

Adjustment Instruction for 140MG-H, 140MG-J  
 Settaggio sganciatori  
 Auslöser  
 Dèclencheur  
 Relé

**⚠ Installation - Installazione - Instalación**  
**Instalação - 取付け方法 - 安装**

**WARNING:** To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

**AVVERTENZA:** Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti. (Seguire i requisiti NFPA70E).

**WARNUNG:** Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden. (Befolgen Sie die Anforderungen nach NFPA70E).

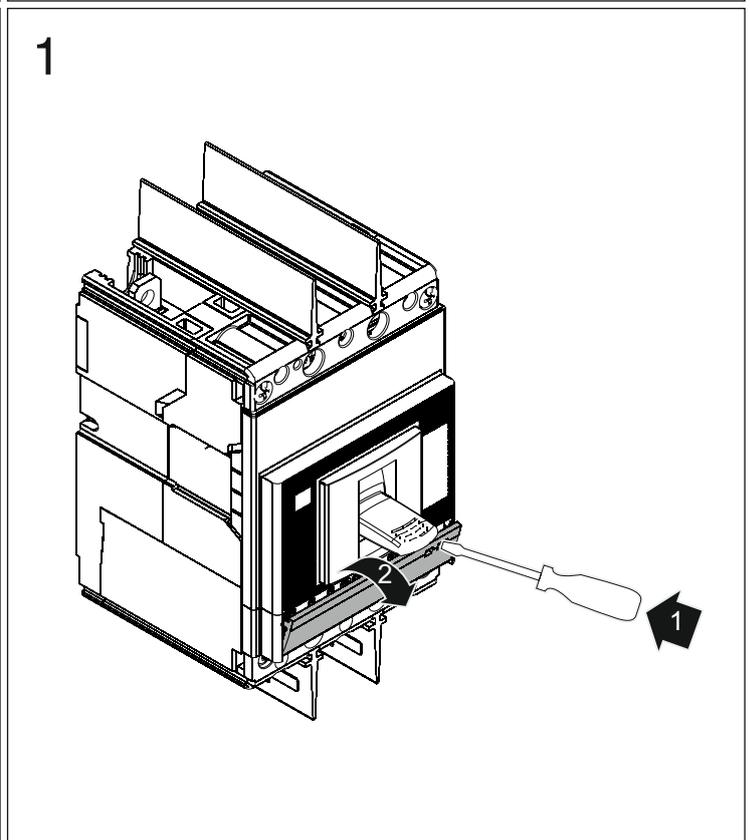
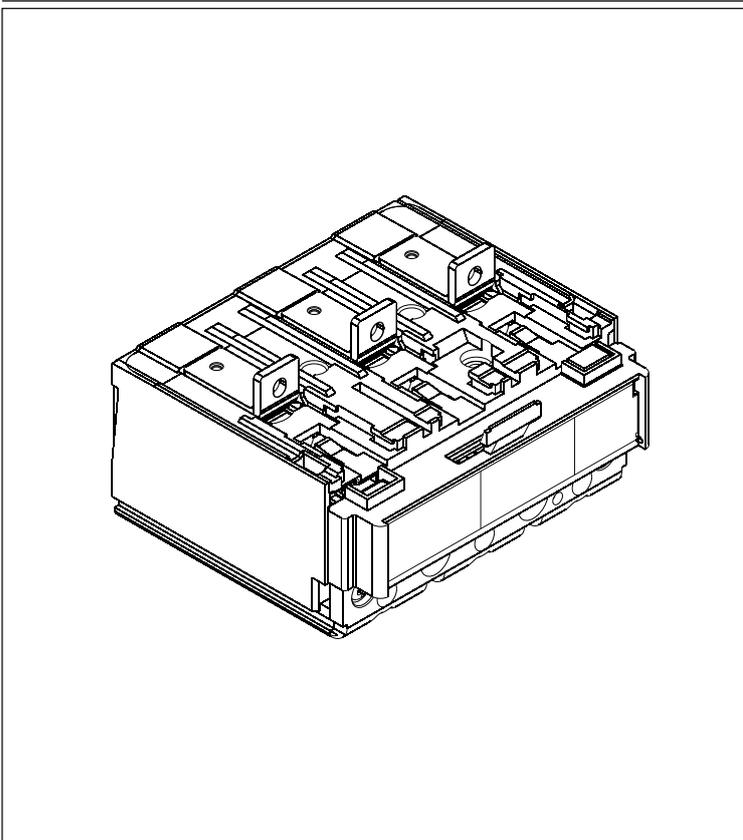
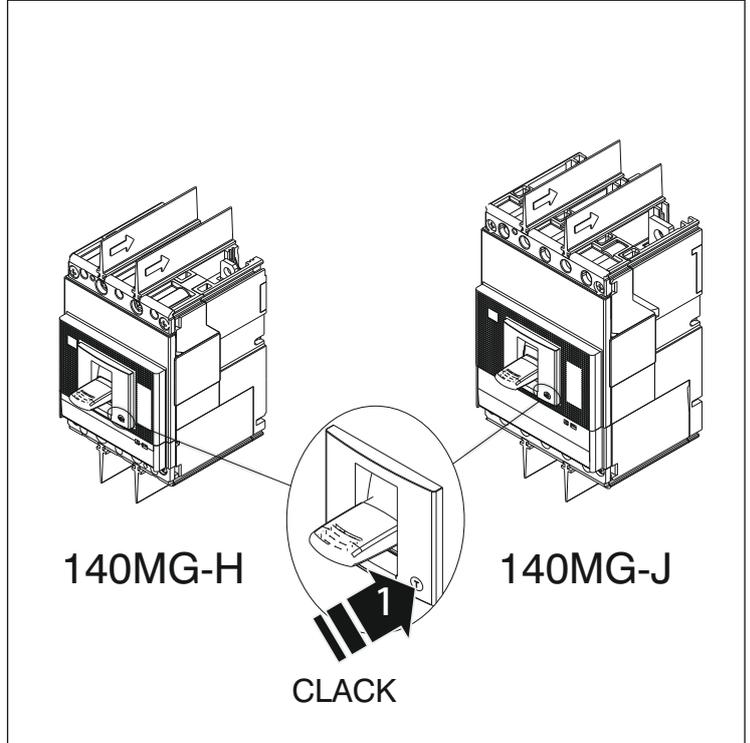
**AVERTISSEMENT:** Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs. (Vous devez respecter la norme NFPA70E).

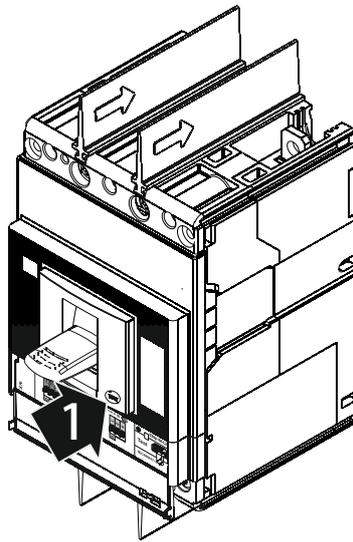
**ADVERTENCIA:** Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes. (Cumpla con los requisitos NFPA70E).

**ATENÇÃO:** Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes. (Cumpra as exigências da norma NFPA70E).

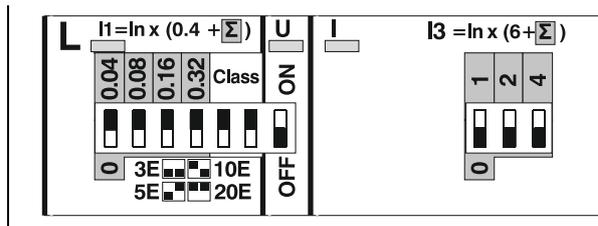
警告: 感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また、汚染物質がないことを確認してください。(NFPA70Eの要件に従ってください)

警告: 为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染物。(符合NFPA70E要求)





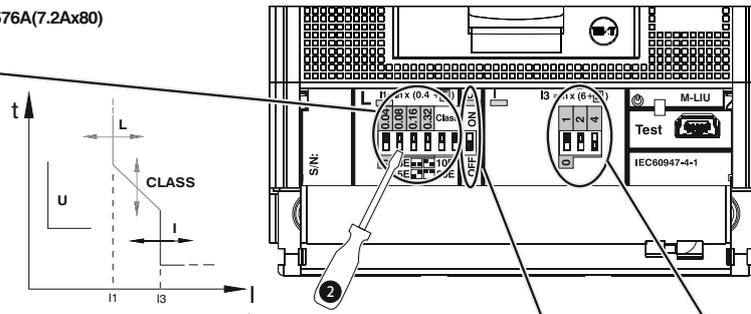
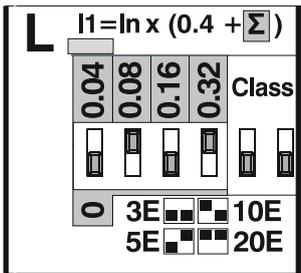
LED	Color	CONDITION Run time	
	Green		
L	Red	LED Fixed = L pre alarm ( $0.9 * I1 < I < 1.2 * I1$ )	LED Blinking = L alarm ( $I > 1.2 * I1$ )
U	Red	LED Blinking = U alarm	
L U I	Red	LED Blinking = Parameters inconsistency - L = I. LED Blinking without Parameters inconsistency = generic fault (please contact Rockwell Automation)	



Default setting  
Default-Einstellung  
Configuration par défaut  
Ajuste de default

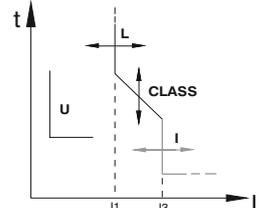
Example:  
Esempio:

$I_n = 100 \text{ A}$   
 $I1 = 100 \times (0.4 + 0.08 + 0.32) = 80 \text{ A}$   
 CLASS = 3E@ $(7.2 \times I1) = 2s < t < 3s @ 576 \text{ A} (7.2 \times 80)$

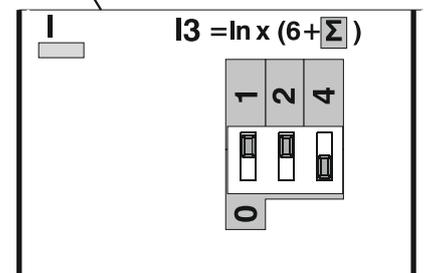
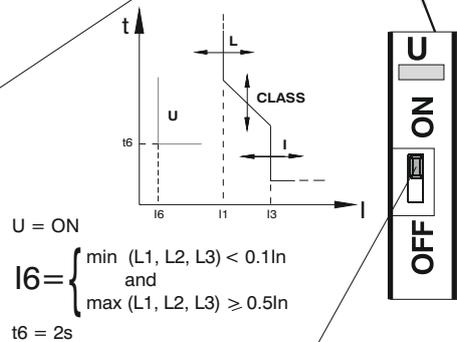


Example:  
Esempio:

$I_n = 100 \text{ A}$   
 $I3 = 100 \times (6 + 1 + 2) = 900 \text{ A}$



3E	$2s < t_i \leq 3s$	@ (7.2 x I1)
5E	$3s < t_i \leq 5s$	
10E	$5s < t_i \leq 10s$	
20E	$10s < t_i \leq 20s$	



1

**DIAGNOSTIC PROCEED**

- UNIT CHECK LED: all the leds in the relay must come on
- LAST TRIP INDICATION: if present in the relay's data store
- LED:  remains on for as long as the 140G-ELTT Tester is connected to the relay
- READY TO TRIP

**PROCEDURA DI CONTROLLO**

- CONTROLLO LED: tutti i led del relè si devono accendere
- ULTIMA INDICAZIONE DI TRIP: se presente nella memoria del relè
- LED:  resta acceso finchè l'unità 140G-ELTT Tester è connessa al relè
- PRONTO PER TRIP

**DIAGNOSTIKABLAUF**

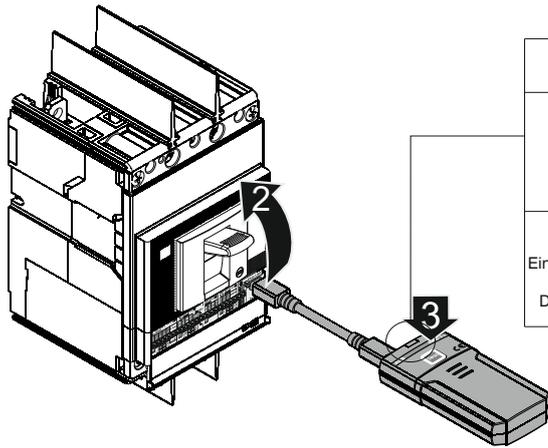
- EINEITHSPRUF-LED: Alle LEDs des Relais müssen aufleuchten
- ANGABE DER LETZTEN AUSLOSUNG: Wenn im Speicher des Relais vorhanden.
- LED:  Bleibt angeschaltet, bis die Einheit 140G-ELTT Tester an die Relais angeschlossen ist.
- AUSLOSEBEREIT

**PROCÉDURE DE DIAGNOSTIC**

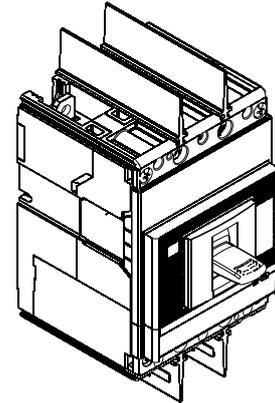
- UNIT CHECK LED : toutes les diodes du relais doivent s'allumer
- LAST TRIP INDICATION : si présente dans la mémoire du relais
- LED:  la DIODE reste allumée tant que l'unité 140G-ELTT Tester est connectée au relais
- READY TO TRIP

**PROCEDIMIENTO DIAGNOSTICO**

- LED CONTROL UNIDAD: todos los led del relé se deben encender
- INDICACION ULTIMA ACTUACION: si está presente en la memoria del relé
- LED:  queda encendido mientras la unidad 140G-ELTT Tester permanece conectada con el relé
- LISTO PARA LA ACTUACION



LED	
Green Verde Grün Vert Verde	Red Rosso Rot Rouge Rojo
Device ON Dispositivo acceso Einrichtung eingeschaltet Dispositif allumé Dispositivo encendido	Change battery Sostituire batterie Batterie ersetzen Remplacer batteries Sustituir baterias



4 CLACK

140G-ELTT  
(Ordered separately)

**LSIG and LSIG-MM trip unit for 140G-N/ 140G-NS/ 140G-R****Installation - Installazione - Instalación  
Instalação - 取付け方法 - 安装**

**WARNING:** To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

**AVVERTENZA:** Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti.

**WARNUNG:** Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden.

**AVERTISSEMENT:** Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs.

**ADVERTENCIA:** Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes.

**ATENÇÃO:** Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes.

警告：感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また、汚染物質がないことを確認してください。

警告：为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染。

# Index

1.	LSIG and LSIG-MM Trip Units Functional Comparison . . . . .	3	3.6.3.2.	Start-up threshold S . . . . .	22
1.1.	Compatibility between trip units and CB. . . . .	3	3.6.4.	Protection "I". . . . .	22
1.2.	Abbreviations . . . . .	3	3.6.5.	Protection "G" . . . . .	23
1.3.	Safety Notes . . . . .	3	3.6.5.1.	Start-up threshold "G" . . . . .	23
1.3.1.	Notes for dielectric tests . . . . .	3	3.6.6.	Protection "U" . . . . .	23
2.	LSIG Trip Unit . . . . .	4	3.6.7.	Protection "T" . . . . .	23
2.1.	Overview . . . . .	4	3.6.8.	Load control function . . . . .	24
2.2.	Main specifications . . . . .	4	3.6.9.	Neutral Protection . . . . .	24
2.2.1.	Protections . . . . .	4	3.6.10.	Protection MM . . . . .	24
2.2.2.	Functions . . . . .	4	3.6.11.	Protection against instantaneous short-circuit "Iinst" . . . . .	24
2.2.3.	Accessories . . . . .	4	3.6.12.	Summary table of protection functions . . . . .	25
2.2.4.	Compatibility CB. . . . .	5	3.6.13.	Trip curves . . . . .	26
2.2.5.	Standards . . . . .	5	3.6.13.1.	Trip curves for functions L-S( $t=k/I^2$ )-I . . . . .	26
2.2.6.	Environmental characteristics . . . . .	5	3.6.13.2.	Trip curves for functions L-S( $t=k$ )-I . . . . .	26
2.2.7.	Electrical characteristics . . . . .	5	3.6.13.3.	Trip curves for function L in accordance with IEC 60255-121 (type A) . . . . .	27
2.3.	User interface . . . . .	6	3.6.13.4.	Trip curves for function L in accordance with IEC 60255-121 (type B) . . . . .	27
2.3.1.	Dip switches . . . . .	6	3.6.13.5.	Trip curves for function L in accordance with IEC 60255-121 (type C) . . . . .	28
2.3.2.	LED . . . . .	7	3.6.13.6.	Trip curves for function G . . . . .	28
2.3.3.	iTest button . . . . .	7	3.6.13.7.	Trip curves for function U . . . . .	29
2.3.4.	Test connector . . . . .	7	3.7.	Measuring functions . . . . .	29
2.4.	Protection functions . . . . .	7	3.7.1.	Runtime measurements: current, voltage, power . . . . .	29
2.4.1.	Protection L . . . . .	8	3.7.2.	Trip . . . . .	30
2.4.2.	Protection S . . . . .	8	3.7.3.	Events . . . . .	30
2.4.3.	Protection I . . . . .	8	3.7.4.	Measurements Log register . . . . .	30
2.4.4.	Protection G . . . . .	8	3.7.5.	Peak factor . . . . .	30
2.4.5.	Neutral Protection . . . . .	9	3.7.6.	Contact wear . . . . .	30
2.4.6.	Protection against instantaneous short-circuit "Iinst" . . . . .	9	3.8.	Main functions . . . . .	31
2.4.7.	Summary table of protections . . . . .	9	3.8.1.	Watchdog . . . . .	31
2.4.8.	Trip curves . . . . .	10	3.8.2.	Circuit-breaker state . . . . .	31
2.4.8.1.	Trip curves for functions L-S( $t=k/I^2$ )-I . . . . .	10	3.8.3.	Function MM. . . . .	31
2.4.8.2.	Trip curves for functions L-S( $t=k$ )-I . . . . .	10	3.9.	Settings Menu . . . . .	31
2.4.8.3.	Trip curves for function G . . . . .	11	3.9.1.	Circuit-breaker . . . . .	31
2.5.	Main functions . . . . .	11	3.9.2.	Network frequency . . . . .	31
2.5.1.	Measurement . . . . .	11	3.9.3.	Measurement Interval . . . . .	31
2.5.2.	Self-monitoring . . . . .	11	3.9.4.	System . . . . .	32
2.6.	Putting into service and recommendations . . . . .	12	3.9.4.1.	Language . . . . .	32
2.6.1.	Installation . . . . .	12	3.9.4.2.	Password . . . . .	32
2.6.2.	Connections . . . . .	12	3.9.5.	Display contrast . . . . .	32
2.6.3.	CS and TC connection check . . . . .	12	3.10.	Test Menu . . . . .	32
2.6.4.	Connection of current sensor for external neutral . . . . .	12	3.10.1.	Autotest . . . . .	32
2.7.	Default parameters . . . . .	12	3.10.2.	Trip test . . . . .	32
2.8.	Troubleshooting . . . . .	13	3.10.3.	MM Test . . . . .	32
2.8.1.	Troubleshooting . . . . .	13	3.11.	Putting into service and recommendations . . . . .	33
2.8.2.	In the case of a fault . . . . .	13	3.11.1.	Installation . . . . .	33
3.	LSIG-MM Trip Unit. . . . .	14	3.11.2.	Uninstalling . . . . .	33
3.1.	Introduction . . . . .	14	3.11.3.	Connections . . . . .	33
3.2.	Overview . . . . .	14	3.11.4.	CS and TC connection test . . . . .	33
3.3.	Specifications . . . . .	14	3.11.5.	Current sensor connection for external neutral . . . . .	33
3.3.1.	Protections . . . . .	14	3.11.6.	Default parameters . . . . .	34
3.3.2.	Functions . . . . .	14	3.12.	Troubleshooting . . . . .	35
3.3.3.	Inputs/Outputs . . . . .	15	3.12.1.	Troubleshooting . . . . .	35
3.3.4.	Accessories . . . . .	15	3.12.2.	In the case of a fault . . . . .	36
3.3.5.	CB compatibility . . . . .	15	4.	ACCESSORIES . . . . .	36
3.3.6.	Standards . . . . .	15	4.1.	External neutral . . . . .	36
3.3.7.	Environmental characteristics . . . . .	15	4.2.	Rating Plug . . . . .	36
3.3.8.	Electrical characteristics . . . . .	15	4.3.	Battery Unit (140G-ELBU). . . . .	36
3.4.	User interface . . . . .	16			
3.4.1.	LEDs. . . . .	16			
3.4.2.	Push-buttons . . . . .	17			
3.4.3.	Display . . . . .	17			
3.4.3.1.	Graphic ammeter . . . . .	18			
3.4.3.2.	CB and trip unit alarms . . . . .	18			
3.4.3.3.	Operating icons . . . . .	19			
3.5.	User menus . . . . .	19			
3.5.1.	Information Pages . . . . .	19			
3.5.2.	Menu Area . . . . .	20			
3.5.2.1.	Menu browsing . . . . .	20			
3.6.	Protection functions . . . . .	21			
3.6.1.	Notes about Protection Operation . . . . .	21			
3.6.2.	Protection L . . . . .	21			
3.6.2.1.	Thermal memory L . . . . .	22			
3.6.3.	Protection S . . . . .	22			
3.6.3.1.	Thermal memory S . . . . .	22			

## 1. LSIG and LSIG-MM Trip Units Functional Comparison

Function/Unit	LSIG	LSIG-MM
Current protections (L, S, I, G)	S	S
Additional protections (U, OT, MM)	-	S
Thermal memory	-	S
Maintenance mode	-	S
Battery unit	O	S

### Key:

- S : standard function/unit,
- O : optional function/unit,
- : function/unit unavailable.

### 1.1. Compatibility between trip units and CB

CB / trip unit	LSIG	LSIG-MM
140G-N/140G-NS	X	X
140G-R	X	X

### 1.2. Abbreviations

Abbreviations	Meaning
Battery	Power supply unit
BA	Opening coil
BC	Closing coil
CB	Circuit-Breaker
CS	Current Sensor (current transformer)
Trip unit	Also called "protection unit"
HW	Hardware
In	Rated current of the Rating Plug installed in the circuit breaker
LSIG	Trip unit for CB 140G-N/140G-NS/140G-R
LSIG-MM	Trip unit for CB 140G-N/140G-NS/140G-R
MT	Thermal memory
RMS	Root mean square value
TC	Trip Coil (opening solenoid)
SW	Software
iTest	"Info/test" button on the front of the trip unit
Trip	CB opening, generated by the trip unit
OT	Over Temperature

### 1.3. Safety Notes

Read this manual carefully and completely: use of the trip units should be reserved to qualified electrical personnel only.



**ATTENTION:** this symbol highlights information about operations, actions or circumstances that can cause injuries to the personnel, damage to the trip unit or economic losses.

It is consider unsafe to operate this circuit breaker if:

1. The trip unit shows visible signs of damage.
2. The trip unit does not function (e.g. with autotest or by means of the trip test unit).

The circuit breaker must be taken out of service. Use lockout tagout procedure per NFPA 70E, or local regulation.



**ATTENTION:** Prior to servicing and/or replacing, the circuit-breaker must be open. Remember to disconnect the circuit breaker from power source(s).

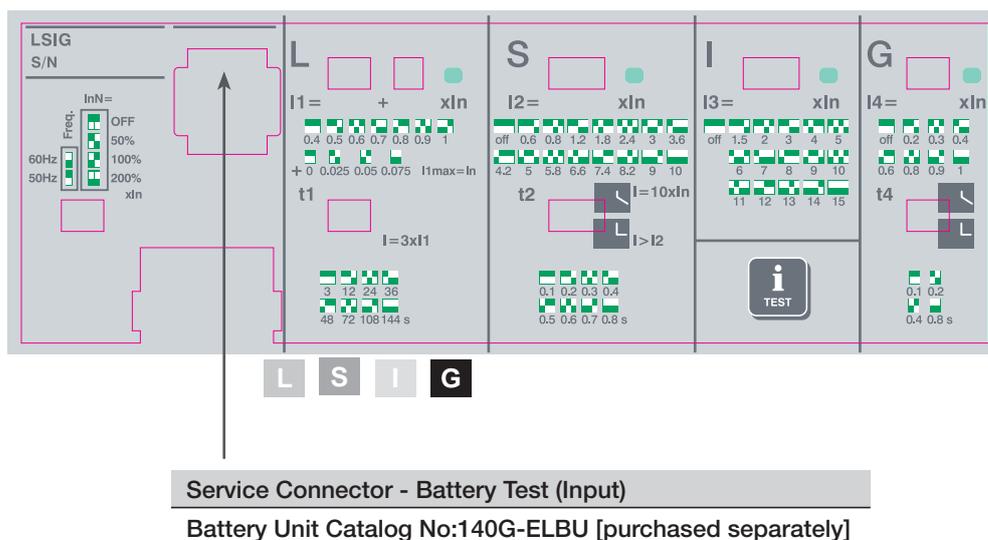
#### 1.3.1. Notes for dielectric tests



**ATTENTION:** Dielectric withstand tests shall not be performed on the inputs or outputs of the trip unit, to prevent possible damage to the electronics.

## 2. LSIG Trip Unit

### 2.1. Overview



### 2.2. Main specifications

LSIG is an electronic device for AB 140G-N/140 G-NS/140G-R range of three-pole and four-pole Molded Case circuit breakers with functions for monitoring and for protecting against abnormal currents.

The trip unit installed on the circuit-breaker is connected to the current sensors for primary current reading, and to the Trip Coil for the circuit-breaker opening command.

The sensors provide the primary current measurement and energy for powering the trip unit even in the absence of external power supply.

Connected directly to an opening mechanism, the Trip Coil allows the CB to open. The control is transmitted to the Trip coil in accordance with the protection settings.

Dip switches on the front allow the main protections and settings to be adjusted, while the state of the trip unit is indicated by the leds of the front interface.

#### 2.2.1. Protections

Symbol	Protection against
L	overload with inverse long time delay
S	overload with adjustable short time delay
I	instantaneous short-circuit
G	earth (ground) fault with adjustable delay

#### 2.2.2. Functions

LSIG includes various different functions:

- Runtime measurement of the phase current and peak factor;
- Autotest: continuous monitoring of the main connections to the trip unit, among which: current sensors, trip coil, rating plug, circuit-breaker state.

#### 2.2.3. Accessories

- External neutral, current sensor for protecting the external neutral pole (can only be configured for three-pole circuit-breakers).

More details are given on page page 36 of chapter 4, or in the dedicated manuals.

#### 2.2.4. Compatibility CB

LSIG can be installed in AB circuit-breakers of the three-pole, three-pole with external neutral or four-pole type from the 140G-R, 140G-N and 140G-NS (any size).

The CB model establishes the rated uninterrupted current the circuit-breaker is able to support (I<sub>u</sub>).

The adjustable protections (L, S, I and G) refer to the I<sub>n</sub> size defined by the interchangeable Rating plug module installed on the actual trip unit.

#### 2.2.5. Standards

LSIG has been designed to operate in accordance with the following international standards:

- IEC 60947-2 Low voltage switchgear and control gear Part 2: Circuit-Breakers.
- UL 489 Molded-Case Circuit-Breaker, Molded-Case Switches and Circuit-Breaker Enclosures
- CSA C22.2 No. 5, Molded-Case Circuit-Breaker, Molded-Case Switches and Circuit-Breaker Enclosures

#### 2.2.6. Environmental characteristics

Operating temperature	-25 °C ... +70 °C
Storage temperature	-40 °C ... +70 °C
Relative humidity	0% ... 98% with condensation
Degree of protection (with LSIG installed in the circuit-breaker)	IP 30

#### 2.2.7. Electrical characteristics

The trip unit is energized:

- Directly by the internal current sensors connected to the busbars of each phase. In this case, the trip unit activates with the circuit-breaker closed and in the presence of a minimum three-phase current value.
- By an external auxiliary power supply. In this case, continuous operation of the unit is guaranteed even with zero current on the busbars or with the circuit-breaker open.

#### Note:

Rockwell Automation recommends use of a separate 24V DC power source to power the trip unit. This will eliminate the possibility of nuisance trips during startup/commissioning when reduced load currents may occur.

Primary current characteristics	Range
Minimum three-phase busbar current	>80A
Frequency	50/60 Hz ±10%

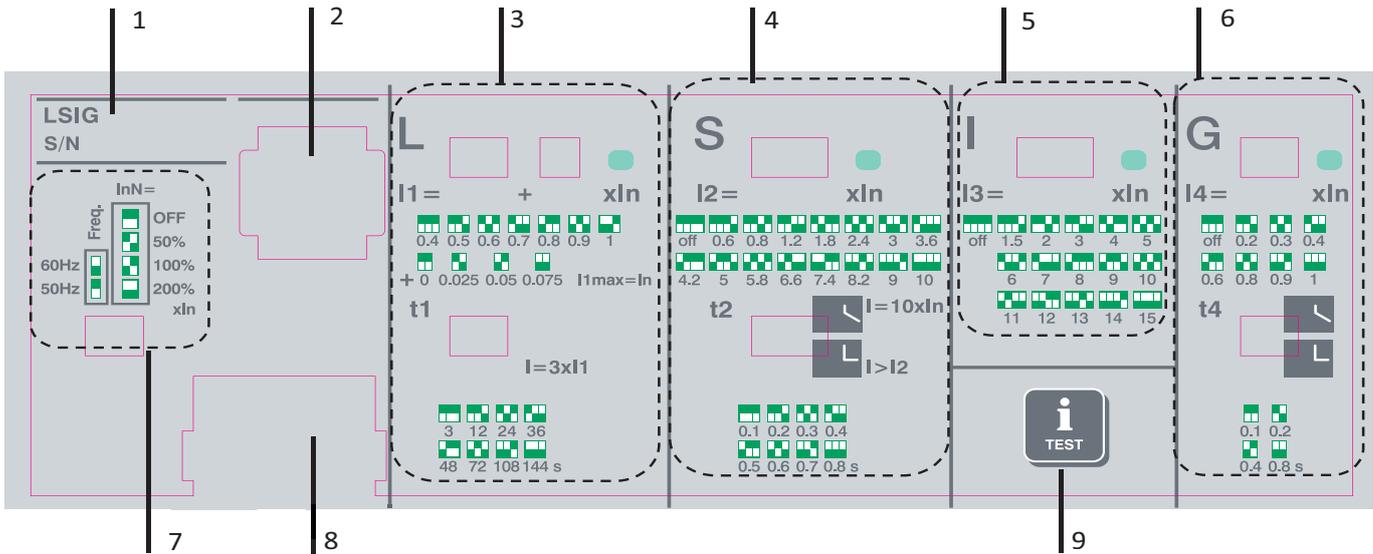
Auxiliary power supply characteristics	Range
DC voltage (galvanically separated)	24 Vdc ±20%
Maximum ripple	5%
Inrush current @ 24V	~2 A for 5ms
Rated power @ 24V	~2 W



**ATTENTION:** Separate DC power source must be galvanically separated from ground, in accordance with UL 60950 (IEC 60950) or equivalent IEC 60364-41 [CEI 64-8].

### 2.3. User interface

LSIG allows the protections and main settings to be adjusted via the dip switches and has signalling LEDs for monitoring the state and alarms.



Ref.	Description
1	Serial number of the trip unit
2	Test connector to connect battery unit
3	Section dedicated to protection L: threshold setting dip switches, time adjustment dip switches and alarm/trip LEDs
4	Section dedicated to protection S: threshold setting dip switches, time adjustment dip switches and alarm/trip LEDs
5	Section dedicated to protection I: threshold setting dip switches and trip LEDs
6	Section dedicated to protection G: threshold setting dip switches, time adjustment dip switches and alarm/trip LEDs
7	Dip Switches and indications for configuration of rated frequency and neutral protection
8	Rating Plug
9	"iTest" button

#### 2.3.1. Dip switches

The dip switches on the front of LSIG are used for adjusting the tripping thresholds of each protection and the tripping time. The available combinations are given alongside each group of dip switches. The dip switches for regulating the tripping times of protections S (t2) and G (t4) can also be used for selecting the tripping curve:

- Fixed time tripping curve. The following relation is used:  $t=k$ .
- Inverse time tripping curve. The relation between the tripping time and over-current is given by the formula:  $t=k/I^2$

The dip switch settings can be changed when the trip unit is on and without alarms: updating is immediate and the unit need not be restarted.

**ATTENTION: Settings changed by the user when the trip unit is in the alarm condition will not be activated until the alarm condition terminates.**

An example of the dip-switch setting for the protection L function, with 2000A Rating Plug ( $I_n = 2000A$ ) is given below.



$$I_1 = 0,4 + 0,025 \times I_n$$

$$I_1 = 850A$$

### 2.3.2. LED

The following table shows LEDs signaling in accordance with the IEC standard 60073 (clause 4.2.3.2).

Type of information	Flashing slowly (0,5Hz)		Flashing fast (2Hz)			LED flashing with two 0.5 sec pulses every 2 sec		LED flashing with one pulse every 3 sec	LED on permanently		
	All LEDs	Single LED	All LEDs	Single LED		All LEDs	Single LED	Single LED	All LEDs	Single LED	
	RED	ORANGE	RED	RED	ORANGE	RED	ORANGE	ORANGE	RED	RED	ORANGE
TC error or TC disconnected			☒								
CS error or disconnected	☒										
Rating Plug/Installation error <sup>(1)</sup>						☒					
Protection timer error				☒							
Last trip <sup>(2)</sup>										☒	
Test button pressed and no failure detected <sup>(3)</sup>									☒		
L pre-alarm											☒
Configuration error <sup>(4)</sup>					☒						
Settings inconsistency							☒				
Normal operation of the trip unit <sup>(5)</sup>								☒			
CB Undefined or CB status error		☒									

(1) Rating plug disconnected or  $I_n > I_u$ .

(2) The LED of the protection that has tripped or is being timed comes on to display the information. If it is the last trip, the LED remains on for 2 sec or with fixed light when there is external 24V power supply or battery: 140G-ELBU.

(3) The information is displayed with all the leds on for as long as the test button remains depressed, or for 2 seconds if it is pressed once.

(4) Installed values differ from those stored by the trip unit: installation required (see par. 2.6.1).

(5) In the absence of other information, "normal operation" is signalled 3s after the trip unit has been turned on.



**ATTENTION: the LEDs only function if the trip unit has been powered. Once powered, the LEDs can be displayed for approximately 48 hours. To maintain trip status beyond 48 hours, use of separate 24V DC power source is recommended.**

### 2.3.3. iTest button

The itest button can be used for different functions:

- with the trip unit off, it allows to check the last recorded event (when pressed for about 1 second). The function is guaranteed for 48 hours after switch-off (absence of internal or external power supply).
- with the trip unit energized by battery unit alone and with the CB open, it allows installation on the CB to be performed (see par. 2.6.1).
- with the trip unit energized by battery unit and the CB closed, it allows performance of the LED test (when pressed for 3 seconds) and the trip coil operation test (when pressed for 7 seconds) with consequent opening of the CB.
- It allows the Trip signal to be reset (when pressed for about 1 second) after a trip, with the trip unit on.

### 2.3.4. Test connector

The front test connector allows battery unit 140G-ELBU to be connected for temporary powering of the trip unit. Consult the chapters dedicated to the accessory modules for further details.

## 2.4. Protection functions

LSIG handles up to 5 independent protection functions.

The current signal from the current sensors is processed by the trip unit which, depending on the protection parameter settings, indicates alarms, performs delay processes and sends commands.

All the adjustable protections process according to the true root mean square value of the current values read by means of the current sensors.

Each protection has an alarm led, which comes on in the case of delays (flashing) or trips (fixed) and goes out when normal conditions restored



**ATTENTION: when activated, the protections must respect the following rule:**

**$I_1(\text{protection L}) < I_2(\text{protection S})$  and  $I_2(\text{protection S}) < I_3(\text{protection I})$ .**

**When the trip unit is on, an incorrect protection threshold setting is signalled by the front leds (inconsistent settings). The trip unit has a "backup-protection" function. If the first command transmitted to the trip coil fails to immediately open the circuit-breaker (partial TC failure), further trip commands are sent until it opens (absence of current and CB open).**

**NOTE:** 2.4.1 through 2.4.6 explains each of the protection functions independently. Actual behavior of a circuit breaker depends on combination of settings for each protection function and is summarized in 2.4.7.

#### 2.4.1. Protection L

Protection L is the only adjustable protection that cannot be disabled since it provides self-protection against circuit-breaker overloads.

- The type of curve setting is  $t=k/I^2$  and the tripping time is calculated according to the value of  $I_f$ :
- For fault currents  $I_f \leq 12I_n$ , the tripping time of the protection is given by the expression:  $t(s) = \frac{9 \cdot t_1}{(I_f/I_1)^2}$ . If the calculated value is less than 1 second, the real tripping time is forced to 1 second ( $t(s) = 1s$ .)
- For fault currents  $I_f > 12I_n$ , the tripping time is always  $t(s) = 1s$ .

#### NOTES:

- $t(s)$ = estimated tripping time;
- $I_f$ = fault current; given in [In] (example: 0.7In)
- $I_1, t_1$ = protection L parameters set by the user, given in [In] and [s]

Protection L has 3 operation conditions established by the primary current level  $I_f$  and by the setting of the protection itself  $I_1$ :

$I_f \leq 0.9 \times I_1$	No alarm, all settings possible. No time setting in progress.
$0.9 \times I_1 < I_f < (1.05 \dots 1.2) \times I_1$	Prealarm L signal, all settings possible. No opening time setting in progress.
$(1.05 \dots 1.2) \times I_1 < I_f$	Alarm L signal, no setting possible. Opening time setting in progress.



#### ATTENTION: the protection L threshold range ensures that:

- the trip unit is not in the alarm condition for current values below  $1.05 \times I_1$ ;
- the trip unit is in the alarm condition for current values over  $1.2 \times I_1$ .

#### 2.4.2. Protection S

The protection, which can be disabled, can be the fixed time ( $t=k$ ) or inverse time ( $t=k/I^2$ ) type.

The tripping time with inverse time curve is given by the expression:  $t(s) = \frac{100 \times t_2}{(I_f)^2}$ . If the calculated value is less than  $t_2$ , the real tripping time is forced to  $t_2$  ( $t(s) = t_2$ .)

#### NOTES:

- $t(s)$ = estimated tripping time;
- $I_f$ = fault current; given in [In] (example: 1.7In)
- $I_2, t_2$ = protection S parameters set by the user, given in [In] and [s]

#### 2.4.3. Protection I

This protection can be disabled; it is of the fixed time ( $t=k$ ) type, and is designed for a nil intentional delay.

#### 2.4.4. Protection G

The protection, which can be disabled, can be the fixed time ( $t=k$ ) or inverse time ( $t=k/I^2$ ) type.

The tripping time with inverse time curve is given by the expression:  $t(s) = \frac{2}{(I_f/I_4)^2}$ ; If the calculated value is less than  $t_4$ , the real tripping time is forced to  $t_4$  ( $t(s) = t_4$ ).

#### NOTES:

- $t(s)$ = estimated tripping time;
- $I_f$ = fault current; given in [In] (example: 3.7In)
- $I_4, t_4$ = protection G parameters set by the user, given in [In] and [s]

LSIG is able to provide Ground (Earth) fault protection, by vectorally adding together the phase and neutral currents. The fault current is defined by the following formula:

$$\vec{I}_G = \vec{I}_1 + \vec{I}_2 + \vec{I}_3 + \vec{I}_N$$

If there is no fault in the circuit,  $I_G = 0$ .

Vice versa, the fault current will acquire an increasingly higher value, depending on the entity of the fault.



**ATTENTION: protection G is disabled for current values exceeding  $8I_n$  (for  $I_4 \geq 0.8I_n$ ), higher than  $6I_n$  (for  $0.5I_n \leq I_4 < 0.8I_n$ ) and higher than  $4I_n$  (for  $I_4 < 0.5I_n$ )**



**ATTENTION: in the absence of a separate supplied 24V DC voltage, the minimum threshold accepted is  $0.25I_n$  with rating plug= 400A and  $0.2I_n$  for all the other sizes. If the entered value fails to comply with this limitation, the SW overrides the threshold until it reaches the minimum value accepted and the LEDs display the "Inconsistent settings" error.**

### 2.4.5. Neutral Protection

LSIG allows the current signal of the neutral pole to be processed with different ratios in relation to the phase values. The following values can be set for this protection:  $I_n N = \text{Off} - 50\% - 100\% - 200\% \cdot I_n$ . The neutral protection is set by default at a current value equal to 50% of the phase regulation.

Regulation of the neutral value ( $I_n N$ ) must conform to the following formula:  $(I_1 \times I_n N) \leq I_u$ .

With four-pole circuit-breakers, the trip unit performs the test automatically and transmits a fault signal following failure to conform to this formula. If the circuit-breaker is the three-pole type with external neutral, no tests will be performed by the trip unit and user needs to correct the settings.

E.g. With CB 140G-R 2000 ( $I_u=2000A$ ), Rating plug 1000A ( $I_n=1000A$ ) and  $I_1=1I_n$ , the  $I_n N$  setting can be: 50-100-200%.  
With CB 140G-R 2000 ( $I_u=2000A$ ), Rating plug 2000A ( $I_n=2000A$ ) and  $I_1=1I_n$ , the  $I_n N$  can be: 50-100%.

The  $I_1=1I_n$  setting is the maximum setting of the protection against overload. The real permissible maximum setting must take account of derating due to the temperature, terminals used and the altitude.



**ATTENTION:** In some installations, where particularly high harmonics occur, the current circulating on the neutral may be higher than that of the phases.



**ATTENTION:** For three-pole circuit-breakers without external neutral, the Neutral protection setting must be Off, otherwise the sensor presence error will be signalled (Error CS). In these cases, connect T5-T6 to the sliding contacts, as shown in the wiring diagrams.



**ATTENTION:** Failure to comply with the setting limits of “ $I_1$ ” and “ $I_n N$ ” may result in damage to the circuit-breaker and consequent risks even for the operator.



**ATTENTION:** The protection setting is automatically 100% when the current value exceeds  $15.5 \times I_n$  on the neutral.

### 2.4.6. Protection against instantaneous short-circuit “Iinst”

Iinst is a software override protection. The purpose of this protection is to maintain the integrity of the circuit-breaker and installation in the case of particularly high current requiring shorter reaction times than those guaranteed by the instantaneous short-circuit protection.

The protection cannot be disabled. It has a single fixed time protection curve and a fixed threshold level.

### 2.4.7. Summary table of protections

Protection	Disabling	Trip threshold	Trip time	Trip threshold tolerance <sup>(2)</sup>	Trip time tolerance <sup>(2)</sup>
<b>L</b> ( $t=k/I^2$ )	<input type="checkbox"/>	<b>I1</b> = 0.4 - 0.425 - 0.45 - 0.475 - 0.5 - 0.525 - 0.55 - 0.575 - 0.6 - 0.625 - 0.65 - 0.675 - 0.7 - 0.725 - 0.75 - 0.775 - 0.8 - 0.825 - 0.85 - 0.875 - 0.9 - 0.925 - 0.975 - 1 x $I_n$	$t1 = 3 - 12 - 24 - 36 - 48 - 72 - 108 - 144 \text{ s}^{(1)}$ @ $I_f=3I_1$	Release between 1.05 and 1.2 x I1	$\pm 10\%$ $I_f \leq 6 \times I_n$ $\pm 20\%$ $I_f > 6 \times I_n$
<b>S</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<b>I2</b> = 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4 - 5 - 6 - 7 - 8 - 8.5 - 9 - 9.5 - 10 x $I_n$	Where $I_f > I2$ $t2 = 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8 \text{ s}$	$\pm 7\%$ $I_f \leq 6 \times I_n$ $\pm 10\%$ $I_f > 6 \times I_n$	The best of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$
<b>S</b> ( $t=k/I^2$ )	<input checked="" type="checkbox"/>	<b>I2</b> = 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4 - 5 - 6 - 7 - 8 - 8.5 - 9 - 9.5 - 10 x $I_n$	$t2 = 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8 \text{ s}$ @ 10 $I_n$	$\pm 7\%$ $I_f \leq 6 \times I_n$ $\pm 10\%$ $I_f > 6 \times I_n$	$\pm 15\%$ $I_f \leq 6 \times I_n$ $\pm 20\%$ $I_f > 6 \times I_n$
<b>I</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<b>I3</b> = 1.5 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 x $I_n$	$\leq 30 \text{ ms}$	$\pm 10\%$	
<b>G</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<b>I4</b> = 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 0.9 - 1 x $I_n$	Where $I_f > I4$ $t4 = 0.1 - 0.2 - 0.4 - 0.8 \text{ s}$	$\pm 7\%$	The best of the two data: $\pm 10\%$ or $\pm 40 \text{ ms}$
<b>G</b> ( $t=k/I^2$ )	<input checked="" type="checkbox"/>	<b>I4</b> = 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 0.9 - 1 x $I_n$	Minimum trip time $t4 = 0.1 - 0.2 - 0.4 - 0.8 \text{ s}$	$\pm 7\%$	$\pm 15\%$

(1) The minimum value of this trip is 1s regardless of the type of curve set (self-protection).

(2) These tolerances apply in the following conditions:

- Self-energized trip unit in service conditions (no start-up) with 2 or 3 supplied phases and/or in presence of auxiliary supply.
- operating temperature within the  $-25^\circ \dots 70^\circ$  range.
- primary current values within the operating limits (see par. 2.2.7)

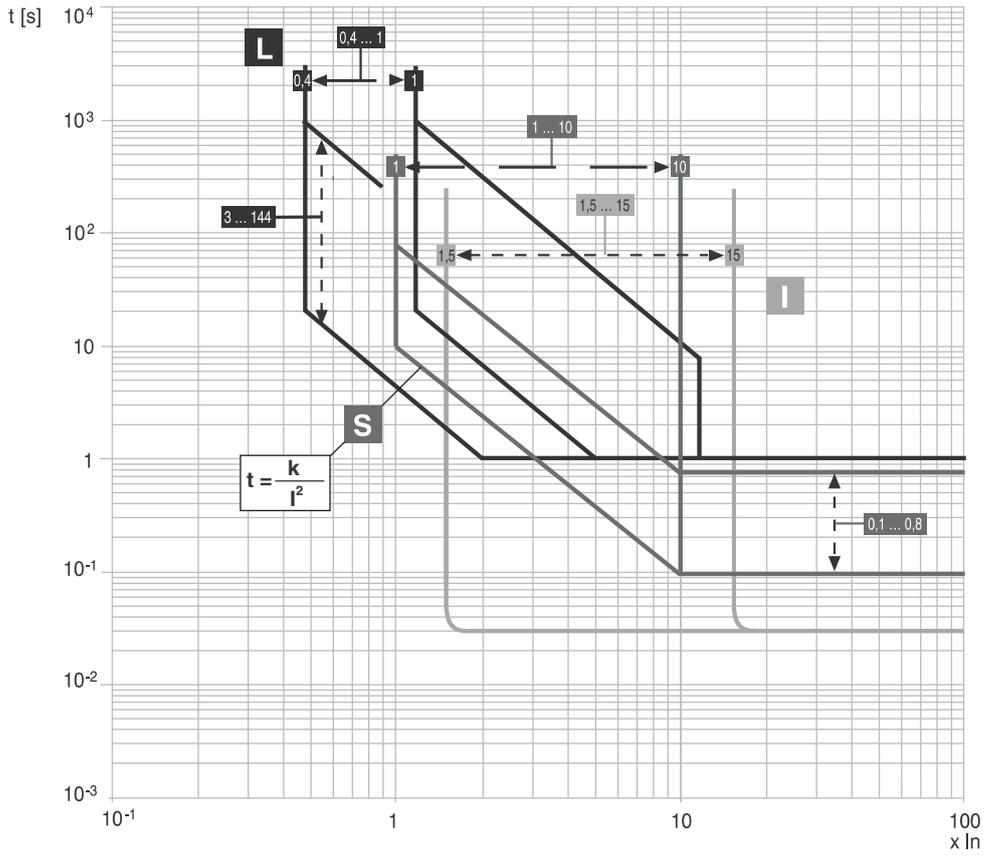
For all cases not covered by the above table, the following tolerances apply:

Protection	Trip threshold	Trip time
<b>L</b>	Release between 1.05 e 1.25 x I1	$\pm 20\%$
<b>S</b>	$\pm 10\%$	$\pm 20\%$
<b>I</b>	$\pm 15\%$	$\leq 60\text{ms}$
<b>G</b>	$\pm 10\%$	$\pm 20\%$
<b>Others</b>	$\pm 20\%$	

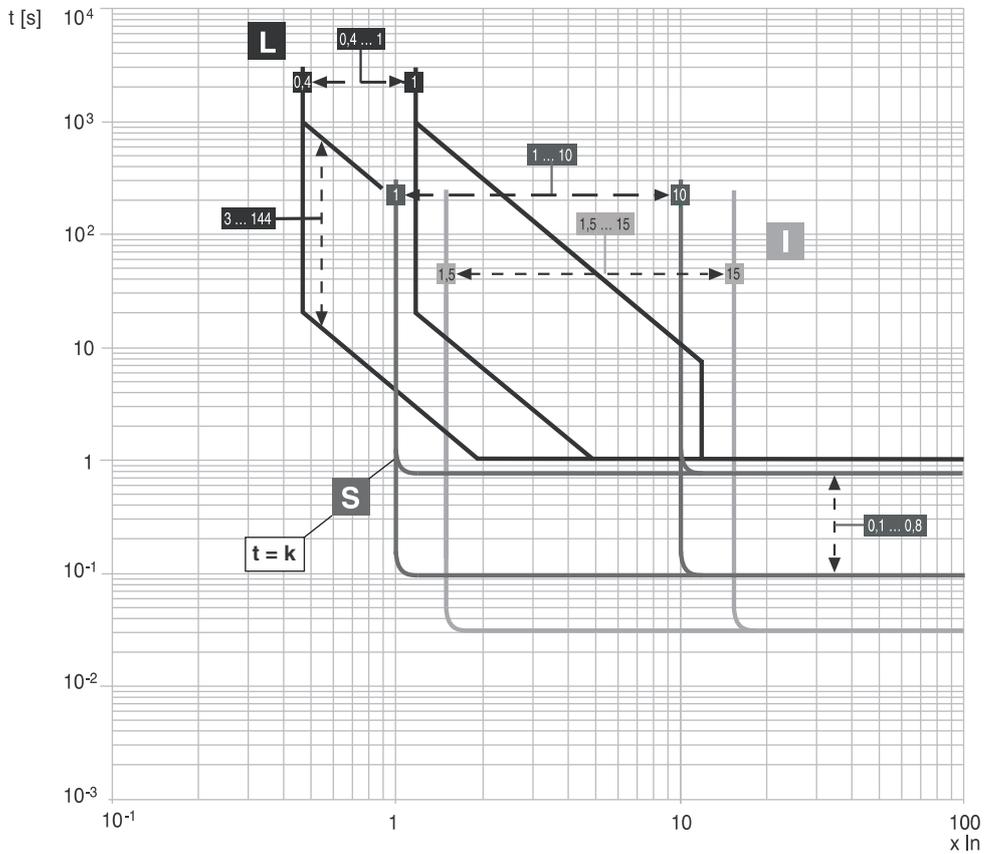
### 2.4.8. Trip curves

The trip curves provided are merely for guidance and only show a sub-group of the possible selections.

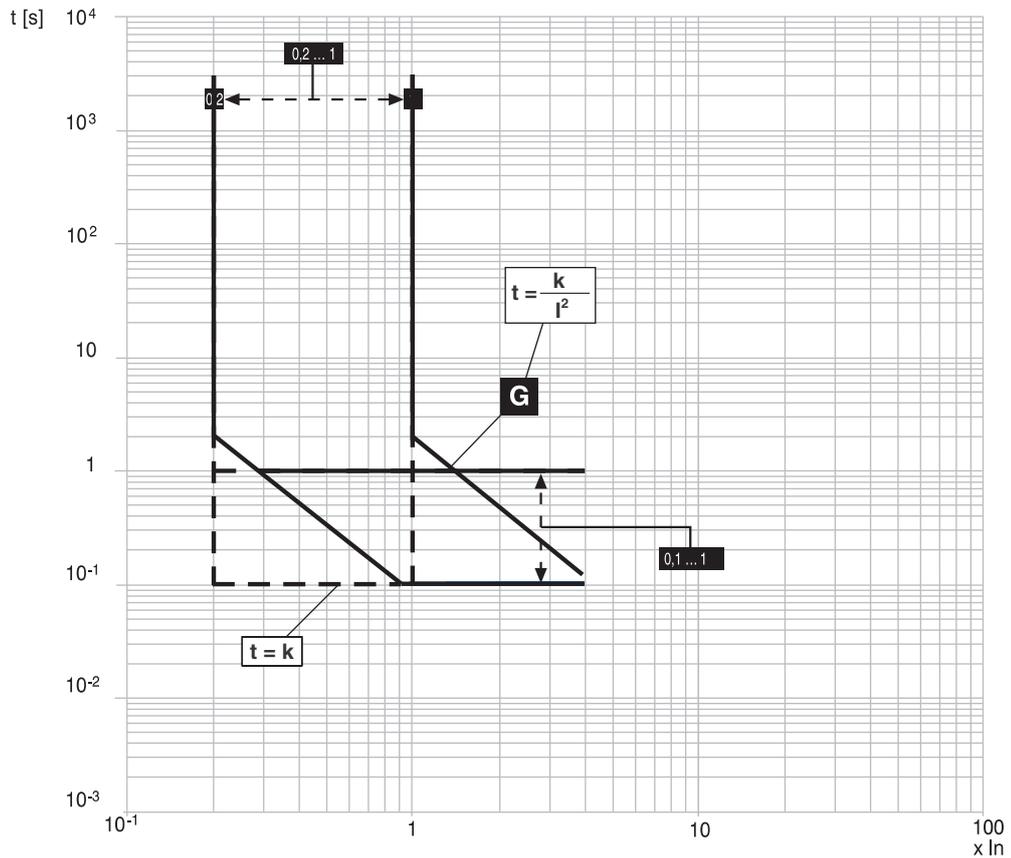
#### 2.4.8.1. Trip curves for functions $L-S(t = k/l^2)-I$



#### 2.4.8.2. Trip curves for functions $L-S(t=k)-I$



### 2.4.8.3. Trip curves for function G



## 2.5. Main functions

### 2.5.1. Measurement

Type of measurement	Range of values measured by the trip unit	Standard operation range	
		Range	Tolerance %
Phase and neutral current	0.05 ... 16 $I_n$	0.3 ... 6 $I_n$	$\pm 1.5$
Earth fault current	0.05 ... 4 $I_n$	0.3 ... 4 $I_n$	$\pm 1.5$

### 2.5.2. Self-monitoring

LSIG provides certain self-testing functions to facilitate failure analysis in the case of faulty operation or incorrect configuration of dip-switches and settings. Faults are signalled by a combination of led lights.

The functions are as follows:

- Rating Plug validity.
- Checks to find out whether the current sensors (CS) are connected correctly.
- Watchdog for proper connection of the Trip Coil (TC).

## 2.6. Putting into service and recommendations

### 2.6.1. Installation

Circuit-Breakers purchased with the trip unit assembled do not require this operation which is, however, necessary in the case of replacement.

Comply with the following instructions if the trip unit on the CB is replaced:

1. With the circuit-breaker open and possibly isolated, connect the trip unit to the circuit-breaker itself by connecting all the cables as indicated in the assembly documents.
2. Power the unit with 24V DC power supply or battery unit 140G-ELBU.
3. If there are no other errors apart from the configuration one, press the "i Test" button for a few seconds until all the red leds flash to confirm that installation has taken place.
4. Remove the battery unit.
5. Power the trip unit by means of any supply source (Vaux, battery unit).
6. Make sure that there are no configuration errors (check that the LEDs are on in the Alive LED ON configuration).
7. The circuit-breaker and trip unit can now be put into service.

### 2.6.2. Connections



**ATTENTION: Strict compliance with the wiring instructions given in this document is required. This will ensure compliance with all the international reference standards and guarantee that the trip unit functions perfectly even in heavy duty environmental and electromagnetic conditions. Pay particular attention to the earth connection.**

### 2.6.3. CS and TC connection check



**ATTENTION: If the LSIG has been installed by the user, remember to check (with the CB open and Vaux or battery unit), prior to putting the circuit-breaker into service, to make sure that the CS and TC cables have been connected correctly. Make the correct connections if this is not the case. If all the red leds come on, it means that there is an error in the CS and/or TC connections**

### 2.6.4. Connection of current sensor for external neutral



**ATTENTION: Remember to set the InN in the appropriate way if the current sensor for the external neutral conductor must be connected to a three-pole circuit-breaker. During this phase, the circuit-breaker must be open and, if possible, isolated.**

## 2.7. Default parameters

Prior to commissioning, adjust protection parameters according to specific application.

Rockwell Automation will apply the adhesive rating plates of all the variables concerning the CB (e.g. Type of CB, Rating Plug size, etc.) so as to provide the user with all the information needed to define the parameters.

LSIG is supplied with the following default settings:

#	Protection	Threshold	Time
1	L	1 In	144 s
2	S	Off	0.1 s
3	I	4 In	--
4	G	Off	0.1 s
5	Mains frequency	50 Hz <sup>(1)</sup>	
6	Neutral sel	<sup>(2)</sup>	

#### NOTES:

(1) = 50 Hz for IEC type CB  
60 Hz for UL type CB

(2) = Off for three-pole CB  
50% for four-pole CB

## 2.8. Troubleshooting

### 2.8.1. Troubleshooting

The following table lists a series of typical service conditions, to help you understand and solve hypothetical faults or malfunctions.

#### NOTES:

1. Before consulting the following table, check for any optical signals provided by the LEDs.
2. FN indicates the normal operation of the LSIG.
3. If the following suggestions fail to solve the problem, please contact the AB assistance service.

N°	Situation	Possible causes	Suggestions
1	The trip test cannot be run	1. The busbar current is > 0 2. The TC is not connected 3. Battery unit is not connected	1. Normal operation (FN) 2. Check TC connection (see par. 2.6.3) 3. Connect the battery unit
2	Trip times lower than expected	1. Threshold too low 2. Curve too low 3. Incorrect neutral selection	1. Correct threshold 2. Correct curve 3. Correct neutral adjustment
3	Trip times higher than expected	1. Threshold too high 2. Curve too high 3. Curve type "t=k/I <sup>2</sup> " 4. Incorrect neutral selection	1. Correct threshold 2. Correct curve 3. Select curve type "t=k" 4. Correct neutral adjustment
4	Rapid trip, with I3=Off	Inst tripped	FN short-circuit with high I
5	Earth fault current beyond threshold	G function automatically inhibited but no trip occurs	FN
6	Expected trip does not happen	Function OFF	FN enable protection function
7	LEDs irregularly turned on		see par. 2.3.2
8	Unexpected trip		see par. 2.3.2
9	L LED (orange) flashing		FN

### 2.8.2. In the case of a fault



**ATTENTION:** If the LSIG is suspected of being faulty, if there are signs of malfunctions or it has generated an unexpected trip, we advise you to strictly follow the recommendations below:

1. Press the "i Test" button (within 48 hours of CB opening or within 24 hours if the operating temperature is in the -40°..-25° range) and make a note of the led that comes on, the type of CB, the number of poles, any accessories connected, In, Serial Number. After 48 or 24 hours, depending on the case, the data is saved. Just the LED display is inhibited.
2. Prepare a brief description of the opening (what LEDs were displayed?, when did it happen?, how many times?, was it always under the same conditions? what type of load? what current? is the event reproducible?).
3. Send/communicate all the information collected, together with the circuit diagram for the circuit-breaker, to your Rockwell Automation Technical Support Team, for analysis.



**ATTENTION:** Letting a Circuit-Breaker run with a fault that has not been remedied may lead to an apparatus malfunction or shutdown. Removing the Circuit-Breaker from service immediately until it can be inspected and evaluated, will minimize the risk of damage to equipment or personnel.

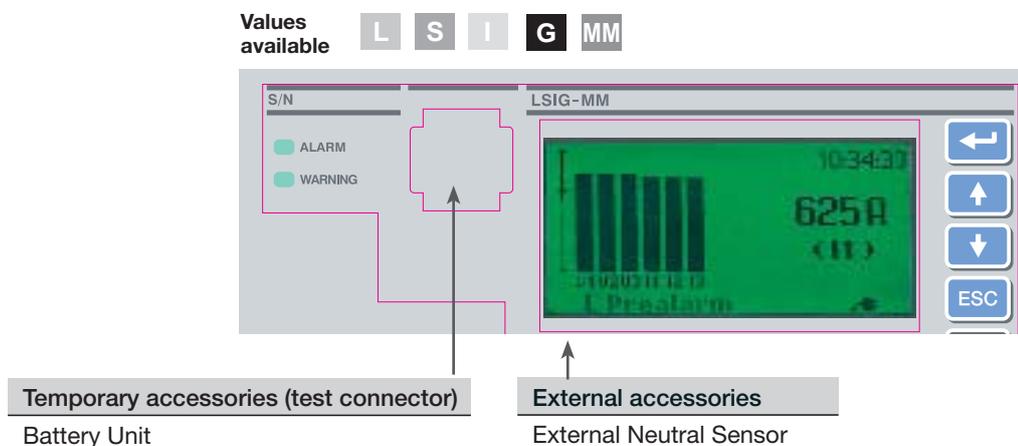
### 3. LSIG-MM Trip Unit

#### 3.1. Introduction

LSIG-MM possesses many common characteristics:

- Graphic interface: display, push-buttons and interactive menu.
- HW: connectors and accessory modules.
- SW: basic protection and measuring functions.

#### 3.2. Overview



#### 3.3. Specifications

LSIG-MM, for 140G-N/140G-NS/140G-R circuit-breakers, is electronic device with functions for monitoring and for protecting against fault currents.

The units also possess Measuring, Data Storage, Self-diagnosis, Load Control functionality.

The trip unit installed in the circuit-breaker is connected to the current sensors for primary current reading, to the Trip Coil for the circuit-breaker opening command and to the CB state contacts.

The sensors provide the primary current measurement and energy for powering the trip unit even in the absence of external power supply.

Connected directly to an opening mechanism, the Trip Coil allows the CB to open. The command is transmitted to the Trip coil in accordance with the protection settings.

The state contacts of the CB provide information about the CB's position.

A graphic display and a set of push-buttons allow all the information about the trip unit to be accessed. They can also be used for adjusting the protections and settings and for reading the state and alarms. In addition, the presence of alarms is indicated by two front leds.

##### 3.3.1. Protections

The adjustable protections available are:

Symbol	Protection against
L	overload with inverse long time delay
S	overload with adjustable delay
I	instantaneous short-circuit
G	earth fault with adjustable delay
U	phase unbalance
OT	temperature off range
MM	Instantaneous short-circuit (maintenance mode)

In addition, LSIG-MM provides fixed protection against instantaneous short-circuits at high currents, known as linst.

##### 3.3.2. Functions

LSIG-MM includes various different functions:

- Runtime measurement of the main electrical quantities available: phase current, peak factor;
- Programmable measurements: periodic storage of maximum and minimum signals and waveforms;
- Autotest: continuous monitoring of the main connections to the trip unit, among which: current sensors, trip coil, rating plug, circuit-breaker state.
- Maintenance information and counters: number of operations, estimated contact wear, events log.

### 3.3.3. Inputs/Outputs

LISG-MM is equipped with:

- K14/K15, input contact for activating protection MM.
- 95S/98S: output contact which supplies the state of protection MM.

Consult chapter 3.8.3 Function MM for further details.

### 3.3.4. Accessories

A set of accessories adds optional functions to the basic version.

- External neutral, current sensor for protecting the external neutral pole (can only be configured for three-pole circuit-breakers).
- Battery unit allows the trip unit to be temporarily energized so as to view its state (via the LEDs) and perform installation.

More details are given from page page page 36 of chapter 4, or in the dedicated manuals.

### 3.3.5. CB compatibility

LSIG-MM can be installed on all three-pole, three-pole with external neutral or four-pole 140G-N, 140G-NS, 140G-R Frames.

The CB model establishes the rated uninterrupted current the circuit-breaker is able to support (I<sub>u</sub>).

The adjustable protections refer to size I<sub>n</sub>, defined by the interchangeable Rating plug module, installed in the trip unit.

### 3.3.6. Standards

LSIG-MM has been designed to operate in accordance with the following international standards:

- IEC 60947-2 Low voltage switchgear and control gear Part 2: Circuit-Breakers.
- UL 489 Molded-Case Circuit-Breaker, Molded-Case Switches and Circuit-Breaker Enclosures.
- CSA C22.2 No. 5, Molded-Case Circuit-Breaker, Molded-Case Switches and Circuit-Breaker Enclosures.

### 3.3.7. Environmental characteristics

Operating temperature (Standard version)	-25°C ... +70°C
Storage temperature	-40°C ... +70°C
Relative humidity	0% ... 98% with condensation
Degree of protection (with trip unit installed in the CB).	IP 30

### 3.3.8. Electrical characteristics

The trip unit is energized:

- Directly by the internal current sensors connected to the busbars of each phase. In this case, the trip unit activates with the circuit-breaker closed and in the presence of a minimum three-phase current value.
- By an external auxiliary power supply. In this case, continuous operation of the unit is guaranteed even with no current on the busbars or with the circuit-breaker open.

Primary current characteristics	Range
Minimum three-phase busbar current (Low Power)	> 80A
Minimum three-phase busbar current (Full Power)	> 160A
Rated operating frequency	50/60Hz ±10%

Auxiliary supply characteristics	Activation of display lighting <sup>(3)</sup>
DC voltage (galvanically separated)	24 Vdc ±20%
Maximum ripple	5%
Inrush current @ 24Vdc	~2 A for 5ms
Rated power @ 24Vdc	~3 W



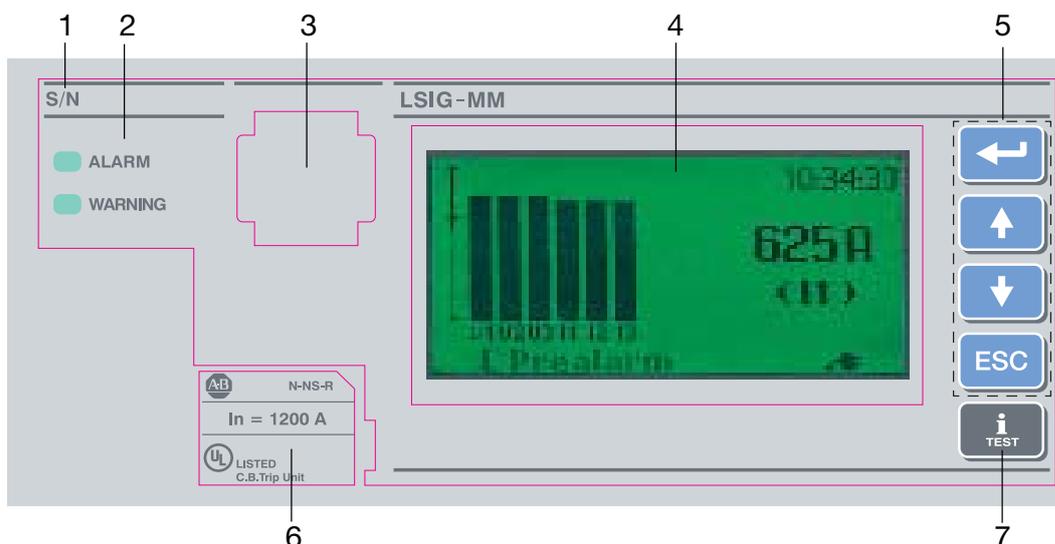
**ATTENTION: Separate DC power source must be galvanically separated from ground, in accordance with UL 60950 (IEC 60950) or equivalent IEC 60364-41 [CEI 64-8].**

If supplied by primary current or voltage, LISG-MM includes 3 different operating modes, depending on the level of the supply signals:

- Low Power: this mode guarantees operation of all the protections provided by the trip unit, operation of the front LEDs and display energizing in the Low Power mode, but access to the menus is not allowed.
- Full Power: this mode guarantees operation of all the protections provided by the trip unit, operation of the front LEDs and display energizing in the Full Power mode. Access to the menus is also allowed.
- Full Power and display lighting: this mode includes all the Full Power functions and powers the display lighting system.

### 3.4. User interface

A graphic display and a push-button panel provide all the available settings and information.



Ref.	Description
1	Serial number of the trip unit
2	State LED
3	Test connector
4	Graphic display
5	Main push-button panel
6	Rating plug
7	"i Test" button

#### 3.4.1. LEDs

The 2 front LEDs provide information about the state of the trip unit and CB. Both leds function when the unit is on.

Signal	Colour	State	Description
ALARM	Red	OFF	No protection or delay alarm
		ON (Flashing @1Hz)	Delay in progress for one or more of the following protections: current (L, S, G), phase unbalance (U) Alarm for one or more: Contact wear, Temperature Connection error of one or more: Rating Plug, Trip Coil , Key plug error, Current sensors Installation error
		ON (Fixed)	Internal error
WARNING	Yellow	OFF	No CB error or alarm
		ON (Flashing @0.5Hz)	OT protection in prealarm
		ON (Flashing @1Hz)	OT protection in alarm state
		ON (Fixed)	Protection L prealarm Protection U alarm with trip disabled Distorted wave form with > 2.1 Form factor Contact wear within range: 80%<CW<100% Iw WARNING threshold exceeded CB state error Configuration error Incongruent settings

### 3.4.2. Push-buttons

A push-button panel with 4 buttons is used to access the menus on the display of the trip unit. There is also an independent button at the side of the display, with various functions (iTest).

Key	Name	Description
	ESC	- Press ESC from the default page to access the main menu - Press ESC from within the menus to return to the previous level
	ENTER	- Press ENTER from within the menus to access the selected level or parameter - Press ENTER to confirm the option selected
	UP	- Press UP or DOWN from the default page to access the pages with the available measurements (current values)
	DOWN	- Press UP or DOWN within the menus to scroll the menu options - Press UP or DOWN within the parameter or setting areas to change their values
	iTest	- Press iTest from the default page to access the area with the information pages concerning the trip unit, the circuit-breaker and the last trip recorded. - Press iTest after the CB has tripped because of an overcurrent event, to reset the TRIP state of the trip unit (the display is redirected to the default page and the SW register corresponding to Trip is reset) - Press iTest when the trip unit is off to obtain a description of the last event that led to the trip unit being shut off (function available within 48h from shut-off).



**ATTENTION:** When parameters whose adjustment includes a large number of options or values are edited, the UP or DOWN buttons can be pressed and held down so as to scroll through the options faster and speed up the editing operations.

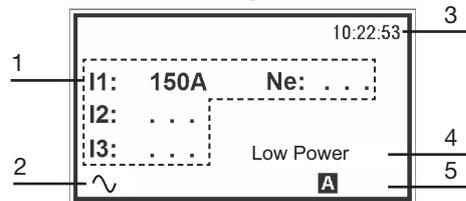
### 3.4.3. Display

LSIG-MM are equipped with a 128x64 pixel graphic LCD display where the operator can view measurements and signals, and access the menus with all the settings.

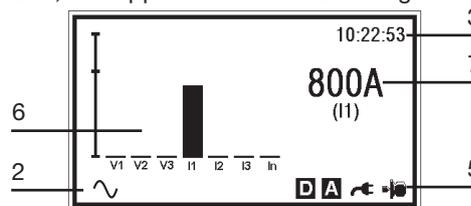
The degree of contrast of the menu display can be adjusted by selecting the Settings menu and Display Contrast parameter.

The display has 2 operating modes (the conditions are described in par. 3.3.8):

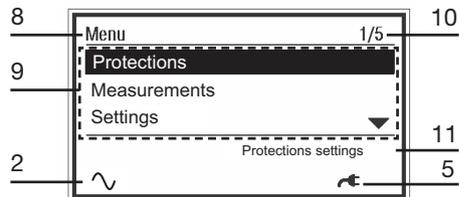
- Low Power: the display is fixed and appears as shown in the figure below:



- Full Power: various menus and information areas can be accessed with the buttons in this configuration: the main page is displayed (default page) during normal operation, and appears as shown in the figure below:



The measurements area or the menu area are accessed from the default page. All the options within the menu are displayed as shown in the figure below:



Access to the menus and the push-button panel is active in the Full Power mode. Consult the dedicated chapter for details about how to browse the menus (See par. 3.5).

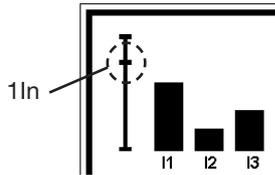
Ref.	Description
1	Phase current measurement
2	CB and/or trip unit alarms (sinewave logo appears in the absence of alarms)
3	Internal clock
4	“Low Power“ message
5	Operating icons
6	Graphic ammeter and voltmeter
7	Rms value and highest measured current phase (cyclically updated value)
8	Name of the menu being browsed
9	List of options available in the menu being browsed (the value that appears in black is the one that has been selected)
10	Number of options available in the menu being browsed
11	Value or description of the selected option

### 3.4.3.1. Graphic ammeter

Graphic ammeter option is available in the default page.

The levels of the available measurements are displayed by a vertical bar.

The current (phase) values are positioned along the abscissae, with the reference and rated value setting along the ordinate: an intermediate line indicates the  $1I_n$  value for the current values.



Example: if the bar corresponding to current I1 exceeds the intermediate line, it means that the measured value is higher than  $1I_n$ .

### 3.4.3.2. CB and trip unit alarms

Information about the state of the trip unit and CB is always available at the bottom left of the display (See par. 3.4.3 Display Ref.2).

The sinewave logo appears in the absence of alarms.

If one or more alarms have occurred, they will be displayed by a message that flashes every 2 seconds. The alarms are displayed in conjunction with an icon showing the type of alarm in question (information, active delay, danger).

Icon	Message	Description
!	Configuration	Inconsistent parameters or inconsistent data between key plug and trip unit
	Prealarm [L] / [T]	Prealarm condition of the specified protection. Example: “Prealarm L”
	Warning Iw	Iw threshold exceeded
	Contact wear	Contact wear prealarm (>80%)
	Date not valid	Incorrect date that must be programmed (new trip unit that has been off for over 48h)
	CB not defined	“Open/closed” circuit-breaker state inconsistent or incorrect
⌚	Alarm T	Internal temperature of trip unit off-range (<-25° or >85°)
	Time delay [L] / [S] / [G] / [U]	Time delay condition of the specified protection, which can conclude with an opening command transmitted to the CB.
⚠	Contact wear	Alarm for contact wear (=100%)
	Harmonic distortion	Alarm for measured harmonic distortion (form factor>2.1)
	[G] / [T] (TRIP OFF)	Alarm of the specified protection, of which the trip function has been disabled.
	Alarm [U]	Alarm of the specified protection, of which the trip function has been disabled or if the trip is activated but the CB is already open
	Load [LC1] / [LC2]	Load control alarm. Example: “Load LC2”
	Sensor [L1] / [L2] / [L3] / [Ne]	Alarm of the specific current sensor (disconnected or faulty). Example: “sensor L3”
	TC disconnected	Trip Coil disconnected or faulty
	Rating Plug	Rating plug absent, disconnected, faulty or of a model superior to the lu
	Installation	Error following an incorrect installation procedure or failure to install
Power factor	Power factor module lower than set limit	

The following table describes all the messages that could appear on the display in a pop-up window after an unallowed attempt to configure parameters or settings.

Alarm message	Description
 Password error	
 Session impossible	A programming session cannot be started due to a contingency (e.g. a timer-controlled delay still elapsing)
 Value off range	Value beyond the established limits
 Failed 1001/2001	Inconsistency between thresholds of protections L and S
 Failed 1002/2002	Inconsistency between thresholds of protections I and S
 Failed 3001	Problems with language change
 Failed 3003	Problems with neutral setting
 Exception 6	Control momentarily unavailable
 Unavailable	Function temporarily unavailable
 Invalid date	Date and time not updated. Set them.
 Parameters revised	Programming session concluded correctly
 Cancelled	Programming session cancelled
 Failed	Programming session rejected

### 3.4.3.3. Operating icons

An area with icons showing the operating conditions of the trip unit is available on the display. The area is at the bottom right of the display (See par. 3.4.3 Display Ref.5) and includes 2 positions in which the icons can be shown.

Starting from the position on the far right, a description of the available icons is given below:

Position	Icon	Condition	Description
1		OFF	Separate 24V DC source is not present
		ON	Separate 24V DC source is present
2		OFF	Editing of parameters and settings via the local mode. No update in progress
		ON	Editing of parameters and settings via the local mode. Update in progress: the icon appears if the users has changed some of the parameters but has not yet completed the operation by selecting CONFIRM. The icon only disappears after the changes ave been confirmed or annulled

## 3.5. User menus

LSIG-MM come on in the Full Power mode in the presence of the supply conditions described in sect. 3.3.8 or if supplied by one of the following: Separate power supply or Battery unit.

The operator can browse the menus on the display in the Full Power mode. When powered, the unit displays a default page from whence the operator can access three different areas:

- Measurements Area, by using the UP and DOWN buttons.
- Information Pages, by using the iTest button.
- Menus Area, by using the ESC button to access and quit the menu section.

### 3.5.1. Information Pages

This area contains 3 pages of information about the trip unit and CB: "Protection unit" page, "Circuit-breaker" page and "Last opening" page.

Press the iTest button within 5 sec to change page.

### 3.5.2. Menu Area

The menu area features a tree structure allowing all the information and parameters to be managed with various levels of detail. The main menu, which the user can access by pressing ESC from the default page, includes 5 options:

Main Menu Option	Description	Paragraph
1. Protections	Reading and adjustment of all the protections available	3.6
2. Measurements	Reading of all the measurements made by the trip unit, Trip and events	3.7
3. Settings	Reading and adjustment of the main settings of the trip unit, CB and modules	3.9
4. Test	Allows diagnosis and state control tests to be performed	3.10
5. Information	Reading of the main details about the trip unit and CB	--

The various different menus are described in the sections indicated in the table.

#### 3.5.2.1. Menu browsing

The operator can browse within each level by using the main push-button panel:

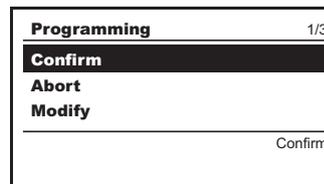
- ENTER to access a submenu or confirm an edited parameter
- ESC to quit a submenu or annul the changes made to a parameter
- UP and DOWN to scroll the menu options

The editing menus can only be accessed after the user password has been entered.

The parameters can be edited by scrolling the options available in the specific menu and by selecting the required option with the ENTER button. Some of the parameters update immediately (such as the date) while others require confirmation (CONFIRM). To accomplish the CONFIRM operation, the operator must quit the menus through to level 1 where there is a new page called PROGRAMMING in which 3 options can be chosen:

- CONFIRM: confirms the changes made
- ANNUL: annuls the changes made
- EDIT: allows the operator to browse the menus again and make further changes to the parameters.

Selection of the first two options accesses a temporary window giving the programming result (parameters updated or operation annulled).



### 3.6. Protection functions

LSIG-MM handle numerous independent protection functions.

The current and internal temperature signals are processed by the trip unit which, depending on the protection parameter settings, indicates alarms, performs delay processes and sends commands.

The various types of adjustable protections are managed by the trip unit in different ways:

- The current protections are processed according to the true root mean square value of the current values read by the current sensors.
- The temperature protection is monitored by means of the internal sensor of the trip unit.

The first fixed protection is also available and can neither be disabled nor adjusted.

The Protections menu also allows the operator to view and edit all the available parameters.

Protections	Options available	Trip unit
		LSIG-MM
Protection L	Threshold, Time, Curve, Thermal memory	S
Protection S	Enabling, Threshold, Time, Curve, Thermal Memory, Startup	S
Protection I	Enabling, Threshold, Startup	S
Protection G	Enabling, Threshold, Time, Curve, Trip enabling, Startup	S
Protection U	Enabling, Threshold, Time, Curve, Trip enabling	S
Protection T	Enabling	S
Load protection	Enabling and threshold (1), Enabling and threshold (2), Enabling and threshold (Iw)	S
Neutral Protection	Enabling, Threshold	S <sup>(1)</sup>
Protection MM	Enabling, Threshold	S

<b>Key:</b> S : standard protection O : optional function	<b>Notes:</b> 1. : function available with four-pole CB, or three-pole CB in the 3P+N configuration
---	--

**NOTE:** 3.6.2 through 3.6.11 explains each of the protection functions independently. Actual behavior of a circuit breaker depends on combination of settings for each protection function and is summarized in 3.6.12.

#### 3.6.1. Notes about Protection Operation

LSIG-MM is equipped with "backup-protection". If the first command to the trip coil fails to open the circuit-breaker immediately (TC locked), further trip commands are transmitted until the circuit-breaker opens.

The declared tolerance values of the measurements and protections of the trip unit could change if the electrical characteristics of the current signals fail to comply with the limits specified in chapter 3.3.8.

#### 3.6.2. Protection L

Protection L is the only protection that cannot be disabled since it provides self-protection against circuit-breaker overloads. The types of trip curves settable are divided into two groups according to the standard they refer to.

##### Standard trip curve according to IEC 60947-2

Only one type of curve is settable ( $t=k/I^2$ ) as defined by the IEC standard 60947-2.

The tripping time is calculated in relation to the value of  $I_f$ :

- For fault currents  $I_f \leq 12I_n$ , the tripping time of the protection is given by the expression:  $t(s) = \frac{9 \cdot t_1}{(I_f/I_1)^2}$ . If the calculated value is less than 1 second, the real tripping time is forced to 1 second ( $t(s) = 1s$ ).
- For fault currents  $I_f > 12I_n$ , the tripping time is always  $t(s) = 1s$ .

##### Standard trip curve according to IEC 60255-121

3 types of curve settings can be made and are defined by standard IEC60255-121 as A, B and C.

The protection trip time, with inverse time, is given by the expression:

$$t = \frac{k}{(I)^{\alpha} - 1} \cdot b \text{ where } I = \frac{I_f}{I_1}$$

#### NOTES:

- $t(s)$ : estimated tripping time
- $I_f$ : fault current; given in [In] (example: 0.7In)
- $I_1, t_1$ : protection L parameters set by the user, given in [In] and [s]
- $\alpha, k$ : parameters suggested by standard IEC60255-121, which vary with the type of gradient selected (e.g. for type B gradients:  $\alpha = 1$  and  $k = 13.5$ )
- $b$ : parameter included to increase the number of curves with the same slope. This parameter is automatically calculated by setting parameter  $t_1$  (required tripping time with  $I_f = 3 \times I_1$ ).

Protection L has 3 operating conditions established by the fault current level  $I_f$  and by the setting of the protection itself  $I_1$ :

$I_f \leq 0.9 x I_1$	No alarm, all settings possible. No time delay in progress.
$0.9 x I_1 < I_f < (1.05...1.2) x I_1$	Prealarm L signal, all settings possible. No opening time delay in progress.
$(1.05...1.2) x I_1 \leq I_f$	Alarm L signal, no setting possible. Opening time delay in progress.



**ATTENTION: the protection L threshold entry range ensures that:**

- the trip unit does not set to the alarm status for current values less than 1.05 x I<sub>1</sub>;
- the trip unit will set to the alarm status for current values exceeding 1.2 x I<sub>1</sub>.

**3.6.2.1. Thermal memory L**

The thermal memory function can be enabled for cable protection. It is based on the “τL” parameter, defined as the tripping time of the curve (t1) selected at 1.25xI<sub>1</sub>.

The tripping time of the trip unit will certainly be 100% of the selected value after time τL has elapsed since the last overload or the last trip, otherwise the tripping time will be reduced in relation to the overload that has occurred or the time that has elapsed.

LSIG-MM trip unit has two instruments for processing the thermal memory. The first only operates when the trip unit is energized (it also records overloads that have not lasted long enough to trip the CB), while the second operates even when the trip unit is not energized, reducing any trip times in the case of immediate reclosing and activating the moment the circuit-breaker trips. It is the trip unit that decides which of the two to use, depending on the situation in question.



**ATTENTION: The thermal memory function can only be activated if the standard type of curve has been selected (t=k/I<sup>2</sup>).**

**3.6.3. Protection S**

This protection can be disabled; it can be of the fixed time (t=k) or inverse time (t=k/I<sup>2</sup>); in the latter case, the trip time is given by the expression.

The tripping time with inverse time curve is given by the expression:  $t(s) = \frac{100 * t_2}{(I_f)^2}$ . If the calculated value is less than t<sub>2</sub>, the real tripping time is forced to t<sub>2</sub> (t(s)= t<sub>2</sub>).

**DEFINITIONS:**

- t(s): estimated tripping time
- I<sub>f</sub>: fault current; given in [In] (example: 1.4In)
- I<sub>2</sub>, t<sub>2</sub>: protection S parameters set by the user, given in [In] and [s]

**3.6.3.1. Thermal memory S**

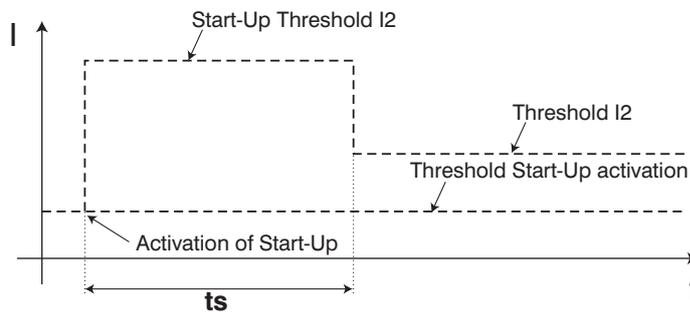
The thermal memory function can be enabled for cable protection in the case where the curve with inverse time is selected. This is based on the “tS” parameter defined as the trip time of the curve (t2) selected at 1.5xI<sub>2</sub>. The other characteristics are the same as those for thermal memory L.

**3.6.3.2. Start-up threshold S**

The start-up function can be selected in the case where the curve with fixed time is selected.

The start-up function enables the protection threshold (S, I and G) to be changed during a time interval lasting “ts”, starting from “start-up”. The latter must be intended as follows:

- Passage of at least one of the phase currents above the activation threshold of the adjustable Start-Up (0.1...10In, by 0.1In steps); A new start-up is possible after the current has dropped below this threshold.



**3.6.4. Protection "I"**

The protection is enabled/disabled from the menu.

### 3.6.5. Protection "G"

Protection G is provided by the trip unit via vectorial calculation of the neutral and phase currents. The fault current is defined by the following formula:

$$\vec{I}_G = \vec{I}_1 + \vec{I}_2 + \vec{I}_3 + \vec{I}_N$$

In the case when the circuit does not show any fault, the module of the sum of these currents is always nil; vice versa the value of the fault current will take on an increasingly large value depending on the size of the fault. This operating mode is enabled by default.

The protection, which can be disabled, can be the fixed time ( $t=k$ ), or inverse time ( $t=k/I^2$ )

The tripping time with inverse time curve is given by the expression:  $t(s) = \frac{2}{(I_f/I_4)^2}$ . If the calculated value is less than  $t_4$ , the real tripping time is forced to  $t_4$  ( $t(s) = t_4$ ).

#### NOTES:

- $t(s)$ : estimated tripping time
- $I_f$ : fault current; given in [In] (example: 0.4In)
- $I_4$ ,  $t_4$ : protection G parameters set by the user, given in [In] and [s]



**ATTENTION: Protection G is disabled for current values of over 8In (for  $I_4 \geq 0.8In$ ), over 6In (for  $0.5In \leq I_4 < 0.8In$ ), over 4In (for  $0.2In \leq I_4 < 0.5In$ ) and over 2In (for  $I_4 < 0.2In$ ).**



**ATTENTION: In the absence of a separate supplied 24V DC voltage, the minimum threshold setting is 0.25In with rating plug= 400A and 0.2In for all the other sizes. If the entered value fails to comply with this limitation, the SW overrides the threshold until it reaches the minimum value accepted and "Configuration" error appears on the display.**



**ATTENTION: It is possible to disable the trip control of the protection ("Enable Trip: Off"). In that case, for the whole duration of the unbalance the CB will not be opened, but only the condition will be signaled by means of the "warning" LED lit up and a warning message.**

#### 3.6.5.1. Start-up threshold "G"

The function behaves in exactly the same way as the protection "S".

### 3.6.6. Protection "U"

Protection against current unbalance with a fixed time response (can be disabled).

The breaker trips when, for the **t6** time setting or longer, an unbalance is detected between two or more phases that is higher than the **I6** threshold setting.

The percentage of current unbalance is calculated in the following way:

$$\% \text{ Unbal} = \frac{I_{\max} - I_{\min}}{I_{\max}} \cdot 100 \quad \text{where } I_{\max} \text{ is the maximum and } I_{\min} \text{ the minimum phase current.}$$

The trip command of the protection can be disabled: in this case, CB opening is not controlled and the condition is merely signalled by leds and a message on the display.



**ATTENTION: When the value of the phase current is above 6xIn, the function "U" excludes itself because, in this case, the other protections intervene because the fault is considered as a phase fault. The protection is not enabled for maximum phase current values lower than 0.3xIn.**

### 3.6.7. Protection "T"

A sensor inside the trip unit signals abnormal temperature conditions which could lead to temporary or continuous faults in the electronic components of the unit.

This protection has two states of operation:

State of "WARNING TEMPERATURE" with  $-25^{\circ}\text{C} < \text{temp.} < -20^{\circ}\text{C}$  or  $70^{\circ}\text{C} < \text{temp.} < 85^{\circ}\text{C}$  :

the display is turned off and the "WARNING" LED flashes at 0.5Hz

State of "ALARM TEMPERATURE" with  $\text{temp.} \leq -25^{\circ}\text{C}$  or  $\text{temp.} \geq 85^{\circ}\text{C}$  : the display is turned off, the "WARNING"

and "ALARM" Leds flash at 2Hz and the Trip is activated (if enabled by means of the "Over Temper. Trip = On" parameter).

In the event of Warning and Alarm, the display is turned off, to preserve its functionality;

The monitored temperature is not visible on the display.

The protection is always active, both with auxiliary supply and in self-supply.



**ATTENTION: If the Trip command of the protection were to be disabled, the trip unit would operate, with the circuit-breaker closed, within a temperature range where correct operation of the protections is not guaranteed.**

### 3.6.8. Load control function

Single loads can be enabled/disabled on the load side before the overload protection L intervenes and trips the circuit-breaker on the supply side. This is performed by means of contactors or switch-disconnectors controlled by the trip unit via contact S51/P1.

The current thresholds are lower than those available with the protection L, so that the load control can be used to prevent tripping due to overloads. The function is active when an auxiliary power supply is present.

The operating logic involves the activation of three contacts when the preset thresholds LC1, LC2 and  $I_w$  are exceeded.

Thresholds LC1 and LC2 are expressed as a percentage of  $I_1$  (current threshold specified for protection L) while the “warning current”  $I_w$  is expressed as an absolute value. The allowable values are given in the following table:

Threshold LC1	50%...100% x $I_1$ step 1% $I_1$
Threshold LC2	50%...100% x $I_1$ step 1% $I_1$
Threshold $I_w$	0.3 ... 10.0 x $I_n$ step 0.05 $I_n$

Contact S51/P1 can be associated with thresholds LC1 and LC2, and the configuration (NO or NC), delay time and latch settings can be entered via the trip unit.

### 3.6.9. Neutral Protection

LSIG-MM allows the current signal of the neutral pole to be processed with different ratios in relation to the value of the phases. The following values can be set for this protection:  $I_nN$  =Off - 50% - 100% - 150% - 200% \*  $I_n$ .

The adjustments can be made via the menu in the Settings-Circuit-breaker-Neutral Protection section.

Regulation of the neutral value ( $I_nN$ ) must conform to the following formula:  $(I_1 \times I_nN) \leq I_u$ .

With four-pole circuit-breakers, the trip unit performs the test automatically and transmits a fault signal following failure to conform to this formula. If the circuit-breaker is the three-pole type with external neutral, no tests will be performed by the trip unit and correction of the settings is at the user's charge.

E.g.: With 140G-N 1200 with Rating Plug at 400A,  $I_u=1200A$  and  $I_1=1I_n$ , adjustment of  $I_nN$  may be 50-100-200%

With 140G-N 1200 with Rating Plug at 800A,  $I_u=1200A$  and  $I_1=1I_n$ , adjustment of  $I_nN$  may be 50-100%

The  $I_1=1I_n$  setting is the maximum setting of the protection against overload. The real permissible maximum setting must take account of derating due to the temperature, the terminals used and the altitude, or  $I_n$  (rating plug)  $\leq 50\%$  of the size of the circuit-breaker.

 **ATTENTION: In some installations, where particularly high harmonics occur, the current circulating on the neutral may be higher than that of the phases.**

 **ATTENTION: For three-pole circuit-breakers without external neutral, the Neutral protection setting must be OFF, otherwise the sensor presence error will be signalled (Error CS). In these cases, short-circuit T5-T6 on the sliding contacts, as shown in the wiring diagrams.**

 **ATTENTION: Failure to comply with the setting limits of “I1” and “InN” may result in damage to the circuit-breaker and consequent risks even for the operator.**

 **ATTENTION: the protection setting is automatically 100% when the current value exceeds 15.5x $I_n$  on the neutral.**

### 3.6.10. Protection MM

The protection, available with LSIG-MM trip unit, protects against short-circuit.

In order to function, it must be enabled via the display menu and activated by means of a signal supplied to inputs K14/K15:

- Signal High: protection activated;
- Signal Low: protection deactivated.

The trip unit handles output contacts 95S/98s as feedback of the protection state, so as to communicate whether it is activated (contacts closed) or deactivated (contacts open).

The state of the input contacts is available in the Test-MM Test-Input menu.

Further details about the electrical characteristics of the inputs and outputs are available in chapter 3.8.3.

### 3.6.11. Protection against instantaneous short-circuit “Iinst”

Iinst is a software override protection. The purpose of this protection is to maintain the integrity of the circuit-breaker and installation in the case of particularly high current values requiring shorter reaction times than those provided by the instantaneous short-circuit-protection.

The protection cannot be disabled. It has a single fixed time protection curve and the threshold level.

3.6.12. Summary table of protection functions

Current protections	Disabling	Disabling of TRIP only	Start-up threshold	Thermal memory	Trip Threshold	Trip time	Trip threshold tolerance <sup>(2)</sup>	Trip time tolerance <sup>(2)</sup>
<b>L</b> all curves: $t=k/I^2$ and IEC 60255-3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$0.4xI_n \leq I_1 \leq 1xI_n$ step $0.01xI_n$	$3s \leq t_1 \leq 144s^{(1)}$ , step 3s @ $I_f=3I_1$	Release between 1.05 and 1.2 x I1	$\pm 10\%$ , $I_f \leq 6I_n$ $\pm 20\%$ , $I_f > 6I_n$
<b>S</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	$0.6xI_n \leq I_2 \leq 10xI_n$ step $0.1xI_n$ $0.6xI_n \leq I_{2 \text{ start-up}} \leq 10xI_n$ step $0.1xI_n$	$I_f > I_2$ $0.05s \leq t_2 \leq 0.8s$ , step 0.01s $0.10s \leq t_{2 \text{ start-up}} \leq 30s$ , step 0.01s $0.04s \leq t_{2 \text{ sel}} \leq 0.2s$ , step 0.01s	$\pm 7\%$ , $I_f \leq 6I_n$ $\pm 10\%$ , $I_f > 6I_n$	The best of the two data $\pm 10\%$ or 40ms
<b>S</b> ( $t=k/I^2$ )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	$0.6xI_n \leq I_2 \leq 10xI_n$ step $0.1xI_n$	$0.05s \leq t_2 \leq 0.8s$ , step $0.01s$ @ $I_f=10I_n$	$\pm 7\%$ , $I_f \leq 6I_n$ $\pm 10\%$ , $I_f > 6I_n$	$\pm 15\%$ , $I_f \leq 6I_n$ $\pm 20\%$ , $I_f > 6I_n$
<b>I</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	$1.5xI_n \leq I_3 \leq 15xI_n$ step $0.1xI_n$ $1.5xI_n \leq I_{3 \text{ Start-Up}} \leq 15xI_n$	$\leq 30ms$ $0.1s \leq t_{3 \text{ start-up}} \leq 30s$ , step 0.01s @ $I_f > I_3$	$\pm 10\%$	
<b>G</b> <sup>(3) (4)</sup> ( $t=k$ )	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	$0.1xI_n \leq I_4 \leq 1xI_n$ step $0.02xI_n$	$0.1s \leq t_4 \leq 1s$ , step 0.05 s $0.1s \leq t_{4 \text{ start-up}} \leq 1s$ , step 0.02s $0.04s \leq t_{4 \text{ sel}} \leq 0.2s$ , step 0.01s @ $I_f > I_4$	$\pm 7\%$	The best of the two data $\pm 10\%$ or 40ms
<b>G</b> <sup>(3) (4)</sup> ( $t=k/I^2$ )	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	$0.1xI_n \leq I_4 \leq 1xI_n$ step $0.02xI_n$ $0.2xI_n \leq I_{4 \text{ Start-Up}} \leq 1xI_4$	$0.1s \leq t_4 \leq 1s$ , step 0.05s (minimum trip time) @ $I_f > 4I_n$	$\pm 7\%$	$\pm 15\%$
<b>U</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	$2\% \leq I_6 \leq 90\%$ step 1%	$0.5s \leq t_6 \leq 60s$ , step 0.5s	$\pm 10\%$	The best of the two data $\pm 10\%$ or 40ms
<b>OT</b> (temp=k)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fixed	Instantaneous	$\pm 5^\circ C$	
<b>LC1/LC2</b> <b>load Control</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	$50\% \div 100\%$ step $1\%xI_1$			
<b>Warning Iw</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	$0.3 \div 10I_n$ step $0.05xI_n$		$\pm 10\%$	10÷40 ms
<b>MM</b> ( $t=k$ )	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	$1.5xI_n \leq I_5 \leq 4xI_n$ step $0.1xI_n$	$\leq 30ms$ @ $I_f > I_5$	$\pm 10\%$	

<sup>(1)</sup> The minimum value of this trip is 1s regardless of the type of curve set (self-protection).

<sup>(2)</sup> These tolerances are based on the following assumptions:

- energized trip unit in service conditions (without start-up) with 2 or 3 phases energized and/or in the presence of auxiliary supply.
- Preset trip time  $\geq 100ms$ .
- Temperature and currents inside working ranges.

<sup>(3)</sup> Protection G can be automatically disabled by the trip unit on the basis of the current measured. For different cases see 3.6.5.

<sup>(4)</sup> Minimum threshold for G protection, without Vaux, is 0.2 In.

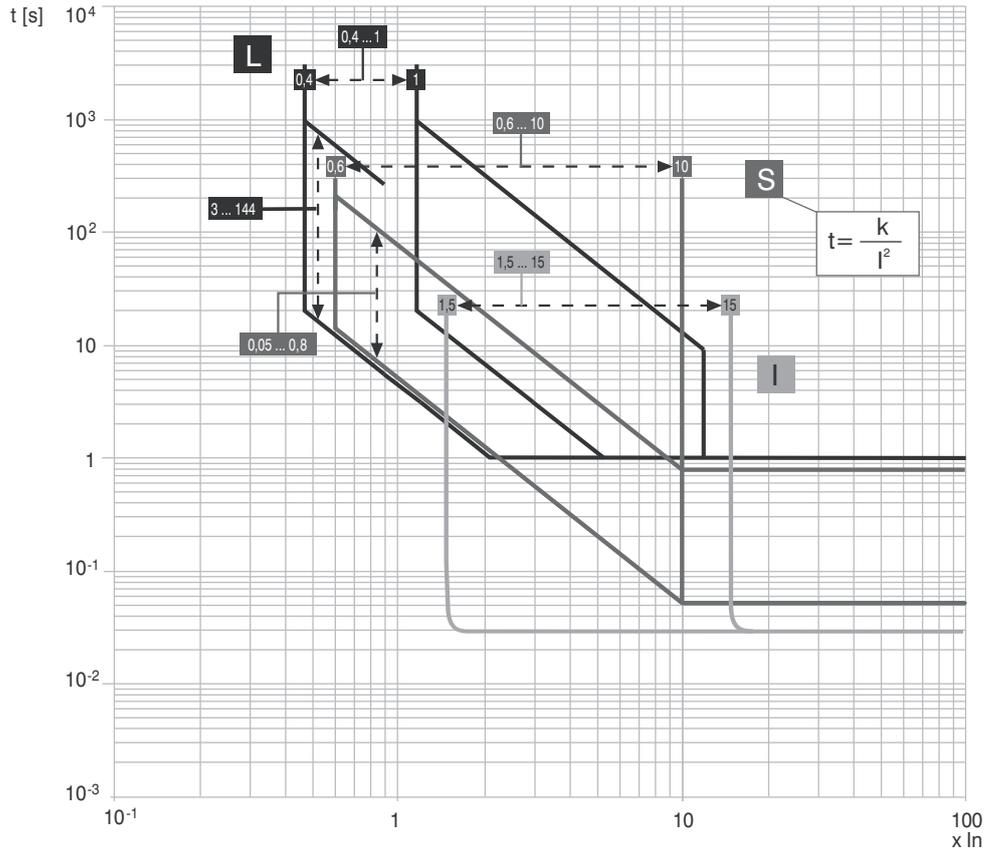
For all cases not covered by the above hypotheses, the following tolerance values apply:

Protection	Trip threshold	Trip time
L	Release between 1.05 e 1.25 x I1	$\pm 20\%$
S	$\pm 10\%$	$\pm 20\%$
I MM	$\pm 15\%$	$\leq 60ms$
G	$\pm 10\%$	$\pm 20\%$
Others		$\pm 20\%$

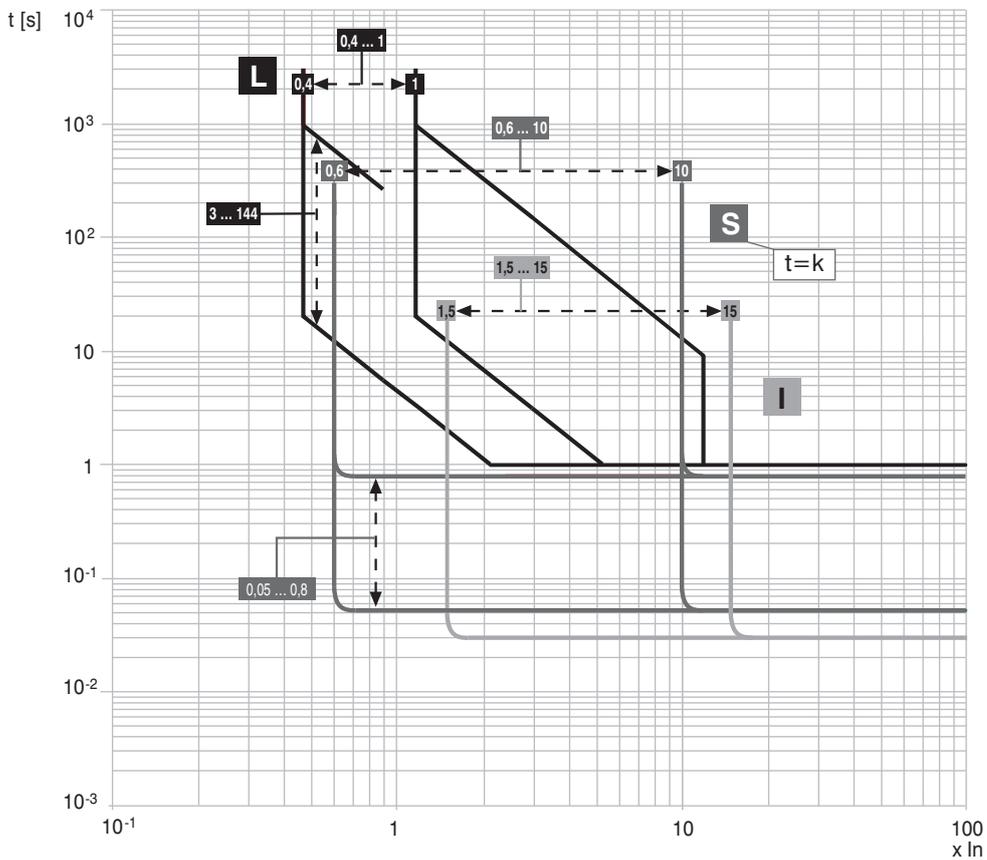
### 3.6.13. Trip curves

The trip curves given are for guidance and only show a sub-group of the possible selections. The graphs do not include the curves of protection functions with the the same principle: MM (I).

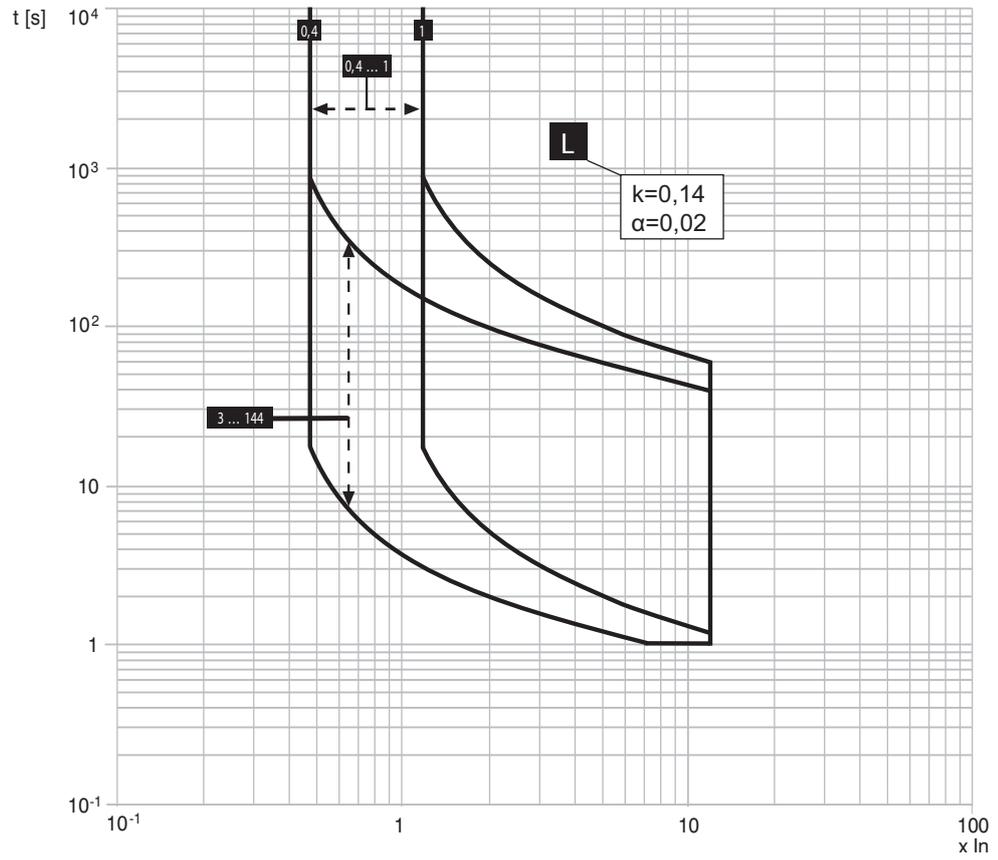
#### 3.6.13.1. Trip curves for functions L-S( $t=k/I^2$ )-I



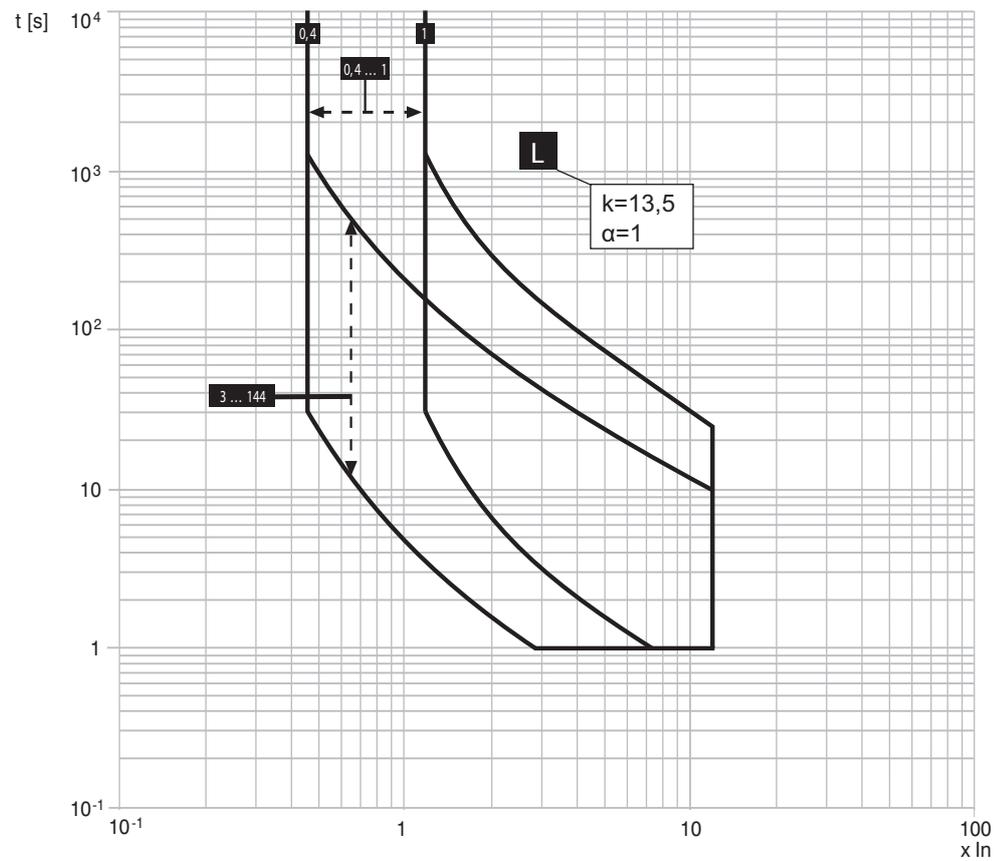
#### 3.6.13.2. Trip curves for functions L-S( $t=k$ )-I



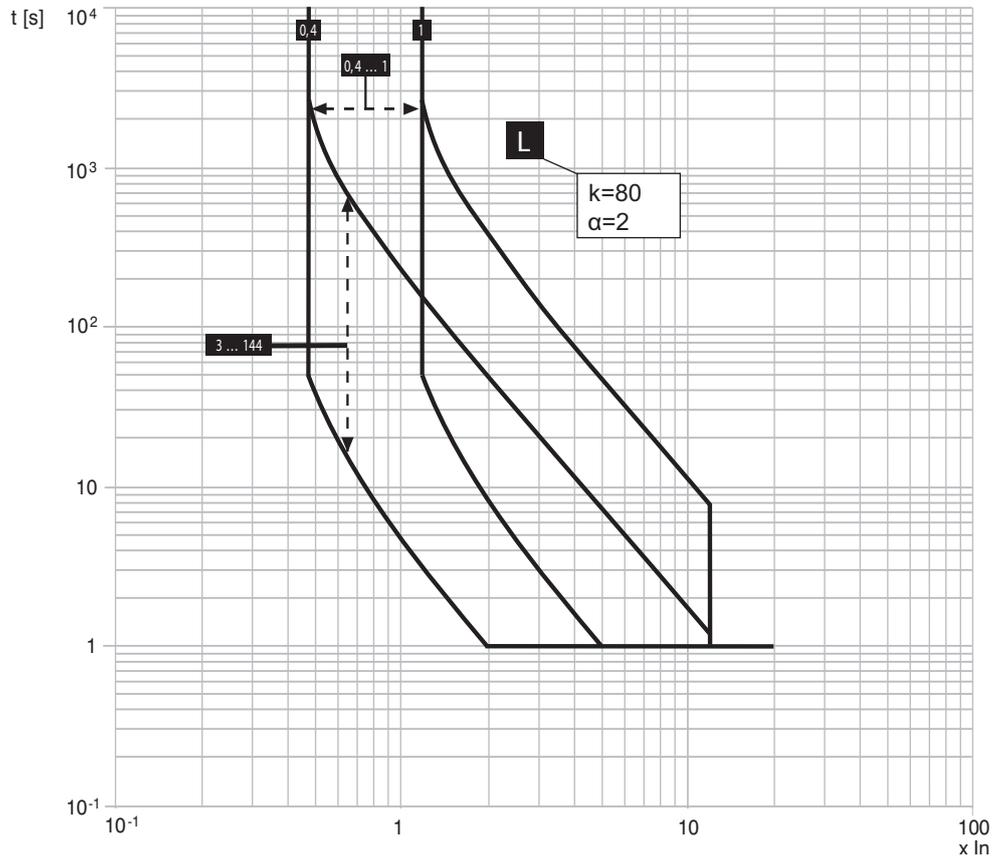
3.6.13.3. Trip curves for function L in accordance with IEC 60255-121 (type A)



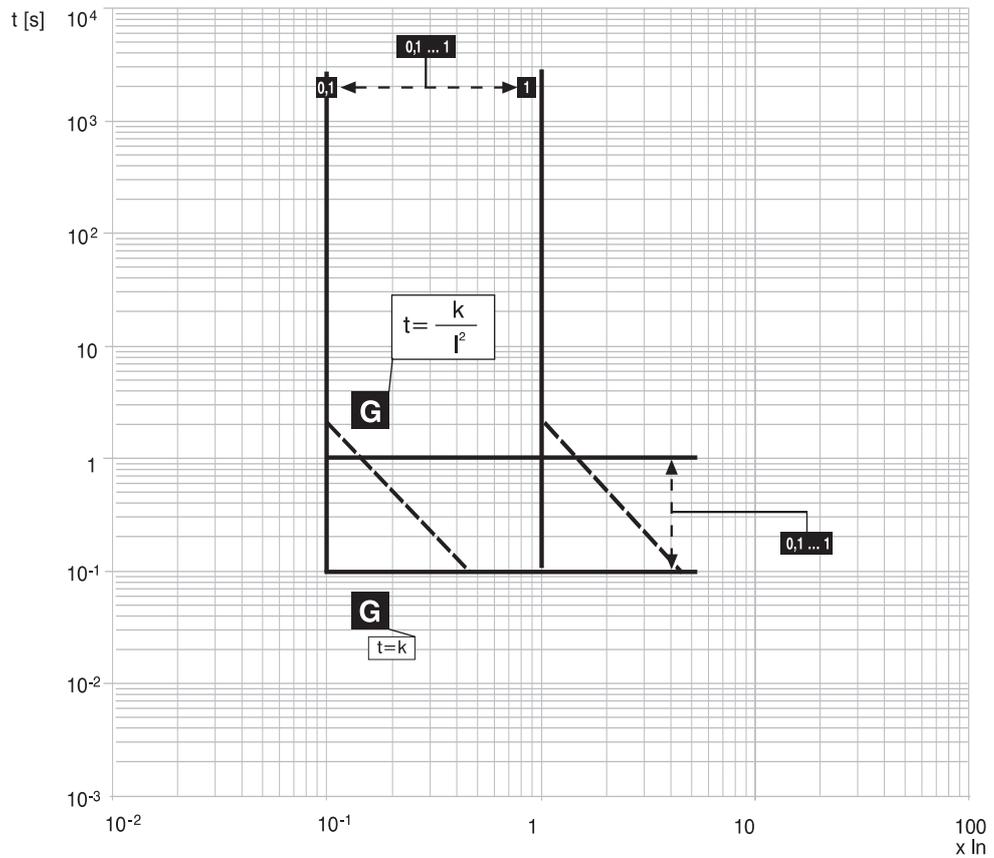
3.6.13.4. Trip curves for function L in accordance with IEC 60255-121 (type B)



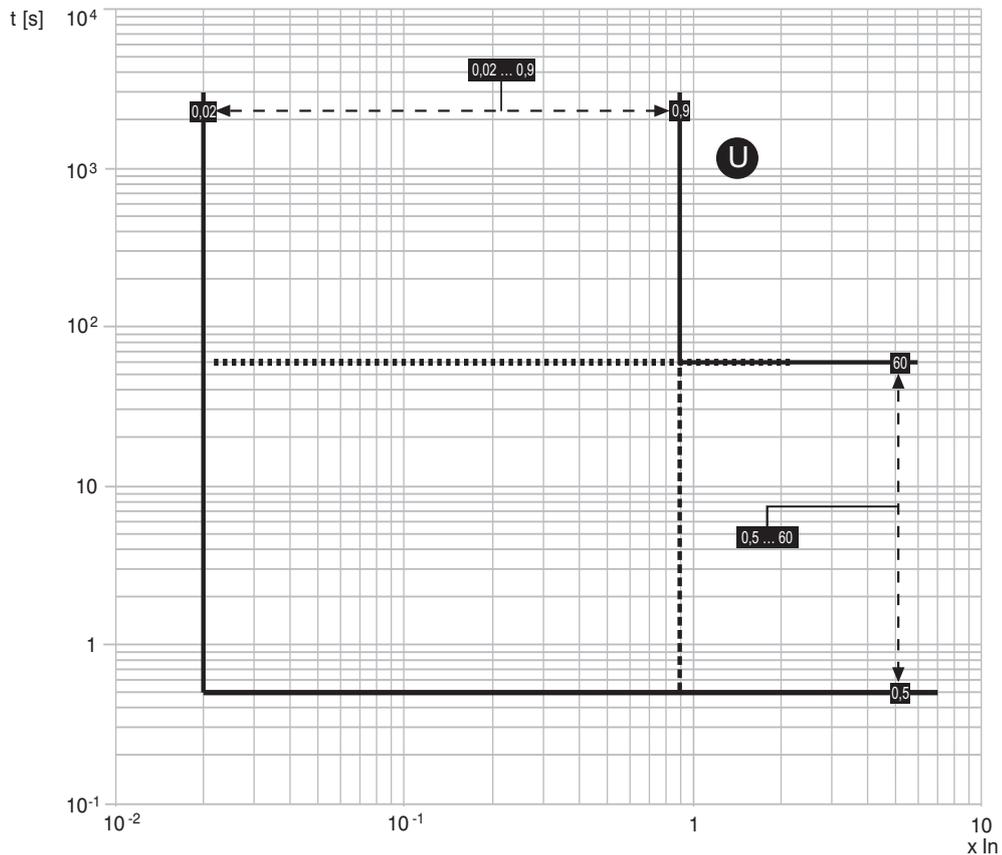
3.6.13.5. Trip curves for function L in accordance with IEC 60255-121 (type C)



3.6.13.6. Trip curves for function G



### 3.6.13.7. Trip curves for function U



### 3.7. Measuring functions

LSIG-MM include various measuring functions.

The basic measurements available in all models are:

- Currents: three phases (L1, L2, L3), neutral (N) and earth fault
- Trips (last 20) and events (last 80)
- Log register: storage of maximum current reading (with the date and time of recording)
- Peak factors: three phases (L1, L2, L3) and neutral (N)
- Percentage of contact wear.

#### 3.7.1. Runtime measurements: current, voltage, power

The main current, measurements can be accessed by using the UP and DOWN buttons from the default page.

In the default page, histograms with the currents appear on the display, while the value and the highest phase are also given in the numerical format.

The following current measurements are available:

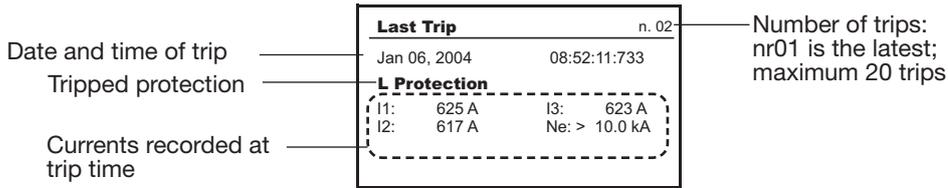
- Three-pole CB: phase currents I1, I2, I3 are available
- Three-pole CB, configuration with external neutral (3P+N): phase currents I1, I2, I3, Ine are available
- Four-pole CB: phase currents I1, I2, I3, Ine are available

The runtime measurement tolerance margins are:

Type of measurement range	Range of values measured by the trip unit	Standard operation	
		Range	Tolerance %
Phase and neutral currents	0.05 ... 16In	0.3 ... 6 In	± 1.5
Internal ground fault current	0.05 ... 16In 4In	0.3 ... 4 In	± 1.5

### 3.7.2. Trip

The list of trips recorded by the trip unit is available in the Measurements-Log Files-Openings section. Information about the last trip is also available from the main page by pressing the iTest button three times. Each trip is recorded with useful information enabling it to be identified:



Use the UP and DOWN buttons to scroll all the trips recorded in the Openings menu.

**ATTENTION:** After a trip has occurred, the page with the recorded trip appears on the display. Press iTest to remove it and go back to the main page.

**ATTENTION:** with the trip unit off after a trip has occurred, press the itest button to display the page with the recorded trip for a few seconds. The trip will be displayed for approximately 48 hours, because the trip unit is self powered. To maintain the trip status beyond 48 hours, the use of a separate 24V DC power source is recommended.

### 3.7.3. Events

The list of trips recorded by the trip unit is available in the Measurements-Log Files-Events section. The page of each event is similar to that of the trips, with a description of the event instead of the message about the protection and numbering that refers to the last event recorded (Last, Last-1, Last-2,...).

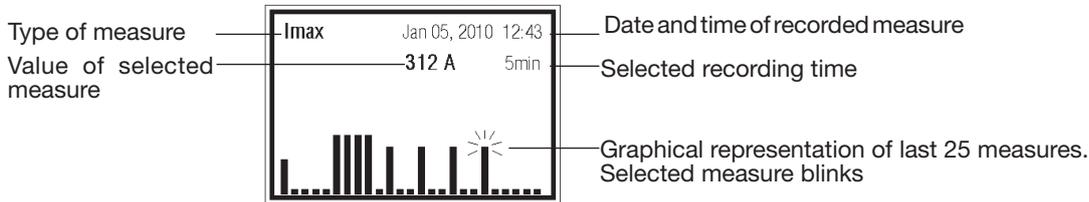
LSIG-MM are able to record up to 80 events. Use the UP and DOWN buttons to scroll all the events.

### 3.7.4. Measurements Log register

LSIG-MM can record various different measurements and allow the recording time between one measurement and the next to be set. The measurements are available in the Measurements-Log Files-Measurements section:

Name	Description
I Max	Rms value and maximum current phase
Reset measurements	Meter reset command

Each measurement available is shown on the display by a graphic page:



Use the UP and DOWN buttons to scroll all the recordings of each measurement. Select the Measurement reset command to reset all the recordings. The recording time can be adjusted in the Settings-Measurement interval menu.

### 3.7.5. Peak factor

The peak factor measurement, a ratio between  $I_{peak} / I_{rms}$  is available for each current phase. The measurement is not displayed if the current is less than  $0.3 \times I_n$  and is not available for currents exceeding  $6 \times I_n$ .

Type of measurement range	Range of values measured by the trip unit	Standard operation	
		Range	Tolerance %
Peak factor	0.3 ... 6 I <sub>n</sub>	0.3 ... 6 I <sub>n</sub>	± 1.5

### 3.7.6. Contact wear

This sub-menu displays the percentage of wear on the CB contacts.

### 3.8. Main functions

#### 3.8.1. Watchdog

LSIG-MM provide certain watchdog functions able to ensure that CB and trip unit faults are managed properly. These functions are as follows:

- Watchdog for presence of Auxiliary power supply with “plug” icon displayed.
- RATING PLUG validity.
- Watchdog for proper connection of the current sensors (CS). If it is enabled, any anomalies are indicated by a special alarm message and the “alarm” LED coming on, and the circuit-breaker opens after 1s.
- Watchdog for proper connection of the Trip Coil (TC). If it is enabled, any anomalies are indicated by a special alarm message and the “alarm” LED coming on.

#### 3.8.2. Circuit-breaker state

LSIG-MM detect the state of the circuit-breaker by means of specific wiring in the CB itself. When the presence of current is detected with the circuit-breaker “OPEN”, state error is signalled by means of a warning message and the “warning” led comes on.

#### 3.8.3. Function MM

LSIG-MM has a pair of input and output contacts for managing protection MM, described in par. 3.6.10:

- **K14/K15**: input for activating protection MM;

The voltage applied between K14 (+) and K15 (-) establishes the state of the protection:

- 0..2Vdc protection deactivated.
- 15..24Vdc protection activated.

Consumption @24Vdc= 3mA max.

- **95S/98S**: the output supplies the state of protection MM:

- If the protection is active, the contact is closed;
- If the protection is deactivated, the contact is open.

The contact is available in all supply configurations and possesses the following electrical characteristics:

Type of contact	
Maximum switching voltage	400 Vac (Peak) / Vdc
Maximum switching current	0.1 Aac (Peak) / Adc
Maximum switching power	40 W
Contact/Circuit insulation	1500 Vac



#### ATTENTION:

- Upon powering, and if there is already energizing voltage on the input contact, the output contact closes within 100 ms.
- Following a trip through protection MM, the output contact can open temporarily for up to 20ms.

### 3.9. Settings Menu

The Settings menu contains various different settings for trip unit operation and for configuring the installation in the correct way. 7 options are available:

Settings Menu Options	Description
1. Circuit breaker	Enabling and adjustment of the Neutral protection, earth protection and the installation commands
2. Mains frequency	Adjustment of the frequency of the installation
3. Measurement interval	Adjustment of the measurement interval for the log file
4. System	Date, time, language, password settings
5. Display Contrast	Adjustment of the display contrast

#### 3.9.1. Circuit-breaker

This area allows you to:

- Enable the Neutral protection (ON/OFF) and adjust its control level (50%- 100% - 200%). All the details about the operating mode are given in the description of the Neutral protection, in par. 3.6.9.
- Perform the installation and uninstalling operations for the trip unit in the CB. Instructions for correct installation are given in par. 3.11.1 and 3.11.2.

#### 3.9.2. Network frequency

This area allows you to enter the frequency of the installation: 50Hz or 60Hz.

Selection of this parameter allows the trip unit to calibrate its protection and measurement functions according to the value chosen by the user.

#### 3.9.3. Measurement Interval

The storage time for the measurements log file can be adjusted in the Settings-Measurement Interval menu. Further details about the measurements function are given in par. 3.7.4.

### 3.9.4. System

The date and time of the trip unit, the Language and Password can be adjusted in the Settings-System menu.

#### 3.9.4.1. Language

When selecting the system language, make sure that:

- the CB is open;
- 24V DC supply or 140G-ELBU is present.

The trip unit will not allow the language to be changed in the absence of one of the above conditions.

#### 3.9.4.2. Password

LSIG-MM is supplied with the default password: 0001.

The password, which is required if all the changes to the protections or settings in the trip unit are to be saved, can be changed in the Settings-System-New Password menu.

The values that can be used in the password range from 0000 to 9999.

To change the PW, first enter the old one, then select the 4 new figures: the value of each figure can be chosen with the UP and DOWN keys. Use ENTER to confirm the figure and pass on to the next one.

The password is checked after the fourth figure has been entered. The procedure will change from the "READ" state to the "EDIT" state if the password is correct.

The password prompt is disabled by setting the value of the password to [0000] (in the "System Configuration" menu). It is therefore always possible to switch from "READ" to "EDIT".



**ATTENTION: The password is valid for up to two minutes from the last time a key was pressed. After that time, it must be entered again so as to validate any changes or to access the menus.**

#### 3.9.5. Display contrast

The degree of contrast on the display can be adjusted in the Settings-Display Contrast menu.

### 3.10. Test Menu

The Test menu provides various options for checking the trip unit and CB.

Up to 5 options are available:

Name	Description
1. CB status	allows the user to view the CB state read by the trip unit.
2. Auto Test	allows the display and led test to be performed
3. Trip test	allows an opening command to be transmitted to the CB
4. MM Test module	allows output 95S/98S to be checked and the state of K14/K15

#### 3.10.1. Autotest

When autotest is activated, the display and leds will perform a test procedure allowing the user to check the state of the display and operation of the leds themselves.

The procedure lasts several seconds and the sequence is as follows:

Phase	ALARM and WARNING leds	Display
1	On and fixed	The words "ALLEN - BRADLEY" and a message with the name of "LSIG-MM"
2	Off	Flashing backlighting (only if 24V DC supply is present)
3	Normal operation	Contrast from 100% (display dark) to 0% (display light), after which the words and logo reappear

The test result and assessment are at the user's discretion. Inform AB if faults occur (Leds fail to function, display areas that fail to function correctly).

#### 3.10.2. Trip test

The state of CB opening can be checked by activating the trip test.

The trip unit sends a command to the CT, which activates a CB opening mechanism. Opening of the circuit-breaker denotes a positive test result.



**ATTENTION: To perform the trip test, there must be no current circulating and the CB must be closed (failing this, the Exception 6 error will appear).**

#### 3.10.3. MM Test

The test menu is available with the MM trip unit version. 2 possible options can be selected:

- Auto Test causes contacts 95s/98s to close for 1s.
- Input allows the state of inputs K14/K15 to be verified: On for > 15 VDC voltage values, Off for < 2 VDC voltage values.

The verifications and test setup are at the user's discretion and must comply with the maximum limits of the inputs and outputs.

### 3.11. Putting into service and recommendations

#### 3.11.1. Installation

Circuit-Breakers purchased with the trip unit assembled do not require this operation which is, however, necessary in the case of replacement.

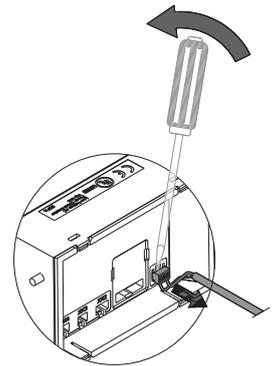
Comply with the following instructions if the trip unit on the CB is replaced:

1. With the circuit-breaker open and possibly isolated, install the trip unit on the circuit-breaker
2. Power the trip unit with battery unit only
3. If there are no other errors, the display will show the message  Configuration (configuration error) accompanied by the yellow LED coming on permanently (warning)
4. Enter the unit's "Settings" menu
5. Select "Circuit-breaker"
6. Select "Unit installation"
7. Input the password
8. Select "Install" and press "ENTER"
9. When the red led flashes on and off and the message  Installation (installation error) is displayed, remove the battery unit
10. Energize the trip unit from any other source
11. Check for the absence of configuration errors.

#### 3.11.2. Uninstalling

To complete the procedure for uninstalling a LSIG-MM unit, follow the steps below:

1. With the circuit-breaker open and/or isolated, power the trip unit with battery unit
2. Enter the unit's "Settings" menu
3. Select "Circuit-breaker"
4. Select "Unit installation"
5. Input the password
6. Select "Uninstall" and press "ENTER"
7. Remove the battery unit
8. Remove the LSIG-MM unit from the circuit-breaker
9. The remove the TC connector, proceed as indicated in the figure alongside.



The uninstalling procedure is not strictly necessary for operation but is strongly recommended as it allows allows circuit-breaker parameters such as contact wear and others that would otherwise be lost, to be stored. The data in question are then re-transmitted to the new trip unit to be installed in the same circuit-breaker.

#### 3.11.3. Connections



**ATTENTION:** For the connections provided by the user, it is recommended that you comply strictly with the recommendations contained in this document. This will ensure compliance with all the international reference standards and guarantee that the trip unit functions perfectly even in heavy duty environmental and electromagnetic conditions.

Pay particular attention to the types of cable, the connections to earth and the maximum distances.

#### 3.11.4. CS and TC connection test



**ATTENTION:** If LSIG-MM has been installed by the user, it is important, before closing the CB, to check the last line on the display when the trip unit is turned on for the first time via battery unit module. No CS and/or TC disconnected messages must appear; if they do, do not close the circuit-breaker and make the correct connections.

#### 3.11.5. Current sensor connection for external neutral



**ATTENTION:** If you want to connect the current sensor for the external neutral conductor to a three-pole circuit-IMPORTANT, remember to set  $I_{n,N}$  accordingly. During this procedure, the circuit-breaker must be open and preferably isolated.

### 3.11.6. Default parameters

Before LSIG-MM is put into service, it is essential for the user to define and carefully adjust the editable parameters to suit the installation requirements.

AB will apply the adhesive rating plates of all the variables concerning the CB (e.g. Type of CB, Rating Plug size, etc.), thereby allowing the user to find the information he needs when defining the parameters.



**ATTENTION: Apart from this, it is essential for the user to change the password and carefully define each editable parameter before putting the trip unit into service.**

LSIG-MM are supplied with the following predefined parameters:

Protection	On/Off	Thresholds	Time	Curve	Trip
L	--	1 In	144 s	I <sup>2</sup> t	--
S	Off	6 In	50 ms	K	--
I	On	4 In	--	--	--
G	Off	0.2 In	0.4 s	K	On
U (currents)	Off	50 %	5 s		Off
OT	--				Off
K LC1	Off	50 % I1			
K LC2	Off	75 % I1			
Language	--	Engl			
Net Frequency	--	50 Hz			
Neutral sel.	--	*			
S startup	Off	6 In	100 ms		
G startup	Off	1 In	100 ms		
Password	--	0001			
Measuring interval	--	60 min			
Iw	Off	3 In			
Warning: harmonic distortion	Off				
Start up activation threshold		0.1In			
MM	On	2.5 In			

#### NOTES:

\* = OFF for three-pole versions

\* = 50% for four-pole versions

\* = 100% for full size versions

### 3.12. Troubleshooting

#### 3.12.1. Troubleshooting

The following table lists a series of typical service conditions, to help you understand and solve hypothetical faults or malfunctions.

#### NOTES:

1. Before consulting the following table, check for any error messages appearing for some seconds on the display.
2. If the suggestions do not help in resolving the problem, please contact your Rockwell Automation technical support team.

N°	Situation	Possible causes	Suggestions
1	The trip test cannot be run	<ol style="list-style-type: none"> <li>1. The busbar current is <math>&gt; 0</math></li> <li>2. The TC is not connected</li> </ol>	<ol style="list-style-type: none"> <li>1. Verify current is not present to the trip unit</li> <li>2. Check the messages on the display</li> </ol>
2	Trip times lower than expected	<ol style="list-style-type: none"> <li>1. Threshold is set too low</li> <li>2. Time is set too low</li> <li>3. Thermal memory enabled</li> <li>4. Incorrect Neutral Selection</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust threshold</li> <li>2. Adjust time</li> <li>3. Exclude if not necessary</li> <li>4. Correct Neutral Selection</li> </ol>
3	Trip times higher than expected	<ol style="list-style-type: none"> <li>1. Threshold is set too high</li> <li>2. Time is set too high</li> <li>3. Curve I<sup>2</sup>t inserted</li> <li>4. Incorrect Neutral Selection</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust threshold</li> <li>2. Adjust time</li> <li>3. Exclude if not necessary</li> <li>4. Correct Neutral Selection</li> </ol>
4	Rapid trip, with I3=Off	Current above I3 override value	Verify the cause of high current condition
5	High earth fault current, but no trip happens	<ol style="list-style-type: none"> <li>1. Incorrect selection of the sensor</li> <li>2. Function G prevented with I<math>&gt;4</math>In</li> </ol>	<ol style="list-style-type: none"> <li>1. Set int. or ext. sensor</li> <li>2. Set function with I<math>&gt;4</math>In</li> </ol>
6	Display off	<ol style="list-style-type: none"> <li>1. 24V DC supply missing and the current is below the minimum value.</li> <li>2. Operating temperature out of range</li> </ol>	<ol style="list-style-type: none"> <li>1. See par. 3.4.3</li> <li>2. See par. 3.3.7 and see par. 3.6.7</li> </ol>
7	Reading of I incorrect	Current below the minimum threshold that can be displayed	Verify current with a meter
8	Message "" instead of expected data	Function disabled or data off range	Verify protection function and settings
9	The expected trip does not occur	Trip function disabled	Enable trip if necessary
10	No activation of the Unbalance U protection	Values of I out of range	See par. 3.6.6
11	No display of trip data	24V DC supply missing, the buffer capacitor is discharged	See par. 1.7.2
12	The password is not requested	The password has been disabled	Re-enter the password with a value other than 0000
13	Impossible to change any parameter	LSIG-MM is activated	Parameter ara not adjustable when MM is activated
14	“  Temp. sensor” or “  Start-up” message	Possible fault inside the trip unit	Contact Rockwell Automation Technical Support
15	Invalid date	<ol style="list-style-type: none"> <li>1. First installation</li> <li>2. Information lost due to power failure</li> </ol>	Change date, see par. 3.9.4
16	Untimely trip		See par. 3.4.3.2
17	LED lighting		See par. 3.4.1
18	The language cannot be changed	<ol style="list-style-type: none"> <li>1. The trip unit is configured in the remote mode</li> <li>2. CB not open</li> <li>3. 24V DC supply or battery unit not installed</li> </ol>	<ol style="list-style-type: none"> <li>1. Set locally</li> <li>2. Open CB</li> <li>3. Power the trip unit</li> </ol>
19	The activation contact of protection MM is not closed	Protection MM has not been enabled or K14/15 has no incoming signal	Check the menu to make sure that the protection is enabled and use a tester to check that voltage and polarity at the ends of K14 and K15 are correct

### 3.12.2. In the case of a fault

 **ATTENTION: If you suspect that the trip unit is faulty, functions incorrectly or has generated an unwanted trip, you are strongly advised to strictly comply with the following instructions in Measurements menu → Historicals → Trip:**

1. Make a note of the type of protection that has tripped by accessing the LAST TRIP page if there is an external power supply (24V DC supply or battery) or by pressing “i Test” if in self-powering mode.
2. Record the type of circuit-breaker, number of poles, any accessories connected, In, Serial Number (see par. 14.4) and the SW version.
3. Prepare a brief description of the opening (what LEDs and/or indications were displayed? when did it happen?, how many times ?, was it always under the same conditions? what type of load? what voltage? what current? is the event reproducible?)
4. Send/communicate all the information collected, together with the circuit diagram for the circuit-breaker, to your nearest AB Customer Support service.

The completeness and accuracy of the information given to the Rockwell Automation Technical Support will facilitate technical analysis of the problem encountered, and will allow us to carry out all actions useful for the user rapidly.

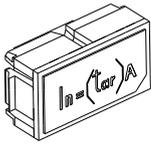
 **ATTENTION: Letting a switch run with a fault that has not been remedied may lead to an apparatus malfunction or shutdown. Remove the apparatus immediately until it can be inspected or repaired. This situation may lead to personal injury or property damage.**

## 4. ACCESSORIES

### 4.1. External neutral

This is a current sensor for the external neutral pole of the circuit-breaker, designed to provide neutral protection for three-pole circuit-breakers. Further details about connection of the external neutral are available in document 1000529R0513.

### 4.2. Rating Plug



The rating plug defines the rated current  $I_n$ , which is essential for regulating the protections. This is because the regulation of all the protections refers to  $I_n$  (e.g.:  $I_1 = 0.4 \times I_n$ ).

The rating plug is installed in the trip unit, on a dedicated front connector and is available to the user.

The trip unit can be equipped with various different Rating Plug models, up to value  $I_u$  (uninterrupted rated current  $I_u$  of the CB given on the rating plate of the front guard).

Example: CB 140G-N 800 has  $I_u = 800$  A, and can be fitted with a rating plug with  $I_n \leq 800$  A.

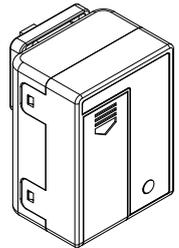
The module is interchangeable, with the trip unit off and the CB open.

The trip unit continuously checks for the presence of the rating plug and signals its absence or any assembly errors.

 **ATTENTION: Replacement of the rating plug with the trip unit on or the CB closed could lead to faulty trip unit operation or undesired opening of the CB.**

### 4.3. Battery Unit (140G-ELBU)

Battery unit is an external unit allowing the trip unit to be energized so that Installation, Autotest and Trip Test can be performed, along with verifications with the CB open. The unit is connected to the trip unit by means of the front service connector.



At the end of its life, this equipment should be collected separately from any unsorted municipal waste

Allen-Bradley, Rockwell Software, and Rockwell Automation are trademarks of Rockwell Automation, Inc.  
Trademarks not belonging to Rockwell Automation are property of their respective companies.

**[www.rockwellautomation.com](http://www.rockwellautomation.com)**

---

**Power, Control and Information Solutions Headquarters**

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Rockwell Automation maintains current product environmental compliance information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>

Adjustment instruction LSI, LSI, LSI-MM for 140G-K, 140G-M

Sganciatori  
Auslöser  
Dèclencheur  
Relé

**Installation - Installazione - Instalación**  
**Instalação - 取付け方法 - 安裝**

**WARNING:** To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

**AVVERTENZA:** Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti.

**WARNUNG:** Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden.

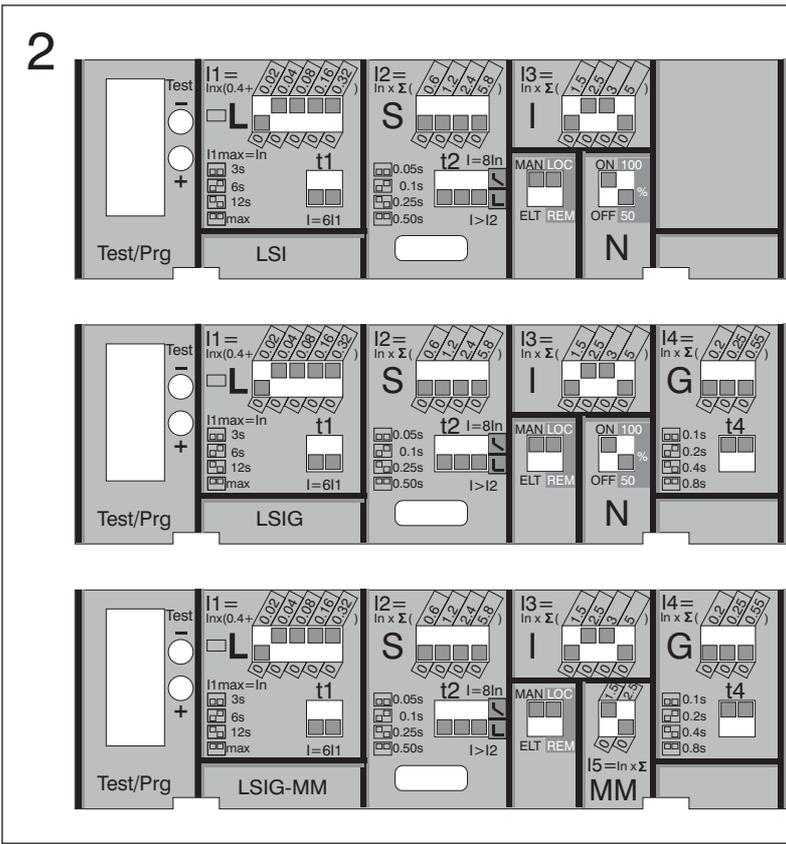
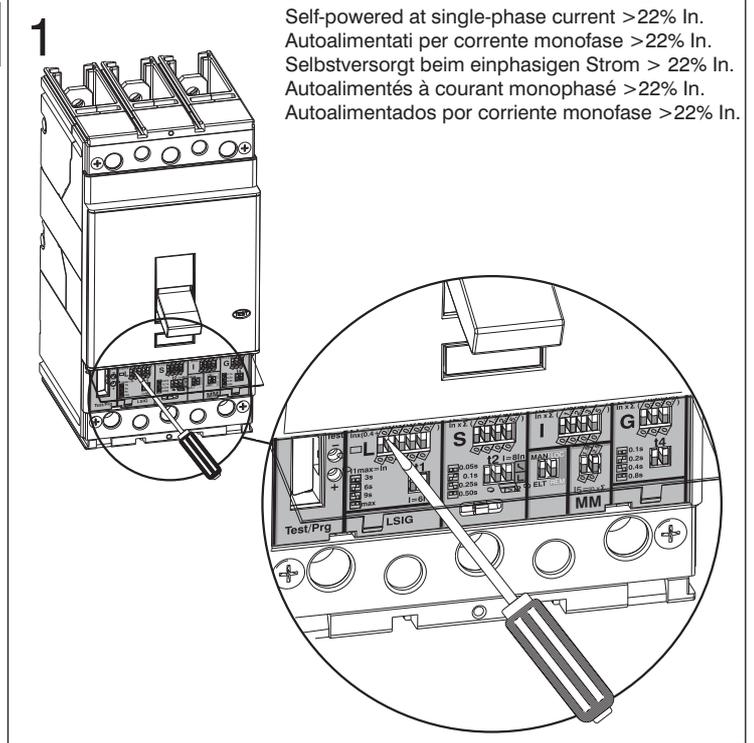
**AVERTISSEMENT:** Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs.

**ADVERTENCIA:** Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes.

**ATENÇÃO:** Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes.

警告：感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また、汚染物質がないことを確認してください。

警告：为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染物。



**LSI**

	L	S	I		N	ELT
See box	4	5	6		8	9

**LSIG**

	L	S	I	G	N	ELT
See box	4	5	6	7	8	9

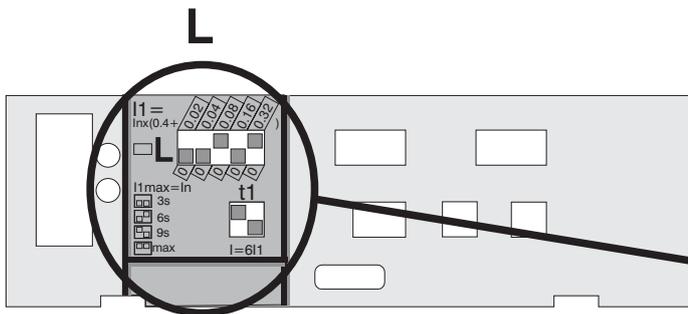
**LSIG-MM**

	L	S	I	G	N	MM	ELT
See box	4	5	6	7	8	9	10

Manual default setting  
 Settaggio di default manuale  
 Manuelle Default-Einstellung  
 Configuration par défaut manuelle  
 Ajuste de default manual  
 默认手动设置

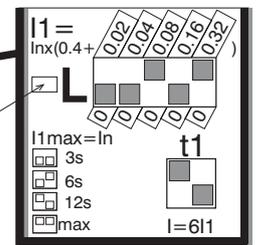
<b>L</b>	<b>S</b>	<b>I</b>	<b>G</b>	<b>N</b>	<b>MM</b>	<b>ELT</b>
I1 = 1 In t1 = 3s @ 6 I1	I2 = 0		I4 = 0	LSI, LSIG only ON* N = 50%	I5 = 2.5 In (LSIG-MM only)	

Example -Esempio - Beispiel - Exemple - Ejemplo  
 In = 300A  
 I1 = 300x(0.4+0.08+0.32)=240A  
 t1 = 9s @1440A (6I1)

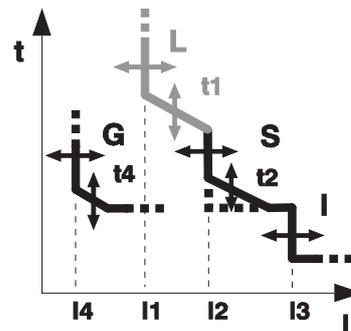
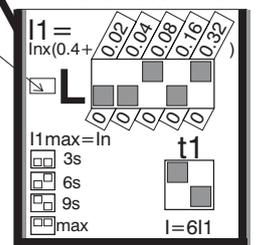


Normal status	L Prealarm ≥ 90% I1	L Alarm I1 > I2 or I2 > I3 LSIG-MM	(1 Hz) (0.33 Hz) (4 Hz)

140G-M600-630



140G-K  
140G-M800



	In(A)	I1(In)							t1
		0.4	0.42	0.44	...	0.96	0.98	1	
140G-K	300	120	126	132	...	288	294	300	18
	400	160	168	176	...	384	392	400	18
140G-M	600	240	252	264	...	576	588	600	18
	800	320	336	352	...	768	784	800	18

\* IEC ONLY

5

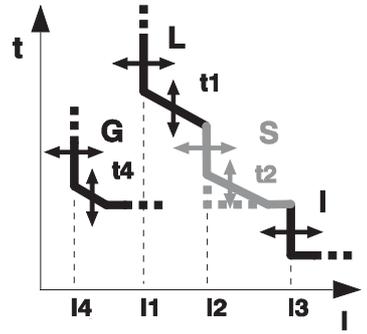
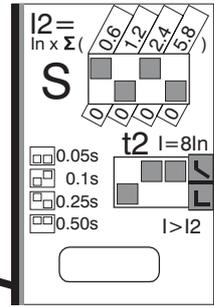
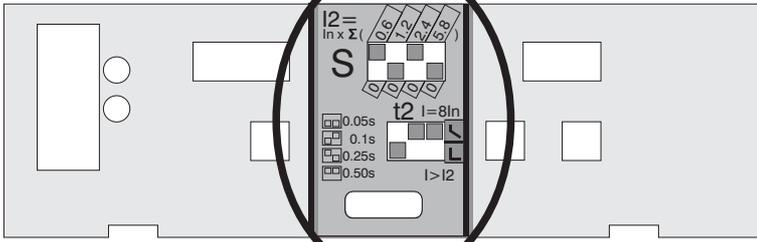
S

Example - Esempio - Beispiel - Exemple - Ejemplo

$I_n = 300A$

$I_2 = 300 \times (0.6 + 2.4) = 900A$

$t_2 (I^2 t = ON) = 0.1s @ 2400A (8I_n)$



		$I_2(I_n)$														
$I_n (A)$		0.6	1.2	1.8	2.4	3	3.6	4.2	5.8	6.4	7	7.6	8.2	8.8	9.4	10
140G-K	300	180	360	540	720	900	1080	1260	1740	1920	2100	2280	2460	2640	2820	3000
	400	240	480	720	960	1200	1440	1680	2320	2560	2800	3040	3280	3520	3760	4000
140G-M	600	360	720	1080	1440	1800	2160	2520	3480	3840	4200	4560	4920	5280	5640	6000
	630**	378	756	1134	1512	1890	2268	2646	3654	4032	4410	4788	5166	5544	5922	6300
	800	480	960	1440	1920	2400	2880	3360	4640	5120	5600	6080	6560	7040	7520	8000

\*\* IEC ONLY

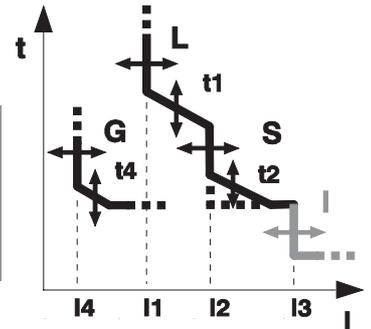
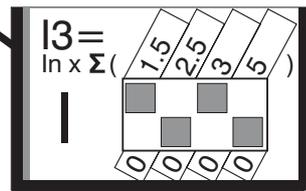
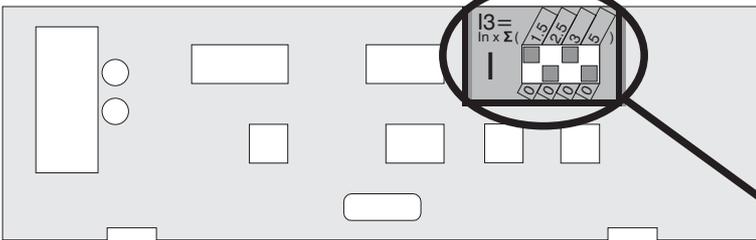
6

I

Example - Esempio - Beispiel - Exemple - Ejemplo

$I_n = 300A$

$I_3 = 300 \times (1.5 + 3) = 1350A$



		$I_3(I_n)$														
$I_n (A)$		1.5	2.5	3	4	4.5	5	5.5	6.5	7	7.5	8	9	9.5	10.5	12
140G-K	300	450	750	900	1200	1350	1500	1650	1950	2100	2250	2400	2700	2850	3150	3600
	400	600	1000	1200	1600	1800	2000	2200	2600	2800	3000	3200	3600	3800	4200	4800
140G-M	600	900	1500	1800	2400	2700	3000	3300	3900	4200	4500	4800	5400	5700	6300	7200
	630***	945	1575	1890	2520	2835	3150	3465	4095	4410	4725	5040	5670	5985	6615	7560
	800	1200	2000	2400	3200	3600	4000	4400	5200	5600	6000	6400	7200	7600	8400**	8400**

\*\*  $I_3 \text{ max} = 10.5 I_n$

\*\*\* IEC ONLY

# 7

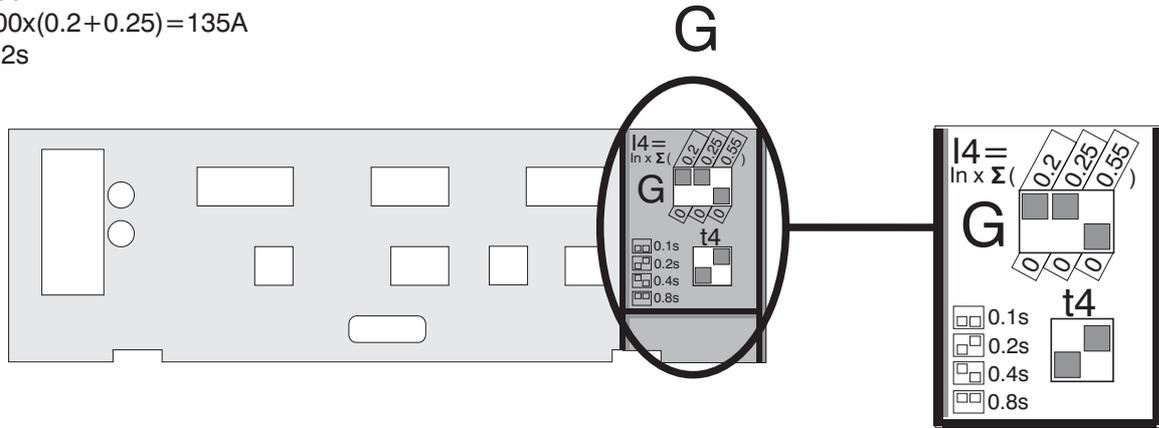
IF PRESENT

Example - Esempio - Beispiel - Exemple - Ejemplo

$$I_n = 300A$$

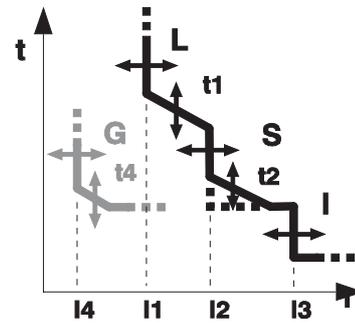
$$I_4 = 300 \times (0.2 + 0.25) = 135A$$

$$t_4 = 0.2s$$



		I4(In)							
		In(A)	0.2	0.25	0.45	0.55	0.75	0.8	1
140G-K	300	60	75	135	165	225	240	300	
	400	80	100	180	220	300	320	400	
140G-M	600	120	150	270	330	450	480	600	
	630*	126	158	283.5	346.5	472.5	504	630	
	800	160	200	360	440	600	640	800	

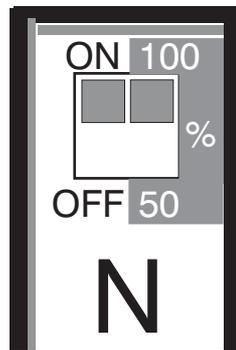
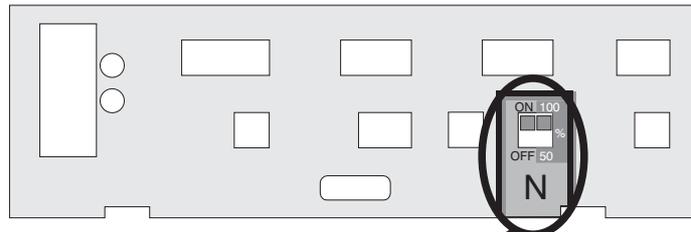
\* IEC ONLY



# 8

NEUTRAL SETTING

(LSIG, LSI Only)



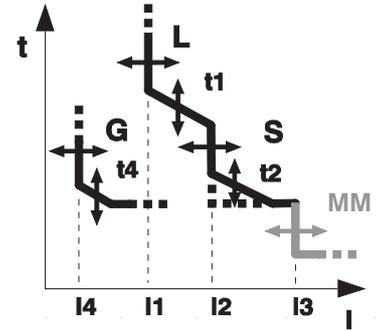
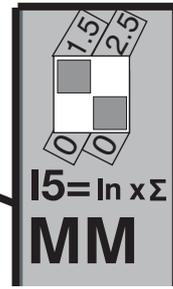
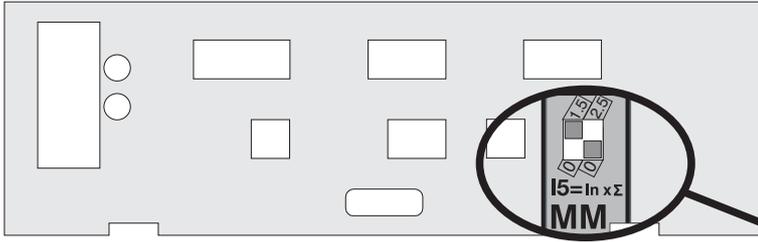
Example - Esempio - Beispiel  
Exemple - Ejemplo

Ne=ON; 100%

Note: Neutral setting is available for LSI, LSIG only. For LSIG-MM setting is fixed ON; 100%

# 9

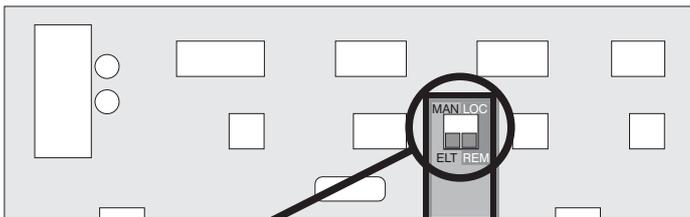
Example - Esempio - Beispiel - Exemple - Ejemplo  
 $I_n = 300A$   
 $I_3 = 300 \times (1.5 + 0) = 450A$



		I5(In)			
		In(A)	1.5	2.5	4
140G-K	300	450	750	1200	
	400	600	1000	1600	
140G-M	600	900	1500	2400	
	630	945	1575	2520	
	800	1200	2000	3200	

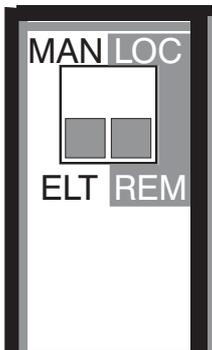
# 10

## ELECTRONIC DEFAULT SETTING



L	I1	1 x In
	t1	MAX
S	I2	OFF
I	I3	4 x In
G	I4	OFF
MM	I5	2.5 In

Electronic default setting  
 Settaggio di default elettronico  
 elektronische Default Einstellung  
 Configuration par défaut électronique  
 Ajuste de default electrónico

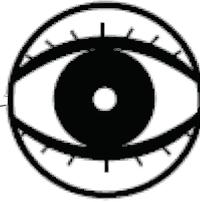
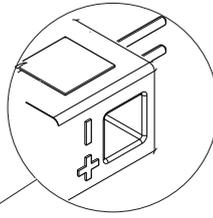


	MAN	ELT
REM	- Electronic parameters can be changed by System Bus	- Electronic parameters can be changed by System Bus
	- Manual parameters in use	- Electronic parameters in use
LOC	- Electronic parameters can't be changed by System Bus	- Electronic parameters can't be changed by System Bus
	- Manual parameters in use	- Electronic parameters in use

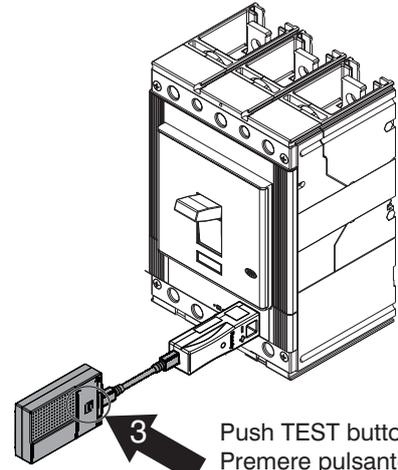
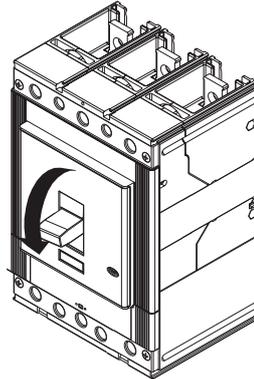
140G-ELTT  
(ORDERED SEPARATELY)



LED TRIP UNIT DEVICE	
- Green	- Red
- Verde	- Rosso
- Grün	- Rot
- Vert	- Rouge
- Verde	- Rojo
- Device ON	- Change battery
- Dispositivo acceso	- Sostituire batteria
- Einrichtung eingeschaltet	- Batterie ersetzen
- Dispositif allumé	- Remplacer batteries
- Dispositivo encendido	- Sustituir baterías

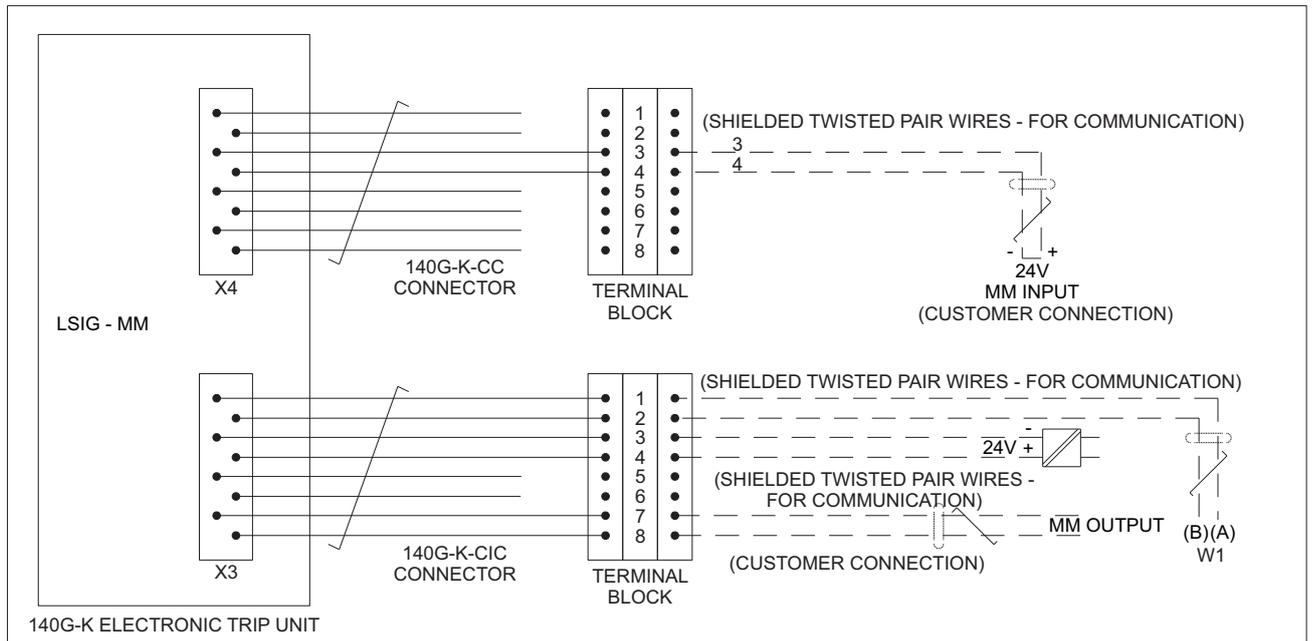


CLACK  
4



Push TEST button  
Premere pulsante TEST  
Drücken Sie die Test-Taste  
Appuyer sur le bouton TEST  
Pulse el pulsador TEST

Charge - Carica - Ladung - Alimentation - Alimentación



Note: LSIG-MM requires use of terminal kits 140G-K-CC and 140G-K-CIC, ordered separately

Allen-Bradley, Rockwell Software, and Rockwell Automation are trademarks of Rockwell Automation, Inc. Trademarks not belonging to Rockwell Automation are property of their respective companies.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

**Power, Control and Information Solutions Headquarters**

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444  
 Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640  
 Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Rockwell Automation maintains current product environmental compliance information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>

LSI-LSIG Adjustment instructions for 140G-H, 140G-J  
 Sganciatori LSI e LSIG  
 Auslöser LSI und LSIG  
 Dèclencheur LSI et LSIG  
 Relé LSI y LSIG

**⚠ Installation - Installazione - Instalación  
 Instalação - 取付け方法 - 安装**

**WARNING:** To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

**AVVERTENZA:** Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti. (Seguire i requisiti NFPA70E).

**WARNUNG:** Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden. (Befolgen Sie die Anforderungen nach NFPA70E).

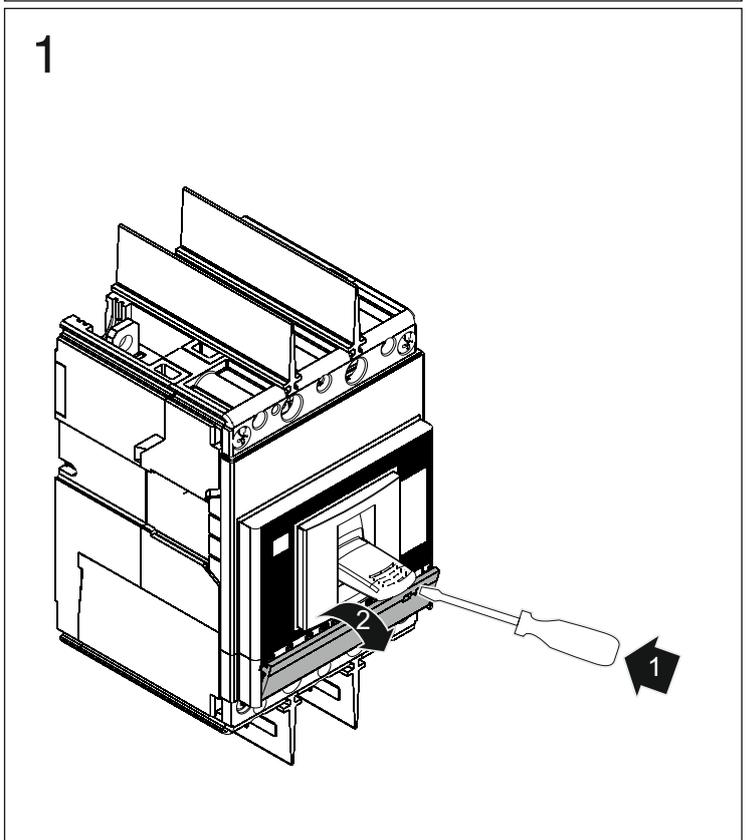
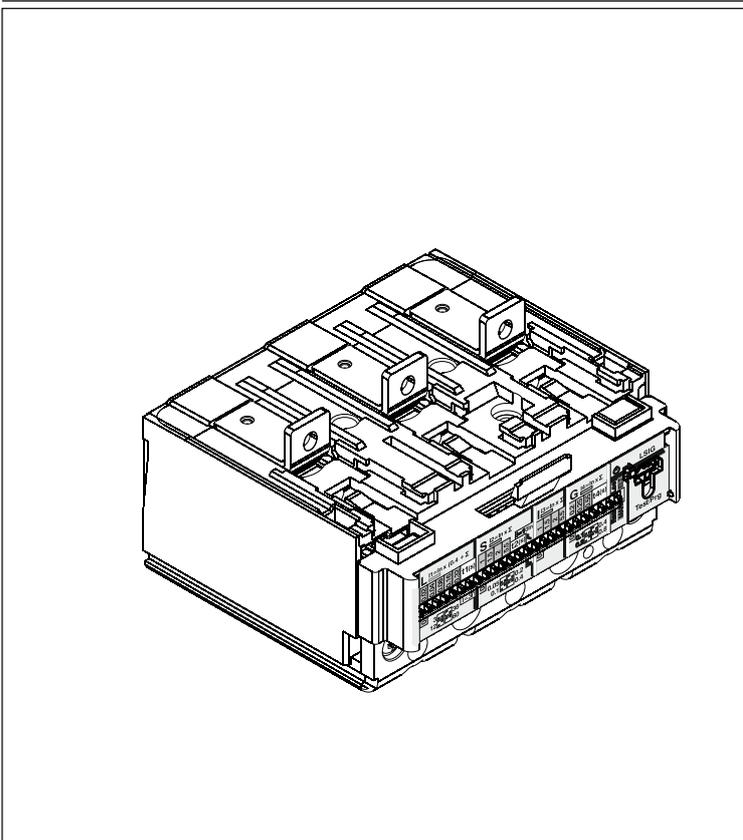
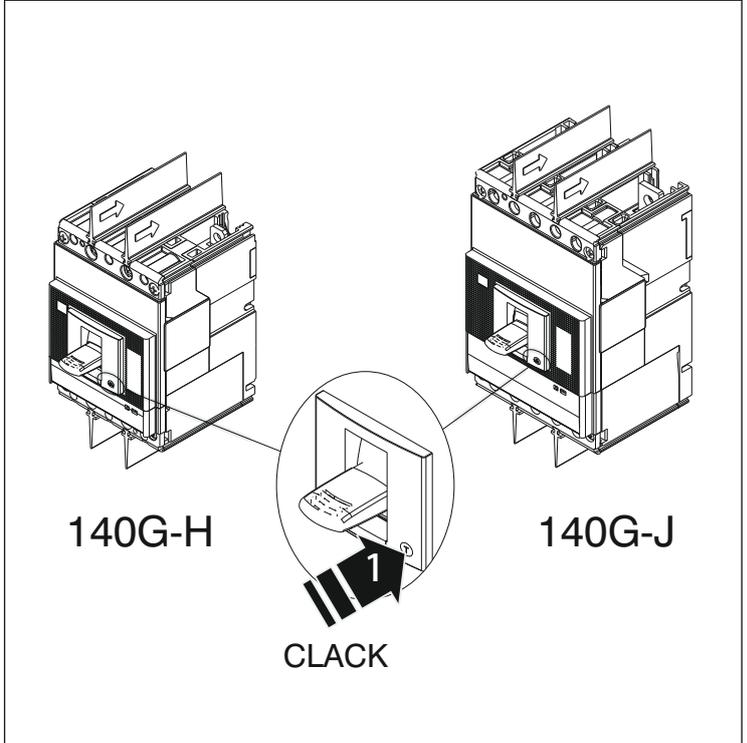
**AVERTISSEMENT:** Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs. (Vous devez respecter la norme NFPA70E).

**ADVERTENCIA:** Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes. (Cumpla con los requisitos NFPA70E).

**ATENÇÃO:** Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes. (Cumpra as exigências da norma NFPA70E).

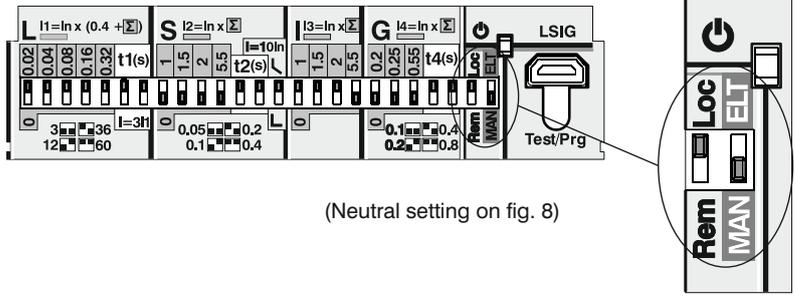
警告: 感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また、汚染物質がないことを確認してください。(NFPA70Eの要件に従ってください)

警告: 为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染物。(符合NFPA70E要求)

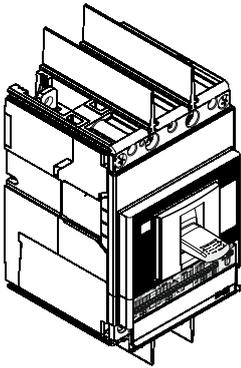


2

Manual default setting  
 Settaggio di default manuale  
 Manuelle Default-Einstellung  
 Configuration par défaut manuelle  
 Ajuste de default manual



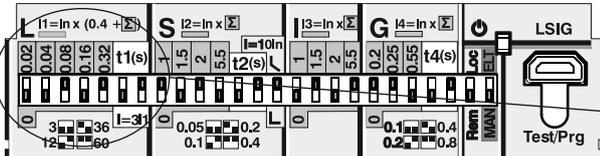
(Neutral setting on fig. 8)



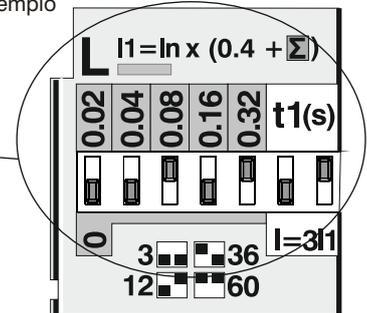
LED	Color	CONDITION Run time	
	Green	LED Fixed = Device active	
L	Red	LED Fixed = L pre alarm ( $0,9 * I1 < I < 1,2 * I1$ )	LED Blinking = L alarm ( $I > 1,2 * I1$ )
S	Red	LED Blinking = S alarm ( $I > I2$ )	
G	Red	LED Blinking = G alarm ( $I > I4$ )	
L S I G	Red	LED Blinking = Parameters inconsistency - L = S or S = I. LED Blinking without Parameters inconsistency = generic fault (please contact Rockwell Automation)	

3

Example - Esempio - Beispiel - Exemple - Ejemplo

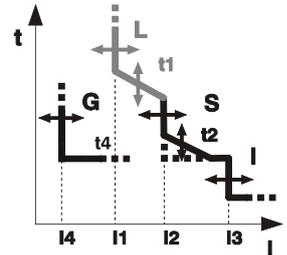


$I_n = 100A$   
 $I1 = 100x(0,4+0,08+0,32) = 80A$   
 $t1 = 12s @ 240A (311)$



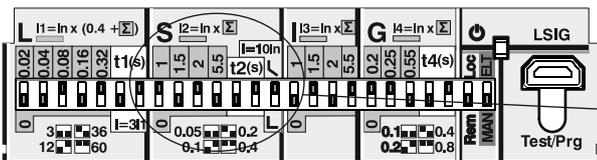
		I1 (In)							
		In (A)	0,4	0,42	0,44	...	0,96	0,98	1
140G-H	25	10	10,5	11		24	24,5	25	
	60	24	25,2	26		58	58,8	60	
	100	40	42	44		96	98	100	
	125	50	53	55		120	123	125	
160*	64	67,2	70,4		153,6	156,8	160		
140G-J	40	16,0	16,8	17,6		38,4	39,2	40	
	60	24	25,2	26,4		57,6	58,8	60	
	100	40	42	44		96	98	100	
	150	60	63	66		144	147	150	
250	100	105	110		240	245	250		

(\*) IEC ONLY

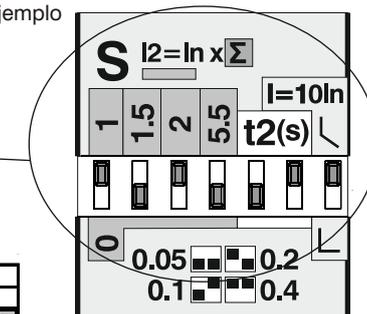


4

Example - Esempio - Beispiel - Exemple - Ejemplo

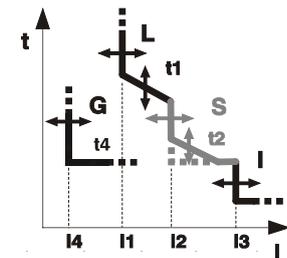


$I_n = 100A$   
 $I2 = 100x(1+2) = 300A$   
 $t2 (I^2t = ON) = 0,1s @ 1000A (10In)$



		I2 (In)															
		In (A)	1	1,5	2	2,5	3	3,5	4,5	5,5	6,5	7	7,5	8	8,5	9	10
140G-H	25	25	37,5	50	62,5	75	87,5	113	138	163	175	188	200	213	225	250	
	60	60	90	120	150	180	210	270	330	390	420	450	480	510	540	600	
	100	100	150	200	250	300	350	450	550	650	700	750	800	850	900	1000	
	125	125	188	250	313	375	438	563	688	813	875	938	1000	1063	1125	1250	
160*	160	240	320	400	480	560	720	880	1040	1120	1200	1280	1360	1440	1600		
140G-J	40	40	60	80	100	120	140	180	220	260	280	300	320	340	360	400	
	60	60	90	120	150	180	210	270	330	390	420	450	480	510	540	600	
	100	100	150	200	250	300	350	450	550	650	700	750	800	850	900	1000	
	150	150	225	300	375	450	525	675	825	975	1050	1125	1200	1275	1350	1500	
250	250	375	500	625	750	875	1125	1375	1625	1750	1875	2000	2125	2250	2500		

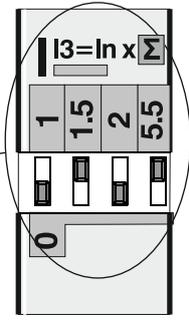
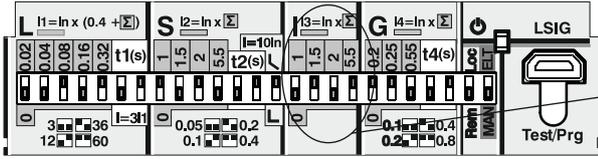
(\*) IEC ONLY



5

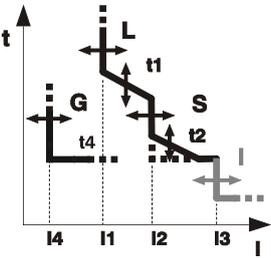
Example - Esempio - Beispiel - Exemple - Ejemplo

$I_n = 100A$   
 $I_3 = 100x(1,5+5,5)=700A$



(\*) IEC ONLY

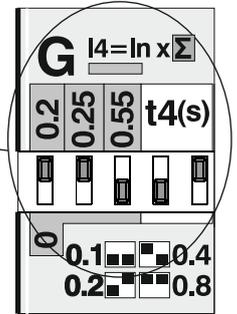
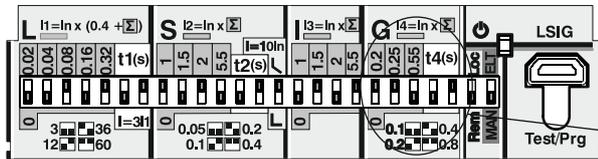
		I3 (In)															
		In (A)	1	1.5	2	2.5	3	3.5	4.5	5.5	6.5	7	7.5	8	8.5	9	10
140G-H	25	25	37,5	50	62,5	75	87,5	113	138	163	175	188	200	213	225	250	250
	60	60	90	120	150	180	210	270	330	390	420	450	480	510	540	600	600
	100	100	150	200	250	300	350	450	550	650	700	750	800	850	900	1000	1000
	125	125	188	250	313	375	438	563	688	813	875	938	1000	1063	1125	1250	1250
	160*	160	240	320	400	480	560	720	880	1040	1120	1200	1280	1360	1440	1600	1600
140G-J	40	40	60	80	100	120	140	180	220	260	280	300	320	340	360	400	400
	60	60	90	120	150	180	210	270	330	390	420	450	480	510	540	600	600
	100	100	150	200	250	300	350	450	550	650	700	750	800	850	900	1000	1000
	150	150	225	300	375	450	525	675	825	975	1050	1125	1200	1275	1350	1500	1500
	250	250	375	500	625	750	875	1125	1375	1625	1750	1875	2000	2125	2250	2500	2500



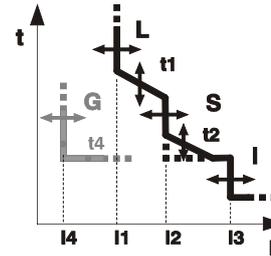
6

Example - Esempio - Beispiel - Exemple - Ejemplo

$I_n = 100A$   
 $I_4 = 100x(0,2+0,25)=45A$   
 $t_4 = 0,2s @ I > I_4$

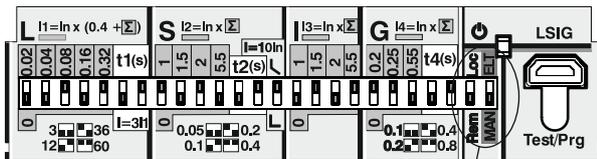


		I4 (In)							
		In (A)	0,2	0,25	0,45	0,55	0,75	0,8	1
140G-H	25	5	6,25	11,3	13,8	18,8	20	25	25
	60	12	15	27	33	45	48	60	60
	100	20	25	45	55	75	80	100	100
	125	25	31,3	56,3	68,8	93,8	100	125	125
	160*	32	40	72	88	120	128	160	160
140G-J	40	8	10	18	22	30	32	40	40
	60	12	15	27	33	45	48	60	60
	100	20	25	45	55	75	80	100	100
	150	30	37,5	67,5	82,5	113	120	150	150
	250	50	62,5	113	138	188	200	250	250



(\*) IEC ONLY

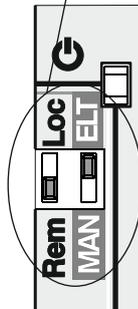
7



Electronic default setting  
 Settaggio di default elettronico  
 elektronische Default Einstellung  
 Configuration par défaut électronique  
 Ajuste de default electrónico

L	1 x In
t1	60 s
S	Off
I	4,5 x In
G	Off

(Neutral setting on fig. 8)

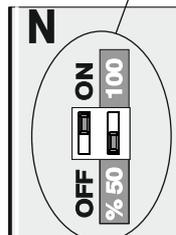
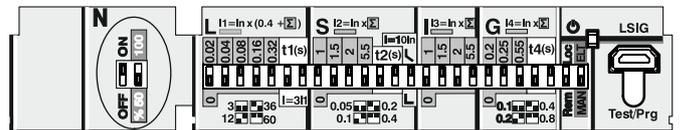


8

NEUTRAL SETTING

	Neutral setting	Default setting
3p	Always only by means of System Bus	ON; 100%
4p	Always only by means of dip switches	ON; 100%

Example - Esempio - Beispiel - Exemple - Ejemplo



Dip switches setting example with 4p:

$N_e = ON; 50\%$

1

**DIAGNOSTIC PROCEED**

- UNIT CHECK LED: all the leds in the relay must come on
- LAST TRIP INDICATION: if present in the relay's data store
- LED:  remains on for as long as the 140G-ELTT Tester is connected to the relay
- READY TO TRIP

**PROCEDURA DI CONTROLLO**

- CONTROLLO LED: tutti i led del relè si devono accendere
- ULTIMA INDICAZIONE DI TRIP: se presente nella memoria del relè
- LED:  resta acceso finchè 140G-ELTT Tester è connessa al relè
- PRONTO PER TRIP

**DIAGISTIKABLAUF**

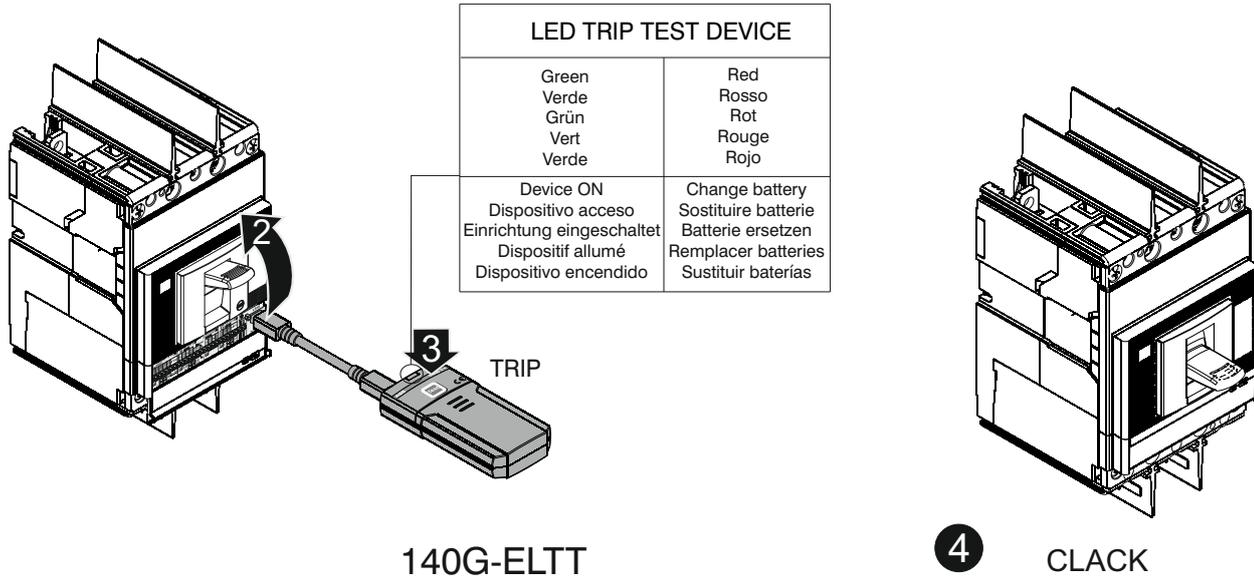
- EINEITHSPRUF-LED: Alle LEDs des Relais müssen aufleuchten
- ANGABE DER LETZTEN AUSLOSUNG: Wenn im Speicher des Relais vorhanden.
- LED:  Bleibt angeschaltet, bis die Einheit 140G-ELTT Tester an die Relais angeschlossen ist.
- AUSLOSEBEREIT

**PROCÉDURE DE DIAGNOSTIC**

- UNIT CHECK LED : toutes les diodes du relais doivent s'allumer
- LAST TRIP INDICATION : si présente dans la mémoire du relais
- LED:  la DIODE reste allumée tant que 140G-ELTT Tester est connectée au relais
- READY TO TRIP

**PROCEDIMIENTO DIAGNOSTICO**

- LED CONTROL UNIDAD: todos los led del relé se deben encender
- INDICACION ULTIMA ACTUACION: si está presente en la memoria del relé
- LED:  queda encendido mientras la 140G-ELTT Tester permanezca conectada con el relé
- LISTO PARA LA ACTUACION



140G-ELTT

4

CLACK

Battery Unit 140G-ELBU for electronic trip units  
 Unità di alimentazione 140-ELBU per relè elettronici  
 Versorgungseinheit 140-ELBU für elektronischen Auslöser  
 Unidad de alimentación 140-ELBU para relè electrónicos  
 Unité de alimentation 140-ELBU pour déclencheur électroniques

**! Installation - Installazione - Instalación  
 Instalação - 取付け方法 - 安装**

**WARNING:** To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

**AVVERTENZA:** Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti. (Seguire i requisiti NFPA70E).

**WARNUNG:** Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden. (Befolgen Sie die Anforderungen nach NFPA70E).

**AVERTISSEMENT:** Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs. (Vous devez respecter la norme NFPA70E).

**ADVERTENCIA:** Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes. (Cumpla con los requisitos NFPA70E).

**ATENÇÃO:** Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes. (Cumpra as exigências da norma NFPA70E).

警告：感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また、汚染物質がないことを確認してください。（NFPA70Eの要件に従ってください）

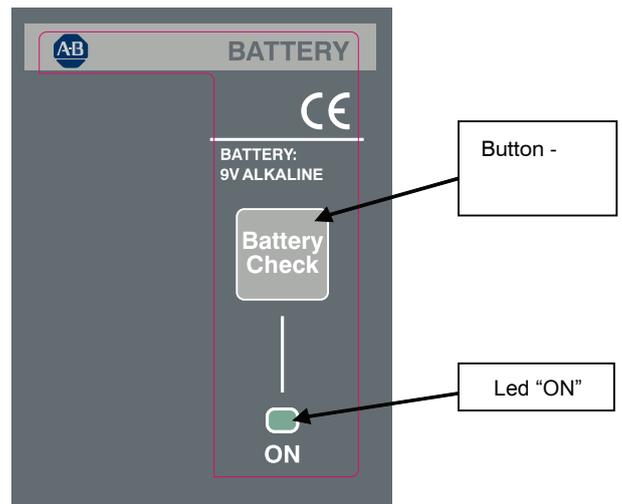
警告：为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染物。（符合NFPA70E要求）

**1 Performance**

The trip unit for this MCCB is self powered when the main power has been applied to the circuit braker. The battery unit is used for self test/diagnostics when the circuit breaker has been OFF or Tripper for extended periods of time.

**Note:**  
 For use with N/NS/R frame Circuit breakers with LSIG, LSIG-MM Trip Units.

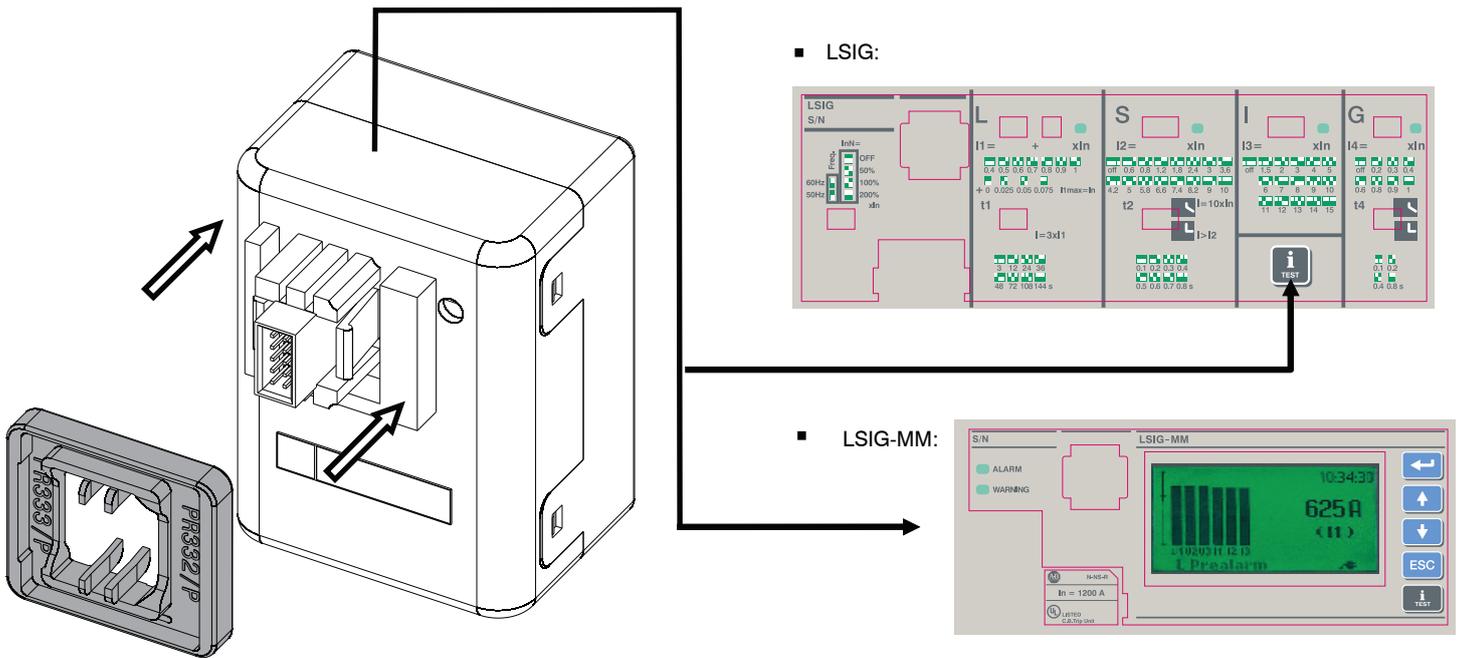
**2 Battery Check**



Battery Check

With unit not connected to trip unit, press the button: LED "ON" turned ON indicates battery charged.

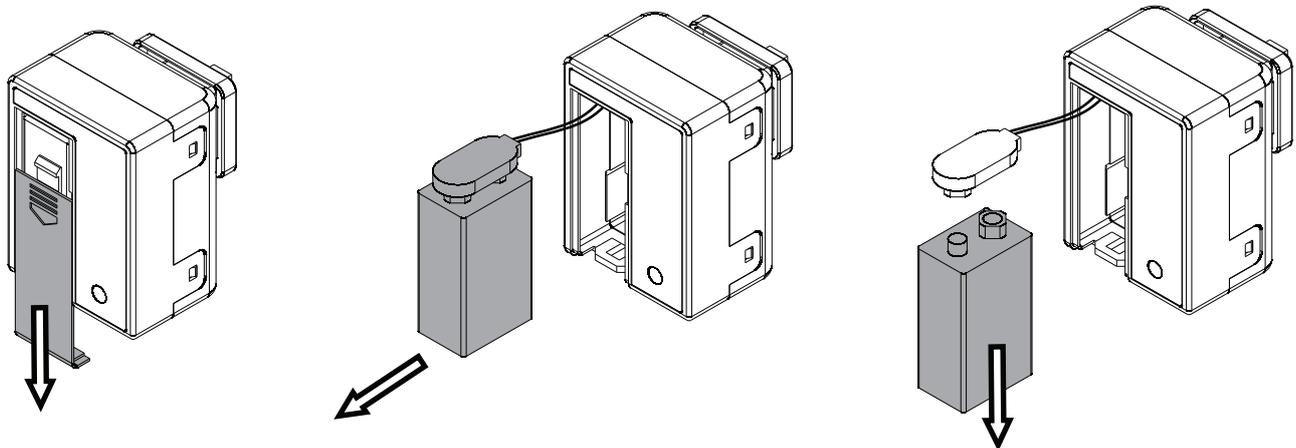
### 3 Connection examples



Use the mechanical adapter to properly align the battery unit with the trip unit. Refer to the figures above.

LSIG	PR331/P
LSIG-MM	PR332/P

### 4 Battery replacement



 This product contains an alkaline battery which is intended to be replaced during the life of the product. At the end of its life, the battery should be collected separately from any unsorted municipal waste.

Allen-Bradley, Rockwell Software, and Rockwell Automation are trademarks of Rockwell Automation, Inc. Trademarks not belonging to Rockwell Automation are property of their respective companies.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

#### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444  
 Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640  
 Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Rockwell Automation maintains current product environmental compliance information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>