



GPU400 SERIES GROUND POWER UNIT
USER MANUAL



Xi'an Jerrystar Instruments Co. Ltd.

Thank you for choosing our products. Please read this manual
completely before operating.

Statement for Check and Correction

The unit listed in this manual is completely in conformity with the nominal standards and properties in the ordinary catalog of our company. The products have passed the quality check and test in our workshop before dispatch. All checking procedures and steps meet the norms and standards of the electronic inspection center.

Product Warranty

Xi'an Jerrystar Co. Ltd. guarantees that your order is warranted to be free from defects in workmanship and material for a period of one (1) years from date of shipment. During the warranty period, Please return the equipment to Xi'an Jerrystar or its branches or distributors for repair. We reserves the right to use its discretion on replacing the faulty parts or replacing the assembly or the whole unit. But the following conditions regarded as voided:

- Operation of the equipment under non-normal conditions
- Any non-authorized modifications, tampering or physical damage
- Elimination of any connections in the earth grounding system
- Use of non-authorized spare parts in the repair of this equipment. Spare parts used must be recommended by us as an acceptable specified part. This warranty does not cover accessories not of Associated ACSOON manufactured.

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Chapter 1 Declaration of Standard

1.1 Standard Reference List

- ❖ MIL-STD-704E:Aircraft Electric Power Characteristics
- ❖ ISO 6858:Aircraft Ground Support Electrical Supplies -- General Requirements
- ❖ GJB151A—97:Electromagnetic Emission and Susceptibility Requirements for Military Equipment and Subsystems
- ❖ GJB152A—97:Electromagnetic Emission and Susceptibility Measurement for Military Equipment and Subsystems
- ❖ GJB 1032-1990:Environmental Stress Screening Process for Electronic Products
- ❖ GJB/Z 35-1993:Derating Criteria for Electrical, Electronic and Electromechanical Parts
- ❖ GB/T14549-93:Quality of Electric Energy Supply. Harmonics in Public Supply Network
- ❖ IEC61000:Electromagnetic Compatibility
- ❖ GB50052-95:Code for Design of Electric Power Supply Systems
- ❖ GB/T4793.1:Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
- ❖ GB/T6833.9-87:Electromagnetic Compatibility Test Specification For Electronic Measuring Instruments -Conducted Interference Test
- ❖ GB/T17626.11-1999: Electromagnetic Compatibility Testing and Measurement Techniques. Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests

1.2 Working principles of ACSOON AC Power Source

The AF60W ,AF50W,AF400M and GPU400 Frequency Converters/AC power source are designed to change conventional 50 Hz or 60 Hz electrical energy to virtually any other frequency. The frequency conversion is accomplished in a two (2)-stage process. The first stage converts the incoming alternating supply voltage to a controlled DC voltage (rectifying). The second stage inverts the DC voltage to an alternating supply voltage at the desired output frequency (Inverter).

Chapter 2 Safety Notifications

All safety information given in these Operating Instructions includes a visual icon, a bold signal word and a description.



Signal Word! (Characterizes the severity of the danger)

NOTE (describes the danger and informs on how to proceed)

Icon	Signal Word	Meaning	Consequences if ignored
	DANGER!	Warns of hazardous electrical voltage.	Risk of severe injury to personnel
	WARNING!	Warns of potential, very hazardous situations.	Risk of severe injury to personnel and/or damage to equipment.
	WARNING! Hot Surface	Warns of hot surface and risk of burns. Labels may be on or inside the equipment to alert people that surfaces may reach dangerous temperatures.	Risk of severe injury to personnel.
	STOP!	Warns of potential damage to material and equipment.	Damage to the operator .
	NOTE	Designates a general, useful note.	None.

Be Careful When Operating The Equipment

Chapter 3 Installation

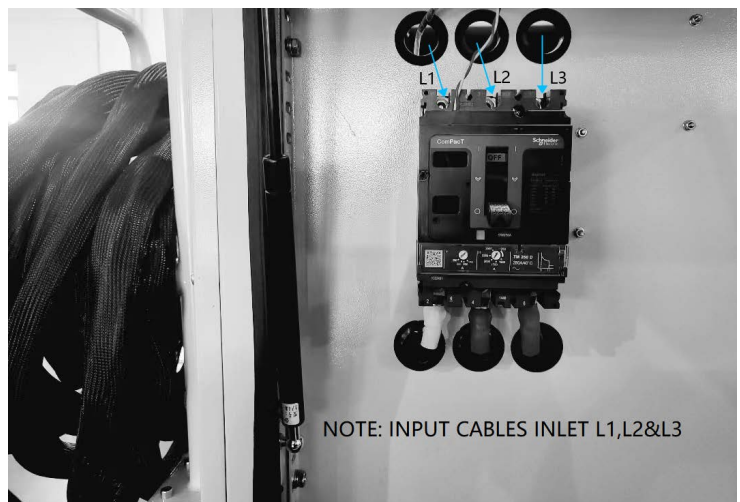
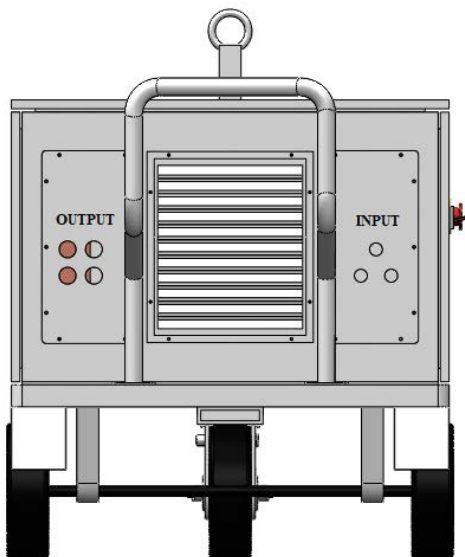
3.1 Unpacking and inspection

- 1) Open the packaging of the product and check the accessories including an operating manual and a certification.
- 2) The product is packaged in a box protected by PE foam. If the box is broken, please check the appearance of the product and find out whether there is deformation, scratch or panel damage.
- 3) Inform us or the authorized distributors and keep the packing box as well as the PE foam if the product is damaged. Don't return the product to us or the agents without informing.

3.2 Requirements of input voltage

Please make sure the available power supply at site comply to specification showed on chapter 4, usually, the unit can withstand input voltage fluctuations $\pm 20\%$. The unit is designed with installation-free, operators only need to pay attention to wiring identification when connect input and output cables, make sure every cable go exactly right where it should be.

3.3 Cable Connection (At front panel of the Trolley)



3.4 Cable Selection

3.4.1 Input cables: Input 380Vac (L-L)

Model	Input Current (A)	Line Cable (mm ²)			Neutral (mm ²)	Ground/ PE (mm ²)
		L1/A	L2/B	L3/C		
GPU400-330030	51A	10mm ²	10mm ²	10mm ²	10mm ²	
GPU400-330045	76A	16mm ²	16mm ²	16mm ²	16mm ²	
GPU400-330090	152A	35mm ²	35mm ²	35mm ²	35mm ²	
GPU400-330180	303A	70mm ²	70mm ²	70mm ²	70mm ²	

3.4.2 Output Cables: Output 115V(L-N) / 200V(L-L)

Model	Output Current (A)	Line Cable (mm ²)			Neutral (mm ²)	Ground/ PE (mm ²)
		L1/A	L2/B	L3/C		
GPU400-330030	87A	16mm ²	16mm ²	16mm ²	16mm ²	
GPU400-330045	130A	25mm ²	25mm ²	25mm ²	25mm ²	
GPU400-330090	261A	70mm ²	70mm ²	70mm ²	70mm ²	
GPU400-330180	521A	120mm ²	120mm ²	120mm ²	120mm ²	

Chapter 4 Standard Technical Parameters

Model	GPU400 – _____ P/N: _____
Circuit Type	IGBT/SPWM
Output Capacity	☐ 30KVA ☐ 45KVA _____ ☐ 60KVA ☐ 90KVA ☐ 120KVA _____ ☐ 150KVA ☐ 180KVA ☐ Other _____
Input Voltage	☐ _____ Phase _____ Wire _____ V±20% ☐ Other _____

Input Frequency	☐ 50Hz±5% ☐ 60Hz ±5% ☐ Other_____
Input Power Factor	☐ ≥0.8(6- pulse) ☐ ≥0.9(12-pulse)
Output Voltage	☐ 3Phase 4 wire 115V/200V,(100-130) L-N,adjustable) ☐ 3 Phase 4 wire 120V/208V,(100-130) L-N,adjustable) ☐ Other_____
Output Frequency	☐ Fixed:400HZ (320-480Hz adjustable) ☐ Other_____
Load Regulation	☐ ≦ 1% ☐ Other_____
Freq Regulation	☐ ≦ 0.1% ☐ Other_____
Voltage transient recovery	<10% and recovery times <50ms @20%- 80% load change
Distortion THD	☐ <2% @ linear loads, ☐ <3% @ linear loads
Efficiency	☐ ≧ 85% @ full load for 6-pulse ☐ ≧ 93% @ full load for 12-pulse
Phase angle symmetry	120°±2° for 30% unbalanced load
Protection	Input over/under voltage,Input phase missing/reverse,DC mian bus over voltage,output over/under voltage,over load,current limit,over heat ,Short Circuit Protection
Overload	125% for 600s,150% for 60s,200% for 10s
Display Resolution	Voltage : ☐ 0.1V ☐ other_____ Current : ☐ 0.1A ☐ other_____ Frequency : ☐ 0.1HZ ☐ other_____
Cable inlet	☐ Terminal block ☐ Connector
Working Condition	Environment:-20℃～55℃ Humidity:10%～90%
Ingress Protection	☐ IP 32 ☐ IP 55 ☐ other_____

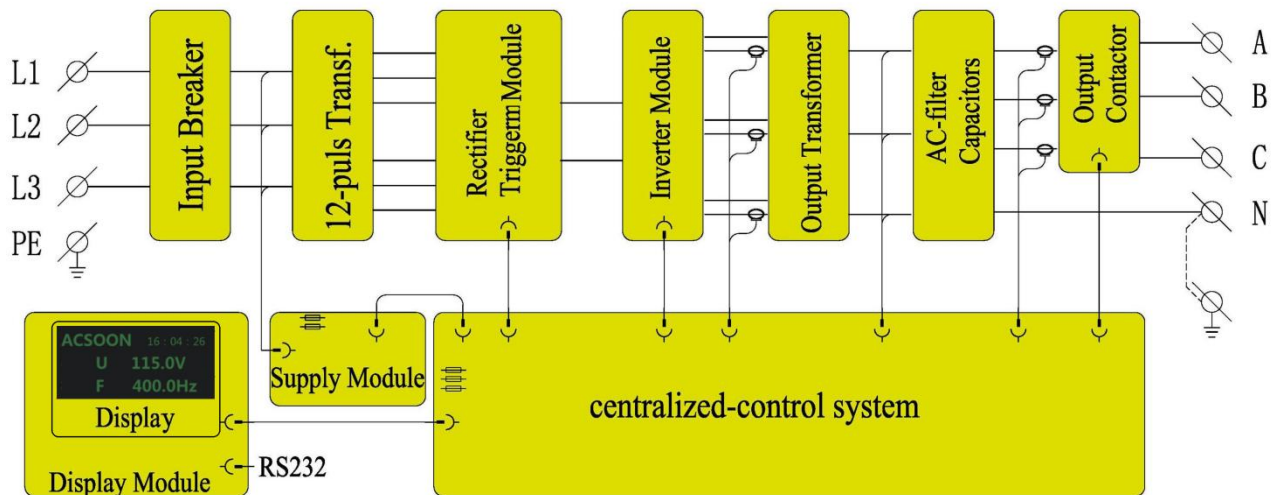
Note:

Perfect output can be guaranteed when GPU works within $\pm 10\%$ of rated voltage; If GPU works within $\pm 20\%$ of rated voltage, the rated output power will be decreased. The GPU would be cut off with alarm on in case it works beyond $\pm 20\%$ of rated voltage.

Chapter 5 Principle Block Diagram

The figure below show the basis principle of the ACSOON GPU400 Series GPU. The 50/60Hz Mains Electricity input voltage is converted into galvanic isolated 3 Phase 400Hz output voltage. A functional description of each part is given in following section.

12-Pulse



Chapter 6 Description of each part

6.1 Input breaker

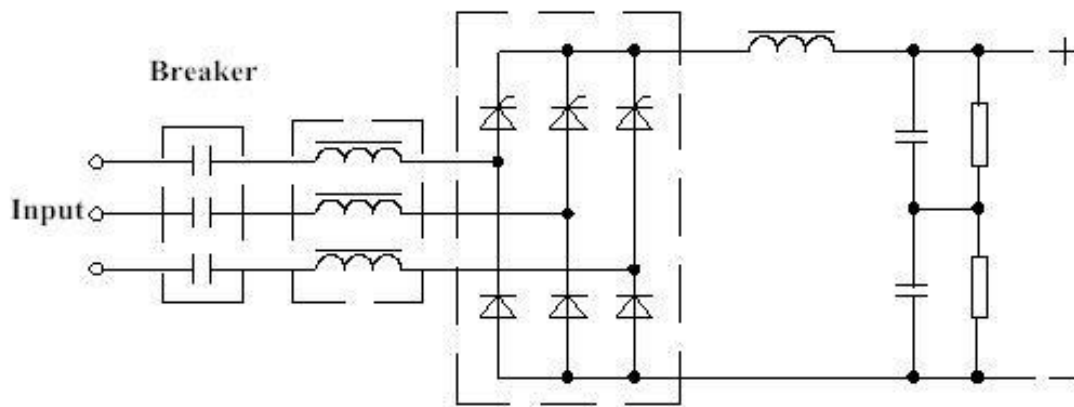
The input breaker disconnects Mains electricity power supply to the GPU, and the GPU enter into standby mode after energized

6.2 12-pulse transformer

The combination of 12-pulse transformer and rectifier situated at inverter module, ensure sinusoidal pure sine waveform. 12-pulse transformer has best waveform with less harmonic than that of the typical 6-pulse transformer.

6.3 Input rectifier

Input rectifiers consist of 3 phase silicon controlled rectifiers. 3 phase chokes suppress common-mode interference. When GPU starts or is powered on, soft start can be achieved by adjusting the angle of flow, as it was shown below. This ensure that inrush current will not exceed allowed current when GPU works at full load. Angle of flow of silicon controlled rectifiers becomes the biggest after soft started. Steady DC from smoothing chokes and electrolytic capacitors is delivered to inverter after rectifying.

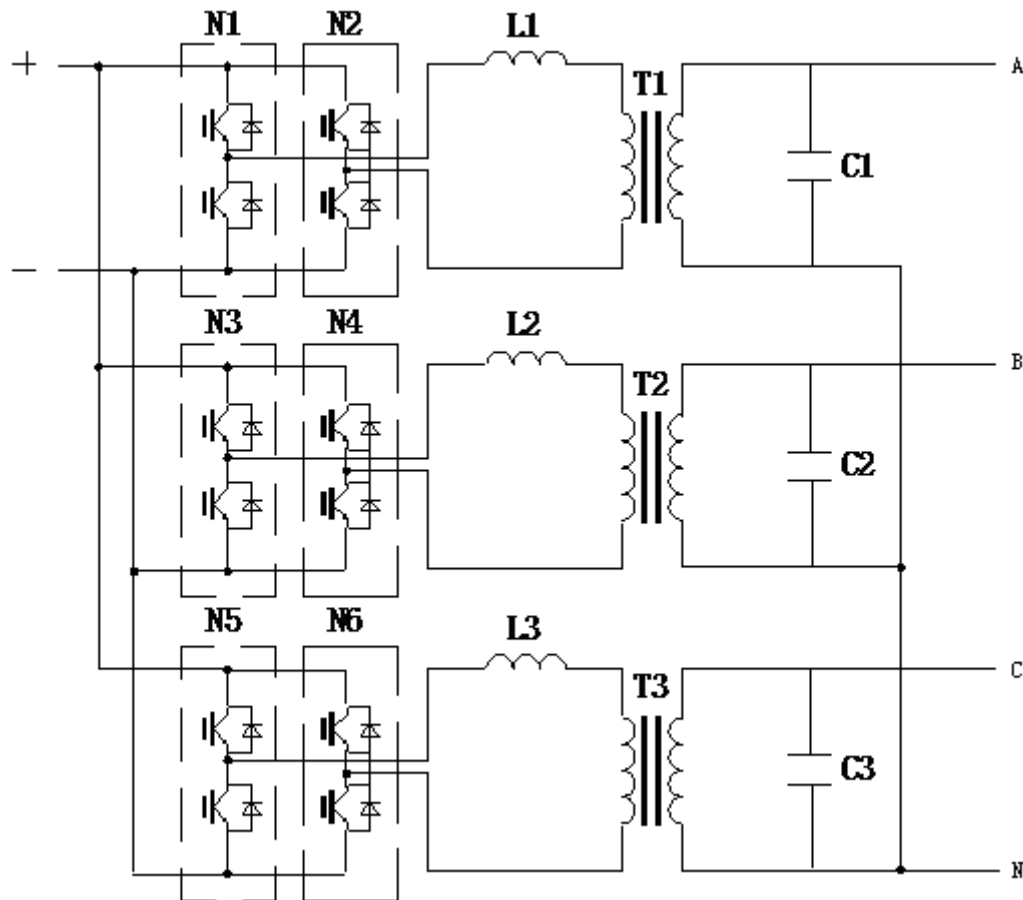


Input rectifying circuit

6.4 Inverter and output circuit

3-phase circuit consists of 3 sets of same single phase circuit and is coupled by

secondary polarity of transformers. Each phase is made up of two pieces of IGBT connected across the DC Busbar. The connection and cutoff of each two pieces of IGBT are controlled by PWM signal. PWM wave is connected with LC filtering circuit to filter out ultra-harmonics and improve quality of output waveform. Coupled by secondary polarity of transformers, these three sets of single phase circuit are the same and independently outputs to achieve 3 Phase 3 Wire or 3 Phase 4 Wire.



Inverter and output circuit

6.5 Output transformer

Output transformers secure galvanic isolation between input and output. They also transform the voltage from the inverter module into the aircraft voltage 115V.

6.6 Output filter capacitor

AC Filter Capacitors: The harmonic of the inverter voltage is further decreased by means of the AC filter, as a positive resulting that Total Harmonic Distortion of less than 3%. Output filter is also to improve the electromagnetic capability of aircraft GPU.

6.7 Output Contactor

The GPU is equipped with output contactor per outlet, the contactor is engaged at start up of output, and it is disengaged when the Reset button was depressed. If the interlock voltage provided by aircraft is not returned GPU within 1 second, the contactor disengages.

6.8 Centralized control system

Centralized control system is based on a micro-controller and a digital signal processor/DSP. They regulate, supervise and diagnose eventual external and internal faults. As soon as the GPU is connected to the mains electricity power, and constantly during normal operation, the processor module runs through a self-check programme which checks all internal functions of GPU. If an internal or external error is detected, the digital display shows the code of the error. The event of failure parameters related to a shut-down are stored.

6.9 Supply Module

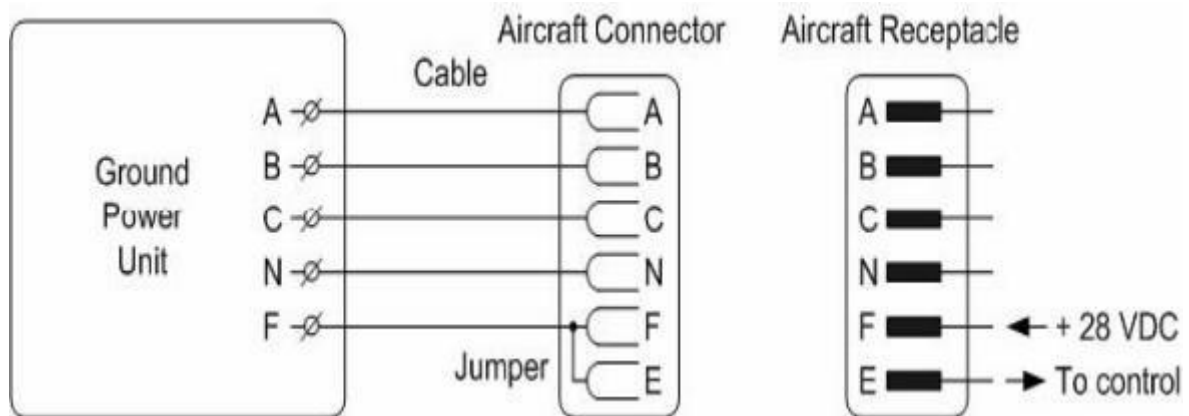
To provide power supply of a 24VDC to the indicating light on control panel, also provide power supply of 48V DC to the centralized control PCB.

6.10 Display module & Keyboard PCB

The display module serves as the interface for daily operation

6.11 E/F interlock

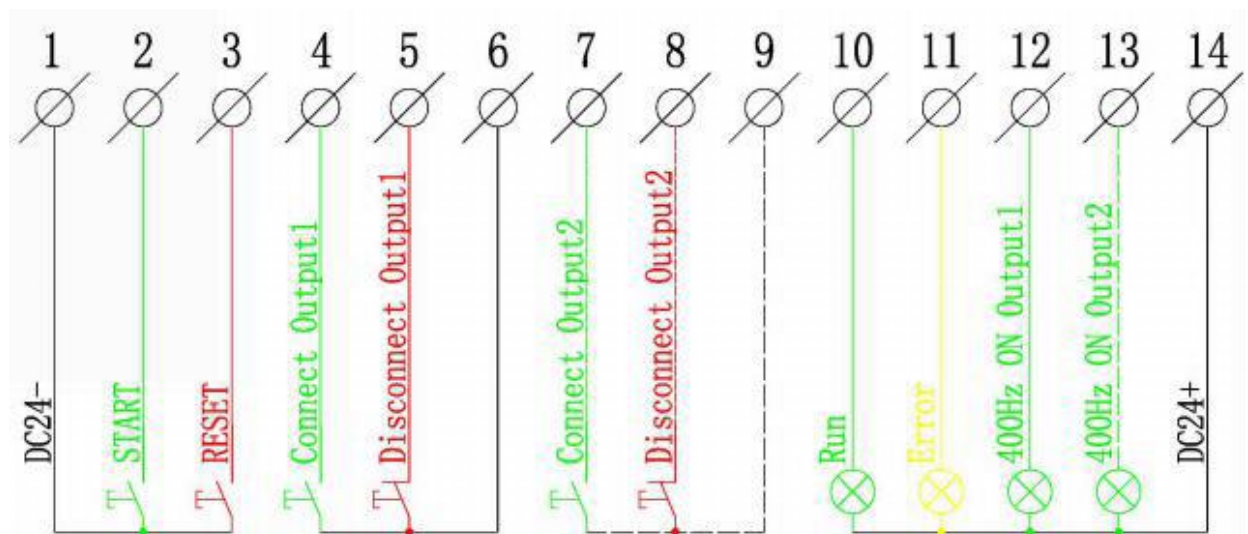
E/F interlock function is available when GPU is to deliver power to aircraft. The diagram of E/F interlock is shown as below. Only when output plug of GPU well connected to aircraft could trigger output contactor on control panel and indicator of interlock light on.



6.12 Remote control function (Optional)

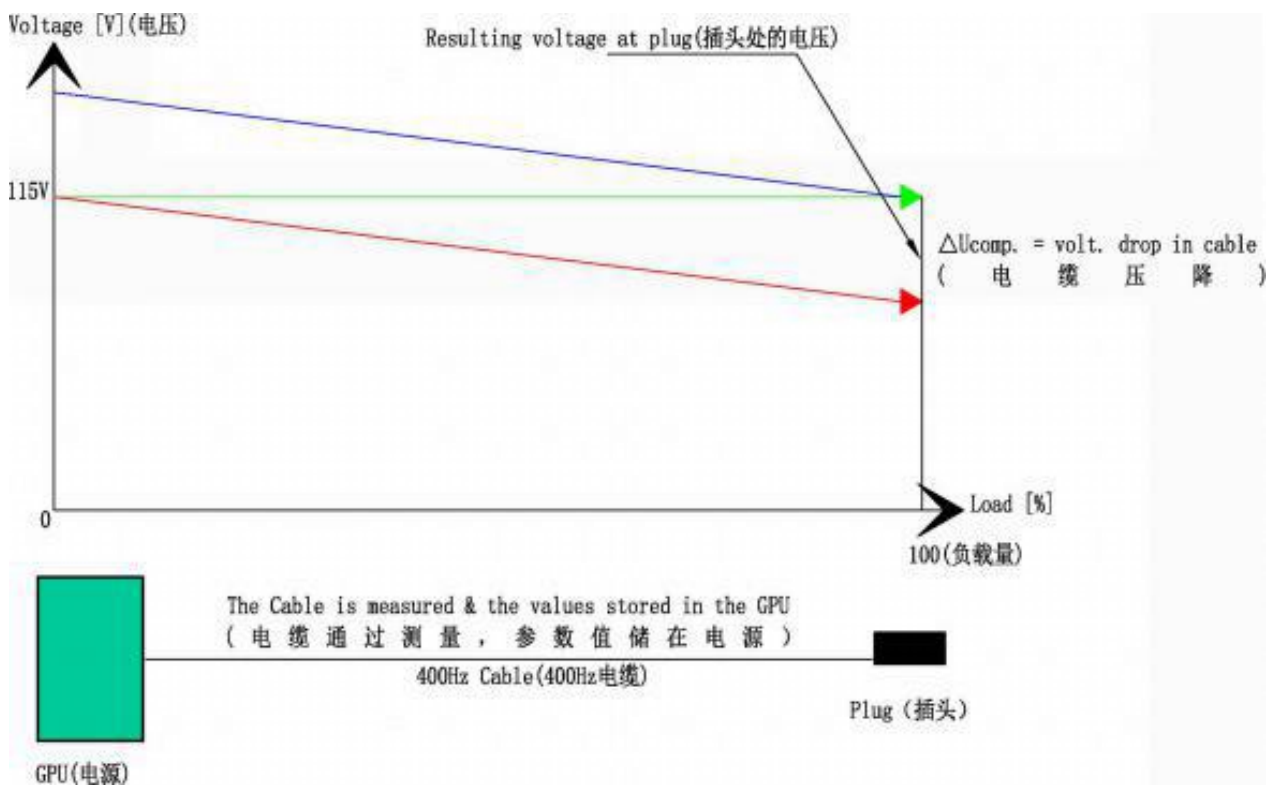
This GPU can be connected with computer by RS232 or RS485 to control the start-up, stop, output on, output off, setting of GPU.

The start-up, stop, output on and output off of GPU can also be controlled by contact signal. The diagram is shown as below. All are contact signals.



6.13 Remote automatic compensation function (Optional)

Green line shows the result when plug is at theoretical voltage value. Red line shows the result when plug is at real voltage value. Blue shows the result when plug is at compensated voltage value. The principle of compensation is: Measure resistance value R at first and then the compensated voltage value B shall be $B=R \times 100$. Usually resistance value of cables is less than 0.05Ω . To make sure the accuracy of the measurement, professional instruments should be adopted when measure the resistance value. If resistance value of cables is above 0.1Ω , it's better to check cables and point of welding. Because of long-time running and operation when resistance value is bigger than 0.1Ω will hugely shorten lifespan of cables and even lead to fire disasters.



Chapter 7 Front Panel



Front Panel /VFD Digital Display

- VFD digital display: in standby mode, it displays setting voltage and setting frequency. In running mode, it displays output frequency, output voltage, output current, and time. While it displays fault information in case of failure.
- No.1: Aircraft interlock 1 (Optional). When aircraft interlock 1 connects to aircraft, its indicator light is lit up.
- No.2: Aircraft interlock 2 (Optional). When aircraft interlock 2 connects to aircraft, its indicator light is lit up.
- K-lock: Keyboard lock indication, when “setting” is locked, indicator light is lit up.
- V-B: Voltage compensation indication. When setting compensation value >0 , its indicator light is lit up.

- Setting: press “setting”, enter setting interface.
- Search: Press “Search”, check the historic status, running information and history failure information.
- Reset: when VFD screen show black screen, press “Reset” can restore VFD display.
- $\wedge$ (plus) / $\vee$ (minus): to adjust value of running data
- Enter/back: Finish setting running data on setting interface, then press “Enter/back”, the setting data will be saved and carried out effectively. On search interface, press “Enter/back”, it return to initial interface.
- Start: Depress “Start”, light lit up and VFD screen shows GPU is self diagnosing, please hold on 8 to 10s later, VFD display shows output voltage of each phase and output frequency.
- Out.On: Depress button “Out.On”. Output AC contactor is engaged, and light is lit up. GPU delivering 400hz AC Power to aircraft at this time
- Out.Off: Depress the button “Out.Off”. Output AC contactor disengaged, light is off. GPU stop delivering power to power at this time.
- Reset: Depress button “Reset”, GPU stops working and go into standby mode. when there is failure on GPU, yellow indicator light “Reset” button lit up.

Chapter 8 Operation Instruction

8.1 Check the input power supply

Please make sure the available power supply at site comply to specification showed on chapter

8.2 Connect Input/Output cables

8.3 Power on

Turn on input breaker,the VFD screen would be lit up,displaying voltage and frequency to be set.
GPU is in standby mode.

8.4 Start up

Press button “Start”,the GPU is in self diagnosing and within 8s to 10s the GPU is ready to run

8.5 “Output On”

Depress button “Out.On” , GPU delivering 400hz AC Power to aircraft at this time

8.6 Turn off “Output”

Depress button “Out Off” to stop GPU delivering 400hz AC Power to aircraft

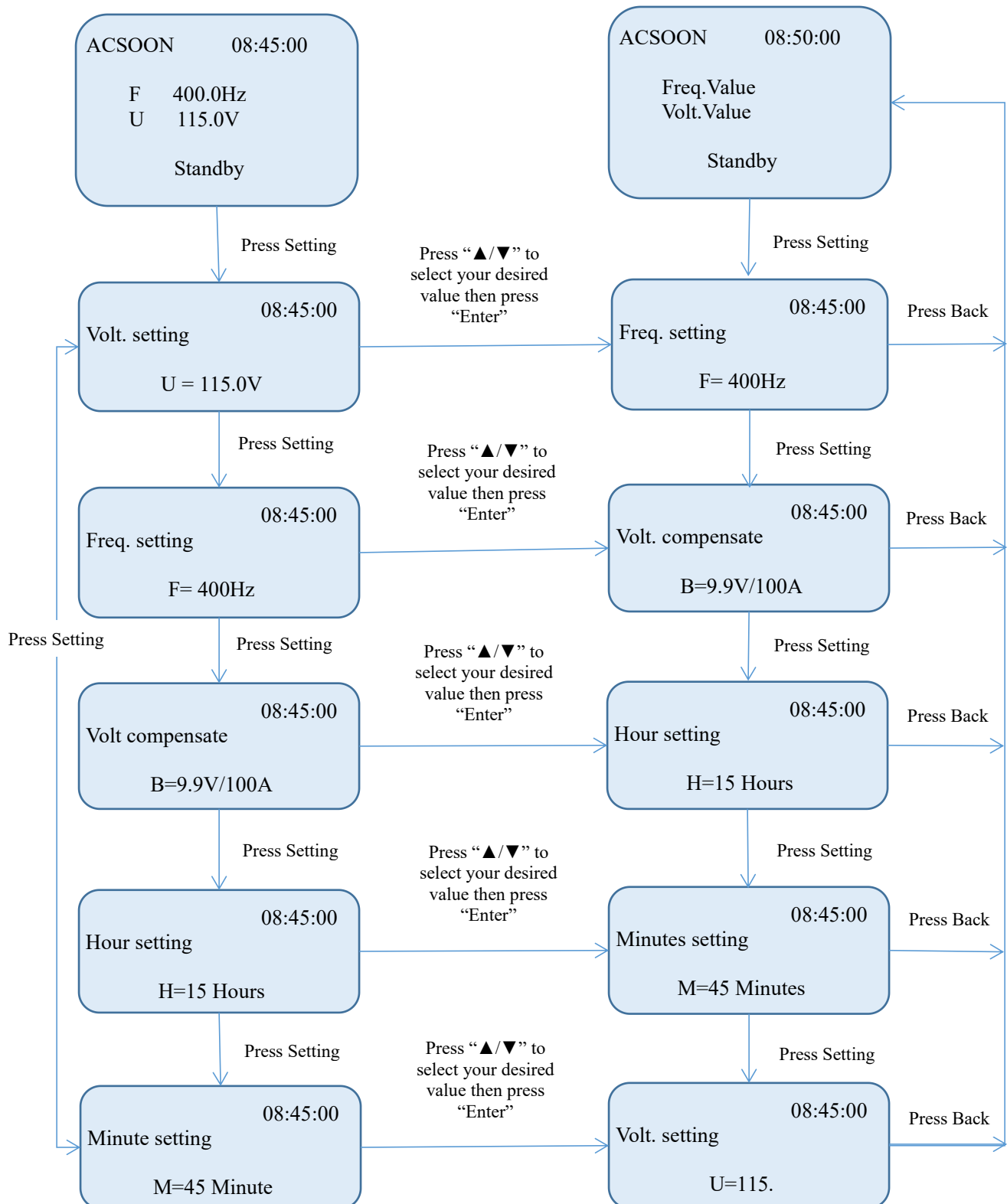
8.7 Stop

Press button “Reset” to stop the GPU working.

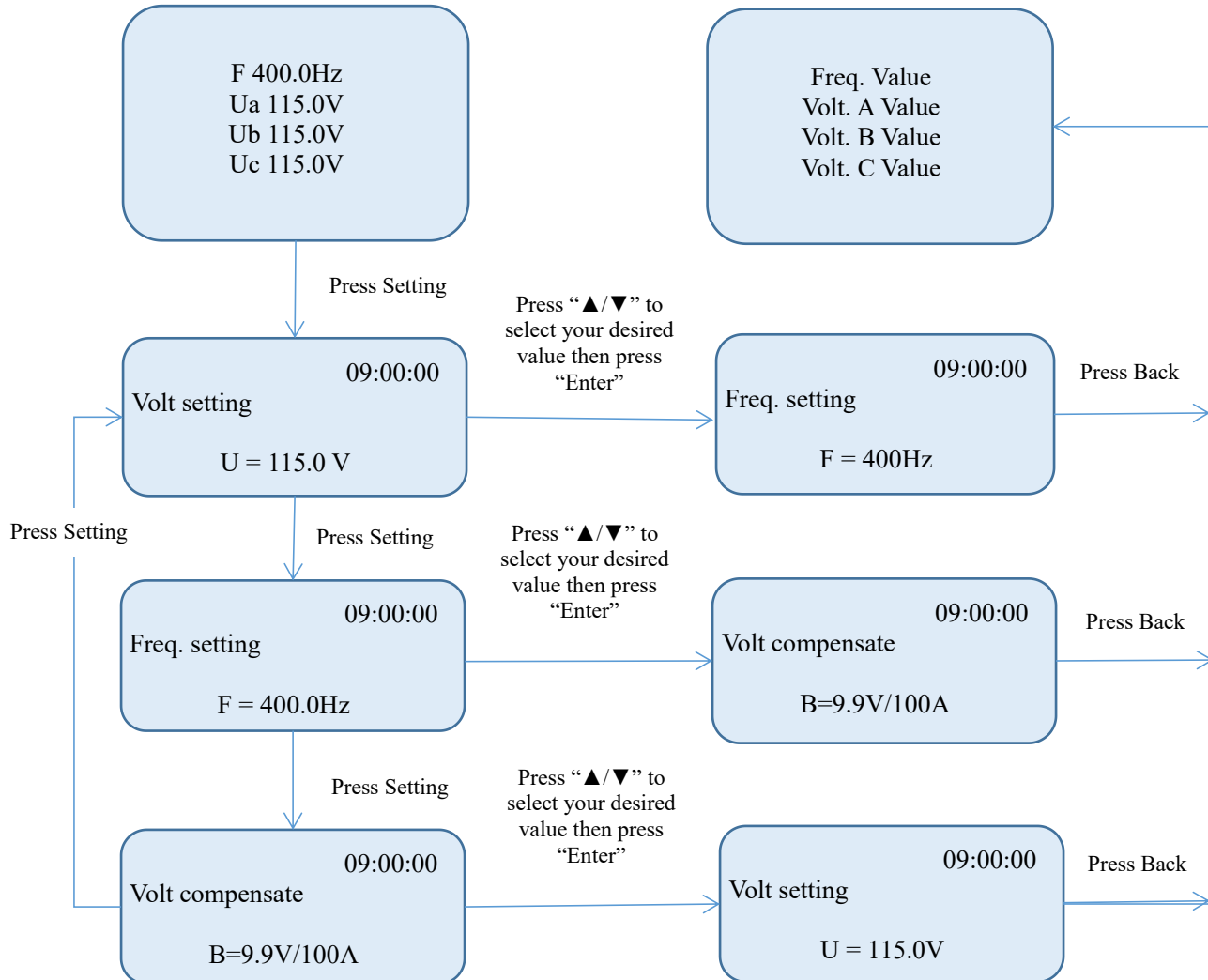
8.8 Power Off

Turn off the input breaker

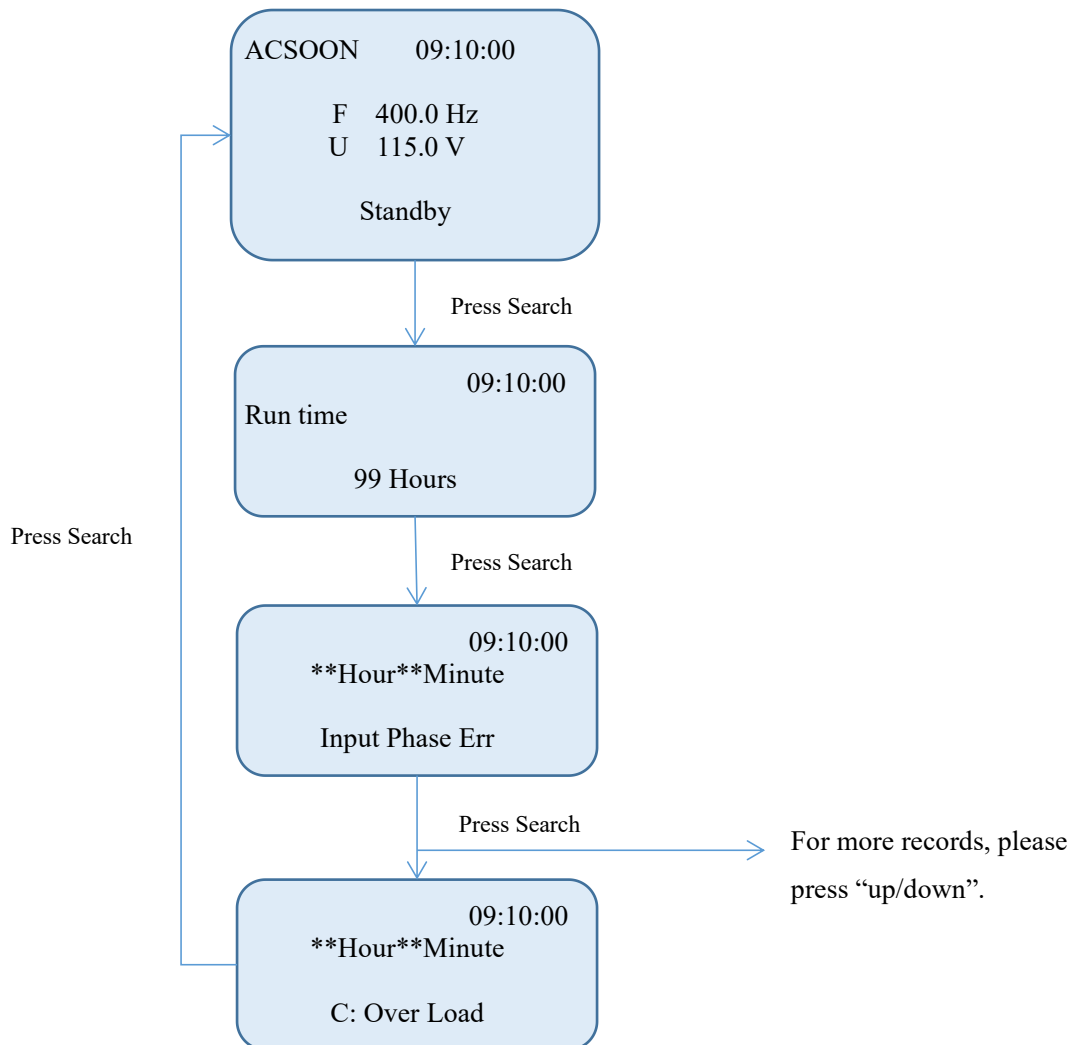
8.9.How to set up your desired parameter under “standby”mode



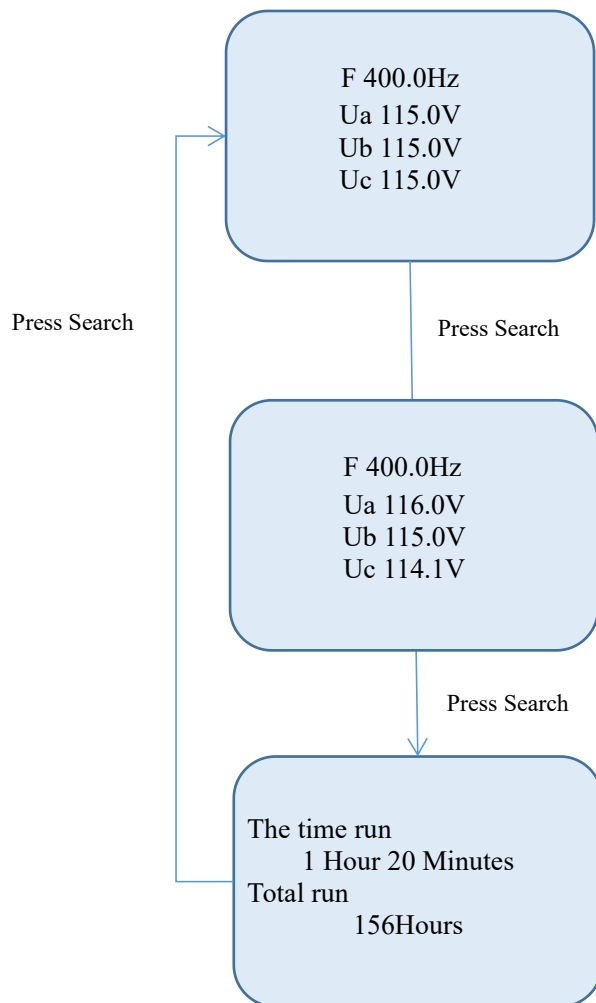
8.10.How to set up your desired parameter under “running”mode



8.11. How to check “search” under standby mode



8.12. How to check “search” under running mod



Chapter 9 Trouble Shooting And Maintenance

Note: Only qualified electricians can remove the metal enclosure for troubleshooting and repair. Please pay attention to the inner high-voltage electricity and be aware that the DC capacitors remaining charged to a dangerous voltage up to 10 minutes after the GPU input power disconnected.

The GPU would go in self-test mode after start up, when something abnormal happens or the setting is incorrect, the GPU will be cut off delivering output power automatically, and in this case, one error info code is showing on displaying panel.

Usually the display text to provide sufficient information to tell what cause the unit not working, below suggest corrective actions to be carried out for each error code. In case the display is blank, please refer to 9.3.1 below

9.1 Error Table

Error info	Communication code	Error info	Communication code	Error info	Communication code
Inner Fault					
A:Drive Over Amp	11	B:Drive Over Amp	21	C:Drive Over Amp	31
A:Over load	12	B:Over load	22	C:Over load	32
A:Over heat	13	B:Over heat	23	C:Over heat	33
A:Over Volt	14	B:Over Volt	24	C:Over Volt	34
A:Drive Under Volt	15	B:Drive Under Volt	25	C:Drive Under Volt	35
Main bus Over Volt	05				
Input Fault		Output Fault		No Fault	
In.Over Heat	41	Out.under Volt	51	No Fault	00
In.Under Volt	42	Out.under Freq.	52		
In.phase missing/reverse	43	Out.over volt	53		
In.under Volt	44	Out.over freq.	54		
		Out.phase missing/reverse	55		

9.2 Error Information And Trouble Shooting

9.2.1 Main Bus Over Volt

Solution:

*Check the main bus to see if the voltage is out of the range or not

* Check the DC main bus board to see if it is faulty(only for the paralleled system)

9.2.2 Rectifier,phase A,B,C over heat

Solution:The Axial fans might not working, replace a new ones or try to cool the environmental temperature down

9.2.3 Input A,B,C phase missing or in reverse

Solution: Check input each phase is well connected or not and make sure no wrong sequence of cable connection between each phase.

9.2.4 Input over voltage and under voltage

Solution:Input voltage is out of range of +/- 20%.Try to boost/reduce the input voltage make it in the range of +/-20%

9.2.5 Output under voltage/under frequency/over frequency/each phase reverse

Solution:the fault come from the control unit.please refer to 9.3.2

9.2.6 Output over voltage

Solution:Check the output terminal to see if output cables is getting loose.

9.2.7 Output phase A/B/C over amperes

Solution:Fault comes from either inverting module or each phase drive PCB,replace the IGBT module or drive PCB.

9.2.8 Output phase A/B/C overload

Solution:Output Amperes value exceed limited current (Usually limit current is twice of rated current),then output voltage value drops down, please reduce the loads capacity accordingly

9.2.9 Output phase A/B/C drive under voltage

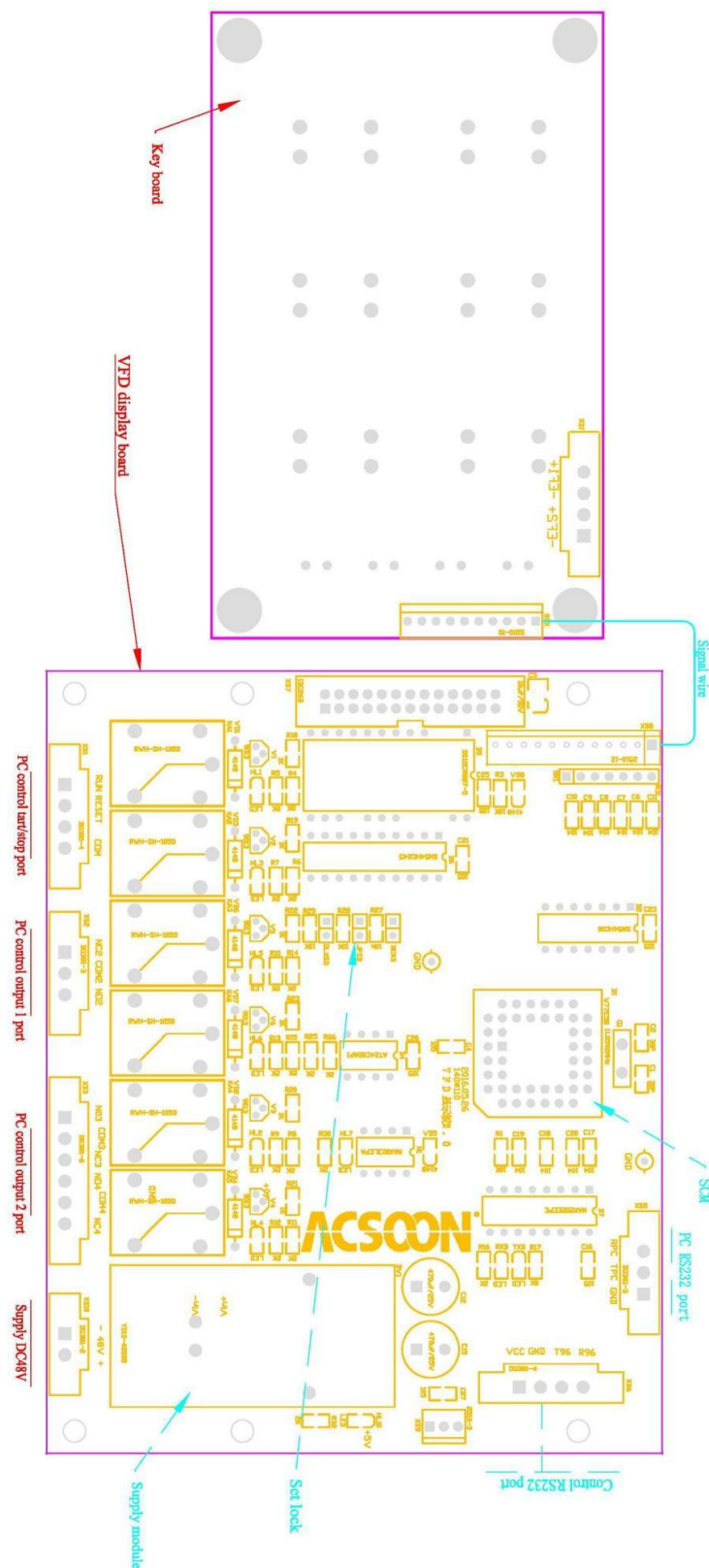
Solution:Check each phase drive PCB to see if any visual damage

9.3 Repair

Usually, fault comes from display module, control unit, inverting unit, see below.

Note: most of the components, especially for the PCB's can not be disassembled and repair, if there is a problem, please replace a new one as per instruction as below.

9.3.1 The display unit (View for back side of display unit)



*Panel press buttons on display panel do not work after depressed.

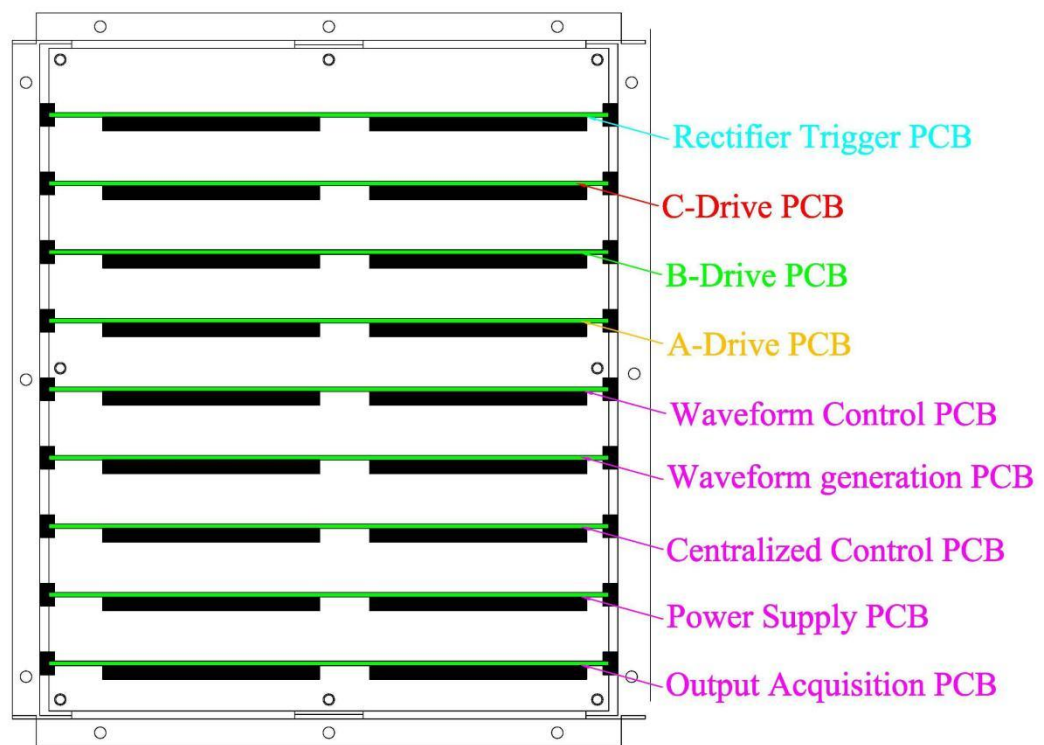
Solution: Check the signal wires between key board to VFD panel is getting loose or not.

*VFD screen is not lighting on, and none of all LED indicator lights on VFD

Solution: Check the supply module showed on the view, replace with a new supply module. If it still does not work after replace the supply module, then the complete display PCB needs to be replaced with a new one.

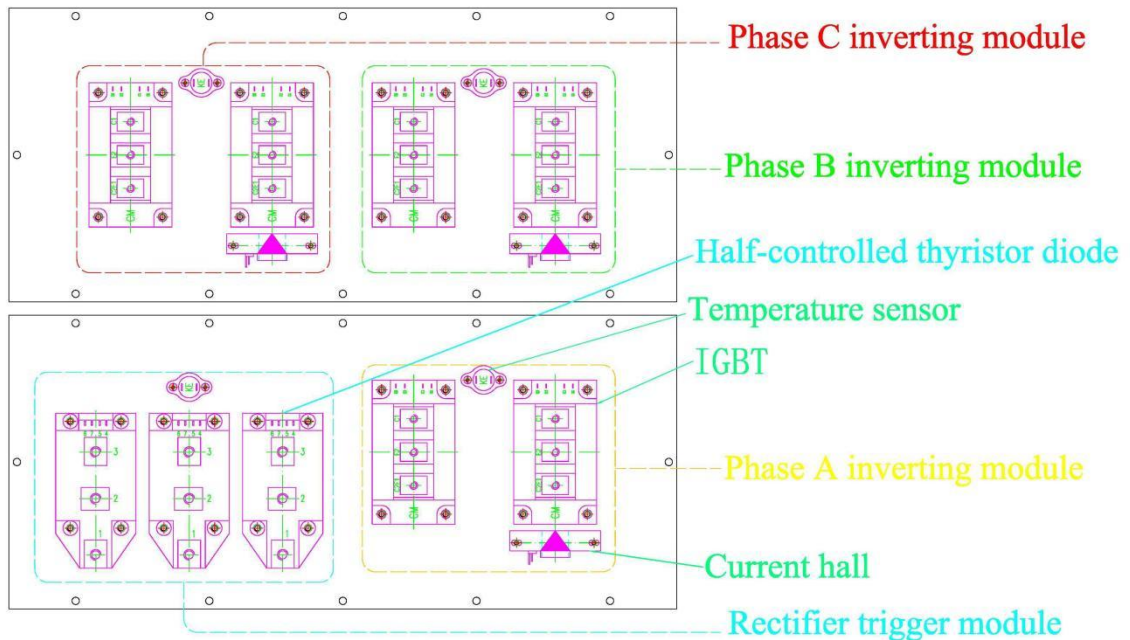
Note: Please keep the SCM on the failed display PCB and re-use it on the new display PCB.

9.3.2 Front View of Control Unit



The control unit contains a few PCB showing as pict above. Any fault related to the control unit, please contact Acsoon Power or our authorised distributors for guidance of specific trouble shooting. In case that any PCB needs to replace, mis-placing the PCB is not going to happen because every PCB has different size of base to hold it.

9.3.3 View of inverting unit



There are high DC voltage after inverting, please note the inner high-voltage electricity and be aware that the DC Capacitors can remain charged to a dangerous voltage up to 10 minutes after the mains input has been disconnected.

It better take a picture before remove the failed IGBT as each wires connected to IGBT must be welded in accordance with the original order. Please contact ACSOON Team for further fault guidance, please do not forget to provide the serial number of the GPU (can be found from the name plate of GPU) and error information digital displayed on the VFD screen.

9.4 Maintenance

(1) GPU must be worked in the specified environment, and please pay attention to the installation condition for the full part of its function as well as its service life:

Avoid rain, moisture, high temperature, higher heat and direct sunlight; the cooling vent should be Non-professionals is prohibited to open the enclosure.

ACSOON GPU designed as maintenance-free. All is about components inside cleaned and inspected at least every six month as following steps

a) Cut off the power from the input coming power, ensure the GPU is not energized.

* Remove the metal covers from the enclosure on the left and right side.

*Check the DC capacitor voltage, to ensure that is completely discharged

*Clean the dust inside the GPU with a vacuum cleaner

*Check the control wiring without loosening.

*Check the electrical and mechanical connection in fastening

*Check all PCBs without any visual damage.

*Check all the Axial fans are working properly.

Chapter 10 Contact Detail

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