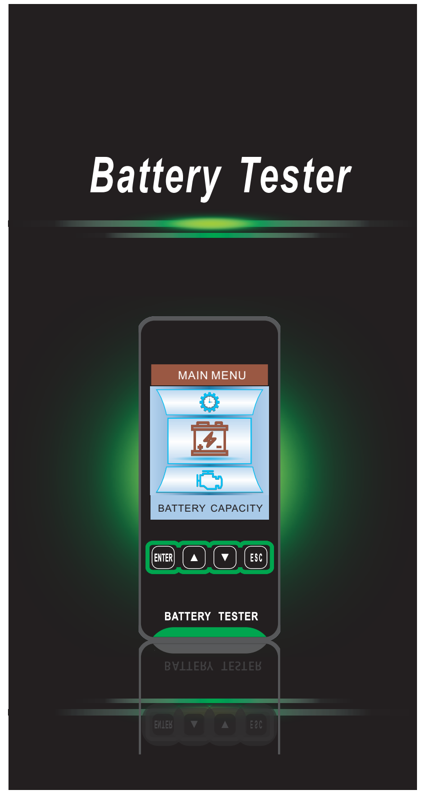


1. Brief Introduction

This battery tester is designed for testing the conditions of the 12V & 24V lead-acid starting battery, cranking system and charging system.

It comes with a large 3.2-inch color LCD screen and it supports classic touch-tone to help you read and operate more efficiently. It utilizes 4-wire Kelvin method to complete the collection of a series of complicated data for calculating every testing data with a build-in precise circuit and improved digital processor. Moreover, some circuit improvements including polar reversal protection, over-voltage input protection, and loose lead detection, ensure safety and convenience during testing.

This is a must-have tool in the fields of battery sales, vehicle repair and battery inspection equipment system.

2 . Safety Rules and Precautions

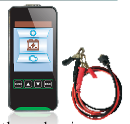
This manual includes operation instruction and warning. Damage to the meter may occur if it is not operated following the rules in this manual. This tester is designed and produced strictly according to IEC/EN61010-1 safety standard. Also, it reaches double insulation over-voltage standard CATⅢ 600V and pollution degree 2

1. Available for 12V&24V Starting Battery.
2. Working voltage is DC 9V to 18V.
3. The voltage value will be higher than the normal situation after the checked battery being fully charged. Please turn on the headlights for 2 to 3 minutes, then check the battery when its voltage value drops to the normal value.
4. Check the insulating layer of the clamps before testing. It can only be operated without any damage, bareness or disconnection. Do not use it when the housing is not covered completely or correctly, which will cause electric shock.

5. Do not use or store the tester in the condition of high temperature, high humidity, combustibility, explosion, and strong electromagnetic field.
6. Do not modify the internal circuit in order to avoid damage to the tester and danger to the user.
7. Wear proper eye mask when testing or repairing in order to avoid objects hitting eyes from the engine.
8. Keep the site ventilated when testing or repairing in order to avoid inhaling toxic gas.
9. When the engine is running, do not place the tester or accessories besides the engine or the exhaust pipe in order to avoid damage by high temperature.
10. Pay attention to the precautions and maintenance procedure from the manufacturer during repairing.
11. Standard of optional storage battery:

CCA：100~2000　IEC：100~1400　BCI：100~2000
E N：100~2000　CA：100~2000　DIN：100~1400
MCA：100~2000　SAE：100~2000　GB：100~1400
J I S：26A17 – 245H52 (100~2000 CCA)

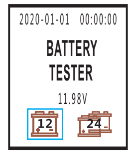
3. Structure of Meter



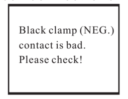
<▲> : increase the value / page up
<▼> : decrease the value / page down
<ESC> : cancel / return
<ENTER> : confirm / test
Red clamp : positive connection
Black clamp : negative connection

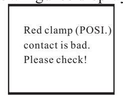
4. Operation Instruction

The tester is powered by the vehicle battery. Please connect the RED clamp to the positive terminal, and connect the BLACK clamp to the negative terminal. It is recommended connect RED clamp prior to BLACK clamp. Once clamps are connected correctly and firmly, LCD screen will display the below figure, which means it is ready to use.

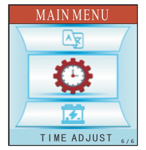


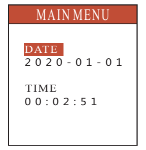
Please check connections if below figures display.

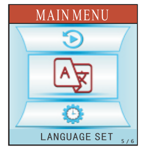




Then adjust time and language by selecting TIME ADJUST and LANGUAGE SET under Main Menu.





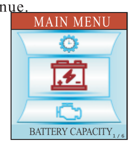


4. 1 Battery Capacity Test

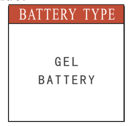
This test determines starting capacity and status of battery by testing CCA/ Voltage/Internal Resistance.

4.1.1
Please ensure engine and all electronic devices are turned off before operating battery test. Voltage will be higher than the normal situation due to the checked battery is fully charged. In this situation, turn on the headlights for 2 to 3 minutes, then turn off all devices and operate the test when the voltage drops to the normal value.

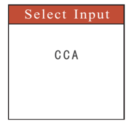
4.1.2
Press <▲> <▼> to select "Battery Capacity" and press <ENTER> to continue.



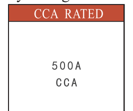
4.1.3
Press <▲> <▼> to select "Battery Type" and press <ENTER> to continue.



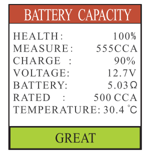
4.1.4
Press <▲> <▼> to select testing standard which is displayed on the battery rating label, and press <ENTER> to continue.



4.1.5
Press <▲> <▼> to select battery rating value which is displayed on the battery rating label.



4.1.6
Press <ENTER> to start Battery Test. The test result will be displayed as below.



4.1.7
Test result will be auto stored for reviewing. Press <ENTER> or <ESC> to return to Main Menu.

Reference Table for Battery Status of Health (SOH)

SOH	RESULT	NOTE
>80%	GOOD	GOOD TO USE
>60%	NORMAL	GOOD TO USE
>45%	CAUTION	KEEP CAUTION
<45%	REPLACE	REPLACE IMMEDIATELY

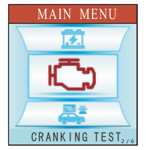
Please NOTE that Internal Resistance refers to the sum total resistance of two series connection 12V batteries when testing 24V system.

4.2 Cranking Test

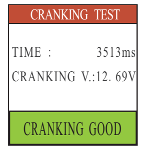
This test determines cranking state by testing cranking voltage and time.

4.2.1
Ensure the engine and all devices are turned off.

4.2.2
Press <▲> <▼> to select "Cranking Test" and press <ENTER> to continue.



4.2.3
Complete test by following guides displayed in screen.



4.2.4
Test result will be auto stored for reviewing. Press <ENTER> or <ESC> to return to Main Menu.

Reading over 9.6V (for 24V system, reading over 16V) means cranking is good.
Reading below 9.6V (for 24V system, reading below 16V) means cranking is abnormal. Please check associated parts , such as connections, wires, starter and battery's terminal corrupted or not.

Reference Table for Cranking Test (12V system)

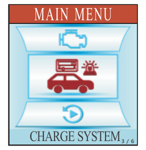
VOLTAGE	CRANKING ABILITY	ACTION TO BATTERY
>10.7V	GOOD	NO ACTION
10.2~10.7V	NORMAL	KEEP CAUTION
9.6~10.2V	BAD	REPLACE IT SOON
<9.6V	VERY BAD	REPLACE IT IMMEDIATELY

4.3 Charge System Test

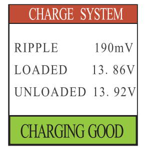
This test determines charge system by testing ripple voltage, loaded voltage and unloaded voltage.

4.3.1
Turn on the engine.

4.3.2
Press <▲> <▼> to select "Charge System" and press <ENTER> to continue.



4.3.3
Complete test by following guides displayed in screen.



4.3.4
Test result will be auto stored for reviewing. Press <ENTER> or <ESC> to return to Main Menu.

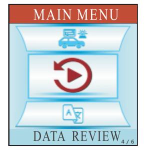
Reference Table for Charge System(12V system)

ACTION	VOLTAGE	ENGINE PERFORMANCE
All Electric System Off (Depress Accelerator)	>13. 5V	NORMAL
	13. 2~13. 5V	GENERAL
	13. 0~13. 2V	KEEP CAUTION
	<13V	INSPECTION IMMEDIATELY
All Electric System On (Depress Accelerator)	13. 4~14. 8V	NORMAL
	13. 2~13. 4V	GENERAL
	<13. 2V	INSPECTION IMMEDIATELY
For reference only. Bad battery will affect the test results.		

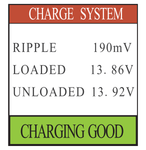
4.4 Data Review

Every last data of each test will be auto stored for reviewing.

4.4.1
Press <▲> <▼> to select "Data Review" and press <ENTER> to continue.



4.4.2
Review every last test result of BATTERY CAPACITY , CRANKING TEST , CHARGE SYSTEM by pressing <ENTER>.



5. FAQ

5.1
What is the measurement principle of this tester?

The battery will gradually aging with increase of time. The main reason is that it can no longer generate some effectively chemical reaction because of aging of the surface of the battery plate. That is why most of the batteries can longer be used mainly. International Electric and Electronic Engineer Association(IEEE)formally looks the Conductivity Test as one of the standard of checking lead acid storage battery. It points out from IEEE standard 1118-1996 that : Conductivity Test is used to test AC current generated by putting the known frequency and amplitude AC signal to both sides of the battery. AC conductivity value is the ratio of AC current signal which keeps same phase with AC voltage and the AC voltage. This tester is designed from this principle actually.

5.2
Will the result be affected by the installation of negative current for the vehicle?

All the negative currency will affect the result. Therefore please remove the negative currency prior to checking, in order to achieve the accurate data.

5.3
Is it possible for us to know the life of battery with this tester?

The internal resistance of the sealed lead-acid battery is complicated. It is generated by ohm internal resistance, concentration polarization internal resistance, chemical reactions internal resistance and interference effect caused by double capacitance's charging. The ingredient of internal resistance and its relative content will change with different test method and different test moment, which can lead to different tested value of the internal resistance. And there is no strict relationship between internal resistance or conductance and capacitance of the sealed lead-acid battery. So it is impossible to predict the life of battery according to a single battery's internal resistance. But it can be predicted the life of the battery will be over soon from the sudden increase of its internal resistance and decrease of its conductance.

5.4
Is the CCA value tested by this tester correct?

CCA is considered as a control standard with the produce of the battery. According to the accumulated records, the tested value of new battery is 10-15% higher than the standard value, and along with consuming of the battery, the value is getting close to standard, even lower afterward.

5.5
What is the difference between the method of this tester and the load test method?

The load test method: According to the physical formula R=V/1, test equipment forcibly make the high permanent DC current (presently 40-80A large current is available) go through the battery shortly (about 2-3 seconds). And then the tested voltage of the battery can be used to figure out the internal resistance by the formula.

Disadvantages of load test method:
(1) Just available for large capacitance battery or storage battery. The small capacitance battery can not load 40-80A large current in 2-3 seconds.
(2) When the large current going through the battery, there comes out polarization phenomenon from internal electrode, which can cause polarization internal resistance. As a result it has to be tested in a short time. Otherwise there is a large error of the internal resistance value.
(3) The internal electrode will be damage generally when large current go through the battery.

The method of this tester: Battery is actually equivalent to an active resistance. So we add a fixed frequency and small current to it, and then sample the voltage value. Eventually the internal resistance can be figured out after some operation such as rectification and smoothing.

Advantages of this method:
(1) It can be used for checking almost all the batteries including low capacity battery and internal resistance of the notebook battery exclusively.
(2) It will not harm the battery to use this method.

6. Specification of Battery

6.1 JIS Switch Table (Reference Only)

Battery		CCA			Battery		CCA		
JIS(NEW)	JIS(OLD)		MF	CMF	JIS(NEW)	JIS(OLD)		MF	CMF
26A17R		200			55B24RS	NT80-S6S	430	420	500
26A17L		200			55B24LS	NT80-S6LS	430	420	500
26A19R	12N24-4	200	220	264	55D26R	N50Z	350	440	525
26A19L	12N24-3	200	220	264	55D26L	N50ZL	350	440	525
28A19R	NT50-N24	250			60D23R		520		
28A19L	NT50-N24L	250			60D23L		520		
32A19R	NX60-N24	270	295		65D23R		420	540	580
32A19L	NX60-N24L	270	295		65D23L		420	540	580
26B17R		200			65D26R	NS70	415	520	625
26B17L		200			65D26L	NS70L	415	520	625
28B17R		245			65D31R	N70	390	520	630
28B17L		245			65D31L	N70L	390	520	630
28B19R	NS40S	245			70D23R	35-60	490	540	580
28B19L	NS40LS	245			70D23L	25-60	490	540	580
32B20R	NS40	270			75D23R		500	520	580
32B20L	NS40L	270			75D23L		500	520	580
32C24R	N40	240	325	400	75D26R	F100-5	490		
32C24L	N40L	240	325	400	75D26L	F100-5L	490		
34B17R		280			75D31R	N70Z	450	540	735
34B17L		280			75D31L	N70ZL	450	540	735
34B19R	NS40ZA	270	325	400	80D23R		580		
34B19L	NS40ZAL	270	325	400	80D26L		580		
36B20R	NS40Z	275	300	360	85B60K				500
36B20L	NS40ZL	275	300	360	85BR60K				500
36B20RS	NS40ZS	275	300	360	95D31R	NX120-7	620	660	850
36B20LS	NS40ZLS	275	300	360	95D31L	NX120-7L	620	660	850
38B20R	NX60-N24	330	340	410	95E41R	N100	515	640	770
38B20RS	NT60-N24S	330	340	410	95E41L	N100L	515	640	770
38B20L	NX60-24L	330	340	410	105E41R	N100Z	580	720	880
38B20LS	NX60-24LS	330	340	410	105E41L	N100ZL	580	720	880
40B20L		330			105F51R	N100Z	580		
40B20R		330			105F51L	N100ZL	580		
42B20R		330			115E41R	NS120	650	800	960
42B20L		330			115E41L	NS120L	650	800	960
42B20RS		330			115F51R	N120	650	800	960
42B20LS		330			115F51L	N120L	650	800	960
46B24R	NS60	325	360	420	130E41R	NX200-10	800		
46B24L	NS60L	325	360	420	130E41L	NX200-10L	800		
46B24RS	NS60S	325	360	420	130F51R			800	
46B24LS	NS60LS	325	360	420	130F51L			800	
46B26R		360			145F51R	NS150	780	920	
46B26L		360			145F51L	NS150L	780	920	
46B26RS		360			145G51R	N150	780	900	1100
34B19RS	NS40ZAS	270	325	400	80D26R	NX110-5	580	580	630
34B19LS	NS40ZALS	270	325	400	80D26L	NX110-5L	580	580	630
46B26LS		360			145G51L	N150L	780	900	1100
48D26R	N50	280	360	420	150F51R	NT200-12	640		
48D26L	N50L	280	360	420	150F51L	NT200-12L	640		
50D20R		310	380	480	165G51R	NS200	935	980	
50D20L		310	380	480	165G51L	NS200L	935	980	
50D23R	85BR60K	500			170F51R	NX250-12	1045		
50D23L	85B60K	500			170F51L	NX250-12L	1045		
50B24R	NT80-S6	390			180G51R	NT250-15	1090		
50B24L	NT80-S6L	390			180G51L	NT250-15L	1090		
50D26R	50D20R		370		195G51R	NX300-51	1145		
50D26L	50D20L		370		195G51L	NX300-51L	1145		

CONTINUED

Battery		CCA			Battery		CCA		
55D23R		355	480	500	190H52R	N200	925	1100	1300
55D23L		355	480	500	190H52L	N200L	925	1100	1300
55B24R	NX100-S6	435	420	500	245H52R	NX400-20	1530	1250	
55B24L	NX100-S6L	435	420	500	245H52L	NX400-20L	1530	1250	

6.2 Comparison Table of DIN & EN

Model	Same Model	DIN	EN	Model	Same Model	DIN	EN
52805	52815	180	240	56420	56322 88066	300	510
53517		175	300	56530	56618 56638	300	510
53520	53521 53522	150	240	56618	56619 56620	300	510
53625	53638 53836	175	300	56633	56647 56641	300	510
53646	53621 88038	175	300	56820	56821 56828	315	540
53653	53624 53890	175	300	57024	57029	315	540
54038	54039	175	300	57113	57539	400	680
54232		175	300	57114	56821 88074	400	680
54313	54324 54464	220	330	57218	57219	420	720
54317	54312 88146	210	360	57220	57217	420	720
54437	54466 54459L	210	360	57230		380	640
54459	54434 88046	210	360	57412	57413 57412L	400	680
54469	54449 54465	210	360	57512	57513 57531	350	570
54519	54533 54612	210	360	58515	58424	450	760
54523	54524	220	300	58521	58513	320	540
54537	54545 54801	190	300	58522	58514	320	540
54551	54580	220	300	58815	58821	395	640
54533	54577 54579	220	300	58820	58515 58527	395	640
54584	54578	220	300	58827		400	640
54590		210	330	58838	58833 88092	400	680
54827		240	360	59040	59017 59018	360	600
55040	88056	265	450	59218	59219	290	480
55041	55042	220	360	59226	59215	450	760
55044	55414 88056	265	450	59514		320	540
55046		300	510	59518	59519	395	640
55056		320	540	59615	59616	360	600
55057	54827 88156	320	540	60018	60019	250	410
55068	55069 55548	220	390	60026	58811	440	720
55218		255	420	60044	60038	500	760
55414	55415 55421	265	450	60527	60528	410	680
55422	55566 55040	265	450	61017	61018	400	680
55428	55423 55427	300	510	61023	62529	450	760
55457		265	450	61047	61048	450	760
55529		220	360	62034	62038 62045	420	680
55531	55545 55559L	255	420	63013		470	680
55559	55530 88056	255	420	63545	63549	420	680
55564	55552 55563	255	420	64020	64317 64318	325	550
55564	55565 55548	255	420	64028	64035	520	760
55570	55567 55565L	255	420	64036		460	760
56012		230	390	64317	64318 64323	540	900
56048	56068 56069	250	390	65513		540	900
56049	56069 56073	250	390	65514	65515	570	900
56077	56030	300	510	67043	67045	600	1000
56091	55811	360	540	68032	68034	600	1000
56111	55048	300	540	70029	70038 70027	630	1050
56218	56092	300	510	70036	68040 68021	570	950
56219	56216	300	510	71014	71015	700	1150
56220		280	510	72512		680	1150
56225	56323	300	510	73011		740	1200
56318	56312 56311	300	510				

7. About Automotive Starting Battery

7.1
Internal Resistance Vary in Different Batteries

The internal resistance varies because of inconformity of internal chemical feature even if with the same type battery. It is very small so that we generally define it with unit of milliohm. Internal resistance is a significant technical standard to measure a battery. Normally the battery with small internal resistance has a great ability to discharge. On the contrary the battery with large internal resistance has a little ability to discharge.

7.2
Impossible to Know Battery Capacity by Intuition

Hydrometer can be used to check the condition of the battery. Battery water is distilled water and pure sulfuric acid of the proportion of 1.260/20 ℃ to allocate. For a new battery, it is supposed to supply distilled water with reduction of battery water for the reason that the degree of acid is fixed when the quantity of battery water remain the normal range. Distilled water supplement can maintain a certain amount of water, but also the PH value. If the battery works normally, in addition to the PH is fixed, the proportion of the value will be in a certain range.

Car Battery		
Voltage	Capacity	Proportion
>12. 7 V	100%	1. 26~1. 28
12. 6V	90%	1. 24
12. 4V	70~80%	1. 22
12. 1V	50%	1. 16
<12V	25%	<1. 13

If the battery finishes charging, the proportion of battery water does not reach 1.26-1.28, along with the tested voltage under 12.7V, the storage capacity of this battery has

descended. It is impossible to recover its life by deliberately adjusting the proportion to 1.26 (Increase the sulfuric acid water), on the contrary shorten its life fast for the reason that it will increase the acidity of battery water, not the voltage however.

7.3
Common Abbreviation Definition of Battery Standard

RC—Reserve Capacity
Every storage battery has the ability to load averagely 25A electric per minute and maintains lowest 10.5V more or less in the situation of 80°F(27°C).

CCA－Cold Cranking Ampere
With the fixed current, every battery can be cooled in the situation of 0°F（-18°C）~ -20°F（-29°C）for 30 seconds and maintain the lowest voltage of 7.2V. The unit of CCA is Ampere. For some vehicles, especially long time used ones, it is hard to start the engine smoothly, and has to be done twice or for some seconds. Actually the electricity consumes most when starting the engine. The voltage drops off from the normal value 12.5V to 10.5V even lower at the moment that large current discharge shortly. The large CCA is very helpful to start the engine smoothly.

CA—Cranking Ampere
The main meaning is very close to that of CCA. The unit is Ampere also. The temperature under testing is the only one difference between them. CCA refers to the result that measured under 0°F(-17.8°C), and CA refers to the result that measured under 32°F (0°C). If there indicates both CCA and CA on the battery, CCA value is lower for the reason that the lower temperature is, the worse battery works.

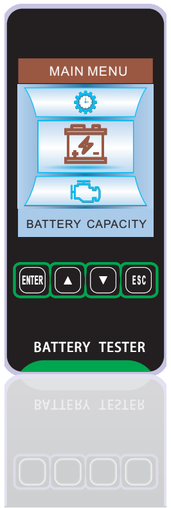
AH－Ampere Hour
This is a standard written by Japanese Industrial Standard (JIS). It is explained that the battery discharges with a fixed ampere for 20 hours along with over 10.5V. Therefore the value multiplied by a fixed ampere and the number of hour is Ampere Hour. For example a battery discharges with 5 ampere fixed for 20 hours, its Ampere Hour is 100.

DIN—Deutsches Institut für Normung e.V.
Under a cold temperature of 0°F（-18°C）, the Ampere quantity is 9.0V 30 seconds with the lowest voltage, while 8.0V 150 seconds.

IEC— International Electrotechnical Commission
Under an average current, every battery cooled in the situation of 0°F（-18°C）can load the lowest voltage of 8.4Vfor 60 seconds.

BSR—Battery Saving Ratio
Under an average current, every battery cooled in the situation of 0°F（-18°C）can load the lowest voltage of 6.0Vfor 180 seconds.

BCI—Battery Commission of International
Under an average current, every battery cooled in the situation of 0°F（-18°C）~ -20°F（-29℃）can load the lowest voltage of 7.2V for 30 seconds.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