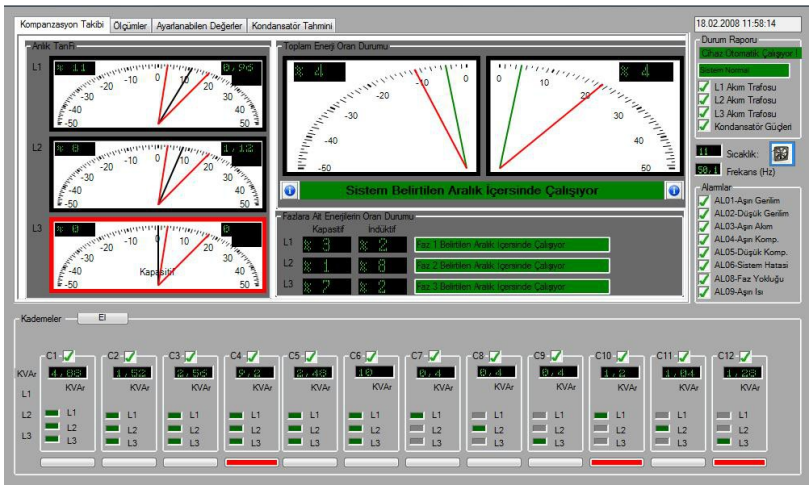
KAEL

VARkombi-PC

Reactive Power Factor Controller
RS485 MODBUS-RTU



USER MANUAL

1. Foreword

All information and warnings about 3 phase controlled reactive power controller, VARkombi-PC, are given in this User's Manual. Please for your power network's and your own safety, read this manual carefully before commissioning the system. Please contact us for unclear points.

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2. Warnings:

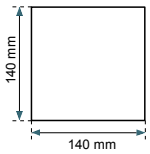
1- The connection, operation and parameter settings of device must be done by authorised technical service staff. Also, system checks must be done by this person when necessary.
2- Since compensation is a complex process, subscribers are advised to keep the system tracking by contracted service staff.
3- Please do not open or do not let others open the device. There are no user serviceable parts inside.
4- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energised.
5- Please do not use the device for purposes other then compensation.
6- Please fix the device to electric panel with apparatuses supplied.
7- Please press the buttons only by your fingers, do not press it with any other objects.
8- Before cleaning the device, please be sure that it is de-energised and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device.
9- Before installing the device, please be sure that the terminal connections are made exactly the same as in the connection diagram and avoid any connection problems, such as loose connections or contact of different cables.
10- For each capacitor bank on the compensation system, please prefer contactors with suitable discharge resistors considering the bank power.
11- Please consider total currents drawn by the inductors of contactors while choosing the common contact line, line 'C', fuse value. When contactors with high inductor currents are chosen, for protecting the contact outputs of the device, auxiliary relay must be used.

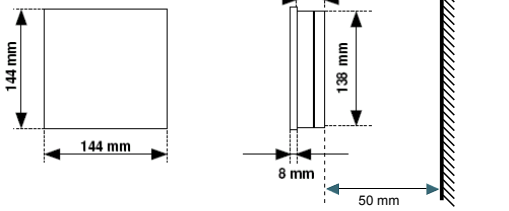
Installation Instructions :

1. A hole with 140 mm x 140 mm must is needed on the panel for device installation
2. Remove the fixing apparatus before installing the device
3. Place the device in the prepared hole from the fromnt side.
4. Use the fixing apparatus to fix the device from the back side to the panel.

CAUTION:
Leave at least 50mm space between the back side of the device and the internal wall of the panel for the airing purpose

Panel Hole Dimensions





3. General Information

When traditional type reactive power controllers are used, specially for unbalanced 3 phase systems, compensation process gets more complex and for some of the situations it is a nightmare. To overcome this problem, experience, knowledge and scientific background are put together with the help of high technology and VARkombi-PC, 3 phase evaluative reactive power controller, is developed by KAEL Elektronik.
The most important properties of VARkombi-PC that make it different from traditional type controllers are;
1- Measuring current and voltage samples from all 3 phases, calculating active and reactive powers and storing consumed energies,
2- Instead of reaching to target tanΦ value, compensating the system as much as close to real axis between the capacitive and inductive bound values. (Bound values can be changed by the user when desired),
3- Automatic C/k calculation,
4- Automatic learning and monitoring of capacitor bank powers (capacitor bank powers can be set by the user when desired. Device also detects any false setting and corrects it by its own as it operates),
5- Dynamically adjusting of normal region boundaries and capacitor switching on&off times with respect to consumed reactive/active percentage,
6- Extending capacitor bank power life by storing switching on&off times separately for each bank,
7- Automatic learning of current transformer polarities even if (k,l) is connected in reverse direction,
8- Calculating current reactive power value and directly switching on or off the most suitable group instead of sequential switching,
9- Making system tracking and fault detection easier with many hand alarms,

3.1 Operating Principles

When the device is energised, it checks first the voltage values. Then, it detects current transformer polarities even if connected in reverse direction. The direction of system's reactive power is calculated through resultant reactive power and resultant power factor. Compensation starts for pulling the system into 'normal region'. Device measures active, inductive (+Q) and capacitive (-Q) powers for each phase and stores the consumed energies. After mathematical calculations, inductive and capacitive percentage values of the system are calculated continuously and the system is kept under control.
Capacitor switching on&off times are calculated separately for each bank. When necessary, the appropriate bank is directly switched if its time is up. Since the Switching Time Values and Normal Region Boundaries are related to consumed energies, they change between the max and min values proportional to percentage energies. During the operation, every capacitor bank's power is calculated when it is switched. Therefore, any change of the capacitor bank's power is detected and stored. Instead of sequential switching of capacitors, the most suitable bank is directly switched. VARkombi-PC contains 8 alarms from AL01 to AL09 and 1 alarm relay output to warn and inform the user. Alarms are; over voltage, under voltage, over current, over compensation, under compensation, system fault, phase failure and over temperature. If desired, as much as alarms can disabled by the user. Device also measures the panel temperature and energises the fan relay when temperature exceeds adjusted fan relay limit (adjusted separately from temperature alarm).

MOD 0 :

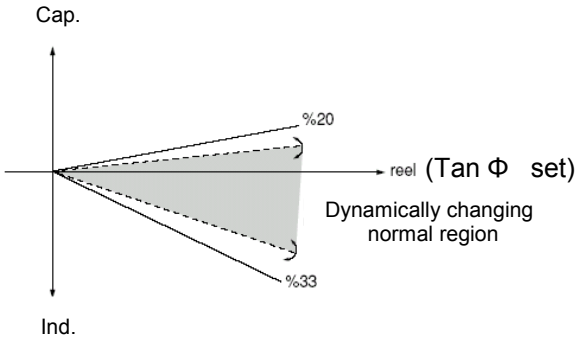
This is the manual mode. In this mode, device does not switch the banks by its own. It is accessed by pressing down the set button 3 seconds in Main Menu. In this mode, both mode leds are off, 'E I' text and current display value are continuously interchanged. By pressing down the up button, capacitors are sequentially switched on and by the down button switched off. During the process, the last parameter accessed in the main menu is displayed on the display. By pressing down the set button, system returns to main menu. This mode is used only for testing the system.

MOD 1 :

When the device is energised for the first time, it start in Mode 1. Since it knows none of the capacitor bank powers, Normal Region is dynamically calculated through penalty boundaries, consumed inductive and capacitive energies. Capacitor switching is done as 'first-in-first-out'. Device tries to calculate each bank's power after every switching.

MOD 2 :

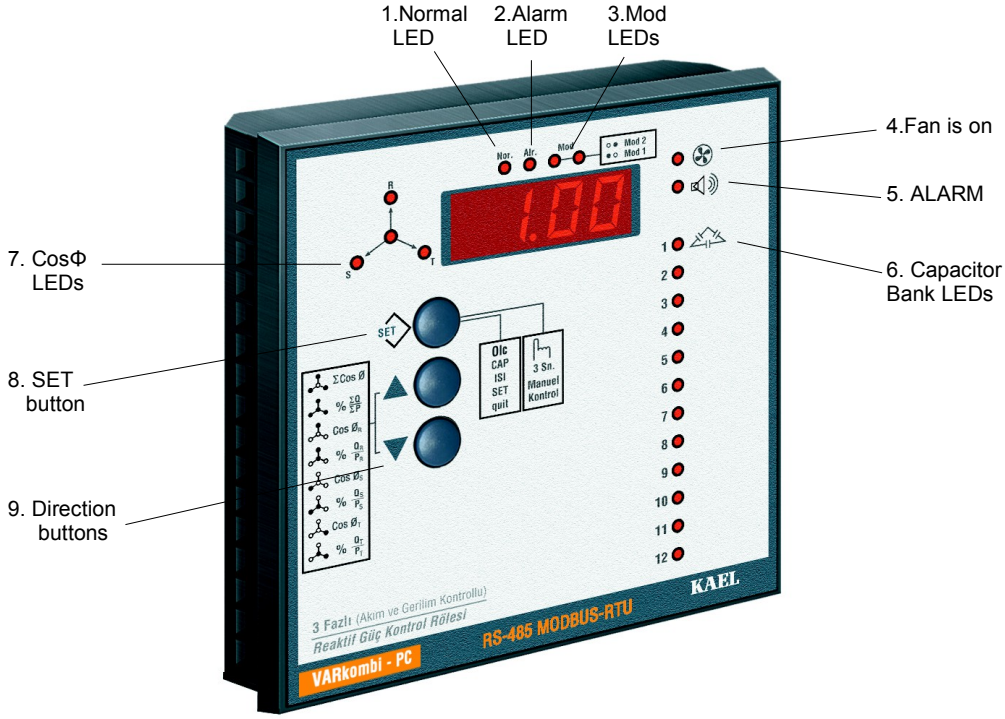
If the device has learned all the capacitor banks' powers, it operates in Mode 2. Learning process can be done fully automatically by the device or it can be done by the user by setting Atrf (Current transformer ratio) and C-01, C-02 ... C-12 parameters under Advanced Menu-Cset, just for gaining time. Normal Region is dynamically calculated through penalty boundaries, consumed inductive and capacitive energies.
Since in this mode device has all necessary information for compensation. Thus, in this mode, switching logic completely changes in a manner to find appropriate bank to keep the system in normal region and response time to changes in load dramatically decreases. This algorithm gives VARkombi-PC the ability of keeping system as close as possible to real axis and adapting itself very fast to load characteristics. Once the device has advanced to Mode 2, it will operate in this mode even if it is de-energised and energised again in the future.



3.2 Measuring Parameters

VARkombi-PC gives user the ability of monitoring the following parameters;
cosΦ and tanΦ of Phase R
cosΦ and tanΦ of Phase S
cosΦ and tanΦ of Phase T
CosΦ and tanΦ that is calculated from vectorial sum 3 phase power values,
Instantaneous percentage value of system (reactive power / active power) respect to vectorial sum of 3 phases
Current values of phases R,S,T
Voltage values of phases R,S,T
Power of each capacitor bank (in case of correctly setting of current transformer ratio)
Panel temperature(°C)

4.FRONT PANEL (Display and LED Functions)

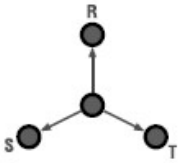


1. Normal LED :Indicates that compensation is in normal region.
2. Alarm LED :If there is any alarm, the LED is on. When the alarm situation disappears, LED is turned off.
3. Mod LEDs : Indicates the operating mode of the device;
Mod 0: Manual operating mode.
Mod 1: Traditional operating mode.
Mod 2: C/k calculation respect to 1st banks power.
Mod 3: Fully automatic operating mode.
4. Fan Is On : When inner panel temperature exceeds set value, fan relay energizes and Fan On LED is turned on.

5. ALARM :In the presence of any alarm, alarm relay is energized for 1 minute, Alarm Output LED and Alarm LED are turned on together. After 1 minute, relay is de-energized, Alarm Output LED is turned on. On the other hand, Alarm LED stays on till the problem disappears.

6.Capacitor Bank LEDs : It shows the switched on capacitor banks.

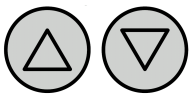
7. CosΦ Leds : Desired values to watch can be accessed in the Main Menu using the direction buttons. In default case, it displays Resultant Power Factor of 3 phase system. When any other value is chosen, if non of buttons is pressed for 1 minute, device returns to default state.



:ΣcosΦ ,ΣtanΦ of 3 phase system
: $Cos\Phi_R$, $Tan\Phi_R$ of phase R
: $Cos\Phi_S$, $Tan\Phi_S$ of phase S
: $Cos\Phi_T$, $Tan\Phi_T$ of phase T
: instantaneous reactive power/active power percentage of 3 phase system.

8. Set Button : It is used to access to User Menu and Advanced Menu. Also it gives the permission of parameter changes in the menus. Short pressing (less than 1s) brings to User Menu. At power up time, long time press (at least 3s), devices is brought to advanced menu.

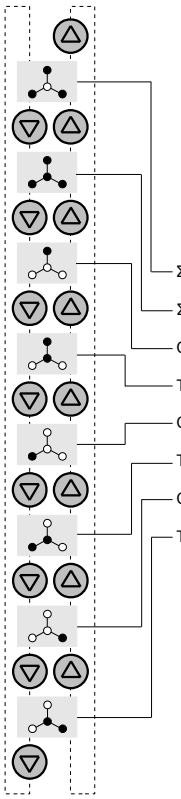
9. Direction Buttons : In the Main Menu, desired parameters can be accessed using these buttons. In other menus, used to browse menus and changing parameter values in setting screen.



5. MENUS and BUTTON FUNCTIONS

Accessing to menus of VARkombi-PC using the buttons is very easy. Using the direction buttons, menus can be browsed in two directions. When you reach the end of the menu, you continue to circular movement. When hold down the directions key, travel speed is increased and you can access to desired location faster. You can enter to desired menu level by pressing down the Set button. Also in the parameter adjustment menus, you can change the values by direction buttons, keep circular movement when you reach to limit values and can store the desired value by pressing down the Set button. In the User Menu, when no button is pressed for 1 minute, device goes back to Main Menu. In Advanced Menu, when no button is pressed for 4 minutes, devices resets itself

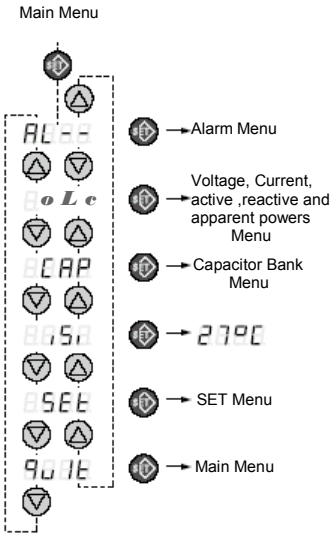
5.1 Main Menu



It is the default menu stage that is active during device operation. Every time the device is energized, it starts to operation by showing the resultant power factor. Power factors of each phase and instantaneous reactive power/active power % of the system can also be monitored separately using the direction buttons. When any of the parameters is being monitored, if non of the buttons is not pressed for 1 minute, device returns to default state, resultant power factor display. The position of monitored value can be tracked from the Status LEDs. When the displayed value has no sign, this means the value is Inductive and when it is negative, '-', signed, this means value is capacitive. Movement in Main Menu using the direction buttons is described on left.

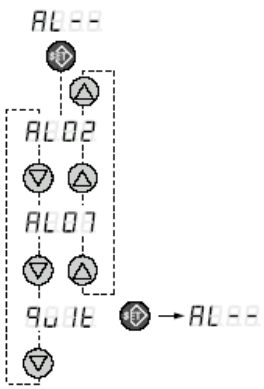
- Σcos Φ : The resultant power factor value of 3 phase system. It is the most important parameter to be watched for tracking the compensation of system.
- Σtan Φ : reactive power / active power % of 3 phase system.
- Cos ΦR : Power Factor of phase R
- Tan ΦR : reactive power / active power % of phase R
- Cos ΦS : Power Factor of phase S
- Tan ΦS : reactive power / active power % of phase S
- Cos ΦT : Power Factor of phase T
- Tan ΦT : reactive power / active power % of phase T

5.2 User Menu



To access the User Menu, press down the Set button for a short time in Main Menu. Direction Buttons are used to move in the menu in desired direction. To enter any sub-menu, use the Set Button. To change any parameter value while the name and the value is flashing on the screen, press the Set button. Adjust the value using the direction buttons and press again the Set button to store the value. To quit from sub-menus and User Menu, advance to 'quit' section at the end of the menu and press Set button on it.

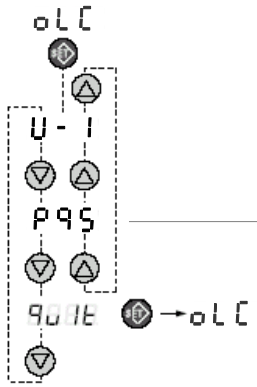
In User Menu, alarms (if exists any at that time), voltage and current values of each phase, capacitor bank powers and panel temperature are tracked. Also some set parameters can also be accessed under this menu. The contents of sub-menus and accessing them is described below.



Alarm Menu

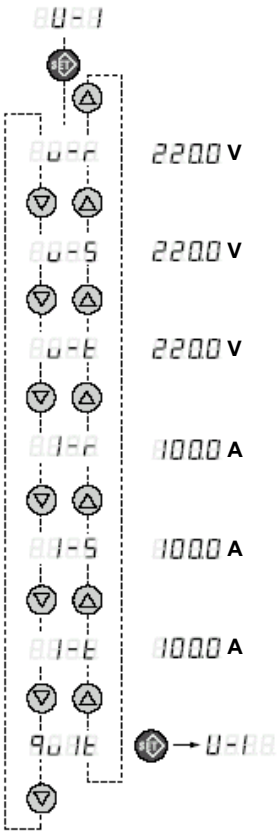
►**AL - - :** This menu is displayed only when at least one alarm is present, otherwise it is disabled. The alarm codes of present alarms are monitored under this menu. It is accessed by pressing the Set button. Alarm codes can be monitored using the direction buttons, if are there any other. It can be quited from the menu by pressing the Set button on 'quit' section. **When all alarm conditions are disappeared, device automatically quits this menu**. Alarm codes and detailed information can be found in ALARMS section.

Measurement menu
►oLC
Voltage, Current, active ,reactive and apparent powers Menu



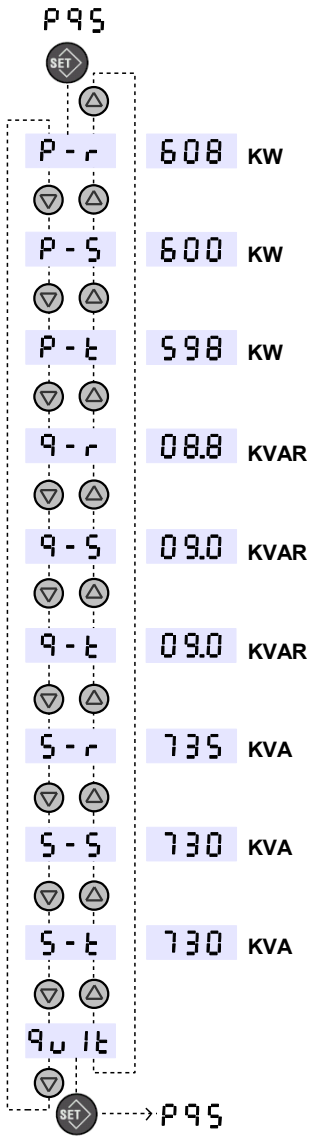
Voltage, Current Menu

►U-I : Phase-neutral voltages and currents of each phase can monitored here. This section is access by pressing the Set button. Direction buttons are used to advance in desired direction. Phase R voltage, Phase S voltage, Phase T voltage and Phase R current, Phase S current, Phase T current are monitored sequentially. When Set button is pressed at the 'quit' section, one level up menu is accessed.
To monitor current values correctly, current transformer ratio must be set in the Advanced Menu.



Active , Reactive and Apparent Power Menu

►PqS : Active,reactive and apparent powers of each phase can monitored here. This section is access by pressing the Set button. Direction buttons are used to advance in desired direction. When Set button is pressed at the 'quit' section, one level up menu is accessed.
To monitor power values correctly, current transformer ratio must be set in the Advanced Menu.

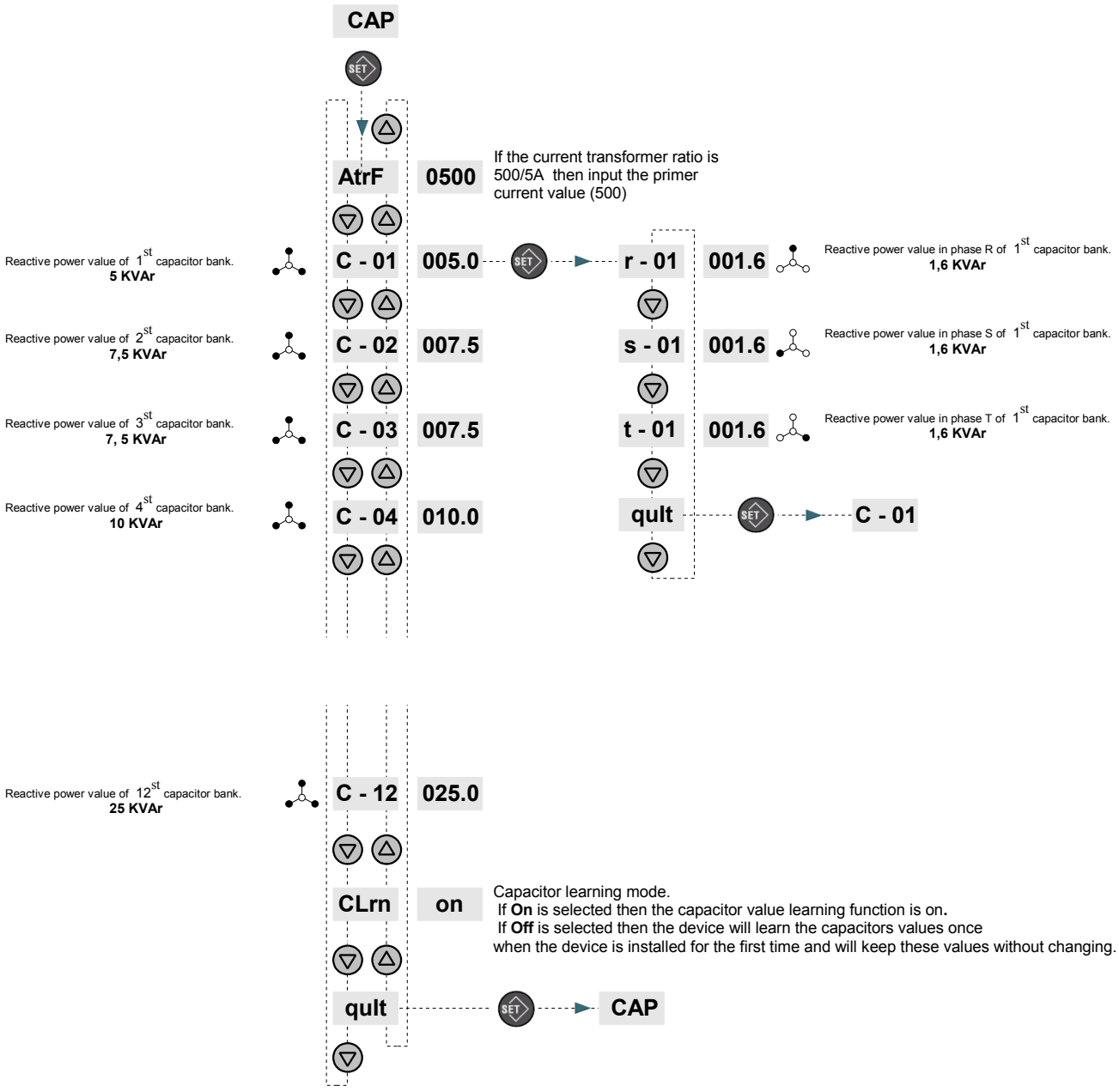


Capacitor Bank Menu

►**CAP :** Current transformer ratio and capacitor bank powers can be displayed separately. This section is accessed pressing the Set button. The current transformer ratio is the first parameter of this menu. Direction button are used to move in the desired direction.

From 1st to the last bank power are monitored in this menu in KVAr unit. When Set button is pressed at the 'quit' section, one level up menu is accessed.
This values are changed in Advanced Menu.

►**Clrn :** Capacitor learning mode. If **On** is selected then the capacitor value learning function is on. If **Off** is selected then the device will learn the capacitors values once when the device is installed for the first time and will keep these values without changing.
For some special loads it is suggested to select the Off option.
At the end of this submenu is quit option, pressing SET will take the device to the upper menu.



Temperature Display Menu

►**ISI :** The temperature (ºC) inside the device housing is monitored here. Please keep in mind that, the displayed value may be 5-10 (ºC) higher than inner panel temperature. Temperature alarm and fan set values can be changed under advanced value.

Set Menu

►**SEt :** The parameters to be set are under this menu. Desired parameter can be accessed by using the direction buttons. On the display, parameter name and numerical value are shown by interchanging. To change the parameter values, press the set button, using the direction buttons reach the desired value. By pressing down the set button, displayed value is stored and the menu is directed to interchange screen. To quit from set menu, advance to 'quit' section and press Set button on it.

tAnF:

It is the section that Tan φ value is set in the range of ± 0 – 75 %

tCOn : (Max. capacitor bank switch on time) It can be adjusted in the range of 10-60 secs.

tCOF :(Max. capacitor bank switch off time) It can be adjusted in the range of 10-60 secs. Device calculates the necessary tCOn/tCOff time in the range of tAlt and set value, according to total consumption. Thus, when not necessary, capacitor banks are not switched fast and when necessary faster compensation is achieved automatically.
(Min. value of capacitor bank switch on&off times) It can be adjusted in the range of 2-10 s.

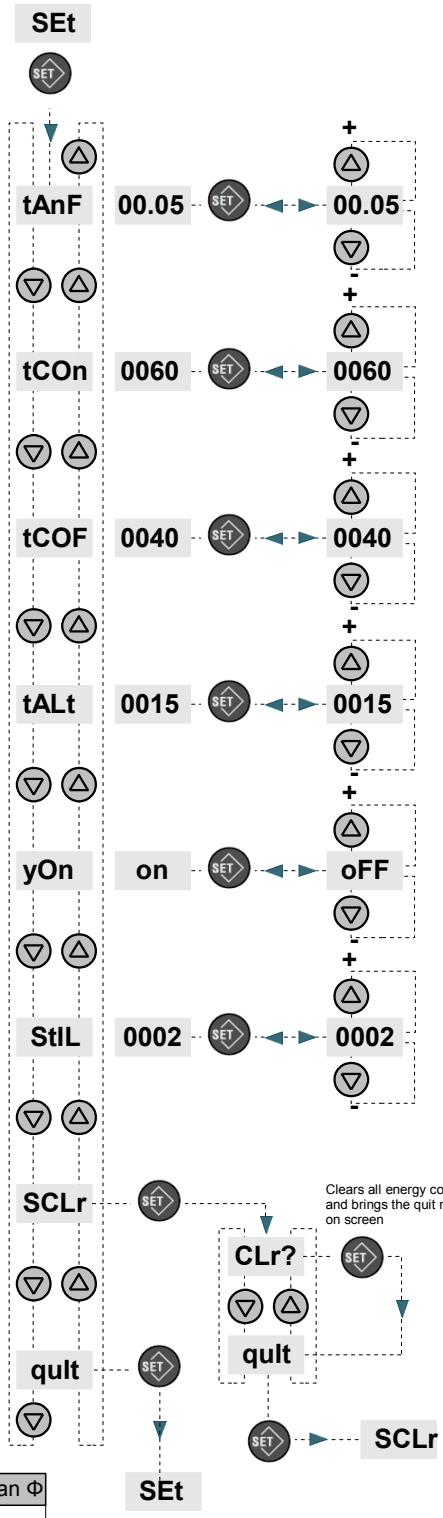
tAlt : (Min. value of capacitor bank switch on&off times) It can be adjusted in the range of 2-10 s.

yOn : The standart value of the direction menu is ***on***. It can be set to ***off*** or ***on***. If it is set to be ***on*** then the learning of the direction of the current transformer will be on all the time. If it is ***off*** then the device will learn the direction once and never try to learn it again. The ***off*** option is suggested for some loads (such as loads that produce export power).

StIL : (Working mode selection) mod01 and mod02 are used to restrict the operating modes of the device.
It must be mod 2.

SCLr: This menu is used to clear active, inductive reactive and capacitive reactive energy counters. For example after getting electricity bills or incase of installing in a new place.
qUIt : Pressing down the set button, the one level up menu section is reached.

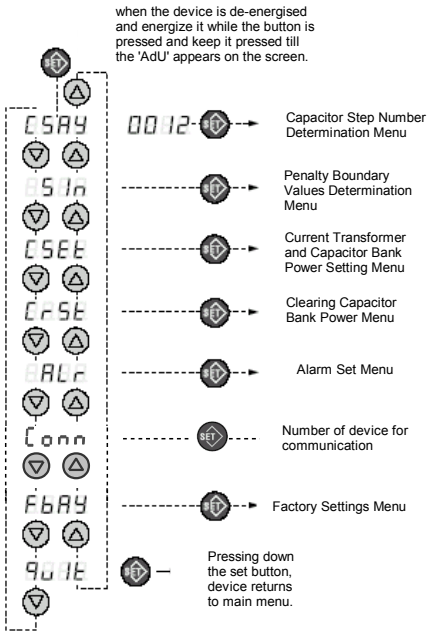
►**qUIt :** Pressing down the set button, device returns to main menu.



Cos Φ	Tan Φ	Cos Φ	Tan Φ	Cos Φ	Tan Φ	Cos Φ	Tan Φ	Cos Φ	Tan Φ
1,0000	0,00	0,9859	0,17	0,9468	0,34	0,8908	0,51	0,8269	0,68
1,0000	0,01	0,9842	0,18	0,9439	0,35	0,8872	0,52	0,8231	0,69
0,9998	0,02	0,9824	0,19	0,9409	0,36	0,8836	0,53	0,8192	0,70
0,9996	0,03	0,9806	0,20	0,9379	0,37	0,8799	0,54	0,8154	0,71
0,9992	0,04	0,9787	0,21	0,9348	0,38	0,8762	0,55	0,8115	0,72
0,9988	0,05	0,9766	0,22	0,9317	0,39	0,8725	0,56	0,8077	0,73
0,9982	0,06	0,9746	0,23	0,9285	0,40	0,8688	0,57	0,8038	0,74
0,9976	0,07	0,9724	0,24	0,9253	0,41	0,8650	0,58	0,8000	0,75
0,9968	0,08	0,9701	0,25	0,9220	0,42	0,8613	0,59		
0,9960	0,09	0,9678	0,26	0,9187	0,43	0,8575	0,60		
0,9950	0,10	0,9654	0,27	0,9153	0,44	0,8537	0,61		
0,9940	0,11	0,9630	0,28	0,9119	0,45	0,8499	0,62		
0,9929	0,12	0,9604	0,29	0,9085	0,46	0,8461	0,63		
0,9917	0,13	0,9578	0,30	0,9050	0,47	0,8423	0,64		
0,9903	0,14	0,9552	0,31	0,9015	0,48	0,8384	0,65		
0,9889	0,15	0,9524	0,32	0,8980	0,49	0,8346	0,66		
0,9874	0,16	0,9496	0,33	0,8944	0,50	0,8308	0,67		

5.3 ADVANCED MENU

It is the section that important and critical settings of the device can be done.
To avoid accidental access to this menu, it is accessed by energizing the device while hold down the set button. It is important to hold down the button when the device is de-energised and energize it while the button is pressed and keep it pressed till the 'AdU' appears on the screen.
Using the direction keys, can be advanced in the desired direction. To enter any section, just press set button on it. When set button is pressed on the 'quit' section, device resets itself and starts in normal mode. Also, when no key is pressed for 4 minutes, device resets itself. In both cases, before reset, device stores the changes in its memory.



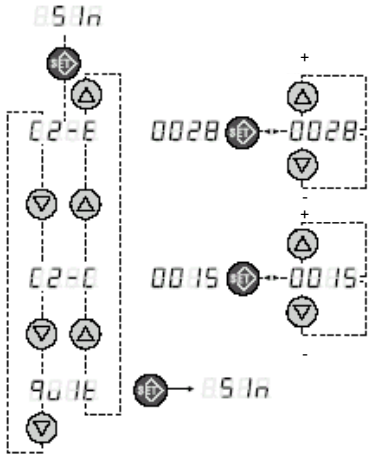
Capacitor Step Number Determination Menu

► **CSAY :**
It is the section that used to set used capacitor step number. Capacitor step number is set in the range of 3-8/12. Parameter name and capacitor step number are shown by interchanging on the screen.

It is advised to set the capacitor step number to the value that you wish to use.

Penalty Boundary Values Determination Menu

► **SIn :**
It is the section that penalty boundary values are adjusted in terms of (reactive energy / active energy) %. It is accessed by pressing the set button. Inductive boundary (CZ-E) and capacitive boundary (CZ-C) are accessed by direction keys. Pressing down the set button, the one level up menu section is reached. Please do not set boundary values to higher values than the limits of your power distributer firm.

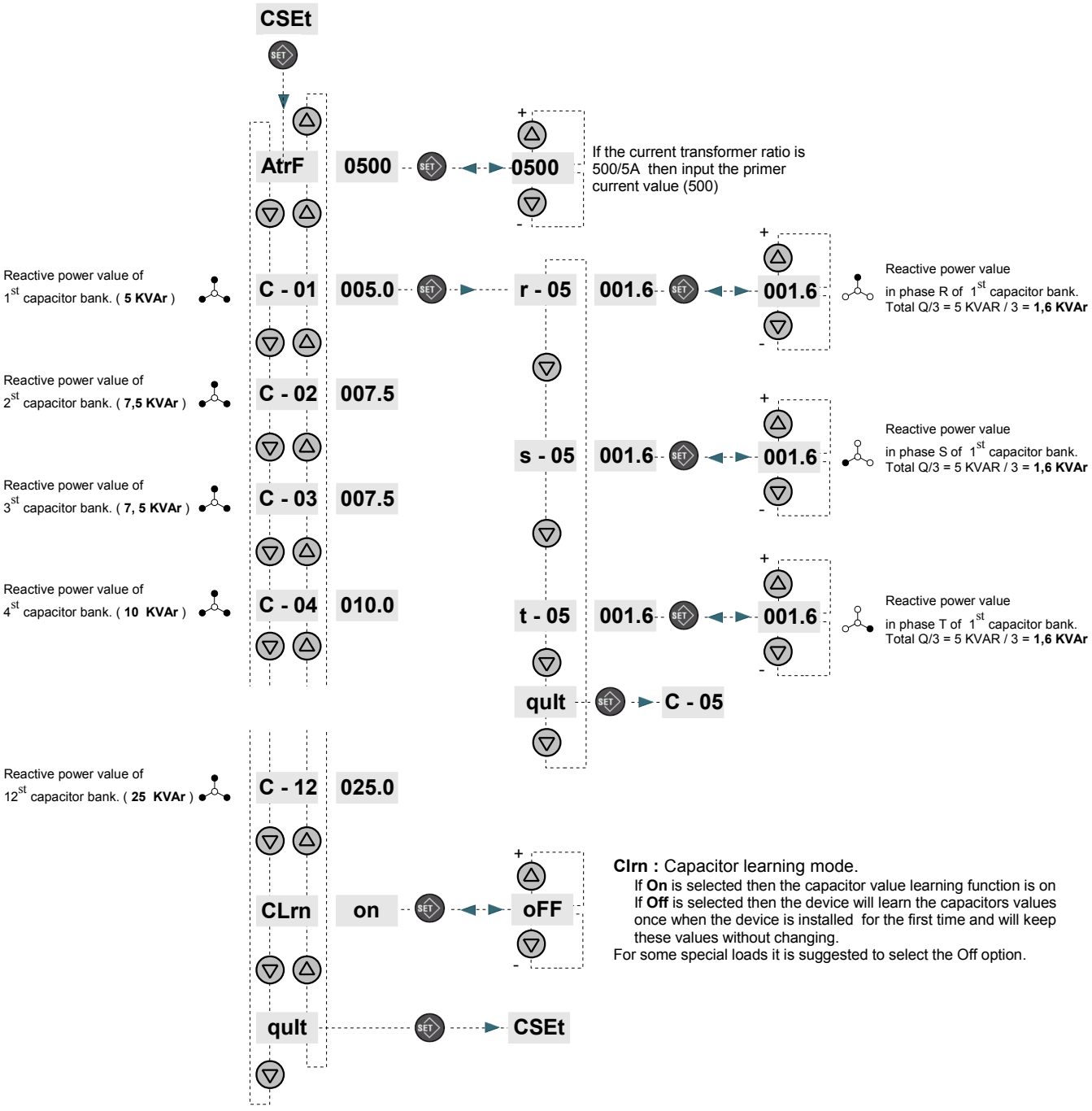


CZ-E : It is the section that inductive penalty value is set as %. It is accessed by pressing the set button, the value is adjusted by using the direction buttons and it is stored by pressing the set button again. It can be set in the range of 10% - 50% (reactive energy / active energy).
If inductive % is close to penalty limit, inductive value can be set to a lower value from here.
CZ-C : It is the section that capacitive penalty value is set as %. It is accessed by pressing the set button, the value is adjusted by using the direction buttons and it is stored by pressing the set button again. It can be set in the range of 5% - 50% (reactive energy / active energy).
If capacitive % is close to penalty limit, capacitive value can be set to a lower value from here.
quit : Pressing down the set button, device returns to main menu.

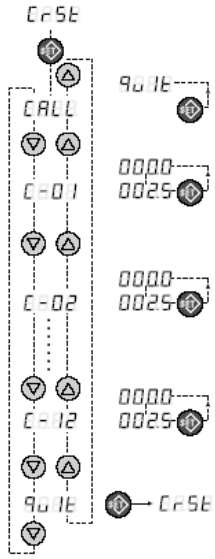
Current Transformer and Capacitor Bank Power Setting Menu

►**CSEt :** It is the section that current transformer ratio and capacitor bank powers are set.
It is accessed by pressing the set button. Using the direction keys, it can be advanced in the desired direction. At quit section, pressing down the set button, the one level up menu section is reached.

AtrF : When current transformer ratio is expressed as x/5, the 'X' value is displayed on the screen and this value is adjusted in the range of 5-10000 by steps of 5. It is accessed by pressing the set button and the value is adjusted using the direction buttons. It is stored by pressing the set button again. Setting this parameter is not necessary for compensation. If you wish to see current values in terms of primer values or want to set capacitor bank powers manually, current transformer value absolutely set.
Keeping the direction button pressed down increases advance speed.
C-XX : It is the section that capacitor bank powers are set in KVAr unit. It can be set in the range of 0-current transformer ratio by steps of 0.1 KVAr. It is accessed by pressing the set button and the value is adjusted using the direction buttons. It is stored by pressing the set button again. Before making this adjustment, current transformer ratio must be set.
Keeping the direction button pressed down increases advance speed.
Remarks
1- Even if capacitor bank powers are not manually set, device learns these values by its own. This may take some time but compensation is continued during learning.
2- In case of setting capacitor bank powers, device directly jumps to mod2 without any time lose.
3- In case of any wrong value setting, device learns the correct value as it operates and overwrites the user set value.
CIrn : Capacitor learning mode.
If **On** is selected then the capacitor value learning function is on
If **Off** is selected then the device will learn the capacitors values once when the device is installed for the first time and will keep these values without changing.
For some special loads it is suggested to select the Off option.



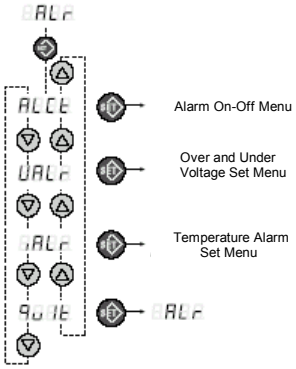
Clearing Capacitor Bank Power Menu



►CrSt :
It is the section that capacitor bank powers in device memory are cleared all together or separately.

CALL : It is the section that all capacitor bank powers are reset all together. After this operation, all stored bank powers are cleared and learned again during bank switchings. Operation is approved by pressing the set button. After the process is accomplished, device jumps to quit section at the end of the menu.
Rem: When device is connected to another panel or when most of the bank powers are changed, it is advised to reset all bank powers.
C-XX : Related bank power is cleared from device memory. During its operation, this bank power is learned again. The operation is approved by pressing the set button. After the process is accomplished, power value is displayed as 0. At the quit section, end of the menu, pressing down the set button, the one level up menu section is reached.
Rem:When a capacitor bank is changed, it is advised to make reset related bank power. It is not obligated because device keeps learning bank powers during operation.

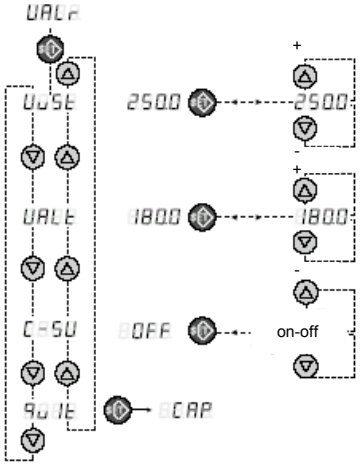
Alarm Set Menu



►ALr : It is the section to enable-disable the alarms of device and setting alarm values. It is accessed by pressing the set button. Using the direction buttons can be advanced in desired direction. To quit, advance to 'quit' section at the end of the menu and press Set button to jump one level up.

Over and Under Voltage Set Menu

►UAlr : It is the section that over and under voltage alarm limits are adjusted and Capacitor Save mode is disabled/enabled. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. To quit, advance to 'quit' section at the end of the menu and press Set button to jump one level up.
UUSt : It is the section that over voltage alarm limit is adjusted. The value can be set in the range of 230 V – 270 V by steps of 1V. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button to store new value and quit.
Please be sure that this alarm is enabled in ALCt section. Otherwise, these limits are meaningless.
UAlt : It is the section that under voltage alarm limit is adjusted. The value can be set in the range of 170 V – 210 V by steps of 1V. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button to store new value and quit.
Please be sure that this alarm is enabled in ALCt section. Otherwise, these limits are meaningless.
C-SU : It is the place that Capacitor Save mode is disabled/enabled.
If capacitor save is enabled, in case of under/over voltage or missing phase alarms, all capacitor banks are switched of sequentially to protect them. It is accessed by pressing the set button, On or Off state is displayed on the screen.
To enable capacitor save, select On and to disable it select Off. Press set button to store the change.

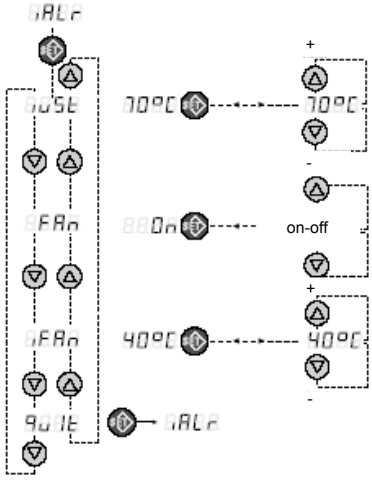


Alarm On-Off Menu

►ALCt : It is the section that all 9 alarms of the device are enabled/disabled all together or seperately. It is accessed by pressing the set button. Using the direction buttons can be advanced in the desired direction. To quit, advance to 'quit' section at the end of the menu and press Set button to jump one level up.
AALr : It is the section that all 9 alarms of the device are enabled/disabled all together. For each alarm, alarm enable state is displayed as On or Off. To enable select On and to disable select Off and to store the change press set button. If you disabled all alarms, separate control menus of alarms will disappear automatically.
AL-XX : It is the section that related alarm is disabled/enabled. For more detailed information about alarms, please refer to **Alarms** section. It is accessed by pressing the set button, On or Off state is displayed on the screen. To enable the related alarm, select On and to disable it select Off. Pressing the set button, store the change. *If you cannot see this section, probably all alarms are disable in AAlr section. First enable them all.*

Temperature Alarm Set Menu

►IAlr : It is the section that Temperature Alarm, Fan Temperature and Fan enable/disable state are set. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button at quit section to jump one level up.



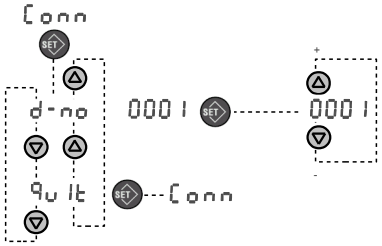
IUSt : It is the section that Temperature Alarm value is set. It is adjusted in the range of (Fan temperature limit + 5C) – 80C by steps of 1C. It is accessed by pressing the set button and using the direction buttons can be advanced in desired direction. Press set button to store new value and quit. *Please be sure that this alarm is enabled in ALCt section. Otherwise, these limits are meaningless.*

Fan : It is the section that Fan enable/disable state is set in case of exceeding set fan value. It is accessed by pressing the set button and On / Off state is displayed. To enable fan operation when necessary select On and to disable it select Off by direction buttons. Press set button to store change and quit.

IFan : It is the section that fan operation temperature limit is set. It is adjusted in the range of 25C – (temperature alarm value(iuSt) -5C) by steps of 1C. It is accessed by pressing the set button, the value is adjusted by direction buttons and set by pressing the set button. *Please be sure that fan operation when necessary is enabled in Fan section, otherwise this temperature setting is meaningless*.

Number of Device Menu

►**Conn :** Adress of device for communication with RS485. It can be between 0001 and 255



Factory Settings Menu

►**FbaY :** It sets back all user settable parameters to factory defaults. On this section, by pressing the set button, stored values are set back to factory defaults and device turns off itself. To restart the device, please de-energize it and re-energize again.
If you think that device parameters are changed incorrectly and you have difficulty to change them back to original values, you can reset them to factory defaults by using this property.

Factory Defaults are;

-Capacitor bank step number for VARko-112 is 12, for VARko-108 is 8
-Inductive penalty limit value (CZ-E) 20%
-Capacitive penalty limit value (CZ-C) 10%
-Capacitor bank switch-on time max. value 15s
-Capacitor bank switch-off time max. value 10s
-Capacitor bank switch-on&off time min. value 5s
-Over voltage alarm set value (UUSt) 250V
-Under voltage alarm set value (UAlt) 190V
-Capacitor save mode (C-SU) OFF (no protection)
-Fan enable when necessary (Fan) On (Fan output is active)
-Temperature alarm value (IUSt) 70C
-Fan on temperature (Ifan) 45C
-Current transformer ratio 5/5
-Mod03
-All capacitor bank powers are reset to zero

6. ALARMS

To fully control compensation system, to be aware of present problems, to investigate the reasons and overcome these problems, handy and settable alarms are necessary. On the other hand, to be able to disable these alarms when necessary will prevent to panic user. VARko-1xx has the all the alarms necessary for a compensation system and more. Thus, system tracking by technical staff and diagnosis of faults become easier. Below, you will find explanations about the alarms of the device. To obtain more information about alarms, please refer to Alarm Set Menu section under Advanced Menu. When an alarm condition occurs, alarm code can be monitored under User Menu –> ALr section. For further information about this topic, please refer to User Menu section.

When any alarm occurs related to a problem, both alarm LED and relay are energized together. Alarm LED is kept on as long as the alarm condition is continuous, however, alarm relay is de-energized after 1 minutes. Thus, until the technical staff resolves the problem, people around are not disturbed. *When the horn connected to alarm relay is silent, this does not indicated that the problem is disappeared. To understand it alarm LED must be tracked. When alarm situation is continuous please call technical staff. An alarm may have more than one reasons. Therefore, when investigating the reasons of an alarm, you do not have to stop it after finding one reason.*

AL01 : Over Voltage (230V – 270V adjustment range)
If voltage value of any phase exceeds alarm set limit value and this situation continues 5s, alarm LED is turned on and alarm relay is energized. When phase voltages goes 5V below to set limit at least 5s, alarm situation is cleared. If “C-SU” is chosen as On, in over voltage case, banks are switched off sequentially. If it is OFF, compensation is continued. Factory default value is “OFF”.

AL02 : Under Voltage (170V – 210V adjustment range)
If voltage value of any phase goes below alarm set limit value and this situation continues 5s, alarm LED is turned on and alarm relay is energized. When phase voltages goes 5V above to set limit at least 5s, alarm situation is cleared. If “C-SU” is chosen as On, in under voltage case, banks are switched off sequentially. If it is OFF, compensation is continued. Factory default value is “OFF”.

AL03 : Over Current(secondary current >8A, constant boundary)
When any of the secondary currents of transformers connected to phases exceed 8A for at least 60s, alarm LED is turned on and alarm relay is energized. If current value goes below 8A at least for 60s, alarm situation is cleared.
Reason: Current transformer is not proper for the system. A higher rate must be preferred.
Solution: Appropriate value must be found by measuring the phase currents and current transformers must be changed with that value.

AL04 : Over Compensation
When system's over all compensation percentage exceeds set capacitive limit, alarm LED is turned on and alarm relay is energized. Until it goes below this limit, alarm condition is continued.
Reason: Capacitor bank powers are chosen to big or improper bank power selection.
Solution: Capacitor bank number must be increased and necessary bank powers must be recalculated & increased. Load must be equally distributed to each phase and the system must be made as balanced as possible. Capacitor switch-off time must be decreased.

AL05 : Under Compensation
When system's over all compensation percentage exceeds set inductive limit, alarm LED is turned on and alarm relay is energized. Until it goes below this limit, alarm condition is continued.
Reason: Capacitor bank powers are chosen to small or improper bank power selection.
Solution: Necessary bank powers must be recalculated and increased. Load must be equally distributed to each phase and the system must be made as balanced as possible. Capacitor switch-off time must be decreased.

AL06 : System Fault
When all capacitor bank powers are measured as 0 KVAr, this alarm is generated.
Reason:
1. Capacitor banks may be connected before the current transformers,
2. Capacitor bank switches may be off
3. Contactor inductance supplies may be off
4. Contact phase (line) may not be connected to device
Solutions:
1. Place capacitor bank connections after current transformers,
2. Check capacitors banks' switches
3. Check contact line connection and contact outputs of devices
4. After all controls, de-energize and re-energize the devices

AL07 is reserved

AL08 : Missing Phase
If at least one of the phases is missing, alarm LED is turned on and alarm relay is energized. If capacitor save mode (C-SU) is on, compensation is stopped and banks are sw itched off. Otherw ise compensation continues. Factory default of C-SU is off.

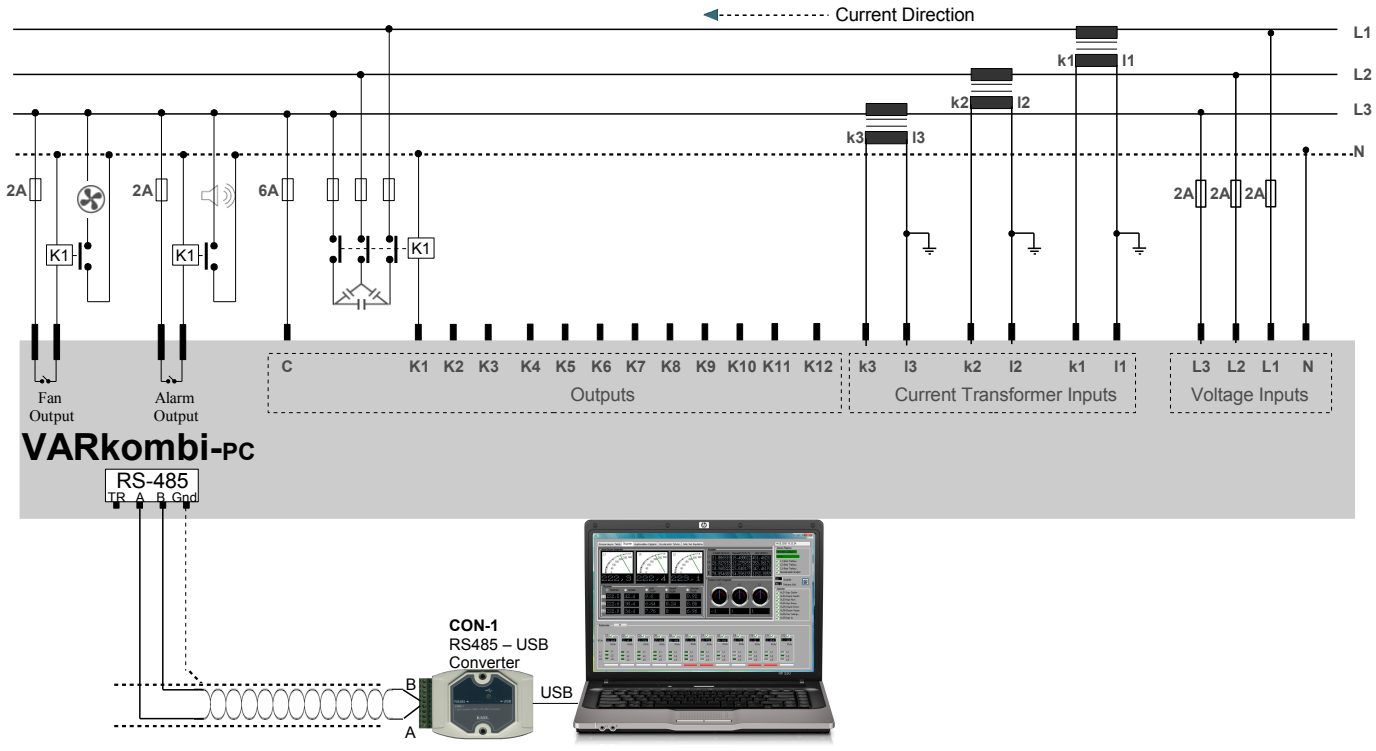
AL09 : Over Temperature (Fan Limit + 5°C – 80°C range)
When inner panel temperature exceeds set alarm value, alarm LED is on and alarm relay is energized. When temperature goes 2°C below to set value, alarm condition is cleared. Fan relay output of device is different and its set value is adjusted separately. When setting temperature value, please keep in mind that, device temperature is 5-10°C higher than panel temperature.

Fan Relay Output: (25°C – Fan limit-5°C)
VARko-1xx gives the user opportunity of tracking and controlling the temperature. When temperature exceeds set fan value, fan relay is energized. If you connect this output to a fan, the panel may be cooled before its temperature reaches to critical limit. If the temperature continues to increase, over temperature alarm is generated and user is warned. The device will let you to adjust Fan temperature value at least 5°C less than temperature alarm value. For example, if over temperature alarm value is 55°C, fan value may be max. 50°C.

7. COMMISSIONING THE SYSTEM

- Please read warnings and cautions in section 2 of this user's manual
- Please be sure that the electric panel being used is de-energized
- Please be sure that compensation panel is supply voltages are taken after the current transformers in main panel
- Please be sure that current, voltage and contact outputs are connected exactly as shown in the connection diagram
- Switch on the switches of capacitor banks
- Energize the compensation system. If you see Err1 or Err2 message on the screen, immediately contact with KAEL Elektronik Ltd. Please.
- VARkoMBİ-PC will immediately start to compensation depending on the consumed power. If there is no current is drawn from the system, device will wait until any current is drawn. In this case, you may consider it as a good test opportunity and test your system in mod00 (manual mode) by switching all capacitor banks on and off.
- If you choose current transformer ratio and capacitor bank power appropriately, in most of the cases you do not need to change any setting of the device.
- Please be sure that alarm LED is off. Otherwise, investigate the reason of alarm and solve the problem.

8. Connection Diagram

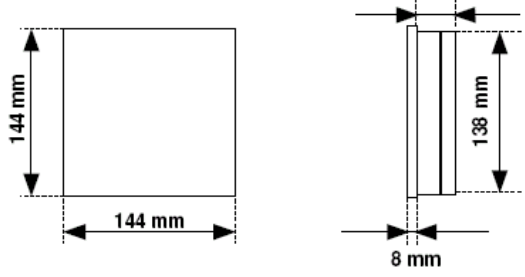


The fuses shown in the connection diagram must be FF type and must have specified current values.
Chosen current transformers' real value must not be less than drawn current and they must be X/5 Amps.
It must be stated on the switches that are connected to supply voltage lines of the device that they will be used to disconnect the device from the power line.
Before making the connections, the warnings and cautions in section 2 must be read.

10. TECHNICAL DATA

Rated Voltage(Un)	: (Phase-Neutral) 220VAC,
Operating Range	: (0.8 – 1.1) x Un
Operating Frequency	: 50 Hz
Power Consumption	: < 10 VA
Measurement Inputs	
Power Consumption	: < 1 VA
Contact Current	: Max. 3 A /240 VAC
Current Measurement Range	: (As secondary current of Curr. Trf.) 0.1-6 Amp AC
Display Range	:(Power Factor) 0.00 – 1.00 Ind.&Cap.
Min. Current Measurement Value	: 50 mA
Measurement Sensitivity	: 1%+- digit
Current Transformer Ratio	: 5/5 .... 10000/5 A
Max. Cap. Bank	
Switch On&Off Time	: 10.... 60 s
Min. Cap. Bank	
Switch On&Off Time	: 2.... 10s
Ind% Set Value	: 10%... 50% (Factory set value=20%)
Cap% Set Value	: 5%... 50% (Factory set value=10%)
Display	: 4 Digits LED Display

Protection Class	: IP 20
Connector Protection Class	: IP 00
Ambient Temperature	: -5°C....+50°C
Humidity	:15%....95%
Connection Type	: To front panel tap
Dimensions	: 144x144x40 mm

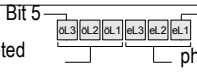


REGISTER TABLE

NO	ADRESS (HEX)	(R)read (W)write	PARAMETER		FORMAT	MULTIPLIER	UNIT	INSTRUCTION	
1	0000	R	COUNTRY CODE (TURKEY)		unsigned int	1		869	
2	0001	R	COMPANY CODE		unsigned int	1		7436	
3	0002	R	PRODUCT CODE	HW	unsigned int	1		0x0001	88100 decimal
4	0003	R		LW	unsigned int	1		0x5824	
5	0004	R	BARCODE CONTROL		unsigned int	1		0	
6	0005	R	SOFTWARE VERSION		unsigned int	1		0x0300	
7	0006	R/W	DEVICE NUMBER	HW	unsigned int	1		0xFFFF - 0x0000	
8	0007	R/W		LW	unsigned int	1		0xFFFF - 0x0000	
1	1000	R/W	CURRENT TRANSFORMER RATIO **(ATRF)**		unsigned int	1	ATRF	1 - 2000	
2	1001	R	OPERATING MODES and Reactive Power Direction Bits ("1" = capacitive , "0" = inductive)		unsigned int	1		**Bit 0:** Direction of phase 1 ("1" = capacitive , "0" = inductive) **Bit 1:** Direction of phase 2 ("1" = capacitive , "0" = inductive) **Bit 2:** Direction of phase 3 ("1" = capacitive , "0" = inductive) **Bit 3:** Direction of total reactive power ("1" = capacitive , "0" = inductive) **Bit 4:** If It is"1" ,Device in mod1. **Bit 5:** If It is"1" ,Device in mod2. Automatic mode. **Bit 6:** If It is"1" ,Device in mod0. Manual mode. **NOTE:** Bit7,....Bit15 reserved	
3	1002	R	PHASE 1 VOLTAGE Phase-Neutral	(VL_{1N})	unsigned int	0,1	VOLT	(V1 x 0,1); Example: 2200 x 0,1 = 220 Volt	
4	1003	R	PHASE 2 VOLTAGE Phase-Neutral	(VL_{2N})	unsigned int	0,1	VOLT	(V3 x 0,1); Example: 2200 x 0,1 = 220 Volt	
5	1004	R	PHASE 3 VOLTAGE Phase-Neutral	(VL_{3N})	unsigned int	0,1	VOLT	(V3 x 0,1); Example: 2200 x 0,1 = 220 Volt	
6	1005	R	PHASE 1 CURRENT	(I1)	unsigned int	(ATRF) x 0,001	AMPER	(I1 x ATRF x 0,001); Example:If 100/5A ; 5000 x(20 x 0,001) = 100 A	
7	1006	R	PHASE 2 CURRENT	(I2)	unsigned int	(ATRF) x 0,001	AMPER	(I2 x ATRF x 0,001)	
8	1007	R	PHASE 3 CURRENT	(I3)	unsigned int	(ATRF) x 0,001	AMPER	(I3 x ATRF x 0,001)	
9	1008	R	PHASE 1 ACTIVE POWER	(P1)	unsigned int	(ATRF)	WATT	(P1 x ATRF)	
10	1009	R	PHASE 2 ACTIVE POWER	(P2)	unsigned int	(ATRF)	WATT	(P2 x ATRF)	
11	100A	R	PHASE 3 ACTIVE POWER	(P3)	unsigned int	(ATRF)	WATT	(P3 x ATRF)	
12	100B	R	PHASE 1 REACTIVE POWER	(Q1)	unsigned int	(ATRF)	VAR	(Q1 x ATRF)	
13	100C	R	PHASE 2 REACTIVE POWER	(Q2)	unsigned int	(ATRF)	VAR	(Q2 x ATRF)	
14	100D	R	PHASE 3 REACTIVE POWER	(Q3)	unsigned int	(ATRF)	VAR	(Q3 x ATRF)	
15	100E	R	PHASE 1 APPARENT POWER	(S1)	unsigned int	(ATRF)	VA	(S1 x ATRF)	
16	100F	R	PHASE 2 APPARENT POWER	(S2)	unsigned int	(ATRF)	VA	(S2 x ATRF)	
17	1010	R	PHASE 3 APPARENT POWER	(S3)	unsigned int	(ATRF)	VA	(S3 x ATRF)	
18	1011	R	PHASE 1 COSØ	(COSØ1)	signed int	0,01	-	(COSØ1 x 0,01)	
19	1012	R	PHASE 2 COSØ	(COSØ2)	signed int	0,01	-	(COSØ2 x 0,01)	
20	1013	R	PHASE 3 COSØ	(COSØ3)	signed int	0,01	-	(COSØ3 x 0,01)	
21	1014	R	TOTAL COSØ	$\overrightarrow{(COS\emptyset)}$	signed int	0,01	-	$\overrightarrow{(COS\emptyset}$ x 0,01)	
22	1015	R	Phase 1 TANØ (Q1/P1 %)	(TANØ1)	signed int	0,01	-	(TANØ1 x 0,01)	
23	1016	R	Phase 2 TANØ (Q1/P1 %)	(TANØ1)	signed int	0,01	-	(TANØ2 x 0,01)	
24	1017	R	Phase 3 TANØ (Q1/P1 %)	(TANØ1)	signed int	0,01	-	(TANØ3 x 0,01)	
25	1018	R	Total TANØ(Q/P %) (TANØ)	$\overrightarrow{\quad}$	signed int	0,01	-	$\overrightarrow{(TAN\emptyset}$ x 0,01)	
26	1019	R	TOTAL ACTIVE POWER	(ΣP)	unsigned int	1	WATT	P1+P2+P3	
27	101A	R	TOTAL INDUCTIVE POWER	(ΣQind)	unsigned int	1	VAR	Q1(ind)+Q2(ind)+Q3(ind)	
28	101B	R	TOTAL CAPACITIVE POWER	(Σcap)	unsigned int	1	VAR	Q1(cap)+Q2(cap)+Q3(cap)	
29	101C	R	TOTAL REACTIVE POWER	$\overrightarrow{(\Sigma Q)}$	signed int	1	VAR		
30	101D	R	TOTAL APPARENT POWER	$\overrightarrow{(\Sigma S)}$	unsigned int	1	VA		
31	101E	R	PHASE 1 TANØ**L** (% IND)		unsigned int	0,01	-		
32	101F	R	PHASE 1 TANØ**C** (%CAP)		unsigned int	0,01	-		
33	1020	R	PHASE 2 TANØ**L** (% IND)		unsigned int	0,01	-		
34	1021	R	PHASE 2 TANØ**C** (%CAP)		unsigned int	0,01	-		
35	1022	R	PHASE 3 TANØ**L** (% IND)		unsigned int	0,01	-		
36	1023	R	PHASE 3 TANØ**C** (%CAP)		unsigned int	0,01	-		
37	1024	R	TOTAL INDUCTIVE TANØ**L** (% Σ IND)		unsigned int	0,01	-		
38	1025	R	TOTAL CAPACITIVE TANØ**C** (% Σ CAP)		unsigned int	0,01	-		

NO	ADRESS (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
39	1026	R	CAPACITIVE BOUNDRY VALUE (1)	unsigned int	0,01	-	For Phase 1
40	1027	R	INDUCTIVE BOUNDRY VALUE (1)	unsigned int	0,01	-	For Phase 1
41	1028	R	CAPACITIVE BOUNDRY VALUE (2)	unsigned int	0,01	-	For Phase 2
42	1029	R	INDUCTIVE BOUNDRY VALUE (2)	unsigned int	0,01	-	For Phase 2
43	102A	R	CAPACITIVE BOUNDRY VALUE (3)	unsigned int	0,01	-	For Phase 3
44	102B	R	INDUCTIVE BOUNDRY VALUE (3)	unsigned int	0,01	-	For Phase 3
45	102C	R	TOTAL INDUCTIVE BOUNDRY VALUE	unsigned int	0,01	-	For 3 phases
46	102D	R	TOTAL CAPACITIVE BOUNDRY VALUE	unsigned int	0,01	-	For 3 phases
47	102E	R	ALARM BITS ("1" Alarm, "0" Normal)	unsigned int	1	-	**Bit 0:** AL01 ; Over voltage **Bit 1:** AL02 ; Under voltage **Bit 2:** AL03 ; Over current **Bit 3:** AL04 ; Over compensation **Bit 4:** AL05 ; Under compensation **Bit 5:** AL06 ; System Fault **Bit 6:** AL08 ; Phase missing **Bit 7:** AL09 ; Over temperature **NOTE:** Bit8,.....Bit15 reserved
48	102F	R	FREQUENCY (f)	unsigned int	0,1	Hz	(f x 0,1)
49	1030	R	TEMPERATURE	unsigned int	1	ºC	
50	1031	R	CURRENT TRANSFORMERS DIRECTION BITS	unsigned int	1	-	**Bit 0:** Current direction of phase 1 (if it is "1", reverse) **Bit 1:** Current direction of phase 2 (if it is "1", reverse) **Bit 2:** Current direction of phase 3 (if is "1", reverse) **Bit 3:** determination of current direction phase 1 (if it is "1", determined) **Bit 4:** determination of current direction phase 2 (if it is "1", determined) **Bit 5:** determination of current direction phase 3 (if it is "1", determined) **Bit 6:** "0" **Bit 7:** "0" **NOTE:** Bit8,....Bit15 reserved
51	1032	R	POSITION OF STEPS	unsigned int	1	-	**Bit 0:** 1st step position...**Bit 11:** 12st step position (If it is"1,output switch on) **Bit12 - Bit13:** reserved **Bit14:** Alarm relay (If it is"1,output switch on) **Bit15:** Fan relay (If it is"1,output switch on)
52	1033	R	CAPACITOR STEP POSITIONS	unsigned int	1	-	**Bit 0:** 1st capacitor position.....**Bit11:** 12st capacitor position (If it is"1 ",capacitor power value is learned) **Bit 15:** If it is"1 ",all capacitor power values are learned)
53	1034	R	DYNAMIC ON TIME	unsigned int	1	sec	ON TIME for phase 1
54	1035	R	DYNAMIC OFF TIME	unsigned int	1	sec	OFF TIME for phase 1
55	1036	R	DYNAMIC ON TIME	unsigned int	1	sec	ON TIME for phase 2
56	1037	R	DYNAMIC OFF TIME	unsigned int	1	sec	OFF TIME for phase 2
57	1038	R	DYNAMIC ON TIME	unsigned int	1	sec	ON TIME for phase 3
58	1039	R	DYNAMIC OFF TIME	unsigned int	1	sec	OFF TIME for phase 3
59	103A	R	DYNAMIC ON TIME	unsigned int	1	sec	ON TIME for 3 phases
60	103B	R	DYNAMIC OFF TIME	unsigned int	1	sec	OFF TIME for 3 phases
1	2000	R	SECOND COUNTER HW	unsigned int	1	sec	
2	2001	R	SECOND COUNTER LW	unsigned int	1	sec	
3	2002	R	TOTAL ACTIVE ENERGY	unsigned int	1	W/s	Bit 47 – Bit 32
4	2003	R	TOTAL ACTIVE ENERGY	unsigned int	1	W/s	Bit 31 – Bit 16

REGISTER TABLE

NO	ADRESS (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
5	2004	R	TOTAL ACTIVE ENERGY	unsigned int	1	W/s	Bit 15 – Bit 0
6	2005	R	TOTAL REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
7	2006	R	TOTAL REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
8	2007	R	TOTAL REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
9	2008	R	TOTAL REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
10	2009	R	TOTAL REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
11	200A	R	TOTAL REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
12	200B	R	PHASE 1 ACTIVE ENERGY	unsigned int	1	W/s	Bit 47 – Bit 32
13	200C	R	PHASE 1 ACTIVE ENERGY	unsigned int	1	W/s	Bit 31 – Bit 16
14	200D	R	PHASE 1 ACTIVE ENERGY	unsigned int	1	W/s	Bit 15 – Bit 00
15	200E	R	PHASE 2 ACTIVE ENERGY	unsigned int	1	W/s	Bit 47 – Bit 32
16	200F	R	PHASE 2 ACTIVE ENERGY	unsigned int	1	W/s	Bit 31 – Bit 16
17	2010	R	PHASE 2 ACTIVE ENERGY	unsigned int	1	W/s	Bit 15 – Bit 00
18	2011	R	PHASE 3 ACTIVE ENERGY	unsigned int	1	W/s	Bit 47 – Bit 32
19	2012	R	PHASE 3 ACTIVE ENERGY	unsigned int	1	W/s	Bit 31 – Bit 16
20	2013	R	PHASE 3 ACTIVE ENERGY	unsigned int	1	W/s	Bit 15 – Bit 00
21	2014	R	PHASE 1 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
22	2015	R	PHASE 1 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
23	2016	R	PHASE 1 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
24	2017	R	PHASE 2 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
25	2018	R	PHASE 2 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
26	2019	R	PHASE 2 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
27	201A	R	PHASE 3 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
28	201B	R	PHASE 3 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
29	201C	R	PHASE 3 REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
30	201D	R	PHASE 1 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
31	201E	R	PHASE 1 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
32	201F	R	PHASE 1 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
33	2020	R	PHASE 2 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
34	2021	R	PHASE 2 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
35	2022	R	PHASE 2 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
36	2023	R	PHASE 3 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
37	2024	R	PHASE 3 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
38	2025	R	PHASE 3 REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
39	2026	R	VECTORAL REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
40	2027	R	VECTORAL REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
41	2028	R	VECTORAL REACTIVE (INDUCTIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
42	2029	R	VECTORAL REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 47 – Bit 32
43	202A	R	VECTORAL REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 31 – Bit 16
44	202B	R	VECTORAL REACTIVE (CAPACITIVE) ENERGY	unsigned int	1	VAR/s	Bit 15 – Bit 00
45	202C	W	TO CLEAR ALL COUNTERS	unsigned int	1	-	Command 0x55AA
1	3000	R/W	SETING POWER OF CAPACITORS — Q_{L1}	unsigned int	(KVAR x 1000) / ATRF	VAR	0x1388 – 0x0000
2	3001	R/W	SETING POWER OF CAPACITORS — Q_{L2}	unsigned int	(KVAR x 1000) / ATRF	VAR	0x1388 – 0x0000
3	3002	R/W	SETING POWER OF CAPACITORS — Q_{L3}	unsigned int	(KVAR x 1000) / ATRF	VAR	0x1388 – 0x0000
4	3003	R/W	SETING POWER OF CAPACITORS — Step number	unsigned int	1	-	2 - 12
5	3004	R/W	CLEARING CAPACITOR STEP NUMBER	unsigned int	1	-	It can enter between 1 and 12. All steps are cleared If it is entered “0”.
6	3005	R/W	MANUAL MODE	unsigned int	1	-	“1” Manual mode, “0” Automatic Mode
7	3006	R/W	SWITCH ON – OFF (steps)	unsigned int	1	-	It can be if manual mode register is “1”. When step number is entered, output is switched as toggle
8	3007	R/W	NUMBER OFF CAPACITOR STEPS	unsigned int	1	-	3 – 12
9	3008	R	C1 Phase connections of Capacitor 1	unsigned int	1	-	If “111”, learning was completed  Bit6 – Bit15 :reserved phases. If Bit =“1”, connected

REGISTER TABLE

NO	ADRESS (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
10	3009	R	Phase 1 , power value for C1 (Q_{C1L1})	unsigned int	ATRF x (Q_{C1L1})	VAR	
11	300A	R	Phase 2 , power value for C1 (Q_{C1L2})	unsigned int	ATRF x (Q_{C1L2})	VAR	
12	300B	R	Phase 3 , power value for C1 (Q_{C1L3})	unsigned int	ATRF x (Q_{C1L3})	VAR	
13	300C	R	C2 Phase connections of Capacitor 2	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
14	300D	R	Phase 1 , power value for C2 (Q_{C2L1})	unsigned int	ATRF x (Q_{C2L1})	VAR	
15	300E	R	Phase 2 , power value for C2 (Q_{C2L2})	unsigned int	ATRF x (Q_{C2L2})	VAR	
16	300F	R	Phase 3 , power value for C2 (Q_{C3L3})	unsigned int	ATRF x (Q_{C2L3})	VAR	
17	3010	R	C3 Phase connections of Capacitor 3	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
18	3011	R	Phase 1 , power value for C3 (Q_{C3L1})	unsigned int	ATRF x (Q_{C3L1})	VAR	
19	3012	R	Phase 2 , power value for C3 (Q_{C3L2})	unsigned int	ATRF x (Q_{C3L2})	VAR	
20	3013	R	Phase 3 , power value for C3 (Q_{C3L3})	unsigned int	ATRF x (Q_{C3L3})	VAR	
21	3014	R	C4 Phase connections of Capacitor 4	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
22	3015	R	Phase 1 , power value for C4 (Q_{C4L1})	unsigned int	ATRF x (Q_{C4L1})	VAR	
23	3016	R	Phase 2 , power value for C4 (Q_{C4L2})	unsigned int	ATRF x (Q_{C4L2})	VAR	
24	3017	R	Phase 3 , power value for C4 (Q_{C4L3})	unsigned int	ATRF x (Q_{C4L3})	VAR	
25	3018	R	C5 Phase connections of Capacitor 5	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
26	3019	R	Phase 1 , power value for C5 (Q_{C5L1})	unsigned int	ATRF x (Q_{C5L1})	VAR	
27	301A	R	Phase 2 , power value for C5 (Q_{C5L2})	unsigned int	ATRF x (Q_{C5L2})	VAR	
28	301B	R	Phase 3 , power value for C5 (Q_{C5L3})	unsigned int	ATRF x (Q_{C5L3})	VAR	
29	301C	R	C6 Phase connections of Capacitor 6	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
30	301D	R	Phase 1 , power value for C6 (Q_{C6L1})	unsigned int	ATRF x (Q_{C6L1})	VAR	
31	301E	R	Phase 2 , power value for C6 (Q_{C6L2})	unsigned int	ATRF x (Q_{C6L2})	VAR	
32	301F	R	Phase 3 , power value for C6 (Q_{C6L3})	unsigned int	ATRF x (Q_{C6L3})	VAR	
33	3020	R	C7 Phase connections of Capacitor 7	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
34	3021	R	Phase 1 , power value for C7 (Q_{C7L1})	unsigned int	ATRF x (Q_{C7L1})	VAR	
35	3022	R	Phase 2 , power value for C7 (Q_{C7L2})	unsigned int	ATRF x (Q_{C7L2})	VAR	
36	3023	R	Phase 3 , power value for C7 (Q_{C7L3})	unsigned int	ATRF x (Q_{C7L3})	VAR	
37	3024	R	C8 Phase connections of Capacitor 8	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
38	3025	R	Phase 1 , power value for C8 (Q_{C8L1})	unsigned int	ATRF x (Q_{C8L1})	VAR	
39	3026	R	Phase 2 , power value for C8 (Q_{C8L2})	unsigned int	ATRF x (Q_{C8L2})	VAR	
40	3027	R	Phase 3 , power value for C8 (Q_{C8L3})	unsigned int	ATRF x (Q_{C8L3})	VAR	
41	3028	R	C9 Phase connections of Capacitor 9	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
42	3029	R	Phase 1 , power value for C9 (Q_{C9L1})	unsigned int	ATRF x (Q_{C9L1})	VAR	
43	302A	R	Phase 2 , power value for C9 (Q_{C9L2})	unsigned int	ATRF x (Q_{C9L2})	VAR	
44	302B	R	Phase 3 , power value for C9 (Q_{C9L3})	unsigned int	ATRF x (Q_{C9L3})	VAR	
45	302C	R	C10 Phase connections of Capacitor 10	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
46	302D	R	Phase 1 , power value for C10 (Q_{C10L1})	unsigned int	ATRF x (Q_{C10L1})	VAR	
47	302E	R	Phase 2 , power value for C10 (Q_{C10L2})	unsigned int	ATRF x (Q_{C10L2})	VAR	
48	302F	R	Phase 3 , power value for C10 (Q_{C10L3})	unsigned int	ATRF x (Q_{C10L3})	VAR	
49	3030	R	C11 Phase connections of Capacitor 11	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0: oL3 oL2 oL1 eL3 eL2 eL1 Bit6 – Bit15 :reserved phases. If Bit ="1", connected
50	3031	R	Phase 1 , power value for C11 (Q_{C11L1})	unsigned int	ATRF x (Q_{C11L1})	VAR	
51	3032	R	Phase 2 , power value for C11 (Q_{C11L2})	unsigned int	ATRF x (Q_{C11L2})	VAR	

REGISTER TABLE

NO	ADRESS (HEX)	(R)read (W)write	PARAMETER	FORMAT	MULTIPLIER	UNIT	INSTRUCTION
52	3033	R	Phase 3 , power value for C11 (Q_{C11L3})	unsigned int	ATRF x (Q_{C11L3})	VAR	
53	3034	R	C12 Phase connections of Capacitor 12	unsigned int	1	-	If "111" , learning was completed Bit 5 … Bit 0 (öL3 öL2 öL1 eL3 eL2 eL1) Bit6 – Bit15 :reserved phases. If Bit ="1", connected
54	3035	R	Phase 1 , power value for C12 (Q_{C12L1})	unsigned int	ATRF x (Q_{C12L1})	VAR	
55	3036	R	Phase 2 , power value for C12 (Q_{C12L2})	unsigned int	ATRF x (Q_{C12L2})	VAR	
56	3037	R	Phase 3 , power value for C12 (Q_{C12L3})	unsigned int	ATRF x (Q_{C12L3})	VAR	
1	4000	R/W	SET TAN Φ	unsigned int	1	-	+0,75 (%75 ind).....0 (%0).....(%75 cap)-0,75 ind. ◄——► cap. 0.....75.....150
2	4001	R/W	INDUCTIVE BOUNDRY VALUE	unsigned int	0,01	-	5 – 50 ; %
3	4002	R/W	CAPACITIVE BOUNDRY VALUE	unsigned int	0,01	-	5 – 50 ; %
4	4003	R/W	ON TIME (Ton)	unsigned int	1	s	10 – 60 ; second
5	4004	R/W	OFF TIME (Toff)	unsigned int	1	s	10 – 60 ; second
6	4005	R/W	MINIMUM TIME (Talt)	unsigned int	1	s	2 – 10 ; second
7	4006	R/W	Learning to power of capacitors	unsigned int	1	-	"0" enabled ; "1" dissabled
8	4007	R/W	AKIM TRAFO YÖN BULMA FONKSİYONUNUKİLİTLEME	unsigned int	1	-	"0" ise akım trafo yön bulma fonksiyonu sürekli devrede. "1" ise akım trafo yön bulma fonksiyonu sadece bir kere yönü bulur ve kilitler.
9	4008	R/W	ALARM POSITIONS If Bit = "1" ; Alarm in active	unsigned int	1	-	**Bit 0:** AL01 ; Over Voltage **Bit 1:** AL02 ; Under Voltage **Bit 2:** AL03 ; Over Current **Bit 3:** AL04 ; Over compensation **Bit 4:** AL05 ; Under compensation **Bit 5:** AL06 ; System Fault **Bit 6:** AL08 ; Missing Phase **Bit 7:** AL09 ; Over Temperature **NOT:** Bit8,.....Bit15 reserved
10	4009	R/W	PROTECTIONS	unsigned int	1	-	**Bit 0:** Capacitor protection (If Bit= "1" ; protection in active) **Bit 1:** Temperature protection (If Bit= "1" ; protection(fan output) in active) **NOT:** Bit2,.....Bit15 reserved
11	400A	R/W	OVER VOLTAGE SET VALUE	unsigned int	0,1	Volt	Adjustable between 2300 x 0,1 and 2700 x 0,1
12	400B	R/W	UNDER VOLTAGE SET VALUE	unsigned int	0,1	Volt	Adjustable between 1700 x 0,1 and 2100 x 0,1
13	400C	R/W	OVER TEMPERATURE SET VALUE	unsigned int	1	ºC	Adjustable between 80ºC and ((temperature set value of fan start)+ 5) ºC
14	400D	R/W	TEMPERATURE SET VALUE OF FAN START	unsigned int	1	ºC	Adjustable between ((Over temperature set value) - 5) ºC and 25 ºC
15	400E	R/W	OPERATING MODES	unsigned int	1	-	It must be "2" , Device in mod2. Automatic mode in active.
16	400F	R/W	NUMBER OF DEVICE	unsigned int	1	-	Adjustable between 1 and 255
17	4010	R/W	CLEARING COUNTER OF PERCENTILE	unsigned int	1	-	Command 0x55AA
1	FFFE	W	BACK TO THE FACTORY ADJUSTMENT	unsigned int	1	-	Command 0x55AA
2	FFFF	W	RESET THE DEVICE	unsigned int	1	-	Command 0x55AA