



RC6-VSP 80W / 7A AC/DC Balance Charger

for LiPo/LiFe/LiIo/NiMH/NiCd/Pb batteries



Operating Manual

Thank you for purchasing the balance charger. This is a rapid charger/discharger with a built in balancer, computerised with microprocessor and specialised operating software. Please read this entire operating manual completely and attentively before using.

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1. Features

Optimised operating software

When charging or discharging, it has an 'AUTO' function that sets the feeding current automatically. Especially for Lithium batteries, it can prevent over-charging which can lead to an explosion by users fault. Every program in the unit is controlled with mutual links and communication for every possible error so it introduces a maximum safety. These can be set at user's option.

Special recharge plugs for receiver, transmitter and igniter charger. And for frequently used charger ports such as multipurpose, crocodile pin etc.

It provides most convenient balance charge port for Lithium batteries, with separated 3,4,5,6 charge ports, and external reverse connector.

High-power and high-performance circuit

It employs the circuit that has a maximum output power of 80W. As a result it can charge or discharge up to 15 cells of NiCd/NiMH and 6 series of Lithium batteries with a maximum current of 7.0A. Furthermore the cooling system is so efficient that it can hold such a power without any trouble of running the CPU or the operating program.

Individual voltage balancer for Lithium batteries inside

It has an individual-cell-voltage balancer inside. This does not require any extra balance separately when charging Lithium batteries (LiLo/LiPO/LiFe) for cell voltage balancing.

Balance individual cells on discharge

It also can monitor and balance individual cells of the Lithium battery packs during the discharge process. If the voltage of any one cell varies abnormally, the process will be stopped with the error message.

Accept various types of Lithium battery

It can accept three types of Lithium batteries- Li-Ion, LiPo and LiFe. They have different characteristics by their chemistry. You can select any one of them that you are going to process before the job. For their specifications, refer to 'Warnings and safety notes' section.

Lithium battery 'Fast' and 'Storage' mode

You can charge Lithium batteries for special purposes. 'Fast' charge reduces the charging time of Lithium batteries and 'Storage' mode controls the final voltage of the battery to be suitable for long time storage.

Maximum safety

Delta-peak sensitivity: The automatic charge termination program works on the principle of the Delta-peak voltage detection.(NiCd/NiMH)

Auto-charge current limit: When charging NiCd or NiMH at 'AUTO' current mode, you can set the upper limit of charge current to avoid high current charging. This is very useful when charging the low impedance and small capacity NiMH battery in 'AUTO' mode.

Capacity limit: The charging capacity is always calculated by multiple of the charging current and time. If the charging capacity exceeds the limit the process will be terminated automatically when you set the maximum value.

Temperature limit: The temperature of the battery on charging will rise by its internal chemical reaction. If you set the limit of temperature the process will be expired forcibly when the limit has reached.

Processing time limit: you can also restrain the maximum process time to prevent any possible defect.

Input power monitor: To protect the car battery (using as input power) from being damaged the voltage of it is always monitored. If it drops below the lower limit the process will be ended automatically.

Automatic cooling fan: The electric cooling fan comes into action automatically, only when the internal temperature of the unit is raised.

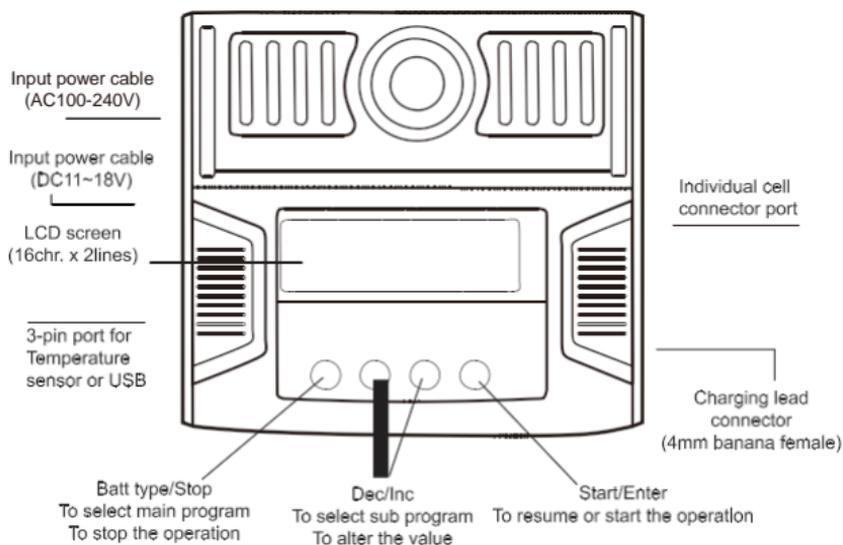
Data store/load

For users convenience it can store a maximum of 5 different batteries data. You can establish the data contains program setting of the battery to charge or discharge continually. These data's can be called out at any time you need and the process can be executed without program setting.

Cyclic charging/discharging

Perform 1 to 5 cycles of charge>discharge or discharge>charge continually for battery refreshing and balancing.

2. Exterior of the unit



3. Warnings and safety notes

- Never leave the charger unsupervised when it is connected to its power supply. If any malfunction is observed immediately terminate the process and refer to the operation manual.
- Keep the unit away from dust, damp, rain, heat, direct sunshine and vibrations. Do not drop it.
- The circuit of the unit is designed to be powered by a 10-18V DC only.
- This unit and the battery whether charging or discharging, should be set up on a heat-resistant, non-flammable and non-conductive surface. Never place them on a car seat, carpet or similar. Keep all the inflammable volatile materials well away from operating area.
- Be sure to understand the information of the battery to be charged or discharged accurately. If the program is set up incorrectly the battery can be severely damaged. Especially Lithium battery, they can cause a fire or an explosion by over-charging.
- To avoid short-circuits between the charge lead, always connect the charge cable

NiCd/NiMH	voltage level:1.2V/cell allowable fast charge current:1C~2C depends on the performance of cell discharge voltage cut off level 0.85V/cell(NiCd), 1.0V/cell(NiMH)
Lilo	voltage level:3.6V/cell max.charge voltage:4.1V/cell allowable fast charge current: 1C or less min.discharge voltage cut off level:2.5V/cell or higher
LiPo	voltage level:3.7V/cell max.charge voltage:4.2V/cell allowable fast charge current: 1C or less discharge voltage cut off level:3.0V/cell or higher
Life	voltage level:3.3V/cell max.charge voltage:3.6V/cell allowable fast charge current: 4C or less(e.g. A123M1) discharge voltage cut off level:2.0V/cell or higher
Pb	voltage level:2.0V/cell (Lead-acid) max.charge voltage:2.46V/cell allowable fast charge current:0.4C or less discharge voltage cut off level:1.50V/cell or higher

to the unit first and only then to the battery to be charged or discharged. Reverse the sequence when disconnecting.

- Do not attempt to disassemble the battery pack arbitrarily.

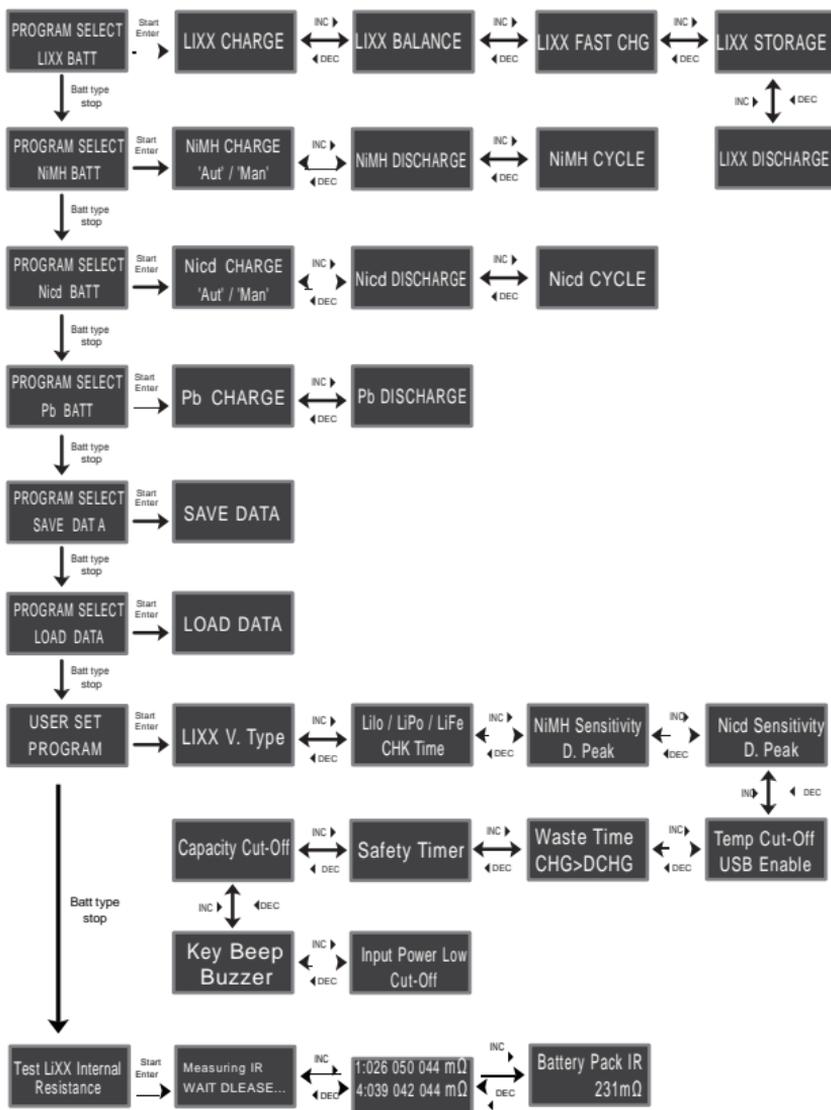
You have to pay attention to verify the capacity and the voltage of the Lithium battery pack. It may be composed of parallel and series connection mixed. In parallel link the capacity of the battery pack is multiplied by the number of cells but the voltage remains same. That kind of voltage imbalance causes a fire or explosion during the charge process. We recommend you compose the Lithium battery pack in series only.

Discharge

- The typical purpose of a discharge is to determine the residual capacity of the battery, or to lower the voltage of a battery to a defined level. When you discharge the battery you also have to pay attention as you would to the process same as charging. To avoid the battery becoming deep-discharged, set the final discharge voltage correctly. Lithium batteries should not be deep-discharged to lower than the minimum voltage, as this leads to a rapid loss of capacity or a total failure.
- Some rechargeable batteries are said to have a memory effect. If they are partly used and recharged before the whole charge is drawn out, they 'remember' this and next time will only use that part of their capacity. This is a 'memory effect'. NiCd and NiMH batteries are said to suffer from memory effect. They prefer complete cycles; fully charge then use until empty, do not recharge before storage-allow them to self-discharge during storage. NiMH batteries have less memory effect than NiCd.
- The Lithium battery prefers a partial rather than a full discharge. Frequent full discharges should be avoided if possible. Instead, charge the battery more often or use a larger battery.
- A brand-new NiCd battery pack is partially useful with its capacity until it has been subjected to 10 or more charge cycles in any case. The cyclic process of charge and discharge will help to optimise the capacity of the battery pack.

Those warnings and safety notes are particularly important. Please follow the instructions for maximum safety; otherwise the charger and the battery can be damaged violently. And also it can cause a fire, injure a human body, or damage the property.

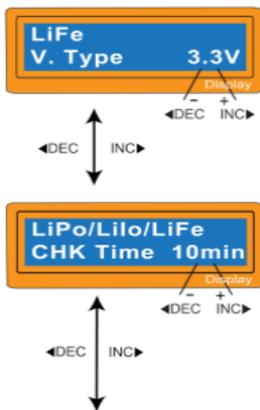
4. Program flow chart



5. Initial Parameter set up (Users' set up)

It will be operated with the default value of the essential user settings when it is connected to a 12V battery for the first time. The screen displays the following information in sequence and the user can change the value of parameter on each screen.

When you are wanting to alter the parameter value in the program, press **Start/ Enter** key to make it blink then change the value with **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.



The screen displays the nominal voltage of the Lithium battery. There are three kinds of Lithium battery; LiFe(3.3V), Lilo(3.6V) or LiPo(3.7V). This is very important so you have to check the battery carefully and set it up correctly. If it is different from the correct value the battery can explode during the charge process.

It recognises the cell count of Lithium battery automatically at the beginning of charge or discharge process to avoid from erroneous setting by user. But a deeply discharged battery can be perceived incorrectly. To prevent the error, you can set the time term to verify the cell count by the processor. Normally, 10 minutes is enough to perceive the cell count correctly. For the battery of larger a capacity, you may extend the time term. But, if you set the time term too long for the battery of smaller capacity, the charge or discharge process can be finished within the time term with the erroneous cell count. This may cause the fatal result. If the processor recognises the cell count incorrectly at the beginning of charge or discharge process, you may extend the time. Otherwise, you had better use it with the default value.



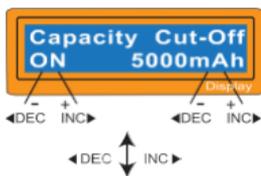
This shows the trigger voltage for automatic charge termination of NiMH and NiCd battery. The effective value ranges from 5 to 20mV per cell .if the trigger voltage is set higher, there is a danger of overcharging the battery; if it is set lower, there is a possibility of premature termination. Please refer to the technical specifications of the battery. (NiCd default:12mV, NiMH default:7mV)

The 3-pin port at the left side is a temp. Port. You can

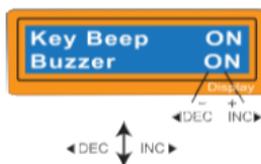
use an optional temperature probe to contact the surface of a battery. You can set the maximum temperature at which the charger will allow the battery to reach during charging. Once a battery reaches this temperature during charge, the process will be terminated to protect the battery.

The battery is on the cyclic process of charge and discharge which can often become warm after the charge or discharge period. The program can insert a time delay to occur after each charge and discharge process to allow the battery adequate time to cool down before being subjected to the next process. The value ranges from 1 to 60 minutes.

When you start a charge process, the integral safety timer automatically starts running at the same time. This is programmed to prevent overcharge. The battery if it proves to be faulty, or if the termination circuit cannot detect if the battery is full. The value for the safety timer should be generous enough to allow a full charge of the battery.



This program sets the maximum charge capacity that will be supplied to the battery during charge. If the delta-pack voltage is not detected nor the safety timer expired by any reason, this feature will automatically stop the process at the selected capacity value.



The beep sounds at every time pressing the buttons to confirm your action. The beep or melody sounded at various times during operation to alert different mode changes. These audible sounds can be on or off.



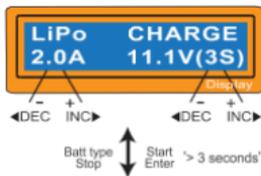
This program monitors the voltage of input to the battery. If the voltage drops below the value you set the operation forcibly terminates to protect the input battery.

6. Lithium battery(LiLo/LiPo/LiFe)program

These programs are only suitable for charging and discharging Lithium batteries with a nominal voltage of 3.3V, 3.6V and 3.7V per cell. These batteries need to adopt different charge techniques, this is termed a constant voltage(CV) and constant current(CC) method. The charge current varies according to the battery capacity and performance. The final voltage of the charge process is also very important; it should be precisely matched with the correct voltage of the battery. They are 4.2V for LiPo, 4.1V for LiLo, and 3.6 V for LiFe. The charge current and nominal voltage as for cell count set on the charge program must always be correct for the battery to be charged.

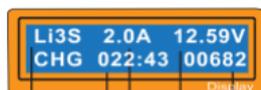
When you are willing to alter the parameter value in the program, press **Start/Enter** key to make it blink then change the value with **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.

6.1 Charging Lithium Battery



The left side of the first line shows the type of battery you select at the users setting. The value on the left side of second line sets a charge current and the value on the right side of second line sets the voltage of the battery pack.

After setting the current and voltage press **Start/Enter** key for more than 3 seconds to start the process.
(Charge current:0.1~7.0A,Voltage:1~6 series)



number of cells charging time battery voltage charged capacity
 charge current

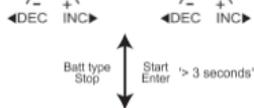
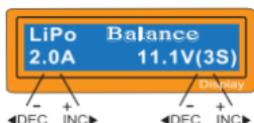
This shows the number of cells you set up and the processor detects. 'R:' shows the number of cells found by the charger and 'S:' is the number of cells selected by you at the previous screen. If both numbers are identical you can start charging by press **Start/Enter** button. If not, press **Batt Type/Stop** button to go back to previous screen. Then carefully check the number of cells of the battery pack to charge again.

The screen shows the present situation during charge process. To stop charging press **Batt Type/Stop** key once.

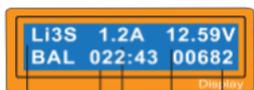
6.2 Charging Lithium battery at balance mode

This is for balancing the individual cells of Lithium batteries to be charged. The battery pack to be charged should be connected to the suitable balance port at the right side of the charger. And also, you need to connect the battery output plug to the output of charger.

In this mode, the charging process will be different from the ordinary charging mode. The internal processor of the charger will monitor the voltages of each cell of the battery pack and control the charging current that is feeding to each cell to normalise the voltage.



Batt type Stop Start Enter > 3 seconds'



number of cells charging time battery voltage charged capacity
 charge current

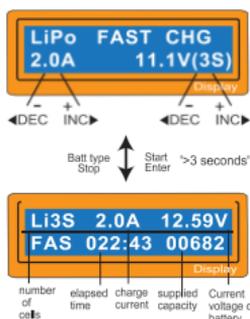
The value on the left side of second line sets a charge current and the value on the right side of second line sets the voltage of the battery pack. After setting the current and voltage press **Start/Enter** key for more than 3 seconds to start the process. (Charge current:0.1~7.0A, Voltage:1~6 series)

This shows the number of cells you set up and the processor detects.'R:' shows the number of cells found by the charger and 'S:' is the number of cells selected by you at the previous screen. If both numbers are identical you can start charging by press **Start/Enter** button. If not, press **Batt type/Stop** button to go back to previous screen. Then carefully check the number of cells of the battery pack to charge again.

The screen shows the present situation during charge process. To stop charging press **Batt type/Stop** key once.

6.3 'FAST' charging Lithium battery

The charging current gets smaller as the process goes to the near end term of Lithium battery charging. To finish the charging process earlier, this program eliminates certain terms of the CV process. Actually, the charging current goes to 1/5 from the initial value to end the process while the normal charging current goes to 1/10 during the CV term. The charging capacity may be a bit smaller than the normal charging current but the process time will be reduced.

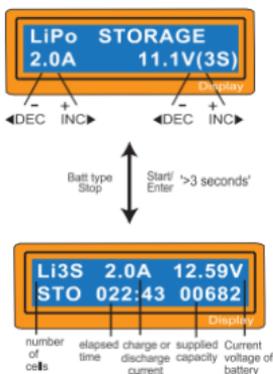


You can set up the charging current and the voltage of the battery pack which is being charged. As you press **Start/ Enter** button the voltage confirmation will be displayed. And then, if you confirm the voltage and current, press **Start/ Enter** button again to start charging.

This shows the present state of 'FAST' charging. To stop charging arbitrary, press **Batt type/Stop** key once.

6.4 'STORAGE' control Lithium battery

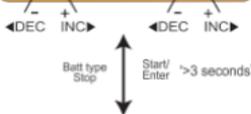
This is for charging or discharging Lithium batteries, not to be used for the time being. The program will determine to charge or discharge the battery to the certain voltage depending on the voltage of the battery at its initial stage. They are different from the type of the battery, 3.75V for Lilo, 3.85V for LiPo and 3.3V for LiFe per cell. If the voltage of the battery at its initial stage is over the voltage level to storage, the program will start to discharge.



You can set up the current and the voltage of the battery pack to be charged. The current will be used for charge or discharge the battery to reach the 'storage' level of voltage.

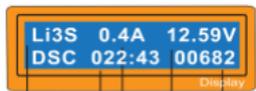
The screen shows the present situation during the charge process. To stop charging press **Batt type/Stop** key once.

6.5 Discharging Lithium battery



The value of discharge current on the left side of screen may not exceed 1C for a maximum safety and the final voltage on the right should not be under the voltage level that is recommended by the battery manufacturer to avoid deep discharging.

To start to discharge, press **Start/ Enter** key for more than 3 seconds.

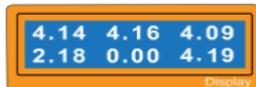
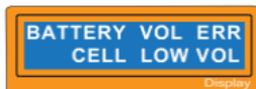


This shows the present state of discharge. To stop discharging press **Batt type/Stop** key once.

6.6 Voltage balancing and monitoring during the discharge

The processor monitors the voltage of individual cells during 'storage-mode' and 'discharge' of the Lithium battery pack. It tries to normalise the voltages to be equal. For this feature, the individual plug of the battery pack should be connected to the individual port of the charger.

If the voltage of any one or more cells varies abnormally during the procedure, It terminates the process forcibly with the error message. If this happens, the battery pack contains a bad cell, or a bad connection of the cable plug. You can easily know which one cell is bad by pressing **INC button** at the time of showing the error message.



The processor found that the voltage of one of the cell in the Lithium battery pack is too low.

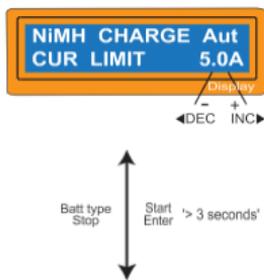
In this case, the 5th cell is bad. If this happens the connection-break of the cable or plug, the voltage value may show zero.

7. NiMH/NiCd battery program

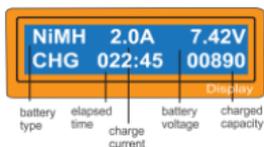
These programs are for charging or discharging NiMH (Nickel-Metal-Hydride) or NiCd (Nickel-Cadmium) batteries, commonly used for R/C model applications. To alter the value at the display, press **Start/Enter** key to make it blink then change the value using **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.

To start the process, press **Start/Enter** button for more than 3 seconds.

7.1 Charging NiCd/NiMH battery

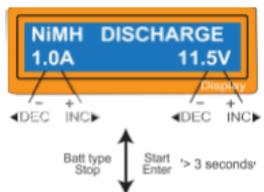


This program simply charges the battery using the current you set. In 'Aut' mode, you need to set the upper limit of charge current to avoid from higher feeding current that may damage the battery. Because some batteries of low impedance and small capacity can lead to the higher charge current by the processor at automatic charge mode. But in 'Man' mode, it will charge the battery with the charge current you set at the display. Each mode can be switched by pressing **INC** and **DEC** button simultaneously when the current field is blinking.

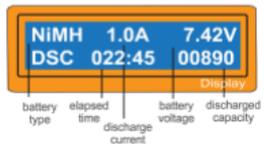


The screen displays the current state of charging. To stop the process, press **Batt type/Stop** key once. The audible sound indicates you the end of process.

7.2 Discharging NiCd/NiMH battery

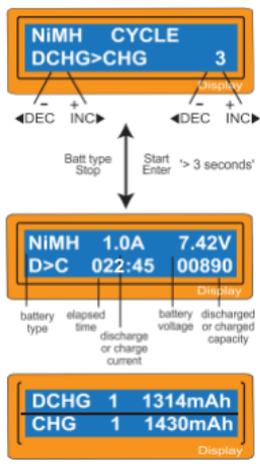


Set discharge current on the left and final voltage on the right. The discharge current ranges from 0.1 to 1.0A and the final voltage ranges from 0.1 to 25.0V. To start the process, press **Start /Enter** key more than 3 seconds.



The screen displays the current state of discharge. You can alter the discharge current by pressing **Start/Enter** key during the process. Once you change the current value, store it by pressing **Start/Enter** button again. To stop discharging press **Batt type/Stop** key once. The audible sound indicated you are at the end of process.

7.3 Charge-to-discharge & discharge-to-charge cycle NiMH/NiCd battery



Set the sequence on the left and the number of cycle on the right. You can use this function for balancing, refreshing and break-in the battery. To avoid rising temperature of the battery, there will be a brief cool-off period that's already fixed at 'User setting' after each charge and discharge process. The cycling number ranges from 1 to 5.

To stop the process, press **Batt type/Stop** key once. You can change the discharge or charge current by pressing **Start/Enter** key once during the process. The audible sound indicates you are at the end of the process.

At the end of the process, you can see charged or discharged electric capacities of the battery at each cyclic process.

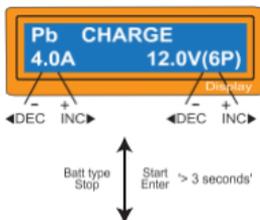
By pressing **INC** or **DEC** button, the screen shows the result of each cycle in order.

8. Pb(lead-sulphuric acid) battery program

This is programmed for charging a Pb (lead-sulphuric acid) battery with a nominal voltage from 2 to 20V. Pb batteries are totally different from NiCd or NiMH batteries. They can only deliver relatively lower current compared to their capacity, and similar restrictions definitely apply to charge. So the optimal charge current will be 1/10 of the capacity. Pb batteries must not be charged rapidly. Always follow the instruction supplied by the manufacturer of battery.

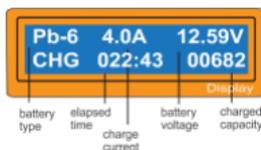
When you are willing to alter the parameter value in the program, press **Start/Enter** key to make it blink then change the value with **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.

8.1 Charging Pb battery



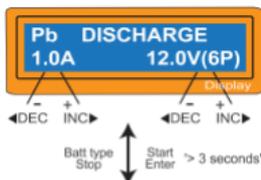
Set up the charge current on the left and the nominal voltage of the battery on the right. The charge current ranges from 0.1 to 7.0A and the voltage should be matched with the battery being charged.

Start the charge process by pressing **Start/Enter** key for more than 3 seconds.



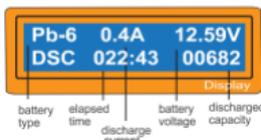
The screen displays the state of the charging process. To stop charging forcibly, press **Batt type/Stop** key once. The audible sound indicates you at the end of process.

8.2 Discharging Pb battery



Set discharge current on the left and final voltage on the right. The discharge current ranges from 0.1 to 1.0A.

To start the process, press **Start/Enter** key for more than 3 seconds.



The screen displays the current state of discharge. You can alter the discharge current by pressing **Start/Enter** key during the process. Once you change the current value, store it by pressing **Start/Enter** button again.

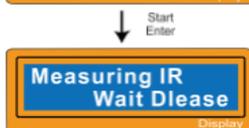
To stop discharging press **Batt Type/Stop** key once. The audible sound indicates you are at the end of process.

9. Battery internal resistance testing system

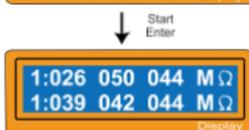
Lithium battery internal resistance is one of the important index about battery discharge capacity and efficiency. We can know battery performance and the matching of each battery by getting the battery resistance value. The lithium battery internal resistance value tested by this charger is relative(not absolute), which is tested under the testing voltage. But it can also know the battery performance and matching through the relative value. If you want more battery performance comparison, you had better put them under the same voltage to detect. For example, to compare two 3-cells batteries, you should ensure that the total voltage is consistent. Testing in the single voltage of 4.20V, the test data is smaller the performance better and the data more close to the battery the better matching nature.



Interface of the Internal Resistance Testing.



Press "Enter" to enter into it.



Show the data of Battery Pack IR.

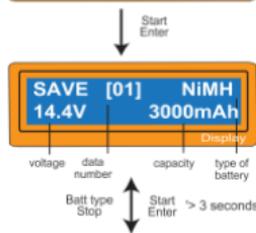
Press 'INC' to check the total data of the Battery Pack IR (Press 'INC' again to back to show the data of the single cell IR.)

10. Save Data Program

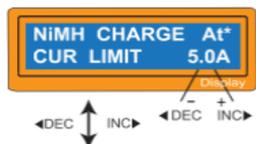
It has a data storage and load program for your convenience. This feature can store up to 5 battery data by number that represent the individual specification of batteries you are using. They can be called back for the process of charging or discharging without setting up the program again. To set up the parameter value in the program, press **Start/Enter** key to make it blink then change the value with **INC** or **DEC** key.



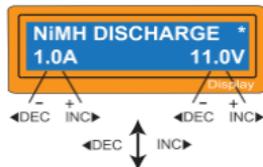
Program select.



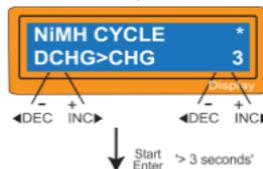
The parameter value setting up in this screen does not effect the charge or discharge process. They only represent the specification of the battery. The following screens will automatically be displayed exactly matched to the battery type you set up. The example shows the battery pack of NiMH, 12cells and 3000mAh of capacity.



Set up the charge current for the manual charge mode, or the current limit for the automatic charge mode. Each mode can be switched by pressing **INC** and **DEC** button at the same time when the current field is blinking.



Setting up the discharge current and final voltage.



Setting up the sequence of charge and discharge, and the cycling number.



Saving the data.

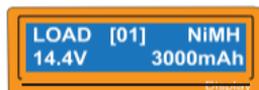
11. Load Data Program

This program calls back the data that was stored at 'Save Data' program. To load the data, press **Start/Enter** key once to blink the data number field and select the number using **INC** or **DEC** key then press **Start /Enter** key for more than 3 seconds.



Program select.

Start
Enter



Select the data number to be called back.

The data matched with the number will be displayed at this time.

Start
Enter '> 3 seconds'



Loading the data.

12. Various information during the process

You can inquire various information on the LCD screen during charging or discharging process. When you press **DEC** button the charger shows the establishment of user settings. And also you can monitor the voltage of the individual cell by pressing **INC** button when the individual connection cable is linked to the Lithium battery being processed.



Set-voltage protection.

◀DEC ↓



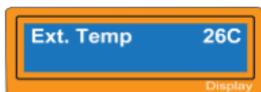
Set the charge-discharge capacity of the protection.

◀DEC ↓



Set the charge and discharge time protection.

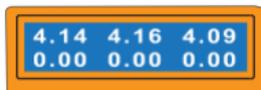
◀DEC ↓



The external temperature only will be displayed when using the thermal probe.



The present voltage of input DC power.



Using the individual connection cable to the battery, you can check the individual voltage of each cell in the battery pack. When you have connected the cable to the port on the right side of the charger the program shows the voltage of each cells for maximum 6 cells in sequence. To utilise this feature, the battery pack must have an output connector thats linked to each of the cells.

13. Warning and error messages

It incorporates various functions of protective and monitoring the system to verify functions and the state of its electronics. In any case of occurring error, the screen displays the cause of error that is self- explanatory with audible sound.



The output is connected to a battery with incorrect polarity.



This will be displayed in case of detecting an interruption of the connection between the battery and output or voluntarily disconnecting the charge lead during the operation of charge or discharge on output.



There was a short-circuit at OUTPUT. Please check the charging leads.



The voltage of input power drops below the limit.



The voltage of the Lithium battery pack was selected incorrectly. Verify the voltage of battery pack carefully.



There Is a malfunction within the charger circuit.



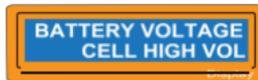
The processor detects the voltage is lower than you set at Lithium program. Please check the cell count of the battery pack.



The processor detects the voltage is higher than you set at Lithium program. Please check the cell count of the battery pack.



The voltage of one of the cells in the Lithium battery pack is too low. Please check the voltage of the cells one by one.



The voltage of one of the cells in the Lithium battery pack is too high. Please check the voltage of the cells one by one.



There is a bad connection at the individual connector. Please check the connector and cables carefully.



The internal temperature of the unit goes too high. Cool down the unit.



The processor cannot continue to control the feeding current by any reason. The unit needs to be repaired.



The battery balance port or the power line to Connector is incorrect.

