Troubleshooting Guide for Growatt Off Grid Low Frequency Inverters

(Ver1.1) 2021-12-21

Version	Date	Note
Ver1.1	2021.12.21	First draft By Amos
Ver1.1		

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General

This document is applicable for Off Grid Low Frequency inverters, including

SPF 6KT-12KT

SPF 12KT

Low Frequency inverter means that the frequency of mosfet switching on and off is not high, in usual, it can reach 50-60 HZ.

Maintenance tool list

Maintenance Tool		
Computer OS Win10	Used to upgrade the inverter or monitor the inverter via PVkeeper	

Multimeter	Fluke 179C	
USB Cable	Used to upgrade or monitor the inverter	
ISP tool	Upgrade software	
PV Keeper	Monitor the inverter real time data	
cross screwdriver	Used to uncover the inverter	

Inverter System introduction:

SPF 6KT-12KT System Introduction	
Mainboard ,Including 32 PCS MOSFETS	
MPPT Board, Including Buck Circuit, mainly used to conver PV input voltage into almost 48V battery voltage	
Control Board, mainly used to form PWM wave to drive MOFET and IGBT	
COMM Board in charge of Datalogger Communication	

SPF 6KT-12KT Fault condition and Troubleshooting

Part I. Inverter fault

1. 09 fault, 06fault, 53fault, 58fault

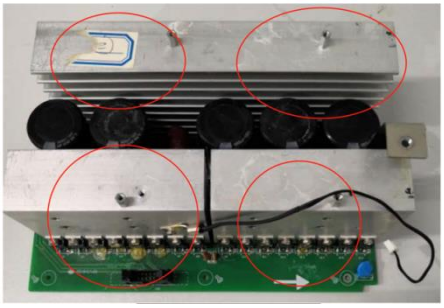
09, 06, 53, 58fault are related with mainboard.

Testing method:

a. Just connect battery into the inverter. Don't connect Utility input and PV input into the inverter.
b. If the inverter still shows "09 Error", "06Error", "53 Error" , "58 Error"you can replace mainboard directly.

Malfunction Reason:

a. Mosfets on mainboard are damaged.



You can test 32 mosfets on mainboard via multimeter. 8 pcs mosfets in one group, 4 groups in total.

Solution:

For usual client, suggest replacing mainboard

For professional client, suggest deliverying some mosfets to them and try to repair it.

Repairing Method:

a. please kindly turn to diode position on multimeter.

Fig.1 Diode Posion

b. You can test these mosfets via multimeter(these faults are caused by these mosfets. If good luck, you can replace mosfets and repair it well.

Fig.2 MOSFET Label

Fig.3 MOSFET Testing

Every mosfet has 3 pins (G, D, S). Put black tong of multimeter on D pin and Put Red tong of multimeter on S pin.

0.38-0.7V on multimeter is normal. If multimeter display zero, it means the mosfet has short circuit.

2 05 fault

Output Short Circuit

Testing method:

1. Disconnect load from inverter, then check if 05fault will disappear.

2. If 05fault still occurs, Switch off inverter until black screen, then test the continuity on AC output. If beeping, there is short circuit inside the inverter.

Solution:

Uncover the inverter and check inside.

Malfunction Reason:

Most of time, it is caused by damaged mosfets or IGBT.

3 07 fault

07fault means over load time out.

Testing method:

a. Try to disconnect the load from inverter, then observe if inverter has normal AC output 230V and no 07fault again.

b. If still abnormal, most of time it is caused by control board.

Solution:

After the check of load, try to replace control board

OR

On Bypass mode(Utility input supply power for all load) , it still has 07fault, try to upgrade it

Malfunction Reason:

There are 2 conditions that will trigger the fault:

a. Load power has been greater than 100% and lower than 120% and lasted for 10s.
b. Load power has been greater than 120% and lasted for 5s.

07fault may also be software bug. If on Bypass mode(Just utility supply the power for load), if it still alarms, please request the 07 fault firmware from research dep. and upgrade it.

4 51 fault

51fault means over current fault.

Testing method:

a. Try to disconnect all load from inverter. Then observe if 51fault will disappear.
b. Confirm if real AC output voltage is normal
c. Try to swap control board from normal inverter, then observe if it becomes normal

Solution:

If it is not caused by load, try to replace control board.

Malfunction Reason:

Load or driving circuit on control board, broken mosfets on mainboard.

5 03fault

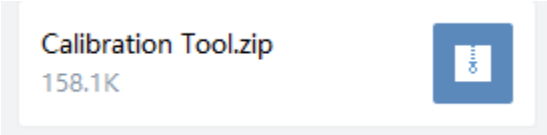
03fault means battery voltage is too high.

Testing method:

a. Firstly ,disconnect battery from inverter and test the battery voltage separately
b. If battery voltage is normal, then connect battery into inverter and check battery voltage on LCD. If abnormal battery voltage on LCD, Try to adjust to the battery on LCD via inverter battery voltage setting.

Method:

1. Only connect battery to inverter(Don't connect to utility, PV system and load)
2. Install Calibration Tool



3. Select com port and set real battery voltage

If above all still can't solve the issue, it may be hardware issue. Try to replace control board

Solution:

If real battery voltage is normal, while,battery voltage on LCD is abnormal, you should doubt if battery sample circuit has some trouble. Suggest replacing control board

Malfunction Reason:

Battery voltage sample circuit on control board may have some trouble. You can try to uncover the inverter and check inside.

6 52fault

52fault means battery voltage is too low.

Testing method:

a. Restart the battery and inverter
b. Try to disconnect all load from inverter. Then observe if it is normal. If YES, it may be caused by load.
c. Try to change battery connection type. Like ARK battery, try to divide them into 2 groups in parallel.

Solution:

Restart the battery and inverter, reduce the load and change battery connection type.

Malfunction Reason:

Most of time, because of heavy load, battery can't supply enough power for load and cause the low battery voltage. Then 52fault will occur.

7 56fault

56fault means battery connection is open

Testing method:

a. Test the real battery voltage via multimeter
b. if battery voltage is normal:

    1) please confirm the battery type, for lithium-ion battery , please check 2nd and 5th option on inverter. Too large charging current on 2nd option will cause BMS protection on battery so that it will shut down the mosfet inside the battery, then battery connection is open. For lithium-ion battery ,ONLY US2 or Li can be used. If lead acid battery, in usual, charging current is 0.2-0.3C (C means battery capacity).

    2) After testing above, if 56fault still occurs. You can doubt if mainboard or control board is broken. Please uncover the inverter and confirm if mainboard or control board is ok.

c. if battery voltage is abnormal, please check battery further.

Solution:

Restart the battery and inverter
OR
Replace control board or mainboard.

Malfunction Reason:

Incorrect charging current on 2nd option ,5th option or broken mainboard or control board

Part II. Warning

1 01warning

01 warning is related with fans.

Testing method:

1. **Check if 2 fans inside the inverter are working.**
2. **If fans are working, you can upgrade 01warning firmware to clear it.**
3. **If fans are not working, try to swap fans from normal inverter. Then observe if fans can work normally. What if fans have been replaced and are still not working. Try to check fan interface on control board.**

Solution:

Replace fans or control board.

Malfunction Reason:

1. Maybe fans itself.

2. Control board

3. Misinformation, actually fans are working normally. it is often caused by firmware and often happens at night. You can request new firmware from research dep. and upgrade it.

KQH1BGT001	KQH1BGT001	储能机	2022-01-11 00:03:21		
KQH1BGT001	KQH1BGT001	储能机	2022-01-10 13:56:50		
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-10 00:04:52	5101	风扇故障(Fault)
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-09 00:03:44	5101	风扇故障(Fault)
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-08 19:33:17	5101	风扇故障(Fault)
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-08 15:40:59	5107	过载(Fault)
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-08 15:35:58		
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-08 07:45:19	5107	过载(Fault)
GYH2BGF00V	GYH2BGF00V	储能机	2022-01-08 00:00:43	5101	风扇故障(Fault)
KQH1BGT001	KQH1BGT001	储能机	2022-01-07 08:11:48	230	电池开路

2 02 warning

02 warning means over temperature

Testing method:

1. Check 2 temperature sensors on MPPT board and mainboard. Try to swap good temperature sensors from normal inverter. Then observe if it will disappear.
2. If above still can't be solved, try to replace control board.

Solution:

1. You can replace 2 temperature sensors on MPPT board and mainboard.
2. You can replace control board

Malfunction Reason:

1. Temperature sensors have the trouble.
2. Control board have the trouble.

3 03 warning

03 warning means Battery is over-charged.

Testing method:

1. Firstly, confirm battery type, lead acid battery or lithium-ion battery.
2. For lead acid battery, please check 19th ,20th option on LCD. The issue may be caused by too high Bulk Charging voltage or floating voltage.
3. For Lithium-ion battery, please confirm if lithium-ion battery can communicate with inverter. if the inverter is communicating with battery and it has 03warning, try to contact battery manufacturer and upgrade battery. If it has no communication, please make sure that US2 on 5th option, less than 30A on 2nd option for single battery are set.

Solution:

Based on battery type, if lead acid battery ,adjust to 19th, 20th option. If lithium-ion battery, try to upgrade battery or inverter.

What if you have excluded above all, you should think about if control board has some trouble.

4 04 warning

04 warning means low battery.

Testing method:

1. Please confirm the battery type, lead acid battery or lithium-ion battery
2. If lead acid battery, please test the real battery voltage via multimeter. Too low battery voltage will cause this.
3. If lithium-ion battery, confirm if battery brand can communicate with inverter, if yes, it may be caused by abnormal communication.So check communication between inverter and battery. Most of time,04 warning is caused by communication issue. If no, try to set US2 on 5th option, less than 30A on 2nd option.
4. If you can exclude above all and 04 warning still can't be cleared. You should doubt if it is caused by broken sample circuit on control board.

Solution:

Based on the experience, most of time, it is caused by lithium-ion battery communication issue. So try to solve communication issue firstly.

Besides, if you figure out all possibilities based on testing method, try to replace mainboard or control board.

Malfunction Reason:

Abnormal communication or too low battery voltage or abnormal sample circuit

5 20 warning

20 warning means BMS communication error.

Solution:

Based on the experience, most of time, it is caused by lithium-ion battery communication issue. So try to solve communication issue firstly.

Malfunction Reason:

Abnormal communication often causes the warning.

6 07 warning

07warning means over load time out.

Testing method:

c. Try to disconnect the load from inverter, then observe if inverter has normal AC output 230V and no 07fault again.

d. If still abnormal, most of time it is caused by control board.

Solution:

Reduce the load

OR

Try to replace control board

7 10 warning

10warning means output power degrading

Testing method:

e. Try to disconnect the load from inverter, then observe if inverter has normal AC output 230V and no

10 again.

f. If still abnormal, most of time it is caused by control board.

Solution:

If it is not caused by load, you can try to replace control board.

8 13 warning

13warning means solar charger stops due to high PV voltage.

Testing method:

a. Max PV open circuit voltage is 147V; Please test the real PV input voltage via multimeter.

Solution:

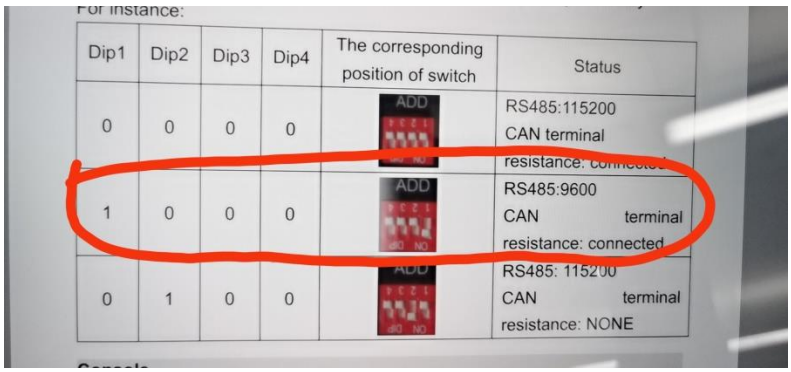
Reduce solar panels until it is lower than allowed max PV input voltage

Part III. Battery Communication

1 Pylontech Battery

a. 485 Communication

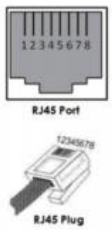
1) For 485 communication, Please set Li 05 on 5th option, L04 on 36th option. On battery dip switch, please set 1000(ON OFF OFF OFF)



1) 485 Pinout：

Definition of RJ45 Port Pin (Battery side)

No.	RS485 Pin
1	--
2	--
3	--
4	--
5	--
6	GND
7	RS485A
8	RS485B



Definition of RJ45 Port Pin (Inverter side)

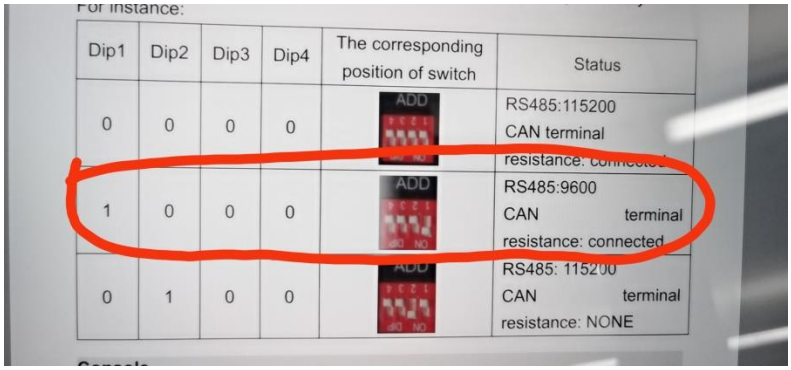
No.	RS485Pin
1	RS485B
2	RS485A
3	--
4	--
5	--
6	--
7	--
8	--

- Make sure it`s using a cross PIN communication cable follow above table, to connect between battery and inverter.

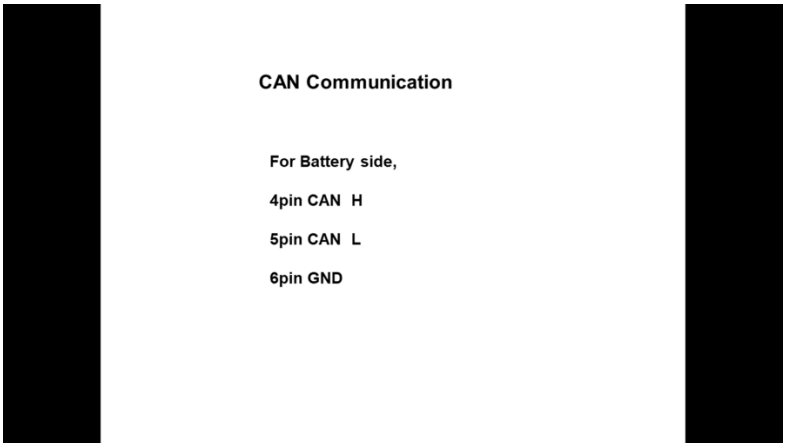
2) 485 wire should be plugged into BMS port on inverter. 485 port on inverter is prepared for future use.

b. CAN Communication

For CAN communication, Please set Li 05 on 5th option, L52 on 36th option. On battery dip switch, please set 1000(ON OFF OFF OFF)



1) CAN Communication Pinout



Both Battery and inverter side are same.

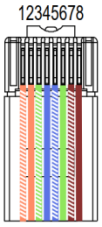
2. Dyness Battery

a. 485 Communication

1) communication protocol type： L01 ; Battery Dip Switch：0110(off on on off)

2) 485 Pinout

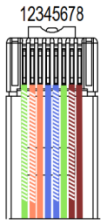
BATTERY-Dyness



Battery （RJ45 IN）			
PIN	Color	Definition	
1	Orange/white	485_A	
2	Orange	XGND	
3	Green/white	485_B	
4	Blue	CANH	
5	Blue/white	CANL	
6	Green	X+5V	
7	Brown/white	XIN	
8	Brown	NC	

INVERTER-GROWATT

Inverter			
PIN	Color	Definition	
1	Green/white	485_B	
2	Orange/white	485_A	
3	Orange	NC	
4	Blue	NC	
5	Blue/white	NC	
6	Green	NC	
7	Brown/white	NC	
8	Brown	NC	



3. Hope Battery

Please note that hope battery only has CAN communication. And hope battery just can work when BMS communicaton with inverter is normal. Or it will shut off automatically.

SPF 2000-5000TL HVM doesn't have CAN port, if client insists on CAN communication, you can delivery newest com board to client.

4. EVE Battery

Model GBLI5010, can't be used in parallel

485 Communication protocol type：L01

5 Shoto Battery

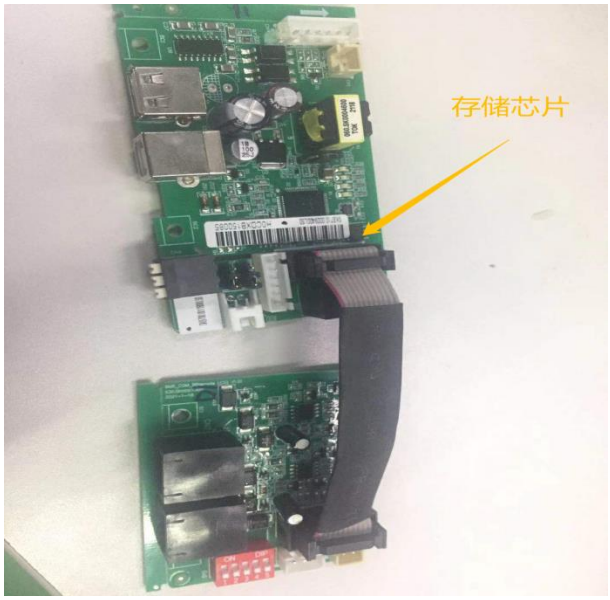
Model: SDA10-48100, can't be used in parallel

485 Communication protocol type：L07

Attention:

The difference between newest com board and old com board:

1. Newest one has shorter distance between 2 interfaces below, and it has 12pins.



2. Newest com board has both 485 and CAN function , while old one just has 485 function. SPF 5000TL HVM assembles with old com board, so it just has 485 communication.

3.

The red dip switch is used for LCD Display for low frequency inverter, it can prolong the length of

connection wire.