# SERVICE MANUAL

**HT series 6~20K**

CONTENT

# 1. General Information of This Document

## 1.1 Getting start

This is a service manual for HT series 6K~20K Tower UPS, intend to help service personal perform a maintenance and repair service.

If you want to know:

**What is special for this UPS from service point of view;** please refer to section characteristic of the product.

**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.
7. Verify input source (voltage and frequency) is within the maximum range before service.

## 2. Characteristic of the Product

The HT series UPS are utilizing most advantage and mature technologies, provides the basal performance, and most cost-performance ratio in the industrial. Following benefit the product has:

- High output Power Factor; provides real power capability to the user.
- Perfect output sine waveform, suitable almost all critical equipment.
- High Input Power Factor, save for power, wiring expense for user. Low input current distortion, which avoid power pollution.
- Two or three phases input.
- Outstanding adaptability to the worst mains input condition, Extra Wide Input voltage, Frequency range and waveform, avoid excessive dissipating limited battery energy,
- Compact size; occupy minimum install space, saving real estate expense
- Most functional sub-circuit become modular, easy to identify the problem and repair by replacing an appropriate module

# 3. PRINCIPLE OF OPERATION

## 3.1 Electric Specifications

| | 1106S | 1110S | 1106L | 1110L | 1115L | 1120L | 3310L | 3315L | 3320L |
|---|---|---|---|---|---|---|---|---|---|
| **INPUT** | | | | | | | | | |
| **Cold Start** | YES, default frequency=50Hz or settable | | | | | | | | |
| **Acceptable Input Voltage** | 50%~125%(220VAC/230VAC/240VAC) | | | | | | | | |
| | 100% load@80%~125% | | | | | | | | |
| | 90% load@70%~80% | | | | | | | | |
| | 80% load@60%~70% | | | | | | | | |
| | 65% load@50%~60% | | | | | | | | |
| **Transfer Voltage Range** | | | | | | | | | |
| -Line low transfer | 110VAC/115VAC/120VAC | | | | | | | | |
| -Line low recovery | 116VAC/122VAC/127VAC | | | | | | | | |
| -Line high transfer | 275VAC/288VAC/300VAC | | | | | | | | |
| -Line high recovery | 268VAC/279VAC/291VAC | | | | | | | | |
| **Input Power Factor** | ≥0.99 | | | | | | | | |
| **Input Frequency Range** | 40Hz - 70Hz | | | | | | | | |
| **Generator** | Support Any Generator. | | | | | | | | |
| **OUTPUT** | | | | | | | | | |
| **Frequency adaptable** | Settable | | | | | | | | |
| **Power** | | | | | | | | | |
| **Output Voltage** | | | | | | | | | |
| -Waveform | Pure sine wave | | | | | | | | |
| -Nominal voltage | 220/230/240VAC | | | | | | | | |
| -Voltage regulation | ± 1 % | | | | | | | | |
| -Transient response | ≤5% (50% - 100% -50%) | | | | | | | | |
| -Transient recovery | ≤15ms (0% - 100% -0%) | | | | | | | | |
| -Voltage distortion | ≤1% THD, linear load | | | | | | | | |
| | ≤ 5% THD, non-linear load | | | | | | | | |

| | |
|---|---|
| **Output Frequency** | |
| -Synchronization range | settable,±3Hz default |
| -Slew rate | 0.5~5Hz/s,2 Hz/s default |
| -Battery mode | (50±0.05) Hz |
| **Transfer Time** | |
| -Line mode to battery mode | 0 |
| -Inverter to bypass | 0 |
| **Efficiency** | |
| -Line mode with battery full charged | 93.0% |
| -ECO mode | 98.0% |
| -Battery mode | 92.0% |
| **Noise** | <48dB@<70%load,<58dB@>70%load;1m away |
| **Overload Capability (Line Mode)** | 110%: Transfer to bypass after 10 mins. |
| | 130%: Transfer to bypass after 1 min |
| | 150%: Transfer to bypass after 30s, shutdown after 1 min.(Line mode) |
| **Overload Capability (Battery Mode)** | 110%: Shutdown after 10mins (Battery mode) |
| | 125%:Shutdown after 10s(Battery mode) |
| | >125%: Shutdown after 1s (Battery mode) |
| **Crest Ratio** | 3:1 |

**BATTERY**

| | | |
|---|---|---|
| **Rating/Type** | 12VDC/7Ah | Depend on the capacity of external batteries |
| **Quantity** | 16 | |
| **DC Voltage** | 192VDC | 192/240VDC |
| **Back-up Time** | 4mins @80% load | Depend on the capacity of external batteries |
| **Battery-Low Voltage** | (176±3)VDC | |
| **Charger** | | |

| | | |
|---|---|---|
| -Charging voltage | (220±1%)VDC | |
| -Charging current (max) | 1A | 5A (8A optional) |
| -Charging time | 7h recharge to 90% | Depend on the capacity of external batteries |
| **Leakage current** | <1mA | |
| **INDICATOR & ALARM** | | |
| **Display** | LED+LCD | |

## 3.2 Functional Block of the Product

As a true online UPS, the product employ a double conversion topology, comprise following functional blocks, as shown in Figure 3.2

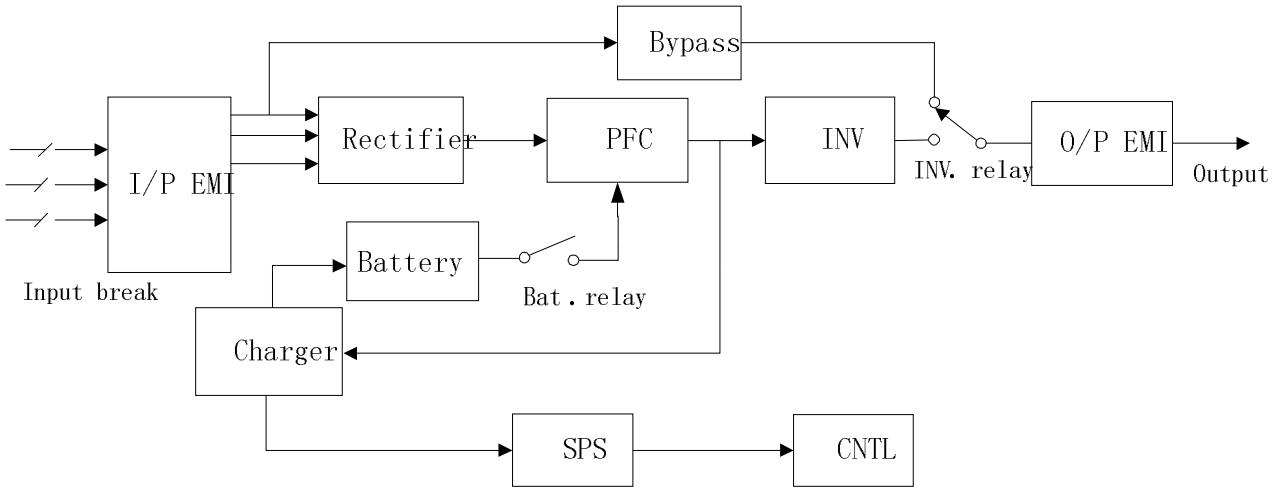



**Figure 3.2.1 Function block Diagram of the product**

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 indicating the status of the UPS.

The rectifier is the input stage of the UPS, The Rectifier block converts the two phases AC mains input power into a pair of stable DC power storing on the DC-BUS. In means time, Power Factor Correction is performed, the input current tracking the reference waveform

which is given by DSP, and the input power factor can be very close to 1, achieve maximum efficiency and product lowest power pollution to the power supply system.

The DC/DC module, called also Booster, used to converse the low level DC power into higher level and more stable DC power, storing on the DC-BUS also.

The inverter is the output stage of the UPS, used to converse the DC power from the DC-BUS into clean sine wave AC output power.

When the mains is within the tolerance range, the UPS use the mains input, at this time, the Rectifier work; In case the mains supply is output tolerance range, due to either the voltage or the frequency, the UPS will stop the Rectifier working and start the Battery Booster. In case the input mains supply interrupts suddenly, the controller can detect the interruption in very short time, and in the interval before detecting the interruption, the output power will be maintain by energy stored in the DC-BUS capacitor, there will never be appear interruption on output.

The battery charger charges the battery when the BUS Voltage is normal. The battery charger module converse the BUS input into DC power for recharging the Battery. Two type of charger can be available, one is for the standard model, and another is for long backup time model that connects external battery.

The Input or Output EMI part provides EMI filter function. The input EMI filter and output EMI filter are used for two purpose, the first one is to prevent the UPS being interference by external electronic/magnetic noise which generated by the other electronic system, the second is to prevent the noise generated inside the UPS system interference other system.

The SPS generates DC power supply needed by operation of the circuit of the UPS itself.

The internal Bypass provides an alternative path in case the power conversion stage become out of order, to maintain the continuity of output supply.

## 3.3 Operating Principle of the Major Functional Block

### 3.3.1 The basic circuit of power supply

The Power Supply (SPS) module supplies DC power for UPS operation. The input of the SPS is the battery, or the output of the charger.

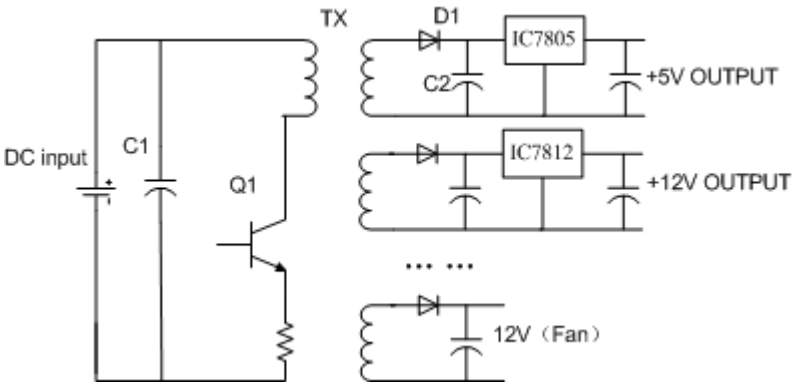



**Figure 3.3.1 Basic circuit of power supply**

This is a flyback converter topology. When the MOSFET 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 lp. When the MOSFET 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: ±15V, ＋12V, ＋5V, 12V（Fan）. The power of ±15V, ＋12V, ＋5V supply a steady voltage for all kinds of IC and other device. The 12V（Fan）is supplied for fans and relays.

### 3.3.2 PFC/Boost circuit

PFC：Power Factor Correction

Because the SCR will be ON only if it’s positive voltage is higher than its negative voltage, after the utility power is rectified by the full waveform, the current waveform of the diode will appear characteristics of high and sine. Thus current waveform not only contains a great number of harmonics, but also makes the UPS input power factor lower.

Add a DC/DC PFC after rectifying and correct the input current as a sine wave to make the input power factor is close to 1.

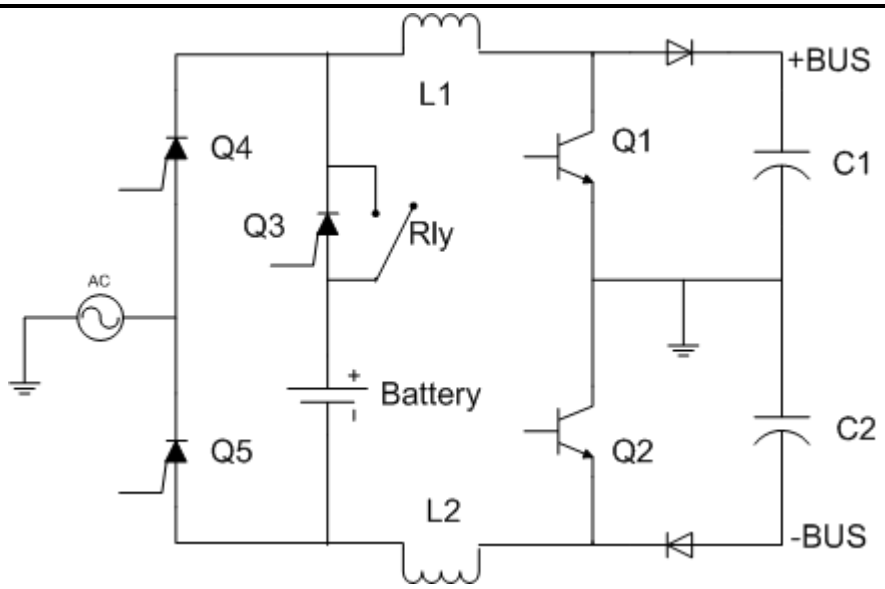



**Figure 3.3.2 PFC circuit**

As shown in the diagram, when the IGBT is on and the DIODE is off, the CHOKE will store energy and the current crossing the choke will increase by degrees with time pass. When the IGBT is off, the choke releases energy and the DIODE is on, the current of the choke will be descending with time pass. Therefore, we can control the current waveform of chokes (input current) by regulating the time of IGBT on and off.

### 3.3.3 IP SCR Board

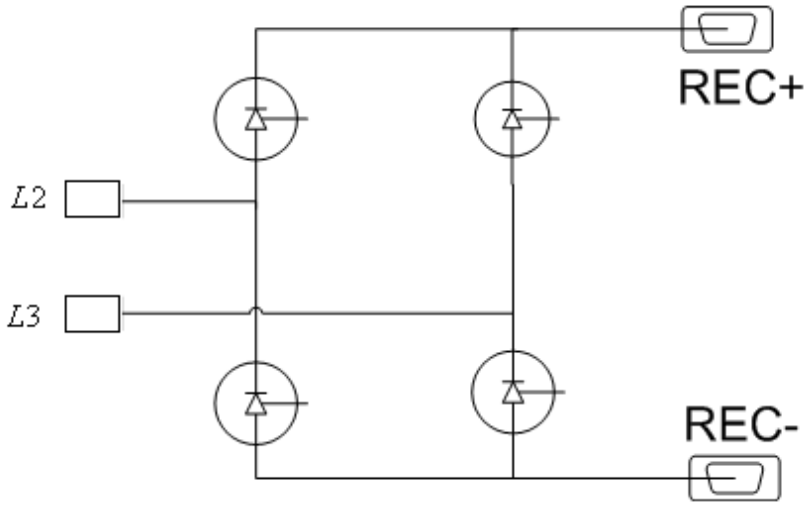



Figure 3.3.3 Frame diagram of the SCR board

The input of IP SCR board is connected to the another two phases. The input utility power were rectified by 4 SCRs. And the output send to the rectifier +/- on the PFC board.

### 3.3.4 Inverter circuit

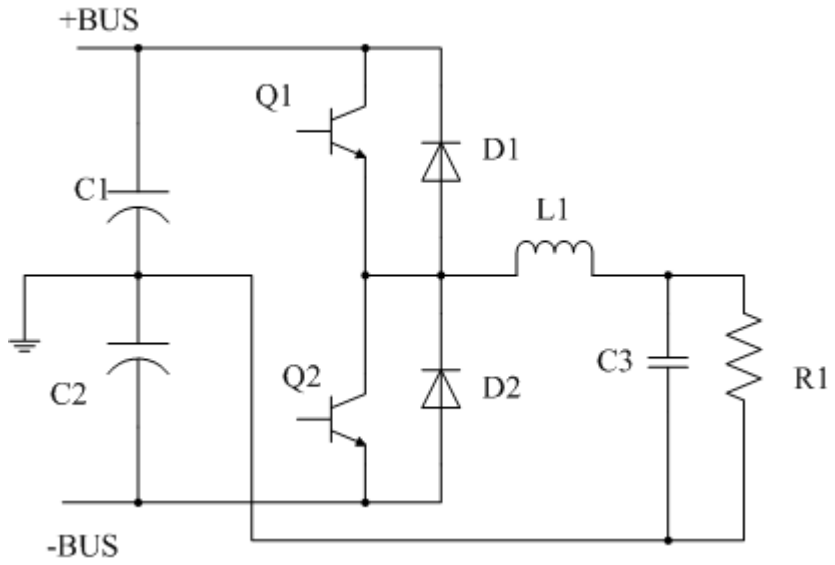



**Figure 3.3.4 Half-bridge inverter topology**

The input of the half-bridge inverter topology is DC voltage, and the output is AC voltage. Half-bridge topology major advantage is that it subjects their transistors on the off state to a voltage stress equal to the DC input voltage and not twice that as do the push-pull and singled forward converter. An additional valuable feature of the half-bridge topology is that leakage inductance spikes are easily clamped to the DC supply bus and any energy stored in the leakage inductance is returned to the input bus instead of having to be dissipated in some resistive element.

The topology works as follows. Q1 and Q2 are switched on at alternate half cycles. The junction voltage of up and down bridges is a high frequency rectangular waveform. This rectangular wave through the LC filter will become a standard sine wave.

### 3.3.5Standard Charger and Super Charger

The utility of charger is to recharge and maintain the batteries at fully charged condition. The charger charges the batteries with a constant current at initial stage and as the battery voltage keep increasing, the charge current decreases accordingly until the batteries come to the floating charge voltage point .In general, the charger will control the output voltage at a constant level (220±1%Vdc ) In this way, to make the battery full recharged but not over recharged, protects and prolongs the lifetime of charged batteries.

As shown in the following diagram; the battery charger employed a Flyback topology,

under controlling of the controller mainly comprise an ASIC TL3845, when the MOSFET is turned on, the current in the transformer increases, and a certain amount of energy is stored in the transformer, when the MOSFET is turned off, the energy stored in the transformer start to be released from the secondary side of the transformer and to charge the output capacitor, by controlling the duty cycle, energy transfer to secondary side of the Flyback circuit can be controlled, and so on the output voltage.

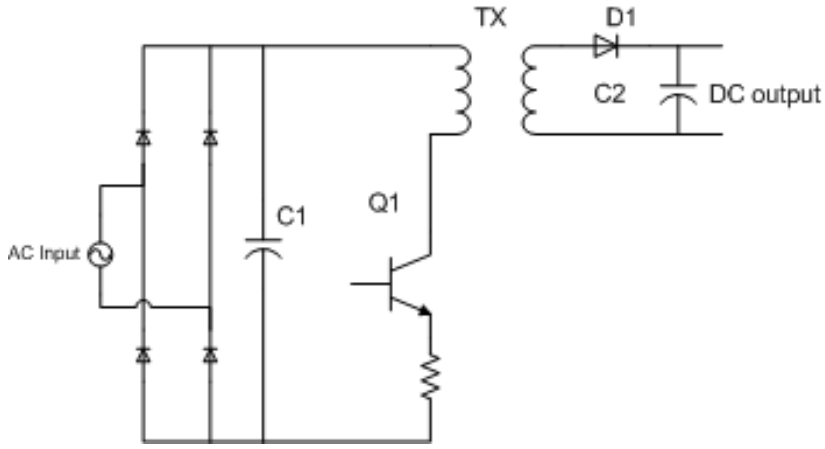



**Figure 3.3.5 Topology of the standards and supper charger**

NOTE:

There are two kinds of charger for standard model UPS and long backup time model UPS. Both operating in the same principle, but difference in output capacity, the one for standard model UPS capable of outputting 1.2A current, A super charger module with maximum 5A charge current capacity, is used in the long backup time model UPS.

### 3.3.6 EMI Board

Input EMI choke board is connected between mains and the input of Rectifier.

Output EMI choke board is connected between the output of Inverter and output terminal block.

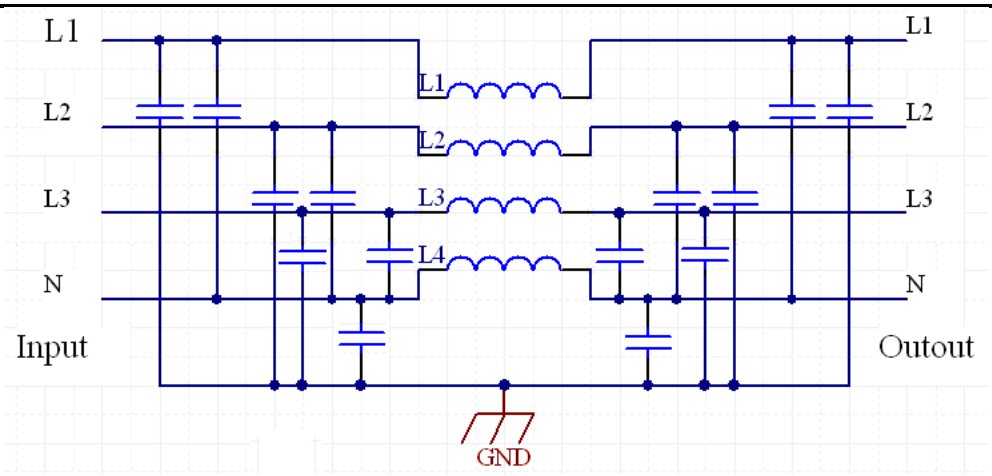



**Figure 3.3.6 I/P EMI circuit**

## 3.3.7 Control circuit

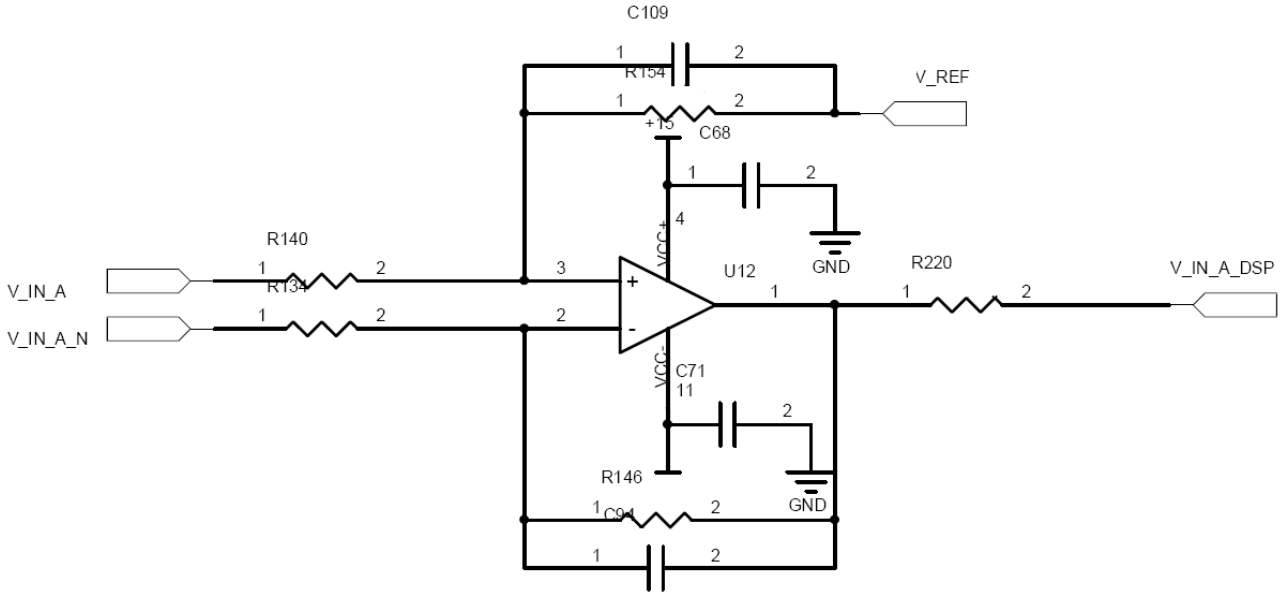
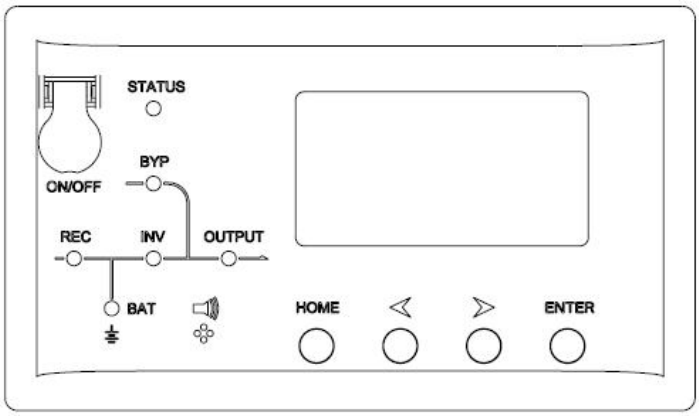



**Figure 3.3.7 Utility power sense circuit**

The sense signals adopt difference input signals through some multiple attenuation, which can get a new signal. The new signal send to the I/O port of DSP via a protect circuit.

# 4. LED Display




### 1) LED definition

There are total 6 LEDs to indicate the status of UPS.

| | |
|---|---|
| STATUS | UPS status: green--normal mode, red--UPS is abnormal |
| REC | Rectifier indicator: green--rectifier is normal, green flicker--rectifier is starting, red--rectifier fault, red flicker--rectifier alarm, dark—rectifier is not working |
| INV | Inverter indicator: green--inverter is normal, green flicker--inverter is starting or tracking with bypass(ECO), red—inverter fault and load is not on inverter, red flicker—inverter fault and load is on inverter, dark—inverter is not working |
| BYP | Bypass indicator: green—bypass is normal, dark—UPS is in normal mode and bypass is normal, red—bypass fault, red flicker—bypass alarm |
| BAT | Battery indicator: green—battery charge, green flicker—battery discharge, dark—battery is connected, red—battery fault, red flicker—battery alarm |
| OUTPUT | Output indicator: green—output is normal, red—output alarm |

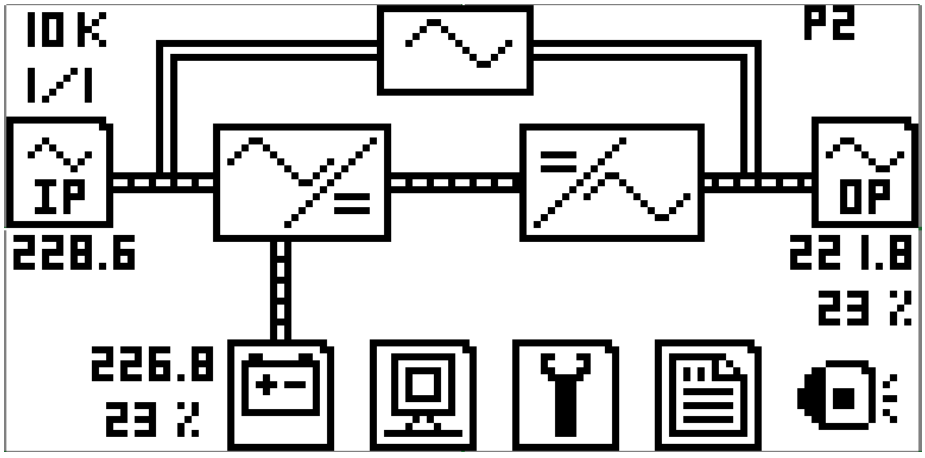



Fig 8. LCD Main Menu

Description of Main Menu

| Display | Function | Submenu |
|---|---|---|

| Display | Function | Submenu |
|---|---|---|
|  | Input information | Main input: voltage, current, frequency, PF<br>Bypass input:<br>Voltage, current, frequency, PF |
|  | Battery information | Battery: voltage, discharge current, battery status, battery temperature, capacity<br>DCbus voltage |
|  | Output information | Output information:<br>Voltage, current, frequency, PF<br>Load information:<br>Active power, apparent power, percent |
|  | Status of UPS | Alarms, S-code, firmware version, system information |
|  | Set and function | Set: language, contrast, communication set(SNT, Modbus), Modbus set<br>Function: function 1(transfer to bypass/escape, fault clear, mute on/off), function 2(battery test, maintenance test, stop test) |
|  | History log | / |
|  | Rated capacity:<br>10KVA<br>1phase in/out: 1/1 | / |
|  | Input voltage | / |
|  | Battery voltage and capacity remained | / |
|  | Output voltage and load percent | / |
|  | System working mode | S--single mode, E--ECO mode, P-parallel mode, 2-the unit ID is 2 in system, the units ID in parallel system should be different |
|  | Mute on, mute off | |

# 5. TROUBIE SHOOTING

This section describes checking the UPS's status. This section also indicates various UPS symptoms a user may encounter and provides a troubleshooting guide in the event the UPS develops a problem. Use the following information to determine whether external factors caused the problem and how to remedy the situation.

## 5.1 Checking UPS status

It recommended that checking the UPS operation status every six months.

- Check whether the UPS is faulty: Is the Fault Indicator on? Is the UPS sounding an alarm?
- Check whether the UPS is operating in Bypass mode. Normally, the UPS operates in Normal Mode. If it is operating in Bypass Mode, stop and contact your local representative, or Channel Support.
- Check whether the battery is discharging. When the utility input is normal, the battery should not discharge. If the UPS is operating in Battery Mode, stop and contact your local

representative, or Channel Support.

## 5.2 Adjust the factors caused the problem

When the fault indicator is on, press  button to get S-code. So,S1 indicates status and A0-A5 indicates the exact fault of UPS, S-code list is shown as follow:

Description of S-Code

| Seq. | | | Items | 0 | 1 | Solution |
|---|---|---|---|---|---|---|
| 1 | A0 | 1 | Synchronous Fault | Sync | Not sync. | Check whether bypass voltage/frequency is normal |
| 2 | | 2 | Main Input Fault | OK | Fault | Check whether input is normal |
| 3 | | 3 | REC Fault | OK | Fault | REC over temperature, bus over voltage, input current unbalance, soft start fail |
| 4 | | 4 | INV Fault | OK | Fault | INV over temperature, INV IGBT broken, INV relay fault |
| 5 | | 5 | Reserved | | | |
| 6 | | 6 | Reserved | | | |
| 7 | | 7 | Reserved | | | |
| 8 | | 8 | Reserved | | | |
| 9 | | 9 | Reserved | | | |
| 10 | | 10 | Reserved | | | |
| 11 | | 11 | Reserved | | | |
| 12 | | 12 | Reserved | | | |
| 13 | | 13 | Input phase A over current | OK | Fault | Check if rectifier IGBT is broken, DC bus is shorted, or IGBT drivers are lost, input voltage display is wrong |
| 14 | | 14 | Input phase B over current | OK | Fault | |
| 15 | | 15 | Input phase C over current | OK | Fault | |
| 16 | | 16 | Output voltage Fault | OK | Fault | Check if inverter IGBT is broken, IGBT drivers are lost |
| 17 | A1 | 1 | Reserved | | | |
| 18 | | 2 | Reserved | | | |
| 19 | | 3 | Reserved | | | |
| 20 | | 4 | Reserved | | | |
| 21 | | 5 | Reserved | | | |
| 22 | | 6 | Reserved | | | |
| 23 | | 7 | Reserved | | | |
| 24 | | 8 | Reserved | | | |
| 25 | | 9 | Input voltage Fault | OK | Fault | Input voltage out of range |
| 26 | | 10 | Input Frequency Fault | OK | Fault | Input frequency out of range |
| 27 | | 11 | Input Sequence Fault | OK | Fault | Input sequence is wrong, check whether input wires connection is ok. |
| 28 | | 12 | REC soft-start Fault | OK | Fault | Check whether rectifier SCR is broken, or SCR drivers are lost. |
| 29 | | 13 | Reserved | | | |

| Seq. | | | Items | 0 | 1 | Solution |
|---|---|---|---|---|---|---|
| 30 | | 14 | Reserved | | | |
| 31 | | 15 | REC over temperature | OK | Fault | Check if the environmental temperature is over 40, if rectifier IGBTs is properly installed. |
| 32 | | 16 | Positive bus over voltage | OK | Fault | UPS requires service |
| 33 | A2 | 1 | Negative bus over voltage | OK | Fault | UPS requires service |
| 34 | | 2 | Fan Fault | OK | Fault | At least one of fans fail. |
| 35 | | 3 | Reserved | | | |
| 36 | | 4 | Reserved | | | |
| 37 | | 5 | Positive bus under voltage | OK | Fault | UPS requires service |
| 38 | | 6 | Negative bus under voltage | OK | Fault | UPS requires service |
| 39 | | 7 | Battery reversed | OK | Fault | Check if the battery wires connection is OK |
| 40 | | 8 | Reserved | | | |
| 41 | | 9 | Reserved | | | |
| 42 | | 10 | Reserved | | | |
| 43 | | 11 | Reserved | | | |
| 44 | | 12 | Reserved | | | |
| 45 | | 13 | Battery over temperature | OK | Fault | Check if environmental temp is too high or batteries life is over |
| 46 | | 14 | Reserved | | | |
| 47 | | 15 | Reserved | | | |
| 48 | | 16 | Reserved | | | |
| 49 | A3 | 1 | Battery voltage low | OK | Fault | |
| 50 | | 2 | Reserved | | | |
| 51 | | 3 | Battery EOD | OK | Fault | |
| 52 | | 4 | Reserved | | | |
| 53 | | 5 | Reserved | | | |
| 54 | | 6 | Reserved | | | |
| 55 | | 7 | BYP voltage Fault | OK | Fault | Check if bypass input voltage is normal |
| 56 | | 8 | Bypass SCR or relay fault | OK | Fault | UPS requires service. |
| 57 | | 9 | Reserved | | | |
| 58 | | 10 | Reserved | | | |
| 59 | | 11 | BYP frequency over track range | OK | Fault | Check if bypass input frequency is abnormal |
| 60 | | 12 | Reserved | | | |
| 61 | | 13 | Reserved | | | |
| 62 | | 14 | Over load time out | OK | Fault | |
| 63 | | 15 | Reserved | | | |
| 64 | | 16 | Reserved | | | |
| 65 | A4 | 1 | Manual shutdown | normal | shutdown | |

| Seq. | | | Items | 0 | 1 | Solution |
|---|---|---|---|---|---|---|
| 66 | | 2 | INV protect | OK | Fault | |
| 67 | | 3 | Transfer times limit in one hour | OK | Fault | Transfer times between inverter and bypass is over 5 times in one hour |
| 68 | | 4 | Reserved | | | |
| 69 | | 5 | Reserved | | | |
| 70 | | 6 | Reserved | | | |
| 71 | | 7 | Reserved | | | |
| 72 | | 8 | INV over temperature Fault | OK | Fault | Check if environmental temp is over 40°C, or fans are abnormal |
| 73 | | 9 | Reserved | | | |
| 74 | | 10 | Reserved | | | |
| 75 | | 11 | Over load | OK | Over load | Check load level indicator and remove non-essential load. Recalculate the load and remove number of loads connected to UPS. |
| 76 | | 12 | INV relay or fuse Fault | OK | Fault | Check if inverter relay is shorted or opened. |
| 77 | | 13 | Reserved | | | |
| 78 | | 14 | Parallel connection fault | OK | Fault | Check whether parallel connection cable disconnect. |
| 79 | | 15 | Reserved | | | |
| 80 | | 16 | Reserved | | | |
| 81 | A5 | 1 | Reserved | | | |
| 82 | | 2 | Output shorted | OK | Fault | Shutdown UPS and open output breaker, check if load is effective or short internally, check if output connector is shorted. |
| 83 | | 3 | Battery test | None | OK | 2--Fault |
| 84 | | 4 | Battery maintenance | None | OK | 2--Fault |
| 85 | | 5 | Reserved | | | |
| 86 | | 6 | Reserved | | | |
| 87 | | 7 | Reserved | | | |
| 88 | | 8 | Reserved | | | |
| 89 | | 9 | Reserved | | | |
| 90 | | 10 | Reserved | | | |
| 91 | | 11 | Reserved | | | |
| 92 | | 12 | Reserved | | | |
| 93 | | 13 | Reserved | | | |
| 94 | | 14 | Reserved | | | |
| 95 | | 15 | Reserved | | | |
| 96 | | 16 | Reserved | | | |

### 5.3 Trouble shooting in else cases

| Problem | Possible cause | Action |
|---|---|---|
| Battery discharging time diminishes | Battery not yet been fully charged. | Keep UPS connected to utility power persistently for more than 10 hours to recharge the batteries. |
| | UPS overloaded. | Check the loads and remove some non-critical loads. |
| | Battery aged. | Replace the batteries. |
| | Charger failed | Check the charger. |
| The UPS cannot power on after pressing the button | The button is pressed too briefly. | Press the button continuously for more than 2 seconds. |
| | Battery is not connected or battery voltage is too low, or Charger failed. | Check the charger and battery. |

## 5.4 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

### 5.4.1 Maintenance tools

1、A computer with a serial port and a standard RS232 cable;

2、A suitcase or a toolbox;

3、Wire cutters and clamps;

4、Balance equipments, current limiting resistors, a electric soldering iron, tubes and clamp terminals with different specifications;

5、A multimeter and a oscilloscope（or current meter）;

6、Other tools in common use：Diagonal pliers、Snipe nose pliers、Cross screw drivers (150mm/75mm length), Straight screwdrivers (75mm length) and PVC insulating tapes etc;

7、PCB and some other materials.

### 5.4.2 The Setting Method of Single UPS

Equipment:

One computer with a serial port;

One standard RS232 serial cable;

One multimeter;

**Parameter Setting Method:**

1. Connect the RS232 port of the UPS to the serial port of the computer with a serial cable. The COM port is set "COM1" automately and the other settings as Fig.1

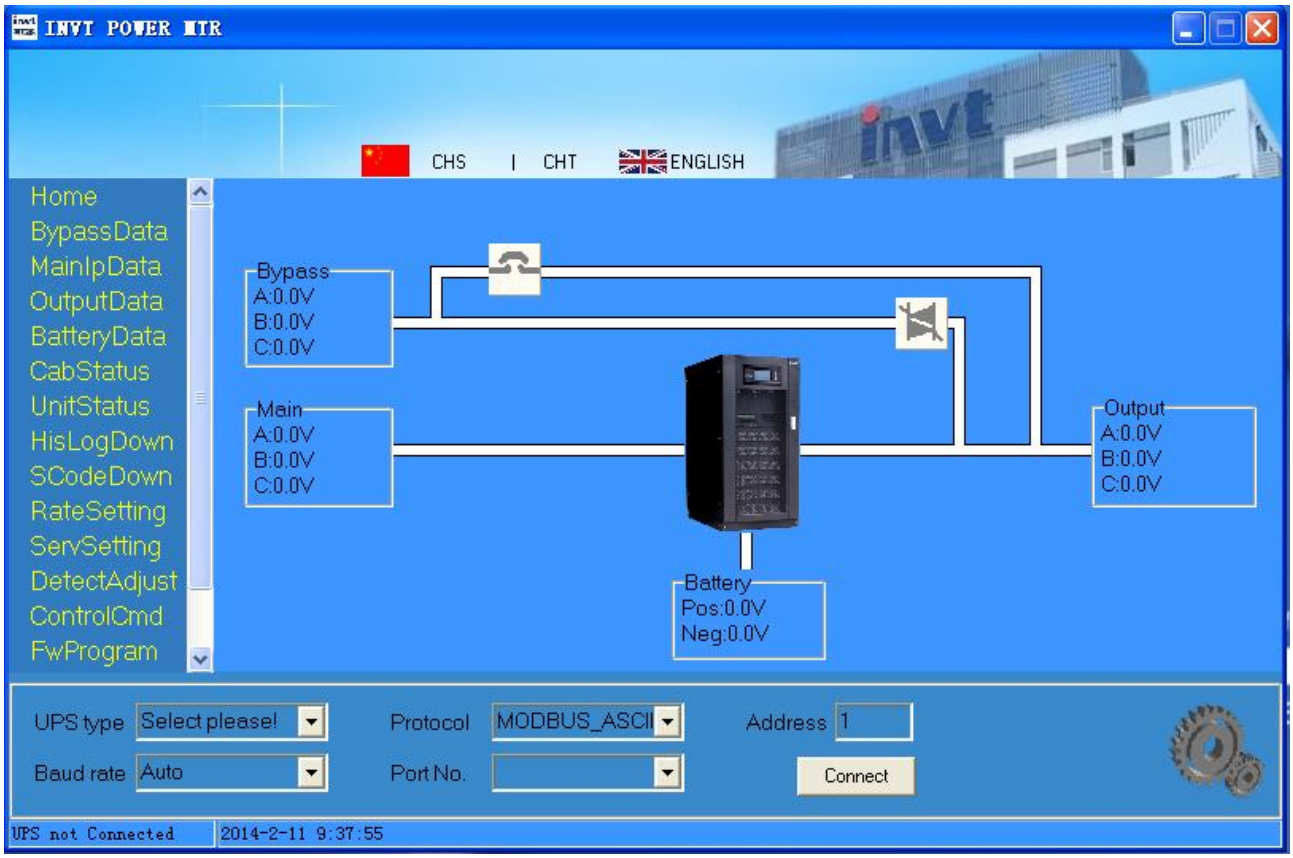
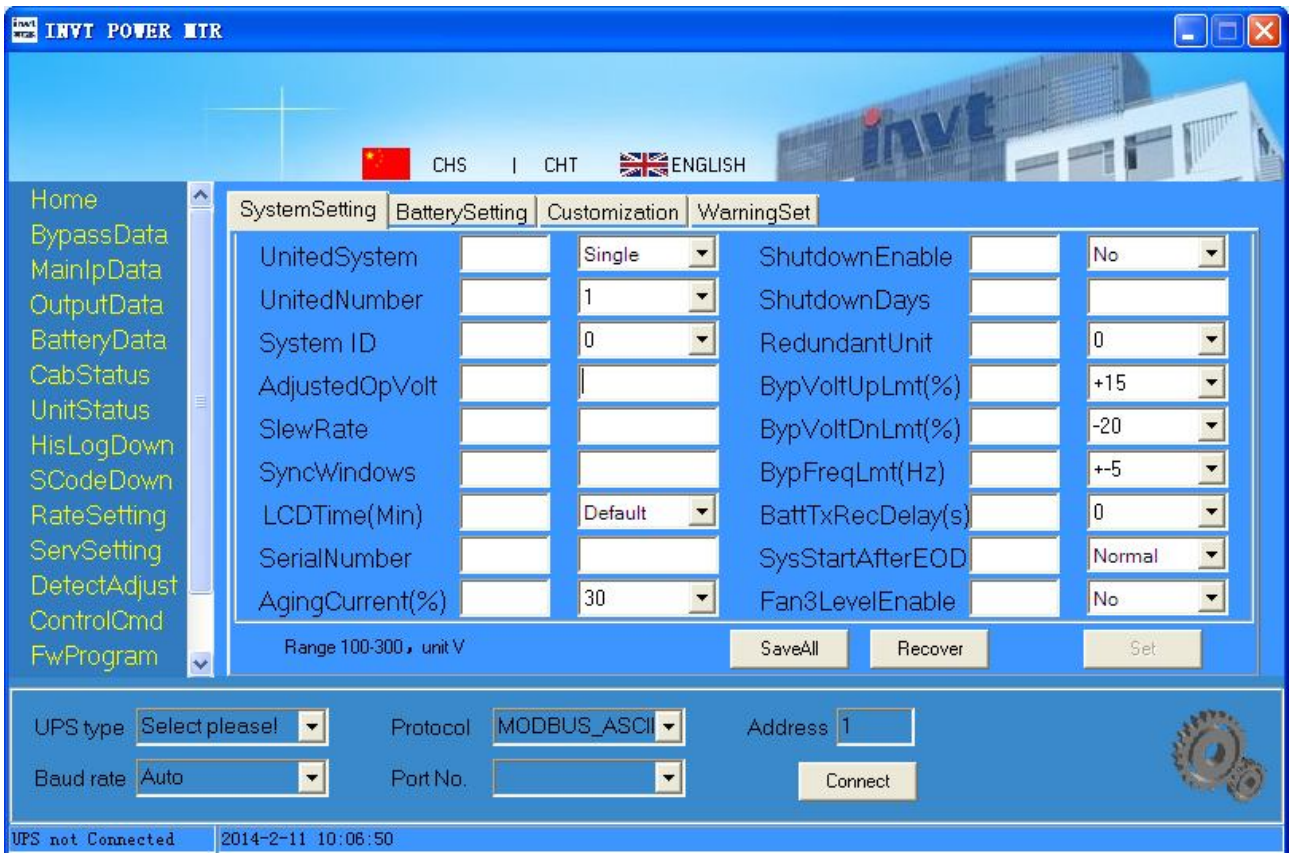
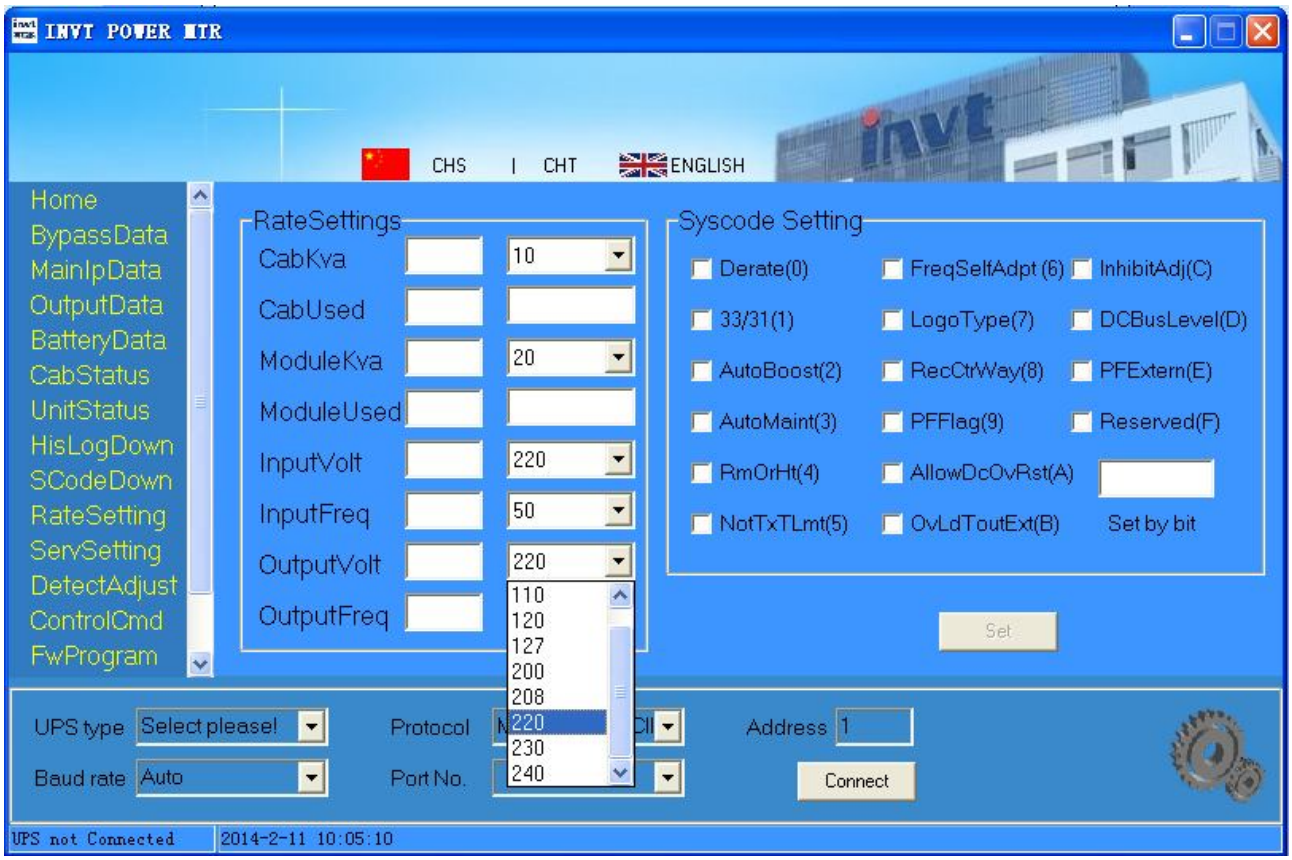



**Fig.1**

2. After you chose UPS type, press "Connect", then UPS is connected with computer.

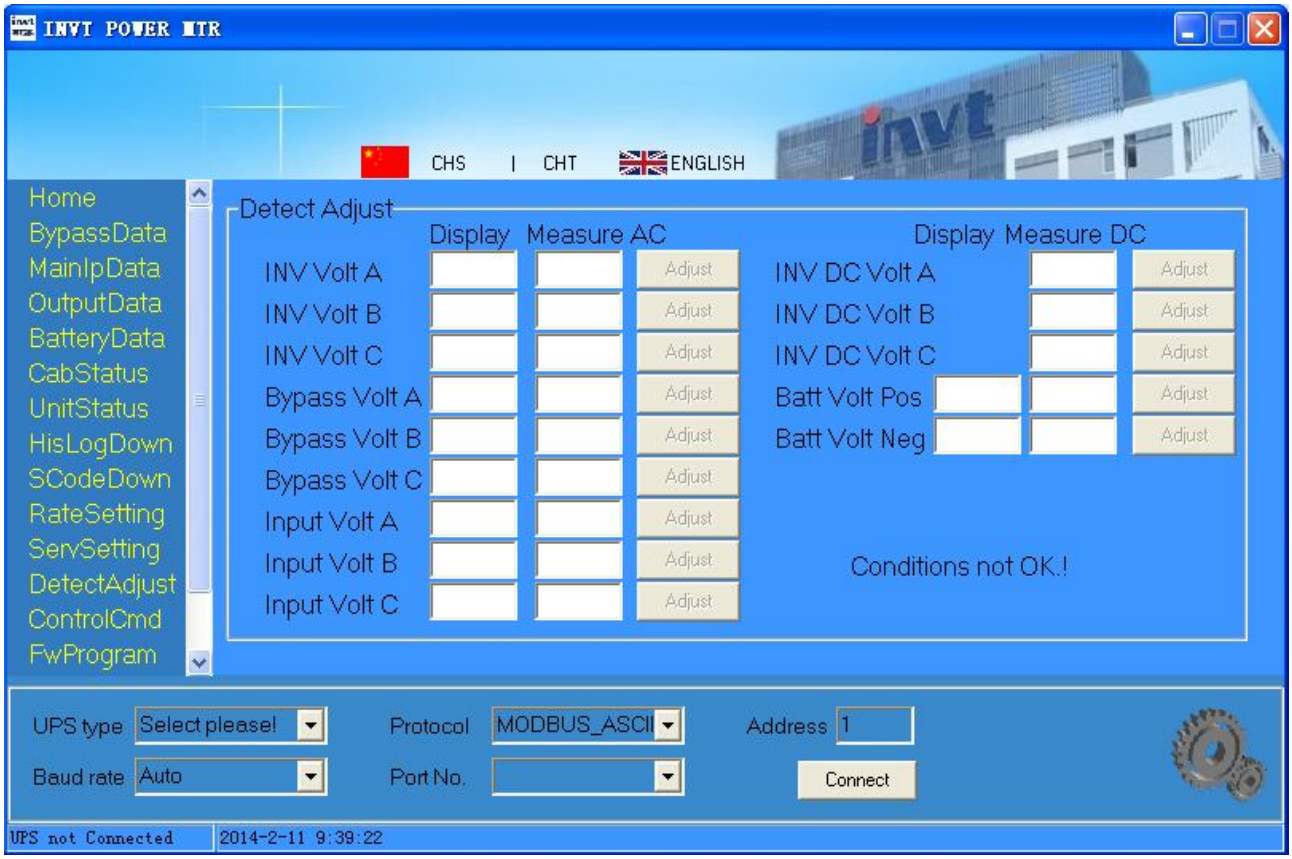



3. INV output voltage tiny regulation: Set "AdjustedOpVolt" values, then press the "ENTER" key, output voltage will rise (drop) .



4. INV output voltage setting: Type "OutputVoltXXX" command (XXX is 220/230/240), then press the "ENTER" key, INV output voltage will be set to 220V/230V/240V.

**Regulation Process for Single UPS**




INV output voltage regulation: When the UPS run into the Inverter mode, measure the output voltage with the multimeter. Then regulate the output voltage to 220±0.5V by using output voltage regulation command. (INV output voltage can be regulated about 0.8V every point by using output voltage regulation command).

**Notes:**

1. be sure the ground of the UPS connect earth safely while parameter regulation.
2. The new assembly UPS must be regulated.
3. The UPS who have been replaced CNTL/PSDR must be regulated again.
4. All the commands use capital letters.
5. All the above parameter regulation cannot be accumulated.
6. All the regulation will be saved in CPU of the CNTL. So if you want to re-regulate the CNTL, you should reset the CPU and clean all the parameters setting by the following commands:

BUSP+00

BUSN+00

V+0

After all the commands have been executed, CPU be reset and then we can re-regulate the UPS according to the above regulation process.

7. If you are not sure whether the CNTL has been regulated, reset before your regulation

## 5.4.3 Quick Start

Before any detail check of UPS, please check the components listed in the following table. This action could help you find problem quickly and make following debug procedures go smoothly.

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

| **Related Circuit Block** | **Components to be checked** | **Component Type** | **Fail condition** |
|---|---|---|---|
| BAT FUSE | F2 | Fuse | Open |
| I/P FUSE (on PSDR) | F1 | Fuse | Open |
| PFC | D1,D2 | Diode | Short or open |
| | Q3, Q4, Q5, Q6, Q7, Q8 | IGBT | C-E short or open |
| | Q1,Q2 | SCR | short |
| INV | 6K slave board: Q4, Q6 | IGBT | C-E short or open |
| | 10K(S)/20K/15K master board: Q2, Q4, Q5,Q6 | | |
| Charger | Q1 | MOSFET | D-S short or open |

| | | | |
|---|---|---|---|
| | D1, D2 | Power Diode | Short or open |
| | D3 | Rectifier | Short or open |
| | F1,F2,F3 | Fuse | Open |
| SPS | Q10 | MOSFET | D-S short or open |
| | D32，D47 | Power Diode | Short or open |
| | F1 | Fuse | Open |

If the fuse is open, replacing fuse only **DOES NOT** mean you have solved the problem. In most case, open of fuse is caused by other failure of components; therefore, before restart that UPS, you must find the real failure components and replace them!

## 1． PFC Analysis:

Most problem of PFC can result to component damage: I/P Fuse, the IGBT, the DIODE, and the SCR and the driver resistor. When checked PFC Part, directly checked the IGBT with resistor probe or the DIODE with voltage probe with multimeter.

| **Item** | **Checked components** | | **Instrument function** | **Reference Value** | **Failed condition** |
|---|---|---|---|---|---|
| 1 | F1,F2 | | Resistance | About 0.4 Ω | Open |
| 2 | Q1, Q2 | (A, K) | Resistance | ≈1.4MΩ | Short |
| | | (G, K) | Resistance | ≈30Ω | Short |
| | Q3, Q4, Q5, Q6, Q7, Q8 | (E, C) | Resistance | ≈800kΩ | Short |
| | | (G, E) | Resistance | 47.5 kΩ(6KS) | Short or open |
| | | | | 15.8KΩ | |
| 3 | Q3, Q4, Q5, Q6, Q7, Q8 | | Body Diode Voltage Droop | About 0.35V | Short or open |
| 4 | R120 | | Resistance | About 40Ω | Short |

| | | | | | |
|---|---|---|---|---|---|
| 5 | R118,R119 | | Resistance | About 33Ω | Short |
| 6 | D1, D2 | | Diode Voltage Droop | About 0.35V | Short or open |
| 7 | R8,R9,R11,R12,R13,R14 | | Resistance | 10Ω | Infinite or value change |
| | R85,R86,R87,R88,R89,R90 | | Resistance | 51KΩ | |
| 8 | Q14 | (A, K) | Resistance | ≈2.5MΩ | Short |
| | | (G, K) | Resistance | ≈30Ω | Short |

## 2． Inverter Analysis

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

| **Item** | **Checked components** | | **Instrument function** | **Reference Value** | **Failed Condition** |
|---|---|---|---|---|---|
| 1 | D16, D17, D18 | | Diode Voltage Droop | About 0.36V | Short or open |
| 2 | 6K(S): Q4, Q6 | (C, E) | Resistance | 100 KΩ | Short |
| | | (G, E) | Resistance | 51KΩ | |
| | 10K(S): Q2, Q4, Q5, Q6 | (C, E) | Resistance | 100 KΩ | |
| | | (G, E) | Resistance | 25.5KΩ | |
| 3 | 6K(S): | R50 | Resistance | 10Ω | Infinite or value change |
| | | R49,R55, R56 | Resistance | 20Ω | |
| 4 | 10K(S): | R50,R52 | Resistance | 10Ω | Infinite or value change |
| | | R49,R51,R55, R56, R57, R58 | Resistance | 20Ω | |
| 5 | D9,D10 | | Diode Voltage Droop | About 0.36V | Short or open |

If fail condition stated in item 3 occurs, it is very possible that the corresponding IGBT driver module is damaged, so please try to change the IGBT driver module.

## 3. SPS Analysis

| Item | Checked components | Instrument function | Reference Value | Failed condition |
|---|---|---|---|---|
| 1 | Q10 (S, D) | Body Diode Voltage Droop | About 0.42V | Short or open |
| 2 | Q10 (G, S) | Resistance | About 46.8KΩ | Short |
| 3 | F1,F2 | Resistance | About 0.4 Ω | Open |
| 4 | D38,D39,D59 | Diode Voltage Droop | About 0.48V | Short or open |
| 5 | U11,U12,U13,U14 | Resistance | About 1.44MΩ | Short |

## 4．1A Charger Module Analysis

| Item | Checked components | | Instrument function | Reference Value | Failed condition |
|---|---|---|---|---|---|
| 1 | Q1 (S, D) | | Body Diode Voltage Droop | About 0.48V | Short or open |
| 2 | Q1 | (G, S) | Resistance | About 32.8KΩ | Short |
| | | (D, S) | Resistance | About 10MΩ | Short |
| 3 | F1, F2, F3 | | Resistance | About 0.4 Ω | Open |
| 4 | D3,D5 | | Diode Voltage Droop | About 0.43V | Short or open |

## 5．5A Charger Module Analysis

| Item | Checked components | Instrument function | Reference Value | Failed condition |
|---|---|---|---|---|
| 1 | F1.F2.F3 | Resistance | About 0.4Ω | Open |

| Item | Checked components | | Instrument function | Reference Value | Failed condition |
|---|---|---|---|---|---|
| 2 | D1, D2, D3, D5, | | Diode Voltage Droop | About 0.5V | Open/Short |
| 3 | Q1 (S→D) | | Body Diode Voltage Droop | About 0.45V | Open/Short |
| 4 | Q1 | (G, S) | Resistance | About 45KΩ | Short |
| | | (D, S) | Resistance | About 3MΩ | Short |

## 6. Test and Finish

After replace all defected components on power stage, following test the steps can be adopted to verify the repair result and the reliability of the UPS.

1. Connect all of boards, cable, and connector right to place.
2. Check the Wiring
3. Apply DC Power from power source with current limitation function to the BAT terminal on the PSDR
4. Press the ON-switch on front panel for more than 2 seconds until you hear the note ringing and loosen the button, you will see "current limit" for a short time on the DC power supply for about only 2 seconds, then UPS should be DC started, If UPS does not start successfully, no LED indicator is lightened. Please try diagnosing procedure again.
5. If UPS does not start up for several trying or DC power supply is on current-limit state continuously, there must be some defected components exists. Please follow trouble-shooting chart to debug again.
6. Stop the UPS; apply AC mains to the UPS module. Try on the UPS. If fail you may have start one new round of trouble shooting
7. Check and adjust Charging Voltage

8. Check the output voltage waveform and DC-offset voltage, at no-load and full load condition.