SIA-C
WITHDRAWABLE
Self Power O/C & E/F 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:

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

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

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

1.2. **Relay verification**

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

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

- LCD and front cover not damaged or scratched.

- Quality sticker and terminal sticker correctly stuck.

- Rear terminals in good state, being able to do a good wiring connection.
1.3. Powering the relay up with kitcom

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

The power comes from two AA batteries (IEC LR06) of 1.5 Volts placed at the bottom of the kitcom. The equipment has a small Dc/Dc power supply that raises the voltage till the required 12 volts to operate the equipment and that is plugged into the front RS232 communications port (KITCOM).

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

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

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

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

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

Once the relay is powered through the Kitcom, it 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 the name of phase and neutral currents (instead the complete model) is displayed on the top of LCD Standby screen

```
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
```

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

- **Firmware Version** ➔ In “Firmware Version” menu (HOLD ▲)
1.3.1. **Keypad & LCD**

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

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

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

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

1.3.2. **Test menu**

**NOTE:** When performing test menu, protection won’t be available and it will possible to open circuit breaker. Only authorized personnel can do this job.

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

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

<table>
<thead>
<tr>
<th>Action</th>
<th>Checking</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK, OK</td>
<td>Led 1 activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>Led 2 activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>Led 3 activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>Trip output activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>Output 2 activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>Output 3 activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>Output 4 activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>O/C Trip activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>HS O/C Trip activated</td>
</tr>
<tr>
<td>▼, OK</td>
<td>E/F &amp; HS E/F O/C Trip activated</td>
</tr>
<tr>
<td>C</td>
<td>Skip from test menu</td>
</tr>
</tbody>
</table>
1.4. Relay installation

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

The relay should be installed in the cut-out of the switchgear, according to the dimensional cut defined in User Manual. Try to enter the relay smoothly, not forced. Don’t damage lateral sides of the relay and fix it securely.

This Withdrawable SIA C relay is based on two parts:

- External part: This is the part that will be permanently fixed in the panel and the one that will allow the connection of the Current Transformers by means of shortcircuitable terminal contacts.
- Internal part: This part is the one containing all the PCBs and circuits, components of the relay. In improbably case of relay failure, it is only necessary to take out this part and substitute it by a new one

1.5. Relay rear part

Consider the wiring of the switchgear and connect relay properly:

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Phase A current input for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A2</td>
<td>Phase A current output for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A3</td>
<td>Phase B current input for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A4</td>
<td>Phase B current output for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A5</td>
<td>Phase C current input for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A6</td>
<td>Phase C current output for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A7</td>
<td>Neutral current input for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>A8</td>
<td>Neutral current output for Measurement &amp; Self-powering</td>
</tr>
<tr>
<td>D10-D11</td>
<td>O/C Trip digital output</td>
</tr>
<tr>
<td>D12-D13</td>
<td>E/F Trip digital output</td>
</tr>
<tr>
<td>D14-D15</td>
<td>Watchdog digital output</td>
</tr>
<tr>
<td>D16</td>
<td>Trip output positive</td>
</tr>
<tr>
<td>D17</td>
<td>Trip output gnd</td>
</tr>
</tbody>
</table>
1.6. Connection diagram

1.6.1. Connection diagram. Three CTs and solid neutral.

![Connection diagram](image)

2. USER INTERFACE

2.1. Relay front part

![Relay front panel](image)

2.2. Bistable magnetic indicators (flags)

The front panel is equipped with 3 bistable magnetic indicators which indicate the specific cause of the last trip, O/C Trip HS O/C Trip or E/F & HS E/F Trip respectively. The indicators remain in position even when the equipment loses power, so that the maintenance service can see the cause of the trip even through the equipment is not powered.

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

<table>
<thead>
<tr>
<th>3 bistables</th>
<th>Magnetic indicator “O/C TRIP” activated</th>
<th>A trip has been caused by phase inverse time overcurrent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Magnetic indicator “HS-O/C TRIP” activated</td>
<td>A trip has been caused by phase instantaneous time overcurrent</td>
</tr>
<tr>
<td></td>
<td>Magnetic indicator “E/F&amp;HS E/F TRIP”</td>
<td>A trip has been caused by neutral instantaneous overcurrent or neutral inverse time overcurrent</td>
</tr>
</tbody>
</table>
2.3. **LED Indicators**

The SIA-C front panel has three configurable LEDs. By default, they show: healthy, self-power and battery.

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>Healthy: Activated (LED blinking) if it detects the relay is ready</td>
</tr>
<tr>
<td>LED 2</td>
<td>Self power: Activated (LED blinking) if it detects the self-power current</td>
</tr>
<tr>
<td>LED 3</td>
<td>Battery: Activated (LED blinking) if it detects voltage from an external battery</td>
</tr>
</tbody>
</table>

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

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

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

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

<table>
<thead>
<tr>
<th>ACCESS LEVEL</th>
<th>Read-only permission: Status and measurements</th>
<th>Settings Events</th>
<th>Permission to: Change settings Download and Delete the Events buffer</th>
<th>Permission to: Execute Commands</th>
<th>Permission to: Change Configuration</th>
<th>Permission to: Change Protected Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>2</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>3</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>4</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>5</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PASSWORD</th>
<th>ACCESS LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2222</td>
<td>2</td>
</tr>
<tr>
<td>3333</td>
<td>3</td>
</tr>
<tr>
<td>4444</td>
<td>4</td>
</tr>
<tr>
<td>5555</td>
<td>5</td>
</tr>
</tbody>
</table>

3. FUNCTIONAL DIAGRAM
## 4. TECHNICAL SPECIFICATION

### Complete model

**SIAC11500032AFA:**
- 1: Phase measurement $I_n = 1$ A; (0.10 – 30.00 A)
- 1: Neutral measurement $I_n = 1$ A; (0.10 – 30.00 A)
- 5: Net frequency $\rightarrow$ 50 Hz
- 0: Power supply $\rightarrow$ Self powered
- 0: Additional functions $\rightarrow$ striker
- 0: Communications $\rightarrow$ Local ModBus port (RS 232)
- 3: Inputs-Outputs $\rightarrow$ 3 outputs for signaling
- 2: Memory $\rightarrow$ Non-volatile RAM memory + Fast start-up
- A: Language $\rightarrow$ English, Spanish, and German
- F: Mechanic $\rightarrow$ Vertical, Compact Size, 3 Flags, Backlight LCD, withdrawable
- A: Adaptation $\rightarrow$ 50_2 + 50N/G_2 + 3 Settings group

### Function 50_1

- **Permission:** yes/no
- **Operating range:** 0.10 to 30 x In (step 0.01 x In)
- **Operating time:** 0.02 to 300 s (step 0.01 s)
- **Activation level 100%**
- **Deactivation level 95%**
- **Instantaneous deactivation**
- **Timing accuracy:** $\pm$ 20 ms or $\pm$ 0.5% (whichever is greater)

### Function 50_2

- **Permission:** yes/no
- **Operating range:** 0.10 to 30 x In (step 0.01 x In)
- **Operating time:** 0.02 to 300 s (step 0.01 s)
- **Activation level 100%**
- **Deactivation level 95%**
- **Instantaneous deactivation**
- **Timing accuracy:** $\pm$ 20 ms or $\pm$ 0.5% (whichever is greater)

### Function 50N/G_1

- **Permission:** yes/no
- **Operating range:** 0.10 to 30 x In (step 0.01 x In)
- **Operating time:** 0.02 to 300 s (step 0.01 s)
- **Activation level 100%**
- **Deactivation level 95%**
- **Instantaneous deactivation**
- **Timing accuracy:** $\pm$ 20 ms or $\pm$ 0.5% (whichever is greater)

### Function 50N/G_2

- **Permission:** yes/no
- **Operating range:** 0.10 to 30 x In (step 0.01 x In)
- **Operating time:** 0.02 to 300 s (step 0.01 s)
- **Activation level 100%**
- **Deactivation level 95%**
- **Instantaneous deactivation**
- **Timing accuracy:** $\pm$ 20 ms or $\pm$ 0.5% (whichever is greater)

### Function 50/51

- **Permission:** yes/no
- **Operating range:** 0.10 to 7 x In (step 0.01 x In)
- **Curves:** IEC 60255-151 and IEEE
- **Operating time:** IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve
- **Defined time:** 0.02 to 300 s (step 0.01 s)
- **Dial:** 0.02 to 1.25 (step 0.01)
- **Curve, activation level 110%**
- **Curve, deactivation level 100%**
| Function 50/51N/G | Defined time, activation level 100%  
|                  | Defined time, deactivation level 95%  
|                  | Instantaneous deactivation  
|                  | Timing accuracy: ± 5% or ±30 ms (whichever is greater) when the protection works with inverse time and ± 20 ms or ± 0.5% (whichever is greater) when it works with definite time  
| Permission: yes/no | Operating range: 0.10 to 7 x In (step 0.01 x In)  
| Curves: IEC 60255-151 and IEEE | Operating time: IEC Inverse curve, IEC very inverse curve, IEC extremely inverse curve IEC long time inverse, IEEE Inverse curve, IEEE very inverse curve, IEEE extremely inverse curve. Defined time: 0.02 to 300 s (step 0.01 s)  
| Dial: 0.02 to 1.25 (step 0.01) | Curve, activation level 110%  
| Curve, deactivation level 100% | Defined time, activation level 100%  
| Defined time, deactivation level 95% | Instantaneous deactivation  
| Timing accuracy: ± 5% or ±30 ms (whichever is greater) when the protection works with inverse time and ± 20 ms or ± 0.5% (whichever is greater) when it works with definite time  
| Programmable logic control (PLC) | OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, AND4_LATCH, NOR4_TIMERUP, NOR4_PULSE, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, NAND4, NAND4_TIMERUP, NAND4_PULSE, NOR4_PULSES  
| Fault reports | 20 fault reports, 16 events in each  
| Demand of current | Demand of current with the following characteristics:  
|                  | • Number of records: 168  
|                  | • Recording mode circular  
|                  | • Sampling rate (interval): configurable through communications: 1 – 60 min  
|                  | • Record format: Date/Time; IMAX (in interval); IMAX (actual); IA; IB; IC; IN  
| Trip output contact | For Striker: 24 Vdc-135 mJ  
| Signalling outputs contacts | 3 configurable outputs (output 2, output 3 and output 4):  
|                  | 220 Vdc – 1 A (30 W max)  
|                  | 250 Vac – 1 A (62.5 VA max)  
| Frequency | 50Hz  
| Communication | RS232 port: Modbus RTU  
| Battery supply | Externally, with adapter (Kitcom) port DB9  
| Self-power from current | Three phase self-power level:  
|                  | I > 0,1 x In  

www.fanox.com  
SIAC11500032AFA_Rev. 14  
11/32
### Environment
- **Operating temperature:** -40 to 70°C
- **Storage temperature:** -40 to 80°C
- **Humidity:** 95%

### Transformers
- **Power supply and measurement CT/1**

### Mechanical features
- **Metallic box**
- **Panel Mounting**
- **1/3 Rack – 4 U**
- **IP-54**

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

### 4.1. IEC60255-151 Curves

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

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

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

\[ t = \frac{A \times D}{V^P - Q} + B \times D + K \]

\[ V = \frac{I}{I_{adjusted}} \]

<table>
<thead>
<tr>
<th>Parameters</th>
<th>A</th>
<th>P</th>
<th>Q</th>
<th>B</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Time Inverse</td>
<td>120</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ext. Inverse</td>
<td>80</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Very Inverse</td>
<td>13.5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inverse</td>
<td>0.14</td>
<td>0.02</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

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

\( I_{adjusted} \) is the initial operating current, set by the user.
4.2. IEEE Curves

The IEEE curves follow the following mathematical equation:

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

\[ V = \frac{I}{I_{\text{adjusted}}} \]

And we have the following curves:

- Inverse Curve
- Very Inverse Curve
- Extremely Inverse Curve

Which relate to the parameters figuring in the following table:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>A</th>
<th>P</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext. Inverse</td>
<td>28.2</td>
<td>2</td>
<td>0.1217</td>
</tr>
<tr>
<td>Very Inverse</td>
<td>19.61</td>
<td>2</td>
<td>0.491</td>
</tr>
<tr>
<td>Inverse</td>
<td>0.0515</td>
<td>0.02</td>
<td>0.114</td>
</tr>
</tbody>
</table>

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

\( I_{\text{adjusted}} \) 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, this is, the trip is associated to a striker. There are a lot of models of strikers in the market, with different trip energies, being for example 50 mJ (0.05W·s) and operation voltage of 6V, or 135 mJ (0.1W·s) and operation voltage of 24V.

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

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

- 12 Vdc
- 17 Vdc
- 22 Vdc
- 24 Vdc

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

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

Striker

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

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

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

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

<table>
<thead>
<tr>
<th>LED Numbers</th>
<th>Output Gate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Led 1</td>
<td>OR4_PULSES</td>
</tr>
<tr>
<td>Led 2</td>
<td>OR4_PULSES</td>
</tr>
<tr>
<td>Led 3</td>
<td>OR4_PULSES</td>
</tr>
</tbody>
</table>

### PHYSICAL OUTPUTS

<table>
<thead>
<tr>
<th>Output Numbers</th>
<th>Output Gate</th>
<th>Binary States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip Output</td>
<td>OR4_PULSES</td>
<td>• General Trip</td>
</tr>
<tr>
<td>Output 2</td>
<td>AND4</td>
<td>• Phase Trip</td>
</tr>
<tr>
<td>Output 3</td>
<td>AND4</td>
<td>• Neutral Trip</td>
</tr>
<tr>
<td>Output 4</td>
<td>NOR4</td>
<td>• Ready</td>
</tr>
</tbody>
</table>

**NOTE**: The option OR4_LATCH is only applicable for relays with trip outputs designed for coils (this configuration is not applicable for relays with trip output designed for strikers). Besides, as it is described above, the options NOR4_LATCH and NAND4_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, outputs configuration is:

<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>LOGICAL GATE</th>
<th>BINARY STATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>OR4_PULSES</td>
<td>• Ready</td>
</tr>
<tr>
<td>LED 2</td>
<td>OR4_PULSES</td>
<td>• Self-Power</td>
</tr>
<tr>
<td>LED 3</td>
<td>OR4_PULSES</td>
<td>• Battery</td>
</tr>
<tr>
<td>Trip output</td>
<td>OR4_PULSES</td>
<td>• General Trip</td>
</tr>
<tr>
<td>Output 2</td>
<td>AND4</td>
<td>• Phase Trip</td>
</tr>
<tr>
<td>Output 3</td>
<td>AND4</td>
<td>• Neutral Trip</td>
</tr>
<tr>
<td>Output 4</td>
<td>NOR4</td>
<td>• Ready</td>
</tr>
</tbody>
</table>

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

- Single phase \(0.35 \times I_n\), this is 0.35 amperes.
- Three phase \(0.17 \times I_n\), this is 0.17 amperes.
7. FLOWCHART

7.1. Test menu

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

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

To go through all options, press “▼”. To activate and deactivate the options follow the same steps as in case of Led 1.
7.2. Direct Access

Version
The equipment versions menu can be accessed from the standby mode screen by holding “▲” key.
Press the “C” key to return to the standby mode screen.

Date and time
Press the “►” key from the standby mode screen to access the date and time menu
Press the “OK” key to access the date-time modification screen. Use the “►” and “◄” keys to position the cursor over the digit that you want to change, and assign a value to this digit using the “▲” and “▼” keys. Once the date-time has been entered, press “OK” to change the equipment date.
Press the “C” key to return to the standby mode screen.

Contrast
Hold “◄” key from standby menu to access to Contrast menu. Use the “▲” and “▼” keys to select the desired value.
Press the “C” key to return to the standby mode screen.

Communication parameters
Hold “▼” key from standby menu to access to communication parameters menu.
Press the “C” key to return to the standby mode screen.
7.3. Menus

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

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

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

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

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

7.3.1. Measurements menu

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

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

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

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

States menu indicates the 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 you to the status groups' line.

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

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

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

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 protection function

The parameters to adjust are:

➢ **Permission**: The function is available to trip only if the permission is “YES”. While this permission is “NO” the function will never be activated and the relay will not trip.

➢ **Tap**: It is the threshold. Once it is exceeded the function picks-up.

➢ **Time Delay**: If the function is picked-up during the adjusted value the relay will trip.

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

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

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

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

51P protection function

The parameters to adjust are:

➢ **Permission**: The function is available to work only if the permission is “YES”. While this permission is “NO” the function will never be activated and the relay will not trip.

➢ **Curve type**: It will be possible to choose between IEC Inverse, IEC Very inverse, IEC Extremely Inverse and Definite time.

➢ **Time Dial**: This parameter moves the previous curves along the “Y” axis.

➢ **Tap**: It is the threshold. Once it is exceeded the function picks-up.

➢ **Time Delay**: This parameter has only sense if in “Curve type” it is selected Definite time option. If the function is picked-up during this adjusted value the relay will trip.

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

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

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

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

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

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

The value of the “CT Phase ratio” and “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 CT 500/5, the setting would be 100.

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

How to set CT Phase ratio

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

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

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

After inserting the password 5555 it will be possible to adjust the wanted value.
How to set Trip Voltage level

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

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

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

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

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 faults reports are deleted consciously by the user.
7.3.5. Demand menu

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

- Number of records: 168
- Recording mode circular
- Sampling rate (interval): configurable through communications: 1 – 60 min
- Record format:
  - Date/Time
  - IMAX (in interval)
  - IMAX (actual)
  - IA
  - IB
  - IC
  - IN

**How to delete the demand**

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

7.3.6. Fault reports menu

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

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

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

**How to delete the fault reports**

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

8.1. Thermal resistance

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

- 3xIn continuously
- 20xIn during 10 seconds
- 70xIn during 1 second

In the following table the different injection modes are described:

<table>
<thead>
<tr>
<th>CURRENT GENERATION</th>
<th>INJECTION MODE</th>
<th>INJECTION SYSTEM</th>
<th>RELAY CONNECTION</th>
<th>RELAY ENERGY WAVEFORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single phase</td>
<td>Phase-Neutral</td>
<td>NOT APPLY</td>
<td>P-N:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Waveform" /></td>
</tr>
<tr>
<td>Phase-Phase</td>
<td></td>
<td></td>
<td>P-P:</td>
<td><img src="image3" alt="Waveform" /></td>
</tr>
<tr>
<td>Three phase</td>
<td>Phase-Neutral</td>
<td>Balanced (120°)</td>
<td>P-N Balanced:</td>
<td><img src="image4" alt="Waveform" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Un balanced (0°)</td>
<td>P-N Unbalanced:</td>
<td><img src="image5" alt="Waveform" /></td>
</tr>
</tbody>
</table>

---

www.fanox.com  SIAC11500032AFA_Rev. 14  24 / 32
Considering this description, the real thermal image that will support the relay depending on the injection mode and injection system is shown below:

<table>
<thead>
<tr>
<th>WAVE FORM</th>
<th>INJECTION MODE</th>
<th>THERMAL RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Diagram]</td>
<td>SINGLE PHASE P-N</td>
<td>3xIn continuously</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20xIn during 10 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70xIn during 1 seconds</td>
</tr>
<tr>
<td>[Diagram]</td>
<td>3-PHASE BALANCED</td>
<td>3xIn continuously</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20xIn during 10 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70xIn during 1 seconds</td>
</tr>
<tr>
<td>[Diagram]</td>
<td>3-PHASE UNBALANCED</td>
<td>1xIn continuously</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.5xIn during 10 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23 xIn during 1 seconds</td>
</tr>
</tbody>
</table>

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

Commissioning recommendation:

- It is recommended to use Kitcom accessory for relay protection functions settings. Connect it for setting and disconnect it for testing purpose.
- Adjust manually current generation value without injecting current to relay, for not stressing it during adjustment process.
- Be sure that relay output contact is connected to generator tripping input in order to stop the generator, hence the current injection, after reaching adjusted tripping time. This way, relay will only withstand rated injected current during adjusted time at protection function settings, not maintaining current injection constantly, which could become a damaging situation for relay, as in other case, the internally handle energy will be higher than rated one.
- Not to perform repetitive trips continuously as the stress of the relay will be increased drastically, especially when high current is being injected on the relay.

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

8.2.1. Single phase minimum self-powering checking

Adjust the current generator with HOLD 0.2xIn, 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 generator with HOLD 0.1xIn, 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 generator with HOLD 0.2xIn, and suddenly, inject it to the relay, as it would happened in real situation when circuit breaker is close, powering network line. Once the relay is switched up, increase current injection until 0.35xIn is reached. At this value, the Leds and LCD backlit should be switched on:
8.3. Measurements

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

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

8.4. Protection functions

Current injection procedure:

Adjust the Sverker current generator with HOLD 0,2xIn, 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

- **50P instantaneous phase overcurrent protection:**

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

  The following information will be checked:
  - Pick-up at 100% of the tap
  - Trip output is activated
  - Output 2 is activated
  - HS O/C trip flag is activated

- **50N instantaneous neutral overcurrent protection:**

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

  The following information will be checked:
  - Pick-up at 100% of the tap
  - Trip output is activated
  - Output 3 is activated
  - E/F & HS E/F Trip flag is activated
• 51P Inverse time phase overcurrent protection:

TEST 1:

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

The following information will be checked:
- Pick-up at 110% of the tap
- Trip output is activated
- Output 2 is activated
- O/C Trip flag is activated

TEST 2

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

The following information will be checked:
- Trip output is activated
- Output 2 is activated
- O/C Trip flag is activated

TEST 3

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

The following information will be checked:
- Trip output is activated
- Output 2 is activated
- O/C Trip flag is activated
• 51N Inverse time neutral overcurrent protection:

**TEST 1**

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

**The following information will be checked:**
- Pick-up at 110% of the tap
- Trip output is activated
- Output 3 is activated
- E/F & HS E/F Trip flag is activated

**TEST 2**

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

**The following information will be checked:**
- Trip output is activated
- Output 3 is activated
- O E/F & HS E/F Trip flag is activated

**TEST 3**

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

**The following information will be checked:**
- Trip output is activated
- Output 3 is activated
- E/F & HS E/F Trip flag is activated

Note: In TEST 2 and TEST 3 for 51 and 51N, 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. SIAC11500032AFA REGISTRY

<table>
<thead>
<tr>
<th>Model:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Number:</td>
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</tr>
<tr>
<td>Correct packing and unpacking</td>
<td>☐ OK</td>
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<tr>
<td>Relay verification</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Installation process</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Connection process</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Test menu</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Model and Versions:</td>
<td>Reading LCD model:</td>
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<tr>
<td></td>
<td>Version:</td>
</tr>
<tr>
<td>Wiring checking</td>
<td>☐ OK ☐ NOK</td>
</tr>
<tr>
<td>DB9 communication port:</td>
<td>☐ OK ☐ NOK</td>
</tr>
<tr>
<td>Signalling and Keypad</td>
<td>Led 1 ☐ OK Led 2 ☐ OK Led 3 ☐ OK</td>
</tr>
<tr>
<td></td>
<td>O/C Trip ☐ OK HS O/C Trip ☐ OK E/F&amp;HS E/F Trip ☐ OK</td>
</tr>
<tr>
<td></td>
<td>Trip Output ☐ OK</td>
</tr>
<tr>
<td></td>
<td>Output 2 ☐ OK</td>
</tr>
<tr>
<td></td>
<td>Output 3 ☐ OK</td>
</tr>
<tr>
<td></td>
<td>Output 4 ☐ OK</td>
</tr>
<tr>
<td></td>
<td>Keypad ☐ OK</td>
</tr>
<tr>
<td>Self-power 3P (SIAC&gt;0.1In)</td>
<td>Phase A ☐ OK Phase B ☐ OK Phase C ☐ OK</td>
</tr>
<tr>
<td>Communications</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Settings and configuration</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Current measurements</td>
<td>☐ OK</td>
</tr>
<tr>
<td>Protection Functions</td>
<td>50 phase A: ☐ OK 50 phase B: ☐ OK 50 Phase C: ☐ OK</td>
</tr>
<tr>
<td></td>
<td>50_2 phase A: ☐ OK 50_2 phase B: ☐ OK 50_2 phase C: ☐ OK</td>
</tr>
<tr>
<td></td>
<td>50N ☐ OK 50N_2 ☐ OK</td>
</tr>
<tr>
<td></td>
<td>51 phase A: ☐ OK 51 phase B: ☐ OK 51 phase C: ☐ OK</td>
</tr>
<tr>
<td></td>
<td>51N ☐ OK</td>
</tr>
<tr>
<td>RTC</td>
<td>☐ OK</td>
</tr>
</tbody>
</table>