

Catalogue numbers  
**NSX100/400 for utilities,**  
**"tarif jaune" public distribution**

Installation and connection with or without the visible break function

Conventional installation

Combination assembly

Upstream and downstream connection

INV100 to 250 - NSX100/160/250	4 snap-on bare cable	1.5 to 95 mm <sup>2</sup> ; ≤ 160 A	2x	LV429243
	connectors for cables:	10 to 185 mm <sup>2</sup> ; ≤ 250 A	2x	LV429260
	10 clips for bare cable connector		1x	LV429241
	4 right-angle terminal extensions		2x	LV429262
INV320/400 - NSX100/160/250	2 long terminal shields		1x	LV429518
	4 bare cable connectors:	For 1 cable, 35 mm <sup>2</sup> to 300 mm <sup>2</sup>	1x	LV432480
		For 2 cables, 35 mm <sup>2</sup> to 240 mm <sup>2</sup>	1x	LV432482
	4 right-angle terminal extensions		1x	LV432485
	1 long terminal shield		1x	LV432594
	4 snap-on bare cable	1.5 to 95 mm <sup>2</sup> ; ≤ 160 A	1x	LV429243
INV320/400 - NSX400	connectors for cables:	10 to 185 mm <sup>2</sup> ; ≤ 250 A	1x	LV429260
	10 clips for bare cable connector		1x	LV429241
	4 right-angle terminal extensions		1x	LV429262
	1 long terminal shield		1x	LV429518
	4 bare cable connectors:	For 1 cable, 35 mm <sup>2</sup> to 300 mm <sup>2</sup>	2x	LV432480
		For 2 cables, 35 mm <sup>2</sup> to 240 mm <sup>2</sup>	2x	LV432482
	4 right-angle terminal extensions		2x	LV432485
	1 long terminal shield		1x	LV432594

Installation in cabinet or enclosure

Combination assembly (mounting in duct)

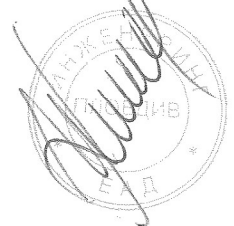
Flexible connection assembly (mounting in cubicle)

Upstream and downstream connection

INV100 to 250 - NSX100/160/250	4 snap-on bare cable	1.5 to 95 mm <sup>2</sup> ; ≤ 160 A	2x	LV429243
	connectors for cables:	10 to 185 mm <sup>2</sup> ; ≤ 250 A	2x	LV429260
	1 short terminal shield		1x	LV429516
INV320/400 - NSX100/160/250	4 bare cable connectors:	For 1 cable, 35 mm <sup>2</sup> to 300 mm <sup>2</sup>	1x	LV432480
		For 2 cables, 35 mm <sup>2</sup> to 240 mm <sup>2</sup>	1x	LV432482
	1 short terminal shield		1x	LV432592
	4 snap-on bare cable	1.5 to 95 mm <sup>2</sup> ; ≤ 160 A	1x	LV429243
INV320/400 - NSX400	connectors for cables:	10 to 185 mm <sup>2</sup> ; ≤ 250 A	1x	LV429260
	1 short terminal shield		1x	LV429516
	4 bare cable connectors:	For 1 cable, 35 mm <sup>2</sup> to 300 mm <sup>2</sup>	2x	LV432480
		For 2 cables, 35 mm <sup>2</sup> to 240 mm <sup>2</sup>	2x	LV432482
	1 short terminal shield		1x	LV432592

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ВЯРНО С ОРИГИНАЛА



# Compact NSX100 to NSX630 order form

Name of customer: .....  
 Address for delivery: .....  
 Requested delivery date: .....  
 Customer order no.: .....

To indicate your choices, check the applicable square boxes   
 or note the quantity  
 and enter the appropriate information in the rectangles

**Circuit breaker or switch-disconnector**

Compact type **NSX100/160/250 -**  
**160A not available with R, HB1 or HB2**  
**NSX400/630**

Rating **A**

Circuit breaker **B, F, N, H, S, L, R, HB1, HB2**

Switch-disconnector **NA**

Number of poles **1, 2, 3 or 4**

Number of poles **2d, 3d or 4d**  
 protected

Fixed device  Front connections

Plug-in/withdr.  Plug-in  Withdrawable

Earth-leakage protection **ME, MH, MIB**  
 (not available with R, HB1 or HB2)

Vigi add-on Voltage < 550 V  V  
 4P option on 3P NSX

**Trip unit**

**Thermal-mag.** **TMD** rating (16 ... 250 A) (40 ... 250 A)  
 with R, HB1 and (63...250 A) with HB2

**TMG** rating (16 ... 250 A) - not available  
 with R, HB1 or HB2

**MA** rating (2.5 ... 220 A) (12.5 ... 220 A)  
 with R, HB1 and HB2

**Electronic**

\* Not available with R, HB1 or HB2

Micrologic 2.2	Micrologic 2.3
Micrologic 2.2 G*	Micrologic 2.3 AB*
Micrologic 2.2 AB*	Micrologic 2.3 AL
Micrologic Vigi 4.2	Micrologic Vigi 4.3
Micrologic Vigi 4.2 AL	Micrologic Vigi 4.3 AB
Micrologic Vigi 4.2 AB	Micrologic 5.3 A*
Micrologic 5.2 E	Micrologic 5.3 E
Micrologic 5.2 A*	Micrologic 5.3 A-Z*
Micrologic 5.2 A-Z*	Micrologic 5.3 A*
Micrologic 5.2 A*	Micrologic 5.3 E
Micrologic 5.2 E	Micrologic Vigi 7.3 E
Micrologic Vigi 7.2 E	Micrologic Vigi 7.3 E AL
Micrologic Vigi 7.2 AL	Micrologic 1.3 M
Micrologic 2.2 M	Micrologic 2.3 M
Micrologic 5.2 E-M	Micrologic 5.3 E-M
<b>SDTAM Module</b>	

**External neutral CT**

24 V DC power supply connector

ZSI connector accessory for plug-in and withdrawable

ZSI wiring accessory for NS630b / MTZ

External power supply module 24 V DC

24-30 V DC	48-60 V DC
100-125 V AC	110-130 V AC
200-240 V AC	

**Battery module**

**Connection**

Rear-connection kit  Short  Long

NSX100/250 connectors

Snap-on 1.5 <sup>o</sup> to 95 <sup>o</sup> (< 160 A)	
Snap-on 25 <sup>o</sup> to 95 <sup>o</sup> (< 250 A)	
Snap-on 120 <sup>o</sup> to 185 <sup>o</sup> (< 250 A)	
Distribution 6 x 1.5 <sup>o</sup> to 35 <sup>o</sup>	
Aluminium 1 cable 25 to 95	
Aluminium 1 cable 120 to 185	
Aluminium 1 cable 120 to 250	
Aluminium 2 cables 50 <sup>o</sup> to 120 <sup>o</sup>	

NSX400/630 connectors

1 cable 35 <sup>o</sup> to 300 <sup>o</sup>	
2 cables 35 <sup>o</sup> to 240 <sup>o</sup>	

Right-angle terminal extensions

Straight extensions **NSX100/250**

Edgewise extensions  45° terminal extension  Double-L terminal extensions

Spreader **NSX100/250** (one piece)  (45 mm)

**NSX400/630** (52.5 mm)  (70 mm)

Cu cable lugs

NSX100/250	120 <sup>o</sup>	150 <sup>o</sup>	185 <sup>o</sup>
NSX400/630		240 <sup>o</sup>	300 <sup>o</sup>

Al cable lugs

NSX100/250	150 <sup>o</sup>	185 <sup>o</sup>
NSX400/630	240 <sup>o</sup>	300 <sup>o</sup>

Voltage measurement input for connector For lugs NSX100/250 ≤ 185<sup>o</sup>  
 For lugs NSX400/630

Terminal shields **NSX100/250**  Short  Long

**NSX400/630**  Short  Long for 52.5 mm spreaders

Short ≥ 500 V

Interphase barriers  Set of 6

2 insulating screens: **NSX100/250**  **NSX400/630**  70 pitch

**Test tool**

Pocket battery for Micrologic	Power supply 110-240 V AC
Maintenance case	Spare Micrologic cord
USB maintenance interface	

**Indication and measurement**

PowerTag NSX	3P	4P
Ammeter module	standard	4P
	I max	4P
Current-transformer module	3P	4P
Current-transformer module + TCU	3P	4P
Insulation-monitoring module - not available with HB1 or HB2	3P	4P
Voltage-presence indicator - not available with HB1 or HB2		
Auxiliary contact	OF, SD, SDE or SDV	Standard <input type="checkbox"/> Low level <input type="checkbox"/>
SDE adapter (TM, MA or Micrologic 2 trip units)		
SDX module		
Remote operation		
Electrical operation	Motor mechanism	AC <input type="checkbox"/> DC <input type="checkbox"/> V <input type="checkbox"/>
Voltage releases	Instantaneous	MX AC <input type="checkbox"/> DC <input type="checkbox"/> V <input type="checkbox"/>
		MN AC <input type="checkbox"/> DC <input type="checkbox"/> V <input type="checkbox"/>
	Fixed time delay	MN AC <input type="checkbox"/> DC <input type="checkbox"/> V <input type="checkbox"/>
	Adjust. time delay	MN AC <input type="checkbox"/> DC <input type="checkbox"/> V <input type="checkbox"/>

**Rotary handles**

Direct	Black	Red and yellow front
	MCC conversion access.	CNOMO conversion access.
Extended	Black	Red and yellow front
	Telescopic handle for withdrawable device	
	Open door shaft operator	

**Indication auxiliary**

1 early-break switch  2 early-make switches

**Locking**

Toggle (1 to 3 padlocks)  Removable  Fixed

Rotary handle

Keylock adapter (keylock not included)	
Keylocks Ronis 1351B.500	Profalux KS5 B24 D4Z

**Motor mechanism**

Keylock adapter + keylock Ronis (special)	NSX100/250
Keylock adapter (keylock not included)	NSX400/630
Keylocks Ronis 1351B.500	Profalux KS5 B24 D4Z

**Interlocking**

Mechanical	Toggle operated	Rotary Handle
By key (2 keylocks, 1 key) for rotary handle	Locking kit without locks	
	Keylocks Ronis 1351B.500	Profalux KS5 B24 D4Z

**Installation accessories**

IP30 escutcheon for all types (toggle/rotary handle/motor mechanism)

IP30 escutcheon (with access to toggle + trip unit)

IP30 escutcheon for Vigi add-on

IP40 escutcheon for all types (toggle/rotary handle/motor mechanism)

IP40 escutcheon for Vigi add-on

IP40 escutcheon for Vigi add-on or ammeter module

Toggle cover

Sealing accessories

DIN rail adapter **NSX100/250**

3P 60 mm busbar adapter

**Plug-in / withdrawable configuration accessories**

Auxiliary connections

1 automatic connector fixed part with 9 wires (for base)

1 automatic connector moving part with 9 wires (for circuit breaker)

1 support for 3 automatic connector  1 support for 2 automatic connector

9-wire manual auxiliary connector (fixed + moving)

**Plug-in base accessories**

Long insulated terminals  Set of 2

2 IP4 shutters for base

Escutcheon collar  Toggle  Vigi

Locking kit (keylock not included)

2 carriage switches (conn./disconnected position indication)

**Parts or plug-in**

Plug-in base FC/RC  2P  3P  4P

Withdrawable kits

Set of two power connections  Standard  Vigi

Safety trip for advanced opening

For 3P/4P chassis  Moving part  Fixed part

**Adapter for plug-in base (for terminal shield or interphase barriers)**

**Communication**

NSX Cord L = 0.35 m  NSX Cord L = 1.3 m

NSX Cord U > 480 V AC L = 0.35 m  NSX Cord L = 3 m

**BSCM**

Communicating motor mechanism 220-240 V

Switchboard front display module FDM121

FDM mounting accessory

Ethernet interface + Gateway

Ethernet interface

Modbus interface

I/O Application Module  Qty 1  Qty 2

**Stacking accessory**

ULP line termination

RJ45 connectors female/female

Wire length RJ45 L = 0.3 m	Wire length RJ45 L = 0.6 m
Wire length RJ45 L = 1 m	Wire length RJ45 L = 2 m
Wire length RJ45 L = 3 m	Wire length RJ45 L = 5 m

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# Glossary

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For each major section (Accessories, Switchgear, etc.) and for each item (Adapter for plug-in base, Connection terminal, etc.), this glossary provides:

- the page number in the concerned catalogue
- the reference standard
- the standardised IEC symbol
- the definition.

Text in quotation marks is drawn from the standards.

## Accessories .....

### Adapter for plug-in base

The adapter is a plastic component that can be installed upstream and/or downstream of the plug-in base and enables use of all the connection accessories of the fixed device.

### Bare-cable connector

Conducting part of the circuit breaker intended for connection to power circuits. On Compact NSX, it is an aluminium part that screws to the connection terminals of the circuit breaker. There are one or more holes (single or multiple cable connector) for the ends of bare cables.

### Connection terminals

Flat copper surface, linked to the conducting parts of the circuit breaker and to which power connections are made using bars, connectors or lugs.

### One-piece spreader

The spreader is a plastic component with copper connectors that can be installed upstream and/or downstream of a Compact NSX100 to 250 circuit breaker with a pole pitch of 35 mm. It increases the pitch of the circuit-breaker terminals to the 45 mm pitch of a NSX400/630 device to facilitate connection of large cables.

### Spreaders

Set of three (3P device) or four (4P) flat, conducting parts made of aluminium. They are screwed to the circuit-breaker terminals to increase the pitch between poles.

## Circuit-breaker characteristics (IEC 60947-2) .....

### Breaking capacity

Value of prospective current that a switching device is capable of breaking at a stated voltage under prescribed conditions of use and behaviour. Reference is generally made to the ultimate breaking capacity (Icu) and the service breaking capacity (Ics).

### Degree of protection (IP) IEC 60529

Defines device protection against the penetration of solid objects and liquids, using two digits specified in standard IEC 60259. Each digit corresponds to a level of protection, where 0 indicates no protection.

■ First digit (0 to 6): protection against penetration of solid foreign objects.  
1 corresponds to protection against objects with a diameter > 50 mm, 6 corresponds to total protection against dust.

■ Second digit (0 to 8): protection against penetration of liquids (water).  
1 corresponds to protection against falling drops of water (condensation),  
8 corresponds to continuous immersion.

The enclosure of Compact NSX circuit breakers provides a minimum of IP40 (protection against objects > 1 mm) and can reach IP56 (protection against dust and powerful water jets) depending on the installation conditions.

### Degree of protection against external mechanical impacts (IK)

Defines the aptitude of an object to resist mechanical impacts on all sides, indicated by a number from 0 to 10 (standard IEC 62262). Each number corresponds to the impact energy (in Joules) that the object can handle according to a standardised procedure.

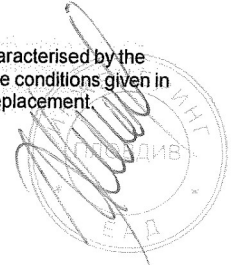
0 corresponds to no protection, 1 to an impact energy of 0.14 Joules, 10 to an impact energy of 20 Joules. Compact NSX provide IK07 (2 Joules) and can provide IK08 (5 Joules) depending on the installation conditions.

### Durability

The term "durability" is used in the standards instead of "endurance" to express the expectancy of the number of operating cycles which can be performed by the equipment before repair or replacement of parts. The term "endurance" is used for specifically defined operational performance.

### Electrical durability IEC 60947-1

With respect to its resistance to electrical wear, equipment is characterised by the number of on-load operating cycles, corresponding to the service conditions given in the relevant product standard, which can be made without replacement.



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<b>Frame size</b>	<p>"A term designating a group of circuit breakers, the external physical dimensions of which are common to a range of current ratings. Frame size is expressed in amperes corresponding to the highest current rating of the group. Within a frame size, the width may vary according to the number of poles. This definition does not imply dimensional standardization."</p> <p>Compact NSX has two frame sizes covering 100 to 250 A and 400 to 630 A.</p>
<b>Insulation class</b>	<p>Defines the type of device insulation in terms of earthing and the corresponding safety for user, in one of three classes.</p> <ul style="list-style-type: none"> <li>■ Class I. The device is earthed. Any electrical faults, internal or external, or caused by the load, are cleared via the earthing circuit, thus ensuring user safety.</li> <li>■ Class II. The device is not connected to a protective conductor. User safety is ensured by reinforced insulation around the live parts (an insulating case and no contact with live parts, i.e. plastic buttons, molded connections, etc.) or double insulation.</li> <li>■ Class III. The device may be connected only to SELV (safety extra-low voltage) circuits. The Compact NSX are class II devices (front) and may be installed through the door in class II switchboards (standards IEC 61140 and IEC 60664-1), without reducing insulation, even with a rotary handle or motor mechanism module.</li> </ul>
<b>Making capacity</b>	Value of prospective making current that a switching device is capable of making at a stated voltage under prescribed conditions of use and behaviour. Reference is generally made to the short-circuit making capacity Icm.
<b>Maximum break time</b>	Maximum time after which breaking is effective, i.e. the contacts separated and the current completely interrupted.
<b>Mechanical durability</b>	With respect to its resistance to mechanical wear, equipment is characterised by the number of no-load operating cycles which can be effected before it becomes necessary to service or replace any mechanical parts.
<b>Non-tripping time</b>	This is the minimum time during which the protective device does not operate in spite of pick-up overrun, if the duration of the overrun does not exceed the corresponding voluntary time delay.
<b>Pollution degree of environment conditions IEC 60947-1 IEC 60664-1</b>	<p>"Conventional number based on the amount of conductive or hygroscopic dust, ionized gas or salt and on the relative humidity and its frequency of occurrence, resulting in hygroscopic absorption or condensation of moisture leading to reduction in dielectric strength and/or surface resistivity". Standard IEC 60947-1 distinguishes four pollution degrees.</p> <ul style="list-style-type: none"> <li>■ Degree 1. No pollution or only dry, non-conductive pollution occurs.</li> <li>■ Degree 2. Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation may be expected.</li> <li>■ Degree 3. Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation.</li> <li>■ Degree 4. The pollution generates persistent conductivity caused, for instance, by conductive dust or by rain or snow. Compact NSX meets degree 3, which corresponds to industrial applications.</li> </ul>
<b>Prospective short-circuit current</b>	Current that would flow through the poles if they remained fully closed during the short-circuit.
<b>Rated current (In)</b>	This is the current that the device can carry continuously with the contacts closed and without abnormal temperature rise.
<b>Rated impulse withstand voltage (Uimp)</b>	"The peak value of an impulse voltage of prescribed form and polarity which the equipment is capable of withstanding without failure under specified conditions of test and to which the values of the clearances are referred. The rated impulse withstand voltage of an equipment shall be equal to or higher than the values stated for the transient overvoltages occurring in the circuit in which the equipment is fitted".
<b>Rated insulation voltage (Ui)</b>	"The rated insulation voltage of an equipment is the value of voltage to which dielectric tests and creepage distances are referred. In no case shall the maximum value of the rated operational voltage exceed that of the rated insulation voltage".
<b>Rated operational current (Ie)</b>	"A rated operational current of an equipment is stated by the manufacturer and takes into account the rated operational voltage, the rated frequency, the rated duty, the utilization category and the type of protective enclosure, if appropriate".
<b>Rated operational voltage (Ue)</b>	<p>"A value of voltage which, combined with a rated operational current, determines the application of the equipment and to which the relevant tests and the utilisation categories are referred. For multipole equipment, it is generally stated as the voltage between phases".</p> <p>This is the maximum continuous voltage at which the equipment may be used.</p>

**Rated short-time withstand current (Icw)**

"Value of short-time withstand current, assigned to the equipment by the manufacturer, that the equipment can carry without damage, under the test conditions specified in the relevant product standard". Generally expressed in kA for 0.5, 1 or 3 seconds. This is an essential characteristic for air circuit breakers. It is not significant for molded-case circuit breakers for which the design targets fast opening and high limiting capacity.

**Service breaking capacity (Ics)**

Expressed as a percentage of Icu, it provides an indication on the robustness of the device under severe conditions. It is confirmed by a test with one opening and one closing/opening at Ics, followed by a check that the device operates correctly at its rated current, i.e. 50 cycles at In, where temperature rise remains within tolerances and the protection system suffers no damage.

**Short-circuit making capacity (Icm)**

Value indicating the capacity of the device to make and carry a high current without repulsion of the contacts. It is expressed in kA peak.

**Suitability for isolation (see also below Positive contact indication)**

This capability means that the circuit breaker meets the conditions below.

- In the open position, it must withstand, without flashover between the upstream and downstream contacts, the impulse voltage specified by the standard as a function of the Uimp indicated on the device.
- It must indicate contact position by one or more of the following systems:
  - position of the operating handle
  - separate mechanical indicator
  - visible break of the moving contacts
- Leakage current between each pole, with the contacts open, at a test voltage of 1.1 x the rated operating voltage, must not exceed:
  - 0.5 mA per pole for new devices
  - 2 mA per pole for devices already subjected to normal switching operations
  - 6 mA, the maximum value that must never be exceeded.
- It must not be possible to install padlocks unless the contacts are open. Locking in the closed position is permissible for special applications. Compact NSX complies with this requirement by positive contact indication.

**Suitable for isolation with positive contact indication (see also above Suitability for isolation)**

Suitability for isolation is defined here by the mechanical reliability of the position indicator of the operating mechanism, where:

- the isolation position corresponds to the O (OFF) position
- the operating handle cannot indicate the "OFF" position unless the contacts are effectively open.

The other conditions for isolation must all be fulfilled:

- locking in the open position is possible only if the contacts are effectively open
- leakage currents are below the standardised limits
- overvoltage impulse withstand between upstream and downstream connections.

**Ultimate breaking capacity (Icu)**

Expressed in kA, it indicates the maximum breaking capacity of the circuit breaker. It is confirmed by a test with one opening and one closing/opening at Icu, followed by a check that the circuit is properly isolated. This test ensures user safety.



## Communication

**Acti 9 Smartlink Ethernet**

Acti 9 Smartlink Ethernet collects data from Smartlink Modbus and transfers them via the Ethernet network.

**Acti 9 Smartlink Modbus**

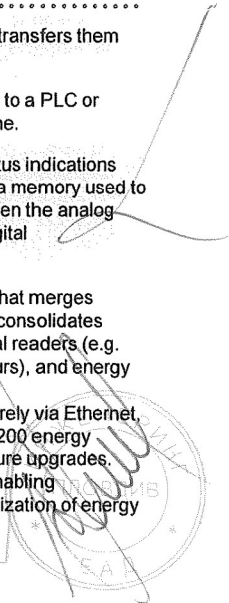
Acti 9 Smartlink Modbus is used to transfer data from Acti 9 devices to a PLC or monitoring system via the communication system: Modbus serial line.

**BSCM (Breaker status and control module)**

The optional BSCM for Compact NSX is used to acquire device status indications and control the communicating remote-control function. It includes a memory used to manage the maintenance indicators. It serves as a converter between the analog outputs of the device indication contacts (O/F, SD, SDE) and the digital communicating functions.

**Com'X 200 energy server**

Com'X 200 energy server is a compact, plug-and-play data logger that merges seamlessly with the Smart Panels energy management solution. It consolidates inputs from analog environmental sensors (e.g. temperature), digital readers (e.g. pulsed signals from smart energy or water meters, load running hours), and energy management equipment running over the Modbus protocol. Designed for ease of implementation, data can be transmitted securely via Ethernet, Wi-Fi, or GPRS to any energy management platforms. The Com'X 200 energy server is scalable and can be easily adaptable to accommodate future upgrades. Com'X 200 is a perfect fit with our energy management services, enabling visualization, tracking, and analysis of energy data to support optimization of energy performance and cost management.



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**Ethernet TCP/IP  
(Transmission Control Protocol /  
Internet Protocol)**

Ethernet is a very common network protocol and complies with IEEE standard 802.3. Ethernet TCP/IP is the protocol that brings web functions to Ethernet networks. Most PCs have an Ethernet 10/100 card (10 or 100 Mbit/s) for connection to the internet. Data communicated from Compact NSX via Modbus are accessible on a PC via a TCP/IP-Modbus gateway such as MPS100 or EGX100.

**FDM121 switchboard display**

An FDM121 switchboard display unit can be connected to a ULP IMU using a prefabricated cord to display all measurements, alarms, histories and event tables, maintenance indicators, management of installed devices on a screen. The result is a veritable 96 x 96 mm Power Meter. The FMD121 display unit requires a 24 V DC power supply. The FDM121 is a switchboard display unit that can be integrated in the Compact NSX 100 to 630 A, Powerpact H/J/L/P/R, Compact NS or Masterpact systems.

**FDM128 switchboard display**

The FDM128 is an intelligent Ethernet display. It collects the data from up to 8 devices via Ethernet network. The FDM128 is a large display, but requires very little depth. The anti-glare graphic screen is backlit for very easy reading even under poor ambient lighting and at sharp angles.

**IFE Ethernet interface,  
IFE Ethernet interface + gateway**

The IFE Ethernet interface for LV circuit breaker enables an intelligent modular unit (IMU), for example a Masterpact NT/NW or Compact NSX circuit breaker to be connected to an Ethernet network.

**IFM Module interface Modbus**

This module required for connection to the network, contains the Modbus address (1 to 99) declared by the user via the two dials in front. It automatically adapts (baud rate, parity) to the Modbus network in which it is installed. It is equipped with a lock-out switch to enable or disable operations involving writing to Micrologic, i.e. reset, counter reset, setting modifications, device opening and closing commands, etc. There is a built-in test function to check the connections of the Modbus interface module with the Micrologic and FDM121 display unit.

**I/O application module**

The I/O (Input/Output) application module for LV breaker is part of an ULP system with built-in functionalities and applications to enhance the application needs. The ULP system architecture can be built without any restrictions using the wide range of circuit breakers. The I/O application module is compliant with the ULP system specifications. Two I/O application modules can be connected in the same ULP network.

**Network**

Set of communicating devices that are interconnected by communication lines in order to share data and resources.

**Open protocol**

A protocol for system communication, interconnection or data exchange for which technical specifications are public, i.e. there are no restrictions on access or implementation. An open protocol is the opposite of a proprietary protocol.

**Protocol**

Standardised specification for dialog between digital components that exchange data. It is an operating mode based on the length and structure of binary words and it must be used by all the components exchanging data between themselves. Communication is not possible without using a protocol.

**RJ45 connector**

Universal, 8-wire connector that is widely used in digital communication networks. The RJ45 connector is used to interconnect computer equipment (Ethernet, Modbus, etc.), telephones and audiovisual equipment.

**RS485 Modbus**

Modbus is the most widely used communication protocol in industrial networks. It operates in master-slave mode. An RS485 multipoint link connects the master and slaves via a pair of wires offering throughputs of up to 38400 bits/second over distances up to 1200 m). The master cyclically polls the slaves which send back the requested information.

The Modbus protocol uses frames containing the address of the targeted slave, the function (read, write), the datum and the CRC (cyclical redundancy check).

**SDTAM**

Relay module with two static outputs specifically for the motor-protection Micrologic trip units 1 M, 2 M and 6 E-M. An output, linked to the contactor controller, opens the contactor when an overload or other motor fault occurs, thus avoiding opening of the circuit breaker. The other output stores the opening event in memory.

**SDx**

Relay module with two outputs that remotes the trip or alarm conditions of Compact NSX circuit breakers equipped with a Micrologic electronic trip unit.

**Static output**

Output of a relay made up of a thyristor or triac electronic component. The low switching capability means that a power relay is required. This is the case for the SDx and SDTAM outputs.

**ULP (Universal Logic Plug)**

Connection system used by Compact NSX to communicate information to the Modbus interface via a simple RJ45 cable. Compatible modules are indicated by the symbol opposite.

## Components .....

- ASIC (Application Specific Integrated Circuit)**  
Integrated circuit designed, built and intended for a specific application. It carries out repetitive sequences of instructions engraved in the silicon chip. For that reason, it is extremely reliable because it cannot be modified and is not affected by environment conditions.  
Micrologic trip units use an ASIC for the protection functions. The ASIC cyclically polls the network status at a high frequency, using the values supplied by captors. Comparison with the settings forms the basis for orders to the electronic trip units.
- Microprocessor**  
A microprocessor is a more general purpose device than an ASIC. In Micrologic, a microprocessor is used for measurements and it can be programmed. It is not used for the main protection functions that are carried out by the ASIC.

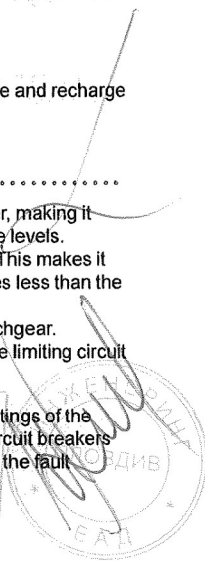
## Controls .....

- Communicating motor mechanism**  
For Compact NSX remote control via the communication system, a communicating motor mechanism is required. Except for the communication function, it is identical to the standard motor mechanism module and connects to and controlled by the BSCM module.
- CNOMO machine-tool rotary handle**  
Handle used for machine-tool control enclosures and providing IP54 and IK08.
- Direct rotary handle**  
This is an optional control handle for the circuit breaker. It has the same three positions I (ON), O (OFF) and TRIPPED as the toggle control. It provides IP40, IK07 and the possibility, due to its extended travel, of using early-make and early-break contacts. It maintains suitability for isolation and offers optional locking using a keylock or a padlock.
- Emergency off**  
In a circuit equipped with a circuit breaker, this function is carried out by an opening mechanism using an MN undervoltage release or an MX shunt release in conjunction with an emergency off button.
- Extended rotary handle**  
Rotary handle with an extended shaft to control devices installed at the rear of switchboards. It has the same characteristics as direct rotary handles. It offers multiple locking possibilities using a keylock, a padlock or a door interlock.
- Failsafe remote tripping**  
Remote tripping is carried out by an opening mechanism using an MN undervoltage release in conjunction with an emergency off button. If power is lost, the protection device opens the circuit breaker.
- Manual toggle control**  
This is the standard control mechanism for the circuit breaker, with a toggle that can be flipped up or down. In a molded-case circuit breaker (MCCB), there are three positions, I (ON), O (OFF) and TRIPPED. Once in the TRIPPED position, manual reset is required by switching to O (OFF position before reclosing. The TRIPPED position does not offer isolation with positive contact indication. This is guaranteed only by the O (OFF) position.
- MCC rotary handle**  
Handle used for motor control centres and providing IP43 and IK07.
- Motor mechanism module**  
The optional motor mechanism module is used to remotely open, close and recharge the circuit breaker.



## Selectivity / Cascading .....

- Cascading**  
Cascading implements the current-limiting capacity of a circuit breaker, making it possible to install downstream circuit breakers with lower performance levels. The upstream circuit breaker reduces any high short-circuit currents. This makes it possible to install downstream circuit breakers with breaking capacities less than the prospective short-circuit current at their point of installation. The main advantage of cascading is to reduce the overall cost of switchgear. Because the current is limited throughout the circuit downstream of the limiting circuit breaker, cascading applies to all the devices located downstream.
- Current selectivity**  
Selectivity based on the difference between the current-protection settings of the circuit breakers. The difference in settings between two successive circuit breakers in a circuit must be sufficient to allow the downstream breaker to clear the fault before the upstream breaker trips.



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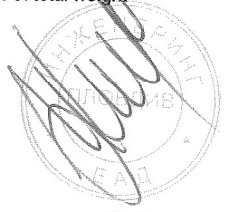




<b>Selectivity</b>	Selectivity is ensured between upstream and downstream circuit breakers if, when a fault occurs, only the circuit breaker placed immediately upstream of the fault trips. Selectivity is the key to ensuring the continuity of service of an installation.
<b>Energy selectivity</b>	This function is specific to Compact NSX (see Reflex tripping on page G-7) and supplements the other types of selectivity.
<b>Partial selectivity</b>	Selectivity is partial if the conditions for total selectivity are not met up to the ultimate short-circuit current I <sub>cu</sub> , but only up to a lesser value. This value is called the selectivity limit. If a fault exceeds the selectivity limit, both circuit breakers trip.
<b>Time selectivity</b>	Selectivity based on the difference between the time-delay settings of the circuit breakers. The upstream trip unit is delayed to provide the downstream breaker the time required to clear the fault.
<b>Total selectivity</b>	Total selectivity is ensured between upstream and downstream circuit breakers if, for all fault values, from overloads up to solid short-circuits, only the downstream circuit breaker trips and the upstream circuit breaker remains closed.
<b>Zone selective interlocking (ZSI)</b>	A number of circuit breakers with Micrologic electronic trip units are interconnected one after another by a pilot wire. In the event of a short-time or ground fault: <ul style="list-style-type: none"> <li>■ in the absence of information from downstream, the circuit breaker directly concerned by the fault (i.e. located just upstream of the fault) shifts to the shortest time delay and sends a signal upstream</li> <li>■ the upstream device, on receiving the signal from the downstream device, maintains its normal time delay.</li> </ul> In this manner, the fault is cleared rapidly by the circuit breaker closest to the fault.

## Environment.....

<b>EMC (Electromagnetic compatibility)</b>	EMC is the capacity of a device not to disturb its environment during operation (emitted electromagnetic disturbances) and to operate in a disturbed environment (electromagnetic disturbances affecting the device). The standards define various classes for the types of disturbances. Micrologic trip units comply with annexes F and J in standard IEC IE60947-2.
<b>Power loss Pole resistance</b>	The flow of current through the circuit-breaker poles produces Joule-effect losses caused by the resistance of the poles.
<b>Product environmental profile (PEP) LCA: Life-cycle assessment ISO 14040</b>	<p>An assessment on the impact of the construction and use of a product on the environment, in compliance with standard ISO 14040, Environmental management, life-cycle assessment (LCA), principles and framework.</p> <p>For Compact NSX, this assessment is carried out using the standardised EIME (Environmental Impact and Management Explorer) software, which makes possible comparisons between the products of different manufacturers.</p> <p>It includes all stages, i.e. manufacture, distribution, use and end of life, with set usage assumptions:</p> <ul style="list-style-type: none"> <li>■ use over 20 years at a percent load of 80% for 14 hours per day and 20% for ten hours</li> <li>■ according to the European electrical-energy model.</li> </ul> <p>It provides the information presented below.</p> <ul style="list-style-type: none"> <li>■ Materials making up the product: composition and proportions, with a check to make sure no substances forbidden by the RoHS directive are included.</li> <li>■ Manufacture: on Schneider Electric production sites that have set up an environmental management system certified ISO 14001.</li> <li>■ Distribution: packaging in compliance with the 94/62/EC packaging directive (optimised volumes and weights) and optimised distribution flows via local centres.</li> <li>■ Use: no aspects requiring special precautions for use. Power lost through Joule effect in Watts (W) must be &lt; 0.02% of total power flowing through the circuit breaker. Based on the above assumptions, annual consumption from 95 to 200 kWh.</li> <li>■ End of life: products dismantled or crushed. For Compact NSX, 81% of materials can be recycled using standard recycling techniques. Less than 2% of total weight requires special recycling.</li> </ul>



M

**Product environmental profile (PEP)  
Environmental indicators**

Environmental indicators are also frequently used for the PEP (sheet available on request for Compact NSX):

- Depletion of natural resources
- Depletion of energy
- Depletion of water
- Potential for atmospheric warming (greenhouse effect)
- Potential for stratospheric ozone depletion
- Creation of atmospheric ozone (ozone layer)
- Acidification of air (acid rain)
- Production of hazardous waste.

**RoHS directive (Restriction of Hazardous substances)**

European directive 2002/95/EC dated 27 January 2003 aimed at reducing or eliminating the use of hazardous substances. The manufacturer must attest to compliance, without third-party certification. Circuit breakers are not included in the list of concerned products, which are essentially consumer products. That notwithstanding, Schneider Electric decided to comply with the RoHS directive. Compact NSX products are designed in compliance with RoHS and do not contain (above the authorised levels) lead, mercury, cadmium, hexavalent chromium or flame retardants (polybrominated biphenyls PBB and polybrominated diphenyl ether PBDE).

**Safety clearances**

When installing a circuit breaker, minimum distances (safety clearances) must be maintained between the device and panels, bars and other protection systems installed nearby. These distances, which depend on the ultimate breaking capacity, are defined by tests carried out in accordance with standard IEC 60947-2.

**Temperature derating**

An ambient temperature varying significantly from 40°C can modify operation of magnetic or thermal-magnetic protection functions. It does not affect electronic trip units. However, when electronic trip units are used in high-temperature situations, it is necessary to check the settings to ensure that only the permissible current for the given ambient temperature is let through.

**Vibration withstand IEC 60068-2-6**

Circuit breakers are tested in compliance with standard IEC 60068-2-6 for the levels required by merchant-marine inspection organisations (Veritas, Lloyd's, etc.):

- 2 to 13.2 Hz: amplitude of ±1 mm
- 13.2 to 100 Hz: constant acceleration of 0.7 g.

**WEEE directive (Waste of Electrical and Electronic Equipment)**

European directive on managing the waste of electrical and electronic equipment. Circuit breakers are not included in the list of concerned products. However, Compact NSX products respect the WEEE directive.

**Harmonics**.....

**Current harmonics**

Non-linear loads cause harmonic currents that flow in the 50 Hz (or 60 Hz) distribution system. Total harmonic current is the sum of sinusoidal AC currents for which the rms values can be measured and broken down into:

- the fundamental current at the 50/60 Hz frequency of the distribution system, with an rms value of  $I_{H_1}$
- harmonic currents with whole, odd multiples (3, 5, 7, etc.) of the 50/60 Hz frequency, called the third-order, fifth-order, etc. harmonics. For example,  $I_{H_3}$ , the third-order harmonic at 150/180 Hz,  $I_{H_5}$ , the fifth-order harmonic at 250/300 Hz, etc.

The presence of harmonics in the system must be monitored and limited because it results in temperature rise, currents in the neutral (caused by the third-order harmonics and multiples), malfunctions of sensitive electronic devices, etc. Micrologic E trip units take into account harmonics up to order 15 in the THDI and THDU calculations.

**Non-linear load**

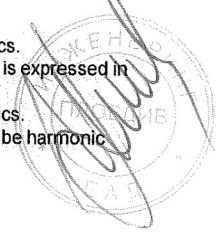
Systems producing harmonics are present in all industrial, commercial and residential sectors. Harmonics are caused by non-linear loads. A load is said to be non-linear when the current drawn does not have the same waveform as the supply voltage. Typically, loads using power electronics are non-linear. Examples of non-linear loads include computers, rectifiers, variable-speed drives, arc furnaces and fluorescent lighting.

**Total harmonic distortion of current (THDI)**

THDI characterises the distortion of the current wave by harmonics. It indicates the quantity of harmonics in the resulting waveform. It is expressed in percent. The higher the THDI, the more the current is distorted by harmonics. THDI should remain below 10%. Above that level, there is said to be harmonic pollution that is considered severe when it rises above 50%.



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**Total harmonic distortion of voltage (THDU)**

THDU characterises the distortion of the voltage wave by harmonics. It indicates the quantity of harmonics in the resulting waveform. It is expressed in percent.

The higher the THDU, the more the system voltage is distorted by harmonics. It is advised not to exceed 5% for low-voltage systems.

**Voltage harmonics**

For each current harmonic  $I_{Hk}$ , there is a voltage harmonic  $U_{Hk}$  of the same order  $k$ , where the resulting voltage is the sum of the two waves.

The voltage wave is therefore distorted with respect to the standard sinusoidal wave.

**Measurements****Contact wear**

Each time Compact NSX opens, the Micrologic 5/6 trip unit measures the interrupted current and increments the contact-wear indicator as a function of the interrupted current, according to test results stored in memory.

**Current transformer with iron-core toroid**

It is made up of a coil wound around an iron frame through which a power busbar runs. The current flowing in the bar, on passing through the sensor, induces a magnetic field that reverses for each half period. This variation in the field in turn creates an induced current in the coil. This current is proportional to the current flowing in the bar. It is sufficient to supply the measurement electronics. The disadvantage of iron-core measurement current transformers (CT) is that they rapidly saturate for currents  $> 10$  In.

**Current transformer with Rogowski toroid or air-core CT**

It is made up of a coil without an iron frame, through which a power busbar runs. The output voltage at the coil terminals is proportional to the current flowing through the bar. The result is a current transformer (CT) with a voltage output. The advantage is that it never saturates whatever the primary current and thus enables measurement of high currents. The output is however a very low current that is too low to supply the measurement electronics.

For Micrologic, Rogowski CTs measure the current and a second CT, with an iron core, provides the electrical supply.

**Demand current, demand power and peak values**

Average of the instantaneous current or power values over an adjustable fixed or sliding time interval. The highest value observed over the time interval is the peak value. The time interval runs from the last reset.

**Instantaneous current**

True rms value of the current measured by the current transformers over a sliding time interval. Available on Micrologic 5/6 A or E.

**Instantaneous voltage**

True rms value of the voltage measured by the voltage sensors over a sliding time interval. Available on Micrologic 5/6 A or E.

**Maximeters/minimeters**

Micrologic 5 and 6 A or E can record the minimum and maximum values of electrical parameters over set time periods.

**Overvoltage category (OVC - Overvoltage category) IEC 60947-1, Annex H**

Standard IEC 60664-1 stipulates that it is up to the user to select a measurement device with a sufficient overvoltage category, depending on the network voltage and the transient overvoltages likely to occur.

Four overvoltage categories define the field of use for a device.

- Cat. I. Devices supplied by a SELV isolating transformer or a battery.
- Cat. II. Residential distribution, handheld or laboratory tools and devices connected to standardised 2P + earth electrical outlets (230 V).
- Cat. III. Industrial distribution, fixed distribution circuits in buildings (main low voltage switchboards, rising mains, elevators, etc.).
- Cat. IV. Utility substations, overhead lines, certain industrial equipment.

**Percent load**

Percentage of current flowing through the circuit breaker with respect to its rated current. Micrologic 6 E-M offers this information and can sum it over the total operating time to provide the load profile for the following ranges, 0 to 49%, 50 to 79%, 80 to 89% and  $\geq 90\%$ .

**Phase sequence**

The order in which the phases are connected (L1, L2, L3 or L1, L3, L2) determines the direction of rotation for three-phase asynchronous motors. Micrologic 6 E-M trip units provide this information.

**Power and energy metering (consumption)**

The digital electronics in Micrologic 5/6 E calculate the instantaneous power levels, apparent (S in kVA), active (P in kW) and (Q in kV), and integrate over a time interval to determine the corresponding energies (kVAh, kWh kvarh). Calculations are for each phase and for the total.

G

**Time-stamped histories**

Micrologic trip units store information on events (e.g. alarms and their cause) that are time-stamped to within a millisecond.

**Protection** .....

**Ground-fault protection G (Ig)**

Protection function specific to electronic circuit breakers, symbolised by G (Ground). This protection can calculate high-threshold residual earth-leakage currents (in the order of tens of Amperes) on the basis of phase-current measurements. Micrologic 5/6 offers this protection function with adjustable pick-up Ig and time delay.

**Instantaneous protection I (Ii)**

This protection supplements Isd. It provokes instantaneous opening of the device. The pick-up may be adjustable or fixed (built-in). This value is always lower than the contact-repulsion level.

**Long-time protection L (Ir)**

Protection function where the adjustable Ir pick-up determines a protection curve similar to the thermal-protection curve (inverse-time curve I<sup>2</sup>t). The curve is generally determined on the basis of the Ir setting which corresponds to a theoretically infinite tripping time (asymptote) and of the point at 6 Ir at which the tripping time depends on the rating.

**Magnetic protection (Im)**

Short-circuit protection provided by magnetic trip units (see this term). The pick-up setting may be fixed or adjustable.

**Neutral protection (IN)**

The neutral is protected because all circuit-breaker poles are interrupted. The setting may be that used for the phases or specific to the neutral, i.e. reduced neutral (0.5 times the phase current) or OSN (oversized neutral) at 1.6 times the phase current. For OSN protection, the maximum device setting is limited to 0.63 In.

**Residual-current earth-leakage protection (IΔn)**

Protection provided by Vigi add-on, in which the residual-current toroids directly detect low-threshold earth-leakage currents (in the order of tens of mA) caused by insulation faults.

**Short-delay protection S (Isd)**

Protection function specific to electronic circuit breakers, symbolised by S (Short delay or short time). This protection supplements thermal protection. The reaction time is very short, but has a slight time delay to enable selectivity with the upstream device. The short-delay pick-up Isd is adjustable from approximately 1.5 to 10 Ir.

**Short-delay protection with fixed time delay So (Isd)**

Short-delay protection, but with a fixed time delay. This function is available on Micrologic 2. It is symbolised by So. It ensures selectivity with downstream devices.

**Thermal protection (Ir)**

Overload protection provided by thermal trip units (see this term) using an inverse-time curve (I<sup>2</sup>t).

**Relays and auxiliary contacts** .....



**Auxiliary contact IEC 60947-1**

"Contact included in an auxiliary circuit and mechanically operated by the switching device".

**Break contact IEC 60947-1**

"Control or auxiliary contact which is open when the main contacts of the mechanical switching device are closed and closed when they are open".

**Make contact IEC 60947-1**

"Control or auxiliary contact which is closed when the main contacts of the mechanical switching device are closed and open when they are open".

**Relay (electrical) IEC 60947-1**

"Device designed to produce sudden, predetermined changes in one or more electrical output circuits when certain conditions are fulfilled in the electrical input circuits controlling the device".

**Relay module with static output**

Output of a relay made up of a thyristor or triac electronic component. The low interrupting capacity means that a power relay is required. This is the case for the SDx and SDTAM outputs.

ВЕРНО С ОРИГИНАЛА



## Switchgear

### Circuit breaker IEC 60947-2



"Mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuit". Circuit breakers are the device of choice for protection against overloads and short-circuits. Circuit breakers may, as is the case for Compact NSX, be suitable for isolation.

### Circuit-breaker utilisation category IEC 60947-2

The standard defines two utilisation categories, A and B, depending on breaker selectivity with upstream breakers under short-circuit conditions.

- Category A. Circuit breakers not specifically designed for selectivity applications.
- Category B. Circuit breakers specifically designed for selectivity, which requires a short time-delay (which may be adjustable) and a rated short-time withstand current in compliance with the standard.

Compact NSX 100 to 630 circuit breakers are category A, however, by design, they provide selectivity with downstream devices (see the Complementary technical information guide).

### Contactors IEC 60947-1



"Mechanical switching device having only one position of rest, operated otherwise than by hand, capable of making, carrying and breaking currents under normal circuit conditions including operating overload conditions". A contactor is provided for frequent opening and closing of circuits under load or slight overload conditions. It must be combined and coordinated with a protective device against overloads and short-circuits, such as a circuit breaker.

### Contactors utilisation categories IEC 60947-4-1

The standard defines four utilisation categories, AC1, AC2, AC3 and AC4 depending on the load and the control functions provided by the contactor. The class depends on the current, voltage and power factor, as well as contactor withstand capacity in terms of frequency of operation and endurance.

### Current-limiting circuit breaker IEC 60947-2

"A circuit-breaker with a break-time short enough to prevent the short-circuit current reaching its otherwise attainable peak value".

### Disconnectors IEC 60947-3



"Mechanical switching device which, in the open position, complies with the requirements specified for the isolating function". A disconnector serves to isolate upstream and downstream circuits. It is used to open or close circuits under no-load conditions or with a negligible current level. It can carry the rated circuit current and, for a specified time, the short-circuit current.

### Switch-disconnector IEC 60947-3



"Switch which, in the open position, satisfies the isolating requirements specified for a disconnector". A switch-disconnector serves for switching and isolation. The switch function breaks the circuit under load conditions and the disconnection function isolates the circuit. Protection is not provided. It may be capable of making short-circuit currents if it has the necessary making capacity, but it cannot break short-circuit currents. Compact NSX 100 to 630 NA switch-disconnectors have a making capacity.

### Switch-disconnector utilisation category IEC 60947-3

The standard defines six utilisation categories, AC-21A or B, AC-22 A or B, AC23 A or B. They depend on the rated operational current and the mechanical durability (A for frequent operation or B for infrequent operation). Compact NSX NA switch-disconnectors comply with utilisation categories AC22A or AC23A.



## Three-phase asynchronous motors and their protection

### Locked-rotor protection (Ijam)

This function steps in when the motor shaft cannot or can no longer drive the load. The result is a high overcurrent.

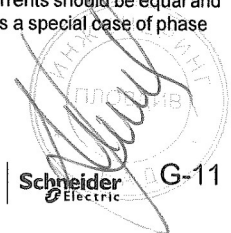
### Long-start protection (Ilong)

An overly long start means the current drawn remains too high or too low for too long, with respect to the starting current. In all cases, the load cannot be driven and the start must be interrupted. The resulting temperature rise must be taken into account before restarting.

### Phase-unbalance or phase-loss protection (Iunbal)

This protection function steps in if the current values and/or the unbalance in the three phases supplying the motor exceeds tolerances. Currents should be equal and displacement should be one third of a period. Phase loss is a special case of phase unbalance.

ВЕРНО С ОРИГИНАЛА



103A

**Starting current**

Start-up of a three-phase, asynchronous motor is characterised by:

- a high inrush current, approximately 14 I<sub>n</sub> for 10 to 15 ms
- a starting current, approximately 7.2 I<sub>n</sub> for 5 to 30 seconds
- return to the rated current after the starting time.

**Starting time**

Time after which the motor ceases to draw the starting current and falls back to the operating current I<sub>r</sub> (≤ I<sub>n</sub>).

**Thermal image of the rotor and stator**

The thermal image models the thermal behaviour of a motor rotor and stator, taking into account temperature rise caused by overloads or successive starts, and the cooling constants. For each motor power rating, the algorithm takes into account a theoretical amount of iron and copper which modifies the cooling constants.

**Thermal protection**

Protection against overcurrents following an inverse time curve I<sup>2</sup>t = constant, which defines the maximum permissible temperature rise for the motor. Tripping occurs after a time delay that decreases with increasing current.

**Trip class  
IEC 60947-4-1**

The trip class determines the trip curve of the thermal protection device for a motor feeder. The standard defines trip classes 5, 10, 20 and 30. These classes are the maximum durations, in seconds, for motor starting with a starting current of 7.2 I<sub>r</sub>, where I<sub>r</sub> is the thermal setting indicated on the motor rating plate.

**Under-load protection (Iund)**

This function steps in when the driven load is too low. It detects a set minimum phase current which signals incorrect operation of the driven machine. In the example of a pump, under-load protection detects when the pump is no longer primed.

**Trip units**

**Electronic trip unit (Micrologic)**

Trip unit that continuously measures the current flowing through each phase and the neutral if it exists. For Micrologic, the measurements are provided by built-in current sensors linked to an analog-digital converter with a high sampling frequency. The measurement values are continuously compared by the ASIC to the protection settings. If a setting is overrun, a Mitop release trips the circuit-breaker operating mechanism.

This type of trip unit offers much better pick-up and delay setting accuracy than thermal-magnetic trip units. It also provides a wider range of protection functions.

**Magnetic release**

Release actuated by a coil or a lever. A major increase in the current (e.g. a short-circuit) produces in the coil or the lever a change in the magnetic field that moves a core. This trips the circuit breaker operating mechanism. Action is instantaneous. The pick-up setting may be adjustable.

**Reflex tripping**

Compact NSX circuit breakers have a patented reflex-tripping system based on the energy of the arc and that is independent of the other protection functions. It operates extremely fast, before the other protection functions. It is an additional safety function that operates before the others in the event of a very high short-circuit.

**Release  
IEC 60947-1**

Device, mechanically connected to a mechanical switching device (e.g. a circuit breaker), which releases the holding means and permits the opening or the closing of the switching device. For circuit breakers, releases are often integrated in a trip unit.

**Shunt release (MX)**

This type of release operates when supplied with current. The MX release provokes circuit-breaker opening when it receives a pulse-type or maintained command.

**Thermal-magnetic trip unit**

Trip unit combining thermal protection for overloads and magnetic protection.

**Thermal release**

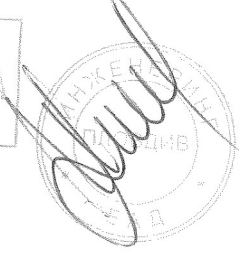
Release in which a bimetal strip is heated by the Joule effect. Above a temperature-rise threshold that is a function of the current and its duration (I<sup>2</sup>t curve = constant, which is representative of temperature rise in cables), the bimetal strip bends and releases the circuit-breaker opening mechanism. The pick-up setting may be adjustable.

**Undervoltage release (MN)**

This type of release operates when the supply voltage drops below the set minimum.



ВЕРНО С ОРИГИНАЛА



AM

## Additional characteristics

### Compact NSXm up to 160 A

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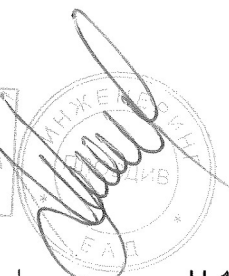
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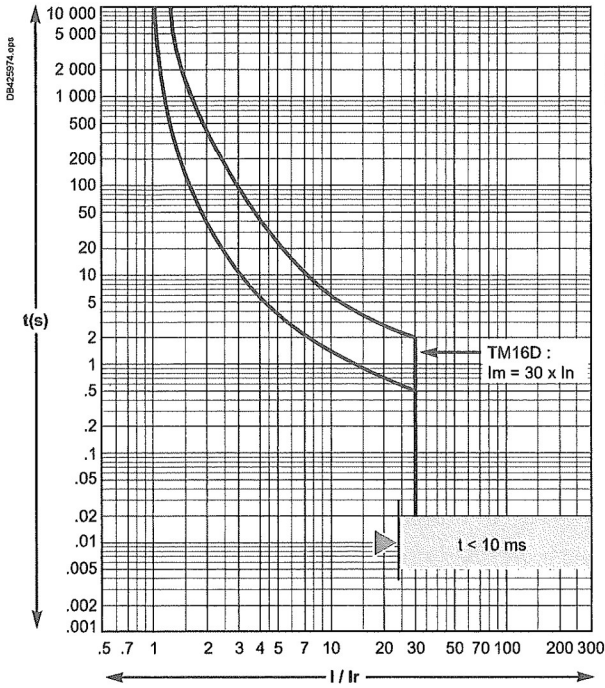
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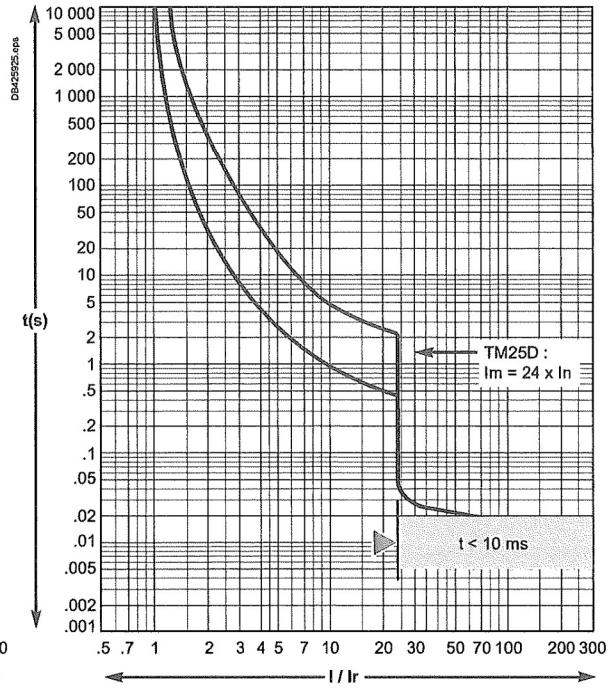


# Compact NSXm up to 160 A TMD magnetic trip units, tripping curves Protection of distribution systems

TM16D

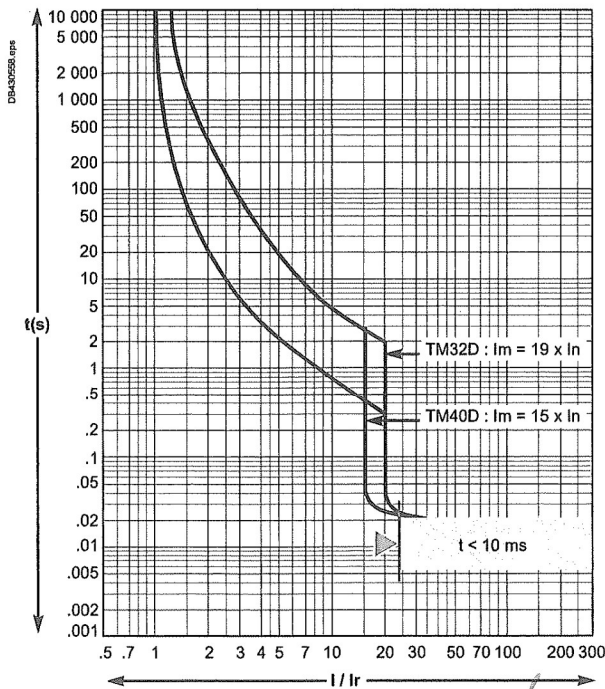


TM25D

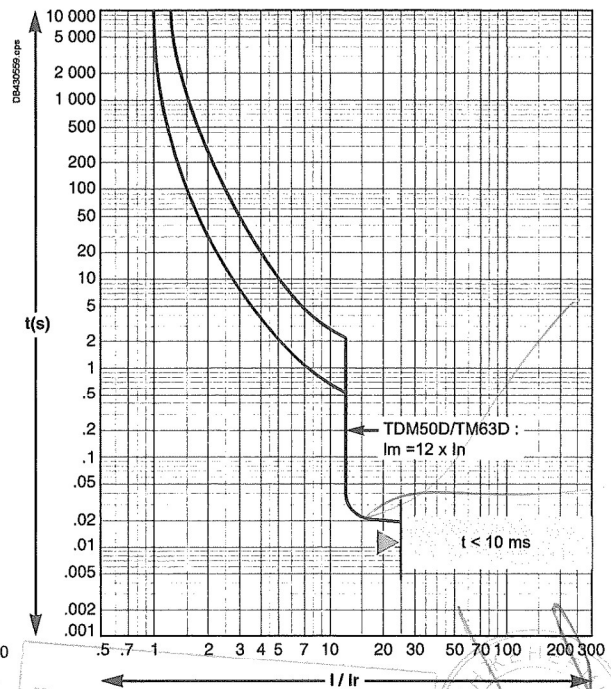


Reflex tripping.

TM32D / TM40D



TM50D / TM63D



Reflex tripping.



ВЯРНО С ОРИГИНАЛА



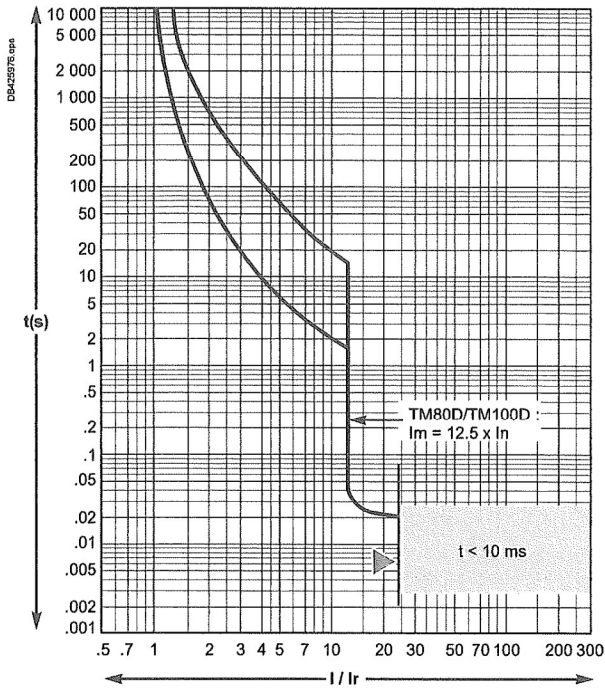
# Additional characteristics

## Compact NSXm up to 160 A

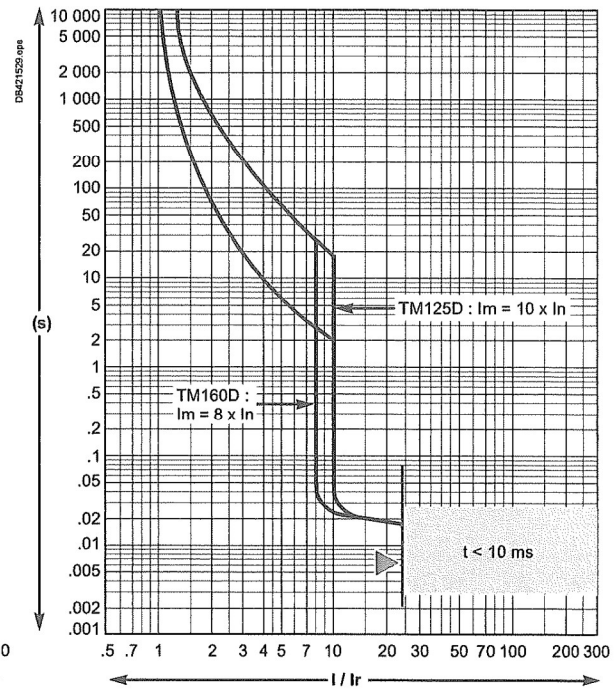
### TMD magnetic trip units, tripping curves

### Protection of distribution systems

TM80D / TM100D



TM125D / TM160D



Reflex tripping.

For all TMD curves :  
 Values are given for 40 °C ambient,  $I_r = 1 \times I_n$ , 3 poles loaded, cold start.  
 For  $I_r = k \times I_n$ , read the time corresponding to  $1/k$  times given current.  
 For 1 pole tripping, read the time corresponding to 0.85 times given current.  
 For hot start ( $0.9 \times I_r$ ), divide max. time by 2, min. time by 4.



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ВЯРНО С ОРИГИНАЛА

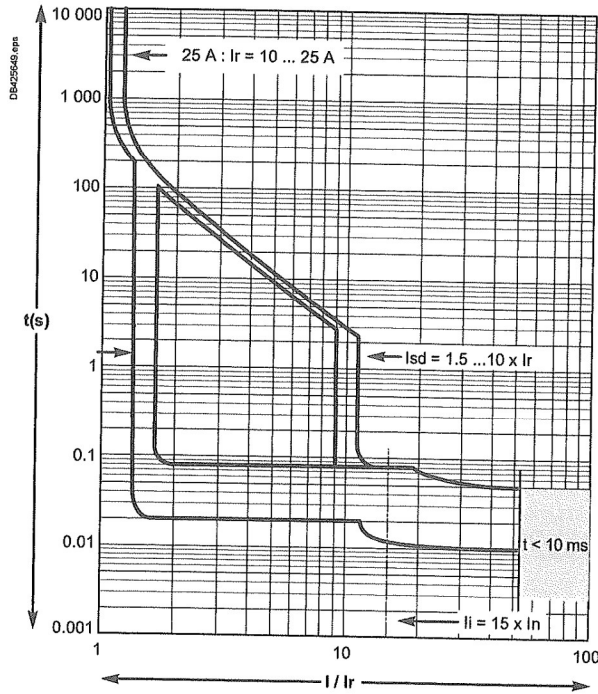
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Additional characteristics

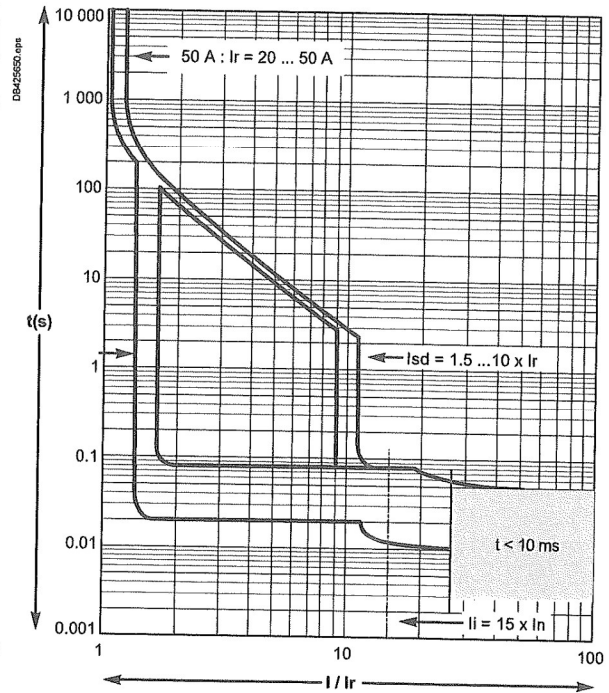
www.schneider-electric.com

# Compact NSXm up to 160 A Micrologic Vigi 4.1, tripping curves Protection of distribution systems

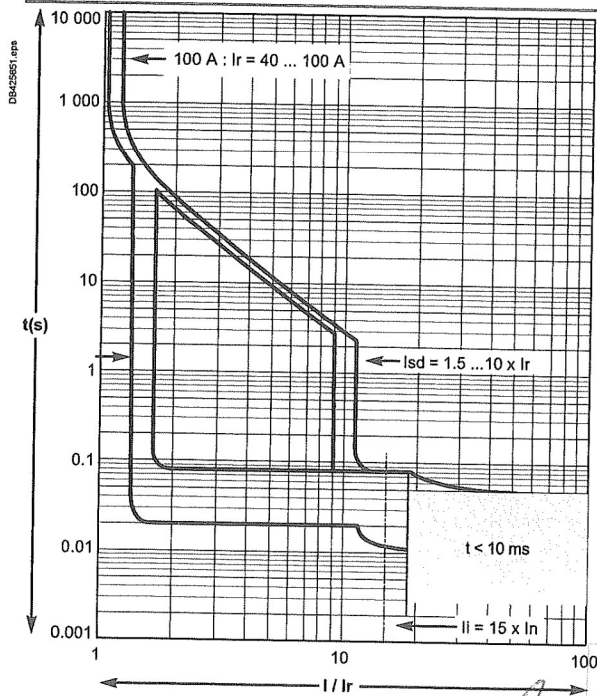
25 A



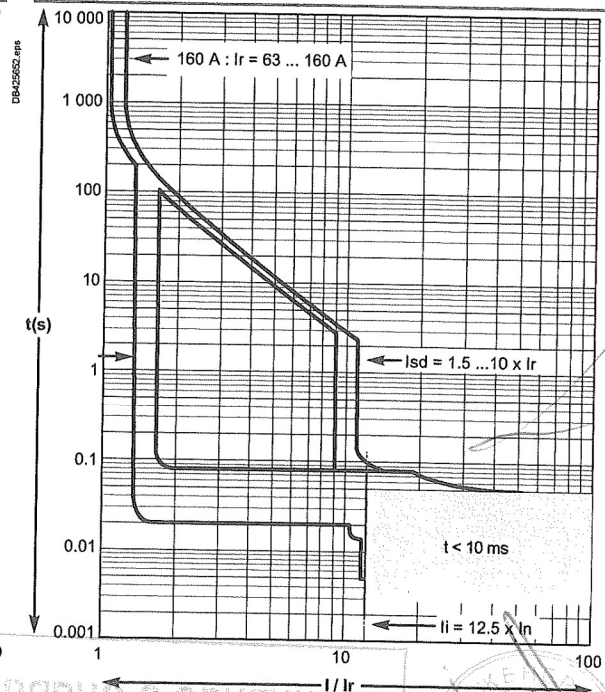
50 A



100 A



160 A

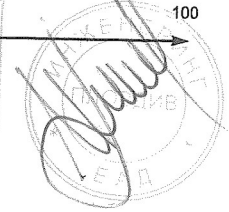


Reflex tripping.

H-4

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ВАРНО С ОРИГИНАЛА



1036

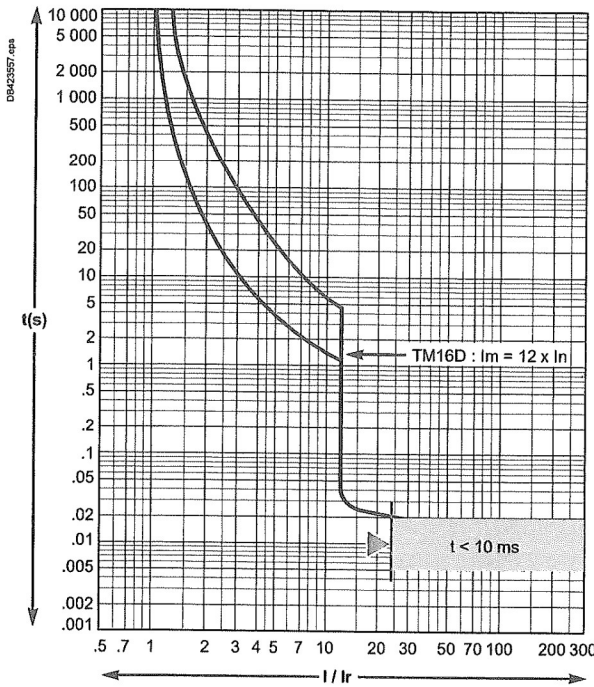
# Additional characteristics

## Compact NSX100 to 250

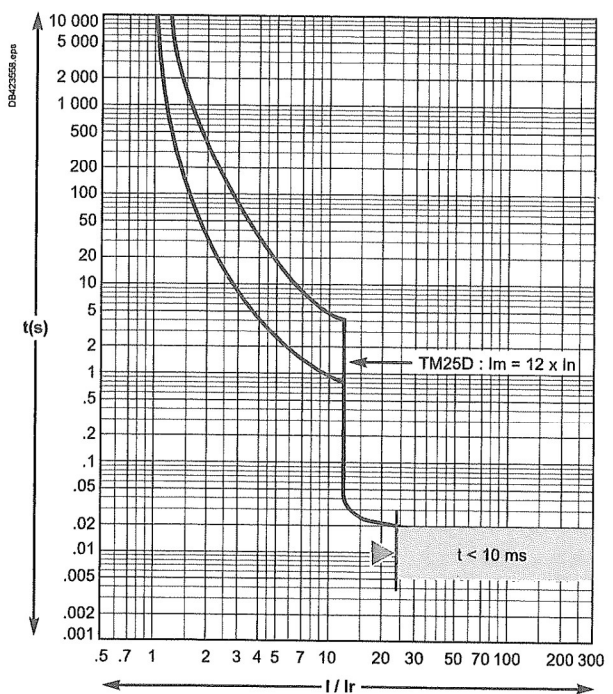
### TMD magnetic trip units, tripping curves

#### Protection of distribution systems

TM16D

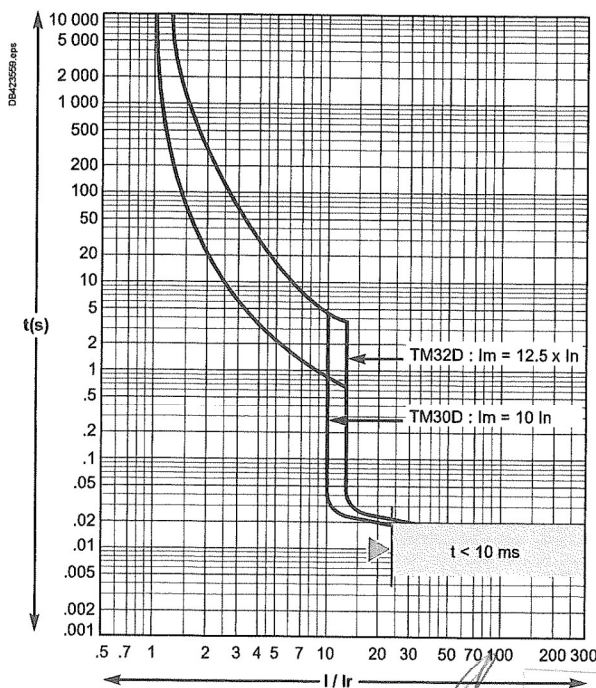


TM25D

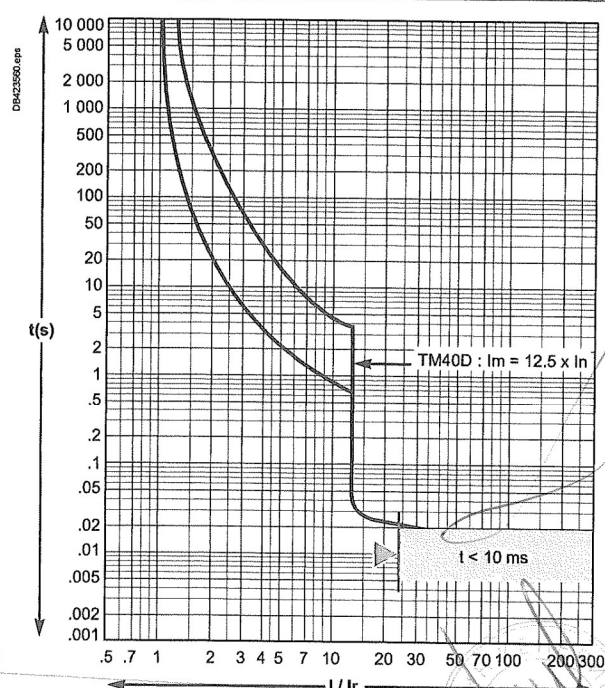


Reflex tripping.

TM30D / TM32D

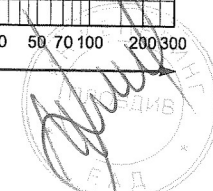


TM40D



Reflex tripping.

ВЯРНО С ОРИГИНАЛА



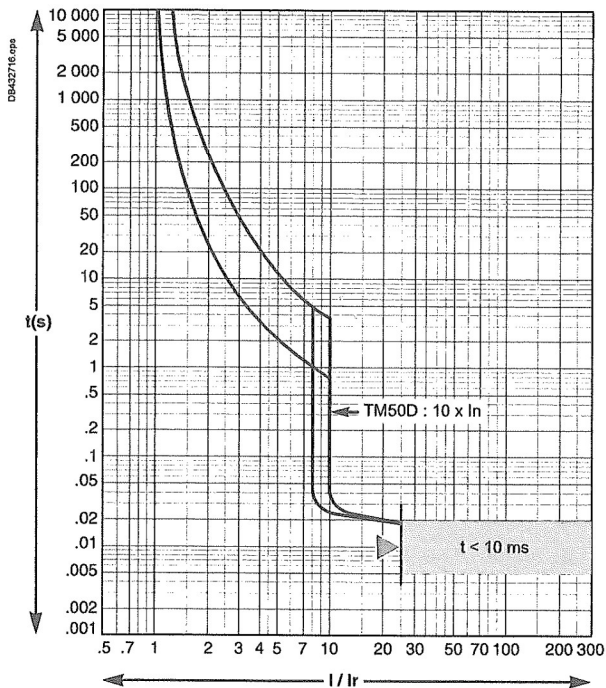
1037

# Compact NSX100 to 250

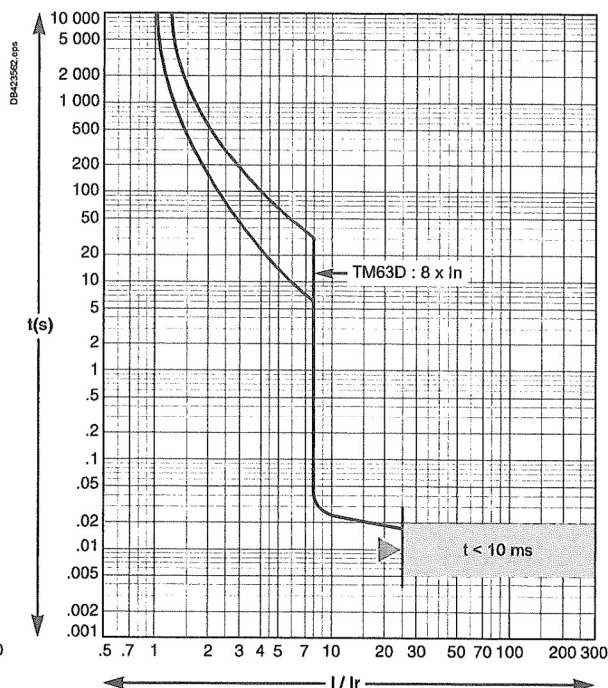
## TMD magnetic trip units, tripping curves

### Protection of distribution systems

TM50D

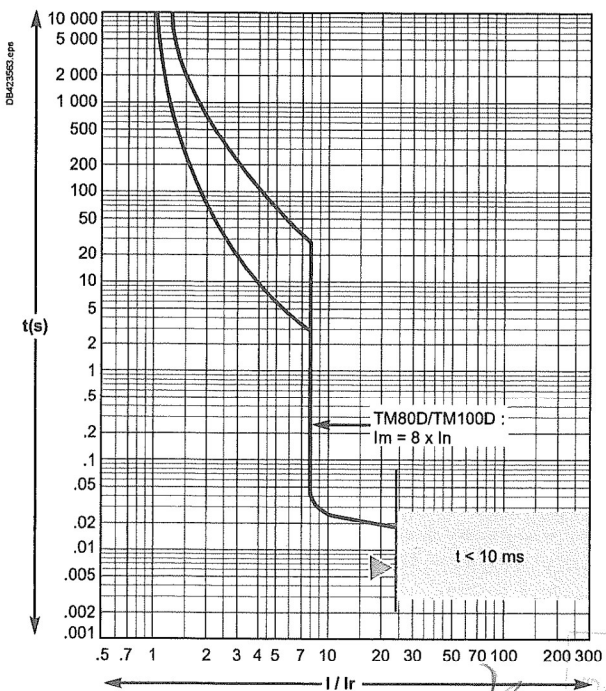


TM63D

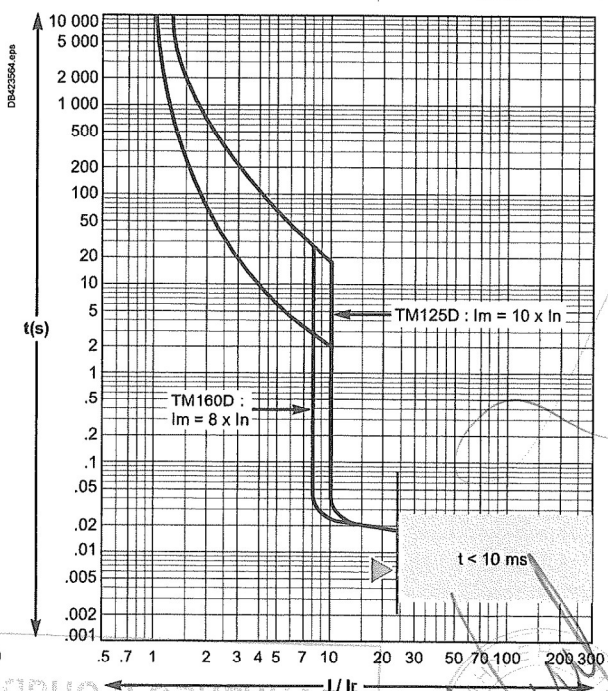


Reflex tripping.

TM80D / TM100D

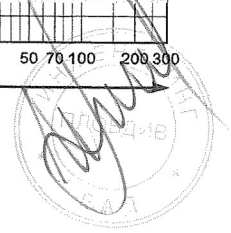


TM125D / TM160D



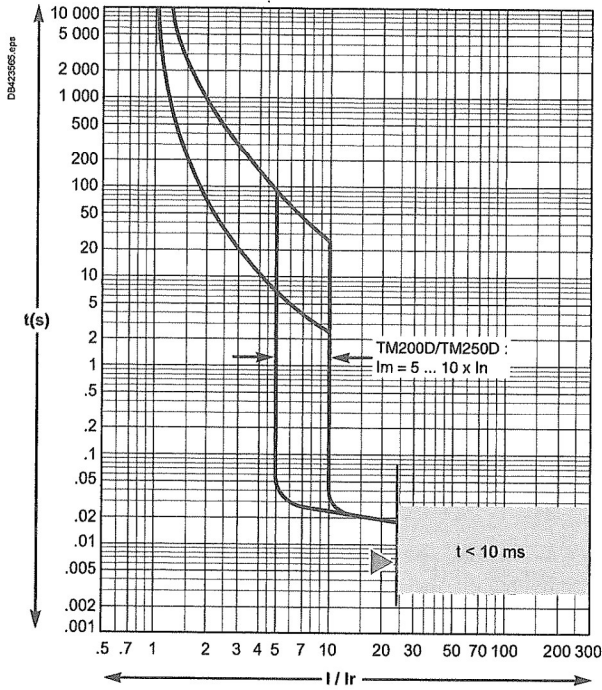
Reflex tripping.

ВАРНО С ОПРИГНАЈА



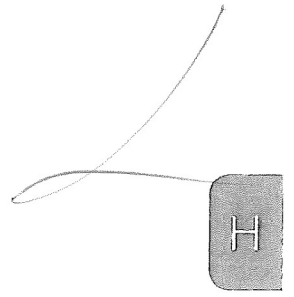
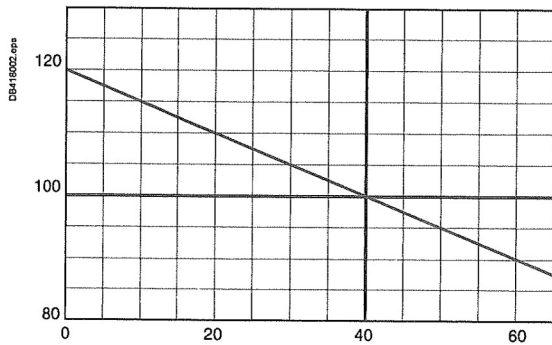
Additional characteristics  
**Compact NSX100 to 250**  
 TMD magnetic trip units, tripping curves  
 Protection of distribution systems

TM200D / TM250D

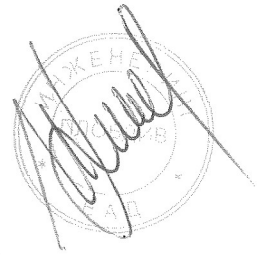


Reflex tripping.

**For all TDM curves :**  
 Values are given for 40 °C ambient,  $I_r = 1 \times I_n$ , 3 poles loaded, cold start.  
 For  $I_r = k \times I_n$ , read the time corresponding to  $1/k$  times given current.  
 For 1 pole tripping, read the time corresponding to 0.85 times given current.  
 For hot start ( $0.9 \times I_r$ ), divide max. time by 2, min. time by 4.



ВЯРНО С ОРИГИНАЛА



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1039

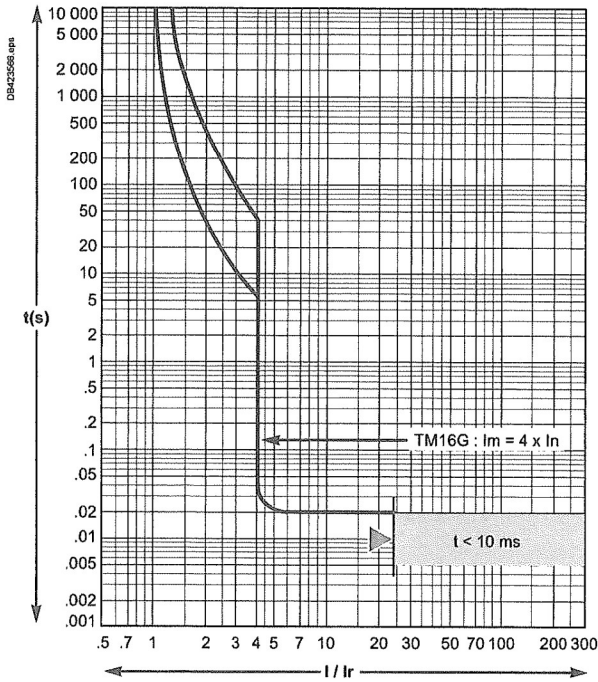
# Compact NSX100 to 250

## TMG magnetic trip units, tripping curves

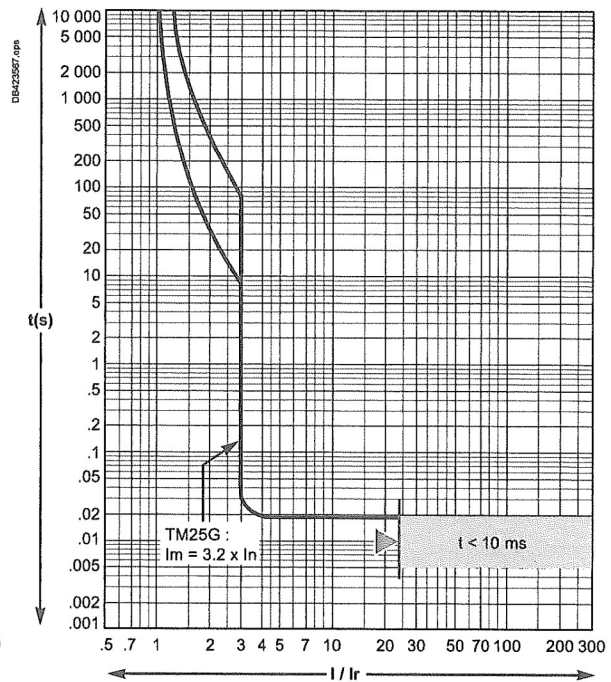
### Protection of distribution systems

*M*

TM16G

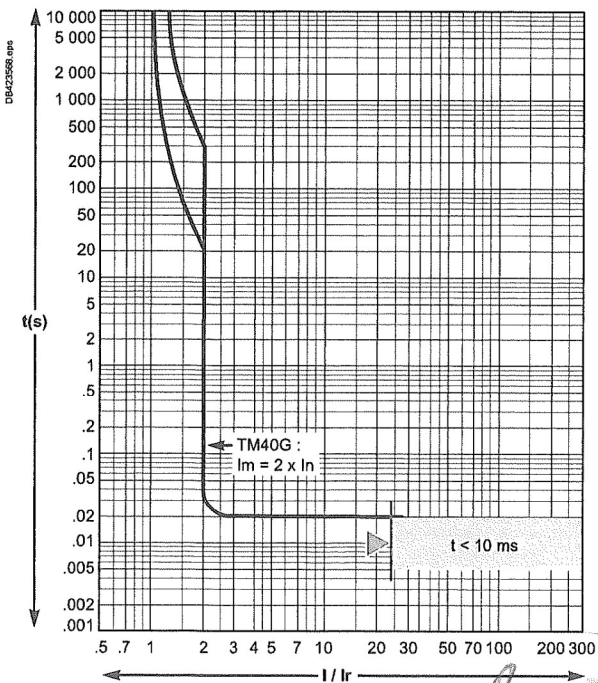


TM25G

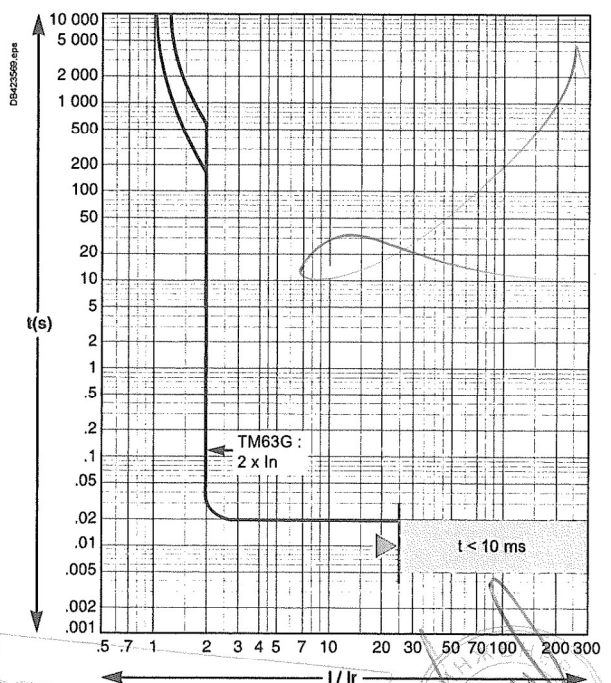


Reflex tripping.

TM40G



TM63G



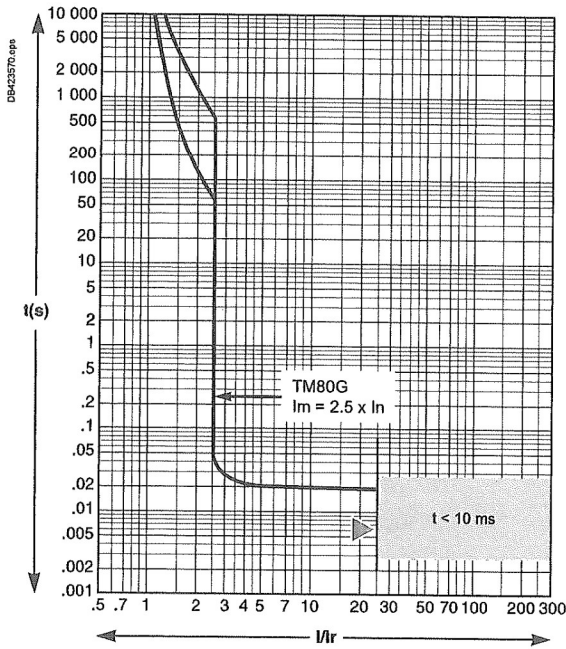
Reflex tripping.

ВЕРНО С ОРИГИНАЛА

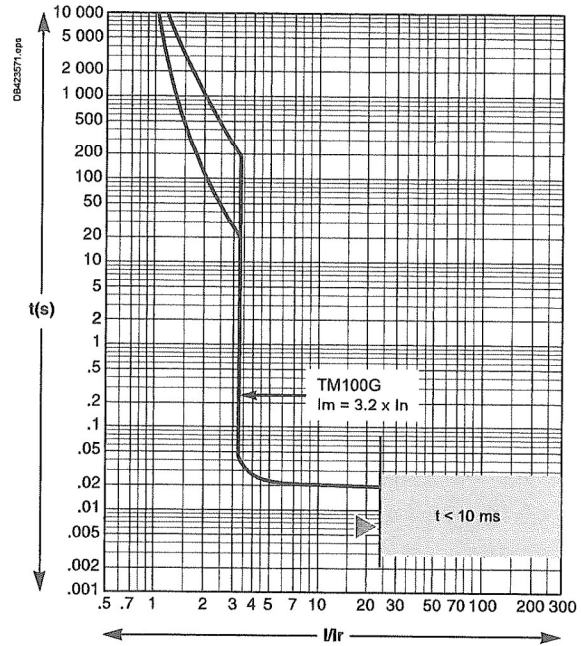
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# Additional characteristics Compact NSX100 to 250 TMG magnetic trip units, tripping curves Protection of distribution systems

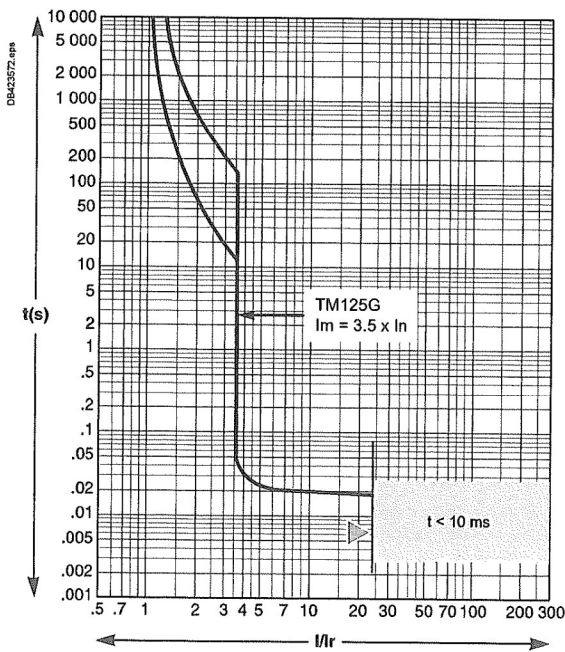
TM80G



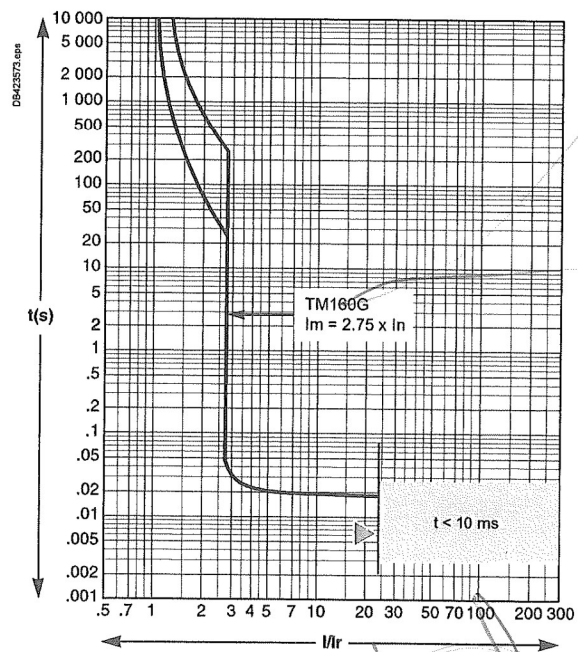
TM100G



TM125G



TM160G



ВЯРНО С ОРИГИНАЛА

*[Handwritten signature]*

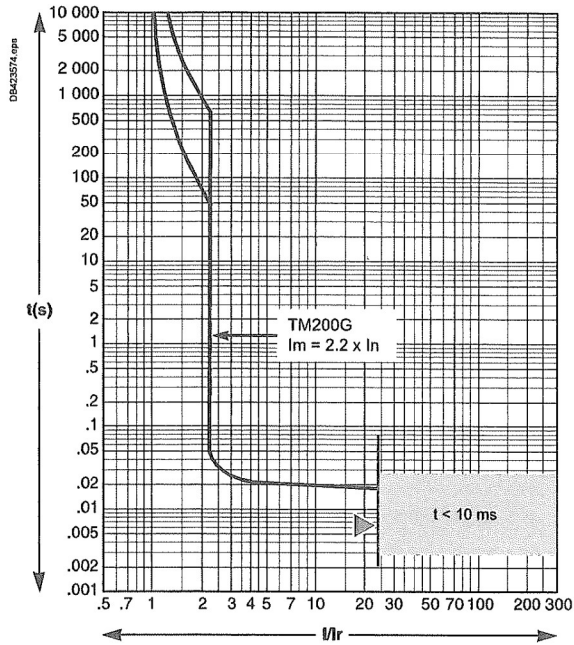
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# Compact NSX100 to 250

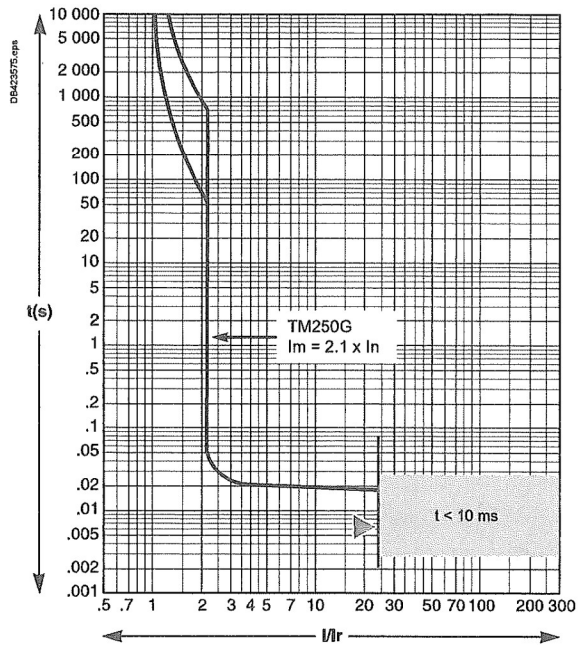
## TMG magnetic trip units, tripping curves

### Protection of distribution systems

TM200G



TM250G



Reflex tripping.

ВЯРНО С ОРИГИНАЛА

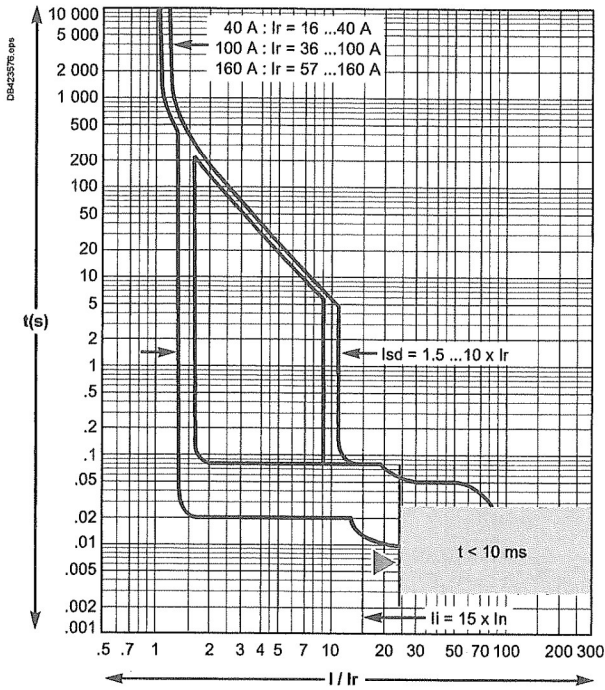




# Additional characteristics Compact NSX100 to 250

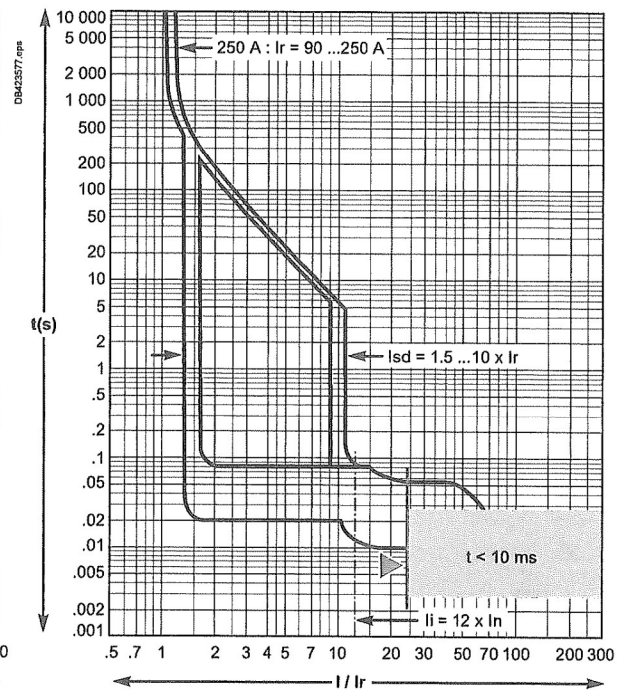
## Micrologic 2.2, 4.2 and 2.2 G electronic trip units, tripping curves Protection of distribution systems

Micrologic 2.2, 4.2 - 40... 160 A

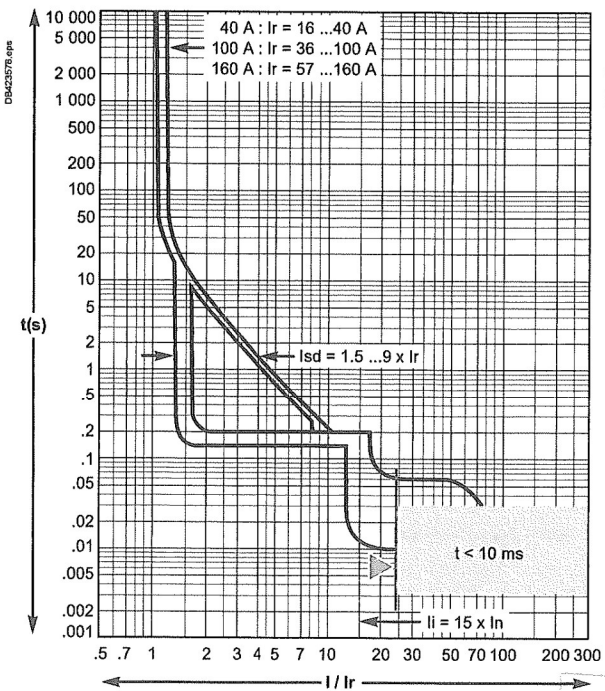


Reflex tripping.

Micrologic 2.2, 4.2 - 250 A

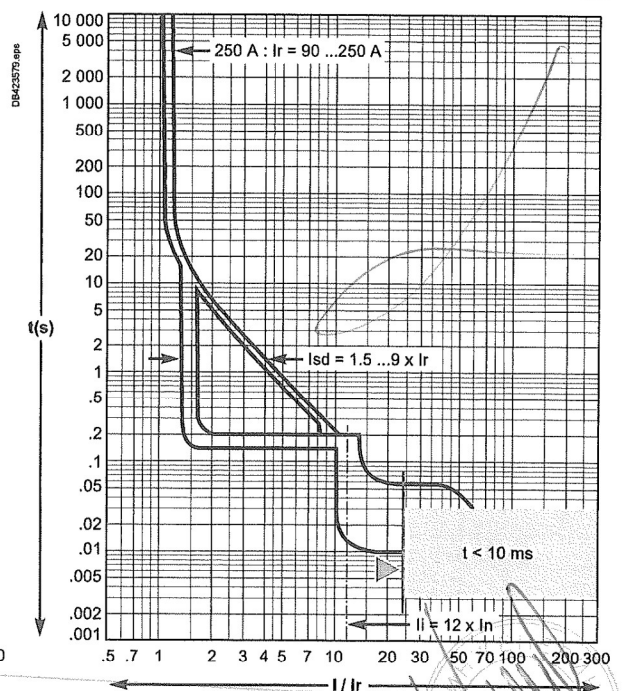


Micrologic 2.2 G - 40... 160 A



Reflex tripping.

Micrologic 2.2 G - 250 A



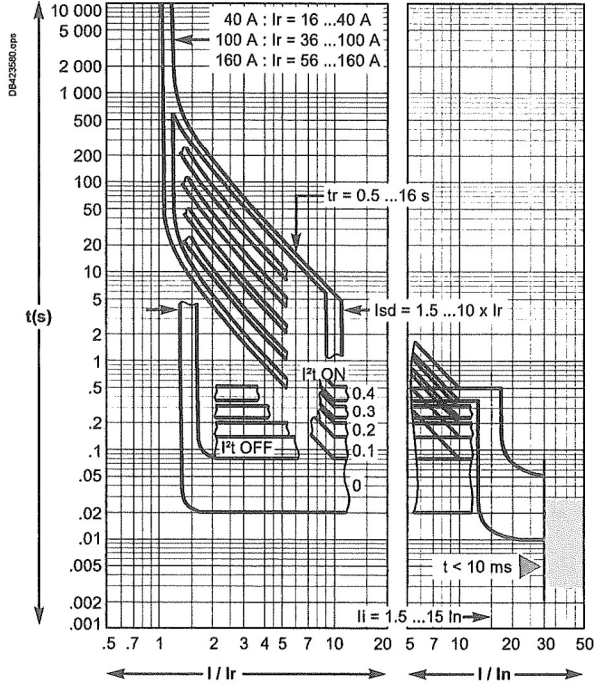
ВАРНО С ОРИГИНАЛА

1093

# Compact NSX100 to 250

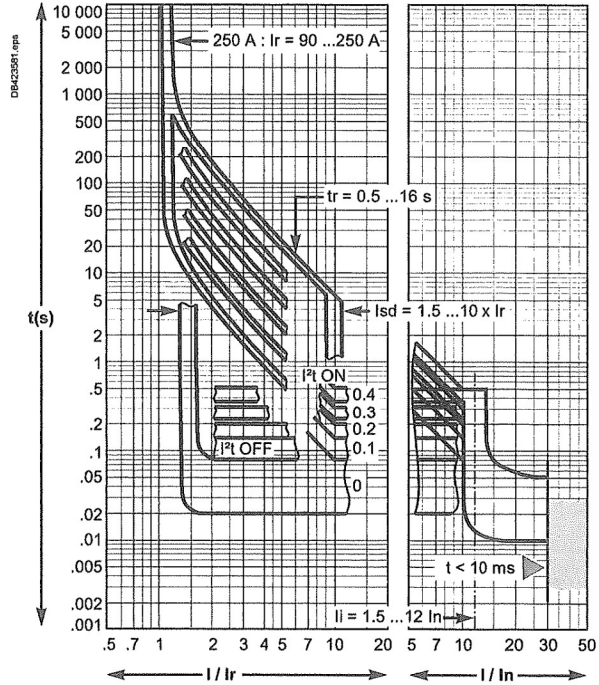
Micrologic 5.2 and 6.2 A or E and 7.2 E electronic trip units, tripping curves - Protection of distribution systems

Micrologic 5.2 and 6.2 A or E and 7.2 E - 40... 160 A

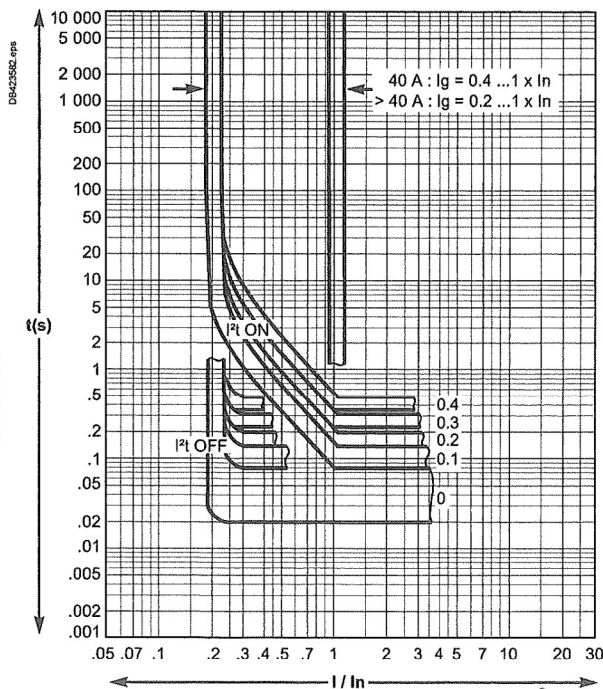


Reflex tripping.

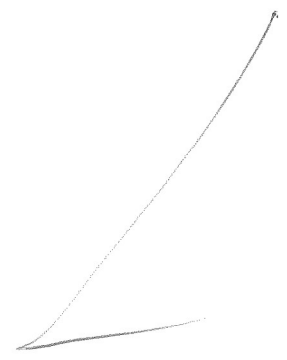
Micrologic 5.2 and 6.2 A or E and 7.2 E - 250 A



Micrologic 6.2 A or E (ground-fault protection)



Reflex tripping.



ВЯРНО С ОРИГИНАЛА

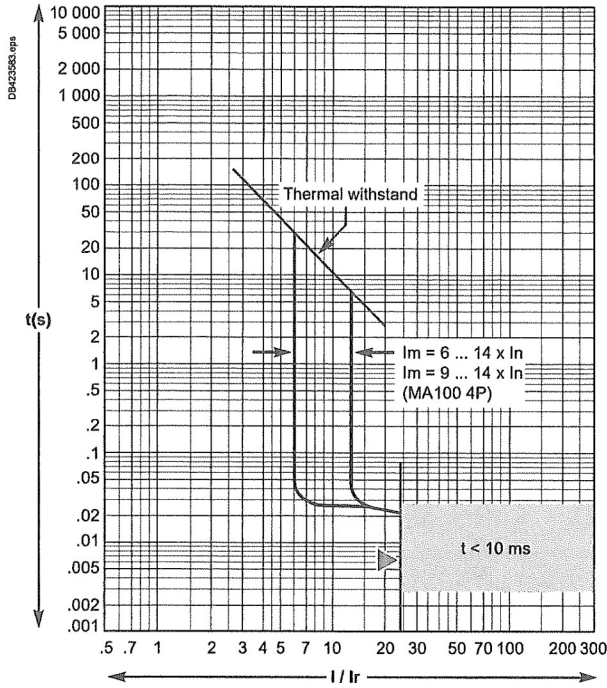


1044

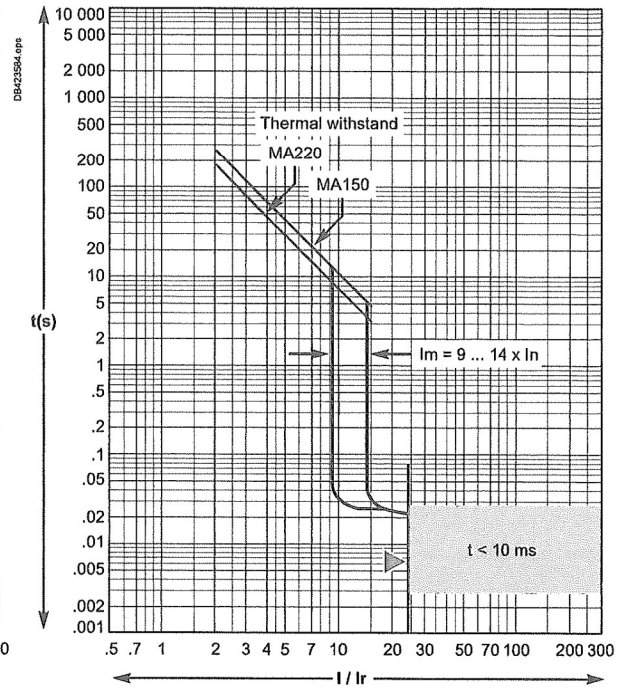
# Compact NSX100 to 250

## MA magnetic trip units, Micrologic 2.2 M electronic trip units, tripping curves - Motor protection

MA2.5... MA100

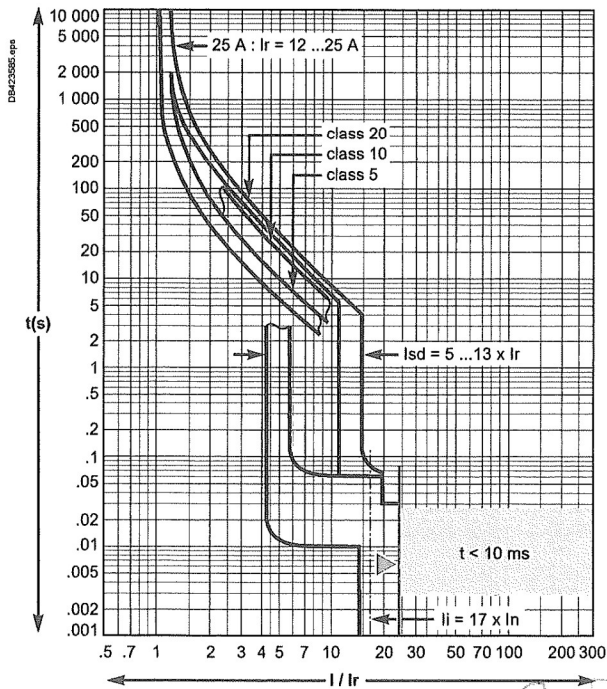


MA150 and MA220

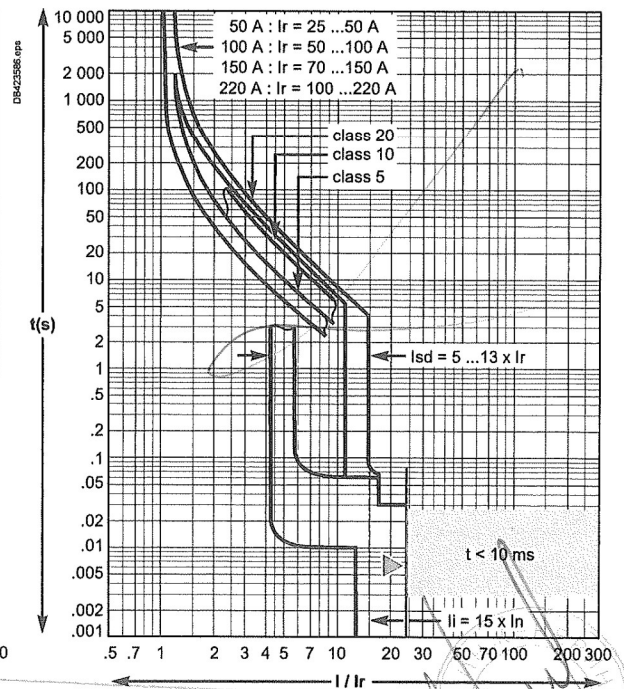


Reflex tripping.

Micrologic 2.2 M - 25 A



Micrologic 2.2 M - 50... 220 A



Reflex tripping.

ВАРНО С ОРИГИНАЛА

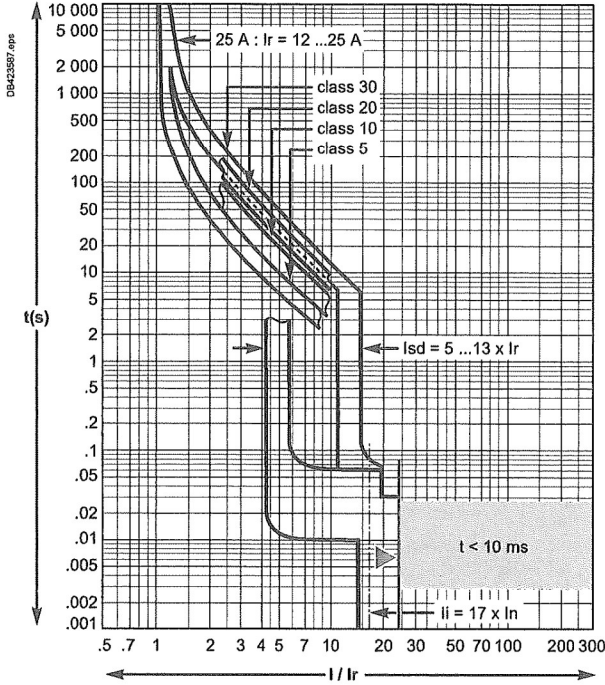
1045

# Compact NSX100 to 250

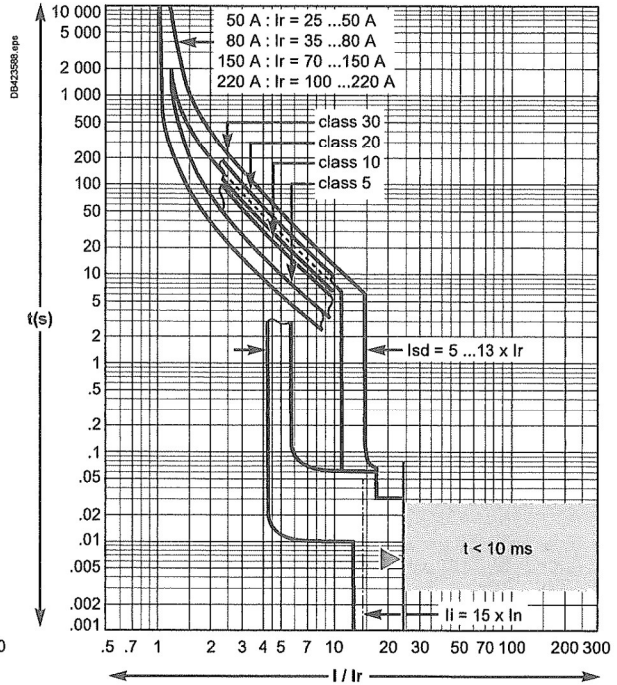
## Micrologic 6.2 E-M electronic trip units, tripping curves

### Motor protection

Micrologic 6.2 E-M - 25 A

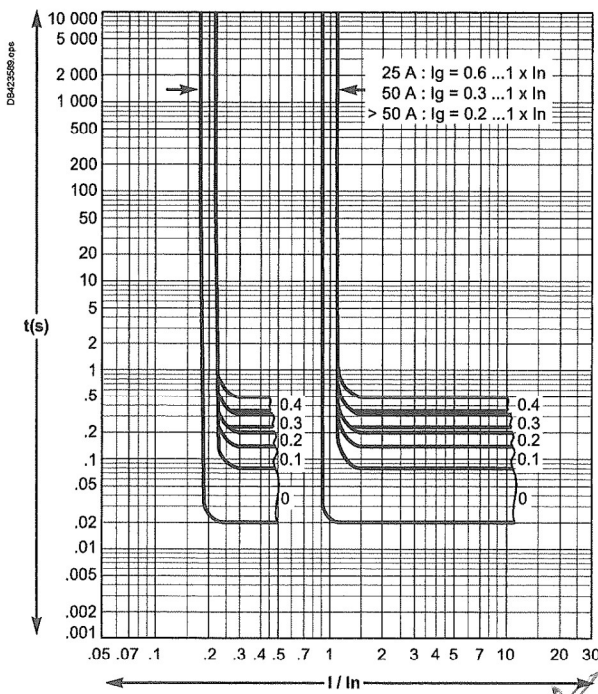


Micrologic 6.2 E-M - 50... 220 A

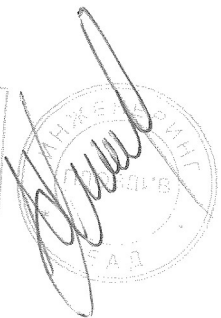


Reflex tripping.

Micrologic 6.2 E-M (ground-fault protection)



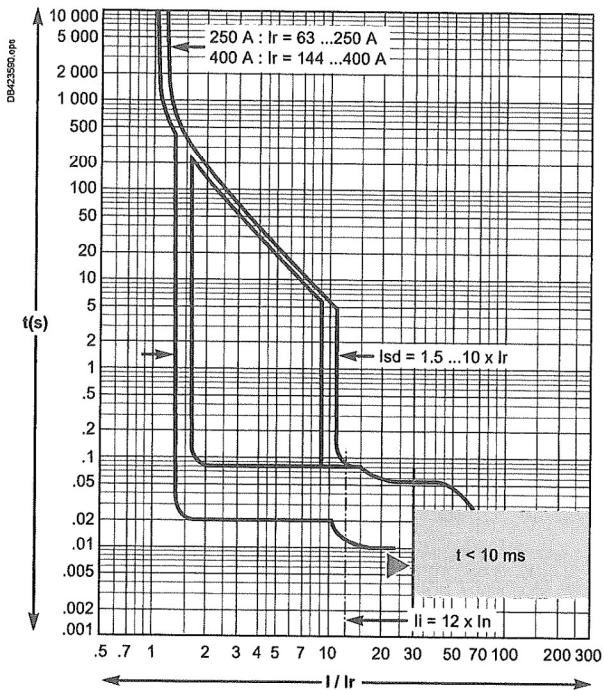
ВЯРНО С ОРИГИНАЛА



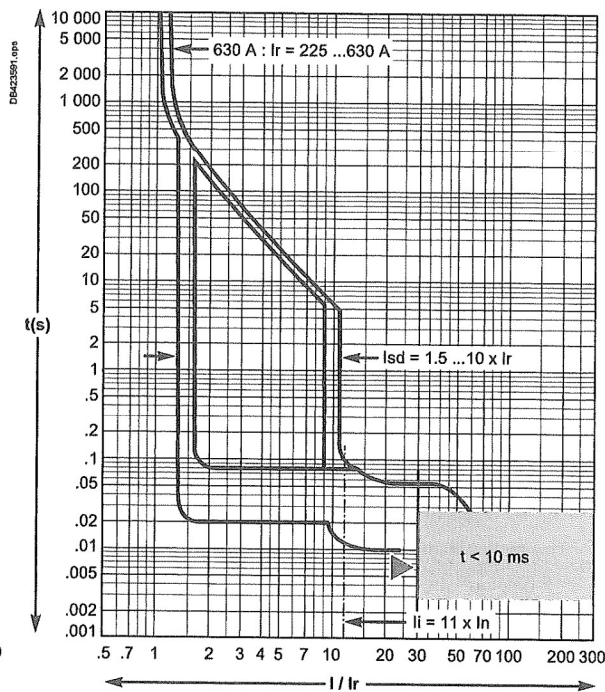
# Additional characteristics Compact NSX400 to 630

## Micrologic 2.3, 4.3, 5.3 and 6.3 A or E and 7.3 E electronic trip units, tripping curves - Protection of distribution systems

Micrologic 2.3, 4.3 - 250... 400 A

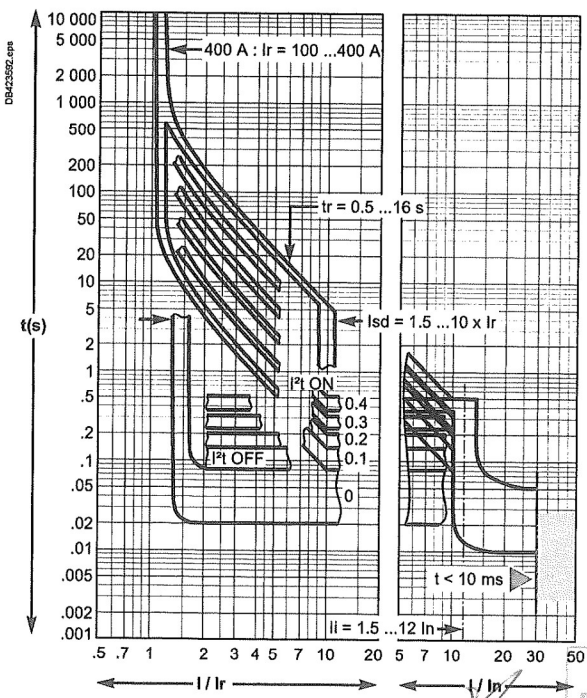


Micrologic 2.3, 4.3 - 630 A

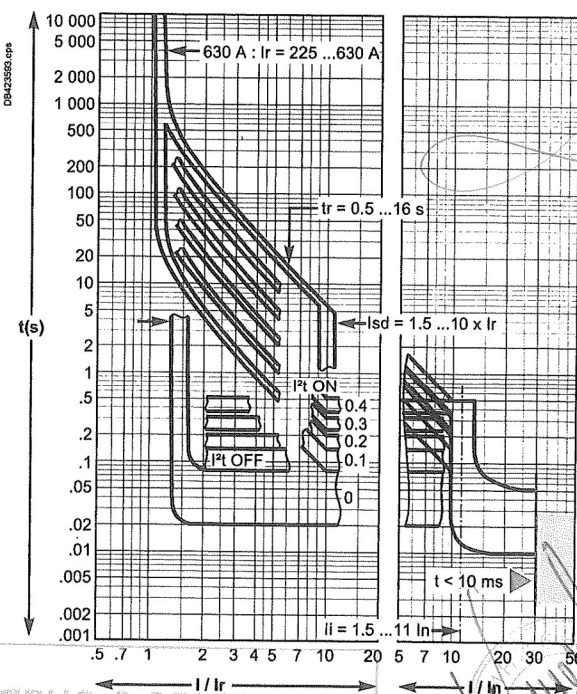


Reflex tripping.

Micrologic 5.3 and 6.3 A or E and 7.3 E - 400 A



Micrologic 5.3 and 6.3 A or E and 7.3 E  
(up to 570 A) - 630 A



Reflex tripping.

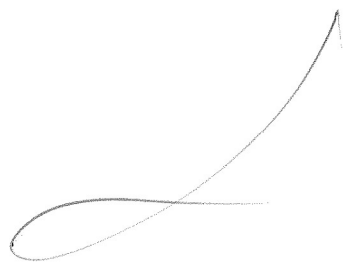
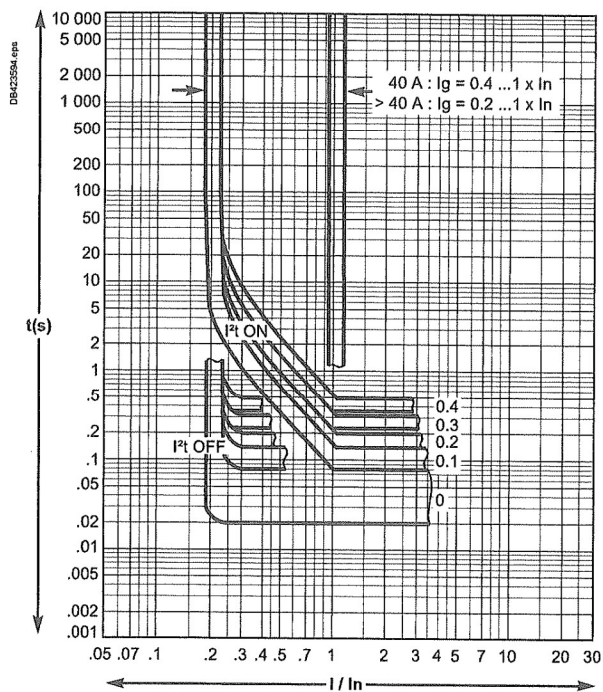
ВЯРНО С ОРИГИНАЛА

1044

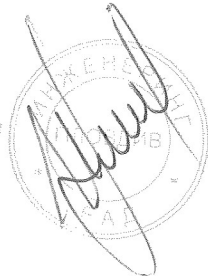
# Compact NSX400 to 630

## Micrologic 6.3 A or E and 7.3 E electronic trip units, tripping curves - Protection of distribution systems

Micrologic 6.3 A or E and 7.3 E (up to 570 A)  
(ground-fault protection)

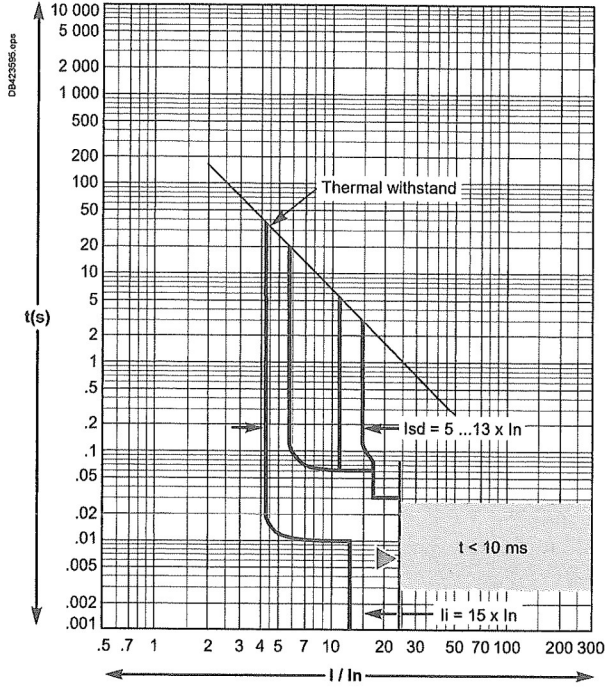


ВЯРНО С ОРИГИНАЛА

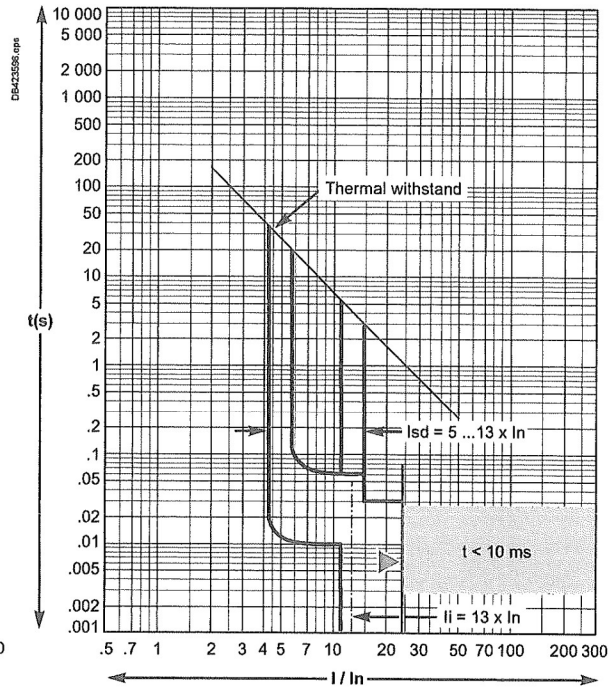


Additional characteristics  
**Compact NSX400 to 630**  
 Micrologic 1.3 M and 2.3 M electronic trip units, tripping curves  
 Motor protection

Micrologic 1.3 M - 320 A

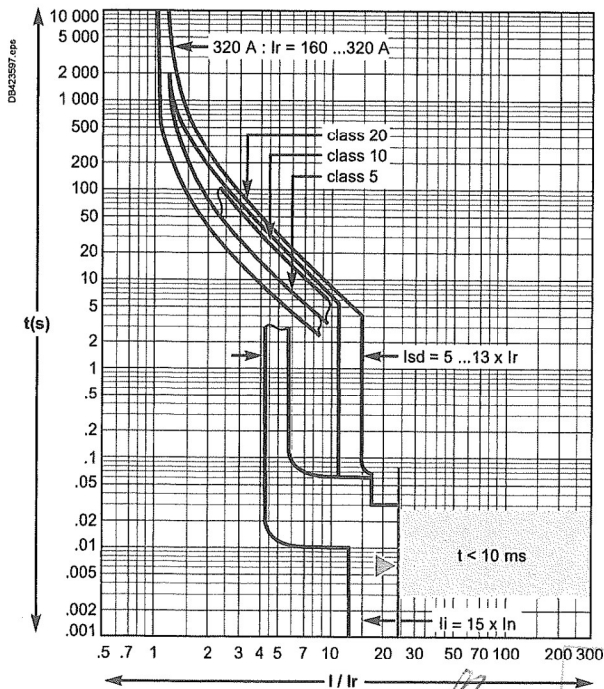


Micrologic 1.3 M - 500 A

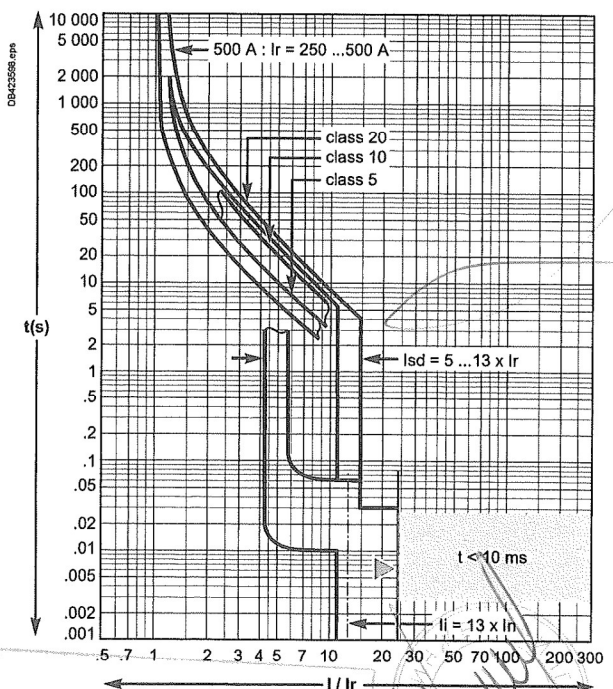


Reflex tripping.

Micrologic 2.3 M - 320 A



Micrologic 2.3 M - 500 A



Reflex tripping.

ВЯРНО С ОРГИНАЛА

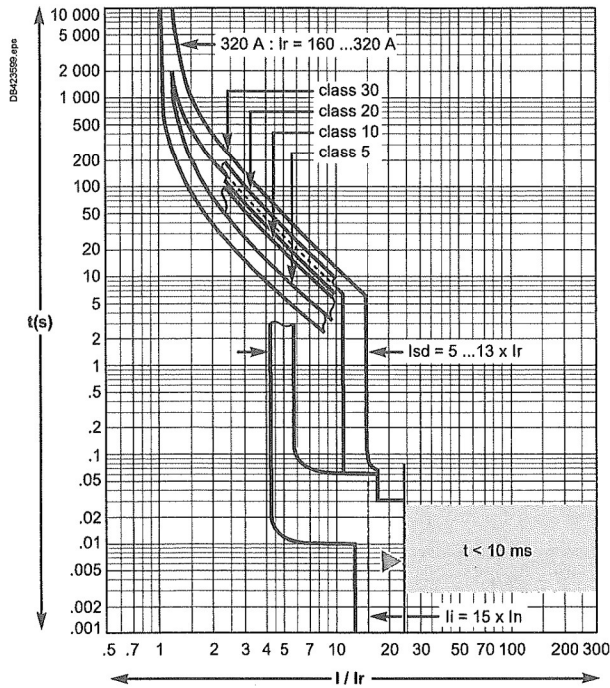
1049

# Compact NSX400 to 630

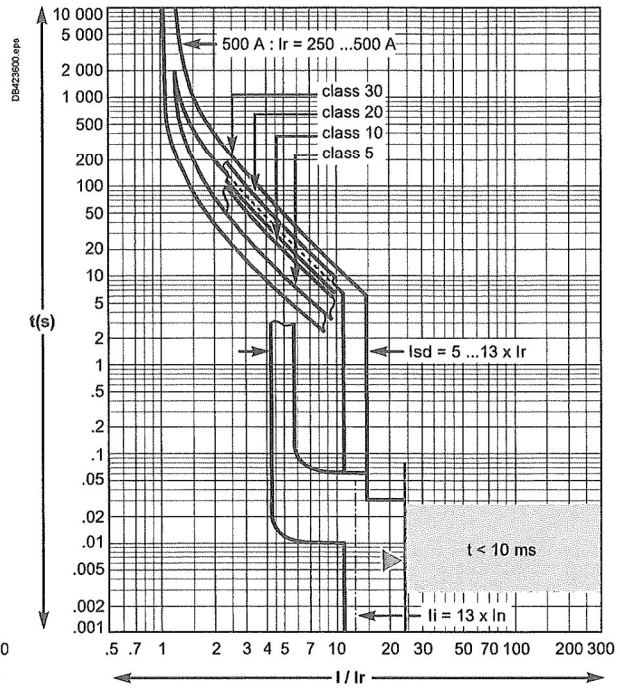
## Micrologic 6.3 E-M electronic trip units, tripping curves

### Motor protection

Micrologic 6.3 E-M - 320 A

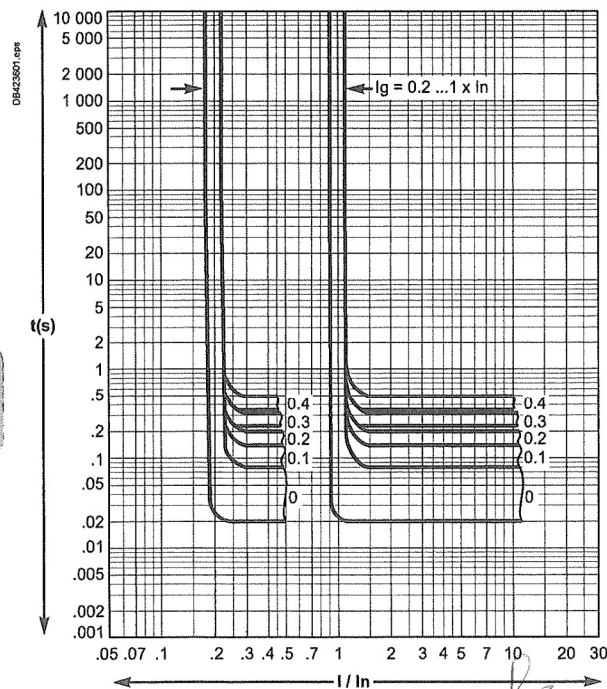


Micrologic 6.3 E-M - 500 A



Reflex tripping.

Micrologic 6.3 E-M (ground fault protection)



ВЕРНО С ОРИГИНАЛА



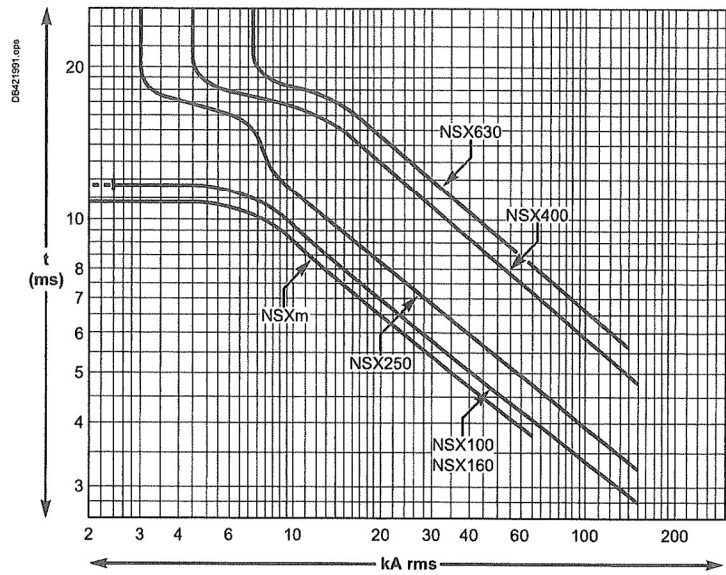


# Additional characteristics

## Tripping curves Compact NSXm and NSX

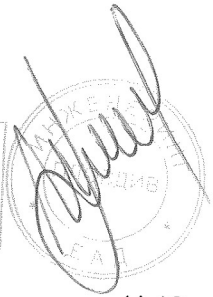
### Reflex tripping

Compact NSXm and NSX100 to 630 devices incorporate the exclusive reflex-tripping system. This system breaks very high fault currents. The device is mechanically tripped via a "piston" actuated directly by the pressure produced in the breaking units by the short-circuit. For high short-circuits, this system provides a faster break, thereby ensuring selectivity. Reflex-tripping curves are exclusively a function of the circuit-breaker rating.



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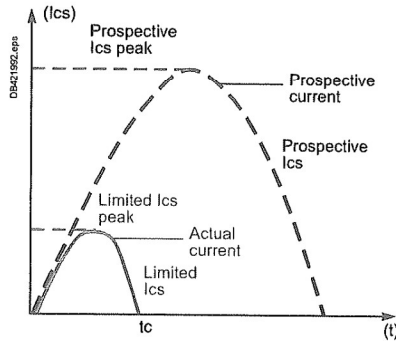
ВЕРНО С ОРИГИНАЛА



105A

# 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 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).

$I_{cs} = 100\% I_{cu}$

The exceptional limiting capacity of the Compact NSX and NSXm ranges 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  $I_{cs}$  is equal to 100 % of  $I_{cu}$ .

The  $I_{cs}$  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  $I_{cu}$
- 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  $1 \Omega$ .

**Example**

What is the real value of a 70 kA rms prospective short-circuit (i.e. 100 kA peak) limited by an NSXm160H upstream ?

The answer is 20 kA peak.

**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 mm <sup>2</sup>	2.5 mm <sup>2</sup>	4 mm <sup>2</sup>	6 mm <sup>2</sup>	10 mm <sup>2</sup>
PVC	Cu	2.97x10 <sup>4</sup>	8.26x10 <sup>4</sup>	2.12x10 <sup>5</sup>	4.76x10 <sup>5</sup>	1.32x10 <sup>6</sup>
	Al					5.41x10 <sup>5</sup>
PRC	Cu	4.10x10 <sup>4</sup>	1.39x10 <sup>5</sup>	2.92x10 <sup>5</sup>	6.56x10 <sup>5</sup>	1.82x10 <sup>6</sup>
	Al					7.52x10 <sup>5</sup>
PVC	Cu	3.4x10 <sup>6</sup>	8.26x10 <sup>6</sup>	1.62x10 <sup>7</sup>	3.31x10 <sup>7</sup>	
	Al	1.39x10 <sup>6</sup>	3.38x10 <sup>6</sup>	6.64x10 <sup>6</sup>	1.35x10 <sup>7</sup>	
PRC	Cu	4.69x10 <sup>6</sup>	1.39x10 <sup>7</sup>	2.23x10 <sup>7</sup>	4.56x10 <sup>7</sup>	
	Al	1.93x10 <sup>6</sup>	4.70x10 <sup>6</sup>	9.23x10 <sup>6</sup>	1.88x10 <sup>7</sup>	

**Example**

Is a Cu/PVC cable with a CSA of 10 mm<sup>2</sup> adequately protected by an NSX160F?

The table above indicates that the permissible stress is  $1.32 \times 10^6 A^2s$ .

All short-circuit currents at the point where an NSX160F ( $I_{cu} = 35 \text{ kA}$ ) is installed are limited with a thermal stress less than  $6 \times 10^5 A^2s$ .

Cable protection is therefore ensured up to the limit of the breaking capacity of the circuit breaker.



# Additional characteristics

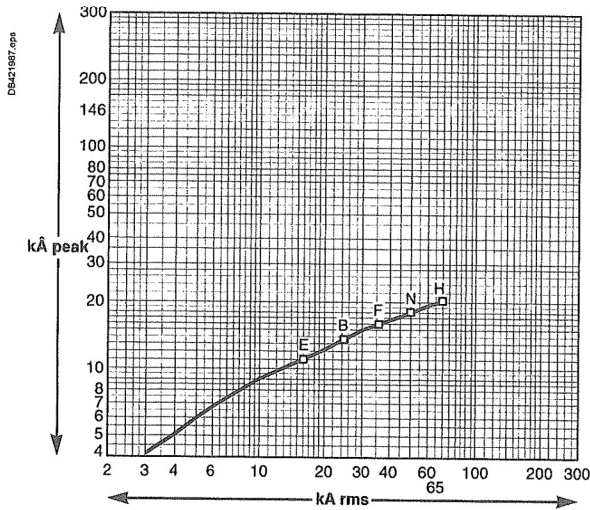
## Current and energy limiting curves

### Compact NSXm

#### Current-limiting curves

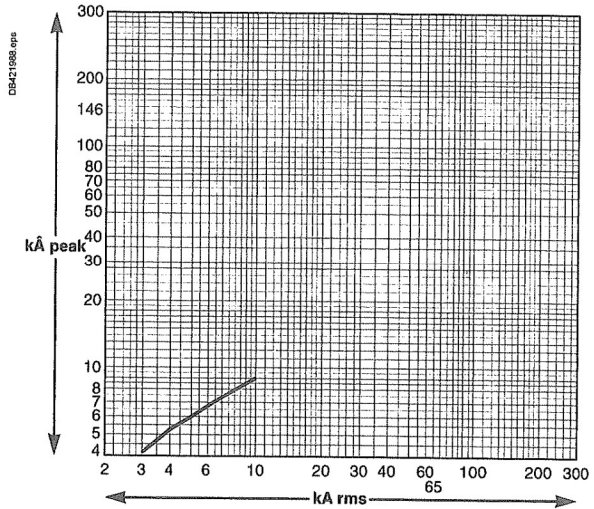
Voltage 400/440 V AC

Limited short-circuit current (kA peak)



Voltage 660/690 V AC

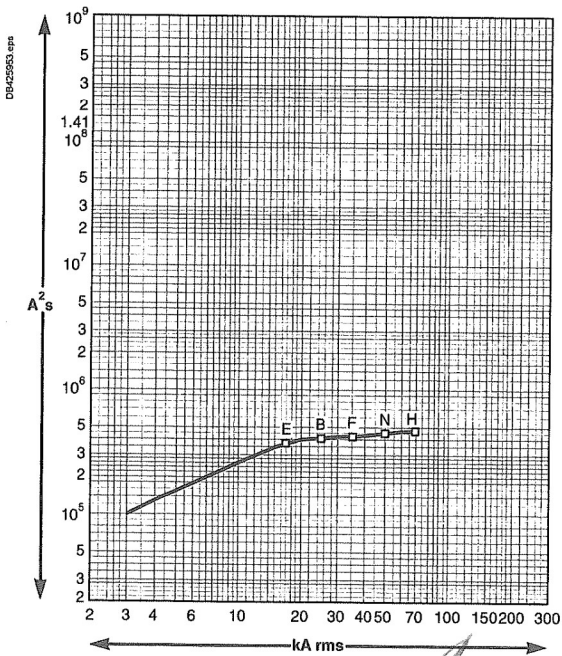
Limited short-circuit current (kA peak)



#### Energy-limiting curves

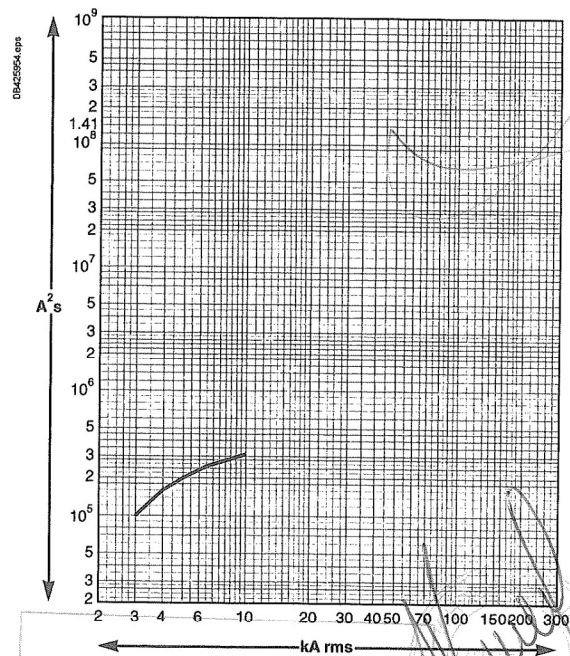
Voltage 400/440 V AC

Limited energy



Voltage 660/690 V AC

Limited energy



ВЯРНО С ОРИГИНАЛА

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# Current and energy limiting curves

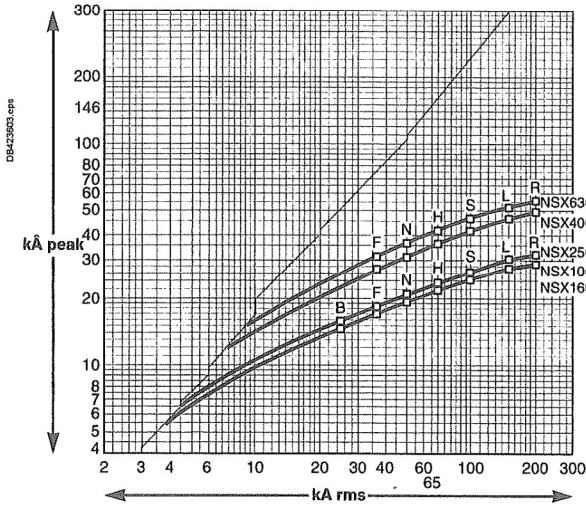
## Compact NSX

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### Current-limiting curves

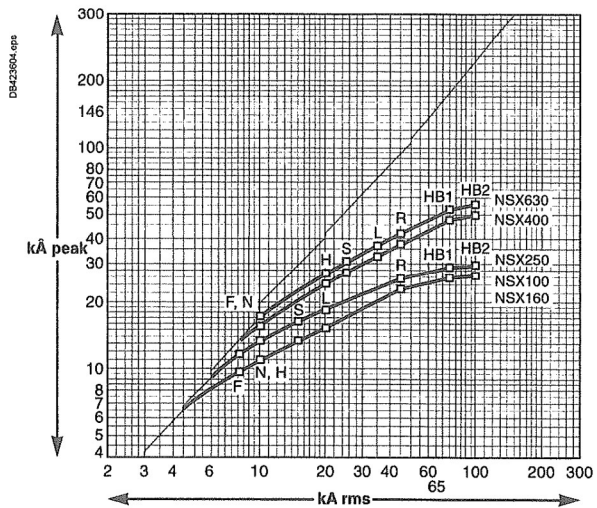
Voltage 400/440 V AC

Limited short-circuit current (kA peak)



Voltage 660/690 V AC

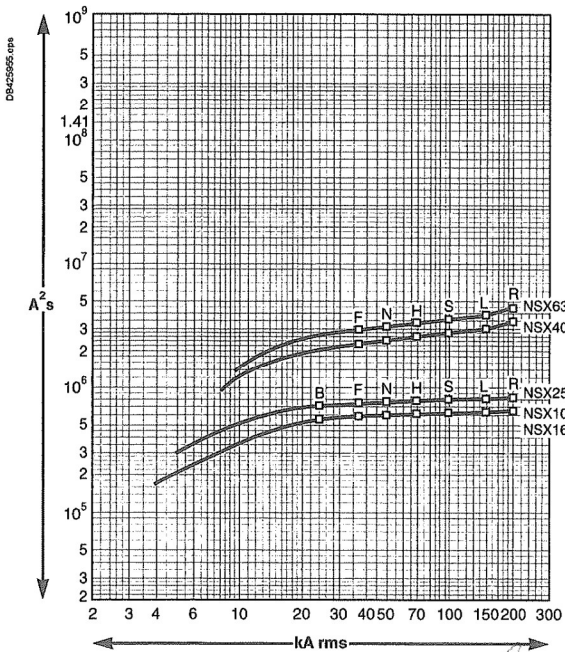
Limited short-circuit current (kA peak)



### Energy-limiting curves

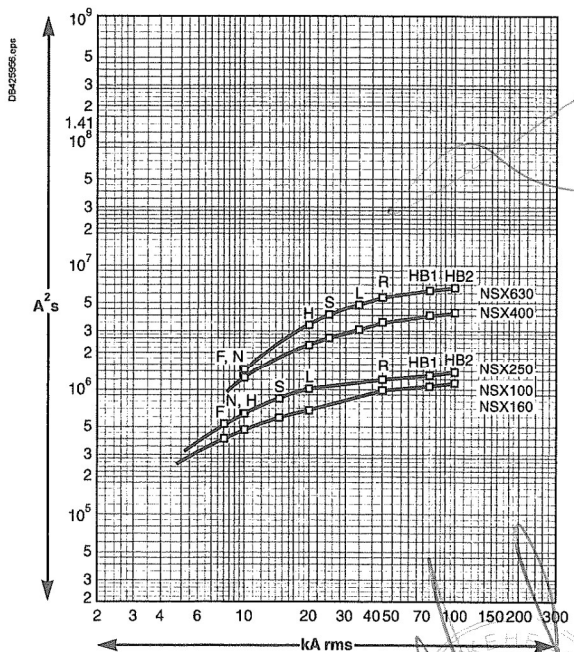
Voltage 400/440 V AC

Limited energy



Voltage 660/690 V AC

Limited energy



# Additional characteristics Note

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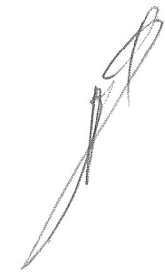
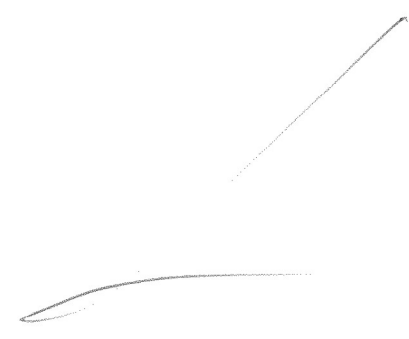
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*[Signature]*  
MKЖЕЛ ПИИТ  
БЕЛ  
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Additional characteristics  
Note

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*1056*

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ВЯРНО С ОРИГИНАЛА



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1054

*Handwritten mark*

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Приложение №3 към Техническото предложение

**СРОКОВЕ ЗА ДОСТАВКА**

№	Наименование	Мярка	Количество със срок на доставка до 7 кал. дни	Количество със срок на доставка до 30 кал. дни
1	2	3	4	5
1	Електромерно табло за индиректно измерване, за монтиране на фасада	бр.	35	140
2	Електромерно табло НН, за индиректно измерване до 250А, за монтиране на фасада/стълб	бр.	5	15
2.1	Резервна външна врата за ел. табло НН, за инд.изм. до 250 А, за монт.на фасада/стълб	бр.	5	10
2.2	Резервна вътрешна врата за ел. табло НН, за инд.изм. до 250 А, за монт.на фасада/стълб	бр.	5	10
3	Електромерно табло НН, за индиректно измерване до 250А, с основа и стабилизираща плоча	бр.	5	10
3.1	Резервна външна врата за ел. табло НН, за инд.изм. до 250 А, с основа и стаб.плоча	бр.	5	10
3.2	Резервна вътрешна врата за ел. табло НН, за инд.изм. до 250 А, с основа и стаб.плоча	бр.	5	10
3.3	Резервен автоматичен прекъсвач 250 А	бр.	5	10
3.4	Резервен товаров прекъсвач 250 А	бр.	5	10
4	Електромерно табло НН за индиректно измерване до 630 А	бр.	5	10
4.1	Резервна външна врата за ел. табло НН за инд.изм. до 630 А	бр.	5	10
4.2	Резервна вътрешна врата за ел. табло НН за инд.изм. до 630 А	бр.	5	10
4.3	Резервен автоматичен прекъсвач 630 А	бр.	5	10
4.4	Резервен товаров прекъсвач 630 А	бр.	5	10

**Забележки:**

1/ Срокът на доставките започва да тече от датата на изпращане на поръчката.

2/ Количествата в колона 4, със срок на доставка до 7 /седем/ календарни дни, се доставят след SAP поръчка до посочените в обявлението складове на Възложителя за покриване на спешни нужди на Възложителя.

Възложителят може да поръчва посоченото спешно количество веднъж месечно.

3/ В случай, че крайният срок на доставката съвпада с празничен или неработен ден, то доставката се извършва не по-късно от първия работен ден след изтичането на срока.

4/ При поръчки на Възложителя на количества в рамките на потвърдените от Изпълнителя и недоставени в посочените срокове, ще бъдат налагани неустойки, съгласно условията на договора.

5/ Възложителят може да поръчва количества по-малки от посочените в колони 4 и 5.

6/ Възложителят може да поръчва количества по-високи от посочените в колони 4 и 5, като това обстоятелство ще бъде посочено текстово в съответната поръчка изпратена към Изпълнителя. С потвърждението на поръчката, Изпълнителят вписва в същата очаквана дата за доставка на количествата надвишаващи посочените в колони 4 и 5.

7/ Възложителят може да поръчва количества до 10 пъти по-високи от посочените в колона 5. Срокът за доставка на надвишените количества не може да бъде по-дълъг от 180 дни от датата на изпращане на поръчката. При доставка на поръчаните по-високи количества след този срок, Изпълнителят дължи неустойка съгласно условията на договора.

8/ Количествата за доставка в колони 4 и 5 са отделни и независими едно от друго.

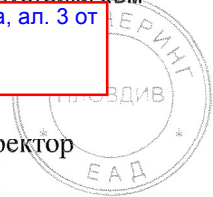
9/ Количествата за доставка в колона 5 не включват в себе си количествата за доставка в колона 4.  
10/ Възложителят има право да направи едновременно поръчки за доставка на количества от колони 4 и 5.  
11/ Възложителят има право да анулира направена поръчка, ако тя е в закъснение с повече от 180 дни от очакваната дата за доставка. Анулирането на поръчка не спира напагането на неустойки към Изпълнителя съгласно условията на договора.

Дата 20.01.2020 г.

**ПОДПИС и ПЕЧАТ:**

на основание чл. 36а, ал. 3 от ЗОП

Ивелин Дончев  
Изпълнителен директор  
Инженеринг ЕАД



1060