Power Analyzers
User Manual



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PROPER USE AND SAFETY REQUIREMENTS



Cut all the power when connecting and disconnecting the device to a panel.



Do not clean the device with a solvent or similar material. Only use a dry cloth.



Please do not intervene to the device when a technical problem is encountered and get in contact with a technical service within the shortest time.



If the warnings are not taken into account, our company or the authorized dealer shall not be held responsible for the negative consequences.



Do not dispose in the trash, the device must be delivered to the collection centers (electronic device recycling centers). It should be recycled or disposed of without harming human health and environment.



The installation, assembly, activation and operation of the device should be done and used by only expert professionals and in accordance with safety regulations and instructions



The device operates with current transformers. Do not strictly leave current transformer tips unattached. Dangerous high voltage can occur.

1. INTRODUCTION

1.1. General Features

Power Analyzer is able to measure and monitor currents of 3 phases, phase–neutral and phase-phase voltages, frequency, active and reactive powers, apparent powers, Cos Ø and power factor values. In addition, it records active and reactive energy consumptions.

The demand and peak values for those measured quantities can be monitored via the analyzer.

Many settings (Current Transformer, Voltage Transformer etc.) related to the device can be made through the menu screens.

In the models with communication property, all read parameters can be monitored remotely via standard Modbus protocol and various adjustments can be made.

In the models which have relay output feature, relay outputs can be managed according to many different parameters (Current, Voltage, Active and Reactive Power, Cos Ø, PF etc.) which set through device menu.

1.2. Technical Features

- Microprocessor based.
- It supports RS-485 Standard Modbus RTU protocol communication channel.
- The operating ambient temperature of the device is between -10 °C and +55 °C.
- The power consumption of measuring input is under 1 VA.
- The line voltage between phase-phase can be adjusted between 190-36200V.
- The measurement voltage between phase-phase is between 100-480 V AC (45-65 Hz) and the measurement voltage between phase-neutral is 10-280 V AC (45-65 Hz).
- The current transformer ratio can be adjusted between 5/5 and 10000/5.
- Optionally, it can be used with CT30 type current transformers.
- To adjust polarity direction of the current transformers there are three different modes as automatic, manual and reverse.
- The working frequency is 45-65 Hz.

- Minimum measurement values are 2 mA and 10 V.
- The measurement precision is %1.
- It periodically records the peak values of energy, demand and all parameters in non-volatile memory. Even if the energy is cut off, it continues to record the values where it left when the device is open again.
- Demand measurement time can be adjusted to between 1-60 minutes.
- Active, reactive powers and all electrical parameters can be monitored remotely through RS-485 communication channel.
- The peak values of energy, demand and all parameters can be reset in device menu.
- The power consumption in our Power Analyzer: It is 5-10.5 VA in the version with relay output and is between 4.5-9 VA in the normal version.
- Our Power Analyzer can optionally have two 5A relay outputs.
- In our Power Analyzer, there are three 4-digit 7 segment displays.
- The sizes of Power Analyzer are (width-length-depth) 97.5 x 97.5 x 50.5 mm.
- Our Power Analyzer operates under 85-265 V AC voltage.
- Our Power Analyzer has IP20 protection class.
- Our Power Analyzer has current, voltage, active power, reactive power, cos Ø, power factor, maximum and minimum peak values, average, demand, total power, phase-phase, frequency, apparent power, THDI, export, control outputs, menu, RS-485 communication (Com) and k (x1000) LEDs.

1.3. Technical Drawing

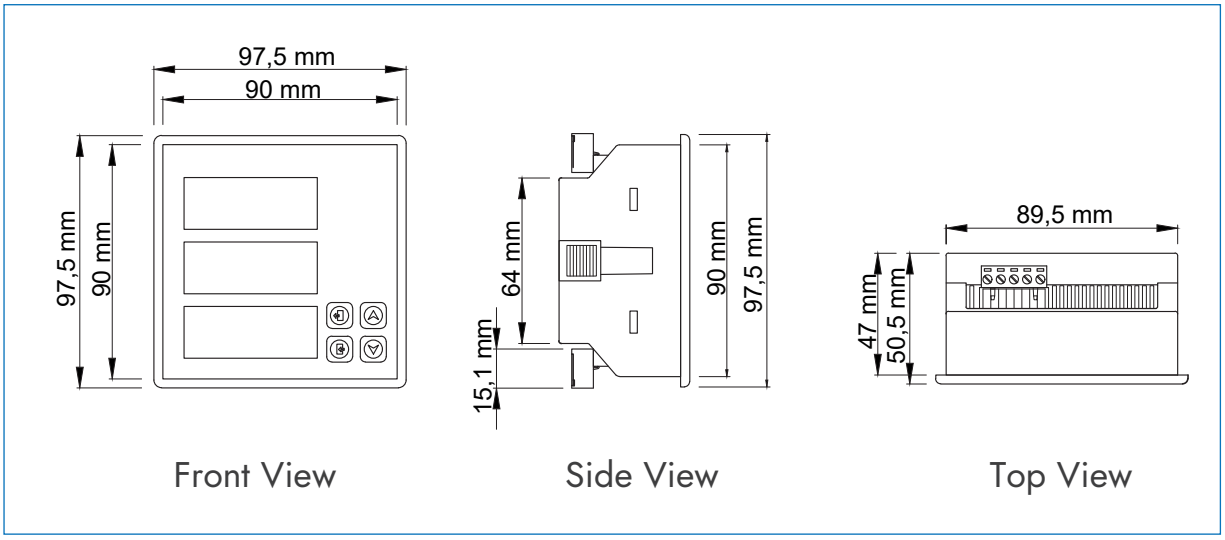
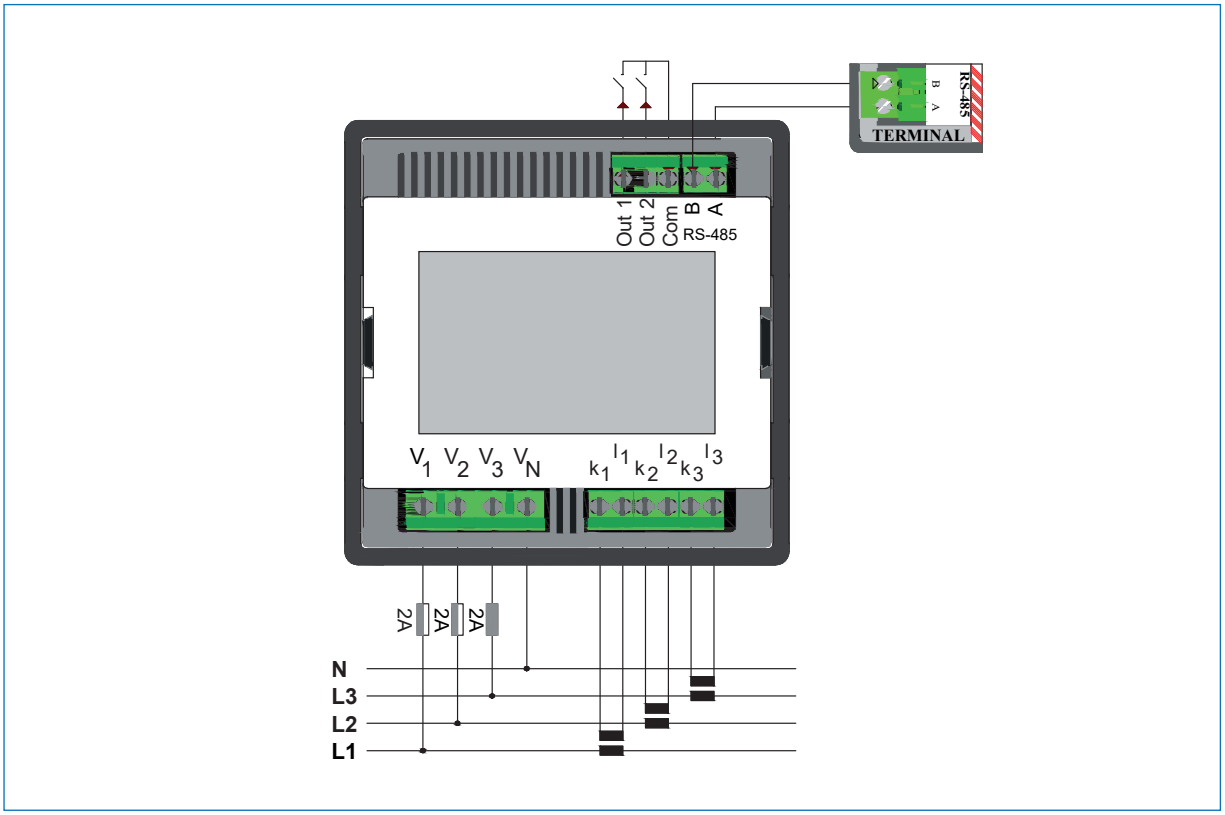


Figure 1.1

1.4. Connection Diagrams



1.5. Measurable Line Parameters

Our Power Analyzer can measure phase-neutral, active powers, reactive powers, cos Ø and tan Ø, power factors, averages of voltage-current-frequency, total active energies, total inductive energies, total capacitive energies, average inductive and capacitive ratios, frequency, voltage demand, current demand, active power demand, inductive power demand, capacitive power demand and total power demand which belong to L1-L2-L3 phases.

1.6. Buttons and Their Functions

	PRG button enables to access the menu when on operation screen. It fulfills selection function when scrolling through the menu.
	It enables to return to the previous process and exit from the menu.
	Up arrow button enables to change parameters displaying on operation screen and stroll between the menus.
	Down arrow button enables to change parameters displaying on operation screen and stroll between the menus.

1.7. Modbus Connection Error

In the case of Modbus connection error, you need to check the followings:

- Make sure that RS-485 A and B communication tips are matched correctly.
- Check whether Modbus address is typed correctly.
- Check whether 120 Ohm terminating resistor is installed or not.

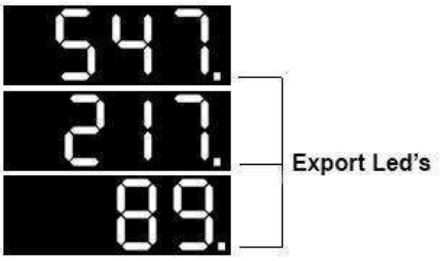


Figure 1.5

NOTE: If Export LEDs on the device are on, the values displaying on the screen are **"EXPORT"** values.

NOTE: There are three K(x1000) LEDs on the left side of the screen. If the corresponding LED is on, the unit of the value displaying on the screen is in **Kilo**.

2. INSTALLATION

2.1. Device Installation

Make the current and voltage inputs connection of the device in accordance to diagrams in Figure 1.2.

Make sure that the inputs of current and voltage are matched correctly when connecting the device.

Give energy to the device after checking and verifying the connections.

2.2. Installation Menu



Figure 2.1

After giving energy to the device, a screen like in Figure 2.1 will shown. That screen gives information of serial number of your device. After confirming with PRG button, the current transformer ratio menu like in Figure 2.2 will appear.

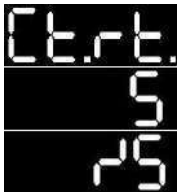
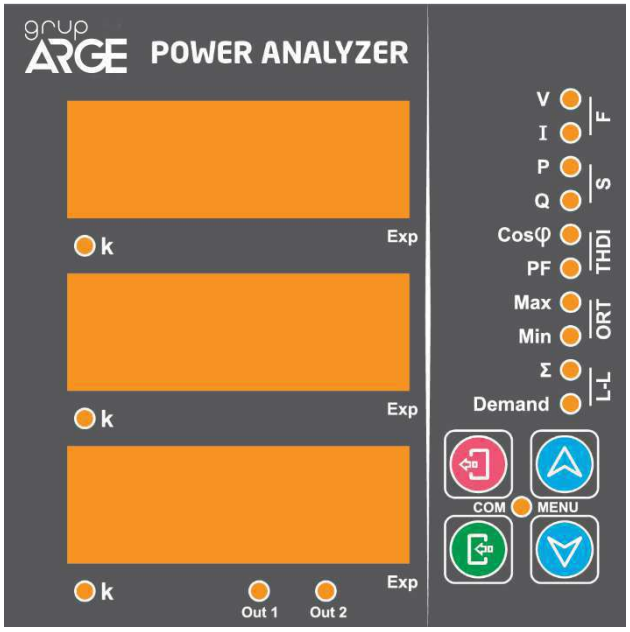


Figure 2.2

The current transformer ratio is adjusted with direction buttons and confirm by pressing PRG button in that screen.

NOTE: The factory default of the current transformer ratio is 5/5.

2.3. Displaying Quantities on The Screen



There are 16 LEDs on the device. You can scroll between the parameters by using the down and up arrows. Which parameter is displayed on the screen depends on LEDs that are on.

When the values that belongs to 3 phase are displayed, L1 phase is displayed in line 1, L2 phase in line 2 and L3 phase in line.
Example; two LEDs in the Figure 2.3 can be on at the same time.

The descriptions of Figure 2.3 LEDs that are on together or alone are as follows.

The LEDs on right;

If V LED is on;

The phase-neutral voltage values that belong to L1, L2 and L3 phases are displayed.

If V, ∑ and Demands LEDs are on together ;

The phase-phase(L-L) voltage values that belong to L1, L2 and L3 phases are displayed.

If I LED is on;

The current values that belong to L1, L2 and L3 phases are displayed.

If V and I LEDs are on together;

The frequency values that belong to L1, L2 and L3 phases are displayed.

If P LED is on;

The active power values that belong to L1, L2 and L3 phases are displayed.

If Q LED is on;

The reactive power values that belong to L1, L2 and L3 phases are displayed.

If P and Q LEDs are on together;

The apparent power values that belong to L1, L2 and L3 phases are displayed.

If V, I, Max and Min LEDs are on together;

Up to down;

Line-1: The average voltage values that belong to L1, L2 and L3 phases are displayed on the screen.

Line-2: The average current values that belong to L1, L2 and L3 phases are displayed on the screen.

Line-3: The average frequency values that belong to L1, L2 and L3 phases are displayed on the screen.

If P, Q, Max and Min LEDs are on together;

Up to down;

Line-1: The average active power values belong to L1, L2 and L3 phases are displayed on the screen.

Line-2: The average reactive power values belong to L1, L2 and L3 phases are displayed on the screen.

Line-3: The average apparent power values that belong to L1, L2 and L3 phases are displayed on the screen.

If Cos Ø LED is on;

The Cos Ø values that belong to L1, L2 and L3 phases are displayed on the screen.

If PF LED is on;

The power factor values that belong to L1, L2 and L3 phases are displayed on the screen.

If Cos Ø and PF LEDs are on together;

The Total Harmonic Distortion values that belong to L1, L2 and L3 are displayed.

PF and ∑ LEDs are on together;

Up to down;

Line-1: The inductive ratio values are displayed on the screen.

Line-2: "0Ran" on the screen.

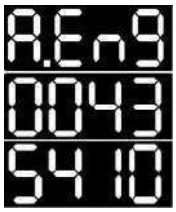
Line-3: The capacitive ratio values are displayed on the screen.

If P and ∑ LEDs are on together;

The average active energy "AEn9" writing is seen on the first screen. The total active energy values are displayed on the following screens.

NOTE: The digits after first four digits will be displayed on the middle screen to avoid overflow on the bottom screen because the screens are with 4 characters.

If the active energy value is bigger than an 8-digit number, the K(x1000) LEDs that are on the left side of the screen will be on.



Example; if a screen like on the left occurs, the active energy value is 435410 Wh.

Figure 2.4

If Q and ∑ LEDs are on together;

This index displays the total reactive energies (capacitive and inductive). Firstly, the writing "IEn9" is displayed on the screen. The total inductive energies are displayed on the screens under that writing. To display the total capacitive energies, press the down arrow button. After that process, the writing "CEn9" is displayed. The total capacitive energy values are read on the screens under that writing.

NOTE: The operating structure is same with the total active energy operating structure.

If V and Demand LEDs are on together;

The voltage demand values that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If I and Demands LEDs are on together;

The demand values belong to I1, I2 and I3 currents are displayed.

NOTE: If the Export LEDs are flashing, the values displaying on the screen are Export values.

If P and Demands LEDs are on together;

The demand values that belong to P1, P2 and P3 powers are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If Q and Demands LEDs are on together;

The demand values that belong to Q1, Q2 and Q3 powers are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If P, Q and Demands LEDs are on;

The demand values that belong to S1, S2 and S3 powers are displayed.

NOTE**:** If the Export LEDs are flashing, the values displaying on the screen are Export values.

If V and Max LEDs are on together;

The maximum voltage (V_{MAX}) values that belong to L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are flashing, the values displaying on the screen are Export values.

If V and Min LEDs are together;

The minimum voltage (V_{MIN}) values that belong to L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are flashing, the values displaying on the screen are Export values.

If I and Max LEDs are on together;

The maximum current (I_{MAX}) values in the phases that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If I and Min LEDs are on together;

The minimum current (I_{MIN}) values in the phases that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If P and Max LEDs are on;

The maximum active power (P_{MAX}) values that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If P and Min LEDs are on together;

The minimum active power (P_{MIN}) values that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If Q and Max LEDs are on together;

The maximum reactive power (Q_{MAX}) values that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If Q and Min LEDs are on together;

The minimum reactive power (Q_{MIN}) values that belong to L1, L2 and L3 phases are displayed

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If Q, P and Max LEDs are on together;

The maximum apparent power (S_{MAX}) values that belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

If Q, P and Min LEDs are on together;

The minimum apparent power (S_{MIN}) values belong to L1, L2 and L3 phases are displayed.

NOTE: If Export LEDs are flashing, the values displaying on the screen are Export values.

3. USER MODES

There are three different user modes in total. These modes are adjusted according to certain levels.



User Mode: It is the simplest user mode. The device starts to operate in this mode after the first installation. If the operator or supervisor passwords are entered, the device exits from this mode. The authorization of displaying and changing setting are limited in this mode. The user can monitor only electrical quantities that are read.



Operator Mode: A few settings can be made on the device in addition to the user mode. The transition from the user mode to the operator mode can be made by entering 4 digit “0000” password. This password can be changed in password setting menu.



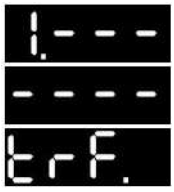
Supervisor Mode: This is the most advanced user mode. All the settings related to the device can be made in this mode. The transition from the user mode to the supervisor mode can be done by entering 4 digit "1000" password. This password can be changed in password setting menu.When the device is in "Operator" or "Supervisor" mode, it transfers to "User" mode 5 minutes after exiting from the menu.

4. MAIN MENU AND SUB-MENUS

To enter menu, press the PRG button in the front panel of the device. The up and down buttons are used to scroll between menus in the device. There are seven main menus in total. Press the PRG button to enter the wanted menu.

NOTE: When scrolling through the menu, holding down to up button makes the transition fast and the menu come to the top. Moreover, holding down to down button makes the transition fast and the menu comes to the bottom.

4.1. Transformer Menu



The settings related to current and voltage transformer is made in transformer menu.

Figure 4.1

4.1.1. Current Transformer Ratio Menu



The current transformer ratio setting was explained in the installation menu. The present current transformer ratio will be flashing in "" menu.

The current transformer ratio can be adjusted by using the up and down buttons in there. The wanted value is selected by pressing the PRG button. The value range and factory setting that can be entered are as follows:

Min. Value: 5/5 - **Max. Value**: 10000/5 – **Factory Default**: 5/5

4.1.2. Current Transformer Setting Menu



The current transformer setting can be done in  menu. There are 4 modes here. From the menu:

If "nor" mode is selected, the current directions are positive.

If "auto" mode is selected, the current directions are automatic.

If "nEGt" mode is selected, the current directions are negative.

If "inur" mode is selected, the present current mode is turned down.

4.1.3. Current Transformer Direction Menu



The current directions are displayed in "Ct.dr" menu.

If the current direction is negative, it is stated with "-" mark. If it is positive, it is stated with "".

4.1.4. Line Voltage Menu



In "Lin2" menu, the line voltage value is adjusted among the values that are seen in the following table.

LINE VOLTAGE	190	380	400	480	500	525	550	650	690
	725	900	1000	6300	10500	11000	14000	15800	28500
	29250	30000	30750	31500	32800	33600	34500	35400	36200

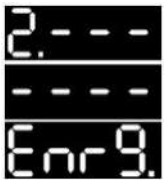
4.1.5. Measurement Voltage Menu



In "SEnS" menu, the measurement voltage value is adjusted among the values that seen in the following table.

MEASUREMENT VOLTAGE	100	110	115	120	190	380	400	480

4.2. Energy Menu



There is only “energy values reset” menu in the energy menu.

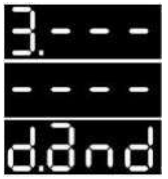
Figure 4.2

4.2.1. Energy Values Reset Menu



“” menu is the menu that the present energy values of the device are reset.To reset energy values, come “” option with direction buttons and approve this option with PRG button. Therefore, the energies are deleted.

4.3. Demand Time Setting Menu





The periods of demand values can be adjusted, and the values can be reset in this menu. To enter demand setting menu, a screen like the below will be appeared.

Figure 4.3

4.3.1. Demand Values Reset Menu



The present demand values can be reset in this menu. If “” is selected here, two options as “” and “” will be displayed. If “” is selected, the demand values will be reset.

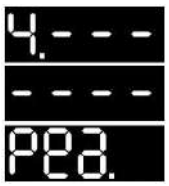
4.3.2. Demand Period Menu



The demand period is set between 1-60 minutes. The setting process is done with the direction buttons in “” menu. The demanded value is selected with the PRG button.

NOTE: The factory default demand period of the device is 15 minutes.

4.4. Peak Values (Min-Max) Reset Menu

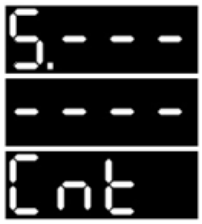


The menu that the minimum and maximum values of electrical quantities are reset. A screen like Figure 4.4 will be appeared.

Figure 4.4

If "rSt" button is selected with the PRG button in this menu, the minimum and maximum values of the present electrical quantities will be reset.

4.5. Control Setting Menu



The output control setting can be made in "Cnt" (control setting) menu. It determines according to which parameters the device will produce output. A screen like Figure 4.5 will be appeared in the main menu.

Figure 4.5

There are two output controls as "Out1" and "Out2".

4.5.1. Out1 Menu

The setting related to the first output control in the "Out1" menu. There are sub-menus as "tYPE", "Filtr", "Inur", "SEt.A", "SEt.b", "t.on", "t.oFF" and "t.rdY" in that menu.

Inverse Menu

If "YES" is selected by entering "Inur" menu, the relay outputs will be set reverse to the present state.

Type Menu



By entering "TYPE" menu, the parameter to produce output value will be selected.

"bUS" → The output controls are managed remotely via **Modbus communication.**
"Volt" → The output controls are managed according to the **voltage parameter.**
"Curr" → The output controls are managed according to the **current parameters.**
"CoS" → The output controls are managed according to the **cosine(cos) parameter**.
"PF" → The output controls are managed according to the **power factor (PF) parameter.**
"tAn" → The output controls are managed according to the **tangent parameter.**
"rAt1" → The output controls are managed according to the **energy ratios.**
"A.Po" → The output controls are managed according to **active powers.**
"r.Po" → The output controls are managed according to the **reactive powers.**
"non" → For output control, no parameter is selected.

from "TYPE" menu;

Filter Menu

It indicates via what the selected output control parameter from "TYPE" menu works. It enables to control outputs for "AVEr" average, "L1" (L1 phase), "L2" (L2 phase), "L3" (L3 phase) or "L123" (any phase) with "FILtr" (filter).

Example; if the filter "L1" is selected, the output can be controlled via only "L1" phase.

SetA Menu

A value is given to the parameter that is selected before in "SEt.A" menu.

For Cosine (+, Inductive) :

If the selected parameter is "CoS" (cosine) and the value of the cosine is positive, the A point in Figure 4.6 indicates the required quantity (between 0,75 – 1) in order for the output to be "OFF".

If the value of the cosine is smaller than the value that is determined in the "SEt.A" menu, the analyzer output becomes "On" and "Out 1" LED becomes on. If it is bigger than A point, the output becomes "OFF".

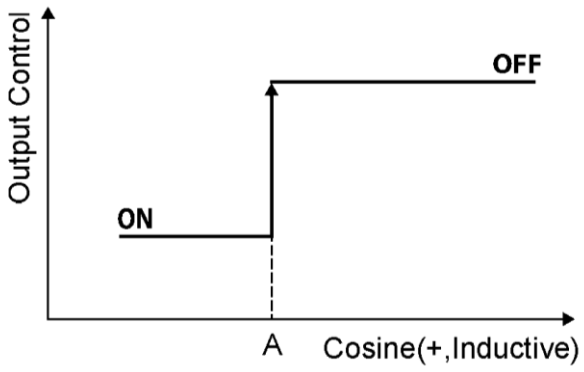


Figure 4.6

For Power Factor (+, Inductive) :

If the selected parameter is "PF" (power factor) and the value of the power factor is positive, the A point in Figure 4.7 indicates the required quantity (0,75 – 1) in order for the output to be "OFF". If the power value is smaller than the value that is determined in the "SEt.2" menu, the analyzer output becomes "On" and "Out 1" LED becomes on. If it is bigger than A point, the output becomes "OFF".

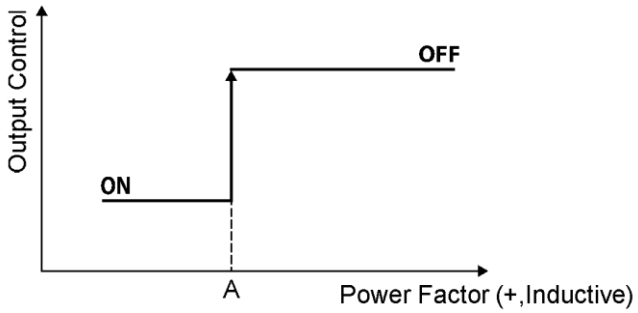


Figure 4.7

For Tangent (+, Inductive):

If the selected parameter is "tAn" (tangent) and the value of the tangent is positive, the A point in Figure 4.8 indicates the required quantity (0 – 99,99) in order for the output to be "On". If the tangent value is bigger than the value that is determined in the "SEt.2" menu, the analyzer output becomes "On" and "Out 1" LED becomes on.

NOTE: The "SEt.2" states the inductive value of Tangent "+" and the "SEt.b" states the capacitive value "-".

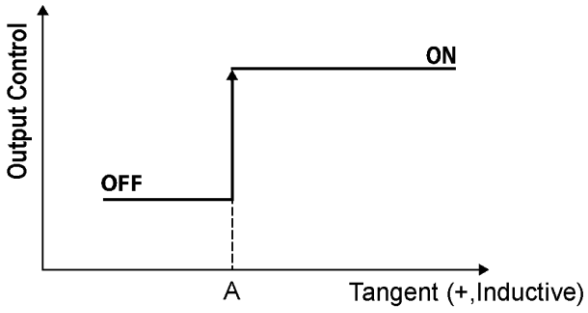


Figure 4.8

For Reactive Energy Ratio (+, Inductive) :

If the selected parameter is "rAt.1" (reactive energy ratio), the A point in Figure 4.9 indicates the required quantity (0 – 999,9) in order for the output to be "On". If the reactive energy value is bigger than the value that is determined in the "SEt.A" menu, the analyzer output becomes "On" and "Out 1" LED becomes on.

NOTE: The values on the screen are in percent.

NOTE: The "SEt.A" states the inductive value of the reactive energy ratio "+"; the "SEt.b" states the capacitive value "-".

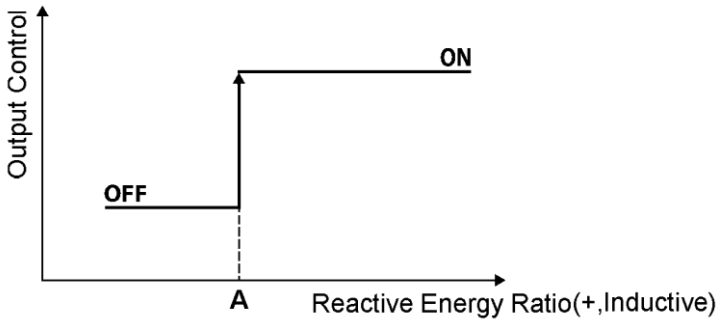


Figure 4.9

For Active Power :

If the selected parameter is "APo" (Active Power), the A point in Figure 4.10 indicates the required quantity (-999 – 999,9) in order for the output to be "On".

If the active energy value is bigger than the value that is determined in the "SEt.A" menu, the analyzer output becomes "On" and "Out 1" LED becomes on.

NOTE: The values are compares as absolute value.

For Reactive Power :

If the selected parameter is "rPo." (Reactive Power), the A point in Figure 4.10 indicates the required quantity (-999 – 999,9) in order for the output to be "On".

If the active energy value is bigger than the value that is determined in the "SEt.A" menu, the analyzer output becomes "On" and "Out 1" LED becomes on. If the value is smaller, the current transformer ratio, line voltage,

measurement voltage, demand period and all the settings except energies are reset.

NOTE: The values are compared as absolute values.

NOTE: The entered values are in KiloWatt and KiloVAr.

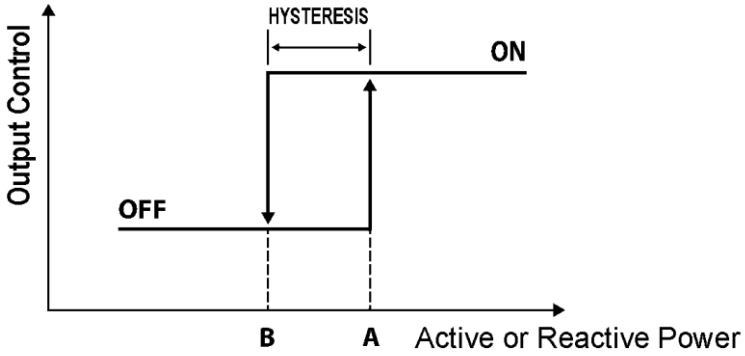


Figure 4.10

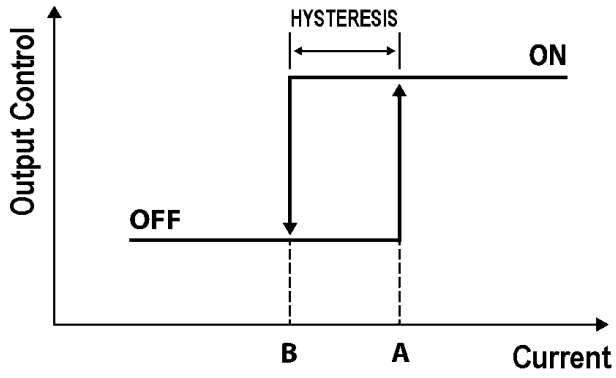
For Voltage :

If the selected parameter is "Volt", the A point in Figure 4.11 indicates the required quantity (0 - 1000) in order for the output to be "On". If the voltage value is bigger than the value that is determined in the "SEt.a" menu, the analyzer output becomes "On" and "Out 1" LED becomes on. If the voltage value is smaller than "SEt.b" value, the analyzer output becomes "OFF" and "Out 1" LED becomes off.

For Current :

If the selected parameter is "Curr" (current), the A point in Figure 4.11 indicates the required quantity (0 – 999,9) in order for the output to be "On". If the voltage value is bigger than the value that is determined in the "SEt.a" menu, the analyzer output becomes "On" and "Out 1" LED becomes on. If the A value is smaller than "SEt.b" value, the analyzer output becomes "OFF" and "Out 1" LED becomes off.

NOTE: The entered values are in Ampere and Volt.



The A and B points in the figure are current and voltage points.If the selected mode (example L1 phase) from the filter menu is bigger than A value, the multimeter related output becomes on.If the measured value is smaller than B,the multimeter output becomes off.

Figure 4.11

SetB Menu

In "SEt.b", a value is given to the parameter that is selected before in "tYPE" menu.

For Cosine (-, Capacitive):

If the selected parameter is "CoS" (cosine) and the cosine value is negative, the B point in Figure 4.12 indicates the required quantity (0,75 – 1) in order for the output to be "OFF". If the cosine value is smaller than the value that is determined in the "SEt.b" menu, the analyzer output becomes "On" and "Out 1" LED becomes on. If the value is bigger than the value in B point, the output becomes "OFF".

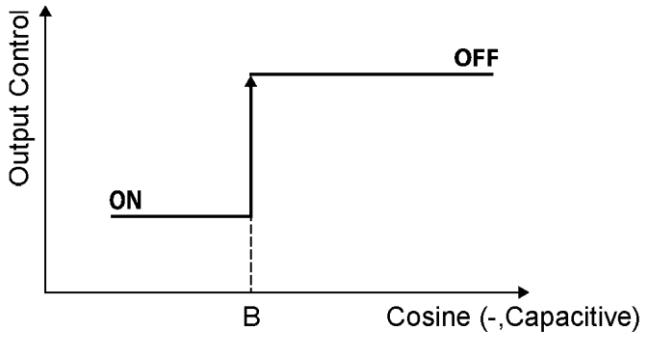


Figure 4.12

Power Factor (-, Capacitive) :

If the selected parameter is "PF" (power factor) and the power factor value is negative, the A point in Figure 4.31 indicates the required quantity (0,75 – 1) in order for the output to be "OFF". If the power factor value is smaller than the value that is determined in the "SEt.b" menu, the analyzer output becomes "On" and "Out1" LED becomes on. If it is bigger than the value in B point, the output becomes "OFF".

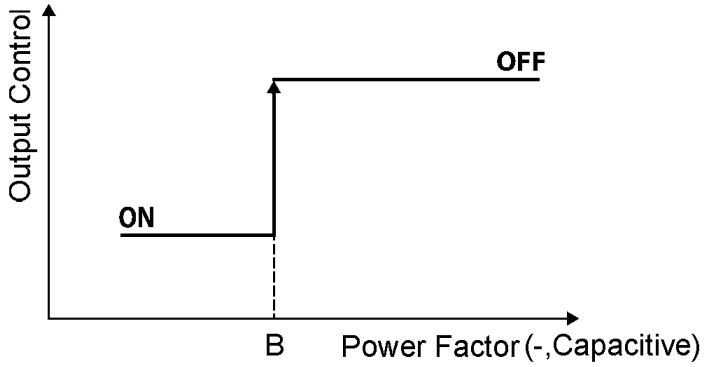


Figure 4.13

For Tangent (-, Capacitive) :

If the selected parameter is "tAn" (tangent), the B point in Figure 4.14 indicates the required quantity (0 – 0,999) in order for the output to be "On". If the tangent value is bigger than the value that is determined in the "SEt.b" menu, the analyzer output becomes "On" and "Out1" LED becomes on.

NOTE: The "SEt.d" states the inductive value of tangent "+", the "SEt.b" states the capacitive value "-".

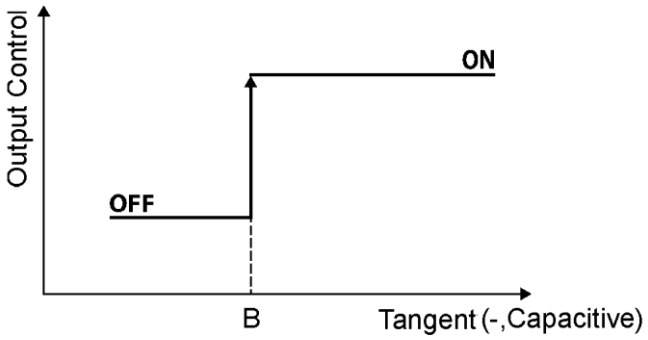


Figure 4.14

Reactive Energy Ratio (-, Capacitive)

If the selected parameter is "rAt.1" (reactive energy ratio), the B point in Figure 4.15 indicates the required quantity (0 – 0.999) in order for the output to be "On". If the B value is bigger than the value that is determined in the "SEt.b" menu, the analyzer output becomes "On" and "Out1" LED becomes on.

NOTE: The values on the screen are in percentage.

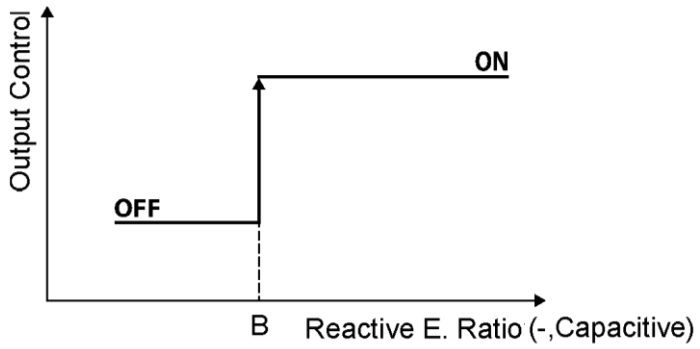


Figure 4.15

For Active Power:

If the selected parameter is "tPo" (active power), it indicates the quantity(-999 – 999,9) of B in Figure 4.10. If the active power value is smaller than the value that is determined in "SEt.b", the analyzer output becomes "OFF" and the "Out1" LED becomes off.

For Reactive Power :

If the selected parameter is "rPo" (reactive power), it indicates the quantity (-999 – 999,9) of A in Figure 4.10. If the reactive power value is smaller than the value that is determined in "SEt.b", the analyzer output becomes "OFF" and the "Out1" LED becomes off.

NOTE: The entered values are in KiloWatt and KiloVAr.

For Voltage:

If the selected parameter is "Volt", it indicates the quantity (0 - 1000) of B in Figure 4.11. If the voltage value is smaller than B value that is determined in "SEt.b", the analyzer output becomes "OFF" and the "Out.1" LED becomes off.

For Current:

If the selected parameter is "Curr" (current), it indicates the quantity(0– 0,999) of B in Figure 4.11. If the current value is smaller than the value that is determined in "SEt.b", the analyzer output becomes "OFF" and the "Out.1" LED becomes off.

NOTE: The entered values are in Ampere and Volt.

Relay Control Time Menu

In "t.on" menu, in the case of the electrical values exceed the "SEt.a" value ,the time to wait for pulling the relay is determined.

In "t.oFF" menu, in the case of the electrical values drop below the "SEt.b" values, the time to wait for releasing the relay is determined.

In "t.rdY" menu, the time between relay pull and release processes are determined. A period of time is waited depends on charge and discharge states of the capacitor and then the relay is pulled or released.

NOTE: The main aim to determine time is to prevent the relay to be pulled and released frequently in case of sudden increasing and decreasing of values.

4.5.2. Out2 Menu

The "Out.2" menu has the same content and technical features of "Out.1" menu. The only difference is that it uses "Out2" LED.

4.6. Password Menu

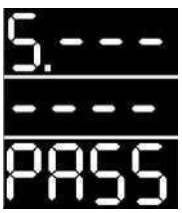
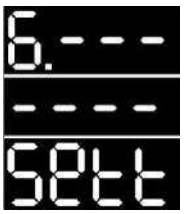


Figure 4.16

The password menu consists of "EntP" menu that the password for switching between different user types is entered and the "nPAS." menu that the password can be changed in. When setting a new password in the changing password process, the numbers are changed between 0-9 starting from the first digit with the direction buttons and the selected number is approved with the PRG button.

This process is repeated for all the 4 digits and then the password is confirmed by pressing the PRG button.

4.7. Setting Menu



The settings related to the device are done in this menu. When the figure 4.17 appears on the screen, press the PRG button to enter the menu.

Figure 4.17

4.7.1. Information Menu



There are the information of the serial number of the device "Sr.no", software version "SUEr", hardware version "bUEr", access level "ALu", language option "Lng", reset status "rSt.S" and operating hour "r.Hou" in "InFo" menu.

NOTE: The menu language can be set as Turkish or English with the language option.

NOTE: The reset status menu indicates where the device gets the reset from.

4.7.2. Modbus Communication Menu

The settings related to Modbus communication of the device are made in the communication settings menu.

Modbus Address Menu



A Modbus address different than the devices that are connected to the device is created in address "AdrS" menu. The values can be changed between 1-247 with the direction buttons and the demanded address can be given to the device with the PRG button.

NOTE**:** The factory default Modbus address of the device is 1.

Baud Rate Menu



The baud rate of the device is determined in this menu. The baud rate can be changed with the direction buttons and the desired value can be confirmed with the PRG button.

If “4.8” is selected, the baud rate becomes 4800 bps.

If “9.6” is selected, the baud rate becomes 9600 bp.

If “19.2” is selected, the baud rate becomes 19200 bps.

If “38.4” is selected, the baud rate becomes 38400 bps.

If “57.6” is selected, the baud rate becomes 57600 bps.

If “115.2” is selected, the baud rate becomes 115200 bps.

If “256” is selected, the baud rate becomes 256000 bps.

Modbus Reading Blocking Menu



There are two options as “YES” and “no” in “r.Pro” menu. If “YES” option is selected, a password is wanted from the user in order for the device to be monitored remotely with Modbus communication.

Modbus Writing Blocking Menu



There are two options as “YES” and “no” in “W.Pro” menu. If “YES” is selected, a password is wanted from the user in order for the device to be monitored remotely with Modbus communication.

Modbus Reading Coding Menu



The demanded password in the process of reading remotely with Modbus communication is determined in “r.PSW” menu. This password is determined in reading coding menu of the device. If the user who wants to do reading remotely enter the password correctly, the reading process can occur.

Modbus Writing Coding Menu



The demanded password in the process of writing remotely with Modbus communication is determined in “W.PSW” menu. This password is determined in the writing coding menu of the device. If the user who wants to do writing remotely enter the password correctly, the writing process can occur.

Modbus Reading Confirmation Password Menu



“r.Ch.P” menu is the menu where the password that is determined via the device for reading remotely with Modbus communication is displayed.

Modbus Writing Confirmation Password



"u.ChP" menu is the menu where the password that is determined via the device for writing remotely with Modbus communication is displayed.

4.7.3. Default Settings Menu



All the settings except for current transformer ratio, voltage transformer ratio, Modbus address and demand period are reset in the "dSEt menu. (return to default values). Press the PRG button to enter the menu. There appear two options as "YES" and "no". If "YES" option is selected with the PRG button, the device will return to the factory default settings.

4.7.4. Reset Menu



The "rSt" (Reset) menu bring the device back to its state before the installation. All the saved information and parameters are reset with this menu. It also provides to use the same device in different panels. Press the PRG button to enter the "rSt" menu. There appear two options as "YES" and "no". If the "YES" is selected with the PRG button, the device will be reset.

NOTE: The current transformer ratio, voltage transformer ratio and Modbus address settings do not return to factory default settings.

4.7.5. Screen Setting Menu

It is the menu which the settings related to displaying the quantities that are shown on the device are made.

Screen Switching Menu



In "trnS" menu, the settings related to index switching time in operating screen are made. When you enter the menu, there will appear options as "Auto" (automatic) "Manu", and "t 10". If "YES" is selected in "Auto" mode, the index on the operating screen is changed automatically and the automatic change time (1-180 seconds) is adjusted with "t 10" mode.

Power Menu



The power values on the screen can be displayed in KiloWatt and KiloVAr with "Pur" menu. Select "W2S" from power menu by using direction buttons and confirm with the PRG button.

NOTE: The percentage menu can be set up to 40%.

Screen Options Menu



The settings related to displaying electrical quantities on the operating screen are made in "dCnS" menu. In this menu, there are three modes as "Full", "Adun" and "bASc".

If "Full" mode is selected, all the electrical parameters can be displayed on the operating screen by changing them with the direction buttons. If "Adun" mode is selected, all the parameters except export values can be displayed on the operating screen. If the "bASc" mode is selected, all the electrical parameters except demand and min-max values can be displayed on the operating screen.

The values displaying on the operating screen in Simple Mode:

- Phase-neutral voltage, phase-phase voltage, phase current, phase frequency
- Active Power (P), Reactive Power (Q), Apparent Power (S)
- Cos Ø, Tan Ø, Power Factor
- THDI (Total Harmonic Current Distortion)
- Inductive Ratio, Capacitive Ratio, Total Active Energy, Total Inductive Reactive Energy, Total Capacitive Reactive Energy, Total Apparent Power

NOTE**:** The factory default operating screen of the device is simple mode.

The values that added in the operating screen in Details Mode:

- Phase-Neutral Voltage Demands, Current Demands, Active Power (P) Demands, Reactive Power (Q) Demands (Inductive-Capacitive), Apparent Power (S) Demands
- Max/Min Phase-Neutral Voltages
- Max/Min Current Values
- Max/Min Active Power (P), Max/Min Reactive Power (Q) (Inductive-Capacitive), Max/Min Apparent Power (S)

The values that added in the operating screen in All Mode:

- Total Active Energy Export Values, Total Reactive Energy Export Values (Inductive-Capacitive)
- Export Values of Phase-Neutral Voltage Demands
- Export Values of Current Demands
- Export Values of Active Power (P), Export Values of Reactive Power (Q) (Inductive-Capacitive), Export Values of Apparent Power Demands (S)
- Export Values of Phase-Neutral Max/Min Voltages
- Export Values of Max/Min Current, Export Values of Max/Min Active Power(P), Export Values of Max/Min Reactive Power (Q) (Inductive-Capacitive)
- Export Values of Max/Min Apparent Power (S)

Average Menu



In average menu, there appears two options as "SoP" (sampling number) and "Prc" (percentage). In "SoP" menu, the settings related to how many samples will be taken to make the values on the operating screen are made.

Example, in "SoP" menu, if the sampling number is selected as 8, eight samples are taken in total and the average of those samples are displayed on the screen.

NOTE: The sampling period is 100 ms.

The "Prc" menu determines the tolerance rage of the sampling average. If any of the sampling is outside of this tolerance, this sampling is displayed on the screen immediately without waiting other samplings. If the sampling number is selected as 1,"Prc" menu has no function.

We recommend that the cable to be used for RS-485 communication be selected according to the table below.

Cable Distance	Recommended Cable	Alternative Recommendation
Up to 30 m	3*0,22 Shielded and Twisted Signal Cable	CAT-5 Ethernet Cable
Over 30 m	3*0,50 Shielded and Twisted Signal Cable	CAT-6 Ethernet Cable

5. MODBUS COMMUNICATION

The parameters that the user can read, write and clear are shown in the table below. In the R/W/C column of the table;
R → indicates that the parameter can be read,

W→ indicates that the parameter can be written,

C → indicates that the parameter can be cleared.

Note: A parameter can have more than one property at the same time. For example, if R/W is written in the column, it indicates that the parameter can be both read and written.

Communication Parameters	
Baud Rate (bps)	9600
Data Bits	8
Parity Bit	None
Stop Bit	1

Figure 5.1

Default Modbus Address

Power Analyzers (ANL 13/14/15/16) => 1

Modbus Speed

Modbus speed is determined by indices between 0-5. The table below shows the modbus speeds according to the indices.

Index	0	1	2	3	4	5
Modbus Speed (bps)	4800	9600	19200	38400	57600	115200

Figure 5.2

Output Type

Output type is determined by indices between 0-7. Outputs are taken according to the selected index. For example; If index 1 is selected, output control is according to voltage (V). The table below shows the output types according to the indices.

Index	0	1	2	3	4	5	6	7
Output Type	None	Voltage (V)	Current (A)	Active Power (P)	Reactive Power(P)	Tangent	Ratio	Bus Control

Figure 5.3

Current Transformer Ratio

Current transformer ratio is determined by an index between 0-38. The table below shows the current transformer ratios according to the indices.

Index	A.T.O	A.T.O (X/5)
0	1	5/5
1	2	10/5
2	3	15/5
3	4	20/5
4	5	25/5
5	6	30/5
6	8	40/5
7	10	50/5
8	12	60/5
9	15	75/5
10	16	80/5
11	20	100/5
12	25	125/5
13	30	150/5
14	32	160/5
15	40	200/5
16	50	250/5
17	60	300/5
18	80	400/5
19	100	500/5
20	120	600/5
21	150	750/5
22	160	800/5
23	200	1000/5
24	240	1200/5
25	250	1250/5
26	300	1500/5
27	320	1600/5
28	360	1800/5
29	400	2000/5
30	500	2500/5
31	600	3000/5
32	640	3200/5
33	800	4000/5
34	1000	5000/5
35	1200	6000/5
36	1500	7500/5
37	1600	8000/5
38	2000	10000/5

Figure 5.4

5.1. Modbus Map

MODBUS REGISTER MAP					
PARAMETER NAME	**ADDRESS(dec)**	**MULTIPLIER**	**UNIT**	**DATA TYPE**	**R/W/E**
Serial Number	100		-	32 bit	R
Product (Type, SubType) + Application Vers . (Main, Sub)	102		-	32 bit	R
Hardware (0, Type) + Hardware Vers. (Main, Sub)	104		-	32 bit	R
Parameter Vers. + System Vers. (Main, Sub)	106		-	32 bit	R
PARAMETERS					
Parameter Version	200	1	-	16 bit	R
Operation Time	201	1	-	16 bit	R
Reset Status	202	1	-	16 bit	R
Power Down Counter	203	1	-	16 bit	R
Modbus Address	206	1	-	16 bit	R/W
Bus Speed (Table Index)	207	1	-	16 bit	R/W
Read Protection Bit	208	1	-	16 bit	R
Write Protection Bit	209	1	-	16 bit	R
Reading Password Confirmation	210	1	-	16 bit	R/W
Writing Password Confirmation	211	1	-	16 bit	R/W
Current Transformer Ratio (Table Index)	214	1	-	16 bit	R/W
Line Voltage (Table Index)	215	1	-	16 bit	R/W
Measurement Voltage (Table Index)	216	1	-	16 bit	R/W
Demand Period	219	1	-	16 bit	R/W

Modbus Current Precision	220	1	-	16 bit	R/W
Energy Period	221	1	-	16 bit	R/W
Reset PowerOn Counter	229	1	-	16 bit	R/W
Reset BrownOut Counter	230	1	-	16 bit	R/W
Reset MCLR Low Power Counter	231	1	-	16 bit	R/W
Reset MCLR Full Power Counter	232	1	-	16 bit	R/W
Reset WatchDog Counter	233	1	-	16 bit	R/W
Reset Soft Reset Counter	234	1	-	16 bit	R/W
Reset StackOverFlow Counter	235	1	-	16 bit	R/W
Reset StackUnderFlow Counter	236	1	-	16 bit	R/W
Reset Config Mismatch	237	1	-	16 bit	R/W
Reset Unknown Counter	238	1	-	16 bit	R/W
Sample Count	241	1	-	16 bit	R/W
Display Percentage	242	1	-	16 bit	R/W
Reserved	243	1	-	16 bit	R/W
Display Index	244	1	-	16 bit	R/W
Display Auto Show Bit	245	1	-	16 bit	R/W
Display Range	246	1	-	16 bit	R/W
Display Mode	247	1	-	16 bit	R/W
Serial Number	998	1	-	32 bit	R
Current Precision	1000	1	-	16 bit	R
Current Transformer Ratio	1001	1	-	16 bit	R
Line Voltage	1002	1	Volt	16 bit	R
Measurement Voltage	1003	1	Volt	16 bit	R
L1 Phase Neutral Voltage	1004	0,1	Volt	16 bit	R
L1 Phase Current	1005	0,001	Amper	16 bit	R
L1 Phase Active Power	1006	1	Watt	16 bit	R
L1 Phase Reactive Power	1007	1	VAr	16 bit	R
L1 Phase Apparent Power	1008	1	VAr	16 bit	R
L1 Phase Frequency	1009	0,01	Hz	16 bit	R
L2 Phase Neutral Voltage	1010	0,1	Volt	16 bit	R
L2 Phase Current	1011	0,001	Amper	16 bit	R
L2 Phase Active Power	1012	1	Watt	16 bit	R
L2 Phase Reactive Power	1013	1	VAr	16 bit	R
L2 Phase Apparent Power	1014	1	VAr	16 bit	R
L2 Phase Frequency	1015	0,01	Hz	16 bit	R
L3 Phase Neutral Voltage	1016	0,1	Volt	16 bit	R

L3 Phase Current	1017	0,001	Amper	16 bit	R
L3 Phase Active Power	1018	1	Watt	16 bit	R
L3 Phase Reactive Power	1019	1	VAr	16 bit	R
L3 Phase Apparent Power	1020	1	VAr	16 bit	R
L3 Phase Frequency	1021	0,01	Hz	16 bit	R
Neutral Voltage	1022	0,1	Volt	16 bit	R
Neutral Current	1023	0,001	Amper	16 bit	R
L1-L2 Phase to Phase Voltage	1024	0,1	Volt	16 bit	R
L2-L3 Phase to Phase Voltage	1025	0,1	Volt	16 bit	R
L3-L1 Phase to Phase Voltage	1026	0,1	Volt	16 bit	R
L1 Phase cosφ	1027	0,001	-	16 bit	R
L1 Phase tanφ	1028	0,001	-	16 bit	R
L1 Phase Power Factor	1029	0,001	-	16 bit	R
L1 Phase Total Harmonic Distortion (THD)	1030	0,001	-	16 bit	R
L1 Phase Total Harmonic Current Dist. (THDI)	1031	0,001	-	16 bit	R
L1 Total Harmonic Voltage Dist. (THDV)	1032	0,001	-	16 bit	R
L2 Phase cosφ	1033	0,001	-	16 bit	R
L2 Phase tanφ	1034	0,001	-	16 bit	R
L2 Phase Power Factor	1035	0,001	-	16 bit	R
L2 Phase Total Harmonic Distortion (THD)	1036	0,001	-	16 bit	R
L2 Phase Total Harmonic Current Dist. (THDI)	1037	0,001	-	16 bit	R
L2 Phase Total Harmonic Voltage Dist. (THDV)	1038	0,001	-	16 bit	R
L3 Phase cosφ	1039	0,001	-	16 bit	R
L3 Phase tanφ	1040	0,001	-	16 bit	R
L3 Phase Power Factor	1041	0,001	-	16 bit	R
L3 Phase Total Harmonic Distortion (THD)	1042	0,001	-	16 bit	R
L3 Phase Total Harmonic Current Dist. (THDI)	1043	0,001	-	16 bit	R
L3 Phase Total Harmonic Voltage Dist. (THDV)	1044	0,001	-	16 bit	R
Total Active Power (Import)	1045	1	Watt	16 bit	R
Total Inductive Power (Import)	1046	1	VAr	16 bit	R
Total Capacitive Power (Import)	1047	1	VAr	16 bit	R
Total Reactive Power (Import)	1048	1	VAr	16 bit	R
Total Apparent Power (Import)	1049	1	VAr	16 bit	R
Total Active Power (Export)	1050	1	Watt	16 bit	R
Total Inductive Power (Export)	1051	1	VAr	16 bit	R

Total Capacitive Power (Export)	1052	1	VAr	16 bit	R
Total Reactive Power (Export)	1053	1	VAr	16 bit	R
Total Apparent Power (Export)	1054	1	VAr	16 bit	R
Average Current (Import)	1055	0,001	Amper	16 bit	R
Average Active Power(Import)	1056	1	Watt	16 bit	R
Average cosφ (Import)	1057	0,001		16 bit	R
Average tanφ (Import)	1058	0,001		16 bit	R
Average Power Factor (Import)	1059	0,001		16 bit	R
Average Current (Export)	1060	0,001		16 bit	R
Average Active Power (Export)	1061	1	Watt	16 bit	R
Average cosφ (Export)	1062	0,001		16 bit	R
Average tanφ (Export)	1063	0,001		16 bit	R
Average Power Factor (Export)	1064	0,001		16 bit	R
Average THD (Import/Export)	1065	0,001		16 bit	R
Average THDI (Import/Export)	1066	0,001		16 bit	R
Average THDV (Import/Export)	1067	0,001		16 bit	R
Average Voltage (Import/Export)	1068	0,1	Volt	16 bit	R
Serial Number	1069	1	-	32 bit	R
Current Precision	1071	1	-	16 bit	R
Current Transformer Ratio	1072	1	-	16 bit	R
Line Voltage	1073	1	-	16 bit	R
Measurement Voltage	1074	1	-	16 bit	R
L1 Phase Min Voltage (Import)	1075	0,1	Volt	16 bit	R
L1 Phase Max Voltage (Import)	1076	0,1	Volt	16 bit	R
L1 Phase Min Current (Import)	1077	0,001	Amper	16 bit	R
L1 Phase Max Current (Import)	1078	0,001	Amper	16 bit	R
L1 Phase Min Active Power (Import)	1079	1	Watt	16 bit	R
L1 Phase Max Active Power (Import)	1080	1	Watt	16 bit	R
L1 Phase Min Reactive Power (Import)	1081	1	VAr	16 bit	R
L1 Phase Max Reactive Power (Import)	1082	1	VAr	16 bit	R
L1 Phase Min Apparent Power (Import)	1083	1	VAr	16 bit	R
L1 Phase Max Apparent Power (Import)	1084	1	VAr	16 bit	R
L2 Phase Min Voltage (Import)	1085	0,1	Volt	16 bit	R
L2 Phase Max Voltage (Import)	1086	0,1	Volt	16 bit	R
L2 Phase Min Current (Import)	1087	0,001	Amper	16 bit	R
L2 Phase Max Current (Import)	1088	0,001	Amper	16 bit	R
L2 Phase Min Active Power (Import)	1089	1	Watt	16 bit	R

L2 Phase Max Active Power (Import)	1090	1	Watt	16 bit	R
L2 Phase Min Reactive Power (Import)	1091	1	VAr	16 bit	R
L2 Phase Max Reactive Power (Import)	1092	1	VAr	16 bit	R
L2 Phase Min Apparent Power (Import)	1093	1	VAr	16 bit	R
L2 Phase Max Apparent Power (Import)	1094	1	VAr	16 bit	R
L3 Phase Min Voltage (Import)	1095	0,1	Volt	16 bit	R
L3 Phase Max Voltage (Import)	1096	0,1	Volt	16 bit	R
L3 Phase Min Current (Import)	1097	0,001	Amper	16 bit	R
L3 Phase Max Current (Import)	1098	0,001	Amper	16 bit	R
L3 Phase Min Active Power (Import)	1099	1	Watt	16 bit	R
L3 Phase Max Active Power (Import)	1100	1	Watt	16 bit	R
L3 Phase Min Reactive Power (Import)	1101	1	VAr	16 bit	R
L3 Phase Max Reactive Power(Import)	1102	1	VAr	16 bit	R
L3 Phase Min Apparent Power (Import)	1103	1	VAr	16 bit	R
L3 Phase Max Apparent Power (Import)	1104	1	VAr	16 bit	R
L1 Phase Min Voltage (Export)	1105	0,1	Volt	16 bit	R
L1 Phase Max Voltage (Export)	1106	0,1	Volt	16 bit	R
L1 Phase Min Current (Export)	1107	0,001	Amper	16 bit	R
L1 Phase Max Current (Export)	1108	0,001	Amper	16 bit	R
L1 Phase Min Active Power (Export)	1109	1	Watt	16 bit	R
L1 Phase Max Active Power (Export)	1110	1	Watt	16 bit	R
L1 Phase Min Reactive Power (Export)	1111	1	VAr	16 bit	R
L1 Phase Max Reactive Power (Export)	1112	1	VAr	16 bit	R
L1 Phase Min Apparent Power (Export)	1113	1	VAr	16 bit	R
L1 Phase Max Apparent Power (Export)	1114	1	VAr	16 bit	R
L2 Phase Min Voltage (Export)	1115	0,1	Volt	16 bit	R
L2 Phase Max Voltage (Export)	1116	0,1	Volt	16 bit	R
L2 Phase Min Current (Export)	1117	0,001	Amper	16 bit	R
L2 Phase Max Current (Export)	1118	0,001	Amper	16 bit	R
L2 Phase Min Active Power (Export)	1119	1	Watt	16 bit	R

L2 Phase Max Active Power (Export)	1120	1	Watt	16 bit	R
L2 Phase Min Reactive Power (Export)	1121	1	VAr	16 bit	R
L2 Phase Max Reactive Power (Export)	1122	1	VAr	16 bit	R
L2 Phase Min Apparent Power (Export)	1123	1	VAr	16 bit	R
L2 Phase Max Apparent Power (Export)	1124	1	VAr	16 bit	R
L3 Phase Min Voltage (Export)	1125	0,1	Volt	16 bit	R
L3 Phase Max Voltage (Export)	1126	0,1	Volt	16 bit	R
L3 Phase Min Current (Export)	1127	0,001	Amper	16 bit	R
L3 Phase Max Current (Export)	1128	0,001	Amper	16 bit	R
L3 Phase Min Active Power (Export)	1129	1	Watt	16 bit	R
L3 Phase Max Active Power (Export)	1130	1	Watt	16 bit	R
L3 Phase Min Reactive Power (Export)	1131	1	VAr	16 bit	R
L3 Phase Max Reactive Power (Export)	1132	1	VAr	16 bit	R
L3 Phase Min Apparent Power (Export)	1133	1	VAr	16 bit	R
L3 Phase Max Apparent Power (Export)	1134	1	VAr	16 bit	R
Serial Number	1135	1	-	32 bit	R
Current Precision	1137	1		16 bit	R
Current Transformer Ratio	1138	1		16 bit	R
Line Voltage	1139	1	Volt	16 bit	R
Measurement Voltage	1140	1	Volt	16 bit	R
L1 Phase Demand Voltage (Import)	1141	0,1	Volt	16 bit	R
L1 Phase Demand Current (Import)	1142	0,001	Amper	16 bit	R
L1 Phase Demand Active Power (Import)	1143	1	Watt	16 bit	R
L1 Phase Demand Reactive Power (Import)	1144	1	VAr	16 bit	R
L1 Phase Demand Apparent Power (Import)	1145	1	VAr	16 bit	R
L2 Phase Demand Voltage (Import)	1146	0,1	Volt	16 bit	R
L2 Phase Demand Current (Import)	1147	0,001	Amper	16 bit	R
L2 Phase Demand Active Power (Import)	1148	1	Watt	16 bit	R
L2 Phase Demand Reactive Power (Import)	1149	1	VAr	16 bit	R
L2 Phase Demand Apparent Power (Import)	1150	1	VAr	16 bit	R

L3 Phase Demand Voltage (Import)	1151	0,1	Volt	16 bit	R
L3 Phase Demand Current (Import)	1152	0,001	Amper	16 bit	R
L3 Phase Demand Active Power (Import)	1153	1	Watt	16 bit	R
L3 Phase Demand Reactive Power (Import)	1154	1	VAr	16 bit	R
L3 Phase Demand Apparent Power (Import)	1155	1	VAr	16 bit	R
L1 Phase Demand Voltage (Export)	1156	0,1	Volt	16 bit	R
L1 Phase Demand Current (Export)	1157	0,001	Amper	16 bit	R
L1 Phase Demand Active Power (Export)	1158	1	Watt	16 bit	R
L1 Phase Demand Reactive Power (Export)	1159	1	VAr	16 bit	R
L1 Phase Demand Apparent Power (Export)	1160	1	VAr	16 bit	R
L2 Phase Demand Voltage (Export)	1161	0,1	Volt	16 bit	R
L2 Phase Demand Current (Export)	1162	0,001	Amper	16 bit	R
L2 Phase Demand Active Power (Export)	1163	1	Watt	16 bit	R
L2 Phase Demand Reactive Power (Export)	1164	1	VAr	16 bit	R
L2 Phase Demand Apparent Power (Export)	1165	1	VAr	16 bit	R
L3 Phase Demand Voltage (Export)	1166	0,1	Volt	16 bit	R
L3 Phase Demand Current (Export)	1167	0,001	Amper	16 bit	R
L3 Phase Demand Active Power (Export)	1168	1	Watt	16 bit	R
L3 Phase Demand Reactive Power (Export)	1169	1	VAr	16 bit	R
L3 Phase Demand Apparent Power (Export)	1170	1	VAr	16 bit	R
Serial Number	1171	1	-	32 bit	R
Current Precision	1173	1		16 bit	R
Current Transformer Ratio	1174	1		16 bit	R
Line Voltage	1175	1	Volt	16 bit	R
Measurement Voltage	1176	1	Volt	16 bit	R
L1 Phase Min Voltage (Generator)	1177	0,1	Volt	16 bit	R
L1 Phase Max Voltage (Generator)	1178	0,1	Volt	16 bit	R
L1 Phase Min Current (Generator)	1179	0,001	Amper	16 bit	R
L1 Phase Max Current (Generator)	1180	0,001	Amper	16 bit	R
L1 Phase Min Active Power (Generator)	1181	1	Watt	16 bit	R
L1 Phase Max Active Power (Generator)	1182	1	Watt	16 bit	R
L1 Phase Min Reactive Power	1183	1	VAr	16 bit	R

(Generator)					
L1 Phase Max Reactive Power (Generator)	1184	1	VAr	16 bit	R
L1 Phase Min Apparent Power (Generator)	1185	1	VAr	16 bit	R
L1 Phase Max Apparent Power (Generator)	1186	1	VAr	16 bit	R
L2 Phase Min Voltage (Generator)	1187	0,1	Volt	16 bit	R
L2 Phase Max Voltage (Generator)	1188	0,1	Volt	16 bit	R
L2 Phase Min Current (Generator)	1189	0,001	Amper	16 bit	R
L2 Phase Max Current (Generator)	1190	0,001	Amper	16 bit	R
L2 Phase Min Active Power (Generator)	1191	1	Watt	16 bit	R
L2 Phase Max Active Power (Generator)	1192	1	Watt	16 bit	R
L2 Phase Min Reactive Power (Generator)	1193	1	VAr	16 bit	R
L2 Phase Max Reactive Power (Generator)	1194	1	VAr	16 bit	R
L2 Phase Min Apparent Power (Generator)	1195	1	VAr	16 bit	R
L2 Phase Max Apparent Power (Generator)	1196	1	VAr	16 bit	R
L3 Phase Min Voltage (Generator)	1197	0,1	Volt	16 bit	R
L3 Phase Max Voltage (Generator)	1198	0,1	Volt	16 bit	R
L3 Phase Min Current (Generator)	1199	0,001	Amper	16 bit	R
L3 Phase Max Current (Generator)	1200	0,001	Amper	16 bit	R
L3 Phase Min Active Power (Generator)	1201	1	Watt	16 bit	R
L3 Phase Max Active Power (Generator)	1202	1	Watt	16 bit	R
L3 Phase Min Reactive Power (Generator)	1203	1	VAr	16 bit	R
L3 Phase Max Reactive Power (Generator)	1204	1	VAr	16 bit	R
L3 Phase Min Apparent Power (Generator)	1205	1	VAr	16 bit	R
L3 Phase Max Apparent Power (Generator)	1206	1	VAr	16 bit	R
Serial Number	1207	1	-	32 bit	R
Current Precision	1209	1		16 bit	R
Current Transformer Ratio	1210	1		16 bit	R
Line Voltage	1211	1	Volt	16 bit	R
Measurement Voltage	1212	1	Volt	16 bit	R
L1 Phase Demand Voltage (Generator)	1213	0,1	Volt	16 bit	R
L1 Phase Demand Current	1214	0,001	Volt	16 bit	R

(Generator)					
L1 Phase Demand Active Power (Generator)	1215	1	Watt	16 bit	R
L1 Phase Demand Reactive Power (Generator)	1216	1	VAr	16 bit	R
L1 Phase Demand Apparent Power (Generator)	1217	1	VAr	16 bit	R
L2 Phase Demand Voltage (Generator)	1218	0,1	Volt	16 bit	R
L2 Phase Demand Current (Generator)	1219	0,001	Volt	16 bit	R
L2 Phase Demand Active Power (Generator)	1220	1	Watt	16 bit	R
L2 Phase Demand Reactive Power (Generator)	1221	1	VAr	16 bit	R
L2 Phase Demand Apparent Power (Generator)	1222	1	VAr	16 bit	R
L3 Phase Demand Voltage (Generator)	1223	0,1	Volt	16 bit	R
L3 Phase Demand Current (Generator)	1224	0,001	Volt	16 bit	R
L3 Phase Demand Active Power (Generator)	1225	1	Watt	16 bit	R
L3 Phase Demand Reactive Power (Generator)	1226	1	VAr	16 bit	R
L3 Phase Demand Apparent Power (Generator)	1227	1	VAr	16 bit	R
Serial Number	1398	1	-	32 bit	R
Current Precision	1400	1		16 bit	R
Current Transformer Ratio	1401	1		16 bit	R
Line Voltage	1402	1	Volt	16 bit	R
Measurement Voltage	1403	1	Volt	16 bit	R
Total Active Energy (Import)	1404	1	Wh	32 bit	R/E
Total Inductive Energy (Import)	1406	1	VArh	32 bit	R/E
Total Capacitive Energy (Import)	1408	1	VArh	32 bit	R/E
Total Active Energy (Export)	1410	1	Wh	32 bit	R/E
Total Inductive Energy (Export)	1412	1	VArh	32 bit	R/E
Total Capacitive Energy (Export)	1414	1	VArh	32 bit	R/E
Total Active Energy Generator (Import)	1416	1	Wh	32 bit	R/E
Total Inductive Energy Generator (Import)	1418	1	VArh	32 bit	R/E
Total Capacitive Energy Generator (Import)	1420	1	VArh	32 bit	R/E
Total Active Energy Generator (Export)	1422	1	Wh	32 bit	R/E
Total Inductive Energy Generator	1424	1	VArh	32 bit	R/E

(Export)					
Total Capacitive Energy Generator (Export)	1426	1	VArh	32 bit	R/E
L1 Phase Active Energy (Import)	1428	1	Wh	32 bit	R/E
L1 Phase Inductive Energy (Export)	1430	1	VArh	32 bit	R/E
L1 Phase Capacitive Energy (Export)	1432	1	VArh	32 bit	R/E
L1 Phase Active Energy (Export)	1434	1	Wh	32 bit	R/E
L1 Phase Inductive Energy (Export)	1436	1	VArh	32 bit	R/E
L1 Phase Capacitive Energy (Export)	1438	1	VArh	32 bit	R/E
L2 Phase Active Energy (Import)	1440	1	Wh	32 bit	R/E
L2 Phase Inductive Energy (Import)	1442	1	VArh	32 bit	R/E
L2 Phase Capacitive Energy (Import)	1444	1	VArh	32 bit	R/E
L2 Phase Active Energy (Export)	1446	1	Wh	32 bit	R/E
L2 Phase Inductive Energy (Export)	1448	1	VArh	32 bit	R/E
L2 Phase Capacitive Energy (Export)	1450	1	VArh	32 bit	R/E
L3 Phase Active Energy (Import)	1452	1	Wh	32 bit	R/E
L3 Phase Inductive Energy (Import)	1454	1	VArh	32 bit	R/E
L3 Phase Capacitive Energy (Import)	1456	1	VArh	32 bit	R/E
L3 Phase Active Energy (Export)	1458	1	Wh	32 bit	R/E
L3 Phase Inductive Energy (Export)	1460	1	VArh	32 bit	R/E
L3 Phase Capacitive Energy (Export)	1462	1	VArh	32 bit	R/E
L1 Phase Active Energy Generator (Import)	1464	1	Wh	32 bit	R/E
L1 Phase Inductive Energy Generator (Import)	1466	1	VArh	32 bit	R/E
L1 Phase Capacitive Energy Generator (Import)	1468	1	VArh	32 bit	R/E
L1 Phase Active Energy Generator (Export)	1470	1	Wh	32 bit	R/E
L1 Phase Inductive Energy Generator (Export)	1472	1	VArh	32 bit	R/E
L1 Phase Capacitive Energy Generator (Export)	1474	1	VArh	32 bit	R/E
L2 Phase Active Energy Generator (Import)	1476	1	Wh	32 bit	R/E
L2 Phase Inductive Energy Generator (Import)	1478	1	VArh	32 bit	R/E
L2 Phase Capacitive Energy Generator (Import)	1480	1	VArh	32 bit	R/E
L2 Phase Active Energy Generator (Export)	1482	1	Wh	32 bit	R/E
L2 Phase Inductive Energy	1484	1	VArh	32 bit	R/E

Generator (Export)					
L2 Phase Capacitive Energy Generator (Export)	1486	1	VArh	32 bit	R/E
L3 Phase Active Energy Generator (Import)	1488	1	Wh	32 bit	R/E
L3 Phase Inductive Energy Generator (Import)	1490	1	VArh	32 bit	R/E
L3 Phase Capacitive Energy Generator (Import)	1492	1	VArh	32 bit	R/E
L3 Phase Active Energy Generator (Export)	1494	1	Wh	32 bit	R/E
L3 Phase Inductive Energy Generator (Export)	1496	1	VArh	32 bit	R/E
L3 Phase Capacitive Energy Generator (Export)	1498	1	VArh	32 bit	R/E
Device Special Command					
Device Status	9000	1		16 bit	W
Reset Energies	9001	1		16 bit	W
Reset Peak Value	9002	1		16 bit	W
Reset Demands	9003	1		16 bit	W
Learn Polarity	9023	1		16 bit	W
Restore Factory Settings	9024	1		16 bit	W
Device Restart	9025	1		16 bit	W

Figure 5.5