Vertiv™ Liebert® AF4

User Manual

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-in/support/ for additional assistance.

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1 General Instructions

- Instructions and precautionary measures listed in this manual should be strictly used for the safety of the product as well as the operators.
- All the ratings and/or variants of Vertiv™ Liebert® AF4, (Active Filter) in their open-door condition on any side, have exposed live parts (holding/operating high voltage) such as components, PCBs, terminals, and cables.
- The energy storage elements used in the Liebert® AF4 hold the high DC voltage even after switching/disconnecting all the power connections.
- Only the trained and authorized electrical personnel are allowed to handle and/or install and/or repair the Liebert® AF4.
- Improper handling and/or use and/or maintenance of the Liebert® AF4 will be hazardous to humans as well as the product. Such instances should be strictly avoided.

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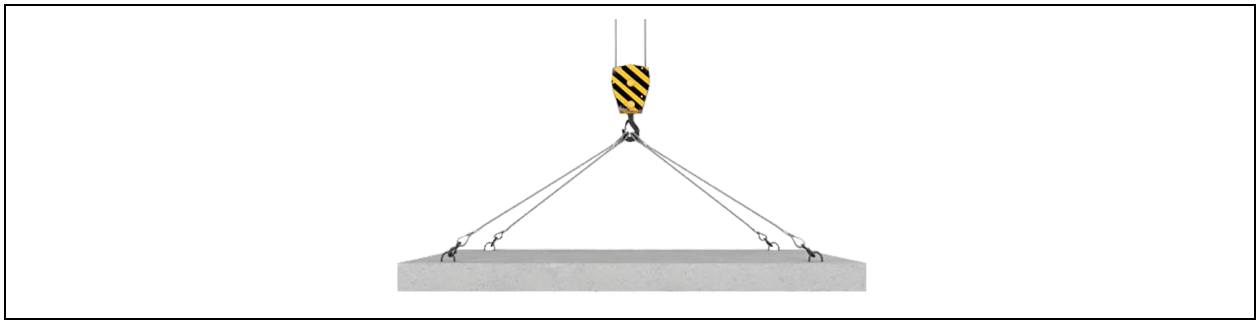
2 Handling Instructions

- Equipment while in packed condition should be kept in the upright position as per the arrow indication mark on the packing.
- Store the equipment in dry location having temperature range between -10 °C to 70 °C.
- Once received at the site on a dedicated transport vehicle, use the fork lift and/or cranes to move the equipment as close as possible to the installation site.
- Ensure proper unpacking by the experienced personnel at site as per standard practices.
- The unpacked equipment should be physically inspected for any signs of apparent damage either during the transportation and/or handling. In case of any such signs, do not install the equipment, and inform the Vertiv service team accordingly.
- Each Liebert® AF4 unit is equipped with 4 eye bolts on top. Once unpacked, an appropriate eye hook with sufficient loading capacity should be utilized to position the Liebert® AF4 at the sit.

Figure 2.1 Eye bolt

Figure 2.2 Lifting hook

Figure 2.3 Lifting Liebert® AF4 using lifting-hook (Top View)



3 Recommended Environmental Conditions

- Equipment should be installed in a room free from water in any form such as vapor, steam, droplets, seepage, spills, etc.
- The location should be free from vibrations and/or shocks.
- Vertiv™ Liebert® AF4 should be installed in a shaded room to avoid exposure to direct sunlight.
- The place should be well-ventilated ensuring the room temperatures (considering 3% thermal losses from Liebert® AF4), stay below the specified product ambient temperature (< 50 °C). The ventilation system should ensure that no direct dust deposits form in the room.
- The foundation should be able to handle the weight of the Liebert® AF4 with provisions to facilitate bottom cable entry into the unit.
- The minimum clearance on all sides of the Liebert® AF4 should be provided to ensure proper ventilation and maintenance space. Minimum requirements are 1000 mm at the front, 300 mm on all three sides, and 400 mm on top.
- Approximate product weight and heat losses in the Liebert AF4 range are given in the table below:

Table 3.1 Product weight and heat losses in the Vertiv™ Liebert® AF4

Rating (A)	3-Wire		4-Wire	
	Weight (kg)	Heat Loss (W)	Weight (kg)	Heat Loss (W)
30	85	550	95	733
60	120	1022	132	1363
100	138	1430	190	1907
150	210	2148	244	2864
200	240	2834		
300	410	4296		
400	460	5668		

NOTE: The space in which the Vertiv™ Liebert® AF4 is installed should be designed to dissipate the additional thermal losses specified in the table.

NOTE: The platform on which the Vertiv™ Liebert® AF4 is installed should be able to support twice the original weight of the Vertiv™ Liebert® AF4 mentioned in the table.

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4 Electrical Installation Requirements

- A provision for electrical isolation and protection for the Vertiv™ Liebert® AF4 should be kept upstream to the Vertiv™ Liebert® AF4 connection, for the use during emergency and maintenance periods.
- Ensure the minimum possible cable lengths between the Liebert® AF4 and its point of connection. In typical applications, cable lengths are to be below 30 m. In case of deviations, please contact our product application engineer.
- Recommended to use flexible copper cables for the power terminations to Liebert® AF4.

The recommended cable sizes are as follows:

Table 4.1 Recommended sizes flexible copper cables

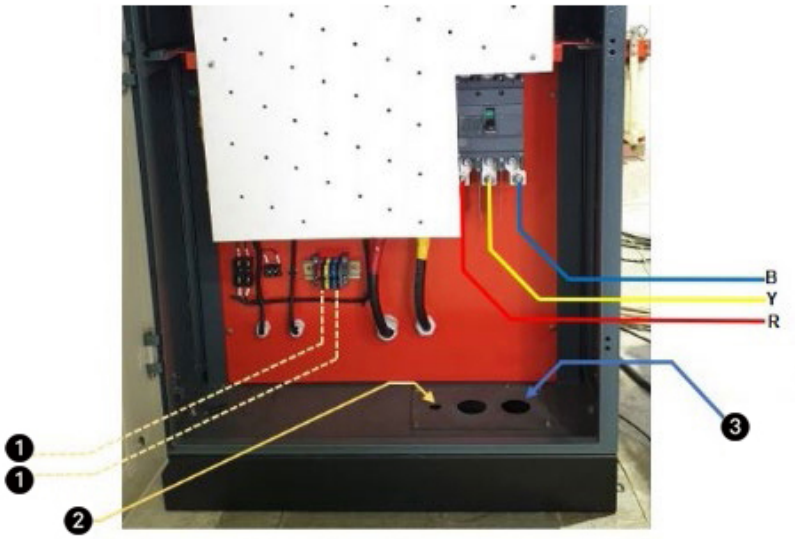
Size	Flexible Copper Cable	C.T Cables (Sq. mm)	C.T	Earthing Cable
(2-Level)	Size in Sq.mm	6-Core Cu.	VA Loading	1-Core Cu.
30	10	2.5	15	2.5
60	25	2.5	15	4
100	50	2.5	15	6
150	70	2.5	15	6
200	120	2.5	15	10
300	240	2.5	15	10
400	2 Runs of 185	2.5	15	10

- Neutral cable is only needed for 3-Phase 4-Wire Liebert® AF4s, which is of the same rating as phases.
- A 2.5 Sq. mm, 6-Core Copper Cable should be used to connect the CTs and CT terminals inside the Liebert AF4.
- Three-phase power terminals for 3-Phase 3-Wire Liebert® AF4, Three-phase and neutral power terminals for 3-Phase 4-Wire Liebert® AF4, three-phase CT connections, and external control supply connections (if necessary) are located inside the enclosure on the front side. Earth connection provision has been made at the base frame.
- Insert a current transformer (CT) on each phase of the load or main supply terminals, where the harmonic correction should be done. P1 of all CTs should be towards the incoming side, while P2 is towards the load side.
- The same phase sequence (either RYB or RBY) should be followed while terminating three-phase power cables and CT secondary cables.
- A proper earthing connection should be made using the cable/strip of appropriate grade and size, as per applicable standards.

- All the connections and terminations should be made by a qualified electrical technician.

Standard Vertiv™ Liebert® AF4 power connections will be as shown in the Figure 4.1 below:

Figure 4.1 Power connections



Denotation	Description
1	CT Terminals
2	6-Core CT Cable Entry
3	Power Cable Entry (3-Core)
B	Power Terminals
Y	Power Terminals
R	Power Terminals

5 Maintenance Requirements

- All the power and control supplies are to be kept in OFF condition, prior to any kind of service or maintenance activities.
- Even during the OFF condition, one should strictly avoid any physical contact with the internal components/parts, to avoid the electrical shock due to charged capacitor banks inside.
- Liebert® AF4s have air filters located on the air filter pockets of the back and side doors, which should be periodically cleaned using forced air flow and/or suction by an authorized and skilled technician.
- In case of any service calls and/or maintenance requirements, one should contact the email and/or contact details printed on the product nameplate.

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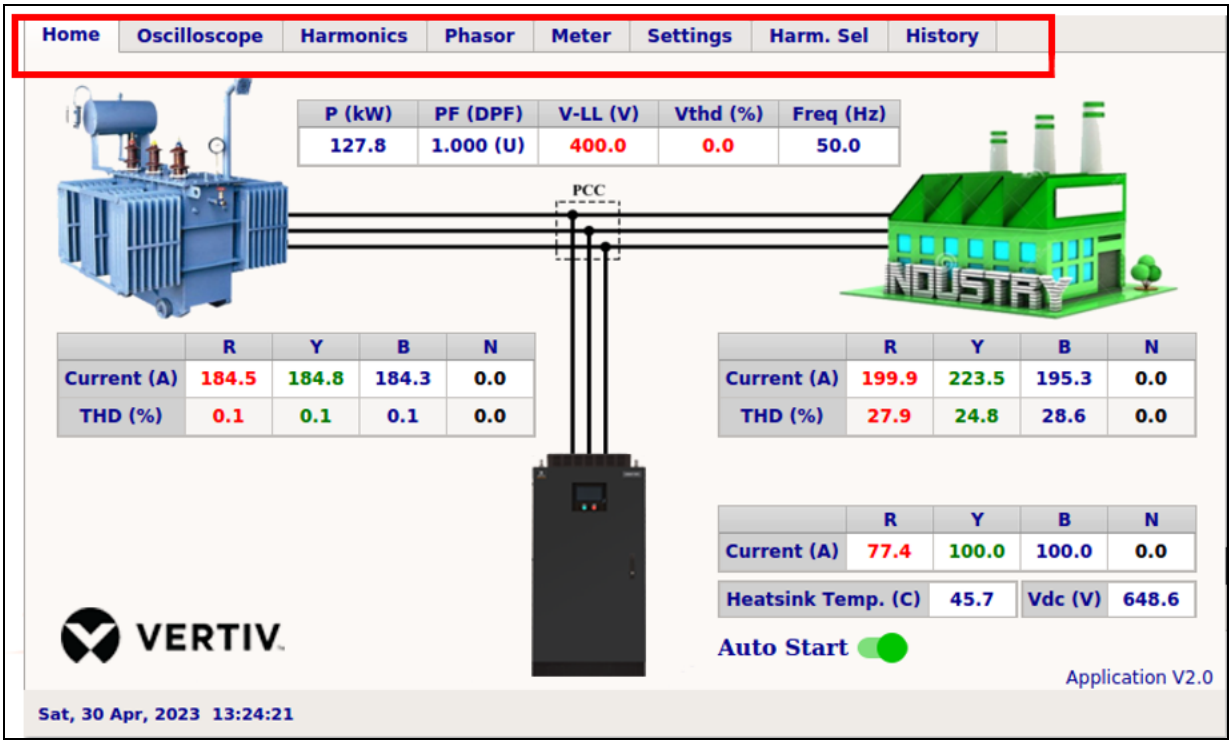
6 HMI Operating Instructions

The Vertiv™ Liebert® AF4 is equipped with high-performance 7-inch capacitive touch TFT display-based Human Machine Interface (HMI). The same HMI is meant for product configuration, visualization of product and plant parameters, and waveforms. The Default HMI screen appears as below:

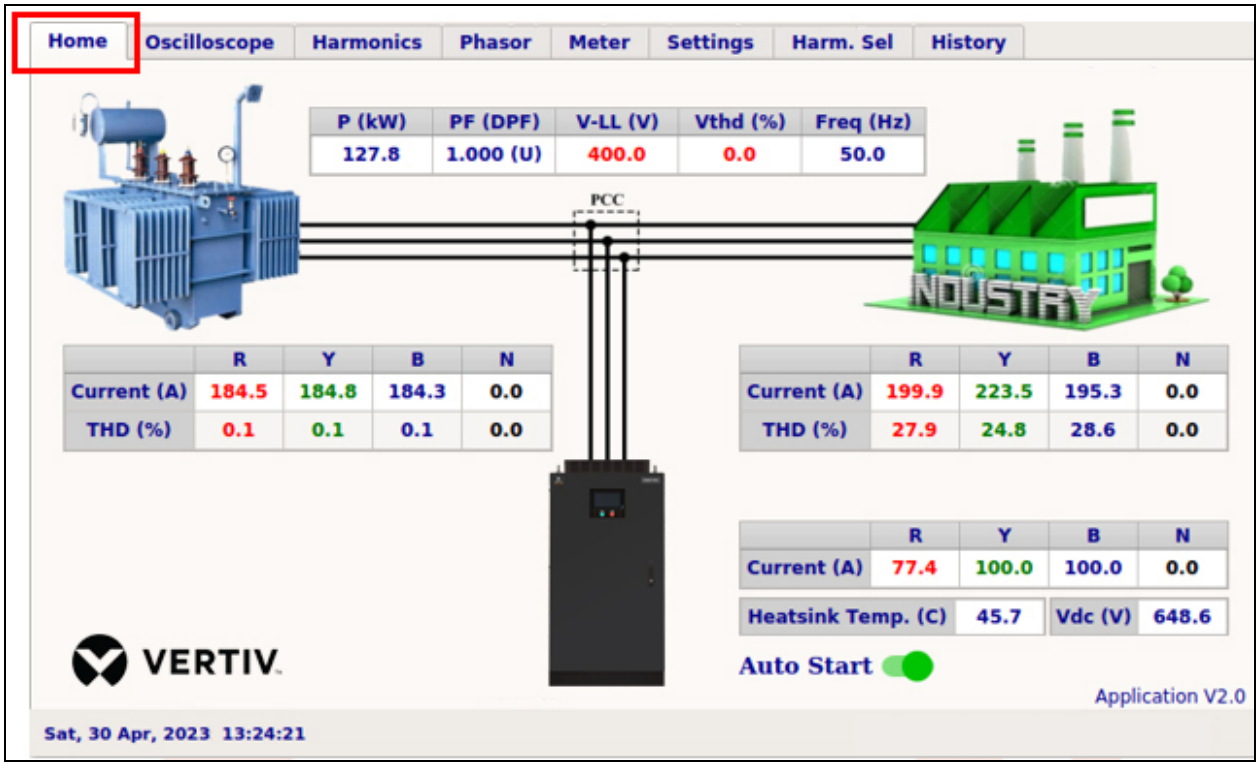


Different functions of HMI are accessible through the following eight tabs:

1. Home
2. Oscilloscope
3. Harmonics
4. Phasor
5. Meter
6. Settings
7. Harmonic Selection (Displayed in short form as “Harm. Sel”)
8. History

The following section provides the detailed description on functionality of each tab:

6.1 Home



The Home tab is designed to display the real-time performance of the Vertiv™ Liebert® AF4 in terms of the following parameters:

a) Current harmonics mitigation

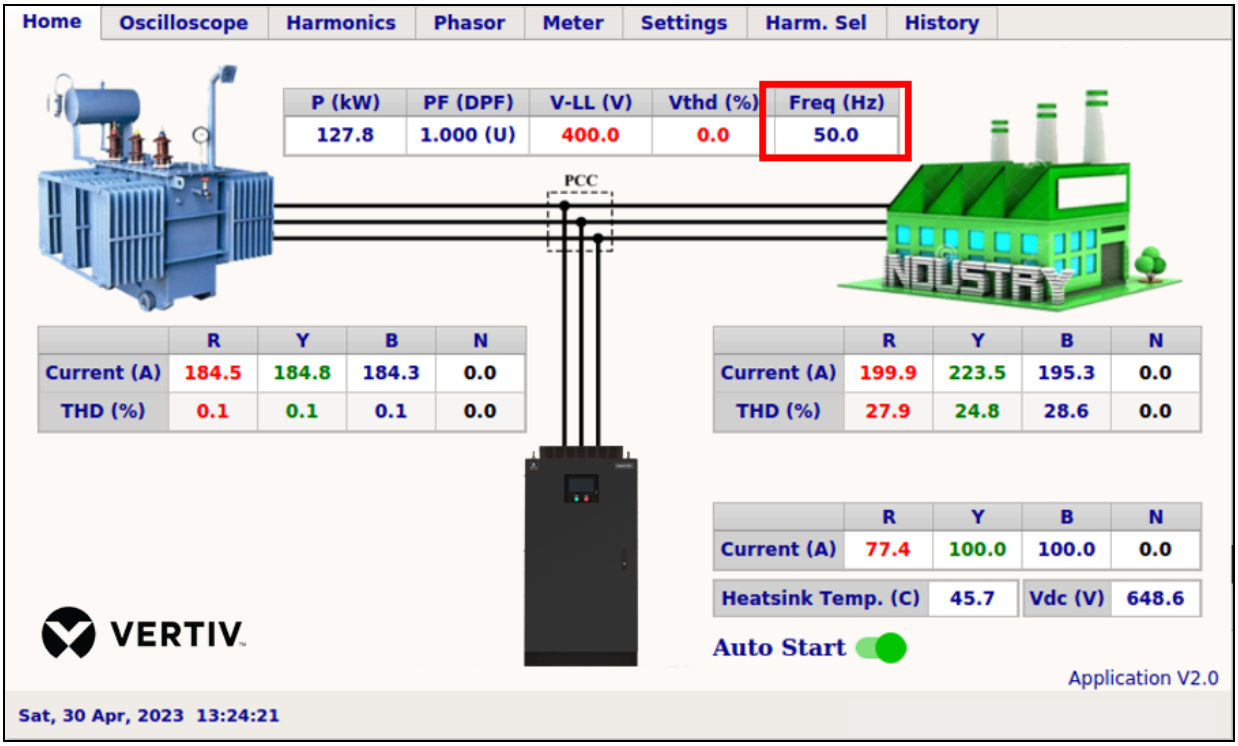
b) Basic power parameters of the electrical system

c) Critical Vertiv™ Liebert® AF4 operating parameters

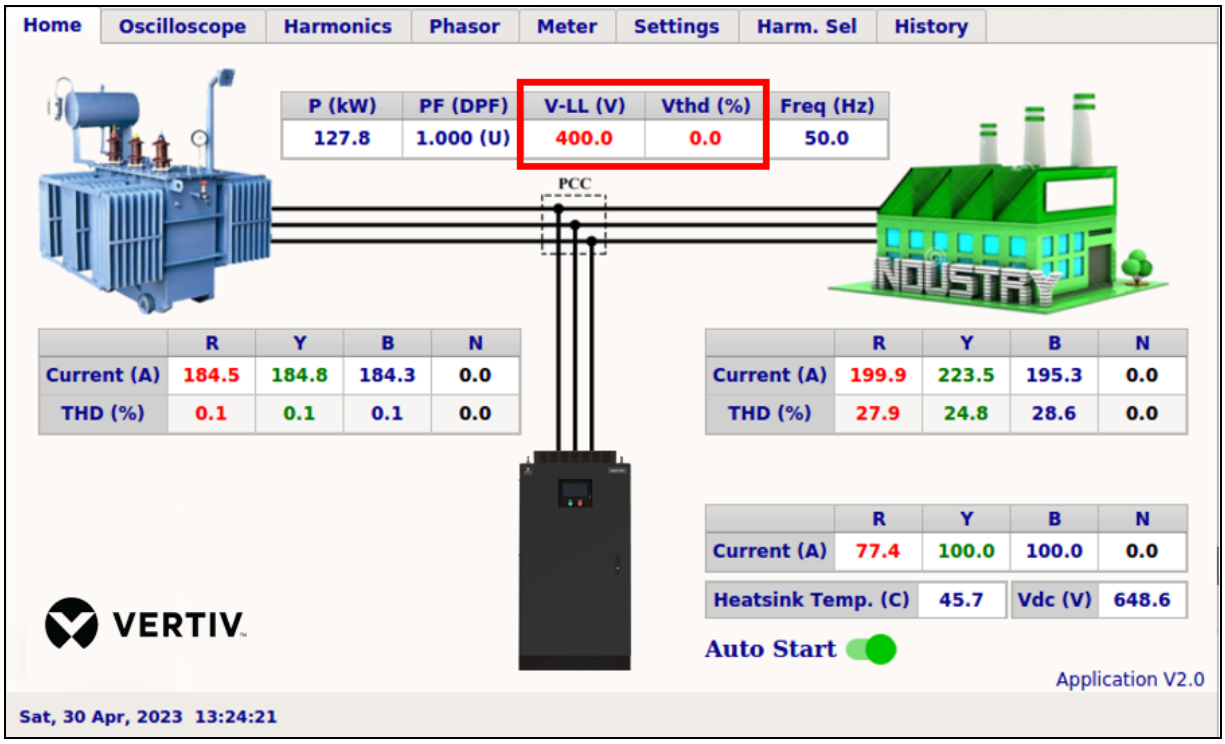
d) Control to Enable/Disable auto restart of the Liebert® AF4.

The user can visualize the following parameters in real-time on the Home tab:

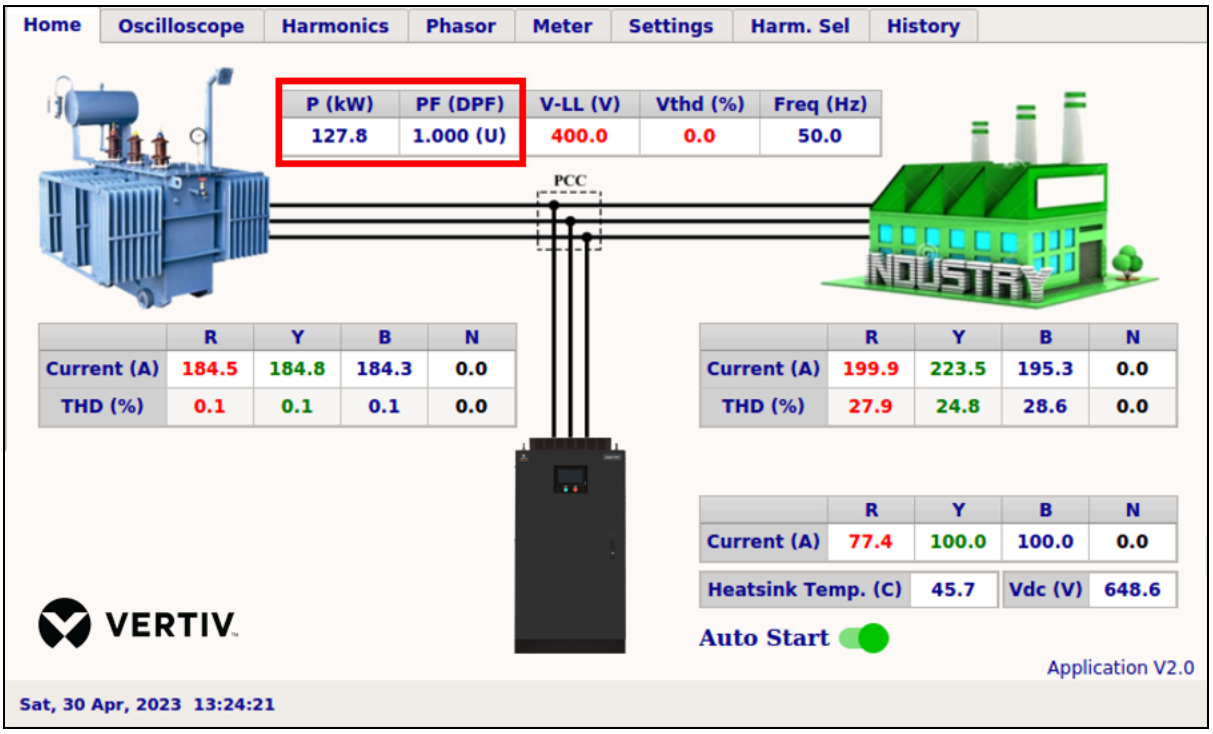
- Supply frequency



- True RMS values of three-line (R, Y and B) voltages (V-LL) and their respective THDs.

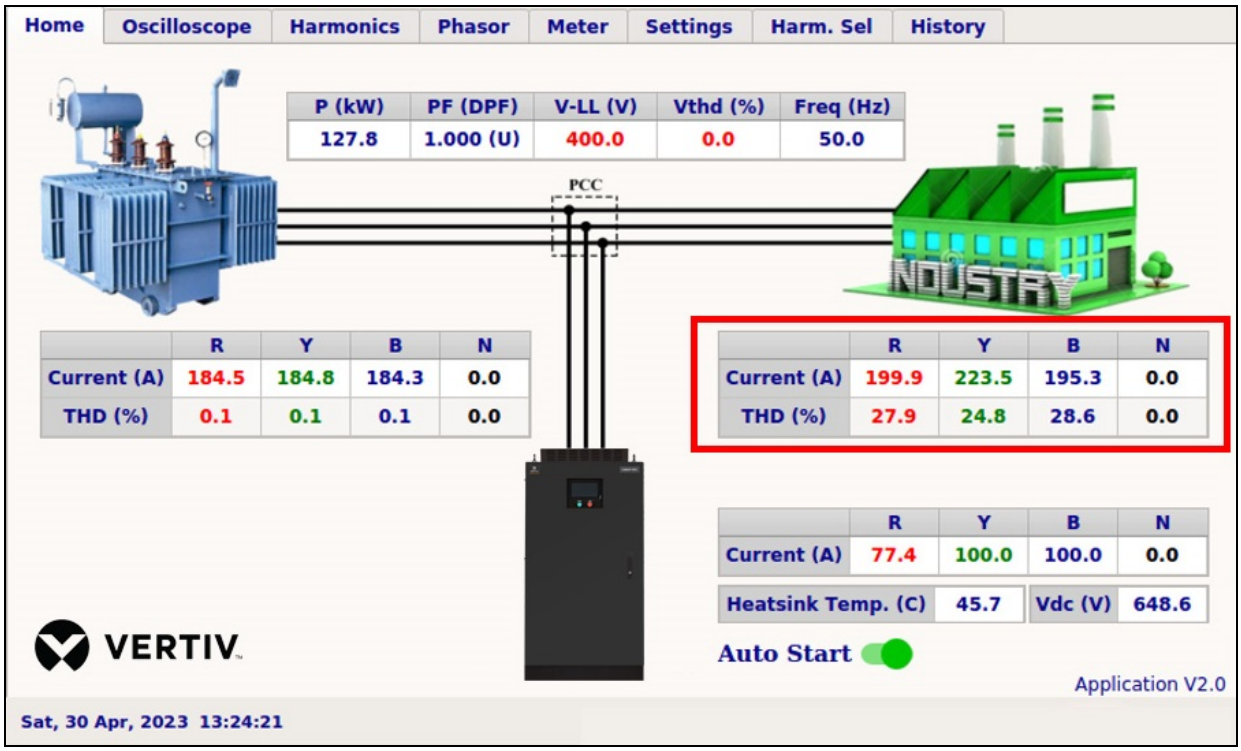


- Three-Phase Active (P), Reactive (Q), and Apparent (S) Powers along with Displacement Power Factors (DPF):

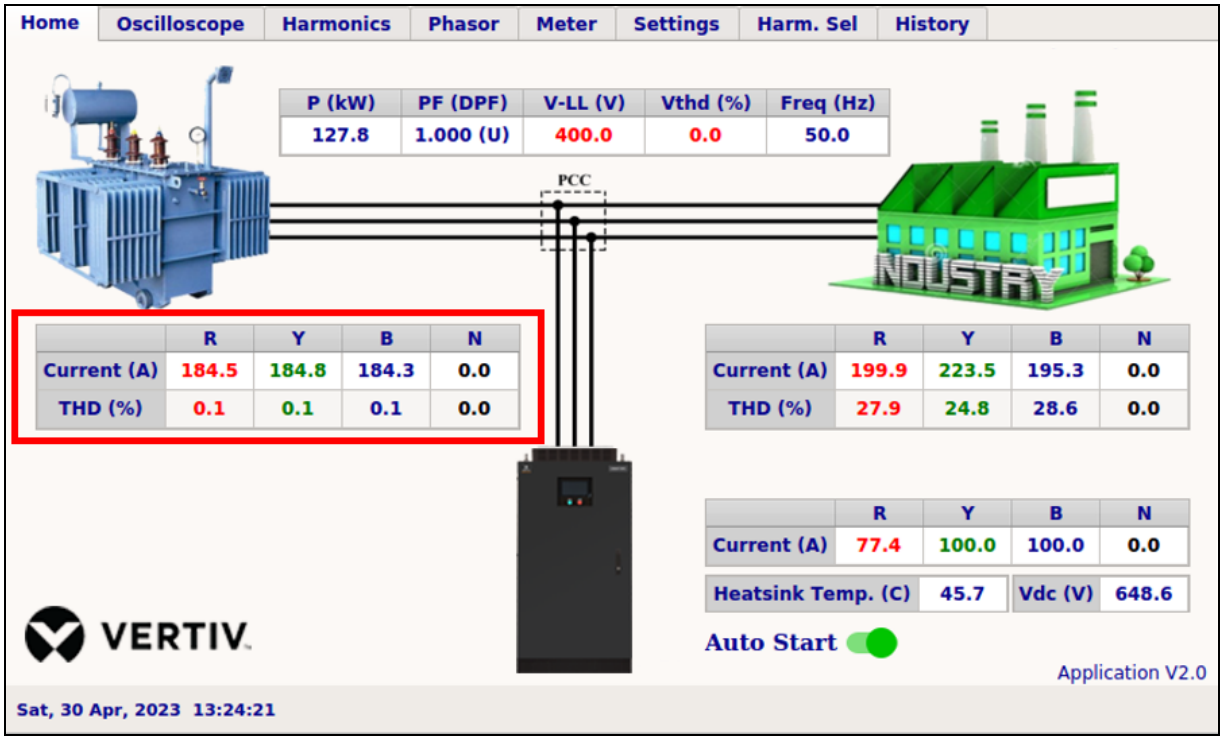


Power Parameters changes roll one after other.

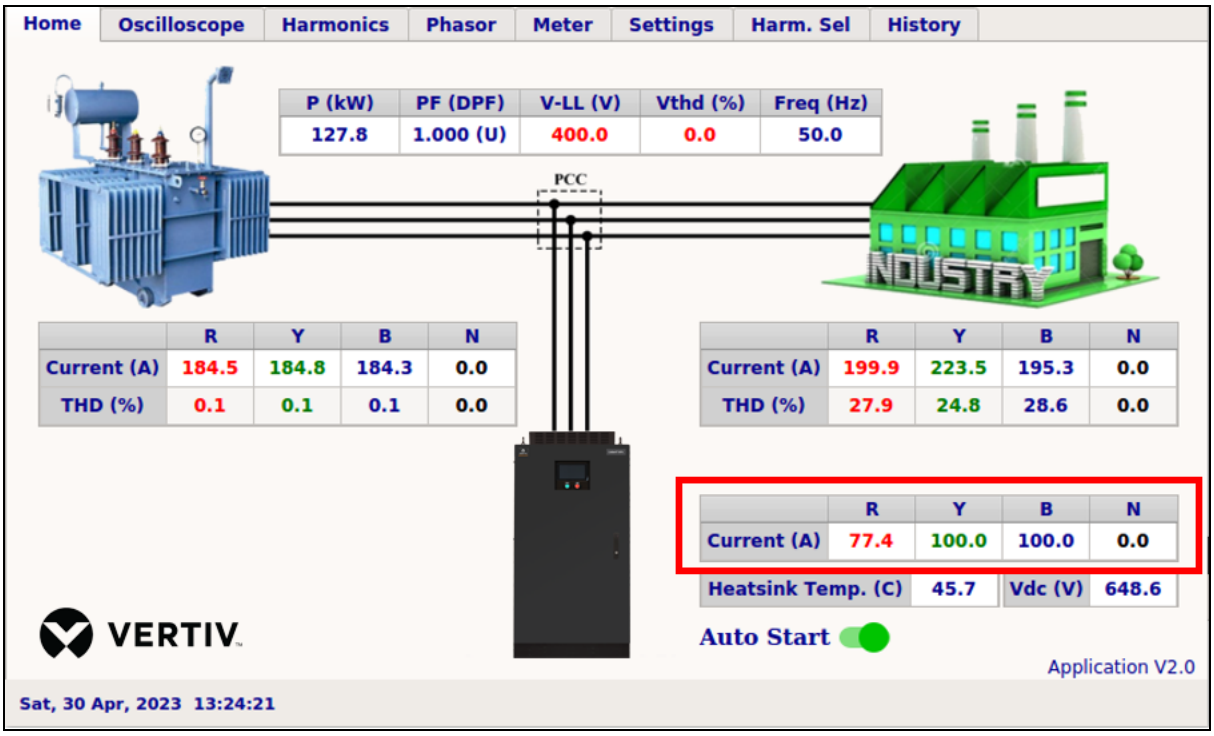
- True RMS values of three-phase (R, Y, B, and N) load currents and their respective THDs:



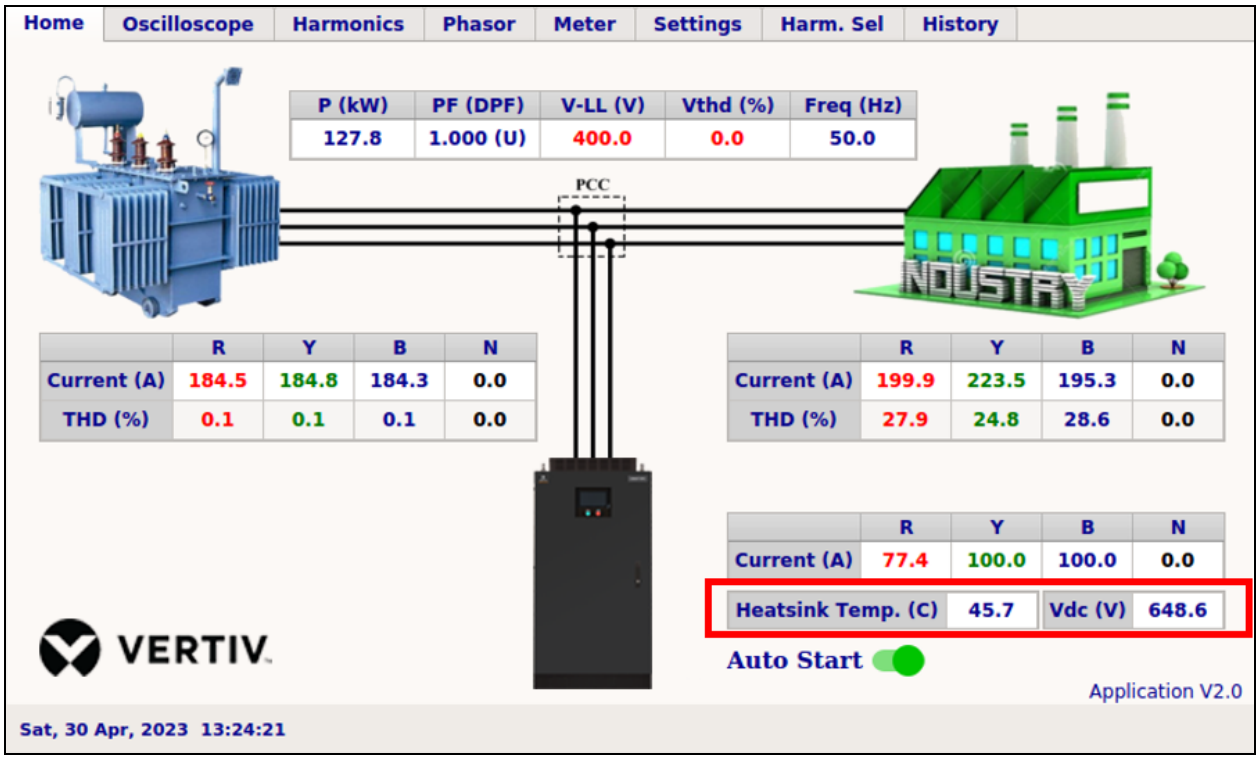
- True RMS values of three-phase (R, Y, B, and N) source currents and their respective THDs:



- True RMS values of three-phase (R, Y, B, and N) currents:

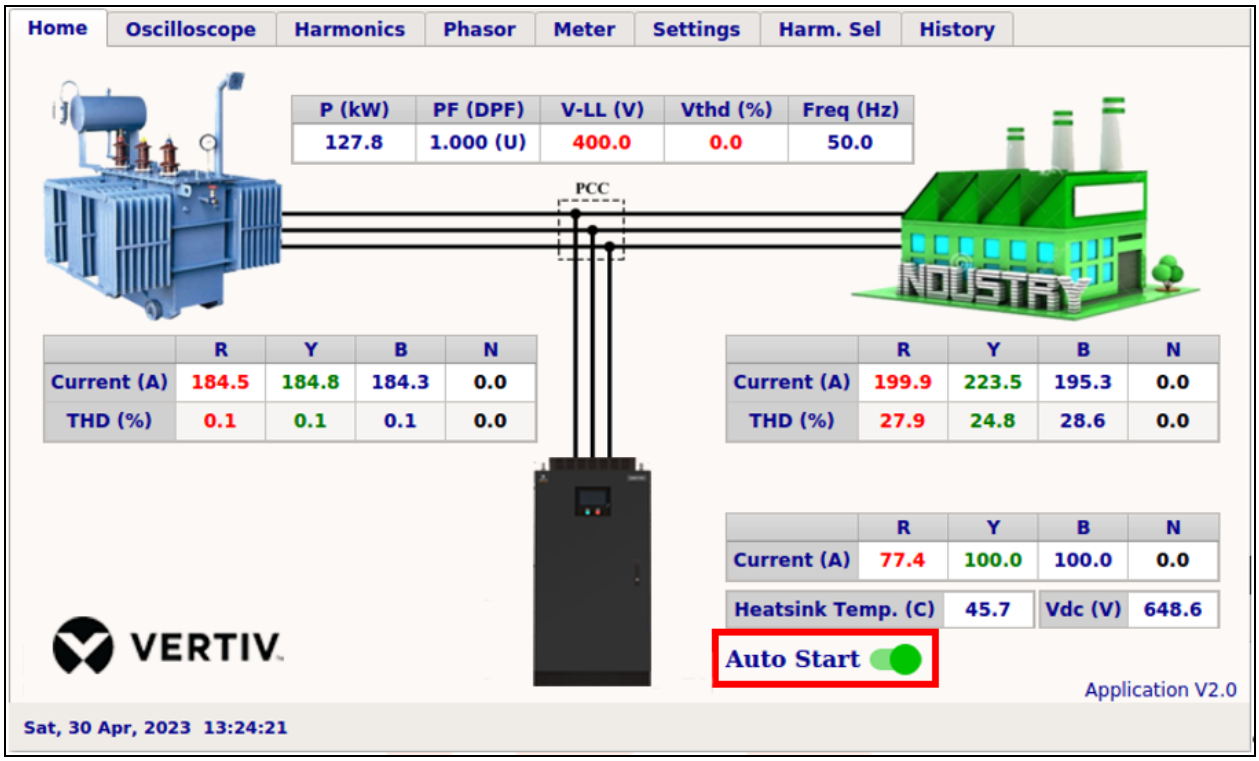


- Internal DC bus voltage, and heat sink temperatures:



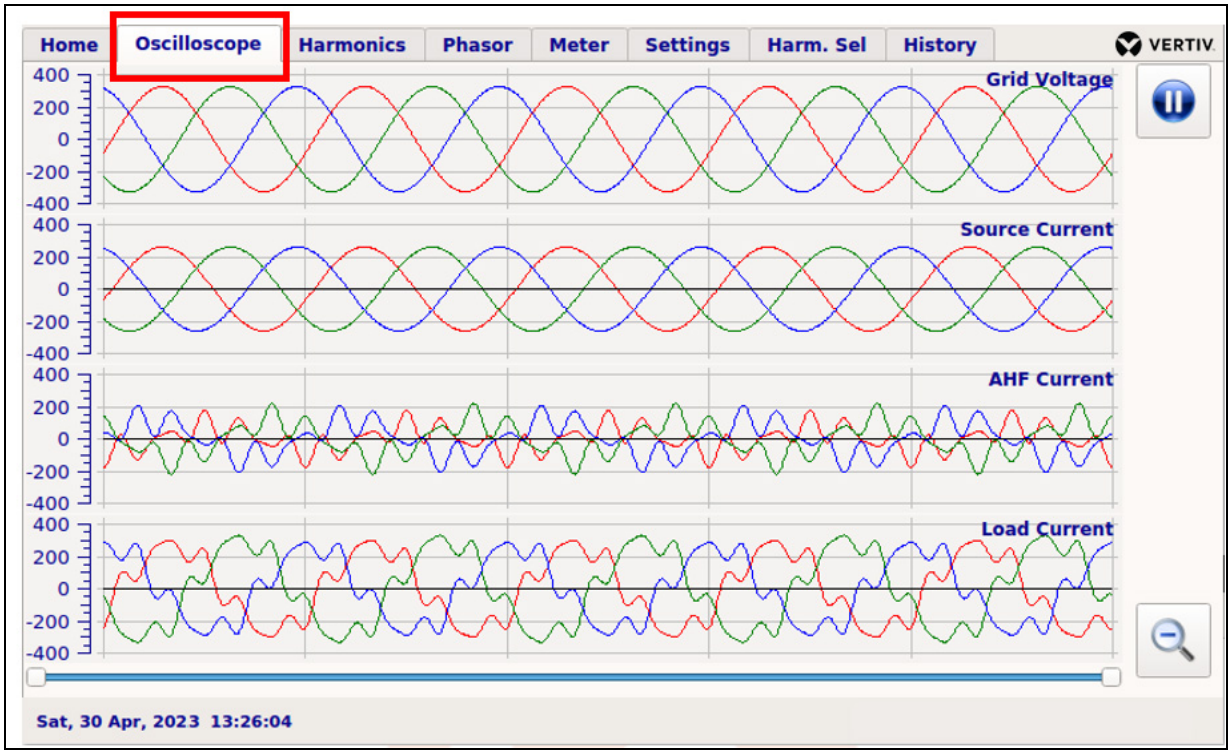
- Auto Start:

  The “Auto Start” switch provided on the Home tab (on the left side of the Liebert® AF4 picture) controls the starting functioning of AHF (Active Harmonic Filters) in case of power cycling. When ON, AHF automatically starts in case of power resumption after the outage. When OFF, AHF does not start automatically. The status of the “Auto Start” switch can be changed by finger touch on the switch.



NOTE: When the user presses the AHF ON push button, the “Auto Start” switch automatically gets ON. While it gets OFF when the AHF OFF button is pressed. This is to ensure AHF is always in auto-start mode once AHF has been started by the user. This is to ensure that the last user ON/OFF command is stored within the AHF, and shall be used after power resumption followed by grid faults/outages.

6.2 Oscilloscope



The Oscilloscope tab is equipped with 15 channel real-time oscilloscope, for graphical visualization of AHF performance in mitigating the current harmonics. The following waveform groups are displayed in real-time on Oscilloscope tab:

- **Group-1:** R, Y, and B phase Grid voltage waveforms (No. of channels - 3)
- **Group-2:** R, Y, B and N phase Source current waveforms (No. of channels - 4)
- **Group-3:** R, Y, B and N phase AHF/Filter current waveforms (No. of channels - 4)
- **Group-4:** R, Y, B and N phase Load current waveforms (No. of channels - 4)

The following functionality of the oscilloscope is provided to enhance the user experience:

a. **Pause/Play**  **button (provided in the upper right corner):**

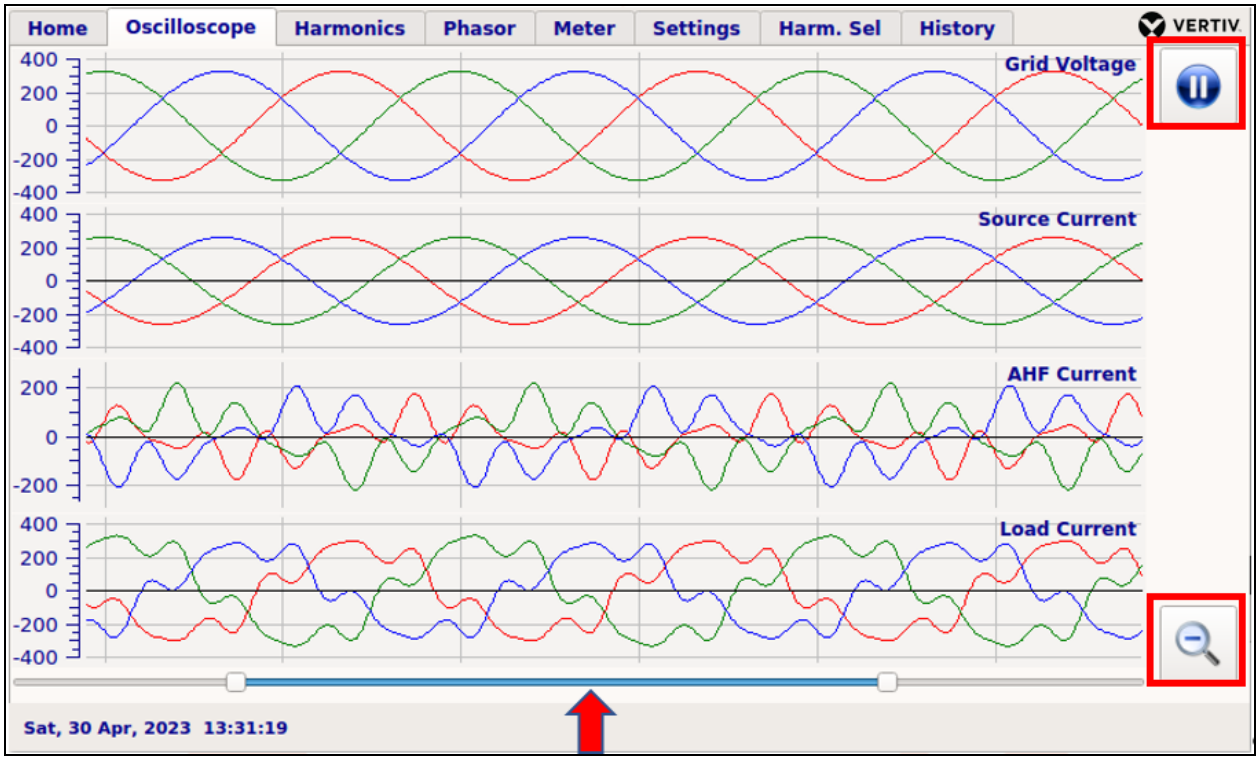
This button controls the acquisition of waveforms. Pressing the pause button stops the acquisition of new waveforms and continuously shows the last acquired waveforms on the screen for further analysis. Pressing again the same button starts the waveform update in real-time.

b. Un-zoom button  (provided in the lower right corner):

   Pressing this button un-zooms the waveforms in case they are zoomed by the user.

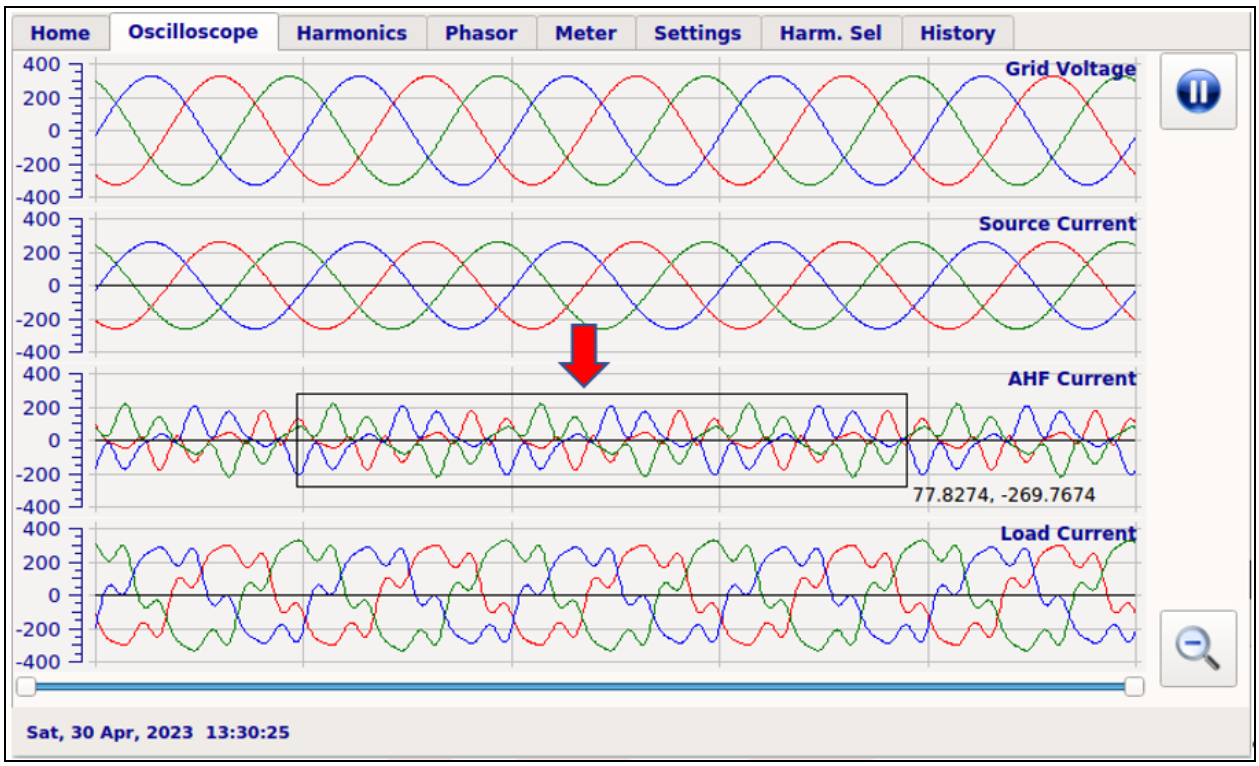
c. Horizontal zoom double-sided slider (provided below the waveforms window):

   By adjusting the slider position user can horizontally zoom all the waveforms as shown below.

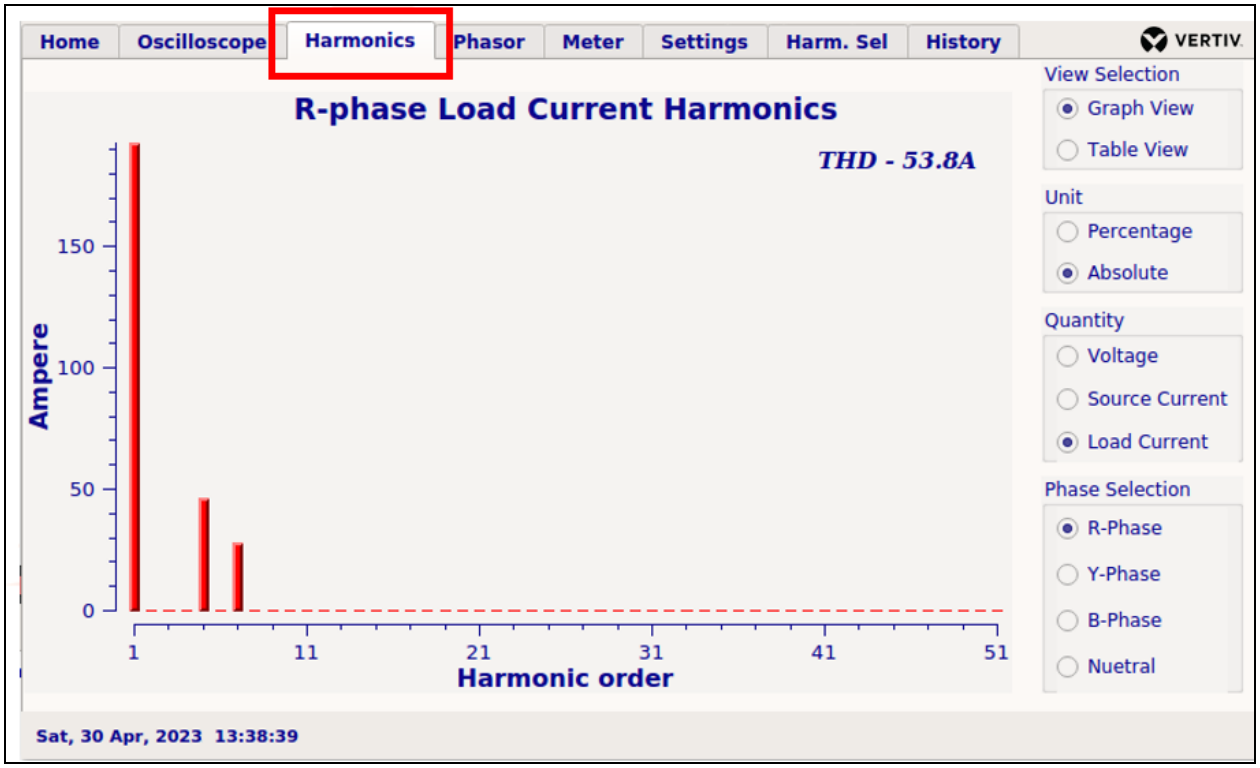


d. Box zoom:

Users can zoom the particular area of the waveform by touching on the screen and dragging the finger to cover the rectangular area of interest as shown below.



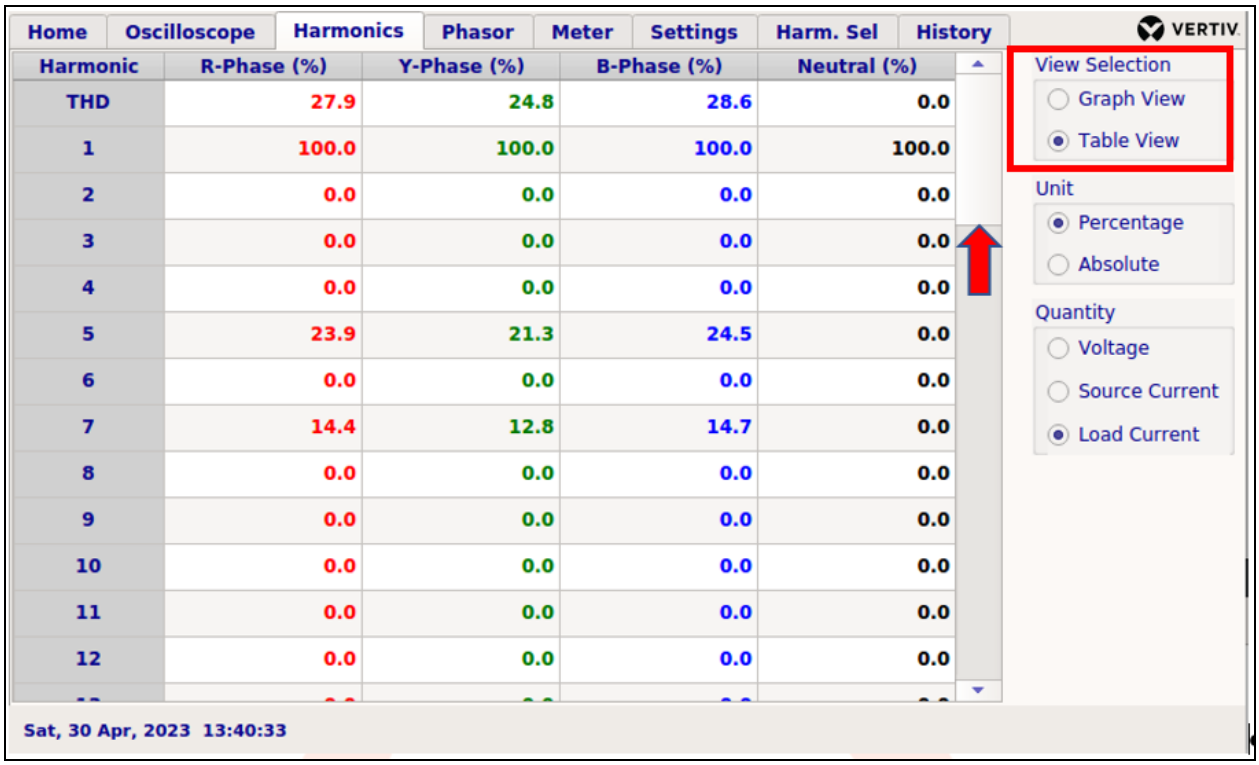
6.3 Harmonics



The Harmonics tab is designed for real-time analysis of individual harmonics present in the load as well as source current waveforms. The individual harmonics are shown in percentage with respect to fundamental current.

The Harmonics tab does provide real-time analysis of the harmonic contents in the grid voltages, load currents, and source currents.

The radio buttons provided on the right side of the screen, are meant for appropriate selection as desired. The following four different selection groups are provided:



a. View Selection:

- Graph View: The selection of this view shows the individual harmonic distortion of phase current/voltage (in line with other selections) graphically as a classical bar-chart.
- Table View: The selection of this view shows the individual harmonic distortion of three phase currents/voltages (in line with other selections) quantitatively in tabular form. The harmonics analysis window in which the case of the “Table View” selection is shown below. Users can drag the table rows using the Vertical slider provided on the right side of the table.

b. Unit Selection:

- Percentage: The individual and total harmonic levels will be shown in percentage with respect to the corresponding phase fundamental components (voltage/current).
- Absolute: The individual and total harmonic levels will be shown in absolute values (Volts/Amperes).

c. Quantity Selection:

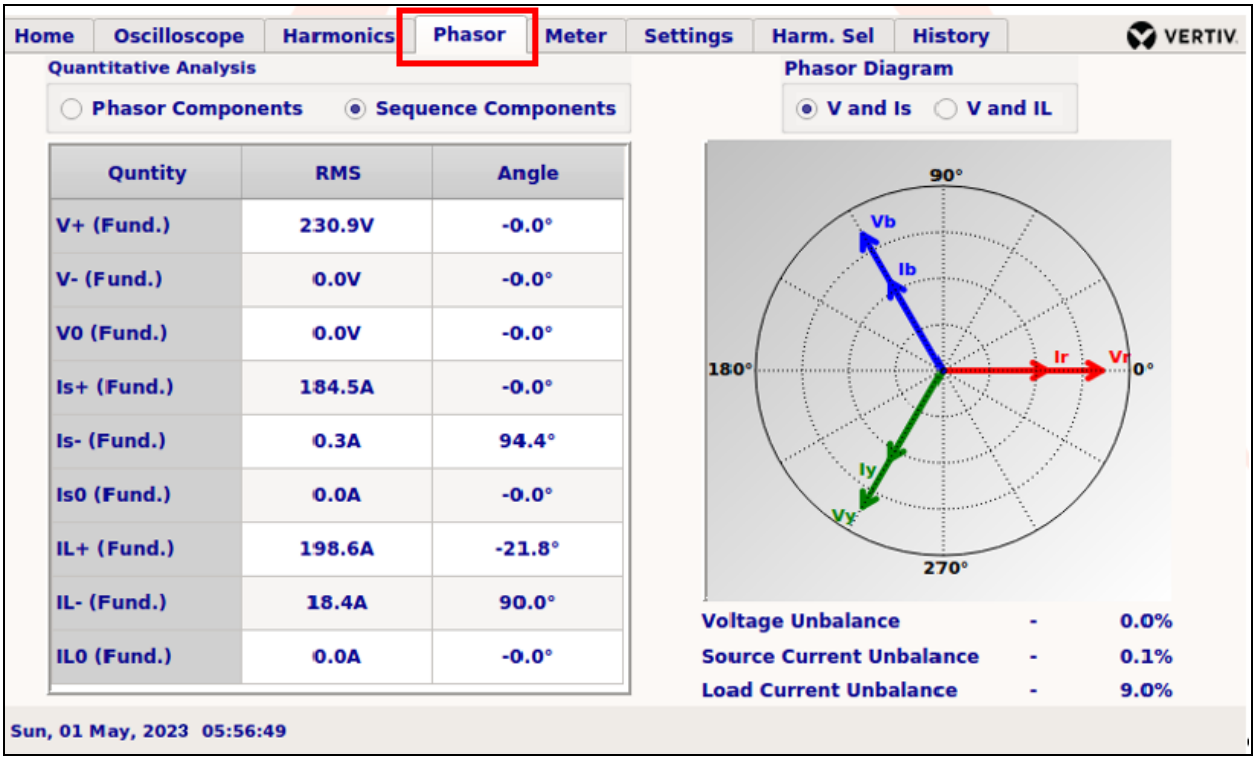
- **Voltage:** Checking this radio button selects grid voltages for harmonic analysis.
- **Source Current:** Checking this radio button selects source currents for harmonic analysis.
- **Load Current:** Checking this radio button selects load currents for harmonic analysis.

d. Phase Selection:

Available only when “Graph View” is selected.

- **R-Phase:** Checking this radio button selects R-phase voltage/current subjected selection.
- **Y-Phase:** Checking this radio button selects Y-phase voltage/current subjected selection.
- **B-Phase:** Checking this radio button selects B-phase voltage/current subjected selection.
- **Neutral:** Checking this radio button selects Neutral current subjected to Quantity selection.

6.4 Phasor



The Phasor tab does provide real-time phasor diagrams as well as sequence components analysis.

The two sets of radio button selections in the Phasor tab work as follows:

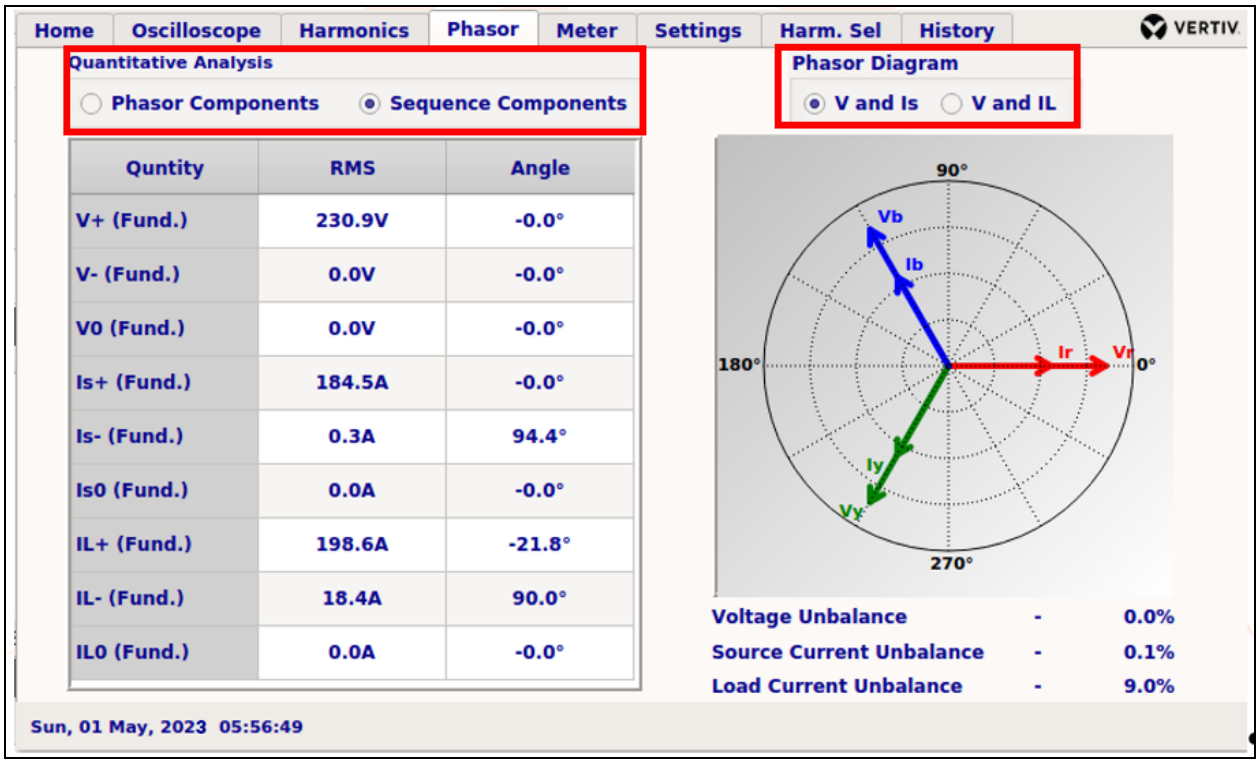
a. Phasor diagrams:

- V and IL: three-phase voltages vs three-phase load currents, and
- V and Is: three-phase voltages vs three-phase source currents.

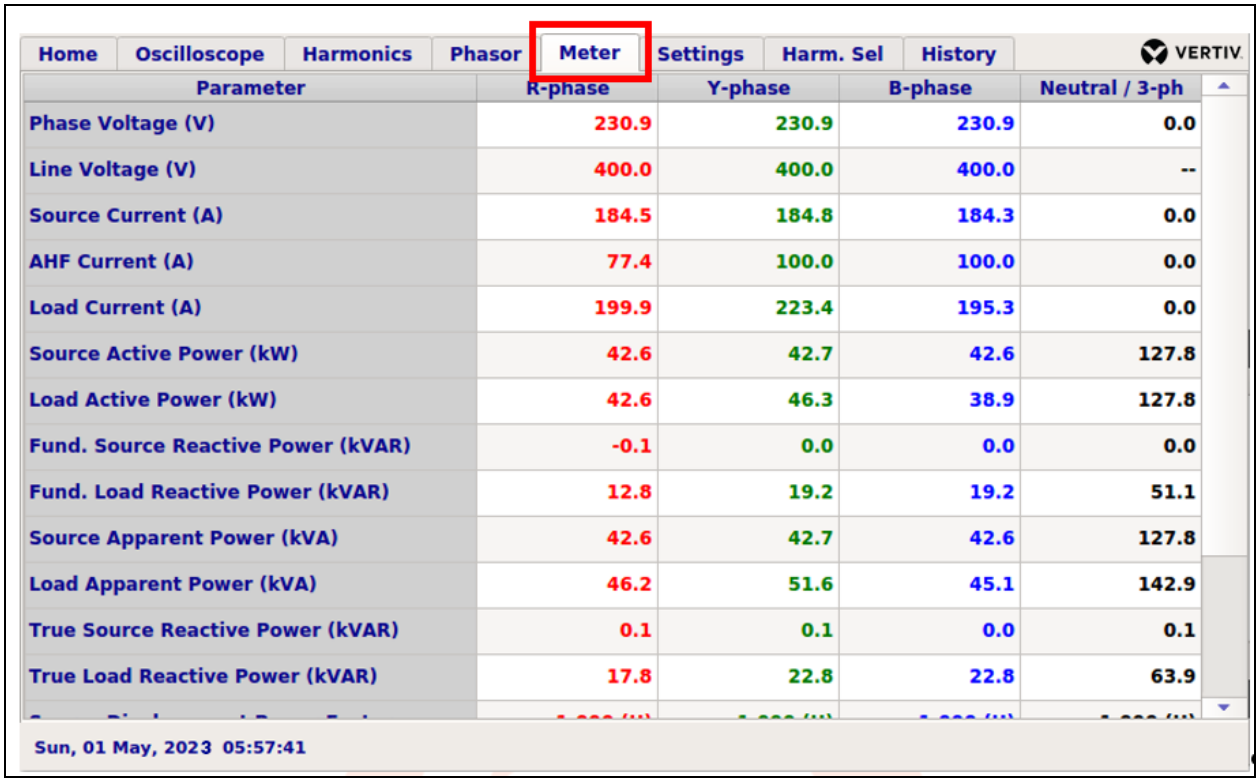
b. Quantitative Analysis:

- Phasor Components: three-phase magnitudes of voltages, load and source currents and their respective phase angles shall be displayed.
- Sequence Components: magnitudes of the positive sequence, negative sequence, and zero sequence components of the voltages, load and source currents, and their respective phase angles shall be displayed.

In addition to be above, percentage unbalance in the voltages, load and source currents shall also be shown in this Phasor tab:



6.5 Meter



Parameter	R-phase	Y-phase	B-phase	Neutral / 3-ph
Phase Voltage (V)	230.9	230.9	230.9	0.0
Line Voltage (V)	400.0	400.0	400.0	--
Source Current (A)	184.5	184.8	184.3	0.0
AHF Current (A)	77.4	100.0	100.0	0.0
Load Current (A)	199.9	223.4	195.3	0.0
Source Active Power (kW)	42.6	42.7	42.6	127.8
Load Active Power (kW)	42.6	46.3	38.9	127.8
Fund. Source Reactive Power (kVAR)	-0.1	0.0	0.0	0.0
Fund. Load Reactive Power (kVAR)	12.8	19.2	19.2	51.1
Source Apparent Power (kVA)	42.6	42.7	42.6	127.8
Load Apparent Power (kVA)	46.2	51.6	45.1	142.9
True Source Reactive Power (kVAR)	0.1	0.1	0.0	0.1
True Load Reactive Power (kVAR)	17.8	22.8	22.8	63.9

The Meter tab shows various electrical parameters of R, Y, and B phase in tabular form. User can drag the table rows using Vertical slider provided on the right side of table. All the parameters shown are true RMS values.

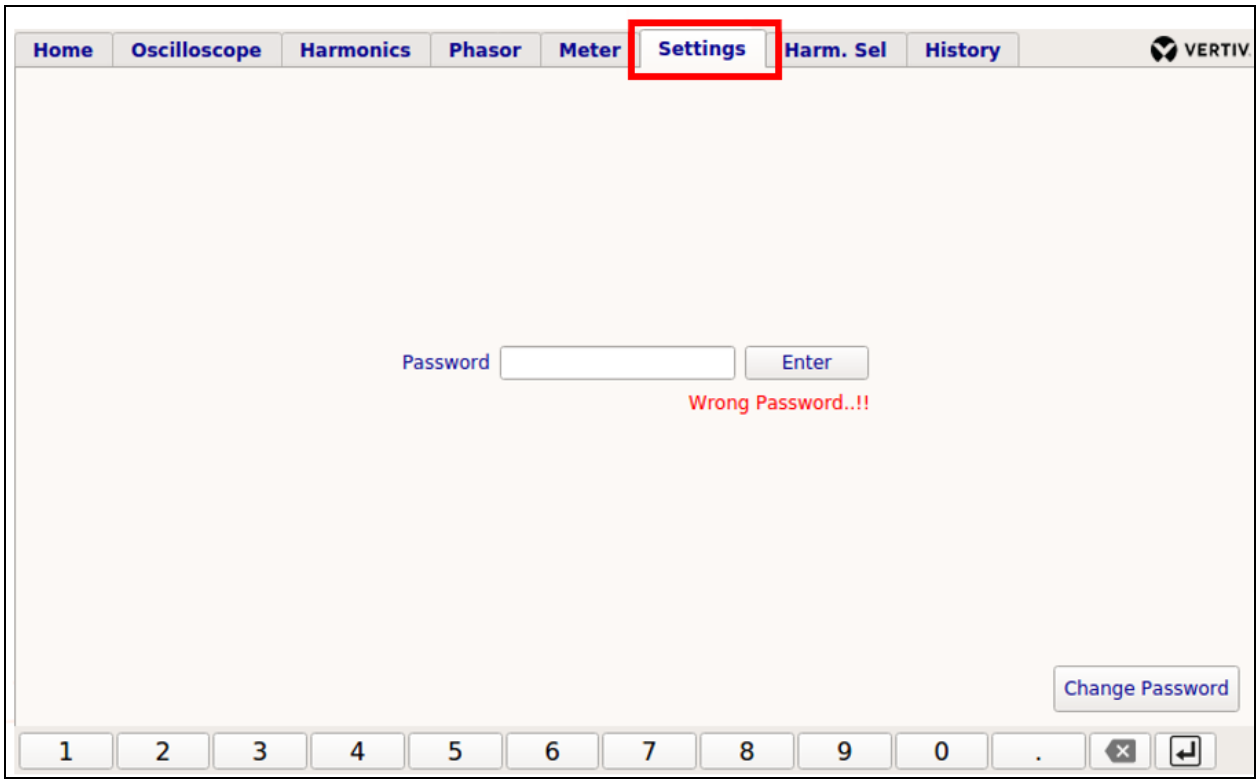
Following measurements of R, Y, and B phase are available in Power tab:

- Phase voltages (V)
- Line voltages (V)
- Source currents (A) – Phase wise and Neutral
- AHF currents (A) – Phase wise and Neutral
- Load currents (A) – Phase wise and Neutral
- Source (phase-wise and total) active powers (kW)
- Load (phase-wise and total) active powers (kW)
- Fundamental source (phase-wise and total) reactive powers (kVAR)
- Fundamental load (phase-wise and total) reactive powers (kVAR)

- Source apparent (phase-wise and total) powers (kVA)
- Load apparent (phase-wise and total) powers (kVA)
- True source (phase-wise and total) reactive powers (kVAR)
- True load (phase-wise and total) reactive powers (kVAR)
- Source displacement power factors (phase-wise and total)
- Load displacement power factors (phase-wise and total)
- Source true power factors (phase-wise and total)
- Load true power factors (phase-wise and total)

6.6 Settings

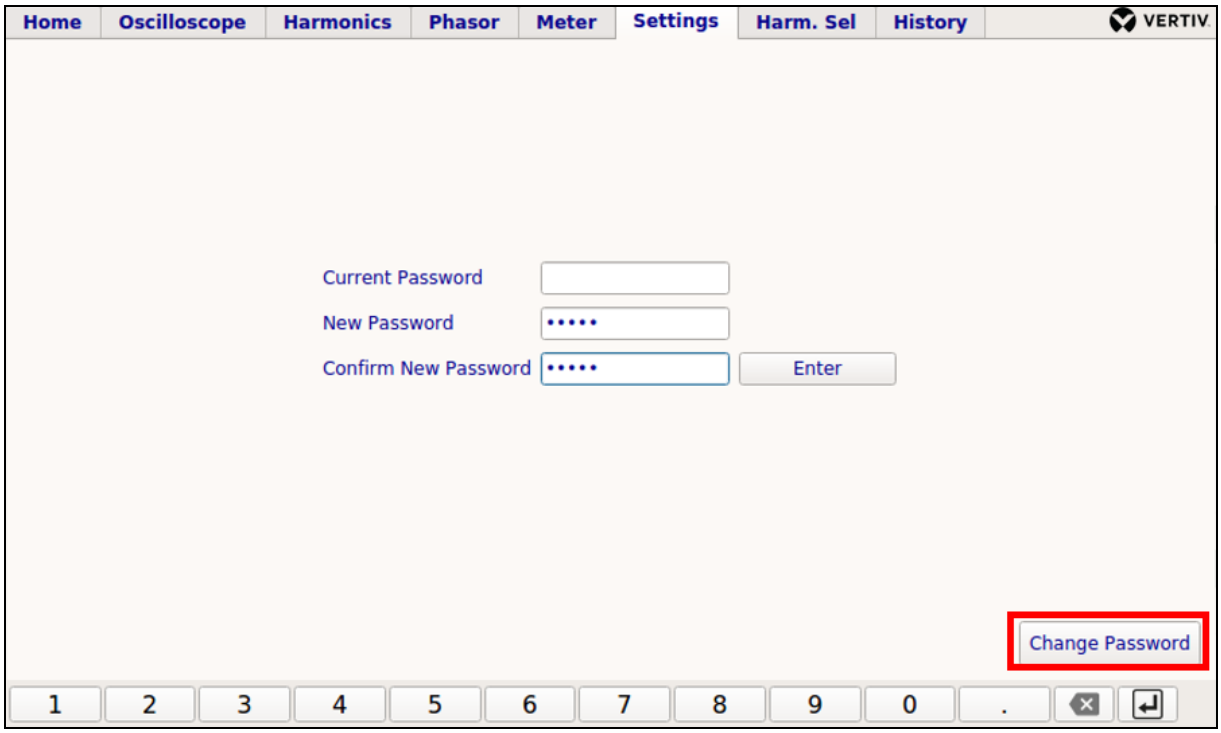
The Settings tab is two level (level-1 and level-2) password protected to restrict any unauthorized access to the AHF settings. Level-1 password is meant for user while the Level-2 password is meant for admin or authorized installation engineer from Vertiv.



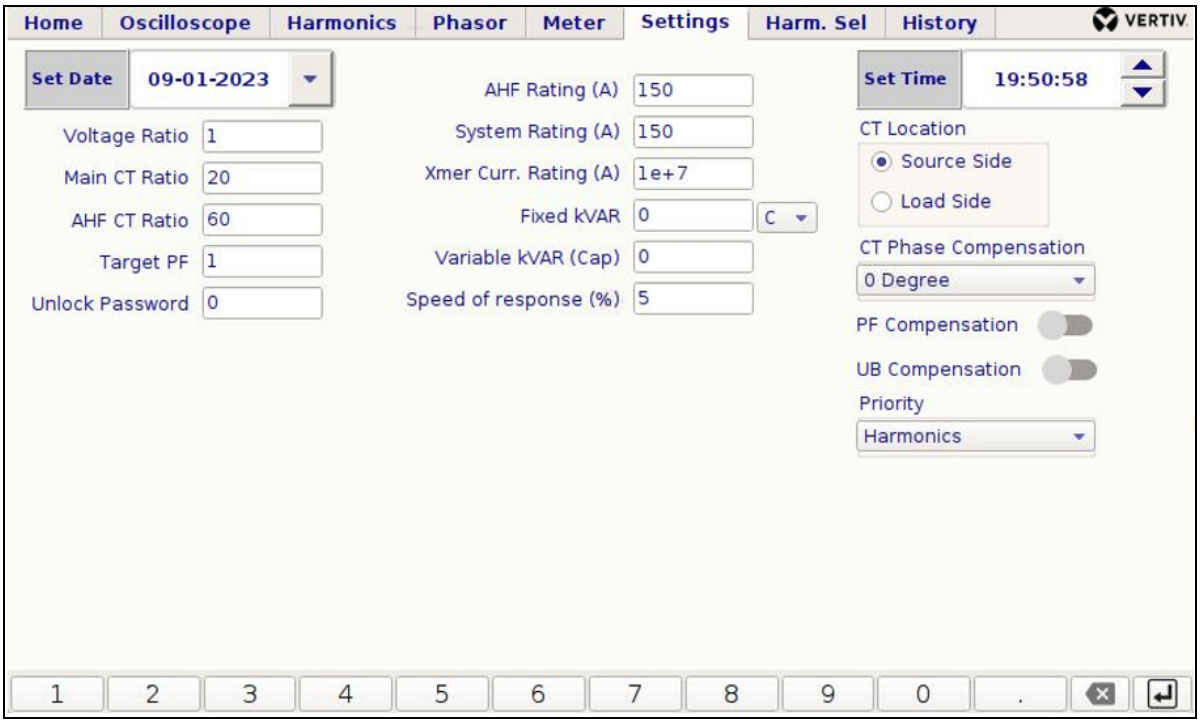
To enter the password first touch in the edit box and enter the numeric user password using key pad provided at the bottom of the screen. After entering the password press the Enter button next to edit box, to unlock the harmonic selection screen shown below.

NOTE: Please contact Vertiv representative to get your user password.

The user password can be changed by clicking on "**Change Password**" button on Settings tab.



Entering the user password will grant access to the AHF settings which can be altered by the user with the prior information/approval to Vertiv authorized installation engineer.



The settings accessible through the user settings window has the following significance:

- Voltage Ratio: The default value is 1. The same should be used as long as the CT feedback to the AHF is from LT side (400 V or 415 V or 433 V side). If the feedback CTs are placed on HT side of the step-down transformer/system, then the voltage ratio should be altered as follows:

$$Voltage\ Ratio = \frac{Voltage\ rating\ of\ the\ Transformer\ on\ HT\ side}{Voltage\ rating\ of\ the\ Transformer\ on\ LT\ side}$$

  For example, if the step-down transformer is rated for 33 k V/433 V, although the AHF will always be connected on LT side (i.e. 433 V) while the feedback CTs are placed on 33 kV incomer, the Voltage ratio will be:

$$Voltage\ Ratio = \frac{33{,}000}{433} = 76.21$$

  In case of multiple step-down transformers connected between the feedback CTs and the AHF, then the voltage ratio needs to be calculated from the primary voltage rating of the first (from incomer towards the load) step-down transformer, and secondary voltage rating of the last step-down transformer, where AHF is connected.

- Main CT Ratio: The is the ratio of the primary current to the secondary current (i.e. 5 A unless otherwise specified) of the feedback CTs placed on Incomer or Load feeder.

  For example, for a 1200/5 A CTs on the incomer, the main CT ratio will be:

$$Main\ CT\ Ratio = \frac{1{,}200}{5} = 240$$

- AHF CT Ratio: This setting needs to be configured only when multiple AHFs are being paralleled with common main CT feedback, connected on a common AHF feeder. In such cases, another dedicated set of 3 CTs to be placed on such common AHF feeder (P1 towards to the AHFs and P2 towards the incomer/load).

  The AHF CT ratio is ratio of the primary current rating to the secondary current rating (i.e. 5 A) of CTs placed on common AHF feeder. The primary current rating of this CT should be, at least, twice the rating of the combined rating of the all AHFs being paralleled.

  For the paralleling 400 A and 100 A AHFs, the primary rating of the AHF CT should be at least 1000 A [= 2 × (400 + 100)]. For this 1000/5 A CTs on the common AHF feeder, the AHF CT ratio will be:

$$AHF\ CT\ Ratio = \frac{1{,}000}{5} = 200$$

- Target PF: This setting needs to be configured only when AHF is being configured for PF (displacement power factor) correction. This can be configured from 0.01 inductive to 0.01 capacitive as desired by the user at the time of configuration/commissioning.
- Unlock Password: Each AHF comes with an one-time encrypted factory password which should be entered during the first AHF service, falling within 90 days from the AHF commissioning. Please contact Vertiv representative to get your Unlock Password.
- AHF Rating: Rating of the AHF in Amperes. This is factory setting and cannot be altered.
- System Rating: This setting needs to be configured only when multiple AHFs are being paralleled with common main CT feedback, connected on a common AHF feeder. This the combined rating of the AHFs being paralleled. For paralleling 400 A and 100 A AHFs, the System Rating will be 500 (= 400 + 100).
- Xmer Curr. Rating: This is a short form to “Transformer Current Rating”. This setting needs to be configured only when AHF is being configured for PF (displacement power factor) correction.

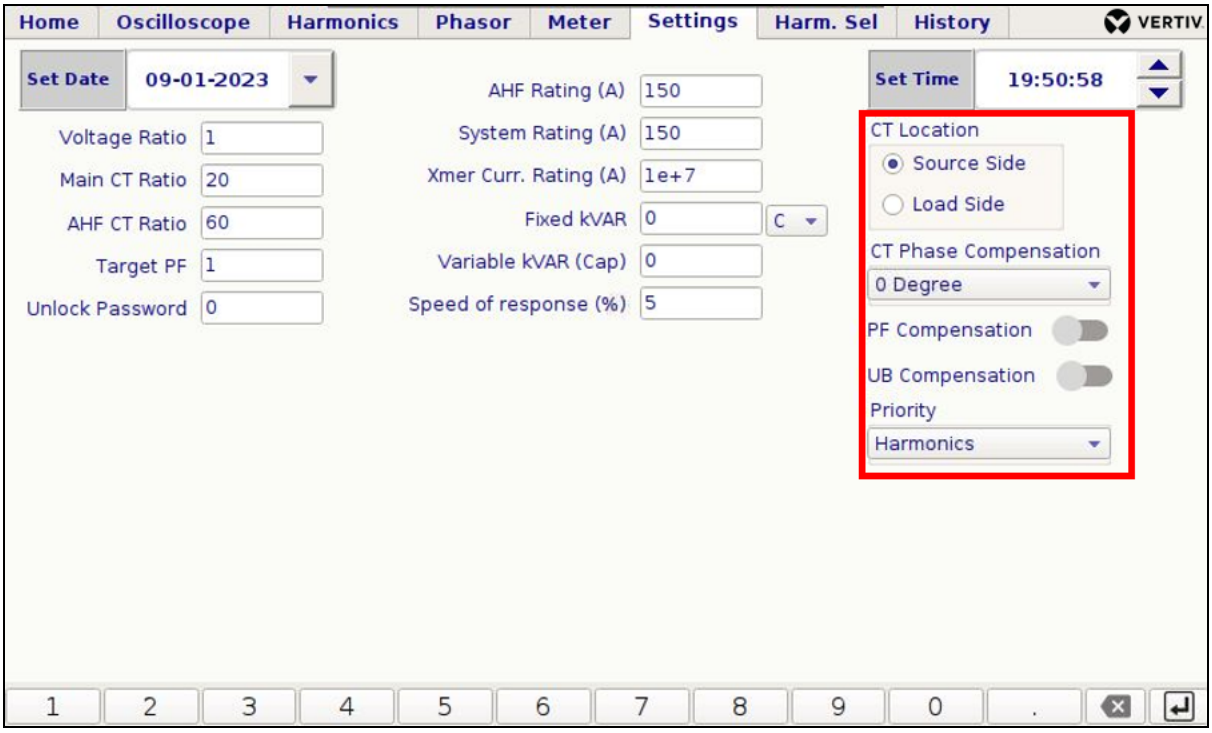
  For sites, where single step-down transformer is being employed, we can simply use the secondary current rating of the step-down transformer.

  For sites, where AHF is installed for a dedicated power distribution panel, we can use maximum incomer load current of the corresponding power distribution panel.

  For sites where AHF is being used HT side correction with HT CT feedback, this is the anticipated full-load current of the system (being measured by the main feedback CTs), referred to the LT side where AHF is connected.

  For example: for a plant having a maximum load current of 20 A on 33 kV side, being measured by the AHF feedback CTs, then load current referred to 433 V side will be, 1524.25 A [=20 × 33,000/433]

- Fixed kVAR: This setting needs to be configured only when AHF is being configured for PF (displacement power factor) correction. This is the amount of Fixed kVAR (L for inductive and C for capacitive) that user wants to inject in to the electrical system over and above the Target PF entered. This setting will be help to compensate the upstream transformer inductances and/or cable capacitances which are fixed in nature.
- Variable kVAR: This setting needs to be configured only when AHF is being configured for PF (displacement power factor) correction. This is the amount of kVAR (L for inductive and C for capacitive) that user wants to inject in to the electrical system over and above the Target PF entered, when the system is operating at current specified in “Xmer Curr. Rating”. This setting will be help to compensate the load dependent transformer internal reactive power requirements. The AHF will deliver variable reactive power, part of Variable kVAR in square proportion to the system loading percentage.



- **CT Location:** This is the critical setting in AHF configuration.

  When the main feedback CTs of AHF are measuring Load and AHF currents together, then "Source Side" setting should be selected.

  When the main feedback CTs of AHF are measuring Load currents only, and AHF power connections are upstream to this feedback CTs, then "Load Side" setting should be selected.

- **CT Phase Compensation:** The default value is 0 degrees. The same should be used as long as the CT feedback to the AHF is from LT side (400 V or 415 V or 433 V side). If the feedback CTs are placed on HT side of the step-down transformer/system, then the CT Phase Compensation should be the phase displacement of LV winding with reference to the HV winding (where feedback CTs are placed).

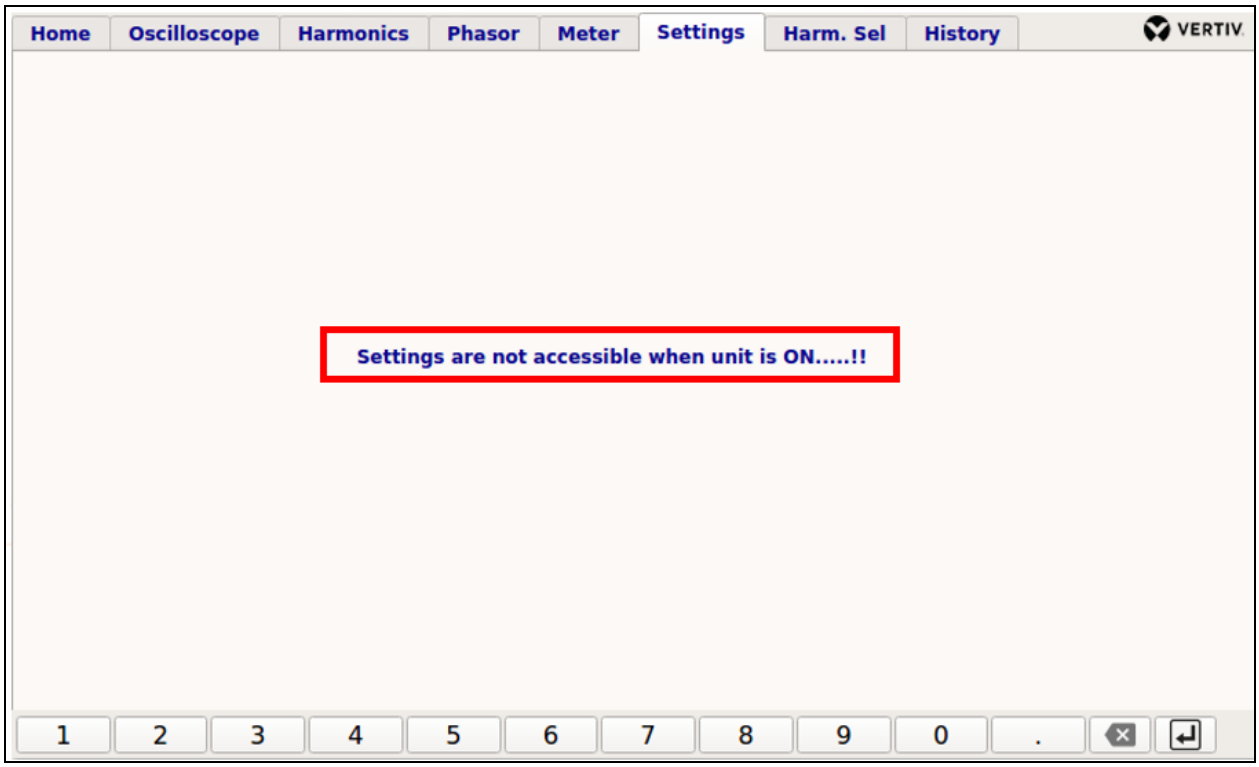
  For typical Dyn11, user needs to select 30 degrees.

  For Dyn1, we need to select 300 degrees.

- **PF Compensation:** This toggle switch Enable/Disable the PF (displacement power factor) correction functionality of the AHF.
- **UB Compensation:** This toggle switch Enable/Disable the Unbalance (negative sequence current) correction functionality of the AHF.

- **Priority:** Through this setting, user will be able to prioritize the current harmonic mitigation and negative sequence unbalance current correction functionalities of the AHF. The AHF will use up to its full capacity to fulfill the user priority, and does the other correction only with the left-over capacity.

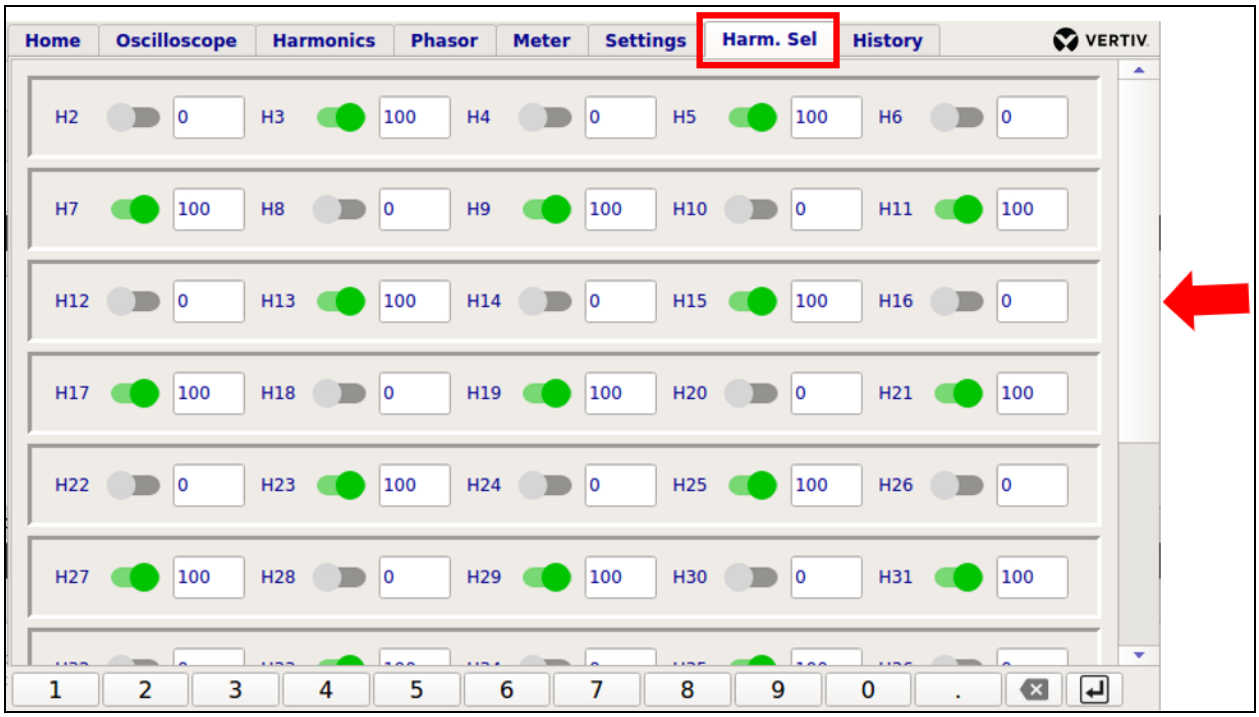
  Settings are not accessible when the AHF is operational. Please press Stop Push Button to access the Settings window.



6.7 Harmonics Selection (Harm. Sel)

The Harmonic Selection tab is user password (level-1) protected to restrict any unauthorized access. To enter the password first touch in the edit box and enter the numeric user password using keypad provided at the bottom of the screen. After entering the user password press the Enter button to unlock the harmonic selection screen shown below.

NOTE: Please contact the Vertiv representative to get your user password.

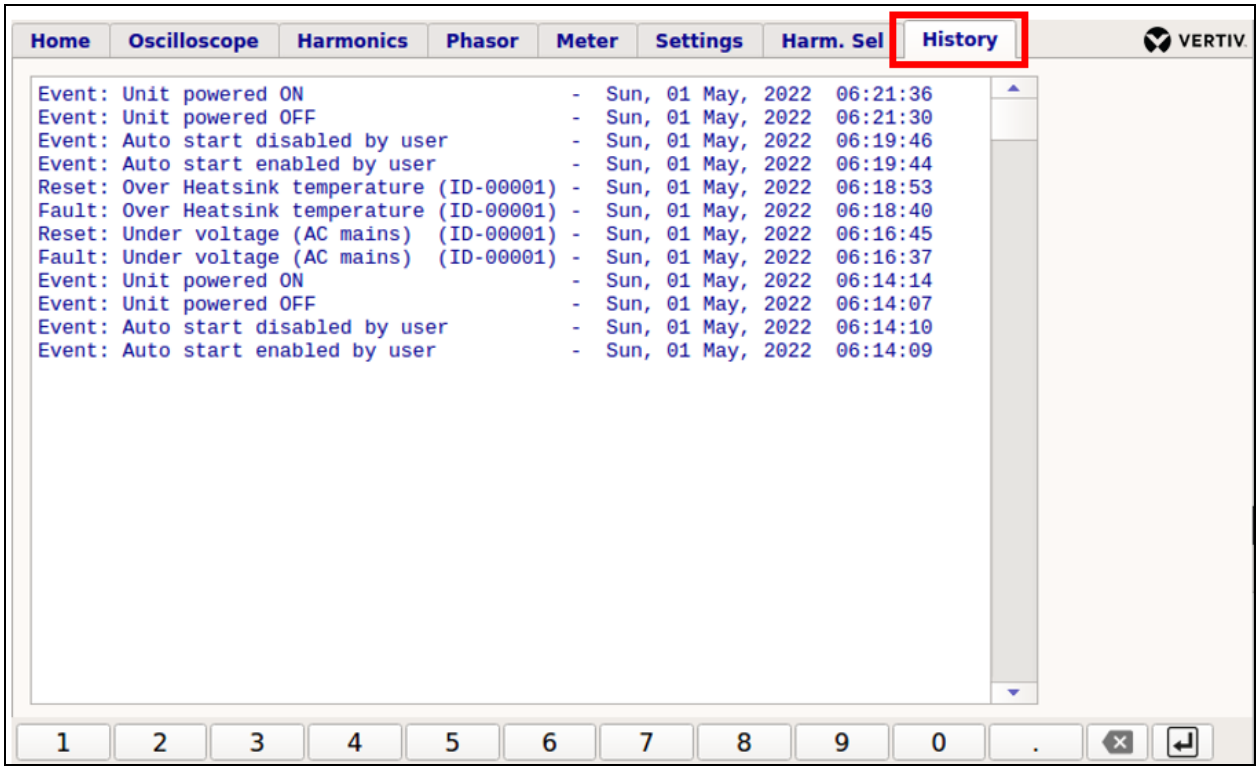


This screen allows the user to select or deselect the harmonic order to be compensated by the AHF. The selection/deselection can be made by switching ON/OFF the switch corresponds to harmonic order by a gentle touch on the toggle switch. There is no limitation on total number of harmonic orders that can be selected simultaneously for compensation. User can also enter the required percentage compensation for any selected harmonic order in the edit box corresponds to the harmonic order.

Use the Vertical scroll on the right side of the Harm. Sel tab to access the harmonics up to 51st order.

6.8 History

The History tab is user password (Level-1) protected to restrict any unauthorized access. To enter the password first, touch the edit box and enter the numeric user password using key pad provided below the screen. After entering the user password press the enter button to unlock the History screen shown below. The History screen keeps a record of last 1000 events on last-in first-out basis. Use the Vertical Scroll to scroll up/down to visualize range of events stored in the AHF.



Faults :

Example of fault bar:

Any abnormal operation condition detected by the AHF is reported as the fault and will be displayed in the status bar (lower area of the screen) as a red colored bar. The status bar will blink with red background in case of any abnormality.

In case of transient faults upon fault clearance, if Auto Start is active, AHF will start automatically start after the fault clearance and/or predefined time. The user can also reset the fault by pressing Reset button in the status bar (at lower right corner).

Following is the list of faults that Vertiv™ Liebert® AF4 would detect:

- Voltage/current Surge – Check for any voltage transients in the system, resulting the current surges within the AHF
- Voltage sensor error – Missing or an offset in the AC voltage sensor feedback.
- Current sensor error – Missing or an offset in Hall-Effect current sensor feedback.
- Over voltage – Incomer voltage is higher than the specified maximum operating voltage.
- Under voltage – Incomer voltage is lower than the specified minimum operating voltage.
- Over DC link voltage – DC bus voltage is higher than the safe operating DC voltage for IGBT stack. Could be due to resonance and/or voltage transients.
- Pre-charging circuit error – Failure of pre-charging circuit to soft charge the DC link and/or missing DC voltage sensor feedback.
- Over heat-sink temperature – Heat sink temperature is higher than the threshold value. Could be due to failure of heatsink cooling fans and/or temperature sensors.
- IGBT driver DESAT/UVLO fault – Malfunctioning of IGBT driver card(s) and/or potential short-circuit of IGBT stack and/or High input voltage transients and/or resonance in the System.
- Unit Locked – Unable to enter the unlock password within 90 days of AHF commissioning.

NOTE: Inactivity for 2 minutes on touch screen will bring display automatically to Home tab.

NOTE: The display will go in to sleep mode if any activity is not detected for 5 minutes on touch screen to enhance the life of HMI. The display will wake up in case of touch anywhere on the screen.

7 Technical Specifications

Table 7.1 Mechanical parameter

Model		Vertiv™ Liebert® AF4						
Ratings (A)		30 A	60 A	100 A	150 A	200 A	300 A	400 A
Dimension (W x D x H) mm	3P3W	560 x 540 x 750 mm	600 x 640 x 1000 mm	600 x 640 x 1000 mm	700 x 750 x 1325 mm	700 x 750 x 1425 mm	1150 x 750 x 1500 mm	1150 x 750 x 1500 mm
Weight (kg)		85 kg	120 kg	138 kg	210 kg	240 kg	410 kg	460 kg
Dimension (W x D x H) mm	3P4W	560 x 540 x 750 mm	600 x 640 x 1000 mm	700 x 750 x 1325 mm	700 x 750 x 1425 mm	700 x 750 x 1650 mm	-	-
Weight (kg)		95 kg	132 kg	190 kg	244 kg	260 kg	-	-

Table 7.2 Electrical parameters

Model	Vertiv™ Liebert® AF4						
Plant Input Conditions	30 A	60 A	100 A	150 A	200 A	300 A	400 A
System Voltage (RMS)	350-460 V Fundamental						
Frequency (Hz)	50 ± 5%						
System Configuration	3P3W and 3P4W (Single-phase option available)						

Table 7.3 Product Specification

Model	Vertiv™ Liebert® AF4						
Plant Input Conditions	**30 A**	**60 A**	**100 A**	**150 A**	**200 A**	**300 A**	**400 A**
Power Semiconductor Devices	IGBTs						
Peak Compensating Current	2.2 time RMS Value (No need of over sizing with VFD loads)						
Harmonic Compensation Range	All odd harmonics up to 51st order						
Selective Harmonic Compensation	From 0% to 100% for all 51 Harmonics (No limit on the number of harmonics selection at a time)						
Harmonic Attenuation Factor	More than 97% at rated load						
Load Current Balancing	Yes						
Cooling	Forced Air Cooling						
Cable Entry	Bottom						
Mounting	Floor Mounting						
Ingress Protection Level	IP20						

Table 7.4 Control System

Model	Vertiv™ Liebert® AF4						
Plant Input Conditions	**30 A**	**60 A**	**100 A**	**150 A**	**200 A**	**300 A**	**400 A**
Controller Type	Digital control						
Control Method	Based on Adaptive Artificial Neural Networks (ANN) (Ultra-fast computation)						
Dynamic Response Time	100 Micro-seconds						

Table 7.5 User Interface

Model	Vertiv™ Liebert® AF4						
Plant Input Conditions	**30 A**	**60 A**	**100 A**	**150 A**	**200 A**	**300 A**	**400 A**
HMI Display Type	7-inch Capacitive Touchscreen Display						
Remote Monitoring	MODBUS/through Instaview software on USB port Additional Details						

Table 7.6 Product Specification

Model	Vertiv™ Liebert® AF4						
Plant Input Conditions	**30 A**	**60 A**	**100 A**	**150 A**	**200 A**	**300 A**	**400 A**
Operating Temperature Range	0 °C to 50 °C (No derating required in the entire operating range)						
Active Power Loss	Less than 3%						
Parallel Operation	Yes						
Short-circuit protection	Yes						
Color	RAL7021						
Noise Level	<65 dB						

NOTE: Specifications are subject to change without any further notification.

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