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Ver. 07

Technical & Usage Manual

GYFP4875T LFP Battery Backup System for R4G

Technical & Usage Manual	Version 07
LFP Battery Backup System	Issue Date: 2015-1-27
	GYFP4875T
Software	

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I. Brief Introduction

GYFP-4875T series lithium battery system is a high-tech product, which is developed independently by HARBIN COSLIGHT POWER CO., LTD. It has outstanding advantages in power backing-up area for telecom or specified area, which is widely used in access network equipment, remote switching office, mobile communication equipment, transmission equipment, satellite ground stations and microwave communication equipment. The product has terrific expansibility, and it not only can be used independently, but also can be used with multi-groups in parallel, meanwhile the connection method is simple and reliable.

II. Features

2.1 Small in size, light in weight

It is particularly suitable for the base station which is difficult to find in cities, and the small size can solve the problem of small space size in base station.

2.2 Excellent high temperature performance

At 45°C each cycling index of lithium battery corresponds to 8 times of LA battery performance, so the lithium battery has better cost performance. Under this advantage, it especially applies to the base station at high operating temperature area, e.g. the base station without air-conditioning or the base station out of the way.

2.3 Long cycle life

At 25°C the life of lithium battery corresponds to 10 times of LA battery life, and lithium battery cycle life is 8000 cycles @50%DOD, so the lithium battery has better cost performance. Under this advantage, it especially applies to Class III and Class IV power-supply area.

2.4 Flexible configuration

Multiple modules in parallel can extend system backup time.

2.5 BMS

- 2.5.1 The battery system adopts advanced BMS unit, having the function of over-discharging alarm, over-charging alarm, over-current alarm, temperature alarms and protection function. The BMS also can keep the communication between battery system and power supply unimpeded.
- 2.5.2 Protect the battery when discharging, and manage the battery charge.
- 2.5.3 It has twice power-down function. It will send warning information if the battery volt is lower than warning value; it will take automatic power-down protection if cell voltage or battery pack voltage is too low;
- 2.5.4 Having good electromagnetic compatibility;
- 2.5.5 High intelligence: Communicate with upper computer via system serial port.

2.5.6 High reliability: It is perfect combination of power supply control technology and computer technology, which can monitor and control various parameters and status in real time.

III. Key Components for Composition

The product consists of 4 parts as below:

- 48V75AH LFP Battery (15 pieces of 3.2V75AH cells in series)
- BMS
- System cabinet
- Data recorder

IV. Specification Parameters

Model	GYFP4875T
Single box overall dimension (mm)	482×400×178
Weight (KG)	43
Rated voltage [V]	-48V
Rated capacity [C2][Ah]	75Ah
Voltage range (V)	-42V~-54V
Charging voltage (V)	-54V
Charging mode	CC/CV
Rated charging current (A)	≤37.5A
Rated discharging current (A)	≤37.5A
Operating ambient temperature	-20℃~+60℃
Storage temperature	0℃~+40℃
Relative humidity	5%~95%RH

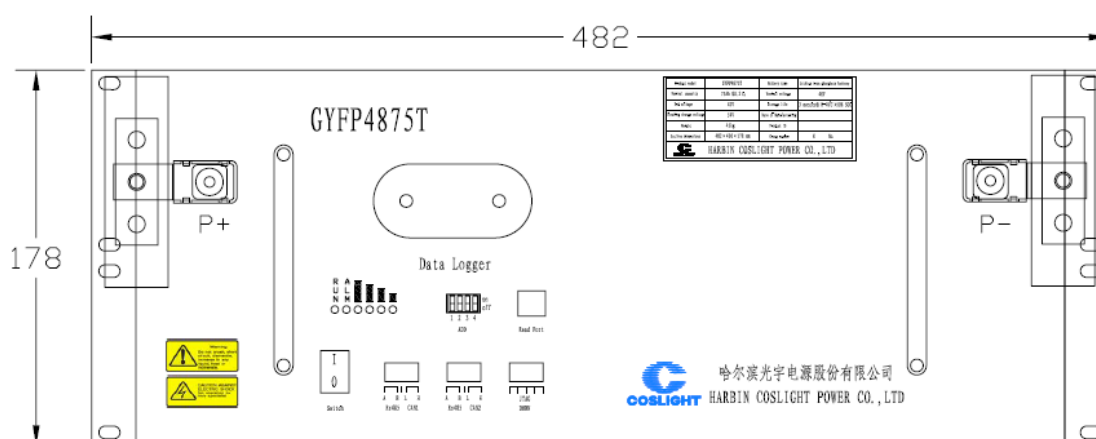


Fig. 4 Whole Module Overall Dimension Diagram

V. Working Principle and Parameters

5.1 System working parameter

The working principle of GYFP-4875T LFP battery backup power system is as the **Fig 5.1**. By inputting 220V/380V mains power into system, and after the rectifier module processes, the output will be -48V. When the power grid is normal, the rectifier power module will supply power to load, and at the same time it will charge the lithium battery; when the AC power is off, the lithium battery system will supply power to load and ensure the DC power system to work normally in order to realize uninterrupted power supply. Battery system has automatic charging/discharging management and twice power-down function, which adequately extent the life of lithium battery.

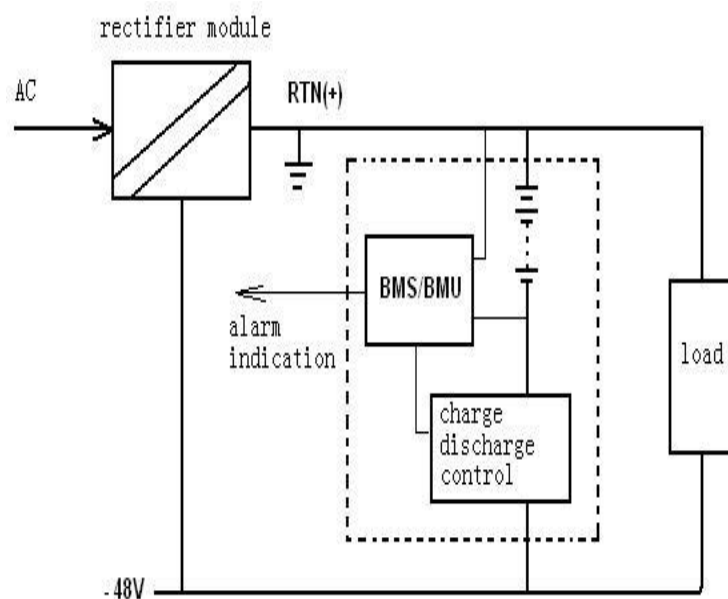


Fig. 5.1

5.2 Function and parameter of system protection

This product has improved protection and alarm function, which can intelligently check fault itself and take appropriate measures according to different failure in order to prevent expansion of accident. The alarm function will be activated and alarm indicator will be on when external or internal environment has problem, which remind the user to check the fault, whatever the equipment can still work normally. When the external or internal environment has more serious problem and hits the set protection point, the equipment will cut off charge and discharge loop automatically, and it will not restart until hits to the recovery point.

Below is the alarm and protection action point, please strictly follow the parameter when using:

Name	Alarm and protection type	Set range	Typical value	Reaction
Cell	Over voltage warning	3.0~4.2V	4.1V	Warning indicator on
	Over voltage warning recovery	2.8~3.8V	3.7V	Warning indicator off
	Over voltage protection	3.4~4.2V	4.2V	Cut off charging loop
	Over voltage protection recovery	3.0~3.9V	3.6V	Connect charging loop
	Under voltage warning	2.4~3.0V	2.5V	Warning indicator on
	Under voltage warning recovery	2.8~3.2V	3.0V	Warning indicator off
	Under voltage protection	2.0~3.2V	2.0V	Cut off discharging loop
	Under voltage protection recovery	2.5~3.4V	3.2V	Connect discharging loop
	Charging over temperature warning	40~60℃	50℃	Warning indicator on
	Charging over temperature warning recovery	40~60℃	45℃	Warning indicator off
	Charging over temperature protection point	40~70℃	55℃	Cut off charging loop
	Charging over temperature protection recovery point	30~70℃	50℃	Connect charging loop
	Charging under temperature protection point	-10~5℃	3℃	Cut off charging loop
	Charging under temperature protection recovery point	0~8℃	5℃	Connect charging loop
	Charging under temperature protection warming	0~10℃	5℃	Warning indicator on
	Charging under temperature protection warming recovery	5~10℃	7℃	Warning indicator off
	Discharging over temperature warning	40~60℃	50℃	Warning indicator on
	Discharging over temperature warning recovery	40~60℃	45℃	Warning indicator off
	Discharging over temperature protection point	40~70℃	60℃	Cut off charging loop
	Discharging over temperature protection recovery point	30~70℃	55℃	Connect discharging loop
Battery	Battery over-voltage warning	48~58V	55.5V	Warning indicator on
	Battery over-voltage warning recovery	48~55.5V	54.5V	Warning indicator off
	Battery over-voltage protection	40~58V	56.25V	Cut off charging loop
	Battery over-voltage protection recovery	40~58V	51.75V	Connect charging loop
	Battery under-voltage warning	40~50V	43.2V	Warning indicator on
	Battery under-voltage warning recovery	40~58V	45V	Warning indicator off
	Battery under-voltage protection	40~55V	42V	Cut off discharging loop
	Battery under-voltage protection recovery	40~58V	50V	Connect charging loop
	Battery charging over current warning	25~300A	50A	Warning indicator on
	Battery discharging over current warning	25~300A	50A	Warning indicator on
	Battery charging over current alarm recovery	20~250A	45A	Warning indicator off
	Battery discharging over current alarm recovery	20~250A	45A	Warning indicator off
	Battery charging over current protection	30~300A	60A	Cut off charging/ discharge loop
	Battery discharging over current protection	30~300A	60A	Cut off charging/ discharge loop

Battery charging voltage protection point	50~60V	52.5V; $I \leq 0.02C$	Cut off charging loop
Battery charging voltage recovery point	48~55V 7-20 days	$\leq 50.25V$ 15 days	Recover charging loop

VI. System Installation

6.1 Unpacking inspection

Note: After open the wooden box, please strictly follow the markings on the box. Put the carton with battery module out of the box horizontally, notice to handle with care. Prohibit to place aslope or vertically.



- 6.1.1 Open the packaging of GYFP4875T LFP battery backup power system, and notice packing way and accessory. The accessory should include all of the items on the packing list except system cabinet.
- 6.1.2 Check if the machine is damaged in transportation. Do not turn on the system and inform the carrier and agency if damage or absence happens.
- 6.1.3 Confirm if the machine model is the just one by checking the type silk-print on front panel.

6.2 Installation tool

Installation personnel should prepare the following tools before install GYFP4875T system.

Tool name	Unit	Quantity
Grand cross screwdriver	pair	1
Medium-sized cross screwdriver	pair	1
3# internal hexagonal wrench	pair	1
6# internal hexagonal wrench	pair	1
4-20N.M adjustable torque spanner	pair	1

Note: The torque spanner is used to fasten crews on battery pole, and the torque force should be set to 8N.

6.3 System cabinet panel function

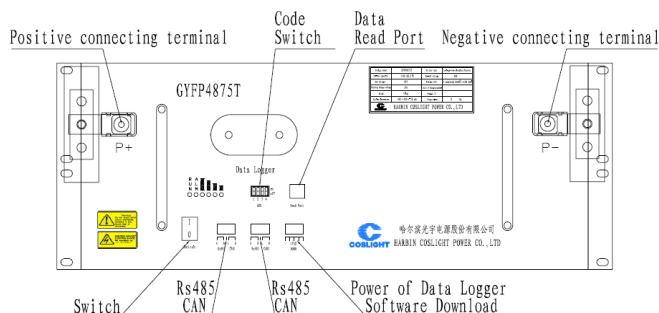


Fig. 6.3 Panel Components Diagram

6.4 Battery running switch



Fig. 6.4 Running Switch

- 6.4.1 When the system is abnormal, switch the button to “O” to turn off the BMS and cut off battery output; when the abnormal is solved, switch the button to “I” to charge the battery and make battery running.
- 6.4.2 In all cases, as long as the system is out of running status, it should switch the button to “O” position and stop the BMS in order to protect system against over discharge.

6.5 Battery interface definition

As Fig. 6.3

- P+: Positive wiring terminal
- P-: Negative wiring terminal

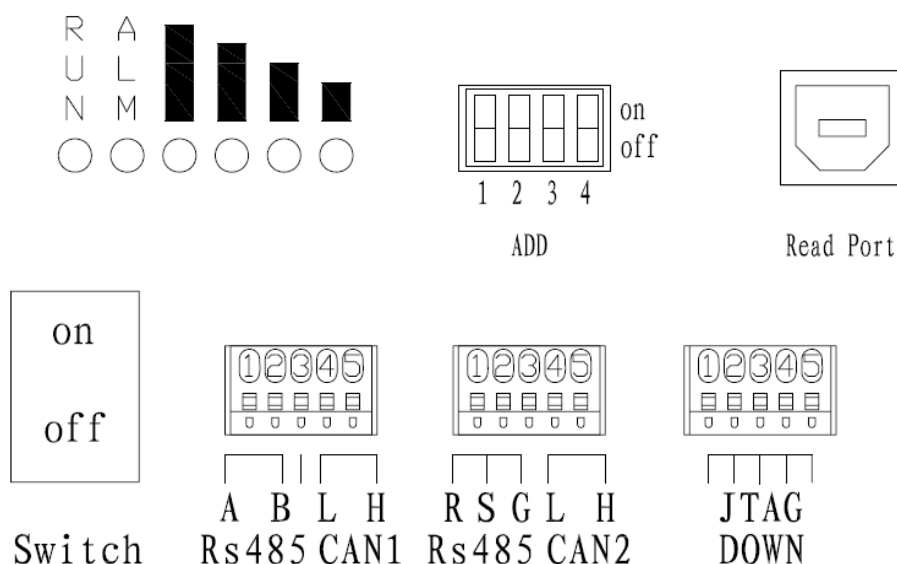
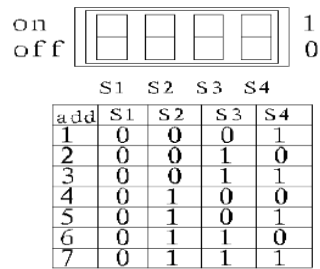


Fig. 6.5-1

- RS485, CAN1: Pin 1, pin 2 is 485 communication (1=A, 2=B), which is used for module to SMPS communication; pin 4 and pin 5 is CAN communication, which connects with another module CAN communication of similar system.(As Fig. 6.5-1)
- RS485, CAN2: Pin 1, pin 2 is 485 communication (1=A, 2=B), which is used for background communication; pin 4 and pin 5 is CAN communication, which connects with another CAN communication of similar system or data recorder. (As Fig. 6.5-1)
- DOWN: BMS program download port. (As Fig. 6.5-1)
- Read Port: USB port for reading data in the data logger. (As Fig. 6.5-1)
- ADD: Dial switch

ADD**Fig. 6.5-2****6.6 Battery system running indicator**

RUN indicator: Green light will display 1s slow flash in charging, and 0.15s fast flash in discharging, and no flash in standby mode

6.7 Battery warning indicator

ALM indicator: Red light will be on when any fault or alarm happens.

6.8 Battery capacity indicator

Battery capacity indicator: 4green light, each light represents 25% of capacity.

6.9 Battery LED indicator definition**LED indicator definition**

System status	Running status	RUN	ALM	Capacity LED (green)				Definition
		●	●	●	●	●	●	
Power off		Off	Off	Off	Off	Off	Off	All are off
Standby	Normal	Always on	Off	According to capacity indicator				Standby status
	Warning	Always on	Always on					
Charge	Normal	Slow flash	Off					
	Warning	Slow flash	Slow flash					
	Protection	Slow flash	Slow flash					Stop charging
Discharge	Normal	Fast flash	Off					
	Warning	Fast flash	Fast flash					
	Protection	Fast flash	Fast flash					Stop discharging

SOC indicator definition

System status	SOC scope	Capacity LED (green)			
Charge	$SOC < 25\%$	Off	Off	Off	Off
	$25 \leq SOC < 50\%$	Off	Off	Off	on
	$50 \leq SOC < 75\%$	Off	Off	on	on
	$75 \leq SOC < 100\%$	Off	on	on	on
	$SOC = 100\%$	on	on	on	on
Discharge	$SOC = 0$	Off	Off	Off	Off
	$0 < SOC \leq 25$	Off	Off	Off	on
	$25 < SOC \leq 50$	Off	Off	on	on
	$50 < SOC \leq 75$	Off	on	on	on
	$75 < SOC \leq 100$	on	on	on	on

LED flash definition

Flash mode	On
Fast flash	0.15s
Slow flash	1s

6.10 Pre-installation Check

The installation personnel should make power-on check before installation.

The system is in charging action mode under working: It needs to supply 48V DC power again for activating the system after every power off, so the system can't start before accessing the DC power supply.

6.11 Single module installation

6.11.1 Firstly, install the suspension loops on both sides of battery module with M4X8 socket head cap screw.

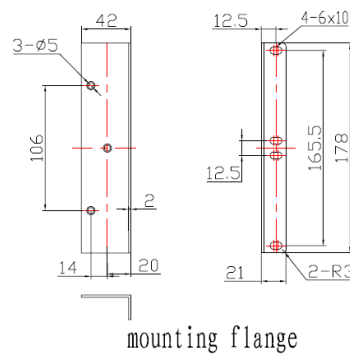


Fig. 6.11.1-1

- GBM style module should be installed as **Fig. 6.11.1-2:**

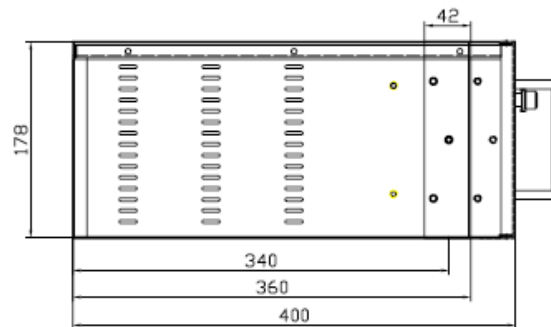


Fig. 6.11.1-2

- 19" rack style module should be installed as **Fig. 6.11.1-3:**

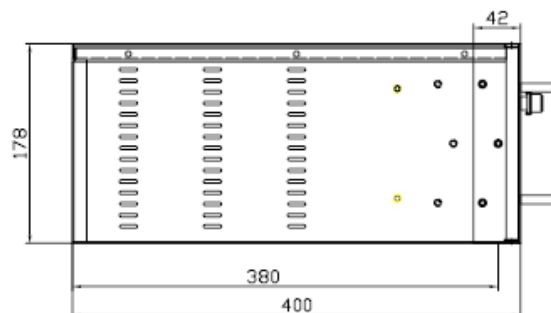


Fig. 6.11.1-3

Then put the module on correct position of rack.

- GBM style module should be placed as **Fig. 6.11.1-4**:

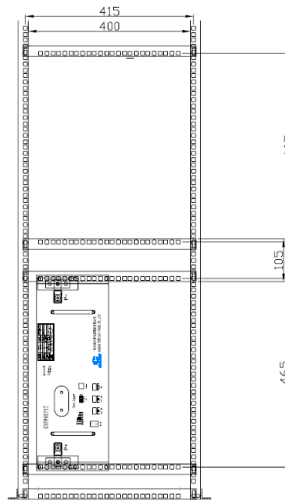


Fig. 6.11.1-4

- 19" rack style module should be placed as **Fig. 6.11.1-5**:

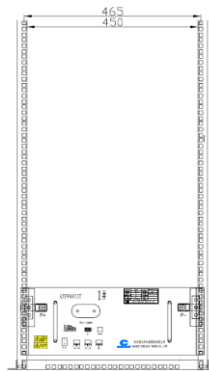


Fig. 6.11.1-5

Fix the mounted battery module on battery rack with M5 bolt by mounting flange, and each mounting flange should make 2 hole sites at least. The position of mounting hole is as **Fig. 6.11.1-6**:

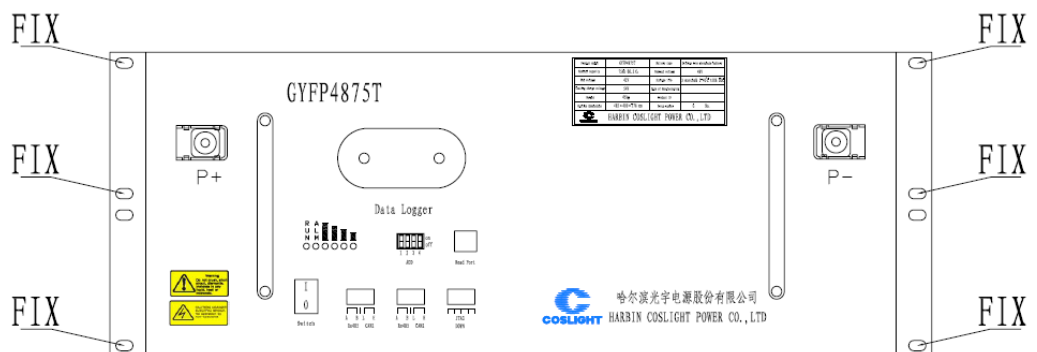


Fig. 6.11.1-6

6.11.2 Installation of battery leading-out terminal

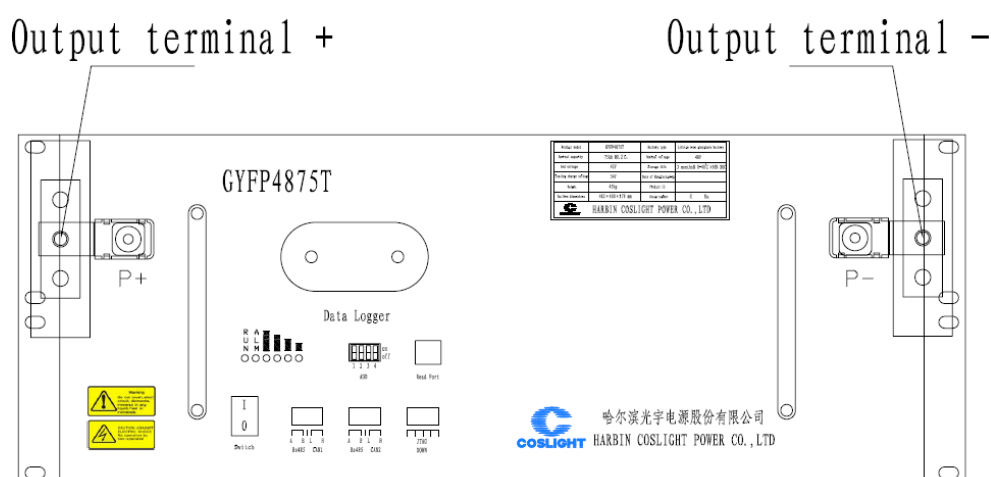


Fig. 6.11.2-1

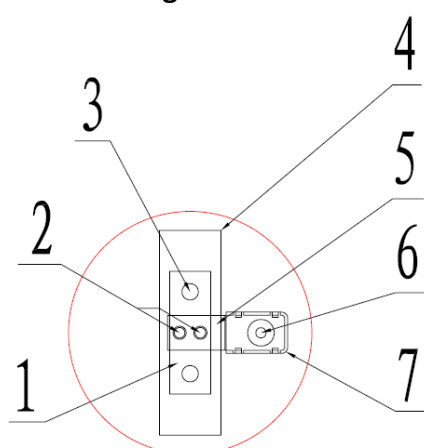


Fig. 6.11.2-2

Serial No.	Name	Quantity	Material
1	Cascade connection bar	2	2.5X20X60
2	Bolt for output bar	4	M4X12
3	Bolt for cascade connection	4	M8X16
4	Insulation box	2	PE 30X30X100
5	Output bar	2	2x17x25
6	Bolt for module terminal	2	M6X12
7	Battery terminal insulation cap	2	PE

6.11.2.1 Fix the output bar by the M6X12 bolt with 6.5N.m torque force, and keep the copper bar horizontal, and with no obvious bevel angle. Cover the terminal with battery terminal insulation cap. And the operating mode of anode and that of cathode is the same.

6.11.2.2 Fix the cascaded connection bar by the M4X12 inside hexagonal bolt with 3.6N.m torque force, and keep the cascade connection bar perpendicular with output bar, and with no obvious bevel angle.

6.11.3 Check the polarity of power line, after confirmation, Fasten the external power line by the M8X16 inside hexagonal bolt with

10N.m torque force, and keep the external power line in same direction with cascade connection bar, and with no obvious bevel angle. At last, install the Insulation box on the cascade connection bar, and pay attention to that the side opening position of battery terminal insulation cap should face toward output bar of module. And the operating mode of anode and that of cathode is the same.

6.11.4 Installation of background RS485 communication

Connect one side of 2000mm RS485 communication cable which is attached in system cabinet with user side, and connect the other side with RS485 communication port on panel, and notice that the first point on left of terminal is A, and the second point is B.

6.11.5 Power on check for battery module

After the above operation, the installation personnel should make power-on check for system. And affirm if the wiring of positive and negative is correct or not, and also if the SMPS parameter setting is correct or not.

6.11.6 Charging operation

It is 60% of rated capacity when leaving the factory. The battery should be charged or additional charged when initial power-on or storage time is more than 3 months.

Please refer to below charging steps and preparations:

- Measure the output voltage of charger, and its value should meet the charge voltage requirements in Section 4.
- Make sure that the current supplied by charger is less than the system set value in order to meet the running requirements of the device.
- Turn on the switch of "I/O", and check the indicator status according to **Section 6.9** If there is any fault, you should do as table of **Section 5.2** and determine the failure point, and then go to next step after troubleshooting.
- Measure the voltage between "+" and "-" of lithium battery, and there should be 51V~54V DC voltage.
- After all the capacity indicators are on, at the same time, the fault indicator and fusing indicator are still off, which means the device is in full capacity status, then the device can be put into operation.

Notes: The battery should be charged above 3 °C

Battery system will come to standby mode automatically when battery is fully charged in order to reduce energy loss.

6.12 Modules using in parallel

6.12.1 After the first module is fixed, the operation of added modules can follow the details of section 6.11.1 and section 6.11.3.

6.12.2 Before connecting the power, open the power switch first and

observe the status of indicator, if the warning indicator is still off and the running indicator flashes normally, it means the lithium works normally. And the module can be connected with system for work. At this time, turn off the power switch, and ensure that the panel indicator is off, and there is no output voltage on positive and negative of module.

Notes: The battery should be charged above 3 °C

- 6.12.3 Open the positive terminal insulation cap of previous battery module, and connect two anodes of two modules with each other by anode cascade connection cable (flexible wire with SC50-8 OT heads pressed at two ends and disposed by red heat-shrink tube). The mounting direction of cascade connection cable is as below:

GBM: Cascade connection cable installation drawing

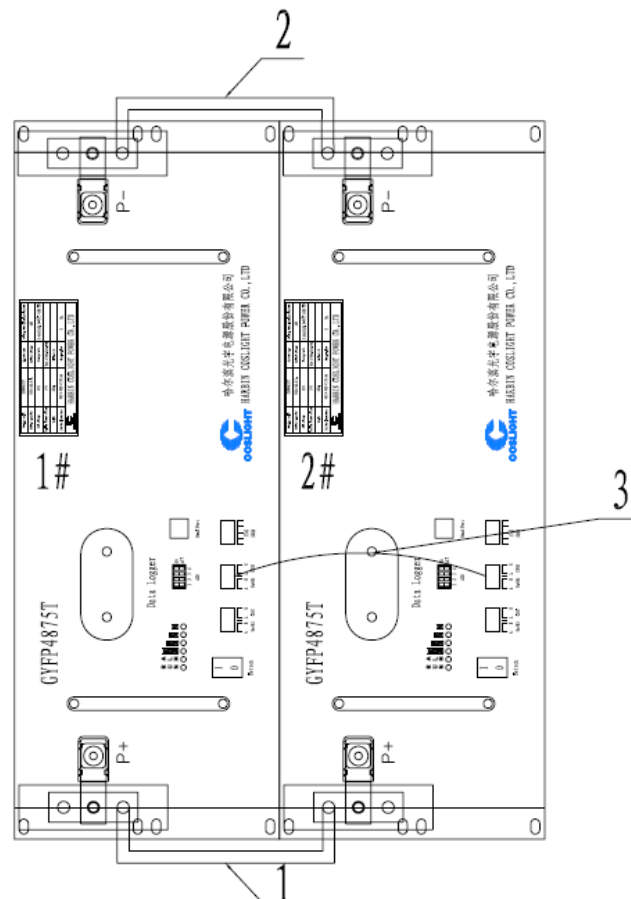


Fig. 6.12.3-1

19" rack: Cascade connection cable installation drawing

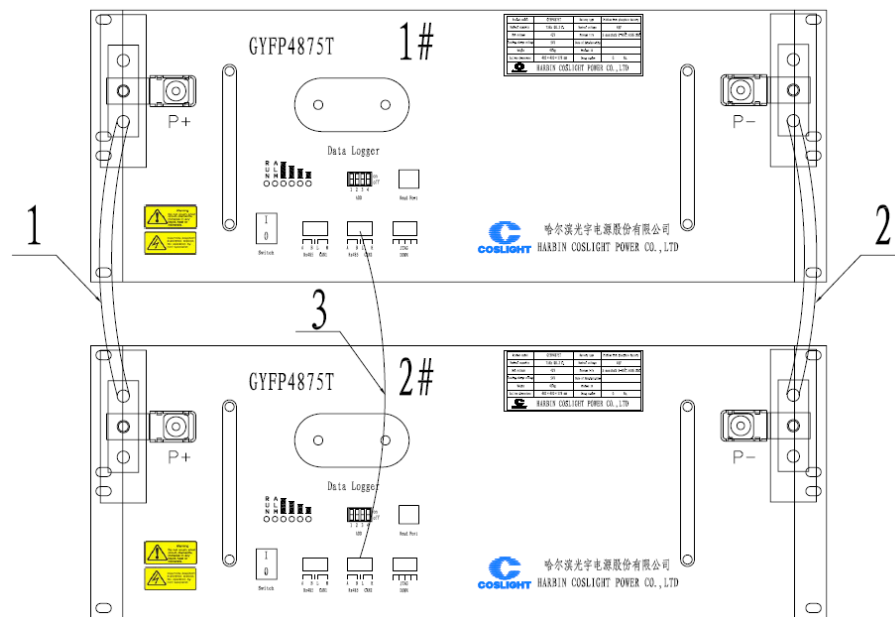


Fig. 6.12.3-2

- 6.12.4 After correct connection, cover the insulation cap for two modules, notice that the open mouth direction of cap should be correct.
- 6.12.5 Open the negative terminal insulation cap of previous battery module, and connect two cathodes of two modules with each other by cathode cascade connection cable (flexible wire with SC50-8 OT heads pressed at two ends and disposed by blue heat-shrink tube), and the mounting method of cascade connection cable is same as that of anode. After correct connection, cover the insulation cap for two modules, notice that the open mouth direction of cap should be correct.
- 6.12.6 Insert module communication cable into CAN communication interface of two modules according to correct direction.
- 6.12.7 The precondition of battery module in parallel
 - The differences of SOC are no more than 10%. That is the quantity of alight capacity indicator of two modules is same.
 - In charging process, if the capacity differences between each other is big, the battery module should be charged alone, and ensure that the SOC value of two modules prepared for parallel connection are close.
- 6.12.8 When precondition of battery modules in parallel is satisfied, turn on the power switch, and observe the status of indicator, if the warning indicator is still off and the running indicator flashes normally, it means the lithium works normally.

VII. System Maintenance

7.1 Daily maintenance

View the communication data every day to check whether it exists abnormalities or whether there is warning information, and please process the error in time if any fault happens.

7.2 Regular maintenance

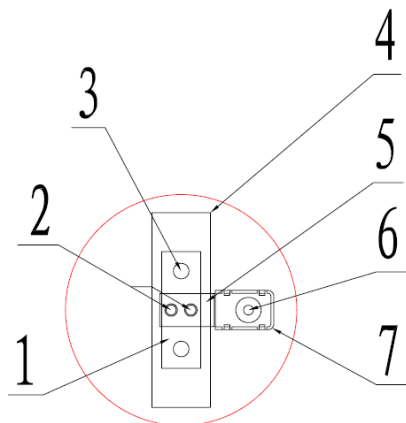
Make regular routing inspection to battery every 6 months, and inspection contents are as below:

- Keep the base station clean
- Measure and record ambient temperature in base station;
- Check if pests, mice, flood disaster happens;
- Clean the battery and check heat trace of terminals, also if there is any damage on housing or over heat sign.
- Measure and record the total voltage of battery system and cell voltage.
- Check if there is any looseness about interconnecting piece or pole bolt.

7.3 Replacement

When using in parallel, please replace the battery module as follow steps if any fault happens.

- 7.3.1 Push the switch power of faulted battery to “O” (off), turn off the BMS, and cut off the battery output.
- 7.3.2 Disconnect the CAN communication cascade line
- 7.3.3 Take down all the fixed bolts from mounting flange.



Serial No.	Name	Quantity	Material
1	Cascade connection bar	2	2.5X20X60
2	Bolt for output bar	4	M4X12
3	Bolt for cascade connection	4	M8X16
4	Insulation box	2	PE 30X30X100
5	Output bar	2	2x17x25
6	Bolt for module terminal	2	M6X12
7	Battery terminal insulation cap	2	PE

- 7.3.4 Take down the positive insulation box, and cover the insulation cap for positive cascade connection bar after take the M4 inside

- hexagonal bolt of location 2 down.
- 7.3.5 Take down the positive battery terminal insulation cap, bolt for battery terminal (M6X12), and output bar.
- 7.3.6 Take down the negative insulation box, and cover the insulation cap for negative cascade connection bar after take the M4 inside hexagonal bolt of location 2 down.
- 7.3.7 Take down the battery negative terminal insulation cap, bolt for battery terminal (M6X12), and output bar.
- Notice: All this operation is hot-line work, and the other equipments are still in working, so it must make insulating treatment for the disassembled cascade connection bar, otherwise, there is risk of electrical shock !**
- 7.3.8 Put the faulted battery out of battery rack, and notice that don't make interference between electric power BUS and modules in disassembling process.
- 7.3.9 Replace a new battery module at the position, and notice that don't make interference between electric power BUS and modules in disassembling process.
- 7.3.10 Turn on the power switch and observe the status of indicator, if the warning indicator is still off and the running indicator flashes normally, it means the lithium works normally.
- 7.3.11 Install the output bar on battery module according to section 6.11.2, and cover battery terminal by battery terminal insulation cap
- 7.3.12 Open the positive terminal insulation cap of new battery, and install the cascade connection bar on the output bar, and then cover the cascade connection bar with insulation cap
- 7.3.13 Open the negative terminal insulation cap of new battery, and install the cascade connection bar on the output bar, and then cover the cascade connection bar with insulation cap
- 7.3.14 Adjust the dial switch address of new battery according to the replaced one.
- 7.3.15 Insert CAN communication cascade line as previous position.
- 7.3.16 When precondition of battery modules in parallel is satisfied, turn on the power switch, and observe the status of indicator, if the warning indicator is still off and the running indicator flashes normally, it means the lithium works normally, and the new module can be put into operation.
- Notice: If there is data recorder on the faulted battery box, it must take the data recorder down first, and install it on the new battery box.**
- 7.3.17 Make fault detect for faulted battery box and dispose it in time.

VIII. Typical Failure Analysis

8.1 After installation there is no reaction by turning on switch.

Reason: The SMPS switch is not started or the switch damaged.

8.2 After turn on the switch, the module can normally work, but after one minute later, the warning indicator is on.

Reason: The charging current is much too big, please adjust the current-limiting value below 0.5C.

8.3 When turn on the switch, the warning indicator is on.

Reason: System failure, it should access background test software to view the cause of the malfunction.

8.4 In running process, it comes BMS hardware failure warning, and it can't get automatic recovery.

Reason: The system has got large current shock, and the BMS executes short-circuit protection. It should check if there is any short circuit happening on external cable. If everything is normal, it should turn off the switch and restart the system, by which, the failure may be solved. If the failure is still existing, it should access background test software to view the cause of the malfunction.

IX. Package & Transport & Storage

9.1 Package

Package of this product is moisture-proof and quakeproof, and in accordance with the requirements of GB 3873-83. System adopts integrated package, to ensure that it is free from harmful gases, moisture, mechanical damage, chemical pollution, static during handling, transportation, and storage. Product name, model specification, production date, quantity and batch number are all marked on the surface of package.

9.2 Transport

It should be in strict accordance with the direction of package during the handling, and put it down gently and avoid quaking. It should be placed according to the direction marked on the package in order to avoid damage. In transportation process, it must protect battery against sunlight exposure or storage in high temperature (above 60°C).

9.3 Storage

The product should be stored in dry environment. The temperature range of 0-40°C is preferred and humidity should be no more than 95%. No exposure or rain. It should be charged additionally if the storage period is more than 3 months. The product should be taken an experiment about the capacity if the storage period is more than 12 months, and the user can use the product if qualified.

X. Safety Caution

- 10.1 Do not put the battery into water. It should be stored in dry and cool environment when not in use.

- 10.2 Do not use or place the battery near to the high temperature object or source.
- 10.3 Please operate the system according to the specified charging and discharging parameter of the specification.
- 10.4 Do not connect the battery into socket directly.
- 10.5 Do not throw the battery into the fire or heater.
- 10.6 Do not unpack the battery and its components.
- 10.7 Do not hit, throw or step the battery, etc.
- 10.8 Even if the commercial power is off, system is still having power; Avoid electric shock or short circuit when using.