

Instruction Manual

For

Lithium Ion Rechargeable Battery Charger

I Conception

Lithium ion rechargeable battery charger can adjust and control the charging parameters with its constant current & voltage charging mode. Along with BMS, it can protect the Li-ion batteries under the following circumstance: Over Voltage (OV), Under Voltage (UV), Over Current (OC), Short Circuit (SC) and Over Temperature (OT), and/or emergencies.

Before charging, when any cell in the battery pack appears OV, charging will be prohibited automatically. Recharging can be started unless the failure is solved.

During charging, when any cell in the battery pack appears OV, OC, OT, BMS should give signals, and the charger will automatically adjust the charge voltage and current to prevent the cells from OV, OC.

During charging, if the operating temperature is too low, BMS will give signals to warn the users that they should take actions, and adjust charging methods at low temperature according to the *Instruction Manual for Lithium Power Battery* (hereinafter “*Li Battery Manual*”).

During charging, if any abnormal circumstance occurs, such as too high voltage, BMS short circuit, too high temperature and so on, BMS will give signals, burn out the main circuit fuse and cut the power supply to the charger.

II Charging mode, methods and controlling functions

1. Charging mode

Constant current & voltage charging mode

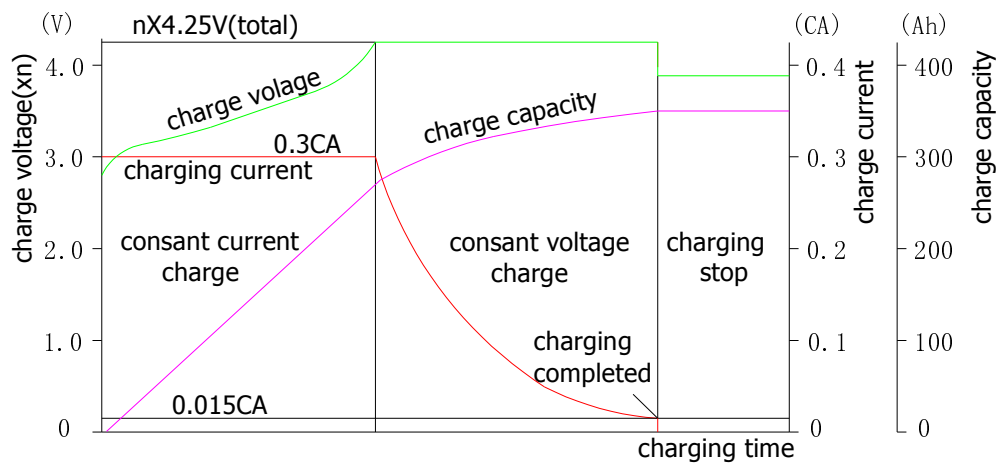
2. Charging methods and controlling functions

1) Constant current charging mode

In the beginning of charging, charge the cells under constant current at its limit maximum (Generally, $\text{max current} \leq 0.3\text{CA}$, CA means the charge and discharge current, C means Capacity, A means Ampere, 0.3CA means the current is 0.3 times of the capacity). During constant current charging, the charge current keeps the same, but the charge voltage will gradually increase until it reaches the limit maximum charge voltage.

2) Constant voltage charging mode

When the charge voltage reaches the limit maximum charge voltage (according to the *Li Battery Manual*), then it will be under constant voltage charging mode. At this moment, charge current will decrease as time goes by. When it reaches at 0.015CA , charging stops. You can refer to the following charging procedure chart, it shows the relation among charge voltage, current and capacity.



3) Adjust voltage automatically

During charging, especially when it is under constant voltage charging mode, if the charge voltage of any cell in the battery pack exceeds the limit (Generally, limit charge voltage is 4.3V), the charger can decrease the charge voltage and current to prevent the cell from OV charging.

4) Prohibit charging automatically

Before charging, if the voltage of any cell in the battery pack is less than 2.5V (or 2.8V), the charger will cut charging automatically. When it is confirmed that it can be charged again, the charger will automatically adjust the charge current to 1/3 of that in constant charging mode. Only when the battery voltage reaches 2.5V (or 2.8V), the charging mode will be normal. When the charge current decrease to 0.015CA, charging stops.

5) OT protection

During charging, if the temperature of the battery is higher than 75°C, the charger will automatically decrease the charge current until charging stops.

6) OC, SC protection

During charging, if the charge current is too high or any short circuit occurs, the charger will stop charging automatically.

III Charger operation method and standard

1. Preparation

1) Pay attention to the positive and negative pole of the 12V power-supply, DON'T connect them in a wrong way.

2) Set the "Power Switch" to "OFF", and connect AC 380V power-supply, the input is AC 380V 3-phase 4-line system. Connect the yellow green cable with neutral cable, and connect the cable outside the charger with the earth wire.

3) Set the "Power Switch" (which is only equipped on the medium power charger) on the charger board to "OFF"; Set the "Charging Switch" to "Adjust"; Set the "Voltage Adjust" button & "Current Adjust" button clockwise to minimum, then rotate 1/4 circle anti-clockwise.

4) Connect the battery pack charging lead with the charger, tighten it clockwise. Pay attention to the positive and negative pole, DON'T connect them in a wrong way.

2. Start to charge

1) Switch on the AC 380V power-supply, the charger in turn. 8 seconds later, the charger starts to work.

2) Check the status of the battery pack; If it is abnormal or any failure occurs, deal with the failure first, then charging is allowed.

3) Under the circumstances that the "Charging Switch" is set to "Adjust", rotate the "Charge voltage" button clockwise to set the charge voltage under constant voltage charging mode (the voltage = $N \times 4.25V$, N stands for the quantity of batteries connected in series, 4.25V is the maximum charge voltage of a single cell. Different battery model and temperature will result in different maximum charge voltage. Detail technical information please refer to the *Li Battery Manual*). During adjustment, if the green indicator light is on (30 seconds later the green indicator light will be on), press the "UV Recharge" button, continue to adjust until it reaches to the limit voltage.

4) Set the "Charging Switch" (which is on the charger board) to "Charging", then charging begins; Rotate the "Charge current" button to set the charge current under the constant current charging mode (Generally, the current $\leq 0.3CA$).

5) When charging begins, if UV occurs violently in any cell, the UV indicator light will be on and there is no voltage output, charging is not allowed. Only after the failure is solved, press the "UV Recharge" button, the charger begins charging slow, which is 1/3 of that under constant current charging mode. When the voltage of this cell increases to the "UV alarm" voltage, the charging mode will be normal again.

6) If the battery quantity decreases, reset and re-adjust the charge voltage under constant charging mode according to the methods mentioned above.

3. Observation during charging

Since the charging proceeds automatically, users only need to check at times the charger. If any abnormality or failure occurs, deal with it immediately.

During charging, if you need a pause, you can set "Charging Switch" to "Limit Voltage". At this moment, there is no voltage output, the charge capacity will stay the same. If the power is off, the capacity data display will disappear. And because once the maximum capacity exceeded, it will go back to "zero" and circle again, so DO memorize the circle times.

4. Charge complete

When the charge voltage reaches the limit voltage under constant charging mode, the charge current decreases to (generally) 0.015CA, and has a limited time lapse, the charger stops charging automatically. Cut the power-supply and remove the charging lead from the battery pack.

If you need to stop charging halfway, set the "Charging Switch" to "Adjust" first, then cut the power-supply and remove the charging lead from the battery pack.

IV Technical Specification of the charger

Technical Specification of the charger (1)

| | | | |
|------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Charger Model | DCM 200-600V/0-120A | DCM 460-600V/0-100A | DCM 100-425V/0-80A |
| Output Power | 72kw | 60kw | 34kw |
| Power-Supply | AC3-380V/ 50Hz | AC3-380V/ 50Hz | AC3-380V/ 50Hz |
| Output Voltage | DC200~600V | DC460~600V | DC100~425V |
| Output Current | DC0~120A | DC0~100A | DC0~80A |
| Efficiency | ≥ 93% | ≥ 93% | ≥ 93% |
| Input Protection | Fuse: 290A | Fuse: 240A | Fuse: 140A |
| | Disconnect: 360A | Disconnect: 300A | Disconnect: 170A |
| Requirement of cable section | Input ≥ 28 mm ² | Input ≥ 25 mm ² | Input ≥ 14 mm ² |
| | Output ≥ 25 mm ² | Output ≥ 20 mm ² | Output ≥ 16 mm ² |
| | Earth wire ≥ 16 mm ² | Earth wire ≥ 16 mm ² | Earth wire ≥ 16 mm ² |
| Dimension H×A×B | 600×530×1185 mm | 620×580×1115 mm | 600×490×970mm |
| Weight | 175kg | 145kg | 95kg |

Technical Specification of the charger (2)

| | | | |
|------------------------------|---------------------------------|---------------------------------|--------------------------------|
| Charger Model | DCM 4-258V/0-120A | DCM 28-280V/0-100A | DCM 100-180V/0-120A |
| Output Power | 30.96 kw | 28 kw | 21.6 kw |
| Power-Supply | AC3-380V/ 50Hz | AC3-380V/ 50Hz | AC3-380V/ 50Hz |
| Output Voltage | DC4~258V | DC28~280V | DC100~180V |
| Output Current | DC0~120A | DC0~100A | DC0~120A |
| Efficiency | ≥ 93% | ≥ 93% | ≥ 93% |
| Input Protection | Fuse: 125A | Fuse: 115A | Fuse: 86A |
| | Disconnect: 155A | Disconnect: 140A | Disconnect: 110A |
| Requirement of cable section | Input ≥ 12 mm ² | Input ≥ 12 mm ² | Input ≥ 8 mm ² |
| | Output ≥ 25 mm ² | Output ≥ 20 mm ² | Output ≥ 25 mm ² |
| | Earth wire ≥ 12 mm ² | Earth wire ≥ 12 mm ² | Earth wire ≥ 8 mm ² |
| Dimension H×A×B | 600×490×970mm | 540×460×810mm | 540×460×660mm |
| Weight | 87kg | 75kg | 62kg |

Technical Specification of the charger (3)

| | | | |
|------------------|-----------------------|-----------------------|-----------------------|
| Charger Model | DCM 100-430V/0-50A | DCM 4-4.25V/0-200A | DCM 60-260V/10-30A |
| Output Power | 21.5kw | 8.5kw | 7.8 kw |
| Power-Supply | AC3-380V/ 50Hz | AC3-380V/ 50Hz | AC3-380V/ 50Hz |
| Output Voltage | DC100~430V | DC4~4.25V | DC60~260V |
| Output Current | DC0~50A | DC0~200A | DC10~30A |
| Efficiency | ≥ 93% | ≥ 93% | ≥ 93% |
| Input Protection | Fuse: 86A | Fuse: 34A | Fuse: 70A |

| | | | |
|------------------------------|----------------------------------|----------------------------------|----------------------------------|
| | Disconnect: 110A | Disconnect: 43A | Disconnect: 88A |
| Requirement of cable section | Input $\geq 8 \text{ mm}^2$ | Input $\geq 4 \text{ mm}^2$ | Input $\geq 8 \text{ mm}^2$ |
| | Output $\geq 10 \text{ mm}^2$ | Output $\geq 35 \text{ mm}^2$ | Output $\geq 6 \text{ mm}^2$ |
| | Earth wire $\geq 8 \text{ mm}^2$ | Earth wire $\geq 8 \text{ mm}^2$ | Earth wire $\geq 8 \text{ mm}^2$ |
| Dimension H×A×B | 540×460×660mm | 330×500×570mm | 460×310×420mm |
| Weight | 62kg | 37kg | 28kg |

Technical Specification of the charger (4)

| | | | |
|------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Charger Model | DCM 20-32V/100-180A | DCM 50-85V/30-50A | DCM 18-60V/6-60A |
| Output Power | 5. 76kw | 4. 25kw | 3. 6kw |
| Power-Supply | AC3-380V/ 50Hz | AC220V/ 50Hz | AC220V/ 50Hz |
| Output Voltage | DC20~32V | DC50~85V | DC18~60V |
| Output Current | DC100~180A | DC30~50A | DC6~60A |
| Efficiency | $\geq 93\%$ | $\geq 93\%$ | $\geq 93\%$ |
| Input Protection | Fuse: 86A | Fuse: 34A | Fuse: 70A |
| | Disconnect: 110A | Disconnect: 43A | Disconnect: 88A |
| Requirement of cable section | Input $\geq 55 \text{ mm}^2$ | Input $\geq 40 \text{ mm}^2$ | Input $\geq 32 \text{ mm}^2$ |
| | Output $\geq 70 \text{ mm}^2$ | Output $\geq 50 \text{ mm}^2$ | Output $\geq 40 \text{ mm}^2$ |
| | Earth wire $\geq 6 \text{ mm}^2$ | Earth wire $\geq 4 \text{ mm}^2$ | Earth wire $\geq 4 \text{ mm}^2$ |
| Dimension H×A×B | 440×470×580mm | 500×265×200mm | 460×170×280mm |
| Weight | 39kg | 12kg | 11. 5kg |

Technical Specification of the charger (5)

| | | | |
|------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Charger Model | DCM 20-60V/10-60A | DCM 2-34V/0-100A | DCM 10-60V/10-50A |
| Output Power | 3. 6 kw | 3. 4 kw | 3kw |
| Power-Supply | AC110V/ 50Hz | AC3-380V/ 50Hz | AC220V/ 50Hz |
| Output Voltage | DC20~60V | DC2~34V | DC10~60V |
| Output Current | DC10~60A | DC0~100A | DC10~50A |
| Efficiency | $\geq 93\%$ | $\geq 93\%$ | $\geq 93\%$ |
| Input Protection | Fuse: 86A | Fuse: 34A | Fuse: 70A |
| | Disconnect: 110A | Disconnect: 43A | Disconnect: 88A |
| Requirement of cable section | Input $\geq 65 \text{ mm}^2$ | Input $\geq 13 \text{ mm}^2$ | Input 缆 $\geq 27 \text{ mm}^2$ |
| | Output $\geq 82 \text{ mm}^2$ | Output $\geq 17 \text{ mm}^2$ | Output $\geq 35 \text{ mm}^2$ |
| | Earth wire $\geq 6 \text{ mm}^2$ | Earth wire $\geq 2 \text{ mm}^2$ | Earth wire $\geq 3 \text{ mm}^2$ |
| Dimension H×A×B | 460×170×280mm | 460×170×280mm | 170×420×260mm |
| Weight | 11. 5kg | 11. 5 kg | 11kg |

Technical Specification of the charger (6)

| | | | |
|---------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Charger Model | DCM 2-65V/0-40A | DCM 20-60V/10-30A | DCM 30-77V/10-21A |
| Output Power | 2. 6 kw | 1. 8 kw | 1. 6 kw |
| Power-Supply | AC110V/ 50Hz | AC3-380V/ 50Hz | AC220V/ 50Hz |
| Output Voltage | DC20~60V | DC2~34V | DC10~60V |
| Output Current | DC10~60A | DC0~100A | DC10~50A |
| Efficiency | ≥ 93% | ≥ 93% | ≥ 93% |
| Input Protection | Fuse: 86A | Fuse: 34A | Fuse: 70A |
| | Disconnect: 110A | Disconnect: 43A | Disconnect: 88A |
| Requirement of cable section | Input ≥ 65 mm ² | Input ≥ 13 mm ² | Input ≥ 27 mm ² |
| | Output ≥ 82 mm ² | Output ≥ 17 mm ² | Output ≥ 35 mm ² |
| | Earth wire ≥ 6 mm ² | Earth wire ≥ 2 mm ² | Earth wire ≥ 3 mm ² |
| Dimension H×A×B | 460×170×280mm | 170×300×160mm | 170×300×160mm |
| Weight | 11. 5kg | 7. 5 kg | 7. 5kg |

Technical Specification of the charger (7)

| | | | |
|---------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Charger Model | DCM 30-85V/10-17A | DCM 30-85V/10-17A | DCM 18-60V/6-20A |
| Output Power | 1. 45 kw | 1. 45 kw | 1. 2 kw |
| Power-Supply | AC110V/ 50Hz | AC220V/ 50Hz | AC220V/ 50Hz |
| Output Voltage | DC30~85V | DC30~85V | DC18~60V |
| Output Current | DC10~17A | DC10~17A | DC6~20A |
| Efficiency | ≥ 93% | ≥ 93% | ≥ 93% |
| Input Protection | Fuse: 13A | Fuse: 13A | Fuse: 11A |
| | Disconnect: 32A | Disconnect: 16A | Disconnect: 13A |
| Requirement of cable section | Input ≥ 2 mm ² | Input ≥ 2 mm ² | Input ≥ 2 mm ² |
| | Output ≥ 4 mm ² | Output ≥ 4 mm ² | Output ≥ 4 mm ² |
| | Earth wire ≥ 2 mm ² | Earth wire ≥ 2 mm ² | Earth wire ≥ 2 mm ² |
| Dimension H×A×B | 170×300×160mm | 170×300×160mm | 170×300×160mm |
| Weight | 7 kg | 7 kg | 6. 5 kg |

Technical Specification of the charger (8)

| | | | |
|------------------|---------------------|---------------------|----------------------|
| Charger Model | DCM 24-60V/0-15A | DCM 24-30V/0-15A | DCM 18-46V/30-60A |
| Output Power | 0. 9 kw | 0. 45 kw | 27. 6 kw |
| Power-Supply | AC220V/ 50Hz | AC220V/ 50Hz | AC3-380V/ 50Hz |
| Output Voltage | DC24~60V | DC24~30V | DC18~46V |
| Output Current | DC0~15A | DC0~15A | DC30~60A |
| Efficiency | ≥ 93% | ≥ 93% | ≥ 93% |
| Input Protection | Fuse: 8A | Fuse: 4A | Fuse: 110A |
| | Disconnect: 10A | Disconnect: 6A | Disconnect: 136A |

| | | | |
|------------------------------|----------------------------------|----------------------------------|-----------------------------------|
| Requirement of cable section | Input $\geq 1 \text{ mm}^2$ | Input $\geq 1 \text{ mm}^2$ | Input $\geq 12 \text{ mm}^2$ |
| | Output $\geq 3 \text{ mm}^2$ | Output $\geq 3 \text{ mm}^2$ | Output $\geq 12 \text{ mm}^2$ |
| | Earth wire $\geq 1 \text{ mm}^2$ | Earth wire $\geq 1 \text{ mm}^2$ | Earth wire $\geq 12 \text{ mm}^2$ |
| Dimension H×A×B | 270×160×180mm | 270×160×180mm | 600×500×970mm |
| Weight | 5 kg | 5kg | 72 kg |

Technical Specification of the charger (9)

| | | | |
|------------------------------|----------------------------------|-------------------------|-----------------------|
| Charger Model | DCM 60-340V/10-60A | DCM DC4-30V/0-15A | DCM DC4-60V/0-30A |
| Output Power | 20.4 kw | 0.45KW | 1.8KW |
| Power-Supply | AC3-380V/ 50Hz | AC220V/50Hz/60Hz | AC 220V/50/60 Hz |
| Output Voltage | DC60~340V | DC4-30V | DC4-60V |
| Output Current | DC10~60A | DC0-15A | DC0-30A |
| Efficiency | $\geq 93\%$ | $\geq 93\%$ | $\geq 93\%$ |
| Input Protection | Fuse: 80A | 5A | 15A |
| | Disconnect: 100A | 10A | 20A |
| Requirement of cable section | Input $\geq 8 \text{ mm}^2$ | $\geq 1 \text{ mm}^2$ | $\geq 4 \text{ mm}^2$ |
| | Output $\geq 12 \text{ mm}^2$ | $\geq 4 \text{ mm}^2$ | $\geq 6 \text{ mm}^2$ |
| | Earth wire $\geq 8 \text{ mm}^2$ | $\geq 2.5 \text{ mm}^2$ | $\geq 4 \text{ mm}^2$ |
| Dimension H×A×B | 650×460×660mm | 170*180*280MM | 170*180*280MM |
| Weight | 62 kg | 5.6Kg | 6.4Kg |

Technical Specification of the charger (10)

| | | | |
|------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Charger Model | DCM DC4-98V/0-60A | DCM DC4-64V/0-100A | DCM DC4-85V/0-50A |
| Output Power | 5.88 kw | 6.4kw | 4.25 kw |
| Power-Supply | AC220V/ 50Hz/60 Hz | AC3*380V/50Hz/60Hz | AC230V/50Hz/60 Hz |
| Output Voltage | DC4~98V | DC4~64V | DC4-85V |
| Output Current | DC0~60A | DC0~100A | DC0-50A |
| Efficiency | $\geq 93\%$ | $\geq 93\%$ | $\geq 93\%$ |
| Input Protection | Fuse: 50A | Fuse: 25A | Fuse: 40A |
| | Disconnect: 63A | Disconnect: 32A | Disconnect: 50A |
| Requirement of cable section | Input $\geq 7 \text{ mm}^2$ | Input $\geq 4 \text{ mm}^2$ | Input $\geq 6 \text{ mm}^2$ |
| | Output $\geq 15 \text{ mm}^2$ | Output $\geq 25 \text{ mm}^2$ | Output $\geq 12 \text{ mm}^2$ |
| | Earth wire $\geq 6 \text{ mm}^2$ | Earth wire $\geq 6 \text{ mm}^2$ | Earth wire $\geq 6 \text{ mm}^2$ |
| Dimension H×A×B | 320×315×430mm | 320×315×430mm | 320×315×430mm |
| Weight | 23 kg | 23kg | 23 kg |