GTEC UPS MODEL:

MUST15-120

SERVICE MANUAL

www.gtec-power.eu

SERVICE MANUAL
MUST 15-120

CONTENT

1. General Information of This Document

1.1 Getting start

This is a service manual for MUST 15-120 UPS, intend to help service personal perform maintenance and repair service.

If you want to know:

? **Functional block of the UPS, and operating principle thereof,** please refer to Principle of Operation.

? **What's wrong with the UPS and How to solve the problem**, please refer to Trouble Shooting?

? **Basic information about the product, install and operation instruction,** you may please refer to USER MANUAL

1.2 Conventions

This service manual uses the following conventions to alert you some important information for safe operation and quick working.

Warning: Denotes a procedure or operation, which, if not perform correctly, may result in personal injury. **Be sure not to continue operation until indicated conditions are fully understood and met**.

Caution: Denotes a procedure or operation, which, if not perform correctly, may cause damage to the UPS. **Be sure not to continue operation until indicated conditions are fully understood and met**.

Information and Tips: There are some tips and skills after this symbol. During service operations, these skills may help you quickly finish your work.

1.3 Important Safety Instructions

1. **For qualified service personnel only.**
2. **DO NOT** performs any internal service or adjustment of this product unless another person is capable of rendering first aid and resuscitation is present.
3. Dangerous voltage exists at several points in this product. To avoid personal injury, don't touch any exposed connections or components while UPS is active.
4. Turn off the UPS and disconnect input power cord before removing outside protective cover.
5. AC voltage is always present if the input AC power is still available.
6. High voltage may present at DC capacitors. Before opening the outside cover, wait for at least five minutes after turning off the UPS. Make sure that the DC capacitor voltage is lower than the safety voltage (60Vdc) before disassembling any parts.
7. Verify input source (voltage and frequency) is within the maximum range before service.

2. Characteristic of the Product

The MUST 15-120 is a three phase input and three phase output, double conversion online uninterruptible power supply (UPS) product with high efficiencies and performance. One module can supply 15KVA.The MUST 15-120 UPS employs the high intelligent Modulization design. The user can meet his requirement on power output and reliability by adding or reducing the internal modules of the MUST 15-120 UPS and achieve the optimal price-performance ratio.

For all series of UPS, they are strictly tested and carefully designed. We always do our best to make our products more reliable and safer; this is also the goal of our company. However, due to the lifetime of electrical components and some unpredictable reasons, there will be unavoidable failures of this UPS. If this situation occurs, service of qualified person is needed. This service manual will guide the technicians to repair the UPS. If the UPS still does not work properly, please contact with us and we will be glad to solve any problems you met.

3. PRINCIPLE OF OPERATION

3.1 Functional Block of the system

MUST 15-120 adopts a drawer-type high intelligent modular design and each standard UPS-module is designed as an independent UPS of 15KVA which is hot-swappable. The system frame can hold a maximum of 8 UPS-Modules. Besides, MUST 15-120 contains an independent Communication Module (LCD module) which applied is to monitor and communicate with all the UPS-Modules and provides comprehensive information about the UPS system to the user interface. The input circuit, output circuit, battery wire and communication line are parallel connected. All the modules work together and coordinate with each other. The figure 3.1 shows the system's structure

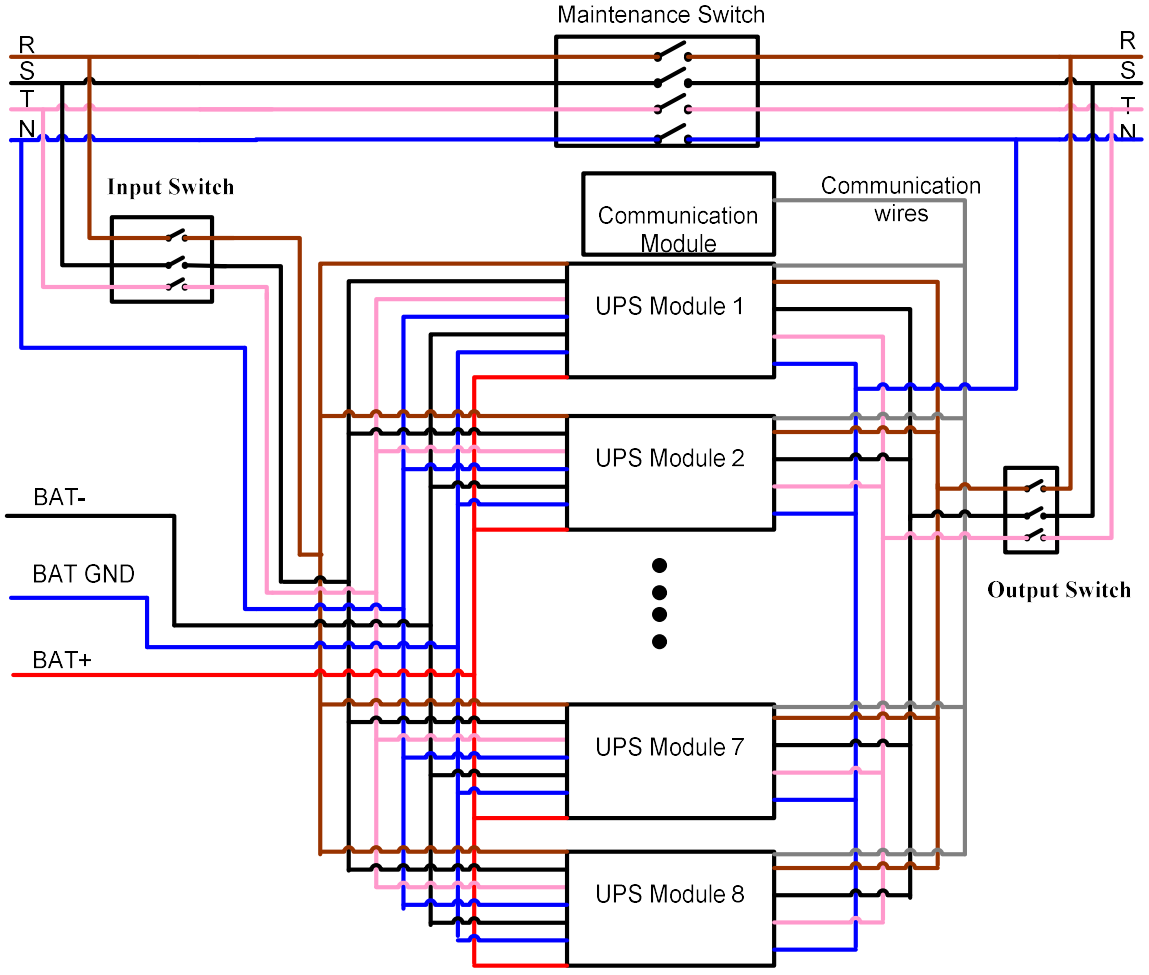


Fig.3.1 the MUST 15-120 system's structure

3.1.1 The function of communication module(LCD module)：

LCD module is independent of the parallel system. It makes no difference to the parallel system whether the LCD module is present or not. So it is available to remove the LCD Modules for servicing no matter the UPS system is off or is operating. LCD Module is the window of MUST 15-120 for communicating with outside. The main purpose of LCD module is to collect and monitor each module and display all the information through CAN BUS, which makes the UPS operation simple and easy.

3.1.2 Maintenance BY-PASS switch

Maintenance switch can keep the load's power supply uninterrupted when customer draw out some or all of the modules from the cabinet. Before this action, customer must confirm the load is compatible with the present utility power. Please read the detailed operating procedure in user manual before operating it. Any questions please consult with service office or the distributor firstly and don't operate the maintenance bypass until you have completely understood the procedure.

3.2 Operating Principle of the Major Functional Block

The MUST 15-120 Module which comprise following functional module:

A. Input EMI
B. Converter (PFC)
C. Inverter
D. Output EMI
E. Power supply
F. Battery Charger
G. CNTL

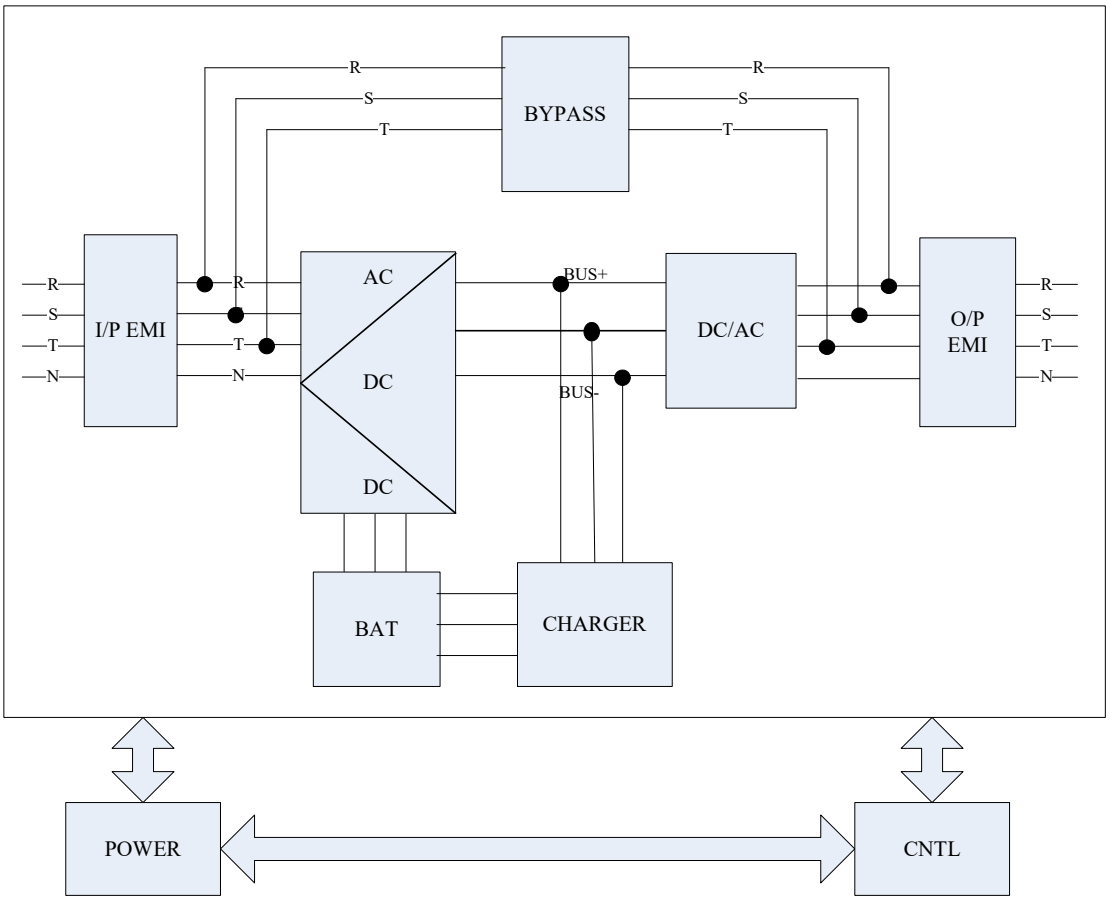


Fig.3.2 MUST 15-120 Module's Electrical Framework

In which:

The CNTL controls the operation of the whole UPS, the CNTL also provides communication interface for receiving and executing command from user via the panel or a preset protocol. When the UPS become abnormal, in most case, the CNTL can provide comprehensive information indication the status of the UPS.

The Converter is the input staged of the Module, the rectifier block converse the AC mains input power into a pair of stable DC power storing on the DC-BUS. At the same time, Power factor correction is performed, the input current tracking the input voltage waveform, achieve maximum efficiency and product lowest power pollution to the UPS system.

The Inverter is the output stage of the Module, used to converse the DC power from the DC_BUS into sine wave AC output power.

The power supply feed the power needed by for each part of the Module.

The battery charger charges the battery when the Mains are normal.

The input or output EMI Part provides EMI filter function, which can prevent the UPS being interference by external electronic or magnetic noise from the other electronic system or the Module internal.

- The block diagram in the figure below shows the structure of MUST 15-120 UPS.

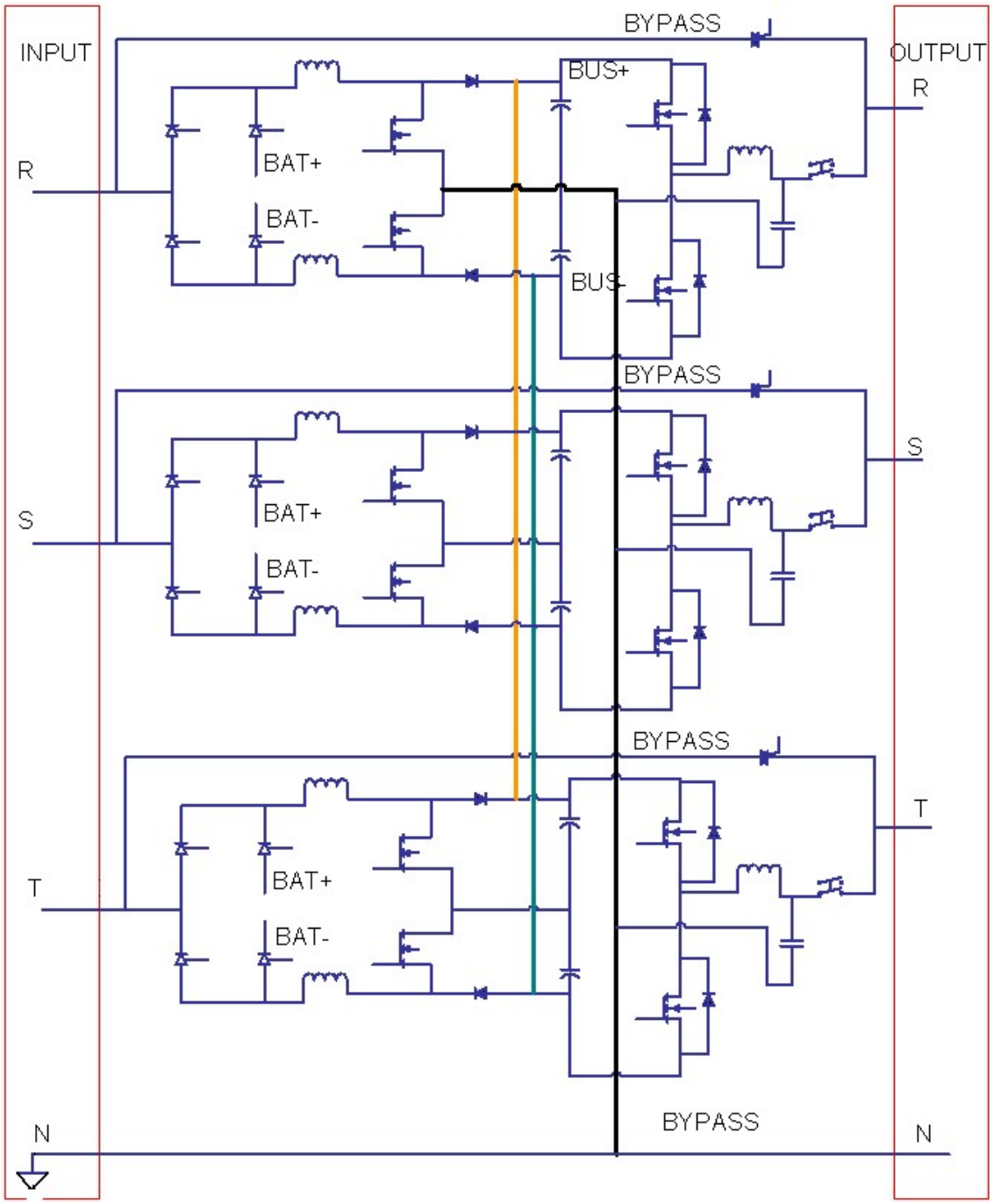


Fig.3.3 shows topology of the MUST 15-120 Module

3.2.1 CNTL

The control module, SCM3, is an intelligence controller; it can fully control the UPS'S running and provide comprehensive information indicating the status of the Module, When the Module become abnormal, in most case, malfunction module can be identified from the information before disassembling entire UPS module.

3.2.2 Power Supply

The DC-to-DC Switching Power Supply Module employs a Flyback topology. The PWM

Controller inside is UC3845.

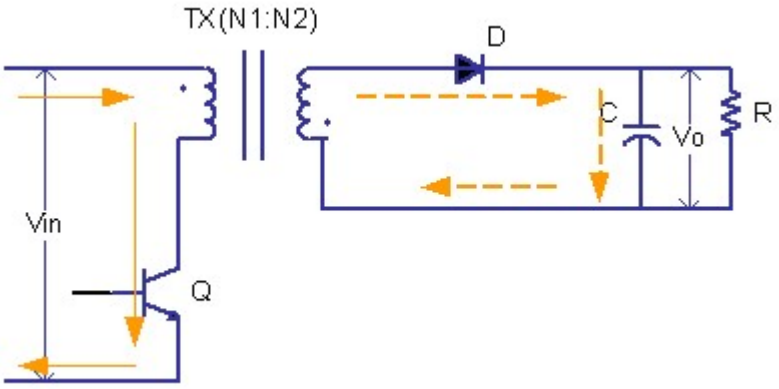


Fig 3.4 the principle of flyback circuit

Note: When Q on, the current flows as " → "

When Q OFF, the current flows as " ⇢ "

This is a Flyback topology. When the Q is on, all rectifier diodes are reverse-based and all output capacitors supply currents to the load. The primary wire acts like a pure inductor and load current builds up linearly in it to a peak Ip. When the Q is off, the primary stored energy is delivered to the secondary to supply load current and replenish the charge on output capacitors that they had lost when the MOSFET was on. This circuit has some output voltages as follows: FAN 14V, HF.POWER, +15V, -15V, +12V, +5V.

3.2.3 Converter

The converter part can be divided into two parts. There are Rectifier and BOOST circuit.

In Rectifier part, The REC module achieves two functions. First, it converts the utility power to a DC power. Second, it is a switch for the CNTL to control whether the MUST 15-120 module works under Line mode or Battery mode.

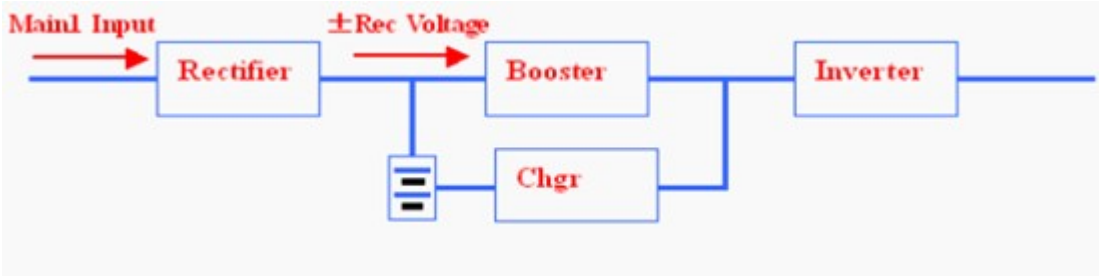


Fig3.5 the UPS working sketch map

A. The PFC–REC:

The working drawing for the Rectifier is as follows:

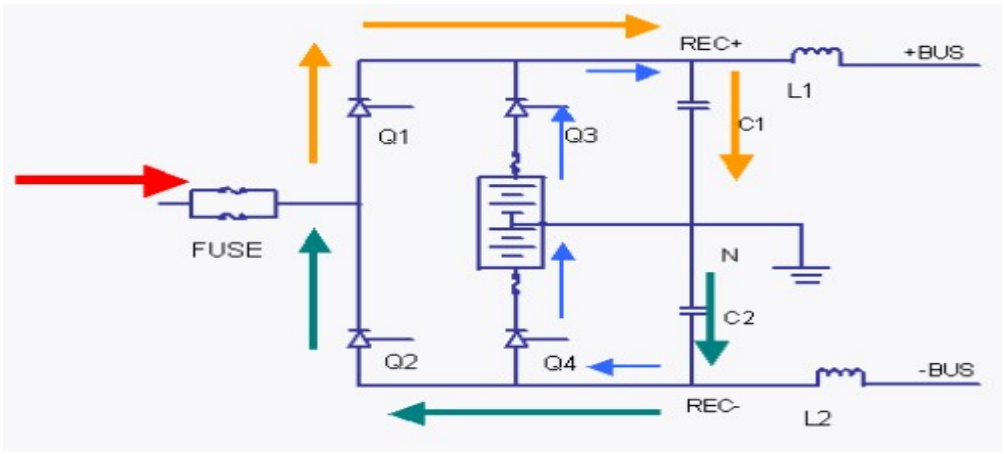


Fig3.6 The working drawing for the Rectifier

Note：

→	The loop for the positive cycle
→	The loop for the negative cycle
→	The loop for the Battery

Line Mode—— positive cycle：Q1 on, negative cycle：Q2 on.

Bat Mode——positive cycle：Q3 on, negative cycle: Q4 on.

B: PFC—BOOST

The working drawing for the BOOST is as follows:

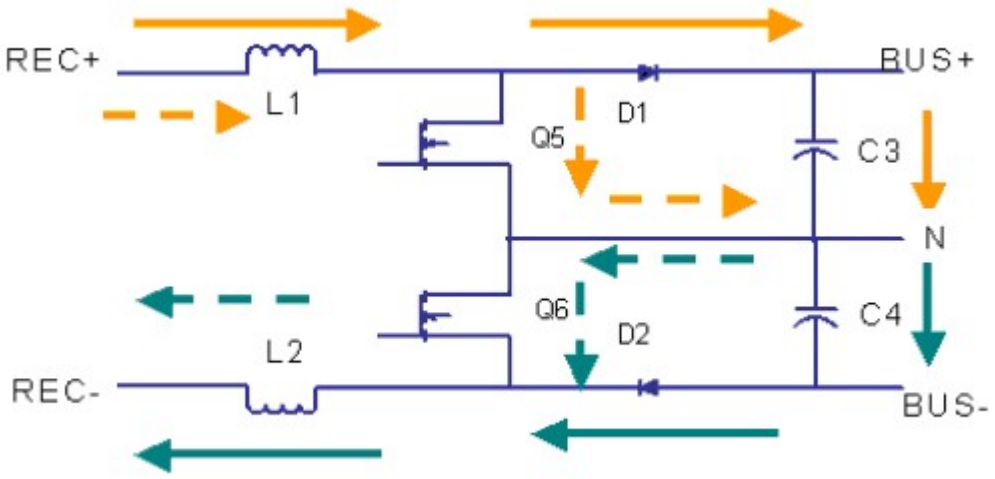


Fig3.7 The working drawing for the BOOST

Note

	The loop for the positive cycle, Q5 off
	The loop for the positive cycle, Q5 on
	The loop for the negative cycle, Q6 off
	The loop for the negative cycle, Q6 on

the positive cycle:

the +BOOST(compose of L1、Q5 and D1) works to charge the +BUS;

the negative cycle:

the -BOOST(compose of L2、Q6 and D2) works to charge the -BUS;

3.2.4 INVERTER MODULE

The Inverter Module in fact is an integration of inverter part and Bypass. The Inverter converts the DC voltage from DC-BUS Voltage into AC output voltage. At this time Bypass will conduct the Mains to feed the load in case the inverter is out of order. Taking positive cycle for example, the working principle for the half-bridge circuit is as follows:

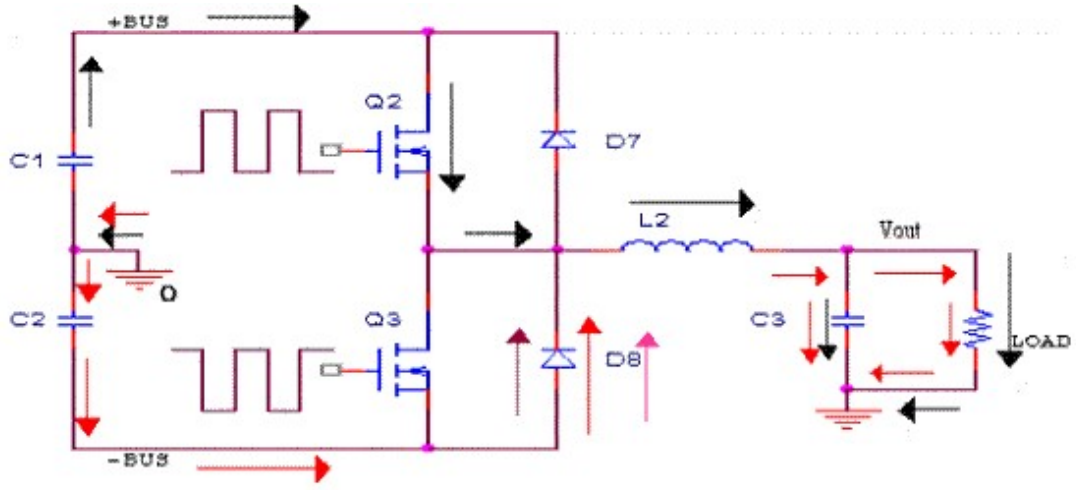


Fig3.8 The working drawing for the half-bridge circuit

A. Q2 on, Q3 off, the current flows as" ⟶ ", L2 is charged, the current in it rises;

B. Q2 off, Q3 off, D8 on, the current flows as" ⟶ ", L2 discharges, the current in it falls;

C. Q2 off, Q3 on, the current flows as" ⟶ ", L2 discharges, the current in it falls;

D. Q2 off, Q3 off, D8 on, the current flows as " ⟶ ", L2 discharges, the current in it falls;

3.2.5 BATTERY CHARGER MODULE

The utility of charger is to recharge and maintain the batteries at fully charged condition. The battery charger converter high voltage DC power from DC-BUS into appropriate charging voltage to charge the Battery, to protect the battery and the charger itself, the charger provides over current limitation, over voltage protection, an reverse connection of battery protection, to prevent the charger

malfunction and cause the Module collapse, the charger has a suicide circuit, Which act and separate the charger from the BUS when the charger is out of controls.

The CHRG module works according to two steps:

Step1: charging with constant current （4.5A/288V）, turn to the step2 as the battery capability attain to 90%;

Step2: charging with 288V/Minute and 270V/Minute alternation until the Battery capability attains to 95%.

Step3: charging with constant voltage (270Vdc).

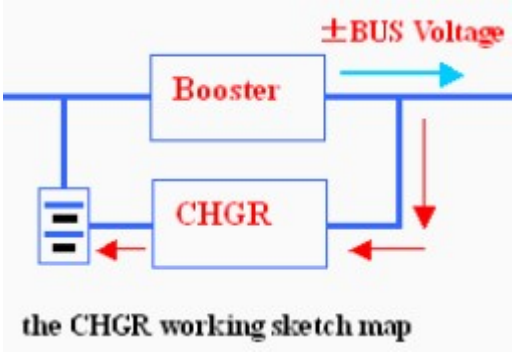


Fig3.9 the CHGR working sketch map

It employs the Buck and the suicide circuit; the suicide circuit can avoid the failure CHGR affects the BUS.

A. The working drawing for the CHGR circuit is as follows:

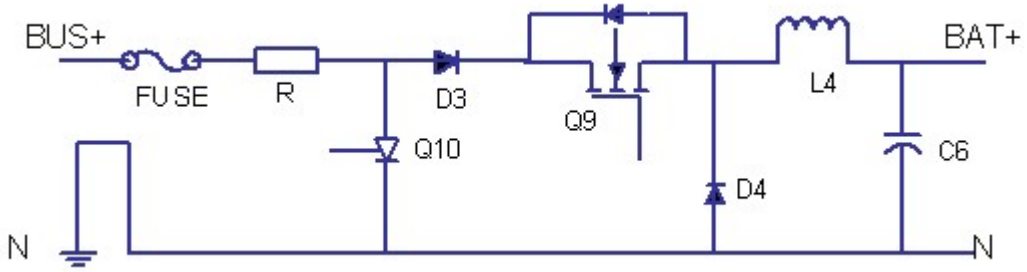


Fig3.10 the working drawing for the CHGR circuit

B. The working drawing for the Buck circuit is as follows:

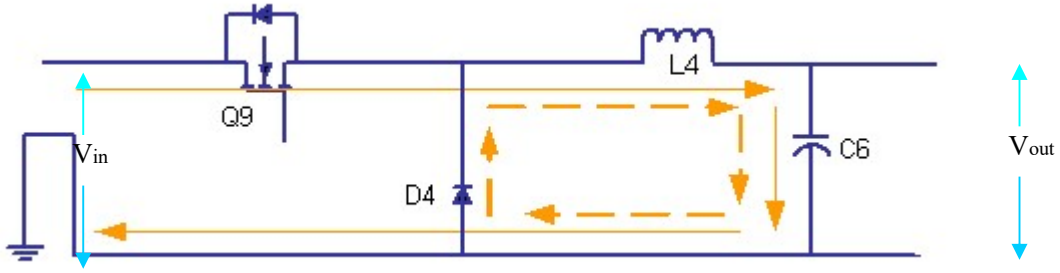


Fig 3.11 the working drawing for the Buck circuit

1.Q9 on: the current flows as" ⟶", D4 off, the L4 store energy,
△Φ1=N*(Vin-vout)*D;

2.Q9 off: the current flows as" - - ▸", D4 on, the L4 release energy,
△Φ2=N*(1-D)*Vout;

Due to the magnetism balance, △Φ1=△Φ2, then Vout/Vin=D

Note: the"N" corresponds to the circle number;

the"D" corresponds to the Q9 on in one cycle;

C. The protecting circuit of the CHGR

The input of the CHGR is connected to the BUS; the CHGR employs the suicide topology to avoid the failure CHGR affects the BUS. The working drawing for the suicide topology is as follows:

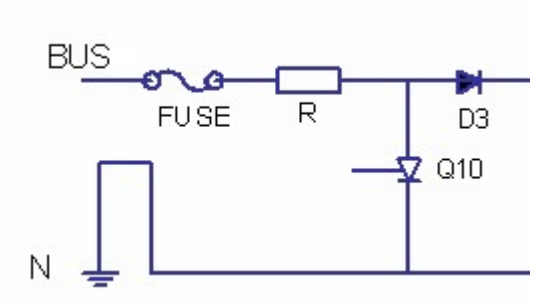


Fig3.12 The working drawing for the suicide topology

The fuse and the Q10 afford the over-current and over-voltage protecting, the NTC afford the over-temperature protecting.

1). the over-current protection

A. When D4 is short and Q9 is on, the current is suddenly increased.

B. The battery is charging, and not full, as Q9 is short, the current is suddenly increased.

2). the over-voltage protection

When the battery is full or open, at the same time, the CHGR's output is over323Vdc, then Q10 is on, the current is suddenly increased.

3.2.6 I/P & O/P EMI MODULE

I/P&O/P EMI Module mainly filer high frequency common mode signal and absorb some surge current to protect module components inside.

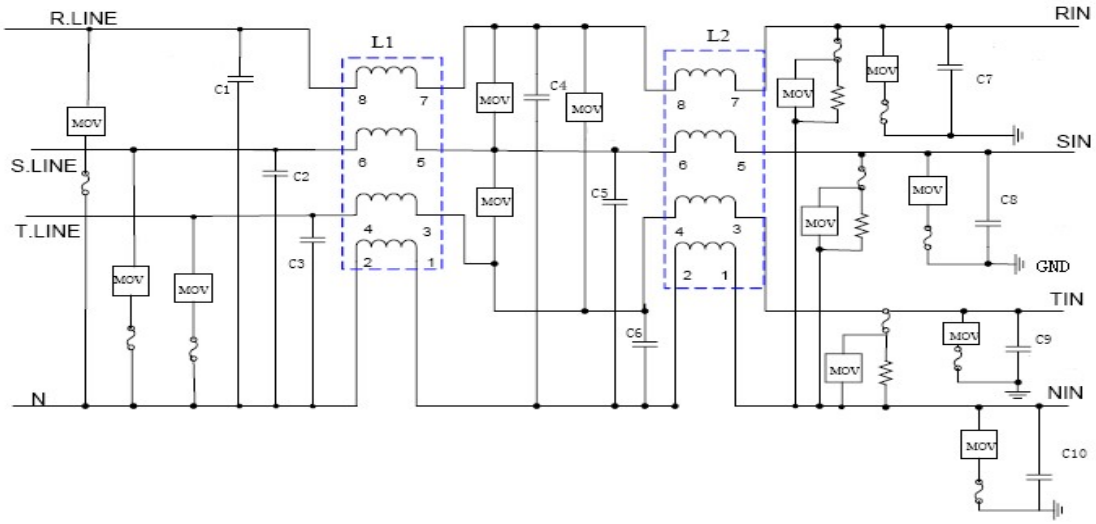


Fig.3.13 The working drawing for input EMI

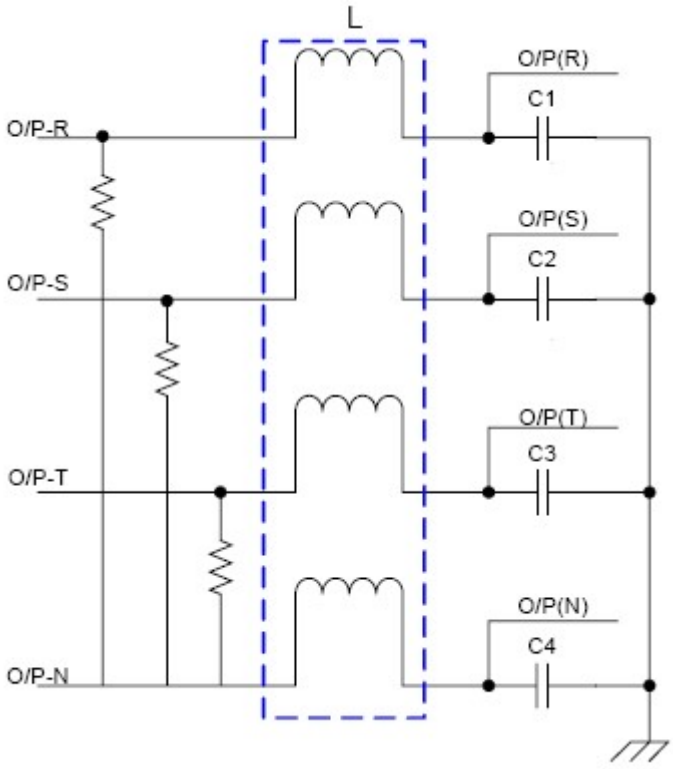
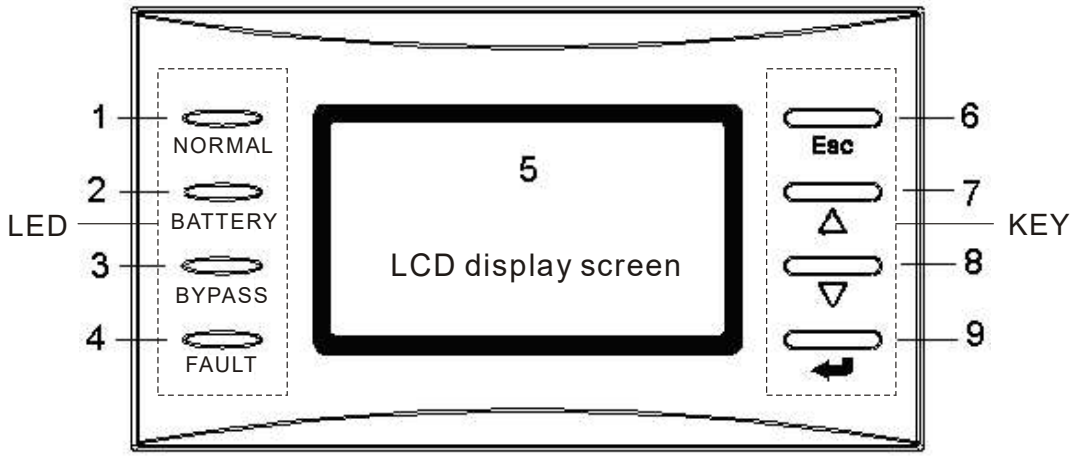


Fig.3.14 The working drawing for output EMI

4. LCD DISPLAY & OPERATION PANEL

The LCD display and the operation panel are located on the front of the cabinet, through which you can see the operating condition of the UPS, query UPS parameters and warning information emitted by the UPS and batteries. After the UPS installation is finished, the user can perform all the UPS operation with the LCD display and operation panel.

The LCD display and operation panel consists of three regions: the LED indication region displaying the UPS status, the LCD data display region and the key-operating region. The LED indication region displaying the UPS status will provide the user with simple information about the UPS status. The LCD data display region will provide the user with detailed information about the UPS status via its LCD screen. The key-operating region will associate the user command with the UPS through its four keys. When the user operates the keys, the corresponding messages will be displayed on the LCD screen.



The LED indication region displaying the UPS status：

1——NORMAL(Green LED)：This LED is lit when the UPS supplies power to the load via the inverter.

2——BATTERY(Yellow LED)：This LED is lit when the utility power fails and the UPS supplies power from its batteries.

3——Bypass（Yellow LED）：This LED is lit when the UPS supplies utility power to the load via bypass.

4——FAULT（Red LED）：This LED is lit when the UPS is abnormal and emits continuous warning tone simultaneously. Or the LED flashes and the UPS emit acoustic warning alarm simultaneously.

The LCD data display region：

5——LCD：Provides detailed information about the UPS status

The key-operating region：

6——ESC：Indicates "escape", you can go back to the last menu or cancel one operation by pressing this key.

7——▲：Indicates "scroll up", you can go back to the last screen message in the same menu by pressing this key.

8——▼：Indicates "scroll down", you can skip to the next screen prompt in the same menu by pressing this key.

9——↵: Indicates "ENTER", and you can select one menu or confirm one operation by pressing this key.

Note: For more detail information about corresponding table of the LED and the UPS status, please refer to the appendix1

For example: How to go into the Service Mode

Service people can get the information from LCD as same as user. But some more setup items are only open to service people; you can go into the Service Mode as follow:

Fig1

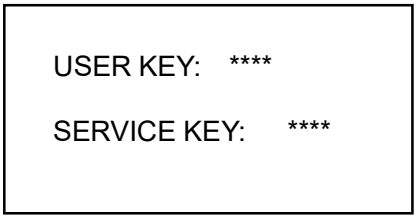


Fig2

In the submenu as Fig1, press ▲ scroll up key for 4~5 seconds, you can see the submenu as Fig2. Enter 1912; you can see the submenu as Fig3.

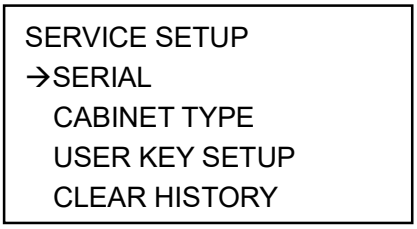


Fig3

In this submenu, the SERIAL and CABINET TYPE have setup in factory, we greatly advice you not change these items. You can setup the USER KEY and clear warning and fault history when you need.

Note: For more detail information about corresponding table of the LCD and the UPS status, please refer to the user manual.

5. Trouble Shooting

Despite of careful design and strict tests, in case UPS become out of order. Basically, designer suggest following service procedure:

1. Check the UPS status by LCD panel display, or listen to the end user description
2. Identify the failure part/boards with the help of failure identify flowchart.
3. Observe the failure board, Static checking
4. Replace the failure components with OK parts
5. Static checking
6. Power up checking
7. Test after repair.

Following section will help service person to solve the most problems.

5.1 Trouble shooting according to LCD display about UPS Chassis

Problem	Possible Cause	Action
LCD display error, white screen, black screen and cannot operate the keys	The communication module and the signal line of the LCD screen is not connected properly	Connect the signal line again and press any key to restore
LCD display blur, white screen, black screen	The LCD backlights are not regulated well and they blot out the message	Regulate the potentiometer (blue) on the reverse of the panel will a cross screwdriver to make the LCD display optimal
The communication interface cannot run normally	The communication module is not fully engaged	Pull out the communication module and slide it into again
LCD fault LED flash and buzzing intermittently	The utility power Abnormal	Check that the input wiring and Mains voltage are normal
	Output over load	Remove the connected load
	Battery disconnected	Check that the battery switch and battery wiring are fully engaged

Monitor software cannot work normally	communication line loosen	Fix the communication line correctly
	there is some wrong with the computer configuration	Reset the software or setting again
	Communication module abnormal.	Replace the communication module.
	Webpower cards abnormal	Replace cards
LCD panel display abnormal	LCD panel defect	Replace the LCD panel
	Communication module defect	Replace the communication module
The system cannot sense the new added module	The UPS module is not fully engaged	Draw out the module and push it to the bay completely again.
The whole UPS system cannot start	The system enable switch is not in the position of ON	Set the system enable switch to the position of ON and restart
	Module's position lock is OFF	Confirm every module's position lock is ON
The new added UPS module cannot be turned on and combined in the network	The position lock of the new added UPS module is in the position of unlocking or the input breaker is in the position of OFF	Set the position lock to the position of locking and set the input breaker in the position of ON
The communication module does not start up when the system enable switch is set to the ON position to turn on the unit in the DC condition	The system startup breaker cannot start the communication module until the battery breaker is in the position of ON and the system enable switch is in the position of OFF for 10 seconds. Maybe it is caused by not waiting enough time.	Switch off the system enable switch for about 10 seconds and then Switch on it again you may start the module
The LCD cannot sense the UPS module when starting the unit in DC condition	After the UPS module power-up, if the module does not receive the command of turn-on the UPS within 30 seconds, it will shutdown automatically. It may be caused by not turning on the unit in time	Turn on the unit within 30 seconds after the UPS module power up

The parallel operation is in the bypass mode and cannot transfer to the utility power (line) mode	The cover plate of the maintenance breaker is not in the position of locking	Set the cover plate of the maintenance breaker to the position of locking
Module blue LED located on one of the modules suddenly flashes and LCD fault LED on and keep on buzzing	The corresponding module internal fault	Draw out the module according to the online module removing process and slide into a new module. Start the module according to the online adding module process
No charging voltage and charging current in the utility power (line) mode	The system sense that the battery is disconnected when starting the unit and shut down the charger	Choose the battery self-test on the LCD panel. The charger will start up automatically after the system sense the battery
The battery self-test fails although the battery exists	The battery breaker is not in the position of ON or the battery is damaged.	Check the battery breaker. Replace the battery if it is damaged

5.2 Trouble shooting according to fault indication

When the UPS is fault, the UPS will transfer to Fault Mode. Beware that there may still output voltage that can endanger the operator safe, due to the Bypass.

Fault Code	Meaning	Possible cause	Solution
1	DC_BUS Over voltage	1). INV Short-circuit 2). In parallel mode, phase-lock failed. 3). DC Offset is over voltage.	1). Replace INV module 2).Replace communication wire. 3). Replace the fault Module of the Parallel system. 4). Replace CNTL board
2	DC_BUS under	1). Input voltage is under	1). Check input voltage

	voltage	voltage 2). Over load	2). Examine Load
3	DC_BUS unbalance	1). Inv output is short-circuit 2). Phase-lock failed 3). DC offset is over range 4). PFC measure circuit damage	1). Replace INV module 2). Replace CNTL board 3). Replace PFC module
4	DC_BUS Short-circuit	1). INV Bridge is short-circuit 2). PFC Boost Diode is short-circuit	1). Replace INV module 2). Replace PFC-Boost module
5	Reserved		
6	DC_BUS Softstart Time out	1). SPS failed 2). CNTL board failed 3). The link wire is not correctly connected to CNTL 4). Soft-start circuit damage	1). Replace PFC module or PFC –REC board 2). Replace CNTL board 3). Replace SPS module
7	Inverter Softstart Time out	1). PWM signal can't be received by INV module. 2). SPS module failure.	1). Replace INV module 2). Replace CNTL board 3). Replace SPS module
8	Inv output over voltage	1). INV module failed 2). The signal wire is missed from INV board to CNTL board.	1). Replace INV module 2). Replace CNTL board 3). Replace the signal wire.
9	Inv output under voltage		
10	Short-circuit Between L1&N output	1). Load Short-circuit 2). INV module failed	1).Examine Load 2).Examine the Module wire connection 3).Replace INV module
11	Short-circuit Between L2&N output		
12	Short-circuit Between L3&N output		
13	Short-circuit Between L1&L2 output		

14	Short-circuit Between L2&L3 output		
15	Short-circuit Between L3&L1 output		
16	L1 phase Inverter Negative power fault	1). Load include discharge load 2). INV module failed.	1). Examine load 2). Replace INV module
17	L2 phase Inverter Negative power fault		
18	L3 phase Inverter Negative power fault		
19	Reserve		
20	Battery Fault	1).Battery connection reversed 2).CN620 disconnection rightly from CNTL to CHGR board	1). Check battery connection 2). Check signal line connection
21	Reserve		
22	Over Temperature	1).Environment Over-temperature 2).PFC module failed 3).INV module failed.	1).Measure environment temperature 2).Replace PFC module 3) Replace INV module
23	Reserve		
24	Reserve		
25	Output Relay stick fault	1).INV Relay failed. 2).CNTL board failed.	1).Replace INV module 2).Replace CNTL board
26	Line SCR Short Circuit	Line SCR failed	Replace PFC module
27	Reserve		
28	Reserve		
29	All phase of the PFC failure, and can not supply power to the DC-BUS no more	1).Fuse failed 2).The PFC module failed 3).CNTL board failed	1).Replace Fuse 2).Replace PFC module 3).Replace CNTL board

30	Reserve		
31	Reserve		
32	Input Over current	One or two phase of PFC module is damaged and the load is over 67% or 33%	Replace PFC module
33	Reserve		
34	Reserve		
35	2 of 2 Fans Locked	1).SPS module failed 2).FANS failed 3).CNTL board failed	1).Replace SPS module 2).Replace FANS 3).Replace CNTL board
36	Reserve		
37	T Phase battery Fuse broken, and the controller cannot detect the battery voltage correctly	T Phase Fuse failed.	1).Replace F311、F312 2).place PFC module
38	Total inverter negative power fault	The sum of L1, L2, and L3's negative power is large. 1).Load include discharge load 2).INV module failed.	1).Examine load 2).Replace INV module
39	Reserve		
40	Reserve		
41	Reserve		
42	Reserve		
43	Output unbalance	1).NTL module failed 2).INV module failed	1).Replace CNTL module 2).Replace INV module
44	Battery status not coherent	1).Signal wire CN401 is not connected 2).CNTL board detection failed 3).PFC module failed	1).Examine CN401 connection 2).Replace CNTL board 3).Replace PFC module

Note:

1) UPS Mode Definition

0: Power on Mode

1: Standby Mode

2: Bypass Mode

3: Line Mode

4: Battery Mode

5: Battery Test Mode

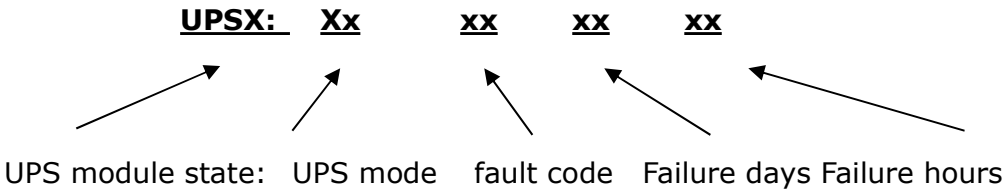
6: Fault Mode

7: Converter Mode

8: Reserve

9: Shut Down Mode

2) How to Understand the Module Failure state



5.3 Trouble shooting according to warning indication

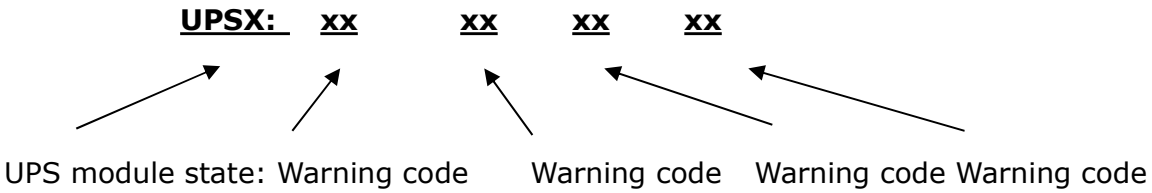
There is warning message given means some abnormity happened in the Module, indicating that some situation that may endanger the reliability of the UPS system has occurred in the UPS system, but these situations do not immediately lead to interruption of power supply. You can see the warnings in the current warning submenu and history warning submenu.

Warning code	Meaning
01	Over-temperature inverter
02	Bypass mains failure
03	Rectifier mains failure
04	Load too high
05	Under-voltage intermediate circuit
06	Over load
07	Reserved
08	Service bypass is on
09	Battery operation
10	Battery rest time exceeded
11	Battery under-voltage
12	Reserved
13	Battery switch not engaged
14	Ventilator lifetime exceeded
15	Connection to charger lost
16	Internal warning 16

17	EPO active
18	Overcharged
19	Turn UPS on abnormal
20	Reserved
21	Communication synchronal signal fail
22	Communication synchronal pulse fail
23	Battery charger communicate failure
24	General battery charger failure
25	Eeprom fail
26	Fan lock
27	Line phase error
28	N loss
29	CAN bus fail
30	Redundant Loss

Note:

How to Understand the Module Failure state



The UPS can record 4 warning codes at the same time.

5.4 Trouble shooting in else cases

Problem	Possible Cause	Action
Power supply cannot established	Power supply board defect	Check Power supply board
	No turn on the mains input breaker of the module	1. Check the F01 on the SPS board 2. check the 3845 on the SPS-CNTL board
When turn on the ups, which cannot have BUS rising.	1. EPO disable or wires are not connected properly	Check the wiring is connected correctly.

	The signal wires become loosen on the PFC and CHGR	1.Check the wires 2.Check PFC-REC: 1) R423 and R424 2) D403、D404、D405、D406、Q405、Q406、F401
	2.control board defect	Change CNTL
Cannot work on inverter mode	1. INV circuit defect on power board	Check Q101~Q106 on inverter part，inverter drive resistance
	2. INV drive board defect	Check drive resistance: (1)R phase：R104、R166、 R167、R106 S phase：R117、R118、R120、R121 T phase：R132、R134、R135、R136 (2)R phase：CN101、CN102 S phase：CN103、CN104、 T phase：CN105、CN106
	3. Inv relay cannot stuck together	Check Q102, Q202, Q302,
UPS module loading abnormal	1.UPS output sense current on power board abnormal	Check CT102、CT202、CT302 and CN406
	2.CNTL abnormal	Change CNTL
Cannot startup on line mode.	1. Line Phase order incorrect	Check the phase order
	2.CNTL defect	Change CNTL
AC Start on line mode is abnormal.	1.PFC circuit abnormal	Check F101、F102、F201、F202、F111、F112、F211、F212、F301、F302、F311、F312.and test drive resistance around
	2.PFC drive panel abnormal	Change PFC drive board
	3. Inv circuit abnormal	Check Q101、Q102、Q103、Q104、Q105、Q106; Meanwhile check that the components on the drive circuit are well.

6. Failure Diagnosis

In this section, some debug skills are listed to help you finding the failure components and problems as soon as possible. Before continuing the following steps listed, we suggest that you should read problem shooting chart in previous section then check the components listed in ***Quick Start*** to find out which block is out of order, in order to shorten the service time.

For the reason of safety, please follow safety instruction to begin your work

High Voltage Danger: Some components contain residue charge and remain dangerous high voltage even if the external power supply is cut off, operator should follow following instruction strictly avoid risk of electrical shock.

1.Switch off the power supply from the utility.
2.Remove connectors from battery;
3.Open the top cover in the beginning of this manual.
4.Discharger energy in BUS capacitor.
5.Disassemble cable from connectors if required.
6.Disassemble PCB if required.

Note: Make sure that the capacitor voltage is lower than the safety voltage before disassembling any parts before any checking operation.

6.1 Quick Start

Usually, you can make a preliminary diagnosis with multimeter even while the Module is shut down (cut off all the power supplies please and make sure the BUS has already discharged). Firstly, open the top panel and check all connectors. Then follow the steps showed in fig.6.1. You can easily make some

primary diagnosis.

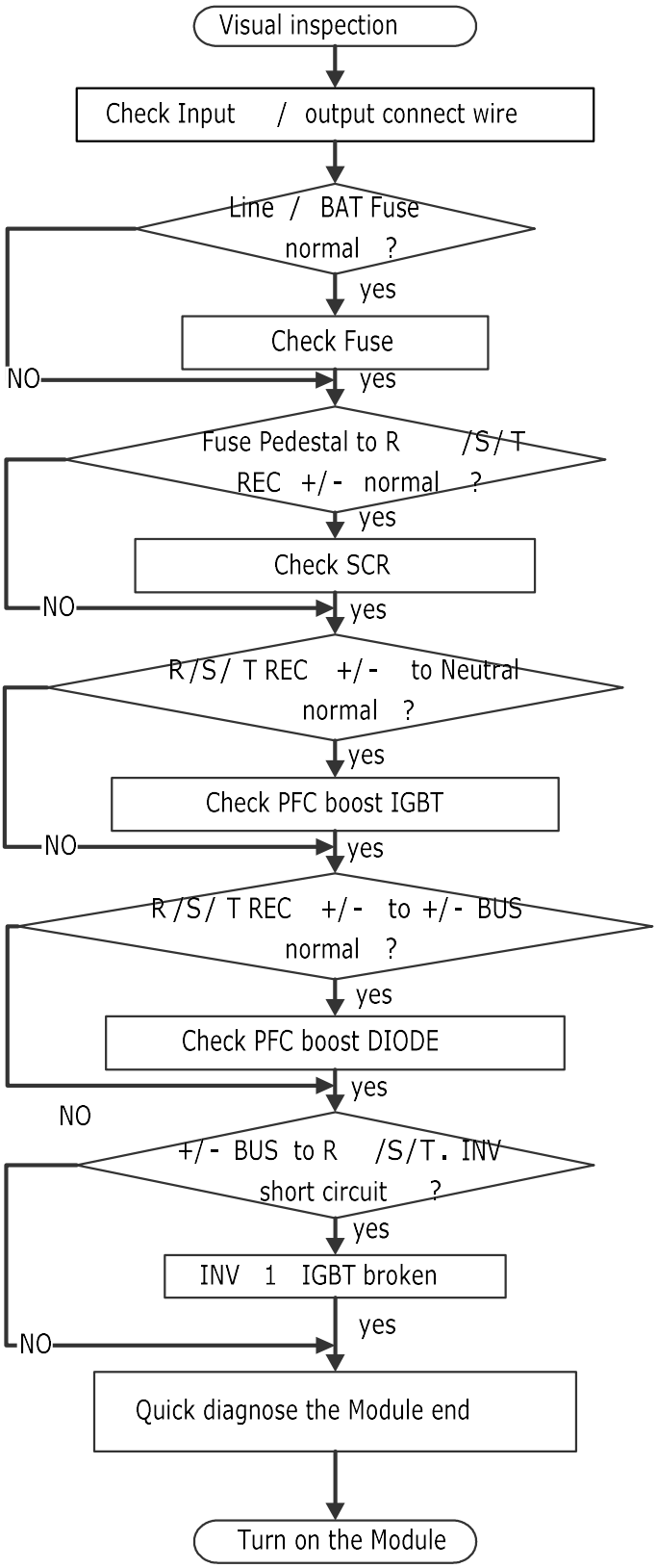


Fig.6.1 preliminary diagnose flowchart

Make the best of the flowchart and follow every step in the instruction, all components can be also diagnosed.

Item	Components	Parameter	Normal	Broken	QUICK ACCESS
1	Line Fuse: F101、F102、F201、F202、F301、F302 Battery Fuse: F112、F212、F312、F111、F211、F311、F401	Impedance	0Ω	Open	SILKSCREEN MARKING ON THE TOP
2	LINESCR: Q101、Q102、Q201、Q202、Q301、Q302 BATSCR: Q111、Q112、Q211、Q212、Q311、Q312	Impedance	≈5MΩ	Short or open	Between Line/Battery Fuse and R/S/T REC±
3	PFC-boost: Q121、Q122、Q211、Q222、Q321、Q322	Resistance	≈1MΩ	Short or open	R/S/T REC+/- to Neutral,
4	PFC-boost: D121、D122、D221、D222、D321、D322	DIODE droop voltage	0.4V+/-0.05v	0V	Between R/S/T.REC+ and +BUS
	PFC-boost: D131、D132、D231、D232、D331、D332	DIODE droop voltage	0.4V+/-0.05v	0V	Between –BUS and R/S/T.REC-
5	INV1: Q101、Q102、Q103、Q104、Q105、Q106	Resistance	≈1MΩ	Short or open	Between ±BUS and R/S/TINV
		DIODE droop voltage	0.4V+/-0.05v	0V	

NOTE: Make sure that the capacitor voltage is lower than the safety voltage before disassembling any parts before doing this diagnose.

6.2 The PFC module

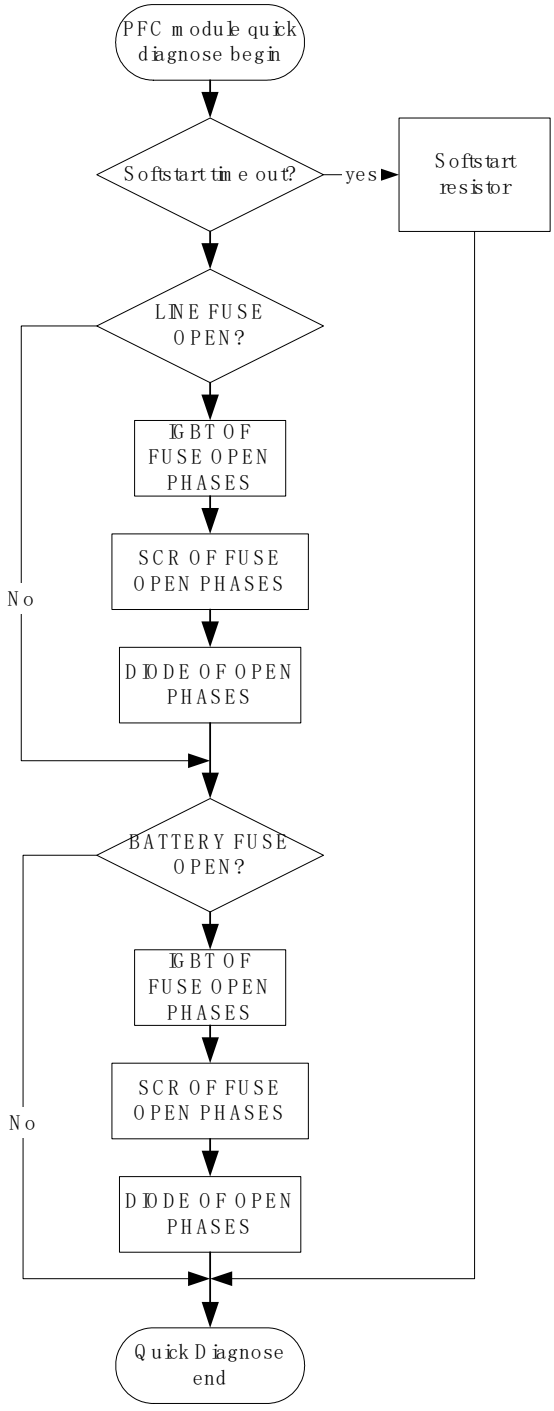


Fig.6.2 PFC diagnose flowchart

Most problem of PFC can result to component damage: Mains Fuse (F101、F102、F201、F202、F301、F302), Battery Fuse (F112、F212、F312、F111、F211、F311、F401), the IGBT, the DIODE, the SCR, the BUS Softstart resistor. Just open the top cover and then you can check the component.

Be caution of the resident charge on the capacitor; make sure discharge the BUS capacitor, before any checking operation.

Characteristic of the components is listed as following table A and B:

Any components broken, replace the module directly.

PCB-Board static test

Table A: PFC-REC-PCB：

Item	Components		Parameter	Normal	Broken	QUICK ACCESS
1	F101、F102、F201、F202、F301、F302、F112、F212、F312、F111、F211、F311、F401		Impedance	0Ω	Open	SILKSCREEN MARKING ON THE TOP
2	R417、R418、R419、R420、R421、R422、		Impedance	About 100Ω	Open	
3	R423、R424		Impedance	About 300Ω	Open	
4	D403、D404、D405、D406		Voltage droop	≈0.4V	Short or open	
5	Q101、Q102、Q201、Q202、Q301、Q302、Q111、Q112、Q211、Q212、Q311、Q312	(A, K)	Impedance	≈5MΩ	Short	SILKSCREEN MARKING ON THE TOP
		(G, K)	Impedance	≈20Ω	Short or open	SILKSCREEN MARKING ON THE TOP

Table B: PFC-BOOST-PCB:

Item	Components		Parameter	Normal	Abnormal	Quick access guide
1	Q121、Q122、Q211、Q222、Q321、Q322	(E, C)	Resistance	≈1MΩ	Short	R/S/T REC+/- to Neutral, or form the check window on the chassis bottom
		(G, E)	Resistance	47.5kΩ +/-0.5KΩ	Short or open	Check window on the chassis bottom
2	D121、D122、D221、D222、D321、D322		DIODE droop voltage	0.4V+/-0.05v	0V	Between R/S/T.REC+ and +BUS
3	D131、D132、D231、D232、D331、D332		DIODE droop voltage	0.4V+/-0.05v	0V	Between –BUS and R/S/T.REC-
4	TVS131-136、TVS231-236、TVS331-336		Resistance	≥MΩ	Short	Accessible only after disassembly
5	R131-138、R231-238、R331-338		Resistance	10Ω	Open	Accessible only after disassembly

6.3 The INV module

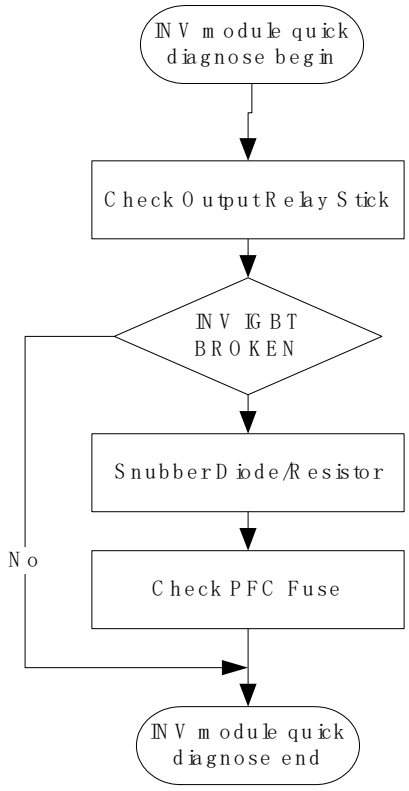


Fig6.3 INV diagnose flowchart

The most likely problems occur on the INV module includes: IGBT broken, and lead to damage of relative Snubber circuit and output relay stick.

Similar as PFC module most the components can be accessed just open cover or the checking windows.

Be caution of the resident charge on the capacitor; make sure discharge the BUS capacitor, before any checking operation.

To minimize checking time usage, following priority and procedure is recommended:

Characteristic of the components is listed as following table C:

Table C: INV1-PCB：

Item	Checked components		Parameter	Normal	Abnormal	Quick access guide
1	Q101、Q102、Q103、Q104、Q105、Q106	(D, S)	Resistance	≈1MΩ	Open	Checking window on the bottom
		(G, S)	Resistance	47kΩ		
2	Snubber Resistor D117 、 D118 、 D119、D120、D121、D122		Diode droop Voltage	≈0.36V	0V	Accessible
3	Snubber Resister R107-R115 、 R122-R130		Resistance	10Ω	Open	Accessible
4	Output Relay RY102/ RY202/RY302		Resistance	Open	0	
5	SCR101/SCR201/301		Resistance	Open	0	

6.4 other module

When the fault code is about other modules, inquire the module's information by the display panel, and replace the corresponding module; First, turn over the module and take off the screw fixed these PCB hole with screwdriver and test parts of an apparatus with the multimeter, according to underside table D /E.

Table D: SPS-PCB：

Item	Checked components	Parameter	Normal	Abnormal
1	FUSE on CN101	Resistance	0Ω	Open
2	Q205(S,D)	Voltage droop	0.4V	0V
3	D209、D210、D211、D213、D216	Voltage droop	0.4V	0V
4	D204	Voltage droop	0.4V	0V
5	R227	Resistance	47Ω	open or short
6	R228	Resistance	1k	open or short

Table E: CHGR-PCB：

Item	Checked components		Parameter	Normal	Abnormal
1	F301、F302		Resistance	0Ω	Open
2	Q102、Q402	（G，S）	Resistance	10KΩ	Short or open
		（D，S）	Resistance	4MΩ	Short
3	D301、D302		Voltage droop	0.4V	0V
4	Q103、Q403	(A, K)	Resistance	≈15MΩ	Short
		(G, K)	Resistance	≈55Ω	Short
5	Q301、Q302	(A, K)	Resistance	≈5MΩ	Short
		(G, K)	Resistance	≈13Ω	Short
6	D108、D408 (A, K)		Voltage droop	0.4V	0V
7	D102、D402 (A, K)		Voltage droop	0.4V	0V

7. DIOAGNOSIS AFTER REPAIR

After replace any parts of the module, PFC/INV part, and so on. Following step is recommended to check the Module.

1. Inspect all the cable, wire, is at right position and reliably tied.
2. Cover the top cover of the Module. Connect the power wire to the connector block; connect the communication cable between the Module and the PC on which monitor software is run.
3. Power up; check communication between the Module and the monitor software.
4. Use the DC Power source with current limiting function to turn on the Module.
5. Cut off all power supply to the Module; apply Mains only; turn on the Module. If results of all step are ok, run the quality diagnose process as a new Module.
6. If results of any step are not ok, check the module combine with the feedback information get from the monitor software.

APPENDIX:

How to Adding or Reducing or Changing the UPS Module Online

N+X is the most reliable power supply configuration at present. N represents the minimum number of modules of the UPS that the total load needs; X represents the number of the redundant modules of the UPS, i.e. the number of the fault modules that the system can handle simultaneously. The bigger X is, the higher the system reliability is. The UPS can be installed up to 8 modules in its cabinet and the N+X parallel redundancy system can be automatically configured as 1+7 or 7+1 etc multiple different modes. The UPS modules can be added, reduced and changed online and the quantity of the N and X of the N+X parallel redundancy system can be changed automatically according to requirement at any time. When the modules fail, if the quantity of the fault modules is less than or equal to X, the fault UPS modules can be changed online without affecting the UPS running.

1.1 Options Supplied By the N+X Parallel Redundancy System

The UPS can be installed from 1 up to 8 modules in its cabinet and can set up a N+X parallel system automatically according to the load power. Suppose the load is 25kVA and the optional solution is listed in the following table 1.1:

Table 1.1:

N+X	Permitted Maximum Power		Permitted quantity of the fault UPS modules
	Apparent Power（KVA）	Active Power (KW)	
2+0	30	24	0
2+1	30	24	1
2+2	30	24	2
2+3	30	24	3
2+4	30	24	4
2+5	30	24	5
2+6	30	24	6

Note：

1）The “permitted maximum power” does not mean that the UPS will be overload if this power value is exceeded. In fact, the power of the UPS can be calculated according to the normal capacity with load, but the original quantity of the redundancy modules of the N+X is destroyed.

2）The “permitted maximum power”indicates the three-phase power, and the permitted maximum power of the single-phase needs to be divided by 3.

1.2 Adding, Reducing and Changing the UPS Modules Online

The UPS module is hot swappable, but to perform this process, some definite procedures must be complied with. When performing the UPS modules adding, reducing and changing online, the operating instructions must be strictly followed.

1.2.1 Removing the UPS Module Online

1. Set the input breaker of the UPS module to the OFF position（The breaker is behind the cabinet. You should open the rear door first.）and set the position lock located on the front panel of the module to “ ”（Fig.1-1）.
2. Two persons each hold the handles located on the front panel of the UPS module with one of their hands and support the bottom of the module with the other hand respectively and they both use their strength together to draw the module outward smoothly and slowly until it is out, and then support it together and put it on the ground or some other temporary supports gently.

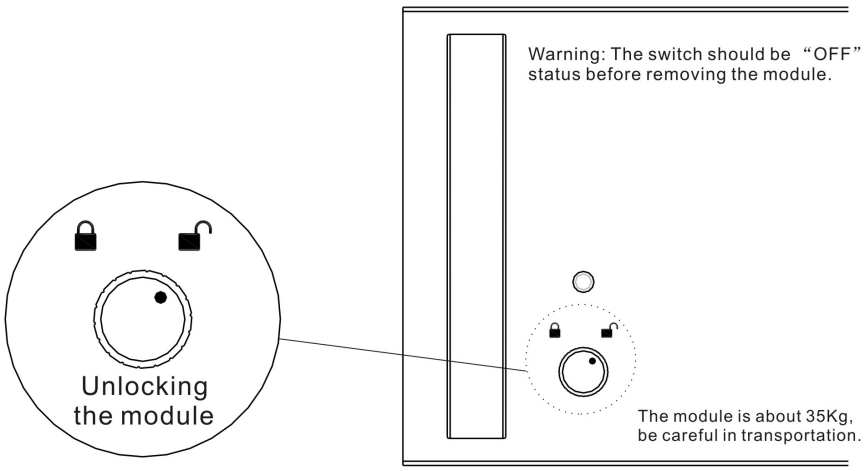


Fig 1-1

1.2.2 Adding the UPS Module Online

1. Remove the cover plate located in the position where the module will be installed in the cabinet.

2. Two persons each hold the handles located on the front panel of the UPS module with one of their hands and support the bottom of the module with the other hand respectively and slide the module into a bay of the frame together

3. Set the position lock located on the front panel of the module to “ ” and turn on the input breaker of the module behind the cabinet. (You should open the rear door first.)(Fig. 1-2)

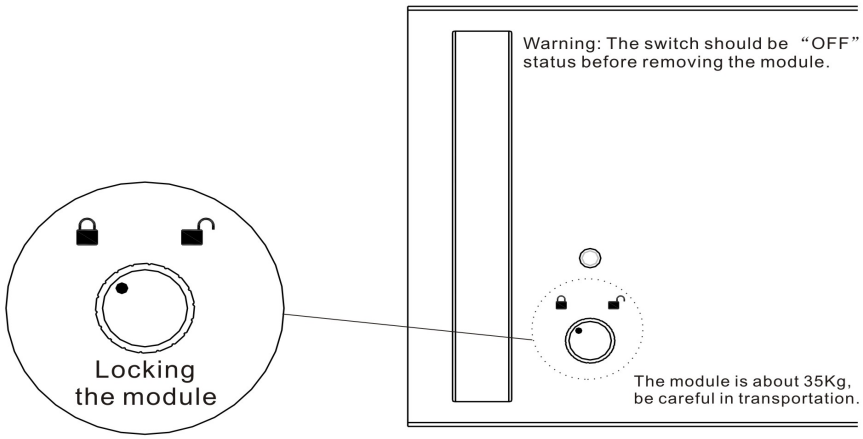


Fig. 1-2

4. If you add a UPS module in the utility power mode, the new added module will enter the parallel system automatically. If you add a UPS module in the battery mode, the new added module will not build a power supply and enter the parallel system until you have completed the above three steps and press the ESC key on the LCD panel for about five seconds (Fig. 1-3).

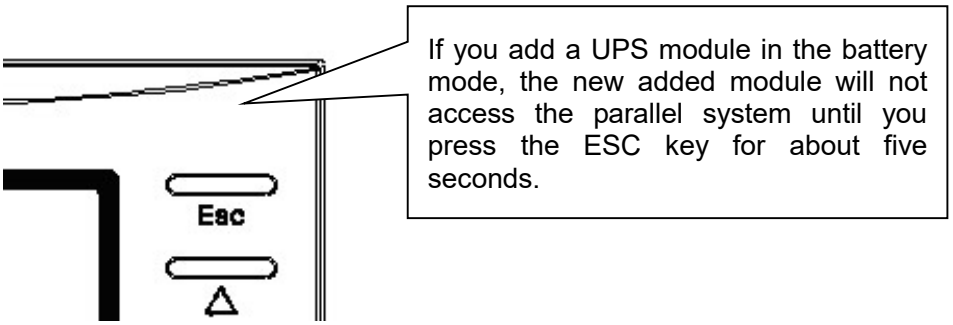


Fig. 1-3