Lifasa
REACTIVE POWER SOLUTIONS

Active Parallel Multi-level Filter

SINAFM

INSTRUCTION MANUAL

(M217B02-03-20A)

CE

SAFETY PRECAUTIONS

Follow the warnings described in this manual with the symbols shown below.

	**DANGER** Warns of a risk, which could result in personal injury or material damage.

	**ATTENTION** Indicates that special attention should be paid to a specific point.

If you must handle the unit for its installation, start-up or maintenance, the following should be taken into consideration:

	Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire. Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.
	**Refer to the instruction manual before using the unit** In this manual, if the instructions marked with this symbol are not respected or carried out correctly, it can result in injury or damage to the unit and /or installations.

LIFASA, reserves the right to modify features or the product manual without prior notification.

DISCLAIMER

LIFASA, reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

LIFASA, on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

www.lifasa.es

	**LIFASA,** recommends using the original cables and accessories that are supplied with the device.

CONTENTS

REVISION LOG

Table 1: Revision log.

Date	Revision	Description
06/19	M217B02-03-19B	Initial Version
09/19	M217B02-03-19C	Change in the following sections: 3.5. - 4.6.2. - 6.3. - 6.16. - 7.6. - 7.7. - 7.8. - 7.13. - 11.
04/20	M217B02-03-20A	Change in the following sections: 3.2.1. - 4.1.1. - 4.6. - 6.3. - 6.4. - 6.11. - 6.14. - 6.15. - 6.16. - 7.6. - 7.7. - 8.2.2.1. - 8.2.2.2.

SYMBOLS

Table 2: Symbols.

Symbol	Description
CE	Compliant with the relevant European standards.
 1 min	After disconnecting the device from all power supplies, wait 1 minute before performing any operations.
	Torque
 2	Screwdriver for **PH2** head screws
 30	Screwdriver for **Torx 30** head screws

1.- VERIFICATION UPON RECEPTION

1.1.- RECEPTION PROTOCOL

Check the following points when you receive the device:

a) The device meets the specifications described in your order.
b) The device has not suffered any damage during transport.
c) Perform an external visual inspection of the device prior to switching it on.
d) Check that it has been delivered with the following:

- Instruction manual
- Communication cable for connecting devices in parallel.(Models **SINAFM** Wall and Rack type).

e) Perform an external and internal visual inspection of the device prior to connecting it.

⚠	If any problem is noticed upon reception, immediately contact the transport company and/or **LIFASA's** after-sales service.

1.2.- TRANSPORT AND HANDLING

⚠	The transport, loading and unloading and handling of the device must be carried out with proper precautions and using the proper manual and mechanical tools so as not to damage it. If the device is not to be immediately installed, it must be stored at a location with a firm and level floor, and the storage conditions listed in the technical features section must be observed. In this case, it is recommended that the device be stored with its original protective packaging.

To move the device a short distance, the device's floor support profiles facilitate handling with a pallet jack or forklift. (**Figure 1**)

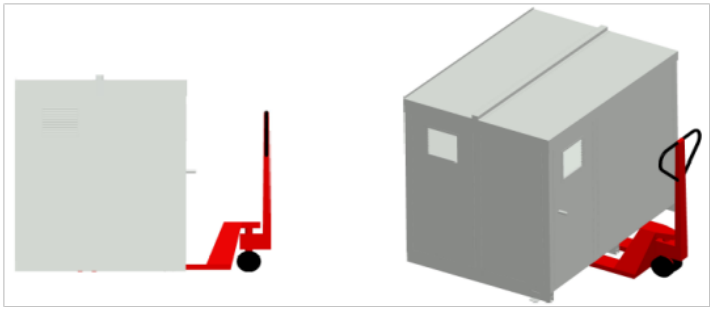


Figure 1: Transport with pallet jack.

⚠	The centre of gravity of some devices may be found at a considerable height. Therefore, when handling with a forklift, it is recommended that the device be securely fastened and that no abrupt manoeuvres made. The device should not be lifted more than 20 cm off the ground

When unloading and moving the device, use a forklift with forks long enough to support the entire length of the base. Otherwise, the forks should be long enough to support at least ¾ of said depth. The forks must be flat and supported firmly by the base. Raise the device by placing the forks underneath the profile that supports the device. (**Figure 2**).

⚠	There might be an offset in the centre of gravity from the centre of the cabinet, as a result of the uneven distribution of loads inside the device. The necessary precautions must be taken to prevent the device from tipping over during abrupt operations.

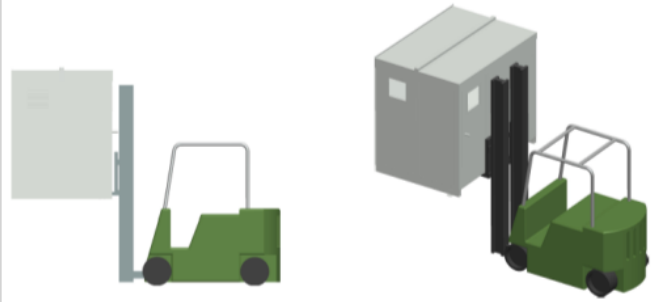


Figure 2: Unloading with a forklift.

When unpacking the device, pay attention to prevent damaging the device if you are using cutting tools, such as cutters, scissors or knives.

The **SINAFM** devices cabinet type, there are also 4 rings (diameter : 28 mm) in the top panel so that they can be transported by a crane. The top panel is inverted, but the rings are mounted, to enable it to be transported without any prior set-up required. The angle of the cables must be greater than 45º

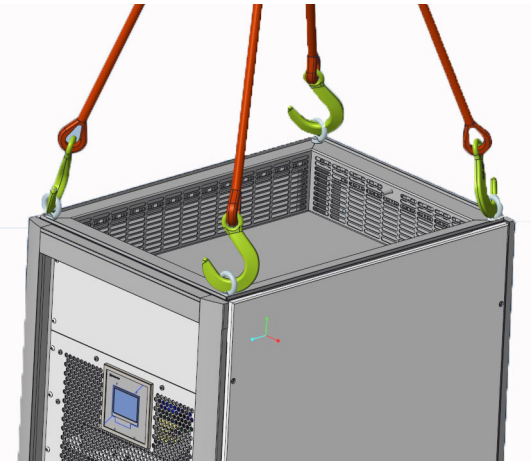


Figure 3: Transport of an cabinet SINAFM by crane.

1.3.- STORAGE

The device should be stored according to the following recommendations:

- ✓ Avoid placing them on uneven surfaces.
- ✓ Do not store them in outdoor areas, humid areas or areas exposed to splashing water.
- ✓ Avoid hot spots (maximum ambient temperature: 50ºC)
- ✓ Avoid salty and corrosive environments.
- ✓ Avoid storing the devices in areas where a lot of dust is generated or where the risk of chemical or other types of contamination is present.

2.- PRODUCT DESCRIPTION

The **SINAFM** active multi-level filters can be used to:

✓Reduce the harmonic currents up to order 50.
✓Correct the unbalanced current consumption in each phase of the electrical installation.
✓Correct the power factor. For both backward (inductive) and forward (capacitive) currents.

There are different models of the device, for different currents:

✓ **30 A filters,**

The device features:

- **3/4-wire multi-level,** for installation in three-phase mains with or without neutral.
- Parallel installation of up to 100 devices.
- **EMI filters**.
- **LCD touch display**, to view the parameters.
- **RS-485** and **Ethernet** communications.
- Wall enclosure.

Table 3:Relation of models SINAFM of 30A.

Model	3 Wires (L1, L2, L3)	4 Wires (L1, L2, L3, N)
SINAFM348030W	✓	-
SINAFM440030W	-	✓

✓ **60 A filters,**

The device features:

- **3/4-wire multi-level,** for installation in three-phase mains with or without neutral.
- Parallel installation of up to 50 devices.
- **EMI filters**.
- **LCD touch display**, to view the parameters.

- **RS-485** and **Ethernet** communications.
- Wall enclosure.

Table 4:Relation of models SINAFM of 60A.

Model	3 Wires (L1, L2, L3)	4 Wires (L1, L2, L3, N)
SINAFM348060W	✓	-
SINAFM440060W	-	✓

✓ **100 A filters,**

The device features:

- **3/4-wire multi-level,** for installation in three-phase mains with or without neutral.
- Parallel installation of up to 100 devices.
- **LCD touch display**, to view the parameters.
- **RS-485** and **Ethernet** communications.
- **EMI filters.**
- **Enclosure** type **Rack, Cabinet** o **Wall.**

Table 5:Relation of models SINAFM of 100A.

Model	3 Wires (L1, L2, L3)	4 Wires (L1, L2, L3, N)	Type		
			Rack	Cabinet	Wall
SINAFM348100W	✓	-	-	-	✓
SINAFM440100W	-	✓	-	-	✓
SINAFM348100C	✓	-	-	✓	-
SINAFM348100C	-	✓	-	✓	-
SINAFM348100R	✓	-	✓	-	-
SINAFM440100R	-	✓	✓	-	-

✓ **200 A, 300 A and 400 A filters,**

The **200A** is a Cabinet model with two **100A** devices connected in parallel; the **300A** model has three devices connected, and the **400A** model has four.

The device features:

- **3/4-wire multi-level,** for installation in three-phase mains with or without neutral.
- Parallel installation of up to 50 devices (Model **200A**), 30 devices (Model **300A**) and 25 devices (Model **400A**).
- **LCD touch display**, to view the parameters.
- **RS-485** and **Ethernet** communications.
- **Cabinet**-type **enclosure**.
- **EMI filters.**

Table 6:Relation of models SINAFM of 200A, 300A and 400A.

Model	3 Wires (L1, L2, L3)	4 Wires (L1, L2, L3, N)
SINAFM348200C	✓	-
SINAFM440200C	-	✓
SINAFM348300C	✓	-
SINAFM440300C	-	✓
SINAFM348400C	✓	-
SINAFM440400C	-	✓

3.- DEVICE INSTALLATION

3.1.- PRELIMINARY RECOMMENDATIONS

	**The device installation and the maintenance operations must only be carried out by authorised and qualified personnel.**
	In order to use the device safely, it is critical that individuals who handle it follow the safety measures set out in the standards of the country where it is being used, use the personal protective equipment necessary (rubber gloves, face protection and approved flame-resistant clothing) to prevent injuries due to electric shock or electric arc due to exposure to current-carrying conductors and pay attention to the various warnings indicated in this instruction manual.
	Incorrect installation or configuration of the device could cause serious damage to the device itself and to other devices of the installation.
	Only suitable for assembly on concrete or other non-combustible surfaces, and in restricted access areas.
	The devices are not intended for use in life support, medical safety equipment or similar applications, whereby a fault in the device could cause loss of life or physical injury. They are neither intended for military or defence applications. They should be installed in areas with restricted access.
	**Disconnect the main switch before starting any maintenance task on the active filters.**
	Make sure the device is properly **earthed** before powering up. Any fault in the earth connection might cause a risk of electrocution to the user and damage to the device itself in the case of lightning or other transients.
	Before handling the **current transformers**, ensure that the secondary is short-circuited. Never open a current transformer secondary under load.

3.2.- INSTALLATION LOCATION

The device must be installed in an environment where the temperature outside the cabinet is between -10ºC and 45ºC, with a maximum humidity of 95% without condensation.
Do not install the device close to a hot spot and keep it out of direct sunlight.

⚠	Install the **SINAFM** in a place protected from water, dust, flammable liquids, gases and corrosive substances.
⚠	Make sure there are no power factor correction devices installed in the same mains as the **SINAFM**. If there are any compensation devices, these must be detuned in order to avoid interference between them and the **SINAFM**.

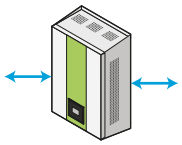
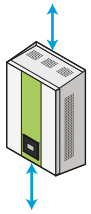
3.2.1.- VENTILATION REQUIREMENTS

Section ***"4.6 - THERMAL PROTECTION"*** describes all the thermal protections available in the device.

3.2.1.1.- Wall-type SINAFM

The device has a power control system that controls the rotation speed of the fans and the maximum power of the device according to the internal temperature, to ensure the best performance in any condition.

Table 7: Ventilation distances: Wall-type SINAFM.

Ventilation distances : Wall-type SINAFM	
	
50 mm	**400 mm**

3.2.1.2.- Rack-type SINAFM

The Rack-type **SINAFM** uses a forced ventilation cooling system, with an air inlet on the front panel and an air outlet at the back of the device.

Once installed, the device's flows of inlet air and outlet air must be allowed to circulate freely. At maximum power, the Rack-type **SINAFM** circulates an airflow of **375 m^3/h**.

The device has a power control system that controls the rotation speed of the fans and the maximum power of the device according to the internal temperature, to ensure the best performance in any condition.

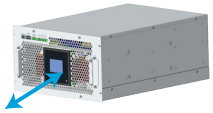
To maintain the device's performance, we recommend ensuring that the air circulates freely

through the front panel of the Rack-type **SINAFM**, and that the rear is free of obstacles, with a gap of at least **300 mm**.

It should be noted that, depending on the installation conditions in the cabinet and in the room where this is placed, the outflows of hot air may be sucked back in by the device's fans, causing a feedback of hot air that will lower the performance of the device.

It is also necessary to bear in mind the power dissipated by the device when choosing where to install it, to ensure proper air recirculation, to make sure that the intake air is a suitable temperature. See "***11.- TECHNICAL FEATURES".***

Table 8: Ventilation distances: Rack-type SINAFM.

Ventilation distances : Rack-type SINAFM	
	
300 mm	**300 mm**

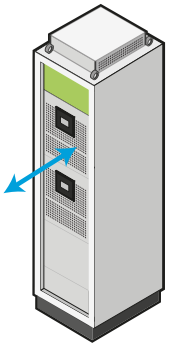
3.2.1.3.- Cabinet-type SINAFM

The cabinet-type **SINAFM** uses a forced ventilation cooling system, with an air inlet on the front panel and an air outlet at the back of the device.

The ventilation grille at the top must not be blocked, leaving enough space to the ceiling to allow the heat to dissipate. The distance depends on the characteristics of the installation site.

There is no need to leave space between the sides or at the back of the cabinet; they can be installed next to other cabinets and against a wall.

Table 9: Ventilation distances: Cabinet-type SINAFM.

Ventilation distances : Cabinet-type SINAFM

300 mm

3.3.- STORAGE FOR LONG PERIODS

If the device is not installed after receipt, the following recommendations must be observed to keep the device in a good state:

- ✓Keep the device in a dry atmosphere and at a temperature of between -20ºC and 50ºC.
- ✓Avoid exposure to direct sunlight.
- ✓Keep the device in its original packaging.

If the active filter is stored for a long time disconnected from the mains, a specific process must be applied to restore the internal dielectric layers of the DC bus capacitors. **Table 10** shows the recommendations for starting the device, according to the length of its storage period.

Table 10: Start-up process, according to storage time.

Storage time	Process
< 1 year	No special treatment required.
> 1 year	Connect the **SINAFM** to the mains at least one hour before starting up the device. Power the device and leave it in STOP mode

3.4.- INSTALLATION

3.4.1.- WALL-TYPE SINAFM

The Wall-type **SINAFM** has a number of holes on the top and bottom of the device, **Figure 4,** to facilitate transport and installation of the device.
These holes can be used as attachment points for external manipulation tools, or a bar (not included) can be passed through them to improve transport and installation of the device.

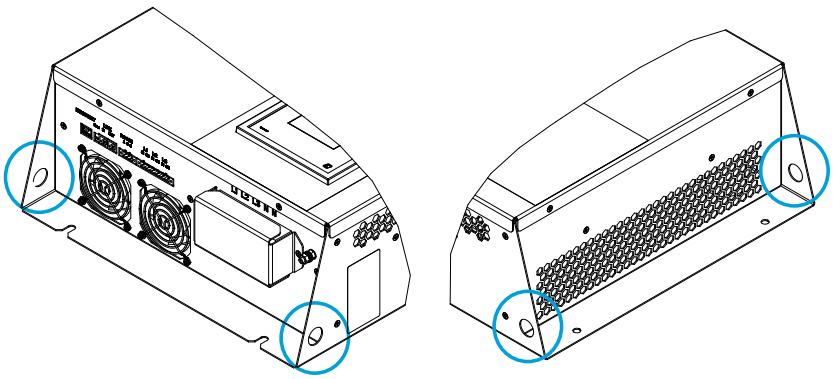


Figure 4: Holes to facilitate transport and installation.

The device must be fixed vertically to a wall or support.
Use 4 fixing screws with a diameter of **8 mm**, suitable for the chosen wall or support.

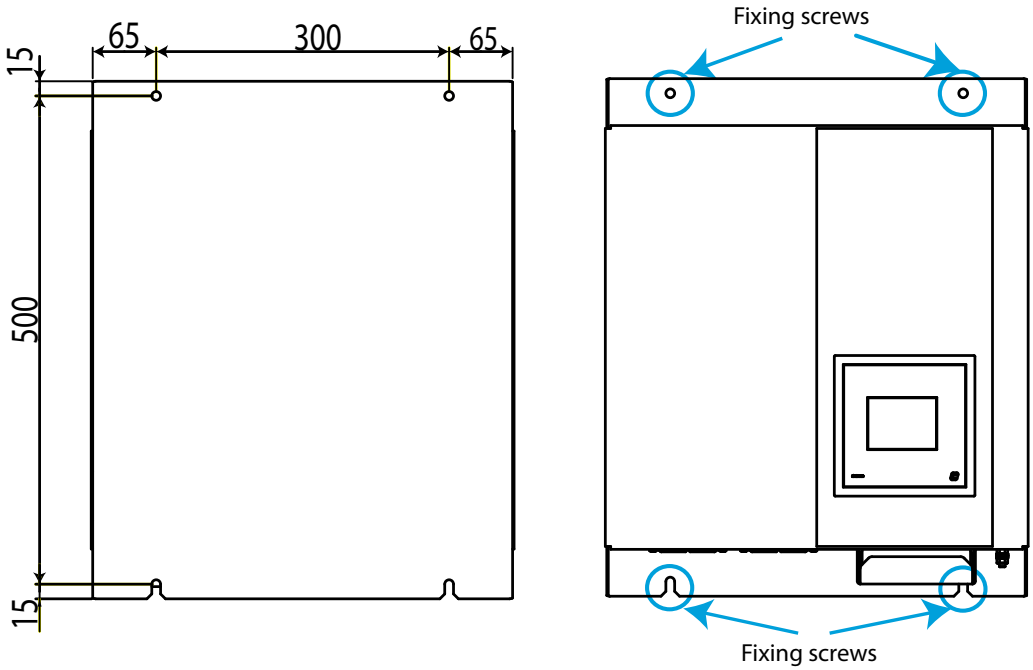


Figure 5: Installation Wall-type SINAFM.

Use **4 M8** fixing screws.

⚠	The ventilation grilles must not obstructed or covered at any time.

3.4.2.- RACK-TYPE SINAFM

The **Rack-type SINAFM** should be installed in a 19” rack cabinet.
The height of the device is equivalent to 9U. (U is the rack unit, 1U = 4.445 cm)

You can install more than one **SINAFM** in a single cabinet.

Follow these steps to install it inside the cabinet:

1.- Extend the rack cabinet’s anti-tip feet.

⚠	Unless the rack cabinet is secured to the floor, the anti-tip feet have to be extended and fixed to the floor, to ensure maximum safety during the assembly process.

2.- Open or remove the door at the front of the cabinet.

3.- Place the **SINAFM** on the cabinet’s rails or shelves. Make sure that they are suitable for the weight of the device; use cross braces if necessary.

⚠	Do not use front handles to carry the module.

⚠	Fit the device with the help of another person.

4.- Fasten the device to the points provided for this purpose. Use **4 M6** fixing screws.

3.4.3.- CABINET-TYPE SINAFM

The Cabinet-type **SINAFM** models are free-standing cabinets with 4 bearing supports on the floor.

⚠	The mounting surface must be solid, support the device's weight and be level.

⚠	The cabinet must never be welded to the floor using arc welding, as this may destroy the electronic components.

The device's top panel is part of the ventilation system. The top panel is inverted to make it easier to transport.
It must be placed in the correct position to enable the device to operate properly. To do this:

1.- Remove the transport rings.

2.- Remove the top panel from the top of the cabinet.

3.- Rotate the top panel. The non-slotted part goes at the front of the cabinet.

4.- Install the transport rings with rubber washers supplied.

20 Nm

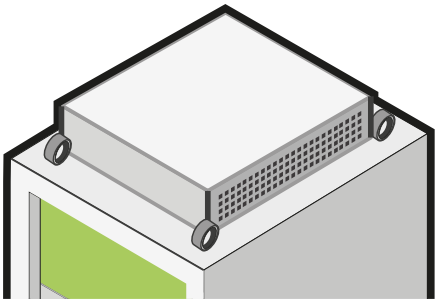


Figure 6: Top panel of an SINAFM cabinet.

3.5.- CONNECTION

Wall and **Rack type SINAFM** models**:**
Use cables of a cross-section suitable for the rated current of the filter and that comply with the standards of the country in which they are being installed.
The earth conductor must have at least the same cross-section as the phase conductors. If the phase conductors exceed 16 mm^2, the earth conductor will be at least 16 mm^2. If the phase conductors exceed 32 mm^2, the earth conductor can be the half of the cross-section of the phase conductors
For **100A models** (**SSINAFMxxx100W** and **SINAFMxxx100R**), under certain circumstances, the contact current may exceed 3.5 mA ~.
The recommended minimum cross-sections are (1):
SINAFMxxx030W : 16 mm^2
SINAFMxxx060W : 25 mm^2
SINAFMxxx100R and **SINAFMxxx100W :** 50 mm^2
Neutral conductor cross-section must suit the expected neutral current and must be selected according to the external protection devices.

Cabinet **type SINAFM** models**:**
For the cabinet's power supply, a cable with a cross-section suitable for the maximum current that can flow through the device must be used. Although the device is composed of 100 A modules, to make installation easier, the modules are already wired, and the user only has to take into account the device's total capacity.
The recommended minimum cross-sections are (1):
SINAFMxxx100C : 50 mm^2
SINAFMxxx200C : 90 mm^2
SINAFMxxx300C : 150 mm^2
SINAFMxxx400C : 240 mm^2
Neutral conductor cross-section must suit the expected neutral current and must be selected according to the external protection devices.

(1) These sections are for informative purposes only. The conductor cross-section must be selected according to the current, prevailing regulations, cable type and type of wiring installation.

Ensure that the **SINAFM** is earthed correctly to prevent the risk of electric shock.

To measure the current, class **0.2S** transformers of the **TC** or **TCH** series are recommended.

The use of transformers with ratios close to the current to be measured is recommended.

The correct connection of the current transformers is vital for the **SINAFM** filters to operate properly. If the phases L1, L2 and L3 are switched in the secondary, the filter will not work properly.

⚠	The **SINAFM** devices have built-in fuse overcurrent protection. Install external protection according to the type of installation, the facility's maximum short-circuit current, the maximum fuse current, and the regulations in force at the place of installation.
⚠	If local regulations require the use of earth leakage protection devices, only DC sensitive RCD (RCD type B) should be used with **SINAFM**. Active filters work internally with DC currents, and, in case of failure, the DC currents may produce malfunction on type A RCD devices.
⚠	Ensure that the installation of the device in your electric distribution system (TN, VT, IT) complies with current standards.

Check that there is a neutral in the place where three-phase active filter connections are made with neutral, **SINAFM440xxxx**.

The active filter must be of the correct size for the harmonic currents it has to filter and to comply with the installation's electrical features.

⚠	Check section ***"4.3.- RATED CURRENT DIMENSIONS"*** to define the correct dimensions of the device. Failing to observe the recommendations described in this section might cause the active filter to work incorrectly and prevent proper compensation of the installation's current harmonics.

⚠	Do not install various filters in series one after another in the same installation, configured to correct the same disturbances. This can produce an overcompensation of the disturbances, which could cause instability in the mains (**Figure 7**)

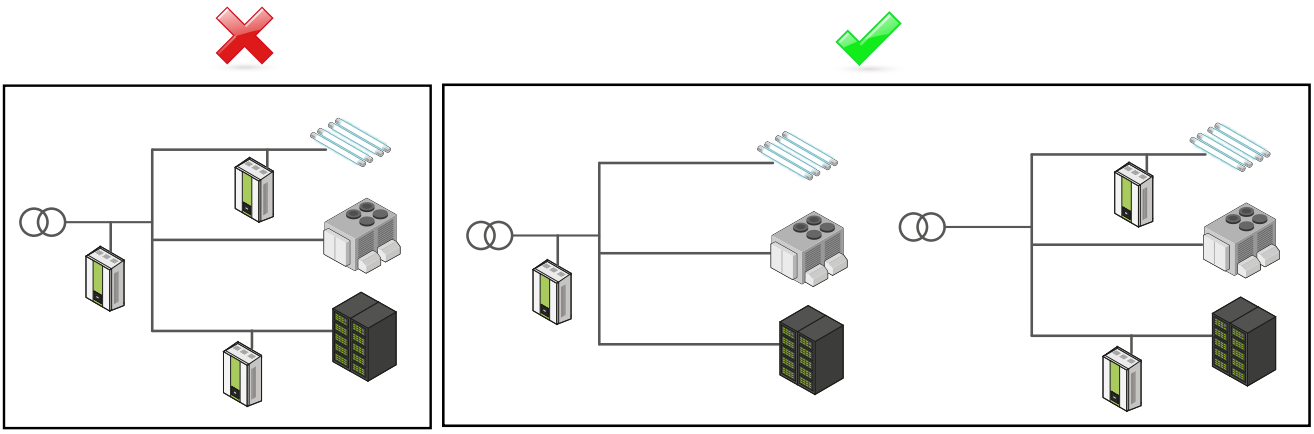


Figure 7: Do not install various active filters in series.

3.6.- DEVICE TERMINALS

3.6.1.- WALL-TYPE SINAFM : SINAFMxxx030W, SINAFMxxx060W and SINAFMxxx100W

The connection terminals of the Wall-type **SINAFM** model are located on the lower face of the device. The device has a terminal cover on the mains connection terminals.

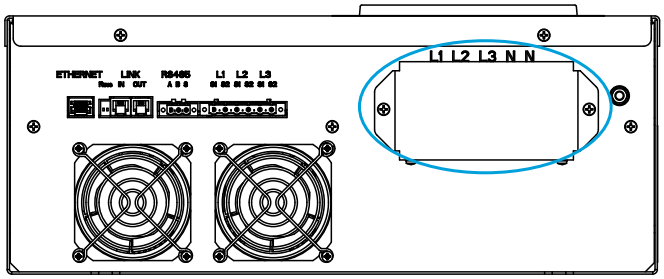


Figure 8: Terminal cover, SINAFMxxx030W and SINAFMxxx060W.

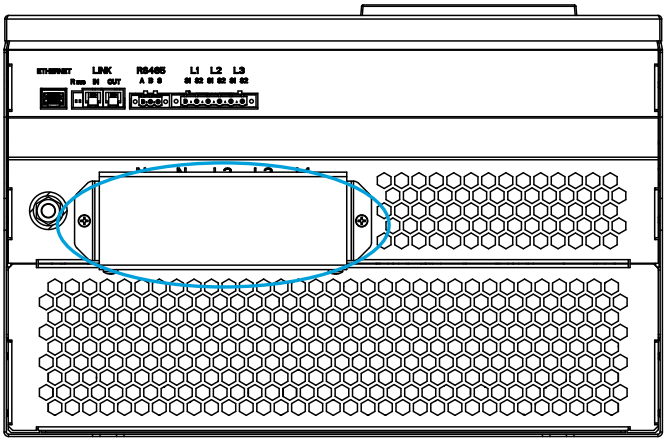


Figure 9: Terminal cover, SINAFMxxx100W.

Remove the terminal cover before connecting the device.

2, M5, 1.5 Nm

⚠	Put the terminal cover back on once the device has been connected.

Table 11:List of terminals.

Device terminals	
1: ETHERNET, Ethernet Connector	**11: S2**, Current input L2
2: RBUS, Terminator switch for parallel connection	**12: S1,** Current input L3
3: IN, Input for parallel connection	**13: S2**, Current input L3
4: OUT, Output for parallel connection	**14: L1**, Mains connection L1
5: A, RS-485 communications	**15: L2**, Mains connection L2
6: B, RS-485 communications	**16: L3**, Mains connection L3
7: S, RS-485 communications	**17: N**, Mains connection N
8: S1, Current input L1	**18: N**, Mains connection N
9: S2, Current input L1	**19:** Earth connection
10: S1, Current input L2	

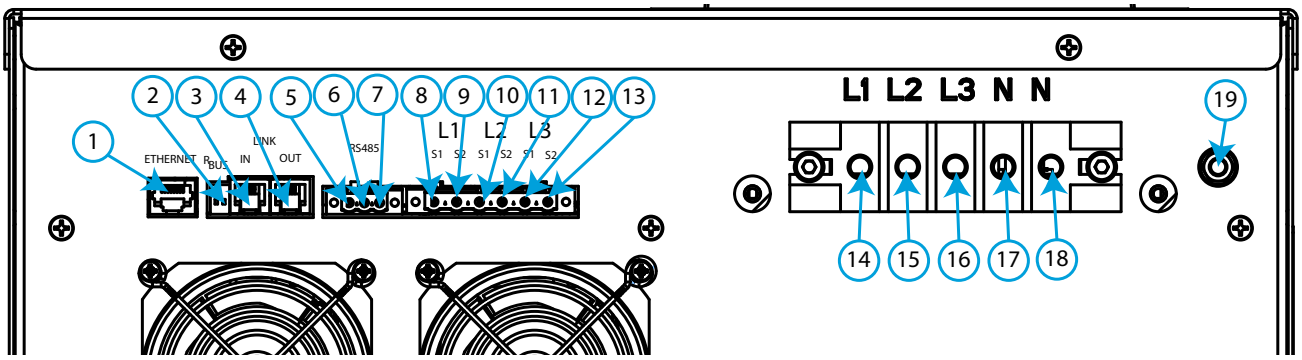


Figure 10: SINAFMxxx030W and SINAFMxxx060W terminals.

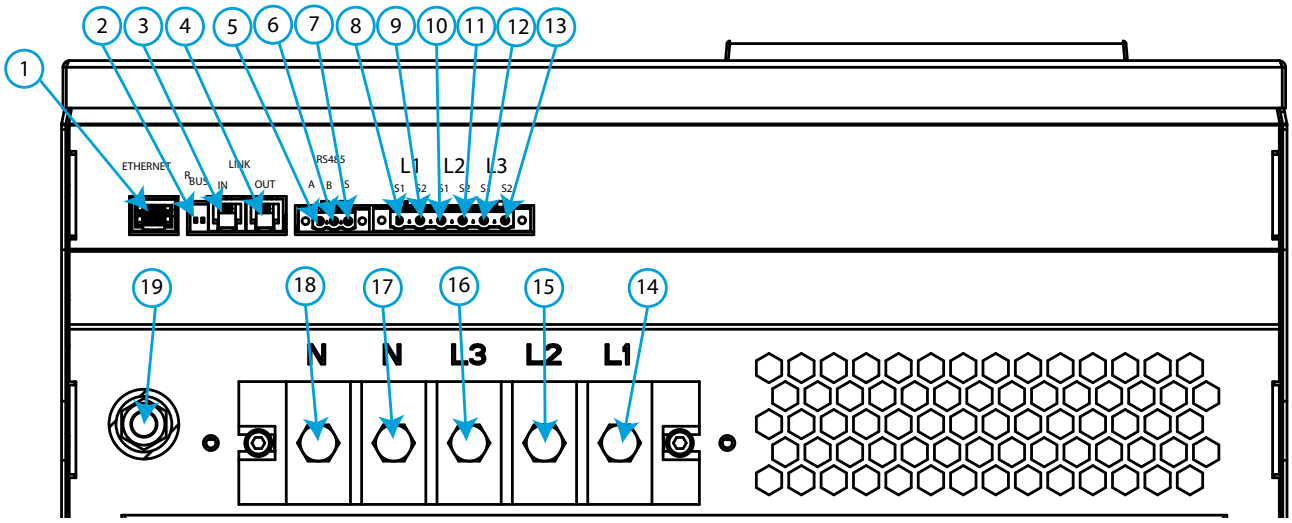


Figure 11: SINAFMxxx100W terminals.

It is recommended to fix the connection cables to the holes that facilitate the transport and installation of the device (**Figure 4**), so that the terminals are not subjected to any mechanical stress.

3.6.2.- RACK-TYPE SINAFM : SINAFMxxx100R

The **SINAFMxxx100R** connection terminals are located at the front and rear of the device.

Table 12:List of terminals.

Device terminals	
1: ETHERNET, Ethernet Connector	**11: S2**, Current input L2
2: RBUS, Terminator switch for parallel connection	**12: S1,** Current input L3
3: IN, Input for parallel connection	**13: S2**, Current input L3
4: OUT, Output for parallel connection	**14: L1**, Mains connection L1
5: A, RS-485 communications	**15: L2**, Mains connection L2
6: B, RS-485 communications	**16: L3**, Mains connection L3
7: S, RS-485 communications	**17: N**, Mains connection N
8: S1, Current input L1	**18: N**, Mains connection N
9: S2, Current input L1	**19:** Earth connection
10: S1, Current input L2	

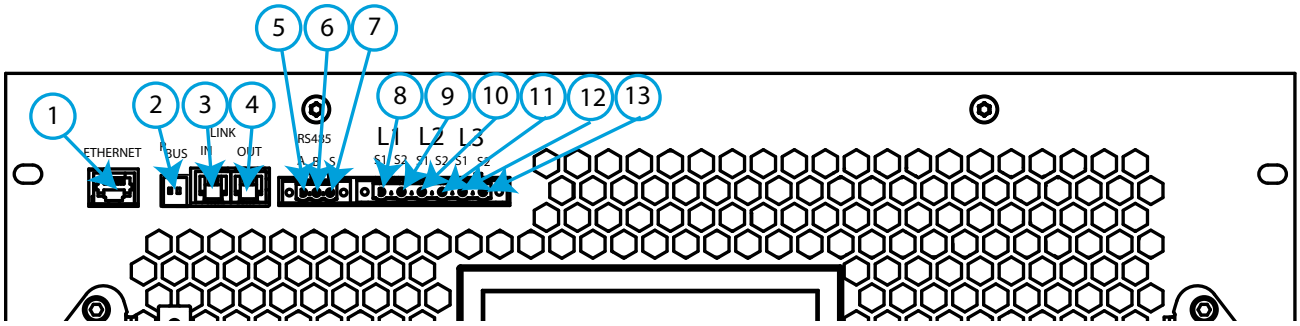


Figure 12:Rack-type SINAFM terminals (terminals at the front of the device).

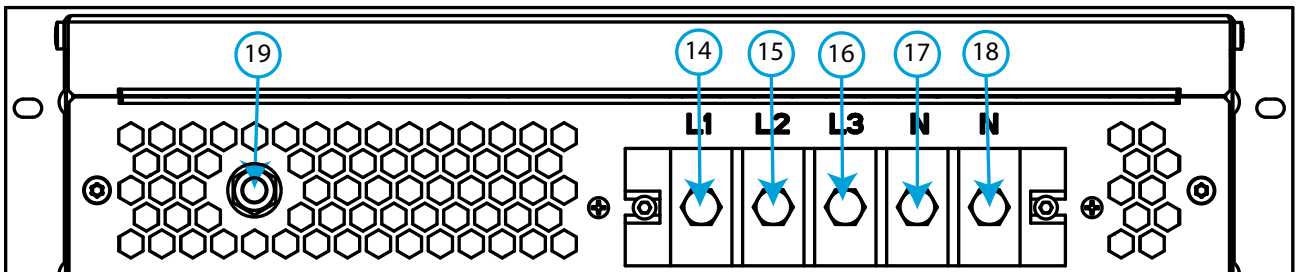


Figure 13:Rack-type SINAFM terminals (terminals at the rear of the device).

3.6.3.- CABINET-TYPE SINAFM : SINAFMxxx100C, SINAFMxxx200C, SINAFMxxx300C AND SINAFMxxx400C

LIFASA has two types of cabinets: cabinets with connections at the top and cabinets with connections at the bottom.

There are sliding windows at the bottom of the cabinet so that the connection wiring can be slotted inside, **Figure 14**. These windows can be removed and machined if it is considered necessary to use a cable gland.

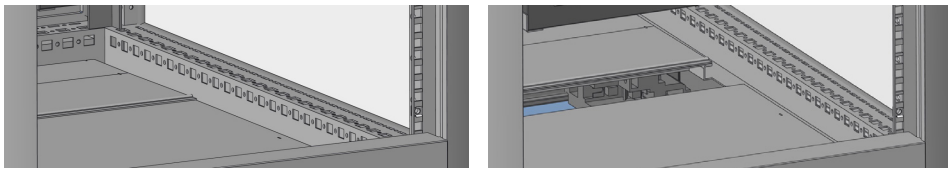


Figure 14: Sliding windows for the connection wiring.

	You should never remove the cover closest to the front part.

Cabinets with connections at the top have a sheet in the upper part of the cabinet which can be machined as shown in **Figure 15**, to insert the connection wiring.

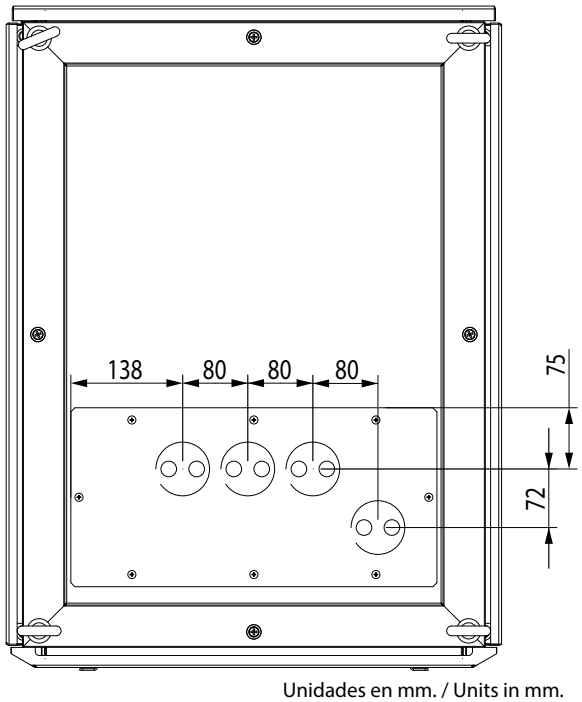


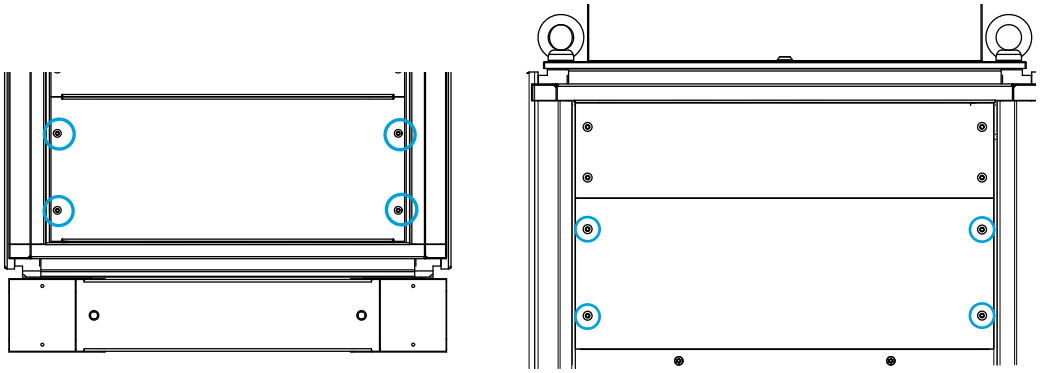
Figure 15: Machining a cabinet with connections at the top.

The current input and the communication ports must be connected to the "**master**" device, which is the located at the top of the cabinet. This connection is described in "***3.6.2.- RACK-TYPE SINAFM: SINAFMxxx100R***".

To access the current input and mains connections, loosen the screws in the lower front cover (in cabinets with connections at the bottom) or the screws in the upper front cover (in cabinets

with connections at the top) **Figure 16**.

30



Cabinet with connections at the bottom - Cabinet with connections at the top

Figure 16: Screws.

Once the front cover is open, the device's terminals can be accessed, **Figure 17, Figure 18** and **Figure 19**:

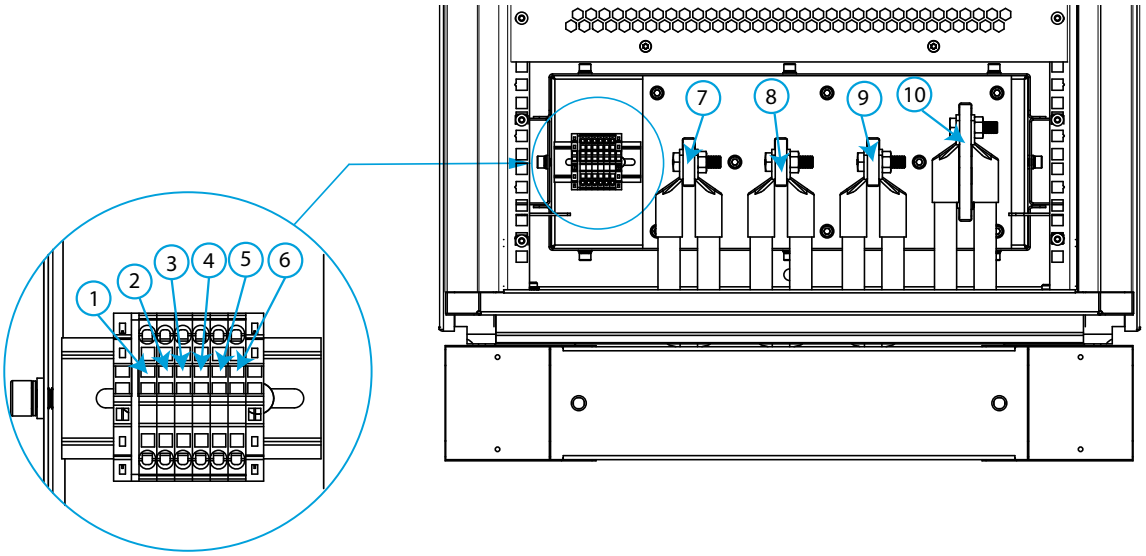


Figure 17:SINAFM cabinet-type terminals (connections at the bottom).

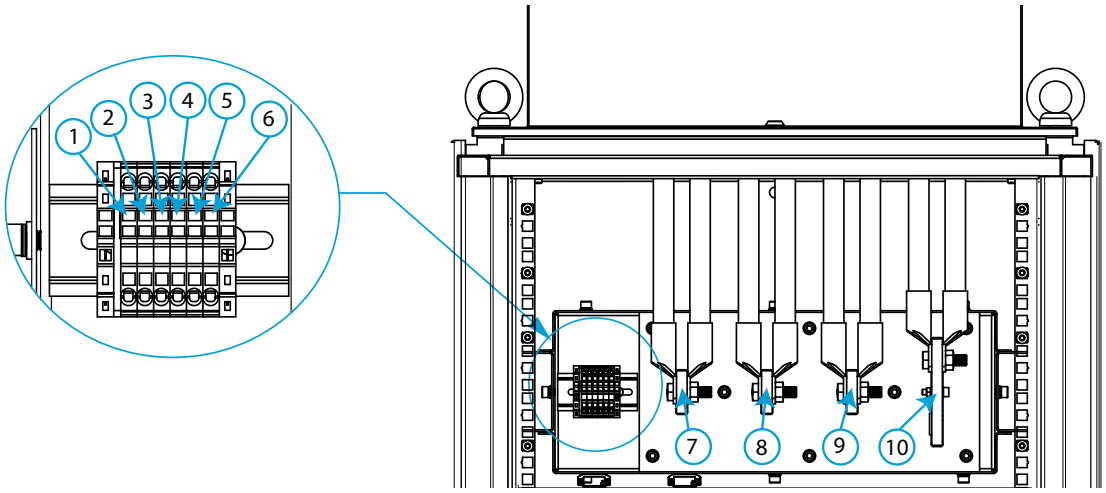


Figure 18:SINAFM cabinet-type terminals (connections at the top).

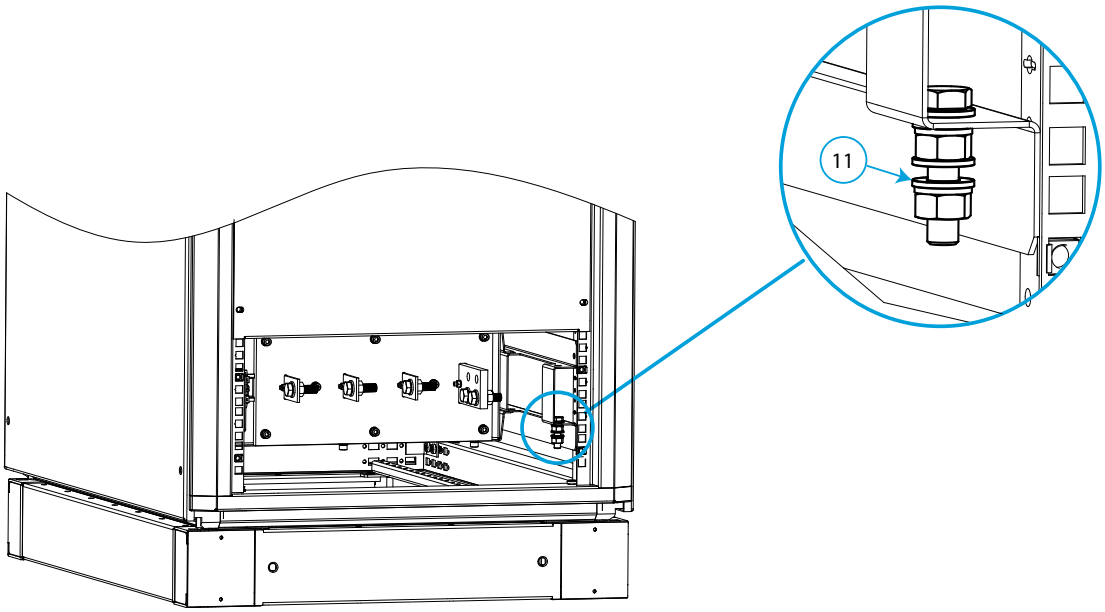


Figure 19:SINAFM cabinet-type earth terminal.

Table 13:List of terminals.

Device terminals	
1: S1, Current input L1	**6: S2**, Current input L3
2: S2, Current input L1	**7: L1**, Mains connection L1
3: S1, Current input L2	**8: L2**, Mains connection L2
4: S2, Current input L2	**9: L3**, Mains connection L3
5: S1, Current input L3	**10: N**, Mains connection N
11: Earth connection	

3.7.- CONNECTION DIAGRAMS

3.7.1.- 4-WIRE CONNECTION AND CURRENT MEASUREMENT ON THE MAINS SIDE.

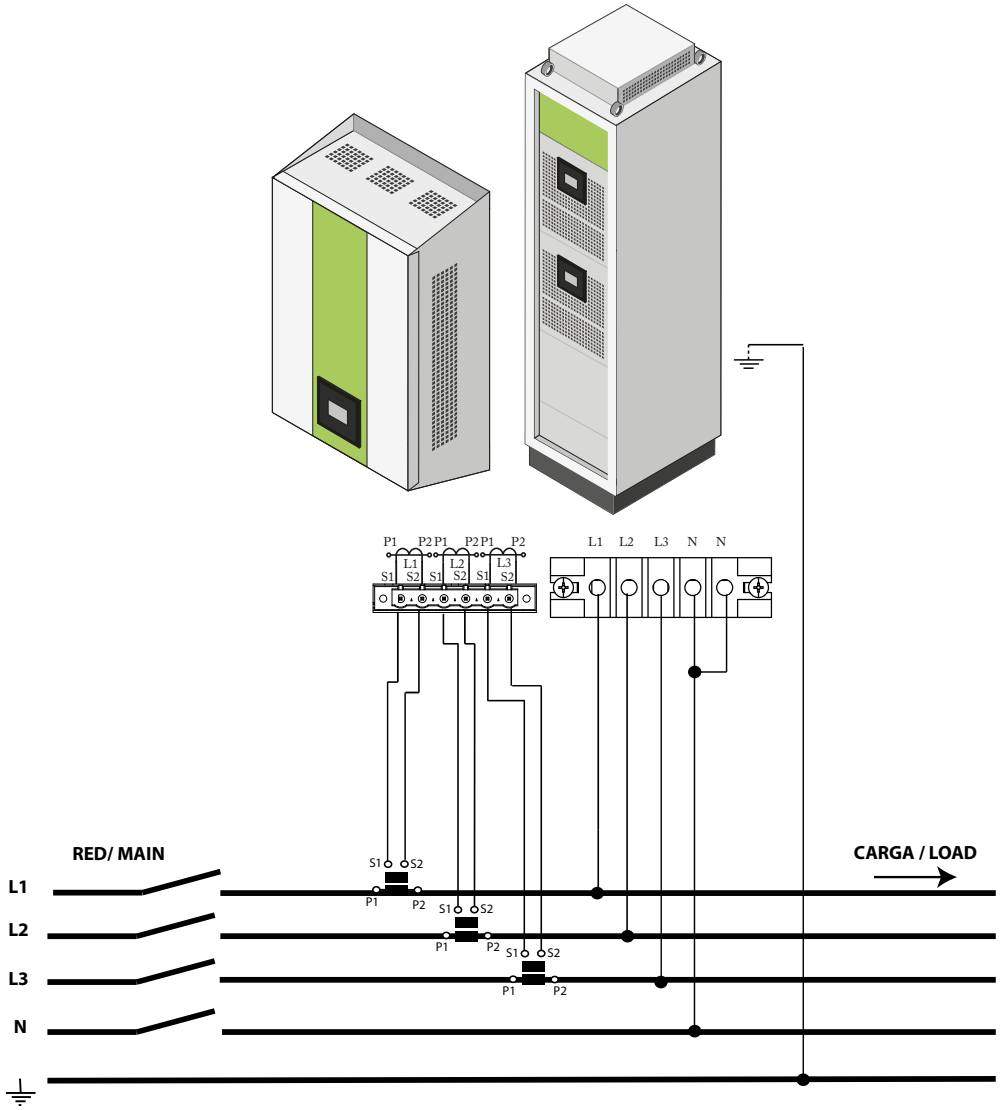


Figure 20: Three-phase measuring with 4-wire connection and current measurement on the mains side.

⚠	Use the 2 neutral current terminals, as **In** can be:In ≈ 3 * I_{PHASE}

3.7.2.- 4-WIRE CONNECTION AND CURRENT MEASUREMENT ON THE LOAD SIDE.

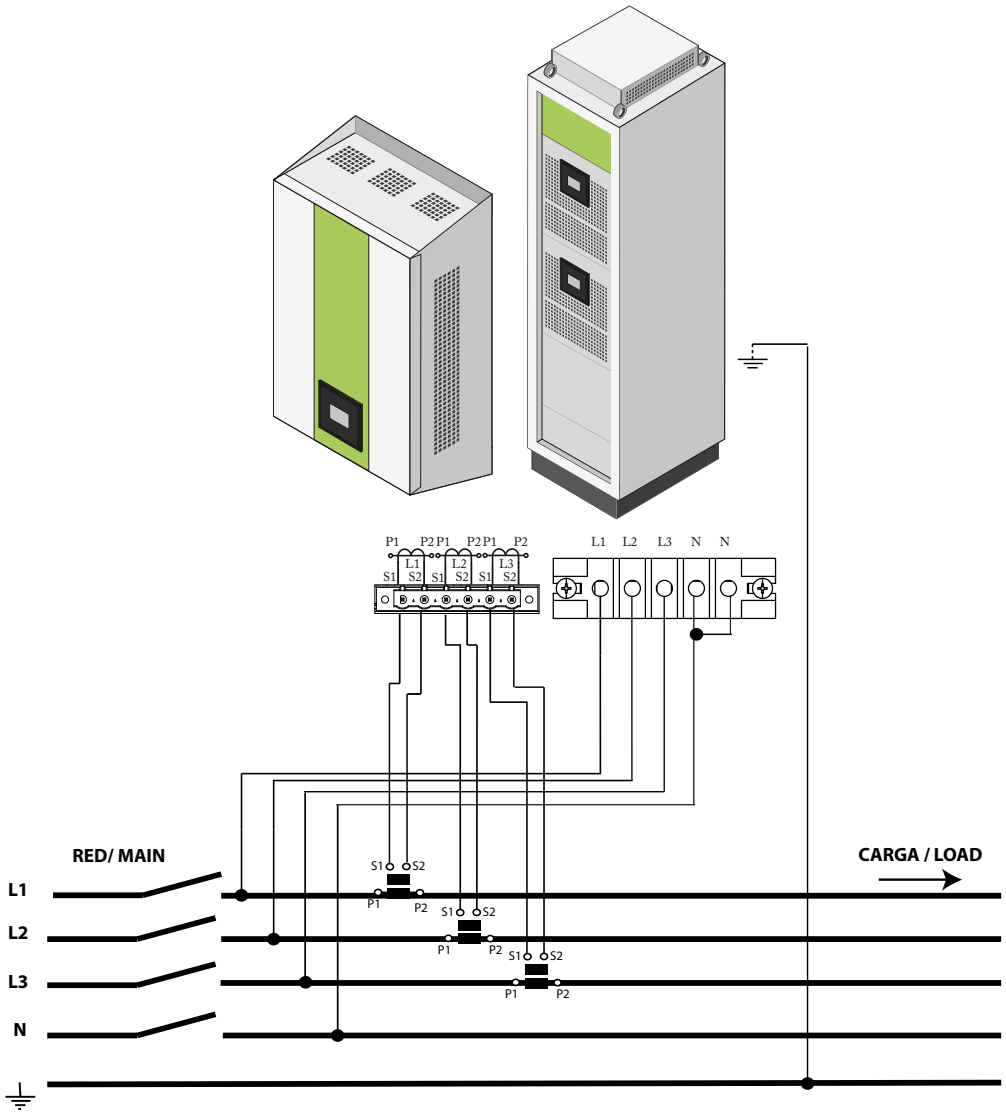


Figure 21: Three-phase measuring with 4-wire connection and current measurement on the load side.

⚠	Use the 2 neutral current terminals, as **In** can be: In ≈ 3 * I_{PHASE}

3.7.3.- 3-WIRE CONNECTION AND CURRENT MEASUREMENT ON THE MAINS SIDE.

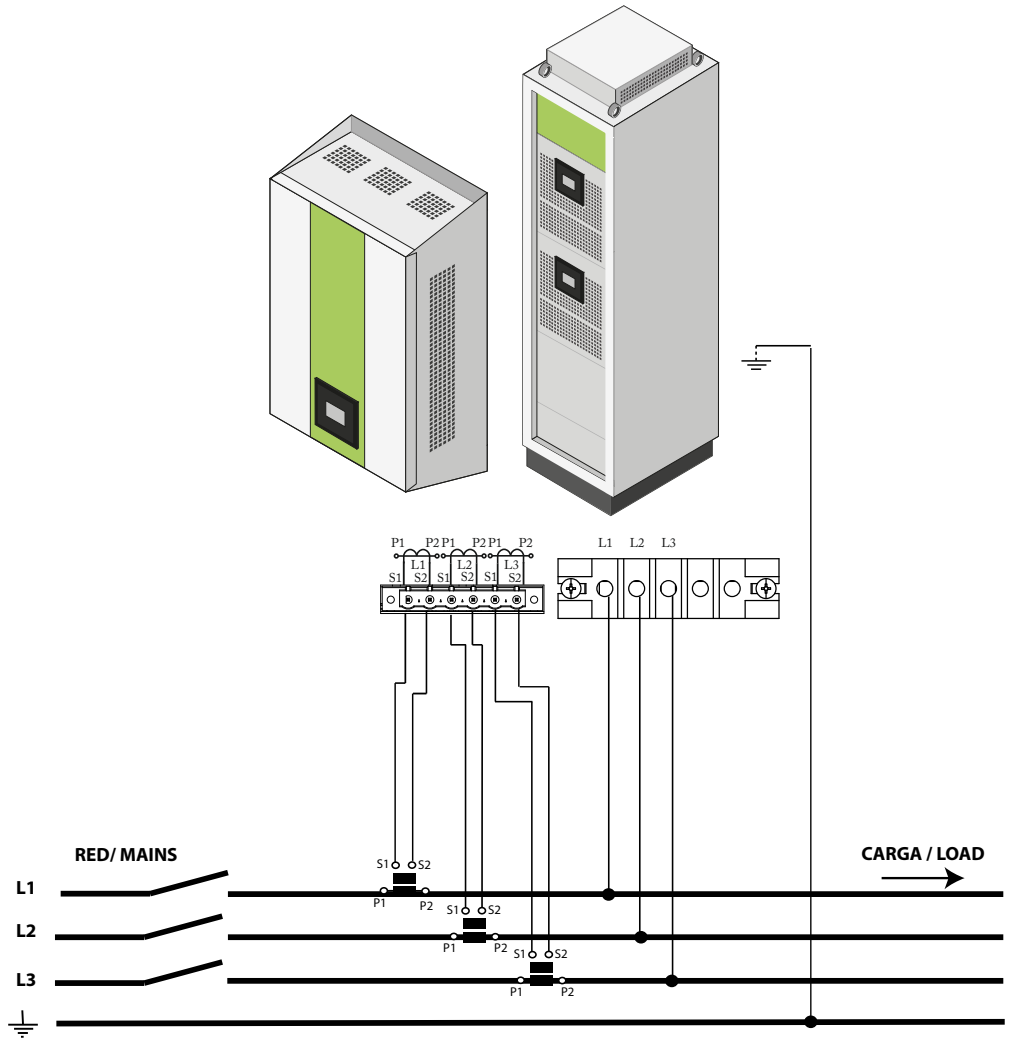


Figure 22: Three-phase measuring with 3-wire connection and current measurement on the mains side.

3.7.4.- 3-WIRE CONNECTION AND CURRENT MEASUREMENT ON THE LOAD SIDE.

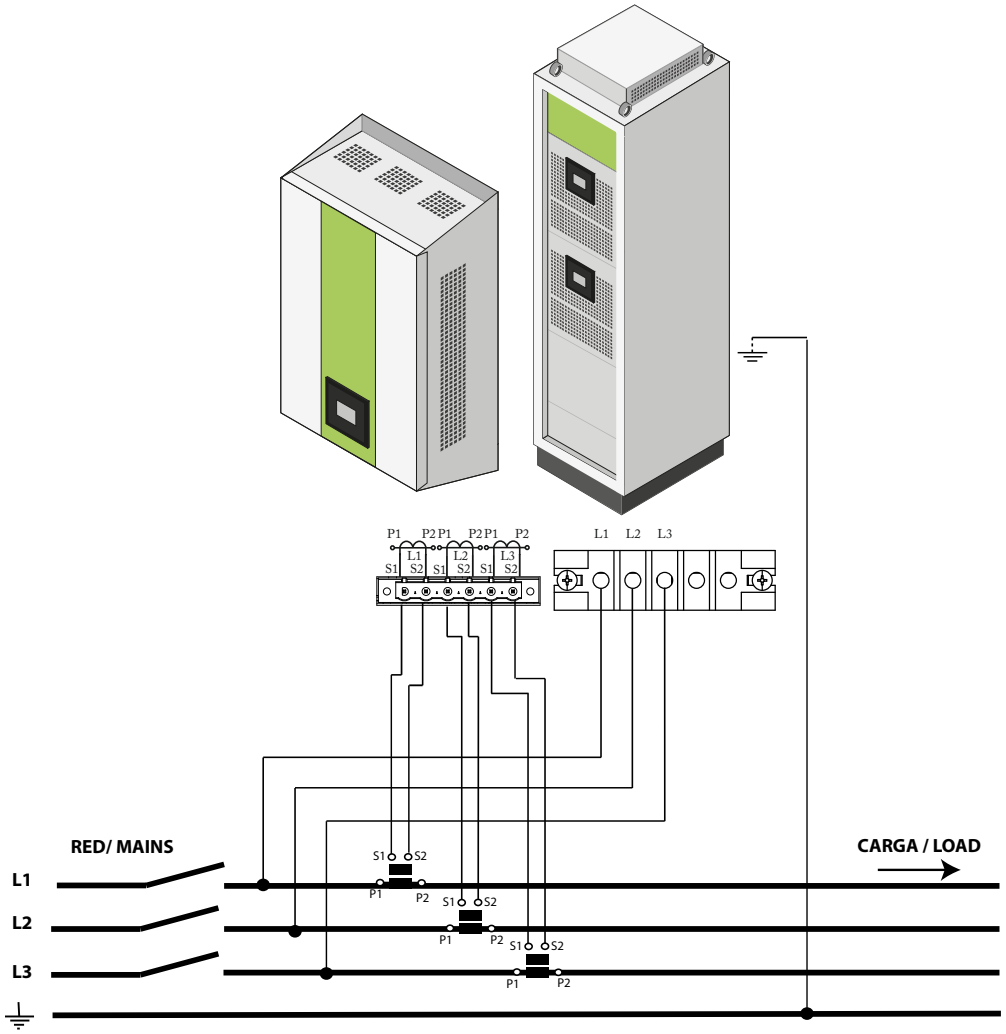


Figure 23: Three-phase measuring with 3-wire connection and current measurement on the load side.

3.7.5.- 3-WIRE CONNECTION AND 2 CURRENT TRANSFORMERS ON THE MAINS SIDE.

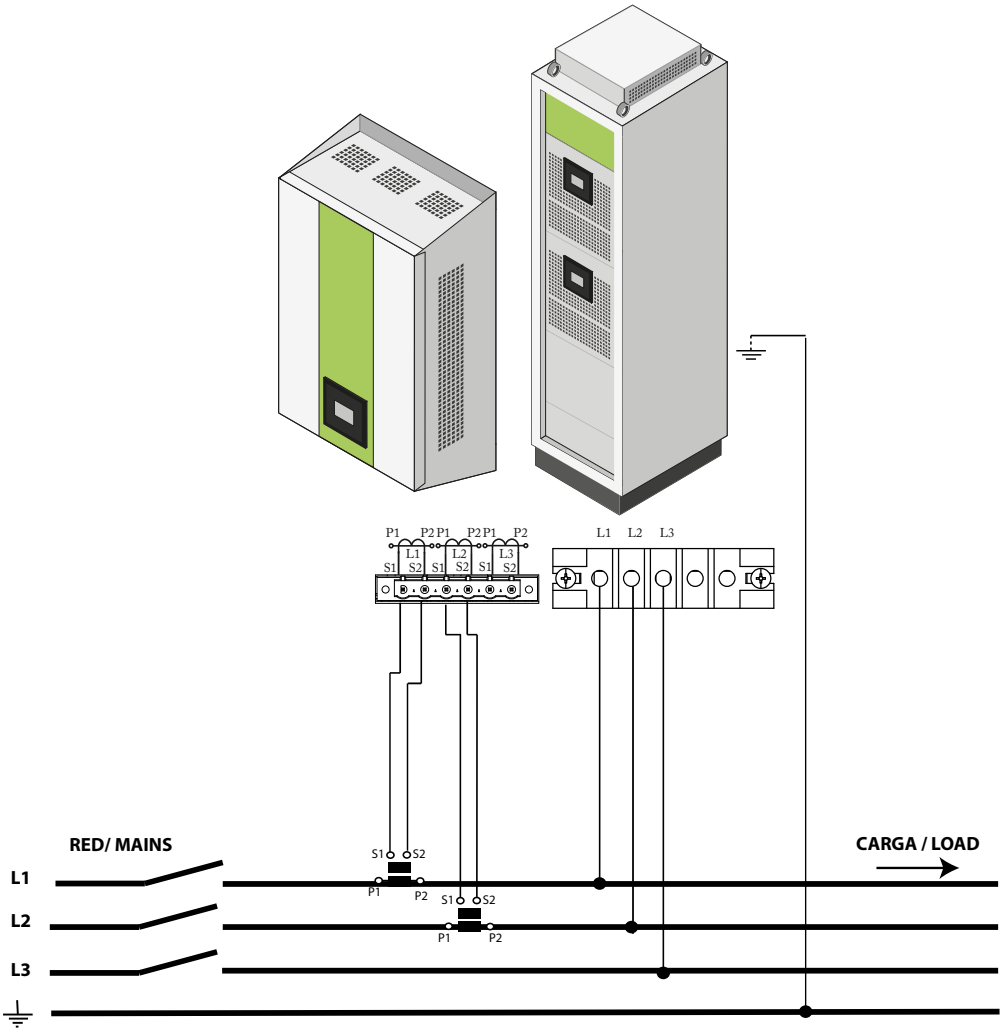


Figure 24: Three-phase measuring with a 3-wire connection and 2 current transformers on the mains side.

⚠	The connection of 2 current transformers is only possible in three-phase mains without neutral (3 wires).

3.7.6.- 3-WIRE CONNECTION AND 2 CURRENT TRANSFORMERS ON THE LOAD SIDE.

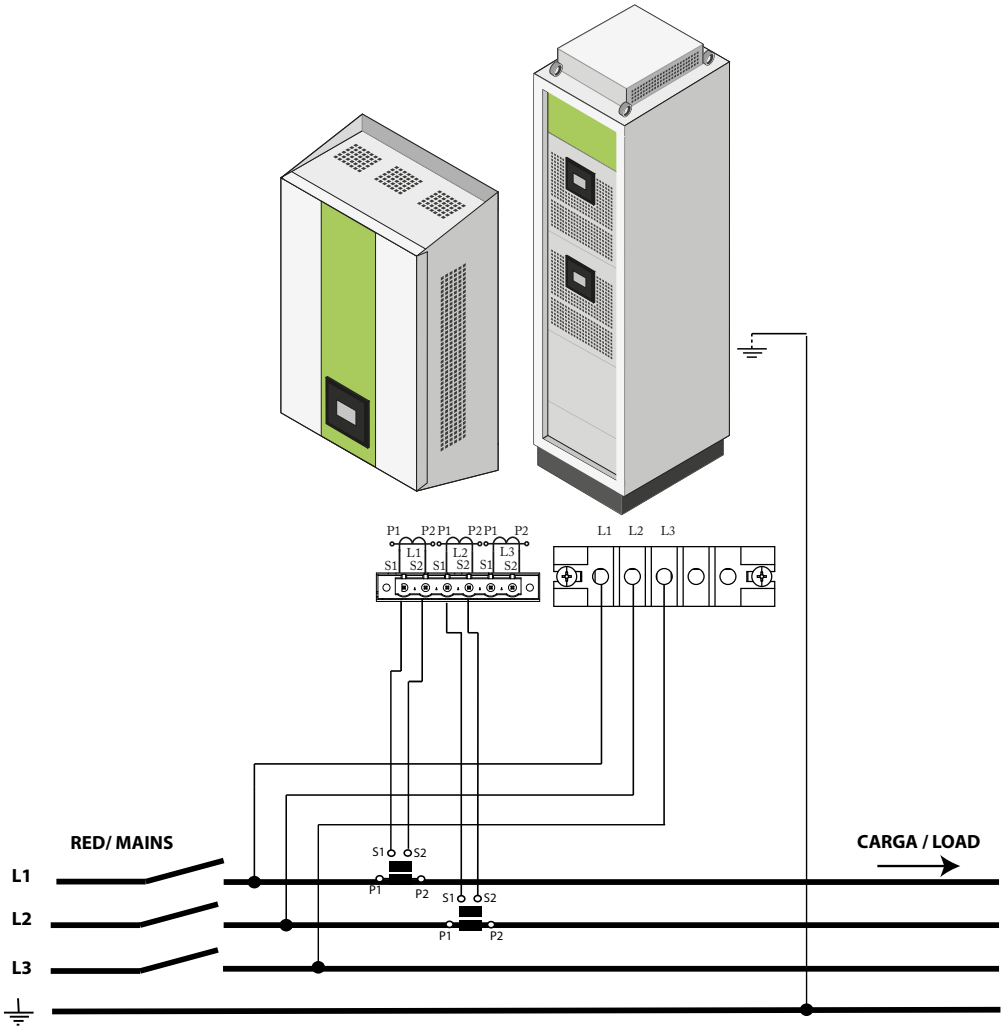


Figure 25: Three-phase measuring with a 3-wire connection and 2 current transformers on the load side.

⚠	The connection of 2 current transformers is only possible in three-phase mains without neutral (3 wires).

3.8.- PARALLEL CONNECTION OF 2 TO 100 ACTIVE FILTERS

The **SINAFM** devices can be arranged in parallel to increase the available filtering power.

Up to 100 devices can be arranged in parallel, either of the **30A, 60A** or **100A** models.

In the case of installations with devices in parallel, a device must be defined as the "***master***", while all others will have "***slave***" devices functions.

The "***master***" will be responsible for measuring the network parameters, so only the current transformers will be connected to it. This allows low-power transformers to be used in these installations, since an individual transformer does not have to be connected to each device.

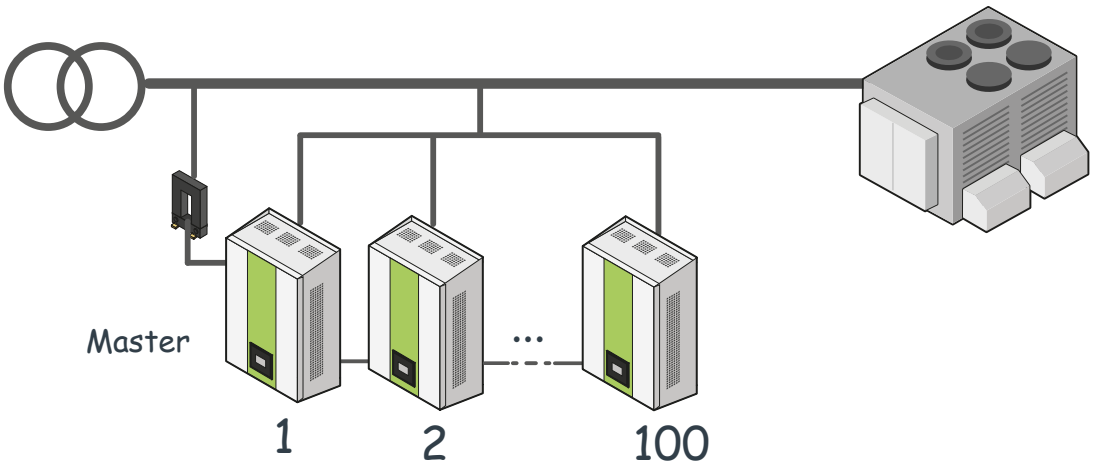


Figure 26:Connection of 2 to 100 filters in parallel (Transformers on the mains side).

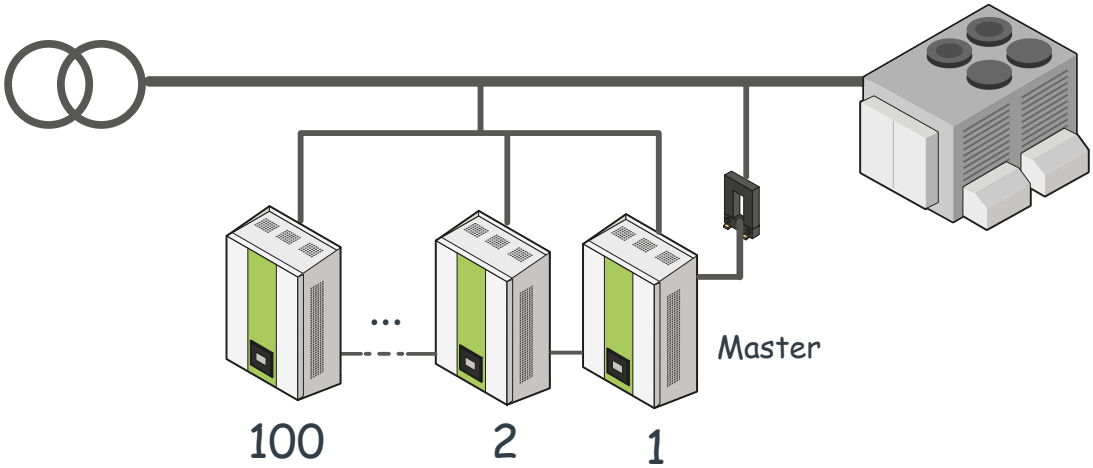


Figure 27:Connection of 2 to 100 filters in parallel (Transformers on the load side).

New device can be connected to existing devices without having to shut down or disconnect them. This ensures filtering capacity can be increased or degraded device in critical installations can be replaced without affecting the installation, allowing connection without shutting down the device and also making it possible to achieve 0 **MTD** (Maximum Tolerable Downtime).

In the event of failure of the "***master***" device, the front connection of the current transformers allows connection to be changed to a "***slave***" device, reconfigured as the "***master***", meaning the system resumes operation quickly with minimum downtime.

3.8.1.- CONNECTING INDIVIDUAL DEVICES

To connect multiple individual devices in parallel, follow these steps:

1.- Select the device that will operate as the "***master***".

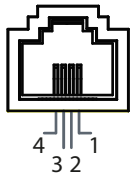
2.- Connect the "***master***" device. The current transformers are only connected to the "***master***" device.

3.- Connect all of the "***slave***" devices.

Note: *Each devices must feature the protection elements indicated in section* ***"3.5.- CONNECTION".***

4.- Connect all of the devices using the communication cables (**Table 8**).

Table 14: Communication cable, devices in parallel.

Communication cable	
RJ11 connector	**Pinout**
	**1:** Not connected. **2:** CAN A **3:** CAN B **4:** Not connected.

Note: *The communication cable must be a CAT 5 cable or higher.*

Connect the **OUT** terminal from the "***master***" filter to the **IN** terminal from the second filter, the **OUT** terminal from the second filter to the **IN** terminal of the third, and so on (**Table 14**).

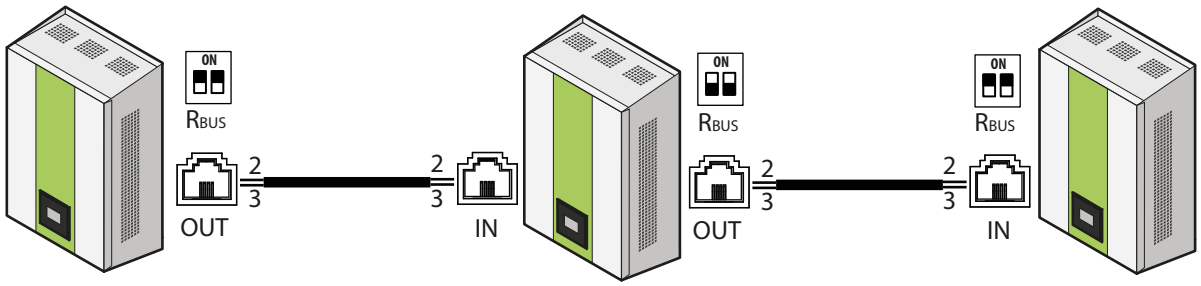


Figure 28:Connecting 3 devices in parallel, using the communication cable.

5.- Configure the installation in the "***master***" device (see ***"7.- CONFIGURATION")***

6.- Complete the configuration of the slave devices (see ***"7.- CONFIGURATION"***).

7.- Enable the terminator switch for parallel connection, **RBUS** (Terminal No 2 of **Table 11** and **Table 12**) in the bus end devices only. Then disable in the other devices.

3.8.2.- CONNECTING CABINETS

Note: *The **200A** (**SINAFMxxx200C**), **300A** (**SINAFMxxx300C**) and **400A** (**SINAFMxxx400C**) cabinets are made up of 2, 3 and 4 **100A** devices in parallel. Both the parallel configuration and connection are factory-set.*

To connect multiple cabinets in parallel, follow these steps:

1.- Select the cabinet that is to contain the "***master***" device.

2.- Connect the "***master***" cabinet. The current transformers are only connected to the "***master***" cabinet.

3.- Connect the "***slave***" cabinets.

4.- Connect all of the devices using the communication cables (**Table 8**).

Connect the **OUT** terminal from the final slave device in the "***master***" cabinet to the **IN** terminal from the "***master***" device of the following cabinet, and the **OUT** terminal from the final "***slave"*** device in this cabinet to the **IN** terminal of the "***master***" device of the following cabinet, and so on (**Figure 29**).

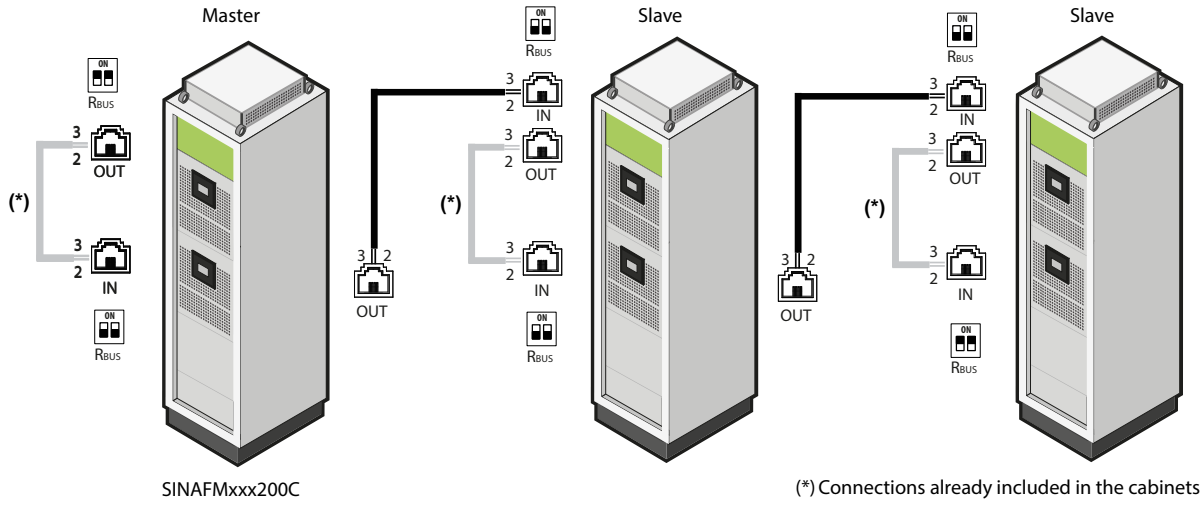


Figure 29:Connecting 3 devices in parallel, using the communication cable (200 A Master SINAFM).

5.- Configure the installation in the "***master***" device (see ***"7.- CONFIGURATION")***.

6.- Complete the configuration of the slave devices (see ***"7.- CONFIGURATION"***).

7.- Enable the terminator switch for parallel connection, **RBUS** (Terminal No 2 of **Table 12**) in the bus end devices only. Then disable in the other devices.

4.- OPERATION

4.1.- HARMONICS

Non-linear loads such as: rectifiers, inverters, variable speed drives, ovens, etc., absorb periodic non sine-wave currents from the mains.

These currents are composed of a fundamental frequency component, rated at 50 or 60 Hz, plus a series of overlapping currents, with frequencies that are multiples of the fundamental frequency; they are defined as **HARMONICS**.

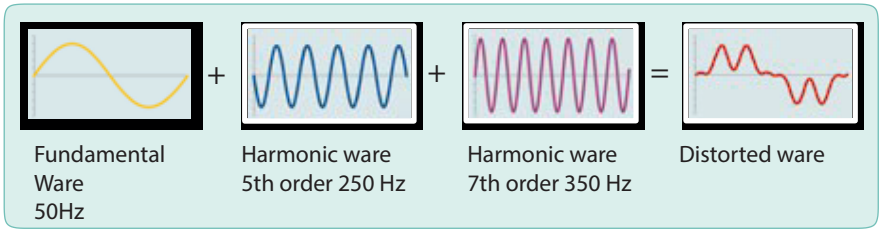


Figure 30:Distorted wave shape decomposition.

The result is a deformation of the current and, as a consequence, of the voltage, causing a series of associated side effects. These can be machinery overload, electric cable heating, circuit breaker disconnection, damage to sensitive devices, etc.

Table 15: Frequency of each harmonic.

Order (n)	Mains frequency	
	Fundamental: 50 Hz	Fundamental: 60 Hz
3	150 Hz	180 Hz
5	250 Hz	300 Hz
7	350 Hz	420 Hz
...	...	...

4.1.1.- BASIC CONCEPTS

It is best to define some terms related to harmonics, fundamental for interpreting any measurement and study:

✓**Fundamental frequency (f_1)**: Original wave frequency (50/60 Hz).

✓**Order of a harmonic (n)**: A whole number given by the ratio between the frequency of a harmonic and the fundamental frequency. The order determines the frequency of the harmonic (E.g.: 5th harmonic → 5•50 Hz: 250 Hz)

✓**Fundamental component (U_1 or I_1)**: A sine wave component of order 1 of the Fourier frequency serial development equal to the original periodic wave.

✓**Harmonic component (U_n or I_n)**: A sine wave component of order over 1 of the Fourier frequency serial development a whole multiple of the original frequency.

✓**Individual distortion rate (U_n% or I_n%)**: A ratio in % between the RMS value of the voltage or harmonic current (Un or In) and the RMS value of the fundamental component (U_1 or I_1).

$$U_n\,\% = \frac{U_n}{U_1} * 100 \qquad I_n\,\% = \frac{I_n}{I_1} * 100$$

Equation 1:Individual distortion rate

✓**True root mean square value (TRMS)**: The square root of the sum of the squares of all components forming the wave.

$$U = \sqrt{U_1^2 + U_2^2 + U_3^2 + U_5^2 + \cdots}$$

$$I = \sqrt{I_1^2 + I_2^2 + I_3^2 + I_5^2 + \cdots}$$

Equation 2:True root mean square value

✓**Harmonic content**: The difference between the total voltage or current and the corresponding fundamental value.

✓**Harmonic distortion rate (THD)**: The ratio between the RMS value of the harmonic content of the voltage and/or current and the value of the fundamental component.

$$THD(U)\% = \frac{\sqrt{U_2^2 + U_3^2 + U_5^2 + \cdots}}{U_1} \qquad THD(I)\% = \frac{\sqrt{I_2^2 + I_3^2 + I_5^2 + \cdots}}{I_1}$$

Equation 3:Harmonic distortion rate.

✓**Total demand distortion (TDD)**: Ratio between the effective value of the residual harmonic current and the value of the maximum demand current.

$$TDD(I)\% = \frac{\sqrt{I_2^2 + I_3^2 + I_5^2 + \cdots}}{I_L}$$

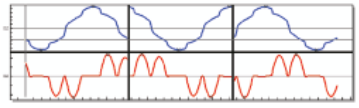
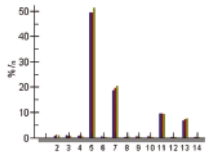
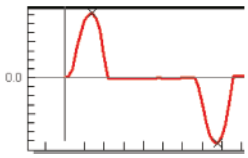
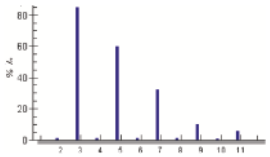
Equation 4:Total demand distortion.

Where I_L, is defined as the average of the maximum demand currents in the last 12 months, measured monthly. If this value is not available, the nominal line current can be used.

4.1.2.- MOST COMMON HARMONICS

Table 16 lists the most common harmonic generator loads and the wave shape of the current they consume, as well as their harmonic spectrum.

Table 16: Most common harmonics.

Type of load	Wave shape	Harmonic spectrum THD(I)
6-pulse converters Variable speed drives UPS Three-phase rectifiers Converters for electrolysis and baths		
Discharge lamps Single-phase converters Lighting lines Computer lines Sound and image devices		

4.1.3.- HARMONIC COMPENSATION

Active filters are devices responsible for the compensation of harmonic currents.
Compensation is achieved by injecting harmonic currents equal to those in the installation in counter phase.
This means that upstream of the filter connection point, the signal shows virtually no harmonic distortion (**Figure 31**).

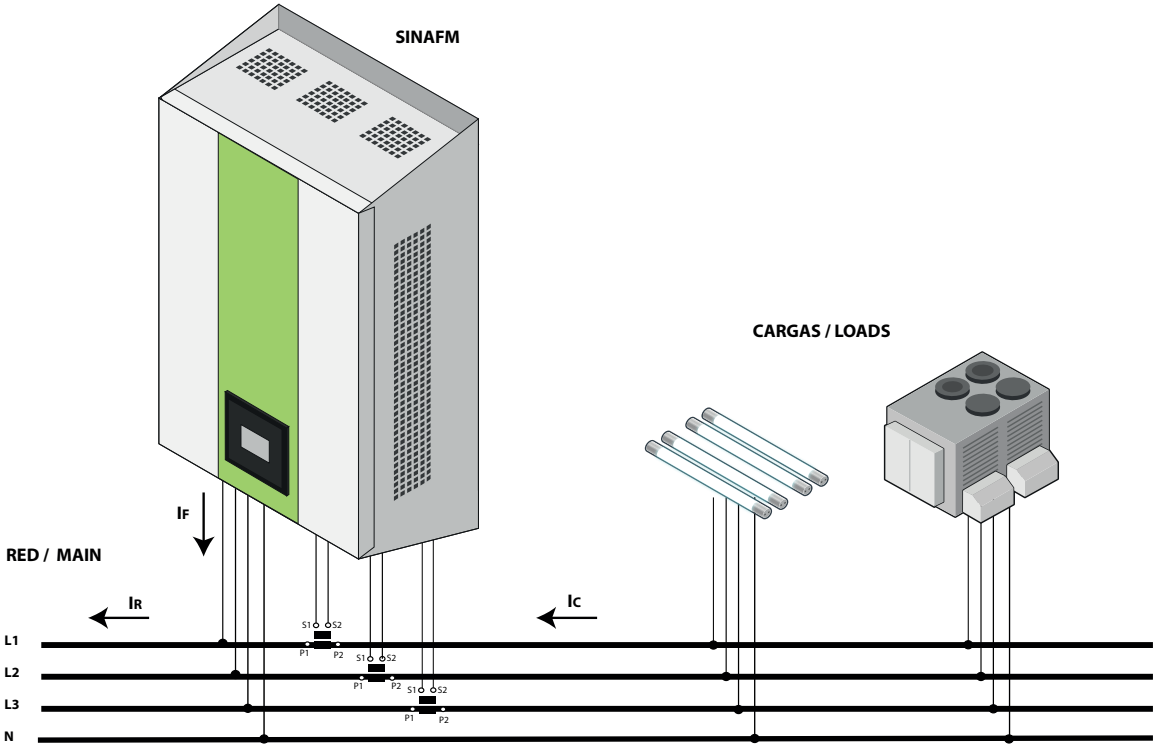


Figure 31:General connection diagram of an active filter.

4.2.- OPERATING PRINCIPLE

Active filters are based on the following principle:

$$I_{FILTER} = I_{MAINS} - I_{LOAD}$$

Equation 5:Operating principle.

In other words, they detect the difference between the desired sine wave (I_{MAINS}) of the current and the signal deformed by the harmonics (I_{LOAD}). And they inject the difference between both waves (I_{FILTER}).

Figure 32 shows the wave shapes of the currents injected by the active filters.
These show the required wave (I_{MAINS}), the existing deformed wave (I_{LOAD}) and the filter current (I_{FILTER}).

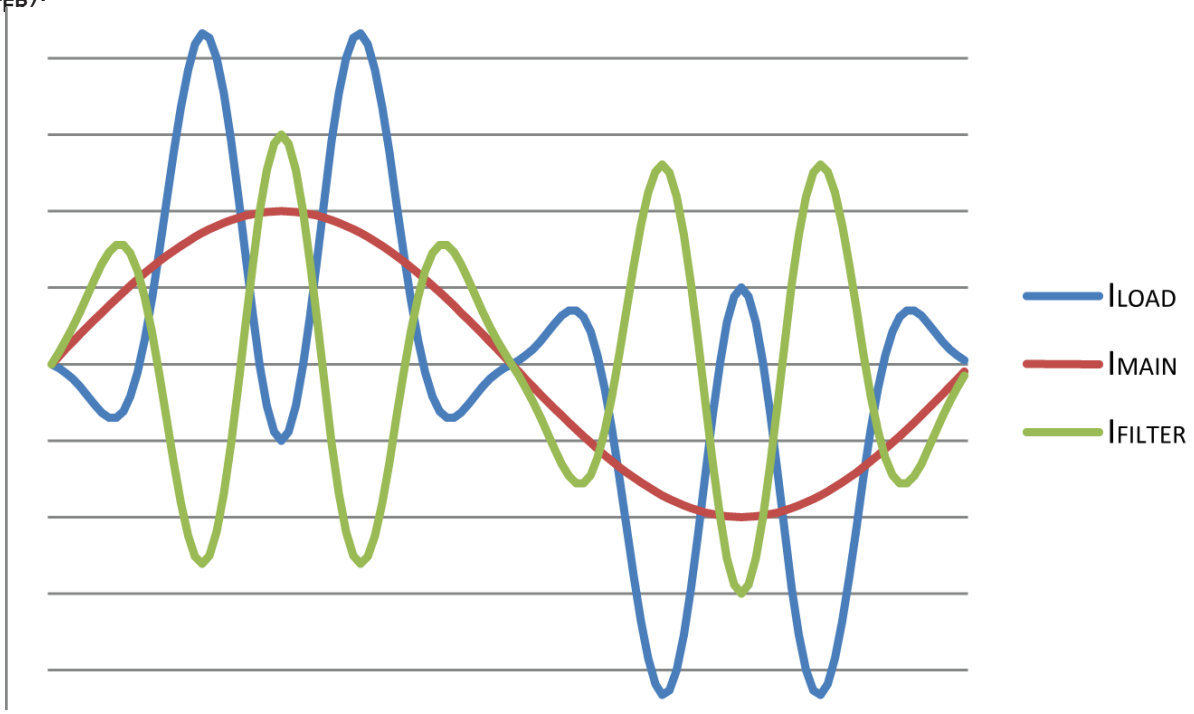


Figure 32:Current in the load, in the filter and in the mains.

4.3.- RATED CURRENT DIMENSIONS

The purchased active filter must be sized for the harmonic currents it has to filter. The rated current of the **SINAFM** must be at least 20% higher than the maximum level of harmonics to be filtered. This factor may be higher depending on the installation features.

The active filters can suffer from overloading when trying to cancel the harmonic currents in high-impedance, short-circuit mains. The clearest symptom for detecting such cases is that they originally start from a **THD(V)** (under voltage) of over 3%. It has been seen that the higher the initial **THD(V)**, the greater the chance of filter overload.
The reason for this behaviour is that the load does not behave as a current source, but rather the larger the harmonic current absorbed by the filter the more harmonics are produced by the load, which can produce up to more than double what was initially measured.
To avoid this phenomenon, it is best to oversize the active filter by multiplying the initial current

of harmonics measured in the load by a **safety factor** (**FS_h**). In other words:

$$I_{FILTER}(SINAFM) = [FS_h * I_{LOAD} * THD(I)]$$

Where:

I_{FILTER} (SINAFM): rated current of the active filter.

FS_h: safety factor > 1.2.

I_{LOAD}: maximum current of the load.

THD(I): harmonic distortion of the load current.

Equation 6: Rated current of the SINAFM.

To calculate this **safety factor** you must first know the parameter called **short-circuit ratio R_{SC}**, at the connection point of the PCL transducers (not on the installation input). The short-circuit ratio is defined as the ratio between the short-circuit current of a mains (**I_{SC}**) and the rated current of the set of non-linear transducers (**I_{CNL}**) producing the harmonics to be filtered.
(**Equation 7**)

$$R_{SC} = \frac{I_{SC}}{I_{CNL}}$$

Equation 7:Calculating the short-circuit ratio R_{SC}.

In a real installation, the short-circuit current (**I_{SC}**) in the PCL can be assessed by having the voltage at the said point for two different load currents.
For example, full load, **I_A** and 10% load, **I_B**. If **V_{OC}** is the rated voltage at no-load, the **I_{SC}**, can be calculated using the formula shown in **Figure 33**:

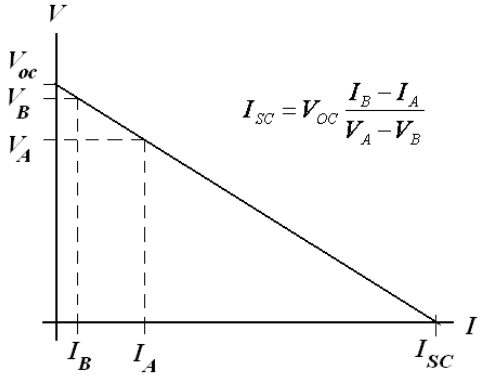


Figure 33:Graph for calculating I_{SC}.

The safety factor (**FS_h**) can be obtained from the graph in **Figure 34**:

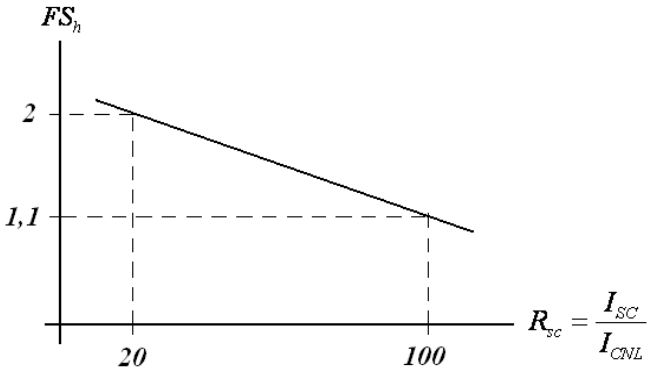


Figure 34:Approximate graph for calculating the FS_h.

4.4.- RESONANCE DETECTION

The **SINAFM** acts as a current, frequency and variable amplitude generator. This current circulates via the path of least impedance, which should be the mains.

In certain cases, there may be a load that provides less impedance than the mains, in which case a resonance phenomenon will be produced with that load. The **SINAFM** has a detection system for resonance with loads, which automatically deactivates the harmonic that causes that resonance.

In environments with a high level of short-circuit impedance of the mains and a high level of voltage **THD**, a condition may occur that the filter erroneously detects as resonance.

In such conditions, the filter action improves the current **THD**, which causes an improvement of the voltage **THD**. The improvement of the voltage **THD** causes the loads to increase their consumption, producing a deterioration of the current **THD**. The user will see that the current **THD** is worse when connecting the filter, or that the filter does not correct the current **THD** as expected. In addition, the filter detects an increase in the current when correcting the current **THD**, which it understands as a resonance, thus activating the protection elements.
If the installation behaves in this way, contact the **TAS** (Technical Assistance Service) to carry out the necessary checks to deactivate the resonance alarm safely.

4.5.- SELF-DIAGNOSIS

The device is fitted with a self-diagnosis system. The device checks the integrity of the hardware and software control elements when starting up. This analysis is carried out according to **IEC60730**.

This system ensures the device remains in a safe state in the event of failure. The user is alerted to the failure thanks to an on-screen message and it is also found in the Modbus register.

This type of failure indicates damage or degradation of any of the control and process elements, both hardware and software. Turning off the device and contacting **TAS** is recommended whenever this alarm comes about.

4.6.- THERMAL PROTECTION

The device features several levels of thermal protection:

✓**Ventilation regulation**, the fan speed is adjusted as needed at any given time, thus minimising the noise in the device.

✓**Static temperature limitation,** the device reduces its power if the internal temperature exceeds certain limits. This maximises the availability of the device in any situation.

✓**Dynamic limitation of the device,** one of the factors affecting the reliability of the device is the stress caused by repeated heating and cooling cycles. The device adjusts both its ventilation and power to minimise the impact that thermal cycling has on the life of the device.

✓**Safety shutdown,** despite the above measures, the temperature of certain components may exceed their maximum allowable level if the device is used in environmental conditions beyond the specified range. To avoid damaging the device or installation, the device will completely shut down automatically. The device must be disconnected from its power supply for 30 minutes to rearm this protection

4.7.- DISPLAY

The device features a 3.5” TFT display on the front part in order to be able to view and configure all of the parameters of the device.

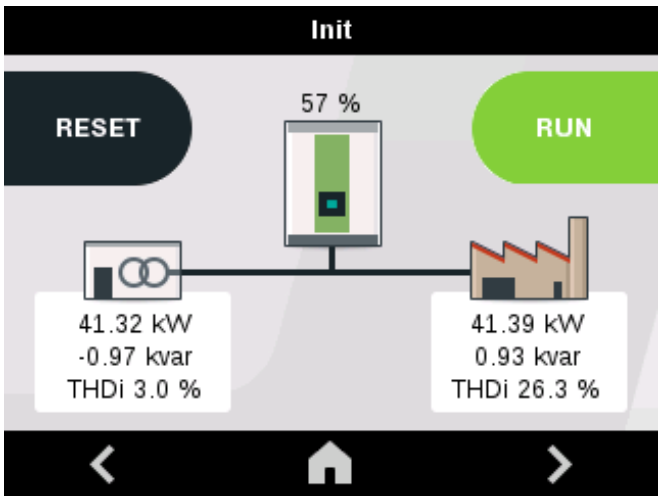


Figure 35: Display.

The display enters the energy saving mode 10 minutes after the last action. To reactivate it, just touch the display. The last screen before entering the energy saving mode will be shown.

The display is divided into three areas (**Figure 36**):

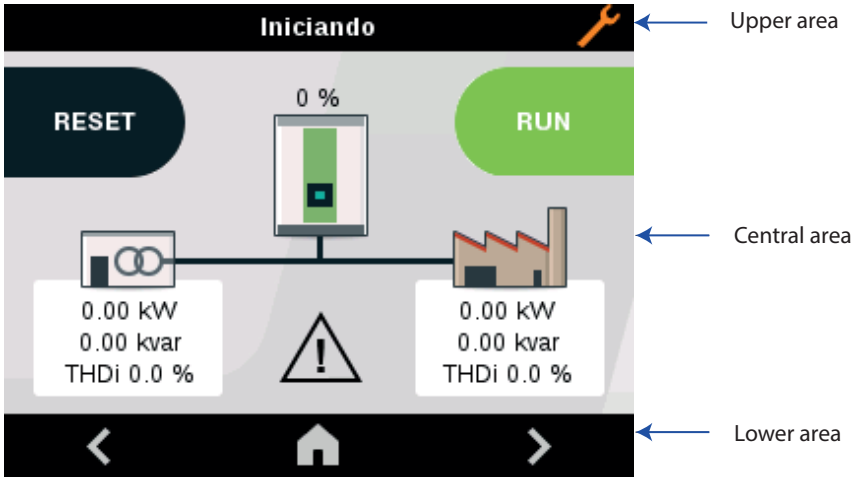


Figure 36:The display is divided into three areas.

4.7.1.- UPPER AREA

The following will be displayed on the upper area:

✓ A short description of the status of the device.
✓ The symbol, when the device requires maintenance, see section "***10.- MAINTENANCE***".

4.7.2.- CENTRAL AREA

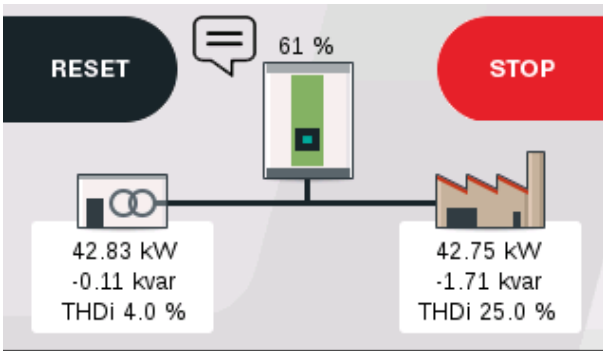


Figure 37: Central area.

This area shows:

✓ The condition of the installation,
✓ All parameters and graphs of the device.
✓ The symbol, when a warning has been generated. See section "***6.17.- WARNINGS***"
✓ The symbol means the device has advice pending that needs to be read. The device continuously analyses its behaviour and interaction with the installation. This analysis enables it to give advice on how to optimise overall system performance. Once the icon has been read, it disappears until further advice is offered.

And the necessary keys at each point, **Table 17**.

Table 17: Central area keys.

Key	Function
	Restarts the device after an alarm.
	Starts the active filter.
	Stops the active filter.

4.7.3.- LOWER AREA

Figure 38: Lower area.

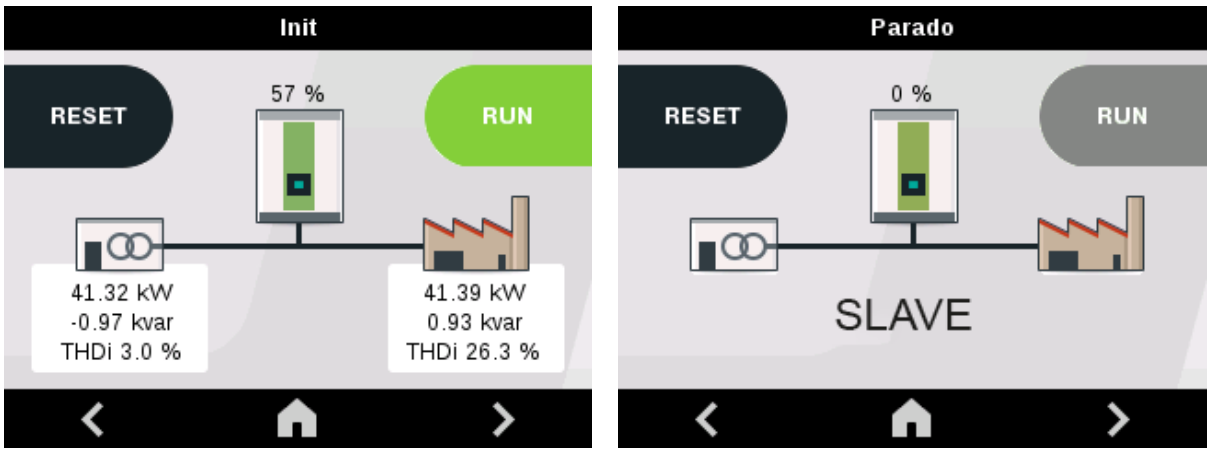
The lower area displays the navigation and configuration keys of the device.

Table 18: Lower area keys.

Key	Function
	Provides access to the main screen of the device.
	Shifting to the left.
	Shifting to the right.

5.- START-UP

When the device has been powered, one of the screens in **Figure 39** appears on the display.



Screen of a "Single" device or "Master" **Screen of a "Slave" device**

Figure 39: Home screen.

Before starting the active filter, it is necessary to follow the steps below:

1.- Use the key to navigate to the configuration screen and implement the appropriate configuration according to the existing installation (*see **" 7.- CONFIGURATION"***).

2.- (Device ***"single"*** or ***"master"***) Use the key to navigate to the voltage and current display screen (***"6.5.- VOLTAGE, CURRENT AND FREQUENCY"***), and:

- ✓ Make sure the **voltage** measurements correspond to the real voltages of the installation.
- ✓ Make sure the load **current** measurements correspond to the current levels of the installation.

3.- (Device ***"single"*** or ***"master"***) Use the key to navigate to the display screen of the load parameters (***"6.7.- POWER AND COS ϕ OF LOAD"***) and:

- ✓Make sure the **active power** measurement of the load corresponds to the active power levels of the installation.
- ✓Make sure the **reactive power** measurement of the load corresponds to the reactive power levels of the installation.
- ✓ Check the **cos** ϕ in the three phases. If phases appear with very high reactive power and very low active power levels, this may indicate an error in the phase order. In this case, check the power supply and current input connections.

4.- (Device ***"single"*** or ***"master"***) Go back to the home screen of the device, **Figure 39**, if there is no problem with the connections, the upper area should show the message "**Stop"**.
If there is a problem with the filter connections or the configuration, the **"Waiting for conditions"** message appears.

5.- (Device ***"single"*** or ***"master"***) Press the RUN key to start the active filter. If it has started correctly, the screen will show the message "**Run**".

6.- DISPLAY

6.1.- MAIN SCREEN

6.1.1. - DEVICE SINGLE OR MASTER

Figure 40 shows the main screen of a ***"single"*** or ***"master"*** device.

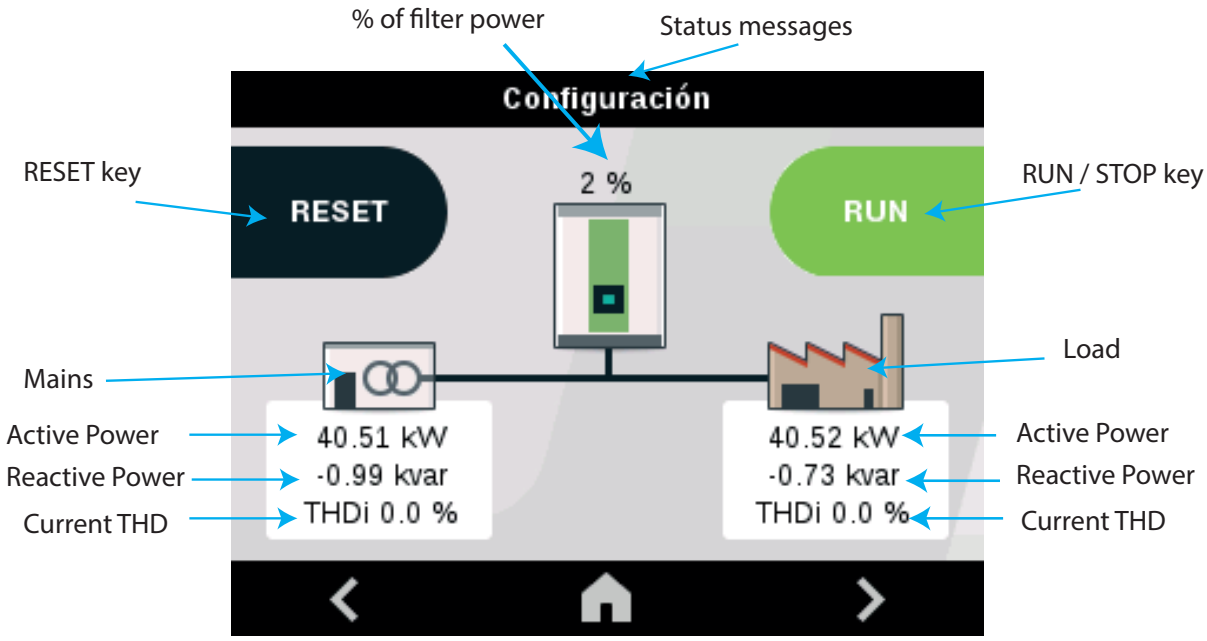


Figure 40: Main screen.

It shows the **Active Power** and **Reactive Power** values, as well as the **Current THD** value in the Mains and in the Load. The **% of filter power** used.

The RESET key allows you to restart the device if an alarm has been generated and this has been resolved.

The RUN / STOP key is the start and stop key of the active filter.

Use the ‹ and › keys to navigate through the different display screens.

In the upper part of the screen, a message with the current status of the device is shown (**Table 19**).

Table 19:Status messages

Status messages	
Starting	
Description	The **SINAFM** is starting up.
Init	
Description	The device is starting the systems.
Waiting comms	
Description	Initiating internal communication systems
Waiting for conditions	
Description	Waiting for the conditions to be met in order to operate.

Table 19 (Cont.) : Status messages

Status messages	
Calibration	
Description	Calibrating the internal sensors.
Configuration	
Description	Configuring the device.
Run	
Description	Device is operating.
Sync	
Description	The **SINAFM** is synchronising with the mains.
Charging Bus DC	
Description	Charging process of the internal bus prior to start-up.
Stop	
Description	Device stopped.
Alarm	
Description	An alarm has been generated. Access the Alarms screen (***"6.16.ALARMS"***) to obtain more information.

6.1.2. - DEVICE SLAVE

In **Figure 41** the main screen of the ***"slave"*** device is shown.

Figure 41: Main screen of the slave device.

This shows the **% for the filter power** used.

The RESET and RUN / STOP keys are disabled in the slave devices.

Use the < and > keys to navigate through the different display screens.

In the upper part of the screen, a message with the current status of the device is shown (**Table 19**).

6.2.- THD

Note: *This screen is not visible on the* ***"slave"*** *devices.*

By pressing the › key from the main screen, the THD display screen is accessed.

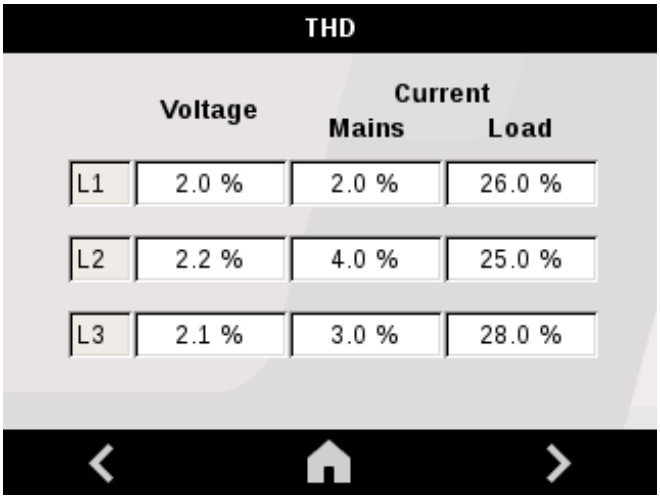


Figure 42: THD display.

It shows:

- ✓ The voltage THD in each of the phases, L1, L2 and L3.
- ✓ The current THD in the Mains in each of the phases, L1, L2 and L3.
- ✓ The current THD in the Load in each of the phases, L1, L2 and L3.

Use the ‹ and › keys to navigate through the different display screens.

6.3.- TDD

Note: *This screen is not visible on the* ***"slave"*** *devices.*

Note: *This screen is only visible if the Line Current* I_L***(A)*** *has been set up on the IEEE519 configuration screen, see* ***"7.8.- IEEE519"****.*

Figure 43 shows the TDD, which is the ratio of the harmonic current to the nominal current in the line.

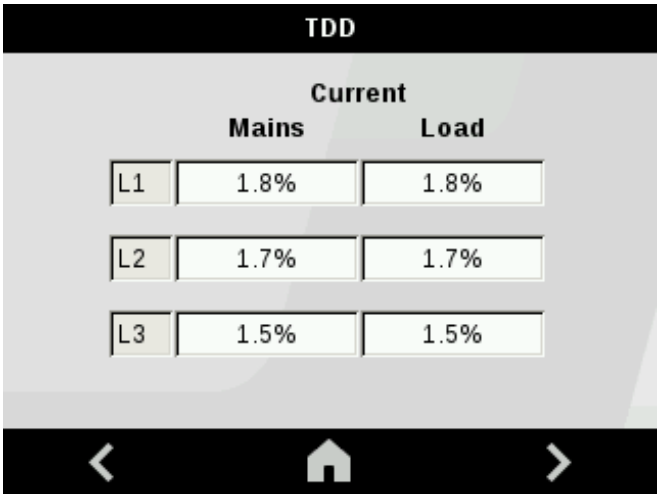


Figure 43: TDD.

Use the ‹ and › keys to navigate through the different display screens.

6.4.- HARMONIC CURRENT

Note: *This screen is not visible on the* ***"slave"*** *devices.*

Figure 44 displays the harmonic current in absolute value for each of the mains and load phases.

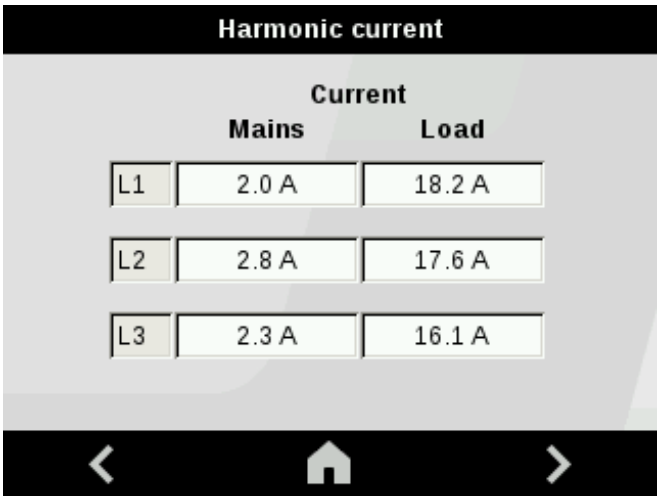


Figure 44: Harmonic current.

Use the ‹ and › keys to navigate through the different display screens.

6.5.- VOLTAGE, CURRENT AND FREQUENCY

Note: *This screen is not visible on the* ***"slave"*** *devices.*

Figure 45 shows the Voltage, Current and Frequency screen.

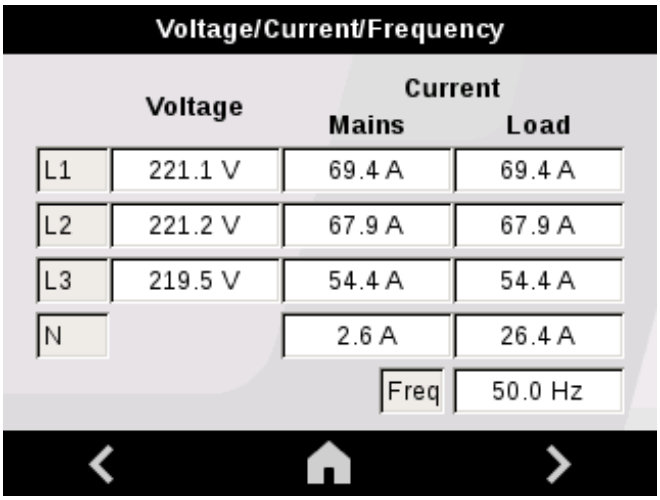


Figure 45: Voltage, Current and Frequency display.

It shows:

- ✓ The Voltage in each of the phases, L1, L2 and L3.
- ✓ The Current in the Mains in each of the phases, L1, L2, L3 and Neutral.
- ✓ The Current in the Load in each of the phases, L1, L2, L3 and Neutral.
- ✓ The Frequency.

Use the < and > keys to navigate through the different display screens.

6.6.- POWER AND COS ϕ OF MAINS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

Figure 46 shows the power and cos ϕ of the mains.

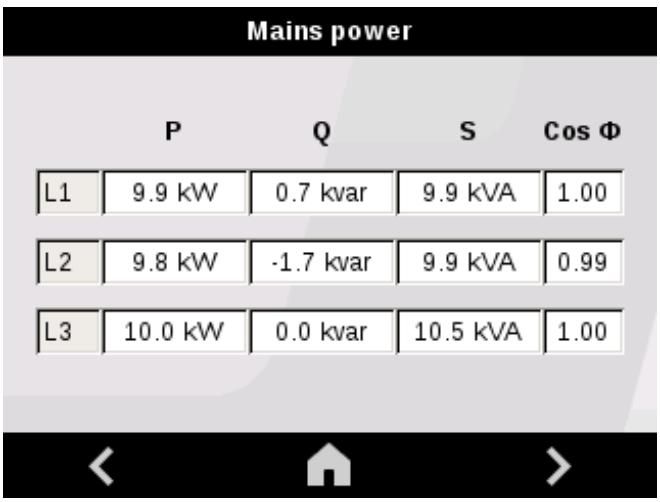


Figure 46: Display of the power and cos ϕ of the mains.

It shows:

- ✓ The Active Power (P), Reactive Power (Q) and Apparent Power (S).
- ✓ The cos ϕ

Note: *The - sign in reactive power indicates that it is capacitive and the + sign that it is inductive.*

Use the < and > keys to navigate through the different display screens.

6.7.- POWER AND COS ϕ OF LOAD

Note: *This screen is not visible on the* ***"slave"*** *devices.*

Figure 47 shows the power and cos ϕ of the load.

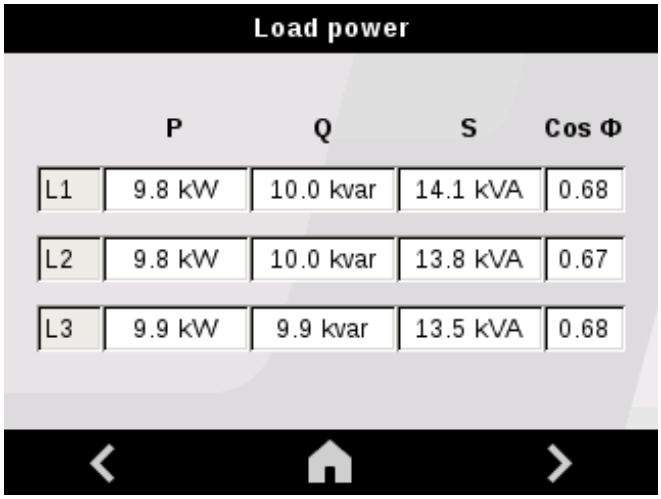


Figure 47: Display of the power and cos ϕ of the load.

It shows:

- ✓ The Active Power (P), Reactive Power (Q) and Apparent Power (S).
- ✓ The cos ϕ.

Note: *The - sign in reactive power indicates that it is capacitive and the + sign that it is inductive.*

Use the < and > keys to navigate through the different display screens.

6.8.- VOLTAGE HARMONICS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 48**, the odd voltage harmonics from 3 to 25, are shown for each of the phases.

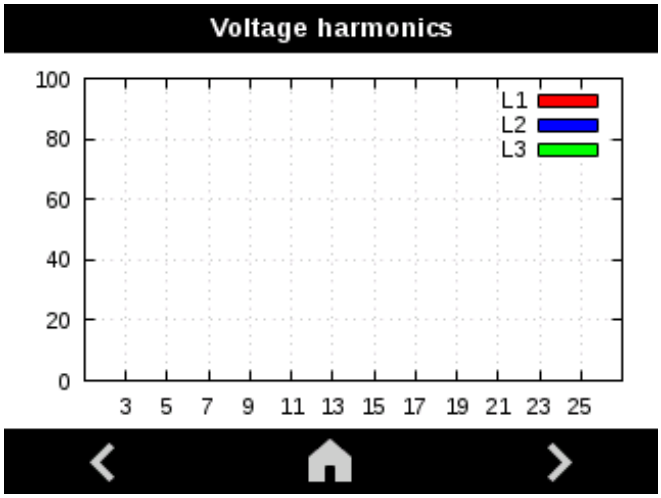


Figure 48: Display of the Voltage harmonics.

Use the < and > keys to navigate through the different display screens.

6.9.- CURRENT HARMONICS (MAINS)

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 49**, the odd harmonics of the Mains, from 3 to 25, are shown for each of the phases.

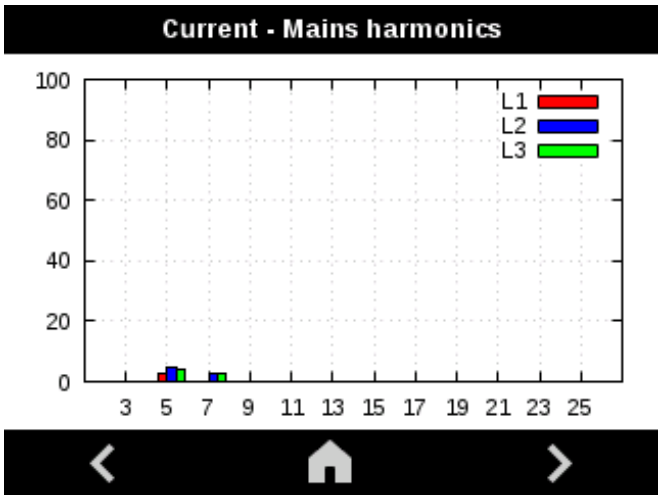


Figure 49: Display of the Mains harmonics.

Use the < and > keys to navigate through the different display screens.

6.10.- CURRENT HARMONICS (LOAD)

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 50**, the odd harmonics of the Load from 3 to 25 are shown for each of the phases.

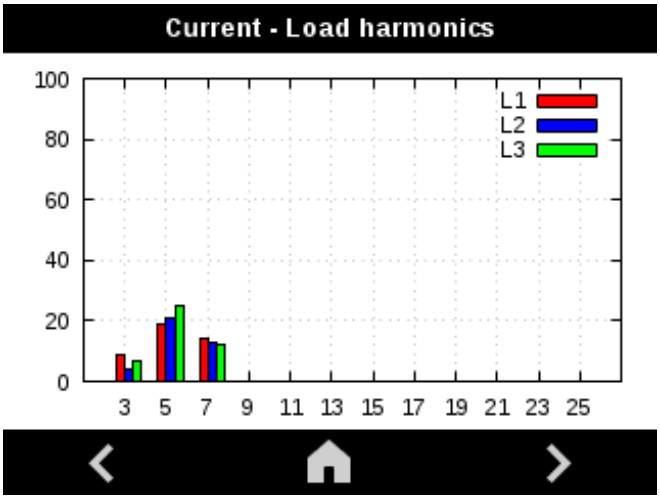


Figure 50: Display of the Load harmonics.

Use the ‹ and › keys to navigate through the different display screens.

6.11.- TABLE OF HARMONICS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 51**, shows all the voltage harmonics, load current and mains current in table form for each phase.

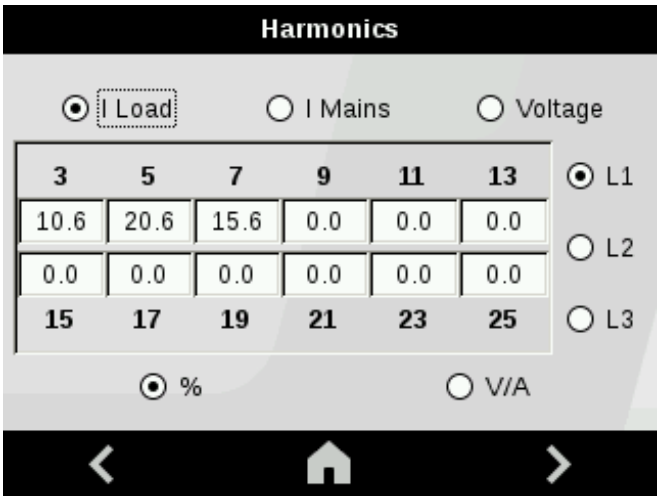


Figure 51: Display of the Table of harmonics.

The harmonics can be displayed as a % ⦿ % or in absolute values. V/A.
Use the ‹ and › keys to navigate through the different display screens.

6.12.- WAVE SHAPE OF MAIN CURRENT

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 52**, the wave shape of the mains current is shown for each of the phases.

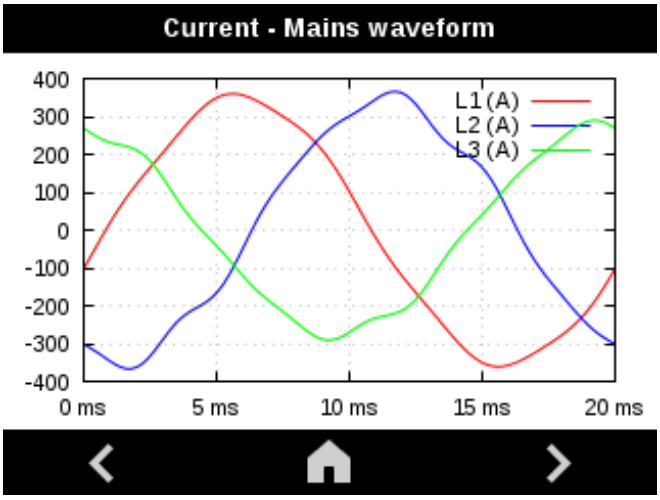


Figure 52: Wave shape of mains current.

Press on the graphs to select the separate display of each phase.

Use the < and > keys to navigate through the different display screens.

6.13.- WAVE SHAPE OF LOAD CURRENT

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 53**, the wave shape of the load current is shown for each of the phases.

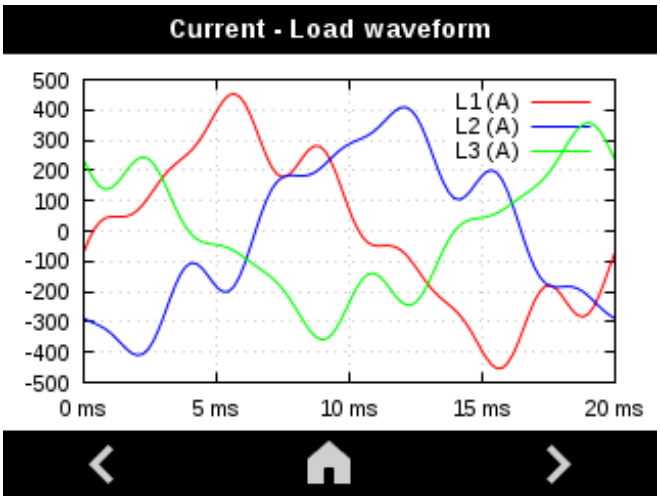


Figure 53: Wave shape of Load current.

Press on the graphs to select the separate display of each phase.

Use the < and > keys to navigate through the different display screens.

6.14.- MAINS PHASORS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 54**, the mains phasors are shown.

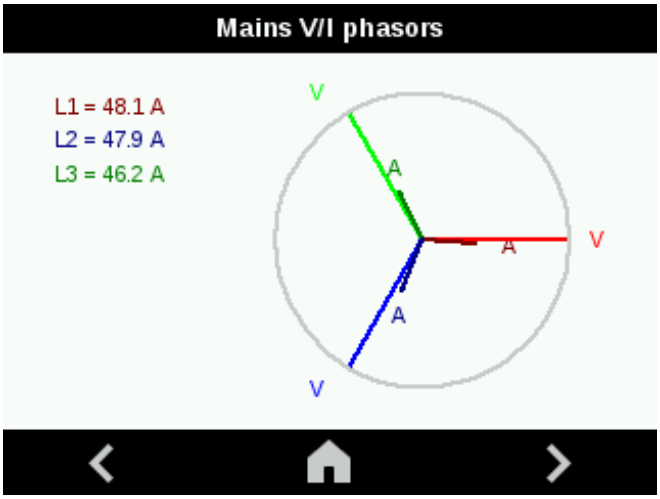


Figure 54: Mains phasors.

Use the < and > keys to navigate through the different display screens.

6.15.- LOAD PHASORS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 55**, the load phasors are shown.

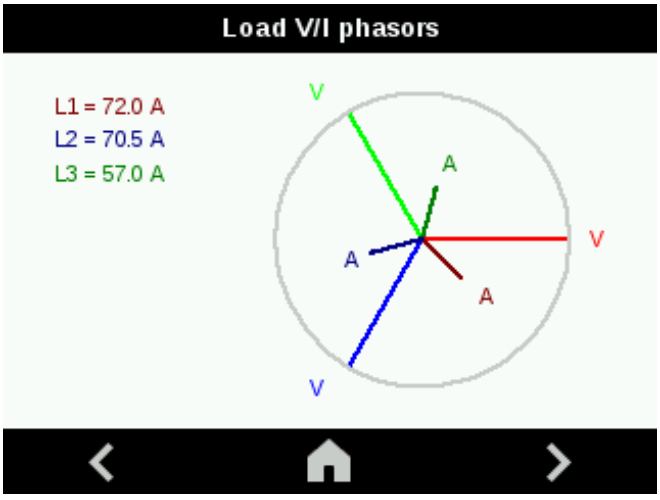


Figure 55: Load phasors.

Use the < and > keys to navigate through the different display screens.

6.16.- ALARMS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 56**, the alarms that have occurred are shown.

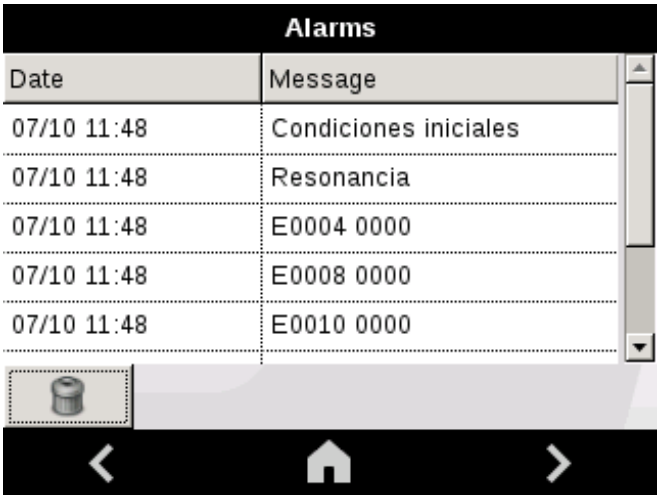


Figure 56: Alarms.

A brief description of the alarm is displayed on the screen, as well as the date and time at which it occurred.

Press the  key to delete the alarm log.

Table 20 shows the messages that could appear on the device.

If the cause of the alarm disappears, the device will be reconnected automatically.
If the same alarm is triggered 5 times during a 1-hour period, the automatic device reconnection function will be disabled.

The 

key rearms the device if the cause of the alarm has disappeared or has been resolved.

If the device remains in a permanent alarm state, the screen shown in **Figure 57**, is displayed.

Figure 57: Permanent alarms.

If the display has entered energy saving mode, it is automatically disabled. The alarm screen disappears when the display is touched.

Use the < and > keys to navigate through the different display screens.

Table 20:Alarm messages.

Alarm messages	
Overcurrent L1/L2/L3	
Description	The **SINAFM** current is too high.
Corrective action	This alarm may be associated with transients and noise in the power supply voltage. Check the quality of the power supply voltage. If it continues, contact the **TAS**.
Mains overvoltage L1/L2/L3	
Description	The mains voltage is too high.
Corrective action	This alarm may be associated with transients and noise in the power supply voltage, or with incorrect mains voltage values. Check the configuration. Check the quality of the power supply voltage. If it continues, contact the **TAS.**
High temp IGBT	
Description	The temperature of the power module is very high.
Corrective action	Check that the fans are working. Clean or replace them if necessary. If it continues, contact the **TAS.**
High temp Inductor	
Description	The temperature of the inductors is very high.
Corrective action	Check that the fans are working. Clean or replace the fans if necessary. If it continues, contact the **TAS.**
Resonance	
Description	Detection of a potential resonance with a load
Corrective action	The resonance detection function can be activated erroneously in installations with a very high voltage THD. Contact the **TAS**.
Initial Conditions	
Description	The start-up conditions have not been met 10 times during the past 5 minutes.
Corrective action	Check the configuration and the ambient temperature. Check the quality of the power supply voltage. If it persists, contact the **TAS.**
Internal communications	
Description	Failure in internal communications.
Corrective action	Restart. Contact the **TAS**.
Hardware failure	
Description	The self-diagnostic system has detected a fault.
Corrective action	Contact the **TAS**.
Exxx or Cxxx	
Description	Internal error.
Corrective action	Contact the **TAS**.

6.17.- WARNINGS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

When the device generates a warning, it will continue to operate, but the ⚠ symbol will be displayed on the main screen.

On pressing the RUN key; if there are active warnings, the screen shown in **Figure 58**, will be displayed and the user will be asked for confirmation to continue with the filter start-up process.

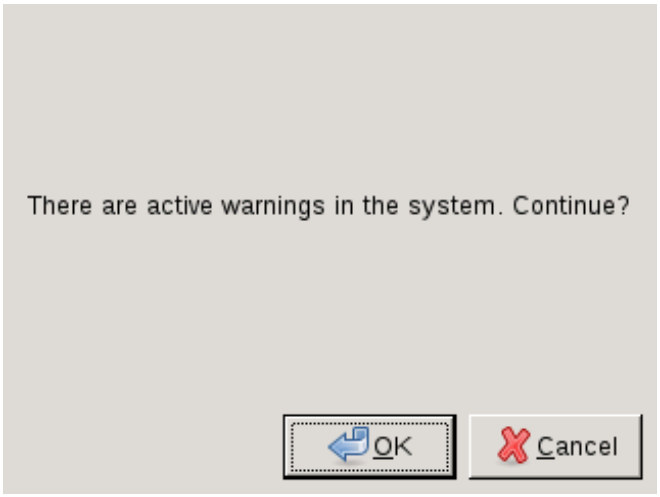


Figure 58: Confirm screen.

This screen, **Figure 59**, shows the active warnings. **Table 21** shows the warnings that can appear on the device's display.

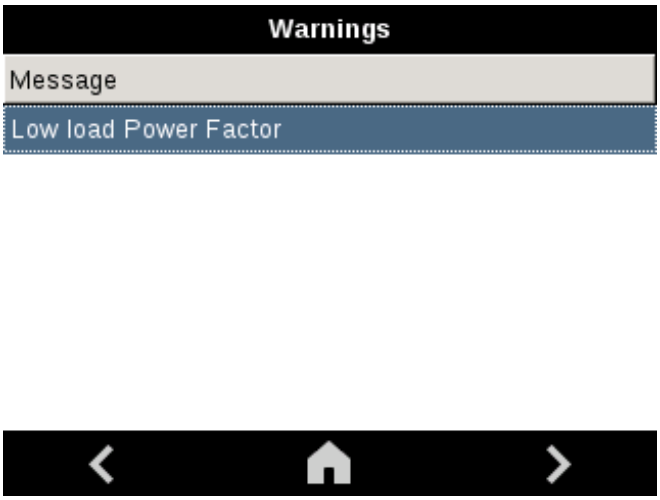


Figure 59: Warnings.

Use the ‹ and › keys to navigate through the different display screens.

Table 21: Warnings messages.

Warnings messages	
Waiting for conditions	
Description	The start-up conditions are not met.
Corrective action	Check the alert messages.

Table 21 (Cont.) : Warnings messages.

Alarm and event messages	
Load polarity	
Description	Detection of an error in the load polarity.
Corrective action	Check the transformer connections. See section ***"7.9.- TRANSFORMER CONFIGURATION"***
Disabled X harmonic	
Description	Harmonic X has been disabled due to resonance.
Corrective action	The resonance detection function can be activated erroneously in installations with a very high voltage THD. Contact the **TAS**.
Annual maintenance	
Description	A year has passed since the last maintenance procedure was carried out and the maintenance meter was reset.
Corrective action	Perform the annual maintenance procedure and reset the maintenance meter. (see ***"10.- MAINTENANCE"***)
Fan maintenance	
Description	Fans have been operating for over 40,000 hours; they must be replaced and the maintenance meter must be reset.
Corrective action	Replace the fans and reset the maintenance meter. (see "***10.- MAINTENANCE***")
Fan deterioration	
Description	Deterioration in the ventilation capacity of the system has been detected.
Corrective action	Check that the fans are clean. Perform the periodic maintenance tasks. Replace the fans if this does not solve the problem. (see "***10.- MAINTENANCE***")
Mains voltage out of limits	
Description	Mains voltage below the minimum
Corrective action	This alert may be associated with transients and noise in the power supply voltage, or with incorrect mains frequency values. Check the configuration. Check the quality of the power supply voltage. If it continues, contact the **TAS.**
Min temperature	
Description	Temperature below the minimum operating value
Corrective action	Wait for the environmental conditions to meet the requirements. If the alarm continues, contact the **TAS.**
Mains frequency limits	
Description	Main frequency out of the limits
Corrective action	This alert may be associated with transients and noise in the power supply voltage, or with incorrect mains frequency values. Check the configuration. Check the quality of the power supply voltage. If it continues, contact the **TAS.**
Minimum current	
Description	Mains current below the programmed level.
Corrective action	Check the configuration.
Maximum load	
Description	Filter working at full load
Corrective action	No action is necessary.
Low power factor	
Description	The power factor value measured is less than 0.7, which might indicate a connection error in the measuring transformers, where the voltage phases do not correspond to the current phases.

Table 21 (Cont.) : Warnings messages.

Alarm and event messages	
Corrective action	Confirm that the connections are correct.
Negative power	
Description	The power value measured is negative (generated power), which might indicate that the transformers have been connected inversely.
Corrective action	Confirm that the connections are correct.
Wxxx	
Description	Internal error.
Corrective action	Contact the Technical Assistance Service.
Parallel filter in alarm	
Description	This is a fault in one or more slaves.
Corrective action	The device does not stop and adjusts its operation to the number of available slaves. On the slave device status screen, "***6.21.- SLAVE DEVICE STATUS***" you can view the status and alarms for each filter. If there is a communications error with any of the slaves, stop the devices and check the communications wiring.

6.18.- TEMPERATURE

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 60**, displays the device's temperature range for inductances and IGBTs.

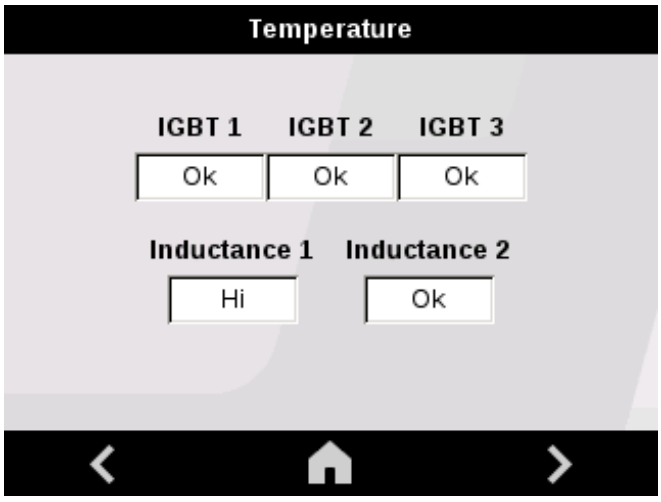


Figure 60: Temperature.

The screen displays:

- ✓ **Ok**, correct temperature.
- ✓ **Hi**, high temperature.
- ✓ **Low**, low temperature.

Use the < and > keys to navigate through the different display screens.

6.19.- ETHERNET COMMUNICATIONS

In this screen, **Figure 61**, the IP address of the device and the netmask are shown.

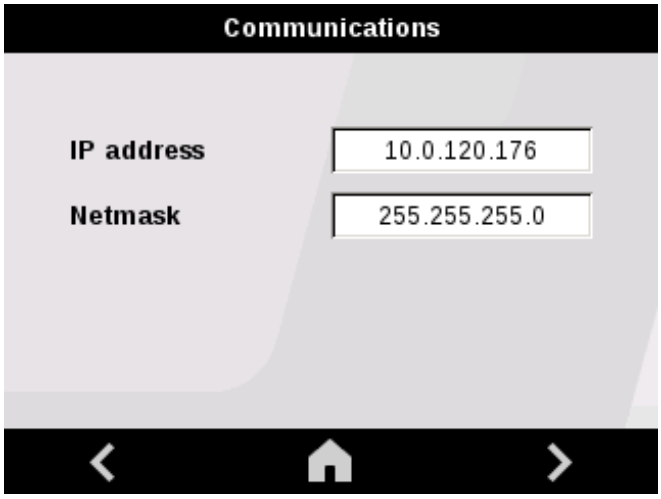


Figure 61: Communications.

Use the < and > keys to navigate through the different display screens.

6.20.- DEVICE INFORMATION

In this screen, **Figure 62**, the serial number, HMI and DSP versions of the device are shown.

Figure 62: Device information.

The touch panel of the display is calibrated from factory, but depending on the installation conditions, it may be necessary to recalibrate it.

It is recommended to use a soft tip pointer (take care not to damage the display) and press icon  . The calibration screen is shown below, **Figure 63**.

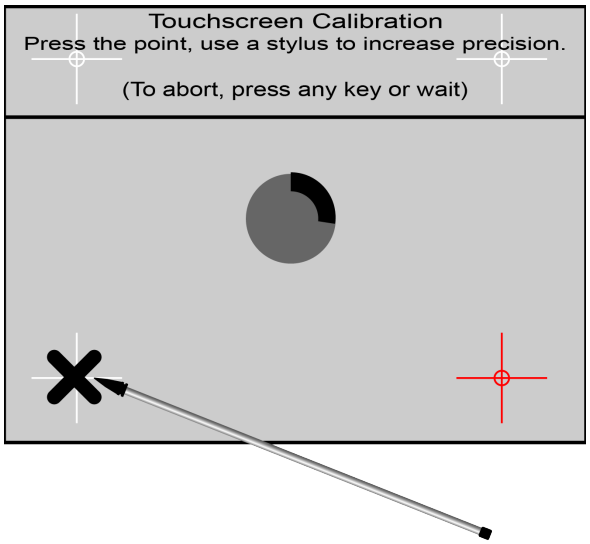


Figure 63: Calibrate touch sensor.

Note: *You have accessed the calibration screen by accident, wait until the line that surrounds the central circle is complete*  *and you will be returned automatically to the information screen of the device (***Figure 62***).*

Use the  and  keys to navigate through the different display screens.

6.21.- SLAVE DEVICE STATUS

Note: *This screen is not visible on the* ***"slave"*** *devices.*
Note: *This screen is only displayed if a system has been configured with devices in parallel.*

This screen, **Figure 64,** shows the status of each "***slave***" device.

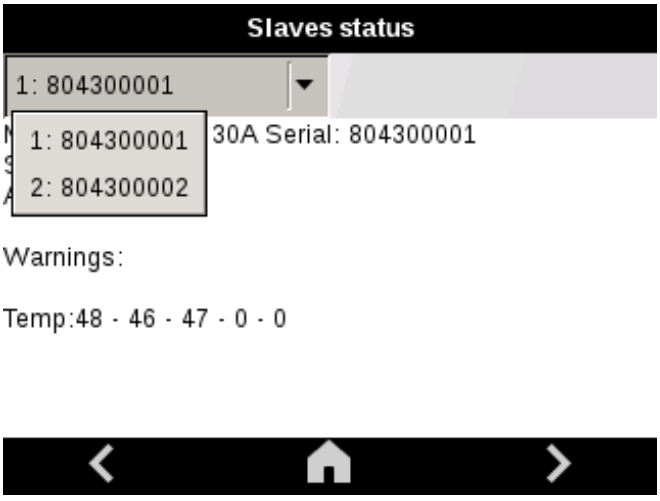


Figure 64: Slave device status screen (1).

The "***slave***" to be checked can be selected from the top tab, by serial number.

Select the "***slave***"; the screen shown in **Figure 65** will be displayed. This screen shows the Model, Type and Serial number of the device, as well as its status, active alarms and the temperature of the IGBTs and inductors.

Figure 65: Slave device status screen (2).

Note: *If there is a communication error, the message "**Communication error**" will appear when you select the affected device.*

7.- CONFIGURATION

Figure 66 shows the main configuration screen.

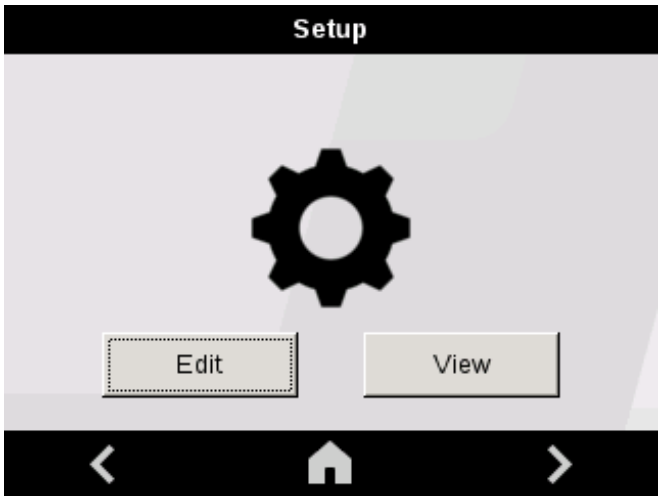


Figure 66: Main configuration screen.

By pressing the View key, the setup menu is accessed in display mode, i.e., all parameters of the device are shown but they cannot be modified.

By pressing the Edit key, the setup menu is accessed in edit mode, i.e., the parameters of the device can be modified. In this case, before entering the setup menu it is necessary to enter the password, **Figure 67**

Password: 1234

Figure 67: Password to access the setup menu in edit mode.

7.1.- LANGUAGE

In this screen, **Figure 68**, the language of the display is selected.

Figure 68: Configuration screen: Language.

● **Language**, display language.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.2.- DEVICE SPECIFICATIONS

Note : *This screen is informative, it can not be modified.*

In this screen, **Figure 69**, the specifications of the device are displayed.

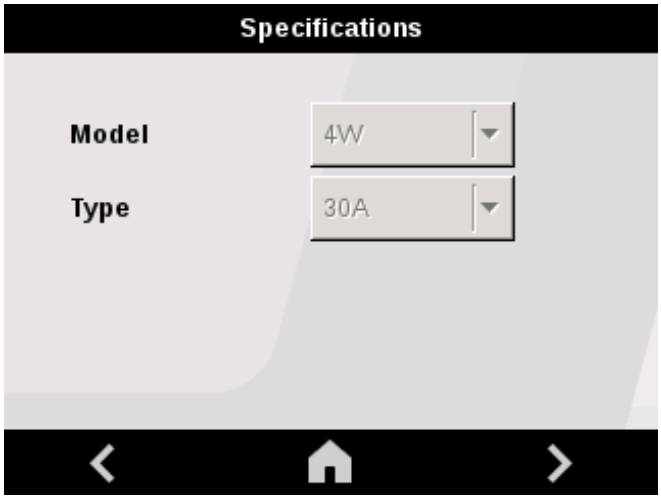


Figure 69: Configuration screen: Device specifications.

● **Model**, device model, the options are:

- ✓ **3W** : 3-wire model.
- ✓ **4W** : 4-wire model.

● **Type,** device range:

✓ **30A** : 30 A model.
✓ **60A** : 30 A model.
✓ **100A** : 100 A model.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.3.- INSTALLED DEVICES

The type of device are configured in this screen, **Figure 70**.

Figure 70: Configuration screen: Installed units

● **Type of device: Master / Single / Slave**

In this screen the type of device is selected, the possible options are:

✓ **Single:** select this option if the **SINAFM** does not have filters connected in parallel.

✓ **Master:** select this option if the filter is going to be used as the "***master***" of a group of devices in parallel.

✓ **Slave:** select this option if the device is going to be used as the "***slave***" of a group of devices in parallel.
Once the device has been configured as the "***slave***", the next configuration step is shown in section "***6.19.- ETHERNET COMMUNICATIONS***".
Note : The RESET and RUN / STOP keys are disabled in the slave devices.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.4.- WORKING MODE

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 71**, the following parameters of the device's operating mode are configured:

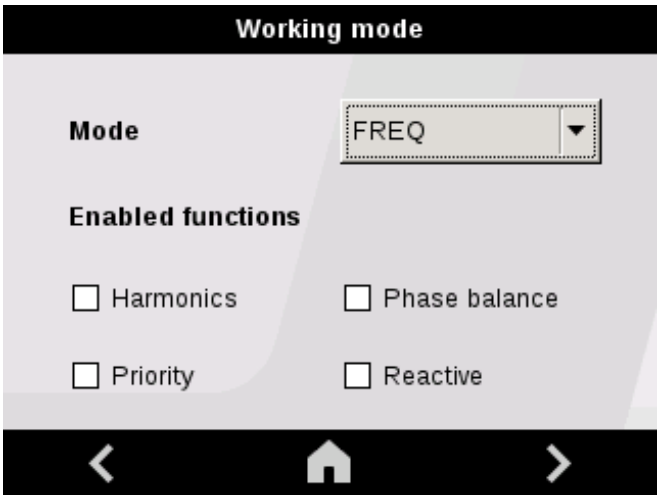


Figure 71: Configuration screen: Operation mode.

● Mode

In this parameter, the control algorithm that the device will use for harmonic filtering is selected, the options are:

✓ **FREQ: Frequency Mode,** Harmonic filtering based on the selection of harmonics to be neutralised from 3 to 25.
✓ **TEMP: Temporary Mode,** Harmonic filtering based on the instantaneous neutralisation of all harmonics.

⚠	Do not use **Temporary mode** if the supplier has not recommended this for their installation. This method can cause resonance in certain installations.

● Enabled Functions

In this parameter, you can select the operating mode of the device, i.e., the functions that the device performs during operation:

✓Harmonics

Enable this function so that the device performs the filtering of the current harmonics.

✓ Phase balance

Enable this function so that the device performs the current balancing between phases.

	The phase balancing option in **SINAFM348xxxx** works in unbalances produced by loads connected between phases in three-phase mains without neutral. The **SINAFM348xxxx** does not compensate unbalances produced by single-phase loads connected between phase and neutral. Use a **SINAFM440xxxx** to correct this type of unbalances.

✓**Priority**

Enable this option so that the device prioritises the functions in case of filter current saturation due to overload:

With the function **enabled**, the current balancing between phases and the reactive current compensation is prioritised over the harmonic filtering.

With the function **disabled**, priority is given to the current harmonic filtering and power factor correction and overload balancing are penalised.

Table 22: Order of priorities

Priority	Order of priorities function	
	Disabled	**Enabled**
+	Harmonic filtering	Phase balancing Power factor correction
-	Phase balancing Power factor correction	Harmonic filtering

✓ **Reactive**

Enable this function so that the device compensates the reactive energy or corrects the displacement power factor, cos Φ.

Press the  key to access the next configuration step
Press the  key to access the main screen of the device without saving the configuration values

7.5.- HARMONICS SELECTION

Note: *This screen is not visible on the* ***"slave"*** *devices.*
Note: *The screen that appears if you have selected the operating mode* ***FREQ: Frequency mode ("7.4.- WORKING MODE")***

The harmonics to be filtered are selected in this screen, **Figure 72**.

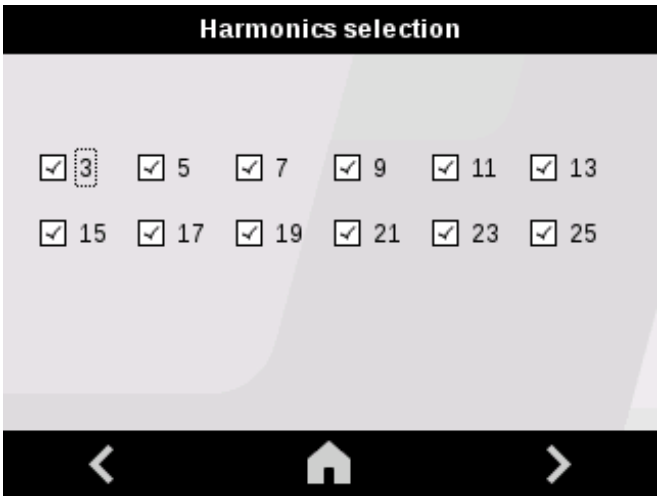


Figure 72: Configuration screen: Harmonic selection.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.6.- OPERATING LIMITS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 73**, the operating limits of the device are configured:

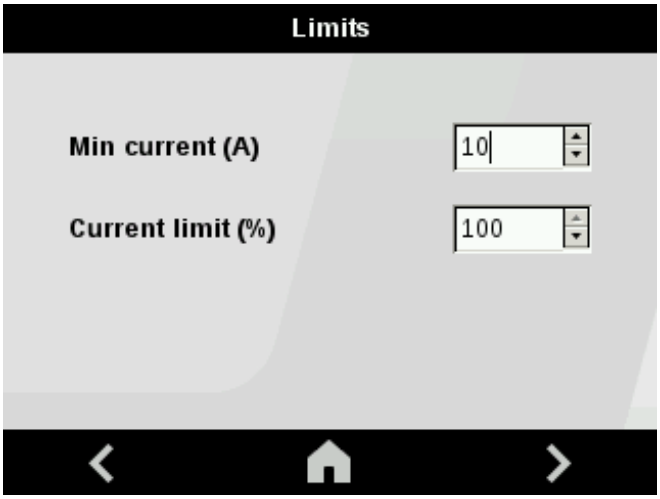


Figure 73: Configuration screen: Operating limits.

• Min current
The minimum load current to start the active filter is configured with this parameter. Minimum

current feature is used to increase the system efficiency, by stopping the filter when required. The **SINAFM** will stop when the load current is below the entered value and will start when it is higher.

Range of values:

Minimum value: 0 A
Maximum value: 5000 A

- **Current limit**

This parameter allows the maximum power of the active filter to be limited. The value is configured as a percentage with respect to the device's rated power.

Range of values:

Minimum value: 20%
Maximum value: 100%

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.7.- cos Φ

Note: *This screen is not visible on the* ***"slave"*** *devices.*

The device has two reactive power compensation modes (**Figure 74).**

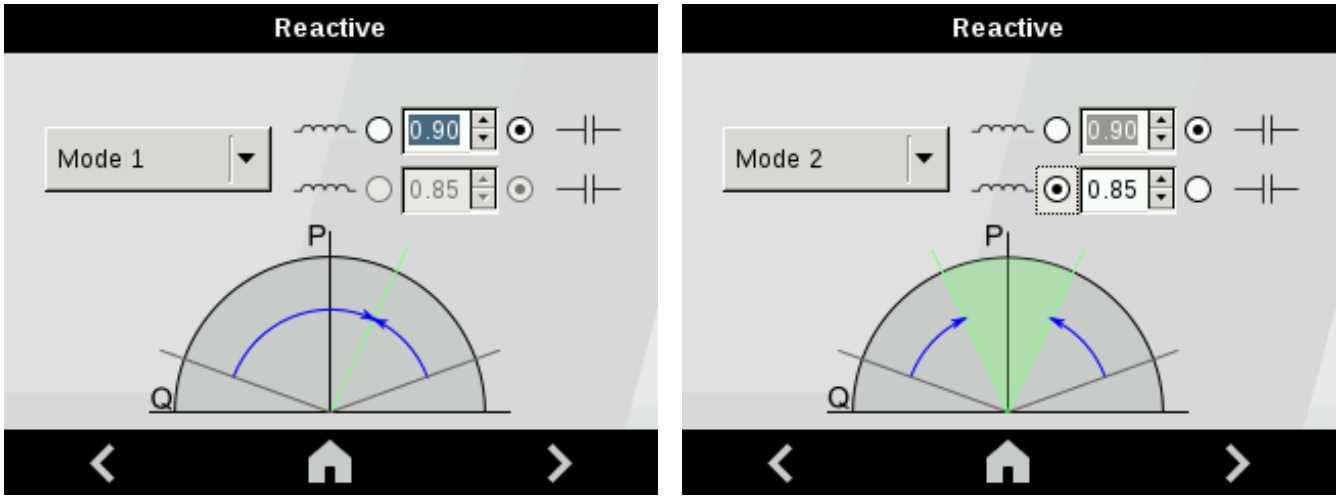


Figure 74: Configuration screen: cos Φ (Mode 1 and Mode 2).

- **Mode 1**

In this mode, cos Φ is set to a fixed value. The device will attempt to ensure that the reactive power on the mains side corresponds to the specified cos Φ.

Range of values: 0.7... -0.7

● **Mode 2**

In this mode, two limits are defined to form an acceptance range. The device will adjust the reactive power on the mains side to keep cos Φ within the specified acceptance range.

This mode minimises the amount of power used by the device to compensate for reactive power, thus reducing its energy consumption.

Range of values: 0.7... -0.7

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.8.- IEEE519

Note: *This screen is not visible on the* ***"slave"*** *devices.*

This screen, **Figure 75**, may be configured if the device is to comply with the filtering limits specified in the IEEE 519-2014 standard:

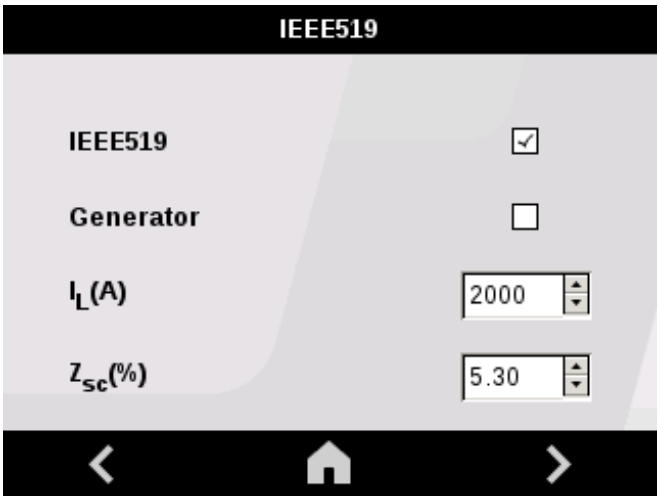


Figure 75: Configuration screen: IEEE519.

● **IEEE519**

The device includes harmonic filtering functions to adjust the power for each harmonic to ensure that the installation complies with the limits under the **IEEE 519-2014** standard. This standard gives recommendations regarding the harmonic emission limits generated by an installation, in order to avoid both internal and external damage to devices and triggering of protections.

The standard specifies the limits for each harmonic at the network operator's connection point, its magnitude depending on the line's short-circuit impedance, and maximum load current demand.

The aim is to limit current harmonics so that voltage distortion caused by them is acceptable. Accordingly, a network with a high short-circuit impedance is more prone to voltage distortions caused by the harmonic current, so the **IEEE 519-2014** standard is more stringent than in an installation with a lower short-circuit impedance.

For the user, only three parameters need to be entered when configuring the device, which will automatically select the maximum harmonic values to comply with the standard:

Note: *If this function is enabled, the device will only correct the harmonics to meet the requirements of the established limits, instead of trying to cancel the harmonics altogether.*

• Generator

The **IEEE519-2014** standard establishes more restrictive limits for a generating installation. In such a case, i.e., where energy may be exported, the appropriate box must be ticked.
The first two parameters may be obtained from the rating plate on the network connection transformer.
If this function is enabled, the device will only correct the harmonics to meet the requirements of the established limits, instead of trying to cancel the harmonics altogether.

• I_L(A), Line current

The standard requires maximum current demand for the previous 12 months. Such a value may be difficult to obtain, so using the nominal line current as a value is an acceptable estimate.

Note: *This parameter may be obtained from the rating plate on the network connection transformer.*

• Z_{sc}(%), Short-circuit impedance

The line's short-circuit impedance depends on the design of the network coupling transformer and the power line's topology.
It is a value that is usually given in %, and indicates the ratio between the primary voltage to give the nominal current in the short-circuited secondary, and the primary's nominal voltage.

If this value is unavailable, but the short-circuit current at the connection point is known, it can be calculated using this formula:

Z(%) = (Il/Isc) * 100

Note: *This parameter may be obtained from the rating plate on the network connection transformer.*

If this function is enabled, the device will only correct the harmonics to meet the requirements of the established limits, instead of trying to cancel the harmonics altogether.

Press the  key to access the next configuration step
Press the  key to access the main screen of the device without saving the configuration values.

7.9.- TRANSFORMER CONFIGURATION

Note: *This screen is not visible on the* ***"slave"*** *devices.*

The transformers that will be installed with the device are configured in this screen, **Figure 76**:

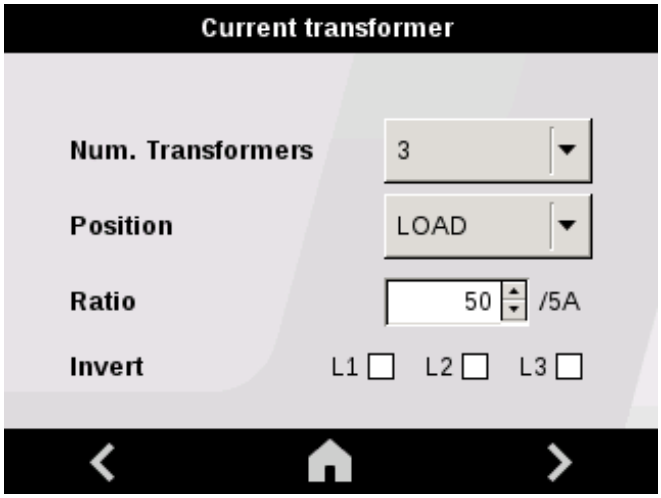


Figure 76: Configuration screen: Transformer configuration.

- **Num transformers**

The number of transformers that will be installed is configured with this parameter, the options are:

- ✓ **2.** This option can only be used on the 3-wire model, **SINAFM348xxxx**
- ✓ **3.**

	With the option of **2** transformers, you should install a transformer measuring the L1 phase and another measuring the L2 phase. The L3 phase is left without a measuring transformer.
	In three-phase mains with neutral, 3 transformers are needed to ensure the correct operation of the device.

- **Position**

The location of the transformers is configured with this parameter, the options are:

- ✓ **LOAD**: If the transformers are installed in the load area, downstream from the **SINAFM**.
- ✓ **MAINS**: If the transformers are installed in the mains area, upstream from the **SINAFM**.

- **Ratio**

The transformer ratio is configured with this parameter, i.e., the ratio between the transformer primary and secondary.
Range of values:

Minimum value: 5 A
Maximum value: 5000 A

- **Invert**

This parameter is used to select the phase whose filter is going to switch the current direction of the load measurement transformer, so installation faults may be corrected.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.10.- ALARMS

Note: *This screen is not visible on the* ***"slave"*** *devices.*

In this screen, **Figure 77**, the enabling or disabling of the resonance alarm is selected.

Figure 77: Configuration screen: Alarms.

If the control algorithm was selected in the **Frequency mode** and this alarm is **enabled**, when the device detects a potential resonance on an harmonic, it disables said harmonic and generates an alarm, but it continues filtering the rest of the harmonics.
If the alarm is **disabled**, the device may interpret a resonance as an overload and continue filtering the harmonic.

	This option is **enabled** by default and it is recommended not to disable it.
	Before **disabling** the resonance alarm, it is essential to make sure there is no resonating current between the active filter and the load. Resonating currents can damage the active filter and other devices connected to the installation.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.11.- ETHERNET COMMUNICATIONS

The Ethernet communication parameters are configured in this screen, **Figure 78**:

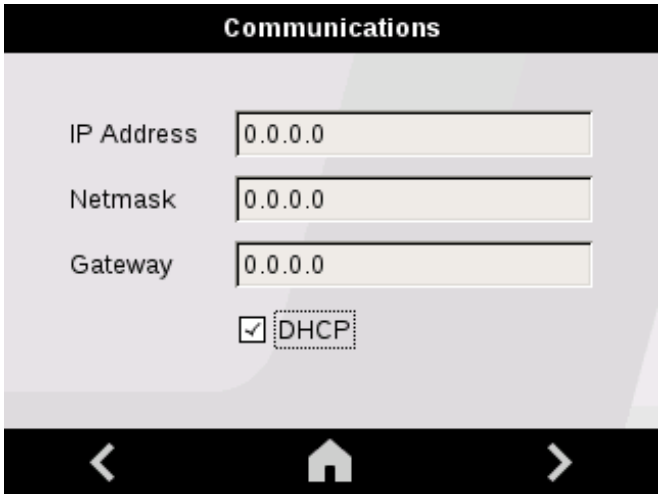


Figure 78: Configuration screen: Ethernet communications.

By activating the DHCP option 

, the device assigns the IP automatically.
If this option is not activated, the parameters must be configured manually:

- **IP Address,** IP address.
- **Netmask,** subnet mask.
- **Gateway,** gateway.

Press the  key to access the next configuration step
Press the  key to access the main screen of the device without saving the configuration values.

7.12.- RS-485 COMMUNICATIONS

The RS-485 communications configuration in **SINAFM** models is set to a Baud rate of 9600 bps, 8 data bits, 1 stop bit and no parity. Only the device's Modbus address can be configured, **Figure 28**.

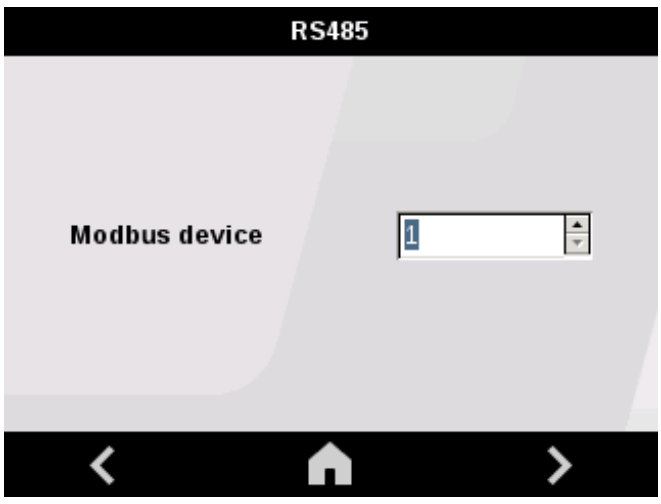


Figure 79: Configuration screen: RS-485 communications.

- **Modbus device,** modbus address.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.13.- DATE / TIME

The time parameters are configured in this screen, **Figure 80**:

Figure 80: Configuration screen: Date / Time

- **Time**.
- **Date**.
- **Time zone**.

By activating the **Internet time** option, the device synchronises with the time of the Web server to which it is connected.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.14.- PASSWORD

This screen, **Figure 81**, is used to configure the device's password:

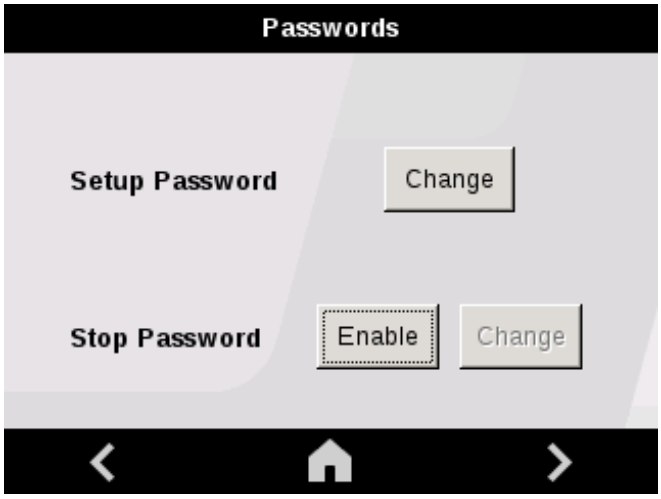


Figure 81: Password.

- **Setup Password**.

This parameter enables the device's configuration access password to be modified.

- **Stop Password**.

The STOP key may be configured with a password; if enabled, the device will request the password on being pressed and will not stop unless the correct password is entered.

Press the key to access the next configuration step
Press the key to access the main screen of the device without saving the configuration values.

7.15.- SAVE DATA

The modified configuration values are saved in the final setup menu screen, **Figure 82**.

Figure 82: Final setup menu screen.

Press the 

key to save the modified data.

Press the  key to exit the setup menu.

8.- RS-485 COMMUNICATIONS

SINAFM devices have an RS-485 serial communication output with the **MODBUS RTU** ® communications protocol.

For an installation with devices in parallel, the RS-485 connection can be made on any device.

8.1.- CONNECTIONS

The RS-485 cable must be wired with twisted pair cable with mesh shield (minimum 3 wires), with a maximum distance between the **SINAFM** and the master device of 1200 metres.
A maximum of 32 **SINAFM** filters can be connected to this bus.

To establish communications with the master device, use an RS-485 intelligent converter.

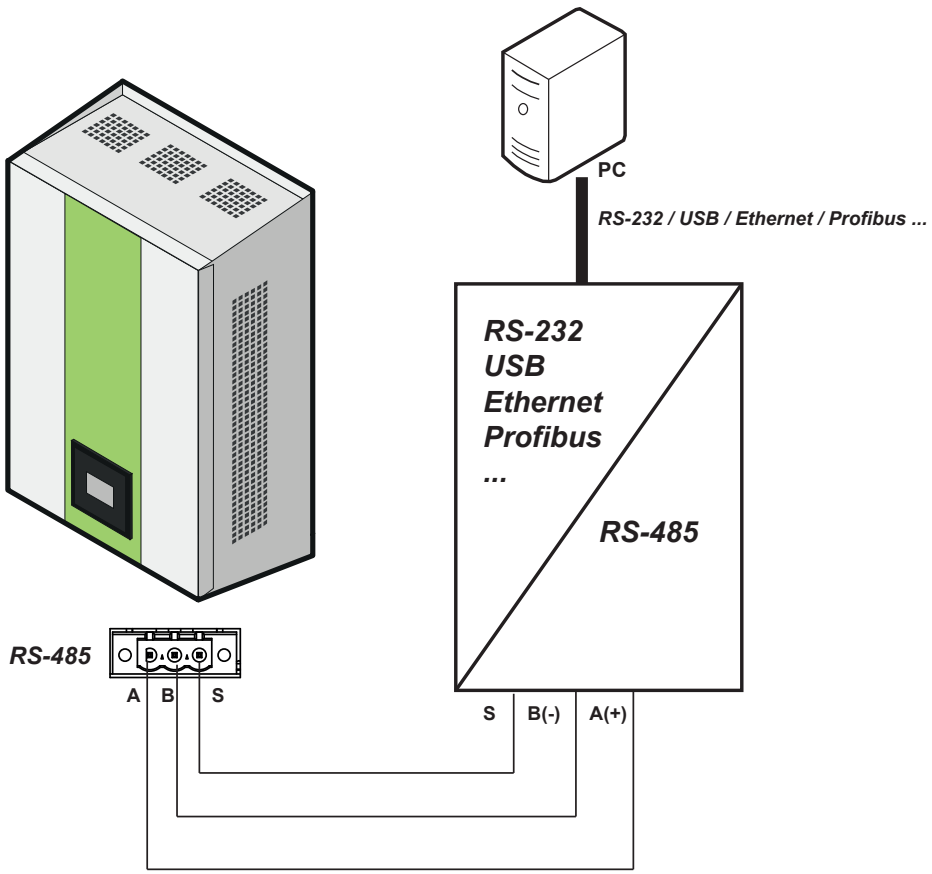


Figure 83: RS-485 Connection diagram.

The RS-485 communications configuration in **SINAFM** models is set to a baud rate of 9600 bps, 8 data bits, 1 stop bit and no parity.

8.2.- PROTOCOL

In the Modbus protocol, the **SINAFM** uses the RTU (Remote Terminal Unit) mode.

The Modbus functions implemented in the device are as follows:

Functions 03 and 04. Reading of n Words (2 bytes).

8.2.1.- EXAMPLE OF MODBUS QUERY

Query: Value of the Load current of L1

Address	Function	Initial register	No. of registers	CRC
0 A	03	92	0002	xxxx

Address: 0A, Peripheral number: 10 in decimal.
Function: 03, Read function.
Initial Register: 92, register from which to start reading.
No. of registers: 0002, number of registers to be read.
CRC: xxxx, CRC character.

Response:

Address	Function	No. of Bytes	Register no. 1	Register no. 2	CRC
0 A	03	04	0000	00FA	xxxx

Address: 0A, Responding peripheral number: 10 in decimal.
Function: 03, Read function.
No. of bytes: 04, No. of bytes received.
Register: 000000FA, value of load current L1, with 1 decimal: 0xFA = 25.0 A
CRC: xxxx, CRC character.

8.2.2.- MODBUS MAP

All Modbus map variables are in hexadecimal format.
For these variables, **Functions 03** and **04** are implemented.

8.2.2.1.- Load Measurements

Table 23:Modbus memory map: Measurements with Load (Table 1).

Parameter	L1	L2	L3	LN	Units
Current with Load	93 - 92	95 - 94	97 - 96	99 - 98	[Hi] + [Low] A with 1 decimal
Active power with Load	AD - AE	AF - B0	B1 - B2	-	kW with 2 decimal places and sign.
Reactive power with Load	B3 - B4	B5 - B6	B7 - B8	-	kVar with 2 decimal places and sign.
Apparent power with Load	B9 - BA	BB - BC	BD - BE	-	kVA with 2 decimal places and sign.
cos ϕ with Load	D1	D2	D3	-	With 3 decimal
Current THD with Load	8C	8D	8E	-	% with 1 decimal

Table 24:Modbus memory map: Measurements with Load (Table 2).

Parameter	Current L1	Current L2	Current L3	Units
Fundamental harmonic	64	71	7E	%
3rd order harmonic	65	72	7F	%
5th order harmonic	66	73	80	%
7th order harmonic	67	74	81	%
9th order harmonic	68	75	82	%
11th order harmonic	69	76	83	%
13th order harmonic	6 A	77	84	%
15th order harmonic	6B	78	85	%
17th order harmonic	6C	79	86	%
19th order harmonic	6D	7 A	87	%
21st order harmonic	6E	7B	88	%
23rd order harmonic	6F	7C	89	%
25th order harmonic	70	7D	8 A	%

Table 25:Modbus memory map: Measurements with Load (Table 3).

Parameter	Current L1	Current L2	Current L3	Units
Fundamental harmonic phase	154	161	16E	0.001 x radians
3rd order harmonic phase	155	162	16F	0.001 x radians
5th order harmonic phase	156	163	170	0.001 x radians
7th order harmonic phase	157	164	171	0.001 x radians
9th order harmonic phase	158	165	172	0.001 x radians
11th order harmonic phase	159	166	173	0.001 x radians
13th order harmonic phase	15 A	167	174	0.001 x radians
15th order harmonic phase	15B	168	175	0.001 x radians
17th order harmonic phase	15C	169	176	0.001 x radians
19th order harmonic phase	15D	16 A	177	0.001 x radians
21st order harmonic phase	15E	16B	178	0.001 x radians
23rd order harmonic phase	15F	16C	179	0.001 x radians
25th order harmonic phase	160	16D	17A	0.001 x radians

Table 26: Modbus memory map: Measurements with Load (Table 4).

Parameter	L1	L2	L3	Units
Fundamental current	1E0	1E1	1E2	A
Harmonic current	1E3	1E4	1E5	A
TDD	1EC	1ED	1EE	%

8.2.2.2.- Mains Measurements

Table 27:Modbus memory map: Measurements in the Mains (Table 1).

Parameter	L1	L2	L3	LN	Units
Current in Mains	9B - 9A	9D - 9C	9F - 9E	A1 - A0	[Hi] + [Low] A with 1 decimal
Active power in Mains	BF - C0	C1 - C2	C3 - C4	-	kW with 2 decimal places and sign.
Reactive power in Mains	C5 - C6	C7 - C8	C9 - CA	-	kVar with 2 decimal places and sign.
Apparent power in Mains	CB - CC	CD - CE	CF - D0	-	kVA with 2 decimal places and sign.
cos ϕ in Mains	D4	D5	D6	-	With 3 decimal
Current THD in Mains	8F	90	91	-	% with 1 decimal
Mains frequency	D7			-	Hz with 1 decimal

Table 28:Modbus memory map: Measurements in the Mains (Table 2).

Parameter	Current L1	Current L2	Current L3	Units
Fundamental harmonic	3C	49	56	%
3rd order harmonic	3D	4 A	57	%
5th order harmonic	3E	4B	58	%
7th order harmonic	3F	4C	59	%
9th order harmonic	40	4D	5 A	%
11th order harmonic	41	4E	5B	%
13th order harmonic	42	4F	5C	%
15th order harmonic	43	50	5D	%
17th order harmonic	44	51	5E	%
19th order harmonic	45	52	5F	%
21st order harmonic	46	53	60	%
23rd order harmonic	47	54	61	%
25th order harmonic	48	55	62	%

Table 29:Modbus memory map: Measurements in the Mains (Table 3).

Parameter	Current L1	Current L2	Current L3	Units
Fundamental harmonic phase	12C	139	146	0.001 x radians
3rd order harmonic phase	12D	13 A	147	0.001 x radians
5th order harmonic phase	12E	13B	148	0.001 x radians
7th order harmonic phase	12F	13C	149	0.001 x radians
9th order harmonic phase	130	13D	14A	0.001 x radians
11th order harmonic phase	131	13E	14B	0.001 x radians
13th order harmonic phase	132	13F	14C	0.001 x radians
15th order harmonic phase	133	140	14D	0.001 x radians
17th order harmonic phase	134	141	14E	0.001 x radians
19th order harmonic phase	135	142	14F	0.001 x radians
21st order harmonic phase	136	143	150	0.001 x radians
23rd order harmonic phase	137	144	151	0.001 x radians
25th order harmonic phase	138	145	152	0.001 x radians

Table 30: Modbus memory map: Measurements in the Mains (Table 4).

Parameter	L1	L2	L3	Units
Fundamental current	1E6	1E7	1E8	A
Harmonic current	1E9	1EA	1EB	A
TDD	1EF	1F0	1F1	%

8.2.2.3.- Other parameters of the SINAFM filter

Table 31:Modbus memory map: Filter parameters (Table 1).

Parameter	Address	Units
Temperature IGBT 1(2)	DB	ºC with 1 decimal
Temperature IGBT 2(2)	DC	ºC with 1 decimal
Temperature IGBT 3(2)	DD	ºC with 1 decimal
Temperature Inductor 1 (2)	E7	ºC with 1 decimal
Temperature Inductor 2 (2)	E8	ºC with 1 decimal
Temperature IGBT 4(2) (3)	F5	ºC with 1 decimal

Table 31 (Cont.): Modbus memory map: Filter parameters (Table 1).

Parameter	Address	Units
Temperature IGBT 5[12] [3]	F6	ºC with 1 decimal
Temperature IGBT 6[2] [3]	F7	ºC with 1 decimal
Temperature Inductor 3 [2] [3]	FB	ºC with 1 decimal
Temperature Inductor 4 [2] [3]	FC	ºC with 1 decimal
Phase L1 - L2 voltage	DE	V with 1 decimal
Phase L2 - L3 voltage	DF	V with 1 decimal
Phase L3 - L1 voltage	E0	V with 1 decimal
Positive DC bus voltage	E1	V with 1 decimal
Negative DC bus voltage	E2	V with 1 decimal

[2] For a system with devices in parallel, the parameter value is that of the device connected with RS-485.

[3] Parameters only accessible for the 60A model.

Table 32:Modbus memory map: Filter parameters (Table 2).

Parameter	L1	L2	L3	LN	Units
Current in the filter	A3 - A2	A5 - A4	A7 - A6	A9 - A8	[Hi] + [Low] A with 1 decimal
Phase – neutral voltage	AA	AB	AC	-	V with 1 decimal
% of filter power used	D8	D9	DA	-	%
Voltage THD	BA	BB	BC	-	% with 1 decimal

Table 33:Modbus memory map: Filter parameters (Table 3).

Parameter	Address	Description
SINAFM serial no. [4]	2710 - 2711	Hi [10] + Low [11] serial no.
DSP software version	10C	-
HMI software version	1C3	-

[4] For a system with devices in parallel, the parameter value is that of the device connected with RS-485.

8.2.2.4.- SINAFM filter messages

Table 34:Modbus memory map: Filter messages (Table 1).

Parameter	Address	
Device status [5]	110	
Bit	**Description**	**Status**
0x0001	Stop	**1**: ON **0**: OFF
0x0002	Start	
0x0004	Reset alarms	

[5] For a system with devices in parallel, the parameter value is that of the device connected with RS-485.

Table 35:Modbus memory map: Filter messages (Table 2).

Parameter	Address
Alarm messages	105 (Hi value), 106 (Low value)
Bit	**Description**
0x00000000	There are no alarms
0x00000002	L1 overcurrent alarm
0x00000004	L2 overcurrent alarm
0x00000008	L3 overcurrent alarm
0x00000010	L1 overvoltage alarm

Table 35 (Cont.): Modbus memory map: Filter messages (Table 2).

Bit	Description
0x00000020	L2 overvoltage alarm
0x00000040	L3 overvoltage alarm
0x00004000	Temperature IGBT 1 alarm
0x00008000	Temperature Inductor 1 alarm
0x00010000	Initial Conditions Error
0x00020000	Resonance Alarm
0x00100000	Contactor faults
0x00200000	Temperature Inductor 2 alarm

Table 36:Modbus memory map: Filter messages (Table 3).

Parameter	Address
Initial Conditions for which the device does not start up. (6)	108
Bit	**Description**
0x0001	Discharging DC bus
0x0002	Minimum Mains Voltage
0x0004	Minimum temperature value
0x0008	Frequency error
0x0010	Charging DC bus
0x0020	Minimum DC bus voltage
0x0040	DC Bus imbalance
0x0080	The device does not communicate
0x0100	Polarity Error
0x0200	Minimum load current
0x0400	Maximum charge current

(6) For a system with devices in parallel, the parameter value is that of the device connected with RS-485.

Table 37:Modbus memory map: Filter messages (Table 4).

Parameter	Address
SINAFM status (7)	104
Status (Decimal value)	**Description**
0	Start-up
10, 20, 30	Calibration
40	Relay test
50	Expect communications
60	Configuration
100	Start
200	Initial conditions
300	Stop
400	Synchronising
500	DC bus load
600	Operation
666	Power off
700	Alarm

(7) For a system with devices in parallel, the parameter value is that of the device connected with RS-485.

Table 38:Modbus memory map: Filter messages (Table 5).

Parameter	Address	
Harmonics status	109	
Bit	**Description**	**Status**
0x0001	Harmonic 3	**1**: Harmonic filtering **0**: Harmonic disabled due to resonance
0x0002	Harmonic 5	
0x0004	Harmonic 7	
0x0008	Harmonic 9	
0x0010	Harmonic 11	
0x0020	Harmonic 13	
0x0040	Harmonic 15	
0x0080	Harmonic 17	
0x0100	Harmonic 19	
0x0200	Harmonic 21	
0x0400	Harmonic 23	
0x0800	Harmonic 25	

9.- ETHERNET COMMUNICATIONS

For an installation with devices in parallel, the Ethernet connection can be made on any device.

9.1.- CONNECTION

The **SINAFM** has an Ethernet port.
This type of communication creates an intranet with IP communications.

If the device that connects to this port is a computer, the network cable must be a crossover Ethernet cable, as shown in **Figure 84**.

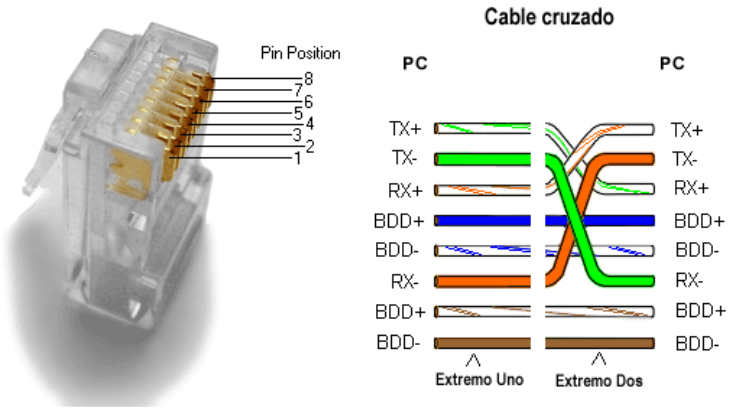


Figure 84:RJ-45 connector: Crossover Ethernet connection diagram.

9.2.- WEB SITE

The device has a web site for viewing and configuring the parameters.

Figure 85 shows the main web server screen, from where you can access all of the information of the **SINAFM**.

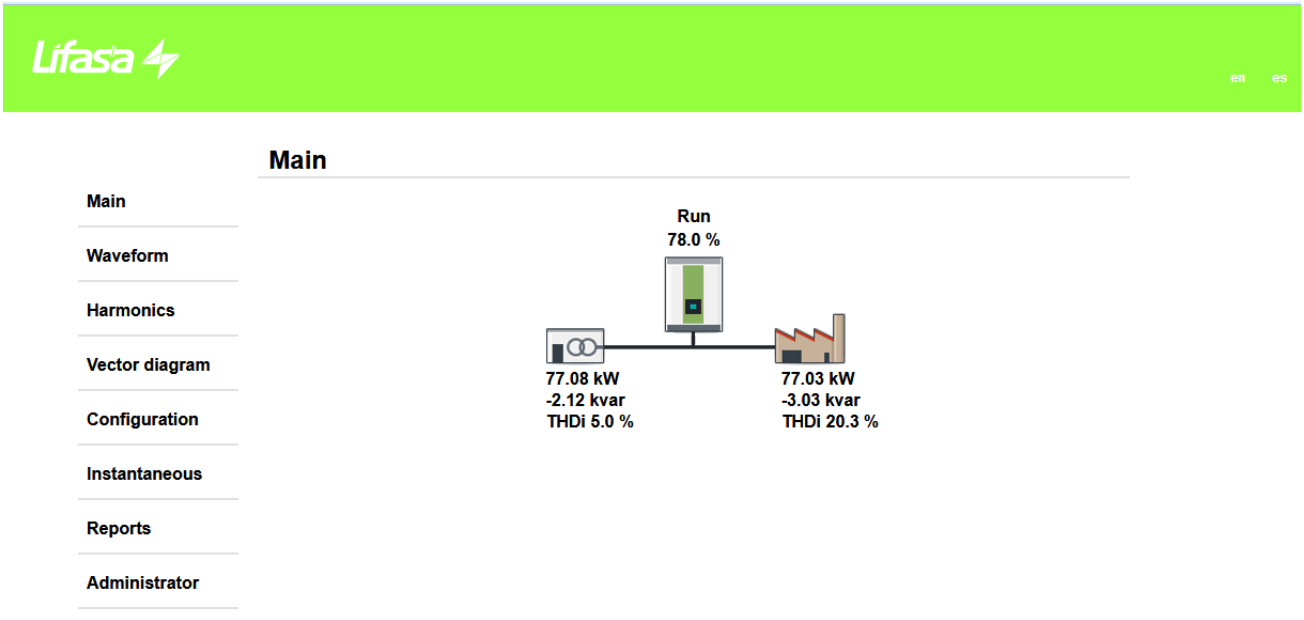


Figure 85: Main screen of the web site.

The language of the web site can be modified using the buttons that appear on the upper right part of the page.

To modify the **Configuration** parameters, it is necessary to enter the ***User*** and ***Password*** in the **Administrator** section.

There are two types of user:

1.- User with write access, **admin**:

Table 39: Default username and password for a user with write access.

Default User and Password	
User name	admin
Password	admin

2.- User with read access, **user**:

Table 40: Default username and password for a user with read access.

Default User and Password	
User name	user
Password	user

For security purposes, change the passwords for accessing the web site.

10.- MAINTENANCE

The **SINAFM** active filter requires minimum preventive maintenance.

	It is recommended to follow the notes described in this chapter to avoid premature damage to the device's components.

Table 41 shows the maintenance jobs with their respective time intervals.

Table 41: Active filter maintenance.

Description	Interval
Standard maintenance	12 months
Replacement of the cooling fans	40000 h

The device controls the maintenance intervals and shows the  symbol on the main screen of the device if maintenance is required.
The warnings screen, "***6.17.- WARNINGS***" describes the type of maintenance procedures that must be carried out.

Note: *The time intervals of the maintenance operations can vary depending on the device's operating conditions and environmental factors.*

	Follow the safety instructions in the ***"SAFETY PRECAUTIONS"*** section before carrying out any maintenance on the **SINAFM** filters. **Failure to follow these instructions may result in injury or even death.**

	**Certain components in the device can reach high temperatures. Allow the device to cool down before performing any maintenance operations.**

10.1.- STANDARD MAINTENANCE

	Perform maintenance every 6 to 12 months, depending on the level of environmental dirt and operation of the device. The device will indicate that the maintenance procedures must be carried out every 12 months.

	For an installation with devices in parallel, standard maintenance must be performed on all devices at the same time.

The points to be inspected are:

1.- Set the **SINAFM** in STOP mode and open the main switch (**OFF** position).
2.- Wait 1 minute for the capacitors to discharge.
3.- Clean the ventilation grilles, removing the dust.
4.- Check the status and torque of the electrical connections, as well as the mechanical attachment to the wall.
5.- Reset the standard maintenance meter, to do so:

Access the main setup screen.

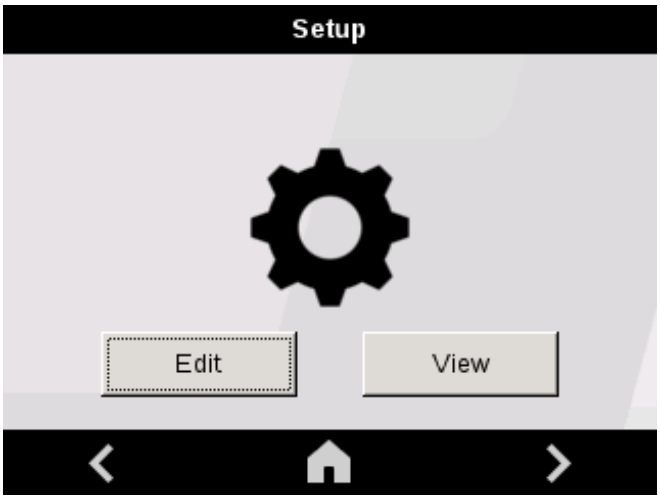


Figure 86: Main configuration screen.

Press the 

Edit key and enter the password used to access the maintenance screen (***Maintenance password:*** *8888*).

The screen shown in **Figure 87** will be displayed.

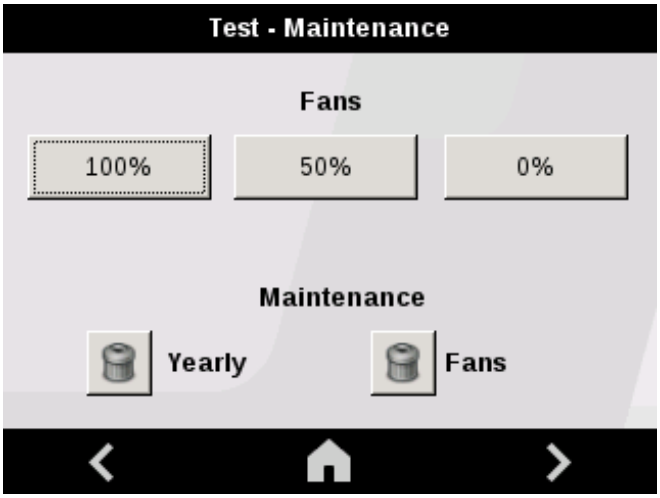


Figure 87: Maintenance screen.

Press the 

key to reset the maintenance meter.

10.2.- COOLING FANS

	The cooling fans must operate correctly to avoid overheating in the active filter components.

The device has high-speed cooling fans, with an estimated useful life of 40000 hours.

Nevertheless, this useful life can be shortened depending on the conditions of use (temperature, humidity, environmental pollution). In the event that the fans lose their efficiency, the device's performance will deteriorate.

The following symptoms in the filter behaviour could indicate a deterioration of the fans:

- ✓ Increase in fan noise.
- ✓ Increase in temperature of the device under the same environmental conditions and load.
- ✓ The **SINAFM** regularly indicates a temperature alarm.
- ✓ Reduction in the filtering capacity.

The set of fans must be replaced if they have exceeded their useful life or show signs of deterioration. In such cases, **LIFASA** will provide a spare part that consists of a set of fans so that the device can be repaired quickly and easily.

	For an installation with devices in parallel, all of the fans must be changed at the same time.

10.3.- CHANGE OF COOLING FANS: **SINAFM OF 30A**

Tabla 1:Tools needed (SINAFMxxx030W)

Tools needed
Fan assembly replacement **SINAFMxxx030W**, **Code: 920121**
2 Screwdriver for **PH2** head screws
3 Screwdriver for **Allen 3** head screws

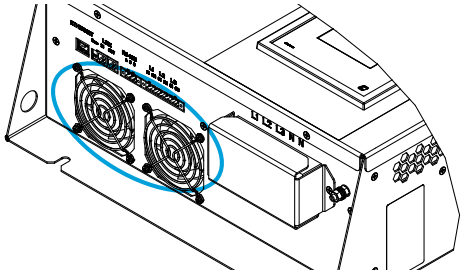


Figure 88: Location of the cooling fans.

To proceed to change the set of fans:

1. Place the **SINAFM** in **STOP** mode and disconnect the device from the power. If necessary, disconnect all the connection cables and short-circuit the current transformers.

2. Wait for 1 minute for the capacitors to discharge before opening the device.

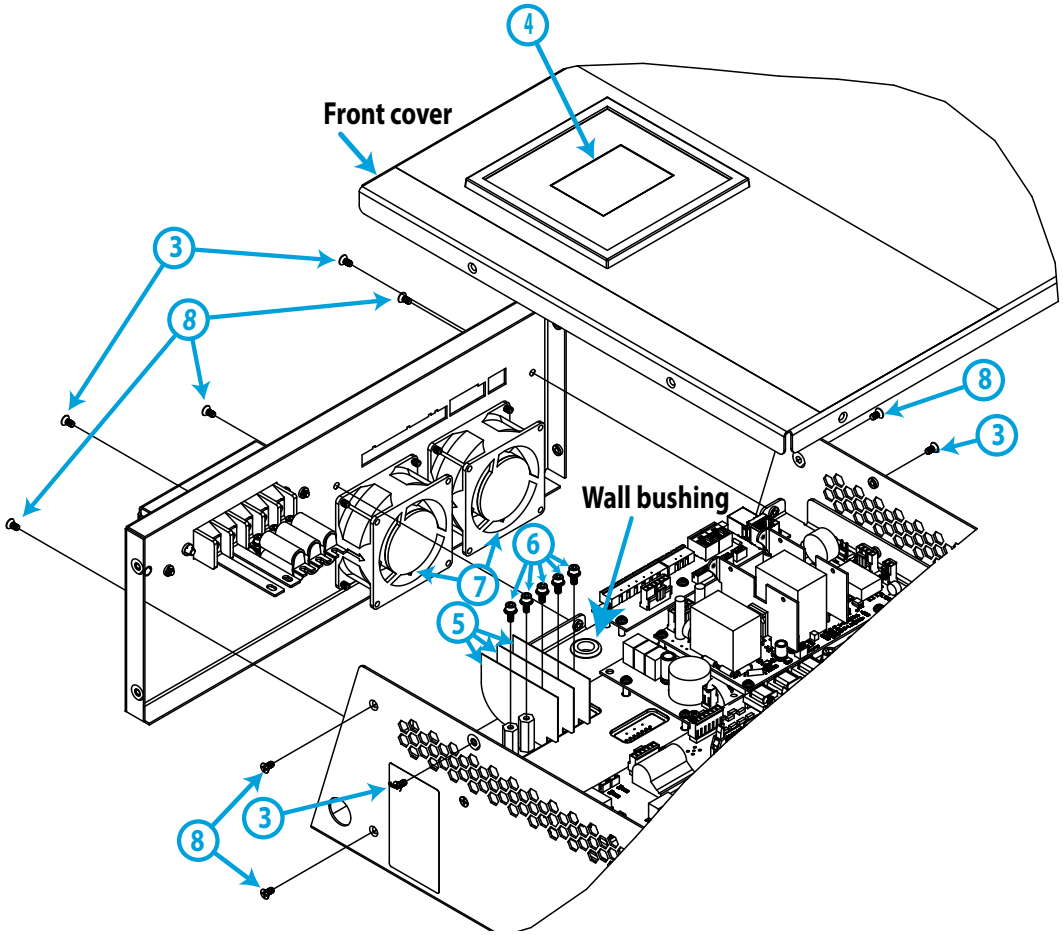


Figure 89:Steps to change fans.

3 Remove the 8 screws from the front cover.

2.

4 Disconnect the display.

5 Remove the insulators.

6 Remove the screws from the fuses.

3

7 Disconnect the fans.

8 Remove the 7 screws from the fan cover.

2

9 Remove the fan cover. Be careful when passing the cable through the wall bushing.

10 Replace the fans.

2 **0.7 Nm**

11 Fit the fan cover, passing the fan cable through the wall bushing.

1.5 Nm

12 Connect the fans.

13 Tighten the fuse screws and the neutral connection bar.

2.2 Nm

14 Place the insulators.

15 Connect the display.

16 Tighten front cover screws.

1.5 Nm

17 Connect, power and start the **SINAFM**.

18 Check the correct operation of the fans.

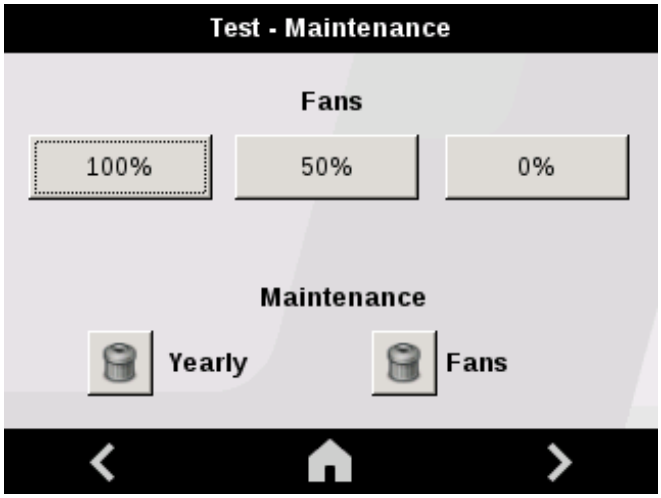


Figure 90: Maintenance screen.

To do this, go to the maintenance screen, via the configuration screen, by pressing the Edit key and entering the password to log into the maintenance screen (***Maintenance password*** : 8888).

The screen in **Figure 90** is displayed.

Checking the operation of the fans:

1.- Press the key 50%, the fan starts to operate at a rotation speed of 50%; check that it is working properly.

Press the key 0%, to stop the fan.

2.- Press the key 100%, the fan starts to operate at a rotation speed of 100%; check that it is working properly.

Press the key 0%, to stop the fan.

Note: *The fans will stop if the key* 0% *is not pressed after 1 minute.*

19 Reset the fans maintenance meter by pressing the Fans key.

10.4.- CHANGE OF COOLING FANS: **SINAFM OF 60A**

Table 42:Tools needed (SINAFMxxx060W)

Tools needed
Fan assembly replacement **SINAFMxxx060W, Code: 920122**
2 Screwdriver for **PH2** head screws
3 Screwdriver for **Allen 3** head screws

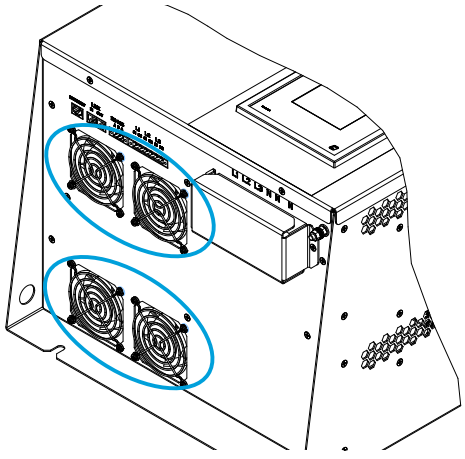


Figure 91: Location of the cooling fans.

To proceed to change the set of fans:

1 Place the **SINAFM** in **STOP** mode and disconnect the device from the power. If necessary, disconnect all the connection cables and short-circuit the current transformers.

2 Wait for 1 minute for the capacitors to discharge before opening the device.

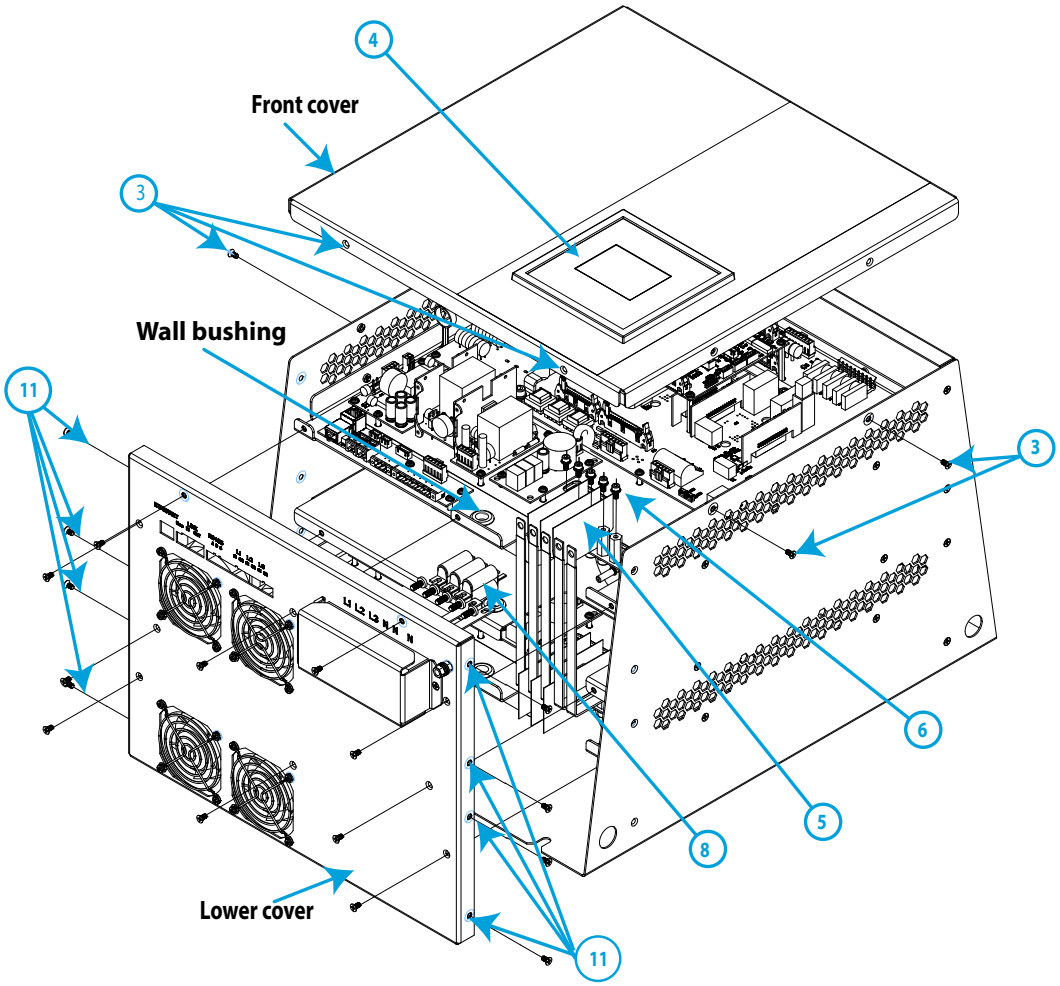


Figure 92:Steps to change fans (Part 1).

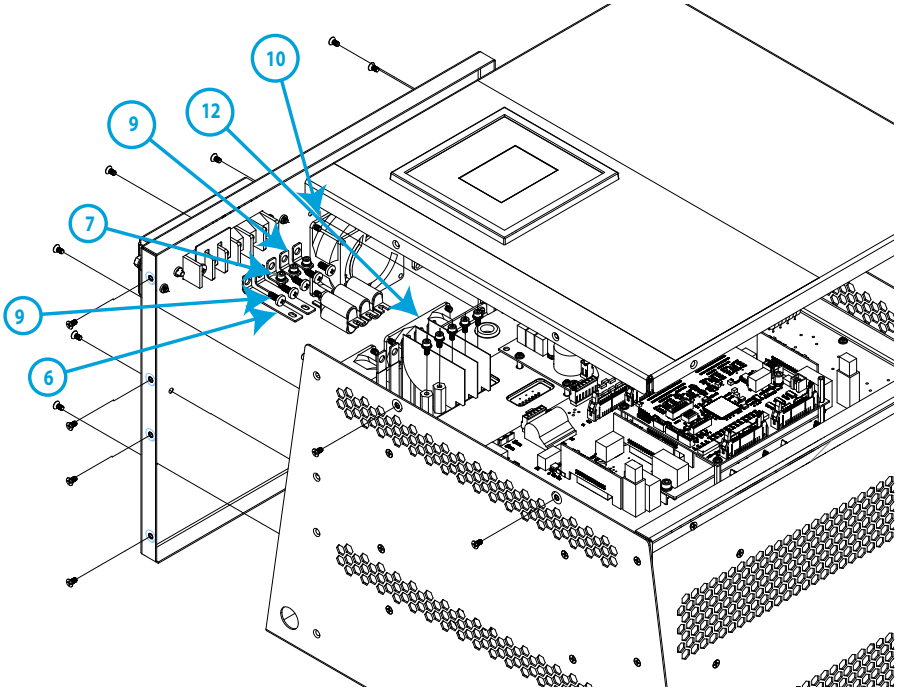


Figure 93:Steps to change fans (Part 2).

3 Remove the 8 screws from the front cover.

2

4 Disconnect the display.

5 Remove the insulators.

6 Remove the screws from the fuses and the neutral connection bar from the side of the board

3

7 Loosen the fuse screws on the side of the terminal block.

3

8 Remove de fuses.

9 Remove the 5 screws from the terminal block. Remove the bar from each of the phases.

2

10 Disconnect the upper floor fans.

11 Remove the 16 screws from the lower fan cover and disassemble. Run the fan cables from the upper level through the wall bushing

2

12 Disconnect the lower floor fans.

13 Remove lower cover.

14 Replace the fans.

2 **0.7 Nm**

15 Place the lower cover.

16 Connect the fans on the lower level. Run the cables for the fans in the upper level through the wall bushing.

17 Assemble the lower cover.

2 **1.5 Nm**

18 Connect the upper floor fans.

19 Tighten the bars to the terminal block.

2 **2.2 Nm**

20 Insert the Allen screws and nuts in the bar, but do not tighten.

21 Mount the fuses. Place the screws in the column. Tighten all the fuse screws.

2.2 Nm

22 Place the insulators.

23 Connect the display.

24 Tighten the front cover screws.

1.5 Nm

25 Connect, power and start the **SINAFM**.

26 Check the correct operation of the fans.

Follow **steps 18** and **19**, section ***"10.3. CHANGE OF COOLING FANS: SINAFM OF 30A"***

10.5.- CHANGE OF COOLING FANS: **SINAFM OF 100A RACK**

Table 43:Tools needed (SINAFMxxx100R)

Tools needed	
Fan assembly replacement **SINAFMxxx100x, Code: 920124**	
 **25**	Screwdriver for **Torx 25** head screws
 **4**	Screwdriver for **Allen 4** head screws
 **5**	Screwdriver for **Allen 5** head screws
 **10**	Screwdriver for **Hexagonal 10 mm** head screws

To proceed to change the set of fans:

1 Place the **SINAFM** in **STOP** mode and disconnect the device from the power. If necessary, disconnect all the connection cables and short-circuit the current transformers.

2 Wait for 1 minute for the capacitors to discharge before opening the device.

3 Remove the 8 screws of the upper cover.

25

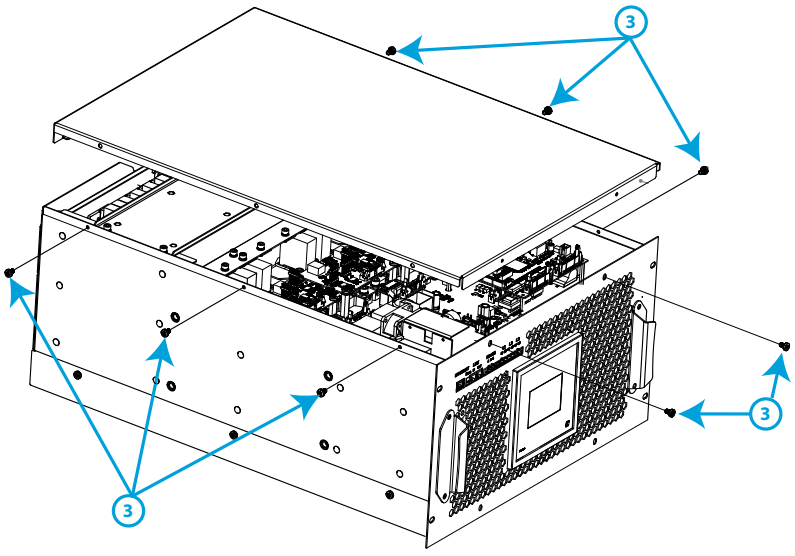


Figure 94:SINAFMxxx100R Change of cooling fans (Step 3).

4 Disconnect the flat belts, Hall-effect sensors and fans.

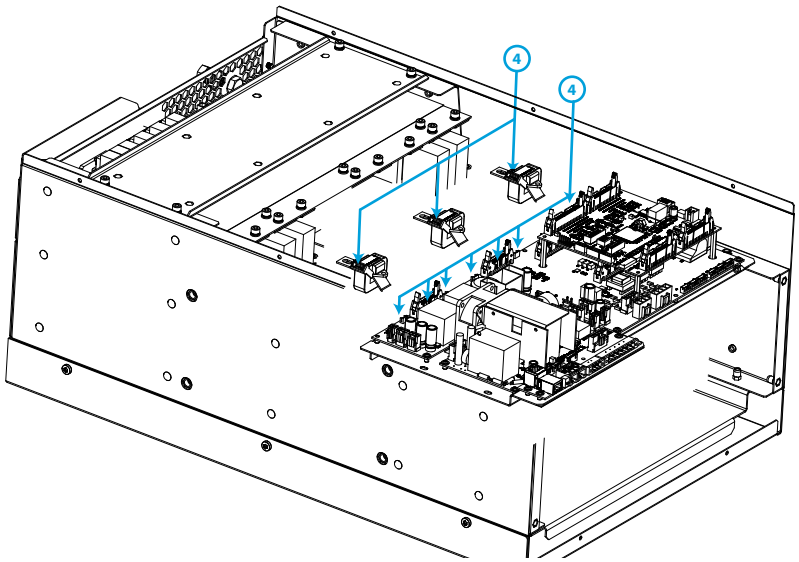


Figure 95:SINAFMxxx100R Change of cooling fans (Step 4).

5 Remove the 4 screws from the board bracket and carefully disassemble the boards. Remove the wall bushing from the fan cables to allow disassembly.

4

6 Remove the screws from the driver board.

25

7 Remove the driver board by gently pulling upwards.

8 Remove the screws from the bars (5), along with the screws in the end of the inductance. (type **5** and **10mm**).

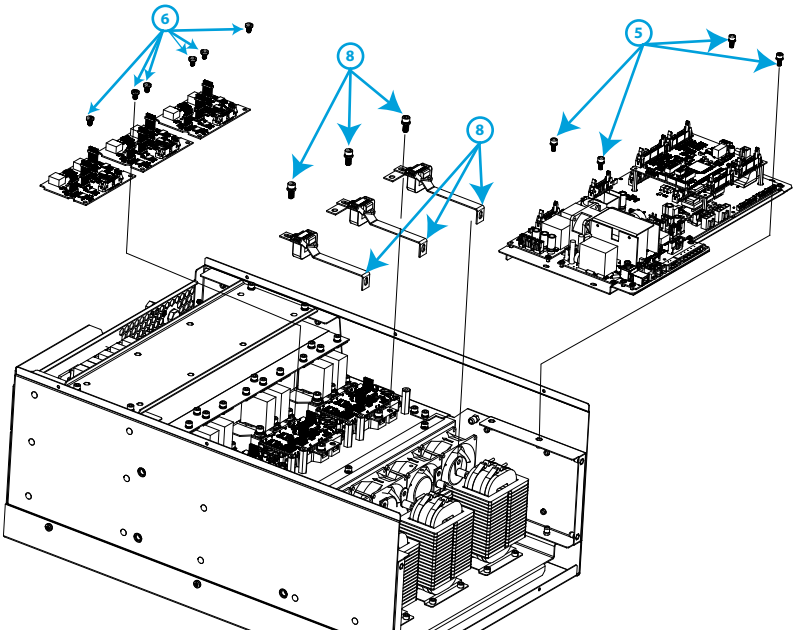


Figure 96:SINAFMxxx100R Change of cooling fans (Step 5, 6, 8).

9 Remove the 3 screws from the fans.

4

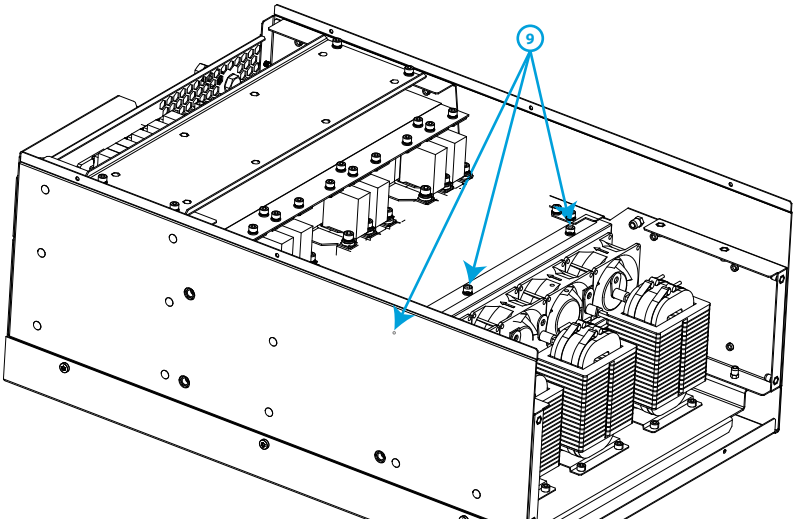


Figure 97:SINAFMxxx100R Change of cooling fans (Step 9).

10 Remove the fan assembly by pulling it up, and replace it with the new fans.

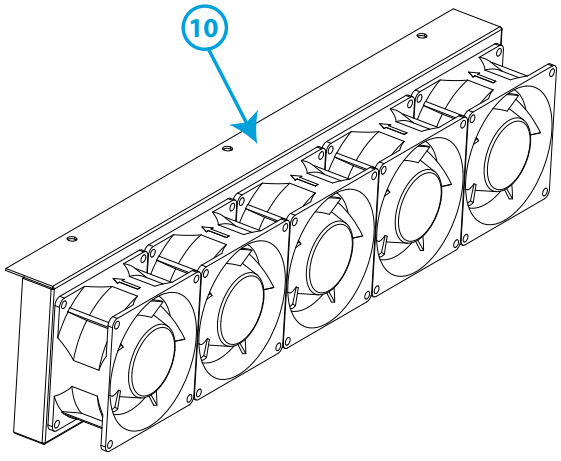


Figure 98:SINAFMxxx100R Change of cooling fans (Step 10).

11 Tighten the fan assembly screws.

 4  **5.5 Nm**

12 Mount the bars. Tighten the IGBT and inductance screws.

IGBT screws :  **4.5 Nm**

Inductance screws :  **8 Nm**

13 Mount the driver board. Use the visual guides. The cross should be seen through the holes in the board.

14 Screw the driver board.

 **0.7 Nm**

15 Place the wall bushing on the bar brackets and reassemble the board bracket. Screw in.

 **4.5 Nm**

16 Connect the flat belts, Hall-effect sensors and fans.

17 Mount the top cover.

 **4.5 Nm**

18 Connect, power and start the **SINAFM**.

19 Check the correct operation of the fans.

Follow **steps 18** and **19**, section ***"10.3. CHANGE OF COOLING FANS: SINAFM OF 30A"***

10.6.- CHANGE OF COOLING FANS: **SINAFM OF 100A WALL**

Table 44:Tools needed (SINAFMxxx100W)

Tools needed	
Fan assembly replacement **SINAFMxxx100x, Code: 920124**	
 **2**	Screwdriver for **PH2** head screws
 **25**	Screwdriver for **Torx 25** head screws
 **4**	Screwdriver for **Allen 4** head screws
 **5**	Screwdriver for **Allen 5** head screws
 **10**	Screwdriver for **Hexagonal 10 mm** head screws

To proceed to change the set of fans:

1 Place the **SINAFM** in **STOP** mode and disconnect the device from the power. If necessary, disconnect all the connection cables and short-circuit the current transformers.

2 Wait for 1 minute for the capacitors to discharge before opening the device.

3 Remove the 6 screws from the front cover.

2

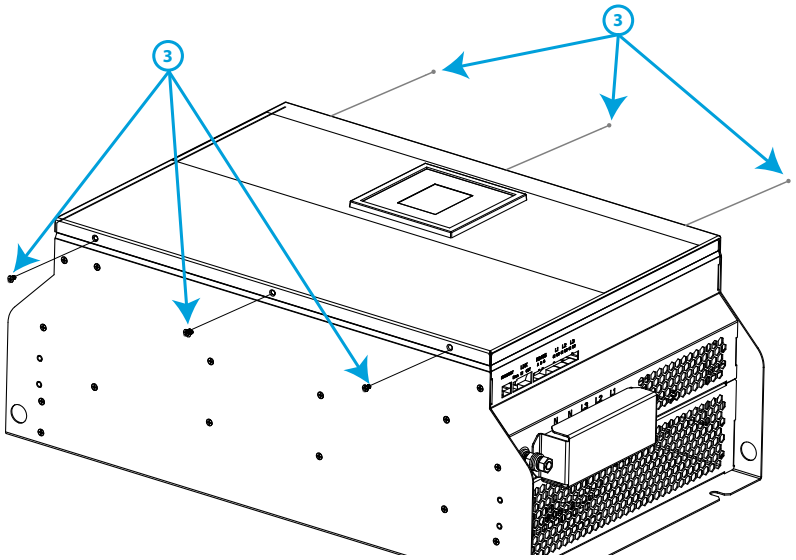


Figure 99:SINAFMxxx100W Change of cooling fans (Step 3).

4 Disconnect the display.

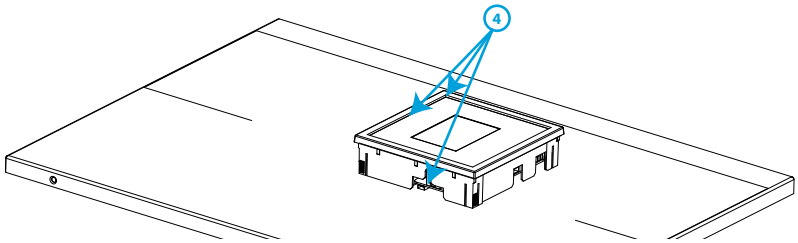


Figure 100: SINAFMxxx100W Change of cooling fans (Step 4).

5 Follow the steps from **step 4** in section ***"10.5.- CHANGE OF COOLING FANS: SINAFM OF 100A RACK"***

10.7.- CHANGE OF COOLING FANS: **CABINET TYPE SINAFM**

Table 45:Tools needed (SINAFMxxx100C, SINAFMxxx200C, SINAFMxxx300C, SINAFMxxx400C)

Tools needed
SINAFMxxx100C: 1 Fan assembly replacement **SINAFMxxx100x, Code: 920124**
SINAFMxxx200C: 2 Fan assembly replacement **SINAFMxxx100x, Code: 920124**
SINAFMxxx300C: 3 Fan assembly replacement **SINAFMxxx100x, Code: 920124**
SINAFMxxx400C: 4 Fan assembly replacement **SINAFMxxx100x, Code: 920124**
 **25** Screwdriver for **Torx 25** head screws
 **30** Screwdriver for **Torx 30** head screws
 **4** Screwdriver for **Allen 4** head screws
 **5** Screwdriver for **Allen 5** head screws
 **10** Screwdriver for **Hexagonal 10 mm** head screws

To proceed to change the set of fans:

1 Place the **SINAFM** in **STOP** mode and disconnect the device from the power. If necessary, disconnect all the connection cables and short-circuit the current transformers.

2 Wait for 1 minute for the capacitors to discharge before opening the device.

3 Access the 100A modules through the front panel. This is done by loosening the front screws.

 **25 y 30**  **1.5 Nm**

4 Proceed from point **3** of section ***"10.5.- CHANGE OF COOLING FANS: SINAFM OF 100A RACK"*** with each of the device's 100A modules.

Note: *When checking the fans in the "***master***" device, the slave device fans will be activated automatically.*

11.- TECHNICAL FEATURES

Mains voltage		
Rated voltage Un	**SINAFM348xxxx**	**SINAFM440xxxx**
	208 ... 480 Vac Ph-Ph ± 10%	208 ... 400 Vac Ph-Ph ± 10%
Frequency Fn	50 / 60 Hz ± 5%	
Maximum THD V	25 %	
Earthing system	TN, TT	

Power				
		SINAFMxxx030W	**SINAFMxxx060W**	**SINAFMxxx100R SINAFMxxx100W**
Maximum consumption		650 W	1300 W	2070 W
Maximum current (phase)		30 A RMS	60 A RMS	100 A RMS
Maximum current (neutral)		90 A RMS	180 A RMS	300 A RMS
Crest factor (current)		2:1	2:1	2:1
Maximum power	**480V**	**SINAFM348030W**	**SINAFM348060W**	**SINAFM348100R SINAFM348100W**
		22906 VA	45812 VA	76300 VA
	400V	**SINAFM440030W**	**SINAFM440060W**	**SINAFM440100R SINAFM440100W**
		20700 VA	41400 VA	69000 VA

		SINAFMxxx100C	**SINAFMxxx200C**
Rated insulation voltage Ui		480 V	480 V
Impulse withstand voltage Uimp		4kV, CAT III Class 1	4kV, CAT III Class 1
Rated current (phase) Ina phase		100 A	200 A
Rated current (neutral) Ina neutral		300 A	600 A
Short-time withstand current Icw		3.5 kA 1 second	3.5 kA 1 second
Peak current Ipk		84 kA peak	84 kA peak
Rated conditional short-circuit current Icc		40 kA	40 kA
Simultaneity RDF		1	1
Maximum consumption		2070 W	4140 W
Maximum current (phase)		100 A RMS	200 A RMS
Maximum current (neutral)		300 A RMS	600 A RMS
Crest factor (current)		2:1	2:1
Maximum power	**480V**	**SINAFM348100C**	**SINAFM348200C**
		76300 VA	152600 VA
	400V	**SINAFM440100C**	**SINAFM440200C**
		69000 VA	138000 VA

	SINAFMxxx300C	**SINAFMxxx400C**
Rated insulation voltage Ui	480 V	480 V
Impulse withstand voltage Uimp	4kV, CAT III Class 1	4kV, CAT III Class 1
Rated current (phase) Ina phase	300 A	400 A
Rated current (neutral) Ina neutral	900 A	1200 A
Short-time withstand current Icw	3.5 kA 1 second	3.5 kA 1 second
Peak current Ipk	84 kA peak	84 kA peak
Rated conditional short-circuit current Icc	40 kA	40 kA
Simultaneity RDF	1	1
Maximum consumption	6210 W	8280 W

(Continuation)			
		SINAFMxxx300C	**SINAFMxxx400C**
Maximum current (phase)		300 A RMS	400 A RMS
Maximum current (neutral)		900 A RMS	1200 A RMS
Crest factor (current)		2:1	2:1
Maximum power	**480V**	**SINAFM348300C**	**SINAFM348400C**
		228900 VA	305200 VA
	400V	**SINAFM440300C**	**SINAFM440400C**
		207000 VA	276000 VA

Current measurement	
Type	Transformer: 5/5A ... 5000/5A
Frequency response	up to 2500 Hz / 3000 Hz (60 Hz)
Consumption	1.5 VA per transformer

Filter specifications		
Filtering	2 ... 50 harmonic (adjustable)	
Response time	< 100 µs	
Phase compensation	Adjustable	
Power factor correction	Adjustable	
Programming of priorities	Adjustable	
Parallel connection	Up to 100 devices of different calibres Connection of the transformers only in the Master device	
	SINAFM348030W **SINAFM348060W**	**SINAFM440030W** **SINAFM440060W**
Efficiency (filter harmonic 5º/7º)	97.2 %	97 %
Efficiency (reactive)	97.5 %	97.2 %
	SINAFM348100W **SINAFM348100R**	**SINAFM440100W** **SINAFM440100R**
Efficiency (filter harmonic 5º/7º)	97.2 %	97.2 %
Efficiency (reactive)	98 %	98 %

Fuses	
SINAFMxxx030W	
Quantity	2 per phase
Type	BS88A1, 25A, 500Vac gG 80kA I2t 21kA2/s
SINAFMxxx060W	
Quantity	2 per phase
Type	BS88A1, 25A, 500Vac gG 80kA I2t 21kA2/s
SINAFMxxx100W, SINAFMxxx100R	
Quantity	2 per phase
Type	tipo BS88 100A, 500Vac, gG 80kA I2t 76.5kA2/s

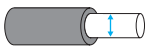
RS-485 Communications	
Field bus	RS-485
Communications protocol	Modbus RTU
Baud rate	9600 bps
Stop bits	1
Parity	none

Ethernet communications	
Network protocol	TCP/IP, Modbus TCP

User interface	
Display	3.5” TFT colour touch screen Web server and datalogger

Environmental features	
Environmental conditions	**Indoor conditioned IEC 60721-3-3**
Operating temperature	-10ºC ... +45ºC
Storage temperature	-20ºC... +50ºC
Relative humidity (with no condensation)	0 ... 95%
Maximum altitude	3000 m a.s.l. (2000 m a.s.l. without performance degradation)
Protection degree	IP20
Overvoltage category	OVC III 300V
SINAFMxxx100C, SINAFMxxx200C, SINAFMxxx300C and SINAFMxxx400C	
Pollution degree	2
Impact resistance	IK 10
Electromagnetic compatibility	Installation in type-A environments

Standards	
Electromagnetic compatibility (CEM). Part 6-4: Generic standards. Emissions standard for industrial environments. (IEC 61000-6-4:2006).	UNE-EN 61000-6-4:2007
Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	UNE-EN 55011:2011
Electromagnetic compatibility (CEM). Part 6-2: Generic standards. Immunity for industrial environments.	UNE-EN 61000-6-2:2006
Safety requirements for power electronic converter systems and equipment - Part 1: General (Endorsed by AENOR in November of 2012.)	EN 62477-1:2012
Low-voltage switchgear and controlgear assemblies - Part 1: General rules	IEC 61439-1:2011

Mechanical features				
SINAFMxxx030W				
Dimensions (mm)	**Figure 101**			
Weight	21 kg			
Enclosure	Galvanised steel 1.5 mm			
Noise	58 dBA[8]			
Connections	**Type**			
Mains	M6 ring terminal	12 mm	2.2 ... 2.4 Nm	PH2
Earth	M6 ring terminal	16 mm	2.2 ... 2.4 Nm	PH2
Connections	**Type**			
Current	6-pole connector	max :2.5 mm²	0.5 ... 0.6 Nm	Flat 3 mm
RS-485	3-pole connector	max :2.5 mm²	0.5 ... 0.6 Nm	Flat 3 mm
Ethernet	RJ-45	-	-	-

[8] 1 metre from the mounting wall, ISO 11201:2010 V2

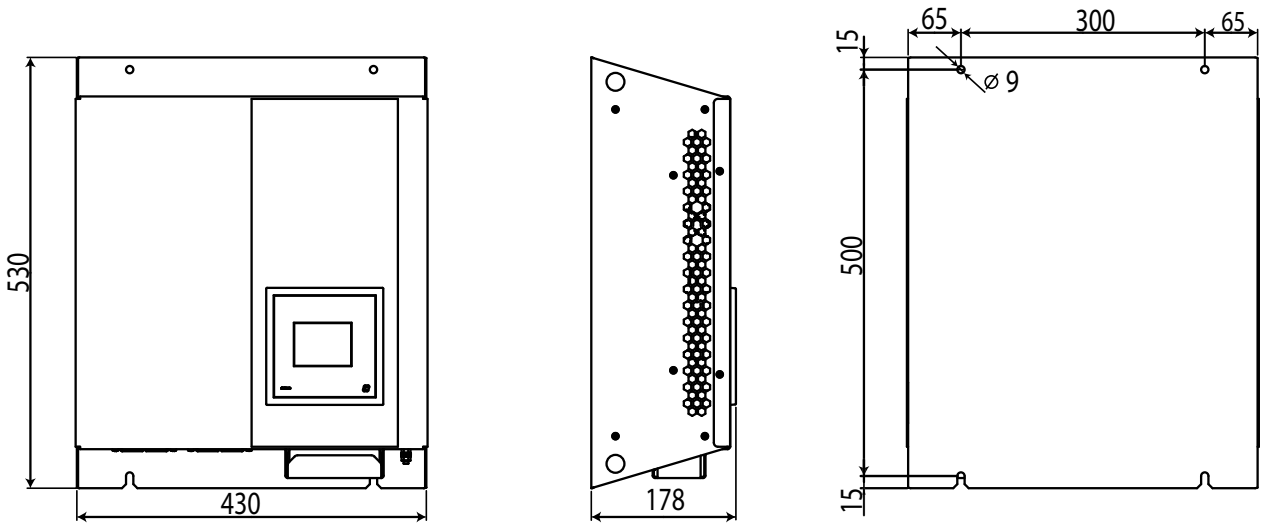
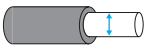


Figure 101: Dimensions SINAFMxxx030W.

SINAFMxxx060W				
Dimensions (mm)	**Figure 102**			
Weight	39 kg			
Enclosure	Galvanised steel 1.5 mm			
Noise	60 dBA [9]			
Connections	**Type**			
Mains	M6 ring terminal	12 mm	2.2 ... 2.4 Nm	PH2
Earth	M6 ring terminal	16 mm	2.2 ... 2.4 Nm	PH2
Connections	**Type**			
Current	6-pole connector	max : 2.5 mm²	0.5 ... 0.6 Nm	Flat 3 mm
RS-485	3-pole connector	max : 2.5 mm²	0.5 ... 0.6 Nm	Flat 3 mm
Ethernet	RJ-45	-	-	-

[9] 1 metre from the mounting wall, ISO 11201:2010 V2

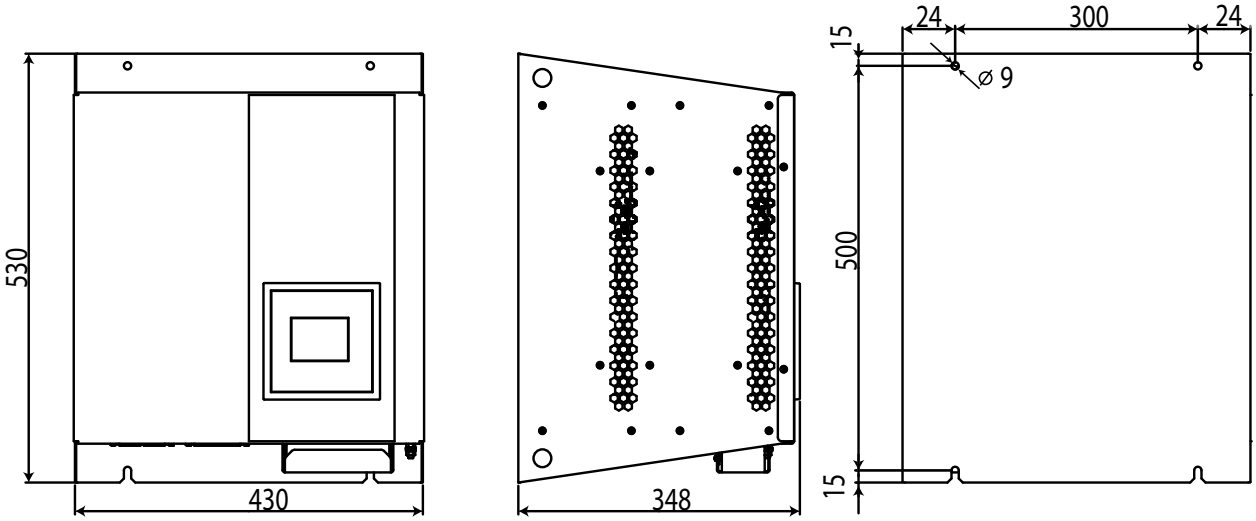
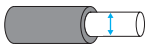


Figure 102: Dimensions SINAFMxxx060W

SINAFMxxx100W				
Dimensions (mm)	**Figure 103**			
Weight	56 Kg			
Enclosure	Galvanised steel 1.5 mm			
Noise	< 60 dBA			
Connections	**Type**			
Mains	M8 ring terminal	23 mm	8 ... 10 Nm	PH2
Earth	M10 ring terminal	-	10 ... 14 Nm	Hex 17 mm
Connections	**Type**			
Current	6-pole connector	max :2.5 mm^2	0.5 ... 0.6 Nm	Flat 3 mm
RS-485	3-pole connector	max :2.5 mm^2	0.5 ... 0.6 Nm	Flat 3 mm
Ethernet	RJ-45	-	-	-

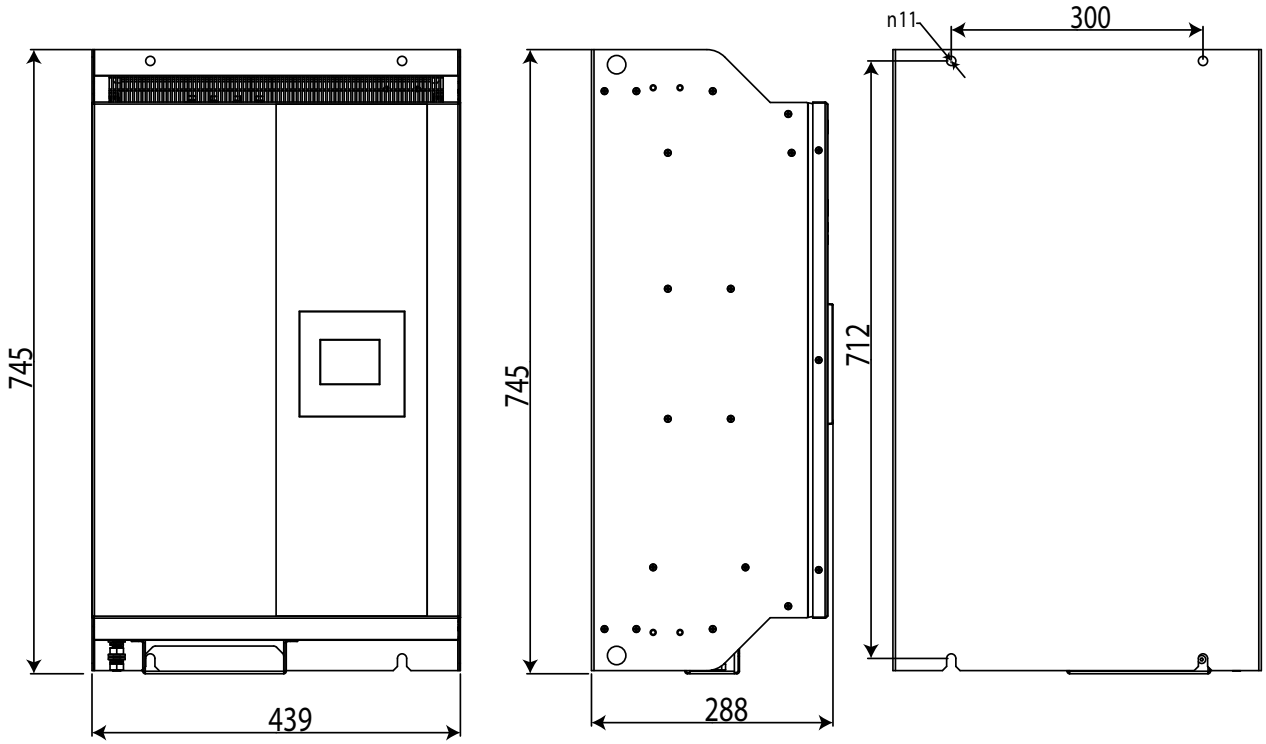
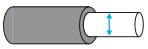


Figure 103: Dimensions SINAFMxxx100W

SINAFMxxx100R				
Dimensions (mm)	**Figure 104**			
Weight	55 kg			
Enclosure	Galvanised steel 1.5 mm			
Noise	< 60 dBA			
Connections	**Type**			
Mains	Ring terminal M8	23 mm	8 ... 10 Nm	PH2
Earth	Ring terminal M10	-	10 ... 14 Nm	Hex 17 mm
Connections	**Type**			
Current	6-pole connector	max : 2.5 mm²	0.5 ... 0.6 Nm	Flat 3 mm
RS-485	3-pole connector	max : 2.5 mm²	0.5 ... 0.6 Nm	Flat 3 mm
Ethernet	RJ-45	-	-	-

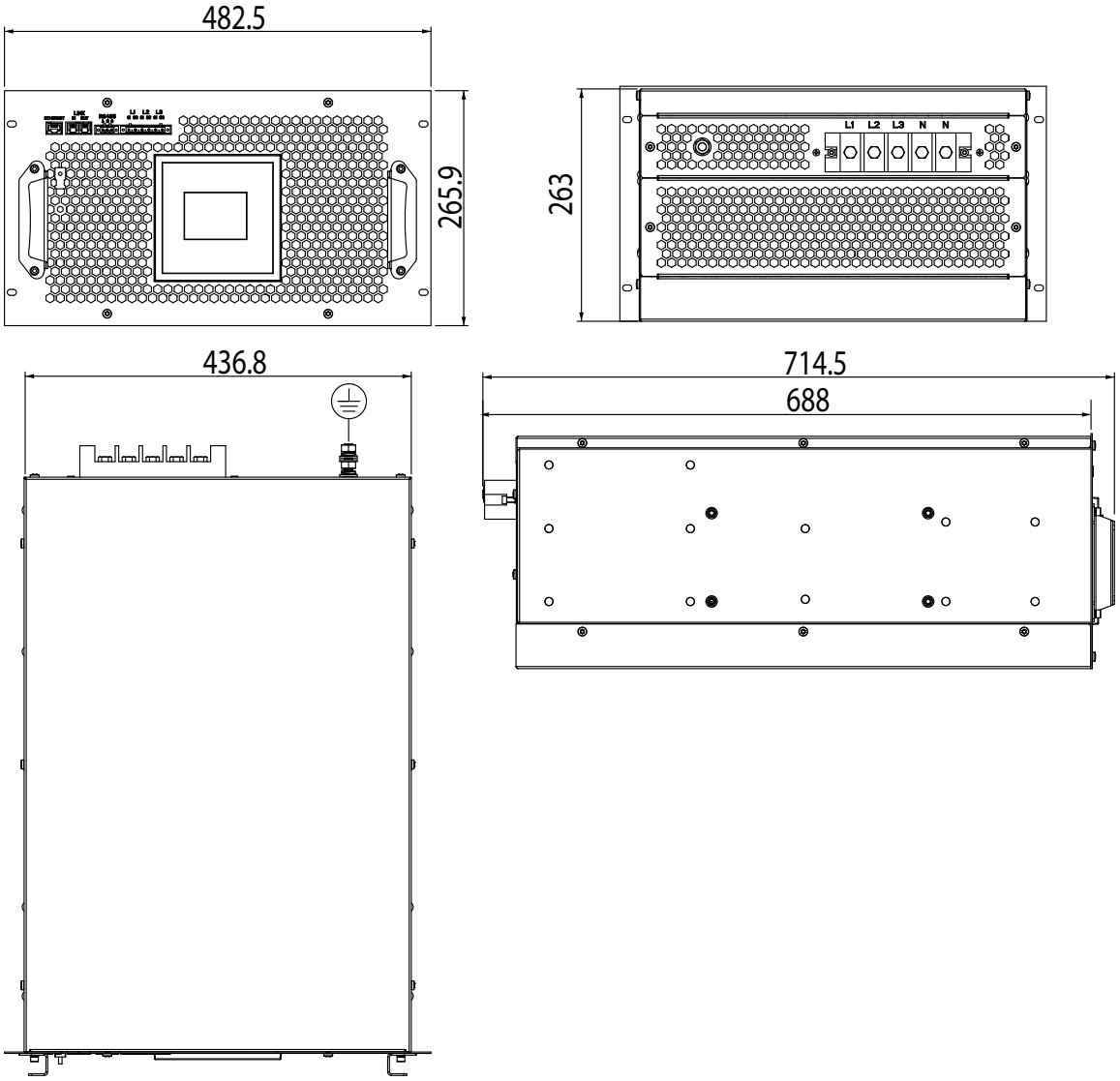
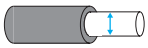


Figure 104: Dimensions SINAFMxxx100R.

SINAFMxxx100C, SINAFMxxx200C, SINAFMxxx300C, SINAFMxxx400C				
Dimensions (mm)	**Figure 105**			
Weight	**SINAFMxxx100C**	**SINAFMxxx200C**	**SINAFMxxx300C**	**SINAFMxxx400C**
	190 kg	245 kg	300 kg	355 kg
Enclosure	Free-standing sheet steel cabinet, for installation indoors, without removable parts.			
Noise	< 60 dBA	< 63 dBA	< 66 dBA	< 69 dBA

Connections				
Current				
Type				
Spring	2.5 mm²			
Earth (10)				
Type				
Ring terminal	8 mm	10 Nm	Hex 13 mm	
Ethernet				
Type				
RJ-45				
Mains				

Filter	**Bar** (11)	**Drill**	**Screw**	**Terminal width**	
SINAFMxxx100C	30x3	1xM10	M10 8.8	≤ 32 mm	45 Nm
SINAFMxxx200C	40x5	1xM10	M10 8.8	≤ 37 mm	45 Nm
SINAFMxxx300C	40x10	1xM10	M10 8.8	≤ 37 mm	45 Nm
SINAFMxxx400C	40x10	1xM10	M10 8.8	≤ 37 mm	45 Nm
Neutral					
SINAFMxxx100C	50x10	2xM10	M10 8.8	≤ 32 mm	45 Nm
SINAFMxxx200C	80x10	2xM10	M10 8.8	≤ 37 mm	45 Nm
SINAFMxxx300C	100x10	3xM10	M10 8.8	≤ 37 mm	45 Nm
SINAFMxxx400C	100x10	3xM10	M10 8.8	≤ 37 mm	45 Nm

(10) If the phase conductors exceed 32 mm², the earth conductor can be the half of the cross-section of the phase conductors.

(11)The connection bars allow the cables to be placed on both sides, and two cables may be routed through each drill hole.

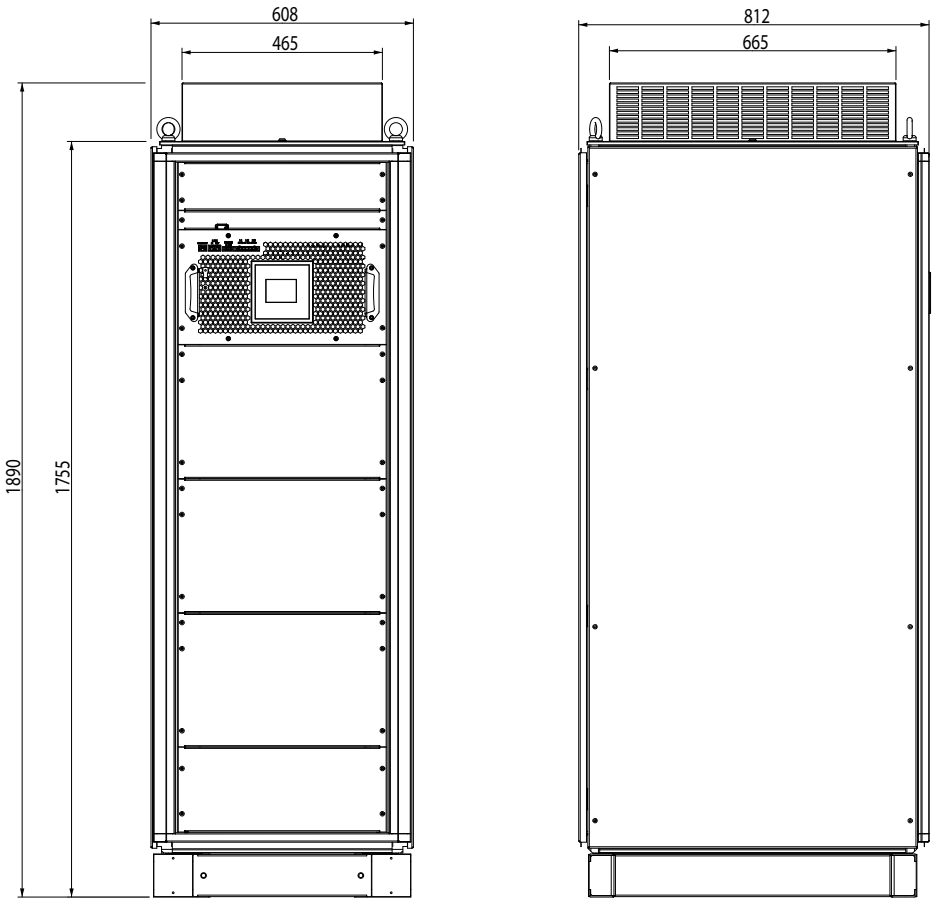


Figure 105:Dimensions Cabinet-type SINAFM.

12.- TECHNICAL SERVICE

In the case of any query in relation to device operation or malfunction, please contact the **LIFASA** Technical Support Service.

Technical Assistance Service
C/Vallès, 32, Pol. Ind. Can Bernades
08130 - Santa Perpètua de Mogoda (Barcelona) ESPAÑA
Tel: (+34) 935 747 017
email: info@lifasa.com

13.- GUARANTEE

LIFASA guarantees its products against any manufacturing defect for two years after the delivery of the units.

LIFASA will repair or replace any defective factory product returned during the guarantee period.

• No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
•The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. “Improper usage” is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual.
• **LIFASA** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or “improper usage” of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:
- Overvoltages and/or electrical disturbances in the supply;
- Water, if the product does not have the appropriate IP classification;
- Poor ventilation and/or excessive temperatures;
- Improper installation and/or lack of maintenance;
- Buyer repairs or modifications without the manufacturer’s authorisation.

14.- CE CERTIFICATE

INTERNATIONAL CAPACITORS, S.A.
C/. Valles 32 - Pol. Ind. Can Bernades
08130 Santa Perpètua de Mogoda (Barcelona) Spain
Tel. +34 935 747 017 Fax +34 935 448 433
E-mail: info@lifasa.com | Web: www.lifasa.com

DECLARACION DE CONFORMIDAD

DECLARATION OF CONFORMITY

DECLARATION DE CONFORMITE

Por la presente **INTERNATIONAL CAPACITORS, S.A.**
We hereby
Par le présent

con dirección en: **Polígono Industrial Can Bernades**
Calle Vallés nº 32
with address in: **08130 Santa Perpètua de Mogoda (Barcelona)**
avec adresse à: **ESPAÑA**

declaramos bajo nuestra responsabilidad que el producto:
we declare under our responsibility that the product:
nous déclarons sous notre responsabilité que le produit:

Filtro activo multi-nivel **Serie SINAFM**

Siempre que sea instalado, mantenido y usado en la aplicación para la que ha sido fabricado, de acuerdo con las normas de instalación aplicables y las instrucciones del fabricante,
Provided that it is installed, maintained and used in application for which it was made, in accordance with relevant installation standards and manufacturer's instructions,
Toujours qu'il soit installé, maintenu et utilisé pour l'application par lequelle il a été fabriqué, d'accord avec les normes d'installation applicables et suivant les instructions du fabricant,

cumple con las prescripciones de la(s) Directiva(s) :
complies with the provisions of Directive(s) :
accomplie avec les prescriptions de la (les) Directive(s) :

2014/35/ UE
2014/30/ UE
2011/65/ UE

Está en conformidad con la(s) siguiente(s) norma(s) u otro(s) documento(s) normativo(s) :
It is in conformity with the following standard(s) or other normative document(s) :
Il est en conformité avec la (les) norme(s) suivante(s) ou autre(s) document(s) normatif (ves) :

IEC 61000-6-4-:2006 Ed. 2.0
IEC 61000-6-2-:2016 Ed. 3.0
IEC 62477-1:2012Ed. 1.0 :A1:2016 CSV
IEC 61439-1:2011 Ed. 2.0

Año de colocación del marcado "CE" :
Year of affixing "CE" marking:
An de mise en application du marquage "CE":

2019

Santa Perpètua, 12 /03 /2019

Nombre y Firma : J.J. Gallego
Name and signature :
Nom et signature :

INTERNATIONAL CAPACITORS, S.A.

lifasa.com

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