PRINCE WILLIAM ROAD, LOUGHBOROUGH, LEICESTERSHIRE,
LE11 5GU. ENGLAND.
TEL (01509) 211 330 FAX (01509) 211 505
Email : general@hallson.co.uk Internet : http://www.hallson.co.uk

EDINA

SWITCHBOARD

OPERATION AND MAINTENANCE

MANUAL

(OUTGOING METERING).

Revision	Date	Details
Original	8TH Mar. 2017	Original Issue

PREFACE

The purpose of this manual is to describe the operation and maintenance of a switchboard manufactured by Hallson Ltd.

Before any operation and maintenance activities are carried out on this equipment this manual should be read and fully understood. The equipment should be worked on only by suitably qualified persons. This equipment must be installed, commissioned and maintained in accordance with the latest health and safety regulations and other instructions as issued by other controlling bodies.

The instructions in this manual are designed to give information and guidance, Hallson Ltd., cannot accept responsibility either for the manner in which they are carried out or for any consequence thereof.

Any questions, requests for spares should be addressed to :-

Hallson Ltd.,
Prince William Road,
Loughborough,
Leicestershire,
LE11 5GU.
England.

Telephone : 01509 211 330
Fax : 01509 211 550
Email :- general@hallson.co.uk

Index.

Section 1

Ratings

1.1

Rated Voltage	415V AC
Rated Frequency	50Hz
System	3 Phase, 4 Wire.
Rated Current	1600A
Form of Separation.	Form 4, Type 6.

SECTION 2

OPERATION.

The incoming section of this switchboard is fitted with a 1600A ACB. This device has a pushbutton operating mechanism and can be switched into two positions, on or off. To enable the device to be closed it needs to have it's springs charged, this is carried out but pumping the manual charging handle until the breakaway clutch disengages the handle. To close the ACB push the 'on' pushbutton. To open the ACB push the 'off' pushbutton. To re-close the springs must be re-charged. After a protection trip push the red reset button on the trip unit before attempting to close the ACB.
The device is provided with padlockable pushbuttons. A cover allows the pushbuttons to be covered and access controlled by a padlock.

For further information the operation of the ACB's refer to the ACB instructions contained within this manual.

All outgoing MCCB's are provided with padlock off devices. They are supplied in to sizes, one that fits 100A – 630A frame MCCB's. To use the units switch the MCCB into the off position. Insert the padlock off device into the toggle mechanism where two slots are moulded into the front cover. Expand the device and fit a padlock.

For further information on the operation of MCCB's please refer to the MCCB instructions contained within this manual.

SECTION 3

ROUTINE MAINTANENCE

4.1 It is recommend that the Switchboard is inspected for signs of damage both internally and externally once every twelve months.

4.1.1 Externally the switchboard must be checked for damage to the paintwork, any damage should be cleaned and prepared using a rust inhibitor and repaired to the exact same standard as the original manufacturers paint finish.

4.1.3 Remove any internal debris.

4.1.4. Check tightness of busbar connections every twelve months and re-tighten if required.

4.1.5. Carry out functional check of protection equipment every 12 months.

SECTION 4

Drawings.

SECTION 5

Manufacturers Information.

MASTERPACT NT

Low Voltage Products

User manual

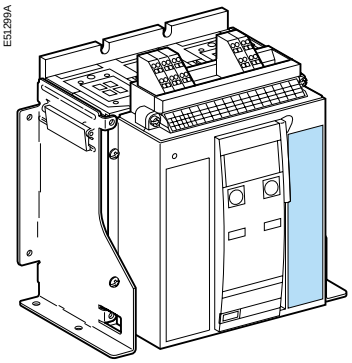
Merlin Gerin
Modicon
Square D
Telemecanique

Schneider Electric
We do more with electricity.

User manual for

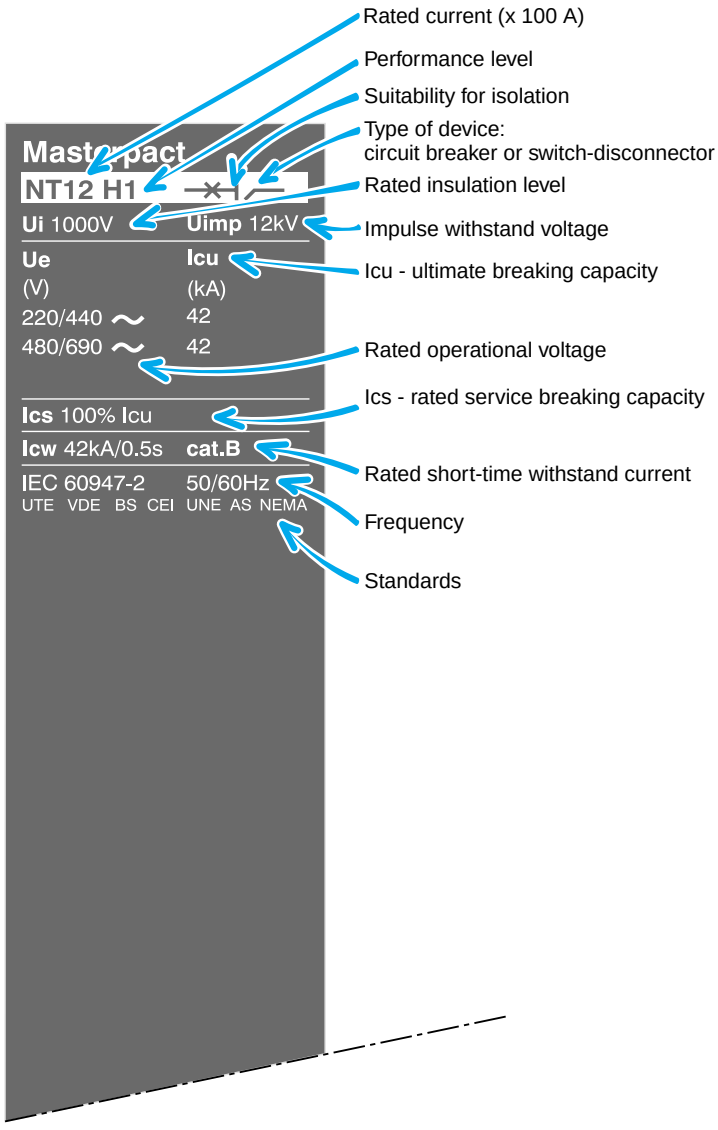
Masterpact NT circuit breakers

E51299A



Rating plate

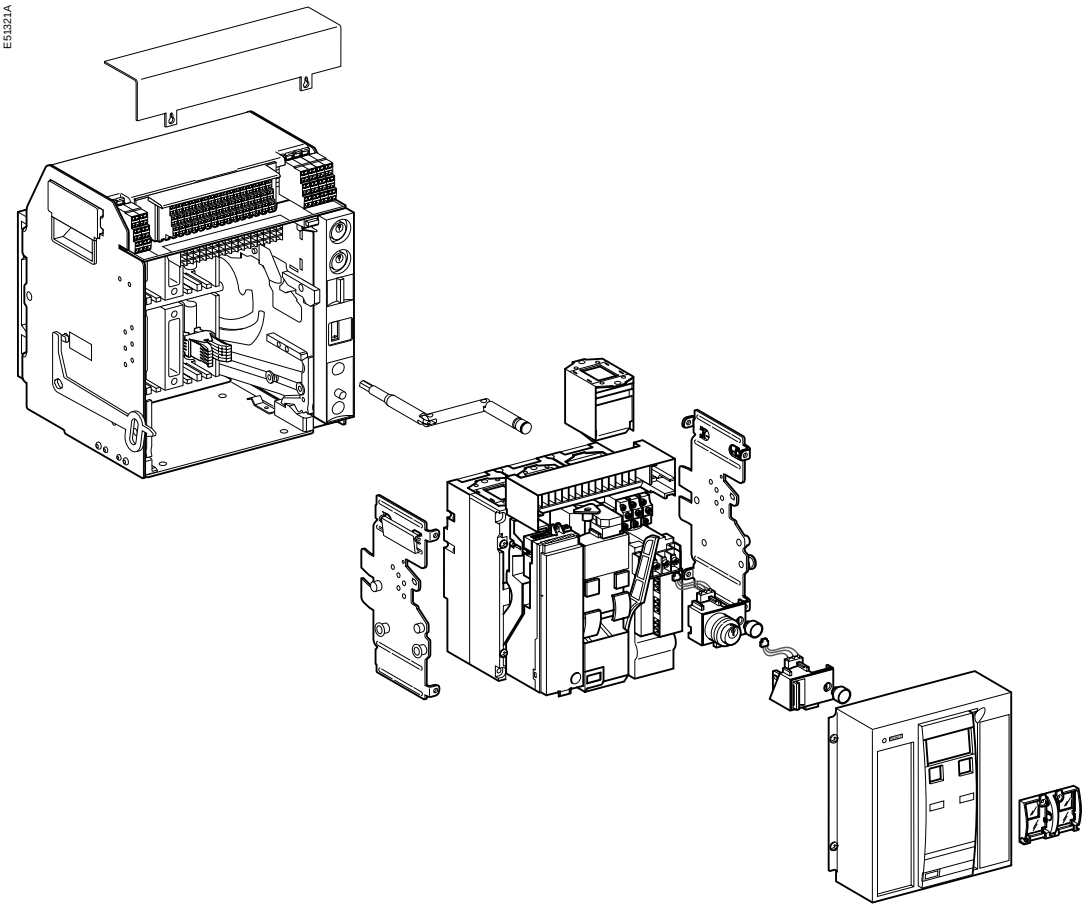
E60055A



Masterpact circuit breakers are available in drawout and fixed versions.
The drawout version is mounted on a chassis and the fixed version is installed using fixing brackets.

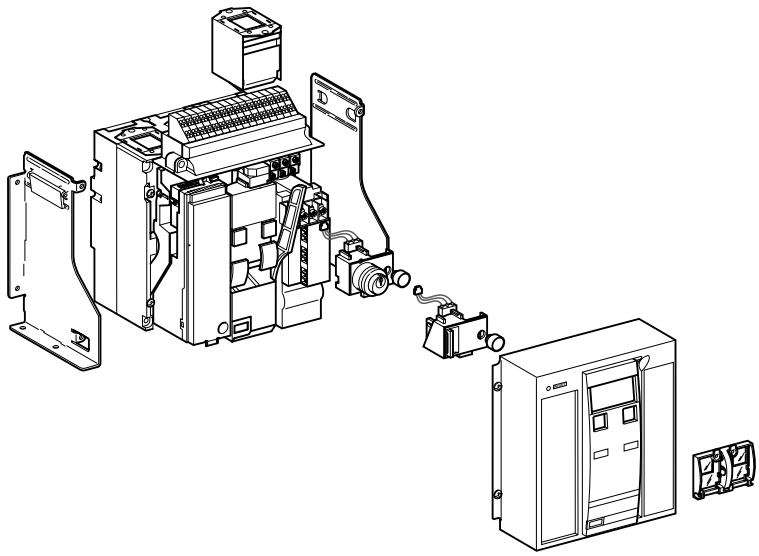
Drawout version

E51321A



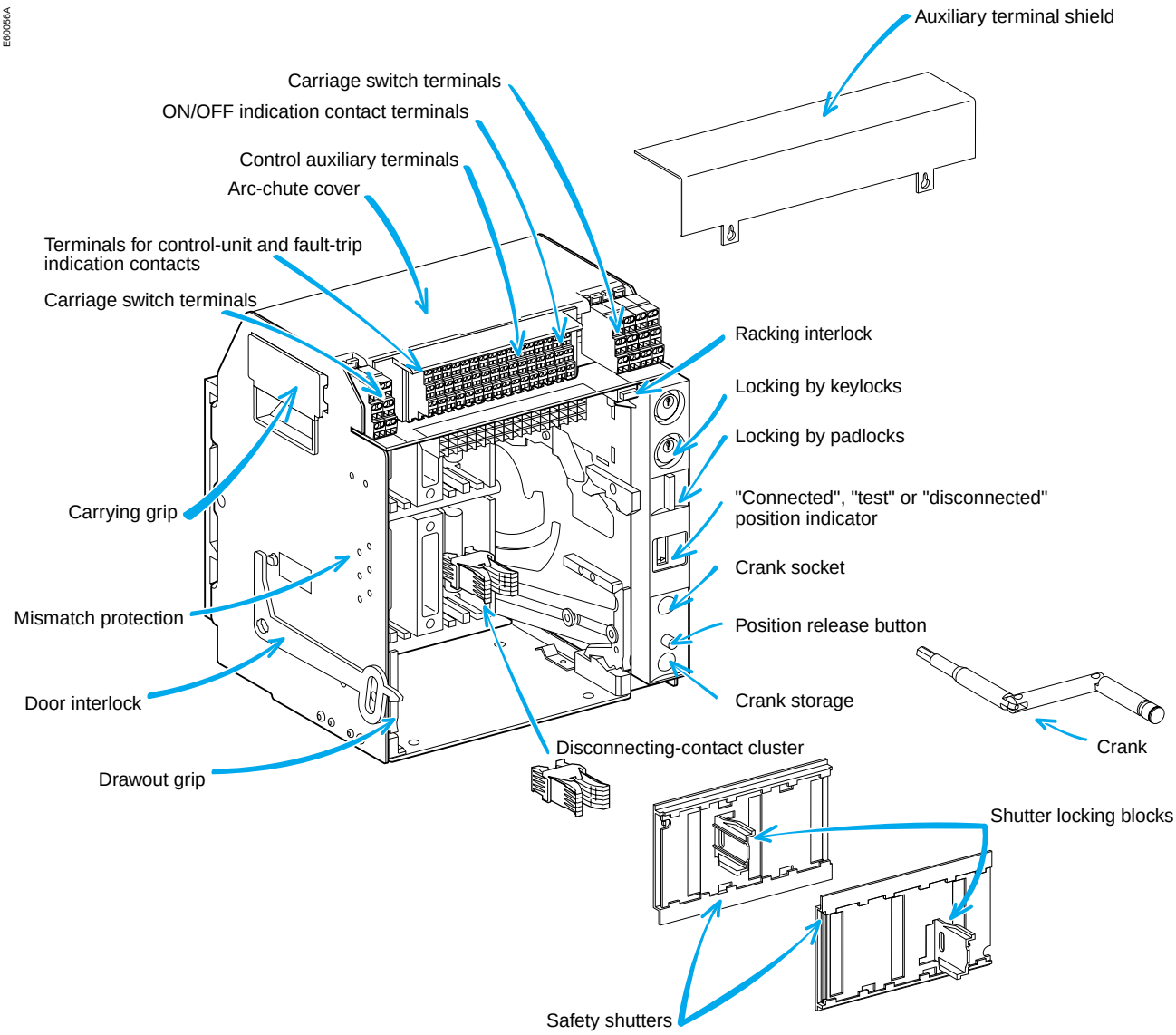
Fixed version

E51322A

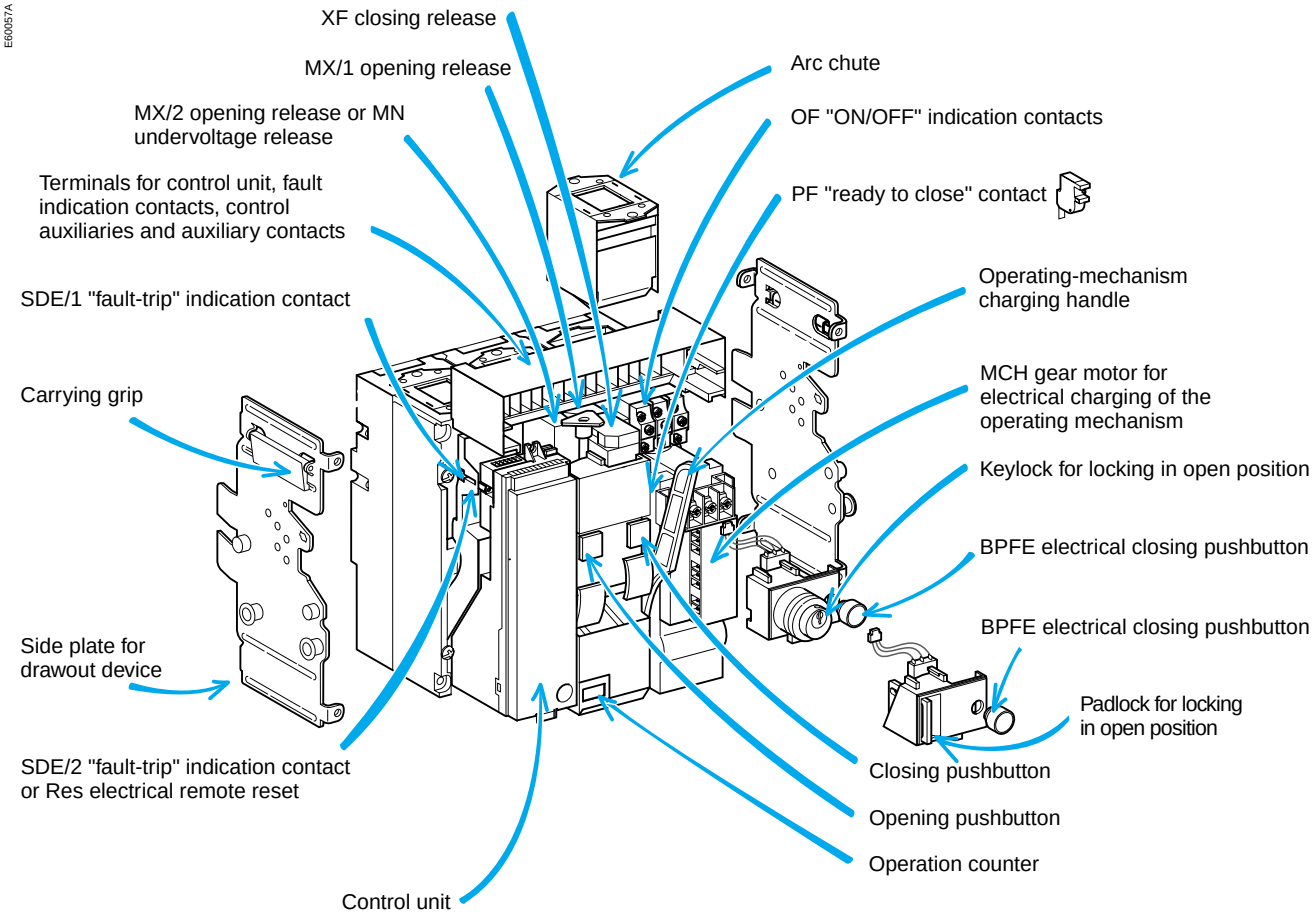


Chassis

E60056A

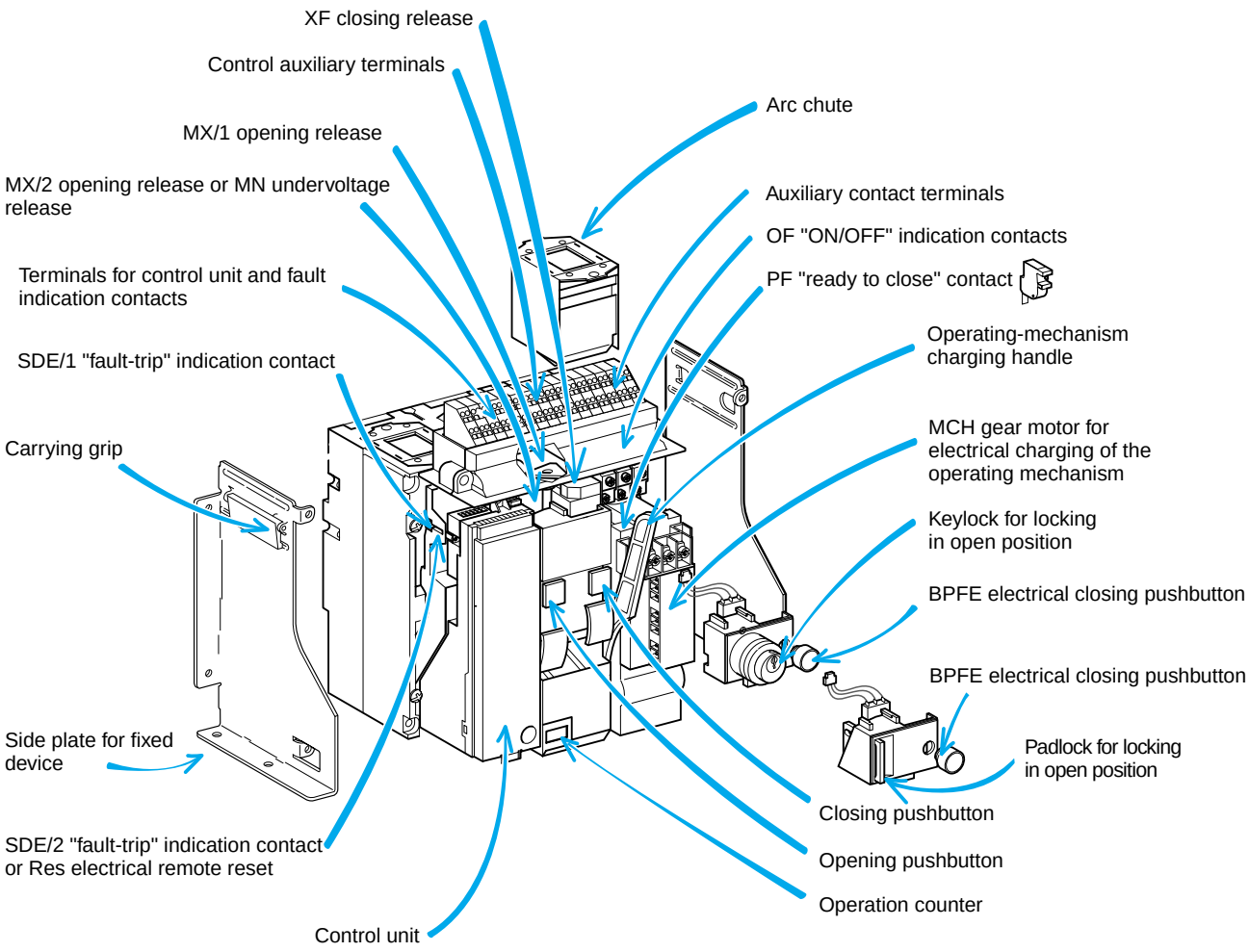


Drawout circuit breaker / switch-disconnector



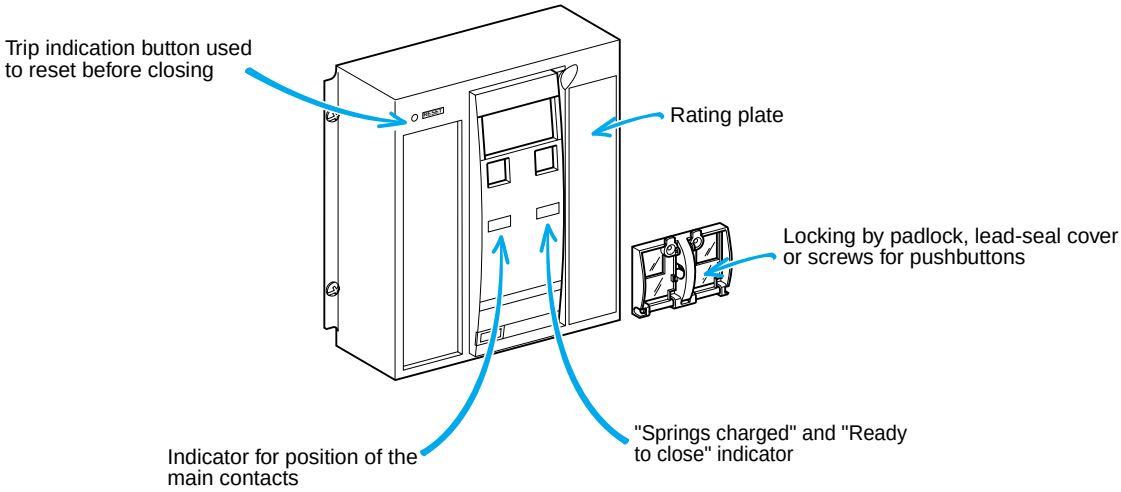
Fixed circuit breaker / switch-disconnector

E60058A



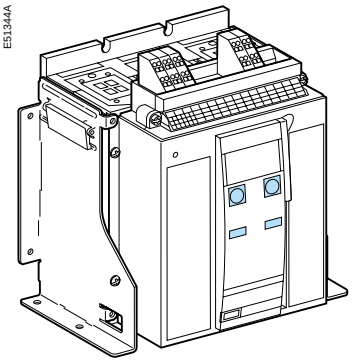
Front

E60059A



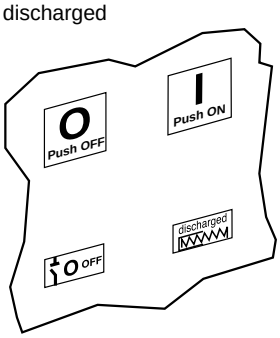
Understanding the controls and indications

E51344A



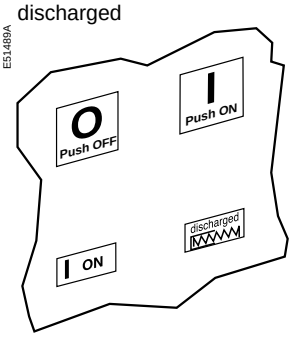
Circuit breaker open and discharged

E51488A



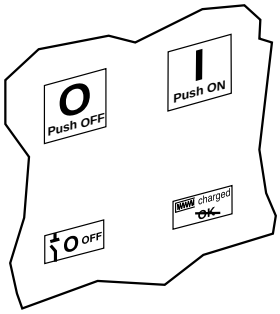
Circuit breaker closed and discharged

E51489A



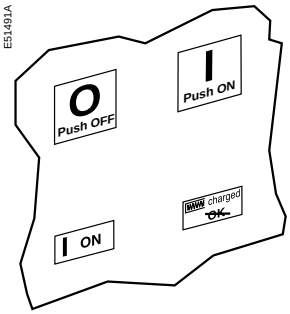
Circuit breaker open, charged and not "ready to close"

E51490A



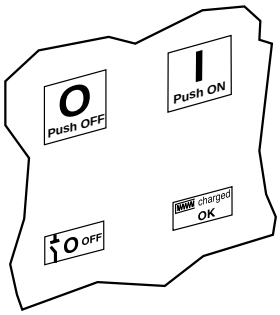
Circuit breaker closed and charged

E51491A



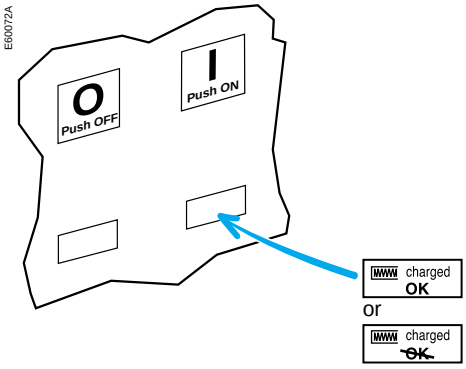
Circuit breaker open, charged and "ready to close"

E51492A



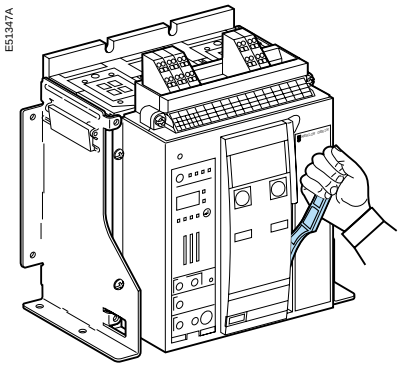
Charging the circuit breaker

The charge status is indicated as follows.

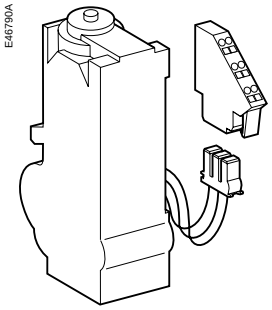


The springs in the circuit breaker operating mechanism must be charged to store the energy required to close the main contacts. The springs may be charged manually using the charging handle or automatically by the optional MCH gear motor.

Manual charging.
Pull the handle down six times until you hear a "clack".



Automatic charging.
If the MCH gear motor is installed, the spring is automatically recharged after each closing.



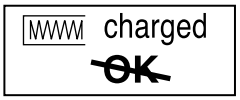
Closing the circuit breaker

Device "ready to close"

E51291A

Device not "ready to close"

E51292A



Closing conditions

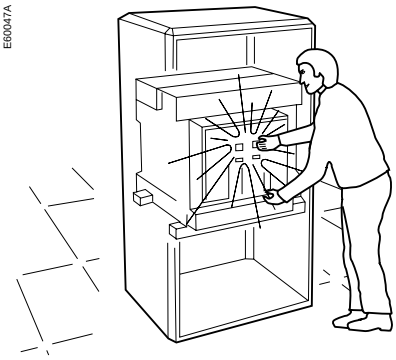
Closing (i.e. turning the circuit ON) is possible only if the circuit breaker is "ready to close".
The prerequisites are the following:

- device open (OFF)
- springs charged
- no opening order present.

The circuit breaker will not close unless it is "ready to close" when the order is given.

Closing the circuit breaker

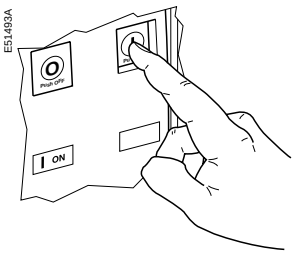
E60047A



Locally (mechanical)

Press the mechanical ON pushbutton.

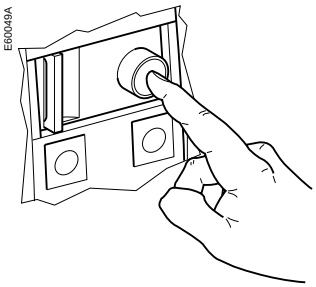
E51493A



Locally (electrical)

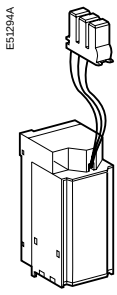
BPFE

E60049A



XF

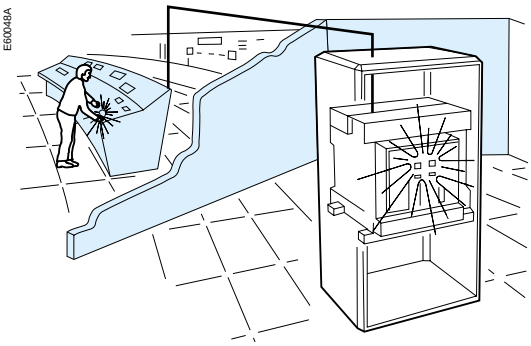
E51294A



Press the electrical closing pushbutton. By adding an XF closing release, the circuit breaker can be closed locally.

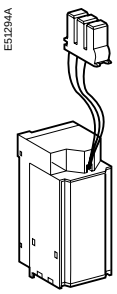
Remotely

E60048A



XF

E51294A



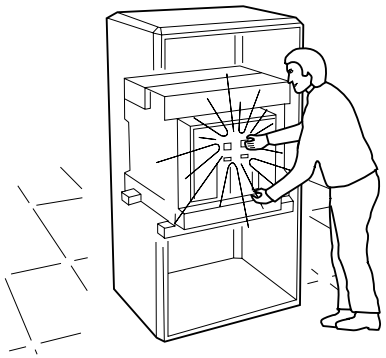
When connected to a remote control panel, the XF closing release can be used to close the circuit breaker remotely.

Anti-pumping function

The purpose of the mechanical anti-pumping function is to ensure that a circuit breaker receiving simultaneous opening and closing orders does not open and close indefinitely.
If there is a continuous closing order, after opening the circuit breaker remains open until the closing order is discontinued. A new closing order is required to close the circuit breaker. A new order is not required if the closing release is wired in series with the PF "ready to close" contact.

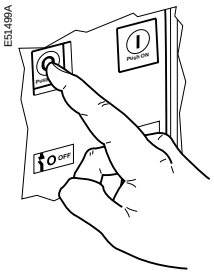
Opening the circuit breaker

E60047A

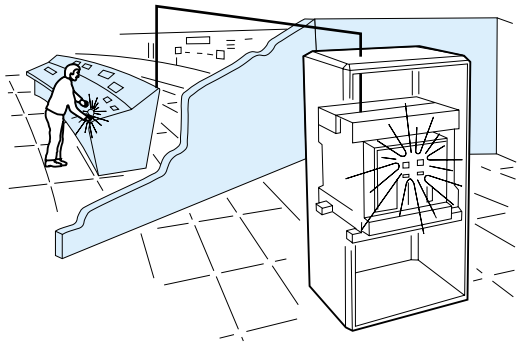


Locally
Press the OFF pushbutton.

E51499A



E60048A

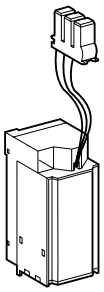


Remotely
Use one of the following solutions:
- one or two MX opening releases (MX1 and MX2)
- one MN undervoltage release
- one MN undervoltage release with a delay unit.

When connected to a remote control panel, these releases can be used to open the circuit breaker remotely.

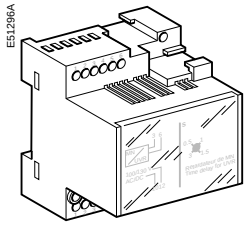
MX1, MX2, MN

E51294A



Delay unit

E51296A



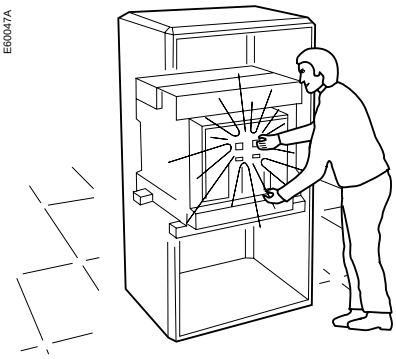
Resetting after a fault trip

The circuit breaker signals a fault trip by:
- a mechanical indicator on the front
- one or two SDE "fault-trip" indication contacts (SDE/2 is optional).

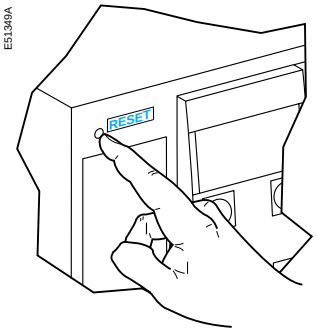
Locally

If the circuit breaker is not equipped with the automatic reset option, reset it manually.

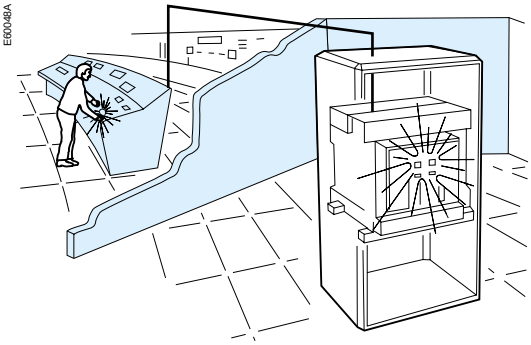
E60047A



E51349A



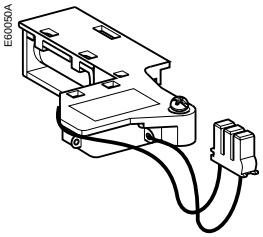
E60048A



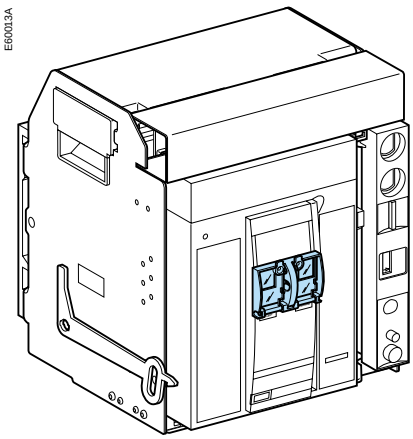
Remotely

Use the Res electrical remote reset option (not compatible with an SDE/2).

E60050A

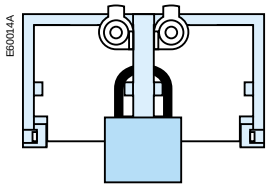


Locking the controls
Disabling circuit-breaker local closing and opening

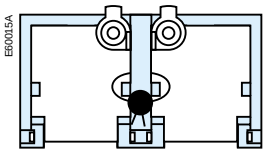


Pushbutton locking using a padlock (shackle diameter 5 to 8 mm), a lead seal or screws.

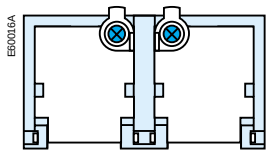
Padlock.



Lead seal.

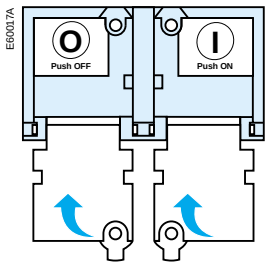


Screws.

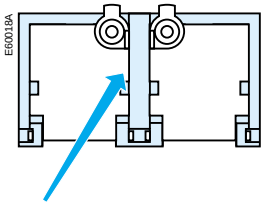


Locking

Close the covers.

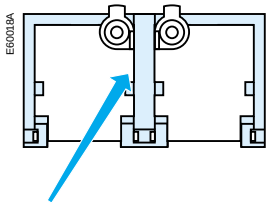


Insert the padlock shackle, lead seal or screws.

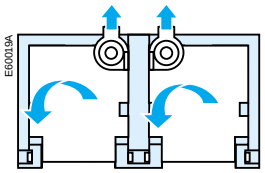


Unlocking

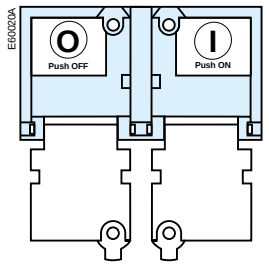
Remove the padlock, lead seal or screws.



Lift the covers and swing them down.



The pushbuttons are no longer locked.



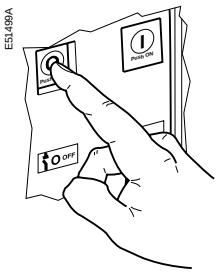
Locking the controls
Disabling local and remote closing

Combination of locking systems
To disable local and remote circuit-breaker closing, use as needed one to three padlocks or a keylock.

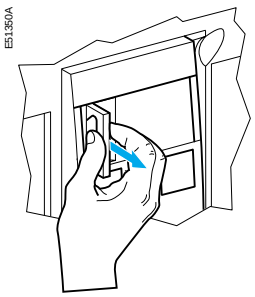
Install one to three padlocks (maximum shackle diameter 5 to 8 mm)

Locking

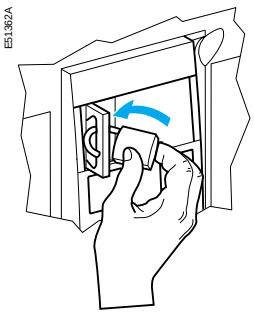
Open the circuit breaker.



Pull out the tab.

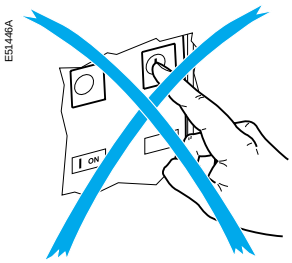


Insert the padlock shackle.



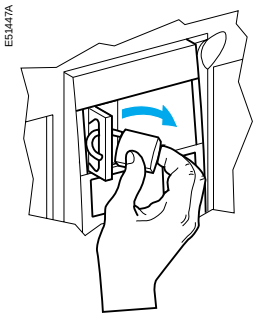
Check

The closing control is inoperative.



Unlocking

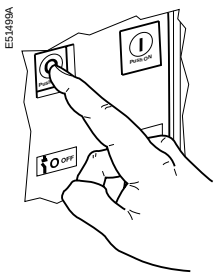
Remove the padlock.



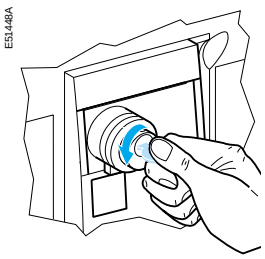
Locking the controls with a keylock

Locking

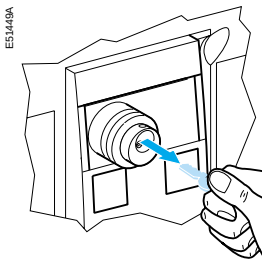
Open the circuit breaker.



Turn the key.

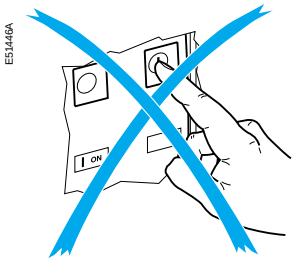


Remove the key.



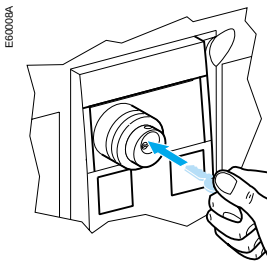
Check

The closing control is inoperative.

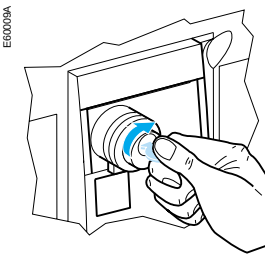


Unlocking

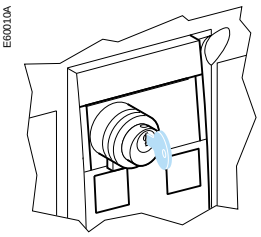
Insert the key.



Turn the key.

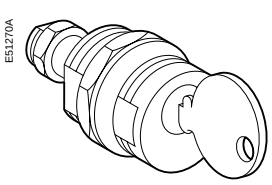


The key cannot be removed.

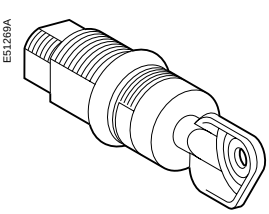


Three types of keylocks are available

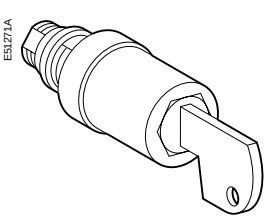
RONIS



PROFALUX

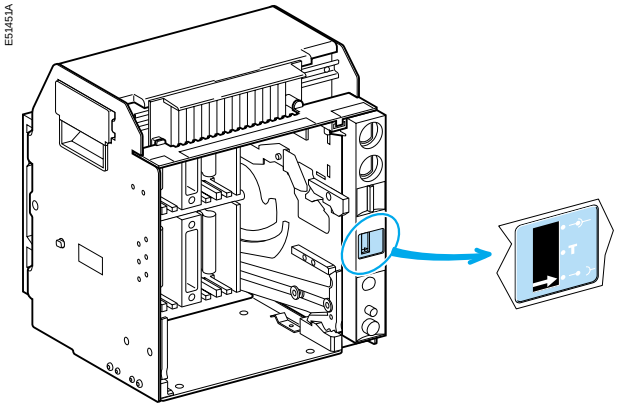


CASTELL

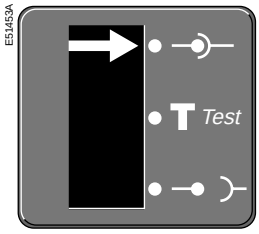


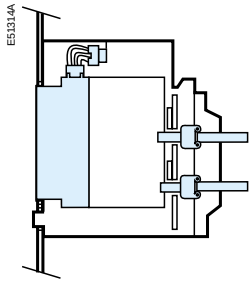
Identifying the circuit breaker positions

The indicator on the front signals the position of the circuit breaker in the chassis.

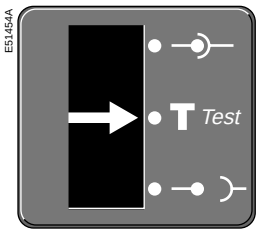


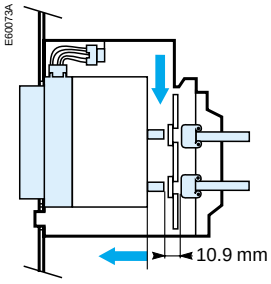
■ "connected" position



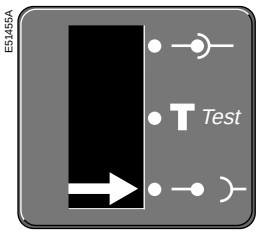


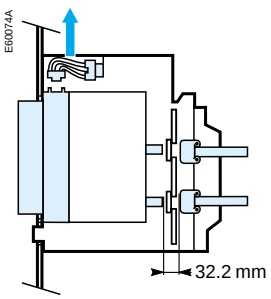
■ "test" position





■ "disconnected" position





Racking

These operations require that all chassis-locking functions be disabled (see page 22).

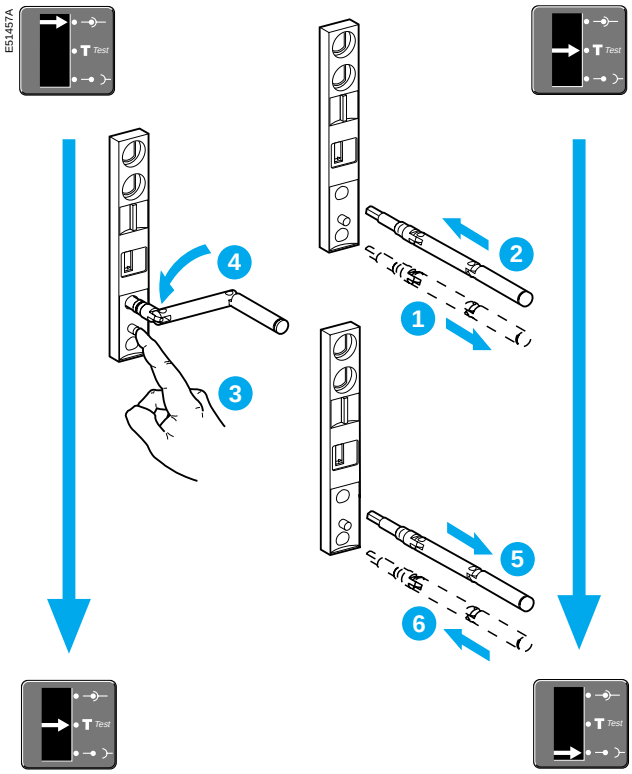
Prerequisites

To connect and disconnect Masterpact, the crank must be used. The locking systems, padlocks and the racking interlock all inhibit use of the crank.

Withdrawing the circuit breaker from the "connected" to "test" position, then to "disconnected" position

The circuit breaker is in "connected" position.

The circuit breaker is in "test" position.



The circuit breaker is in "test" position. Remove the crank or continue to "disconnected" position.

The circuit breaker is in "disconnected" position.

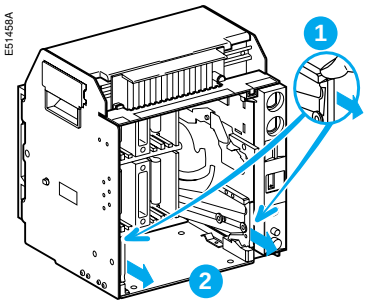
Racking

For complete information on Masterpact handling and mounting, see the installation manual(s).

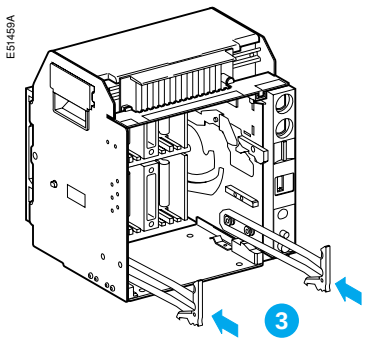
Before mounting the circuit breaker, make sure it matches the chassis.

Removing the rails

Press the release tabs and pull the rails out.

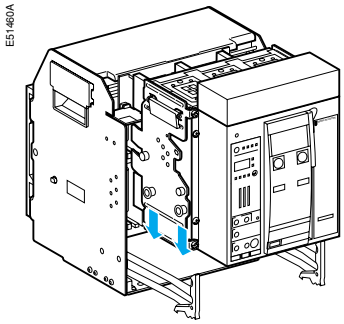


Press the release tabs to push the rails in.

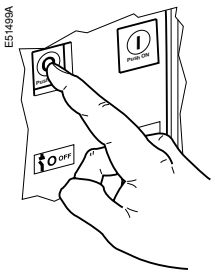


Inserting Masterpact

Position the circuit breaker on the rails. Check that it rests on all four supports.

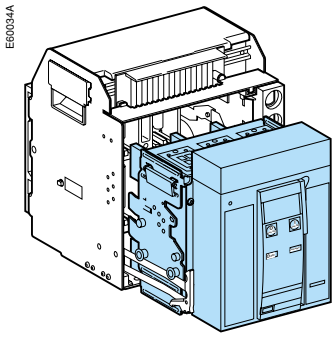


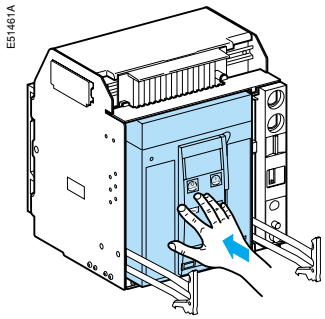
Open the circuit breaker (in any case, it opens automatically during connection).

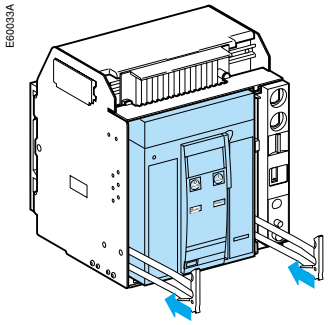


If you cannot insert the circuit breaker in the chassis, check that the mismatch protection on the chassis corresponds to that on the circuit breaker.

Push the circuit breaker into the chassis, taking care not to push on the control unit.



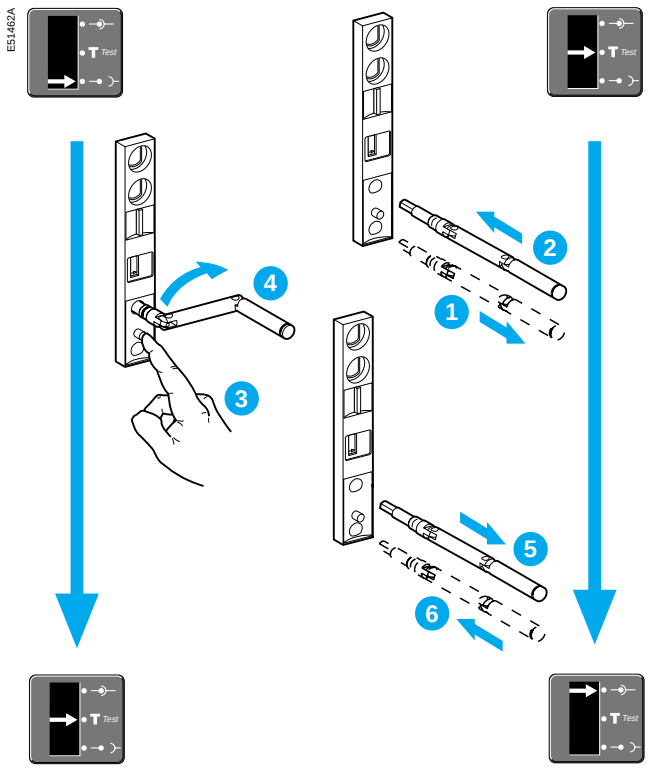




Racking the circuit breaker from the "disconnected" to "test" position, then to "connected" position

The device is in "disconnected" position.

The device is in "test" position.



The device is in "test" position. Remove the crank or continue to "connected" position.

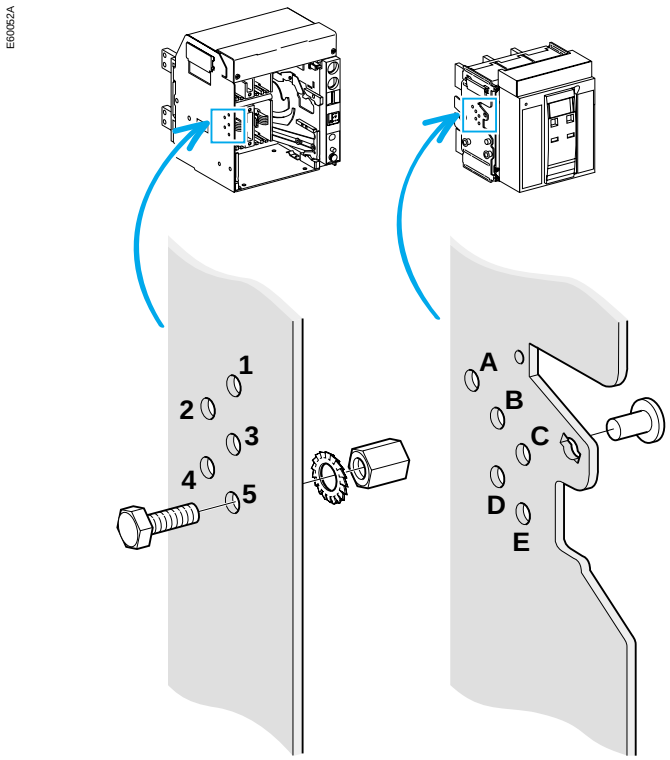
The device is in "connected" position.

Matching a Masterpact circuit breaker with its chassis

To set up a mismatch-prevention combination for the circuit breaker and the chassis, see the mismatch-prevention installation manual.

The mismatch protection ensures that a circuit breaker is installed only in a chassis with compatible characteristics.

The possible combinations are listed below.

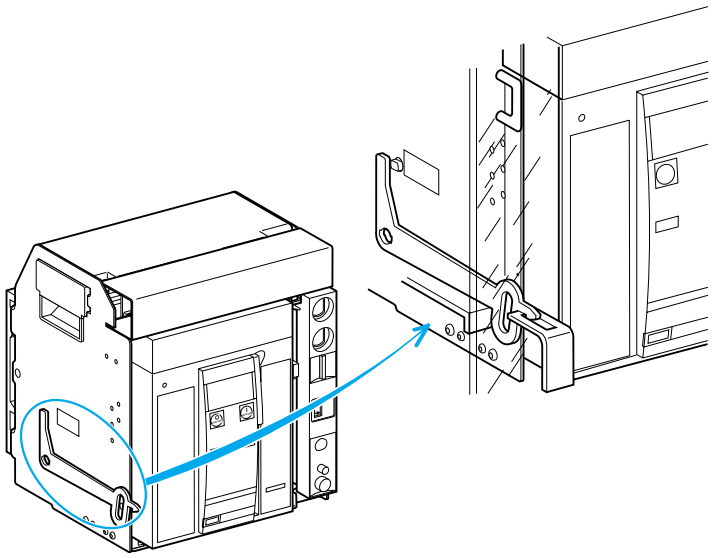


A B C	4 5	B C D	1 5
A B D	3 5	B C E	1 4
A B E	3 4	B C	1 4 5
A B	3 4 5	B D E	1 3
A C D	2 5	B D	1 3 5
A C E	2 4	B E	1 3 4
A C	2 4 5	C D E	1 2
A D E	2 3	C D	1 2 5
A D	2 3 5	C E	1 2 4
A E	2 3 4	D E	1 2 3

Locking the switchboard door

The locking device is installed on the left or right-hand side of the chassis.
■ when the circuit breaker is in "connected" or "test" position, the latch is lowered and the door is locked
■ when the circuit breaker is in "disconnected" position, the latch is raised and the door is unlocked.

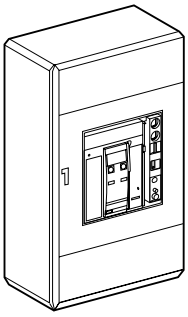
E51464A



Disabling door opening

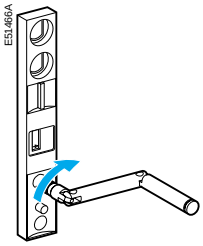
Close the door.

E51465A



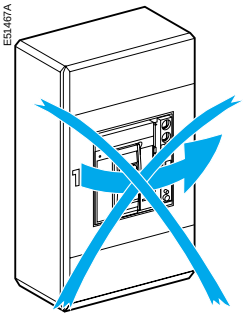
Put the Masterpact in "test" or "connected" position.

E51466A



The door is locked.

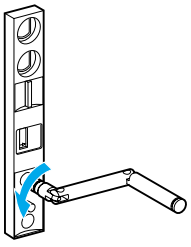
E51467A



Enabling door opening

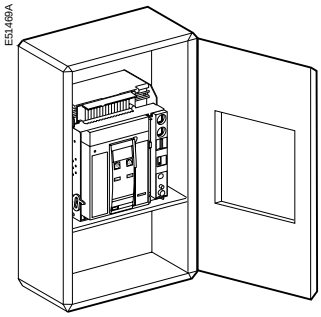
Put the Masterpact in "disconnected" position.

E51468A



The door is unlocked.

E51469A



Locking the circuit breaker in position

Padlocks and keylocks may be used together.

If specified when ordering the chassis, this locking function may be adapted to operate in all positions ("connected", "test" and "disconnected"), instead of in "disconnected" position alone.

Combination of locking systems

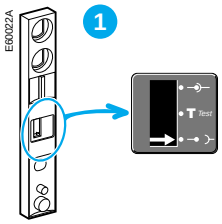
To disable connection of the circuit breaker in "disconnected" position in the chassis, use as needed:

- one to three padlocks
- one or two keylocks
- a combination of the two locking systems.

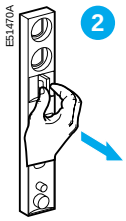
Disabling connection when the circuit breaker is in "disconnected" position, using one to three padlocks (maximum shackle diameter 5 to 8 mm)

Locking

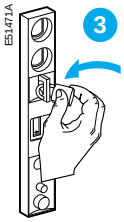
Circuit breaker in "disconnected" position.



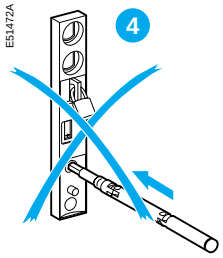
Pull out the tab.



Insert the shackle (max. diameter 5 to 8 mm) of the padlock(s).

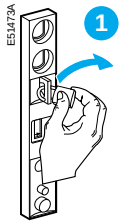


The crank cannot be inserted.

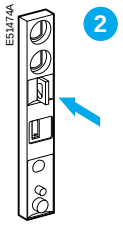


Unlocking

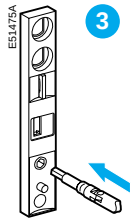
Remove the padlock(s).



Release the tab.



The crank can be inserted.



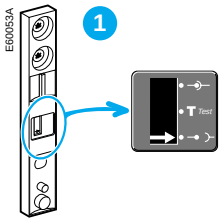
Locking the circuit breaker in position

Padlocks and keylocks may be used together.

Disabling connection when the circuit breaker is in "disconnected" position, using one or two keylocks.

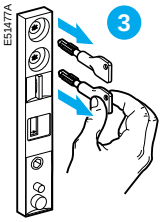
Locking

Circuit breaker in "disconnected" position.

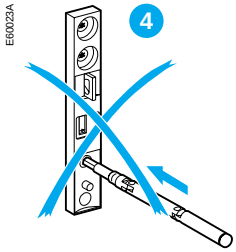


Turn the key(s).

Remove the key(s).

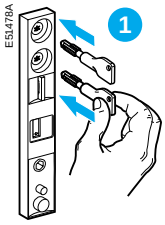


The crank cannot be inserted.



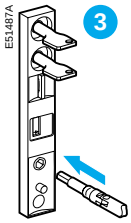
Unlocking

Insert the key(s).



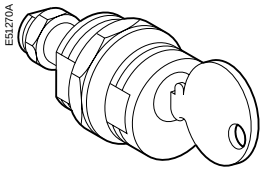
Turn the key(s).

The crank can be inserted.

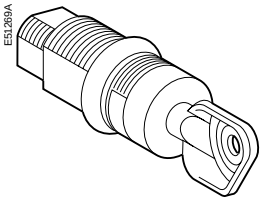


Three types of keylocks are available

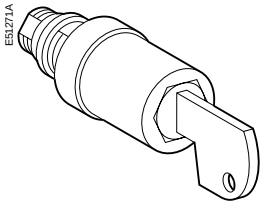
RONIS



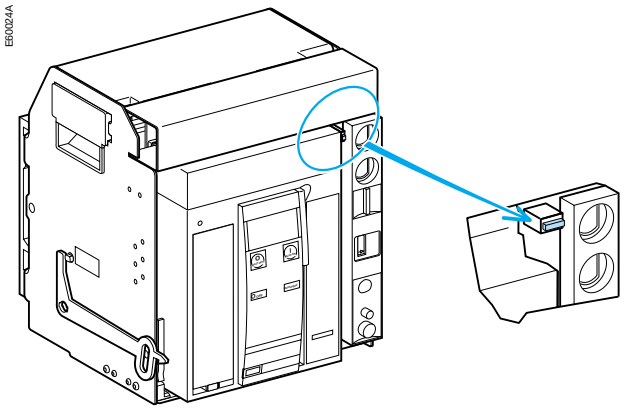
PROFALUX



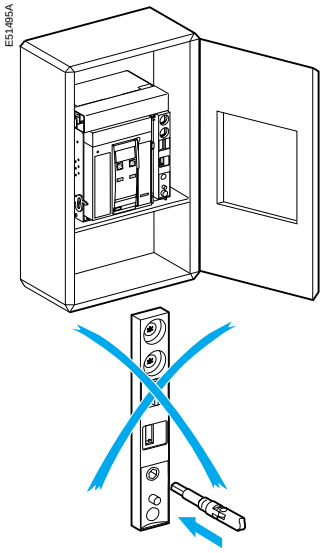
CASTELL



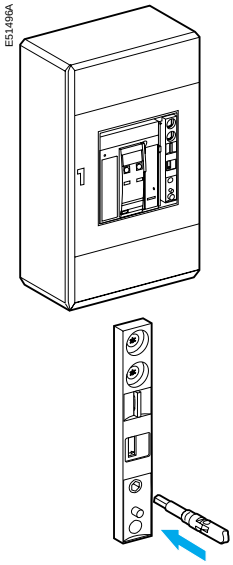
Locking the circuit breaker when the door is open



When the door is open, the crank cannot be inserted.



When the door is closed, the crank can be inserted.

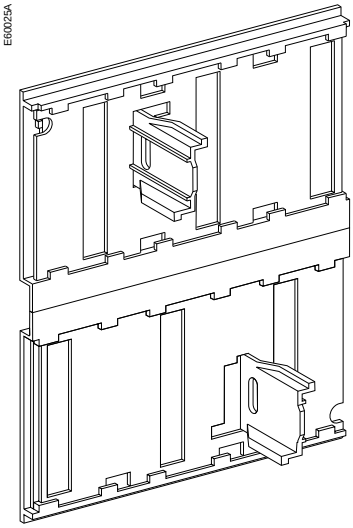


Locking the safety shutters
Padlocking inside the chassis

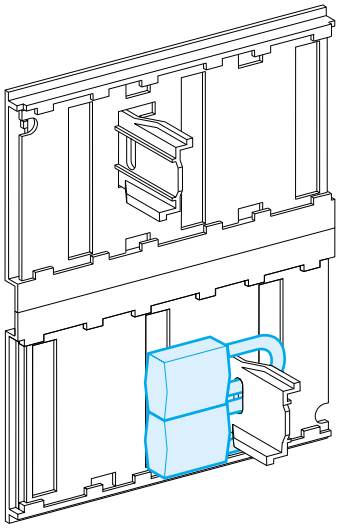
Four locking possibilities: using one or two padlocks (maximum shackle diameter 5 to 8 mm) for each shutter

Top and bottom shutters not locked.

E60025A

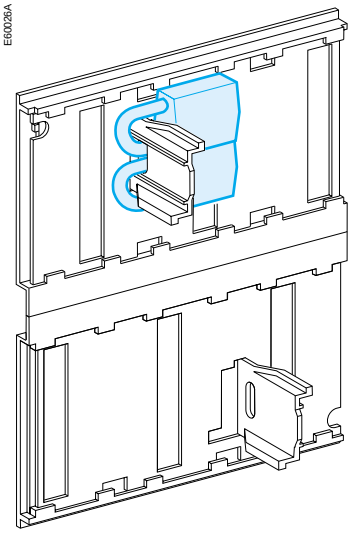


Top shutter not locked.
Bottom shutter locked.

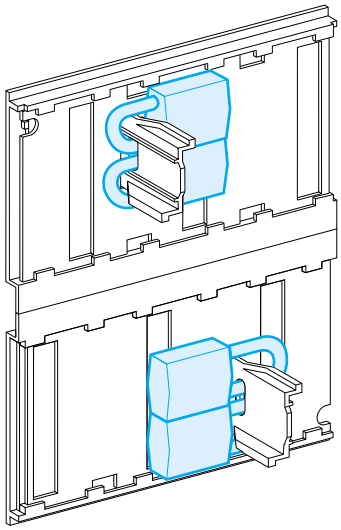


Top shutter locked.
Bottom shutter not locked.

E60026A



Top and bottom shutters locked.



Identification of the connection terminals
Layout of terminal blocks

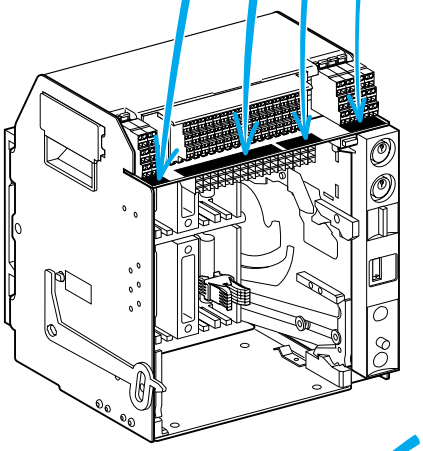
E60044A

CD2	CD1
824	814
822	812
821	811

Com		UC1		UC2		UC3	M2C/UC4	SDE2/Res	SDE1	MN/MX2	MX1	XF	PF	MCH
E5	E6	Z5	M1	M2	M3	F2	484/V3	184/K2	84	D2/C12	C2	A2	254	B2
E3	E4	Z3	Z4	T3	T4	VN	474/V2	182	82	C13	C3	A3	252	B3
E1	E2	Z1	Z2	T1	T2	F1	471/V1	181/K1	81	D1/C11	C1	A1	251	B1

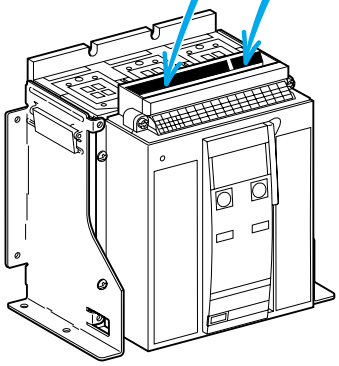
OF4	OF3	OF2	OF1
44	34	24	14
42	32	22	12
41	31	21	11

CE3	CE2	CE1	CT1
334	324	314	914
332	322	312	912
331	321	311	911



Com		UC1		UC2		UC3	M2C/UC4	SDE2/Res	SDE1	MN/MX2	MX1	XF	PF	MCH
E5	E6	Z5	M1	M2	M3	F2	484/V3	184/K2	84	D2/C12	C2	A2	254	B2
E3	E4	Z3	Z4	T3	T4	VN	474/V2	182	82	C13	C3	A3	252	B3
E1	E2	Z1	Z2	T1	T2	F1	471/V1	181/K1	81	D1/C11	C1	A1	251	B1

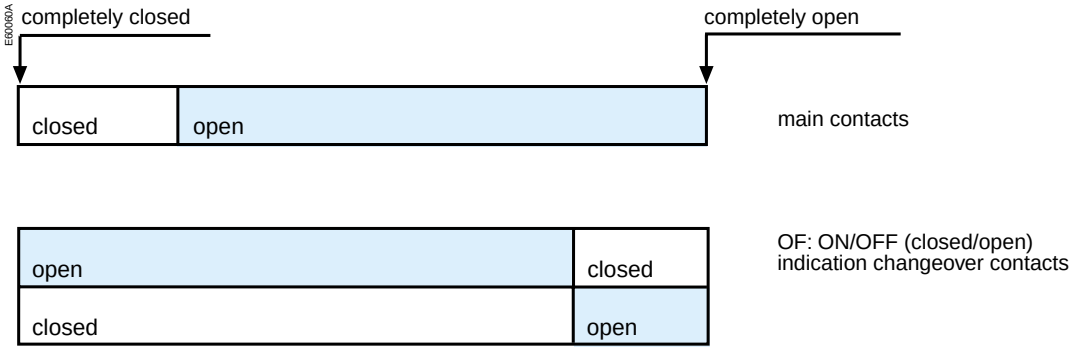
OF4	OF3	OF2	OF1
44	34	24	14
42	32	22	12
41	31	21	11



Operation

The ON/OFF indication contacts signal the status of the device main contacts.

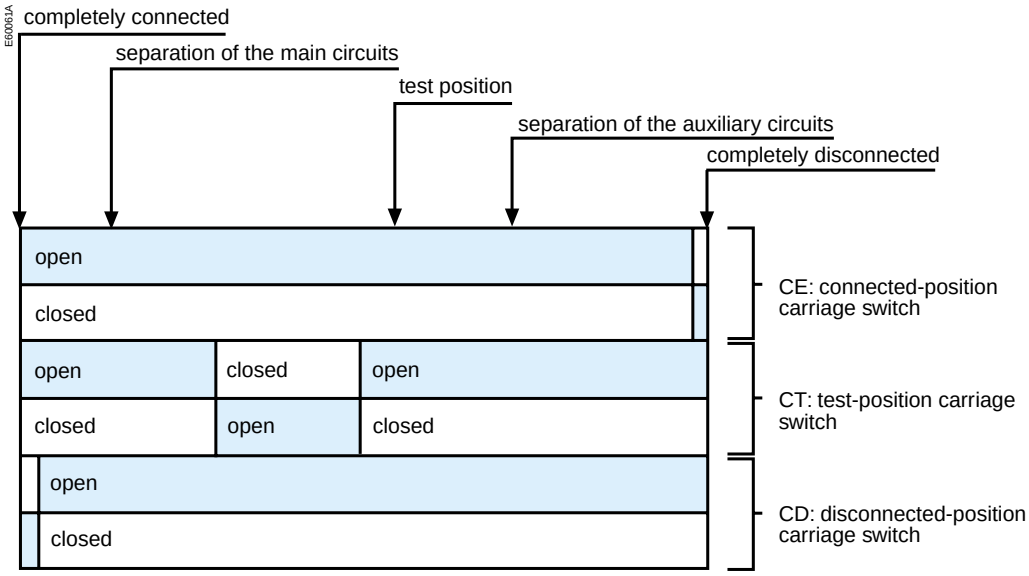
Circuit breaker



The carriage switches indicate the "connected", "test" and "disconnected" positions.

Chassis

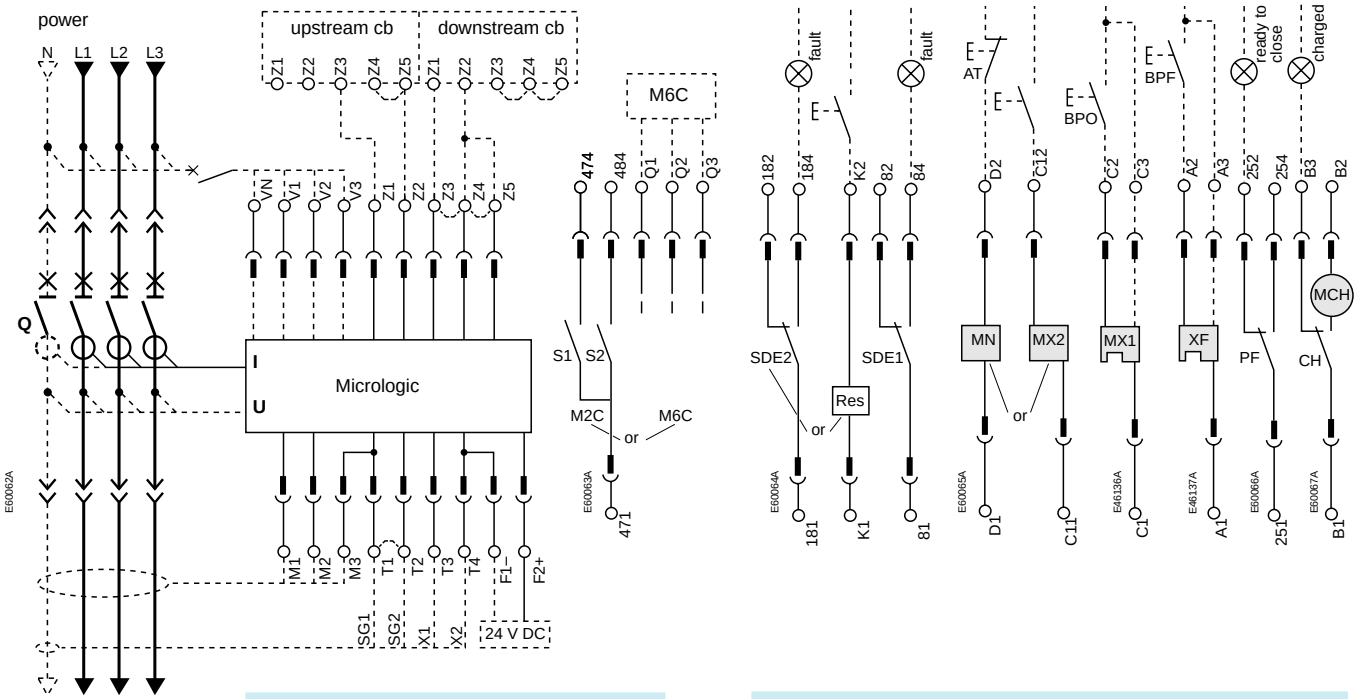
For information on the separation distance of the main circuits in the "test" and "disconnected" positions, see page 16.



Electrical diagrams
Fixed and drawout devices

The diagram is shown with circuits de-energised, all devices open, connected and charged and relays in normal position.

Power | **Control unit** | **Remote operation**



Control unit

Com		UC1		UC2		UC3	UC4 / M2C / M6C
E5	E6	Z5	M1	M2	M3	F2+	V3 / 484 / Q3
E3	E4	Z3	Z4	T3	T4	VN	V2 / 474 / Q2
E1	E2	Z1	Z2	T1	T2	F1 –	V1 / 471 / Q1

Remote operation

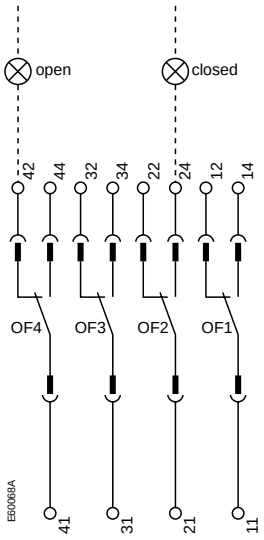
SDE2 / Res		SDE1	MN / MX2		MX1	XF	PF	MCH
184	K2	84	D2	C12	C2	A2	254	B2
182		82			C3	A3	252	B3
181	K1	81	D1	C11	C1	A1	251	B1

A	P	H	Control unit	Remote operation
■	■	■	**Com**: E1-E6 communication	**SDE2**: Fault-trip indication contact **or** **Res**: Remote reset
■	■	■	**UC1**: Z1-Z5 zone selective interlocking; Z1 = ZSI OUT SOURCE Z2 = ZSI OUT; Z3 = ZSI IN SOURCE Z4 = ZSI IN ST (short time) Z5 = ZSI IN GF (earth fault) M1 = Vigi module input (Micrologic 7)	**SDE1**: Fault-trip indication contact (supplied as standard)
■	■	■		**MN**: Undervoltage release **or** **MX2**: Shunt release
■	■	■	**UC2**: T1, T2, T3, T4 = external neutral; M2, M3 = Vigi module input (Micrologic 7)	
■	■	■		**MX1**: Shunt release (standard or communicating)
■	■	■	**UC3**: F2+, F1– external 24 V DC power supply VN external voltage connector	**XF**: Closing release (standard or communicating)
	■	■		**PF**: "Ready to close" contact
	■	■	**UC4**: V1, V2, V3 optional external voltage connector **or**	**MCH**: Gear motor (*)
	■	■	**M2C**: 2 programmable contacts (internal relay); ext. 24 V DC power supply required **or**	
	■	■	**M6C**: 6 programmable contacts (external relay); ext. 24 V DC power supply required.	

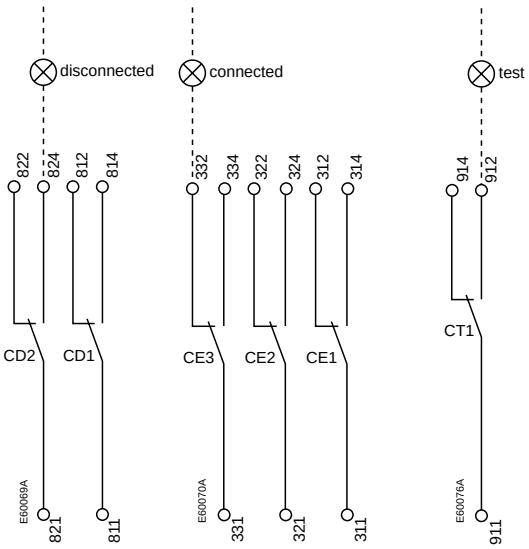
Note:
When communicating MX or XF releases are used, the third wire (C3, A3) must be connected even if the communications module is not installed.

***A**: Digital ammeter*
***P**: A + power meter + programmable protection*
***H**: P + harmonics*

Indication contacts



Chassis contacts



Indication contacts

OF4	OF3	OF2	OF1
44	34	24	14
42	32	22	12
41	31	21	11

Chassis contacts

CD2	CD1	CE3	CE2	CE1	CT1
824	814	334	324	314	914
822	812	332	322	312	912
821	811	331	321	311	911

Indication contacts

OF4 / OF3 / OF2 / OF1: ON/OFF indication contacts

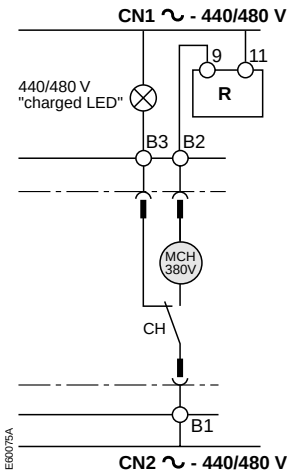
Chassis contacts

CD2-CD1: Disconnected-position

CE3-CE2-CE1: Connected-position

CT1: Test-position contacts

(*) 440/480 V AC gear motor for charging
(380 V motor + additional resistor)



Key:

Drawout device only

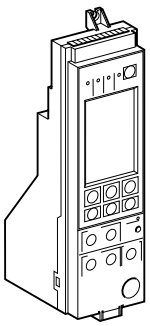
XXX *SDE1, OF1, OF2, OF3, OF4 supplied as standard*

Interconnected connections (only one wire per connection point)

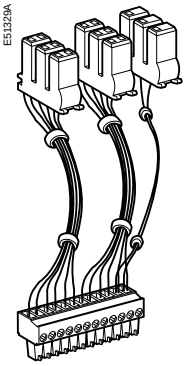
Micrologic control units

For more in-depth information, see the control-unit user manual.

E46109A



E53129A



Micrologic control units

■ standard equipment, one per device
■ part numbers (long-time rating plug and connectors not included, see below):
Micrologic 2.0: 33069
Micrologic 5.0: 33070
Micrologic 2.0A: 33071
Micrologic 5.0A: 33072
Micrologic 6.0A: 33073
Micrologic 7.0A: 33074
Micrologic 5.0P: 47058
Micrologic 6.0P: 47059
Micrologic 7.0P: 47060
Micrologic 5.0H: 47061
Micrologic 6.0H: 47062
Micrologic 7.0H: 47063
■ part numbers for connectors for A, P, H:
□ for fixed device: 47065
□ for drawout device: 47066.

■ depending on the model, control units offer in addition:
□ fault indications
□ measurement of electrical parameters (current, voltage, power, etc.)
□ harmonic analysis
□ communication.

Long-time rating plugs

■ standard equipment, one per control unit
■ part numbers for setting options:
□ standard 0.4 to 1 x Ir setting: 33542
□ low 0.4 to 0.8 x Ir setting: 33543
□ high 0.8 to 1 x Ir setting: 33544
□ off (no long-time protection): 33545.

■ the plugs determine the setting range for the long-time protection.

M2C and M6C programmable contacts

■ optional equipment, used with Micrologic P and H control units
■ part numbers (connectors not included, see below):
□ 2 M2C contacts: 47099
□ 6 M6C contacts: 33104
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ contacts can be programmed using the keypad on the control unit or via the COM option
■ they indicate:
□ the type of fault
□ instantaneous or delayed threshold overruns.

■ M2C: 2 contacts (5 A - 240 V)
■ M6C: 6 contacts (5 A - 240 V).
■ permissible load on each of the M6C relay outputs at cos φ = 0.7
□ 240 V AC: 5 A
□ 380 V AC: 3 A
□ 24 V DC: 1.8 A
□ 48 V DC: 1.5 A
□ 125 V DC: 0.4 A
□ 250 V DC: 0.15 A
■ M2C: 24 V DC ± 5 % power from control unit
■ M6C: 24 V DC ±5 % external supply
■ maximum consumption: 100 mA.

Indication contacts

ON/OFF indication contacts (OF)

■ standard equipment, 4 OF per device
■ part numbers:
□ standard: 47076
□ low level: 47077
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ OF contacts indicate the position of the main contacts
■ they trip when the minimum isolation distance between the main contacts is reached.

■ 4 changeover contacts
■ breaking capacity at cos φ = 0.3 (AC12 / DC12 as per 947-5-1)
□ standard, minimum current 10 mA / 24 V

V AC	240/380	6 A (rms)
	480	6 A (rms)
	690	6 A (rms)
V DC	24/48	2.5
	125	0.5
	250	0.3

□ low level, minimum current 1 mA / 4 V

V AC	24/48	5 A (rms)
	240	5 A (rms)
	380	5 A (rms)
V DC	24/48	5 / 2.5 A
	125	0.5 A
	250	0.3 A

"Fault-trip" indication contact (SDE/1)

■ standard equipment on circuit breakers, one SDE/1 contact per device
■ not available for switch-disconnector versions.

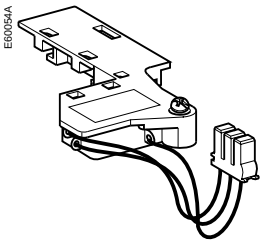
■ the contact provides a remote indication of device opening due to an electrical fault.

■ changeover contact
■ breaking capacity at cos φ = 0.3 (AC12 / DC12 as per 947-5-1)
□ standard, minimum current 10 mA / 24 V

V AC	240/380	5 A (rms)
	480	5 A (rms)
	690	3 A (rms)
V DC	24/48	3 A
	125	0.3 A
	250	0.15 A

□ low level, minimum current 1 mA / 4 V

V AC	24/48	3 A (rms)
	240	3 A (rms)
	380	3 A (rms)
V DC	24/48	3 A
	125	0.3 A
	250	0.15 A



Additional "fault-trip" indication contact (SDE/2)

■ optional equipment for circuit breakers, one additional SDE/2 contact per device
■ not available for switch-disconnector versions
■ not compatible with the Res option
■ part numbers (connectors not included, see below):
□ standard: 47078
□ low level: 47079
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ the contact remotely indicates device opening due to an electrical fault.

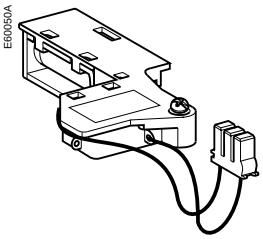
■ changeover contact
■ breaking capacity at cos φ = 0.3 (AC12 / DC12 as per 947-5-1)
□ standard, minimum current 10 mA / 24 V

V AC	240/380	5 A (rms)
	480	5 A (rms)
	690	3 A (rms)
V DC	24/48	3 A
	125	0.3 A
	250	0.15 A

□ low level, minimum current 1 mA / 4 V

V AC	24/48	3 A (rms)
	240	3 A (rms)
	380	3 A (rms)
V DC	24/48	3 A
	125	0.3 A
	250	0.15 A

Indication contacts



Electrical reset after fault trip (Res)

■ optional equipment, one Res per device
■ not compatible with the SDE/2 option
■ part numbers (connectors not included, see below):
□ 110/130 V AC: 47082
□ 220/240 V AC: 47083
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ the contact remotely resets the device following tripping due to an electrical fault.

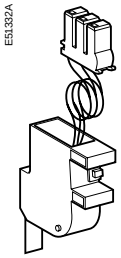
"Springs charged" limit switch contact (CH)

■ equipment included with MCH gear motor, one CH contact per device.

■ the contact indicates the "charged" status of the operating mechanism (springs charged).

■ changeover contact
■ breaking capacity 50/60 Hz for AC power (AC12 / DC12 as per 947-5-1):

V AC	240	10A(rms)
	380	6 A (rms)
	480	6 A (rms)
	690	3 A (rms)
V DC	24/48	3 A
	125	0.5 A
	250	0.25 A



"Ready to close" contact (PF)

■ optional equipment, one PF contact per device
■ part numbers (connectors not included, see below):
□ standard: 47080
□ low level: 47081
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ the contact indicates that the device may be closed because all the following are valid:
□ circuit breaker is open
□ spring mechanism is charged
□ a maintained closing order is not present
□ a maintained opening order is not present.

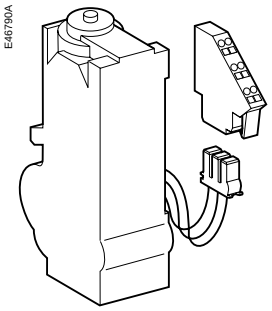
■ changeover contact
■ breaking capacity at cos φ = 0.3 (AC12 / DC12 as per 947-5-1)
□ standard, minimum current 10 mA / 24 V

V AC	240/380	5 A (rms)
	480	5 A (rms)
	690	3 A (rms)
V DC	24/48	3 A
	125	0.3 A
	250	0.15 A

□ low level, minimum current 1 mA / 4 V

V AC	24/48	3 A (rms)
	240	3 A (rms)
	380	3 A (rms)
V DC	24/48	3 A
	125	0.3 A
	250	0.15 A

Auxiliaries for remote operation

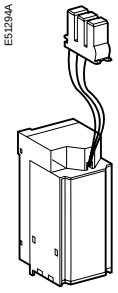

E46790A

Gear motor (MCH)

■ optional equipment, one MCH gear motor per device
■ part numbers (connectors not included, see below):
□ AC 50 / 60 Hz:
48/60: 33186
100/130: 33176
200/240: 33177
277/415: 33179
440/480: 33193 + 33179
□ DC
24/30: 33185
48/60: 33186
100/125: 33187
200/250: 33188
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ the gear motor automatically charges the spring mechanism.

■ power supply:
□ V AC 50/60 Hz: 48/60 100/130 - 200/240 - 277 400/440 - 480
□ V DC: 24/30 - 48/60 100/125 - 200/250
■ operating threshold: 0.85 to 1.1 Un
■ consumption: 180 VA or W
■ inrush current: 2 to 3 In for 0.1 second
■ charging time: 3 seconds max.
■ operating rate: maximum 3 cycles per minute
■ CH contact: see page 32.


E51294A

Opening releases MX/1 and MX/2, closing release XF

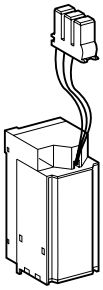
■ optional equipment, 1 or 2 MX releases per device, 1 XF per device
■ the function (MX or XF) is determined by where the coil is installed
■ part numbers (connectors not included, see below)
V AC 50/60 Hz, V DC:
□ standard version:
12 DC: 33658
24/30 AC/DC: 33659
48/60 AC/DC: 33660
100/130 AC/DC: 33661
200/250 AC/DC: 33662
240/277 AC: 33663
380/480 AC: 33664
500/550 AC: 33665
□ communicating version (with COM option):
12 DC: 33032
24/30 AC/DC: 33033
48/60 AC/DC: 33034
100/130 AC/DC: 33035
200/250 AC/DC: 33036
240/277 AC: 33037
380/480 AC: 33038
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ the MX release instantaneously opens the circuit breaker when energised
■ the XF release instantaneously closes the circuit breaker when energised, if the device is "ready to close".

■ power supply:
□ V AC 50 / 60 Hz: 24 48 - 100/130 - 200/250 240/277 - 380/480 500/550
□ V DC: 12 - 24/30 48/60 - 100/130 200/250
■ operating threshold:
□ XF: 0.85 to 1.1 Un
□ MX: 0.7 to 1.1 Un
■ consumption:
□ pick-up: 200 VA or W (80 ms)
□ hold: 4.5 VA or W
■ circuit-breaker response time at Un:
□ XF: 55 ms ± 10
□ MX: 50 ms ± 10.

Auxiliaries for remote operation

E51294A



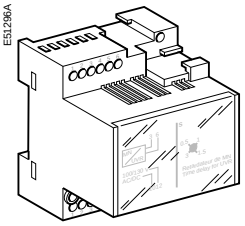
Instantaneous undervoltage releases (MN)

■ optional equipment, 1 MN per device
■ not compatible with the MX/2 opening release
■ part numbers (connectors not included, see below)
V AC 50/60 Hz, V DC:
24/30 AC/DC: 33668
48/60 AC/DC: 33669
100/130 AC/DC: 33670
200/250 AC/DC: 33671
380/480 AC: 33673
500/550 AC: 33674
■ part numbers for connectors:
□ for fixed device: 47074
□ for drawout device: 33098.

■ the MN release instantaneously opens the circuit breaker when its supply voltage drops.

■ power supply:
□ V AC 50/60 Hz: 24/48 100/130 - 200/250 240/277 - 380/480 500/550
□ V DC: 24/30 - 48/60 100/130 - 200/250
■ operating threshold:
□ opening: 0.35 to 0.7 Un
□ closing: 0.85 Un
■ consumption:
□ pick-up: 200 VA or W (80 ms)
□ hold: 4.5 VA or W
■ circuit-breaker response time at Un:
40 ms ± 10.

E51296A



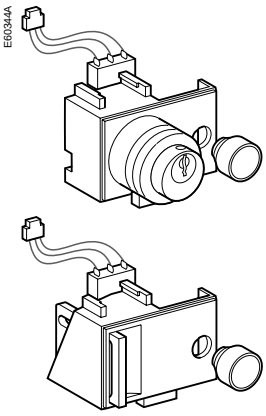
Delay unit for MN releases

■ optional equipment, 1 MN with delay unit per device
■ delay-unit part numbers
V AC 50/60 Hz, V DC:
□ non adjustable:
100/130 AC/DC: 33684
200/250 AC/DC: 33685
□ adjustable:
48/60 AC/DC: 33680
100/130 AC/DC: 33681
200/250 AC/DC: 33682
380/480 AC/DC: 33683.

■ the unit delays operation of the MN release to eliminate circuit-breaker nuisance tripping during short voltage dips
■ the unit is wired in series with the MN and must be installed outside the circuit breaker.

■ power supply V AC 50/60 Hz, V DC:
□ non adjustable:
100/130 - 200/250
□ adjustable:
48/60 - 100/130
200/250 - 380/480
■ operating threshold:
□ opening: 0.35 to 0.7 Un
□ closing: 0.85 Un
■ consumption:
□ pick-up: 200 VA or W (80 ms)
□ hold: 4.5 VA or W
■ circuit-breaker response time at Un:
□ non adjustable:
0.25 second
□ adjustable: 0.5 - 0.9 - 1.5 - 3 seconds.

E60344A



Electrical closing pushbutton (BPFE)

■ optional equipment, 1 BPFE per device
■ part number: 47512.

■ located on the padlock or keylock locking system, this pushbutton carries out electrical closing of the circuit breaker via the XF release, taking into account all the safety functions that are part of the control/monitoring system of the installation
■ it connects to the input of the COM option.

Wiring of control auxiliaries

Under pick-up conditions, the level of consumption is approximately 150 to 200 VA. Consequently, for low supply voltages (12, 24, 48 V), cables must not exceed a maximum length determined by the supply voltage and the cross-section of the cables.

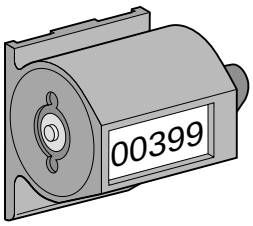
Indicative values for maximum cable lengths (in meters)

		12 V		24 V		48 V	
		2.5 mm²	1.5 mm²	2.5 mm²	1.5 mm²	2.5 mm²	1.5 mm²
MN	100% source voltage	—	—	58	36	280	165
	85% source voltage	—	—	16	10	75	45
MX / XF	100% source voltage	21	12	115	70	550	330
	85% source voltage	10	6	75	44	350	210

***Note**. The indicated length is that for each of the two supply wires.*

Device mechanical accessories

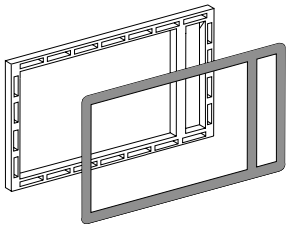
E47341A



Operation counter (CDM)

- optional equipment, one CDM per device
- part number: 33895.
- the operation counter sums the number of operating cycles.

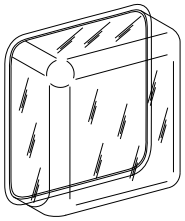
E60499A



Escutcheon (CDP)

- optional equipment, one CDP per device
- part numbers:
  - for fixed device: 33718
  - for drawout device: 33857.
- the CDP increases the degree of protection to IP 40 and IK 07 (fixed and drawout devices).

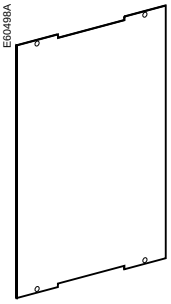
E60497A



Transparent cover (CCP)

- optional equipment, one CCP per device equipped with a CDP
- part number: 38859 (for drawout devices).
- mounted with a CDP, the CCP increases the degree of protection to IP 54 and IK 10 (fixed and drawout devices).

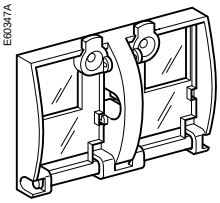
E60498A



Blanking plate (OP)

- optional equipment, one OP per device
- part number: 38858.
- used with the escutcheon, this option closes off the door cut-out of a cubicle not yet equipped with a device. It may be used with the escutcheon for both fixed and drawout devices.

E60347A

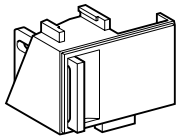


Transparent cover for pushbutton locking using a padlock, lead seal or screws

■ optional equipment, one locking cover per device
■ part number: 33897.

■ the transparent cover blocks access (together or separately) to the pushbuttons used to open and close the device
■ locking requires a padlock, a lead seal or two screws.

E60346A

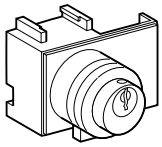


Device locking in the OFF position using a padlock

■ optional equipment, one locking system per device
■ part number: 47514.

■ the unit inhibits local or remote closing of the device
■ up to three padlocks may be used for locking.

E60348A



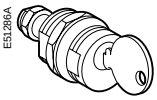
Device OFF position locking kit for keylocks

■ optional equipment: one locking kit (without keylock) per device
■ part numbers:
□ for Profalux keylocks: 47515
□ for Ronis keylocks: 47516
□ for Castell keylocks: 47517
□ for Kirk keylocks: 47518.
■ optional equipment, one locking system per device.

■ the kit inhibits local or remote closing of the device
■ mounted on the chassis and accessible with the door closed, this system locks the circuit breaker in "disconnected" position using one or two keylocks.

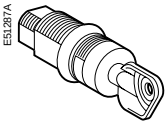
Ronis

E51286A



Profalux

E51287A

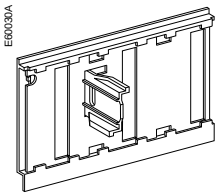


Keylocks required for the device OFF position locking kit

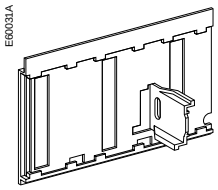
■ one or two keylocks per locking kit
■ part numbers:
□ Ronis:
1 keylock: 41940
□ Profalux:
1 keylock: 42888.

Chassis accessories

Top shutter closed



Bottom shutter closed



Safety shutters

■ optional equipment
■ part numbers (set of shutters for top and bottom) drawout, front/rear connection:
□ 3 poles: 33765
□ 4 poles: 33766.

■ mounted on the chassis, the safety shutters automatically block access to the disconnecting contact cluster when the device is in the "disconnected" or "test" positions.

■ IP 20 for chassis connections
■ IP 40 for the disconnecting contact cluster.

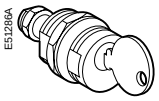
If specified when ordering the chassis, this locking function may be adapted to operate in all positions ("connected", "test" and "disconnected"), instead of in "disconnected" position alone.

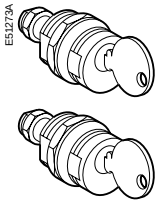
Circuit breaker locking in "disconnected" position

■ optional equipment, one locking system per device
■ part numbers (keylocks not included):
□ for Profalux keylocks: 33769
□ for Ronis keylocks: 33770
□ for Castell keylocks: 33771
□ for Kirk keylocks: 33772.

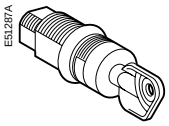
■ mounted on the chassis and accessible with the door closed, this system locks the circuit breaker in "disconnected" position using one or two keylocks.

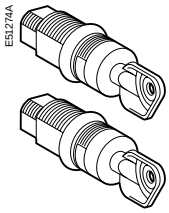
Ronis





Profalux



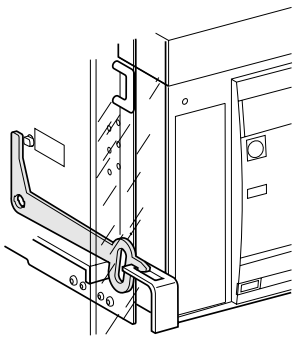


Keylocks required with the "disconnected" position locking system

■ one or two keylocks per locking system
■ part numbers:
□ Ronis:
1 keylock: 41940
1 keylock + one identical keylock: 41950
2 different key locks:
2 x 41940
□ Profalux:
1 keylock: 42888
1 keylock + one identical keylock: 42878
2 different key locks:
2 x 42888.

Chassis accessories

E60011A



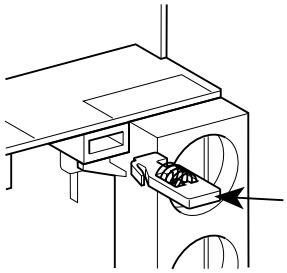
Door interlock

■ optional equipment, one door interlock per chassis
■ part number: 33172.

■ this device inhibits opening of the cubicle door when the circuit breaker is in "connected" or "test" position.

■ it may be mounted on the left or right-hand side of the chassis.

E51498A



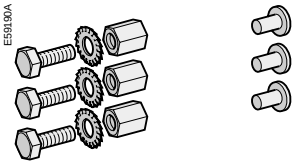
Racking interlock

■ optional equipment, one racking interlock per chassis
■ part number: 33788.

■ this device prevents insertion of the racking handle when the cubicle door is open.

■ it is mounted on the right-hand side of the chassis.

E59190A

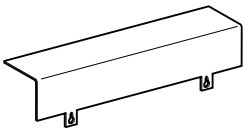


Mismatch protection

■ optional equipment, one mismatch protection device per chassis
■ part number: 33767.

■ mismatch protection offers twenty different combinations that the user may select to ensure that only a compatible circuit breaker is mounted on a given chassis.

E60345A

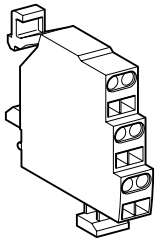


Auxiliary terminal shield (CB)

■ optional equipment, one CB shield per chassis
■ part numbers:
3 poles: 33763
4 poles: 33764.

■ the shield prevents access to the terminal block of the electrical auxiliaries.

E48095A



"Connected", "disconnected" and "test" position carriage switches (CE, CD, CT)

■ optional equipment, one to six carriage switches
■ standard configuration, 0 to 3 CE, 0 to 2 CD, 0 to 1 CT
■ part numbers:
□ standard: 33170
□ low level: 33171.

■ the carriage switches indicate the three positions:
CE: connected position
CD: disconnected position (when the minimum isolation distance between the main contacts and the auxiliary contacts is reached)
CT: test position.

■ changeover contact
■ breaking capacity at cos φ = 0.3 (AC12 / DC12 as per 947-5-1)
□ standard, minimum current 10 mA / 24 V

V AC	240	8 A (rms)
	380	8 A (rms)
	480	8 A (rms)
	690	6 A (rms)
V DC	24/48	2.5 A
	125	0.8 A
	250	0.3 A

□ low level, minimum current 1 mA / 4 V

V AC	24/48	5 A (rms)
	240	5 A (rms)
	380	5 A (rms)
V DC	24/48	2.5 A
	125	0.8 A
	250	0.3 A

Initial tests
Procedure

These operations must be carried out in particular before using a Masterpact device for the first time.

A general check of the circuit breaker takes only a few minutes and avoids any risk of mistakes due to errors or negligence.
A general check must be carried out:
- prior to initial use
- following an extended period during which the circuit breaker is not used.

A check must be carried out with the entire switchboard de-energised.
In switchboards with compartments, only those compartments that may be accessed by the operators must be de-energised.

Electrical tests

Insulation and dielectric-withstand tests must be carried out immediately after delivery of the switchboard. These tests are precisely defined by international standards and must be directed and carried out by a qualified expert.

Prior to running the tests, it is absolutely necessary to:
- disconnect all the electrical auxiliaries of the circuit breaker (MCH, MX, XF, MN, Res electrical remote reset)
- remove the long-time rating plug on the 7.0 A, 5.0 P, 6.0 P, 7.0 P, 5.0 H, 6.0 H, 7.0 H control units. Removal of the rating plug disconnects the voltage measurement input.

Switchboard inspection

Check that the circuit breakers are installed in a clean environment, free of any installation scrap or items (tools, electrical wires, broken parts or shreds, metal objects, etc.).

Conformity with the installation diagram

Check that the devices conform with the installation diagram:
- breaking capacities indicated on the rating plates
- identification of the control unit (type, rating)
- presence of any optional functions (remote ON/OFF with motor mechanism, auxiliaries, measurement and indication modules, etc.)
- protection settings (long time, short time, instantaneous, earth fault)
- identification of the protected circuit marked on the front of each circuit breaker.

Condition of connections and auxiliaries

Check device mounting in the switchboard and the tightness of power connections.
Check that all auxiliaries and accessories are correctly installed:
- electrical auxiliaries
- terminal blocks
- connections of auxiliary circuits.

Operation

Check the mechanical operation of the circuit breakers:
- opening of contacts
- closing of contacts.

Check on the control unit

Check the control unit of each circuit breaker using the respective user manuals.

What to do when the circuit breaker trips

Note the fault

Faults are signalled locally and remotely by the indicators and auxiliary contacts installed on circuit breakers (depending on each configuration). See page 12 in this manual and the user manual of the control unit for information on the fault indications available with your circuit breaker.

Identify the cause of tripping

A circuit must never be reclosed (locally or remotely) before the cause of the fault has been identified and cleared.

A fault may have a number of causes:

- depending on the type of control unit, fault diagnostics are available. See the user manual for the control unit.
- depending on the type of fault and the criticality of the loads, a number of precautionary measures must be taken, in particular the insulation and dielectric tests on a part of or the entire installation. These checks and test must be directed and carried out by qualified personnel.

Inspect the circuit breaker following a short-circuit

- check the arc chutes (see page 43)
- check the contacts (see page 43)
- check the tightness of connections (see the device installation manual)
- check the disconnecting-contact clusters (see page 43).

Reset the circuit breaker

The circuit breaker can be reset locally or remotely. See page 12 in this manual for information on how the circuit breaker can be reset.

Recommended maintenance program

Recommended program for devices used under normal operating conditions:
Ambient temperature: -5 °C / +70 °C
Normal atmosphere

Periodic inspections required

Interval	Operation	Procedure
each year	■ open and close the device locally and remotely, successively using the various auxiliaries	□ see pages 10 and 11
	■ test the operating sequences	□ see pages 10 and 11
	■ test the control unit using the mini test kit	□ see the user manual of the control unit
every two years or when the control-unit maintenance indicator reaches 100	■ check the arc chutes	□ see page 43
	■ check the main contacts	□ see page 43
	■ check the tightness of connections	□ see the device installation manual

Parts requiring replacement, depending on the number of operating cycles

The following parts must be replaced periodically to lengthen the service life of the device (maximum number of operating cycles).

Part	Intervening entity	Description or procedure
arc chutes	■ user	□ see page 43
main contacts	■ inspection: user ■ replacement: Schneider After Sales Support	□ see page 43
MCH gear motor	■ user	□ see page 9
mechanical interlocks	■ user	
connecting-rod springs	■ Schneider After Sales Support	
MX/MN/XF	■ user	□ see pages 10 and 11

Part replacement must be programmed on the basis of the data below, listing the service life of the various parts in numbers of O/C cycles at the rated current.

Number of O/C cycles at the rated current

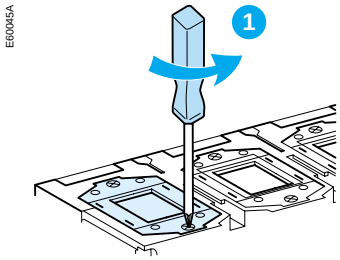
Type of circuit breaker	Maximum service life	Service life of various parts		
		Arc chutes, main contacts	Connecting-rod springs, MCH, interlocking systems	MX / XF / MN releases
NT08 to 10 type H1	25000	440 V: 6000 690 V: 3000	12500	12500
NT12 type H1	25000	440 V: 6000 690 V: 2000	12500	12500
NT16 type H1	25000	440 V: 3000 690 V: 1000	12500	12500
NT08 to 10 type L1	25000	440 V: 3000 690 V: 2000	12500	12500

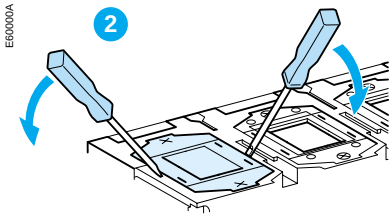
Maintenance operations

Before undertaking any maintenance work, de-energise the installation and fit locks or warnings in compliance with all applicable safety standards.

Arc chutes

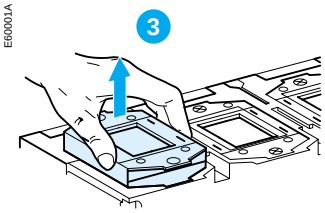
■ remove the fixing screws

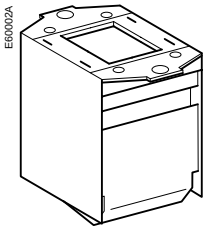




■ check the arc chutes:
□ chamber intact
□ separators not corroded.

If necessary, replace the arc chutes.





■ refit the arc chutes and secure with a tightening torque of 1.5 Nm.

If the control unit has a maintenance indicator, there is no need to systematically check the contacts.

If the contacts are worn, have the concerned poles replaced by the Schneider service centre.

Wear of main contacts

■ remove the arc chutes
■ visually check the contacts.
If necessary, contact Schneider After-sales support.

Disconnecting-contact clusters

■ grease the contacts using the grease listed on page 44, supplied by Schneider Electric
■ check the contacts as follows:
□ open the circuit breaker
□ de-energise the busbars
□ disconnect the circuit breaker
□ remove the circuit breaker
□ check the contact fingers (no sign of copper should be visible).
Replace any worn clusters.

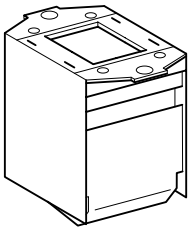
Ordering replacement parts

Electrical accessories

The electrical accessories that may require replacement are the following:
- MCH gear motor
- MX opening release(s)
- XF closing release
- MN undervoltage release.

See pages 33 and 34 in the "Auxiliaries for remote operation" section for their characteristics and part numbers.

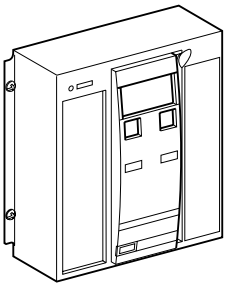
E60002A



Arc chutes

- part numbers (1 arc chute):
  - type H1: 47095
  - type L1: 47096.
- one chute per pole.

E60349A



Front

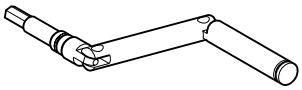
- part number: 47094.
- 1 per 3- or 4-pole device.

E60496A

Charging handle

- part number (1 handle): 47092.
- 1 per device.

E53336A



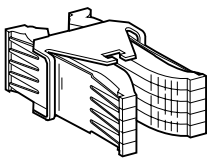
Crank

- part number (1 crank): 47098.
- 1 per device.

Support for MX / XF / MN releases

- part number: 47093.
- 1 per device.

E46237A



Disconnecting-contact clusters

- part number (1 cluster): 33166.

Grease for disconnecting-contact clusters

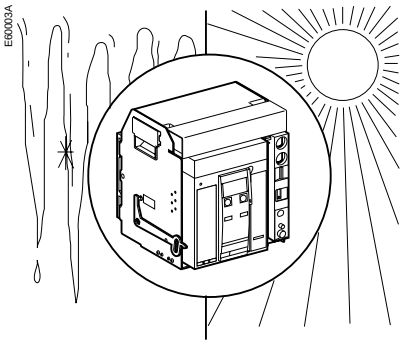
- part number (1 can): 33160.

Troubleshooting and solutions

Problem	Probable causes	Solutions
circuit breaker cannot be closed remotely or locally	■ circuit breaker padlocked or keylocked in the "open" position	□ disable the locking function
	■ circuit breaker interlocked	□ modify the situation to release the interlock
	■ circuit breaker not completely connected	□ terminate racking in (connection) of the circuit breaker
	■ pushbutton indicator signalling a fault trip has not been reset	□ reset the pushbutton indicator
	■ circuit breaker not charged (spring mechanism)	□ if the circuit breaker is not equipped with an MCH gear motor, charge it manually □ if it is equipped with an MCH gear motor, check the supply of power to the motor
	■ MX shunt release supplied with power	□ there is an opening order. Determine the origin of the order. The order must be cancelled before the circuit breaker can be closed.
	■ MN undervoltage release activated	□ there is an opening order. Determine the origin of the order. □ check the voltage and the supply circuit (U > 0.85 Un)
	■ the XF closing release continuously supplied with power, but circuit breaker not "ready to close" (XF not wired in series with PF contact)	□ cut the supply of power to the XF closing release, then send the closing order again via the XF, but only if the circuit breaker is "ready to close"
circuit breaker cannot be closed remotely, can be opened locally using the closing pushbutton	■ XF closing release not supplied with enough power	□ check the voltage and the supply circuit (U > 0.85 Un)
unexpected tripping (pushbutton indicator signalling a fault trip not activated)	■ MN undervoltage release supply voltage too low	□ check the voltage and the supply circuit (U > 0.85 Un)
	■ load-shedding order sent by another device	□ check the overall load on the distribution system □ if necessary, modify the settings of devices in the installation
	■ untimely opening order from the MX shunt release	□ determine the origin of the order
unexpected tripping (pushbutton indicator signalling a fault trip activated)	■ overload ■ earth fault ■ short-circuit	□ determine and clear the causes of the fault □ check the condition of the Masterpact device before putting it back into service
instantaneous opening after each attempt to close the circuit breaker (indicated by the pushbutton indicator signalling a fault trip)	■ thermal memory	□ see the user manual of the control unit □ reset the pushbutton
	■ transient overcurrent when closing	□ modify the distribution system or the control-unit settings □ check the condition of the Masterpact device before putting it back into service □ reset the pushbutton
	■ closing on a short-circuit	□ clear the fault □ check the condition of the Masterpact device before putting it back into service □ reset the pushbutton
circuit breaker cannot be opened remotely, can be opened locally	■ opening order not executed by the MX shunt release	□ check the voltage and the supply circuit (U > 0.85 Un)
	■ opening order not executed by the MN undervoltage release	□ drop in voltage insufficient or residual voltage (> 0.35 Un) across the terminals of the undervoltage release
circuit breaker cannot be recharged electrically, can be charged manually	■ insufficient supply voltage for the MCH gear motor	□ check the voltage and the supply circuit (U > 0.85 Un)
nuisance tripping of the circuit breaker (with pushbutton indicator signalling a fault trip)	■ reset pushbutton indicator not pushed-in completely	□ push in completely the reset pushbutton indicator

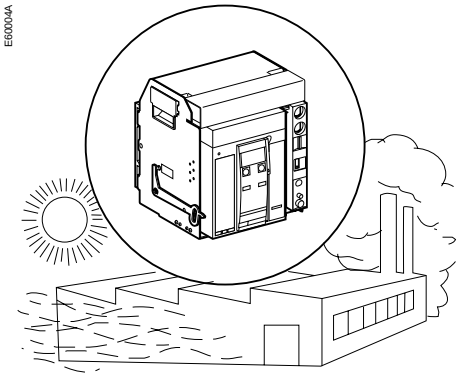
Problem	Probable causes	Solutions
circuit breaker cannot be disconnected (racked out): impossible to insert the crank	■ chassis locking or racking interlock function enabled	□ disable the locking function
circuit breaker cannot be disconnected (racked out): operation impossible	■ the reset button has not been pressed	□ press the reset button
circuit breaker cannot be removed from chassis	■ circuit breaker not in disconnected position	□ turn the crank until the circuit breaker is in disconnected position and the reset button out
	■ the rails are not completely out	□ pull the rails out completely
circuit breaker cannot be connected (racked in)	■ mismatch protection	□ check that the chassis corresponds with the circuit breaker
	■ the safety shutters are locked	□ remove the lock(s)
	■ the disconnecting-contact clusters are incorrectly positioned	□ reposition the clusters
	■ chassis locking enabled	□ disable the chassis locking function
	■ the reset button has not been pressed	□ press the reset button
	■ the circuit breaker is not sufficiently inserted	□ insert the circuit breaker completely so that it is engaged in the racking mechanism
circuit breaker cannot be locked in disconnected position	■ the circuit breaker is not in the right position	□ check the circuit breaker position by making sure the reset button is out
	■ the crank is still in the chassis	□ remove the crank and store it
circuit breaker cannot be locked in connected, test or disconnected position	■ check that the right types of locks have been installed	□ contact our service centre
	■ the circuit breaker is not in the right position	□ check the circuit breaker position by making sure the reset button is out
	■ the crank is still in the chassis	□ remove the crank and store it

Checking Masterpact operating conditions


E60003A

Ambient temperature

Masterpact NT devices can operate under the following temperature conditions:
- the electrical and mechanical characteristics are stipulated for an ambient temperature of -5 °C to +70 °C
- circuit-breaker closing is guaranteed down to -35 °C
- Masterpact NW (without the control unit) can be stored in an ambient temperature of -40 °C to +85 °C
- the control unit can be stored in an ambient temperature of -25 °C to +85 °C.

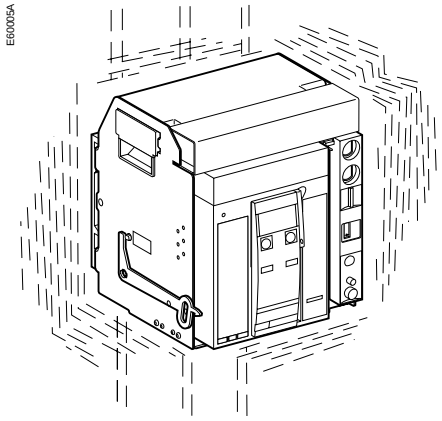

E60004A

Extreme atmospheric conditions

Masterpact NT devices have successfully passed the tests defined by the following standards for extreme atmospheric conditions:
- IEC 68-2-1: dry cold at -55 °C
- IEC 68-2-2: dry heat at +85 °C
- IEC 68-2-30: damp heat (temperature +55 °C, relative humidity 95%)
- IEC 68-2-52 level 2: salt mist.

Masterpact NT devices can operate in the industrial environments defined by standard IEC 947 (pollution degree up to 4).

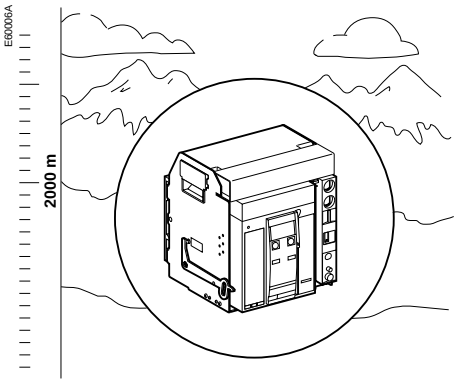
It is nonetheless advised to check that the devices are installed in suitably cooled switchboards without excessive dust.


E60005A

Vibrations

Masterpact NT devices resist electromagnetic or mechanical vibrations.
Tests are carried out in compliance with standard IEC 68-2-6 for the levels required by merchant-marine inspection organisations (Veritas, Lloyd's, etc.):
- 2 to 13.2 Hz: amplitude ±1 mm
- 13.2 to 100 Hz: constant acceleration 0.7 g.

Excessive vibration may cause tripping, breaks in connections or damage to mechanical parts.

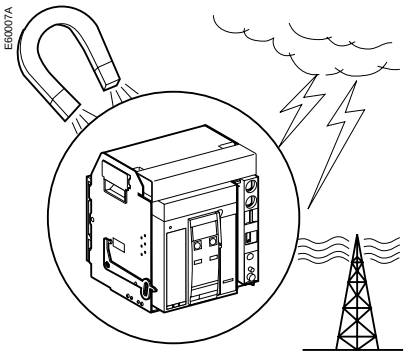


Altitude

Masterpact NT devices are designed for operation at altitudes under 2000 metres.

At altitudes higher than 2000 metres, the modifications in the ambient air (electrical resistance, cooling capacity) lower the following characteristics.

altitude (m)	2000	3000	4000	5000
dielectric withstand voltage (V)	3500	3150	2500	2100
rated insulation level (V)	1000	900	700	600
rated operational voltage (V)	690	590	520	460
rated current (A) at 40 °C	1 x In	0.99 x In	0.96 x In	0.94 x In



Electromagnetic disturbances

Masterpact NT devices are protected against:
- overvoltages caused by devices that generate electromagnetic disturbances
- overvoltages caused by an atmospheric disturbance or by a distribution-system outage (e.g. failure of a lighting system)
- devices emitting radio waves (radios, walkie-talkies, radar, etc.)
- electrostatic discharges produced by users.

Masterpact NT devices have successfully passed the electromagnetic-compatibility tests (EMC) defined by the following international standards:
- IEC 947-2, appendix F
- IEC 947-2, appendix B (trip units with earth-leakage function).

The above tests guarantee that:
- no nuisance tripping occurs
- tripping times are respected.

Schneider Electric Industries SA

5, rue Nadar
92506 Rueil-Malmaison Cedex France
Te l : +33 (0)1 41 29 82 00
Fax : +33 (0)1 47 51 80 20

http://www.schneiderelectric.com

This document has been printed on ecological paper.

Designed by: HeadLines
Printed by:

Low Voltage

Compact NSX

Circuit breakers and switch disconnectors
Measurement and communication
From 100 to 630A

Catalogue
2008

Schneider Electric

Contents

Compact NSX

Next-generation circuit breakers

Today, next-generation Compact NSX circuit breakers provide an intelligent outlook and set the standards of tomorrow. A power monitoring unit enhances their invariably impeccable protective functions. For the first time, users can monitor both energy and power, offering new performance in a remarkably compact device.

Compactness, discrimination and modularity – all of the features which defined the success of the Compact NS generation of circuit breakers combined with new functions for safe, easy monitoring and management of installations.

The new range of Compact NSX circuit breakers stands out from the crowd, thanks to its electronic intelligence. Through direct access to in-depth information, and networking via open protocols, Compact NSX lets operators optimise the management of their electrical installations.

Far more than a circuit breaker, Compact NSX is a measurement and communication tool ready to meet energy-efficiency needs through optimised energy consumption, increased energy availability, and improved installation management.

Safety and performance

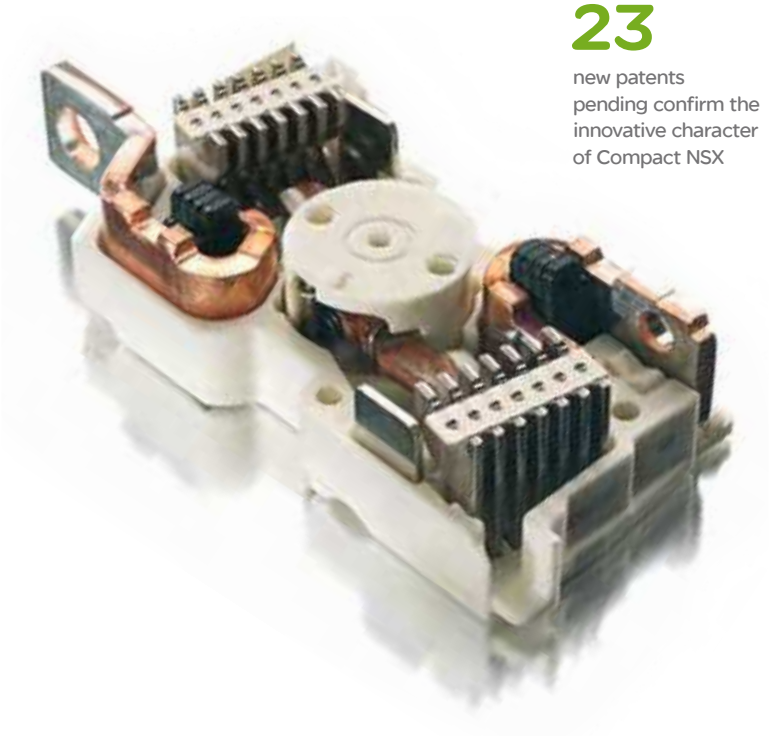
Compactness, discrimination and modularity – new Compact NSX circuit breakers incorporate advanced monitoring and communication functions, from 40 amps up, combined with impeccable protection.

Expert technology

A roto-active contact breaking principle provides each circuit breaker with very high breaking capacity in a very small device, remarkable fault current limitation performance, and endurance.

> Compact NSX benefits from a patented double roto-active contact breaking concept, together with a reflex tripping system for ultimate breaking.

> Exceptional fault current limitation guarantees robust, reliable protection and, above all, reduces the causes of component aging, thus extending service life for installations.



23

new patents pending confirm the innovative character of Compact NSX

New breaking capacities

New performance levels for Compact NSX improve application targeting:

> 36-50 kA – standard applications (industrial plants, buildings and hospitals),

> 70-100 kA – high performance at controlled cost,

> 150 kA – demanding applications (maritime).

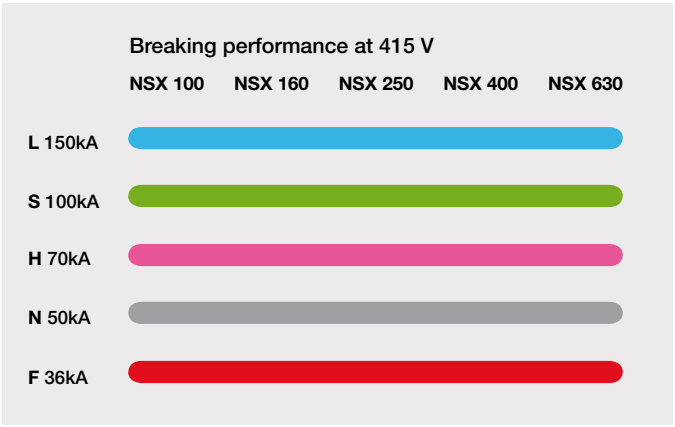
Enhanced protection for motors

Compact NSX meets the requirements of IEC 60947-4-1 standards for protection of motors:

> well adapted to motor-starting solutions up to 315 kW at 400 V, providing protection against short circuits, overloads, phase unbalance and loss,

> also enables set-up of additional protection systems for starting and braking with the motor running, reverse braking, jogging or reversing in complete safety,

> add a Schneider Electric contactor; Compact NSX complies with the requirements of so-called type 2 coordination.

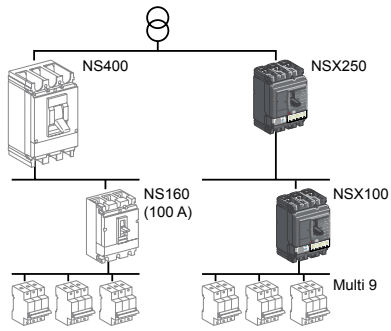


Reduced installation costs

Optimising installations allows for achieving up to 30% savings:

> considerable savings at the time of installation, thanks to total discrimination with miniature circuit breakers,

> smaller devices, more economic switchboards mean best overall installation cost, without overcalibration.



The trip units are now true circuit breaker control systems.

With the integration of electronics, trip units have gained in **speed and accuracy.**

Greater reliability and better discrimination allows more refined settings, especially for time delays.

Monitoring and management

Compact NSX is a single device, which contains a monitoring unit to control energy consumption and power.

Integrated monitoring

> The new Compact NSX range incorporates Micrologic electronic trip units in the circuit breaker, offering both:

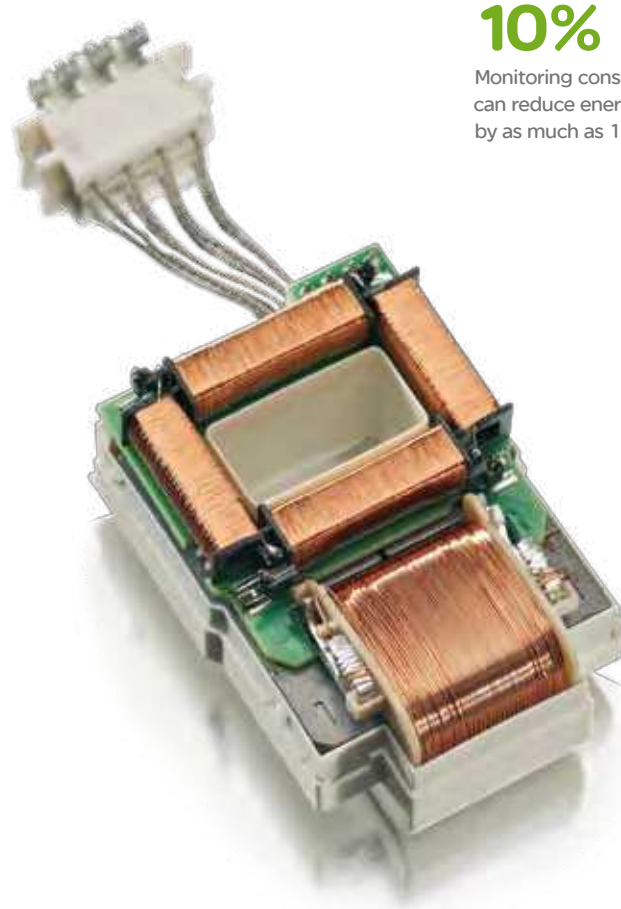
- an accurate power monitoring unit,
- a highly reliable protective device.

> A Micrologic electronic tripping device combines next-generation sensors:

- an "iron" sensor for the power supply to the electronics,
- an "air" sensor (Rogowski coils) for measurement, guaranteeing high accuracy.

> These electronic systems are designed to withstand high temperatures (105°C), ensuring reliability under severe operating conditions.

> The originality lies in how Compact NSX measures, processes and displays data, either directly on screen, on the switchboard front panel, or via a monitoring system.



10%

Monitoring consumption can reduce energy costs by as much as 10%.

Accessibility of information...

To keep costs under control and ensure service continuity, relevant information must be available in real time:

> a kilowatt-hour meter helps optimise costs and their allocation,

> harmonic distortion rate shows the quality of electrical supply,

> alarm notification secures operational control and maintenance planning,

> event logs and tables, activated continuously, ensure the installed equipment base operates correctly, so energy efficiency is maximized.

...for power monitoring

> Together with power monitoring software (e.g., PowerLogic), the Compact NSX Modbus communication interface provides operators with a parameter set and tools that make system monitoring very easy.

> Operators have real-time data to control energy availability, to monitor power supply quality, to optimise consumption of different applications or zones, reducing load peaks and continuously supplying priority loads, and to draw up maintenance schedules.

> A software utility (RSU) allows protection and alarm configuration, in addition to testing communications with all installed devices.

Monitoring software PowerLogic ION-E

ASIC

Measurement functions are controlled by an additional microprocessor.

Protection functions are electronically managed independently of measurement functions.

An ASIC (Application-Specific Integrated Circuit) is common to all trip units, which boosts immunity to conducted or radiated interference and increases reliability.

Simplicity

Compact NSX takes the principles of easy installation and use – which made its predecessor so successful – to a higher level.

Simple in design

Compact NSX is mounted and wired reusing the same measurements as Compact NS.

Cut-outs are the same whatever the type of handle. Engineering drawings are the same, so installation and connection layouts can be used on new projects, simplifying extensions or retrofits, and reducing maintenance costs.

Integration in help software, for parameter settings and switchboard installation, further eases design.

Simple to install

> A transparent lead-sealable cover protects access to tripping device switches and prevents settings from being changed.

> The new electrical control adjustment also has a transparent lead- sealable cover to prevent it from being operated accidentally.

> Compact NSX has an optional functional terminal shield that offers excellent protection against direct contact (IP40 on all sides, IP20 at cable entry points) and easy installation.

> All Compact NSX devices can be equipped with a communication function via a pre-wired connection with a Modbus interface module. When the Modbus address is declared, the Compact NSX device is integrated into the network.

> There are four levels of functionalities:

- communication of device status: On/Off position, trip indication and fault-trip indication,
- communication of commands: open, close, and reset,
- communication of measurements: mainly I, U, f, P, E, and THD,
- communication of operating assistance data: settings, parameters, alarms, histograms and event tables, and maintenance indicators.

> The switchboard "plug & play" display unit connects to the trip unit without any special settings or configuration. A cable fitted with an RJ45 connector allows for easy integration with communications networking.

Simple to use

> Users customise time-stamped alarms for all parameters, assign them to indicator lights, choose display priorities, and configure time delay thresholds and modes.

> Event logs and tables are continuously-activated. Providing a wealth of information, they enable users to ensure that the installed equipment base operates correctly, to optimize settings, and to maximise energy efficiency.

> Local and remote displays offer easy access to operators and provide the main electrical values: I, U, V, f, energy, power, total harmonic distortion, etc. The user-friendly switchboard display unit with intuitive navigation is more comfortable to read, and offers quick access to information.

Performance, yet unimposing.
Compact NSX perfectly blends into its environment.

Attractively designed.
The front of Compact NSX circuit breakers has an attractive curved profile.
Measurements are easy to read on a backlit LCD display.
Screen navigation is intuitive and settings are simplified by immediate readouts in amps.

Service continuity

Compact NSX makes discrimination its main advantage in minimising the impact of short circuits, ensuring service continuity for installations.

Total discrimination

Thanks to its 30 years of experience, Schneider Electric, with Compact NSX, offers perfect mastery of discrimination for ever more reliable service continuity. Compact NSX circuit breakers strongly limit fault currents, occurring as the result of short-circuits, which reduces installation downtime and avoids over-dimensioning cables. When several circuit breakers are used in series, the downstream circuit breaker trips as close as possible to the fault, isolating only the circuit concerned. The upstream circuit breaker is not affected and allows the other circuits to remain operational.

Service continuity

Adding an SDTAM module allows remote indication of motor overloads and actuation of a contactor, ensuring total service continuity:

> the SDTAM switches the contactor instead of tripping the circuit breaker,

> the module allows for machine restart directly from the contactor without having to operate circuit breakers.

Preventive maintenance

Maintenance indicators provide information on the number of operations, level of wear on contacts and total load rates. This makes it far easier to monitor equipment ageing and optimise investments over time. Maintenance is now preventive, avoiding faults.

100%
service continuity

Direct access to maintenance indicators

Schneider Electric expertise

Schneider Electric commits to reducing energy costs and CO2 emissions for its customers. It offers products, solutions and services that integrate with all levels of the energy value chain. Compact NSX is part and parcel of the Schneider Electric energy efficiency approach.

Solutions for the future

With Compact NSX, Schneider Electric works through flexible solutions for commercial and industrial buildings, Schneider Electric commits to help customers gradually move towards an active approach to their energy efficiency. It helps get more return from investments and future design solutions.

Up to **30%**
savings in energy costs

4 steps

> Diagnostics
> Proposals
> Implementation
> Follow-up

Energy performance contracts

An energy performance contract offers innovative service to modernise technical installations.

The objective is dramatically to reduce energy costs, whilst improving comfort and safety, all in an environmentally-responsible way.

Environmentally responsible

Schneider Electric meets the expectations of its markets with products adapted to the practices of the 190 countries where it is present and strongly commits to respect the norms and directives of each of those countries.

- Compact NSX, like all the products in its LV ranges, is a product designed to comply with all European directives for the environment. It has also received international certifications and approval from independent agencies.
- In compliance with ISO 14001 standards, all of its factories are nonpolluting.
- Designed for easy disassembly and recycling at end of life, Compact NSX complies with environmental directives RoHS* and WEEE**.

* RoHS = Restriction of Hazardous Substances

** WEEE = Waste Electrical and Electronic Equipment

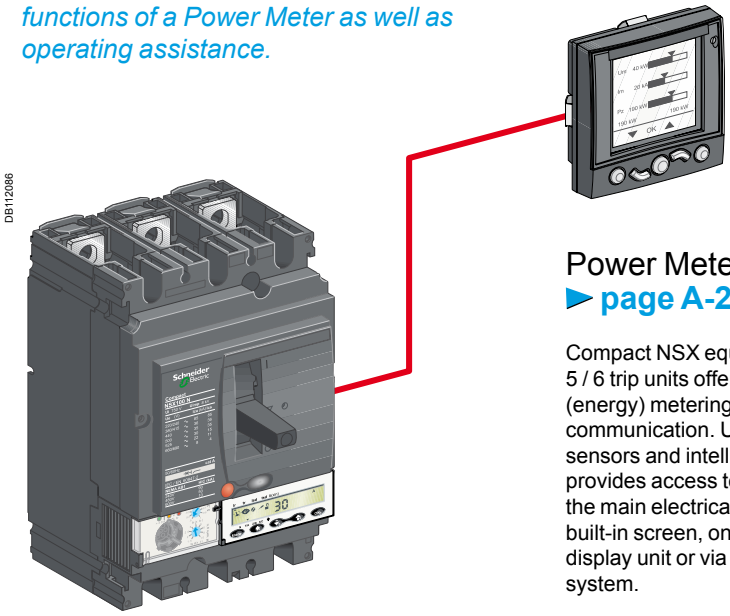
Protection, measurement and communication...

Functions and characteristics

Introduction
Overview of applications

Functions

Compact NSX100 to 630 offers high performance and a wide range of interchangeable trip units to protect most applications. Electronic versions provide highly accurate protection with wide setting ranges and can integrate measurement, metering and communication functions. They can be combined with the FDM121 switchboard display unit to provide all the functions of a Power Meter as well as operating assistance.



Power Meter
► page A-20

Compact NSX equipped with Micrologic 5 / 6 trip units offer type A (ammeter) or E (energy) metering functions as well as communication. Using Micrologic sensors and intelligence, Compact NSX provides access to measurements of all the main electrical parameters on the built-in screen, on a dedicated FDM121 display unit or via the communication system.

Operating assistance
► page A-22

Integration of measurement functions provides operators with operating assistance functions including alarms tripped by user-selected measurement values, time-stamped event tables and histories, and maintenance indicators.

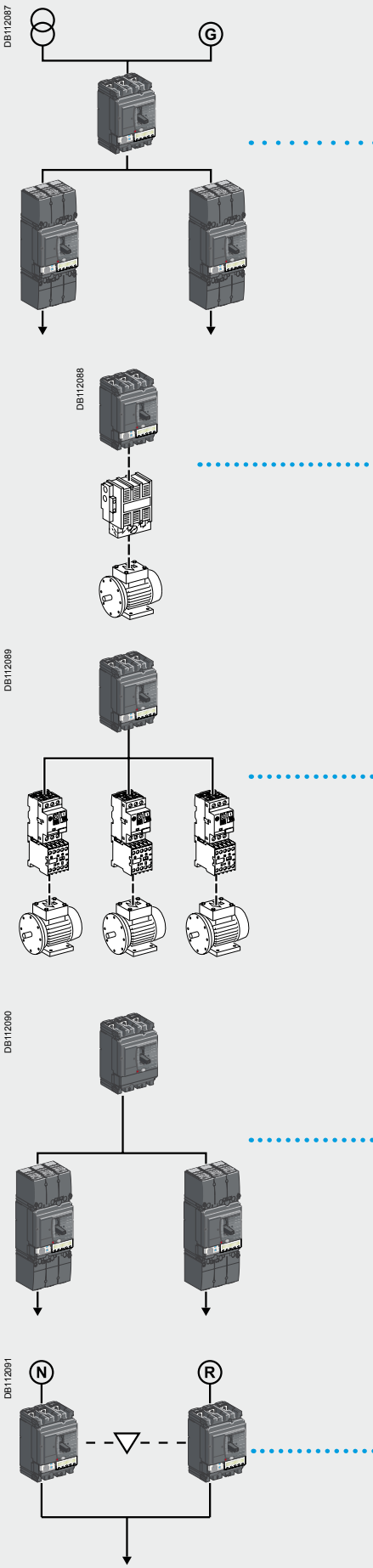
Switchboard display unit
► page A-24

The main measurements can be read on the built-in screen of Micrologic 5 / 6 trip units.
They can also be displayed on the FDM121 switchboard display unit along with pop-up windows signalling the main alarms.

Communication
► page A-26

Compact NSX equipped with Micrologic 5 / 6 trip units provide communication capabilities. Simple RJ45 cords connect to a Modbus interface module.

Applications



Protection of distribution systems (AC 220/690 V)
► page A-14

Compact NSX devices are equipped with MA or TM thermal-magnetic trip units or Micrologic 2 / 5 / 6 electronic trip units to provide protection against short-circuits and overloads for:
- distribution systems supplied by transformers
- distribution systems supplied by engine generator sets
- long cables in IT and TN systems.

They can be easily installed at all levels in distribution systems, from the main LV switchboard to the subdistribution boards and enclosures.
All Compact NSX devices can protect against insulation faults by adding a Vigi module or Vigirex relay.

Protection of motors (AC 220/690 V)
► page A-36

The Compact NSX range includes a number of versions to protect motor applications:
- basic short-circuit protection with MA magnetic trip units or the electronic Micrologic 1-M version, combined with an external relay to provide thermal protection
- protection against overloads, short-circuits and phase unbalance or loss with Micrologic 2-M trip units
- more complete protection against overloads and short-circuits with additional motor-specific protection (phase unbalance, locked rotor, underload and long start) with Micrologic 6 E-M trip units. These versions also offer communication, metering and operating assistance.

The exceptional limiting capacity of Compact NSX circuit breakers automatically provides type-2 coordination with the motor starter, in compliance with standard IEC 60947-4-1.

Protection of special applications
► page A-48

Special applications:
The Compact NSX range offers a number of versions for special protection applications:
- service connection to public distribution systems ► page A-48
- generators ► page A-50
- industrial control panels ► page A-52

with:
- compliance with international standards IEC 60947-2 and UL 508 / CSA 22-2 N14
- compliance with US standard UL 489
- installation in universal and functional enclosures.
- 16 Hz 2/3 systems ► page A-53
- 400 Hz systems ► page A-54

For all these applications, circuit breakers in the Compact NSX range offer positive contact indication and are suitable for isolation in accordance with standards IEC 60947-1 and 2.

Control and isolation using switch-disconnectors
► page A-56

A switch-disconnector version of Compact NSX circuit breakers is available for circuit control and isolation.
All add-on functions of Compact NSX circuit breakers may be combined with the basic switch-disconnector function, including:
- earth-leakage protection
- motor mechanism
- ammeter, etc.

For information on other switch-disconnector ranges, see the Interpact (offering positive contact indication and visible break) and Fupact (fusegear) catalogues.

Source changeover systems
► page A-60

To ensure a continuous supply of power, some electrical installations are connected to two power sources:
- a normal source
- a replacement source to supply the installation when the normal source is not available.

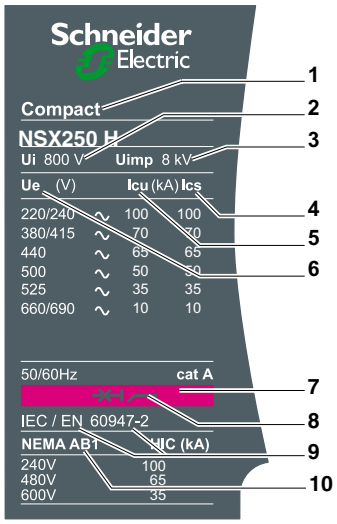
A mechanical and/or electrical interlocking system between two circuit breakers or switch-disconnectors avoids all risk of parallel connection of the sources during switching.

A source-changeover system can be:
- manual with mechanical device interlocking
- remote controlled with mechanical and/or electrical device interlocking
- automatic by adding a controller to manage switching from one source to the other on the basis of external parameters.

Introduction

General characteristics of the Compact NSX range

DB112018



Standardised characteristics indicated on the rating plate:
1 *Type of device: frame size and breaking capacity class*
2 *Ui: rated insulation voltage.*
3 *Uimp: rated impulse withstand voltage.*
4 *Ics: service breaking capacity.*
5 *Icu: ultimate breaking capacity for various values of the rated operational voltage Ue*
6 *Ue: operational voltage.*
7 *Colour label indicating the breaking capacity class.*
8 *Circuit breaker-disconnector symbol.*
9 *Reference standard.*
10 *Main standards with which the device complies.*
Note: *when the circuit breaker is equipped with an extended rotary handle, the door must be opened to access the rating plate.*

Compliance with standards

Compact NSX circuit breakers and auxiliaries comply with the following:
■ international recommendations:
□ IEC 60947-1: general rules
□ IEC 60947-2: circuit breakers
□ IEC 60947-3: switch-disconnectors
□ IEC 60947-4: contactors and motor starters
□ IEC 60947-5.1 and following: control circuit devices and switching elements; automatic control components
■ European (EN 60947-1 and EN 60947-2) and corresponding national standards:
□ France NF
□ Germany VDE
□ United Kingdom BS
□ Australia AS
□ Italy CEI
■ the specifications of the marine classification companies (Veritas, Lloyd's Register of Shipping, Det Norske Veritas, etc.), standard NF C 79-130 and recommendations issued by the CNOMO organisation for the protection of machine tools.
For U.S. UL, Canadian CSA, Mexican NOM and Japanese JIS standards, please consult us.

Pollution degree

Compact NSX circuit breakers are certified for operation in pollution-degree III environments as defined by IEC standards 60947-1 and 60664-1 (industrial environments).

Climatic withstand

Compact NSX circuit breakers have successfully passed the tests defined by the following standards for extreme atmospheric conditions:
■ IEC 60068-2-1: dry cold (-55 °C)
■ IEC 60068-2-2: dry heat (+85 °C)
■ IEC 60068-2-30: damp heat (95 % relative humidity at 55 °C)
■ IEC 60068-2-52 severity level 2: salt mist.

Environment

Compact NSX respects the European environment directive EC/2002/95 concerning the restriction of hazardous substances (RoHS).
Product environment profiles (PEP) have been prepared, describing the environmental impact of every product throughout its life cycle, from production to the end of its service life.
All Compact NSX production sites have set up an environmental management system certified ISO 14001.
Each factory monitors the impact of its production processes. Every effort is made to prevent pollution and to reduce consumption of natural resources.

Ambient temperature

■ Compact NSX circuit breakers may be used between -25 °C and +70 °C. For temperatures higher than 40°C (65°C for circuit breakers used to protect motor feeders), devices must be derated (pages B-8 and B-9).
■ Circuit breakers should be put into service under normal ambient, operating-temperature conditions. Exceptionally, the circuit breaker may be put into service when the ambient temperature is between -35 °C and -25 °C.
■ The permissible storage-temperature range for Compact NSX circuit breakers in the original packing is -50 °C (1) and +85 °C.

(1) -40 °C for Micrologic control units with an LCD screen.

Electromagnetic compatibility

Compact NSX devices are protected against:
- overvoltages caused by circuit switching (e.g. lighting circuits)
- overvoltages caused by atmospheric disturbances
- devices emitting radio waves such as mobile telephones, radios, walkie-talkies, radar, etc.
- electrostatic discharges produced by users.

Immunity levels for Compact NSX comply with the standards below.
- IEC/EN 60947-2: Low-voltage switchgear and controlgear, part 2: Circuit breakers:
  - Annex F: Immunity tests for circuit breakers with electronic protection
  - Annex B: Immunity tests for residual current protection
- IEC/EN 61000-4-2: Electrostatic-discharge immunity tests
- IEC/EN 61000-4-3: Radiated, radio-frequency, electromagnetic-field immunity tests
- IEC/EN 61000-4-4: Electrical fast transient/burst immunity tests
- IEC/EN 61000-4-5: Surge immunity tests
- IEC/EN 61000-4-6: Immunity tests for conducted disturbances induced by radio-frequency fields
- CISPR 11: Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.

Discrimination

Compact NSX reinforces the discrimination capabilities of the Compact NS range by applying the rapid calculation capacity of the Micrologic trip units.
Total discrimination is now possible between NSX100 and modular Multi 9 circuit breakers rated ⩽ 63 A (see page A-8).

PB103578-53

Suitable for isolation with positive contact indication

All Compact NSX circuit breakers are suitable for isolation as defined in IEC standard 60947-2:
- The isolation position corresponds to the O (OFF) position.
- The operating handle cannot indicate the OFF position unless the contacts are effectively open.
- Padlocks may not be installed unless the contacts are open.

Installation of a rotary handle or a motor mechanism does not alter the reliability of the position-indication system.
The isolation function is certified by tests guaranteeing:
- the mechanical reliability of the position-indication system
- the absence of leakage currents
- overvoltage withstand capacity between upstream and downstream connections.

The tripped position does not insure isolation with positive contact indication.
Only the OFF position guarantees isolation.

DB112093

Installation in class II switchboards

All Compact NSX circuit breakers are class II front face devices. They may be installed through the door of class II switchboards (as per IEC standards 61140 and 60664-1) without downgrading switchboard insulation. Installation requires no special operations, even when the circuit breaker is equipped with a rotary handle or a motor mechanism.

Degree of protection

The following indications are in accordance with standards IEC 60529 (IP degree of protection) and IEC 62262 (IK protection against external mechanical impacts).

Bare circuit breaker with terminal shields
- With toggle: IP40, IK07.
- With standard direct rotary handle / VDE: IP40 IK07

Circuit breaker installed in a switchboard
- With toggle: IP40, IK07.
- With direct rotary handle:
  - standard / VDE: IP40, IK07
  - MCC: IP43 IK07
  - CNOMO: IP54 IK08
- With extended rotary handle: IP56 IK08
- With motor mechanism: IP40 IK07.

Introduction

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

PB103354-40

Compact NSX100/160/250.

PB103279-44

Compact NSX400/630.

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

Common characteristics

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

Circuit breakers

Breaking capacity levels

Electrical characteristics as per IEC 60947-2

Rated current (A)	**In**	40 °C		
Number of poles				
Breaking capacity (kA rms)				
	Icu	AC 50/60 Hz	220/240 V	
			380/415 V	
			440 V	
			500 V	
			525 V	
			660/690 V	
Service breaking capacity (kA rms)				
	Ics	AC 50/60 Hz	220/240 V	
			380/415 V	
			440 V	
			500 V	
			525 V	
			660/690 V	
Durability (C-O cycles)		Mechanical		
		Electrical	440 V	In/2
				In
			690 V	In/2
				In

Characteristics as per Nema AB1

Breaking capacity (kA rms)	AC 50/60 Hz	240 V
		480 V
		600 V

Characteristics as per UL 508

Breaking capacity (kA rms)	AC 50/60 Hz	240 V
		480 V
		600 V

Protection and measurements

Short-circuit protection	Magnetic only	
Overload / short-circuit protection	Thermal magnetic	
	Electronic	
		with neutral protection (Off-0.5-1-OSN) (1)
		with ground-fault protection
		with zone selective interlocking (ZSI) (2)
Display / I, U, f, P, E, THD measurements / interrupted-current measurement		
Options	Power Meter display on door	
	Operating assistance	
	Counters	
	Histories and alarms	
	Metering Com	
	Device status/control Com	
Earth-leakage protection	By Vigi module	
	By Vigirex relay	

Installation / connections

Dimensions and weights

Dimensions (mm) W x H x D	Fixed, front connections	2/3P
		4P
Weight (kg)	Fixed, front connections	2/3P
		4P

Connections

Connection terminals	Pitch	With/without spreaders
Large Cu or Al cables	Cross-section	mm²

Common characteristics

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

NSX100	NSX160	NSX250	NSX400	NSX630
F N H S L	F N H S L	F N H S L	N H S L	N H S L
100	**160**	**250**	**400**	**630**
2 (3), 3, 4	2 (3), 3, 4	2 (3), 3, 4	3, 4	3, 4
85 90 100 120 150	85 90 100 120 150	85 90 100 120 150	85 100 120 150	85 100 120 150
36 50 70 100 150	36 50 70 100 150	36 50 70 100 150	50 70 100 150	50 70 100 150
35 50 65 90 130	35 50 65 90 130	35 50 65 90 130	42 65 90 130	42 65 90 130
25 36 50 65 70	30 36 50 65 70	30 36 50 65 70	30 50 65 70	30 50 65 70
22 35 35 40 50	22 35 35 40 50	22 35 35 40 50	22 35 40 50	22 35 40 50
8 10 10 15 20	8 10 10 15 20	8 10 10 15 20	10 20 25 35	10 20 25 35
85 90 100 120 150	85 90 100 120 150	85 90 100 120 150	85 100 120 150	85 100 120 150
36 50 70 100 150	36 50 70 100 150	36 50 70 100 150	50 70 100 150	50 70 100 150
35 50 65 90 130	35 50 65 90 130	35 50 65 90 130	42 65 90 130	42 65 90 130
12.5 36 50 65 70	12.5 36 50 65 70	30 36 50 65 70	30 50 65 70	30 50 65 70
11 35 35 40 50	11 35 35 40 50	22 35 35 40 50	11 11 12 12	11 11 12 12
4 10 10 15 20	4 10 10 15 20	8 10 10 15 20	10 10 12 12	10 10 12 12
50000	40000	20000	15000	15000
50000	10000	20000	12000	8000
30000	20000	10000	6000	4000
20000	15000	10000	6000	6000
10000	7500	5000	3000	2000
40 85 90 100 120 150	40 85 90 100 120 150	40 85 90 100 120 150	40 85 100 120 150	40 85 100 120 150
20 35 50 65 90 130	20 35 50 65 90 130	20 35 50 65 90 130	30 42 65 90 130	30 42 65 90 130
- 8 20 35 40 50	- 20 20 35 40 50	- 20 20 35 40 50	- 20 35 40 50	- 20 35 40 50
- 85 85 85 - -	- 85 85 85 - -	- 85 85 85 - -	85 85 85 - -	85 85 85 - -
- 25 50 65 - -	- 35 50 65 - -	- 35 50 65 - -	35 50 65 - -	35 50 65 - -
- 10 10 10 - -	- 10 10 10 - -	- 15 15 15 - -	20 20 20 - -	20 20 20 - -
■	■	■	■	■
■	■	■	-	-
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
105 x 161 x 86	105 x 161 x 86	105 x 161 x 86	140 x 225 x 110	140 x 225 x 110
140 x 161 x 86	140 x 161 x 86	140 x 161 x 86	185 x 255 x 110	185 x 255 x 110
2.05	2.2	2.4	6.05	6.2
2.4	2.6	2.8	7.90	8.13
35/45 mm	35/45 mm	35/45 mm	45/52.5 mm 45/70 mm	45/52.5 mm 45/70 mm
300	300	300	4 x 240	4 x 240

Introduction
Compact NSX trip units

With Micrologic electronic trip units, Compact NSX stands out from the crowd. Thanks to the new generation of sensors and its processing capability, protection is enhanced even further. It also provides measurements and operating information.

Thermal-magnetic or electronic trip unit?

Thermal-magnetic trip units protect against overcurrents and short-circuits using tried and true techniques. But today, installation optimisation and energy efficiency have become decisive factors and electronic trip units offering more advanced protection functions combined with measurements are better suited to these needs.
Micrologic electronic trip units combine reflex tripping and intelligent operation. Thanks to digital electronics, trip units have become faster as well as more accurate and reliable. Wide setting ranges make installation upgrades easier. Designed with processing capabilities, Micrologic trip units can provide measurement information and device operating assistance. With this information, users can avoid or deal more effectively with disturbances and can play a more active role in system operation. They can manage the installation, anticipate on events and plan any necessary servicing.

Accurate measurements for complete protection

Compact NSX devices take advantage of the vast experience acquired since the launch of Masterpact NW circuit breakers equipped with Micrologic trip units.
From 40 amperes on up to the short-circuit currents, they offer excellent measurement accuracy. This is made possible by a new generation of current transformers combining "iron-core" sensors for self-powered electronics and "air-core" sensors (Rogowski toroids) for measurements.
The protection functions are managed by an ASIC component that is independent of the measurement functions. This independence ensures immunity to conducted and radiated disturbances and a high level of reliability.

Numerous security functions

Torque-limiting screws
The screws secure the trip unit to the circuit breaker. When the correct tightening torque is reached, the screw heads break off. Optimum tightening avoids any risk of temperature rise. A torque wrench is no longer required.

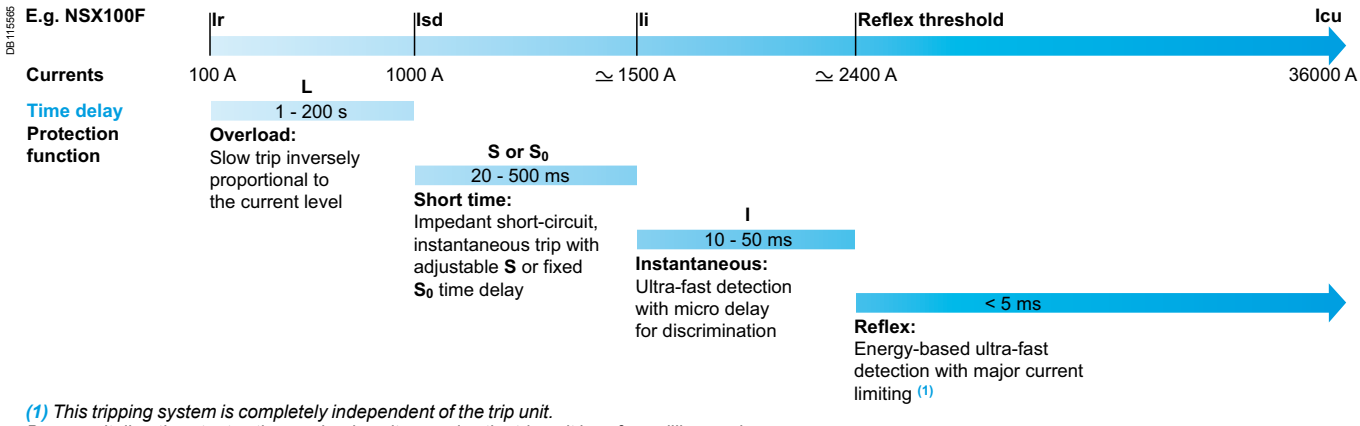
Easy and sure changing of trip units
All trip units are interchangeable, without wiring. A mechanical mismatch-protection system makes it impossible to mount a trip unit on a circuit breaker with a lower rating.

"Ready" LED for a continuous self-test
The LED on the front of the electronic trip units indicates the result of the self-test runs continuously on the measurement system and the tripping release. As long as the green LED is flashing, the links between the CTs, the processing electronics and the Mitop release are operational. The circuit breaker is ready to protect. No need for a test kit. A minimum current of 15 to 50 A, depending on the device, is required for this indication function.

A patented dual adjustment system for protection functions.
Available on Micrologic 5 / 6, the system consists of:
■ a first adjustment, under de-energised conditions and using a dial, sets the maximum value
■ a second adjustment, made via the keypad or remotely, fine-tunes the setting.
The second setting may not exceed the first. It can be read directly on the Micrologic screen, to within one ampere and a fraction of a second.

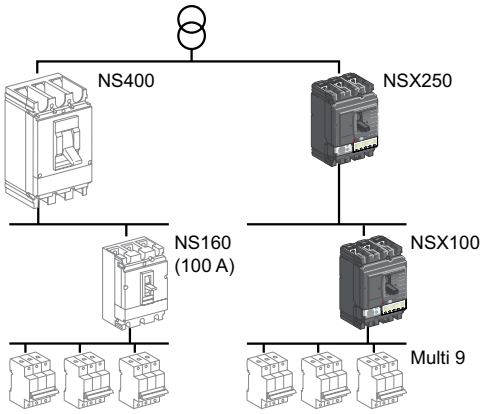
Coordinated tripping systems

Compact NSX detects faults even faster and its tripping time is reduced. It protects the installation better and limits contact wear.



(1) This tripping system is completely independent of the trip unit.
Because it directly actuates the mechanism, it precedes the trip unit by a few milliseconds.

DB111354



Compact NSX100 with Micrologic for total discrimination.*
Better coordination between protection functions reduces the difference in ratings required for total discrimination.
** Please refer to supplementary technical catalogue.*

Unmatched discrimination

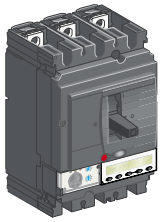
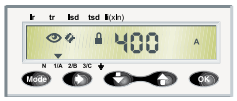
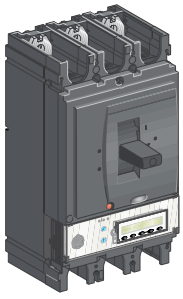
Discrimination

Compact NSX provides maximum continuity of service and savings through an unmatched level of discrimination:

- given the high accuracy of measurements, overload discrimination is ensured even between very close ratings
- for major faults, the fast processing of the Micrologic trip units means the upstream device can anticipate the reaction of the downstream device. The upstream breaker adjusts its tripping delay to provide discrimination
- for very high faults, the energy of the arc dissipated by the short-circuit in the downstream breaker causes reflex tripping. The current seen by the upstream device is significantly limited. The energy is not sufficient to cause tripping, so discrimination is maintained whatever the short-circuit current.

For total discrimination over the entire range of possible faults, from the long-time pick-up Ir to the ultimate short-circuit current Icu, a ratio of 2.5 must be maintained between the ratings of the upstream and downstream devices.
This ratio is required to ensure selective reflex tripping for high short-circuits.

Understanding the names of Micrologic electronic trip units

Protection	Frame	Measurements	Applications
1: I **2**: LS_0I **5**: LSI **6**: LSIG	**2**: NSX100/160/250 DB112094 	**A**: Ammeter DB112155 	Distribution, otherwise **G**: Generator **M**: Motors
I: Instantaneous **L**: Long time **S_0**: Short time (1) (fixed delay) **S**: Short time **G**: Ground fault	**3**: NSX400/630 DB112120 	**E**: Energy DB112156 	

Examples

Micrologic 1.3	Instantaneous only	400 or 630 A		Distribution
Micrologic 2.3	LS_0I	400 or 630 A		Distribution
Micrologic 5.2 A	LSI	100, 160 or 250 A	Ammeter	Distribution
Micrologic 6.3 E-M	LSIG	400 or 630 A	Energy	Motor

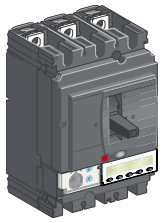
(1) LS_0I protection is standard on Micrologic 2. To ensure discrimination, it offers short-time protection S_0 with a non-adjustable delay and instantaneous protection.

Introduction
Overview of trip units for Compact NSX

Compact NSX offers a range of trip units in interchangeable cases, whether they are magnetic, thermal-magnetic or electronic. Versions 5 and 6 of the electronic trip unit offer communication and metering. Using Micrologic sensors and intelligence, Compact NSX supplies all the information required to manage the electrical installation and optimise energy use.

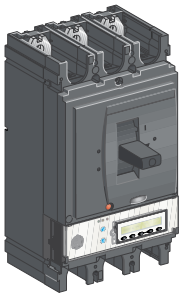
Compact NSX100/160/250

DB112094

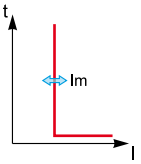
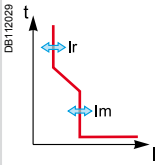


Compact NSX400/630

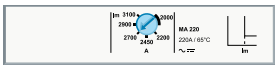
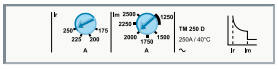
DB112120

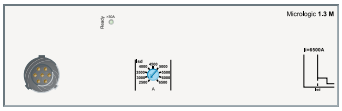


Type of protection and applications

MA magnetic	TM-D thermal-magnetic
DB112028 	DB112029 
■ Distribution and motors	■ Distribution ■ Generators

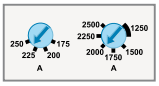
Circuit breakers and trip units

MA magnetic	TM-D thermal-magnetic
DB112022 	DB112023 
MA Distribution and motors	TM-D Distribution TM-G Generators

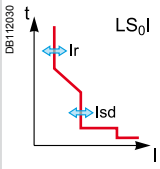
DB112092 

1.3-M Distribution and motors

Settings and indications

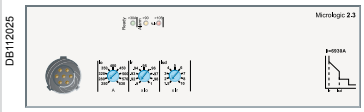
MA magnetic	TM-D thermal-magnetic
DB112037 	DB112038 
Adjustment and reading Pick-up set in amps using dials *Non-adjustable time delay*	**Adjustment and reading** Pick-up set in amps using dials *Non-adjustable time delay*

Micrologic 2 electronic

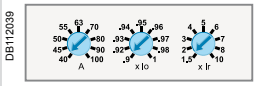


- Distribution
- Service connection (public distribution)
- Generators
- Motors (I only)
- Motors

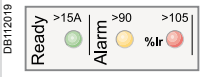
2.2 Distribution
2.2-G Generators
2.2-M Motors



2.3 Distribution
1.3-M Motors (I only)
2.3-M Motors



Adjustment and reading
Pick-up set in amps with fine adjustment using dials
Non-adjustable time delay



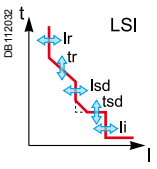
Front indications

Test connector

Self test

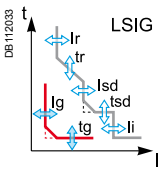
Micrologic 5 / 6 A or E electronic trip units

5 A or E



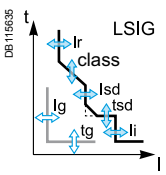
- Distribution and generators

6 A or E



- Distribution and generators

6 E-M



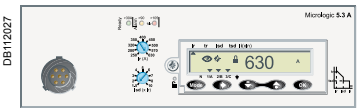
- Motors

***A**: current metering functions*
***E** :current and energy metering functions.*

5.2 A Distribution and generators
5.2 E Distribution and generators
5.2 A-Z 16 Hz 2/3 networks

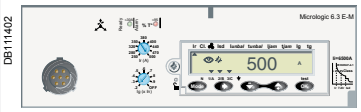
6.2 A Distribution and generators
6.2 E Distribution and generators

6.2 E-M Motors

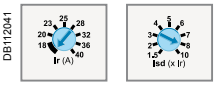


5.3 A Distribution and generators
5.3 E Distribution and generators
5.3 A-Z 16 Hz 2/3 networks

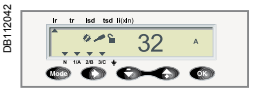
6.3 A Distribution and generators
6.3 E Distribution and generators



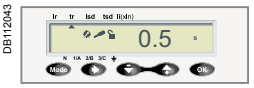
6.3 E-M Motors



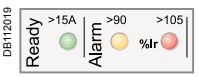
Adjustment and reading
Pick-up set in amps



Fine adjustment via keypad



Adjustable time delays

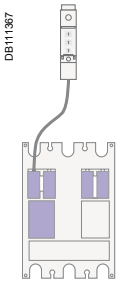


Front indications

Test connector

Self test

Connection to switchboard display unit

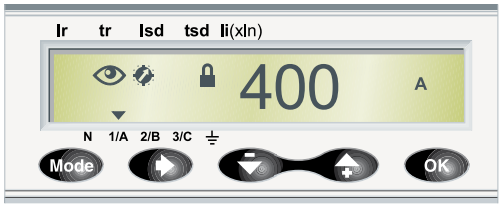


Communication to Modbus

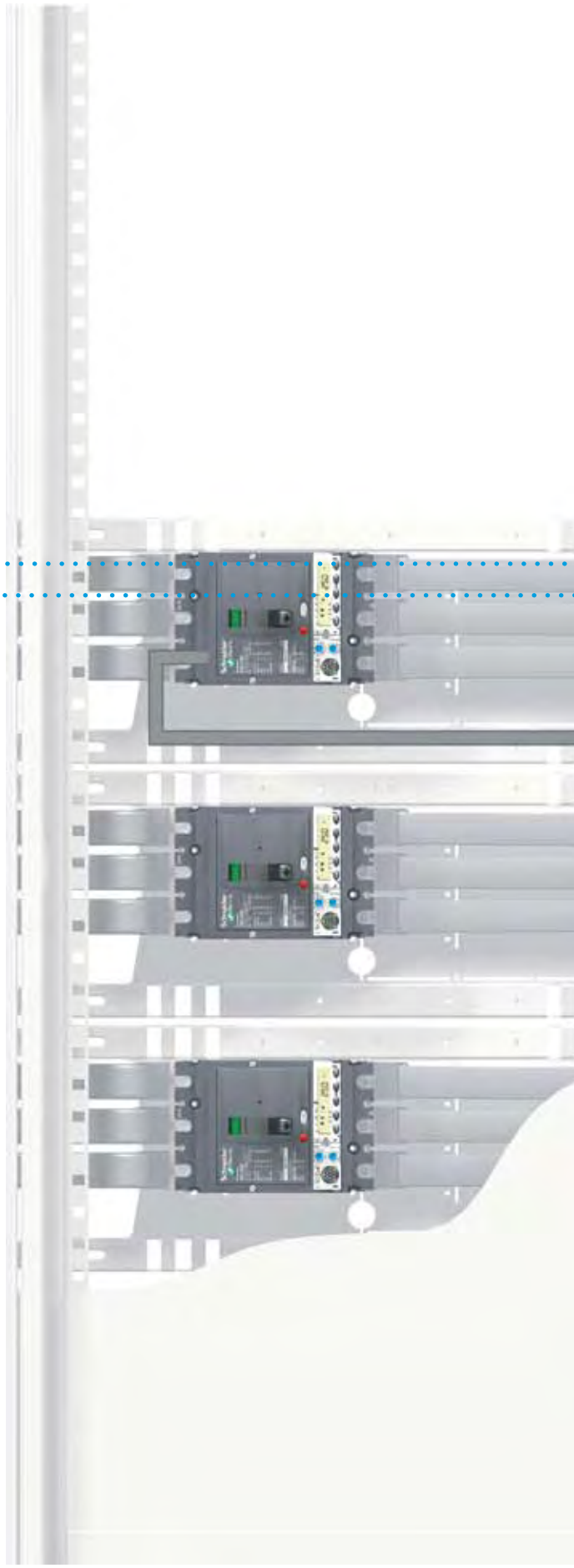
Introduction
Overview of trip units for Compact NSX

The capabilities of Micrologic 5 / 6 A and E trip units come into full play with the FDM121 switchboard display unit.
When the two are connected via a simple cord with RJ45 connectors, the combination offers full Power Meter capabilities and all the measurements required to monitor the electrical installation.

DB112044



DB112526



Ammeter Micrologic (A)

I measurements

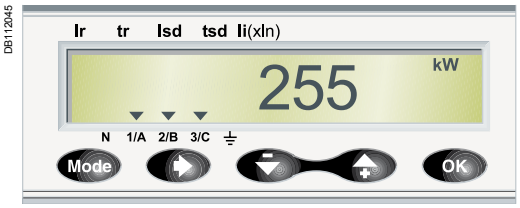
Current measurements
- Phase and neutral currents I1, I2, I3, IN
- Average current of the 3 phases Iavg
- Highest current of the three phases Imax
- Ground-fault current Ig (Micrologic 6.2 / 6.3 A)
- Maximeter/minimeter for I measurements

Operating and maintenance assistance

Indications, alarms and histories
- Indication of fault types
- Alarms for high/low alarm thresholds linked to I measurements
- Trip, alarm and operating histories
- Time-stamped tables for settings and maximeters

Maintenance indicators
- Operation, trip and alarm counters
- Operating hours counter
- Contact wear
- Load profile and thermal image

Communication
- Modbus with add-on module



Energy Micrologic (E)

I, U, f, P, E, THD measurements

Current measurements
- Phase and neutral currents I1, I2, I3, IN
- Average current of the 3 phases Iavg
- Highest current of the three phases Imax
- Ground-fault current Ig (Micrologic 6.2 / 6.3 A)
- Maximeter/minimeter for I measurements
- Current unbalance between phases

Voltage measurements
- Phase-to-phase (U) et phase-to-neutral (V) voltages
- Average voltages Uavg, Vavg
- Ph-Ph (U) and Ph-N (V) voltage unbalance

Frequency measurements
- Frequency (f)

Power-quality indicators
- Total harmonic distortion (THD) for current and voltage

Power measurements
- Active, reactive and apparent power, total and per phase
- Power factor and cos ϕ

Maximeters/minimeters
- For all I, U, f, P, E measurements

Demand current and power measurements
- Demand values, total and per phase
- Maximum demand

Energy metering
- Active, reactive and apparent energy, total and per phase

Operating and maintenance assistance

Indications, alarms and histories
- Indication of fault types
- Alarms for high/low thresholds linked to I, U, f, P, E measurements
- Trip, alarm and operating histories
- Time-stamped tables for settings and I, U, f, P, E maximeters

Maintenance indicators
- Operation, trip and alarm counters
- Operating hours counter
- Contact wear
- Load profile and thermal image

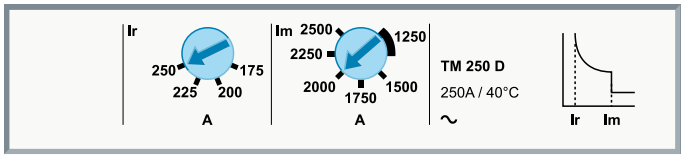
Communication
- Modbus with add-on module

Protection of distribution systems
TM thermal-magnetic and MA magnetic trip units

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

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

DB112046



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

Protection

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

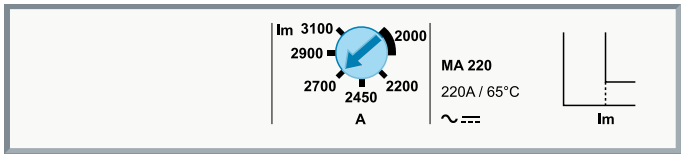
Magnetic protection (Im)
Short-circuit protection with a fixed or adjustable pick-up Im that initiates instantaneous tripping if exceeded.
■ TM-D: fixed pick-up, Im, for 16 to 160 A ratings and adjustable from 5 to 10 x In for 200 and 250 A ratings
■ fixed pick-up for 16 to 630 A ratings.

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

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

MA magnetic trip units

DB112047



In distribution applications, circuit breakers equipped with MA magnetic-only trip units are used for:
■ short-circuit protection of secondary windings of LV/LV transformers with overload protection on the primary side.
■ as an alternative to a switch-disconnector at the head of a switchboard in order to provide short-circuit protection.
Their main use is however for motor protection applications, in conjunction with a thermal relay and a contactor or motor starter (see "Motor protection", page A-36).

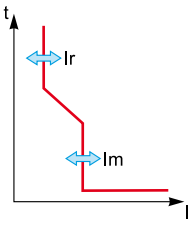
Protection

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

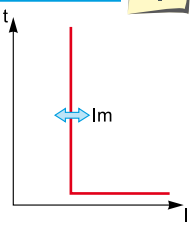
Protection versions
■ 3-pole (3P 3D): 3-pole frame (3P) with detection on all 3 poles (3D).
■ 4-pole (4P 3D): 4-pole frame (4P) with detection on 3 poles (3D).

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

Thermal-magnetic trip units		TM16D to 250D												TM16G to 63G			
Ratings (A)	**In at 40 °C** (1)	**16**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**16**	**25**	**40**	**63**
Circuit breaker	Compact NSX100	■	■	■	■	■	■	■	■	-	-	-	-	■	■	■	■
	Compact NSX160	-	-	■	■	■	■	■	■	■	■	-	-	-	■	■	■
	Compact NSX250	-	-	-	-	-	■	■	■	■	■	■	■	-	-	■	■
Thermal protection																	
Pick-up (A) tripping between 1.05 and 1.20 Ir	**Ir** = In x ...	adjustable in amps from 0.7 to 1 x In															
Time delay (s)	**tr**	non-adjustable												non-adjustable			
	tr at 1.5 x In	120 to 400												120 to 400			
	tr at 6 x Ir	15												-			
Magnetic protection																	
Pick-up (A)	**Im**	fixed										adjustable		fixed			
accuracy ±20 %	Compact NSX100	190	300	400	500	500	500	640	800					63	80	80	125
	Compact NSX160/250	190	300	400	500	500	500	640	800	1250	1250	5 to 10xIn		63	80	80	125
Time delay	**tm**	fixed															
Neutral protection																	
Unprotected neutral	4P 3D	no detection												no 4P3D version			
Fully protected neutral	4P 4D	1 x Ir												1 x Ir			



Magnetic trip units		MA 2.5 to 220							
Ratings (A)	**In at 65 °C**	**2.5**	**6.3**	**12.5**	**25**	**50**	**100**	**150**	**220**
Circuit breaker	Compact NSX100	■	■	■	■	■	■	-	-
	Compact NSX160	-	-	-	■	■	■	■	-
	Compact NSX250	-	-	-	-	-	■	■	■
Instantaneous magnetic protection									
Pick-up (A) accuracy ±20 %	**Im** = In x ...	adjustable in amps from 6 to 14 x In (9 settings)					adjustable in amps from 9 to 14 x In		
Time delay (ms)	**tm**	none							



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

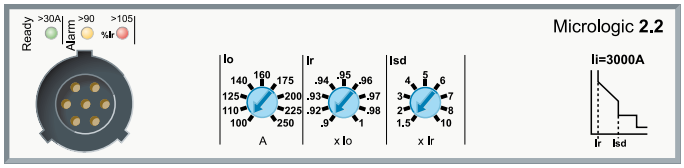
Protection of distribution systems
Micrologic 2 and 1.3-M trip units

Micrologic 2 trip units can be used on Compact NSX100 to 630 circuit breakers with performance levels B/F/H/N/S/L. They provide:
- *standard protection of distribution cables*
- *indication of:*
  - *overloads (via LEDs)*
  - *overload tripping (via the SDx relay module).*

Circuit breakers equipped with Micrologic 1.3-M trip units, without thermal protection, are used in certain applications to replace switch-disconnectors at the head of switchboards. Micrologic 1.3-M trip units are dedicated to Compact NSX400/630 A circuit breakers.

Micrologic 2

DB112050



Circuit breakers equipped with Micrologic 2 trip units can be used to protect distribution systems supplied by transformers. For generators and long cables, Micrologic 2-G trip units offer better suited low pick-up solutions (see page A-50).

Protection

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

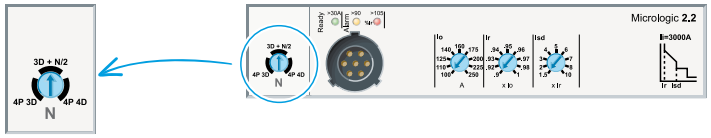
Overloads: Long time protection (Ir)
Inverse time protection against overloads with an adjustable current pick-up Ir set using a dial and a non-adjustable time delay tr.

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

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

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

DB112051



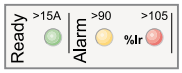
PB103377

SDx remote indication relay module with its terminal block.

Indications

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

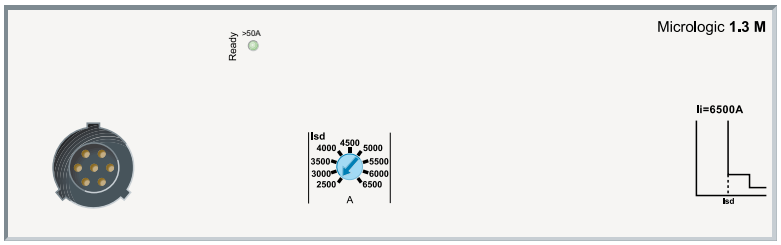
DB112019



Remote indications
An overload trip signal can be remoted by installing an SDx relay module inside the circuit breaker.
This module receives the signal from the Micrologic electronic trip unit via an optical link and makes it available on the terminal block. The signal is cleared when the circuit breaker is reclosed. For description, see page A-81.

Micrologic 1.3-M for magnetic protection only

DB112106

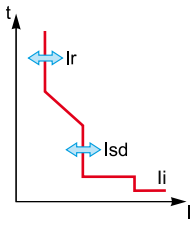


Micrologic 1.3-M trip units provide magnetic protection only, using electronic technology. They are dedicated to 400/630 A 3-pole (3P 3D) circuit breakers or 4-pole circuit breakers with detection on 3 poles (4P, 3D) and are used in certain applications to replace switch-disconnectors at the head of switchboards. They are especially used in 3-pole versions for motor protection, see page A-40.

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

Micrologic 2

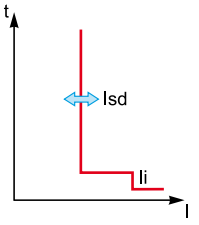
Ratings (A)	In at 40 °C (1)		40	100	160	250	400	630			
Circuit breaker	Compact NSX100		■	■	-	-	-	-			
	Compact NSX160		■	■	■	-	-	-			
	Compact NSX250		■	■	■	■	-	-			
	Compact NSX400		-	-	-	■	■	-			
	Compact NSX630		-	-	-	■	■	■			
L Long-time protection											
Pick-up (A)		Io	value depending on trip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



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

Micrologic 1.3-M

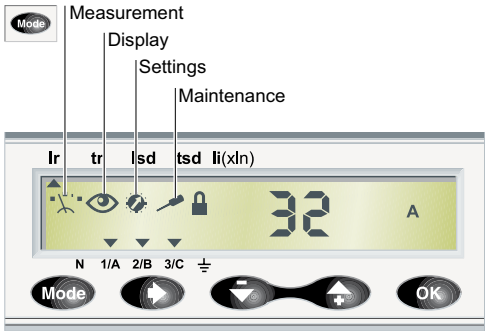
Ratings (A)	In at 65 °C	320	500
Circuit breaker	Compact NSX400	■	-
	Compact NSX630	■	■
S Short time protection			
Pick-up (A) accuracy ±15 %	**Isd**	adjustable directly in amps	
		9 settings: 1600, 1920, 2440, 2560, 2880, 3200, 3520, 3840, 4160 A	9 settings: 2500, 3000, 3500, 4000, 4500, 5000, 5500,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



Protection of distribution systems
Micrologic 5 / 6 A or E trip units

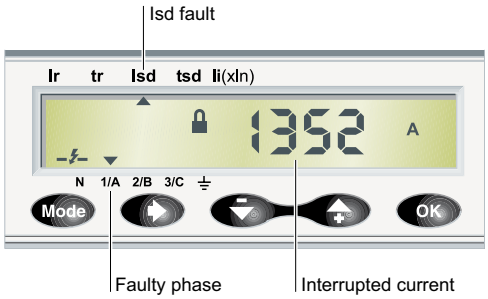
Micrologic 5 / 6 A (Ammeter) or E (Energy) trip units can be used on Compact NSX100 to 630 circuit breakers with performance levels B/F/H/N/S/L. They all have a display unit.
They offer basic LSI protection (Micrologic 5) or LSI and ground-fault protection G (Micrologic 6).
They also offer measurement,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

DB115566



Trip unit menus.

DB115567



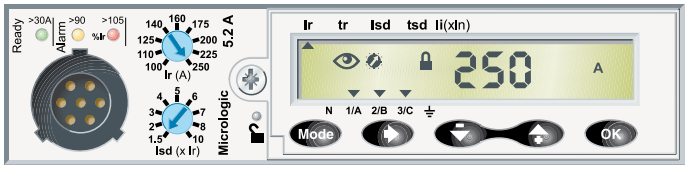
Display of interrupted current.

PB103377

SDx remote indication relay module with its terminal block.

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

DB112109



Protection

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

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

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

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

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

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

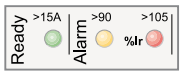
Zone selective interlocking (ZSI)
A ZSI terminal block may be used to interconnect a number of Micrologic control units to provide zone selective interlocking for short-time (Isd) and ground-fault (Ig) protection, without a time delay. For Compact NSX 100 to 250, the ZSI function is available only in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

Display of type of fault

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

Indications

Front indications

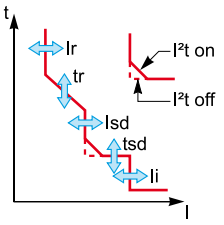


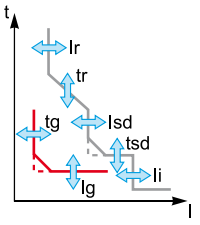
- Green “Ready” LED: flashes slowly when the circuit breaker is ready to trip in the event of a fault.
- Orange overload pre-alarm LED: steady on when I > 90 % Ir
- Red overload LED: steady on when I > 105 % Ir

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

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

Protection	Micrologic 5 / 6 A or E trip units											
Ratings (A)	**In at 40 °C** [1]		**40**	**100**	**160**	**250**	**400**	**630**				
Circuit breaker	Compact NSX100		■	■	-	-	-	-				
	Compact NSX160		■	■	■	-	-	-				
	Compact NSX250		■	■	■	■	-	-				
	Compact NSX400		-	-	-	-	■	-				
	Compact NSX630		-	-	-	-	■	■				
L **Long-time protection**												
Pick-up (A) tripping between 1.05 and 1.20 Ir	**Ir** = ...	dial setting	value depending on trip unit rating (In) and setting on dial									
		In = 40 A	Io =	18	18	20	23	25	28	32	36	40
		In = 100 A	Io =	40	45	50	55	63	70	80	90	100
		In = 160 A	Io =	63	70	80	90	100	110	125	150	160
		In = 250 A	Io =	100	110	125	140	150	175	200	225	250
		In = 400 A	Io =	160	180	200	230	250	280	320	360	400
		In = 630 A	Io =	250	280	320	350	400	450	500	570	630
		keypad setting		Fine adjustment in 1 A steps below maximum value set on dial								
Time delay (s) accuracy 0 to -20 %	**tr** = ...	keypad setting		0.5	1	2	4	8	16			
			1.5 x Ir	15	25	50	100	200	400			
			6 x Ir	0.5	1	2	4	8	16			
			7.2 x Ir	0.35	0.7	1.4	2.8	5.5	11			
Thermal memory				20 minutes before and after tripping								
S **Short-time protection with adjustable time delay**												
Pick-up (A) accuracy ±10 %	**Isd** = Ir x ...	dial setting		1.5	2	3	4	5	6	7	8	10
				Fine adjustment in 0.5 x Ir steps using the keypad								
Time delay (s)	**tsd** = ...	keypad setting	I²Off	0	0.1	0.2	0.3	0.4				
			I²On	-	0.1	0.2	0.3	0.4				
	Non-tripping time (ms)			20	80	140	230	350				
	Maximum break time (ms)			80	140	200	320	500				
I **Instantaneous protection**												
Pick-up (A) accuracy ±15 %	**Ii** = In x	keypad setting		Adjustment in steps of 0.5 x In over the range 1.5 x In to: 15 x In (NSX100/160), 12 x In (NSX250/400) or 11 x In (NSX630)								
	Non-tripping time			10 ms								
	Maximum break time			50 ms for I > Ii								
G **Ground-fault protection - for Micrologic 6 A or E**												
Pick-up (A) accuracy ±10 %	**Ig** = In x	dial setting										
		In = 40 A		0.4	0.4	0.5	0.6	0.7	0.8	0.9	1	Off
		In > 40 A		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1	Off
				Fine adjustment in 0.05 A steps using the keypad								
Time delay (s)	**tg** = ...	keypad setting	I²Off	0	0.1	0.2	0.3	0.4				
			I²On	-	0.1	0.2	0.3	0.4				
	Non-tripping time (ms)			20	80	140	230	350				
	Maximum break time (ms)			80	140	200	320	500				
Test	Ig function			built-in								





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

Power Meter functions
Electronic Micrologic 5 / 6 A or E

In addition to protection functions, Micrologic 5 / 6 trip units offer all the functions of Power Meter products as well as operating-assistance for the circuit breaker.
- *display of settings*
- *measurement functions:*
  - *Ammeter (A)*
  - *Energy (E)*
- *alarms*
- *time-stamped histories and event tables*
- *maintenance indicator*
- *communication.*

PB103365

Micrologic built-in LCD display showing an energy measurement.

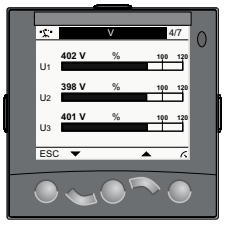
DB112211

FDM121 display: navigation.

DB112131

Current.

DB112132

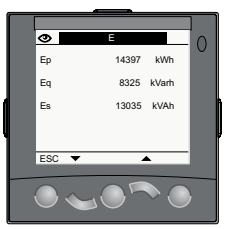


Voltage.

DB112133

Power.

DB112134



Consumption.

Examples of measurement screens on the FDM121 display unit.

Micrologic A and E measurement functions are made possible by Micrologic intelligence and the accuracy of the sensors. They are handled by a microprocessor that operates independent of protection functions.

Display

Micrologic LCD
The user can display all the protection settings and the main measurements on the LCD screen of the trip unit.
- Micrologic A: instantaneous rms current measurements
- Micrologic E: voltage, frequency and power measurements and energy metering, in addition to the measurements offered by Micrologic A

To make the display available under all conditions and increase operating comfort, an external power supply is recommended for Micrologic A.
It is indispensable to:
- display faults and interrupted current measurements
- use all the functions of Micrologic E (e.g. metering of low power and energy values)
- ensure operation of the communication system.

The external power supply can be shared by several devices. For description, see page A-32.

FDM121 display unit
An FDM121 switchboard display unit can be connected to a Micrologic trip unit using a prefabricated cord to display all measurements on a screen. The result is a veritable 96 x 96 mm Power Meter.
In addition to the information displayed on the Micrologic LCD, the FDM121 screen shows demand, power quality and maximeter/minimeter values along with alarms, histories and maintenance indicators.
The FMD121 display unit requires a 24 V DC power supply. The Micrologic trip unit is supplied by the same power supply via the cord connecting it to the FDM121.

PC screen
When the Micrologic, with or without an FDM121 switchboard display unit, is connected to a communication network, all information can be accessed via a PC.

Measurements

Instantaneous rms measurements
The Micrologic A and E continuously display the RMS value of the highest current of the three phases and neutral (Imax). The navigation buttons ◀▶ can be used to scroll through the main measurements.
In the event of a fault trip, the current interrupted is memorised.
The Micrologic A measures phase, neutral, ground fault currents.
The Micrologic E offers voltage, frequency and power measurements in addition to the measurements provided by Micrologic A

Maximeters / minimeters
Every instantaneous measurement provided by Micrologic A or E can be associated with a maximeter/minimeter. The maximeters for the highest current of the 3 phases and neutral, the demand current and power can be reset via the trip unit keypad, the FDM121 display unit or the communication system.

Energy metering
The Micrologic E also measures the energy consumed since the last reset of the meter. The active energy meter can be reset via the keypad and the FDM121 display unit or the communication system.

Demand and maximum demand values
Micrologic E also calculates demand current and power values. These calculations can be made using a block or sliding interval that can be set from 5 to 60 minutes in steps of 1 minute. The window can be synchronised with a signal sent via the communication system. Whatever the calculation method, the calculated values can be recovered on a PC via Modbus communication.
Ordinary spreadsheet software can be used to provide trend curves and forecasts based on this data. They will provide a basis for load shedding and reconnection operations used to adjust consumption to the subscribed power.

Power quality
Micrologic E calculates power quality indicators taking into account the presence of harmonics up to the 15th order, including the total harmonic distortion (THD) of current and voltage.


PB103354


PB103360


PB103364

Micrologic 5 / 6 integrated Power Meter functions			Type		Display	
			A	E	Micrologic LCD	FDM121 display
Display of protection settings						
Pick-ups (A) and delays	All settings can be displayed	Ir, tr, Isd, tsd, Ii, Ig, tg	■	■	■	
Measurements						
Instantaneous rms measurements						
Currents (A)	Phases and neutral	I1, I2, I3, IN	■	■	■	■
	Average of phases	Iavg = (I1 + I2 + I3) / 3	■	■	-	■
	Highest current of the 3 phases and neutral	Imax of I1, I2, I3, IN	■	■	■	■
	Ground fault (Micrologic 6)	% Ig (pick-up setting)	■	■	■	■
	Current unbalance between phases	% Iavg	-	■	-	■
Voltages (V)	Phase-to-phase	U12, U23, U31	-	■	■	■
	Phase-to-neutral	V1N, V2N, V3N	-	■	■	■
	Average of phase-to-phase voltages	Uavg = (U12 + U21 + U23) / 3	-	■	-	■
	Average of phase-to-neutral voltages	Vavg = (V1N + V2N + V3N) / 3	-	■	-	■
	Ph-Ph and Ph-N voltage unbalance	% Uavg and % Vavg	-	■	-	■
	Phase sequence	1-2-3, 1-3-2	-	■	■	■
Frequency (Hz)	Power system	f	-	■	■	■
Power	Active (kW)	P, total and per phase	-	■	■	■
	Reactive (kVAR)	Q, total and per phase	-	■	-	■
	Apparent (kVA)	S, total and per phase	-	■	-	■
	Power factor and cos (fundamental)	PF and cos φ, total and per phase	-	■	-	■
Maximeters / minimeters						
	Associated with instantaneous rms measurements	Reset via Micrologic or FDM121 display unit	■	■	-	■
Energy metering						
Energy	Active (kW), reactive (kVARh), apparent (kVAh)	Total since last reset Absolute or signed mode (1)	-	■	■	■
Demand and maximum demand values						
Demand current (A)	Phases and neutral	Present value on the selected window	-	■	-	■
		Maximum demand since last reset	-	■	-	■
Demand power	Active (kWh), reactive (kVAR), apparent (kVA)	Present value on the selected window	-	■	-	■
		Maximum demand since last reset	-	■	-	■
Calculation window	Sliding, fixed or com-synchronised	Adjustable from 5 to 60 minutes in 1 minute steps	-	■	-	(2)
Power quality						
Total harmonic distortion (%)	Of voltage with respect to rms value	THDU,THDV of the Ph-Ph and Ph-N voltage	-	■	-	■
	Of current with respect to rms value	THDI of the phase current	-	■	-	■

(1) Absolute mode: E absolute = E out + E in; Signed mode: E signed = E out - E in.
(2) Available via the communication system only.

Additional technical characteristics

Measurement accuracy

Accuracies are those of the entire measurement system, including the sensors:

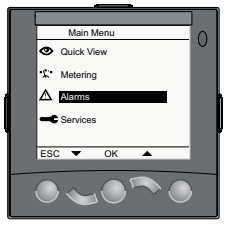
- *Current: Class 1 as per IEC 61557-12*
- *Voltage: 0.5 %*
- *Power and energy: Class 2 as per IEC 61557-12*
- *Frequency: 0.1 %.*

Operating-assistance functions
Micrologic 5 / 6 A or E trip units

PB103365

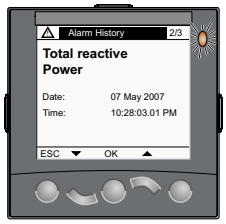
Micrologic built-in LCD display.

DB112212



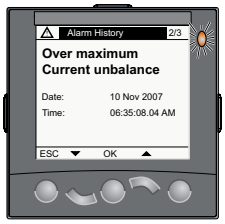
FDM121 display: navigation.

DB112127



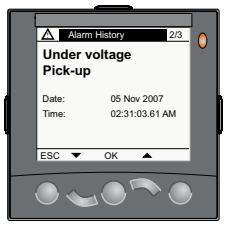
Overpower alarm.

DB112128

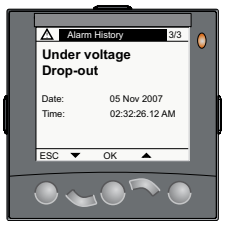


Phase unbalance alarm.

DB112129



DB112130



Alarm pick-up and drop-out.

Examples of operating-assistance screens on the FDM121 display unit.

Personalised alarms with time-stamping

Alarm types

The user can assign an alarm to all Micrologic A or E measurements or events:
- ■ up to 12 alarms can be used together:
- □ two alarms are predefined and activated automatically:
  - Micrologic 5: overload (Ir)
  - Micrologic 6: overload (Ir) and ground fault (Ig)
- □ thresholds, priorities and time delays can be set for ten other alarms.
- ■ the same measurement can be used for different alarms to precisely monitor certain values, e.g. the frequency or the voltage
- ■ alarms can also be assigned to various states: phase lead/lag, four quadrants, phase sequence
- ■ selection of display priorities, with pop-up possibility
- ■ alarm time-stamping.

Alarm settings

Alarms cannot be set via the keypad or the FDM121 display unit. They are set via communication with the PC. Set-up includes the threshold, priority, activation delay before display and deactivation delay. It is also possible to reprogram the standard assignment for the two SDx relay outputs to user-selected alarms.

Alarm reading

Remote alarm indications
- ■ reading on FDM121 display unit or on PC via the communication system
- ■ remote indications via SDx relay with two output contacts for alarms.

Histories and event tables

Micrologic A and E have histories and event tables that are always active.

Three types of time-stamped histories
- ■ Tripping due to overruns of Ir, Isd, Ii, Ig: last 17 trips
- ■ Alarms: last 10 alarms
- ■ Operating events: last 10 events

Each history record is stored with:
- ■ indications in clear text in a number of user-selectable languages
- ■ time-stamping: date and time of event
- ■ status: pick-up / drop-out

Two types of time-stamped event tables
- ■ Protection settings
- ■ Minimeters / maximeters

Display of alarms and tables

The time-stamped histories and event tables may be displayed on a PC via the communication system.

Embedded memory

Micrologic A and E have a non-volatile memory that saves all data on alarms, histories, event tables, counters and maintenance indicators even if power is lost.

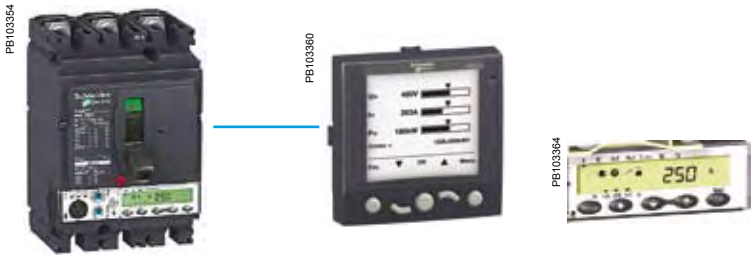
Maintenance indicators

Micrologic A and E have indicators for, among others, the number of operating cycles, contact wear and operating times (operating hours counter) of the Compact NSX circuit breaker.
It is possible to assign an alarm to the operating cycle counter to plan maintenance.
The various indicators can be used together with the trip histories to analyse the level of stresses the device has been subjected to.
The information provided by the indicators cannot be displayed on the Micrologic LCD. It is displayed on the PC via the communication system.

Management of installed devices

Each circuit breaker equipped with a Micrologic 5 or 6 trip unit can be identified via the communication system:
- ■ serial number
- ■ firmware version
- ■ hardware version
- ■ device name assigned by the user.

This information together with the previously described indications provides a clear view of the state of the installed devices.



Micrologic 5 / 6 operating assistance functions			Type		Display	
			A	E	Micrologic LCD	FDM121 display
Operating assistance						
Personalised alarms						
Settings	Up to 10 alarms assigned to all A and E measurements		■	■	-	(2)
	Phase lead/lag, four quadrants, phase sequence, display priority selection		-	■	-	(2)
Display	Alarms and tripping		■	■	-	(2)
Remote indications	Activation of two dedicated contacts on SDx module		■	■	-	-
Time-stamped histories						
Trips (last 17)	Cause of tripping (timestamping with ms)	Ir, Isd, Ii (Micrologic 5, 6)	■	■	-	(2)
		Ig (Micrologic 6)	■	■	-	(2)
Alarms (last 10)			■	■	-	(2)
Operating events (last 10)	Event types	Modification of protection setting by dial	-	■	-	(2)
		Opening of keypad lock	-	■	-	(2)
		Test via keypad	-	■	-	(2)
		Test via external tool	-	■	-	(2)
		Time setting (date and time)	-	■	-	(2)
		Reset for maximeter/minimeter and energy meter	■	■	■	■
Time stamping	Presentation	Date and time, text, status	■	■	-	(2)
Time-stamped event tables						
Protection settings	Setting modified (value displayed)	Ir tr Isd tsd Ii Ig tg	■	■	-	(2)
	Time stamping	Date and time of modification	■	■	-	(2)
	Previous value	Value before modification	■	■	-	(2)
Min/Max	Values monitored	I1 I2 I3 IN	■	-	-	(2)
		I1 I2 I3 IN U12 U23 U31 f	-	■	-	(2)
	Time-stamping of each value	Date and time of min/max record	■	■	-	(2)
	Current min/max value	Min/max value	■	■	-	(2)
Maintenance indicators						
Counter	Mechanical cycles (1)	Assignable to an alarm	■	■	-	(2)
	Electrical cycles (1)	Assignable to an alarm	■	■	-	(2)
	Trips	One per type of trip	■	■	-	(2)
	Alarms	One for each type of alarm	■	■	-	(2)
	Hours	Total operating time (hours)	■	■	-	(2)
Indicator	Contact wear	%	■	■	-	(2)
Load profile	Hours at different load levels	% of hours in four current ranges: 0-49 % In, 50-79 % In, 80 - 89 % In and ≥ 90 % In	■	■	-	(2)

(1) The BSCM module (page A-27) is required for these functions.
(2) Available via the communication system only.

Additional technical characteristics

Contact wear

Each time Compact NSX opens, the Micrologic 5 / 6 trip unit measures the interrupted current and increments the contact-wear indicator as a function of the interrupted current, according to test results stored in memory. Breaking under normal load conditions results in a very slight increment. The indicator value may be read on the FDM121 display. It provides an estimation of contact wear calculated on the basis of the cumulative forces affecting the circuit breaker. When the indicator reaches 80%, it is advised to replace the circuit breaker to ensure the availability of the protected equipment.

Circuit breaker load profile

Micrologic 5 / 6 calculates the load profile of the circuit breaker protecting a load circuit. The profile indicates the percentage of the total operating time at four current levels (% of breaker In):

- *0 to 49 % In*
- *50 to 79 % In*
- *80 to 89 % In*
- *≥ 90 % In.*

This information can be used to optimise use of the protected equipment or to plan ahead for extensions.

Switchboard-display functions
Micrologic 5 / 6 A or E trip units

Micrologic measurement capabilities come into full play with the FDM121 switchboard display. It connects to Compact NSX via a simple cord and displays Micrologic information. The result is a true integrated unit combining a circuit breaker and a Power Meter. Additional operating assistance functions can also be displayed.

FDM121 switchboard display
The FDM121 is a switchboard display unit that can be integrated in the Compact NSX100 to 630 A system. It uses the sensors and processing capacity of the Micrologic trip unit. It is easy to use and requires no special software or settings. It is immediately operational when connected to the Compact NSX by a simple cord.
The FDM121 is a large display, but requires very little depth. The anti-glare graphic screen is backlit for very easy reading even under poor ambient lighting and at sharp angles.

Display of Micrologic measurements and alarms
The FDM121 is intended to display Micrologic 5 / 6 measurements, alarms and operating information. It cannot be used to modify the protection settings.
Measurements may be easily accessed via a menu.
All user-defined alarms are automatically displayed. The display mode depends on the priority level selected during alarm set-up:
- high priority: a pop-up window displays the time-stamped description of the alarm and the orange LED flashes
- medium priority: the orange "Alarm" LED goes steady on
- low priority: no display on the screen.

All faults resulting in a trip automatically produce a high-priority alarm, without any special settings required.
In all cases, the alarm history is updated.
If power to the FDM121 fails, all information is stored in the Micrologic non-volatile memory. The data is automatically recovered when power is restored and can be consulted via the communication system.

Status indications and remote control
When the circuit breaker is equipped with the BSCM module (page A-27), the FDM121 display can also be used to view circuit breaker status conditions:
- O/F: ON/OFF
- SD: trip indication
- SDE: Fault-trip indication (overload, short-circuit, ground fault)

Main characteristics
- 96 x 96 x 30 mm screen requiring 10 mm behind the door (or 20 mm when the 24 volt power supply connector is used).
- White backlighting.
- Wide viewing angle: vertical ±60°, horizontal ±30°.
- High resolution: excellent reading of graphic symbols.
- Alarm LED: flashing orange for alarm pick-up, steady orange after operator reset if alarm condition persists.
- Operating temperature range -10 °C to +55 °C.
- CE / UL marking.
- 24 V DC power supply, with tolerances 24 V -20 % (19.2 V) to 24 V +10 % (26.4 V).

When the FDM121 is connected to the communication network, the 24 V is supplied by the communication system wiring system.
- Consumption 40 mA.

Mounting
The FDM121 is easily installed in a switchboard.
- Standard door cut-out 92 x 92 mm.
- Attached using clips.

To avoid a cut-out in the door, an accessory is available for surface mounting by drilling only two 22 mm diameter holes.
The FDM121 degree of protection is IP54 in front. IP54 is maintained after switchboard mounting by using the supplied gasket during installation.

Connection
The FDM121 is equipped with:
- a 24 V DC terminal block:
  - plug-in type with 2 wire inputs per point for easy daisy-chaining
  - power supply range of 24 V -20 % (19.2 V) to 24 V +10 % (26.4 V)
- two RJ45 jacks.

The Micrologic connects to the internal communication terminal block on the Compact NSX via the pre-wired NSX cord. Connection to one of the RJ45 connectors on the FDM121 automatically establishes communication between the Micrologic and the FDM121 and supplies power to the Micrologic measurement functions.
When the second connector is not used, it must be fitted with a line terminator.

PB103582

FDM121 display.

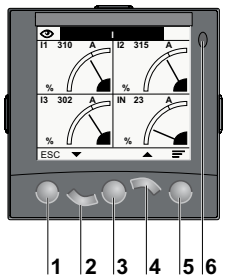
PB103807-32

Surface mount accessory.

PB103581-31

Connection with FDM121 display unit.

DB112135



1 *Escape*
2 *Down*
3 *OK*
4 *Up*
5 *Context*
6 *Alarm LED*

Navigation

Five buttons are used for intuitive and fast navigation.
The “Context” button may be used to select the type of display (digital, bargraph, analogue).
The user can select the display language (Chinese, English, French, German, Italian, Portuguese, Spanish, etc.) Other languages can be downloaded.

Screens

Main menu

When powered up, the FDM121 screen automatically displays the ON/OFF status of the device.


Quick view


Metering


Alarms


Services.

When not in use, the screen is not backlit. Backlighting can be activated by pressing one of the buttons. It goes off after 3 minutes.

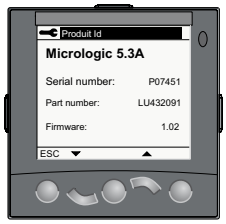
Fast access to essential information

■ “Quick view” provides access to five screens that display a summary of essential operating information (I, U, f, P, E, THD, circuit breaker On / Off).

Access to detailed information

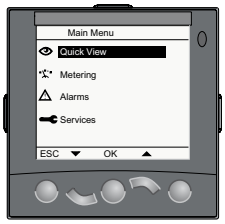
■ "Metering" can be used to display the measurement data (I, U-V, f, P, Q, S, E, THD, PF) with the corresponding min/max values.
■ Alarms displays active alarms and the alarm history.
■ Services provides access to the operation counters, energy and maximeter reset function, maintenance indicators, identification of modules connected to the internal bus and FDM121 internal settings (language, contrast, etc.)

DB112136



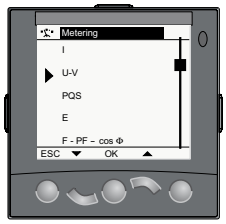
Product identification.

DB112137



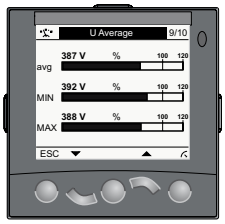
Quick view.

DB112138



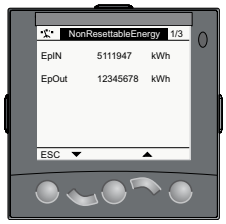
Metering: sub-menu.

DB112139



Metering: U average.

DB112140



Metering: meter.

DB112141

Services.

Compact NSX communication
Communications modules

All Compact NSX devices can be equipped with the communication function via a prewired connection system and a Modbus network interface.
The interface can be connected directly or via the FDM121 switchboard display unit.
Four functional levels can be combined to adapt to all supervision requirements.

Four functional levels

The Compact NSX can be integrated in a Modbus communication environment. Four functional levels can be used separately or combined.

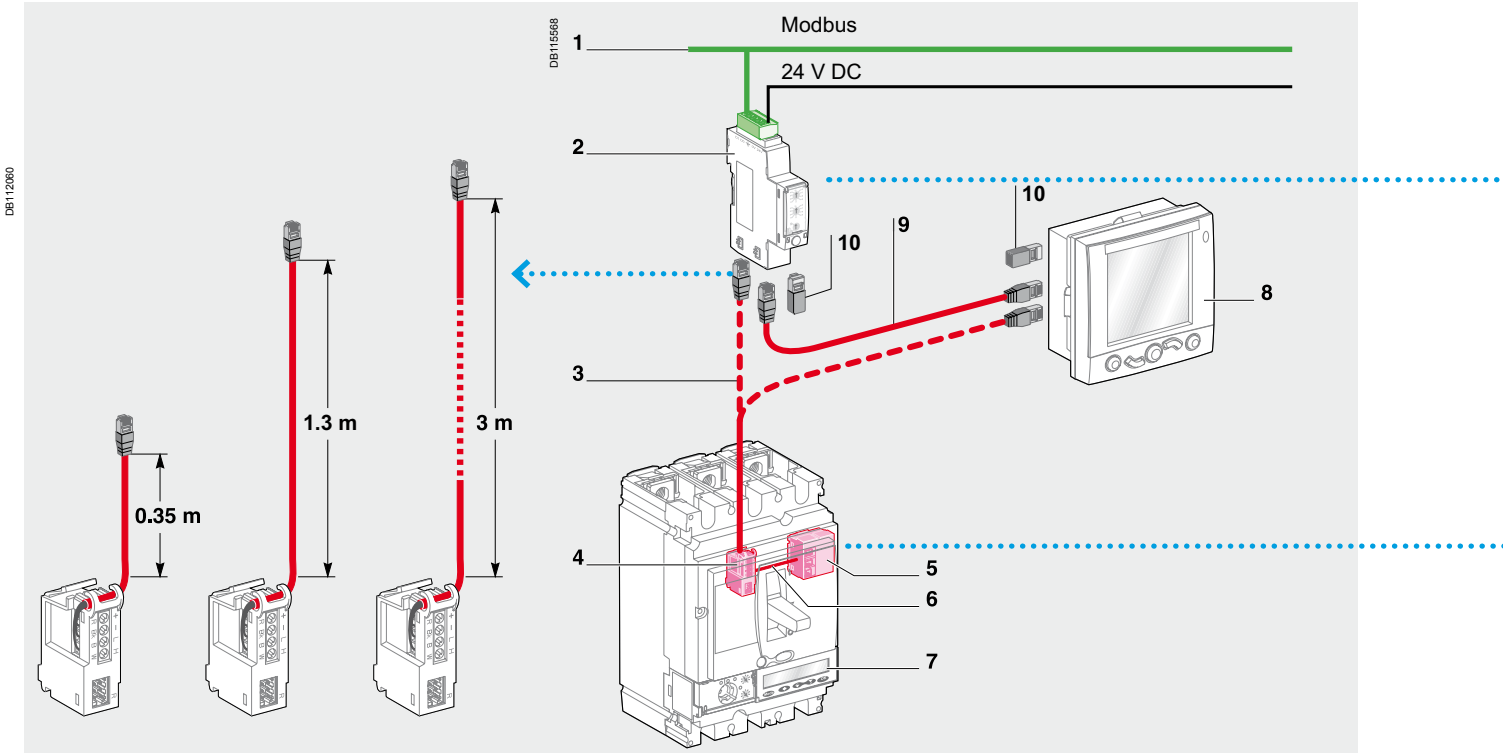
Communication of status indications
This level is compatible with all Compact NSX circuit breakers, whatever the trip unit, and with all switch-disconnectors. Using the BSCM module, the following information is accessible:
- ON/OFF position (O/F)
- trip indication (SD)
- fault-trip indication (SDE).

Communication of commands
Also available on all circuit breakers and switch-disconnectors, this level (communicating remote control) can be used to:
- open
- close
- reset.

Communication of measurements with Micrologic 5 / 6 A or E
This level provides access to all available information:
- instantaneous and demand values
- maximeters/minimeters
- energy metering
- demand current and power
- power quality.

Communication of operating assistance with Micrologic 5 / 6 A or E
- protection and alarm settings
- time-stamped histories and event tables
- maintenance indicators.

Communication components and connections



Connections
- *Compact NSX is connected to the Modbus interface or FDM121 display unit via the internal terminal block for the NSX cord equipped with an RJ45 connector.*
  - *cord available in three lengths: 0.35 m, 1.3 m and 3 m.*
  - *insulated 0.35 m version for installations > 480 V AC*
  - *lengths up to 10 m possible using extensions.*
- *The FDM121 display unit is connected to the Modbus interface by a communication cable with RJ45 connectors on both ends.*

1 *Modbus network*
2 *Modbus interface*
3 *NSX cord*
4 *Internal terminal block for communication via NSX cord*
5 *BSCM module*
6 *Prefabricated wiring*
7 *Micrologic trip unit*
8 *FDM121 display*
9 *RJ45 cable*
10 *Line terminator (on unused connector if applicable)*

Modbus interface module

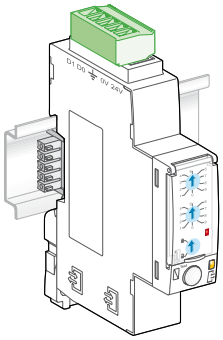
Functions

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

Mounting

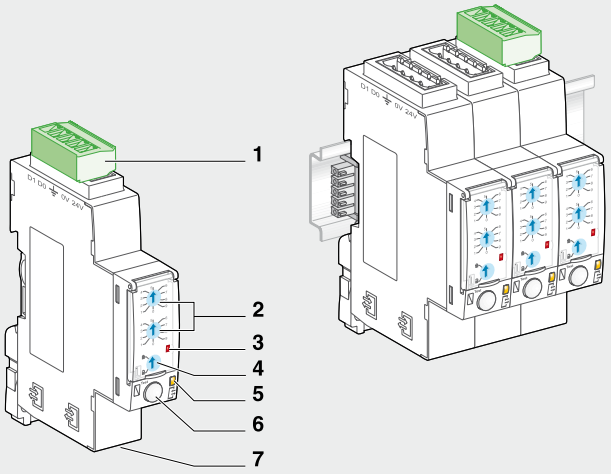
The module is mounted on a DIN rail. A number of modules may be clipped one next to the other.
For this, a stacking accessory is available for fast clip-connection of both the Modbus link and the 24 V DC supply.
The Modbus interface module supplies 24 V DC to the corresponding Micrologic, FDM121 display and BSCM module. Module consumption is 60 mA / 24 V DC.

DB112083



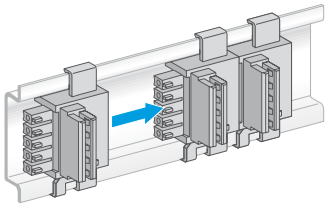
Modbus interface module.

DB112035



***1** Five-point Modbus and 24 V DC connector*
***2** Two Modbus address dials (1 to 99)*
***3** Modbus traffic LED*
***4** Lock-out to disable writing to the NSX*
***5** Test LED*
***6** Test button*
***7** Two connectors for RJ45 cable*

DB112084



Mounting with stacking accessory.

BSCM module

Functions

The optional BSCM Breaker Status & Control Module is used to acquire device status indications and control the communicating remote-control function.
It includes a memory used to manage the maintenance indicators.

Status indications

Indication of device status:
O/F, SD and SDE.

Maintenance indicators

The BSCM module manages the following indicators:
- mechanical operation counter
- electrical operation counter
- history of status indications.

It is possible to assign an alarm to the operation counters.

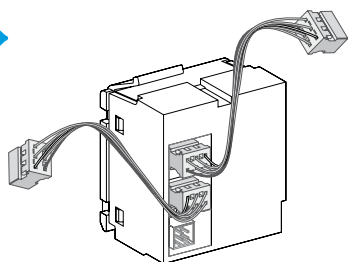
Controls

The module can be used to carry out communicating remote control operations: (open, close and reset) in different modes (manual, auto).

Mounting

The BSCM module can be installed on all Compact NSX circuit breakers and switch-disconnectors. It simply clips into the auxiliary contact slots. It occupies the slots of one O/F contact and one SDE contact. The BSCM is supplied with 24 V DC power automatically via the NSX cord when the communication system is installed.

DB112085



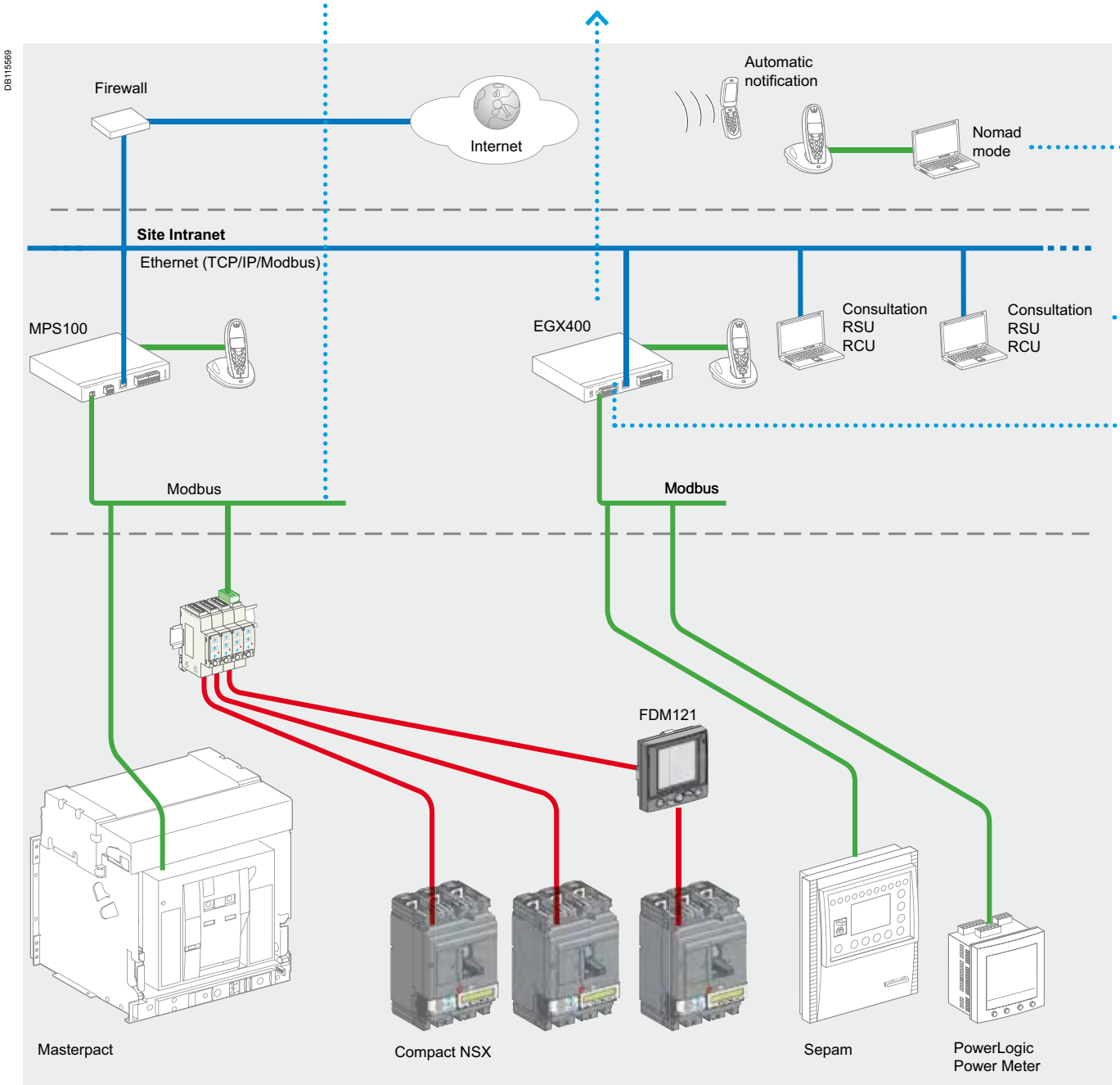
BSCM module.

Compact NSX communication
Networks and software

Compact NSX uses the Modbus communication protocol, compatible with SMS PowerLogic supervision systems. Two downloadable utilities facilitate implementation of communication functions.

Modbus

Modbus is the most widely used communication protocol in industrial networks. It operates in master-slave mode. The devices (slaves) communicate one after the other with a gateway (master).
Masterpact, Compact NSX, PowerLogic and Sepam products all operate with this protocol. A Modbus network is generally implemented on an LV or MV switchboard scale.
Depending on the data monitored and the desired refresh rate, a Modbus network connected to a gateway can serve 4 to 16 devices. For larger installations, a number of Modbus networks can be connected to an Ethernet network (TCP/IP/Modbus protocol) via their gateways.

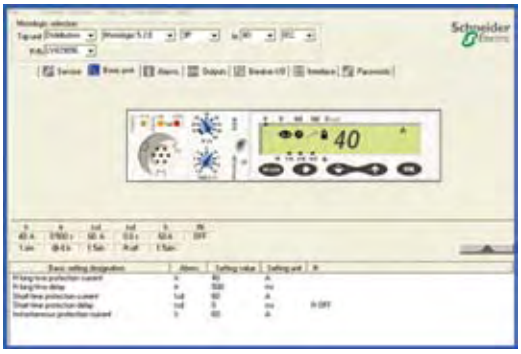


Micrologic utilities

■ Two utilities, RSU and RCU, presented on the next page, are available to assist in starting up a communicating installation. Intended for Compact NSX and Masterpact, the software can be downloaded from the Schneider Electric internet site.

■ The "Live update" function enables immediate updating to obtain the most recent upgrades. These easy-to-use utilities include starting assistance and on-line help. They are compatible with Microsoft Windows 2000, XP and Vista.

DB112125



RSU configuration screen for a Micrologic 5.2.

DB112214

RCU mini-supervision screen for current measurements.

Gateway

The gateway has two functions:

■ access to the company intranet (Ethernet) by converting Modbus frames to the TCP/IP/Modbus protocol

■ optional web-page server for the information from the devices.

Examples include MPS100, EGX400 and EGX100.

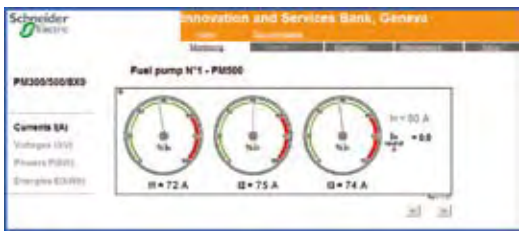
MPS100

■ Plug and play device. It comes loaded with a web-page application for graphic display of currents and voltages and viewing of circuit-breaker status and power and energy values.
To use the application, simply declare the Modbus addresses of the connected slaves. Automatically recognised devices include all Masterpact and Compact NSX Micrologic trip units and the PM500/700/800 and PM9c power monitoring units.

■ Can be used for automatic alarm notification via a messaging server available on the site intranet or via mobile phones (e-mail converted into SMS).

■ Can be used for logging of data that can be automatically sent as e-mail attachments, e.g. a weekly consumption report.

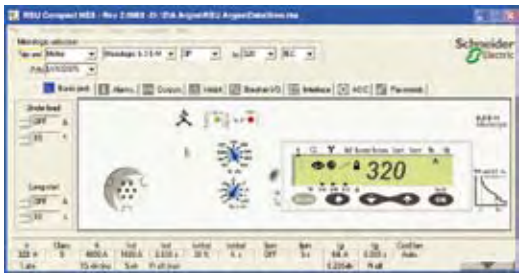
DB112126



Web page.

Two utilities, RSU and RCU, are available to assist in starting up a communicating installation.
They can be downloaded from the Schneider Electric internet site and include a "Live update" function that enables immediate updating.

DB112216



DB112217

RSU: Micrologic Remote Setting Utility.

RSU (Remote Setting Utility)

This utility is used to set the protection functions and alarms for each Masterpact and Compact NSX device.
After connection to the network and entry of the circuit-breaker Modbus address, the software automatically detects the type of trip unit installed.
There are two possible operating modes.

Off-line with the software disconnected from the communication network

For each selected circuit breaker, the user can do the following.

Determine the protection settings
The settings are carried out on a screen that shows the front of the trip unit. The Micrologic setting dials, keypad and screen are simulated for easy use of all Micrologic setting functions.

Save and duplicate the protection settings
Each configuration created can be saved for subsequent device programming. It can also be duplicated and used as the basis for programming another circuit breaker.

On-line with the software connected to the network

Similarly, for each selected circuit breaker, the user can do the following.

Display the current settings
The software displays the trip unit and provides access to all settings.

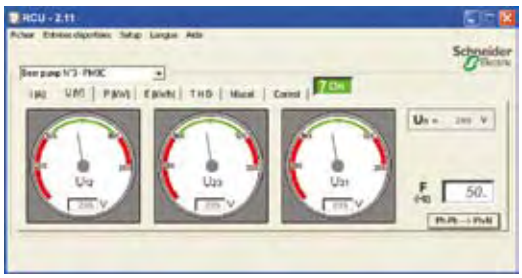
View the corresponding protection curves
A graphic curve module in the software displays the protection curve corresponding to the settings. It is possible to lay a second curve over the first for discrimination studies.

Modify settings in a secure manner
■ There are different levels of security:
□ password: by default, it is the same for all devices, but can be differentiated for each device
□ locking of the Modbus interface module which must be unlocked before the corresponding device can be set remotely
□ maximum settings limited by the positions of the two dials on the trip unit.
These dials, set by the user, determine the maximum settings that can be made via the communication system.
■ Settings are modified by:
□ either direct, on-line setting of the protection settings on the screen
□ or by loading the settings prepared in off-line mode. This is possible only if the positions of the dials allow the new settings.
All manual settings made subsequently on the device have priority.

Program alarms
■ Up to 12 alarms can be linked to measurements or events.
■ two alarms are predefined and activated automatically:
□ Micrologic 5: overload (Ir)
□ Micrologic 6: overload (Ir) and ground fault (Ig)
■ thresholds, priorities and time delays can be set for 10 other alarms. They may be selected from a list of 91 alarms

Set the outputs of the SDx relays
This is required when the user wants to change the standard configuration and assign different signals to the 2 outputs of the SDx relay.

DB112215



RCU: Remote Control Utility for communication tests.

RCU (Remote Control Utility)

The RCU utility can be used to test communication for all the devices connected to the Modbus network. It is designed for use with Compact NSX, Masterpact, Advantys OTB and Power Meter devices. It offers a number of functions.

Mini supervisor
■ Display of I, U, f, P, E and THD measurements for each device, via navigation
■ Display of ON/OFF status

Open and close commands for each device
A common or individual password must first be entered.

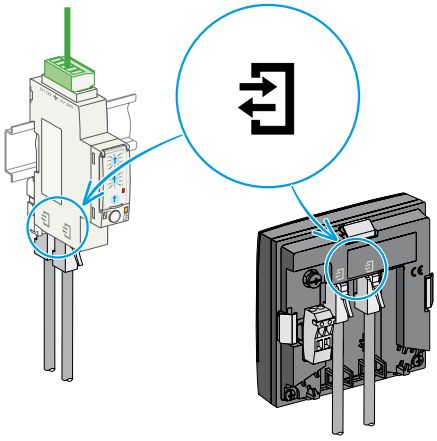
When all functions have been tested, this utility is replaced by the supervision software selected for the installation.

Schneider Electric electrical installation supervision, management and expert system software integrates Compact NSX identification modules.

Types of software

Masterpact and Compact NSX communication functions are designed to interface with software dedicated to electrical installations:
- switchboard supervision
- electrical installation supervision
- power system management: electrical engineering expert systems
- process control
- SCADA (Supervisory Control & Data Acquisition), EMS (Enterprise Management System) or BMS (Building Management System) type software.

DB111370



Connection symbol for Compact NSX compatible modules.

Integration of Compact NSX

Compact NSX devices are integrated via Modbus interface modules connected via FDM121 display units or NSX cords.
For easy connection of the different modules, the prefabricated cables are identified by ULP (Universal Logic Plug) symbols. The connection points on compatible modules are marked in the same manner.

Schneider Electric solutions

Electrical switchboard supervision via MPS100 or EGX400 Web servers

A simple solution for customers who want to consult the main electrical parameters of switchboard devices without dedicated software.
Up to 16 switchboard devices are connected via Modbus interfaces to an MPS100 or EGX400 Ethernet gateway integrating the functions of a web page server. The embedded Web pages can be easily configured with just a few mouse clicks. The information they provide is updated in real time.
The Web pages can be consulted using a standard Web browser on a PC connected via Ethernet to the company Intranet or remotely via a modem. Automatic notification of alarms and threshold overruns is possible via e-mail or SMS (Short Message Service).

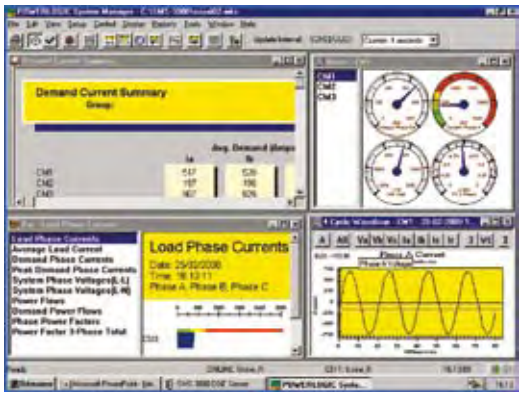
PE86106-62

PowerView software.

Electrical installation supervision via PowerView software

PowerLogic® PowerView software is ideally suited to the supervision needs of small system applications, monitoring up to 32 devices. Installed on a PC under Windows, it represents a cost-effective and easy-to-implement power-monitoring solution that offers:
- automatic detection of compatible devices
- real-time monitoring of data including power consumption
- a report generator with a number of pre-defined reports that can be exported to Excel
- cost allocation
- time-stamped data-logging possibilities
- Modbus serial and Modbus TCP/IP compatible communication.

DB112145



SMS software screen.

SMS electrical engineering expert system software

PowerLogic® SMS is a family of web-enabled software products for high-end power-monitoring applications. It is designed for large power systems.
SMS products offer detailed analysis of electrical events, long-duration data logging and extensive, economical report-building capabilities (e.g. consumption monitoring and tariff management).
A wide variety of screens can be displayed in real time, including more than 50 tables, analogue meters, bargraphs, alarms logs with links to display waveforms and predefined reports on energy quality and service costs.

Other software

Compact NSX devices can forward their measurement and operating information to special software integrating the electrical installation and other technical facilities:
- SCADA process control software: Vijeo CITECT
- BMS Building Management System software: Vista.

Please consult us.

Accessories for Micrologic trip units

PB103843-18

External neutral current transformers.

PB103842-47

External neutral voltage tap (cat. no. LV434208).

PB103583-18

External 24 V DC power-supply module.

External neutral current transformer (ENCT)

The external transformer is a sensor required for a three-pole circuit breaker in a system with a distributed neutral to measure the neutral current in order to:
- protect the neutral conductor
- protect against insulation faults.

This current transformer can be connected to Micrologic 5 / 6 trip units. The transformer rating must be compatible with that of the circuit breaker.

Required current transformers for different circuit breaker models

Type of circuit breaker	Rating	Catalogue number
NSX100/160/250	25 – 100 A	**LV429521**
	150 – 250 A	**LV430563**
NSX400/630	400 – 630 A	**LV432575**

External neutral voltage tap (ENVT)

The neutral voltage transformer is required for Micrologic E power metering with a three-pole circuit breaker in a system with a distributed neutral. It is used to connect the neutral to the Micrologic trip unit to measure phase-to-neutral (Ph-N) voltages.

External 24 V DC power-supply module

Use

An external 24 V DC power supply is required for installations with communication, whatever the type of trip unit.

On installations without communication, it is available as an option for Micrologic 5/6 in order to make it possible to:
- modify settings when the circuit breaker is open
- display measurements when the current flowing through the circuit breaker is low (15 to 50 A depending on the rating)
- maintain the display of the cause of tripping and interrupted current.

Characteristics

A single external 24 V DC supply may be used for the entire switchboard.

The required characteristics are:
- output voltage: 24 V DC ±5 %
- ripple: ±1%.
- overvoltage category: OVC IV - as per IEC 60947-1

External 24 V DC power-supply modules with an output current of 1 A are available:

Available external power-supply modules			Cat. no.
Power supply	V DC (±5 %)	24/30	**54440**
		48/60	**54441**
		100/125	**54442**
	V AC (+10 %, -15 %)	110/130	**54443**
		200/240	**54444**
		380/415	**54445**
Output voltage		24 V DC (±5 %)	
Ripple		±1 %	
Overvoltage category (OVC)		OVC IV - as per IEC 60947-1	

An external 24 V DC power-supply module with an output current of 3 A is also available:

Available external power-supply modules			Cat. no.
Power supply	V DC	110/230	**ABL8RPS24030**
	V AC	110/240	
Output voltage		24 V DC (±5 %)	
Ripple		±1 %	
Overvoltage category (OVC)		OVC II	

Total consumption

To determine the required output current of the 24 V DC power supply, it is necessary to sum up the currents consumed by the different loads supplied:

Consumption of Compact NSX modules Module	Consumption (mA)
Micrologic 5/6	20
BSCM module	10
FDM121	40
Modbus communication interface	60
NSX cord U > 480 V AC	30

PB103790-20

Test battery (cat. no. LV434206).

PB103833-18

Battery module (cat. no. 54446).

PB103799-24

24 V DC power-supply terminal block (cat. no. LV434210).

PB103788-24

NSX cord U > 480 V (cat. no. LV434204).

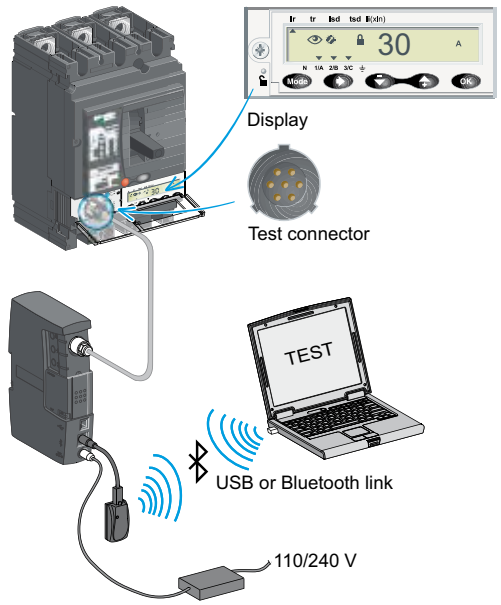
PB103803-27

Maintenance case (cat. no. TRV00910).

PB103794-32

Configuration and maintenance module (cat. no. TRV00911).

DB115570



Using the configuration and maintenance module.

Test battery

This pocket battery connects to the Micrologic test connector. It powers up the Micrologic and the Ready LED. It supplies the screen and allows settings to be made via the keypad.

Battery module

The battery module is a back-up supply for the external power-supply module. The input/output voltages are 24 V DC and it can supply power for approximately three hours (100 mA).

24 V DC power-supply terminal block

The 24 V DC power-supply terminal block can be installed only on Micrologic 5/6 trip units. It is required to power the trip unit when the trip unit is not connected to an FDM121 display unit or to the communication system. When used, it excludes connection of an NSX cord.

NSX cord

- For voltage U ⩽ 480 V, available in 3 prefabricated lengths: 0.35 m, 1.3 m and 3 m.
- For voltages U > 480 V, a special 0.35 m cord with an insulation accessory is required.
- A set of cords with RJ45 connectors is available to adapt to different distances between devices.

Maintenance case

The case includes:

- configuration and maintenance module
- power supply (110...220 V AC / 50-60 Hz 24 V DC - 1 A)
- special cable for connection to the trip-unit test connector
- standard USB cable
- standard RJ45 cable
- user manual
- optional Bluetooth link (to PC).

Configuration and maintenance module

Included in the maintenance kit, this module tests Micrologic operation and provides access to all parameters and settings. It connects to the Micrologic test connector and can operate in two modes.

- Stand-alone mode to:
  - supply the Micrologic and check operation via the Ready LED
  - check mechanical operation of the circuit breaker (trip using pushbutton).
- PC mode, connected to a PC via USB or Bluetooth link. This mode provides access to protection settings, alarm settings and readings of all indicators. Using the associated RSU software utility, it is possible to store, in a dedicated file for each device, all the data that can transferred to another device.

This mode also offers operating-test functions:

- check on trip time delay (trip curve)
- check on non-tripping time (discrimination)
- check on ZSI (Zone Selective Interlocking) function
- alarm simulation
- display of setting curves
- display of currents
- printing of test reports.

Earth-leakage protection

Add-on protection against insulation faults using a Vigi module or Vigirex relay

There are two ways to add earth-leakage protection to any three or four-pole Compact NSX100 to 630 circuit breaker equipped with a magnetic, thermal-magnetic or Micrologic 2, 5 or 6 trip unit:
■ by adding a Vigi module to the circuit breaker to form a Vigicompact NSX
■ by using a Vigirex relay and separate toroids.

PB103579-21

Vigicompact NSX100 to 630.

044322

Earth-leakage relay.

051362

Separate toroids.

Circuit breaker with add-on Vigi module (Vigicompact NSX)

■ For general characteristics of circuit breakers, see pages A-6 and A-7.
■ Add-on Vigi modules. Earth-leakage protection is achieved by installing a Vigi module (characteristics and selection criteria on next page) directly on the circuit breaker terminals It directly actuates the trip unit (magnetic, thermal-magnetic or Micrologic).

Circuit breaker combined with a Vigirex relay

Compact NSX circuit breaker + Vigirex relay

Vigirex relays may be used to add external earth-leakage protection to Compact NSX circuit breakers. The circuit breakers must be equipped with an MN or MX voltage release. The Vigirex relays add special tripping thresholds and time delays for earth-leakage protection.
Vigirex relays are very useful when faced with major installation constraints (circuit breaker already installed and connected, limited space available, etc.).

Vigirex-relay characteristics
■ Sensitivity adjustable from 30 mA to 250 mA and 9 time-delay settings (0 to 4.5 seconds).
■ Closed toroids up to 630 A (30 to 300 mm in diameter), split toroids up to 250 A (46 to 110 mm in diameter) or rectangular sensors up to 630 A.
■ 50/60 Hz, 400 Hz distribution systems.

Options
■ Trip indication by a fail-safe contact
■ Pre-alarm contact and LED, etc.

Compliance with standards
■ IEC 60947-2, annex M
■ IEC/EN 60755: general requirements for residual-current operated protective devices
■ IEC/EN 61000-4-2 to 4-6: immunity tests
■ CISPR11: radio-frequency radiated and conducted emission tests
■ UL1053 and CSA22.2 No. 144 for RH10, RH21 and RH99 relays at supply voltages up to and including 220/240 V.

PB103579-21

Vigicompact NSX100 to 630 circuit breakers with earth-leakage protection

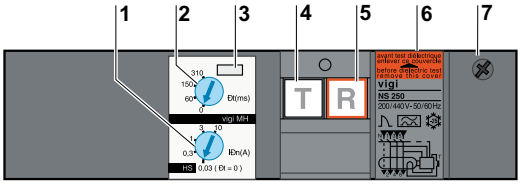
Addition of the Vigi module does not alter circuit-breaker characteristics:

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

Dimensions and weights		NSX100/160/250	NSX400/630
Dimensions	3 poles	105 x 236 x 86	135 x 355 x 110
W x H x D (mm)	4 poles	140 x 236 x 86	180 x 355 x 110
Weight (kg)	3 poles	2.5	8.8
	4 poles	3.2	10.8

PB103580-36

DB112147



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

Plug-in devices

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

Vigi earth-leakage protection modules

Compliance with standards

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

Remote indications

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

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

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

Power supply

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

Vigi module selection

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

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

Operating safety

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

Motor protection
General information on motor feeders

The parameters to be considered for motor-feeder protection depend on:
- *the application (type of machine driven, operating safety, frequency of operation, etc.)*
- *the level of continuity of service required by the load or the application*
- *the applicable standards for the protection of life and property.*

The required electrical functions are:
- *isolation*
- *switching, generally at high endurance levels*
- *protection against overloads and short-circuits, adapted to the motor*
- *additional special protection.*

A motor feeder must comply with the requirements of standard IEC 60947-4-1 concerning contactors and their protection:
- *coordination of feeder components*
- *thermal-relay trip classes*
- *contactor utilisation categories*
- *coordination of insulation.*

Motor-feeder function
A motor feeder comprises a set of devices for motor protection and control, as well as for protection of the feeder itself.

Isolation
The purpose is to isolate the live conductors from the upstream distribution system to enable work by maintenance personnel on the motor feeder at no risk. This function is provided by a motor circuit breaker offering positive contact indication and lockout/tagout possibilities.

Switching
The purpose is to control the motor (ON / OFF), either manually, automatically or remotely, taking into account overloads upon start-up and the long service life required. This function is provided by a contactor. When the coil of the contactor's electromagnet is energised, the contactor closes and establishes, through the poles, the circuit between the upstream supply and the motor, via the circuit breaker.

Basic protection
- Short-circuit protection

Detection and breaking, as quickly as possible, of high short-circuit currents to avoid damage to the installation. This function is provided by a magnetic or thermal-magnetic circuit breaker.
- Overload protection

Detection of overload currents and motor shutdown before temperature rise in the motor and conductors damages insulation. This function is provided by a thermal-magnetic circuit breaker or a separate thermal relay.

Overloads: I < 10 x In
They are caused by:
- *an electrical problem, related to an anomaly in the distribution system (e.g. phase failure, voltage outside tolerances, etc.)*
- *a mechanical problem, related to a process malfunction (e.g. excessive torque) or damage to the motor (e.g. bearing vibrations).*

These two causes will also result in excessively long starting times.
Impedant short-circuits: 10 x In < I < 50 x In
This type of short-circuit is generally due to deteriorated insulation of motor windings or damaged supply cables.
Short-circuits: I > 50 x In
This relatively rare type of fault may be caused by a connection error during maintenance.

- Phase unbalance or phase loss protection

Phase unbalance or phase loss can cause temperature rise and braking torques that can lead to premature ageing of the motor. These effects are even greater during starting, therefore protection must be virtually immediate.

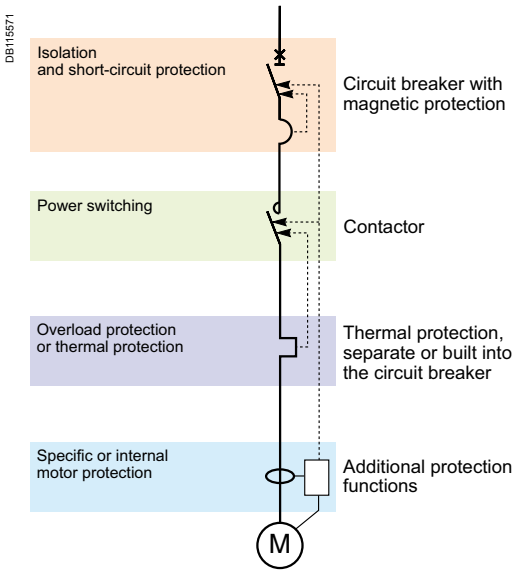
Additional electronic protection
- Locked rotor
- Under-load
- Long starts and stalled rotor
- Insulation faults.

Motor-feeder solutions
Standard IEC 60947 defines three types of device combinations for the protection of motor feeders.

Three devices
- magnetic circuit breaker + contactor + thermal relay.

Two devices
- thermal-magnetic circuit breaker + contactor.

One device
- thermal-magnetic circuit breaker + contactor in an integrated solution (e.g. Tesys U).



Switchgear functions in a motor feeder.

Device coordination

The various components of a motor feeder must be coordinated. Standard IEC 60947-4-1 defines three types of coordination depending on the operating condition of the devices following a standardised short-circuit test.

Type-1 coordination

- No danger to life or property.
- The contactor and/or the thermal relay may be damaged.
- Repair and replacement of parts may be required prior to further service.

Type-2 coordination

- No danger to life or property.
- No damage or adjustments are allowed. The risk of contact welding is accepted as long as they can be easily separated.
- Isolation must be maintained after the incident, the motor feeder must be suitable for further use without repair or replacement of parts.
- A rapid inspection is sufficient before return to service.

Total coordination

- No damage and no risk of contact welding is allowed for the devices making up the motor feeder. The motor feeder must be suitable for further use without repair or replacement of parts.

This level is provided by integrated 1-device solutions such as Tesys U.

Contactor utilisation categories

For a given motor-feeder solution, the utilisation category determines the contactor withstand capacity in terms of frequency of operation and endurance. Selection, which depends on the operating conditions imposed by the application, may result in oversizing the contactor and circuit-breaker protection. Standard IEC 60947 defines the following contactor utilisation categories.

Contactor utilisation categories (AC current)

Contactor utilisation categories	Type of load	Control function	Typical applications
AC1	Non-inductive ($\cos \varphi \geq 0.8$)	Energising	Heating, distribution
AC2	Slip-ring motor ($\cos \varphi \geq 0.65$)	Starting Switching off motor during running Counter-current braking Inching	Wiring-drawing machine
AC3	Squirrel-cage motor ($\cos \varphi = 0.45$ for ≤ 100 A) ($\cos \varphi = 0.35$ for > 100 A)	Starting Switching off motor during running	Compressors, elevators, pumps, mixers, escalators, fans, conveyer systems, air-conditioning
AC4		Starting Switching off motor during running Regenerative braking Plugging Inching	Printing machines, wire-drawing machines

Utilisation category AC3 - common coordination tables for circuit breakers and contactors

This category covers asynchronous squirrel-cage motors that are switched off during running, which is the most common situation (85 % of cases). The contactor makes the starting current and switches off the rated current at a voltage approximately one sixth of the nominal value. The current is interrupted without difficulty.
The circuit breaker-contactor coordination tables for Compact NSX are for use with contactors in the AC3 utilisation category, in which case they ensure type-2 coordination.

Utilisation category AC4 - possible oversizing

This category covers asynchronous squirrel-cage motors capable of operating under regenerative braking or inching (jogging) conditions
The contactor makes the starting current and can interrupt this current at a voltage that may be equal to that of the distribution system.
These difficult conditions make it necessary to oversize the contactor and, in general, the protective circuit breaker with respect to category AC3.

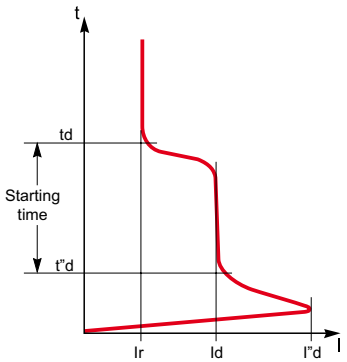
Motor protection
Motor-feeder characteristics and solutions

The trip class determines the trip curve of the thermal protection device (inverse-time curve) for a motor feeder.
Standard IEC 60947-4-1 defines trip classes 5, 10, 20 and 30.
These classes are the maximum durations, in seconds, for motor starting with a starting current of 7.2 Ir, where Ir is the thermal setting indicated on the motor rating plate.

Example: In class 20, the motor must have finished starting within 20 seconds (6 to 20 s) for a starting current of 7.2 Ir.

Standardised values in kW

Rated operational power	Standardised values in kW currents Ie (A) for:			
	230 V	400 V	500 V	690 V
kW	A	A	A	A
0.06	0.35	0.32	0.16	0.12
0.09	0.52	0.3	0.24	0.17
0.12	0.7	0.44	0.32	0.23
0.18	1	0.6	0.48	0.35
0.25	1.5	0.85	0.68	0.49
0.37	1.9	1.1	0.88	0.64
0.55	2.6	1.5	1.2	0.87
0.75	3.3	1.9	1.5	1.1
1.1	4.7	2.7	2.2	1.6
1.5	6.3	3.6	2.9	2.1
2.2	8.5	4.9	3.9	2.8
3	11.3	6.5	5.2	3.8
4	15	8.5	6.8	4.9
5.5	20	11.5	9.2	6.7
7.5	27	15.5	12.4	8.9
11	38	22	17.6	12.8
15	51	29	23	17
18.5	61	35	28	21
22	72	41	33	24
30	96	55	44	32
37	115	66	53	39
45	140	80	64	47
55	169	97	78	57
75	230	132	106	77
90	278	160	128	93
110	340	195	156	113
132	400	230	184	134
160	487	280	224	162
200	609	350	280	203
250	748	430	344	250
315	940	540	432	313



DB115572

Typical motor-starting curve

Trip class of a thermal-protection device

The motor feeder includes thermal protection that may be built into the circuit breaker. The protection must have a trip class suited to motor starting. Depending on the application, the motor starting time varies from a few seconds (no-load start) to a few dozen seconds (high-inertia load).
Standard IEC 60947-4-1 defines the trip classes below as a function of current setting Ir for thermal protection.

Trip class of thermal relays as a function of their Ir setting

Class	1.05 I r (1)	1.2 Ir (1)	1.5 Ir (2)	7.2 I r(1)
5	t > 2 h	t < 2h	t < 2 mn	2 s < t ≤ 5 s
10	t > 2 h	t < 2h	t < 4 mn	4 s < t ≤ 10 s
20	t > 2 h	t < 2h	t < 8 mn	6 s < t ≤ 20 s
30	t > 2 h	t < 2h	t < 12 mn	9 s < t ≤ 30 s

(1) Time for a cold motor (motor off and cold).
(2) Time for warm motor (motor running under normal conditions).

Currents of squirrel-cage motors at full rated load

Standardised values in HP

Rated operational power	Indicative values of the rated operational currents Ie (A) for						
	110 - 120 V	200 V	208 V	220 - 240 V	380 - 415 V	440 - 480 V	550 - 600 V
hp							
1/2	4.4	2.5	2.4	2.2	1.3	1.1	0.9
3/4	6.4	3.7	3.5	3.2	1.8	1.6	1.3
1	8.4	4.8	4.6	4.2	2.3	2.1	1.7
1 1/2	12	6.9	6.6	6	3.3	3	2.4
2	13.6	7.8	7.5	6.8	4.3	3.4	2.7
3	19.2	11	10.6	9.6	6.1	4.8	3.9
5	30.4	17.5	16.7	15.2	9.7	7.6	6.1
7 1/2	44	25.3	24.2	22	14	11	9
10	56	32.2	30.8	28	18	14	11
15	84	48.3	46.2	42	27	21	17
20	108	62.1	59.4	54	34	27	22
25	136	78.2	74.8	68	44	34	27
30	160	92	88	80	51	40	32
40	208	120	114	104	66	52	41
50	260	150	143	130	83	65	52
60	-	177	169	154	103	77	62
75	-	221	211	192	128	96	77
100	-	285	273	248	165	124	99
125	-	359	343	312	208	156	125
150	-	414	396	360	240	180	144
200	-	552	528	480	320	240	192
250	-	-	-	604	403	302	242
300	-	-	-	722	482	361	289

***Note:** 1 hp = 0.7457 kW.*

Asynchronous-motor starting parameters

The main parameters of direct on-line starting of three-phase asynchronous motors (90 % of all applications) are listed below.

■ **Ir**: rated current
This is the current drawn by the motor at full rated load (e.g. approximately 100 A rms for 55 kW at 400 V).

■ **Id**: starting current
This is the current drawn by the motor during starting, on average 7.2 In for a duration td of 5 to 30 seconds depending on the application (e.g. 720 A rms for 10 seconds). These values determine the trip class and any additional "long-start" protection devices that may be needed.

■ **I"d**: peak starting current
This is the subtransient current during the first two half-waves when the system is energised, on the average 14 In for 10 to 15 ms (e.g. 1840 A peak).

The protection settings must effectively protect the motor, notably via a suitable thermal-relay trip class, but let the peak starting current through.

Compact NSX motor circuit breakers are designed for motor-feeder solutions using:
■ three devices, including an MA or 1.3-M magnetic-only trip unit
■ two devices including a TM-D or 2-M thermal-magnetic trip unit.
They are designed for use with contactors in the AC3 utilisation category (80 % of all cases) and they ensure type-2 coordination with the contactor.
For the AC4 utilisation category, the difficult conditions generally make it necessary to oversize the protection circuit breaker with respect to the AC3 category.

Compact NSX motor-protection range

Compact NSX trip units can be used to create motor-feeder solutions comprising two or three devices. The protection devices are designed for continuous duty at 65 °C.

Three-device solutions
■ 1 NSX circuit breaker with an MA or Micrologic 1.3-M trip unit
■ 1 contactor
■ 1 thermal relay.

Two-device solutions
■ 1 Compact NSX circuit breaker
□ with a Micrologic 2.2-M or 2.3-M electronic trip unit
□ with a Micrologic 6 E-M electronic trip unit. This version offers additional protection and Power Meter functions.
■ 1 contactor.

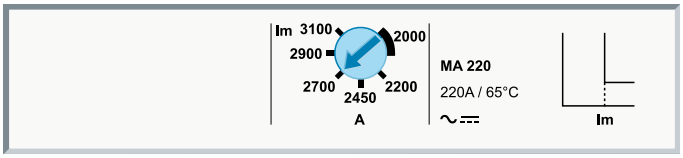
Type of motor protection			**3 devices**		**2 devices**	
Compact NSX circuit breaker			**NSX100/160/250**	**NSX400/630**	**NSX100 to 630**	
	Type-2 coordination with		Contactor + thermal relay		Contactor	
Trip unit	Type		**MA**	**Micrologic 1.3-M**	**Micrologic 2-M**	**Micrologic 6 E-M**
	Technology		Magnetic	Electronic	Electronic	Electronic
						
Thermal relay	Separate		■	■		
	Built-in, class	5			■	■
		10			■	■
		20			■	■
		30				■
Protection functions of Compact NSX circuit breaker						
Short-circuits			■	■	■	■
Overloads					■	■
Insulation faults	Ground-fault					■
Special motor functions	Phase unbalance				■	■
	Locked rotor					■
	Under-load					■
	Long start					■
Built-in Power Meter functions						
	I, U, energy					■
Operating assistance						
	Counters (cycles, trips, alarms, hours)					■
	Contact-wear indicator					■
	Load profile and thermal image					■

Motor protection
MA and Micrologic 1.3-M instantaneous trip units

*MA magnetic trip units are used in **3-device motor-feeder solutions**. They can be mounted on all Compact NSX100/160/250 circuit breakers with performance levels B/F/H/N/S/L.*
They provide short-circuit protection for motors up to 110 kW at 400 V.

MA magnetic trip units

DB112110



Circuit breakers with an MA trip unit are combined with a thermal relay and a contactor or a starter.

Protection

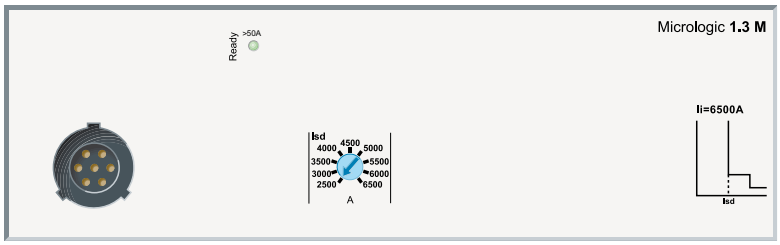
Magnetic protection (Im)
Short-circuit protection with an adjustable pick-up Im that initiates instantaneous tripping if exceeded.
- **Im** = In x ... is set on an adjustment dial in multiples of the rating:
  - 6 to 14 x In (2.5 to 100 A ratings)
  - 9 to 14 x In (150 to 200 A ratings)

Protection version
- 3-pole (3P 3D): 3-pole frame (3P) equipped with detection on all 3 poles (3D).

*Micrologic 1.3-M trip units are used in **3-device motor-feeder solutions** on Compact NSX400/630 circuit breakers with performance levels B/F/H/N/S/L.*
They provide short-circuit protection for motors up to 250 kW at 400 V.
They also provide the benefits of electronic technology:
- *accurate settings*
- *tests*
- *"Ready" LED.*

Micrologic 1.3-M trip units

DB112106



Circuit breakers with a Micrologic 1.3-M trip unit are combined with a thermal relay and a contactor.

Protection
Settings are made using a dial.

Short-circuits: Short-time protection (Isd)
Protection with an adjustable pick-up Isd. There is a very short delay to let through motor starting currents.
- Isd is set in amperes from 5 to 13 x In, as follows:
  - from 1600 to 4160 A for the 320 A rating.
  - from 2500 to 6500 A for the 500 A rating.

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

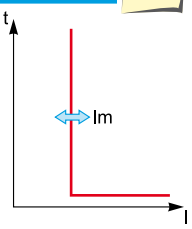
Protection version
- 3-pole (3P 3D): 3-pole frame (3P) equipped with detection on all 3 poles (3D).

Indications

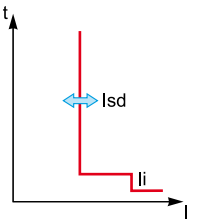
Front indications
- Green “Ready” LED: flashes slowly when the circuit breaker is ready to trip in the event of a fault.

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

Magnetic trip units		MA 2.5 to 220							
Ratings (A)	**In at 65 °C** (1)	**2.5**	**6.3**	**12.5**	**25**	**50**	**100**	**150**	**220**
Circuit breaker	Compact NSX100	■	■	■	■	■	■	-	-
	Compact NSX160	-	-	-	■	■	■	■	-
	Compact NSX250	-	-	-	-	-	■	■	■
Instantaneous magnetic protection									
Pick-up (A) accuracy ±20 %	**Im** = In x ...	Adjustable from 6 to 14 x In (settings 6, 7, 8, 9, 10, 11, 12, 13, 14)					Adjustable from 9 to 14 x In (settings 9, 10, 11, 12, 13, 14)		
Time delay (ms)	tm	fixed							



Micrologic 1.3-M			
Ratings (A)	**In at 65 °C** (1)	**320**	**500**
Circuit breaker	Compact NSX400	■	-
	Compact NSX630	■	■
S Short-time protection			
Pick-up (A) accuracy ±15 %	**Isd**	Adjustable directly in amps	
		9 settings: 1600, 1920, 2440, 2560, 2880, 3200, 3520, 3840, 4160 A	9 settings: 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500 A
Time delay (ms)	**tsd**	Non-adjustable	
	Non-tripping time Maximum break time	20 60	
I Instantaneous protection			
Pick-up (A) accuracy ±15 %	**Ii** non-adjustable	4800	6500
	Non-tripping time Maximum break time	0 30 ms	

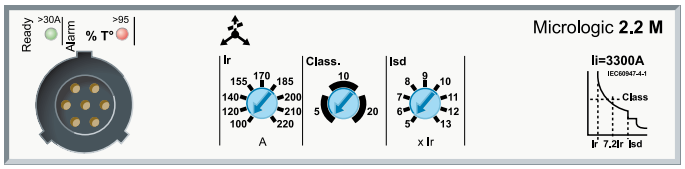


(1) Motor standards require operation at 65 °C. Circuit-breaker ratings are derated to take this requirement into account.

Motor protection
Micrologic 2-M electronic trip units

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

DB112111



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

Protection

Settings are made using a dial.

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

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

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

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

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

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

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

Indications

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

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

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

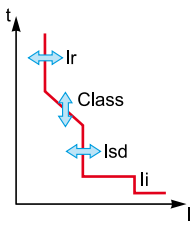
PB103376

SDTAM remote indication relay module with its terminal block.

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

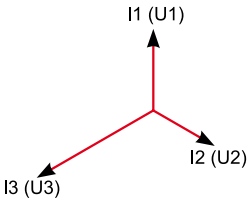
Micrologic 2.2 / 2.3-M

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



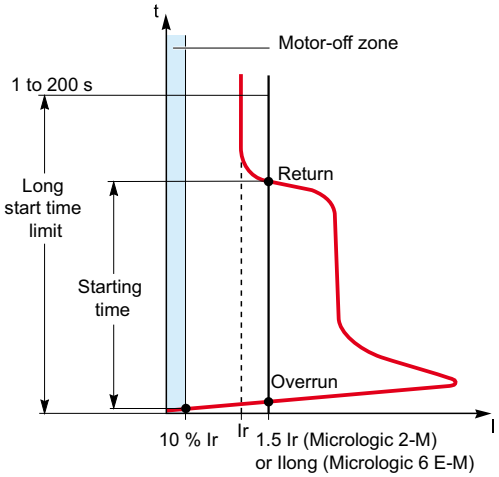
(1) Motor standards require operation at 65°C. Circuit-breaker ratings are derated to take this requirement into account.
(2) The unbalance measurement takes into account the most unbalanced phase with respect to the average current.

DB112114



Unbalance of phase currents and voltages

DB115573



Motor starting and long starts

Additional technical characteristics

Phase unbalance
An unbalance in three-phase systems occurs when the three voltages are not equal in amplitude and/or not displaced 120° with respect to each other. It is generally due to single-phase loads that are incorrectly distributed throughout the system and unbalance the voltages between the phases.
These unbalances create negative current components that cause braking torques and temperature rise in asynchronous machines, thus leading to premature ageing.

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

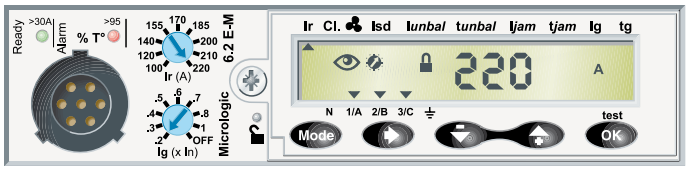
Starting time in compliance with the class (Micrologic 2-M)
For normal motor starting, Micrologic 2-M checks the conditions below with respect to the thermal-protection (long-time) pick-up Ir:
■ current > 10 % x Ir (motor-off limit)
■ overrun of 1.5 x Ir threshold, then return below this threshold before the end of a 10 s time delay.
If either of these conditions is not met, the thermal protection trips the device after a maximum time equal to that of the selected class.
Pick-up Ir must have been set to the current indicated on the motor rating plate.

Long starts (Micrologic 6 E-M)
When this function is not activated, the starting conditions are those indicated above.
When it is activated, this protection supplements thermal protection (class).
A long start causes tripping and is characterised by:
■ current > 10 % x Ir (motor-off limit) with:
■ either overrun of the long-time pick-up (1 to 8 x Ir) without return below the pick-up before the end of the long-time time delay (1 to 200 s)
■ or no overrun of the long-time pick-up (1 to 8 x Ir) before the end of the long-time time delay (1 to 200 s).
Pick-up Ir must have been set to the current indicated on the motor rating plate.
This protection should be coordinated with the selected class.

Motor protection
Micrologic 6 E-M electronic trip units

*Micrologic 6.E-M is used in **2-device motor-feeder solutions**.*
It provides the same protection as Micrologic 2-M:
- *short-circuits*
- *overloads with selection of the same trip classes (5, 10 or 20), plus trip class 30 for starting of machines with high inertia.*

In addition, it offers specific motor-protection functions that can be set via the keypad.



Protection

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

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

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

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

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

Locked rotor (Ijam)
This function detects locking of the motor shaft caused by the load.
During motor starting (see page A-43), the function is disabled.
During normal operation, it causes tripping:
- above the **Ijam** pick-up that can be fine-adjusted from 1 to 8 x Ir
- in conjunction with the **tjam** time delay that can be adjusted from 1 to 30 seconds.

Under-load (Iund)
This function detects motor no-load operation due to insufficient load (e.g. a drained pump). It detects phase undercurrent.
During motor starting (see page A-43), the function is always enabled.
During normal operation, it causes tripping:
- below the **Iund** pick-up that can be fine-adjusted from 0.3 to 0.9 x Ir
- in conjunction with the **tund** time delay that can be adjusted from 1 to 200 seconds.

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

(see "long starts" page A-43)

Display of type of fault

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

Indications

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

Remote indications via SDTAM or SDx module
See description on page A-42 for SDTAM and page A-81 for SDx.

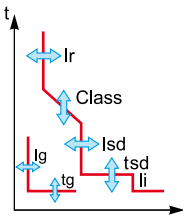
PB103376

SDTAM remote indication relay module with its terminal block.

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

Micrologic 6.2 / 6.3 E-M

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



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

Motor protection
Micrologic 6 E-M electronic trip units (cont.)

Micrologic 6 E-M provides Power Meter functions with energy metering. With the FDM121 display unit, all metering data and operating indicators are available on the switchboard front panel. This version also displays the thermal image of the motor.

PB103365

Micrologic 6 E-M.

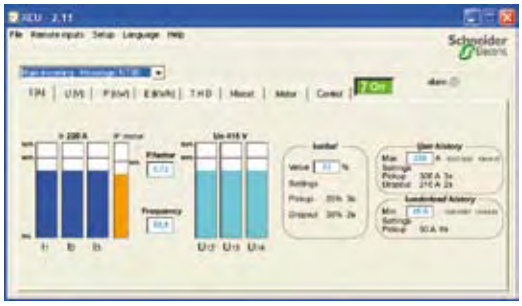
DB111404

Current values.

DB111405

Thermal-image alarm.

DB111403



PC screen with motor thermal image and value monitoring.

Power Meter functions

The built-in Power Meter functions of the Micrologic 6 E-M are the same as those for the Micrologic 6-E presented in the section on distribution (see page A-20). When used exclusively in the three-phase version, neutral measurements are excluded.

Operating-assistance functions

The operating-assistance functions of the Micrologic 6 E-M are the same as those for the Micrologic 6-E presented in the section on distribution (see page A-22).

Special functions for motor feeders

Additional operating functions specifically for motor feeders are available.

Phase sequence

The order in which the phases L1, L2, L3 are connected determines the direction of motor rotation. If two phases are inverted, the direction is reversed.
Information on the direction of rotation is provided. It can be linked to an alarm to detect an inversion in the direction following servicing on the supply under de-energised conditions and disable restarting.

Thermal image of the rotor and stator

Micrologic 6 E-M offers a thermal-image function.
Taking into account the Ir setting and the class, an algorithm simulates rotor and stator temperature rise. It includes the slow temperature rise of the stator and its metal mass. Also included is the faster temperature rise of the copper rotor.
The thermal protection function trips the circuit breaker when the calculated thermal image reaches 100 % of the permissible temperature rise.
The communication indicates the thermal-image value as a percentage of the permissible temperature rise. One or more alarms may be assigned to selected thresholds. A red LED on the front signals when the value exceeds 95 %.
An SDx module with two outputs programmed for thermal-image values can be used to implement other alarm functions.

The additional technical characteristics are identical to those of Micrologic 6-E (see pages A-21 and A-23).



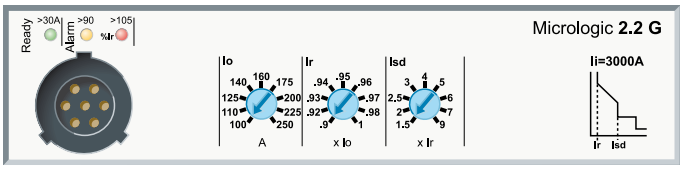
Micrologic 6 E-M integrated Power Meter and operating-assistance functions			Display	
			Micrologic LCD	FDM121 display
Measurements				
Instantaneous rms measurements				
Currents (A)	Phase currents and average value	I1, I2, I3 and Iavg = (I1 + I2 + I3) / 3	■	■
	Highest current of the 3 phases	Imax of I1, I2, I3	■	■
	Ground-fault protection	% Ig (pick-up setting)	■	■
	Current unbalance between phases	% Iavg	-	■
Voltages (V)	Phase-to-phase voltages and average value	U12, U23, U31 and Uavg = (U12 + U21 + U23) / 3	■	■
	Unbalance between phase-to-phase voltages	% Uavg	-	■
	Phase sequence	1-2-3, 1-3-2	■	-
Frequency (Hz)	Power system	F	■	■
Power	Active (kW), reactive (kVAR), apparent (kVA)	P, Q, S total and per phase	-	■
	Power factor and cos φ (fundamental)	PF, cos φ, total and per phase	-	■
Maximeters / minimeters	Associated with instantaneous rms measurements	Reset via Micrologic and the display unit	-	■
Energy metering				
Energy	Active (kWh), reactive (kVARh), apparent (kVAh)	Total since last reset	■	■
		Absolute or signed mode (1)	-	■
Demand and maximum demand values				
Demand current (A)	Phases	Present value on the selected window	-	(2)
		Maximum demand since last reset	-	(2)
Demand power	Active (kWh), reactive (kVARh), apparent (kVAh)	Present value on the selected window	-	(2)
		Maximum demand since last reset	-	(2)
Calculation window	Sliding, fixed or com-synchronised	Adjustable from 5 to 60 minutes in 1 minute steps	-	(2)
		Absolute or signed mode(1)	-	(2)
Power quality				
Total harmonic distortion (%)	Of voltage with respect to rms value	THDU,THDV of the Ph-Ph and Ph-N voltage	-	■
	Of current with respect to rms value	THDI of the phase current	-	■
Operating assistance				
Personalised alarms				
Settings	Up to 10 alarms can be assigned to all measurements and events		-	(2)
	as well as to phase lead/lag, four quadrants, phase sequence and thermal image		-	(2)
Time-stamped histories				
Trips	last 17	Ir, Isd, Ii, Ig, Iunbal, Ijam, Iund, Ilong	-	(2)
Alarms	last 10		-	(2)
Operating events	last 10 events and type:	Modification of protection setting by dial	-	(2)
		Opening of keypad lock	-	(2)
		Test via keypad	-	(2)
		Test via external tool	-	(2)
		Time setting (date and time)	-	(2)
		Reset for maximeter/minimeter and energy meter	■	(2)
Time stamping	Presentation	Date and time, text, status	-	(2)
Time-stamped event tables				
Protection settings	One of the following settings modified	Ir tr Isd tsd Ii Ig tg	-	(2)
	Time-stamping of modification	Date and time of modification	-	(2)
	Previous value	Value before modification	-	(2)
Min/Max	Value monitored	I1 I2 I3 U12 U23 U31 f	-	(2)
	Time-stamping of min/max value	Date and time of record	-	(2)
	Present min/max value	Min/max recorded for the value	-	(2)
Maintenance indicators				
Counter	Mechanical cycles (3)	Assignable to an alarm	-	(2)
	Electrical cycles (3)	Assignable to an alarm	-	(2)
	Trips	One per type of trip	-	(2)
	Alarms	One for each type of alarm	-	(2)
	Hours	Total operating time (hours)	-	(2)
Indicator	Contact wear	%	-	■
Load profile	Hours at different load levels	% of hours in four current ranges: 0-49 % In, 50-79 % In, 80-89 % In, ≥ 90 % In	-	(2)
Thermal image	Stator and rotor	% of permissible temperature rise	-	(2)

(1) Absolute mode: E absolute = E out + E in; Signed mode: E signed = E out - E in.
(2) Available via communication system.
(3) The BSCM module (page A-27) is required for these functions.

Special applications
Generator protection with Micrologic 2.2-G

Micrologic G trip units are used for the protection of systems supplied by generators or comprising long cable lengths. They can be mounted on all Compact NSX100/160/250 circuit breakers. With extensive setting possibilities, Micrologic 5 offers the same functions from 100 to 630 A.
A thermal-magnetic trip unit is also available for the NSX100 (see page A-15).

DB112118



Circuit breakers equipped with Micrologic G trip units protect systems supplied by generators (lower short-circuit currents than with transformers) and distribution systems with long cable lengths (fault currents limited by the impedance of the cable).

Protection

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

Overloads: Long-time protection (Ir)
Inverse-time thermal protection against overloads with an adjustable current pick-up Ir and a very short, non-adjustable time delay **tr** (15 seconds for 1.5 x Ir).

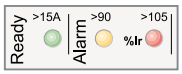
Short-circuits: Short-time protection (Isd) with fixed time delay
Short-circuit protection with an adjustable pick-up **Isd**, delayed 200 ms, in compliance with the requirements of marine classification companies.

Short-circuits: Non-adjustable instantaneous protection (Ii)
Instantaneous short-circuit protection with a fixed pick-up required for generator protection.

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

Indications

Front indications



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

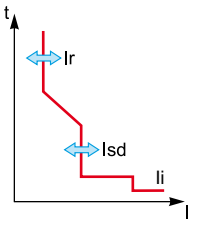
Remote indications
An SDx relay module installed inside the circuit breaker can be used to remote the overload-trip signal.
This module receives the signal from the Micrologic electronic trip unit via an optical link and makes it available on the terminal block. The signal is cleared when the circuit breaker is closed.
The module is described in detail in the section dealing with accessories.

PB103377

SDx remote indication relay module with its terminal block.

Micrologic 2.2-G

Ratings (A)	In at 40°C (1)		40	100	160	250
Circuit breaker	Compact NSX100		■	■	-	-
	Compact NSX160		■	■	■	-
	Compact NSX250		■	■	■	■



L Long-time protection

Pick-up (A) tripping between 1.05 and 1.20 Ir		**Io**	value depending on trip unit rating (In) and setting on dial								
	In = 40 A	Io =	18	18	20	23	25	28	32	36	40
	In = 100 A	Io =	40	45	50	55	63	70	80	90	100
	In = 160 A	Io =	63	70	80	90	100	110	125	150	160
	In = 250 A (NSX250)	Io =	100	110	125	140	150	176	200	225	250
		Ir = Io x ...	9 fine-adjustment settings from 0.9 to 1 for each Io value								
Time delay (s) accuracy 0 to -20%	**tr**		non-adjustable								
		1.5 x Ir	15								
		6 x Ir	0.5								
		7.2 x Ir	0.35								
Thermal memory			20 minutes before and after tripping								

S_0 Short-time protection with fixed time delay

Pick-up (A) accuracy ±10 %	**Isd** = Ir x ...	1.5	2	2.5	3	4	5	6	7	8	9
Time delay (ms)	**tsd**	non-adjustable									
	Non-tripping time	140									
	Maximum break time	200									

I Non-adjustable instantaneous protection

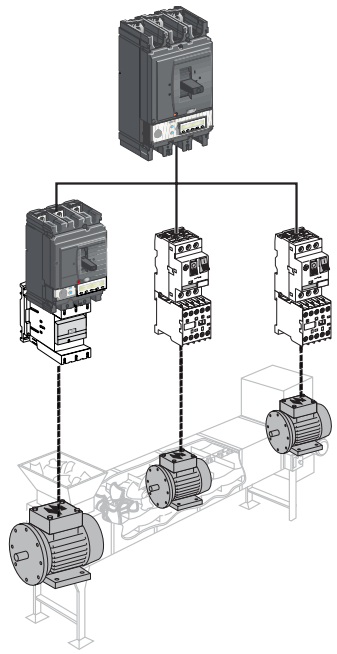
Pick-up (A) accuracy ±15 %	Ii non-adjustable	600	1500	2400	3000
	Non-tripping time	15 ms			
	Maximum break time	50 ms			

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

Special applications
Protection of industrial control panels

Compact NSX circuit breakers are also used in industrial control panels.
They serve as an incoming devices or can be combined with contactors to protect motor feeders:
- *compliance with worldwide standards including IEC 60947-2 and UL 508 / CSA 22-2 no. 14*
- *overload and short-circuit protection*
- *isolation with positive contact indication, making it possible to service machines safely by isolating them from all power sources*
- *installation in universal and functional type enclosures*
- *NA switch-disconnector version.*

DB115233



DB115234

Industrial control panels
Compact NSX circuit breakers equipped for public distribution or motor protection functions as described in the previous pages can be used in industrial control panels. The accessories for the Compact NSX range are suitable for the special needs of these switchboards.

Auxiliaries
All auxiliaries can be added to the circuit breaker by the user:
- padlocking devices (in the OFF position)
- rotary handle
- status-indication auxiliary contacts (ON, OFF and tripped)
- shunt (MX) or undervoltage (MN) releases
- early-make or early-break contacts.

Rotary handle
Direct or extended versions for mounting up to 600 mm behind the front:
- black front with black handle
- yellow front with red handle (for machine tools or emergency off as per IEC 204 / VDE 0013).

All rotary handles can be padlocked in the OFF position. Optional door interlock, recommended for MCC panels (motor control centres).
When the device is equipped with an extended rotary handle, a control accessory mounted on the shaft makes it possible to operate the device with the door open.
The device can be padlocked in the OFF position in compliance with UL508.

Early-make or early-break contacts
These contacts can be used respectively to supply an MN undervoltage release before the circuit breaker closes or to open the contactor control circuit before the circuit breaker opens.

Special functions
- Indication of thermal overloads with the SDx module.
- Early opening of the contactor for overload faults with the SDTAM module.
- Links with PLCs via the communication system.
- Measurement of all electrical parameters with Micrologic A and E.
- Programmable alarms with Micrologic 5 and 6.

Installation in enclosures
Compact circuit breakers can be installed in a metal enclosure together with other devices (contactors, motor-protection circuit breakers, LEDs, etc.) (see page A-90).

Compliance with North American industrial control equipment standards
Compact NSX devices have received UL508 / CSA 22-2 no. 14 approval for industrial control equipment of the "Manual Motor Controller", "Across the Line Starter", "General Use" and "Disconnecting Means" types.
Type NA devices are switch-disconnectors that must always be protected upstream.

UL508 approval

Circuit breakers	Trip units	Approvals
Compact NSX100 to 630 F/N/H	TMD, Micrologic 2, 5 and 6	General Use Motor Disconnecting Means
	NA, MA, Micrologic 1.3 M, 2.2 M, 2.3 M, Micrologic 6.2 E-M and 6.3 E-M	Manual Motor Controller Across the Line Starter Motor Disconnecting Means

Table of 3-phase motor ratings in hp (1 hp = 0.7457 kW)

V AC ratings		115	230	460	575
TMD Micrologic 2, 5 and 6	NA, MA Micrologic 1.3 M, 2.2 M, 2.3 M Micrologic 6.2 E-M and 6.3 E-M				
25	25	3	7.5	15	20
50	50	7.5	15	30	40
100	100	15	30	75	100
160	150	25	50	100	150
250	220	40	75	150	200
400	320	-	125	250	300
550	500	-	150	350	500

The deratings indicated on pages B-8 and B-9 apply to TMD, Micrologic 2, 5 and 6 trip units, rated at 40 °C.

Compact NSX circuit breakers may be used on 16 Hz 2/3 systems with special thermal-magnetic and electronic (Micrologic 5 A-Z) trip units.

16 Hz 2/3 networks

Single-phase distribution networks with a frequency of 16 Hz 2/3 are used for railroad applications in certain European countries.

Breaking capacity for 16 Hz 2/3 at 250/500 V

Compact NSX circuit breakers of the 3P 2D or the 3P 3D type protect 16 Hz 2/3 networks at 250 V or 500 V.
They can be equipped with either:
- a TM-D thermal-magnetic trip unit for Compact NSX100 to 250
- or an electronic Micrologic 5.2 A-Z trip unit for Compact NSX100 to 250 or a 5.3 A-Z for Compact NSX400/630.

The possible breaking-capacity performance levels are B, F, N and H as indicated below.

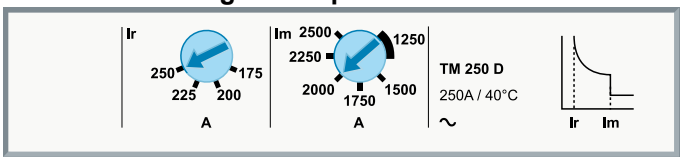
Breaking capacity Icu

Operating voltage		TMD and Micrologic 5 A-Z trip units			
	Performance	B	F	N	H
250 V / 500 V	Icu (kA)	25	36	50	70

Protection

TM-D thermal-magnetic trip units

DB112046



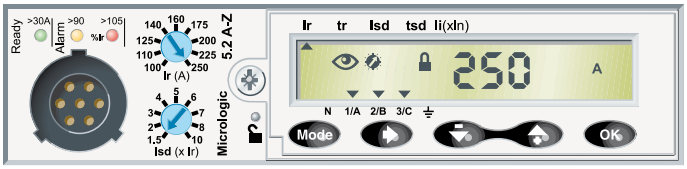
The 16 Hz 2/3 frequency does not modify the thermal settings with respect to those at 50 Hz (see page A-15). The magnetic pick-ups are modified as shown below.

Magnetic protection for Compact NSX 100/160/250 at 50 Hz and at 16 Hz 2/3

Rating (A) In at 40 °C		16	25	32	40	50	63	80	100	125	160	200 250
Pick-up (A) **Im** accur. ±20%		Fixed										Adjustable
NSX100	50Hz	190	300	400	500	500	500	640	800			
	16Hz 2/3	**170**	**270**	**360**	**450**	**450**	**450**	**580**	**720**			
NSX160/250	50Hz	190	300	400	500	500	500	640	800	1250	1250	5 to 10 In
	16 Hz 2/3	**170**	**270**	**360**	**450**	**450**	**450**	**580**	**720**	**1100**	**1100**	**4.5 to 9 In**

Micrologic 5 A-Z trip units

DB112153



Micrologic 5.2 A-Z and 5.3 A-Z are dedicated to 16 Hz 2/3 networks.
They use a suitable sampling frequency. The protection settings are identical to those of Micrologic 5 A (see page A-19). They also offer a current-measurement function for this specific frequency.

Trip-unit selection

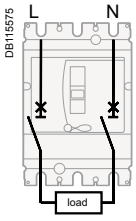
Rating	16	88	100	160	250	400	630
Compact							
NSX100	TM-D						
NSX160		TM-D					
NSX250				TM-D			
NSX100 to 250			Micrologic 5.2 A-Z				
NSX400/630					Micrologic 5.3 A-Z		

Wiring for NSX100 to 630 A

Phase and isolated neutral interrupted- 250 / 500 V

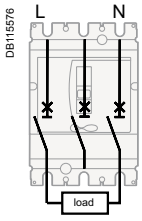
B and F (3P 2D version)

DB115575



N and H (3P 3D version)

DB115576

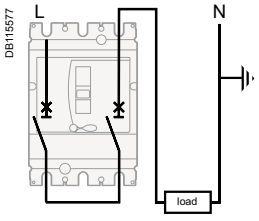


Remark. For an operating voltage > 250 V, the installation must be designed to eliminate all risk of double earth faults.

2 poles in series - Earthed neutral - 250 / 500 V

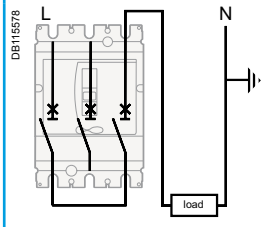
B and F (3P 2D version)

DB115577



N and H (3P 3D version)

DB115578



Special applications
Protection of 400 Hz systems

Compact NSX circuit breakers may be used on 400 Hz systems.

400 Hz distribution systems
The main 400 Hz applications are in aeronautics and certain military ships. Modern aircraft have three-phase 115/200 V 400 Hz networks.

Impact on protective devices
Due to the higher frequency, circuit breakers are subjected to additional temperature rise for identical current levels, resulting from higher losses caused by Foucault currents and an increase in the skin effect (reduction in the useful CSA of conductors). To remain within the rated temperature-rise limits of devices, current derating is required.
The power levels of 400 Hz applications rarely exceed a few hundred kW with relatively low short-circuit currents, generally not exceeding four times the rated current.
The standard Compact NSX and Masterpact NT/NW ranges are suitable for 400 Hz applications if derating coefficients are applied to the protection settings. See the derating table below.

Breaking capacity of Compact NSX circuit breakers in 400 Hz, 440 V systems

Circuit breaker	Breaking capacity Icu
NSX100	10 kA
NSX160	10 kA
NSX250	10 kA
NSX400	10 kA
NSX630	10 kA

PB103366

Micrologic TM-D trip unit.

Trip units equipped with thermal-magnetic protection
The 400 Hz current settings are obtained by multiplying the 50 Hz values by the following adaptation coefficient:
- K1 for thermal trip units
- K2 for magnetic trip units.

These coefficients are independent of the trip-unit setting.

Thermal trip units
The current settings are lower at 400 Hz than at 50 Hz (K1 < 1).

Magnetic trip units
The current settings are conversely higher at 400 Hz than at 50 Hz (K2 > 1). Consequently, when the trip units are adjustable, they must be set to the minimum value.

Adaptation coefficients for thermal-magnetic trip units

Circuit breaker	Trip unit	In (A)	Thermal at 40°C		Im (A)	Magnetic	
		50Hz	K1	400 Hz	50Hz	K2	400 Hz
NSX100	TM16G	16	0.95	15	63	1.6	100
	TM25G	25	0.95	24	80	1.6	130
	TM40G	40	0.95	38	80	1.6	130
	TM63G	63	0.95	60	125	1.6	200
NSX100	TM16D	16	0.95	15	240	1.6	300
	TM25D	25	0.95	24	300	1.6	480
	TM40D	40	0.95	38	500	1.6	800
	TM63D	63	0.95	60	500	1.6	800
	TM80D	80	0.9	72	650	1.6	900
	TM100D	100	0.9	90	800	1.6	900
NSX250	TM100D	100	0.9	90	800	1.6	900
	TM160D	160	0.9	144	1250	1.6	2000
	TM200D	200	0.9	180	1000 to 2000	1.6	1600 to 3200
	TM250D	250	0.9	225	1250 to 2500	1.6	2000 to 4000

Example
NSX100 equipped with a TM16G with 50 Hz settings Ir = 16 A and Im = 63 A.
400 Hz settings Ir = 16 x 0.95 = 15 A and Im = 63 A x 1.6 = 100 A.

PB103363

Micrologic 5 E trip unit.

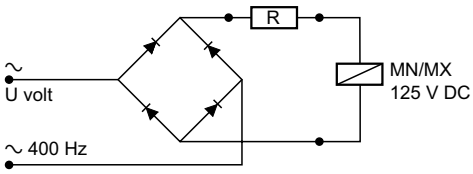
044314

OF auxiliary contact.

044313

MX or MN voltage release.

DB115579



Wiring diagram.

PB103377

SDx remote indication relay module with its terminal block.

Protection(cont.)

Micrologic electronic trip units

Micrologic 2.2, 2.3 or 5.2, 5.3 with A or E measurement functions are suitable for 400 Hz. The use of electronics offers the advantage of greater operating stability when the frequency varies. However the units are still subject to temperature rise caused by the frequency.
The practical consequences are:
- limit settings to 0.9 In (see the Ir derating table below)
- the long-time, short-time and instantaneous pick-ups are not modified (see pages A-17 or A-19)
- the accuracy of the displayed measurements is 2 % (class II).

Thermal derating: maximum Ir setting

Circuit breaker	Maximum setting coefficient	Max. Ir setting at 400 Hz
NSX100N	1	100
NSX250N	0.8	225
NSX400N	0.8	320
NSX630N	0.8	500

Example
An NSX250N, equipped with a Micrologic 2.2, Ir = 250 A at 50 Hz, must be limited to use at Ir = 250 x 0.9 = 225 A.
Its short-time pick-up with fixed time delay is adjustable from 1.5 to 10 Ir (60 to 400 A).
The instantaneous pick-up remains at 3000 A.

OF auxiliary contacts in 400 Hz networks

Electrical characteristics of auxiliary contacts

Contacts		Standard		Low level	
Utilisation cat. (IEC 60947-5-1)		AC12	AC15	CA12	CA15
Operational current (A)	24 V	6	6	5	3
	48 V	6	6	5	3
	110 V	6	5	5	2.5
	220/240 V	6	4	5	2
	380/415 V	6	2	5	1.5

MN and MX voltage releases for Compact NSX100/630 at 400 Hz and 440 V

For circuit breakers on 400 Hz systems, only 125 V DC MN or MX releases may be used. The release must be supplied by the 400 Hz system via a rectifier bridge (to be selected from the table below) and an additional resistor with characteristics depending on the system voltage.

U (V) 400 Hz	Rectifier	Additional resistor
220/240 V	Thomson 110 BHz or General Instrument W06 or Semikron SKB at 1.2/1.3	4.2 kΩ-5 W
380/420 V	Semikron SKB at 1.2/1.3	10.7 kΩ-10 W

Note: *other models of rectifier bridges may be used if their characteristics are at least equivalent to those stated above.*

SDx indication contacts

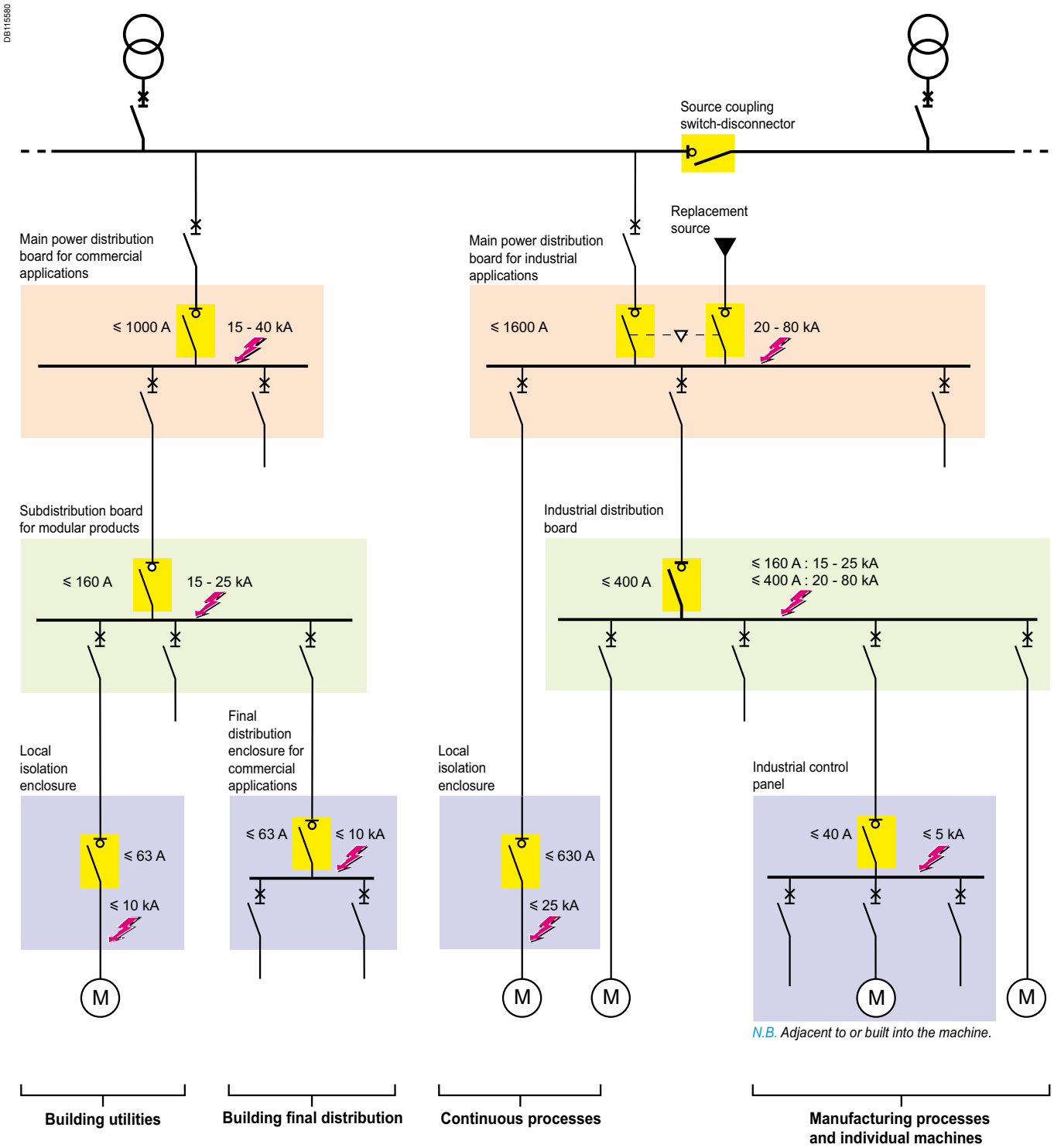
The SDx module may be used in 400 Hz systems for voltages from 24 to 440 V.
An SDx relay module installed inside the circuit breaker can be used to remote the overload-trip signal.
This module receives the signal from the Micrologic electronic trip unit via an optical link and makes it available on the terminal block. The signal is cleared when the circuit breaker is closed.
These outputs can be reprogrammed to be assigned to other types of tripping or alarm (see page A-81).

Switch-disconnectors
Overview of applications

A switch-disconnector is a control device that can be used to open and close a circuit under normal operating conditions.
It is suitable for isolation as indicated on the front by the symbol  .

Position of switch-disconnectors

Compact NSX switch-disconnectors are used primarily for the following applications:
- busbar coupling and isolation
- isolation of industrial distribution boards and industrial control panels
- isolation of subdistribution boards for modular devices
- isolation of local enclosures
- isolation of final distribution enclosures for commercial applications
- industrial control panel switch-disconnectors.



N.B. Adjacent to or built into the machine.

Compact NSX100 to 630 NA switch-disconnectors are available in fixed, plug-in and withdrawable versions. They use the same accessories and offer the same connection possibilities as the circuit-breaker versions.
They may be interlocked with another Compact switch-disconnector or circuit breaker to form a source-changeover system.

PB103199-28

Compact NSX switch-disconnector.

PB103372-34

Compact NSX switch-disconnector equipped with a motor mechanism module.

PB103629-31

Compact NSX switch-disconnector equipped with a Vigi module.

Suitability for isolation with positive contact indication

Compact NSX switch-disconnectors are suitable for isolation as defined by standard IEC 60947-3. The corresponding conformity tests guarantee:
- ■ the mechanical reliability of the position indication, i.e. the O (OFF) position indicated by the control device always reflects the open position of the contacts:
  - □ the required distance between contacts is provided
  - □ padlocks may not be installed unless the contacts are open
- ■ the absence of leakage currents
- ■ overvoltage withstand capacity between upstream and downstream connections.

Installation of a rotary handle or a motor mechanism does not alter the reliability of the position-indication system.

Emergency-off function

A Compact NSX NA is combined with an MN or MX release connected to an emergency-off button. In an emergency, an operator at a remote location can interrupt the circuit at rated load to isolate the entire switchboard and the downstream loads.

Motor mechanism

Compact NSX NA devices equipped with a motor mechanism module enable remote closing and opening. This function may be combined with the emergency-off function. In this case, the emergency off function is combined with a closing lock-out that must be intentionally reset (electrical diagram with closing lock-out).

Earth-leakage protection

A Vigi module may be added to a switch-disconnector to monitor all leakage currents in the outgoing circuits of the switchboard on which the switch-disconnector is installed. When the Vigi module detects an earth-leakage current, the switch-disconnector interrupts the load current. This function may be combined with the motor mechanism and the emergency-off function using an MN or MX release.

Switch-disconnector protection

The switch-disconnector can make and break its rated current. For an overload or a short-circuit, it must be protected by an upstream device, in compliance with installation standards.
The circuit-breaker/switch-disconnector coordination tables determine the required upstream circuit breaker. However, due to their high-set magnetic release, Compact NSX100 to 630 A switch-disconnectors are self-protected.

Switch-disconnector utilisation category

Depending on the rated operational current and the mechanical durability (A for frequent operation or B for infrequent operation), standard IEC 60947-3 defines the utilisation categories as shown in the table below. Compact NSX NA switch-disconnectors comply with utilisation categories AC22A or AC23A.

Utilisation category		Typical applications
Infrequent operation	Frequent operation	
AC-21A	AC-21B	Resistive loads including moderate overloads (cos φ = 0.95)
AC-22A	AC-22B	Mixed resistive and inductive loads including moderate overloads (cos φ = 0.65)
AC-23A	AC-23B	Motor loads or other highly inductive loads (cos φ = 0.45 or 0.35)

Switch-disconnectors

Characteristics and performance of Compact NSX switch-disconnectors from 100 to 630 NA

Installation standards require upstream protection. However Compact NSX100 to 630 NA switch-disconnectors are self-protected by their high-set magnetic release.

PB103199-39

Compact NSX100 to 250 NA.

PB103271

Compact NSX400 to 630 NA.

(1) 2P in 3P case.
(2) Suitable for 480 V NEMA.

Common characteristics

Rated voltages			
Insulation voltage (V)	**Ui**		800
Impulse withstand voltage (kV)	**Uimp**		8
Operational voltage (V)	**Ue**	AC 50/60 Hz	690
Suitability for isolation		IEC/EN 60947-3	yes
Utilisation category		AC 22 A/AC 23 A - DC 22 A/DC 23 A	
Pollution degree		IEC 60664-1	3

Switch-disconnectors

Electrical characteristics as per IEC 60947-3 and EN 60947-3

Conventional thermal current (A)	**Ith 60 °C**			
Number of poles				
Operational current (A) depending on the utilisation category	**Ie**	AC 50/60 Hz		
			220/240 V	
			380/415 V	
			440/480 V (2)	
			500/525 V	
			660/690 V	
		DC		
			250 V (1 pole)	
			500 poles (2 poles in series)	
			750 V (3 poles in series)	
Short-circuit making capacity (kA peak)	**Icm**	min. (switch-disconnector alone)		
		max. (protection by upstream circuit breaker)		
Rated short-time withstand current (A rms)	**Icw**	for	1 s	
			3 s	
			20 s	
Durability (C-O cycles)	mechanical			
	electrical	AC		
			440 V	In/2
				In
			690 V	In/2
				In
		DC	250 V (1 pole) and	In/2
			500 V (2 poles in series)	In
Positive contact indication				
Pollution degree				

Protection

Add-on earth-leakage protection	By Vigi module
	By Vigirex relay

Additional indication and control auxiliaries

Indication contacts	
Voltages releases	MX shunt release
	MN undervoltage release
Voltage-presence indicator	
Current-transformer module	
Ammeter module	
Insulation monitoring module	

Remote communication by bus

Device-status indication	
Device remote operation	
Operation counter	

Installation / connections

Dimensions (mm)	fixed, front connections	2/3P
W x H x D		4P
Weight (kg)	fixed, front connections	3P
		4P

Source-changeover systems (see chapter on Source-changeover systems)

Manual source-changeover systems
Remote-operated or automatic source-changeover systems

Common characteristics

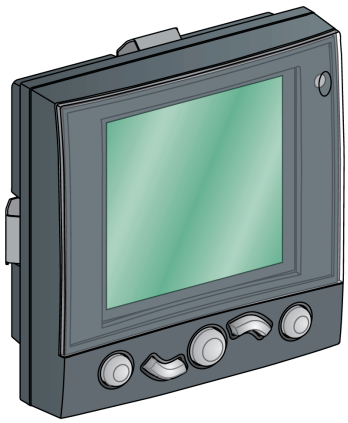
Control			
	Manual	With toggle	■
		With direct or extended rotary handle	■
	Electrical	With remote control	■
Versions			
	Fixed		■
	Withdrawable	Plug-in base	■
		Chassis	■

NSX100NA	NSX160NA	NSX250NA	NSX400NA	NSX630NA
100	**160**	**250**	**400**	**630**
2 (1), 3, 4	2 (1), 3, 4	2 (1), 3, 4	3, 4	3, 4
AC22A / AC23A	**AC22A / AC23A**	**AC22A / AC23A**	**AC22A / AC23A**	**AC22A / AC23A**
100	160	250	400	630
100	160	250	400	630
100	160	250	400	630
100	160	250	400	630
100	160	250	400	630
DC22A / DC23A	**DC22A / DC23A**	**DC22A / DC23A**	**DC22A / DC23A**	**DC22A / DC23A**
100	160	250	400	630
100	160	250	400	630
100	160	250	400	630
2.6	3.6	4.9	7.1	8.5
330	330	330	330	330
1800	2500	3500	5000	6000
1800	2500	3500	5000	6000
690	960	1350	1930	2320
50000	40000	20000	15000	15000
AC22A / AC23A	**AC22A / AC23A**	**AC22A / AC23A**	**AC22A / AC23A**	**AC22A / AC23A**
35000	30000	15000	10000	6000
20000	15000	7500	5000	3000
15000	10000	6000	5000	3000
8000	5000	3000	2500	1500
10000	10000	10000	2000	2000
5000	5000	5000	1000	1000
■	■	■	■	■
III	III	III	III	III
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
■			■	
105 x 161 x 86			140 x 255 x 110	
140 x 161 x 86			185 x 255 x 110	
1.5 to 1.8			5.2	
2.0 to 2.2			6.8	
■			■	
■			■	

FDM121 Display for LV Circuit Breaker

User Guide

06/2014



DOCA0088EN-00

www.schneider-electric.com

Schneider Electric

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.

Table of Contents

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.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designated to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

About the Book

At a Glance

Document Scope

The aim of this guide is to provide installers and maintenance personnel with the information needed to set up and operate the FDM121 display for LV circuit breaker.

Validity Note

This document is applicable to FDM121 display for LV circuit breaker associated with circuit breakers:

- Masterpact™ NT/NW
- Compact NS™ 630–1600 A and 1600b–3200 A
- Compact NSX™ 100–630 A
- PowerPact™ P- and R-frame
- PowerPact™ H-, J-, and L-frame

Related Documents

Title of Documentation	Reference Number
FDM121 Display for LV Circuit Breaker - Instruction Sheet	GHD16275
Micrologic 5 and 6 Trip Units for Compact NSX Circuit Breakers - User Guide	LV434103 (FR) LV434104 (EN) LV434105 (ES)
Micrologic 5 and 6 Trip Units for PowerPact H-, J-, and L- Frame Circuit Breakers - User Guide	48940-312 (EN, ES, FR)
Micrologic A/E Trip Units - User Guide	04443723A (FR) 04443724A (EN) EAV16735 (ES)
Micrologic P Trip Units - User Guide	04443725A (FR) 04443726A (EN) EAV16736 (ES)
Micrologic H Trip Units - User Guide	04443727A (FR) 04443728A (EN) EAV16737 (ES)
Micrologic 2.0A, 3.0A, 5.0A, and 6.0A Trip Units - Instruction Bulletin	48049-136 (EN, ES, FR)
Micrologic 5.0P and 6.0P Trip Units - Instruction Bulletin	48049-137 (EN, ES, FR)
Micrologic 5.0H and 6.0H Trip Units - Instruction Bulletin	48049-330 (EN, ES, FR)
ULP System for Compact and Masterpact Circuit Breakers - User Guide	TRV99100 (FR) TRV99101 (EN) TRV99102 (ES)
ULP System for PowerPact and Masterpact Circuit Breakers - User Guide	48940-329 (EN, ES, FR)
IO Input/Output Interface Module for LV Circuit Breaker - User Guide (IEC Version)	DOCA0055EN DOCA0055ES DOCA0055FR DOCA0055ZH
IO Input/Output Interface Module for LV Circuit Breaker - User Guide (UL Version)	0613IB1317 (EN) 0613IB1318 (ES) 0613IB1319 (FR) 0613IB1320 (ZH)

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

Chapter 1
FDM121 Presentation

Aim of This Chapter

What Is in This Chapter?

This chapter contains the following topics:

Introduction

Description

The FDM121 display unit displays the measurements, alarms, and operating assistance data from the intelligent modular unit (IMU). The FDM121 display unit can control the circuit breaker equipped with a motor mechanism or the pre-defined application performed by the IO module *(see page 32)*.

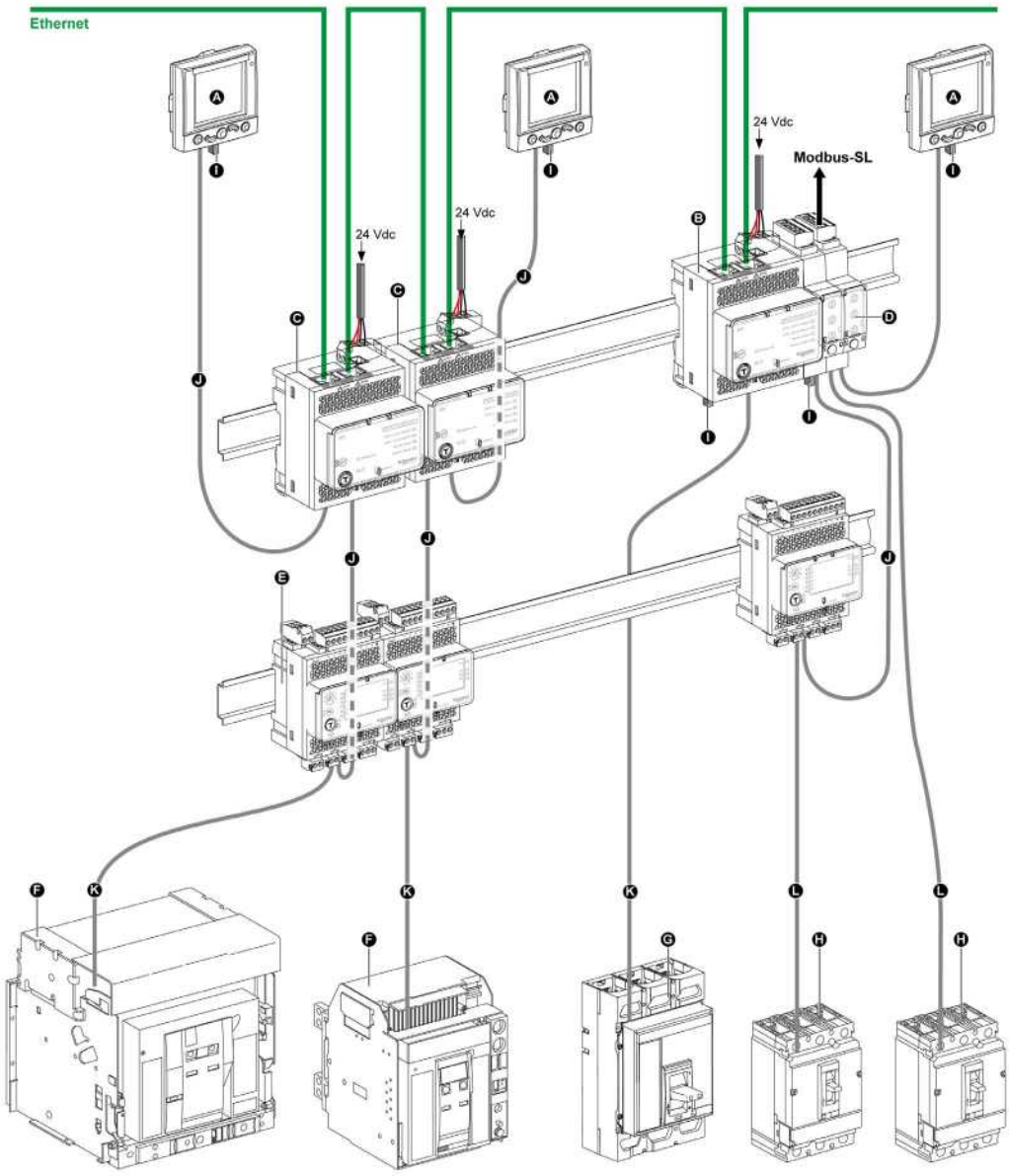
The FDM121 display unit is compatible with Masterpact™ NT/NW, Compact™ NS, Compact™ NSX, and PowerPact™ circuit breakers.

Intelligent Modular Unit

A modular unit is a mechanical and electrical assembly containing one or more products to perform a function in a switchboard (incoming protection, motor command, and control). The modular units are easily installed in the switchboard.

The circuit breaker with its internal communicating components (for example, Micrologic trip unit) and external ULP modules (FDM121 display unit, IO module, and so on) connected to one IFM or IFE communication interface is called an intelligent modular unit (IMU).

Communication Architecture



A FDM121 display for LV circuit breaker
B IFE Ethernet interface for LV circuit breaker and gateway
C IFE Ethernet interface for LV circuit breaker
D IFM Modbus-SL interface for LV circuit breaker
E IO input/output interface module for LV circuit breaker
F Masterpact NT/NW circuit breaker
G Compact NS, PowerPact P- or R-frame circuit breaker
H Compact NSX, PowerPact H-, J-, or L-frame circuit breaker
I ULP termination
J ULP cable
K Breaker ULP cord
L NSX cord

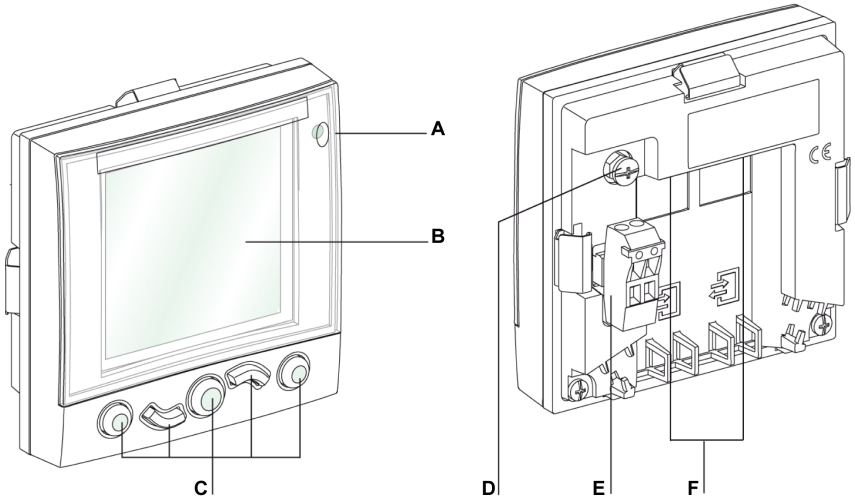
Component Part Numbers

The table below lists the part numbers for the components of the ULP system for circuit breaker:

Component	Description	Part number
Breaker ULP cord	L = 0.35 m (1.15 ft)	LV434195
	L = 1.3 m (4.26 ft)	LV434196
	L = 3 m (9.84 ft)	LV434197
Cord for system voltage greater than 480 Vac	L = 1.3 m (4.26 ft), U > 480 Vac (cord with female socket)	LV434204
BCM ULP breaker communication module	–	33106
IO input/output interface for LV circuit breaker	–	LV434063
FDM121 display for LV circuit breaker	–	• TRV00121 (IEC) • STRV00121 (UL)
Surface-mounting accessory	–	TRV00128
IFM Modbus-SL interface for LV circuit breaker	–	• TRV00210 (IEC) • STRV00210 (UL)
IFE Ethernet interface for LV circuit breaker	Ethernet interface	LV434010
	Ethernet interface and gateway	LV434011
Stacking accessory	10 stacking accessories	TRV00217
Maintenance module	–	• TRV00911 (IEC) • STRV00911 (UL)
ULP cable	L = 0.3 m (0.98 ft), 10 cables	TRV00803
	L = 0.6 m (1.97 ft), 10 cables	TRV00806
	L = 1 m (3.28 ft), 5 cables	TRV00810
	L = 2 m (6.56 ft), 5 cables	TRV00820
	L = 3 m (9.84 ft), 5 cables	TRV00830
	L = 5 m (16.40 ft), 1 cable	TRV00850
RJ45 female/female connector	10 RJ45 female/female connectors	TRV00870
ULP line terminator	10 ULP line terminators	TRV00880
Modbus terminator	2 Modbus cable terminators with impedance of 120 Ω + 1 nF	VW3A8306DRC
24 Vdc power supply	24/30 Vdc-24 Vdc-1 A-overvoltage category IV	• 54440 (IEC) • 685823 (UL)
	48/60 Vdc-24 Vdc-1 A-overvoltage category IV	• 54441 (IEC) • 685824 (UL)
	100/125 Vdc-24 Vdc-1 A-overvoltage category IV	• 54442 (IEC) • 685825 (UL)
	110/130 Vac-24 Vdc-1 A-overvoltage category IV	• 54443 (IEC) • 685826 (UL)
	200/240 Vac-24 Vdc-1 A-overvoltage category IV	• 54444 (IEC) • 685827 (UL)
	380/415 Vac-24 Vdc-1 A-overvoltage category IV	• 54445 (IEC) • 685829 (UL)
	100/500 Vac-24 Vdc-3 A-overvoltage category II	ABL8RPS24030
Modbus cable	Belden: 7 mm (0.27 in) diameter shielded cable with 2 twisted pairs	3084A
	Belden: 9.6 mm (0.38 in) diameter (recommended) shielded cable with 2 twisted pairs	7895A
	Cable with 2 twisted pairs without shielding drain wire	50965
2-wire RS 485 isolated repeater module	–	TRV00211
NSX cord	L = 0.35 m (1.15 ft)	LV434200
	L = 1.3 m (4.27 ft)	LV434201
	L = 3 m (9.84 ft)	LV434202

Hardware Description

Description



A Alarm Indicator LED
B LCD screen
C Navigation keys
D Functional ground
E 24 Vdc power supply terminal block
F ULP RJ45 connectors

Alarm Indicator LED

The orange alarm indicator LED alerts the user when a new high-priority or medium-priority alarm is detected in the IMU. It also indicates that one of the ULP modules of the IMU is in degraded mode or off.

Alarm indicator LED status	Meaning
Steady OFF	Nominal operation (no high-priority or medium-priority alarm detected, no module in degraded mode or off)
Blinking	• At least one high-priority alarm is present in the **Event Log** list and has not been acknowledged by the user. • An IMU module is off. The LED goes off after acknowledgment on the non-operational module or when the module concerned is no longer off.
Steady ON	• At least one medium-priority alarm is present in the **Event Log** list and there is no high-priority alarm. • An IMU module is in degraded mode. The LED goes off after acknowledgment on the degraded module or when the module concerned is no longer degraded.

For more information on the management of events and alarms, refer to the Alarms menu *(see page 35)*.

Functional Ground

In an environment with a high level of electromagnetic disturbance, connect the FDM121 functional ground to the local machine ground in the switchboard by using a grounding strip.

24 Vdc Power Supply

NOTICE

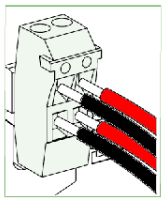
HAZARD OF EQUIPMENT DAMAGE

- Voltage other than 24 Vdc will damage the FDM121 display unit.
- Do not use any voltage other than 24 Vdc.

Failure to follow these instructions can result in equipment damage.

The FDM121 display unit is supplied either through the ULP cables or by direct connection of the power supply to the FDM121 power supply terminal block:

- For a communicating architecture, connect the 24 Vdc power supply to the connector on the IFM or IFE communication interface. The communication interface powers the other modules on the IMU through the ULP cables.
  In this architecture, the FDM121 power supply terminal block can be removed to reduce the dimensions.
- For a standalone architecture, connect the 24 Vdc power supply to the FDM121 power supply terminal block. The FDM121 display unit powers the other modules on the IMU through the ULP cables.

Power supply terminal block	Wire	Color	Description	Cross-section	Stripped length
		Black	0 V	0.2–1.5 mm^2 (24–16 AWG)	7 mm (0.28 in)
		Red	24 V	0.2–1.5 mm^2 (24–16 AWG)	7 mm (0.28 in)

The FDM121 power supply terminal block has two points per terminal to simplify, if necessary, distribution of the power supply to other devices in the switchboard.

ULP Connection

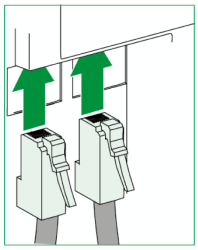
NOTICE

HAZARD OF EQUIPMENT DAMAGE

- The FDM121 RJ45 ports are for ULP modules only.
- Any other use can damage the FDM121 display unit or the device connected to it.
- To check if a ULP module is compatible with the RJ45 ports, refer to the *ULP System User Guide*.

Failure to follow these instructions can result in equipment damage.

Use the two ULP RJ45 connectors on the FDM121 display unit to connect it to the IMU. Both ULP connectors are identical and in parallel, allowing the ULP modules of the IMU to be connected in any order.



NOTE: When the second ULP connector is not used, it must be closed with an ULP line terminator.

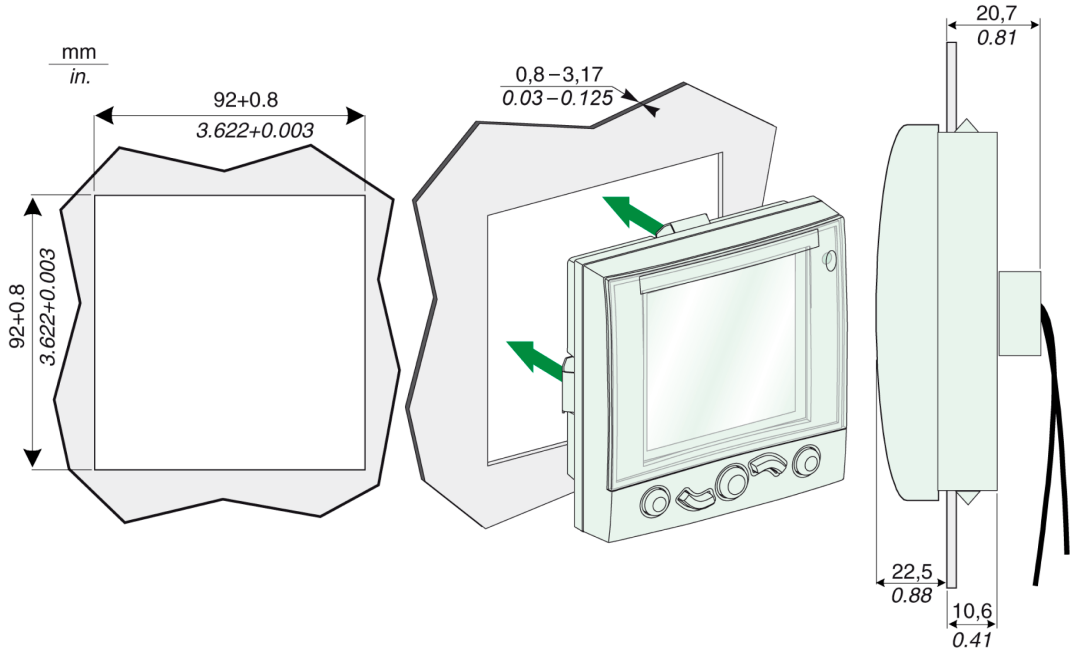
Mounting

There are two possible mounting configurations for the FDM121 display unit:

- Mounting in a door cut-out secure with a clip.
- Retrofit mounting through drill holes and secured with a surface-mounted accessory.

Door Cut-Out Mounting

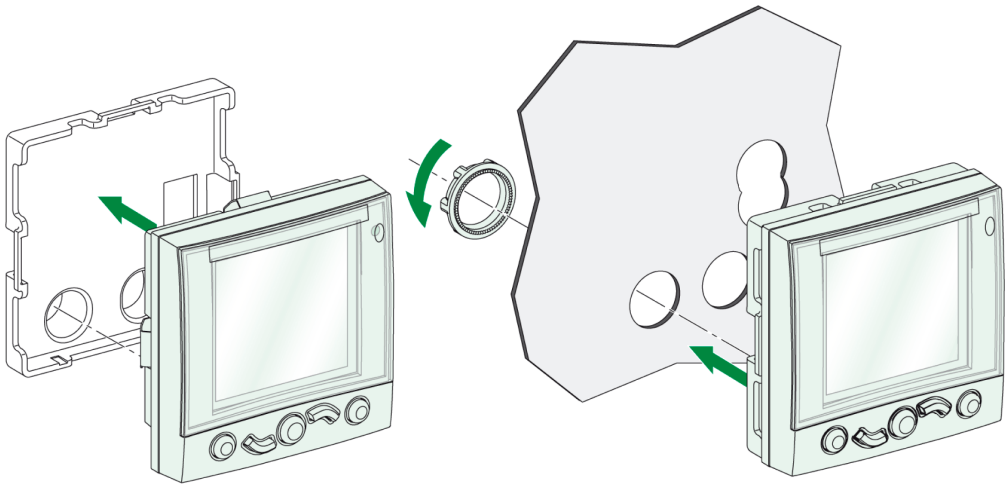
Mount the FDM121 display unit by cutting a standard 92 x 92 mm (3.622 x 3.622 in) cut-out on the door and pushing FDM121 through the hole until secured by clips.



Hole Mounting

Mount the FDM121 display unit by drilling two holes 22.5 mm (0.89 in) in diameter and securing the unit by using a surface-mounting accessory and a locking nut.

If the FDM121 display unit power supply terminal block is used to power the IMUs, a third cut-out made up of two drill holes 22.5 mm (0.89 in) in diameter is needed.



Customer Engineering Tool (CET)

Definition

The customer engineering tool used to configure the FDM121 display for LV circuit breaker can be either Electrical Asset Manager software or:

- Compact NSX RSU software
  - to configure the Compact NSX and PowerPact H-, J-, and L-frame alarms
  - to update the FDM121 firmware
  - to manage the passwords
  - to set date and time
  - to change IMU identification.
- Masterpact RSU software to configure the Masterpact, Compact NS, or PowerPact P- and R-frame pre-defined alarms.
- RCU software to check the network communication with IFM and IFE.

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

Electrical Asset Manager

Electrical Asset Manager is the software which enables the user to have the following features in addition to the features provided by Compact NSX RSU, Masterpact RSU, and RCU software:

- Create projects by device discovery, selection of devices from Schneider Electric catalog and importing Bill Of Material (BOM) files
- Monitor the device protection and IO status
- Read information (alarm logs, measurements, and maintenance parameters)
- Check protection discrimination between two devices
- Upload and download of configuration or settings in batches
- Perform control actions in a secured way
- Generate and print device settings report, communication test report discovered devices report, and imported BOM file devices 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 *Electrical Asset Manager Online Help*.

Compact NSX RSU Software

Compact NSX RSU (Remote Setting Utility) is the Compact NSX and PowerPact H-, J-, and L-frame 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 the SDTAM module output parameters.
- check and set up the BSCM breaker status and control module parameters.
- edit and save configurations.

Compact NSX RSU can also be used to configure the intelligent modular unit (IMU) modules connected to Compact NSX, Compact NS, PowerPact H-, J-, and L-frame, PowerPact P- and R-frame, or Masterpact circuit breakers, and enables the user to:

- check and set up the IFM parameters.
- check and set up the IFE parameters.
- modify passwords in the IMU.
- change IMU identification.
- get and set the time.
- configure the IO assignments.
- modify the IO counters.
- reset the IO 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.)
- edit and save configurations.

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

Masterpact RSU Software

Masterpact RSU (Remote Setting Utility) is the Masterpact, Compact NS, and PowerPact P- and R-frame configuration software. Masterpact RSU enables the user to

- check and set up the Micrologic trip unit parameters:
  - protection parameters
  - measurement parameters
  - alarm parameters.
- display the Micrologic tripping curves.
- edit and save configurations.

For more information, see the *Masterpact RSU Online Help*.

RCU Software

RCU (Remote Control Utility) is a simple SCADA software for:

- Compact NSX and PowerPact H-, J-, and L-frame circuit breakers
- Compact NS and PowerPact P- and R-frame circuit breakers
- Masterpact circuit breakers
- power meters

Depending on the equipment the RCU software is connected to, RCU enables the user to

- display the measurements of current (I), voltage (U), energy (E), and total harmonic distortion (THD).
- display the date and time.
- display the identification and maintenance information of the equipment.
- control the equipment (only for circuit breakers).
- log the measurements of power (P), power factor (PF), and energy (E) every 5 minutes.
- display the status of the IOs.
- check the network communication with IFM or IFE.

The RCU software helps users to monitor and control their equipment and helps installers to check and validate the newly installed equipment.

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

Technical Characteristics

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC/EN 60947-1 • IACS E10

		• UL508 - Industrial Control Equipment
		• No. 142-M1987 - Process Control Equipment
		  • CAN/CSA C22.2 No. 0-M91 - General requirements - Canadian Electrical Code Part
		  • CAN/CSA C22.2 No. 14-05 - Industrial Control Equipment
		  • CSA C22.2 No.14-10

Certification		• CE and C-Tick marking
		• UL • CSA
Ambient temperature	Storage	-40 °C to +85 °C (104–185 °F)
	Operation	-10 °C to +55 °C (14–131 °F) (on the front panel)
Relative humidity	Conforming to IEC/EN 60068-2-78	Four days, 40 °C (104 °F), 93% RH, energized
Protective treatment	Conforming to IEC/EN 60068-2-30	Six cycles of 24 hours, 25/55 °C (77/131° F), 95% RH, energized
Pollution		3
Corrosive atmosphere	Conforming to IEC 60068-2-60	Four gases (H_2S, SO_2, NO_2, Cl_2)
Level of pollution	Access to hazardous parts and water penetration	IP53 (splashing outside the protective cover)
	Conforming to IEC/EN 60947-1 and IEC/EN 60529	IP2x (connectors)
	Conforming to IEC 62262/EN 50102	IK05 (external mechanical impacts)
Flame resistance	Conforming to IEC/EN 60947-1 and IEC/EN 60695-2-11	• 650 °C (1,202 °F) 30 s/30 s on de-energized insulating parts • 960 °C (1,760 °F) 30 s/30 s on de-energized insulating parts
	Conforming to UL94	V0

Mechanical Characteristics

Characteristic		Value
Degree of protection of the installed module		• Part projecting beyond the escutcheon: IP4x • Other module parts: IP3x • Connectors: IP2x
Shock resistance	Conforming to NF EN 22248 (free fall, in packaging)	H = 90 cm (35.4 in)
	Conforming to IEC 60068-2-27	15 g (0.53 oz)/11 ms 1/2 sinusoidal
Resistance to sinusoidal vibration	Conforming to IEC/EN 60068-2-6	1 g (0.035 oz)/5-150 Hz

Electrical Characteristics

Characteristic		Value
Power supply		24 Vdc, -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	21 mA/24 Vdc at 20 °C (68 °F)
	Maximum	30 mA/19.2 Vdc at 60 °C (140 °F)
Resistance to electromagnetic discharges	Conforming to IEC/EN 61000-4-2	• 4 kV (direct) • 8 kV (air)
Immunity to radiated electromagnetic interference	Conforming to IEC/EN 61000-4-3	10 V/m

Characteristic		Value
Immunity to electrical fast transients/burst	Conforming to IEC/EN 61000-4-4	● 2 kV (power) ● 8 kV (signal)
Immunity to radiated fields	Conforming to IEC/EN 61000-4-6	10 V
Immunity to surges	Conforming to IEC/EN 61000-4-5	

Physical Characteristics

Characteristic		Value
Dimensions (W x D x H)		● Without power supply terminal block: 96 x 96 x 33.1 mm (3.8 x 3.8 x 1.3 in) ● With power supply terminal block: 96 x 96 x 43.2 mm (3.8 x 3.8 x 1.7 in)
Weight		0.2 kg (7.06 oz)
Mounting		● Flush-mounted ● Surface-mounted, with surface-mounting accessory
Display	Screen	128 x 128 pixels
	Viewing angle	● Horizontal: ± 30° ● Vertical: ± 60°

Protecting the Environment

Recycling Packaging

The packaging materials from this equipment can be recycled. Please help protect the environment by recycling them in appropriate containers.

Thank you for playing your part in protecting the environment.

End-of-Life Recycling

At end of life, the modules of the ULP system have been optimized to decrease the amount of waste and valorize the components and materials of the product in the usual end of life treatment process.

The design has been achieved so components are able to enter the usual end-of-life treatment processes as appropriate: depollution if recommended, reuse and/or dismantling if recommended to increase the recycling performances, and shredding for separating the rest of materials.

Chapter 2
FDM121 Use

Aim of this Chapter

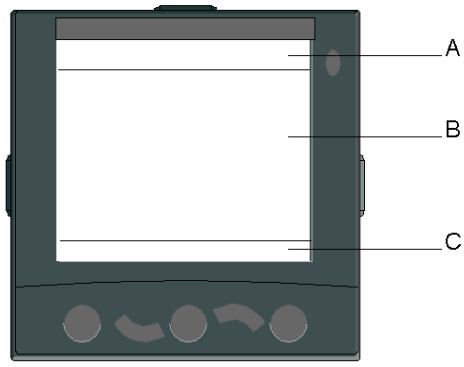
What Is in This Chapter?

This chapter contains the following topics:

Operation

Screen

The screen displays the information needed to operate the ULP modules.

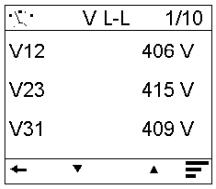


A Identification zone
B Information zone
C Navigation zone

The display is divided in three zones:
- The identification zone identifies the current screen (screen title) and notifies the user when an alarm trips.
- The information zone displays specific data on the screen (such as measurements, alarms, and settings).
- The navigation zone indicates which navigation options are available by using the keys, depending on the menu displayed.

The table below shows an example of the display:

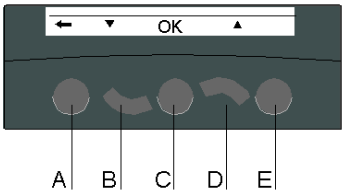
Example	Description

	• Identification zone
	  ◦ The icon indicates that you are in the **Metering** menu.
	  ◦ The measurements displayed are voltages.
	  ◦ The **V L-L V L-N** submenu in the **Metering** menu consists of 10 screens. The **V L-L** screen displayed is number 1.
	• Information zone
	  ◦ The voltage values **V12**, **V23**, and **V31** are displayed.
	• Navigation zone
	  ◦ The navigation options for the **V L-L** screen are displayed.

The FDM121 display unit also has white backlighting:
- Pressing a navigation key turns the backlighting on for 3 minutes.
- The backlighting blinks every 250 ms when a prohibited ULP modular unit configuration is detected (for example, if two identical modules are part of the same IMU).
- The backlighting blinks once per second over a period of 15 seconds when the test mode is active. Push the test button located on one of the ULP modules connected to the FDM121 display unit.

Navigation Keys

There are five keys which provide navigation:



A Back/Home key
B Down key
C Confirm/clear/set-up key
D Up key
E Context-sensitive key

The navigation zone indicates which navigation options are available by using the keys, depending on the menu displayed.

The table below lists the navigation options available from the five keys on the FDM121 display unit. When no icon is displayed in the zone corresponding to a key, this key is inactive for the menu displayed.

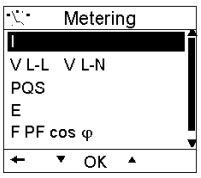
Key	Icon	Description
Back/Home	←	• Exits a menu or a submenu and returns to the previous menu. • Used to return to the **Main menu** from the **Quick view** menu displayed when the FDM121 display unit is powered up.
Down	▼	Used to point to the desired measurements or moves on to the next screen.
Confirm	**OK**	• Confirms selection of a menu option. • Clears a new event.
Set-up		Used to access settings: • FDM121 time and date • Temperature or volume unit • IFE IP address
Up	▲	Used to point to the desired measurements or to go back to the previous screen.
Context-sensitive		Displays measurements in bar graph mode.
		Displays measurements in dial graph mode.
	888	Displays measurements in numeric mode.
	+🔍	Used to display detailed information for an event in the event log or for an alarm in the alarm history.
	-🔍	Used to return to the event log or alarm history.
	▶	Used to change the selected field in edition mode.

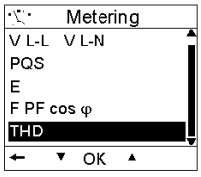
Scrolling

The screen can display a maximum of five visible menu items. When a list includes more than five items, a scroll bar appears on the right side of the screen.

Use the ▲ and ▼ keys to scroll through a menu item list. The position of the scroll bar indicates the relative position of the highlighted item in the list.

Example: The **Metering** menu is displayed on two screens.





Password Management

General Description

Four passwords are defined, each one corresponding to a level.

A level is assigned to a role:
- Levels 1, 2, and 3 are used for general-purpose roles, like an operator role.
- Level 4 is the administrator level. The administrator level is required to write the settings to the ULP modules using the customer engineering tool *(see page 16)*.

When an FDM121 command is protected by password, the user must enter the password of the right level in a dedicated window.

Initial Passwords

The password values set in factory are:

Password level	Factory setting
Level 1	'1111' = 0x31313131
Level 2	'2222' = 0x32323232
Level 3	'3333' = 0x33333333
Level 4 (administrator level)	'0000' = 0x30303030

Password Modification

Passwords are modified with the customer engineering tool *(see page 16)*.

Passwords are composed of exactly four ASCII characters. They are case-sensitive and the allowed characters are:
- digits from 0 to 9
- letters from a to z
- letters from A to Z

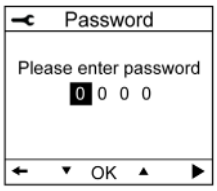
Password Reset

If the initial passwords have been changed, three cases require to reset the passwords to their factory settings with the customer engineering tool *(see page 16)*:
- A password is forgotten.
- A new module is added in the IMU: for example, an FDM121 display unit.
- A faulty module is replaced in the IMU.

Resetting passwords with the customer engineering tool *(see page 16)* is only available with the **Schneider service** user profile.

Password Screen

The **Password** screen displays when a password protected command is to be accessed and the default level 3 password has been modified in the controlled device.



Entering a Password

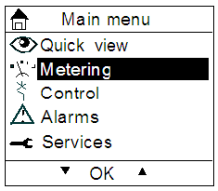
The procedure for entering a password is as follows.

Step	Action
1	Use the ▼ and ▲ keys to increase or decrease the value of the digit. It automatically rolls over from numeric to alphabetical characters.
2	Use the ▶ key to move to the next digit. Pressing this key on the fourth digit loops you back to the first digit.
3	Use the **OK** key to confirm the password. If the password is correct, the given command is sent. Otherwise an error screen is displayed.
4	Use the ← key to return to the previous menu without sending any command.

Main Menu

Presentation

The **Main menu** offers five menus for monitoring and using the ULP system intelligent modular units (IMU).



The description and content of the menus depend on the IMU. For more information, refer to the documentation for the device connected to the FDM121 display unit.

For example, if you have an FDM121 display unit connected to a Compact NSX, refer to the *Micrologic 5 and 6 Trip Units User Guide*.

The menus available in the **Main menu** are as follows:

Menu	Description
Quick view	**Quick view** menu *(see page 27)* The **Quick view** menu provides quick access to the information essential for operation.
Metering	**Metering** menu *(see page 29)* The **Metering** menu displays the data made available by the Micrologic trip unit: ● Current, voltage, power, energy, and harmonic distortion measurements ● Minimum and maximum metering values
Control	**Control** menu *(see page 31)* The **Control** menu is used to control a circuit breaker equipped with a communicating motor mechanism from the FDM121 display unit. The proposed commands are: ● Circuit breaker opening ● Circuit breaker closing with or without self-timer ● Circuit breaker reset after trip ● IO module lighting control ● IO module load control
Alarms	**Alarms** menu *(see page 35)* The **Alarms** menu is used to display: ● The event log file for the last 40 events and alarms detected by the devices connected to the FDM121 display unit since the last power-up of the FDM121. ● The alarm history (for example, alarms, trips, maintenance, and control status) for the device connected to the FDM121 display unit.
Services	**Services** menu *(see page 39)* The **Services** menu contains all the FDM121 display unit setup functions and the operating assistance information: ● Reset (peak demand values, energy meters) ● Setup (display module date and time, parameters) ● Maintenance (operation counters, load profile) ● Product version (identification of the intelligent modular units) ● Language (choice of language display) ● Monitoring and controlling the IO modules (IO status, forcing command, and counters) ● Setup of the IP address of the IFE Ethernet interface for LV circuit breaker

Navigation

Navigation within the **Main menu** is as follows:

- Use the ▲ and ▼ keys to select one of the menus.
- Use the **OK** key to confirm selection of a menu.

Quick View Menu

Presentation

The **Quick view** menu presents information that is essential for operating the device connected to the FDM121 display unit, divided into a number of screens.

The **Quick view** menu is displayed by default when the FDM121 display unit is powered up.

The number of available screens and their content depend on the device connected to the FDM121 display unit. The behavior is the same for Compact, PowerPact, and Masterpact circuit breakers.

For example, with Compact NSX circuit breakers, they depend on:
- The type of Micrologic trip unit (A or E)
- The number of circuit breaker poles (3-pole or 4-pole)
- The presence of options (ENVT or ENCT)

The screen number and the number of available screens are indicated in the upper right of the display.

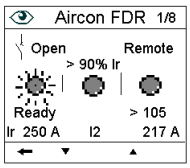
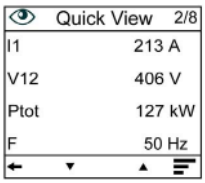
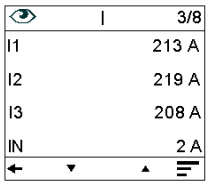
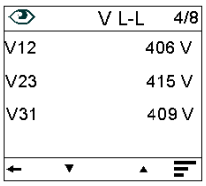
Navigation

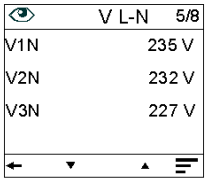
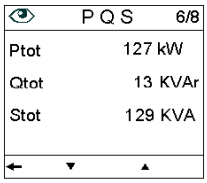
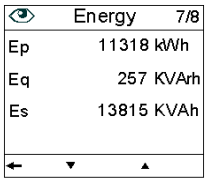
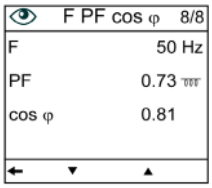
Navigation within the **Quick view** menu is as follows:

- Use the ▲ and ▼ keys to go from one screen to another.
- Use the ← key to return to **Main menu**.
- Use the ☰, ◿, and 888; keys to modify how measurements are displayed.

Example of Screens in the Quick View Menu

The table below shows screens 1 to 8 of the **Quick view** menu for a Compact NSX 4-pole circuit breaker equipped with a Micrologic E trip unit:

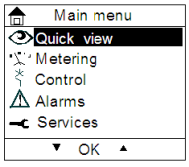
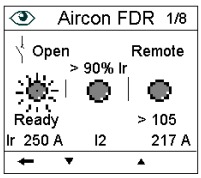
Screen	Description
	Screen 1 in the **Quick view** menu displays the following information: ● The name of the IMU (**Aircon FDR** on the screen example opposite). The name of the IMU is defined with the customer engineering tool or with the remote controller by using the communication network. It can be up to 45 characters long, but only the first 14 characters are visible on the FDM121 display unit. ● The open/closed/trip status of the circuit breaker if the BSCM is present (**Open** on the screen example opposite). ● The status of the LED indicators on the front of the trip unit. ● The long-time protection Ir pickup setting. ● The current intensity of the most heavily loaded phase (**I2 = 217 A** in the screen example opposite). ● The cradle status of the circuit breaker. When two IO modules are connected to the FDM121 display unit, the FDM121 does not display the cradle status in case of configuration discrepancy due to cradle application configured in both the IO modules.
	Screen 2 in the **Quick view** menu displays the current, voltage, active power, and frequency: ● Phase 1 current **I1** ● Phase 1 to phase 2 voltage **V12** ● Active power total **Ptot** ● Frequency **F**
	Screen 3 in the **Quick view** menu displays the currents: ● Phase 1 current **I1** ● Phase 2 current **I2** ● Phase 3 current **I3** ● Neutral current **IN**
	Screen 4 in the **Quick view** menu displays the phase-to-phase voltages: ● Phase 1 to phase 2 voltage **V12** ● Phase 2 to phase 3 voltage **V23** ● Phase 3 to phase 1 voltage **V31**

Screen	Description
	Screen 5 in the **Quick view** menu displays the phase-to-neutral voltages: ● Phase 1 to neutral voltage **V1N** ● Phase 2 to neutral voltage **V2N** ● Phase 3 to neutral voltage **V3N**
	Screen 6 in the **Quick view** menu displays the powers: ● Active power **Ptot** in **kW** ● Reactive power **Qtot** in **kVAr** ● Apparent power **Stot** in **kVA**
	Screen 7 in the **Quick view** menu displays the energy meters: ● Active energy **Ep** in **kWh** ● Reactive energy **Eq** in **kVArh** ● Apparent energy **Es** in **kVAh**
	Screen 8 in the **Quick view** menu displays: ● The frequency **F** in **Hz** ● The power factor **PF** ● **cos** φ

Intelligent Modular Unit (IMU) Name

For optimum use of the electrical equipment, use the customer engineering tool *(see page 16)* or the remote controller by using the communication network to assign a name to the IMU relating to the function with which it is associated.

The procedure for displaying the IMU name is as follows:

Step	Action	Display
1	Select the **Quick view** menu in the **Main menu** by using the ▲ and ▼ keys. Confirm selection of the **Quick view** menu by pressing the **OK** key.	
2	Screen 1 in the **Quick view** menu displays the IMU name: **Aircon FDR**. The IMU name defined with the customer engineering tool or the remote controller can consist of 45 characters maximum, but only the first 14 characters are visible on the FDM121 display unit.	

Metering Menu

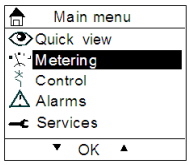
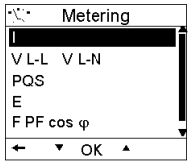
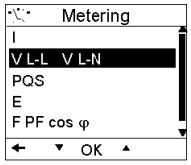
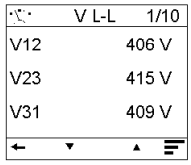
Presentation

Use the **Metering** menu to display current, voltage, energy measurements, and so on.

The full list of measurements displayed depends on the device connected to the FDM121 display unit.

Navigation

The procedure below describes an example of access to the **Metering** menu, the metering screens, and selection of the voltage measurements when a Compact NSX circuit breaker equipped with a Micrologic 5.• E trip unit is connected to the FDM121 display unit.

Step	Action	Display
1	Select the **Metering** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Metering** menu by pressing the **OK** key.	
2	The **Metering** menu is displayed on two screens. The following selections can be made in the **Metering** menu: ● Current **I** ● Voltage **V L-L V L-N** ● Power **PQS** ● Energy **E** ● Frequency **F**, power factor **PF**, and cos φ ● Total harmonic distortion **THD**	
3	Select, for example, the **V L-L V L-N** submenu in the **Metering** menu by using the ▼ and ▲ keys.	
4	Screen 1/10 in the **V L-L V L-N** submenu displays the phase-to-phase voltage values. Use the ▼ and ▲ keys to switch from one screen to another and display all the metering screens in the **V L-L V L-N** submenu. Use the ☰ key to modify the display mode and to switch to bar graph mode.	

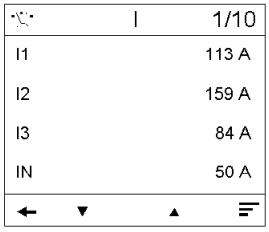
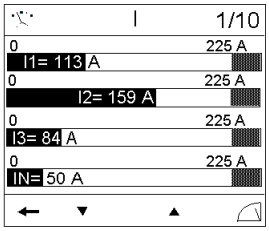
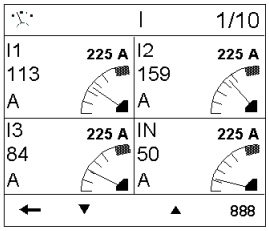
NOTE: Use the ← key to return to the **Metering** menu.

Measurement Display Modes

The current, voltage, and power measurements can be displayed in three different ways, by using the context-sensitive key to switch from one display mode to another:

- The ☰ icon represents bargraph mode display.
- The ◺ icon represents dial mode display.
- The 888 icon represents numeric mode display.

The table below shows an example display for current in the three modes.

Numeric mode	Bargraph mode	Dial mode
		
Press the ☰ key to switch the display to bargraph mode.	Press the ◺ key to switch the display to dial mode.	Press the 888 key to switch the display to numeric mode.

Control Menu

Presentation

The **Control** menu is used to control from the FDM121 display unit:
- the circuit breaker
- the light and load application managed by the IO module

⚠ ⚠ DANGER

RISK OF ELECTROCUTION, ELECTRIC ARC, OR BURNS

Do not execute any commands from the FDM121 display unit before returning the IMU to nominal operating mode when the FDM121 display unit backlighting is blinking.

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

Blinking of the FDM121 display unit indicates that the IMU is operating in degraded mode. It may be an architecture problem. For more information, refer to the *ULP System User Guide*.

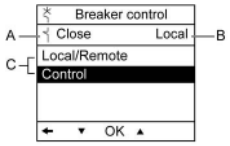
If the IMU operating in degraded mode includes an FDM121 display unit version lower than V2.1.3, there is a risk of controlling a device other than the one intended.

Devices Compatible with Circuit Breaker Control

The table presents the minimum hardware configuration required to control each range of circuit breakers.

Range	Minimum hardware configuration required
• Masterpact NT • Masterpact NW • Compact NS 630b-1600 • PowerPact P-frame	• Fixed or withdrawable circuit breaker + BCM ULP + communicating coils MX and XF or communicating motor mechanism • Fixed or drawout switch-disconnector + BCM ULP + communicating coils MX and XF or communicating motor mechanism
• Compact NSX • PowerPact H-, J-, and L-frame	• Fixed or withdrawable circuit breaker + BSCM with firmware version 2.1.7 and above + communicating motor mechanism in automatic mode • Fixed or withdrawable switch-disconnector + BSCM with firmware version 2.1.7 and above + communicating motor mechanism in automatic mode

Breaker Control Screen



A Circuit breaker status
B Current control mode of the circuit breaker
C Selection of the breaker control commands

Circuit Breaker Status

Depending on the devices connected, the FDM121 display unit displays the following status of the circuit breaker:
- **Open**: The circuit breaker is open.
- **Close**: The circuit breaker is closed.
- **TripSDE**: The circuit breaker is tripped on electrical fault.
- **Trip**: The circuit breaker is tripped.
- **NA:** The status of the circuit breaker is not available (no communication between the circuit breaker and the FDM121 display unit).

Circuit Breaker Control Mode Selection

The FDM121 display unit can select the local or remote control mode of the circuit breaker, except when an IO module configured for Breaker operation is in the IMU, or when the circuit breaker hardware configuration is not compatible.

Local and **Remote** modes are mutually exclusive.

The circuit breaker control mode selection is password protected. If the level 3 default password of the circuit breaker was modified, then a screen asking for the password is displayed *(see page 24)*.

You are not prompted to confirm the selection when selecting the circuit breaker control mode (Local/Remote).

Circuit Breaker Control Commands

The FDM121 display unit can control the circuit breaker only in local control mode. In remote control mode, the **Control** function is not available.

The circuit breaker control commands are password protected. If the level 3 default password of the circuit breaker was modified, then a screen asking for the password is displayed *(see page 24)*.

After selection of a command, you are prompted to confirm it.

The control commands depend on the type of circuit breaker.

Range	Control commands
• Masterpact NT • Masterpact NW • Compact NS 630b-1600 • PowerPact P-frame	• **Open**: command to open the circuit breaker without delay • **Close**: command to close the circuit breaker without delay • **Close self-timer**: command to close the circuit breaker with a 15-second delay **NOTE:** No **Reset** command from the FDM121 display unit. It is only possible to use an electrical reset or to push the reset button on front face of the circuit breaker.
• Compact NSX • PowerPact H-, J-, and L-frame	• **Open**: command to open the circuit breaker without delay • **Close**: command to close the circuit breaker without delay • **Close self-timer**: command to close the circuit breaker with a 15-seconds delay • **Reset**: command to reset the circuit breaker after a trip.

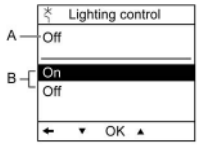
NOTE: The **Close** command and **Close self-timer** command are not allowed when the close order is inhibited.

Light and Load Control

The FDM121 display unit can control the light and load pre-defined application (application 4) performed by an IO module connected to the IMU.

The FDM121 display unit can control the light and load application only in local control mode. In remote control mode, the **Lighting control** and **Load control** functions are not available.

The **Lighting control** screen and the **Load control** screen present the same information:



A Current application status
On Lighting or load is on.
Off Lighting or load is off.
B Application control orders
On Command to switch on the light or the load.
Off Command to switch off the light or the load.

The light control and load control commands are password protected. If the level 3 default password of the IO module was modified, then a screen asking for the password is displayed *(see page 24)*.

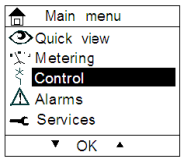
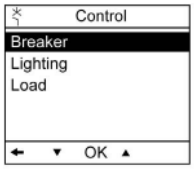
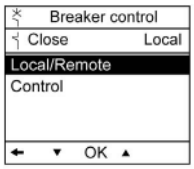
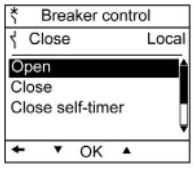
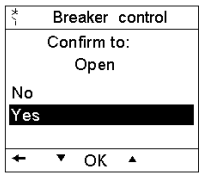
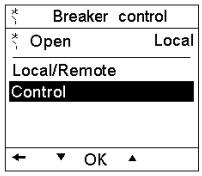
After selection of a command, you are prompted to confirm it.

The light and load commands issued from the local FDM121 display unit are used as follows:
- To switch the lights on and off. The lights are controlled by an impulse relay. The switch order can be either delayed or not.
- To switch the loads on and off. The loads are controlled by a contactor. The switch order can be either delayed or not.

For more information, refer to the *IO Module User Guide*.

Navigation Through the Breaker Control Screens

The procedure for controlling a Masterpact NW circuit breaker in local mode is as follows:

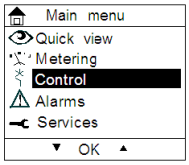
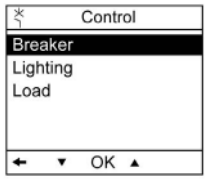
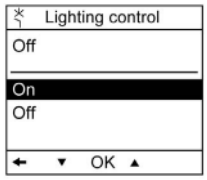
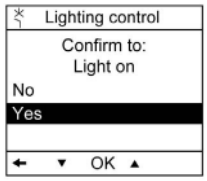
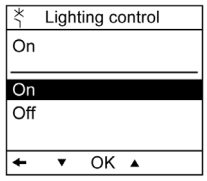
Step	Action	Display
1	Select the **Control** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Control** menu by pressing the **OK** key.	
2	Select the **Breaker** submenu in the **Control** menu by using the ▼ and ▲ keys. Confirm selection of the **Breaker** submenu by pressing the **OK** key.	
3	Select **Control** (1) to control the circuit breaker. Confirm your selection by pressing the **OK** key.	
4	Select one of the three possible actions to control the Masterpact NW circuit breaker: ● **Open** ● **Close** ● **Close self-timer** Confirm the selected action by pressing the **OK** key. **NOTE:** Circuit breaker control commands are password protected. If the level 3 default password of the circuit breaker was modified, then a screen asking for the password is displayed *(see page 24)*.	
5	A screen confirming the action to be carried out is displayed. Select **Yes** to confirm opening the circuit breaker. **NOTE:** If you select **Close self-timer**, a 15-second timer starts before a close command is sent. Pressing the ← key before the end of the countdown returns to the **Breaker control** submenu without sending any command to the circuit breaker.	
6	The new circuit breaker status is displayed on the screen.	
(1) Submenu available only when the hardware is compatible with the function, the control mode is local, and there is no conflict on ULP bus.		

NOTE: Use the ← key to return to the **Breaker control** menu.

Navigation Through the Lighting or Load Control Screens

Navigation through the **Lighting control** and **Load control** screens is similar.

The procedure for controlling the **Lighting** application is as follows:

Step	Action	Display
1	Select the **Control** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Control** menu by pressing the **OK** key.	
2	Select the **Lighting** submenu (1) in the **Control** menu by using the ▼ and ▲ keys. Confirm selection of the submenu by pressing the **OK** key.	
3	Select **On** from the menu to turn on the light. Confirm your selection by pressing the **OK** key. **NOTE:** Light control and load control commands are password protected. If the level 3 default password of the IO module was modified, then a screen asking for the password is displayed *(see page 24)*.	
4	A screen confirming the action to be carried out is displayed. Select **Yes** to confirm turning on the light.	
5	The new lighting status is displayed on the screen.	

(1) Submenu available only when:
- the FDM121 display unit is connected to an IO module configured for the pre-defined application 4 Light and load control,
- the control mode is local,
- there is no conflict on ULP bus.

Alarms Menu

Definitions

An event is a digital data changing state or any incident detected by the modules of the IMU. Events are time-stamped and logged in the module event history.

An alarm is a type of event that requires a specific attention from the user.

The user can associate an alarm with any measurement or event in the IMU.

Each alarm is given a pre-defined priority level:
- High priority
- Medium priority
- Low priority
- No priority

The user can set the alarm parameters and assign priorities with the customer engineering tool *(see page 16)*.

For more information about alarm setup and priorities, refer to the *Micrologic Trip Units User Guides*.

Presentation

Events and alarms are displayed in the **Alarms** menu of the FDM121 display unit, where you have the choice between 2 submenus:
- **Event log** displays the 40 last events from the connected devices. The events are recorded by the FDM121 display unit. The event log file is lost in case of FDM121 power loss.
- **Alarm History** displays the alarms detected by the connected devices. They are not lost in case of FDM121 power loss. The alarms are sorted by types which availability depends on the devices connected to the FDM121 display unit:
  - Alarms
  - Trip
  - Maintenance operations
  - Device status and control
  - Alarms from IO module 1
  - Alarms from IO module 2

NOTE: Events and alarms are displayed in the reverse chronological order on the **Event log** and **Alarm History** screens.

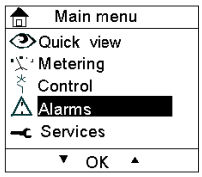
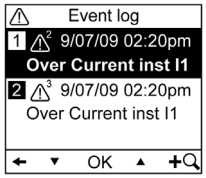
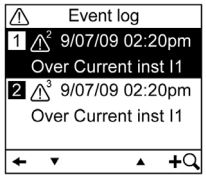
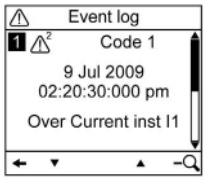
Alarm Real-Time Indication and Acknowledgment

The high-priority and medium-priority alarm are indicated in real time on the FDM121 display unit on a different way. They must be acknowledged also in a different way.

Priority	Indication in real time	Clearing of alarms
High	• **New Event** pop-up screen • Alarm indicator LED blinking	**1** Press the **OK** key to clear the **New Event** message.  **2** Select the new event in the **Event log** screen and press the **OK** key. **3** The LED turns off after every high-priority alarm has been acknowledged.
Medium	• Alarm indicator LED steady ON	**1** Select the new event in the **Event log** screen and press the **OK** key. **2** The LED turns off after every medium-priority alarm has been acknowledged and no high-priority alarm is present.

Navigation Through the Event Log Screens

The procedure for navigating through the **Event log** screens is as follows:

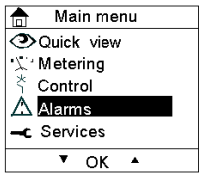
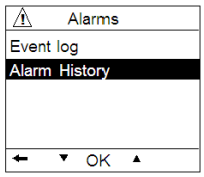
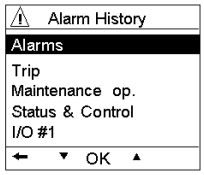
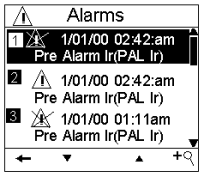
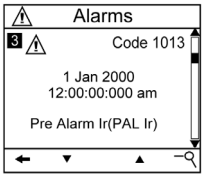
Step	Action	Display
1	Select the **Alarms** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Alarms** menu by pressing the **OK** key.	
2	Select the **Event log** submenu by using the ▼ and ▲ keys. Confirm selection of the **Event log** submenu by pressing the **OK** key.	
3	The **Event log** screen is displayed: ● The events are listed in a reverse chronological order from which they occurred. ● The description of a new event is written in bold font. ● The alarm priority level is indicated at top right of the alert pictogram. Press the **OK** key to clear a new event: the description of the cleared events is written in normal font.	
4	Press the ▼ and ▲ keys to switch from one event to another. Press the +🔍 key to display detailed information about an event.	
5	Press the ▼ and ▲ keys to display detailed information about a previous or subsequent event in the event log. Press the -🔍 key to return to the event log.	

Pressing the ← key in any **Event log** screen returns to the screen displayed before the **New event** pop-up screen has appeared.

NOTE: If no event has occurred since the FDM121 display unit was powered up, the **Event log** submenu displays the screen below. Press the **OK** key to return to the **Alarms** menu.

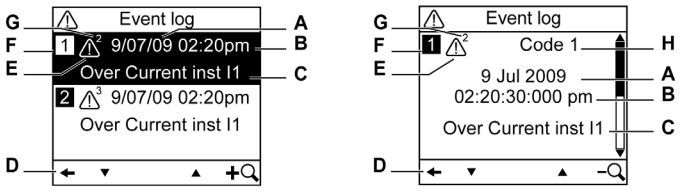
Navigation Through the Alarm History Submenu

The procedure for navigating through the **Alarm History** screens is as follows:

Step	Action	Display
1	Select the **Alarms** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Alarms** menu by pressing the **OK** key.	
2	Select the **Alarm History** submenu by using the ▼ and ▲ keys. Confirm selection of the **Alarm History** submenu by pressing the **OK** key.	
3	Select one of the type of alarms in the **Alarm History** submenu: ● **Alarms** ● **Trip** ● **Maintenance op.** (maintenance operations) ● **Status & Control** (device status and control) ● **I/O #1** ● **I/O #2** Select the **Alarms** submenu by using the ▼ and ▲ keys. Confirm your selection by pressing the **OK** key.	
4	The alarm history is displayed, with the alarms listed in a reverse chronological order from which they were triggered. Press the ▼ and ▲ keys to switch from one alarm to another. Press the +🔍 key to display detailed information about an alarm.	
5	Press the ▼ and ▲ keys to display detailed information about a previous or subsequent alarm in the history. Press the -🔍 key to return to the alarm history.	

Event or Alarm Screen

Event and alarm screens are similar. The general and detailed screens are respectively as follows:



A Event or alarm occurrence date

B Event or alarm occurrence time:

- in hours and minutes in the general screen
- in hours, minutes, seconds, and milliseconds in the detailed screen

C Event or alarm name

D Key to return to the event log or alarm history

E Event or alarm type:

- indicates the occurrence of the event or alarm
- indicates completion of the event or alarm

F Screen number

G Alarm priority level (indicated in the event log only)

H Event or alarm code

Services Menu

Presentation

The **Services** menu provides access to the following functions:
- Reset energy meters and minimum and maximum metering values mode
- Date and time settings from the FDM121 display unit
- FDM121 display unit contrast and brightness settings
- Maintenance indicators (operation counters, load profile, and so on)
- IMU product identification information
- Language selection for the FDM121 screens
- Monitoring and controlling the IO modules (status, forcing command, and counters)
- IFE IP address setting for the IFE Ethernet interface for LV circuit breaker connected to FDM121 display unit

Availability of menu items depends on the devices connected to the FDM121 display unit:
- **Reset** submenu is available when a Micrologic trip unit or BCM ULP is connected.
- **Maintenance** submenu available when a Micrologic trip unit, a BSCM, or a BCM ULP is connected.
- **I/O #1** and **I/O #2** submenus are available when IO modules are connected.
- **IFE IP address** submenu is available when an IFE Ethernet interface for LV circuit breaker is connected.

Settings Retained in the Event of a Power Loss

If the FDM121 power supply is lost, the FDM121 display unit retains the following settings:
- Language setting
- Contrast setting
- Brightness setting

If the FDM121 power supply is lost, the date and time are lost.

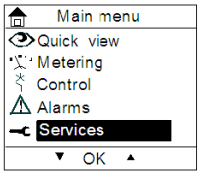
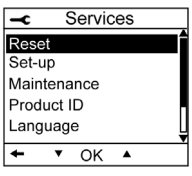
Resetting

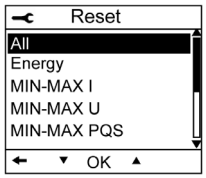
Use the **Reset** submenu to reset:
- all energy meters and minimum and maximum measurement values in a single operation.
- the energy meters only: active energy **Ep**), reactive energy ((**Eq**), and apparent energy (**Es**) meters.
- a group of minimum and maximum measurement values only.

For the group of currents, for example, the following minimum and maximum values are reset simultaneously:
- Phase currents and neutral current (if present)
- Unbalance currents
- Demand current

Availability of submenu items depends on the devices supported.

The procedure for resetting the metering groups of a Masterpact NW circuit breaker in the **Services** menu is as follows:

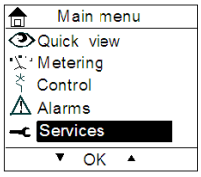
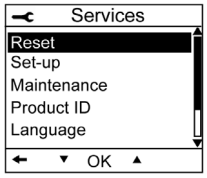
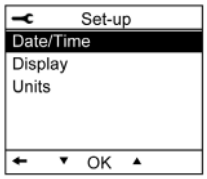
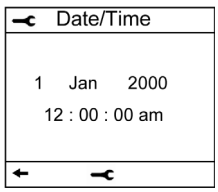
Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **Reset** submenu by using the ▼ and ▲ keys. Confirm selection of the **Reset** submenu by pressing the **OK** key.	

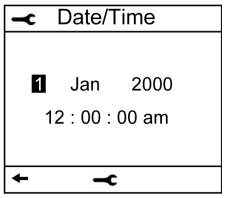
Step	Action	Display
3	The **Reset** submenu is displayed, with the choice of metering groups that can be reset (three screens). Select **MIN-MAX I** by using the ▼ and ▲ keys to reset all of the minimum and maximum values of the currents. Confirm selection of resetting the **MIN-MAX I** group by pressing the **OK** key. **NOTE: Reset** command is password protected. If the level 3 default password of the BCM ULP was modified, then a screen asking for the password is displayed *(see page 24)*.	
4	A reset request confirmation message is displayed. Confirm resetting the **MIN-MAX I** group by pressing the **OK** key.	
5	A confirmation message is displayed whichever **Reset** submenu is selected. Press the **OK** key to return to the **Reset** submenu.	

NOTE: Pressing the ← key returns to the **Services** menu.

Setting the Date and Time on the FDM121 Display Unit

The procedure for setting date and time on the FDM121 display unit from the **Services** menu is as follows:

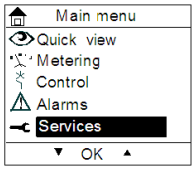
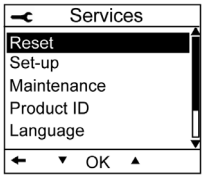
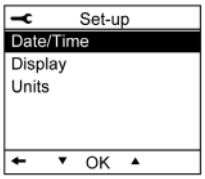
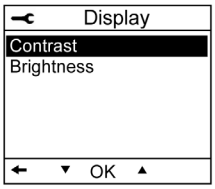
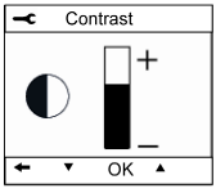
Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **Set-up** submenu by using the ▼ and ▲ keys. Confirm selection of the **Set-up** submenu by pressing the **OK** key.	
3	The **Set-up** submenu is displayed. Confirm selection of the **Date/Time** submenu by pressing the **OK** key.	
4	The **Date/Time** submenu is displayed. Press the 🔧 key to set the system date and time.	

Step	Action	Display
5	Select the field to set by using the ▶ key. The display of the selected field switches to reverse video. Use the ▼ and ▲ keys to adjust the content of the selected field. Press the **OK** key to confirm your settings.	

Setting the Contrast and Brightness on the FDM121 Display Unit

Navigation for setting the contrast and brightness is similar.

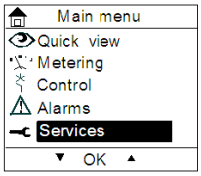
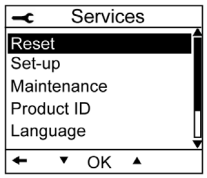
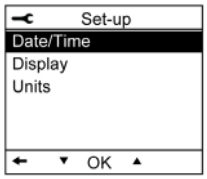
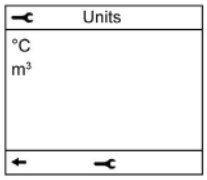
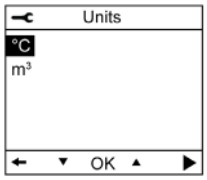
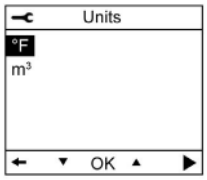
The procedure for setting contrast on the FDM121 display unit from the **Services** menu is as follows:

Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **Set-up** submenu by using the ▼ and ▲ keys. Confirm selection of the **Set-up** submenu by pressing the **OK** key.	
3	The **Set-up** submenu is displayed. Confirm selection of the **Display** submenu by pressing the **OK** key.	
4	The **Display** submenu is used to set the display of the FDM121 display unit. Select the **Contrast** submenu by using the ▼ and ▲ keys. Confirm selection of the **Contrast** submenu by pressing the **OK** key.	
5	The **Contrast** submenu is displayed. Adjust the contrast by using the ▼ and ▲ keys. Confirm the contrast setting by pressing the **OK** key.	

Setting the Units for Temperature and Volume on the FDM121 Display Unit

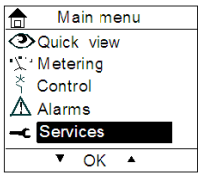
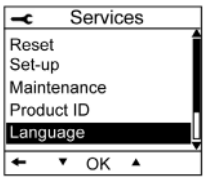
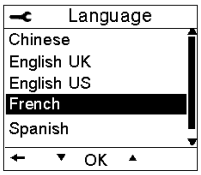
Navigation for setting the physical unit for the display of temperature (° C or ° F) and volume (m^3, US gallon **galUS**, or imperial gallon **galGB**) is similar.

The procedure for setting the temperature from the **Services** menu is as follows:

Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **Set-up** submenu by using the ▼ and ▲ keys. Confirm selection of the **Set-up** submenu by pressing the **OK** key.	
3	The **Set-up** submenu is displayed. Select the **Units** submenu by using the ▼ and ▲ keys. Confirm selection of the **Units** submenu by pressing the **OK** key.	
4	Press the key to edit the current temperature or volume unit.	
5	Select the field to set by using the ▶ key. The display of the selected field switches to reverse video. Confirm selection of the unit to edit by pressing the **OK** key.	
6	Use the ▼ and ▲ keys to adjust the content of the selected field. Confirm the new unit setting by pressing the **OK** key.	

Choosing the Language on the FDM121 Display Unit

The procedure for choosing the language on the FDM121 display unit from the **Services** menu is as follows:

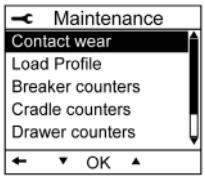
Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **Language** submenu by using the ▼ and ▲ keys. Confirm selection of the **Language** submenu by pressing the **OK** key. **NOTE:** In order to be able to change language easily, whichever language has been chosen, the **Language** submenu label is only in English.	
3	The **Language** submenu is displayed. Select the desired display language by using the ▼ and ▲ keys. Confirm selection of the language by pressing the **OK** key.	

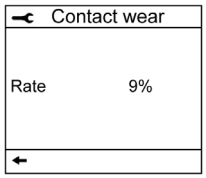
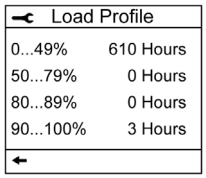
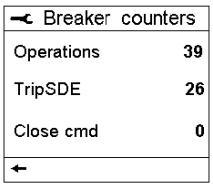
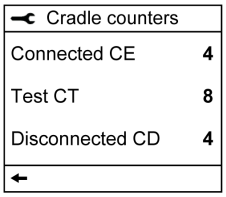
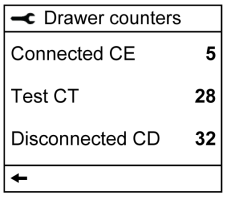
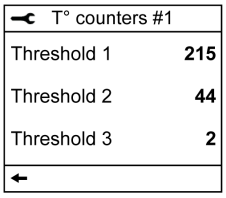
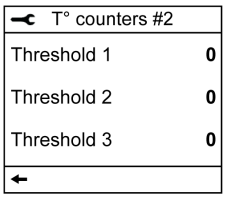
Maintenance Submenu Screens

Availability of submenu items depends on the connected devices:

- **Contact wear** submenu is available when a Micrologic trip unit is connected.
- **Load Profile** submenu is available when a Micrologic trip unit is connected.
- **Breaker counters** submenu is available when a BSCM or BCM ULP is connected.
- **Cradle counters** submenu is available when an IO module configured for cradle management application is connected.
- **Drawer counters** submenu is available when an IO module configured for drawer management application is connected.
- **T° counters #1** submenu is available when the analog input of IO module 1 is assigned to Pt100 sensor.
- **T° counters #2** submenu is available when the analog input of IO module 2 is assigned to Pt100 sensor.

The table below presents the screens in the **Maintenance** submenu available on the FDM121 display unit connected to a Compact NSX circuit breaker. The **Maintenance** submenu is accessible from the **Services** menu in the **Main menu**.

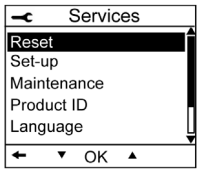
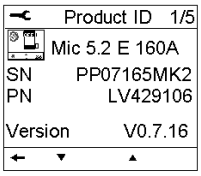
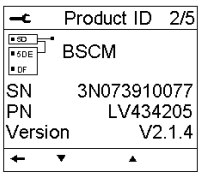
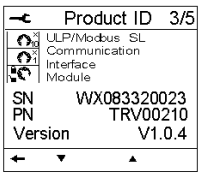
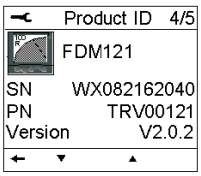
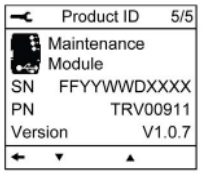
Screens	Description
	Select the maintenance screen in the **Maintenance** submenu by using the ▼ and ▲ keys. Confirm selection of the maintenance screen by pressing the **OK** key.

Screens	Description
	The **Contact wear** screen in the **Maintenance** submenu displays the amount of wear on the circuit breaker contacts.
	The **Load Profile** screen in the **Maintenance** submenu displays four circuit breaker operating hours counters for four loading sections.
	The **Breaker counters** screen in the **Maintenance** submenu displays the values of the counters: ● **Operations**: OF counter (open to close position counter, resettable) ● **TripSDE**: SDE counter (close to SDE position counter) ● **Close cmd**: counter of close commands by using the communicating motor mechanism
	The **Cradle counters** screen in the **Maintenance** submenu displays: ● the cradle connected position counter (CE) ● the cradle test position counter (CT) ● the cradle disconnected position counter (CD)
	The **Drawer counters** screen in the **Maintenance** submenu displays: ● the drawer connected position counter (CE) ● the drawer test position counter (CT) ● the drawer disconnected position counter (CD)
	The **T° counters #1** screen in the **Maintenance** submenu displays: ● the number of times the switchboard temperature measured by IO module 1 exceeds threshold 1 ● the number of times the switchboard temperature measured by IO module 1 exceeds threshold 2 ● the number of times the switchboard temperature measured by IO module 1 exceeds threshold 3
	The **T° counters #2** screen in the **Maintenance** submenu displays: ● the number of times the switchboard temperature measured by IO module 2 exceeds threshold 1 ● the number of times the switchboard temperature measured by IO module 2 exceeds threshold 2 ● the number of times the switchboard temperature measured by IO module 2 exceeds threshold 3

Getting the Product Identification

The FDM121 display unit displays the serial number, the part number, and the version of every module of the IMU.

The procedure for accessing the module identification for an IMU consisting of a Compact NSX circuit breaker equipped with a Micrologic 5.2 E trip unit and a BSCM, an IFM and an FDM121 display unit, and a maintenance module is as follows:

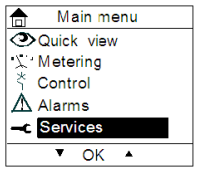
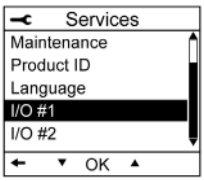
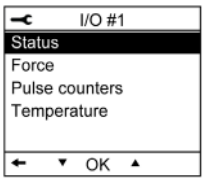
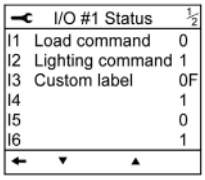
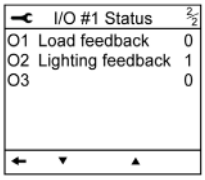
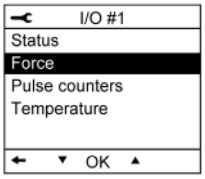
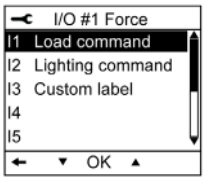
Step	Action	Display
1	Select the **Services** menu in the **Main menu**, then select the **Product ID** submenu by using the ▼ and ▲ keys. Confirm selection of the **Product ID** submenu by pressing the **OK** key.	
2	The first screen displays the identifying information for the Micrologic trip unit: ● Type of Micrologic trip unit ● **SN** = Serial number ● **PN** = Micrologic trip unit part number ● **Version** = Firmware version Pressing the ▼ key switches to the next screen. Pressing the ▲ key switches back to the previous screen.	
3	The next screen displays the identifying information for the BSCM: ● **BSCM** ● **SN** = Serial number ● **PN** = BSCM part number ● **Version** = Firmware version	
4	The next screen displays the identifying information for the IFM Modbus-SL interface of LV circuit breaker: ● IFM description ● **SN** = Serial number ● **PN** = IFM part number ● **Version** = Firmware version	
5	The next screen displays the identifying information for the FDM121 display unit: ● **FDM121** ● **SN** = Serial number ● **PN** = FDM121 part number ● **Version** = Firmware version	
6	The next screen displays the identifying information for the maintenance module: ● **Maintenance module** ● **SN** = Serial number ● **PN** = Maintenance module part number ● **Version** = Firmware version	

Navigation Through the IO Module Screens

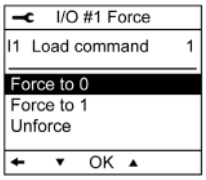
The **I/O #•** submenus provide access to four submenus for monitoring and controlling the IO modules connected to the FDM121 display unit:

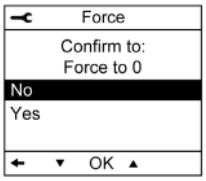
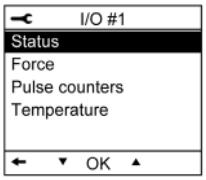
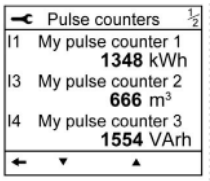
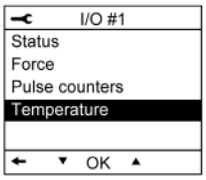
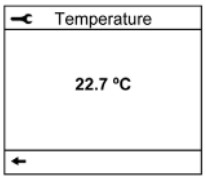
- **Status** submenu displays the I/Os of the IO module
- **Force** submenu is used to force or unforce a command
- **Pulse counters** submenu displays the counters
- **Temperature** submenu displays the switchboard temperature provided by the given IO module

The procedure for navigating through the IO module screens is as follows:

Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **I/O #•** submenu by using the ▼ and ▲ keys. Confirm selection of the **I/O #•** submenu by pressing the **OK** key.	
3	The **I/O #•** submenu is displayed. Select the **Status** submenu by using the ▼ and ▲ keys. Confirm selection of the **Status** submenu by pressing the **OK** key.	
4	The first **I/O #• Status** screen in the **I/O #•** submenu displays the inputs of the given IO module with the following information for each line, from left to right: ● Input number ● Input label ● Input state: **0** or **1** ● Input forcing status: **F** means that the input state is forced. Use the ▼ and ▲ keys to navigate between the screens.	
5	The second **I/O #• Status** screen in the **I/O #•** submenu displays the outputs of the given IO module with the following information for each line, from left to right: ● Output number ● Output label ● Output state: **0** or **1** ● Output forcing status: **F** means that the output state is forced. Use the ▼ and ▲ keys to navigate between the screens.	
6	In the **I/O #•** submenu, select the **Force** submenu by using the ▼ and ▲ keys. Confirm selection of the **Force** submenu by pressing the **OK** key.	
7	The **I/O #• Force** screen displays all the I/Os of the given IO module. Select an input or output by using the ▼ and ▲ keys. Confirm selection by pressing the **OK** key.	

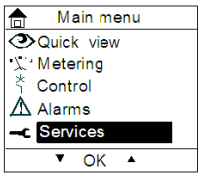
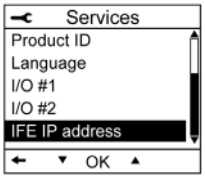
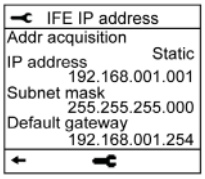
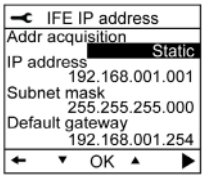
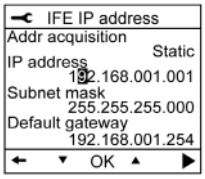
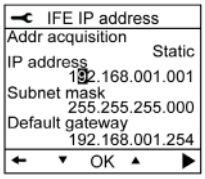
Step	Action	Display

8	The **I/O #• Force** screen of a selected input or output is divided into two parts:
	• The part at the top indicates the current command setting right of the label.
	• The part at the bottom indicates the possible actions which can be carried out on the I/O in the form of a menu:
	  • **Force to 0**
	  • **Force to 1**
	  • **Unforce**
	
	Select the action you want to carry out by using the ▼ and ▲ keys.
	Confirm selection of the action you want to carry out by pressing the **OK** key.
	
	NOTE: I/O #• Force commands are password protected. If the level 3 default password of the IO module was modified, then a screen asking for the password is displayed *(see page 24)*.
		

9	A screen confirming the action to be carried out is displayed. Select **Yes** to confirm the action to be carried out.	
10	In the **I/O #•** submenu, select the **Pulse counters** submenu by using the ▼ and ▲ keys. Confirm selection of the **Pulse counters** submenu by pressing the **OK** key.	
11	The **Pulse counters** screen displays all the inputs assigned to pulse counter function of a given IO module. The pulse meter label, value, and unit are indicated for each input of the IO module. Use the ▼ and ▲ keys to navigate between the screens. To edit the volume unit, see the **Units** screen *(see page 42)*.	
12	In the **I/O #•** submenu, select the **Temperature** submenu by using the ▼ and ▲ keys. Confirm selection of the **Temperature** submenu by pressing the **OK** key.	
13	The **Temperature** screen displays the switchboard temperature measured by Pt100 sensor connected to the analog input of the IO module. To edit the temperature unit, see the **Units** screen *(see page 42)*.	

Setting the IP Address of the IFE Ethernet Interface for LV Circuit Breaker

The procedure for setting the IFE IP address from the **Services** menu is as follows:

Step	Action	Display
1	Select the **Services** menu in the **Main menu** by using the ▼ and ▲ keys. Confirm selection of the **Services** menu by pressing the **OK** key.	
2	The **Services** menu is displayed. Select the **IFE IP address** submenu by using the ▼ and ▲ keys. Confirm selection of the **IFE IP address** submenu by pressing the **OK** key.	
3	The **IFE IP address** screen is displayed. To edit the address settings, press the 🔧 key. **NOTE:** IFE address command is password protected. If the level 3 default password of the circuit breaker was modified, then a screen asking for the password is displayed *(see page 24)*. **NOTE:** If address acquisition mode is different from **Static**, the **IP address**, **Subnet mask**, and **Default gateway** fields are not displayed.	
4	Select the field to set by using the ▶ key. The selected field is displayed in reverse video.	
5	Edit digits when necessary: ● Use the ▼ and ▲ keys to adjust the digit of the selected field. ● Go to the next digit by using the ▶ key.	
6	Press the **OK** key to confirm the IFE IP address and return to the **Services** menu.	

NOTE: Pressing the ← key returns to the **Services** menu and IP address edition is canceled.

DOCA0088EN-00

Schneider Electric Industries SAS
35, rue Joseph Monier
CS30323
F - 92506 Rueil Malmaison Cedex

www.schneider-electric.com

06/2014

PowerLogic™ PM5100 Series Power and Energy Meter

User Guide

EAV15105 - EN03
04/2014

Schneider Electric

Safety Information

Important Information

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

The addition of either 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 an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

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.

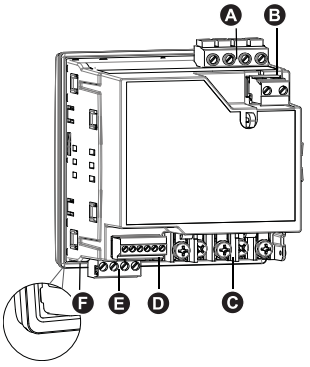
A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Chapter 1—Introduction

This user guide explains how to operate and configure a PowerLogic™ PM5100 Series Power and Energy Meter.

Power and Energy Meter Hardware

Parts of the meter (rear view)



A	Voltage inputs
B	Control power
C	Current inputs
D	Digital output
E	Communications port - RS-485(optional)
F	Gasket

Parts and Accessories

Table 1– 1 Meter Models

Description	Model Numbers
Power and Energy meter with Integrated Display	PowerLogic™ PM5100, PM5110, and PM5111

Box Contents

1. Power and Energy Meter (1)
2. Installation Guide (1)
3. Calibration Certificate (1)
4. Connectors
5. Retainer Clips (2)

Firmware

This user guide is written to be used with firmware version 01.00.0 and higher. See “Identifying the Firmware Version, Model, and Serial Number” on page 81 for instructions on determining the firmware version.

Chapter 2—Safety Precautions

Before You Begin

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

This section contains important safety precautions that must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions outlined below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. In the USA, see NFPA 70E or CSAZ462.
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- If the equipment is not used in a manner specified by the manufacturer, the protection provided by the equipment may be impaired.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of back feeding.
- Turn off all power supplying the meter and the equipment in which it is installed before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Before closing all covers and doors, inspect the work area for tools and objects that may have been left inside the equipment.
- When removing or installing panels, do not allow them to extend into the energized bus.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- Before performing Dielectric (Hi-Pot) or Megger testing on any equipment in which the energy meter is installed, disconnect all input and output wires to the energy meter. High voltage testing may damage electronic components contained in the meter.
- This equipment should be installed in a suitable electrical enclosure.

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

Notices

FCC PART 15 NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.

Chapter 3—Hardware Reference

This section supplements the meter's installation sheet and provides additional information about the meter's physical characteristics and capabilities.

Models, Features and Options

Table 3 –1: PM5100 Series - Models, Features and Options

Features and Options	PM5100 series		
	PM5100	PM5110	PM5111
Installation			
Fast installation, panel mount with integrated display	✓	✓	✓
Accuracy	**Cl 0.5S**	**Cl 0.5S**	**Cl 0.5S**
Display			
Backlit LCD, multilingual, bar graphs, 6 lines, 4 concurrent values	✓	✓	✓
Power and energy metering			
3-phase voltage, current, power, demand, energy, frequency, power factor	✓	✓	✓
Power quality analysis			
THD, thd, TDD	✓	✓	✓
Harmonics, individual (odd) up to	15th	15th	15th
I/Os			
Digital output	1DO	1DO	1DO
Alarms and control			
Alarms	33	33	33
Set point response time, seconds	1	1	1
Communications			
Serial ports with modbus protocol	0	1	1
MID ready compliance, EN50470-1/3, Annex B and Annex D Class C			✓

Functions and Characteristics

Table 3 –2: Functions and Characteristics

General	PM5100 Series
Use on LV and MV systems	✓
Basic metering with THD and min/max readings	✓
Instantaneous rms values	
Current (per phase and neutral)	✓
Voltage (total, per phase L-L and L-N)	✓
Frequency	✓
Real, reactive, and apparent power (Total and per phase)	Signed, Four Quadrant
True Power Factor (Total and per phase)	Signed, Four Quadrant
Displacement PF (Total and per phase)	Signed, Four Quadrant
% Unbalanced I, V L-N, V L-L	✓

Energy Values*	
Accumulated Active, Reactive and Apparent Energy	Received/Delivered; Net and absolute
Demand Values*	
Current average	Present, Last, Predicted, Peak, and Peak Date Time
Active power	Present, Last, Predicted, Peak, and Peak Date Time
Reactive power	Present, Last, Predicted, Peak, and Peak Date Time
Apparent power	Present, Last, Predicted, Peak, and Peak Date Time
Demand calculation (Sliding, fixed and rolling block, thermal methods)	✓
Synchronization of the measurement window to input, communication command or internal clock	✓
Settable Demand intervals	✓
Other Measurements*	
Operating timer	✓
Load timer	✓
Alarm counters and alarm logs	✓
Power Quality Measurements	
THD, thd (Total Harmonic Distortion) I, V L-N, V L-L per phase	I, V L-N, V L-L
TDD (Total Demand Distortion)	✓
Individual harmonics (odds)	15th
Data Recording	
Min/max of instantaneous values, plus phase identification*	✓
Alarms with 1s timestamp*	✓
Min/max log	✓
I/Os	
Digital output	1 (kWh only)
Timestamp resolution in seconds	1

NOTE: *Stored in non-volatile memory

Technical Specifications

Electrical Characteristics	
Type of measurement: True rms on three-phase (3P, 3P + N), zero blind	64 samples per cycle
Measurement accuracy	
IEC 61557-12 [1]	PMD/[SD|SS]/K70/0.5
Active Energy [2]	Class 0.5S as per IEC 62053-22
Reactive Energy [2]	Class 2S as per IEC 62053-23
Active Power	Class 0.5 as per IEC 61557-12 [1]
Reactive Power	Class 2 as per IEC 61557-12 [1]
Apparent Power	Class 0.5 as per IEC 61557-12 [1]
Current, Phase	Class 0.5 as per IEC 61557-12 [1]
Voltage, L-N	Class 0.5 as per IEC 61557-12 [1]
Frequency	Class 0.05 as per IEC 61557-12 [1]

Power Factor	Class 0.5 as per IEC 61557-12 [1]
Voltage Harmonics	Class 5 as per IEC 61557-12 [1]
Voltage THD/thd	Class 5 as per IEC 61557-12 [1]
Current Harmonics	Class 5 as per IEC 61557-12 [1]
Current THD/thd	Class 5 as per IEC 61557-12 [1]
MID Directive (2004/22/EC)	Annex B and Annex D (PM5111) Class C
Input-voltage (up to 1.0 MV AC max, with voltage transformer)	
Nominal Measured Voltage range	UL: 20-347 V L-N/35-600 V L-L IEC: 20-400 V L-N/35-690 V L-L (absolute range 35 V L-L to 760 V L-L)
Impedance	5 M Ω
F nom	50/60 Hz
Input-current (configurable for 1 or 5 A secondary CTs)	
I nom	5 A
Measured Amps with over range and Crest Factor	Starting current: 5mA Operating range: 50mA to 8.5A
Withstand	Continuous 20 A,10s/hr 50 A, 1s/hr 500 A
Impedance	< 0.3 m Ω
F nom	50/60 Hz
Burden	<0.026VA at 8.5A
Frequency measurement	
Measurement range	45 to 65 Hz
AC control power	
Operating range	100 - 277 V AC L-N / 415 V L-L +/-10% CAT III 300V class per IEC 61010
Burden	<5 W,11 VA at 415 V L-L
Frequency	45 to 65 Hz
Ride-through time	80 mS typical at 120V AC and maximum burden. 100 mS typical at 230 V AC and maximum burden 100 mS typical at 415 V AC and maximum burden
DC control power	
Operating range	125-250 V DC ±20%
Burden	<4 W at 250 V DC
Ride-through time	50 mS typical at 125 V DC and maximum burden
Outputs	
Digital output	
Max load voltage	40 V DC
Max load current	20 mA
On Resistance	50 Ω max
Meter constant	from 1 to 9,999,999 pulses per k_h (k_h = kWh, kVARh or kVAh depending on the energy parameter selected)
Pulse width for Digital Output	50% duty cycle
Pulse frequency for Digital Output	25 Hz max.
Leakage current	0.03 micro Amps
Isolation	5 kV rms
Optical outputs	
Pulse width (LED)	200 µs
Pulse frequency	50 Hz. max.
Meter constant	from 1 to 9,999,999 pulses per k_h
Mechanical Characteristics	
Product weight	380 g
IP degree of protection (IEC 60529)	IP52 front display, IP30 meter body
Dimensions W x H x D [protrusion from cabinet]	96 x 96 x 72mm (depth of meter from housing mounting flange) [13mm]
Mounting position	Vertical
Panel thickness	6 mm maximum
Environmental Characteristics	
Operating temperature	
Meter	-25 °C to +70 °C
Display (Display functions to -25º with reduced performance)	-25 °C to +70 °C
Storage temp.	-40 °C to +85 °C
Humidity range	5 to 95% RH at 50 °C (non-condensing)

Pollution degree	2
Altitude	2000 m CAT III / 3000 m CAT II
For indoor use only	
Electromagnetic Compatibility [3]	
Electrostatic discharge	IEC 61000-4-2
Immunity to radiated fields	IEC 61000-4-3
Immunity to fast transients	IEC 61000-4-4
Immunity to surge	IEC 61000-4-5
Conducted immunity 150kHz to 80MHz	IEC 61000-4-6
Immunity to magnetic fields	IEC 61000-4-8
Immunity to voltage dips	IEC 61000-4-11
Radiated emissions	FCC part 15, EN 55022 Class B
Conducted emissions	FCC part 15, EN 55022 Class B
Safety	
Europe	CE, as per IEC 61010-1 (3rd Edition), IEC 62052-11 & IEC61557-12 [1]
U.S. and Canada	cULus as per UL61010-1 (3rd Edition) CAN/CSA-C22.2 No. 61010-1 (3rd Edition)
Measurement category (Voltage and Current inputs)	CAT III up to 400 V L-N / 690 V L-L
Dielectric	As per IEC/UL 61010-1 (3rd Edition)
Protective Class	II, Double insulated for user accessible parts
Communication	
RS-485 port Modbus RTU, Modbus ASCII (7 or 8 bit), JBUS	2-Wire, 9600,19200 or 38400 baud, Parity - Even, Odd, None, 1 stop bit if parity Odd or Even, 2 stop bits if None; (Optional)
Firmware and language file update	Meter firmware update via the communication ports
Isolation	2.5 kVrms, double insulated
Human Machine Interface	
Display type	Monochrome Graphics LCD
Resolution	128 x 128
Backlight	White LED
Viewable area (W x H)	67 x 62.5 mm
Keypad	4-button
Indicator Heartbeat / Comm activity	Green LED
Energy pulse output / Active alarm indication (configurable)	Optical, amber LED
Wavelength	590 to 635 nm
Maximum pulse rate	2.5 kHz

[1] For firmware version 1.1.1 and higher

[2] For 1A nominal CT when I > 0.15A

[3] Tests are conducted as per IEC 61557-12 (IEC 61326-1), 62052-11 and EN50470

Before you begin

Carefully read and follow the safety precautions before working with the meter.

Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

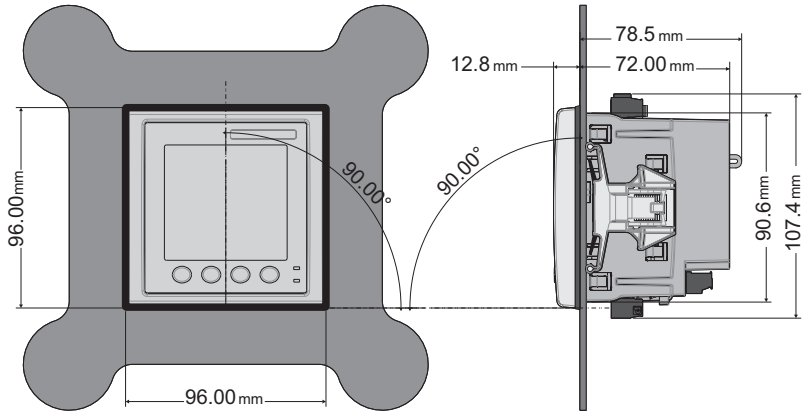
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Always use grounded external CTs for current inputs.

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

1. Turn off all power supplying this device before working on it.
2. Always use a properly rated voltage sensing device to confirm that all power is off.

Dimension

Figure 3–1: Dimension



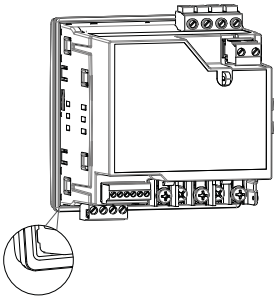
Meter mounting

This section describes how to mount the meter.

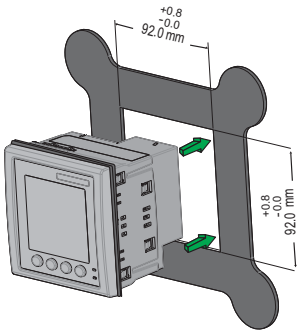
Mounting the PM5100

The meter is designed to be mounted inside a 1/4-DIN panel cutout.

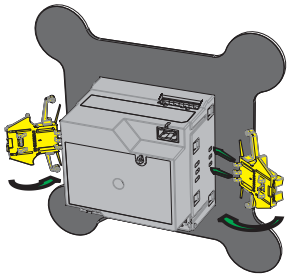
1. Inspect the gasket (installed around the perimeter of the front display) and make sure it is secured properly and not damaged.



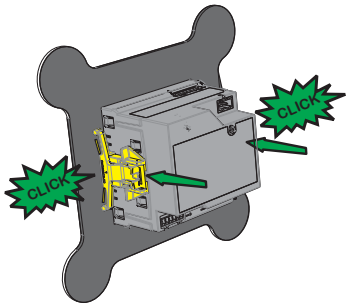
2. Insert the meter through the mounting hole.



3. Line up the tabs of the retainer clips with the slots on either side of the meter. While holding the retainers at a slight angle, push the retainers in and forward to position them in place. In situations where the spacing between meters is tight, use a flat-head screwdriver with a long, narrow shaft to help secure the clips.



4. Push the middle of the clip assembly to lock the retainer in place and secure the meter.

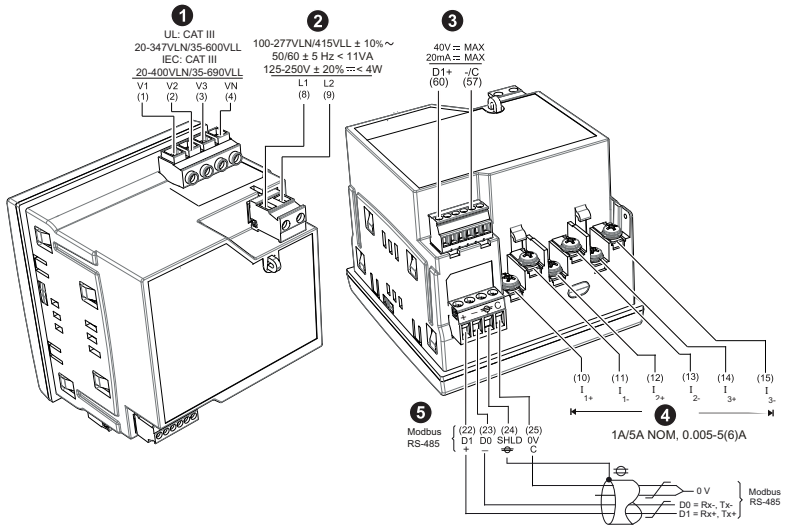


Meter wiring

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

- Wire connections to the meter's voltage inputs, control power, digital output, and RS-485 communications are terminated using the supplied pluggable wire connectors.
- When wiring the meter's current inputs, terminate the wire ends with ring or split-ring crimp connectors.

Use the meter installation sheet when wiring the meter.



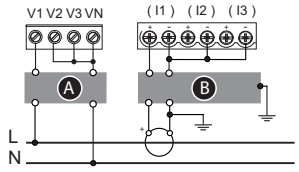
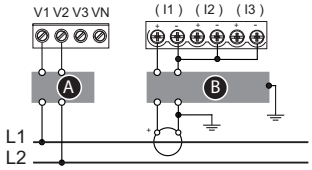
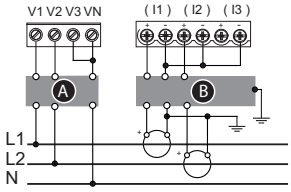
Serial No.	Description	Specification
1	Voltage Inputs (V1, V2, V3, VN)	• **Wire size**: 0.82 - 3.31 mm^2 (18 - 12 AWG) • **Wire strip length**: 0.28 in (7 mm) • **Torque**: 0.5 - 0.6 N·m (4.4 - 5.3 in·lb) • **Screw driver type**: M3
2	Control Power (L1, L2)	• **Wire size**: 0.82 - 3.31 mm^2 (18 - 12 AWG) • **Wire strip length**: 0.28 in (7 mm) • **Torque**: 0.5 - 0.6 N·m (4.4 - 5.3 in·lb) • **Screw driver type**: M3
3	Digital Output (D1+, -/C)	• **Wire size**: 0.33 - 3.31 mm^2 (22 - 12 AWG) • **Wire strip length**: 0.24 in (6 mm) • **Torque**: 0.5 - 0.6 N·m (4.4 - 5.3 in·lb) • **Screw driver type**: M2
4	Current Inputs (I_{1+}, I_{1-}, I_{2+}, I_{2-}, I_{3+}, I_{3-})	• **Wire size**: 0.82 - 3.31 mm^2 (18 - 12 AWG) • **Wire strip length**:0.28 in (7 mm) • **Torque**: 0.9 - 1.0 N·m (8.0 - 9.0 in·lb) • **Screw driver type**: PH1
5	Modbus RS-485 (+,-, ⏚, C)	• **Wire size**: 0.33 - 3.31 mm^2 (22 - 12 AWG) • **Wire strip length**: 0.24 in (6 mm) • **Torque**: 0.5 - 0.6 N·m (4.4 - 5.3 in·lb) • **Screw driver type**: M3

Recommended cables

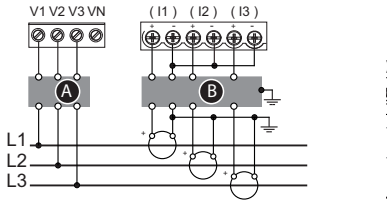
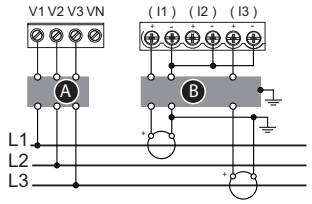
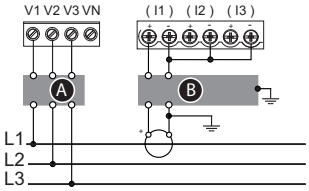
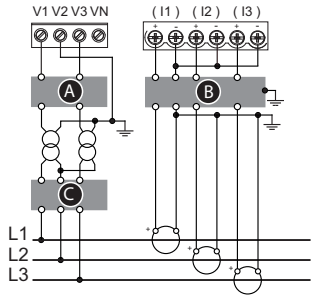
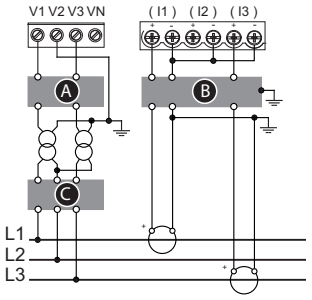
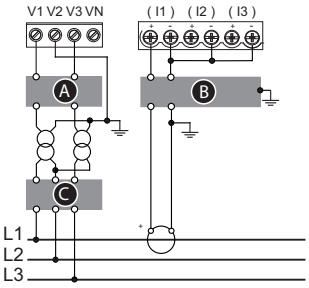
Communication	Make	Part code	Description
RS-485	Belden	3105A	Multi-Conductor - EIA Industrial RS-485 PLTC/CM
		3106A	Multi-Conductor - EIA Industrial RS-485 PLTC/CM

Wiring Diagrams

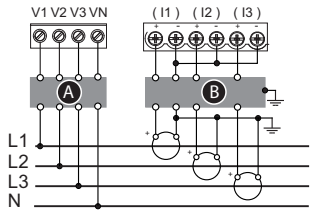
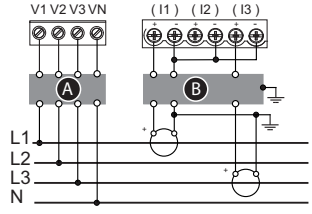
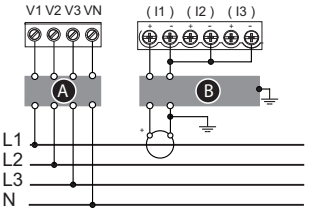
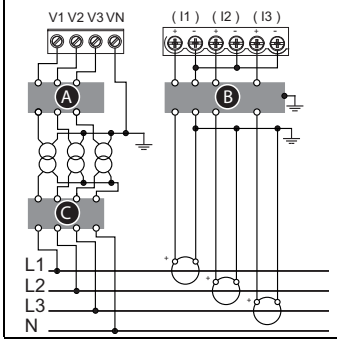
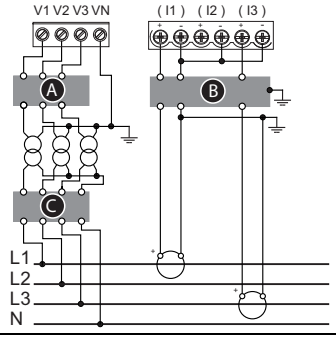
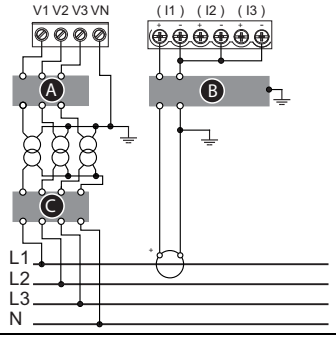
1PH

1PH2WLN	1PH2WLL	1PH3WLL with N
		

3PH3W

3CT	2CT	1CT *
		
2VT, 3CT	**2VT, 2CT**	**2VT, 1CT ***
		

3PH4W

3CT	2CT *	1CT *
		
3VT, 3CT	**3VT, 2CT ***	**3VT, 1CT ***
		

NOTE: According to Blondel's theorem, in an N wire system a minimum of N-1 measuring elements are required for correct measurement.

Symbol	Description
Ⓐ	500 mA fused disconnect / circuit breaker (not supplied)
Ⓑ	Shorting block (not supplied)
Ⓒ	PT primary fuses and disconnect switch (not supplied)
*	Indicates wiring for a balanced system

NOTE:

- Clearly label the device's disconnect circuit mechanism and install it within easy reach of the operator.
- The fuses / circuit breakers must be rated for the installation voltage and sized for the available fault current.
- Fuse for neutral terminal is required if the source neutral connection is not grounded.

	Potential Transformer	Current Transformer
IEC		
ANSI		

Power system

This section outlines typical requirements for wiring the voltage and current inputs of the meter to the electrical power system.

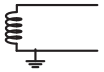
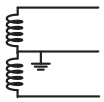
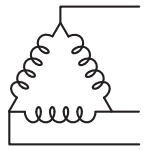
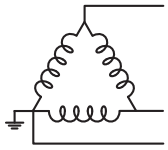
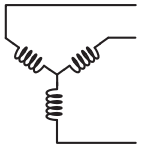
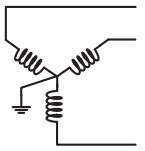
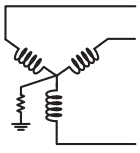
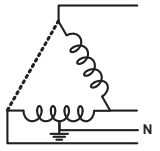
For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

Direct connect voltage limits

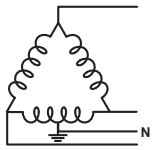
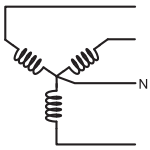
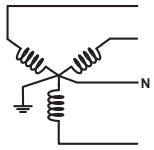
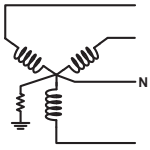
You can connect the meter's voltage inputs directly to the phase voltage lines of the power system if the power system's line-to-line or line-to-neutral voltages do not exceed the meter's direct connect maximum voltage limits. The meter's voltage measurement inputs are rated by the manufacturer for up to 400 V L-N / 690 V L-L. However, the maximum voltage allowed for direct connection may be lower, depending on the local electrical codes and regulations. In US and Canada the maximum voltage on the meter voltage measurement inputs may not exceed 347 V L-N / 600 V L-L.

If your system voltage is greater than the specified direct connect maximum voltage, you must use VTs (voltage transformers) to step down the voltages.

Power system setup parameters

Power system description — Meter setting	Symbol	Direct connect maximum		# of VTs (if required)
		UL	IEC	
Single-phase 2-wire line-to-neutral — 1PH2W LN		347 V L-N	400 V L-N	1 VT
Single-phase 2-wire line-to-line — 1PH2W LL		600 V L-L	600 V L-L	1VT
Single-phase 3-wire line-to-line with neutral — 1PH3W LL with N		347 V L-N / 600 V L-L	400 V L-N / 690 V L-L	2VT
3-phase 3-wire Delta ungrounded — 3PH3W Dlt Ungnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Delta corner grounded — 3PH3W Dlt Crnr Gnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye ungrounded — 3PH3W Wye Ungnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye grounded — 3PH3W Wye Gnd		600 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye resistance-grounded — 3PH3W Wye Res Gnd		600 V L-L	600 V L-L	2 VT
3-phase 4-wire open Delta center-tapped — 3PH4W Opn Dlt Ctr Tp		240 V L-N / 415 V L-N / 480 V L-L	240 V L-N / 415 V L-N / 480 V L-L	3 VT

Power system setup parameters *(continued)*

Power system description — Meter setting	Symbol	Direct connect maximum		# of VTs (if required)
		UL	IEC	
3-phase 4-wire Delta center-tapped — 3PH4W Dlt Ctr Tp		240 V L-N / 415 V L-N / 480 V L-L	240 V L-N / 415 V L-N / 480 V L-L	3 VT
3-phase 4-wire ungrounded Wye — 3PH4W Wye Ungnd		347 V L-N / 600 V L-L	347 V L-N / 600 V L-L	3 VT or 2 VT
3-phase 4-wire grounded Wye — 3PH4W Wye Gnd		347 V L-N / 600 V L-L	400 V L-N / 690 V L-L	3 VT or 2 VT
3-phase 4-wire resistance-grounded Wye — 3PH4W Wye Res Gnd		347 V L-N / 600 V L-L	347 V L-N / 600 V L-L	3 VT or 2 VT

Voltage and current input wiring

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

Voltage input protection

The meter's voltage inputs must be wired to fuses/breakers and a disconnect switch. If using a voltage transformer (VT), both primary and secondary sides of the VT must be wired to fuses/breakers and disconnect switches.

- Clearly label the device's disconnect circuit mechanism and install it within easy reach of the operator.
- The fuses / circuit breakers must be rated for the installation voltage and sized for the available fault current.
- Fuse for neutral terminal is required if the source neutral connection is not grounded.

See the meter installation sheet for fuse ratings.

Current input protection

For all connected current inputs, use a CT shorting block to short-circuit the secondary leads of the CTs before removing the current input connections to the meter.

NOTE: Ground any unused current inputs.

Balanced system considerations

In situations where you are monitoring a balanced 3-phase load, you may choose to connect only one or two CTs on the phase(s) you want to measure, and then configure the meter so it calculates the current on the unconnected current input(s).

NOTE: For a balanced 4-wire Wye system, the meter's calculations assume that there is no current flowing through the neutral conductor.

Balanced 3-phase Wye system with 2 CTs

The current for the unconnected current input is calculated so that the vector sum for all three phase currents equal zero.

Balanced 3-phase Wye or Delta system with 1 CT

The currents for the unconnected current inputs are calculated so that their magnitude and phase angle are identical and equally distributed, and the vector sum for all three phase currents equal zero.

NOTE: You must always use 3 CTs for 3-phase 4-wire center-tapped Delta or center-tapped open Delta systems.

Control power wiring

For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.schneider-electric.com.

The meter can be powered from an AC or DC power source.

- L1 and L2 are non-polarized. If using an AC power supply with neutral, connect neutral to the meter's L2 terminal.
- Always use a fuse on L1. Fuse L2 when connecting an ungrounded neutral to the control power.
- If using a control power transformer, fuse both primary and secondary sides of the transformer.
- The fuses / circuit breakers must be rated for the installation voltage and sized for the available fault current.

Communications

This section provides additional information about the communications ports and topologies supported by the meter. You must wire and configure the RS-485 port in order to communicate with the meter.

Serial communications

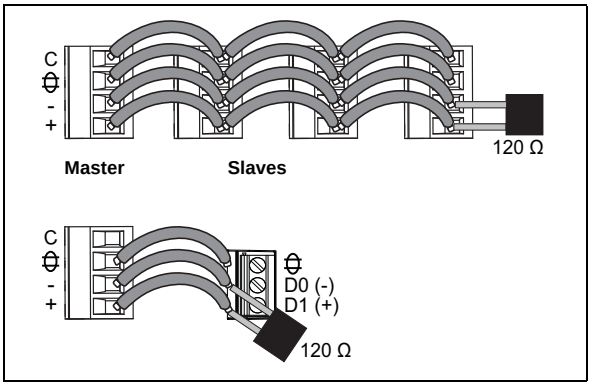
The meter supports serial communications through the RS-485 port. Up to 32 devices can be connected on a single RS-485 bus.

In an RS-485 network, there is one master device, typically an Ethernet to RS-485 gateway. It provides the means for RS-485 communications with multiple slave devices (for example, meters). For applications that require only one dedicated computer to communicate with the slave devices, an RS-232 to RS-485 converter can be used as the master device.

RS-485 wiring

Connect the devices on the RS-485 bus in a point-to-point configuration, with the (+) and (-) terminals from one device connected to the corresponding (+) and (-) terminals on the next device.

RS-485 wiring



RS-485 cable

Use a shielded 1.5 twisted pair or 2 twisted pair RS-485 cable to wire the devices. Use one twisted pair to connect the (+) and (-) terminals, and use the other insulated wire to connect the C terminals.

RS-485 terminals

C	Common. This provides the voltage reference (zero volts) for the data plus and data minus signals.
⏚	Shield. Connect the bare wire to this terminal to help suppress signal noise that may be present. Ground the shield wiring at one end only (either at the master or the last slave device, but not both).
-	Data minus. This transmits/receives the inverting data signals.
+	Data plus. This transmits/receives the non-inverting data signal.

RS-485 maximum cable length

The total distance for devices connected on an RS-485 bus should not exceed 1200 m (4000 ft).

RS-485 network configuration

After you have wired the RS-485 port and powered up the meter, you must configure the serial communications port in order to communicate with the meter.

Each device on the same RS-485 communications bus must have a unique address and all connected devices must be set to the same protocol, baud rate, and parity (data format).

NOTE: To communicate with the meter using ION Setup, you must set the parity to “None” for all devices in the RS-485 network.

For meters that do not have a display, you must first wire and configure each one separately before connecting these meters to the same RS-485 bus.

Related topics

- To configure RS-485 communications, see “Setting up serial communications” on page 34.

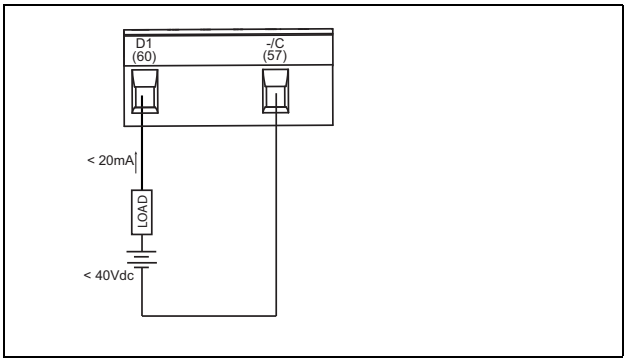
Digital outputs

The meter is equipped with a digital output port (D1). You can configure the digital output for use in the following application:

- energy pulsing applications, where a receiving device determines energy usage by counting the k_h pulses (k_h = kWh, kVARh or kVAh depending on the energy parameter selected) coming from the meter’s digital output port.

The digital output can handle voltages less than 40 V DC. For higher voltage applications, use an external relay in the switching circuit.

Digital output connections



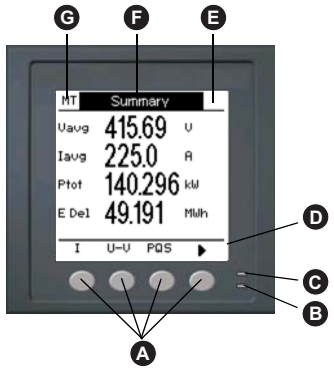
Related topics

- See “Digital output applications” on page 47 for digital output use and configuration details.

Chapter 4—Front panel display and meter setup

The front panel display lets you use the meter to perform various tasks such as setting up the meter, displaying data screens, acknowledging alarms, or performing resets.

Parts of the display

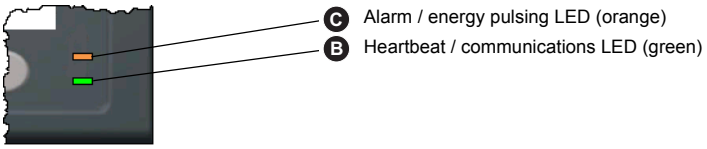


A	Navigation / menu selection buttons
B	Heartbeat / communications LED (green)
C	Alarm / energy pulsing LED (orange)
D	Navigation symbols or menu options
E	Right notification area
F	Screen title
G	Left notification area

LED indicators

The meter has two LED indicators on the front panel.

Front panel LEDs



Heartbeat / communications LED

The (green) heartbeat / communications LED blinks at a slow, steady rate to indicate the meter is operational. The LED flashes at a variable, faster rate when the meter is communicating over a Modbus serial communications port.

You cannot configure this LED for other purposes.

NOTE: A heartbeat LED that remains lit and does not blink (or flash) indicates a possible hardware problem. In this case, power down the meter and reapply power. If the LED still does not blink or flash, contact Technical Support.

Alarm / energy pulsing LED modes

The (orange) alarm / energy pulsing LED can be configured for alarm notification or energy pulsing.

- When configured for alarm notification, this LED flashes when a high, medium or low priority alarm is active. This provides a visual indication of an active alarm condition, or an inactive but unacknowledged high priority alarm.
- When configured for energy pulsing, this LED flashes at a rate proportional to the amount of energy consumed. This is typically used to verify the meter's accuracy.

Related topics

- See “Setting up the alarm / energy pulsing LED” on page 39 for details on using the front panel to switch the LED mode for alarming or energy pulsing applications.
- See “Alarm / energy pulsing LED setup” on page 48 for details on using ION Setup to switch the LED mode for alarming or energy pulsing applications.
- See “Alarm Priorities” on page 53 for a detailed description on the alarm / energy pulsing LED’s behavior when it is configured for alarm notification.

Notification icons

To alert you about meter state or events, notification icons appear at the top left or top right corner of the display screen.

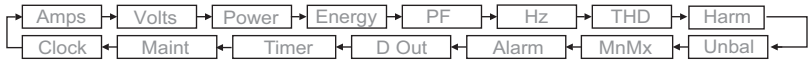
Notification icons

Icon	Description
	The wrench icon indicates that the power meter requires maintenance. See “Maintenance and Troubleshooting” on page 81.
⚠	The alarm icon indicates an alarm condition has occurred. See “About Alarms” on page 51 and “Alarm Priorities” on page 53.
●	The blinking heartbeat icon indicates that the power meter is in normal operating condition.

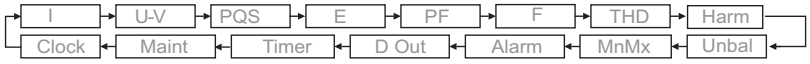
Meter screen menus

All meter screens are grouped logically, according to their function. You can access any available meter screen by first selecting the Level 1 (top level) screen that contains it.

Level 1 screen menus - IEEE display mode



Level 1 screen menus - IEC display mode



Use the buttons to navigate the different meter screens. The navigation symbols and their functions are explained below:

Navigation symbols

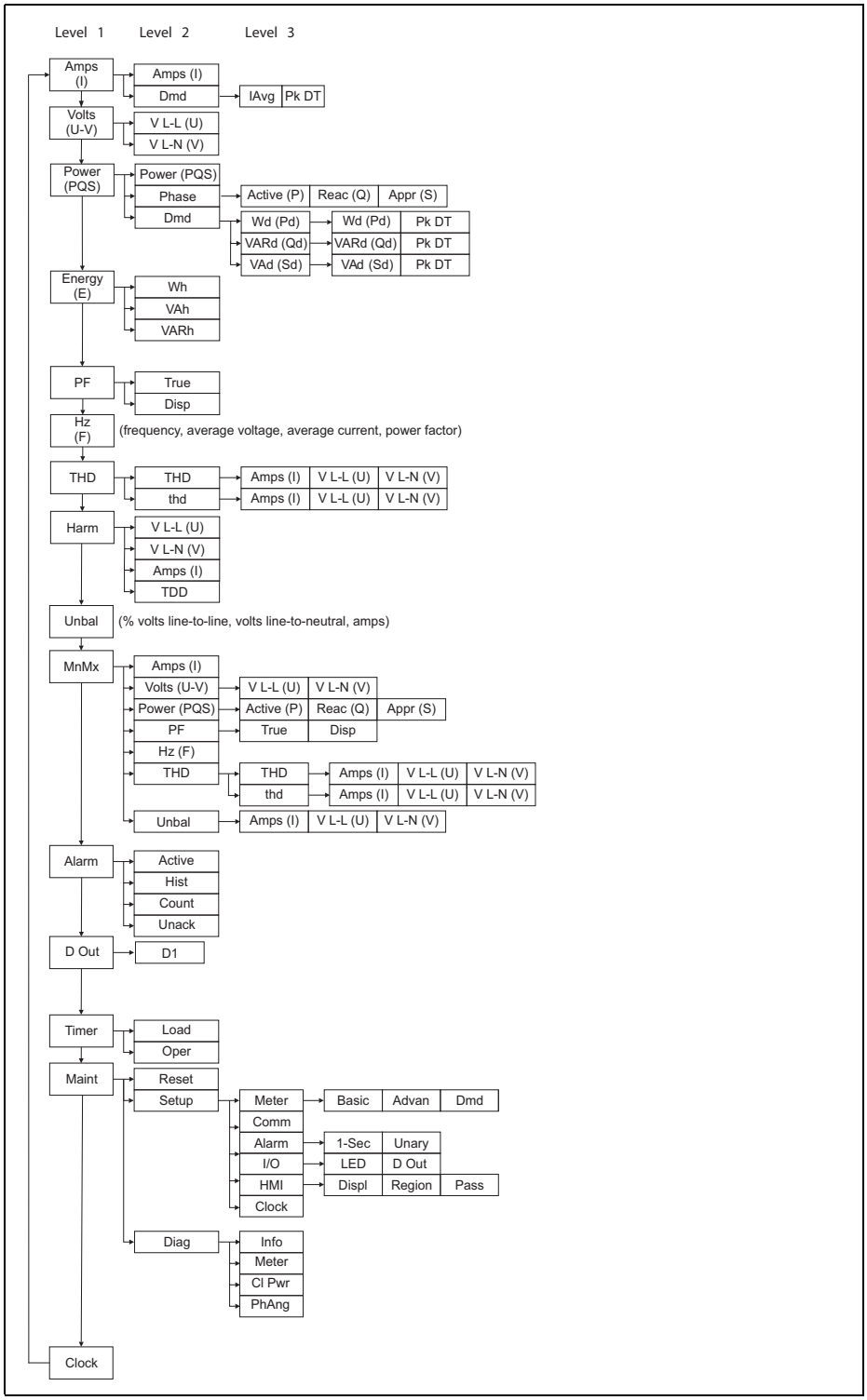
Symbol	Description
▶	Scroll right and display more menu items
▲	Exit screen and go up one level
▼	Move cursor down the list of options or display more items below
▲	Move cursor up the list of options or display more items above
◀	Move cursor one character to the left
+	Increase the highlighted value or show the next item in the list
–	Show the previous item in the list
	Front panel buttons

When you reach the last screen, press ▶ again to cycle through the screen menus.

Menu tree

This summarizes the meter screens (IEEE menus shown, with the corresponding IEC menus in parentheses — see “Setting up regional settings” on page 35).

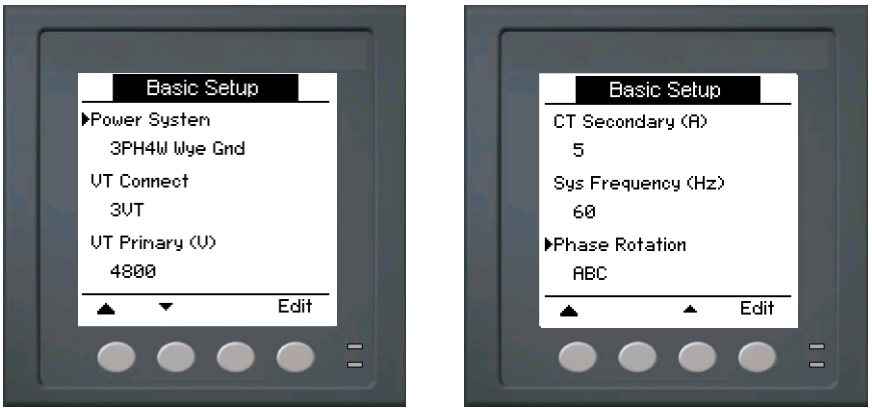
PM5100 display screen menus



Meter setup screen navigation

The meter's front panel buttons and display screen allow you to navigate and configure the meter's setup parameters. The following illustration shows one of the meter setup screens.

Basic setup screen



In this example, the down arrow (▼) indicates there are more parameters below the selected option (▶). Press the down arrow button to display additional parameters. The down arrow disappears when the last item in the list is selected, and there are no more parameters to display.

Front panel meter setup

Meter configuration can be performed directly through the front panel buttons or remotely through software. This section contains instructions on setting up the meter using the front panel.

Related topics

- See "Remote Meter Setup" on page 41 for remote meter setup details.

Configuring the basic setup parameters

Proper configuration of the meter's basic setup parameters is essential for accurate measurement and calculations. Use the Basic Setup screen to define the electrical power system that the meter is monitoring.

NOTICE

UNINTENDED EQUIPMENT OPERATION

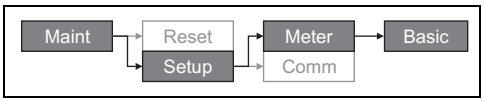
After modifying any basic setup parameter:

- Verify all standard alarms settings are correct and make adjustments as necessary.
- Re-enable all configured alarms.

Failure to follow these instructions can result in incorrect alarm functions.

If standard (1-sec) alarms have been configured and you make subsequent changes to the meter's basic setup, all alarms are disabled to prevent undesired alarm operation. After saving the changes, confirm all configured standard alarm settings are still valid, reconfigure them as required, and re-enable the alarms.

Basic setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **Meter > Basic**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Basic setup parameters

Parameter	Values	Description
Power System	Select the power system type (power transformer) the meter is wired to.	
	1PH2W LN	Single-phase 2-wire line-to-neutral
	1PH2W LL	Single-phase 2-wire line-to-line
	1PH3W LL with N	Single-phase 3-wire line-to-line with neutral
	3PH3W Dlt Ungnd	3-phase 3-wire ungrounded delta
	3PH3W Dlt Crnr Gnd	3-phase 3-wire corner grounded delta
	3PH3W Wye Ungnd	3-phase 3-wire ungrounded wye
	3PH3W Wye Gnd	3-phase 3-wire grounded wye
	3PH3W Wye Res Gnd	3-phase 3-wire resistance-grounded wye
	3PH4W Opn Dlt Ctr Tp	3-phase 4-wire center-tapped open delta
	3PH4W Dlt Ctr Tp	3-phase 4-wire center-tapped delta
	3PH4W Wye Ungnd	3-phase 4-wire ungrounded wye
	3PH4W Wye Gnd	3-phase 4-wire grounded wye
	3PH4W Wye Res Gnd	3-phase 4-wire resistance-grounded wye
VT Connect	Select how many voltage transformers (VT) are connected to the electrical power system.	
	Direct Con	Direct connect; no VTs used
	2VT	2 voltage transformers
	3VT	3 voltage transformers
VT Primary (V)	1 to 1000000	Enter the size of the VT primary, in Volts.
VT Secondary (V)	100, 110, 115, 120	Select the size of the VT secondary, in Volts
CT on Terminal	Define how many current transformers (CT) are connected to the meter, and which terminals they are connected to.	
	I1	1 CT connected to I1 terminal
	I2	1 CT connected to I2 terminal
	I3	1 CT connected to I3 terminal
	I1 I2	2 CT connected to I1, I2 terminals
	I1 I3	2 CT connected to I1, I3 terminals
	I2 I3	2 CT connected to I2, I3 terminals
	I1 I2 I3	3 CT connected to I1, I2, I3 terminals
CT Primary (A)	1 to 32767	Enter the size of the CT primary, in Amps.
CT Secondary (A)	1, 5	Select the size of the CT secondary, in Amps.
Sys Frequency (Hz)	50, 60	Select the frequency of the electrical power system, in Hz.
Phase Rotation	ABC, CBA	Select the phase rotation of the 3-phase system.

7. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

- See “Configuring the basic setup parameters” on page 32 for meter basic setup instructions.

Communications setup

After wiring the meter’s serial communications port, you can configure these ports so you can connect to the meter remotely and use device configuration software such as ION Setup to configure the meter.

Based on the reference model, the meter is equipped with the following communication ports:

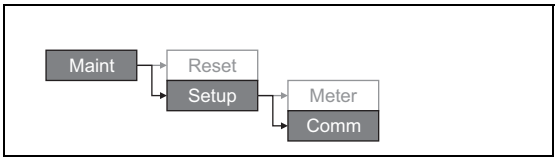
Communication ports

Reference Models	Communication
PM5100	-
PM5110	RS-485
PM5111	RS-485

Setting up serial communications

The Serial Port setup screen allows you to configure the meter’s RS-485 communications port so you can use software to access the meter’s data or configure the meter remotely.

Serial communications setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Press **Comm**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

   Communications setup parameters

Parameter	Values	Description
Protocol	Modbus	The communications format used to transmit data. The protocol must be the same for all devices in a communications loop.
Address	1 to 247	Set the address for this device. The address must be unique for each device in a communications loop. For Jbus protocol, set the device ID to 255.
Baud Rate	9600, 19200, 38400	Select the speed for data transmission. The baud rate must be the same for all devices in a communications loop.
Parity	Even, Odd, None	Select None if the parity bit is not used. The parity setting must be the same for all devices in a communications loop.

7. Press ▲ to exit. Press **Yes** to save your changes.

HMI settings

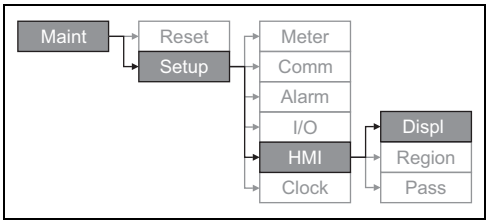
The HMI (human-machine interface) setup screens allow you to:

- control the general appearance and behavior of the display screens,
- change the regional settings, or
- change the meter passwords.

Setting up the display

You can change the display screen's contrast or the screen backlight and timeout settings.

Display setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is "0000"), then press **OK**.
3. Navigate to **HMI > Displ**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

   Display setup parameters

Parameter	Values	Description
Contrast	1 - 9	Increase or decrease the value to increase or decrease the display contrast.
Backlight Timeout (min)	0 - 60	Set how long (in minutes) before the backlight turns off after a period of inactivity. Setting this to "0" disables the backlight timeout feature (i.e., backlight is always on).
Screen Timeout (min)	0 - 60	Set how long (in minutes) before the screen turns off after a period of inactivity. Setting this to "0" disables the screen timeout feature (i.e., display is always on).

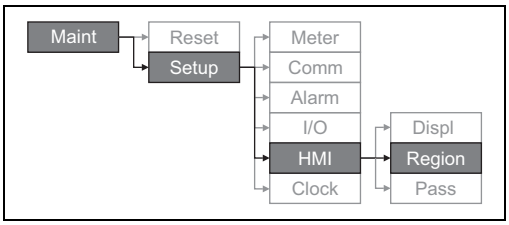
7. Press ▲ to exit. Press **Yes** to save your changes.

Setting up regional settings

You can change the regional settings to localize the meter screens and display data in a different language, using local standards and conventions.

NOTE: In order to display a different language other than those listed in the **Language** setup parameter, you need to download the appropriate language file to the meter using the appropriate firmware upgrade tool such as DLF3000. See "Downloading Firmware" on page 82.

Regional settings menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **HMI > Region**.
4. Move the cursor to point to the parameter you want to modify, then click **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

   Regional settings setup parameters

Parameter	Values	Description
Language	English US, French, Spanish, German, Italian, Portuguese, Chinese, Russian	Select the language you want the meter to display.
Date Format	MM/DD/YY, YY/MM/DD, DD/MM/YY	Set how you want the date to be displayed, e.g., month/day/year.
Time Format	24Hr, AM/PM	Set how you want the time to be displayed, e.g., 17:00:00 or 5:00:00 PM.
HMI Mode	IEC, IEEE	Select the standards convention used to display menu names or meter data.

7. Press ▲ to exit. Press **Yes** to save your changes.

Setting up the screen passwords

This can only be configured through the front panel. The factory-default setting for all passwords is “0000”. Changing the default password for screens that are password-protected prevents unauthorized personnel from accessing certain screens such as the diagnostics and reset screens.

NOTICE

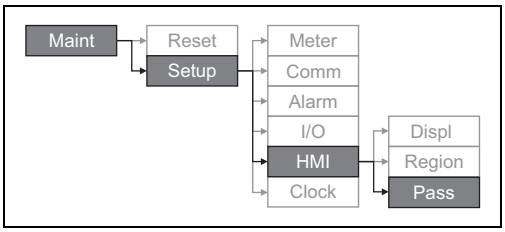
LOST DATA

Record your meter's screen password information in a secure location.

Failure to follow these instructions can result in data loss.

If you lose your password, you must return the meter for factory reconfiguration, which resets your device to its factory defaults and destroys all logged data.

Password setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **HMI > Pass**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

   Password setup parameters

Parameter	Values	Description
Setup	0000 - 9999	Sets the password for accessing the meter setup screens (Maint > Setup).
Energy Resets	0000 - 9999	Sets the password for resetting the meter’s accumulated energy values.
Demand Resets	0000 - 9999	Sets the password for resetting the meter’s recorded peak demand values.
Min/Max Resets	0000 - 9999	Sets the password for resetting the meter’s recorded minimum and maximum values.
Diagnostics	0000 - 9999	Sets the password for accessing the meter’s diagnostics screens.

7. Press ▲ to exit. Press **Yes** to save your changes.

Lost password

If you lose your password, contact technical support for instructions on how to return your meter for factory reconfiguration.

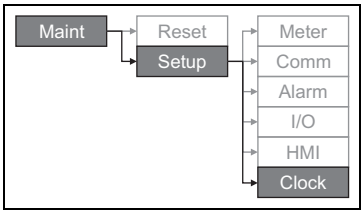
- Global-PMC-Tech-support@schneider-electric.com
- (00) + 1 (250) 544-3010

NOTE: Be sure to include your meter’s serial number in your e-mail or have it readily available when calling technical support.

Setting the clock

The Clock setup screens allow you to set the meter’s date and time.

Clock setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.

3. Navigate to **Clock**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Clock setup parameters

Parameter	Format	Description
Date	MM/DD/YY	Set the current date using the format displayed on screen, where MM = month, DD = day and YY = year.
Time	HH:MM:SS (24 hour format),	Use the 24-hour format to set the current time (GMT or local) in hours (HH), minutes (MM) and seconds (SS).
Meter Time	GMT, Local	Select GMT if you set the current time to Greenwich Mean Time zone. Otherwise, select Local.
GMT Offset (h)	-	Set the GMT Offset between ± 00.0 and ± 12.0 hrs.

7. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

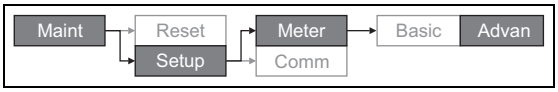
- See “Setting up regional settings” on page 35 for instructions on changing the format of the displayed date and time.

Advanced setup

The advanced setup screens let you change the meter name, set up a timer for monitoring load current, and specify the minimum demand current for total demand distortion calculations.

- Load Timer Setpt: specifies the minimum current at the load before the timer starts.
- Pk I dmd for TDD: specifies the minimum current demand value to consider for total demand distortion calculations.

Advanced setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **Meter > Advan**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Advanced setup parameters

Parameter	Values	Description
Label	-----	This label identifies the device, e.g., “Power Meter”. You cannot use the front panel to edit this parameter. Use ION Setup to change the device label.
Load Timer Setpt (A)	0 - 99999	Specifies the minimum average current at the load before the timer starts. The meter begins counting the operating time whenever the readings are equal to or above this average current threshold.
Pk I dmd for TDD (A)	0 - 99999	Specifies the minimum peak current demand at the load for inclusion in total demand distortion (TDD) calculations. If the load current is below the minimum peak current demand threshold, the meter does not use the readings to calculate TDD. Set this to “0” (zero) if you want the power meter to use the metered peak current demand for this calculation.

7. Press **Yes** to save your changes.

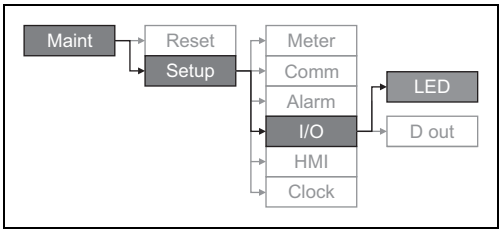
Related topics

- See“Total Harmonic Distortion and Total Demand Distortion” on page 67 for details on how the meter calculates TDD.

Setting up the alarm / energy pulsing LED

The LED setup screen allows you to configure the alarm / energy pulsing LED for alarming or energy pulsing application.

Alarm / energy pulsing LED settings menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **I/O > LED**.
4. Press **Edit**.
5. Press **+** or **–** to modify the parameter as required, then press **OK**.

   LED setup parameter

Parameter	Values	Description
Mode	Off, Alarm, Energy	Off disables the LED. Alarm sets the LED for alarm notification. Energy sets the LED for energy pulsing.

6. Press ▲ to exit. Press **Yes** to save your changes.

Related topics

- See “Setting up the alarm / energy pulsing LED” on page 39 for details on setting up the LED for alarms.

Output setup

The meter’s input/output (I/O) ports extend the capabilities of the meter. The I/O ports can be configured using the front panel or ION Setup.

Related topics

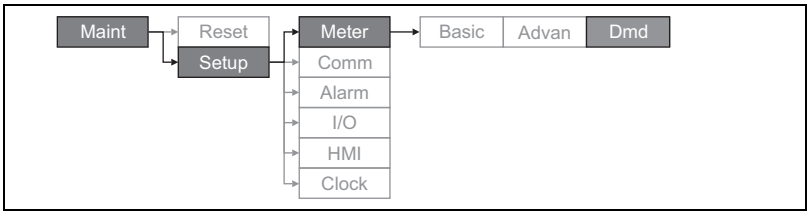
- See “Input / Output” on page 47 for a comprehensive description and setup instructions using the front panel.
- See “Technical Specifications” on page 14 for electrical characteristics and limits of meter’s I/O ports.

Demand setup

Demand is a measure of average consumption over a fixed time interval.

Use the Demand setup screens to define power demand, current demand or input metering demand.

Demand setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **Meter > Dmd**.
4. Move the cursor to select **Power Demand** or **Current Demand**.
5. Move the cursor to point to the parameter you want to modify, then press **Edit**.
6. Modify the parameter as required, then press **OK**.
7. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

Power or current demand setup parameters

Parameter	Values	Description
Method	Timed Sliding Block Timed Block Timed Rolling Block Cmd Sync Block Cmd Sync Roll Block Clock Sync Block Clock Sync Roll Block Thermal	See “Demand” on page 63 for details.
Interval (min)	0 - 60	Set the demand interval, in minutes.
Subinterval (min)	0 - 60	Applies only to rolling block methods. Define how many subintervals the demand interval should be equally divided into.

Power or current demand setup parameters *(continued)*

Parameter	Values	Description
Select Dig Output	None, Digital Output D1	Select which digital output the end of demand interval pulse should be sent to.
Clock Sync Time	0 - 2359	Applies only to clock sync methods (these synchronize the demand interval to the meter's internal clock). Define what time of day you want to synchronize the demand

8. Press **Yes** to save your changes.

Alarms setup

An alarm is the meter's means of notifying you when an alarm condition is detected, such as an error or event that falls outside of normal operating conditions.

Related topics

- See "Alarms" on page 51 for a comprehensive description and detailed setup instructions.

Remote Meter Setup

You can use ION Setup to remotely access the meter.

For more information on the ION setup configuration, please refer to *ION Setup 3.0 Device configuration guide.*

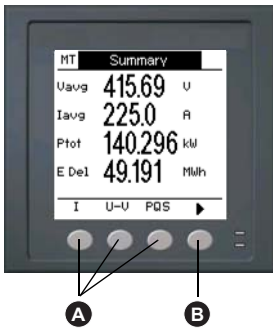
Chapter 5—Viewing Meter Data

You can view meter data from the meter's front panel display, a web browser, or through software.

Viewing meter data from the front panel

The Summary screen displays real-time values for average voltage and current (Vavg, Iavg), total power (Ptot) and energy consumption (E Del).

Summary screen



A	Menu selection buttons
B	Scroll right navigation button

Displaying data screens

To display data screens, press the button below the appropriate menu. To see more menu items, press the ▶ navigation button.

Related topics

- See "Front panel display and meter setup" on page 29 for information on front panel menu navigation.

Meter data display screens

The screen menu items are listed below. The titles listed are for the HMI mode in IEEE, with the corresponding titles in IEC mode in square brackets [ ].

Related topics

- See "Setting up regional settings" on page 35 for details on changing the HMI mode.

Amps [I]

Phase			Instantaneous current measurements for each phase and neutral.
Dmd			Summary of peak current demand values at the last demand interval for each phase and neutral.
	IAvg, Ia [I1], Ib [I2], Ic [I3], In, Ig		Real-time demand (Pres), peak demand (Peak) and predicted demand (Pred) for the present interval. Average demand for the previous interval (Last).
		Pk DT	Date and timestamp for the peak demand readings.
Ig			Average (Iavg), neutral (In) and residual/ground (Ig) current

Related topics

- See “Current demand” on page 65.

Volts [U-V]

V L-L [U]	Line-to-line voltage for each phase.
V L-N [V]	Line-to-neutral voltage for each phase.

Harm

V L-L [U] Fund, 3-11, 7-15	Line-to-line voltage harmonics data: Numeric magnitude and angle for the fundamental harmonic, and graphical representation of harmonics for the 3rd to 11th and 7th to 15th odd harmonics for each line-to-line phase voltage.
V L-N [V] Fund, 3-11, 7-15	Line-to-neutral voltage harmonics data: Numeric magnitude and angle for the fundamental harmonic, and graphical representation of harmonics for the 3rd to 11th and 7th to 15th odd harmonics for each line-to-neutral phase voltage.
Amps [I] Fund, 3-11, 7-15	Current harmonics data: Numeric magnitude and angle for the fundamental harmonics, and graphical representation of harmonics for the 3rd to 11th and 7th to 15th odd harmonics for each phase current.
TDD	Total demand distortion for each phase voltage.

Related topics

- See “Power quality” on page 67.

Power [PQS]

Power [PQS]	Summary of real-time power consumption values for total active power [Ptot] in kW, total reactive power [Qtot] in kVAR, and total apparent power [Stot] in kVA.
Phase Active [P], Reac [Q], Appr [S]	Per phase (A [P1], B [P2], C [P3]) and total (Total [Ptot]) power values for active power in kW, reactive power in kVAR and apparent power in kVA.
Dmd	Summary of peak power demand values in the previous (Last) demand interval period for active power in kW, reactive power in kVAR and apparent power in kVA.
Wd [Pd], VARd [Qd], VAd [Sd]	Total and per phase (A [1], B [2], C [3]) peak power demand values in the previous (Last) demand interval for active power demand (Wd [P]), reactive power demand (VARd [Q]) and apparent power demand (VAd [S]).
Tot, A [P1], B [P2], C [P3]	Each of these sub-screens (total and per phase demand) display power demand values for the current (Pres) demand interval, predicted (Pred) demand based on the current power consumption rate, demand for the previous (Last) demand interval period, and the recorded peak (Peak) power demand value.
Pk DT	Date and timestamp for the peak (Peak) power demand value.

Related topics

- See “Demand” on page 63.

Energy [E]

Wh	Delivered (Del), received (Rec), delivered minus received (D+R) and delivered minus received (D-R) accumulated values for real energy (Wh), apparent energy (VAh) and reactive energy (VARh).
VAh	
VARh	

PF

True	Per phase and total true power factor values and sign.
Disp	Per phase and total displacement power factor values and sign.

Hz [F]

Frequency (Freq), average voltage and current (Vavg, Iavg) and power factor (PF) values.

THD

THD		THD (ratio of harmonic content to the fundamental) for current, line-to-line voltage, and line-to-neutral voltage.
	Amps [I], V L-L [U], V L-N [V]	
thd		thd (ratio of harmonic content to the rms value of total harmonic content) for current, line-to-line voltage, and line-to-neutral voltage.
	Amps [I], V L-L [U], V L-N [V]	

Related topics

- See “Power quality” on page 67.

Unbal

Percent unbalance readings for line-to-line voltage (V L-L [U]), line-to-neutral voltage (V L-N [V]) and current (Amps [I]).

MnMx

MnMx			Summary of maximum values for line-to-line voltage, line-to-neutral voltage, phase current and total power.
	Amps [I]		Minimum and maximum values for phase current.
	Volts		Minimum and maximum values for line-to-line voltage and line-to-neutral voltage.
		V L-L, V L-N	
	Power		Minimum and maximum values for active, reactive, and apparent power.
		Active, Reac, Apr	
	PF		Minimum and maximum values for true and displacement PF and PF sign.
		True, Disp	
	Hz		Minimum and maximum values for frequency.
	THD		Minimum and maximum values for total harmonic distortion (THD or thd).
		THD, thd	
			Amps, V L-L, V L-N	THD or thd minimum and maximum values for phase or neutral current, line-to-line voltage and line-to-neutral voltage.
	Unbal		Minimum and maximum values for current unbalance, line-to-line voltage unbalance and line-to-neutral voltage unbalance..
		Amps, V L-L, V L-N	

Alarm

Active, Hist, Count, Unack	Lists all active alarms, past alarms (Hist), the total number each standard alarm has been tripped (Count), and all unacknowledged alarms.

Related topics

- See “Alarms” on page 51.

D Out

D Out	Current status (on or off) of the selected digital output. Counter shows the total number of times an off-to-on change of state is detected. Timer shows the total time (in seconds) that the digital output is in the on state.

Related topics

- See “Input / Output” on page 47.

Timer

Load	Real-time counter that keeps track of the total number of days, hours, minutes and seconds an active load is connected to the meter inputs.
Oper	Real-time counter for the total number of days, hours, minutes and seconds the meter has been powered.

Maint

Reset	Screens to perform global or single resets.

Maint

Setup	Meter, Comm, Alarm, I/O, HMI, Clock	Setup screens for meter configuration.
Diag	Info, Meter, Cl Pwr, PhAng	Diagnostic screens provide meter information, status and event data for troubleshooting. The PhAng screen displays a graphical representation of the power system the meter is monitoring.

Related topics

- See “Meter resets” on page 77.
- See “Front panel display and meter setup” on page 29.
- See “Maintenance and Troubleshooting” on page 81.

Clock

Meter date and time (local or GMT).

Using ION Setup to view or modify configuration data

You can use ION Setup to view or modify the meter setup parameters.

For more information on configuration, see *ION Setup 3.0 Device configuration guide.*

Using software to view meter data

You can view meter data using energy management software such as Struxureware Power Monitoring Expert or Struxureware Power SCADA. Refer to the software documentation for details.

Chapter 6—Input / Output

This section describes the meter's output features.

The meter is equipped with one digital output port.

After you wire the meter's output ports, you can configure the port so you can use the meter to perform I/O functions.

Digital output applications

The digital output can be used in energy pulsing applications, where a receiving device determines energy usage by counting the kWh pulses coming from the meter's digital output port.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

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

NOTE: Be aware that an unexpected change of state of the digital outputs may result when the supply power to the meter is interrupted or after a meter firmware upgrade.

Related topics

- See "Technical Specifications" on page 14 for electrical characteristics and limits for the digital outputs.

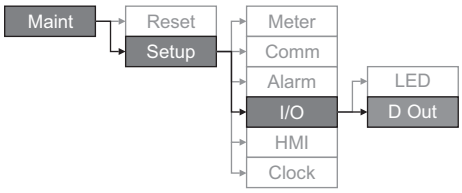
Digital output setup

The digital output port (D1) can be configured using the front panel or ION Setup.

Configuring digital outputs using the front panel

You can use the front panel to configure the digital outputs.

Digital output setup menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Navigate to **I/O > D Out**.
4. Press **Edit**.
5. Press **+** and **-** to scroll through the modes None or Energy.

NOTE: If **Edit** is not displayed, it means the parameter is either read-only or can only be modified through software.

6. Press **OK**.
7. Press **Edit** and modify the parameter as required, then press **OK**.
8. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.
9. Press ▲ to exit. Press **Yes** to save your changes.

NOTE: Be aware that an unexpected change of state of the relay outputs may result when the supply power to the meter is interrupted or after a meter firmware upgrade.

Alarm / energy pulsing LED setup

The meter’s LED can be configured for alarm indication or energy pulsing.

When set to detect alarms, the LED blinks to indicate an alarm condition. See “Alarm Priorities” on page 53 for a description of the LED behavior based on different alarms.

When the LED is set to energy pulsing, the meter sends a readable pulse or signal based on the measured energy. This pulse can be used for accuracy verification or as an input to another energy monitoring system. The meter uses the pulse constant setting in pulses per k_h to determine the frequency and number of pulses sent to the LED (where k_h = kWh, kVARh or kVAh depending on the energy parameter selected).

The LED setup screen allows you to configure the alarm / energy pulsing LED for alarming or energy pulsing applications.

Configuring the LED or digital output for energy pulsing using ION Setup

You can use the ION Setup to configure your meter’s LED or digital output for energy pulsing.

1. Start ION Setup.
2. Connect to your meter

3. Navigate to **I/O configuration** > **Energy Pulsing**.
4. Select the LED or a digital output to configure and click **Edit**. The setup screen is displayed.
5. Enter a descriptive name for the digital output's **Label**.
6. Configure the other setup parameters as required.
7. Click **Send** to save your changes.

Alarm / energy pulsing LED setup parameters available through ION Setup

Parameter	Values	Description
Mode	Off, Alarm, Energy	Off disables the LED. Alarm sets the LED for alarm notification. Energy sets the LED for energy pulsing.
Pulse Wt. (p/k_h)	1 to 9999999	When configured for energy pulsing, this defines how many pulses are sent to the LED for every 1 kWh, 1 kVARh or 1kVAh of accumulated energy.
Channel	Active Energy Delivered	Select which accumulated energy channel to monitor and use for energy pulsing.
	Active Energy Received	
	Active Energy Del+Rec	
	Reactive Energy Delivered	
	Reactive Energy Received	
	Reactive Energy Del+Rec	
	Apparent Energy Delivered	
	Apparent Energy Received	
	Apparent Energy Del+Rec	

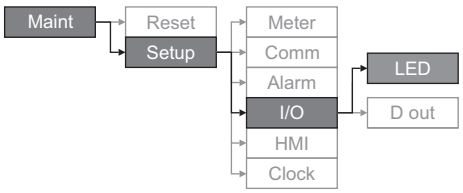
Related topics

- See "Alarm Priorities" on page 53 for a detailed description on the alarm / energy pulsing LED's behavior when it is configured for alarm notification.

Configuring the alarm / energy pulsing LED using the front panel

You can use the front panel display to configure your meter's LED for alarming or energy pulsing application.

Alarm / energy pulsing LED settings menu tree



1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is "0"), then press **OK**.
3. Navigate to **I/O > LED**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

Alarm / energy pulsing LED parameters available through the front panel

Parameter	Values	Description
Mode	Off, Alarm, Energy	Disabled turns off the LED completely. Alarm sets the LED for alarm notification. Energy sets the LED for energy pulsing.
Pulse Wt. (p/k_h)	1 to 9999999	When configured for energy pulsing, this setting defines how many pulses are sent to the LED for every 1 kWh, 1 kVARh or 1kVAh accumulated energy.

Alarm / energy pulsing LED parameters available through the front panel

Parameter	Values	Description
Parameter	Active Del	Select which accumulated energy channel to monitor and use for energy pulsing.
	Active Rec	
	Active Del + Rec	
	Reactive Del	
	Reactive Rec	
	Reactive Del + Rec	
	Apparent Del	
	Apparent Rec	
	Apparent Del + Rec	

5. Press + or − to modify the parameter as required, then press **OK**.
6. Press ▲ to exit. Press **Yes** to save your changes.

Chapter 7—Alarms

This section describes the alarm features on PM5100 series Power and Energy meters.

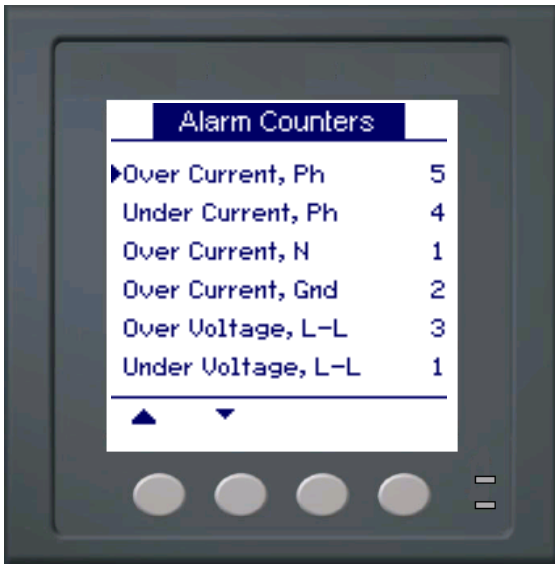
About Alarms

The ⚠ icon appears in the upper-right corner of the meter display when an alarm is active.

If the energy/alarm LED has been configured for alarms, the energy/alarm LED flashes when an alarm is active. See “Alarm / energy pulsing LED setup” on page 48 for more information.

The power meter maintains a counter for each alarm to help keep track of the total number of occurrences (see Figure 7–1).

Figure 7–1: Alarm Counters



If you make changes to the basic power meter setup, all alarms are disabled to prevent undesired alarm operation. Confirm alarm configuration and enable required alarms.

NOTE: Only alarms that apply to the selected power system configuration can be enabled.

The available alarms for this power meter are described in the following sections.

1-Second Alarms

The power meter has 29 standard 1-second over/under alarms. See Table 7–1 for a complete list.

Use the display to configure 1-second alarms with the following values:

- Enable—disable (default) or enable
- Pickup Setpoint (magnitude)
- Pickup Time Delay (in seconds)

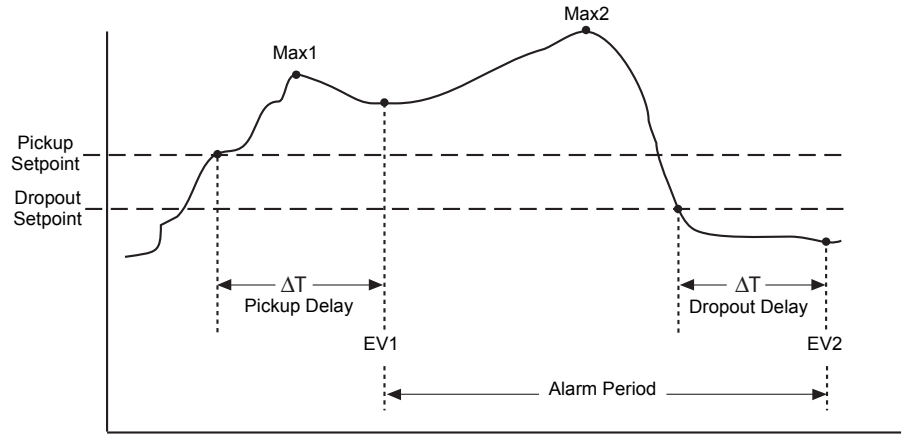
- Dropout Setpoint (magnitude)
- Dropout Time Delay (in seconds)

Table 7–1: List of Standard 1-Second Over/Under Alarms

Alarm Number	Alarm Label
01	Over Current, Phase
02	Under Current, Phase
03	Over Current, Neutral
04	Over Current, Ground
05	Over Voltage, L-L
06	Under Voltage, L-L
07	Over Voltage, L-N
08	Under Voltage L-N
09	Over kW
10	Over kVAR
11	Over kVA
12	Lead PF, True
13	Lag PF, True
14	Lead PF, Disp
15	Lag PF, Disp
16	Over kW Dmd, Pres
17	Over kW Dmd, Last
18	Over kW Dmd, Pred
19	Over kVAR Dmd, Pres
20	Over kVAR Dmd, Last
21	Over kVAR Dmd, Pred
22	Over kVA Dmd, Pres
23	Over kVA Dmd, Last
24	Over kVA Dmd, Pred
25	Over Frequency
26	Under Frequency
27	Over Voltage Unbal
28	Over Voltage THD
29	Phase Loss

Many of the 1-second alarms are three-phase alarms. Alarm setpoints are evaluated for each of the three phases individually, but the alarm is reported as a single alarm. The alarm pickup occurs when the first phase exceeds the alarm pickup magnitude for the pickup time delay. The alarm is active as long as any phase remains in an alarm state. The alarm dropout occurs when the last phase drops below the dropout magnitude for the dropout time delay. See Figure 7–2 below.

Figure 7–2: How the power meter handles setpoint-driven alarms



EV1—The power meter records the date and time that the pickup setpoint and time delay were satisfied, and the maximum value reached (Max1) during the pickup delay period (ΔT). Also, the power meter performs any tasks assigned to the event such as operation of a digital output.

EV2—The power meter records the date and time that the dropout setpoint and time delay were satisfied, and the maximum value reached (Max2) during the alarm period.

Unary Alarms

The power meter has four unary alarms. These alarms help alert you when the meter powers on after a control power loss, when the meter resets for any reason, when the meter self-diagnostic feature detects a problem, or when the meter detects a phase rotation different than expected.

Alarm Priorities

Each alarm has a priority level. Use priorities to help distinguish between events that require immediate action and those that do not require action. See “Setting up the alarm / energy pulsing LED” on page 39 for information on configuring the alarm LED for alarm mode.

- **High priority**—if a high priority alarm occurs, the display informs you in two ways: the alarm LED on the display flashes until you acknowledge the alarm, and the alarm icon blinks while the alarm is active. An alarm message is displayed while the alarm is active. See “Viewing Unacknowledged Alarms and the Alarm History Log” on page 59 for information on acknowledging alarms.
- **Medium priority**—if a medium priority alarm occurs, the alarm LED and the alarm icon blink only while the alarm is active. An alarm message is displayed while the alarm is active.

- **Low priority**—if a low priority alarm occurs, the alarm LED and the alarm icon blink only while the alarm is active. No alarm message is displayed.
- **No priority**—if an alarm is set up with no priority, no visible representation appears on the display. Alarms with no priority are not entered in the alarm Log.

If multiple alarms with different priorities are active at the same time, the display shows the alarms in the order they occurred.

When a pickup event occurs, the active alarm list appears. Press “Detail” to see more event information. See “Alarm Setup” on page 54 for more information.

Alarm Setup

Evaluation of all alarms is temporarily suspended while alarm setup screens are displayed. Evaluation resumes immediately upon exit from alarm setup screens.

To set up standard alarms:

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0000”), then press **OK**.
3. Press **Alarm**.

Use the directions in the following sections to set up alarms.

Setting Up 1-Second Alarms

To set up a standard alarm:

1. Press **1-Sec**. The 1-second alarm Select screen appears.
2. Press ▼ and ▲ to scroll through the list of standard 1–second alarms.
3. Press **Edit** to select an alarm to be configured.
4. Press **Edit** to select Pickup Setpoint.
5. Press + to increment the active digit through the numerals 0-9.
6. Press ◀ to enter the selected value for the active digit and move to the next digit to the left.
7. Continue until all values are selected, then press **OK** to enter the selected number for the pickup setpoint.
8. For power factor alarms (Lead PF, True; Lag PF, True; Lead PF, Disp; and Lag PF, Disp) press ▼ to select PU Set Point Lead/Lag, then press **Edit**. For other alarms, skip to Step 11.
9. Press **+** and **-** to scroll between Lead and Lag.
10. Press **OK** to set the pickup set point lead or lag.
11. Press ▼ and follow Steps 4 to 7 for Pickup Time Delay and Dropout Setpoint.
12. For power factor alarms, press ▼ to select DO Set Point Lead/Lag and follow Steps 10 and 11. For other alarms, proceed to Step 14.
13. Press ▼ and follow Steps 4 to 7 for Dropout Time Delay.
14. Press ▼ to select Enable, then press **Edit**.
15. Press **+** and **-** to scroll between Yes and No.
16. Press **OK** to enable or disable the alarm.

Setting Up 1-Second Alarms (continued)

17. Press ▼ to select Priority, then press **Edit**.
18. Press **+** and **-** to scroll through priority options None, High, Medium, or Low.

    NOTE: See “Alarm Priorities” on page 53 for more information.
19. Press **OK** to set the priority.
20. Press ▲ to save all alarm selections and return to the previous screen.
21. Press ▲ to save all 1-second alarm selections.

NOTE: The Over Demand alarms are applicable for systems in which the energy is delivered to the customer only.

Setting Up Unary Alarms

To set up unary alarms:

1. Press **Unary**. The unary alarm Select screen appears.
2. Press ▼ and ▲ to scroll through the list of unary alarms.
3. Press **Edit** to select an alarm to be configured.
4. Press **Edit** to select Enable.
5. Press **+** and **-** to scroll between Yes and No.
6. Press **OK** to enable or disable the alarm.
7. Press ▼ to select Priority.
8. Press **+** and **-** to scroll through priority options Low, None, High, or Medium.

   NOTE: See “Alarm Priorities” on page 53 for more information.
9. Press **OK** to set the priority.
10. Press ▲ to save all alarms selections and return to the previous screen.
11. Press ▲ to save all unary alarm selections.

Viewing Alarm Activity and History

There are two types of alarm entries: primary and secondary. The primary entry identifies the alarm. The secondary entries provide pickup and dropout information.

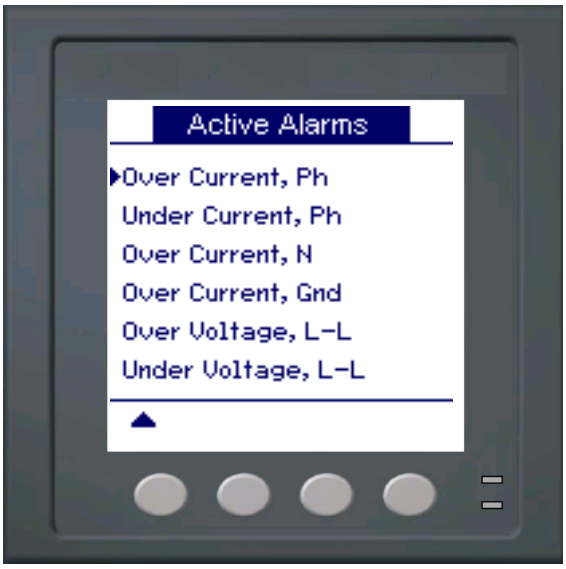
The active alarm list holds 40 entries at a time. The list works as a circular buffer, replacing old entries as new entries over 40 are entered into the alarm event queue. The information in the alarm event queue reinitializes when the power meter resets.

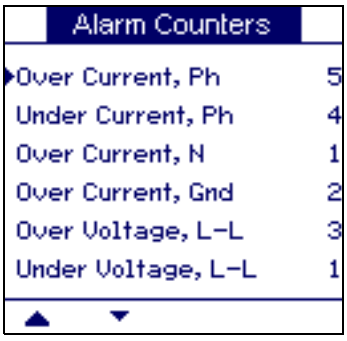
The alarm history log holds 40 entries. The log also works as a circular buffer, replacing old entries with new entries. This information is nonvolatile.

Viewing Active Alarms and Alarm Counters

To view active alarms or alarm counters:

1. Scroll through the menu list at the bottom of the screen until you see **Alarm**.
2. Press **Alarm**.
3. Press the button beneath **Active** or **Count**.
4. Press ▼ and ▲ to scroll through the alarm list.
5. Press ▲ to return to the previous screen.





Viewing Unacknowledged Alarms and the Alarm History Log

To view the unacknowledged alarms or the alarm history log:

1. Scroll through the menu list at the bottom of the screen until you see **Alarm**.
2. Press **Alarm**.
3. Press the button beneath **Unack** or **Hist**.
4. Press ▼ and ▲ to scroll through the list of primary alarm events.
5. Press **Detail** to view pickup and dropout event details.
6. Press ▼ and ▲ to scroll through the pickup and dropout event details.
7. For unacknowledged alarms, press **Ack** to acknowledge the alarm.
8. Press ▲ to return to the alarm list on the previous screen.
9. For unacknowledged alarms, follow Steps 4 to 7 until all alarms are acknowledged.

Chapter 8—Measurements and calculations

This section describes how the meter processes measured and calculated data.

Real-time readings

The power and energy meter measures currents and voltages, and reports in real time the RMS (Root Mean Squared) values for all three phases and neutral. The voltage and current inputs are continuously monitored at a sampling rate of 64 points per cycle. This amount of resolution helps enable the meter to provide reliable measurements and calculated electrical values for various commercial, buildings and industrial applications.

Related topics

- To learn how to navigate to the data screens using the front panel, see “Viewing Meter Data” on page 43.

Energy

The power and energy meter calculates and stores accumulated energy values for real, reactive, and apparent energy.

You can view accumulated energy from the display. The energy value units automatically change, based on the quantity of energy accumulated (e.g., from **kWh** to **MWh**, from **MWh** to **GWh**, then from **GWh** to **TWh, from TWh to PWh**).

Related topics

- To view energy readings from the front panel display, see “Meter data display screens” on page 43.

Min/max values

The meter’s real-time readings are updated once every 50 cycles for 50 Hz systems, or once every 60 cycles for 60 Hz systems. When the readings reach their lowest or highest value, the meter updates and saves these min/max (minimum and maximum) quantities in non-volatile memory.

Power factor

Power factor (PF) is the ratio of active power (P) to apparent power (S), and is a number between zero (0) and one (1). In a purely resistive circuit, PF is equal to 1 (unity PF). Inductive or capacitive loads increase the reactive power (Q) component in the circuit which causes the PF to become less than 1.

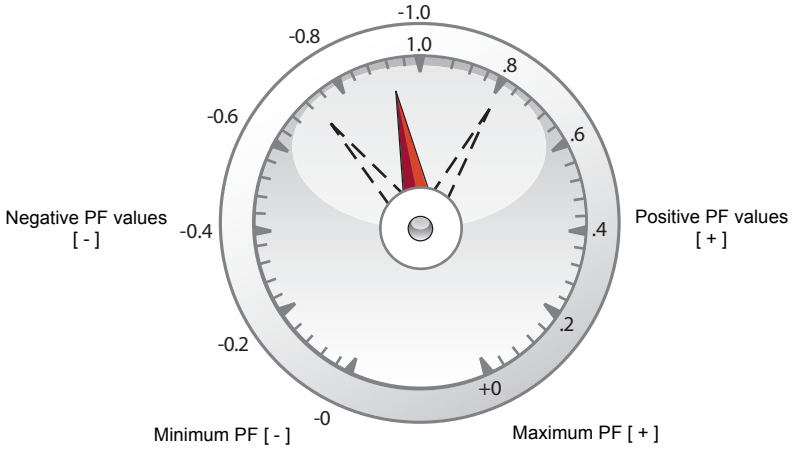
Power factor can have a positive or negative sign, depending on the type of load or direction of power flow. See “Power factor sign convention” on page 62.

Power factor min/max convention

The meter uses the following convention for power factor minimums and maximums:

- For negative PF readings, the minimum PF value is the measurement closest to -0 for PF readings between -0 to -1. For positive PF readings, the minimum PF value is the measurement closest to +1 for PF readings between +1 to +0.
- For negative PF readings, the maximum PF value is the measurement closest to -1 for PF readings between -0 to -1. For positive PF readings, the maximum PF value is the measurement closest to +0 for PF readings between +1 to +0.

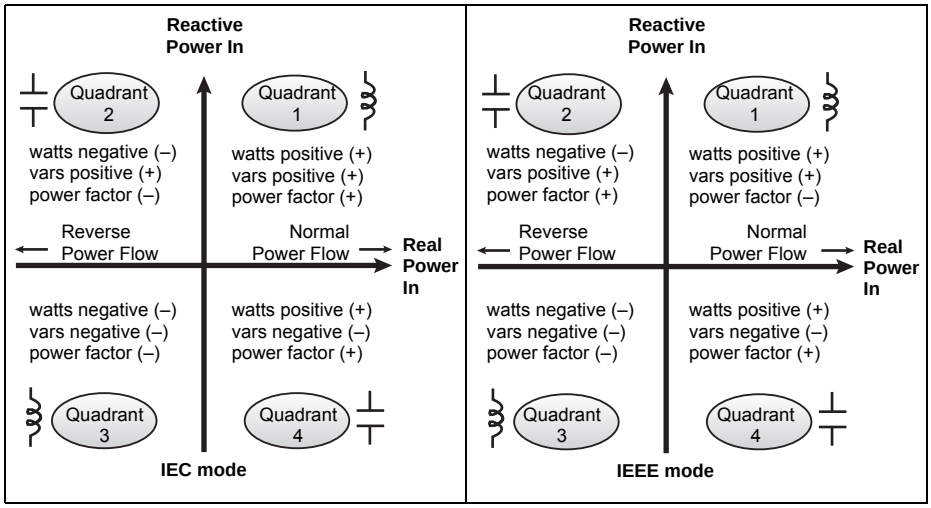
Power factor minimum and maximum



Power factor sign convention

You can set the power factor sign (PF sign) convention by changing the HMI mode to either IEC or IEEE.

Power factor sign convention



IEC mode

In IEC mode, the PF sign follows the direction of power flow. PF sign is positive (+) for positive (normal) power flow. PF sign is negative (-) for negative (reverse) power flow.

IEEE mode

In IEEE mode, the PF sign is determined by the type of load (inductive or capacitive) contributing to the reactive power component of apparent power. PF sign is positive (+) for capacitive loads (leading power factor). PF sign is negative (-) for inductive loads (lagging power factor).

Related topics

- To change the HMI mode, see “Setting up regional settings” on page 35.
- To learn how the meter calculates power factor, see “Power factor” on page 61.

Demand

Demand is a measure of average consumption (typically power or current) over a fixed programmed time interval.

The meter measures instantaneous consumption and can calculate demand using various methods.

Related topics

- For instructions on configuring demand using the front panel, see “Demand setup” on page 40

Power demand calculation methods

Power demand is calculated by dividing the energy accumulated during a specified period by the length of that period. How the power meter performs this calculation depends on the method and time parameters you select (for example, timed rolling block demand with a 15-minute interval).

To be compatible with electric utility billing practices, the power meter provides the following types of power demand calculations:

- Block interval demand
- Synchronized demand
- Thermal demand

You can configure the power demand calculation method from the front panel or using ION Setup.

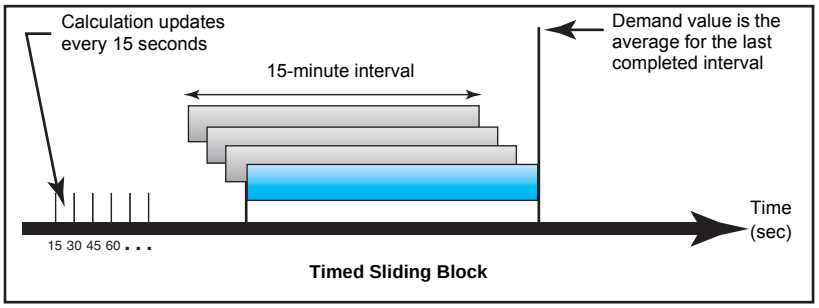
Block interval demand

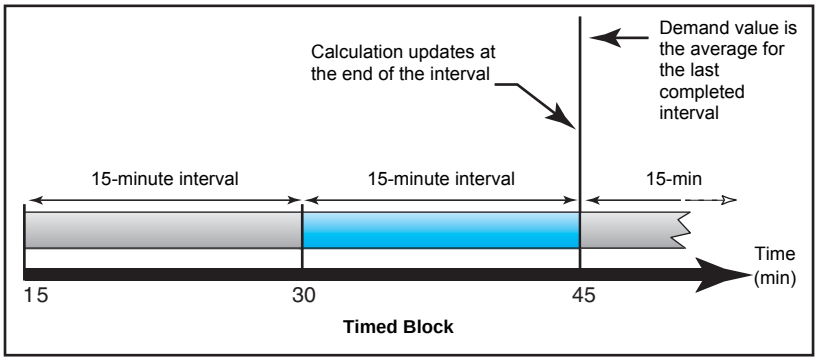
For block interval demand method types, you specify a period of time interval (or block) that the power meter uses for the demand calculation. Select/configure how the power meter handles that interval from one of these different methods:

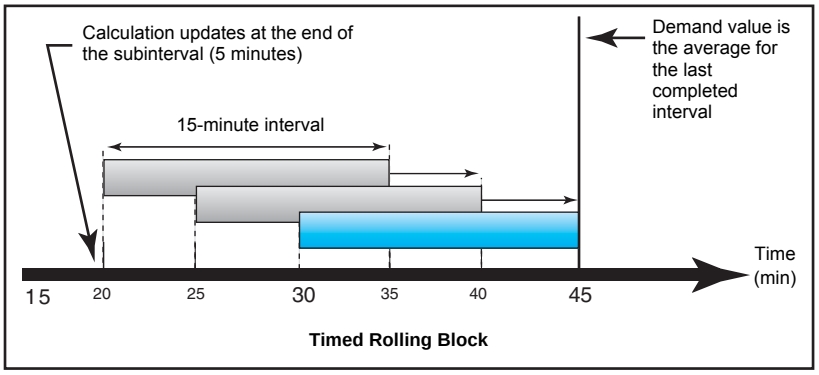
- **Timed Sliding Block**: Select an interval from 1 to 60 minutes (in 1-minute increments). If the interval is between 1 and 15 minutes, the demand calculation *updates every 15 seconds*. If the interval is between 16 and 60 minutes, the demand calculation *updates every 60 seconds*. The power meter displays the demand value for the last completed interval.
- **Timed Block**: Select an interval from 1 to 60 minutes (in 1-minute increments). The power meter calculates and updates the demand at the end of each interval.
- **Timed Rolling Block**: Select an interval and a subinterval. The subinterval must divide evenly into the interval (for example, three 5-minute subintervals for a 15-minute interval). Demand is *updated at the end of each subinterval*. The power meter displays the demand value for the last completed interval.

The following illustration shows the different ways power demand is calculated using the block interval method. In this example, the interval is set to 15 minutes.

Block interval demand example







Synchronized demand

You can configure the demand calculations to be synchronized using an external pulse input, a command sent over communications, or the device's internal real-time clock.

- **Command synchronized demand:** This method allows you to synchronize the demand intervals of multiple meters on a communications network. For example, if a programmable logic controller (PLC) input is monitoring a pulse at the end of a demand interval on a utility revenue meter, you can program the PLC to issue a command to multiple meters whenever the utility meter starts a new demand interval. Each time the command is issued, the demand readings of each meter are calculated for the same interval. When setting up this type of demand, you can choose **Cmd Sync Block** (command-synchronized block demand) or **Cmd Sync Roll Block** (command-synchronized rolling block demand). **Cmd Sync Roll Blk** requires that you specify a subinterval.
- **Clock synchronized demand:** This method allows you to synchronize the demand interval to the power meter's internal real-time clock. This helps you synchronize the demand to a particular time, typically on the hour (for example, at 12:00 am). If you select another time of day when the demand intervals are to be synchronized, the time must be specified in minutes from midnight. For example, to synchronize at

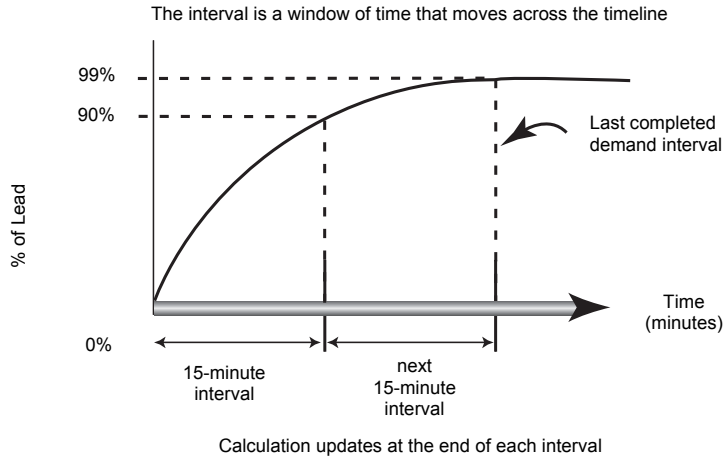
8:00 am, select 0800 (in hhmm format). When setting up this type of demand, you can choose **Clock Sync Block** (clock-synchronized block demand) or **Clock Sync Roll Blk** (clock-synchronized rolling block demand). **Clock Sync Roll Blk** requires that you specify a subinterval.

Thermal demand

Thermal demand calculates the demand based on a thermal response, which imitates the function of thermal demand meters. The demand calculation updates at the end of each interval. You can set the demand interval from 1 to 60 minutes (in 1-minute increments).

The following illustration shows the thermal demand calculation. In this example, the interval is set to 15 minutes.

Thermal demand example



Current demand

The power meter calculates current demand using one of the methods described in “Power demand calculation methods” on page 63. You can set the demand interval from 1 to 60 minutes in 1-minute increments (for example, 15 minutes).

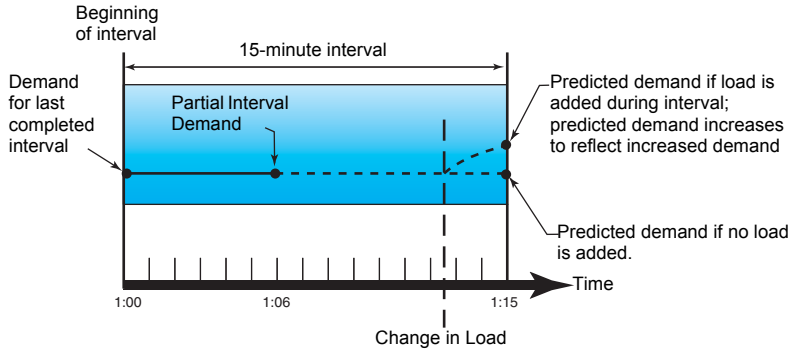
Predicted demand

The power meter calculates predicted demand for the end of the present interval for kW, kVAR, kVA and Amps demand. This prediction takes into account the energy consumption so far within the present (partial) interval and the present rate of consumption.

Predicted demand is updated every second.

The following illustration shows how a change in load can affect predicted demand for the interval. In this example, the interval is set to 15 minutes.

Predicted demand example



Peak demand

The maximum values for the kWD, kVARD, kVAD power, and amps (or peak demand) is maintained in the meter's non-volatile memory. The peak for each value is the highest average reading since the meter was last reset. The power meter also stores the date and time when the peak demand occurred. In addition to the peak demand, the power meter also stores the coinciding average 3-phase power factor. The average 3-phase power factor is defined as "demand kW/demand kVA" for the peak demand interval.

Related topics

- To reset peak demand values from the power meter display, see "Single resets" on page 78.

Chapter 9—Power quality

This section describes the meter's power quality features and how to access power quality data.

The meter measures voltage and current harmonics up to the 15th harmonic, and calculates Total Harmonic Distortion (THD) and Total Demand Distortion (TDD and tdd).

Harmonics overview

Harmonics are integer multiples of the fundamental frequency of the power system. Harmonics information is valuable for power quality analysis, determining properly rated transformers, maintenance and troubleshooting.

Harmonics measurements include per-phase magnitudes and angles for the fundamental and higher harmonics relative to the fundamental frequency. The meter's power system setting defines which phases are present and determines how line-to-line or line-to-neutral voltage harmonics and current harmonics are calculated.

Harmonics data provide information to determine how non-linear loads affect the power system. For example, power system harmonics can cause current flow on the neutral conductor, increase heating in electric motors, and eventually damage connected equipment. Power conditioners or harmonic filters can be used to minimize unwanted harmonics.

Total Harmonic Distortion and Total Demand Distortion

Total Harmonic Distortion (THD) is a measure of the total per-phase voltage or current harmonic distortion present in the power system. It provides a general indication of the quality of a waveform. THD is calculated for each phase of both voltage and current.

Total Demand Distortion (TDD) is the per-phase harmonic current distortion against the full load demand of the electrical system. TDD indicates the impact of harmonic distortion in the system. For example, if your system is showing high THD values but a low demand, the impact of harmonic distortion on your system might be insignificant. However at full load, the THD value for the current harmonics is equal to TDD, so this could negatively impact your system.

The meter uses the following series of equations to calculate THD and TDD.

Harmonic content calculations

1. Calculate harmonic content (HC).

$$HC = \sqrt{(H2)^2 + (H3)^2 + (H4)^2 \ldots}$$

`HC` (harmonic content) is equal to the RMS value of all the non-fundamental harmonic components in one phase of the power system.

2. Calculate the harmonic content for current (HCI).

$$HCI = \sqrt{(HI2)^2 + (HI3)^2 + (HI4)^2 \ldots}$$

`HCI` (harmonic content current) is equal to the RMS value of all the non-fundamental current harmonic components (`HI2…HIn`) in one phase of the power system.

THD and thd calculations

The meter supports two methods of calculating total harmonic distortion: THD and thd.

THD is a quick measure of the total distortion present in a waveform and is the ratio of harmonic content to the fundamental. The meter uses the following equation to calculate THD:

$$\text{THD} = \frac{\text{HC}}{\text{H1}} \times 100$$

Where `H1` is equal to the fundamental harmonic.

thd is an alternate method for calculating total harmonic distortion. It uses the RMS value for the total harmonic content rather than the fundamental content. The meter uses the following equation to calculate thd:

$$\text{thd} = \frac{\text{HC}}{\sqrt{(\text{H1})^2 + (\text{HC})^2}} \times 100$$

TDD calculation

TDD (total demand distortion) evaluates the harmonic currents between an end user and a power source. The harmonic values are based on a point of common coupling (PCC), which is a common point where each user receives power from the power source. The meter uses the following equation to calculate TDD:

$$\text{TDD} = (\sqrt{(\text{HCIA})^2 + (\text{HCIB})^2 + (\text{HCIC})^2}) / (\text{ILoad}) \times 100$$

Where `ILoad` is equal to the maximum demand load on the power system.

Displaying harmonics data

The meter displays the numeric magnitude and angle of the fundamental (first) harmonic.

Viewing harmonics using the front panel

You can view harmonics data using the front panel.

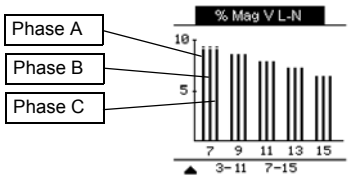
1. Navigate to **Harm**. The Harmonics % screen displays, with the following menu options:

   Harmonics % display screens

IEEE mode	IEC mode	Description
V L-L	U	Line-to-line voltage harmonics data
V L-N	V	Line-to-neutral voltage harmonics data
Amps	I	Current harmonics data
TDD	TDD	Total demand distortion

2. Press the voltage or current harmonics you want to view. The fundamental (1st) harmonic's numeric magnitudes and angles for all phases are displayed.
3. Press **3-11** or **7-15** to view the graphs for the 3rd to 11th or 7th to 15th harmonics, respectively. For example, to display the 7th to 15th harmonics screen, press **7-15**.

Example: 7th to 15th harmonics for line-to-neutral voltage



The vertical axis of the harmonics graph indicates the harmonic's magnitude as a percentage of the fundamental harmonic, and is scaled based on the largest harmonic displayed. At the top of each vertical bar is a marker that shows the maximum value of the harmonic. If the harmonic is greater than the fundamental harmonic, this marker is triangular-shaped to show that the value is out of range.

Viewing TDD

1. Navigate to **Harm > TDD**. The Total demand distortion information displays.

   Power Quality display screen

IEEE mode	IEC mode	Description
TDD	TDD	Total demand distortion

   NOTE: Your meter's Modbus map includes registers for harmonics data for integration into your power or energy management system.

2. Press ▲ to return to the main display screens.

Related topics

- See "Front panel display and meter setup" on page 29 for front panel menu navigation details.
- Search PM5100 Modbus register list at www.schneider-electric.com to download the Modbus map.

Viewing THD/thd using the front panel

You can view THD/thd data using the front panel.

1. Navigate to **THD**. On the THD/thd Select screen, press **THD** to display values that use the calculation method based on the fundamental harmonic, or **thd** to display values that use the calculation method based on the RMS value of all harmonics in that phase (including the fundamental).

   THD (or thd) display screens

IEEE mode	IEC mode	Description
Amps	I	Total harmonic distortion data for per phase and neutral currents.
V L-L	U	Total harmonic distortion data line-to-line voltage.
V L-N	V	Total harmonic distortion data line-to-neutral voltage.

2. Press the current or voltage THD or thd values you want to view. The total harmonic distortion percentage values are displayed.
3. Press ▲ to return to the main display screens.

NOTE: Your meter's Modbus map includes registers for total harmonic distortion data for integration into your power or energy management system.

Related topics

- See “Front panel display and meter setup” on page 29 for front panel menu navigation details.
- Search PM5100 Modbus register list at www.schneider-electric.com to download the Modbus map.

Chapter 10—Verifying accuracy

All meters are tested and verified at the factory in accordance with International Electrotechnical Commission (IEC) and American National Standards Institute (ANSI) standards.

Your digital power meter does not require re-calibration. However, in some installations a final accuracy verification of the meters is required, especially if the meters will be used for revenue or billing applications.

Testing overview

The most common method for testing meter accuracy is to apply test voltages and currents from a stable power source and compare the meter's readings with readings from a reference device or energy standard.

Accuracy test requirements

Signal and power source

The meter maintains its accuracy during voltage and current signal source variations but its energy pulsing output needs a stable test signal to help produce accurate test pulses. The meter's energy pulsing mechanism needs approximately 10 seconds to stabilize after every source adjustment.

The meter must be connected to control power in order to conduct accuracy verification testing. Refer to your meter's installation documentation for power supply specifications.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Verify the device's power source meets the specifications for your device's power supply.

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

Control equipment

Control equipment is required for counting and timing the pulse outputs from the alarm / energy pulsing LED or the digital outputs.

- Most standard test benches have an arm equipped with red light sensors to detect LED pulses.

NOTE: The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, florescent tubes, sunlight reflections, floodlights, etc). This can cause test errors. Use a hood, if necessary, to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 23 °C (73 °F). Make sure the meter is warmed up sufficiently before testing.

A warm-up time of 30 minutes is recommended before beginning energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating

temperature before calibration to help ensure that the meters will reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Energy meter standards allow the manufacturers to specify meter accuracy derating due to ambient temperature changes and self-heating.

Your meter complies with and meets the requirements of these energy metering standards.

For a list of accuracy standards that your meter complies to, contact your local Schneider Electric representative or download the meter brochure from www.schneider-electric.com.

Reference device or energy standard

To help ensure the accuracy of the test, it is recommended that you use a reference device or reference energy standard with a specified accuracy that is 6 to 10 times more accurate than the meter under test. Before you start testing, the reference device or energy standard should be warmed up as recommended by its manufacturer.

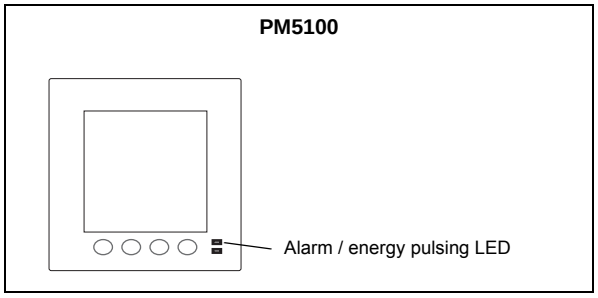
NOTE: Verify the accuracy and precision of all measurement equipment used in accuracy testing (for example, voltmeters, ammeters, power factor meters).

Energy pulsing

You can configure the meter's alarm /energy LED or one of the digital outputs for energy pulsing.

- The meter is equipped with an alarm / energy pulsing LED. When configured for energy pulsing, the LED emits pulses that are then used to determine the accuracy of the meter's energy measurements.

  Location of energy pulsing LED

- The meter is equipped with a digital output. When you configure the digital output for energy pulsing, the meter sends voltage pulses to the digital output port, which are then used to determine the accuracy of the meter's energy measurements.

Verifying accuracy test

The following are guidelines for testing the meter; your meter shop may have specific testing methods.

⚠ DANGER

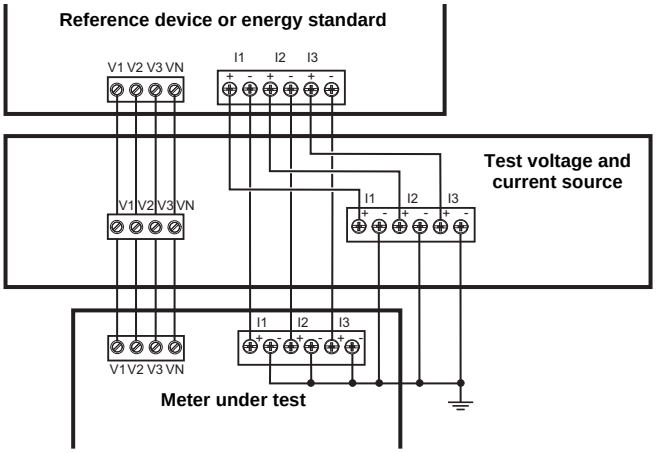
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Verify the device's power source meets the specifications for your device's power supply.

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

1. Turn off power to all test equipment. Use a properly rated voltage sensing device to confirm power is off.
2. Connect the test voltage and current source to the reference device or energy standard. Ensure all voltage inputs to the meter under test are connected in parallel and all currents inputs are connected in series.

   Connecting the meter to the reference standard and test equipment



3. Connect the control equipment used for counting the standard output pulses using one of these methods:

Alarm / energy LED	Align the red light sensor on the standard test bench armature over the front panel alarm / energy LED.
Digital output	Connect the meter's digital output to the standard test bench pulse counting connections.

   NOTE: When selecting which method to use, be aware that the Alarm / energy LED and digital outputs have different pulse rate limits. See "Energy pulsing considerations" on page 75 for details.

4. Before performing the verification test, let the test equipment power up the meter and apply voltage for at least 30 seconds. This helps stabilize the internal circuitry of the meter.
5. Set the meter's power system to 3PH4W Wye Gnd (3-phase, 4 wire Wye with ground).

6. Depending on the method selected for counting the energy pulses, configure the meter's alarm / energy LED or one of the digital outputs to perform energy pulsing. Set the meter's energy pulse constant so it is in sync with the reference test equipment.
7. Perform accuracy verification on the test points. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Calculating the number of required pulses

The reference test equipment typically requires you to specify the number of pulses required for a test duration of "t" seconds.

Use the following formula to calculate the required number of pulses:

$$\text{Number of pulses} = \text{Ptot} \times \text{K} \times \frac{\text{t}}{3600}$$

Where:

- Ptot = total instantaneous power in kilowatts (kW)
- K = the meter's pulse constant setting, in pulses per kWh
- t = test duration, in seconds (typically greater than 30 seconds)

Calculating total power

The test voltage and current source supplies the same test signals to both the energy reference/standard and the meter under test. Total power is calculated as follows:

For a balanced 3-phase Wye system:

$$\text{Ptot} = 3 \times \text{VLN} \times \text{I} \times \text{PF} \times \frac{1\ \text{kW}}{1000\ \text{W}}$$

NOTE: A balanced 3-phase system assumes the voltage, current and power factor values are the same for all phases.

For a single-phase system:

$$\text{Ptot} = \text{VLN} \times \text{I} \times \text{PF} \times \frac{1\ \text{kW}}{1000\ \text{W}}$$

Where:

- Ptot = total instantaneous power in kilowatts (kW)
- VLN = test point line-to-neutral voltage in volts [V]
- I = test point current in amps [A]
- PF = power factor

The result of the calculation is rounded up to the nearest integer.

Percent error calculation

For every test point:

$$\text{Energy Error} = \frac{\text{EM} - \text{ES}}{\text{ES}} \times 100\%$$

Where:

- EM = energy measured by the meter under test
- ES = energy measured by the reference device or energy standard.

NOTE: If accuracy verification reveals inaccuracies in your meter, they may be caused by typical sources of test errors. If there are no sources of test errors present, please contact your local Schneider Electric representative.

Energy pulsing considerations

The meter's alarm / energy LED and digital outputs are capable of energy pulsing within the following limits:

Energy pulsing limits

Description	Alarm / energy LED	Digital output
Maximum pulse frequency	50 Hz	25 Hz
Minimum pulse constant	1 pulse per k_h	
Maximum pulse constant	9,999,999 pulses per k_h	

The pulse rate depends on the voltage, current and PF of the input signal source, the number of phases, and the VT and CT ratios.

If Ptot is the instantaneous power (in kW) and K is the pulse constant (in pulses per k_h), then the pulse period is:

$$\text{Pulse period (in seconds)} = \frac{3600}{\text{K} \times \text{Ptot}} = \frac{1}{\text{Pulse frequency (Hz)}}$$

VT and CT considerations

The test points are always taken at the secondary side, regardless of whether VTs or CTs are used. Ptot is derived from the values of the voltage and current inputs at the secondary side, and takes into account the VT and CT ratios.

If VTs and CTs are used, you must include their primary and secondary ratings in the equation. For example, in a balanced 3-phase Wye system with VTs and CTs:

$$\text{Ptot} = 3 \times \text{VLN} \times \frac{\text{VT primary}}{\text{VT secondary}} \times \text{I} \times \frac{\text{CT primary}}{\text{CT secondary}} \times \text{PF} \times \frac{1\ \text{kW}}{1000\ \text{W}}$$

Total power limit for alarm / energy LED

Given the maximum pulse constant (Kmax) you can enter is 9,999,999 pulses per kWh, and the maximum pulse frequency for the alarm / energy LED is 83 Hz, the maximum total power (Max Ptot) the alarm / energy LED's energy pulsing circuitry can handle is 29.88 Watts:

$$\text{Maximum Ptot} = \frac{3600 \times (\text{Maximum pulse frequency})}{\text{Kmax}} = \frac{3600 \times 83}{9{,}999{,}999} = 0.02988\ \text{kW}$$

Total power limit for digital output

Given the maximum pulse constant (Kmax) you can enter is 9,999,999 pulses per kWh, and the maximum pulse frequency for the digital output is 25 Hz, the maximum total power (Max Ptot) the digital input's energy pulsing circuitry can handle is 9 Watts:

$$\text{Maximum Ptot} = \frac{3600 \times (\text{Maximum pulse frequency})}{\text{Kmax}} = \frac{3600 \times 25}{9{,}999{,}999} = 0.009\ \text{kW}$$

Test points

The meter should be tested at full and light loads and at lagging (inductive) power factors to help ensure testing over the entire range of the meter. The test amperage and voltage input rating are labeled on the meter. Refer to the installation sheet or data sheet for your meter's nominal current, voltage and frequency specifications.

Watt-hour test points example

Watt-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

Var-hour test points example

Var-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.87 lagging power factor (current lagging voltage by 30° phase angle).

Typical sources of test errors

If excessive errors are observed during accuracy testing, examine your test setup and test procedures to eliminate typical sources of measurement errors:

- Loose connections of voltage or current circuits, often caused by worn-out contacts or terminals. Inspect terminals of test equipment, cables, test harness and the meter under test.
- Meter ambient temperature is significantly different than 23 °C (73 °F).
- Floating (ungrounded) neutral voltage terminal in any configuration with unbalanced phase voltages.
- Inadequate meter control power, resulting in the meter resetting during the test procedure.
- Ambient light interference or sensitivity issues with the optical sensor.
- Unstable power source causing energy pulsing fluctuations.
- Incorrect test setup: not all phases connected to the reference device or the energy standard. All phases connected to the meter under test should also be connected to the reference meter/standard.
- Moisture (condensing humidity), debris or pollution present in the meter under test.

Chapter 11—Meter resets

Reset commands clear the meter's onboard data logs and related registers. Meter resets are typically performed after you make changes to the meter's basic setup parameters (such as power system, frequency, or PT/CT settings), to clear invalid or obsolete data in preparation for putting the meter into active service.

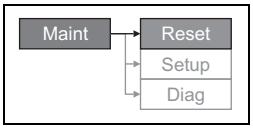
The meter reset commands are grouped into two categories: Global Resets and Single Resets.

NOTICE
LOST DATA Record all important data before performing meter resets. **Failure to follow these instructions can result in data loss.**

Front panel meter reset screens

To access the meter reset screens, navigate to **Maint > Reset**.

Reset menu tree



Global resets

Global resets allow you to clear all data of a particular type, such as all energy values or all minimum/maximum values.

Meter Initialization is a special command that clears the meter's recorded logged data, counters and timers. It is common practice to initialize the meter after its configuration is completed, before adding it to an energy management system.

1. Navigate to **Maint > Reset**.
2. Move the cursor to point to **Global Reset**, then press **Select**.
3. Move the cursor to point to the parameter you want to reset, then press **Reset**.

   Global reset options

Parameter	Description
Meter Initialization	Clears all data listed in this table (energy, demand, min/max values, counters, logs, timers, and input metering data).
Energies	Clears all accumulated energy values (kWh, kVARh, kVAh).
Demands	Clears all the demand registers.
Min/Max	Clears all the minimum and maximum registers.
Alarm Counts & Logs	Clears all the alarm counters and alarm logs.

4. Enter the reset password (default is "0000"), then press **OK**.
5. Press **Yes** to confirm the reset or **No** to cancel and return to the previous screen.

Single resets

Single resets allow you to clear data only in a specific register or register type.

1. Navigate to **Maint > Reset**.
2. Move the cursor to point to **Single Reset**, then press **Select**.
3. Move the cursor to point to the parameter you want to reset, then press **Reset**. If there are additional options for the parameter, press **Select**, move the cursor to point to the option you want, then press **Reset**.

Single reset options

Parameter	Option		Description
Energy	Accumulated		Clears all accumulated energy values (kWh, kVARh, kVAh).
Demand	Power, Current		Select which demand registers to clear (power demand, current demand or input metering demand).
Alarms	Event Queue		Clears the alarm event queue register.
	History Log		Clears the alarm history log.
	Counters	All Alarm Counts, (various alarm counters) — see the next table	Select “Counters”, then select which counter to clear (choose all or individual alarm counters listed in the “Alarm counter options” table below).
Active Load Timer			Clears and restarts the load operation timer.

4. Enter the reset password if prompted (default is “0000”), then press **OK**.
5. Press **Yes** to confirm the reset or **No** to cancel and return to the previous screen.

Alarm counter options

Alarm counter	Option	Description
Current	Over Current, Ph	Select which alarm counter register to reset from the current alarm condition counters.
	Under Current, Ph	
	Over Current, N	
	Over Current, Gnd	
Voltage	Over Voltage, L-L	Select which alarm counter register to reset from the voltage alarm condition counters.
	Under Voltage, L-L	
	Over Voltage, L-N	
	Under Voltage, L-N	
	Over Voltage Unbal	
	Over Voltage THD	
	Phase Loss	
Power	Over kW	Select which alarm counter register to reset from the power alarm condition counters.
	Over kVAR	
	Over kVA	
Power Factor	Lead PF, True	Select which alarm counter register to reset from the power factor alarm condition counters.
	Lag PF, True	
	Lead PF, Disp	
	Lag PF, Disp	
Demand	Over kW Dmd, Pres	Select which alarm counter register to reset from the demand alarm condition counters.
	Over kW Dmd, Last	
	Over kW Dmd, Pred	
	Over kVAR Dmd, Pres	
	Over kVAR Dmd, Last	
	Over kVAR Dmd, Pred	
	Over kVA Dmd, Pres	
	Over kVA Dmd, Last	
	Over kVA Dmd, Pred	

Alarm counter options *(continued)*

Alarm counter	Option	Description
Frequency	Over Frequency	Select which alarm counter register to reset from the frequency alarm condition counters.
	Under Frequency	
Unary	Meter Powerup	Select which alarm counter register to reset from the unary alarm condition counters.
	Meter Reset	
	Meter Diagnostic	
	Phase Reversal	

Chapter 12—Maintenance and Upgrades

Password Recovery

If you lose your password, contact technical support for password recovery assistance:

- Global-PMC-Tech-support@schneider-electric.com
- (00) + 1 (250) 544-3010

NOTE: Be sure to include your power meter's serial number in your e-mail or have it readily available when calling technical support.

Power Meter Memory

The power meter users its nonvolatile memory to retain all data and metering configuration values. Under the operating temperature range specified for the power meter, this nonvolatile memory has an expected life of at least 45 years.

NOTE: Life expectancy is a function of operating conditions and does not constitute any expressed or implied warranty.

Identifying the Firmware Version, Model, and Serial Number

1. Scroll to **Maint** in the menu list.
2. Press **Maint**.
3. Press **Diag**.
4. Press **Info**.
5. Press ▼ and ▲ to view the model, firmware (OS) version, serial number, and other power meter information.
6. Press ▲ to return to the Maintenance screen.

Additional Meter Status Information

Meter

1. Scroll to **Maint** in the menu list.
2. Press **Maint**.
3. Press **Diag**.
4. Press **Meter**.
5. View the power meter status.
6. Press ▲ to return to the Maintenance screen.

Control Power

1. Scroll to **Maint** in the menu list.
2. Press **Maint**.
3. Press **Diag**.
4. Press **Cl Pwr**.
5. View control Power information.
6. Press ▲ to return to the Maintenance screen.

Downloading Firmware

The power meter supports the downloading of new firmware and language files over the communications link. This requires the free DLF3000 software, which is available at www.schneider-electric.com. The DLF3000 offers an extensive Help file with information on operating the software. The most recent firmware and language files are also available on the website. Recommended baud rate for firmware download through communications link is 19200.

Troubleshooting

The information in Table 12–1 on page 84 describes potential problems and their possible causes. It also describes checks you can perform or possible solutions for each. After referring to this table, if you cannot resolve the problem, contact your local Schneider Electric sales representative for assistance.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical practices. For example, in the United States, see NFPA 70E.
- This equipment must be installed and serviced only by qualified personnel.
- Turn off all power supplying this equipment before working on or inside.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Carefully inspect the work area for tools and objects that may have been left inside the equipment.
- Use caution while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which could cause personal injury.

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

Heartbeat/Comms LED

The heartbeat/comms LED helps to troubleshoot the power meter. The heartbeat/comms LED works as follows:

- **Normal operation** — the LED flashes at a steady rate during normal operation.
- **Communications** — the LED flash rate changes as the communications port transmits and receives data. If the LED flash rate does not change when data is sent from the host computer, the power meter is not receiving requests from the host computer.
- **Hardware** — if the heartbeat LED remains lit and does not flash ON and OFF, there is a hardware problem. Perform a hard reset of the power meter (turn OFF power to the power meter, then restore power to the power meter). If the heartbeat LED remains lit, contact your local sales representative.
- **Control power and display** — if the heartbeat LED flashes, but the display is blank, the display may not be functioning properly or may have timed out (see “Setting Up the Display” on page 8). If the display is blank and the LED is not lit, verify that control power is connected to the power meter.

Table 12–1: Troubleshooting

Potential Problem	Possible Cause	Possible Solution
The maintenance (wrench) icon is illuminated on the power meter display.	When the maintenance (wrench) icon is illuminated, it indicates an event has occurred which may require attention.	Go to [Maint] > [Diag]. Event messages display to indicate the reason the icon is illuminated. Note these event messages and call the Technical Support or contact your local sales representative for assistance.
The display is blank after applying control power to the power meter.	The power meter may not be receiving the necessary power. The display may have timed out.	Verify that the power meter line and terminals are receiving the necessary power. Verify that the heartbeat LED is blinking. Press a button to see if the display timed out.
The data being displayed is inaccurate or not what you expect.	Incorrect setup values.	Check that the correct values have been entered for power meter setup parameters (CT and VT ratings, Nominal Frequency, and so on). See “Configuring the basic setup parameters” on page 32 for setup instructions.
	Incorrect voltage inputs.	Check power meter voltage input terminals (1, 2, 3, 4) to verify that adequate voltage is present.
	Power meter is wired improperly.	Check that all CTs and VTs are connected correctly (proper polarity is observed) and that they are energized. Check shorting terminals. See the recommended torque in the Wiring section of the installation manual.
Cannot communicate with power meter from a remote personal computer.	Power meter address is incorrect.	Check to see that the power meter is correctly addressed. See “Communications setup” on page 34 for instructions.
	Power meter baud rate is incorrect.	Verify that the baud rate of the power meter matches the baud rate of all other devices on its communications link. See “Communications setup” on page 34 for instructions.
	Communications lines are improperly connected.	Verify the power meter communications connections. Refer to the “Communications” on page 25 section for instructions.
	Communications lines are improperly terminated.	Check to see that a multi-point communications terminator is properly installed.
	Incorrect route statement to power meter.	Check the route statement. Contact Global Technical Support for assistance.
Energy/Alarm LED not working.	May have been disabled by user.	See “Setting up the alarm / energy pulsing LED” on page 39.

The power meter does not contain any user-serviceable parts. If the power meter requires service, contact your local sales representative. Do not open the power meter. Opening the power meter voids the warranty.

Getting Technical Support

Please refer to the *Technical Support Contacts* provided in the power meter shipping carton for a list of support phone numbers by country, or go to www.schneider-electric.com, then navigate to Support area for contact information.

Register List

To download the latest version of the power meter PM5100 Modbus register list, go to www.schneider-electric.com. Type PM5100 in the search field.

Chapter 13—MID Compliance

This section applies only to PM5111(referred to in the section as the meter) and contains descriptions and procedures that supplement the meter installation sheet. The information contained here supports the meter's declaration of compliance with the Measuring Instruments Directive (2004/22/EC).

MID overview

Directive 2004/22/EC is the Measuring Instruments Directive ("MID") from the European Parliament & Council that harmonises many aspects of legal metrology across the EU states.

Scope

Although MID applies to various measuring instruments, the scope of this section is limited only to the MID standards that apply to AC electricity metering equipment:

- **EN 50470-1:2006**
  Electricity metering equipment (a.c.) — Part 1: General requirements, tests and test conditions - Metering equipment (class indexes A, B and C)
- **EN 50470-3:2006**
  Electricity metering equipment (a.c.) — Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

Related topics

- Search the Internet for "Measuring Instruments Directive" or "Directive 2004/22/EC" for more information.
- The CE declaration document is available from the website. Search for ECDPM5000.

MID compliance for the meter

The meter complies to these MID standards and class indexes:

- EN 50470-1:2006 Class C
- EN 50470-3:2006 Class C

The meter achieves MID compliance through application of Annex B (Type Examination) and Annex D (Declaration of Conformity to Type Based on Quality Assurance of the Production Process).

Specifications relevant to MID

The meter meets all specifications listed in "Technical Specifications" on page 14. See that section for mechanical and electrical specifications such as IP rating, rated operating conditions, protective class and environmental conditions.

In addition, the following specifications, function limitations and specific conditions are relevant to MID:

Applicable MID standards and class index	• EN 50470-1:2006 Class C • EN 50470-3:2006 Class C
Type of measuring equipment	Static watt-hour meter

Intended use		Indoor use only, permanently mounted in residential, commercial or light industrial applications, where levels of vibration and shock are of low significance
Mechanical environment		M1
Electromagnetic (EMC) environment		E2
Active Accuracy Class (kWh)		C(kWh)
System types (for MID-compliant applications)		• 3-phase 4-wire Wye grounded • 3-phase 3-wire Wye ungrounded
Voltage at voltage terminals	3-phase 4-wire Wye grounded	3 x 63.5(110) to 3 x 277(480) V AC
	3-phase 3-wire Wye ungrounded	3 x 110 to 3 x 480 V L-L
Current Rating (Imin – Iref (Imax))		0.05-5(6) A
Electrical network frequency		50 Hz
Optical pulse output (energy pulsing LED)	Location	Meter front panel
	Frequency	50 Hz maximum
	Pulse constant[1]	10,000 pulses per kWh
	Wavelength	590 to 635 nm
Temperature Range		-25°C to +70°C
IP Rating		IP51
Insulation Protective Class		Class II
Impulse Voltage Rating		6kV
AC Voltage Rating		4kV
Main Cover Sealing Type		Wire and Crimp
Intended Location of the Meter		Indoor

[1] See “MID-protected setup parameters” on page 88 for additional details.

Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local standards.
- Turn off all power supplying this device before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device’s ratings for maximum limits.
- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- Never short the secondary of a voltage transformer (VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.

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

1. Turn off all power supplying this device before working on it.
2. Always use a properly rated voltage sensing device to confirm that all power is off.

Installation and wiring

Refer to the installation sheet that shipped with your meter for meter installation and wiring instructions.

Related topics

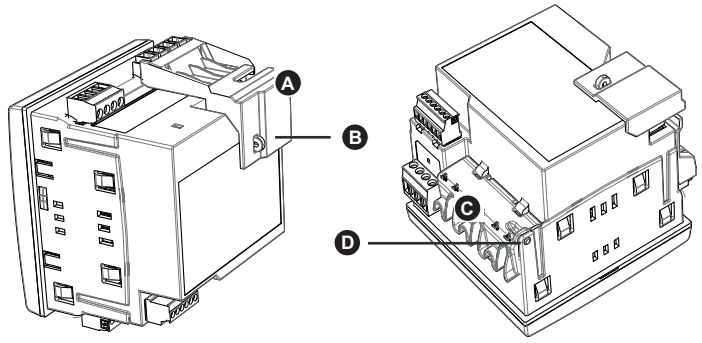
- See “Meter mounting” on page 17 and “Meter wiring” on page 19 for additional information.

Installing the terminal covers

The voltage and current terminal covers help prevent tampering with the meter’s voltage and current measurement inputs. The terminal covers enclose the terminals, the conductor fixing screws and a suitable length of the external conductors and their insulation. The terminal covers are secured by tamper-resistant meter seals.

The meter terminal covers must be installed by a qualified installer. The installation of both the voltage and current terminal covers is required to provide tamper evidence for MID installations.

Location of terminal covers



A	Voltage terminal cover
B	Voltage terminal sealing point
C	Current terminal cover
D	Current terminal sealing point

1. Install the voltage terminal cover (A) and apply the seal at the sealing point (B).
2. Install the current terminal cover (C) and apply the seal at the sealing point (D).

PM5111 default screen

The meter’s default home screen displays the following information.

Default PM5111 display screen

A	Accumulated real energy (delivered + received)
B	System frequency
C	Power system setting
D	Locked / unlocked icon

Related topics

- See “Front panel display and meter setup” on page 29 for detailed information on front panel menu navigation, LED indicators and display screen notification icons.

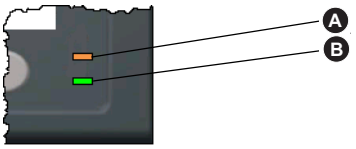
Meter firmware version

You can access information about the meter’s OS and RS firmware versions by navigating to **Maint > Diag > Info**.

MID-protected setup parameters

This section describes the setup parameters that are permanently set at the factory and cannot be modified, regardless of the lock or unlock settings.

Front panel LEDs



The alarm / energy pulsing LED on the meter is permanently set for energy pulsing and cannot be disabled or used for alarms. All other setup parameters for the energy pulsing LED are also permanently set and cannot be modified.

Lock-protected setup parameters

This section lists the meter’s lock-protected setup parameters for MID compliance. After the meter is locked, these setup parameters are protected and cannot be edited.

The setup parameters can be accessed from the maintenance menu screen. Use the front panel buttons to navigate to the **Maint > Setup** menu.

Lock-protected setup parameters

Setup menu	Setup sub-menu	Lock-protected setup parameter
Meter	Basic	• Power System • VT Connect • VT Primary (V) and VT Secondary (V)[1] • CT on Terminal • CT Primary (A) • CT Secondary (A) • Sys Frequency • Phase Rotation
	Advanced	• Label
HMI	User Passwords	• Energy Resets
Clock		• Date

[1] If using VTs (i.e., if **VT Connect** is set to 3VT or 2VT)

Lock-protected functions

This section lists the meter’s lock-protected functions for MID compliance. After the meter is locked, these functions are disabled.

These functions can be accessed from the maintenance menu screen. Use the front panel buttons to navigate to the **Maint > Reset** menu.

Lock-protected functions

Menu	Sub-menu	Lock-protected function
Resets	Global Resets	• Meter Initialization (all) • Energies
	Single Resets	• Energy

Setting up the PM5111

You must configure all the lock-protected setup parameters before locking the meter. When the meter is locked, those setup parameters cannot be edited.

Basic setup menu

See “Configuring the basic setup parameters” on page 32 to perform basic setup.

For MID compliance, the Power System must be set to one of the following settings:

- 3PH4W Wye Gnd (three-phase 4-wire wye grounded)
- 3PH3W Wye Ungnd (three-phase 3-wire wye ungrounded)

Advanced setup menu

See “Advanced setup” on page 38 to perform advanced setup.

You must use ION Setup to edit the device label.

Clock setup menu

See “Setting the clock” on page 37 to change the meter time using the display.

You can also use ION Setup to set or sync the meter time.

Passwords setup menu

See “Setting up the screen passwords” on page 36 to change the meter screen passwords.

Initializing the meter

Initializing the meter clears the meter’s logged data, counters and timers. It is common practice to initialize the meter after its configuration is complete, before adding it to an energy management system.

1. After configuring all the meter setup parameters, navigate through the different meter display screens and make sure the displayed data is valid.
2. See “Meter resets” on page 77 for instructions on clearing the meter’s recorded logged data, counters and timers.
3. Select **Meter Initialization** to clear all recorded data.

Locking or unlocking the meter

After you initialize the meter, you must lock it in order to conform to MID standards.

1. Navigate to **Maint > Setup > Meter >Lock**.
2. Press **Edit** to activate or deactivate the lock.

3. Enter your lock password.

   NOTE: The default password is 0000. To set up a new password see “Setting up lock password” on page 90.

4. Press **+** and **-** to scroll between **Active** and **Inactive**.
5. Press **OK** to select the option.
6. Select **Yes** to confirm the selected option, and exit the screen.

   On activating the lock, a lock icon appears on the upper left corner of the screen.

7. Make sure you record and store the lock password in a secure location. A lost lock password cannot be recovered.

Setting up lock password

To set up a new lock password, perform the below procedure. To change the password, make sure the lock is inactive and perform the below procedure.

NOTE: You cannot change the lock password when the lock is active.

NOTICE
IRRECOVERABLE PASSWORD Record your meter's lock password information in a secure location. **Failure to follow this instruction can result in a permanently locked meter.**

1. Navigate to **Maint > Setup > HMI > Pass**.
2. Press ▼ to scroll to **Revenue Lock** in the **Passwords** screen.
3. Press **Edit** to select a password.
4. Press **+** to increment the active digit through the numerals 0-9.
5. Press ◀ to move to the next digit to the left.
6. Continue until all values are selected, and then press **OK** to set the password.
7. Press **Yes** to save the changes.

Glossary

Terms

accumulated energy—energy accumulates as either delivered to the customer or received from the customer.

active alarm—an alarm that has been set up to trigger the execution of a task or notification when certain conditions are met. An icon in the upper-right corner of the power meter indicates that an alarm is active (!).

ASCII—American Standard Code for Information Interchange

baud rate—specifies how fast data is transmitted across a network port.

block interval demand—demand calculation method for a block of time; includes sliding block, fixed block, or rolling block method.

communications link—a chain of devices connected by a communications cable to a communications port.

current transformer (CT)—current transformer for current inputs.

debounce time—amount of time an input must be consistently on before the transition is accepted as valid.

demand—average value of a quantity, such as power, over a specified interval of time.

device address—used to identify a device on the Modbus communications link; defines where the power meter resides in the power monitoring system.

energy delivered—the utility delivers energy to the facility; energy in.

energy received—the utility receives energy from the facility; the customer provides power to the utility; energy out.

event—the occurrence of an alarm condition, such as *Undervoltage Phase A*, configured in the power meter.

firmware—operating system within the power meter.

fixed block—a demand calculation method using an interval selected from 1 to 60 minutes (in 1-minute increments). The power meter calculates and updates the demand at the end of each interval.

frequency—number of cycles in one second.

GMT—Greenwich Mean Time

k_h— kWh, kVARh or kVAh depending on the energy parameter selected.

lagging current (I)—current is lagging voltage up to 180°.

leading current (I)—current is leading voltage up to 180°.

lagging power factor (PF) —active and reactive power flowing in the same directions.

leading power factor (PF) —active and reactive power flowing in opposite directions.

line-to-line voltages—measurement of the rms line-to-line voltages of the circuit.

line-to-neutral voltages—measurement of the rms line-to-neutral voltages of the circuit.

maximum value—highest value recorded of the instantaneous quantity such as Phase A Current, Phase A Voltage, etc., since the last reset of the minimums and maximums.

minimum value—lowest value recorded of the instantaneous quantity such as Phase A Current, Phase A Voltage, etc., since the last reset of the minimums and maximums.

nominal—typical or average.

parity—refers to binary numbers sent over the communications link. An extra bit is added so that the number of ones in the binary number is either even or odd, depending on your configuration. Used to detect errors in the transmission of data.

partial interval demand—equal to energy accumulated thus far in the interval divided by the length of the complete interval.

peak demand current—highest demand current measured in amperes since the last reset of demand.

peak demand real power—highest demand real power measured since the last reset of demand.

peak demand—highest demand measured since the last reset of demand.

phase currents (rms)—measurement in amperes of the rms current for each of the three phases of the circuit.

phase rotation—refers to the order in which the instantaneous values of the voltages or currents of the system reach their maximum positive values. Two phase rotations are possible: A-B-C or A-C-B.

potential transformer (PT)—also known as a voltage transformer (VT).

power factor (PF)—power factor is the degree to which voltage and current to a load are out of phase. Total power factor is the difference between the total power your utility delivers and the portion of total power that does useful work. True power factor is the ratio of real power to apparent power using the complete harmonic content of real and apparent power. Calculated by dividing watts by volt amperes. Displacement power factor is the cosine of the angle between the fundamental components of current and voltage, which represents the time lag between fundamental voltage and current.

real power—calculation of the real power (3-phase total and per-phase real power calculated) to obtain kilowatts.

rms—root mean square. Power meters are true rms sensing devices.

rolling block—a selected interval and subinterval that the power meter uses for demand calculation. The subinterval must divide evenly into the interval. Demand is updated at each subinterval, and the power meter displays the demand value for the last completed interval.

sliding block—an interval selected from 1 to 60 minutes (in 1-minute increments). If the interval is between 1 and 15 minutes, the demand calculation updates every 15 seconds. If the interval is between 16 and 60 minutes, the demand calculation updates every 60 seconds. The power meter displays the demand value for the last completed interval.

thermal demand—demand calculation based on thermal response.

Total Demand Distortion (TDD)—indicates the harmonic currents between an end user and a power source.

Total Harmonic Distortion (THD or thd)—indicates the degree to which the voltage or current signal is distorted in a circuit.

total power factor—*see power factor*.

true power factor—see *power factor*.

unary alarm—an alarm based on singular events or specific conditions for which setpoints are not appropriate.

voltage transformer (VT)—also known as a potential transformer (PT).

Abbreviations

A—Ampere
Amps—Amperes
Comms—Communications
CPT—Control Power Transformer
CT—Current Transformer
D Out—Digital Output
DMD—Demand
DO—Drop Out
F—Frequency
GMT—Greenwich Mean Time
Hz—Hertz
I—Current
I/O—Input/Output
Imax—Current maximum demand
k_h— kWh, kVARh or kVAh depending on the energy parameter selected
kVA—Kilovolt-Ampere
kVAD—Kilovolt-Ampere demand
kVAR—Kilovolt-Ampere reactive
kVARD—Kilovolt-Ampere reactive demand
kVARH—Kilovolt-Ampere reactive hour
kW—Kilowatt
kWD—Kilowatt demand
kWH—Kilowatthours
kWH/P—Kilowatthours per pulse
kWmax—Kilowatt maximum demand
Mag—Magnitude
Maint—Maintenance
Min—Minimum
MnMx—Minimum and maximum values
MSec—Milliseconds
MVAh—Megavolt ampere hour
MVARh—Megavolt ampere reactive hour
MWh—Megawatt hour
OS—Operating System (firmware version)
P—Real power
Pd—Real power demand
PF—Power factor
PM—Power meter
PQS—Real, reactive, apparent power
PQSd—Real, reactive, apparent power demand
Prim—Primary
PT—Potential Transformer (also known as VT–Voltage Transformer)
PU—Pick Up
Pulse—Pulse output mode

Pwr—Power
Q—Reactive power
Qd—Reactive power demand
RS—Firmware reset system version
S—Apparent power
SN—Power meter serial number
Sd—Apparent power demand
Sec—Secondary
Sub-I—Subinterval
TDD—Total Demand Distortion
THD—Total Harmonic Distortion
U—Voltage line to line
V—Volts
VT—Voltage Transformer (also known as PT–Potential Transformer)
VAR—Volt ampere reactive
Vmax—Maximum voltage
Vmin—Minimum voltage

- This product must be installed, connected and used in compliance with prevailing standards and/or installation regulations.
- If this product is used in a manner not specified by the manufacturer, the protection provided by the product may be impaired.
- The safety of any system incorporating this product is the responsibility of the assembler/installer of the system.

As standards, specifications and designs change from time to time, always ask for confirmation of the information given in this
publication.

Schneider Electric
35, rue Joseph Monier
CS 30323
F - 92506 Rueil Malmaison Cedex
www.schneider-electric.com

Contact your local Schneider Electric sales representative for assistance or go to www.schneider-electric.com