MAKELSAN®

Uninterruptible Power Supplies

USER MANUAL

CHALLENGER SERIES

80 - 120 KVA

USER MANUAL

CHALLENGER SERIES

80-120 KVA

AG-SD-36

Document Y.No:1 Rev:0

About The Manual

This manual is prepared for the users of Boxer 80-120 kVA.

Companion Manuals

For more info about this device and its options, please visit www.makelsan.com.tr .

Updates

Please, visit www.makelsan.com.tr for updates. Always use the latest manuals.

Contents

1. SAFETY AND WARNINGS

1.1. Warnings

This manual must be read before installing the UPS. The device can be installed and started only by Makelsan staff.

Installation or start-up by unauthorized personal may cause damage to the device and serious injury or death.

The UPS is designed to be used in continuous vertical fixed position applications.

Warning:

THE UPS MUST BE USED WITH GROUND CONNECTION.

Connect the ground cable before connecting the mains.

Ground currents may be as high as 0.4A

THE UPS MUST BE DISCONNECTED FROM THE MAINS AND BATTERIES BEFORE SERVICING. ALSO WAIT FOR AT LEAST 5 MINUTES FOR THE DC BUS CAPACITORS TO DISCHARGE AFTER POWER OFF.

Service and Maintenance

All servicing and maintenance is done internally. All parts in the device can be serviced and replaced only by a trained technician.

preventative maintenance is recommended at least once a year from the installation by authorized technical staff. (This service will be provided for a fee by our authorized MAKELSAN staff.)

Battery Voltage may rise up to 700 V DC!

Battery terminal voltages can be at hazardous levels (700Vdc). Nobody except trained staff should touch batteries.
Batteries certainly must not be thrown into fire. Regarding the topic of batteries which are dead and defected: The waste batteries must definitely not be thrown to nature. They must delivered to MAKELSAN authorized technicians or to the foundations which are authorized for collecting waste batteries by the Ministry of Environment.

Fire extinguishing equipment must be kept nearby the UPS.

1.2. Clearance and Access

Clearance

There is no any air inlet or outlet grill on the left or right sides of our 80-120 kVA UPS. All air goes in to UPS from the front and is evacuated from the rear through fans. There must be spaces at least 1 meter at the front side of UPS. Should not be permanent or temporary use within the limits specified. Otherwise, the UPS performance will decrease.

Access

Operator reaches UPS via front panel on 80-120 kVA UPS. Therefore, enough area must be left for operator.. There is no limit to the sides of the device.

1.3. Storage

UPS should be kept in a room or area where is protected from excessive moisture and heat before commissioning.

WARNING:

Unused batteries must be charged at regular intervals. This time interval is determined by the battery supplier. Charging can be performed periodically by connecting to a proper mains for a while.

1.4. Shipment

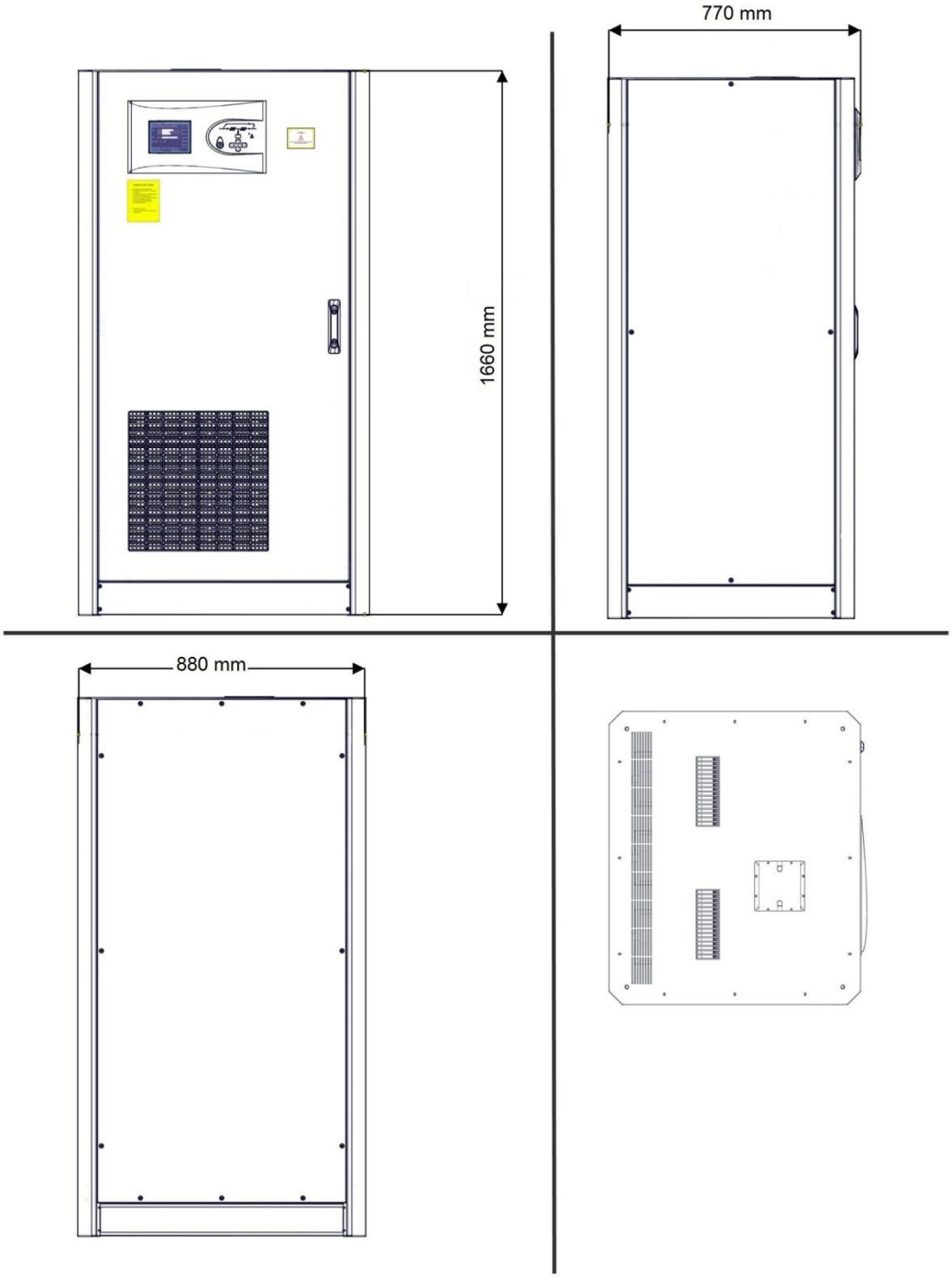
Carrying vehicles must have enough features and characteristics to carry UPS.

Be more careful of sudden movements, especially when batteries are inside of cabinet.

Move the UPS as rarely as possible.

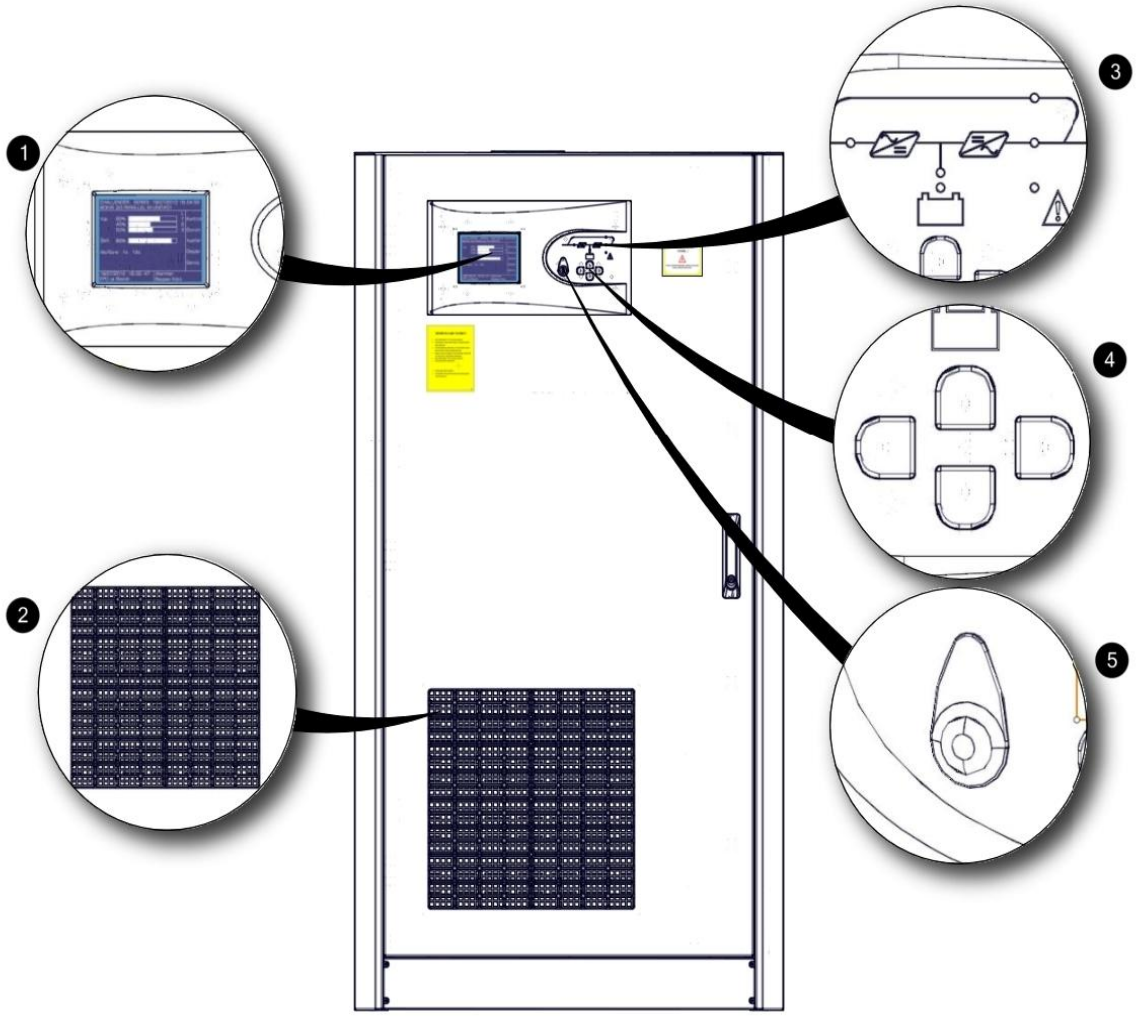
2. Product Description

General View



CH80120EN02R0

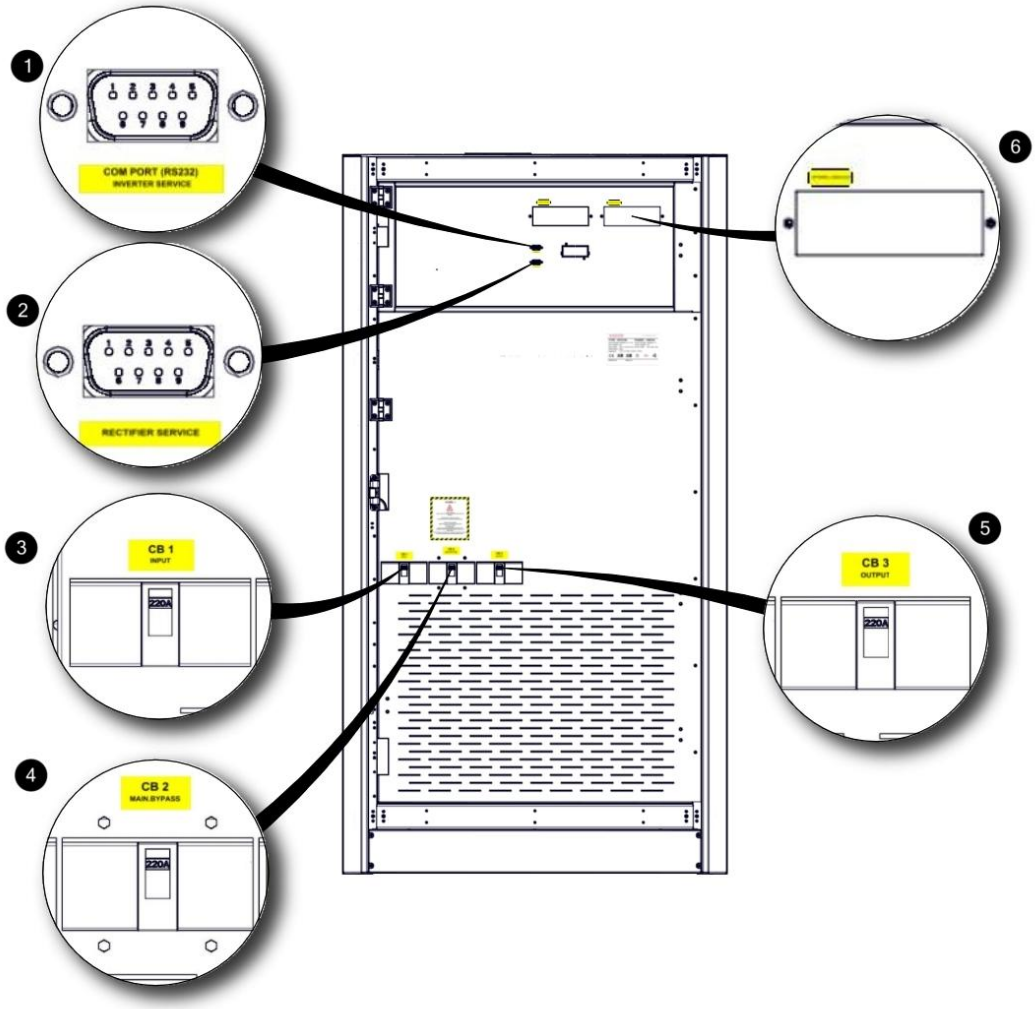
Front View



CH80120EN03R0

1	320x240 6” Grafik LCD
2	Ventilation Inlets
3	Mimic Diagram
4	Menu Keys
5	EPO (Emergency Power Off) Button

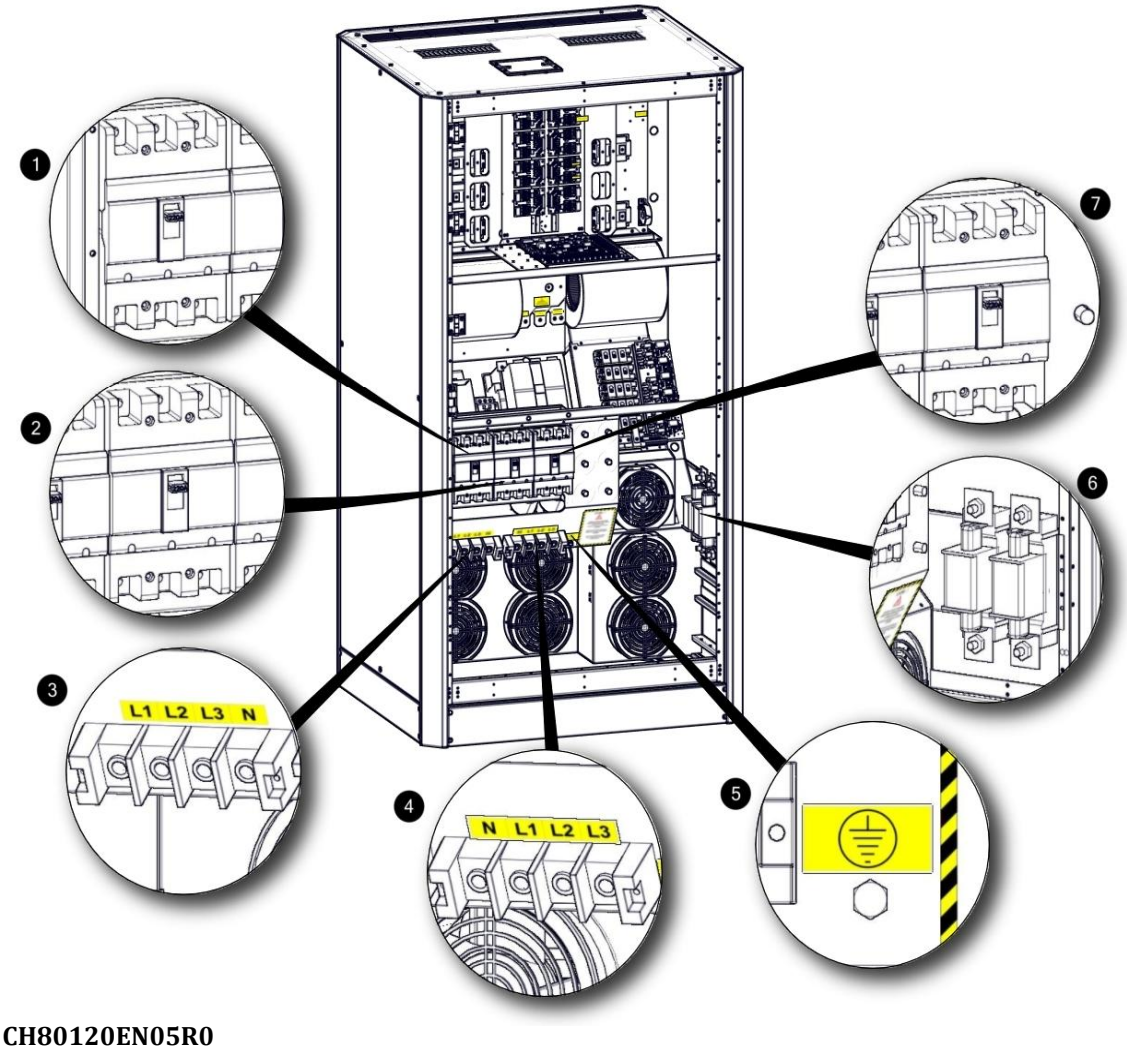
Front Cover View



CH80120EN04R0

1	RS232 Serial Interface for Inverter
2	RS232 Serial Interface for Rectifier
3	Input Circuit Breaker
4	External Bypass Circuit Breaker
5	Output Circuitr Breaker
6	Optional Card Slots

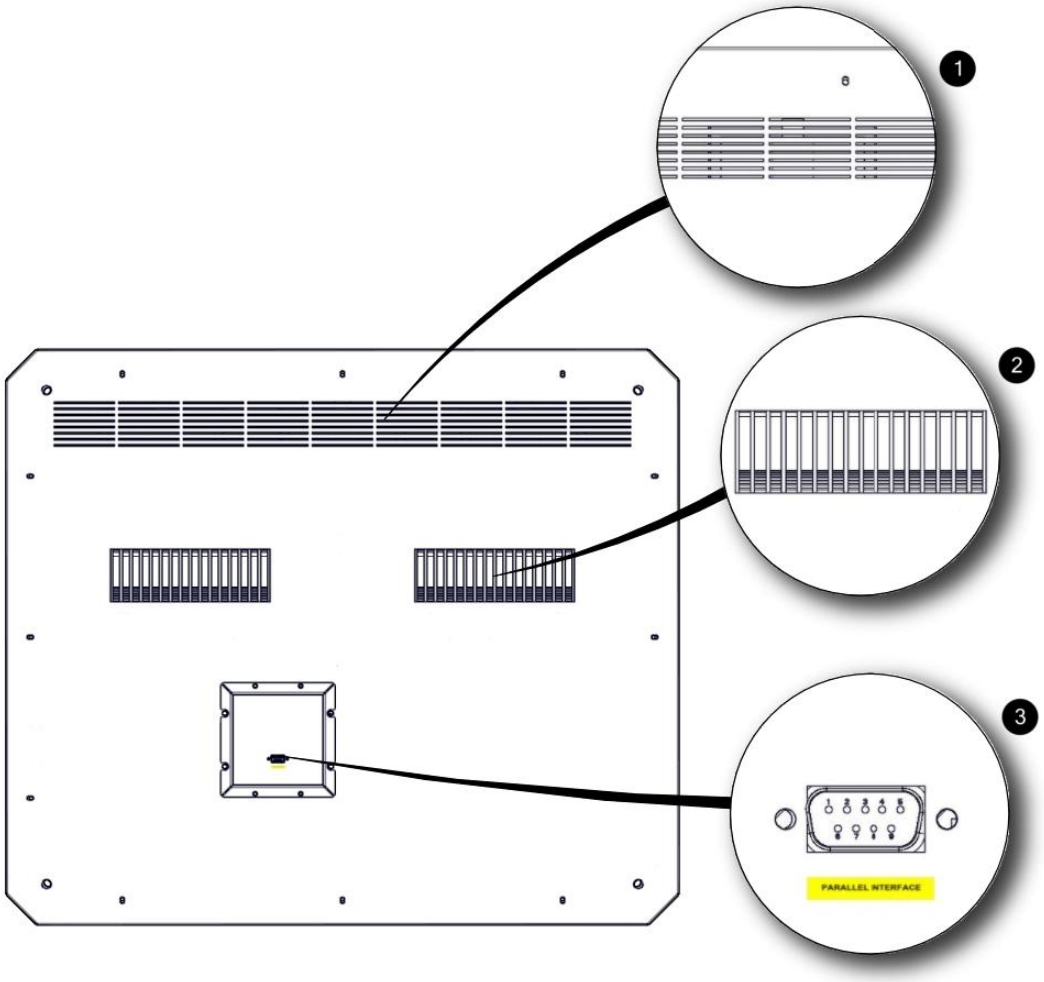
Front Inside View



CH80120EN05R0

1	Maintenance Circuit Breaker
2	External Bypass Circuit Breaker
3	Input Connectiion Terminals
4	Output Connection Terminals
5	Earth Ground Connection
6	Battery Rapid Fuses and Battery Connection Terminals
7	Output Circuit Breaker

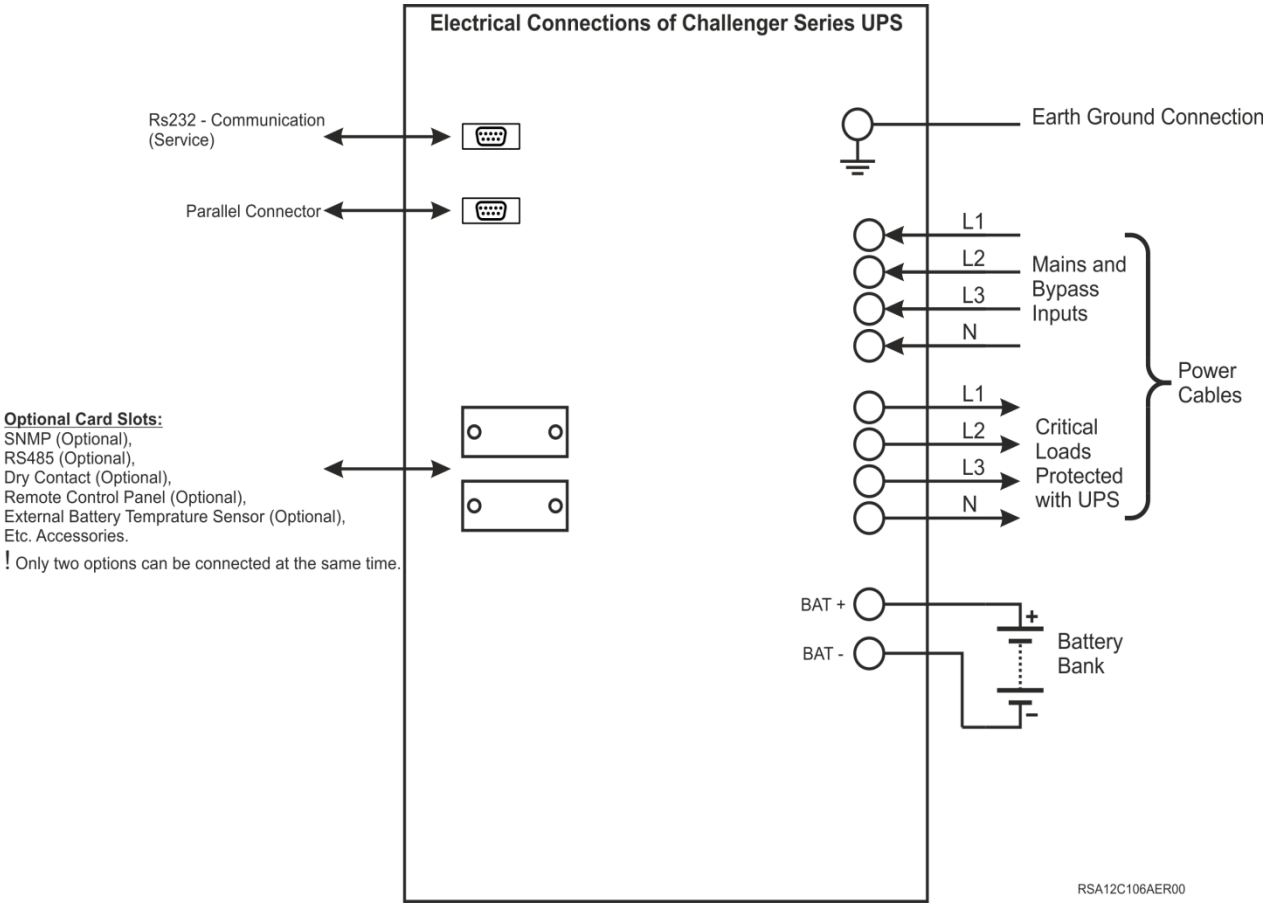
Top View



CH80120EN06R0

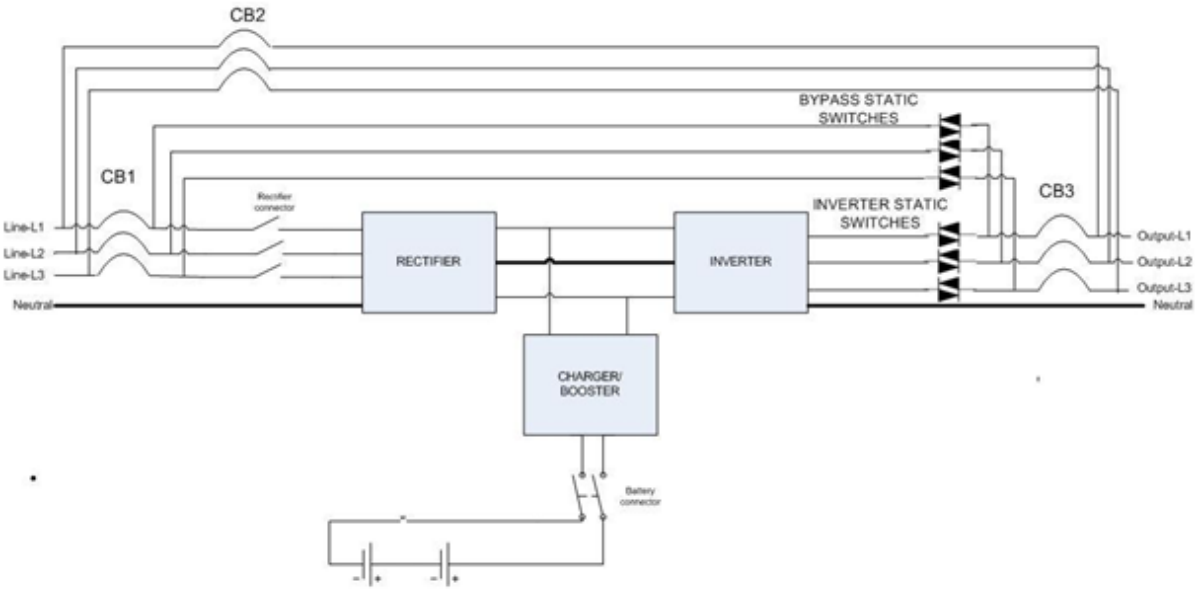
1	Ventilation Outlets for inductors
2	Ventilation Outlets for pfc, charger and inverter
3	Parallel Interface

Electrical Connection



2.1. General Information

General operation topology of Boxer Series UPS can be recognized as follows.



The UPS is connected to the mains voltage through the CB1 breaker. As DC bus is ramped up, the rectifier starts to operate and converts the AC mains to DC Voltage. When the mains voltage is not available, the DC/DC booster pumps the battery voltage to the necessary level. DC DC bus voltage is then converted to mains synchronized AC voltage by the inverter. This is a high quality voltage. Generated AC power is applied the loads after passed from static semi-conductor switches and output (load) breakers.

2.1.1. Static Transfer Switch

Some blocks are named as “static switches” as can be seen above. These blocks consist of inverse parallel connected thyristors. These switches, which are under the control of the mainboard control unit (DSP), provides controlling of supplying the loads through either mains or inverters. The loads are supplied through inverter during the normal operating mode. Therefore, Inverter static switches are active if there is no problem with the system.

User can switch the UPS between mains and inverter by using front panel. While the loads are fed directly by mains with the order of user, in case of either power off or mains values out of tolerances, the UPS will start to supply the loads through battery mode.

If the user wants, can provide mains to feed load continuously by switching on the maintenance bypass without making adjustment on the front panel. Later on, the user can make the input and output switch fuses short circuit.

If user wants, can provide mains to feed load continuously by switching on the maintenance bypass without making adjustment on the front panel. Later on, the user can make the input and output switch fuses short circuit.

If Maintenance or repair are necessary, maintenance switch must be turned "ON" before the input and output breakers are switched ON. After that, input and output of UPS are switched OFF respectively.

NOT: In the meantime, the loads are unprotected against the power-off, damage, twist etc. problems.

2.1.2. Battery Temperature Regulation

Optional temperature sensor is given with external battery cabinet. Battery temperature are perceived by mentioned temperature sensor. UPS adjusts battery charge parameters according to the information of the perceived temperature. These parameters can easily be adjusted via LCD or TELNET interface by authorized staff of MAKELSAN.

In this case, We recommend you to order "**External Battery Temperature Measurement Kit**" to detect the temperature.

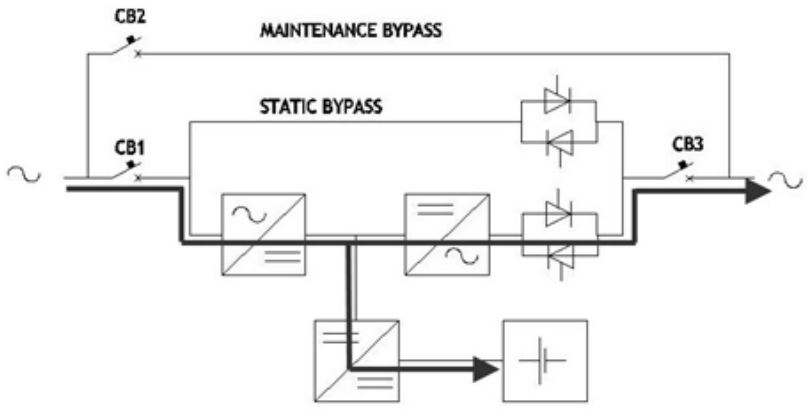
2.2. UPS's Operation Modes

Challanger series UPS's on-line and has a double loop structure. Our products operate in the following modes:

- Online Mode
- Battery Mode
- Bypass Mode
- Auto restart Mode
- Maintenance Mode

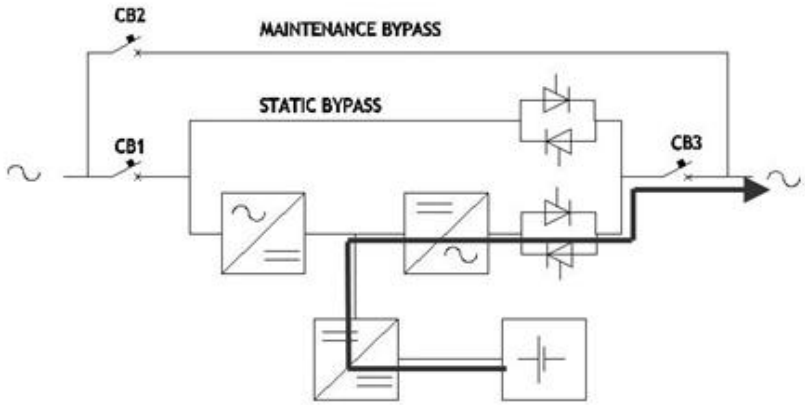
2.2.1. Normal (Online) Mode

In this mode, UPS supplies the load through the inverters. Rectifier unit is supplied by the AC mains. Inverter and battery charger units are energized by the generated DC supply.



2.2.2. Battery(stored) Mode

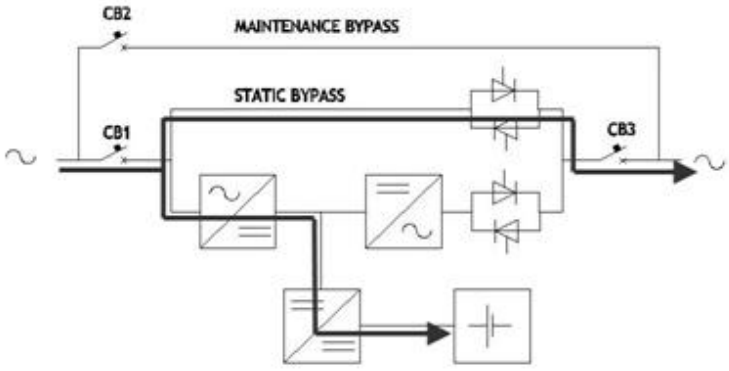
UPS runs on battery mode when the mains voltage is bad.Battery Voltage is boosted for the sufficient Dc bus voltage.



2.2.3. Bypass Mode

In an overload condition, or if there is a problem with the double conversion, the loads are fed by the bypass line.

UPS switches to AC supply from inverter for that by static switches. Inverter must be synchronized with the mains supply for these transitions to be seamless.This transitions might take 15 ms depending on the type of load if inverter output is not synchronized with the mains.

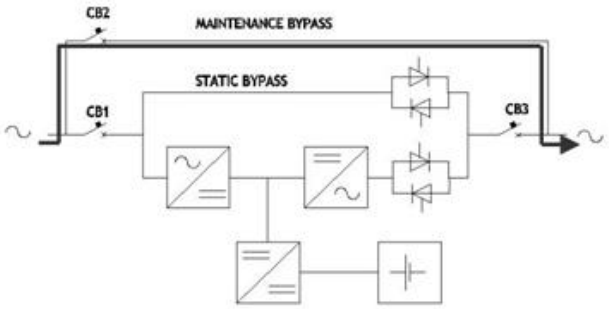


2.2.4. Auto Restart Mode

UPS supplies its critical loads up to end of discharge voltage level due to any mains failure. UPS feeds critical loads untill end of battery discharge voltage level caused by any mains failure. Ups will operate until batteries charging process completing after that will be switched off. UPS can operate by itself in specified time after mains turned back to normal mode. In this case, UPS keeps operating proper as long as UPS voltage being in accordance criterias. For Challenger Series UPS, this feature is not activated as factory initial setups.

2.2.5. Maintenance Mode

In maintenance mode, UPS equipped with a switch capable for not to be interrupted of the loads. This switch was choosen to meet the full load.



2.3. Battery Management

Lead – Acid Batteries are used with UPSs as internal.

2.3.1. Normal Operation Mode

Constant Charge Current

Current is limited to 0.1C untill the float reaches to charge voltage. (adjustable between 0.05C - 0.25C.) The applied current can not exceed maximum charge power.

Float Charge

Depending on the battery discharge current the third percent energy of the battery is charged at this level. Thanks to this level, batteries are kept ready for use at the highest capacity. For lead-acid batteries, this voltage varies between values 2.2-2.35 V/cell This voltage may differ slightly with temperature adaptation. Option of setting this coefficient is provided with our UPS. If the temperature sensor is used, it is recommended to use.

Deep Discharge Protection

While the system operates on battery mode, if battery voltage has dropped below the discharge level UPS shuts down and stops absorbing energy from the batteries. This value varies between 1.6-1.75 V/cell for Lead-Acid batteries, and for Ni-Cd batteries between 0.9-1.1 V / cell.

Low Battery Warning

While the system operates in battery (stored) mode, according to actual loads if the battery capacity drops below its 40% value, it will give audible and visible alarms. This percentage value is adjustable for user between 20%-70%.

2.3.2. Advanced Level Functions (Automatic Battery Test)

The auto battery test discharges 30% of the battery energy in a user defined period (default is 90 days). This period can be adjusted between 30-360 days. Test reports the battery condition as "**good or replace**". Results of the latest test can be seen on the battery screen from the status menu.

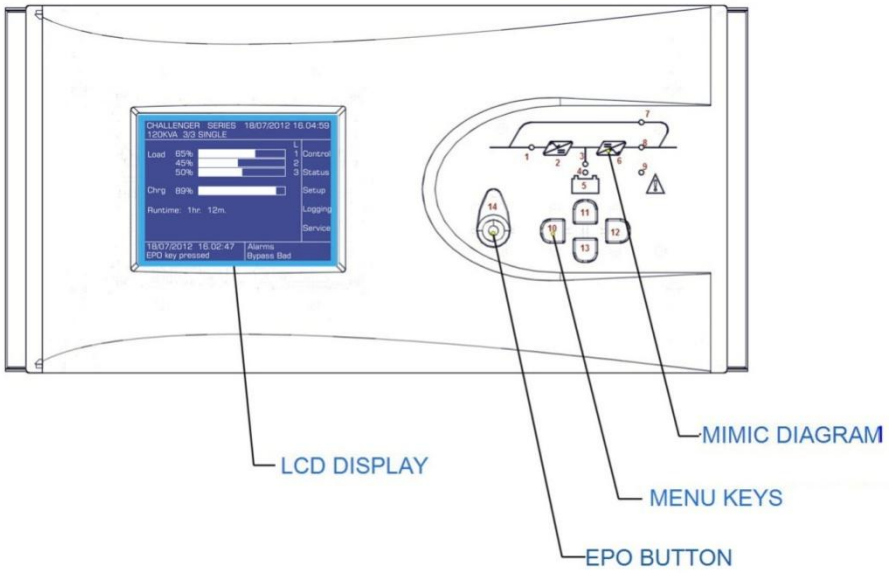
WARNING: If the test result is "**replace**", then the batteries are completely drained during the test. This situation may cause the load remained unpowered in case of mains voltage is out of the limits or mains power off.

This test can be started by command from front panel monitor, via TELNET interface, via RS232 smart communication or via MAKNET (SNMP, see the options).

It is checked that if the batteries can supply the minimum back-up time needed in case of the first power-off by using the results of all these tests. Checking the test results with a regular period is recommended.

2.4. User Panel

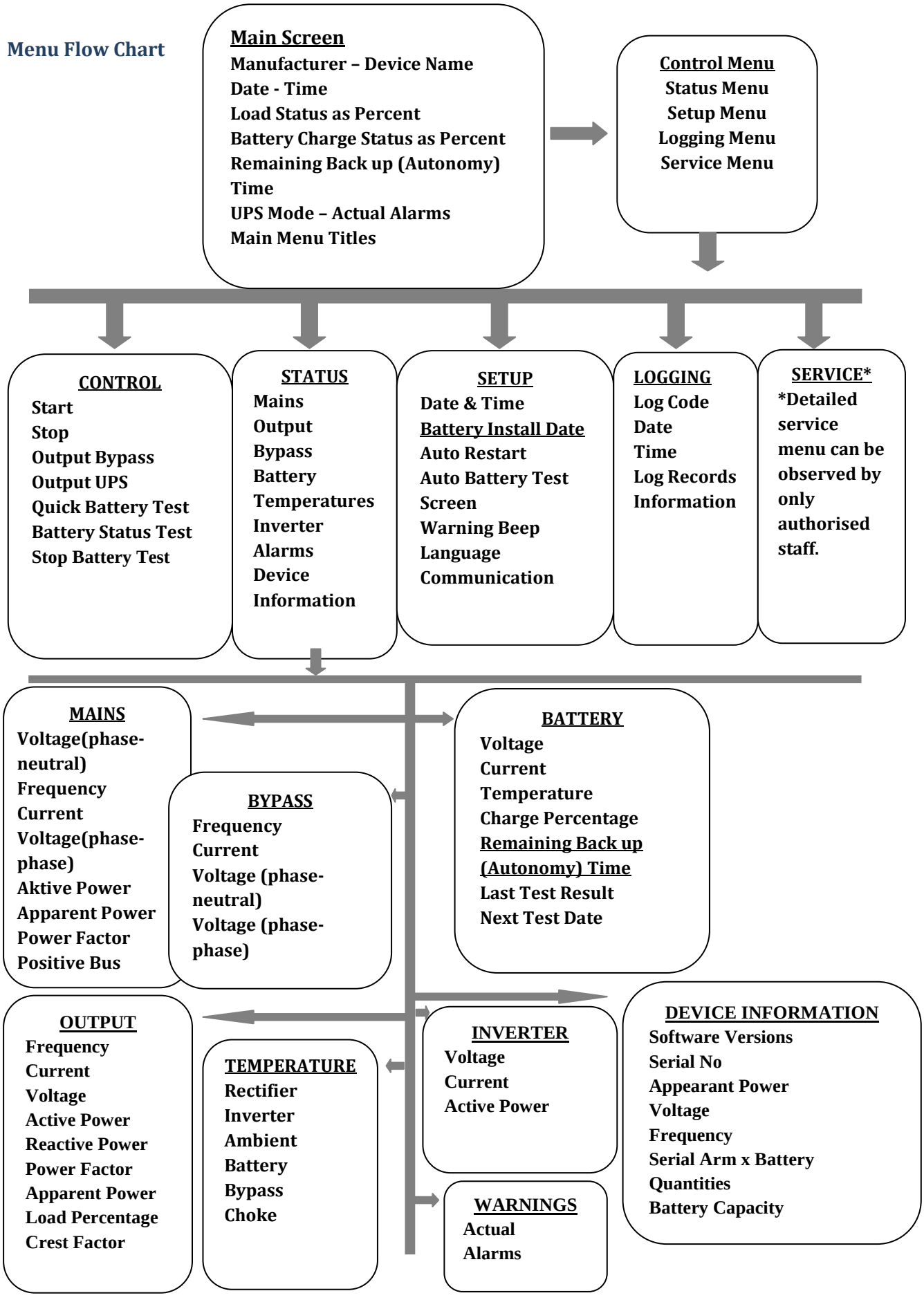
User panel consists of mimic diagram, LCD screen, EPO button and menu keys. The UPS can be controlled via this panel.



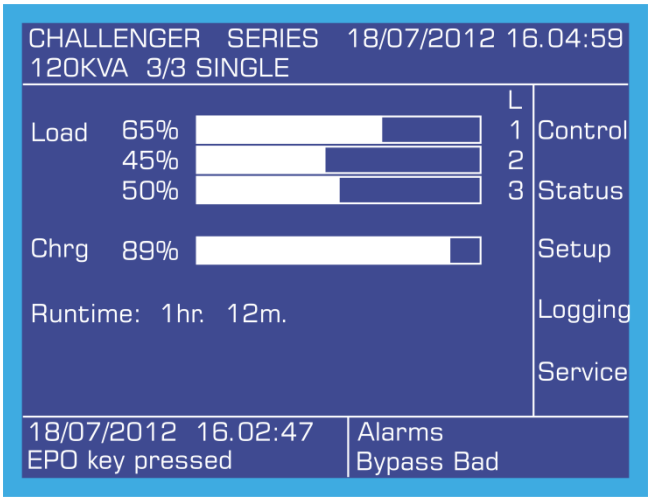
CH80120EN07R0

1	**Rectifier indicator LED** Flashes while the DC bus is ramping up. Illuminates when Rectifier works.
2	**AC/DC module (Rectifier)**
3	**Boost mode indicator LED** Illuminates in battery mode. Flashes when UPS is started up through batteries.
4	**Battery charge indicator LED** Illuminates while the batteries are charging.
5	Battery module
6	DC/AC module (Inverter)
7	**Mains bypass indicator LED** Illuminates while the loads are fed through bypass line.
8	**Inverter static switch indicator LED** Illuminates when the load is fed by the inverter
9	Alarm/Warning indicator LED
10-13	Menu keys
14	EPO (Emergency Power Off) Button

Menu Flow Chart



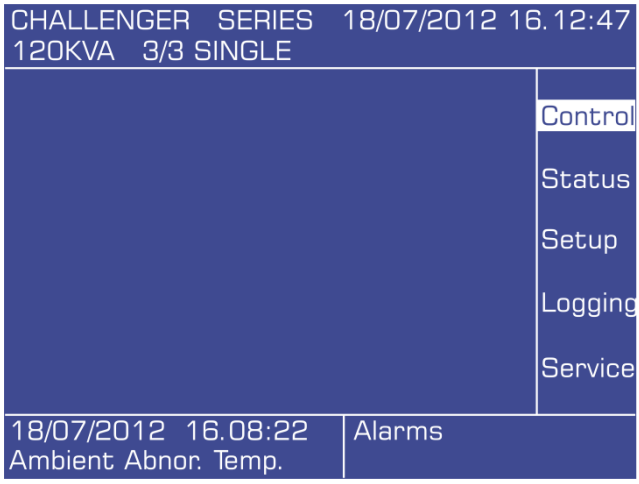
2.4.1. Openning Screen



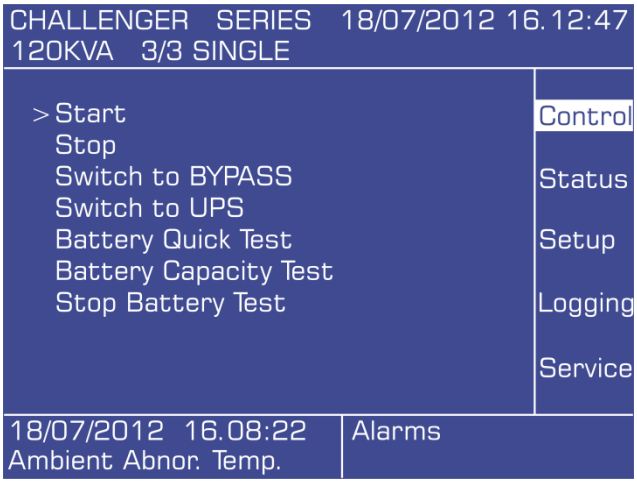
When the front panel monitor is turned on, firstly opening screen is observed. Manufacturer – Device Name, Date – Time, Load Status as Percent, Battery Charge Status as Percent, Remaining Back up (Autonomy) Time, UPS Mode – Actual Alarms, Main Menu Titles can be observed here.Last event (log) is shown at the bottom left and active alarms list that appears 2,5 second intervals are shown at the bottom right. If no button is pressed for 5 minutes, system returns to the opening screen.

2.4.2. Main Menu

Press ***ENT*** button to switch to the main menu.



2.4.3. Navigating Through the Menus

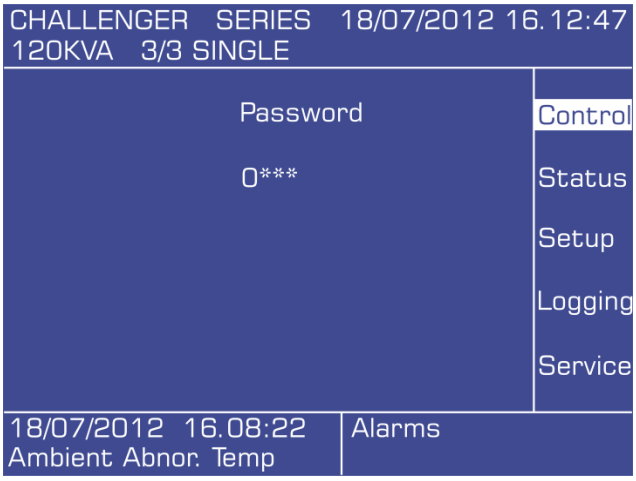


Use UP and DOWN keys to move the cursor arrow. Press enter to open a sub- menu. Press ESC to go back to the previous menu. Control sub-menu is shown on left.

Hold the UP or DOWN key to navigate between the sub- menus.

Some menus have changeable options like ON/OFF, durations or quantities. To change some setups in such a menu, press ENTER to choose the variable, use up and down keys. To change the value, press ENTER to set the new value, press ESC to cancel.

2.4.4. Password Protected Menus



Some menus such as the control menu are password protected.Press UP and DOWN to set each digit and press ENTER to confirm.

User level password is: 0000 (zero-zero-zero-zero)

2.4.5. Control Menu

In the control menu, you can do one of the following:

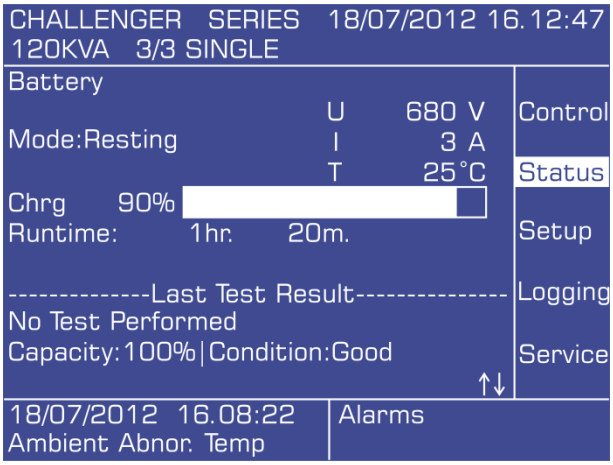
- **Start** Start the UPS
- **Stop** Stop the UPS
- **Switch to BYPASS** Switch to static BYPASS mode
- **Switch to UPS** Switch to online mode
- **Bat. Quick Test** Start the quick battery test
- **Bat. Capacity Test** Start the deep battery test
- **Stop Battery Test** Stop the battery test

Battery status test, drains the 30% of battery energy and reports batteries which has more capacity than 15-30% as **"Good"**, less capacity than 15% as **"Replace"** according to the test results.

After UPS is started and every 24 hours, it makes a quick battery test ,if test counter value is zero (0).

Note: Batteries must have been fully charged and kept in floating situation for at least one hour before performing the quick battery test.

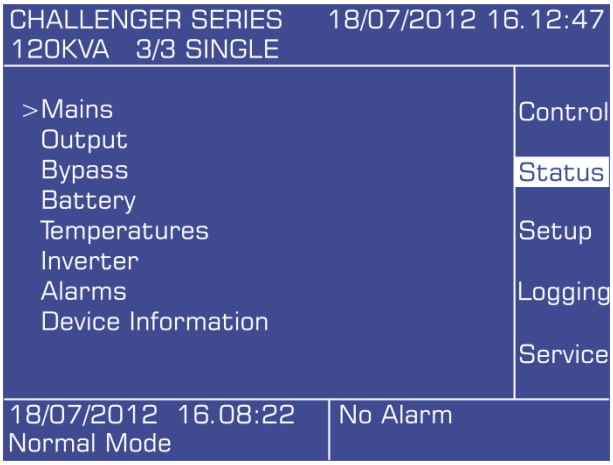
Status on the System > *Battery* > *Remaining Time can be seen*.



If "**Stop Battery Test**" is chosen from the menu, the UPS cancels the battery test and goes back to the previous operating state.

2.4.6. Status Menu

Mains Output, Bypass, Battery, Temperatures, inverter, Alarms and UPS information can be seen on this menu.



Mains

UP, I, Hz	Voltage (phase-neutral), current and frequency of each phase.
UL, S, P	Voltage(phase phase), reactive and active power of each phase.
PF, U, D	Power factor, positive DC bus and negative DC Bus of each phase.

Output

UP, I, Hz	Voltage(phase-neutral), current and frequency of each phase.
UL, S, P	Voltage(phase phase), reactive and active power of each phase.
PF, L, CF	Load percentage for each phase and crest factor.

Bypass

UP, I, Hz	Voltage(phase-neutral), current and frequency of each phase.
UL	Voltage of each phase (phase to phase).

Battery

Mode	Battery Mode.
U, I, T	Battery Voltage, Charge Current and Temperature.
Charge %	Charge Percentage.
Battery Time	The estimated battery run time with current load.
Last Test Result	Test type, test number, test date and time. Battery capacity and condition.
Next Test Time	Next test date
Time	Timer countdown for the next test availability.

Temperature

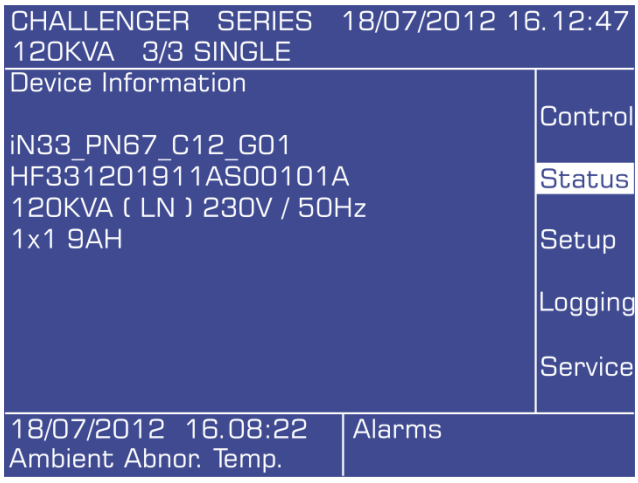
°C,°C,°C,°C,°C,°C,°C	*Rectifier, inverter, charger, ambient, battery and thyristor temperatures.*

Inverter

U, I, P	Voltage, current and frequency of each phase.

Alerts UPS alarms.

UPS Information

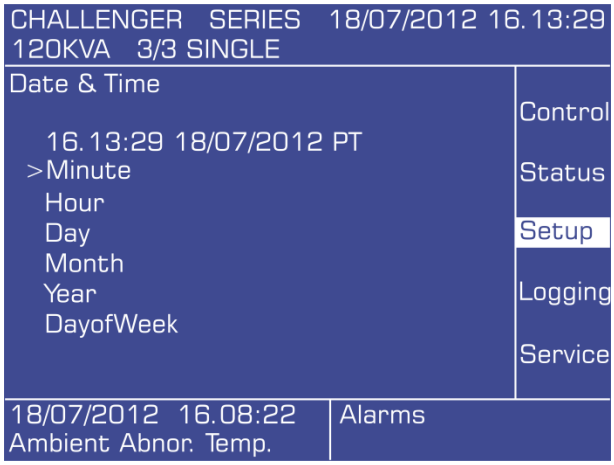


Software Version of inverter,rectifier,CPLD and front panel; UPS's apparent power(kVA), nominal output voltage (phase-neutral), nominal output frequency (Hz); number of batteries in parallel , serial and battery capacity can be seen via version menu.

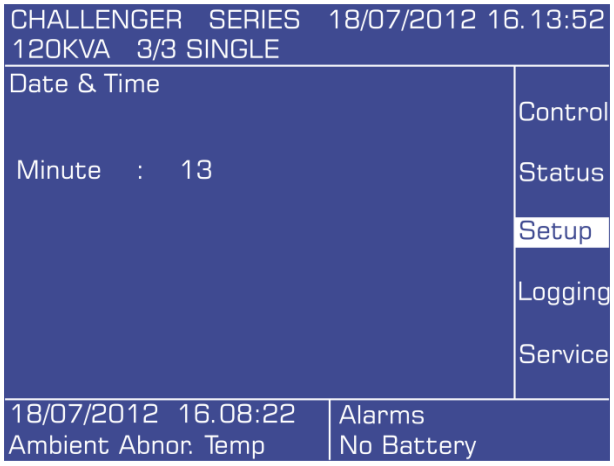
2.4.7. Setup Menu

The following adjustments can made on setup menu:

Date & Time

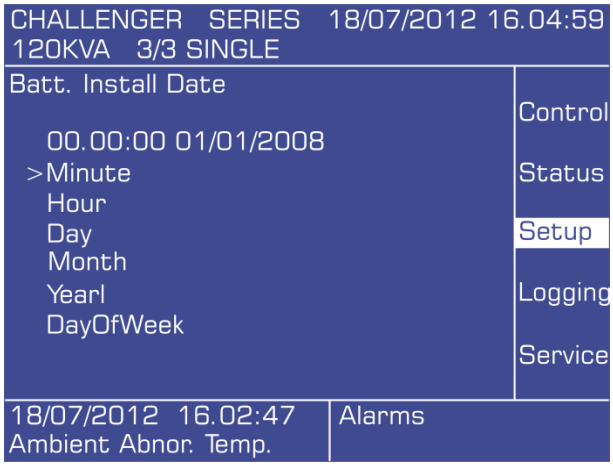


To set date and time, use up and down keys to choose the variable you want to set.



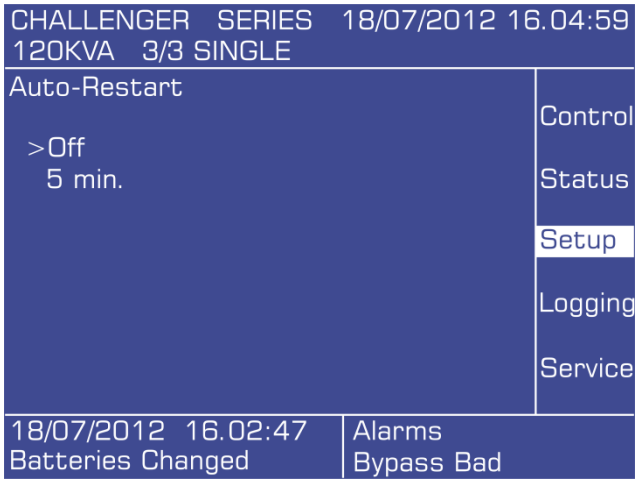
Then use up and down keys to set the value, and press ENTER.

Battery Replacement Date



Set the date of battery installation through this menu.

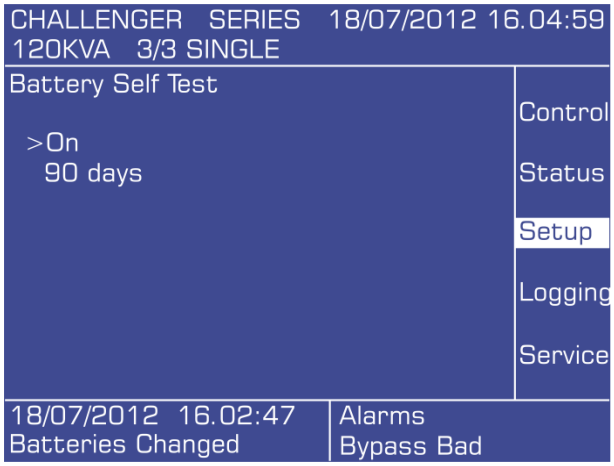
Auto Restart



On the battery mode, UPS operates until charging process completed. the device turns off

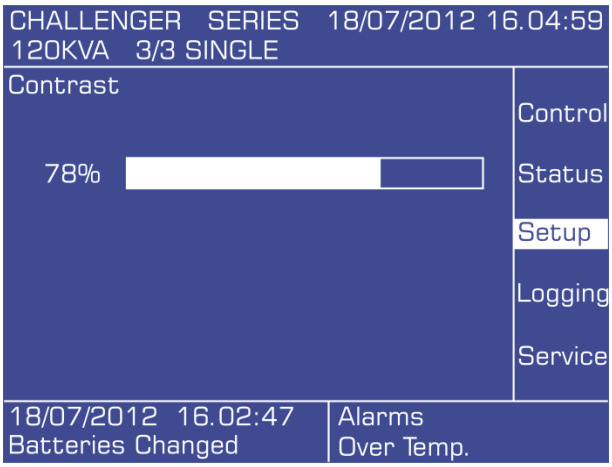
at the end of battery discharge process. Auto-restart can be used to restart the UPS automatically when the mains comes back to limits.
Turn on auto-restart and set the time to define when the device will be started after the mains is normal.

Auto Battery Test



This function can be turned on to start the user independent battery tests.
Time interval sets when the test will be repeated.
Note: Auto Battery test is the equivalent of battery quick test.

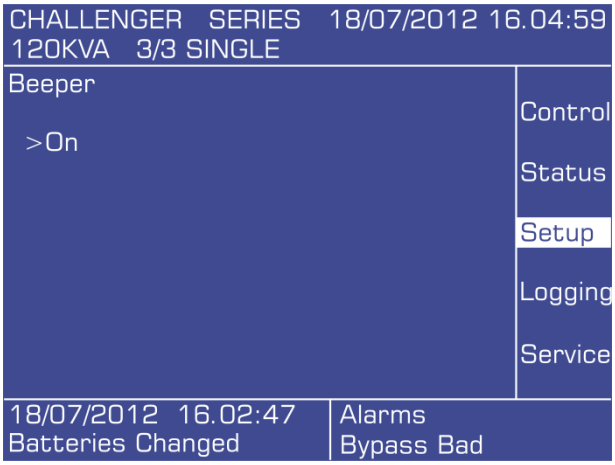
Screen



Change the screen contrast to make it more visible on different environmental conditions.

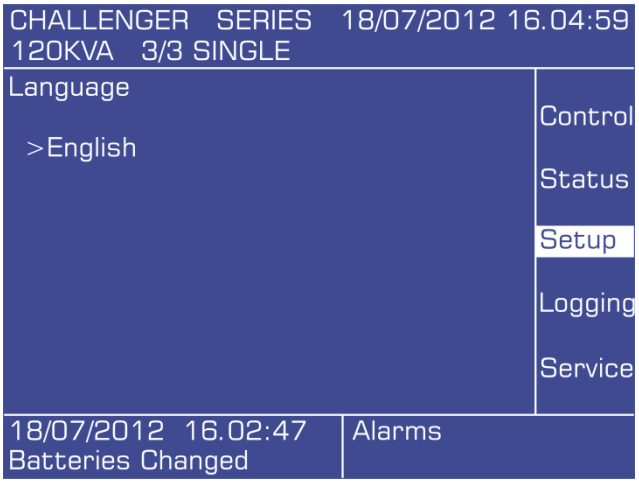
Beep

Turn the beeper sound on/off.

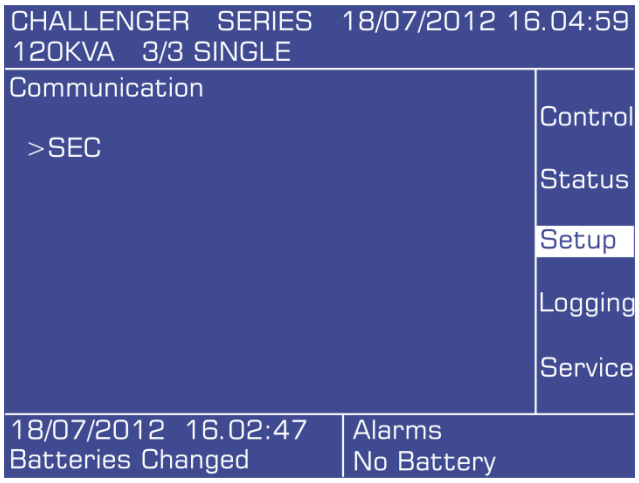


Language

Set the menu language.

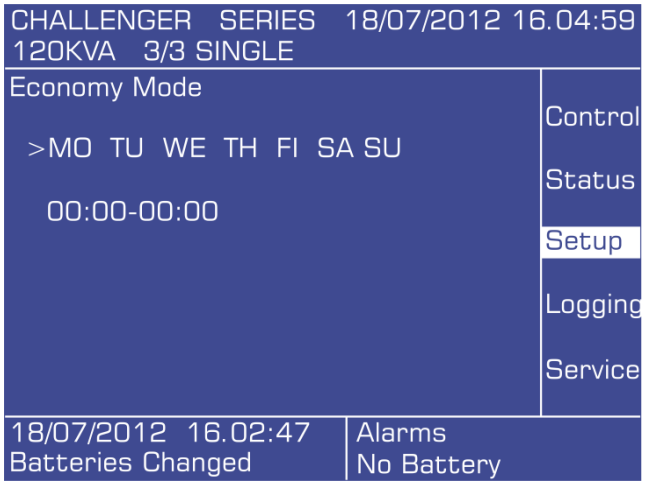


Communication



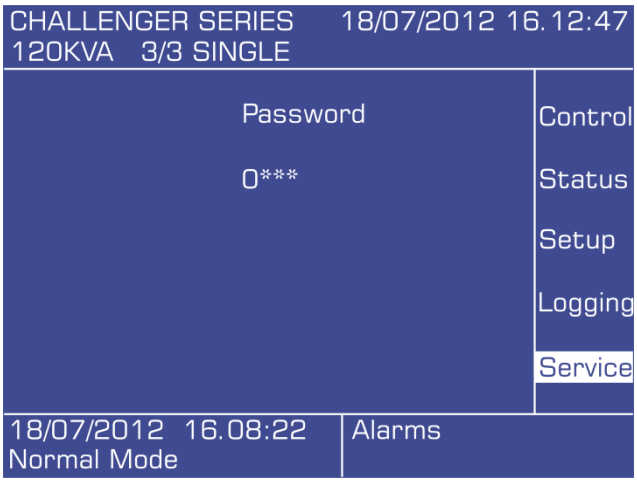
Set the protocol for the RS232 connection. The options are SEC, Megatech and TELNET.

Economy Mode



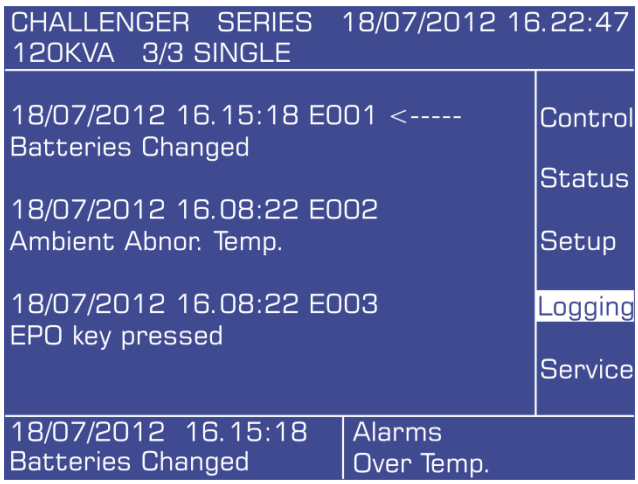
Economy mode (ECO) and UPS switch to static bypass mode at the specified days and hours. Use this menu to setup the days and hours.

Service Menu



Service menu is password secured, and cannot be accessed with the user password.

2.4.8 Logging Menu



Last 500 events of the device can be seen in this menu.

When viewing an event, press enter to see detailed info about the UPS. Use up and down keys to see older/newer event logs.

3. Installation

3.1. Single Mode Installation

In this section, the warnings which must be obeyed and the checking which must be performed before starting-up the UPS are stated. Additionally, you can find informations about the points you must pay attention during carrying the cabinets, positioning and connections.

3.1.1. Warnings

The UPS must be installed by a certified electrician.

Do not energize the UPS before proper installation.

Battery Hazard

Battery terminal voltage reaches up to 450 Vdc during operation.

Proper safety gear must be used to protect the skin and the eyes from electrical arcs.

Check the batteries for leakage before using them.

ESD-protected rubber gloves should be used.

Battery ingredients are hazardous. In case of contact with battery ingredients, rinse the skin with water, and consult a physician if irritation occurs.

Remove any metal accessories (ring, watch, etc.) before working on the device.

UPS, needs a feeding which has 3-phases and four-wire (+earth) on the input. Feeding type is suitable for connection to IEC 60364-3. Optional 3-wire to 4-wire conversion transformers are available.

If it is used in IT AC power distribution systems, a 4-pole circuit breaker must be used on the input and refer to the relative IT Systems2 standart.

Detail of the subject is explained in more detail on the standart named IEC 60364-3.

3.1.2. Pre-installation check up

Before installing the device, the following checks should be carried , these are the first and most important steps in the operation of the product correctly.

- Check if any damage was done to the device during transportation. Report any damages instantly.
- Make sure that the model power rating is right. Check the device label for the actual power rating.

3.1.3. Positioning

UPS and batteries are designed for indoor use; UPS must be placed in a places where has clean and easy air flow.

3.1.3.1. Positioning of UPS

In Challenger 80-120 kVA series, air enters the device from the front side ventilation holes, goes out from the rear side of UPS through fans. Air inlet and outlet ports should never be covered. It should be positioned in a place where is far from the risk of liquid contact.
If the area is dusty, Optional filters must be used on dusty environments.
The using of these filters will be made according to the instructions on.
UPS is an energy-loss system due to its nature. Energy losses emerges as heat. You can see what kind of a forced air-cooling is needed in the following table. This table can be used to calculate the capacity of air conditioning which must be used in UPS ambiance.

UPS	Amount of BTU /h for cooling	Bridge Load 100% (Non-lineer) estimated BTU / h value for load working
80 KVA	17500	21000
100 KVA	21900	26300
120 KVA	26300	31500

3.1.3.2. External Battery Configration

Batteries must be used in balanced and uniform temperature environments. temperature, is the most important factor that directly affect to battery capacity and usage lifes. in general, battery manufacturers recommend the batteries to be used between 20-25 °C. In addition, Battery manufacturers give the performance of their products in this temperature range. If temperature exceeds this specific limits, battery life will decrease. If the temperature drops below this range, the battery capacity is severely reduces. Therefore, the expected autonomy time will not be sufficient during redundancy process. As a result, keep the batteries away from the points where a heat source and serious air flow are located. Please observe the following points on connecting external batteries by taking into account these issues:

- Keep batteries away from main heat sources.
- Keep batteries away from main air inlets.
- Keep batteries away from the humid places.Hereby batteries can be prevented from terminal oxidations and possible leakage currents.
- Please use aR or gR semi-conductor type fuse at the battery rooms and cabinets.
- If it is possible, please use breaker switch without fuse for the bateery cabinet.
- Keep battery cabinets and shelves high above the ground. UPS should be protected against floods or liquid contacts.
- Battery rooms should be properly ventilated.

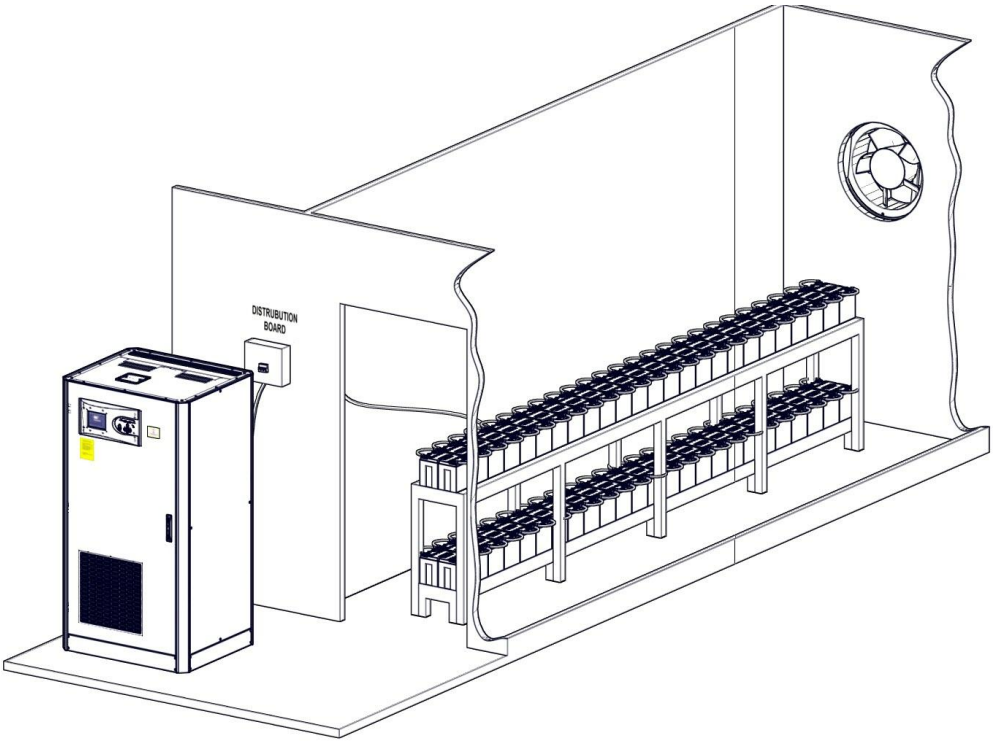
- Shelves will be accessible in touch if batteries are in battery room. Therefore please keep restricted accessing to battery room. Use necessary safety writings and strips

Espacially, for the external cabinet batteries system of UPS, fuses must definitely be used. These fuses must be mounted as close as possible to the batteries. This closeness will increase the electrical operation safety.

THE TABLE OF BOXER EXTERNAL BATTERY USAGE			
Device Power (KVA)	**80**	**100**	**120**
Total number of Batt.	**50**	**50**	**50**
$I_{bat.max}$ @ $V_{bat.max}$ **(A)**	18,6	23,2	27,8
$I_{bat.max}$ @ V_{cutoff} **(A)**	136	170	204
Recommended internal fuse (A)	**160**	**200**	**250**

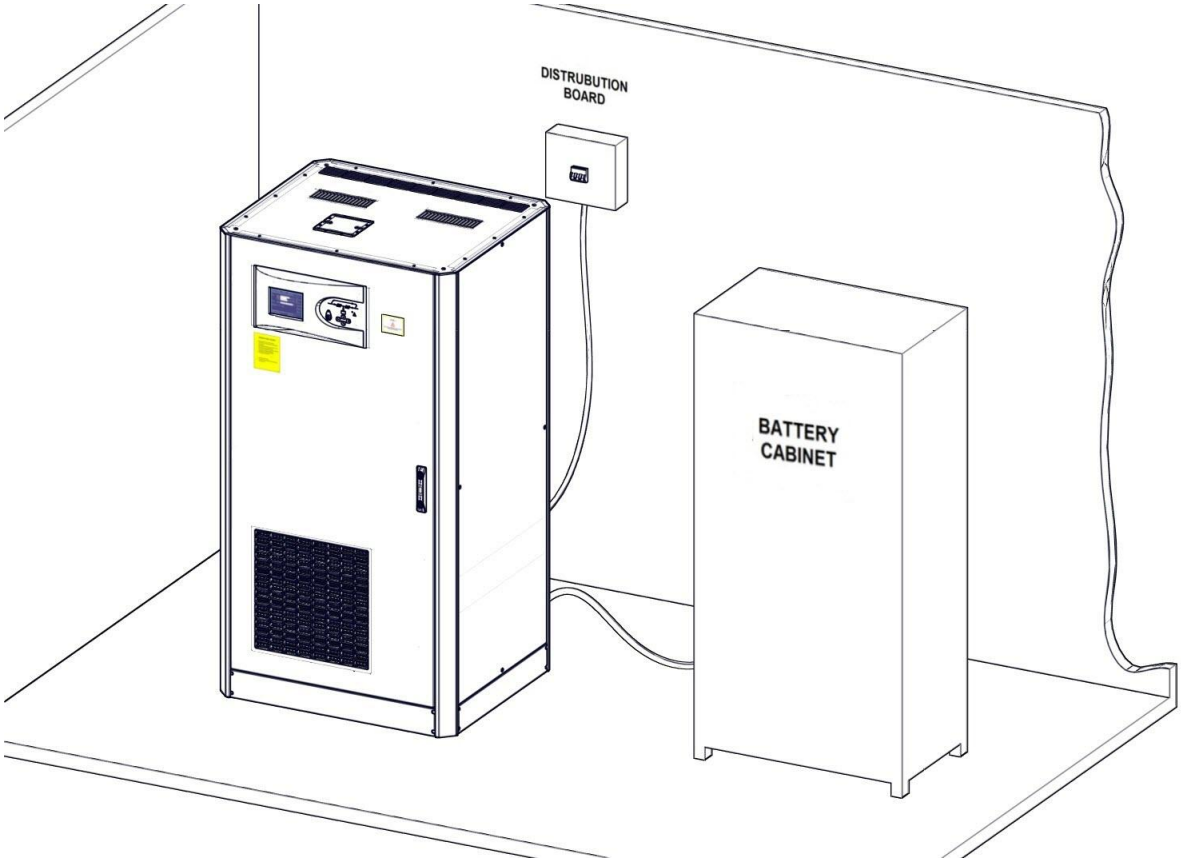
External battery cabinet and battery room applications are given below as an example.

The method of application may vary according to the customer.



CH80120EN08R0

Example Battery Chamber Application



CH80120EN09R0

External Battery Cabinet Application

3.1.4 Transportation Type of Cabinets

Carrying vehicles or handling accessories must have enough features and characteristics to carry UPS's weight.

Cabinet is equipped with four-wheel. Thanks to this feature, it can be moved easily. These wheels must be used only on smooth surfaces.
The front side wheels of UPS must be locked after positioning properly. The back side wheels are fixed. Be more careful of sudden movements, especially when batteries are inside of cabinet.

Move the UPS as rarely as possible.

3.1.5 Main, Load and Battery Connections

Makelsan strictly recommends a distribution board for the UPS outputs. Proper fuses and breakers must be used in such distribution board. A-B type fuses or magnetic breakers are recommended if the load is suitable.

3.1.5.1 External Protection

To protect the AC inputs, thermal magnetic breakers or V type breakers must be installed on the distribution board.

Over current protecting must be installed on mains input distribution board and fuses must be chosen 135% higher rated than the ones given in the table below. Fuses must be C-type.

Ground leakages flow to the ground through the EMI filters on the input and the output of the UPS. Makelsan recommends the use of 700mA rated relays for handling leakage currents.

Leakage current relays that set at the input of UPS are shown below;

- ✓ Resistant to both positive and negative DC pulses,
- ✓ And not sensitive to transient currents.
- ✓ Must be sensitive to currents which is average between 0,3-1 A

3.1.5.2 Cable and Fuse Selection

Cable designs must be suitable to mentioned currents and voltages; additionally, local guidelines on this topic must be considered.

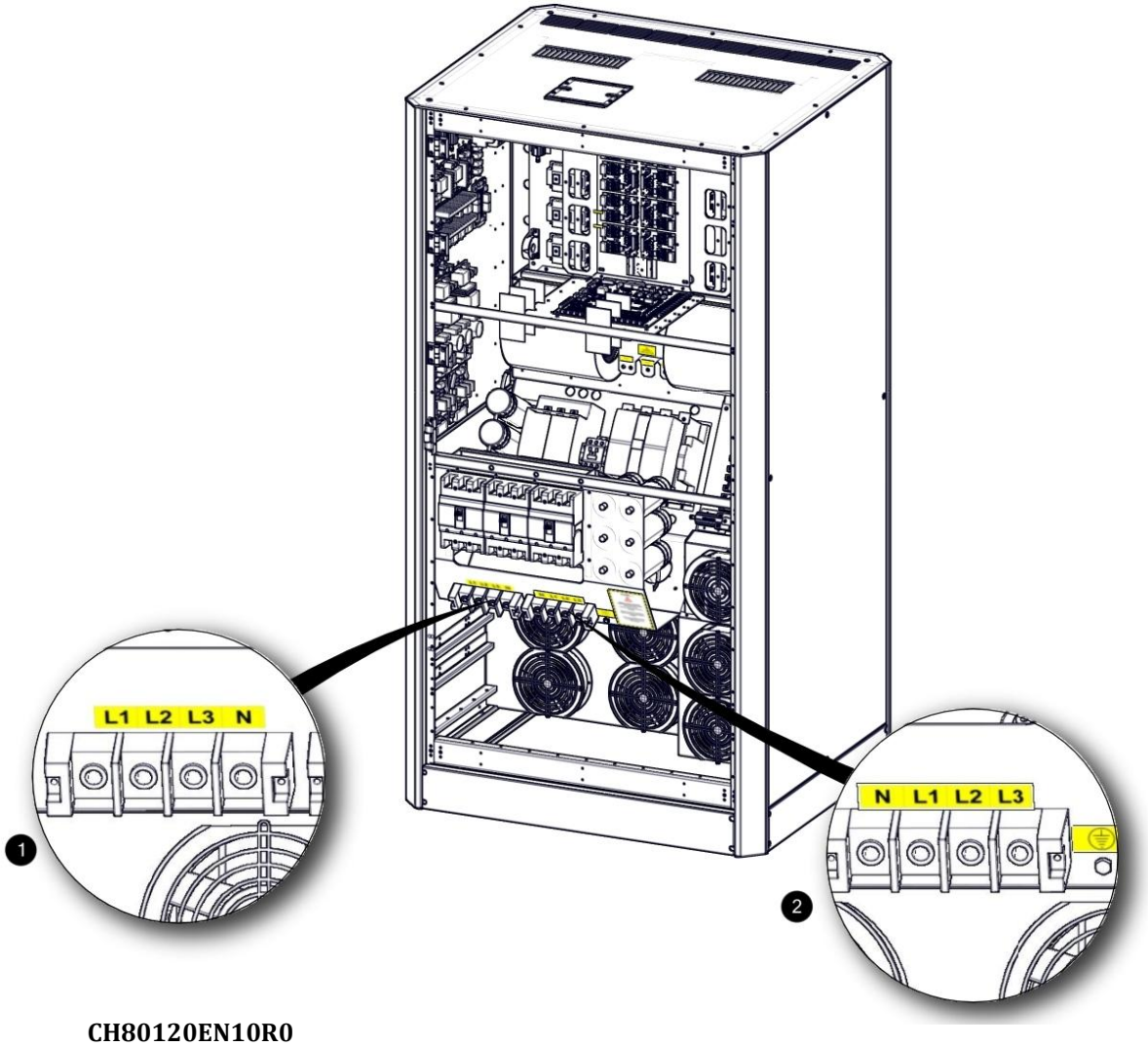
UPS Power (KVA)	Nominal Currents (A)					
	Input currents@max charge current (3P+N)			Output Currents @100% Load (3P+N)		
	380V	*400V*	*415V*	*380V*	*400V*	*415V*
80	*137,6*	*128,0*	*127,0*	*123,2*	*116,8*	*112,8*
100	*172,0*	*160,0*	*158,7*	*154,0*	*146,0*	*141,0*
120	*206,4*	*192,0*	*190,5*	*184,8*	*175,2*	*169,2*

Non-linear loads (computer-type loads) may affect design of cable cross-sectional. The Neutral currents may be bigger than the phase currents, even it may rise up to 1,5 times of phase current. Protection Ground cable must be connected to directly each cabinet and ground line easily. Typical ground line cable cross-sections for 80 kVA should be 50mm2, for 100 kVA should be 70mm2 and for 120 kVA should be 95mm2.

3.1.5.3 Connecting the Cables

All electrical connections of the UPS are made from the rear side of the device.

ATTENTION! 3 pole-circuit breakers (switch) are used for the input and output of UPS, Neutral line is not be interrupted.

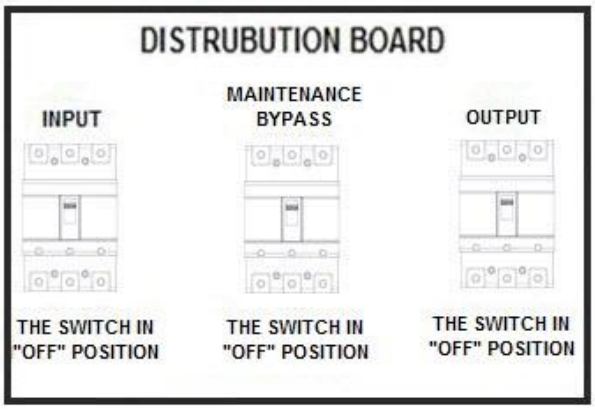


CH80120EN10R0

1	Input Terminals
2	Output Terminals

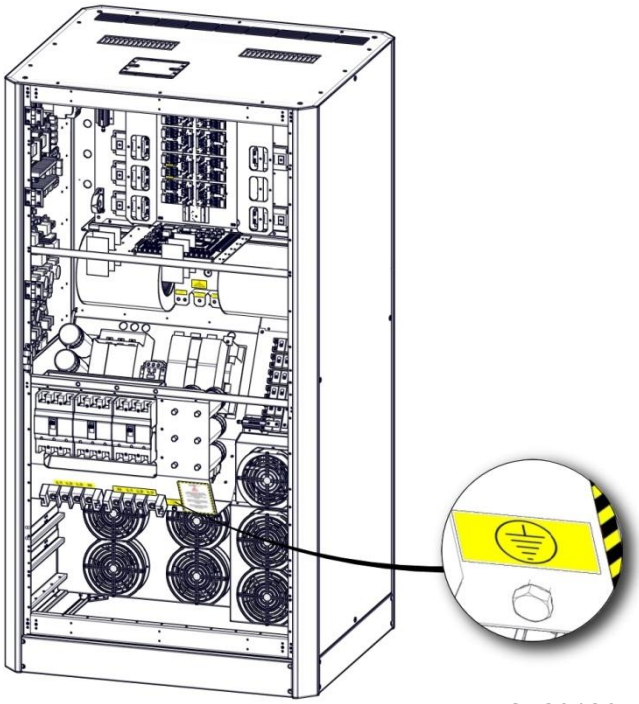
Follow the steps below to electrical connections:

1. Make sure that the network and loads are isolated through cables by turning off the all breakers on the distrubution board.



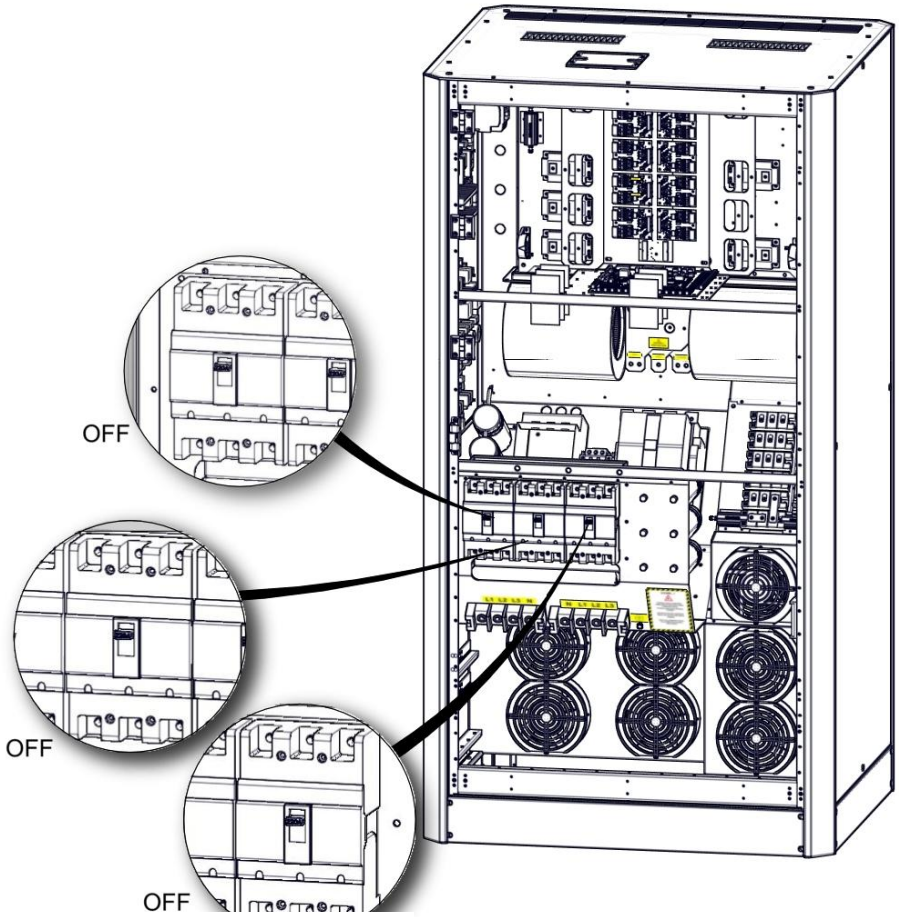
CH80120EN11R0

2. Connect the ground cable.



CH80120EN12R0

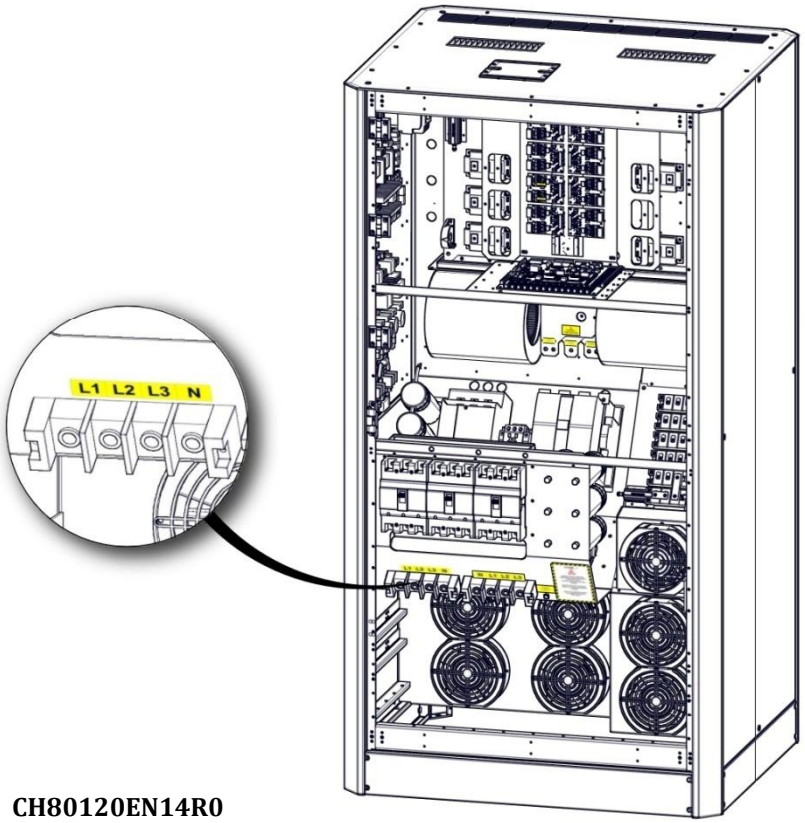
3. Make sure that the circuit breakers are off. The use of these circuit breakers are explained on the next sections.



CH80120EN13R0

4. Connect the input cables.;

- R to INPUT L1,
- S to INPUT L2,
- T to INPUT L3,
- N(Neutral) to INPUT N.



CH80120EN14R0

5. Check the phase sequence.
6. Repeat steps 4-5 for output cables.

Use the cable clips to stabilize the cables when the connections are done.

WARNING: Make sure that the loads are isolated from the UPS output if they are not ready to be connected

WARNING: Make sure that the cables are connected properly before UPS is started. Additionaly, check if there is galvanic isolation transformers at input of UPS and consider the local directions.

WARNING: Check the grounding before starting the UPS. Wrong works or grounding on UPS or other devices of installaton may be hazardous. Wrong works and grounding may damage UPS and another system on the installation

3.1.5.4 Battery Connections

You can find explanations about installation procedures and connections of internal and external batteries in this section.

Battery Hazard

- The battery terminal voltage can reach up to 700 Vdc.

- Preserve your eyes and skin against possible arcs.
- Check for leaks before connecting the batteries.
- Batteries have harmful content. In case of contact wash with plenty of water If irritation persists, consult a doctor.

  Remove the metal accessories such as ring ,watch before working with batteries

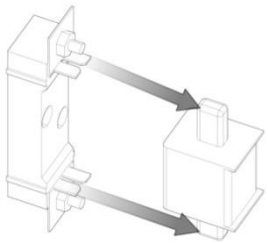
3.1.5.4.1 External Battery Installation Procedure and Connection

You can see detailed information about how to be positioned of external batteries under the title of external batteries positioning above. In this section, Information about connecting batteries to UPS was given

Avoid short circuiting batteries .Exploding batteries can damage you and your environment!

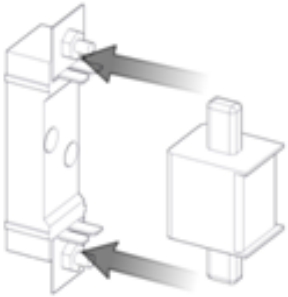
Battery terminal may rise up to 700 Vdc

1. If any switch breaker exist on the battery cabinet, switch Off them.
2. Remove the battery fuse in the battery cabinet.
3. Remove the battery fuse on the UPS.



CH80120EN15R0

4. Make sure that the batteries are connected properly in series and parallel.
5. Connect the negative battery terminal to –BAT cable, also connect the positive battery terminal to the +BAT cable in the UPS.
6. Check the polarity of the battery connection once again.
7. Replace the battery fuse on the UPS.



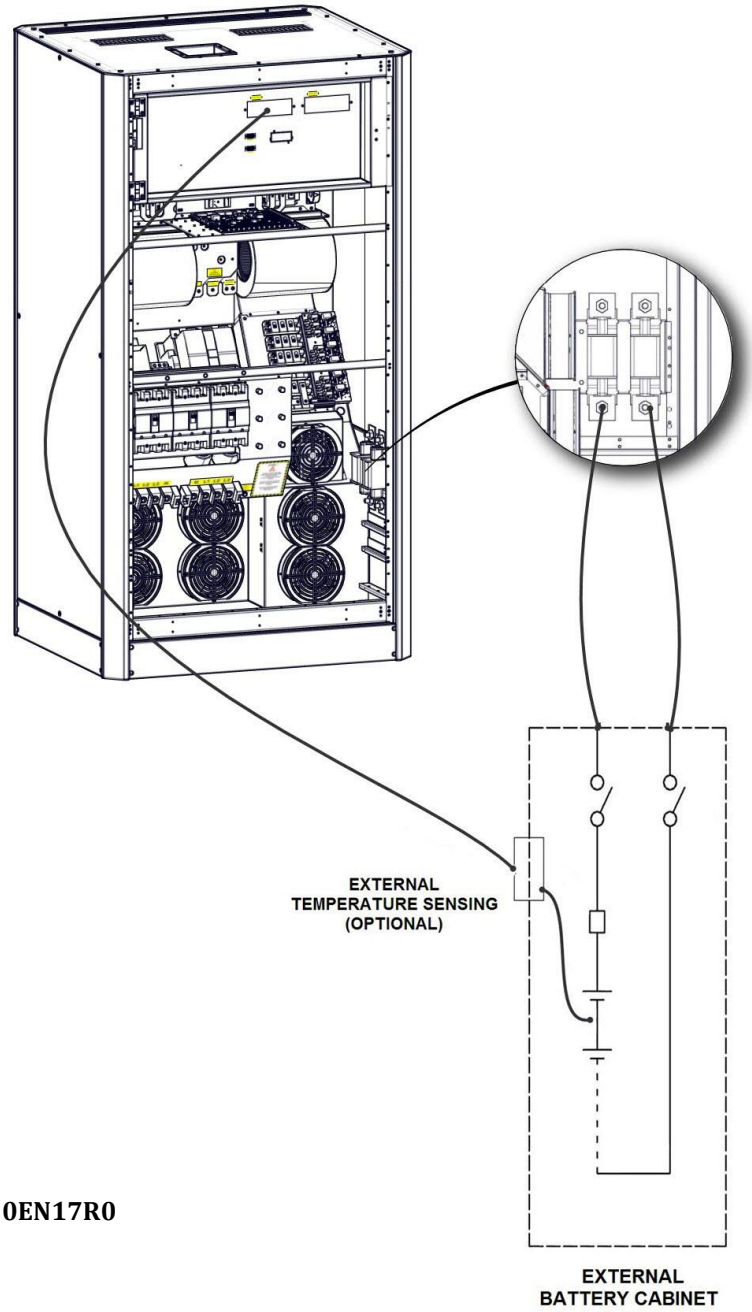
CH80120EN16R0

8. Replace the battery fuse in the battery cabinet.
9. Replace the battery fuse on the UPS
10. If any switch breaker exist on the battery cabinet, switch ON them.

11. Please check that whether there is appropriate battery voltage on the input terminals of the battery of UPS by measurement tool.

    The external battery cable selection is determined by the application. Recommended fuses are given for UPS and battery cabinet. The lowest diameter cable that can be connected to those fuses is recommended to be used. Please, refer to standard called EN 50525-2-31(VDE 0100-430) in this subject. Bu konuda EN 50525-2-31(VDE 0100-430) adlı standardı referans alınız. selection should be such that the cable will allow at most 0.5 Vdc decreasing.

    "**External Battery Temperature Measurement Kit**" which is sold as optional is recommended to purchase for optimization according to battery temperatures on the external battery cabinets applications. Otherwise, your batteries will not be optimized according to temperatures.



CH80120EN17R0

3.1.5.5 Control and Communication Cable Connections

MAKELSAN UPS have standart or optional connections of advanced external battery cabinet, environmental monitoring, control panels and various intelligent monitoring.

Connections on the side of UPS :

• One RS232 serial communication connector (RS232/Rectifier Service)

• One RS232 serial communication connector (RS232/Inverter Service)

• Two optional card slot

Connections on the UPS:

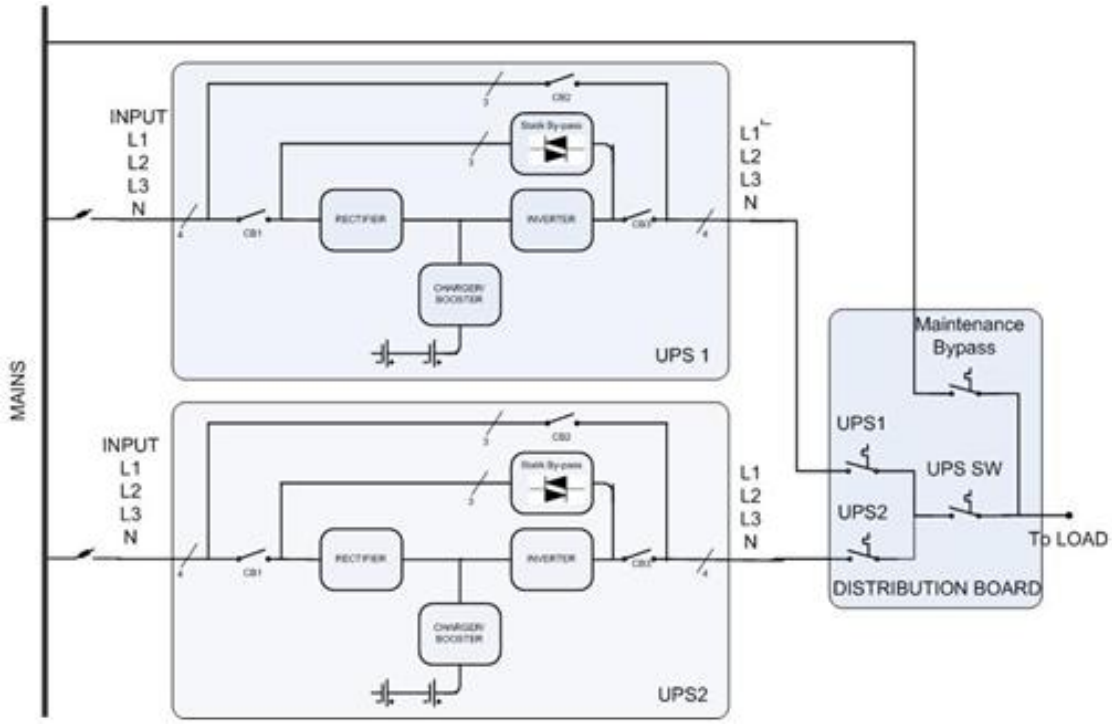
- One paralleling connection connector

3.2 Parallel Installation

The product which you have bought can be operated in parallel; however, this feature is offered as an option. Please contact your dealer for parallel operation.

Parallel application should be made by authorized personal of Makelsan !

In case of need for redundancy or more power, Boxer series UPS can be operated in parallel up to quantity 8 (eight). A schematic diagram which shows two UPS connected in parallel can be seen below.

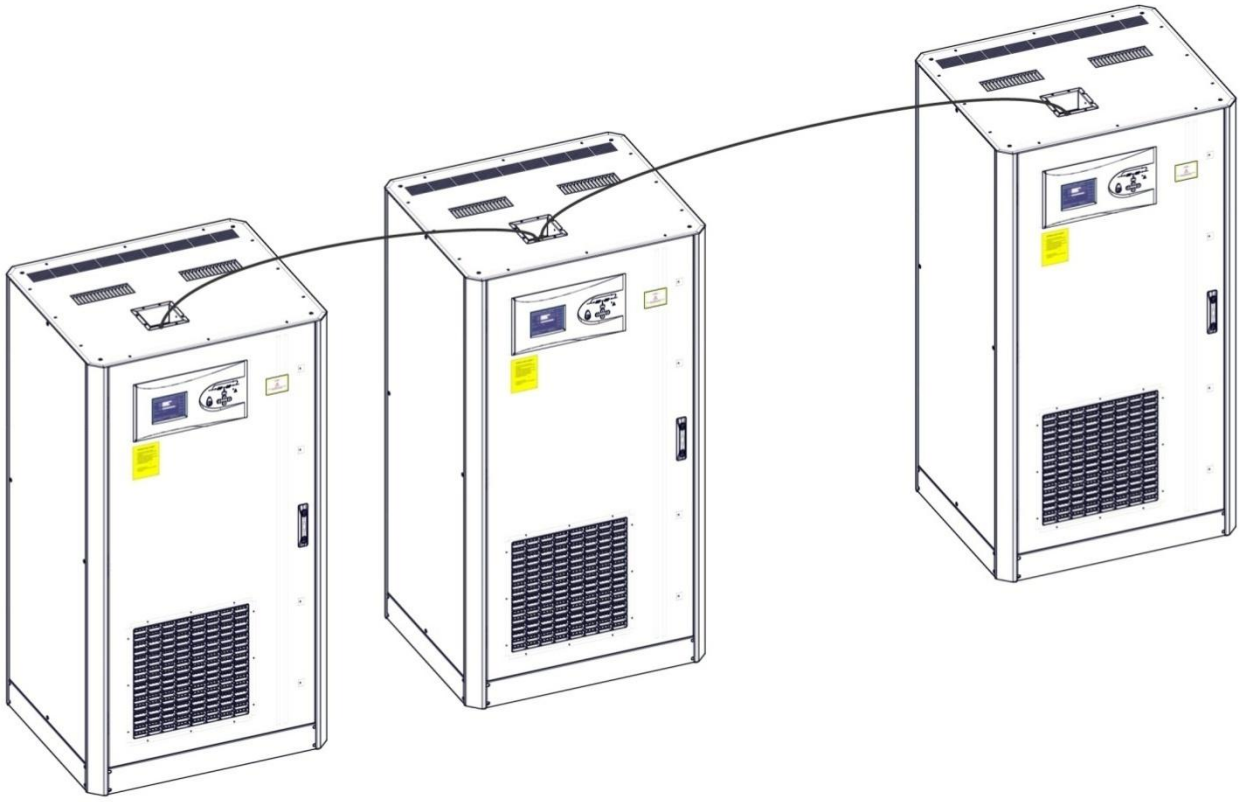


Inputs and outputs of more than one UPS are connected to each other; but definitely each battery group is different from another, batteries can not be used in common. The following points should be considered while placement of UPS in parallel system and their electrical connections are made:

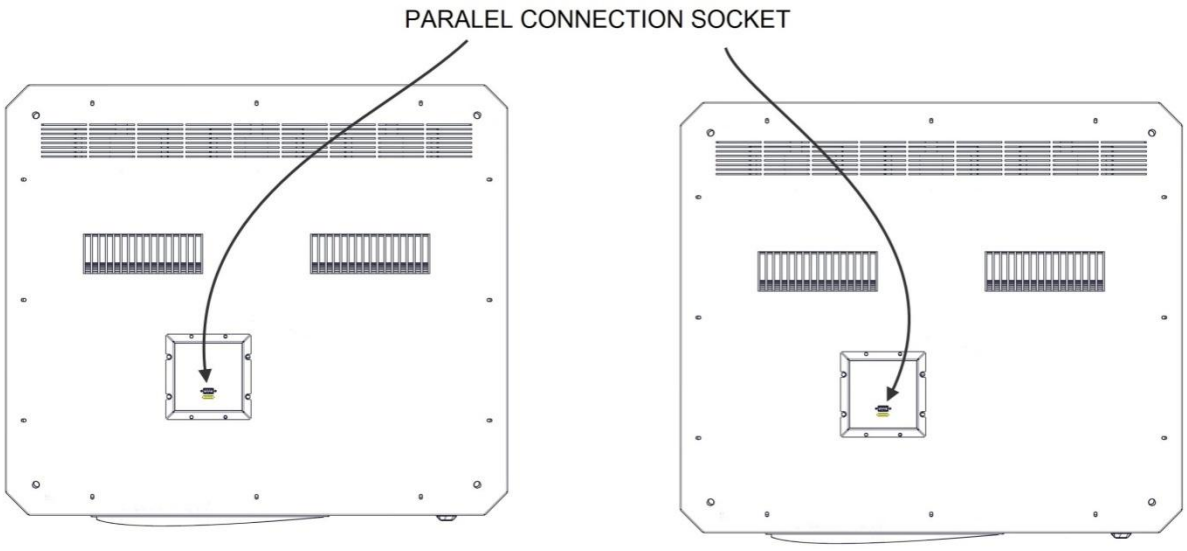
- ✓ UPSs connected in parallel must have the same power rating and must be the same series.
- ✓ Devices must be running on the same firmware, if not, old firmwares must be updated.
- ✓ Devices must be located as close as possible to each other (max. 6 x 110 cm paralleling cables.)
- ✓ Each device must have its own neutral cable .
- ✓ Each device must have its own ground connection.
- ✓ UPS must be connected in paralel on the distribution panel and phases must be connected correctly. (U_1-U_2-…-U_N), (V_1-V_2-…-V_N), (W_1-W_2-…-W_N).
- ✓ Each UPS must have their own battery set, batteries cannot be used for more than one device at the same time.
- ✓ The length of all cables which are connected to distribution panel must be the same for the equal current sharing.

Parallel Settings

Connect the parallel cable as shown in figure below. Only use the cables provided by Makelsan.



CH80120EN18R0



CH80120EN19R0

- Software settings on the user panel should be made by authorized personel.

4 OPERATION

4.1 Operation Procedure

You can find informations about circuit breaker, first start-up, types of UPS operation tests, turning UPS off, EPO and RS232 serial communication system in this section.

4.1.1 Circuit Breakers

UPS has three circuit breakers that can be reached from the front panel, these are used for AC input, maintenance bypass and output connections respectively.

Three-phase AC voltage is applied through **CB1** to input of UPS.

AC input voltage is applied directly to loads through **CB2**. In this way, maintenance purposed switching is done properly. If UPS is actived while it is operating thanks to auxilary short circuit info located in CB3, mains makes the bypass static switches actived. The system will be switched to maintenance mode smoothly.

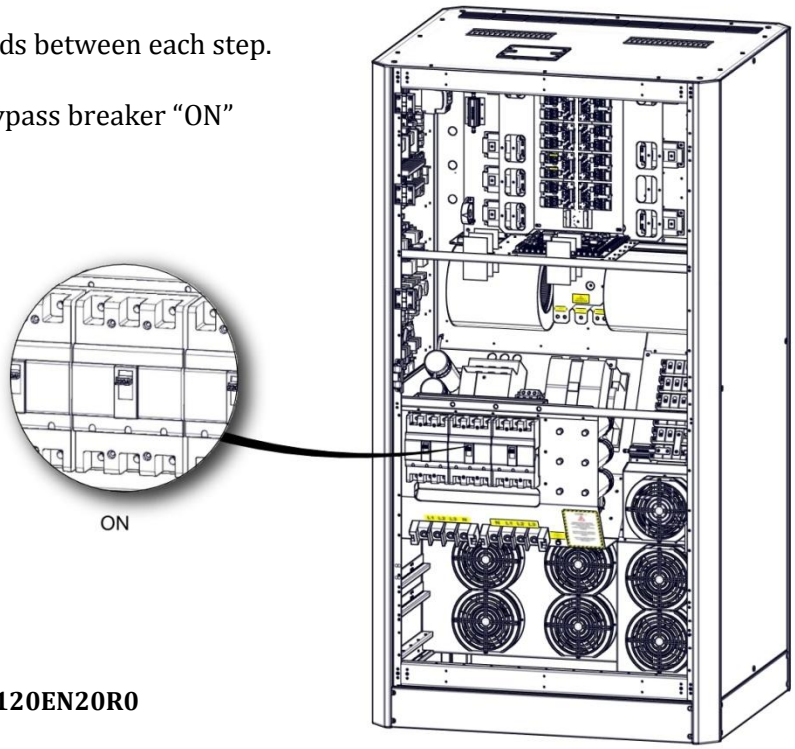
CB3 is used to connect or seperate AC voltage that comes from static switches to the loads on UPS**.**

Active Brakers	Operation Mode	Explanation
CB1, CB3	Normal Mode	UPS operates in normal mode..
CB1, CB3	Static Bypass Mode	UPS is overloaded, loads will be transferred to static bypass line temporarily.
CB2	Test Mode	UPS is ON, but loads will be fed through mechanical bypass line.
CB2	Maintenance Mode	UPS is shut down for maintanence, loads will be fed through mechanical bypass line.

4.1.2 First Start-Up

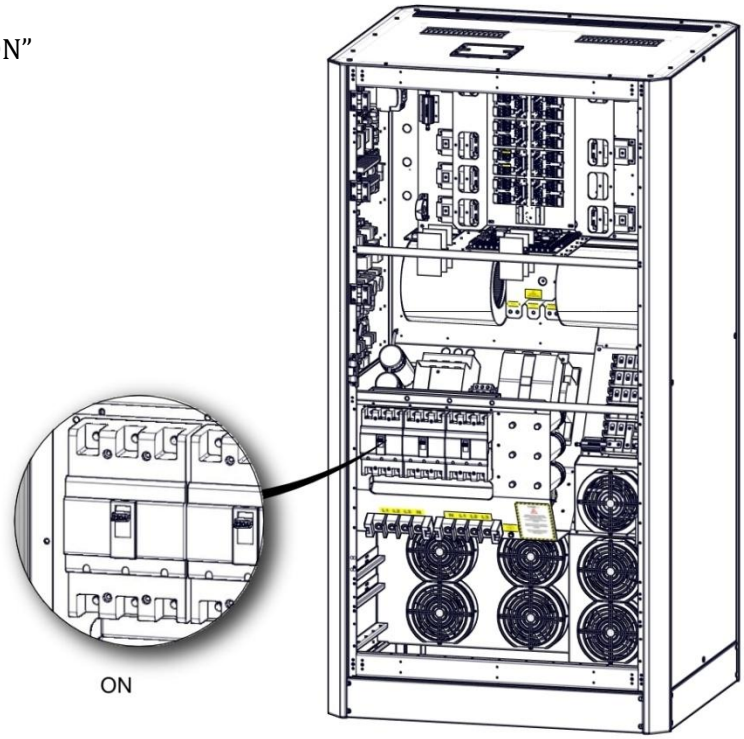
WARNING: Wait for at least 5 seconds between each step.

1. Turn the Maintenance (CB2) bypass breaker “ON”



CH80120EN20R0

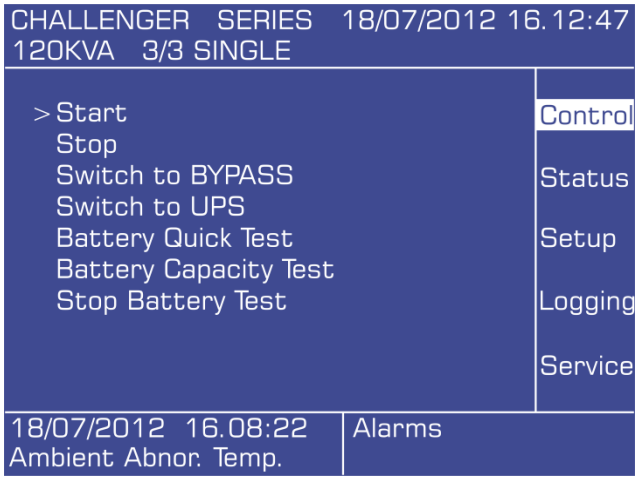
2. Turn the input (CB1) breaker “ON”



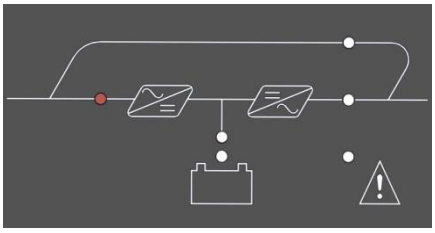
CH80120EN21R0

3. Start the UPS using the front panel.

Main menu> Control > Password > Start

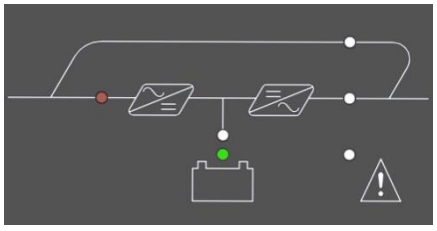


4. Wait for the operation of the rectifier. Rectifier LED on the mimic diagram will flash for a while, and then remain lit.



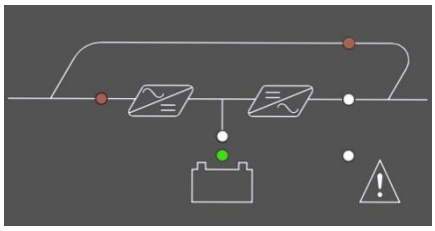
CH80120EN22R0

5. Wait for the operation of the battery charge. Battery charge LED on the mimic diagram will be lit continuously.



CH80120EN23R0

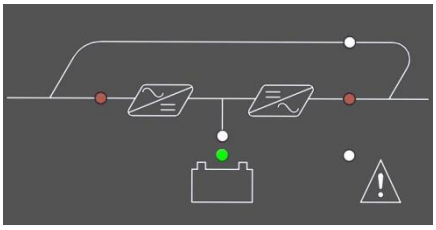
6. Wait for the switching of UPS to static bypass mode. Static bypass LED on the mimic diagram will light up.



CH80120EN24R0

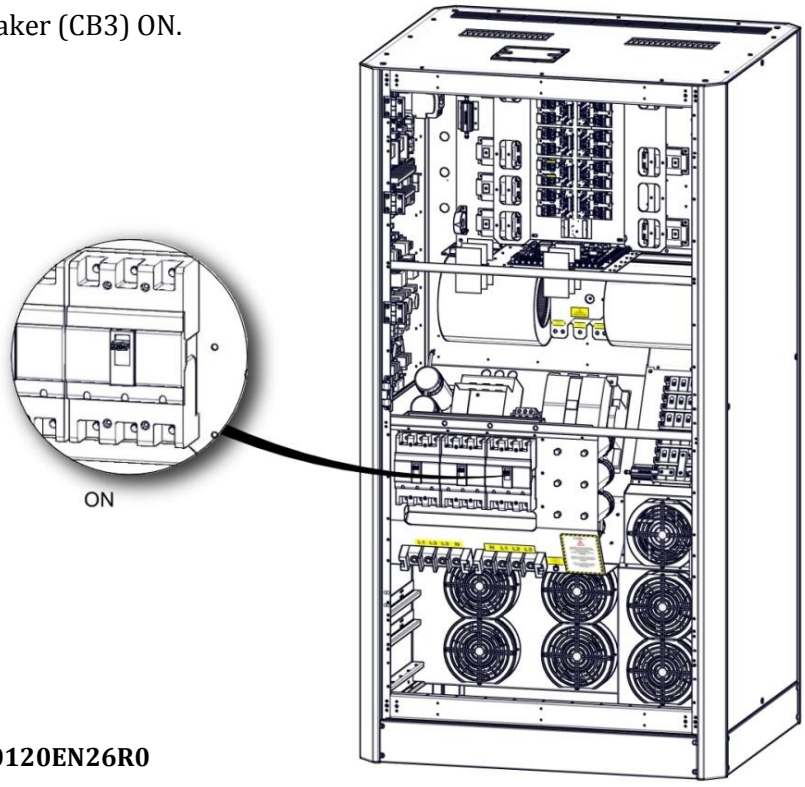
7. Check the UPS has switched to normal operation mode, via mimic diagram LEDs and LCD panel.

8. Verify that batteries are switched via front panel indicator and "Status > Battery" menu.



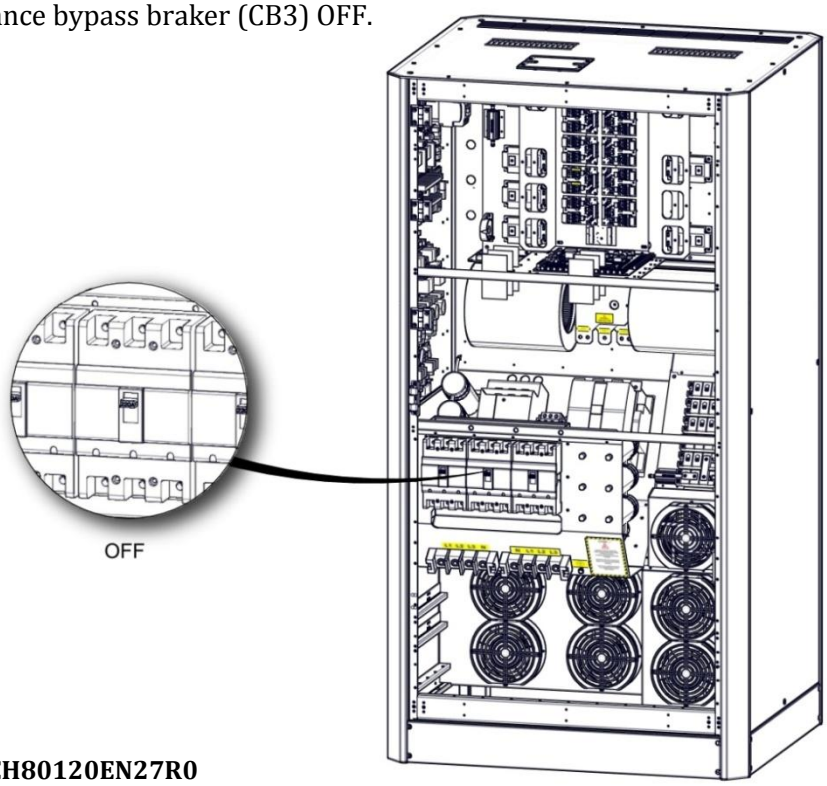
CH80120EN25R0

9. Turn output circuit braker (CB3) ON.



CH80120EN26R0

10. Turn the maintenance bypass braker (CB3) OFF.



CH80120EN27R0

11. The loads which are connected to UPS can be turned on.

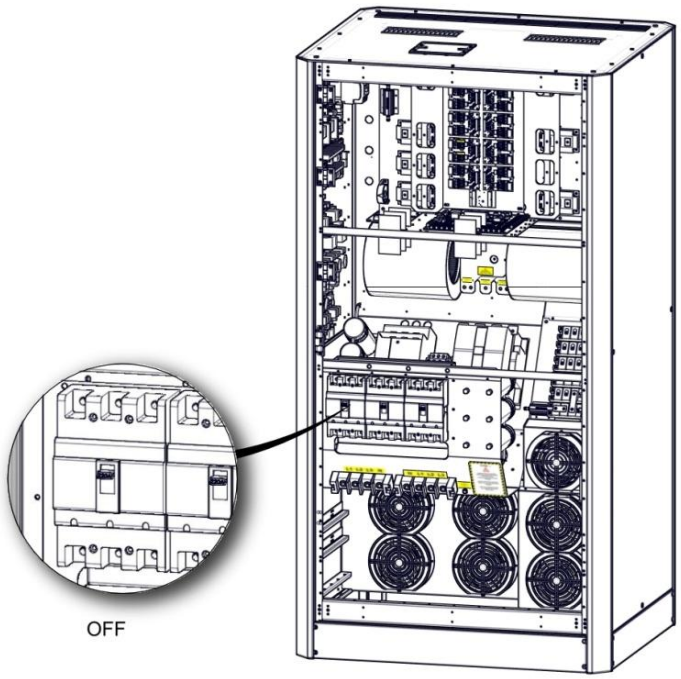
After all these steps, check that load is fed through inverter static switches via mimic diagram. In a contrary situation, check UPS total and phase loads. The UPS gives audio alerts in an overload condition, without feeding critical AC loads.

4.1.3 Testing of Types of UPS Operation

After first start-up check device operation by switching between the following modes manually.

4.1.3.1 Switching from Online Mode to Battery Mode

Turn CB1 OFF. This action cuts off the mains voltage and the UPS starts operating on battery mode. Turn CB1 back ON again if everything is ok.

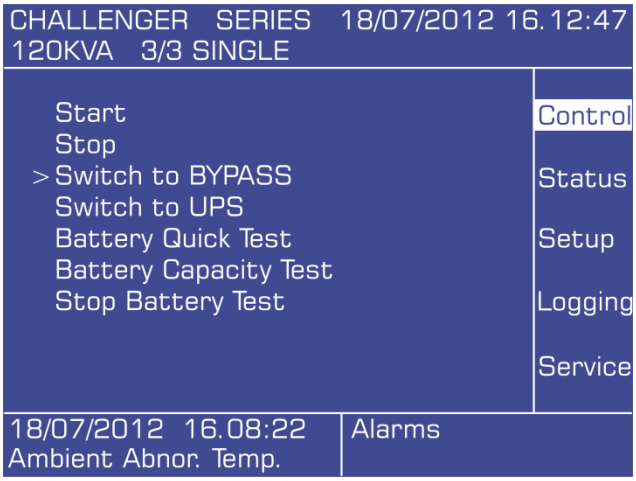


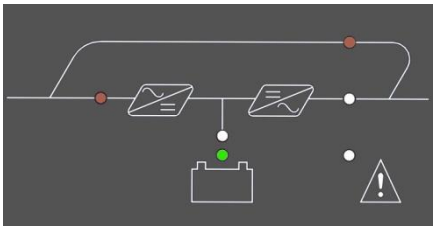
CH80120EN28R0

4.1.3.2 Switching from Online Mode to Static Bypass Mode

Use the front panel to switch the device to static bypass mode. Check the mimic panel to make sure that the device has switched to bypass mode.

Main menu> Control > Switch to Bypass





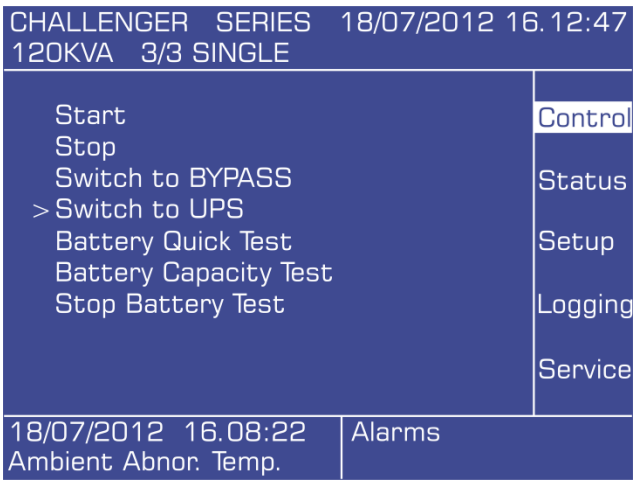
CH80120EN24R0

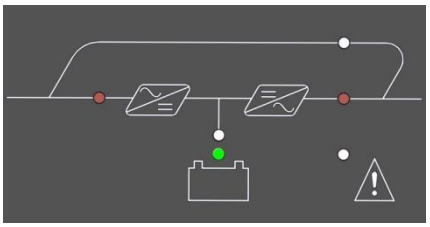
NOTE: UPS will not switch to bypass mode if the inverter voltage is out of limits or there is and overload or overtemperature situation.

4.1.3.3 Switching from Static Bypass Mode to Online

Use the front panel to switch the device to online mode. Check the mimic panel to make sure that the device has switched to online mode.

Main menu > Control > Switch to UPS





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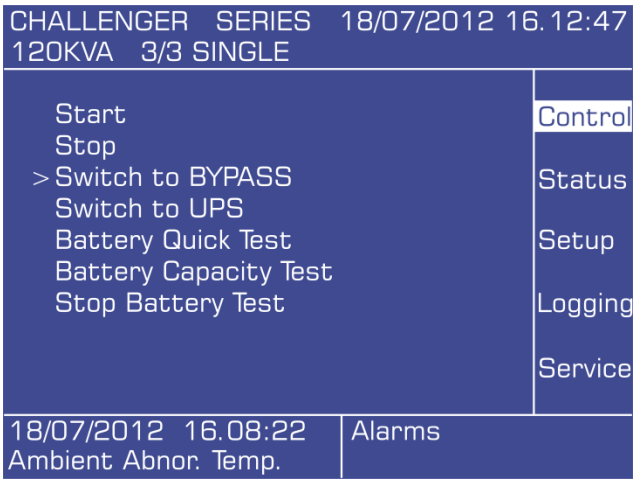
NOTE: The UPS will not switch to normal mode if the inverter voltage is out of limits, or there is and over load or over temperature situation.

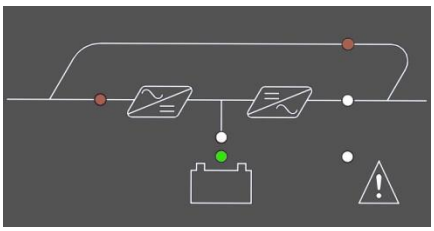
4.1.3.4 Switching from Online Mode to Maintenance Bypass Mode

WARNING: Make sure that the inverter output is synchronous with the maintenance bypass line before switching to maintenance bypass mode. Otherwise there is a possibility of cutting off the load power for a short while.

Use the front panel to switch the device to static bypass mode. Check the mimic panel to make sure that the device has switched to bypass mode.

Main Menu > Control > Output BYPASS





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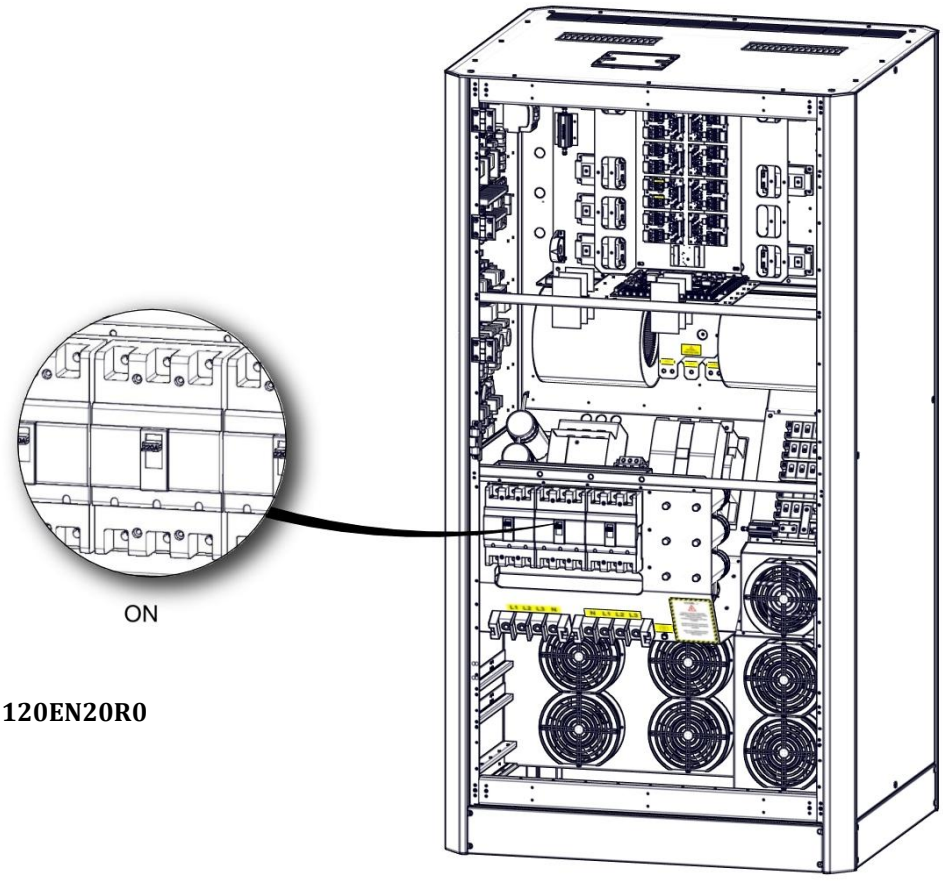
1. Turn CB2 **ON**.



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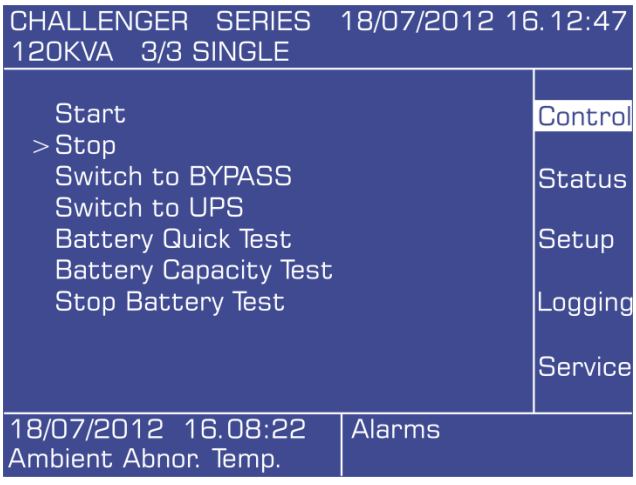
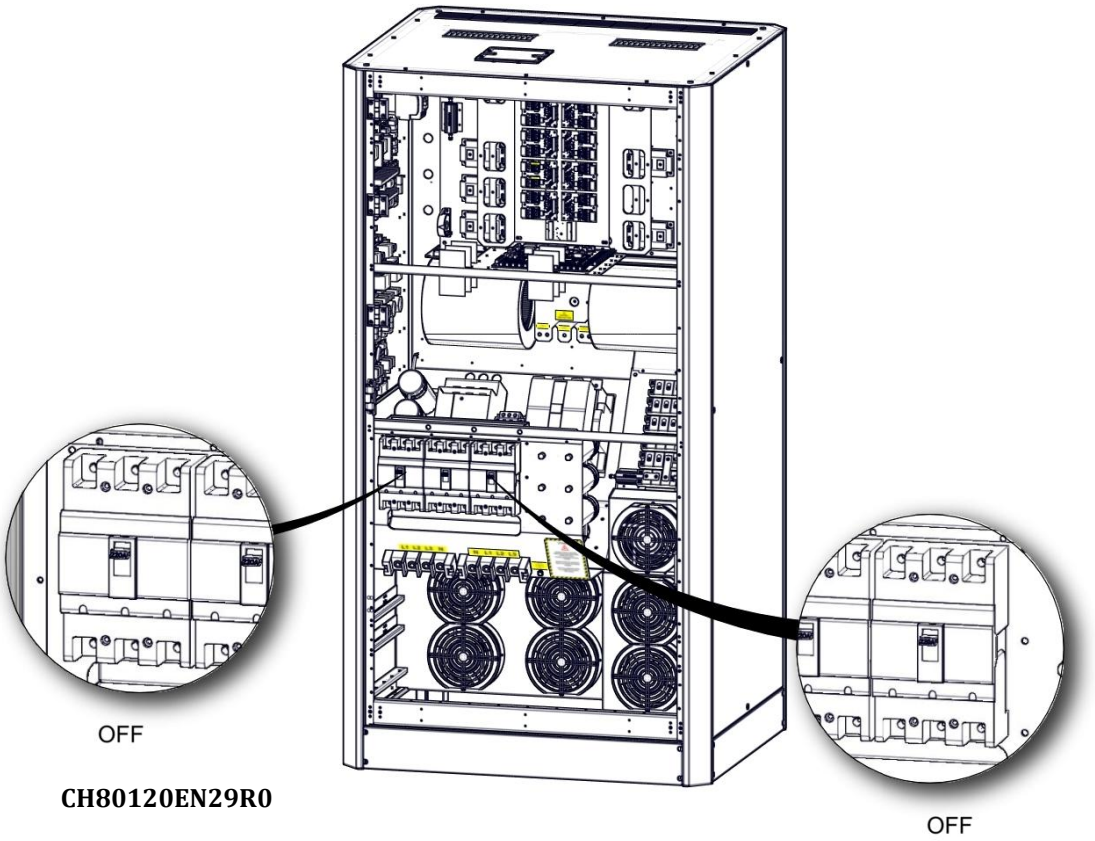
Stop the UPS by using front panel.

Main menu > Control > Stop



2. Turn CB1, CB3 and CB4 **OFF.**



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WARNING:

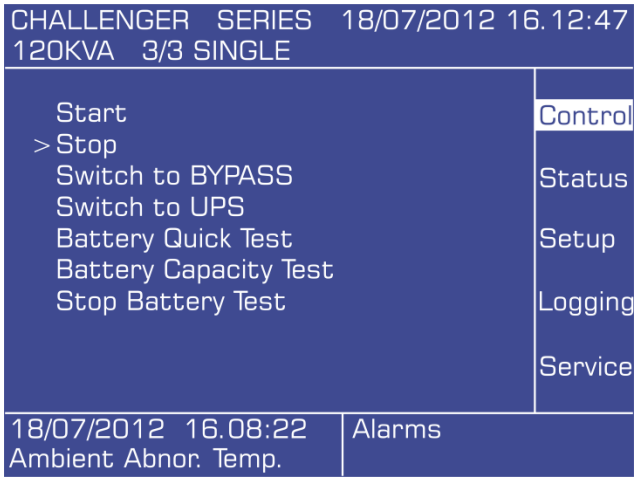
Wait at least 5 minutes before opening up the device after it is completely turned off, for safety

4.1.4 Performing a Complete Shutdown

Turn off the loads connected to the device.

Use the front panel to turn the device OFF

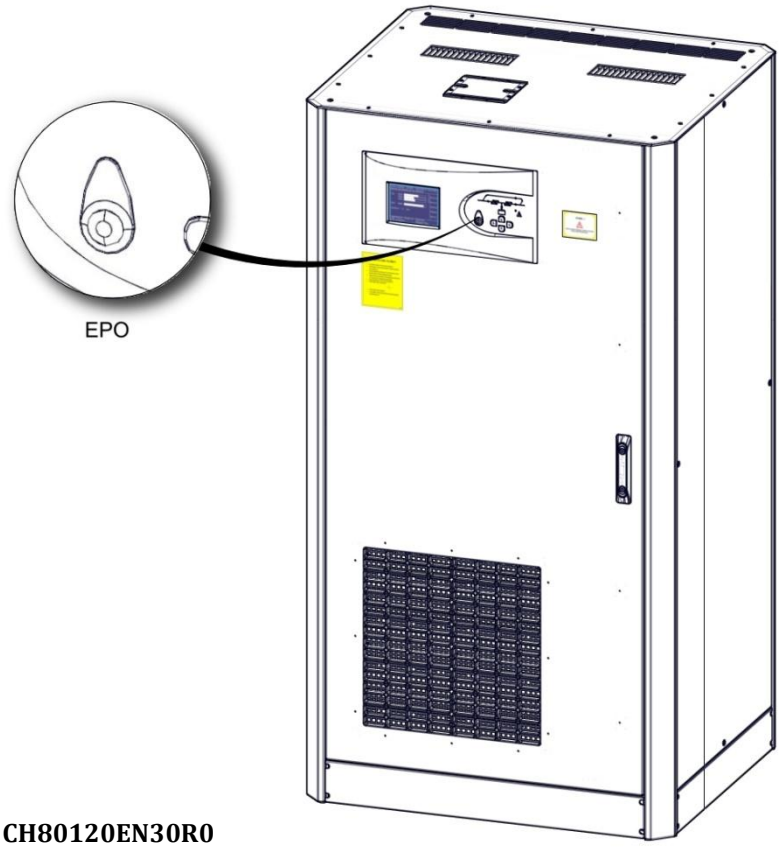
Main Menu> Control> Password> Stop



WARNING: Make sure that there are no critical loads on the UPS output before performing a complete shutdown.

4.1.5 EPO (Emergency Power Off)

UPS turns off rectifier, amplifier and inverter respectively when the EPO button is pressed. UPS is completely separated from the system, if the shutdown option of output circuit breaker is setted.



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4.1.6 RS232 Serial Communication Installation and investigation

Boxer series has an RS-232 interface which supports SEC and TELNET protocol as standart.

This interface is fully isolated and safe. UPS can be monitored remotely via a computer (PC) or SNMP by using this protocol. This connection works with all kinds of options.

5 Explanations of Logging

UPS will beep when any problem is detected. You can see the first information about the situation on the front monitor panel. This may not be enough most of the time. In this case, you can see the following warnings by using log screen.

	Warning	Warning Description
1	**RS232 Start Command**	UPS was started by RS232 communication software.
2	**RS232 Stop Command**	UPS was stopped by RS232 communication software.
3	**Auto Restart**	After the batteries discharge totally, UPS restarted itself automatically after the mean time which adjusted that follows the mains getting back
4	**UPS Startup**	The main board of the UPS is energized.
5	**Soft Start Fail**	UPS could not ramp the DC bus up.
6	**Quick Battery Test**	Quick battery test has began.
7	**Deep Battery Test**	Battery capacity test has began.
8	**Battery Self Test**	Periodical battery test has began.
9	**End Of Discharge**	Batteries' voltage has gone below cut off voltage value while UPS was operating on the battery mode.
10	**Overload Timeout**	UPS has operated at overload more than time limit adjusted. The Loads will be transferred to bypass line.
11	**End of Battery Test**	Battery test has completed. You can see the all results via front panel status menu.
12	**Batt. Test Aborted**	Test was aborted manually or by UPS since the criterias were not provided during battery test.
13	**Manuel Switch To BYP**	Static switchs directions were changed manually to the bypass line via UPS command menu.

14	**No Battery**	No battery detected.
15	**Maint. BYP. Sw. On**	Maintenance bypass switch has been activated.
16	**Ambient Abnor. Temp.**	The ambient temperature is over limit. Check the ventilation of UPS room.
17	**Battery over-current**	UPS battery charge current is out of the specified limits. Charge will be OFF until return to normal operating.
18	**Mains Voltage bad**	Mains voltage is out of the specified limits, UPS will switched to battery mode.
19	**Inverter Overtemp.**	Inverters temperature is out of limit, in case of 5 degrees more increme Load will be transferred to Bypass line.
20	**PFC Overtemp.**	Rectifier 's temperature is out of limit, in case of 5 degrees more increment ,Load will be transferred to Bypass line.
21	**Chrg OverTemp.**	Charge / boost module temperature is out of the specified limits. If it is in charge mode, Charge will be stopped. If it is in boost mode, UPS will be stopped.
22	**STS Overtemp.**	Static Transfer Switches' temperatures are out of limits. UPS will be stopped.
23	**Outp.PL1 Cur. Limit.**	Short circuit protection is activated for output L1 phase.
24	**Outp.PL2 Cur. Limit.**	Short circuit protection is activated for output L2 phase.
25	**Outp.PL3 Cur. Limit.**	Short circuit protection is activated for output L3 phase.
26	**Bypass Voltage Bad**	Bypass voltage value is out of limit while UPS was operating on the bypass mode. UPS will switch to normal mode if temperature and load status are normal.If not ,UPS will stop.
27	**Bypass Freq. Bad**	Bypass frequency value is out of limit while UPS was operating on the bypass mode. UPS will switch to normal mode if temperature and load status are normal.If not ,UPS will stop.
28	**Coil Overtemp**	Over temperature is observed for UPS' inverter and rectifier coils.

29	**Inverter Voltage Bad**	Inverter voltage is out of limit. Load will be transferred to bypass line, when inverter voltage gets back to normal values,UPS will switch to normal mode again.
30	**Overload**	Output load value is over %105, overloading counter will start to count, If UPS is on normal mode, the charging will be stopped until load value gets back to normal.
31	**Maint. BYP. Sw. Off**	Maintenance bypass switch is deactivated.
32	**Ambient Nor. Temp.**	UPS ambient temperature has got back to allowed limit values.
33	**Mains Voltage Nor.**	Mains voltage is in the limited values, UPS will switch to normal mode.
34	**Inverter Nor. Temp.**	Inverter temperature is in the limited values. If load and temperature values are normal, UPS will switch to normal mode.
35	**PFC Nor. Temp.**	Rectifier temperature is in the limited values. If load and temperature values are normal, UPS will switch to normal mode.
36	**Charger Nor. Temp.**	Charger/booster module temperature is in the allowed limits, charging will be activated again.
37	**STS Nor. Temp.**	Temperature of Static transfer switches is in the allowed limit.
38	**Bypass Voltage Nor.**	Bypass voltage is within defined limits.
39	**Bypass Freq. Nor.**	Bypass frequency is within defined limits.
40	**Coil Normal temp.**	UPS inverter or rectifier coil temperature has got back to normal values.
41	**Inverter Volt. Norm.**	Inverter voltage is in the limited values, UPS will switch to normal mode.
42	**Normal Load**	Output load is under %100, If charging was OFF, It will be ON .
43	**BYP Thyr.L1 Short C.**	UPS has detected short circuit at bypass L1 thyristor. UPS will shut down.
44	**BYP Thyr.L2 Short C.**	UPS has detected short circuit at bypass L2 thyristor. UPS will shut down.

45	**BYP Thyr.L3 Short C**	UPS has detected short circuit at bypass L3 thyristor. UPS will shut down.
46	**UPS Thyr.L1 Short C.**	UPS has detected short circuit at inverter L1 thyristor. UPS will shut down.
47	**UPS Thyr.L2 Short C.**	UPS has detected short circuit at inverter L2 thyristor. UPS will shut down.
48	**UPS Thyr.L3 Short C.**	UPS has detected short circuit at inverter L3 thyristor. UPS will shut down.
49	**UPS Thyr.L1 Open C.**	UPS has detected that inverter L1 thyristor can not be activated. Load will be transferred to bypass line.
50	**UPS Thyr.L2 Open C.**	UPS has detected that inverter L2 thyristor can not be activated. Load will be transferred to bypass line.
51	**UPS Thyr.L3 Open C.**	UPS has detected that inverter L3 thyristor can not be activated. Load will be transferred to bypass line.
52	**BYP Thyr.L1 Open C.**	UPS has detected that bypass L1 thyristor can not be activated. Load will be transferred to inverter line.
53	**BYP Thyr.L2 Open C.**	UPS has detected that bypass L2 thyristor can not be activated. Load will be transferred to inverter line.
54	**BYP Thyr.L3 Open C.**	UPS has detected that bypass L3 thyristor can not be activated. Load will be transferred to inverter line.
55	**Parl. Phs. Rot. Err.**	One or more of UPSs which operate in paralel mode do not match in phase sequence.
56	**Battery Start**	Starting through battery command has been given to UPS.
57	**Parl. Start Error**	One or more of UPSs which operate in paralel mode could not start to operate.
58	**Inverter Fault**	UPS couldn't prepare the inverter voltage.
59	**Output Off**	Static transfer switches all disabled. The loads can not be energized.
60	**Normal Mode**	UPS is operating in the normal mode, load are energized through rectifier – inverter line.
61	**Battery Mode**	UPS is operating in the battery mode, load are energized through battery – inverter line.

62	**Bypass Mode**	UPS is operating in the bypass mode, load are energized through bypass line.
63	**Maintenance Bypass Mode**	UPS is operating in the bypass mode, load are energized through bypass line.
64	**Parallel Mode**	2 or more UPS are operating in power sharing mode. Load is fed through UPSs' inverter lines.
65	**Test Mode**	UPS has switched to battery test mode, loads are energized through rectifier- battery- inverter line as source sharing.
66	**EKO Mod**	KGK eko moddan çalışıyor. Yükler bypass hattı üzerinden besleniyor.
67	**Switch to Inverter Command**	The direction of the static switches was varied manually on the rectifier through UPS commands menu.
68	**Output Voltage Error**	Output voltage is detected during the period of starting UPS . UPS has been stopped.
69	**PFC Stop Cmd.**	Abnormal stuation is detected during the moment of rectifier operating.UPS has stopped itself.
70	**Manuel Start Command**	Start command is given via UPS command menu.
71	**Manuel Stop Command**	Stop command is given via UPS command menu.
72	**Batt. Swtch. Failure**	An error occurred while ramping up the battery bus, Batteries could not be activated.
73	**UPS Stopped**	UPS has been stopped.
74	**Bypass Problem**	UPS has switched to bypass mode so many times i a short period, UPS will be shut down.
75	**Parameters Changed**	Device-related parameters were changed on the service menu
76	**Batterys Changed**	Battery replacement date has been changed. Battery statistics will be reset.
77	**Battery Contactor OFF**	Battery mechanical switch on the service menu was deactivated. Batteries are not active.
78	**Battery Contactor ON**	Battery mechanical switch on the service menu was activated. Batteries are active.

79	**Battery Err.**	Although connected to the UPS, batteries can not be charged.
80	**Parallel Command**	UPS which is operating in paralel mode has been given a command to change the status of static switches.
81	**No P.CAN Bus Comm.**	Slave UPS which is operating in paralel mode can't reach to master UPS from CAN bus. If UPS is operating, will be shut down.
82	**Ext. Start Command**	UPS which is operating in paralel mode has been given a command to start up by another (master) UPS.
83	**Ext. Stop Command**	UPS which is operating in paralel mode has been given a command to stop by another (master) UPS.
84	**Ext. Switch To BYP.**	UPS which is operating in paralel mode has been given a command to transfer the load to bypass line.
85	**Ext. Switch To UPS**	UPS which is operating in paralel mode has been given a command to transfer the load to inverter line.
86	**Parallel Comm. FE.**	Slave UPS which is operating in paralel mode has detected a failure of input current sharing.
87	**Inverter OKEY**	Inverter voltage reached needed value after UPS is started up. UPS can feed the loads through inverter.
88	**Batt. Temp. Err.**	Battery temperature is out of defined limits, batteries can be damaged.
89	**Booster Overcurrent**	Overcurrent in Battery mode, UPS will be shut down.
90	**EPO key pressed**	EPO key button is pressed.
91	**Battery Low**	Battery capacity has decreased below defined " battery low limit" while UPS was operating in battery mode.
92	**No P.485 Bus Comm.**	Parallel RS485 communication between the systems is not available.
93	**STS OverCurrent**	OverCurrent in Bypass line.
94	**Output Signal OFF**	UPS output breaker is turned off. Loads can not be energized.
95	**BYP. Phase Rot. Err.**	Reverse phase sequence was detected in mains at the UPS run time.

96	**Fan Failure**	Unable to communicate with the fan control system. Only for UPSs that contain the fan control system.
97	**Output DC Volt. Fault**	Over Inverter DC voltage. Loads will be transferred to the bypass line.
98	**Battery Temp. Nor.**	Battery temperature is normal.
99	**Output Signal ON**	UPS output switch is opened. Loads can be energized.
100	**Fans Active**	Able to communicate with the fan control system. Only for UPSs that contain the fan control system.
101	**PFC Pbus OverVoltage**	Positive DC Bus overvoltage.
102	**PFC Nbus OverVoltage**	Negatif DC Bus overvoltage
103	**PFC PhL1 OverCurrent**	Short circuit protection is activated for rectifier L1 phase.
104	**PFC PhL2 OverCurrent**	Short circuit protection is activated for rectifier L2 phase.
105	**PFC PhL3 OverCurrent**	Short circuit protection is activated for rectifier L3 phase.
106	**Single Stop**	Command to stop itself has been given to UPS which is operating in paralel mode separately from paralel system.
107	**Master Changed**	UPS became master device in paralel system.
108	**Par. Bus ID Collision**	ID value of one or more UPS is the same as each other in parallel system.
109	**Output Offset Err.**	One or more phase of slave UPS' output is not connected to master UPS in Parallel systems.
110	**Bypass Short Circuit**	Short-circuit current limit has been exceeded in the maintenance bypass mode. UPS is shut down.
111	**RMS output Failure**	The value of output voltage is out of the limits. UPS will be shut down.
112	**Stop All Units**	Stop all units command was given via front panel.
113	**Float Charge Mode**	UPS charge mode has switched to the standby mode at the constant voltage from constant current mode.

114	**Pwr. Supply Fault**	The error signal is detected on UPS through power source circuit debugger.
115	**Generator Mode**	Signal is detected from "generator mode input" of dry contact board. UPS will switch to "generator mode".

Alarms and Descriptions

	Alarm	Decription of Alarm
1	Over Temperature	Over Temperature at the UPS units, Check the Status> Temperatures menu
2	Over Load	UPS is overloaded, reduce the load.
3	Bypass Bad	Bypass line voltage or frequency is out of limits, can not be bypassed.
4	UPS Stopped	
5	Charge Failure	The charging circuit problem is detected, batteries can not be charged. In the case of mains interruption, critical loads remain energized.
6	Fan Failure	Fan control board can not be reached, control will not be made.
7	Fuse Failure	Output Fuse is turned OFF.
8	Shutting Down	Stop command was given to the UPS, UPS will shut down at the end of the period.
9	No Battery	No battery detected.
10	M. Byp. Sig. Active	Maintenance bypass fuse is ON.
11	Static. Byp. Mode	UPS feeds the critical loads via bypass line.
12	Test is progressing	UPS is operating in the battery test mode.
13	Replace the batteries	At the end of the battery test, battery capacity was found to be insufficient. Critical loads remain energized, In the case of mains interruption.

14	Inverter Fault	Inverter voltage can not be created.
15	Battery Mode	UPS switched to battery mode.
16	Parallel. ID Conflict	There is more than one UPS with the same ID number at the system connected in parallel. Check ID numbers. In this case, the system can not be started.
17	No Parallel Comm.	UPS cannot communicate with the master UPS of the parallel system.
18	Low Battery	The battery capacity has fallen below defined limit in battery mode.
19	EKO Mode	UPS is operating in ECO mode.
20	Thyristor Failure	One or more thyristor is faulty. See the history logs for details.
21	BYP. Phase Rot. Err.	Bypass line phase sequence is not compatible with inverting the phase sequence.
22	Par. UPSMissing	Number of perceived UPS at the parallel system is not the same as number of set UPS.
23	Curr. Char. Err	One or more other phase of UPS is energized as different from other UPS.
24	Power Supply Failure	One of the power supplies that operates in paralel stopped.
25	Generator Mode	UPS switched to generator mode. Switching to generator mode command was given by dry contact board.

6 Technical Specifications

Technical Specifications			
Power	80KVA	100KVA	120KVA
Active Power	64kW	80kW	96kW
Input			
Input Voltage Range	220 ± %15 (L-N) or 380 ± %15 (L-L) 3P + N + PE		
Input Power Factor	At Full Load > 0,99		
Input Frequency Range	50Hz ± 10% / 60Hz ± 10% (Adjustable)		
Rectifier	IGBT Rectifier		
Total Harmonic Distortion (THDi)	<%5		
Output			
Output Voltage Range	220/380 VAC (230/400 VAC adjustable) 3P + N ± 1% Static, ± 1% Dynamic		
Recovery	At 0% - 100% - 0% load, maximum output tolerance %5, %1 Back to band <40ms		
Efficiency	Up to %93		
Output Frequency Range	synchronous with the network at the range of 50Hz ±2% , mains when is out of range 50Hz ± 0,2%, battery mode 50Hz ± 0,2%		
Output THD (THDv)	Lineer <%3		
	Non-Lineer <%4		
Crest Factor (CF)	3:1		
Overload Capacity	At %125 load 10 min. , at %150 load 1 min.		
Protections	The input voltage is out of tolerance, input frequency is out of tolerance, input phase failure, output voltage is out of tolerance, output frequency is out of tolerance, output phase failure, DC component that can occur at the output voltage, Overload that will occur at the output (out of the periods specified), Overheating that will cause failure related to over temperature, high voltage which will occur at DC Bus voltage, low voltage which will occur at DC Bus voltage, short circuit at the output.		
Battery			
Quantity (12V DC VRLA)	50		
Charge Value (C)	Nominal 0.1 C, adjustable.		
Battery Power	25% of the device power		
Communnication			

Communication	RS232 Standart, RS485 and SNMP adapter option		
Dry Contact	Optional		
Protocol	Megatec, SEC, TELNET		
Certificates			
Quality	ISO 9001		
Standard	CE, TSE		
Safety	TS EN 62040-1-1, IEC60950		
EMC/LVD	TS EN 62040-2; A Class		
General			
Running Temperature	At the range of 0 °C ~40 °C (for batteries 0 ~ 25 °C)		
Storage Temperature	At the range of -15 °C ~ 45 °C (for batteries -10 ~ 60°C)		
Protection Class	IP20		
Chassis	Anti-Static Paint Protection		
Humidity	0-95 %		
Altitude	<1000m, Correction Factor 1. <2000m, Correction Factor >0,92, <3000m; Correction Factor >0,84		
Acoustic Noise (1m)	<70dBA		
Log Recording	500Event Log. (Optional Status Record)		
Parallel Operation	Parallel power increase up to 8 pcs.		
EPO (Emergency Power Off)	Standard		
Isolation Transformer	Optional		
Net Weight	300 kg	320 kg	350 kg
Dimensions (W x D x H)mm	880 x 770 x 1660 mm		

Contact Information

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