FANOX

Registered Company nº 437451

FANOX power T&D

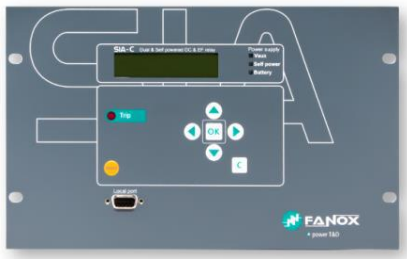
SIA-C

Self Power O/C & E/F Protection Relay

KEMA Laboratories

DNV·GL

SELF POWERED



INSTALLATION & COMMISSIONING GENERIC GUIDE

1. RECEPTION & INSTALLATION

1.1. Relay unpacking

Previously to any handling action, confirm that relay carton box is in good conditions, no broken or damaged due to external manipulation or during storing or moving process. If packing is correct, proceed to unpack and you should find following element:

- SIAC Electronic protection relay.
- User Guide.
- Testing protocol.

Testing protocol is a certificate that relay has passed all factory testing process with correct results.

In case some fault is detected, consider putting into quarantine period the relay and contact Fanox for further instructions.

1.2. Relay verification

When relay is unpacked, please, take your time to confirm following checking list to be sure that everything is ok:

- Metallic case not damaged and well assembled. No loose screws due to transport or movement conditions

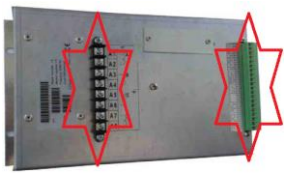
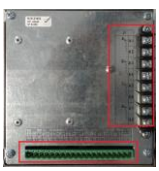



- LCD and front cover not damaged or scratched.




- Quality sticker and terminal sticker correctly stuck.

- Rear terminals in good state, being able to do a good wiring connection.


1.3. Powering the relay up with kitcom

Thanks to the external battery KITCOM the powering and adjusting process of the relay is very easy and it allows the user to test the relay.

The power comes from two AA batteries (IEC LR06) of 1.5 Volts placed at the bottom of the kitcom. The equipment has a small Dc/Dc power supply that raises the voltage till the required 12 volts to operate the equipment and that is plugged into the front RS232 communications port (KITCOM).
Once the KITCom is connected, the relay will be switched on and a led on the right of the relay (led battery) will blink indicating the relay is powered on through an external battery (KITCOM).

The relay is totally maintenance free. This is, there is no need of batteries to log events and fault reports and there is no need of batteries to maintain date and time.

NOTE: Date and time must be correctly set the first time the relay is operative, and energy must be kept at least “1 hour” to maintain the RTC for 72 hours once the energy is lost.

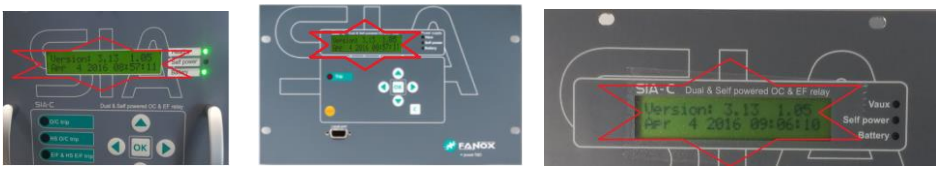
Besides, the possibility of using external battery power, together with the possibility of activating the trip contact from the test menu, allows the trip circuit to be tested before the transformation center is powered up. So, it is clear the KITCOM useful for cases like commissioning operations, discharges and repairs to the transformation center.

Using battery power does not block the RS232 communications port, as it can be used simultaneously.

Once the relay is powered through the Kitcom, it is recommended to check:

- Model →Directly, complete model on top line and phases/neutral current measurement on bottom line are displayed. Once “C” key is pressed the name of phase and neutral currents (instead the complete model) is displayed on the top of LCD Standby screen.

- Serial number (8 digits) and Firmware Version → HOLD ▲



1.3.1. Keypad & LCD

- Use the KEYPAD, ensure that all the push-buttons work correctly (no difficulties while pushing them, check out if the relay reacts by pushing each of the buttons).



- Use the KEYPAD to enter in the relay´s menu and make sure that no text is lost while going from one menu to another.

- Follow the sequence: Left ◄, Down ▼, Right ►, Up ▲, OK, C and RESET and the following screen should be displayed:

- If the contrast of the LCD is not the correct one, enter to "*CONTRAST"* menu by holding "◄ "for 3 seconds. Then, change it by using up or down buttons to increase or decrease the contrast.

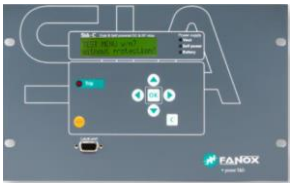


1.3.2. Test menu

NOTE: When performing test menu, protection won´t be available and it will possible to open circuit breaker. Only authorized personnel can do this job.

Press ◄, ▼, ► sequentially and hold **OK.** The relay will ask for the password "5555" to enter to the test menu (or customer password if default "5555" has been modified).

It will be checked that the LEDs, Magnetic indicator flags and Outputs are activated if OK key is pressed and it will be deactivated if OK key is pressed again. LEDs, Magnetic indicators and outputs will be checked to verify the hardware is OK:

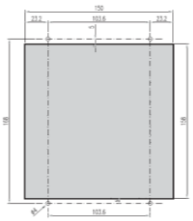
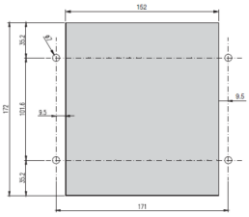




	Action	Checking
OK, OK	Led 1	Led 1 activated
▼, OK	Led 2	Led 2 activated
▼, OK	Led 3	Led 3 activated
▼, OK	Trip output	Trip output activated
▼, OK	Output 2	Output 2 activated **(*)**
▼, OK	Output 3	Output 3 activated **(*)**
▼, OK	Output 4	Output 4 activated **(*)**
▼, OK	Bistable Trip	Trip activated
C	Skip from test menu	

(*) Depending on model

1.4. Relay installation

To fix the relay to the switchgear, use default holes in front of relay with appropriate fixing system. Do not manipulate relay to fix it on the switchgear.

How to change the internal commissioning battery (DEPENDING ON MODEL)

1. Disconnect the relay. Switch the power supply off to avoid any dangerous situation.
2. Unscrew the 4 screws on the front of the relay to extract it from the RMU and access to the rear side of the relay.



3. Unscrew the 2 screws to remove the cover from the battery compartment.

4. Remove the battery and replace it respecting polarity (+ facing up):
   Battery characteristics:
   - AA 3.6V lithium battery
   - Model LS14500 from SAFT
   - Do not use rechargeable batteries or other types of battery


5. Put on the battery cover and tighten the 2 screws.

6. Put the relay into the RMU again and tighten the 4 screws on the front to fix the relay.

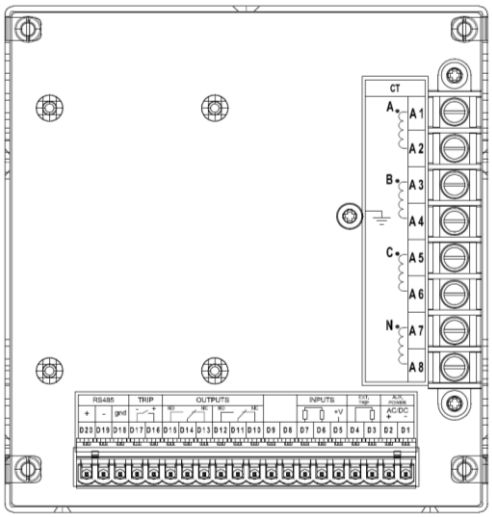
Warning: HAZARD OF EXPLOSION

- Do not recharge the battery.
- Do not short circuit the battery.
- Do not crush the battery.
- Do not disassemble the battery.
- Do not heat the battery above 100ºC (212ºF)
- Do not throw the battery into fire or water.

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

1.5. Relay rear part

Depending on the model, the rear part will be different. Consider the wiring of the switchgear and connect relay properly:

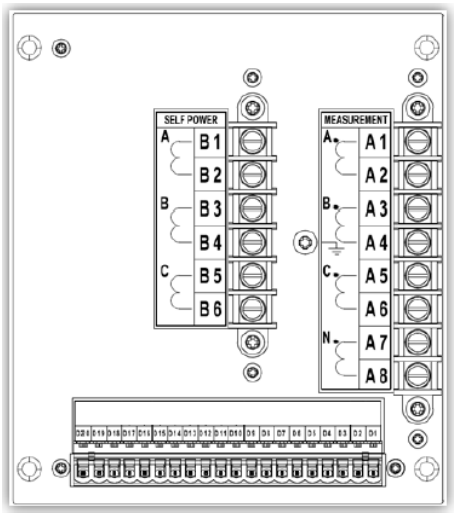


A1	Phase A current input for Measurement & power supply
A2	Phase A current output for Measurement & power supply
A3	Phase B current input for Measurement & power supply
A4	Phase B current output for Measurement & power supply
A5	Phase C current input for Measurement & power supply
A6	Phase C current output for Measurement & power supply
A7	Neutral current input for Measurement & power supply
A8	Neutral current output for Measurement & power supply
D1	Auxiliary Voltage – **(*)**
D2	Auxiliary Voltage + **(*)**
D3-D4	External trip **(*)**
D5	Positive for the inputs **(*)**
D6	Digital input 1 **(*)**

D7	Digital input 2 **(*)**
D10	Digital output 1 NC **(*)**
D11	Digital 1 common output **(*)**
D12	Digital output 1 NA **(*)**
D13	Digital output 2 NC **(*)**
D14	Digital 2 common output **(*)**
D15	Digital output 2 NA **(*)**
D16	Trip output positive / ATC free potential output **(*)**
D17	Trip output gnd / ATC free potential output **(*)**
D18	RS485 – ground **(*)**
D19	RS485 - **(*)**
D20	RS485 + **(*)**
⏚	Earthing screw

(*) Optional depending on model.

Considering the mechanic “D”:



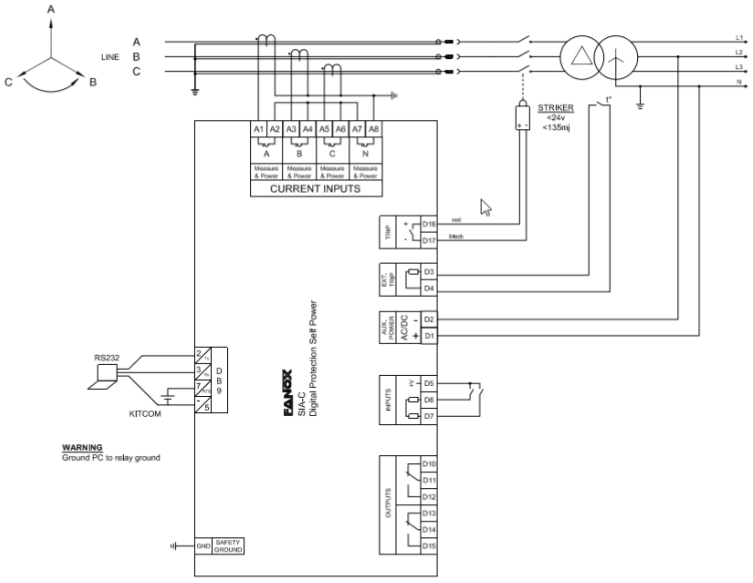
A1	Phase A current input for Measurement
A2	Phase A current output for Measurement
A3	Phase B current input for Measurement
A4	Phase B current output for Measurement
A5	Phase C current input for Measurement
A6	Phase C current output for Measurement
A7	Neutral current input for Measurement
A8	Neutral current output for Measurement
B1	Phase A current input for power supply
B2	Phase A current output for power supply
B3	Phase B current input for power supply
B4	Phase B current output for power supply
B5	Phase C current input for power supply
B6	Phase C current output for power supply
D1	Auxiliary Voltage – **(*)**
D2	Auxiliary Voltage + **(*)**

D3-D4	External trip **(*)**
D5	Positive for the inputs **(*)**
D6	Digital input 1 **(*)**
D7	Digital input 2 **(*)**
D10	Digital output 1 NC **(*)**
D11	Digital 1 common output **(*)**
D12	Digital output 1 NA **(*)**
D13	Digital output 2 NC **(*)**
D14	Digital 2 common output **(*)**
D15	Digital output 2 NA **(*)**
D16	Trip output positive / ATC free potential output **(*)**
D17	Trip output gnd / ATC free potential output **(*)**
D18	RS485 – ground **(*)**
D19	RS485 - **(*)**
D20	RS485 + **(*)**
⏚	Earthing screw

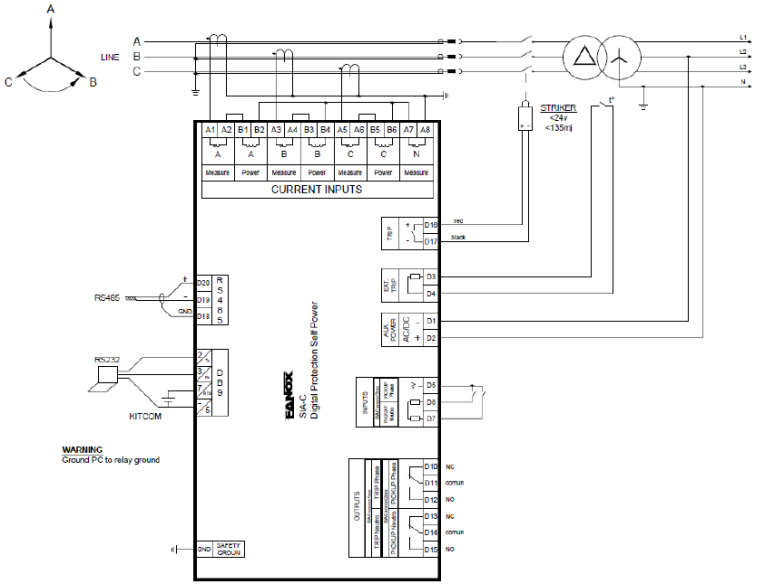
(*) Optional depending on model.

1.6. Connection diagrams

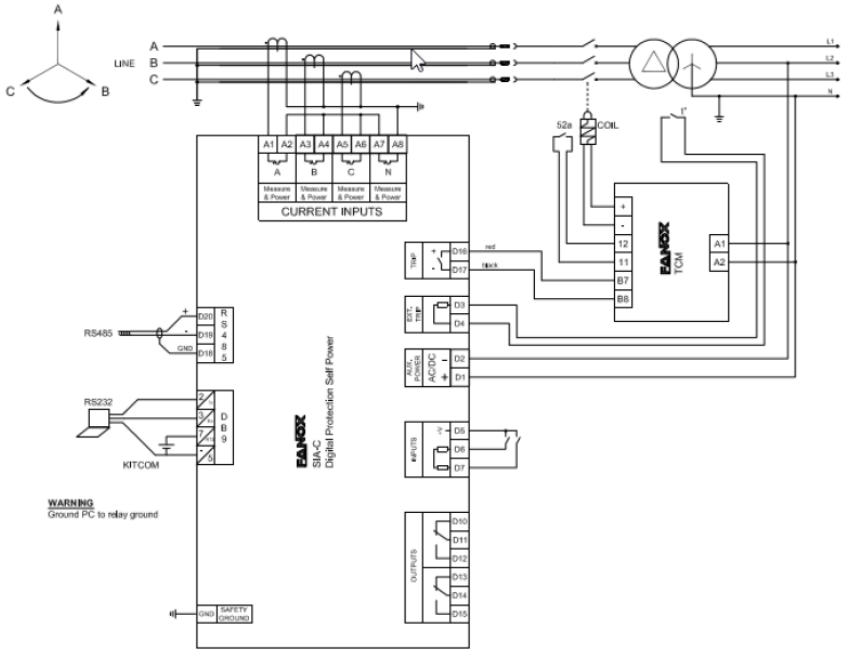
3 Phase CTs + Solid Neutral (Striker).



3 Phase CTs + Solid Neutral (Striker) Mechanic D (Double terminals)

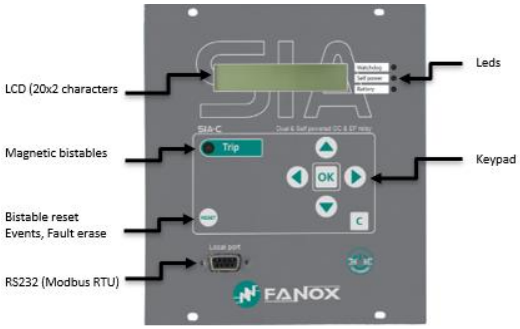


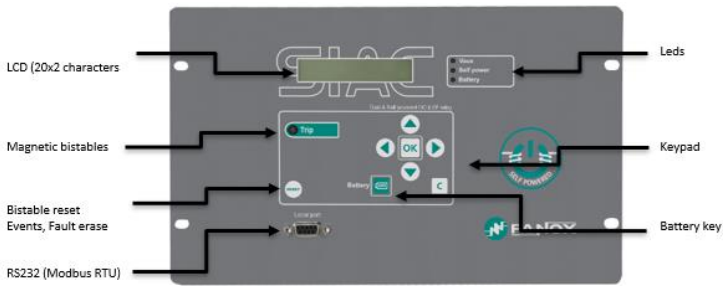
3 Phase CT + Solid neutral + TCM + Coil.

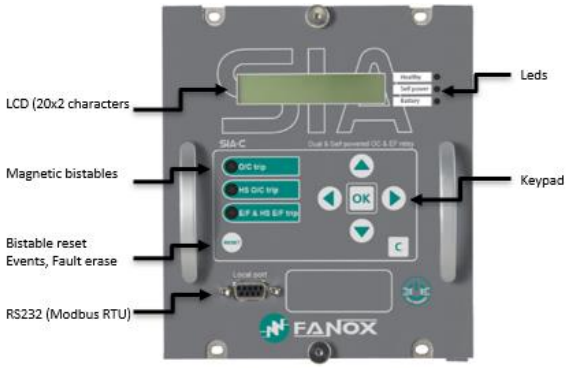


2. USER INTERFACE

2.1. Relay front part







1.7. Bistable magnetic indicators (flags)

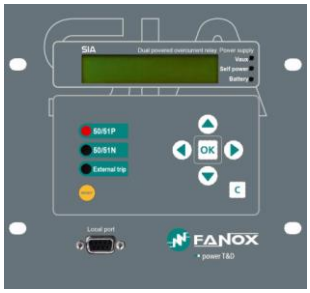
The front panel is equipped with 1, 2 or 3 bistable magnetic indicators (depending model list) which indicate the general trip or the specific cause of the last trip, respectively. The indicators remain in position even when the equipment loses power, so that the maintenance service can see the cause of the trip even through the equipment is not powered.

Once they have been activated, it is necessary to manually reset them by pressing the “RESET” button. The operation of the magnetic indicators can be checked from the test menu.

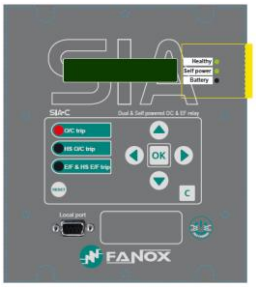
Model 3 bistables	Magnetic indicator “50/51” activated	A trip has been caused by phase instantaneous overcurrent or phase inverse time overcurrent
	Magnetic indicator “50/51N” activated	A trip has been caused by neutral instantaneous overcurrent or neutral inverse time overcurrent
	“External trip” magnetic indicator	A trip has been caused by the activation of the direct trip input
Model 3 bistables for withdrawable model	Magnetic indicator “O/C TRIP” activated	A trip has been caused by phase inverse time overcurrent
	Magnetic indicator “HS-O/C TRIP” activated	A trip has been caused by phase instantaneous time overcurrent
	Magnetic indicator “E/F&HS E/F TRIP”	A trip has been caused by neutral instantaneous overcurrent or neutral inverse time overcurrent
Model 1 bistable	Magnetic indicator “TRIP”	There is a general trip without indicating the reason.

Apart from this signaling, the LCD will show the text <<PICK-UP>> when any protection function is activated.

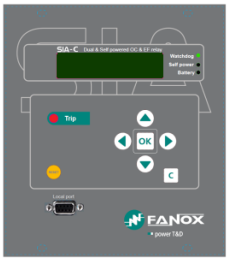
3 Bistable magnetic indicators



Withdrawable model



1 Bistable magnetic indicator



Once they have been activated, it is necessary to manually reset them by pressing the “RESET” button. The operation of the magnetic indicators can be checked from the test menu.

1.8. LED Indicators

The SIA-C front panel has three configurable LEDs. Depending on the model, by default have different meaning.

More than one type of power can be used simultaneously, and more than one LED can be activated thus. The operation of the LED indicators can be checked from the test menu.

The user can change the configuration of the LEDs depending on its requirements and the labels for the LEDs can also be adapted.

1.9. How to install SICOM Software

To install the SICom it is necessary the following link:

http://fanox.blob.core.windows.net/sicom/publish.htm

The necessary drivers depending on the operative system can be downloaded from this page. The update of the software does not require any user´s action, this is, if the computer is connected to Internet, SICom updates itself when it is started.

1.10. Setting-up the session: Password and access levels

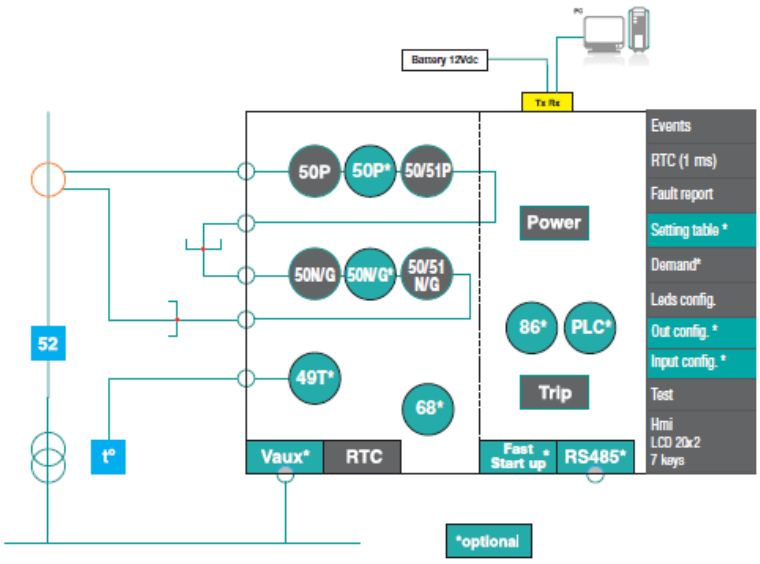
Users must identify themselves with a password in order to start communications and to change the equipment settings or configuration using the HMI. Depending on the access level, it may or may not be possible to perform the operations shown on the table below.

ACCESS LEVEL	Read-only permission: Status and measurements Settings Events	Permission to: Change settings Download	Permission to: Execute Commands	Permission to: Change Configuration	Permission to Change Protected Settings
1	YES	YES	NO	NO	YES
2	YES	YES	NO	NO	NO
3	YES	NO	YES	NO	NO
4	YES	YES	YES	NO	NO
5	YES	YES	YES	YES	NO

Four passwords and their associated levels of access are set up when the equipment is configured using the SIcom program. By default, the equipment is programmed with the following passwords and their associated levels:

PASSWORD	ACCESS LEVEL
2222	2
3333	3
4444	4
5555	5

3. FUNCTIONAL DIAGRAM



4. SELECTION & ORDERING CODES

SIA C												
												Protection Functions 50 + 50/51 + 50N/G + 50/51N/G + 86 + PLC
	1 5											**Phase Measurement** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A)
		1 5 A B										**Neutral Measurement** In = 1 A; (0,10 – 30,00 A) In = 5 A; (0,50 – 150,00 A) In = 0,1 A; (0,01 – 3,00 A) In = 0,2 A; (0,02 – 6,00 A)
			5 6									**Net Frequency** 50 Hz 60 Hz
				0 1 3 4 5 A B D E F								**Power Supply** Self powered Self powered + 230 Vac (Dual) Self powered + 24 Vdc (Dual) Self powered + 48 Vdc (Dual) Self powered + 85-265 Vac/dc (Dual) Self powered + Commissioning battery Self powered + 230 Vac (Dual) + Commissioning battery Self powered + 24 Vdc (Dual) + Commissioning battery Self powered + 48 Vdc (Dual) + Commissioning battery Self powered + 85-265 Vac/dc (Dual) + Commissioning battery
					0 1 2 3 4							**Additional Functions** Striker Striker and with external trip (49T) Coil Coil and with external trip (49T) Striker and 230 Vac adapted external trip
						0 1						**Communications** RS232 (Modbus RTU) RS232 (Modbus RTU) + RS485 (Modbus RTU)
							0 1 2 3					**Inputs and Outputs** Trip Trip + 2 Outputs Trip + 2 Outputs + 2 Inputs Trip + 3 Outputs
								1 2				**Memory** Non-volatile RAM memory Non-volatile RAM memory + Fast start-up
									A B C D			**Languages** English, Spanish and German English, Spanish and Turkish English, Spanish and French English , Spanish and Russian
										B C D E F G		**Mechanics** Horizontal Assembly with 1 magnetic indicator Horizontal Assembly with 3 magnetic indicators Vertical Assembly with 1 magnetic indicator Vertical Assembly, compact Size with 3 magnetic indicators Vertical Assembly, compact size with 3 magnetic indicators, Backlit LCD ,Withdrawable Vertical Assembly, compact size with 1 magnetic indicator, Backlit LCD
											- A B	**Adaptation** 50 + 50/51 + 50N/G + 50/51N/G + 86 + PLC + 50_2 + 50N/G_2 + 3 Settings group +CLP + 4 Settings groups

5. TECHNICAL SPECIFICATION

Function 50_1 **Function 50_2 (*)**	Permission: yes/no
	Operating range: 0.10 to 30 x In (step 0.01 x In)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 20 ms or ± 0.5% (whichever is greater)
Function 50N/G_1 **Function 50N/G_2 (*)**	Permission: yes/no
	Operating range: 0.10 to 30 x In (step 0.01 x In)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 20 ms or ± 0.5% (whichever is greater)
Function 50/51	Permission: yes/no
	Operating range: 0.10 to 7 x In (step 0.01 x In)
	Curves: IEC 60255-151 and IEEE
	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve IEC long time inverse, IEEE Inverse curve, IEEE very inverse curve, IEEE extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 5% or ±30 ms (whichever is greater) when the protection works with inverse time and ± 20 ms or ± 0.5% (whichever is greater) when it works with definite time
Function 50/51N/G	Permission: yes/no
	Operating range: 0.10 to 7 x In (step 0.01 x In)
	Curves: IEC 60255-151 and -IEEE

	Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve IEC long time inverse, IEEE Inverse curve, IEEE very inverse curve, IEEE extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)
	Dial: 0.02 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 5% or ±30 ms (whichever is greater) when the protection works with inverse time and ± 20 ms or ± 0.5% (whichever is greater) when it works with definite time
Function 49T (*)	Charging time 10 s. It is activated by short-circuiting the terminals without external supply
Function 68 (*)	Available through configurable inputs and outputs thanks to programmable logic
CLP (Cold Load Pickup) (*)	Permission: yes/no
	Setting group 1 to 4 (step 1)
	No Load Time: 0.02-300 s (step 0.01 s)
	Cold Load Time: 0.02-300 s (step 0.01 s)
	CLP activation threshold: 8% In
	CLP deactivation threshold: 10% In
Programmable logic control (PLC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE
Fault reports	20 fault reports, 16 events in each
Demand of current	Demand of current with the following characteristics: • Number of records: 168 • Recording mode circular • Sampling rate (interval): configurable through communications: 1 – 60 min • Record format: Date/Time IMAX (in interval) IMAX (actual) IA IB IC IN

Trip output contact (*)	For Striker: 24 Vdc-135 mJ For coil (optionally with TCM adapter): • 250 Vac – 8A • 30 Vdc – 8A • Resistive load (cos φ = 1)
Signalling outputs (*)	3 configurable outputs (output 2, output 3 and output 4): 220 Vdc – 1 A (30 W max) 250 Vac – 1 A (62,5 VA max)
Frequency	50/60Hz
Communication (*)	RS232 port: Modbus RTU RS485 port: Modbus RTU **(*)**
Auxiliary supply (*)	Self-powered
	Self-powered + 230 Vac, ±20 %
	Self-powered + 24 Vdc ±10 %
	Self-powered + 48 Vdc ±10 %
	Self-powered + 85-265 Vdc/Vac ±20 %
Battery and power supply	Externally, with adapter (Kitcom) port DB9 + Commissioning battery (Depending on model)
Self-power from current	Three phase self-power level: I > 0,1 x In
Environment	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80 ºC
	Humidity: 95%
Transformers (*)	Power supply and measurement CT/1 or CT/5
Mechanical features	Metallic box
	Panel Mounting
	Height x Width: Compact Vertical model:177 x 155 (mm) Standard Vertical model: 177 x 189 (mm) Horizontal model: 177.8 x 290.3 (mm)
	Depth: Compact Vertical model:132.8 mm / 135 mm for the withdrawable model Standard Vertical model: 145.8 (mm) Horizontal model: 100.75 mm
	IP-54

Thermal resistance	3xIn continuously 20xIn during 10 seconds 70xIn during 1 second

(*) Optional depending on model

1.11. IEC60255-151 Curves

The SIA-C relay complies with the curves shown in standard IEC60255-151:

- Inverse Curve.
- Very Inverse Curve.
- Extremely Inverse Curve.
- Long-time inverse.

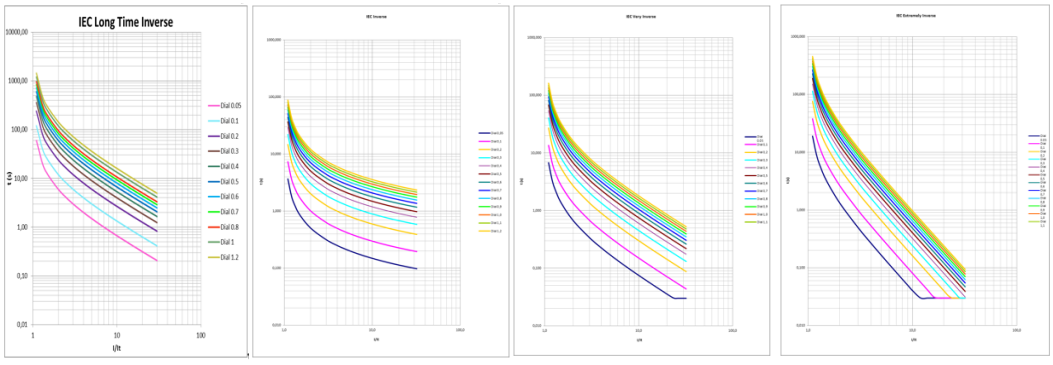
There is a general mathematical equation that defines the time in seconds as a function of the current:

$$t = \frac{A \times D}{V^P - Q} + B \times D + K \qquad V = \frac{I}{I_{adjusted}}$$

Parameters	A	P	Q	B	K
Long Time Inverse	120	1	1	0	0
Ext. Inverse	80	2	1	0	0
Very Inverse	13,5	1	1	0	0
Inverse	0,14	0,02	1	0	0

The curve can mode from its axis using the D time selection device, which the user can adjust.

$I_{adjusted}$ is the initial operating current, set by the user.



1.12. IEEE Curves

The IEEE curves follow the following mathematical equation:

$$t = (TD) \times \left[\left(\frac{A}{V^P - 1} \right) + B \right] \qquad V = \frac{I}{I_{adjusted}}$$

And we have the following curves:

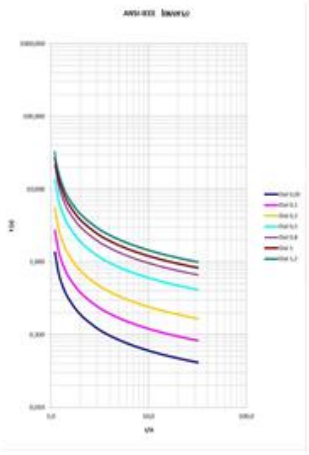
- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve

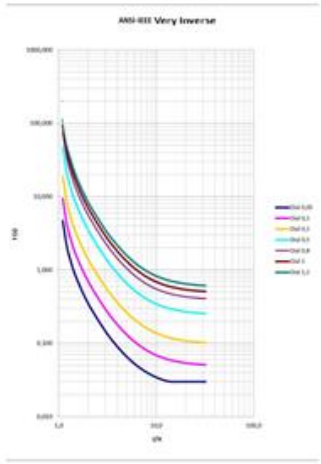
Which relate to the parameters figuring in the following table:

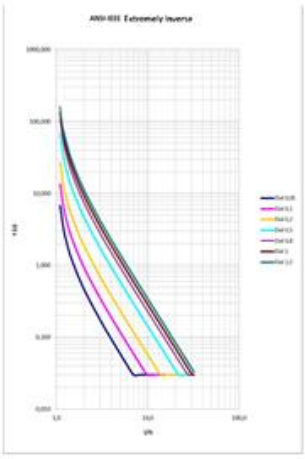
Parameters	A	P	B
Ext. Inverse	28,2	2	0,1217
Very Inverse	19,61	2	0,491
Inverse	0,0515	0,02	0,114

The curve can move from its axis using the TD time selection device, which the user can adjust.

$I_{adjusted}$ is the initial operating current, set by the user.







6. OPENING MECHANISM (DEPENDING ON MODEL)

The trip voltage level is associated to a striker, so the type of trip is a polarized one. If the opening mechanism is a coil the trip is a free potential one. There are a lot of models of strikers in the market, with different trip energies, being for example 50 mJ (0,05W·s) and operation voltage of 6V, or 135 mJ (0,1W·s) and operation voltage of 24V.

The opening mechanism is activated by means of a striker. The activation of the trip generates a pulse train.

The **Trip Voltage Level** setting allows adjusting the trip voltage level required by the selected striker. The default value is 17 Vdc, although there are several options:

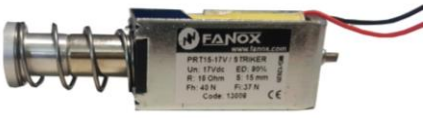
12 Vdc 17 Vdc 22 Vdc 24 Vdc

The equipment will allow the trip when it gets the selected trip voltage, so if a lower level than the required by the striker is adjusted, it may result on tripping without enough energy and not activating the striker.

On the other hand, if a higher level that the required by the striker is selected, the activation of the striker is guaranteed, however, the fault trip time during start-up may be increased. Fanox encourages selecting the correct value of this critical setting and offers its expertise at any doubt.

Striker

The striker is a bistable device with a simple action. The striker shaft is moved by a spring. The striker is activated by a polarized low-power electrical signal, supplied by the relay if a fault occurs. Resetting the shaft to its position is done manually. Resetting the striker has to be done in such a way as to guarantee that the opening mechanism is closed. This is normally done manually.



Due to the existing variety in the market, it is important to check the voltage, the impedance and the necessary energy for its activation.

7. PROGRAMMABLE LOGIC CONTROL (*)

Physical outputs are the real outputs of the Device. SIA C has a trip output and depending on the model, up to three digital outputs (*Output 2, Output 3 and Output 4*) and up to two inputs. SIA C device has 3 configurable LEDS, which receive the same treatment as the physical outputs. All the outputs (Leds and physical outputs) are the result of a PROGRAMMABLE LOGIC CONTROL which can be configured from HMI or from SICom software.

For each output, there is a LOGICAL GATE. It can perform a logical operation up to 4 binary states to obtain other binary result. In V3 of the PLC the LOGICAL GATES that are supported by SIAC are:

LEDs	LED 1
	LED 2
	LED 3
PHYSICAL OUTPUTS	TRIP OUTPUT **(NOT CONFIGURABLE) (*)**
	Output 2 **(*)**
	Output 3 **(*)**
	Output 4 **(*)**
LOGICAL SIGNALS	Block 50 **(*)**
	Block 50N **(*)**
	Active settings group 1 **(*)**
	Active settings group 2 **(*)**

LOGICAL GATE	HMI SYMBOL
OR4	+
NOR4	τ
OR4_LACTH	Ю
NOR4_LACTH	Φ
OR4_PULSES	∫
AND4	&
NAND4	§
AND4_PULSES	$
OR_TIMER_UP	O
NOR_TIMER_UP	P
AND_TIMER_UP	Q
NAND_TIMER_UP	R
OR_PULSE	o
NOR_PULSE	p
AND_PULSE	q
NAND_PULSE	r

(*) Optional depending on model

(*) **NOTE**: Despite being possible to configure the trip output with SICOM software, the relay does not consider this configuration, because this output must adapt how it works to the associated trip mechanism.

By default, outputs configuration is:

	OUTPUT	*LOGICAL GATE*	BINARY STATES
LEDs	LED 1	NOR4	• Ready
	LED 2	OR4_PULSES	• Self-Power
	LED 3	OR4_PULSES	• Battery
PHYSICAL OUTPUTS (*)	Output 2	AND4	• Phase Trip • General trip
	Output 3	AND4	• Neutral Trip • General Trip
	Output 4	NOR4	• Ready
	TRIP OUTPUT **(NOT CONFIGURABLE)**	OR4_PULSES	• General Trip
LOGICAL SIGNALS (*)	Block 50	Not configured	------
	Block 50N	Not configured	------
	Active settings group 1	Not configured	------
	Active settings group 2	Not configured	------

Outputs and LEDs require, to be activated, the following minimum current:

Single phase→0.35xIn, this is 0.35 amperes. Three phases→0.17xIn, this is 0.17 amperes

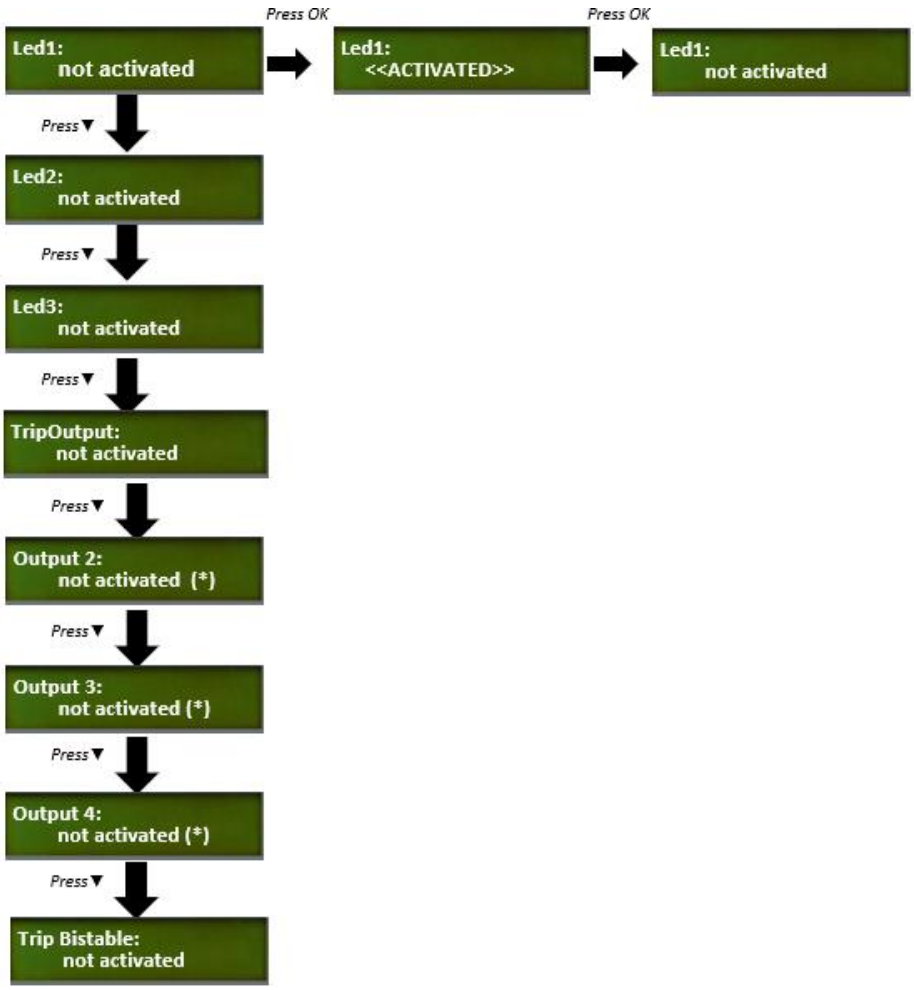
8. FLOWCHART (EXAMPLE)

1.13. Test menu

From the main menu, press the keys "◄", "▼", and "►" in sequence and then press and hold the "OK" key until the "Test menu" appears on the display. The test menu is accessed by pressing the "OK" key again, and the "▲" and "▼" keys can be used to navigate through the different menu items. Each item can be activated or deactivated by pressing "OK" on it (if the item is deactivated, it is activated by pressing OK; if the item is activated, it is deactivated by pressing "OK"). Press the "C" key to exit the test menu.

Once "Led 1" appears, pressing "OK" the led is activated and pressing "OK" again, it is deactivated.

To go through all options, press "▼". To activate and deactivate the options follow the same steps as in case of Led 1.



(*) Depending on model

Direct Access

Version

The equipment versions menu can be accessed from the standby mode screen by holding "▲" key.

Press the "C" key to return to the standby mode screen.

Date and time

Press the "►" key from the standby mode screen to access to date and time menu

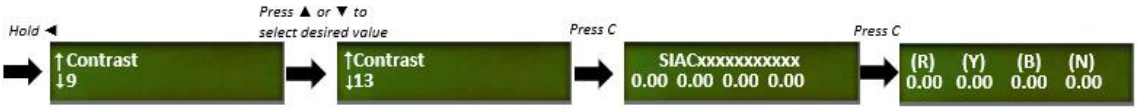
Press the "OK" key to access the date-time modification screen. Use the "►" and "◄" keys to position the cursor over the digit that you want to change and assign a value to this digit using the "▲" and "▼" keys. Once the date-time has been entered, press "OK" to change the equipment date.

Press the "C" key to return to the standby mode screen.

Contrast

Hold "◄" key from standby menu to access to Contrast menu. Use the "▲" and "▼" keys to select the desired value.

Press the "C" key to return to the standby mode screen.



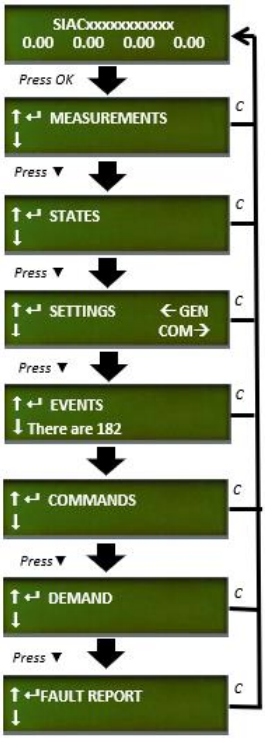
Communication parameters

Hold "▼" key from standby menu to access to communication parameters menu.

Press the "C" key to return to the standby mode screen.

(*) Remote communication depending on model

1.14. Menus



The information in SIAC relay is organized through the following menus:

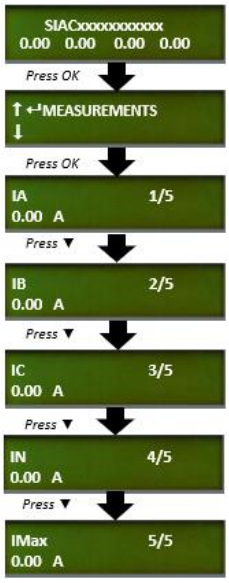
- Measurements
- Status
- Settings
- Events
- Demand
- Fault Report

From standby screen press “OK” key to access to the fist menu “MEASUREMENTS” and press “▼” key to overview the rest of the menus in the relay

To return to standby screen, press “C” key.

It is also possible to access to Fault reports by pressing “◄” key.

1.14.1. Measurements menu



From the standby mode screen, press the “OK” key to access the first line of menus.

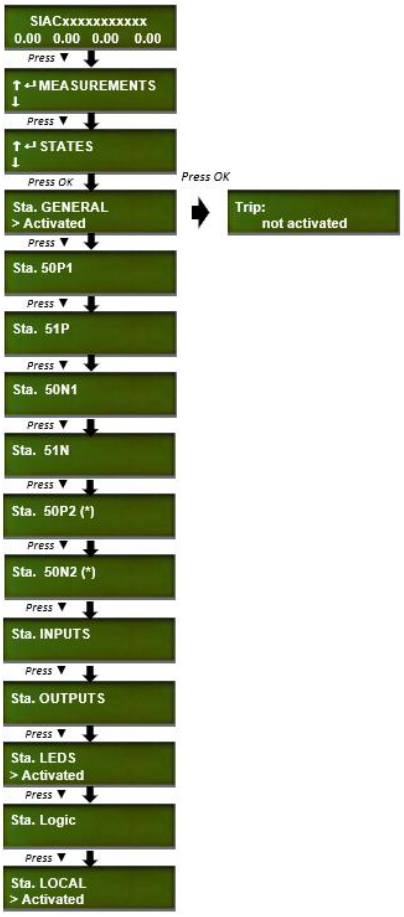
Use the “▲” and “▼” keys to position the cursor over the “MEASUREMENTS” screen and press “OK”.

Use the “▲” and “▼” keys to position the cursor over the measurement and to see its value.

Press the “C” key to return to the standby mode screen.

If “OK” key is pressed in any of the current measurements, the current is displayed in secondary instaed of in primary.

1.14.2. States menu



States menu indicates the stuses of the relay (activated or deactivated) at real time.

From the standby mode screen, press the “OK” key to access the first line of menus.

Use the “▲” and “▼” keys to position the cursor over the “STATES” screen and press “OK”. This takes you to the status groups’ line.

Move the cursor over a group of statuses, and press the “OK” key to access the statuses that belong to this group. Use the “▲” and “▼” keys to browse through the different statuses.

The information shows whether each status is active. The message “>Activated” appears under the name of the group in the status group menus if any of the statuses in that group are active.

Press the “C” key to return to the standby mode screen.

Depending on model: 50P2, 50N2, Inputs, Outputs and Logic.

1.14.3. Settings menu

From the standby mode screen, press the “OK” key to access the first line of menus.

Use the “▲” and “▼” keys to position the cursor over the “SETTINGS” screen and press “OK”. This takes you to the settings groups’ line.

Use the “▲” and “▼” keys to position the cursor over a settings group, and press the “OK” key to access the settings that belong to this group.

Use the “▲” and “▼” keys to move through the different settings. The information that appears underneath the setting name is its value.

Depending on model: 50P2, 50N2

50 protection function

The parameters to adjust are:

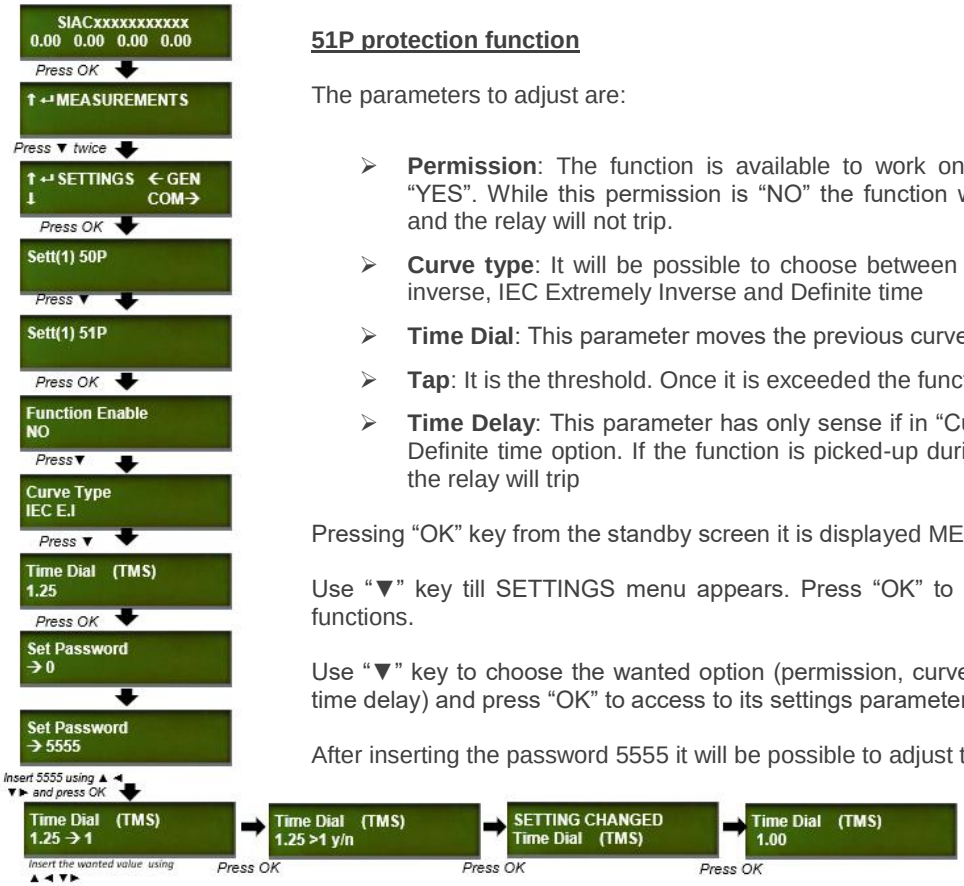
- **Permission**: The function is available to trip only if the permission is "YES". While this permission is "NO" the function will never BE ACTIVATED AND THE RELAY WILL NOT TRIP.
- **Tap**: It is the threshold. Once it is exceeded the function picks-up.
- **Time Delay**: If the function is picked-up during the adjusted value the relay will trip

Pressing "OK" key from the standby screen it is displayed MEASUREMENT menu.

Use "▼" key till SETTINGS menu appears. Press "OK" to access to the different functions.

Use "▼" key to choose the wanted option (Permission, Tap or Time delay) and press "OK" to access to its settings parameters.

After inserting the password 5555 it will be possible to adjust the wanted value.



51P protection function

The parameters to adjust are:

- **Permission**: The function is available to work only if the permission is "YES". While this permission is "NO" the function will never be activated, and the relay will not trip.
- **Curve type**: It will be possible to choose between IEC Inverse, IEC Very inverse, IEC Extremely Inverse and Definite time
- **Time Dial**: This parameter moves the previous curves along the "Y" axis.
- **Tap**: It is the threshold. Once it is exceeded the function picks-up.
- **Time Delay**: This parameter has only sense if in "Curve type" it is selected Definite time option. If the function is picked-up during this adjusted value, the relay will trip

Pressing "OK" key from the standby screen it is displayed MEASUREMENT menu.

Use "▼" key till SETTINGS menu appears. Press "OK" to access to the different functions.

Use "▼" key to choose the wanted option (permission, curve type, time dial, tap or time delay) and press "OK" to access to its settings parameters.

After inserting the password 5555 it will be possible to adjust the wanted value.

General settings

From the standby mode screen, press the “OK” key to access the first line of menus. Use the “▲” and “▼” keys to position the cursor over the “SETTINGS” screen. Press the “◄” key to access the general settings from the "SETTINGS" screen.

The general setting "Equipment name" can be viewed from the HMI, but it can only be modified by using the SICom program.

The value of the "CT Phase ratio” and “TI Neutral ratio” general settings, is the result given by dividing the number of turns on the primary winding by the number on the secondary winding. For example: With TI 500/5, the setting would be 100.

The frequency is selected for each model. The value is read only.

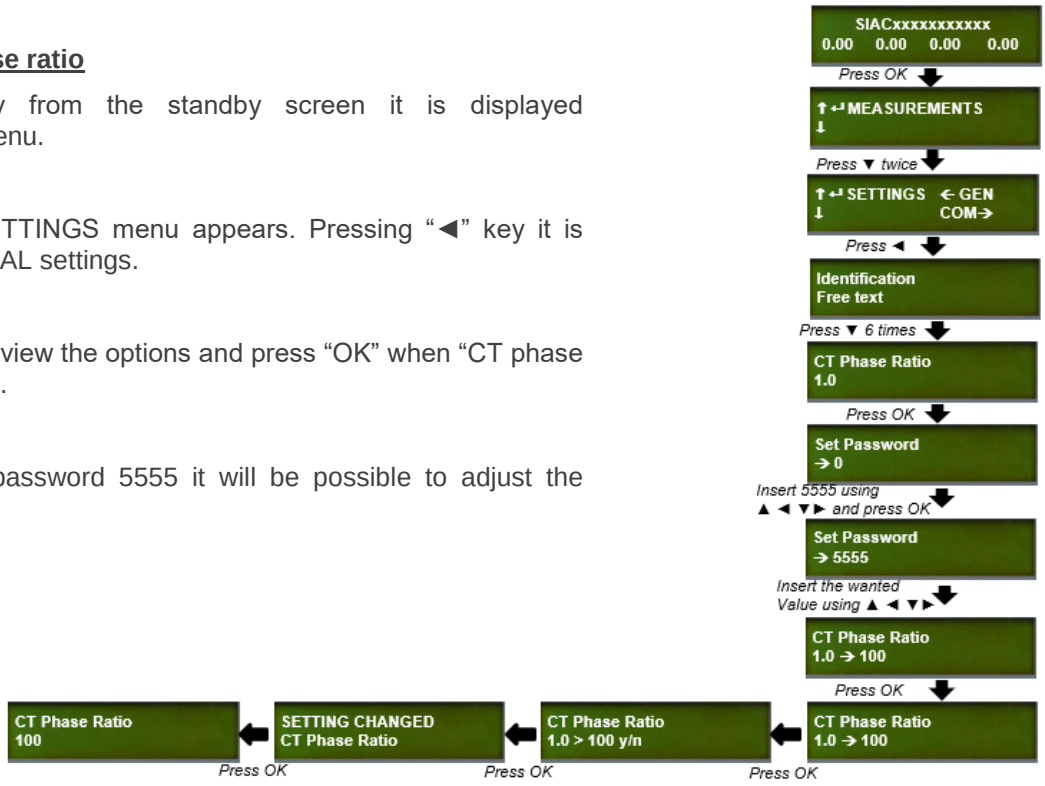
How to set CT Phase ratio

Pressing “OK” key from the standby screen it is displayed MEASUREMENT menu.

Use “▼” key till SETTINGS menu appears. Pressing “◄” key it is accessed to GENERAL settings.

Use “▼” key to overview the options and press “OK” when “CT phase ratio” option appears.

After inserting the password 5555 it will be possible to adjust the wanted value.



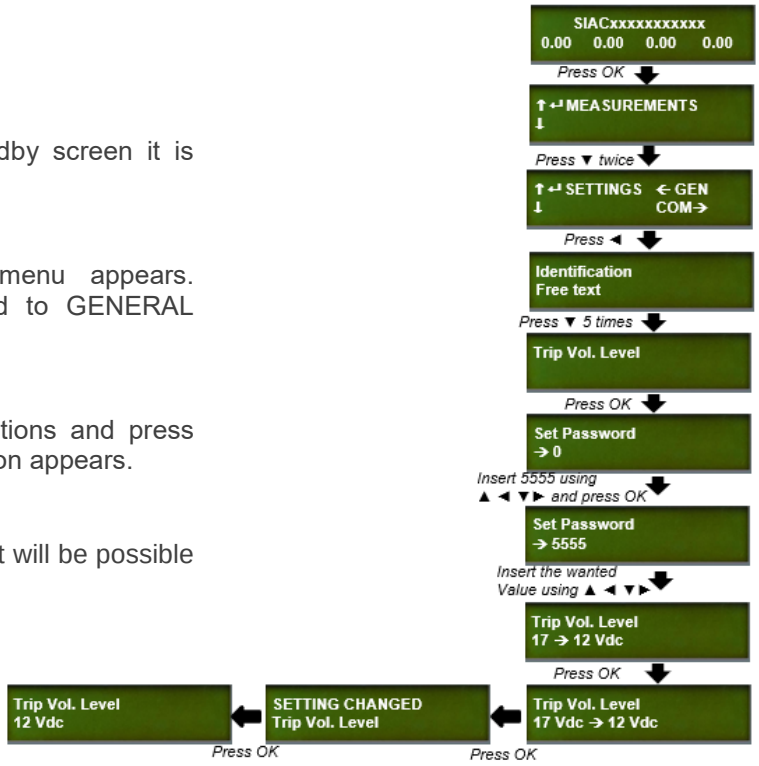
How to set Trip Voltage level

Pressing “OK” key from the standby screen it is displayed MEASUREMENT menu.

Use “▼” key till SETTINGS menu appears. Pressing “◄” key it is accessed to GENERAL settings.

Use “▼” key to overview the options and press “OK” when “Trip Voltage level” option appears.

After inserting the password 5555 it will be possible to select the desired value.



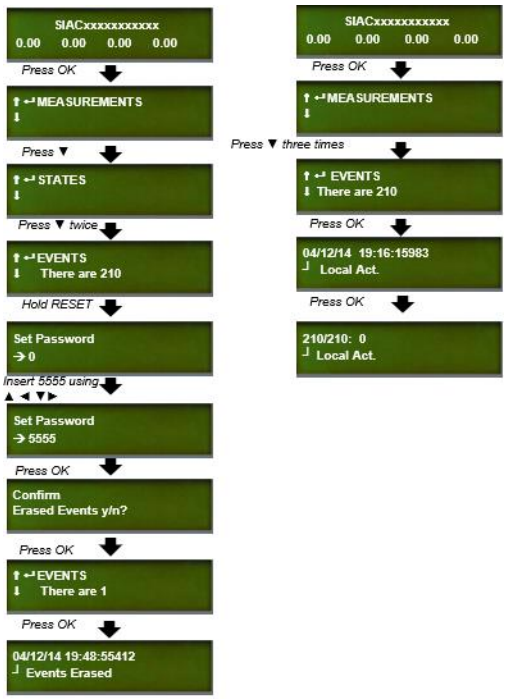
1.14.4. Events menu

From the standby mode screen, press the “OK” key to access the first line of menus. Use the “▲” and “▼” keys to position the cursor over the “EVENTS” screen and the number of events in the buffer will be displayed. Press "OK" and use the “▲” and “▼” keys to position the cursor over the events.

The “┘” and “┐” shows the event has been caused by the activation or reset.

Each event contains the following information:

- Date-time
- Description of the event
- Size of the events buffer
- Position of the event within the list
- Caused by activation or reset
- Associated measurement

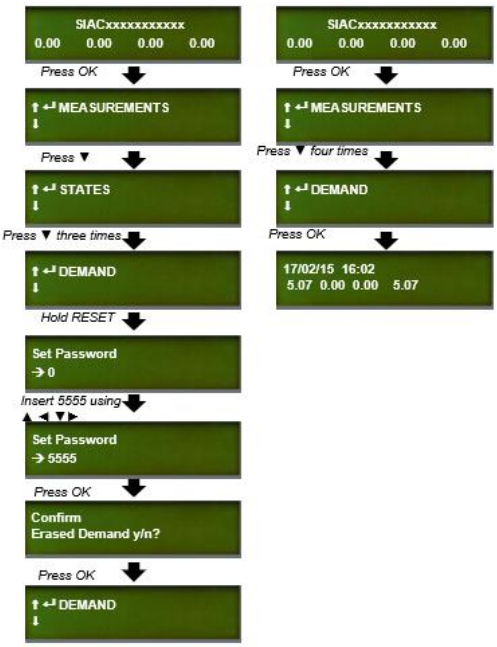


How to delete the events

To delete the events from the relay it is necessary to insert the password 5555 from the events menu. After the erasing of the events it will be appear there is 1 event corresponding to “Events erased”

NOTE: When the events are deleted, the faul reports persist in the relay to analyze the fault situation until these faults reports are deleted consciously by the user.

1.14.5. Demand menu



SIA-C relay provides the demand of current with the following characteristics:

- Number of records: 168
- Recording mode circular
- Sampling rate (interval): configurable through communications: 1 – 60 min
- Record format:

  Date/Time

  IMAX (in interval)

  IMAX (actual)

  IA

  IB

  IC

  IN

How to delete the demand

To delete the demand from the relay it is necessary to insert the password 5555 from the demand menu.

1.14.6. Fault reports menu

From the standby mode screen, press the “OK” key to access the first line of menus. Use the “▲” and “▼” keys to position the cursor over the “FAULT REPORT” screen. Press "OK" and use the “▲” and “▼” keys to position the cursor over the faults.

Once it is accessed to a fault report, press “OK”, to visualize the cause which has originated the fault report.

Pressing “OK” again it is accessed to the registered events that are related with that fault reports. The first event is the activation of the fault report. To visualize the rest events, use “▼” key.

How to delete the fault reports

To delete the fault reports from the relay it is necessary to insert the password 5555 from the fault report menu.

9. COMMISSIONING

1.15. Thermal resistance

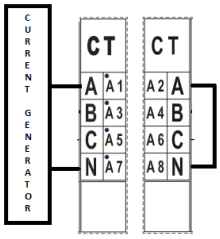
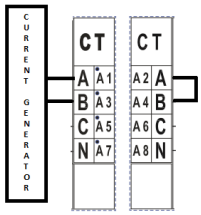
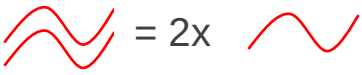
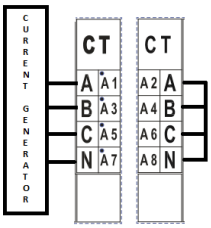
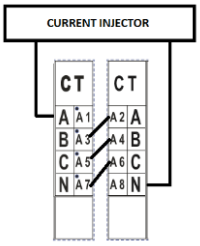
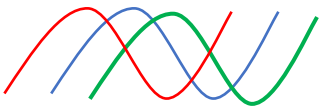
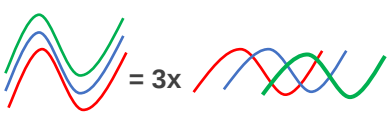
The relay can support, with 3-phase balanced injection, the following values according to International Standards:

3xIn continuously

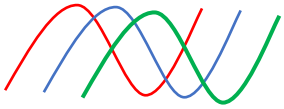
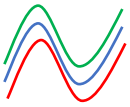
20xIn during 10 seconds

70xIn during 1 seconds

In the following table the different injection modes are described:

CURRENT GENERATION	INJECTION MODE	INJECTION SYSTEM	RELAY REAR CONNECTION	RELAY WITHSTAND ENERGY WAVEFORM
Single phase	Phase-Neutral	NOT APPLY	P-N: 	
	Phase-Phase		P-P: 	
Three phase	Phase-Neutral	Balanced (120°) Un balanced (0°)	P-N Balanced:  P-N Unbalanced: 	 

Considering this description, the real thermal image that will support the relay depending on the injection mode and injection system is shown below:

WAVE FORM	INJECTION MODE	THERMAL RESISTANCE
	SINGLE PHASE P-N	3xIn continuously 20xIn during 10 seconds 70xIn during 1 seconds
	3-PHASE BALANCED	3xIn continuously 20xIn during 10 seconds 70xIn during 1 seconds
	3-PHASE UNBALANCED	1xIn continuously 6.5xIn during 10 seconds 23 xIn during 1 seconds

NOTE: It is checked that thermal image values are re-defined not to exceed the declared value in the International Standard.

Commissioning recommendation:

- It is recommended to use Kitcom accessory for relay protection functions settings. Connect it for setting and disconnect it for testing purpose.

- Adjust manually current generation value without injecting current to relay, for not stressing it during adjustment process.
- Be sure that relay output contact is connected to generator tripping input in order to stop the generator, hence the current injection, after reaching adjusted tripping time. This way, relay will only withstand rated injected current during adjusted time at protection function settings, not maintaining current injection constantly, which could become a damaging situation for relay, as in other case, the internally handle energy will be higher than rated one.

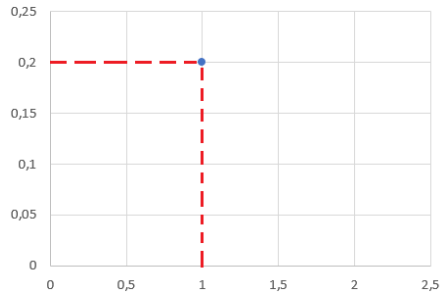
- Not to perform repetitive trips continuously as the stress of the relay will be increased drastically, especially when high current is being injected on the relay.

By following these recommendations, relay should pass commissioning test successfully. If commissioning test is performed not following these recommendations, manufacturer won't be responsible for relay failure.

1.16. Self-powering

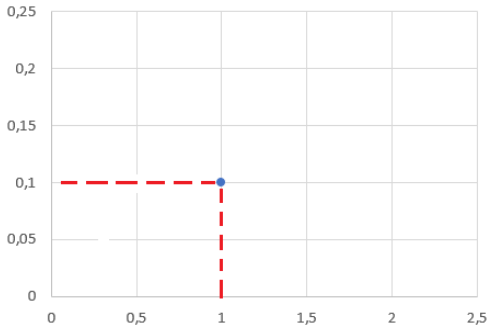
1.16.1. Single phase minimum self-powering checking

Adjust the current generator with HOLD 0.2 amperes, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line.



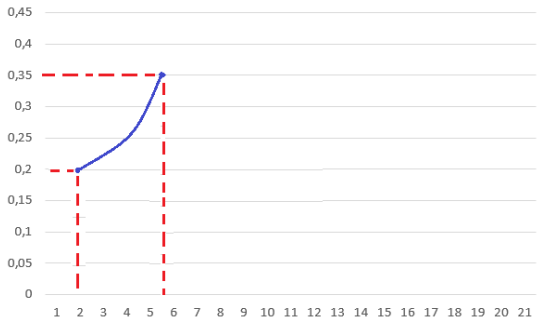
1.16.2. Three phase minimum self-powering checking

Adjust the current generator with HOLD 0.1 amperes, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line.



1.16.3. Verification of Leds/Signalling Outputs/LCD in self-powering conditions

Adjust the current generator with HOLD 0.2 amperes, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line. Once the relay is switched up, increase current injection until 0.35xIn is reached. At this value, the Leds and LCD backlit should be switched on:



1.17. Measurements

The accuracy of the measurement is ±2% on a band of ±20% over the nominal current and ±4% over the rest of the measurement range.

Some examples are shown below:

- Current injected => I=1 A:→ ±2% accuracy is complied.
- Current injected => I=2A as this current value is 20% higher than the nominal current (In= 1A) → 4% accuracy is complied.

1.18. Protection functions

Current injection procedure:

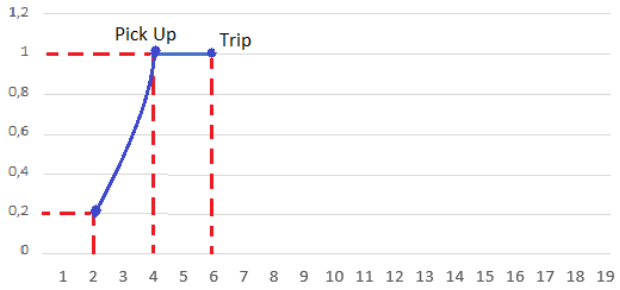
Adjust the Sverker current generator with HOLD 0,2 amperes, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line. From this value, increase the current to achieve the function pick-up and the function trip.

1.18.1. Protection functions testing

- 50P instantaneous phase overcurrent protection:

Settings:

- Permission: YES.
- TAP: 1xIn.
- Time: 2 (sec)



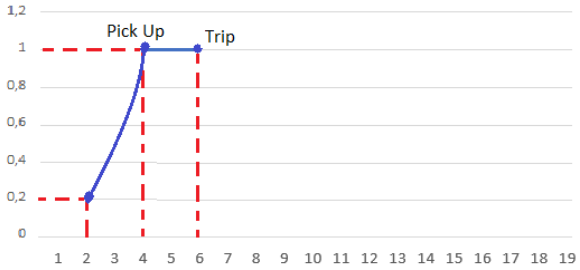
The following information will be checked:

- Pick-up at 100% of the tap (1 A)
- Trip output is activated
- Output 2 is activated
- Bistable is activated

- 50N instantaneous neutral overcurrent protection:

Settings:

- Permission: YES.
- TAP: 1xIn.
- Time: 2 (sec)



The following information will be checked:

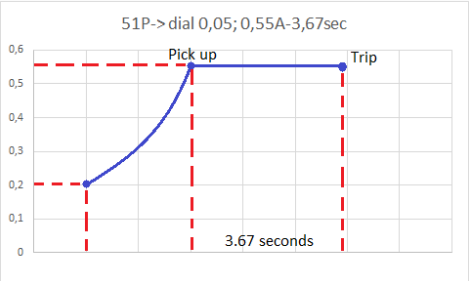
- Pick-up at 100% of the tap (1 A)
- Trip output is activated
- Output 3 is activated
- Bistable is activated

- 51P Inverse time phase overcurrent protection:

TEST 1:

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 0.05
- TAP: 0.5xIn.
- Theoretical tripping time= 3.67 seconds (Fault current 0.55 A)



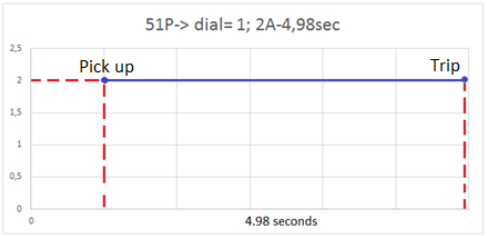
The following information will be checked:

- Pick-up at 110% of the tap (0.55 A)
- Trip output is activated
- Output 2 is activated
- Bistable is activated

TEST 2

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 0.5xIn.
- Theoretical tripping time = 4.98 seconds (fault current 2 A)



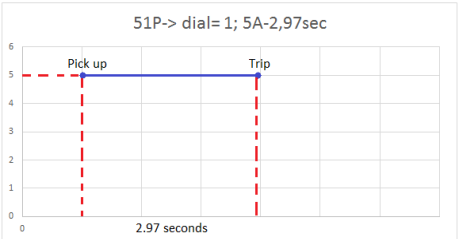
The following information will be checked:

- Trip output is activated
- Output 2 is activated
- Bistable is activated

TEST 3

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 0.5xIn.
- Theoretical tripping time = 2.97seconds (Fault current 5 A)



The following information will be checked:

Trip output is activated

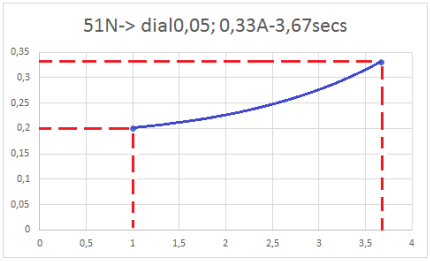
Output 2 is activated

Bistable is activated

- 51N Inverse time neutral overcurrent protection:

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 0.05
- TAP: 0.3xIn.
- Theoretical tripping time= 3.67 seconds (Fault current 0.33 A)



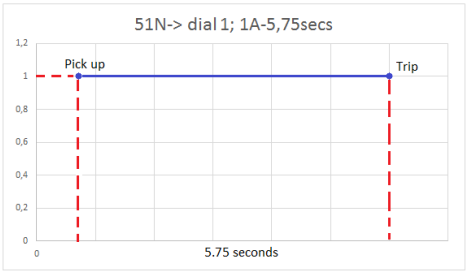
The following information will be checked:

- Pick-up at 110% of the tap (0.33 A)
- Trip output is activated
- Output 3 is activated
- Bistable is activated

TEST 2

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 0.3xIn.
- Theoretical tripping time = 5.75 seconds (fault current 1 A)



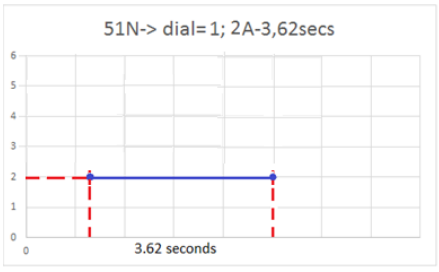
The following information will be checked:

- Trip output is activated
- Output 3 is activated
- Bistable is activated

TEST 3

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 0.3xIn.
- Theoretical tripping time = 2.97seconds (Fault current 2 A)



The following information will be checked:

- Trip output is activated
- Output 3 is activated
- Bistable is activated

Note: In TEST 2 and TEST 3 for 51 and 51N, fault current will be injected the directly to check the theoretical tripping time. Consider this time is calculated through an equation and this time depends on the injected current, so doing a ramp is possible but the theoretical tripping time will not be checked.

10. SIACXXXXXXXXXXX REGISTRY

Model:			
Serial Number:			
Correct packing and unpacking	❒ OK		
Relay verification	❒ OK		
Installation process	❒ OK		
Connection process	❒ OK		
Test menu	❒ OK		
Model and Versions:	Reading LCD model:		
	Version:		
Wiring checking	❒ OK ❒ NOK		
DB9 communication port:	❒ OK ❒ NOK		
Signalling and Keypad	Led 1 ❒ OK	Led 2 ❒ OK	Led 3 ❒ OK
	(*) FLAG1 ❒ OK	**(*)** FLAG2 ❒ OK	**(*)** FLAG3 ❒ OK
	Trip Output ❒ OK ❒ NOK		
	Output 2 **(*)** ❒ OK ❒ N/A		
	Output 3 **(*)** ❒ OK ❒ N/A		
	Output 4 **(*)** ❒ OK ❒ N/A		
	Keypad ❒ OK ❒ NOK		
Self-power 3P (SIAC>0.1In)	Phase A ❒ OK	Phase B ❒ OK	Phase C ❒ OK
Communications	❒ OK ❒ NOK		
Settings and configuration	❒ OK ❒ NOK		
Current measurements	❒ OK ❒ NOK		
Protection Functions	50 phase A: ❒ OK	50 phase B: ❒ OK	50 Phase C: ❒ OK
	(*) 50_2 phase A: ❒ OK ❒ N/A	**(*)** 50_2 phase B: ❒ OK ❒ N/A	**(*)** 50_2 phase C: ❒ OK ❒ N/A
	50N ❒ OK		
	(*) 50N_2 ❒ OK ❒ N/A		
	51 phase A: ❒ OK	51 phase B: ❒ OK	51 phase C: ❒ OK
	51N ❒ OK		
	49T **(*)** ❒ OK ❒ N/A		
	(*) CLP ❒ OK ❒ N/A		
RTC	❒ OK		

(*) Depending on model.

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