SIL-A

Feeder Relay

Overcurrent & Earth Fault Protection

KEMA Labs

c UL us LISTED

INDUSTRIAL CONTROL EQUIPMENT
E514543

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:

- SILA Electronic protection relay.
- 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

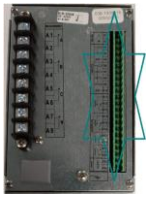
When relay is unpacked, please, take your time to confirm following checking list to be sure that everything is ok:

- 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 micro-USB port installed on the front of the relay the powering and adjusting process of the relay is very easy and it allows the user to test the relay.

5 volts are required to operate the equipment and that should be plugged into the front communications port (micro-USB). The power could come from a laptop, power supply or external battery for example.

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.

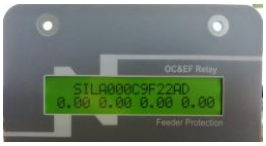
Besides, the possibility of using external battery power, together with the possibility of activating the trip contact from the test menu, allows the trip circuit to be tested before the distribution center is powered up.

The SIL-A is designed to be powered with an auxiliary voltage of 24-230Vac/dc.

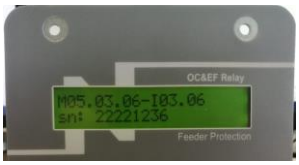
The tolerance for the voltage is ±20% for the range 24-220 Vdc and ±15% for the range 100-230 Vac. Outside of this range is possible for the relay to work but is not guaranteed.

Once the relay is powered through the micro-USB, 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 and 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.

- Press once left ◄ key 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 from the standby menu. Then, change it by using up and dwon 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).

LEDs and outputs will be checked to verify the hardware is OK:

all LEDs are turned on when Test Menu is activated. Just Outputs can be activated/deactivated.

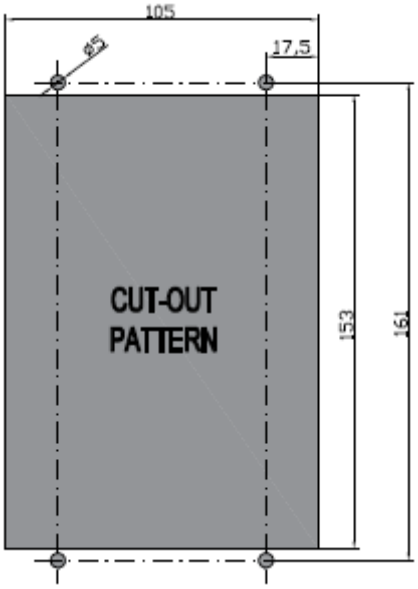
	Action	Checking
▼, **OK**	Output 1	Output 1 activated
▼, **OK**	Output 2	Output 2 activated
▼, **OK**	Output 3	Output 3 activated
▼, **OK**	Output 4 **(*)**	Output 4 activated
▼, **OK**	Output 5 **(*)**	Output 5 activated
▼, **OK**	Output 6 **(*)**	Output 6 activated
▼, **OK**	Output 7 **(*)**	Output 7 activated
▼, **OK**	Logic Signal 08	Logic Signal 08 activated
▼, **OK**	Logic Signal 09	Logic Signal 09 activated
▼, **OK**	Logic Signal 10	Logic Signal 10 activated
▼, **OK**	Logic Signal 11	Logic Signal 11 activated
▼, **OK**	Logic Signal 12	Logic Signal 12 activated

▼, **OK**	Logic Signal 13	Logic Signal 13 activated
▼, **OK**	Logic Signal 14	Logic Signal 14 activated
▼, **OK**	Logic Signal 15	Logic Signal 15 activated
▼, **OK**	Logic Signal 16	Logic Signal 16 activated
▼, **OK**	Logic Signal 17	Logic Signal 17 activated
▼, **OK**	Logic Signal 18	Logic Signal 18 activated
▼, **OK**	Logic Signal 19	Logic Signal 19 activated
▼, **OK**	Logic Signal 20	Logic Signal 20 activated
▼, **OK**	Logic Signal 21	Logic Signal 21 activated
▼, **OK**	Logic Signal 22	Logic Signal 22 activated
▼, **OK**	Logic Signal 23	Logic Signal 23 activated
▼, **OK**	Logic Signal 24	Logic Signal 24 activated
▼, **OK**	Logic Signal 25	Logic Signal 25 activated
▼, **OK**	Logic Signal 26	Logic Signal 26 activated
▼, **OK**	Logic Signal 27	Logic Signal 27 activated
▼, **OK**	Logic Signal 28	Logic Signal 28 activated
▼, **OK**	Logic Signal 29	Logic Signal 29 activated
▼, **OK**	Logic Signal 30	Logic Signal 30 activated
▼, **OK**	Logic Signal 31	Logic Signal 31 activated
▼, **OK**	Logic Signal 32	Logic Signal 32 activated
	Skip from test menu	
C		

(*) Depending on the model.

1.4. Relay installation

To fix the relay to the switchgear, use default holes in front of relay with appropriate fixing system. The required screws to fix the relay should be M4. Do not manipulate relay to fix it on the switchgear.

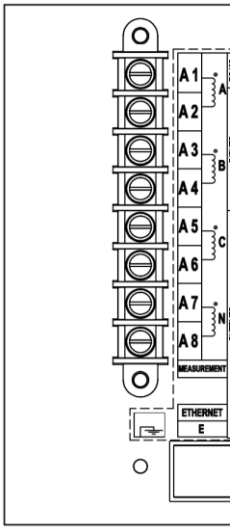


Failure to follow these instructions can result in death, serious injury, or equipment damage.

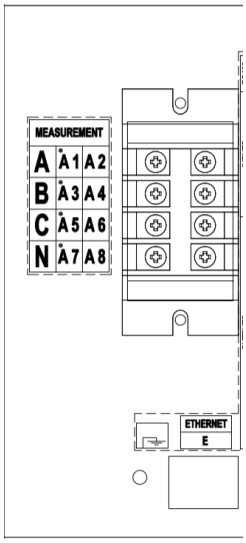
1.5. Relay rear part

Consider the wiring of the switchgear and connect relay properly.

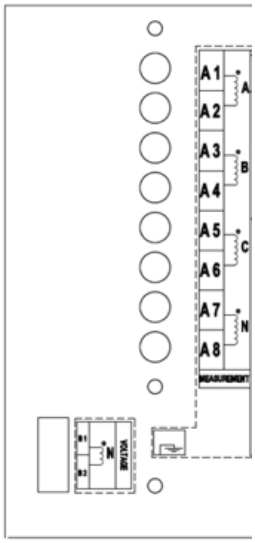
Measurement terminals:



Standard current terminals



Short-circuitable current terminals



Current and voltage terminals

A1-A2	Phase A current measurement
A3-A4	Phase B current measurement
A5-A6	Phase C current measurement
A7-A8	Neutral current measurement
B1-B2 (*)	Neutral voltage measurement

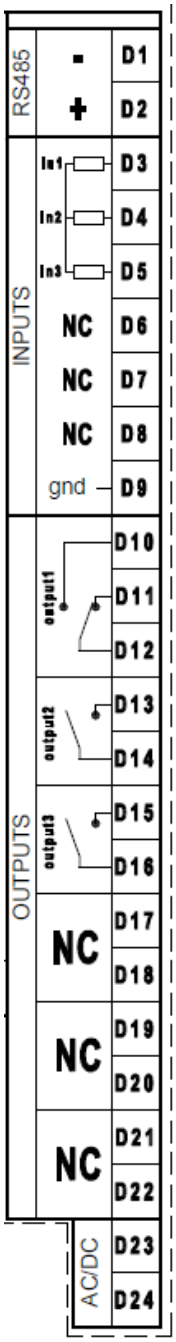
(*) Available depending on model. Only for SILAxxxx8xxxxx.

Inputs, outputs, communication, and auxiliary voltage terminals:

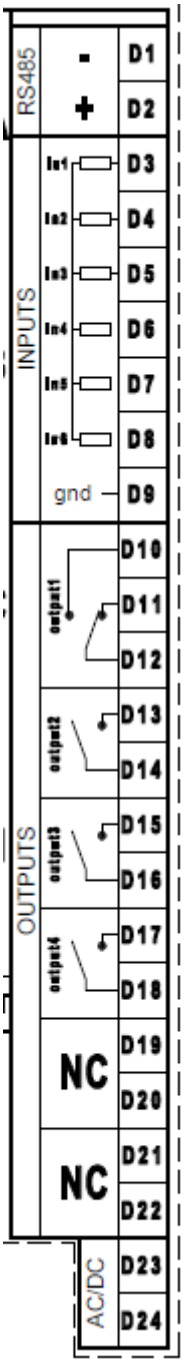
D1-D2	RS485 connection
D3-D22	Digital Input and digital output contacts
D23-D24	Auxiliary supply

Inputs/outputs number depending on the model

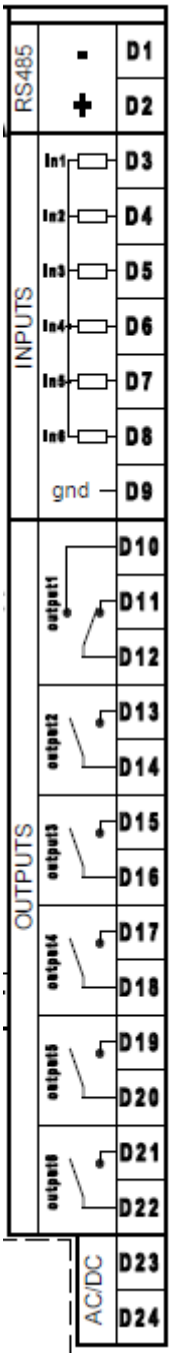
SILAxxxxxx0xxx
3 inputs / 3 outputs



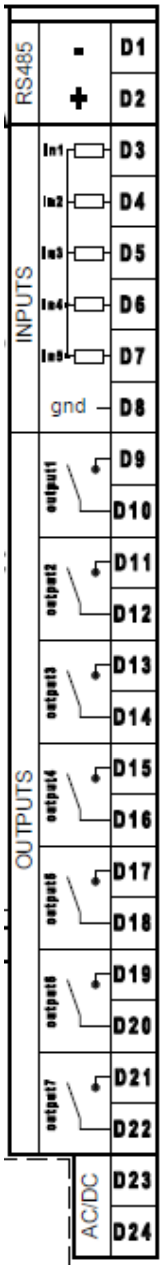
SILAxxxxxx1xxx
6 inputs / 4 outputs



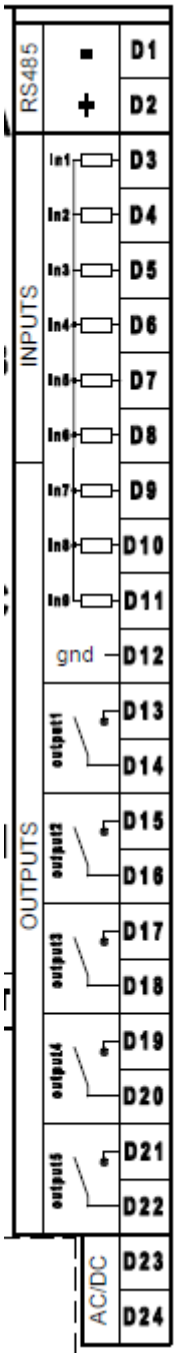
SILAxxxxxx2xxx
6 inputs / 6 outputs



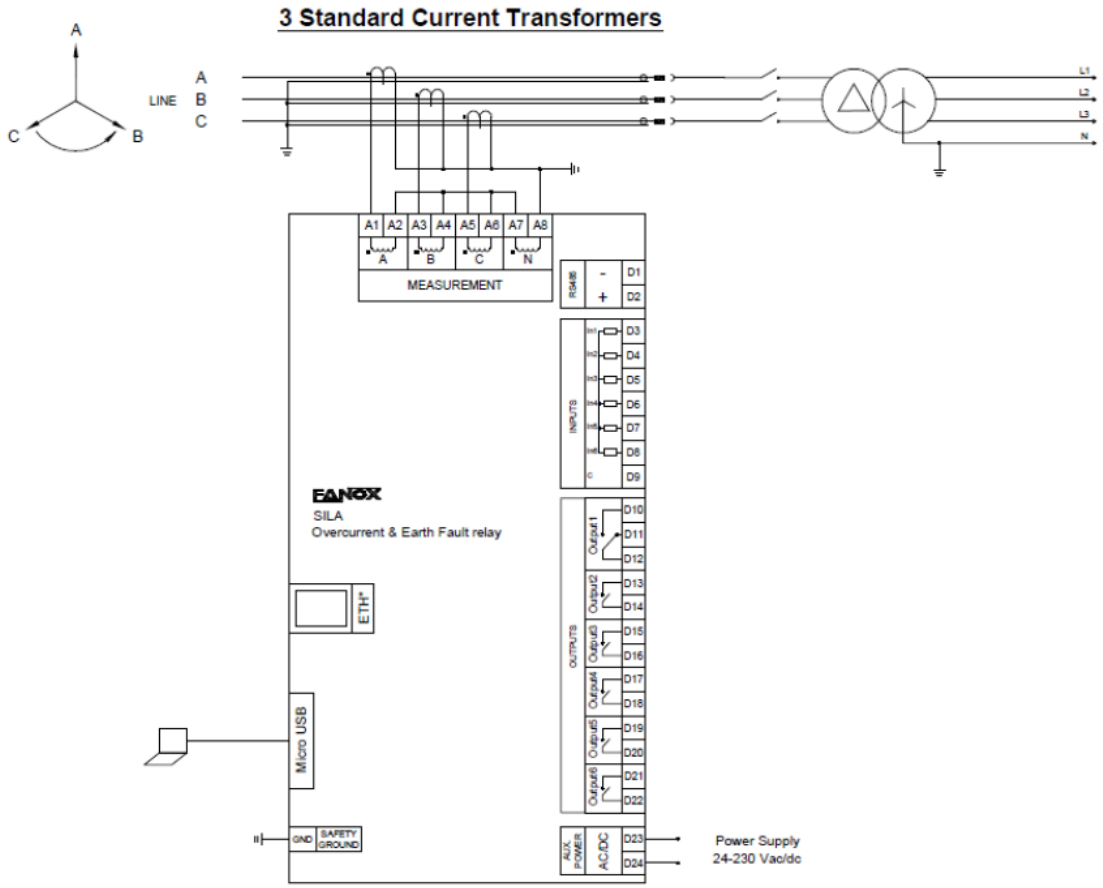
SILAxxxxxx3xxx
5 inputs / 7 outputs



SILAxxxxxx4xxx
9 inputs / 5 outputs

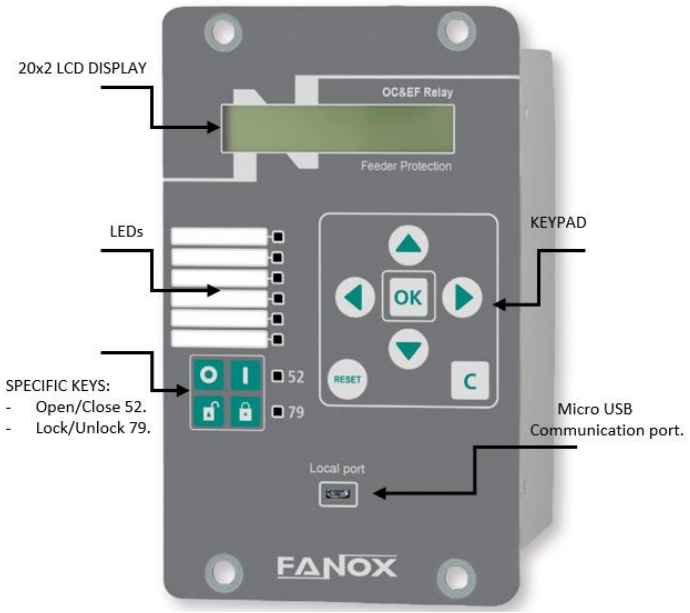


1.6. Connection diagram



2. USER INTERFACE

2.1. Relay front part



2.2. LED indicators

The SILA front panel has 8 LEDs. The operation of the LED indicators can be checked from the test menu.

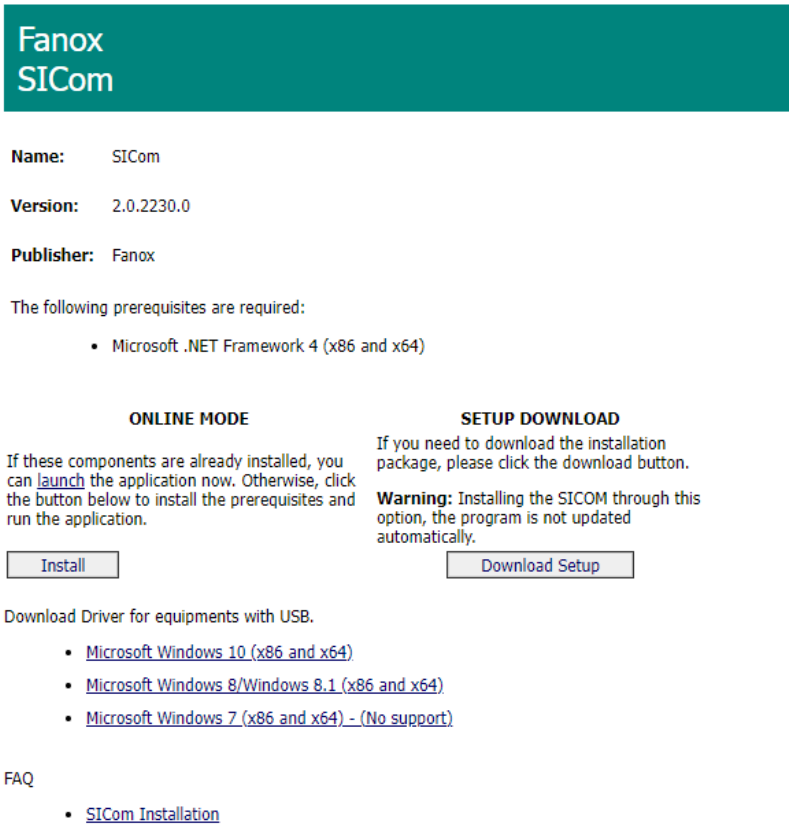
The user can change the configuration of the LEDs depending on its requirements.

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 button “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 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.

HMI:

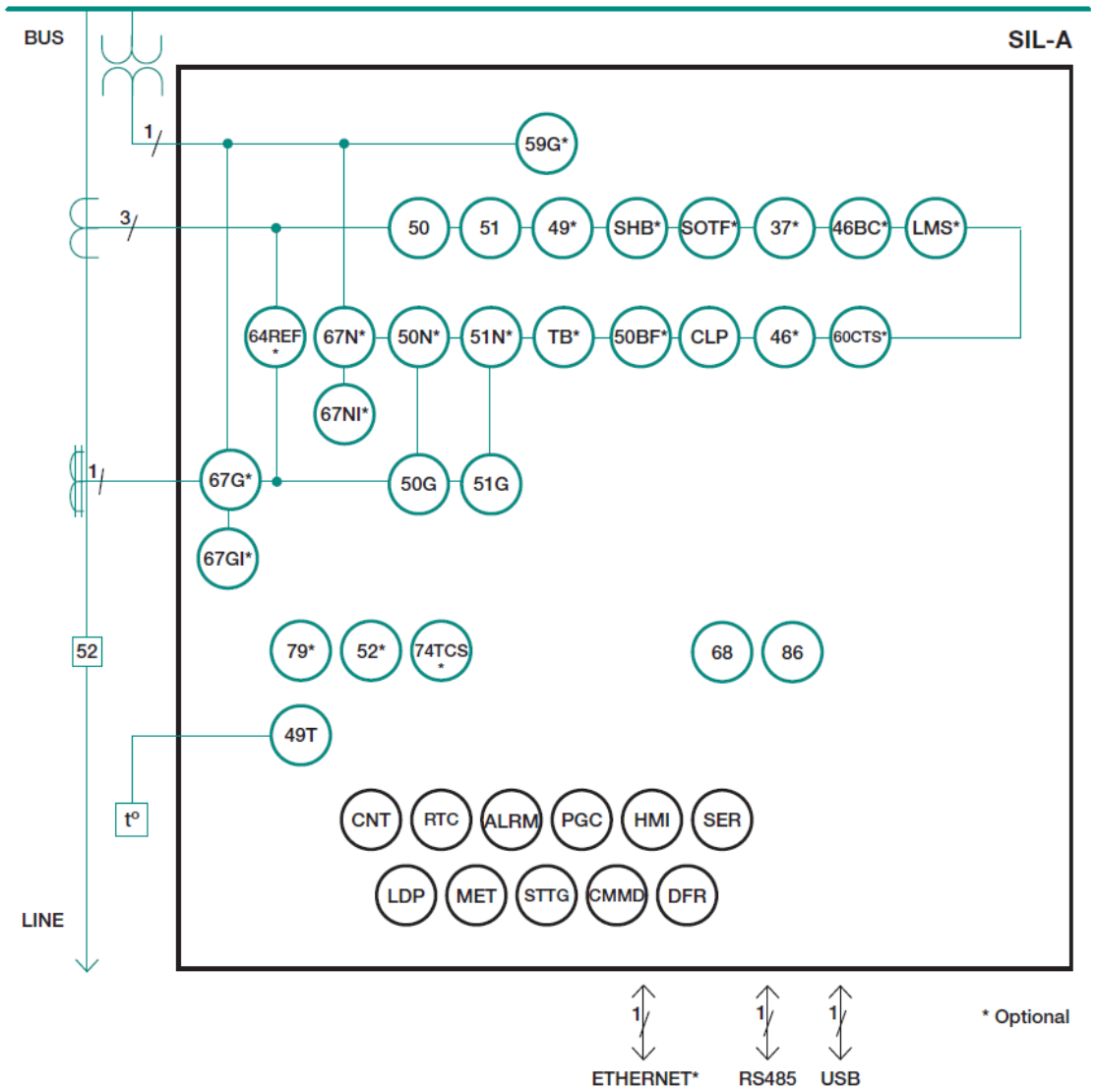
ACCESS LEVEL	PASSWORD	Permission to: Change settings Set date/Time	Permission to: Execute Commands Set Counters Delete Events Delete DFR Delete LDP	Permission to: Change user´s Configuration Delete user´s configuration
0	0000	NO	NO	NO
1	1111 2222 3333 6666 7777 8888	YES	NO	NO
2	4444	YES	YES	NO
3	5555	YES	YES	YES

SICOM:

ACCESS LEVEL	PASSWORD	Read-only permission: Status and measurements Settings Configuration Events/DFR	Permission to: Change settings	Permission to: Execute Commands Set Counters Delete Events Delete DFR	Permission to: Change user´s Configuration Delete user´s configuration	Permission to: Upgrade the FW (flashing process)
0	Fanox/0000	YES	NO	NO	NO	NO
1	Fanox/1111 Fanox/2222 Fanox/3333 Fanox/6666 Fanox/7777 Fanox/8888	YES	YES	NO	NO	NO
2	Fanox/4444	YES	YES	YES	NO	NO
3	Fanox/5555	YES	YES	YES	YES	YES

NOTE: if the access level allows the user to check the passwords, only the passwords from a lower level than the one is using will be shown. However, all the passwords can be changed if the used access level allows it.

3. FUNCTIONAL DIAGRAM



ADDITIONAL FUNCTIONS	
CNT	Counters
RTC	Real Time Clock
ALRM	Alarm panel
PGC	Programmable Logic Control
HMI	Human Machine Interface
SER	Sequential Event Recording
DFR	Disturbance Fault Recording
LDP	Load Data Profiling
MET	Metering
STTG	Settings Groups
CMMD	Commands

4. SELECTION & ORDERING CODES

SIL-A

Overcurrent & Earth Fault Protection Relay for Primary & Secondary Distribution

0 1										**PHASE CURRENT MEASUREMENT** 1 A or 5 A 1 A (For short-circuitable terminals: Mechanics options 3 and 5)
	0 1									**NEUTRAL CURRENT MEASUREMENT** 1 A or 5 A 1 A (For short-circuitable terminals: Mechanics options 3 and 5)
		0								**NET FREQUENCY** Defined by General Settings
			C							**POWER SUPPLY** 24-230 Vdc / 100-230Vac
				0 2 4 5 6 8 9						**ADDITIONAL FUNCTIONS** 0: - 2: + 49 + 60CTS + 37 + 46BC + Trip Block (Only for adaptation “B”) 4: + SHB + 49 + 46BC (Only for adaptation “C”) 5: + 52 + 50BF + Trip Block (Only for adaptation “A”) 6: + 60CTS + 37 + 46BC + Trip block (Only for Adaptation “D”) 8: + 60CTS + 37 + 46BC + Trip block + (2) 59G + (2) 67G/51G + 67GI + 67NI (Only for Adaptation “D”) 9: + 60CTS + 37 + 46BC + Trip block + LMS (Only for Adaptation “D”)
					E F G H					**COMMUNICATIONS** E: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) F: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (Modbus TCP, DNP3 TCP or IEC 60870-5-104) + Web Server + SNTP protocol G: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (IEC61850) + SNTP Protocol H: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (Modbus TCP, DNP3 TCP, IEC 60870-5-104 or IEC61850) + Web Server + SNTP protocol
						0 1 2 3 4				**INPUTS AND OUTPUTS** 3 Inputs + 3 Outputs 6 Inputs + 4 Outputs 6 Inputs + 6 Outputs 5 Inputs + 7 Outputs 9 Inputs + 5 Outputs
							2 3 4 5 R T			**MECHANICAL ASSEMBLY** 2: Vertical Assembly 3: Vertical Assembly and short-circuitable current terminals 4: Vertical Assembly with anticorrosive treatment 5: Vertical Assembly with anticorrosive treatment and short-circuitable current terminals R: Vertical Assembly + UL certification T: Vertical Assembly with anticorrosive treatment + UL certification
								A		**LANGUAGE** English, Spanish, German and French

5. TECHNICAL SPECIFICATIONS

Function 50-1 **Function 50-2 (*)**	Function enable: No/Alarm/Trip/SHB Trip(1)
	Current tap: 0.010 to 30.000 xIn (step 0.001xIn)
	Time delay: 0.000 to 300.000 s (step 0.001 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ± 35 ms or ± 0.5% (greater of both)
Function SOTF (*)	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Current tap: 0.010 to 30.000 xIn (step 0.001xIn)
	Time delay: 0.000 to 295.000 s (step 0.001 s)
	Safe Time: 0.020 to 300.000 s (step 0.001 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ± 35 ms or ± 0.5% (greater of both)
Function 50N-1 (*) **Function 50N-2 (*)**	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Current tap: 0.050 to 30.000 xIn (step 0.001xIn)
	Time delay: 0.000 to 300.000 s (step 0.001 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ± 35 ms or ± 0.5% (greater of both)
Function 50G-1 **Function 50G-2 (*)**	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Current tap: 0.010 to 30.000 xIn (step 0.001xIn)
	Time delay: 0.000 to 300.000 s (step 0.001 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ± 35 ms or ± 0.5% (greater of both)
Function 51-1 **Function 51-2 (*)**	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Curve Type: IEC 60255-151 and IEEE curves.
	Curve type: IEC Standard Inverse, IEC Very Inverse, IEC Extremely Inverse, IEC Long Time Inverse, IEC Short Time Inverse, IEEE Moderately Inverse, IEEE Very Inverse, IEEE Extremely, Defined Time. Time delay: 0.000 to 300.000 s (step 0.001 s)
	Time Dial (TMS): 0.05 to 25.00 (step 0.01) - If Curve type IEC: 0.05 to 1.00 (step 0.01) - If Curve type IEEE: 0.10 to 25.00 (step 0.01)
	Current Tap: 0.010 to 20.000 xIn (step 0.001 xIn)
	Curve, activation level: 110%
	Curve, deactivation level: 100%
	Defined time, activation level: 100%
	Defined time, deactivation level: 95%
	Temporized deactivation
	Timing accuracy for IEC and IEEE curves selection: ± 30 ms or ± 5% (greater of both). Timing accuracy for defined time curve selection: ± 35 ms or ± 0.5% (greater of both)
Function 51N-1 (*)	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Curve Type: IEC 60255-151 and IEEE curves.

Function 51N-2 (*)	Curve type: IEC Standard Inverse, IEC Very Inverse, IEC Extremely Inverse, IEC Long Time Inverse, IEC Short Time Inverse, IEEE Moderately Inverse, IEEE Very Inverse, IEEE Extremely, Defined Time. Time delay: 0.000 to 300.000 s (step 0.001 s)
	Time Dial (TMS): 0.05 to 25.00 (step 0.01) - If Curve type IEC: 0.05 to 1.00 (step 0.01) - If Curve type IEEE: 0.10 to 25.00 (step 0.01)
	Current Tap: 0.050 to 20.000 xIn (step 0.001 xIn)
	Curve, activation level: 110%
	Curve, deactivation level: 100%
	Defined time, activation level: 100%
	Defined time, deactivation level: 95%
	Temporized deactivation
	Timing accuracy for IEC and IEEE curves selection: ± 30 ms or ± 5% (greater of both). Timing accuracy for defined time curve selection: ± 35 ms or ± 0.5% (greater of both)
Function 51G-1 **Function 51G-2 (*)**	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Curve Type: IEC 60255-151 and IEEE curves.
	Curve type: IEC Standard Inverse, IEC Very Inverse, IEC Extremely Inverse, IEC Long Time Inverse, IEC Short Time Inverse, IEEE Moderately Inverse, IEEE Very Inverse, IEEE Extremely, Defined Time. Time delay: 0.000 to 300.000 s (step 0.001 s)
	Time Dial (TMS): 0.05 to 25.00 (step 0.01) - If Curve type IEC: 0.05 to 1.00 (step 0.01) - If Curve type IEEE: 0.10 to 25.00 (step 0.01)
	Current Tap: 0.010 to 20.000 xIn (step 0.001 xIn)
	Curve, activation level: 110%
	Curve, deactivation level: 100%
	Defined time, activation level: 100%
	Defined time, deactivation level: 95%
	Temporized deactivation
	Timing accuracy for IEC and IEEE curves selection: ± 30 ms or ± 5% (greater of both). Timing accuracy for defined time curve selection: ± 35 ms or ± 0.5% (greater of both)
Function 67G/51G-1 (*) **Function 67G/51G-2 (*)**	Function enable: No/Alarm/Trip/SHB Trip(1)
	Curve Type: IEC 60255-151 and IEEE curves. IEC (Definite time, standard inverse, very inverse, extremely inverse, long time inverse, short time inverse) and IEEE (Moderately inverse, very inverse, extremely inverse). Time delay: 0.000 to 300.000 s (step 0.001 s)
	Time dial (TMS): 0.05 to 25.00 (step 0.01) If Curve type IEC: 0.05 to 1.00 (step 0.01) If Curve type IEEE: 0.10 to 25.00 (step 0.01)
	Current tap: 0.010 to 20.000 xIn (step 0.001xIn)
	Directionality: No/Forward/Reverse
	Polarization voltage: 0.08 to 2.00 xUn (step 0.01xUn)
	Operating angle: 0 to 359º (step 1º)
	Halfcone angle: 10 to 170º (step 1º)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Voltage activation level: 100%
	Voltage deactivation level: 95%
	Temporized deactivation
	Timing accuracy for IEC and IEEE curves selection:

	± 30 ms or ± 5% (greater of both) Timing accuracy for defined time curve selection: ± 35 ms or ± 0.5% (greater of both)
Function 67NI (*)	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Directionality: No/Forward/Reverse
	Low Current Tap: 0.010 to 30.000 xIn (step 0.001xIn)
	High Current Tap: 0.010 to 30.000 xIn (step 0.001xIn)
	Low Voltage Tap: 0.08 to 2.00 xUn (step 0.01xUn)
	High Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Time delay: 0.000 to 300.000 s (step 0.001 s)
	Operating angle: 0 to 359º (step 1º)
	Halfcone angle: 10 to 170º (step 1º)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Voltage activation level: 100%
	Voltage deactivation level: 95%
	Temporized deactivation
	Timing accuracy for defined time curve selection: ± 30 ms or ± 0.5% (greater of both)
Function 67GI (*)	Function enable: No/Alarm/Trip/ SHB Trip(1)
	Directionality: No/Forward/Reverse
	Low Current Tap: 0.010 to 30.000 xIn (step 0.001xIn)
	High Current Tap: 0.010 to 30.000 xIn (step 0.001xIn)
	Low Voltage Tap: 0.08 to 2.00 xUn (step 0.01xUn)
	High Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Time delay: 0.000 to 300.000 s (step 0.001 s)
	Operating angle: 0 to 359º (step 1º)
	Halfcone angle: 10 to 170º (step 1º)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Voltage activation level: 100%
	Voltage deactivation level: 95%
	Temporized deactivation
	Timing accuracy for defined time curve selection: ± 30 ms or ± 0.5% (greater of both)
Function 64REF (*)	Function enable: No/Alarm/Trip/ IN SHB Trip
	Current tap: 0.050 to 20.000 xIn (step 0.001xIn)
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Block Threshold: 5 to 50% (step 1%)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ± 30 ms or ± 0.5% (greater of both)
Function 49 (*)	Function enable: No/Alarm/Trip
	Current tap: 0.100 to 2.400 In (step 0.001 xIn)
	ζ heating: 3 to 600 min (step 1 min)
	ζ cooling: 1 to 6 xζ heating (step 1)
	Alarm: 20 to 99% (step 1%)
	Trip level: 100%
	Deactivation level: 95% of alarm level
	Timing accuracy: ± 5% respect of theorical value.

Function 49T	Available through configurable inputs thanks to the programmable logic
Function SHB (*)	Function enable: No/Yes
	Current Tap: 5 to 50% (step 1%)
	Reset Time: 0.000 to 300.000 (step 0.001 s)
	Block Threshold: 0.010 to 30.000xIn (step 0.001 xIn)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
Function CLP	Function enable: Yes/No
	Settings group: 1 to 4 (step 1)
	No load time: 0.020 to 300.000 s (step 0.001 s)
	Cold load time: 0.020 to 300.000 s (step 0.001 s)
	Open breaker activation 0.8% In and reset threshold: 1% In
Function 46 (*)	Function enable: No/Alarm/Trip/SHB Trip (1)
	Curve Type: IEC 60255-151 and IEEE curves.
	Curve type: IEC Standard Inverse, IEC Very Inverse, IEC Extremely Inverse, IEC Long Time Inverse, IEC Short Time Inverse, IEEE Moderately Inverse, IEEE Very Inverse, IEEE Extremely, Defined Time. Time delay: 0.000 to 300.000 s (step 0.001 s)
	Time Dial (TMS): 0.05 to 25.00 (step 0.01) - If Curve type IEC: 0.05 to 1.00 (step 0.01) - If Curve type IEEE: 0.10 to 25.00 (step 0.01)
	Current Tap: 0.010 to 20.000 xIn (step 0.001 xIn)
	Curve, activation level: 110%
	Curve, deactivation level: 100%
	Defined time, activation level: 100%
	Defined time, deactivation level: 95%
	Temporized deactivation
	Timing accuracy for IEC and IEEE curves selection: ± 30 ms or ± 5% (greater of both). Timing accuracy for defined time curve selection: ± 35 ms or ± 0.5% (greater of both)
Function 46BC (*)	Function enable: No/Alarm/Trip
	Current Tap: 15 to 100 % (step 1%)
	Time delay: 0.030 to 300.000 s (step 0.001 s)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
Function 37 (*)	Function enable: No/Alarm/Trip
	Current tap: 0.010 to 30.000 xIn (step 0.001 xIn)
	Minimum Level: 0.000 to 1.000 xIn (step 0.001 xIn)
	Time delay: 0.060 to 300.000 s (step 0.001 s)
	Activation level: 100%
	Deactivation level: 105%
	Temporized deactivation
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
Function 59G-1 (*) **Function 59G-2 (*)**	Function enable: No/Alarm/Trip
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Time delay: 0.045 to 300.000 s (step 0.001 s)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Activation level: 101%
	Deactivation level: 99%
	Temporized deactivation

	Timing accuracy: ±0.5% or ±30 ms (greater of both)
Function 79 (*)	Number of recloses: 0 to 4 (step 1)
	Reclose time 1, 2, 3, 4: 0.020 to 2000.000 s (step 0.001 s)
	Hold Enable: No/Yes/No Time
	Hold time: 0.000 to 2000.000 s (step 0.001 s)
	Reset time: 0.000 to 2000.000 s (step 0.001 s)
	Safe time: 0.020 to 2000.000 s (step 0.001 s)
	Locking possibilities: pulse inputs, level inputs, commands.
Function 52 (*)	Maximum number of openings: 1 to 100,000 (step 1)
	Maximum accumulated amperes: 1 to 100,000 M(A2) (step 1 M(A2))
	Repetitive number of openings: 1 to 100,000 (step 1)
	Time for a repetitive number of openings: 1 to 300 min (step 1 min)
	Maximum opening time: 0.020 to 300.000 s (step 0.001 s)
	Maximum closing time: 0.020 to 300.000 s (step 0.001 s)
	Open breaker activation and reset threshold: 0.8% In
Function 74TCS (*)	Function enable: No/Yes
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Continuity in coils A and B
Function 60CTS (*)	Function enable: No/Yes
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Open breaker activation and reset threshold: 0.8% In
	Detection of the loss of one phase CT
Function 50BF (*)	Function enable: No/Yes
	Time delay: 0.020 to 1.000 s (step 0.001 s)
	Open breaker activation and reset threshold: 0.8% In
Function TRIP BLOCK (*)	Function enable: No/Yes
	Current Tap: 1.500 to 30.000 xIn (step 0.001 xIn)
Function LMS (*)	Function enable: No/Yes
	Peak period starting month: January to December
	Peak period starting day: 1 to 31 (step 1)
	Peak period ending month: January to December
	Peak period ending day: 1 to 31 (step 1)
	Peak period starting hour: 0 to 23 (step 1 hour)
	Peak period starting minute: 0 to 59 (step 1 minute)
	Peak period ending hour: 0 to 23 (step 1 hour)
	Peak period Ending minute: 0 to 59 (step 1 minute)
	Peak period starting day of week: Monday to Sunday
	Peak period ending day of week: Monday to Sunday
	Contractual Load: 0.010 to 30.000 xIn (step 0.001xIn)
	Peak period value: 0.010 to 30.000 xIn (step 0.001xIn)
	No peak period trip time: 1 to 300 minutes (step 1 minute)
	Peak period trip time: 1 to 300 minutes (step 1 minute)
	Number of recloses: 1 to 247 (step 1)
	Reset time: 1 to 300 minutes (step 1 minute)
	Interval time: 1 to 300 minutes (step 1 minute)
Function 86	It allows to latch (lock out) the contact trip due to programmable logic (PGC: RSFF or SRFF).
Function 68	Available through configurable inputs and outputs thanks to the programmable logic (PGC).
Programmable logic control (PGC)	OR, OR_1PULSE, OR_PULSES, OR_BLINKING, OR_TIMER UP, OR_TIMER DOWN NOR, NOR_1PULSE, NOR_PULSES, NOR_BLINKING, NOR_TIMER UP, NOR_TIMER DOWN AND, AND_1PULSE, AND_PULSES, AND_BLINKING, AND_TIMER UP, AND_TIMER DOWN

	NAND, NAND_1PULSE, NAND_PULSES, NAND_BLINKING, NAND_TIMER UP, NAND_TIMER DOWN XOR, OR_1PULSE, XOR_PULSES, XOR_BLINKING, XOR_TIMER UP, XOR_TIMER DOWN SRFF, SRFF_1PULSE, SRFF_PULSES, SRFF_BLINKING, SRFF_TIMER UP, SRFF_TIMER DOWN, SRFF_NON VOLATIL RSFF, RSFF_1PULSE, RSFF_PULSES, RSFF_BLINKING, RSFF_TIMER UP, RSFF_TIMER DOWN, RSFF_NON VOLATIL R_EDGE, R_EDGE_1PULSE F_EDGE, F_EDGE_1PULSE
Settings Groups	4 settings groups
	Selectable by input, communications, user commands or general setting.
Sequential Events Recording (SER)	2048 events
Disturbance fault recording (DFR)	32 samples/cycle
	Fault start configurable
	4 analog channels and 96 configurable digital channels
	5 COMTRADE records (300 cycles each record): 1 to 8 pre-fault cycles + 292 to 299 postfault cycles 25 COMTRADE records (60 cycles each record): 1 to 8 pre-fault cycles + 52 to 59 postfault cycles. 50 COMTRADE records (30 cycles each record): 1 to 8 pre-fault cycles + 22 to 29 postfault cycles. 100 COMTRADE records (15 cycles each record): 1 to 8 pre-fault cycles + 7 to 14 postfault cycles.
	COMTRADE IEEE C37.111-1991 - 4 analog channels and 96 digital channels
	Up to 100 fault reports (data format) with 29 events each one
Load Data Profiling (LDP)	Demand of current with the following characteristics: - Number of records: 744 - Recording mode circular - Sampling rate (interval): configurable through communications (1-60 min) - Record format: Date/Time IMAX (in interval) Imax (at the moment of the record) IA IB IC IN
Inputs (*)	Depending on model: - 3 configurable inputs - 5 configurable inputs - 6 configurable inputs - 9 configurable inputs The voltage of the inputs is the same as the auxiliary power supply Burden: 24 Vdc: <20 mW 230 Vdc: <200 mW 24 Vac: <50 mW 230 Vac: < 500 mW
Outputs (*)	Depending on Model: - 3 configurable outputs - 4 configurable outputs - 5 configurable outputs - 6 configurable outputs - 7 configurable outputs 250 V AC – 8 A / 30 V DC – 8 A Contact current short duration: 30A – 200ms
	Output 1 (NC + NO) Output 2, Output 3, Output 4(*), Output 5(*) and Output 6(*): NO Model with 5 or 7 outputs (*): All the outputs NO
Frequency	50/60Hz
Burden	Burden of current inputs: <0.015 VA (1 A) & <0.375 VA (5 A) Burden of voltage input (*):

	<70 mVA Burden of power supply unit: 24 Vdc (quiescent): < 4 W 24 Vdc (50% Load): < 7 W 230 Vdc (quiescent): < 5 W 230 Vdc (50% Load): < 6 W 230 Vac (quiescent): < 13 VA 230 Vac (50% Load): < 17 VA Burden for binary inputs: 24 Vdc: <20 mW 230 Vdc: <200 mW 230 Vac: < 500 mW
Measurements	Phase current (I-A, I-B, I-C), neutral (3I0* and IN), neutral voltage (V-R*), positive sequence (I-1*), negative sequence (I-2*), I-2/I-1*, phase second harmonic current (IA-2H, IB-2H, IC-2H, and I-N2H)*, maximum current (Imax), Total Harmonic Distortion (THD-A, THD-B, and THD-C), thermal image (TI*) and neutral angle (Ang 3I0-IN and Ang 3I0-VR, Ang IN-VR)*
	Fundamental values (DFT)
	Sampling: 32 samples/cycle
	Current: ±2% precision in a band covering ±20% of nominal current and ±4% or ± 5 mA in the rest of the range Voltage: 1% precision in a band covering ±20% of nominal voltage and 4% in the rest of the range (*) Angle: ± 1º
	Current measurement range: From 0.01 to 30 times the nominal current Voltage (phase to phase) measurement range with conventional VTs: From 3 to 250 V Angle measurement range: From 0 to 359º
Communications	Local port (micro-USB): Modbus RTU
	Remote port RS485: IEC60870-5-103, Modbus RTU or DNP3.0 Serial (selectable by general settings).
	Remote port RJ45 (10/100 Base-Tx): DNP3.0 TCP/IP, Modbus TCP/IP (selectable by general settings) + SNTP Protocol + Web Server (*)
	RJ45 Port (10/100 Base-Tx): IEC61850 (*)
Power supply	24-230 Vac/dc (24-220 Vdc (±20%) / 100-230 Vac (±15%)) Burden: 24 Vdc (quiescent): < 4 W 24 Vdc (50% Load): < 7 W 230 Vdc (quiescent): < 5 W 230 Vdc (50% Load): < 6 W 230 Vac (quiescent): < 13 VA 230 Vac (50% Load): < 17 VA
Environmental conditions	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80 ºC
	Relative humidity: 95%
Transformers	Measurement 3 or 4 CT /5 or /1 (depending on model)
Mechanical characteristics	Metallic box
	Panel mounted
	Height x Width: 177 x 107 (mm)
	Depth: 122.1 mm
	IP-54
	The required screws to fix the relay should be M4

(*) Optional depending on model

[1] Only for models with SHB function

5.1. IEC60255-151 Curves

The SIL-A relay complies with the curves shown in standard IEC 60255-151:

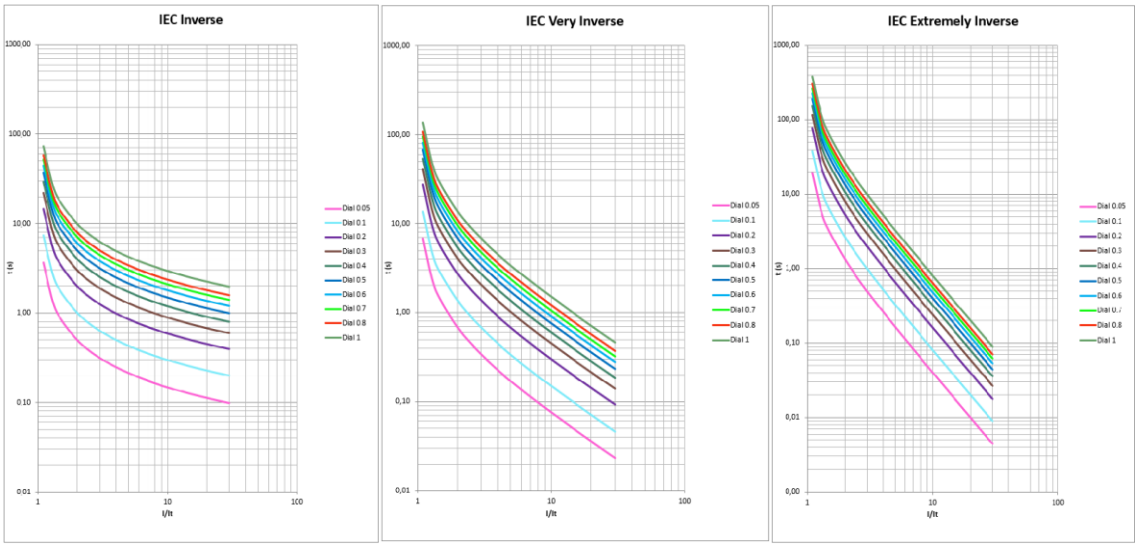
- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve
- Long time Inverse Curve
- Short time Inverse Curve

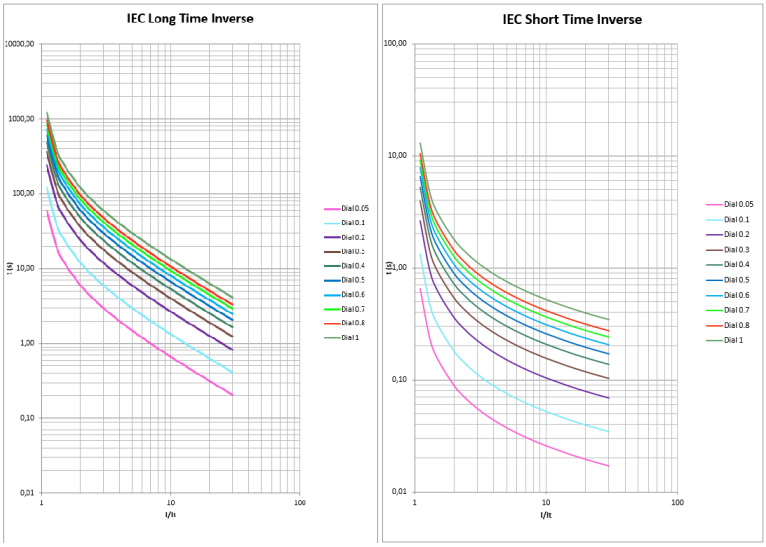
There is a general mathematical equation that defines the time in seconds as a function of the current:

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

Parameters	A	P	Q	B	K
Long time Inverse	120	1	1	0	0
Short Time Inverse	0.05	0.04	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.





5.2. IEEE Curves

The SIL-A relay complies with the curves shown in standard IEEE:

- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve

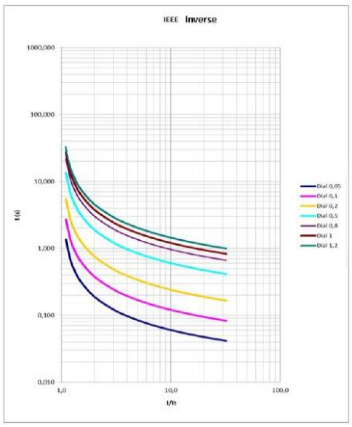
There is a general mathematical equation that defines the time in seconds as a function of the current:

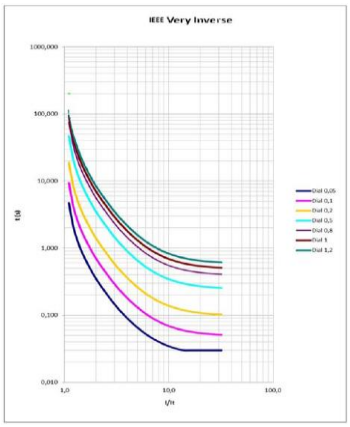
$$t = (TD) \times \left[\left(\frac{A}{V^P - 1} \right) + B \right] \qquad V = \frac{I}{I_{adjusted}}$$

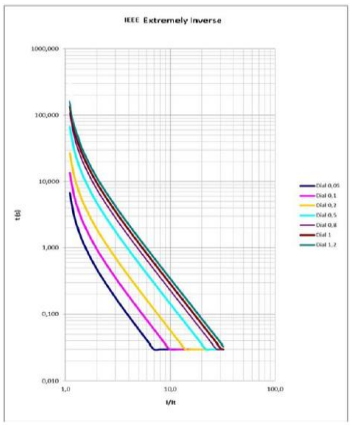
Which relate to the parameters figuring in the following table:

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

The curve can move from its axis using the TD time selection device, which the user can adjust. $I_{adjusted}$ is the initial operating current, set by the user.







6. PROGRAMABLE LOGIC CONTROL

Firstly, it is defined the concept of physical input, physical output, and logical signal. Physical inputs are the real inputs of the device. SIL-A device has 3, 5, 6 or 9 physical inputs, depending on model. These inputs are translated to internal binary states which later, can be assigned to logical signal to get a specific operation. SIL-A is provided with 32 outputs. Physical outputs are the real outputs of the device. SIL-A has up to 7 physical outputs, (3, 4, 5, 6 or 7 outputs depending on model) and the rest of them are logic outputs to configure the relay. Besides, the relay is provided with 32 alarms. The first 6 alarms correspond to the 6 configurable front LEDs and the rest are logic alarms to configure the relay. All the outputs (physical and logic alarms, physical and logic outputs) are the result of a PROGRAMMABLE LOGIC CONTROL which can be configured from HMI or from SICom software. In addition, the following 25 predefined actions and 7 free PGCs are available to be configured by the user in the PGC configuration section:

Logical inputs	Description
Open Breaker	Conditions to send the open breaker command
Close Breaker	Conditions to send the close breaker command
79 Block (*)	Conditions to send the 79 Block command
79 Unblock (*)	Conditions to send the 79 Unblock command
Local Control	Conditions to send the Local Control command
Remote Control	Conditions to send the Remote Control command
52a (*)	Circuit breaker contact a
52b (*)	Circuit breaker contact b
Settings Group 1	Active Settings Group assignment
Settings Group 2	Active Settings Group assignment
Hot Line Tag	Conditions to activate the Hot Line Tag. When it is activated, the function 79 is blocked and reclosing is not permitted.
79 Enable (*)	Conditions to activate auto reclosing
79N1 Start (*)	Start of first cycle of 79 protection function
79N2 Start (*)	Start of second cycle of 79 protection function
79N3 Start (*)	Start of third cycle of 79 protection function
79N4 Start (*)	Start of fourth cycle of 79 protection function
DFR Start	Disturbance Fault Report Start
50BF Start (*)	Start of circuit breaker failure protection
SOTF Start (*)	Conditions to start the switch on to fault function
Reset Thermal Image	Conditions to reset the thermal image
74TCS Coil A Continuity (*)	Trip circuit supervision input for coil A
74TCS Coil B Continuity (*)	Trip circuit supervision input for coil B
Neutral Block	Conditions to block neutral trip
Phase Block	Conditions to block phase trip
External trip	External Trip
PGC 1	Free PGC 1
PGC 2	Free PGC 2
PGC 3	Free PGC 3
PGC 4	Free PGC 4
PGC 5	Free PGC 5
PGC 6	Free PGC 6
PGC 7	Free PGC 7 / Input 3 for LMS Bypass (additional function 9 model)

(*) depending on the model and additional functions digit

For each output, there is a LOGICAL GATE. It can perform a logical operation up to 4 binary states to obtain other binary result. The LOGICAL GATES that are supported by SIL-A are:

LOGICAL GATE	HMI SYMBOL
OR4	OR
OR4 PULSE	OR 1P
OR4 PULSES	OR PS
OR4 BLINKING	OR BL
OR4 TIMER UP	OR TU
OR4 TIMER DOWN	OR TD
NOR4	NOR
NOR4 PULSE	NOR 1P
NOR4 PULSES	NOR PS
NOR4 BLINKING	NOR BL
NOR4 TIMER UP	NOR TU
NOR4 TIMER DOWN	NOR TD
AND4	AND
AND4 PULSE	AND 1P
AND4 PULSES	AND PS
AND4 BLINKING	AND BL
AND4 TIMER UP	AND TU
AND4 TIMER DOWN	AND TD
NAND4	NAND
NAND4 PULSE	NAND 1P
NAND4 PULSES	NAND PS
NAND4 BLINKING	NAND BL
NAND4 TIMER UP	NAND TU
NAND4 TIMER DOWN	NAND TD
XOR4	XOR

LOGICAL GATE	HMI SYMBOL
XOR4 PULSE	XOR 1P
XOR4 PULSES	XOR PS
XOR4 BLINKING	XOR BL
XOR4 TIMER UP	XOR TU
XOR4 TIMER DOWN	XOR TD
RSFF	RSFF
RSFF PULSE	RSFF 1P
RSFF PULSES	RSFF PS
RSFF BLINKING	RSFF BL
RSFF TIMER UP	RSFF TU
RSFF TIMER DOWN	RSFF TD
RSFF NON VOLATIL	RSFF NV
SRFF	SRFF
SRFF PULSE	SRFF 1P
SRFF PULSES	SRFF PS
SRFF BLINKING	SRFF BL
SRFF TIMER UP	SRFF TU
SRFF TIMER DOWN	SRFF TD
SRFF NON VOLATIL	SRFF NV
R_EDGE	R EDGE
R_EDGE PULSE	R EDGE 1P
F_EDGE4	F EDGE
F_EDGE4 PULSE	F EDGE 1P

By default, configuration is:

Output	Description	Criteria	States	Logic Gate
OUTPUT 1	Ready	Self-Diagnosis Self-Diagnosis General	Hardware Error Model Error Ready	RRSS
OUTPUT 2	Close Breaker	PGC	Close Breaker	OR
OUTPUT 3	Open Breaker	PGC General	Open Breaker Trip	OR
ALARM LED	**Description**	**Criteria**	**States**	**Logic Gate**
ALARM 1	Ready	Self-Diagnosis Self-Diagnosis General	Hardware Error Model Error Ready	RSFF
ALARM 2	Phase Trip	General HMI USB COM	Phase Trip Key reset Reset	SRFF
ALARM 3	Neutral Trip	General HMI USB COM	Neutral Trip Key reset Reset	SRFF
ALARM 4	Settings Group 1	General	Settings Group 1	OR BL
ALARM 5	Settings Group 2	General	Settings Group 2	OR BL
ALARM 6	Local Control	General	Local Control	OR
CONTROL LED	**Description**	**Criteria**	**States**	**Logic Gate**
Led 7	52 Closed	Control Leds	Virtual Led-2 Virtual Led-3	OR
Led 8	79 Blocked	79	Blocked	OR
Virtual Led-1	-	-	-	-
Virtual Led-2	52 WITHOUT ERROR	52 52	Closed Error (NOT)	AND
Virtual Led-3	52 ERROR	52	Error	OR_PULSES

7. SUMMARY OF SILA RATINGS FOR UL MODEL

For models SILAxxxxxxxRxx, SILAxxxxxxxSxx, SILAxxxxxxxTxx:

Installation:

The relay must be used within the stipulated electrical and environmental limits (Surrounding air temperature of 70 ºC). Suitable for mounting in a flat surface of a type 1 enclosure.

Terminals:

Use copper conductors only, rated 75 ºC minimum.

Outputs, inputs, serial communication, and auxiliary power terminals for 24 AWG – 12 AWG: 0.25 - 2.5 mm2 cable with a torque of 4.42-5.31 lb in (0.5 Nm-0.6 Nm).

Current terminals for 10 AWG – 24 AWG with a torque of 8 – 13 in-lbs.

Auxiliary supply:

24-220Vdc (±20%) / 100-230 Vac (±15%).

Current inputs:

Nominal current (In) 1A or 5A.

15A Continuous, 30xIn for 10 seconds, 100xIn for 1 second.

Measurement range: 0.01xIn – 30xIn.

Accuracy: ±2% in a band of ± 20% the nominal current and ±4% or ± 5 mA in the rest of the range.

Voltage inputs:

Only for models with an ‘8’ in the fifth digit.

Nominal Voltage (Un): 130Vac maximum.

2xUn Continuous, 2.4xUn for 10 seconds.

Accuracy: ±1% in a band of ± 20% the nominal voltage and ±4% in the rest of the range.

Digital outputs:

Configurable outputs: DO1, DO3, DO4, DO5, DO6 or DO7:

1A - 250Vac.

1A - 30Vdc.

Tripping Digital Outputs: DO-2, DO-4:

4A continuous - 250Vac.

4A continuous - 30Vdc.

250 Vac or 30 Vdc.

30 A make for 0.2 s.

Digital inputs:

3, 5, 6 or 9 Inputs. Activated at 24-230 Vac/Vdc +10/-20%.

Overvoltage category: III.

Pollution degree: 2.

8. FLOWCHART

8.1. Test menu

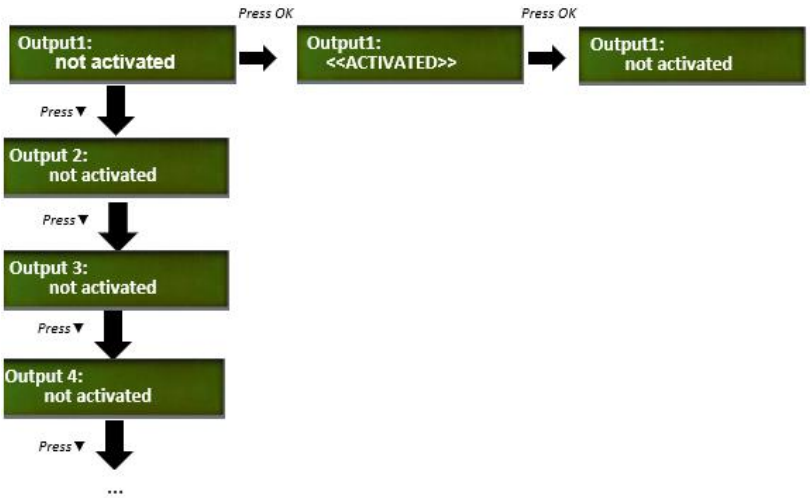
From standby screen, press ◄,▼,► sequentially and hold OK until the 'Test menu' appears on the display. The relay will ask for the password '5555' to be entered in the test menu (or other if the customer password by default is '5555' has been modified). The test menu is accessed by pressing the 'OK' key again, and the '▲' and '▼' keys can be used to navigate through the different menu items.

All the LEDs will be activated simultaneously when entering on Test Menu. In case of the outputs, they will be activated or deactivated by pressing OK key.

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, by pressing "OK" the Output is activated and by 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.

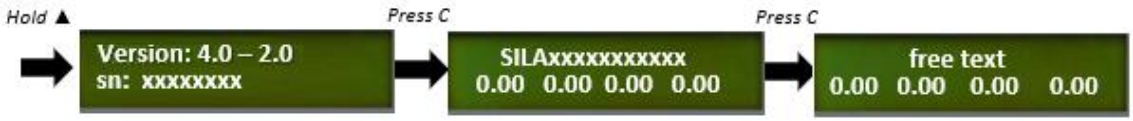


8.2. Direct Access

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. The relay will ask for the password, use "▲" and "▼" keys to put the password and "OK" to enter the menu. 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.

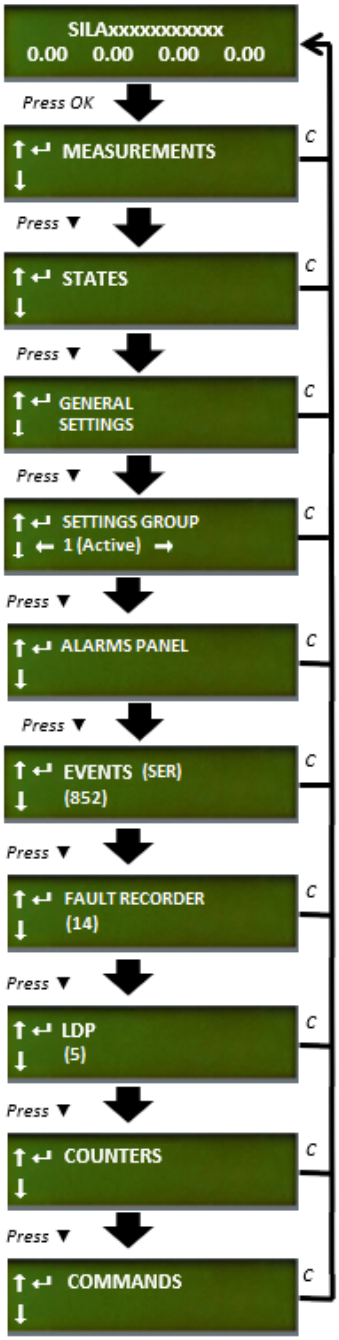
Press the "C" key to return to the standby mode screen.

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.

8.3. Menus



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

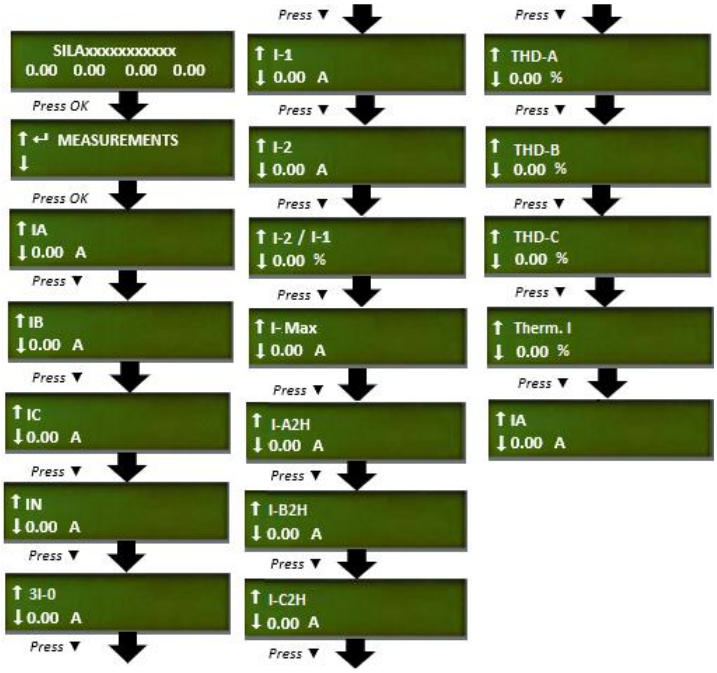
- Measurements
- States
- General Settings
- Settings Groups
- Alarms Panel
- Events
- Fault Recorder
- LDP
- Counters
- Commands

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

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

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

8.3.1.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.

(*) Depending on model different measurements will be shown.

8.3.2.States menu

States menu indicates the statuses 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 to the states menu.

The states are grouped by their criteria. Move the cursor over the criterias with “▲” and “▼” keys 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.

(*) Depending on model different statuses are available.

How to configure a signal

As an example, Led 8 is configured to general trip with AND logical signal.

From the standby mode screen, press the “OK” key to access the first line of menus. Use “▼” key untill “STATES” menu appears. Pressing “OK” key it is accessed to this menu.

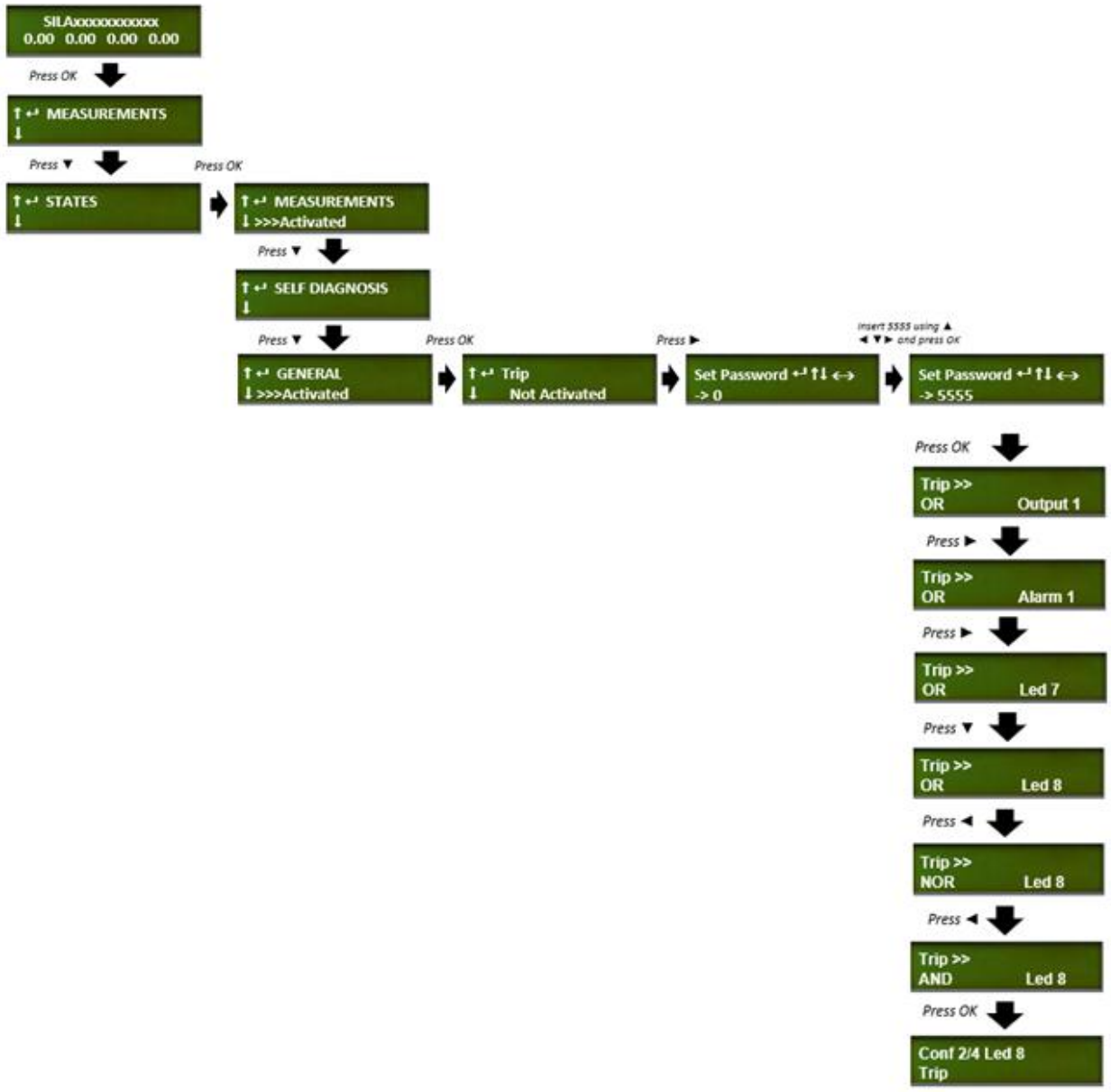
Use “▼” key to overview the submenu options and press “OK” on “GENERAL” submenu. Press “OK” key to access the menu and use “▼” key until the desired status appears. Press “►” key, insert the password 5555 and then press “OK”.

Press “►” key until the desired criteria appears and then “▼” key until the status in this criteria group that is wanted to be configured shows.

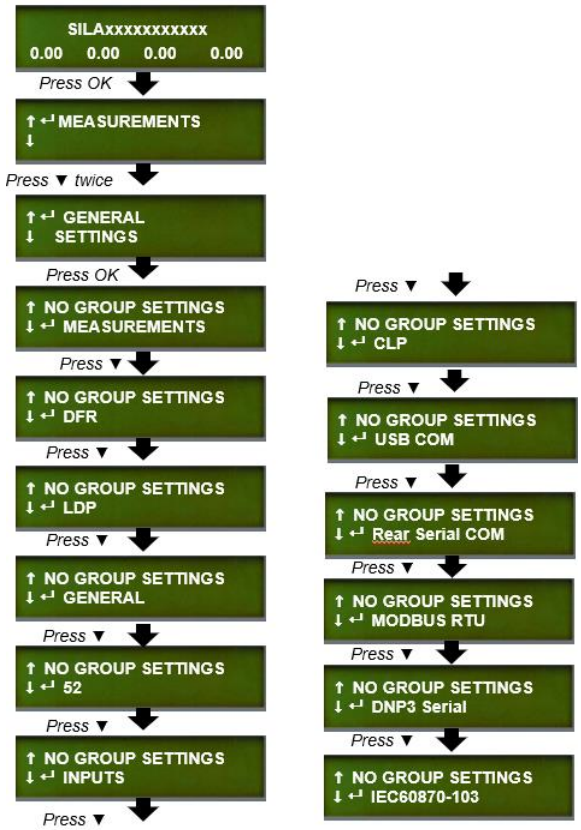
To select the logic gate, press “◄” key until the desired gate appears. Finally press “OK”.

This procedure is the same if instead of a status in the “GENERAL” criteria of the “STATES” menu, a status in another criteria group wants to be configured.

To erase the configuration, go to “CONTROL LEDS” in the “STATES” menu, press “OK” in the desired Led (use “▼” key to browse the different Leds) and hold the “RESET” button in the signal that is wanted to erase until the password is asked for. After inserting the password, it is possible to confirm the deletion of the signal.



8.3.3.Settings menus



General settings

General settings establish some parameters that are necessary for the relay to operate. These settings are defined as general because they affect the entire relay.

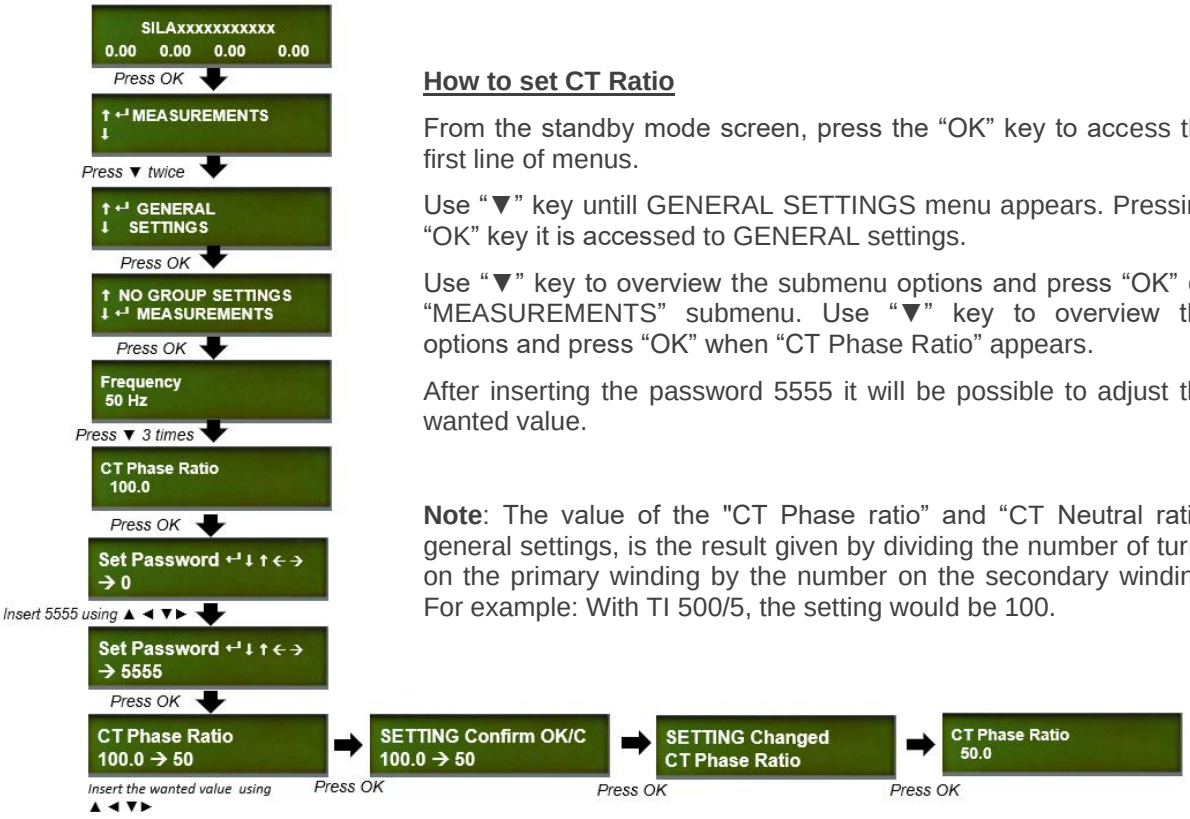
From the standby mode screen, press the “OK” key to access the first line of menus.

Use the “▲” and “▼” keys to position the cursor over the “GENERAL SETTINGS”. Press “OK” key to access.

From the general settings menu other sub menus of settings can be access.

(*) Depending on model different submenus will be available.

NOTE:The general setting "Identification" (on GENERAL submenu) can be viewed from the HMI, but it can only be modified by using the SICom program.



How to set CT Ratio

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

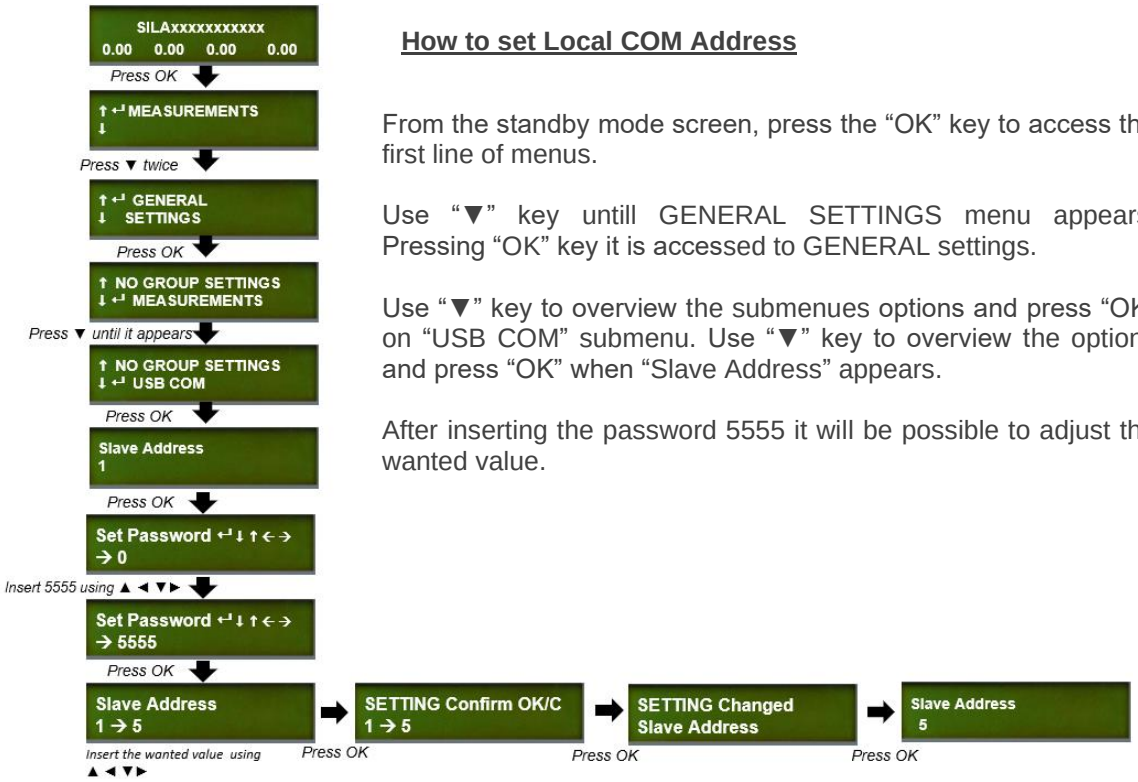
Use “▼” key untill GENERAL SETTINGS menu appears. Pressing “OK” key it is accessed to GENERAL settings.

Use “▼” key to overview the submenu options and press “OK” on “MEASUREMENTS” submenu. Use “▼” key to overview the options and press “OK” when “CT Phase Ratio” appears.

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

Note: 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 500/5, the setting would be 100.

How to set Local COM Address



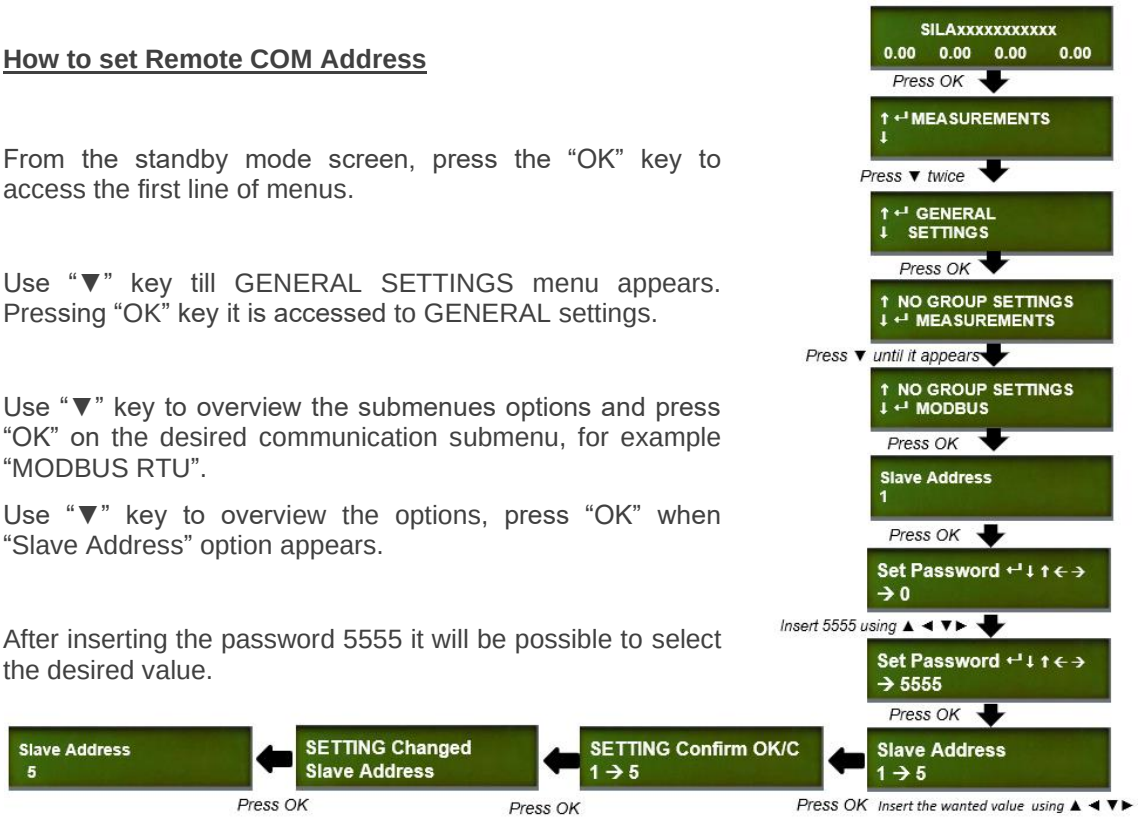
From the standby mode screen, press the “OK” key to access the first line of menus.

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

Use “▼” key to overview the submenues options and press “OK” on “USB COM” submenu. Use “▼” key to overview the options and press “OK” when “Slave Address” appears.

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

How to set Remote COM Address



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

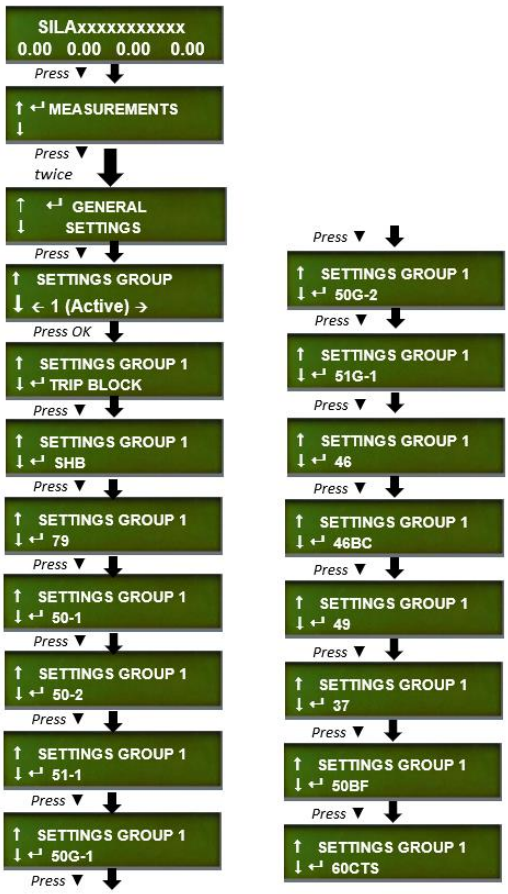
Use “▼” key till GENERAL SETTINGS menu appears. Pressing “OK” key it is accessed to GENERAL settings.

Use “▼” key to overview the submenues options and press “OK” on the desired communication submenu, for example “MODBUS RTU”.

Use “▼” key to overview the options, press “OK” when “Slave Address” option appears.

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

Settings groups



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 GROUP” screen. With “►” and “◄” keys the settings group table can be choose. The table that is being used will appear with “(active)” message. Press “OK” on the desired table to enter on its settings.

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

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

(*) Depending on model different settings are available

50 protection function

The parameters to adjust are:

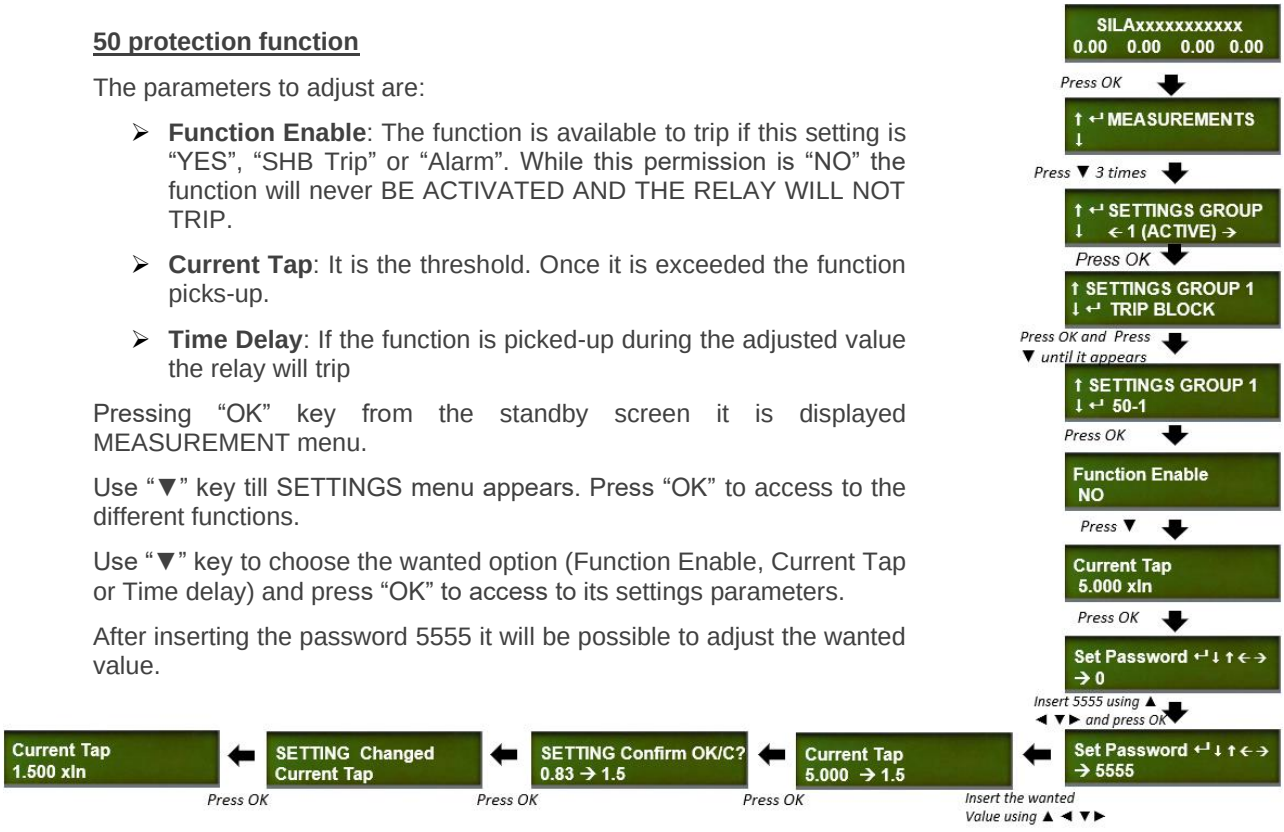
- **Function Enable**: The function is available to trip if this setting is “YES”, “SHB Trip” or “Alarm”. While this permission is “NO” the function will never BE ACTIVATED AND THE RELAY WILL NOT TRIP.
- **Current Tap**: It is the threshold. Once it is exceeded the function picks-up.
- **Time Delay**: 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.

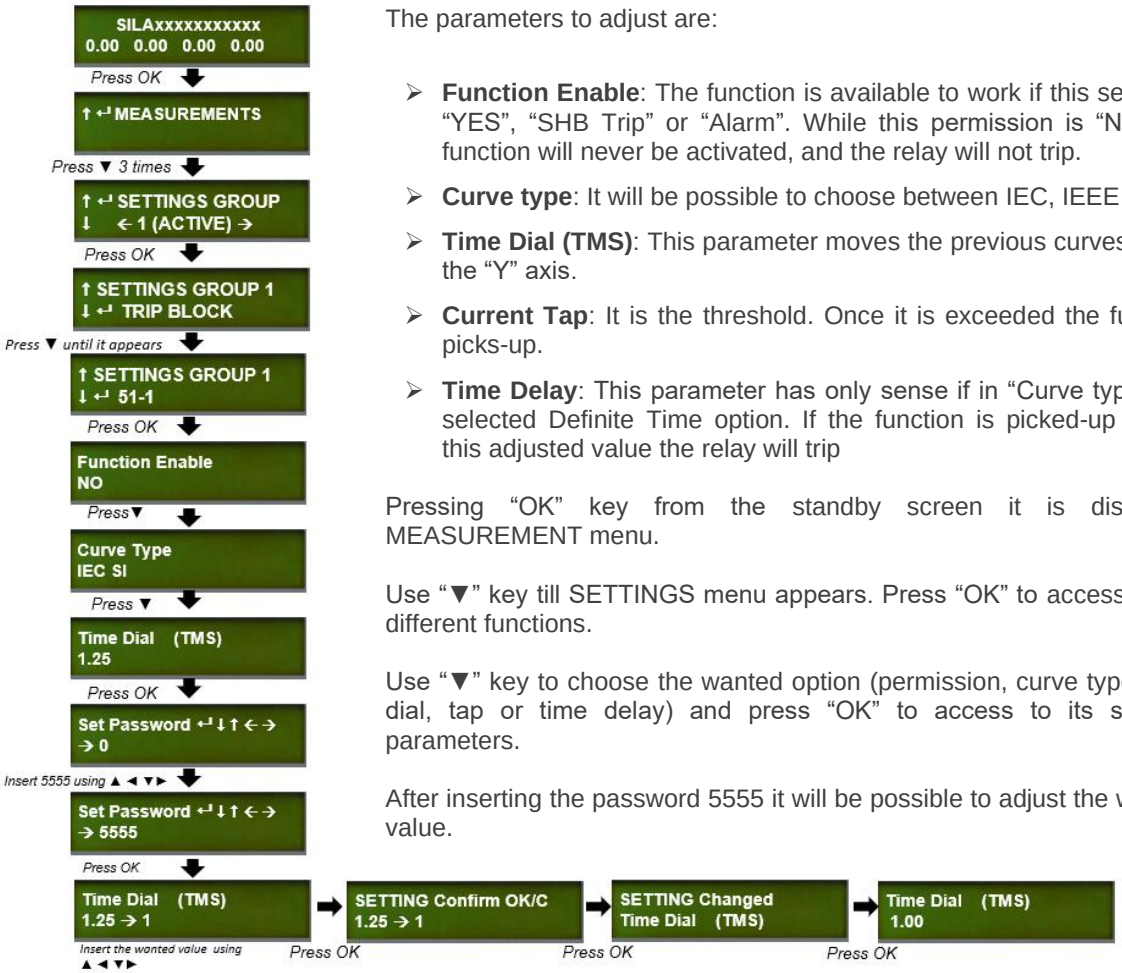
Use “▼” key till SETTINGS menu appears. Press “OK” to access to the different functions.

Use “▼” key to choose the wanted option (Function Enable, Current 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:

- **Function Enable**: The function is available to work if this setting is "YES", "SHB Trip" or "Alarm". 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, IEEE or TD.
- **Time Dial (TMS)**: This parameter moves the previous curves along the "Y" axis.
- **Current 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.

8.3.4.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.

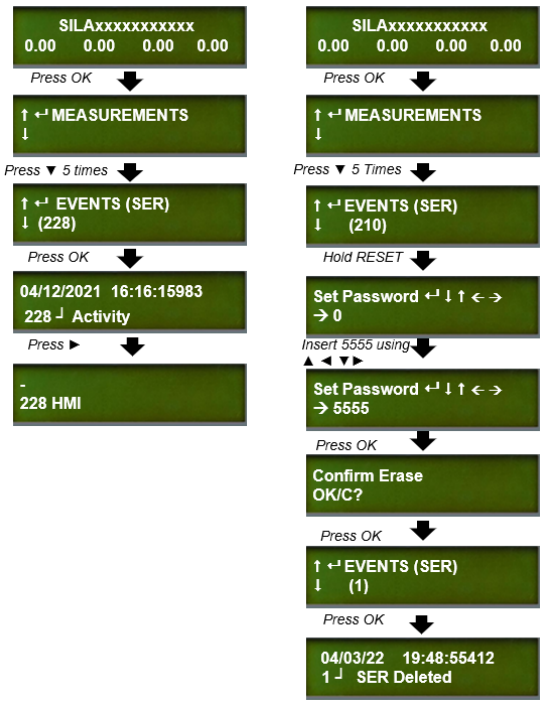
The "┘" and "┐" shows the event has been caused by the activation or deactivation.

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 ("-" if there is not)



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 “SER deleted” event.

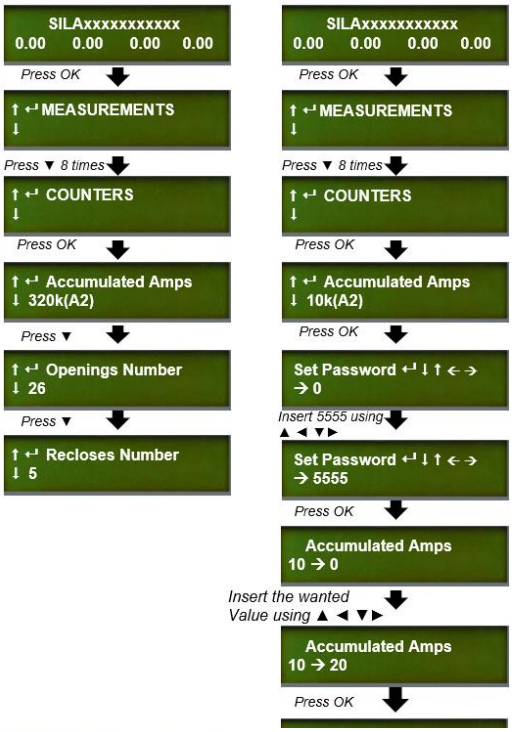
NOTE: When the events are deleted, the fault reports persist in the relay to analyze the fault situation until these fault reports are deleted consciously by the user.

8.3.5.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.

Counters give us the following information:

- Acumulated Amps
- Openings Number
- Reclosings Number



How to set a counter

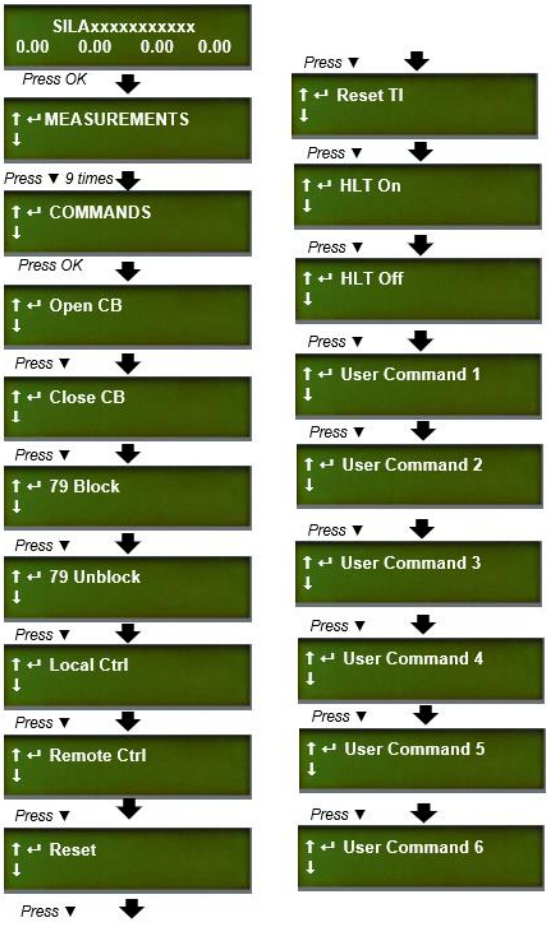
To set a counter from the relay it is necessary to insert the password 5555 from the specific counter menu.

8.3.6.Commands

SIL-A relay provides up to 8 commands that can be executed from the HMI:

- Open / Close breaker
- 79 Block / Unblock
- Local / Remote Control
- Reset
- Reset TI (*)

(*) Depending on model different commands are available.



How to execute a command

To execute a command from the relay it is necessary to insert the password 5555 on the specific command menu.

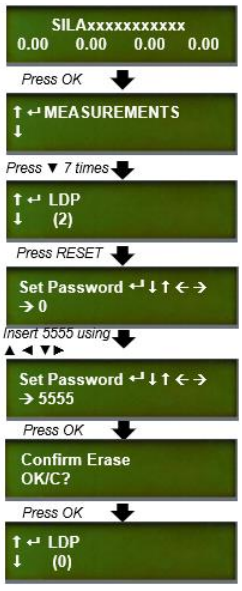
8.3.7. Demand (LDP)

SIL-A relay provides the demand of current with the following characteristics:

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

  Date/Time; IMAX (in interval); IMAX (actual)

  IA; IB; IC; IN



How to delete the demand

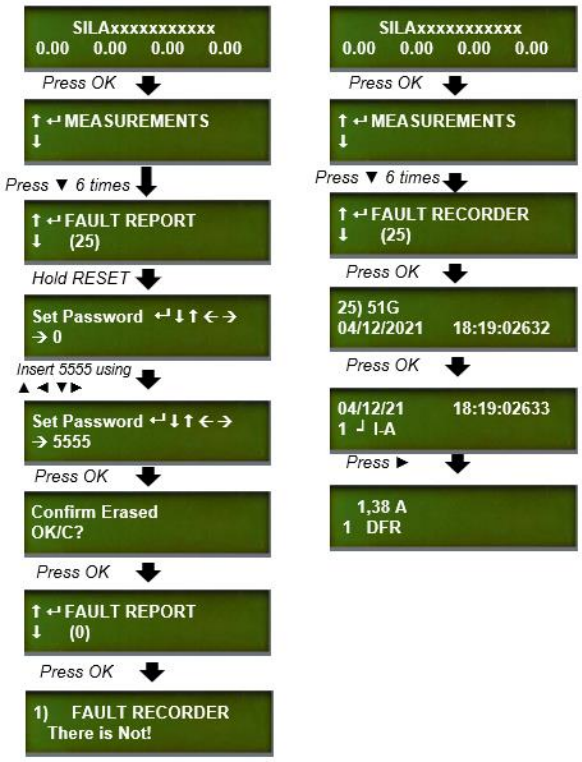
To delete the demand from the relay it is necessary to insert the password 5555 from the LDP menu.

8.3.8.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.

9. COMMISIONING

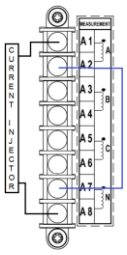
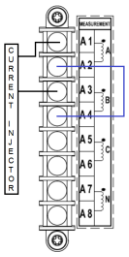
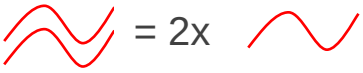
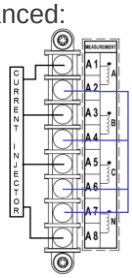
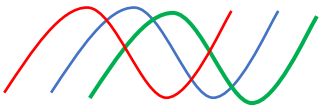
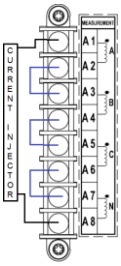
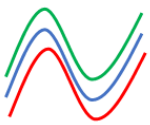
9.1. Thermal resistance

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

- 4 times rated current continuously.
- 30 times rated current for 20s.
- 100 times rated current for 1s.

- 2 times rated voltage continuosly.
- 2.4 times rated voltage for 10s.

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>  </td></tr>
<tr><td>Unbalanced (0°)</td><td>P-N Unbalanced:
  </td><td>  </td></tr>
</table>

Commisioning recommendation:

- It is possible to power the relay through the USB port for changing the protection functions settings. Connect it for setting and disconnect it for testing purpose.
- Adjust 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.
- Do not 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.

9.2. Measurements

Current Measurement

The accuracy of the current measurement is ±2% on a band of ±20% over the nominal current and ±4% or ±5 mA (greater of both) over the rest of the measurement range. Some examples are shown below:

- Current injected => I=1 A:→ ±2% accuracy is complied.

- Current injected => I=2A. As this current value is over the 20% of the nominal current (In= 1A) → 4% accuracy is complied.

Voltage Measurement (available depending on model)

The accuracy of the voltage measurement is ±1% on a band of ±20% over the nominal voltage and ±4% in the rest of the measurement range. Connection through VTs (Un setting: 100-130 V P-P): 3 to 250 V.

Angle Measurement

The accuracy of the angle measurement is ±2 degrees.

9.3. Protection functions

Current injection procedure:

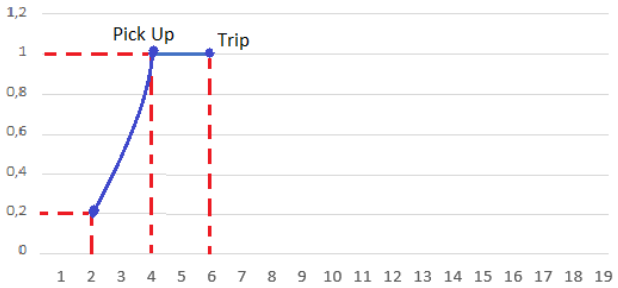
Adjust the Sverker current injector with HOLD 0.2A , and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line. From this value, increase the current to achieve the function pick-up and the function trip.

9.3.1.Protection functions testing

- 50 instantaneous phase overcurrent protection:

Settings:

- Function Enable: YES.
- Current Tap: 1xIn.
- Time: 2 (sec)



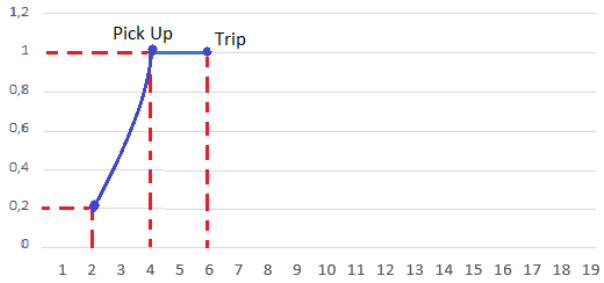
The following information will be checked:

- Pick-up at 100% of the tap
- Output 3 is activated
- LED 2 is activated

- 50N/G instantaneous neutral overcurrent protection:

Settings:

- Funciton Enable: YES.
- Current Tap: 1xIn.
- Time: 2 (sec)



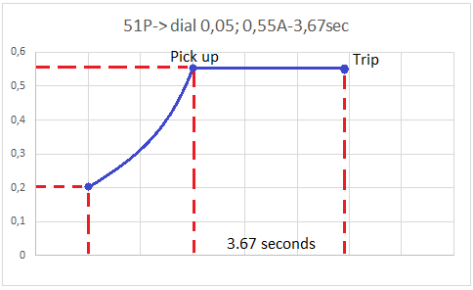
The following information will be checked:

- Pick-up at 100% of the tap
- Output 3 is activated
- LED 3 is activated

- 51 Inverse time phase overcurrent protection:

TEST 1:

Settings:



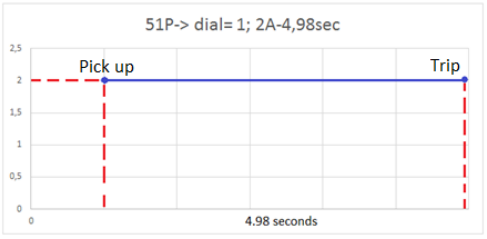
- Function Enable: YES.
- Curve: IEC Inverse.
- Dial (TMS): 0.05
- Current Tap: 0.5xIn.
- Theoretical tripping time= 3.67 seconds (Fault current 0.55 A)

The following information will be checked:

- Pick-up at 110% of the tap
- Output 3 is activated
- LED 2 is activated

TEST 2

Settings:



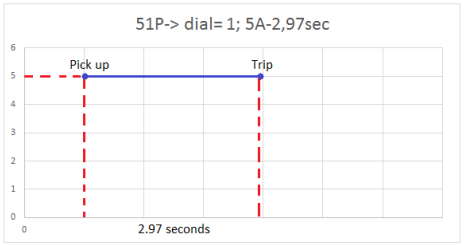
- Function Enable: YES.
- Curve: IEC Inverse.
- Dial (TMS): 1
- Current Tap: 0.5xIn.
- Theoretical tripping time = 4.98 seconds (fault current 2 A)

The following information will be checked:

- Pick-up at 110% of the tap
- Output 3 is activated
- LED 2 is activated

TEST 3

Settings:

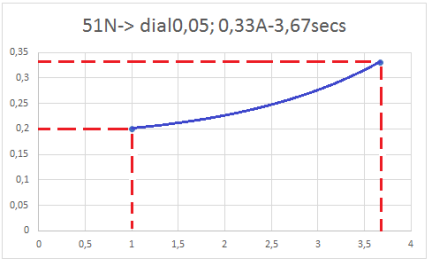


- Function Enable: YES.
- Curve: IEC Inverse.
- Dial (TMS): 0.5
- Current Tap: 16xIn.
- Theoretical tripping time = 5.01seconds (Fault current 32)

The following information will be checked:

- Pick-up at 110% of the tap
- Output 3 is activated
- LED 2 is activated

- 51N/G Inverse time neutral overcurrent protection:



TEST 1

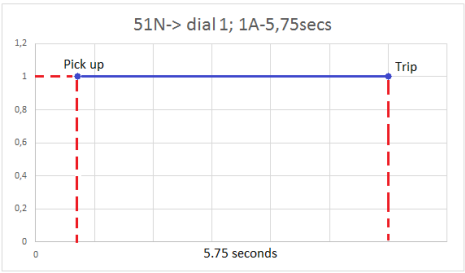
Settings:

- Function Enable: YES.
- Curve: IEC Inverse.
- Dial (TMS): 0.05
- Current Tap: 0.3xIn.
- Theoretical tripping time= 3.67 seconds (Fault current 0.33A)

The following information will be checked:

- Pick-up at 110% of the tap
- Output 3 is activated
- LED 3 is activated

TEST 2



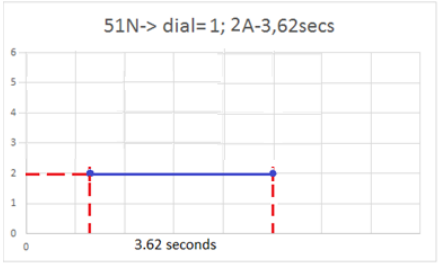
Settings:

- Function Enable: YES.
- Curve: IEC Inverse.
- Dial (TMS): 1
- Current Tap: 0.3xIn.
- Theoretical tripping time = 5.75 seconds (fault current 1A)

The following information will be checked:

- Pick-up at 110% of the tap
- Output 3 is activated
- LED 3 is activated

TEST 3



Settings:

- Function Enable: YES.
- Curve: IEC Inverse.
- Dial (TMS): 1.
- Current Tap: 0.3xIn.
- Theoretical tripping time = 2.97seconds (Fault current 2A)

The following information will be checked:

- Pick-up at 110% of the tap
- Output 3 is activated
- LED 3 is activated

Note: In TEST 2 and TEST 3 for 51 and 51G, 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.

10. SIL-A PROTOCOL

Code:	**Model:** SILAxxxxxxxxxx	**Serial Number**:		
Version		U305:		
		U820:		
		U905:		
		Texts:		
Insulation test		☐ OK		
Burning test (60ºC – 24 hours)		☐ OK		
Power supply test		Frontal port power supply (+5 Vdc)	☐ OK	
		24-230 Vac/dc Auxiliary power supply	☐ OK	
Signalling test		LED 1	☐ OK	
		LED 2	☐ OK	
		LED 3	☐ OK	
		LED 4	☐ OK	
		LED 5	☐ OK	
		LED 6	☐ OK	
		LED 7	☐ OK	☐ No apply
		LED 8	☐ OK	☐ No apply
Digital outputs test		OUTPUT 1	☐ OK	
		OUTPUT 2	☐ OK	
		OUTPUT 3	☐ OK	
		OUTPUT 4	☐ OK	☐ No apply
		OUTPUT 5	☐ OK	☐ No apply
		OUTPUT 6	☐ OK	☐ No apply
		OUTPUT 7	☐ OK	☐ No apply
Digital inputs test		INPUT 1	☐ OK	
		INPUT 2	☐ OK	
		INPUT 3	☐ OK	
		INPUT 4	☐ OK	☐ No apply
		INPUT 5	☐ OK	☐ No apply
		INPUT 6	☐ OK	☐ No apply
		INPUT 7	☐ OK	☐ No apply
		INPUT 8	☐ OK	☐ No apply
		INPUT 9	☐ OK	☐ No apply
Communication ports test		Frontal communication port (USB)	☐ OK	
		Rear communication RS485 port (ModBus RTU, IEC 60870-5-103 and DNP3.0 Serial)	☐ OK	
		Rear communication RJ45 port (ModBus TCP, DNP3.0 TCP and IEC60870-5-104) Rear TCP IP:192.168.200.100	☐ OK	☐ No apply
		Rear communication RJ45 port (IEC61850) IP:192.168.200.121	☐ OK	☐ No apply
Current measurement test		Phase A (R) (R)	☐ OK	
		Phase B (S) (Y)	☐ OK	
		Phase C (T) (B)	☐ OK	
		Neutral N	☐ OK	
Voltage measurement test		Neutral N	☐ OK	
Angle measurement test		Neutral N	☐ OK	
Protection functions test		50 (I>> High set Phase O/C)	☐ OK	
		50N (I0>> High set E/F)	☐ OK	☐ No apply
		50G (IG>> High set E/F)	☐ OK	
		51 (I> Low set Phase O/C)	☐ OK	
		51N (I0> Low set E/F)	☐ OK	☐ No apply
		51G (IG> Low set E/F)	☐ OK	
		46 (Phase balance protection)	☐ OK	☐ No apply
		37 (I< Instantaneous phase undercurrent)	☐ OK	☐ No apply
		59G (U0>> Neutral Overvoltage)	☐ OK	☐ No apply
		67G (IG> Low set Directional E/F)	☐ OK	☐ No apply
		67GI (IG> Low set Directional E/F isolated neutral)	☐ OK	☐ No apply

	67NI (I0> Low set Directional E/F isolated neutral)	☐ OK	☐ No apply
Settings & configuration test	RTC	☐ OK	
	E2PROM Serial	☐ OK	
	FRAM	☐ OK	
	Default settings record	☐ OK	
	Default configuration record	☐ OK	
	Events check and reset	☐ OK	
	DFR check and reset	☐ OK	
	Version checking	☐ OK	

QC Final check	☐ PASSED
Sign & Stamp	

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