25	25	16
4	5.5	8.1	25	25	16
5.5	7.5	11	32	32	16
7.5	10	14.4	50	50	20
9.33	12.5	17.3	63	50	20
11	15	21	63	63	25
13	17.5	25	-	-	32
15	20	28	-	-	40
18.5	25	35	-	-	50
22	30	40	-	-	50
30	40	54	-	-	63
37	50	65.5	-	-	-

Table 2 - 1 phase 240V AC D.O.L. starting

kW	Hp	Running I	**C60HB**	**C60HC**	**C60HD**
0.12	0.166	0.95	4	2	1
0.18	0.25	1.5	4	4	2
0.25	0.33	1.7	6	4	2
0.37	0.5	3	10	6	4
0.55	0.75	4.5	16	10	6
0.75	1	5.5	16	16	10
1.1	1.5	8.5	25	25	16
1.5	2	10.5	32	32	20
2.2	3	15.5	40	40	25
3	4	20	63	63	32
3.75	5	24	-	63	40
5.5	7.5	34	-	-	50
6.3	8.5	36.5	-	-	63
7.5	10	45	-	-	63
11	15	66.5	-	-	-

Transformers

High inrush currents are also produced when transformers are switched on, typically 10-15 times full load current.

Assumptions

The tables give recommended mcb ratings for single phase transformers up to 12500 VA and three phase transformers up to 30000 VA based on the following formula.

Table 3 - 3 phase transformers 415V AC supply

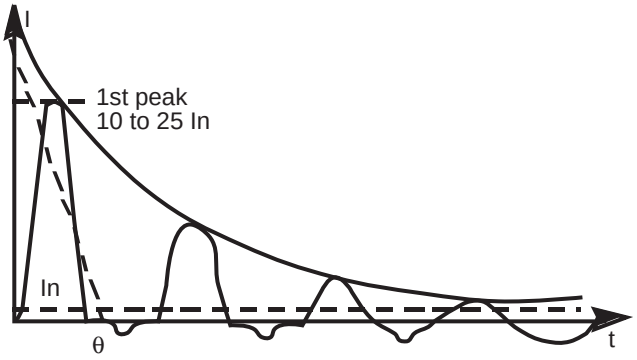
VA	Primary In (A)	C60HB	C60HC	C60HD
500	0.7	4	2	1
750	1.04	6	4	2
1000	1.39	10	6	4
2000	2.78	16	10	6
5000	6.95	40	25	16
10000	13.89	-	50	25
15000	20.84	-	63	32
20000	27.78	-	-	50
25000	34.73	-	-	63
30000	41.67	-	-	63

Table 4 - 1 phase transformers 240V AC supply

VA	Primary In (A)	C60HB	C60HC	C60HD
50	0.21	2	-	-
100	0.42	4	2	1
250	1.04	6	4	2
500	2.08	16	10	4
1000	4.17	25	16	10
2500	10.42	63	32	16
5000	20.84	-	63	32
10000	41.66	-	-	63
12500	52.08	-	-	-

Inrush currents

When LV/LV transformers are switched on, very high inrush currents are produced which must be taken into account when choosing overcurrent protection devices. The peak value of the first current wave often reaches 10 to 15 times the rated rms current of the transformer and may reach values of 20 to 25 times the rated current even for transformers rated less than 50kVA. This transient inrush current decays very quickly (in a few milliseconds).



Earth faults

Introduction

Merlin Gerin's range of rcd's offer high or medium sensitivity and are intended to provide "personnel protection", from the risk of electric shocks and/or "fire protection" - a fire can be initiated by the heat produced in a high resistance path to earth. Their high sensitivity (i.e. small operating current) ensures excellent system protection if compared with an installation containing standard overcurrent devices i.e. mcb's, fuses etc. An installation without RCD's would contain components with current ratings far in excess of the tens or hundreds of milli-amperes necessary to operate these rcd devices. Where larger current ratings lower sensitivities or longer time delays are required for discrimination or other reasons please ask for our MCCB catalogue.

Which sensitivity?

10mA offering a high degree of protection against electrocution in an accidental shock hazard situation, such units should only be employed on final circuits or single socket outlets of a small current rating, or where a high risk exists especially where external resistance would reduce the current flowing through the human body to less than 30mA.

30mA offer a high degree of protection against electrocution in an accidental shock hazard situation, such units are the most popular in the U.K. Typically a current of 80mA to 240mA will flow through the human body depending on the voltage across it etc, a 30mA rcd will typically operate in less than 30mS at these fault currents cutting off the current well within the time specified In the IEC publication 479 "Effects of current passing through the human body".

100mA normally provides protection against electrocution in an accidental shock hazard situation, however there is an increased likelihood that the fault current will drop below the operating current of the rcd. Generally the device is a compromise to offer earth leakage protection to groups of circuits.

300mA provides protection from the risk of electrical fire only (inherently 10, 30 or 100 mA rcd's offer fire protection), they are typically used on lighting circuits etc. where the risk of shock is extremely small. It should be remembered that a current of less than 500mA flowing in a high resistance path is sufficient to bring metallic parts to incandescence and start a fire under suitable circumstances.

Note: standard overcurrent devices would require currents far in excess of 300mA to operate.

Figure 1: Indirect contact

Applications

BS 7671 defines two types of contact.

Indirect defined as "contact of persons or livestock with exposed conductive parts made live by a fault and which may result in electric shock" see Figure 1. Effective earthing is always the first line of defence against electric shock, fire etc, a low resistance path back to the supply from the fault is provided, such that the overcurrent protective device will operate and disconnect the fault before damage occurs. BS 7671 requires the use of an rcd where the earth loop impedance (the impedance value from the supply and back via the earth connection) is too high to ensure automatic disconnection within the specified time by the operation of the overcurrent protection device. In this instance the product of the rcd sensitivity in amperes and the earth fault loop impedance in ohms shall not exceed 50.

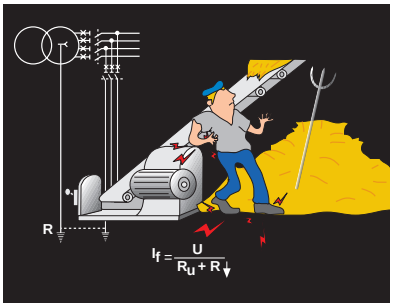


Figure 1: Indirect contact

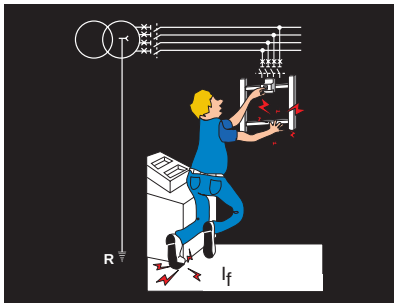


Figure 2: Direct contact

Maximum values for the earth loop impedance for the range of sensitivities offered by the Merlin Gerin range of rcd's is as follows:

RCD Sensitivity	**Permissible earth loop impedance**
10mA	5000Ω
30mA	1667Ω
100mA	500Ω
300mA	167Ω

The above is covered by regulations sections 413 and 471-08. Rcd's are further specified by the regulations to offer protection in the following applications reg: 471-16 socket outlets within the equipotential zone intended to supply equipment outside the zone. Reg: 471 -13 all sockets in a TT installation, this includes the majority of site electrical installations during building works and Reg: 608-03-02. All socket outlets for supplies on a caravan site.

Figure 2: Direct contact

Direct contact

defined as "contact of persons or livestock with live parts which may result in electric shock," see figure 2.

BS 7671 recognises only two main means of offering protection from direct contact to erect suitable barriers, equipment enclosures, insulation of cables etc. RCD's must never be used to provide the sole means of offering direct contact protection. They are indispensable as a means of offering supplementary protection against direct contact particularly in instances where damage may occur, trailing socket outlets, equipment used outside, equipment used in wet or other areas where a significantly increased risk exists. Most rcd's are employed in this role and they are common in schools, hospitals and domestic installations to name but a few.

An increasing number of government bodies, trade unions and institutions recognise the safety benefits of installing rcd's. They are therefore more frequently specified by codes of practice and other advisory documents published by these bodies.

Two families of rcd are offered in this catalogue

(1) Those without overcurrent protection (RCD's) e.g. RMG's

(2) Those with overcurrent protection (RCBO's) e.g. C60H RCBO's

miniature circuit breakers combined with a residual current device, this rcd/mcb combination can be realised in the form of the C60H rcbo combined rcd/mcb or by combining a vigi module with an mcb.

All of these units can be used to protect individual circuits or as devices mounted within individual enclosures. Individual out going circuits within type A or type B mcb distribution boards can be protected by installing rcd/mcb combinations on that particular outgoing way. Groups of circuits can be protected within distribution boards by selection of either split-load or dual incomer units with selected circuits protected by rcd incoming devices. Complete distribution systems can be given rcd protection by installing an RMG rcd in a separate enclosure ahead of the distribution board or by using a distribution board having an incoming rcd.

Unwanted tripping

The principal reasons for unwanted tripping of rcd's are lack of discrimination between rcd's (see following paragraph) and transient earth leakage currents, which have various causes such as lightning strikes, switching surges (caused by switching inductive loads) or switching capacitive loads (RF filter networks, mineral insulated cables etc) All Merlin Gerin rcd's and rcd/mcb's incorporate a filtering device which minimises their response to transients, virtually eliminating unwanted tripping.

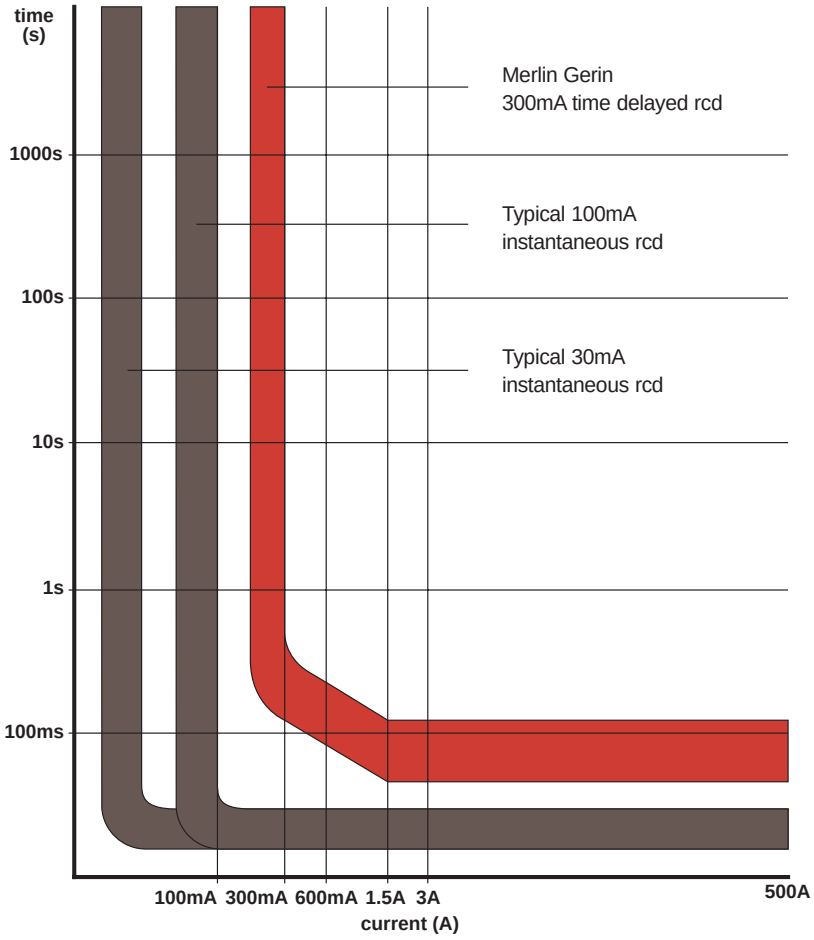
Discrimination of RCD's

Figure 3: characteristic of **23116**, 300mA time delayed rcd with 10, 30 and 100mA instantaneous devices superimposed to show discrimination.

Wherever two or more rcd's are installed in series with one another, measures must be taken to ensure that they discriminate properly - in the event of an earth fault, only the device next upstream should operate.

Rcd's do **not** discriminate on rated residual operating current sensitivity alone. In other words, a 100mA device upstream of a 30mA device will not offer inherent discrimination.

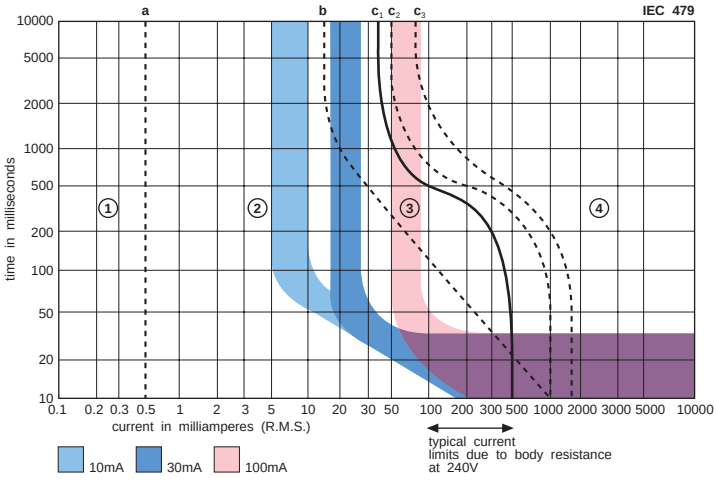
To provide the necessary discrimination, rcd's can be provided with an inbuilt time delay mechanism, usually 50ms. This inbuilt time delay is sufficient to allow the downstream device to open the circuit before the upstream device starts to operate. Such an rcd must be used as the incomer to a split load board incorporating two RCD's.



(fig. 3)

IEC publication 479 "effects of currents passing through the human body"

TIME/CURRENT ZONES OF EFFECTS OF A.C. CURRENT (15 TO 100HZ) ON PERSONS WITH STANDARD RCD CHARACTERISTICS SUPERIMPOSED



Zone Physiological Effects

1 Usually no reaction effects

2 Usually no harmful physiological effects

3 Usually no organic damage to be expected. Likelihood of muscular contraction and difficulty of breathing reversible disturbances of formation and conduction of impulses in the heart and transient cardiac arrest without ventricular fibrillation increases with current magnitude and time

4 In addition to the effects of zone 3 probability of ventricular fibrillation increased up to 5% (Curve C2) up to 50% (Curve C3) and above 50% beyond Curve C3 Increasing with magnitude and time. pathyphysiological effects such as cardiac arrest, breathing arrest and heavy burns may occur.

RCD Technical data
CT2000 contactor applications

Voltage applications

RCD type	Nominal voltage	Test button operating voltage (50Hz) Min.	Max.
RMG 2 pole	240	115	264
RMG 4 pole	415	115	264
C60H RCBO	240	110	264
MGV 2P	240/415	100	264
MGV 4P	415	112	456

High frequency applications - consult us.

CT 2000 contactor applications

Choice of contactor

- Heating circuits: (AC7a table 1)
  Table 1: maximum power (kW) controlled by a contactor as a function of contactor rating and service voltage. Example of use: electric heating units, water heaters.
- Lighting circuits: (AC5, table 2 and 3)
  choice of contactor and maximum number of load devices controlled as a function of the unit power (W) of the load devices and the service voltage: incandescent lamps, fluorescent lamps with starter, (individual mounting), sodium vapour lamps.
- Utility motors (AC7b, table 4) maximum power (kW) controlled by a contactor as a function of contactor rating and operating voltage. Typical applications: small pumps, compressors and machine tools.

Grouping of contactors

When contactors are mounted side by side on the same DIN rail, a spacer must be fitted between every pair of contactors. Contactor bank spacer cat. ref. **27062** enables contactors to be spaced 9mm apart to improve ventilation and prevent overheating.

Note:

For normal usage there is generally no requirement to derate due to the high calibration temperature employed.

Installation recommendations for contactors - when sited in close proximity to electronic equipment i.e. remote control switches, programmable timers etc.

1. Install two contactor spacers between the contactor and the electronic equipment.
2. Ensure contactor coil circuit and electronic equipment supply circuit are separated.
3. Where more than one DIN rail is available the contactor must be mounted on the upper rail and the electronic equipment on the lower rail.
4. Where only one DIN rail is available, the contactor must be mounted to the RHS of electronic equipment on horizontal rails and above electronic equipment on vertical rails.

Table 1: Heating — Maximum power (kW) for a given rating

Type of heating (AC1-AC7a categories)		Contactor rating (A) 25	40	63	100
400/415V heating					
Nº. of ops per day	25	5.4	8.6	14	21.6
	50	5.4	8.6	14	21.6
	75	4.6	7.4	12	18
	100	4	6	9.5	14
	250	2.5	3.8	6	9
	500	1.7	2.7	4.5	6.8
230/240V heating					
Nº. of ops per day	25	16	26	41	63
	50	16	26	41	63
	75	14	22	35	52
	100	11	17	26	40
	250	5	8	13	19
	500	3.5	6	9	14

Table 2: Lighting

230/240V	Power (W)	Maximum number of lamps for a given rating **Contactor rating (A)** **16**	**25**	**40**	**63**	**100**
Incandescent lamp with/without halogen gas						
	40	38	57	115	172	250
	60	30	45	85	125	187
	75	25	38	70	100	150
	100	19	28	50	73	110
	150	12	18	35	50	75
	200	10	14	26	37	55
	300	7	10	18	25	37
	500	4	6	10	15	22
	1000	2	3	6	8	12
12V halogen lamp (with ELV transformer)						
	20	15	23	42	63	94
	50	10	15	27	42	63
	75	8	12	23	35	52
	100	6	9	18	27	40
	150	4	6	13	19	28
26mm fluorescent (single tube with parallel capacitor)						
	15	15	20	40	60	90
	18	15	20	40	60	90
	20	15	20	40	60	90
	36	15	20	40	60	90
	40	15	20	40	60	90
	58	10	15	30	43	64
	65	10	15	30	43	64
	115	5	7	14	20	30
	140	5	7	14	20	30
26mm fluorescent tube (single tube without capacitor)						
	15	22	30	70	100	150
	18	22	30	70	100	150
	20	22	30	70	100	150
	36	20	28	60	90	135
	40	20	28	60	90	135
	58	13	17	35	56	84
	65	13	17	35	56	84
	115	7	10	20	32	48
	140	7	10	20	32	48
26mm fluorescent (twin tube with parallel capacitor)						
	2x18	30	46	80	123	180
	2x20	30	46	80	123	180
	2x36	17	25	43	67	100
	2x40	17	25	43	67	100
	2x58	10	16	27	42	63
	2x65	10	16	27	42	63
	2x118	6	10	16	25	37
	2x140	6	10	16	25	37
26mm fluorescent (four tube with parallel capacitor)						
	4x18	15	23	46	69	100
Electronic ballast (1 x 26mm tube)						
	18	74	111	222	333	500
	36	38	58	117	176	260
	58	25	37	74	111	160
Electronic ballast (2 x 26mm tube)						
	2x18	36	55	111	166	250
	2x36	20	30	60	90	135
	2x58	12	19	38	57	85
Electronic compact						
	7	133	200	400	600	900
	11	80	120	240	360	540
	15	58	88	176	264	396
	20	44	66	132	200	300
	23	38	57	114	171	256

Table 3: Sodium lighting

230/240V	Power (W)	Maximum number of lamps for a given rating **Contactor rating (A)** **16**	**25**	**40**	**63**	**100**
Low pressure sodium (with compensation)						
	18	14	21	40	60	60
	35	3	5	10	15	15
	55	3	5	10	15	15
	90	2	5	6	11	11
	135	1	2	4	6	6
	180	1	2	4	6	6
High pressure sodium (without compensation)						
	70	8	12	20	32	32
	150	4	7	13	18	18
	250	2	4	8	11	11
	400	1	3	5	8	8
	1000	-	1	2	3	3
High pressure sodium (with compensation)						
	70	6	9	18	25	25
	150	6	9	18	25	25
	250	2	4	8	12	12
	400	2	3	6	9	9
	1000	1	2	4	6	6

To obtain the maximum number of lamps on three phase four wire circuits, multiply the maximum number of lights for single phase by three.

For three phase, three wire, the following formula must be applied

$$\frac{\text{Single phase quantity} \times 3}{1{,}732}$$

Table 4: Utility motors

Type of motor (AC7b category)	Maximum power (kW) for a given rating **Contactor rating (A)** **16**	**25**	**40**	**63**	**100**
230/240V	-	1.4	2.5	4	4
400/415V	-	4	7.5	15	15

TL impulse relay

For use with lighting

The table below indicates the maximum power rating of a number of lamps that can be installed on impulse relay controlled 240V single-phase circuit.
For other voltages please consult us.

							impulse relay max power (W)	
Impulse relay rating							16A	32A
Lighting								
Incandescent lighting	Tungsten filament (240 V)							
		40	**60**	**75**	**100**	**200 W**		
		40	25	20	16	8	1600	
		106	66	53	42	21		4260
	With halogen (240 V)							
			300	**500**	**1000**	**1500 W**		
			5	3	1	1	1500	
			13	8	4	2		4000
	VLV halogen lighting (12 or 24 V with transformer)							
			20	**50**	**75**	**100 W**		
			70	28	19	14	1400	
			180	74	50	37		3700
Fluorescent lighting	Single with starter (non compensated)							
				18	**36**	**58 W**		
				70	35	21	1300	
				186	93	55		3400
	Single with starter (compensated)							
				18	**36**	**58W**		
				50	25	16	930	
				133	66	42		2400
	Double with series compensated starter							
				2x18	**2x36**	**2x58W**		
				56	28	17	2000	
				148	74	45		5300
	Single HF ballast							
				16	**32**	**50W**		
				80	40	26	1300	
				212	106	69		3400
	Double HF ballast							
				2x16	**2x32**	**2x50W**		
				40	20	13	1300	
				106	53	34		3400
Discharge lamps	Low pressure sodium vapour							
			55	**90**	**135**	**180 W**		
			24	15	10	7	1300	
			63	40	26	18		3400
	High pressure sodium vapour or metal halide							
				250	**400**	**1000 W**		
				5	3	1	1300	
				13	8	3		3400

Additional specifications

Pick-up consumption = 200VA.
Hold consumption = l.l VA
Voltage = 220 V/240 V AC (40 to 60 Hz).
Service temperatures: - 10°C, + 50°C.

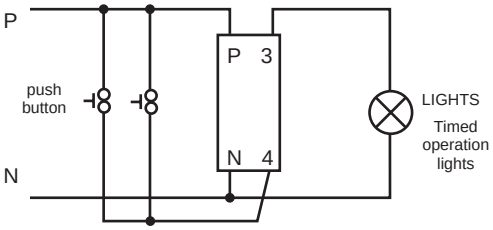
Note: The control circuit must operate at the same voltage as the supply circuit (220/240 V AC).
Breaking capacity of contacts: 16 A at p.f. = 1 Maximum power incandescent or fluorescent lighting: 2000 W.

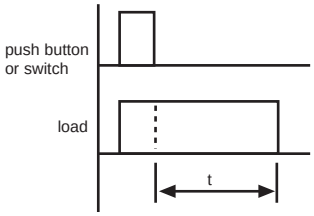
Guide for use
Setting of the time delay relay is by means of a graduated knob on the front face of the timer: l to 7 minutes, in graduations of 15 seconds. For 60 Hz, time delay of 48 sec. to 5.6 minutes approximately.

Applications
Mainly for lighting stairs, entrances, corridors and passages in blocks of flats, and offices. The timer has a locking device which allows lighting to remain on permanently.

It is important to ensure the correct selection position of 3 or 4.

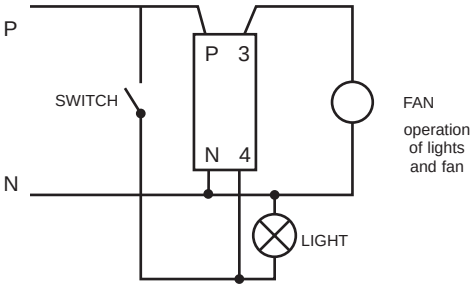
Circuit diagrams for position 4: phase switching

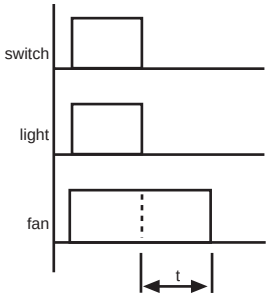




t = time set on MIN timer

Phase switching position



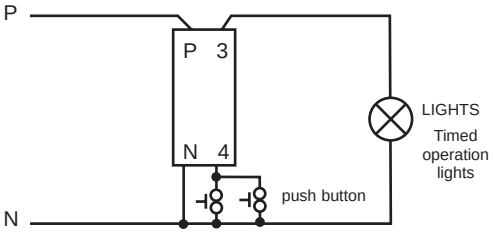


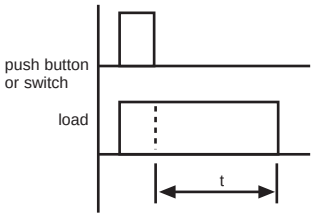
t = time set on MIN timer

Phase switching position

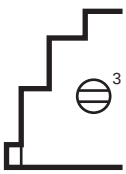
Circuit diagram for position 3: neutral switching

Neutral/phase switching selector





t = time set on MIN timer



Neutral switching position

Time delay relays

RTA, RTB, RTC, RTH, RTL

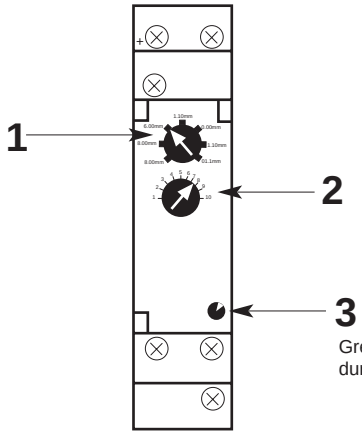
Designed to delay ON or OFF signals from remote or local controls by the operation of a set of changeover contacts.

1. Selector switch for time delay
2. Setting of time delay
3. Contact indicator- green = closed

Setting of the time delay:
RTA, RTB, RTC, RTH, RTL

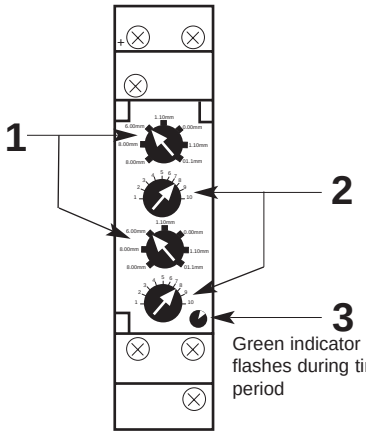
- ☐ Step 1: select desired time delay from the 7 time delay ranges (1)
- ☐ Step 2: select fine time delay multiple for actual time delay required (2)

RTA RTB RTC RTH



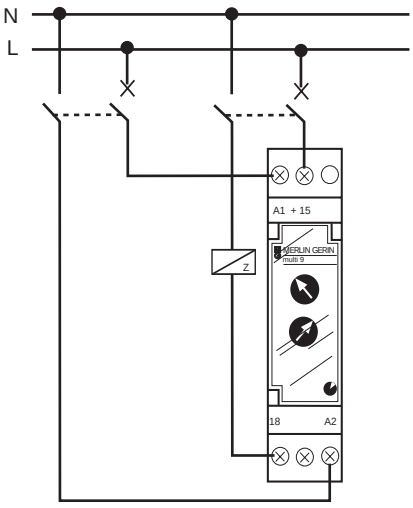
Green indicator lamp flashes during timing period

RTL

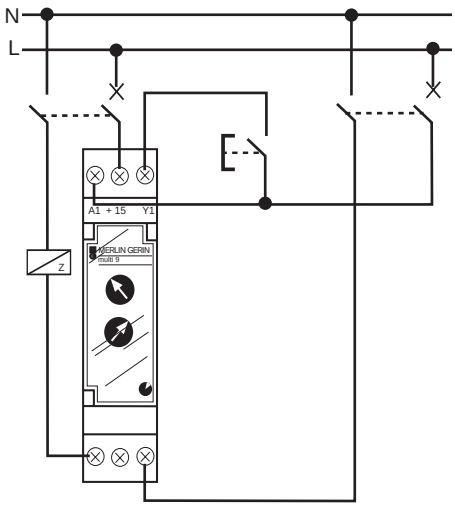


Green indicator lamp flashes during timing period

RTA, RTH and RTL



RTB RTC



Load considerations

- ■ The surge arrester's level of protection (Up) depends on the installed equipment and the rated voltage of the installation
- ■ Up must lie between:
- □ The full voltage of the permanent operating conditions (Uc),
- □ The impulse withstand voltage (Uchoc) of the equipment to be protected: Uc < Up < Uchoc.

8/20 impulse withstand table for equipment to be protected

■ General standard: IEC 60364-4

Rated voltage of the installation	**Equipment sensitivity withstand (Uchoc)**			
Three phase networks	**Reduced**	**Normal**	**High**	**Very high**
	electronic circuit devices:	electrical household appliances:	industrial devices:	industrial devices:
	televisions, alarms, HiFi, video recorders, computers telecommunication	dishwashers, ovens refrigerators, portable tools	motors, cabinets, current sockets, transfos.	distribution electric meters, telemeters
400/690/1000	2.5 kV	4 kV	6 kV	8 kV
230/440 V	1.5 kV shock wave category I	2.5 kV shock wave category II	4 kV shock wave category III	6 kV shock wave category IV

Earthing systems	**TT**	**TN-S**	**TN-C**	**IT**
Uc value for common mode (protection between live conductors and earth)	≥ 1.5 Uo	≥ 1.5 Uo	≥ 1.5 Uo	≥ 1.732 Uo
Uc value for differential mode (protection between phase and neutral)	≥ 1.1 Uo	≥ 1.1 Uo		≥ 1.1 Uo

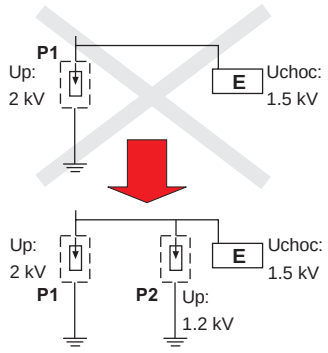
Uo: Simple network voltage between phase and neutral.
Uc: Full voltage under permanent operating conditions.
Uc: Value as in the French standard: NF C 15100 section 534.

Placing several surge arresters in a cascading configuration

The incoming surge arrester (P1) is dimensioned to run-off lightning currents at the source of the installation, 2 cases are possible:

- ■ If there is a level of protection (Up) too high for the impulse withstand voltage (Uchoc) of the installation's equipment:
- □ A secondary protection surge arrester (P2) placed near loads is sufficient, to lower the voltage and make it compatible with the impulse withstand voltage of the equipment to be protected (see installation constraints page 179).

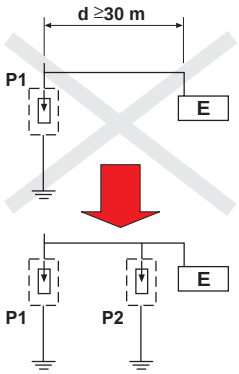
Example figure 1



E: Equipment to be protected with impulse withstand of 1.5 kV
P1: incoming surge arrester dimensioned with In and Imax that are sufficient enough to face lightning currents that may appear and with a level of protection of 2.5 kV
P2: Surge arrester near equipment to be protected with an adapted level of protection and which is co-ordonated with P1

- ■ If sensitive equipment is too far from the incoming surge arrester (d ≥ 30 m figure 2):
- □ A secondary protection surge arrester (P2) placed near loads suffices, to lower the voltage and make it compatible with the impulse withstand voltage of the equipment to be protected (see installation constraints page 179).

Example figure 2



E: Equipment to be protected with impulse withstand of 1.5 kV
P1: Incoming surge arrester dimensioned with In and Imax that are sufficient enough to face lightning currents that may appear and with a level of protection of 1.5 kV. This level of 1.5 kV is acceptable in principle (even though there is no margin), but the distance d is too great
P2: Surge arrester near equipment to be protected with an adapted level of protection and which is co-ordonated with P1

Surge arresters

Choosing surge arresters for LV networks

Site characteristics

■ If a lightning rod is planned or has already been installed on the building (or in a 50 m radius):
☐ Choose an incoming protection device with an Imax of 65 kA. lightning flash density (Ng).

■ Mount a surge arrester Imax: 8 kA in a cascading configuration if:
☐ The distance between the incoming surge arrester and loads is ≥30 m,
☐ The surge arrester's voltage Up is too high in regards to the sensitivity of the load to be protected (Uchoc).

Up surge arrester < Uchoc switchgear

Installation without a lighting conductor

Residential

Geographical location	**Urban**			**Rural**		
Lightning flash density (Ng)	≤ 0.5	0.5<Ng<1.6	≥ 1.6	≤ 0.5	0.5<Ng<1.6	≥ 1.6
Imax (kA) incoming protection	15*	15	15	15	30-40	65
Imax (kA) secondary protection if: Up too high and/or d ≥ 30 m					8	8

(*) recommended

Tertiary/industrial (1)

Continuity of supply of the operation	**Not necessary**			**Partial**			**Essential**		
Consequence (financial) of a lightning stroke on equipment to be protected	**Low**			**High**			**Very high**		
Lightning flash density (Ng)	≤0.5	0.5<Ng<1.6	≥1.6	≤0.5	0.5<Ng<1.6	≥1.6	≤0.5	0.5<Ng<1.6	≥1.6
Imax (kA) incoming protection	15	15	30-40	15	30-40	65	30-40	65	65
Imax (kA) secondary protection if: Up too high and/or d ≥ 30 m			8		8	8	8	8	8

(1) since in the tertiary/industrial sector the cost of equipment to be protected is higher, damage due to lightning is more significant

Selection depending on the earthing system

Earthing systems		**TT**	**TN-S**	**TN-C**	**IT distributed neutral**	**IT non-distributed neutral**
Draw-out surge arresters						
PRD	MC			1P		
	Uc = 275 V					
	MC			3P		
	Uc = 440 V					3P
	MC/MD	1P+N	1P+N		1P+N	
	Uc = 440/275 V	3P+N	3P+N		3P+N	
Fixed surge arresters						
PF 30-65 kA	MC	1P+N	1P+N		1P+N	
	Uc = 440 V	3P+N	3P+N		3P+N	
PF 8-15 kA	MC/MD	1P+N	1P+N		1P+N	
	Uc = 440/275 V	3P+N	3P+N		3P+N	
PE	MC			1P		
	(Uc = 440 V)			3x1P		3x1P

Choosing a disconnection circuit breaker

Maximum lightning discharge current	disconnection circuit breaker		
	Rating	Curve	Range
8-15-30-40 kA	20 A	C	-
65 kA	50 A	C	-

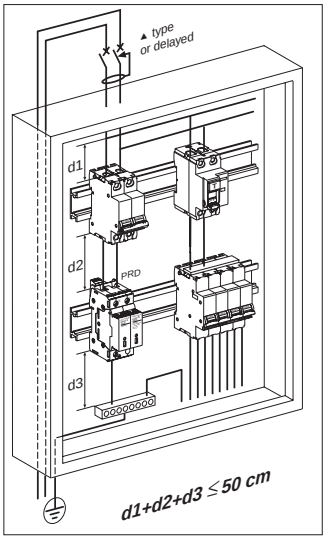
After having chosen the surge arrester(s) needed to protect the installation, the appropriate disconnection circuit breaker is to be chosen from the opposite table:

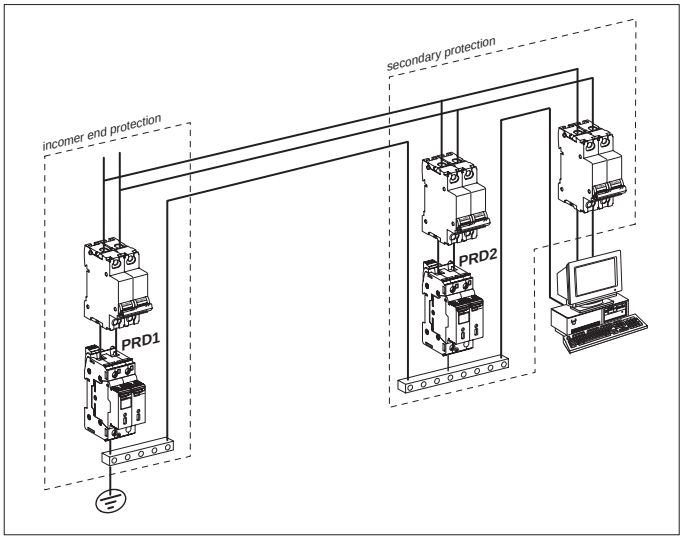
- Its breaking capacity must be compatible with the installation's breaking capacity.
- Each live conductor must be protected example: a 1P+N surge arrester must be combined with a 2P disconnection circuit breaker (2 protected poles).

Installation constraints

The 50 cm rule in the switchboard
Connections must be as short as possible.
Do not exceed a distance of 50 cm, to efficiently protect electrical loads.

Co-ordinating 2 surge arresters (the 10 m rule)
In the case of an exposed site and the presence of sensitive loads, it is recommended to co-ordinate upstream and downstream protection in a cascading configuration.





Current transformers

Output

The output that may be drawn from the current transformers depends upon the output accuracy required. This table gives the output available for the various accuracy classes.

Ratio	Standard	Tropicalised	Class 0.5 VA	Class 1 VA	Class 3 VA
40/5	**-**	**16500**	-	-	-
50/5	**16501**	**16451**	-	1.25	1.5
75/5	**16502**	**16452**	-	1.5	3
100/5	**16503**	**16453**	2	2.5	4
125/5	**16504**	**16454**	2.5	4	5
150/5	**16505**	**16455**	3	4	6.5
150/5	**16509**	**16459**	1.5	5.5	6.5
200/5	**16506**	**16456**	4	6	7
200/5	**16510**	**16460**	4	7	8.5
200/5	**16526**	**16476**	-	2	5
250/5	**16511**	**16461**	6	9	11
250/5	**16518**	**16468**	2.5	5	8
250/5	**16527**	**16477**	1	4	6
300/5	**16512**	**16462**	7.5	11	13.5
300/5	**16519**	**16469**	4	8	12
300/5	**16528**	**16478**	1.5	6	7
400/5	**16513**	**16463**	10.5	15	18
400/5	**16520**	**16470**	8	12	15
400/5	**16529**	**16479**	5	7.5	10
500/5	**16514**	**16464**	12	18	22
500/5	**16521**	**16471**	10	12	15
500/5	**16530**	**16480**	8	10	12
600/5	**16515**	**16465**	14.5	21.5	26
600/5	**16531**	**16481**	8	10	12
800/5	**16532**	**16482**	12.5	15	20

How to use

One advantage of the Multi 9 light sensitive switch is that only the waterproof photoelectric cell need be installed outside. The electronics are installed in the control unit (usually in an indoor enclosure). The length and section of the cable connecting the photoelectric cell with the light sensitive switch does not affect operation.

■ **Setting:**

Photoelectric cell mounted outdoors (refer to fig. 1)

Carry out setting at a time when the light is at the value selected for the setting. Turn button (1) to position 1 and turn potentiometer (2) from "max." to " min. " until the lamp lights. Then turn back until the lamp goes out. The equipment is then set.
As the light falls below the setting, the switch operates with a time delay of 80 seconds to avoid undesired switching owing to transient fluctuations in light (car headlights etc).

Photoelectric cell installed indoors

Turn button (1) to position 2 and carry out setting using the same procedure. Example: boosting the lighting in a factory as it becomes dusk.

Application

Switching off shop window lighting (see example below), public lighting, sports fields etc.

Note: If the power controlled is above 1100W, interpose a contactor or a changeover relay in the system: see fig. 3.

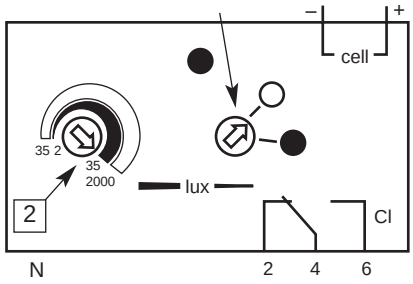
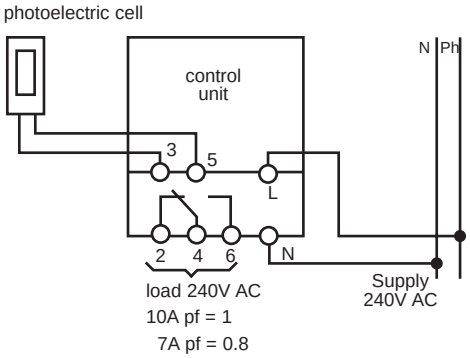


Fig. 1: front of light sensitive switch



Note: For lighting loads with other power factors e.g. sodium, consult us.

Fig. 2: wiring diagram

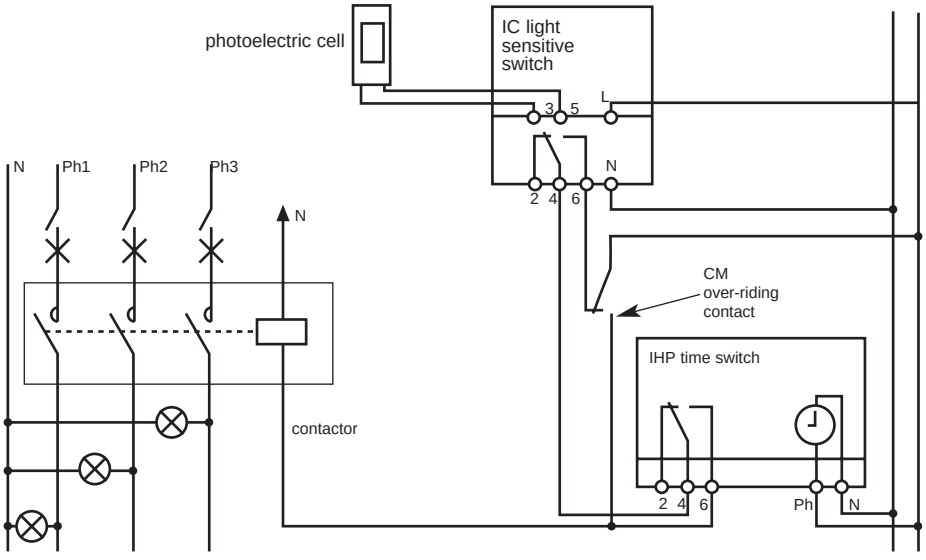


Fig. 3: wiring diagram incorporating changeover switch and contactor

Passive infra red movement detector

CDM/CE30

CDM/CE30 operating principle

Remote lighting control by movement sensing within the detection zone (see diagrams) .

- An optical lens detects the movement of passive infra-red radiation sources such as the human body.
- A built in light sensitive cell can be used to automatically switch the CDM on and off according to the preset luminosity threshold.
- A timer keeps the lights on for a preset time after movement detection. The timer resets automatically if another movement is detected before the end of the first time period.
- The CDM operates continuously to detect movements and to control the lighting of a given sector within the preset parameters.

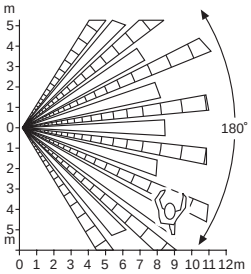
Use a screwdriver to adjust the potentiometer

- When the potentiometer is fully clockwise (position), the CDM/CE30 operates whatever the luminosity.
- When it is fully counter-clockwise. (position), the CDM/CE30 operates only from dusk to dawn (5 lux). Adjust as necessary.

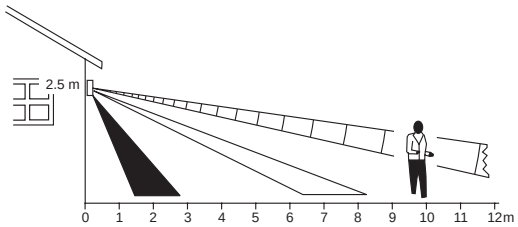
Use a screwdriver to adjust the potentiometer

- When the potentiometer is fully counterclockwise ("test" position), the lights will remain on for 45 CDM 1 s CE 30 after a movement detection.
- When it is fully clockwise, the lighting time is 15 minutes - CDM-CE30, 11 minutes.

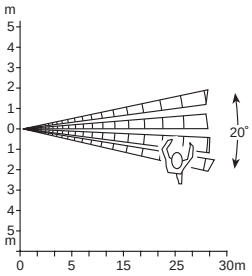
Horizontal Scan

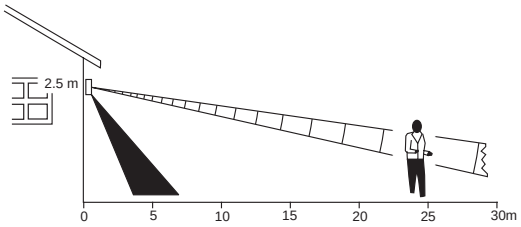


Vertical Scan

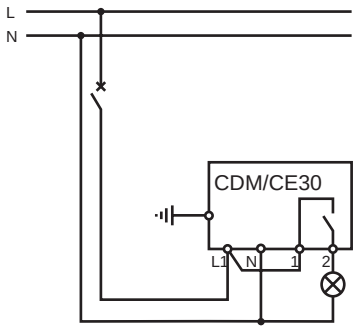


CDM
distance 12 metres scan of 180˚

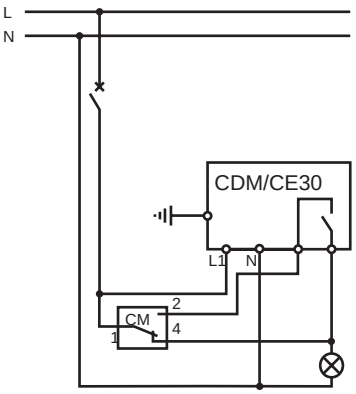




CE30
distance 30 metres scan of 20˚



The CDM/CE30 may also be used in conjunction with a time clock to operate only at preset times.



☐ A CM changeover switch may be used to obtain constant or automatic operation of the lighting of a given sector.

Minipact

Discrimination limits for Minipact downstream of other Merlin Gerin products

Upstream device	NS160N/H/L Trip unit TM-D				NS250N/H/L Trip unit TM-D			NS160N/H/L Trip unit STR22SE		NS250N/H/L Trip unit STR22SE	
Downstream rating (A) Device	80	100	125	160	160	200	250	125	160	200	250
Minipact <50A	2	2	2	2	T	T	T	2	2	T	T
63A		2	1.25	1.25	T	T	T		2		T

Upstream device	NS400N/H/L Trip unit STR22SE/53UE					NS630N/H/L Trip unit STR22SE/53UE				
Downstream rating (A) Device	160	200	250	320	400	25	320	400	500	630
Minipact <50A	T	T	T	T	T	T	T	T	T	T
63A	T	T	T	T	T	T	T	T	T	T

Full discrimination is also achieved with the following Merlin Gerin devices:
All “Compact C” MCCB's equal to and above 800A.
All H1 and H2 “Masterpact” ACB's
For discrimination values between Minipact and “L” type “Masterpacts” please consult us.
Discrimination values in kA.
‘T’ = total discrimination up to breaking capacity of downstream device.

Discrimination limits for Minipact upstream of other Merlin Gerin products

Upstream device Downstream device	Rating (A)	Minipact 63
C60H	<10	T
B, C, D	16A	T
	20A	T
	25A	T
	32A	6
	40A	
	50A	
	63A	

Guidance for motor loads

Specific “magnetic only” MCCB's are available for short circuit protection of motors. However, the standard MCCB may be used, as detailed below.

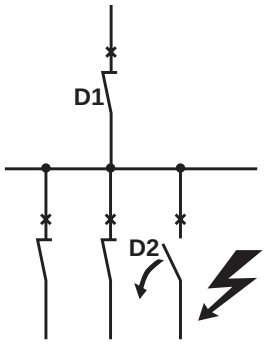
	Max motor size (kW)	Running current (A) @ 415V
16A	2.2	5.0
25A	3.7	7.5
40A	4	8.4
63A	9	17
80A	15	28
100A	22	40
125A	25	47
160A	33	60
200A	45	80
250A	69	128

Note:
- ■ These tables offer guidance only, for DOL starting assuming:
- □ A starting current of 7 x FLC
- □ Run-up time =8 seconds for motors < 3kW
  10 seconds for motors > 3kW
- ■ The running current is a typical value and may vary from manufacturer to manufacturer.

Safepact 2

Discrimination

The table below indicates where total discrimination exists between devices.



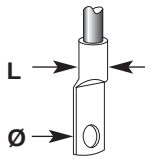
Upstream	Compact rating (A)		MGE1003	MGE1253	MGE1603	MGE2003	MGE2508	MGE4003	MGE6303
Downstream circuit breaker		Rating (A)							
multi 9	C60H	10 to 16	■	■	■	■	■	■	■
		20 to 25		■	■	■	■	■	■
		32 to 40		■	■	■	■	■	■
		50 to 63			■	■	■	■	■
Compact	NS80H	2.5 to 6.3	■	■	■	■	■	■	■
		12.5		■	■	■	■	■	■
		25 to 80			■	■	■	■	■
	NS100N	16 to 100				■	■	■	■
	NS160N	125 to 160						■	■
	NS250N	200 to 250							■

Note: For further information on this product range: consult us.

Technical data

Powerpact 4 panelboards

Technical data



Current	device		Possible terminal capacity for crimped lug (mm) Ø	@ L	Breaking capacity 415V
100A	MGP100	MCCB SP	6	25	25,000A @ 240V
100A	MGP100	MCCB TP	6	25	25,000A
160A	MGP160	MCCB TP	6	25	36,000A
250A	MGP250	MCCB	8	25	36,000A
	MGP250NA	Switch disconnector	8	25	–
400A	MGP400	MCCB	10	32	45,000A
	MGP400A	Switch disconnector	10	32	–
630A	MGP630	MCCB	10	32	45,000A
	MGP630NA	Switch disconnector	10	32	–
800A	C801N		12	40	50,000A
	C801NI	Switch disconnector	12	40	–
	MGP INC	Direct connection	10	32	–
	Outgoing	Earth connection	6	25mm tunnel	–
	Outgoing	Neutral connection	6	25	–
	Incoming	Earth connection	10	32	–
	Incoming	Neutral connection	12	40	–

Other connections available on request. If you require higher breaking capacity, consult us.

Guidance for motor loads

Specific “magnetic only” MCCB's are available for short circuit protection of motors. However, the standard MCCB may be used, as detailed below.

	Max motor size (kW)	Running current (A) @ 415V
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80A	15	28
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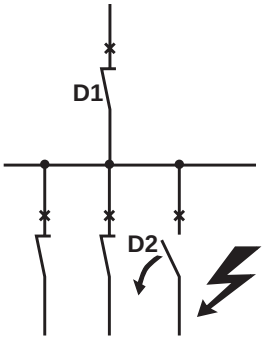
125A	25	47
160A	33	60
200A	45	80
250A	69	128

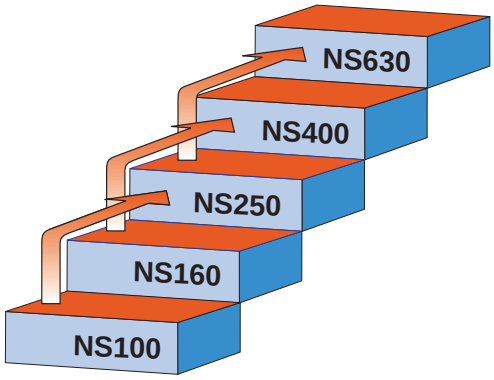
Note:

- ■ These tables offer guidance only, for DOL starting assuming:
- ☐ A starting current of 7 x FLC
- ☐ Run-up time =8 seconds for motors < 3kW
  10 seconds for motors > 3kW
- ■ The running current is a typical value and may vary from manufacturer to manufacturer.

Discrimination



Total discrimination on the standard range



Simple rule for the standard range: just take a step between each frame rating to obtain total discrimination.

All the circuit breakers are equipped with standard trip units.

Consult us for full details of discrimination/cascading.

Degrees of protection provided by enclosures

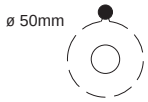
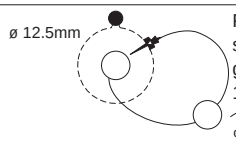
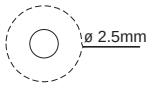
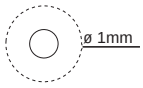
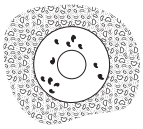
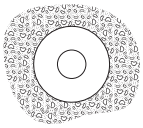
External influences
In many national and international standards, a large number of external influences to which an electrical installation can be subjected are indexed and coded: presence of water, presence of solid objects, risk of impact, vibrations, presence of corrosive substances, etc. These influences may be present with variable intensity depending on the conditions of installation: The presence of water may be in the form of a few drops or total immersion.

Protection index
European standard EN60529 gives a protection code (IP) which characterises the ability of equipment to withstand the following external influences:
- Presence of solid bodies,
- Presence of water.

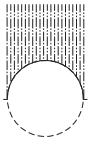
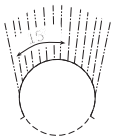
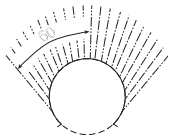
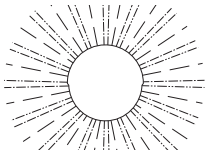
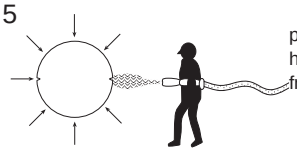
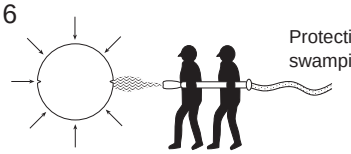
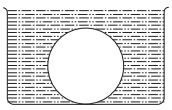
This code comprises two digits, depending on these external influences. The protection index is assigned to the equipment following a series of tests laid down in the respective standards.

Test according to EN60529

1st digit
Protection against solid bodies

0		no protection
1		Protection against solid bodies greater than 50 mm
2		Protection against solid bodies greater than 12.5mm
3		Protection against solid bodies greater than 2.5 mm
4		Protection against solid bodies greater than 1 mm
5		Protection against dust (no harmful deposits)
6		Total protection against dust

2nd digit
Protection against liquids

0		No protection
1		Protection against vertical drops of water (condensation)
2		Protection against drops of water falling up to 15° from vertical
3		Protection against rainwater up to 60° from vertical
4		Protection against water projected from all directions
5		protection against hosing with water from all directions
6		Protection against swamping with water
7		Protection against immersion

Example
IP 55
- 5 → Protection against dust (no harmful deposits)
- 5 → Protection against hosing with water from all directions