Introduction

Characteristics and performance of Compact NSX circuit breakers from 100 to 630 A

Compact NSX100/160/250.

Compact NSX400/630.

(1) OSN: Over Sized Neutral protection for neutrals carrying high currents (e.g. 3rd harmonics).
(2) ZSI: Zone Selective Interlocking using pilot wires.
(3) 2P circuit breaker in 3P case for B and F types, only with thermal-magnetic trip unit.

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

Breaking capacity levels																																				
Electrical characteristics as per IEC 60947-2																																				
Rated current (A)	**In**	40 °C																																		
Number of poles																																				
Breaking capacity (kA rms)																																				
	Icu	AC 50/60 Hz	220/240 V	40	85	90	100	120	150	40	85	90	100	120	150	40	85	90	100	120	150	40	85	100	120	150	40	85	100	120	150
			380/415 V	25	36	50	70	100	150	25	36	50	70	100	150	25	36	50	70	100	150	36	50	70	100	150	36	50	70	100	150
			440 V	20	35	50	65	90	130	20	35	50	65	90	130	20	35	50	65	90	130	30	42	65	90	130	30	42	65	90	130
			500 V	15	25	36	50	65	70	15	30	36	50	65	70	15	30	36	50	65	70	25	30	50	65	70	25	30	50	65	70
			525 V	-	22	35	35	40	50	-	22	35	35	40	50	-	22	35	35	40	50	20	22	35	40	50	20	22	35	40	50
			660/690 V	-	8	10	10	15	20	-	8	10	10	15	20	-	8	10	10	15	20	10	10	20	25	35	10	10	20	25	35
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	40	85	90	100	120	150	40	85	100	120	150	40	85	100	120	150
			380/415 V	25	36	50	70	100	150	25	36	50	70	100	150	25	36	50	70	100	150	36	50	70	100	150	36	50	70	100	150
			440 V	20	35	50	65	90	130	20	35	50	65	90	130	20	35	50	65	90	130	30	42	65	90	130	30	42	65	90	130
			500 V	7.5	12.5	36	50	65	70	15	30	36	50	65	70	15	30	36	50	65	70	25	30	50	65	70	25	30	50	65	70
			525 V	-	11	35	35	40	50	-	22	35	35	40	50	-	22	35	35	40	50	10	11	11	12	12	10	11	11	12	12
			660/690 V	-	4	10	10	15	20	-	8	10	10	15	20	-	8	10	10	15	20	10	10	10	12	12	10	10	10	12	12
Durability (C-O cycles)		Mechanical		50000						40000						20000						15000					15000				
		Electrical	440 V	In/2	50000					40000						20000						12000					8000				
				In	30000					20000						10000						6000					4000				
			690 V	In/2	20000					15000						10000						6000					6000				
				In	10000					7500						5000						3000					2000				
Characteristics as per Nema AB1																																				
Breaking capacity (kA rms)		AC 50/60 Hz	240 V	40	85	90	100	120	150	40	85	90	100	120	150	40	85	90	100	120	150	40	85	100	120	150	40	85	100	120	150
			480 V	20	35	50	65	90	130	20	35	50	65	90	130	20	35	50	65	90	130	30	42	65	90	130	30	42	65	90	130
			600 V	-	8	20	35	40	50	-	20	20	35	40	50	-	20	20	35	40	50	-	20	35	40	50	-	20	35	40	50
Characteristics as per UL 508																																				
Breaking capacity (kA rms)		AC 50/60 Hz	240 V	-	85	85	-	-		-	85	85	85	-	-	-	85	85	85	-	-		85	85	85	-	-	85	85	85	-	-
			480 V	-	25	50	65	-	-	-	35	50	65	-	-	-	35	50	65	-	-		35	50	65	-	-	35	50	65	-	-
			600 V	-	10	10	10	-	-	-	10	10	10	-	-	-	15	15	15	-	-		20	20	20	-	-	20	20	20	-	-
Protection and measurements																																				
Short-circuit protection	Magnetic only			■						■						■						■					■				
Overload / short-circuit protection	Thermal magnetic			■						■						■						-					-				
	Electronic			■						■						■						■					■				
		with neutral protection (Off-0.5-1-OSN) (1)		■						■						■						■					■				
		with ground-fault protection		■						■						■						■					■				
		with zone selective interlocking (ZSI) (2)		■						■						■						■					■				
Display / I, U, f, P, E, THD measurements / interrupted-current measurement				■						■						■						■					■				
Options	Power Meter display on door			■						■						■						■					■				
	Operating assistance			■						■						■						■					■				
	Counters			■						■						■						■					■				
	Histories and alarms			■						■						■						■					■				
	Metering Com			■						■						■						■					■				
	Device status/control Com			■						■						■						■					■				
Earth-leakage protection	By Vigi module			■						■						■						■					■				
	By Vigirex relay			■						■						■						■					■				
Installation / connections																																				
Dimensions and weights																																				
Dimensions (mm) W x H x D	Fixed, front connections		3/3P	105 x 161 x 86						105 x 161 x 86						105 x 161 x 86						140 x 255 x 110					140 x 255 x 110				
			4P	140 x 161 x 86						140 x 161 x 86						140 x 161 x 86						185 x 255 x 110					185 x 255 x 110				
Weight (kg)	Fixed, front connections		3/3P	2.05						2.2						2.4						6.05					6.2				
			4P	2.4						2.6						2.8						7.90					8.13				
Connections																																				
Connection terminals	Pitch		With/without spreaders	35/45 mm						35/45 mm						35/45 mm						45/52.5 mm 45/70 mm					45/52.5 mm 45/70 mm				
Large Cu or Al cables	Cross-section		mm²	300						300						300						4 x 240					4 x 240				

Common characteristics

Control			
	Manual	With toggle	■
		With direct or extended rotary handle	■
	Electrical	With remote control	■
Versions			
	Fixed		■
	Withdrawable	Plug-in base	■
		Chassis	■

Protection of distribution systems

Compact NS circuit breakers from 630b up to 3200 A

Compact NS800L.

Compact NS2000H.

Compact circuit breakers					NS630b		NS800		NS1000			NS1250		NS1600		NS1600b		NS2000	NS2500	NS3200
Number of poles					3, 4				3, 4			3, 4		3, 4		3, 4				
Control	manual		toggle		■				■			■		■		■				
			direct or extended rotary handle		■				■			■		■		-				
	electric				■ (except LB)				■			■		■		-				
Type of circuit breaker					**N**	**H**	**L**	**LB**	**N**	**H**	**L**	**N**	**H**	**N**	**H**	**N**	**H**			
Connections	fixed		front connection		■	■	■	-	■	■	■	■	■	■	■	■	■			
			rear connection		■	■	■	■	■	■	■	■	■	■	■	-	-			
			front connection with bare cables		■	■	-	-	■	■	-	■	■	-	-	-	-			
	withdrawable (on chassis)		front connection		■	■	■	■	■	■	■	■	■	■	■	-	-			
			rear connection		■	■	■	■	■	■	■	■	■	■	■	-	-			
Electrical characteristics as per Nema AB1					**N**	**H**	**L**	**LB**	**N**	**H**	**L**	**N**	**H**	**N**	**H**	**N**	**H**			
Breaking capacity at 60 Hz (kA)				240 V	50	65	125	200	50	65	125	50	65	50	65	85	125			
				480 V	35	50	100	200	35	50	100	35	50	35	50	65	85			
				600 V	25	50	-	100	25	50	-	25	50	25	50	50	-			
Electrical characteristics as per IEC 60947-2 and EN 60947-2																				
Rated current (A)		**In**	50 °C		630		800		1000			1250		1600		1600		2000	2500	3200
			65 °C (1)		630		800		1000			1250		1510		1550		1900	2500	2970
Rated insulation voltage (V)		**Ui**			800				800			800		800		800				
Rated impulse withstand voltage (kV)		**Uimp**			8				8			8		8		8				
Rated operational voltage (V)		**Ue**	AC 50/60 Hz		690				690			690		690		690				
Type of circuit breaker					**N**	**H**	**L**	**LB**	**N**	**H**	**L**	**N**	**H**	**N**	**H**	**N**	**H**			
Ultimate breaking capacity (kA rms)	**Manual**	**Icu**	AC 50/60 Hz	220/240 V	85	85	150	200	85	85	150	85	85	85	85	85	125			
				380/415 V	50	70	150	200	50	70	150	50	70	50	70	70	85			
				440 V	50	65	130	200	50	65	130	50	65	50	65	65	85			
				500/525 V	40	50	100	100	40	50	100	40	50	40	50	65	-			
				660/690 V	30	42	-	75	30	42	-	30	42	30	42	65	-			
		Ics	AC 50/60 Hz	220/240 V	50	52	150	200	50	52	150	50	52	37	37	65	94			
				380/415 V	50	52	150	200	50	52	150	50	52	37	37	52	64			
				440 V	50	48	130	200	50	48	130	50	48	25	32	65	64			
				500/525 V	40	37	100	100	40	37	100	40	37	20	25	65	-			
				660/690 V	30	31	-	75	30	31	-	30	31	15	21	65	-			
	Electrical	**Icu**	AC 50/60 Hz	220/240 V	50	70	150	-	50	70	150	50	70	50	70	-				
				380/415 V	50	70	150	-	50	70	150	50	70	50	70					
				440 V	50	65	130	-	50	65	130	50	65	50	65					
				500/525 V	40	50	100	-	40	50	100	40	50	40	50					
				660/690 V	30	42	-	-	30	42	-	30	42	30	42					
		Ics	AC 50/60 Hz	220/240 V	37	35	150	-	37	35	150	37	35	37	35	-				
				380/415 V	37	35	150	-	37	35	150	37	35	37	35					
				440 V	37	32	130	-	37	32	130	37	32	37	32					
				500/525 V	30	25	100	-	30	25	100	30	25	30	25					
				660/690 V	22	21	-	-	22	21	-	22	21	22	21					
Short-time withstand current (kA rms)		**Icw**	AC 50/60 Hz	1 s	19.2	19.2	-	-	19.2	19.2	-	19.2	19.2	19.2	19.2	-				
				3 s	-	-	-	-	-	-	-	-	-	-	-	32				
Integrated instantaneous protection			kA peak ±10 %		40	40	-	-	40	40	-	40	40	40	40	130				
Suitability for isolation					■				■			■		■		■				
Utilisation category					B	B	A	A	B	B	A	B	B	B	B	B				
Durability (C-O cycles)	mechanical				10000				10000			10000		10000		5000				
	electrical		440 V	In/2	6000	6000	4000	4000	6000	6000	4000	5000		5000		3000				
				In	5000	5000	3000	3000	5000	5000	3000	4000		2000		2000				
			690 V	In/2	4000	4000	3000	3000	4000	4000	3000	3000		2000		2000				
				In	2000	2000	2000	2000	2000	2000	2000	2000		1000		1000				
Pollution degree					3				3			3		3		3				

(1) 65 °C with vertical connections. See the temperature derating tables for other types of connections.
(2) Ics: 100 % Icu for breaking capacity 440V/500V/660V
Ics: 75 % Icu for breaking capacity 220V/380V.

Protection of distribution systems

TM thermal-magnetic and MA magnetic trip units

TM thermal-magnetic and MA magnetic trip units can be used on Compact NSX100/160/250 circuit breakers with performance levels B/F/H/N/S/L.
TM trip units are available in 2 versions:
■ TM-D, for the protection of distribution cables
■ TM-G, with a low threshold, for the protection of generators or long cable lengths.
Vigi modules or Vigirex relays can be added to all the circuit breakers to provide external earth-leakage protection.

TM-D and TM-G thermal-magnetic trip units

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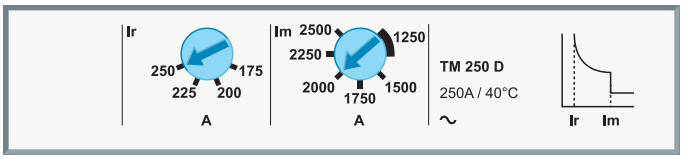

Circuit breakers equipped with thermal-magnetic trip units are used mainly in industrial and commercial electrical distribution applications:
■ TM-D, for protection of cables on distribution systems supplied by transformers
■ TM-G, with a low pick-up for generators (lower short-circuit currents than with transformers) and distribution systems with long cable lengths (fault currents limited by the impedance of the cable).

Protection

Thermal protection (Ir)
Thermal overload protection based on a bimetal strip providing an inverse time curve I^2t, corresponding to a temperature rise limit. Above this limit, the deformation of the strip trips the circuit breaker operating mechanism.
This protection operates according to:
■ **Ir** that can be adjusted in amps from 0.7 to 1 times the rating of the trip unit (16 A to 250 A), corresponding to settings from 11 to 250 A for the range of trip units
■ a non-adjustable time delay, defined to ensure protection of the cables.

Magnetic protection (Im)
Short-circuit protection with a fixed or adjustable pick-up Im that initiates instantaneous tripping if exceeded.
■ TM-D: fixed pick-up, Im, for 16 to 160 A ratings and adjustable from 5 to 10 x In for 200 and 250 A ratings
■ fixed pick-up for 16 to 63 A ratings.

Protection against insulation faults
Two solutions are possible by adding:
■ a Vigi module acting directly on the trip unit of the circuit breaker
■ a Vigirex relay connected to an MN or MX voltage release.

Protection versions
■ 3-pole:
□ 3P 3D: 3-pole frame (3P) with detection on all 3 poles (3D)
□ 3P 2D: 3-pole frame (3P) with detection on 2 poles (2D).
■ 4-pole:
□ 4P 3D: 4-pole frame (4P) with detection on 3 poles (3D).
□ 4P 4D: 4-pole frame (4P) with detection on all 4 poles (same threshold for phases and neutral).

MA magnetic trip units

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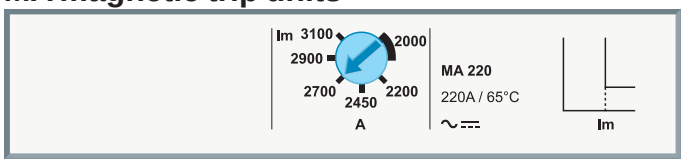


In distribution applications, circuit breakers equipped with MA magnetic-only trip units are used for:
■ short-circuit protection of secondary windings of LV/LV transformers with overload protection on the primary side.
■ as an alternative to a switch-disconnector at the head of a switchboard in order to provide short-circuit protection.
Their main use is however for motor protection applications, in conjunction with a thermal relay and a contactor or motor starter (see "Motor protection", page A-34).

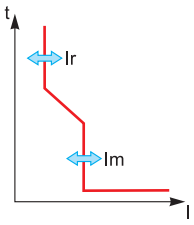
Protection

Magnetic protection (Im)
Short-circuit protection with an adjustable pick-up Im that initiates instantaneous tripping if exceeded.
■ **Im = In x ...** set in amps on an adjustment dial covering the range 6 to 14 x In for 2.5 to 100 A ratings or 9 to 14 In for 150 to 220 A ratings.

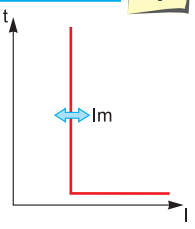
Protection versions
■ 3-pole (3P 3D): 3-pole frame (3P) with detection on all 3 poles (3D).
■ 4-pole (4P 3D): 4-pole frame (4P) with detection on 3 poles (3D).

Note: All the trip units have a transparent lead-sealable cover that protects access to the adjustment dials.

Thermal-magnetic trip units		TM16D to 250D												TM16G to 63G			
Ratings (A)	**In at 40 °C** (1)	**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**16**	**25**	**40**	**63**
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												non-adjustable			
	tr at 1.5 x In	120 to 400												120 to 400			
	tr at 6 x Ir	15												-			
Magnetic protection																	
Pick-up (A)	**Im**	fixed										adjustable		fixed			
accuracy ±20 %	Compact NSX100	190	300	400	500	500	500	640	800					63	80	80	125
	Compact NSX160/250	190	300	400	500	500	500	640	800	1250	1250	5 to 10xIn		63	80	80	125
Time delay	**tm**	fixed															
Neutral protection																	
Unprotected neutral	4P 3D	no detection												no 4P3D version			
Fully protected neutral	4P 4D	1 x Ir												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)						adjustable in amps from 9 to 14 x In	
Time delay (ms)	**tm**	none							



(1) For temperatures greater than 40 °C, the thermal protection characteristics are modified. See the temperature derating table.

Protection of distribution systems
Micrologic 2 and 1.3 M trip units

Micrologic 2 trip units can be used on Compact NSX100 to 630 circuit breakers with performance levels B/F/H/N/S/L.
They provide:
■ standard protection of distribution cables
■ indication of:
□ overloads (via LEDs)
□ overload tripping (via the SDx relay module).
Circuit breakers equipped with Micrologic 1.3 M trip units, without thermal protection, are used in certain applications to replace switch-disconnectors at the head of switchboards. Micrologic 1.3 M trip units are dedicated to Compact NSX400/630 A circuit breakers.

Micrologic 2

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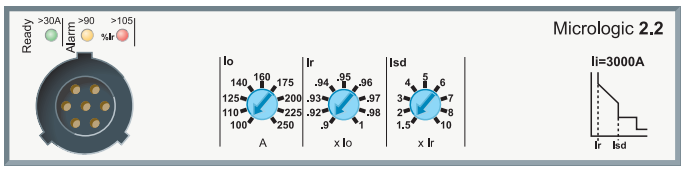

Circuit breakers equipped with Micrologic 2 trip units can be used to protect distribution systems supplied by transformers. For generators and long cables, Micrologic 2 G trip units offer better suited low pick-up solutions (see page A-48).

Protection

Settings are made using the adjustment dials with fine adjustment possibilities.

Overloads: Long time protection (Ir)
Inverse time protection against overloads with an adjustable current pick-up Ir set using a dial and a non-adjustable time delay tr.

Short-circuits: Short-time protection with fixed time delay (Isd)
Protection with an adjustable pick-up Isd. Tripping takes place after a very short delay used to allow discrimination with the downstream device.

Short-circuits: Non-adjustable instantaneous protection
Instantaneous short-circuit protection with a fixed pick-up.

Neutral protection
■ On 3-pole circuit breakers, neutral protection is not possible.
■ On four-pole circuit breakers, neutral protection may be set using a three-position switch:
□ 4P 3D: neutral unprotected
□ 4P 3D + N/2: neutral protection at half the value of the phase pick-up, i.e. 0.5 x Ir
□ 4P 4D: neutral fully protected at Ir.

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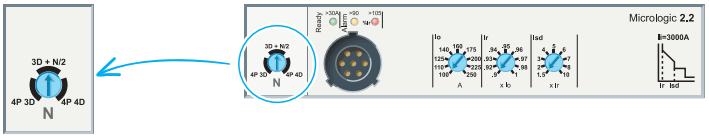

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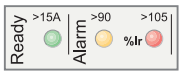
SDx remote indication relay module with its terminal block.

Indications

Front indications
■ Green “Ready” LED: flashes slowly when the circuit breaker is ready to trip in the event of a fault.
■ Orange overload pre-alarm LED: steady on when I > 90 % Ir.
■ Red overload LED: steady on when I > 105 % Ir.



Remote indications
An overload trip signal can be remoted by installing an SDx relay module inside the circuit breaker.
This module receives the signal from the Micrologic electronic trip unit via an optical link and makes it available on the terminal block. The signal is cleared when the circuit breaker is reclosed. For description, see page A-77.

Micrologic 1.3 M for magnetic protection only

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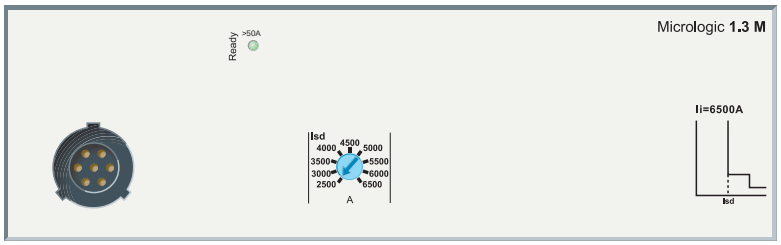
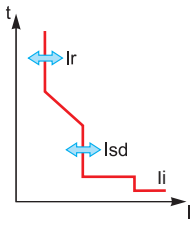


Micrologic 1.3 M trip units provide magnetic protection only, using electronic technology. They are dedicated to 400/630 A 3-pole (3P 3D) circuit breakers or 4-pole circuit breakers with detection on 3 poles (4P, 3D) and are used in certain applications to replace switch-disconnectors at the head of switchboards. They are especially used in 3-pole versions for motor protection, see page A-38.

Note: *all the trip units have a transparent lead-sealable cover that protects access to the adjustment dials.*

Micrologic 2

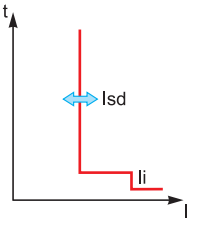
Ratings (A)	In at 40 °C (1)		40	100	160	250	400	630			
Circuit breaker	Compact NSX100		■	■	-	-	-	-			
	Compact NSX160		■	■	■	-	-	-			
	Compact NSX250		■	■	■	■	-	-			
	Compact NSX400		-	-	-	■	■	-			
	Compact NSX630		-	-	-	■	■	■			
L Long-time protection											
Pick-up (A)		Io	value depending on trip unit rating (In) and setting on dial								
tripping between 1.05 and 1.20 Ir	In = 40 A	Io =	18	18	20	23	25	28	32	36	40
	In = 100 A	Io =	40	45	50	55	63	70	80	90	100
	In = 160 A	Io =	63	70	80	90	100	110	125	150	160
	In = 250 A (NSX250)	Io =	100	110	125	140	160	175	200	225	250
	In = 250 A (NSX400)	Io =	70	100	125	140	160	175	200	225	250
	In = 400 A	Io =	160	180	200	230	250	280	320	360	400
	In = 630 A	Io =	250	280	320	350	400	450	500	570	630
	Ir = Io x ...		9 fine adjustment settings from 0.9 to 1 (0.9 - 0.92 - 0.93 - 0.94 - 0.95 - 0.96 - 0.97 - 0.98 - 1) for each value of Io								
Time delay (s) accuracy 0 to -20%	**tr**		non-adjustable								
		1.5 x Ir	400								
		6 x Ir	16								
		7.2 x Ir	11								
Thermal memory			20 minutes before and after tripping								
S_0 Short-time protection with fixed time delay											
Pick-up (A) accuracy ±10 %	**Isd** = Ir x ...		1.5	2	3	4	5	6	7	8	10
Time delay (ms)	**tsd**		non-adjustable								
	Non-tripping time		10								
	Maximum break time		80								
I Instantaneous protection											
Pick-up (A) accuracy ±15 %	Ii non-adjustable		600	1500	2400	3000	4800	6900			
	Non-tripping time		10 ms								
	Maximum break time		50 ms for I > 1.5 Ii								



(1) If the trip units are used in high-temperature environments, the Micrologic setting must take into account the thermal limitations of the circuit breaker. See the temperature derating table.

Micrologic 1.3 M

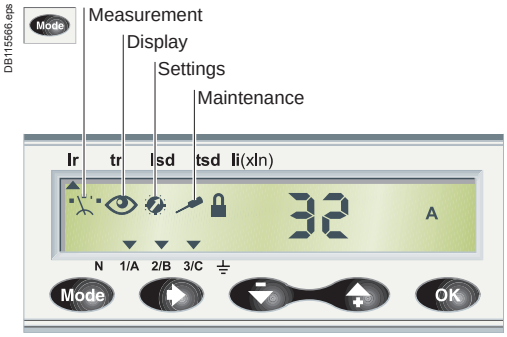
Ratings (A)	In at 65 °C	320	500
Circuit breaker	Compact NSX400	■	-
	Compact NSX630	■	■
S Short time protection			
Pick-up (A) accuracy ±15 %	**Isd**	adjustable directly in amps	
		9 settings: 1600, 1920, 2440, 2560, 2880, 3200, 3520, 3840, 4160 A	9 settings: 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500 A
Time delay (ms)	**tsd**	non-adjustable	
	Non-tripping time	20	
	Maximum break time	60	
I Instantaneous protection			
Pick-up (A) accuracy ±15 %	**Ii** non-adjustable	4800	6500
	Non-tripping time	0	
	Maximum break time	30 ms	



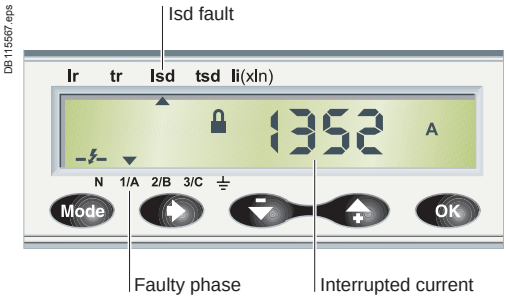
Protection of distribution systems

Micrologic 5 / 6 A or E trip units

Micrologic 5 / 6 A (Ammeter) or E (Energy) trip units can be used on Compact NSX100 to 630 circuit breakers with performance levels B/F/H/N/S/L. They all have a display unit.
They offer basic LSI protection (Micrologic 5) or LSI and ground-fault protection G (Micrologic 6).
They also offer measurement, alarm and communication functions.



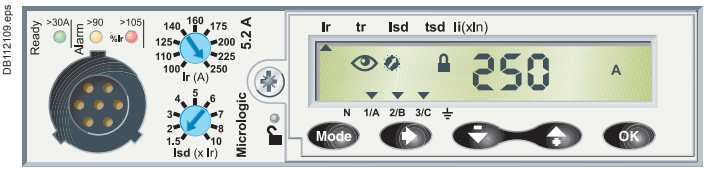
Trip unit menus.



Display of interrupted current.

SDx remote indication relay module with its terminal block.

Note: all the trip units have a transparent lead-sealable cover that protects access to the adjustment dials.



Protection

Settings can be adjusted in two ways, using the dials and/or the keypad. The keypad can be used to make fine adjustments in 1 A steps below the maximum value defined by the setting on the dial. Access to setting modifications via the keypad is protected by a locking function displayed on the screen and controlled by a microswitch. The lock is activated automatically if the keypad is not used for 5 minutes. Access to the microswitch is protected by a transparent lead-sealable cover. With the cover closed, it is still possible to display the various settings and measurements using the keypad.

Overloads: Long time protection (Ir)
Inverse time protection against overloads with an adjustable current pick-up **Ir** set using a dial or the keypad for fine adjustments. The time delay **tr** is set using the keypad.

Short-circuits: Short-time protection (Isd)
Short-circuit protection with an adjustable pick-up **Isd** and adjustable time delay **tsd**, with the possibility of including a portion of an inverse time curve (I^2t On).

Short-circuits: Instantaneous protection (Ii)
Instantaneous protection with adjustable pick-up **Ii**.

Additional ground fault protection (Ig) on Micrologic 6
Residual type ground-fault protection with an adjustable pick-up **Ig** (with Off position) and adjustable time delay **tg**. Possibility of including a portion of an inverse time curve (I^2t On).

Neutral protection
- On 4-pole circuit breakers, this protection can be set via the keypad:
  - Off: neutral unprotected
  - 0.5: neutral protection at half the value of the phase pick-up, i.e. 0.5 x Ir
  - 1.0: neutral fully protected at Ir
  - OSN: Oversized neutral protection at 1.6 times the value of the phase pick-up. Used when there is a high level of 3rd order harmonics (or orders that are multiples of 3) that accumulate in the neutral and create a high current. In this case, the device must be limited to Ir = 0.63 x In for the maximum neutral protection setting of 1.6 x Ir.
- With 3-pole circuit breakers, the neutral can be protected by installing an external neutral sensor with the output (T1, T2) connected to the trip unit.

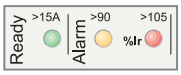
Zone selective interlocking (ZSI)
A ZSI terminal block may be used to interconnect a number of Micrologic control units to provide zone selective interlocking for short-time (Isd) and ground-fault (Ig) protection, without a time delay. For Compact NSX 100 to 250, the ZSI function is available only in relation to the upstream circuit breaker (ZSI out).

Display of type of fault

On a fault trip, the type of fault (Ir, Isd, Ii, Ig), the phase concerned and the interrupted current are displayed. An external power supply is required.

Indications

Front indications

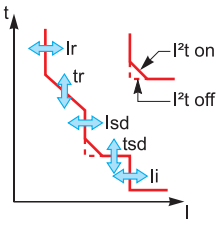


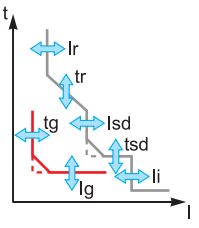
- Green “Ready” LED: flashes slowly when the circuit breaker is ready to trip in the event of a fault.
- Orange overload pre-alarm LED: steady on when I > 90 % Ir.
- Red overload LED: steady on when I > 105 % Ir.

Remote indications
An SDx relay module installed inside the circuit breaker can be used to remote the following information:
- overload trip
- overload prealarm (Micrologic 5) or ground fault trip (Micrologic 6).

This module receives the signal from the Micrologic electronic trip unit via an optical link and makes it available on the terminal block. The signal is cleared when the circuit breaker is closed.
These outputs can be reprogrammed to be assigned to other types of tripping or alarm. The module is described in detail in the section dealing with accessories.

Protection	Micrologic 5 / 6 A or E trip units										
Ratings (A)	**In at 40 °C** (1)		**40** (2)	**100**	**160**	**250**	**400**	**630**			
Circuit breaker	Compact NSX100		■	■	-	-	-	-			
	Compact NSX160		■	■	■	-	-	-			
	Compact NSX250		■	■	■	■	-	-			
	Compact NSX400		-	-	-	-	■	-			
	Compact NSX630		-	-	-	-	■	■			
L **Long-time protection**											
Pick-up (A) tripping between 1.05 and 1.20 Ir	**Ir** = ...	dial setting	value depending on trip unit rating (In) and setting on dial								
		In = 40 A	Io =	18	18	20	23	25	28	32	36	40
		In = 100 A	Io =	40	45	50	55	63	70	80	90	100
		In = 160 A	Io =	63	70	80	90	100	110	125	150	160
		In = 250 A	Io =	100	110	125	140	160	175	200	225	250
		In = 400 A	Io =	160	180	200	230	250	280	320	360	400
		In = 630 A	Io =	250	280	320	350	400	450	500	570	630
		keypad setting		Fine adjustment in 1 A steps below maximum value set on dial								
Time delay (s) accuracy 0 to -20 %	**tr** = ...	keypad setting		0.5	1	2	4	8	16			
			1.5 x Ir	15	25	50	100	200	400			
			6 x Ir	0.5	1	2	4	8	16			
			7.2 x Ir	0.35	0.7	1.4	2.8	5.5	11			
Thermal memory				20 minutes before and after tripping								
S **Short-time protection with adjustable time delay**											
Pick-up (A) accuracy ±10 %	**Isd** = Ir x ...	dial setting for Micrologic 5		1.5	2	3	4	5	6	7	8	10
				Fine adjustment in 0.5 x Ir steps using the keypad								
		keypad settings for micrologic 6		Adjustment in steps of 0.5 x In over the range 1.5 x In to: 15 x In (40 to 160 A), 12 x In (250 to 400 A) or 11 x In (630 A)								
Time delay (s)	**tsd** = ...	keypad setting	I^2Off	0	0.1	0.2	0.3	0.4				
			I^2On	-	0.1	0.2	0.3	0.4				
		Non-tripping time (ms)		20	80	140	230	350				
		Maximum break time (ms)		80	140	200	320	500				
I **Instantaneous protection**											
Pick-up (A) accuracy ±15 %	**Ii** = In x	keypad setting		Adjustment in steps of 0.5 x In over the range 1.5 x In to: 15 x In (40 to 160 A), 12 x In (250 to 400 A) or 11 x In (630 A)								
		Non-tripping time Maximum break time		10 ms 50 ms for I > Ii								
G **Ground-fault protection - for Micrologic 6 A or E**											
Pick-up (A) accuracy ±10 %	**Ig** = In x	dial setting										
		In = 40 A		0.4	0.4	0.5	0.6	0.7	0.8	0.9	1	Off
		In > 40 A		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1	Off
				Fine adjustment in 0.05 A steps using the keypad								
Time delay (s)	**tg** = ...	keypad setting	I^2Off	0	0.1	0.2	0.3	0.4				
			I^2On	-	0.1	0.2	0.3	0.4				
		Non-tripping time (ms)		20	80	140	230	350				
		Maximum break time (ms)		80	140	200	320	500				
Test	Ig function			built-in								





(1) If the trip units are used in high-temperature environments, the Micrologic setting must take into account the thermal limitations of the circuit breaker. See the temperature derating table.
(2) For 40 A rating, the neutral N/2 adjustment is not possible.

Micrologic control units
Overview of functions

All Compact circuit breakers are equipped with a Micrologic control unit that can be changed on site. Control units are designed to protect Power circuits and loads. Alarms may be programmed for remote indications.
Measurements of current, voltage, frequency, power and power quality optimise continuity of service and energy management.

Dependability
Integration of protection functions in an ASIC electronic component used in all Micrologic control units guarantees a high degree of reliability and immunity to conducted or radiated disturbances.
On Micrologic A, E and P control units, advanced functions are managed by an independent microprocessor.

Accessories
Certain functions require the addition of Micrologic control unit accessories, described on page A-27.
The rules governing the various possible combinations can be found in the documentation accessible via the Products and services menu of the www.schneider-electric.com web site.

Micrologic name codes

2.0 E
X Y Z

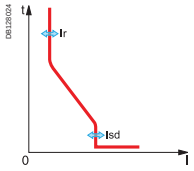
X: type of protection
- 2 for basic protection
- 5 for selective protection
- 6 for selective + earth-fault protection
- 7 for selective + earth-leakage protection.

Y: control-unit generation
Identification of the control-unit generation.
"0" signifies the first generation.

Z: type of measurement
- A for "ammeter"
- E for "energy"
- P for "power meter"

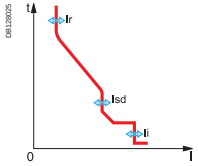

Current protection

Micrologic 2: basic protection



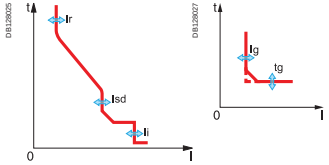
Protection:
long time
+ instantaneous

Micrologic 5: selective protection



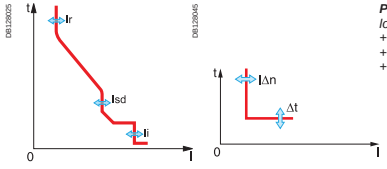
Protection:
long time
+ short time
+ instantaneous

Micrologic 6: selective + earth-fault protection



Protection:
long time
+ short time
+ instantaneous
+ earth fault

Micrologic 7: selective + earth-leakage protection 6: selective + earth-fault protection



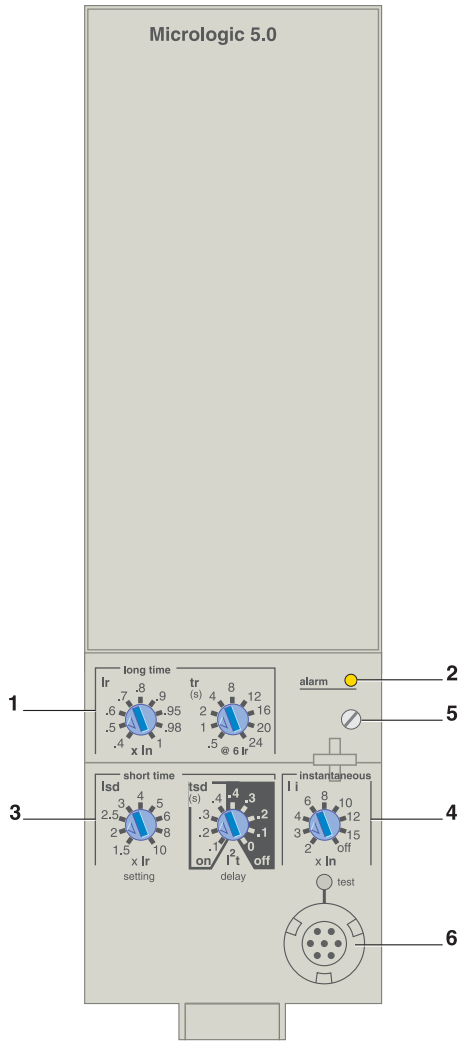
Protection:
long time
+ short time
+ instantaneous
+ earth leakage up to 3200A

Micrologic without measurement	Measurements and programmable protection		
	A: ammeter ■ I_1, I_2, I_3, I_N, $I_{earth-fault}$, $I_{earth-leakage}$ and maximeter for these measurements ■ fault indications ■ settings in amperes and in seconds.		
		E: Energy ■ incorporates all the rms measurements of Micrologic A, plus voltage, power factor, power and energy metering measurements. □ calculates the current demand value □ "Quickview" function for the automatic cyclical display of the most useful values (as standard or by selection).	**P: A + power meter + programmable protection** ■ measurements of V, A, W, VAR, VA, Wh, VARh, VAh, Hz, V_{peak}, A_{peak}, power factor and maximeters and minimeters ■ IDMTL long-time protection, minimum and maximum voltage and frequency, voltage and current imbalance, phase sequence, reverse power ■ load shedding and reconnection depending on power or current ■ measurements of interrupted currents, differentiated fault indications, maintenance indications, event histories and time-stamping, etc.
2.0 	**2.0 A** 	**2.0 E** 	
5.0 	**5.0 A** 	**5.0 E** 	**5.0 P** 
6.0 	**6.0 A** 	**6.0 E** 	**6.0 P** 
	7.0 A 		**7.0 P** 

Micrologic control units
For Compact NS630b to 3200

Micrologic 2.0, 5.0 and 6.0 control units protect power circuits. Micrologic 5.0 and 6.0 offers time discrimination for short-circuits as well.

DB128030



1 long-time threshold and tripping delay
2 overload alarm (LED)
3 short-time pick-up and tripping delay
4 instantaneous pick-up
5 fixing screw for long-time rating plug
6 test connector

Protection
Protection thresholds and delays are set using the adjustment dials.

Overload protection
True rms long-time protection.
Thermal memory: thermal image before and after tripping.
Setting accuracy may be enhanced by limiting the setting range using a different long-time rating plug.
Overload protection can be cancelled using a specific LT rating plug "Off".

Short-circuit protection
Short-time (rms) and instantaneous protection.
Selection of I^2t type (ON or OFF) for short-time delay.

Earth-fault protection
Residual or source ground return earth fault protection.
Selection of I^2t type (ON or OFF) for delay.

Neutral protection
On three-pole circuit breakers, neutral protection is not possible.
On four-pole circuit breakers, neutral protection may be set using a three-position switch: neutral unprotected (4P 3d), neutral protection at 0.5 Ir (4P 3d + N/2) or neutral protection at Ir (4P 4d).

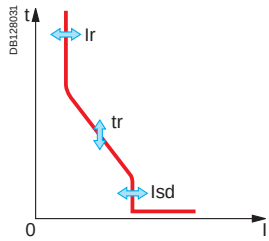
Indications
Overload indication by alarm LED on the front; the LED goes on when the current exceeds the long-time trip threshold.

Test
A mini test kit or a portable test kit may be connected to the test connector on the front to check circuit-breaker operation after installing the trip unit or accessories.

Note.
Micrologic control units are equipped with a transparent lead-seal cover as standard.

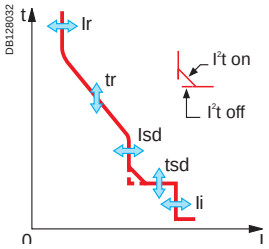
Protection — Micrologic 2.0

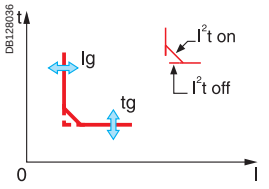
Long time												
Current setting (A)	**Ir** = In x …		0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
tripping between 1.05 and 1.20 x Ir			other ranges or disable by changing long-time rating plug								
Time setting		t_r (s)	0.5	1	2	4	8	12	16	20	24
Time delay (s)	accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	accuracy: 0 to -20 %	6 x Ir	0.7 (1)	1	2	4	8	12	16	20	24
	accuracy: 0 to -20 %	7.2 x Ir	0.7 (2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
Thermal memory			20 minutes before and after tripping								
(1) 0 to -40 % - (2) 0 to -60 %											
Instantaneous											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
accuracy: ±10 %											
Time delay			max. resettable time: 20 ms; max break time: 80 ms								



Protection — Micrologic 5.0 / 6.0

Long time											
Current setting (A)	**Ir** = In x …		0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Tripping between 1.05 and 1.20 x Ir			Other ranges or disable by changing long-time rating plug								
Time setting		**tr (s)**	0.5	1	2	4	8	12	16	20	24
Time delay (s)	Accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20 %	6 x Ir	0.7(1)	1	2	4	8	12	16	20	24
	Accuracy: 0 to -20 %	7.2 x Ir	0.7(2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
Thermal memory			20 minutes before and after tripping								
(1) 0 to -40 % - (2) 0 to -60 %											
Short time											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
Accuracy: ±10 %											
Time setting tsd (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms) at 10 x Ir	**tsd** (max resettable time)		20	80	140	230	350				
(I^2t Off or I^2t On)	**tsd** (max break time)		80	140	200	320	500				
Instantaneous											
Pick-up (A)	**Ii** = In x …		2	3	4	6	8	10	12	15	off
Accuracy: ±10 %											
Time delay			Max resettable time: 20 ms Max break time: 50 ms								
Earth fault			**Micrologic 6.0**								
Pick-up (A)	**Ig** = In x …		A	B	C	D	E	F	G	H	J
Accuracy: ±10 %	In ≤ 400 A		0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	400 A < In < 1250 A		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	In ≥ 1250 A		500	640	720	800	880	960	1040	1120	1200
Time setting tg (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms)	**tg** (max resettable time)		20	80	140	230	350				
at In or 1200 A (I^2t Off or I^2t On)	**tg** (max break time)		80	140	200	320	500				

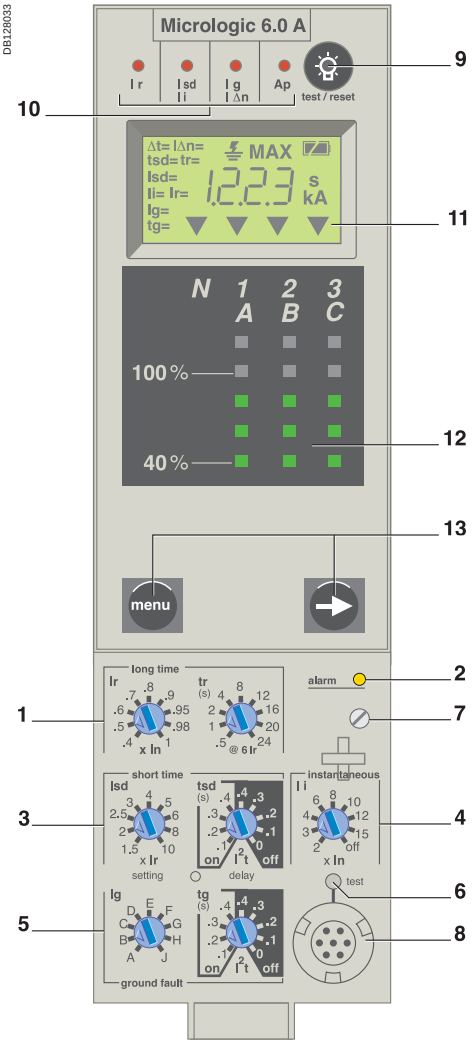




Note: *all current-based protection functions require no auxiliary source.*
The test / reset button resets maximeters, clears the tripping indication and tests the battery.

Micrologic control units
Micrologic A "ammeter"

Micrologic A control units protect power circuits. They also offer measurements, display, communication and current maximeters. Version 6 provides earth-fault protection, version 7 provides earth-leakage protection.



1 long-time threshold and tripping delay
2 overload alarm (LED) at 1.125 Ir
3 short-time pick-up and tripping delay
4 instantaneous pick-up
5 earth-leakage or earth-fault pick-up and tripping delay
6 earth-leakage or earth-fault test button
7 long-time rating plug screw
8 test connector
9 lamp test, reset and battery test
10 indication of tripping cause
11 digital display
12 three-phase bargraph and ammeter
13 navigation buttons

"Ammeter" measurements
Micrologic A control units measure the true (rms) value of currents.
They provide continuous current measurements from 0.2 to 1.2 In and are accurate to within 1.5 % (including the sensors).
A digital LCD screen continuously displays the most heavily loaded phase (Imax) or displays the I_1, I_2, I_3, I_N, I_g,$I\Delta_n$, stored-current (maximeter) and setting values by successively pressing the navigation button.
The optional external power supply makes it possible to display currents < 20 % In. Below 0.1 In, measurements are not significant. Between 0.1and 0.2 In, accuracy changes linearly from 4 % to 1.5 %.

Communication option
In conjunction with the COM communication option, the control unit transmits the following:
- settings
- all “ammeter” measurements
- tripping causes
- maximeter readings.

Protection
Protection thresholds and delays are set using the adjustment dials.

Overload protection
True rms long-time protection.
Thermal memory: thermal image before and after tripping.
Setting accuracy may be enhanced by limiting the setting range using a different long-time rating plug.
Overload protection can be cancelled using a specific LT rating plug "Off".

Short-circuit protection
Short-time (rms) and instantaneous protection.
Selection of I^2t type (ON or OFF) for short-time delay.

Earth-fault protection
Residual or source ground return earth fault protection.
Selection of I^2t type (ON or OFF) for delay.

Residual earth-leakage protection (Vigi).
Operation without an external power supply.
⎍ Protected against nuisance tripping.
⏦ DC-component withstand class A up to 10 A.

Neutral protection
On three-pole circuit breakers, neutral protection is not possible.
On four-pole circuit breakers, neutral protection may be set using a three-position switch: neutral unprotected (4P 3d), neutral protection at 0.5 Ir (4P 3d + N/2), neutral protection at Ir (4P 4d).

Zone selective interlocking (ZSI)
A ZSI terminal block may be used to interconnect a number of control units to provide total discrimination for short-time and earth-fault protection, without a delay before tripping.

Overload alarm
A yellow alarm LED goes on when the current exceeds the long-time trip threshold.

Fault indications
LEDs indicate the type of fault:
- overload (long-time protection Ir)
- short-circuit (short-time Isd or instantaneous Ii protection)
- earth fault or earth leakage (Ig or IΔn)
- internal fault (Ap).

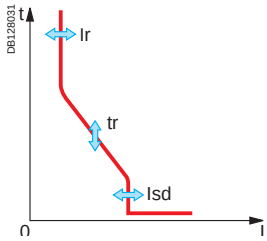
Battery power
The fault indication LEDs remain on until the test/reset button is pressed. Under normal operating conditions, the battery supplying the LEDs has a service life of approximately 10 years.

Test
A mini test kit or a portable test kit may be connected to the test connector on the front to check circuit-breaker operation. For Micrologic 6.0 A and 7.0 A control units, the operation of earth-fault or earth-leakage protection can be checked by pressing the test button located above the test connector.

Note.
Micrologic A control units come with a transparent lead-seal cover as standard.

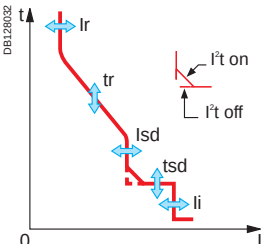
Protection — Micrologic 2.0 A

Long time											
Current setting (A)			0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Tripping between 1.05 and 1.20 x Ir			Other ranges or disable by changing long-time rating plug								
Time setting		**tr (s)**	0.5	1	2	4	8	12	16	20	24
Time delay (s)	Accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20 %	6 x Ir	0.7(1)	1	2	4	8	12	16	20	24
	Accuracy: 0 to -20 %	7.2 x Ir	0.7(2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
Thermal memory			20 minutes before and after tripping								
(1) 0 to -40 % - (2) 0 to -60 %											
Instantaneous											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
Accuracy: ±10 %											
Time delay			Max resettable time: 20 ms Max break time: 80 ms								

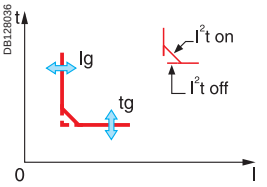


Protection — Micrologic 5.0 / 6.0 / 7.0 A

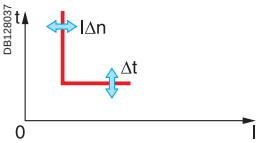
Long time			**Micrologic 5.0 / 6.0 / 7.0 A**								
Current setting (A)	**Ir** = In x …		0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Tripping between 1.05 and 1.20 x Ir			Other ranges or disable by changing long-time rating plug								
Time setting		**tr (s)**	0.5	1	2	4	8	12	16	20	24
Time delay (s)	Accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20 %	6 x Ir	0.7(1)	1	2	4	8	12	16	20	24
	Accuracy: 0 to -20 %	7.2 x Ir	0.7(2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
Thermal memory			20 minutes before and after tripping								
(1) 0 to -40 % - (2) 0 to -60 %											
Short time											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
Accuracy: ±10 %											
Time setting tsd (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms) at 10 x Ir	**tsd** (max resettable time)		20	80	140	230	350				
(I^2t Off or I^2t On)	**tsd** (max break time)		80	140	200	320	500				
Instantaneous											
Pick-up (A)	**Ii** = In x …		2	3	4	6	8	10	12	15	off
Accuracy: ±10 %											
Time delay			Max resettable time: 20 ms Max break time: 50 ms								



Earth fault		**Micrologic 6.0 A**									
Pick-up (A)	**Ig** = In x …		A	B	C	D	E	F	G	H	J
Accuracy: ±10 %	In ⩽ 400 A		0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	400 A < In < 1250 A		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	In ⩾ 1250 A		500	640	720	800	880	960	1040	1120	1200
Time setting tg (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms)	**tg** (max resettable time)		20	80	140	230	350				
at In or 1200 A (I^2t Off or I^2t On)	**tg** (max break time)		80	140	200	320	500				



Residual earth leakage (Vigi)		**Micrologic 7.0 A**									
Sensitivity (A)	**IΔn**		0.5	1	2	3	5	7	10	20	30
Accuracy: 0 to -20 %											
Time delay Δt (ms)	Settings		60	140	230	350	800				
	Δt (max resettable time)		60	140	230	350	800				
	Δt (max break time)		140	200	320	500	1000				



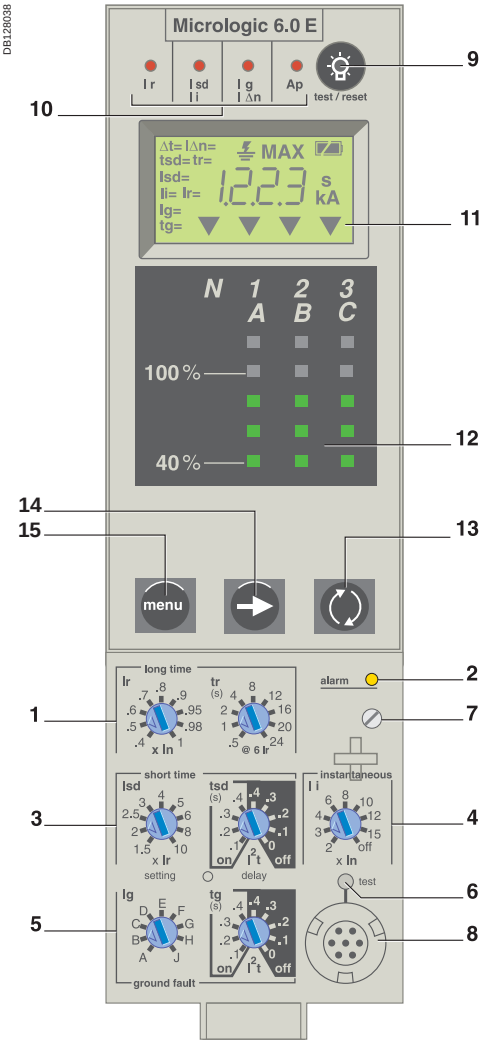
Ammeter — Micrologic 2.0 / 5.0 / 6.0 / 7.0 A

Type of measurements		**Range**	**Accuracy**
Instantaneous currents	I1, I2, I3, IN	0.2 x In to 1.2 x In	± 1.5 %
	Ig (6.0 A)	0.2 x In to In	± 10 %
	IΔn (7.0 A)	0 to 30 A	± 1.5 %
Current maximeters of	I1, I2, I3, IN	0.2 x In to 1.2 x In	± 1.5 %

Note: all current-based protection functions require no auxiliary source.
The test / reset button resets maximeters, clears the tripping indication and tests the battery.

Micrologic control units
Micrologic E "energy"

Micrologic E control units protect power circuits. They also offer measurements, display, communication and current maximeters. Version 6 provides earth-fault protection.



1 long-time threshold and tripping delay
2 overload alarm (LED) at 1.125 Ir
3 short-time pick-up and tripping delay
4 instantaneous pick-up
5 earth-leakage or earth-fault pick-up and tripping delay
6 earth-leakage or earth-fault test button
7 long-time rating plug screw
8 test connector
9 lamp test, reset and battery test
10 indication of tripping cause
11 digital display
12 three-phase bargraph and ammeter
13 navigation button "quick View" (only with Micrologic E)
14 navigation button to view menu contents
15 navigation button to change menu

(1) Display on FDM121 only.

***Note:** Micrologic E control units come with a transparent lead-seal cover as standard.*

"Energy meter" measurements

In addition to the ammeter measurements of Micrologic A
Micrologic E control units measure and display:
- current demand
- voltages: phase to phase, phase to neutral, average (1) and unbalanced (1)
- instantaneous power: P, Q, S
- power factor: PF
- power demand: P demand
- energy: Ep, Eq (1), Es (1).

Accuracy of active energy Ep is 2 % (including the sensors). The range of measurement is the same as current with Micrologic A, depending of an external power supply module (24 V DC).

Communication option

In conjunction with the COM communication option, the control unit transmits the following:
- settings
- all "ammeter" and "energy" measurements
- enable connection to FDM121
- tripping causes
- maximeter / minimeter readings.

Protection

Protection thresholds and delays are set using the adjustment dials.

Overload protection
True rms long-time protection.
Thermal memory: thermal image before and after tripping.
Setting accuracy may be enhanced by limiting the setting range using a different long-time rating plug. Overload protection can be cancelled using a specific LT rating plug "Off".

Short-circuit protection
Short-time (rms) and instantaneous protection.
Selection of I^2t type (ON or OFF) for short-time delay.

Earth-fault protection
Source ground return earth fault protection.
Selection of I^2t type (ON or OFF) for delay.

Neutral protection
On three-pole circuit breakers, neutral protection is not possible.
On four-pole circuit breakers, neutral protection may be set using a three-position switch: neutral unprotected (4P 3d), neutral protection at 0.5 Ir (4P 3d + N/2), neutral protection at Ir (4P 4d).

Zone selective interlocking (ZSI)
A ZSI terminal block may be used to interconnect a number of control units to provide total discrimination for short-time and earth-fault protection, without a delay before tripping.

Overload alarm

A yellow alarm LED goes on when the current exceeds the long-time trip threshold.

Programmable contacts

The programmable contacts may be used to signal events (Ir, Isd, Alarm Ir, Alarm Ig, Ig). They can be programmed using the keypad on the Micrologic E control unit or remotely using the COM option (BCM ULP) and RSU software.

Fault indications

LEDs indicate the type of fault:
- overload (long-time protection Ir)
- short-circuit (short-time Isd or instantaneous Ii protection)
- earth fault (Ig)
- internal fault (Ap).

Trip history
The trip history displays the list of the last 10 trips. For each trip, the following indications are recorded and displayed:
- the tripping cause: Ir, Isd, Ii, Ig or Auto-protection (Ap) trips
- the date and time of the trip (requires communication option).

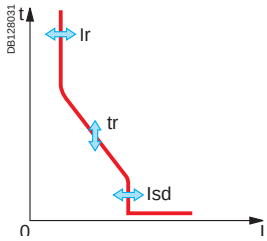
Battery power
The fault indication LEDs remain on until the test/reset button is pressed. Under normal operating conditions, the battery supplying the LEDs has a service life of approximately 10 years.

Test

A mini test kit or a portable test kit may be connected to the test connector on the front to check circuit-breaker operation. For Micrologic 6.0 E control units, the operation of earth-fault or earth-leakage protection can be checked by pressing the test button located above the test connector.

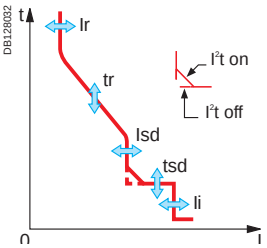
Protection — Micrologic 2.0 E

Long time											
Current setting (A)			0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Tripping between 1.05 and 1.20 x Ir			Other ranges or disable by changing long-time rating plug								
Time setting		**tr (s)**	0.5	1	2	4	8	12	16	20	24
Time delay (s)	Accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20 %	6 x Ir	0.7(1)	1	2	4	8	12	16	20	24
	Accuracy: 0 to -20 %	7.2 x Ir	0.7(2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
Thermal memory			20 minutes before and after tripping								
(1) 0 to -40 % - (2) 0 to -60 %											
Instantaneous											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
Accuracy: ±10 %											
Time delay			Max resettable time: 20 ms Max break time: 80 ms								

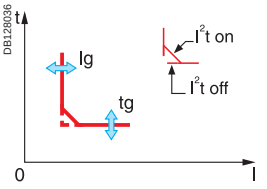


Protection — Micrologic 5.0 / 6.0 E

Long time			**Micrologic 5.0 / 6.0 E**								
Current setting (A)	**Ir** = In x …		0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Tripping between 1.05 and 1.20 x Ir			Other ranges or disable by changing long-time rating plug								
Time setting		**tr (s)**	0.5	1	2	4	8	12	16	20	24
Time delay (s)	Accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20 %	6 x Ir	0.7(1)	1	2	4	8	12	16	20	24
	Accuracy: 0 to -20 %	7.2 x Ir	0.7(2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
Thermal memory			20 minutes before and after tripping								
(1) 0 to -40 % - (2) 0 to -60 %											
Short time											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
Accuracy: ±10 %											
Time setting tsd (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms) at 10 x Ir	**tsd** (max resettable time)		20	80	140	230	350				
(I^2t Off or I^2t On)	**tsd** (max break time)		80	140	200	320	500				
Instantaneous											
Pick-up (A)	**Ii** = In x …		2	3	4	6	8	10	12	15	off
Accuracy: ±10 %											
Time delay			Max resettable time: 20 ms Max break time: 50 ms								



Earth fault			**Micrologic 6.0 E**								
Pick-up (A)	**Ig** = In x …		A	B	C	D	E	F	G	H	J
Accuracy: ±10 %	In ⩽ 400 A		0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	400 A < In < 1250 A		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	In ⩾ 1250 A		500	640	720	800	880	960	1040	1120	1200
Time setting tg (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms)	**tg** (max resettable time)		20	80	140	230	350				
at In or 1200 A (I^2t Off or I^2t On)	**tg** (max break time)		80	140	200	320	500				



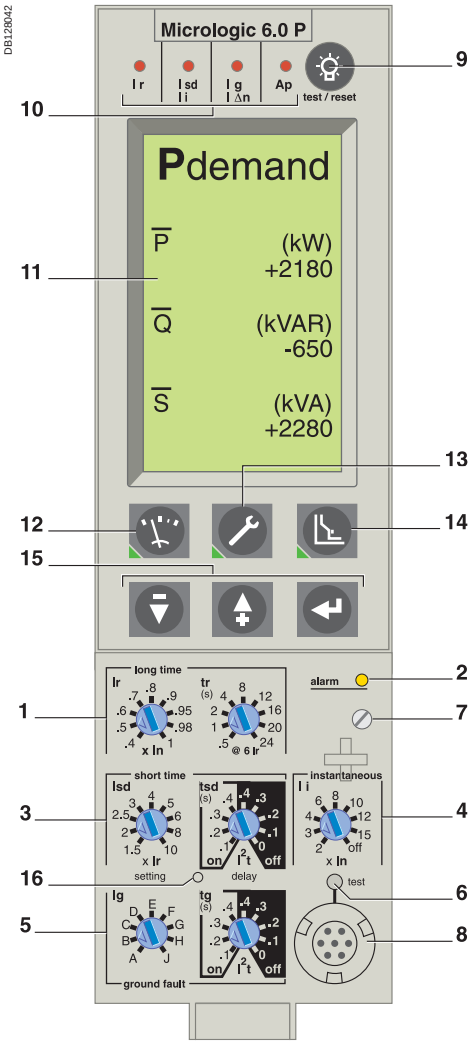
Energy — Micrologic 2.0 / 5.0 / 6.0 E

Type of measurements		**Range**	**Accuracy**
Instantaneous currents	I1, I2, I3, IN	0.2 x In to 1.2 x In	± 1.5 %
	Ig (6.0 E)	0.05 x In to In	± 10 %
Current maximeters of	I1, I2, I3, IN	0.2 x In to 1.2 x In	± 1.5 %
Demand currents of I1, I2, I3, Ig		0.2 x In to 1.2 x In	± 1.5 %
Voltages	V12, V23, V31, V1N, V2N, V3N	100 to 690 V	± 0.5 %
Active power	P	30 to 2000 kW	± 2 %
Power factor	PF	0 to 1	± 2 %
Demand power	P demand	30 to 2000 kW	± 2 %
Active energy	Ep	-10^{10} GWh to 10^{10} GWh	± 2 %

Note: *all current-based protection functions require no auxiliary source.*
The test / reset button resets maximeters, clears the tripping indication and tests the battery.

Micrologic control units
Micrologic P "power"

Micrologic P control units include all the functions offered by Micrologic A.
In addition, they measure voltages and calculate power and energy values.
They also offer new protection functions based on currents, voltages, frequency and power reinforce load protection in real time.



1 *Long-time current setting and tripping delay.*
2 *Overload signal (LED).*
3 *Short-time pick-up and tripping delay.*
4 *Instantaneous pick-up.*
5 *Earth-leakage or earth-fault pick-up and tripping delay.*
6 *Earth-leakage or earth-fault test button.*
7 *Long-time rating plug screw.*
8 *Test connector.*
9 *Lamp + battery test and indications reset.*
10 *Indication of tripping cause.*
11 *High-resolution screen.*
12 *Measurement display.*
13 *Maintenance indicators.*
14 *Protection settings.*
15 *Navigation buttons.*
16 *Hole for settings lockout pin on cover.*

Note: *Micrologic P control units come with a non-transparent lead-seal cover as standard.*

Protection

Protection settings
The adjustable protection functions are identical to those of Micrologic A (overloads, short-circuits, earth-fault and earth-leakage protection).

Fine adjustment
Within the range determined by the adjustment dial, fine adjustment of thresholds (to within one ampere) and time delays (to within one second) is possible on the keypad or remotely using the COM option.

IDMTL (Inverse Definite Minimum Time Lag) setting
Coordination with fuse-type or medium-voltage protection systems is optimised by adjusting the slope of the overload-protection curve. This setting also ensures better operation of this protection function with certain loads.

Neutral protection
On three-pole circuit breakers, neutral protection may be set using the keypad or remotely using the COM option, to one of four positions: neutral unprotected (4P 3d), neutral protection at 0.5 Ir (4P 3d + N/2), neutral protection at Ir (4P 4d) and neutral protection at 1.6 Ir (4P 3d + 1.6N). Neutral protection at 1.6 Ir is used when the neutral conductor is twice the size of the phase conductors (major load imbalance, high level of third order harmonics).
On four-pole circuit breakers, neutral protection may be set using a three-position switch or the keypad: neutral unprotected (4P 3d), neutral protection at 0.5 Ir (4P 3d + N/2), neutral protection at Ir (4P 4d). Neutral protection produces no effect if the long-time curve is set to one of the IDMTL protection settings.

Programmable alarms and other protection
Depending on the thresholds and time delays set using the keypad or remotely using the COM option, the Micrologic P control unit monitors currents and voltage, power, frequency and the phase sequence. Each threshold overrun is signalled remotely via the COM option. Each threshold overrun may be combined with tripping (protection) or an indication carried out by an optional M6C programmable contact (alarm), or both (protection and alarm).

Load shedding and reconnection
Load shedding and reconnection parameters may be set according to the power or the current flowing through the circuit breaker. Load shedding is carried out by a supervisor via the COM option or by an M6C programmable contact.

Indication option via programmable contacts
The M6C (six contacts) auxiliary contacts may be used to signal threshold overruns or status changes. They can be programmed using the keypad on the Micrologic P control unit or remotely using the COM option (BCM ULP) and RSU software.

Communication option (COM)
The communication option may be used to:
- remotely read and set parameters for the protection functions
- transmit all the calculated indicators and measurements
- signal the causes of tripping and alarms
- consult the history files and the maintenance-indicator register.
- maximeter reset.

An event log and a maintenance register, stored in control-unit memory but not available locally, may be accessed in addition via the COM option.

Protection — Micrologic 5.0 / 6.0 / 7.0 P

Long time (rms)			Micrologic 5.0 / 6.0 / 7.0 P								
Current setting (A)	**Ir** = In x …		0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Tripping between 1.05 and 1.20 x Ir			Other ranges or disable by changing long-time rating plug								
Time setting		t_r (s)	0.5	1	2	4	8	12	16	20	24
Time delay (s)	Accuracy: 0 to -30 %	1.5 x Ir	12.5	25	50	100	200	300	400	500	600
	Accuracy: 0 to -20 %	6 x Ir	0.7(1)	1	2	4	8	12	16	20	24
	Accuracy: 0 to -20 %	7.2 x Ir	0.7(2)	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
IDMTL setting	Curve slope		SIT	VIT	EIT	HVFuse	DT				
Thermal memory			20 minutes before and after tripping								

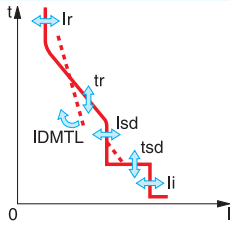
(1) 0 to -40 % - (2) 0 to -60 %

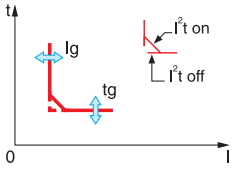
Short time (rms)											
Pick-up (A)	**Isd** = Ir x …		1.5	2	2.5	3	4	5	6	8	10
Accuracy: ±10 %											
Time setting t_{sd} (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms) at 10 Ir	t_{sd} (max resettable time)		20	80	140	230	350				
(I^2t Off or I^2t On)	t_{sd} (max break time)		80	140	200	320	500				

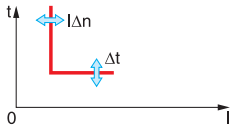
Instantaneous											
Pick-up (A)	**Ii** = In x …		2	3	4	6	8	10	12	15	off
Accuracy: ±10 %											
Time delay			Max resettable time: 20 ms Max break time: 50 ms								

Earth fault			Micrologic 6.0 P								
Pick-up (A)	**Ig** = In x …		A	B	C	D	E	F	G	H	J
Accuracy: ±10 %	In ⩽ 400 A		0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	400 A < In < 1250 A		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
	In ⩾ 1250 A		500	640	720	800	880	960	1040	1120	1200
Time setting t_g (s)	Settings	I^2t Off	0	0.1	0.2	0.3	0.4				
		I^2t On	-	0.1	0.2	0.3	0.4				
Time delay (ms)	t_g (max resettable time)		20	80	140	230	350				
at In or 1200 A (I^2t Off or I^2t On)	t_g (max break time)		80	140	200	320	500				

Residual earth leakage (Vigi)			Micrologic 7.0 P								
Sensitivity (A)	**IΔn**		0.5	1	2	3	5	7	10	20	30
Accuracy: 0 to -20 %											
Time delay Dt (ms)	Settings		60	140	230	350	800				
	Δt (max resettable time)		60	140	230	350	800				
	Δt (max break time)		140	200	320	500	1000				

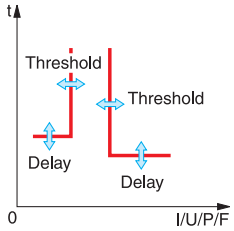






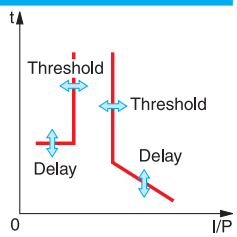
Alarms and other protection — Micrologic 5.0 / 6.0 / 7.0 P

Current		Threshold	Delay
Current unbalance	**Iunbalance**	0.05 to 0.6 Iaverage	1 to 40 s
Max. demand current	**Imax demand** : I1, I2, I3, IN,	0.2 In to In	15 to 1500 s
Earth fault alarm			
	I⏚	10 to 100 % In(3)	1 to 10 s
Voltage			
Voltage unbalance	**Uunbalance**	2 to 30 % x Uaverage	1 to 40 s
Minimum voltage	**Umin**	100 to Umax between phases	1.2 to 10 s
Maximum voltage(4)	**Umax**	Umin to 1200 between phases	1.2 to 10 s
Power			
Reverse power	**rP**	5 to 500 kW	0.2 to 20 s
Frequency			
Minimum frequency	**Fmin**	45 to Fmax	1.2 to 5 s
Maximum frequency	**Fmax**	Fmin to 440 Hz	1.2 to 5 s
Phase sequence			
Sequence (alarm)	**ΔØ**	Ø1/2/3 or Ø1/3/2	0.3 s



Load shedding and reconnection — Micrologic 5.0 / 6.0 / 7.0 P

Measured value		Threshold	Delay
Current	**I**	0.5 to 1 Ir per phases	20 % tr to 80 % tr
Power	**P**	200 kW to 10 MW	10 to 3600 s



Power — Micrologic 5.0 / 6.0 / 7.0 P

Type of measurements		Range	Accuracy
Current maximeters of	I1, I2, I3, IN	0.2 x In to 1.2 x In	± 1.5 %
Voltages	V12, V23, V31, V1N, V2N, V3N	100 to 690 V	± 0.5 %
Power factor	PF	0 to 1	± 2 %
Frequency (Hz)			0.1 %

(3) In ⩽ 400 A 30 %
400 A < In < 1250 A 20 %
In ⩾ 1250 A 10 %

(4) For 690 V applications, a step-down transformer must be used if the voltage exceeds the nominal value of 690 V by more than 10 %.

***Note:** all current-based protection functions require no auxiliary source.*
Voltage-based protection functions are connected to AC power via a voltage measurement input built into the circuit breaker.

Motor protection
Micrologic 2.2 / 2.3 M electronic trip units

Micrologic 2.2 / 2.3 M trip units provide built-in thermal and magnetic protection. They are used in **2-device motor-feeder solutions** on Compact NSX100 to 630 circuit breakers with performance levels B/F/H/N/S/L. They provide protection for motors up to 315 kW at 400 V against:
- short-circuits
- overloads with selection of a trip class (5, 10 or 20)
- phase unbalance.

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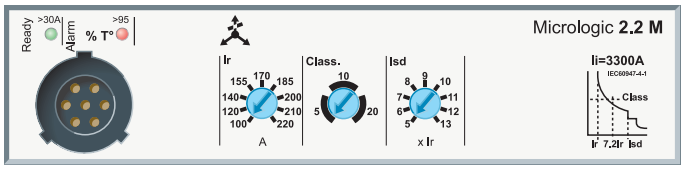


Circuit breakers with a Micrologic 2.2 / 2.3 M trip unit include protection similar to an inverse-time thermal relay. They are combined with a contactor.

Protection

Settings are made using a dial.

Overloads (or thermal protection): Long-time protection and trip class (Ir)
Inverse-time thermal protection against overloads with adjustable pick-up Ir. Settings are made in amperes. The tripping curve for the long-time protection, which indicates the time delay **tr** before tripping, is defined by the selected trip class.

Trip class (class)
The class is selected as a function of the normal motor starting time.
- Class 5: starting time less than 5 s.
- Class 10: starting time less than 10 s.
- Class 20: starting time less than 20 s.

For a given class, it is necessary to check that all motor-feeder components are sized to carry the 7.2 Ir starting current without excessive temperature rise during the time corresponding to the class.

Short-circuits: Short-time protection (Isd)
Protection with an adjustable pick-up **Isd**. There is a very short delay to let through motor starting currents.

Short-circuits: Non-adjustable instantaneous protection (Ii)
Instantaneous protection with non-adjustable pick-up **Ii**.

Phase unbalance or phase loss (Iunbal) ( )
This function opens the circuit breaker if a phase unbalance occurs:
- that is greater than the 30 % fixed pick-up **Iunbal**
- following the non-adjustable time delay **tunbal** equal to:
  - 0.7 s during starting
  - 4 s during normal operation.

Phase loss is an extreme case of phase unbalance and leads to tripping under the same conditions.

Indications

Front indications
- Green “Ready” LED: flashes slowly when the circuit breaker is ready to trip in the event of a fault.
- Red alarm LED for motor operation: goes ON when the thermal image of the rotor and stator is greater than 95 % of the permissible temperature rise.

Remote indications via SDTAM module
Compact NSX devices with a Micrologic 2 can be equipped with an SDTAM module dedicated to motor applications for:
- a contact to indicate circuit-breaker overload
- a contact to open the contactor. In the event of a phase unbalance or overload, this output is activated 400 ms before circuit-breaker tripping to open the contactor and avoid circuit breaker tripping.

This module takes the place of the MN/MX coils and an OF contact.

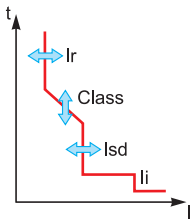
PB103376.eps

SDTAM remote indication relay module with its terminal block.

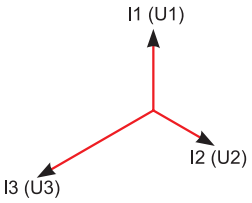
Note: *all the trip units have a transparent lead-sealable cover that protects access to the adjustment dials.*

Micrologic 2.2 / 2.3 M

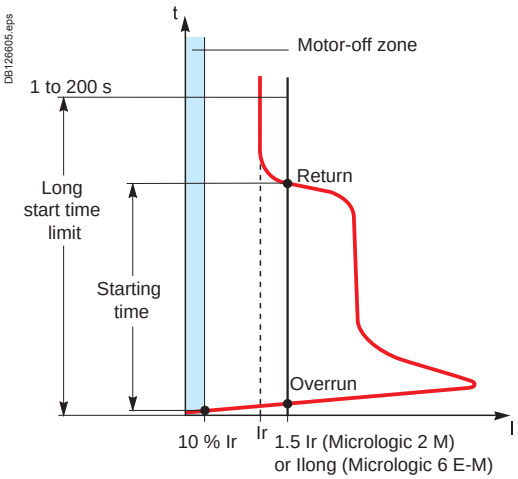
Ratings (A)	In at 65 °C (1)		25	50	100	150	220	320	500		
Circuit breaker	Compact NSX100		■	■	■	-	-	-	-		
	Compact NSX160		■	■	■	■	-	-	-		
	Compact NSX250		■	■	■	■	■	-	-		
	Compact NSX400		-	-	-	-	-	■	-		
	Compact NSX630		-	-	-	-	-	■	■		
L Overloads (or thermal protection): Long-time protection and trip class											
Pick-up (A) tripping between 1.05 and 1.20 Ir	**Ir**		value depending on trip unit rating (In) and setting on dial								
	In = 25 A	Ir =	12	14	16	18	20	22	23	24	25
	In = 50 A	Ir =	25	30	32	36	40	42	45	47	50
	In = 100 A	Ir =	50	60	70	75	80	85	90	95	100
	In = 150 A	Ir =	70	80	90	100	110	120	130	140	150
	In = 220 A	Ir =	100	120	140	155	170	185	200	210	220
	In = 320 A	Ir =	160	180	200	220	240	260	280	300	320
	In = 500 A	Ir =	250	280	320	350	380	400	440	470	500
Trip class as per IEC 60947-4-1			5	10	20						
Time delay (s)	**tr**	1.5 x Ir	120	240	480	for warm motor					
depending on selected trip class		6 x Ir	6.5	13.5	26	for cold motor					
		7.2 x Ir	5	10	20	for cold motor					
Thermal memory			20 minutes before and after tripping								
Cooling fan			non-adjustable - motor self-cooled								
S_0 Short-circuits: Short-time protection with fixed time delay											
Pick-up (A) accuracy ±15 %	**Isd** = Ir x ...		5	6	7	8	9	10	11	12	13
Time delay (ms)	**tsd**		non-adjustable								
	Non-tripping time		10								
	Maximum break time		60								
I Short-circuits: Non-adjustable instantaneous protection											
Pick-up (A) accuracy ±15 %	Ii non-adjustable		425	750	1500	2250	3300	4800	6500		
Time delay (ms)	Non-tripping time		0								
	Maximum break time		30								
Phase unbalance or phase loss											
Pick-up (A) accuracy ±20 %	Iunbal in % average current (2)		> 30 %								
Time delay (s)	non-adjustable		0.7 s during starting 4 s during normal operation								



(1) Motor standards require operation at 65 °C. Circuit-breaker ratings are derated to take this requirement into account.
(2) The unbalance measurement takes into account the most unbalanced phase with respect to the average current.



Unbalance of phase currents and voltages.



Motor starting and long starts.

Additional technical characteristics

Phase unbalance

An unbalance in three-phase systems occurs when the three voltages are not equal in amplitude and/or not displaced 120° with respect to each other. It is generally due to single-phase loads that are incorrectly distributed throughout the system and unbalance the voltages between the phases.

These unbalances create negative current components that cause braking torques and temperature rise in asynchronous machines, thus leading to premature ageing.

Phase loss

Phase loss is a special case of phase unbalance.

- *During normal operation, it produces the effects mentioned above and tripping must occur after four seconds.*
- *During starting, the absence of a phase may cause motor reversing, i.e. it is the load that determines the direction of rotation. This requires virtually immediate tripping (0.7 seconds).*

Starting time in compliance with the class (Micrologic 2 M)

For normal motor starting, Micrologic 2 M checks the conditions below with respect to the thermal-protection (long-time) pick-up Ir:

- *current > 10 % x Ir (motor-off limit)*
- *overrun of 1.5 x Ir threshold, then return below this threshold before the end of a 10 s time delay.*

If either of these conditions is not met, the thermal protection trips the device after a maximum time equal to that of the selected class.

Pick-up Ir must have been set to the current indicated on the motor rating plate.

Long starts (Micrologic 6 E-M)

When this function is not activated, the starting conditions are those indicated above.

When it is activated, this protection supplements thermal protection (class).

A long start causes tripping and is characterised by:

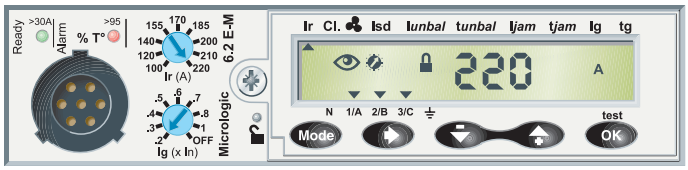
- *current > 10 % x Ir (motor-off limit) with:*
- *either overrun of the long-time pick-up (1 to 8 x Ir) without return below the pick-up before the end of the long-time time delay (1 to 200 s)*
- *or no overrun of the long-time pick-up (1 to 8 x Ir) before the end of the long-time time delay (1 to 200 s).*

Pick-up Ir must have been set to the current indicated on the motor rating plate.

This protection should be coordinated with the selected class.

Motor protection
Micrologic 6 E-M electronic trip units

Micrologic 6.E-M is used in **2-device motor-feeder solutions.**
It provides the same protection as Micrologic 2 M:
■ short-circuits
■ overloads with selection of the same trip classes (5, 10 or 20), plus trip class 30 for starting of machines with high inertia.
In addition, it offers specific motor-protection functions that can be set via the keypad.



Protection

The protection functions are identical to those of Micrologic 2 M and can be fine-adjusted via the keypad .
Access to setting modifications via the keypad is protected by a locking function that is controlled by a microswitch . The lock is activated automatically if the keypad is not used for 5 minutes. Access to the microswitch is protected by a transparent lead-sealable cover. It is possible to scroll through settings and measurements with the cover closed.

Overloads (or thermal), class and short-circuits
The long-time, short-time and instantaneous functions are identical to those of Micrologic 2 M.
In addition, there is trip class 30 for long-time protection and a setting for self-cooled or fan-cooled motors ( ).

Ground-fault protection (Ig)
Residual type ground-fault protection with an adjustable pick-up **Ig** (with Off position) and adjustable time delay **tg**.

Phase unbalance or phase loss (Iunbal)
This function opens the circuit breaker if a phase unbalance occurs:
■ that is greater than the **Iunbal** pick-up that can be fine-adjusted from 10 to 40 % (30 % by default)
■ following the **tunbal** time delay that is:
□ 0.7 s during starting
□ adjustable from 1 to 10 seconds (4 seconds by default) during normal operation.
Phase loss is an extreme case of phase unbalance and leads to tripping under the same conditions.

Locked rotor (Ijam)
This function detects locking of the motor shaft caused by the load.
During motor starting (see page A-41), the function is disabled.
During normal operation, it causes tripping:
■ above the **Ijam** pick-up that can be fine-adjusted from 1 to 8 x Ir
■ in conjunction with the **tjam** time delay that can be adjusted from 1 to 30 seconds.

Under-load (Iund)
This function detects motor no-load operation due to insufficient load (e.g. a drained pump). It detects phase undercurrent.
During motor starting (see page A-41), the function is always enabled.
During normal operation, it causes tripping:
■ below the **Iund** pick-up that can be fine-adjusted from 0.3 to 0.9 x Ir
■ in conjunction with the **tund** time delay that can be adjusted from 1 to 200 seconds.

Long starts (Ilong)
This protection supplements thermal protection (class).
It is used to better adjust protection to the starting parameters.
It detects abnormal motor starting, i.e. when the starting current remains too high or too low with respect to a pick-up value and a time delay.
It causes tripping:
■ in relation with a **Ilong** pick-up that can be fine-adjusted from 1 to 8 x Ir
■ in conjunction with the **tlong** time delay that can be adjusted from 1 to 200 seconds.
(see "long starts" page A-41)

Display of type of fault

On a fault trip, the type of fault (Ir, Isd, Ii, Ig, Iunbal, Ijam), the phase concerned and the interrupted current are displayed.

Indications

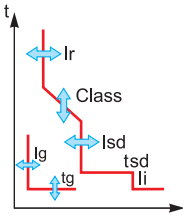
Front indications
■ Green “Ready” LED: flashes slowly when the circuit breaker is ready to trip in the event of a fault.
■ Red alarm LED for motor operation: goes ON when the thermal image of the rotor or stator is greater than 95% of the permissible temperature rise.

Remote indications via SDTAM or SDx module
See description on page A-40 for SDTAM and page A-77 for SDx.

SDTAM remote indication relay module with its terminal block.

***Note:** all the trip units have a transparent lead-sealable cover that protects access to the adjustment dials.*

Micrologic 6.2 / 6.3 E-M



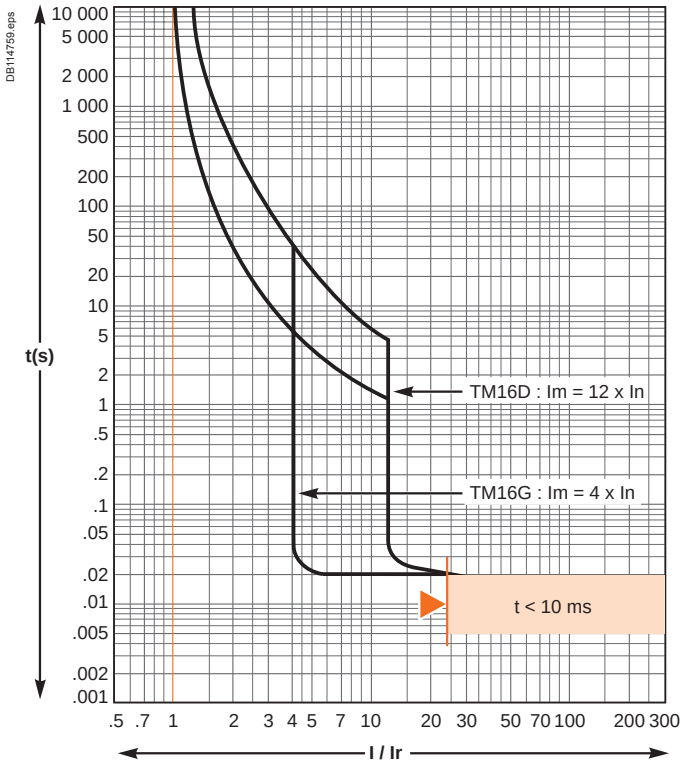
Ratings (A)	In at 65 °C (1)			25	50	80	150	220	320	500		
Circuit breaker	Compact NSX100			■	■	■	-	-	-	-		
	Compact NSX160			■	■	■	■	-	-	-		
	Compact NSX250			■	■	■	■	■	-	-		
	Compact NSX400			-	-	-	-	-	■	-		
	Compact NSX630			-	-	-	-	-	■	■		
L Overloads: Long-time protection												
Pick-up (A)	**Ir**	Dial setting		Value depending on trip-unit rating (In) and setting on dial								
Tripping between 1.05 and 1.20 Ir		In = 25 A	Ir =	12	14	16	18	20	22	23	24	25
		In = 50 A	Ir =	25	30	32	36	40	42	45	47	50
		In = 80 A	Ir =	35	42	47	52	57	60	65	72	80
		In = 150 A	Ir =	70	80	90	100	110	120	130	140	150
		In = 220 A	Ir =	100	120	140	155	170	185	200	210	220
		In = 320 A	Ir =	160	180	200	220	240	260	280	300	320
		In = 500 A	Ir =	250	280	320	350	380	400	440	470	500
		Keypad setting		Fine adjustments in 1 A steps below maximum value defined by dial setting								
Trip class as per IEC 60947-4-1				5	10	20	30					
Time delay (s)	**tr**		1.5 x Ir	120	240	480	720	for warm motor				
depending on selected trip class			6 x Ir	6.5	13.5	26	38	for cold motor				
			7.2 x Ir	5	10	20	30	for cold motor				
Thermal memory				20 minutes before and after tripping								
Cooling fan				Settings for self-cooled or fan-cooled motors								
S_0 Short-circuits: Short-time protection with fixed time delay												
Pick-up (A) accuracy ±15 %	**Isd** = Ir x ...			5	6	7	8	9	10	11	12	13
				Fine adjustment In 0.5 x Ir steps using the keypad								
Time delay	**tsd**			non-adjustable								
	Non-tripping time			10 ms								
	Maximum break time			60 ms								
I Short-circuits: Non-adjustable instantaneous protection												
Pick-up (A) accuracy ±15 %	**Ii** non-adjustable			425	750	1200	2250	3300	4800	6500		
	Non-tripping time			0 ms								
	Maximum break time			30 ms								
G Ground faults												
Pick-up (A) accuracy ±10 %	**Ig** = In x ...			Dial setting								
		In = 25 A	Ig =	0.6	0.6	0.6	0.6	0.7	0.8	0.9	1	Off
		In = 50 A	Ig =	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	Off
		In > 50 A	Ig =	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1	Off
				fine adjustments in 0.05 x In steps								
Time delay (ms)	**tg**			0	0.1	0.2	0.3	0.4				
	Non-tripping time			20	80	140	230	350				
	Maximum break time			80	140	200	320	500				
Phase unbalance or phase loss												
Pick-up (A) accuracy ±20 %	**Iunbal** = in % average current (2)			adjustable from 10 to 40 %, default setting = 30 % fine adjustments in 1 % steps using the keypad activated during motor starting								
Time delay (s)	**tunbal**			0.7 s during starting 1 to 10 seconds during normal operation, default setting = 4 seconds fine adjustments in 1 s steps using the keypad								
Locked rotor												
Pick-up (A) accuracy ±10 %	**Ijam** = Ir x ...			1 x 8 Ir with Off position, default setting = Off fine adjustments in 0.1 x Ir steps using the keypad disabled during motor starting								
Time delay (s)	**tjam** =			1 to 30 seconds fine adjustments in 1 s steps using the keypad, default setting = 5 s								
Under-load (under-current)												
Pick-up (A) accuracy ±10 %	**Iund** = Ir x ...			0.3 x 0.9 Ir with Off position, default setting = Off Fine adjustments in Ir x 0.01 steps using the RSU software activated during motor starting								
Time delay (s)	**tund** =			1 to 200 seconds fine adjustments in 1 s steps using the RSU software, default setting = 10 s								
Long starts												
Pick-up (A) accuracy ±10 %	**Ilong** = Ir x ...			1 x 8 Ir with Off position, default setting = Off Fine adjustments in Ir x 0.1 steps using the RSU software activated during motor starting								
Time delay (s)	**tlong** =			1 to 200 seconds fine adjustments in 1 s steps using the RSU software, default setting = 10 s								

(1) Motor standards require operation at 65 °C. Circuit-breaker ratings are derated to take this requirement into account.
(2) The unbalance measurement takes into account the most unbalanced phase with respect to the average current.

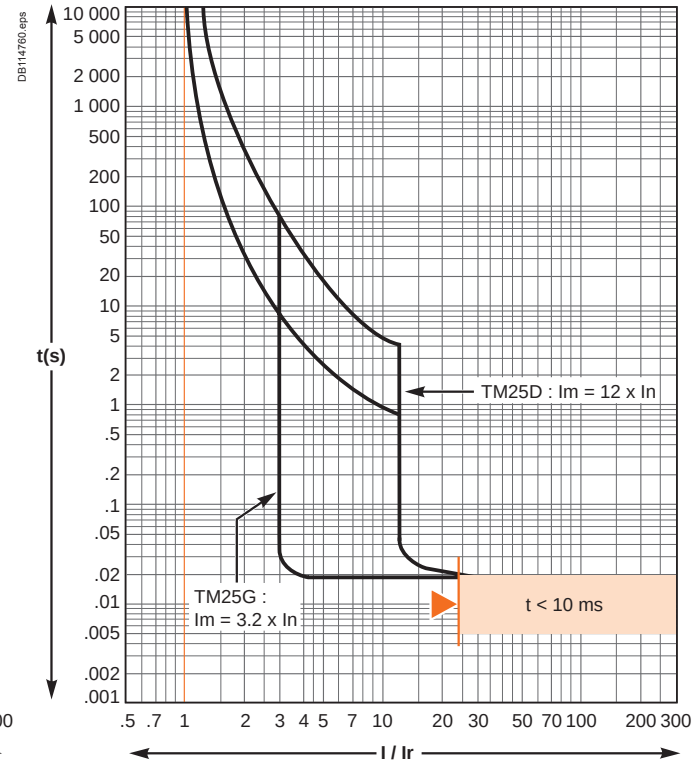
Tripping curves
Compact NSX100 to 250
Protection of distribution systems

TM magnetic trip units

TM16D / TM16G

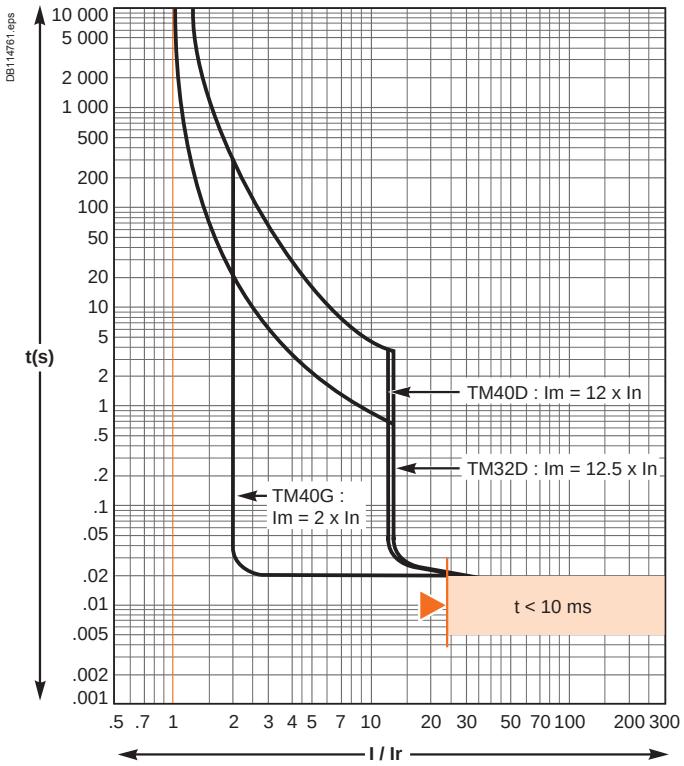


TM25D / TM25G

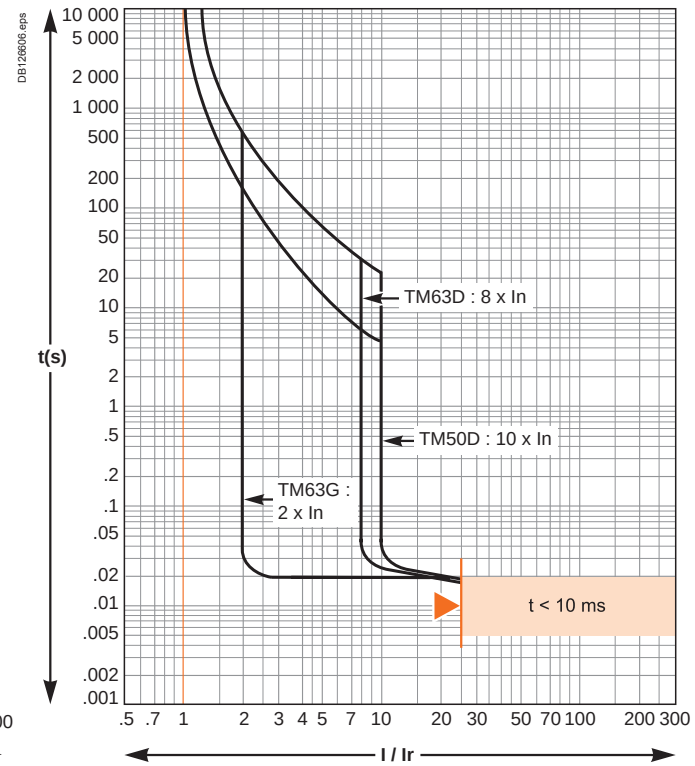


Reflex tripping.

TM32D / TM40D / TM40G



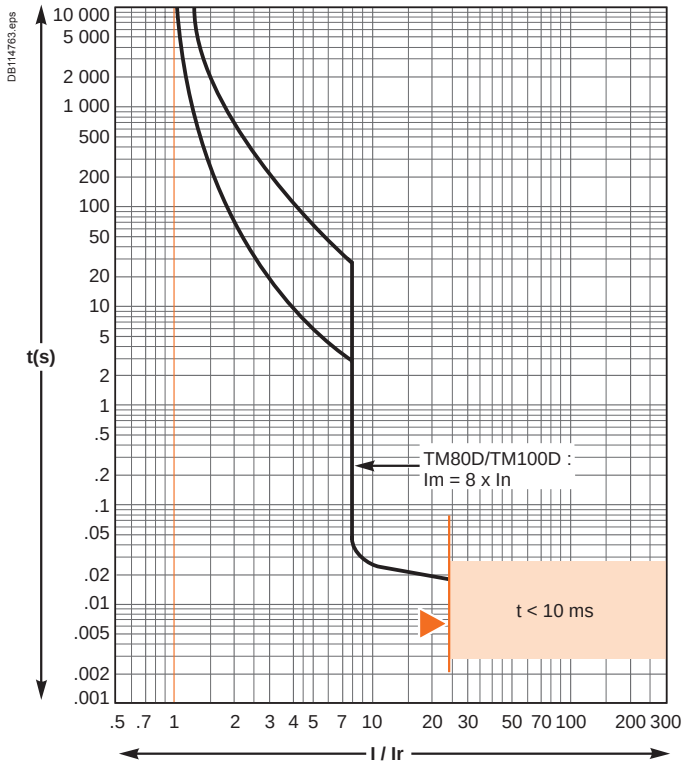
TM50D / TM63D / TM63G



Reflex tripping.

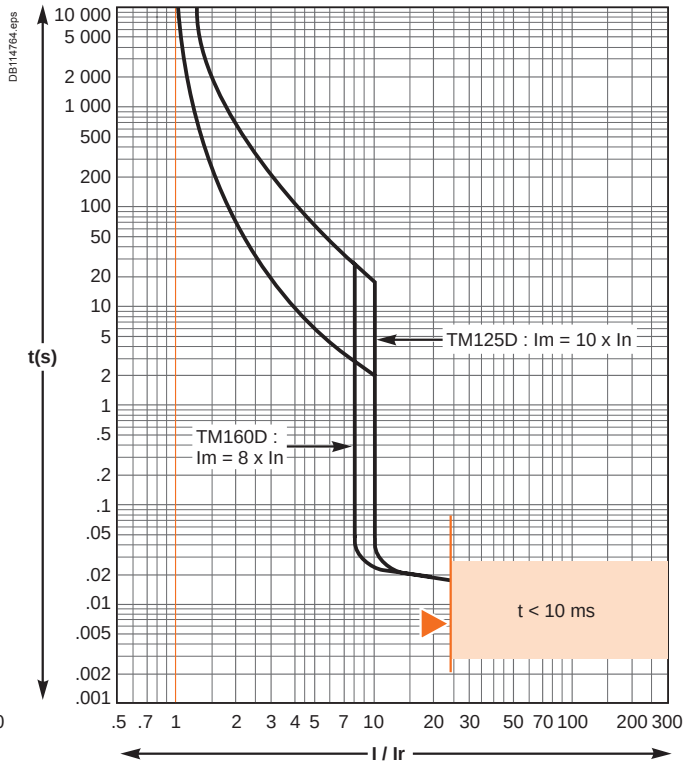
TM magnetic trip units (cont.)

TM80D / TM100D

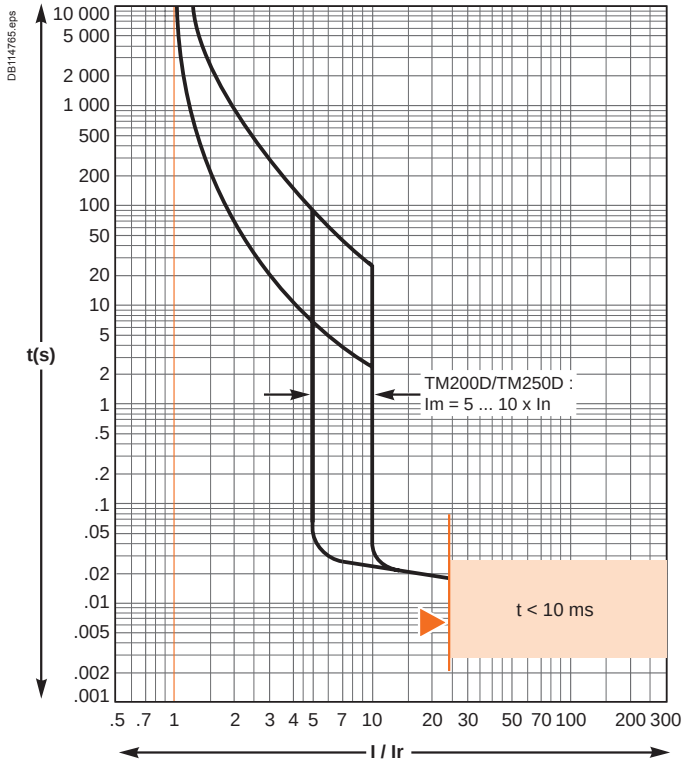


Reflex tripping.

TM125D / TM160D



TM200D / TM250D

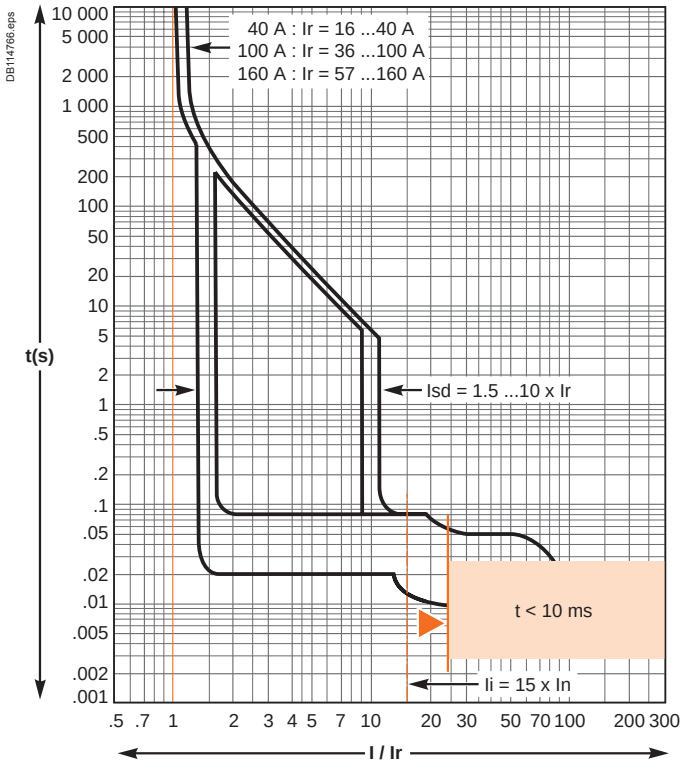


Reflex tripping.

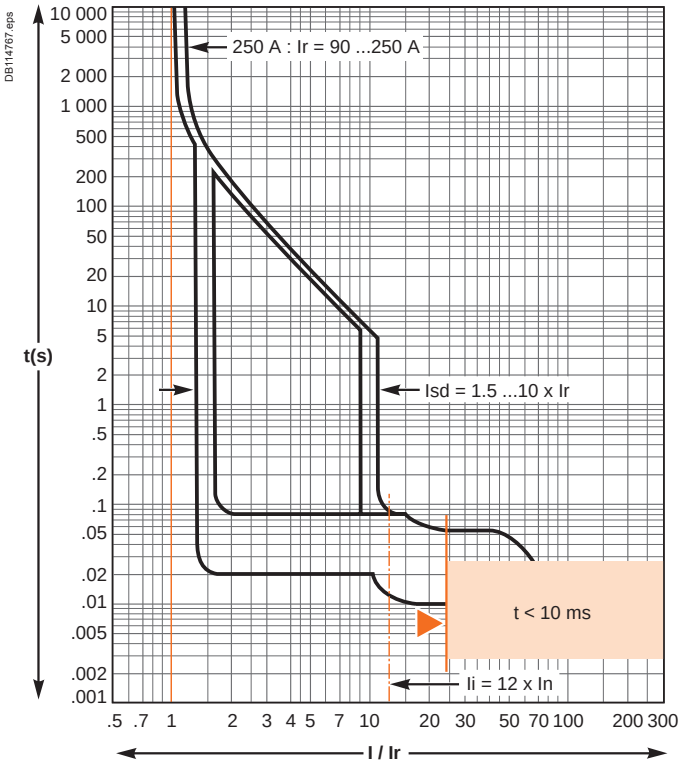
Tripping curves
Compact NSX100 to 250
Protection of distribution systems (cont.)

Micrologic 2.2 and 2.2 G electronic trip units

Micrologic 2.2 - 40... 160 A

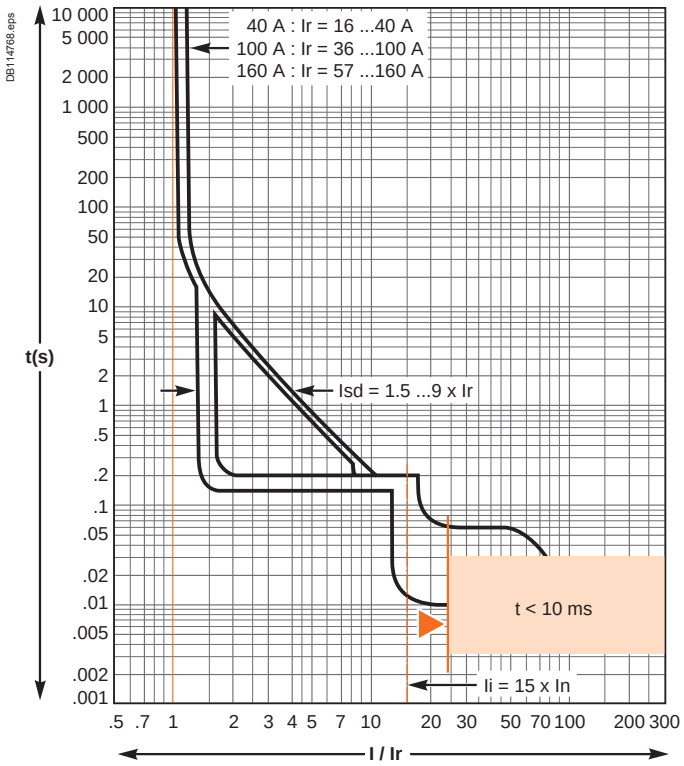


Micrologic 2.2 - 250 A

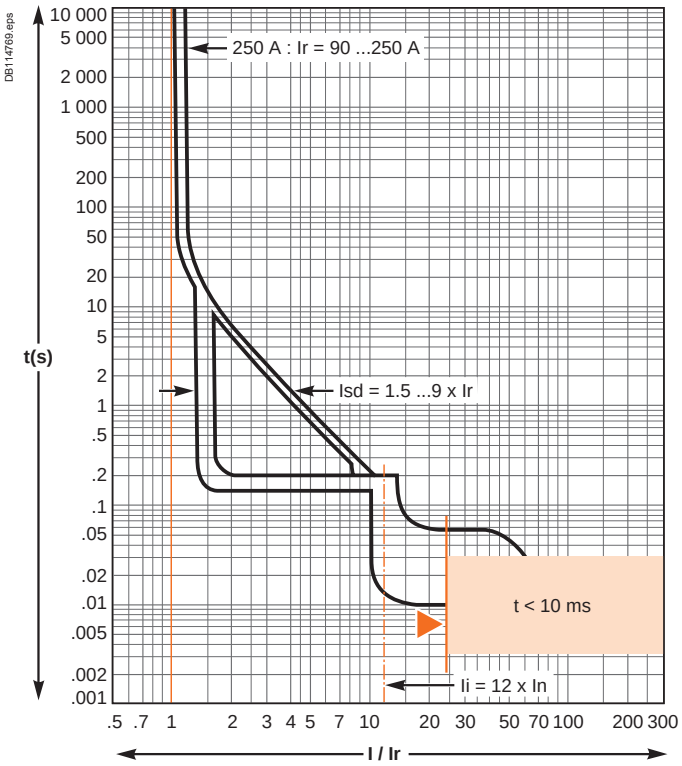


Reflex tripping.

Micrologic 2.2 G - 40... 160 A



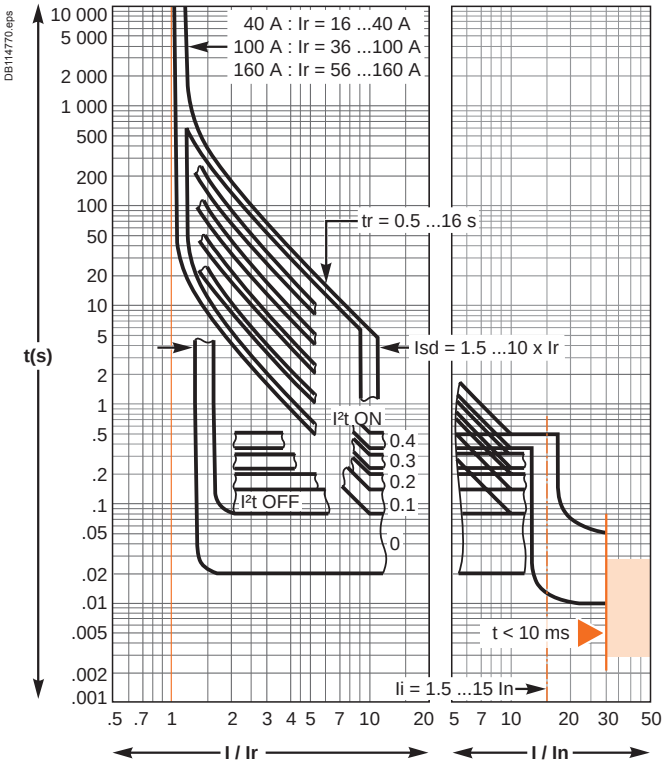
Micrologic 2.2 G - 250 A



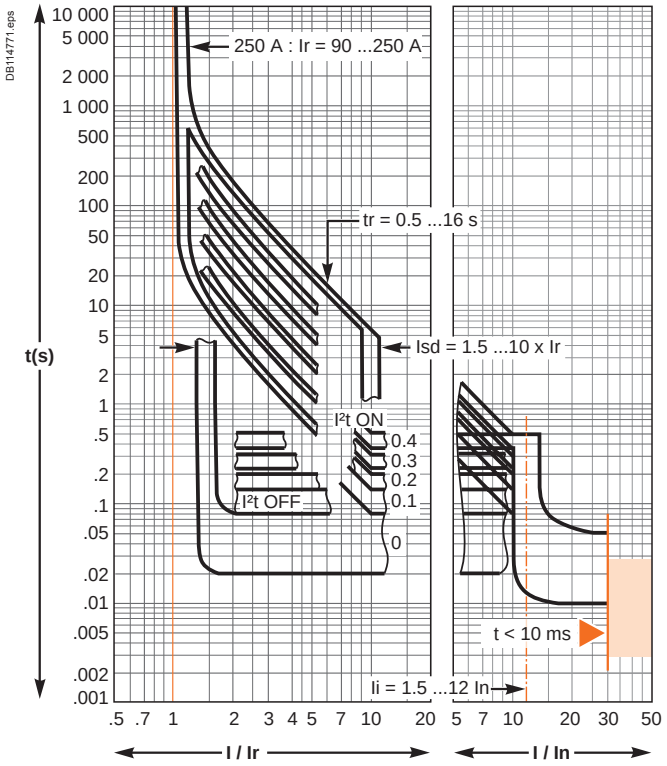
Reflex tripping.

Micrologic 5.2 and 6.2 A or E electronic trip units

Micrologic 5.2 and 6.2 A or E - 40... 160 A

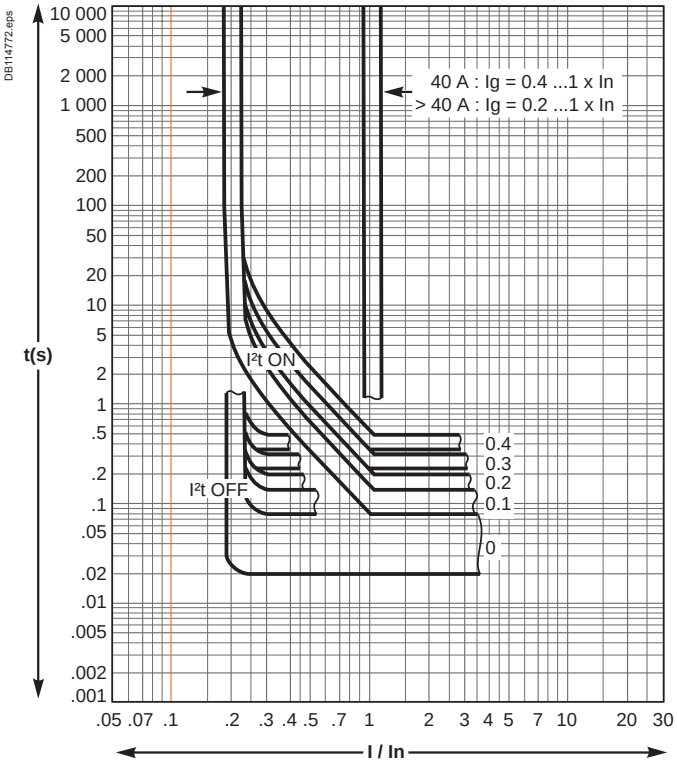


Micrologic 5.2 and 6.2 A or E - 250 A



Reflex tripping.

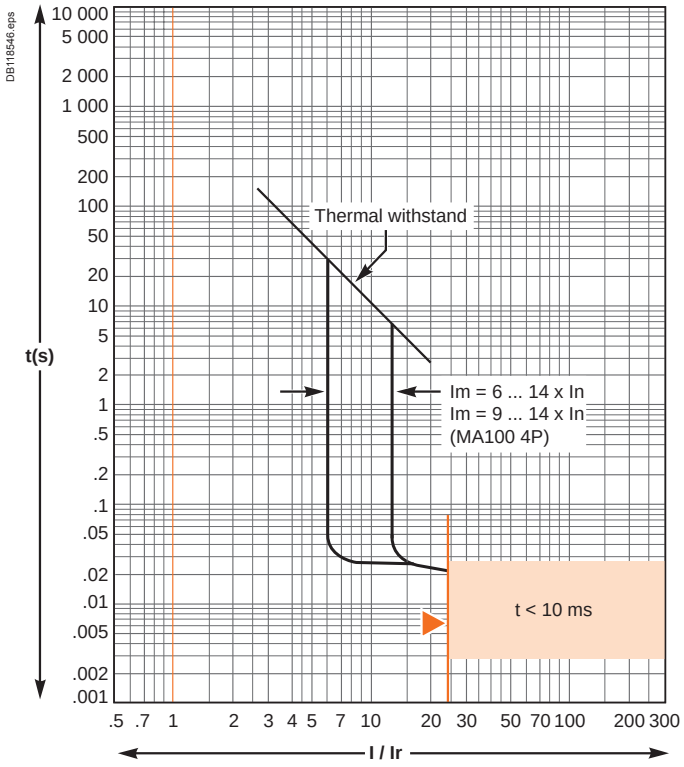
Micrologic 6.2 A or E (ground-fault protection)



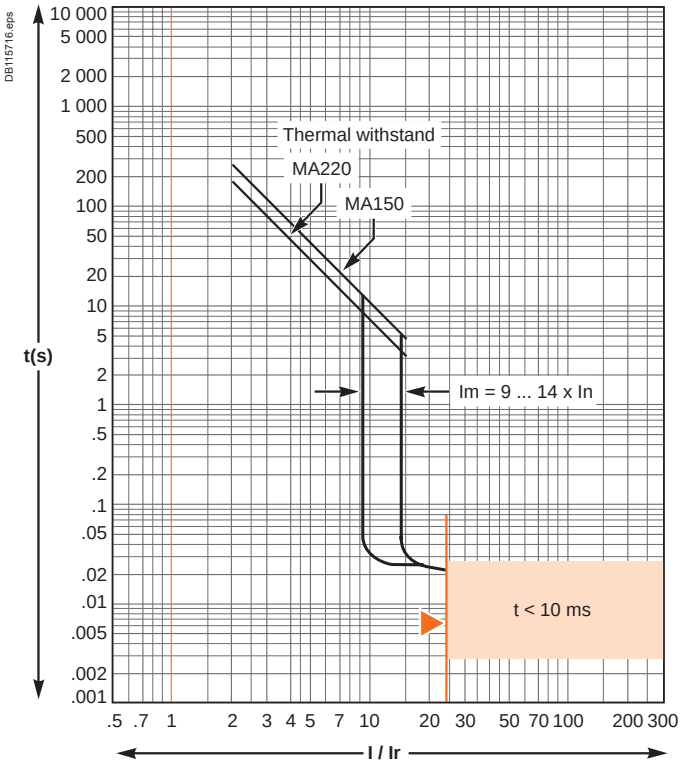
Tripping curves
Compact NSX100 to 250
Motor protection

MA magnetic trip units

MA2.5... MA100



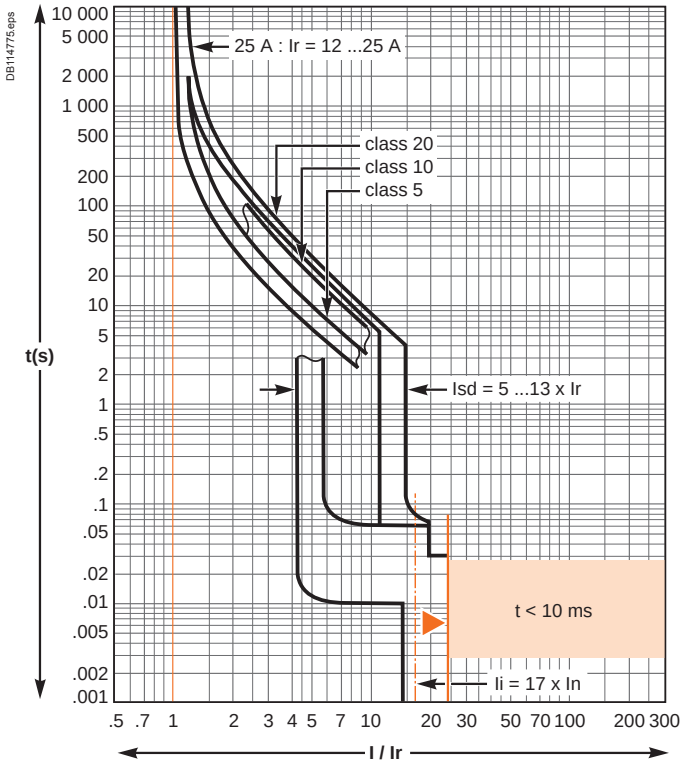
MA150 and MA220



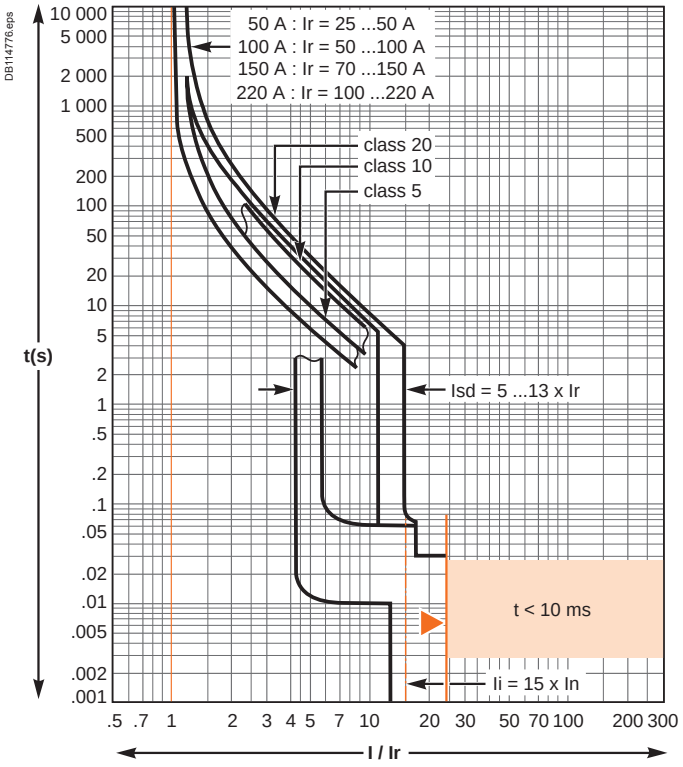
Reflex tripping.

Micrologic 2.2 M electronic trip units

Micrologic 2.2 M - 25 A



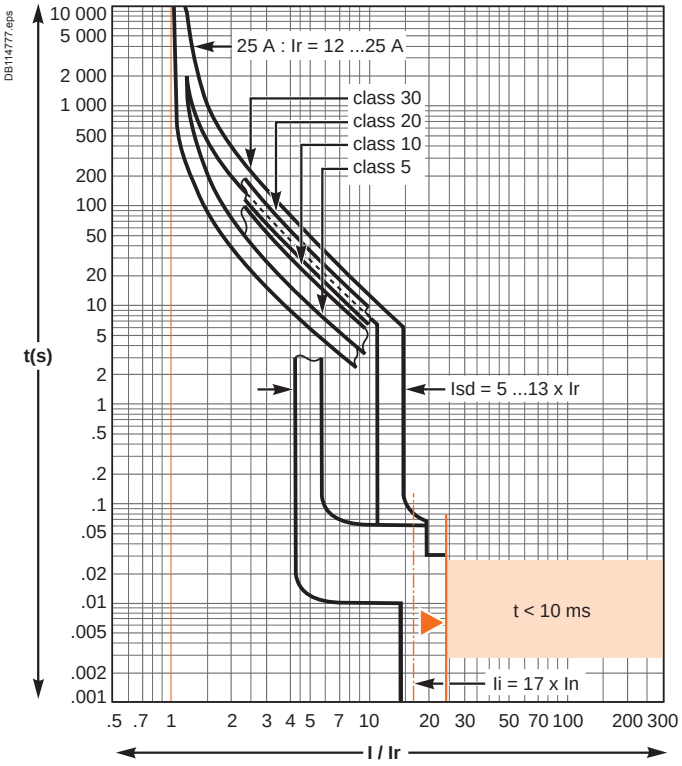
Micrologic 2.2 M - 50... 220 A



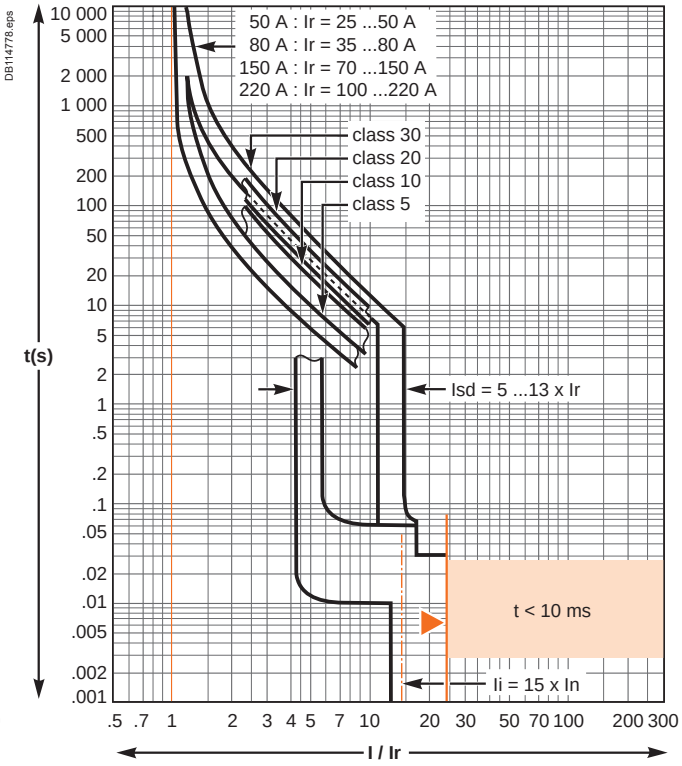
Reflex tripping.

Micrologic 6.2 E-M electronic trip units

Micrologic 6.2 E-M - 25 A

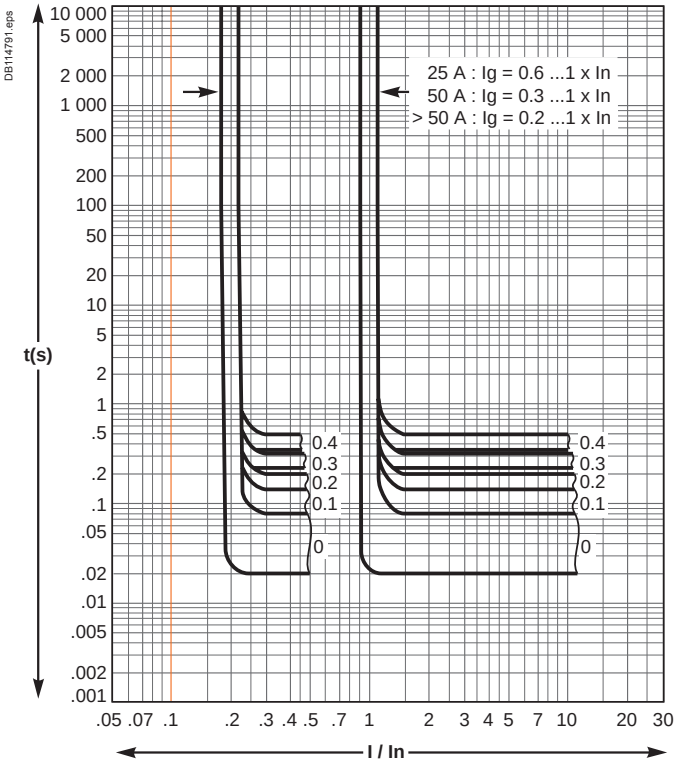


Micrologic 6.2 E-M - 50... 220 A



Reflex tripping.

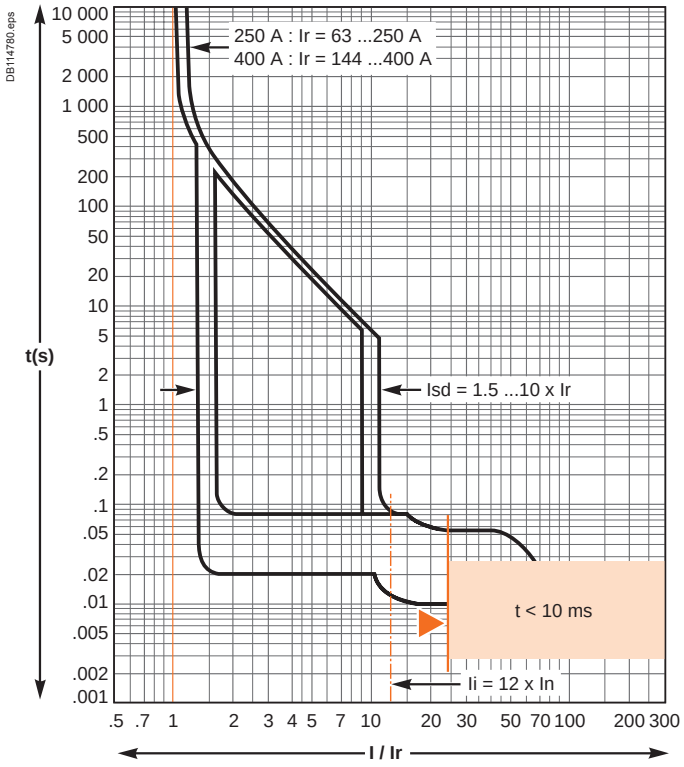
Micrologic 6.2 E-M (ground-fault protection)



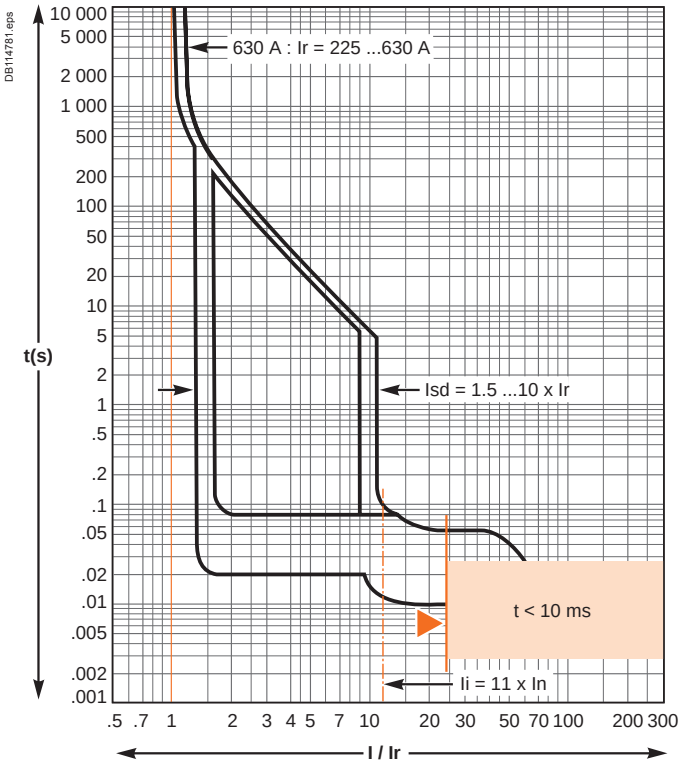
Tripping curves
Compact NSX400 to 630
Protection of distribution systems

Micrologic 2.3, 5.3 and 6.3 A or E electronic trip units

Micrologic 2.3 - 250... 400 A

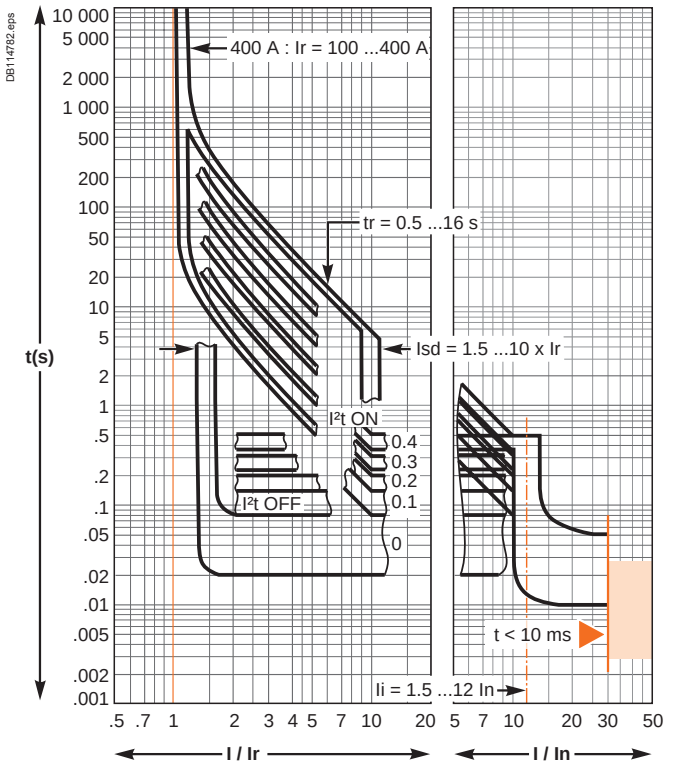


Micrologic 2.3 - 630 A

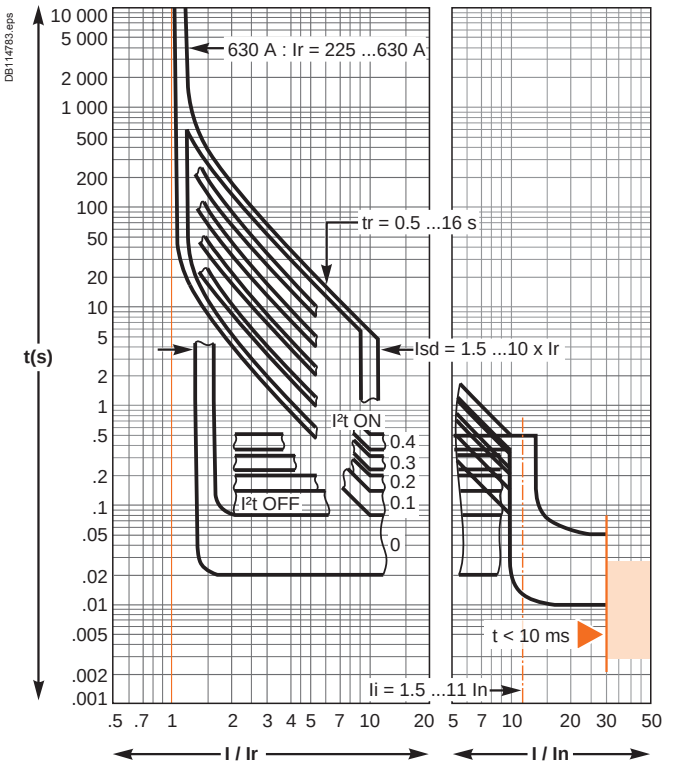


Reflex tripping.

Micrologic 5.3 and 6.3 A or E - 400 A



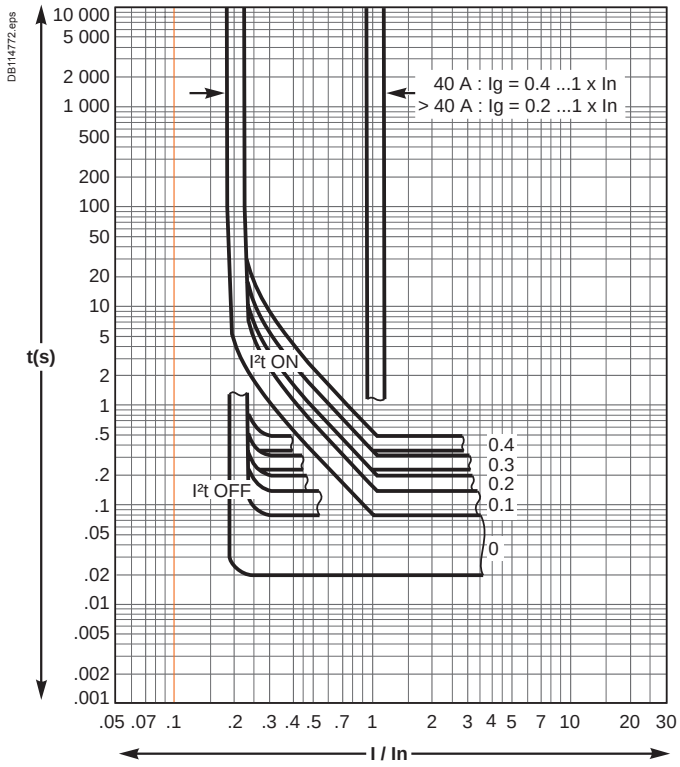
Micrologic 5.3 and 6.3 A or E - 630 A



Reflex tripping.

Micrologic 6.3 A or E electronic trip units (cont.)

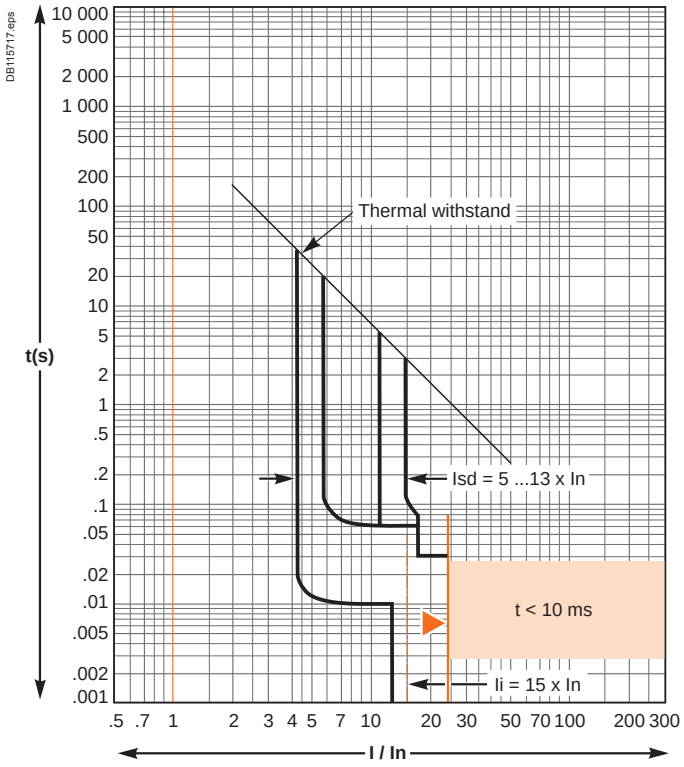
Micrologic 6.3 A or E (ground-fault protection)



Tripping curves
Compact NSX400 to 630
Motor protection

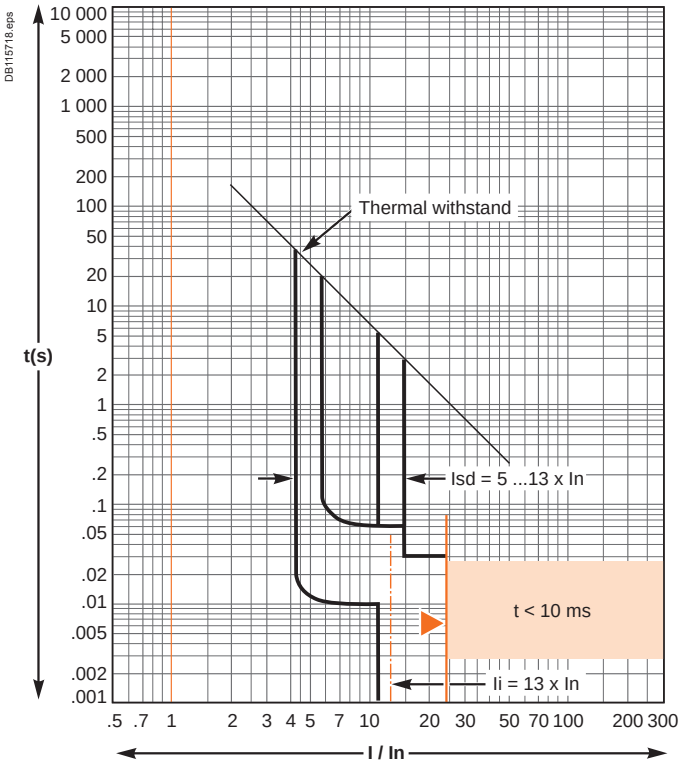
Micrologic 1.3 M and 2.3 M electronic trip units

Micrologic 1.3 M - 320 A

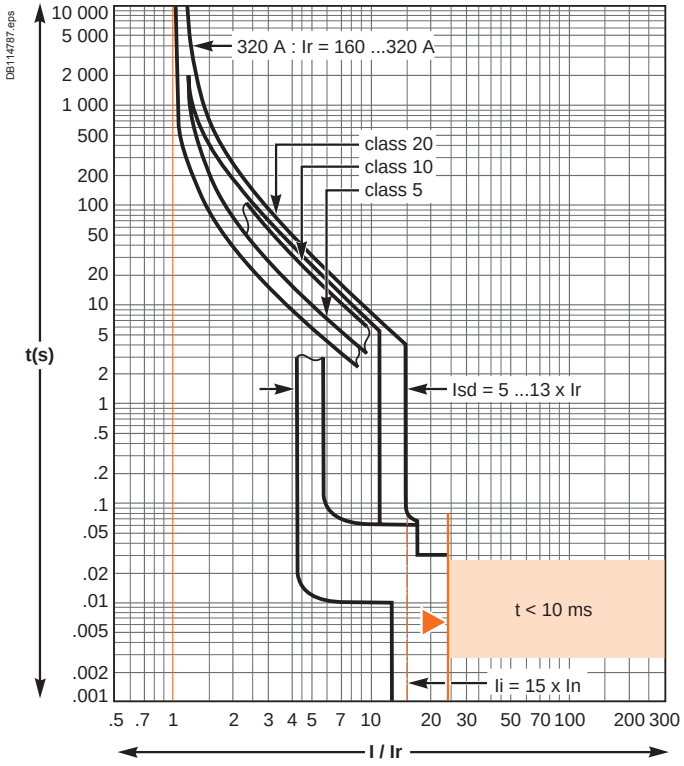


Reflex tripping.

Micrologic 1.3 M - 500 A

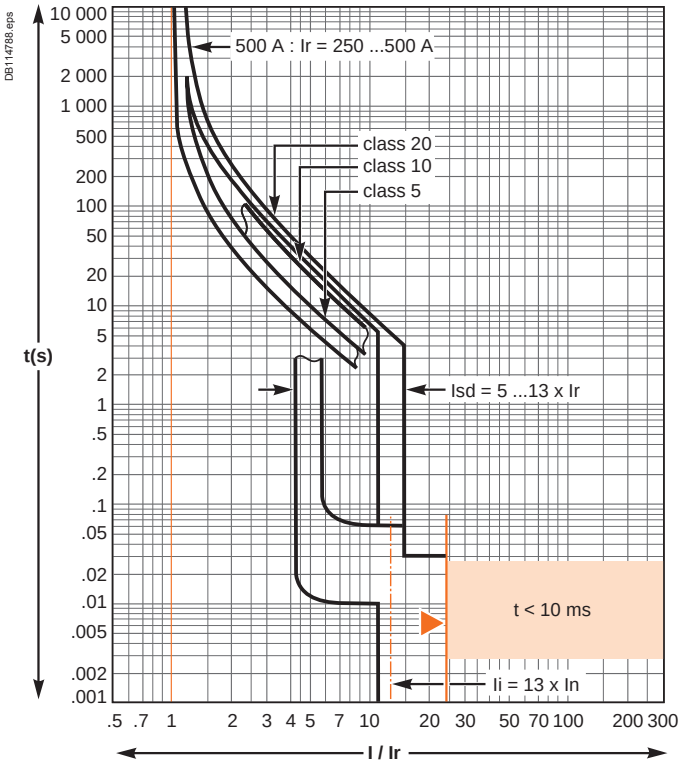


Micrologic 2.3 M - 320 A



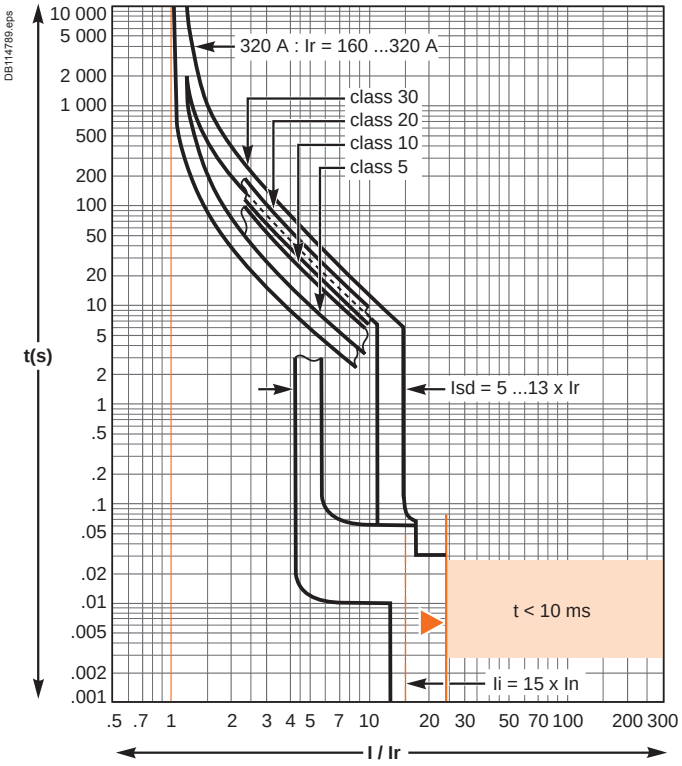
Reflex tripping.

Micrologic 2.3 M - 500 A

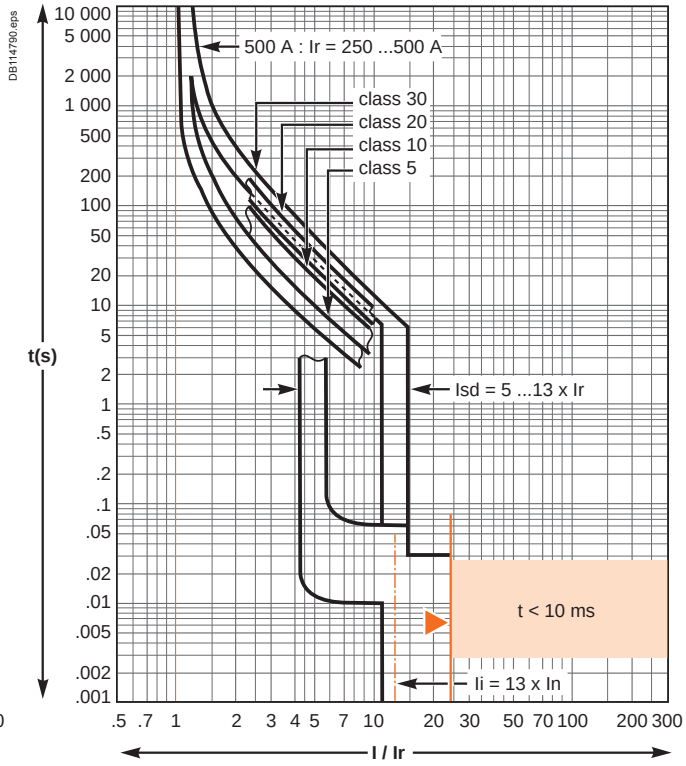


Micrologic 6.3 E-M electronic trip units

Micrologic 6.3 E-M - 320 A

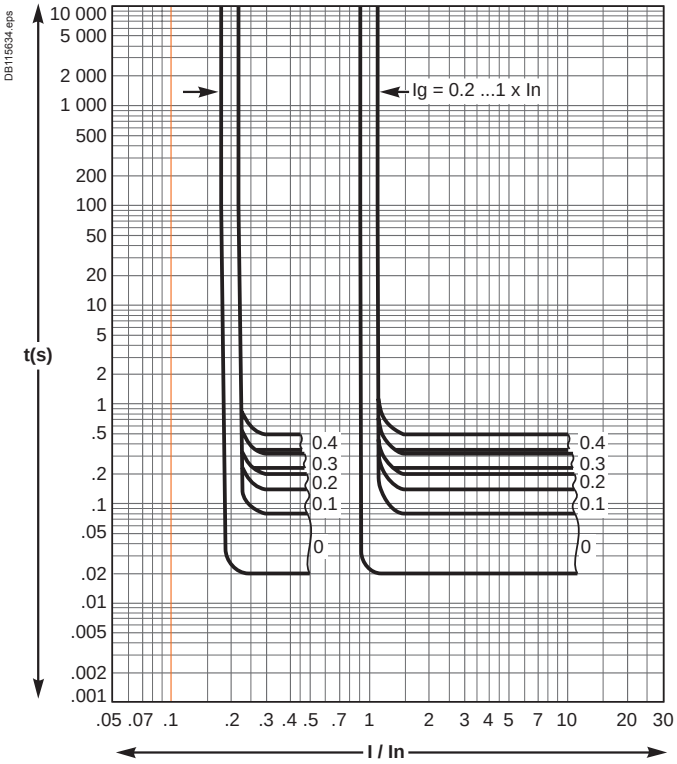


Micrologic 6.3 E-M - 500 A



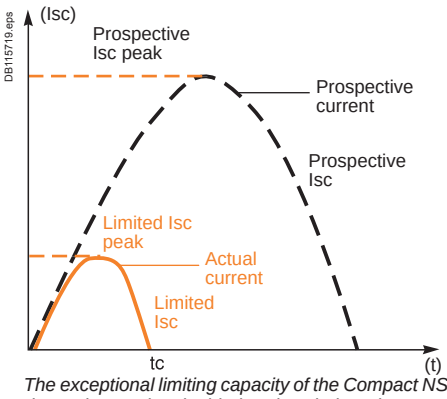
Reflex tripping.

Micrologic 6.3 E-M (ground fault protection)



Current and energy limiting curves

The limiting capacity of a circuit breaker is its aptitude to let through a current, during a short-circuit, that is less than the prospective short-circuit current.



The exceptional limiting capacity of the Compact NSX range is due to the rotating double-break technique (very rapid natural repulsion of contacts and the appearance of two arc voltages in-series with a very steep wave front).

Ics = 100 % Icu

The exceptional limiting capacity of the Compact NSX range greatly reduces the forces created by fault currents in devices.
The result is a major increase in breaking performance.
In particular, the service breaking capacity Ics is equal to 100 % of Icu.
The Ics value, defined by IEC standard 60947-2, is guaranteed by tests comprising the following steps:

- ■ break three times consecutively a fault current equal to 100 % of Icu
- ■ check that the device continues to function normally, that is:
  - □ it conducts the rated current without abnormal temperature rise
  - □ protection functions perform within the limits specified by the standard
  - □ suitability for isolation is not impaired.

Longer service life of electrical installations

Current-limiting circuit breakers greatly reduce the negative effects of short-circuits on installations.

Thermal effects
Less temperature rise in conductors, therefore longer service life for cables.

Mechanical effects
Reduced electrodynamic forces, therefore less risk of electrical contacts or busbars being deformed or broken.

Electromagnetic effects
Fewer disturbances for measuring devices located near electrical circuits.

Economy by means of cascading

Cascading is a technique directly derived from current limiting. Circuit breakers with breaking capacities less than the prospective short-circuit current may be installed downstream of a limiting circuit breaker. The breaking capacity is reinforced by the limiting capacity of the upstream device. It follows that substantial savings can be made on downstream equipment and enclosures.

Current and energy limiting curves

The limiting capacity of a circuit breaker is expressed by two curves which are a function of the prospective short-circuit current (the current which would flow if no protection devices were installed):

- ■ the actual peak current (limited current)
- ■ thermal stress (A^2s), i.e. the energy dissipated by the short-circuit in a conductor with a resistance of 1 Ω.

Example
What is the real value of a 150 kA rms prospective short-circuit (i.e. 330 kA peak) limited by an NSX250L upstream ?
The answer is 30 kA peak (curve page E-14).

Maximum permissible cable stresses

The table below indicates the maximum permissible thermal stresses for cables depending on their insulation, conductor (Cu or Al) and their cross-sectional area (CSA). CSA values are given in mm^2 and thermal stresses in A^2s.

CSA		1.5 mm²	2.5 mm²	4 mm²	6 mm²	10 mm²
PVC	Cu	$2.97x10^4$	$8.26x10^4$	$2.12x10^5$	$4.76x10^5$	$1.32x10^6$
	Al					$5.41x10^5$
PRC	Cu	$4.10x10^4$	$1.39x10^5$	$2.92x10^5$	$6.56x10^5$	$1.82x10^6$
	Al					$7.52x10^5$
CSA		**16 mm²**	**25 mm²**	**35 mm²**	**50 mm²**	
PVC	Cu	$3.4x10^6$	$8.26x10^6$	$1.62x10^7$	$3.31x10^7$	
	Al	$1.39x10^6$	$3.38x10^6$	$6.64x10^6$	$1.35x10^7$	
PRC	Cu	$4.69x10^6$	$1.39x10^7$	$2.23x10^7$	$4.56x10^7$	
	Al	$1.93x10^6$	$4.70x10^6$	$9.23x10^6$	$1.88x10^7$	

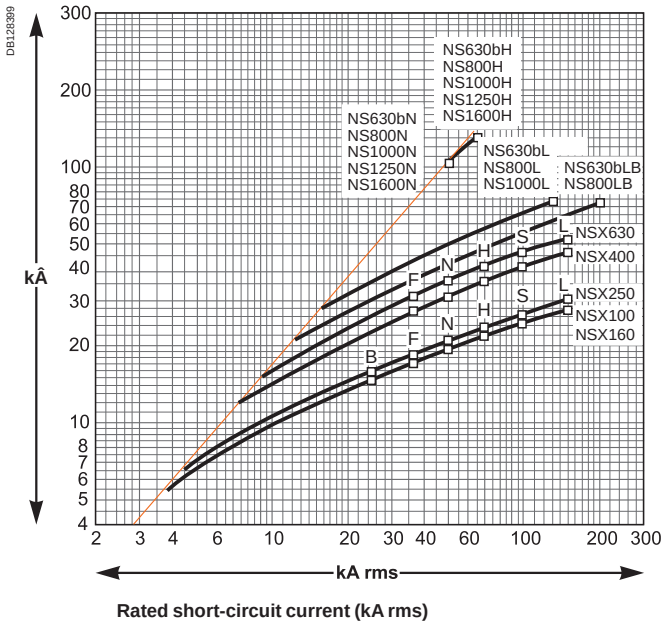
Example
Is a Cu/PVC cable with a CSA of 10 mm^2 adequately protected by an NSX160F?
The table above indicates that the permissible stress is $1.32x10^6$ A^2s.
All short-circuit currents at the point where an NSX160F (Icu = 35 kA) is installed are limited with a thermal stress less than $6x10^5$ A^2s (curve page E-14).
Cable protection is therefore ensured up to the limit of the breaking capacity of the circuit breaker.

Current-limiting curves

Current-limiting curves

Voltage 400/440 V AC (1)

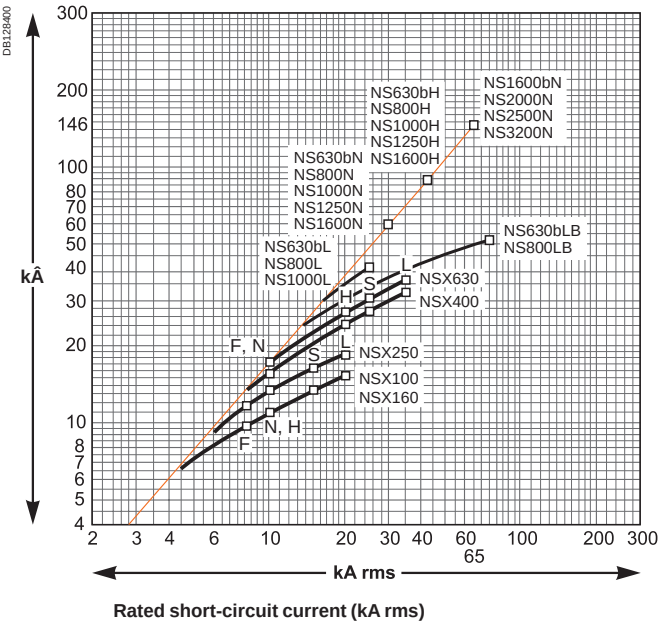
Limited short-circuit current (kÂ peak)



Rated short-circuit current (kA rms)

Voltage 660/690 V AC

Limited short-circuit current (kÂ peak)

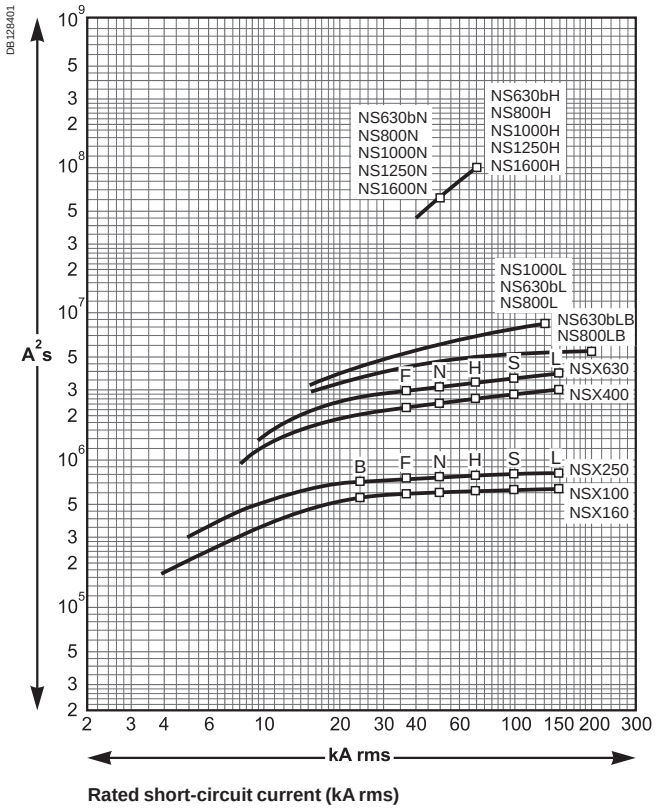


Rated short-circuit current (kA rms)

Thermal-stress curves

Voltage 400/440 V AC (1)

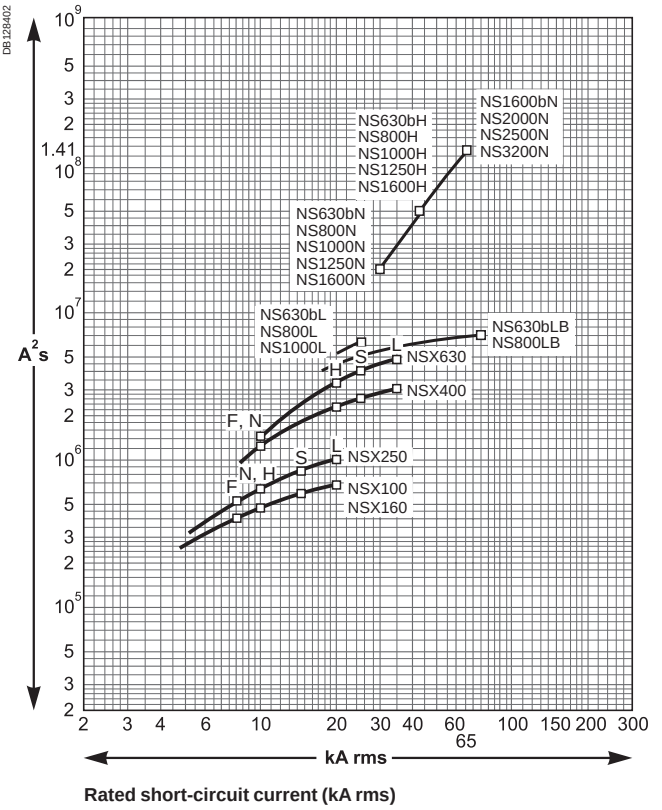
Limited energy



Rated short-circuit current (kA rms)

Voltage 660/690 V AC

Limited energy



Rated short-circuit current (kA rms)

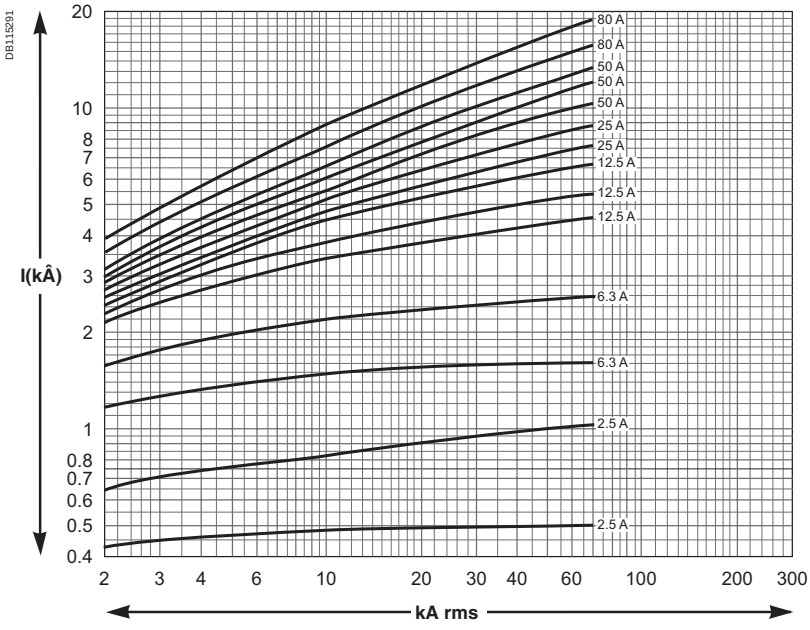
(1) Valid for 480 V Nema.

Current-limiting curves

Circuit breaker NS80H-MA	Thermal relay		Contactor	
Cal. 80 A	LRD-33	63	63/80	LC1-D80
Cal. 80 A	LRD-33	59	48/65	LC1-D65
Cal. 50 A	LRD-33	57	37/50	LC1-D65
Cal. 50 A	LRD-33	55	30/40	LC1-D65
Cal. 50 A	LRD-33	53	23/32	LC1-D65
Cal. 25 A	LRD-33	22	17/25	LC1-D65
Cal. 25 A	LRD-13	21	12/18	LC1-D65
Cal. 12.5 A	LRD-13	16	09/13	LC1-D65
Cal. 12.5 A	LRD-13	14	07/10	LC1-D65
Cal. 12.5 A	LRD-13	12	5.5/08	LC1-D32
Cal. 6.3 A	LRD-13	10	04/06	LC1-D65
Cal. 6.3 A	LRD-13	08	2.5/04	LC1-D65
Cal. 2.5 A	LRD-13	07	1.6/2.5	LC1-D65
Cal. 2.5 A	LRD-13	06	01/1.6	LC1-D09

Voltage 400/440 V AC (1)

Limited short-circuit current (kÂ peak)



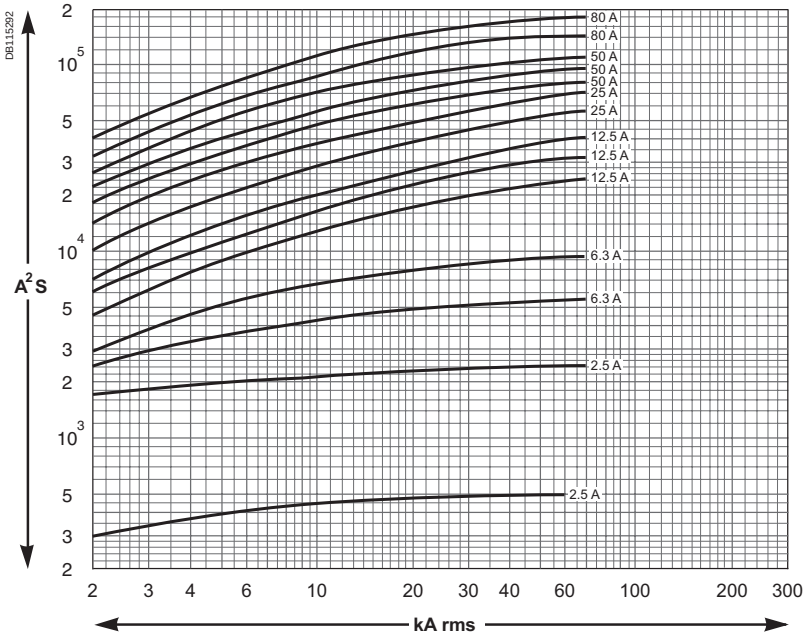
Rated short-circuit current (kA rms)

Thermal-stress curves

Circuit breaker NS80H-MA	Thermal relay		Contactor	
Cal. 80 A	LRD-33	63	63/80	LC1-D80
Cal. 80 A	LRD-33	59	48/65	LC1-D65
Cal. 50 A	LRD-33	57	37/50	LC1-D65
Cal. 50 A	LRD-33	55	30/40	LC1-D65
Cal. 50 A	LRD-33	53	23/32	LC1-D65
Cal. 25 A	LRD-33	22	17/25	LC1-D65
Cal. 25 A	LRD-13	21	12/18	LC1-D65
Cal. 12.5 A	LRD-13	16	09/13	LC1-D65
Cal. 12.5 A	LRD-13	14	07/10	LC1-D65
Cal. 12.5 A	LRD-13	12	5.5/08	LC1-D32
Cal. 6.3 A	LRD-13	10	04/06	LC1-D65
Cal. 6.3 A	LRD-13	08	2.5/04	LC1-D65
Cal. 2.5 A	LRD-13	07	1.6/2.5	LC1-D65
Cal. 2.5 A	LRD-13	06	01/1.6	LC1-D09

Voltage 400/440V AC (1)

Limited energy



Rated short-circuit current (kA rms)

(1) Valid for 480 V Nema.