FORTE SERIES

THREE PHASE IN – THREE PHASE OUT
10-200kVA

INSTALLATION and OPERATING MANUAL

UNINTERRUPTIBLE POWER SYSTEMS

288717245 INF511-Y01-U761-1-01

Important Notices!

Thank you for choosing Inform UPS Systems.

This manual contains important information about technical properties, installation, comissioning of the UPS and contains safety information for users and loads. Learning and applying of the subjects in this manual is necessary to use UPS safely and correctly.

☞	Read the manual completely before working on this equipment!
☞	Keep this manual near UPS for easy consultation!
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☞	The manufacturer reserves the rights to change the technical specifications and design without notice.
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Units that are labeled with a CE mark comply with the Standard: EN 62040-1 and EN 62040-2.

Description of the Symbols Used in the Manual

	This symbol points out the instructions which are especially important.
	This symbol points out the risk of electric shock if the following instruction is not obeyed.
	This symbol points out the instructions, which may be resulted with the injury of the operator or damage of the equipment if not obeyed.
	All packing material must be recycled in compliance with the laws in force in the country where the system is installed.

Description of the Abbreviations Used in the Guide

UPS: Uninterruptible Power Systems
EPO: Emergency Power Off
RS232: Serial Communication Protocol
SNMP: Simple Network Management Protocol
V: Voltage
A: Ampere
P: Power

For Input, Output and Manual Bypass Circuit Breaker;
“I” (ON): Closing the Circuit
“0” (OFF): Opening the Circuit

For Battery Circuit Breaker;
Active (ON/I): Closing the Fast Fuse Holder
Passive (OFF/0): Opening the Fast Fuse Holder

Manufacturer

INFORM ELEKTRONİK SAN. ve TIC. A.S.
Emek Mah. Ordu Cad. No: 51 34785 Sancaktepe/ISTANBUL
Phone : 0216 622 58 00
Fax : 0216 621 46 55

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1. WARRANTY

1.1. Terms of Warranty

- Warranty period begins from the date of commissioning of the UPS by Inform or authorized Inform distributor technical personnel.
- The UPS including all the internal parts is under the warranty of Inform.
- If the UPS is malfunctioned because of component, manufacturing, or installation (if it's done by authorized personnel) problems during the warranty period, the UPS will be repaired without asking any price for spare parts and labor cost.

Replacements, repairs or modifications of the parts during the warranty period can not extend the duration of the warranty

1.2. Out of Warranty Terms and Conditions

This Warranty does not cover any defects or damages caused by;

- If the UPS is not used or installed according to the terms in the manual, then the UPS is out of warranty,
- Neglect, accident, misuse, misapplication or incorrect installation,
- Failure due to fortuitous circumstances or force majeure,
- After delivery of the UPS to the customer, unloading and transportation damage and failures,
- Damage or injuries caused by negligence, lack of inspection or maintenance, or improper use of the products,
- Faulty electrical wiring,
- Defects arising either from designs or parts imposed or supplied by the purchaser,
- Defects and damage by fire and lightning,
- Failures due to modification in the products without Inform approval,
- Improper testing, operation, maintenance, repair, alteration, adjustment, or modification of any kind by unauthorized personnel,

The Manufacturer will repair the device above cases for a fee and is not responsible for the shipment of the equipment.

This Warranty is not valid if the Product's Serial Number have been removed or is illegible.

2. SAFETY

2.1. Important Notice for UPS

Information related to safety of the UPS, battery, load and the user is summarized below. But the equipment should not be installed before reading the manual completely.

- The equipment may only be installed and commissioned by authorized technical personnel.
- This manual contains important instructions that you should follow during installation and maintenance of the UPS and batteries. Please read all instructions before operating the equipment and save this manual for future reference.
- Not obeying the instructions written on this manual which may be resulted with the injury of the operator or damage of the equipment.
- Even with no connections have been done, hazardous voltages and/or high temeperature may exist on connection terminals and inside the UPS. Before beginning with the any installation or maintenance, isolate the input and output of UPS and wait for 5 minutes for DC capacitor discharge. If UPS has internal battery; remove the cover of UPS and disconnect the battery cables.
- The equipment shall be packed properly during transportation and proper equipment should be used for transportation.
- The UPS must always stands in a vertical position. Make sure that the floor can support the weight of the system.
- Connect the PE ground connector before connecting any other cable.
- UPS is designed for indoor use. To reduce the risk of fire or electric shock, install this UPS in a temperature and humidity controlled indoor environment, free of conductive contaminants. Ambient temperature must not exceed 40°C (104°F). Do not operate near water or excessive humidity (95% maximum).
- Equipment and batteries whose packages are damaged during transportation shall be inspected by qualified technical personnel before starting with the installation.
- UPS requires Ph-N+PE input connection.
- It should be checked between all the terminals included PE to be sure that no hazardous voltage exists.
- Do not connect the output neutral to the protective ground or protective bounding.
- The connections shall be made with cables of appropriate cross-section in order to prevent the risk of fire. All cables shall be of insulated type and shall not be laid out on the walking path of the persons.
- Contact your local recycling or hazardous waste center for information on proper disposal of the used battery or UPS.
- Make sure that the UPS is not overloaded in order to provide a higher quality energy supply to the connected loads.
- In case of an extraordinary situation (damaged body or cabinet or connections, penetration of foreign materials into the body or cabinet etc.) deenergize the UPS immediately and consult to the Technical Service.

2.2. Important Notice for Battery

- **The batteries may only be installed and commissioned by authorized technical personnel.**
- Make sure that the battery qty is proper for the unit and they are same type and capacity. Otherwise danger of explosion and fire is within the bounds of possibility.
- Do not dispose of batteries in a fire. The batteries may explode.
- Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
- In case of electrolyte in contact with skin, immediately wash the contamimated skin with water.
- Replaced batteries must be disposed of at authorized battery waste disposal centers.
- **A battery can present risk of electric shock and high short circuit currents.**
  The following precautions should be observed when working on batteries;
    - ❖ Remove rings, watches, neckleaces, bracelets and all metal objects.
    - ❖ Only use tools with insulated handles.
    - ❖ Wear rubbers gloves and a rubber apron when handling batteries.
    - ❖ Do not lay tools or metal parts on top of batteries.
    - ❖ Eye protection should be worn to prevent injury from accidental electrical arcs.
- **Before a maintenance or repair work on the UPS;**
    - ❖ Switch the input, output and battery circuit breakers (F1, F2 and F5) to “0” position.
    - ❖ If UPS has internal batteries; Remove **+** battery (red), **-** battery (black) and **N** battery neutral (blue) cables.
    - ❖ If UPS has external batteries; switch the circuit breakers of the battery cabinet to “0” position.
    - ❖ Determine if the battery is inadvertently grounded. If inadvertently grounded; remove source of ground. Contact with any part of a grounded battery can result in electrical shock.
- Battery fuses shall only be replaced with the same rating and type which came along with the UPS.

2.3. Description of the Symbols Used on the Labels Applied to the UPS

	PE: PROTECTIVE EARTH
	PB: PROTECTIVE BOUNDING
	DANGER! HIGH VOLTAGE (BLACK/YELLOW)
	This symbol points out the instructions, which may be resulted with the injury of the operator or damage of the equipment if not obeyed.

3. REQUIREMENT

3.1. Transportation

The UPS must be placed and stand in a vertical position throughout the transportation.

Use suitable equipment to remove the UPS from the pallet.

The equipment shall be packed properly during transportation. Therefore it is recommended to keep the original package for feature need.

All packing material must be recycled in compliance with the laws in force in the country where the system is installed.

3.2. Placement

This product meets the safety requirements for devices to be operated in restricted access locations according to EN 62040-1 safety standard, which states that the owner should guarantee the following:

- Access to the equipment can only be gained by service person or by user who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken,
- Access is through the use of a tool or lock and key, or other means of security and is controlled by the authority responsible for the location.
- UPS is not designed for outdoor application.
- The equipment and the batteries should not be exposed to direct sunlight or placed near to a heat source.
- Recommended operating temperature and humidity values are listed on the Appendix-3 Technical Specifications section. To provide the required enviromental condition, it might be needed to climate the room.
- Avoid dusty environments or areas where dust of conductive or corrosive materials is present.
- The connection and the circuit breakers are at the front of UPS. Leave at least 50 cm at the front of the UPS for maintenance.
- Air outlets of the UPS are on front, rear and top sides. Leave at least 50 cm at the front side, rear and top side for maintenance and ventilation.
- Even though the operating temperature of the UPS and batteries are between 0-40 °C, It is suggested to provide an environment temperature between 20-25°C to get maximum performance from the UPS and batteries.
- Adviced Environmental humidity condition is between 20% 80% (non-condensing).

3.3. Storage

Please store the UPS in an environment where the temperature is between –25 °C +55 °C, no receipt of direct sunlight, far from the heating, in a dry place.
Advised Environmental humidity level is between 20% 80% (none condensing).
If the batteries will be stored for longer than 6 months, they should be charged periodically. Charge period depends on the storage temperature. The relationship is as shown below:

- Every 9 months if the temperature is below 20°C,
- Every 6 months if the temperature is between 20°C and 30°C,
- Every 3 months if the temperature is between 30°C and 40°C,
- Every 2 months if the temperature is over 40°C

For long storage duration; please follow up the instructions of installation described in Section 4, start-up UPS described in Section 7 and charge the batteries at least 10 hours.

3.4. Electrical Requisites

The installation must comply with international installation regulations.
The electrical distribution panels for the mains and separated bypass mains inputs must have a protection and disconnection system. Disconnection devices used in these panels shall disconnect all line conductors simultaneously. The following table shows the recommended size of the mains and separate bypass mains input protection devices (thermal, magnetic and differential) and the cable cross-sections for the linear loads.

POWER	INPUT CIRCUIT BREAKER	OUTPUT CIRCUIT BREAKER	BYPASS CIRCUIT BREAKER	INPUT CABLE	BYPASS CABLE	OUTPUT CABLE	NEUTRAL CABLE	BATTERY CABLE	BATTERY FAST FUSE	LEAKAGE CURRENT PROTECTION**
10 kVA	20 A	20 A	20 A	3x4mm2	3x4mm2	3x4mm2	6mm2	4mm2	25 A	300 mA
15 kVA	32 A	32 A	32 A	3x6mm2	3x6mm2	3x6mm2	10mm2	6mm2	32 A	300 mA
20 kVA	40 A	40 A	40 A	3x10mm2	3x10mm2	3x10mm2	16mm2	10mm2	50 A	300 mA
30 kVA	63 A	63 A	63 A	3x16mm2	3x16mm2	3x16mm2	25mm2	16mm2	63 A	300 mA
40 kVA	80 A	80 A	80 A	3x16mm2	3x16mm2	3x16mm2	25mm2	16mm2	80 A	300 mA
60 kVA	125 A	125 A	125 A	3x35mm2	3x35mm2	3x35mm2	50mm2	35mm2	100 A	300 mA
80 kVA	160 A	160 A	160 A	3x50mm2	3x50mm2	3x50mm2	70mm2	50mm2	125 A	300 mA
100 kVA	175 A	175 A	175 A	3x70mm2	3x70mm2	3x70mm2	95mm2	70mm2	160 A	300 mA
120 kVA	200 A	200 A	200 A	3x95mm2	3x95mm2	3x95mm2	120mm2	95mm2	200 A	300 mA
160 kVA	320 A	250 A	250 A	3x150mm2	3x150mm2	3x150mm2	185mm2	150mm2	250 A	300 mA
200 kVA	400 A	320 A	320 A	3x185mm2	3x185mm2	3x185mm2	240mm2	185mm2	315 A	300 mA

**Load leakage currents are added to those generated by the UPS. If loads with high leakage currents are present, adjust this value accordingly. It is recommended to adjust the protective device after measuring the total leakage current with the UPS installed and operational with the intended load.
During transitory phases (power failure, return and voltage fluctuations) short leakage current peaks may occur. Make sure that the protection is not activated in such cases.

If the loads have a nonlinear characteristic, the current on the mains input, separate by-pass mains input and output neutral conductors may have a value that is 1.5-2 times the phase value during operation. In this case, size the neutral cables and the input/output protection adequately.

4. UNPACKING AND INSTALLATION OF UPS

Equipment and batteries whose packages are damaged during transportation shall be inspected by qualified Technical Personnel before starting with the installation.

If any equipment has been damaged during shipment, keep the shipping and packing materials for the carrier or place of purchase and file a claim for shipping damage. If you discover damage after acceptance, file a claim for concealed damage.

Check if the following are provided with the equipment

- UPS
- User Manual
- Test Report
- Key of the cabin door
- Battery fuses (three pieces) (excluding FORTE 10-15-20kVA)

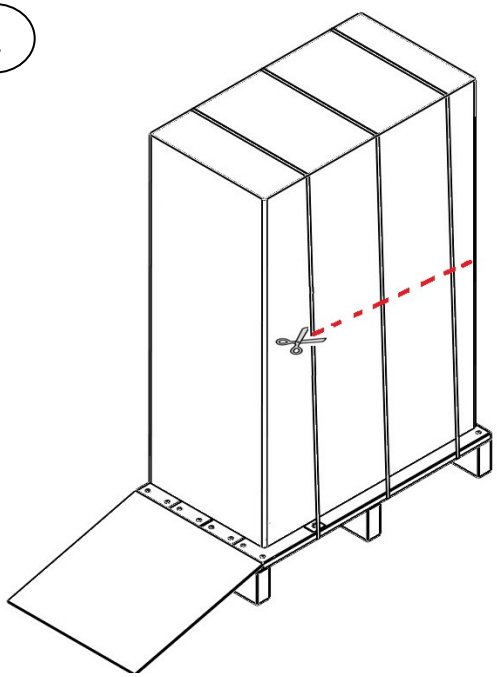
Before the installation, please check if your UPS is customized following your special requirements (if any).

UPS output voltage and frequency is set to 220V/50Hz per phase, as default.

4.1. Unpacking and Moving

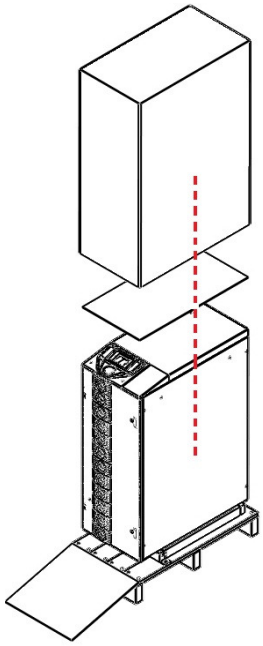
It is recommended to store the original UPS packaging for future needs.

1



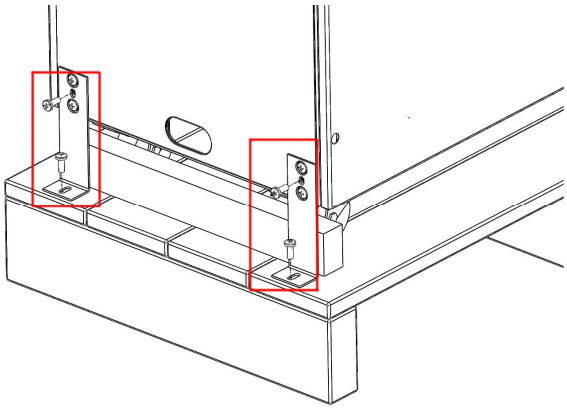
Place the platform and remove the wrap.

2



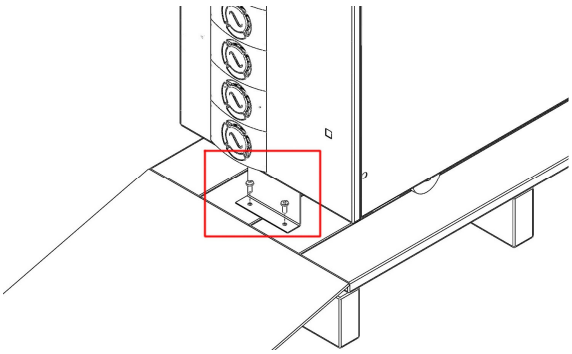
Remove the package and styraphors.

3



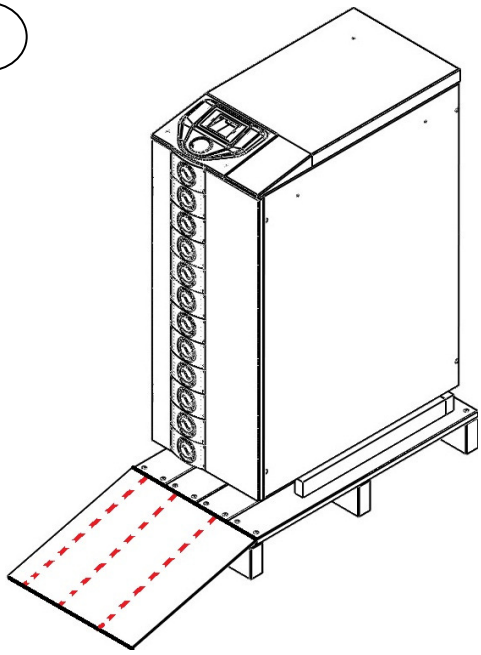
Screw off the stop plates placed at the back of the UPS.

4



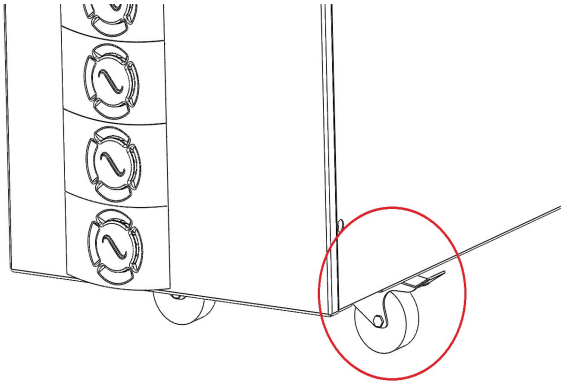
Screw off the stop plates placed at the front of the UPS.

5



Move the UPS down from pallet by pushing from behind.

6

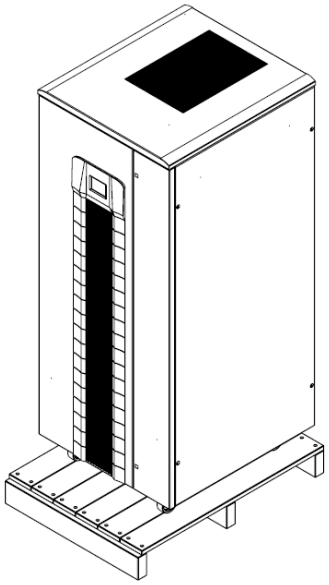


Push the lock of the wheel down to make the UPS stand stable.

7

10-60kva external battery type UPS's; Loosen the screw of the UPS present at the bottom side and fix it to the floor as shown in the picture.

8



80-200kVA: Remove the ups from the pallet by using a transpallet or forklift.

4.2. Installation Procedures

The equipment may only be installed and commissioned by authorized Technical Personnel.

When the UPS is brought from a cold place to a warmer place, humidity of the air may condensate in it. In this case, wait for 2 (two) hours before beginning with the installation.

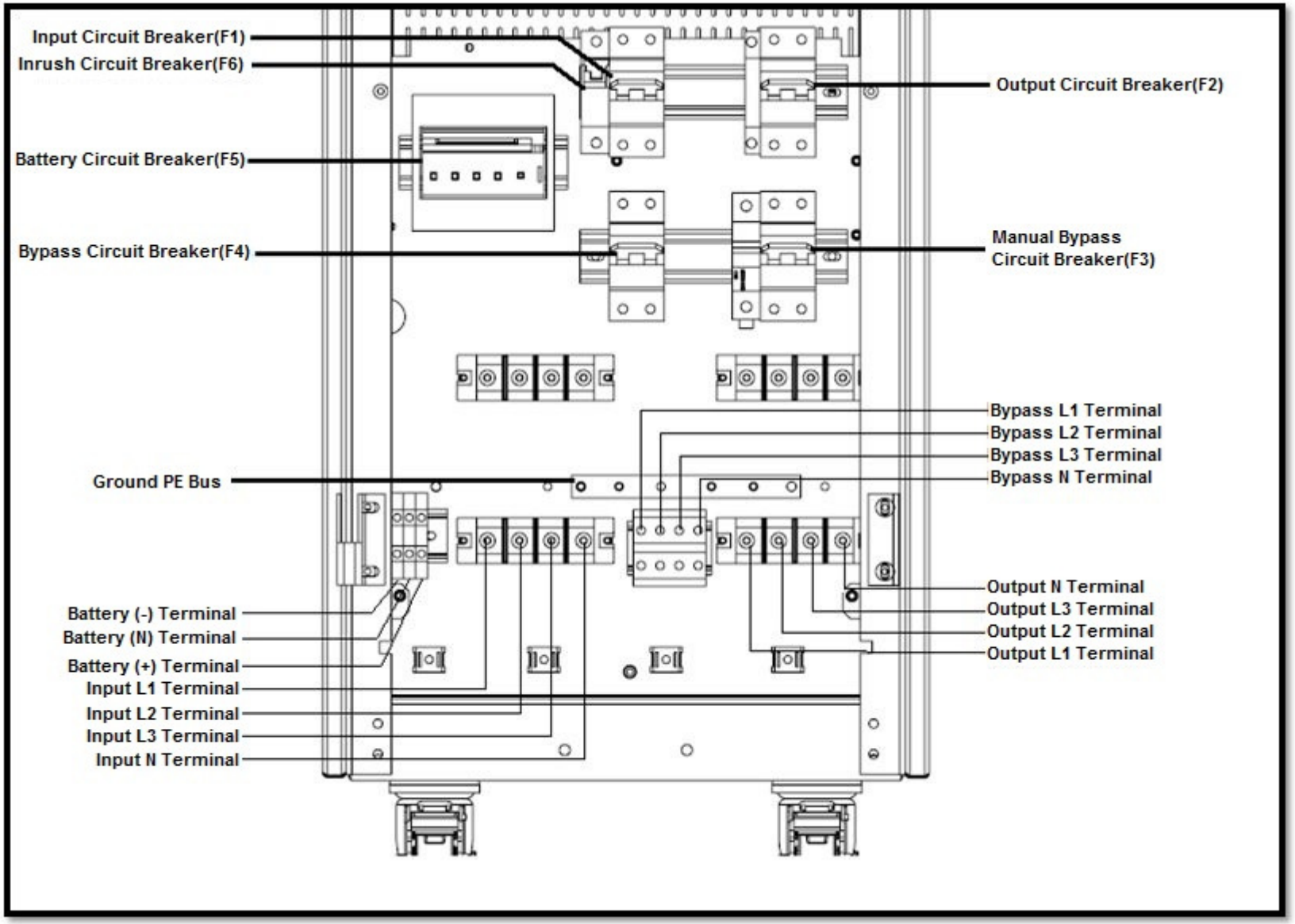
Devices with internal batteries may have dangerous voltages on the battery terminals.

4.2.1. Power Connections

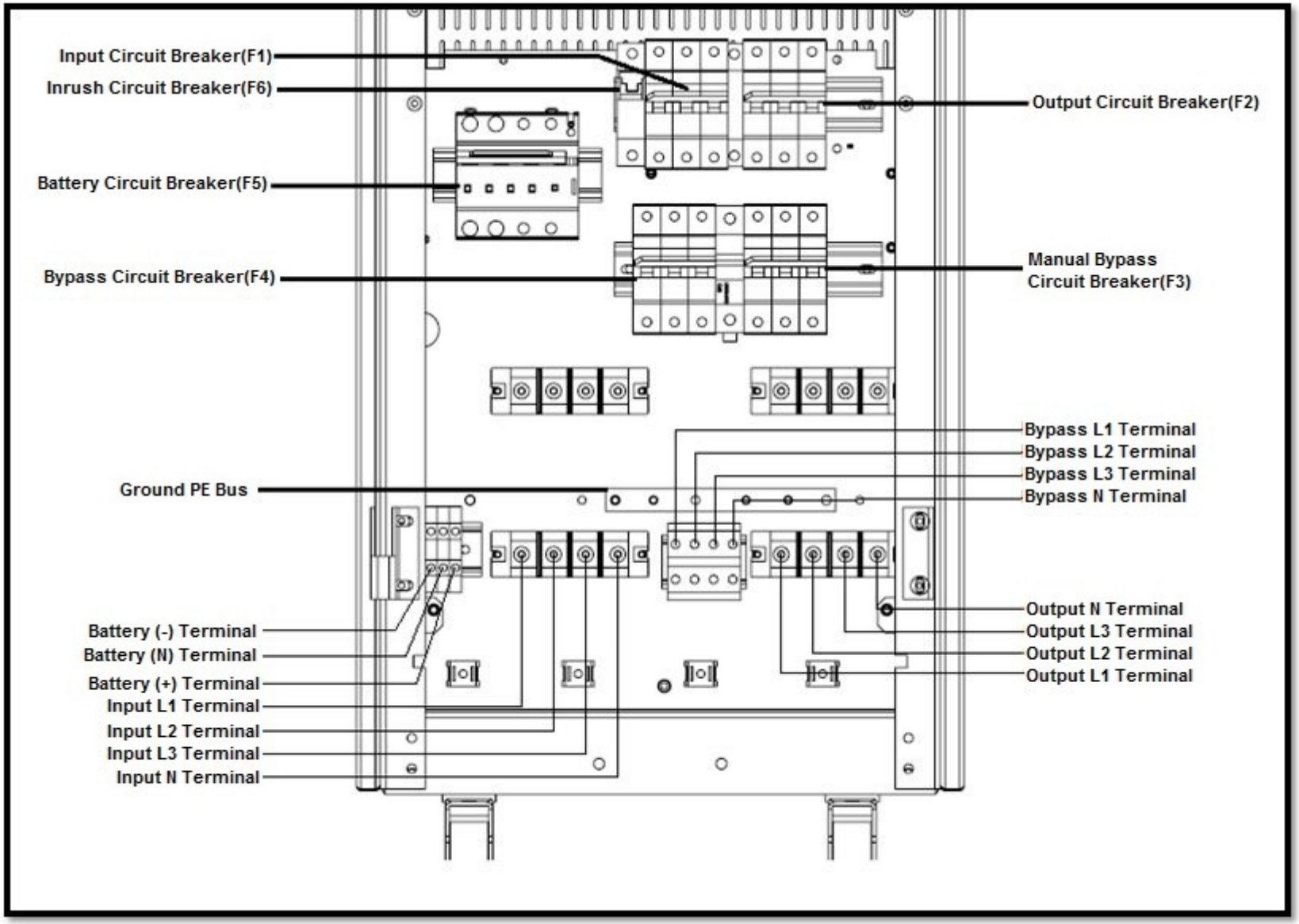
Make sure that all circuit breakers are “OFF” before starting with the installation.

The power screw terminals are located on the lower front side of the UPS. Terminal details are shown separately in the below figures. Refer to the names of each terminal to identify it during connection:
After the terminal front cover is removed, the cables shall be passed through the hole under the connection terminals.

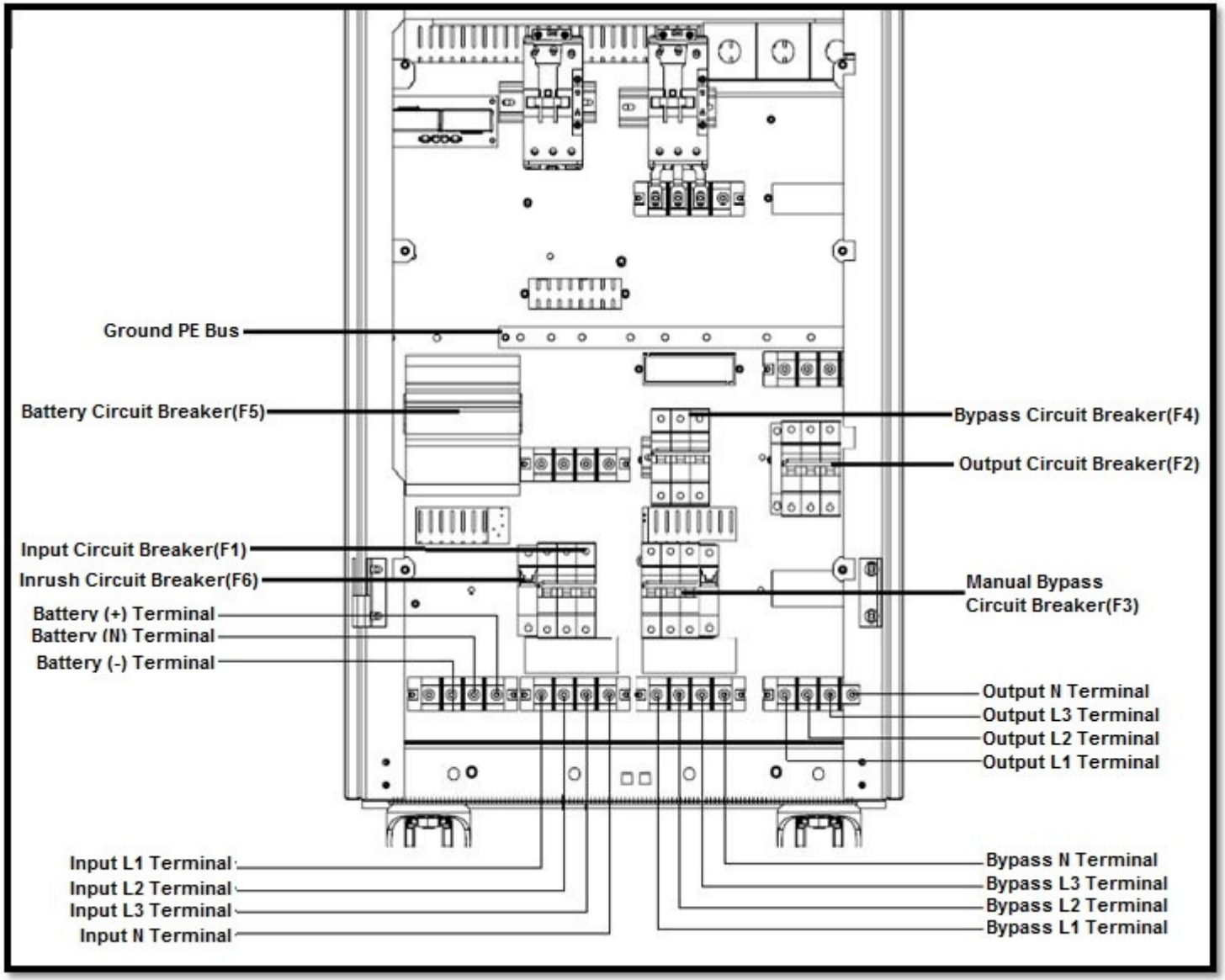
10-15kVA (3Ph Input – 3Ph Output) Terminal Connections



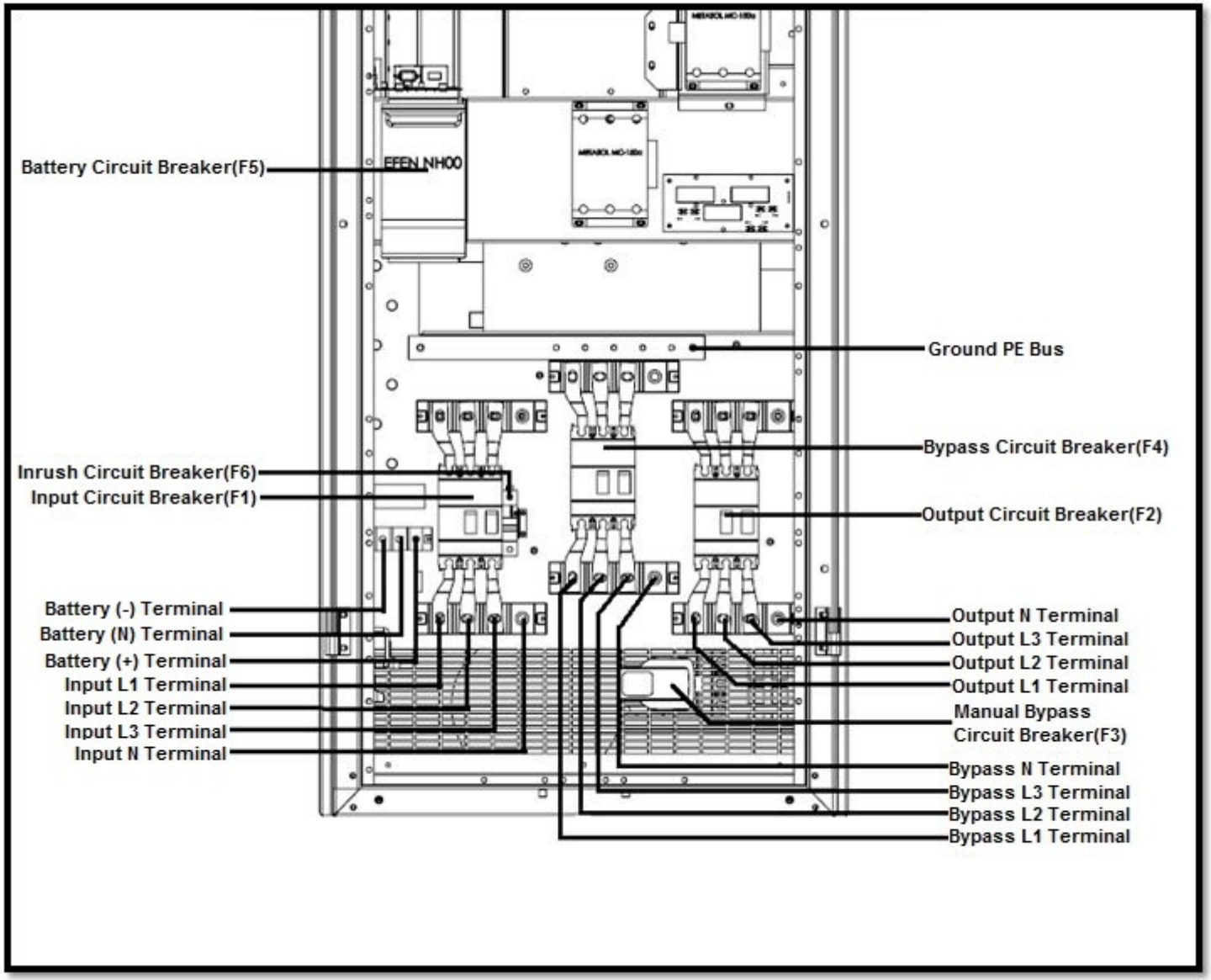
20-30kVA(3Ph Input – 3Ph Output) Terminal Connections



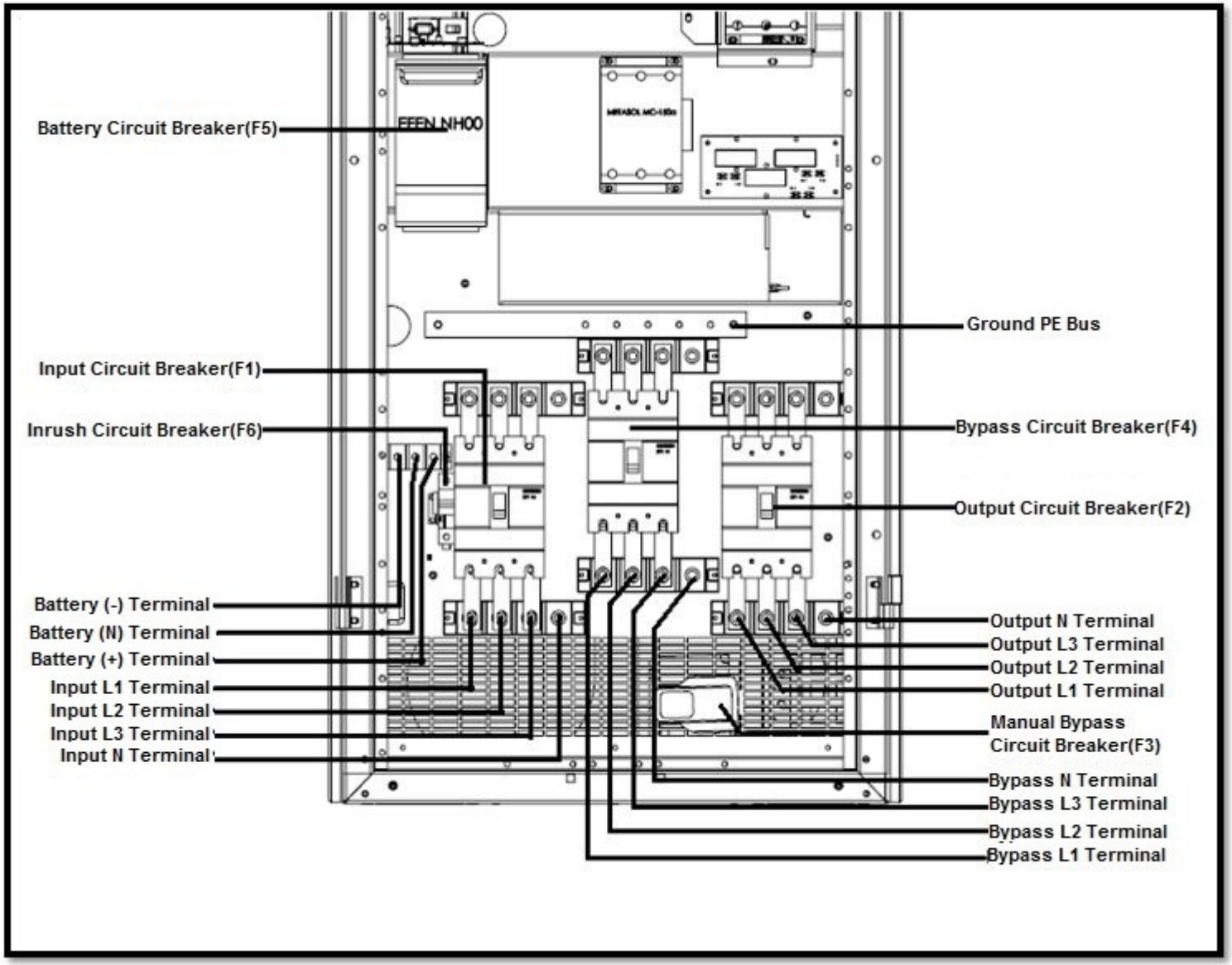
40-60kVA (3Ph Input – 3Ph Output) Terminal Connections



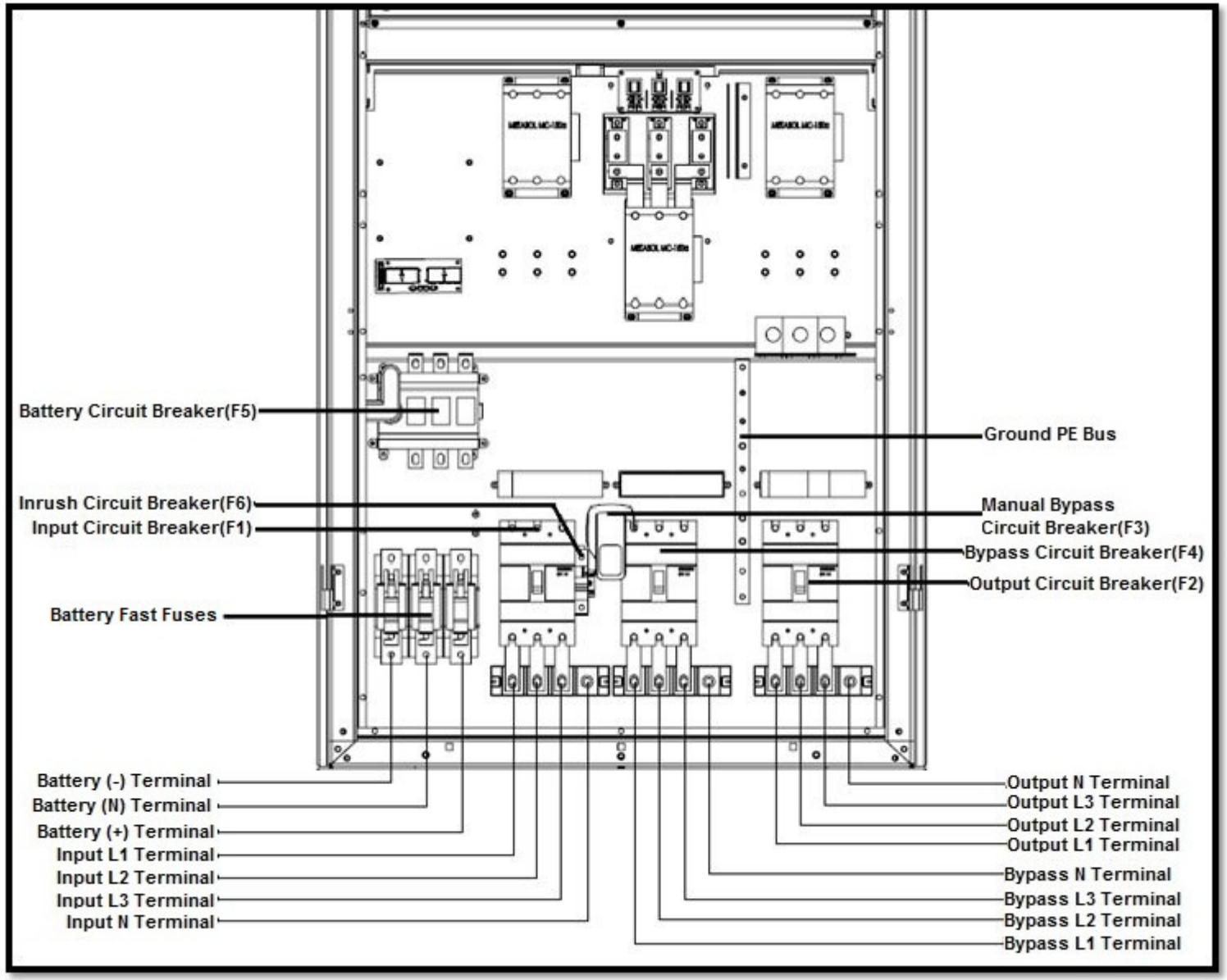
80kVA (3Ph Input – 3Ph Output) Terminal Connections



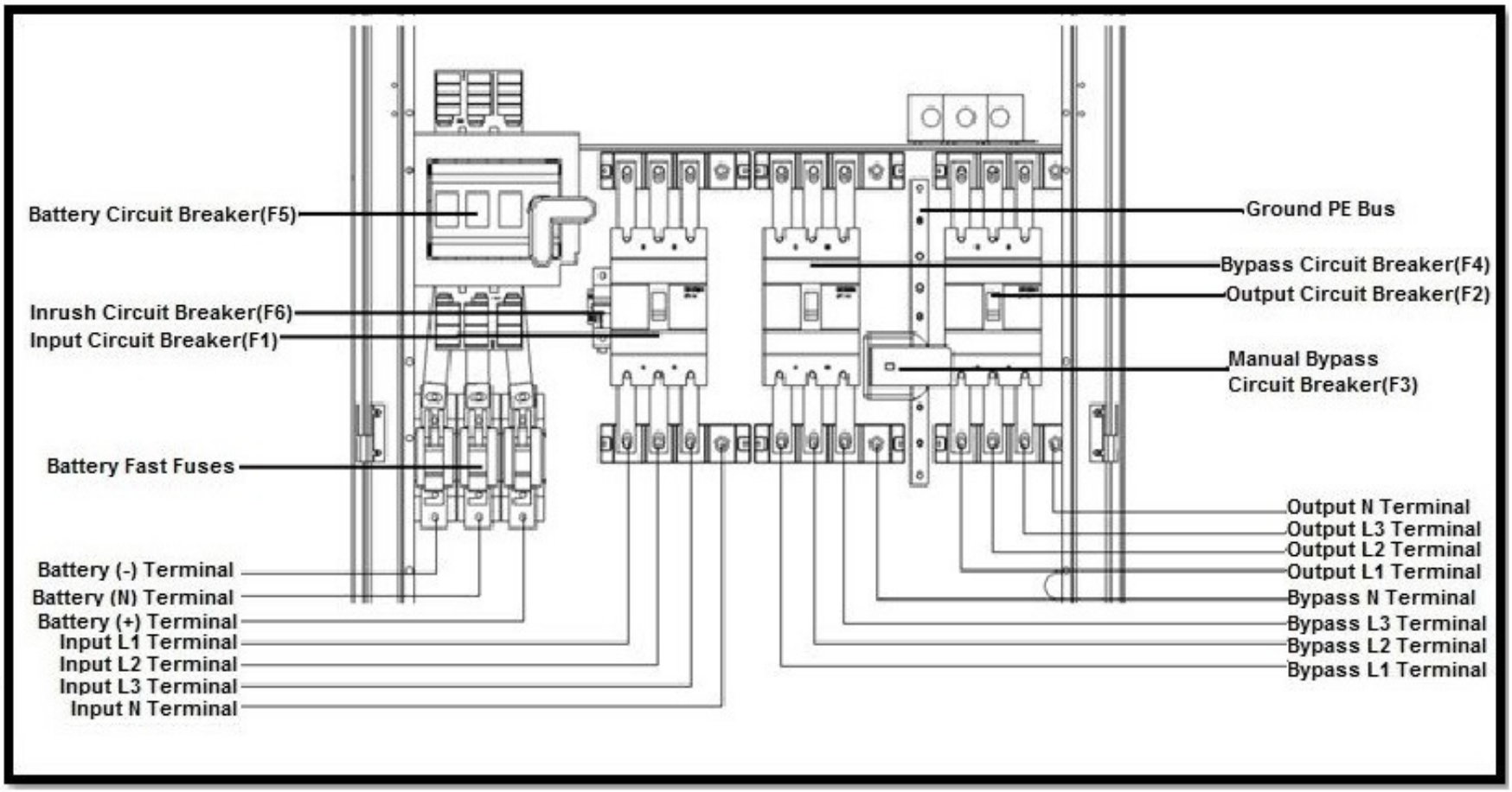
100kVA (3Ph Input – 3Ph Output) Terminal Connections



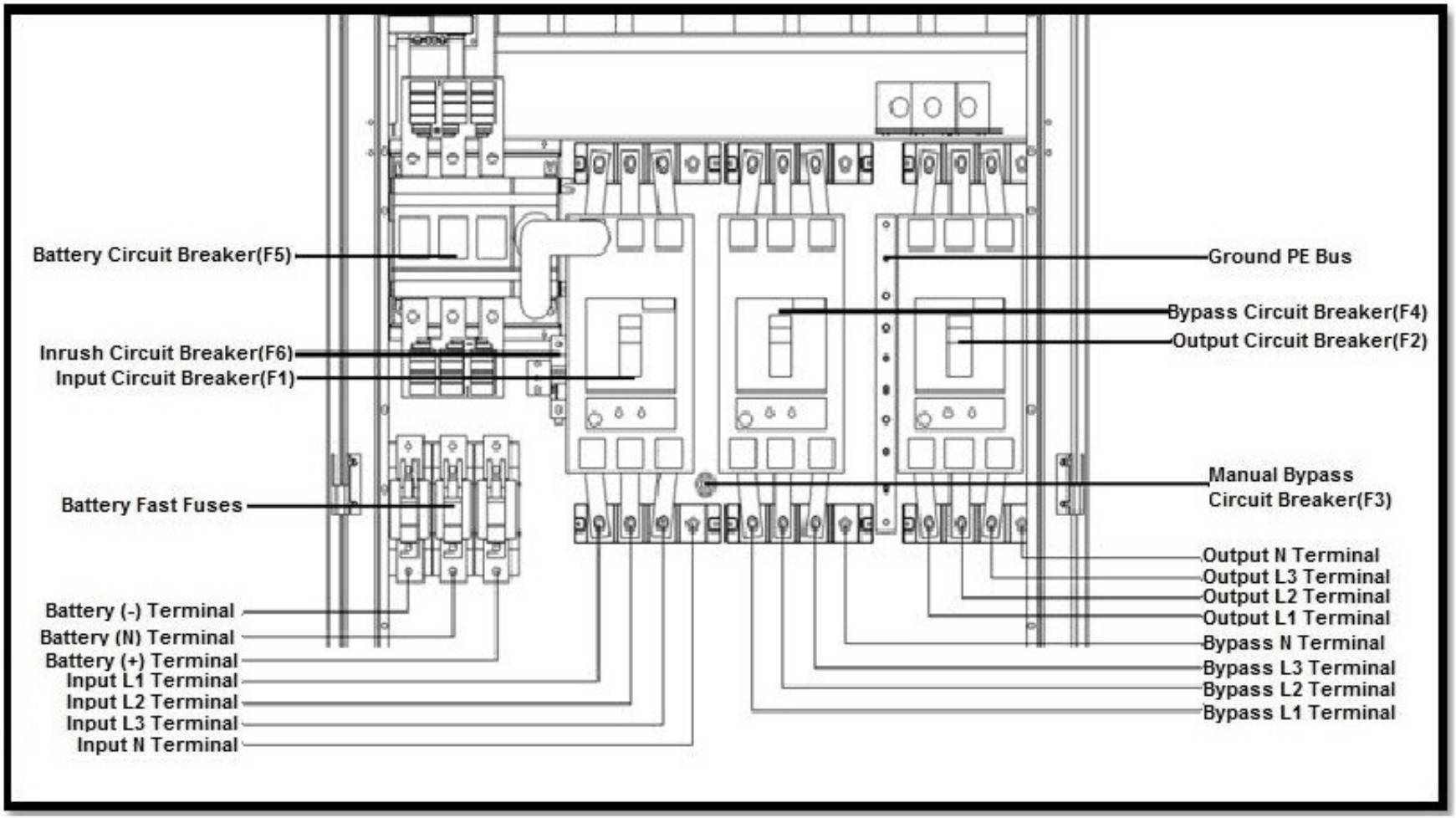
120kVA (3Ph Input – 3Ph Output) Terminal Connections



160kVA (3Ph Input – 3Ph Output) Terminal Connections



200kVA (3Ph Input – 3Ph Output) Terminal Connections



Connections shall be made in the following order;

4.2.1.1. Protective Earth (PE) Connection

	The device shall be earthed for a safe and reliable operation. Connect the PE ground connectors before connecting any other cable.

Input protective earth connection terminal **PE** of the UPS shall be connected to ground with a low impedance connection.

PE terminal of the loads shall be connected to output protective earth terminal of the UPS.
If there is an external battery cabinet present, it shall be grounded via battery protective earth terminal of the UPS.

	If PE cables come along with the power cables; PE cable should be min. 10cm longer than the other cables.

4.2.1.2. Input Connection

	The installation and adjustment of distribution panel should be done by authorized Technical Personnel.

	Switch the circuit breaker on the distribution panel to “0” position before making the connections.

Please add three-pole (3-pole) circuit breaker (equivalent UPS input breaker) to distribution panel where UPS is to be connected. Do not connect any other load to this circuit breaker and please do not forget to add leakage current relay.
Leakage protection relay value must be the total value of 300mA (UPS input leakage current relay) and total leakage current value of the load connected to UPS. Relay must be protected type against peak current that can be happened on EMI filter capacitor.
Connect the phase cables to **Input L1-L2-L3** terminals, the neutral to **Input N** terminal. Neutral connection should be done directly from distributon neutral bus to UPS neutral.

	According to IEC/EN 62040-3, the user should place a warning label on the input distribution panel and the other primary power isolators, in order to prevent the risk of voltage feedback. The label should carry the following indication:
	**RISK OF VOLTAGE BACKFEED** • Isolate Uninterruptable Power Supply before working on this circuit. • Then check for Hazardous Voltage between all terminals including the protective earth (PE)

4.2.1.3. Bypass Input Connection

Bring the circuit breaker on the distribution panel to “OFF” position before making the connections

Please add three-pole (3-pole) circuit breaker (equivalent UPS Bypass breaker) to distribution panel where UPS is to be connected.
Connect the phase cables to **Bypass L1-L2-L3** terminals, the neutral to **Bypass N** terminal. Neutral connection should be done directly from distributon neutral bus to UPS neutral.

4.2.1.4. Battery Connection

Devices with internal batteries may have dangerous voltages on the battery terminals.

Do not switch the battery circuit breaker (F5) to **ON** position before operating the equipment and seeing “Online Operation” message on the LCD.

If the batteries are already built-in inside the UPS cabinet; remove the cover of UPS and connect the **Positive (red), Negative (black) and Neutral (blue**) cables of the batteries. There is no need any further connection so replace the cover.

If the batteries shall be put in a separate additional battery cabinet, please follow up the instructions below;

- Connect between battery circuit breaker and battery terminals with using proper cross-section **Positive (red), Negative (black) and Neutral (blue)** cables.
- Switch on to “**0**” position the battery cabinet circuit breaker.
- Connect the **“-“**on the battery cabinet to **“-“**on the UPS.
- Connect the **“+“**on the battery cabinet to **“+“**on the UPS.
- Connect the **“N“**on the battery cabinet to **“N“**on the UPS.

Read the **FORTE Service Manual** carefully for External Battery connection!

Danger of explosion and fire if the batteries of the wrong type are used.

The batteries must be charged min. 10 hours before first-use.

Battery fast fuses should be replaced with fuses of the same type and rating.

UPS can operate with 60 or 62 batteries. 62 battery connection cables may be sent with UPS or battery cabinet. Use the quantity of cables depending on your battery configuration. If your battery configuration is 60, do not use 31st and 62nd batteries in the battery connection schematics.

4.2.1.5. Output Connection

Please add three-pole circuit breaker (equivalent to UPS output breaker) to distribution panel where the loads are to be connected. Connect the phase cable to **Output L1-L2-L3** terminal and the neutral cable to **Output N** terminal. Neutral connection should be done directly.

To enable the short circuit protection feature of the UPS, each load shall be supplied through a separate circuit breaker chosen according to the load current. This may provide quick disconnection of the short circuited load and maintain operation continuity of the other loads. To obtain maximum protection, the rating of each individual load circuit breaker shall have the minimum value, which is enough to carry the full load current continuously.

Make sure that all circuit breakers are at “0” position before starting with the installation.

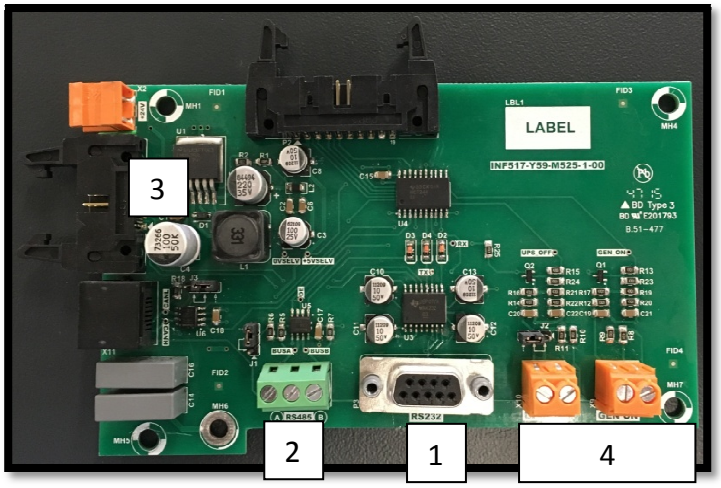
Each load should be supplied through separate circuit breaker and the cable cross section should be chosen according to the load current value.

Make sure that the UPS is not overloaded to provide a higher quality supply to the loads.

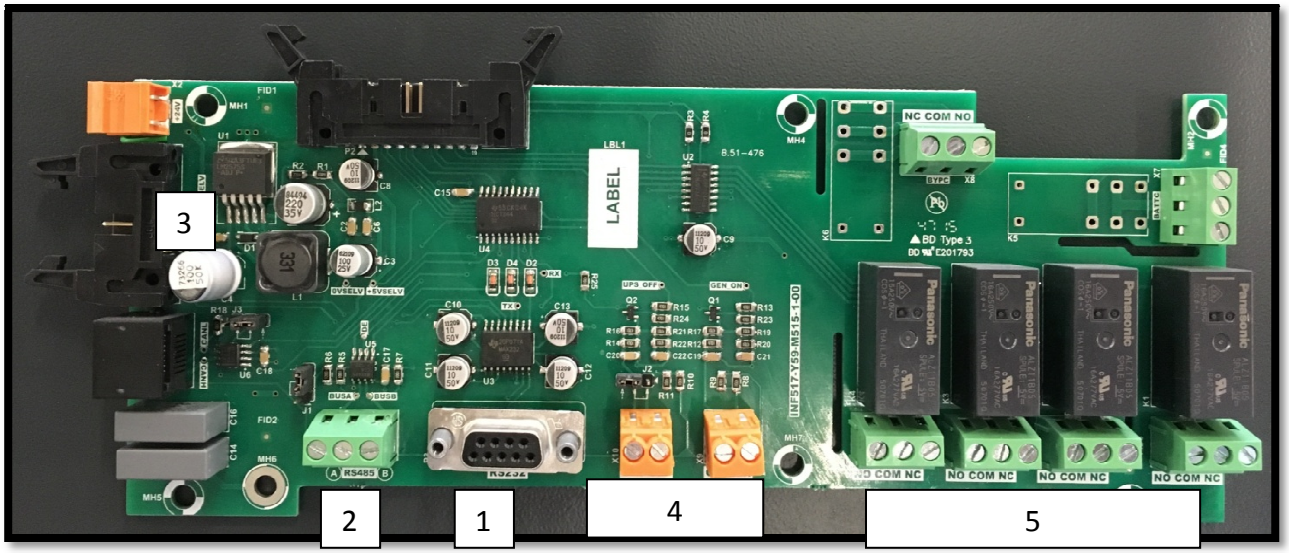
4.2.2 Communiation Interface Connection

Connectivity cards allow the UPS to communicate in a variety of networking environment and with different type of devices.

A. **FACTORY DEFAULT:** Standard Interface Card on UPS



B. **OPTIONAL :** Interface card with Relays



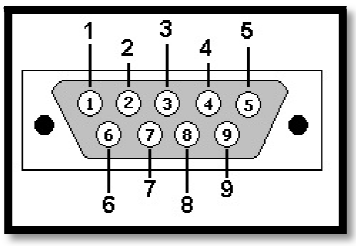
Interface Card Components:

1. Serial Communication: RS232 Port (can be connected to External SNMP also)
2. RS485 MODBUS Port
3. Internal SNMP Connection Point
4. Emergency Power Off and Generator Connection Ports
5. Dry Contacts (On Optional Interface Card)

4.2.2.1. Serial Communication (RS232)

UPS is equipped with Serial Communication as standard.

RS232: DSUB-9 male connector with the following pin layout shall be used on the UPS side of the connection cable.



RS232 PIN LAYOUT		
PIN#	**Signal Name**	**Signal Description**
2	RX	Received Data
3	TX	Transmited Data
5	GND	Signal Grounding

RS232 cable shall be shielded and not more than 25m.

The hardware and software listed below can be used with this RS232 port;

- **Monitoring Software - UPSMAN (Optional):** This software is installed on a computer. To establish communication between the UPS and a computer, connect your computer to the UPS communication port using the RS232 communication cable. With the software; many ups parameters such voltage, current, frequency …etc can be monitored.
- **External SNMP Adapter (Optional):** It gives opportunity to monitor UPS through a Web browser interface. External SNMP adapter is connected via serial communication cable to UPS (If there is no internal SNMP). By IP address assignment SNMP adapter is connected to current network, hence UPS can be monitored on web browser interface.

Via SNMP; the information listed below can be monitored;

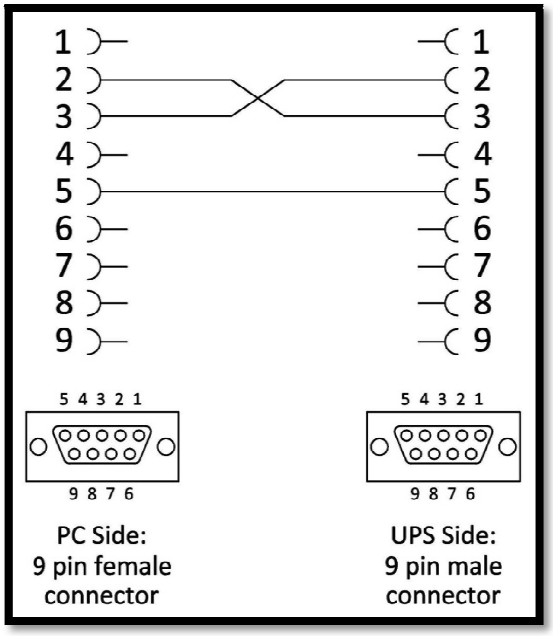
- The Latest Battery Test Date
- UPS Information (example: 220V - 50Hz)
- Input Data (V_{in}, F_{in}, V_{max} vb.)
- Output Data (V_{out}, Load Percantge...etc.)
- Battery Situation (V_{batt}...etc)

- **Service Software:** This software is used only by authorized Technical Service Personnel.

Do not let unauthorized people to use this software; otherwise, damage may occur on your equipment and void your warranty.

It is essential to use the FORTE serial communication cable to enable to UPS communicate with above mentioned hardwares and softwares.

If serial communication cable is needed, it can be produced according to the pin configuration described as below;



Cable Schema of Serial Communication

4.2.2.2. RS485 MODBUS Interface

3-Pin Terminal Connection point is used on the power supply side.

Pin layout is given below:

RS485 PIN LAYOUT		
Pin #	**Signal Name**	**Signal Description**
1	A (D+)	Incoming Signal
3	B (D-)	
2	GND	Ground

RS485 cable shall be shielded and not more than 100 m.
Only one of the RS232 or RS485 communications can be activated at one time.

4.2.2.3. Internal SNMP Communication

Internal SNMP can be installed into SNMP slot placed at the front rear of UPS. As soon as SNMP installed, RS232 port would be disabled.
Internal SNMP has the same logic with External SNMP so please read Section 4.2.2.1 for more information.

In case of internal SNMP use with UPS, serial communiation port (RS232) is disabled. In order to activate the RS232 serial port, Internal SNMP should be removed.

4.2.2.4. SNMP Switch

If internal SNMP would be used, SNMP switch should be switched to SNMP side as indicated by the arrows. If RS232 Serial Communication would be used, switch should be switched to RS232 side as indicated by the arrows.

If the switch is switched to SNMP side, RS232 Serial Communiation is disabled.

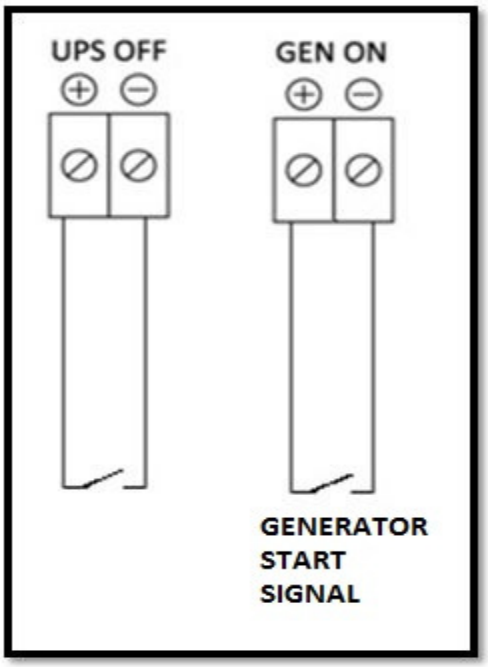
4.2.2.5. Emergency Power Off and Generator Connections

Upon request, UPS can be remote shut down and can make softstart to prevent the generator loaded instantly when it is ON. For this purpose, there are two terminals on the Interface card which operate with digital input.

Digital Inputs should be connected like dry contacts. Do not apply any voltage.

Input	Function
UPS OFF (EPO)	If the UPS OFF Input is activated then UPS stops supplying the load. When the energy is removed, UPS returns back to NORMAL operation mode.
GEN ON	If GEN ON input is activated, then UPS reduces the absorbed current from Generator during the transfer from Battery Mode to Normal Mode.

Emergency Power Off Connection	GEN ON Connection



4.2.2.6. Dry Contacts (On optional interface card)

There are 4 dry contact sockets on the Inteface Board. The relays can be programmable from **RELAYS** menu (under SETTINGS menu). “Bypass Active, General Alarm, High Temperature, Synchronization OK, Battery Test Failure, Output Failure, Input Failure” alarms can be assigned to these contacts. Each alarm can be assigned to separate contacts but also one alarm may be assigned to multiple contacts.
Each output socket 3-pin and middle pin is fixed, the upper pin is normally closed and lower pin is normally open. The maximum values of the relays is 250VAC 5A.

Free contact relay connection cables shall have a cross-section of 1.5 mm^2.

	Maximum voltage to be applied to the relay contacts is 42V AC rms (sinus) or 60 Vdc. Maximum contact current depends on the applied voltage and the load characteristic. Both maximum voltage and maximum contact current corresponding to the applied voltage shall not be exceeded.

Maximum allowed resistive contact currents for several voltages are given on the table below:

Applied voltage	**Maximum contact current for resistive load**
Up to 42 VAC	16 A
Up to 20 VDC	16 A
30 VDC	6 A
40 VDC	2 A
50 VDC	1 A
60 VDC	0.8 A

Each relay has both a normally open (NO) and a normally closed (NC) contact. One end of these contacts is common. Normal states of the relay contacts are shown on the figure at the beginning of the “communications” section.

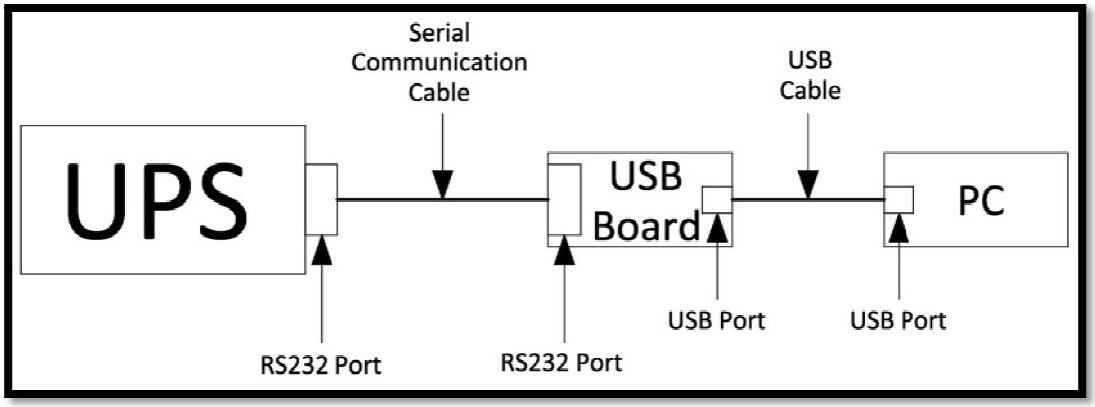
Relay functions:

Relay	**Function**
Relay 1	General Alarm (default value, can be changed from LCD)
Relay 2	General Alarm (default value, can be changed from LCD)
Relay 3	General Alarm (default value, can be changed from LCD)
Relay 4	General Alarm (default value, can be changed from LCD)

General alarm is active when one or more alarms are active.

4.2.2.7. USB Converter (Optional)

This card is connected to serial port of UPS. It maintains connection availability to to USB port present on your computer.
The connection of the USB converter card is described below;



5. MODES OF OPERATION

Uninterruptible **P**ower **S**upplies (UPS) have an important function in the protection of the critical and sensitive loads from the irregular mains electricity conditions and they are used to supply uninterruptible energy to these loads. In such irregular mains electricity conditions, the user can provide an artificial energy supply to the equipment present in the office or at home by using an UPS.

FORTE UPS during Inverter operation provides stable pure sine wave. This pure sine wave is not affected from the input voltage fluctuations. This helps to extend the life time of your sensible loads. Power factor of the current consumed from the mains is nearly one. You do not have any problem on generator or isolation transformer applications. The reactive energy consumption decreases.

During the mains failure, the energy needed for the load is provided by the battery in UPS (or in external battery cabinet/s). These batteries are charged by an intelligent battery charging circuit during the mains within the limits. Batteries are lead acid battery (VRLA) and do not require any maintenance until the end of their life time.

In case of longer overload or inverter failure situation, UPS transfers the load to Bypass line, and load is supplied from the mains. When the condition turns back to normal, UPS shall continue to supply the load through inverter.

UPS control and management is done by Digital Signal Processor (DSP) which is 200 times faster than standard microprocessors. This helps to make your UPS smarter. DSP uses all the sources on optimum conditions, observes the failure conditions, and communicates with your computer system.

UPS can be operated in one of the following operational modes depending on the condition of mains, battery, bypass, UPS and/or user preference.

You may see the block diagram of UPS in Appendix-4 Description of UPS and Block Diagram.

5.1. Bypass Operation (Eco-Mode)

In this mode, as long as the mains voltage and frequency within the limits, the load is supplied by the mains in a controlled manner (the inverter is in standby state). The purpose of using this mode is to increase the efficiency up to 98,5% and to provide energy saving; since the loads are supplied by the mains directly, the loads are unprotected against any possible future risks. (e.g. surge voltage, etc.). Devices without separate bypass mains input, absorb energy from the mains. In devices with separate bypass mains input, energy is drawn from the separate bypass mains.

Bypass Mode Operation can be chosen through the Commands Menu.

If this mode is not chosen by the user, UPS transfers the load automatically to the mains in order to protect them during abnormal conditions (the inverter is disabled).
While UPS operates in Online Operation, UPS switches to bypass automatically (in case the mains voltage and frequency is within the limits of bypass) in the following conditions;

- During the start-up
- Bypass Priority
- Inverter Fault
- Prolonged Overload
- High Heatsink Temperature

After these conditions are eliminated, the UPS automatically returns to inverter.

UPS switches to another mode in case the mains voltage or frequency go beyond the Bypass limits. UPS returns to Bypass Operation when the mains returns to the limits.

Bypass Operation mode does not provide perfect stability in frequency/waveform/rms value of the output voltage like in Online Operation. Thus, the use of this mode should be carefully executed according to the level of protection required by the application.

Bypass Operation mode does not provide electronic short circuit protection as provides in Online Operation. If a short circuit occurs on the output during this operation, the thermal/magnetic protection will act and all loads will be deenergized.

Prolonged overloads in Bypass Operation may cause the thermal/magnetic protection act. In this case, all loads will be deenergized.

Bypass Operation Voltage Range

The mains voltage is required to be in certain range for Bypass Operation. Voltage tolerance is set ±10% of the output voltage in the factory. For instance; if the output voltage is 220V, the tolerance range of bypass voltage would be 198V – 242V. In case the input voltage decreases below 198V or increases above 242V; if UPS runs in Bypass Operation UPS, then switches to Online Operation; if UPS runs in Online Operation, then it can not switch to Bypass Operation even if a fault occurs. If the batteries and the inverter are suitable to supply the loads, then UPS switches to Battery Operation.

Bypass Operation voltage tolerance limit can be adjusted in certain ranges, depending on the customer's request, in the factory as well as at the field by Technical Service Personnel.

To return to Bypass Operation; the mains voltage should turn back to +5V above of lower limit, -5V down of upper limit of bypass limits. Default settings are 203V – 237V for 220V UPS.

5.2. Online Operation

Energy is drawn from the mains input. Loads are supplied through the rectifier and the inverter. The AC voltage at the input is converted to a DC voltage by the rectifier. The inverter converts this DC voltage to an AC voltage with a stable sinusoidal waveform, amplitude and frequency. Output voltage and frequency can be set via front panel. Output voltage is sinusoidal and has a regulated amplitude and frequency. It is independent from the input voltage. The loads are not affected by the negativities of the mains.

If the mains voltage and frequency are in certain range, Online Operation is possible. For the mains limits for Online Operation, please see Appendix-3 Technical Specifications.

The upper limit of mains voltage is independent from the load percentage and it is 270V. UPS switches to Battery Operation mode when the mains is over 270V. The mains is required to decrease below 260V for UPS to return Online Operation.

Online Operation Conditions;

- In case Online Operation is set as operation mode of UPS, the mains is within the limits and/or if there is no abnormal condition (overheat, overload, failure…etc.) UPS operates in Online Operation. Except for failures, as soon as the abnormal conditions are eliminated, UPS switches to Online Operation automatically.
- In case Bypass Operation is set as operation mode of UPS and the voltage and frequency is out of the bypass limits but within the rectifier limits, UPS swithes to Online Operation.

5.3. Battery Operation

In this operation, energy is drawn from the batteries. The loads are supplied via inverter. Output voltage is sinusoidal and has a regulated amplitude and frequency. It is independent from the battery voltage. Battery voltage should be in acceptable limits and the inverter should be enabled for the UPS to operate in this mode.

UPS operates in Battery Operation in the following cases:

- While UPS is operationg in Onlne Operation; if frequency/waveform/rms value of mains voltage go beyond the rectifier limits,
- While UPS is operationg in Bypass Operation, if frequency/waveform/rms value of mains voltage go beyond the rectifier and Bypass limits,
- Inverter "ENABLE", Rectifier "DISABLE" is selected through the front panel.

Battery Management and Battery Back-Up Time

As it is known, battery back-up can not be indicated with 100% accuracy, but approximation can be done. Even UPS operates in Online or Bypass Operation; it continuously calculates and displays the remaining back-up time. **However the calculated values will be more healthier and accurate a few minutes after the UPS switches to Battery Operation.**

Autonomy time depends on battery type, quantity, capacity, situation and load level. UPS stops supplying the loads if the battery voltage decreases under a specific value.

In order to obtain longer autonomy time, you may add batteries in an external battery cabinet.

When the mains voltage returns to normal conditions after Battery Operation, UPS charges the batteries for 10 hours and tests the batteries. This procedure is repeated after each Battery Operation. If Battery Test is successful, UPS resumes normal operation. If not, "Battery test failure" alarm is displayed on LCD.

Battery life depends on some parameters such as battery type, charge-discharge cycle, and depth of discharge, ambient temperature, conditions. Please look at Appendix-3: Technical Specifications for the ideal environmental conditions for the batteries. Using the batteries outside this temperature range will decrease battery operation time and battery life.

5.4. No Operation

This mode is used to make settings through Front Panel or by Service Software. To start-up UPS in No Operation mode; all the circuit breakers must be at "0" position except **F1** Input circuit breaker and **F4** Bypass circuit breaker- if exits -. In this mode UPS does not produce output voltage to supply the loads.

5.5. Manual Bypass Operation

This procedure may only be executed by authorized Technical Service personnel.

Some parts inside the UPS (terminals, EMC filters and measurement circuits) are still energized during Maintenance Bypass Operation. In order to deenergize all UPS parts, circuit breakers on mains and bypass mains distribution panels feeding the UPS and circuit breakers on external battery cabinet shall be brought to “OFF” position. Internal batteries should also be isolated from the system.

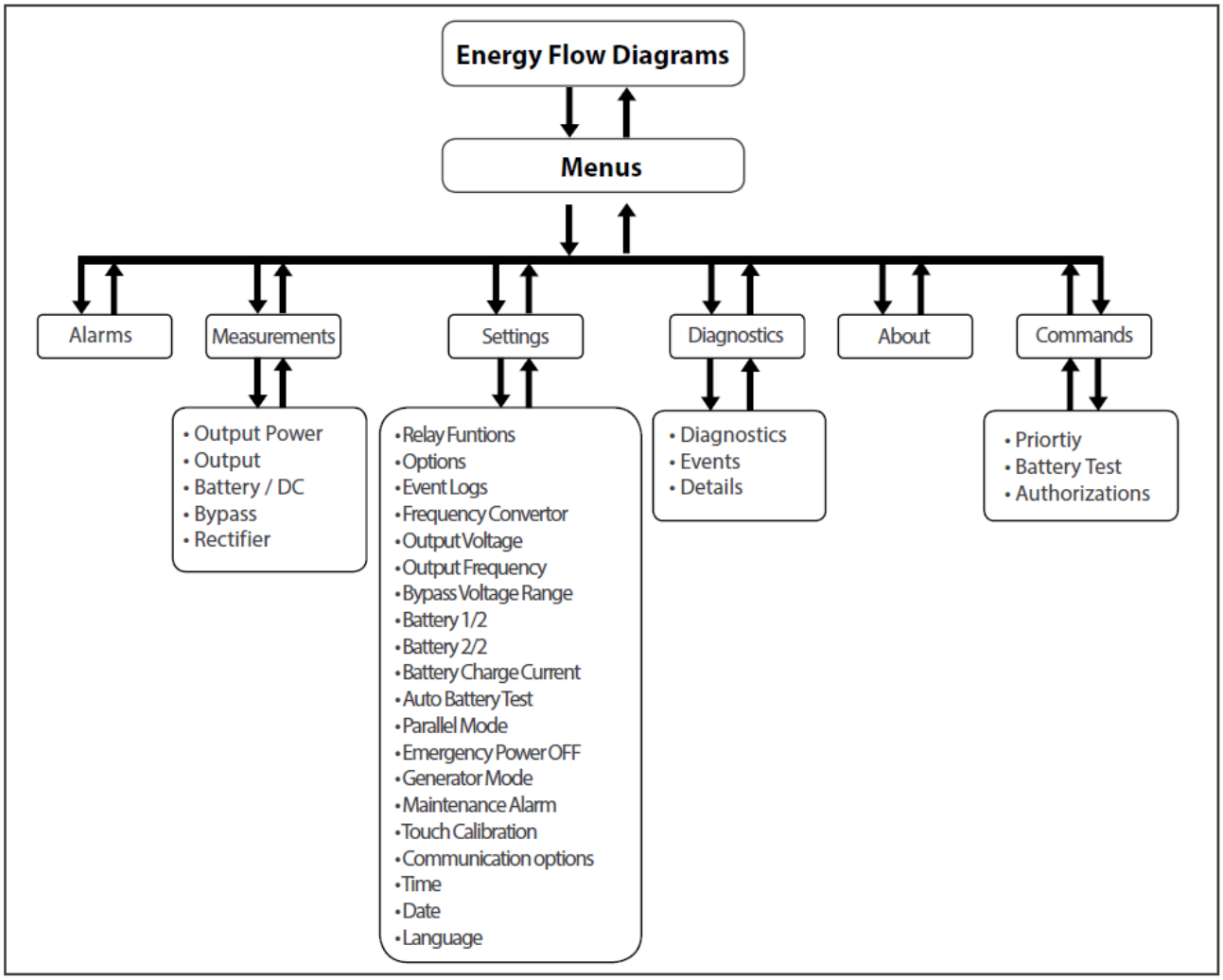
Manual Bypass enables the user to isolate the electronic circuitry of the UPS from the mains and the load without interrupting the load operation by connecting the loads directly to the bypass utility supply. This feature is useful while performing maintenance or service and should only be executed by authorized technical service personnel.

During Manual Bypass operation; in case of any mains interruption occurs, all loads on the output will be deenergized. Manual Bypass Operation should not be preferred for long time use.

6. FRONT PANEL

The front panel is located at the top / front of the UPS which informs the user about operating status, alarm conditions and measurements. It also provides access to control commands and user parameter settings.

Main screen image shows the energy flow path and Operation Modes. The information of the current operation is written at the upper side of the panel. Additionally, the energy flow path is given by a graphical animation.

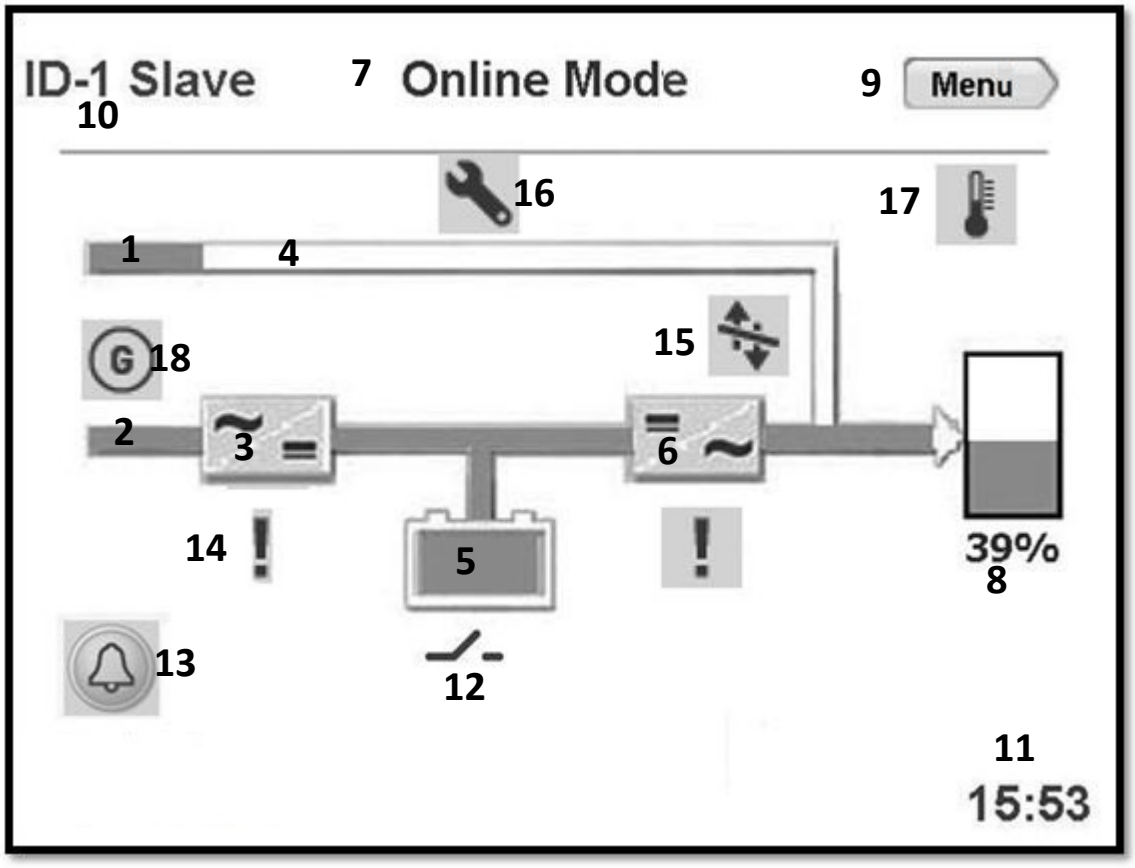


Password protected menu for SETTINGS and COMMANDS;

Password Authorizations	
User Password by default: 1111	Service Password: access only by INFORM Technical Service Personnel
• Relay Functions	• Options
• Communication Options	• Event Logs
• Time	• Frequency Converter
• Date	• Output Voltage
• Language	• Output Frequency
• Priority Mode	• Bypass Voltage Range
• Battery Test	• Battery 1/2
	• Battery 2/2
	• Battery Charge Current
	• Auto Battery Test
	• Parallel Mode
	• ESD
	• Generator Mode
	• Maintenance Alarm
	• Touch Calibration
	• Authorizations

6.1. Colourful Graphical Touchscreen Panel

Energy Flow Diagram/Modes Of Operation and **Menus** are displayed on LCD.

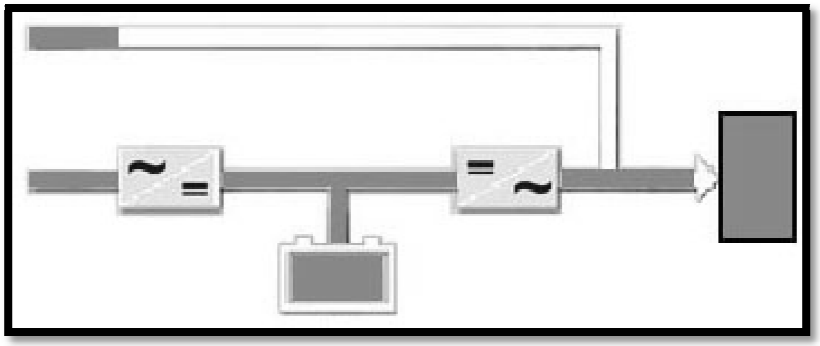


The description of the symbols in the energy flow diagram:

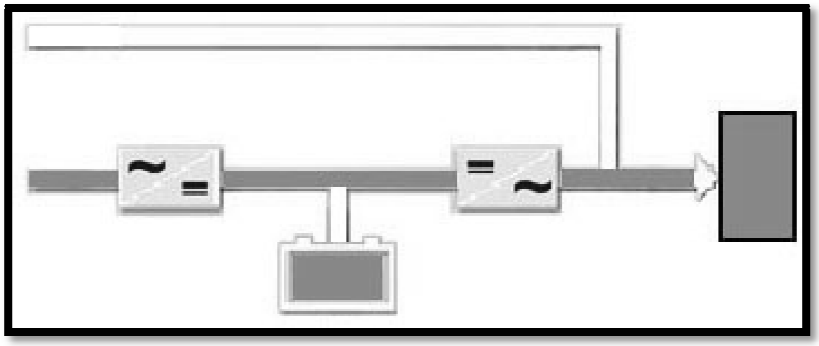
1. **Bypass Input:** If Bypass voltage is within the limits and in synchronization with inverter, then it lits Green, If Bypass voltage is within the limits and not in synchronization with inverter; it lits Orange.
2. **Rectifier Input:** If Input voltage is within the limits, then it lits Green
3. **Rectifier:** Converts AC voltage at the input into DC voltage. You may reach the rectifier measurements by touching it
4. **Bypass Line:** Shows that the loads are supplied via Bypass and line colour is Orange. If UPS is on EcoMode it is Green.
5. **Battery:** Shows battery condition. If it is discharging the indicator goes down, if it is charging then the indicator goes up. You may reach the battery/DC measurement by touching it.
6. **Inverter:** Converts DC voltage into AC voltage. You may reach the output measurement by touching it.
7. **Operation Mode Information:** Shows UPS's current operation mode.
8. **Load:** Shows the percentage of the load as numerical and graphical information. If there is overload at the output then the load graphic lits Red. You may reach the output power measurement by touching it.
9. **Menu:** You may reach the menus by touching it.
10. **Configuration:** It indicates if UPS is in parallel or single operation configuration. In Single Mode; there is no symbol
11. **Time:** It indicates the time
12. **Circuit Breaker:** It appears if battery Fuse is in "OFF" position or battery fuse has blown. If battery Fuse is in "ON" position; the circuit breaker icon is not displayed, instead battery capacity percentage is displayed.
13. **Alarms:** If there is an alarm on UPS, then this icon appears and informs the user by flashing. You may reach the alarms by touching it.
14. **Exclamation Mark:** Indicates that there is a problem when this icon appears.
15. **Transfer:** Indicates that transfer to bypass is disabled
16. **Wrench:** Indicates that UPS requires Periodic Preventive Maintenance
17. **Temperature:** Indicates ambient temperature of UPS is too high
18. **Generator Mode:** Indicates that UPS operates on Generator Mode.

Operation Modes of UPS and Energy Flow Diagram;

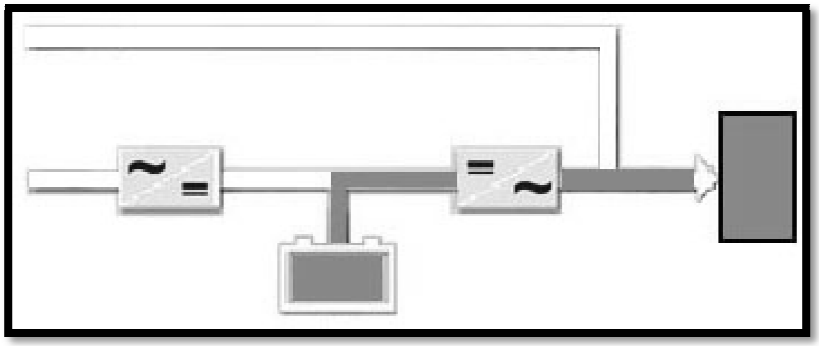
Online Mode:



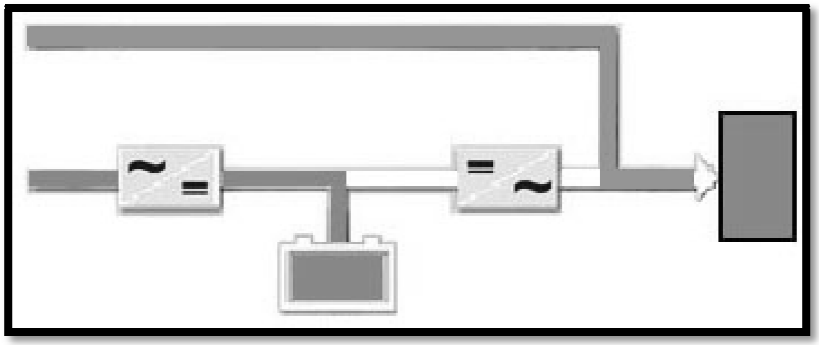
Frequency Converter Mode:



Battery Mode:

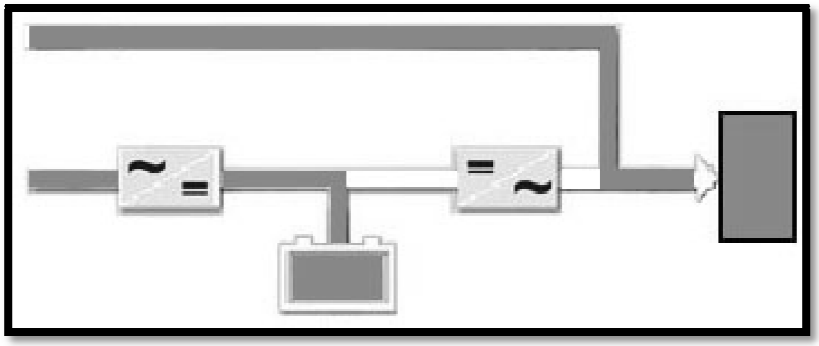


Bypass Mode:



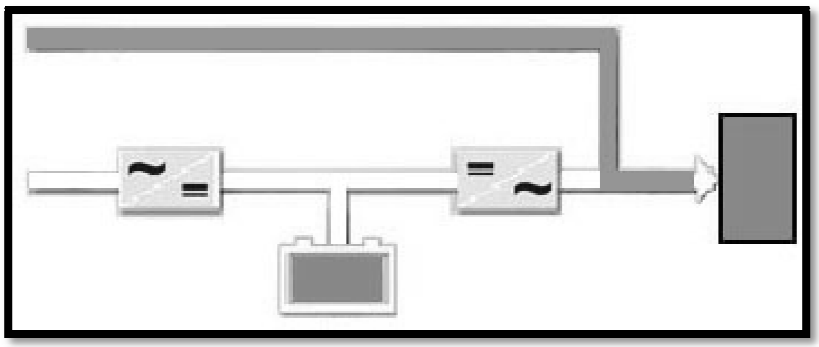
*Bypass Line indication has Orange color

EcoMode:



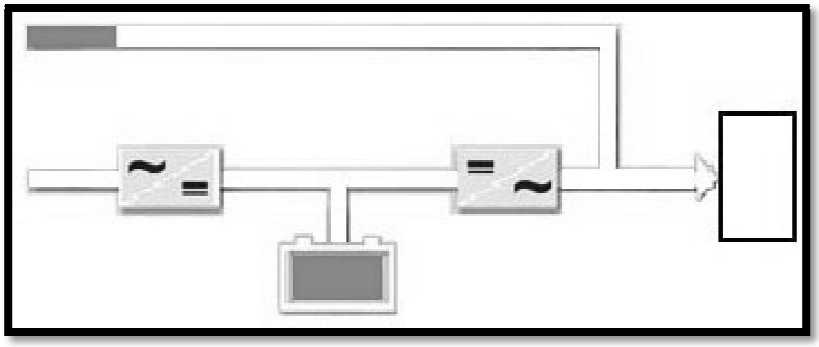
*Bypass Line indication has Green color

Maintenance Manual Bypass Mode



**Bypass Line indication has Orange color and no Battery Charging

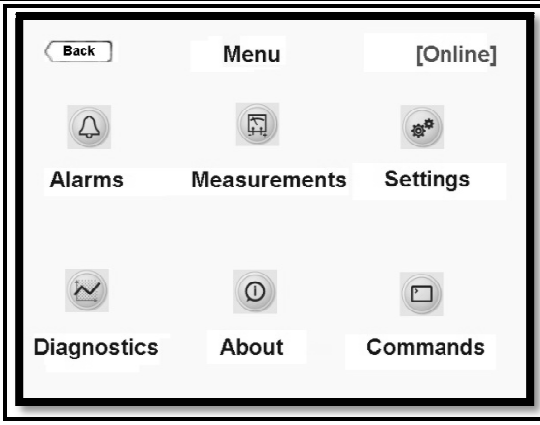
No Operation Mode:



6.2. Menu

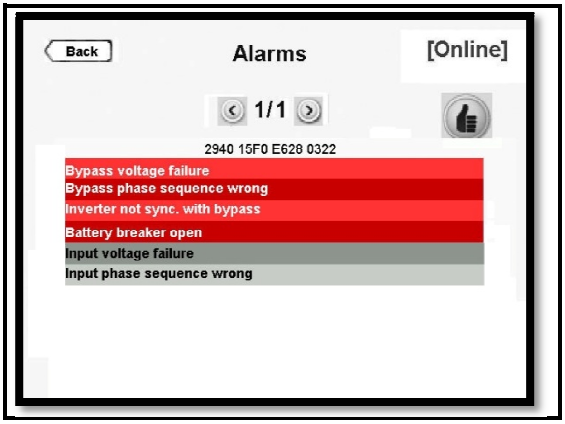
The related sub-menus under the main Menu can be accessed by touching MENU icon while main screen image is displayed. It provides information to user about the UPS, the measurements, and status of UPS.
By touching **Back** icon you may exit from the menu.

You may see the sub-menus as shown below;

	You may access the sub-menus by touching Menu icon; The Sub-Menu list is as follows; Alarms, Measurements, Settings, Diagnostics, About and Commands.

6.2.1. Alarms Menu

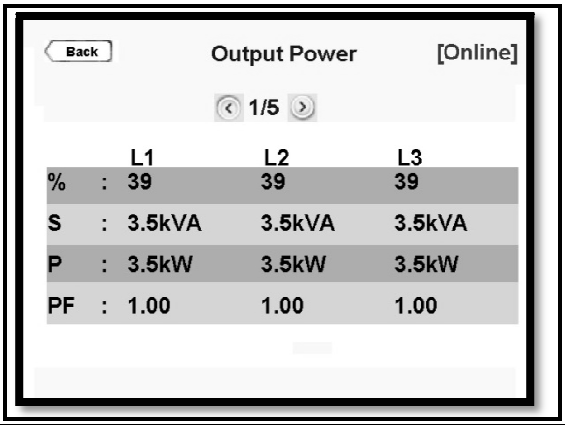
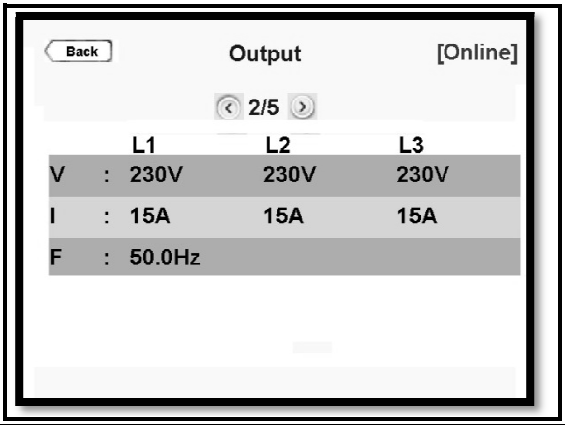
UPS displays 24 different alarms under “Alarms” menu. For detailed information about alarms, please check Appendix-2-Alarms List section.

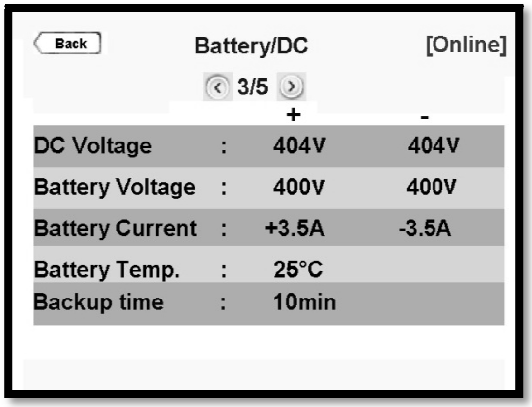
	All active alarms are displayed on the “Alarms” screen. They will appear in red colour and as soon as acknowledged by touching the hand icon at the right side of the screen, they switch to gray colour and the buzzer will stop. In case a new alarm occurs; the buzzer is activated again, and new alarm is displayed in red colour. It is necessary to acknowledge again the new alarm to stop the buzzer, then alarm text switch to gray colour.

6.2.2. Measurements Menu

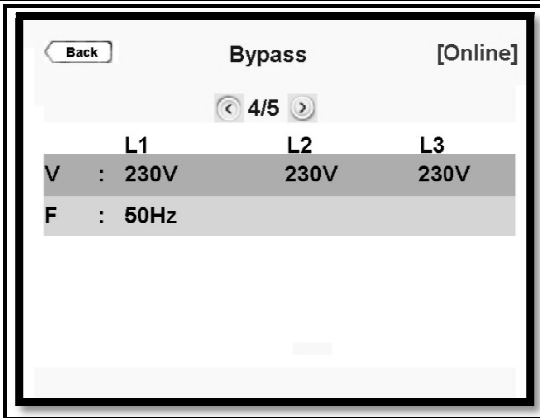
It provides useful measurement information about the UPS and the load.

You may scroll to right and left by touching right and left keys through Measurements menu.
The screens of MEASUREMENTS menu are as follows:

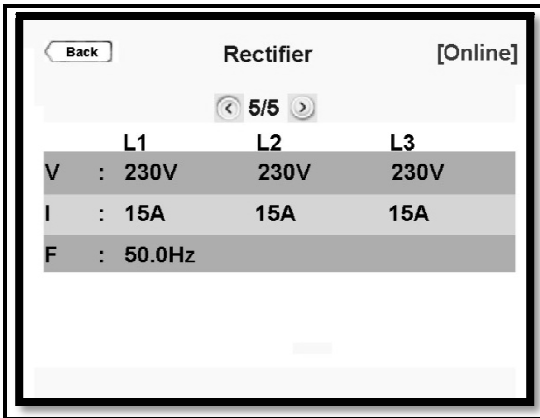
	Output load percentage (%), Apparent power (kVAa), Active power(kW) and Power factor , Information of each phase is displayed.
	Output voltage (V) (Ph-N), Current (Amp), Frequency (Hz) Information of each phase is displayed.



DC Bus and Positive-Negative string of battery voltage is displayed.
When the battery circuit breaker is closed, then it gives just Battery Voltage measurement.
It also displays the Charge and Discharge current value;
*Charge **(if it is +)** battery current,
*Discharge **(if it is -)** battery current,
Ambient temperature and remaining back-up time are also displayed.



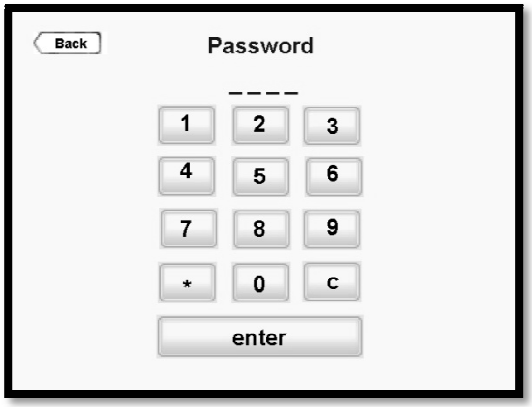
Bypass voltage (Ph-N) and Bypass Frequency information of each phase are displayed.
If the INPUT and BYPASS are connected in COMMON, then Rectifier and Bypass values will be the same.



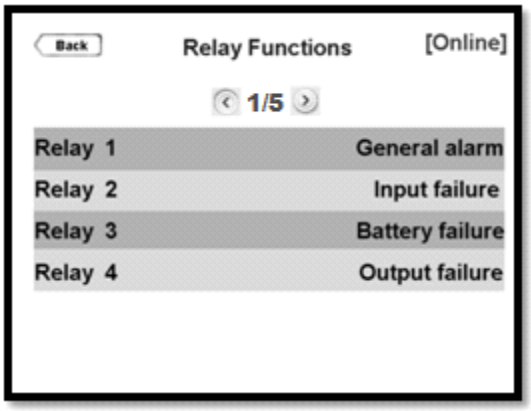
Rectifier voltage (Ph-N), Current and Frequency information of each phase are displayed.
If the INPUT and BYPASS are connected in COMMON, Rectifier and Bypass values will be the same.

6.2.3. Settings Menu

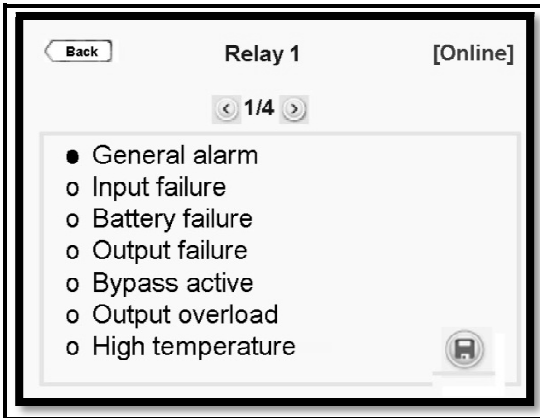
This menu is the section where all the settings related to UPS use customization can be done.
User Password must be entered to make changes in this section.
User Password: 1111 (the password cannot be changed)



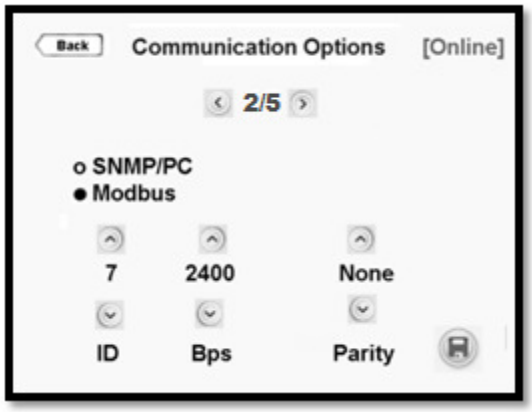
When the Password Screen appears, enter 1111, touch **ENTER** to confirm.



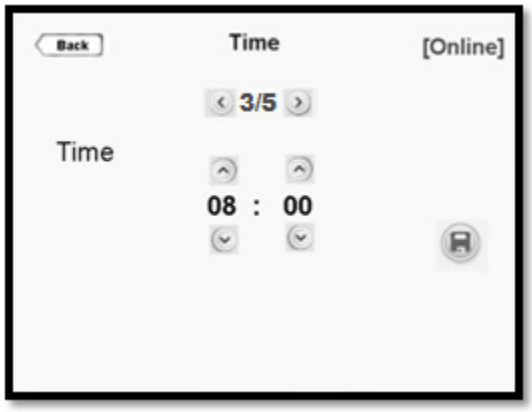
There are 4 different relays and one alarm is assigned to each relay.



There are 7 different alarms defined in the selection list.
By default, one alarm is assigned to each relay;
However this can be changed by the user. It is also possible to assign the same alarm to each of the 4 relays. You may set each relay via this menu.
When you touch the **save icon** key, a confirmation pop-up bar will appear. You should touch **Yes** to save the settings. Touch **No** to exit without saving the changes.

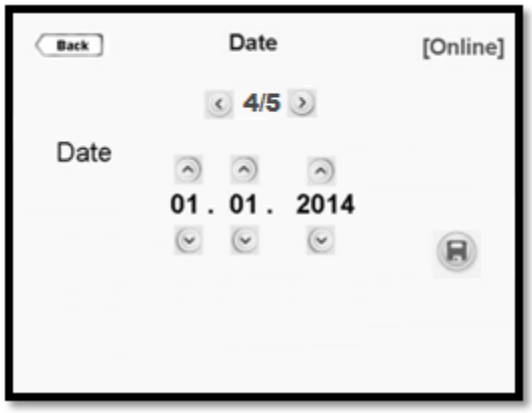


You may choose communication options here.
If Modbus is chosen; you may also make Modbus communication type adjustments.



UPS records the event log with the date and time information. Thus, in order to follow up the events chronologically, the Time adjustment of the UPS should be done from this menu.

When you touch the **save icon** key, a confirmation pop-up bar will appear. You should touch **Yes** to save the settings. Touch **No** to exit without saving the changes.

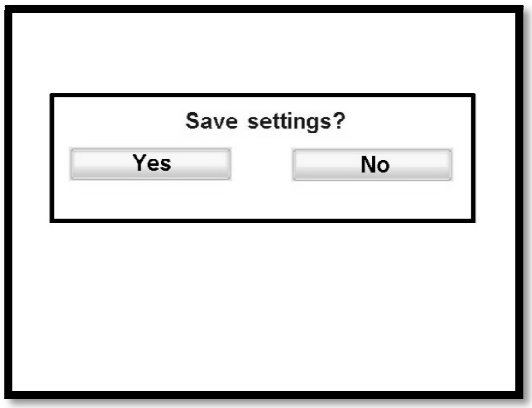


UPS records the event log with the date and time information. Thus, in order to follow up the events chronologically, the Date adjustment of the UPS should be done from this menu.

When you touch the **save icon** key, a confirmation pop-up bar will appear. You should touch **Yes** to save the settings. Touch **No** to exit without saving the changes.

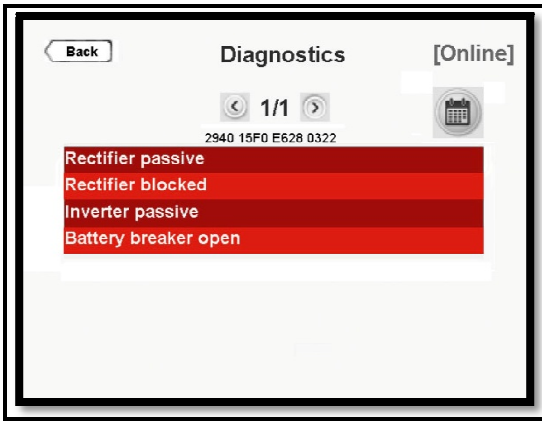
Set the date and time of UPS during the commissioning.

	You may choose the required language from the package installed in UPS menu.

	When you touch the **save icon** key, a confirmation pop-up bar will appear. You should touch **Yes** to save the settings. Touch **No** to exit without saving the changes.

6.2.4. Diagnostics Menu

All the alarms/notifications are logged real-time and can be accessed via this menu.
UPS displays up to 380 last events. Events are stored in EEPROM using FIFO method. Order number of last occurred event is 001, the oldest event is erased.
You may touch **right/left** arrow through the menu pages. When you touch any event log, you may reach the details of it.



You may see UPS status here. There are 17 different notifications.
When you touch the **calendar icon**; you may reach below Event Menu.

You may see the logged events with time and date info.
Events are stored in EEPROM using FIFO method.
When you touch any event log, you may reach the details of it as you see on the picture.

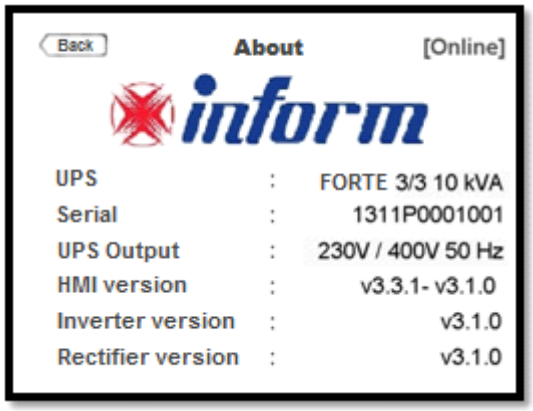
You may see the details of the event with event code.

If Technical Support required; taking notes of current event logs would be useful.

You may reach detailed information about events from Appendix-2: Event List.

6.2.5. About Menu

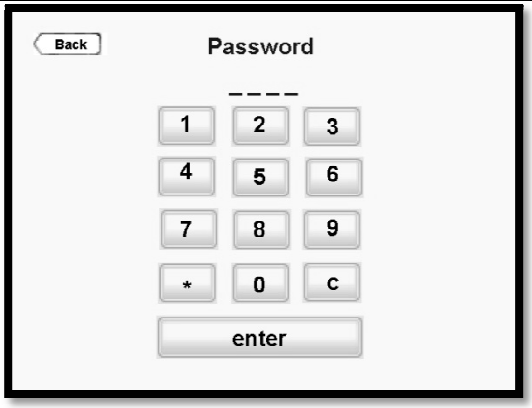
This menu provides information about the UPS itself.



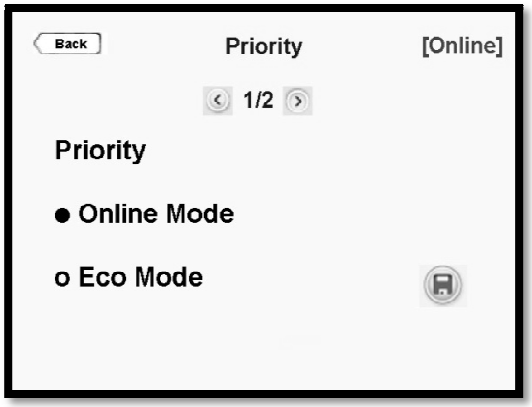
- **UPS:** UPS model and nominal power
- **Serial:** UPS serial number
- **UPS output:** UPS output voltage (Ph-N / Ph-Ph) and frequency
- **HMI version:** Interface firmware version
- **Inverter version:** Inverter firmware version
- **Rectifier version:** Rectifier firmware version

6.2.6. Command Menu

Through this menu; you may send some commands to UPS. User Password must be entered to make changes in this section.
User Password: 1111 (the password cannot be changed).
You may see the COMMAND Menu's screen as below;



When the Password Screen appears, enter 1111, touch **enter** to confirm.



Via this menu; you may choose operation mode of UPS as Online or Eco Mode.

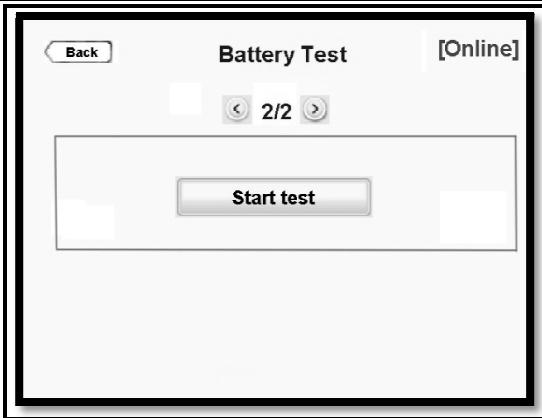
If system is configured as ***Single;*** you may choose operation mode of UPS Online or Eco Mode.

When you touch the **Save icon** key, a confirmation pop-up bar will appear.
You should touch **Yes** to save the settings. Touch **No** to exit without saving the changes.

Via this menu; you may choose operation mode of UPS as Online or Bypass.

If system is configured as ***Parallel Mode;*** you may choose the priority operation mode of UPS as Online or Bypass. At parallel systems, it is enough to set one UPS, the other UPS's switch to set mode automatically.

When you touch the **Save icon** key, a confirmation pop-up bar will appear.
You should touch **Yes** to save the settings. Touch **No** to exit without saving the changes.



With this command, UPS battery test feature can be started.
When you touch the **Start test** key, a confirmation pop-up bar will appear.
You should touch **Yes** to start the test; otherwise touch **No**.
UPS tests the battery automatically once each 90 days.

7. OPERATING PROCEDURES

7.1. Preparations

At some powers of FORTE UPS, fuse breaker is present on the UPS. On other powers, UPS is shipped with 3pcs battery fast fuses in a plastic package attached to the UPS. Separate the package from UPS and take out the fuses.

After all connections are completed as described in Section 4, the battery fuses must be placed as shown below. **Do not close the circuit breaker yet!**

Do not leave the battery fuse package at the front of UPS. Otherwise the fans would be blocked and UPS may overheat.

7.2. Presettings of UPS

In case no special request is specified, UPS will be shipped with the following features:

i. Run Mode : Inverter
ii. Output Voltage : 220V
iii. Output Frequency : 50Hz
iv. Battery : 2*30pcs
v. Battery Capacity : 4.5Ah

7.3. Commissioning

After all connections and settings have been done, UPS can be switched on.

Even with no connections have been done, hazardous voltage may exist on the connection terminals and inside the UPS. Do not touch these parts.

If you work on terminals; all circuit breakers in the input/bypass distribution panel, and the battery circuit breakers (if any) in the external battery cabinet should be brought to “0” position.

Units with internal batteries have hazardous voltages on the battery connectors even if the battery circuit breaker is at “0” position. **Do not touch the battery connectors!**

7.3.1. Starting Up the UPS with Internal Battery

1. Put the battery fast fuses (if exist) into the battery circuit breaker (F5). **Do not close the circuit breaker yet!**
2. Switch the input circuit breaker on the distribution panel to “ON” position.
3. Switch the input circuit breaker (F1) to “ON” position.
4. If exists, switch Bypass circuit breaker (F4) to “ON” position.
5. Switch the inrush circuit breaker (F6) to “ON” position.
6. Wait till ‘Online Operation’ shown on LCD.
7. Switch the battery circuit breaker (F5) to “ON” position.
8. Switch the output circuit breaker (F2) to “ON” position.
9. Switch the output circuit breaker on the distribution panel to “ON” position.

Afterwards UPS starts to supply the loads.

7.3.2. Starting Up the UPS with External Battery

1. Put the battery fast fuses(if exist) into the battery circuit breaker (F5). **Do not close the circuit breaker yet!**
2. Switch the input circuit breaker on the distribution panel to “ON” position.
3. Switch the input circuit breaker (F1) to “ON” position.
4. If exists, switch Bypass circuit breaker (F4) to “ON” position.
5. Switch the inrush circuit breaker (F6) to “ON” position.
6. Wait till ‘Online Operation’ shown on LCD.
7. Switch the circuit breaker on external battery cabinet to “ON” position.
8. Switch the battery circuit breaker on UPS (F5) to “ON” position.
9. Switch the output circuit breaker (F2) to “ON” position.
10. Switch the output circuit breaker on the distribution panel to “ON” position.

Afterwards UPS starts to supply the loads.

7.4. Decommissioning

Follow the order written below to decommission the UPS:

1. Switch the output circuit breaker on the distribution panel to “OFF” position.
2. Switch the output circuit breaker (F2) to “OFF” position.
3. Switch battery circuit breaker (F5) to “OFF” position.
4. If exists, external battery cabinet circuit breakers to “OFF” position.
5. Switch the input circuit breaker on the distribution panel to “OFF” position.
6. Switch the inrush circuit breaker (F6) to “OFF” position.
7. Switch the input circuit breaker (F1) to “OFF” position.
8. If exists, switch Bypass circuit breaker (F4) to “OFF” position.
9. Wait a few minutes till UPS completely turn off.

7.5. Starting Up the UPS without Battery

It is possible to use UPS without batteries as a voltage and frequency regulator. If the UPS is used in this feature, you must set the battery PARALLEL string number to “0” through Setting Menu. This setup can be done by Service Password so please contact with your Authorized Technical Personnel.

If you set “BYPASS: DISABLED”and in the meantime the inverter is disabled or blocked because of any reason, all loads at the output would be deenergized.

7.6. Manual (Maintenance) Bypass Commissioning Instruction

This procedure may only be executed by authorized Technical Service Personnel.

Manual by-pass enables the user to isolate the electronic circuitry of the UPS from the mains and the load without interrupting the load operation by connecting the loads directly to the bypass supply.
This feature is useful while performing maintenance or service and shall only be executed by authorized technical service personnel.
In order to transfer to Manual Bypass without interruption, do the following instruction respectively;

- Open the front cover.
- Switch the Manual Bypass circuit breaker (F3) to “ON” position.
- See “Manual Bypass Operation” written on LCD.
- Switch the output circuit breaker (F2), the battery circuit breakers (F5) –the breakers on external battery cabinets if any-, the input circuit breaker (F1) and inrush circuit breakers (F6) to “0” position.
- If UPS with split-bypass option, then switch the bypass (F4) circuit breaker to “0” position.
- LCD would be off and the alarms would be silenced.

The loads will be continued to be supplied directly from the mains.

Some parts inside the UPS (terminals, EMC filters and measurement circuits) are still energized during maintenance bypass operation. In order to deenergize all UPS parts, circuit breakers on mains and bypass mains distribution panels feeding the UPS and circuit breakers on external battery cabinet shall be brought to “OFF” position. Internal batteries shall also be isolated from the system.

During Manual Bypass operation; in case of any mains interruption occurs, all loads on the output will be deenergized. Manual Bypass Operation should not be preferred for long time use.

7.7. Manual (Maintenance) Bypass Decommissioning Instruction

In order to transfer the loads from Manual Bypass to UPS without interruption, do the following instruction respectively;

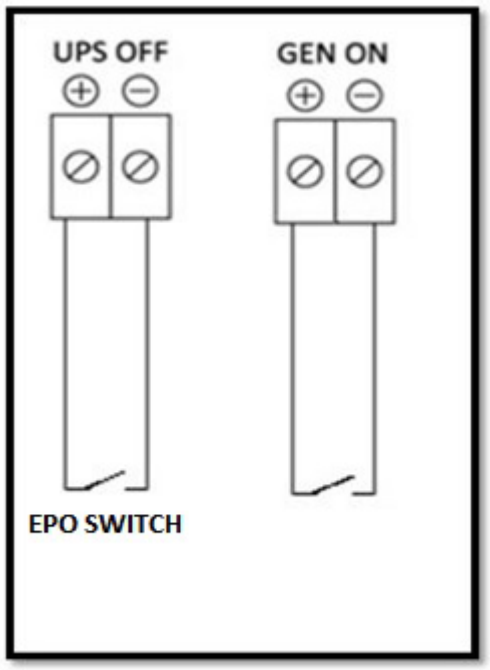
- Switch the input circuit breaker (F1) to “I” position.
- If exists, switch Bypass circuit breaker (F4) to “I” position.
- Switch the inrush circuit breaker (F6) to “I” position.
- LCD will be ON. Go to **Measurements** menu and wait till DC busbar voltages be min. 360VDC.
- Switch the battery circuit breaker (F5) and external battery cabinet breaker if any to “I” position.
- Switch the output circuit breaker (F2) to “I” position.
- See “Manual Bypass Operation” written on LCD.
- Wait 2 minutes till the UPS completes the test.
- Switch the Manual Bypass circuit breaker (F3) to “0” position.
- See “Online Operation” written on LCD.
  The Load will be started to be supplied through inverter.

7.8. Emergency Power Off (EPO)

UPS output can be cut off immediately by EPO connection if desired. EPO connection contact mode can be set via **Settings** Menu.

In case EPO connection is used in distance; a latched switch can be used as described in below figure. When UPS operates in Online Operation; if EPO is needed, then you have to make the switch opened or closed regarding to EPO contact mode settings you have done before to turn the UPS off.

Emergency Off Connection



EPO switch should be placed where unauthorized people can not reach it. Unauthorized use may cause the load be deenergized.

8. MAINTENANCE

All the maintenance operations should be done by authorized Technical Service Personnel.

Hazardous voltage and high temperature metal parts inside even if the UPS is disconnected. Contact may cause electric shock and burns. All operations except replacing battery fuses shall be carried out by the authorized Technical Personnel only.

Some parts inside the UPS (terminals, EMC filters and measurement circuits) are still energized during maintenance bypass operation. In order to deenergize all UPS parts, circuit breakers on mains and bypass mains distribution panels feeding the UPS and circuit breakers on external battery cabinet shall be brought to “OFF/0” position. Internal batteries shall also be isolated from the system.

Maintenance includes fully control of all the electronic and mechanical components in UPS. And they needed to be replaced after their lifetime is over. Systematic maintenance ensures to improve UPS’s efficiency and to extend life-time. INFORM recommends every 3 to 6 months of period for systematic maintenance after warranty by authorized service.

8.1. Batteries

The life of batteries strongly depends on the usage and environmental conditions. (ambient temperature, frequency of electricity cuts, etc.). There are also other factors like the number of charge-discharge cycles and discharge depth. Performing battery test can provide you information about battery condition. But not to come acrross any unrequired condition during electricity cut, the batteries should be maintained periodically by authorized Technical Personnel.

Danger of explosion and fire if the batteries of the wrong type are used.

Do not open or multilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

When replacing batteries; use the same quantity and type that were originally fitted.

Batteries must always be disposed of according to local environmental laws.

8.2. Battery Fuses

Switching the battery circuit breaker to “I” position before seeing “Online Mode” message on the LCD may cause battery fuses to blow out.

Battery fuses should only be replaced with the same rating or equivalent.

8.3. Fans

The life of fans used to cool the power circuits depends on the usage and environmental conditions. FANs have a certain life time and its life time depends on environmental conditions (Temperature, dust, humidity…etc)
Please look at Appendix-3: Technical Specifications for detailed environment conditions.
Preventive maintenance shall be done by authorized Technical Personnel periodically.

8.3. Capacitors

There are two type of Capacitors used inside the UPS;

1) Electrolytic Capacitors on the DC Bus
2) AC Filter Capacitors on the UPS output

The life time of these capacitors depend on the usage and environmental conditions (temperature, humidity, load %..etc)

Preventive maintenance on Capacitors should be done by authorized Technical Personnel periodically.

9. TROUBLESHOOTING

The aim of this chapter is to understand some specific problems, to verify the cause of the problems and to provide solution to them.

Hazardous voltage exists and high temperature metal parts present inside even if the UPS is disconnected. Contact may cause electric shock and burns. All operations except replacing battery fuses shall be carried out by the authorized technical personnel only.

First things to do:

1. Check and verify that PE connections are done properly.
2. Check and verify if all the cables are connected to the right terminals.
3. Check and verify if the mains exist and if it is within the limits.
4. Check and verify that all the circuit breakers for UPS in the distribution panel are at "I" position.
5. Check and verify that all the circuit breakers of UPS are at "I" position.
6. Check and verify that Input/Bypass sequence is correct.

9.1. Output Short Circuit Alarm

If a short circuit occurs at the output of the unit, UPS acts like a current source (as long as the over current is drawn, it decreases the output voltage keeping the output current constant at a certain value) forcing to trigger the circuit breaker that is between the UPS and the short-circuited load. By triggering the mentioned circuit breaker, the short circuited line is being removed and the other loads that are present on the other lines are being prevented to be affected from this failure.

To enable the short circuit protection feature of the UPS, each load shall be supplied over a separate circuit breaker chosen according to the load current. This may provide quick disconnection of the short circuited line and operation continuity of the other loads. To obtain maximum protection, the rating of each individual load circuit breaker shall have the minimum value, which is enough to carry the full load current continuously. Additionally UPS should operate in Online or Battery Operation.

Please follow the steps below when "**Output short circuit**" alarm occurs;

- Switch the output circuit breaker (F2) of UPS to "0" position.
- Start-up UPS in Online Operation.
- Wait to see "Online Operation" shown on LCD.
- Switch the output circuit breaker (F2) of UPS to "I" position.
- If the rating of each individual load circuit breaker is properly selected; then the circuit breaker of short circuited load would be blown. If not properly selected, then "Short Circuit Alarm" would be shown on LCD. In this case the short-circuited load should be found-out and removed.

9.2. High Inrush Current Load at the Output

Some loads absorb more current than their nominal current value for a short period of time when they are energized. Ordinary UPS's either switch off their output and they cause all the loads to remain without energy or they pass to bypass, transferring all the loads to the mains.
FORTE UPS behaves like a current source in such a situation. (As long as the over current is drawn, it decreases the output voltage keeping the output current constant at a certain value). Thus none of the loads on the output are affected from this situation.

UPS performs this feature if it is working in Online or Battery Operation.

9.3. Bypass voltage bad shape Alarm

It means that Bypass mains voltage is different than the inverter reference signal. (e.g. it's out of its limits or the total harmonic distortion > %10)
Make sure that the bypass circuit breaker is "I" (if the UPS has no separate bypass mains input, make sure that the input circuit breaker is "I ").

9.4. Bypass phase sequence wrong Alarm

It means that phase sequence of bypass mains voltage is not OK. Phase sequence of the separate bypass mains input should be changed.

9.5. Bypass not synchronized Alarm

Frequency of bypass mains voltage is out of the frequency range for bypass operation or bypass mains voltage is very low. Check if the bypass mains voltage is within the specified limits.

9.6. Input phase sequence wrong Alarm

It means that phase sequence of input mains voltage is not OK. Phase sequence of input mains input should be changed.

9.7. Input not synchronized Alarm

Frequency of input mains voltage is out of the frequency range for input operation or input mains voltage is very low. Check if input mains voltage is within specified limits.

9.8. DC voltage low/DC not equal to input voltage Alarms

Any of the DC bus voltage is lower than its lower limit. It means that the batteries had been discharged. It is removed when the rectifier resets. If you encounter this alarm during start-up, check if the inrush circuit breaker is at "I" position. Charge the batteries, perform battery test and check if the alarm is removed.

9.9. Emergency power off active Alarm

It means that Emergency stop (EPO) is activated (digital input "UPS OFF" is set high). Check the "EPO" input

9.10. Input Circuit Breaker Blown Out

If the input circuit breaker blows; it points out that there is output short circuit on Bypass Operation or UPS might be breakdown. Please look at also Section 9.1. Output Short Circuit Alarm.

9.11. Ambient temperature high Alarm

It is shown "**Ambient temperature high**" on Alarm List. If the ambient temperature is high, it causes a rise in the internal temperature of UPS and this alarm appears. In this case; the first thing to do is cool down the environment.

9.12. Overload Alarms

Connected loads to the output of the UPS that exceed the nominal power of the unit is called "**Rectifier overload**" and/or "**Inverter overload**". Check if there is an overload and remove the excessive load. Hence the alarm would be off.
UPS can supply the load that exceeds the nominal power of the unit for a limited period while operating in Online Mode. This period depends on the load % and the initial temperature of the overload on the semiconductors.
The Unit follows up the following procedure in the calculation of the overload time:

- It supplies the load for a period which is specified in Appendix-3 Technical Specifications, and then it transfers the load to bypass line if the bypass input voltage/frequency value is within the allowed limits.
- Meanwhile if the junction temperature passes over a certain value, than it transfers the load to bypass line (assuming the bypass voltage/frequency is acceptable).

If the unit is working on bypass mode during the initial start of the overload or if it has passed to bypass mode because of the overload, then the only protection in the system is the automatic circuit breakers in the circuit. In case of the UPS circuit breaker is switched off then all the loads on the output would be deenergized.

Make sure that the UPS is not overloaded to provide a higher quality supply to the loads.

9.13. Manual bypass active Alarm

If Manual Mypass circuit breaker is brought to "I" position, this alarm appears. If Manual Bypass circuit breaker is brought to "I" position without any reason (except the reasons explained in Section 7.6), switch this circuit breaker to "0" position to remove the alarm.

9.14. Battery test failure Alarm

UPS tests the batteries periodically. In case the batteries failed in the battery test, this alarm appears. Perform the test again when the batteries have been charged for min. 10 hours and verify the battery circuit breaker is at "I" position.
If the alarm continues, contact to authorized Technical Service.

9.15. Input voltage high/Input voltage low Alarms

If the input voltage is not within the specified limits, these alarms appear. In this case, UPS operates in Battery Operation mode, as soon as the mains returns to specified limits, then the alarm shall dissappear.

If the mains does not return to normal conditions during Battery Operation, UPS will be turned off and all loads at the output would be deenergized at the end of battery autonomy.

9.16. Bypass voltage high/ Bypass voltage low Alarms

If the bypass voltage is not within the specified limits, these alarms appear. In this case, UPS operates in Online Operation mode, as soon as the mains returns to specified limits, the alarm shall dissappear, but never switches to Bypass Operation. If UPS needs to be switched to bypass at this moment, UPS will cut the output and load would be deenergized.

9.17. Inverter temperature high/ Rectifier temperature high Alarms

If temperature of the inverter or rectifier block rises, these alarms appear. The reasons can be; overload (see Section 9.12), broken fans and high ambient temperature (see Section 9.11). If the fans are broken or any other problem is defined, contact to an authorized Technical Service.

9.18. Junction/Heatsink temperature high Alarms

If temperature of the heatsink or junction rises up, these alarms appear. The reasons can be; overload (see Section 9.12), broken fans and high ambient temperature (see Section 9.11). If the fans are broken or any other problem is defined, contact to an authorized Technical Service.

Any other alarm occurs except the alarms explained above, contact to an authorized Technical Service instantly.

Please have the following information ready before you contact to service:

- Ensure you read the troubleshooting section carefully and apply the procedure.
- Model Number
- Serial Number
- Firmware version
- Date of failure or problem
- Symptoms of failure or problem
- Customer return address and contact information

You may find all the alarms and description in Appendix-1: Alarms List.

Appendix-1: Alarms List

Rectifier passive	Rectifier does not operate now.
Rectifier blocked	Rectifier operation is automatically stopped due to a fault.
Rectifier off	Rectifier is set as “OFF” from front panel.
Rectifier temperature high	Rectifier section temperature is very high.
Rectifier overload	RMS current drawn from any of the input line exceeds its nominal value.
Rectifier current high	RMS current drawn from any of the input line exceeds its nominal value.
Rectifier no response	Communication between the rectifier and the front panel is lost.
Inverter passive	Inverter does not operate now.
Inverter blocked	Inverter operation is automatically stopped due to a fault.
Inverter off	Inverter is set as “OFF” from front panel.
Inverter temperature high	Inverter section temperature is very high.
Inverter overload	RMS current drawn from any of the output line exceeds its nominal value.
Inverter current high	RMS current drawn from any of the output line exceeds its nominal value.
Inverter no response	Communication between the inverter and the front panel is lost.
Bypass active	UPS is on Bypass operation.
Bypass off	Bypass is set as “OFF” from front panel.
Bypass priority	Operation priority is set as Bypass.
Bypass voltage bad shape	Bypass mains voltage is different than the inverter reference signal (e.g. its frequency is beyond synchronization limits or it has a total harmonic distortion > %10)
Bypass voltage high	Bypass mains voltage is higher than its upper limit.
Bypass voltage low	Bypass mains voltage is lower higher than its lower limit.
Bypass sequence wrong	Phase sequence of bypass mains voltages is not OK
Bypass not synchronized	Frequency of bypass mains voltage is beyond the frequency range for bypass operation or bypass mains voltage is very low.
Battery open circuit	Battery Circuit Breaker is open.
Battery test active	Battery test is on.
Battery discharging	Batteries are discharging after a mains failure.
Battery test failure	Batteries failed in the battery test.

Input voltage high	Input mains voltage is higher than its upper limit.
Input voltage low	Input mains voltage is lower higher than its lower limit.
Input sequence wrong	Phase sequence of input mains voltages is not OK
Input not synchronized	Frequency of input mains voltage is beyond the frequency range for input operation or input mains voltage is very low.
DC not equal to input voltage	Rectified input voltage is not equal to DC bus voltage.
DC voltage high	DC bus voltage is higher than its upper limit.
DC voltage low	DC bus voltage is lower than its lower limit may mean that the battery is empty during battery operation.
Ambient temperature high	Ambient temperature exceeds its upper limit.
Junction temperature high	Junction of IGBT temperature exceeds its upper limit.
Heatsink temperature high	Heatsink temperature exceeds its upper limit.
Output voltage failure	Output voltage is beyond its limits
Output short circuit	Short circuit at the output.
Generator mode active	Generator friendly operation is activated.
Emergency power off active	Emergency stop is activated.
Manual bypass active	Manual bypass switch is “ON”.
Output open circuit	Output circuit breaker is at “0” position (just for parallel UPSs)
N number failure	Parallel system alarm. If the UPS number in parallel is less than the pre-adjusted N number, than this alarm appears.
Redundancy lost	Parallel system alarm. The total load is more than the redundancy load. The formula is Load % x (N+1) / N > 100

Appendix-2: Event List

Bypass voltage ok	:	Bypass voltage is within its limit.
Bypass frequency ok	:	Bypass frequency is within its limit.
Bypass synchronized	:	Frequency of bypass mains voltage synchronized with output frequency.
Bypass sequence ok	:	Phase sequence of bypass mains voltage is OK.
Manual bypass passive	:	Manual bypass switch is at “0” position.
Inverter temperature ok	:	Inverter section temperature is within the limits.
Inverter load ok	:	RMS current drawn from any of the output line does not exceed its nominal value.
Bypass passive	:	Bypass does not operate now.
Inverter active	:	Inverter operates now.
Inverter unblocked	:	Inverter is not blocked and ready to operate.
Output voltage ok	:	Output voltage is within the limits.
Master communication ok	:	There is no communication problem with master UPS.
Paralelling cable plugged	:	Parallel cable is plugged.
Input voltage ok	:	Input voltage is within the limits.
Input frequency ok	:	Input frequency is within the limits.
Input synchronized	:	Rectifier is synchronized to input frequency.
Input sequence ok	:	Phase sequence of input voltages is OK.
Rectifier temperature ok	:	Rectifier section temperature is within the limits.
Rectifier load ok	:	RMS current drawn from any of the input line does not exceed its nominal value.
DC voltage ok	:	DC bus voltage is within the limits.
Rectifier active	:	Rectifier operates now.
Rectifier unblocked	:	Rectifier is not blocked and ready to operate.
Output breaker closed	:	Output circuit breaker is at “I” position.
Battery test completed	:	Battery test is completed.
Redundancy ok	:	All parallel UPS is OK.
N number ok	:	All parallel UPS is OK.
Rectifier on	:	Rectifier is set as “ON” from front panel.
Inverter on	:	Inverter is set as “ON” from front panel.
Bypass on	:	Bypass is set as “ON” from front panel.
Inverter priority	:	Priority is Inverter operation.
Battery not discharging	:	Battery is not discharging.
DC voltage ok	:	DC bus voltage is within the limits.
Ambient temperature ok	:	Ambient temperature is within the limits.
Generator mode passive	:	Generator friendly operation is passive.
EPO passive	:	EPO is passive.
No minor alarm	:	There is no minor alarm.
No major alarm	:	There is no major alarm.
Battery test succeed	:	Battery test result is success.
Battery breaker closed	:	Battery circuit breaker is at “I” position.

DC equal to input	:	DC bus voltage is equal to input voltage.
Inverter response ok	:	Communication between the inverter and the front panel is OK.
Rectifier response ok	:	Communication between the rectifier and the front panel is OK.
Bypass voltage bad shape	:	Bypass mains voltage is not sinusoidal.
Bypass voltage high	:	Bypass voltage is higher than its limit.
Bypass voltage low	:	Bypass voltage is lower than its limit.
Bypass frequency high	:	Bypass frequency is higher than its limit.
Bypass frequency low	:	Bypass frequency is lower than its limit.
Bypass not synchronized	:	Frequency of bypass mains voltage not synchronized with output frequency.
Bypass sequence wrong	:	Phase sequence of bypass mains voltage is not OK
Manual bypass active	:	Manual bypass switch is “ON”
Inverter temperature high	:	Inverter section temperature is very high.
Inverter overload	:	RMS current drawn from any of the output line exceeds its nominal value.
Bypass active	:	UPS is on Bypass Operation.
Inverter passive	:	Inverter does not operate now.
Inverter blocked	:	Inverter operation is automatically stopped due to a fault.
Output voltage failure	:	Output voltage is beyond its limits
Master communication lost	:	This alarm is observed when information flow from master ups is interrupted
Cable unplugged	:	Parallel Communication cable is unplugged or damaged
Input voltage high	:	Input voltage is higher than its limit.
Input voltage low	:	Input voltage is lower than its limit.
Input frequency high	:	Input frequency is higher than its limit.
Input frequency low	:	Input frequency is lower than its limit.
Input not synchronized	:	Frequency of input voltage is beyond the frequency range for bypass operation or bypass mains voltage is very low
Input sequence wrong	:	Phase sequence of input mains voltage is not OK.
Rectifier temperature high	:	Rectifier section temperature is very high.
Rectifier overload	:	RMS current drawn from any of the input line exceeds its nominal value.
DC voltage high	:	DC bus voltage is higher than its upper limit.
DC voltage low	:	DC bus voltage is lower than its lower limit. may mean that the battery is empty during battery operation.
Rectifier passive	:	Rectifier does not operate now.
Rectifier blocked	:	Rectifier operation is automatically stopped due to a fault.
Output breaker open	:	Output Circuit Breaker is at “OFF” position.
Battery testing	:	Battery test is on progress.
Redundancy lost	:	Parallel system alarm. The total load is more than the redundancy load. The formula is Load % x (N+1) / N > 100
N number failure	:	Parallel system alarm. If the UPS number in parallel is less than the pre-adjusted N number, than this alarm appears.
Rectifier off	:	Rectifier is set as “OFF” from front panel.
Inverter off	:	Inverter is set as “OFF” from front panel.

Bypass off	:	Bypass is set as “OFF” from front panel.
Bypass priority	:	Priority is Bypass Operation.
Battery discharging	:	Battery is discharging.
DC voltage failure	:	DC bus voltage is lower than its lower limit. It may mean that the battery is empty during battery operation
Ambient temperature high	:	Ambient temperature exceeds its upper limit.
Generator mode active	:	Generator friendly operation is activated.
EPO active	:	Emergency stop is activated.
Minor alarm	:	There is minor alarm.
Major alarm	:	There is major alarm.
Battery test failure	:	Batteries failed in the battery test.
Battery breaker open	:	Battery Circuit Breaker is at “OFF” position.
DC not equal to input	:	DC bus voltage is not equal to input voltage.
Inverter no response	:	Communication between the inverter and the front panel is lost.
Rectifier no response	:	Communication between the rectifier and the front panel is lost.

Appendix-3: Technical Specifications

Tower Model (3Ph/3Ph)	FORTE 33010	FORTE 33015	FORTE 33020	FORTE 33030	FORTE 33040	FORTE 33060	FORTE 33080	FORTE 33100	FORTE 33120	FORTE 33160	FORTE 33200
Output Power (kVA)	**10**	**15**	**20**	**30**	**40**	**60**	**80**	**100**	**120**	**160**	**200**
Nominal Active Power (kW)	**10**	**15**	**20**	**30**	**40**	**60**	**80**	**100**	**120**	**160**	**200**
INPUT											
Input Voltage Tolerance (VAC) (at 50% Load)	140 - 265 (Ph-N)										
Input Voltage olerance (VAC) (at 100% Load)	207 - 265 (Ph-N)										
Frequency (Hz)	45 - 65										
Power Factor	≥ 0.99										
OUTPUT											
Nominal Voltage (VAC)	220-230-240 (Adjustable)										
Power Factor	1.0										
Wave Form	Sinusoidal										
Frequency (Hz)	50 or 60 (Adjustable)										
Frequency Tolerance (Battery Operation)	0.005%										
Voltage Regulation (Static)	±1%										
Output voltage unbalance at reference unbalance load	0										
Maximum phase angle variation	0°										
Crest Factor	3:1										
Nominal Power (kVA)	10	15	20	30	40	60	80	100	120	160	200
Overload Protection	10min (at 100 - 125% Load) 1min (at 125 - 150% Load)										
Toltal Efficiency*	96% (Eco Mode Operation > 98,5%)									96,5% Ecomode: >98,5%	
THD_V	Non-Linear Load < 4% Linear Load < 2%										
BATTERY											
Battery Type	Maintenance-Free Lead Acid Batteries										
Battery Quantity (Pcs)	2*30										

BYPASS										
Voltage Tolerance	±10% as default (adjustable at -15% +12% range)									
Frequency Tolerance (Hz)	47-53 (for 50Hz) 57-63 (for 60Hz)									
Transfer Time (sec)	0									
PROTECTION										
Overload Protection, High Temperature, Over Voltage, Over Current, Battery Deep Discharge Protection, Short-Circuit Protection										
COMMUNICATION**										
RS232, RS485 MODBUS, GEN & EPO ports as standard, USB Converter, SNMP, Programmable Free Contacts as Optional										
ENVIRONMENT										
Operating Temperature Range (°C)	0 - 40									
Battery Temperature Range (°C)	20 - 25 (Recommended For Longer Battery Life)									
Maximum Altitude without Deratimg (m)	1000									
Relative Humudity Range	0-95% (Non-Condensing)									
Acoustic Noise (dBA)	< 55 (at 1m)				< 60 (at 1m)		< 68 (at 1m)		< 72 (at 1m)	
PYHSICAL										
Dimensions (cm)	40 x 75 x 110				52 x 88 x 131		67 x 77 x 165		85 x 80 x 185	
Weigth (kg) (w/o battery)	100	114	116	122	180	202	253	285	356	392	460
STANDARDS										
Safety	IEC/EN 60950,62040-1									
EMC	IEC/EN 62040-2									
Performance	IEC/EN 62040-3									
Protection Class	IP 20									

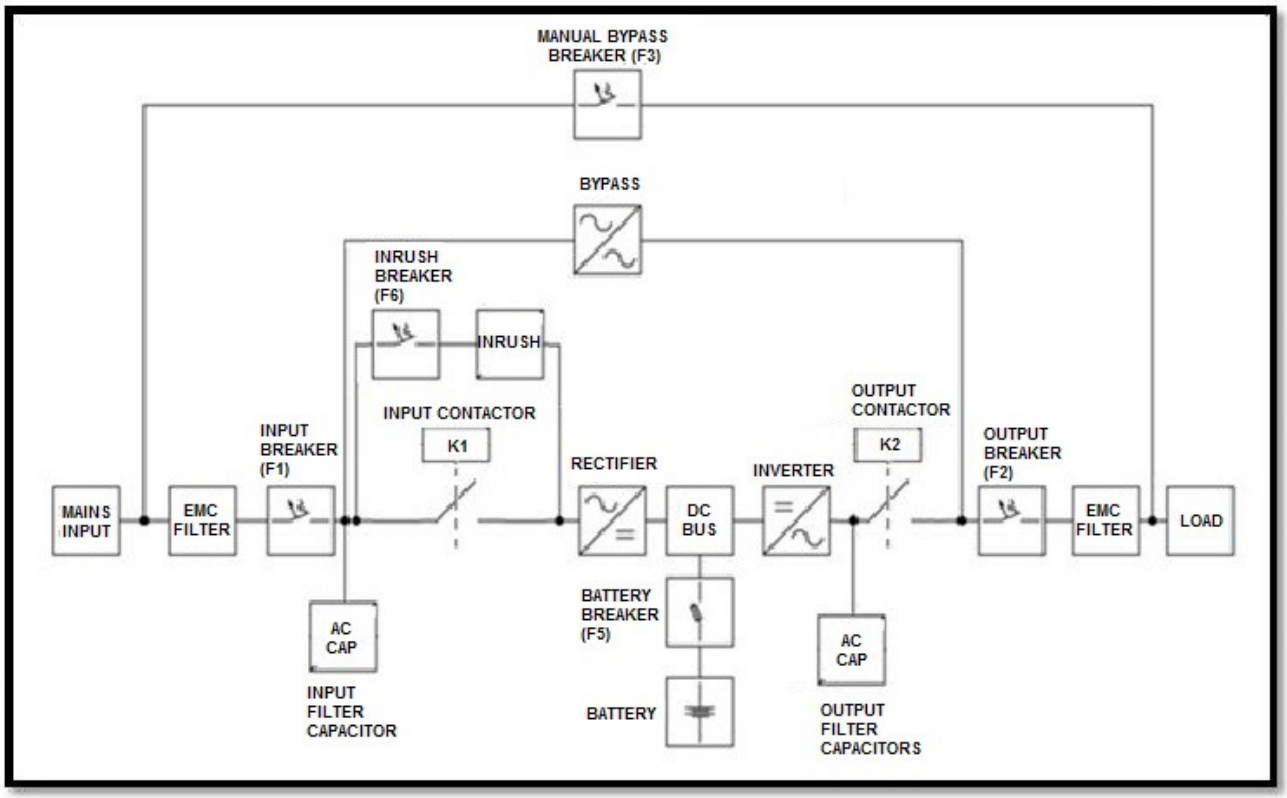
* Varies depending on UPS power and environmental conditions.

** Please contact with your local authorized distributer for optional communication interfaces.

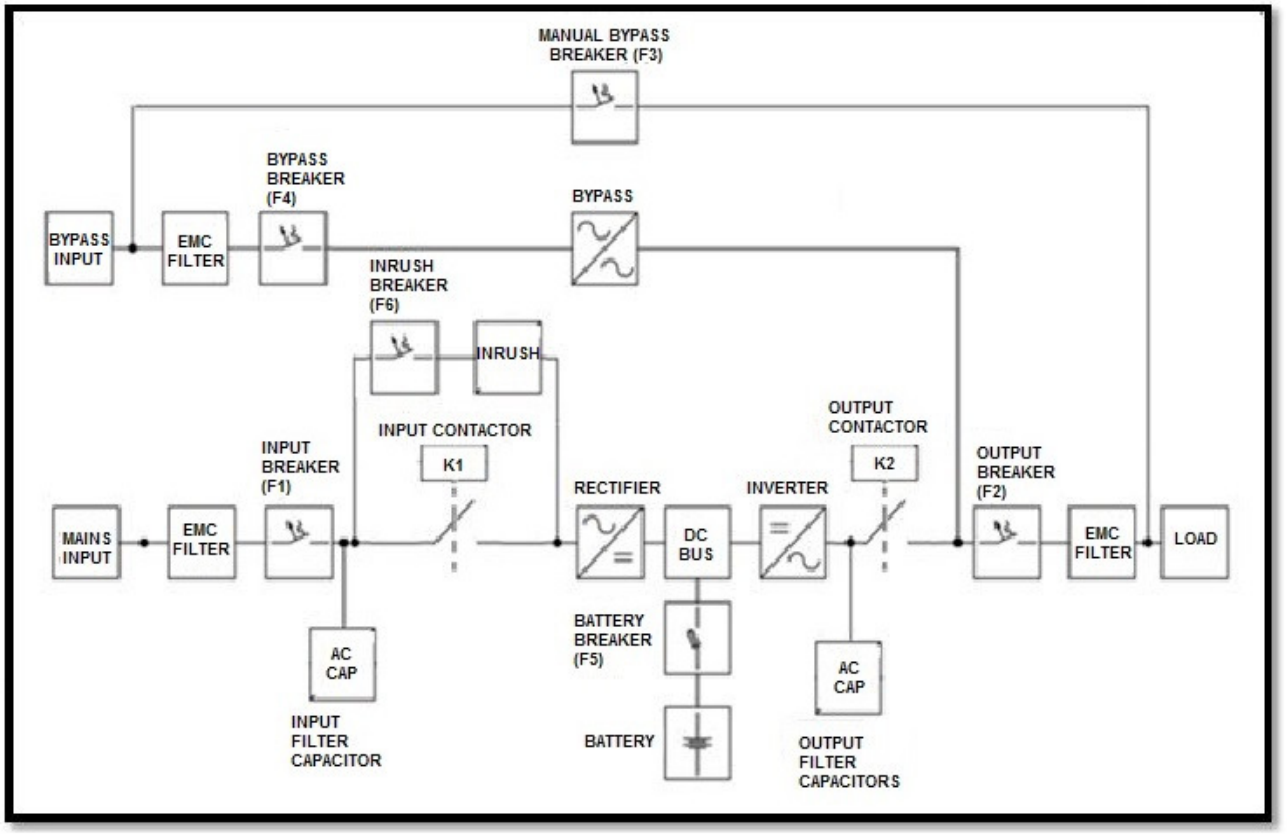
*** The manufacturer reserves the rights to change the Technical Specifications and design without notice.

Appendix-4: Description of UPS and Block Diagram

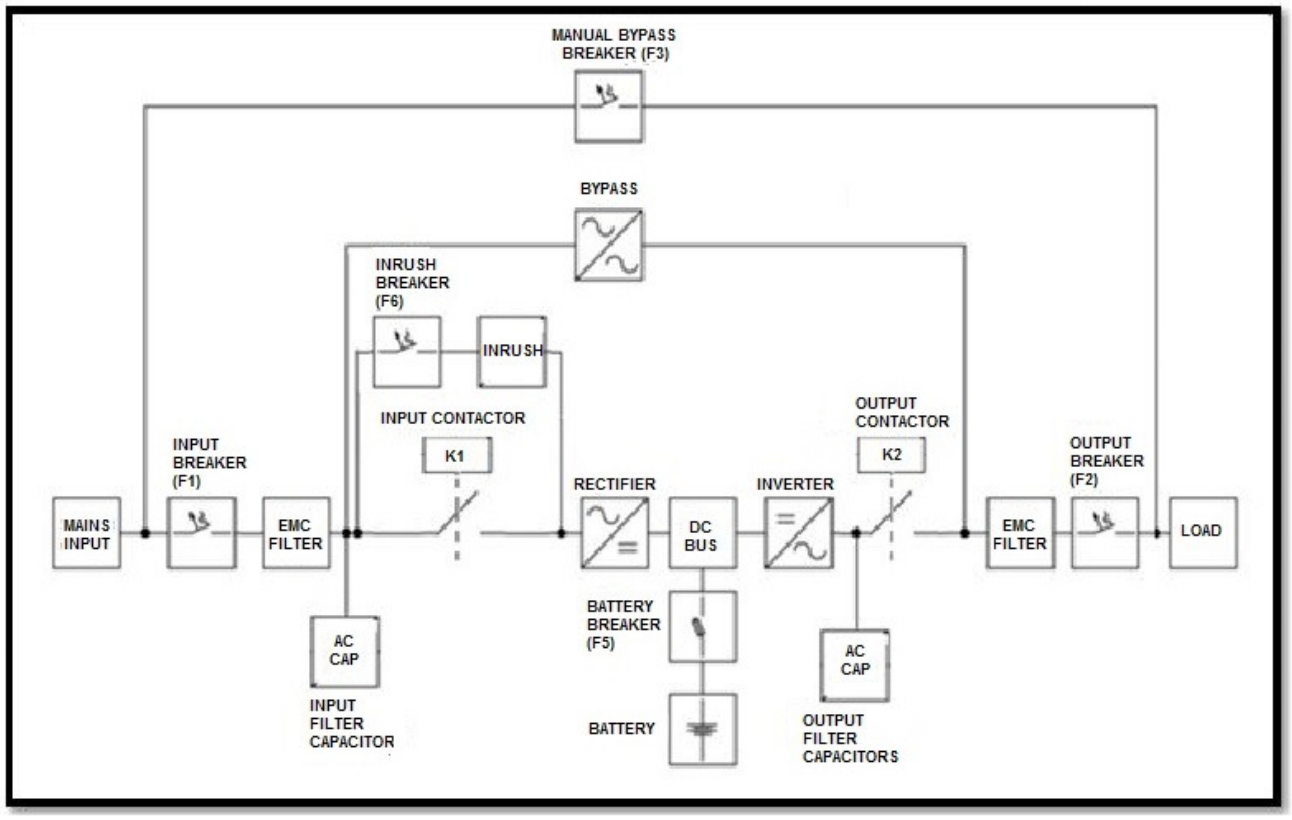
10-30kVA Standard UPS :



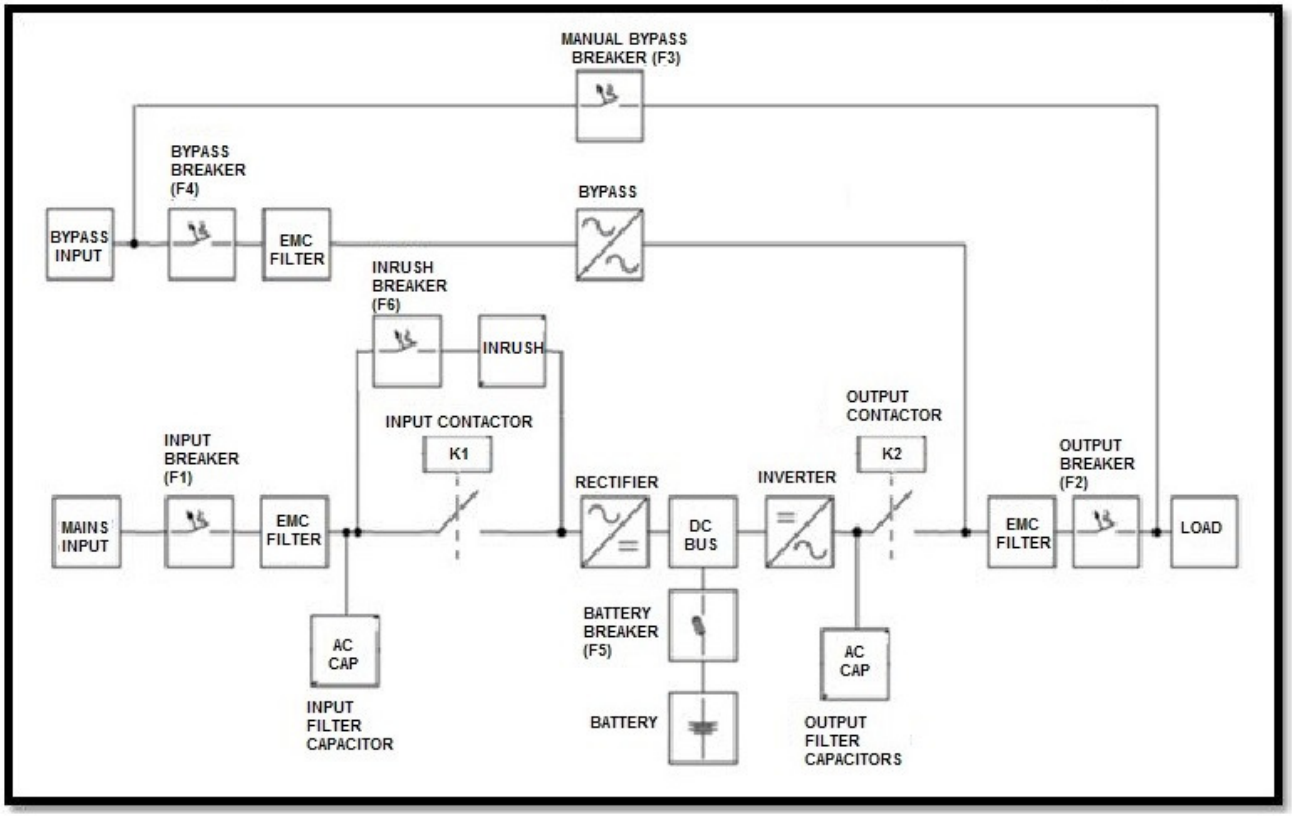
10-30kVA UPS with Split-Bypass :



40-200kVA Standard UPS :



40-200kVA UPS with Split-Bypass :



Input & Output EMI Filter: These filters (EMI – **E**lectro **M**agnetic **I**nterference) prevent electromagnetic interference between the mains and the load. Additionally, protect UPS and loads from any surge.

Bypass Thyristor: In case any inverter fault occurs; Bypass thyristor transfers the energy electronically from input to output without any cut at the output.

Rectifier: The rectifier obtains a very constant DC voltage level by drawing current from the input of where the power factor is close to 1.

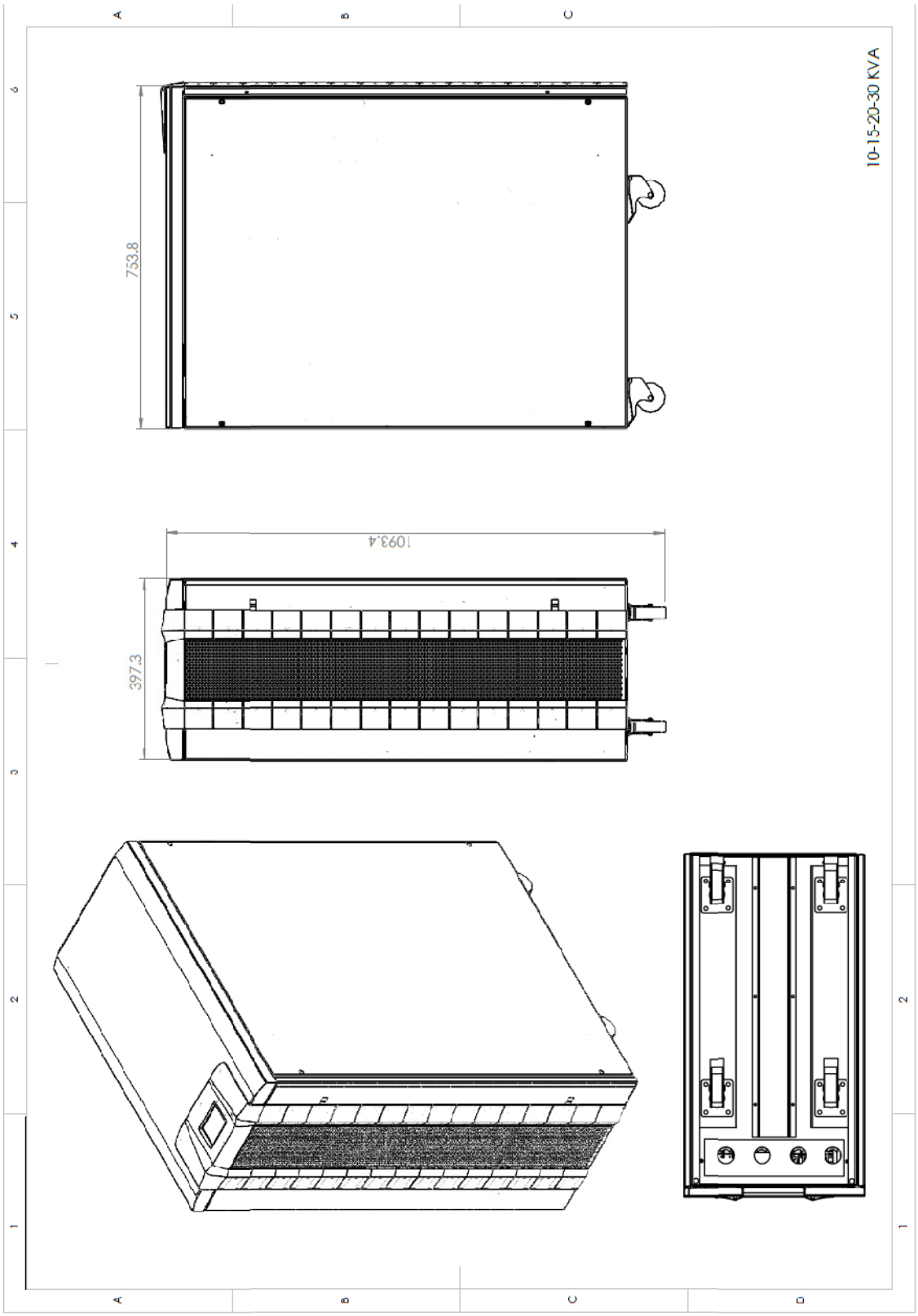
Inverter: The inverter helps to obtain a very constant AC voltage level at the output by using DC voltage at the rectifier's output.

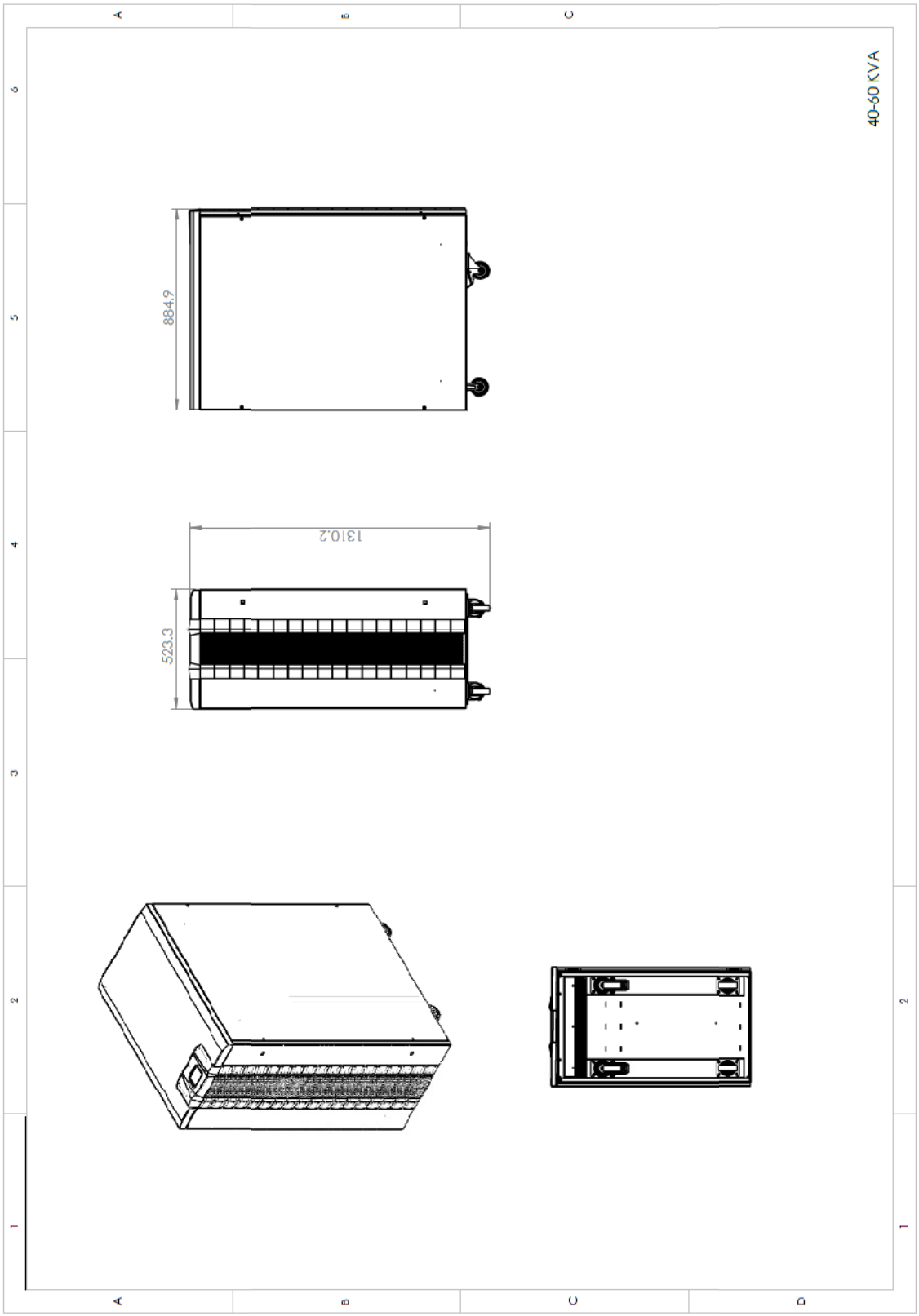
Battery Breker / Fast Fuse: This helps to separate battery from the rectifier electronically.

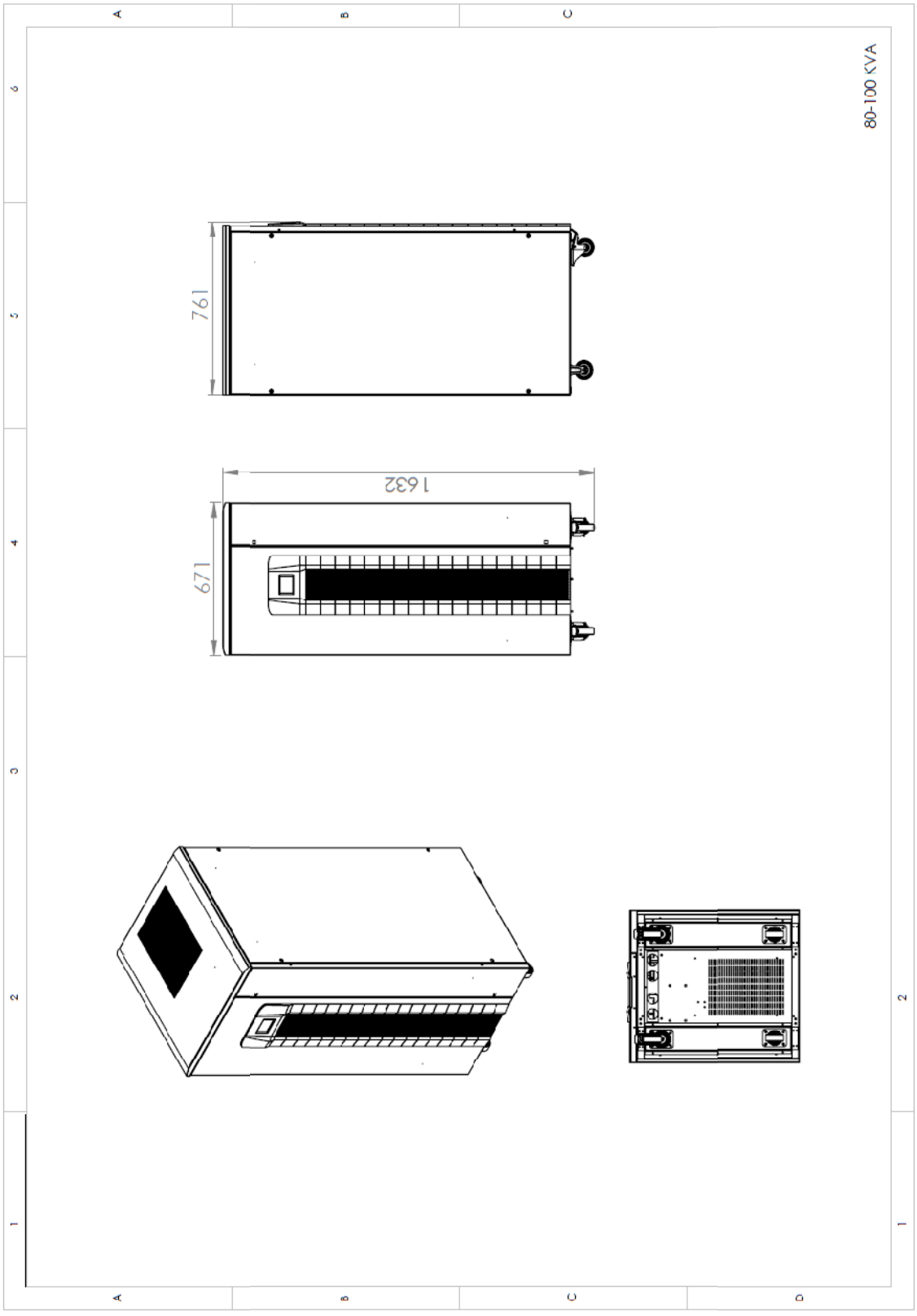
Battery: The necessary energy is supplied from the batteries when the mains is not available.

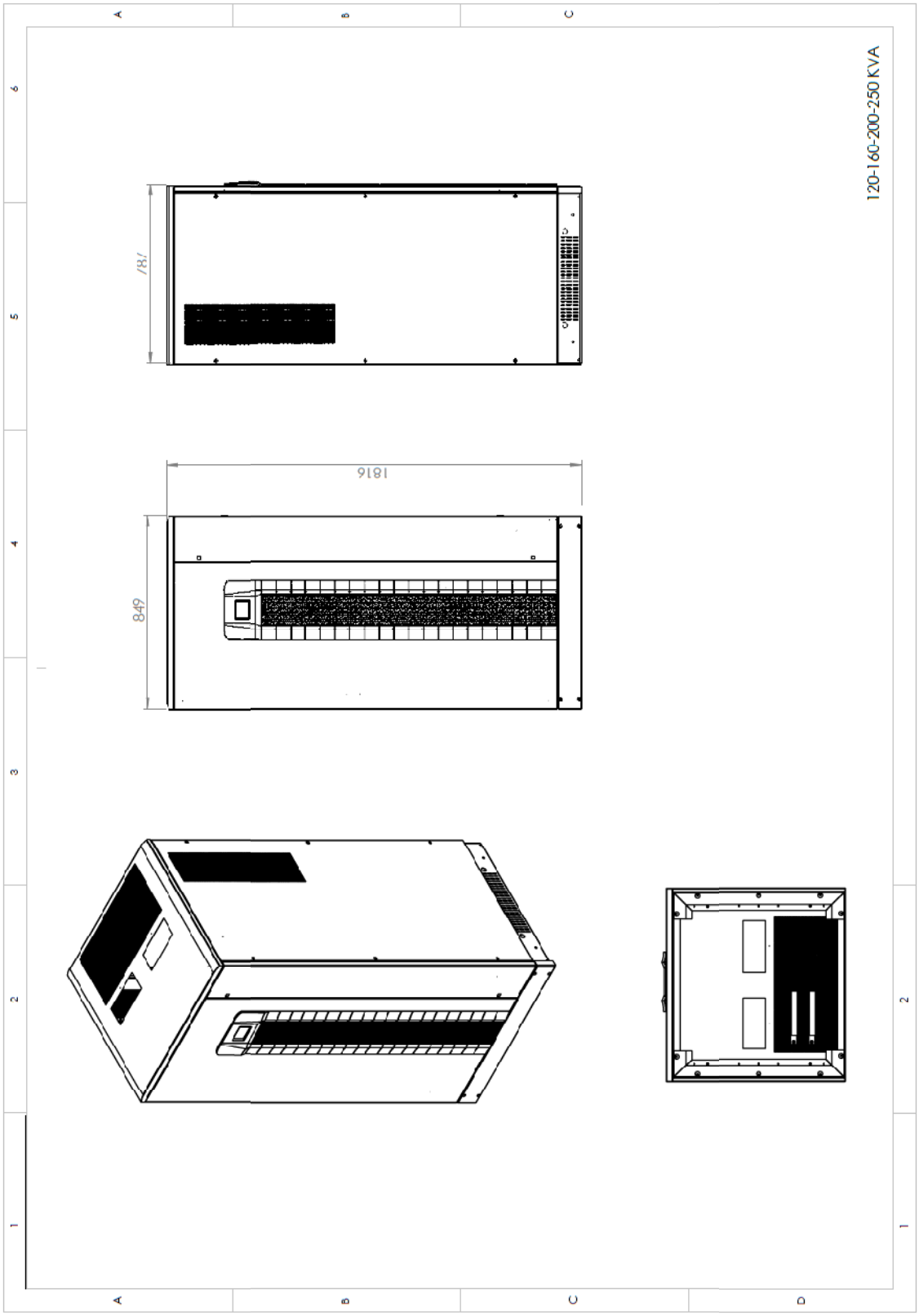
Manual Bypass Breaker: This is an automatic breaker which connects the output of the UPS to the Bypass input. It is used mainly for maintenance purposes on the UPS without deenergizing the load and supplying it from the mains.

Appendix-5: Mechanical Drawing




40-60 KVA
884.9
1310.2
523.3


80-100 KVA
761
1632
671


120-160-200-250 KVA
787
1816
849