Low Voltage Circuit Breakers Specifications & Selection

4th Feb 2015

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Schneider Electric

Topics

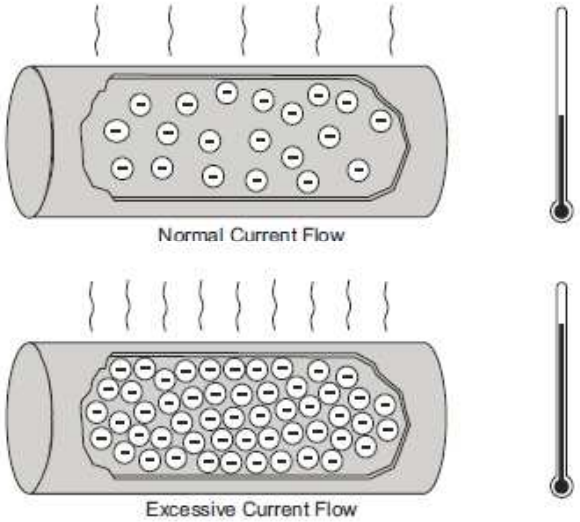
1. The functions and characteristics of LV Circuit Breakers
2. Circuit breaker specifications & performances in accordance with IEC60947-2
   - Rated voltages & current
   - Rated breaking capacities
   - Coordination - Discrimination & Cascading
3. The NEW generation of circuit breakers – advanced features
4. Specification and selection of circuit breakers



Why protect?

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Why the need for circuit protection?



Electric current flow in conductors always generate heat
More current flow ➔ More Heat generated
Excessive current is referred to as Overcurrent

The heat generated will cause extensive damage to connected equipment and conductors. This dangerous current must be interrupted immediately when a short circuit occurs.

The various types of Overcurrent



Overcurrent

A current value exceeding the rated value
Includes overload current, short-circuit or fault current

Overload current

An overcurrent occurring in a circuit which is electrically sound

eg. Overloaded machines, error in design or load assessment

Short-circuit current

An overcurrent resulting from negligible impedance between live conductors

eg. Ph/N, Ph/E, Ph/Ph or 3Ph

Earth fault current

A fault current which flows to Earth

A Typical Low Voltage System



Overcurrent protection (by circuit breakers) is deployed in every section of the network

Main Switchboard

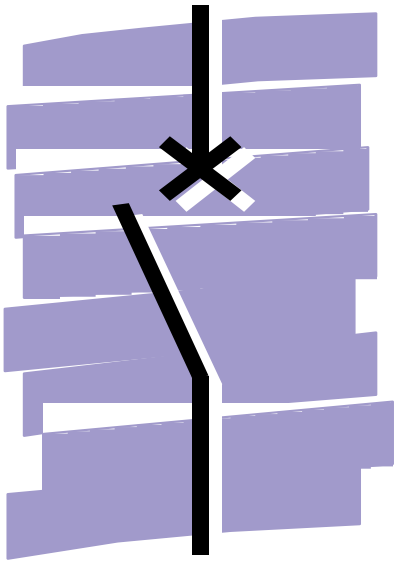
Air Circuit Breakers – Masterpact NT /NW
Molded Case Circuit Breakers – Compact NS

Sub-Distribution Switchboard

Molded Case Circuit Breakers:
- Compact NS / NSX
- EasyPact CVS/EZC

Final Distribution

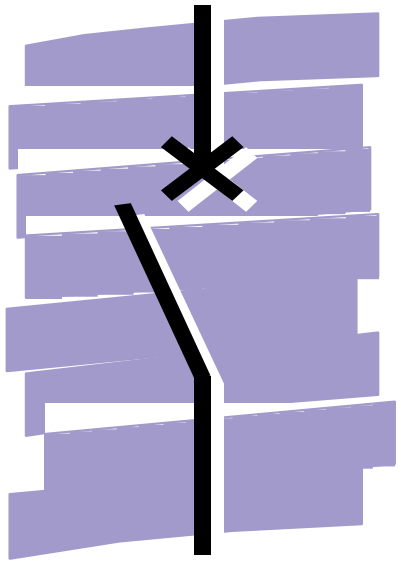
Molded Case Circuit Breakers – EasyPact CVS/EZC
Miniature Circuit Breakers – Acti 9, Domae



What is a circuit breaker?

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What is a Circuit Breaker?



A mechanical switching device capable of :

- making, carrying and breaking currents under **normal** circuit conditions and also

- making, carrying for a specified time and breaking currents under specified **abnormal** circuit conditions such as those of short-circuit.

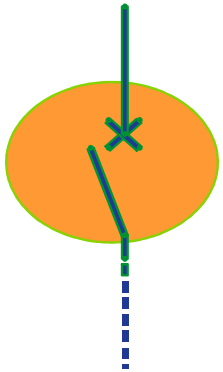
Functions of a circuit breaker

1.Permits the installation to be used to it full rated current capacity
2.Detects & protects against dangerous conditions
3.Local circuit control switching, fault-making & isolation

What is a Circuit Breaker?

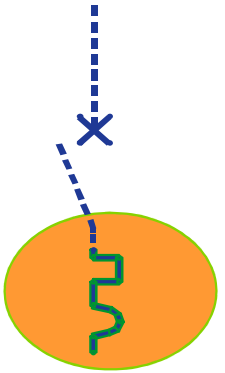
Mechanical switch

A mechanical **switch** that makes and breaks the contact

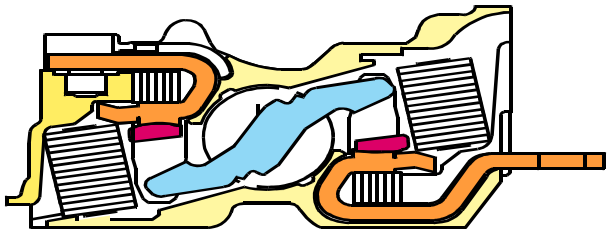


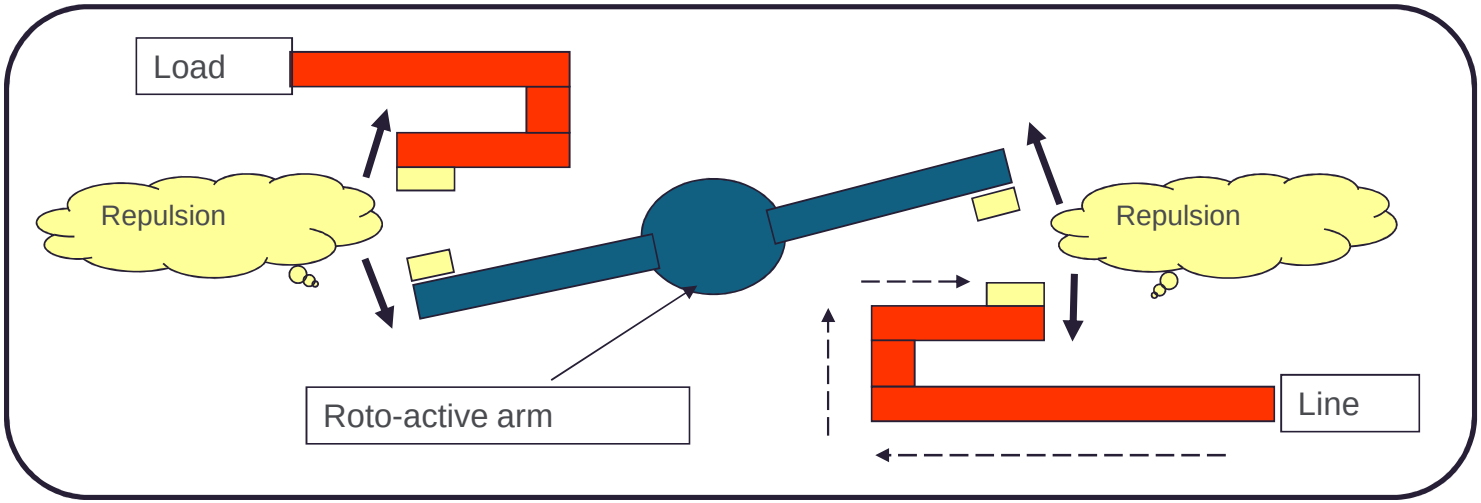
Trip unit

A thermal-magnetic or electronic **controller** that orders the switch to open



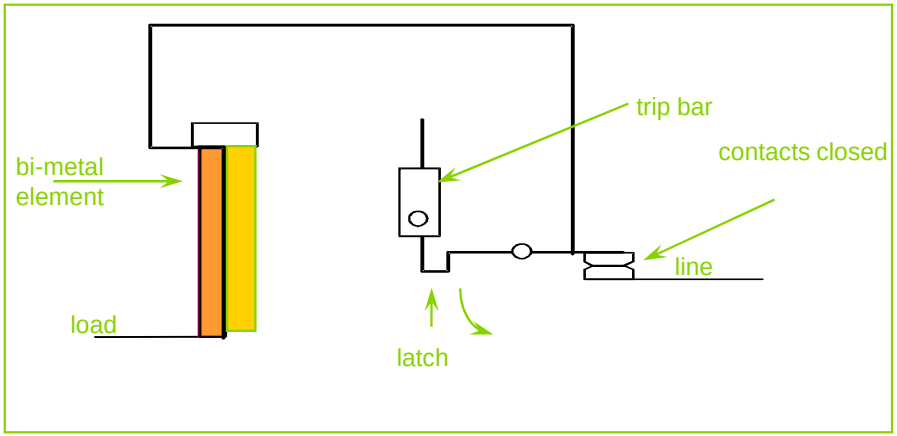
Circuit Breaker (1) – mechanical switching

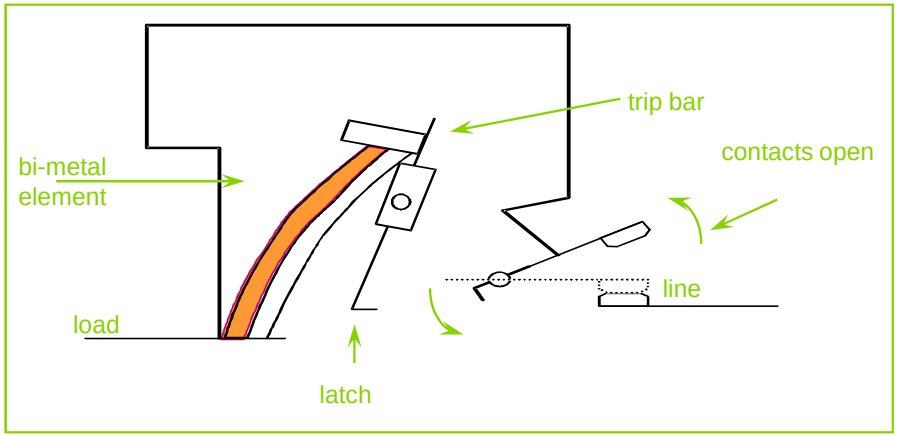




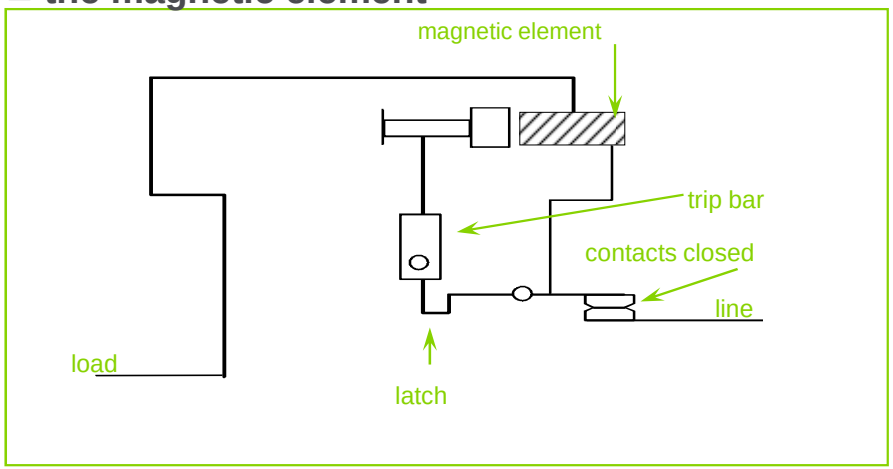
Circuit Breaker (2) – Thermal/Mag Trip Unit

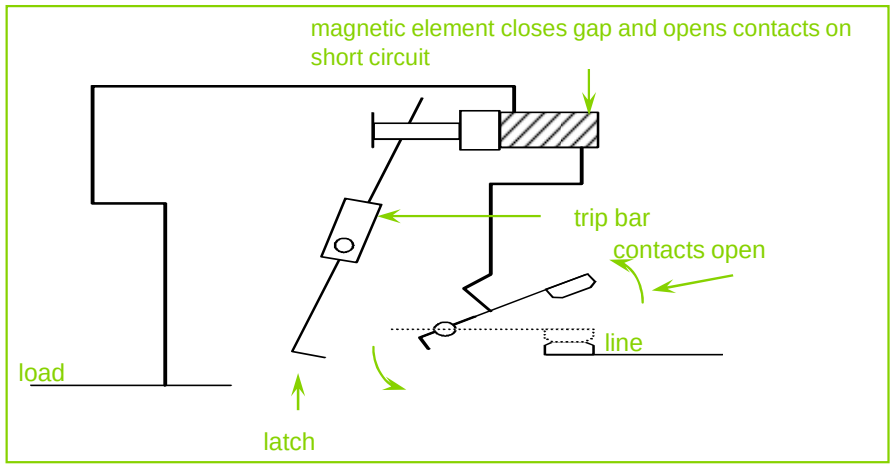
■ the thermal element



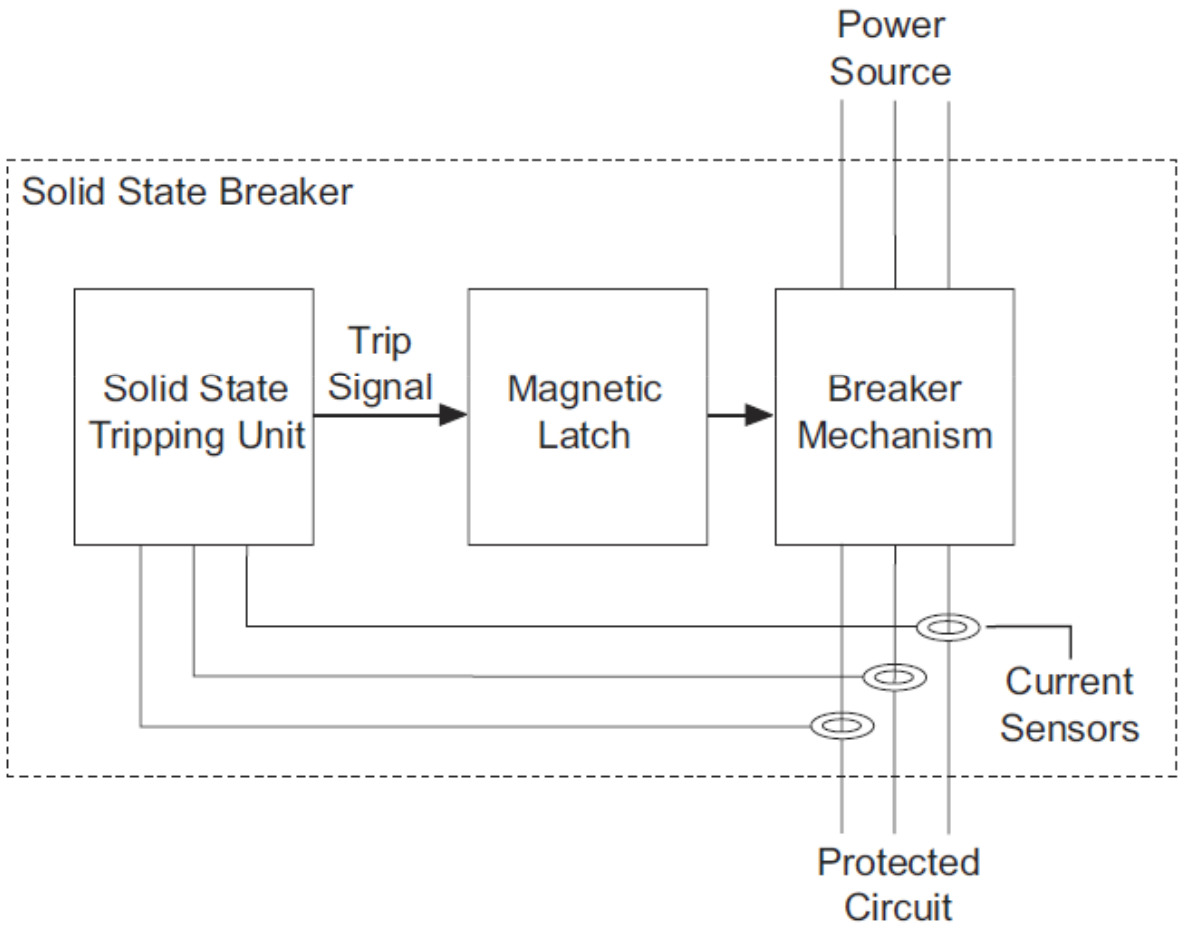


■ the magnetic element





Circuit Breaker (2) – Electronic Trip Unit





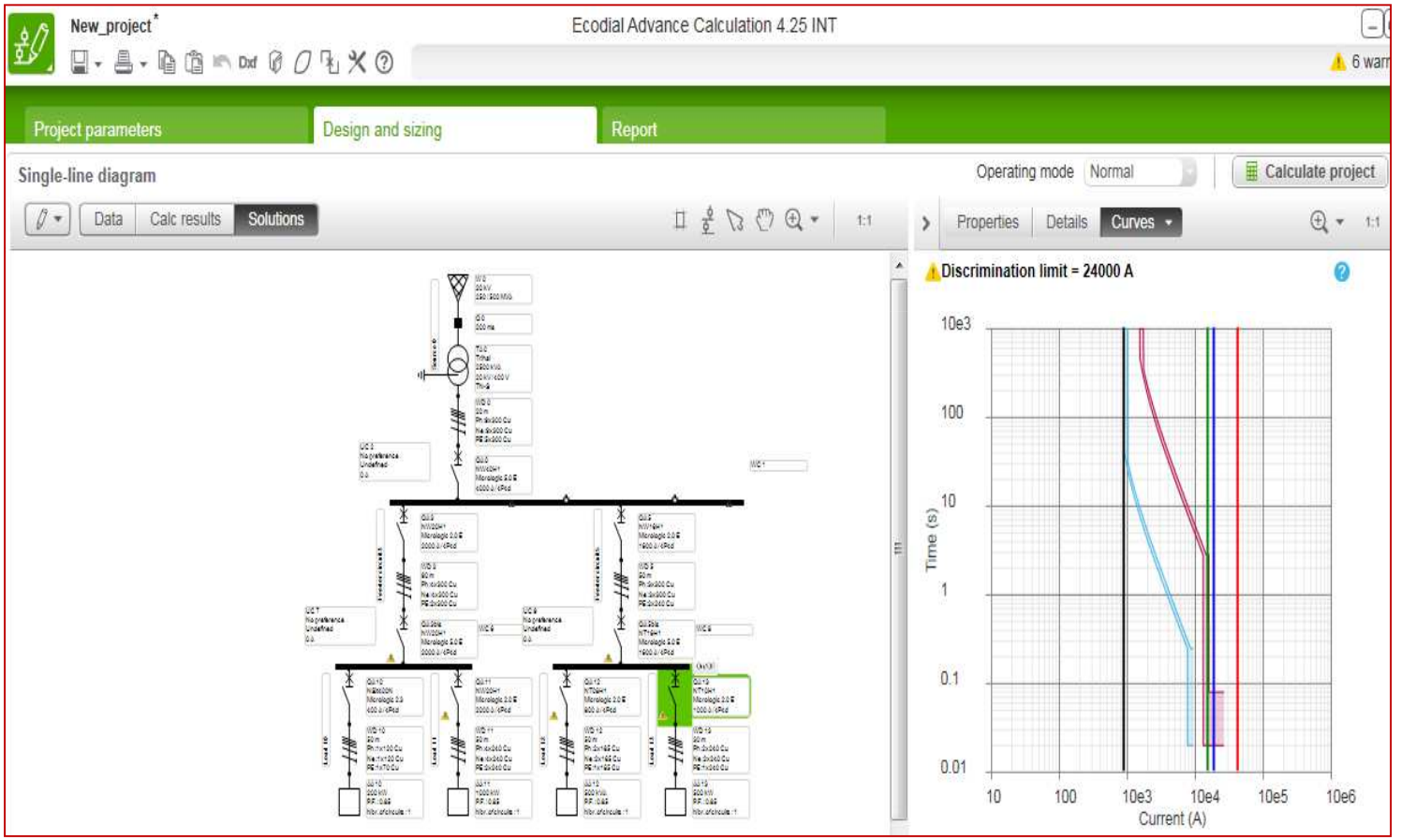
How to select circuit breakers?

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Using Software to simplify selection

Ecodial Advanced Calculation Software





Typical Circuit Breaker Datasheet

Common characteristics			
Rated voltages			
Insulation voltage (V)	Ui		800
Impulse withstand voltage (kV)	Uimp		8
Operational voltage (V)	Ue	AC 50/60 Hz	690
Suitability for isolation		IEC/EN 60947-2	yes
Utilisation category			A
Pollution degree		IEC 60664-1	3

Circuit breakers				NSX100						NSX160					
Breaking capacity levels				**B**	**F**	**N**	**H**	**S**	**L**	**B**	**F**	**N**	**H**	**S**	**L**
Electrical characteristics as per IEC 60947-2															
Rated current (A)	**In**	40 °C		**100**						**160**					
Number of poles				2 [3], 3, 4						2 [3], 3, 4					
Breaking capacity (kA rms)															
	Icu	AC 50/60 Hz	220/240 V	40	85	90	100	120	150	40	85	90	100	120	150
			380/415 V	25	36	50	70	100	150	25	36	50	70	100	150
			440 V	20	35	50	65	90	130	20	35	50	65	90	130
			500 V	15	25	36	50	65	70	15	30	36	50	65	70
			525 V	-	22	35	35	40	50	-	22	35	35	40	50
			660/690 V	-	8	10	10	15	20	-	8	10	10	15	20
Service breaking capacity (kA rms)															
	Ics	AC 50/60 Hz	220/240 V	40	85	90	100	120	150	40	85	90	100	120	150
			380/415 V	25	36	50	70	100	150	25	36	50	70	100	150
			440 V	20	35	50	65	90	130	20	35	50	65	90	130
			500 V	7.5	12.5	36	50	65	70	15	30	36	50	65	70
			525 V	-	11	35	35	40	50	-	22	35	35	40	50
			660/690 V	-	4	10	10	15	20	-	8	10	10	15	20

International Circuit Breaker Standard – IEC60947-2



- **Rated operational voltage (Ue)**

  Determines the application of the equipment

- **Rated Current (In)**

  The current which the breaker will carry continuously

- **Rated Ultimate S/C Breaking Capacity (Icu)**

  The calculated prospective fault current at the incoming terminals of the circuit breaker should not exceed Icu

  Icu = o - t - co

- **Rated Service Breaking Capacity (Ics)**

  The maximum level of fault current operation after which further service is assured without loss of performance

  Ics = o - t - co - t - co

- **Rated Short-time Withstand Current (Icw) for Cat B breakers**

  The current which the breaker will withstand for the maximum short-time delay. Preferred times are 0.05, 0.1, 0.25, 0.5 & 1s

A closer look at Icu & Ics – IEC60947-2

2.15.1
ultimate short-circuit breaking capacity, Icu
a breaking capacity for which the prescribed conditions according to a specified test sequence do not include the capability of the circuit-breaker to carry its rated current continuously

2.15.2
service short-circuit breaking capacity, Ics
a breaking capacity for which the prescribed conditions according to a specified test sequence include the capability of the circuit-breaker to carry its rated current continuously

A closer look at Icu & Ics – IEC60947-2

What is Icu? Rated Ultimate S/C Breaking Capacity

- Test is done in 2 successive disconnection at defined Icu current

  O --- CO

- Verification tests after breaking on short-circuit :

  Dielectric strength, trip test loaded at 2.5In

PASSED : If it can break the defined Icu current

What is Ics? Rated Service Breaking Capacity

- Test is done in 3 successive disconnection at defined Ics current

  O --- CO --- CO

- Verification tests after breaking on short-circuit :

  Dielectric strength, temperature rise, trip operation, etc

PASSED : Only if it can break the defined Ics current and to carry it's rated current continuously without excessive temperature rise

Let’s do a simple comparison

Model A



At 240V

Icu = 85kA

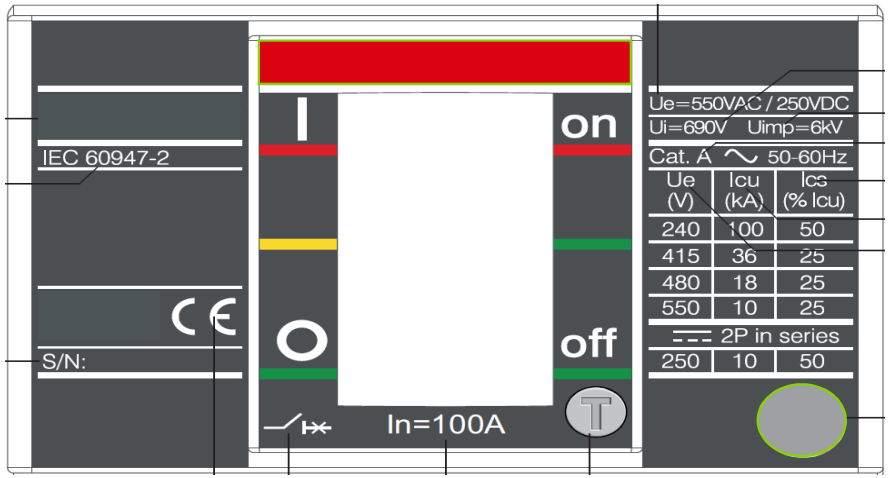
Ics = 85kA

At 415V

Icu = 36kA

Ics = 36kA

Model B



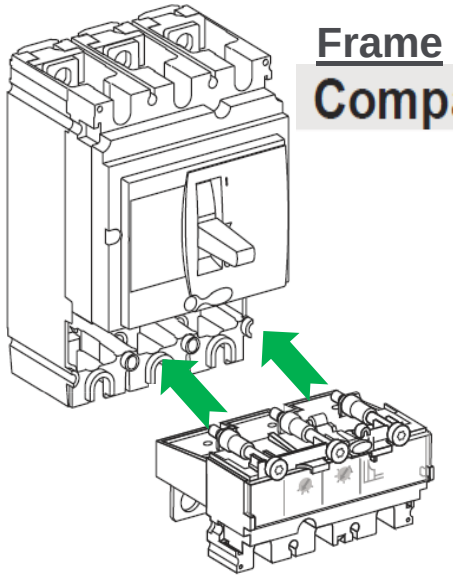
Icu = 100kA

Ics = 50% x Icu = 50kA

Icu = 36kA

Ics = 25% x Icu = 9kA

The Frame Size



Frame
Compact NSX100

Trip
Rating
TM16D
TM25D
TM32D
TM40D
TM50D
TM63D
TM80D
TM100D

eg. 100AF/80AT
Frame = Compact NSX100
Trip = TM80D

- The circuit breaker frame includes all the various components that make up a circuit breaker except for the trip unit
- For any given frame, circuit breakers with a range of current ratings can be manufactured by installing a different trip unit for each rating.
- The breaker **frame size is the highest continuous current rating offered for a breaker with a given frame.**

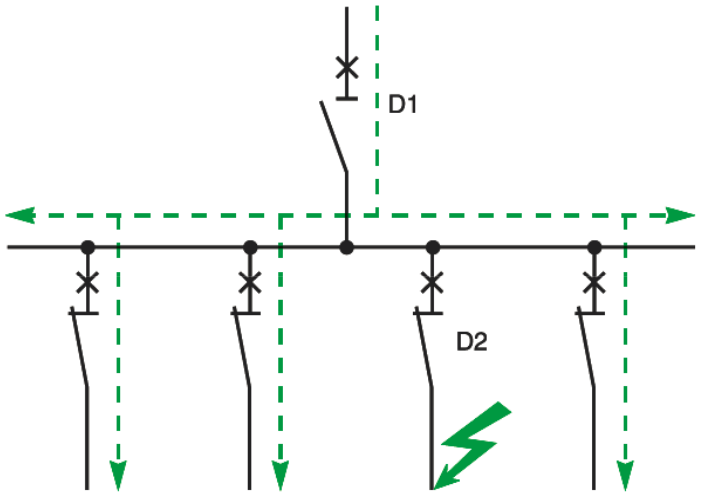
The key selection criteria

(1) Rated Operational Voltage, Ue

(2) Nominal Rated current, In

(3) Breaking capacity, Icu/Ics

(4) Discrimination / Cascading



Coordination of circuit breakers

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What is Co-ordination?







Co-ordination is the selection of the ***RIGHT COMPONENTS*** to ***PROTECT*** and ensure the ***CONTINUITY OF SUPPLY*** to loads and equipment without causing unnecessary inconvenience to the users concerned.

How to achieve good Co-ordination?

Optimising LV electrical distribution through 3 key actions at the Protection Planning Stage

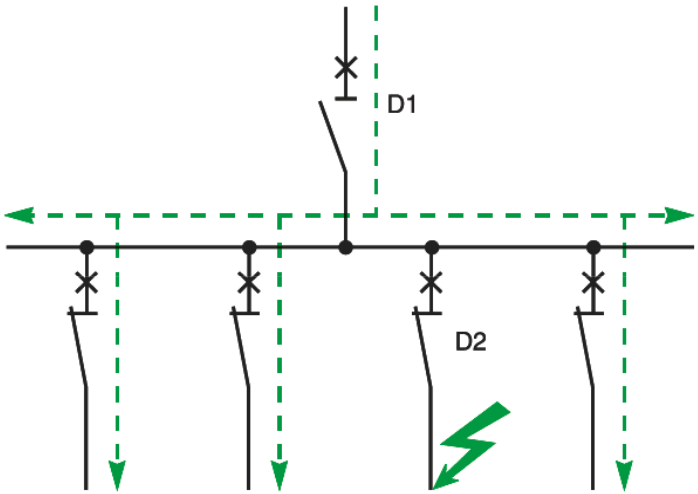
1) ***Discrimination*** to guarantee continuity of supply

2) ***Current Limiting*** to reduce stress & disturbances

3) ***Cascading*** to optimise performances

What is Discrimination?

Discrimination (selectivity) is the *co-ordination* of protective devices such that *only* the faulty load or feeder is disconnected.



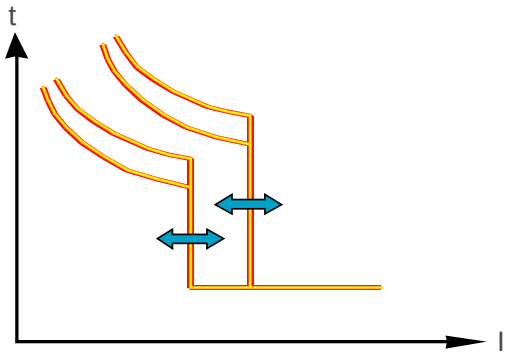
Whatever the fault:
- overload,
- short-circuit

Only one breaker immediately upstream trips

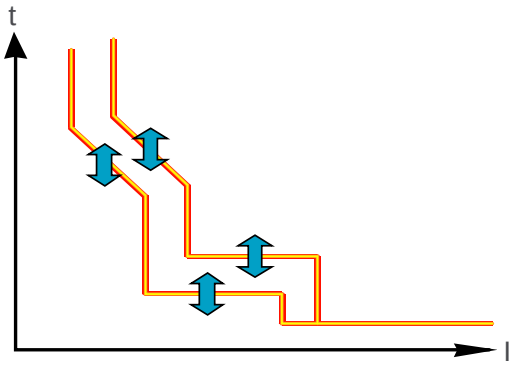
A coordinated network guarantees good Continuity-of-Supply

The various Discrimination techniques

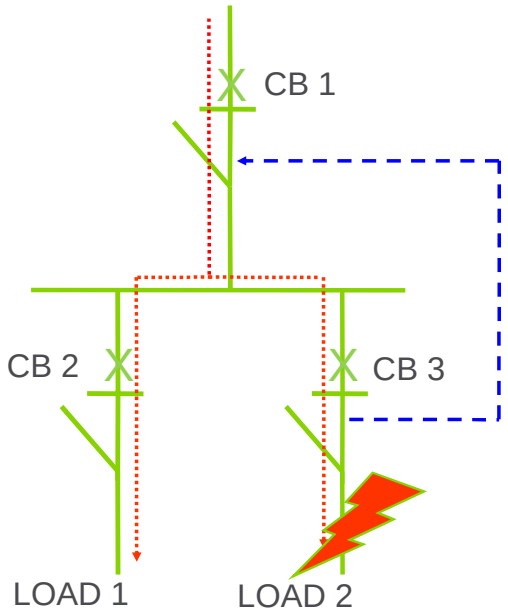
1) Current Discrimination



2) Time Discrimination



3) Logic Discrimination



- The protection system installed at CB3 detects the fault and sends a signal to CB1
- The protection system installed at CB1 receives CB3's signal.
- CB3 eliminates the fault and CB1 remains closed

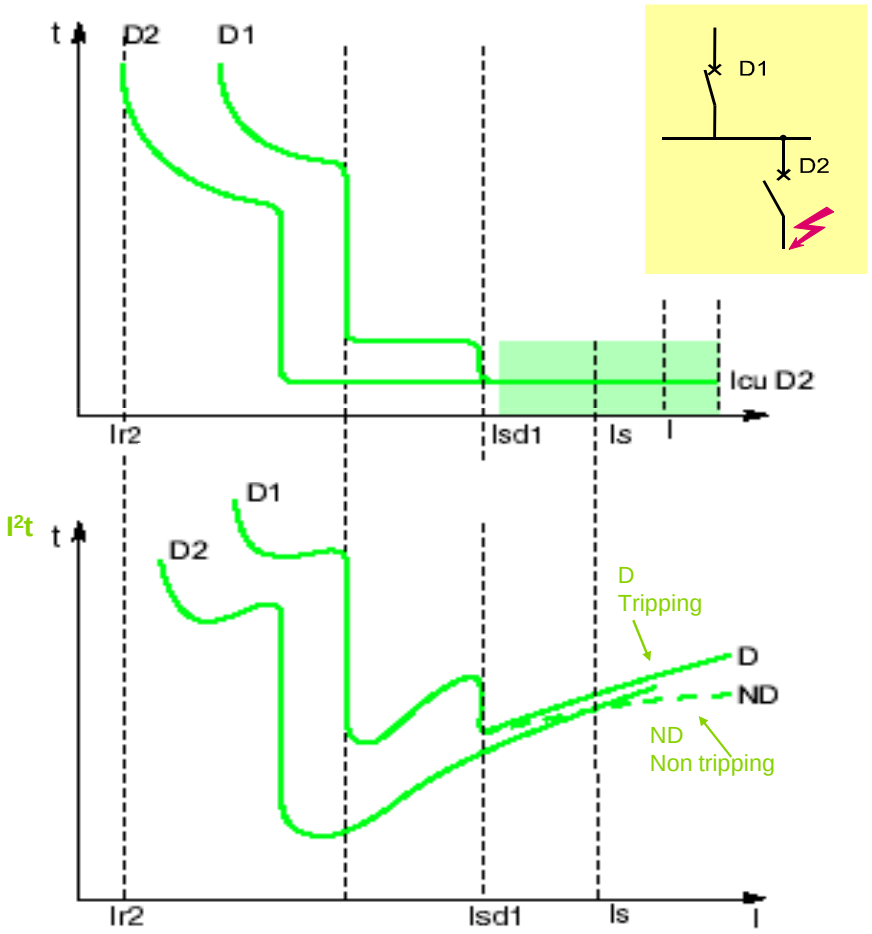
The various Discrimination techniques

4) Energy Discrimination

> Comparison of energy curves (tripping **D** downstream/non tripping **ND** upstream) allows for the discrimination limit **Is** to be determined

> Only the manufacturer can guarantee the quality of energy discrimination

This is the *most important* consideration for short-circuit discrimination and is recommended in the IEC60947-2



How to ensure good Discrimination?

The IEC 60947-2 (2006) standard appendix A: Discrimination

A.1 Introduction

To ensure co-ordination under short-circuit conditions between a circuit-breaker (C_1) and another short-circuit protective device (SCPD) associated with it in the same circuit, it is necessary to consider the characteristics of each of the two devices as well as their behaviour as an association.

NOTE An SCPD may incorporate additional protective means, for example, overload releases.

The SCPD may consist of a fuse (or a set of fuses) – see Figure A.1 – or of another circuit-breaker (C_2) (see Figures A.2 to A.5.)

The comparison of the individual operating characteristics of each of the two associated devices may not be sufficient, when reference has to be made to the behaviour of these two devices operating in series, since the impedance of the devices is not always negligible. It is recommended that this should be taken into account. For short-circuit currents it is recommended that reference be made to I^2t instead of time.

How to ensure good Discrimination?

The IEC 60947-2 (2006) standard appendix A: Discrimination

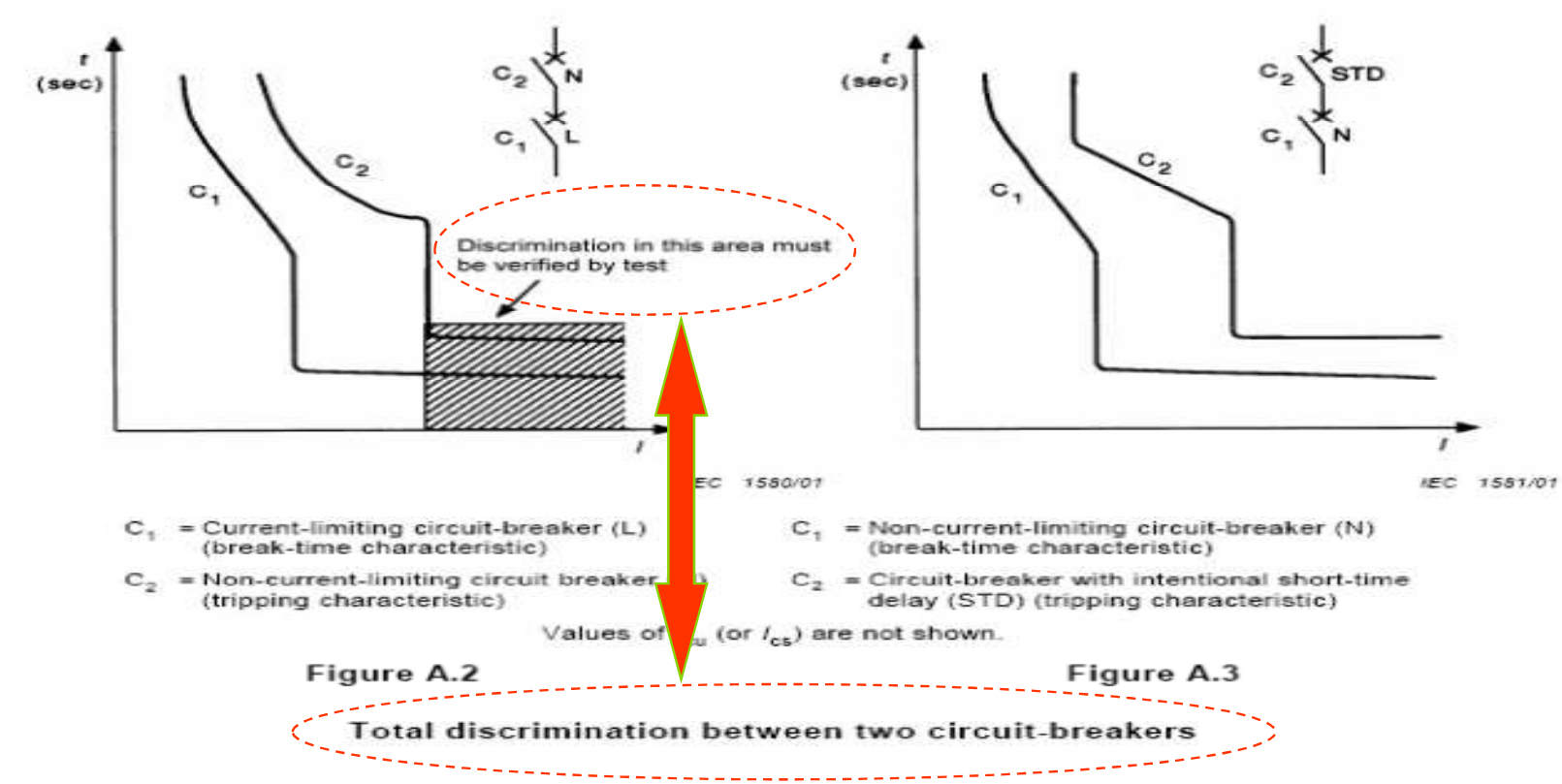
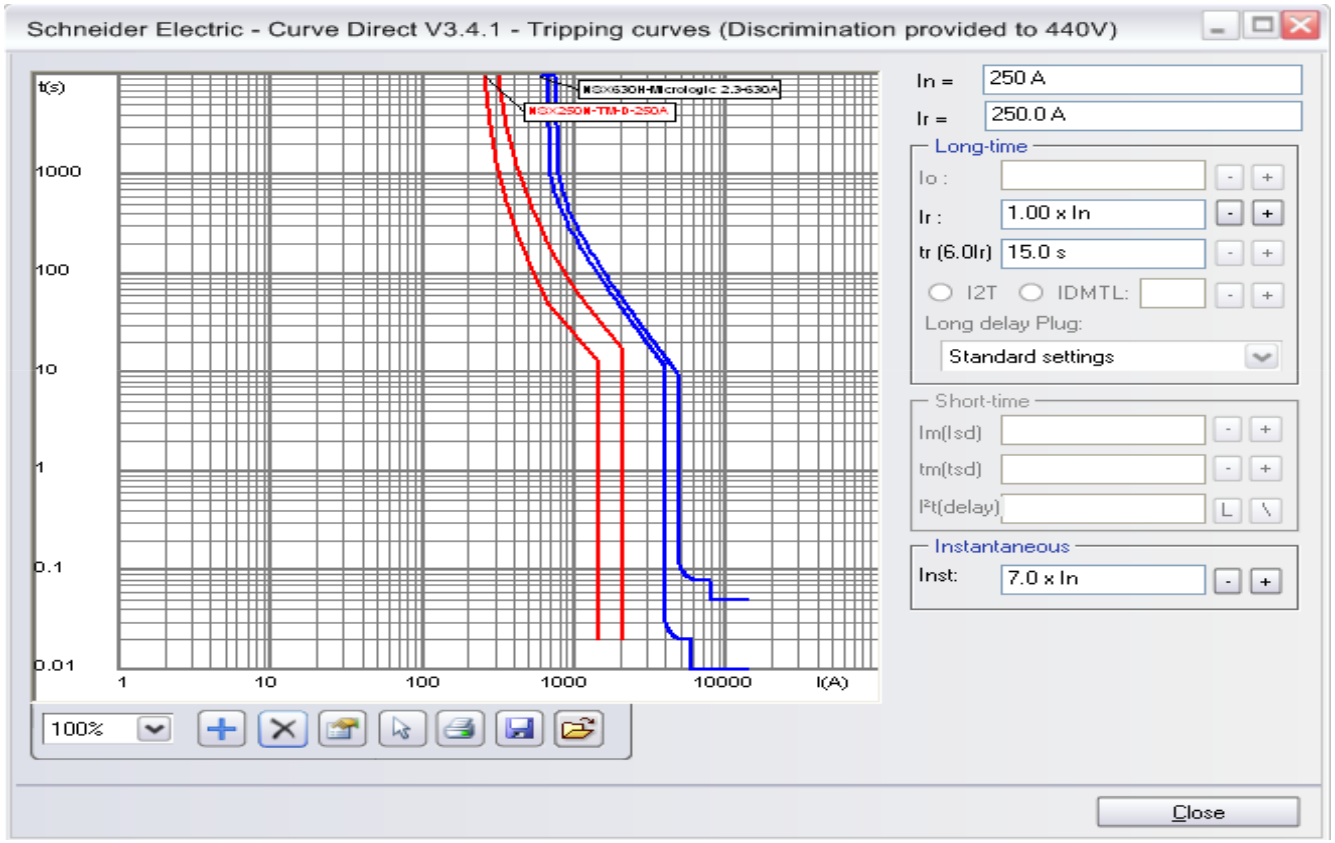


Figure A.2 Figure A.3

Total discrimination between two circuit-breakers

How to ensure good Discrimination?

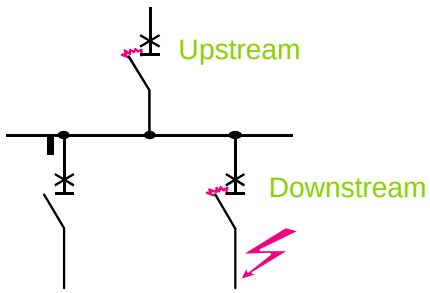


For **overloads and low level short-circuits**, it is possible to use software to plot characteristic curves

Ecodial / Curve Direct is the easiest and fastest choice

How to ensure good Discrimination?

Upstream Trip unit		Masterpact NW08/12/16/20 N1/H1/H2 Micrologic 2.0					
Downstream	Rating (A)	800		1000	1250	1600	2000
	Setting Ir	630	800	1000	1250	1600	2000
Discrimination limit (kA)							
Compact NS630b N/H Micrologic	250	6.3	8	10	12.5	16	20
	320	6.3	8	10	12.5	16	20
	400	6.3	8	10	12.5	16	20
	500		8	10	12.5	16	20
	630			10	12.5	16	20
Compact NS800 N/H Micrologic	320	6.3	8	10	12.5	16	20
	400	6.3	8	10	12.5	16	20
	500		8	10	12.5	16	20
	630			10	12.5	16	20
	800				12.5	16	20

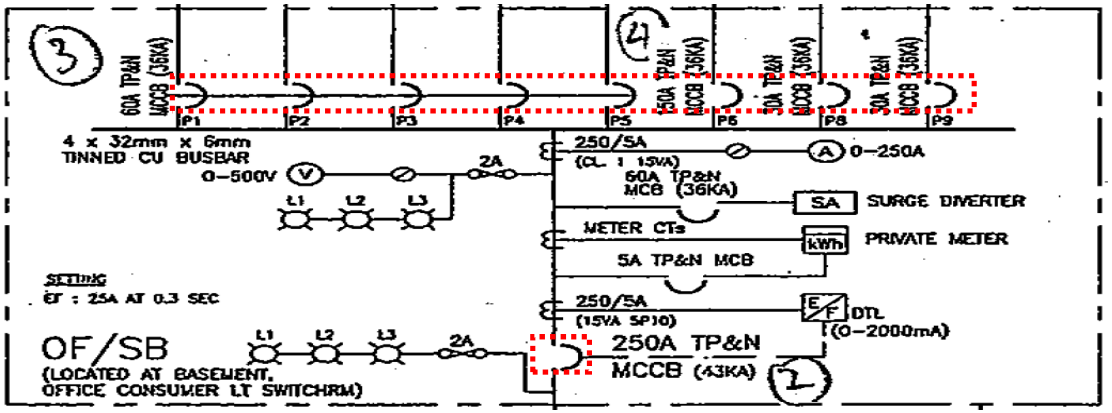


For **high short-circuits**, it is imperative to make reference to Discrimination Tables provided by the circuit breaker manufacturer.

Three levels :
i. No coordination
ii. Partial coordination
iii. Total coordination

How to ensure good Discrimination?

Upstream Trip unit		Compact NSX250B/F/N/H/S/L Micrologic		
Downstream	Rating (A) Setting	250 160	200	250
Discrimination limit (kA)				
Compact NSX100 B/F TM-D	16	T	T	T
	25	T	T	T
	32	T	T	T
	40	T	T	T
	50	T	T	T
	63	T	T	T
	80	T	T	T
	100	T	T	T
Compact NSX100 N/H/S/L TM-D	16	T	T	T
	25	T	T	T
	32	36	36	36
	40	36	36	36
	50	36	36	36
	63	36	36	36
	80	36	36	36
	100	36	36	36



For **high short-circuits**, it is imperative to make reference to Discrimination Tables provided by the circuit breaker manufacturer.

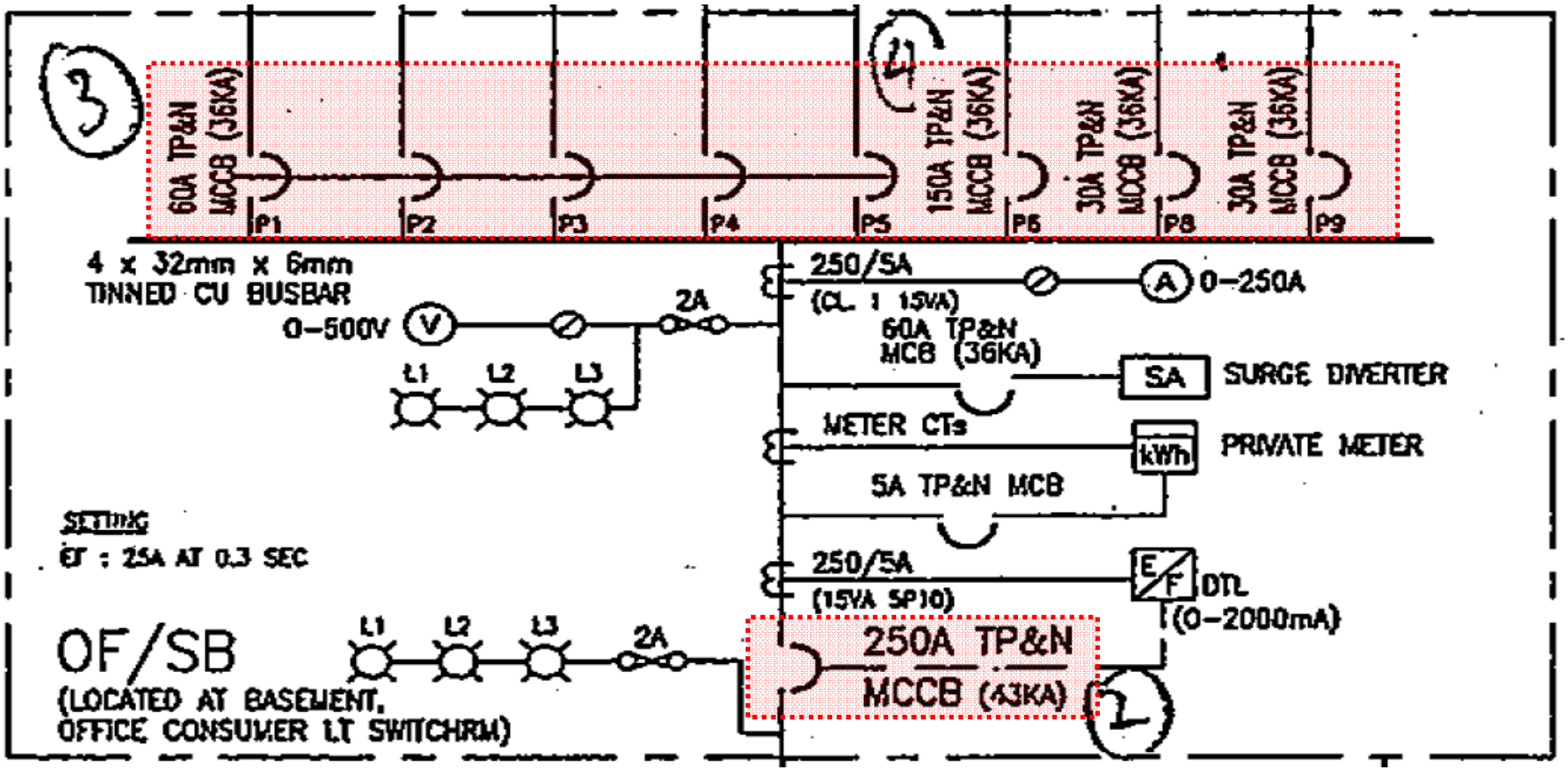
Three levels :

i. No coordination

ii. Partial coordination

iii. Total coordination

How to choose the right MCCB?



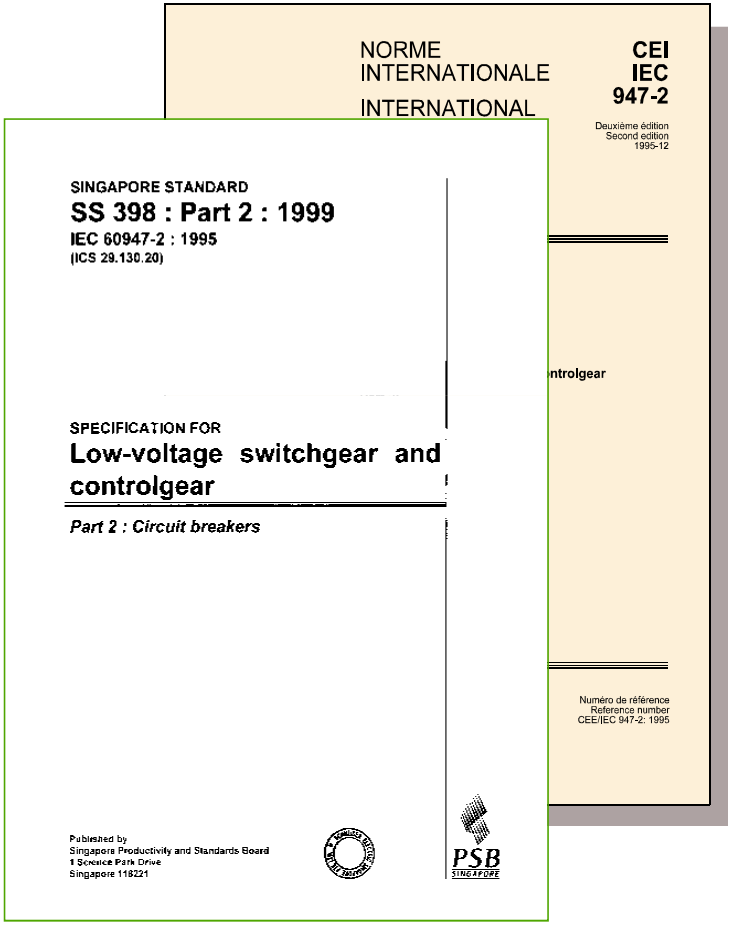
What is Cascading?

Cascading (also know as Back-up Protection or Series rating) is the use of the ***current limiting*** capability of circuit breakers at a given point to *permit* installation of lower- rated and therefore *lower cost breakers downstream*

It means:

1. Upstream breaker acts as a Barrier to block the short circuit current
2. This technique can only be checked by lab tests or curve comparison and possible combinations can be specified only by the circuit breaker manufacturer.

What is Cascading?



Recognition by Product Standards

The IEC 60947-2 and SS398 Pt 2 (Singapore Standard) on co-ordination of protective devices

Annex A

A.5 Verification of discrimination

Discrimination can normally be considered by desk study alone, i.e. by a comparison of the operating curves

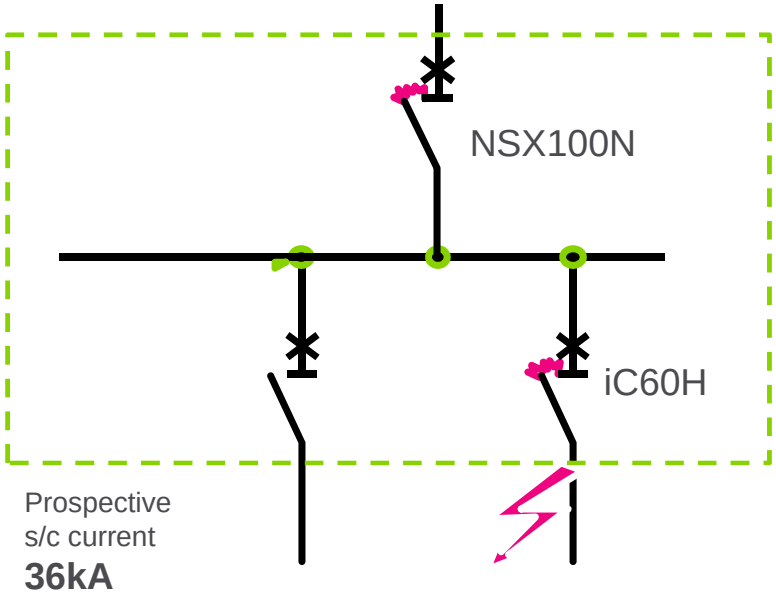
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A.6.2 Verification of back-up protection

a) Verification by tests

b) Verification by comparison of characteristics

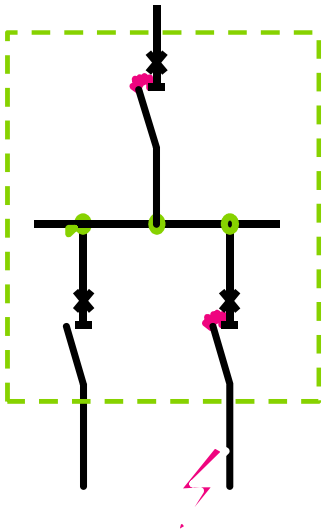
How to achieve Cascading?



Upstream	NSX100					
	NSX100B	NSX100F	NSX100N	NSX100H	NSX100S	NSX100L
Breaking capacity (kA)	25	36	50	70	100	150

Downstream								
	In Max (A)	Icu (kA)						
iC60N	63	10	20	25	30	30	30	30
iC60H	40	15	25	36	40	40	40	40
	63	15	25	36	36	36	36	36
iC60L	25	25		36	40	40	40	40
	40	20	25	36	40	40	40	40
	63	15	25	36	36	36	36	36

What is Cascading with Discrimination?

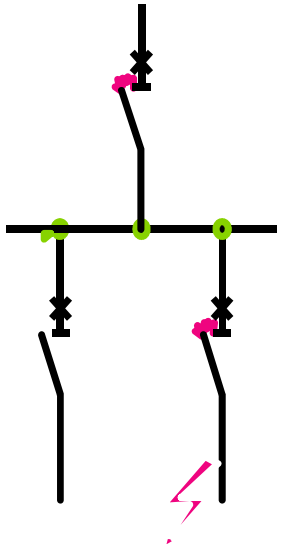


Selectivity limit enhanced by cascading (in kA) ← **30/30** → Downstream device breaking capacity enhanced by cascading (in kA)

Upstream		NSX100					
		NSX100B	NSX100F	NSX100N	NSX100H	NSX100S	NSX100L
Breaking capacity (kA)		25	36	50	70	100	150
Trip unit		Micrologic	Micrologic	Micrologic	Micrologic	Micrologic	Micrologic

Downstream														
Rating (A)			40	100	40	100	40	100	40	100	40	100	40	100
		Breaking capacity (kA)	Reinforced breaking capacity (kA)											
iC60N	⩽ 25 A	10	20/20	20/20	25/25	25/25	30/30	30/30	30/30	30/30	30/30	30/30	30/30	30/30
	32-40 A	10		20/20		25/25		30/30		30/30		30/30		30/30
	50-63 A	10												
iC60H	⩽ 25 A	15	25/25	25/25	36/36	36/36	40/40	40/40	40/40	40/40	40/40	40/40	40/40	40/40
	32-40 A	15		25/25		36/36		36/36		36/36		36/36		36/36
	50-63 A	15												
iC60L	⩽ 25 A	25			36/36	36/36	40/40	40/40	40/40	40/40	40/40	40/40	40/40	40/40
	32-40 A	20		25/25		36/36		40/40		40/40		40/40		40/40
	50-63 A	15												

Cascading is approved for use in CP5:1998



434-03-01

Except where the following paragraph applies, the ***breaking capacity rating of each device shall not be less than the prospective short-circuit current*** or earth fault current at the point at which the device is installed.

A ***lower breaking capacity is permitted*** if another protective device or devices having the necessary breaking capacity is installed in the **supply side**. In this case, the characteristics of the devices shall be ***co-ordinated*** so that the ***energy let-through*** of these devices does not exceed that which can be withstood, without damage, by the device or devices on the load side

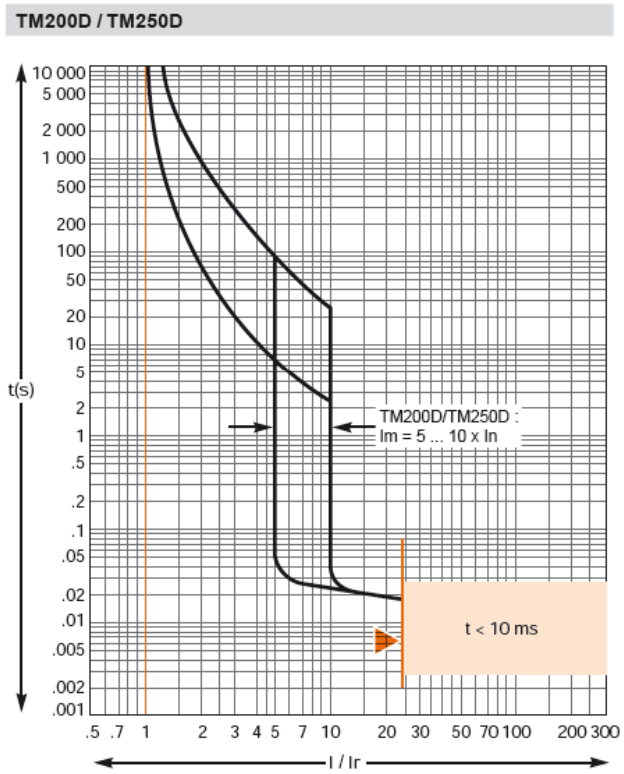
Benefits of Cascading

Cascading *with enhanced discrimination* provides….

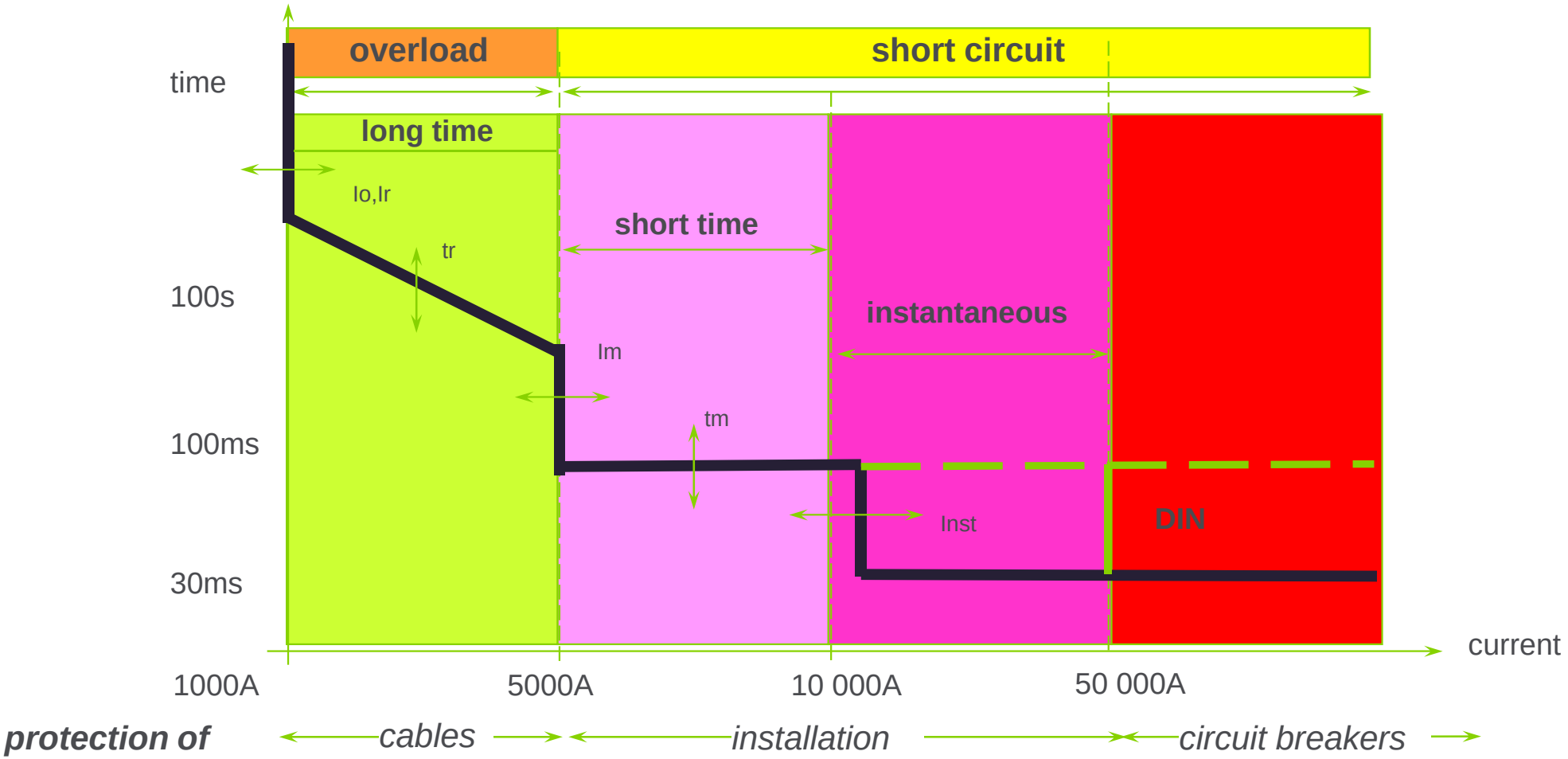
- Continuity of electrical energy supply +
- Cost saving of installation +
- Space saving

The coordination **must be tested** and therefore only works when all the products are from the **same manufacturer**

Circuit breaker trip unit characteristics

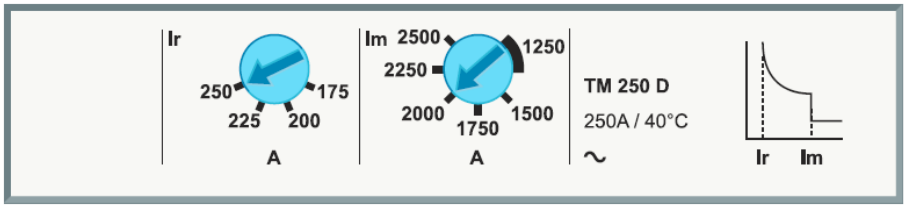


Typical trip curve



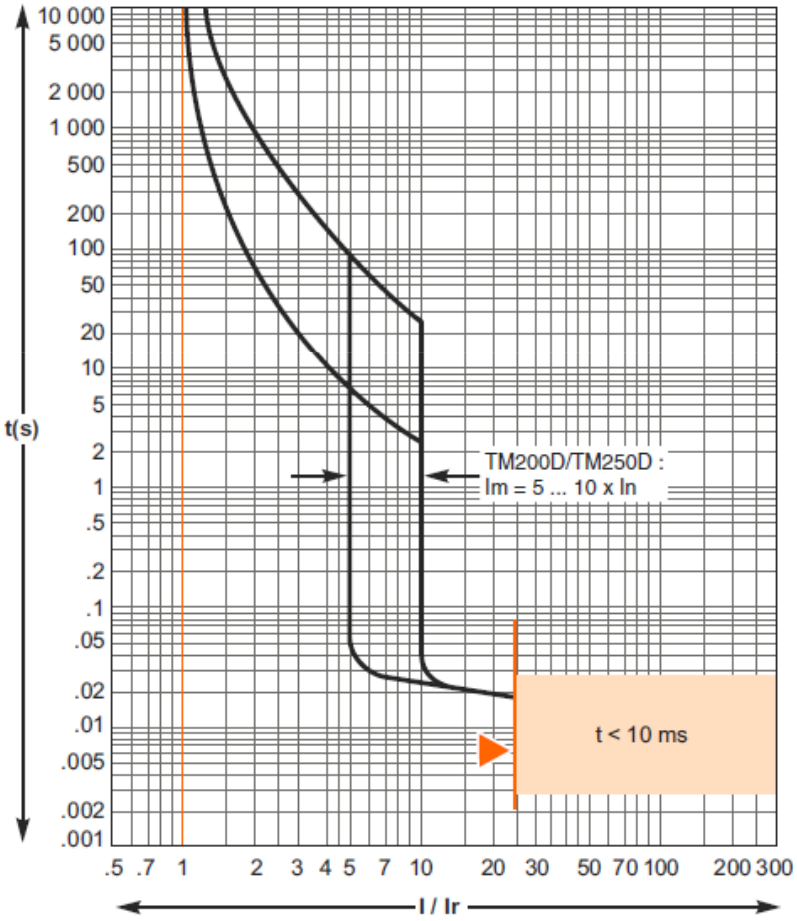
The Thermal-Magnetic trip unit

Thermal-magnetic trip units		TM16D to 250D											
Ratings (A)	**In at 40 °C** (1)	**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
Circuit breaker	Compact NSX100	■	■	■	■	■	■	■	■	-	-	-	-
	Compact NSX160	-	-	■	■	■	■	■	■	■	■	-	-
	Compact NSX250	-	-	-	-	-	■	■	■	■	■	■	■
Thermal protection													
Pick-up (A) tripping between 1.05 and 1.20 Ir	Ir = In x ...	adjustable in amps from 0.7 to 1 x In											
Time delay (s)	tr	non-adjustable											
	tr at 1.5 x In	120 to 400											
	tr at 6 x Ir	15											
Magnetic protection													
Pick-up (A)	Im	fixed											adjustable
accuracy ±20 %	Compact NSX100	190	300	400	500	500	500	640	800				
	Compact NSX160/250	190	300	400	500	500	500	640	800	1250	1250		5 to 10xIn
Time delay	tm	fixed											

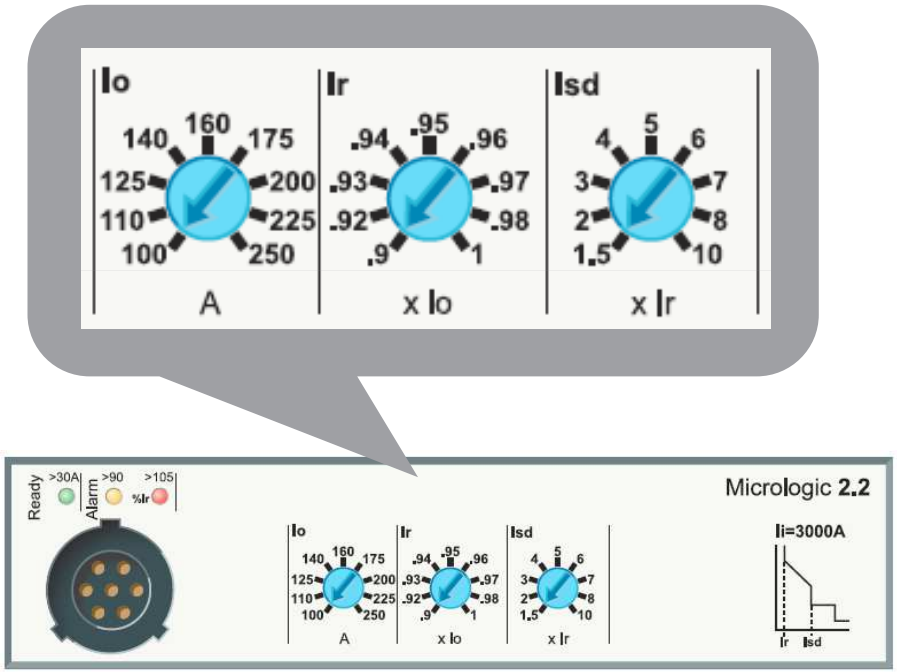


- Ir = Overload protection setting
- Im = Short-circuit protection setting

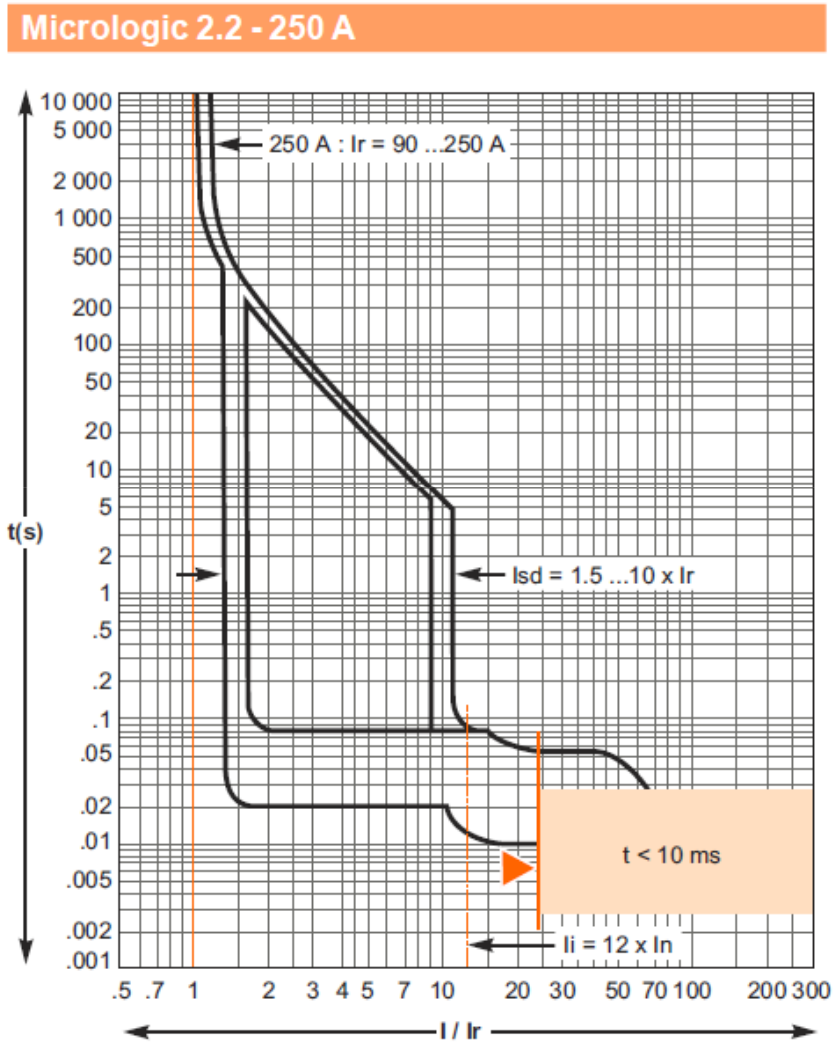
TM200D / TM250D



The Electronic trip unit

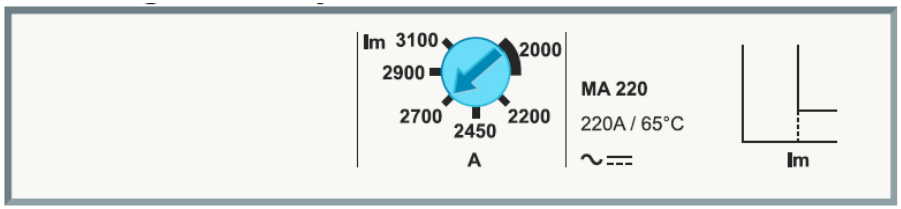


- Ir = Overload protection setting
- Isd = Short-circuit protection setting



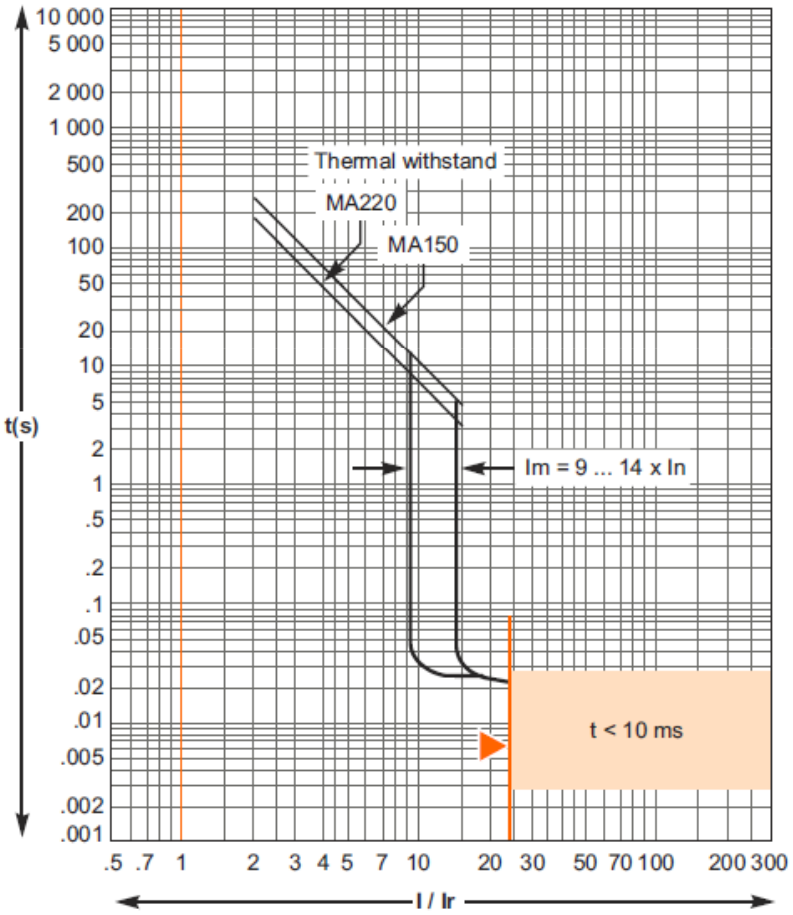
Motor Protection - Magnetic trip unit

Neutral protection									
Unprotected neutral	4P 3D	no detection							
Fully protected neutral	4P 4D	1 x Ir							
Magnetic trip units		**MA 2.5 to 220**							
Ratings (A)	**In at 65 °C**	**2.5**	**6.3**	**12.5**	**25**	**50**	**100**	**150**	**220**
Circuit breaker	Compact NSX100	■	■	■	■	■	■	-	-
	Compact NSX160	-	-	-	■	■	■	■	-
	Compact NSX250	-	-	-	-	-	■	■	■
Instantaneous magnetic protection									
Pick-up (A) accuracy ±20 %	Im = In x ...	adjustable in amps from 6 to 14 x In (9 settings)							
Time delay (ms)	tm	none							

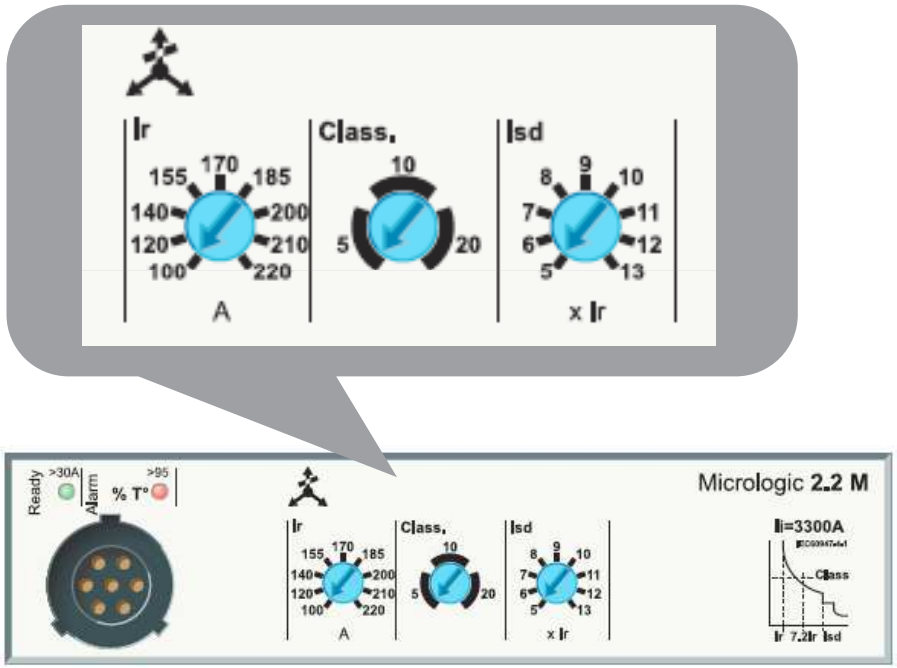


- Im = Short-circuit protection setting

MA150 and MA220

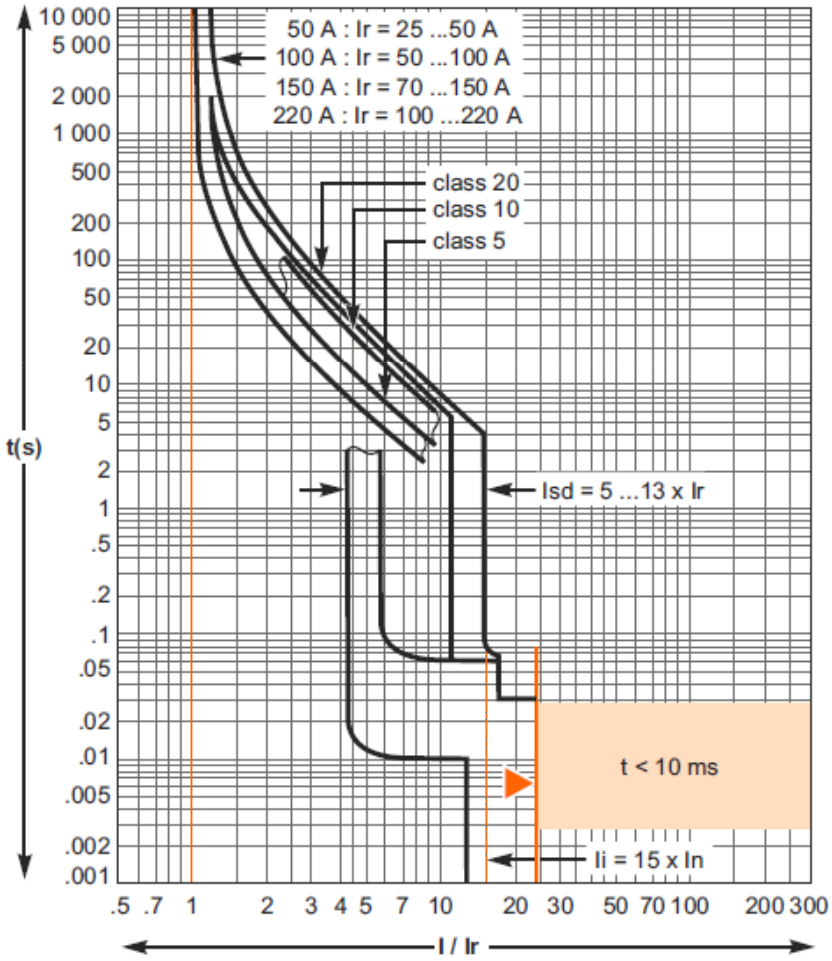


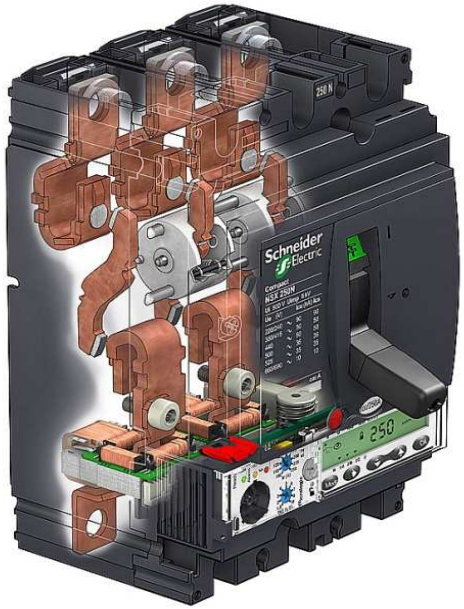
Motor protection - Electronic trip unit



- Ir = Overload protection setting
- Isd = Short-circuit protection setting

Micrologic 2.2 M - 50... 220 A





The New generation of circuit breakers

Schneider Electric

Air Circuit Breakers – Ratings 800A to 6300A

Masterpact NT/NW



- **High Power Air circuit breakers**
- **Two families, 3 physical sizes**
  - NT 630A - 1600A
  - NW 800A - 4000A, 4000A - 6300A
- **Interrupting capacity**
  - Ics = 100% Icu
  - 42kA to 150kA @ 440V
- **Configurations**
  - 3P or 4P
  - Fixed or Withdrawable
- **Equipped with *Micrologic***
  - Protection
  - Metering, Monitoring & Control

Masterpact NT/NW is a modular all-in-one ***Protection, Monitoring & Control***

The 630 to 6300A Masterpact range

- 2 families, 3 sizes

Masterpact NT 630 to 1600 A	Masterpact NW 800 to 4000 A	Masterpact NW 4000 to 6300 A
		

Masterpact NW – Ratings 800A to 6300A

Micrologic Trip Units

- 4 protection levels
  - > LI, LSI, LSIG, LSIV

- Combined with 4 measurement levels
  - > **Type A**: current
  - > **Type E**: A + voltage + power + energy
  - > **Type P**: E + frequency
  - > **Type H**: P + energy quality management (harmonics)

- Available functions
  - > Monitoring and protection
  - > Measure
  - > Network monitoring
  - > Maintenance assistance



Molded Case Circuit Breakers – Ratings 100A to 630A

Compact NSX

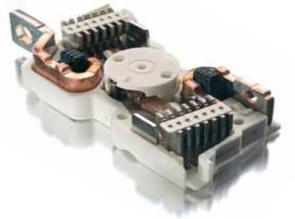


- **Available range in 2 physical frames**
  - Compact NSX
    - 100A/160A/250A
    - 400A/630A
- **Interrupting capacity**
  - Ics = Icu
  - 25kA to 150kA @ 415V
- **Configurations**
  - 3P or 4P
  - Fixed or Plug-in/Withdrawable
- **Equipped with TM or *Micrologic***
  - Protection
  - Metering, Monitoring & Control

Molded Case Circuit Breakers – Ratings 100A to 630A

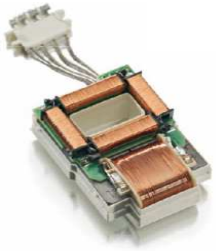
Compact NSX – the innovation

Double-rotor active contacts



High kA performance & ultra current limiting

Dual core current sensor

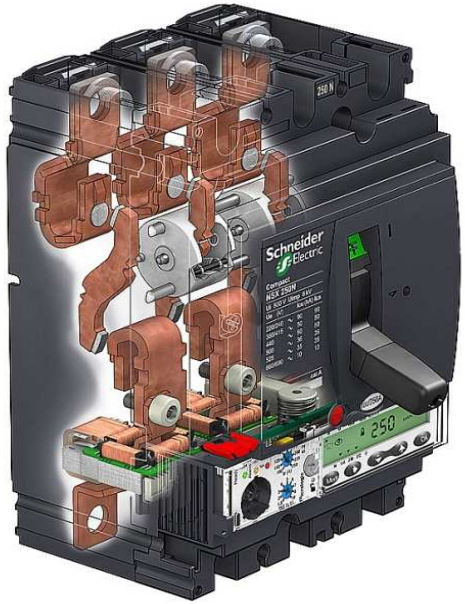


Self powering of trip units and high precision for measurement

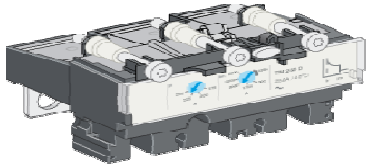
Active signaling



Watchdog and pre-alarms



Easy Upgrade



Modular design enables upgrade of performance at any time



Power Monitoring & Comm



Integration into an Energy Management or BMS system with ease

Compact NSX is the most advanced and innovative MCCB today

Advanced features



Micrologic 5 / 6 operating assistance functions			Type A	Type E
Operating assistance				
Personalised alarms				
Settings	Up to 10 alarms assigned to all A and E measurements [2]		■	■
	Phase lead/lag, four quadrants, phase sequence, display priority selection [2]		-	■
Display	Alarms / tripping		■	■
Remote indications	Activation of two dedicated contacts on SDx module		■	■
Time-stamped histories (ms)				
Trips (last 17)	Cause of tripping	Ir, Isd, Ii (Micrologic 5, 6)	■	■
		Ig (Micrologic 6)	■	■
		Phase fault	■	■
		Interrupted current value	■	■
Alarms (last 10)			■	■
Operating events (last 10)	Event types	Modification of protection setting by dial	-	■
		Opening of keypad lock	-	■
		Test via keypad	-	■
		Test via external tool	-	■
		Time setting (date and time)	-	■
		Reset for maximeter/minimeter and energy meter	■	■
Time stamping (date and time, text, status)			■	■
Time-stamped event tables				
Protection settings	Setting modified (value displayed)	Ir tr Isd tsd Ii Ig tg [2]	■	■
	Time-stamping	Date and time of modification [2]	■	■
	Previous value	Value before modification [2]	■	■
Min/Max	Values monitored	I1 I2 I3 IN	■	■
		U12 U23 U31 f	-	■
	Time-stamping of each value	Date and time of min/max record	■	■
	Current min/max value	Min/max value	■	■
Maintenance indicators				
Counter	Mechanical cycles [1]	Assignable to an alarm	■	■
	Electrical cycles [1]	Assignable to an alarm	■	■
	Trips	One per type of trip [2]	■	■
	Alarms	One for each type of alarm [2]	■	■
	Hours	Total operating time (hours) [2]	■	■
Indicator	Contact wear	%	■	■
Load profile	Hours at different load levels	% of hours in four current ranges: 0-49 % In, 50-79 % In, 80-89 % In and ≥ 90 % In	■	■

Miniature Circuit Breakers – Ratings 1A to 63A

Acti 9



- **An MCB with the BEST features**

VisiSafe VisiTrip

- **One comprehensive range**
  - B, C & D Curves
- **Interrupting capacity**
  - IEC60898 : 6kA & 10kA
  - IEC60947-2 : 10kA & 15kA
- **Configurations**
  - 1P, 2P, 3P or 4P
  - Fixed or Withdrawable (with accessories)

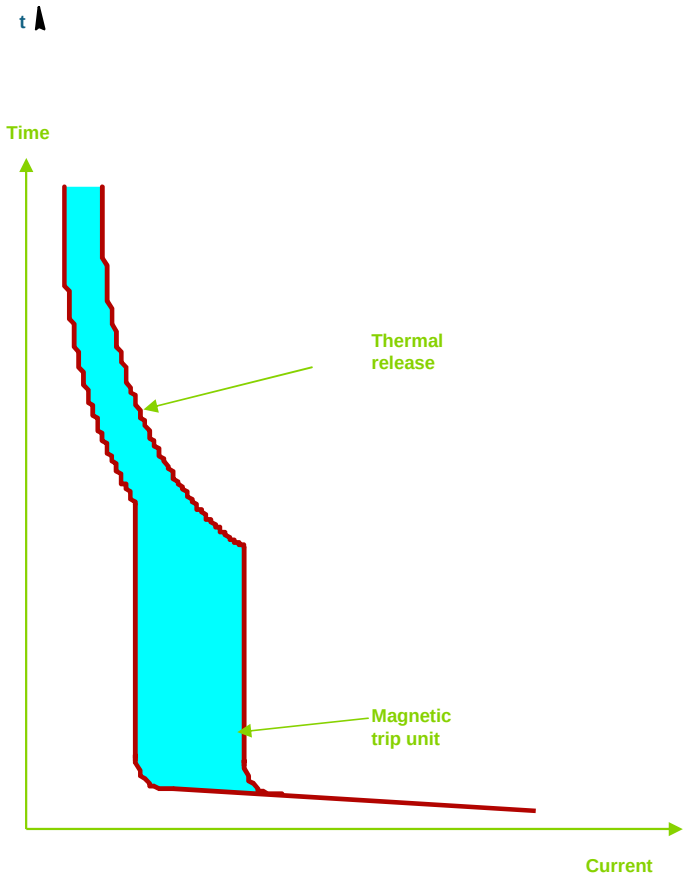
Acti 9 – the MCB with built-in “Trip” indication offered as standard

Acti 9 Complying with both IEC standards

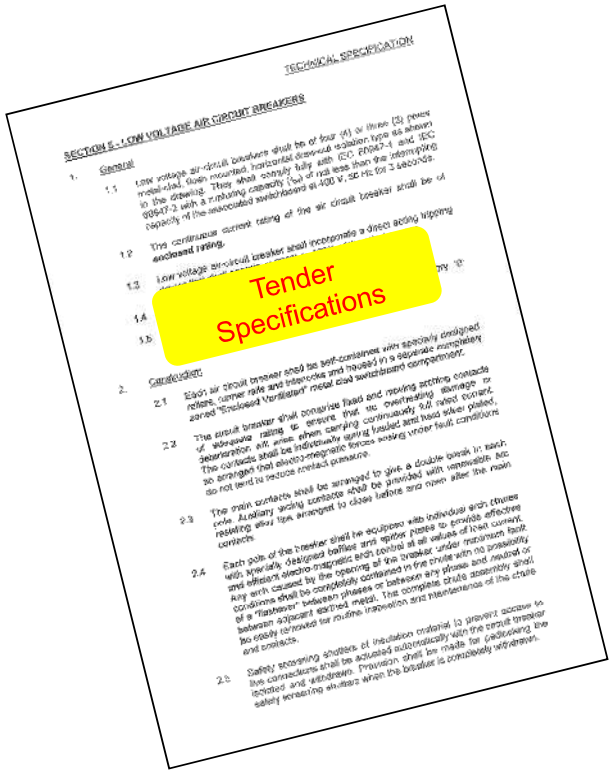


Alternating current (AC) 50/60 Hz						
Breaking capacity (Icu) according to IEC/EN 60947-2						Service breaking capacity (Ics)
		Voltage (Ue)				
Ph/Ph (2P, 3P, 4P)		12 to 133 V	220 to 240 V	380 to 415 V	440 V	
Ph/N (1P)		12 to 60 V	100 to 133 V	220 to 240 V	-	
Rating (In)	1 to 4 A	70 kA	70 kA	70 kA	50 kA	100 % of Icu
	6 to 40 A	42 kA	30 kA	15 kA	10 kA	50 % of Icu
	50/63 A	42 kA	-	15 kA	10 kA	50 % of Icu
Breaking capacity (Icn) according to IEC/EN 60898-1						
		Voltage (Ue)				
Ph/Ph		400 V				
Ph/N		230 V				
Rating (In)	1 to 63 A	10000 A				

Trip characteristics defined by IEC60898



- **B curve**
  - Tripping: 3 to 5 times the rated current (In);
  - circuit protection (lighting, power outlets) & general applications
  - protection of generators, persons, long cables; no current peaks
- **C curve**
  - Tripping: 5 to 10 In;
    circuit protection (lighting, power outlets)
    general applications
- **D curves**
  - Tripping: 10 to 14 In;
    protection of circuits with high current inrush;
    transformers, motors



Specification & Selection of circuit breakers

Schneider Electric

DATSUN 120Y

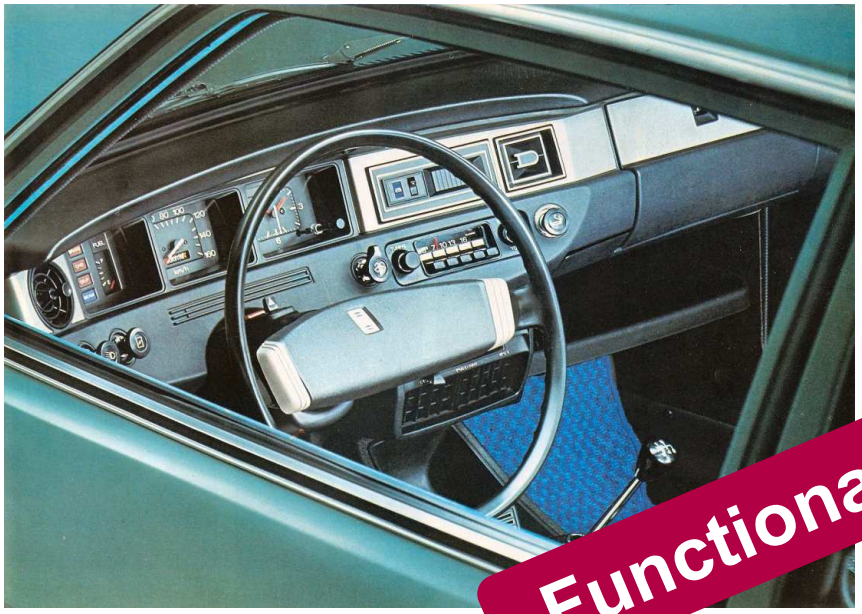




De Datsun 120Y
4-deurs Sedan

Gemaakt voor de snelle rijder, die ruimte nodig heeft. Die krijgt hij dan ook volop. Plaats genoeg voor vier personen en voldoende bagageruimte voor een verre reis. Van buiten mooi om te zien. Wij wijzen U op de lange motorkap en de dynamische korte achterkant. Ook van binnen is hij mooi. In het dashboard zijn allerlei nuttige accessoires gebouwd zoals: noodknipperlichtinstallatie, elektrische ruitensproeier, verstelbare zijventilatie-uitgangen, een controlelampje, dat waarschuwt bij een aangetrokken handrem, maar óók wanneer één van de beide hydraulische remcircuits eventueel defect zou raken.

Technical specifications & equipment level





Beroemde 4-cilinder, 1200 cc Nissan motor. In talloze rally's beproefd op betrouwbaarheid en uithoudingsvermogen.

Functional focused



IJzersterk stuurslot, houdt het stuur muurvast in zijn greep en voorkomt diefstal.



Toerenteller voor safe en sportief rijden (alleen bij coupé-uitvoering standaard)



Zeer efficiënt verwarmingssysteem waarvan zich de bediening onder handbereik bevindt.



Uitsparingen in het dashboard voor het monteren van radio en/of cassetterecorder.



Ruim en handig handschoenenkastje


PRIUS


TOYOTA

Technical specifications & equipment level

Comfort



HEADLAMPS
SLEEK IMPRESSION



FOG LAMPS
SPORTY IMAGE



DAYTIME RUNNING LIGHTS
IMPROVED VISIBILITY



ELECTRONIC SHIFT LEVER
CUTTING EDGE TECHNOLOGY



AUDIO SYSTEM WITH
BACK MONITOR
ACOUSTIC SOUND QUALITY



DRIVE MODES
CUSTOMISED DRIVING STYLE



SMART ENTRY & START
HASSLE-FREE EXPERIENCE



STEERING WHEEL CONTROLS
TOTAL CONTROL

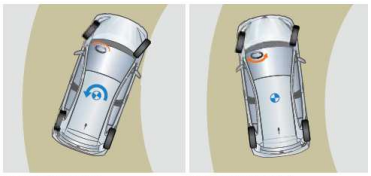


HEAD-UP DISPLAY
CONVENIENCE AT A GLANCE

Safety



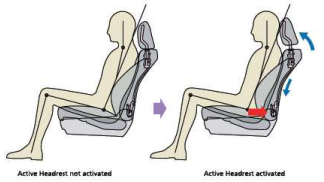
CRASH SAFETY BODY
UNPARALLELED PROTECTION



VEHICLE STABILITY CONTROL (VSC)
MAINTAINS STABILITY

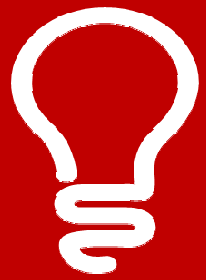


7 SRS AIRBAGS
360° PROTECTION

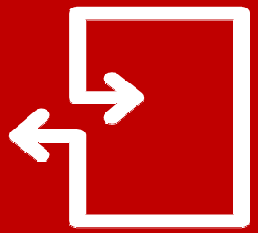


ACTIVE HEADREST
INTUITIVE SAFETY

The evolution in Low Voltage .....



Smart



Simple



Safe



Energy Efficient

Protection Devices are getting *smarter*



What?

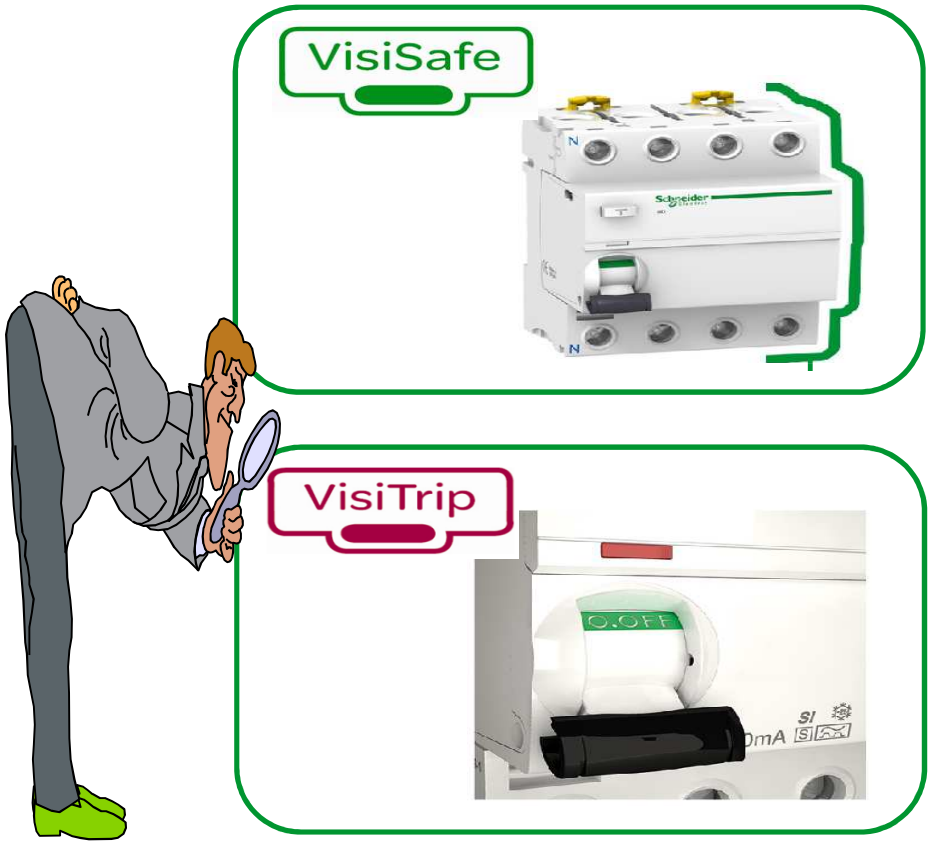
- Pre-trip over current alarm
- On-board memory
  - Trip history (fault diagnostics, date & time stamp)
  - Operating events

Key Benefits

- Prevents unwanted trips
- Enables faster fault tracing & isolation
- Lower downtime ➔ $$
- Maintenance information

Information is POWER

Protection Devices are getting *safer*



What's new?

- Takes the guessing out of Electrical Engineering
  - Clear contact status indication
  - Clear Fault Trip indication

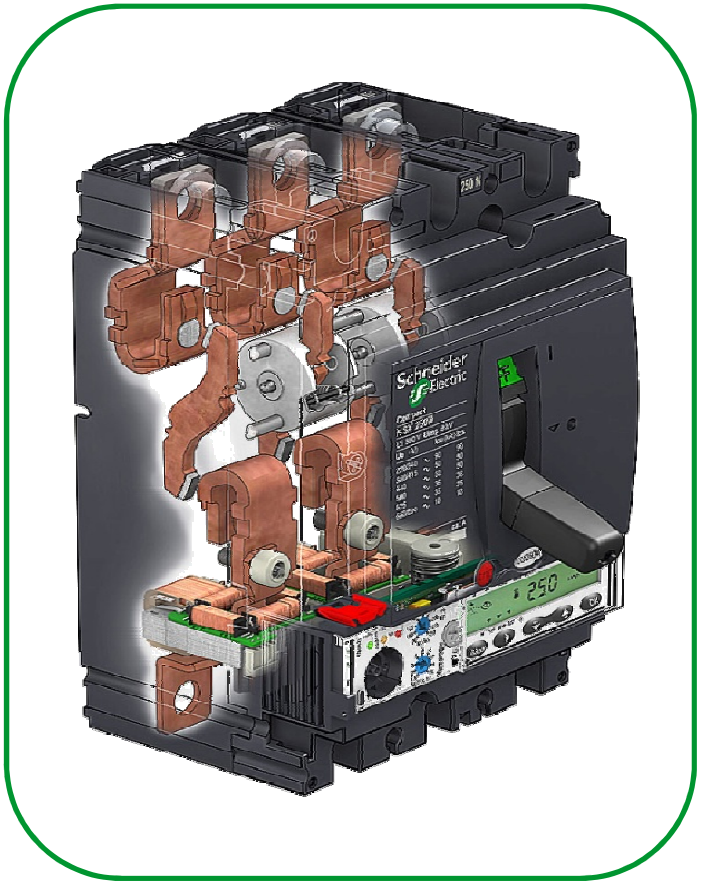
Key Benefits

- User safety
- Quick fault tracing

Not all MCBs are built equal

Hard Truth No. 2

Protection Devices are getting *safer*



What?

- Watchdog that ensures the continuous functionality of the protection module

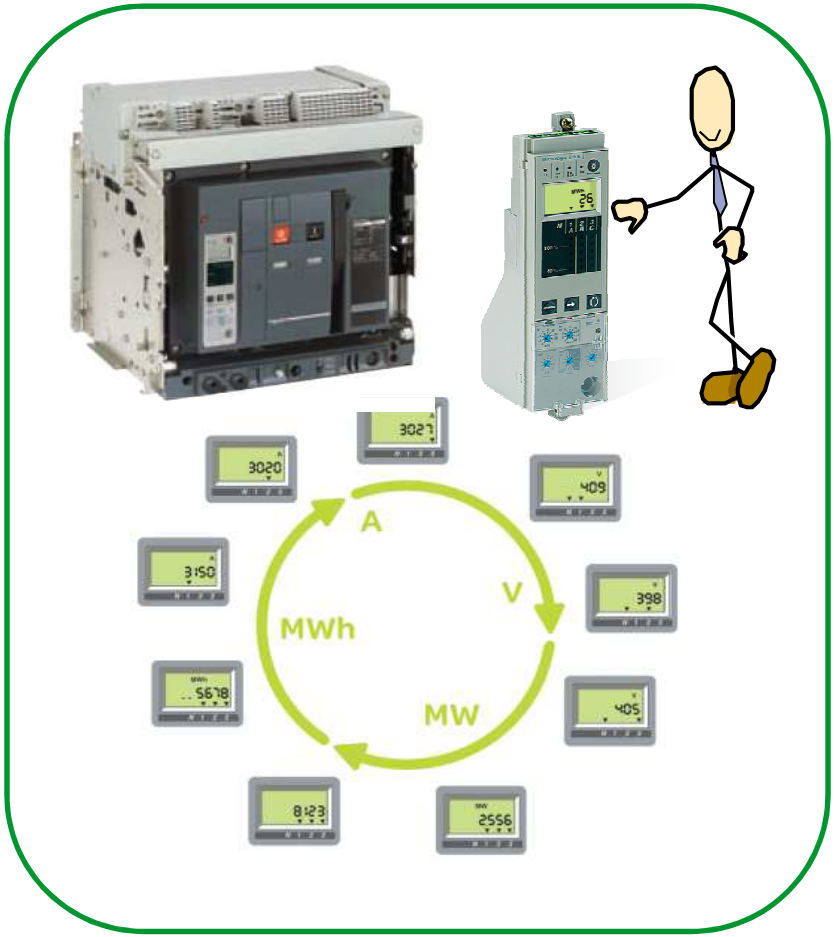
Key Benefits

- Eliminate risk of unpleasant incidents
- Information and ease of maintenance

Guarding the network 24/7

Hard Truth No. 3

Protection Devices are getting *simpler*



What?

- Protection adjustment settings by dials
- LCD display for information on operating parameters
- Auto-scroll, no touch

Key Benefits

- Ease of setting protection levels
- Ease of acquiring operating information

Less is MORE

Hard Truth No. 4

Protection Devices are *energy efficiency* tools



What?

- Circuit Breakers are now equipped with Power/Energy monitoring capabilities

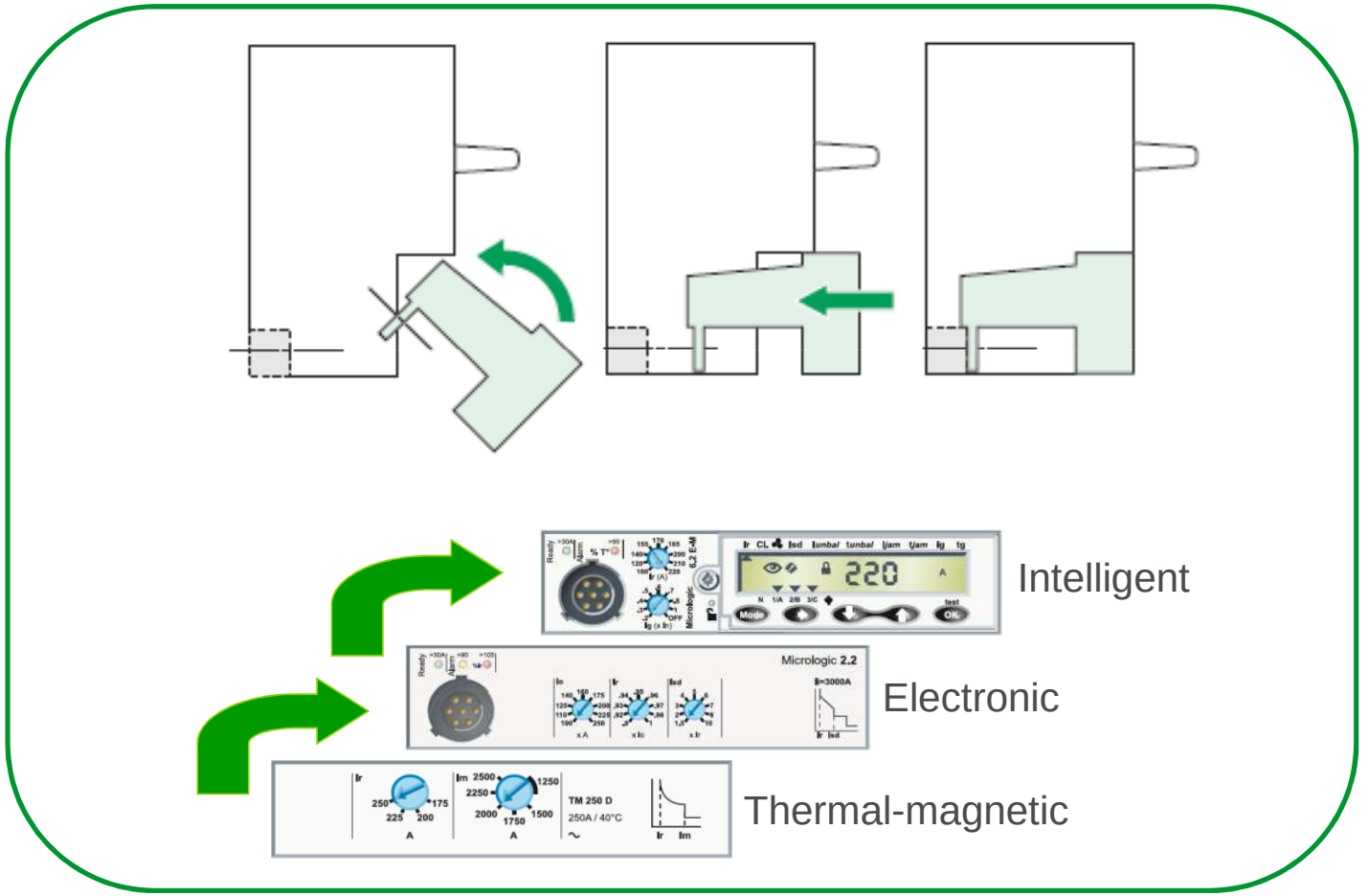
Key Benefits

- Manage Energy cost & be Green
- Fast installation & saves space
- Easy Upgrade
- No installation of CT needed

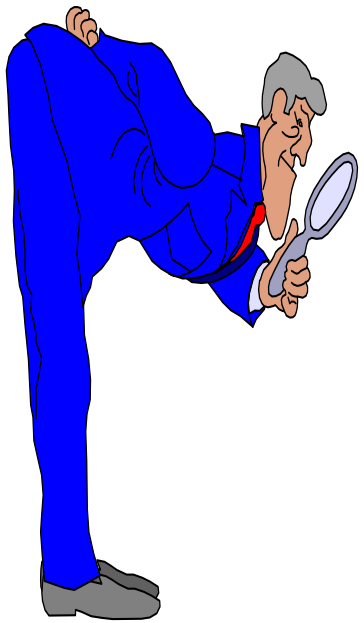
Manage Energy with ease

Hard Truth No. 4

Protection Devices are *energy efficiency* tools

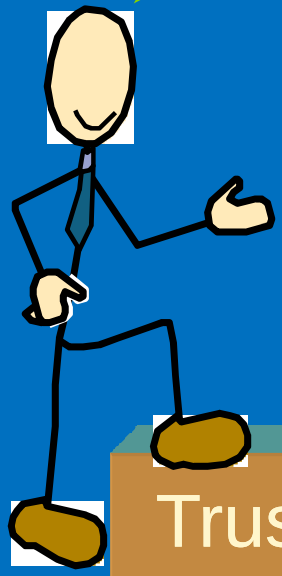


Ingredients for a robust specification …



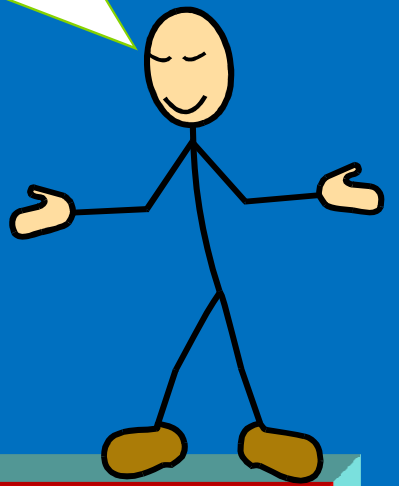
1. Does your specification make reference to the **latest IEC standards**?
2. Are the interrupting capacities of circuit breakers based on **Icu or Ics**?
3. Is **Total Discrimination/Selectivity** clearly mentioned?
4. Did the spec called for **interchangeable trip units** for easy upgrade?
5. Did you say visual **“TRIP” indication** for all the circuit breakers?
6. What about Measure – Connect – Save?

Mr Toa Pao, just follow my spec …… make sure you have **NO deviation**



Trusty Consulting Engineers

Mr. Consultant,
Don’t worry, I give you the BEST circuit breakers…. Sure follow the kA in your spec



Pian Jiak M&E Contractor



Thank you!

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