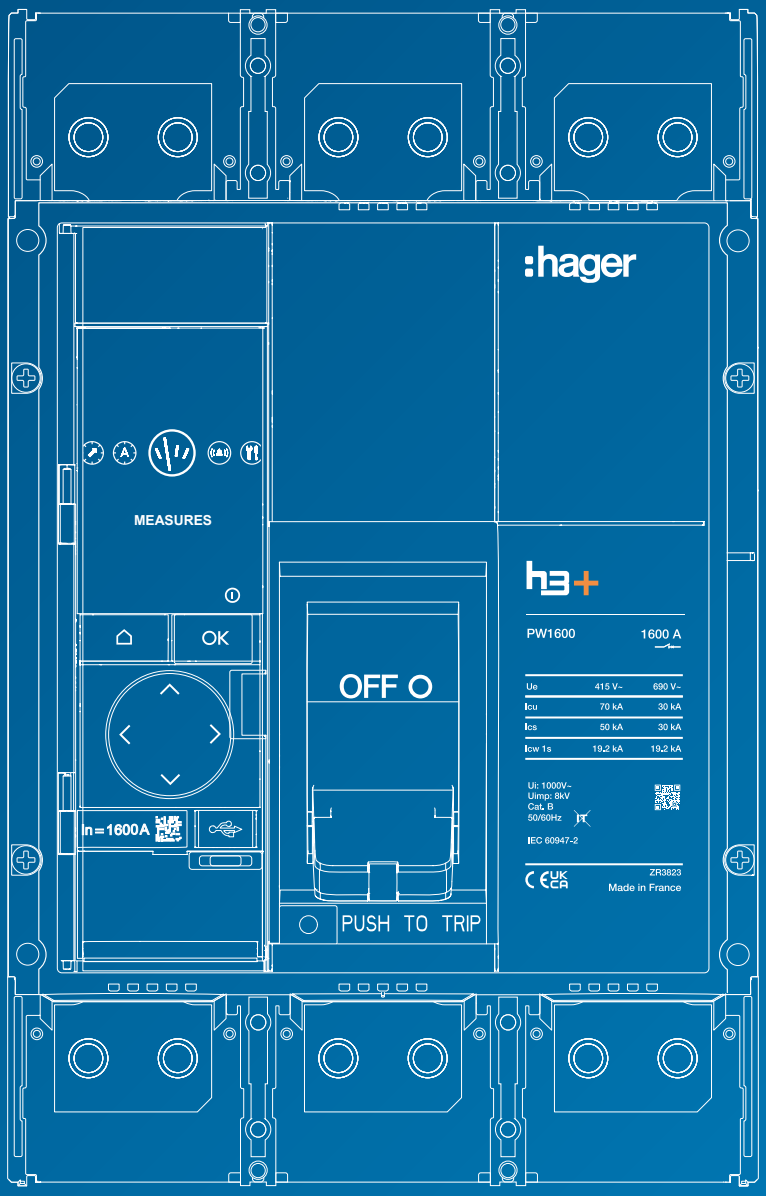
Technical catalogue

h3+

Moulded Case Circuit Breakers
PW1600



:hager

DISCLAIMER:
Whilst every effort has been made to ensure that the information is correct at the time of publication, Hager cannot guarantee the accuracy of all information contained in this document. Corrections and amendments, once verified, will be included in future editions.

Index

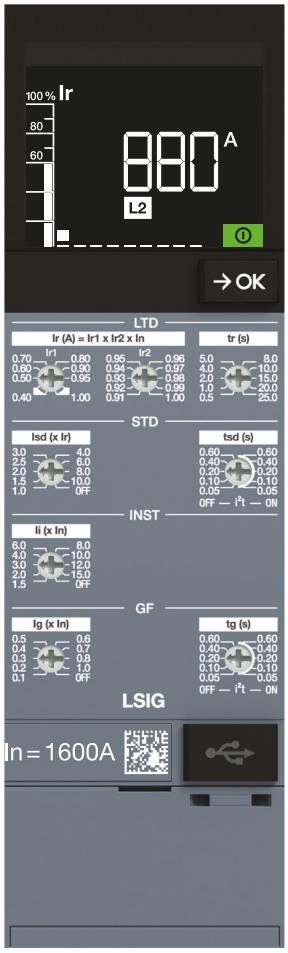
h3+ circuit breakers range

The new generation of h3+ circuit breakers and switch-disconnectors brings flexibility and ease in the choice of power protections at the core of electrical installations.

Two trip units for two levels of use

The sentinel and sentinel Energy electronic trip units have distinctive dark backgrounds that allow the information displayed to be seen with great clarity. The icons and indicator lights following a precise colour code:

- Green: trip unit ready to perform its functions, particularly its protection functions,
- Orange: operating alert not requiring the circuit breaker to be tripped,
- Red: tripping imminent or serious malfunction.



sentinel electronic trip unit

Designed for limited use with the basic L, S, I, G settings, the sentinel electronic trip unit has a user interface with settings dials and an OK button enhanced by a colour LCD display. This displays the maximum instantaneous current flowing through the circuit breaker in real time.

sentinel Energy electronic trip unit

Designed for advanced use of protection, alarm, measurement, control and communication functions, the sentinel Energy electronic trip unit features an interactive display and keyboard.

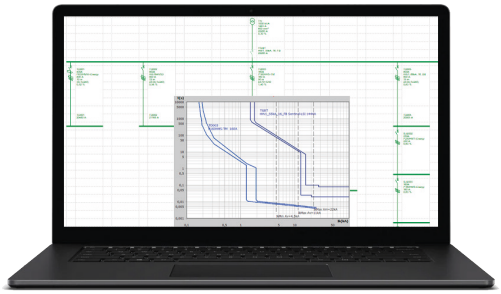
The sentinel Energy trip unit allows a wireless Bluetooth Low Energy connection to be established with a smartphone using the Hager Power touch application.

A new digital experience

The new generation of h3+ circuit breakers and switch disconnectors is designed to facilitate interaction with digital tools at all stages of the installation project from design to commissioning and operation.

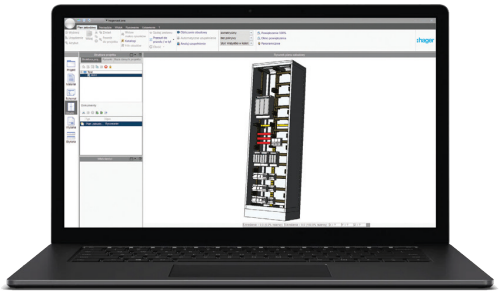
The Hager Power setup software establishes a link between the protection setting values calculated at the project design stage and the settings applied during commissioning of the h3+ circuit breakers.
With Hager Power setup you can generate a commissioning report proving that the settings of the h3+ circuit breakers conform with the values defined in Hagercad.

Design



Electrical network calculation software

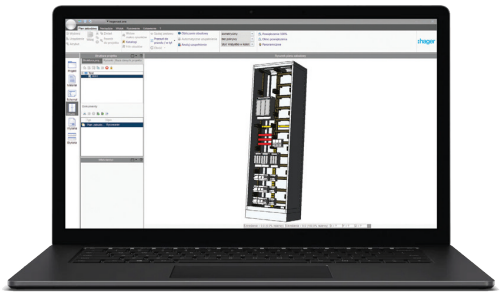
Allows the installation's short circuit currents and voltage dips to be calculated.



Hagercad software

Software for the design and costing of electrical distribution boards up to 4000A.

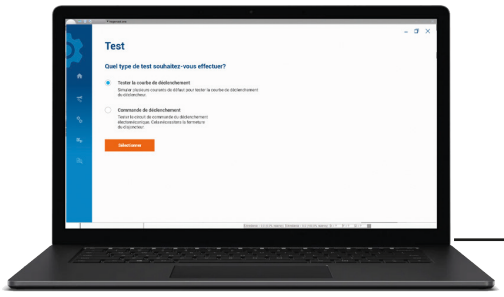
Configuration



Hagercad software

Allows h3+ circuit breakers and switch disconnectors to be configured.

Installation and commissioning

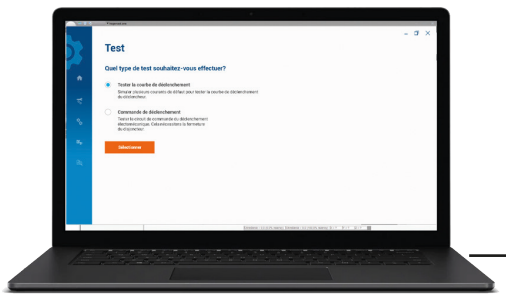


Hager Power setup software

Test the settings of the h3+ circuit breakers and generate a commissioning report proving that the settings conform with the values defined in Hagercad.

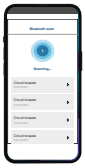
Extended digital experience with the sentinel Energy trip unit

h3+ circuit breakers equipped with the sentinel Energy electronic trip unit offer an extended and enhanced digital experience thanks to the Hager Power touch application. This makes it easier and quicker to change the parameter protection settings.



Hager Power setup software

Gain time by sending setting values from Hager Power setup to the sentinel Energy trip unit.
Test the trip unit and generate a commissioning report proving that the settings conform with the values defined in Hagercad.



Hager Power touch application

User Hager Power touch from your smartphone to monitor the status, measurement and alert information provided by the sentinel Energy trip unit.

Access the documentation online

Scan the QR code from your smartphone to access information and technical documents online.

Class 1 measurement with the sentinel Energy trip unit

The h3+ circuit breaker equipped with the sentinel Energy electronic trip unit and integrated measurement sensors constitutes a PMD-DD class measurement device in accordance with the standard IEC/EN 61557-12.
The measurement accuracy reaches class 0.5 for voltage and current measurements, and class 1 for power and active energy measurements.
For each measurement, the accuracy is certified within a temperature range from -25 °C to 70 °C, taking into account all the specific errors of the components belonging to the measurement chain.

The new generation of h3+ circuit breakers provides optimal protection against overloads, short circuits and ground faults in low voltage distribution.

MCCB PW1600 are available in 3 and 4 pole versions, from 630 A to 1600 A.

The range offers high-performance protection with a breaking capacity up to 70 kA with a voltage of 415 V AC.

h3+ circuit breakers and switch disconnectors

PW1600 630 - 1600 A

Energy circuit breaker

sentinel circuit breaker

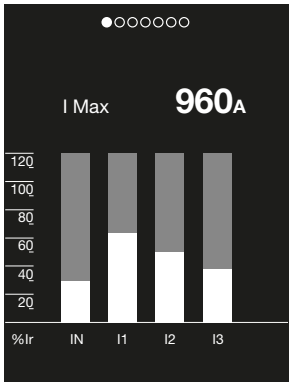
Switch-disconnector

The new generation of h3+ circuit breakers and switch-disconnectors offers several key benefits.

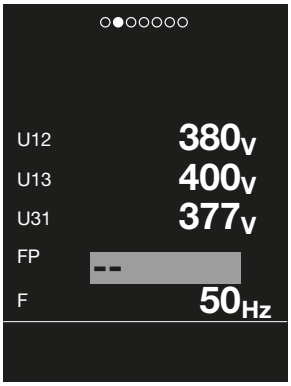
Customise your sentinel Energy trip unit
The sentinel Energy trip unit has a TFT graphical display allowing your favourite views to be displayed in Live mode. It also allows up to 12 individual optional alarms to be programmed, according to your requirements.

Live mode
Live mode allows up to 16 favourite views to be continuously displayed among a list of 27 views available. These are views of measured values or protection setting values.

Customised alarms
Up to 12 optional alarms can be configured, offering you personalised monitoring to detect any threshold breach or abnormal measurement by the trip unit. You can choose the types of measurements you want to monitor, such as voltage, current, etc., and be notified instantly by a message window if something unusual happens.



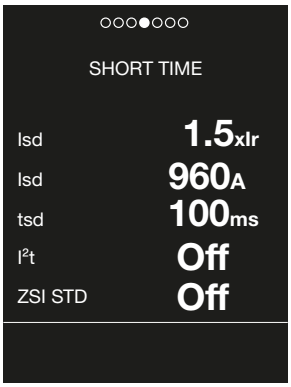
Ammeter view



Multimeter view


Example of overshoot for single voltage V1N.

Long time delay view



Short time delay view

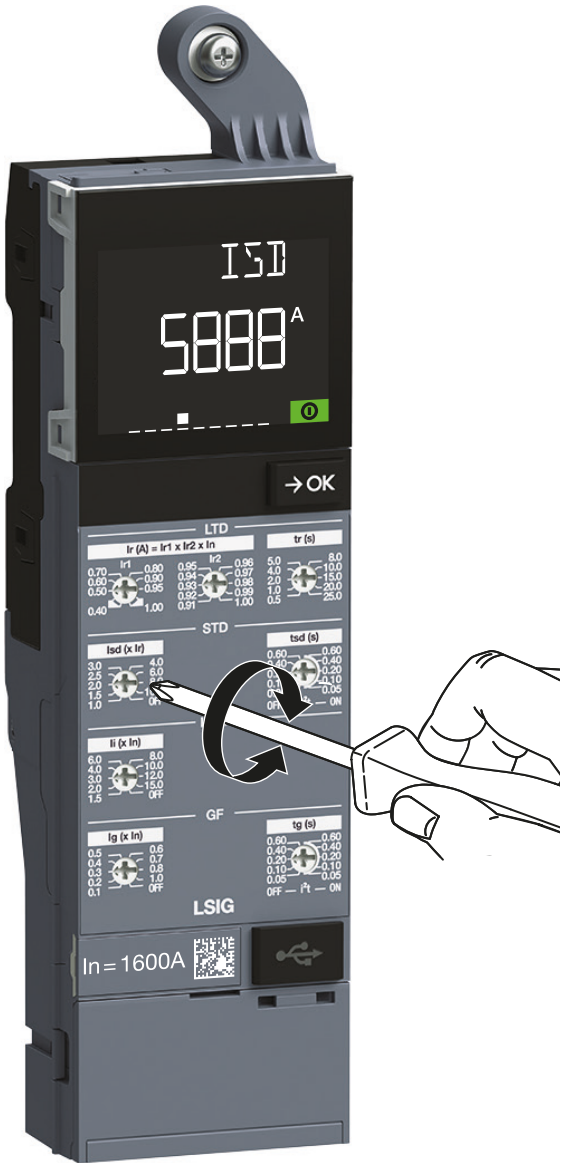
Benefit from the sentinel trip unit's dynamic display

The sentinel trip unit's dynamic LCD display makes commissioning, operation and maintenance of your circuit breaker easier.

Dynamic settings display

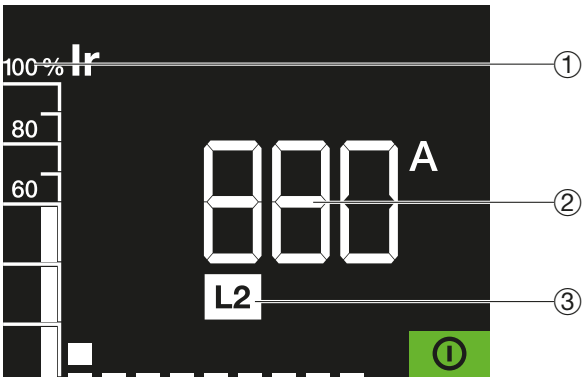
For Settings, the LCD display gives a precise indication of the setting values defined in amps and seconds.

Its high contrast allows easy reading of the settings whether in a dark or bright environment.



Dynamic load display

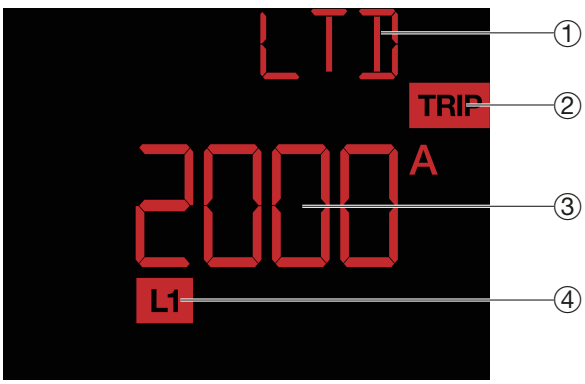
The main screen displays the maximum current flowing through the circuit breaker for the phase concerned.



1. Value of the current flowing through the circuit breaker as % of Ir
2. Value of the current flowing through the circuit breaker
3. Relevant phase

See the trip cause

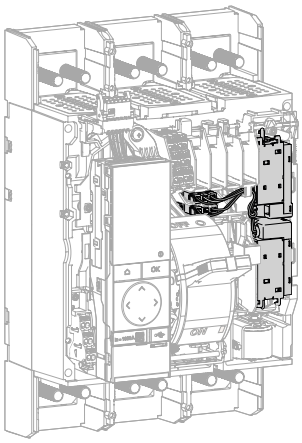
After tripping, a detailed message indicates the reasons of the fault.



1. Trip cause
2. Trip icon
3. Fault current value
4. Phase concerned

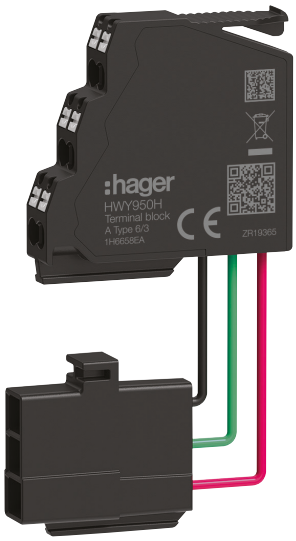
Settings viewable at all times

The OK button on the electronic trip unit allows switching between screens displaying all possible settings of the electronic trip unit.



Quick and secure fitting of coils

The opening coils can be easily installed without tools.

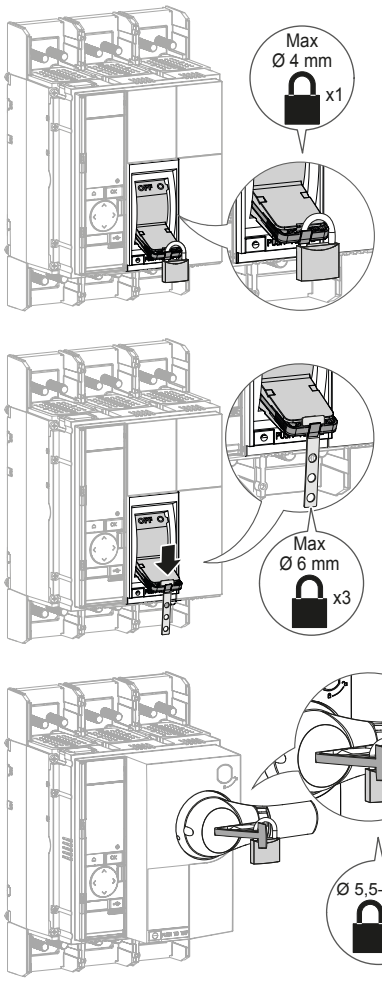


QuickConnect system for faster wiring of accessories

A connection terminal block is available to connect each coil to the circuit breaker.

These connections are made with the QuickConnect feature.

- Saves time: thanks to the QuickConnect technology, wiring is quick, easy and tool-free.
- safer: cable maintenance is ensured,
- test point: used to check for the presence of voltage with a voltmeter.
- Cable disconnection: the QuickConnect terminal can be released quickly and easily with a screwdriver.



Integrated padlocking facility

Locking in the OFF position ensures isolation and compliance to standard IEC 60947-2.

The various padlocking options are as follows:
•using the single operation handle (1 padlock of 4 mm max.)
•using the operation handle + accessories (up to 3 padlock of 6 mm max.)
• rotary handle (up to 3 padlocks 5.5 to 8 mm max.)

Programmable output contacts

The OAC output contacts module has 5 alarm output contacts.
The OAC contacts are assigned by default to the following events:
• LTD tripping
• STD or INST tripping
• GF tripping
• PTA overload pre-alarm
• Tripping due to HWF critical system alarm.

On a circuit breaker fitted with the sentinel Energy trip unit, this contact assignment can be programmed. Each OAC contact can be reassigned to a distinct trip, alarm or operational event, chosen from a predefined list offering more than 40 options.

	With the sentinel trip unit	With the sentinel Energy trip unit
OAC contacts 1 to 5	Non-programmable	Programmable

The PW1600 h3+ range is equipped with circuit breakers and switch-disconnectors.
The circuit breakers have an electronic trip unit.
The switch-disconnectors do not have an electronic trip unit.

h3+ circuit breakers

3 poles	4 poles
	

h3+ switch-disconnectors

3 poles	4 poles
	

Accessories

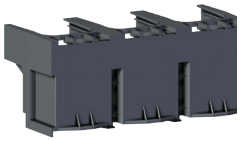
Control accessories

Signalling accessories

Interlocking accessories

With connection accessories

Protection accessories



Communication accessories

sentinel electronic trip units

LI

LSI

LSIG

sentinel Energy electronic trip units

LSIG

Integration in electrical distribution boards

The h3+ circuit breakers and switch-disconnectors are generally used in electrical switchboard located on the input of low-voltage electrical installations.

h3+ circuit breakers and switch-disconnectors can be installed in Hager distribution board systems.

h3+ circuit breakers and switch disconnectors

Page

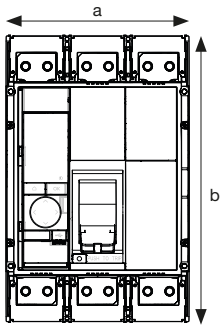
Introduction to circuit breaker functions.

Characteristics of the circuit breaker

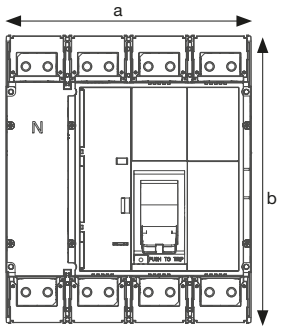
Rated current In (A)	This is the maximum value of current that the circuit breaker can permanently withstand. This value is always stated for an ambient temperature (50 °C) in accordance with standard IEC 60947–2. If this temperature is higher, the operating current must be reduced.
Rated operational voltage Ue (V)	This is the voltage at which the circuit-breaker has been designed to operate, in normal operating conditions. The value provided is usually the maximum value.
Rated insulation voltage Ui (V)	This value indicates the insulation performance of the device. The dielectric test voltages (power frequency, impulse) are established based on this value.
Impulse withstand voltage Uimp (kV)	This value indicates the capacity of the device to withstand transient overvoltages such as lightning.
Rated ultimate short-circuit breaking capacity Icu (kA)	This is the maximum short circuit current that a circuit breaker can break for a given voltage and phase angle without being damaged. The tests are performed using the sequence O – t – CO. O represents an automatic tripping operation, t an interval of time and CO a closing operation followed by an automatic tripping operation. After the test, the circuit breaker must continue to provide a minimum level of safety (insulation, dielectric strength).
Rated operational short-circuit breaking capacity Ics (kA)	This value is expressed in kA or as a percentage of Icu. The circuit breaker must be able to function normally after having cleared the Ics current three times according to the sequence O-t-CO-t-CO.
Rated short-time withstand current Icw (kA)	This is the short circuit current that a category B circuit breaker is able to withstand for a defined period of time without altering its characteristics. This value is intended to provide discrimination between upstream and downstream devices The circuit breaker in question can remain closed while the fault is cleared by the downstream device.
Rated short-circuit making capacity Icm (kA peak)	This is the maximum current value that a device can establish at its rated voltage under standard conditions. Devices without protection functions, such as switches, must be able to withstand short circuit currents for a defined period of time to perform together with other associated protection devices.

Common data		**PW1600 size**	
Pollution degree according to IEC 60947-1		-	3
Short-time withstand current rating capacity	(kA) Icw	1s - 415 V CA	19.2
Rated breaking capacity	(kA peak) Icm	220-240 V CA	38.4
		380-415 V CA	
		690 V AC	
Mechanical durability	(cycles x 1000)	-	10
Electrical endurance up to In = 1600 A	(cycles x 1000)	415 V AC	6
Electrical endurance up to In = 1600 A	(cycles x 1000)	690 V AC	4
Type of socket outlets		front connections	standard
		rear connections	As an accessory
Dimensions a x b x c **(max value in mm)**		3 poles	210 x 330 x 200
		4 poles	280 x 330 x 200
Weight **(kg)** Version without accessories		3 poles	14
		4 poles	17
Rated operational voltage	Ue	(V AC - 50/60 Hz)	690
Rated insulation voltage	Ui	(V)	1,000
Rated impulse withstand voltage	Uimp	(kV)	8
Number of poles			3 / 4

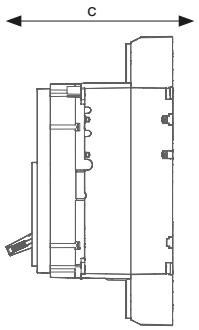
3 poles



4 poles



3 / 4 poles



h3+ circuit breakers		PW1600 size		
Reference			HMQ...	HEQ...
Rated current at 50°C	(A)	HxQ**630**xx	630	
		HxQ**800**xx	800	
		HxQ**970**xx	1000	
		HxQ**980**xx	1250	
		HxQ**990**xx	1600	
Selectivity category according to IEC 60947-2		-	B	
Rated ultimate short-circuit breaking capacity	(kA) Icu	220-240 V CA	50	70
		380-415 V CA		
		690 V AC	30	42
Rated operational short-circuit breaking capacity	(% Icu) Ics	-	100	100(1)
Break time between tripping order and arc extinction	(ms)	-	< 25	< 25
sentinel trip unit		-	Yes	
sentinel Energy trip unit		-	Yes	
Standards compliance		-	IEC 60947-2	

(1) Ics: 50 kA for voltages 240 to 415 V

Compatible calibrators for h3+ circuit breakers

Reference	Compatible rating plug
HxQ**630**xx	630
HxQ**800**xx	630 to 800
HxQ**970**xx	630 to 1000
HxQ**980**xx	630 to 1250
HxQ**990**xx	630 to 1600

h3+ switch-disconnectors		PW1600 size	
Reference			HMQxxxAx
Rated current at 50°C	(A)	HMQ63xAx	630
		HMQ80xAx	800
		HMQ97xAx	1000
		HMQ98xAx	1250
		HMQ99xAx	1600
Utilization category according to IEC 60947-3		-	AC-23A
Standards compliance		-	IEC 60947-3

Switch-disconnector protection

The h3+ switch-disconnector is adapted to switching loads as per AC-22A and AC-23A. It guarantees the disconnection of the circuit which can be secured by the locking accessories available in the h3+ range.

Protection against overload and short circuit must be provided by a circuit breaker upstream of the switch-disconnector and in compliance with installation standards.

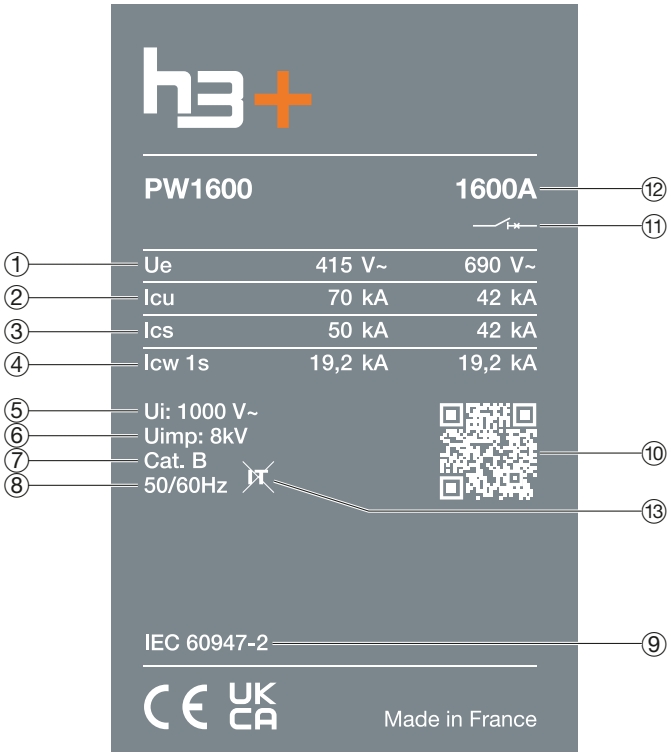
Disconnection is fully visible by means of the status indicator.

Front view of the circuit breakers and switch-disconnectors

① Front sockets
② Front cover
③ Electronic trip unit
④ Operating handle
⑤ Type label
⑥ Contact switch closing indicator
⑦ Mechanical tripping test button

Example of a 3-pole withdrawable circuit breaker

Type label



① Ue: Operating voltage

② Icu: Rated ultimate short-circuit breaking capacity

③ Ics: Rated operational short-circuit breaking capacity

④ Icw 1 s: Rated short-time withstand current for 1 second

⑤ Ui: Rated insulation voltage

⑥ Uimp: Rated impulse withstand voltage

⑦ Selectivity category

⑧ Frequency

⑨ Standards

⑩ QR code to access the documentation online

⑪ Symbol of a circuit breaker suitable for disconnection or symbol of a switch-disconnector

⑫ Maximum rating of the circuit breaker

⑬ Not suitable for protection in an IT earthing system (depending on version)

Breaking capacity classification:

	Icu (380-415 V CA)
	PW1600
M	50 kA
E	70 kA

Compliant with standards

The h3+ circuit breakers and the related auxiliary devices comply with the following standards:

International standards:
- IEC 60947-1: general rules
- IEC 60947-2: circuit breakers
- IEC 60947-3: switch-disconnectors
- IEC 60947-5-1: control circuit devices and switching elements

European standards:
- EN 60947-1: general rules
- EN 60947-2: circuit breakers
- EN 60947-3: switch-disconnectors
- EN 60947-5-1: control circuit devices and switching elements

National standards:
- China CCC, GB/T140248.2
- China CCC, GB/T140248.3
- China CCC, GB/T140248.1

Pollution degree

h3+ circuit breakers are certified for operation in environments with a pollution degree 3 as defined by IEC/EN standard 60947-1.

Ambient temperature

h3+ circuit breakers can be used at temperatures between -25 °C and +70 °C.
For ambient temperatures greater than 50 °C, the devices must be derated.

h3+ circuit breakers must be operated under normal ambient temperature conditions.

The permissible storage temperature range in the original packaging is from -25 °C to +85 °C.

Electromagnetic interference

h3+ circuit breakers are protected against:
- Overvoltage caused by circuit switching, overvoltage caused by atmospheric disturbances or a breakdown in the distribution system.
- Devices emitting radio waves (walkie-talkies, radar, etc.).
- Electrostatic discharges produced directly by users.

The immunity levels comply with the following standards:
- IEC/EN 60947-2: Low-voltage switchgear and controlgear, Part 2: Circuit breakers.
- Appendix F 4.1: Current harmonic
- Appendix F 4.7: Current dips.
- Appendix 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.

Selectivity

Selectivity is a coordination technique between protection devices enabling the downstream device to trip on overcurrent without tripping the upstream device. This improves the service continuity. The h3+ devices have the characteristics necessary to implement this technique.

Total selectivity

Selectivity is said to be total if it is provided for all levels of short circuit up to the breaking capacity of the downstream device.

Partial selectivity

Selectivity is partial if its value is less than the breaking capacity of the downstream device. This value is called the selectivity limit and is the short circuit value beyond which both circuit breakers are likely to trip simultaneously.

The selectivity tables are provided in a separate document.

Cascading

Cascading is a technique combining protection devices so as to be able to install circuit breakers which have a lower breaking capacity than the presumed short circuit level. This technique is based on the energy limiting capacity of the circuit breakers.
The tables of cascadings between the various devices are published in a separate document.

The different values of short-circuit currents between different cascadings of protection devices (ACB-MCCB-MCB) are given in coordination tables that are published in a separate document.

Suitable for isolation with positive contact indication

All h3+ circuit breakers are suitable for isolation as defined in standard IEC 60947-2:
- The isolation position corresponds to the O (OFF) position.

The isolation function is certified by tests guaranteeing:
- The mechanical reliability of the position indication system,
- The absence of leakage currents,
- The capacity to withstand overvoltage between upstream and downstream connections.

Vibrations

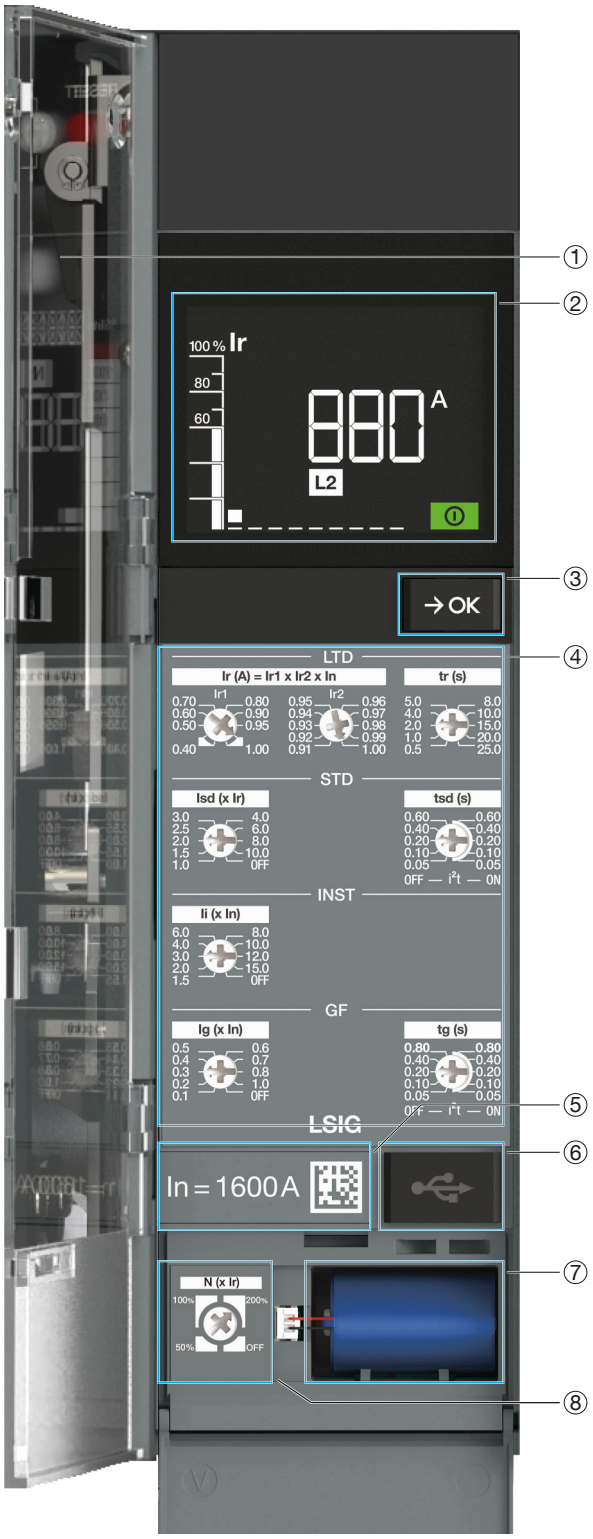
h3+ circuit breakers withstand mechanical vibrations.
h3+ complies to standard IEC 60068-2-6:
- 2.0 to 13.2 Hz and amplitude ±1 mm.
- 13.2 to 100 Hz acceleration ±0.7 g.
- Resonance frequency (±1 mm/±0.7 g for 90 min).

Excessive vibration may cause nuisance tripping and/or damage to connections and/or mechanical parts.

sentinel electronic trip units

h3+ circuit breakers are equipped with a sentinel electronic trip unit to protect against overloads, short circuits and earth faults. The circuit breaker has a display and dials enabling the user to configure the protection settings and monitor its correct operation.

The following characteristics are common to all versions of the sentinel electronic trip units:



① Transparent cover protecting access to the sentinel electronic trip unit settings (sealable).

② LCD display.

③ Button →OK which can be used:
- to acknowledge and clear an alarm after a trip,
- to navigate through the different screens of the display.

④ Settings dials of the sentinel electronic trip unit.

⑤ Rated current value In of the circuit breaker. This value is limited by the rating plug fitted on the electronic trip unit.

⑥ USB-C port to connect an external battery.
This USB-C port is also used to connect to computers equipped with the Hager Power setup commissioning and test software.

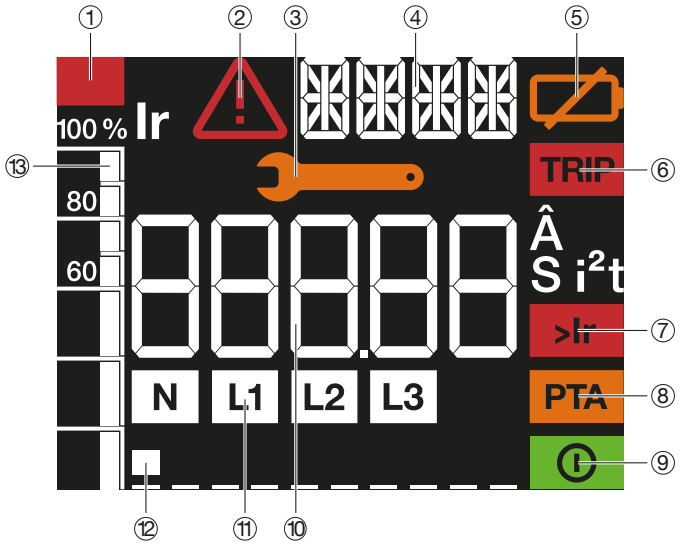
⑦ Backup battery compartment.
The backup battery powers the display after electrical tripping. This enables the display to signal the tripping and its cause.
This icon lights up on the display when the battery needs to be replaced.

⑧ Neutral protection settings dial.

INFORMATION
The electronic trip unit must be powered in order for it to perform its protection functions. It is powered as long as a minimum current of 20% of the nominal current In passes through the circuit breaker.
Nevertheless, it is strongly recommended that a 24V DC SELV external power supply be connected (recommended product reference Hager HTG911H) on the terminal to ensure the trip unit's continuity of operation.
To connect a 24V DC power supply to a circuit-breaker fitted with a trip unit:
- when using sentinel : wiring harness HYH957H and D-type terminal block HXH957H must be added.
- when using sentinel Energy, D-type terminal block HXH957H must be added.

Description of the LCD display

sentinel electronic trip units are equipped with an LCD display that makes it easy to adjust the settings and read the cause of the tripping of h3+ circuit breakers.



① **Overload indicator**: shows when the current exceeds 105% of Ir.

② **Error indicator d**: displays when an error is detected.

③ **Maintenance indicator**: displays when a maintenance intervention is required.

④ **Text display area**: displays the name of the protection parameter during setting or after a trip as well as the error codes of detected operating system alarms.

⑤ **Battery weak or absent indicator**: displays when it is necessary to change the back-up battery of the electronic trip unit or when it is not connected.

⑥ **Tripping indicator**: allows the cause of the tripping to be identified precisely using the numerical display area, the text display area and the phase display.

⑦ **Overload indicator**: flashes when the current exceeds 105 % of Ir and is constant when above 112.5 % of Ir.

⑧ **Overload pre-alarm indicator**: provides an alert when there is an imminent risk of tripping.

⑨ **ReadyToProtect indicator**: displays when the trip unit is operational and ready to protect.

⑩ **Numerical display area**: allows the values of the different settings to be displayed directly and also indicates what the trip value was for the following units.

A	Ampere
Â	Peak current
S	Second
I^2t	I^2t curve

Also displays the codes of the critical system alarms.

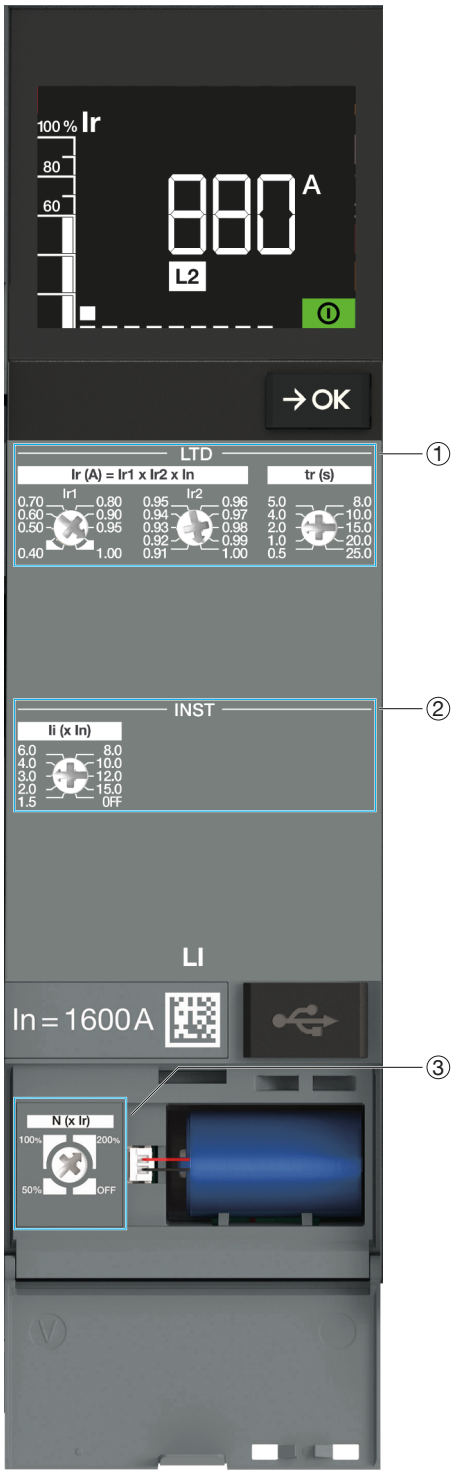
⑪ **Phase display:** Neutral on the left / Phase L1 / Phase L2 / Phase L3.

⑫ **Marker screen**: shows the number of screens in the trip unit as well as its position in the display order.

⑬ **Bargraph:** used to view the currents read on the most highly loaded phase L1, L2 or L3 as a percentage of the Ir setting.

There are 3 versions of the sentinel electronic trip unit: **LI**, **LSI** and **LSIG**

LI sentinel trip unit
The LI sentinel trip unit is used to protect long cable lines where the rated fault current is limited due to the impedance of the cable.
The dials are accessible from the front of the electronic trip unit, allowing precise adjustment of the protection settings. The protection adjusted in this way is independent of the ambient temperature.

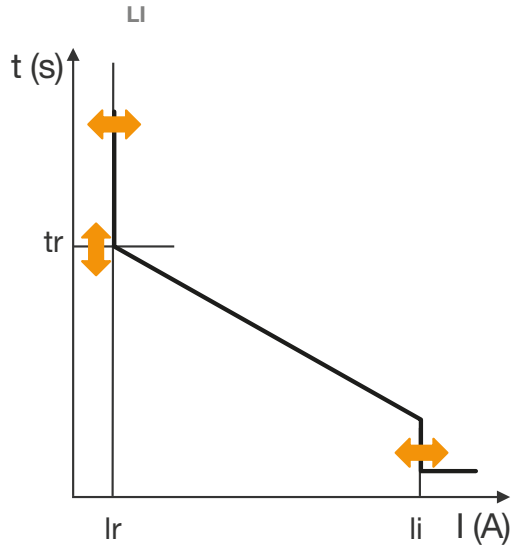


① **LTD Long Time Delay protection**
The long time delay curve offers overload protection.
Fine setting of Ir (A) is done using two dials Ir1 and Ir2.
The time delay tr (s) can be set using a dial from 0.5 to 25 s.

② **INST Instantaneous protection**
The Instantaneous protection against short-circuits Ii (x In) can be set using a dial from 1.5 to 15 times the rated current value In.
This protection can also be deactivated (OFF).

③ **Neutral protection N**
This protection is factory-installed on 4-pole circuit breakers and as an option with the addition of the ENCT external neutral sensor on 3-pole versions. It is necessary if the neutral conductor cross section is less than that of the phases, or if the neutral conductor is heavily loaded (for example, in office buildings).
It uses similar tripping curve characteristics as the Long time delay, Short time delay and instantaneous protection parameters.

LI sentinel trip unit



Rated current In

	In at 50 °C	630 A	800 A	1000 A	1250 A	1600 A

Long Time Delay protection L (ANSI 49)

Ir (tripping threshold between 1.05 and 1.20 x Ir)		
Ir1		0.40 - 0.50 - 0.60 - 0.70 - 0.80 - 0.90 - 0.95 - 1.00
Ir2		0.91 - 0.92 - 0.93 - 0.94 - 0.95 - 0.96 - 0.97 - 0.98 - 0.99 - 1.00
Ir (A) = Ir1 x Ir2 x In		0.364 x In … 1 x In
	In = 630 A	229.3 - 630 A
	In = 800 A	291.2 - 800 A
	In = 1000 A	364 - 1000 A
	In = 1250 A	455 - 1250 A
	In = 1600 A	582.4 - 1600 A
Time delay (s)	tr	0.5 - 1.0 - 2.0 - 4.0 - 5.0 - 8.0 - 10.0 - 15.0 - 20.0 - 25.0
	accuracy	0 % to -20 %

Instantaneous Protection INST (ANSI 50)

Ii = In x …		OFF - 1.5 - 2.0 - 3.0 - 4.0 - 6.0 - 8.0 - 10.0 - 12.0 - 15.0
	accuracy	+/- 15 %
Tripping time (ms)		> 20
Maximum breaking time (ms)		⩽ 80

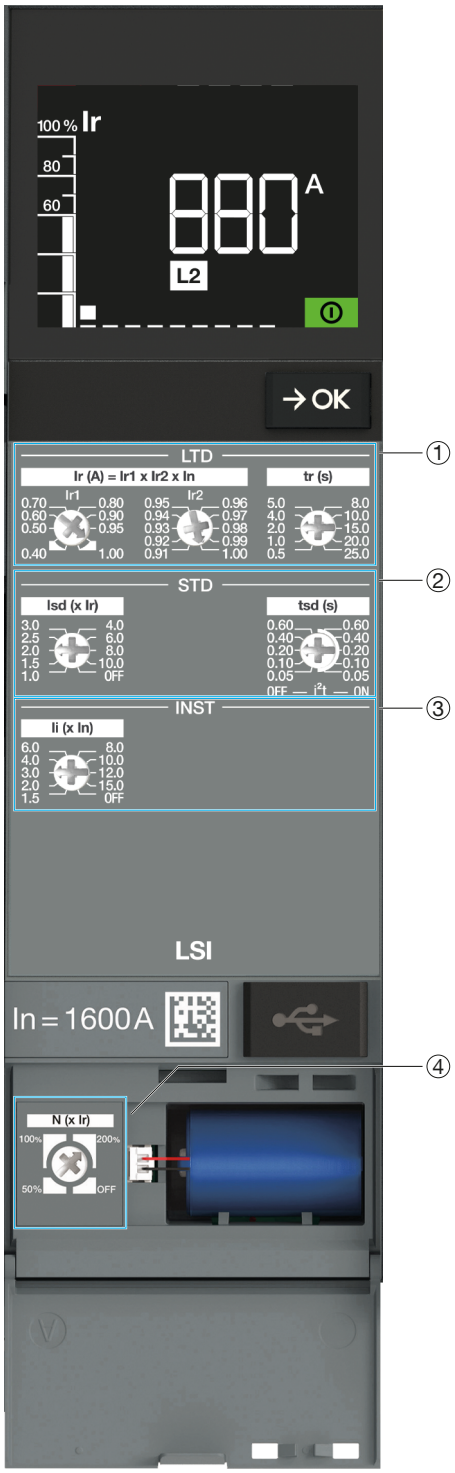
Neutral protection N

Neutral protection = Phase protection Ir x …	OFF - 50% - 100% - 200% (1)
Instantaneous protection	same as phases
Time delay	same as phases for tr and instantaneous

(1) Neutral protection at 200% is limited to 1600A.

LSI sentinel trip unit

The LSI sentinel trip unit is used to protect cable lines and equipment requiring a wide variety of protection settings. The settings dials are accessible from the front of the h3+ circuit breakers, allowing precise adjustment of the protection settings. The protection adjusted in this way is independent of the ambient temperature.



① **LTD Long Time Delay protection**
The long time delay curve offers overload protection.
Fine setting of Ir (A) is done using two dials Ir1 and Ir2.
The time delay tr (s) can be set using a dial from 0.5 to 25 s.

② **STD Short Time Delay Protection**
Short Time Delay protection is for short-circuits. The Isd (x Ir) current can be adjusted using a dial from 1 to 10 times the protection of the Ir Long Time Delay protection of the circuit breaker.
This protection can also be deactivated (OFF).
Time delay tsd (s) is adjustable via a dial from 50 to 600 ms with the possibility of including an inverse time curve (I^2t OFF or ON).

③ **INST Instantaneous protection**
The Instantaneous protection against short-circuits Ii (x In) can be set using a dial from 1.5 to 15 times the rated current value In.
This protection can also be deactivated (OFF).

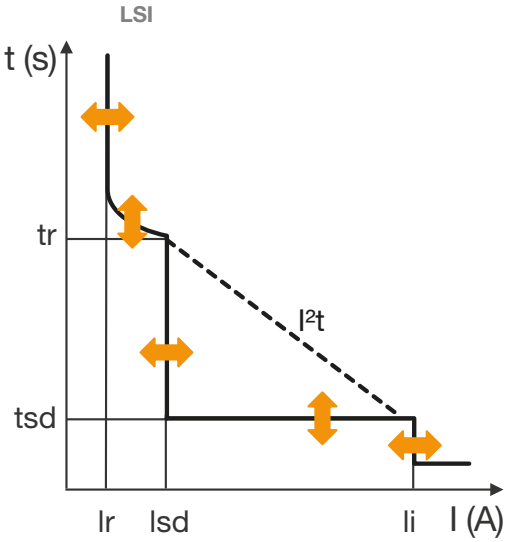
④ **Neutral protection N**
Neutral protection is factory-installed on 4-pole circuit breakers and as an option with the addition of the ENCT external neutral sensor on 3-pole versions. It is necessary if the neutral conductor cross section is less than that of the phases, or if the neutral conductor is heavily loaded (for example, in office buildings).
It uses the long time delay, short time delay and instantaneous protection settings.

Zone selectivity (ZSI) (1)

Zone Selectivity (ZSI) is available on LSI sentinel trip units. It can be used for short time delay protection (ZSI STD). The function is activated using the Hager Power setup software.

(1) In order to use the ZSI function, the terminal block accessory must be added to a circuit-breaker with a sentinel trip unit.

LSI sentinel trip unit



Rated current In

In at 50 °C	630 A	800 A	1000 A	1250 A	1600 A

Long Time Delay protection L (ANSI 49)

Ir (tripping threshold between 1.05 and 1.20 x Ir)		
Ir1		0.40 - 0.50 - 0.60 - 0.70 - 0.80 - 0.90 - 0.95 - 1.00
Ir2		0.91 - 0.92 - 0.93 - 0.94 - 0.95 - 0.96 - 0.97 - 0.98 - 0.99 - 1.00
Ir (A) = Ir1 x Ir2 x In		0.364 x In … 1 x In
	In = 630 A	229.3 - 630 A
	In = 800 A	291.2 - 800 A
	In = 1000 A	364 - 1000 A
	In = 1250 A	455 - 1250 A
	In = 1600 A	582.4 - 1600 A
Time delay (s)	tr	0.5 - 1.0 - 2.0 - 4.0 - 5.0 - 8.0 - 10.0 - 15.0 - 20.0 - 25.0
	accuracy	0 % to -20 %

Short Time Delay protection STD (ANSI 50TD/51)

Isd = Ir x …		OFF - 1.0 - 1.5 - 2.0 - 2.5 - 3.0 - 4.0 - 6.0 - 8.0 - 10.0				
	accuracy	+/- 10 %				
Time delay (s)	tsd I²t OFF	0.05	0.10	0.20	0.40	0.60
	tsd I²t ON	0.05	0.10	0.20	0.40	0.60
Non-tripping time (s)		0.025	0.075	0.175	0.375	0.575
Maximum breaking time (s)		0.12	0.17	0.27	0.47	0.67

Instantaneous Protection INST (ANSI 50)

Ii = In x …		OFF - 1.5 - 2.0 - 3.0 - 4.0 - 6.0 - 8.0 - 10.0 - 12.0 - 15.0
	accuracy	+/- 15 %
Tripping time (ms)		> 20
Maximum breaking time (ms)		⩽ 80

Neutral protection N

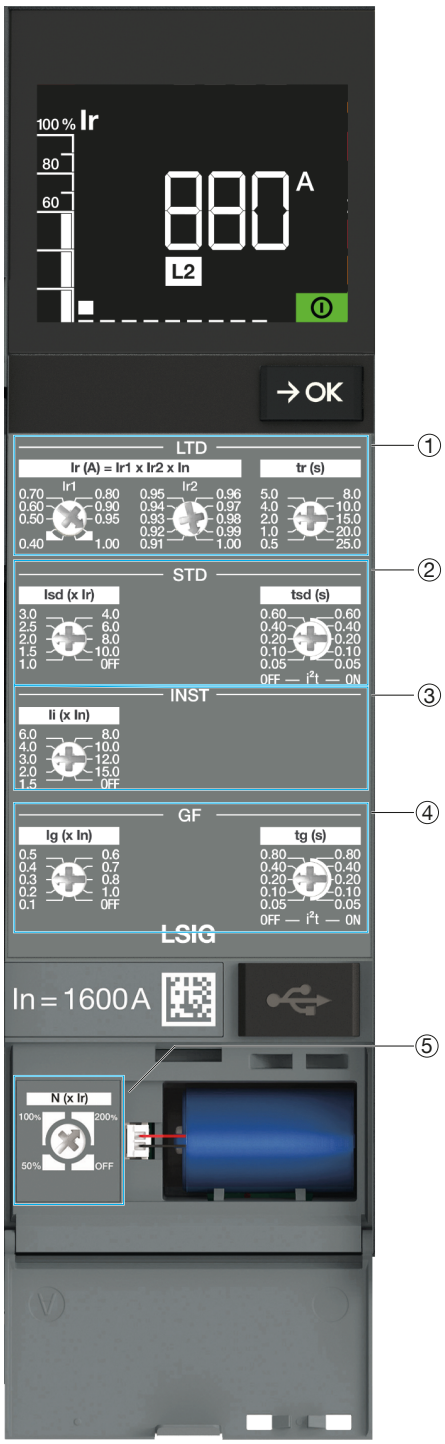
Neutral protection = phase protection Ir x … phase protection Isd x …	OFF - 50% - 100% - 200% (1)
Instantaneous protection	same as phases
Time delay	same as phases for tr and instantaneous

(1) Neutral protection at 200% is limited to 1600A.

LSIG sentinel trip unit

The LSIG sentinel trip unit is used to protect cable lines and equipment for scenarios with a TN earthing system where earth fault protection is required.

The settings dials are accessible from the front of the h3+ circuit breakers, allowing precise adjustment of the protection settings. The protection adjusted in this way is independent of the ambient temperature.



① **LTD Long Time Delay protection**
The long time delay curve offers overload protection.
Fine setting of Ir (A) is done using two dials Ir1 and Ir2.
The time delay tr(s) can be set via a dial from 0.5 to 25 s.

② **STD Short Time Delay Protection**
Short Time Delay protection is for short-circuits. The Isd (x Ir) current can be adjusted using a dial from 1 to 10 times the protection of the Ir Long Time Delay protection of the circuit breaker.
This protection can also be deactivated (OFF).
Time delay tsd (s) is adjustable via a dial from 50 to 600 ms with the possibility of including an inverse time curve (I^2t OFF or ON).

③ **INST Instantaneous protection**
The Instantaneous protection against short-circuits Ii (x In) can be set using a dial from 1.5 to 15 times the rated current value In.
This protection can also be deactivated (OFF).

④ **GF earth fault protection**
The earth protection is used against phase-to-earth faults. The earth fault currents can reach a high enough amplitude that they are similar to a short circuit. It is based on the calculation of the sum of the phases and the neutral current.
The current Ig (x In) can be set using a dial from 0.1 to 1 times the rated current In.
The earth fault protection can also be disabled (OFF).
The time delay tg (s) is adjustable via a dial from 50 to 600 ms with the possibility of including an inverse time curve (I^2t OFF or ON).

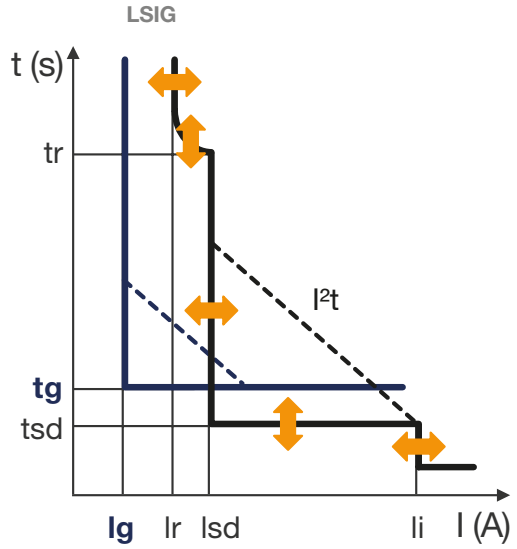
⑤ **Neutral protection N**
Neutral protection is factory-fitted on 4-pole circuit breakers and as an option by adding the ENCT external neutral sensor on 3-pole versions. It is necessary if the neutral conductor cross section is less than that of the phases, or if the neutral conductor is heavily loaded (for example, in office buildings). It uses similar tripping curve characteristics as the Long time delay, Short time delay and instantaneous protection parameters.

Zone selectivity interlocking (ZSI) (1)

Zone Selectivity (ZSI) is available on LSIG sentinel trip units. It can be used for the Short Time Delay protection (ZSI STD) and the earth Fault protection (ZSI GF). The function is activated using the Hager Power setup software.

(1) In order to use the ZSI function, the terminal block accessory must be added to a circuit-breaker with a sentinel trip unit.

LSIG sentinel trip unit



Rated current In

	In at 50 °C	630 A	800 A	1000 A	1250 A	1600 A

Long Time Delay protection L (ANSI 49)

Ir (tripping threshold between 1.05 and 1.20 x Ir)		
Ir1		0.40 - 0.50 - 0.60 - 0.70 - 0.80 - 0.90 - 0.95 - 1.00
Ir2		0.91 - 0.92 - 0.93 - 0.94 - 0.95 - 0.96 - 0.97 - 0.98 - 0.99 - 1.00
Ir (A) = Ir1 x Ir2 x In		0.364 x In … 1 x In
	In = 630 A	229.3 - 630 A
	In = 800 A	291.2 - 800 A
	In = 1000 A	364 - 1000 A
	In = 1250 A	455 - 1250 A
	In = 1600 A	582.4 - 1600 A
Time delay (s)	tr	0.5 - 1.0 - 2.0 - 4.0 - 5.0 - 8.0 - 10.0 - 15.0 - 20.0 - 25.0
	accuracy	0 % to -20 %

Short Time Delay protection STD (ANSI 50TD/51)

Isd = Ir x …		OFF - 1.0 - 1.5 - 2.0 - 2.5 - 3.0 - 4.0 - 6.0 - 8.0 - 10.0				
	accuracy	+/- 10 %				
Time delay (s)	tsd I^2t OFF	0.05	0.10	0.20	0.40	0.60
	tsd I^2t ON	0.05	0.10	0.20	0.40	0.60
Non-tripping time (s)		0.025	0.075	0.175	0.375	0.575
Maximum breaking time (s)		0.12	0.17	0.27	0.47	0.67

Instantaneous Protection INST (ANSI 50)

Ii = In x …		OFF - 1.5 - 2.0 - 3.0 - 4.0 - 6.0 - 8.0 - 10.0 - 12.0 - 15.0
	accuracy	+/- 15 %
Non-tripping time (ms)		> 20

Maximum breaking time (ms)	⩽ 80

GF earth fault tripping (ANSI 50N TD/51N)

Ig = In x …	OFF - 0.1 (1) - 0.2 - 0.3 - 0.3 -0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.9 - 1.0				
Time delay (s) tg	0.05	0.10	0.20	0.40	0.80
Non-tripping time (s)	0.025	0.075	0.175	0.375	0.575
Maximum breaking time (s)	0.12	0.17	0.27	0.47	0.67

Neutral protection N

Neutral protection = phase protection Ir x … phase protection Isd x ...	OFF - 50% - 100% - 200% (2)
Instantaneous protection	same as phases
Time delay	same as phases for tr and instantaneous

(1) To set the Ig to 0.1, an external 24 V DC power supply must be used on circuit-breakers with ratings lower than 1250 A.
In order to connect an external 24 V DC power supply, the terminal block accessory must be added to a circuit breaker with a sentinel trip unit.

(2) Neutral protection at 200% is limited to 1600A.

sentinel Energy electronic trip units

The sentinel Energy electronic trip unit provides protection, alarm, measurement, communication and remote control functions.

In addition to the standard functions, offers optional functions for advance use tailored to the needs of the electrical installation.
The availability of the optional functions depends on the type of rating plug installed.

The standard functions are indicated in the following table.

Standard functions	**Energy LSI**	**Energy LSIG**
Long Time Delay protection against overcurrent (L)	■	■
Long Time Delay protection against overcurrent IEC 60255-151	■	■
Short Time Delay protection against overcurrent (S)	■	■
Instantaneous protection against overcurrent (I)	■	■
Earth fault protection (G)	-	■
Neutral protection	■	■
Dual settings (profile A - profile B)	■	■
Zone Selective Interlocking (ZSI)	■	■
Trip and overload alarms	■	■
Optional alarms	■	■
Protection against electronic malfunctions (HWF)	■	■
Trip Test	■	■
Trip history	■	■
History of status and parameter changes	■	■
Class 1 embedded energy meter	■	■
Measurement of current, voltage and power	■	■
Measurement of frequency, phase sequence and power factors	■	■
Maintenance alarm	■	■

The optional functions are indicated in the following table.

Optional functions	**Meter Plus**	**Harmonic**	**Advanced**	**Ultimate**
Measurement of total harmonic distortion THDV and THDV	■	■	■	■
Analysis of individual harmonics	-	■	-	■
Measurement of voltage unbalances	-	■	■	■
Alarm for voltage dips and swells	-	■	■	■
Multi-tariff energy meters	■	■	-	■
Undervoltage protection - ANSI 27	-	-	■	■
Overvoltage protection - ANSI 59	-	-	■	■
Underfrequency protection - ANSI 81L	-	-	■	■
Overfrequency protection - ANSI 81H	-	-	■	■
Reverse active power protection - ANSI 32R	-	-	■	■
Phase unbalance protection - ANSI 46	-	-	■	■
Voltage unbalance protection - ANSI 47	-	-	■	■

The sentinel Energy trip unit accepts the same compatible standard rating plug reference models as the sentinel trip unit.

Standard rating plug

If a standard rating plug is fitted, only the standard functions will be installed on the sentinel Energy trip unit.

Optional rating plug

The sentinel Energy trip unit also accepts optional rating plugs recognizable by their colour.

If an optional rating plug is fitted, only the standard functions and group of related optional functions Meter Plus, Harmonic, Advanced or Ultimate will be installed on the sentinel Energy trip unit.
The optional rating plugs are not compatible with the sentinel trip unit.

Long Time Delay protection against overcurrent IEC 60255-151

In addition to the usual L, S, I and G protections, the sentinel Energy trip unit allows the Long time delay protection to be configured in accordance with the requirements of the IEC 60255-151 in order to adapt the protection of the conductors, the busbars and the busbar trunckings against overcurrents when selectivity needs to be improved with an upstream protection device.

Dual settings (profile A - profile B)

Dual settings allow two protection setting profiles A and B to be defined so that the trip unit can switch operating between protection profile A and protection profile B if a single circuit breaker is intended to protect 2 sources of a changeover switch.

Zone Selective Interlocking (ZSI)

Zone Selectivity (ZSI) is available on sentinel and sentinel Energy trip units. It can be used for the Short Time Delay protection (ZSI STD) and the earth Fault protection (ZSI GF).

Optional alarms

The sentinel Energy trip unit enables programming of up to twelve optional alarms to audit an event of measurement by defining thresholds and activation time delays and deactivation of these alarms.
The same measurement can be used for different custom alarms to precisely monitor certain values, e.g. the frequency or the voltage.

Communication

The sentinel Energy trip unit allows Bluetooth Low Energy communication with the Hager Power touch application.
It allows a Modbus-RTU or Modbus-TCP communication module to be added.
The HTD210H panel display
is compatible with the sentinel Energy trip unit.

Measurement with the sentinel Energy trip unit

The sentinel Energy trip unit includes as standard all functions of a measurement device classified PMD-II in accordance with IEC 61557-12 Version 2, with in particular a class 1 measurement accuracy of active powers and energies. This includes all measurements of current, voltage, frequency, power and energies.
As an option, the measurement of harmonic distortion rates in voltage and current allows equivalence to a PMD-III type measurement device to be achieved.
As an option, the sentinel Energy trip unit enables measurement of the individual harmonics up to the 40th order and to increment up to 8 tariff energy meters.

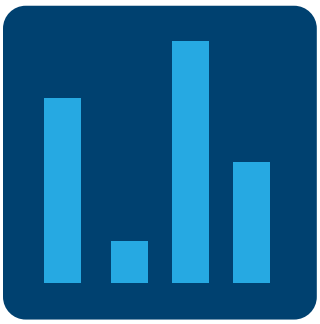
Advanced protections
As an option, it is possible to use up to seven advanced protections to generate alarms or trip the circuit breaker in situations where the voltage, frequency, current or active power values exceed acceptable limits for the installation.
- undervoltage protection,
- overvoltage protection,
- underfrequency protection,
- overfrequency protection,
- reverse active power protection,
- current unbalance protection,
- voltage unbalance protection.

Voltage monitoring alarms
As an option, the sentinel Energy trip unit allows alarms to be activated to monitor the electrical grid and provide alerts if there is a variation in voltage manifesting as a voltage dip or voltage peak in accordance with the IEC 61000-4-30 standard.

Neutral protection N
Neutral protection is factory-installed on 4-pole circuit breakers and as an option with the addition of the ENCT external neutral sensor on 3-pole versions. It is necessary if the neutral conductor cross section is less than that of the phases, or if the neutral conductor is heavily loaded (for example, in office buildings).
It uses similar tripping curve characteristics as the Long time delay, Short time delay and instantaneous protection parameters.

Event management
The sentinel Energy trip unit generates events used to provide alarm warnings on the sentinel Energy display as well as other connected media: panel display, Hager Power touch application, Hager Power setup software.
These events are also used to generate a event history categorized in the following sections:
- Trip,
- Alarm,
- Optional alarm,
- Error,
- Diagnostic,
- Operation,
- Protection setting,
- Measurements settings,
- Test.

All log events are timestamped and recorded in the memory of the sentinel Energy trip unit.



Hager Power touch mobile application
The Hager Power touch mobile application displays status, measurement and settings information, and allows the circuit breaker to be remotely controlled in order to perform an opening or closing command.

It is compatible with the h3+ circuit breakers with the sentinel Energy trip unit.

This application is particularly useful for day-to-day operation and maintenance.

The Energy trip unit must be powered for it to establish the Bluetooth connection. Only one smartphone can be connected to a circuit breaker at a time.

The Hager Power touch mobile application allows access to a Home page showing the circuit breaker's principal characteristics, its operating state and maintenance information.

The other information and functions are described in the sections below:

Voltage and current ...	displays real-time voltage and current values.
Quality of l... Frequency, power fac...	displays frequency, power factor, harmonic distortion rate and individual harmonic values.
Demand Current and power	displays the current demand and power demand values.
Power... +Quadrant, phase rotation...	display the power and real-time energy measurement values as well as the power quadrant and phase sequence.
Parameters Overview of...	gives a read-only view of the values of the protection setting, advanced protections, alarms, electrical grid and the date and time of the circuit breaker.
History Overview of all events	display the events history by section.

The application can be installed on a smartphone and downloaded from:
- Google Play Store for Android smartphones,
- App Store for iOS smartphones.

Compatibility

The application is only available for Apple and Android smartphones.
The dedicated page on the App Store indicates the compatibility of the application with the various versions of iOS.
The dedicated page on the Google Play Store indicates the compatibility of the application with the various versions of Android.

The sentinel Energy electronic trip unit includes:
- A colour screen and a keyboard with six buttons allowing interaction with the trip unit
- A ReadyToProtect indicator: displays when the trip unit is operational and ready to protect. Pilot lamps allowing the cause of trips and alarms to be monitored.

The following characteristics are common to all the versions of the sentinel Energy electronic trip units:

① Graphical colour display

② ReadyToProtect LED

③ Home button

④ Acknowledgement and confirmation OK button

⑤ Navigation buttons

⑥ Rated current value In and indication of optional functions. This value is shown on the rating plug fitted on the trip unit.

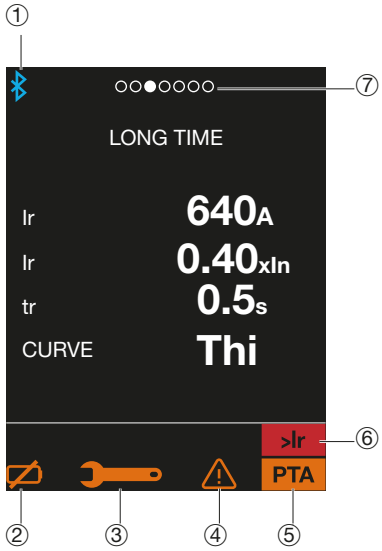
⑦ USB-C port to connect an external power battery or a computer equipped with the Hager Power setup software.

⑧ Backup battery powering the display after electrical tripping. This enables the display to signal the tripping and its cause.

⑨ Backup battery housing cover.

INFORMATION
The electronic trip unit must be powered in order for it to perform its protection functions. It is powered as long as a minimum current of 20% of the nominal current In passes through the circuit breaker.
Nevertheless, it is strongly recommended that a 24V DC SELV external power supply be connected (recommended product reference Hager HTG911H) on the terminal to ensure the trip unit's continuity of operation.
To connect a 24V DC power supply to a circuit-breaker fitted with a trip unit:
- when using sentinel : wiring harness HYH957H and D-type terminal block HXH957H must be added.
- when using sentinel Energy, D-type terminal block HXH957H must be added.

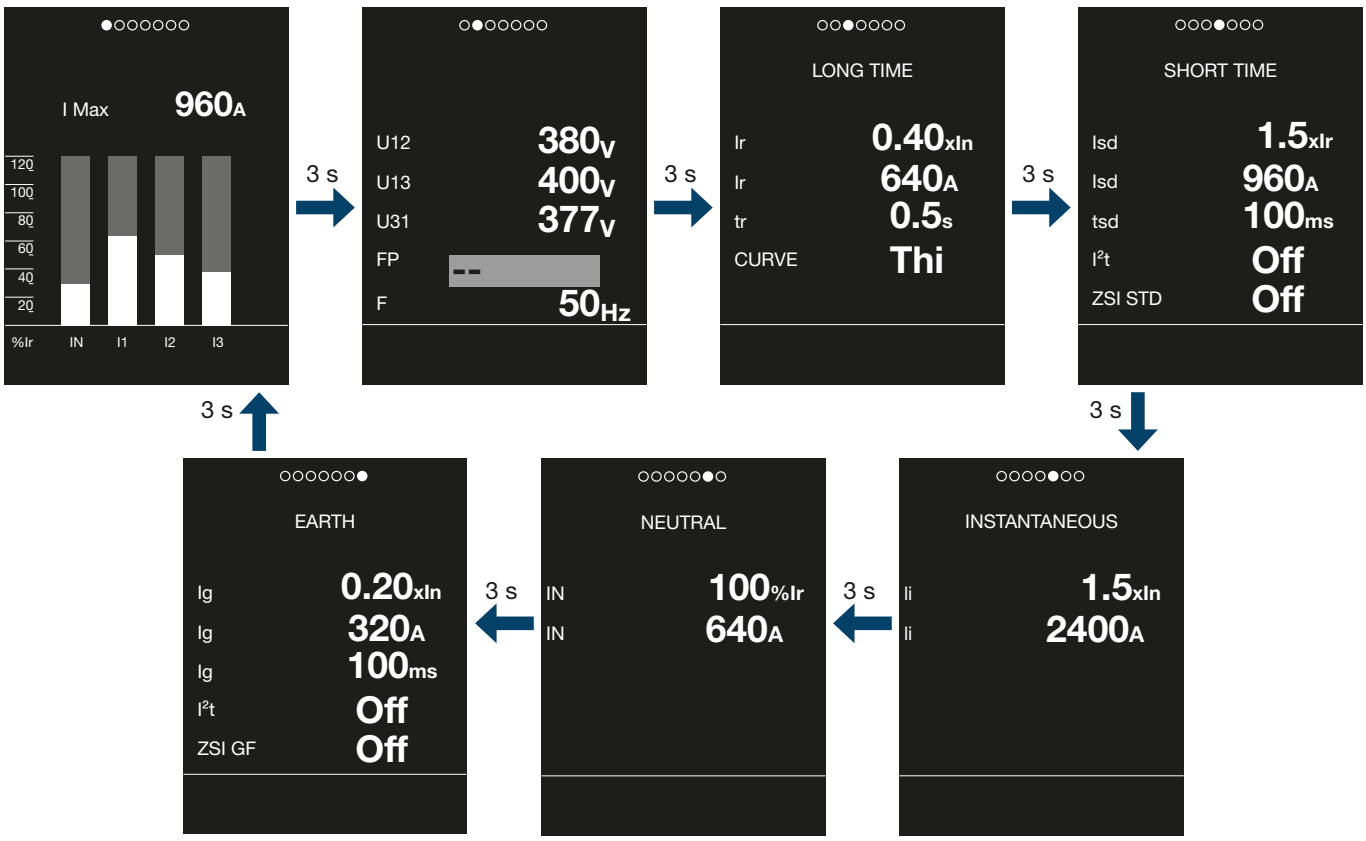
The sentinel Energy display has 3 display zones:
High: position marker in the sequence of views available at this menu level, indication of Bluetooth activation,
Middle: information, message, relevant values,
Low: alarm icons and notifications of alarms



①	**Bluetooth**	appears as soon as the Bluetooth connection is activated.
②	**Low or missing backup battery alarm indicator**	displayed when the trip unit backup battery needs to be changed or is not connected.
③	**Maintenance alarm indicator**	appears when maintenance operations are required.
④	**System alarm indicator**	appears when a system alarm is present and the INFORMATION ⇨ HISTORY ALARM menu has not been viewed yet.
⑤	**Overload pre-alarm indicator**	appears when the current crosses the PTA 1 threshold. Allows warnings about a risk of imminent overload.
⑥	**Overload alarm indicator**	flashes when the current exceeds 105 % of Ir and is constant when above 112.5 % of Ir. Allows warnings about a risk of imminent tripping.
⑦	**View marker**	indicates the positioning order of the screen in the view sequence.

Live mode

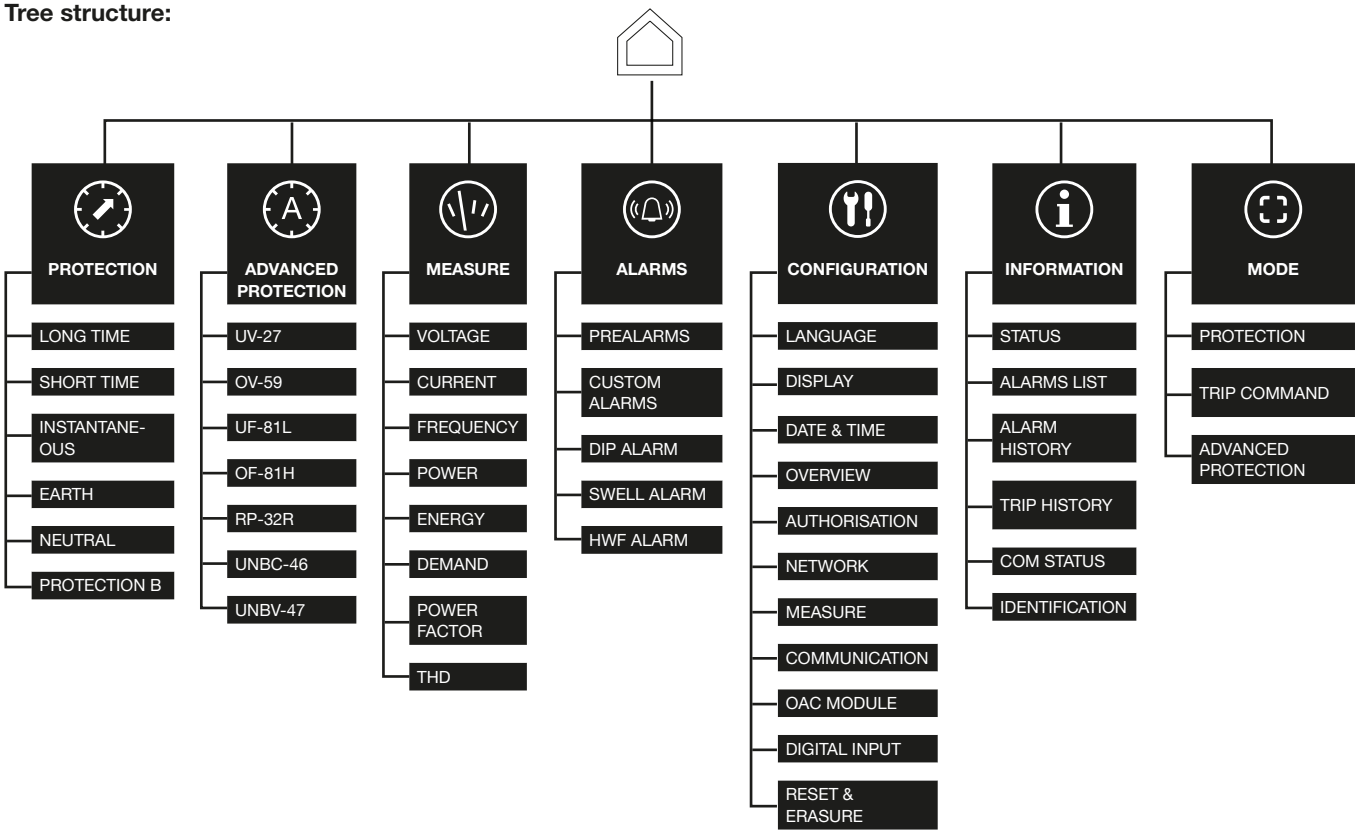
Live mode allows up to 16 favourite views to be continuously displayed among a list of 27 views available.
These are views of measured values or protection setting values.



Main menus

You can switch to the main menus at any time to access settings parameters, measurement values and status and alarm information from the circuit breaker.

Tree structure:



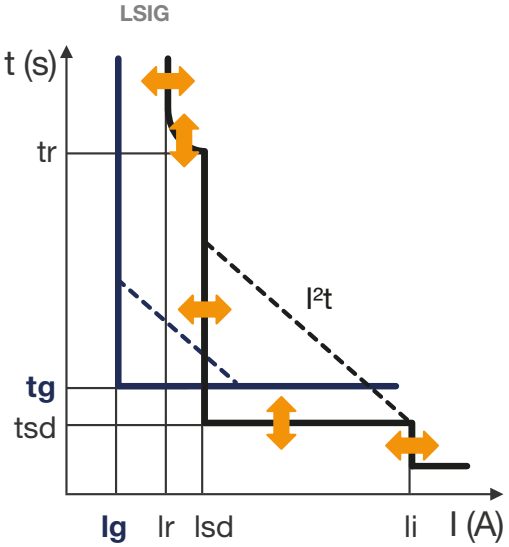
LSIG sentinel Energy trip unit
The LSIG sentinel Energy trip unit is used to protect cable lines and equipment in TN earthing systems where earth fault protection is required.

The protection parameter settings are adjustable from the sentinel Energy display or the panel display or the Hager Power setup software.

Neutral protection N
Neutral protection is factory-installed on 4-pole circuit breakers and as an option with the addition of the ENCT external neutral sensor on 3-pole versions. It is necessary if the neutral conductor cross section is less than that of the phases, or if the neutral conductor is heavily loaded (for example, in office buildings).
It uses similar tripping curve characteristics as the Long time delay, Short time delay and instantaneous protection parameters.

Zone Selective Interlocking (ZSI)
Zone Selectivity (ZSI) is available on LSIG sentinel Energy trip units. It can be used for the Short Time Delay protection (ZSI STD) and the earth Fault protection (ZSI GF). The function is activated using the Hager Power setup software.

LSIG sentinel Energy trip unit



Long Time Delay protection L (ANSI 49)

Trip curve		Thi
Ir (tripping threshold between 1.05 and 1.20 x Ir)		0.40 to 1 x Ir in increments of 0.01
Time delay (s)	tr	0.5 to 25 s in increments of 0.5 s
	accuracy	0 to -+20%

Long Time Delay protection IEC 20255-151

Trip curve		SI $I^{0.02t}$ - VI It - EI I^{2t} - HVF I^{4t}
Ir		0.40 to 1 x Ir in increments of 0.01
Time delay (s)	tr	0.5 to 25 s in increments of 0.5 s

Short Time Delay protection STD (ANSI 50TD/51)

Activation		On/Off											
Isd		0.10 to 1.00 x In in increments of 0.10											
	accuracy	± 10%											
Time Delay (ms)	tsd	50	100	150	200	250	300	350	400	450	500	550	600
Non-tripping time (ms)		25	75	125	175	225	275	325	375	425	475	525	575
Maximum tripping time (ms)		100	150	200	250	300	350	400	450	500	550	600	650
Maximum break time (ms)		120	170	220	270	320	370	420	470	520	570	620	670

Instantaneous Protection INST (ANSI 50)

Activation		On/Off
Ii		1.5 to 15 x In in increments of 0.5
	accuracy	± 15%
Non-tripping time (ms)		20
Maximum tripping time (ms)		80
Maximum break time (ms)		100

GF earth fault protection (ANSI 50N TD/51N)

Activation		On/Off											
Id		1 to 10 x Ir in increments of 0.5											
I^2t		± 10%											
Time Delay (ms)	tg	50	100	150	200	250	300	350	400	450	500	550	600
Non-tripping time (ms)		25	75	125	175	225	275	325	375	425	475	525	575
Maximum tripping time (ms)		100	150	200	250	300	350	400	450	500	550	600	650
Maximum break time (ms)		120	170	220	270	320	370	420	470	520	570	620	670

Neutral protection N

Activation		On/Off
	Neutral protection = Phase protection Ir x … phase protection Isd x ...	50 -100 - 150 - 200 % (1)
	Instantaneous protection	same as phases
	Time delay	same as phases for tr and instantaneous

(1) Neutral protection at 200% is limited to 1600A.

INFORMATION
To set the Ig to 0.1, a 24 V DC external power supply must be used on circuit-breakers with rating lower than 1250 A.

The h3+ circuit breaker equipped with the sentinel Energy trip unit and embedded sensors is defined as a type PMD-DD measurement device of accuracy class 1 on power and energy measurements in accordance with the IEC 61557-12 version 2 standard.

The sentinel Energy trip unit makes available all the measurement values necessary for control and monitoring of the quality of the energy, energy management and energy efficiency.
The calculations are made in accordance with the requirements of the standard IEC/EN 61557-12:
• rms values of current and voltages,
• active, reactive and apparent powers,
• active, reactive and apparent powers,
- power factor,
• frequency,
• phase order,
• power quadrant,
• voltage unbalance,
• current unbalance,
• average current and power (current and power demand).

In addition to these measurements, an optional calibrator provides the following values.

Optional measurements	Meter Plus	Harmonic	Advanced	Ultimate
Measurement of total harmonic distortion THDV and THDV	■	■	■	■
Analysis of individual harmonics	-	■	-	■
Measurement of voltage unbalances	-	■	■	■
Multi-tariff energy meters	■	■	-	■

The average current (current demand) and average power (power demand) calculations are carried out in accordance with the IEC/EN 61557-12 standard. Average currents are calculated with the thermal integration method.
The integration time constant is adjustable from 1 to 60 minutes in steps of 1 minute.
The average powers are calculated using arithmetic integration of the powers over a predefined period, divided by the length of this period. The average power calculations are carried out over a fixed period or a sliding period adjustable from 1 to 60 minutes in increments of 1 minute.

The calculated electrical values are available from the sentinel Energy display, the Bluetooth Hager Power touch application or the panel display. They are available via the Modbus communication.
They are refreshed every second.

The sentinel Energy trip unit records and timestamps the minimum and maximum values for voltage, current, frequency, power ... from the time of the last reset.
The minimum and maximum values can be reset from the sentinel Energy display, the panel display or the Hager Power setup software.

The voltages between phase and neutral are available for the 4-pole circuit breakers and also 3-pole circuit breakers if the neutral potential is connected to the vN terminal of the h3+ circuit breaker.

INFORMATION
In the case of a 3-pole circuit breaker equipped with a sentinel Energy trip unit and installed in a earth fault protection system where the neutral is distributed, the vN terminal must be connected to the neutral potential.
This connection is essential for getting correct measurement values:
• voltages between phase and neutral (V1N, V2N, V3N),
• for powers per phase.
As well as for the correct operation of advanced protections :
• reverse active power protection
- against under- or overvoltages.

The list of measurement values available is as follows.

Measurements in real-time		sentinel Energy display	Panel display	Hager Power touch
Voltages				
phase-phase	U12, U23, U31	■	■	■
phase-neutral	V1N, V2N, V3N	■	■	■
Ph-Ph arithmetic mean	Uavg = (U12 + U21 + U23) / 3	■	■	■
Ph-N arithmetic mean	Vavg = (V1N + V2N + V3N) / 3	■	■	■
Instantaneous maximum	Voltages Ph-Ph and Ph-N	-	-	-
Instantaneous minimum	Voltages Ph-Ph and Ph-N	-	-	-
Unbalances Ph-Ph and Ph-N (1)	% Uavg and % Vavg	■	■	■
Max. instant. unbalance (1)	Unba U, Unba V	-	■	-
Phase sequence	1-2-3, 1-3-2	■	■	■
Currents				
Phase and neutral	I1, I2, I3, IN	■	■	■
Arithmetic mean	Iavg = (I1 + I2 + I3)/3	-	■	■
Instantaneous maximum	Imax of I1, I2, I3, IN	-	■	■
Instantaneous minimum	Imin of I1, I2, I3	-	■	-
Earth fault	IG	■	■	■
Unbalance per phase	Inba1, Inba2, Inba3	■	■	■
Neutral unbalance	InbaN	-	■	■
Max. instant. unbalance	Inba	■	-	-
Frequency				
Frequency	f	■	■	■
Quadrant	I, II, II, IV	■	■	■
Rotary field	direct, inverse	■	■	■
Power				
Active	P total per phase	■	■	■
Reactive	Q total per phase	■	■	■
Apparent	S total per phase	■	■	■
Energy				
Total active energy imported/ exported (consumed/produced)	EaIn / EaOut	■	■	■
Total reactive energy imported/ exported (consumed/produced)	ErIn / ErOut	■	■	■
Total active energy imported/ exported (consumed/produced) (partial counter)	EaIn part / EaOut part	■	■	■
Total apparent energy	Es	■	■	■
Total net active energy	Ea net	-	-	-
Total net reactive energy	Er net	-	-	-
Absolute value of the total net active energy	Ea	-	-	-
Absolute value of the total net reactive energy	Er	-	-	-

(1) The availability of these measurements depends on the type of rating plug installed.

Measurements in real-time		sentinel Energy display	Panel display	Hager Power touch
Maximum and minimum values since last reset				
Max. and min. of the phase-phase, phase-neutral and arithmetic mean voltages	max U12, max U23, max U32, min U12, min U23, min U31, max V1N, max V2N, max V3N, max Uavg, min Uavg, max Vavg, min Vavg	■	■	■
Max. of currents and arithmetic mean	max I1, max I2, max I3, max Iavg,	■	■	■
Min. of currents and arithmetic mean	min I1, min I2, min I3, min Iavg	■	-	■
Max. and min. of the voltage and current unbalances	max U12nba, max U23nba, max U32nba, min U12nba, min U23nba, min U31nba, max V1Nnba, max V2Nnba, max V3Nnba…	-	-	-
Max. of powers, max IG	max P1 max P2, max P3, max Ptot,	■	■	-
Min. of powers, power factors, cos φ and min IG	min P1, min P2, min P3, min Ptot, min FP1, min FP2, min FP3, min FPtot, min cos φ1, min cos φ2, min cos φ3, min cos φtot	-	-	-
Max. of power factors, cos φ	max Ptot, max FP1, max FP2, max FP3, max FPtot, max cos φ1, max cos φ2, max cos φ3, max cos φtot,	-	-	-
Max. and min. of the THD of the voltages and currents	max THD U12, max THD U12, max THD U31, min THD U12, min THD U23, min THD U31, max THD V1N, max THD V2N, max THD V3N, min THD V1N…	-	-	-
Max. and min. of the frequency	max Freq, min Freq	-	-	■
Min. of the THD of IN	min THD IN	-	-	-
Max. of the THD of IN	max THD IN	■	■	-
Averages over interval (demand)				
Active (kW), reactive (kvar), apparent (kVA) power demand	P Dmd, Q Dmd, S Dmd Total and per phase	total only	■	■
Peak power demand since last reset.	Max P Dmd, Max Q Dmd, Max S Dmd Total and per phase	total only	■	■
Current demand	I1 Dmd, I2 Dmd, I3 Dmd; IN Dmd, Iavg Dmd	■	-	■
Peak current demand since last reset.	Max I1 Dmd, Max I2 Dmd, Max I3 Dmd; Max IN Dmd	■	-	■
Integration interval sliding, fixed or synchronised by Modbus	Adjustable from 5 to 60 minutes in increments of one minute	■	■	■

Measurements in real-time		sentinel Energy display	Panel display	Hager Power touch
Power factor				
Power factor and cos φ (fundamental)	Total	■	■	■
Power factor and cos φ (fundamental)	Per phase	■	■	■
Total harmonic distorsion				
Voltage THD (1)	THDU (Ph -Ph), THDV (Ph -N)	■	■	■
Current THD (1)	THDI per phase	■	■	■
THD IN	Neutral THDI	■	■	■

(1) The availability of these measurements depends on the type of rating plug installed.

Measurement accuracy

The measurement accuracy values are the result of the h3+ circuit breaker equipped with the sentinel Energy circuit breaker and the sensors:

Variables	Symbols	Measuring range	Class IEC 61557-12 or accuracy
Currents and Max./Min. current	I1, I2, I3; IN, Iavg, Imax, Imin,…	0.2 x Ib ... Imax	0.5
Earth fault	% IG	0.2 x Ib ... Imax	0.5
Current unbalance	Inba1, Inba2, Inba 3, InbaN, Inba	-	-
Phase-phase and Min/Max voltages	U12, U23, U31, Uavg	120 V - 690 V	0.5
Phase-neutral and Min/Max voltages	V1N, V2N, V3N, Vavg	70 V - 440 V	0.5
Unbalances	U12 Unb, U23 Unb, U31 Unb, V1N Unb, V2N Unb, V3N Unb, Max Unb U, Max Unb V	0.8…1.2 x Vn	-
Frequency	f	45 Hz - 65 Hz	0.02
Power	P total, P per phase, Q total, Q per phase, S total, S per phase	0.05 x Ib... Imax	1
Active energy	EaIn, EaOut, Ea Abs, Ea, EaIn EaOut	0.05 x Ib... Imax	1
Reactive energy	ErIN, ErOut, Er Abs, Er	0.05 x Ib... Imax	2
Apparent energy	Es	0.05 x Ib... Imax	1
Average power over interval	P Dmd per phase, P Dmd Total, Q Dmd per phase, Q Dmd Total, S Dmd per phase, S Dmd Total	0.05 x Ib... Imax	1
	Max P Dmd per phase, Max P Dmd Total, Max Q Dmd per phase, Max Q Dmd Total, Max S Dmd per phase, Max S Dmd Total		
Average currents over interval	I1 Dmd, I2 Dmd, I3 Dmd, IN Dmd, Iavg Dmd, Max I1 Dmd, Max I2 Dmd, Max I3 Dmd; Max IN Dmd, Max I1 Dmd, Max I2 Dmd, Max I3 Dmd; Max IN Dmd	0.2 x Ib ... Imax	0.5
Power factors	PF1, PF2, PF3, PFtot, Cos φ 1, Cos φ 2, Cos φ 3, Cos φ tot	0.5 inductive to 0.8 capacitive	1
Voltage THD	THDU (ph.-ph.), THDV (ph.-N)	0…20 %	2
Current THD	THDI per phase or per neutral pole	0…200 %	2

The seven advanced protections below are optionally available for the Advanced and Ultimate rating plugs:

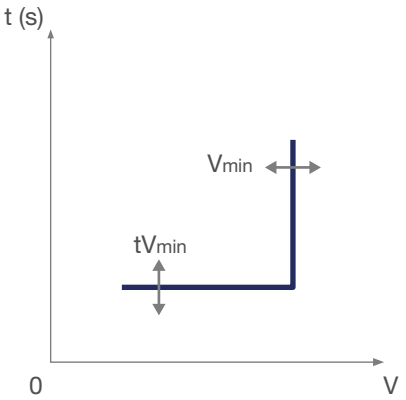
- Undervoltage protection - ANSI 27
- Overvoltage protection - ANSI 59
- Underfrequency protection - ANSI 81L
- Overfrequency protection - ANSI 81H
- Reverse active power protection - ANSI 32R
- Phase unbalance protection - ANSI 46
- Voltage unbalance protection - ANSI 47

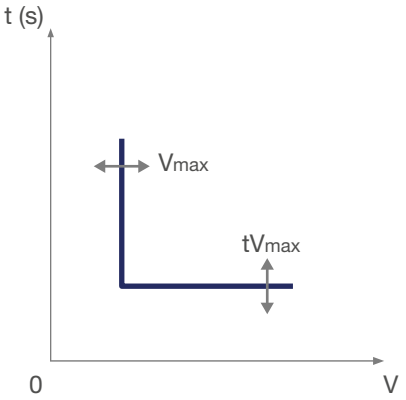
N.B.
For correct operation an external 24 V DC SELV power supply must be connected to the circuit breaker to allow the advanced protections to operate correctly.

Undervoltage and overvoltage protection
The undervoltage protections ANSI 27 (UV-27) and overvoltage protections ANSI 59 (OV59) permanently monitor the installation voltage. When the voltage exceeds acceptable limits, the information provided by the protection allows alarms to be generated or the circuit breaker to be tripped.

Benefit
These protections are appropriate for generators.
In addition, continuous monitoring of phase-phase or phase-neutral voltages allows the appropriate action to be performed to secure the electrical installation, e.g.:
- load-shedding,
- power source switching,
- start a standby generator set.

Operating principle
These protections allow the three phase-phase voltages to be monitored or the three phase-neutral voltages.
They start at the end of the activation time delay set when one of the three voltages reaches the activation threshold.

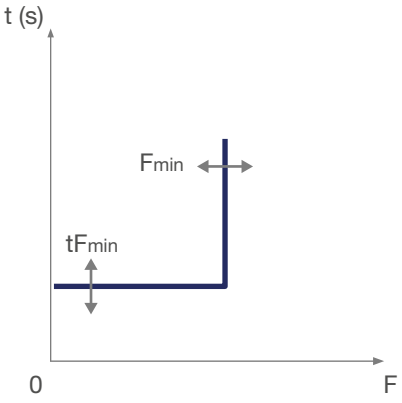
Undervoltage protection		**ANSI 27**
	Activation	On/Off
	Inhibition of the protection	On/Off
	Voltage to be monitored, type U-V	Choice of voltages to monitor: Three-phase voltages U12, U23, U31 or single voltages V1N, V2N, V3N
	Activation threshold Vmin (V)	100 to 1000 V in increments of 5 V
	Accuracy	+/- 1 %
	Activation time delay tVmin (s)	0.1 to 300 s in increments of 0.1
	Accuracy	+/- 40 ms from 0.1 to 2 s +/-2 % above 2 s
	Hysteresis	102 %
	Minimum tripping time (ms)	60 ms
	Maximum tripping time (ms)	140 ms with time delay set to 0.1 s

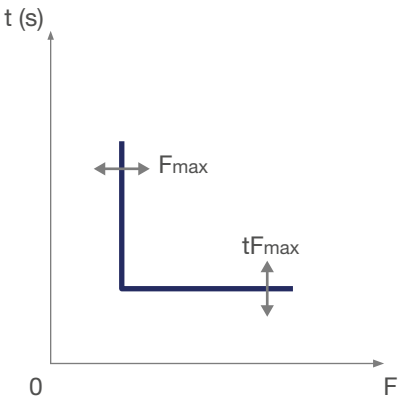
Overvoltage protection		**ANSI 59**
	Activation	On/Off
	Inhibition of the protection	On/Off
	Voltage to be monitored, type U-V	Choice of voltages to monitor: Three-phase voltages U12, U23, U31 or single voltages V1N, V2N, V3N
	Activation threshold Vmax (V)	100 to 1000 V in increments of 5 V
	Accuracy	+/- 1 %
	Activation time delay tVmax (s)	0.1 to 300 s in increments of 0.1
	Accuracy	+/- 40 ms from 0.1 to 2 s +/-2 % above 2 s
	Hysteresis	98 %
	Minimum tripping time (ms)	60 ms
	Maximum tripping time (ms)	140 ms with time delay set to 0.1 s

Underfrequency and overfrequency protections
The underfrequency protections ANSI UF-81L (UF-81L) and overfrequency protections ANSI OF-81H (OF-81H) permanently monitor the installation voltage. When the frequency exceeds acceptable limits, the information provided by the protection allows alarms to be generated or the circuit breaker to be tripped.

Benefit
The frequency of an electrical installation must be kept within a strict operating range to maintain the correct level of performance of loads and to limit the risk of damage to drive loads and sensitive electronic equipment.
These protections are appropriate for generators.
In addition, continuous monitoring of phase-phase or phase-neutral voltages allows the appropriate action to be performed to secure the electrical installation, e.g.:
- Load-shedding,
- power source switching,
- start a standby generator set.

Operating principle
These protections start at the end of the activation time delay set when the measured frequency reaches the activation threshold.

Underfrequency protection		**ANSI 81L**
	Activation	On/Off
	Inhibition of the protection	On/Off
	Activation threshold Fmin (Hz)	45.0 to the nominal frequency Fn in increments of 0.1
	Accuracy	+/- 0.1 Hz
	Activation time delay tFmin (s)	0.1 to 300 s in increments of 0.1
	Accuracy	+/- 40 ms from 0.1 to 2 s +/-2 % above 2 s
	Hysteresis	102 %
	Minimum tripping time (ms)	60 ms
	Maximum tripping time (ms)	140 ms with time delay set to 0.1 s

Overfrequency protection		**ANSI 81H**
	Activation	On/Off
	Inhibition of the protection	On/Off
	Activation threshold Fmax (Hz)	From the nominal frequency Fn to 65.0 Hz in increments of 0.1
	Accuracy	+/- 0.1 Hz
	Activation time delay tFmax (s)	0.1 to 300 s in increments of 0.1
	Accuracy	+/- 40 ms from 0.1 to 2 s +/-2 % above 2 s
	Hysteresis	98 %
	Minimum tripping time (ms)	60 ms
	Maximum tripping time (ms)	140 ms with time delay set to 0.1 s

Reverse active power protection

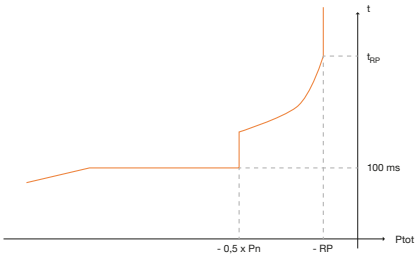
The reverse active power protection ANSI 32R (RP-32R) detects when a synchronous power generator connected in parallel to other sources is functioning as a synchronous motor.

Benefit

It enables the tripping of the circuit-breaker to disconnect the generator from other sources. It can also be used to monitor the active power exchanged between two sources and generate an alarm to take a load-shedding step or to trip once the flow coming back from the active power exceeds the set value.

Operating principle

The reverse active power protection is based on the measurement.
The sentinel Energy trip unit assigns the sign + or - to the active power according to the power sign convention parameter.
By default this parameter is set for a situation where the power source of the installation is connected upstream of the circuit breaker.
When the power source is connected downstream of the circuit breaker, the power sign convention parameter must be changed to enable the reverse active power protection to operate correctly.
It starts when the total active power is negative, when the power threshold is reached and when the activation time delay has elapsed.

Reverse active power protection		**ANSI 32R**
	Activation	On/Off
	Inhibition of the protection	On/Off
	Activation threshold RP (% x Pn)	4.0 to 15.0 % x Pn in increments of 0.5
	Accuracy	0 % to -20 %.
	Activation time delay tRP (s)	0.5 to 25 s in increments of 0.5
	Accuracy	- 15 % to + 15 % + 100 ms
	Minimum tripping time (ms)	425 ms
	Maximum tripping time (ms)	675 ms with time delay set to 0.5 s

Current unbalance protection

The current unbalance protection ANSI 46 (UNBC-46) permanently monitors the current unbalances of each phase. When the unbalance is detected on one of the phases, the UNBC-46 protection allows an alarm to be generated or the circuit breaker tripped.

Benefit

Current unbalance protection is recommended for a motor.
The unbalances in phase currents generate significant heating and braking torques that can cause the motor to degrade prematurely.

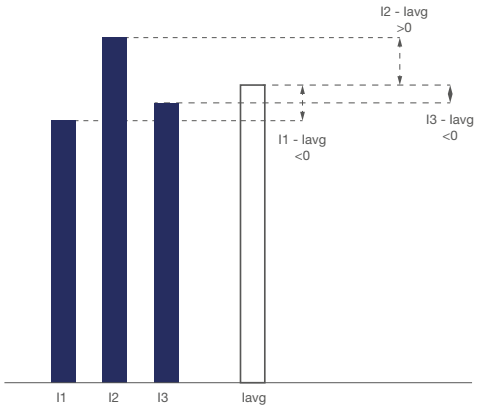
Operating principle

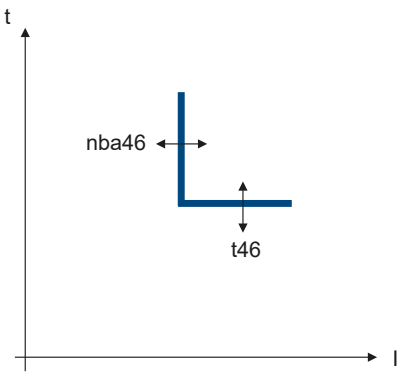
Current unbalance protection calculates the current unbalances for each phase, in relation to the average current, expressed as a percentage:

$$I_{nba}p[\%] = 100 * \frac{I_p - I_{avg}}{I_{avg}} \quad \text{avec } p = 1, 2, 3$$

$$I_{avg} = \frac{I_1 + I_2 + I_3}{3}$$

Example of maximum positive unbalance on phase 2:



Current unbalance protection		ANSI 46
	Activation	On/Off
	Inhibition of the protection	On/Off
	Activation threshold nba46 (%)	2 to 90 % in increments of 1
	Accuracy	+/- 5 units, for example for a 20 % threshold the accuracy will be between 15 % and 25 %
	Activation time delay t46 (s)	0.5 to 60.0 s with steps of 0.1
	Accuracy	+/- 40 ms from 0.1 to 2 s +/-2 % above 2 s
	Hysteresis	98 %
	Minimum tripping time (ms)	60 ms
	Maximum tripping time (ms)	140 ms with time delay set to 0.5 s

Voltage unbalance protection

The voltage unbalance protection ANSI 47 (UNBV-47) permanently monitors the voltage unbalances of each phase. When the unbalance is detected on one of the phases, the UNBV-47 protection allows an alarm to be generated or the circuit breaker tripped.

Benefit

The voltage unbalances in a 3-phase system are caused by the connection of too many 1-phase loads on a single phase. These unbalances can cause major problems for those administering the electrical grid.
Voltage unbalances also have an influence on all three-phase equipment and in particular on motors, because they then experience undesirable braking torque which then takes the form of overheating. Any voltage unbalance greater than 2% results in overheating of equipment, which makes it necessary for the latter to be overdimensioned to compensate for the overheating and prevent premature degradation.

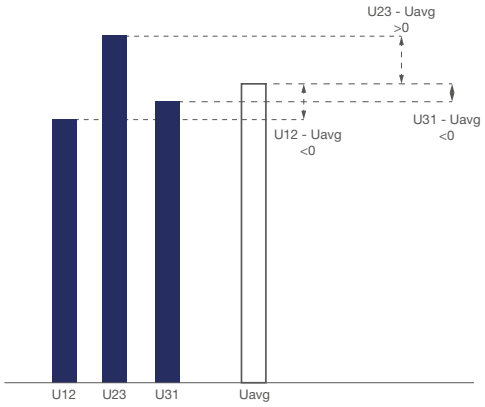
Operating principle

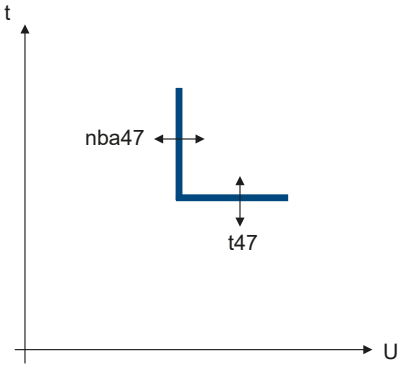
Current unbalance protection calculates the voltage unbalances for compound voltages, in relation to the average current, expressed as a percentage:

$$U_{nba}pp[\%] = 100 * \frac{U_{p\text{-}p} - U_{avg}}{U_{avg}} \text{ avec p = 1, 2, 3}$$

$$U_{avg} = \frac{U_{12} + U_{23} + U_{31}}{3}$$

Example of voltage unbalance on phase 2:



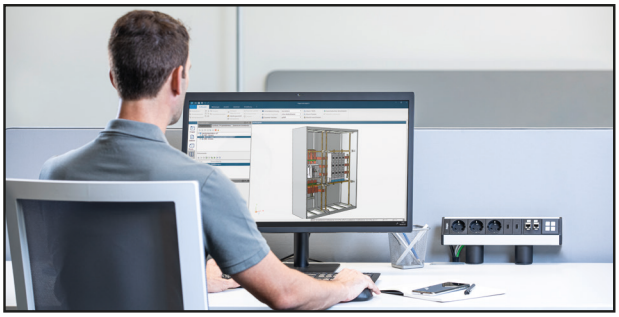
Voltage unbalance protection		**ANSI 47**
	Activation	On/Off
	Inhibition of the protection	On/Off
	Activation threshold nba47 (%)	2 to 90 % in increments of 1
	Accuracy	+/- 2 units, for example for a 20 % threshold the accuracy will be between 18 % and 22 %
	Activation time delay t47 (s)	0.5 to 60.0 s with steps of 0.1
	Accuracy	+/- 40 ms from 0.1 to 2 s +/-2 % above 2 s
	Hysteresis	98 %
	Minimum tripping time (ms)	60 ms
	Maximum tripping time (ms)	140 ms with time delay set to 0.5 s

Selection and commissioning

Order your Hager circuit breaker via the Hagercad configurator.
Whatever the size of your project (small or large commercial project), save time using the Hagercad configurator to edit:
- the list of materials
- the wiring diagram
- the enclosure
- the customer quote.

Fast, comprehensive and smart, Hagercad is the essential tool to configure your circuit breaker:
Quick: You have clear visibility over your projects and the products used.
Comprehensive: all the characteristics (breaking capacity, rated current, type of electronic trip unit, etc.) for your circuit breaker can be selected based on your needs.
Intelligent: No more risk of errors, the software checks your installation according to the IEC 61439 standard.

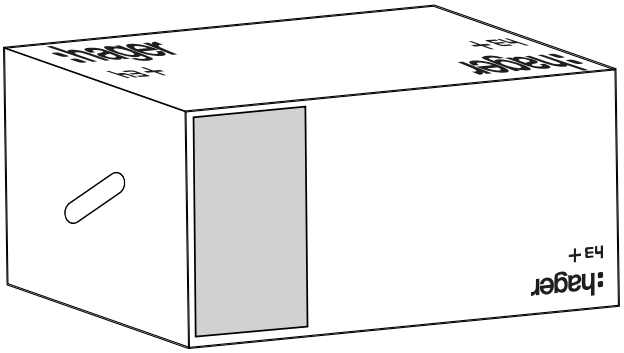
For all of this:
1/ Visit your local Hager website for more information.



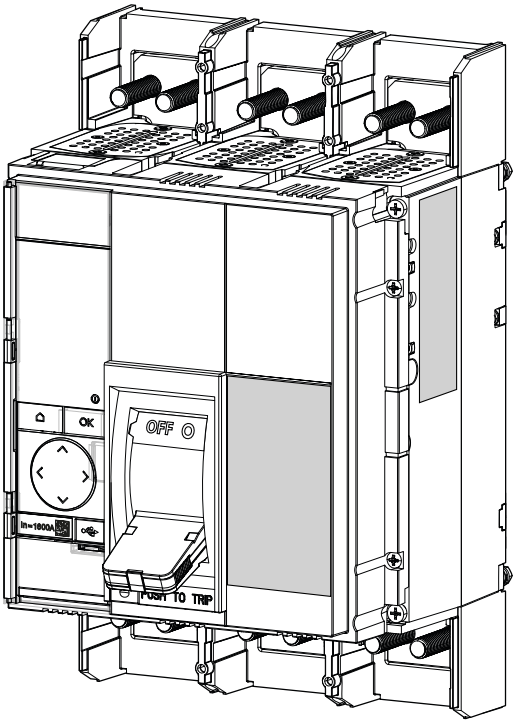
2/ Configure the circuit breaker according to your needs.

You can find the product reference and the main technical information for the air circuit breaker.

On the packaging labels:



On the side of the circuit breaker:

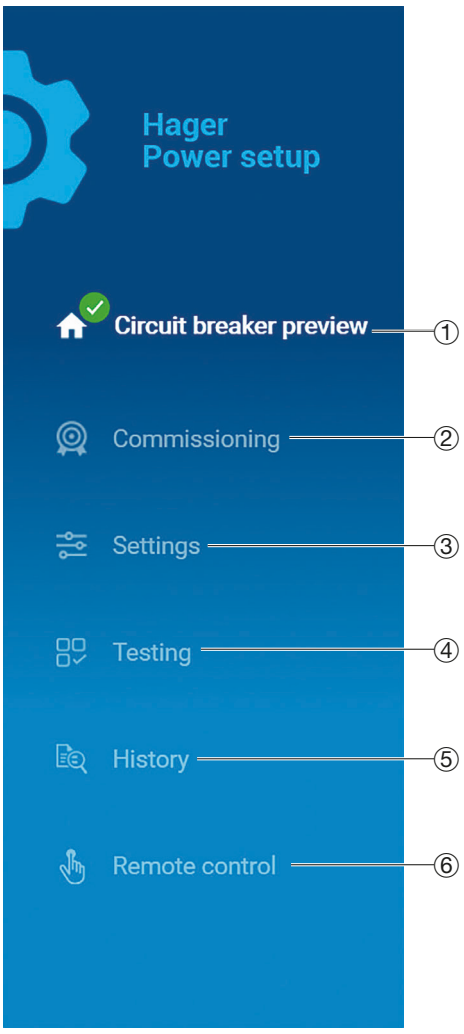


The Hager Power setup software has been designed for testing and commissioning h3+ circuit breakers.

Principal functions

- Display the functional state of the circuit breaker, maintenance information and principal technical characteristics.
- Perform a commissioning by importing settings from Hagercad.
- Generate and print test reports and commissioning reports.
- Perform a manual test of the tripping curve of the h3+ circuit breakers.
- Perform a forced electro-mechanical tripping of the circuit breakers.
- Display and modify all the electronic trip unit parameter settings.
- Display alarms in progress.
- Download and export the electronic trip unit settings in a file in CSV format.
- Save the settings of a circuit breaker from within the Energy family to load them into one or more similar circuit breakers.
- Force the opening or closing of the OAC and ZSI output contacts.
- Display the active alarms.
- View the event logs and export them in a file in CSV format.
- Display the status of the operating counters available (handling cycles, tripping operations...).

The functions of the Hager Power setup software can be accessed through six menus:



① Circuit breaker overview	Functional state of the circuit breaker, maintenance information and principal technical characteristics.
② Start-up	Three-stage procedure 1. Setting, 2. Test, 3. Tripping, to commission the circuit breaker using settings data imported from the Hagercad software.
③ Settings	Access to all the parameter settings of the trip unit.
④ Test	Access to the tripping curve of the manual test, the forced electro-mechanical tripping and activation of the output contacts available on the circuit breaker.
⑤ History	Access to event history. Display of active alarms. Operating counters panel.
⑥ Remote control	Access to remote controls available on the sentinel Energy circuit breaker: remote opening, switch between protection profiles, inhibition of advanced protections.

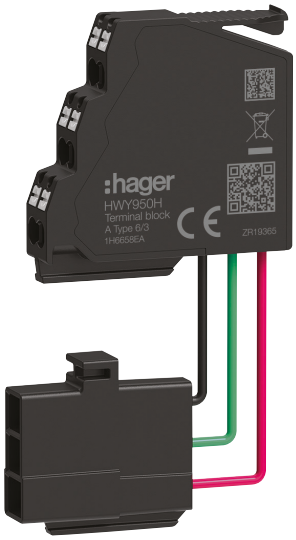
The Hager Power setup software is available on the Hager website for your country.

Minimum configuration requirements

	Minimal	Recommended
Operating system	Windows 10 x32 bits	Windows 10 x64 bits
Memory	4 Gb RAM	8 Gb RAM
Disk space	50 Mb	50 Mb
Components	Microsoft .NET Framework 4.7.2 .NET Core Runtime 3.1.13 .NET Desktop Runtime 3.1.13 Microsoft web view 2 v1.0.818.14	Microsoft .NET Framework 4.7.2 or higher .NET Core Runtime 3.1.13 or higher .NET Desktop Runtime 3.1.13 or higher Microsoft web view 2 v1.0.818.14 or higher
Resolution	1024x768 pixels	1280x1024 pixels

Accessories

TB terminal block connection

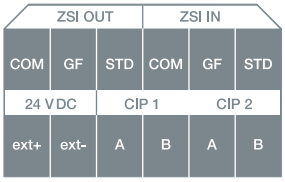


TB terminal block with QuickConnect system

This terminal block facilitates the wiring of control and signalling accessories thanks to an easy connection system:

- Saves time: thanks to the QuickConnect technology, wiring is quick, easy and tool-free.
- safer: cable maintenance is ensured,
- test point: used to check for the presence of voltage with a voltmeter.
- Cable disconnection: the QuickConnect terminal can be released quickly and easily with a screwdriver.

Two types of terminal block can be selected depending on the accessory to be connected:

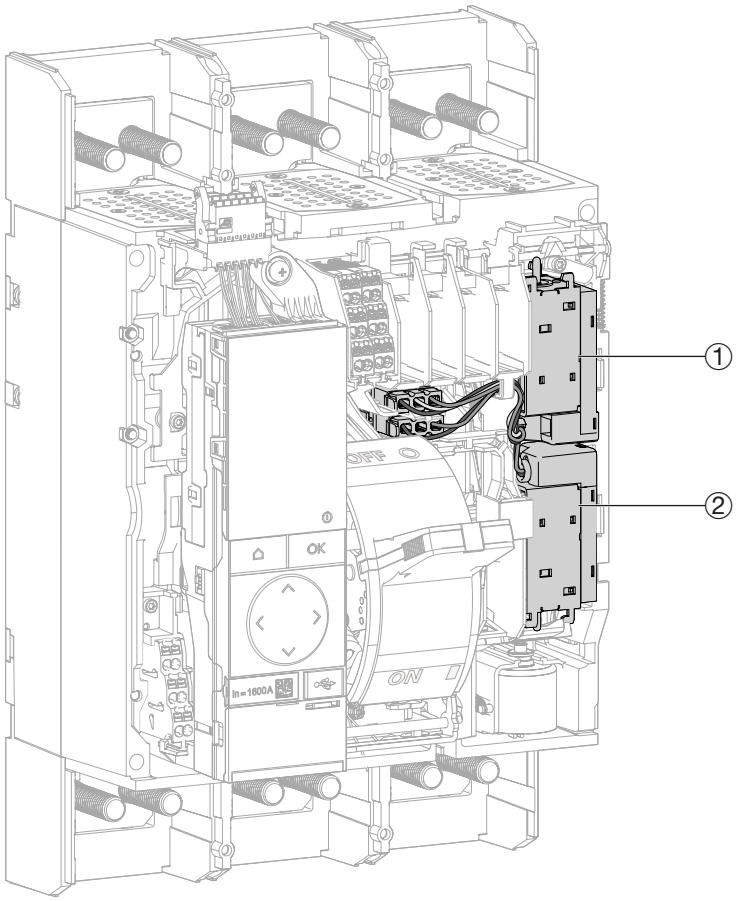
Description	Characteristics		
Connection terminal block	A-type		SH shunt trip coil, UV undervoltage release coil
	D-type		**Identification of connector terminals**  Zone selectivity function on the STD protection and/or earth fault protection. Connection to downstream circuit breakers: • ZSI OUT STD: Selectivity on short delay protection • ZSI out GF: Selectivity on earth fault protection • ZSI OUT COM: common Connection to the upstream circuit breaker: • ZSI IN STD: Selectivity on short delay protection • ZSI IN GF: Selectivity on earth fault protection • ZSI IN COM: common Electronic trip unit: •24 V + and -: external 24V DC SELV power supply (recommended Hager reference HTG911H) is necessary to use the OAC output alarm contact module and/or the continuous powersupply of the electronic trip unit. • CIP 1 and 2: connection to the HTD210H panel display.

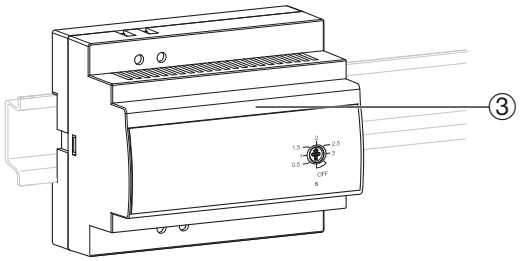
The cables used must have a cross section between 0.6mm² and 2.5mm². They can be flexible or rigid.

In order to be correctly maintained in the terminal blocks, the connected cables must be stripped in advance by 10 to 12 mm. The flexible cables can be inserted without end caps and must not be twisted.

Overview of electrical control accessories

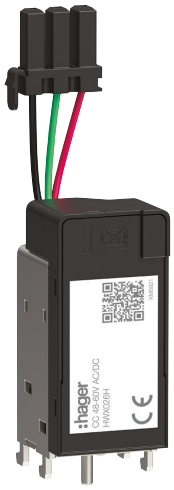
The electrical control accessories allow remote opening operations to be carried out using the TB connection terminals of the control accessories.





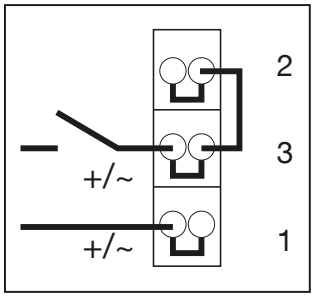
①	SH shunt trip coil	page 69
②	UV undervoltage release coil	page 70
③	UVTC Time Delay controller for undervoltage release coil	page 70

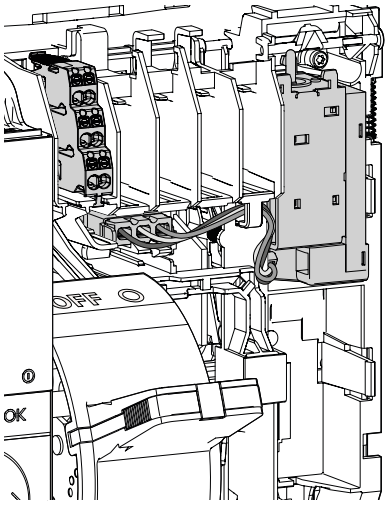
UV undervoltage release/ SH shunt trip coil



The UV and SH coils are used to remotely open the circuit breaker. They are fitted with connectors for connection to the TB terminal blocks.

Connection diagram





SH shunt trip coil in the UV / SH position

SH shunt trip coil

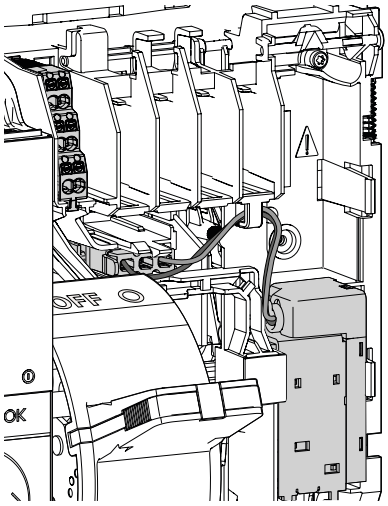
The SH shunt trip coil activates the circuit breaker opening mechanism when it is energised.
The pulse duration must be at least 100 ms. The coil is suitable for continuous supply.

Up to two SH shunt trip coils can be installed.

INFORMATION
If two SH coil are installed, it is no longer possible to install a UV undervoltage release coil.

Electrical characteristics of the SH shunt trip coil

Rated voltage (Vn)		Operating range (V)	Frequency (Hz)	Electricity consumption (VA)		Circuit breaker response time at Vn (ms)
DC (V)	AC (V)			Inrush	Holding	
24-30		17-33	50/60	300 (200 ms)	5	50
48-60		34-66	50/60			
100-130		70-143	50/60	200 (200 ms)		
200-250 (1)		140-275	50/60			
-	380-480 (2)	266-528	50/60			



UV undervoltage release coil in the SH / UV position

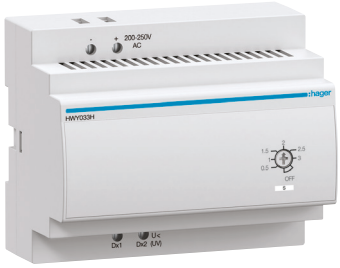
UV undervoltage release coil

The UV undervoltage coil activates the circuit breaker opening mechanism when it is no longer supplied or when its rated voltage drops between 40% and 70% of the rated voltage.
The circuit breaker can only close if the coil supply voltage returns to normal or exceeds a defined threshold.
It is possible to add a UVTC time delay controller to the UV undervoltage release coil to delay the operation of the coil and thus reduce unwanted tripping of the circuit breaker.

Electrical characteristics of UV undervoltage release coil

Rated voltage (Vn)		Closing voltage (V)	Opening voltage (V)	Frequency (Hz)	Electricity consumption (VA)		Circuit breaker response time at Vn (ms)
DC (V)	AC (V)				Inrush	Holding	
24-30		> 21	8-21	50/60	300 (200 ms)	5	less than 90
48-60		> 41	17-42	50/60			
100-130		> 85	35-91	50/60	200 (200 ms)		
200-250		> 170	70-175	50/60			
-	380-480	> 323	133-336	50/60			

UVTC Time Delay controller for undervoltage release coil



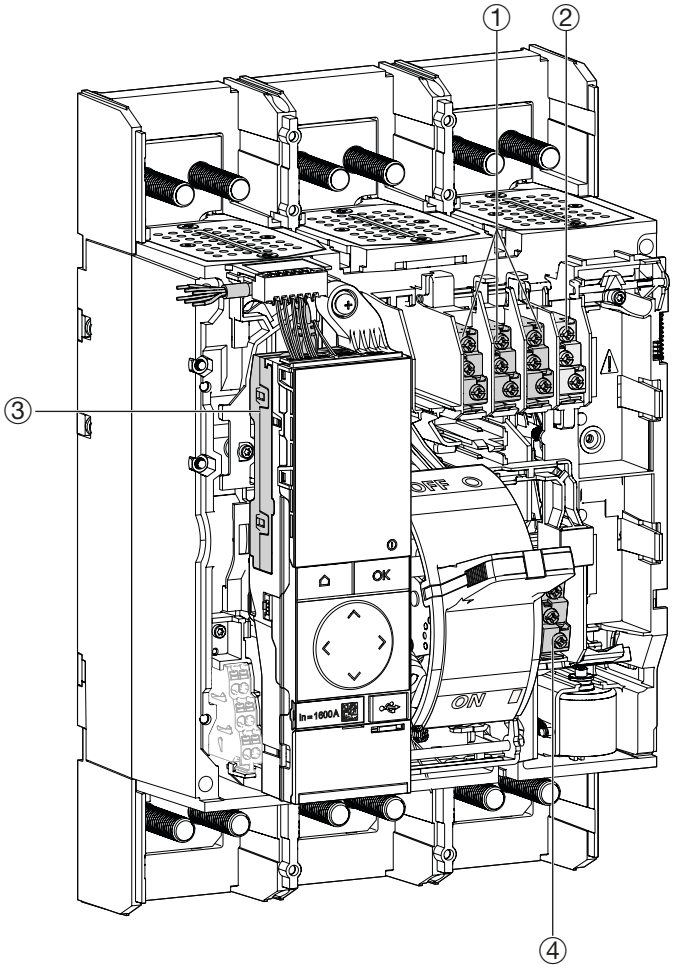
The UVTC time delay controller allows the tripping of the UV undervoltage release coil to be delayed in order to deal with a transient voltage drop of less than 3 seconds. The time delay can be set to OFF - 0.5 - 1.0 - 1.5 - 2.0 - 2.5 - 3 seconds. The time controller is DIN rail-mounted.

Electrical characteristics of UVTC undervoltage release coil

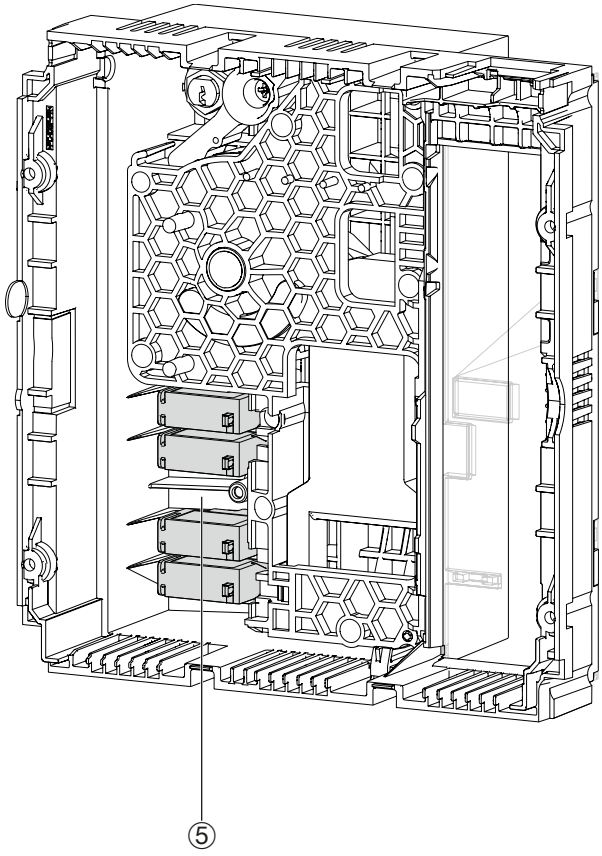
Rated voltage (Vn)	
DC (V)	AC (V)
24-30	
48-60	
	200-250
	380-480

Signalling accessories overview

The signalling accessories provide information concerning the status of the circuit breaker and the presence of an electrical fault.



Example of an Energy circuit breaker

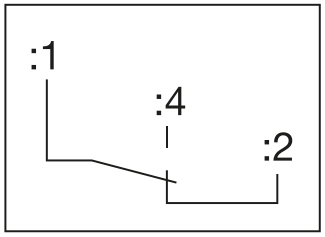


Interior view of the rotary handle

1	AX auxiliary contact	page 72
2	Alarm contact ALL	page 72
3	OAC output alarm contacts module	page 73
4	FS fault trip contact	page 72
5	Contact AXO / AXC	page 72

Signalling contact

Connection diagram



AX auxiliary contact	The AX auxiliary contacts are used for remote signalling of the “open” or “closed” status of the circuit breaker power contacts. The fitted contacts can be “standard” or “low level” (See table below).
Alarm contact AL	Function AL is used to indicate the tripping of the circuit-breaker due to fault detection (overload / short-circuit / earth fault) or after an opening command (via opening coil / via "Push to Trip" / via trip test).
FS fault trip contact	The FS fault trip contact is used to signal the opening of the circuit breaker following a trip due to an electrical fault. The causes for the tripping can be of different types: • overload, • short circuit, • earth fault GF, • critical system alarm.
Contact AXO / AXC	The pre-opening or pre-closing function signals the position of the rotary handle, specifically used to anticipate the opening of safety trip units (pre-opening) or to supply power to a control device before the circuit-breaker closes (pre-closing).

characteristics of AX / AL / AXO / AXC contacts

Minimum load			15 V 2 mA
Breaking capacity (A)	Usage(1)	Ue (V)	AC12
	V AC	127	5.0
		240	5.0
		380	5.0
		440	5.0
		480	5.0
		690	-
	Usage(1)	Ue (V)	DC12
	V DC	24	5.0
		48	2.5
		125	0.4
		240	0.2

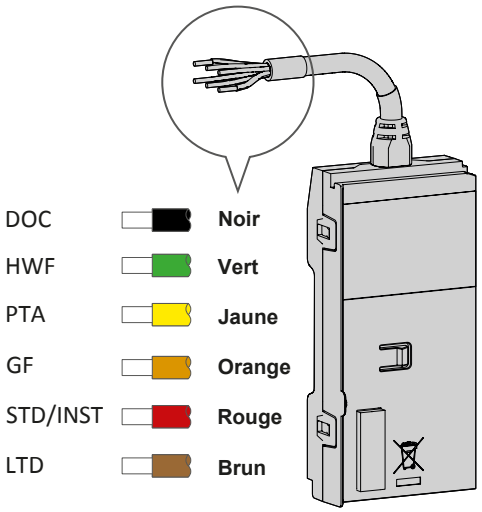
(1) According to standard IEC 60947-5-1

OAC output alarm contacts module

The OAC output contacts module can be used to signal an alarm, trip or operational event.

The OAC contacts are assigned permanently to the following events on a circuit breaker equipped with the sentinel trip unit:

Output alarm contact marking:

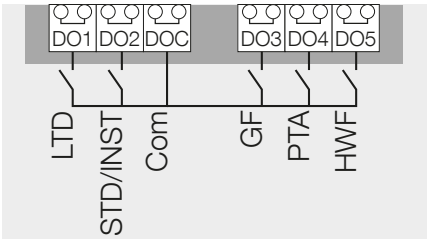


DO1	LTD	LTD Long time delay protection tripping
DO2	STD/INST or S/I	tripping of the Short Time Delay, Instantaneous or MCR protection
DOC	DOC	common
DO3	GF	tripping of the GF earth fault protection
DO4	PTA	Activation of the PTA overload prealarm
DO5	HWF	tripping due to a critical system alarm HWF.

The assignment of OAC contacts is programmable on a circuit breaker equipped with a sentinel Energy trip unit.
Each OAC contact cannot be reassigned to a distinct trip, alarm or operational event, chosen from a predefined list offering more than 40 options.

INFORMATION
For correct operation, an external 24 V CC SELV power supply must be connected to the circuit breaker.
For a circuit-breaker, it is necessary to add a D-type terminal block to connect a 24 V power supply.

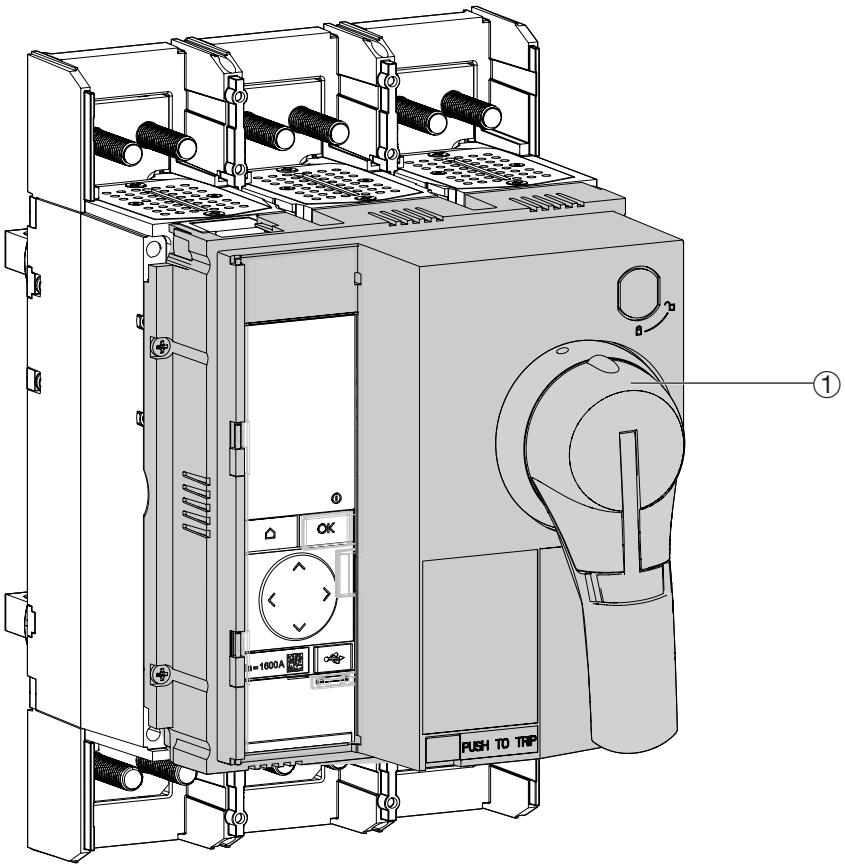
Connection diagram



Characteristics of the contacts:
250 V AC - 2 A - AC1
30 V DC - 2 A - DC1

Overview of mechanical control accessories

The mechanical control accessories are intended to isolate the installation. The rotary handle makes it easy to open and close contacts either directly or remotely from the front of the panel.



① Rotary handle

page 76

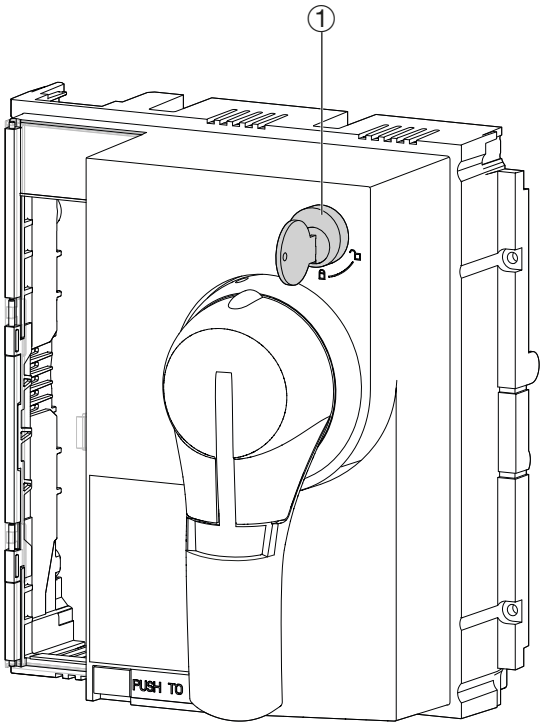
Rotary handle

Rotary handle

Characteristics of the rotary handle:
- Ensures the disconnection of the circuit breaker,
- Clear indication of the 3 positions: ON, OFF and TRIP (tripping),
- The “push-to-trip” test button
- Lockable (padlocks are not supplied), up to 3 padlocks with a diameter of 5.5 - 8 mm can be fitted directly to the handle.
- An optional Ronis key lock can be used to lock the circuit breaker in the ON or OFF position.
- A 320 mm long shaft can be cut to assemble the toggle on the front of the panel.

Locking and interlocking accessories overview

The locking and interlocking accessories are safety devices designed to protect users as well as the distribution system.
They:
- give access to the circuit breaker only to authorised and approved operators.
- limit the risks of errors during operation.



Rotary handle

Accessories

1 Locking of the circuit breaker using key locks page 78

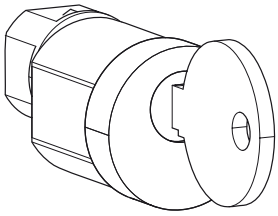
Locking of the circuit breaker using key locks

This device locks the rotary handle in the ON, OFF, or ON and OFF positions.

Locking with key locks

Locking device with a Ronis type key lock

The adaptation accessory for the key lock can be mounted on the rotary handle kit.

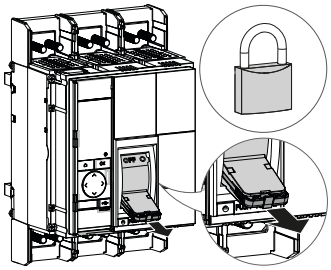


Ronis type lock

Compatible locks

Description	
Ronis type key lock	Ronis key possible: HXS999H

Padlocking on the operation handle of the circuit-breaker

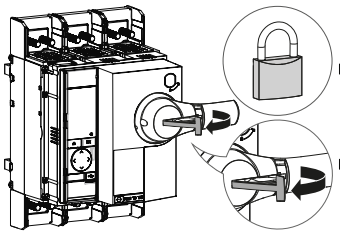


Padlocking

Description

- Maximum padlock diameter: 4 mm max.
- Can be locked in OFF and ON positions
- Up to 3 padlocks Ø 6 mm max. with accessory HXA039H

Padlocking on the rotary handle



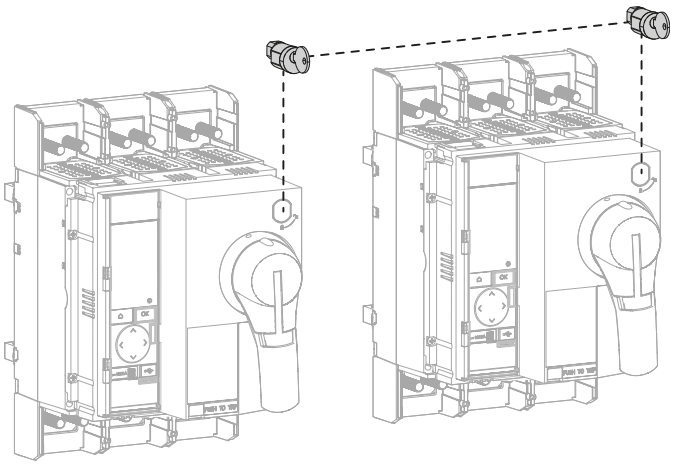
Padlocking

Description

- Maximum padlock diameter: 5.5...8 mm
- Can be locked in OFF position
- Up to 3 padlocks 5.5 to 8 mm max.

Interlocking with keys

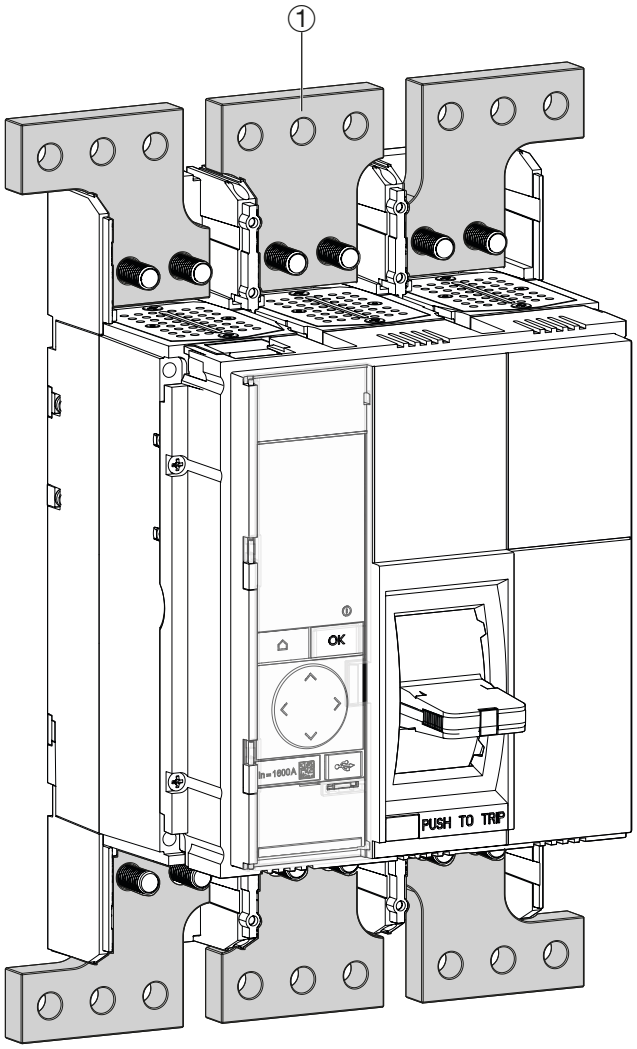
Interlocking possible between 2 circuit-breakers using two key locks on the rotary handles and a single key.
It relies on the use of two identical locks controlled by a single key. This approach enables interlocking between two remote devices, between equipment having different technical characteristics, such as low and medium voltage devices or between circuit breakers and switch-disconnectors.

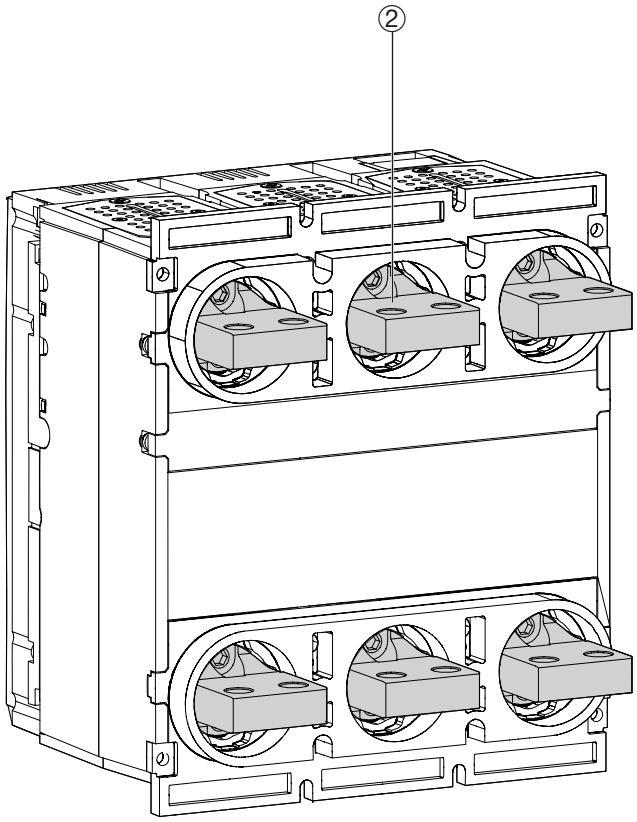


INFORMATION
The circuit-breaker can be locked to ON by means of a specific setting.
Refer to the installation instructions of the accessory.

Overview of the power connection accessories

The connections facilitate the integration of the circuit breaker into distribution systems.
Additional accessories simplify connection according to the needs.





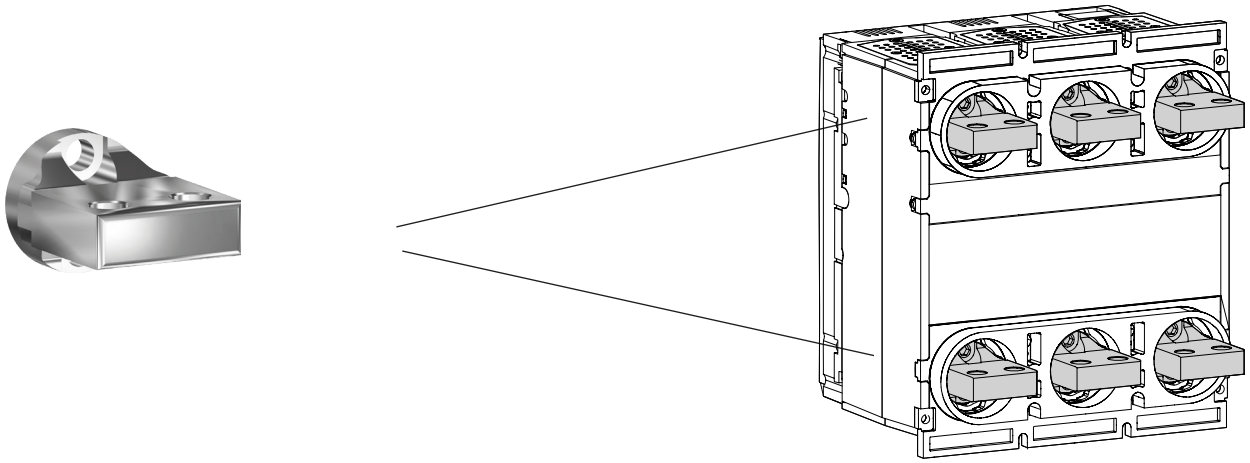
① Rear vertical / horizontal RC connections page 82
② SP spreaders page 82

Connections

PW1600 circuit-breakers are supplied with front connections. A range of optional accessories can be used to adapt connection to the busbar.

Rear vertical / horizontal RC connections

The rear connections can be easily pivoted to the horizontal or vertical.

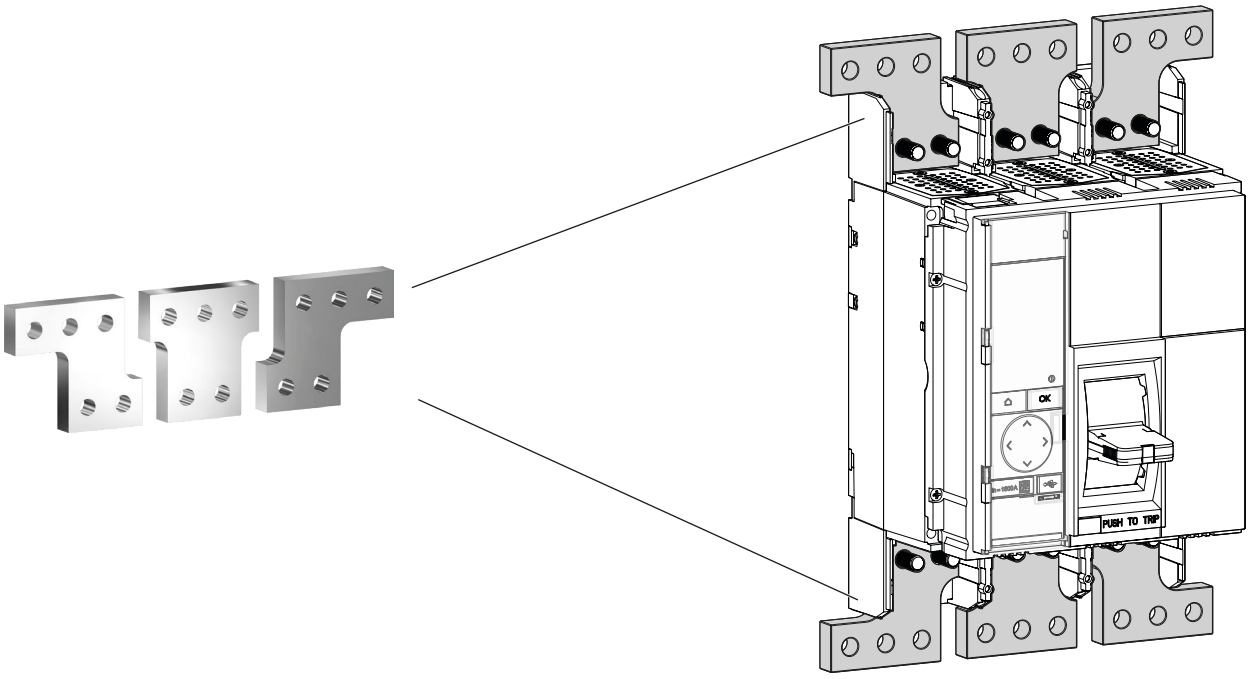


SP spreaders

The spreaders are complementary accessories mounted on the front or rear horizontal connections of PW1600 circuit breakers.

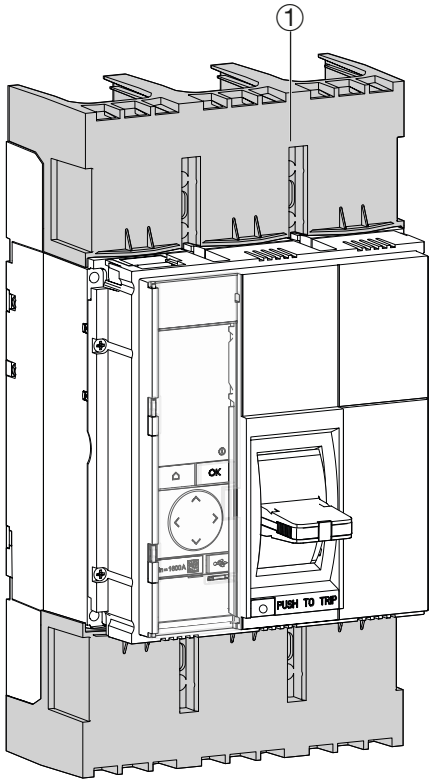
They are used where the connection bars are wider than the circuit breaker connections or for connection by means of cables.

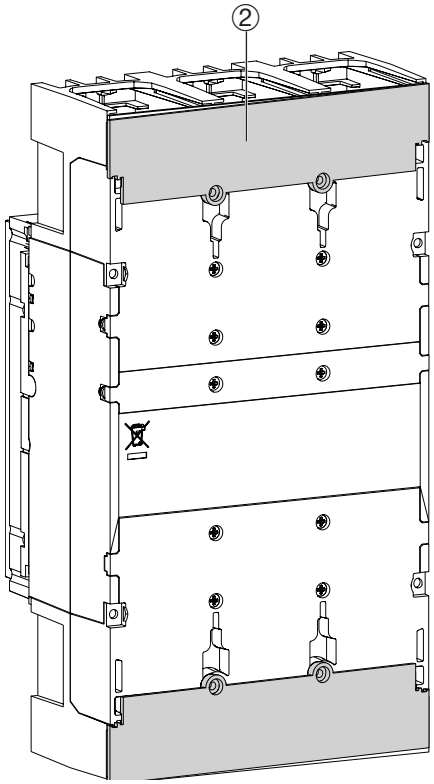
INFORMATION
The use of spreaders is prohibited if the voltage is greater than or equal to 500 V.

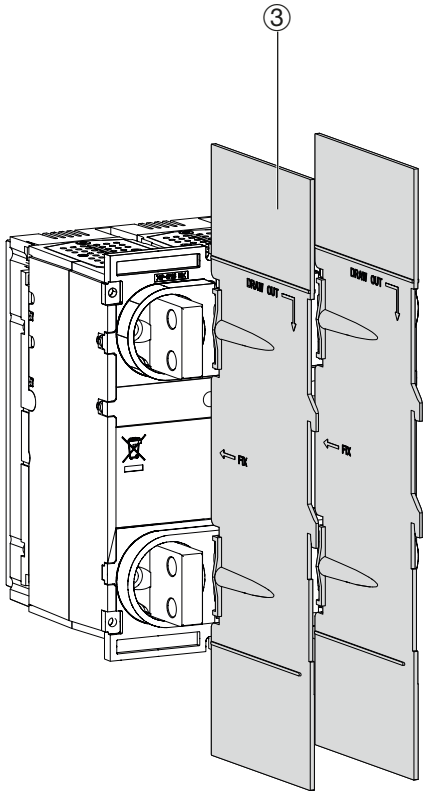


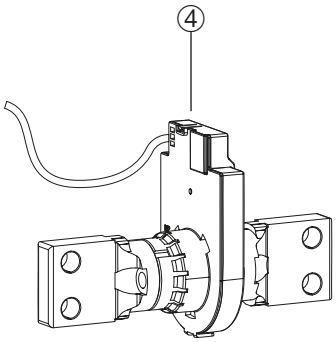
Protection accessories overview

Mechanical protection accessories increase the level of safety in the event of physical intervention on the installation. The electrical protection accessories (ENCT) help prevent deterioration in the assets and improve the level of electrical protection.

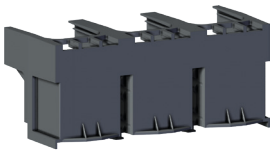






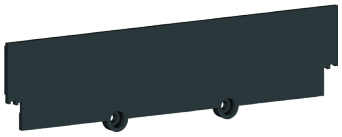


Terminal covers



The circuit-breakers can be fitted with terminal covers to isolate the power connections.

Rear protections



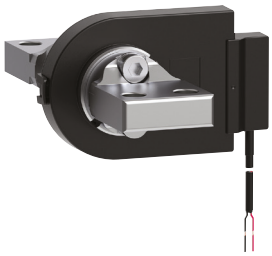
Rear protections provide complete isolation of the rear terminals.

Interphase barriers

The interphase barriers are complementary accessories mounted vertically between the rear connections of the circuit breakers.
Each interphase barrier improves the insulation between the connection sockets and prevents arcing between two connections.

INFORMATION
Interphase barriers cannot be installed with spreaders.
Installing interphase barriers is mandatory on a circuit breaker if the voltage is greater than or equal to 500 V.

ENCT external neutral sensor

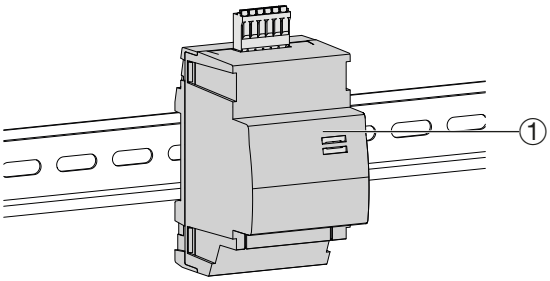


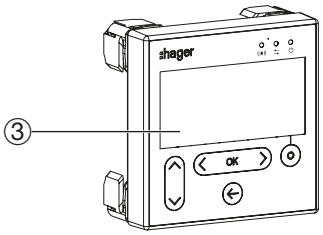
ENCT External Neutral Sensor

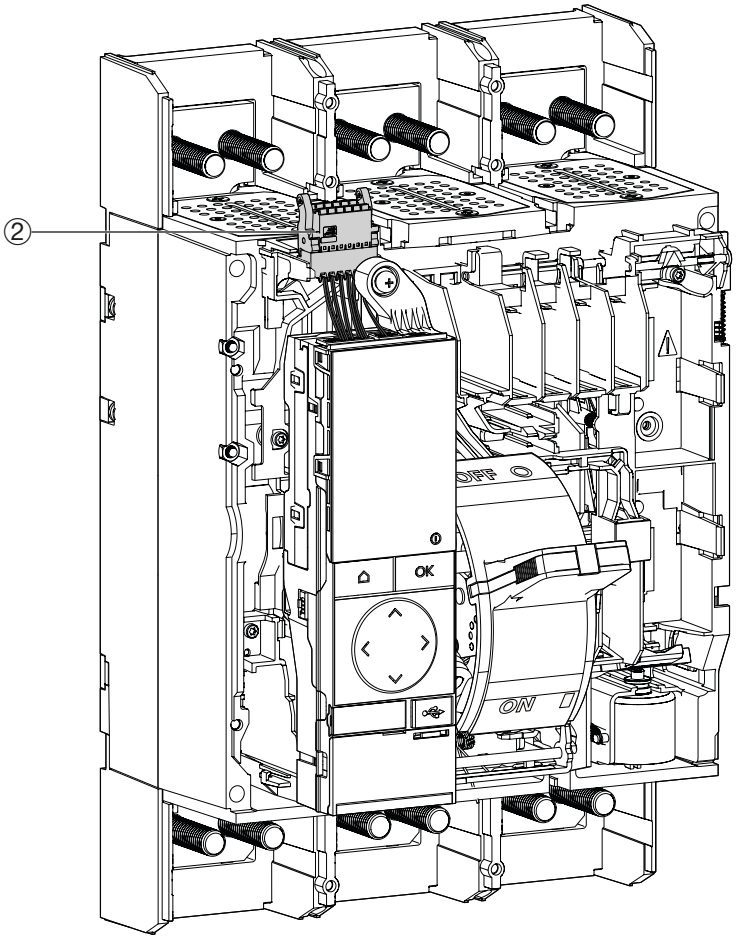
The ENCT external neutral current sensor allows neutral protection to be provided on a 3-pole circuit breaker in a TN earthing system.
It is installed on the neutral distribution bar and connects to the electronic trip unit using the ENCT terminal connection of the circuit breaker.

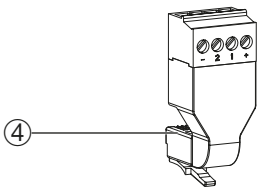
Communication accessories overview

The communication accessories allow access to state data, electrical values and control of devices via the Modbus TCP/IP and Modbus RTU communication protocols. These accessories are compatible only with the Energy circuit breakers range.









Accessories

Communication modules

The Modbus-RTU and Modbus-TCP communication modules allow the h3+ circuit breakers with Energy trip units to be connected either to a master Modbus for an RTU module, or to a client Modbus for a TCP module.

Modbus RTU module

The Modbus-RTU communication module connects to an RS 485 serial communication network using the Modbus-RTU protocol.

Modbus TCP module

The Modbus-TCP communication module connects to an Ethernet network using the Modbus TCP/IP protocol.

These communication modules are compatible and specially indicated to interface with the agardio.manager HTG411H data server.
They enable the following principal functions:
- Reading of diagnostic and measurement data,
- Reading of state conditions and remote operations,
- Changing and displaying protection settings,
- Reading of identification and configuration data of the circuit breakers,
- Remote control of the circuit breaker,
- Setting the clock and synchronisation,
- The configuration of protections and alarms,
- The configuration and remote control of multi-tariff counters,
- the setting of various other parameters,
- remote inhibition of advanced protections,
- remote switching between profile A and profile B,
- the use of other embedded commands,
- the transfer of the timestamped events history.

Modbus-RTU module technical specifications

The Modbus-RTU HWY967H communication module has two RJ45 sockets to facilitate insertion in to the Modbus daisy chain. It does not have a 120 Ω terminal resistor. It is recommended that the reference item HTG467H be used to connect a 120 Ω terminal resistor to the module.

MODBUS RTU	Value	Description
ADDRESS	1 to 247	Modbus address setting
BAUD	4800; 9600; 19200; 38400	BAUD rate setting
PARITY	Odd	1 stop bit
	Even	1 stop bit
	No	2 stop bits
STOP BIT	1 or 2	Setting the parity includes automatically managing the automatic adjustment of the number of Stop bits.

Modbus-TCP module technical specifications

The Modbus-TCP HWY968H communication module has an RJ45 socket to connect to an Ethernet bus. It does not have a router function.

This module includes a secure web server (HTTPS) enabling configuration of the IP parameters (static or dynamic configuration), time synchronisation mode and TLS security for the web servers and Modbus TCP/IP servers.

MODBUS TCP	Default value	Description
DHCP	Off	Off: the IP address must be configured manually On: the IP address is assigned automatically by the internet network
IP ADDRESS	172.16.1.1	Enter the unused fixed IP address corresponding to the network parameter
SUBNET MASK	255.255.255.0	Enter the subnet mask
GATEWAY	0.0.0.0	Enter the address of the network gateway

Electrical characteristics

Rated DC supply voltage	24 V (+/- 30 %) SELV
Modbus-RTU module power consumption	25 mA
Modbus-TCP module power consumption	35 mA

Panel display

The HTD210H panel display allows the state, measurement and setting information for a door or panel of the electrical assembly to be displayed.
It also allows the main protection and alarm settings to be changed.
The HWY210H adapter is necessary to connect the HTD210H panel display, a 24V DC power supply and the cables enabling the connection to the terminals CIP 1 and CIP 2.

HWY210H adapter

The HWY210H adapter is necessary to connect the HTD210H panel display, a 24V DC power supply and the cables enabling the connection to the terminals CIP 1 and CIP 2.

Functions of the HTD210H panel display

It allows the following to be displayed:
- the protection parameters
- the measured values
- the alarm management parameters
- the optional alarm and tripping event logs
- the circuit breaker's status and identification information.

It allows the following to be changed:
- the circuit breaker protection parameters
- the measurement parameters
- the date and time
- the optional alarms and overload prealarms.

It also allows the minimum/maximum measurement counters to be reset and the optional alarm and trip logs to be erased.

Electrical characteristics

Rated DC supply voltage	24 V (+/- 30 %) SELV
Current consumption	85 mA

Environmental and mechanical characteristics

Operating temperature range	-10 °C…+55 °C
Storage temperature	-20 °C…+70 °C
Pollution degree	2
Installation category	III
IP class of front side	IP65
IP class of back side	IP20
Mechanical protection (front face)	IK07

Physical characteristics

Dimensions L x H x D	97 x 97 x 46 mm
Panel/door cut-out dimensions	92 x 92 mm
Weight	165 g
Display dimensions	37 x 78 mm
Type of connector	RJ9
Cable length max.	10 m

Installation and operating recommendations

Altitude derating
Up to an altitude of 2000 m above sea level, there is no derating required for the electrical properties of the circuit breakers.
However, above 2000 m, due to decrease in air density, the heat loss ability of the circuit breaker is reduced and decreases the dielectric strength. A derating factor must be applied to the electrical characteristics; for that, please consult us.

Circuit breaker marking
Markings on the circuit breakers comply with the International Standard IEC 60947-1, Appendix C.

Vibrations
The circuit breakers withstand mechanical vibrations.
They comply with the standard IEC 60068-2-52:
- 2.0 to 13.2 Hz and amplitude ±1 mm.
-13.2 to 100 Hz acceleration ±0.7 G
- Resonance frequency ±1 mm/±0.7 G for 90 minutes.
Excessive vibration may cause nuisance (false) tripping and/or damage to connections and/or mechanical parts.

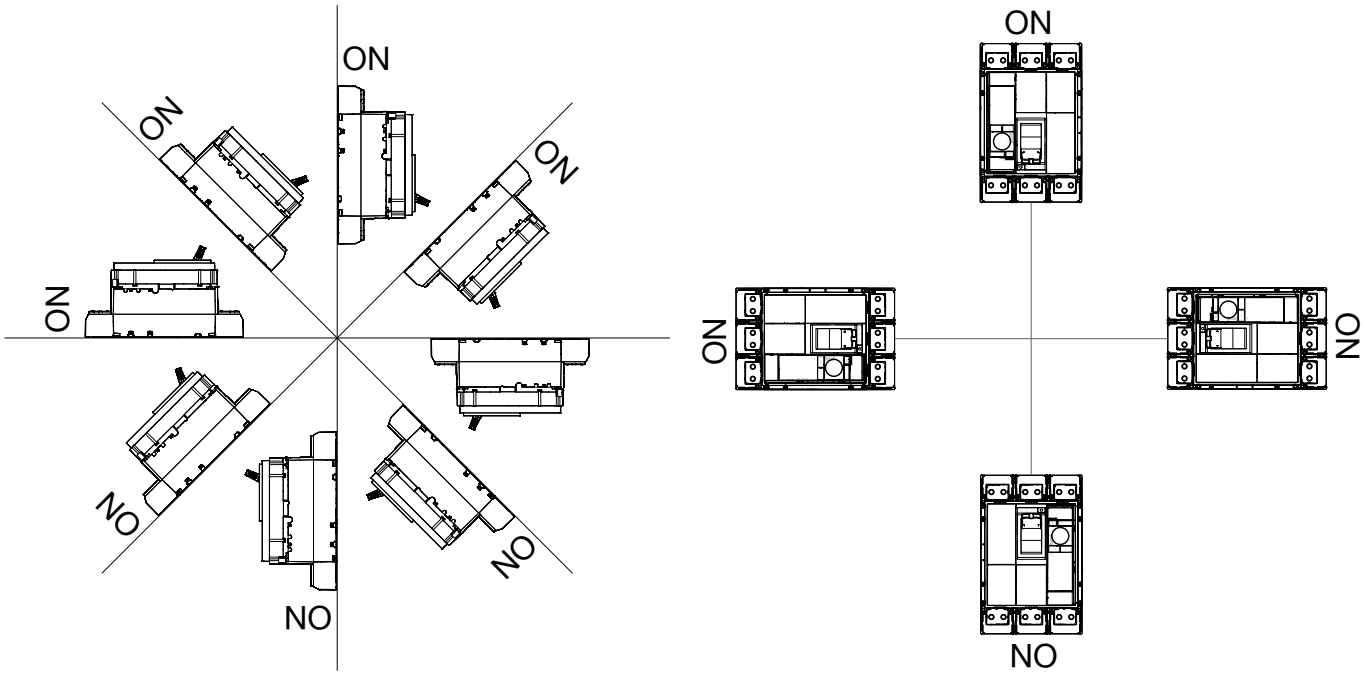
Electromagnetic interference
The circuit breakers are protected against:
- overvoltage caused by circuit switching,
- overvoltage caused by atmospheric disturbances or a distribution system fault (e.g. failure of a lighting system),
- devices emitting radio waves (radios, walkie-talkies, radar, etc.),
-Electrostatic discharges produced directly by users.

The circuit breakers have successfully passed the electromagnetic compatibility tests (EMC) with immunity levels listed in the chapter on General Characteristics.

IP protection ratings
The IP protection class of the circuit breakers is dependent on their integration into their cabinets. The front and the connection terminal blocks are IP20.

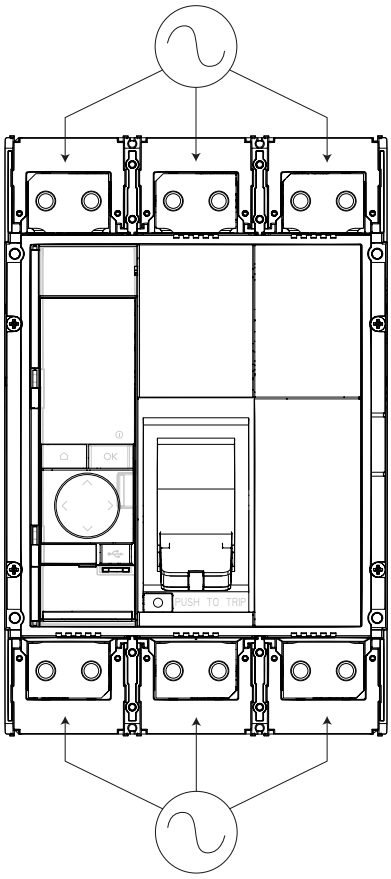
Mounting position

The circuit breakers can be mounted at any angle without affecting the performance and the characteristics.



Direction of power supply

The circuit breakers can be powered from either the top or the bottom connections, without any decrease in performance. All connections and isolation accessories can be used on circuit breakers powered either from the top or from the bottom.



Reclassification due to temperature
The circuit breakers are calibrated at an ambient temperature of 50°C for overload protection. The temperature reclassifications given below are as per the IEC 60947-2 conditions for tests performed in the open air.

Influence of ambient temperature on rated current values (In) of electronic circuit breakers

The temperature of electronic circuit breakers depends on the operating current and ambient temperature.

However, ambient temperature does not affect the protection setting of electronic circuit breakers.

Derating table for rated current:
Fixed PW1600 with vertical rear sockets

	Temperature °C			
In (A)	**50**	**60**	**65**	**70**
630	630	630	630	630
800	800	800	800	800
1000	1000	1000	1000	1000
1250	1250	1250	1250	1250
1600	1600	1600	1600	1553

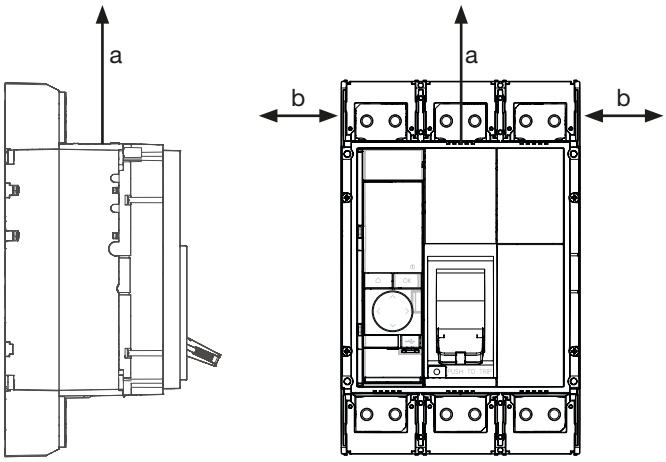
WARNING

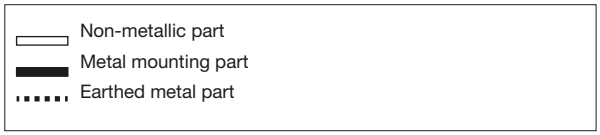
Risk of electric shock
Danger to life, risk of injury due to electric shock, or risk of serious injury.
Make sure that the device is only operated by qualified personnel in accordance with to the installation standards in force in the relevant country.

Safety clearances and minimum distances
The safety clearance distances between the circuit breaker and its enclosure parts (grounded metal parts) must be maintained to prevent arcing faults.

In some cases where other specifications require different isolation distances to those shown here, the greater distance must be maintained. If two different circuit breaker models are installed one above the other, the safety clearance distance between the two models should comply with the model specifications of the bottom circuit breaker.

Minimum distance between the circuit breaker and the top, bottom or side metal parts of the cabinet





	Insulating parts	Metallic part	Active part
a (mm)	0	150	180
b (mm)	0	10	60

Power loss

The power loss values of the circuit breakers are used to calculate the temperature rise in the switchboard in which they are installed.

The values given in the tables below are typical values for a device operating at a full rated load with a frequency of 50/60 Hz.

The value given is the power loss per pole at In, 50/60 Hz. Measurement and calculation of power loss are carried out in compliance with the recommendations of Appendix G of standard IEC 60947-2.

Total power loss at full rated load and a frequency of 50/60 Hz is equal to the power losses per pole multiplied by 3.

Power loss of the circuit breakers

Number of poles	Rating In (A)	P / pole (W)	Total P / circuit breaker (W)
3 /4	630	4.5	13.4
	800	7.9	23.6
	1000	15.7	47
	1250	22.8	68.4
	1600	43.2	129.6

Additional power loss

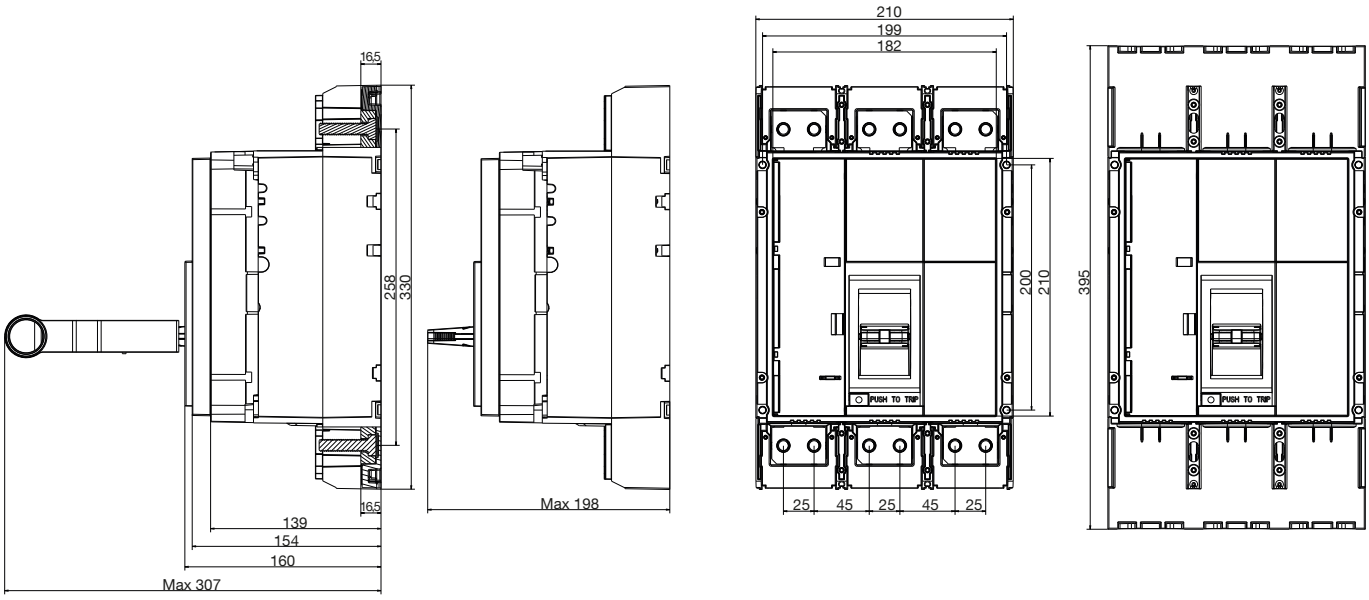
Power loss caused by the connection accessories has to be taken into account. Thus, the total power loss is equal to the sum of the power losses of the circuit breaker and all the corresponding connection accessories.

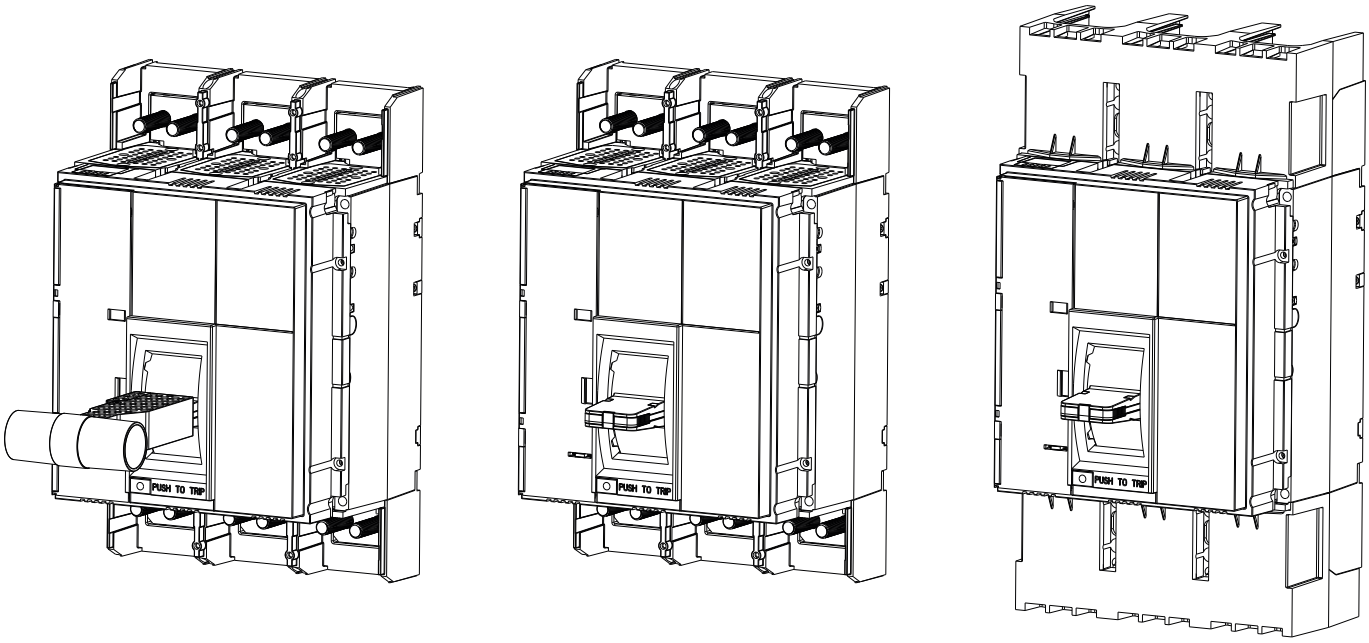
Power loss of the circuit breakers + accessories

Number of poles	Rating In (A)	Total P / circuit breaker (W)	Additional P/ accessory kit (W)			
			Rear connections	Front connections	Vertical connection bar VCA	Terminal extension spreaders
3	630	13.4	6.3	8.4	3	8.1
	800	23.6	10.2	13.6	4.9	13.1
	1000	47	15.9	21.2	7.6	20.4
	1250	68.4	24.8	33.2	11.8	31.9
	1600	129.6	40.7	54.3	19.39	52.2
4	630	13.4	6.3	8.4	1.2	9.1
	800	23.6	10.2	13.6	3	14.6
	1000	47	15.9	21.2	4.9	22.8
	1250	68.4	24.8	33.2	11.8	35.6
	1600	129.6	40.7	54.3	19.39	58.3

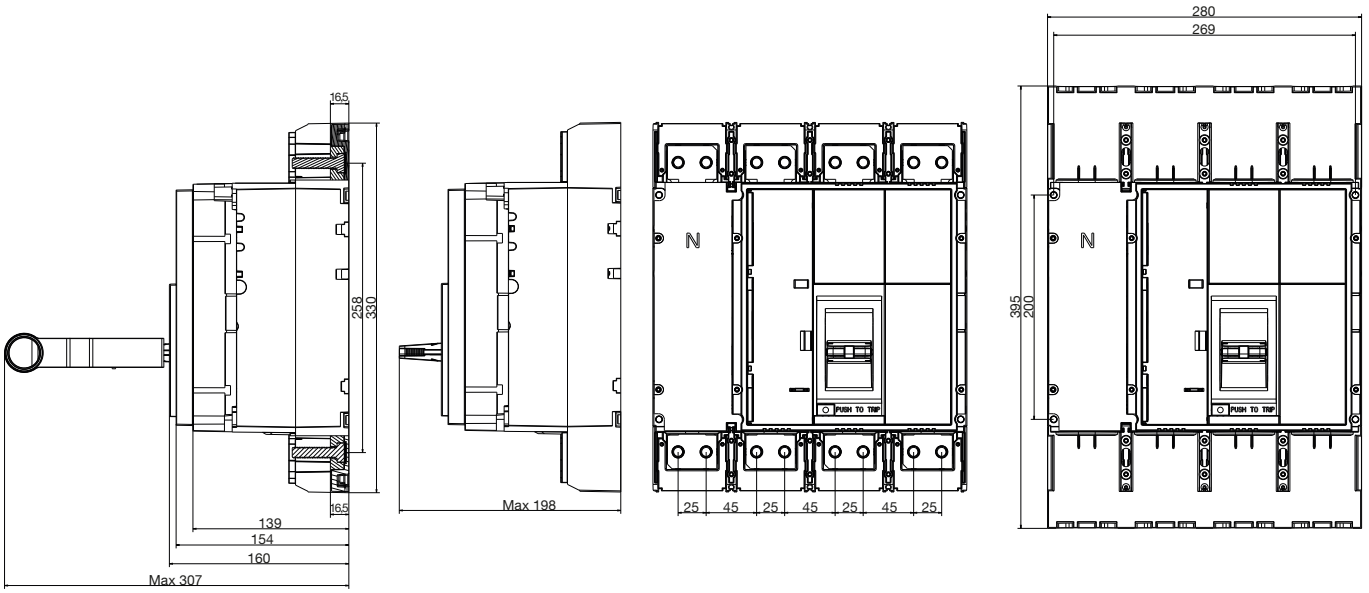
Dimensions

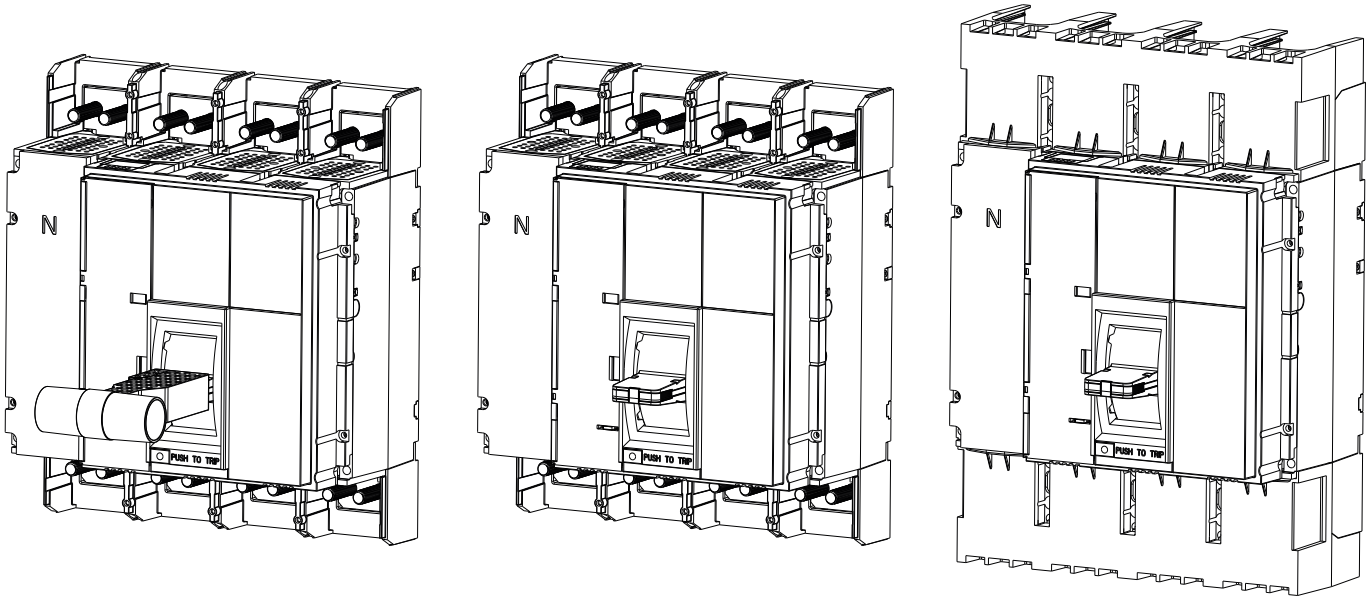
3 poles - standard version



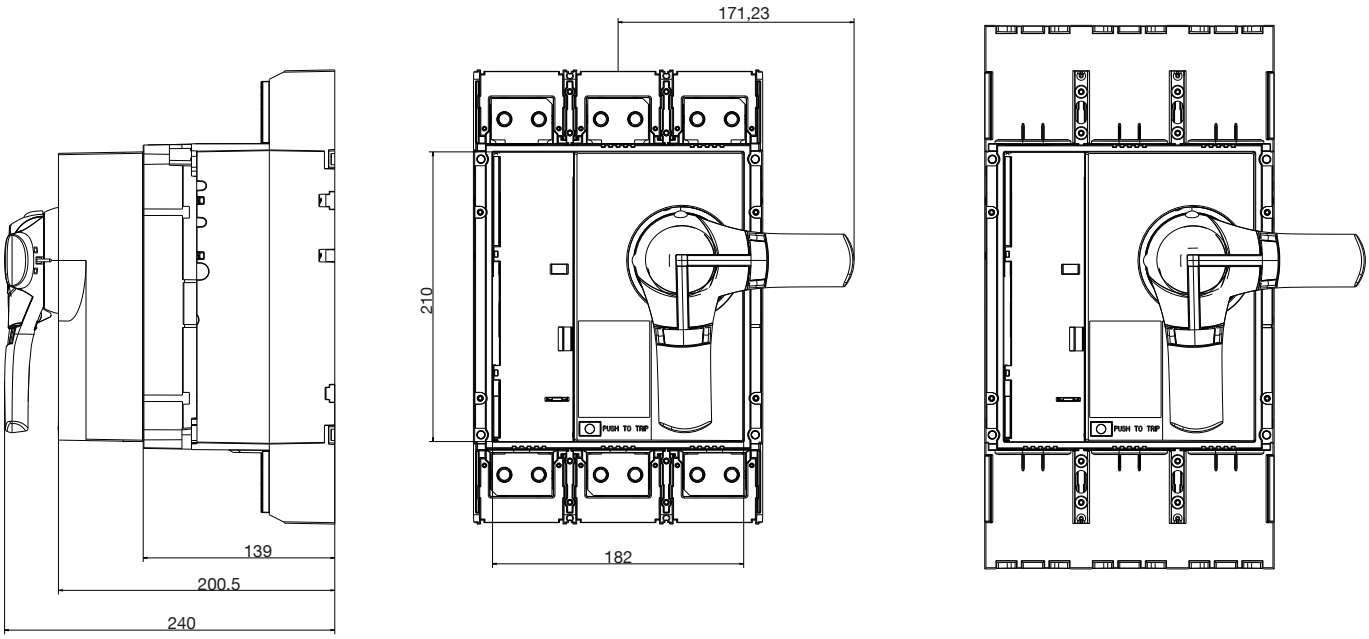


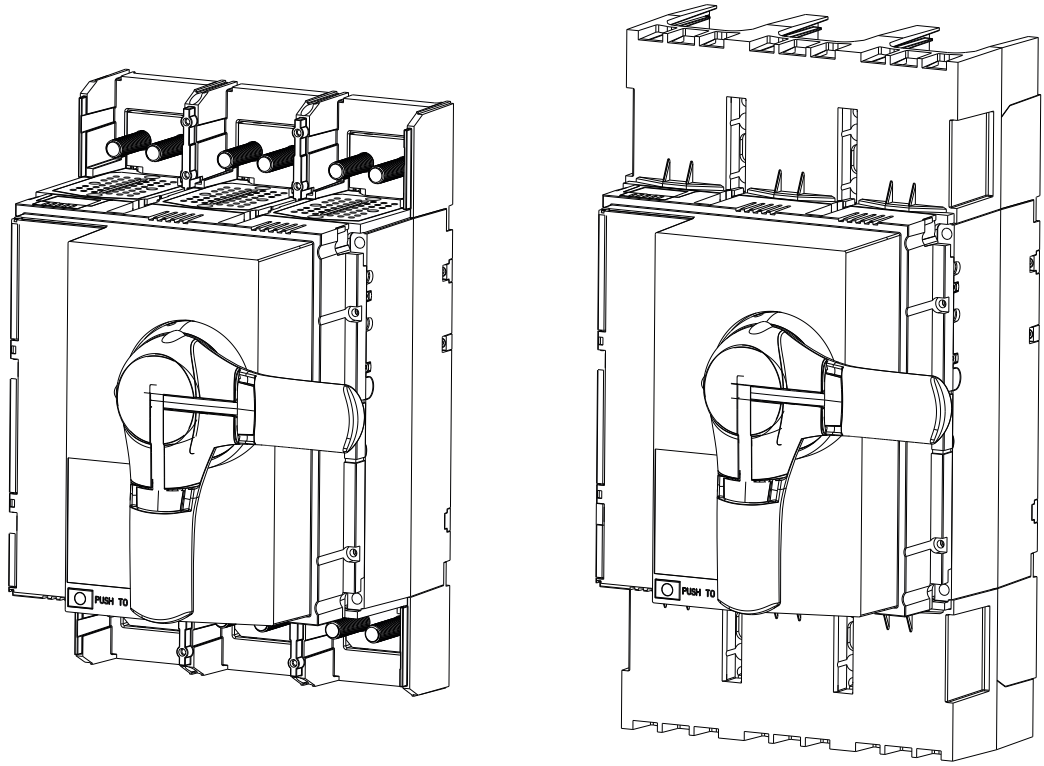
4 poles - standard version





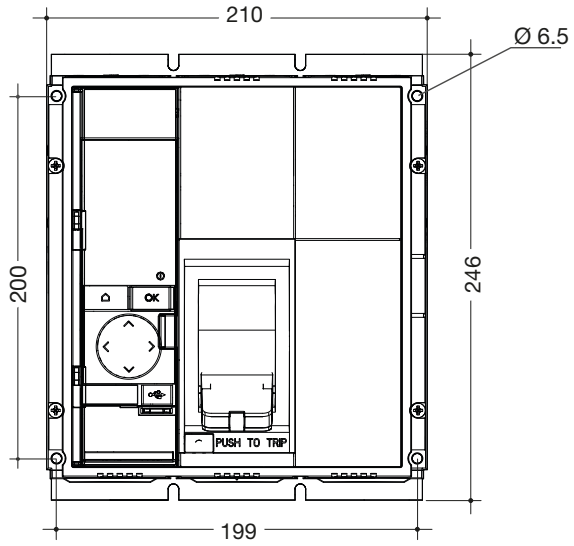
3 Poles - Rotary handle



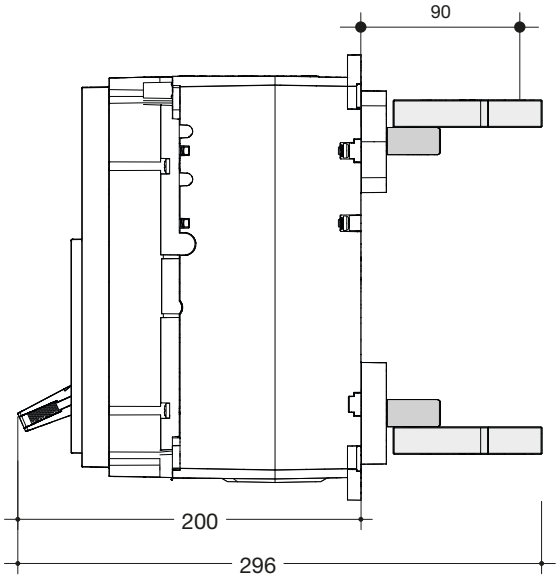


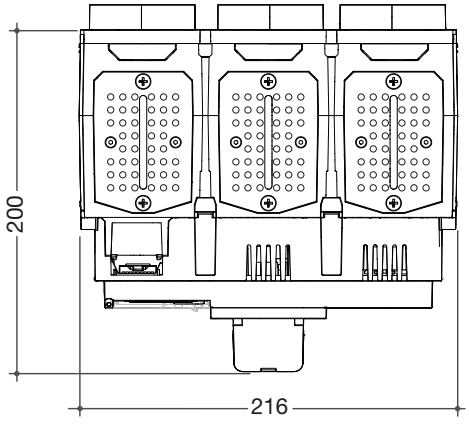
3 Pole and 4 Pole - With RC rear connections

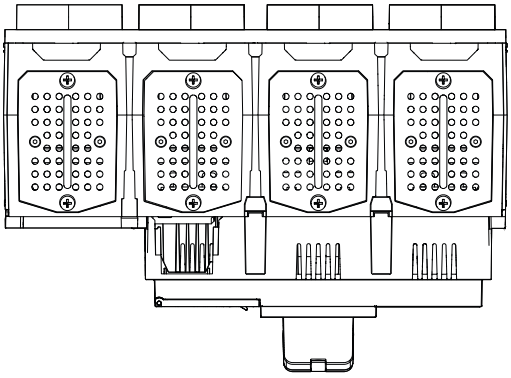
Front view



Side view



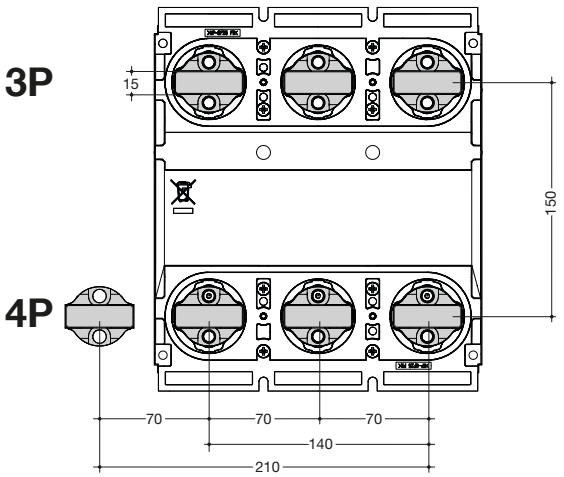




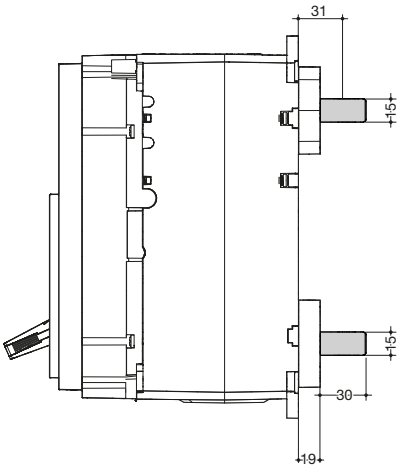
Rear horizontal RC connections

For 3-pole or 4-pole circuit breaker

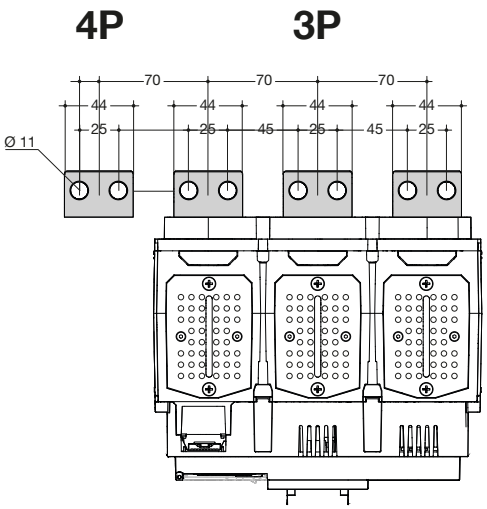
Rear view



Side view



Top view



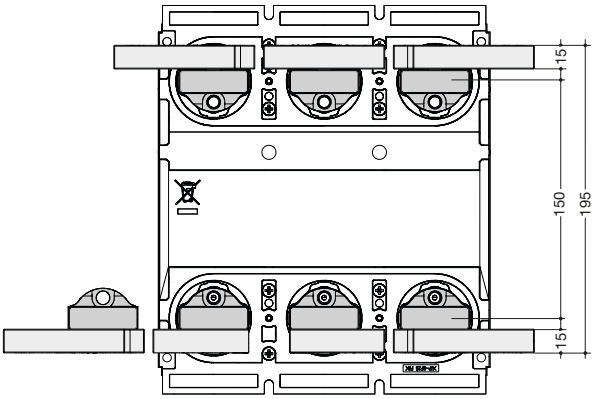
Rear horizontal RC connections

With SP spreaders for 3-pole or 4-pole circuit breakers

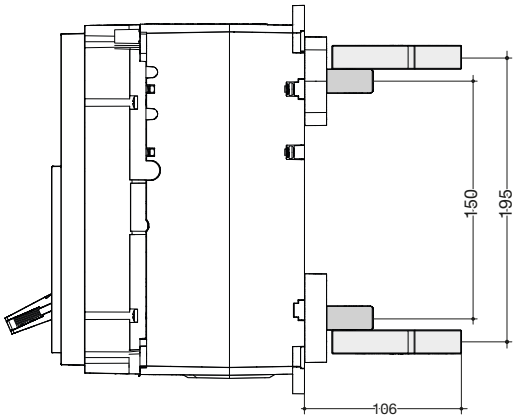
Rear view

3P

4P

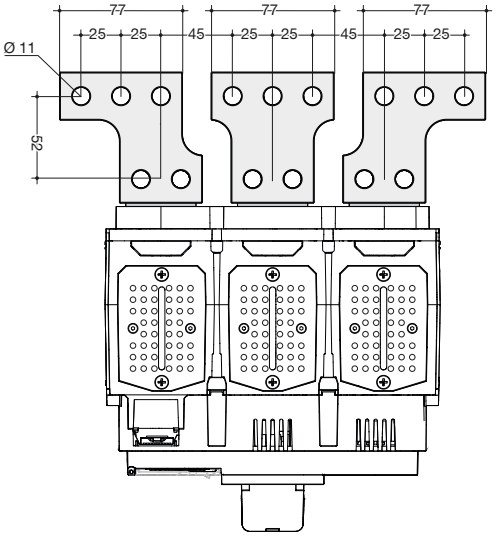


Side view

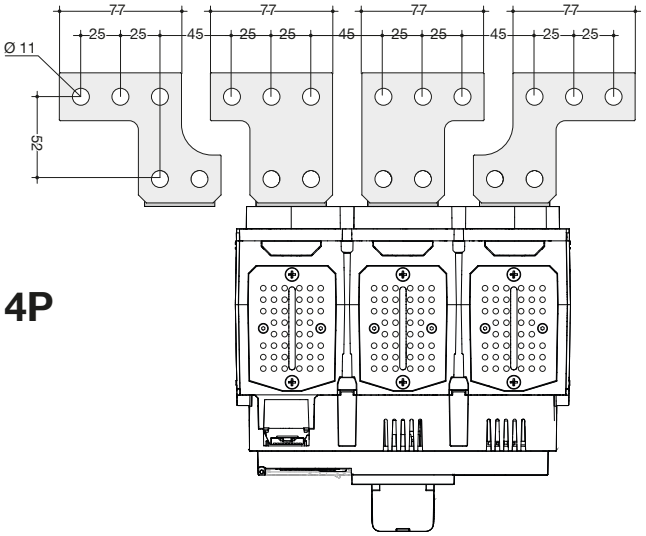


Top view

3P



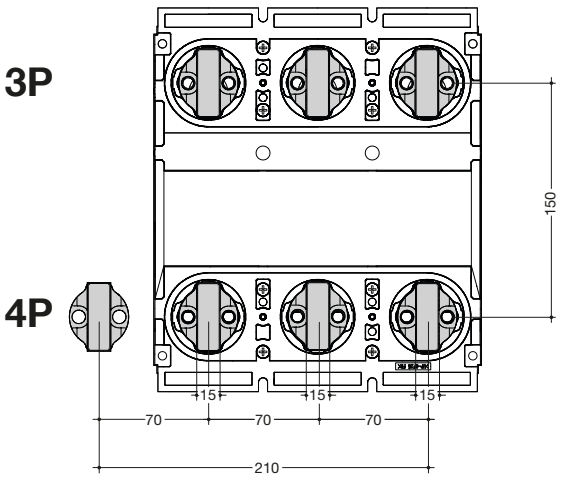
4P



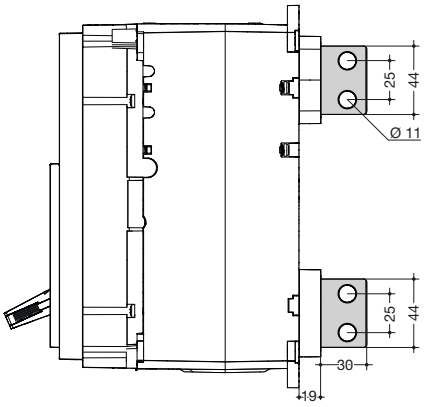
Rear vertical RC connections

For 3-pole or 4-pole circuit breaker

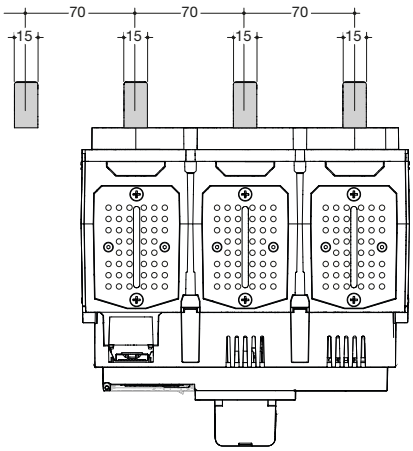
Rear view



Side view



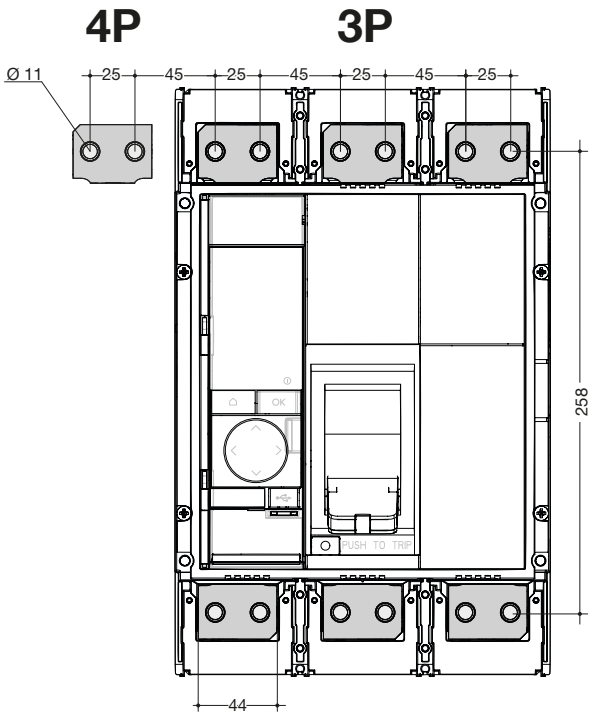
Top view



Front sockets

For 3-pole or 4-pole circuit breaker

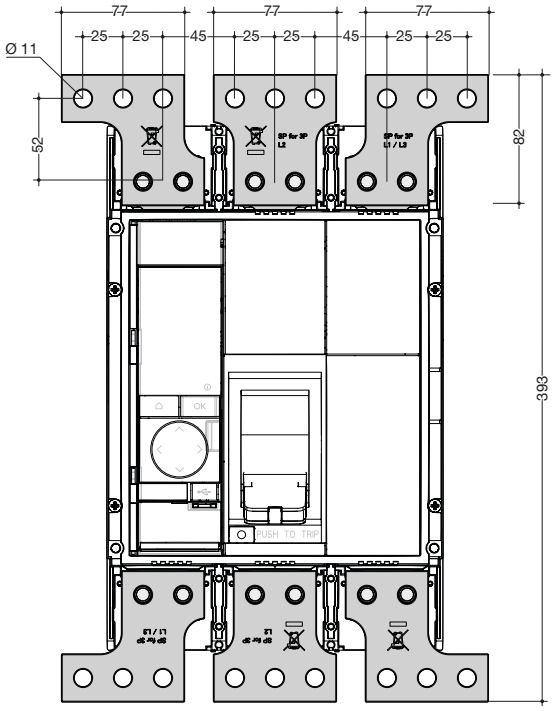
Front view



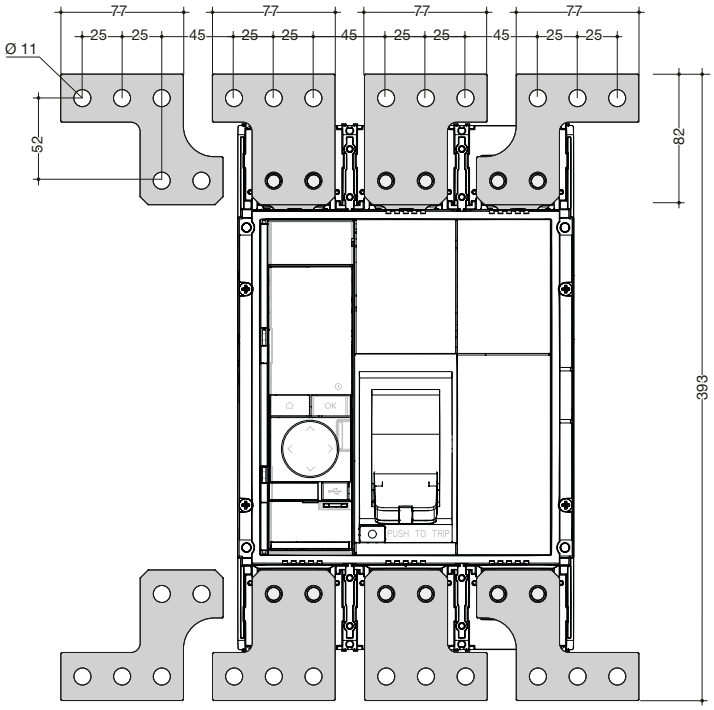
Front sockets

With SP spreaders for 3-pole or 4-pole circuit breakers

Front view



3P



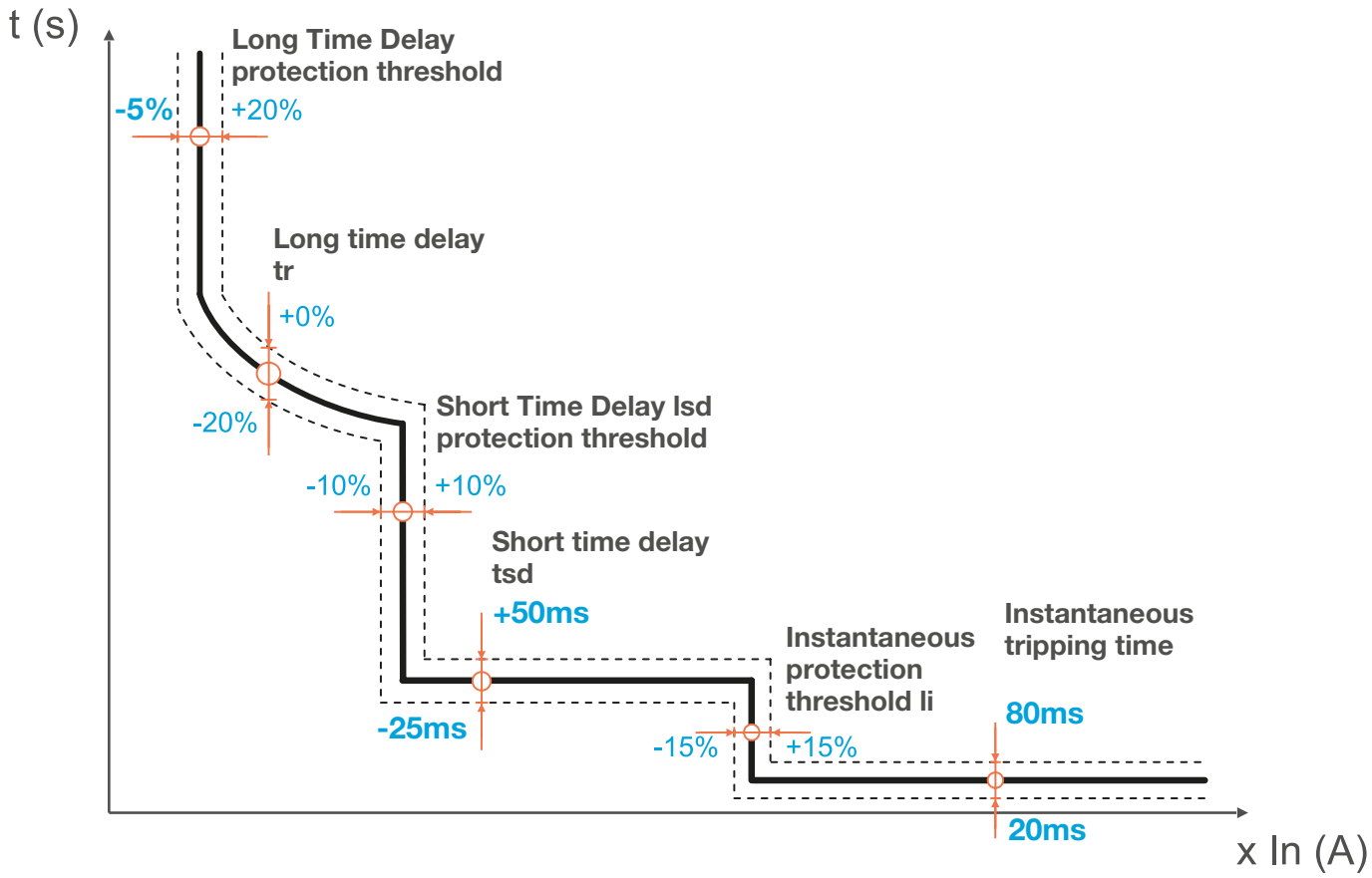
4P

Complementary characteristics

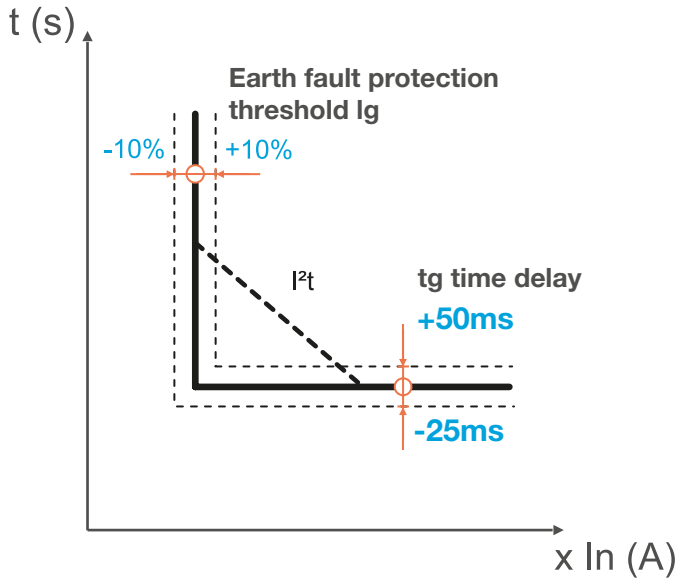
Tripping tolerance of electronic trip units

The tolerances of the protection tripping curves for electronic trip units are described below.

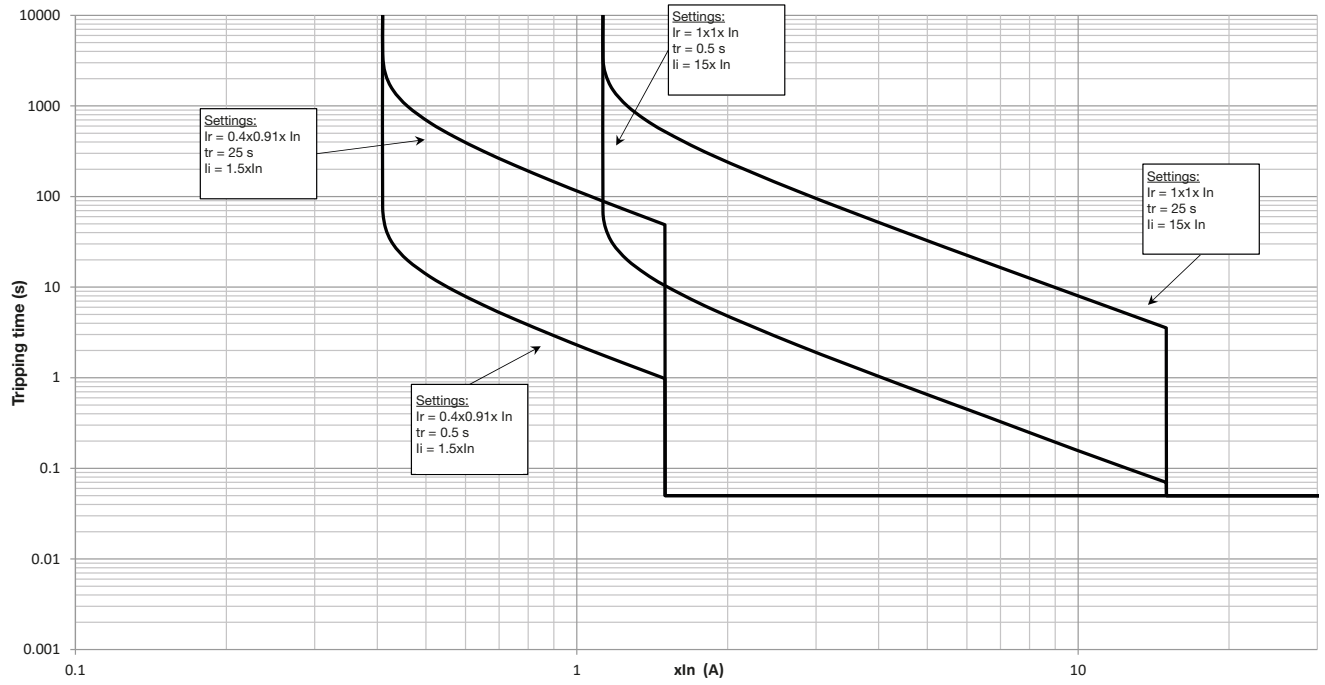
Tolerances of LI, LSI and LSIG tripping curves



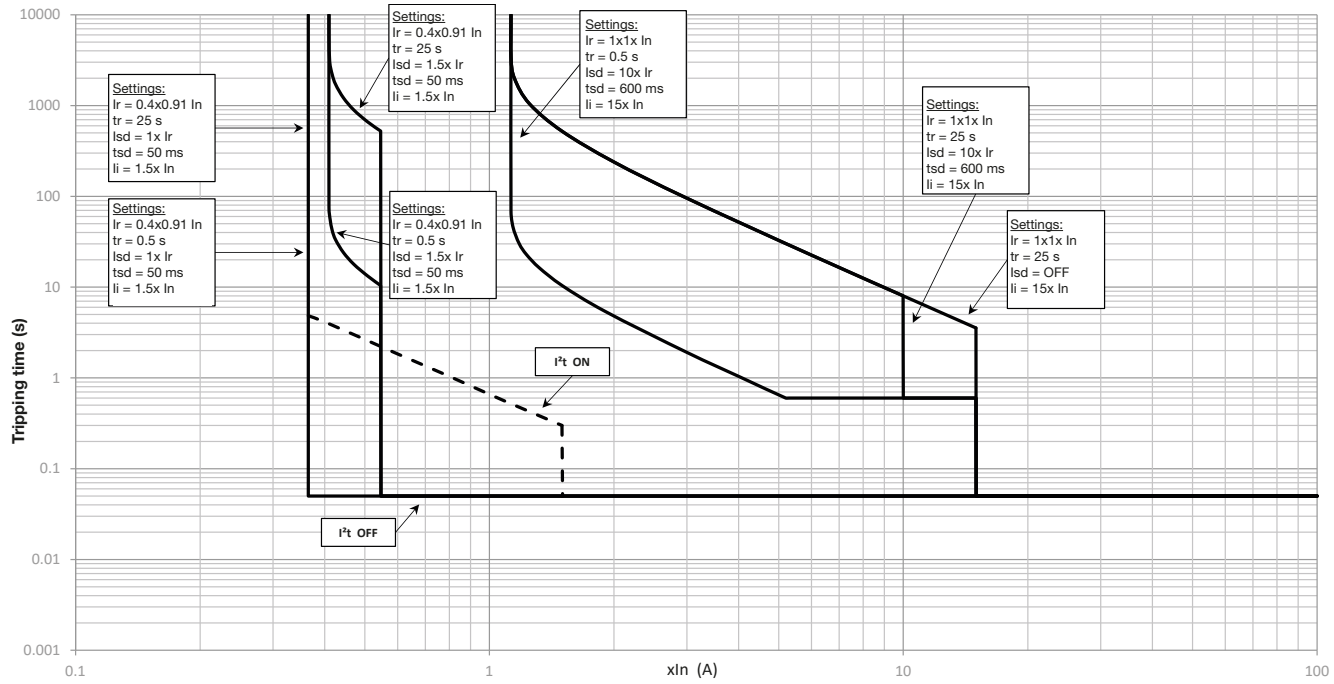
Tolerances of the earth fault protection curve (GF) for the LSIG trip unit



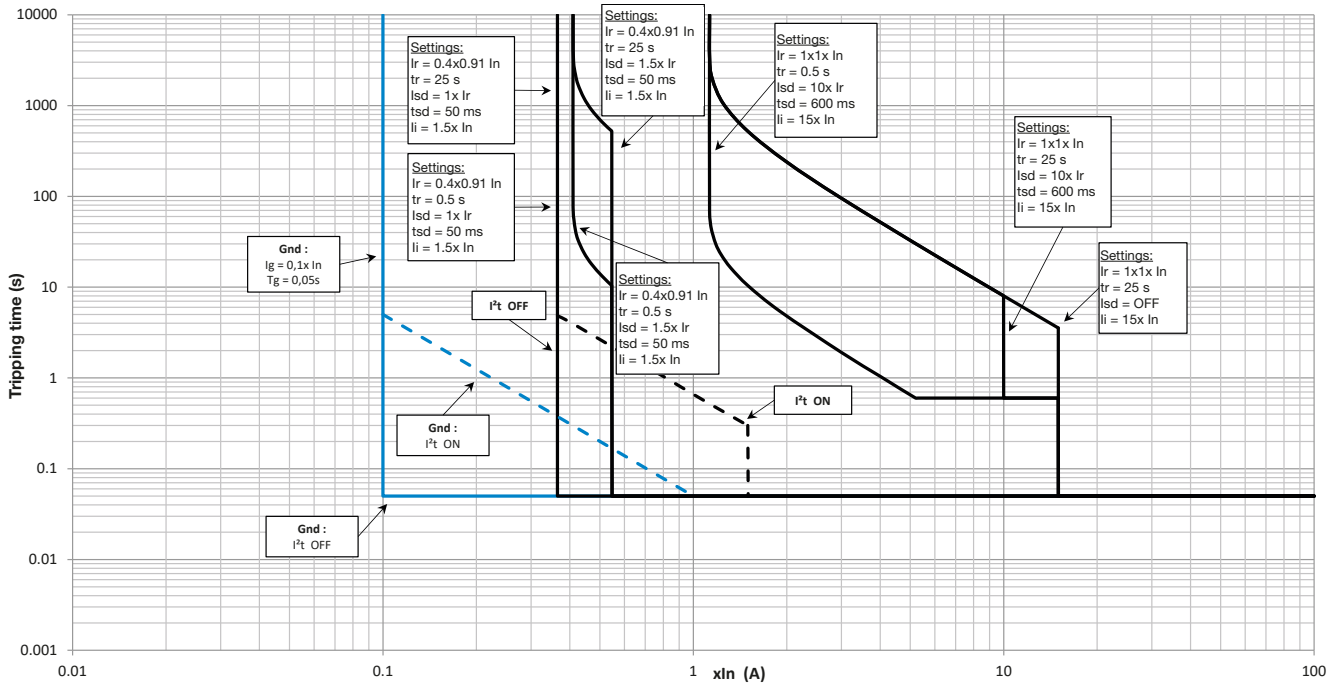
Circuit breaker with LI sentinel electronic trip unit



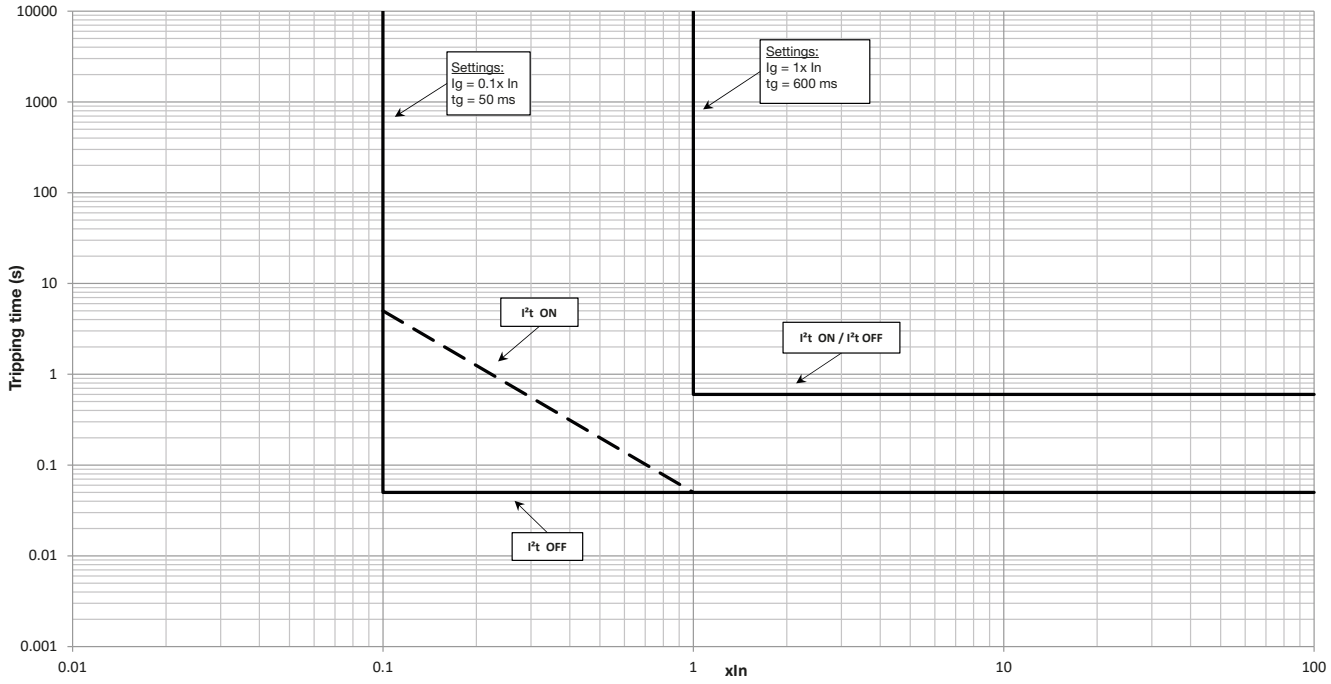
Circuit breaker with LSI sentinel electronic trip unit



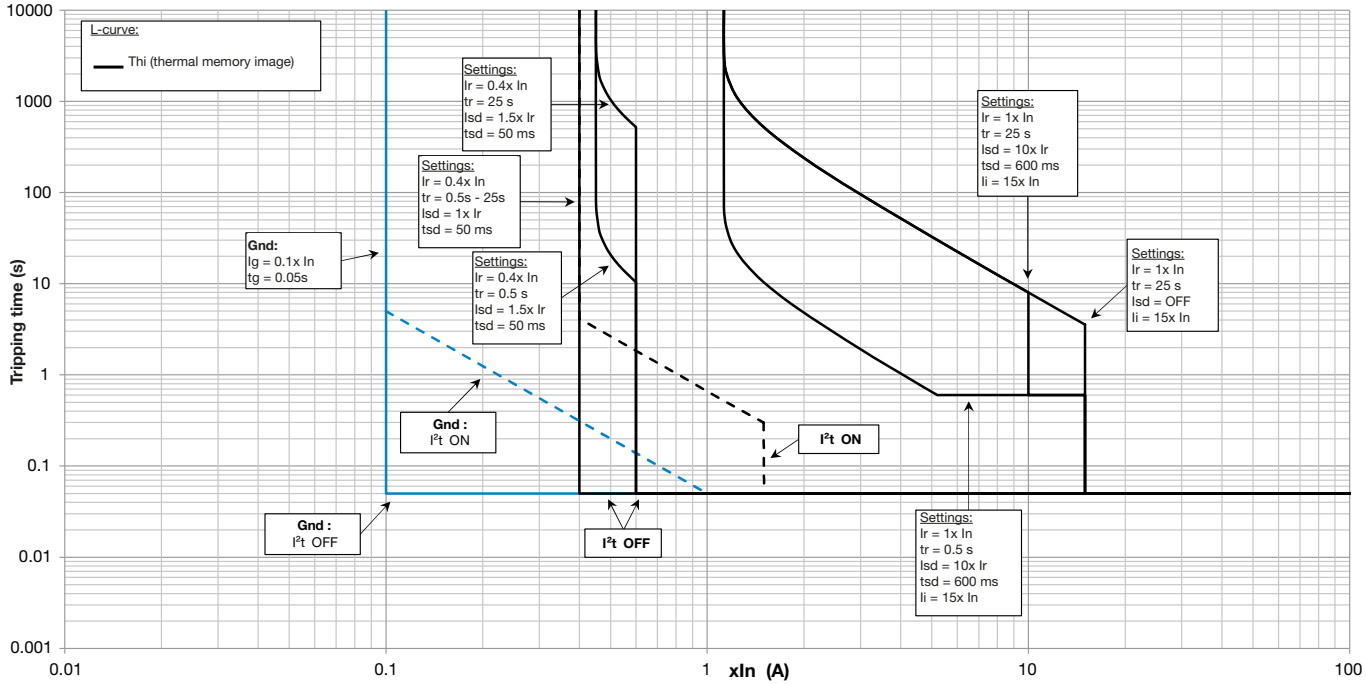
Circuit breaker with LSIG sentinel electronic trip unit



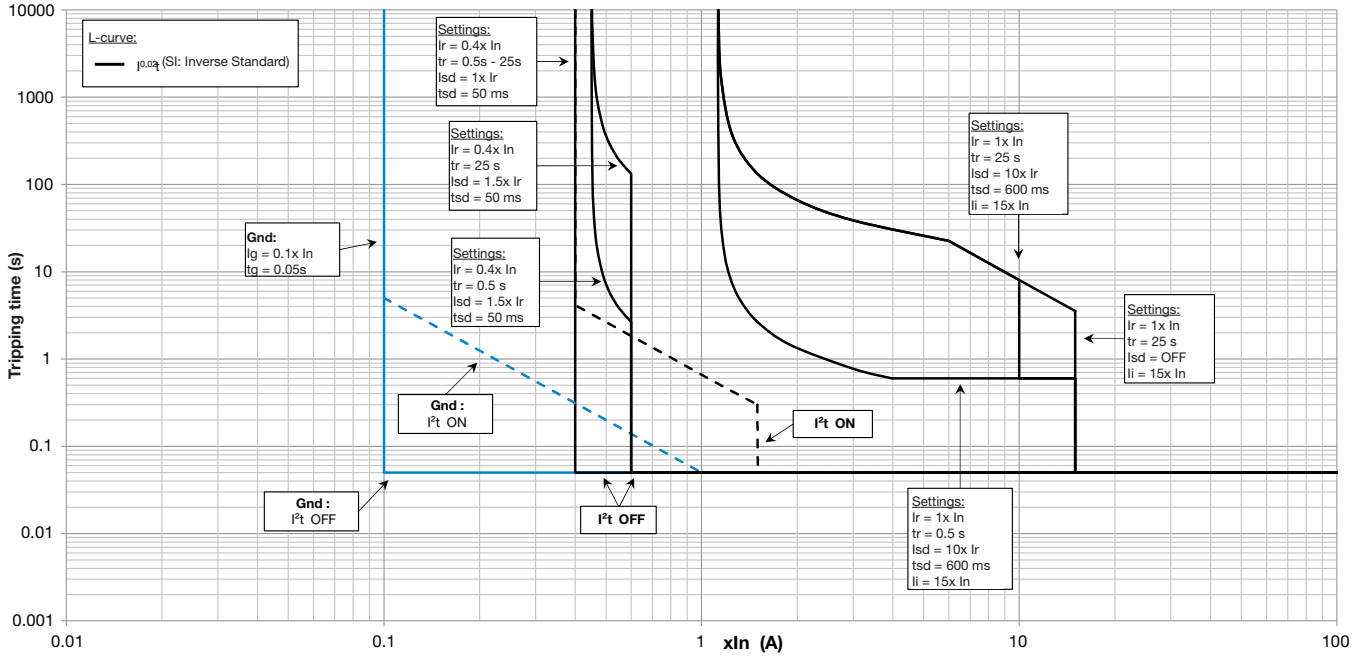
Earth fault curve



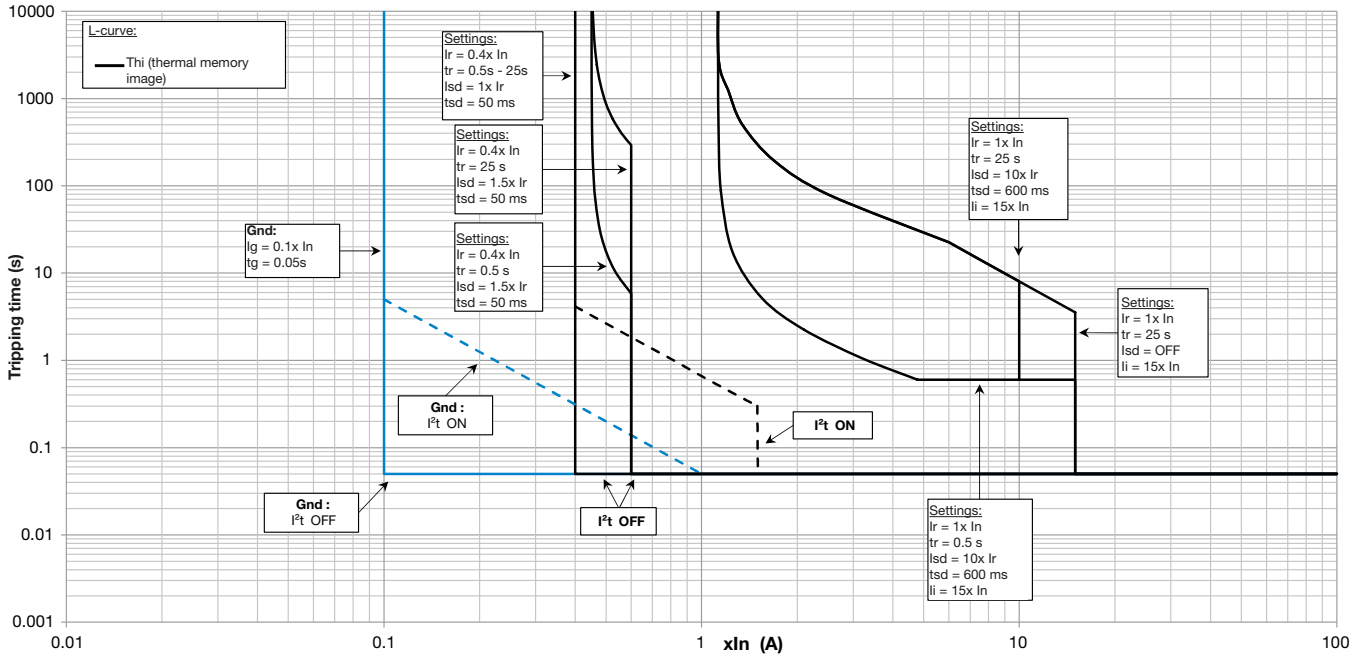
Circuit breaker with LSIG sentinel Energy electronic trip unit – Thi curve



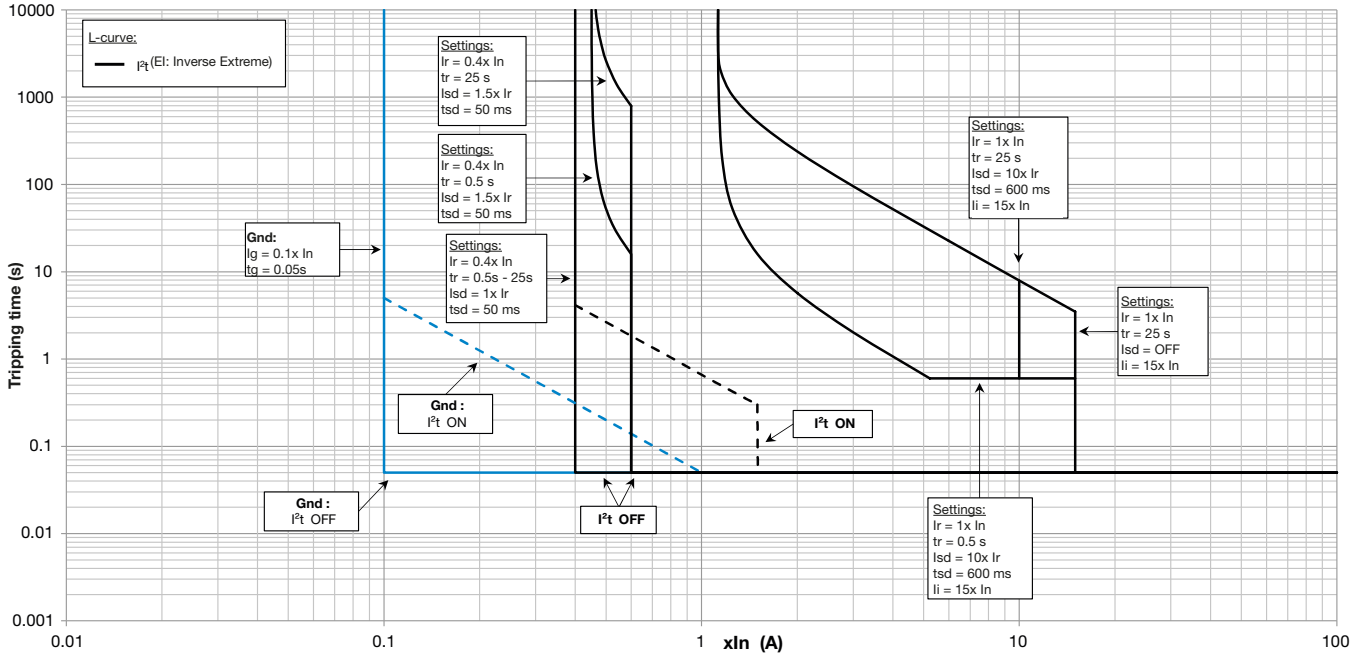
Circuit breaker with LSIG sentinel Energy electronic trip unit – SI I0.02t



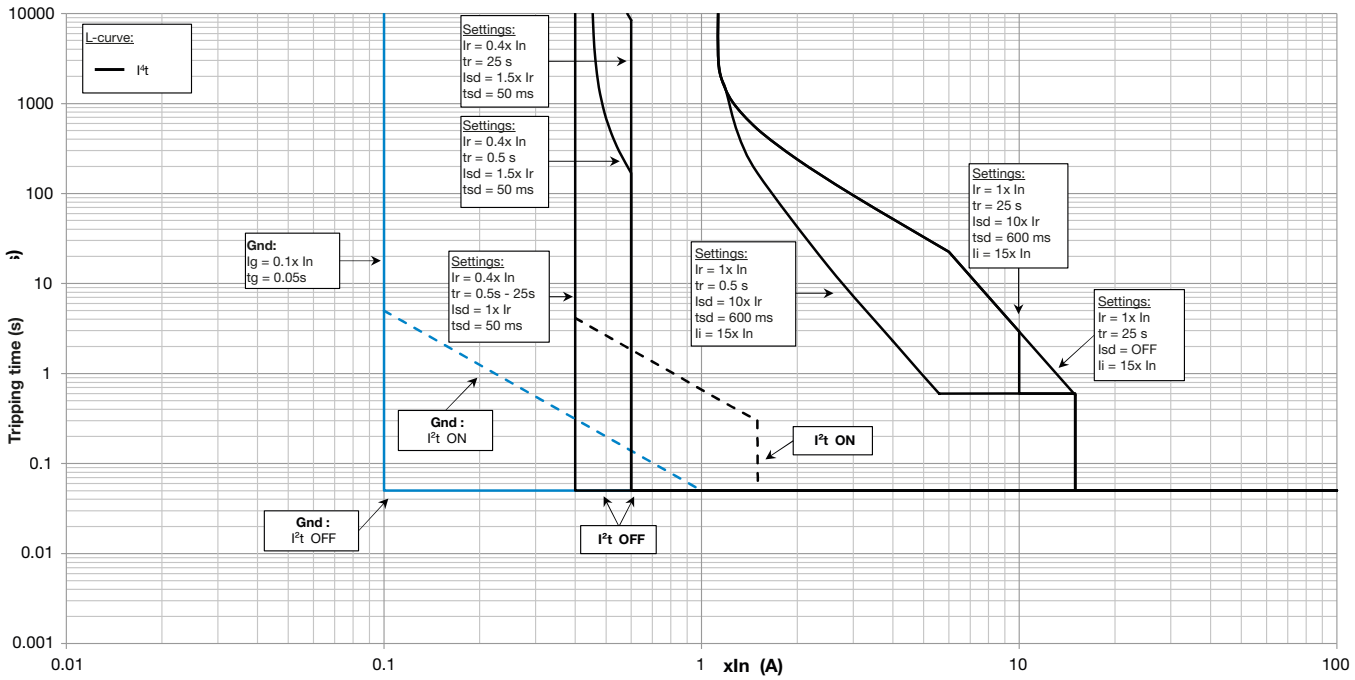
Circuit breaker with LSIG sentinel Energy electronic trip unit – VI It



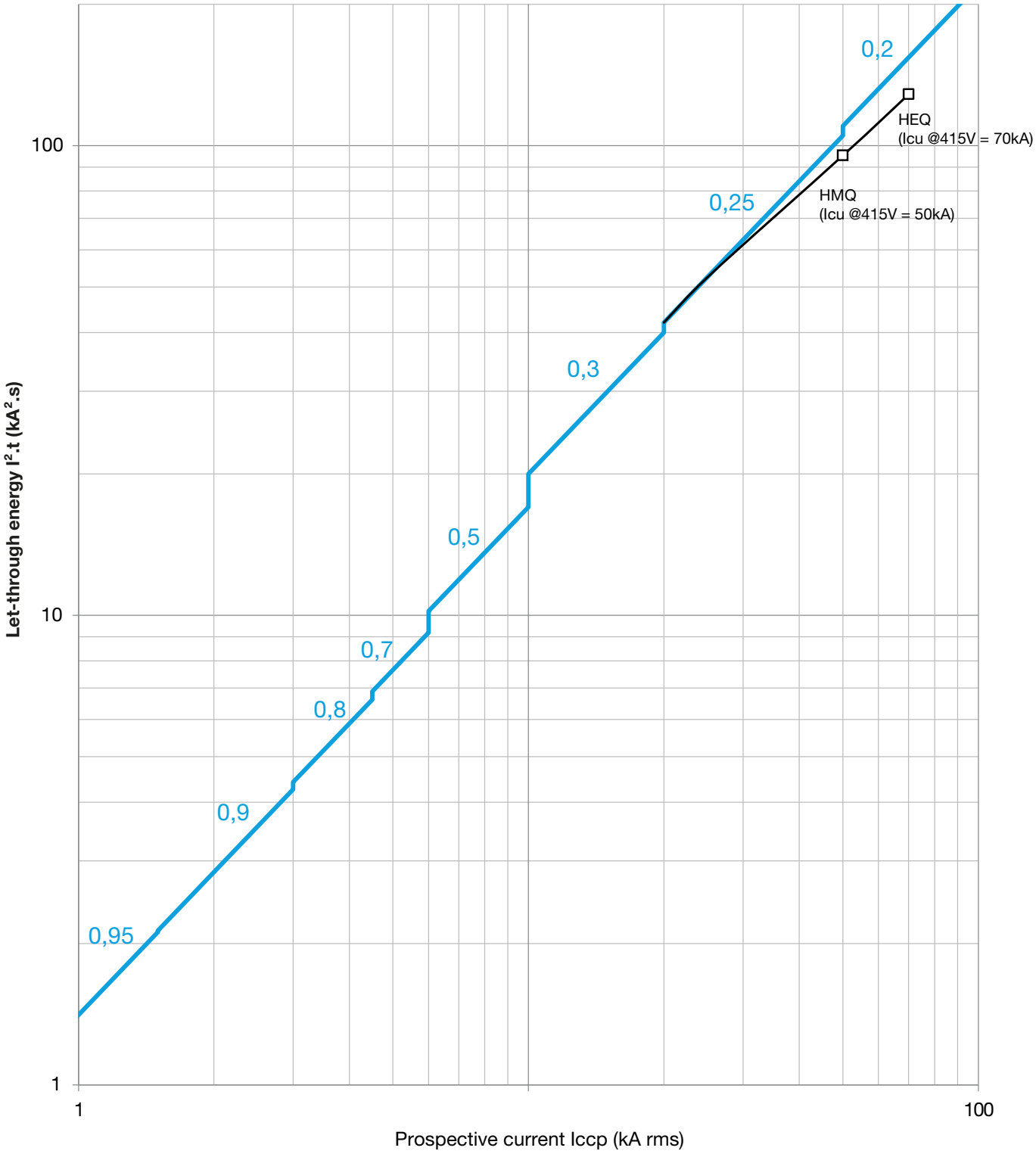
Circuit breaker with LSIG sentinel Energy electronic trip unit – EI I2t



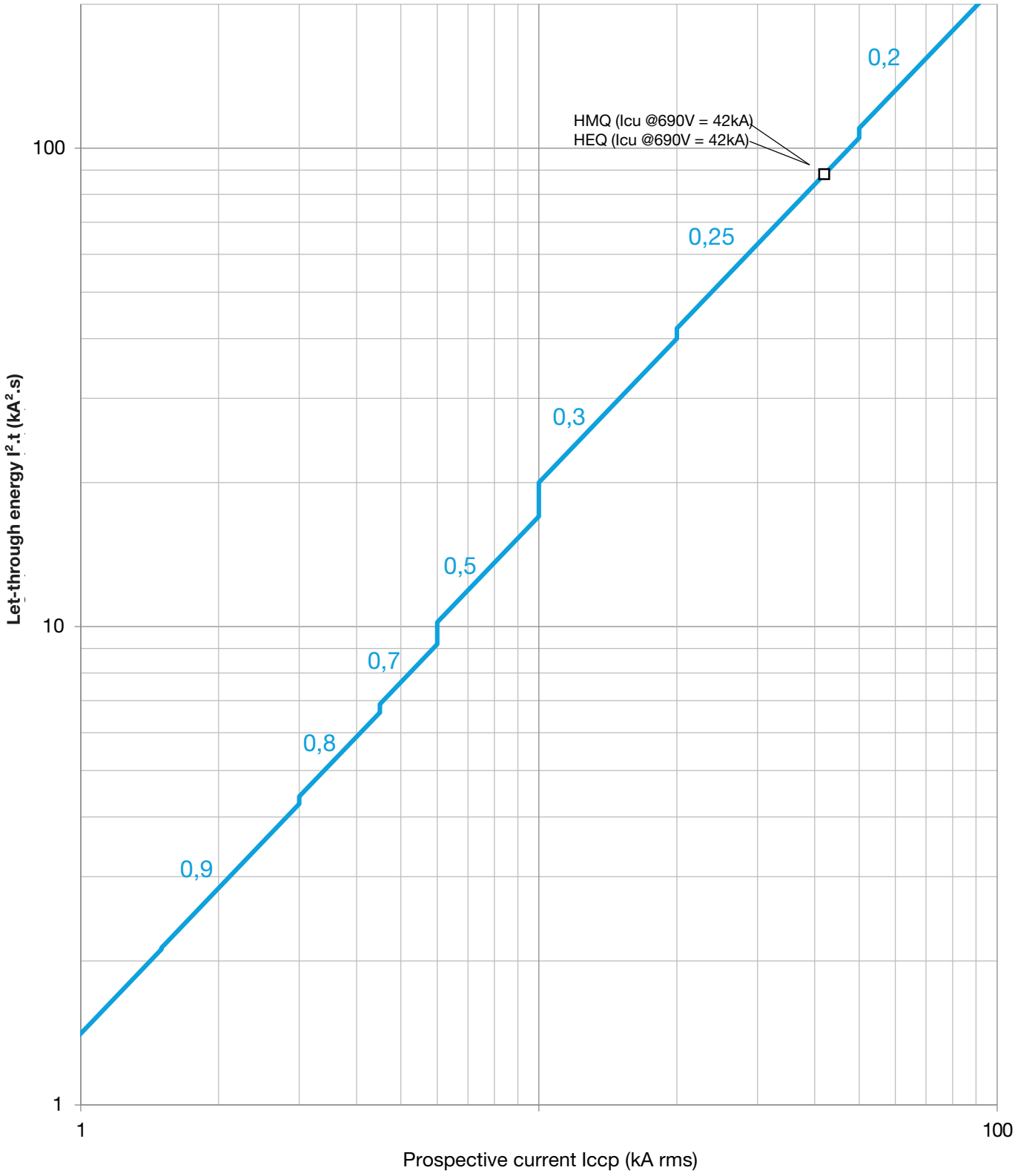
Circuit breaker with LSIG sentinel Energy electronic trip unit – HVF I4t



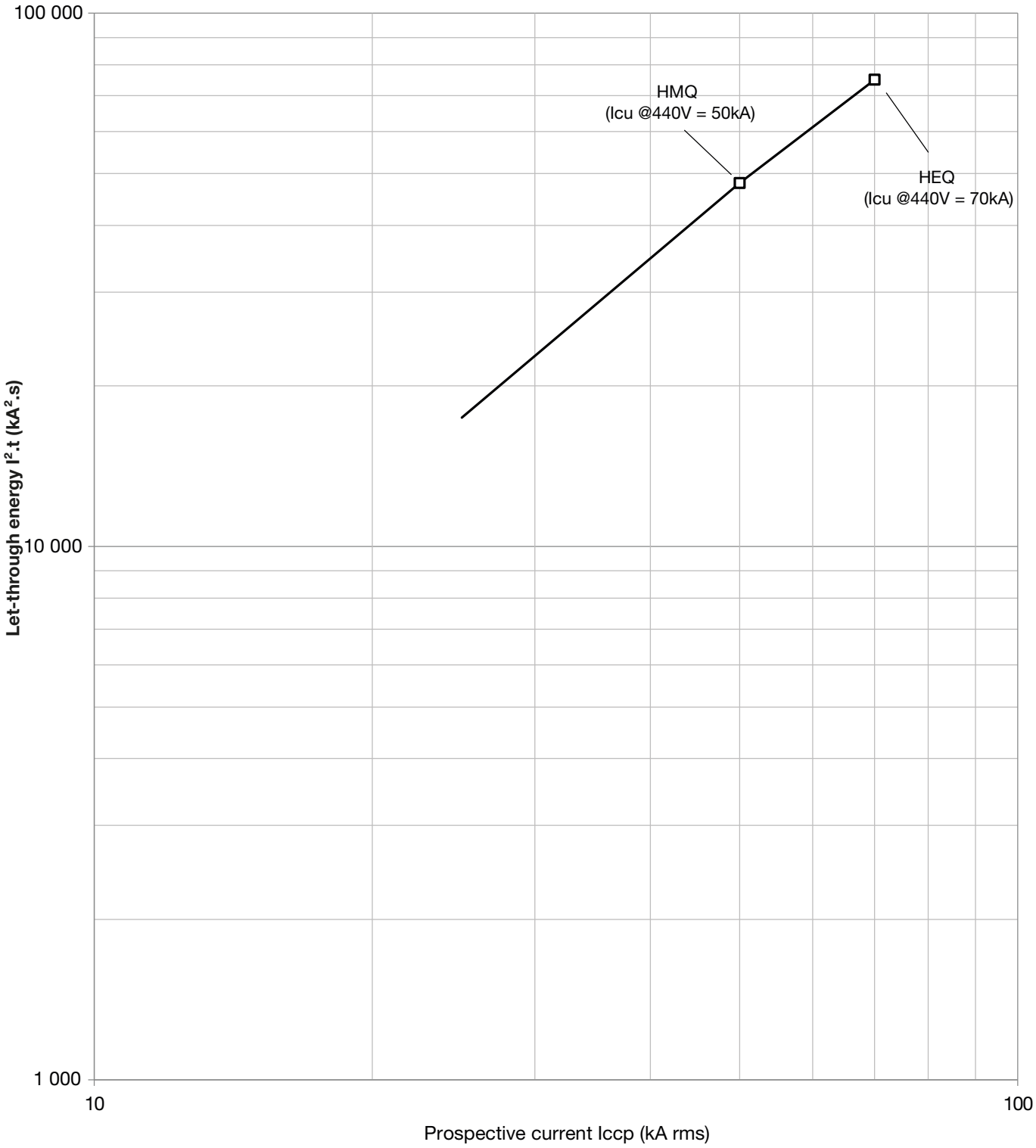
Current limiting characteristics 380/415 V AC for PW1600



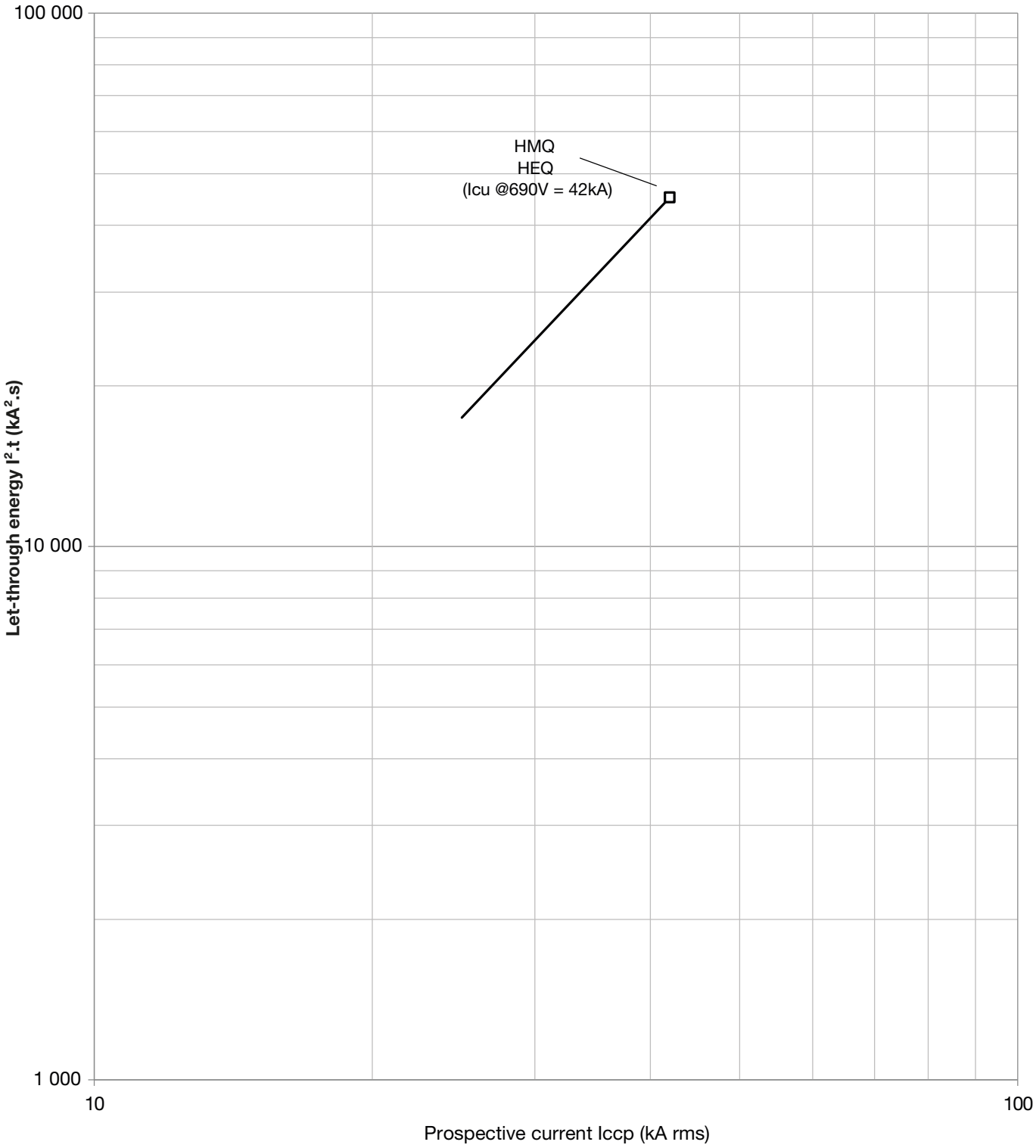
Current limiting characteristics from 415 V AC to 690 V AC for PW1600



Let-through energy curve (thermal constraint) 380/415 V AC for PW1600



Let-through energy curve (thermal constraint) from 415 V AC up to 690 V AC for PW1600



List of references

Circuit breaker for sentinel electronic trip unit


HMQ990LR

Icu 380 – 440 V~	Trip units	In (A)	3 poles	4 poles
50 kA	LI	630	HMQ630FR	HMQ631FR
	LI	800	HMQ800FR	HMQ801FR
	LI	1000	HMQ970FR	HMQ971FR
	LI	1250	HMQ980FR	HMQ981FR
	LI	1600	HMQ990FR	HMQ991FR
	LSI	630	HMQ630JR	HMQ631JR
	LSI	800	HMQ800JR	HMQ801JR
	LSI	1000	HMQ970JR	HMQ971JR
	LSI	1250	HMQ980JR	HMQ981JR
	LSI	1600	HMQ990JR	HMQ991JR
	LSIG	630	HMQ630LR	HMQ631LR
	LSIG	800	HMQ800LR	HMQ801LR
	LSIG	1000	HMQ970LR	HMQ971LR
	LSIG	1250	HMQ980LR	HMQ981LR
	LSIG	1600	HMQ990LR	HMQ991LR
70 kA	LI	630	HEQ630FR	HEQ631FR
	LI	800	HEQ800FR	HEQ801FR
	LI	1000	HEQ970FR	HEQ971FR
	LI	1250	HEQ980FR	HEQ981FR
	LI	1600	HEQ990FR	HEQ991FR
	LSI	630	HEQ630JR	HEQ631JR
	LSI	800	HEQ800JR	HEQ801JR
	LSI	1000	HEQ970JR	HEQ971JR
	LSI	1250	HEQ980JR	HEQ981JR
	LSI	1600	HEQ990JR	HEQ991JR
	LSIG	630	HEQ630LR	HEQ631LR
	LSIG	800	HEQ800LR	HEQ801LR
	LSIG	1000	HEQ970LR	HEQ971LR
	LSIG	1250	HEQ980LR	HEQ981LR
	LSIG	1600	HEQ990LR	HEQ991LR

Circuit breakers for sentinel Energy electronic trip unit


HEQ991NR

Icu 380 – 440 V~	Trip units	In (A)	3 poles	4 poles
50 kA	Energy LSIG	630	HMQ630NR	HMQ631NR
	Energy LSIG	800	HMQ800NR	HMQ801NR
	Energy LSIG	1000	HMQ970NR	HMQ971NR
	Energy LSIG	1250	HMQ980NR	HMQ981NR
	Energy LSIG	1600	HMQ990NR	HMQ991NR
70 kA	Energy LSIG	630	HEQ630NR	HEQ631NR
	Energy LSIG	800	HEQ800NR	HEQ801NR
	Energy LSIG	1000	HEQ970NR	HEQ971NR
	Energy LSIG	1250	HEQ980NR	HEQ981NR
	Energy LSIG	1600	HEQ990NR	HEQ991NR

Switch-disconnectors

	In (A)	3 poles	4 poles
 HMQ990AR	630	HMQ630AR	HMQ631AR
	800	HMQ800AR	HMQ801AR
	1000	HMQ970AR	HMQ971AR
	1250	HMQ980AR	HMQ981AR
	1600	HMQ990AR	HMQ991AR

Rating plug for sentinel and sentinel Energy electronic trip unit

HWW469H

In	Reference
630 A	HWW465HSA
800 A	HWW466HSA
1000 A	HWW467HSA
1250 A	HWW468HSA
1600 A	HWW469HSA

Meter Plus rating plug for sentinel Energy electronic trip unit

HWW669H

In	Reference
630 A	HWW665HSA
800 A	HWW666HSA
1000 A	HWW667HSA
1250 A	HWW668HSA
1600 A	HWW669HSA

Harmonic rating plug for sentinel Energy electronic trip unit

HWW689H

In	Reference
630 A	HWW685HSA
800 A	HWW686HSA
1000 A	HWW687HSA
1250 A	HWW688HSA
1600 A	HWW689HSA

Advanced rating plug for sentinel Energy electronic trip unit

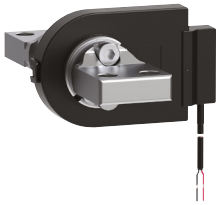
HWW709H

In	Reference
630 A	HWW705HSA
800 A	HWW706HSA
1000 A	HWW707HSA
1250 A	HWW708HSA
1600 A	HWW709HSA

Ultimate rating plug for sentinel Energy electronic trip unit

	In	Reference
 HWW729H	630 A	HWW725HSA
	800 A	HWW726HSA
	1000 A	HWW727HSA
	1250 A	HWW728HSA
	1600 A	HWW729HSA

ENCT External Neutral Sensor

		Reference
 HWY970H	ENCT External Neutral Sensor	HWY970H

TB connection terminal block

		Reference
 HWY950H	Connection terminal block A-type 6/3 TB	HWY950HSA
 HXH957H	Connection terminal block D-type	HXH957H
 HYH957H	Wiring harness for D-type connection terminal block	HYH957H

SH shunt trip coil

	Voltage	Inrush current (VA)	Holding current (VA)	Reference
	24 - 30 V AC/DC	-	5	HWX020HSA
	48 - 60 V AC/DC	300 (200 ms)	5	HWX021HSA
	100 - 130 V AC/DC	200 (200 ms)	5	HWX022HSA
	200 - 250 V AC/DC	200 (200 ms)	5	HWX023HSA
	380 - 480 V AC	200 (200 ms)	5	HWX024HSA

HWX023H

UV undervoltage release coil

	Voltage	Inrush current (VA)	Holding current (VA)	Reference
	24 - 30 V AC/DC	-	5	HWX030HSA
	48 - 60 V AC/DC	300 (200 ms)	5	HWX031HSA
	100 - 130 V AC/DC	200 (200 ms)	5	HWX032HSA
	200 - 250 V AC/DC	200 (200 ms)	5	HWX033HSA
	380 - 480 V AC	200 (200 ms)	5	HWX034HSA

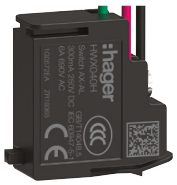
HWX033H

UVTC Undervoltage Time Delay Controller

	Voltage	Reference
	24 - 30 V AC/DC	HWY030H
	48 - 60 V AC/DC	HWY031H
	200 - 250 V AC	HWY033H
	380 - 480 V AC	HWY034H

HWY033H

AX Auxiliary Contact

		Reference
 HXH027H	Auxiliary contact	HXH027H
	Low level auxiliary contact	HXH028H

OAC output alarm contacts module

		Reference
 HXH090H	OAC output alarm contacts module	HXH090H

Rotary handle


HXH037H

	Reference
Rotary handle for switch-disconnector	HXH035H
Rotary handle for MCCB PW1600 sentinel	HXH036H
Rotary handle for MCCB PW1600 sentinel Energy	HXH037H
Axle, 320 mm	HXH102H

Ronis type key lock

		Reference
	Ronis key	HXS999H
	Kit Ronis Rotary	HXH888H

HWY701

SP spreaders

	Number of poles	Position	Reference (factory-assembled)	Reference
	3 poles	top / bottom	-	HWY001H
	4 poles	top / bottom	-	HWY002H

HWY001H

Rear vertical / horizontal RC connections

	Number of poles	Position	Rating (A)	Reference (factory-assembled)	Reference
	3 poles	top / bottom		-	HWY048HSA
	4 poles	top / bottom		-	HWY049HSA

HWY048H

Communication modules

		Reference
 HWY967H	Modbus-RTU communication module	HWY967H
	Modbus-TCP communication module	HWY968H

Modbus-RTU cables

			Reference
 HTG481H	RJ45 - RJ45	0.2 m	HTG480H
		1 m	HTG481H
		2 m	HTG482H
		5 m	HTG484H
 HTG471H	RJ45 - RJ45 with earth wire	1 m	HTG471H
		2 m	HTG472H
		5 m	HTG474H
 HTG465H	RJ45 with earth - bare wires	3 m	HTG465H
 HTG485H	Modbus cable	25 m	HTG485H
 HTG467H	120 Ohm RJ45 terminal resistor		HTG467H

Panel display

		Reference
 HTD210H	Panel display	HTD210H
 HWY210H	RJ9 adapter for panel display	HWY210H

ANSI
American National Standards Institute. Each electrical protection corresponds to an ANSI code.

CIP
Communications interface port with the panel display.

DHCP
Dynamic Host Configuration Protocol. Dynamic Host Configuration Protocol used to manage IP addresses.

ENCT
External neutral current sensor.

ENVA
External neutral potential.

GF
Earth fault protection.

HWF
Internal protection against electronic failures in the trip unit (hardware failure).

INST
Instantaneous Protection.

LTD
Long Time Delay Protection.

MCR
Making Current Release. Automatic instantaneous protection upon closure of the power contacts for short-circuit fault.

MHT
Magnetic Hold trigger. Coil connected directly to the electronic trip unit, which activates the mechanical opening lock of the circuit breaker in case of electrical fault or action by an SH shunt trip coil or UV undervoltage release coil.

OAC
Output alarm contact.

PF
Power factor. Power factor.

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

Rated ultimate short-circuit breaking capacity (Icu)
Expressed in kA, it indicates the maximum breaking capacity of the circuit breaker. It is confirmed by a test sequence O - t - CO (according to IEC 60947-2) at Icu, followed by a test to prove that the circuit is correctly isolated. This test ensures safety for the user.

PTA
Overload pre-alarm.

SNTP
Simple Network Time Protocol. Used by a server managing the date and time of the communication network.

STD
Short Time Delay Protection.

Thi
Thermal image. Default setting of the Long time delay protection in accordance with IEC 60947-2.

ZSI
Zone selectivity.

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