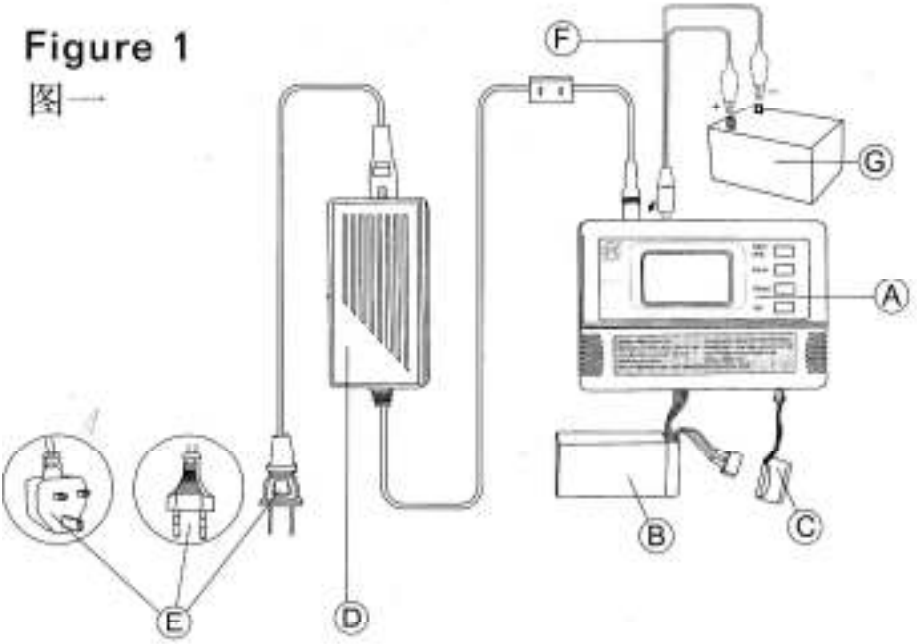
Connection for Li-Poly Battery Pack or Ni-MH Battery Pack
锂电池组/镍氢电池组连接示意图

Figure 1
图一



A:JB–1100充电器	A:JB-1100 CHARGER
B:锂电池组	B:LI-POLY BATTERY PACK
C:镍氢电池组	C:NI-MH BATTERY PACK
D:电源适配器	D:ADAPTER
E: 可选择的插头	E: SELECTABLEN PLUGS
F:直流线 + 红色 – 黑色	F:DC Wire +Red -Black
G:蓄电池	G:ACCUMULATOR

注：A和F为基本配置，D为选配件，E中三种插头选配一种，G，B和C仅作示意。

In the above sketch map, A and F are included in the package; D is selectable; One plug is to be selected in E; G,B and C are only for examples.

Operation Manual of JB-1100 Microcomputer Controlled Smart Charger

JB-1100 Microcomputer Control Smart Charger has adopted the most advanced technology of MCU controlled closed loop current feedback balance charging for Li-Poly battery pack. With intelligent applications, designed and programmed by professional technologists, and the latest micro-processor, closed loop feedback circuit was specially and creatively devised. Under the control of that, dynamic voltage of each cell can be clearly monitored on the LCD screen and appropriate current can be automatically adjusted according to voltage of each cell. Therefore, this will largely promote charging efficiency, extend the service life of battery pack and ensure the security while charging. Besides those functions, it also possesses the function of battery repair for over discharged battery, which ensures the full charge of each cell. Unique circuit design of safety protection for battery reverse can detect and alarm by micro-processor when one cell or the battery pack is incorrectly connected.

JB-1100 Microcomputer controlled smart charger is capable of parallel (balance) charging 2-4 cells Li-Poly battery pack and series charging 1-9 cells Ni-MH battery pack. Manually selectable charge time, safety protective charge voltage, current and cell count. LCD screen indicates dynamic charge current, voltage of each cell and the pack voltage, which provides convenient, safe and reliable charge.

I Technical Specification:

Input voltage range: 12V-15V DC
Selectable output current: 500mA, 700mA, 900mA, 1100mA for choice
Battery repair current: 120mA
Recommended charging rate: 1C Max.
Battery type and number: Li-Poly battery pack with 2-4 cells or
Ni-MH battery pack with 1-9 cells
LCD display: 4×32 characters
Dimension: 94mm×140mm×41.5mm
Weight: 239g
Adapter (selectable): Input voltage: 100V-240V
Output voltage: 12V
Output current: 5A
Dimension: 55mm×33mm×109mm
Weight: 218g

II Main Functional Features:

1.Free charge option of Li-Poly battery or Ni-MH battery:
The Smart Charger is capable of parallel charging Li-Poly battery pack and series charging Ni-MH battery pack.

2.Charge time control:
Charge time can be manually set. When the fixed time is reached, battery charging will terminate automatically. (Default setting is 3 hours)

3.Selection of terminated charge voltage:
3 types of terminated charge voltage can be chosen, 4.15V, 4.25V, 4.35V (Default setting is 4.15 V)

4.Charge current set:
The charger has four segments of charge current for choice, 500mA, 700mA, 900mA, 1100mA. (Default setting is 500mA)

5.Selection of cells count:
In Li-Poly mode, cell number is 2-4 and in Ni-MH mode, cell number is 1-9. (For Li-Poly pack,if the number is not selected, the charger will sense the number of cells automatically).

6.Protection from battery reverse:

When battery pole is connected incorrectly, the charger will give an alarm. Meanwhile, the LCD indicator will show "BATTERY REVERSE" on the screen and the position of the reversed battery.

7.Automatically battery repair:

If an over discharged battery with exceedingly low voltage is charged with ordinary current, the battery may be unrepairablly damaged. The smart charger can automatically sense voltage of each cell when a Li-Poly battery pack is connected. If an over discharged battery (voltage is lower than 2.4V) is detected, the charger will intelligently charge the over discharged battery with smaller current. And when the voltage of the over discharged battery has reached 2.4V, the charge current will turn into ordinary current to continue charging it.

8.Identification of bad battery:

When charging a Li-Poly battery pack, if one cell or several cells are damaged, the smart charger will automatically give an alarm, indicate "BATTERY BAD" and stop charging.

9.Indication of Full Charge:

When the battery voltage has reached the final safety protective charge voltage or the fixed charge time is over, the charger will automatically stop charging, give an alarm and show "CHARGE OK" on the LCD indicator.

10.Function of LCD indication:

- Set and indicate charge battery type, Li-Poly or Ni-MH.
- Set and indicate charge time (counting down)
- Set and indicate charge voltage (4.15V, 4.25V, 4.35V). The LCD indicator will show dynamic charging voltage of each Li-Poly battery and the Li-Poly battery pack, and the static voltage when full. For Ni-MH battery, the LCD indicator will show dynamic voltage of series charge and static voltage when full.
- Set and indicate charge current (500mA, 700mA, 900mA, 1100mA). The LCD indicator will show charge current of each Li-Poly battery or series charge current of Ni-MH battery.
- Set and indicate number of cells (2-4 cells Li-Poly battery, 1--9 cells Ni-MH battery)
- Indicate "BATTERRY REPAIR" when the battery is over discharged and show the position and number of the repairing battery, whose repair current, will be shown separately. (as Fig2 G)
- Indicate "CHARGE OK" when the pack has been fully charged. (as Fig2 H)
- Indicate "BATTERY REVERSE" when battery poles are incorrectly connected and show the position of the reversed battery. (as Fig2 I)
- Indicate "BATTERY BAD" when sense a bad battery and show the position and number of the bad batteries. (as Fig2 J)

11.Buzzer Indicator:

Under such conditions: starting the charger, setting, battery reverse, identifying bad battery and full charge, buzzer indicator will sound.

III Operation Instruction

1.Button Function

* **Enter** Button:

By pressing this button, the user can choose the following items:

- Enter the option of Li-Poly battery pack or Ni-MH battery pack. Default setting is Li-Poly battery pack.
- Enter the option of charge time, default setting is 3 hours.
- Enter the option of safety charge voltage, default setting is 4.15V.
- Enter the option of charge current, default setting is 500 mA.
- Enter the option of battery count.

The smart charger can automatically sense Li-Poly battery count. In Ni-MH mode, the user has to input cell numbers.

* **Select** Button:

By pressing this button, the user can select the following items:

- Select Li-Poly mode or Ni-MH mode
- Select charge time: hour setting:0-9; minute setting: 5 minutes one step
- Select safety charge voltage: three types of charge voltage can be chosen, 4.15 V, 4.25V, 4.35V. Not suitable for Ni-MH battery.
- Select charge current: four steps of selectable charge current, 500mA, 700mA, 900mA, 1100mA.
- Select battery count: 2-4 cells Li-Poly battery pack
  1-9 cells Ni-MH battery pack

* **Set** Button:

After each setting, by pressing this button, the user can confirm the messages entered into the charger.

* **Start/Stop** Button

Press this button to start charging when all the settings are finished. After starting, further press of this button will stop the charger. If battery pack is correctly connected after starting the device, directly press of Start/Stop button will immediately start charging (for Li-Poly battery pack connected into parallel port only).

2.Charge Under Default Settings

Only for 2-4 cells Li-Poly battery pack (we take 3 cells of 11.1V as an example)

Connect the power source, adaptor and Li-Poly pack correctly according to the connection sketch map. LCD screen will display as fig2 a.

Please check Fig3 for battery voltage and poles of each port.

Press the start button. After a click sound, the charger starts working. Default setting of time is 3 hours and start counting down. Default settings of voltage is 4.15V, current is 500mA and number of cells is 3. During the process of charging, voltage and current of each cells and the total voltage of the battery pack will be shown by turns on the LCD screen as fig2 B, C, D and E. When one cell of the battery pack reaches the final voltage (4.15 V), the full cell will stop charging and charge current of it is "0" on the LCD screen. Other cells continue charging until all cells reach the fixed voltage (4.15V) and the process of charging is finished. LCD screen will indicate full charge and the total voltage of the battery pack as fig2F. Buzzer indicator will sound several times to remind the user of full charge.

3.Charge Under Manual Settings

3.1 Li-Poly Battery Pack (Parallel Charging)

Connect the power source, adaptor and Li-Poly pack correctly according to the connection sketch map. (we take 3 cells of 11.1V as an example).

Fig 2A

Fig 2B Voltage and Current of Cell 1

Fig 2C Voltage and Current of Cell 2

Fig 2D Voltage and Current of Cell 3

Fig 2E Voltage of the Pack

Fig 2F Full Charge

Fig 2G Battery Repair

Fig 2H Battery Bad

Fig 2 I Battery Reverse

First, press **Enter** button, "Li" will be shown on the upper right corner of the screen. On the second line is "parallel". Further press of **Enter** button is for charge time set, which should be set according to battery capacity and charge current. Press **Set** button to confirm setting. Another press of **Enter** button is for charge voltage set. Press **Select** button to select safety charge voltage. (Commonly set 4.15V or 4.25V. 4.35V is not recommended except when battery manufacturer specially marked). Press **Enter** button again to set charge current, which is supposed to be set according to battery capacity. Press **Set** button to confirm setting. **Warmly recommendation**: If you are not engaged, small current is suggested to efficiently extend battery service life. Having finished selecting charge current, press **Enter** button for the last item—battery count, which should be select according the number of cells connected. Press **Select** button to choose cell number and press **Set** button to confirm. (For parallel charged Li-Poly battery, the micro-processor can automatically sense and display cell count.) So far, all functions have been set. Then press **Start/Stop** button to start charging. The charge will work according to the parameters fixed.

3.2 Ni-MH Battery Pack (Series Charging)

Connect the power source, adaptor and Li-Poly pack correctly according to the connection sketch map. First, press **Enter** button, "Li" will be shown in the upper right corner of the screen. Press **Select** button to choose "Ni-MH". The second line reads "series". Further press of **Enter** button is for charge time set, which should be select according to battery capacity and charge current. Press **Set** button to confirm setting. Press **Enter** button to jump to voltage set, which is **NOT** necessary for Ni-MH. Another press of **Enter** button for current set, which can be set according to battery capacity by pressing **Select** button. Press **Set** button to confirm settings. Having finished selecting charge current, press **Enter** button for the last item, battery count, which is Necessary for Ni-MH battery pack. Press **Set** button to confirm setting. Press **Start/Stop** button to start charging under the fixed data.

Cautions:

1.In order to ensure charging security, Li-Poly is only allowed to be parallel (balance) charged.

2.In the process of charging, the charger will get very hot. A cooling fan is equipped inside the housing. When the charger is started, the cooling fan begins to work. In case that the cooling fan does not work (work status of the fan can be judged according to its sound), please stop charging and exchange a new fan, or send it to the retailer or the manufacturer for repair.

IV Safe Notes

1.Please connect the battery pack into proper port. Port 1, Port 2 and Port 3 are special for Li-Poly battery pack and Port 4 is for Ni-MH battery pack only.

2.In the 4 charging ports, one and only one battery pack is allowed to be input each time.

3.Please connect the charger to suitable power adapters (12V-15V DC, 3A-5A) or 12V accumulator.

4.Please check whether the cooling fan inside the housing work when charging. (When the device starts charging, the cooling fan should start working)

5.If the charger, the power adapter or the battery gets very hot to the touch, please immediately interrupt the power supply and take out the battery.

6.Do not operate the device in wet environment.

7.Do not open the housing. In case of defects of the device, please contact distributors or contact us directly.

8.Always observe the charging current limit recommended by the battery manufacturer. Excessive current can damage the battery or shorten its service time.

9.On selection of charge current, it's better to keep the current under 1C to prevent Li-Poly battery from being damaged. For example, a Li-Poly battery has a capacity of 700mAH; charge current should be 500mA - 700mA.

Under the following conditions, the device will stop charging:

1.Voltage of each cell in the Li-Poly battery pack has reached charging safety protective voltage.

2.Voltage of Ni-MH battery pack has reached safety protective voltage or has reached Delta peak.

3.Having reached the fixed charge time.

4.Pressed **Start/Stop** while charging.

5.Battery pack is removed while charging.

6.Battery poles are reversed. "BATTERY REVERSE" will be shown on the LCD screen. Please disconnect battery pack and check immediately.

7.Battery is bad. "BATTERY BAD" will be shown on the LCD screen. Please disconnect battery pack.

V Comparisions Among Several Common Charging Methods

In recent years, as Li-Poly battery manufacture technology progresses, capability of Li-Poly battery has been largely increased with some of them reached 3-5 Ah. At the same time, the discharged rate of Li-Poly battery has been continuously increased, with many of them having reached 10C, some even reaching 20C.Today Li-Poly battery is more and more widely used, however, it has a high risk of fire and explosion. Thus how to charge it fast and safely becomes the question that every Li-Poly battery user has to face.

We will make a comparison among several common Li-Poly battery charge methods.

1 Series Charging in Constant Voltage

This is the most convenient charging method characterized by easy circuit and low cost. Its principle is to realize the design of steady circuit with constant voltage, which is small than or equal to the safety charge voltage of Li-Poly battery pack. Therefore, voltage of the battery pack will not exceed the charge voltage no matter how long it is charged. For single battery, constant charging voltage will be finally equal to its battery voltage, so charging in constant voltage is usually used for single battery. But it is not suitable for battery pack with more than 2 cells. Because of differences in inner resistance of each cell (though they have been aboratively selected to be close to each other at factory), after a period of charging, especially being discharged in large current, changes of inner resistance will occur. If charged in series, under the same charge current and time, as the inner resistance of each cell is different, it will result in different voltage of each cell in the same battery

pack. As time goes, battery capacity will drop and battery service life will also be shortened. Even worse, if one cell in battery pack is damaged by short circuit, voltage of the battery pack will fall down. In case that the user can not discover it in time and continue charging in constant voltage, it will cause fire, even burning, which will make unnecessary damages. In the first period of charging in constant voltage, output voltage of the charger is much larger than battery voltage, charge current is also bigger. As the promotion of battery voltage, gaps between output voltage of the charger and battery voltage become smaller, charge current is also smaller, and charge time will be prolonged. Constantly, this method is not suitable for fast charging battery pack. Normally, series charging in constant voltage is used in charger without micro-processor.

2 Series Charging in Constant Current

In order to resolve the shortcomings of constant voltage circuit being not able to fast charge, technologists designed series charging circuit in constant current (or adjustable current). This type of circuit commonly adopts design of micro-processor, by which real-time voltage of the battery pack can be monitored, and appropriate current can be adjusted according to battery voltage. Monitoring the battery pack voltage by the micro-processor can effectively avoid that battery voltage exceeds the safety protective charge voltage. As this circuit adopting series charging, there is only one group of charging circuit, the cost is much lower and manufacture is relatively easier. At present, most chargers in large current in the markets are of this type. However, as in one battery pack, inner resistance of each cell is different. If all cells are charged by the same current, it will also cause different voltage among cells in one pack. As time goes, this charging method will have drop battery capacity and shorten its service life.

3 Parallel (Balance or Safety) Charging in Constant Voltage

In order to solve the unbalance of battery voltage caused by being charged in same current and time in series circuit, technologists have improved it and designed parallel charging in constant voltage. Its charging principle is basically same to constant voltage series circuit. What have been changed is that constant voltage of battery pack has been divided into constant voltage of each cell and then several such divided circuits are paralleled (under isolation processed) to charge each cell separately. In this case, the charger can monitor voltage of each cell and damage from over charging can be effectively avoided. However, because of the limit of constant voltage charging, charge current can not be adjusted appropriately according to charge voltage. In the situation of discharging in large rate, battery pack will always be over discharged, which will shorten battery service life. As I have mentioned above, this charging method can not meet the demand of fast charge. Parallel charging in constant voltage is commonly used in charger without micro-processor. Some special chargers designed for IC are also of this type.

4 Parallel Closed Loop Current Feedback Circuit Charge

According to defects of charging circuit above, we designed micro-processor controlled parallel closed loop current feedback charge circuit, which can charge each cell separately while monitoring battery voltage and charge current of each cell. According to the data, processed and analyzed by the micro-processor, charge current can be adjusted. On the basis of state of each cell or the pack, the charger is able to detect and repair over discharged battery, which will ensure that all batteries are fully charged in the same charge cycle. This has effectively prolonged battery service life. Because dynamic real-time battery voltage can be monitored, risks from charging damaged battery is radically avoided.