KUSAM-MECO®

An ISO 9001:2015 Company

BATTERY QUALITY ANALYZER

MODEL - KM 900 SERIES



OPERATION MANUAL

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Notes for Safe Operation

Please review following items regarding safety in order to prevent harm or damage to the Battery Quality Analyzer or any connecting system. To prevent any potential harm, operate the Analyzer according to the instructions in the manual. (Refer Battery Quality Analyzer as Analyzer hereafter)

The Analyzer is designed and tested according to International Safety Standard IEC 61010-1 before delivery.

Any improper or incorrect measurement method may cause personal injury and damage to the Analyzer

[Safety Terms and Symbol]
Technical Terms which appear in this manual are listed below.
Before use the Analyzer, please read following Safety Symbol carefully

⚠ : *User should read* ⚠ *making area in the Manual and need pay attention.*

User should operate the Analyzer after read the manual where ⚠ *marking on the Analyzer. .*

⎓ : DC *(Direct Current or Voltage)*

: Fuse

⏚ : *Grounding Terminal*

⚠ : WARNING

WARNING statements identity conditions or practices that could result in injury or loss of life.

⚠ : CAUTION

CAUTION statements identity conditions or practices that could result in damage to the product or property.

□ Operation Environment

- Temperature, Relative Humidity Range: 0~40℃, max 80% RH
  (Non- Dew condition)
- Guaranteed Accuracy Temperature, Relative Humidity Range
  23±5℃, max 70%RH (Non Dew condition)
- Please do not use Analyzer for a long time at following environments where Analyzer may cause trouble and accident.

☞ Under direct sunlight
☞ High Temperature
☞ Where Water flow
☞ High Humidity and Dew
☞ Dusty
☞ Explosion Gas
☞ Strong Electromagnetic field
☞ Nearby Electronic Objects
☞ Machine or System shaking

□ Caution before use Analyzer

- Check whether the Analyzer is good operation condition during delivery to user. If any problem found, immediately inform to the supplier whether the Analyzer purchased.
- Check test lead-covered wire is not peel off or any inside metal is exposed. If any damaged test lead may cause Electric Shock and should replace with good test lead.
- To prevent Electric Shock, do not use Analyzer when the Cover Case of the Analyzer is opened.
- To prevent damage on the Analyzer, avoid drop to the ground or severe impact during moving or handling.

□ Caution when Measurement

To prevent Electric Shock, please pay following caution

- When measure Internal Resistance (Impedance), Battery Voltage should not exceed 100V DC. When measure Voltages, Input Voltage should not exceed 300V DC.
- Do not measure AC Voltages
- Proper connection of Battery Test Probes(for Internal Resistance, Voltages, Temperature), ADC Current Adapter (CT for measurement Float Current /Ripple Current /40A/400A *Ripple Current measurement function is an optional), USB Lead (for PC Communication)
- Special attention on Spark when Test Probes contact Battery. Can catch fire if area is with inflammable gas.

□ Caution on Test Probes

- For Safe and Accurate measurements, use the Battery Test Probes supplied with the Analyzer.
- To prevent fault from breaking of wire, do not pull or fold the cable of Test Probe.
- Tip of Test Probe is sharp, be careful not to hurt from it.
- To prevent damage on the tip, do not press the tip by force.

1. Introduction

1.1 Battery Health (Deterioration) Judgment

To judge Battery Deterioration, measure and manage the internal resistance of the battery being installed or new replacement battery periodically.

In general, internal resistance value increased by 1.5 ~ 2 times from initial value (reference value) when battery is deteriorated

[Judgment of Health (Deterioration)]

- In case Lead Storage Cell (Lead-Acid battery), Warning status starts when internal resistance value increased by 1.5 from initial internal resistance value.
  Deterioration standard is little different by manufacturer of Battery

- Even though Same Capacity battery, Initial Internal Resistance value of Battery is different from Type and manufacturer.
- “WARNING”, “FAIL” level of Internal Resistance is little different by manufacturer.

[Recommendation of Battery Replacement Time]

Periodically measure Impedance, Voltages and Temperature of the battery.
In management and save the measurement data which recommends the Time of Battery Replacement.

[Judgment of Battery Replacement Time]

- Based on the specifications of the battery in management when installed,
  Trend of changing data from every measurement displayed in graphic.
- Timing of replacement of Battery may be estimated and displayed on LCD display backed by accumulated measurement data .

1.2 Description

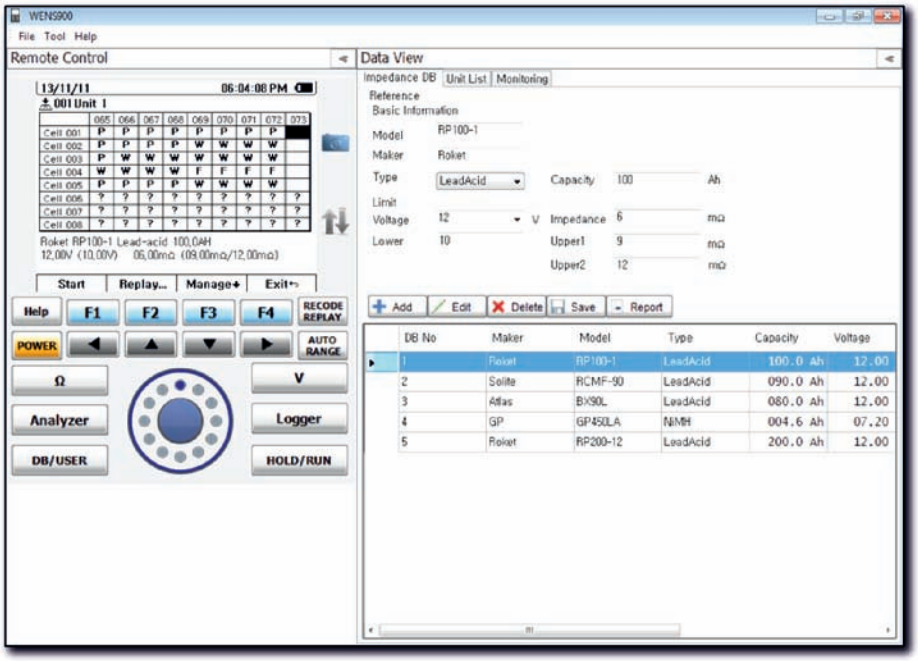
- The Analyzer designed for measuring the internal resistance, interconnect resistance, open circuit voltage, environmental temperature and Currents (Float/Ripple/40A/400A) of secondary batteries including lead storage cells, nickel-cadmium batteries, lithium–ion batteries and nickel-metal hydride batteries.
- 4 Terminal Battery Test Probe can measure Resistance, Voltage and Temperature simultaneously.



[Analyzer]

• Data from measurements may transfer to computer through USB cable.
The Measurement Data to computer can be saved or edited to analyze or manage of the battery health (deterioration) at computer.

• May input or remove of reference data of the battery in management through computer.



[PC Interface]

1.3 Special Features

□ **Measurement Cells while loaded at UPS system.**

The Analyzer applies high technology on Resistance, Voltage, Currents and Temperature measurement while UPS system is loaded.

□ **Accurate Measurement**

AC four-terminal method to measure the internal resistance by eliminating, lead resistance and contact resistance to get the accurate results.

□ **Internal Resistance, Voltage, Temperature measurement and saving** can be done within **3 second simultaneously**

□ **Comparator**

It has 99 sets of composite comparator function, which can be set at resistance and voltage value (Limit) to get the reliable detection of battery deterioration. LCD displays PASS, WARNING, FAIL results and beeper for "Warning and Fail" results.

□ **SD High Capacity Memory**

All measurement data (up to 7,530,000 data) including Resistance, Voltage, Temperature, Currents, Comparator result can be saved at SD memory inside of Analyzer. This capacity allows to stored data as

Unit (Bank) : Max 251 (including 1 Auto Unit No : 000 - Reference D/B not registered and Open Unit No: 001 ~ 250 : Reference D/B registered)

Cell : Max 300 cells per unit

Slot : 100 times (measurement)per Cell.

□ **Auto Saving**

If User set “AUTO HOLD” measurement data is automatically saved at internal memory. Maximum 300 Cell data can be saved in order. The saved data can be transferred to assigned address of memory or can be removed.

□ **PC Interface - Function Control through PC**

Measured Data can be down-load to PC and can be saved or edited at PC.

The Analyzer function can be controlled or up-load DB data through PC.

□ **Pin Type Test Probe**

Sharp and Long Tip of Probe may access to Battery Electrode which allows Battery Electrodes measurement without opening the Battery Electrodes Cover.

□ **Measurement Data Average**

When in “Auto Hold “ mode, maximum 100 measurement data can be average and display at upper left of LCD screen of the Analyzer.

Very practical function when there is change of measurement value.

The Average Data can be cleared by pressing F3 (AVG Clear) key.

□ **Auto Protection and Warning on Over Voltage Input**

When input over voltage while measuring Impedance, when over 100V DC , waring sound come out and show on LCD display .and when over 150V DC, the circuit will be shut off to protect circuit damage.

□ **Warning** when opposite pole of test lead connected, sounds Beef Warning Sound and “ Reverse Pole “ Pop Up Warning is displayed on LCD display. Self -Protected.

□ **Warning** when over voltage is applied when Internal Resistance measurement. When over 100V DC, warning sound. When over 150V DC, the Circuit is shut off and Self -Protected.

1.4 Description of each part and functions



① Impedance, Volt Input*: Connect plug of the BLACK test probe.*

② Impedance, Volt Input: *Connect plug of the RED test probe.*

③ LCD display.

④ Help 

⑤ Power 

: *Power ON/OFF (press longer than 2 seconds)*

⑥ LCD Back Light 

⑦ Auto/Manual Ranging  *(to enter Manual ranging from Auto ranging, press key momentarily. To return back to Auto ranging, press key longer than 2 seconds)*

⑧ Up/Down/Left/Right direction Function 

⑨ Menu Key(F1~F4) 

⑩ Impedance (Internal Resistance) Key 

⑪ Record 

⑫ Analyzer 

Function key

⑬ V . A 

key

Volt : Max DC 300V Input

Currents : Indirect measurement with external CT :

Float/Ripple Current and High Current (Ripple Current is Optional function)*

⑭ Data Base / User key 

D/B key : press short time to enter. User key :Press longer than 2 seconds to enter.

⑮ Data HOLD / Auto HOLD key: 

Data Hold: press short time to enter or exit.

Auto Hold: press the key longer than 2 seconds to enter or exit

⑯ Encoder Rotary switch

Select any menu on LCD display and Setting . Whirl around to left or right direction. Automatic Setting is done momentarily.

⑰ Current input jack: *Indirect connects with CT (recommended Optional ADC 40A/400A current adapter).*

⑱ USB interface: *PC interface connector.*

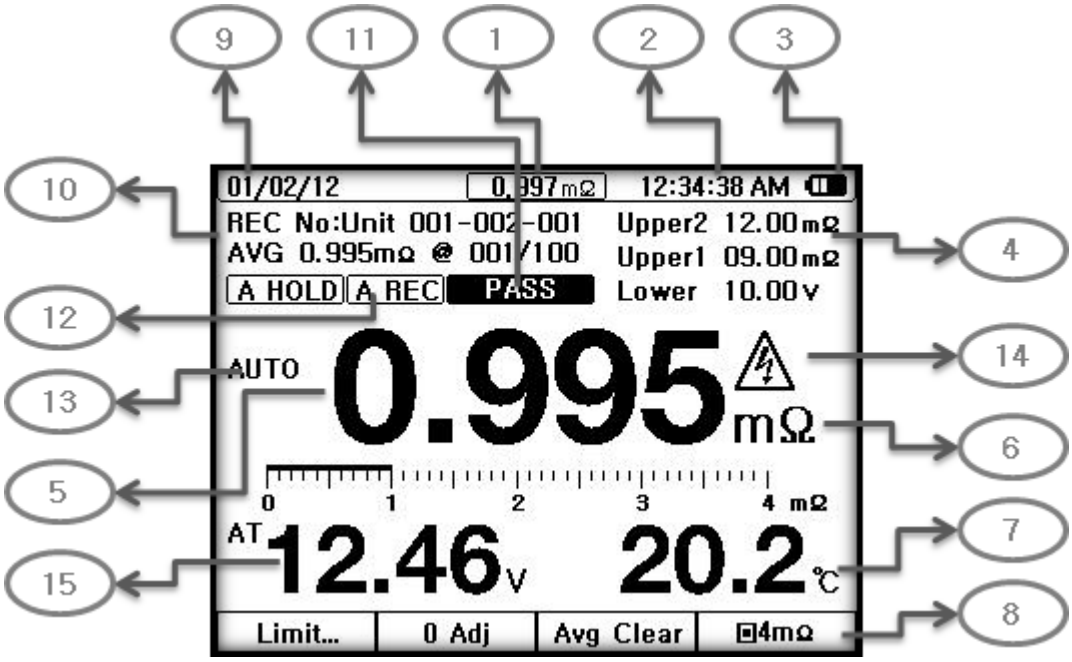
⑲ AC adaptor input jack: *Connects to the AC Power adapter*

[Note]



are Dual function keys.

Press Short Time to enter Upper Line functions (HOLD, D/B) and press long time (longer than 2 seconds) to enter Under line functions (AHOLD-AREC, User)



[Display]

① Present Measurement Value when AutoHold mode

(When measurement at AutoHold mode, Auto Hold data “0.995” is holding at Center of Display and present measurement data shows “0.997” .
This Data Box does not show if AutoHold mode stop)

② Measurement Data and Time

③ Battery/Adapter Sign

④ Limit: Upper, Lower

⑤ Impedance Value Display

⑥ Unit of Measurement

⑦ Temperature Value Display

⑧ 4m Ω Convert key

⑨ “ Unit-Cell-Times” display

⑩ Measurement Ave range and number of Averaged data

(displayed with Auto Hold)

⑪ Limit (Comparator) Pass –Warning-Fail

⑫ Auto Saving : When Auto Holding, Auto Saving is automatically activated . Saved at Auto Record Memory in order, max 300 cells x 100 times measurement Record number : storage date Recording Number.

⑬ Auto : Auto, manual ranging

⑭ Warning Sign

⑮ DC Voltage measurement

1.5 Dimensions and Weight

Dimensions: 107㎜(W) x 220㎜(H) x 55㎜(D)/ 4.2” (W) x 8.3”(H)x2.2” (H)

Weight (main unit including battery): 1.0㎏/ 2.2 Ibs

2. Initial Setting before use

2.1 Battery Install and Replacement

Before start to use the Analyzer, install 2 x NiMH Battery Packs supplied with the Analyzer and charge up to full level if the charged level is not sufficient.

- Before install or replace Battery Pack, please Power Off of the Analyzer.
- After install or replace the Battery Pack, make sure to cover the Battery Pack with Battery Cover before use the Analyzer.
- Do not mix to use with other type of Battery.
  Make sure to meet Correct Polarity Contact (+, -) of the Battery Pack to the Correct Polarity (+, -) of the battery room of the Analyzer.
  Do not put reverse polarity. It also cause deterioration of capacity or Leakage

- Do not cut Battery Pack or draw into fire which is dangerous to cause explosion to wire.
- Dispose of the used battery according to regulation and rule.
- When Low Battery displayed in LCD screen, recharge it or replace it.

[Battery Replacement procedure]

① Power-Off the Analyzer. Disconnect Test Probes from the Analyzer.

② Open the Tilt Stand and unscrew the 2 x Battery Cover Screws on the Bottom Housing. Separate Tilt Stand and open the 2 Battery Cover (Left and Right).

③ Place 2 x NiMH Pack (3.6V) into Battery Room. Make sure to meet Correct Polarity Contact (+, -) of the Battery Pack to the Correct Polarity (+, -) of the battery room of the Analyzer.

④ Place Battery Covers and Tilt Stand

⑤ Fix the 2 x screws on the Battery Covers.

□ **Recharging Adapter** (Use for Recharging purpose only, Not use for Measurement)

- Input Voltage: AC 100V~240V(Free Voltage)
- Output Voltage: DC 12V/1A 50/60Hz

□ **Battery Pack**

- Voltage : 7.2V [NiMH 1.2V x3(3.6V) x 2 packs]
- Capacity: 2700mAh

2.2 Insert Test Probe

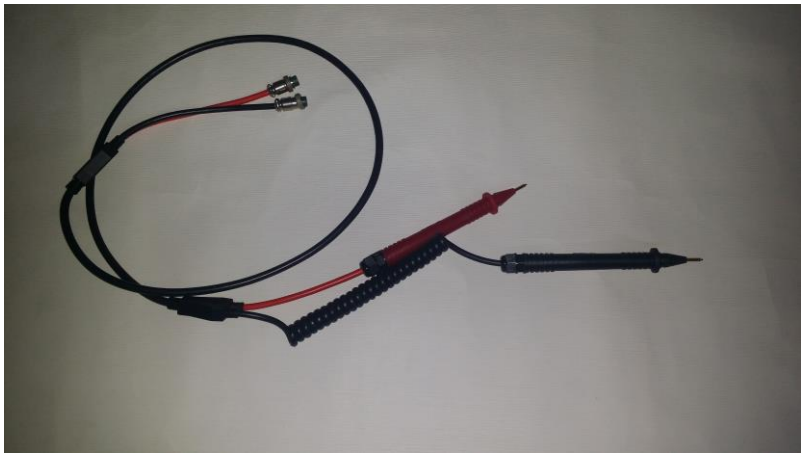
To avoid measurement error or electrical shock, make sure to insert to the Analyzer correctly.

- For safe and accurate measurement of Resistance, Voltage , Temperature make sure to use the Battery Test Probe supplied with the Analyzer.
- Special care on any hurt from sharp tip of test probe during measurement.

Insert SCK Plug type Test Probe to (+) and (-) as shown below picture.



[Insert Test Probe]



[Pin Type Battery Test Probe for
Impedance, Voltage and Temperature measurement]



[Clip Type Battery Test Probe for
Impedance, Voltage, Temperature measurement] * Optional Accessory

- Current Probe (CT) * Optional Accessory

  DC Current (Float Current / High DC Currents)
  AC Current (Ripple Current / High AC Currents)

2.3 Power ON/OFF 

Use “POWER” key on the Analyzer to power ON or OFF.

Press longer than 2 seconds to power ON or OFF.

[ON]

- Press Power Key longer than 2 seconds. Then Power is “ON” with beeper sound.
- After Power “On”, Initial Display on Screen shows manufacturer and Firm Ware Information momentarily and change to Measurement function.
- Initial measurement function is always set Impedance (Internal Resistance) measurement.

[OFF]

- Press Power Key longer than 2 seconds. Then Power is “OFF” with beeper sound.

2.4 Timer function

Once Power ON, timers works Real Time Clock. Upper Left area of LCD Screen display: Day / Month / Year, Hour / Minute / Second.

- Press “D/B User” 

key for longer than 2 seconds to enter User mode. Select ◉Date Format “Year/Month/day” or “Day/Month/Year “
- If time is not correct, select ◉Time and Enter to adjust time.
- Set Day, Month, Year, Hour, Minute and press F4 OK↩ key to complete Time setting.
- While setting Time, Timer is stop. Time may not accurate if takes long setting time.

2.5 Back Light Display 

- Press  key , Back Light “ON” with click sound and

  When backlight “OFF”, press  key .

3. Measurement

For Safe and Accurate measurement, read Manual carefully.
Make sure to pay attention on following

- Do not measure over DC 100 V Capacity Battery at Impedance 

measurement range. Do not over DC 300V Input when measure Voltage at 

is measurement range . This is to protect from Electric Shock
- Do not measure AC Voltage

[Caution]

- Do not Input exceeding Maximum Voltage, Currents of each measuring range. Exceeding Input may cause damage to the Analyzer.
- When measure Low Voltage Battery after measure High Voltage Battery, residue in Analyzer may damage Low Voltage Battery. Be sure to measure safely after discharge on DC Condenser inside of Analyzer by shorting the Test Probe.

[Note]

- Internal Resistance of Battery being measured can be different from Current Flow status and Discharge status. To support accuracy and reliability of judgment, be sure to measure at following condition.
- Lead Storage battery has big resistance on electrodes. Resistance can be different between the area of electrode toward Case and the area of End of Electrode. Contact area between Electrode and Test Probe should be consistent.
- Use USB type temperature probe to measure Temperature.
- Foreign materials or rust on electrodes may not measure or may cause measurement error. Need to clean electrodes before measurement.

3.1 Check Point before Measurement

- Check weather Test Probe is normal status.

① Test Probe is recommended to " 0" adjustment for accurate measurement. Need to "O" adjustment with supplied Adjustment Board

together with Analyzer and Test Probe.

② Display should be “0000”. If “----” is displayed, Test Probe wire maybe broken or no contact.

• Check remaining battery capacity.

When use internal battery to operate, present battery status of the internal battery inside of Analyzer is displayed at Upper Right corner of LCD screen. When Low Battery is displayed, charge the battery through ADC Adapter / Internal Charger supplied with Analyzer or replace with new battery pack.

- Check the Battery Status to be measured. .
- Any Foreign materials or rust on electrodes of the battery may not measure or may cause measurement error. Need to clean electrodes before measurement.

3.2 “0 ADJ “ O Adjustment Method and Procedure

(for accurate Resistance measurement)

In order to get accurate measurement, anytime old test probes are replaced with new ones it is strongly recommend to perform a 0 ADJ before measurements.

Before measuring impedance, in order to improve accuracy, insert test probes onto the 0 ADJ board (supplied with unit) and conduct a 0 ADJ.

In the Ω Test function, HOLD the key for longer than two seconds. Adjustment value to be set to zero and measurement value is displayed.

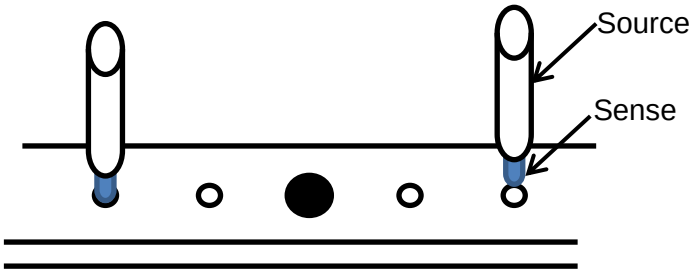
Trying to do a 0 ADJ without probes in contact with the 0 ADJ board will cause a fail message to be displayed. Failure to adjust may also indicate a faulty set of test probes.

The 0 ADJ or 0.0 point of all measurement ranges is automatically adjusted in order.
Even when the tester power is off, the 0 adjusted values are retained until the next 0 ADJ is conducted. .“0 ADJ” should be conducted with the “O ADJ board” supplied with Analyzer.

□ How to short Test Probe when “0 ADJ ” is proceeding

1) Pin Type Test Probe

- Use “0 ADJ Board ” with AC 4-Terminal procedure
- As below illustration, select Hole meeting Distance between Battery Terminal(Electrodes) and press Probe Tip
- “0 ADJ Board ” is recommended as far as away from the Analyzer.



[“0” ADJ]

- “0” Adjustment require to fit Tip of Probe down into the hole of “ O ADJ board “ and press down Probe so that SOURCE, SENSE terminal of Probe is stick together .

- Do not put “0 ADJ board” on Battery or Metal. Adjustment Error may occur from Electro Magnetic Interference.

- “O ADJ” can be done by Contact Pin - Pin of Probe or “ 0 ADJ Board. Other type of “0 ADJ” may cause Inaccurate Measurement..

- If the Battery Terminal – Terminal distance is longer than the Holes in the “ O ADJ Kit ” , Use the 1st Left Hole and last Right hole in the Adjust Kit

2) Clip Type Test Probe



[“ O ADJ]

• As shown above, Use Adjust Kit. Insert pin of Test Probe into the Adjust Kit to conduct “O Adjustment”

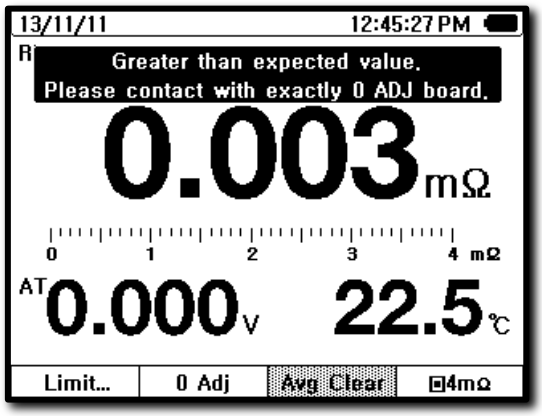
□ How to conduct “0 Adjustment”

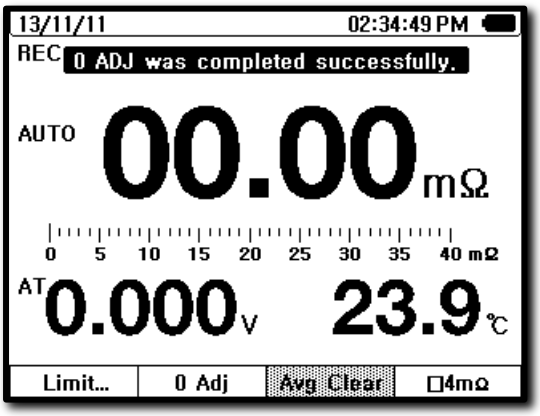
① Insert Test Probe Pin to “ O Adjust Kit”

② Press F2 | 0 Adj | key for longer than 2 seconds.
Test Probe to be connected to “0 ADJ”

☞ If Pin does not contact “O Adjust Kit “ within 10 seconds after F2 | 0 Adj | key is pressed, “O Adj” can not proceed.

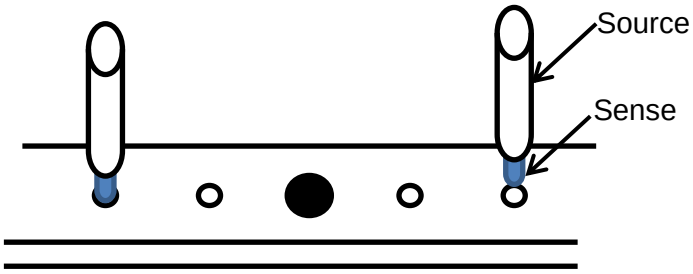
☞ When “0 Adj” value is out of range, Analyzer display Error Message and Adjust procedure stop.





["0" ADJ processing display] ["0" ADJ complete display]

③ "0" Adjustment is conducted by Range in order.



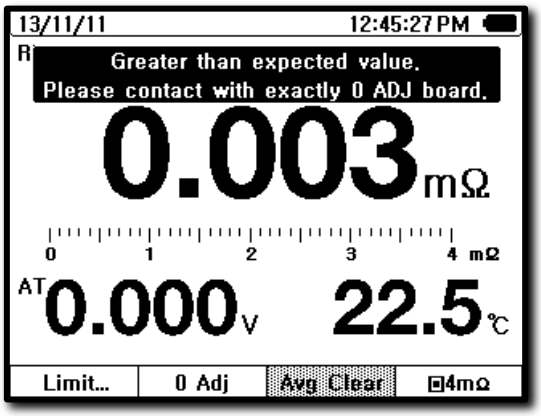
- Contact of Test Probe should remained until “0” ADJ is completed.

④ If Adjustment is completed, A confirmation message is displayed ..

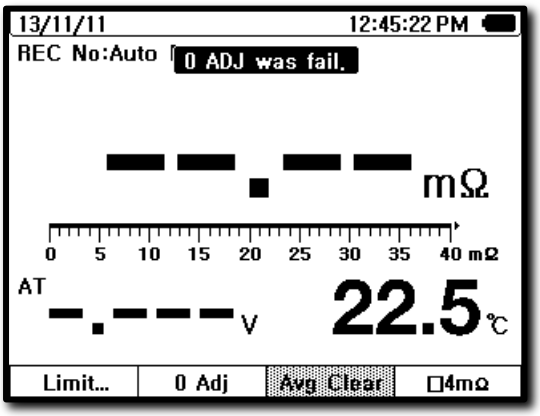
[“0” Adjustment Error Display]

While “0” adjustment, Error will occur if Adjustment value is not achieved in normal condition or achieve over value above certain level

- Adjustment Value is achieved over 300 count.
- Test Probe is not connected to Analyzer..
- When there is foreign material on “0” ADJ board.
- Passed 10 seconds after “O ADJ” started.



["0" ADJ Error Warning]



["0" ADJ Error Result]

3.3 Measurement

Resistance measurement operates Auto/Manual Ranging, Voltages operates Auto/Manual ranging and Current measurement in Manual Ranging.

AUTO means “Auto Ranging”, Range means is “Manual Ranging”.

Range key operation : when change AUTO ranging to Manual ranging, press key Short time . When change Manual ranging to Auto ranging, press key for longer than 2 seconds.

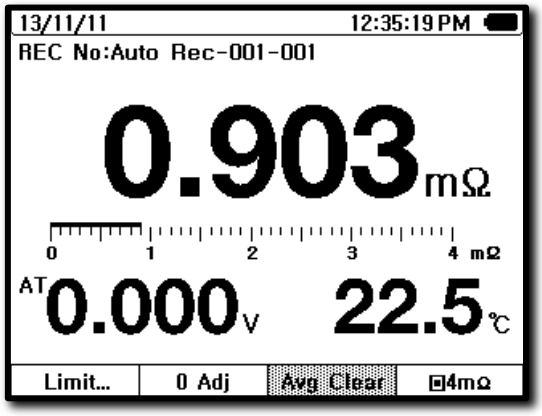
1) **Resistance** Ω (Internal Resistance, Impedance)

- If press Resistance “Ω” Ω key, Resistance, Voltage and Temperature are measured simultaneously.
- If press “Ω” Ω key, always enter Auto Ranging (40mΩ- 4 Ω)

  4mΩ range is activated in Manual Ranging only – press F4 ⊡4mΩ key to convert.

  If need to change Range in Manual Ranging in 40mΩ- 4 Ω range, press Range Key Range and change Range with click sound. Each time key press changes Range respectively (moves decimal point each time).

• After change Range, when the Analyzer Power Off (Power) and Power On (Power) again, Measurement Range automatically revert ..



[Resistance measurement]

2) Voltage (V·A)

Note : Battery Voltage measurement reading can be obtained automatically when Resistance (Ω) measurement mode. This mode uses when measure DC Voltage only upto 300V DC.

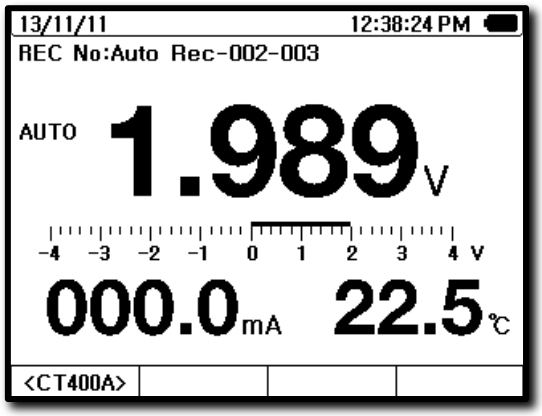
• If press"V.A" (V·A) key. Then Voltage measurement mode entered automatically. If connect Battery Test Probe only, Main Display shows Voltage reading and Sub Display shows Temperature reading simultaneously.

While Battery Test Probe connected on top of Analyzer, If connect CT (Current Probe) between Battery and UPS (Loader/Charger), Voltage, Temperature and Current can be measured simultaneously.

• To change Voltage to Manual ranging from Voltage Auto ranging, press Range (Range) Key momentarily. Then AUTO symbol on LCD screen is erased with click sound and set to Manual ranging (Range).

• Each time (Range) key press, changes Range respectively (moves decimal point each time) with click sound.

• When change from Manual Ranging to AUTO Ranging, press Range Key longer than 2 seconds then AUTO symbol on LCD, Screen is displayed with click sound and set to AUTO Ranging.



[Voltage measurement]

3) Current (Float Current/ Ripple Current/ 40A/400A)

DC Current (including Float Current) and *AC Current (including Ripple Current)measurement

DC Current measurement function is a Standard function , * AC Current function is an Optional measurement function.

Float / Ripple Currents can be measured while battery is loaded.
The measurement through Clamp Probe(CT) does not affect battery. and Measurement solution is safe

[Measurement Procedure]

DC Current (including Float Current)

- Press “V.A” V·A key on the Analyzer.
- Press F1 key to select DC A or AC A. Select DC A.

  Then menu shows F3 40A or F4 400A

  When measure Float Current, generally below 40A DC.

  Press F3 key to enter 40A DC mode. And be sure the Select range on Current probe is set at 40A DC

AC Current (including Ripple Current) * Optional Function

- Press “V.A” V·A key on the Analyzer.
- Press F1 key to select DC A or AC A. Select AC A.

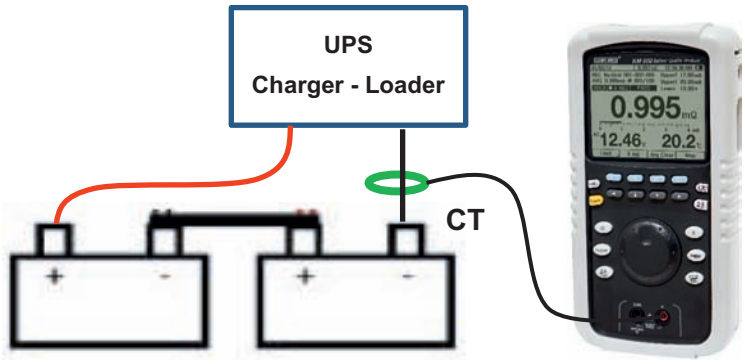
  Then menu shows F3 40A or F4 400A

  When measure Ripple Current, generally below 40A AC.

  Press F3 40A key to enter 40A AC mode. And be sure the Select range on Current probe is set at 40A AC

How to connect Current Probe (CT) with the system and Analyzer

- Connect CT as below illustration diagram. Insert the Input Jack of the CT to the lower part of the Analyzer (be sure Black lead goes to Black Input **COM** and Red(+) goes to Red Input Hole (**A**) and Clamp the Jaw of the Current Probe(CT) to the Cable between UPS (Loader/Charger) and Battery.
- . If Battery Test Probe (connected between Unit and Battery Terminals) and Current Probe (CT) are connected together, Main Display (Voltage : V) and Sub display (Current – AC or DC A and Temperature) are displayed simultaneously.



[CT Connection]

NOTE

-Measurement through external Current Probe * Optional Item
KM 900 provide DC 40A/400A and AC 40A/400A range

-The V.A function set at Voltage (V) at Main display
Currents (A) and Temp(deg) at Sub display

4) Temperature

Temperature measurement is subsidiary measurement function in Resistance measurement Ω or Voltage measurement V·A. While measuring Resistance or Voltage, Temperature measurement is displayed simultaneously.

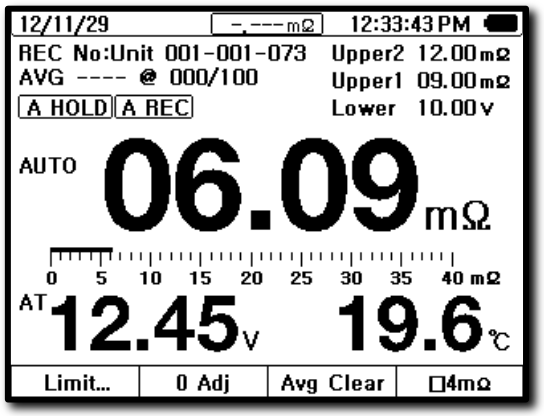
Temperature reading shows the environmental temperature to (-) Battery Terminal.

• ℃ or ℉ is selectable at MENU mode

3.4 Auto Hold - Auto Record

1) Auto Hold (AHOLD)

- If pass 2 seconds after measurement, “Auto Hold” function is activated automatically to Auto Record of the measurement data.
- Press “HOLD/ AHOLD-AREC ” key longer than 2 seconds to set “Auto Hold”
- If Auto Hold is set, “ A HOLD ” is displayed at top head middle line of LCD screen.
- When Measurement data shows “----”, Auto Hold does not activate
- Auto Hold and Auto Record always work together. If Auto Hold works, measured data automatically recorded at Auto Record memory room.
- When new measurement proceed while in Auto Hold, Auto Hold function is restarted.



[Auto Hold]

2) Stop “Auto Hold” function

To stop “Auto Hold” function, press “HOLD/AHOLD-AREC” key for longer than 2 seconds.

3) AVG Clear

- In “Auto Hold” function, AVG (Average) is automatically activated.
- AVG measurement function calculates average value from multiple repeated measurements (max 100 measurements) of the object battery in measurement deviation.
- AVG measurement is available only on Main Measurement.

- In Impedance (Internal Resistance) mode, Main measurement (main display) “Ω” can only be AVR measurement. Sub measurement (sub display) Voltage or Temperature can not be AVR measurement.
- In Voltage mode, Voltage can only be AVR measurement. Other sub display measurement can not be AVR measurement.
- To cancel “AVR” measurement, press F3 Avg Clear key. Then AVG is cleared and Initial Set up.

3.5 Data Hold HOLD AHOLD-AREC

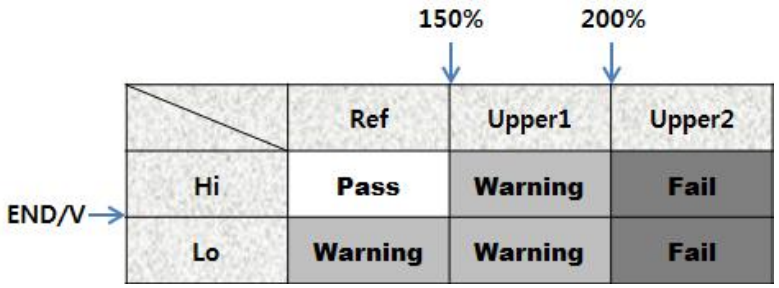
Present measurement Data can be holding if User wants to keep the data on LCD display. To enter DATA HOLD mode, press HOLD HOLD AHOLD-AREC key one time for a short time. (if press longer than 2 seconds, may enter other mode : Auto Hold-Auto Record mode)

- To release from “Data HOLD”, press HOLD HOLD AHOLD-AREC key for a short time.

3.6 Judgment of Battery Deterioration

Battery Deterioration can be judged based on measurement data of Battery Impedance (Internal Resistance) and Voltage

- ☐ Battery Reference Value (Example): 4mΩ, 1.6V.
- ☐ Standard to judge on Battery Deterioration.
- ◆ Impedance :
  - ☞ [WARNING] 6mΩ(1.5 times increased from Initial data: 4mΩ).
  - ☞ [FAIL] 8mΩ(2 times increased from Initial data: 4mΩ).
- ◆ Voltage :
  - ☞ [WARNING] 1.44V (90% of Initial data: 1.6V).



[Standard to judge on Battery Deterioration]

- Battery deterioration can be judged from Impedance. Impedance value usually increased by 1.5 ~ 2 times from Initial Data from new or good battery. There is little difference from manufacture even though same capacity.
- Measurement voltage decreased from Initial Data from new or good battery.

  Above Impedance and Voltage data can be a reference to judge Battery Deterioration.

4. Limit (Comparator)

4.1 Limit judgment function

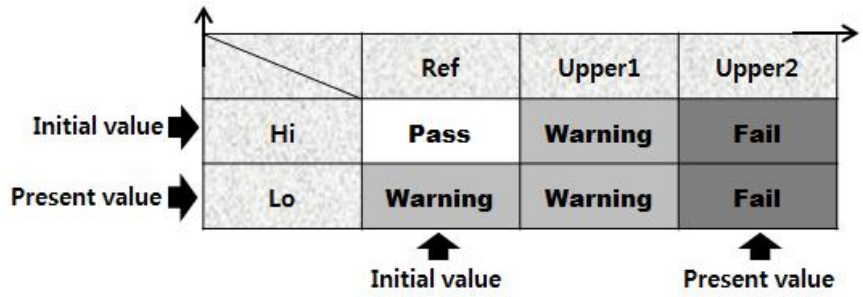
Compare Initial Set Up data of the Battery when installed and present measurement data of the Battery. Three rank rating can be found from the Comparison "**PASS, WARNING, FAIL"** status.

Beeper sounds at **WARNING, FAIL** status.

☐ Impedance : Upper 1 level Max Limit (**WARNING**).

Upper 2 Level Max limit (**FAIL**).

☐ Voltage : Minimum Limit (**WARNING**).



[LIMIT Setting]

- Press "Ω" Ω key (Impedance) and press F1 Limit... key. Then, Limit Set Up display is appeared. Select F1 ▣Limit to activate.

After LIMIT set up, measure battery and measurement result can be identified in one of Pass, Fail, warning.

- Limit set up can be done by User. Two kinds of Set Up method is available
  - ☞ Direct Setting Method.
  - ☞ Call from the data from D/B and setting.
- When there is measurement, main display shows 「---」 and Judgment result (Pass, Warning, Fail) does not display.
- When Power-Off the Analyzer, Already set Limit data is saved.
  When Power On and Limit "On". The last set data is displayed.
- Voltage judgment is based on absolute value. Therefore measurement in Reverse polarity of Test Probe also to be valid. (saved as Absolute value)

4.2 Limit function Operation Procedure

1) Limit function selection

① In Impedance measurement mode (Ω), select F1 Limit...

② At Limit setting mode, set up Limit value at F2 Recall...

or F3 Edit and press F1 ▣Limit to activate.

③ Press F4 Back key or "Ω" Ω key to complete Limit setting.

④ After setting, Function is converted to measurement mode . upper right of Screen shows Limit value already set.

⑤ After measurement is completed , to release the function of LIMIT,

press F1 ▣Limit and press F4 Back, Then Function is released and of LIMIT data at upper right of LCD screen is simultaneously disappeared.

2) Direct Input of LIMIT value

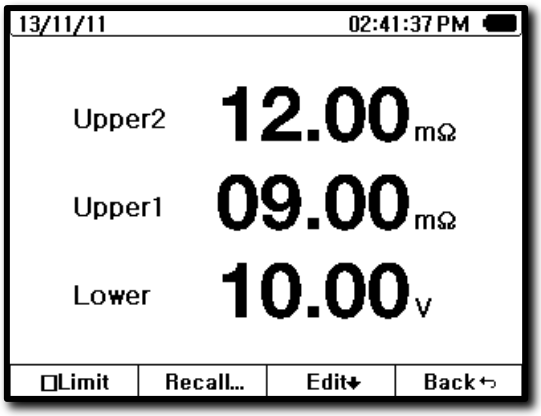
① At Limit setting mode, press F3 Edit Key.

② Press Direction Keys (Left/Up/Down/Right) and Encode Switch to set Limit value.

③ After Value is set, press F1 ▣Limit to activate.

④ After Setting and Selection is done, press F4 Back “ Key to convert to Measurement stand by status.

⑤ At Measurement Stand by status. LIMIT values are displayed at Upper Right of LCD screen.



[LIMIT display]

3)Setting data calling from D/B (Recall)

Recall the DB in the Analyzer and use it as Limit Value set up.

If select the Value saved in D/B, it automatically set up. Desired D/B can be selected by UP/Down ▲ ▼ key or Encoder S/W .

① At Limit set up mode, press F2 “Recall” Key to move to D/B.

② Select desired D/B by using Up/Down ▲ ▼ key or Encoder Switch.

③ After D/B is selected, press F1 “Limit” to activate

④ Set Up or Selection is completed, press F4 “Back” key or Encoder Switch to enter Measurement Standby status.

4.3 Judgment of Limit

Limit set up Upper 1 level Max Limit, Upper 2 Level Max limit of Resistance and Minimum Limit of Voltage.

[Example]

Reference (Initial Set up)Value: Resistance value and Voltage value of New or Good battery (0.4Ω, 2V).

☞ Resistance Upper 1 Max Limit: 0.6Ω (1.5 times of Initial Value)

☞ Resistance Upper 2 Max Limit: 0.8Ω (2 times of Initial Value)

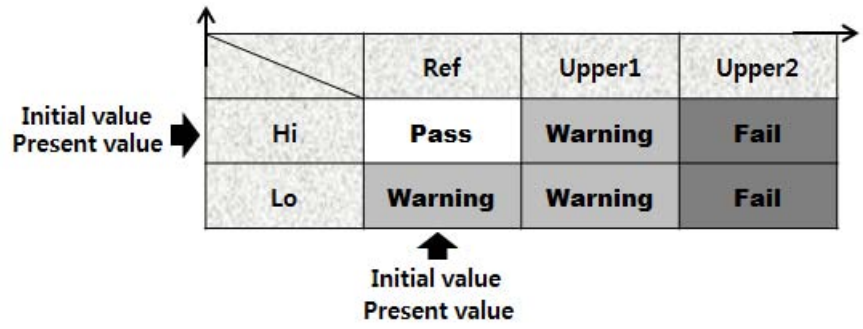
☞ Voltage Minimum Limit: 1.8V(90% of Initial Value)

[Set Up standard of Upper Max Limit and Lower Minimum Limit can be little different from Battery Type and Battery Manufacturer. Before set up, make sure this matter. Above is example of general standard]

[How to evaluate LIMIT – Comparator Table]

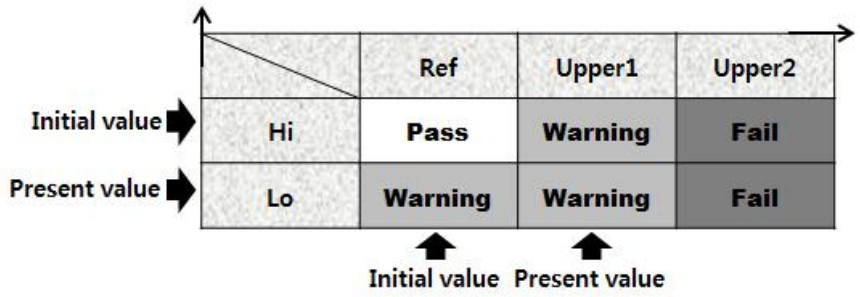
- Measured value of Resistance is lower than Upper 1 Level Max Limit, If Voltage measured simultaneously is higher than Minimum Limit “Pass”, If Voltage measured simultaneously is lower than Minimum Limit “Warning” light on.
- Measured value of Resistance is higher than Upper 1 Level Max Limit and lower than Upper 2 Level Max limit. If Voltage measured simultaneously is higher or lower than Minimum Limit, both case “Warning” light on with Beeper sound.
- Measured value of Resistance is higher than Upper 2 Level Max Limit. If Voltage measured simultaneously is higher or lower than Minimum Limit, both case “Warning” light on with Beeper sound.
- Any of Resistance or Voltages exceeds Limit, “Warning”or “Fail” message appear.

[If Judgment is “**PASS**”]



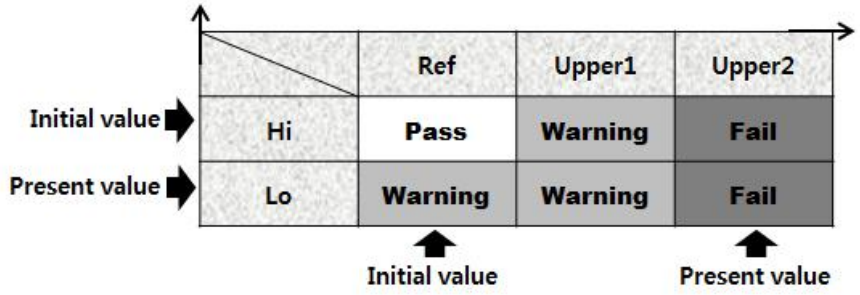
- Resistance is lower than Upper 1 Level Max Limit.
- Voltage is higher than Minimum Limit.

[If Judgment is “**WARNING**”]



- Resistance is below than Upper 1 Level Max Limit. Voltage is below than Minimum Limit.
- Resistance is higher than Upper 1 Level Max Limit. Voltage is higher than Minimum Limit.
- Resistance is higher than Upper 1 Level Max Limit. Voltage is lower than Minimum Limit.

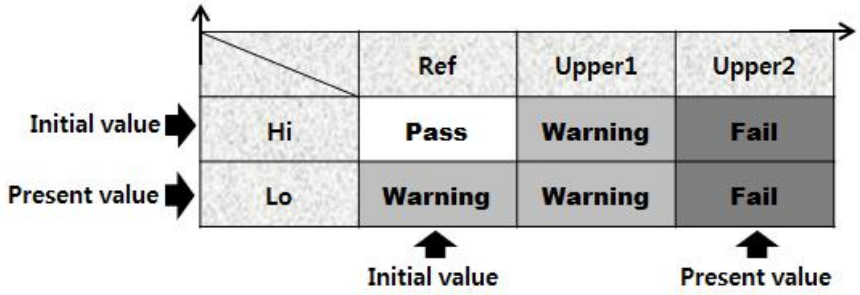
[Judgment is “**FAIL”**]



- Resistance is higher than Upper 2 Level Max Limit. Voltage is higher than Minimum Limit.
- Resistance is higher than Upper 2 Level Max Limit. Voltage is lower than Minimum Limit.

[Comparator -**LIMIT**]

- Judgment of Battery Status indicates with Display and Beeper sound as per following table.



- Conditions

1) Resistance: PASS≤ Upper 1 Level MAX limit≤WARNING≤Upper 2 Level Max Limit < FAIL

2) Voltage: WARNING< **Minimum Limit**<PASS

4.4 LIMIT function – Beeper Set Up

When judge the measured value with comparator, Beeper sounds depend on result of judgment. User can recognize the Result from different Beeper sound.

Judge Result	Beeper Sound
PASS	After judgment, sounds 1 time for short time(100ms).
WARNING	After judgment, sounds 2 times shortly(each 150ms).
FAIL	After judgment, sounds 1 time for long.(400ms)

4.5 Release LIMIT function

To release LIMIT function, in LIMIT set up mode, select F1 F1 " Limit" to stop the Limit mode.

5. Record Record

5.1 Record function

Save the measured data to Internal Memory or recall the saved data. Press RECORD Record key.

Saved Data includes "**Date, Hour, Resistance Value, Voltage Value, Temperature,**

Comparator Limit value, Judgment Result".

Saved Data can be recalled and display form in Trend Graph which is very useful for Deterioration Trend Analysis.

Saved Data can transmit to Computer for Storage in Computer memory.

5.2 Record Diagram

Memory Format is consists of 251 unit (bank).

There are max 251 Unit (including 1 Open Unit No : 000 - Reference D/B not registered and Registered Unit No: 001 ~ 250 : Reference D/B registered)

I unit has max 300 cells. 1 cell (battery) has 100 slot (measurement times)

Therefore, 1Unit (bank) - Length 300 cells x Width 100 Slot per cell

1 unit contains 30,000 data. Analyzer inside Memory can save total 251 Units which total 7,530,000 measurement data.

Unit	Cell	Address						
Open Unit	Cell001	001	002	003	..	098	099	100
	..	001	002	003	..	098	099	100
	Cell300	001	002	003	..	098	099	100
Unit 001	Cell001	001	002	003	..	098	099	100
	..	001	002	003	..	098	099	100
	Cell300	001	002	003	..	098	099	100
..	..	001	002	003	..	098	099	100
Unit 250	Cell001	001	002	003	..	098	099	100
	Cell300	001	002	003	..	098	099	100

1)Unit (Bank)

Total Battery Bank is consist of many battery which is connect to 1 UPS .

Batteries consisting Unit should be same Battery Model.

Each Unit takes a Reference Data which is selected from Impedance D/B.

When the measuring Unit Reference D.B is not registered ,

the Unit measurement is recorded at Open Unit No. 000. Open Unit may

have Limited Analyzer function including Trend Graph , Report Output through PC .etc.

Meter mode (Voltage, Current, Temp)measured at 

key function can be recorded at Open Unit only, while other Registered Units (No :001 ~ 250) can not record meter mode because the 001 ~ 250 Unit Reference D/B are already registered.

Addition , Correction and Delete of Unit can be done through PC Software

2)Cell (Battery)

Each Battery consist of Unit is called Cell .

Measure Each Cell maximum 100 times in order and record on each slot.
Record for references of Battery Deterioration Analysis.

Measure Cells while " A REC" is on . Cell number is increased by one by one and saved in order.

5.3 Record Display

Press Encoder Switch to call the Unit Index List ..

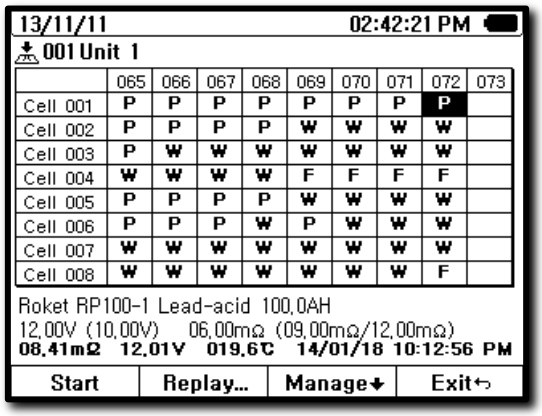
Use up/down/left/right direction keys on the Analyzer to select the Record Address..
List on the Display is RECORD SPACE of selected unit..

Wide is Slot number (001 ~100) of each cell , Long is Cell number (001~300)..

Data Recorded space indicates Judgment Result (P : Pass W : Warning F : Fail)

When select Unit, Reference Data of Unit shows at bottom.

Move Cursor to select the Recorded Address. then ,Recorded Data displayed at bottom .



5.4 Unit Set Up

Unit is the Group of batteries to be measured.

However Open Unit (# 000) does not have registered D/B which limits Analysis function. To use Analysis function, need to set up unit and D/B of the battery.

[Unit Addition on Unit]

① Press “Record” Record key to enter RECORD display screen.

② Press Encoder key (Big Round key at Center of Unit) to display UNIT LIST

③ Use Up/Down ▲ ▼ key to move to Vacant Unit number

④ Press F2 New Unit... key to convert to New Unit Page Display Screen

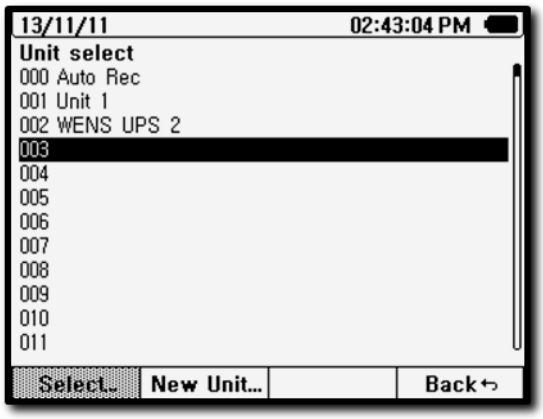
⑤ Use ◄ ► keys to select Reference data from D/B . And press F3 OK key to finish New Unit set up

⑥ Modification of Model Number , Manufacturer name need to be done through PC

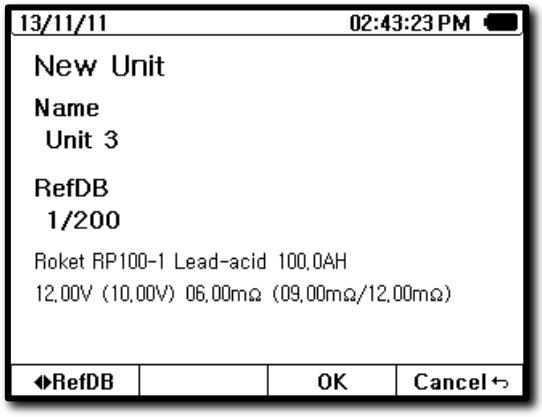
Software.

⑦ New Unit is displayed on Unit List .

Unit Add ,Edit can be done through PC software



[New Unit Number selection]



[New Unit Display]

5.5 Address set up

[Address set up Procedure]

① Press “Record”  key to enter setting menu.

② Select Unit and Address by Left/Right/Up/Down  direction keys or Encoder Switch.

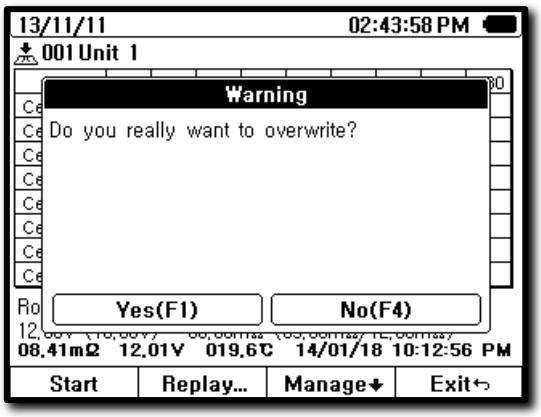
③ After selection of Unit and Address, press Encoder Switch or F1 F1 Start to complete setting and convert to record standby mode..

④ When operating at " A-REC" mode, automatically recorded at next address.

[NOTE]

When start Recording, please follow above procedure.

- If the address is already used or in use, it tells the status and ask whether to use next address or overwrite on already existing data in the address.
- If record without address, record at temporary room which is A-Record in order.
- When convert to measurement mode from record stand-by mode, selected unit and address are shown on LCD screen.
- If impedance value shows [----], can not record.



[Overwrite Saving]

5.6 A-REC (Auto Recording)

- "**Auto Recording**" function can transfer the measured data and automatically store in series simultaneously when measure the data.

[Operation Method and Procedure]

1) Auto Recording Operation Method

- Before start , select Record Address of the battery (please refer 5.5 Record Address set up)

- Press " AHOLD-AREC " 

key for longer than 2 seconds to display A REC symbol at upper LCD screen.
- When start measurement with Analyzer, once Auto Hold activates the measured data recorded at memory and recorded address is displayed.
- Recorded Data is stored in sequence of input. When filled up the record memory space 100 slots , first come first out base, stored data will be removed from 1st stored data and 2nd stored data as # 101 data and # 102 data come in storage room in memory.

2) Management of A-Record data.

- Unless Record Mode is not released, measured data is continuously recorded.
- To release A-Record mode, press "Record" 

key longer than 2 seconds. "REC NO"on LCD screen will also be disappeared simultaneously.
- Recorded data at A-Record can move to desired Unit, Address by Up/Down/ Left/Right  direction key and encoder switch.,
- When select address by Left /Right  direction key or Encoder Switch, information (measured date, time, item) of measured data displayed on LCD screen.

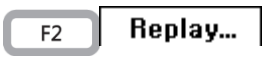
5.7 Replay of Recorded Data

Recall the Recoded data from memory and replay the data.

[Operation Procedure]

① Press "Record" 

Key for longer than 2 seconds to enter Initial Display of Record/Replay.

② Select the Replay Data from Recorded Data Address by Left/Right/Up/Down  direction key or Encoder Key. After select, press F2 

key to show recorded data on display.

③ When in Replay, Record Data with REC No is displayed on LCD screen.

④ To continue to Replay of other Recorded Data, press F4 [F4] [Back↩] while in replaying the data. Then, Initial Display appears and may proceed as above step 2.

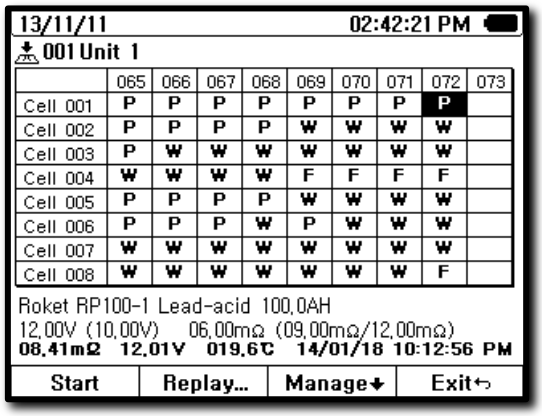
⑤ When convert to measurement mode, press any measurement key on Analyzer

[NOTE]

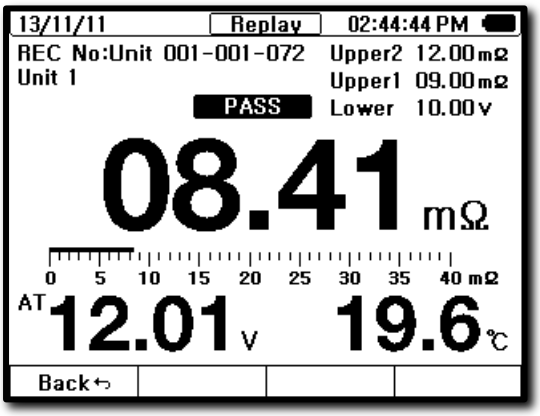
- If select Record Address, Record Data and Recorded Data are displayed at bottom of display.
- Limit judgment result also displayed together (If Reference (Initial) data of the Unit is set)
- If there is no Recorded Data, displayed in Blank.

[Replay LCD screen]

- Recorded Date will replay in LCD Screen – STILL status.
- Upper Center of Screen shows [Replay] "Replay".
- REC No of Replay Data shows at Upper Left of Screen.



[Replay Select]



[Replay Screen]

5.8 Erase of Recorded Data

[Operation Procedure]

① Press [Record] key to enter initial screen of Record

② Select [F3] [Manage↓] key

③ Select the Data to erase from Recorded Data Address by Left/Right/Up/Down

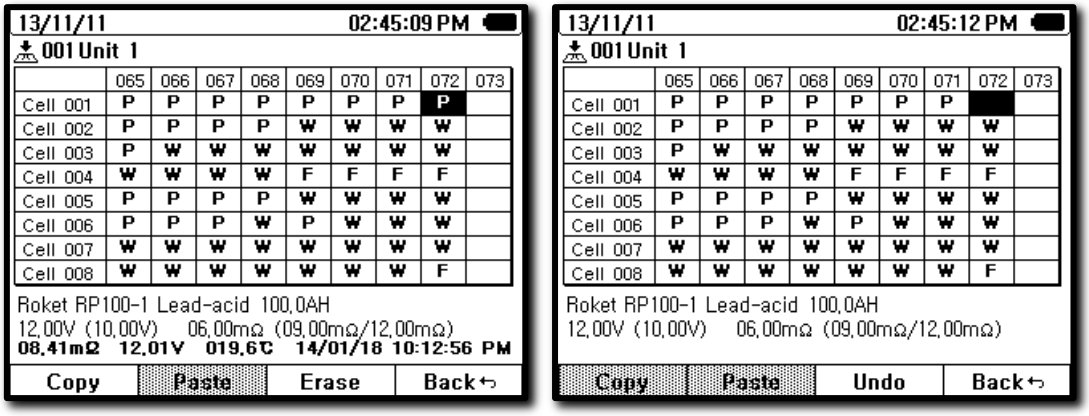
direction key

④ After Address is selected, press F3 Erase key to erase of the data.

⑤ If press F3 Erase key

To erase single data, press the key for a short time. To erase whole Unit record, press the key for longer than 2 seconds. Them A Pop Up widow will open and after Confirmation, whole Unit record can be erased.

⑥ Press F4 Back↩ to exit from the Erase function



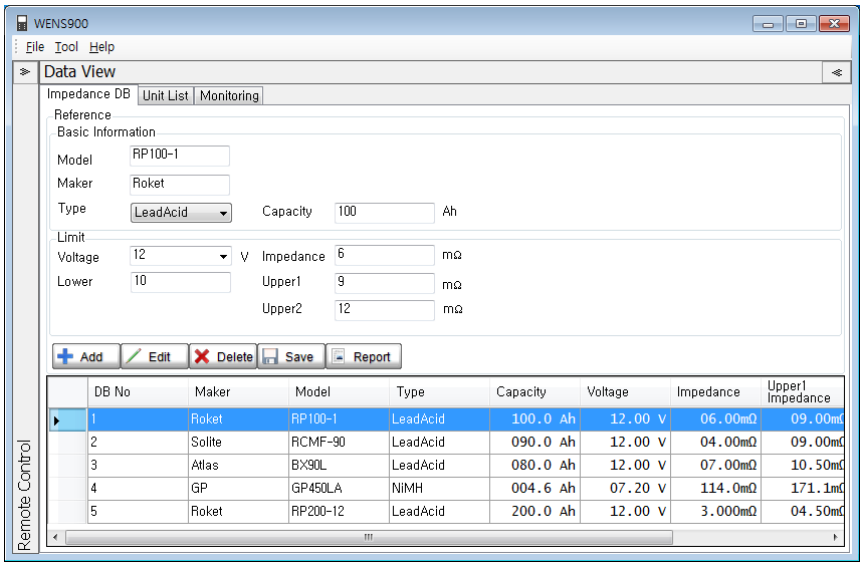
[Erase Data]

5.9 How to input Reference (Initial) Data

Each Battery Cell (unit) Reference Data can be little bit different each other under Battery Management System. Need to achieve the Battery Cell (unit)
Reference data (initial data) and input it to Data Base (D/B) in the Analyzer in advance. The Measurement Data (measurement periodically) after use the Battery will be recorded and accumulated in the Memory of the Analyzer to create Battery Trend Curve compare with the reference (initial) data and provide information of Battery Deterioration judgment (Battery Health)

After Record/Replay is selected, use left/right/up/down direction keys or Encoder

to select unit ,then, recorded DB data is displayed at bottom of display.



[Input Reference Input Display]

1) How to input from PC program

[Operation Procedure]

① Activate Analyzer after connecting PC Interface Software program.

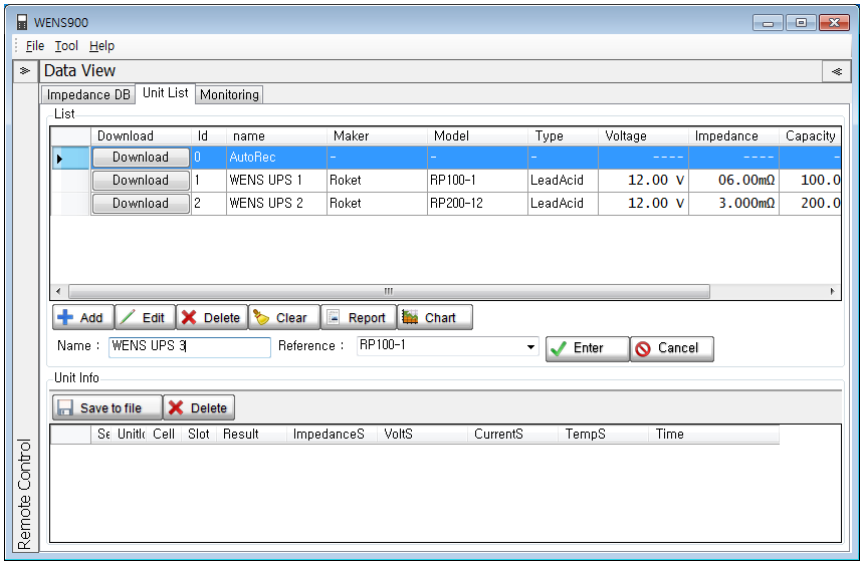
② Activate “Impedance DB” on PC program. .

③ Input reference data of New battery .

④ Press “ADD” key to store .

2) Unit information Input procedure

Input Location of Unit and Basic Information of Battery which support more efficient battery management. Use Impedance DB previously input as basic data information



[Unit Information Input]

[Input through PC Software]

① Click "Unit List" on PC Program window.

② Select Unit to input or correct Data .

③ Press ADD or Edit.

④ Input Location Information and select DB value in Reference.

⑤ After complete Input, press " ENTER" at right side of PC program .

⑥ Input Value is confirmed directly on display of Analyzer

[Input through Unit Program]

① At RECORD display, press Encoder key to display "Unit List"

② Move to vacant address through ▲ ▼ key.

③ Press F2 **New Unit** Key to enter NEW UNIT Display

④ Press F1 Reference D/B key and select Reference D/B by ◀ ▶ key

or Encoder key.

⑤ Press F3 **OK** key to complete.

Modification of Unit Name is available only through PC Program.

5.10 Move of Recorded Data

Move any specific measurement data stored in Auto Record to specific Unit for Management.

[Moving Procedure]

① At Initial mode of Record function, press F3 Manage key..

② Select Data of Address to be moved by left/right/up/down direction key or Encoder

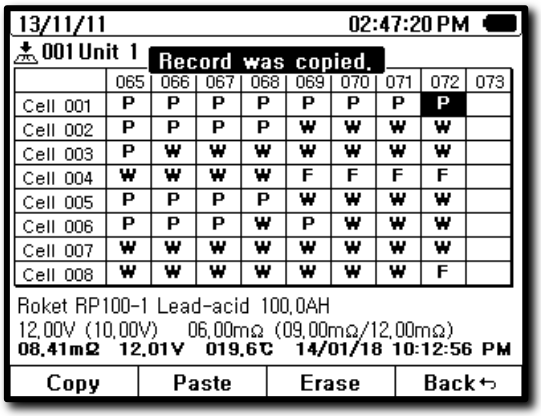
③ Press F1 Copy key to select data. . .

④ Select Final Address to be moved by Left/Right / Up/Down ◄ ► ▲ ▼ keys or Encoder key.

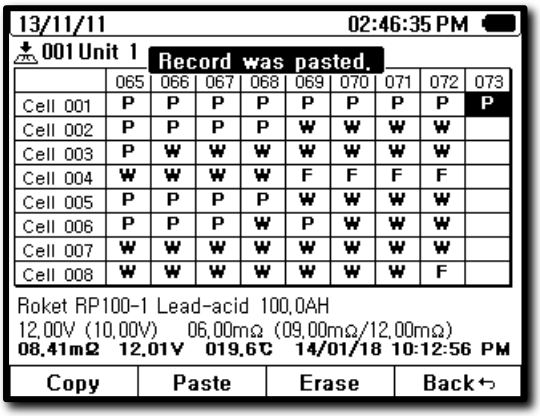
.

⑤ Select F2 Paste to move Data..

⑥ Press F4 Back key to return to previous display or press any major function key to measurement mode..



[Record Data Copy]



[Data Paste]

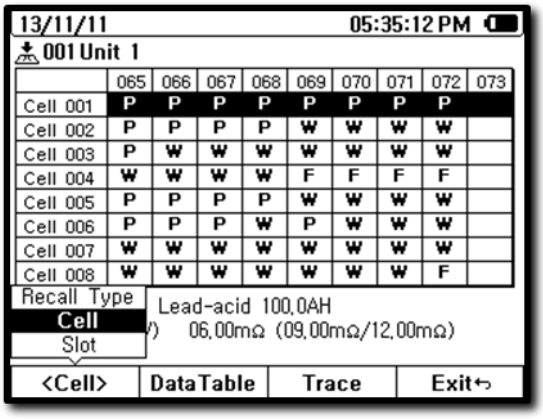
6. Analyzer

Analyzer function is very specialized and independent function.
Measured Data and Saved Values enable to judge the Battery Health in management precisely and enable to analyze Deterioration Trend and decide Time of replacement.

6.1 Recall

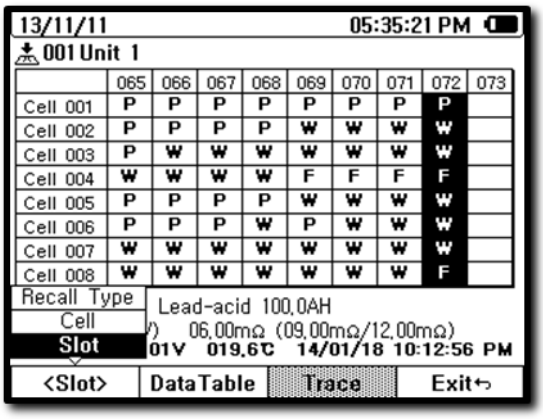
[Operation Procedure]

. Press “Analyzer” key for a short time to enter Analyzer function.
① When UNIT LIST is displayed on display, select Desired Unit to analyze
by Up/Down keys and press F1 Select.. key
② Press F1 Select.. key to select Data Type (Cell or Slot)
If want to see Deterioration Analysis on specific individual battery ,select “Cell”.
If press F2 F2 Data Table, recoded data is displayed in Table format
If press F3 F3 Trace, Trend Curve of Battery Deterioration is displayed.



[Analysis Selection : Cell]

If want to see measurement records done on many batteries at specific measurement time, select “ Slot



[Analysis selection : Slot]

6.2 Data Table

The function shows Recorded Measured Data in Data Table

□ When select “ Cell “

Data is displayed in the reversed order of Slot number.

Can analyze measurement vale change on specific battery (cell) by Measurement time base.

□ When select “Slot”

One measurement time(Slot), Impedance of many batteries are measured. If Batteries of unit installed at same time, date, Impedance of the batteries increase similar. If any Specific Cell shows higher impedance data than average data, the specific cell deteriorates in quickly than the others. Useful function to quick detect and manage such risky battery

□ **Battery Deterioration Order Sort Table**

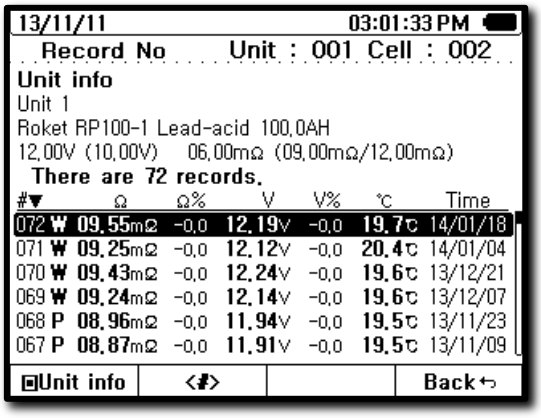
Sort by order of Impedance data, Voltage order or Measurement (Slot) time which is very useful to check and manage

1) Cell

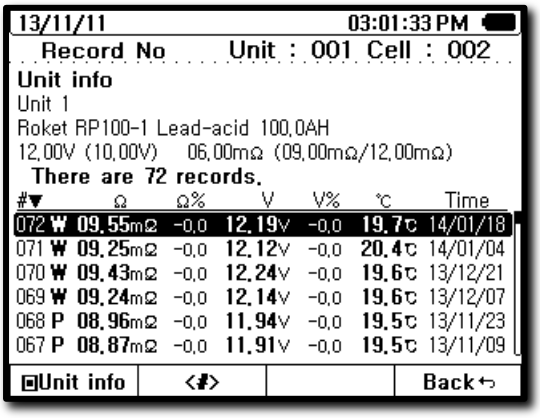
Accumulated measurement data of individual cell can be sorted by order from highend Impedance slot to lower impedance slot, from lower voltage slot to higher voltage slot or from latest measurement slot to older time slot.

[Operation Procedure]

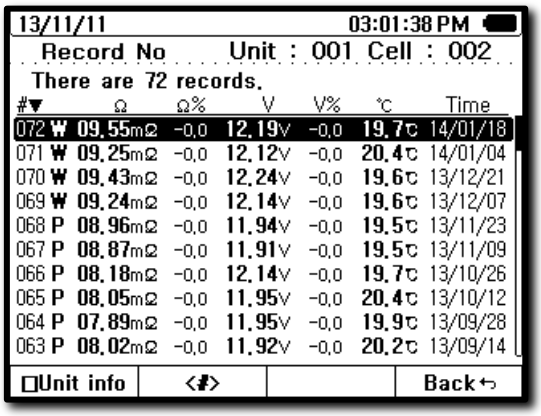
① Press Analyzer Analyzer Logger key to enter the Analyze
② When Unit List is on window, select "Unit"
③ press ▲ ▼ key to select Unit to analyze and press F1 **"select"** key.
④ press F2 **"call"** key to decide Data to call.
⑤ select " Cell "
⑥ press F2 **"Data Table"**
⑦ press F1
⑧ press F2 **< # >** . Then, a pop up window showing # (slot number),**Ohm, V** is on, then select .



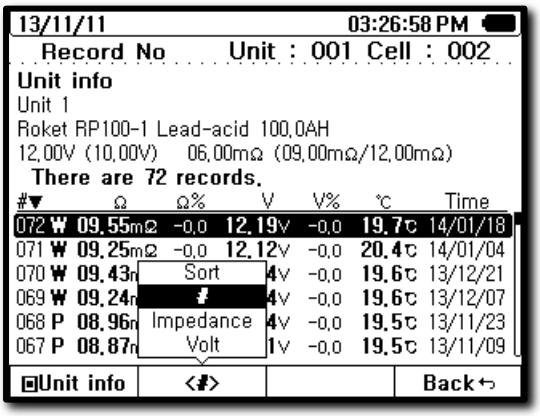
[Data Table display]



[Data Table display option]



[Data Table Unit Information Hide]



[Data Table Display Order Selection]

2) Slot

Accumulated measurement data of The multiple cells in the unit are measured same slot (measurement time). The cells can be sorted by order from highend Impedance cell to lower impedance cell, from lower voltage cell to higher voltage cell or from latest measurement cell to older time cell

[Operation Procedure]

① Press Analyzer Analyzer/Logger key to enter the Analyze

② When Unit List is on window, select "Unit"

③ press ▲ ▼ key to select Unit to analyze and press F1 **"select"** key.

④ press F2 **"call"** key to decide Data to call.

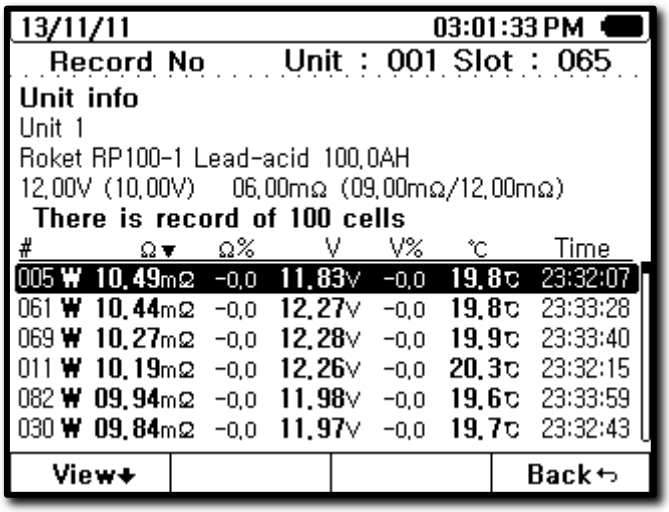
⑤ select " Slot "

⑥ press F2 **"Data Table"**

⑦ Press F1

⑧ press F2 **< # >** . Then, a pop up window showing # (cell number),**Ohm,**

⑨ **V** is on, then select one of them.



[Deterioration Order Table : Resistance]

6.3 Trace (Trend Curve Analysis) and Fitting (Battery Change Estimation)Trace (Trend Curve Analysis)

- Impedance, Voltage measurement data saved at RECORD -memory (in Unit/Cell address) are displayed in Curve Line which allows to observe the Trend of the change.

  Impedance, Voltage, Temperature line thickness are displayed differently for user Recognition convenience.

[Operation Procedure]

① Press Analyzer (Analyzer) (Analyzer/Logger) key.

② Press (F1) [Select..] UNIT-Cell

③ Press (F3) [Trace] to enter TRACE mode

④ Select Soft Key Menu (F1) [Zoom] (F2) [◆▶<Cursor>] (F3) [☐Fitting] as needed.

⑤ To exit from TRACE mode to previous mode , press F4 

Exit key .

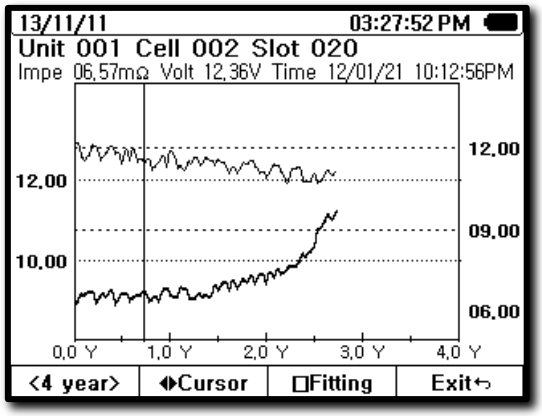
To exit from ANAYZER function, press Analyzer 

key for a short time.

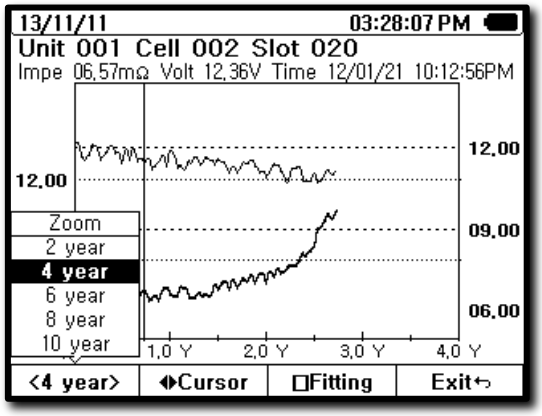
.

[Note]

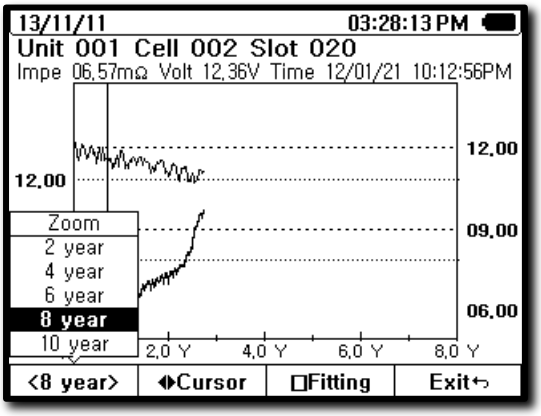
Measurement Number of dots (displayed in Line) is maximum 100 per cell.



[TRACE Display]

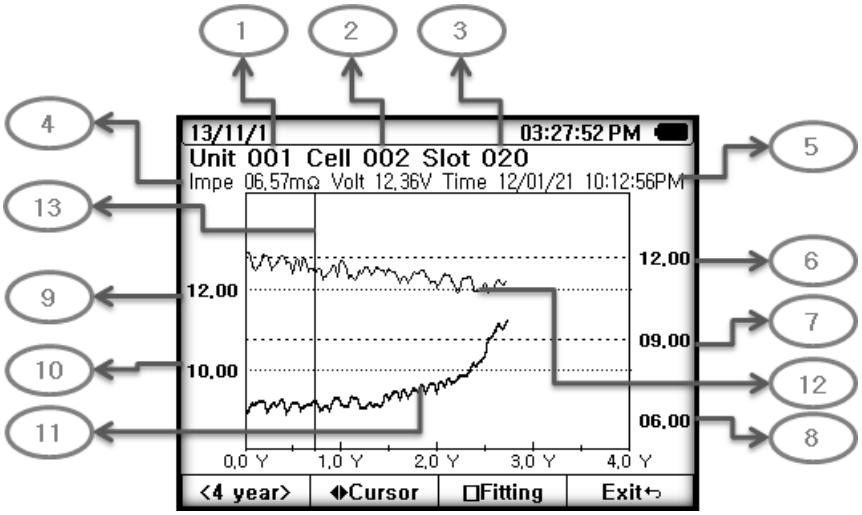


[TRACE Zoom : X Axis 4 year]



[TRACE Zoom : X Axis 8 year]

X Axis indicates TIME. Y Axis curve changes according to Impedance, Voltage measurement data.



① Unit (Bank) number.

② Battery Cell number.

③ Slot(Measurement) number of Cell 002.

④ Measurement Data (Impedance, Voltage) of Slot 20.

⑤ Measurement Time of Slot 20.

⑥ Upper 2 (FAIL)Impedance level of Cell. 002 (Reference Impedance x 2.0 times)

⑦ Upper1 (Warning) Impedance level of Cell. 002 (Reference Impedance x 1.5 times)

⑧ Reference Impedance of Cell. 002

⑨ Reference Voltage of Cell.002

⑩ Lower Voltage level of Cell.002 (90 % level of Reference Voltage)

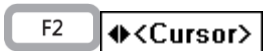
⑪ Impedance Trend Curve of Cell.002 based on saved measured data of Slot

⑫ Voltage Trend Curve of Cell.002 based on Saved measured data.

⑬ Vertical Bar (Cursor) to move left –right of Slot (measurement)



[How to select the Slot – measurement number]

Vertical Bar can pick up the Slot no- measured data and
Shows on upper top area of display. To see the other slot data
, press 

Key and use  key to move Slot bar to the required Slot no. Slot (measured Data can be max 100 slots (measurements) on Each Battery Cell.

Fitting (Battery Change Estimation)

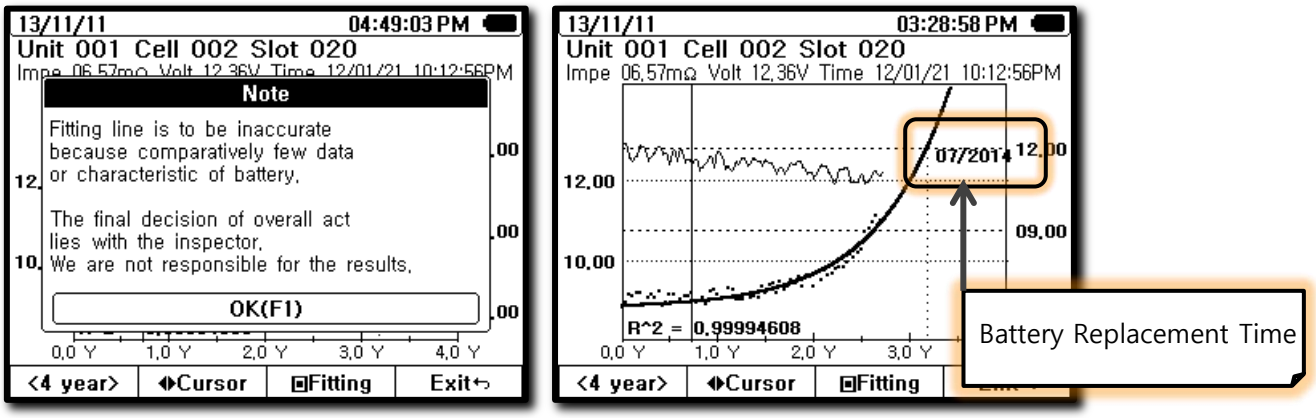
Battery Replacement Timing can be estimated roughly.
At TRACE mode, based on present Trend Curve, estimate when the Impedance Curve line may reach Upper 2 line.
Trend Curve , reaching time to upper 2 line, R- Squared value are displayed.

R-Squared value : indicates correspondence level between Estimate Trend Curve And actual data . 0 ~ 1 . When 1 or close to 1, indicates most stable, called Coefficient of Determination.

NOTE

Set Up of Upper 1(Warning), Upper 2 (Fail) are designed as per Chapter 4.2 Limit on this manual data. The Lines can be adjusted as per User decision and set up Data as per Chapter D/B Input 5.9 procedure

Trend Curve- Fitting is just based on mathematic calculation of Impedance, Voltage and does not apply various and complicated factors, characteristics of battery which may affect battery health and battery life.
Fitting Curve is for reference only which manufacturer of the Analyzer may not guarantee the accuracy of the data. Ultimate decision is to be made by User.



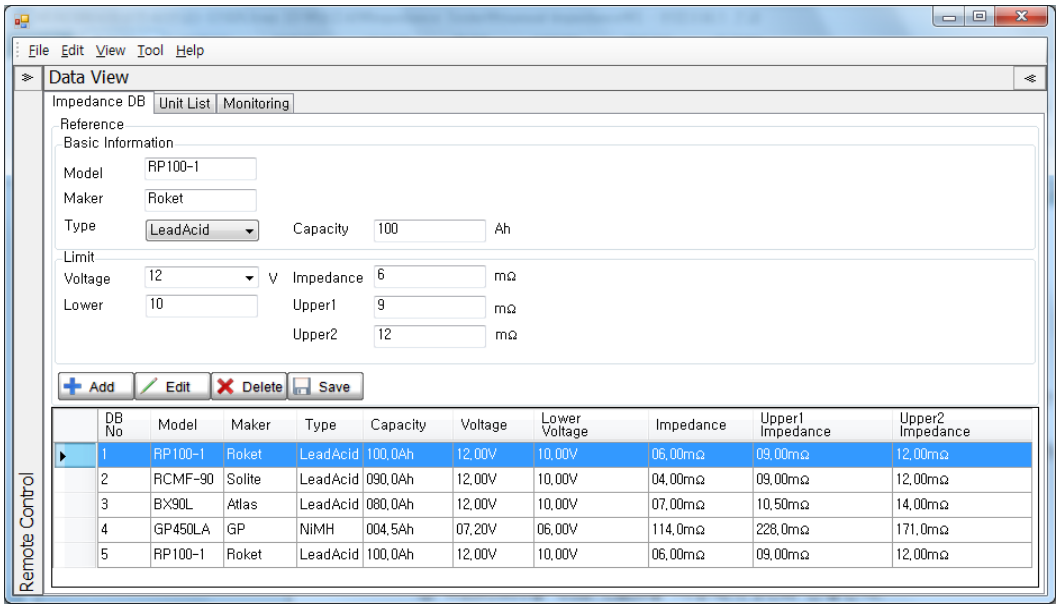
[TRACE – Fitting]

7. Data Base (D/B)

Data Base is the Reference Data (Initial Data) of Battery in management which evaluating and analyzing Battery Performance.

Reference data in Data Base is saved by Battery Type and Battery Manufacturer which is consist of Battery type, Battery Manufacturer, Impedance, Battery Voltage.

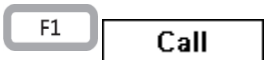
Reference Data saved in Data Base can use to Limit Set Up and Trace function in Analyzer as reference data which help judgment of battery deterioration



DB No	Model	Maker	Type	Capacity	Voltage	Lower Voltage	Impedance	Upper1 Impedance	Upper2 Impedance
1	RP100-1	Roket	LeadAcid	100.0Ah	12.00V	10.00V	06.00mΩ	09.00mΩ	12.00mΩ
2	RCMF-90	Solite	LeadAcid	090.0Ah	12.00V	10.00V	04.00mΩ	09.00mΩ	12.00mΩ
3	BX90L	Atlas	LeadAcid	080.0Ah	12.00V	10.00V	07.00mΩ	10.50mΩ	14.00mΩ
4	GP450LA	GP	NiMH	004.5Ah	07.20V	06.00V	114.0mΩ	228.0mΩ	171.0mΩ
5	RP100-1	Roket	LeadAcid	100.0Ah	12.00V	10.00V	06.00mΩ	09.00mΩ	12.00mΩ

[Data Base Initial Display]

- Press DB/User  Key for a shortly one time to enter DB mode.
- To observe DB Data, use Up/Down  key or Encoder Switch. DB address and Data displayed simultaneously.

- Press  to set up DB Data as reference data and Limit is automatically set up.

- Release of DB function can be done by pressing other function key.
- Add or Delete of DB Data can be done through Computer only.

7.1 Saving Data Base

[Information in DB]

- DB No
- Battery Voltage
- Capacity
- Impedance
- Model Number
- Maker

7.2 Data Base function

- Before analyze Battery, recall the Reference Data of Battery in management saved in DB and use as Battery Basic Specifications.
- At Limit, press F1  “Call” key to automatically convert to DB mode and set up DB data as Reference data by using Up/Down key. Then Limit is working.
- In Analyzer function, data measured periodically are saved by unit. The DB is used as reference data when evaluate Data Change status or Trend of Battery Deterioration.

7.3 Recall DB Application at Limit

• At Limit function, without input Maximum Limit and Minimum Limit, Recall the Data in saved in DB and use as reference to set up Limit.

• At Limit function, press F2 [F2] "Recall" to activate whole contents of DB.

• Use Up/Down [▲][▼] or Encode key to select desired "DB No" and press F1 [F1] " CALL "key

• DB is used as reference data of Limit setting.

7.4 DB Application at TRACE in Analyze mode

• In Analyzer mode, use DB data (reference data saved by each unit) to judge Battery Deterioration with Trace.

• Reference data is saved at Record Unit의 "000" cell of Record unit.

• Input procedure of reference DB is available only through PC program .

7.5 Input and Erase of DB

Input, erase and modification of DB in the Analyzer is available only through PC Program.

• Load PC Program on Computer.

• Connect the Analyzer (mini USB port) to Computer with USB cable.

• Click "ON" on PC Program Initial Screen .

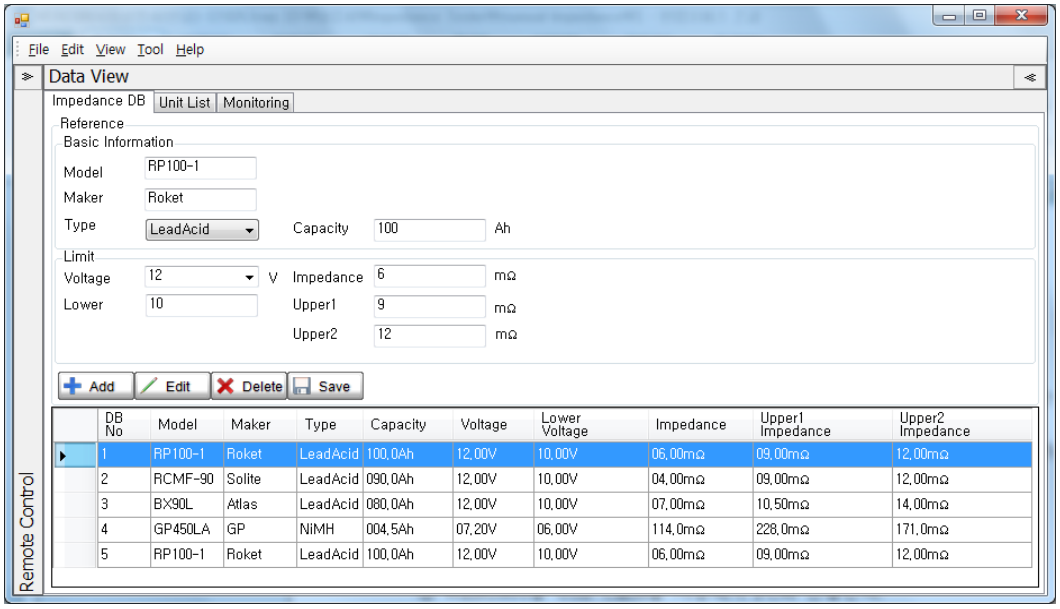
• Click " Impedance Data Base" in the menu

• When add DB data, input battery data in " Basic Information" in order and click"ADD" to complete data Input.

• When correct the DB Data already saved, first Click the DB No . Second, correct the data in " Basic Information" and press "Edit" to complete the correction.

• When delete the DB Data, click DB no and click " Delete"

- When input DB data, DB No is automatically created.
- Input Data: Battery Type, Capacity, Model Number, Voltage, Impedance, Manufacturer.



DB No	Model	Maker	Type	Capacity	Voltage	Lower Voltage	Impedance	Upper1 Impedance	Upper2 Impedance
1	RP100-1	Roket	LeadAcid	100,0Ah	12,00V	10,00V	06,00mΩ	09,00mΩ	12,00mΩ
2	RCMF-90	Solite	LeadAcid	090,0Ah	12,00V	10,00V	04,00mΩ	09,00mΩ	12,00mΩ
3	BX90L	Atlas	LeadAcid	080,0Ah	12,00V	10,00V	07,00mΩ	10,50mΩ	14,00mΩ
4	GP450LA	GP	NiMH	004,5Ah	07,20V	06,00V	114,0mΩ	228,0mΩ	171,0mΩ
5	RP100-1	Roket	LeadAcid	100,0Ah	12,00V	10,00V	06,00mΩ	09,00mΩ	12,00mΩ

[Data Base Input Display]

8. Auxiliary Functions

8.1 Auto Power Off

The function is activated when the Analyzer is working by Battery installed inside. This function does not activate if the Analyzer is powered through AC Power adapter.

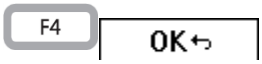
When user forgot to power off of the Analyzer, Auto Power Off function works to save the Battery Power Consumption and prevent shorten battery life from complete discharge.

- Works only when Battery is used as power of Analyzer. When there is no input signal within the preset time, power is automatically off.
- Auto Power Off time can be set among OFF, minimum 10 minutes to maximum 1 hour at User mode.
- When use power through AC Adapter, Auto Power Off function is automatically cut off.
- Initial set up (Default) is set up with 30 minutes. User can set up desired time at User mode.
- When use Analyzer long time and when the Auto Power Off function does not need, set up OFF to release the function.

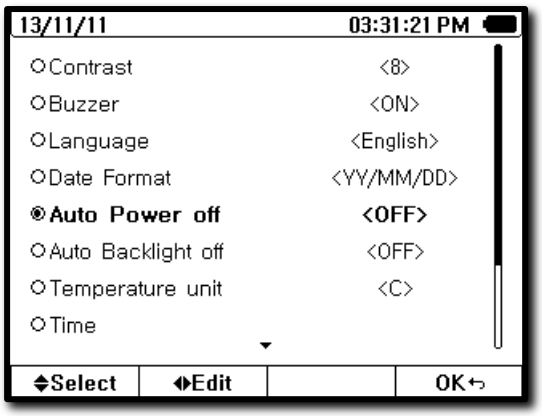
- When Power On again while Auto Power Off is working, the Auto Power Off setting does not change.

[Operation Procedure]

- Press DB/ User 

key for longer than 2 seconds to enter User mode.
- Select Auto Power Off with Up/Down  keys.
- Use Left/Right  to select Auto Power Off time.
- After selected, Press Enter Key or 

key to set.
- If press Exit key, Setting is completed and proceed to previous measurement mode.



8.2 Low Battery Warning

Remaining Battery power of NiMH Rechargeable Battery Pack installed inside of Analyzer is displayed in BARGRAPH form at Upper Right corner of the Analyzer. This function gives information of low battery to user to prepare inconvenience from battery power shortage in advance.

[Remaining Battery Indication]

Indication	Status
	NiMH Battery is fully charged.
	After continuous use approx. 1 hours.
	After continuous use approx. 3~4 hours.
	After continuous use approx. 5~6 hours.
	No Remaining Power. Beeper sound.

- When use Battery or AC Adaptor, the Symbol of Battery or AC Adapter is displayed on Upper Right on LCD Screen.
- If connected with AC Adaptor, Battery Symbol is disappeared.
- If disconnect AC Adapter, Battery symbol is appeared.

8.3 User Mode 

User can set up many functions as needed.

[User Set up Functions]

- Contrast
- Buzzer On/Off
- Language
- Date Format
- Auto Power Off
- Temperature Unit
- Time
- Factory Reset
- Device Information
- Auto Power OFF

[Operation Procedure]

① Press DB/User 

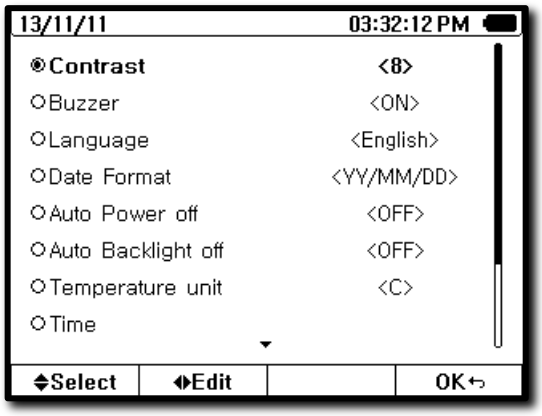
key longer than 2 seconds to enter User mode.

② Select function to set by Up/Down 
keys.

③ After function is selected, Change setting by Left/Right 
keys or Encoder Switch.

④ After setting is changed, press Enter key to complete Setting and Save.

⑤ Enter F4 [F4] Exit Key to enter Measurement mode.



[User Menu Initial Display]

[Contrast Adjust]

- Set Brightness of LCD Screen: Can change between 1 ~ 15 steps..
- Initial Set Up (Default) is set in 8 steps

[Key Buzzer]

- When Function key is pressed, Beeper sound
- Initial Set up (Default) is ON.
- Can change to OFF.
- When operates Key Scan, Over Voltage, Limit, Beeper activated.
- No Beeper symbol displayed on LCD Screen.

[Language]

- Help language set up.
- Initial Set Up is English, Korean

[Date Format]

- Display Method: Year, Month, Day
- Initial Set up is Year –Month -Day.
- User can change to Day -Month-Year

[Time Setting]

- Time Setting: Hour-Minute-Second.

[Auto Power OFF]

• Auto Power Off time setting: OFF, between 10 min ~1 hour

• Initial Setting (Default) set as 30 minutes.

[Temperature Unit]

• Temperature Unit can be selected ℃/℉.

• Initial (default) set up is ℃.

[Device Information]

• System Information loaded.

• F/W Version No

• System Format

[Factory Reset]

- Initiate All System of the Analyzer while using: Operates at User mode.

- When this function is activated, convert to Factory Mode.

8.4 HELP 

Brief Information on each functions are described on HELP mode.

HELP function is to help User to understand Measurement Functions or other functions.

[Operation Procedure]

• Press Help 

key to convert to HELP mode and Explanation is displayed on LCD Screen.

• If HELP has multiple pages. Use Up/Down 

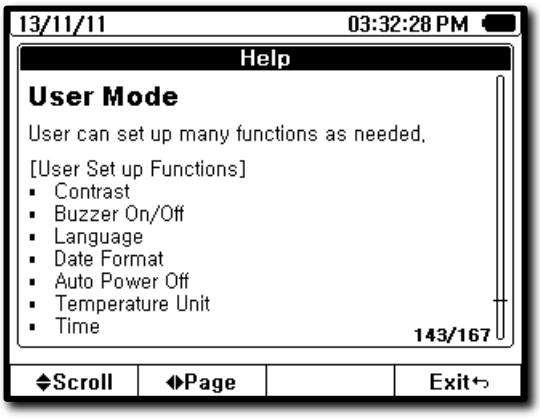
key or Encoder Switch to read.

• To release HELP. Press Exit key or other function keys.

• HELP mode support multi language. Select Language at USER mode.

press 

key longer than 2 seconds to enter and select Language.



8.5 Others

[Warning Display]

- In Auto Ranging mode, when input over M
- In Manual Range mode, when Over Voltage.

[Power Key] Power

• Press Power ON/OFF F4 key longer than 2 seconds.

[Encoder Switch]

• Rotate to Clock direction or reverser clock direction as Left / Right ◄ ► direction key function.

• ENTER: push down. Enter Key (Confirmation of Function Setting)

[Left/Right/Up/Down direction ◄ ► ▲ ▼ Key]

- Find function or change the setting value.
- Use when Limit or User Mode setting.

[Auto/Manual] Range

• When change from Auto ranging to Manual ranging mode, Press Range key for a short time.

- While in Manual Ranging, press “Auto/Range” 

key shortly to move the measuring range. One range move per one time press (short time) of Auto/Range 

key.
- When change from Manual Ranging to Auto ranging, press the Key 

longer than 2 seconds.

[Note]

- Impedance: Auto /Manual Ranging
- Voltage: Auto / Manual ranging (Initial Set at Auto ranging)
- Currents: 400㎃(Fix), 40A/400A(Manual)
- Temperature : Fix Range

[HOLD/ Auto Hold – Auto Record] 

• Press Key (for a short time) to enter HOLD. To release HOLD, press Key for a short time.

• To enter Auto Hold, press key for longer than 2 seconds.

• To release from AutoHold, press key for longer than 2 seconds,

[F1~F4] 

• Subsidiary Function key. Use when Impedance, Voltage, Analyzer, Logger, User, Record, Replay mode.

[Adapter]

- Main Power supply of the Analyzer is NiMH (7.2V) battery.
  Use 2 x (3.6 V) battery Packs on the Analyzer. When Battery Power is not available, AC Adapter (12V/1A) is also used as main power supply.
- When insert AC Adapter to the Analyzer, Operation is done by Adapter power supply, while maintain power is supplied to Battery to continue Charging.
- When the Analyzer is operated by AC Adapter, Auto Power OFF (Default) function is released.

9. PC Interface Program

9.1 Description

By connecting USB cable, The Analyzer can transmit the Measured Data in internal memory of Analyzer or Data in present measurement to Computer at real time. Through Compute, Available Data Management, Data Analysis, Program Update, input Referenced Data to Data Base in Analyzer. In order to communicate between Analyzer and Computer, following Software set up procedure is required. Software Program can be set up through supplied Software CD or Download Software Program from manufacturer website.

9.2 Suggested Operation Environments

- OS Windows XP,Vista, 7
- True Color(32 bit) or more
- Memory 128 MB or more
- HDD capacity 20MByte or more
- Interface USB Version 2.0

9.3 Connection between Analyzer and PC

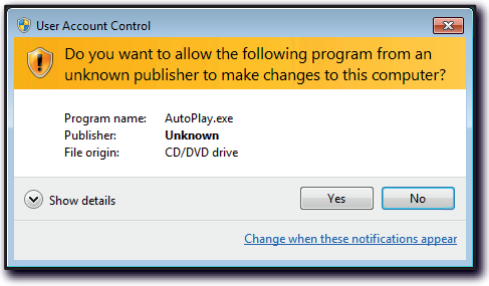
Before connect Analyzer with Computer, please install PC Interface program of Analyzer to PC

- After Power On, enter User Mode and select USB ON at USB ON/OFF
- In order to communicate between Computer and Analyzer, USB mini type socket is provided at below the AC Adapter power port at right side of Analyzer.
- Before USB communication, Driver should be installed at Computer.
- USB cable is recommended to use as supplied with the Analyzer. When use other USB cable, please make sure that cable should have same type, specifications of original USB cable supplied from manufacturer.

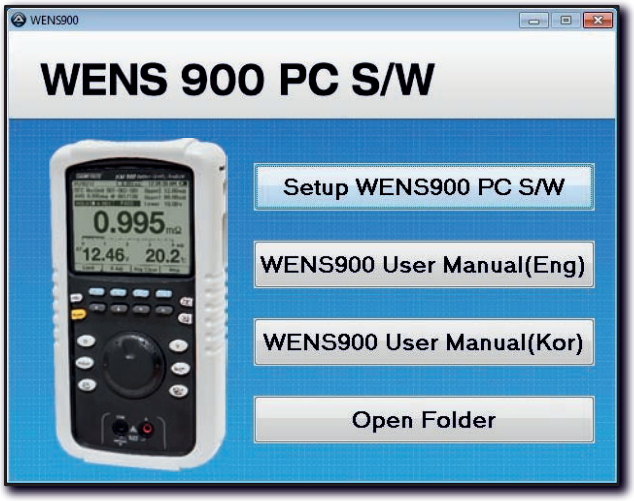
9.4 PC Interface Software Installation Procedure

- If insert Interface Software (CD) to PC , following Selection menu is shown

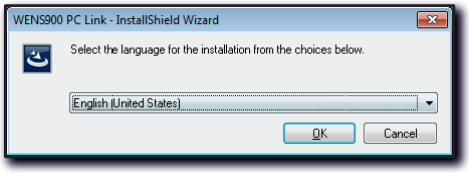




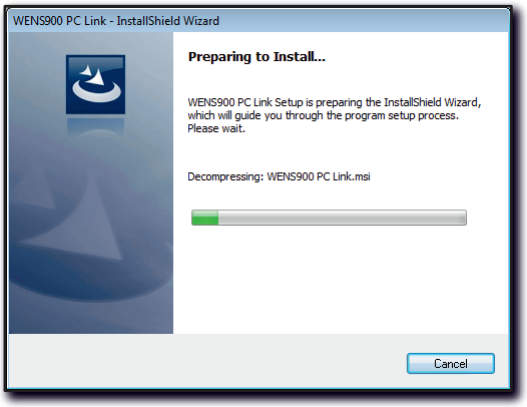
- Select "Auto Play" User Authorization Click " Yes"

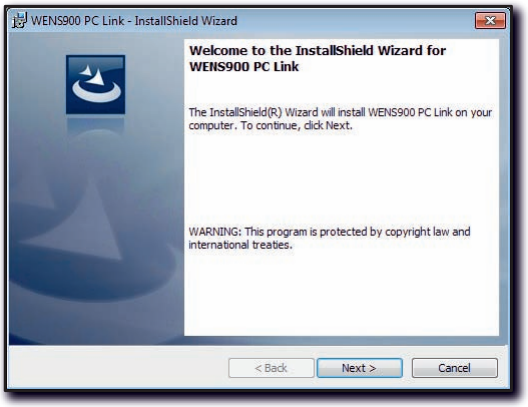


- Click " Setup WENS 900 PC S/W "

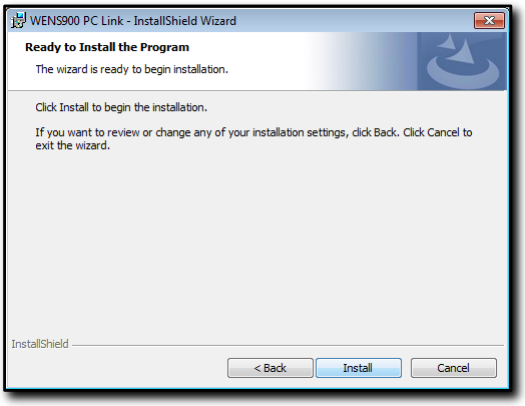


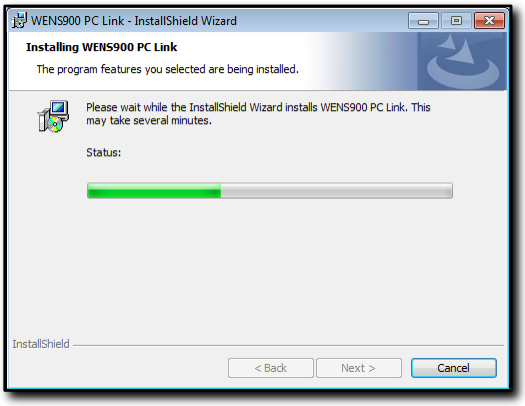
- Select language " English "



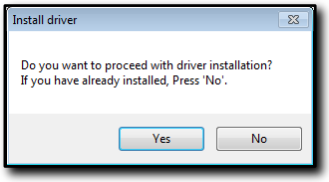


- Click “ Next”



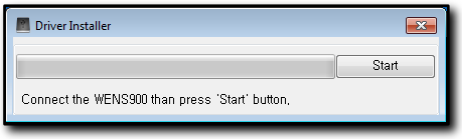


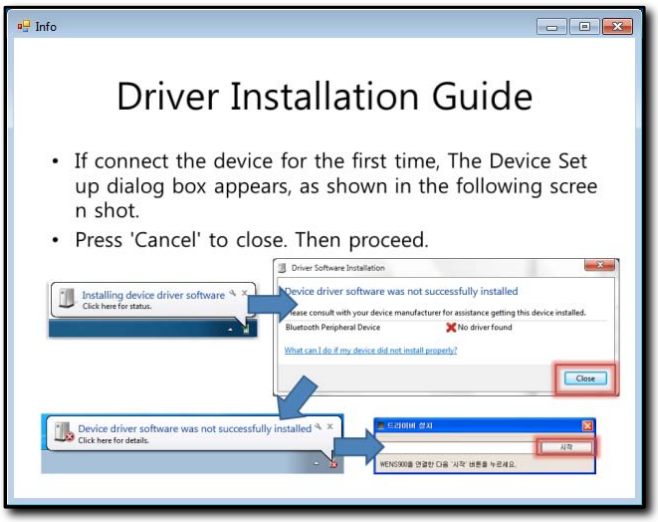
- After Click “ Install” , wait for a moment.



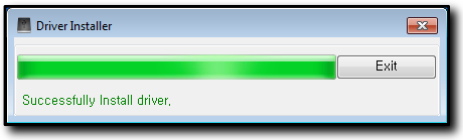
If 1st installation, click “Yes”. Then, Installation Driver starts

If already installed , click No “ No”

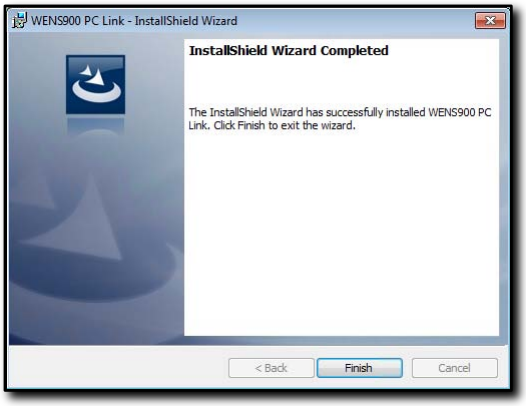




- If connect the system first time, Driver Installation starts automatically at Window. Be sure to close other open windows. Otherwise Driver installation may be failed.



- If click “ Start “ , after a moment, Driver Installation is completed.



- Click finish “Finish” , then, Software installation is finished.



- ICON will be made at bottom of PC display Screen.

9.5 Removal of Software

If Analyzer is working while connected with Application Software, Separate it from Analyzer and remove it.

☞ [Start]-[Control Board] select [Program Add or Delete]

☞ Select [900 Software] and click [Delete]

9.6 How to use Software

[Connection between Analyzer and Computer]

① .Connect USB cable between Analyzer and Computer

② Double Click the SOFTWARE Icon on Computer Display screen.
Then, Software Initial Screen will be displayed.

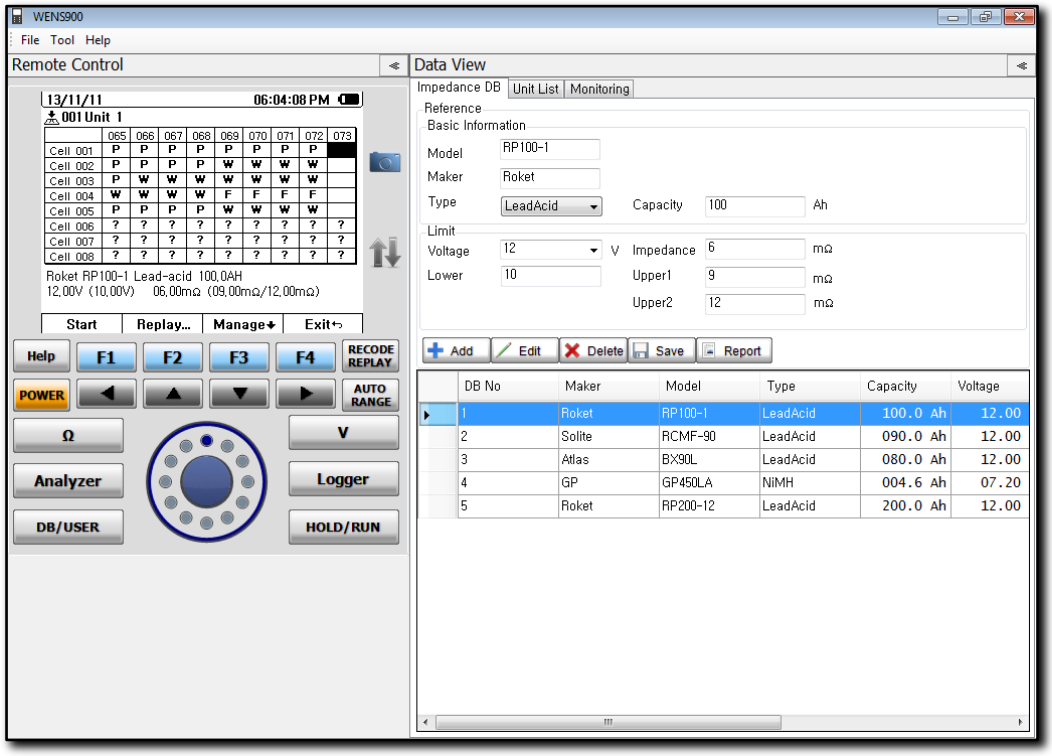
③ Power On 

Analyzer

[Note]

• If USB cable is not connected, An Error comes

• When PC Interface is working, Auto Power Off function on Analyzer is shut off.



[Initial Screen]

Interface Program Structure

• Left half block of window is for Remote Control (Control panel)
LCD screen of present Analyzer is displayed simultaneously at real time base.
Lower block is buttons same as Analyzer.

• Right half block of window is D/B, Measurement Record, menus for PC Log of Analyzer (Data Panel)

• When either Control Panel or Data Panel does not need to display, user can Remove or Recall it with button ≫ ≪ on Display

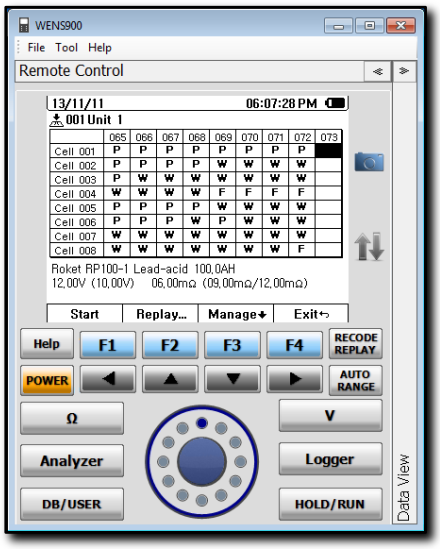
1) Remote Control

• PC Interface can control Function of Analyzer same as Analyzer can control function

of Computer program

- Screen Capture of Present display is available if click  at upper Left of Computer Screen.

- Check Interface Status of Data:  at Middle Left area of Computer indicates LCD screen of present Analyzer is displayed at Present PC Screen. simultaneously at real time base.



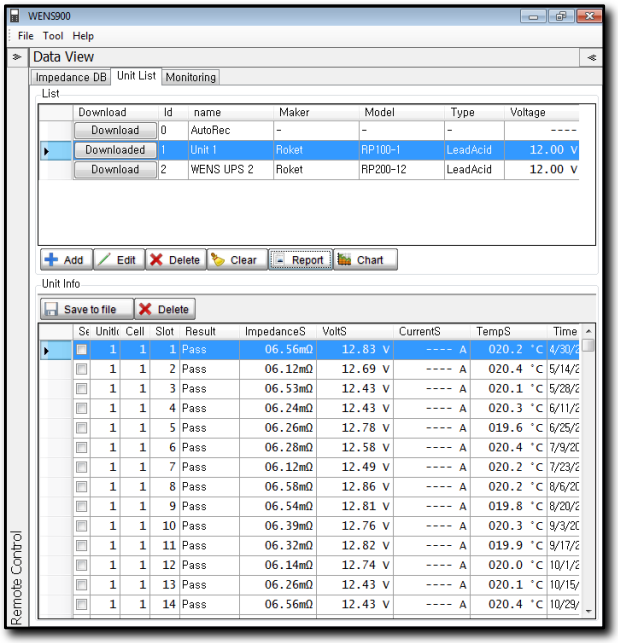
[Control Panel]

2) Management of Recorded Data

Manage the measured data and store. Maximum 7,530,000 data is available to store.

Data is stored and managed as below

- Data of Unit (Name,Reference, Battery D/B)
- Addition, Edit ,Delete of Unit
- Data Display recorded on Unit (Impedance, Voltages, Temperature,Comparator result)
- Delete of record on Unit (individual delete, vacant)
- Measurement Data - Saved in Excel file



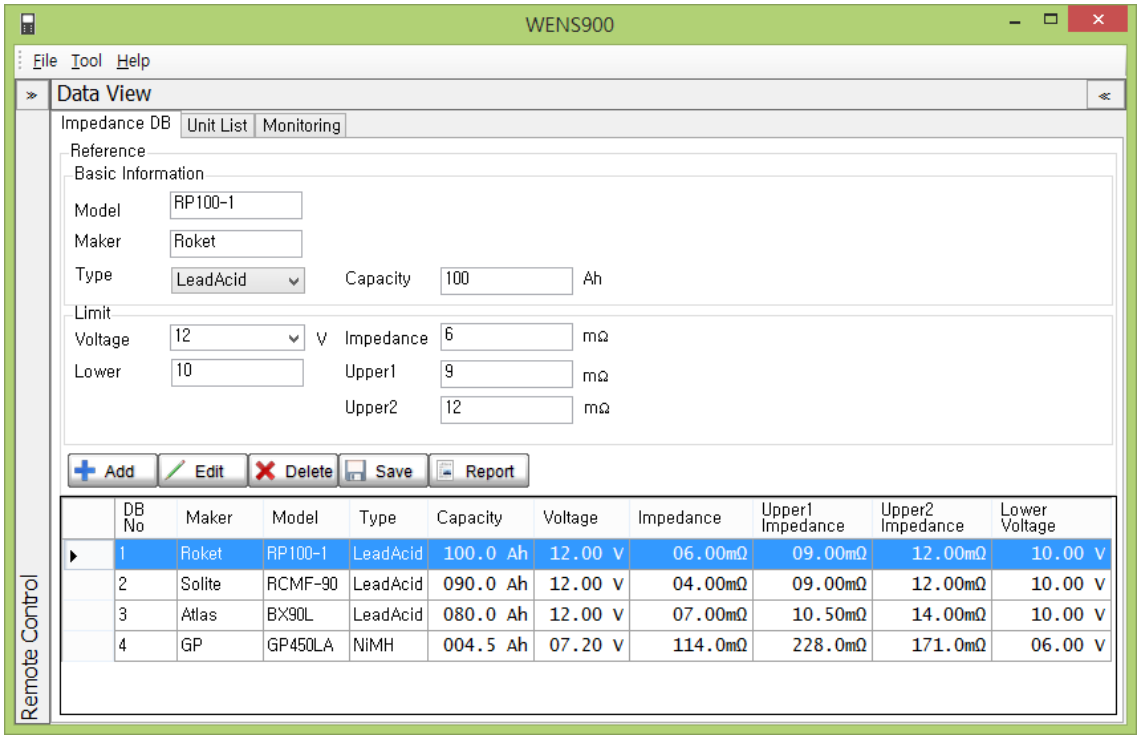
[Recoded Data Management]

3) Data Base

To judge battery deterioration and Battery aging with the measured data, can input and modify Battery Manufacturer, Battery Type, Capacity, Model number, Voltages, Impedance etc.

[Available functions at PC Program]

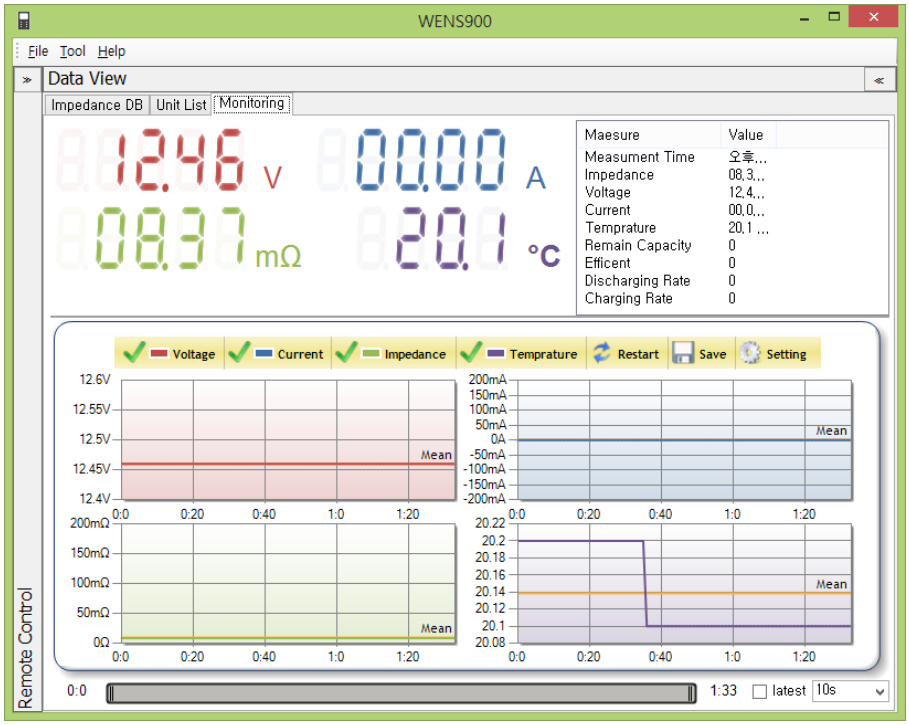
- Data Base Add, Edit , Delete
- Data Base into Excel file
- Data Base number: Maximum 200



4) Monitor

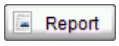
While Analyzer and Computer is connected, measured Data in the Analyzer transmit at real time base to Computer and display or save the Trend of Value in Graphic format.

- Measurement Value on Analyzer displayed same on Computer monitor.
- Measurement and Calculation value are displayed in Index.
- Measurement Value display in Graphic at real time base.
- 1 ~ 4 Graphs can be selected to draw. Maximum 4 Graphs can be drawn simultaneously.
- Drawn Graphs are available to save at Computer.



[PC Monitor]

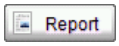
5) Report

a) Report 

D/B or Measurement Data can be printed in Report Format already designed.

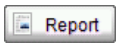
Following Data can be REPORT.

• Battery D/B report

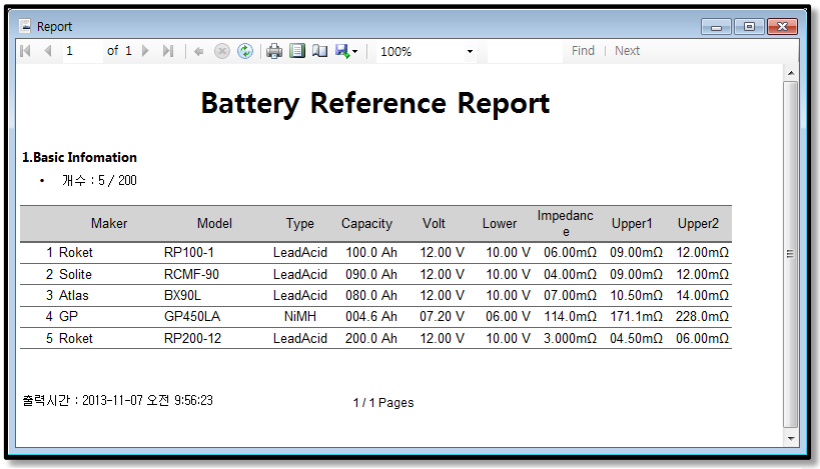
Press 

button on D/B Edit Screen

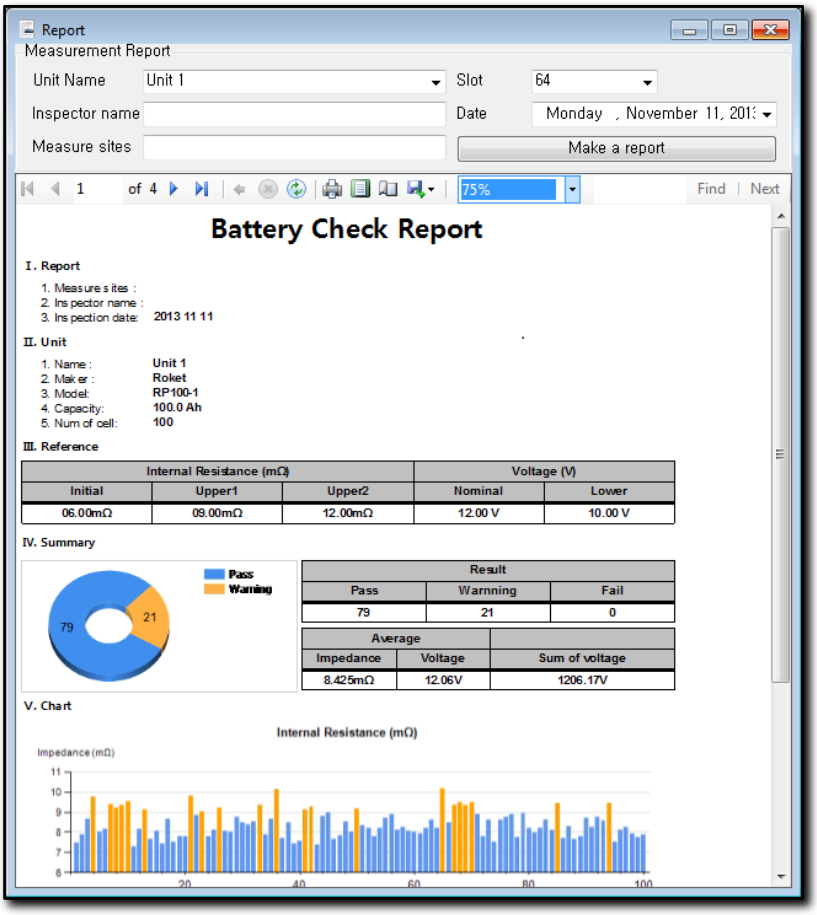
• One Time (Slot) report of Unit

Select Unit and press 

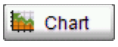
button.

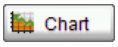


[Battery D/B Report]



[Battery Measurement Report]

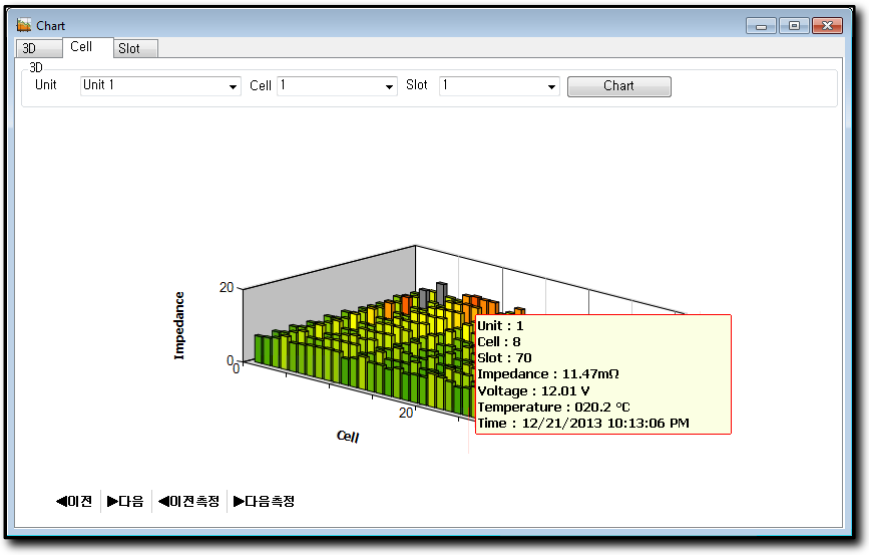
B) Chart 

Accumulated Measurement Data can be displayed in 2D or 3D Chart.
Press 

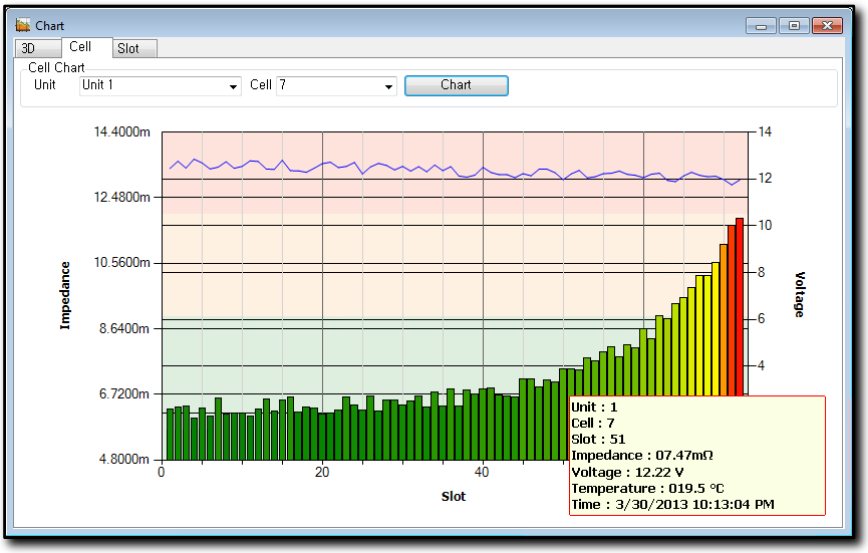
button.

Following Data can be displayed in Chart.

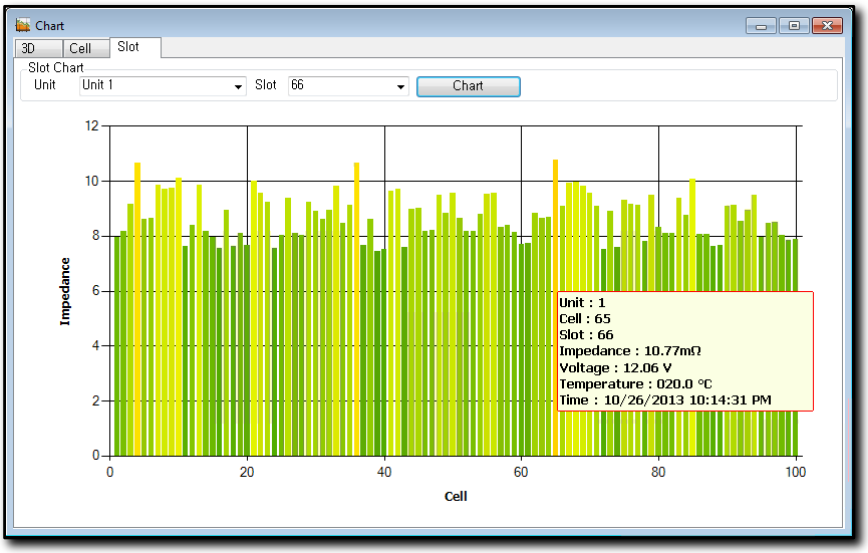
- Measurement Data Change of individual Cell
- Comparison Chart among cell to Cell in same Unit (One time SLOT)
- After select Unit, Comparison Cell to Cell, Measurement Data Change of individual cell can be displayed same time in 3D Chart(30 cell x 10 measurements)
- If Mouse indicates specific Cell, the Measurement Data of the Cell is available to Display.
- Comparator Measurement Result (Pass, Warning, Fail)display in different Color



[3D Chart]



[Cell Chart]



[Measurement Time Chart]

9.7 How to finish Software

Click X button  at Upper Right of Screen. Then,

PC Program screen will be disappeared and Connection with Analyzer is finished.

10. Specifications

10.1 General Specifications

Special Features and Functions

- Battery Internal Resistance (Impedance) measurement.
- Battery Terminal Voltage (DC Voltage measurement)
- DC Current/ Float Current measurement.
- Ripple Current measurement (* Optional)
- Temperature measurement
- 4–Terminal measurement: Impedance, Voltage, simultaneous measurement and independent measurement.
- Accumulated measurement data enables to judge Battery Deterioration and estimate Battery Replacement Time.

- SD card storage capacity enables to manage up max 7,530,000 data management.
- Measurement data analysis(Text and Graphic display)
- Battery Trend Analysis (Impedance, Voltage)
- Auto Hold and Data Storage
- Limit function (Comparator) of Impedance and Voltage
- Help function

General Specifications

- 3.8 ” Graphic Mono LCD Module (320 x 240 pixel)
- USB Client
- Input Method : Differential (Impedance, Voltages, Temperature and DC Current measurement)
- Battery: 7.2V NiMH / 2.7A (2 x 3.6V NiMH/2.7A battery pack)
- Battery Life : Approximate 6 hours
- Battery Full Charging Time : Approximately 5 hours.
- AC Adapter: 100V ~ 240V/AC (Automatic) Output DC12V/1A.
- Operation Temperature: 0°C ~ 40°C, below 80% RH (No Dew)
- Storage Temp. Humidity: -10℃~50℃, below 80% RH (No Dew)
- Temperature Coefficient: 0.05 x (accuracy) / °C (below18 °C or above 28 °C)
- Max Input Voltage “+” Measurement Terminal (Electrodes) ⇔ “- “ Between Electrodes: Max DC 300V
- EMC : EN61326:1997+A1:1998+A2:2001+A3:2003
- Safety Standard : EN61010-1: 2001 Pollution degree 2, Measurement Category II (Estimated Over Voltage 300V)
- Dimensions: 107㎜(W) × 220㎜(H) × 55㎜(D)/4.2” x 8.3 “ x 2.2 “
- Weight (Main Unit only): 1.0㎏ / 2.2 lbs

10.2 Electrical Specifications

[Guaranteed Accuracy Temperature Condition]

□ Accuracy is valid within 18°C ~ 28°C (64°F ~ 82°F), Relative Humidity Max 80% for 1 year.

□ Accuracy Specifications: ± ([% of reading] + [Last digit number]).

- **Impedance (Internal Resistance)** (Auto/Manual)

Range	Resolution	Current	Accuracy
+ 4mΩ	1uΩ	100mA	±0.8%rdg±10dgts
40mΩ	10uΩ	100mA	±0.5%rdg±10dgts
400mΩ	100uΩ	10mA	
4 Ω	1mΩ	10mA	

+ 4mΩ Range is Manual Ranging only.

Other Ranges are AUTO/Manual Ranging

- Measurement Current Accuracy: ±10%
- Measurement Current Frequency: 1㎑±30㎐

When measurement " Impedance " Voltage of the measuring Battery should be under 100V DC. Between 100V ~ 150V. Impedance can be measured with Warning Sound. If Battery is over 150V, the protection circuit is off and Impedance measurement function shut off.

- DC Voltage (Auto / Manual)

Range	Max Display	Resolution	Accuracy
4V	±4	1㎷	±0.5%rdg±5dgts
40V	±40	10mV	
300V	±300	100㎷	

- Temperature

Range	Resolution	Accuracy
-10℃ ~ 100℃/ 14° F~ 212 °F	0.1℃/0.1°F	N.S.

- **Current**

- Measurement through external Current Probe (CT)

Range	Output Reading	Resolution	Accuracy
40A	AC/DC 1mV/A	0.01A	±0.5%rdg + specified CT accuracy
400A	AC/DC 1mV/A	0.1A	

Float Current is DC Current (Generally below 40A DC)
Ripple Current is AC Current (Generally below 40A AC) * Optional Item

Measurement Range and Measurement Reading accuracy are depend on Optional Current Probe (CT) specifications. Current Probe can be selected and obtained by End user to fit to end user' applications.

10.3 Accessories

Standard accessory

- Pin Type Battery Test Lead : 1 set
- USB Cable : 1
- PC Software (CD): 1
- Operator Manual: 1
- Carrying Bag: 1
- 0 Adjustment Board: 1
- NiMH Battery Pack: 2 x 3.6V MiMH Battery Pack
- AC/DC power Adapter / Charger AC100V ~240V 50/60Hz, DC 12V/1A

Optional Accessory

- Clamp type Battery Test Lead
- ADC Current Probe

:

11. Maintenance

[Warning]

Recommend to use qualified personnel to avoid possible Electric Shock or Body Injury.

11.1 General Maintenance

- Clean the Analyzer Case with wet fabrics and detergent periodically.
- Do not use abrasive, Alcohol or solvent. .
- Input Tip area of Test Probe should always be cleaned off. Any foreign material on the tip may cause measurement error.

11.2 Fuse Replacement

[Warning]

To avoid Electric Shock or Body Injury, remove any Input Signal on Test Probe before replace Fuse. Fuse should be replaced with proper rated fuse.

[Replacement Procedure]

① Power " Off" the Analyzer.
② Disconnect Test Probe from Battery Terminal.
③ Remove Holster Case
④ Open Tilt Stand and unscrew the 2 screws at left battery cover and at right battery cover by standard + screw driver.
⑤ Unscrew the screw at lower area of Bottom Case.
⑥ And Open the Bottom Case.
⑦ Remove Used Fuse and replace with New Fuse.
⑧ Proceed revere steps as above

11.3 Battery Replacement

[Warning]

To avoid Electric Shock or Body Injury, remove any Input Signal on Test Probe before replace Battery. Battery should be replaced only with the same Battery Pack supplied with the Analyzer.

[Replacement Procedure]

① Power Off Analyzer

② Disconnect any Test Probe, Test Lead, Temperature Probe, AC Power Adapter, USB Cable from the Analyzer

③ Remove Holster Case

④ Open Tilt Stand and unscrew the 2 screws at left battery cover and at right battery cover by standard “+” screw driver.

⑤ Unscrew the screw at lower area of Bottom Case. And Open the Bottom Case.

⑥ Separate Battery Pack and replace with New Battery Pack.

⑦ Make sure to meet (+, -) contact of Battery Pack and (+ -) terminal in the Battery Room. Put the Battery Cover over the original place.

⑧ Fix the Screws and assembly of the Bottom Case as reverse step as above

11.4 When Unit is not working

① Check Battery Contact and Polarity

② Check Case whether any damage.

③ Check Fuse and Test Probe, other Test Lead, AC Adapter connecting Analyzer.

④ Check Operator Manual whether Unit is working properly.

11.5 Test Probe Pin Replacement

When Tip of the Test Probe is broke, damaged or abrasion, Tip Replacement is available. Purchase Tip only to replace with New Tip

① Power Off and separate Test Probe.

② Twist the Head Area where Tip.



③ Pull in Tip and separate Tip.



④ Assembly Tip and Test Probe in accordance with reverse steps as above.

⑤ Check whether Measurement with New Tip is no problem and accurate.

To prevent any damage from contact , make sure the cable is tightly connected And no move when pull in or rotate the cable.

11.6 Cleaning

Use soft fabrics to clean lightly dust with wet with water or detergent. Never use Benzene, alcohol, acetone, ether etc which may change color.

11.7 Scrap

[Warning]

When scrap unit, separate Battery which disposal should be in accordance of rule.

To avoid electric shock, Power off and separate battery after Test Probe disconnected.

① Power Off and Separate Test Probe

② Using Screw Driver, separate Screw on Battery Cover.

③ Separate Battery Pack.