powerpal MINI

For LiPo/LiFe/LiHv/Lilo/NiMH/NiCd/Pb Batteries

OPERATING MANUAL

Thank you for purchasing the balance charger.
This is a rapid charger/dischargerwith built-in balancer.
Please read this entire operating manual completely
and attentively before using.

ETRONIX MODEL ELECTRONICS

Contents

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 the over-charging 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 users option.

It provides most convenient balance charge port for Lithium batteries, with separated 2,3,4 charge port, and external reverse connector.

High-power and high-performance circuit

It employs the circuit that has maximum output power of 60W. As a result it can charge or discharge up to 8 cells of NiCd/NiMH and 4 series of Lithium batteries with maximum current of 6.0A. Furthermore the cooling system is so efficient that 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 balancer separately when charging Lithium batteries(Lilo/ LiHv/ LiPo/ LiFe) for cell voltage balancing.

Balance individual cells on discharge

It also can monitor and balance individual cells of the Lithium battery pack 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 4 types of Lithium batterles- Lilo, LiHv,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 'Warnings and safety notes' section.

Lithium battery 'Fast' and 'Storage' mode

You can charge Lithium battery for special purposes. 'Fast' charge reduces the charging time of Lithium battery and 'Storage' mode controls the final voltage of the battery to be suit 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 change current to avoid from high current charging. This is very useful when charging the low impedance and small capacity NiMH battery in 'AUTO' mode.

Capacity limit: The changing capacity 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 from any possible defect.

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

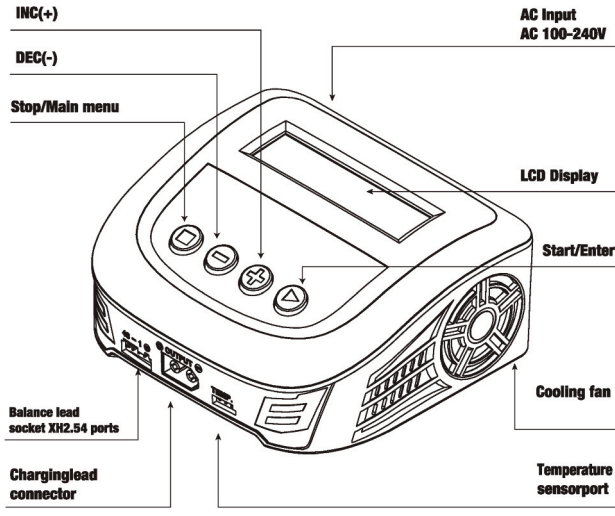
Data store/load

For users convenience it can store maximum 5 data of each battery type. You can establish the data contains program setting of the battery to charge or discharge continually. These data 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 charge 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 away the unit from dust, damp, rain, heat direct sunshine and vibration. Do not drop it.
- The circuit of the unit is designed to be powered by a 100-240V AC only.
- This unit and the battery to charge or discharge should be set up on a heat - resistant, non-infiammable 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 severely be damaged. Especially Lithium battery can cause a fire or an explosion by over-charging.

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
LiHv	voltage level:3.8V/cell max.charge voltage:4.35V/cell allowable fast charge current: 1C or less min.discharge voltage cut off level:3.0V/cell
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 avoid short-circuits between the charge lead, always connect the charge cable to the unit first and only then to the battery to be charged or discharged. Reverse the hsequence when disconnecting.

- Do not attempt to disassemble the battery pack arbitrarily.

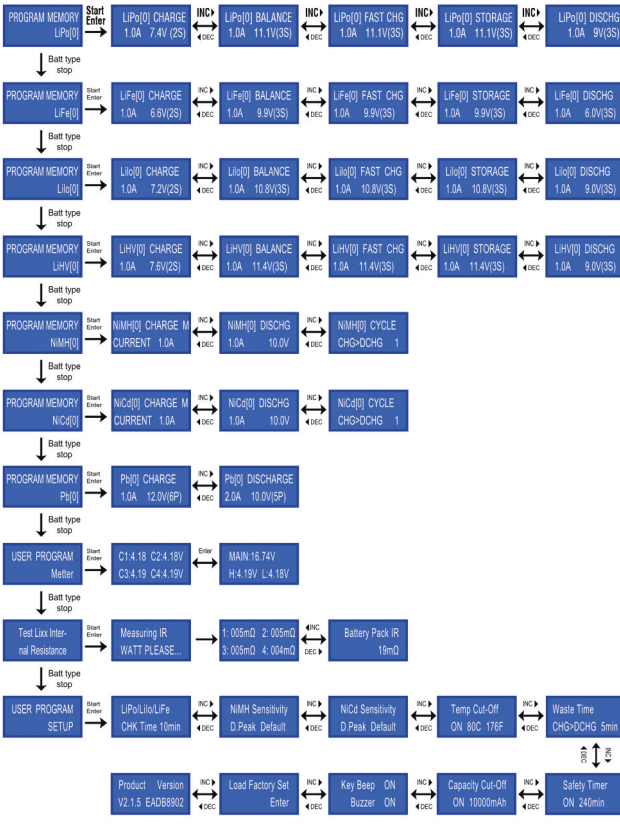
  You have to pay attention to verify the capacity and the voltage of the Lithium battery pack. It may be composed of parallel and series connection mixed. In parallel link the capacity of the battery pack is multiplied by the number of cells but the voltage remains same. That kind of voltage imbalance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

Discharge

- The typical purpose of discharge is to determine the residual capacity of the battery, or to lower the voltage of battery to a defined level. When you discharge the battery you also have to pay attention on 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. Generally, you do not need to discharge Lithium battery voluntarily.
- 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.
- The brand-new NiCd battery pack is partially useful with its capacity until it has beeen subjected to 10 or more charge cycles in any case. The cyclic process of charge and discharge will lead to optimise the capacity of battery pack.

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

4. Program flow chart

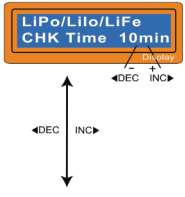


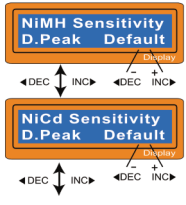
5. Initial Parameter set up (Users' set up)

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

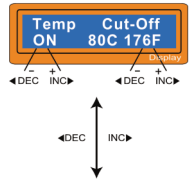
When you are willing to alter the parameter value in the program, press **Start/ Enter** key to make it blink then change the value with **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.

It recognise the cell count of Lithium battery automatically at the beginning of charge or discharge process to avoid from erroneous setting by user. But 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 are enough to perceive the cell count correctly. For the battery of larger 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 with the default value.



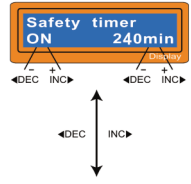


This shows the trigger voltage for automatic charge termination of NiMH and NiCd battery. The effective value ranges from 5 to 20mV per cell .if the trigger voltage is set higher, there is a danger of overcharging the battery; if it is set lower, there is a possibility of premature termination. Please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

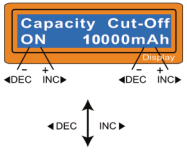


You can set the maximum temperature at which the charger should allow battery to reach during charge. Once a battery reaches this temperature during charge, the process will be terminated to protect the battery.

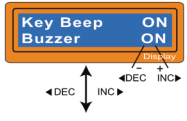
The battery is on the cyclic process of charge and discharge can often become warm after charge or discharge period. The program can insert a time delay to occur after each charge and discharge process to allow the battery adequate time to cool down before being subjected to the next process. The value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



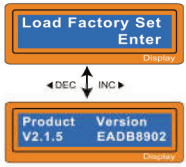
When you start a charge process, the integral safety timer automatically starts running at the same time. This is programmed to prevent overcharge the battery if it proves to be faulty, or if the termination circuit cannot detect the battery full. The value for the safety timer should be generous enough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



Press Enter for 3 seconds to restore factory setting (default).

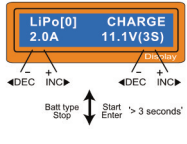
This program aims to indicate the current software version number and hardware ID number.

6. Lithium battery(Lilo/LiPo/LiFe/LiHv)program

Use these programs only when charging a lithium battery (Lilo/LiPo/LiHV/LiFe) with a nominal voltage of 3.6V, 3.7V, 3.8V or 3.3V per cell, respectively. The charge current going into the battery will vary depending on the chemistry type so it is VERY IMPORTANT that you select the correct type for your battery. The ending voltage of the charge is also important as it varies for all four types:4.1V for Lilo, 4.2V for LiPo, 4.35V for LiHV and 3.6V for LiFe. The charge current (how many Amps you are putting into the pack) and nominal voltage(Proper voltage for the cell count of the battery you are charging) must be correct for the battery to be charged. To change these settings, press the **START/ENTER** key to make the selected value blink. Using the increase and decrease buttons, set you desired amperage, then press **START/ENTER** to save the setting. You will then be asked to select your nominal voltage/cell count. Again, use the increase/decrease buttons to reach your desired setting and press the **START/ENTER** button to confirm and save.

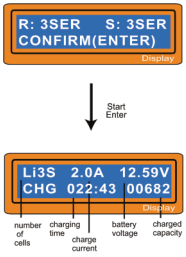
When you are willing to alter the parameter value in the program, press **Start/ Enter** key to make it blink then change the value with **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.

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: 0.1~6.0A, Voltage: 2~4S)



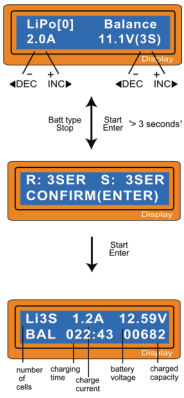
This shows the number of cells you set up and the processor detects. 'R:' shows the number of cells found by the charger and 'S:' is the number of cells selected by you at the previous screen. If both numbers are identical you can start charging by press **Start/Enter** button. If not, press **Batt Type/ 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 voltages of Lithium batteries of the battery park 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 ordinary charging mode. The internal processor of the charger will monitor the voltages of each cell of the battery pack and controls charging current that is feeding to each cell to normalise the voltage.



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.

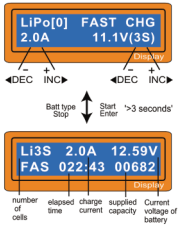
After setting the current and voltage press **Start/Enter** key for more than 3 seconds to start the process. (Charge current: 0.1~6.0A, Voltage: 2~4S)

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

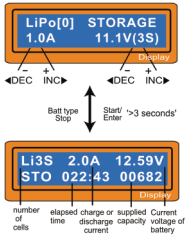


You can set up the charging current and the voltage of the battery pack being charged. As you press **Start/ Enter** button the voltage confirmation will be displayed. And then, if you confirm the voltage and current, press **Start/ Enter** button again to start charging.

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

6.4 'STORAGE' control Lithium battery

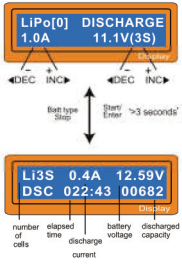
This is for charging or discharging Lithium battery not to be used for the time being. The program will determine to charge or discharge the battery to the certain voltage depending on the voltage of the battery at its initial stage. They are different from the type of the battery, 3.70V for Lilo, 3.80V for LiPo, 3.85V for LiHv and 3.3V for LiFe per cell. If the voltage of 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 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, the discharge current ranges from 0.1 to 2.0A 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.

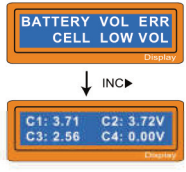
To start to discharge, press **Start/ Enter** key for more than 3 seconds.

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 Lithium battery pack. It tries to normalise the voltages to be equal. For this feature, the individual plug of the battry 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 massage. If this happens, the battery pack contains the bad cell, or the bad connection of the cable plug. You can easily know which one cell is bad by pressing **INC** button at 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 3th cell is bad. If there happens the connection-break of th cable or plug, the voltage value may show zero.

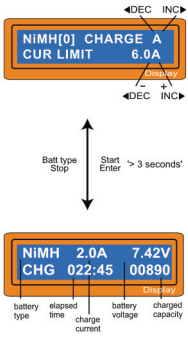
7. NiMH/NiCd battery program

These programs are for charging or discharging NiMH (Nickel-Metal- Hydride) or NiCd (Nickel-Cadmium) battery commonly used for R/C model aplications. 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.

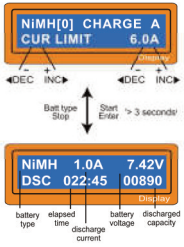
7.1 Charging NiCd/NiMH battery



This program simply charge the battery using the current you set. In 'A' 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 'M' 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



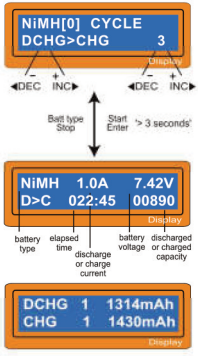
Set discharge current on the left and final voltage on the right. The discharge current ranges from 0.1 to 2.0A and the final voltage ranges from 0.1 to 16.0V). To start the process, press **Start /Enter** key more than 3 seconds.

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 at the end of process.

7.3 Cycling NiMH & NiCd batteries



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 temperture of the battery, there will a brief cool-off period that 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 the end of process.

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

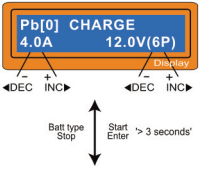
By pressing **INC** or **DEC** button, the screen shows the result of each cycle in order.

8. Pb(lead-sulphuric acid) battery program

This is programmed for charging Pb(lead-sulphuric acid) battery with nominal voltage from 6 to 12V. Pb batteries are totally different from NiCd or NiMH batteries. They can only deliver relatievely lower current compare 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 is supplied by the manufacturer of battery.

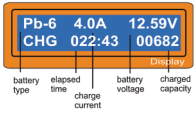
When you are willing to alter the parameter value in the program, press **Start/ Enter** key to make it blink then change the value with **INC** or **DEC** key. The value will be stored by pressing **Start/Enter** key once.

8.1 Charging Pb battery



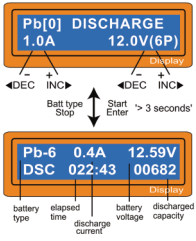
Set up the charge current on the left and the nominal voltage of the battery on the right. The charge current ranges from 0.1 to 6.0A and the voltage should be matched with the battery being charged.

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



The screen displays the state of 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 2.0A.

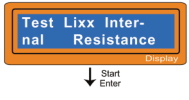
To start the process, press **Start/Enter** key for more than 3 seconds.

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 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.



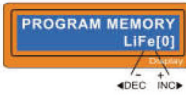
Interface of the Internal Resistance Testing.

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/Load Data Program



Under the bettery type interface, press "**INC**" or "**DEC**" key to select storage number for quick operation.

Press "**Enter**" to enter, users can set and storage common data, set values will automatically saved to corresponding storage number.

Users can store 5 sets common data for each battery type, [0]-[4].

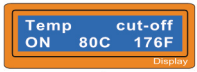
11. Various information during the process

You can inquire various information on 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 individual cell by pressing **INC** button when the individual connection cable is linked to the Lithium battery being processed.

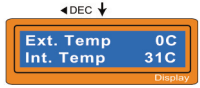
It comes to the final voltage when the program ended.

Displayed capacity cut-off function is turn on and the setting value of capacity.

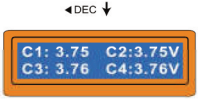
Displayed safety timer is turn on and duration of time in minutes.



Displayed temperature cut-off function is turn on.



The external temperature is displayed when the temperature probe is used. Int temperature is displayed the internal temperature of changer.



The battery is connected with each port through cable; you can check voltage of each cell in the battery pack. When the cable is connected with the ports on the charger, the program will display voltage of up to 4 batteries.

12. Warning and error messages

It incorporates a 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.

Incorrect polarity connected.

Battery connection is interrupted.

Short-circuit of the output termination.

The voltage of the battery pack has been selected incorrectly!

The charger has malfunctioned for some reason. Seek professional advice.

The voltage is lower than which is set. Please check the number of cells in the battery pack.

The voltage is higher than which is set. Please check the number of cells in the battery pack.

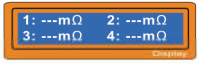
Voltage of one cell in the battery pack is too low, pleasecheck the voltage of each cell.

Voltage of one cell in the battery pack is too high; please check the voltage of each cell.

Wrong connection of the connector detected; please check the connector and cable.

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

The processor cannot control the feeding current, please repair it.



The battery balance port or the power line to connect incorrect.

13. Specifications

Operating voltage range:	AC100.0-240.0Volt
Circuit power:	max.60W for charging
	max.10W for discharging
Charge current range:	0.1~6.0A
Discharge current range:	0.1~2.0A
Current drain for balancing Li-po:	300mAh/cell
NiCd/ NiMH battery cell count:	6-8S
Lithium battery cell count:	2-4S
Pb battery voltage:	6V(3P)-12V(6P)
Weight:	302g
Dimension:	115×112×55mm

14.Warranty and service

We warrant this productfor a periodofone year(12 months) from the date of purchase. The guarantee applies only to such material or operational defects, which are present at the time of purchasing the product. During that period, we will replace without service charge any product deemed defective due to those causes. You will berequired to presentproof of purchase(invoice orreceipt). Thiswarranty doesnot cover the damage due to wear, overloading, incompetetent handling or using of incorrect accessories.

Note:

WARNING! **FIRE HAZARD!**

NEVER USE CHARGER UNSUPERVISED!

- **Batteries pose a SEVERE risk of fire if not properly handled.**
- **Read Entire operation manual before using charger.**
- **This unit may emit heat during use.**
- **Only operate this device in a cool ventilated area away from flammable objects.**
- **Failure to observe safety procedures may cause damages to property or injury.**