



Battery Electrical System Analyzer

Model: 12-1012



User's Manual

Version 13.08

Table of Contents

1.0 Introduction	-----	
1.1 The Product	-----	3
1.2 Specifications	-----	4
2.0 Safety Measures	-----	
2.1 Safety Precautions	-----	5
2.2 Other Precautions	-----	7
3.0 Working with Batteries	-----	8
4.0 The Battery Electrical System Analyser	-----	
4.1 MODEL 12-1012	-----	10
4.2 Keypad Functions	-----	10
4.3 Functions of Individual Key	-----	11
5.0 HELP Key	-----	12
6.0 Battery Test	-----	
6.1 Start Testing	-----	14
7.0 Battery Rating Charts	-----	
7.1 Japanese Industrial Standards (JIS#) Rating Chart	-----	24
7.2 DIN & EN Standards Rating Charts	-----	26
7.3 YUASA Battery Rating Chart	-----	28
7.4 Rough CCA Guide	-----	28
8.0 Grounding Test	-----	
8.1 Start Testing	-----	29
9.0 Starter Test	-----	34
9.1 Begin Testing	-----	35
10.0 Alternator Test	-----	38
10.1 Start Testing	-----	39
No load testing at 3,000 RPM	-----	39
Testing with load at 2,000 RPM	-----	42
11.0 View Last Test Results	-----	45
12.0 Setting Up the PC ready for MODEL 12-1012	-----	47
12.1 Installing Driver	-----	47
12.2 Printing Results from normal printer	-----	50
12.3 Saving results	-----	50
13.0 Warranty Information	-----	
13.1 Limited Warranty	-----	51
13.2 Limitations of Warranty	-----	52

1.0 - Introduction

1.1-The Product:



As we all know battery plays a very important role in a vehicle by providing power to all the electrical components and also the initial power to get the engine started. Once the engine runs, the alternator will take over and at the same time it charges the battery. In order these power systems to perform efficiently at all times, they need to be checked regularly during service and maintenance of the vehicle.

For quick and convenient way of checking the condition of these power systems, this Battery Electrical System Analyzer is designed to perform the following tasks:

1. Battery Test:

- Analyzes the battery condition using microprocessor controlled testing methods without the need of fully charging it before test.
- The unit consumes very little current during testing hence the test can be repeated numerous times without worry of draining the battery and its results are highly accurate.
- Extremely safe as it does not create any sparks during clamp on and it takes less than 8 seconds to obtain the full analyzed results of tested battery.

2. Grounding Test:

- Analyzes the condition of the electrical return circuit contact resistance which was connected to the engine or chassis body from the battery terminal with results and recommendations display after test.

3. Starter Test:

- Checks the cranking effectiveness of the battery to predict when the battery will fail to crank a vehicle basing on voltage profiles with results and recommendations display.

4. Alternator Test:

- This test checks the alternator charging condition during load at 2,000 RPM and without load at 3,000 RPM with results and recommendations display after each test.

This Analyzer is maintenance free and does not require internal batteries. It powers up when connected to the battery posts during testing or through an external 12 Volts DC source for later review of the test results.

The operation is fast and simple. When hooked up to the battery posts, the displayed instructions on the screen will lead you through and a warning tone to caution you to perform the correct steps. In event that you need assistance, there is a  key. It will display information about each function when selected.

Its result is consistent and repeatable and can be performed numerous times without heating up the unit. It is very safe as it does not create any sparks when connected to the battery terminals during testing on the vehicle.

After the test, the results will be stored in its memory and can be reviewed again later and it is equipped with an USB port to be connected to the PC to store the results or have it printed out from normal computer printer.

1.2 Specifications:

Operating Voltage:	9V ~ 15V DC (max)		
Analyzing Capacity (Amps):	CCA:	100 ~ 1700	EN: 100 ~ 1700
	IEC:	100 ~ 1000	DIN: 100 ~ 1000
	JIS#:	100 ~ 1700	
Battery analyzing time:	Less than 8 seconds.		
DC Volts Accuracy:	± 2% Reading		
Working Temperature:	0°C (32°F) ~ 50°C (122°F).		
Working Humidity:	10% ~ 80 %		
Dimensions:	181 x 110 x 90 mm		

2.0 Safety Measures:



For safety reasons, read this manual thoroughly before operating the Tool.

Always refer to and follow the safety instructions and testing procedures provided by the car or equipment manufacturer. The safety messages presented below and throughout this user's manual are reminders to the operator to exercise extreme care when using this test instrument.

2.1 Safety Precautions:



⚠ DANGER

When the engine is running, it produces carbon monoxide, a toxic and poisonous gas. Always operate the vehicle in a well ventilated area. Do not breathe exhaust gases – they are hazardous that can lead to death.



⚠ CAUTION

To protect your eyes from propellant object such as caustic liquids, always wear safety eye protection.



⚠ DANGER

Fuel and battery vapors are highly flammable.
DO NOT SMOKE NEAR THE VEHICLE DURING TESTING.



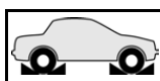
⚠ CAUTION

When engine is running, many parts (such as pulleys, coolant fan, belts, etc) turn at high speed. To avoid serious injury, always be alert and keep a safe distance from these parts.



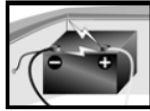
⚠ WARNING

Before starting the engine for testing or trouble shooting, always make sure the parking brakes is firmly engaged. Put the transmission in Park (automatic transmission) and Neutral (manual transmission).



⚠ WARNING

Always block the drive wheels.
Never leave vehicle unattended while testing.

**CAUTION**

Never lay tools on vehicle battery. You may short the terminals together causing harm to yourself, the tools or the battery.

**CAUTION**

Engine parts become very hot when engine is running. To prevent severe burns, avoid contact with hot engine parts.

**WARNING**

Do not wear loose clothing or jewelry while working on engine. Loose clothing can get caught in fan, pulleys, belts, etc. Jewelry can conduct current and can cause severe burns if comes in contact between power source and ground.

**CAUTION**

When the engine is running, be cautious when working around the ignition coil, distributor cap, ignition wires and spark plugs. They are HIGH VOLTAGE components that can cause electrical Shock.

**IMPORTANT**

Always keep a fire extinguisher readily available and easily accessible in the workshop.

2.2 Other Precautions:



- This battery analyzer is meant for testing of 12 Volts batteries only.
- Its operating voltage is from 9V ~ 15V DC and should not be tested on 24V directly. It will cause damage the unit. For 12V x 2 batteries (in series or parallel), disconnect the connections and test them individually.
- Battery that has just been charged by the charger contains surface charge and it should be discharged by turning ON the Head lights for 3~5 minutes before testing.
- Always attached the analyzer clips on the lead side of the battery terminal posts during testing so that it has a good contact. This will provide better and accurate results.
- Do not attach the analyzer clips directly onto the steel bolt that tightened to the battery terminal posts; this may give inaccurate readings or inconsistent results. (Note: This also applies to all other battery testing methods.)
- If the battery terminal posts were oxidized or badly corroded and the connections were bad, the analyzer will prompt you to check the connections. In this case, clean the terminal posts and performs testing directly on the terminal posts it-self.
- During testing on the battery whilst it is still in the car, make sure the engine is OFF.
- Do not store the analyzer near high humidity or temperature area. Exposing to extreme temperatures will cause damage to the unit.

3.0 Working with Batteries



Lead-acid batteries contain a sulfuric acid electrolyte, which is a highly corrosive poison and will produce gasses when recharged and explode if ignited. It can hurt you badly.

When working with batteries, make sure you have plenty of ventilation, remove your hand jewelry, watch and wear protective eyewear (safety glasses), clothing, and exercise caution.

Do not allow battery electrolyte to mix with salt water. Even small quantities of this combination will produce chlorine gas that can KILL you!

Whenever possible, please follow the manufacturer's instructions for testing, jumping, installing, charging and equalizing batteries.



- Never disconnect a battery cable from a vehicle with the engine running because the battery acts like a filter for the electrical system.

Unfiltered [pulsating DC] electricity can damage expensive electronic components, e.g., emissions computer, radio, charging system, etc.

Turn off all electrical switches and components; turn off the ignition before disconnecting the battery.

- For non-sealed batteries, check the electrolyte level. Make sure it is covering the plates, and it is not frozen before starting to recharge (especially during winters).
- Do not add distilled water if the electrolyte is covering the top of the plates because during the recharging process, it will warm and expand. After recharging has been completed, recheck the level.

- Reinstall the vent caps BEFORE recharging, recharge ONLY in well-ventilated areas, and wear protective eye ware (safety goggle).

Do NOT smoke or cause sparks or flames while the battery is being recharged because batteries give off explosive gasses.

- If your battery is an AGM or a sealed flooded type, do NOT recharge with current ABOVE 12% of the battery's RC rating (or 20% of the ampere-hour rating).

Gel cells should be charged over a 20-hour period and never over the manufacturer's recommended level or over 14.1 VDC.

- Follow the battery and charger manufacturer's procedures for connecting and disconnecting cables and other steps to minimize the possibility of an explosion or incorrectly charging the battery.

You should turn the charger OFF before connecting or disconnecting cables to a battery.

Do not wiggle the cable clamps while the battery is recharging, because a spark might occur, and this could cause an explosion. Good ventilation or a fan is recommended to disperse the gasses created by the recharging process.

- If a battery becomes hot, over 110°F (43.3°C), or violent gassing or spewing of electrolyte occurs, turn the charger off temporarily or reduce the charging rate.
- When charging the battery in the car with an external MANUAL charger, make sure that it will not damage the vehicle's electrical system or components with high voltages.

Even if this is a remote possibility, it is best to disconnect the vehicle's battery cables from the battery BEFORE connecting the charger.

4.0 - The Battery Electrical System Analyzer

4.1 – MODEL 12-1012



Figure 1

4.2 - Keypad Functions:

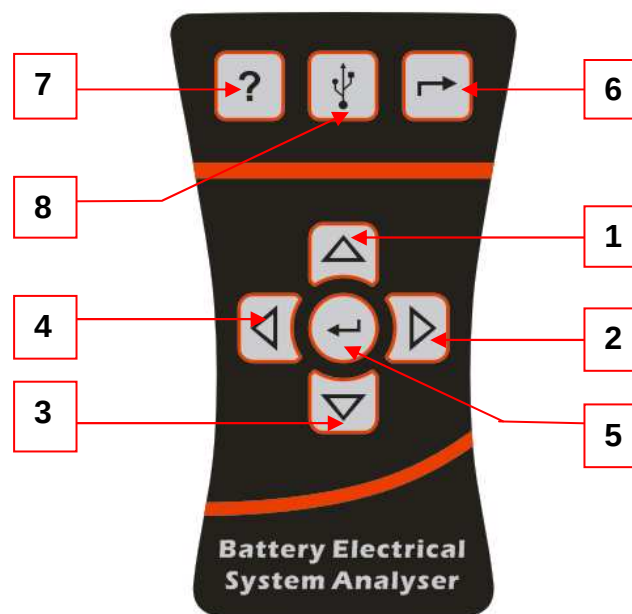


Figure 2

4.3 - Functions of Individual key:

1.  Use this key to scroll up to the next item OR when it is in the keying-in Battery Ratings values mode, press this key once will increase the value by step of 5 units.
2.  Use this key to shift the selection tab to the right item OR when it is in the keying-in Battery Ratings values mode, press this key once will increase the value by step of 100 units.
3.  Use this key to scroll down to the next item OR when it is in the keying-in Battery Ratings values mode, press this key once will decrease the value by step of 5 units.
4.  Use this key to shift the selection tab to the left item OR when it is in the keying-in Battery Ratings values mode, press this key once will decrease the value by step of 100 units.
5.  Press this key will get into the selected function or proceed to the next step.
6.  To EXIT the function, press this key once will return back to the previous screen.
7.  This is the HELP key. Press this key will enter into the help menu and it will explain the functions of the item you have selected in detail.
8.  Press this key when the Analyzer has connected to the computer to activate the communication which allows data retrieving and printing of the Last Tested Results.

5.0 – Help Key

This selection helps you to familiarize with the usage of the MODEL 12-1012 as well as explaining the various test functions and its results. To get into this function, just press  key at any one of the functions displayed on the menu screens as shown below (Fig.3 and Fig 4):

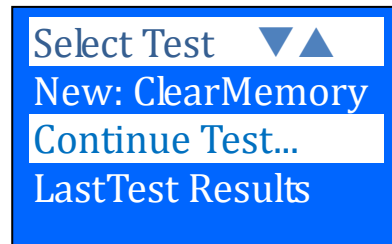


Figure 3

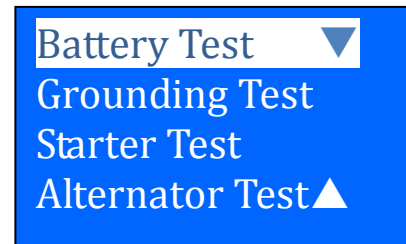


Figure 4

For Example:

If help is needed on “Battery Test”, then press  key on this item and the display will change to as shown (Fig 5).

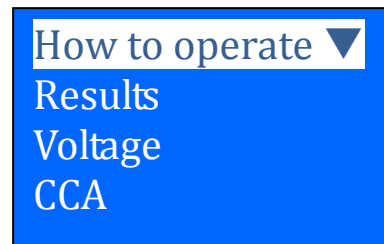


Figure 5

Pressing the  key will scroll down to the next item “Results” (Fig 6) and so forth until it reaches “Life”.

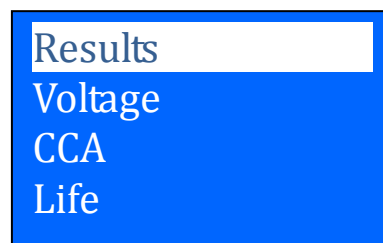
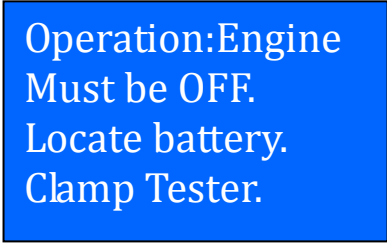


Figure 6

To see the help text, press  key again on the selected item and it will display on the screen.

If you need to quit, just press  key will go back to the main menu (Fig. 4)

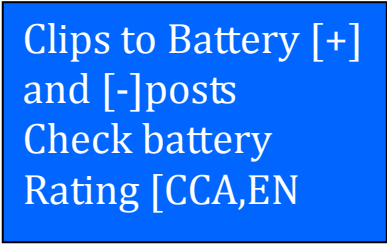
Let say if you need help on “How to operate”, press  key in this selection will get into the display as shown below:



Operation:Engine
Must be OFF.
Locate battery.
Clamp Tester.

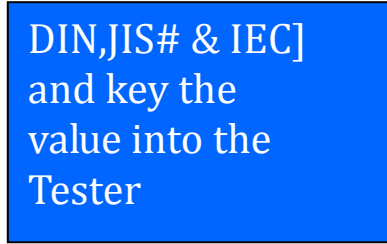
Figure 7

Press  key will scroll down to the next page to continue reading the text (Fig. 8 and Fig 9) below.



Clips to Battery [+]
and [-]posts
Check battery
Rating [CCA,EN

Figure 8



DIN,JIS# & IEC]
and key the
value into the
Tester

Figure 9

If you wish to continue help on rest of the item like “Results, Voltage, CCA, Life”, press  key anytime will go back to the main menus (Fig. 5).

Here just select the item you want with  key and then press  key will enter into the display screen with the explanation text.

To exit press  key twice will go back to the main menu for you to begin testing. (Fig.4)

6.0 - Battery Test

6.1 – Start Testing

Performing Battery Test whilst it is still in the car:

Vehicle that was running has to have its engine OFF first and then switch ON the headlights for 30 seconds to remove the surface charge. After the headlights had switched OFF, let the battery rest for at least 1 minute to recover before testing commences.

The car engine and all other accessory loads must be **OFF** during test in order to have accurate results. When attaching the analyzer clips, make sure that the battery posts were not oxidized or badly corroded. Clean them first before clamping to it. Do not clamp onto the steel bolts directly which may give inaccurate and inconsistent results.

Testing on stand-alone batteries:

Clean the battery posts with a wire brush prior testing. For side - post batteries, install stud adaptors. Do not use steel bolts for better results.

1. Attach the Analyzer clips onto the battery terminal posts [Red to (+) and Black to (-)] the unit will power up and lights up the LCD display screen as shown (Fig.10).



Figure 10

2. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 11)

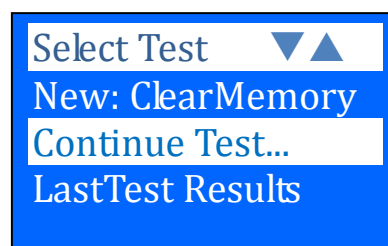


Figure 11

Here, it will let you select your choice from the Menu:

New: Clear Memory

Selecting this item will allow the tester to clear the last tested results stored in its memory and begin a new test.

Continue... Test

Selecting this item will allow you to continue the last test on the same car from where you had stopped.

For example:

If you had done Battery Test and later you wish to do Alternator Test or Grounding Test on the same car, just select this item and it will update the results after each test in its memory so that it can be review later or to be printed out from the printer.

Last Test Results

Here it will let you review the test results of the last tested car. The results stored will always depends on the tests that you had done.

Use  or  keys to scroll for the pages during viewing.

Examples:

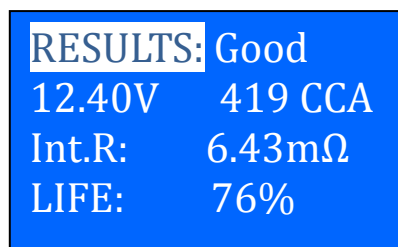


Figure 12

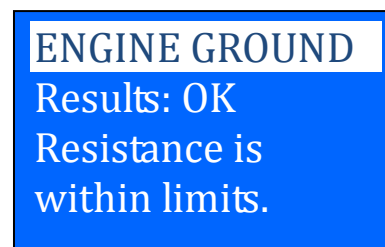


Figure 13

3. After you have made your choice, selecting "New: Clear Memory" or "Continue...Test" will proceed to the display below: (Fig. 14)

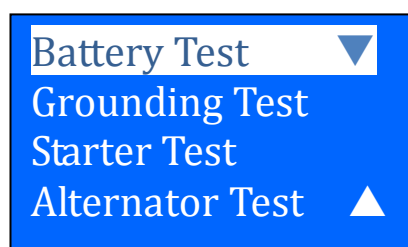
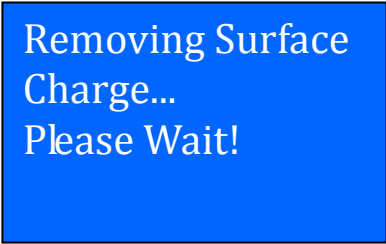


Figure 14

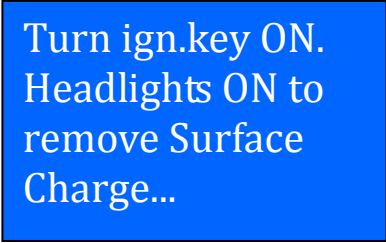
4. Pressing  key once will scroll down to the next item if there is a need to select it.
5. As an example (Fig.14) the selected item was on "Battery Test" and it is being highlighted.
6. Press  key will proceed to do the battery testing and if it has detected any surface charge on the battery, it will start to remove and a message is shown (Fig. 15) below.



Removing Surface
Charge...
Please Wait!

Figure 15

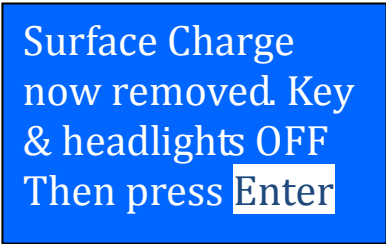
7. If the surface charge is too great for the analyzer to handle, it will prompt you with the instructions as shown: (Fig. 16) below.



Turn ign.key ON.
Headlights ON to
remove Surface
Charge...

Figure 16

8. Wait until the surface charge removal had completed, the analyzer will advise as follows: (Fig.17) and then press  key.



Surface Charge
now removed. Key
& headlights OFF
Then press **Enter**

Figure 17

9. If there is no surface charge present, then it will straight away enter into "Select Rating" menu screen as shown in Fig. 18

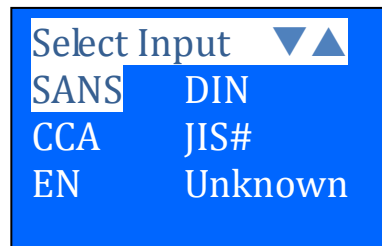
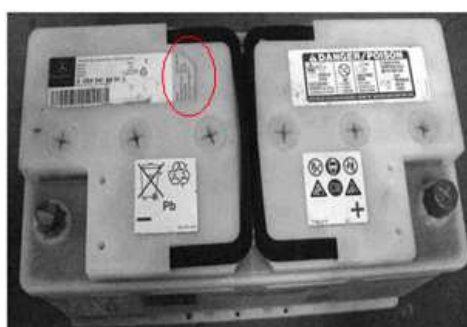
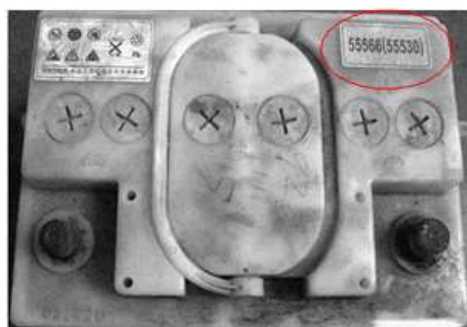


Figure 18

10. Before selecting the ratings 'CCA, EN, IEC, DIN and JIS #' from the menu, check the battery specification value. This value can be checked on the battery labels as some of the examples shown below:



If it is selected under JIS # (Japanese Industrial Standard) then the display will prompt you as shown (Fig.19) below.

JIS# to CCA:
See user manual
for conversion
Enter to proceed

Figure 19

Refer to the battery model (example: 80D26L or NX110-5L) on the Cold Cranking Amps (CCA) Table list supplied separately or from this manual on page 24 & 25 (See example Fig.20 below.)

Battery Model (JIS#)		CCA			Battery Model (JIS#)		CCA		
NEW	OLD	WET	MF	CMF SMF	NEW	OLD	WET	MF	CMF SMF
50D20R		310	380	480	80D26L	NX110-5L	580	580	630
50D20L		310	380	480	85B60K				500
50D23R	85BR60K	500			85BR60K				500
50D23L	85B60K	500			95D31R	NX120-7	620	660	850
50D24R	NT80-S6	390			95D31L	NX120-7L	620	660	850
50B24L	NT80-S6L	390			95E41R	N100	515	640	770
50D26R	50D20R		370		95E41L	N100L	515	640	770

Figure 20

Press  key and the display will show: (Fig.21) below:

Input Value ▼▲
Set 500 CCA ◀▶
Enter to start..

Figure 21

11. Referring to the Table list (Fig.20) basing on 80D26L, check the battery type: WET, MF, Sealed MF or Closed MF (CMF) as each category has different CCA ratings. For instance, if the battery is a Sealed MF (CMF) then it is rated at 630 CCA.

Note:

WET	-	Wet Cell Type
MF	-	Maintenance Free Type
SMF	-	Closed or Sealed Maintenance Free

12. To enter the value 630, press  key will increase the original value

of 500 (Fig.21) by step of 100 units to 600. Likewise use  key to increase the last two digits (00) to 30 by step of 5 units for each pressing. (Fig. 22)

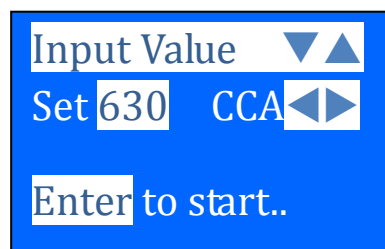


Figure 22

13. Once the CCA rating of the battery is confirmed, press  key will start the testing process. Refer to the display below (Fig. 23).

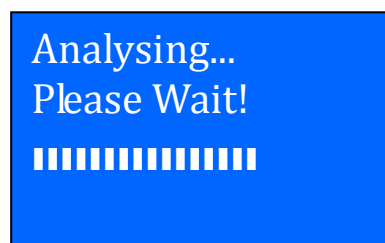


Figure 23

14. For less than 5 seconds, the results of the testing will be displayed on the LCD screen. (Fig. 24)

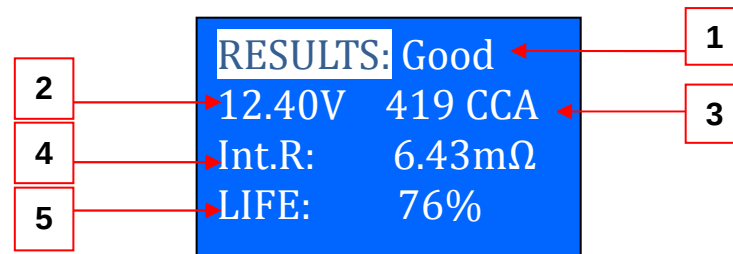


Figure 24

Interpretations of the above results:

1. **RESULTS: Good**
A very straight forward display of the final results basing on the evaluation of the tested condition. 'Good' indicates the battery in good condition. 'Replace' indicates that the battery needs to be replaced. If not, the battery will fail anytime without any warning.
2. **Voltage : 12.40V**
This indicates the tested battery voltage (12.46V). It depends on the state of charge on the battery:

100% fully charged	-	13.20V
90% charged	-	12.90V
75% charged	-	12.45V
3. **CCA (Cold Cranking Amps): 419 CCA**
CCA ratings has been used here, therefore the tested result is in 406 CCA. If other rating (DIN or JIS, or IEC, or EN) were selected, it will base on the respective rating to calculate and show the results in that selected rating.

Please take Note:

This output value (406 CCA) is related to the actual power available in the battery in relation to that battery's rating (630 CCA). On average, a new battery's CCA as measured by this tester will read 10-15 % higher than its stated rating. As the battery ages, the CCA number measured by this tester

will decrease so it reads near its rating. While this value is not the same as a CCA test, it is the best available measurement for showing a battery's current condition in relation to its rating.

From the above example, a 630 CCA rated battery measuring 406 CCA available power does not mean that the battery would pass a CCA test at 406 CCA. The available power reading shows that the battery is not able to perform up to its rated ability (630 CCA).

In comparison to another battery when fully charged, the 630 CCA battery measuring 406 CCA is no stronger than a 400 CCA battery showing 400 CCA available power when fully charged.

The available power number is meant for comparison to its own rating. In fact, in this example the 630 CCA battery is failing to perform to its rating, while the 400 CCA battery is still working.

Basing on SAE, CCA test is a manufacturing process control test applicable only on new, fully charged batteries. It does not produce an actual value, but is a PASS / FAIL test.

It measures the discharge load, in amps, that a battery can supply for 30 seconds at 0°F/-18°C while maintaining a voltage of 1.2 volts per cell (7.2 volts per battery) or higher.

Thus, the CCA test shows the minimum power requirement for the battery as rated, which means a battery rated at 400 CCA must measure 7.2 volts or above for 30 seconds when a load of 400 amps is applied at 0°F/ -18°C.

The above methods also hold for DIN, IEC, JIS, EN basing on its individual ratings.

4. **Int. R (Internal Resistance): 6.43mΩ**

In normal condition, the internal resistance should fall between 2.0 mΩ ~ 15.0 mΩ. As a matter of fact, the higher the battery CCA readings obtained the lower the internal resistance should be.

5. **LIFE: 76 %**

This is an indication of the battery life expectancy in percentage. If the life falls below 45 %, the RESULT will display "Replace" and it is time to change to a new battery.

Explanation of the following terms used as shown on the LCD display:

- **CCA (Cold Cranking Amps) – most commonly used Standard.**
CCA is a rating used in the battery industry to rate a battery's ability to start an engine in cold temperatures. This rating is the number of amperes that a new fully charged battery can deliver at 0 °F (-18 °C) for 30 seconds, while maintaining a voltage of at least 7.2 Volts for a 12V battery.

The bigger the CCA will have the greater starting power of the battery.

- **IEC (International Electro-technical Commission) Standard.**
IEC amperes rating require that at 0 °F (-18 °C), the number of amperes that the 12V battery can deliver while maintaining a voltage of at least of 8.4 Volts for 60 seconds during cranking.

- **EN (European Norms) Standard**
EN amperes rating require that at 0 °F (-18 °C), the number of ampere that the 12V battery can deliver while maintaining a voltage of at least 6.0 Volts for 180 seconds during cranking.

- **JIS# (Japanese Industrial Standard)**
JIS # amperes' rating is based on Ampere Hours and is calculated using 20 hours rating. In this manual, it is using CCA ratings reference table list provided basing on the JIS model number (See page 24 & 25).

- **DIN (Deutsches Institut für Normung)**
German Institute for Standardization.
Basing on DIN , the rating requires that at 0 °F (-18 °C), the 12V battery is able to deliver the number of amperes while maintaining a voltage of at least of 9.0 Volts for 30 seconds and 8.0 Volts for 150 seconds during cranking.

- **Unknown**
If you are not sure which ratings (CCA, EN, IEC, JIS or DIN) that the battery is based on then choose this setting. It will show the battery's Voltage, CCA and the Internal Resistance (mΩ) only. This selection can also be used to test 12V - Deep Cycle Batteries.

An example of the results display is shown below: (Fig.25)

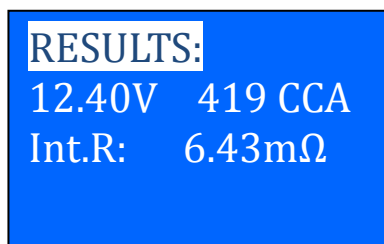


Figure 25

To determine the condition of the tested Deep Cycle Batteries, refer the **Voltage** reading (*should not fall below 12.6V when fully charged*) and the Internal Resistance [**Int.R**] (*should not more 15mΩ*) readings.

Batteries that had been left idle for long periods can still be tested with this analyzer. To perform the test, just clamp the analyzer clips onto the battery terminals and it will display the screen (Fig.26) as shown if its voltage falls below the normal 12 volts and a buzzing sound is heard.

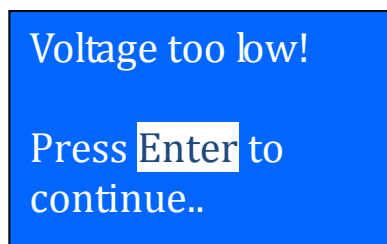


Figure 26

Press  key to continue and the display will show: (Fig.27)

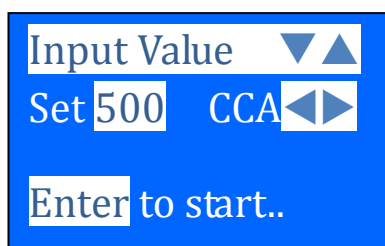


Figure 27

Check the battery ratings and enter it as described in step 10 and 11 (page 17~19) and the results will show as an example below: (Fig. 28)

RESULTS:
09.76V 38 CCA
Int.R: 70.09mΩ
LIFE:Charge>Test

Figure 28

You will notice that there is no indication of message (Good or Replace) on the RESULTS instead on LIFE; it indicates "Charge > Test". It means that the battery has to be fully charged and repeat the test again.

15. Pressing the  key at any moment will exit and return back to the previous screen.

7.0 – Battery Ratings Charts

7.1 Japanese Industrial Standard (JIS#) CCA Ratings

Battery Model (JIS#)		CCA Rating			Battery Model (JIS#)		CCA Rating		
NEW	OLD	WET	MF	CMF SMF	NEW	OLD	WET	MF	CMF SMF
26A17R		200			34B17L		280		
26A17L		200			34B19R	NS40ZA	270	325	400
26A19R	12N24-4	200	220	264	34B19L	NS40ZAL	270	325	400
26A19L	12N24-3	200	220	264	34B19RS	NS40ZAS	270	325	400
28A19R	NT50-N24	250			34B19LS	NS40ZALS	270	325	400
28A19L	NT50-N24L	250			36B20R	NS40Z	275	300	360
32A19R	NX60-N24	270	295		36B20L	NS40ZL	275	300	360
32A19L	NX60-N24L	270	295		36B20RS	NS40ZS	275	300	360
26A17R		200			36B20LS	NS40ZLS	275	300	360
26B17L		200			38B20R	NX60-N24	330	340	410
28B17R		245			38B20RS	NT60-N24S	330	340	410
28B17L		245			38B20L	NX60-24L	330	340	410
28B19R	NS40S	245			38B20LS	NX60-24LS	330	340	410
28B19L	NS40LS	245			40B20L		330		
32B20R	NS40	270			40B20R		330		
32B20L	NS40L	270			42B20L		330		
32C24R	N40	240	325	400	42B20RS		330		
32C24L	N40L	240	325	400	42B20LS		330		
34B17R		280			46B24L	NS60L	325	360	420

Battery Model (JIS#)		CCA Ratings			Battery Model (JIS#)		CCA Ratings		
NEW	OLD	WET	MF	CMF SMF	NEW	OLD	WET	MF	CMF SMF
46B24R	NS60	325	369	420	75D31L	N70ZL	450	540	725
46B24RS	NS60S	325	360	420	80D23R		580		
46B24LS	NS60LS	325	360	420	80D23L		580		
46B26R	NS60	360			80D26R	NX110-5	580	580	630
46B26L		360			80D26L	NX110-5L	580	580	630
46B26RS		360			85B60K				500
46B26LS		360			85BR60K				500
48D26R	N50	280	360	420	95D31R	NX120-7	620	660	850
48D26L	N50L	280	360	420	95D31L	NX120-7L	620	660	850
50B24L	NT80-S6L	390			95E41R	N100	515	640	770
50B24R	NT80-S6	390			95E41L	N100L	515	640	770
50D20R		310	380	480	105E41R	N100Z	580	720	880
50D20L		310	380	480	105E41L	N100ZL	580	720	880
50D23R	85BR60K	500			105F51R	N100Z	580		
50D23L	85B60K	500			105F51L	N100ZL	580		
50D26R	50D20R		370		115E41R	NS120	650	800	960
50D26L	50D20L		370		115E41L	NS120L	650	800	960
55B24R	NX100-S6	435	420	500	115F51R	N120	650	800	960
55B24L	NX100-S6L	435	420	500	115F51L	N120L	650	800	960
55B24RS	NT80-S6S	430	420	500	130E41R	NX200-10	800		
55B24LS	NT80-S6LS	430	420	500	130E41L	NX200-10L	800		
55D23R		355	480	500	130F51R		800		
55D23L		355	480	500	130F51L		800		
55D26L	N50ZL	350	440	525	145F51R	NS150	780	920	
55D26R	N50Z	350	440	525	145F51L	NS150L	780	920	
60D23R		520			145G51R	N150	780	900	1100
60D23L		520			150F51R	NT200-12	640		
65D23R		420	540	580	150F51L	NT200-12L	640		
65D23L		420	540	580	165G51R	NS200	935	980	
65D26R	NS70	415	520	625	165G51L	NS200L	935	980	
65D26R	NS70L	415	520	625	170F51R	NX250-12	1045		
65D31R	N70	390	520	630	170F51L	NX250-12L	1045		
65D31L	N70L	390	520	630	180G51R	NT250-15	1090		
70D23R	35-60	490	540	580	180G51L	NT250-15L	1090		
70D23L	25-60	490	540	580	195G51R	NX300-51	1145		
75D23R		500	520	580	195G51L	NX300-51L	1145		
75D23L		500	520	580	190H52R	N200	925	1100	1300
75D26R	F100-5	490			190H52L	N200L	925	1100	1300
75D26L	F100-5L	490			245H52R	NX400-20	1530	1250	
75D31R	N70Z	450	540	735	245H52L	NX400-20L	1530	1250	

7.2 DIN & EN Standards Rating Chart

Battery Model No.	Amps		Battery Model No.	Amps	
	DIN	EN		DIN	EN
52805	180	240	55057	320	540
52815	180	240	55068	220	390
53517	175	300	55069	220	390
53520	150	240	55218	255	420
53521	150	240	55414	265	450
53522	150	240	55415	265	450
53621	175	300	55421	265	450
53624	175	300	55422	265	450
53625	175	300	55423	300	510
53638	175	300	55427	300	510
53646	175	300	55428	300	510
53653	175	300	55457	265	450
53836	175	300	55529	220	360
53890	175	300	55530	255	420
54038	175	300	55531	255	420
54039	175	300	55545	255	420
54232	175	300	55548	255	420
54312	210	360	55552	255	420
54313	220	330	55559	255	420
54317	210	360	55559L	255	420
54324	220	330	55563	255	420
54434	210	360	55564	255	420
54437	210	360	55565	255	420
54449	210	360	55565L	255	420
54459	210	360	55566	265	450
54459L	210	360	55567	255	420
54464	220	330	55811	360	540
54465	210	360	56012	230	420
54466	210	360	56048	250	390
54469	210	360	56049	250	390
54519	210	360	56068	250	390
54523	220	300	56069	250	390
54524	220	300	56073	250	390
54533	210	360	56077	300	510
54537	190	300	56091	360	540
54545	190	300	56092	300	510
54551	220	300	56111	300	540
54577	220	300	56216	300	510
54578	220	300	56218	300	510
54579	220	300	56219	300	510
54580	220	300	56220	280	510
54584	220	300	56225	300	510
54590	210	330	56311	300	510
54612	210	360	56312	300	510
54801	190	300	56318	300	510
54827	240	360	56322	300	510
55040	265	450	56323	300	510
55041	220	360	56420	300	510
55042	220	360	56530	300	510
55044	265	450	56618	300	510
55046	300	510	56619	300	510
55048	300	540	56620	300	510
55056	320	540	56633	300	510

Battery Model No.	Amps		Battery Model No.	Amps	
	DIN	EN		DIN	EN
56638	300	510	60026	440	720
56641	300	510	60038	500	760
55647	300	510	60044	500	760
56821	315	540	60527	410	680
56820	315	540	60528	410	680
56828	315	540	61017	400	680
57024	315	540	61018	400	680
57029	315	540	61023	450	760
57113	400	680	61047	450	760
57114	400	680	61048	450	760
57217	420	720	62034	420	680
57218	420	720	62038	420	680
57219	420	720	62045	420	680
57220	420	720	62529	450	760
57230	380	640	63013	470	680
57412	400	680	63545	420	680
57412L	400	680	63549	420	680
57413	400	680	64020	325	550
57512	350	570	64028	520	760
57513	350	570	64035	520	760
57531	350	570	64036	460	760
58424	450	760	64317	540	900
58513	320	540	64318	540	900
58514	320	540	64323	540	900
58515	450	760	65513	540	900
58521	320	540	65514	570	900
58522	320	540	65515	570	900
58527	395	640	67043	600	1000
58811	440	720	67045	600	1000
58815	395	640	68021	570	950
58820	395	640	68032	600	1000
58821	395	640	68034	600	1000
58827	400	640	68040	570	950
58833	400	680	70027	630	1050
58838	400	680	70029	630	1050
59017	360	600	70036	570	950
59018	360	600	70038	630	1050
59040	360	600	71014	700	1150
59215	450	760	71015	700	1150
59218	290	480	72512	680	1150
59219	290	480	73011	740	1200
59226	450	760	88038	175	300
59514	320	540	88046	210	360
59518	395	640	88056	265	450
59519	395	640	88066	300	510
59615	360	600	88156	320	540
59616	360	600	88074	400	680
60018	250	410	88092	400	680
60019	250	410			

7.3 YUASA Battery Rating Chart

Battery Model No.	CCA	Battery Model No.	CCA
24-500	500	75A-72	630
34-6MF	500	75-660	660
34-60	525	78A-72	670
34-610MF	610	78-710	710
34-710	710	GR40R-MF	700
35-580	580	GR40R-CMF	820
41-580	580	GTH40	277
55D23R	522	GTH40L	276
58-6MF	530	GTH40S	275
58-60	525	GT50L	356
58-530	530	GTH55DL	356
65-70	700	GTH60L	325
65-730	730	GTH60DL	325
65-900	850	GTH75DL	520
74-60	525	GTH75DR	521
75-6MF	615	GR96R-MF	500
75-72	500	GR96R-CMF	580

7.4 Rough CCA Guide

Given below is a rough CCA ratings guide for any unknown battery model basing on the capacity of the vehicle:

Vehicle Capacity

Approximate Battery CCA Rating

1200 ~ 1600 cc

350 CCA

1600 ~ 2000 cc

500 CCA

2000 ~ 3000 cc

650 CCA

3000 cc and above

750 CCA

M. Benz over 3000 cc

760 CCA

8.0 – Grounding Test

The engine body and the vehicle chassis are always connected to the battery negative terminal to provide the electrical return path (grounding) for all the electrical components. Due to the surrounding environmental effect, the surface contacts of these joints or connections of these circuits will subject to oxidation and corrosion in a matter of time rendering them to have high resistance in it. One typical example is the connection at the battery terminals where oxidation and corrosion takes place very often. If these contacts were no good then it will pose a lot of electrical problems to the vehicle.

To check the grounding condition, this Analyser will measure the resistance from the engine body contact to the battery terminal then it will display the results and the recommendations.

8.1 – Start Testing

1. Make sure that the engine is switched OFF. Attach the clips onto the battery terminal posts and the analyzer will power up and lights up the LCD display screen as shown (Fig.29).



Figure 29

2. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 30)

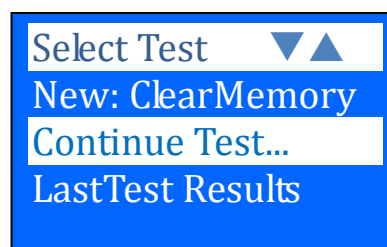


Figure 30

3. After you have made your choice, selecting "New: Clear Memory" or "Continue...Test" will proceed to the display below: (Fig. 31)

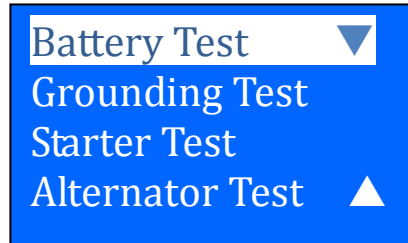


Figure 31

4. Pressing  key once will scroll down to the 'Grounding Test' (Fig.32)

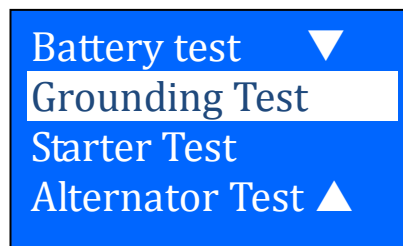


Figure 32

5. Press  key will proceed to the display as follows: (Fig. 33)

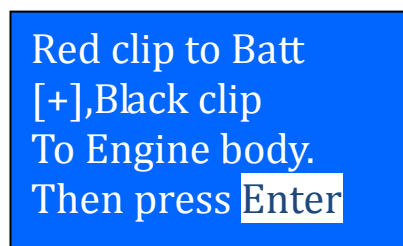


Figure 33

6. Now transfer the BLACK tester clip from the battery [-] terminal to a suitable position on the engine or chassis body leaving the RED clip still attached to the battery [+] terminal.

7. Press  key again and it will start analyzing (Fig. 34)

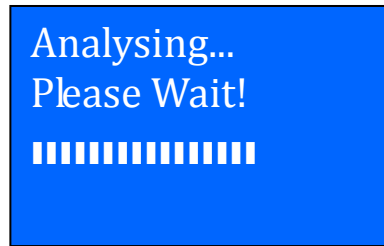


Figure 34

8. Once it has finished analyzing, it will prompt you with an instruction (Fig. 35) stating that you should unclamp the Black tester clip from the engine or chassis body and transfer to the battery negative [-] terminal within 20 seconds time limit if not the testing procedure has to be repeated again as the gathered data will be lost.

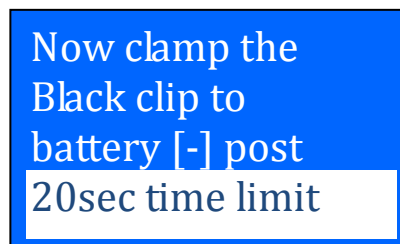


Figure 35

9. Once the Black clip is clamped onto the battery [-] terminal, the Analyzer display will light up as shown. (Fig. 36)

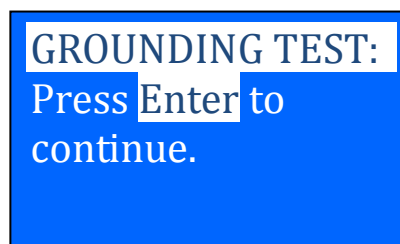


Figure 36

10. Now you need to press  key to proceed and the display will show as follows (Figure 37).

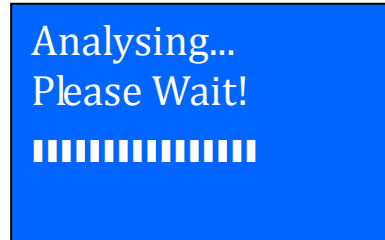


Figure 37

10. If the measured resistance reading is within limits, then it will display as follows (Fig. 38)

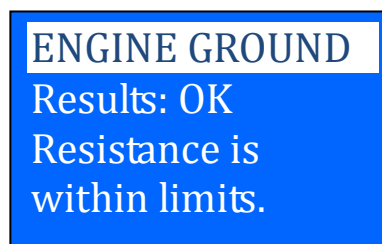


Figure 38

11. If the measured resistance reading has gone beyond the limits, then it will display the screen as follows (Fig. 39).

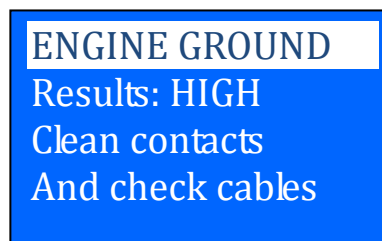


Figure 39

Note:

The above indicates that the ground contact from the engine body to the battery is bad. Check for rusted or corroded point of contacts. If found, dismantle it for cleaning or replace before fixing back. Repeat the test again after fixing.

Another thing is that if you suspect that the result is in question, you may conduct the test with the Black clip clamp at different location.

12. If you did not follow the right procedures during the testing, it will display the results as follows (Fig. 40) below:

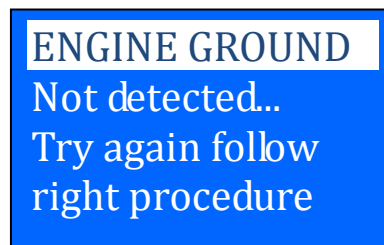


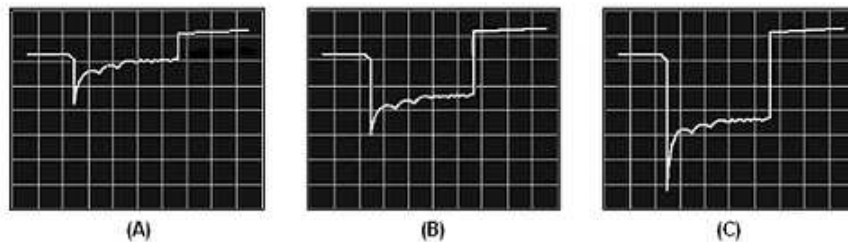
Figure 40

13. To exit the program, pressing the  key at any moment will exit and return back to the main menu screen (Fig.30).

9.0 – Starter Test

This test actually checks the cranking effectiveness of the battery and also can predict when the battery will fail to crank a vehicle.

This Analyzer is designed to address the weakness of conventional testers with its cranking power measurements. Simply connect the analyzer to the battery in the vehicle and start the engine!



To understand the working principle of the tests, let's look at the wave form displays taken during the cranking tests with an oscilloscope.

Figure (A) above shows the voltage profile of a healthy battery during the cranking of an engine. The graph starts off at the battery's nominal voltage, and a voltage drop is detected when the vehicle is cranked. The voltage recovers to the battery's nominal voltage and eventually rises to approximately 14.4 V when the alternator starts charging the battery.

For Figure (B) where a typical 2 year-old battery, you noticed the difference in the voltage drop which indicates that it is weaker but still usable.

Whereas Figure (C) represents a very weak battery that can barely crank a car and is due to fail in the very near future.

As voltage profiles can indicate the relative ability of the tested battery in starting an engine, so there is no need for knowledge on the starter motor requirement or the battery's rating and size.

MODEL 12-1012 will capture the highest voltage drop and calculate the final results which should not be lower than 9.6V average during cranking and computes the result after the test.

9.1– Begin Testing

1. With engine OFF, place the vehicle transmission in NEUTRAL for Manual and PARK for Automatic then apply the parking brake.
2. Connect the analyzer to the battery terminals and the display will light up as shown (Fig 41).

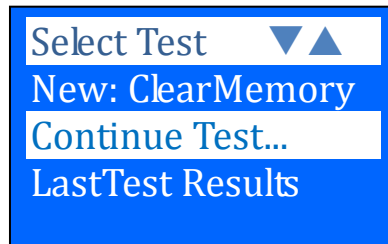


Figure 41

3. After you have made your choice, selecting either “New: Clear Memory” or “Continue...Test” will proceed to the display below: (Fig. 42)

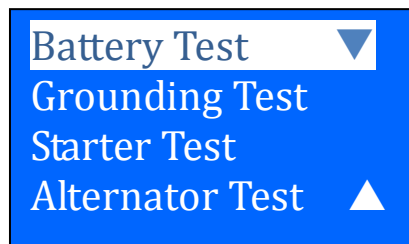


Figure 42

4. From the main MENU, select ‘Starter Test’ by scrolling down using  key. (Fig.43)

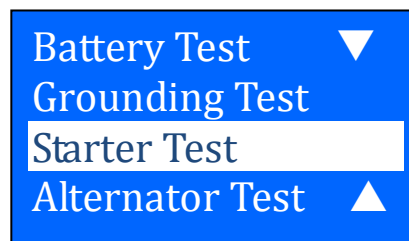
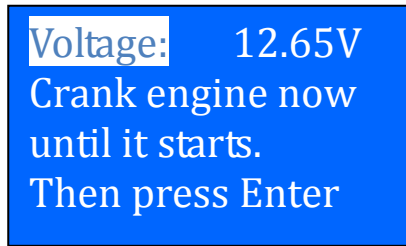


Figure 43

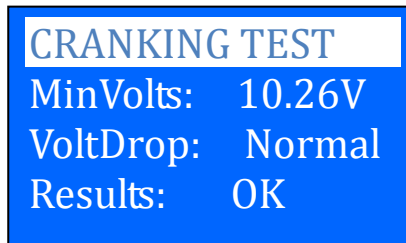
2. Press  key to continue and the display will show: (Fig.44)



Voltage: 12.65V
Crank engine now
until it starts.
Then press Enter

Figure 44

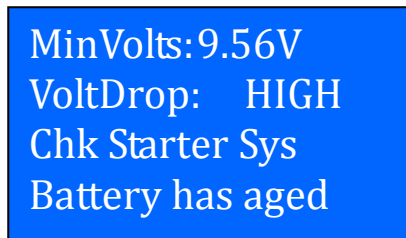
3. Switch the ignition key to ON and start cranking the engine until it starts. Immediately after that press  key and the results will show as follows (Figure 45):



CRANKING TEST
MinVolts: 10.26V
VoltDrop: Normal
Results: OK

Figure 45

4. If the voltage drop is too great during the cranking, the tested results will display as follows (Figure 46) and will prompt you to check the starter system.



MinVolts: 9.56V
VoltDrop: HIGH
Chk Starter Sys
Battery has aged

Figure 46

5. During cranking when it detects that there is no drop in voltage, it will display the following screen (Figure 47).

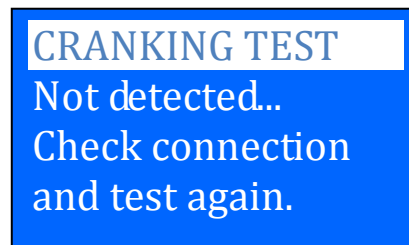
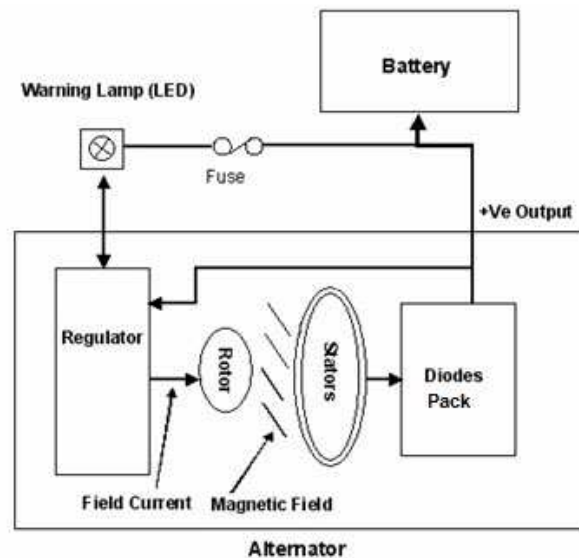


Figure 47

6. Pressing the  key at any moment will exit and return back to the previous screen.

10.0 – Alternator Test

An alternator is the device used to produce the electricity the car needs to run and to keep the battery charged. The alternator uses the principle of electromagnetic induction to produce voltage and current. The four main parts of the alternator are the Rotor, Stator, Diode Pack, Voltage Regulator and an Ammeter or Indicator Light to inform the driver of any problems. All of these parts must be in good working order for the alternator to do its job.



The Rotor is a coil of wire wound around an iron core. The Rotor rotates as the alternator shaft rotates and current passes through brushes. The Rotor winding passes the Field current. This causes the Rotor to produce a magnetic field. So basically the Rotor is a rotating electro magnet.

The Stator is a set of three windings fixed to the case of the alternator and these windings are static i.e. they don't rotate. As the Rotor rotates its magnetic field "cuts" each Stator winding in turn, this induces a current in each winding. The outputs from the Stator windings are 120 degrees apart and are alternating current (AC).

But vehicles run on DC current, so we need something that will convert the AC current to DC current. This is the job of the diode pack. A diode is an electrical one-way check valve that will let current flow in only one direction. The typical diode pack uses four diodes to accomplish this. AC current is feed in on one side of the diode pack and DC current comes out the other side. The diode pack here will rectify the alternating 3 phases from the Stators and combine them into a single Direct Current which also works the dash ammeter or indicator light.

Now that we have a DC current that the vehicle can use, we need a way to control that current. That is the job of the voltage regulator. As the name implies, it regulates the voltage going to the battery. It does this by turning current to the field (stator) terminal of the alternator on and off.

If the battery voltage goes below 13.5 volts, the voltage regulator sends current to the field terminal and allows the alternator to start charging. Current will then flow into the battery and bring it up to full charge.

If the voltage goes above 15.0 volts, the voltage regulator shuts off the current to the field terminal and keeps the battery from overcharging and cooking itself. This is how the voltage regulator controls the alternator output.

When you first start your vehicle, the alternator needs some current to start working. The voltage regulator supplies this current from the battery to the field (stator) terminal of the alternator to get it started.

The state of charge of the battery controls amperage output of the alternator. When the battery has a full charge, the electro-motive force of the voltage lowers the amperage to almost zero. As the battery charge wears down, the electro-motive force is not enough to stop the amperage, so it flows into the battery and charges it again.

10.1 – Start Testing

This test is to check the MAX and MIN charging voltages output of the alternator at 3000 RPM without load and 2000 RPM with all loads ON. With this test you can determine the alternator's condition when in reference with the vehicle's Service Manual.

No load testing at 3,000 RPM

1. With engine OFF, place the vehicle transmission in NEUTRAL for Manual and PARK for Automatic and apply the parking brake.
2. Attach the Analyzer clips onto the battery terminal posts and it will power up and lights up the LCD display screen as shown (Fig.48)



Figure 48

- It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 49)

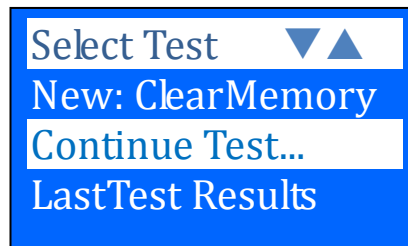


Figure 49

- After you have made your choice, selecting either "New: Clear Memory" or "Continue...Test" will proceed to the display below: (Fig. 50)

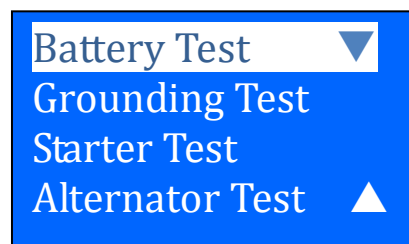


Figure 50

- Pressing  key to scroll down to the 'Alternator Test' (Fig.51)

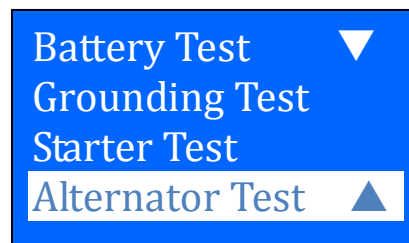


Figure 51

- Press  key to continue and the display will show: (Fig.52)

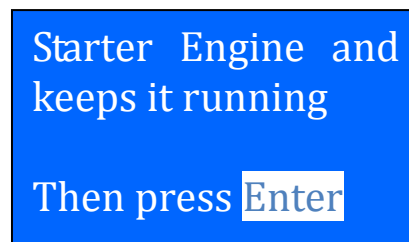
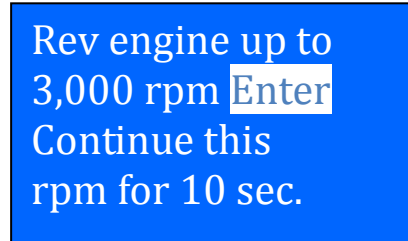


Figure 52

Start the engine and then press  key again and the screen will prompt you as shown below (Fig. 53).



Rev engine up to
3,000 rpm **Enter**
Continue this
rpm for 10 sec.

Figure 53

Make sure that all loads (lights, air-condition, etc) are OFF.

Rev the engine up to **3,000 ~ 3,500 RPM** by referring to the dashboard meter, then press  key and maintain it for about 10 seconds and release the pedal. The maximum and minimum voltages values will be captured.

After that press  key again and it show as below (Fig 54.)

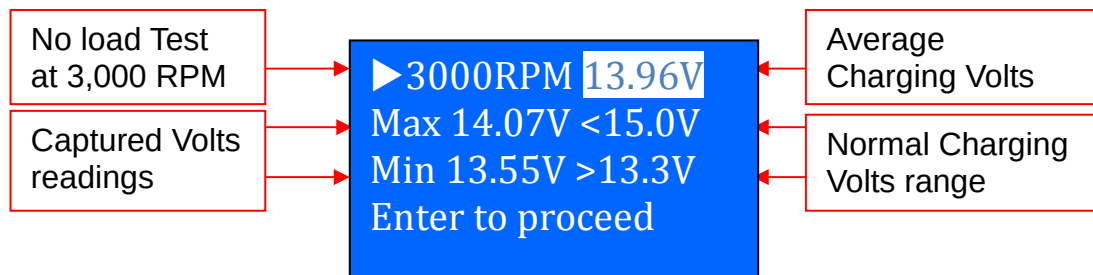
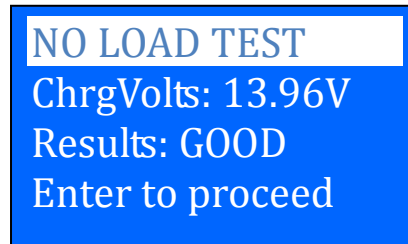


Figure 54

With the captured readings, analysis can be done by referring to the limits as indicated that **MAX voltage should not exceed 15.0V** (max. voltage at 3,000 RPM) and **MIN voltage should be more than 13.3V** (min voltage during idling speed).

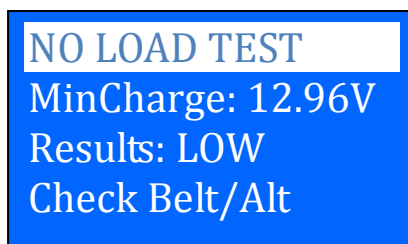
6. Press  key will show the results of the test (Figure 55):



NO LOAD TEST
ChrgVolts: 13.96V
Results: GOOD
Enter to proceed

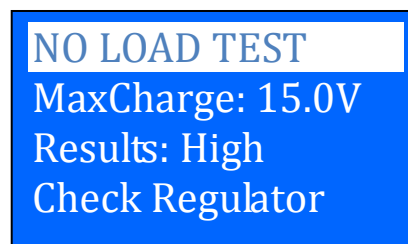
Figure 55

7. If either minimum or maximum charging volts are not within the voltage range limits then it will display one of the screen as below (Figures 56 & 57) and it will prompt you to check the charging system for the fault.



NO LOAD TEST
MinCharge: 12.96V
Results: LOW
Check Belt/Alt

Figure 56



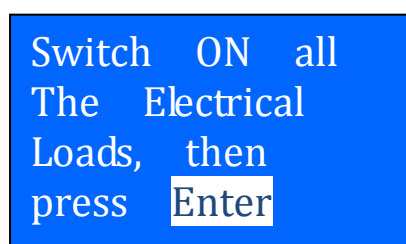
NO LOAD TEST
MaxCharge: 15.0V
Results: High
Check Regulator

Figure 57

Testing with load at 2,000 RPM

As more electrical accessories, such as lights, heater, air condition, car stereos, etc. were used; the electro-motive force decreases and this will allow more amperage from the alternator to flow into the battery to compensate for the added load. This test is to check the alternator's behavior during loading.

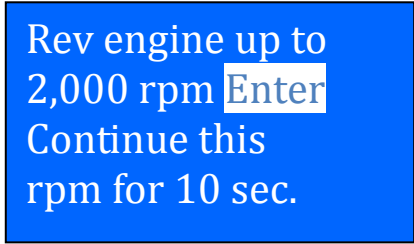
8. Continue from the previous test (either Fig. 55, 56 or 57); proceed to the next step by pressing  key will enter to the display as follows. (Fig.58)



Switch ON all
The Electrical
Loads, then
press **Enter**

Figure 58

Now, switch ON all loads (Head Lights, Radio, Air-condition, Heater, etc) and press  enter key will display: (Fig.59)



Rev engine up to
2,000 rpm **Enter**
Continue this
rpm for 10 sec.

Figure 59

Make sure that all electrical loads (lights, air-condition, etc) are ON.

Rev the engine up to **2,000 ~ 2,500 RPM** by referring to the dashboard meter, then press  key and maintain it for about 10 seconds and release the pedal. The maximum and minimum voltages values will be captured.

After that press  key again and it show as below (Fig 60.)

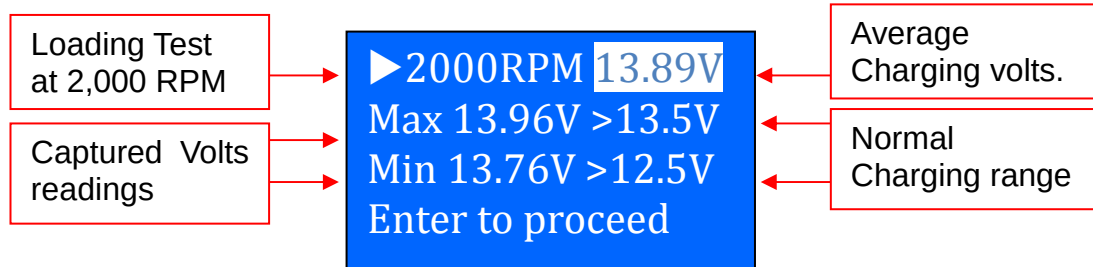
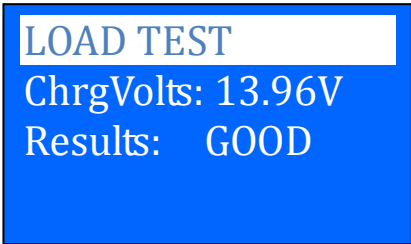


Figure 60

With the captured readings, analysis can be done by referring to the limits as indicated that **MAX voltage should exceed 13.5V** (max. voltage at 2,000 RPM) and **MIN voltage should be more than 12.5V** (min voltage during idling speed).

9. Press  key will proceed to show the results of the test:



LOAD TEST
ChrgVolts: 13.96V
Results: GOOD

Figure 61

If either minimum or maximum charging volts are not within the voltage range limits then it will display one of the screen as below (Figures 62& 63) and it will prompt you to check the alternator system for the fault.

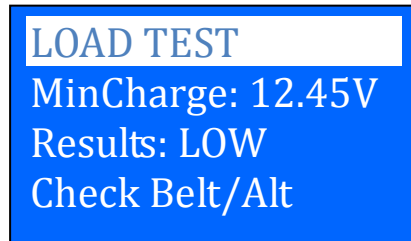


Figure 62

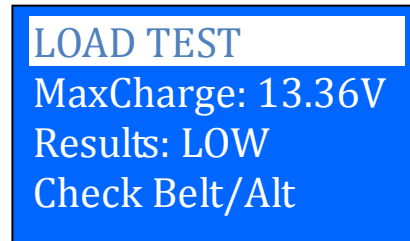


Figure 63

10. To exit the program, pressing the  key at any moment will exit and return back to the previous screen.

11.0 – View Last Test Results

To view the results of the last test, the MODEL 12-1012 has to be connected to an external power source by either clamping its clips directly to a 12Volt car battery or connected to a PC via the USB port.



Figure 64

1. Once power up, the wakeup screen will display as follows:



Figure 65

2. It will run through a self-test and when completed it displays the Main Menu as shown: (Fig. 66)

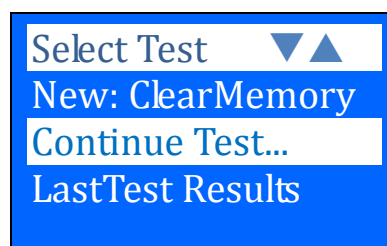


Figure 66

3. Pressing  key once will scroll down to the 'Last Test Results'

Fig. 67 below.

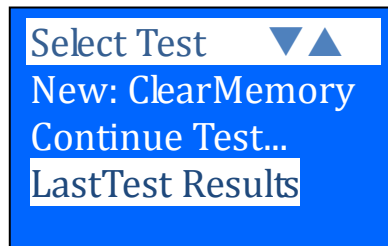


Figure 67

4. Press  key will proceed to display the last test results depending the type of test you had performed earlier. (Fig. 68)

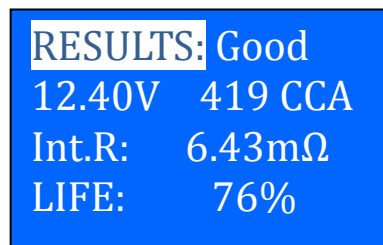


Figure 68

5. To view the next page, press  or  key to get to the page you want.

Some examples below are: (Figs. 69, 70, 71 & 72)

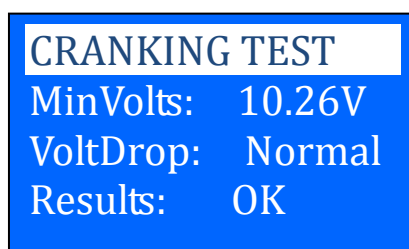


Figure 69

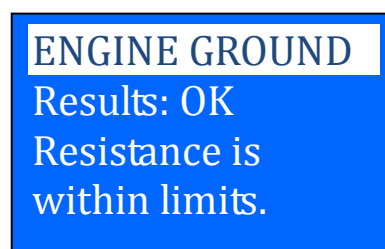


Figure 70

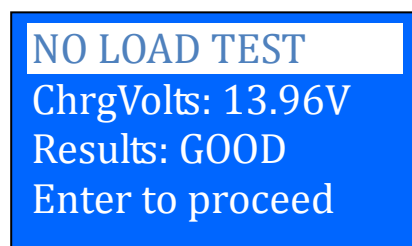


Figure 71

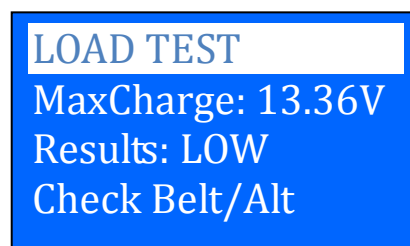


Figure 72

12.0 –Setting up the PC ready for MODEL 12-1012

12.1 - Installing Driver.

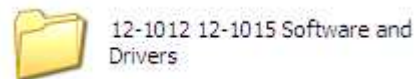
Important Note:

Before you start to install the driver, please do not plug the Analyzer into the computer's USB port or else the installation will fail and the computer cannot detect the proper driver when it is connected.

If you have made the above error and wish to install the driver the second time, you need to uninstall the previously installed driver first before starting to reinstall again. This time make sure that the Analyzer is not plugged in.

- Step 1.** You can install the driver from the CD provided or download it from our website:
http://associatedequip.com/downloads/12-1012-15_Drivers.zip

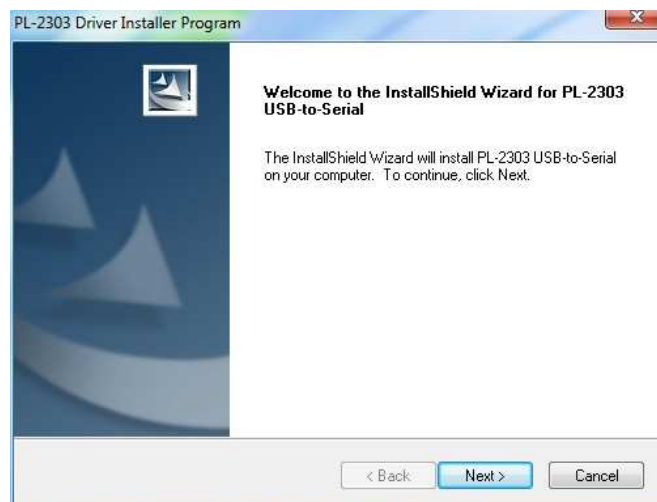
First click to open the folder:



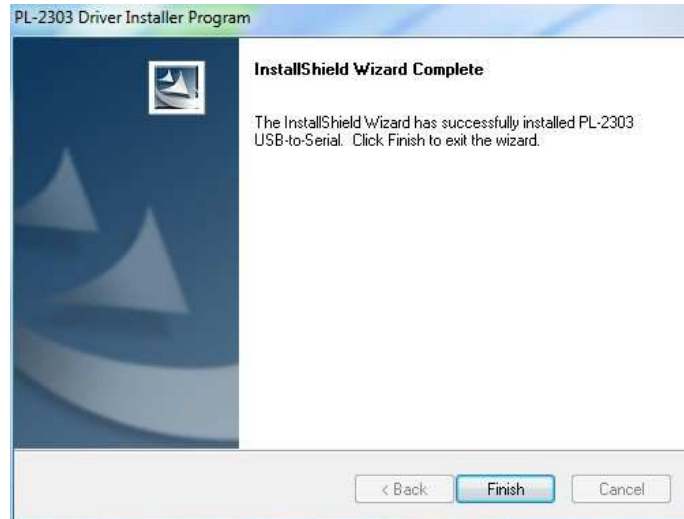
You will find the following files:



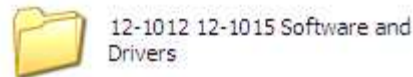
- Step 2.** Double click on the icon . The installation will start automatically. Typical example below is for Windows 7 operating system.



As instructed, click [Next>] tab the program will continue to install the driver on the computer. Once it had finished, it will prompt you as shown below. Click [Finish] tab to complete the installation.



Step 3. Next open this folder again:



Look for the program icon (see below).

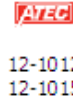


Then double click it. The software will start to install and will prompt with the display below:



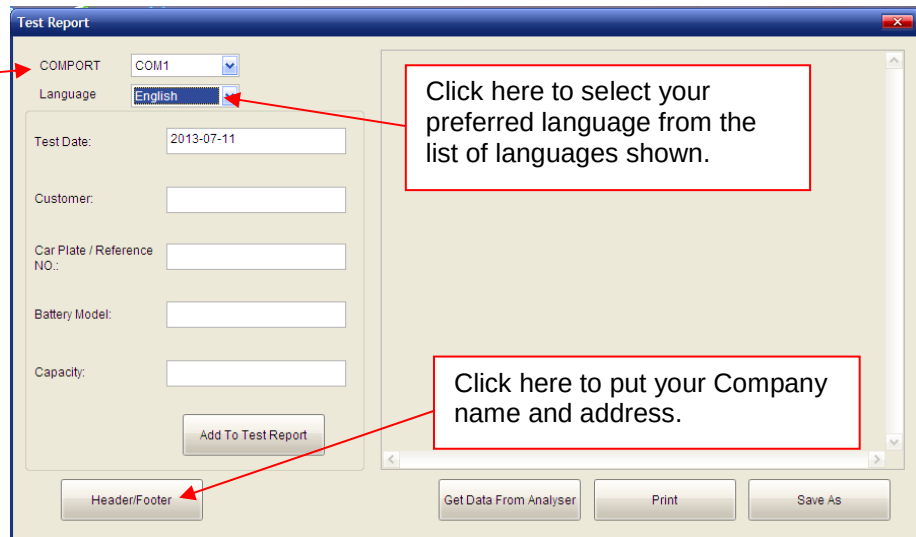
Click "OK" tab to continue the installation and the software will be successfully installed.

Step 4. Now plug the Analyzer into any one of the PC USB ports.

Step 5. On the PC, go to desktop display and look for  icon.

Left click on this icon to open the program and the display page will show as below:

It will automatically detect the COM Port. If you find that this field is blank, close the program, unplug the analyzer cable and then plug back again. Repeat Step 5 to open the program. The COM Port(s) will now appear in the drop down menu.

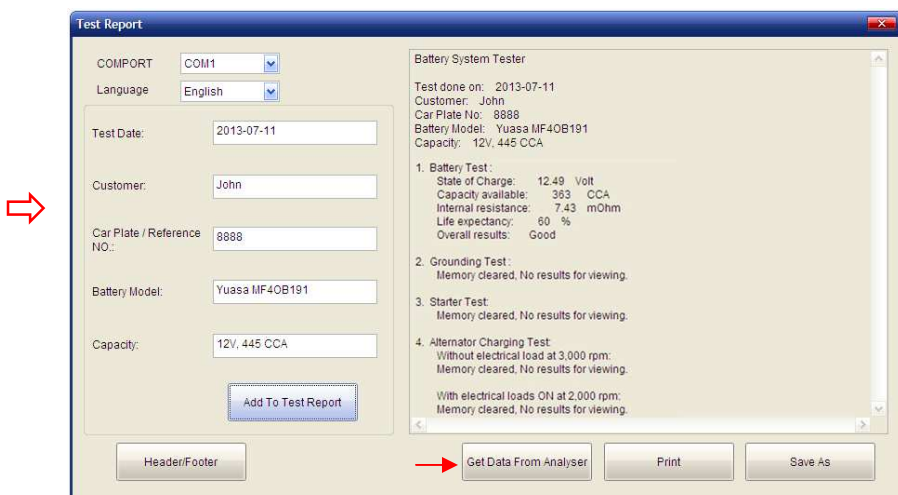


Click here to select your preferred language from the list of languages shown.

Click here to put your Company name and address.

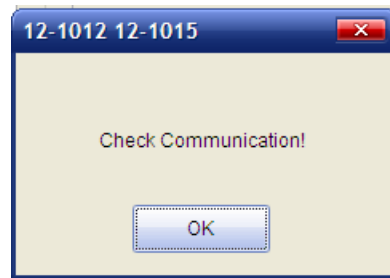
Step 6. Now press the communication key  on the Analyzer to log onto the computer; To confirm whether there is communication; click on [Get Data From Analyser] tab and the Last Test Result will appear. See example below:

You can type in the particulars here and then click [Add to Test Report] tab to be included in the test report which will be stored and printed out if you wish.



Get Data From Analyser

If there is no communication, a message text box will appear (see below).



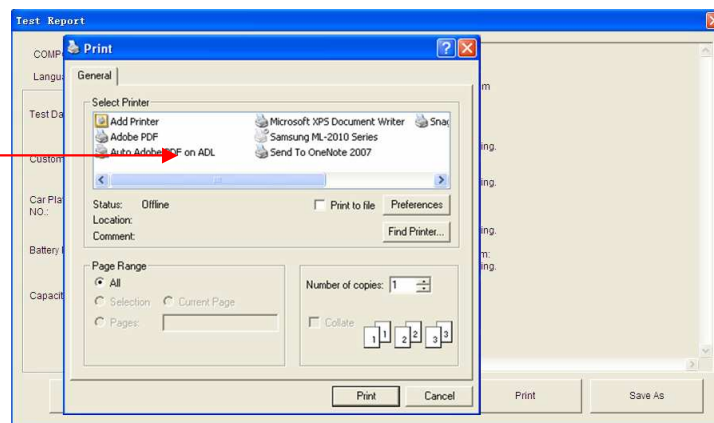
In this case, unplug the Analyzer from PC and repeat Step 4 to Step 6. If problem persists, then select an alternate COMPORT individually from the dropdown list and click [Get Data From Analyser] tab to see whether the Last Test Result will appear (as displayed in Step 6).

If the above fails again, then try plugging the Analyzer to the PC's another USB port and repeating Step 4 to 6 again.

12.2 Printing Results from normal printer:

While on this page, if you wish to print out the results, make sure that your printer is connected to the computer. Click on [PRINT] tab and a text box will appear. Select the right printer and click [Print] tab to print.

Select the printer which is connected to your computer here.

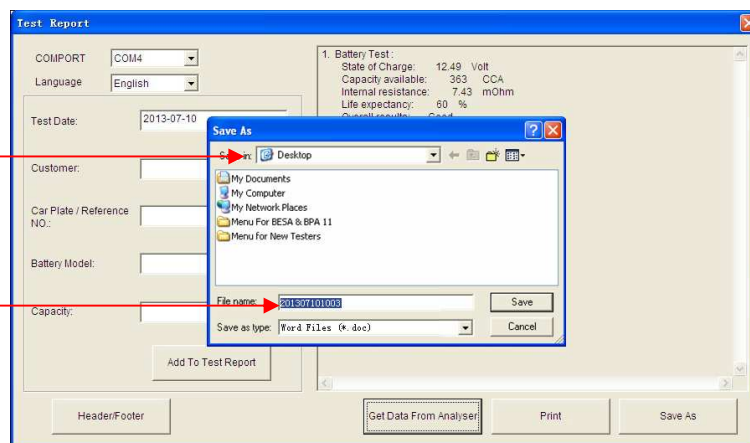


12.3 Saving Results:

If you wish to save the results from this page, then click on [Save As] tab. A message box will appear. Type in the file name and click [Save] tab.

Select where you want to save in.

Type the file name here.



Disclaimer

All information, illustrations, and specifications contained in this user manual are based on the latest information available at the time of printing. The right is reserved to make any changes at any time without obligation to notify any person or organization of such revisions or changes.

Furthermore, the manufacturer or its sales agents are not liable for errors contained herein or for incidental or consequential damages (including lost profits) in connection with the furnishing, performance or use of this material.

This user manual tells how to use and perform the required procedures on vehicles. Safe and effective use of this Analyzer is very much dependant on the user following the normal practices and procedures outline in this manual.

13.0 – Warranty Information

13.1 – Limited Warranty

This limited warranty cover defects in materials and workmanship for a period of twelve (12) months which begins from the date the product is purchased by the end user and is subjected to the following terms and conditions:

1. Within the warranty period, the manufacturer will repair or replace, at their options, any defective parts and return to the owner in good working condition.
2. Any repaired or replaced parts will be warranted for the balance of the original warranty or three months (3) months from the date of repair, whichever is longer.
3. This warranty only extends to the first owner and not assignable or transferable to any subsequent owner.
4. Cost of delivery charges incurred for the repair of the product to and from the manufacturer will be borne by the owner.
5. This limited warranty covers only those defects that arises as a result of normal use and does not cover those that arises as a result of:
 - Unauthorized modifications and repair.
 - Improper operation or misuse.
 - Accident or neglect such as dropping the unit onto hard surfaces.

- Contact with water, rain or extreme humidity.
- Contact with extreme heat.
- Cables that have broken, bent contact pins or subject to extreme stress or wear.
- Physical damage to the product surface including scratches, cracks or other damage to the display screen or other externally exposed parts.

13.2 - Limitations of Warranty

Other than the foregoing limited warranty, the manufacturer does not make any other warranty or condition of any kind, whether express or implied.

Any implied warranty of merchantability, or fitness for use shall be limited to the duration of the foregoing limited warranty.

Otherwise, the foregoing limited warranty is the owner's sole and exclusive remedy and is in lieu of all other warranties whether express or implied.

The manufacturer or any of its exclusive sales agents shall not be liable for any consequential or incidental damages or losses arising of the loss of uses of this product.

All warranty information, product features and specifications are subjected to change without prior notice.