SIA-B Standard CTs

Self & Dual Power Overcurrent Protection Relay

INSTALLATION & COMMISSIONING 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:

- **SIAB Electronic protection relay.**
- **User Guide.**
- **Testing protocol.**

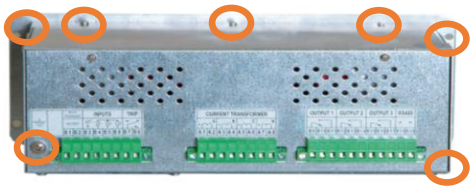
Testing protocol is a certificate that relay has passed all factory testing process with correct results.

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

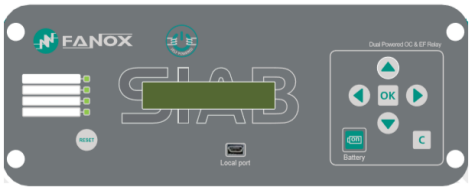
1.2. Relay verification

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 relay has a small Dc/Dc power supply that raises the voltage till the required 5 volts to operate the relay and that is plugged into the front USB communications port.

Once the Kitom 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.

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.

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.

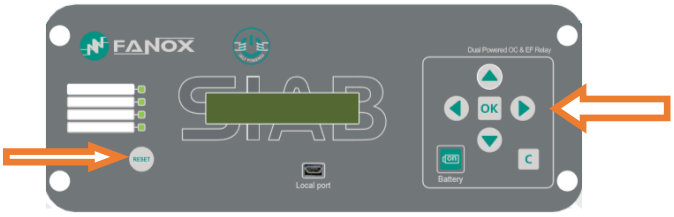
Using battery power does not block the USB communications port, as it can be used simultaneously.

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 (8 digits) and Firmware Version → HOLD ▲

- 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:

- 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 and down buttons to increase or decrease the contrast.

1.3.1.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).

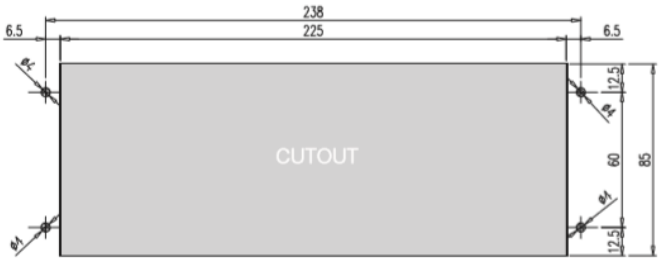
Once the password is entered, check that all the LEDs are switched on at the same time. Then press OK key to start the test menu.

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

	Action	Checking
OK, **OK**	Output 1	Output 1 activated
▼, **OK**	Output 2	Output 2 activated
▼, **OK**	Output 3	Output 3 activated
▼, **OK**	TripOutput	Trip Output activated
C	Skip from test menu	

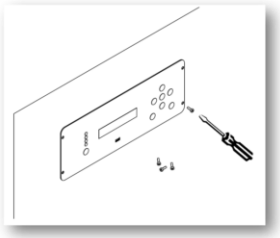
1.4. Relay intallation

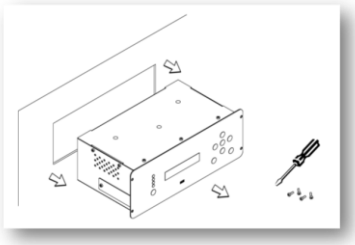
To fix the relay to the switchgear, use default holes in front of relay with appropriate fixing system. Do not manipulate relay to fix it on the switchgear.



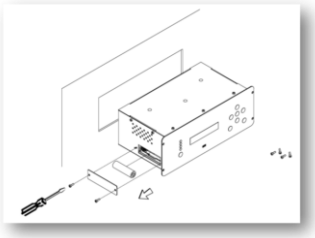
How to change the internal battery (DEPENDING ON MODEL)

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.



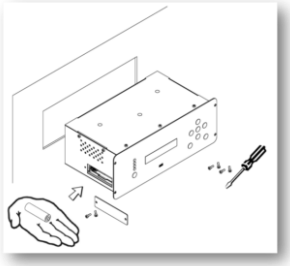


3. Unscrew the 2 screws to remove the cover from the battery compartment.

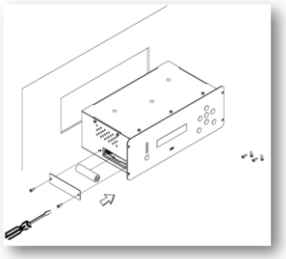


4. Remove the battery and replace it respecting polarity (+ facing up):
   Battery characteristics:

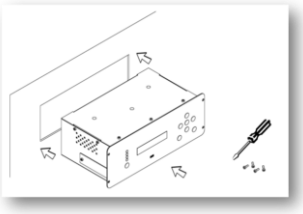
   - AA 3.6V lithium battery
   - Model LS14500 from SAFT
   - Do not use rechargeable batteries or other types of battery



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.



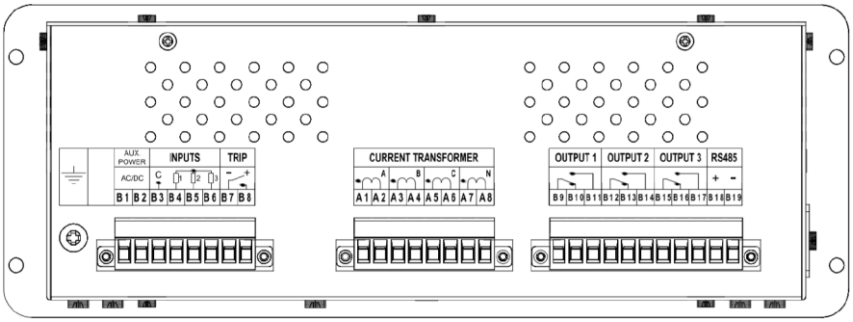
Warning HAZARD OF EXPLOSION

- 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, severe injury, or relay damage.

1.5. Relay rear part

Consider the wiring of the switchgear and connect relay properly:



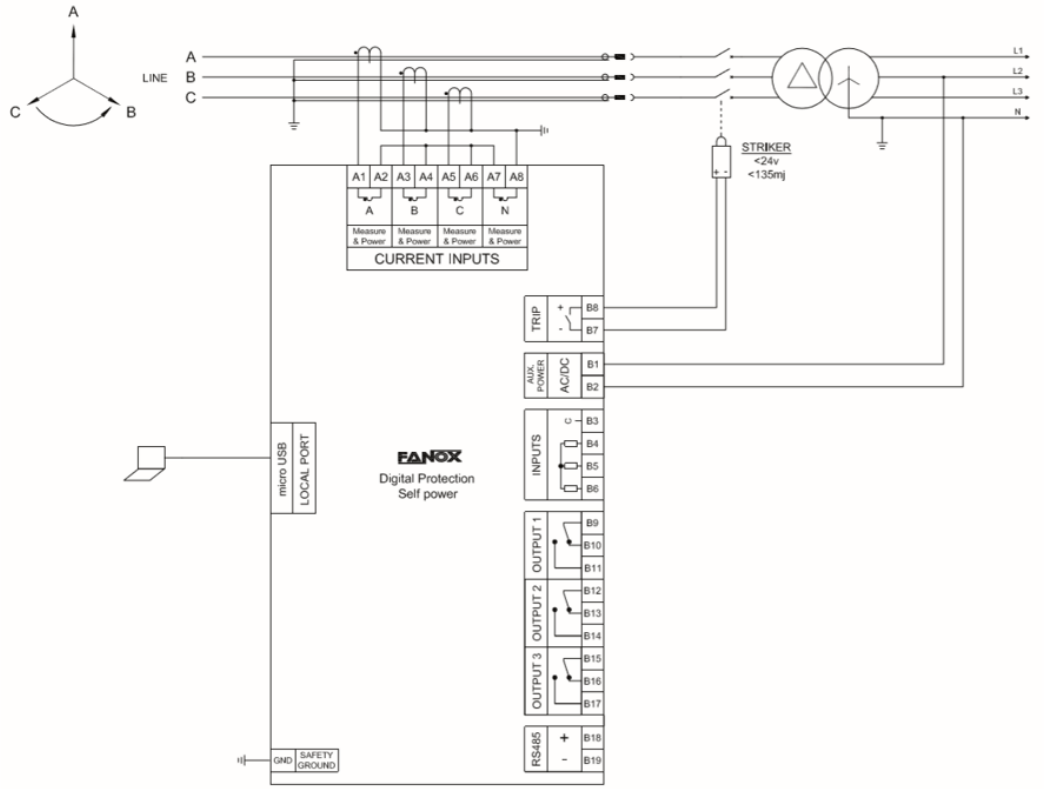
A1	Phase A current input for measurement and self-power
A2	Phase A current output for measurement and self-power
A3	Phase B current input for measurement and self-power
A4	Phase B current output for measurement and self-power
A5	Phase C current input for measurement and self-power
A6	Phase C current output for measurement and self-power
A7	Neutral current input for measurement
A8	Neutral current output for measurement

B7	Trip output -
B8	Trip output +
B9	Digital 1 common output
B10	Digital output 1 NC
B11	Digital output 1 NO
B12	Digital 2 common output
B13	Digital output 2 NC
B14	Digital output 2 NO

B1	Auxiliary power supply +
B2	Auxiliary power supply -
B3	Common of the Inputs
B4	Input 1
B5	Input 2
B6	Input 3

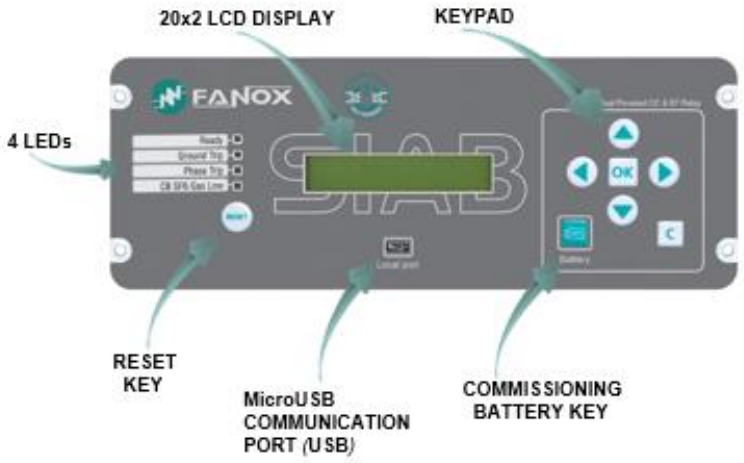
B15	Digital 3 common output
B16	Digital output 3 NC
B17	Digital output 3 NO
B18-B19	RS485 Remote communication

1.6. Connection diagram



2. USER INTERFACE

2.1. Relay front part



2.2. LED indicators

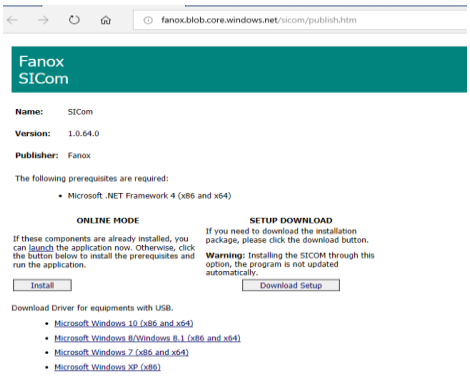
There are four configurable LED indicators on the front of the SIA-B relay. By default, they indicate:

LEDS	DEFAULT CONFIGURATION
Led 1	Ready
Led 2	Ground trip
Led 3	Phase Trip
Led 4	CB SF6 Gas Low

2.3. 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 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.

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

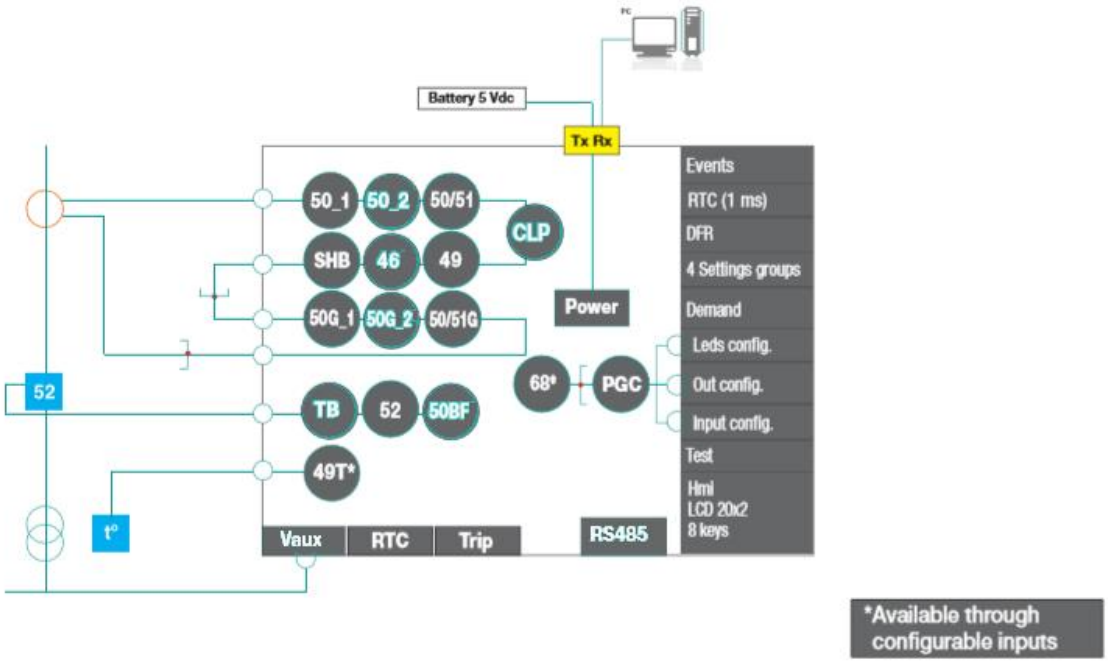
Users must identify themselves with a password in order to start communications and to change the relay settings or configuration using the HMI. Depending on the access level, it may or may not be possible to perform the operations shown on the table below.

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

Four passwords and their associated levels of access are set up when the relay is configured using the SIcom program. The password must be made up of 4 characters (passwords with more or less characters will not be accepted). By default, the relay 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	**SIAB110FD232AC:**
	1: Phase Measurement → In=1 A
	1: Neutral Measurement → In=1 A
	0: Net Frequency → Defined by General Settings
	F: Power Supply → Self-powered + 24-230 Vdc / Vac (Dual) + Commissioning Battery
	D: Additional Functions → + 49 + SHB + 4 Settings groups + LDP + DFR + 52 + 46 + TBLK + 50P2 + 50G2 + CLP + 50BF
	2: Communications → USB (Modbus RTU) + RS485 (Modbus RTU or DNP3)
	3: Inputs and Outputs → 4 LEDs + Trip (striker) + 3 Outputs + 3 Inputs
	2: Mechanics → Extended Horizontal Assembly
	A: Languages → English, Spanish and German
	C: Adaptation → Standard CTs /1
Function 50-1 **Function 50-2**	Function Enable: Yes/No/SHB
	Current Tap: 0.07 to 20 xIn (step 0.01 xIn)
	Time Delay: 0.02 to 300 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function 50G-1	Function Enable: Yes/No/SHB
	Current Tap: 0.05 to 10 xIn (step 0.01 xIn)

Function 50G-2	Time Delay: 0.02 to 300 s (step 0.01s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function 50/51	Function Enable: Yes/No/SHB
	Current Tap: 0.07 to 7 xIn (step 0.01 xIn)
	Curves: IEC 60255-151 and IEEE
	Curve Type: 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. Time Delay: 0.02 to 300.00 s (step 0.01 s)
	Time Dial (TMS): 0.01 to 1.5 (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 for IEC and IEEE curve selection: Without SHB permitted: ± 30 ms or ± 5% (greater of both). With SHB permitted: ± 50 ms or ± 5% (greater of both). Timing accuracy for defined time selection: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function 50/51G	Function Enable: Yes/No/SHB
	Operating range: 0.05 to 7 xIn (step 0.01 xIn)
	Curves: IEC 60255-151 and IEEE
	Curve Type: 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. Time Delay: 0.02 to 300.00 s (step 0.01 s)
	Time Dial (TMS): 0.01 to 1.5 (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 for IEC and IEEE selection: Without SHB permitted: ± 30 ms or ± 5% (greater of both). With SHB permitted: ± 50 ms or ± 5% (greater of both). Timing accuracy for defined time curve selection: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function SHB	Function Enable: Yes/No
	Current Tap: 5% to 50% (step 1%)
	Reset Time: 0.00 to 300.00 s (step 0.01 s)
	Block Threshold: 0.07 to 20xIn (step 0.01xIn)
Function 49T	Through configurable inputs
Function 49	Function Enable: Yes/No
	Current Tap: 0.10 to 2.40 xIn (step 0.01 xIn)
	ζ heating: 3 to 600 minutes (step 1 min)
	ζ cooling: 1 a 6 x ζ heating (step 1)
	Alarm level: 20 a 99% (step 1 %)
	Trip level: 100%
	Trip reset: 95% of alarm level
	Timing accuracy: ± 5% regarding theoretical value
Function 52	Maximum number of openings: 1 to 10,000 (step 1)
	Maximum accumulated amperes: 0 to 100,000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30 s (step 0.01 s)
	Closing time: 0.02 to 30 s (step 0.01 s)
	Excessive repeated openings: 1 to 10,000 (step 1)
	Repetitive openings/Time: 1 to 300 min (step 1 min)
	Open circuit breaker activation threshold: 60 mA
TRIP BLOCK	Function Enable: Yes/No
	Tap: 1.5 to 20 xIn (step 0.01)
Function 46	Function Enable: Yes/No
	Operating range: 0.1 to 7 xIn (step 0.01 xIn)
	Curves: IEC 60255-151 and IEEE
	Curves Type: 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. Time Delay: 0.02 to 300 s (step 0.01 s)
	Time Dial (TMS): 0.01 to 1.5 (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 for IEC and IEEE curve selection: Without SHB permitted: ± 30 ms or ± 5% (greater of both). With SHB permitted: ± 50 ms or ± 5% (greater of both). Timing accuracy for defined time curve selection: Without SHB permitted: ± 30 ms or ± 0.5% (greater of both). With SHB permitted: ± 50 ms or ± 0.5% (greater of both).
Function CLP	Function Enable: Yes/No
	Settings group: 1 to 4 (step 1)
	No load Time: 0.02 to 300 s (step 0.01 s)
	Cold load Time: 0.02 to 300 s (step 0.01 s)
	CLP activation threshold: 60 mA
	CLP reset threshold: 80 mA
Function 50BF	Function Enable: Yes/No
	Time Delay: 0.02 to 1.00 s (step 0.01 s)
	Open circuit breaker activation threshold: 60 mA
Programmable logic control (PLC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_TIMERUP, NOR4_PULSE, NOR4_PULSES, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, AND4_LATCH, NAND4, NAND4_TIMERUP, NAND4_PULSE.
Trip output	24 Vdc; 135 mJ (activation of the striker or low powered coil)
Signaling outputs	3 configurable outputs (output 1, output 2 and output 3): 220 Vdc – 8 A 250 Vac – 8 A
Signaling Inputs	3 inputs: they are activated by short-circuiting the terminals without external supply
Frequency	50/60Hz
Current measurement	Fundamental values (DFT)
	Sampling: 16 samples/cycle
	Accuracy: ±2% in a band of ± 20% the nominal current and ±4% or ± 5 mA in the rest of the band.
Events	1024 events
Disturbance Fault Recording (DFR)	20 fault reports, 16 events in each 10 Oscillographic records (50 cycles each) in COMTRADE format
Load Data Profiling (Current Demand)	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
Communication	USB port: Modbus RTU
	RS485 rear port: Modbus RTU or DNP3.0 Serial
Auxiliary power supply	24-230 Vdc/Vac +10/-20%

Battery supply	With USB KITCOM adapter or standard power bank
	Commissioning internal battery
Self-powering from current	Three phase self-power level: I > 75 mA
Environmental conditions	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80 ºC
	Humidity: 95%
Transformers	Power supply and measurement standard CTs /1
Mechanical features	Metallic box
	Panel Mounting
	Height x Width: 90 mm x 245 mm
	Depth: 139.4 mm
	IP-54 panel mounted
Thermal resistance	4 x In continuously 30 x In for 10 seconds 100 x In for 1 second

4.1. Phase CT and neutral CT selection

SIA-B relay requires current transformers with the following specifications:

SIAB/1: CT Burden 2 VA. The relay can measure up to 20xIn in the phases and up to 16xIn in the neutral (Phases measurement: 0.07-20xIn; Neutral measurement: 0.05-16xIn).

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4.2. 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

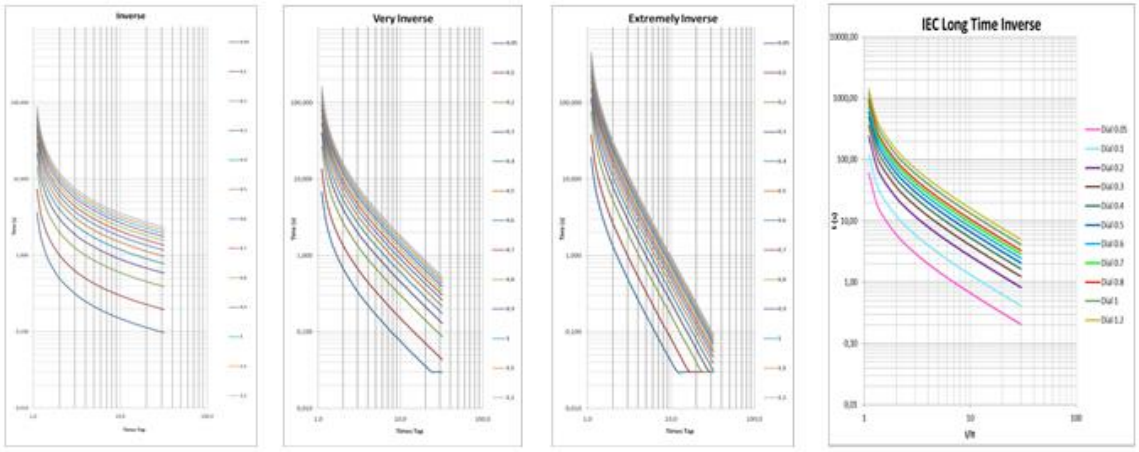
There is a general mathematical equation that defines the time in seconds as a function of the current:

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

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 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.



4.3. 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:

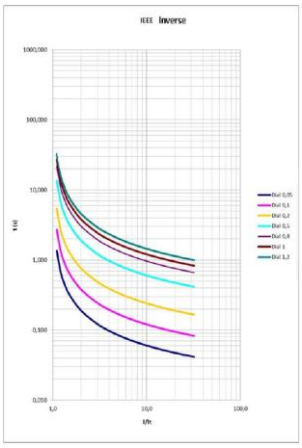
- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve

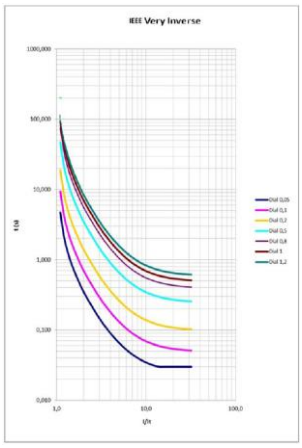
Which relate to the parameters figuring in the following table:

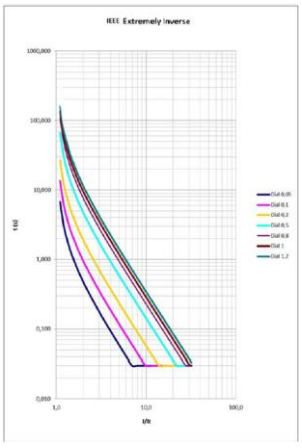
Parameters	A	P	B
Ext. Inverse	28,2	2	0,1217
Very Inverse	19,61	2	0,491
Inverse	0,0515	0,02	0,114

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.







5. 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 relay will allow the trip when it gets the selected trip voltage, so if a lower level that 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 must 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.

6. PROGRAMMABLE LOGIC CONTROL

SIA-B relay is provided with 4 configurable LEDs. Besides, up to 3 configurable outputs can be included (Output1, Output 2 and Output 3). Consider, the trip output, although is available in configuration menu, cannot be configured due to its design is associated to the opening mechanism.

LEDS	LED 1
	LED 2
	LED 3
	LED 4
OUTPUTS	Output 1
	Output 2
	Output 3
	Trip Output (NON-CONFIGURABLE)

6.1. Outputs

All the outputs (Physical outputs) are the result of a PROGRAMMABLE LOGIC CONTROL which can be configured from HMI or from SICom software.

PHYSICAL OUTPUTS	Trip Output (**NOT CONFIGURABLE**)
	Output 1
	Output 2
	Output 3
LOGIC	52a
	52b
	External trip
	Block 50/51
	Block 50/51G
	Settings group 1
	Settings group 2
	Reset
	Logic Signal 1
	Logic Signal 2
	Logic Signal 3
	Logic Signal 4

LOGICAL GATE	HMI SYMBOL
OR4	+
NOR4	τ
OR4_LACTH	Ю
AND4_LACTH	Φ
OR4_PULSES	∫
AND4	&
NAND4	§
AND4_PULSES	$
OR4_TIMER_UP	O
NOR4_TIMER_UP	P
AND4_TIMER_UP	Q
NAND4_TIMER_UP	R
OR4_PULSE	o
NOR4_PULSE	p
AND4_PULSE	q
NAND4_PULSE	r
NOR4_PULSES	t

(*) When the logical gates (LATCH, TIMER_UP, PULSES or PULSE) are added to the standard gates (OR/NOR/AND/NAND) it is necessary to switched the relay off and to switch it on again (due to this configuration requires the setting of a time that will be charged in the relay only when it is switched off).

NOTE: As it is described above, the options NOR_LATCH, NAND_PULSES and NAND_LATCH are not available in the relay. Although, using SICOM software allows the user to configure these options, the relay will not recognize them and it will not work properly.

By default, the configuration is:

	OUTPUT	*LOGICAL GATE*	BINARY STATES
PHYSICAL OUTPUTS	Output 1	*NOR4*	• Ready
	Output 2	*AND4*	• Phase Trip • General Trip
	Output 3	*AND4*	• Ground Trip • General Trip
	Trip Output	*OR4_PULSES*	• General Trip
LOGIC	52a	*Not configured*	----
	52b	*Not configured*	----
	External trip	*OR4*	• Input 1
	Block 50/51	*Not configured*	----

	Block 50/51G	*Not configured*	----
	Settings group 1	*OR4*	----
	Settings group 2	*Not configured*	----
	Reset	*OR4*	• Input 3
	Logic Signal 1	*Not configured*	----
	Logic Signal 2	*Not configured*	----
	Logic Signal 3	*Not configured*	----
	Logic Signal 4	*Not configured*	----

To get the outputs all together to be operative at the same time, it is required Single phase→305 mA or Three phases→170 mA. To activate an output it is required Single phase→270 mA or Three phases→90 mA. Once the relay detects these levels of current these outputs are instantaneously operative.

6.2. Leds

In case of LEDs the behavior is different to the outputs. The only available configuration is as follows:

LOGICAL GATE	HMI SYMBOL
OR4	+
NOR4	τ
AND4	&
NAND4	§

Depending on the associated signal the signaling will offer 2 options:

After being switched off, when the relay is switched on again, the LEDs should show the state just before being switched off. For this reason, and to have as much information as possible, the LEDs will light up in a different way depending on if the user has recognized the LED before the switched off or not. To recognize the LEDs, it is necessary to hold RESET key from standby menu.

So, the LEDs will light as follows:

SIGNAL ASSOCIATED TO THE LED KEEPS ITSELF ACTIVATED

The signal that origins the activation of the LED remains activated (the LED and the associated signal are activated at the same time): In this case the LED will blink at a fixed frequency. Once the LED is recognized, it will still be blinking with a different frequency.

If after being recognized, the associated signal is deactivated, the LED will be switched off.

SIGNAL ASSOCIATED TO THE LED IS SWITCHED OFF BEFORE BEING RECOGNIZED

If the signal that origins the activation of the LED does not remain activated, once this associated signal is deactivated the LED will be fixed. Once the LED is recognized, the LED will be switched off (due to the signal that provoked its activation is deactivated).

By default, the configuration is:

	OUTPUT	*LOGICAL GATE*	BINARY STATES
LEDS	LED 1	*OR4*	• Ready
	LED 2	*AND4*	• Ground Trip • General Trip
	LED 3	*AND4*	• Phase Trip • General Trip
	LED 4	*OR4*	• Input 2

Leds require, to be activated, the following mínimum current:

- Single-phase→270 mA
- Three-phase→90 mA

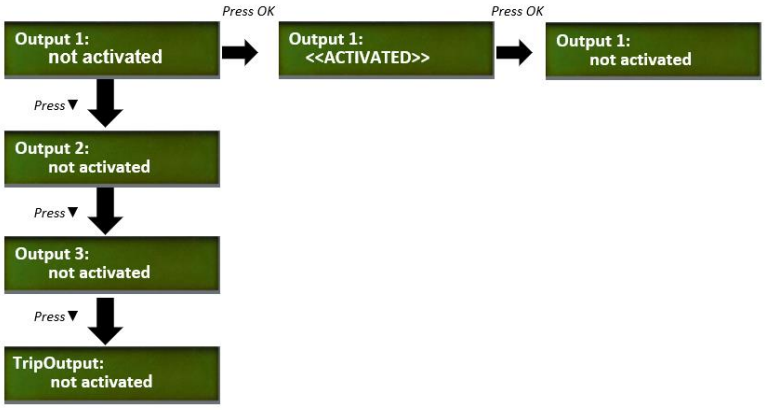
7. FLOWCHART

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 "Output 1" appears, pressing "OK" the Output 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 Output 1.

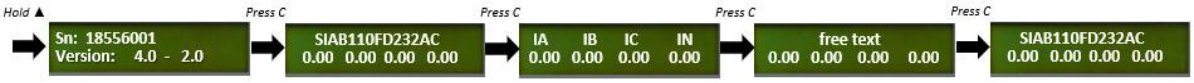


7.2. Direct Access

Version

The relay 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 relay 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.

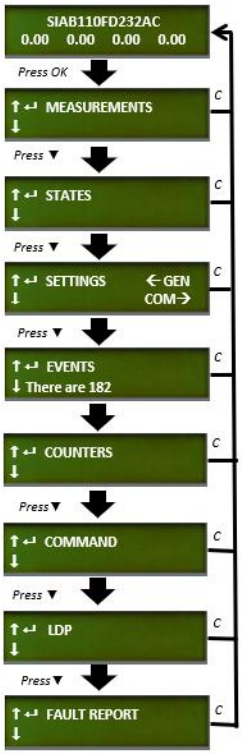
Press the "C" key to return to the standby mode screen.

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
- Counters
- Command
- LDP
- 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.

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 states 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 states 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.

How to configure LED's

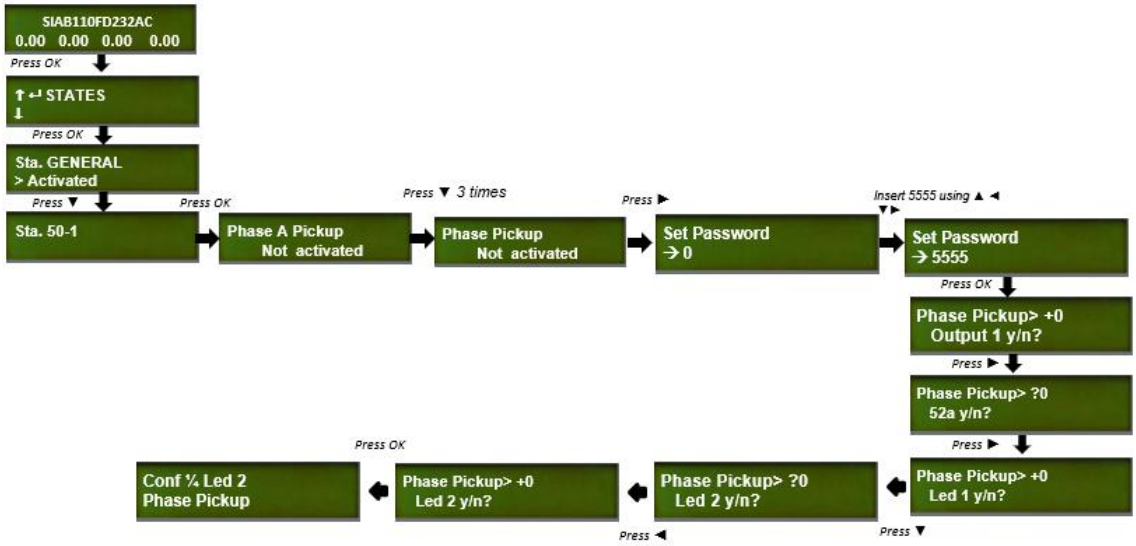
Pressing "OK" key from the standby screen it is displayed MEASUREMENT menu.

Use "▼" key till STATES menu appears. Pressing "OK" key it is accessed to states.

Use "▼" key to overview the states and press "OK" when the desired option appears.

Use "►" key to assign that state to a LED.

After insering the password, It will be possible to assign the selected state to the configuration.



How to delete configured LED's

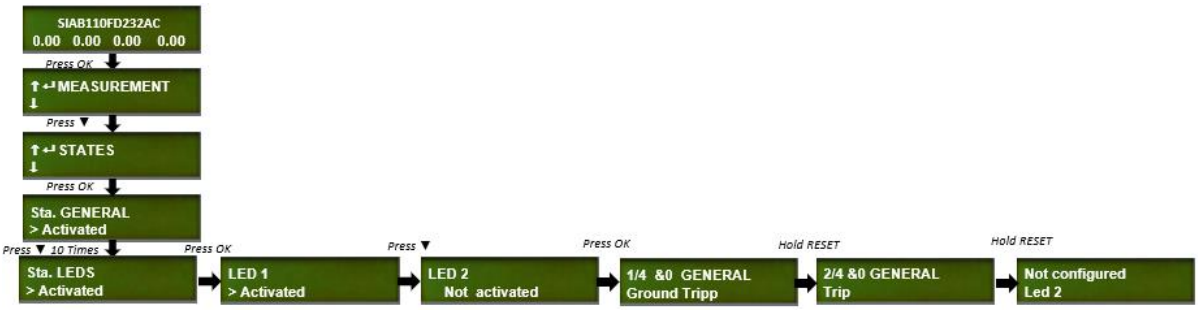
Pressing "OK" key from the standby screen it is displayed MEASUREMENT menu.

Use "▼" key till STATES menu appears. Pressing "OK" key it is accessed to states.

Use "▼" key to overview the states and press "OK" when "Sta. LEDS" option appears.

Use "▼" key to overview the state of each LED and press "OK" when the desired LED appears.

It will be possible to reset the configuration of the selected LED, holding the RESET button.



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.

50-1 protection function

The parameters to adjust are:

- **Permission**: The function is available to trip if the permission is "YES". While this permission is "NO" the function will never BE ACTIVATED AND THE RELAY WILL NOT TRIP. With SHB selected, if the second harmonic percentage is higher than the pre-set value, the trip will be blocked during the time set in reset time parameter.
- **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

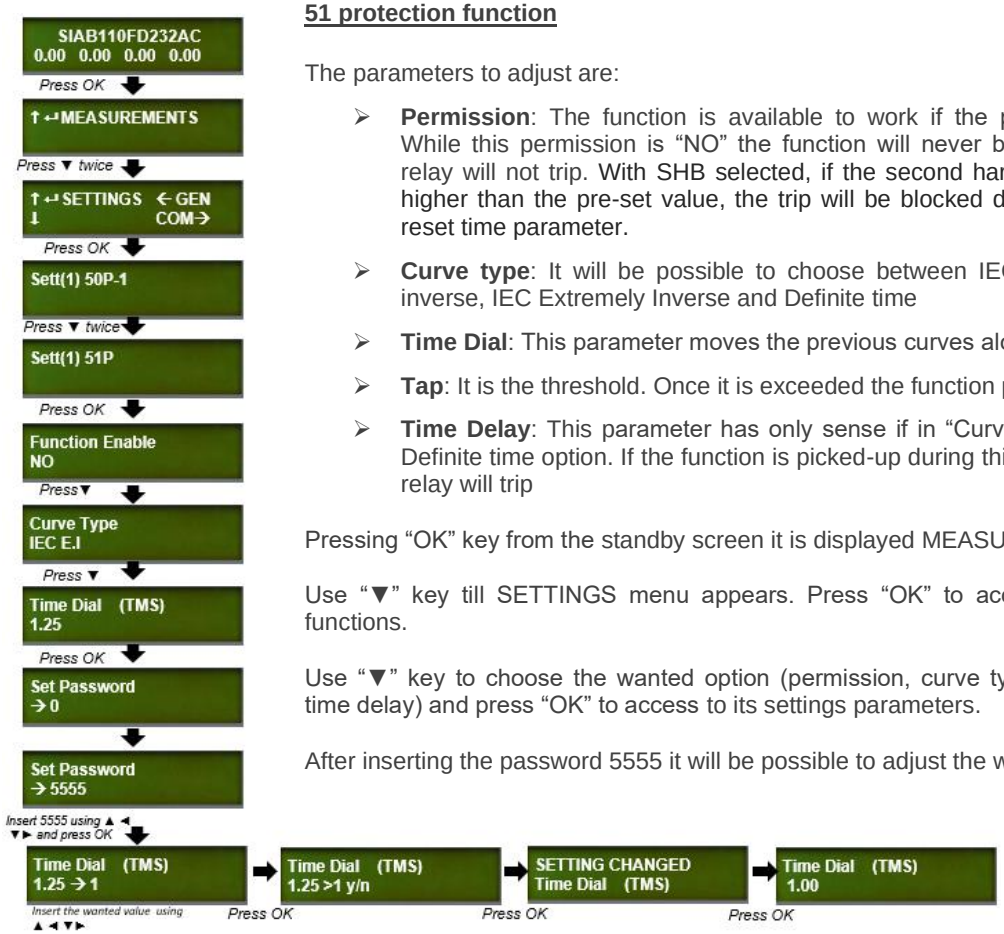
Pressing "OK" key from the standby screen it is displayed MEASUREMENT menu.

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.

51 protection function



The parameters to adjust are:

- **Permission**: The function is available to work if the permission is "YES". While this permission is "NO" the function will never be activated, and the relay will not trip. With SHB selected, if the second harmonic percentage is higher than the pre-set value, the trip will be blocked during the time set in reset time parameter.
- **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 “CT 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 500/1, the setting would be 500.

The frequency is also selected by general settings.

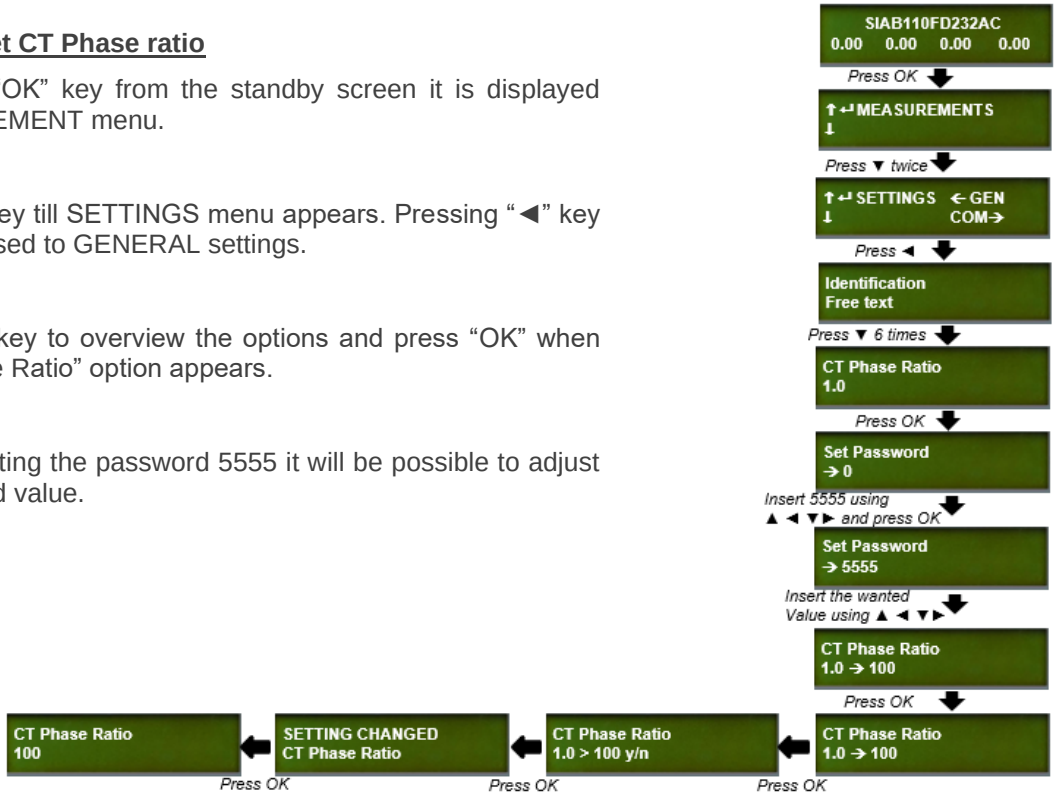
How to set CT Phase ratio

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.

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 “┘” 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

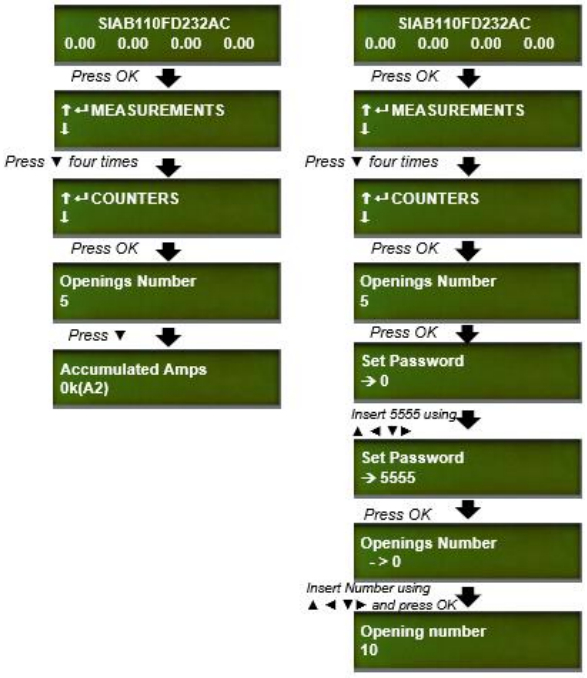
To delete the events from the relay it is necessary to insert the password 5555 from the events menu.
After the erasing of the events it will be appear there is 1 event corresponding to “Events erased”

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

7.3.5.Counters

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 “COUNTERS” screen. Press "OK" and use the “▲” and “▼” keys to position the cursor over the counters.

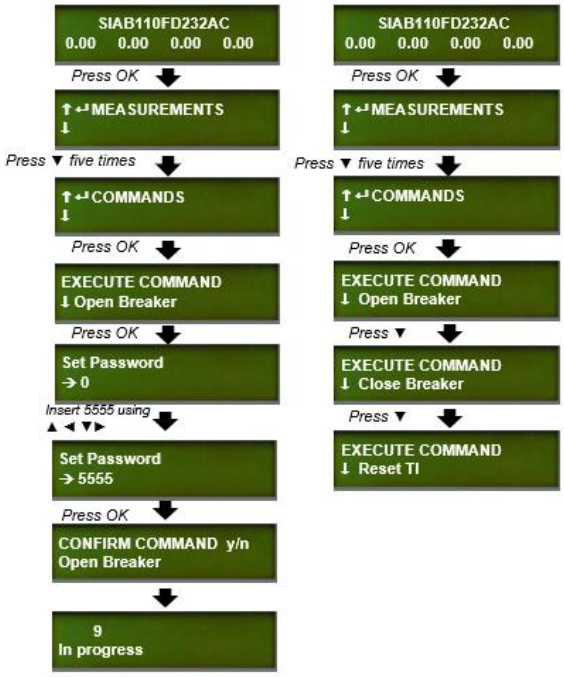
Pressing “OK” you can change the value of the counter after inserting the password.



7.3.6.Commands

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 “COMMANDS” screen. Press "OK" and use the “▲” and “▼” keys to position the cursor over the commands.

Pressing “OK” it is possible to execute the command after inserting the password.



7.3.7.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.

7.3.8.LDP menu

SIA-B relay provides the demand of current (LDP – Load Data Profiling) 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

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 “LDP” screen. Press "OK" and use the “▲” and “▼” keys to position the cursor over the faults.

How to delete the Load data profiling

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

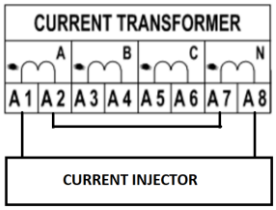
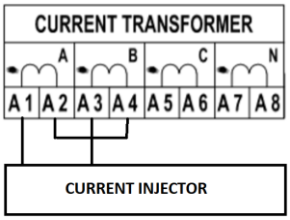
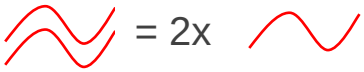
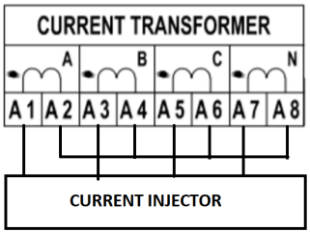
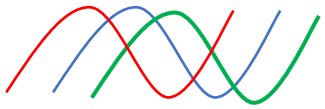
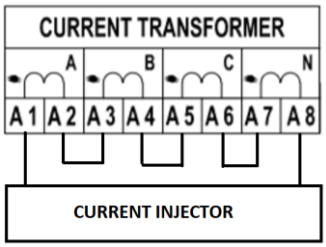
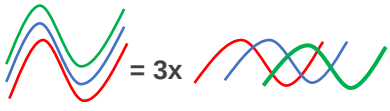
8. COMMISSIONING

8.1. Thermal resistance

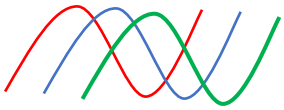
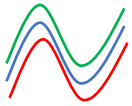
The relay can support, with 3-phase balanced injection, the following values according to International Standards:

- 4 x In continuously.
- 30 x In for 10 seconds.
- 100 x In for 1 second.

In the following table the different injection modes are described:

<table>
<tr><th>CURRENT GENERATION</th><th>INJECTION MODE</th><th>INJECTION SYSTEM</th><th>RELAY REAR CONNECTION</th><th>RELAY WITHSTAND ENERGY WAVEFORM</th></tr>
<tr><td rowspan="2">Single phase</td><td>Phase-Neutral</td><td rowspan="2">NOT APPLY</td><td>P-N:
 
</td><td>  </td></tr>
<tr><td>Phase-Phase</td><td>P-P:
 
</td><td> 
</td></tr>
<tr><td rowspan="2">Three phase</td><td rowspan="2">Phase-Neutral</td><td>Balanced (120°)</td><td>P-N Balanced:
 
</td><td rowspan="2">  </td></tr>
<tr><td>Unbalanced (0°)</td><td>P-N Unbalanced:
 
</td></tr>
<tr><td colspan="4"> 
</td></tr>
</table>

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	4 x In continuously. 20 x In for 10 seconds. 100 x In for 1 second.
	3-PHASE BALANCED	4 x In continuously. 20 x In for 10 seconds. 100 x In for 1 second.
	3-PHASE UNBALANCED	1xIn continuously 6.5xIn for 10 seconds 23 xIn for 1 second

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

Commisioning recommendation:

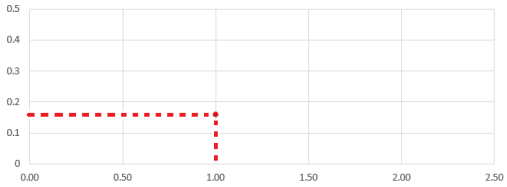
- It is recommended to use Kitcom accessory for relay protection functions settings. Connect it for setting and disconnect it for testing purpose.
- Adjust manually current generation value without injecting current to relay, for not stressing it during adjustment process.
- Be sure that relay output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

8.2. Self powering

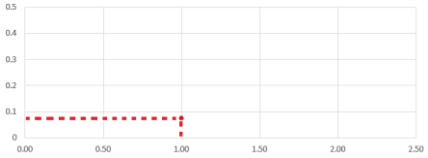
8.2.1. Single phase minimum self-powering checking

Adjust the current injector with HOLD 160mA, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line.



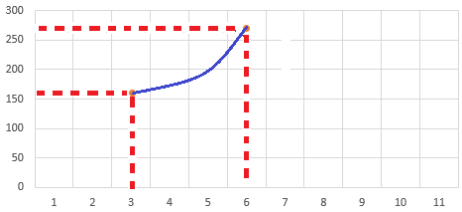
8.2.2. Three phase minimum self-powering checking

Adjust the current injector with HOLD 75mA, 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 current injector with HOLD 160mA, 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 270mA is reached. At this value, the Leds should be switched on:



8.3. Measurements

The accuracy of the measurement is ±2% on a band of ±20% over the nominal current and ±4% or ± 5 mA over the rest of the measurement range.

It is shown some examples below:

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

8.4. Protection functions

Current injection procedure:

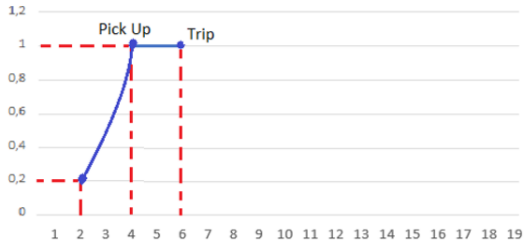
Adjust the current injector with HOLD 0.2A, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line. From this value, increase the current to achieve the function pick-up and the function trip.

8.4.1. Protection functions testing

- 50 instantaneous phase overcurrent protection:

Settings:

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



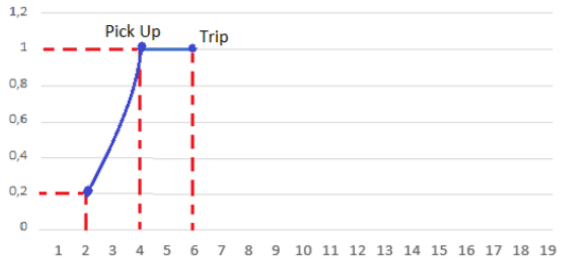
The following information will be checked:

- Pick-up at 100% of the tap
- Trip output is activated
- Output 2 is activated
- Led 1 is activated
- Led 3 is activated

- 50G instantaneous neutral overcurrent protection:

Settings:

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



The following information will be checked:

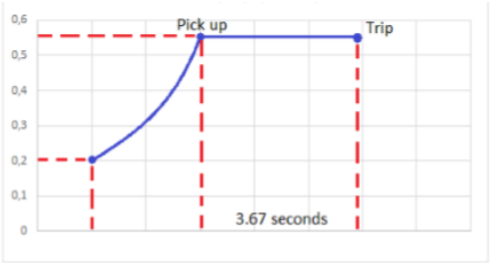
- Pick-up at 100% of the tap
- Trip output is activated
- Output 3 is activated
- Led 1 is activated
- Led 2 is activated

- 51 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
- Trip output is activated

- Output 2 is activated
- Led 1 is activated
- Led 3 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
- Led 1 is activated
- Led 3 is activated

TEST 3

Settings:

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

The following information will be checked:

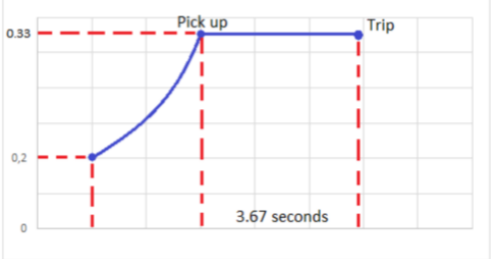
- Trip output is activated
- Output 2 is activated
- Led 1 is activated
- Led 3 is activated

- <u>51G Inverse time neutral overcurrent protection:</u>

TEST 1

Settings:

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

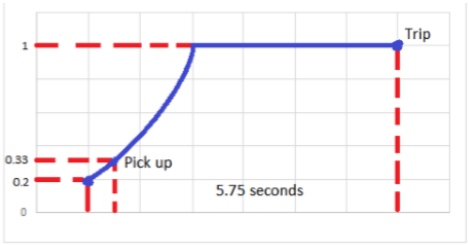


The following information will be checked:

- Pick-up at 110% of the tap
- Trip output is activated
- Output 3 is activated
- Led 1 is activated
- Led 2 is activated

TEST 2

Settings:



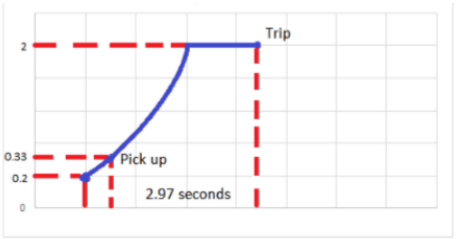
- Permission: YES.
- Curve: IEC Inverse.
- Dial: 1
- TAP: 0.3xIn.
- Theoretical tripping time = 5.75 seconds (Fault current 1 A)

The following information will be checked:

- Trip output is activated
- Output 3 is activated
- Led 1 is activated
- Led 2 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
- Led 1 is activated
- Led 2 is activated

Note: In TEST 2 and TEST 3 for 51 and 51G, fault current will be injected 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. SIAB110FD232AC REGISTRY

Model:				
Serial Number:				
Model and Versions	Reading LCD model:			
	Version:			
KITCOM supply	❒ OK			
Comissioning Batery	❒ OK			
Wiring checking	❒ OK ❒ NOK			
Signalling and keypad	Led 1 ❒OK	Led 2 ❒OK	Led 3 ❒ OK	Led 4 ❒ OK
	Trip Output ❒ OK			
	Output 1 ❒OK	Output 2 ❒OK	Output 3 ❒OK	
	Keypad ❒ OK			
	Battery key ❒ OK			
Self-power 3P (SIAB < 75mA)	Phase A, Phase B and Phase C ❒ OK			
Self-power 1P (SIAB < 160mA)	Phase A ❒ OK	Phase B ❒ OK	Phase C ❒ OK	
V_{aux} supply	24-230 Vdc ❒ OK	24-230 Vac ❒ OK		
Communication	USB ❒ OK			
Current measurements	❒ OK			
Protection Functions	50-1 phase A: ❒ OK	50-1 phase B: ❒ OK	50-1 phase C: ❒ OK	
	50-2 phase A: ❒ OK	50-2 phase B: ❒ OK	50-2 phase C: ❒ OK	
	50G-1: ❒ OK			
	50G-2: ❒ OK			
	51 phase A: ❒ OK	51 phase B: ❒ OK	51 phase C: ❒ OK	
	51G: ❒ OK			
	46: ❒ OK			
	49: ❒ OK			
	52: ❒ OK			
	SHB: ❒ OK			
	CLP: ❒ OK			
	50BF: ❒ OK			
	T. BLOCK: ❒ OK			
RTC	❒ OK			

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