Compact NSX DC

Circuit Breakers 100-1200 A
Switch-Disconnectors 100-630 A
User Guide

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The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

The aim of this guide is to provide users, installers, and maintenance personnel with the technical information needed to operate Compact NSX direct current (DC) circuit breakers and switch-disconnectors in compliance with the IEC standards.

Validity Note

This document applies to the range of Compact NSX DC circuit breakers and switch-disconnectors.

Related Documents

Title of Documentation	Reference Number
Compact NSX AC 100-630 A - User Guide	LV434100 (FR) LV434101 (EN) LV434102 (ES)
Modbus Compact NSX - User Guide	LV434106 (FR) LV434107 (EN) LV434108 (ES)
ULP System - User Guide	TRV99100 (FR) TRV99101 (EN) TRV99102 (ES)
Compact NSX and Masterpact NW DC - DC PV - Catalogue	LVPED208006EN
Compact NSX DC PV - Catalogue	COM-POWER-NSX DC PV
Compact NSX 100-630 A - Catalogue	LVPED208001FR LVPED208001EN

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

Chapter 1
Compact NSX DC Circuit Breakers

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
1.1	Compact NSX DC Circuit Breakers Presentation	10
1.2	Circuit Breakers With Toggle Handle	21
1.3	Circuit Breaker With Rotary Handle	28
1.4	Motor-Operated Circuit Breakers	39

Section 1.1
Compact NSX DC Circuit Breakers Presentation

What Is in This Section?

This section contains the following topics:

Topic	Page
Compact NSX DC Range	11
Operating the Circuit Breakers	14
Customer Engineering Tool (CET)	16
De-Energizing the Circuit Breakers	17
Environmental Conditions	19

Compact NSX DC Range

Description

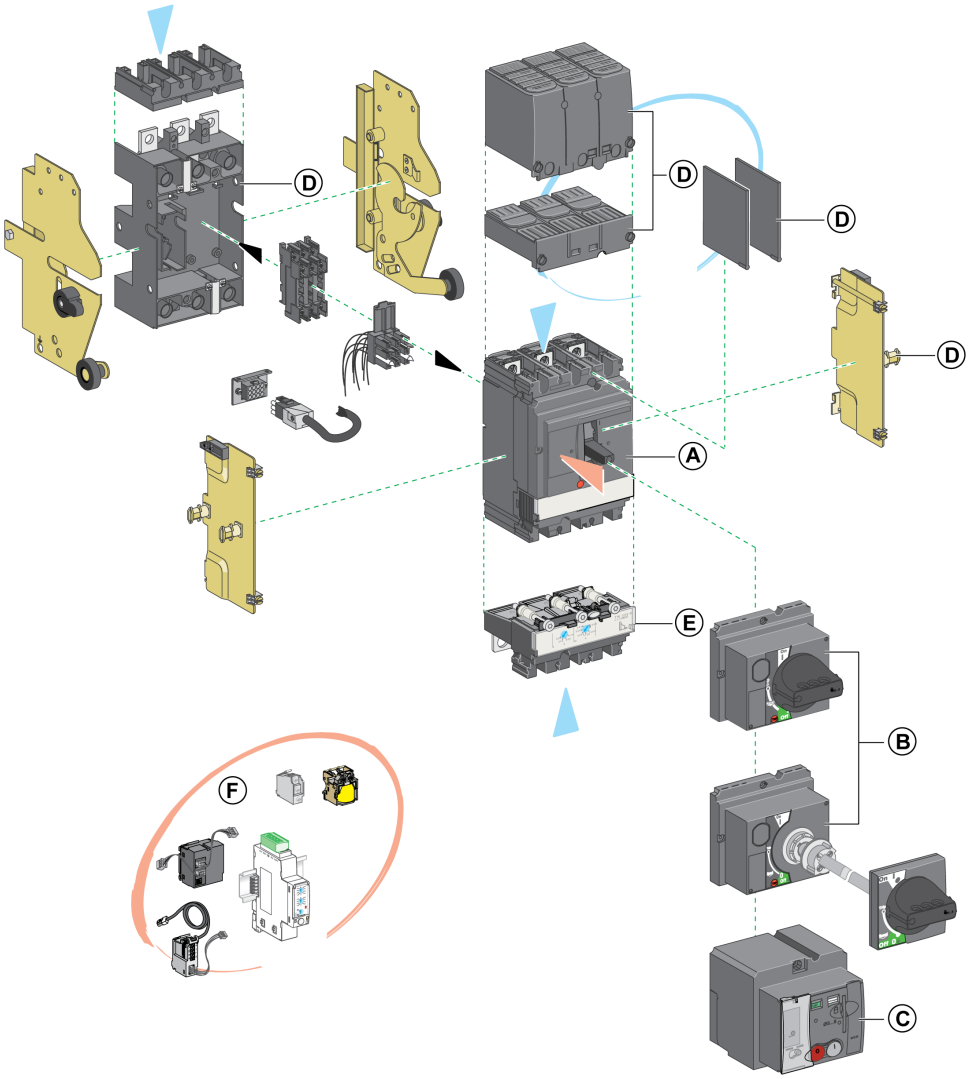
The Compact NSX direct current (DC) range consists of
- circuit breakers operating on direct current from 16 to 1200 A
- switch-disconnectors operating on direct current from 16 to 630 A
- a set of standard accessories and auxiliaries shared with the Compact NSX AC range
- a set of specific accessories to meet the needs of series or parallel connection of poles required in high-voltage DC systems
- circuit breakers for general-purpose (GP) applications:
  - 1 and 2 poles from 16 to 160 A
  - 3 and 4 poles from 16 to 600 A
  - 2 poles from 630 to 1200 A, obtained from a Compact NSX 4P 630 A with 2 poles in parallel
- circuit breakers for photovoltaic (PV) applications:
  - 4 poles from 16 to 500 A
- standard compliance:
  - IEC 60947-2, and IEC 60947-3 for switch-disconnectors
  - UL 489B

Definition

In this guide, the phrase circuit breaker covers circuit breakers and switch-disconnectors.

Modular Functionalities

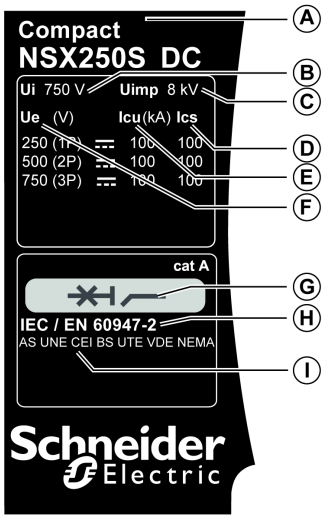
The Compact NSX DC circuit breakers offer a wide choice of field-installable functions.



A Toggle handle
B Rotary handles
C Motor mechanism
D Installation accessories
E Trip unit
F Communication accessories and electric auxiliary devices

Identification

The faceplate on the front of the circuit breaker identifies the circuit breaker and its characteristics.



A Circuit breaker type: Case rating and breaking performance
B Ui: Insulation voltage
C Uimp: Rated impulse withstand voltage
D Ics: Service breaking capacity
E Icu: Ultimate breaking capacity
F Ue: Operating voltage
G Circuit breaker disconnector symbol
H Reference standard IEC 60947-2
I Performance according to the NEMA standard

NOTE: For extended rotary handles, open the door to view the faceplate label.

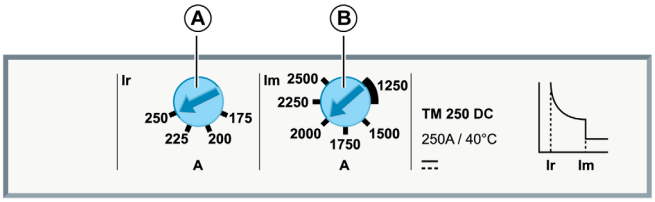
Trip Units

The Compact NSX DC circuit breakers use thermal-magnetic trip units.

For more information about trip units, see the related description *(see page 74)*.

Dial Settings

The dial positions on the front of the thermal-magnetic trip unit set the circuit breaker pickup settings.



A Overload protection setting
B Short-circuit protection setting

Trip Unit Settings

The circuit breaker trip unit settings must satisfy the requirements of the performance and installation diagram *(see page 88)*.

Operating the Circuit Breakers

Circuit Breaker Operating Control Accessories for General-Purpose Applications

The table below shows the operating control accessories compatible with the Compact NSX DC circuit breakers for general-purpose applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Operating Control Accessory	NSX100 DC			NSX160 DC			NSX250 DC	NSX400 DC	NSX630 DC	NSX1200 DC
	1P	2P	3P/4P	1P	2P	3P/4P	3P/4P	3P/4P	3P/4P	2P
Toggle handle	X	X	X	X	X	X	X	X	X	X
Rotary handle			X			X	X	X	X	X
Motor mechanism			X			X	X	X	X	X
Communicating motor mechanism			X			X	X	X	X	X

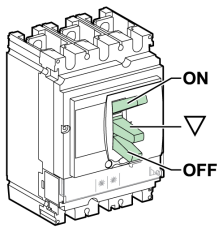
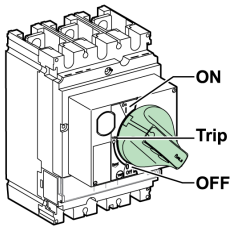
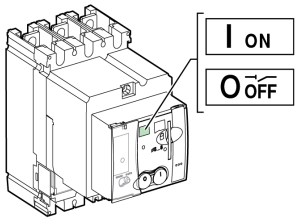
Circuit Breaker Operating Control Accessories for Photovoltaic Applications

The table below shows the operating control accessories compatible with the Compact NSX DC circuit breakers for photovoltaic applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Operating Control Accessory	NSX80 DC PV	NSX100 DC PV	NSX125 DC PV	NSX160 DC PV	NSX200 DC PV	NSX400 DC PV	NSX500 DC PV
	4P	4P	4P	4P	4P	4P	4P
Toggle handle	X	X	X	X	X	X	X
Rotary handle	X	X	X	X	X	X	X
Motor mechanism	X	X	X	X	X	X	X
Communicating motor mechanism	X	X	X	X	X	X	X

Toggle Handle Position

The handle position indicates the state of the circuit breaker:

Toggle Handle	Rotary Handle	Motor Mechanism
		
• **I (ON)**: Circuit breaker closed. Closed manually. • **O (OFF)**: Circuit breaker open. Opened manually. • **Trip** or **Tripped**: Circuit breaker tripped. Tripped by the protection (trip unit or trip releases), the push-to-trip button, or the maintenance module.		• **I (ON)**: Circuit breaker closed (in Auto or Manu mode). • **O (OFF)**: Circuit breaker open or tripped (in Auto or Manu mode).

Remote Indication

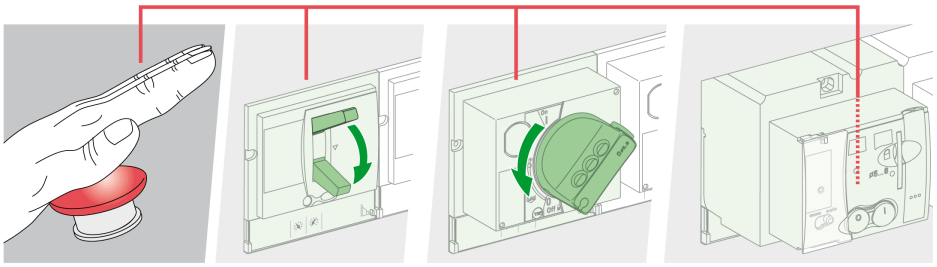
Information is available remotely:
- from the indication contacts
- by using a communication bus

These indication auxiliaries can be installed on site.

For more details on the remote indication and communication options, see the summary tables of auxiliaries *(see page 62)*.

Remote Electrical Stop Command

The remote electrical stop command can be given by electrical control auxiliaries regardless of the control type in use.



To obtain a remote electrical stop command, use:

- an MX shunt trip release, or
- an MN undervoltage trip release, or
- an MN undervoltage trip release with time-delay unit (the time-delay unit overcomes the problem of micro-cuts).

For more details on the electrical control auxiliaries, see the relevant topic *(see page 72)*.

NOTE: It is advisable to test operation of the remote electrical stop commands at regular intervals (every 6 months).

Customer Engineering Tool (CET)

Definition

The customer engineering tool used to configure the breaker status control module (BSCM) and the communicating motor mechanism is:

- Ecoreach, the Electrical Asset Manager software, or
- Compact NSX RSU software.

The customer engineering tools are available at *www.schneider-electric.com*.

Ecoreach

Ecoreach software enables the user to have the following features in addition to the features provided by Compact NSX RSU software:

- create projects by device discovery and selection of devices from Schneider Electric catalog
- monitor the status of protection and IO status
- read information (alarms, measurements, parameters)
- upload and download of configuration or settings in batches
- performs control actions in a secured way
- generate and print device settings report and communication test report
- manage multiple devices with electrical and communication hierarchy model
- manage artifacts (project and device documents)
- check consistency in settings between devices in a communication network
- compare configuration settings between the project and device (online)
- download latest firmware and upgrade devices
- safe repository of projects in Schneider Electric Cloud and sharing of projects with other users

For more information, see the *Ecoreach Online Help*.

Compact NSX RSU Software

Compact NSX RSU (Remote Setting Utility) is the Compact NSX configuration software. It enables the user to:

- check and set up the Micrologic trip unit parameters:
  - protection parameters
  - measurement parameters
  - alarm parameters.
- display the Micrologic tripping curves.
- check and set up the SDx module output parameters.
- check and set up the SDTAM module output parameters.
- check and set up the circuit breaker status and control module (BSCM) parameters.
- edit and save configurations.

Compact NSX RSU is used also to configure the IMU (Intelligent Modular Unit) modules connected to Compact NSX, Compact NS, or Masterpact circuit breakers, and enables the user to:

- modify passwords in the IMU.
- change IMU identification.
- get and set the time.
- configure the IO module assignments.
- modify the IO module counters.
- reset the IO module counters (only with **Schneider service** user profile).
- update firmware of ULP (Universal Logic Plug) modules (only with **Schneider service** user profile).
- reset the passwords to their factory values (only with the **Schneider service** user profile.)
- reset the IO module settings to their factory values (only with the **Schneider service** user profile.)
- edit and save configurations.

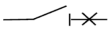
For more information, see the *Compact NSX RSU Online Help*.

De-Energizing the Circuit Breakers

Isolation Capacity

Compact NSX circuit breakers offer positive contact indication and are suitable for isolation in accordance with standards IEC 60947-1 and 2. The **O (OFF)** position of the actuator is sufficient to isolate the circuit breaker concerned.

The following marking on the faceplate label indicates that the circuit breaker is capable of isolation:



To confirm this capability, standards IEC 60947-1 and 2 require specific shock withstand tests.

Compact NSX circuit breakers can be locked in the **O (OFF)** position to allow work to be carried out with the power off in accordance with installation rules. The circuit breaker can only be locked in the open position if the circuit breaker is in the **O (OFF)** position.

NOTE: Locking a Compact NSX circuit breaker in the open position is sufficient to isolate the circuit breaker.

The locking devices depend on the type of actuator:

- For circuit breakers with toggle handles, use the locking accessories *(see page 26)*.
- For circuit breakers with rotary handles, see how to lock the circuit breaker with direct rotary handle *(see page 33)* and how to lock the circuit breaker with extended rotary handle *(see page 37)*.
- For circuit breakers with motor mechanisms, see how to lock the circuit breaker *(see page 46)*.

Maintenance and Servicing Work on Installation

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or local equivalent.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Repair the installation immediately if an insulation fault occurs during operation.

Failure to follow these instructions will result in death or serious injury.

Turn off all power supplying the equipment before working on or inside equipment. For a partial powering down of the installation, the installation and safety rules require clearly labeling and isolating the feed being worked on.

Maintenance Work Following a Trip on Electrical Fault

⚠ CAUTION

HAZARD OF CLOSING ON ELECTRICAL FAULT

Do not close the circuit breaker again without first inspecting and, if necessary, repairing the downstream electrical equipment.

Failure to follow these instructions can result in injury or equipment damage.

The fact that a protection has tripped does not remedy the cause of the fault on the downstream electrical equipment.

The table below describes the procedure to be followed after a fault trip.

Step	Action
1	Isolate the feed before inspecting the downstream electrical equipment.
2	Look for the cause of the fault.
3	Inspect and, if necessary, repair the downstream equipment.
4	Inspect the equipment in the event of a short-circuit trip.
5	Close the circuit breaker again.

For more information on troubleshooting and restarting following a fault, see what to do in the event of a trip *(see page 93)*.

Checking Settings

Checking settings must be done by a qualified person. Checking settings does not require any particular precautions.

Testing Circuit Breaker

⚠ CAUTION

HAZARD OF NUISANCE TRIPPING

Protection tests must be done only by trained electrical personnel.

Failure to follow these instructions can result in injury or equipment damage.

When testing trip mechanisms, precautions must be taken:
- to not disrupt operations
- to not trip inappropriate alarms or actions

For example, tripping the circuit breaker with the push-to-trip button or the test software can lead to inappropriate fault indications or corrective actions (such as switching to a replacement power source).

Setting Trip Unit

⚠ CAUTION

HAZARD OF NUISANCE TRIPPING OR FAILURE TO TRIP

Protection setting adjustments must be done only by trained electrical personnel.

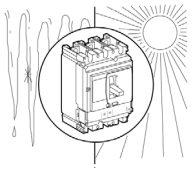
Failure to follow these instructions can result in injury or equipment damage.

Modifying trip unit settings requires a thorough knowledge of the installation and safety rules.

Environmental Conditions

Ambient Temperature

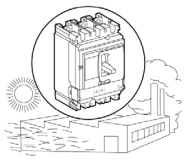
The ambient temperature refers to the temperature of the air immediately surrounding the circuit breaker.



- Operation temperature: -25 °C to +70 °C (-13 °F to +158 °F)
  NOTE: Commissioning is possible at -35 °C (-31 °F)
- Storage temperature: -50 °C to +85 °C (-58 °F to +185 °F)

Extreme Atmospheric Conditions

The circuit breakers are designed to operate in industrial atmospheres as defined in standard IEC 60947-2 for the highest level of pollution (level 3).



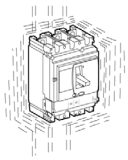
They are tested for extreme storage conditions according to the following standards:

Standard	Title
IEC 60068-2-2	Dry heat, severity level +85 °C (+185 °F)
IEC 60068-2-1	Dry cold, severity level –55 °C (–67 °F)
IEC 60068-2-30	Damp heat, cyclic ● temperature +55 °C (+131 °F) ● relative humidity 95%
IEC 60068-2-52	Salt-mist test

To obtain the best use from the circuit breakers, install them in properly ventilated switchboards where excessive dust is not a problem.

Vibration

The circuit breakers are tested against vibration.

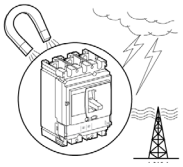


Conformity tests are carried out in accordance with standard IEC 60068-2-6 at the levels of severity required by the merchant shipping regulatory bodies (IACS, Veritas, Lloyd's namely):

- 2 Hz to 13.2 Hz with an amplitude of +/- 1 mm (+/- 0.04 in.)
- 13.2 Hz to 100 Hz at a constant acceleration of 0.7 g

Electromagnetic Disturbances

The circuit breakers are immune to electromagnetic disturbance.



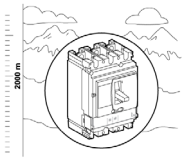
They comply with the requirements of the electromagnetic compatibility (EMC) standard IEC 60947-2 Appendixes F and J - Overcurrent protection tests.

Check for compliance with EMC standards by testing for immunity to:
- Overvoltages produced by the operation of electromagnetic circuit breaker
- Overvoltages produced by atmospheric disturbance that pass through the electrical network (for example, lightning)
- The use of apparatus emitting radio waves (such as radio transmitters, walkie-talkies, or radar)
- Electrostatic discharges produced by the operators themselves

Conformity with EMC standards as described above ensures:
- The circuit breaker operates correctly in a disturbed environment
  - without nuisance tripping
  - in accordance with the trip time
- There is no disturbance to any type of industrial or commercial environment

Altitude

The circuit breakers are designed to operate within specification at altitudes of up to 2,000 m (6,600 ft.).



Operation above 2,000 m (6,600 ft) requires derating as follows:

Altitude (m/ft)		**2,000 m (6,600 ft)**	**3,000 m (9,800 ft)**	**4,000 m (13,000 ft)**	**5,000 m (16,500 ft)**
Impulse withstand voltage Uimp (kV)		8	7.1	6.4	5.6
Rated insulation voltage (Ui)		750	710	635	560
Maximum rated operational DC voltage	Compact NSX DC ≤250 V	250	220	200	175
	Compact NSX DC 250–500 V	500	440	400	350
	Compact NSX DC 500–750 V	750	660	600	525
Rated current (A)		In	0.96 x In	0.93 x In	0.90 x In

Operation for photovoltaic applications above 2,000 m (6,600 ft) requires derating as follows:

Altitude (m/ft)		**2,000 m (6,600 ft)**	**3,000 m (9,800 ft)**	**4,000 m (13,000 ft)**	**5,000 m (16,500 ft)**
Impulse withstand voltage Uimp (kV)		8	7.1	6.4	5.6
Rated insulation voltage (Ui)		1,000	900	800	700
Maximum rated operational DC voltage	Compact NSX DC PV	1,000	900	800	700
Rated current (A)		In	0.96 x In	0.93 x In	0.90 x In

Section 1.2
Circuit Breakers With Toggle Handle

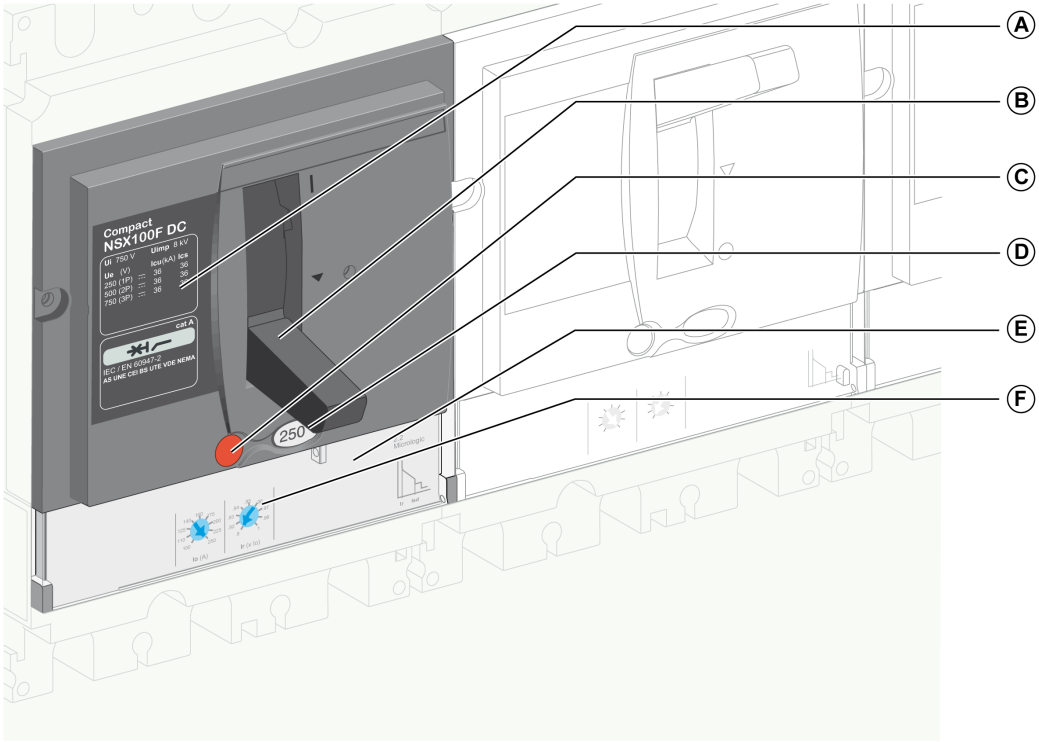
What Is in This Section?

This section contains the following topics:

Topic	Page
Front Face Description	22
Opening, Closing, and Resetting the Circuit Breakers	23
Testing the Circuit Breaker	25
Locking the Circuit Breaker	26

Front Face Description

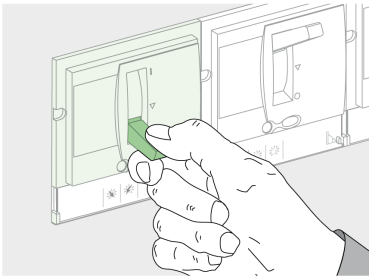
Front Face



A Faceplate
B Toggle handle for opening, closing, and resetting
C Push-to-trip button
D Circuit breaker rating
E Trip unit (circuit breaker only)
F Trip unit adjustment dials (circuit breaker only)

Opening, Closing, and Resetting the Circuit Breakers

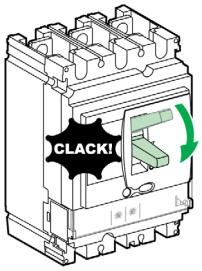
Opening and Closing Locally



- To close the circuit breaker, move the toggle handle from the **O (OFF)** position to the **I (ON)** position.
- To open the circuit breaker, move the toggle handle from the **I (ON)** position to the **O (OFF)** position.

Resetting After a Trip on Electrical Fault

The circuit breaker has tripped on electrical fault, the toggle handle has moved from the **I (ON)** position to the tripped ▼ position.



⚠ CAUTION

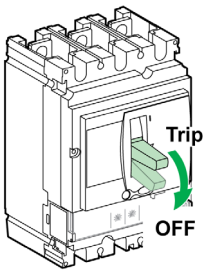
HAZARD OF CLOSING ON ELECTRICAL FAULT

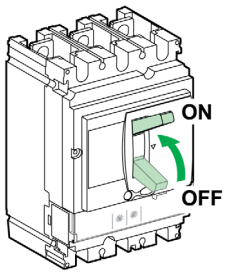
Do not close the circuit breaker again without first inspecting and, if necessary, repairing the downstream electrical equipment.

Failure to follow these instructions can result in injury or equipment damage.

The fact that a circuit breaker has tripped does not remedy the cause of the fault on the downstream electrical equipment.

To reset after a fault trip:

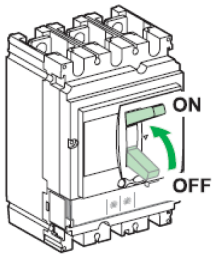
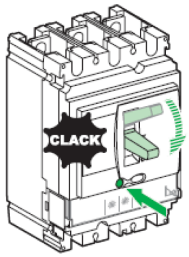
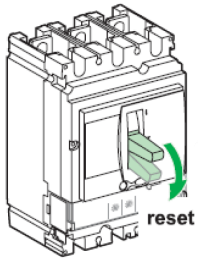
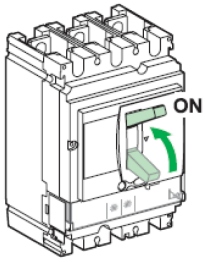
Step	Action		Position
1	–	Isolate the feed, following the instructions in the topic on maintenance and servicing work on installation *(see page 17)*, before inspecting the downstream electrical equipment.	▼
2	–	Look for the cause of the fault.	▼
3	–	Inspect and, if necessary, repair the downstream equipment.	▼
4	–	Inspect the equipment in the event of a short-circuit trip.	▼
5		Reset the circuit breaker by moving the toggle handle from the Trip position to the **O (OFF)** position: the circuit breaker is open.	**O (OFF)**

Step	Action		Position
6		Close the circuit breaker by moving the toggle handle from the **O (OFF)** position to the **I (ON)** position: the circuit breaker is closed.	**I (ON)**

Testing the Circuit Breaker

Push-to-Trip Procedure

To check whether the trip mechanism is working correctly, press the push-to-trip button.

Step	Action		Position
1		Close the circuit breaker.	**I (ON)**
2		Press the push-to-trip button to trip the circuit breaker.	▼
3		Move the toggle handle to the **O (OFF)** position to reset the circuit breaker.	**O (OFF)**
4		Move the toggle handle to the **I (ON)** position to close the circuit breaker.	**I (ON)**

Locking the Circuit Breaker

Locking Accessories

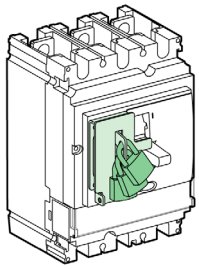
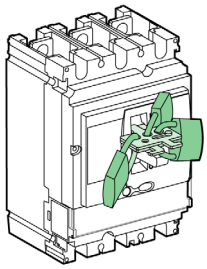
⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

When circuit breaker toggle handle is locked **OFF (O)**, always use a properly rated voltage sensing device to confirm power is off before working on equipment.

Failure to follow these instructions will result in death or serious injury.

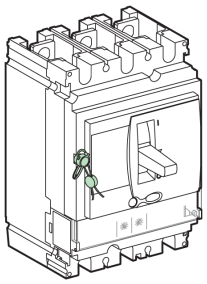
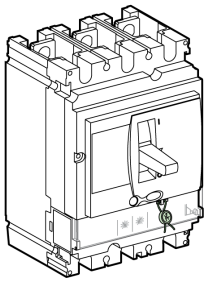
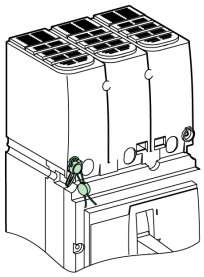
Use locking accessories to lock the toggle handle in the **I (ON)** or **O (OFF)** position.

Accessory		Padlocks
	Accessory that is part of the case	Use up to 3 padlocks (not supplied) 5–8 mm (0.2–0.3 in.) in diameter
	Accessory that is detachable	Use up to 3 padlocks (not supplied) 5–8 mm (0.2–0.3 in.) in diameter

NOTE: Locking the toggle handle in the **I (ON)** position does not disable the circuit breaker protection functions. If there is a fault, the circuit breaker trips without altering its performance. When unlocked, the toggle handle moves to the tripped position. To return the circuit breaker to service, see how to open, close, and reset the circuit breaker *(see page 23)*.

Sealing Accessories

Use sealing accessories to prevent circuit breaker operations.

Seal		Prohibited Operations
	Escutcheon mounting screw	• Dismantling the escutcheon • Accessing the auxiliaries • Dismantling the trip unit
	Transparent protective cover	Altering trip unit settings
	Mounting screw for terminal shields	Accessing the power connection (protection against direct contact)

Section 1.3
Circuit Breaker With Rotary Handle

What Is in This Section?

This section contains the following topics:

Topic	Page
Front Face Description	29
Opening, Closing, and Resetting the Circuit Breaker	30
Testing a Circuit Breaker With Direct Rotary Handle	32
Locking a Circuit Breaker With Direct Rotary Handle	33
Testing a Circuit Breaker With Extended Rotary Handle	36
Locking a Circuit Breaker With Extended Rotary Handle	37

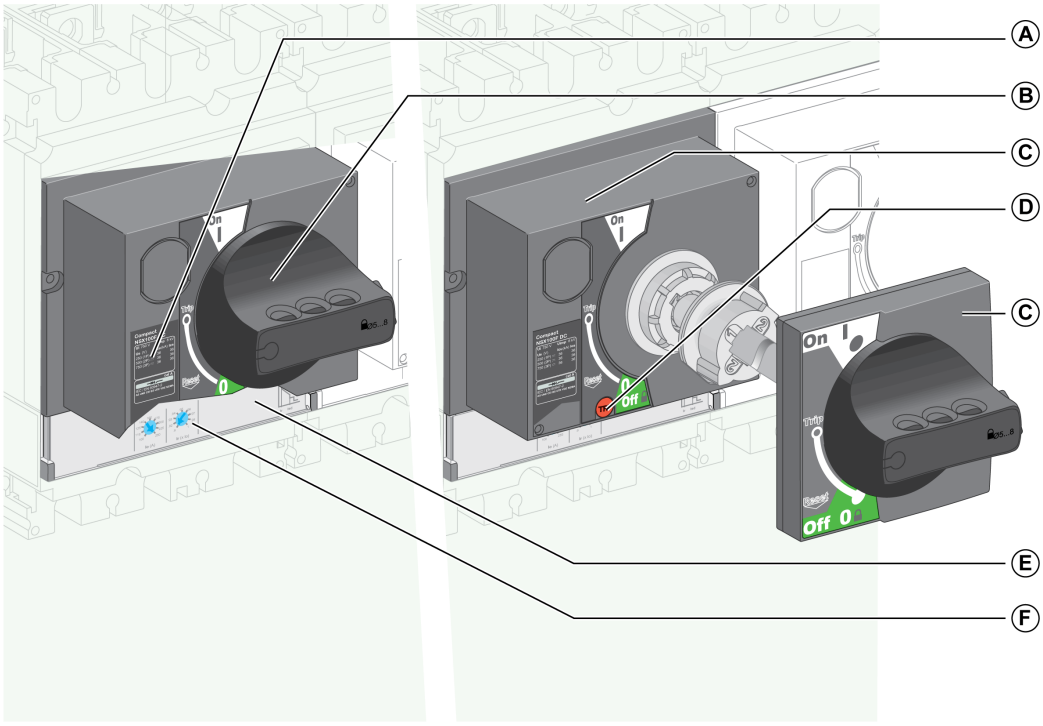
Front Face Description

Front Face

The circuit breaker operating controls, operation indicators, settings, and locking mechanisms for the direct rotary handle are on the front of the circuit breaker.

If there is an extended rotary handle:

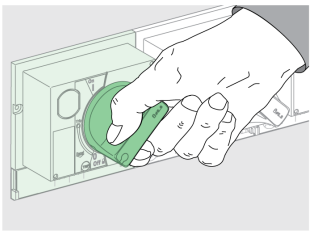
- The circuit breaker operating controls are on the door escutcheon.
- The operation indicators and settings are only accessible when the door is open.
- Operate the locking mechanisms on the circuit breaker or on the door escutcheon (door closed).



A Faceplate
B Direct rotary handle
C Extended rotary handle
D Push-to-trip button
E Trip unit (circuit breaker only)
F Trip unit adjusting dials (circuit breaker only)

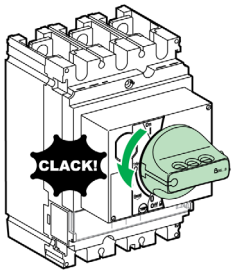
Opening, Closing, and Resetting the Circuit Breaker

Opening and Closing Locally



- To close the circuit breaker, turn the rotary handle clockwise from the **O (OFF)** position to the **I (ON)** position.
- To open the circuit breaker, turn the rotary handle anticlockwise from the **I (ON)** position to the **O (OFF)** position.

Resetting After a Trip on Electrical Fault

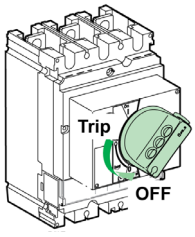


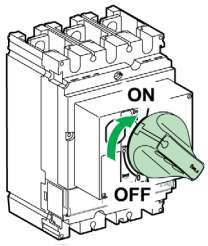
The circuit breaker has tripped on electrical fault, the rotary handle has moved from the **I (ON)** position to the Trip position.

⚠ CAUTION
HAZARD OF CLOSING ON ELECTRICAL FAULT Do not close the circuit breaker again without first inspecting and, if necessary, repairing the downstream electrical equipment. **Failure to follow these instructions can result in injury or equipment damage.**

The fact that a circuit breaker has tripped does not remedy the cause of the fault on the downstream electrical equipment.

To reset after a fault trip:

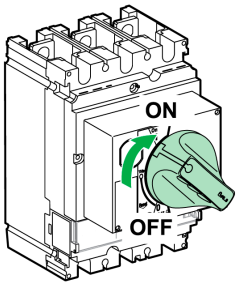
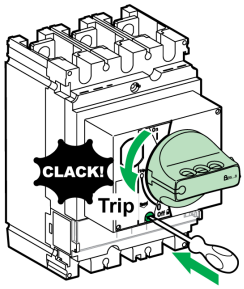
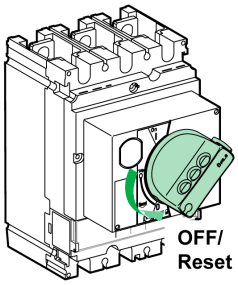
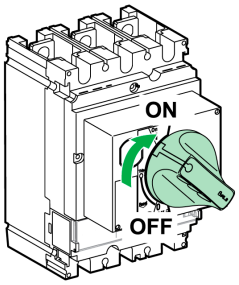
Step	Action		Position
1	–	Isolate the feed *(see page 17)* before inspecting the downstream electrical equipment.	▼
2	–	Look for the cause of the fault.	▼
3	–	Inspect and, if necessary, repair the downstream equipment.	▼
4	–	Inspect the equipment in the event of a short-circuit trip.	▼
5		Reset the circuit breaker by turning the rotary handle counterclockwise from the Trip position to **O (OFF)**.	**O (OFF)**

Step	Action		Position
6		Close the circuit breaker by turning the rotary handle clockwise to **I (ON)**.	**I (ON)**

Testing a Circuit Breaker With Direct Rotary Handle

Push-to-Trip Procedure

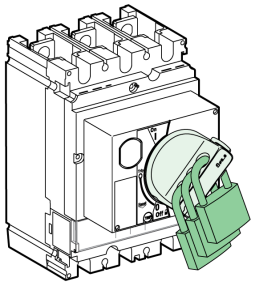
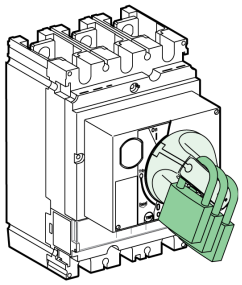
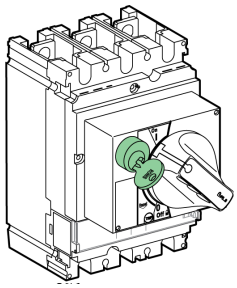
To check whether the trip mechanism is working correctly, press the push-to-trip button.

Step	Action		Position
1		Close the circuit breaker.	**I (ON)**
2		Press the push-to-trip button: the circuit breaker trips.	Trip
3		Turn the rotary handle counterclockwise to the **O (OFF)** position. The circuit breaker is open.	**O (OFF)**
4		Turn the rotary handle clockwise from the **O (OFF)** position to the **I (ON)** position. The circuit breaker is closed.	**I (ON)**

Locking a Circuit Breaker With Direct Rotary Handle

Locking Accessories

The rotary handle can be locked with up to 3 padlocks (not supplied) or a keylock.

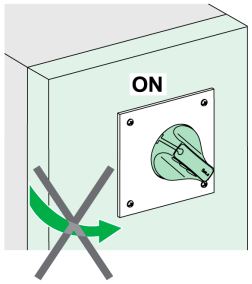
Accessory		Padlocks
	Padlocking (standard) only in the **O (OFF)** position.	Lock rotary handle with up to 3 padlocks (not supplied) with shackle diameters of 5–8 mm (0.2–0.3 in.).
	Padlocking (after modification to the rotary handle during installation) in the 2 positions **I (ON)** and **O (OFF)**.	Lock rotary handle with up to 3 padlocks (not supplied) with shackle diameters of 5–8 mm (0.2–0.3 in.).
	Keylocking with a Profalux® or Ronis® lock (optional). The circuit breaker can be locked in the **O (OFF)** position only or in the **O (OFF)** and **I (ON)** position, depending on the bolt chosen.	A Profalux or Ronis lock can be installed on site. Keylocking can be used at the same time as padlocking.

NOTE: Locking the rotary handle in the **I (ON)** position does not disable the circuit breaker protection functions. If there is a fault, the circuit breaker still trips. When unlocked, the rotary handle moves to the Trip position. To return the circuit breaker to service, follow the resetting instructions *(see page 30)*.

Door Locking (MCC Function)

Further options are offered with the direct rotary handle in the MCC function.

The direct rotary handle locks the door in the closed position when the circuit breaker is in the **I (ON)** position.



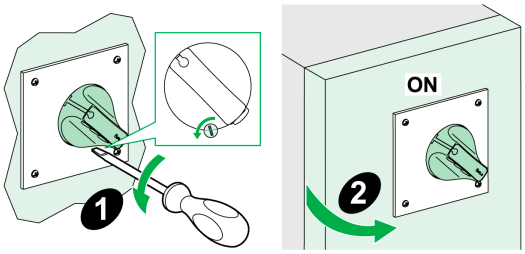
⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disabling the door lock must be done only by trained electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Temporarily disable the door lock to open the door.



Preventing Circuit Breaker Closing When the Door Is Open

The door locking device can also prevent moving the direct rotary handle to the **I (ON)** position when the door is open.

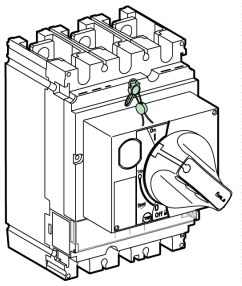
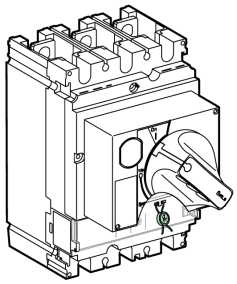
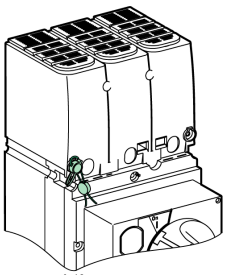
Non-Interlocked Door Option

Disabling the lock requires modifying the extended rotary handle (see *Quick Reference Guide*).

If the lock has been disabled, the extended rotary handle functions for door locking and preventing the circuit breaker from being closed when the door is open are inoperative.

Sealing Accessories

Use sealing accessories to prevent circuit breaker operations.

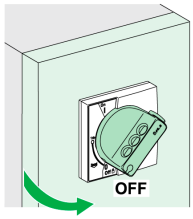
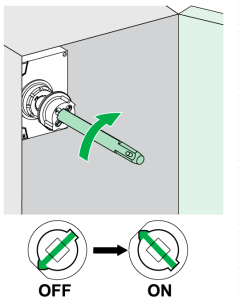
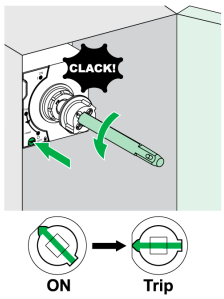
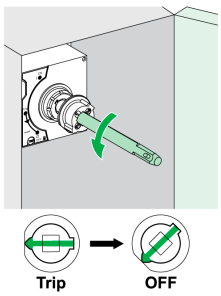
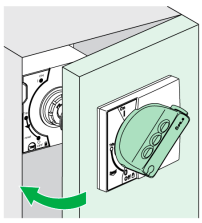
Seal		Prohibited Operations
	Escutcheon mounting screw	• Dismantling the escutcheon • Accessing the auxiliaries • Dismantling the trip unit
	Transparent protective cover	Altering trip unit settings
	Mounting screw for terminal shields	Accessing the power connection (protection against direct contact)

Testing a Circuit Breaker With Extended Rotary Handle

Push-to-Trip Procedure

To check the trip mechanism, press the push-to-trip button.

The push-to-trip button is not accessible on the front face; conduct the test with the door open.

Step	Action		Position
1		Switch the circuit breaker to the **O (OFF)** position. Open the door.	**O (OFF)**
2		Use a special tool(1) to turn the extension shaft clockwise and switch the circuit breaker to the **I (ON)** position. The circuit breaker is ready for the test.	**I (ON)**
3		Press the push-to-trip button. The circuit breaker trips.	Trip
4		Use a special tool(1) to turn the extension shaft counterclockwise and switch the circuit breaker from the Trip position to the **O (OFF)** position. The circuit breaker is in the open position.	**O (OFF)**
5		Close the door.	–

(1) The special tool can be:
- A standard rotary handle designed for tests
- A flat wrench, taking care not to damage either the extension shaft (the hollow square 10 x 10 mm (0.39 x 0.39 in.) tube) or its surface treatment

Locking a Circuit Breaker With Extended Rotary Handle

Locking Accessories

The extended rotary handle offers several locking functions to:

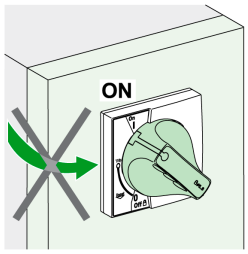
- Prevent the door being opened
- Prevent the rotary handle being operated

Some locking functions can be disabled on different adaptations.

NOTE: Locking the rotary handle in the **I (ON)** position does not disable the circuit breaker protection functions. If there is a fault, the circuit breaker still trips. When unlocked, the rotary handle moves to the Trip position. To return the circuit breaker to service, follow the resetting instructions *(see page 30)*.

Locking the Door

The extended rotary handle locks the door in the **I (ON)** position as standard.



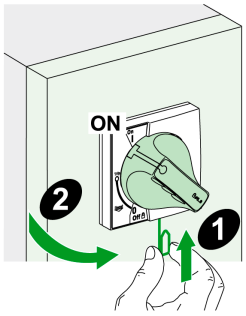
⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Disabling the door lock must be done only by trained electrical personnel.

Failure to follow these instructions will result in death or serious injury.

Temporarily disable this lock to open the door.



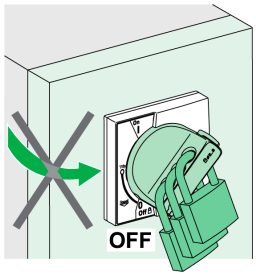
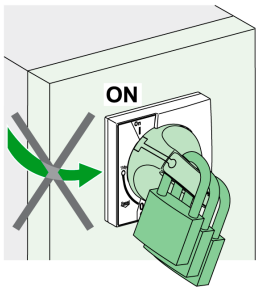
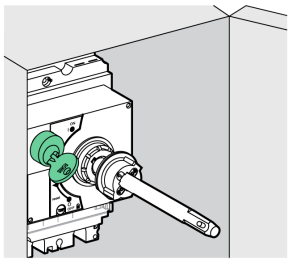
Disabling this lock requires modifying the extended rotary handle (see *Quick Reference Guide*).

Example:

An application includes a circuit breaker for a switchboard incoming supply and several receiver circuit breakers with extended rotary handles installed behind the same door. Locking the door with a single rotary handle (incoming supply circuit breaker) simplifies maintenance work on the switchboard.

Locking the Extended Rotary Handle

The rotary handle can be locked with up to 3 padlocks (not supplied) or keylock.

Accessory		Padlocks
	Padlocking (standard) only in the **O (OFF)** position. Padlocking the rotary handle prevents the door opening.	Lock rotary handle with up to 3 padlocks (not supplied) with shackle diameters of 5–8 mm (0.2–0.3 in.).
	Padlocking (after modification to the rotary handle during installation) in the 2 positions **I (ON)** and **O (OFF)**. There is a choice of 2 options when locking the rotary handle in the **I (ON)** position: ● Standard with the door opening locked. ● As an option, door is not interlocked, and locking the rotary handle does not stop the door from opening.	Lock rotary handle with up to 3 padlocks (not supplied) with shackle diameters of 5–8 mm (0.2–0.3 in.).
	Keylocking with a Profalux® or Ronis® lock (optional). The lock is mounted on the case inside the switchboard. Lock the circuit breaker in the **O (OFF)** position only or in the **O (OFF)** and **I (ON)** positions depending on the bolt chosen.	A Profalux or Ronis lock can be installed on site. Keylocking can be used at the same time as padlocking.

Key-Operated Locking Procedure

Keylocking can be done with circuit breaker in either the **O (OFF)** position or the **I (ON)** position.

Step	Action (Circuit Breaker in the O (OFF) Position)	Action (Circuit Breaker in the I (ON) Position)
1	Open the door.	Open the door by disabling the door locking device if necessary.
2	Use the keylock mounted on the case inside the switchboard to lock the rotary handle.	Use the keylock mounted on the case inside the switchboard to lock the rotary handle.
3	Close the door.	Close the door, disabling the door locking device if necessary.

Sealing Accessories

The sealing accessories for circuit breakers with extended rotary handles are identical to those for circuit breakers with direct rotary handles *(see page 33)*.

Section 1.4
Motor-Operated Circuit Breakers

Aim

This section describes the controls, indications, and locking mechanisms accessible on the front of the Compact NSX DC circuit breaker with motor mechanism.

There are 2 possible types of motor mechanism:
- Motor mechanism, which can open and close a circuit breaker remotely with electrical commands (using push buttons)
- Communicating motor mechanism, which can open and close a circuit breaker remotely using the communication bus

What Is in This Section?

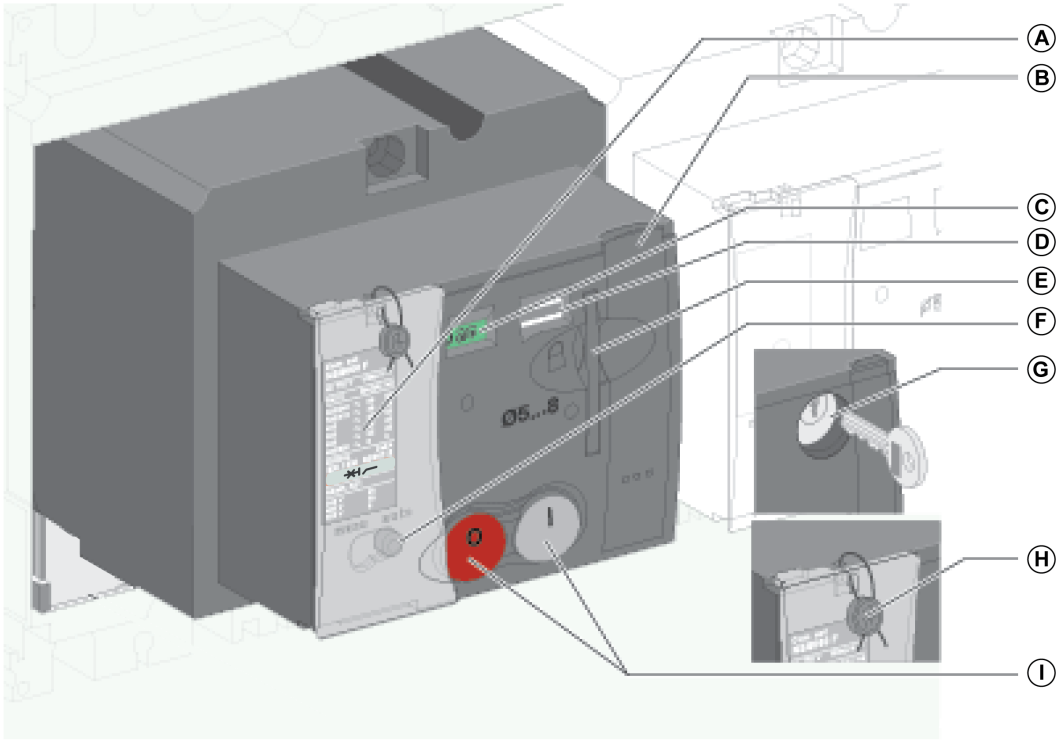
This section contains the following topics:

Topic	Page
Front Face Description	40
Opening, Closing, and Resetting Circuit Breakers With Motor Mechanism	42
Opening, Closing, and Resetting Circuit Breakers With Communicating Motor Mechanism	45
Locking the Circuit Breaker	46

Front Face Description

Front Face

The main controls, operation indicators, settings, and locking mechanisms are on the front of an electrically operated circuit breaker (with motor mechanism).



A Faceplate
B Stored energy control in manual mode
C Main contacts position indicator
D Control charge indicator
E Padlocking in **O (OFF)** position
F Manual/automatic operating mode selector
G Keylocking in **O (OFF)** position
H Sealing accessory
I Closing (**I**) and opening (**O**) controls
J Trip unit front indications (circuit breaker only)

Main Contacts Position Indicator

Indicator	Description
I ON	The circuit breaker is closed.
O OFF	The circuit breaker is open or tripped.

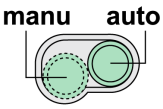
NOTE: Use the SD or SDE switch to distinguish the tripped position from the **O (OFF)** position.

Control Charge Indicator

Indicator	Description
charged	Stored energy control charged
discharged	Stored energy control discharged

NOTE: Stored energy control only provides the necessary energy to close the circuit breaker. The circuit breaker mechanism supplies the energy for tripping.

Manu/Auto Selector



The Manu/Auto selector is used to select operating mode:

- In automatic operating mode, only electrical commands are executed.
- In manual operating mode, all electrical commands are disabled.

Opening, Closing, and Resetting Circuit Breakers With Motor Mechanism

Introduction

The motor mechanism can open and close the circuit breaker remotely with electrical commands.

⚠ CAUTION
HAZARD OF REPEATED CLOSING ON ELECTRICAL FAULT
Do not modify the wiring diagrams for the motor mechanism.
Failure to follow these instructions can result in injury or equipment damage.

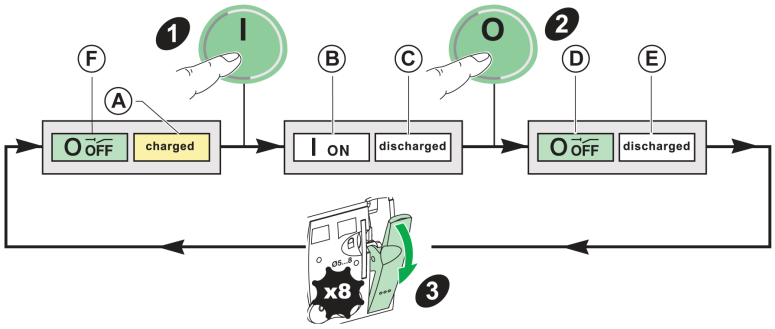
Wire the motor mechanism in strict accordance with the motor mechanism wiring diagram in the Appendix *(see page 97)*.

In automatic operating mode, wiring the SDE contact prevents the circuit breaker from resetting automatically on an electrical fault. For more details on the SDE contact, see the indication contacts *(see page 66)*.

Manual Operation: Opening, Closing, and Resetting Locally

Move the selector to the Manu position.

Cycle of operation:



Manual Operation Description

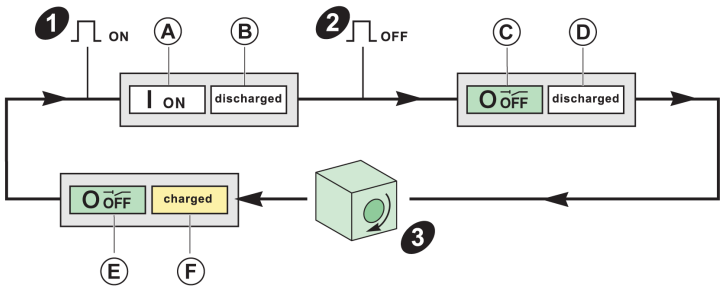
Check that the stored energy control is charged (the charge indicator is on **charged** (**A**). If not, reset the circuit breaker.

Step	Action	Comment
1	Close the circuit breaker by pressing the closing switch .	When the circuit breaker is closed: ● The contact position indicator (**B**) changes to **I (ON)**. ● The charge indicator (**C**) changes to **discharged**.
2	Open the circuit breaker by pressing the opening switch .	When the circuit breaker is open: ● The contact position indicator (**D**) changes to **O (OFF)**. ● The charge indicator (**E**) stays on **discharged**.
3	Reset the circuit breaker: recharge the stored energy control by operating the charging handle (8 times).	When the circuit breaker is ready to be closed: ● The contact position indicator (**F**) stays on **O (OFF)**. ● The charge indicator (**A**) changes to **charged**.

Automatic Operation: Opening, Closing, and Resetting Remotely

Move the selector to the Auto position.

Cycle of operation:

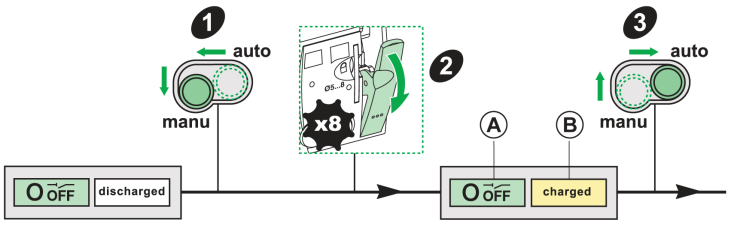


Automatic Operation Description

Step	Action	Comment
1	Close the circuit breaker by sending a close (**ON**) command.	When the circuit breaker is closed: ● The contact position indicator (**A**) changes to **I (ON)**. ● The charge indicator (**B**) changes to **discharged**.
2	Open the circuit breaker by sending an open (**OFF**) command.	When the circuit breaker is open: ● The contact position indicator (**C**) changes to **O (OFF)**. ● The charge indicator (**D**) stays on **discharged**.
3	Recharge the stored energy control using the 3 reset modes, depending on the wiring diagram: ● Automatic reset ● Remote reset using the push button ● Manual reset by operating the charging handle	The circuit breaker is ready to be closed: ● The contact position indicator (**E**) stays on **O (OFF)**. ● The charge indicator (**F**) changes to **charged**.

Resetting After a Trip on Electrical Fault

Resetting after a trip on electrical fault can only be done locally. When operating in automatic mode, return to manual operation to reset the circuit breaker.



⚠ CAUTION

HAZARD OF CLOSING ON ELECTRICAL FAULT

Do not close the circuit breaker again without first inspecting and, if necessary, repairing the downstream electrical equipment.

Failure to follow these instructions can result in injury or equipment damage.

The fact that a protection has tripped does not remedy the cause of the fault on the downstream electrical equipment.

To reset after a fault trip:

Step	Action
1	Isolate the feed *(see page 17)* before inspecting the downstream electrical equipment.
2	With selector on Manu, operate the charging handle 8 times to reset the circuit breaker in ready-to-close position. **Result:** The charge indicator changes to charged (**B**) and the internal mechanism goes from the Tripped position to the **O (OFF)** position (**A**).
3	Lock the circuit breaker.
4	Look for the cause of the fault.
5	Inspect and, if necessary, repair the downstream equipment.
6	Inspect the equipment in the event of a short-circuit trip.
7	Reset and close the circuit breaker.

Opening, Closing, and Resetting Circuit Breakers With Communicating Motor Mechanism

Introduction

Manage the communicating motor mechanism with the communication bus.

For this function, it is necessary to:
- Install a BSCM Breaker Status Control Module *(see page 67)* and the NSX cord *(see page 70)*
- Use a communicating motor mechanism

Connect the BSCM to the communication bus by the NSX cord:
- to receive closing, opening, and reset commands from the circuit breaker.
- to transmit the circuit breaker states: **O (OFF)**, **I (ON)**, Tripped by SDE.

NOTE: The communicating motor mechanism has a specific reference (see the *Compact NSX and Masterpact NW DC - DC PV Catalog*).

The BSCM can be configured using the customer engineering tool (CET) *(see page 16)*.

⚠ CAUTION

HAZARD OF REPEATED CLOSING ON ELECTRICAL FAULT

Do not modify the wiring diagrams for the motor mechanism.

Failure to follow these instructions can result in injury or equipment damage.

The schematic for the communicating motor mechanism in the BSCM can be configured. It must be created in strict accordance with the simplified schematic shown in the appendix *(see page 104)*.

Manual Operation: Opening, Closing, and Resetting Locally

The process is the same as the standard motor mechanism *(see page 45)*.

Automatic Operation: Opening, Closing, and Resetting Remotely

The process is the same as the standard motor mechanism *(see page 45)*.

Resetting After a Trip on Electrical Fault

Without modifying the factory configuration, the process is the same as the standard motor mechanism *(see page 45)*.

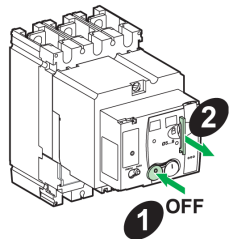
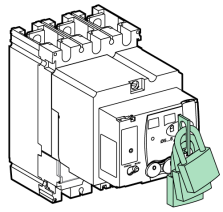
Reconfiguration of the BSCM *(see page 69)* authorizes remote resetting after a trip on electrical fault on a circuit breaker with communicating motor mechanism.

Locking the Circuit Breaker

Locking Accessories

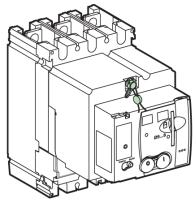
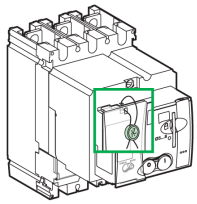
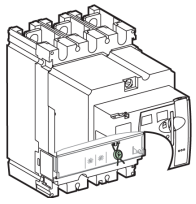
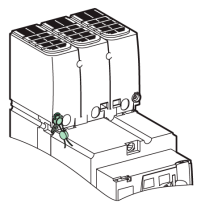
Lock the mechanism with up to 3 padlocks (not supplied) or a keylock.

Both locking methods can be used at the same time.

Action		Result
	**1** Switch the circuit breaker to the **O (OFF)** position. **2** Pull out the tab. **3** Lock the circuit breaker using the keylock (leaving the tab out).	The circuit breaker is locked. No commands in Auto mode or Manu mode are executed.
	**1** Switch the circuit breaker to the **O (OFF)** position. **2** Pull out the tab. **3** Lock the tab using up to 3 padlocks 5–8 mm (0.2–0.3 in.) in diameter.	The circuit breaker is locked. No commands in Auto mode or Manu mode are executed.

Sealing Accessories

Use sealing accessories to prevent circuit breaker operations.

Seal		Prohibited Operations
	Motor mechanism mounting screw	● Dismantling the escutcheon ● Accessing the auxiliaries ● Dismantling the trip unit
	Transparent cover for the motor mechanism	Accessing the manual/automatic selector (depending on its position, manual operation(1), or automatic operation is disabled).
	Transparent protective cover for the trip units	Altering any settings.
	Mounting screw for terminal shields	Accessing the power connection (protection against direct contact)
(1) In this case, no local operations are possible.		

Chapter 2
Compact NSX DC Installation Accessories

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Installation Accessories Summary	48
Plug-in Circuit Breaker	49
Withdrawable Circuit Breaker	52
Installation Accessories	56
Installation Rules for Photovoltaic Applications	57

Installation Accessories Summary

Accessories for General-Purpose Applications

The table below shows the installation modes compatible with the Compact NSX DC circuit breakers for general-purpose applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Installation Modes	NSX100 DC			NSX160 DC			NSX250 DC	NSX400 DC	NSX630 DC	NSX1200 DC
	1P	2P	3P/4P	1P	2P	3P/4P	3P/4P	3P/4P	3P/4P	2P
Fixed	X	X	X	X	X	X	X	X	X	X
Plug-in		X	X		X	X	X	X	X	
Withdrawable		X	X		X	X	X	X	X	

Accessories for Photovoltaic Applications

The table below shows the installation modes compatible with the Compact NSX DC circuit breakers for photovoltaic applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Installation Modes	NSX80 DC PV	NSX100 DC PV	NSX125 DC PV	NSX160 DC PV	NSX200 DC PV	NSX400 DC PV	NSX500 DC PV
	4P	4P	4P	4P	4P	4P	4P
Fixed	X	X	X	X	X	X	X
Plug-in							
Withdrawable							

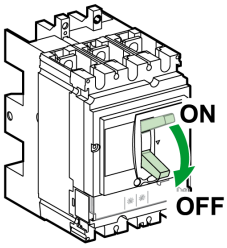
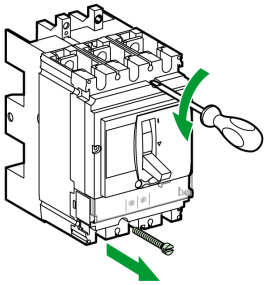
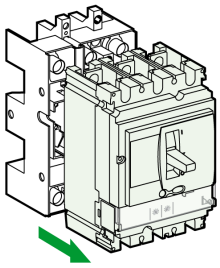
Plug-in Circuit Breaker

Introduction

Plug-in base circuit breakers make it possible to

- extract and/or rapidly replace the circuit breaker without having to touch the connections on the base
- allow for the addition of future circuits by installing bases that will be equipped with a circuit breaker at a later date
- isolate the power circuits when the circuit breaker is mounted on or through a panel. It acts as a barrier for the connections of the plug-in base. Insulation is made complete by the mandatory short terminal shields on the circuit breaker *(see page 51)*.

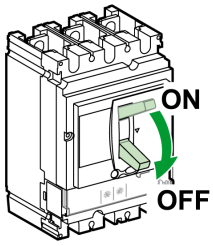
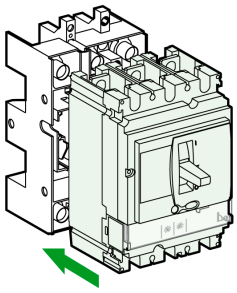
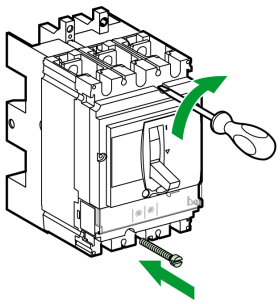
Disconnection Procedure

Step	Action	
1		Switch the circuit breaker to the **O (OFF)** position.
2		Remove both mounting screws.
3		Pull out the circuit breaker, keeping it horizontal.

NOTE:

- The auxiliary circuits automatically disconnect because of the connectors located on the base and at the rear of the circuit breaker.
- Open the circuit breaker before disconnecting it. If the circuit breaker is in the closed **I (ON)** position when disconnecting, a pre-trip mechanism trips the circuit breaker before the pins are disconnected.

Connection Procedure

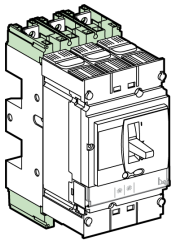
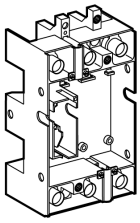
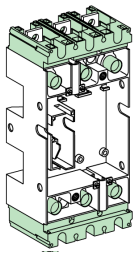
Step	Action	
1		Switch the circuit breaker to the **O (OFF)** position.
2		Connect the circuit breaker.
3		Replace both mounting screws.

NOTE:

- The auxiliary circuits automatically disconnect because of the connectors located on the base and at the rear of the circuit breaker.
- Open the circuit breaker before connecting it. If the circuit breaker is in the closed **I (ON)** position when connecting, the pre-trip mechanism trips it before the pins are connected.

Protection Against Direct Contact with Power Circuits

An adapter enables the base to take the same isolation and connection accessories as the unit-mount circuit breaker.

Circuit Breaker Connected		IP40 with terminal shields
Circuit Breaker Removed		IP20 base only
		IP40 base equipped with terminal shields and blanking plates

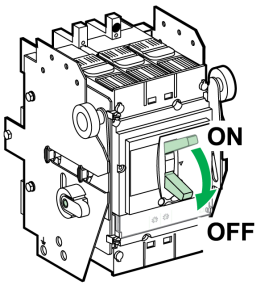
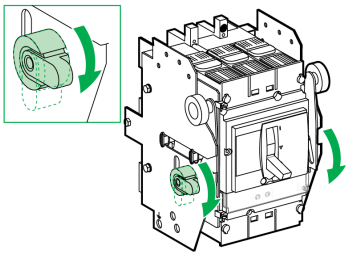
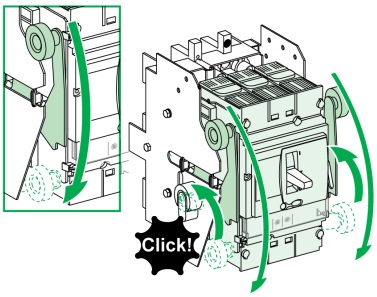
Withdrawable Circuit Breaker

Introduction

In addition to the advantages provided by a plug-in base, installation of the circuit breaker on a cradle facilitates handling. Drawout cradle circuit breakers offer 3 positions, with transfer from one to the other after mechanical unlocking:

- connected: the power circuits are connected
- disconnected: the power circuits are disconnected, the circuit breaker can be operated to check auxiliary operation
- removed: the circuit breaker is free and can be removed from the cradle

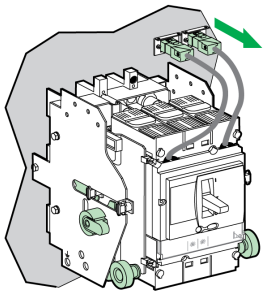
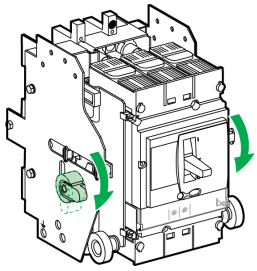
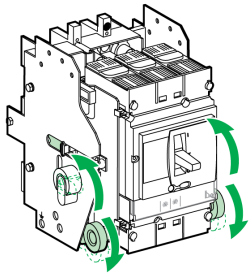
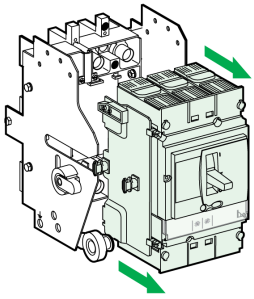
Disconnection Procedure

Step	Action	
1		Switch the circuit breaker to the **O (OFF)** position.
2		Move both locking levers down as far as they can go.
3		Push down both operating handles at the same time until you hear a double-click from the locking levers (as the locking levers return to their original position). The circuit breaker is disconnected.

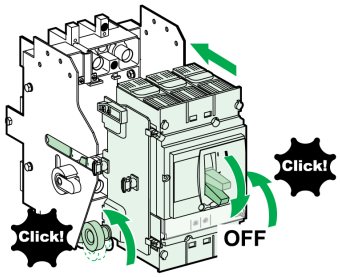
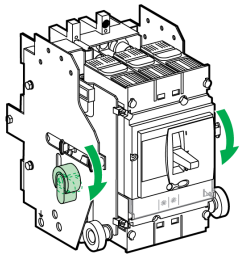
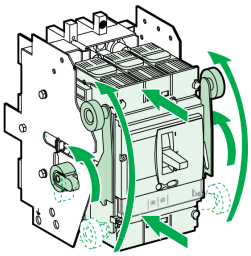
NOTE:

- The auxiliary circuits can be
  - automatically disconnected because of the connectors located on the cradle and at the rear of the circuit breaker.
  - left connected for a circuit breaker with a manual auxiliary connector.
- Open the circuit breaker before disconnecting it. If the circuit breaker is in the closed **I (ON)** position when disconnecting, a safety mechanism ensures that the poles open automatically by tripping the circuit breaker before the pins disconnect.

Removal Procedure

Step	Action	
1		Disconnect the circuit breaker. Disconnect the manual auxiliary connector (if the circuit breaker has one).
2		Move both locking levers down.
3		Push down both operating handles as far as the next notch.
4		Remove the circuit breaker, keeping it horizontal.

Connection Procedure

Step	Action	
1		Switch the circuit breaker to the **O (OFF)** position. Move both operating handles down to the low position on the cradle. Push in the circuit breaker until the locking levers clicks.
2		Move both locking levers forward.
3		Raise both locking levers at the same time.

NOTE: Open the circuit breaker before connecting it. If the circuit breaker is in the closed **I (ON)** position when connecting, a safety mechanism ensures that the poles open automatically by tripping the circuit breaker before the pins connect.

Protection of the Cradle from Direct Contact

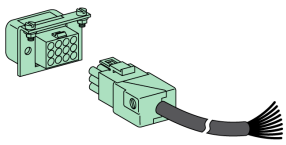
Use blanking plates to protect the cradle from direct contact.

When the circuit breaker is disconnected or removed, the cradle protection is:

- IP20, without blanking plates
- IP40, with blanking plates.

Auxiliary Circuit Test with Circuit Breaker Disconnected

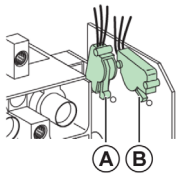
The auxiliary circuit test function is possible with circuit breakers which have manual auxiliary connectors.



In the disconnected position, operate the circuit breaker (by the actuator or push-to-trip button) to check whether the auxiliary circuits are working correctly.

Cradle Switches (Optional)

2 changeover contacts can be installed on the cradle:

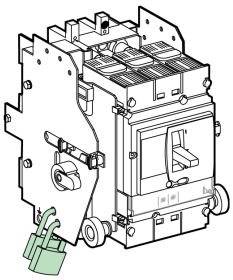
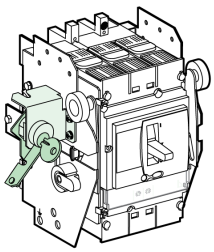
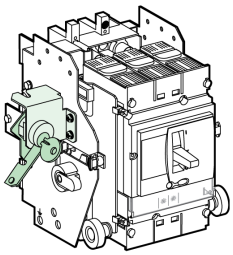


A Connected-position cradle switch (CE)
B Disconnected-position cradle switch (CD)

For more details of contact operation, see control auxiliaries *(see page 72)*

Locking the Cradle

The cradle handle can be locked with up to 3 padlocks (not supplied) or keylock.

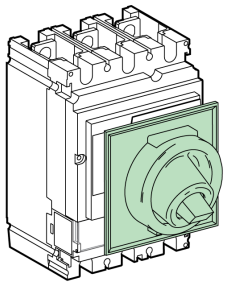
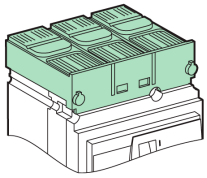
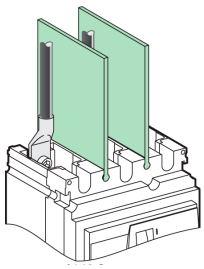
Illustration	Description
	Lock the circuit breaker using up to 3 padlocks (not supplied) with a shackle diameter of 5–8 mm (0.2–0.3 in.) to prevent connection.
	Lock the circuit breaker using a keylock in the connected position.
	Lock the circuit breaker using a keylock in the disconnected position.

Installation Accessories

Accessories for Safety

A comprehensive range of accessories is available for Compact NSX DC circuit breakers.

Accessories can be installed on site to improve safety and ease of operation.

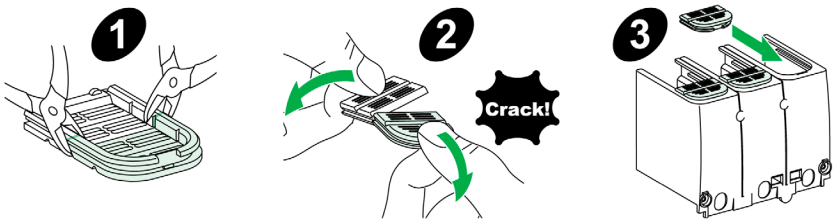
		
Sealed boot for the toggle handle, providing IP43 protection on the front	Short or long terminal shields, providing IP40 protection	Flexible interphase barriers improving isolation between power connections

For more details on the range of accessories, see the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Accessories for Safety According to Circuit Breakers

- For switch-disconnectors ≥ 500 Vdc, compulsory accessories for safety are:
  - terminal shields
  - interphase barriers
- For circuit breakers ≥ 500 Vdc, compulsory accessories for safety are terminal shields
- For circuit breakers or switch-disconnectors < 500 Vdc, optional accessories for safety are:
  - terminal shields
  - interphase barriers

Terminal Shields with Precut Grids



1 Cutting a grid
2 Adjusting the size of the grid
3 Inserting the grid in the terminal shield

Terminal shields with precut grids simplify the onsite connection of circuit breakers regardless of the number of conductors to be connected (see *Instruction Sheet)*.

Installation Rules for Photovoltaic Applications

Introduction

When installing Compact NSX DC circuit breakers and switch-disconnectors in photovoltaic systems, minimum distances (safety clearances) must be maintained between the devices and panels, bars, or any metal installed nearby.

These distances, which depend on the ultimate breaking capacity, are defined by tests carried out in accordance with standard IEC 60947-2.

If installation conformity is not checked by type tests, it is also necessary to:
- use insulated bars for circuit breaker connections
- block off the busbars using insulating screens

The use of accessories for safety in photovoltaic installations up to 1,000 Vdc depends on the device:
- for circuit breakers: terminal shields and the insulation kit are mandatory accessories.
- for switch-disconnectors:
  - the insulation kit is a mandatory accessory.
  - terminal shields and interphase barriers are optional accessories.

To break a fault current at the operational photovoltaic system voltage, a minimum number of poles must be working in series. The minimum number of poles is a function of the system voltage and voltage rating per pole of the circuit breaker (circuit breaker or switch-disconnector). This minimum number must be respected. The series connections are prefabricated due to the power ratings.

Installation Rules for Photovoltaic Applications up to 1,000 Vdc

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or local equivalent.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Repair the installation immediately if an insulation fault occurs during operation.

Failure to follow these instructions will result in death or serious injury.

The following rules must be respected when installing Compact NSX DC circuit breakers in photovoltaic systems:
- Minimum distances for safety clearance must be respected.
- Perform dielectric strength tests, thermal calculations, and temperature rise tests according to your installation configuration.
- Respect the limits defined in the derating tables depending on the ambient temperature (ratings are based on IEC 60947-2 standard).

⚠ ⚠ DANGER

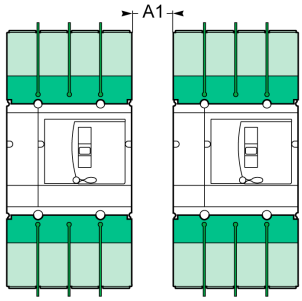
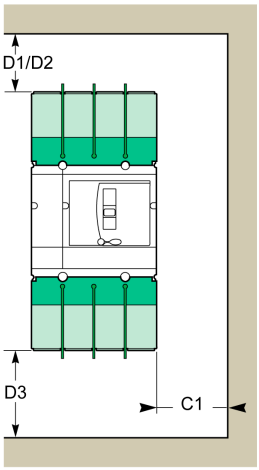
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Install circuit breaker so minimum clearance distance to grounded metal is maintained.

Failure to follow these instructions will result in death or serious injury.

Safety Clearance Using Terminals Shields

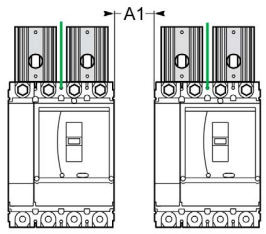
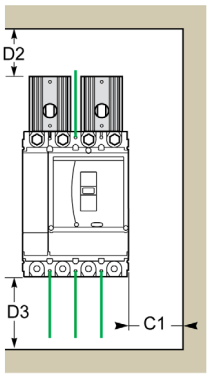
- Terminal shields must be used with all DC photovoltaic circuit breakers up to 1,000 Vdc.
- Terminal shields can be used in option with DC photovoltaic switch-disconnectors up to 1,000 Vdc.

Minimal Distance Between 2 Adjacent Devices	Minimal Distance Between the Device and Panels (Insulated Bars or Painted Metal Sheet)
	

Circuit Breaker or Switch-Disconnector	Distances (mm/in.)	
	A1	C1, D1/D2, D3
NSX80-200 TM DC PV	30 (1.2)	30 (1.2)
NSX100-200 NA DC PV	30 (1.2)	30 (1.2)
NSX400-500 NA DC PV	• 30 mm (1.2 in.) for 600 Vdc applications • 51 mm (2.0 in.) for 1,000 Vdc applications	30 (1.2)

Safety Clearance Using Interphase Barriers

Interphase barriers can be used only with DC photovoltaic switch-disconnectors up to 1,000 Vdc.

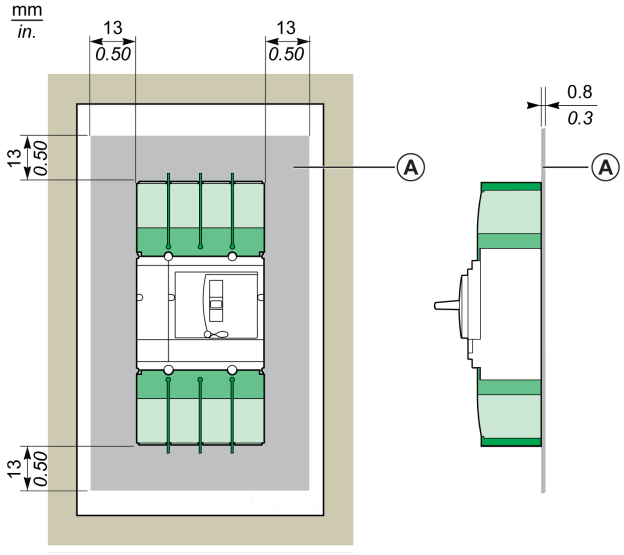
Minimal Distance Between 2 Adjacent Switch-Disconnectors	Minimal Distance Between the Switch-Disconnector and Panels (Insulated Bars or Metal Sheet)
	

Switch-Disconnector	Distances (mm/in.)			
	A1	C1	D2 (Metal Sheet)	D3
NSX100-200 NA DC PV	50 (2)	50 (2)	100 (4)	100 (4)
NSX400-500 NA DC PV	70 (2.7)	70 (2.7)	100 (4)	100 (4)

Fiber Insulating Plate for 1,000 Vdc Applications

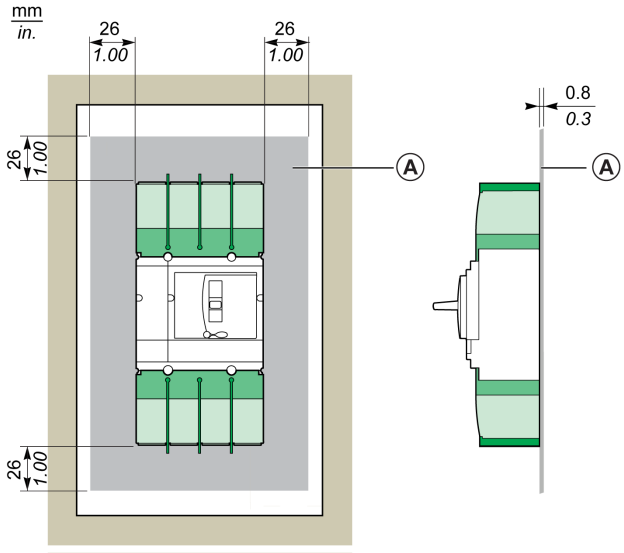
For 1,000 Vdc applications a fiber insulating plate must be inserted between the device and the metal sheet.

Compact NSX 80-200 A



A Fiber insulating plate

Compact NSX 400-500 A



A Fiber insulating plate

Chapter 3
Compact NSX DC Electric Auxiliary Devices

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Electric Auxiliary Devices Summary	62
Indication Contacts	66
BSCM Breaker Status Control Module	67
NSX Cord	70
Control Auxiliaries	72

Electric Auxiliary Devices Summary

Electric Auxiliary Devices for General-Purpose Applications

The table below shows the electric auxiliary devices that can be added to the Compact NSX DC circuit breakers for general-purpose applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Electric Auxiliary Device	NSX100 DC			NSX160 DC			NSX250 DC	NSX400 DC	NSX630 DC	NSX1200 DC
	1P	2P	3P/4P	1P	2P	3P/4P	3P/4P	3P/4P	3P/4P	2P
OF or SD auxiliary contact		X	X		X	X	X	X	X	X
SDE auxiliary contact			X			X	X	X	X	X
MN undervoltage trip release		X	X		X	X	X	X	X	X
MX shunt trip release		X	X		X	X	X	X	X	X
BSCM breaker status control module			X			X	X	X	X	X
NSX cord			X			X	X	X	X	X

Electric Auxiliary Devices for Photovoltaic Applications

The table below shows the electric auxiliary devices that can be added to the Compact NSX DC circuit breakers for photovoltaic applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Electric Auxiliary Device	NSX80 DC PV	NSX100 DC PV	NSX125 DC PV	NSX160 DC PV	NSX200 DC PV	NSX400 DC PV	NSX500 DC PV
	4P	4P	4P	4P	4P	4P	4P
OF or SD auxiliary contact	X	X	X	X	X	X	X
SDE auxiliary contact	X	X	X	X	X	X	X
MN undervoltage trip release	X	X	X	X	X	X	X
MX shunt trip release	X	X	X	X	X	X	X
BSCM breaker status control module	X	X	X	X	X	X	X
NSX cord	X	X	X	X	X	X	X

Safety Instructions for Photovoltaic Applications

Special care is required when adding electric auxiliary devices into circuit breakers for photovoltaic applications.

⚠ ⚠ DANGER

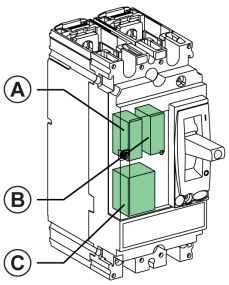
HAZARD OF ELECTRIC SHOCK

- Isolate the circuit breaker upstream and downstream before removing the front cover.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the front cover before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

Slots for Electric Auxiliary Devices on Compact NSX100/160 2P Circuit Breakers

The table below shows the possible slots for the electric auxiliary devices mounted in the case. Only one auxiliary can be installed per slot. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

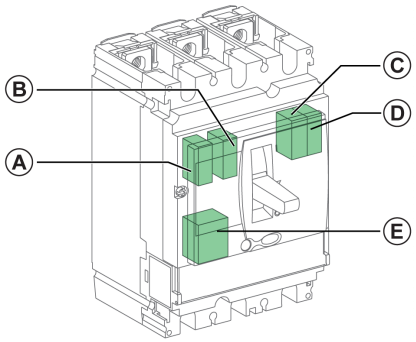


The choice of auxiliaries depends on the functions desired.

Electric Auxiliary Device	Slot		
	A	B	C
OF1 auxiliary contact	X		
SD auxiliary contact		X	
MN undervoltage trip release			X
MX shunt trip release			X

Slots for Electric Auxiliary Devices on Compact NSX100-250 DC 3P/4P Circuit Breakers

The table below shows the possible slots for the electric auxiliary devices mounted in the case. Only one auxiliary can be installed per slot. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

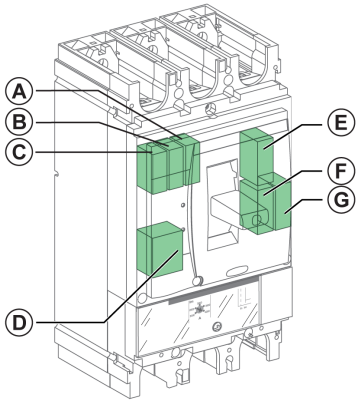


The choice of auxiliaries depends on the functions desired.

Electric Auxiliary Device	Slot					Comments
	A	B	C	D	E	
Standard remote indication and control auxiliaries						
OF1 auxiliary contact	X					For all trip unit types and control types (toggle handle, rotary handle, or motor mechanism).
OF2 auxiliary contact				X		
SD auxiliary contact		X				
SDE auxiliary contact			X			
MN undervoltage trip release					X	
MX shunt trip release					X	
Communication						
BSCM breaker status control module			X	X		For sending OF, SDE (BSCM), and SD (NSX cord) data to the communication bus.
NSX cord		X				

Slots for Electric Auxiliary Devices on Compact NSX400-630-1200 DC 3P/4P Circuit Breakers

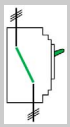
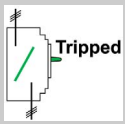
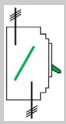
The table below shows the possible slots for the electric auxiliary devices mounted in the case. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.



Electric Auxiliary Device	Slot							Comments
	A	B	C	D	E	F	G	
Standard remote indication and control auxiliaries								
OF1 auxiliary contact			X					
OF2 auxiliary contact		X						For all trip unit types and control types (toggle handle, rotary handle, or motor mechanism).
OF3 auxiliary contact	X							
OF4 auxiliary contact							X	
SD auxiliary contact					X			
SDE auxiliary contact						X		
MN undervoltage trip release				X				
MX shunt trip release				X				
Communication								
BSCM breaker status control module						X		For sending OF, SDE (BSCM), and SD (NSX cord) data to the communication bus.
NSX cord					X			

Operation of the Auxiliary Indication Contacts

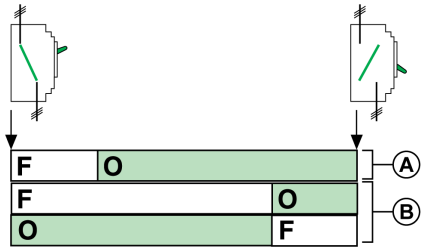
The table below shows the position of the indication contacts (or outputs) relative to the position of the actuator and main contacts.

	Position of the Actuator and the Main Contacts				
	 **ON**	 **Tripped by:**			 **OFF**
		MN/MX	**Push-to-Trip**	**Trip Unit**	
Name	**Position of Indication Contacts**				
OF auxiliary contact	X	–	–	–	–
SD auxiliary contact	–	X	X	X	–
SDE auxiliary contact	–	–	–	X	–
X : Contact closed **–** : Contact open					

NOTE: The auxiliary indication (changeover) contacts are represented in the switchboard by the state of the Normally Open (NO) contact.
The state of the NO contact is open:

- for OF auxiliary contacts when the circuit breaker is in the **O (OFF)** position.
- for SD and SDE auxiliary contacts when the associated function is not active.

Sequence chart of the OF auxiliary contacts relative to the main contacts



A Main contacts
B Position of OF changeover contacts

Indication Contacts

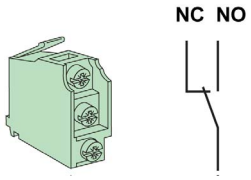
Characteristics of Indication Contacts

Indication contacts are either under the front face of the circuit breaker, under the motor mechanism, or in the rotary handle. Installation is in a compartment isolated from the power circuits. There are 2 types:

- Standard contact
- Low-level contact

Standard and Low-Level Contacts

Standard and low-level contacts are the common point changeover type.



NC Normally closed contact
NO Normally open contact

NOTE: One indicator contact model provides OF, SD, and SDE indication functions. The position of the contact inside the case determines the function (OF, SD, or SDE contacts).

The table below describes the operation of standard and low-level volt-free contacts:

Name	Definition
OF auxiliary contact	**Changeover**: The NO contact is normally open when the circuit breaker is in the **O (OFF)** position.
SD auxiliary contact	**Trip indication**: The SD contact indicates that the circuit breaker has tripped due to: ● Operation of the push-to-trip button ● Operation of the MX or MN trip releases ● Electrical fault detected by the trip unit ● Connecting/Disconnecting withdrawable circuit breaker ● Manually opening through the motor mechanism
SDE auxiliary contact	**Electrical fault indication**: The SDE contact indicates that the circuit breaker has tripped on an electrical fault due to: ● Electrical fault detected by the trip unit

BSCM Breaker Status Control Module

Introduction

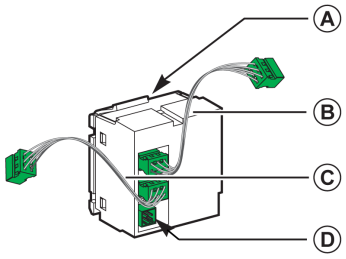
The BSCM Breaker Status Control Module can be used to send the following data via the communication bus:

- Circuit breaker states from OF, SD, and SDE auxiliary contacts
- Control instructions for the communicating motor mechanism (if present): opening, closing, and resetting
- Information to assist the operator: storage of the last 10 events

Installation of the BSCM requires:

- the NSX cord
- pre-installation of the communicating motor mechanism (if present)

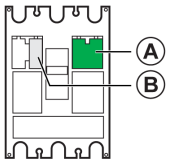
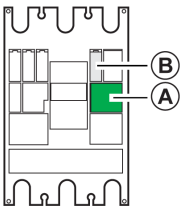
Description



Item	Data Medium	Data Transmitted	Comments
A	BSCM microswitches	State of OF and SDE contacts	The BSCM takes the place of the auxiliary contacts in the OF and SDE slots.
B	Connector for the NSX cord	Communication bus and state of SD contact through the microswitch on the NSX cord	The NSX cord goes in the SD slot instead of the auxiliary contact.
C	Connector for the Micrologic 5 or 6 trip unit	Communication bus	The connector can be removed: no Micrologic trip unit
D	Connector for the communicating motor mechanism	Controlling the communicating motor mechanism Status of the communicating motor mechanism	Use the connector supplied with the communicating motor mechanism.

Installation

The slots used to install the BSCM depend on the circuit breaker type.

Compact NSX100-250 DC 3P/4P	Compact NSX400-630 DC 3P/4P Compact NSX1200 DC 2P
	
A BSCM **B** NSX cord	

The BSCM cannot be installed at the same time as an OF contact or the SDE contact.

The BSCM can be installed on site.

Connection

To install the BSCM:
- Plug in the module.
- Connect the connectors.

Setting Up the BSCM

Setting up the BSCM on the communication bus requires no addressing.

Data Provided by the BSCM

Configuration	Information	Can Be Reset
All circuit breakers with BSCM	Count of the total number of times the circuit breaker opens and closes (count of OF auxiliary contact operations). This counter (totalizer) cannot be reset.	No
	Count of the total number of times the circuit breaker opens and closes (count of OF auxiliary contact operations)(1)	Yes
	Maximum number of times the circuit breaker can open and close(2)	Yes
	Count of the number of fault trips by the circuit breaker (count of SD auxiliary contact operations)(1)	Yes
	Count of the number of electrical fault trips by the circuit breaker (count of SDE auxiliary contact operations)(1)	Yes
Circuit breakers with BSCM and communicating motor mechanism	Count of the number of times the communicating motor mechanism opens(1)	No
	Count of the number of times the communicating motor mechanism closes(1)	Yes
	Maximum number of times the communicating motor mechanism can close(2)	Yes
	Count of the number of times the communicating motor mechanism resets(1)	Yes
(1) The user can modify the content of the counter if, for example, the BSCM is installed or replaced during operation. (2) Overshooting the threshold results in a medium priority alarm. To acknowledge the alarm, modify the content of the counter or the value of the threshold.		

Configuration of the BSCM

To configure the BSCM, use a computer running the customer engineering tool (CET) *(see page 16)* and connected to the maintenance module. The maintenance module must be connected to the RJ45 connector of a ULP module (for example, IFM Modbus communication interface module).

With the customer engineering tool, you can configure:
- the maximum number of times the circuit breaker can open and close.
- the maximum number of times the communicating motor mechanism can close.
- the reset mode of the communicating motor mechanism.

Configuring the Resetting of the Communicating Motor Mechanism

⚠ CAUTION

HAZARD OF REPEATED CLOSING ON ELECTRICAL FAULT

Reconfiguring of the BSCM Breaker Status Control Module must be done only by trained electrical personnel.

Failure to follow these instructions can result in injury or equipment damage.

The reset mode of the communicating motor mechanism can be configured using the customer engineering tool:

- **Enable Reset even if SDE** to authorize resetting of the mechanism using the communication bus even after an electrical fault trip.
- **Enable Automatic Reset** to authorize automatic resetting after tripping by the MN, MX trip release, or push-to-trip button.
- **Enable Reset even if SDE** and **Enable Automatic Reset** to authorize automatic resetting even after an electrical fault trip.

NSX Cord

Introduction

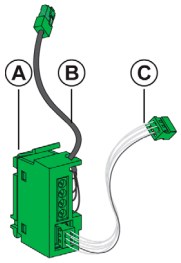
The NSX cord connects a circuit breaker to the communication bus.

The NSX cord is used with a BSCM Breaker Status Control Module.

For more details on integrating Compact NSX DC circuit breaker communication functions, see the *ULP System - User Guide* and the *Modbus Compact NSX - User Guide*.

Description

The NSX cord consists of a junction box, a cable equipped with an RJ45 connector, and a cable equipped with a screw terminal block.



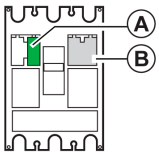
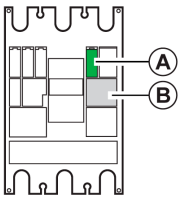
Item	Data Medium	Data Transmitted	Comments
A	NSX cord microswitch	State of SD auxiliary contact	The NSX cord goes in the SD slot instead of the auxiliary contact.
B	Cable equipped with an RJ45 connector for connection to a ULP module (for example, IFM Modbus communication interface module)	Communication bus	3 cable lengths are available: 0.3 m (9.84 ft), 1.3 m (4.27 ft), and 3 m (14.7 ft).
C	Internal link to the BSCM	Communication bus	

The NSX cord also provides the 24 Vdc power supply for the BSCM.

The NSX cord cannot be installed at the same time as the SD auxiliary contact.

Installation

The slots used to install the NSX cord depend on the circuit breaker type.

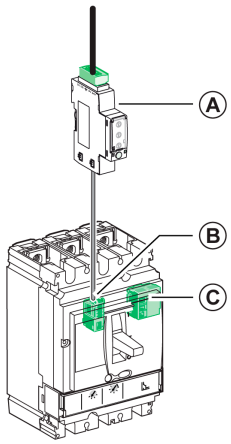
Compact NSX100-250 DC 3P/4P	Compact NSX400-630 DC 3P/4P Compact NSX1200 DC 2P
	
A NSX cord **B** BSCM	

The NSX cord can be installed on site.

Communication with the NSX Cord

The NSX cord connects to any ULP module.

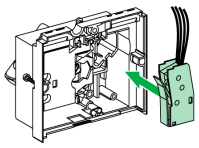
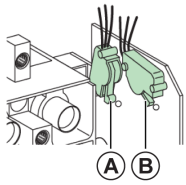
The figure below illustrates the connection of the NSX cord (**B**) to the IFM Modbus communication interface module (**A**) and to the BSCM (**C**).



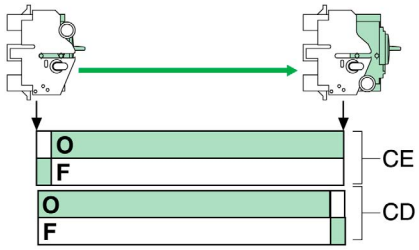
Control Auxiliaries

Control and Indication Contacts Installed Outside the Circuit Breaker

Control and indication contacts installed outside the case are contacts for specific applications (see *Compact NSX and Masterpact NW DC - DC PV Catalog*).

CAM contacts 	**Early-operation contacts** Install in the rotary handle: ● Early-make contacts (CAF1, CAF2) actuate before the poles close when a circuit breaker manual command is given. ● The early-break changeover contact (CAO1) actuates before the poles open when a circuit breaker manual command is given.
Cradle switches 	**Connected (CE)/Disconnected (CD) cradle switches** Install on the cradle to indicate the position of the circuit breaker in the cradle: **A** Connected position cradle switch (CE) **B** Disconnected position cradle switch (CD)

Operation of connected/disconnected cradle switches

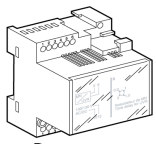
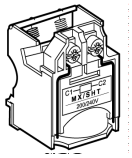


CE Connected position cradle switch
CD Disconnected position cradle switch

Voltage Trip Releases

Use voltage trip releases to trip circuit breakers deliberately using an electrical signal. Install these auxiliaries in the case under the front face.

The characteristics of these auxiliaries comply with the recommendations of standard IEC 60947-2.

MN 	**MN undervoltage trip release** This release: ● Trips the circuit breaker when the voltage is less than 0.35 times the rated voltage Un. If the voltage is between 0.35 and 0.7 times the rated voltage Un, tripping is possible but not guaranteed. Above 0.7 times the rated voltage Un, tripping is impossible. ● Closes the circuit breaker again once the voltage reaches 0.85 times the rated voltage. Use this type of trip release for fail-safe emergency stops.
Time-delay unit 	**Time-delay unit for MN undervoltage trip release** The time-delay unit eliminates nuisance tripping of an undervoltage trip release due to transient voltage dips lasting < 200 ms. There are 2 types of time-delay units: adjustable or fixed.
MX 	**MX shunt trip release** This release trips the circuit breaker when the voltage exceeds 0.7 times the rated voltage Un.

Chapter 4
Compact NSX DC Trip Units

What Is in This Chapter?

This chapter contains the following topics:

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Trip Units Summary

General-Purpose Applications

The table below shows the trip units compatible with the Compact NSX DC circuit breakers for general-purpose applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Trip Units	Built-in / Interchangeable	NSX100 DC			NSX160 DC			NSX250 DC	NSX400 DC	NSX630 DC	NSX1200 DC
		1P	2P	3P/4P	1P	2P	3P/4P	3P/4P	3P/4P	3P/4P	2P
NA (switch-disconnector)	Built-in								X	X	
NA (switch-disconnector)	Interchangeable			X			X	X			
TM-D	Built-in	X	X		X	X					
TM-D	Interchangeable			X			X				
TM-DC	Built-in								X	X	X
TM-DC	Interchangeable			X			X	X			
TM-G	Interchangeable			X			X	X			

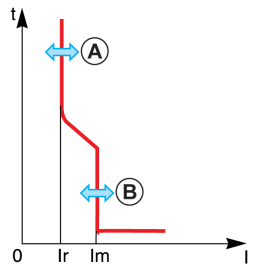
Photovoltaic Applications

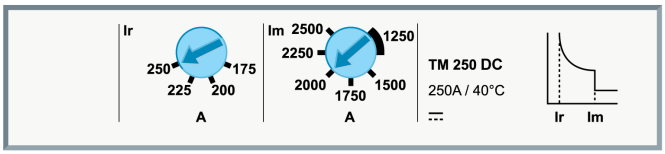
The table below shows the trip units compatible with the Compact NSX DC circuit breakers for photovoltaic applications. For further details, refer to the *Compact NSX and Masterpact NW DC - DC PV Catalog*.

Trip Units	Built-in / Interchangeable	NSX80 DC PV	NSX100 DC PV	NSX125 DC PV	NSX160 DC PV	NSX200 DC PV	NSX400 DC PV	NSX500 DC PV
		4P	4P	4P	4P	4P	4P	4P
NA (switch-disconnector)	Built-in		X		X	X	X	X
TM-DC PV	Built-in	X		X	X	X	X	X

Protections and Settings of Thermal-Magnetic Trip Units

The adjustment dials are the trip units.





A Overload protection threshold
B Short-circuit protection pick-up

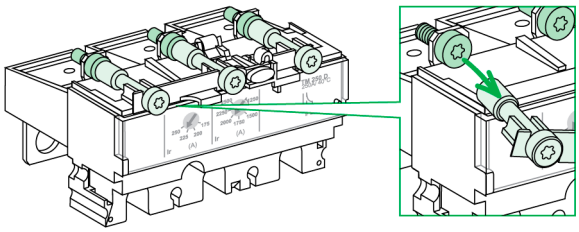
Upgradability of Thermal-Magnetic Trip Units

Upgradability of trip units depends on the circuit breaker type:

- For 1 or 2 poles, trip units are built-in.
- For 3 or 4 poles, trip units are interchangeable.

Onsite swapping of interchangeable trip units is simple and reliable:

- No connections to make
- No special tools (for example, calibrated torque wrench)
- Compatibility of trip units ensured by mechanical cap
- Torque limited screw ensures proper mounting (see drawing below)

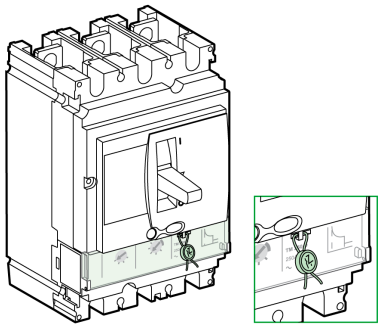


The design of the trip units limits the risk of incorrect tightening or oversights. The simplicity of the swapping process means that it is easy to make the necessary adjustments as operation and maintenance processes evolve.

NOTE: When the trip unit has been mounted by this means, the trip unit can still be removed: the screw head is accessible.

Sealing the Protection

The transparent cover on thermal-magnetic trip units can be sealed to prevent modification of the protection settings.



TM-D Thermal-Magnetic Trip Unit for 1P and 2P Circuit Breakers

Introduction

The TM-D thermal-magnetic trip unit for 1P/2P circuit breakers up to 160 A are built-in trip units.

They are designed for AC and DC general-purpose applications.

The TM-D built-in 1P/2P trip units provide:
- fixed thermal threshold
- fixed magnetic pick-up

Setting the Thermal Protection

The thermal protection pick-up Ir cannot be adjusted and equals the value shown below:

Trip Unit Rating In (A) at 40 °C (104 °F)										
16	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
Fixed Pick-up Ir (A) at 40 °C (104 °F)										
16	20	25	32	40	50	63	80	100	125	160

Setting the Magnetic Protection

The magnetic protection pick-up cannot be adjusted and equals the value shown below:

	Trip Unit Rating In (A)										
	16	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
	Fixed Pick-up Im (A) +/– 20%										
Marked AC value(1)	190	190	300	300	500	500	500	640	800	1,000	1,250
True DC value	260	260	400	400	700	700	700	800	1,000	1,200	1,250
(1) TM-D 1P/2P trip units are marked with AC values. A correction coefficient is required to obtain the DC pick-up values indicated.											

TM-D Thermal-Magnetic Trip Unit for 3P and 4P Circuit Breakers up to 63 A

Introduction

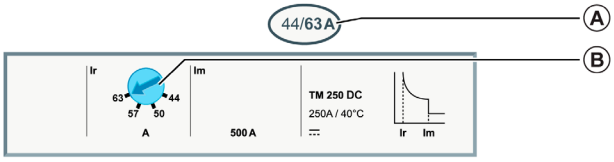
The TM-D thermal-magnetic trip unit for 3P/4P circuit breakers up to 63 A are interchangeable trip units.

They are designed for AC and DC general-purpose applications.

The TM-D interchangeable 3P/4P trip units provide:
- adjustable thermal threshold
- fixed magnetic pick-up

Description

The setting range and adjustment dials are on the front of the trip unit.

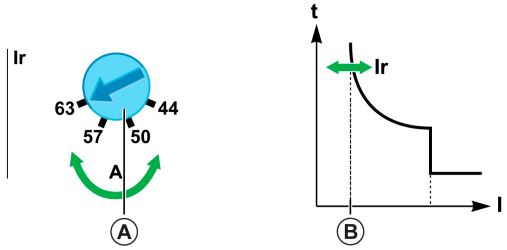


A Setting range for TM-D thermal-magnetic 3P/4P trip unit
B Adjustment dial for the thermal protection pick-up Ir

Setting the Thermal Protection

The thermal protection pick-up Ir is set by a 4-setting dial.

Turning the thermal protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Ir (in amperes) for thermal protection (values indicated on the dial) with respect to every trip unit rating, relative to the position of the dial Ir.

Trip Unit Rating In (A) at 40 °C (104 °F)					
16	**25**	**32**	**40**	**50**	**63**
Pick-up Ir (A) at 40 °C (104 °F)					
11	18	22	28	35	44
13	20	26	32	40	50
14	23	29	36	45	57
16	25	32	40	50	63

Setting the Magnetic Protection

The magnetic protection pick-up cannot be adjusted and equals the value shown below:

	Trip Unit Rating In (A)					
	16	**25**	**32**	**40**	**50**	**63**
	Fixed Pick-up Im (A) +/– 20%					
Marked AC value(1)	190	300	400	500	500	500
True DC value	260	400	550	700	700	700
(1) TM-D 3P/4P trip units up to 63 A are marked with AC values. A correction coefficient is required to obtain the DC pick-up values indicated.						

TM-DC Thermal-Magnetic Trip Unit for 3P and 4P Circuit Breakers from 80 A to 250 A

Introduction

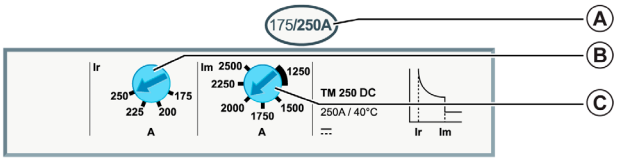
The TM-DC thermal-magnetic trip unit for 3P/4P circuit breakers from 80 A to 250 A are interchangeable trip units.

They are designed for DC general-purpose applications.

The TM-DC 3P/4P trip units provide:
- adjustable thermal threshold
- fixed magnetic pick-up on trip units with In from 80 A to 160 A
- adjustable magnetic pick-up on trip units with In 200 A and 250 A

Description

The setting range and adjustment dials are on the front of the trip unit.

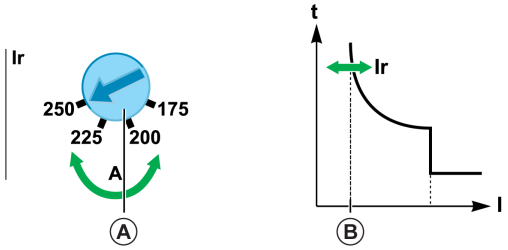


A Setting range for TM-DC thermal-magnetic 3P/4P trip unit
B Adjustment dial for the thermal protection pick-up Ir
C Adjustment dial for the magnetic protection pick-up Im (for TM-DC 200/250 only)

Setting the Thermal Protection

The thermal protection pick-up Ir is set by a 4-setting dial.

Turning the thermal protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Ir (in amperes) for thermal protection (values indicated on the dial) with respect to every trip unit rating, relative to the position of the dial Ir.

Trip Unit Rating In (A) at 40 °C (104 °F)					
80	**100**	**125**	**160**	**200**	**250**
Pick-up Ir (A) at 40 °C (104 °F)					
56	70	87	112	140	175
64	80	100	128	160	200
72	90	112	144	180	225
80	100	125	160	200	250

Setting the Magnetic Protection on Trip Units With In from 80 A to 160 A

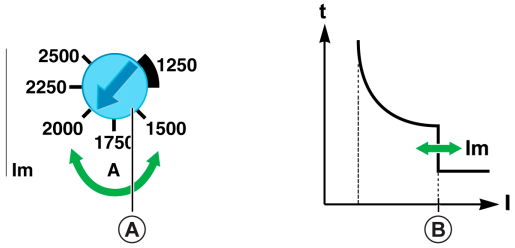
For trip units rated below 200 A, the magnetic protection pick-up cannot be adjusted and equals the value shown below:

	Trip Unit Rating In (A)			
	80	**100**	**125**	**160**
	Fixed Pick-up Im (A) +/– 20%			
True DC value	800	800	1,250	1,250

Setting the Magnetic Protection on Trip Units With In 200 A and 250 A

For trip units rated between 200 A and 250 A, the magnetic protection pick-up Im is set by a 6-setting dial.

Turning the magnetic protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Im (in amperes) for magnetic protection (values indicated on the dial), relative to the position of the Im dial:

Trip Unit Rating In (A)	
200	**250**
Pick-up Im (A) +/– 20%	
1,000	1,250
1,200	1,500
1,400	1,750
1,600	2,000
1,800	2,250
2,000	2,500

TM-DC Thermal-Magnetic Trip Unit for 3P and 4P Circuit Breakers from 250 A to 600 A

Introduction

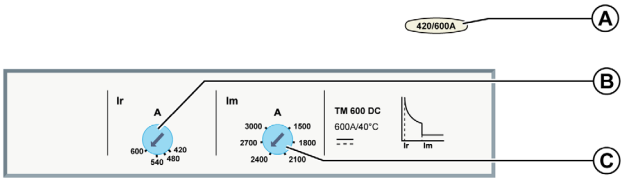
The TM-DC thermal-magnetic trip unit for 3P/4P circuit breakers from 250 A to 600 A are built-in trip units.

They are designed for DC general-purpose applications.

The TM-DC 3P/4P trip units provide:
- adjustable thermal threshold
- adjustable magnetic pick-up

Description

The setting range and adjustment dials are on the front of the trip unit.

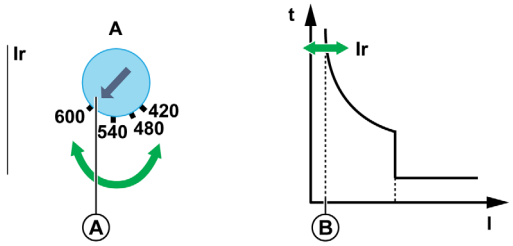


A Setting range for TM-DC thermal-magnetic 3P/4P trip unit
B Adjustment dial for the thermal protection pick-up Ir
C Adjustment dial for the magnetic protection pick-up Im

Setting the Thermal Protection

The thermal protection pick-up Ir is set by a 5-setting dial.

Turning the thermal protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Ir (in amperes) for thermal protection (values indicated on the dial) with respect to every trip unit rating, relative to the position of the dial Ir.

Trip Unit Rating In (A) at 40 °C (104 °F)				
250	**320**	**400**	**500**	**600**
Pick-up Ir (A) at 40 °C (104 °F)				
175	224	280	350	420
200	256	320	400	480
225	288	360	450	540
250	320	400	500	600

Setting the Magnetic Protection

The magnetic protection pick-up cannot be adjusted and equals the value shown below:

Trip Unit Rating In (A)				
250	**320**	**400**	**500**	**600**
Pick-up Im (A) +/– 20%				
625	800	1000	1250	1500
750	960	1200	1500	1800
875	1120	1400	1750	2100
1000	1280	1600	2000	2400
1125	1440	1800	2250	2700
1250	1600	2000	2500	3000

TM-DC Thermal-Magnetic Trip Unit for 2P Circuit Breakers from 630 A to 1200 A

Introduction

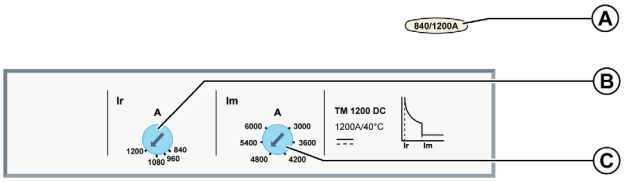
The TM-DC thermal-magnetic trip unit for 2P circuit breakers from 630 A to 1200 A are built-in trip units.

They are designed for DC general-purpose applications.

The TM-DC 2P trip units provide:
- adjustable thermal threshold
- adjustable magnetic pick-up

Description

The setting range and adjustment dials are on the front of the trip unit.

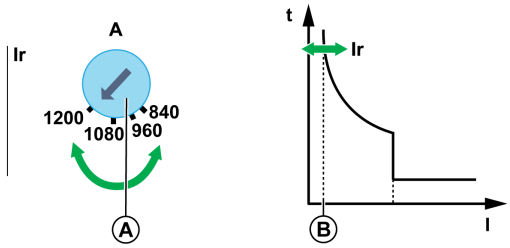


A Setting range for TM-DC thermal-magnetic 2P trip unit
B Adjustment dial for the thermal protection pick-up Ir
C Adjustment dial for the magnetic protection pick-up Im

Setting the Thermal Protection

The thermal protection pick-up Ir is set by a 4-setting dial.

Turning the thermal protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Ir (in amperes) for thermal protection (values indicated on the dial) with respect to every trip unit rating, relative to the position of the dial Ir.

Trip Unit Rating In (A) at 40 °C (104 °F)			
630	**800**	**1000**	**1200**
Pick-up Ir (A) at 40 °C (104 °F)			
441	560	700	840
504	640	800	960
567	720	900	1080
630	800	1000	1200

Setting the Magnetic Protection

The magnetic protection pick-up cannot be adjusted and equals the value shown below:

Trip Unit Rating In (A)			
630	**800**	**1000**	**1200**
Pick-up Im (A) +/– 20%			
1575	2000	2500	3000
1890	2400	3000	3600
2205	2800	3500	4200
2520	3200	4000	4800
2835	3600	4500	5400
3150	4000	5000	6000

TM-G Thermal-Magnetic Trip Unit for 3P and 4P Circuit Breakers up to 250 A

Introduction

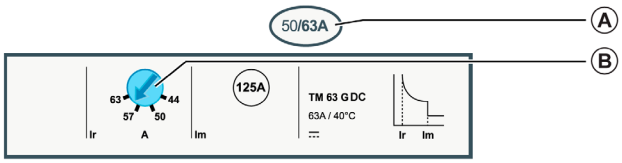
The TM-G thermal-magnetic trip unit for 3P/4P circuit breakers up to 250 A are interchangeable trip units.

They are designed for DC general-purpose applications.

The TM-G interchangeable 3P/4P trip units provide:
- adjustable thermal threshold
- fixed magnetic pick-up

Description

The adjustment dial is on the front of the trip unit.

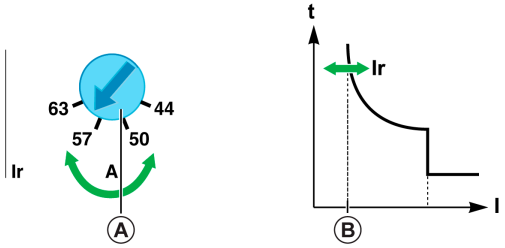


A Setting range for the TM-G thermal-magnetic trip unit
B Adjustment dial for the thermal protection pick-up Ir

Setting the Thermal Protection

The thermal protection pick-up Ir is set by a 4-setting dial.

Turning the thermal protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Ir (in amperes) for thermal protection (values indicated on the dial) with respect to every trip unit rating, relative to the position of the dial Ir.

Trip Unit Rating In (A)									
16	**25**	**40**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
Pick-up Ir (A)									
11	18	28	44	56	70	88	112	140	175
13	20	32	50	64	80	100	128	160	200
14	23	36	57	72	90	113	144	180	225
16	25	40	63	80	100	125	160	200	250

Setting the Magnetic Protection

The magnetic protection pick-up cannot be adjusted and equals the value shown below:

	Trip Unit Rating In (A)									
	16	**25**	**40**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
	Fixed Pick-up Im (A) +/– 20%									
Marked AC value(1)	63	80	80	125	200	320	440	440	440	520
True DC value	80	100	100	150	240	380	530	530	530	620
(1) TM-G 3P/4P trip units up to 63 A are marked with AC values. A correction coefficient is required to obtain the DC pick-up values indicated.										

TM-DC PV Thermal-Magnetic Trip Unit for 4P Circuit Breakers

Introduction

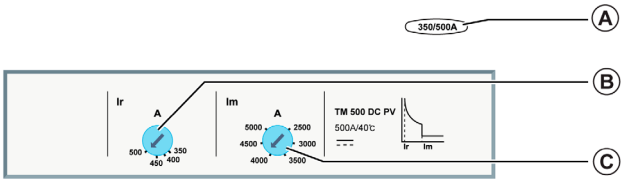
The TM-DC PV thermal-magnetic trip unit for 4P circuit breakers from 80 A to 500 A are built-in trip units.

They are designed for DC photovoltaic applications.

The TM-DC PV 4P trip units provide:
- adjustable thermal threshold
- fixed magnetic pick-up on trip units with In from 80 A to 160 A
- adjustable magnetic pick-up on trip units with In 200 A and 500 A

Description

The setting range and adjustment dials are on the front of the trip unit.

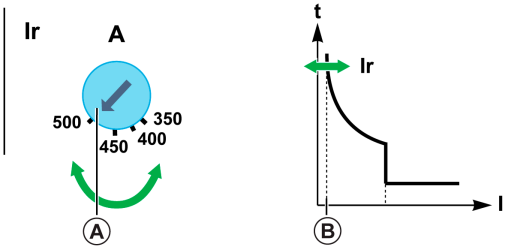


A Setting range for TM-DC PV thermal-magnetic trip unit
B Adjustment dial for the thermal protection pick-up Ir
C Adjustment dial for the magnetic protection pick-up Im

Setting the Thermal Protection

The thermal protection pick-up Ir is set by a 4-setting dial.

Turning the thermal protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Ir (in amperes) for thermal protection (values indicated on the dial) with respect to every trip unit rating, relative to the position of the dial Ir.

Trip Unit Rating In (A) at 40 °C (104 °F)								
80	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**
Pick-up Ir (A) at 40 °C (104 °F)								
56	70	87	112	140	175	224	280	350
64	80	100	128	160	200	256	320	400
72	90	112	144	180	225	288	360	450
80	100	125	160	200	250	320	400	500

The thermal protection setting is fixed at the trip unit rating.

Setting the Magnetic Protection on Trip Units With In from 80 A to 160 A

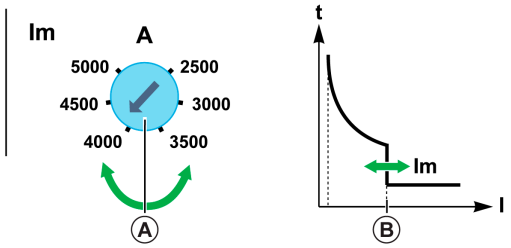
For trip units rated below 200 A, the magnetic protection pick-up cannot be adjusted and equals the value shown below:

	Trip Unit Rating In (A)			
	80	**100**	**125**	**160**
	Fixed Pick-up Im (A) +/– 20%			
True DC value	800	800	1,250	1,250

Setting the Magnetic Protection on Trip Units With In from 200 A to 500 A

For trip units rated between 200 A and 500 A, the magnetic protection pick-up Im is set by a 6-setting dial.

Turning the magnetic protection adjustment dial (**A**) modifies the trip curve as shown (**B**).



The table below shows the values of the pick-up Im (in amperes) for magnetic protection (values indicated on the dial), relative to the position of the Im dial:

Trip Unit Rating In (A)				
200	**250**	**320**	**400**	**500**
Pick-up Im (A) +/– 20%				
1,000	1,250	1,600	2,000	2,500
1,200	1,500	1,920	2,400	3,000
1,400	1,750	2,240	2,800	3,500
1,600	2,000	2,560	3,200	4,000
1,800	2,250	2,880	3,600	4,500
2,000	2,500	3,200	4,000	5,000

Protection Against Ground Faults for Photovoltaic Applications

Introduction

Protection against ground faults in photovoltaic applications is provided by:

- insulation monitoring devices
- overcurrent ground fault protection

Double Ground Faults

To break a fault current at the operational photovoltaic system voltage, a minimum number of poles must be working in series. The minimum number of poles is a function of the system voltage and voltage rating per pole of the protective device (circuit breaker or switch-disconnector).

Under certain conditions, a double ground fault can occur in photovoltaic systems that are isolated from ground. If an initial ground fault (initial isolation breakdown to ground) exists, without being detected and cleared, a second fault (second isolation breakdown to ground) can lead to a double fault.

Depending on the location of the faults, it is possible that a subset number of the required poles only be involved in the interruption of the fault. Not designed for this situation, property damage or personal injury may occur.

To prevent such double fault scenarios, it is therefore imperative to detect the initial isolation breakdown (first fault) using an isolation monitoring system and clear without delay the initial isolation breakdown to reduce the risk of double fault.

Chapter 5
Compact NSX DC Circuit Breakers Operation

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Commissioning	88
Maintaining the Circuit Breaker During Operation	91
In the Event of a Trip	93

Commissioning

List of Checks and Inspections

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or local equivalent.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Repair the installation immediately if an insulation fault occurs during operation.

Failure to follow these instructions will result in death or serious injury.

When commissioning new equipment, or following lengthy downtime, a general check should be done. Such a check reduces the risk of a malfunction due to error or oversight.

The table below indicates the checks and inspections to be performed according to the event:

	A	B	C	D	E	F	G	H
Before commissioning	X	X	X	X	X	X	X	X
Periodically during operation *(see page 91)*	X				X	X	X	X
After carrying out work on the switchboard			X	X	X	X	X	X
Periodically during lengthy downtime			X		X		X	X
Following lengthy downtime			X		X	X	X	X
Following lengthy downtime and modification to the switchboard	X	X	X	X	X	X	X	X

A Insulation and dielectric strength tests
B Temperature rise tests
C Inspect switchboard
D Check compliance with the diagram
E Inspect mechanical equipment
F Check mechanical operation
G Check communication
H Clean equipment

A: Insulation and Dielectric Strength Tests

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

Insulation and dielectric strength tests must be done only by trained electrical personnel.

Failure to follow these instructions can result in injury or equipment damage.

Insulation and dielectric strength tests are carried out before the switchboard is delivered. These tests are subject to the currently applicable standards.

These tests must be carried out periodically on photovoltaic 1,000 Vdc applications.

Dielectric strength tests impose great stress on the equipment and can cause damage if performed incorrectly. In particular:

- Reduce the value used for the test voltage according to the number of consecutive tests on the same piece of equipment
- Disconnect electronic equipment if necessary

B: Temperature Rise Tests

Compact NSX DC circuit breakers are designed to dissipate the temperature rise produced by the relatively short series of connections of the poles. This is especially important for photovoltaic applications where 4 poles in series (2 poles in series for each polarity) are required to break the rated current or fault current with all poles open at the open-circuit maximum voltage when it is equal to 1,000 Vdc.

Temperature rise tests are carried out before the switchboard is delivered. Compact NSX DC circuit breakers comply with product standards IEC 60947-1 and 2.

For general-purpose systems, the tests are carried out with an ambient temperature of 40 °C (104 °F). Above 40 °C (104 °F), overload protection characteristics are slightly modified and values defined in the derating tables must be taken into account. The values are valid for fixed and withdrawable circuit breakers with or without terminal shields.

For photovoltaic applications, the tests are carried out with
- an ambient temperature of 20 °C (68 °F)
- vertical mounting of fixed circuit breakers
- terminal shields (mandatory for all DC photovoltaic circuit breakers with rated voltage above 500 Vdc) heat sinks on top
- 4 cables on the bottom connections with section and length according to IEC 60947-1 Table 9:
  - when used in array boxes, with short connection to string protections, the cross section of the bars or cables must have a higher cross section
  - when cables have a cross section lower than the value indicated in the table, an additional 0.9 derating coefficient must be applied

C: Inspect Switchboard

Check that the circuit breakers are installed:
- In a clean environment without waste from assembling the equipment (such as wiring, tools, shavings, metallic particles)
- In a properly ventilated switchboard (unobstructed ventilation grilles)

D: Check Compliance with the Diagram

Check that the circuit breakers comply with the installation diagram *(see page 13)*:
- Identification of the feeds on the front of the circuit breakers
- Rating and breaking capacity (shown on the faceplate label)
- Identification of the trip units (type, rating)
- Presence of additional functions (motor mechanism, rotary handle, control or indication auxiliaries, locking, sealing)
- Protection settings: visually check the position of the switches on the trip unit

E: Inspect Mechanical Equipment

Visually inspect general state of circuit breaker: terminal shields and interphase barriers, escutcheon, trip unit, case, cradle, connections.

Check the equipment integrity: a circuit breaker found with a cracked case or burn marks must be immediately taken out of service and replaced.

Check the mounting and mechanical strength:
- Of circuit breakers in the switchboard, and of power connections and heat sinks (torque: 50 N•m)
- Of auxiliaries and accessories on the circuit breakers:
  - Rotary handles or motor mechanisms
  - Installation accessories (such as terminal shields, interphase barriers, escutcheons)
  - Auxiliary circuit connections
- Of the cradle (drawout circuit breaker)
- Of locks, padlocks, and padlock support tabs

Photovoltaic application operating conditions involve various environmental stresses: wide temperature variations, humidity, and electrical stresses. In order to ensure performances of equipment during all the life cycle of installation, particular attention must be paid to the following:
- Enclosure integrity (double isolation IP level)
- Circuit breaker operating condition and integrity
  - to evaluate if any overheating has occurred
  - to examine circuit breakers for the presence of dust, moisture, and so on.
- Visual check of electrical connections
- Functional test of equipment and auxiliaries

- Insulation monitoring device test
- Insulation resistance test

F: Check Mechanical Operation

Check the circuit breaker mechanical operation *(see page 9)*:

- Opening
- Closing
- Tripping with the push-to-trip button
- Resetting

G: Check Communication

Check that the communication via the bus works correctly (see *ULP System - User Guide*).

H: Clean Equipment

To avoid dust deposits that can affect the circuit breaker mechanical operation, clean the circuit breakers when performing maintenance:

- for nonmetallic parts: always use a dry cloth. Do not use cleaning products.
- for metallic parts: preferably use a dry cloth. If a cleaning product must be used, do not apply or splash the product onto nonmetallic parts.

This operation is especially important for the photovoltaic 1,000 Vdc applications.

Maintaining the Circuit Breaker During Operation

Introduction

The electrical switchboard and all its equipment continue to age whether they operate or not. This aging process is due mainly to environmental influences and operating conditions.

To ensure that circuit breaker retains the operating and safety characteristics specified in the catalog for the whole of its service life:

- Install the circuit breaker in optimum environmental and operating conditions (described in the table below).
- Have routine inspections and regular maintenance done by qualified personnel.

Environmental and Operating Conditions

The environmental conditions previously described refer to harsh operating environments *(see page 19)*.

The table below describes the optimum environmental and operating conditions:

Environmental and Operating Factor	Comments
Temperature	Average annual temperature outside the switchboard: < 25 °C (77 °F).
Loading	Loading remains < 80% of In 24 hours a day.
Harmonics	The harmonic current per phase is < 30% of In.
Humidity	The relative humidity is < 70%.
Corrosive atmosphere (SO_2, NH_3, H_2S, Cl_2, NO_2)	Install the circuit breaker in environmental category 3C1 or 3C2 (IEC 60721-3-3).
Saline environment	Install the circuit breaker in an environment free of salt mist.
Dust	The dust level is low: protect the circuit breaker within a switchboard fitted with filters or IP54 ventilated
Vibration	Continuous vibration is < 0.2 g.

The maintenance programs apply to optimum environmental and operating conditions. Outside these limits circuit breakers are subject to accelerated aging which can quickly lead to malfunctions.

Regular Preventive Maintenance

Maintenance (servicing and inspection) recommendations for each product are intended to maintain the equipment or subassemblies in a satisfactory operational state for their useful service life.

There are 3 recommended maintenance levels.

The table below indicates maintenance operations and their intervals according to the level:

Level	Maintenance Interval	Maintenance Operations
Level II	1 year	Visual inspection and functional testing, replacement of inoperative accessories
Level III	2 years	As for level II plus servicing operation and subassembly tests
Level IV	5 years	As for level III plus diagnostics and repairs (by Schneider Electric Services)
The intervals stated are for normal environmental and operating conditions.		

Provided all the environmental conditions are more favorable, maintenance intervals can be longer (for example, Level III maintenance can be carried out every 3 years).

If just one of the conditions is more severe, perform maintenance more frequently (for advice, contact Schneider Electric Services).

Functions linked specifically to safety require particular maintenance intervals.

NOTE: Test that the remote safety commands work at regular intervals (every 6 months).

Inspection and Servicing Operations Required

Inspection and servicing chiefly consist of checks and inspections A, E, F, G, and H as defined for the servicing commissioning phase *(see page 88)*.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

Insulation and dielectric strength tests must be done only by trained electrical personnel.

Failure to follow these instructions can result in injury or equipment damage.

	Inspection Definition	Level II	Level III	Level IV
A	Insulation and dielectric strength tests *(see page 88)*	Yes	As for level II	As for level II
E	Inspect mechanical equipment *(see page 89)*	Yes	As for level II	As for level III plus measurement of insulation resistance
F	Check mechanical operation *(see page 90)*	Yes	As for level II plus check of the closing times, opening times, and voltage trip release characteristics	As for level III
G	Check communication *(see page 90)*	Yes	As for level II	As for level II
H	Clean equipment *(see page 90)*	Yes	As for level II	As for level II

For a detailed definition of these operations, contact Schneider Electric Services.

Maintenance Following Short-Circuit Trip

Test a circuit breaker in severe conditions, in accordance with standard IEC 60947-2, to check that it can break a short-circuit current at maximum permissible value 3 times.

After a short-circuit fault, it is necessary to:
- Carefully clean off any traces of black smoke (the particles may be conducting)
- Check the power connections and control wires
- Operate the circuit breaker several times at no load (at least 5 times)

Replacement of Electric Auxiliary Devices in Photovoltaic Circuit Breakers

Special care is required when adding electric auxiliary devices into circuit breakers for photovoltaic applications.

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK

- Isolate the circuit breaker upstream and downstream before removing the front cover.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace the front cover before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

In the Event of a Trip

Identifying the Cause of the Trip

Local and remote indication provides information on the probable cause of a trip.

The causes are of several types:
- Faults on the installation
- Faults due to a malfunction
- Intentional tripping

Trip Following a Fault on the Installation

The control mechanism is positioned on ▼, Trip, or Tripped.

Indication	Probable Cause
SD	Tripped manually by: ● Push-to-trip test ● Manually opening the motor mechanism ● Disconnecting the circuit breaker ● MN or MX trip releases
SD and SDE	Tripped on electrical fault, cause unknown

Maintenance of the Equipment Following Trip on Electrical Fault

⚠ CAUTION

HAZARD OF CLOSING ON ELECTRICAL FAULT

Do not close the circuit breaker again without first inspecting and, if necessary, repairing the downstream electrical equipment.

Failure to follow these instructions can result in injury or equipment damage.

The fact that the protection has tripped does not remedy the cause of the fault on the downstream equipment.

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462 or local equivalent.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- Repair the installation immediately if an insulation fault occurs during operation.

Failure to follow these instructions will result in death or serious injury.

Isolate the feed before inspecting the electrical equipment downstream of the protection.

Depending on the type of fault, perform maintenance inspections on all or part of the equipment where the fault occurred *(see page 88)*:
- Minor faults: Tripped by long-time protection
  Following repairs, checks E, F, and G must be carried out.
- Serious or destructive faults:
  - Tripped due to unknown electrical fault
  - Tripped by short-time protection
  - Tripped by ground-fault protection
    Special care must be taken to prevent double ground faults in photovoltaic applications *(see page 85)*.

  Following repairs, checks A, D, E, F, and G must be carried out. Check the circuit breaker that tripped before being returned to service *(see page 91)*.

NOTE: Checks, tests, and inspections must be carried out by qualified personnel.

If restarting is a high priority (for example, a safety installation), the defective part of the installation must be isolated and logged in order to carry out this maintenance.

Malfunction: Repetitive Tripping

The table below shows the checks or repairs to be carried out in relation to the probable causes of the malfunction indicated.

Indication	Probable Cause	Checks or Repairs
SD	Supply voltage to the MN undervoltage trip release is too low or subject to significant variations	Check the power supply for the release (for example, a supply powering motors with high-power ratings may be unstable). If so, connect the release to a clean or stable supply.
	Supply voltage to an MX shunt trip release applied unintentionally	Check that the release connection is correct compared to the installation diagram.
SD and SDE	Operating temperature too high	Check the switchboard ventilation and the temperature in the room.

Malfunction: Circuit Breaker Fails to Close

The table below shows the checks or repairs to be carried out in relation to the probable causes of the malfunction indicated.

Indication	Probable Cause	Checks or Repairs
Manually Operated Circuit Breaker		
SD	MX shunt trip release energized MN undervoltage trip release not energized	Check that the release connection is correct compared to the installation diagram.
OF	Circuit breaker interlocked	Check the installation and interlock diagram (mechanical or electrical) for both circuit breakers.
Motor Operated Circuit Breaker		
OF	Close instruction not operational	Check the Auto position of the selector on the front of the circuit breaker. Also check: ● The power supply to the motor mechanism, the motor voltage ● The voltage at the motor terminals on the motor mechanism ● The close command path

Appendices

Appendix A
Wiring Diagrams

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Fixed Circuit Breakers	98
Plug-in or Withdrawable Circuit Breakers	100
Motor Mechanism	104

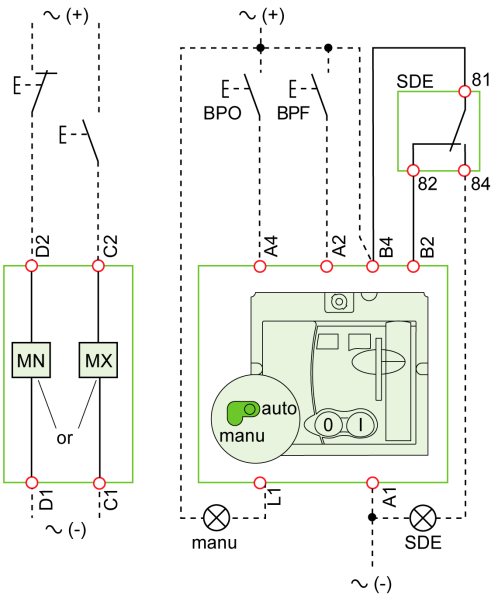
Fixed Circuit Breakers

Introduction

The diagrams are shown with circuits de-energized, all devices open, connected, and charged, and relays in normal position.

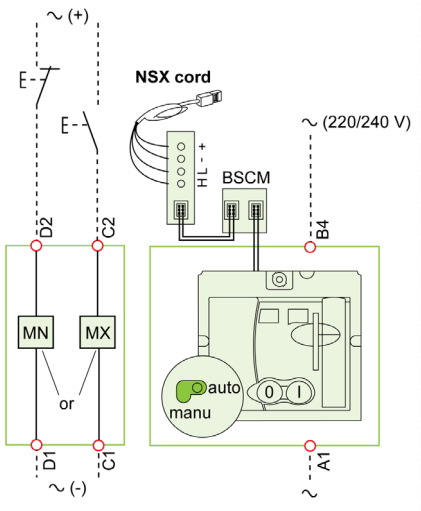
Terminals shown in red O must be connected by the customer.

Remote Operation with Motor Mechanism



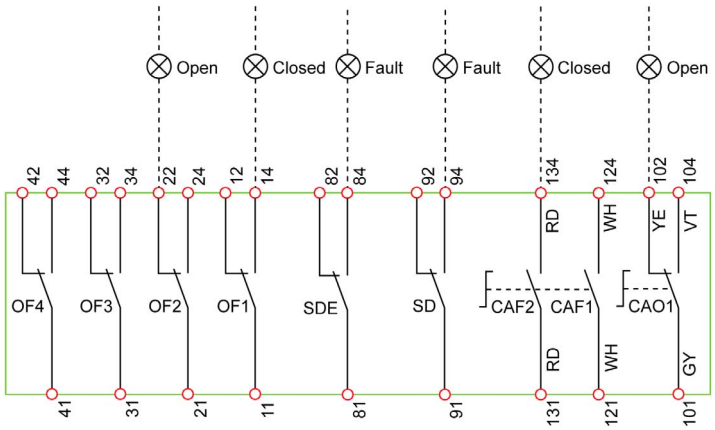
Symbol	Description
MN	Undervoltage trip release
MX	Shunt trip release
A4	Opening order
A2	Closing order
B4, A1	Motor mechanism power supply
L1	Manual position (manu)
B2	SDE interlocking (mandatory for correct operation)
BPO	Opening push button
BPF	Closing push button

Remote Operation with Communicating Motor Mechanism



Symbol	Description
MN	Undervoltage trip release
MX	Shunt trip release
B4, A1	Motor mechanism power supply
BSCM	Breaker status control module

Indication Contacts



Symbol	Description
OF2/OF1	Device ON/OFF indication contacts
OF4/OF3	Device ON/OFF indication contacts (NSX400-630 DC)
SDE	Electrical-fault indication contact
SD	Trip-indication contact
CAF2/CAF1	Early-make contact (rotary handle only)
CAO1	Early-break contact (rotary handle only)

Color Code for Auxiliary Wiring	Description
RD	Red
WH	White
YE	Yellow
VT	Violet
GY	Gray

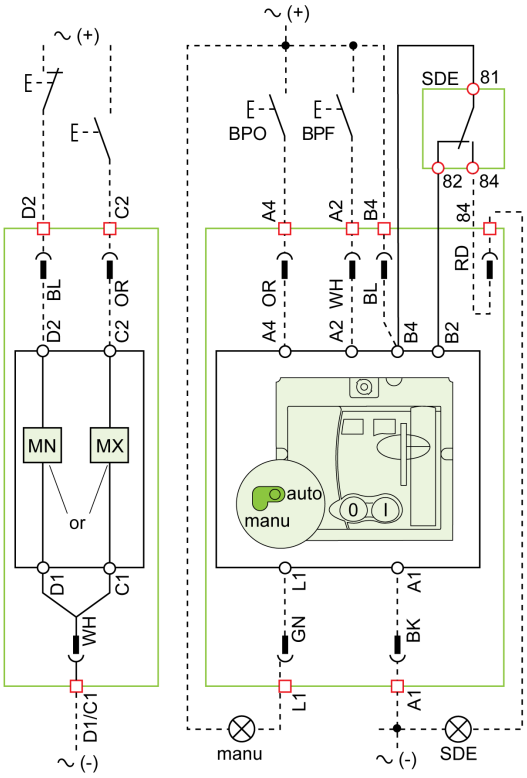
Plug-in or Withdrawable Circuit Breakers

Introduction

The diagrams are shown with circuits de-energized, all devices open, connected, and charged, and relays in normal position.

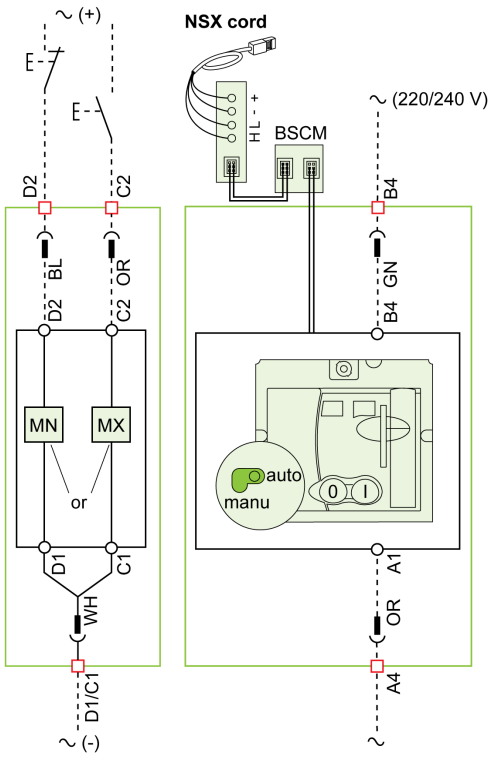
Terminals shown in red O must be connected by the customer.

Remote Operation with Motor Mechanism



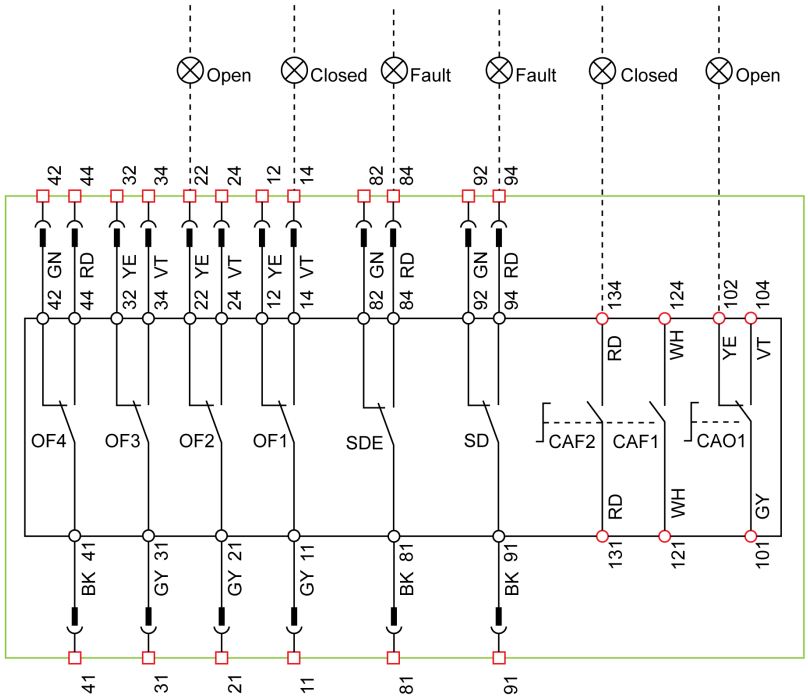
Symbol	Description
MN	Undervoltage trip release
MX	Shunt trip release
A4	Opening order
A2	Closing order
B4, A1	Motor mechanism power supply
L1	Manual position (manu)
B2	SDE interlocking (mandatory for automatic or remote recharging)
BPO	Opening push button
BPF	Closing push button

Remote Operation with Communicating Motor Mechanism



Symbol	Description
MN	Undervoltage trip release
MX	Shunt trip release
B4, A1	Motor mechanism power supply
BSCM	Breaker status control module

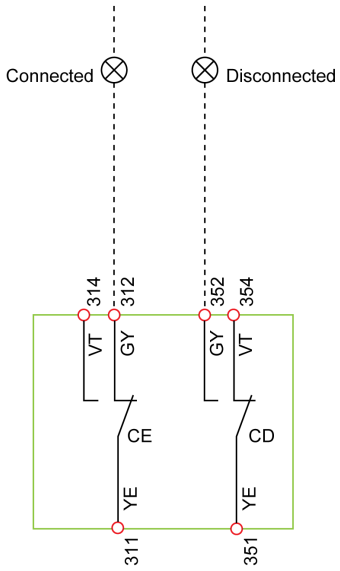
Indication Contacts



Symbol	Description
OF2/OF1	Device ON/OFF indication contacts
OF4/OF3	Device ON/OFF indication contacts (NSX400-630 DC)
SDE	Electrical-fault indication contact
SD	Trip-indication contact
CAF2/CAF1	Early-make contact (rotary handle only)
CAO1	Early-break contact (rotary handle only)

Color Code for Auxiliary Wiring	Description
RD	Red
WH	White
YE	Yellow
BK	Black
GN	Green
VT	Violet
GY	Gray

Cradle Switches



Color Code for Auxiliary Wiring	Description
YE	Yellow
VT	Violet
GY	Gray

Motor Mechanism

Introduction

The diagrams are shown with circuits de-energized, all devices open, connected, and charged, and relays in normal position.

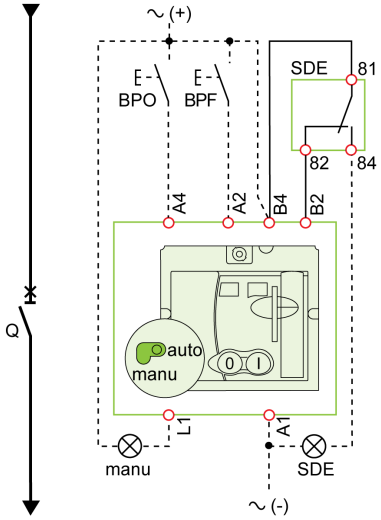
Terminals shown in red O must be connected by the customer.

After tripping initiated by the push-to-trip button or by the MN undervoltage trip release or the MX shunt trip release, device reset can be:

- automatic
- remote
- manual

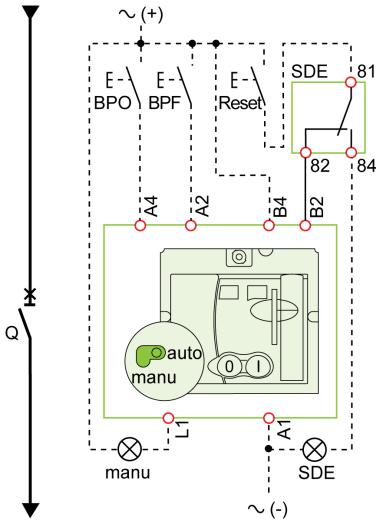
Following tripping due to an electrical fault (with an SDE contact), reset must be carried out manually.

Motor Mechanism with Automatic Reset



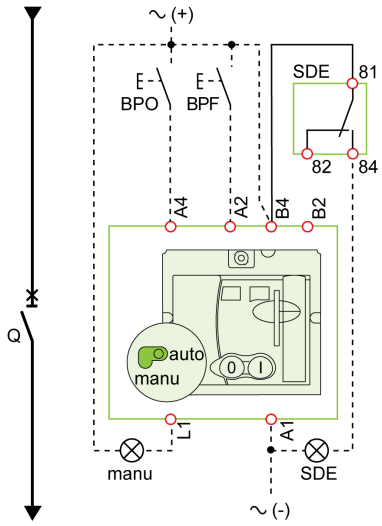
Symbol	Description
Q	Circuit breaker
A4	Opening order
A2	Closing order
B4, A1	Motor mechanism power supply
L1	Manual position (**manu**)
B2	SDE interlocking (mandatory for contact operation)
BPO	Opening push button
BPF	Closing push button
SDE	Electrical-fault indication contact

Motor Mechanism with Remote Reset



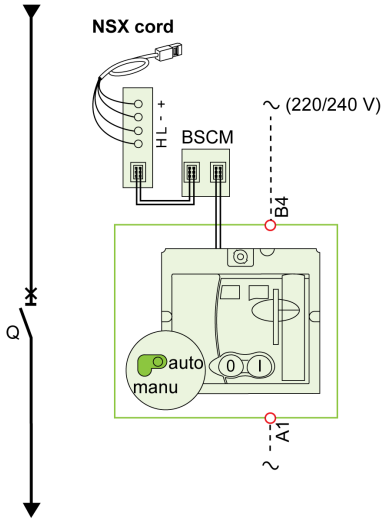
Symbol	Description
Q	Circuit breaker
A4	Opening order
A2	Closing order
B4, A1	Motor mechanism power supply
L1	Manual position (**manu**)
B2	SDE interlocking (mandatory for contact operation)
BPO	Opening push button
BPF	Closing push button
SDE	Electrical-fault indication contact

Motor Mechanism with Manual Reset



Symbol	Description
Q	Circuit breaker
A4	Opening order
A2	Closing order
B4, A1	Motor mechanism power supply
L1	Manual position (**manu**)
B2	SDE interlocking (mandatory for contact operation)
BPO	Opening push button
BPF	Closing push button
SDE	Electrical-fault indication contact

Communicating Motor Mechanism



Symbol	Description
Q	Circuit breaker
B4, A1	Motor mechanism power supply
BSCM	Breaker status control module

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