

User's Manual of Faratel UPS Smart Ferro Resonant Series

Models:

■ SFR3000-DT

■ SFR5000-DT

Read This First!

Faratel Message

Thank you for selecting this product of Faratel Company.

Entering the third millennium, Faratel with the idea of being pioneer of electronic industries, make effort to provide new products with up to date technology and try to support the satisfactory and necessity of its customers by improving the quality of products.

All Faratel's Departments are ready to receive any comment from customers by phone, fax or email.

Please Save This Manual!

It includes important instructions for the safe use of this UPS and for obtaining factory service should the proper operation of the UPS come into question. In that case please save it for future refers.

About this User Manual

- While reading this manual you may face to some words as "Front Panel" or "Rear Panel". Please refer to Appendix 2 and 3 for the related figures.

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1- Package Content

- UPS System
- User's Manual
- CD-ROM of UPSwing Family Softwares
- RS232 Interface Cable
- Telephone Cable
- Four Female plastic legs in SFR3000-DT
- Spade Terminals (6 PCS) with cable ties (2 PCS) in SFR5000-DT
- Guarantee License
- List of Authorized Support Representatives in Iran

2- Introduction of Product

Faratel Smart Ferroresonant UPS series are designed with Ferroresonant technology and can provide pure sine wave in output independent from input AC line even in power failure.

It can protect computers and peripheral devices from utility line failures which may result in the loss or corruption of valuable data or make some hardware damages. In the event of a utility failure such as a blackout, brownout or sag, the UPS rapidly (0msec) transfers loads (computer equipment) to an alternative power source which is derived from a battery within the UPS and provides the user with ample time to save files and properly close operations.

Faratel SFR series are equipped with smart micro-processing system to check for proper operation of UPS and find probable errors in any part of the UPS.

SFR UPS series are designed for Computer systems, medical devices, Telecommunication or any other power sensitive devices.

Note:

Refer to Appendix 1 to check the Block Diagram of internal structure of UPS.

2-1- Advance Features

- Ability to remove EMI and RFI Noises
- Power Factor Correction
- System modulated for better and easy Servicing
- Equipped with External Battery Connector
- Includes Switch mode Charger
- Equipped with Smart RS232 Port
- Includes UPSwing Pro software for controlling and monitoring UPS, auto saving open files and shutdown OS and UPS in critical events
- Includes Test Button for checking if UPS works properly in lack of AC line Voltage
- Intelligent Microprocessor controlled
- Cold Start
- Automatically Battery Charging in UPS off mode
- Ability to add UPS Device Managers as SNMP Cards (Optional)

2-2- Protection Systems

- Lightning, Spike and Surge Protection
- Spike protection and reduction in scale of 2000V:1
- Back Feed Protection on Battery Mode
- Protection against two phased AC line
- Protection against output voltage variations out of range
- Protection against Input voltage and frequency variations
- Over Heat protection
- Common Mode Noise protection
- Output short circuit and overload protection
- Reversed Battery connection protection
- Charger short circuit protection
- Battery Terminal short circuit protection
- Protection against over-discharge

- Protection against upper battery charger voltage
- Tel/Fax/Modem/Network Surge Suppression

3- UPSwing Family Software

There is a CD-ROM in UPS Package which includes all UPSwing family softwares. After installing the UPS as following current user's manual, you can install the Single User version of UPSwing Pro Software free of charge.

Briefly, the Faratel UPS management Family Software have four main duties as below:

- 1- Auto Saving Mechanism: Auto saving applications and open files, downing OS(s) safely and power off the UPS in critical events as the end of backup time
- 2- Monitoring UPS: On-line Monitoring all main parameters and different status of AC line and UPS (locally or remotely)
- 3- Controlling UPS: Ability to sending on-line/scheduled commands to UPS to change the internal UPS settings (locally or remotely)
- 4- Event Messenger System: Uses so many tools as email, SNMP Traps, SMS and etc. for sending alarm or message in any different conditions of UPS and AC line also the ability of registering different events in text files and the facility of events commentary.

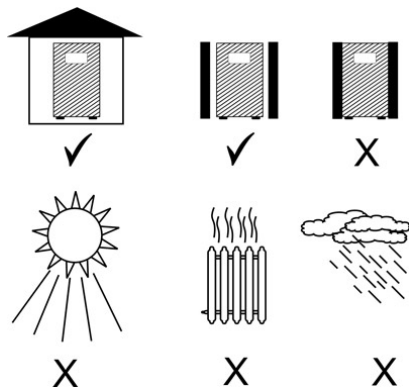
Note:

- Description of choosing appropriate software and the way of installing and using software is in PDF file named software user's manual that is available on CD-ROM.
- Installing all kinds of Faratel Software is considered as customers responsibilities.
- There is some more about the Faratel Family Software in Appendix 5.
- Refer to <http://www.faratel.com/software/> (Faratel Website) for more details about the UPSwing Power Management Software, downloading the latest version of

software, sizing the network by Faratel Software or finding the User's Manual of the Software.

4- Placement

- In order to place the UPS please pay attention to the following points:
- The UPS should be installed in protected environment. The location should provide adequate air flow around the unit, in an atmosphere free from excessive dust, corrosive fumes or conductive contaminants.
- Position the UPS to allow at least 10cm clearance with other devices. Keep the ventilation intake open.
- Do not operate the UPS in an environment where the ambient temperature or humidity is outside the limits given in the Appendix 4 (Technical Specification Table).
- UPS should be placed stand-up on an even surface. The Rack-mount models should be installed correctly inside the Rack.
- UPS and its Battery Cabinet connection cables should not be placed on passage.



5- Connections and installing the UPS

5-1- RS232 interface Cable Connection (Optional)

- In order to use the advantages of UPSwing Pro Family Software you need to connect the Serial Cable to Computer.
- Please turn off computer and UPS before connecting the cable to them, then connect the Male side to UPS and the Female side to one of the Computer COM Ports.
- Although the UPS do its own duty without using UPSwing Pro but it is recommended.

5-2- Telephone/LAN Cable Connection (Optional)

In order to have surge protection for your Telephone, Modem, LAN or any other devices, connect the data line to INPUT RJ45/11 socket (in rear panel) and by using another data cable connect your device to OUTPUT RJ45/11 socket. A telephone cable is contained in UPS package to use for connecting the Telephone, Modem and etc. to OUPUT socket.

5-3- UPS Device Management Connection (Optional)

- UPS can be under monitoring or managing via network in two ways that the first way comes to our notice in this part.
 Direct way: by using UPS Device Management (Internal or External hardware devices)
 Indirect way: by using UPSwing Software Family
- Before buying any UPS Device Managements please check with Faratel Authorized Customer Services to avoid from any UPS or device damaging.
- While installing the device turn off the UPS, open the Screw of intelligent slot cover on real panel and enter the card in the slot carefully, then fasten related screws.
- In order to install the UPS Device Management refer to its own user's manual.

- Refer to Faratel web site or UPSwing user's manual for more information about ways of UPS remote controlling.

5-4- Battery Cabinet Connection

- In order to provide power for loads in power fail mode, connect the Battery Cabinet to UPS.
- The Battery connectors have high voltage so for connecting or disconnecting the Battery Cabinet, turn off the UPS.
- If there is breaker on the battery cabinet before connecting any thing to the UPS, turn off the breaker.
- If you use a Battery Cabinet with its own charger check UPS rear panel to see if it has special outlet for the power of the charger or not. If yes please connect it otherwise make sure in three phase wiring the input line for both UPS and Battery Cabinet must come from the same phase.
- It is not possible to connect any kind of Battery Cabinets to the UPS. They should be compatible in voltage. In that case for sizing battery cabinet refer to Faratel web site or call Faratel Sales Department.
- Read the user's manual of Battery Cabinet before using or installing.
- In order to check the runtime versus load table, refer to Faratel web site.

5-5- Loads Connection

- Before connecting any load except Computers please call Faratel Authorized Customer Services for avoiding any problem with UPS or the loads. Do not connect any Platters or Leaser Printers to UPS.
- In SFR3000 Connect the Computer equipments plugs to UPS output Receptacles. There is two output Receptacles on rear panel of SFR5000 that it's possible to connect 10A to each of them or 16A load to both. For more loads use the output terminals on the rear panel. For more information about connecting to input/output terminals refer to "AC Line Connection" part in current user's manual.

- Pay attention that connected loads just obtain their earth connection from UPS and do not have any other patch to the earth. Also for earth system bonding, it is recommended to use the earth screw on the rear panel of UPS.
- It is recommended to use just 70% of UPS nominal power.

5-5-1- Estimating Power of Valid Loads

Follow as below to estimate the total power of loads and check if it is possible for UPS or not.

- 1- Make the list of loads.
- 2- Computer equipment manufacturers must provide a load rating for their products. Usually, the rating is written on a name plate or label nears the line cord in VA. If there is not, read the Current in Ampere (A) and the Voltage in Volts (V) and multiply them to find out the Power of each load in VA.
- 3- Sum all the VA values to find out the total power of loads. The result value should not be more than UPS nominal power. As mentioned before it is recommended to use 70% of UPS nominal power.

5-6- Earth & AC Line Connection

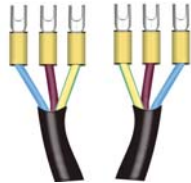
- Please make sure that the receptacles and connection wires are grounded.
- There shouldn't be any connection between input and output wiring of UPS. It means wiring should not use Neutral sharing. For checking the correct wiring, refer to Appendix 6.
- After AC line connected, if SWF (Site Wiring Fault) LED indicator on rear panel turns on, first check if the input Line (Phase) and Neutral is not reversed. If the indicating continued the problem should be caused by bad grounding (Earth Fault) which should be solved by Customer. In order to calculate the Earth Impedance refer to Appendix 7.
- In SFR3000 Model for earth system bonding, it is recommended to use special earth connection screw on the rear panel. In this case even if you get the plug out from outlet, the connection of earth system will be available. Pay attention

that earth wire of receptacles and earth wire connected to the screw both coming from the same point and there shouldn't be voltage difference between them.

- The earth hole must be built upon Iranian Construction Engineering instructions. Standard earth connection is necessary for safety of users and protection against common mode noises. If there is not appropriate earth hole, just for reducing common mode noises you can use the connection of UPS frame to the metal frame of building or metal water pipe.
- For SFR3000 connect input plug to the wall outlet.
- SFR5000 has input/output terminal. Follow the below steps to connect AC line and loads.


1- Prepare two PCS of 3 conductor cable having 2.5mm² with 2m length. For more distances, use thicker cables.

2- There are six Spade Terminals in the UPS package. Crimp them to one side of both cables as below figure. If you have not Crimper, solder them.



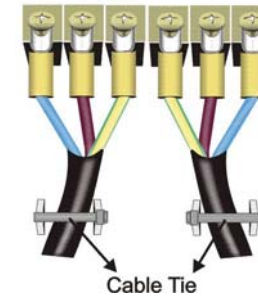
3- Open the cover of Terminals from rear panel of UPS.

4- Now, connect input and output cables to input and output Terminals of UPS correctly. Please pay attention to the sequence of Line, Neutral and Ground (as described in below table).

Symbol	Description	Wire Color
L	Line	Blue or Black
N	Neutral	Brown
	Ground	Yellow/Green

5- in order to avoiding from pulling the cables use two cable ties which are

included in UPS package and tie the cables as below figure.



6- Now the input cable should connect to the AC line by 50A Circuit Breaker which is installed on the wall with correct Line and Neutral connection. Also connect the loads to the output cable as mentioned in the current user's manual.

7- At the end, fix the cover of terminal to its place.

6- Controlling Operations

6-1- Power On UPS

- After choosing the best place for installing the UPS, according to current user's manual, it is the time for power on and using the UPS.
- If this is the first time for power on the UPS, please charge the batteries for 10 hours. In order to charging, just connect the UPS to AC line. It means UPS charger do its job even the UPS is in Power off and the AC line is connected to UPS.
- In order to power on the UPS, become sure that the input circuit breaker on rear panel of UPS is in ON mode. If the input voltage and frequency are in normal range, UPS powers on Normal mode otherwise UPS uses batteries for output and powers on in Battery mode.

6-2- UPS Test

- The Test function allows you to check for proper operation by initiating a transfer to on-battery operation. This test ensures that UPS will support the system load during an actual power disturbance. By using the Test function throughout the life of the UPS, you can estimate when the UPS's battery should be replaced.
- By pushing TEST/MUTE button for a moment from front panel of UPS the test function starts. After the process, by observing LED indicators which are displayed in "LED Indicators and Audible Alarms" or using advance tools in UPSwing Pro Software you can check if the Batteries are OK or needed to replace or charge them.

6-3- Mute/Unmute Audible alarms during Power Failure

While UPS is supplying output provided by Battery, the UPS internal audible alarm is beeping. In Battery Mode by pressing "TEST/MUTE" button (Placed on front panel) for more than 1 second, the sound alarm will disabled, for enabling audible alarm UPS must be turn off and turn on once.

6-4- Power Off UPS

For turning off the UPS, turn circuit breaker on rear panel to "OFF" mode. In order to switch off the input AC line, disconnect input plug in SFR3000 and input terminals in SFR5000, otherwise UPS will charge the batteries.

6-5- Controlling by UPSwing Pro Software

By installing UPSwing Pro Software and depends on Firmware version of UPS you will achieve to send some commands or change some settings of UPS which are listed in below:

- Ability to send Shutdown command in Power Fail Mode to save Battery charge. UPS will automatically power on when the AC Line becomes normal.
- Ability to Test UPS manually or by schedule (Daily, weekly, monthly and etc.)

- Ability to set the UPS work time by scheduling the Sleep and Wake up time weekly or by date
- Ability to set the UPS not to wake up on battery mode.
- Ability to mute or unmute the UPS sound alarms as Power Fail, Site Wiring Fault and etc.
- Ability to send restart command for restarting the Computers and UPS
- Ability to set UPS to turn off on battery mode while there is no load.
- Ability to set UPS Sleep/Shutdown delay because of unknown Computers shutdown time
- Ability to enter Ampere per Hour value of battery for better indicating charge value

7- UPS Status Indicators

There are 2 ways for getting the UPS operating status:

- 1- By using UPSwing Pro Software
- 2- By LED indicators in front/rear panel of UPS, audible alarms or combination of them

7-1- UPSwing Pro Event Messenger System

- By installing UPSwing Pro you can monitor all statuses of UPS and AC line locally or via network. Some parameters of monitoring are mentioned such as: Input/output Voltage, Load Level, Battery Level, Input/Output Frequency, UPS Model, UPS Nominal Power and etc.
- Also UPSwing Pro notices some events and statuses such as: On Battery, Site Wiring Fault, Standby, Over Heat, Fault, Overload, Normal, Bad V Out, High Bat, Battery Defect, Enable/Disable Audible Alert, Low/Weak Battery, Low/High Voltage, Power Fail and etc.

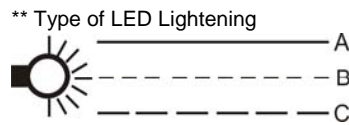
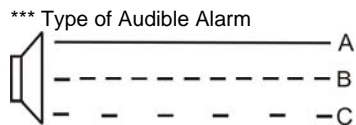
- UPSwing Pro equipped with a great Event Messenger system which contains some strong tools. By these tools the user can receive the message of any event status in different ways which are described below:

- Ability to pop up a message in corner of monitor screen or by pop up a new page when you are monitoring the UPS via web in order to notice the events
- Ability to play user defined wave files in any different conditions
- Ability to send messages via pager
- Ability to dial up and send voice message of any events
- Ability to execute user defined files in each condition of UPS.
- Ability to send Fax of the latest events by UPSwing Telephony
- Ability to send emails, SNMP Traps, SMS in all different events

7-2- LED Indicators and Audible Alarms

UPS indicates operating status using a combination of visual and audible indicators.

In following there is a table which describes the different statuses and events. The numbers in column "*" define the place of the LED indicator in figures which are in Appendix 2 (Front Panel View) or Appendix 3 (Rear Panel View). Also the columns "***" and "****" is defined in the following figures which show the type of LED lighting and audible alarm.



*	Visual Indicators		***Audible Indicators			Status/Event Description
	Name	**Lightning				
2	Output	On	A			Existence of AC line in UPS output
		Flashing	B			Waiting for connecting AC line after seconds
3	AC IN	On	A			Suitable input voltage
		Flashing	B	Beeping	C	Input voltage/frequency is out of range
4	Charger	On	A			While charging batteries
5	Low Battery	On	A			Back up time of batteries is finished and they need to be charged
		Flashing	C	Beeping	B	Battery supporting isn't enough while disconnecting AC line
6	Inverter	On	A	Beeping	C	UPS has been supported by Battery
7	Over Load	On	A	On	A	Over Load more than 150% of nominal power so UPS will turn off quickly
		Flashing	C	Beeping	B	110%~150% of nominal power if loads don't have been reduced until 1 minutes, UPS would turn off after 3 minutes
8	Fault	On	A			Battery voltage is high In AC Mode: UPS will turn off after 2 minutes In Battery Mode: UPS will turn off rapidly
		Flashing	C	Beeping	B	Rising internal temperature of UPS and after 2 minutes it will turn off
8, 5	Fault/ Low Battery	On	A			Test result: Battery is too low or spoiled and need to charge for at least 10 hours
		Flashing	C			AC Mode: Battery is too low and need to charge for at least 10 hours
8, 2	Fault/ Output	Flashing	C	Beeping	B	Out put voltage is abnormal UPS will turn off after 2 minutes
10, 9	Sleep	Flashing around	B			The UPS has slept by UPSwing Pro software and will wake up manually or by scheduled settings.
3 (Rear panel)	Site Wiring Fault	On	A	Disable ⁽¹⁾	A	Input "Line" and "Neutral" wires are reversed or the ground wiring is missing for debugging reverse the plug otherwise check the ground

1- Audible Indicator will be enabled or disabled by UPSwing Pro software

8- Important Safety, Maintenance and Storage

- During the environment where the ambient temperature is -15°C to $+30^{\circ}\text{C}$, charge the UPS's battery every 6 months and it reduces to 3 months in $+30^{\circ}\text{C}$ to $+45^{\circ}\text{C}$.
- Check isolation of input and output connection cables monthly.
- Do not dispose of Batteries in a fire.
- Hazardous live parts inside the UPS are energized from the battery supply even when the input AC power is disconnected. In that case, the risk of electric shock is existing so do not remove cover of UPS.
- Do not touch external battery cabinet terminals, it causes electronic shocks.
- Do not open or mutilate the Battery, released electrolyte is harmful to skin and eyes.
- Keep the UPS clean, uncover and vacuum the ventilation intake periodically and wipe UPS with soft loose and damp cloth.
- Do not stack material and liquids on the UPS.

9- Terms of Guarantee

Faratel guarantees the operation and quality of its UPS for one year. In order to use Faratel Customer Services, Guarantee License (which included in UPS package) should fill by Faratel representative and post Customer Service section to Faratel. If any trouble occurs while UPS operating, first take a note of model and serial number of UPS then contact with nearest Faratel representative.

These instances are out of guarantee:

- Non-observance the points which are in user's manual and Guarantee License
- Non-observance of correct wiring or earth connection
- Opening the cover of case or repairing the UPS by not authorized representatives
- Not filling or not sending the Guarantee License (contains in UPS package) to Faratel Central Customer Support Service after 1 month of buying
- Any damages as a result of wrong operation, dropping from height, crash, heat to other things, fire, earthquake or being in touch with water or acid and any other similar things
- Not installing or using the batteries inside the UPS or battery cabinet after 6 months

10- How to Contact Faratel

10-1- Central Customer Service

Address: Faratel, Shahid Abdolrahimi St., 17 Shahrivar St., Sanay-e Felezi St., Fifth Kilometer of Old Karaj Rd., Tehran, Iran
 Postal Code: 1378763511
 Telephone: (+98 21) 6680 9495 up to 7
 Fax: (+98 21) 6680 5525
 Email: support@faratel.com
 URL: <http://www.faratel.com/support/>

In order to find the nearest authorized representatives of Customer Service in Iran please refer to the above URL or the list which is included in UPS package.

10-2- Central Sales Department

Address: Faratel Bldg., No. 21, Kandovan Alley (Opposite of Nejatolahi St.), Enqelab St., Tehran, Iran
 Postal Code: 1131834914
 Telephone: (+98 21) 6670 0001 up to 5
 Fax: (+98 21) 6670 9493
 Email: sales@faratel.com
 URL: <http://www.faratel.com>

Appendix 1: UPS Block Diagram

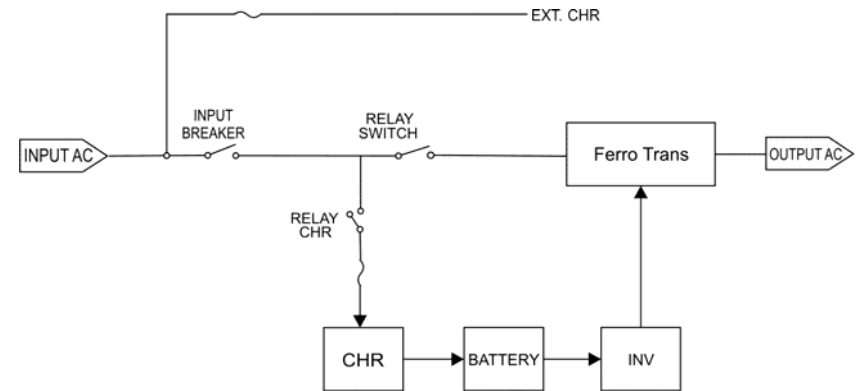


Figure 1: Block Diagram of SFR UPS series

Appendix 2: Front Panel View

The meaning of each indicator or operations of the buttons are described in this User's Manual especially in "UPS Status Indicators" and "Controlling Operations".

- 1- TEST/MUTE Button
- 2- OUTPUT Indicator
- 3- AC IN Indicator
- 4- Charger Indicator
- 5- Low Battery Indicator
- 6- INV/BAT Indicator
- 7- Over Load Indicator
- 8- Fault Indicator
- 9- Load Level Indicators
- 10- Battery Level Indicators

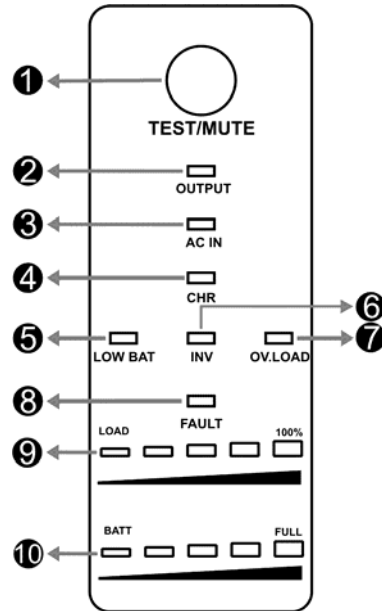


Figure 1: Front Panel of SFR UPS Series

Appendix 3: Rear Panel View

- | | |
|---|--|
| 1- Input AC Line Cable/Terminal | 9- Receptacle for Charger of External Battery |
| 2- Input Fuse/ Breaker | 10- Input Fuse for Charger of External Battery |
| 3- Earth Connection Screw | 11- Smart RS232 Port |
| 4- Site Wiring Fault Indicator | 12- Intelligent Card Slot |
| 5- Output Receptacles/Terminal | 13- Modem/Network Surge Protection |
| 6- Especial Fuse for Output Receptacles | 14- Fans |
| 7- External Battery Connector | 15- On/Off Breaker |
| | 16- Terminal Cables Keeper |

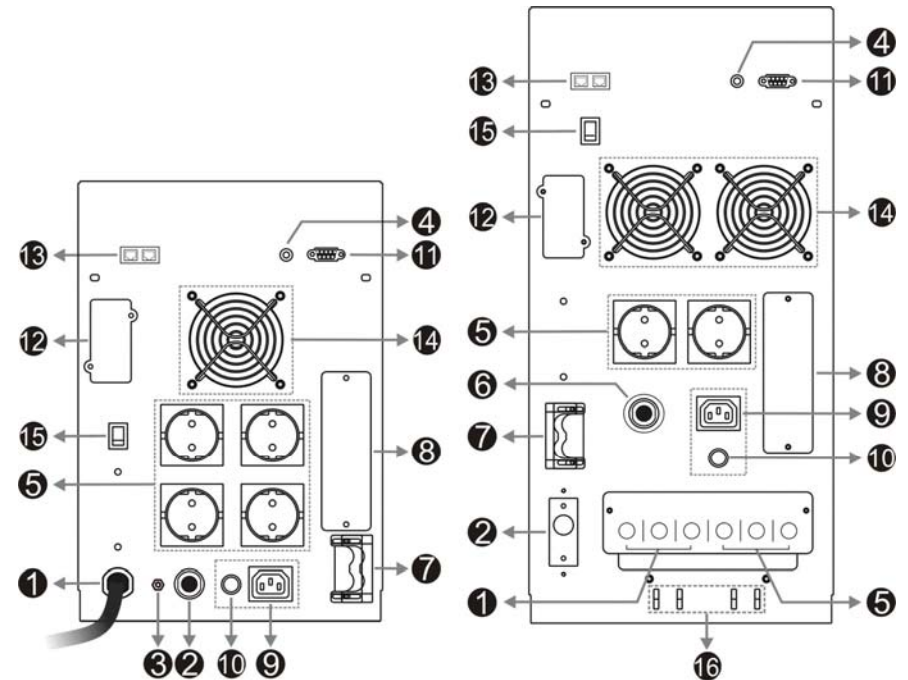


Figure 1: Rear Panel of SFR3000-DT

Figure 2: Rear Panel of SFR5000-DT

Appendix 4: Technical Specification Table

Model		SFR3000-DT	SFR5000-DT
Technology		Ferroresonant	
Power		3000VA - 1800Watt	5000VA - 3000Watt
Input	Voltage	170~260VA	
	Max. Current	20A	30A
	Frequency	48.5Hz~52.5HZ	
	Phase	Single Phase	
	Power Factor	0.9	
Output	Voltage	220 VAC±2.5% Pure Sine Wave	
	Current	13.6A	22.7A
	Frequency	AC Mode: Synch With Input Battery Mode: 50Hz±0.5%	
	Phase	Single Phase	
	Nominal Power Factor	0.6	
	THD	<4% at linear load	
	Overload Capacity	110%~150% of nominal power for 3 Minutes	
Battery	Type	Sealed Lead Acid Batteries with Free Maintenance	
	Voltage	48VDC	
	Internal Battery	Has not	
	Recharge time	10 hours after 90% discharge	
	External Battery	Equipped with External Battery Connector	
Efficiency		80% in Normal Mode	
Transfer time		0msec	
Physical Specification	Dimension(W*D*H)(mm)	250*514*374	250*838*575
	Shipping Weight (Kg)	52.4	107
	Net Weight (Kg)	50.5	100.3
Environment	Audible Noise	Less than 50dB at 1 meter from surface	
	Ambient Operation	0-40°C	
		0 ~ 95% humidity non-condensing 1000 meters max. elevation	

Appendix 5: Faratel Software Products

Faratel has designed UPSwing Family Softwares for Monitoring and Controlling the UPS locally or remotely. The below table shows the Faratel software products are divided into two main groups.

Software		Summary of Usage
UPSwing Pro/Plus	Single User	This software is designed for Windows OS to monitoring and controlling the local UPS via RS232 connection. This software is free of charge and every one can download the latest version from Faratel website for installing and using.
	Network Support	This Software is designed for monitoring and controlling the local and remote UPSs. This Software supports HTTP and TCP/IP protocols for having the remote managing. Also this software can make connection to UPSwing Netshut. In order to install and using this Software you need to buy License Cards from Faratel Sales Department.
UPSwing Netshut		This software installs for client PCs or other Servers to make communication with UPSwing Pro Family Software to receive Shutdown commands in any critical events of UPS. UPSwing Netshut will save the open files automatically, close applications and down the OS normally after receiving the Shutdown commands. In order to install and using this software you need to buy a License Card (for each Client) from Faratel Sales Dept.

All above Software support the following Operating Systems:

Windows, Linux, SCO UNIX, SCO UNIX Ware, FreeBSD, Sun Solaris, OS/2, Novell, HP-UNIX

Note:

Please refer to <http://www.faratel.com/software/> for more information.

Appendix 6: Checking Isolation between input and output

- Purpose:

In order to use and operate the UPS, input and output wiring must be isolated. For confidence, do the below test and check if the input line and neutral is completely isolated from output line and neutral.

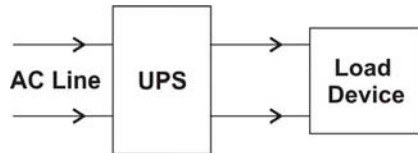
- Required tools for testing:

1- One Lamp with its holder

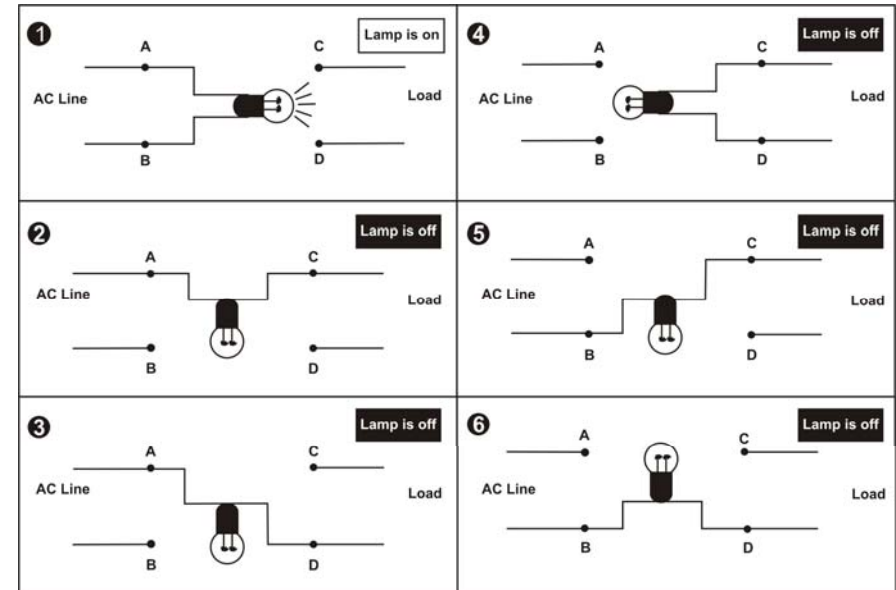
Note: Use two serried lamps if there is a case of two or three phase in wiring.

2- Electrical wires for connections

-Test recipe and results:



According to above figure, UPS is installed between AC Line and load device. By using lamp instead of UPS in different case (6 cases) as the following figure we expect that the Lamp lights just in one case. Just by this way we become sure about the input and output isolation.



Appendix 7: Simple way for Calculating Ground Impedance

- Purpose:

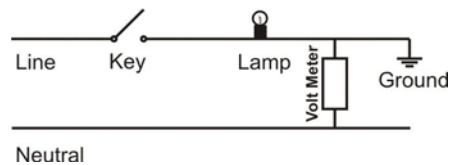
A good ground system is required for installing and using the UPS. Therefore, the below test will show how to calculate the ground impedance and finding if it has a good status or not.

- Required tools for testing:

- 1- One 100Watt Lamp with its holder
- 2- One Voltmeter
- 3- ON/OFF Key
- 4- Electrical wires for connections

-Test recipe

1- Connect lamp, volt meter and key as following circuit to line and neutral.



2- Turn the Key to OFF mode (lamp is off) and read the AC voltage from voltmeter and set it to V1.

3- Turn the key to ON mode (lamp is on) and read the AC voltage and set it to V2.

- Calculating:

1- The Current of 100Watt lamp in ampere calculate as below formula.

$$I_{Lamp} = \frac{P}{V} = \frac{100W}{220V} = 0.4545 \quad (1)$$

2- Now calculate the impedance (R) between ground and neutral from below formula in OHM.

$$R = \frac{\Delta V}{I} = \frac{V2 - V1}{I_{Lamp}} = \frac{V2 - V1}{0.4545} \quad (2)$$

- Result:

- 1- The ground system would be more appropriate whenever the value of R which calculated from equation 2 become lower.
- 2- The safety of ground system will be determined according to load and device technical specification
- 3- Whenever the calculated impedance is less than 2Ω , the ground system status is fine.