Kortslutningsbeskyttelse af fejlstrømsafbrydere

foransiddende: C60, C120, NG125 automatsikringer eller sikringer efterfølgende: fejlstrømsafbryder

Fejlstrømsafbryder
En fejlstrømsafbryder har begrænset kortslutningsholdbarhed. Den skal derfor kortslutningsbeskyttes ved hjælp af et kortslutningsbeskyttelsesudstyr.

Som kortslutningsbeskyttelsesudstyr for ID felstrømsafbrydere kan anvendes automatsikringer, maksimalafbrydere eller smeltesikringer type gG.

Kortslutningsbeskyttelsesudstyret kan være placeret i strømkredsen foran fejlstrømsafbryderen eller i en eller flere strømkredse efter fejlstrømsafbryderen.

Placeres kortslutningsbeskyttelsesudstyret i en eller flere strømkredse efter fejlstømsafbryderen skal denne være placeret i samme tavlesektion som kortslutningsbeskyttelsesudstyret. Endvidere skal lederne fra fejlstrømsafbryderens afgangsklemmer til og mellem efterfølgende beskyttelsesudstyr være oplagt på en sådan måde at kortslutning eller jordslutning kan anses for udelukket. Se nærmere herom i Stærkstrømsbekendtgørelse, Afsnit 439-1, 7.5.5

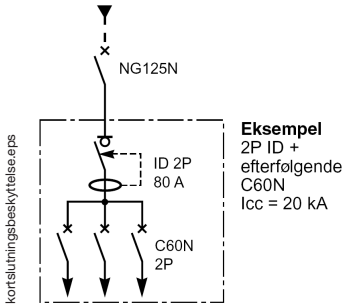
Oplysninger om kortslutningsholdbarhed
I nedenstående tabeller er anført betinget kortslutningsstrøm (Icc eller Icf) for ID fejlstrømsafbrydere beskyttet med automatsikringer, maksimalafbrydere og smeltesikringer.

2-polede fejlstrømsafbrydere har mærkespændingen 240 V, og anvendes derfor i almindelighed her i landet som beskyttelsesudstyr for 1-fasede (L+N) strømkredse. (De kan dog anvendes i 2-fasede strømkredse med en spænding mellem faselederne på max. 240 V). Den betingede kortslutningsstrøm kortslutningsholdbarhed for 2-polede fejstrømsafbrydere) kan derfor bestemmes i tabelkolonnerne for 230/240 V strømkredse.

4-polede fejlstrømsafbrydere har mærkespændingen 415 V, kan anvendes som beskyttelsesudstyr for eller i såvel 1-fasede (L+N) strømkredse som 2- eller 3-fasede stømkredse med eller uden N-leder

Er en 4-polet fejlstrømsafbryder tilsluttet 230 V kan den betingede kortslutningsstrøm (kortslutningsholdbarhed) for den 4-polet fejlstrømsafbryder bestemmes i tabelkolonnerne for 230/240 V strømkredse.
Tabelkolonnerne for 230/240 V strømkredse kan også anvendes i tilfælde, hvor der gennem en fejlstrømsafbryder, som er tilsluttet f.eks. 3 faseleder og N-leder, udelukkende forsynes 230 V strømkredse og hvor lederne fra afgangsklemmerne på fejlstrømsafbryderne til og mellem efterfølgende kortslutningsbeskyttelsesudstyr er oplagt på en sådan måde, at kortslutning og jordslutning kan anses for udelukket.

Forsynes gennem en 4-polet fejlstrømsafbryder strømkredse for 2 eller 3 faseledere skal den betingede kortslutningsstrøm for fejlstrømsafbryderen bestemmes i tabelkolonnerne for 400/415 V strømkredse.



Kortslutningsbeskyttelse med smeltesikring type gG
betinget kortslutningsstrøm med sikring Icf [kAeff] for kombinationen smeltesikring og fejlstrømsafbryder

fejlstrømsafbryder ID	**230 V/240 V strømkredse 2- eller 4-polede fejlstrømsafbrydere**					**400 V/415 V strømkredse 4-polede fejlstrømsafbrydere**				
In (A)	25	40	63	80-100	125	25	40	63	80-100	125
smeltesekring mærkestrøm (A) type gG										
16	100	100	100	100	100	100	100	100	100	100
25	100	100	100	100	100	100	100	100	100	100
32	100	100	100	100	100	100	100	100	100	80
40	80	80	80	80	80	80	80	80	80	50
50	50	50	50	50	50	50	50	50	50	30
63	30	30	30	30	30	30	30	30	30	30
80	20	20	20	20	30	20	20	20	20	20
100	20	20	20	20	30	10	10	10	10	10

Kortslutningsbeskyttelse med automatsikring og maksimalafbryder
betinget kortslutningsstrøm Icc [kAeff] for kombinationen automatsikring/maksimalafbryder og fejlstrømsafbryder

fejlstrømsafbryder ID	**230 V/240 V strømkredse 2- eller 4-polede fejlstrømsafbrydere**					**400 V/415 V strømkredse 4-polede fejlstrømsafbrydere**				
In (A)	25	40	63	80-100	125	25	40	63	80-100	125
aut. sikr./maks. afbryder										
DPN	6	6	6	6	6					
C60N	20	20	20	20	10	10	10	10	10	10
C60H	30	30	30	20	10	15	15	15	10	10
NG 125N	15	15	15	10	7	15	15	15	10	7
NG125L	20	20	20	15	7	15	15	15	15	7
C120H	10	10	10	10	5	10	10	10	10	5
C120N	10	10	10	10	5	10	10	10	10	5

Overblik over produktudvalg til beskyttelse mod lækstrøm til jord

Udvælgelsesvejledning

Type			Fejlstrømsafbrydere			
			iID K	iID	RCCB-ID 125 A	RCCB-ID type B
			PB104497-35 	PB104472-35 	PB107413 	PB101616_SE-35 
Standarder			IEC/EN 61008	IEC/EN 61008	IEC/EN 61008-1 og VDE 0664	IEC/EN 61008 og VDE 0664
Antal poler		1P+N	–	–	–	–
		2P	•	•	•	–
		3P	–	–	–	–
		4P	•	•	•	•
Type		AC	•	•	•	–
		A	–	•	•	–
		SI	–	•	•	–
		B	–	–	–	•
Spænding (V)	Ue		230/400	230/400	230/400	230/400
Impulsspænding (kV)	Uimp		4	6	4	4
Isoleringsspænding (V)	Ui		440	500	400	400
Mærkestrøm (A)	In		25 - 40 - 63	16 til 100	125	25 til 125
Frekvens (Hz)			50/60	50	50	50
Nominel brydeevne (A)	Icn		–	–	10.000	–
Nominel betinget kortslutningsstrøm	Inc		4.500	10.000	10.000	10.000
Nominel residualbryde- og slutteevne (A)	(IΔm)		10 In (500 A min.)	1.500	1.250	10 In (500 A min.)
Kurve			–	–	–	–
Følsomhed (mA)	(IΔn)	10	–	•	–	–
		30	•	•	•	•
		100	–	•	•	–
		300	•	•	•	•
		500	–	•	•	•
		1.000	–	–	–	–
		3.000	–	–	–	–
		300 s	–	•	•	•
		500 s	–	•	–	–
		1.000 s	–	–	–	–
		3.000 s	–	–	–	–
Elektriske egenskaber						
Kurver		B	–	–	–	–
		C	–	–	–	–
		D	–	–	–	–
		L	–	–	–	–
		K	–	–	–	–
		MA	–	–	–	–
Få flere oplysninger			**se side 62, 72 og 370**	**se side 62, 176 og 370**	**se side 62, 176 og 370**	**se side 62, 176 og 370**
Tilbehør			**–**	**se side 140**	**se side 74**	**se side 76**
Hjælpeenheder			**–**	**se side 128 og 184**	**se side 74**	**se side 76**

	Ekstra fejlstrømsafbrydermoduler			Fejlstrømsafbrydere – RCBO
	Vigi iC60	Vigi C120	Vigi NG125	DPN N Vigi
	PB104466-40 	056776_SE-35 	056945N_SE-35 	PB104318-35 
	IEC/EN 61009	IEC/EN 61009	IEC/EN 61009	IEC/EN 61009
	–	–	–	•
	•	•	•	–
	•	•	•	–
	•	•	•	–
	•	•	•	•
	•	•	•	•
	•	•	•	•
	–	–	–	–
	230/400	230/400	230/400	230
	6	6	8	4
	500	500	690	400
	25 - 40 - 63	10 til 125	63 til 125	4 til 40
	50/60	50/60	50/60	50
	–	–	–	6.000
	–	–	–	–
	–	–	–	6.000
	–	–	–	B, C
	•	–	–	–
	•	•	•	•
	•	–	–	–
	•	•	•	•
	•	•	•	–
	–	–	•	–
	–	–	•	–
	•	•	•	–
	•	•	•	–
	•	•	•	–
	–	–	•	–
	Afhængigt af den anvendte kortslutningsudløser	Afhængigt af den anvendte kortslutningsudløser	Afhængigt af den anvendte kortslutningsudløser	•
				•
				–
				–
				–
				–
				–
	se side 62, 82 og 370	**se side 62, 88 og 370**	**se side 62, 92 og 370**	**se side 62, 176 og 370**
	se side 140	**se side 146**	**se side 148**	**se side 146**
	se side 128 og 176	**se side 128 og 184**	**se side 189**	**se side 133, 153 og 184**

Inc: nominel betinget kortslutningsstrøm
Værdien af den prospektive vekselstrøm, som en fejlstrømsafbryder beskyttede ved hjælp af en relevant serieforbundet SCPD (short-circuit protective device), der kan modstå belastningen under de angivne brugsforhold.

IΔc: nominel fejlstrøm
Værdien af den prospektive fejlstrøm, som en fejlstrømsafbryder beskyttede ved hjælp af en relevant serieforbundet SCPD (short-circuit protective device), der kan modstå belastningen under de angivne brugsforhold.

Im: nominel fejlstrøm- og slutteevne
Værdien af den prospektive vekselstrøm, som en fejlstrømsafbryder kan oprette eller afbryde under de angivne brugsforhold.

IΔm: nominel fejlstrøm- og slutteevne
Værdien af den prospektive fejlstrøm, som en fejlstrømsafbryder kan oprette og fastholde inden for dens åbningstid og afbryde under de angivne brugsforhold og med den angivne virkemåde.

SCPD
Beskyttelsesenhed mod kortslutninger (en sikring i forhold til vores markeringer): dette er den maksimale sikring, der kan bruges til at klare værdien Inc = IΔc.

Beskyttelse mod
lækstrøm til jord

Overblik over produktudvalg til beskyttelse mod lækstrøm til jord

iID-fejlstrømsafbrydere med to klemmer (A-type)

IEC/EN 61008-1

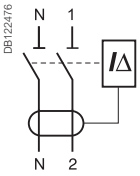
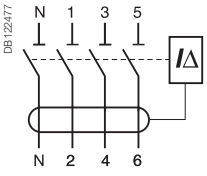
PB107413-40

PB107414-40

- iID-fejlstrømsafbrydere med to terminalklemmer giver:
  - personbeskyttelse mod elektrisk stød ved direkte kontakt (≤ 30 mA),
  - personbeskyttelse mod elektrisk stød ved indirekte kontakt (≥ 100 mA),
  - beskyttelse af installationer mod brandfare (300 mA).

Katalognumre

iID fejlstrømsafbrydere med to klemmer

Type Produkt			A iID							Modul-bredde= 9 mm
Hjælpeenheder			**Kan acceptere hjælpeenheder, se side 176 og 178**							
2P		**Følsomhed**	**10 mA**	**30 mA**	**100 mA**	**100 mA s**	**300 mA**	**300 mA s**	**500 mA**	
DB122476 	Mærke	16 A	**A9Z20216**	-	-	-	-	-	-	4
		25 A	**A9Z20225**	**A9Z21225**	-	-	**A9Z24225**	-	-	
		40 A	-	**A9Z21240**	**A9Z22240**	-	**A9Z24240**	**A9Z25240**	-	
		63 A	-	**A9Z21263**	**A9Z22263**	-	**A9Z24263**	**A9Z25263**	-	
		80 A		**A9Z21280**	**A9Z22280**	-	**A9Z44280**	**A9Z25280**	-	
		100 A	-	**A9Z21291**	**A9Z22291**	-	**A9Z24291**	**A9Z25291**	-	
4P		**Følsomhed**	**10 mA**	**30 mA**	**100 mA**	**100 mA s**	**300 mA**	**300 mA s**	**500 mA**	
DB122477 	Mærke	25 A	-	**A9Z21425**	-	-	**A9Z24425**	-	**A9Z26425**	8
		40 A	-	**A9Z21440**	**A9Z22440**	-	**A9Z24440**	**A9Z25440**	**A9Z26440**	
		63 A	-	**A9Z21463**	**A9Z22463**	-	**A9Z24463**	**A9Z25463**	**A9Z26463**	
		80 A	-	**A9Z21480**	**A9Z22480**		**A9Z24480**	**A9Z25480**	**A9Z26480**	
		100 A	-	**A9Z21491**	**A9Z22491**		**A9Z24491**	**A9Z25491**	**A9Z26491**	
Mærkespænding (Ue)		2P	230-240 V							
		4P	400-415 V							
Driftsfrekvens			50/60 Hz							
Tilbehør			**se side 128 og 140**							

iID-fejlstrømsafbrydere med to klemmer (SI-type)

IEC/EN 61008-1

PB107413-40

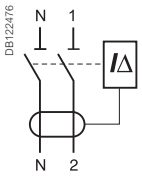
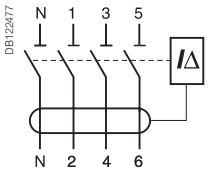
PB107414-40

- iID-fejlstrømsafbrydere med to terminalklemmer giver:
- personbeskyttelse mod elektrisk stød ved direkte kontakt (≤ 30 mA),
- personbeskyttelse mod elektrisk stød ved indirekte kontakt (≥ 100 mA),
- beskyttelse af installationer mod brandfare (300 mA).

Si-typen giver større immunitet over for elektrisk interferens og forurenede eller ætsende miljøer.

Katalognumre

iID fejlstrømsafbrydere med to klemmer

Type Produkt			Si iID					Modul-bredde= 9 mm
Hjælpeenheder			**Kan acceptere hjælpeenheder, se side 176 og 178**					
2P		**Følsomhed**	**10 mA**	**30 mA**	**100 mA**	**100 mA** s	**300 mA** s	
DB122476 	Mærke	25 A	**A9Z30225**	**A9Z31225**	-	-	-	4
		40 A	-	**A9Z31240**	**A9Z32240**	-	**A9Z35240**	
		63 A	-	**A9Z31263**	**A9Z32263**	-	**A9Z35263**	
		80 A		**A9Z31280**	**A9Z32280**	-	**A9Z35280**	
		100 A		**A9Z31291**	**A9Z32291**	-	**A9Z35291**	
4P		**Følsomhed**	**10 mA**	**30 mA**	**100 mA**	**100 mA** s	**300 mA** s	
DB122477 	Mærke	25 A	-	**A9Z31425**	-	-	-	8
		40 A	-	**A9Z31440**	**A9Z32440**	-	**A9Z35440**	
		63 A	-	**A9Z31463**	**A9Z32463**	-	**A9Z35463**	
		80 A	-	**A9Z31480**	**A9Z32480**	-	**A9Z35480**	
		100 A	-	**A9Z31491**	**A9Z32491**	-	**A9Z35491**	
Mærkespænding (Ue)		2P	230-240 V					
		4P	400-415 V					
Driftsfrekvens			50/60 Hz					
Tilbehør			**se side 128 og 140**					

Fejlstrømsafbryder type B, AC/DC

PB101616_SE-35

16766

PB107510-33

16940

PB100572-18

16939

IEC/EN 61008, VDE 0664

- RCCB-ID type B fejlstrømsafbryderne giver:
- personbeskyttelse mod elektrisk stød ved direkte kontakt (30 mA),
- personbeskyttelse mod elektrisk stød ved indirekte kontakt (≥ 300 mA),
- beskyttelse af installationer mod brandfare (300 eller 500 mA).

B-type ~ ⎓

RCCB-ID-fejlstrømsafbrydere af B-typen giver:

- beskyttelse i tilfælde af en kontinuerlig fejlstrøm i trefasenetværk forårsaget af:
- Frekvensomformer og drev med variable hastighed,
- batteriladere og omformere,
- strømforsyninger med back-up.

- De omfatter og garanterer også beskyttelse mod fejlstrømme:
- sinusformede vekselfejlstrømme (AC-typen),
- pulserende DC-fejlstrømme (A-typen).

De kan tilpasses til alle de anvendelsesformer, der er defineret i IEC 60364- og EN 50178-standarden.

- Schneider Electric garanterer, at RCCB-ID af B-typen fungerer korrekt i kombination med drev med variable hastighed produceret af Schneider Electric.

OFsp-hjælpekontakt

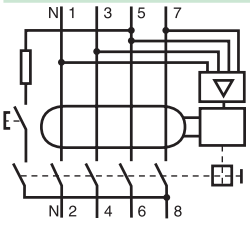
- Elektrisk indikation: for OFsp-hjælpekontakt monteret til venstre. Den har en dobbelt omskifter, der indikerer den "åbne" eller "lukkede" position af RCCB-IB-afbryderen af B-typen.

Tilbehør

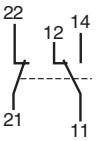
- 4P plomberbar skrueafdækning.

Katalognumre

RCCB-ID fejlstrømsafbrydere af B-typen

Type			B ~ ⎓				Modulbredde=9 mm.
4P		Følsomhed	30 mA	300 mA	300 mA s	500 mA	
DB123726 	Mærke	25 A	**16750**	**16751**	**-**	**-**	8
		40 A	**16752**	**16753**	**16754**	**16755**	
		63 A	**16756**	**16757**	**16758**	**16759**	
		80 A	**16760**	**16761**	**16762**	**-**	
		125 A	**16763**	**16764**	**16765**	**16766**	
Mærkespænding (Ue)			230/400 V				
Driftsfrekvens			50 Hz				

Hjælpeenhed

Type				Modulbredde=9 mm.
OFsp-kontakt	Kontakt	Spænding		
E91415 	1 A	110 V DC	**16940**	1
	6 A	230 V AC (AC15)		

Tilbehør

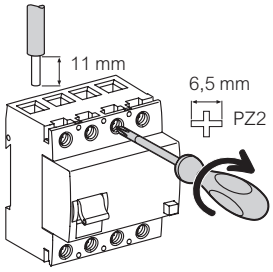
Type	Antal poler	
Skrueafdækning (sæt à 10) til upstream eller downstream	4P	**16939**

Fejlstrømsafbryder type B, AC/DC

Forbindelse

- Med terminalklemmer til:

DB123736



Type	Tilspændings-moment	Kobberkabler	
		Fast	Bøjeligt eller forskruning
	DB112804	DB112805	
RCCB-ID af B-typen	3 N.m	1 x 1,5 to 50 mm²	1 x 1,5 to 35 mm²
		2 x 1,5 to 16 mm²	2 x 1,5 to 16 mm²
OFsp	0,8 N.m	1 til 1,5 mm²	1 til 1,5 mm²

OFsp-kontaktstatus, afhængigt af fejlstrømsafbryderens position				
Type				
RCCB-ID B-type	Lukket	•	-	-
	Åben	-	•	-
	Udløst ved fejl	-	-	•
Kontakt OF sp	22/21 12/11	Åben	Lukket	Lukket
	14/11	Lukket	Åben	Åben

DB122842

Indikering af status for fejlstrømsafbryderen af B-typen via 3-positionsomskifteren og feltet på frontpanelet

- Lukket (rød felt)
- Udløst ved fejl (grøn felt)
- Åben (grøn felt).

Tekniske specifikationer

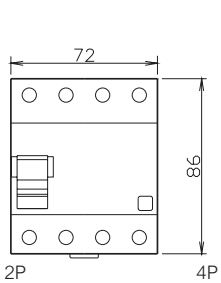
Elektriske egenskaber			
Isoleringsspænding (Ui)			400 V
Forureningsgrad			3
Nominel impulsholdespænding (Uimp)			4 kV
Ifølge IEC/EN 61008-1			
Indkoblings- og brydeevne (Im/IΔm)	25/40 A		500 A
	63/80 A		800 A
	125 A		1.250 A
Overstrømsmodstand (8/20 µs) uden udkobling	Ingen selektiv s		250 A
	Selektiv s		3 kA
Betinget nominel kortslutningsstrøm (Inc/IΔc)	**Følsomhed**	**Maks. sikring type gl eller gG**	
	25 A	25 A	100 kA
	40 A	40 A	80 kA
	63 A	63 A	30 kA
	80 A	80 A	20 kA
	125 A	125 A	10 kA
	Kontakt: dk-ts@schneider-electric.com for yderligere info.		
Yderligere egenskaber			
Beskyttelsesgrad	Kun enhed		IP20 IP40 med skrueafdækning
	Enhed i modulær afdækning		IP40 Isolationsklasse II
Holdbarhed (O-C)	Elektrisk		> 2.000 (O-C)
	Mekanisk		> 5.000 (O-C)
Driftstemperatur			-25 °C til +40 °C
Opbevaringstemperatur			-40 °C til +85 °C

Vægt (g)

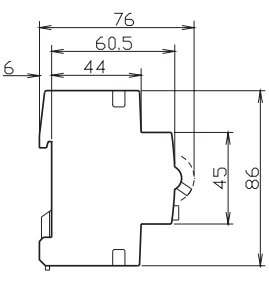
Fejlstrømsafbrydere og hjælpeudstyr		
Type	RCCB-ID af B-typen	OFsp
4P	450	40

Mål (mm)

DB122838



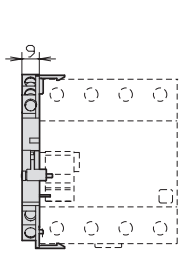
2P

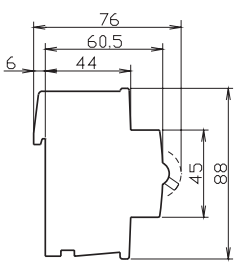


4P

RCCB-ID af B-typen

212410





OFsp-kontakt

Kombiafbryder iDPN Vigi

PB110002-40

iDPN N Vigi

PB110001-40

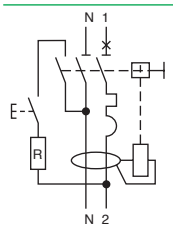
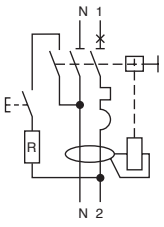
iDPN H Vigi

IEC/EN 61009

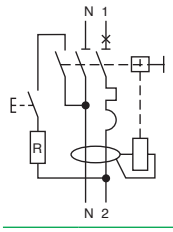
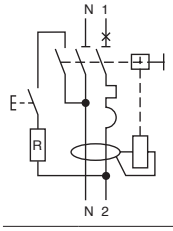
iDPN Vigi-fejlstrømsenheden yder fuld beskyttelse til slutkredsløb (imod overstrøm og isoleringsfejl):
- personbeskyttelse af brugere mod elektrisk stød ved direkte kontakt (≤ 30 mA),
- personbeskyttelse af brugere mod elektrisk stød ved indirekte kontakt (300 mA),
- beskyttelse af installationerne mod brandfare (300 mA).

Si-sortimentet er beregnet til at opretholde et netværk med optimal sikkerhed og driftskontinuitet i installationer, der forstyrres af:
- ekstreme atmosfæriske forhold,
- harmonisk genererende belastninger,
- transiente driftsstrømme.

iDPN N Vigi 6000

Type			A				Si			Modulbredde = 9 mm.
Hjælpeenheder			Ekstern indikation og udkobling, se side 128 og 176							
1P+N	B-kurve	Følsomhed	10 mA	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	
DB123871 	Mærke-værdi (In) 4 A		-	A9D56604	A9D60604	A9D69604	-	-	-	4
	6 A		-	A9D56606	A9D60606	A9D69606	-	-	-	
	10 A		A9D08610	A9D56610	A9D60610	A9D69610	-	-	-	
	13 A		-	A9D56613	A9D60613	A9D69613	-	-	-	
	16 A		A9D08616	A9D56616	A9D60616	A9D69616	-	-	-	
	20 A		-	A9D56620	A9D60620	A9D69620	-	-	-	
	25 A		-	A9D56625	A9D60625	A9D69625	-	-	-	
	32 A		-	A9D56632	A9D60632	A9D69632	-	-	-	
	40 A		-	A9D56640	A9D60640	A9D69640	-	-	-	
1P+N	C-kurve	Følsomhed	10 mA	30 mA	100 mA	300 mA	30 mA	100 mA	300 mA	
DB123871 	Mærke-værdi (In) 6 A		-	A9D32606	A9D52606	A9D42606	A9D33606	A9D53606	A9D43606	4
	10 A		A9D02610	A9D32610	A9D52610	A9D42610	A9D33610	A9D53610	A9D43610	
	13 A		-	A9D32613	A9D52613	A9D42613	A9D33613	A9D53613	A9D43613	
	16 A		A9D02616	A9D32616	A9D52616	A9D42616	A9D33616	A9D53616	A9D43616	
	20 A		-	A9D32620	A9D52620	A9D42620	A9D33620	A9D53620	A9D43620	
	25 A		-	A9D32625	A9D52625	A9D42625	A9D33625	A9D53625	A9D43625	
	32 A		-	A9D32632	A9D52632	A9D42632	A9D33632	A9D53632	A9D43632	
	40 A		-	A9D32640	A9D52640	A9D42640	A9D33640	A9D53640	A9D43640	
Mærkespænding (Ue)			230 V AC							
Driftsfrekvens			50Hz							
Tilbehør			se side 140, 152, 176 og 180 for hjælpekontakt							

iDPN H Vigi 10000

Type			A		Si		Modulbredde = 9 mm.
Hjælpeenheder			Ekstern indikation og udkobling, se side 133 og 176				
1P+N	B-kurve	Følsomhed	30 mA	300 mA	30 mA	300 mA	
DB123871 	Mærke (In) 6 A		A9D07606	-	-	-	4
	10 A		A9D07610	-	-	-	
	16 A		A9D07616	-	-	-	
	20 A		A9D07620	-	-	-	
	25 A		A9D07625	-	-	-	
	32 A		A9D07632	-	-	-	
1P+N	C-kurve	Følsomhed	30 mA	300 mA	30 mA	300 mA	
DB123871 	Mærke (In) 6 A		A9D37606	A9D47606	A9D38606	A9D48606	4
	10 A		A9D37610	A9D47610	A9D38610	A9D48610	
	16 A		A9D37616	A9D47616	A9D38616	A9D48616	
	20 A		A9D37620	A9D47620	A9D38620	A9D48620	
	25 A		A9D37625	A9D47625	A9D38625	A9D48625	
	32 A		A9D37632	A9D47632	A9D38632	A9D48632	
Mærkespænding (Ue)			230 V AC				
Driftsfrekvens			50 Hz				
Tilbehør			se side 140, 152, 176 og 180 for hjælpekontakt				

PB105113.eps

Vigicompact NSX100 to 630 circuit breakers with earth-leakage protection

Addition of the Vigi module does not alter circuit-breaker characteristics:

- compliance with standards
- degree of protection, class II front-face insulation
- positive contact indication
- electrical characteristics
- trip-unit characteristics
- installation and connection modes
- indication, measurement and control auxiliaries
- installation and connection accessories.

Dimensions and weights		NSX100/160/250	NSX400/630
Dimensions	3 poles	105 x 236 x 86	140 x 355 x 110
W x H x D (mm)	4 poles	140 x 236 x 86	185 x 355 x 110
Weight (kg)	3 poles	2.5	8.8
	4 poles	3.2	10.8

PB103680-36.eps

Vigi earth-leakage protection modules

Compliance with standards

- IEC 60947-2, annex B.
- Decree dated 14 November 1988 (for France).
- IEC 60755, class A, immunity to DC components up to 6 mA.
- Operation down to -25 °C as per VDE 664.

Remote indications

Vigi modules may be equipped with an auxiliary contact (SDV) to remotely signal tripping due to an earth fault.

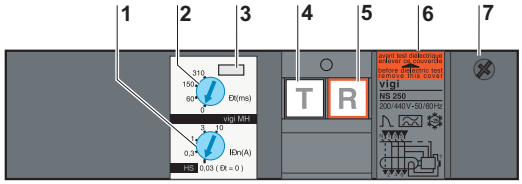
Use of 4-pole Vigi module with a 3-pole Compact NSX

In a 3-phase installation with an uninterrupted neutral, an accessory makes it possible to use a 4-pole Vigi module with connection of the neutral cable.

Power supply

Vigi modules are self-supplied internally by the distribution-system voltage and therefore do not require any external source. They continue to function even when supplied by only two phases.

DB112147.eps



1 Sensitivity setting
2 Time-delay setting (for selective earth-leakage protection).
3 Lead-seal fixture for controlled access to settings.
4 Test button simulating an earth-fault for regular checks on the tripping function
5 Reset button (reset required after earth-fault tripping).
6 Rating plate
7 Housing for SDV auxiliary contact.

Plug-in devices

The Vigi module can be installed on a plug-in base. Special accessories are required (see catalogue number chapter).

Vigi module selection

Type	Vigi ME	Vigi MH	Vigi MB
Number of poles	3, 4 (1)	3, 4 (1)	3, 4 (1)
NSX100	■	■	-
NXS160	■	■	-
NSX250	-	■	-
NSX400	-	-	■
NSX630	-	-	■
Protection characteristics			
Sensitivity	fixed	adjustable	adjustable
IΔn (A)	0.3	0.03 - 0.3 - 1 - 3 - 10	0.3 - 1 - 3 - 10 - 30
Time delay	fixed	adjustable	adjustable
Intentional delay (ms)	< 40	0 - 60 (2) - 150 (2) - 310 (2)	0 - 60 - 150 - 310
Max. break time (ms)	< 40	< 40 < 140 < 300 < 800	< 40 < 140 < 300 < 800
Rated voltage V AC 50/60 Hz	200...440	200... 440 - 440...550	200...440 - 440...550

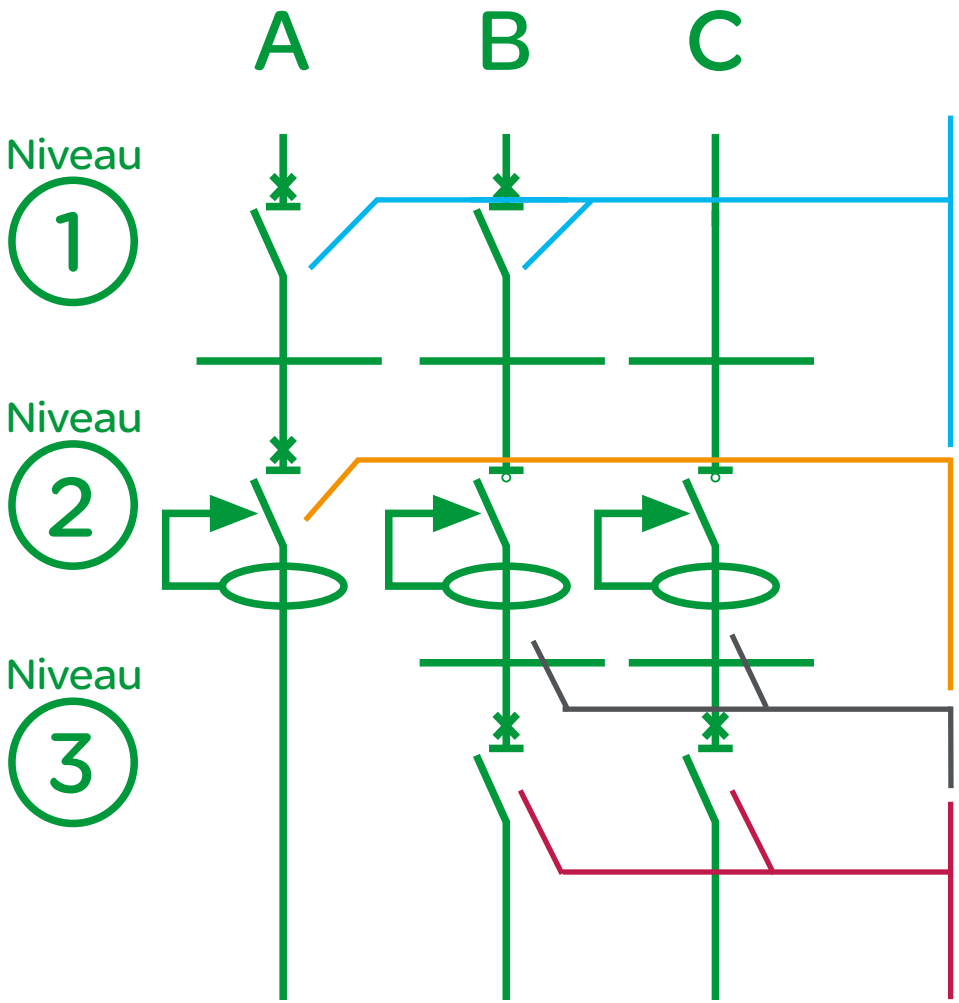
(1) Vigi 3P modules may also be used on 3P circuit breakers used for two-phase protection.
(2) If the sensitivity is set to 30 mA, there is no time delay, whatever the time-delay setting.

Operating safety

The Vigi module is a user safety device. It must be tested at regular intervals (every 6 months) via test button.

Vejledning til valg af materiel med fejlstrømsbeskyttelse – 10kA

Følgende komponenter kan benyttes:



Un: 230-240V/380-415V TT og TN systemer			
Brydere	**Relæ**	**In**	**Kombination**
NG125N	Termomagnetisk	10-125A	A/B/C* (≤ 63A iID)
NG125L	Termomagnetisk	10-80A	A/B/C* (≤ 80A iID)
NG160E/N/H	Termomagnetisk	16-160A	A/B
NSX100	TM/Micrologic	16-100A	A/B
NSX160	TM/Micrologic	16-160A	A/B
NSX250	TM/Micrologic	16-250A	A/B
Kombiafbrydere	**Poler**	**In**	**Kombination**
iDPN N Vigi (Clario)	1P+N/3P+N	1-40A	A
iDPN N Vigi	1P+N	1-40A	A
DCP N	3P+N	1-32A	A
iC60N/H/L Vigi	1P+N/3P+N	0,5-63A	A
Fejlstrømsafbrydere	**Poler**	**In**	**Kombination**
iID fejlstrømsafbryder	2/4	25-100A	B/C*
Automatsikringer	**Poler**	**In**	**Kombination**
iDPN N (Clario)	1P+N/3P+N	1-40A	B
iDPN N	1P+N	1-40A	B
iC60N/H/L	1+N–4P	0,5-63A	B/C* (≤ 63A iID)

Forbindelser mellem niveau 2 og 3 fra afgangsklemmer på fejlstrømsafbryder til efterfølgende automatsikringer skal oplægges således, at kortslutning og jordslutning kan anses for udelukket. * For kombination C kan bryderen placeres enten i niveau 1 eller 3. Er den placeret i niveau 1, behøver forbindelsen mellem niveau 1 og 2 ikke at være udført som ovennævnte.

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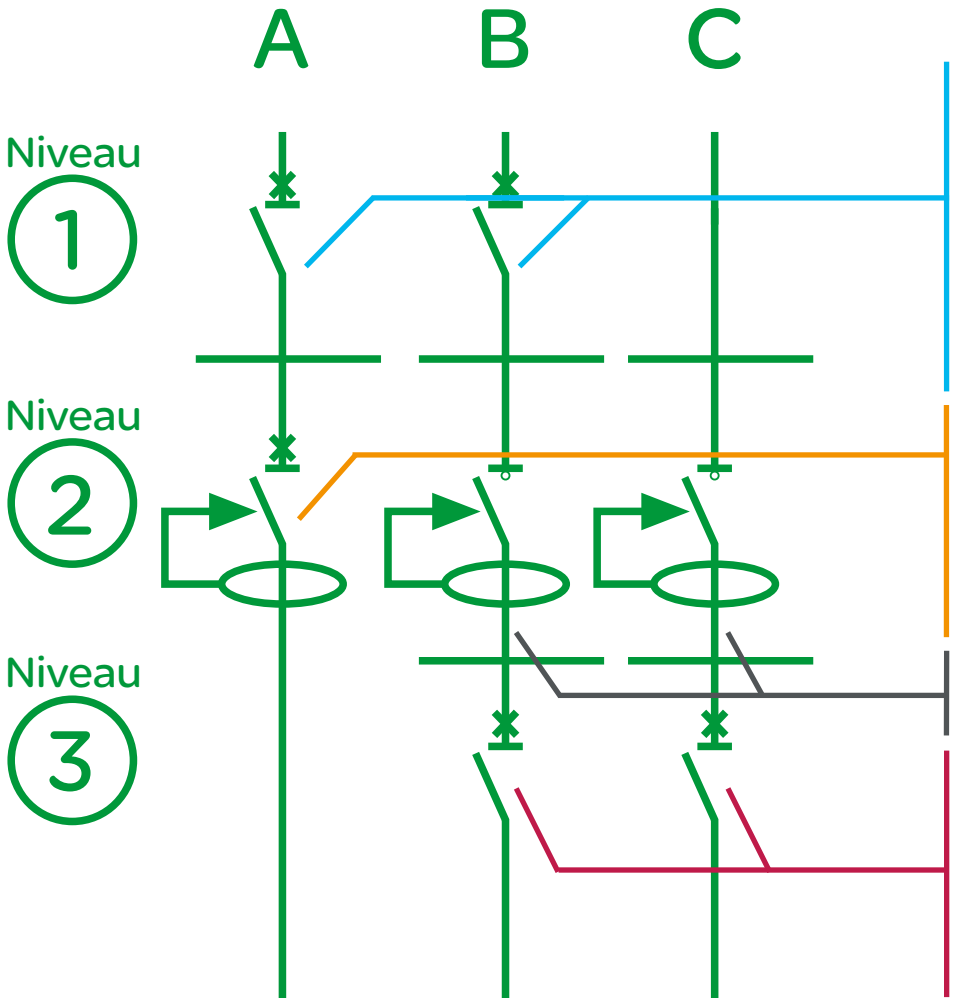
Vejledning til valg af materiel med fejlstrømsbeskyttelse – 16kA

Følgende komponenter kan benyttes:



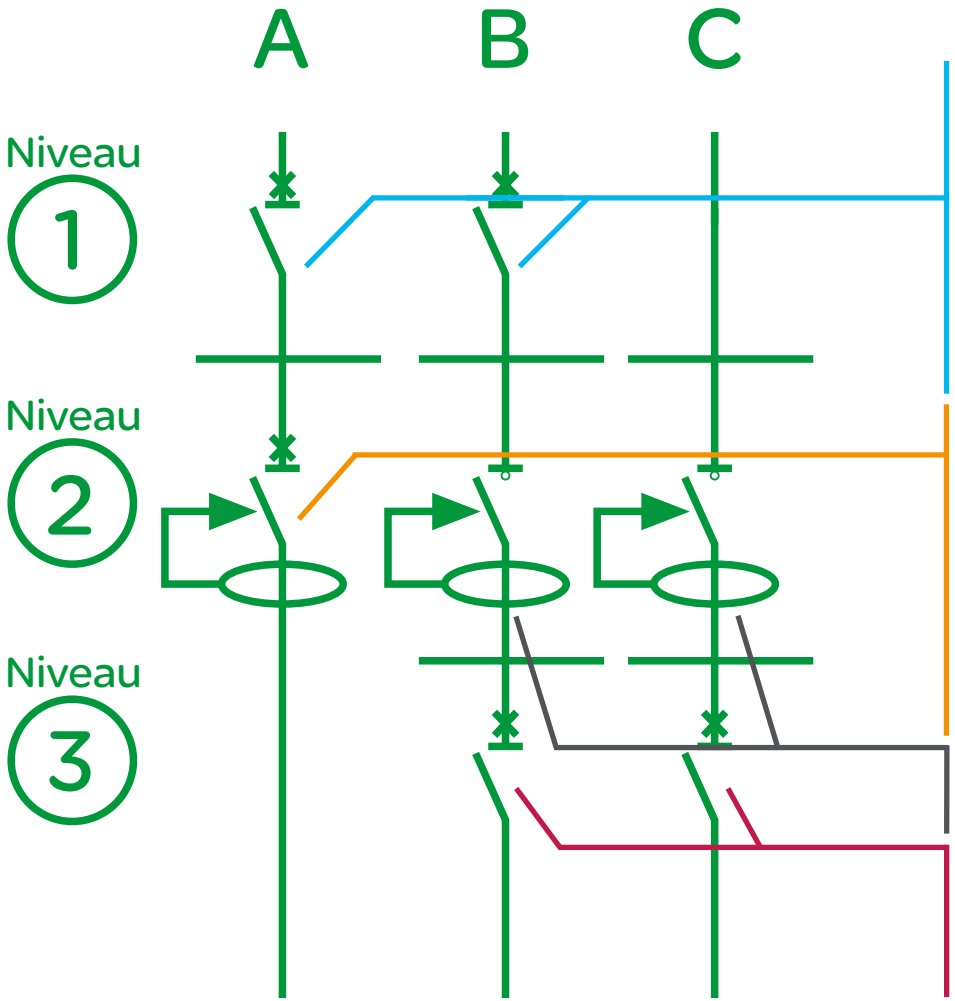
Un: 230-240V/380-415V TT og TN systemer			
Brydere	**Relæ**	**In**	**Kombination**
NG125N	Termomagnetisk	10-125A	A/B/C* (≤ 40A iID)
NG125L	Termomagnetisk	10-80A	A/B/C* (≤ 40A iID)
NG160E/N/H	Termomagnetisk	16-160A	A/B
NSX100	TM/Micrologic	16-100A	A/B
NSX160	TM/Micrologic	16-160A	A/B
NSX250	TM/Micrologic	16-250A	A/B
Kombiafbrydere	**Poler**	**In**	**Kombination**
iDPN N Vigi (Clario)	1P+N/3P+N	1-40A	A
iDPN N Vigi	1P+N	1-40A	A
DCP N	3P+N	1-16A	A
iC60N/H/L Vigi	1P+N/3P+N	0,5-63A	A
Fejlstrømsafbrydere	**Poler**	**In**	**Kombination**
iID fejlstrømsafbryder	2/4	25-100A	B/C*
Automatsikringer	**Poler**	**In**	**Kombination**
iDPN N (Clario)	1P+N / 3P+N	1-16A	B
iDPN N	1P+N	1-16A	B
iC60N	1P+N–4P	0,5-63A	B
iC60H/L	1P+N–4P	0,5-63A	B/C* (≤ 63A iID)

Forbindelser mellem niveau 2 og 3 fra afgangsklemmer på fejlstrømsafbryder til efterfølgende automatsikringer skal oplægges således, at kortslutning og jordslutning kan anses for udelukket. * For kombination C kan bryderen placeres enten i niveau 1 eller 3. Er den placeret i niveau 1, behøver forbindelsen mellem niveau 1 og 2 ikke at være udført som ovennævnte.

Schneider Electric

Vejledning til valg af materiel med fejlstrømsbeskyttelse – 20kA

Følgende komponenter kan benyttes:



Un: 230-240V/380-415V TT og TN systemer			
Brydere	**Relæ**	**In**	**Kombination**
NG125N	Termomagnetisk	10-125A	A/B
NG125L	Termomagnetisk	10-80A	A/B/C * (≤ 40A iID)
NG160N/H	Termomagnetisk	16-160A	A/B
NSX100	TM/Micrologic	16-100A	A/B
NSX160	TM/Micrologic	16-160A	A/B
NSX250	TM/Micrologic	16-250A	A/B
Kombiafbrydere	**Poler**	**In**	**Kombination**
iDPN N Vigi (Clario)	1P+N/3P+N	1-16A	A
iDPN N Vigi (Clario)	1P+N/3P+N	20-40A	A (kun med NG125L)
iDPN N Vigi	1P+N	1-16A	A
iDPN N Vigi	1P+N	20-40A	A (kun med NG125L)
DCP N	3P + N	1-16A	A (kun med NG125L)
iC60N/H/L Vigi	1P+N/3P+N	0,5-63A	A
Fejlstrømsafbrydere	**Poler**	**In**	**Kombination**
iID fejlstrømsafbryder	2/4	25-100A	B/C*
Automatsikringer	**Poler**	**In**	**Kombination**
iC60N/H	1P+N–4P	0,5-40A	B
iC60L	1P+N–4P	0,5-40A	B/C* (≤ 40A iID)

Forbindelser mellem niveau 2 og 3 fra afgangsklemmer på fejlstrømsafbryder til efterfølgende automatsikringer skal oplægges således, at kortslutning og jordslutning kan anses for udelukket. * For kombination C kan bryderen placeres enten i niveau 1 eller 3. Er den placeret i niveau 1, behøver forbindelsen mellem niveau 1 og 2 ikke at være udført som ovennævnte.

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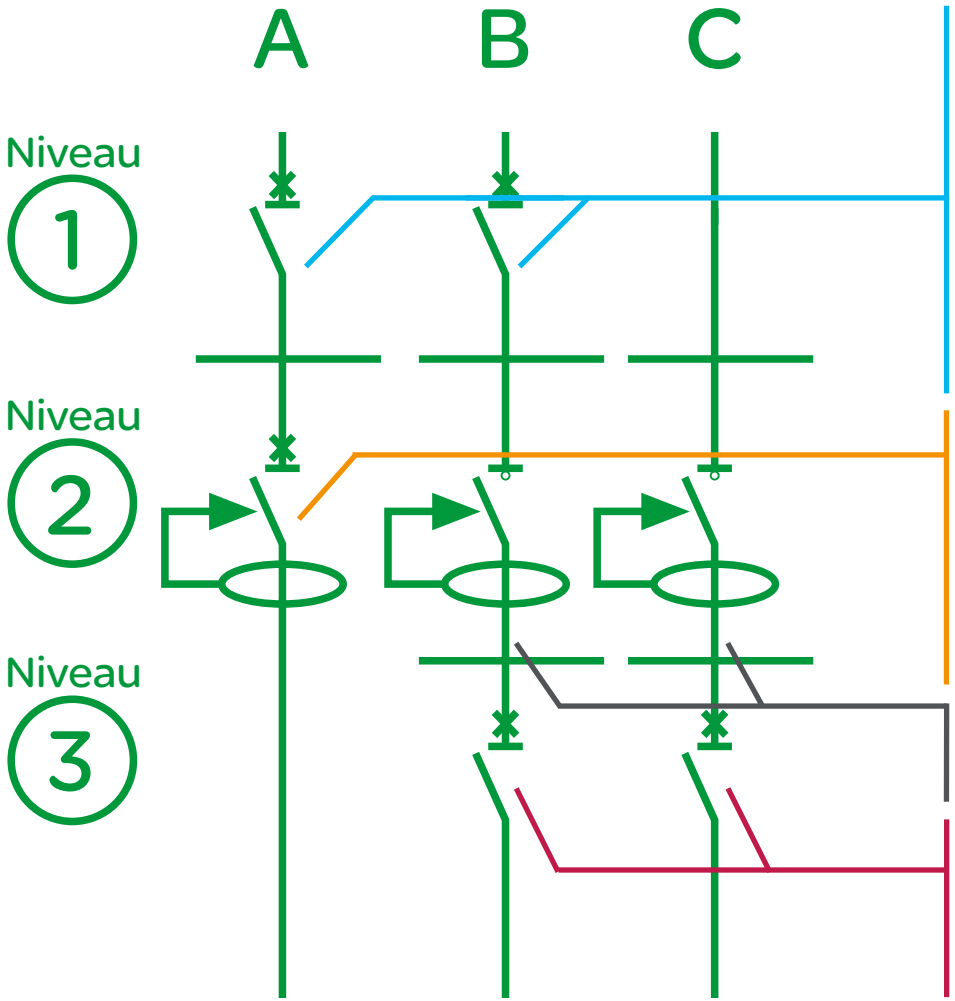
Vejledning til valg af materiel med fejlstrømsbeskyttelse – 25kA

Følgende komponenter kan benyttes:



Un: 230-240V/380-415V TT og TN systemer			
Brydere	**Relæ**	**In**	**Kombination**
NG125N	Termomagnetisk	10-125A	A/B
NG125L	Termomagnetisk	10-80A	A/B/C*(≤ 25A iID)
NG160N/H	Termomagnetisk	16-160A	A/B
NSX100	TM/Micrologic	16-100A	A/B
NSX160	TM/Micrologic	16-160A	A/B
NSX250	TM/Micrologic	16-250A	A
Kombiafbrydere	**Poler**	**In**	**Kombination**
iDPN N Vigi (Clario)	1P+N/3P+N	1-40A	A (kun med NG125L)
iDPN N Vigi	1P+N	1-40A	A (kun med NG125L)
iC60N Vigi	1P+N/3P+N	0,5-63A	A**
iC60H/L Vigi	1P+N/3P+N	0,5-63A	A
Fejlstrømsafbrydere	**Poler**	**In**	**Kombination**
iID fejlstrømsafbryder	2/4	25-100A	B/C*
Automatsikringer	**Poler**	**In**	**Kombination**
iC60N/H	1P+N–4P	0,5-40A	B
iC60L	1P+N–4P	0,5-40A	B/C* (≤ 25A iID)

Forbindelser mellem niveau 2 og 3 fra afgangsklemmer på fejlstrømsafbryder til efterfølgende automatsikringer skal oplægges således, at kortslutning og jordslutning kan anses for udelukket. * For kombination C kan bryderen placeres enten i niveau 1 eller 3. Er den placeret i niveau 1, behøver forbindelsen mellem niveau 1 og 2 ikke at være udført som ovennævnte.
** Gælder ikke for NSX100/160/250B og NG160N.

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Back-up tabeller

Kombination A:								
	Bryder ①	NG125N	NG125L	NG160E	NG160N/H	NS(X)100B/ F/N	NS(X)160B/ F/N	NS(X)250B/ F/N
RCBO ②	In							
iDPNN Vigi	1-16A	20	25	16	20	20	20	20
iDPNN Vigi	20-40A	16	25	16	16	16	16	16
iDPNN Vigi	1-16A	20	25	16	20	20	20	20
iDPNN Vigi	20-40A	16	25	16	16	16	16	16
DCP N	1-16A	16	20	16	16	16	16	16
DCP N	20-32A	10	10	10	10	10	10	10
iC60N Vigi	0,5-63A	25	25	16	20/25	20/25/30	20/25/30	20/25/25
iC60H Vigi	0,5-63A	25	36	16	25	36	30	25
iC60L Vigi	0,5-25A	30	50	16	25	40	40	30
iC60L Vigi	32-40A	25	50	16	25	40	40	30
iC60L Vigi	50-63A	25	36	16	25	36	30	25

Kombination B & C:			
Foransiddende bryder ①	Eftersiddende bryder ③	Mærkestrøm	Back-up
NG125N/L	iDPN N/DPN N	1-16A	16
NG125N/L	iDPN N/DPN N	20-40A	10
NG160E/N/H	iDPN N/DPN N	1-16A	16
NG160E/N/H	iDPN N/DPN N	20-40A	10
NS(X)100/160/250	iDPN N/DPN N	1-16A	16
NS(X)100/160/250	iDPN N/DPN N	20-40A	10
NG125N/L	iC60N/H/L	0,5-40A	25
NG125N/L	iC60N/H/L	50-63A	16
NG160E	iC60N/H/L	0,5-63A	16
NG160N/H	iC60N/H/L	0,5-40A	25
NG160N/H	iC60N/H/L	50-63A	16
NS(X)100/160	iC60N/H/L	0,5-40A	25
NS(X)100/160	iC60N/H/L	50-63A	16
NS(X)250	iC60N/H/L	0,5-40A	20
NS(X)250	iC60N/H/L	50-63A	16
-	iC60N	0,5-63A	10
-	iC60H	0,5-63A	16
-	iC60L	0,5-63A	25(25A iID) – 20(40A iID) – 16(63A iID)
NG125N (10-63A)	-	-	16(25-40A iID) – 10(63A iID)
NG125L	-	-	25(25A iID) – 20(40A iID) – 10(63-80A iID)
NG160E/N/H	-	-	7
NSX100/160	-	-	5

Gælder for fejlstrømsafbrydere (iID) med en mærkestrøm på 25-100A, hvis andet ikke er angivet i tabellen.

Bemærk at belastningsstrømmen igennem fejlstrømsafbryderen ikke må være større end dens mærkestrøm.

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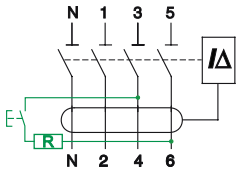
www.lk.dk

10- 2013

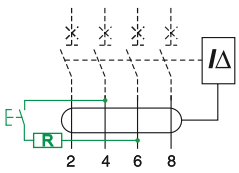
Earth leakage protection
Routine operating checks

Residual current devices are vital for the safety of people.
That is why:
■ the electrical installation operation and maintenance standards require these protection devices to be tested at regular intervals,
■ the product standards IEC 61008 and IEC 61009 require such devices to be fitted with a test button (marked "T") on the front panel.
The user can therefore check and be certain that the device is working correctly.

The test button provides reliable information about how the device is working: tripping as soon as the button is pressed guarantees that the protection is working properly. If the device fails to trip, it must be examined to determine the cause of this malfunction.



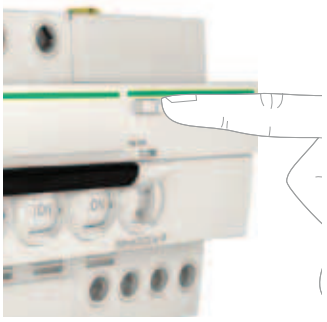
Example iID



Example Vigi iC60

Test frequency
The residual current devices must be tested as frequently as required by the installation regulations and/or the safety regulations currently in force.
In the absence of any regulations, Schneider Electric recommends the test to be carried out:
■ after initial connection and any subsequent reconnection,
■ every years, for devices recently installed in good environmental conditions (no dust, corrosion, humidity, etc.),
■ every 3 months, for devices that have been in use for seven years or more in good environmental conditions,
■ every months, for devices used in corrosive or harsh environmental conditions or highly exposed to lightning strikes.

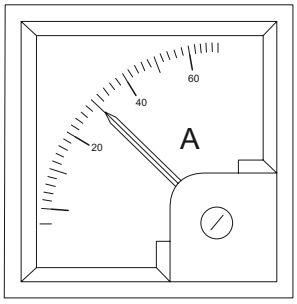
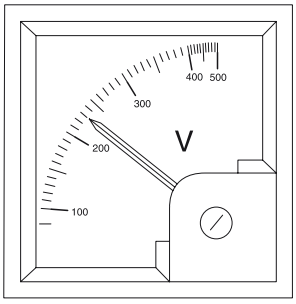
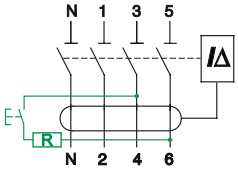
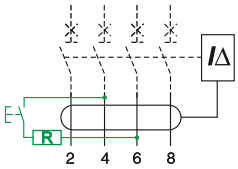
Procedure

The residual current device is powered on and the loads are connected.	**Briefly** press the test button marked "T" on the front panel. ⚠ Pressing the test button too long can seriously damage the device.	The residual current device should trip instantly. If it fails to trip, the additional checks described below should be performed.	When the test is finished, put the residual current device back into service.
			

Earth leakage protection
Routine operating checks

Failure to trip during the test

Failure to trip during the test is often due to a cause that is external to the residual current device.
The table below shows the possible causes, the additional checks and tests to be carried out and the corrective actions to be taken, depending on the results.
After a corrective action has been performed, repeat the test until a correct result is obtained.

Cause of the malfunction			
Network frequency	**Network voltage**	**Connection (three-pole or four-pole device)**	**Load leakage currents**
Additional test			
Check that the network frequency is the same as the frequency read on the device.	Check that the mains voltage is the same as that indicated on the front face of the device.	Measure the voltage between terminals: ■ 3 and 6 for iID ■ 4 and 6 for Vigi iC60. This voltage must be between 85 % and 110 % of the voltage indicated on the device.	Disconnect the loads and press the test button again.
		 iID  Vigi iC60	
Incorrect test result			
If the network frequency is different, the button test is not significant.	■ If the voltage measured is less than 85 % of that indicated on the device, the test button may not work, although the protection device will continue to function. ■ If the voltage measured is more than 110 % of the voltage indicated on the device there is a risk that the device will be destroyed.	The incorrect voltage may be due to a connection error (e.g. phase/neutral inversion/missing phase, etc.). The Acti 9 three-pole and four-pole residual current devices cannot be used on single-phase circuits. The Acti 9 four-pole residual current devices can be used normally on three-phase circuits without neutral.	If the device trips, the earth leakage protection is working correctly.
Corrective actions			
The device must be checked by an external device (see below).	**If the voltage measured is different from the rated voltage of the mains, look for the problem on the power supply or on the downstream circuits (lines, loads):** **■ if the rated voltage of the mains is lower than that indicated on the device it must be replaced by a device with a suitable rated voltage the next time it is shut down** **■ if the rated voltage of the mains is higher than the voltage indicated on the device it must immediately be replaced by a device with a suitable rated voltage.**	**Modify the connection to obtain the rated voltage (phase-phase) between terminals.**	**Measure the permanent leakage current of each load.** **■ in the event of abnormal load leakage, correct the insulation fault.** **■ otherwise, separate the circuits to reduce the permanent leakage currents seen by each residual current device.**

If none of the additional tests indicate a fault, the residual current device is faulty. Checking with an external device (see below) will show whether or not it has to be replaced urgently.

Test result	Positive	Negative
Diagnosis		
	■ the earth leakage protection device is working properly ■ the test circuit is faulty	Earth leakage protection is not working
Corrective actions		
	The residual current device must be replaced quickly (as soon as it is no longer being used).	**The residual current device must be replaced immediately**

Earth leakage protection
Routine operating checks

Some tertiary and industrial installation safety regulations require residual current devices to be checked with a specific device.

Checking with a specific test device
For the tests performed to be valid, these devices must comply with IEC 61557-6.

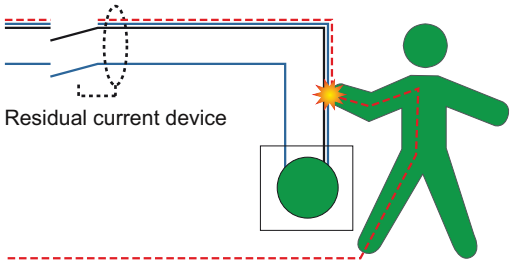
These devices are used to check:
- the operating voltage
- the tripping threshold (according to the sensitivity IΔn) of the residual current device
- the tripping times at IΔn, 2 x IΔn, 5 x IΔn, etc. The normal values are shown on pages CT6-1 and CT6-4.

With an IT earthing system (isolated neutral), a first insulation fault should be created artificially to allow a fault current to circulate during the tests.

Procedure
- Disconnect the fixed and mobile loads (if the residual current device protects the power outlets).
- Connect the test device to the downstream terminals of the residual current device or to a downstream power outlet.

Earth leakage protection
Response time of high-sensitivity residual current devices 30 mA

All the high-sensitivity residual current devices (30 mA) in the Acti 9 range conform to the IEC/EN 61008 and IEC/EN 61009 standards. The response times defined by these standards guarantee their effectiveness in protecting people against direct contacts.



Response time

The response time of a residual current device is the time between the appearance of a dangerous leakage current and circuit power down.

Types AC, A, *Si*

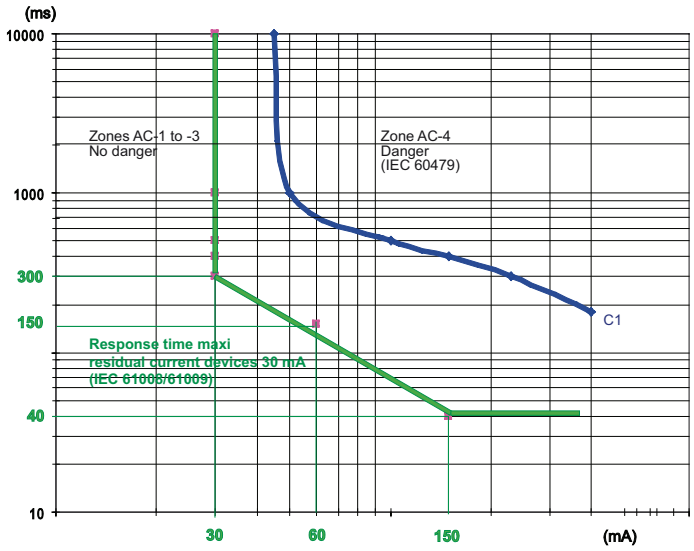
Fault current (mA)		Maximum response time (ms)
I∆n/2	15 mA	No tripping
I∆n	30 mA	300 ms
2 x I∆n	60 mA	150 ms
5 x I∆n	150 mA	40 ms

Type B, DC leakage current

Fault current (mA)		Maximum response time (ms)
I∆n/2	15 mA	No tripping
2 x I∆n	60 mA	300 ms
4 x I∆n	120 mA	150 ms
10 x I∆n	300 mA	40 ms

These response times conform to the specifications of the IEC/EN 61008, IEC/EN 61009 and IEC/EN 62423 (DC leakage current) standards.

They guarantee protection of people against direct contacts for the following reasons :
- when a person comes into direct contact with a live conductor, the current passes directly through the human body,
- this current, with the same magnitude, is detected by the residual current device.



- The IEC 60479 technical report studies the sensitivity of the human body to the electric current. Curve c1 defines for each current value the maximum time before the current causes injury to a person.
- Superimposing the two curves shows that the above response times protects the users.

Measuring the response time

If the user wishes to check the response time of his residual current devices, he should follow a specific procedure to:
- establish a leakage current of calibrated magnitude,
- measure the exact response time.

Procedure

The measuring instruments must conform to **IEC**/EN 61557-6.
Carry out the operations in the following order according to the safety instructions:
- disconnect the loads,
- install the measuring instrument downstream of the residual current device to be tested (for example on a power outlet),
- perform the measurement.

Earth leakage protection
Response time of medium-sensitivity residual current devices 100 mA...1000 mA

Response time of iC60 Vigi and iID residual current devices
The medium-sensitivity residual current devices (100…1000 mA) in the Acti 9 range conform to IEC/EN 61008, IEC/EN 61009 and IEC/EN 62423 (DC leakage current):
- their response time guarantees personal protection against indirect contacts and fire risks,
- in the case of selective versions (S), a "non-tripping time" guarantees discrimination with the residual current devices installed downstream.

Types AC, A, *Si*

Instantaneous residual current devices

Residual current device		Sensitivity (IΔn) 100 mA	300 mA	500 mA	
Fault current (mA)	IΔn/2	50	150	250	No tripping
					Max. response time
	IΔn	100	300	500	300 ms
	2 x IΔn	200	600	1000	150 ms
	5 x IΔn	500	1500	2500	40 ms
	500 A				40 ms

Selective (S) and time-delayed (R) residual current devices

Residual current device		Sensitivity (IΔn) 100 mA	300 mA	500 mA	1000 mA	Type Selective (S)		Time-delayed (R)	
Fault current (mA)	IΔn/2	50	150	250	500	No tripping		No tripping	
						Non-tripping time	Response time	Non-tripping time	Response time
	IΔn	100	300	500	1000	130 ms	500 ms	300 ms	1000 ms
	2 x IΔn	200	600	1000	2000	60 ms	200 ms	150 ms	500 ms
	5 x IΔn	500	1500	2500	5000	50 ms	150 ms	150 ms	300 ms
	500 A					40 ms	150 ms	150 ms	300 ms

Type B, DC leakage current

Instantaneous residual current devices

Residual current device		Sensitivity (IΔn) 300 mA	500 mA	
Fault current (mA)	IΔn/2	150	250	No tripping
				Max. response time
	2 x IΔn	600	1000	300 ms
	4 x IΔn	1200	2000	150 ms
	10 x IΔn	3000	5000	40 ms
	5 A...200 A			40 ms

Selective (S) residual current devices

Residual current device		Sensitivity (IΔn) 300 mA		
Fault current (mA)	IΔn/2	150	No tripping	
			Non-tripping time	Response time
	2 x IΔn	600	130 ms	500 ms
	4 x IΔn	1200	60 ms	200 ms
	10 x IΔn	3000	50 ms	150 ms
	5 A...200 A		40 ms	150 ms

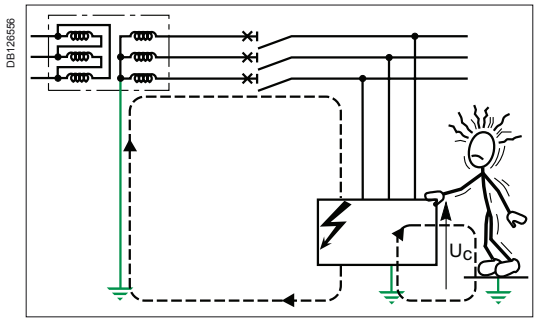
Definitions

Response time
Time between the appearance of a hazardous leakage current and circuit power down.

Non-tripping time
For selective and time-delayed devices, the non-tripping time is the time between the appearance of a hazardous leakage current and the device tripping.
If the leakage current disappears before this time, the device does not trip.
This fast disappearance of the leakage current can be due to:
- the transient nature of the fault (e.g. the current generated by a switching surge),
- the interruption of the fault current by another faster residual current device situated downstream.

Selective and time-delayed devices therefore afford the user:
- better immunity against nuisance tripping,
- total discrimination between residual current devices.

Earth leakage protection
Response time of medium-sensitivity residual current devices 100 mA...1000 mA



Protection against indirect contacts

The response times of residual current devices guarantee personal protection against indirect contacts, in conformance with the requirements of the installation standards (IEC 60364 or equivalent).

Indirect contacts

A person who comes into contact with an accidentally live frame caused by an insulation fault experiences an indirect contact: the contact voltage Uc creates a current that passes through the human body.

Maximum breaking time

The maximum breaking time required by the installation standards, in the event of an insulation fault, depends on:

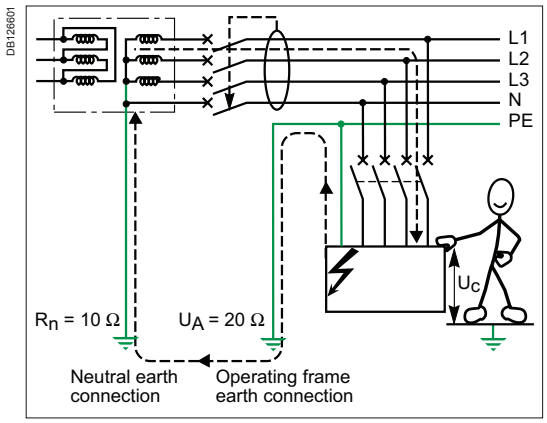
- the network voltage,
- the earthing system.

Maximum breaking time for terminating circuits (ms)

Earthing system	Network phase/neutral voltage			
	50...120V	120...230V	230...400V	> 400 V
TN or IT	800	400	200	100
TT	300	200	70	40

Note: a breaking time of no more than 5 s is permitted for distribution circuits to ensure discrimination with the devices installed on the terminating circuits.
This time should be reduced to the essential minimum.

These times are based on the maximum prospective values of the contact voltage Uc and on the contact times authorised by technical report IEC 60479.



Example

On a three-phase phase/neutral voltage network Uo = 230 V in a TT system:

- the resistance of the neutral earth connection Rn is 10 Ω,
- the resistance of the operating frame earth connection RA is 100 Ω.

In the event of an insulation fault, the leakage current Id is equal to: Uo/ (RA + Rn) i.e. 230 V/110 Ω = 2.1 A.
The contact voltage Uc is therefore Id x RA i.e. 2.1 A x 100 Ω = 210 V.

Protection sensitivity

The residual current device must trip as soon as the leakage current corresponds to a hazardous situation, i.e. a contact voltage of 50 V (in a dry atmosphere).
Hence, IΔn = 50 V / RA, i.e. 50 V/100 Ω = 500 mA.

Maximum breaking time

For a 230 V phase/neutral voltage network in a TT system, the IEC 60364 standard requires a maximum breaking time of 200 ms.
For the 2.1 A leakage current:

- □ an instantaneous residual current device with a sensitivity of 300 mA will power down the circuit in less than 40 ms,
- □ an instantaneous residual current device with a sensitivity of 500 mA will power down the circuit in less than 60 ms.

Note: For well-designed and regularly maintained electrical installations, the resistance of the operating frame earth connection can be less than 100 Ω.

Use of the time-delayed residual current devices

In accordance with the breaking times required by the installation standards (above), the selective and time-delayed residual current devices can be used in the following cases:

Circuit	Network voltage (phase/neutral)	Residual current device		
		Instantaneous I	Selective S	Time-delayed R
Terminating circuit	≤ 230 V	■	■	(1)
	> 230 V	■		
Sub-distribution or general		■	■	■

(1) Only in a TN system for a phase/neutral voltage < 120 V.

Earth leakage protection

Response time of medium-sensitivity residual current devices 100 mA...1000 mA

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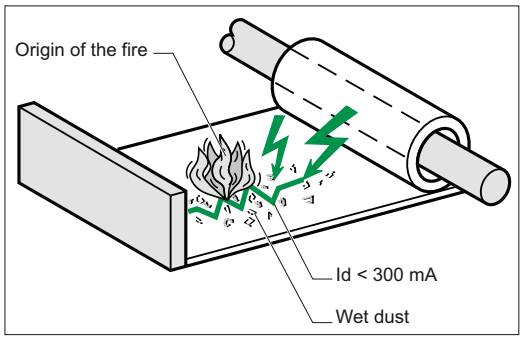

Protection against fire hazards

Most fires of electrical origin are caused by the creation and propagation of electric arcs in building materials, in the presence of moisture, dust, pollution, etc.
These arcs appear and develop due to the wear and tear or ageing of the insulating materials. The fire risk occurs when the leakage currents reach a few hundred milliamps for a few seconds.
For fault currents of this magnitude, residual current devices with a sensitivity of 300 or 500 mA trip in less than a second, whether they be instantaneous, selective or time-delayed.

The response times of residual current devices with a sensitivity of 300 mA guarantee protection against fires generated by leakage currents

IEC 60364-4-42 (subclause 422.3.10) states that it is mandatory to install a residual current device with a sensitivity less than or equal to 500 mA:
- on premises with a risk of explosion (BE3),
- on premises with a risk of fire (BE2),
- in agricultural and horticultural buildings,
- for circuits supplying fair, exhibition and entertainment equipment,
- on temporary outdoor leisure facilities.

In certain countries, the installation rules and/or local safety regulations require a sensitivity of 300 mA.

Earth leakage protection

Response time of medium-sensitivity residual current devices 100 mA...1000 mA

Discrimination of residual current devices

The non-tripping times of type (S) and (R) residual current devices ensure discrimination with the residual current devices located downstream.

Combination rules

To ensure discrimination between two cascading residual current devices, the following two conditions must be met simultaneously:

- the sensitivity of the upstream device must be at least 3 times the sensitivity of the downstream residual current device,
- the upstream residual current device must be one of the following types:
  - Selective (S) if the downstream residual current device is instantaneous,
  - Time-delayed (R) if the downstream residual current device is selective (S).

The figure below shows how compliance with these rules provides discrimination on three levels: whatever the value of the fault current, it will be interrupted by the device situated immediately upstream of the fault and only by this device.

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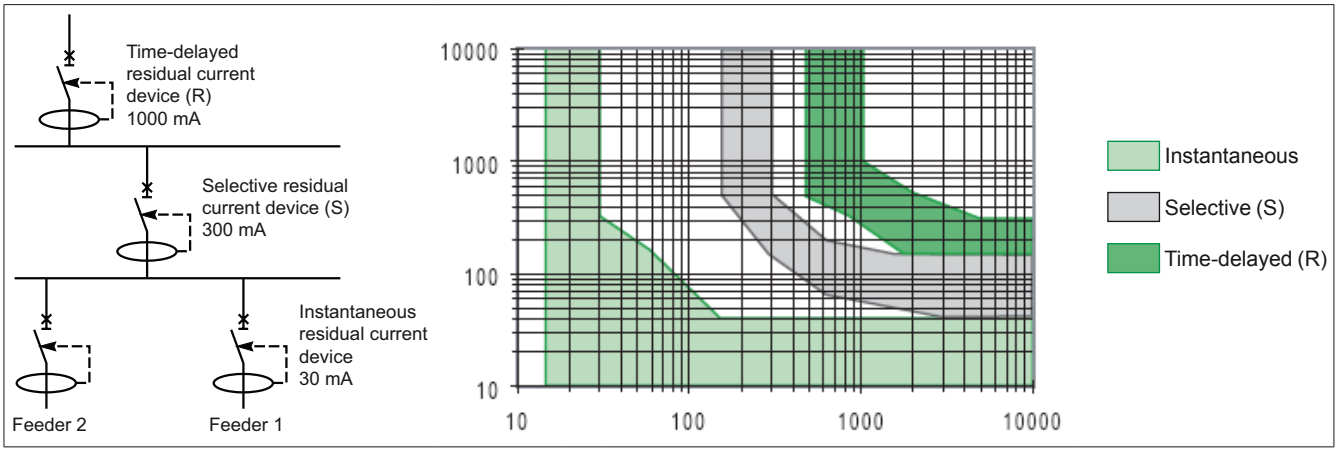


Example:

In the above diagram for a fault current of 1000 mA:

- if the fault occurs downstream of the 30 mA residual current device, the latter will interrupt the current in less than 40 ms, whereas type S and R devices "wait" for 80 ms and 200 ms respectively. Therefore, neither of the two devices trips,
- if the fault occurs downstream of the type S residual current device, the latter will interrupt the current in less than 175 ms, whereas the type R device "wait" for 200 ms and therefore does not trip.

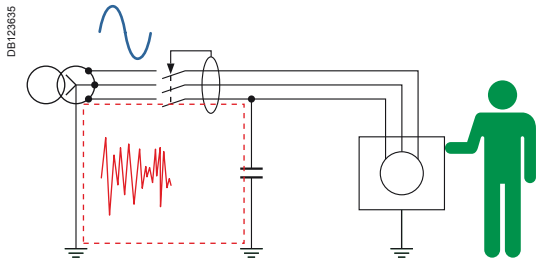
If these cascading combination rules are complied with, the level of continuity of service provided to the user depends on the way in which the "horizontal discrimination" is implemented: the terminal feeders must be divided into as many circuits as necessary, each protected by a residual current device.

Electrical and electromagnetic interference

Operation of earth leakage protection devices

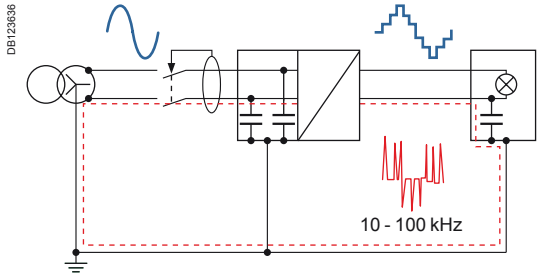
Some types of electrical and electromagnetic interference caused by the network or its environment may affect the operation of earth leakage protection devices and result in:
■ **Nuisance tripping** (tripping in a non-dangerous situation). Such tripping is often repetitive, which is highly detrimental to satisfying the user's energy requirements.
■ **Risk of non-tripping** in dangerous situations. This risk must be carefully analysed, because it affects people's safety. The standards define three categories of earth leakage protection devices according to their ability to control these types of situation.

■ The risk of interference must be taken into account when selecting earth leakage protection devices (see module CA902000), according to the loads supplied and the environment.
■ The explanations given below specify the main types of interference, their origin and how Schneider Electric's earth leakage protection devices respond, according to their type.



Nuisance tripping

This type of tripping is caused by the combination of two factors:
■ A transient or continuous high-frequency voltage that is superimposed on the normal network voltage (50 Hz).
■ The presence of capacitors between the electrical network and the earth (or frames). As these capacitors are exposed to a high-frequency voltage, a current which can trip an earth leakage protection device flows to earth.
The causes, duration and frequency spectra of such interference, which is often difficult to identify, can vary greatly, as shown in the examples below.



High-frequency harmonics

The current absorbed by non-linear loads such as IT equipment power supplies, frequency converters, variable speed drive motor controls, electronic ballast lights, etc. includes high-order harmonics.
If the natural capacitances of the protected circuit are significant (between the cables and earth, or between the live parts of the devices and their frames), earth leakage protection devices may be tripped, although no danger is present.
This risk of nuisance tripping is all the more likely to occur when a large number of identical loads are supplied in parallel and protected by the same earth leakage protection device.

Low-frequency continuous leakage currents

These leakage currents are mainly generated by the filtering capacitors in the power supply stage of electronic devices. Depending on the number of devices protected by the same earth leakage protection device, these leakage currents may:
■ Increase the risk of tripping in the event of high-frequency interference.
■ Cause frequent tripping

To guarantee satisfactory operation, these continuous leakage currents must not exceed 25% of the sensitivity (IΔn) of the earth leakage protection device, by limiting the number of "interfering" loads protected by the same earth leakage protection device.
■ If more accurate data is unavailable, the leakage current can be estimated on the following basis, for a 230 V, 50 Hz network:
□ heating floor: 1 mA / kW,
□ fax, printer: 1 mA,
□ PC, workstation: 2 mA,
□ photocopier: 1.5 mA.

If long cables are installed downstream of the earth leakage protection devices, it may be necessary to take the natural capacitance formed by the cable/earth pair into account (order of magnitude: at 230 V, approximately 1.5 mA for 100 m).

Back-up table for residual current devices with fuses

Un: 230/400V TT and TN earthing systems												
	Upstream	Fuses, type gG										
Downstream	In(A)	2-13	16	20	25	35	40	50	63	80	100	125
		Combined breaking capacity (kA)										
iDPNN Vigi (Clario) & iDPNN Vigi	1	100	-	-	-	-	-	-	-	-	-	-
iDPNN Vigi (Clario) & iDPNN Vigi	2	100	100	100	100	-	-	-	-	-	-	-
iDPNN Vigi (Clario) & iDPNN Vigi	3-4	100	100	100	100	-	-	-	-	10	-	-
iDPNN Vigi (Clario) & iDPNN Vigi	6-13	100	100	100	100	100	100	100	25	16	-	-
iDPNN Vigi (Clario) & iDPNN Vigi	16-20	100	100	100	100	100	100	100	100	25	-	-
iDPNN Vigi (Clario) & iDPNN Vigi	25-40	100	100	100	100	100	100	100	100	100	-	-
DCPN Vigi	6-32	100	100	100	100	100	100	100	35	35	35	35
ID 2 & 4-pole	16-40	100	100	100	100	80	80	30	30	16	10	-
ID 2 & 4-pole	63-100	100	100	100	100	80	80	30	30	16	10	5

The fuse can be placed either upstream or downstream of the residual current device. If it is placed downstream the connection between the residual current device and the fuse must be installed so that a short-circuit or earth fault can be ruled out.

Please note that the RCCB's have to be protected against overload situation.

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