



SIA-B

Self & Dual Power
Overcurrent Protection
Relay



INSTALLATION & COMMISSIONING GUIDE

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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:

- SIAB 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.

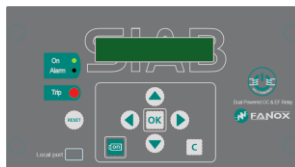
1.2. Relay verification

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

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 5 volts to operate the equipment and that is plugged into the front USB communications port (KITCOM).

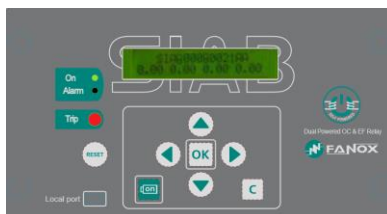
Once the KITCom is connected, the relay will be switched on and a led on the left of the relay (led on) will blink indicating the relay is powered on through an external battery (KITCOM).

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.

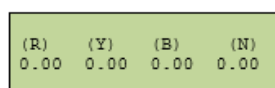
Besides, the possibility of using external battery power, together with the possibility of activating the trip contact from the test menu, allows the trip circuit to be tested before the transformation center is powered up. So, the KITCOM is useful for cases like commissioning operations, discharges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

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



Once the relay is powered through the Kitcom, it should be checked:

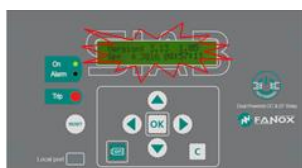
- Model → Directly, complete model on top line and phases/neutral current measurement on bottom line are displayed. Once “C” key is pressed the name of phase and neutral currents (instead the complete model) is displayed on the top of LCD Standby screen.



- Serial Number → In “General Settings” menu serial number of 8 digits can be checked (OK - ▼ - ▼ - ◀ - ▼ - ▼)



- Firmware Version → In “Firmware Version” menu (HOLD ▲)



1.3.1. Keypad & LCD

- Use KEYPAD to 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 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:

LOCAL Setting
1 19200-8-N-1

- If the contrast of the LCD is of the correct one, enter to "CONTRAST" menu by holding "◀" for 3 seconds. Then, change it by using up and 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 be 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).

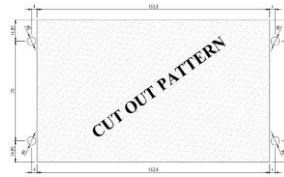
It will be checked that the LEDs, Magnetic indicator flags and Outputs are activated if OK key is pressed and it will be deactivated if OK key is pressed again. LEDs, Magnetic indicator and outputs will be checked to verify the hardware is OK:



Action		Checking
OK, OK	Led ON	Led ON activated
▼, OK	Led ALARM	Led ALARM activated
▼, OK	Magnetic Indicator	Trip Magnetic indicator
▼, OK	Trip output	Trip Output activated
C	Skip from test menu	

1.4. Relay intallation

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 battery

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

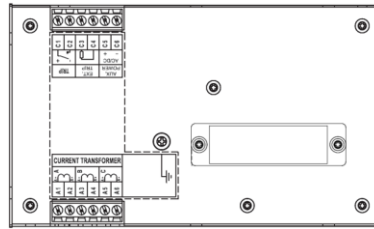
HAZARD OF EXPLOSION

- 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 100°C (212°F)
- Do not throw the battery into fire or water.

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

1.5. Relay rear part

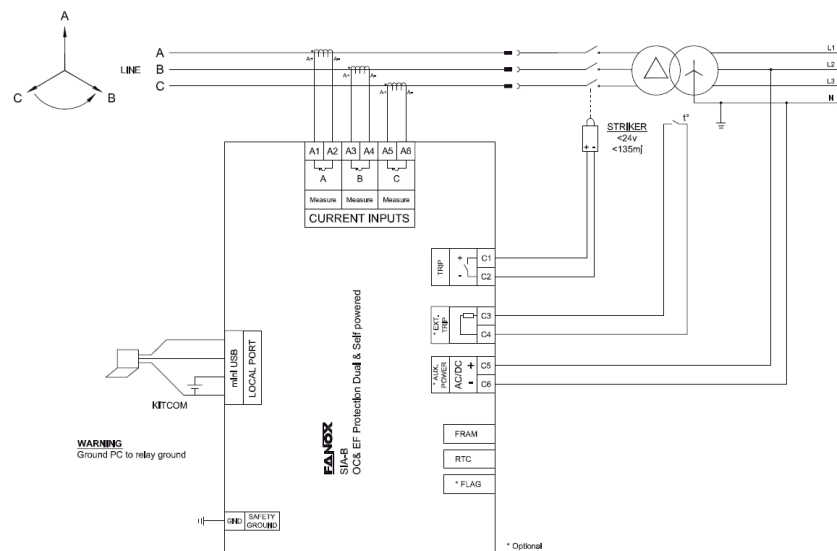
Consider the wiring of the switchgear and connect relay properly:



A1	Phase A current input for measurement and self-power	C1	Trip output +
A2	Phase A current output for measurement and self-power	C2	Trip output –
A3	Phase B current input for measurement and self-power	C3-C4	External trip
A4	Phase B current output for measurement and self-power	C5	Auxiliary power supply +
A5	Phase C current input for measurement and self-power	C6	Auxiliary power supply -
A6	Phase C current output for measurement and self-power	⊥	Earthing screw

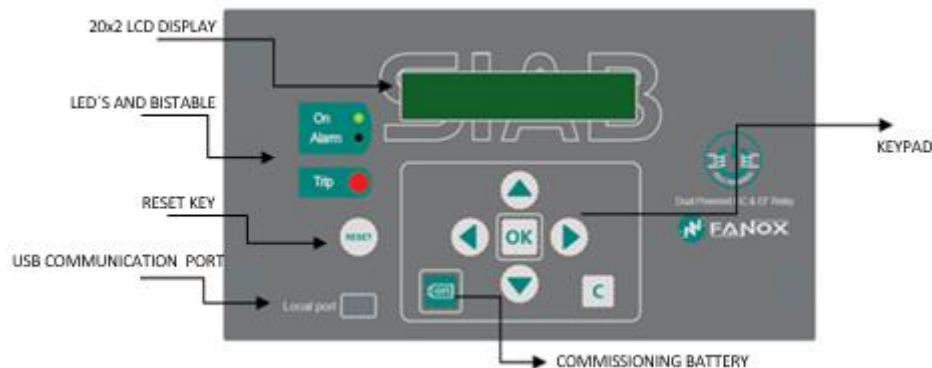
1.6. Connection diagram

1.6.1. Connection diagram. Three phase diagram, neutral internally calculated



2. USER INTERFACE

2.1. Relay front part



2.2. Bistable magnetic indicator (Flag)

The front panel is equipped with 1 bistable magnetic indicator which indicates the general trip. The indicator remains in position even when the equipment loses power, so that the maintenance service can see the trip even through the equipment is not powered.

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

1 bistable	Magnetic Indicator “trip”	There is a general trip without indicating the reason.
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2.3. LED indicators

The SIA-B front panel has two not configurable LEDs. By default, they show: ready (LED ON) and alarm (LED ALARM).

LED ON	Activated (Green LED blinking) if the relay is ready
LED ALARM	Activated (Red LED blinking) if an alarm occurs.

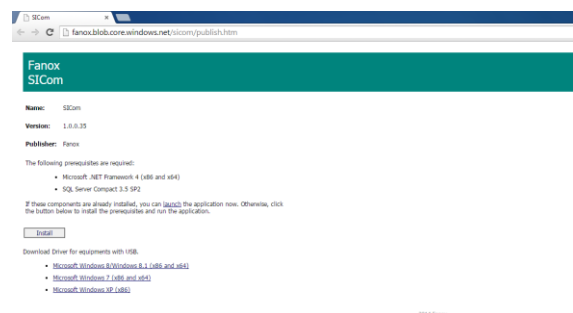
2.4. How to install SICOMM software

To install the SICom it is necessary the following link:

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

The link will open the next screen, where key “install” must be pressed:

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.



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

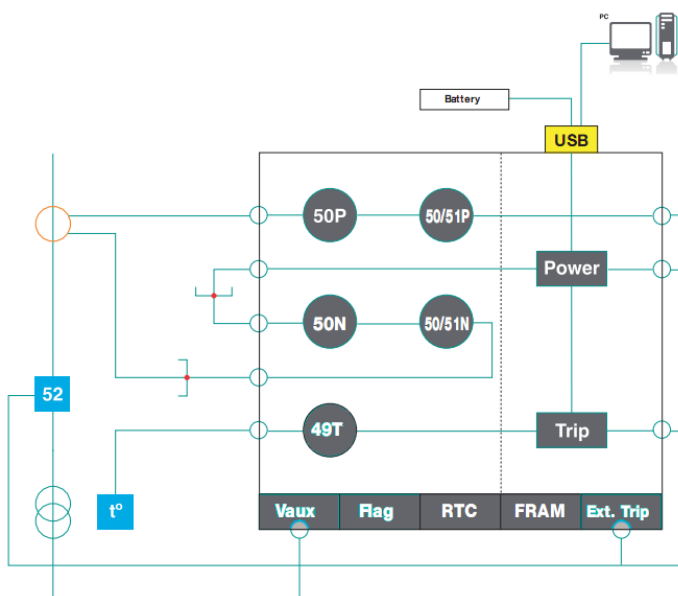
Users must identify themselves with a password to start communications and to change the equipment settings or configuration using the HMI. Depending on the access level, it may or may not be possible to perform the operations shown on the table below.

ACCESS LEVEL	Read-only permission: Status and measurements Settings Events	Permission to: Change settings Download and Delete the Events buffer	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. TECHNICAL SPECIFICATIONS

Complete model	SIAB000B0011AA
	0: Phase measurement → Defined by General Settings.
	0: Neutral measurement → Internal measurement.
	0: Net frequency → Defined by General settings.
	B: Power supply → Self-powered + 230 Vac (Dual) + Commisisonig battery
	0: Additional functions → none.
	0: Communications → USB (modubs RTU)
	1: Inputs–Outputs → Trip (for Striker) + External trip input (49T) + 1 magnetic indicator
	1: Mechanics → Horizontal. Assembly.
	A: Languages → English, Spanish and German
	A: Adaptation → -
Function 50	Permission: yes/no
	Operating range: 0.20 to 20 x Is (step 0.01 x Is)
	Operating time: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: ± 40 ms or ± 0.5% (whichever is greater)
Function 50N	Permission: yes/no
	Operating range: 0.20 to 20 x Is (step 0.01 x Is)
	Operating time: 0.05 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: ± 40 ms or ± 0.5% (whichever is greater)
Function 50/51	Permission: yes/no
	Operating range: 0.20 to 7 x Is (step 0.01 x Is)
	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: 0.05 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 90%
	Instantaneous deactivation

	Timing accuracy: $\pm 5\%$ or ± 30 ms (whichever is greater) when the protection works with inverse time and ± 40 ms or $\pm 0.5\%$ (whichever is greater) when it works with definite time
Function 50/51N	Permission: yes/no
	Operating range: 0.20 to 7 x Is (step 0.01 x Is)
	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: 0.05 to 1.25 (step 0.01)
	Curve, activation level 110%
	Curve, deactivation level 100%
	Defined time, activation level 100%
	Defined time, deactivation level 90%
	Instantaneous deactivation
	Timing accuracy: $\pm 5\%$ or ± 30 ms (whichever is greater) when the protection works with inverse time and ± 40 ms or $\pm 0.5\%$ (whichever is greater) when it works with definite time
Fault reports	4 fault reports, 24 events each
Trip output contact	For Striker: 24 Vdc – 135 mJ
Frequency	50/60 Hz
Communication	USB port: Modbus RTU
Battery and power supply	Externally, with adapter (Kitcom) USB port + 230 Vac + Commissioning battery
Self-powering from current	Three phase self-power level: $I > 0,4 \times I_s$ min
Environment	Operating temperature: -40 to 70°C
	Storage temperature: -40 to 80 °C
	Humidity: 95%
Transformers	Power supply and measurement specific CTs
Mechanical features	Metallic box
	Panel Mounting
	167.8 x 120.65 mm
	Depth: 56.2 mm
	IP-54 when panel mounted
Thermal resistance	10 x Ismin or 2.85xIsmax: Continuously
	20 x Ismin or 5.7 x Ismax for 60 seconds
	25 x Ismin or 7.14 x Ismax for 10 seconds.

4.1. IEC60255-151 Curves

The SIA-B relay complies with the curves shown in standard IEC 60255-151:

- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve
- Long time Inverse Curve

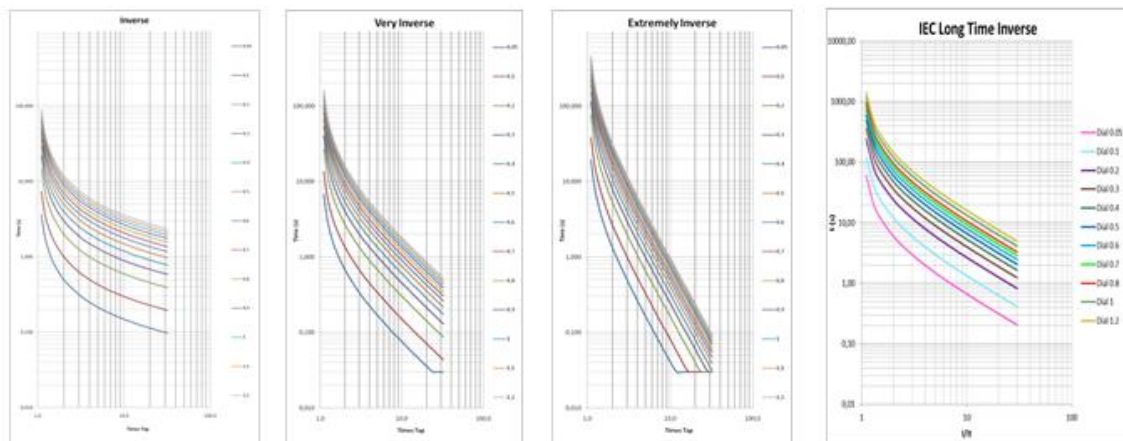
There is a general mathematical equation that defines the time in seconds as a function of the current:

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

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 move 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.



4.2. IEEE Curves

The IEEE curves follow the following mathematical equation:

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

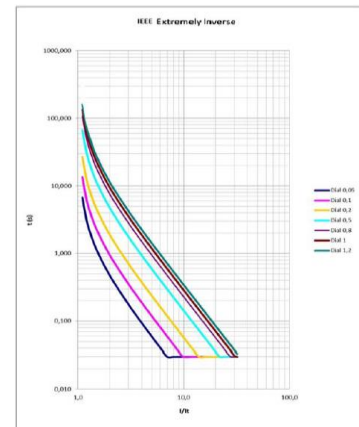
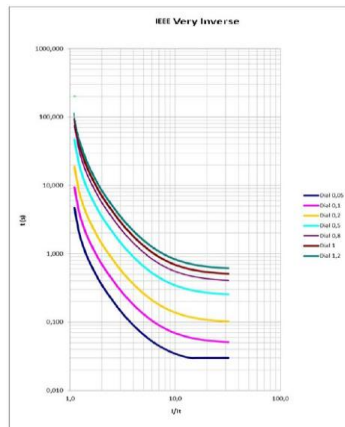
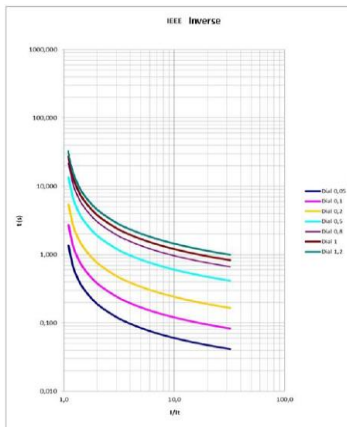
And we have the following curves:

- 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_{adj} is the initial operating current, set by the user.



5. SPECIFIC CURRENT TRANSFORMERS

SIA-B relay requires specific CTs to achieve not only the line current measurement, but also the power to keep the relay switched on with tripping capability.



P1	Primary Input
P2	Primary output
S2	Output for current measurement
S1	Input for current measurement
C-D	Test wiring terminals

Depending on the requirements there are the following possibilities:

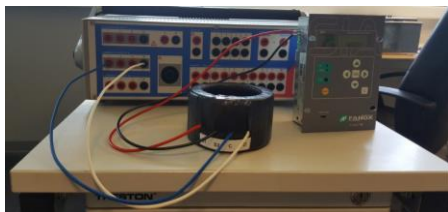
I _s Range	I _n range	CT type
8-28 (A)	3-33 (A)	CT008-5
16-56 (A)	6-65 (A)	CT016-5 CT016-10
32-112 (A)	12-130 (A)	CT032-5
64-224 (A)	25-260 (A)	CT064-5
128-448 (A)	51-520 (A)	CT128-5
256-896 (A)	102-1040 (A)	CT256-5

5.1. Test Winding

Unlike the standard current transformers that provide a nominal secondary current of 1A or 5A, these specific current transformers have a very low current at their secondary.

SIA-B relay has been designed to work with these current levels. For this reason, it is not possible to do the same tests that are performed with relays that use standard CTs.

The testing consists on the injection of 1A in test winding terminals, providing a simulated primary current value, that will have a different primary value depending on the selected CT.



CURRENT TRANSFORMER	Injected Current	Primary induced Current
CT08	1 A	25 A
CT16	1 A	50 A
CT32	1 A	100 A
CT64	1 A	200 A
CT128	1 A	400 A
CT256	1 A	800 A

6. OPENING MECHANISM

The trip is associated to a striker. The type of trip is a polarized trip. 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 than 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 and the necessary energy for its activation.

7. FLOWCHART

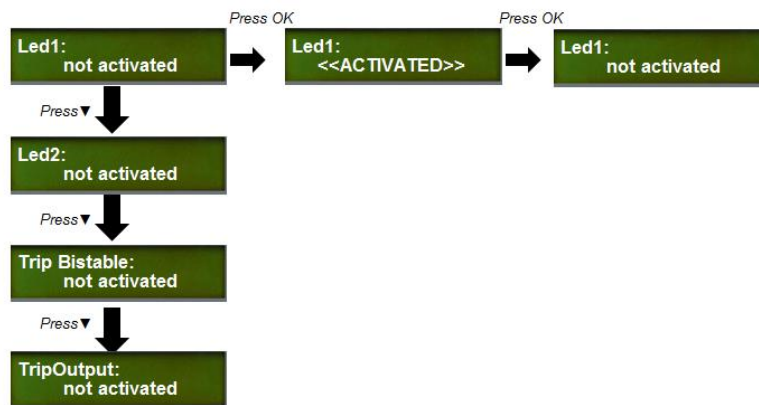
7.1. Test menu

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.

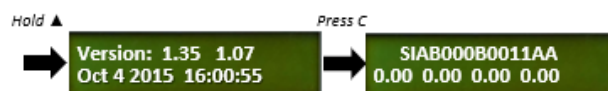


7.2. Direct Access

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.

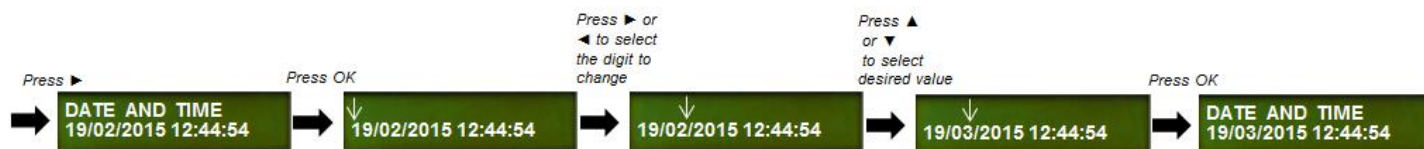


Date and time

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.



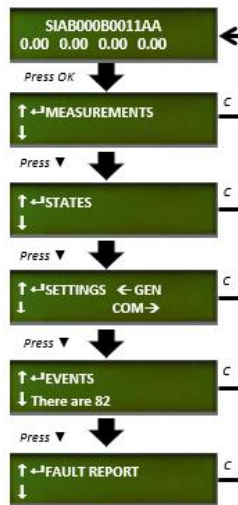
Communication parameters

Hold “▼” key from standby menu to access to communication parameters menu.

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



7.3. Menus



The information in SIA-B relay is organized through the following menus:

- Measurements
- States
- Settings
- Events
- Fault Report

From standby screen press “OK” key to access to the first 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.

7.3.1. Measurements menu



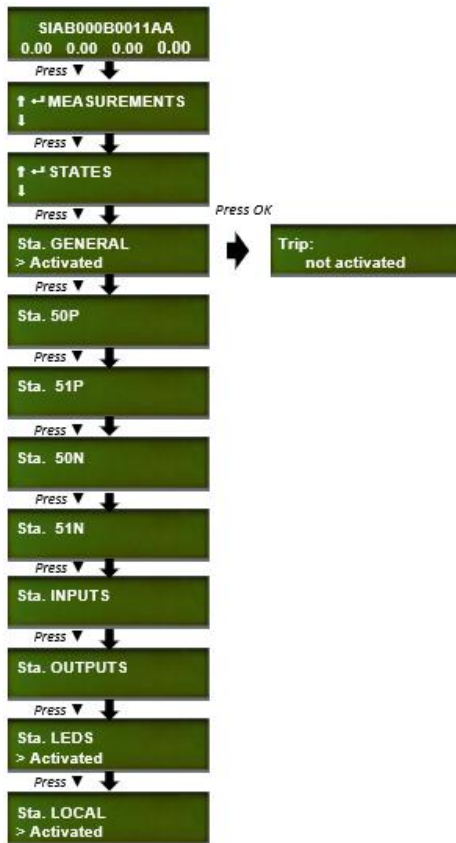
From the standby mode screen, press the “OK” key to access the first line of menus.

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.

7.3.2.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.

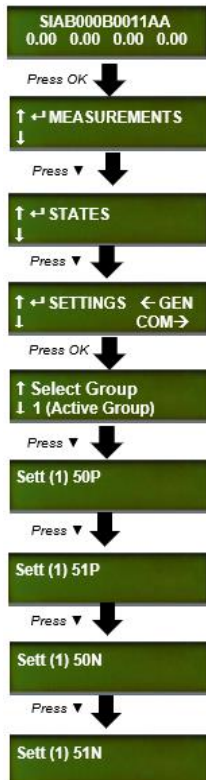
Use the “▲” and “▼” keys to position the cursor over the “STATES” screen and press “OK”. This takes you to the status groups’ line.

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 if 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.

7.3.3.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.

50P 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:

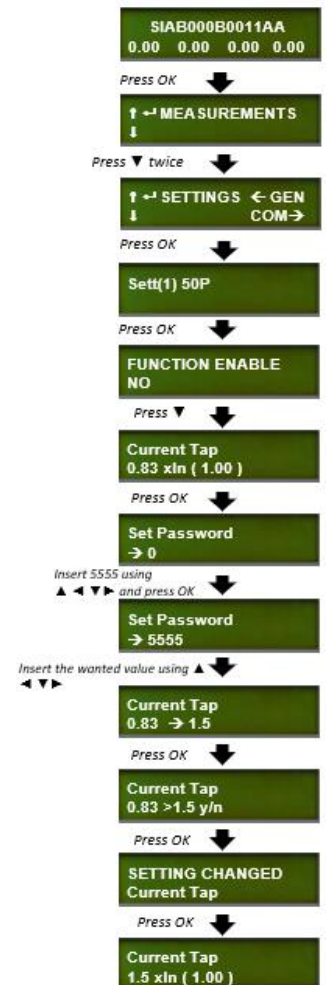
- **Permission:** The function is available to work only if the permission is "YES". While this permission is "NO" the function will never be activated and the relay will not trip.
- **Curve type:** It will be possible to choose between IEC Inverse, IEC Very inverse, IEC Extremely Inverse and Definite 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.

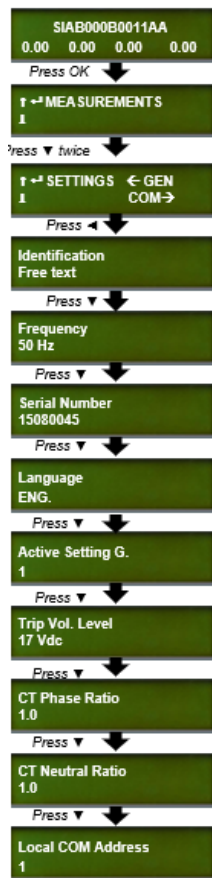
Use "▼" key till SETTINGS menu appears. Press "OK" to access to the different functions.

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 “CT type” and the “Nominal Current” general settings, depends on which specific CT will be used in the application. For example: if a CT016 is used, the “Nominal Current” would be the nominal current of the installation (NOTE: the installation nominal current value must be inside the range of the CT’s working range).

The frequency is also selected by general settings.

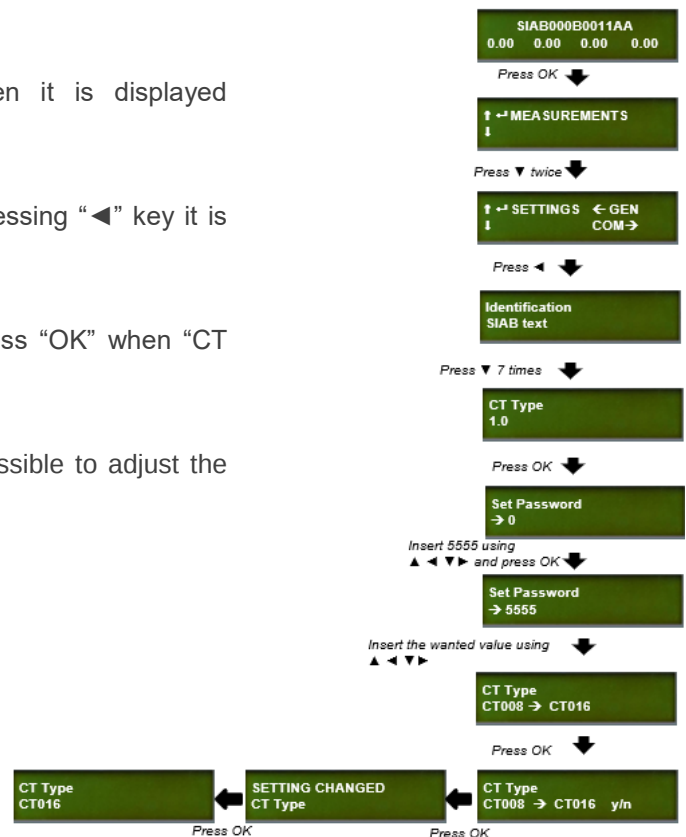
How to set CT type

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 type” option appears.

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



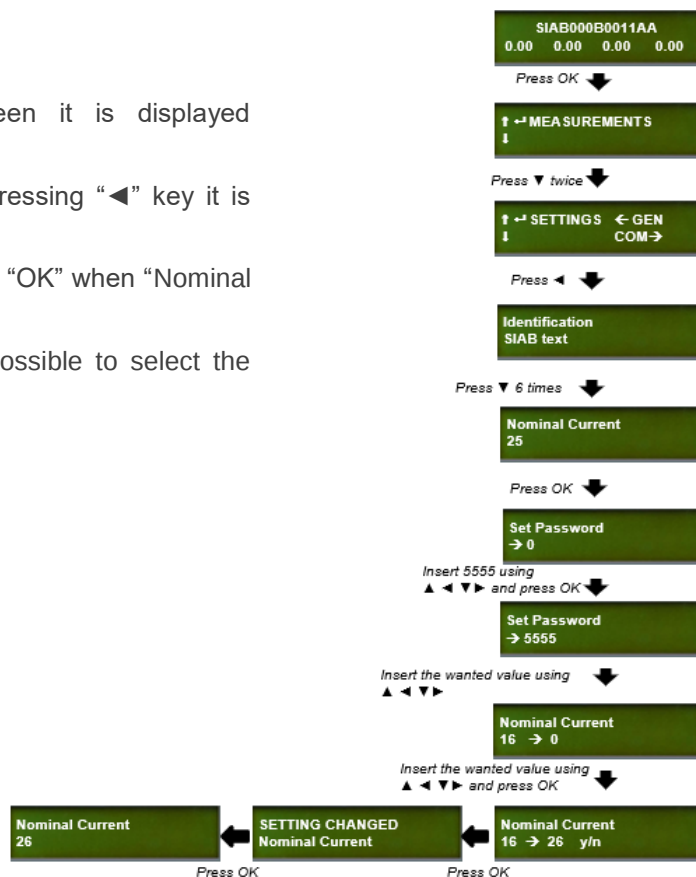
How to set Nominal Current

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 “Nominal current” option appears.

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



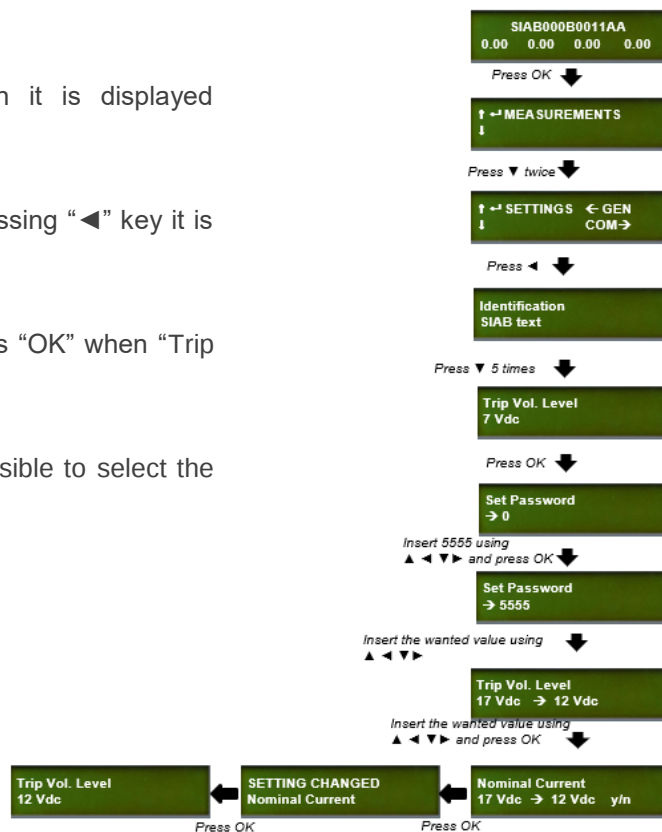
How to set Trip Voltage level

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.



7.3.4.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 “J” and “7” 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 fault reports persist in the relay to analyze the fault situation until these faults reports are deleted consciously by the user.



7.3.5.Fault reports menu

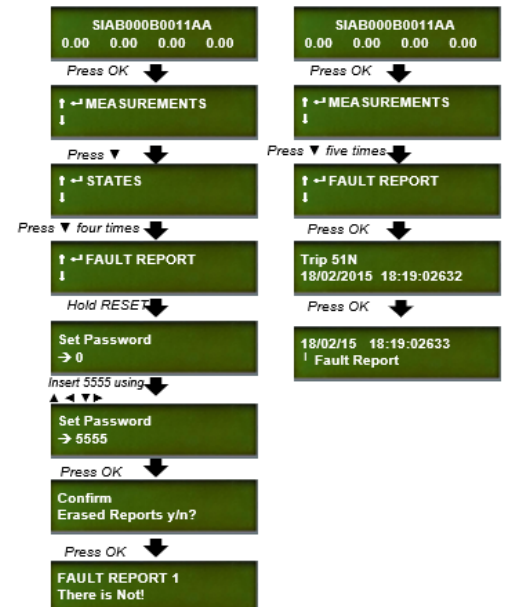
From the standby mode screen, press the “OK” key to access the first line of menus. Use the “▲” and “▼” keys to position the cursor over the “FAULT REPORT” screen. Press “OK” and use the “▲” and “▼” keys to position the cursor over the faults.

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 report. 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.



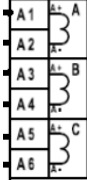
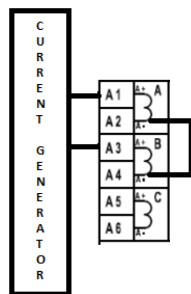
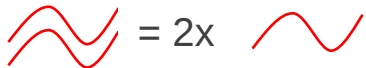
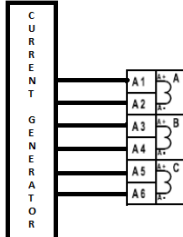
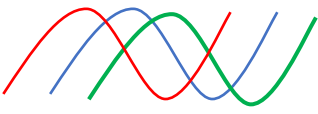
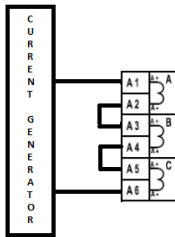
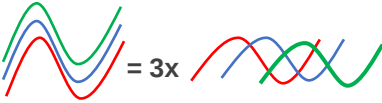
8. COMMISIONING

8.1. Thermal resistance

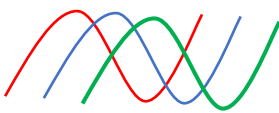
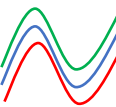
The relay can support, with 3-phase balanced injection, the following values according to International Standards:

- 10 x I_{smin} or 2.85x I_{smax} continuously.
- 20 x I_{smin} or 5.7 x I_{smax} for 60 seconds.
- 25 x I_{smin} or 7.14 x I_{smax} for 10 seconds.

In the following table the different injection modes are described:

CURRENT GENERATION	INJECTION MODE	INJECTION SYSTEM	RELAY CONNECTION	REAR	RELAY WITHSTAND ENERGY WAVEFORM
Single phase	Phase-Neutral	NOT APPLY	P-N: 		
	Phase-Phase		P-P: 		
Three phase	Phase-Neutral	Balanced (120°)	P-N Balanced: 		
		Unbalanced (0°)	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	10xI _{smin} or 2.85xI _{smax} continuously 20xI _{smin} or 5.7xI _{smax} for 60 seconds 25xI _{smin} or 7.14xI _{smax} for 10 seconds
	3-PHASE BALANCED	10xI _{smin} or 2.85xI _{smax} continuously 20xI _{smin} or 5.7xI _{smax} for 60 seconds 25xI _{smin} or 7.14xI _{smax} for 10 seconds
	3-PHASE UNBALANCED	3xI _{smin} or 0.95xI _{smax} continuously 6.5xI _{smin} or 1.9xI _{smax} 60 seconds 8xI _{smin} or 2.38xI _{smax} 10 seconds

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

Commissioning recommendation:

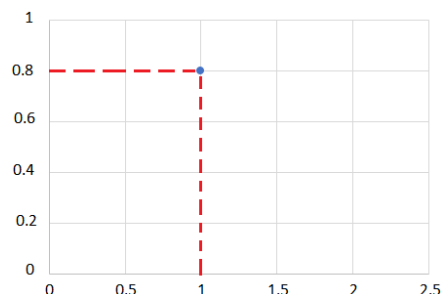
- It is recommended to use USB cable or powerbank for relay protection functions settings. Connect it for setting and disconnect it for testing purpose.
- Adjust manually current generation value without injecting current to relay, for not stressing it during adjustment process.
- Be sure that relay 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.

8.2. Self powering

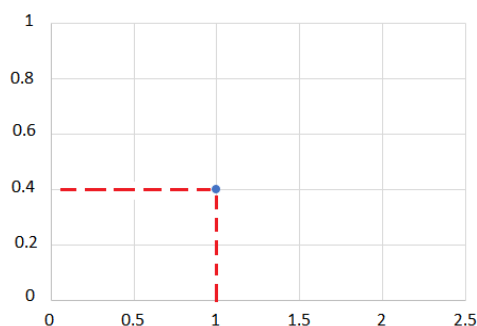
8.2.1. Single phase minimum self-powering checking

Adjust the Sverker current generator with $HOLD\ 0.8 \times I_{smin}$, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line.



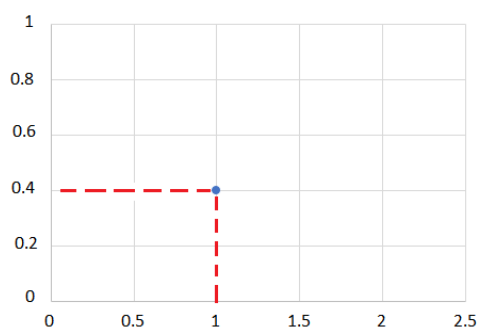
8.2.2. Three phase minimum self-powering checking

Adjust the Sverker current generator with $HOLD\ 0.4 \times I_{smin}$, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line.



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

Adjust the Sverker current generator with $HOLD\ 0.4 \times I_{smin}$, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line. The Led ON and LCD should be switched on:



8.3. Measurements

The accuracy of the measurement depends on the CT type:

- With CTxx-5 type $\rightarrow < \pm 5\%$.
- With CTxx-10 type $\rightarrow < \pm 10\%$

The relay is able to measure up to 20 times the maximum nominal current of the CT.

8.4. Protection functions

Current injection procedure:

As an example the nominal current (I_s) adjusted in general settings will be 16 amperes and the CT type will be CT16. Adjust the Sverker current injector with HOLD $0,8 \times I_{smin}$, 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.

8.4.1. Protection functions testing

NOTE: The following testing processes will be done with the specific CTs 5P80. So in this case, the measurement accuracy will be $\pm 5\%$.

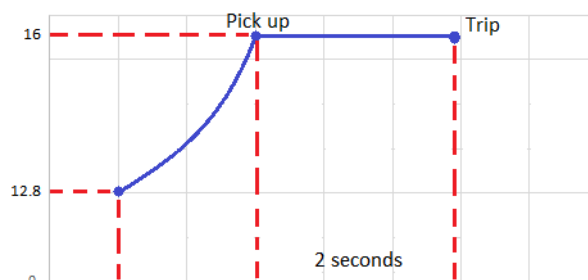
- 50P instantaneous phase overcurrent protection:

Settings:

- Permission: YES.
- TAP: $1 \times I_s = 16 \text{ A}$
- Theoretical tripping time: 2 (sec)
- Tripping time range: 1,9...2,1 s.

The following information will be checked:

- Pick-up at 100% of the tap
- Trip output is activated
- Trip flag is activated



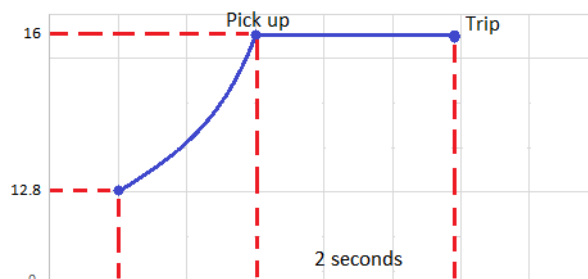
- 50N instantaneous neutral overcurrent protection:

Settings:

- Permission: YES.
- TAP: $1 \times I_s = 16 \text{ A}$
- Theoretical tripping time: 2 (sec)
- Tripping time range: 1,9...2,1 s.

The following information will be checked:

- Pick-up at 100% of the tap
- Trip output is activated
- Trip flag is activated



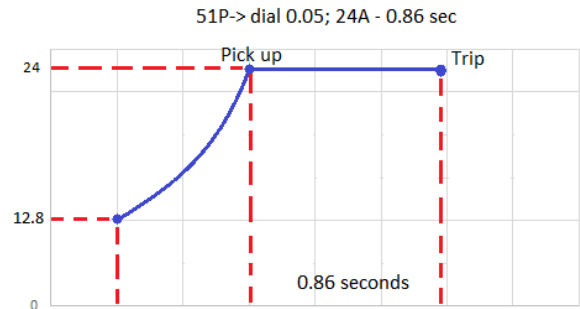
NOTE: Apart from the measurement accuracy ($\pm 5\%$), it must be also considered the admissible current measurement ($\pm 5\%$).

- 51P Inverse time phase overcurrent protection:

TEST 1:

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 0.05
- TAP: 1xIs=16 A
- Theoretical tripping time= 0.86 seconds (Fault current 24 A):
 - o admissible current measurement: $24+5\%= 25.2 \text{ A} \rightarrow \text{Time: } 0.77\text{s} -5\% = 0.7315\text{s}$
 - o admissible current measurement: $24-5\%= 22.8 \text{ A} \rightarrow \text{Time: } 0.98\text{s} +5\% = 1.029\text{s}$.



Real admissible tripping time range: [0.7315s...1.029s]

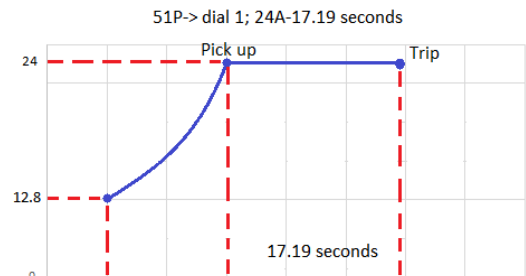
The following information will be checked:

- Pick-up at 110% of the tap
- Trip output is activated
- Trip flag is activated

TEST 2

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 1xIs=16 A.
- Theoretical tripping time = 17.19 seconds (fault current 24 A)
 - o admissible current measurement: $24+5\%= 25.2 \text{ A} \rightarrow \text{Time: } 15.34\text{s} -5\% = 14.573\text{s}$
 - o admissible current measurement: $24-5\%= 22.8 \text{ A} \rightarrow \text{Time: } 19.69\text{s} +5\% = 20.674\text{s}$.



Real admissible tripping time range: [14.573s...20.674s]

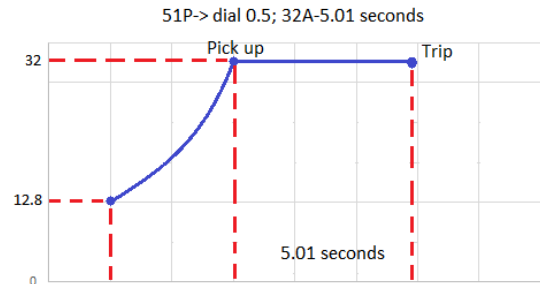
The following information will be checked:

- Pick-up at 110% of the tap
- Trip output is activated
- Trip flag is activated

TEST 3

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 0.5
- TAP: 1xIs=16 A.
- Theoretical tripping time = 5.01 seconds (Fault current 32A)
 - o admissible current measurement: $32+5\%= 33.6 \text{ A}$. → Time: $4.68\text{s} -5\% = 4.446\text{s}$
 - o admissible current measurement: $32-5\%= 30.4 \text{ A}$ → Time: $5.42\text{s} +5\% = 5.691\text{s}$.



Real admissible tripping time range: [4.446s...5.691s]

The following information will be checked:

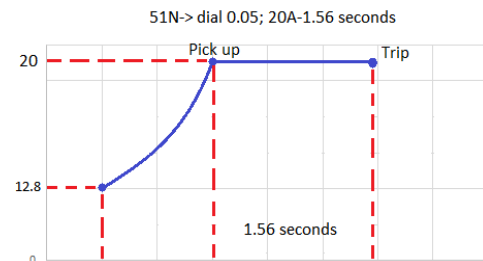
- Pick-up at 110% of the tap
- Trip output is activated
- Trip flag is activated

- 51N Inverse time neutral overcurrent protection:

TEST 1

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 0.05
- TAP: 1xIs.
- Theoretical tripping time= 1.56 seconds (Fault current 20A)
 - o admissible current measurement: $20+5\%= 21 \text{ A}$. → Time: $1.28\text{s} -5\% = 1.216\text{s}$
 - o admissible current measurement: $20-5\%= 19 \text{ A}$ → Time: $2.03\text{s} +5\% = 2.1315\text{s}$.



Real admissible tripping time range: [1.216s...2.1315s]

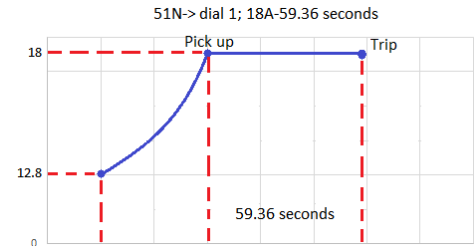
The following information will be checked:

- Pick-up at 110% of the tap
- Trip output is activated
- Trip flag is activated

TEST 2

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 1xIs.
- Theoretical tripping time = 59.36 seconds (fault current 18A)
 - o admissible current measurement: $18+5\%= 18.9 \text{ A}$ → Time: $41.95\text{s} -5\% = 39.852\text{s}$
 - o admissible current measurement: $18-5\%= 17.1 \text{ A}$ → Time: $105.21\text{s} +5\% = 110.47\text{s}$.



Real admissible tripping time range: [39.852s...110.47s]

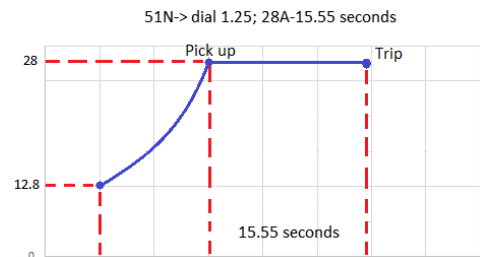
The following information will be checked:

- Trip output is activated
- Trip flag is activated

TEST 3

Settings:

- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1.25.
- TAP: 1xIs.
- Theoretical tripping time = 15.55seconds (Fault current 28A)
 - o admissible current measurement: $18+5\%= 29.4 \text{ A}$ → Time: $14.29\text{s} -5\% = 13.575\text{s}$
 - o admissible current measurement: $18-5\%= 26.6 \text{ A}$ → Time: $17.13\text{s} +5\% = 17.98\text{s}$.



Real admissible tripping time range: [13.57s...17.98s]

The following information will be checked:

- Trip output is activated
- Trip flag 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. Take into account 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.

9. SIAB000B0011AA 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	
USB communication port:	☐ OK	☐ NOK	
Signalling and Keypad	Led 1 ☐ OK	Led 2	☐ OK
	Trip ☐ OK		
	Trip Output ☐ OK		
	Keypad ☐ OK		
Self-power 3P (SIAC>0.4Is)	Phase A ☐ OK	Phase B ☐ OK	Phase C ☐ OK
Commissioning battery checking	☐ OK		
Auxiliary power checking	☐ OK		
Communincations	☐ OK		
Settings and configuration	☐ OK		
Current measurements	☐ OK		
Protection Functions	50 phase A: ☐ OK	50 phase B: ☐ OK	50 Phase C: ☐ OK
	50N ☐ OK		
	51 phase A: ☐ OK	51 phase B: ☐ OK	51 phase C: ☐ OK
	51N ☐ OK		
	49T ☐ OK		
RTC	☐ OK		

NOTES:



Specialized in
Self Powered Relays



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