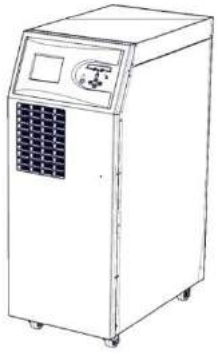
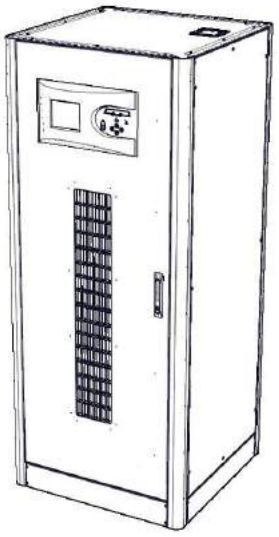
AEC IST5 SERIE SERVICE MANUAL

10-15-20-30-40-60-80-100-120-160-200-300 KVA



10-15-20-30-40 KVA



60-80-100-120-160-200-300 KVA

SERVICE MANUAL

10-15-20-30-40-60-80-100-120-160-200-300 KVA

About the Manual

This Manual is prepared for the users of IST5 Ups Series10-15-20-30-40-60-80-100-120-160-200-300 kVA.

Companion Manuals

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

Updates

Visit www.aecups.com for updates. Always use the latest manual.

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 AEC authorized personnel.

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-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 personnel. (This service will be provided for a fee by our authorized AEC personnel.)

Battery Voltage may rise up to 450V DC!

Battery terminal voltages can be at hazardous levels (450Vdc). Nobody except trained personnel should touch batteries.
Batteries must not be thrown into fire. The damaged batteries and batteries with completed life cycle must not be thrown to nature. For the collection and disposal batteries must delivered to AEC 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 10-20 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 for UPS's front side and 1,2 meter at the back side. 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 10-20 kVA UPS. Therefore, enough area must be left for operator. Also, UPS can be intervened in the back of it for service and maintenance. Because of this reason, enough area for personal must be left at the rear side of UPS.

1.3 Storage

UPS should be kept in a room or area where is protected from excessive moisture and heat before commissioning. UPS and battery cabinets must be kept in the original packaging.

WARNING:
Unused batteries must be charged at regular intervals. This time interval are 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 be equipped properly and have features and characteristics sufficient to carry UPS.
The UPS device shipment must be done on pallets.

The 10-20kVA UPS are delivered on the pallet sized 87x55x140 mm (WxDxH). The height of device together with pallet is approximately 200mm. The pallet measurements are given below.

Cabinet is equipped with four-wheel. In this way, it can be placed by moving easily. These wheels are to be used on smooth surfaces only.

The front wheels of UPS must be locked after positioning properly. The rear side wheels are fixed.

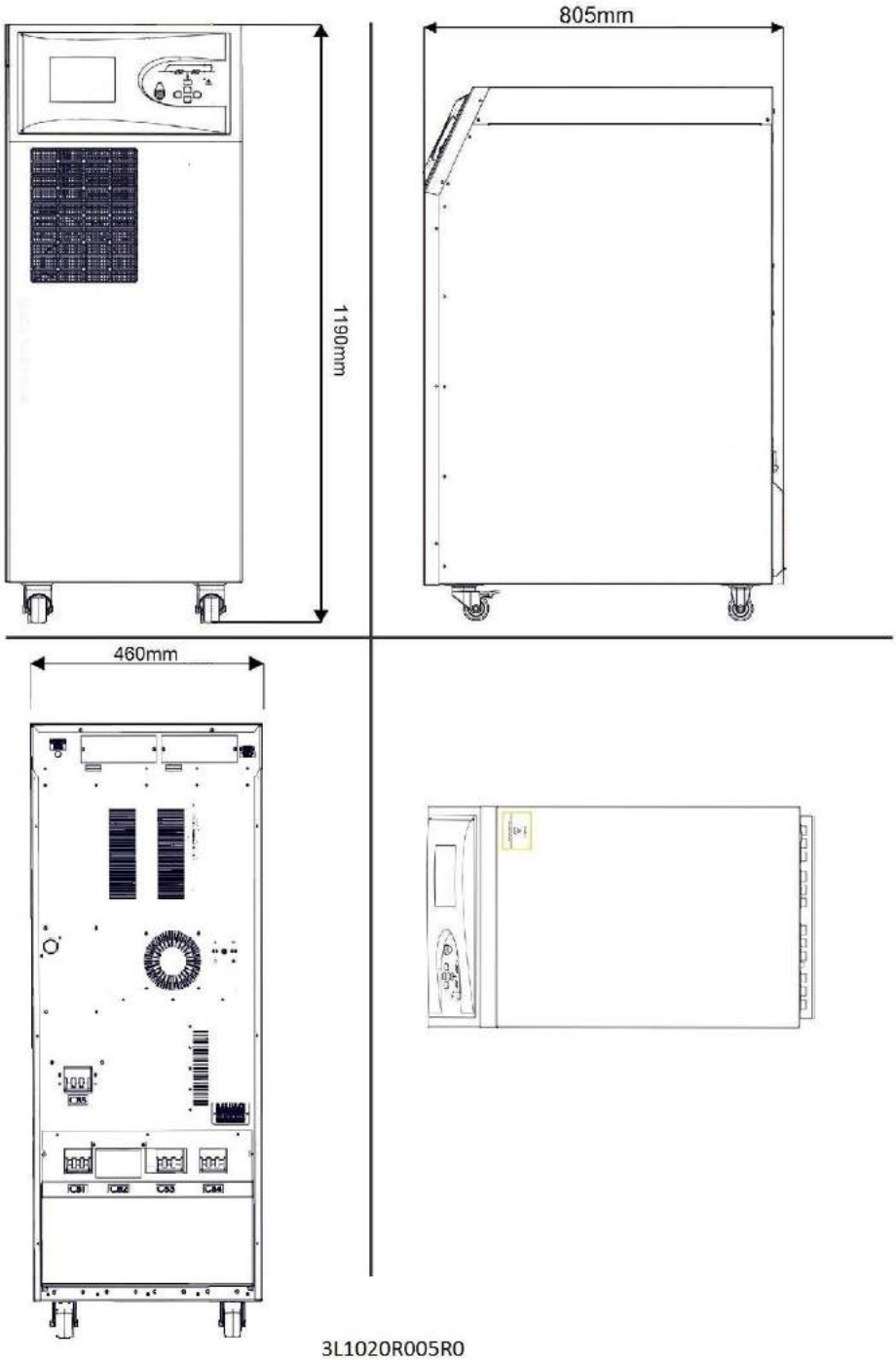
Be more careful of sudden movements, especially when batteries are inside of cabinet.

Move the UPS as rarely as possible

2 PRODUCT DESCRIPTION

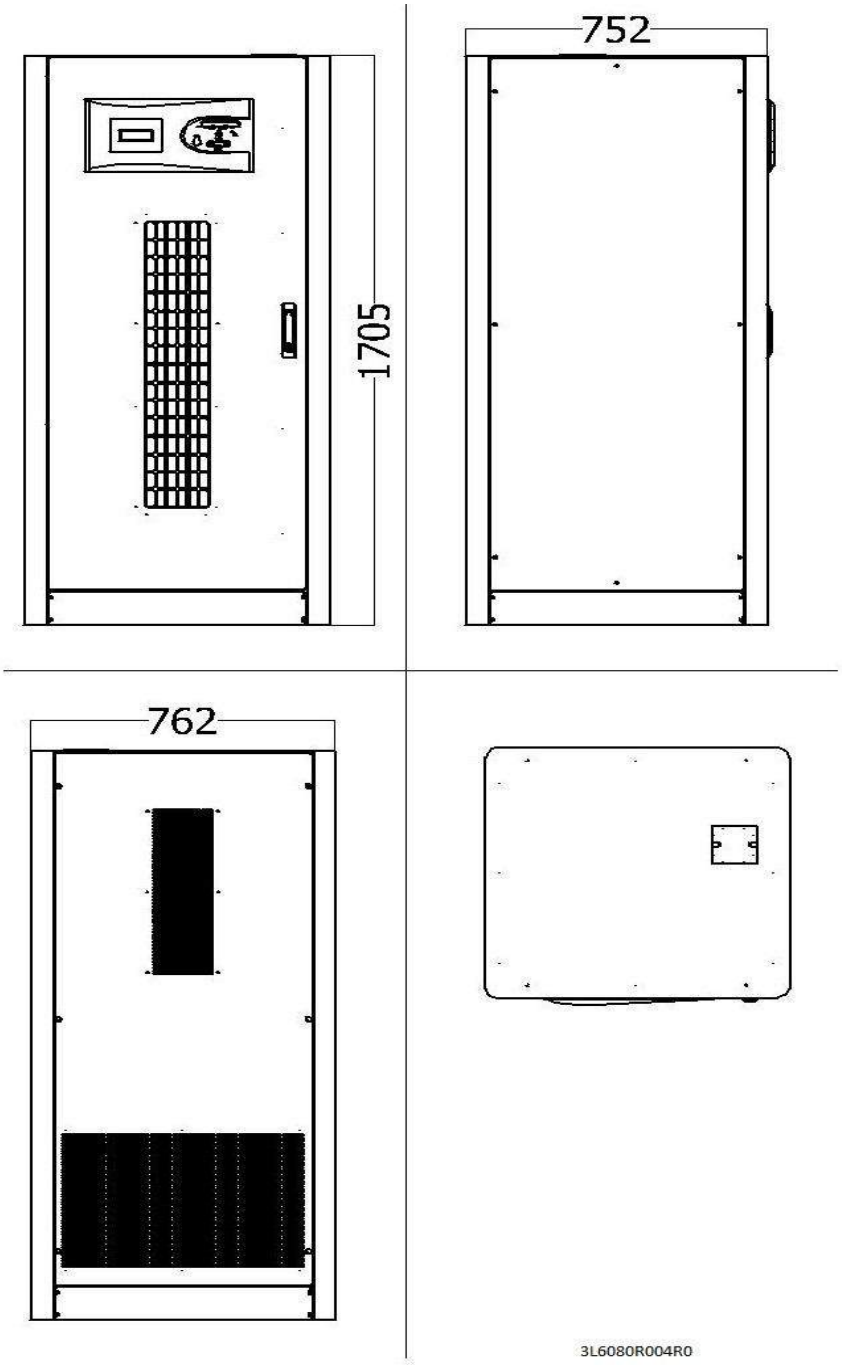
2.1 General View

- **10-15-20-30-40KVA**

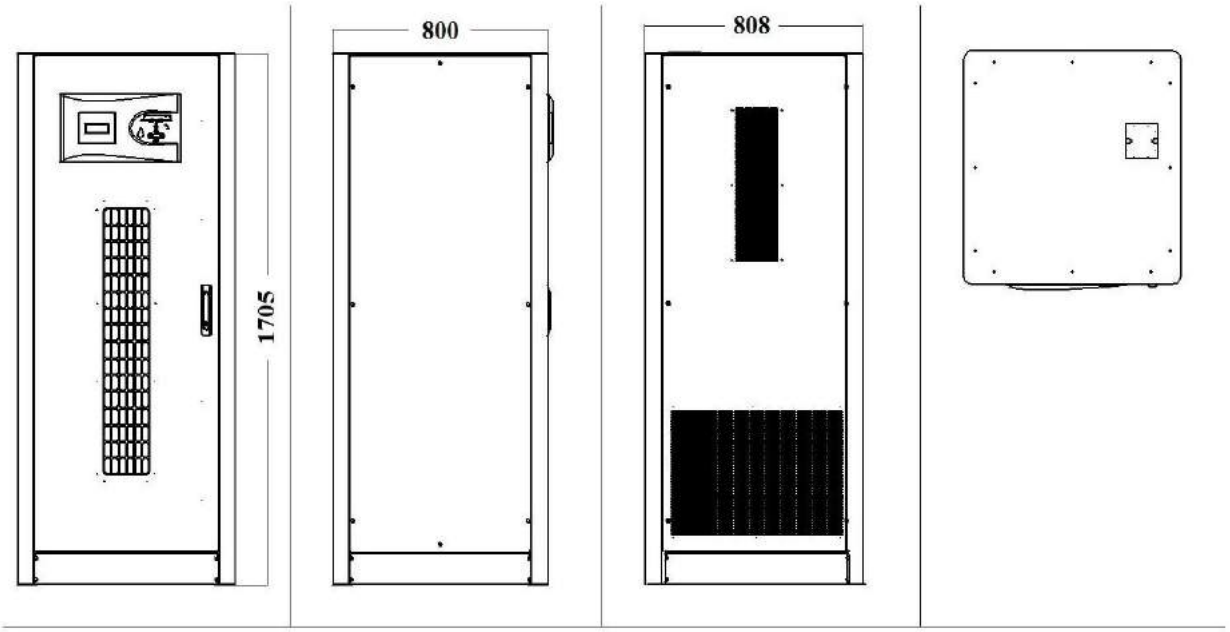


3L1020R005R0

- **60-80KVA**



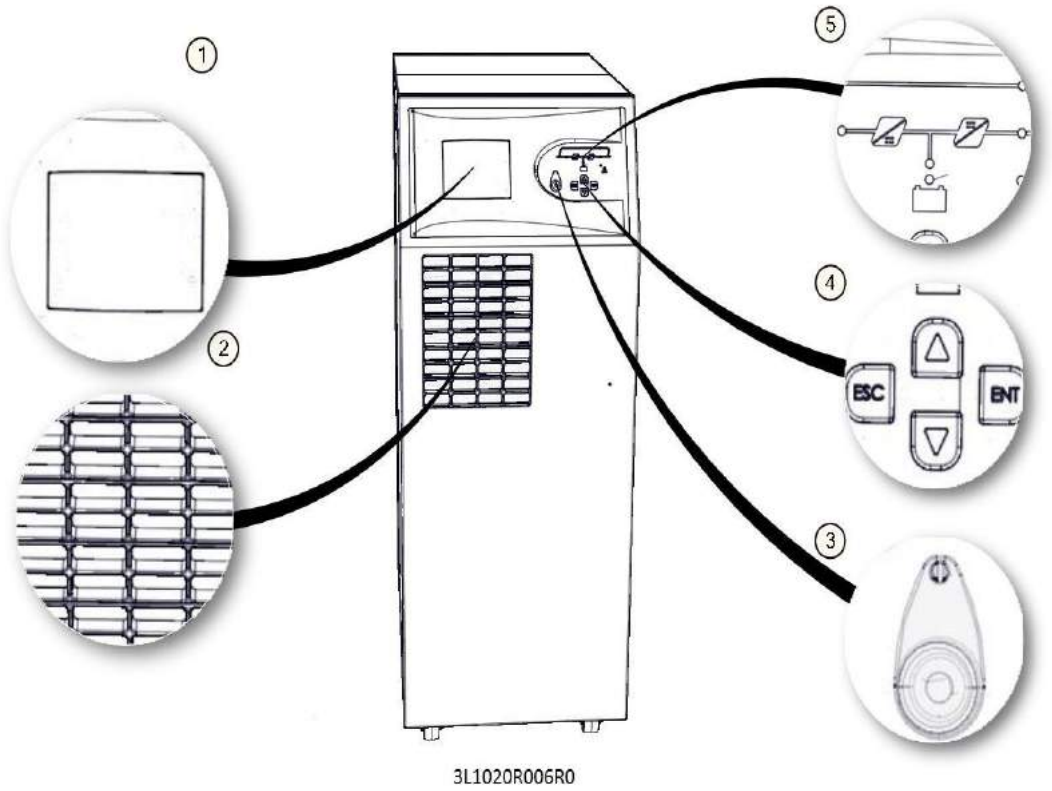
- **100-120-160-200-300 KVA**



3L100120R004R0

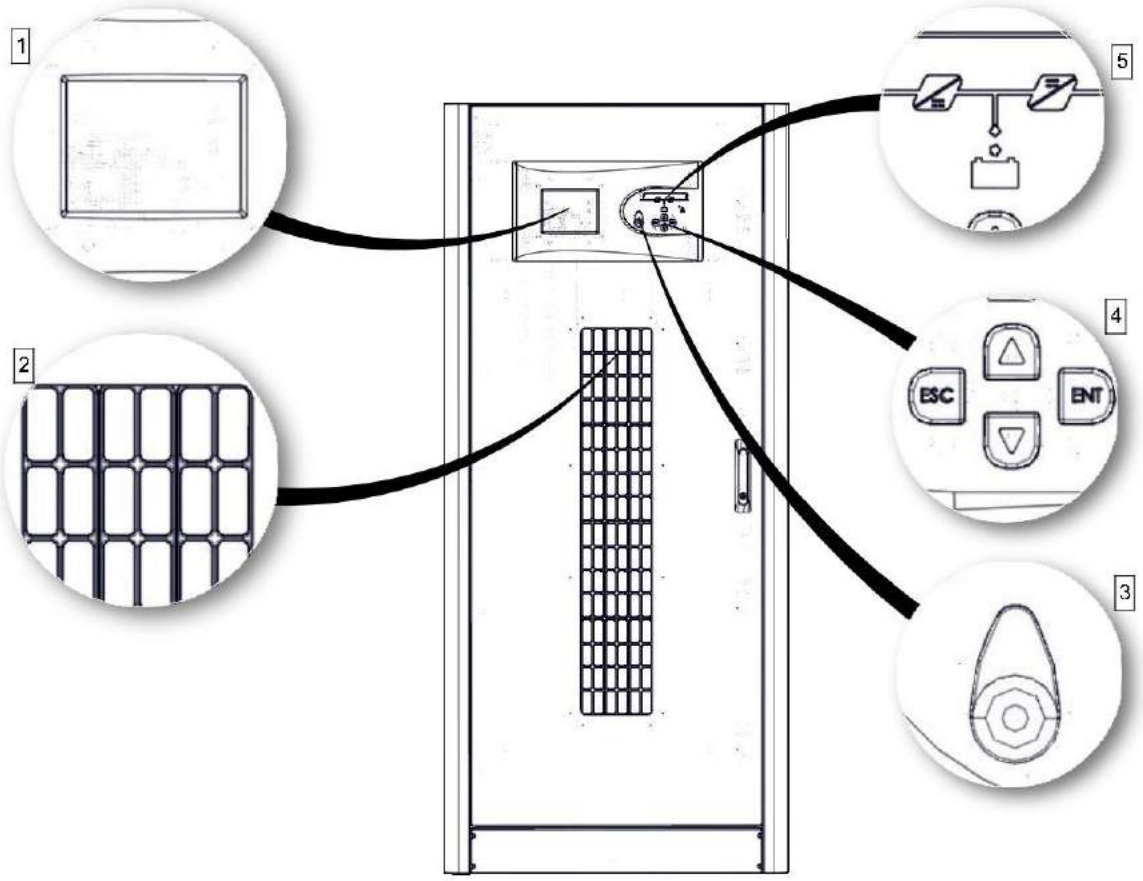
2.2 Front View

- **10-15-20-30-40KVA**



1	320*240 LCD DISPLAY
2	FRESH AIR GRIDS
3	EPO BUTTON
4	MENU KEYS
5	MIMIC DIAGRAM

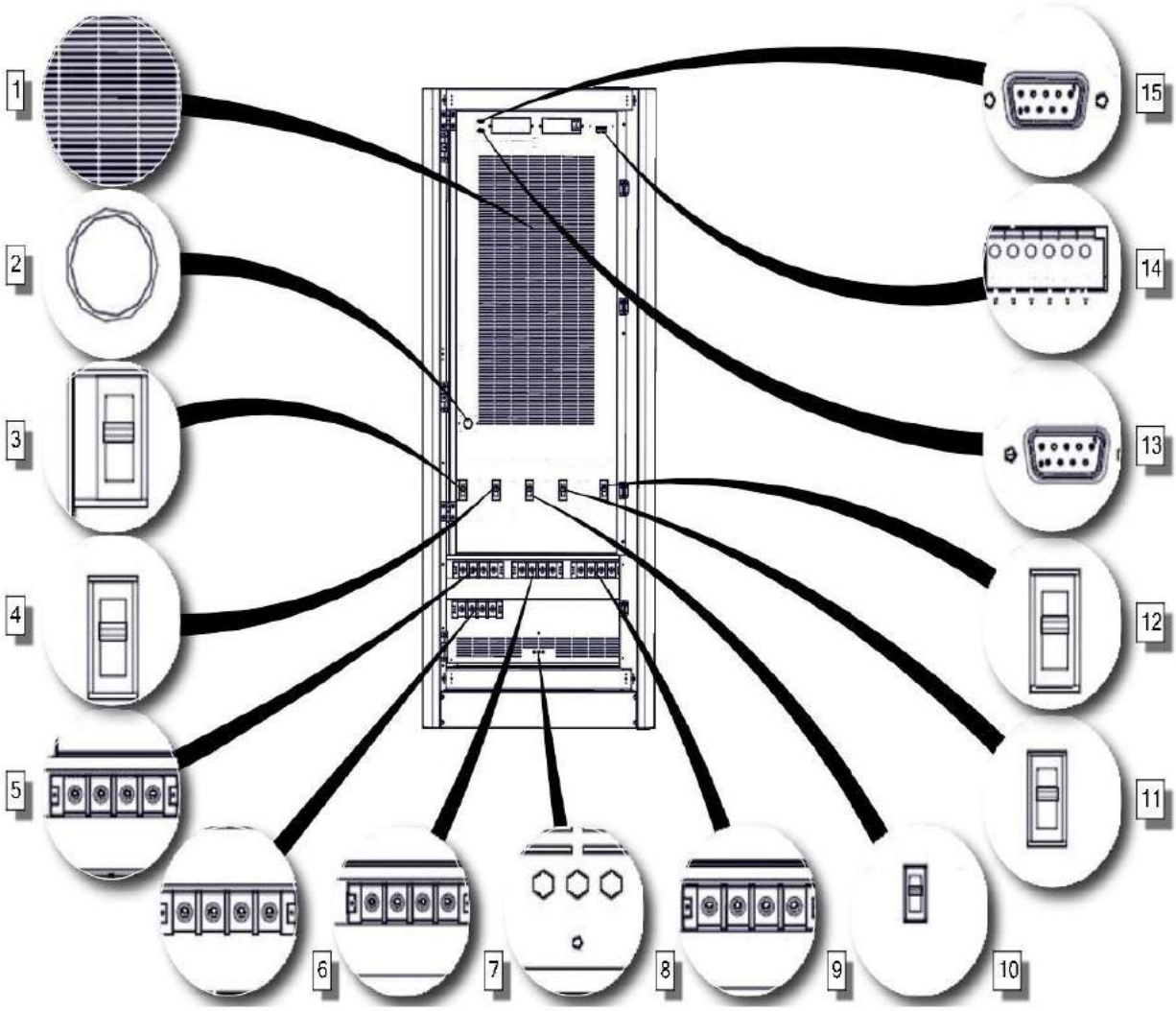
- **60-80-100-120-160-200KVA**



1	320*240 LCD DISPLAY
2	FRESH AIR GRIDS
3	EPO BUTTON
4	MENU KEYS
5	MIMIC DIAGRAM

2.3 Front Panel View

- **60-80-100-120-160-200-300 KVA**



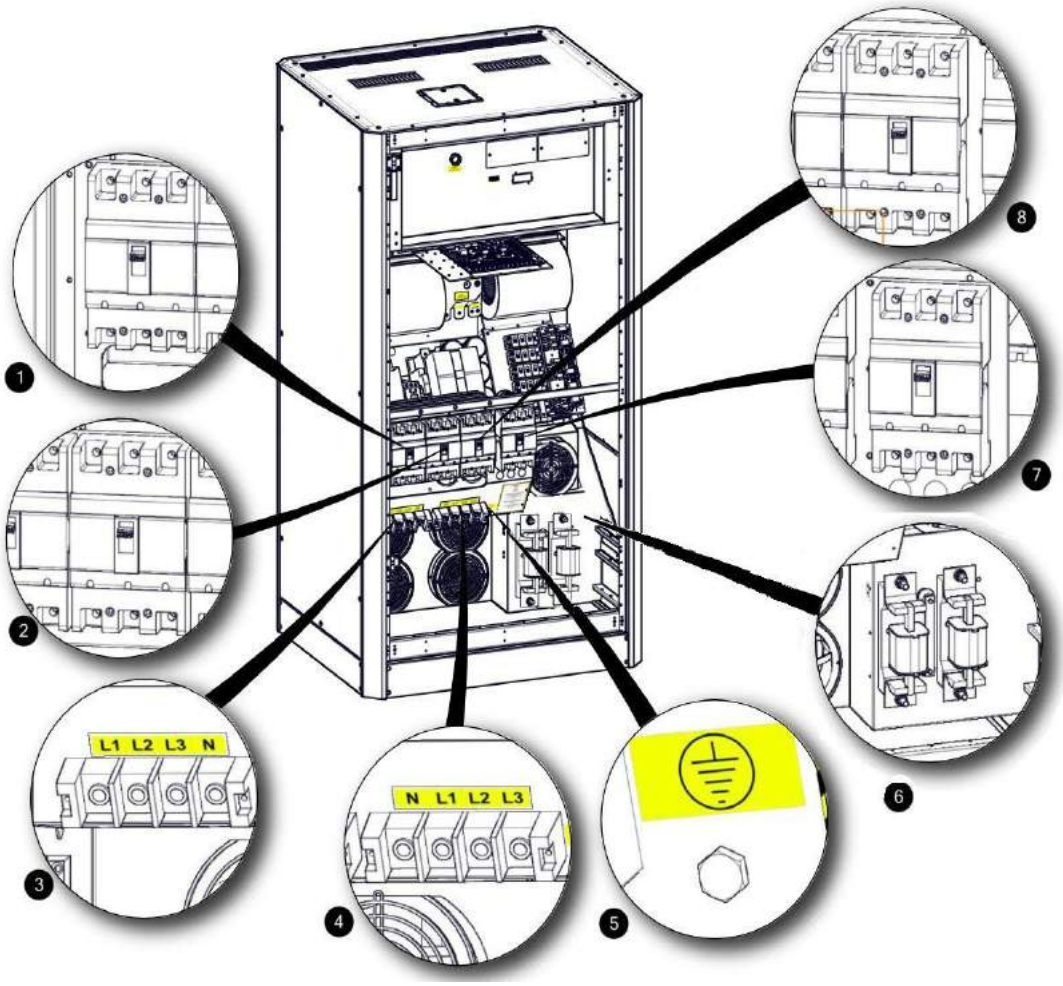
3L100120R006R0

1	RECTIFIER/CHARGE-INVERTER COOLING FANS
2	DC BAS RAMPING UP BUTTON
3	MAINS SWITCH
4	MAINTENANCE BYPASS SWITCH
5	BYPASS TERMINALS
6	MAIN CONNECTION TERMINALS
7	OUTPUT CONNECTORS TERMINALS
8	GROUND CONNECTION
9	BATTERY FAST FUSES AND CONNECTION TERMINALS
10	EXTERNAL BYPASS SWITCH
11	OUTPUT BREAKER

12	BARTTERY START-UP SWITCHES
13	RS232 TERMINAL FOR COMMUNICATION SOFTWARE
14	CONNECTION TERMINALS FOR EXTERNAL BATTERY TEMPERATURE READING
15	RS232 TERMINAL FOR COMMUNICATION SOFTWARE

2.4 Front Interior View

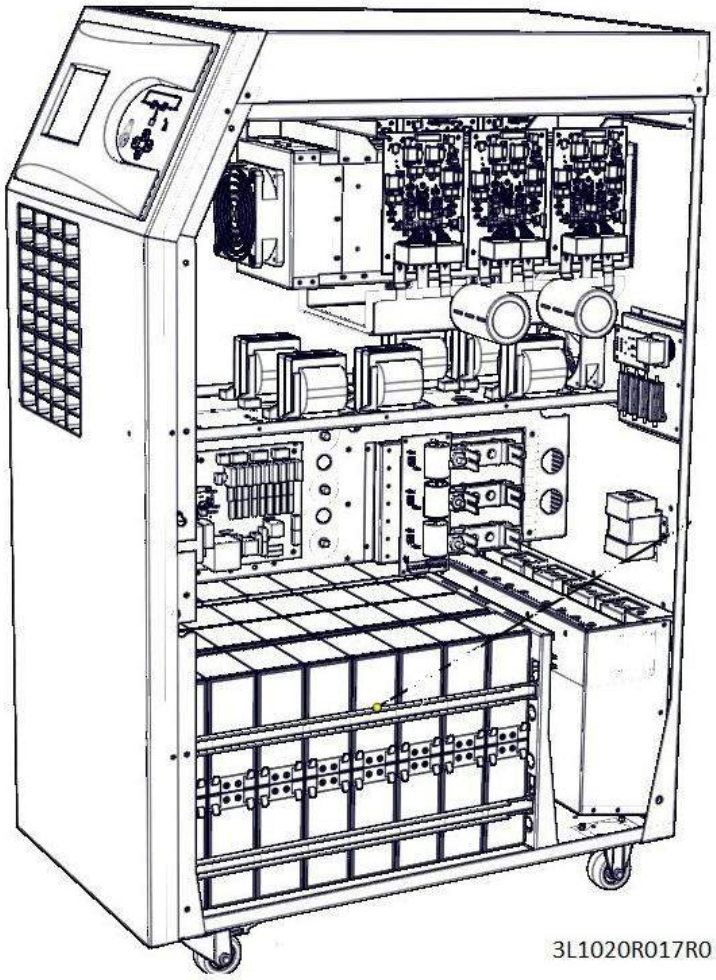
- **60-80-100-120-160-200-300 KVA**



1	MAINS SWITCH
2	MAINTENANCE BYPASS SWITCH
3	MAIN CONNECTION TERMINALS
4	OUTPUT CONNECTORS TERMINALS
5	GROUND CONNECTION
6	OUTPUT FUSES
7	BATTERY FAST FUSES AND CONNECTION TERMINALS
8	BATTERY START-UP SWITCH

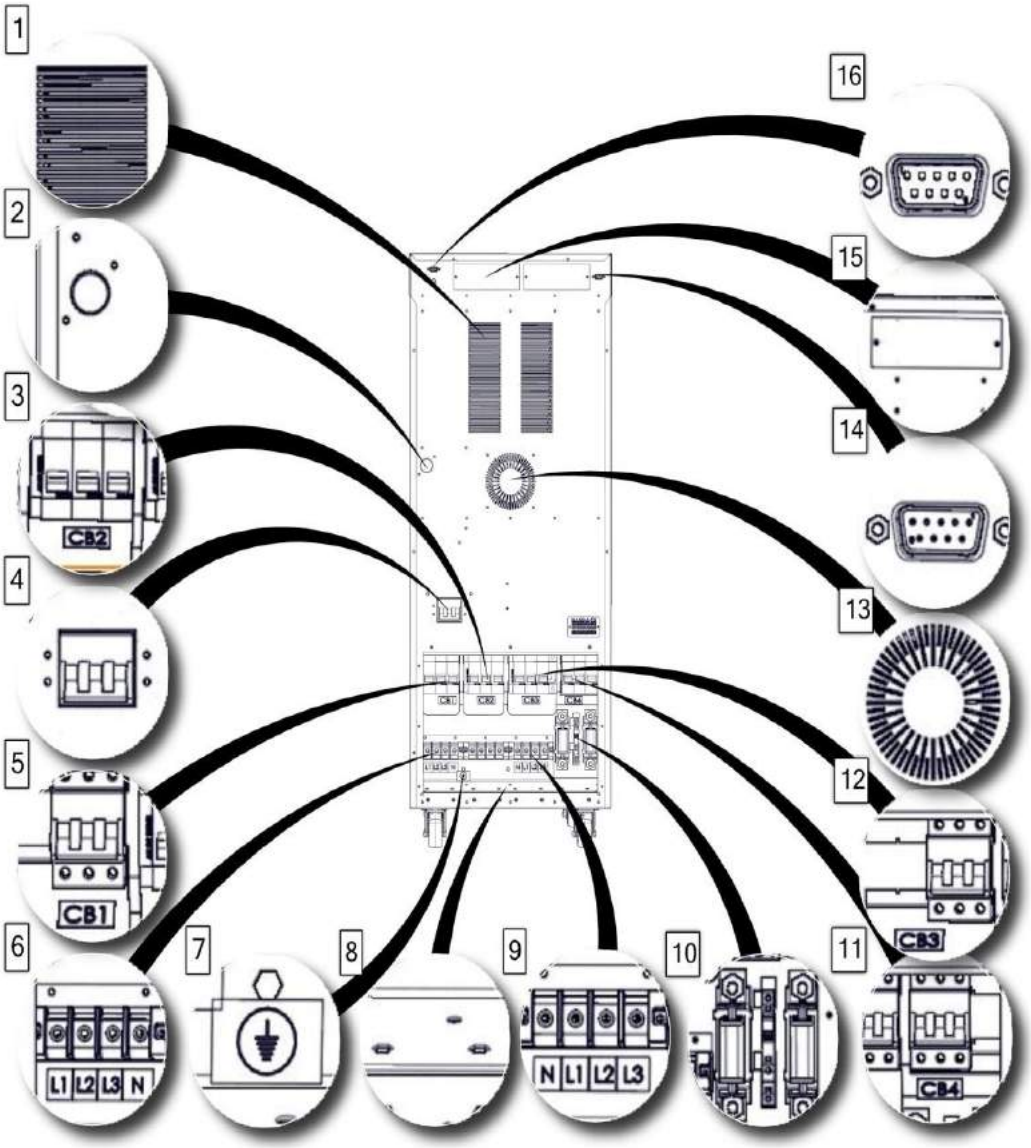
2.5 Side Interior View

- **10-15-20-30-40KVA**



2.6 Rear View

- **10-15-20-30-40KVA**

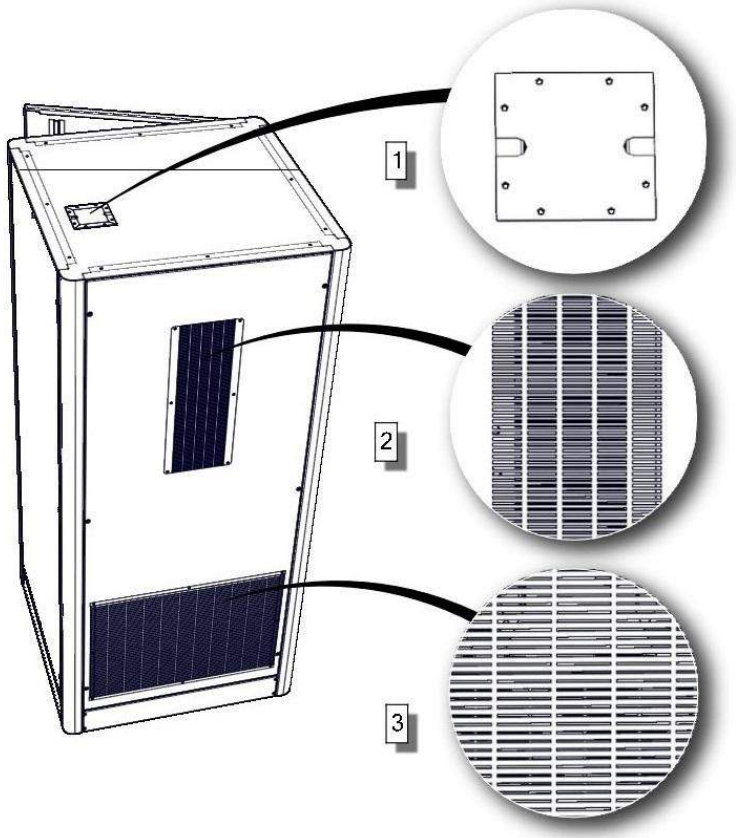


3L3040TRR005R0

1	HOT AIR EVACUATION CHANNEL
2	DC BAS RAMPING UP BUTTON
3	EXTERNAL BYPASS SWITCH
4	MAINTENANCE BYPASS SWITCH
5	MAINS SWITCH
6	MAINS CONNECTION TERMINALS
7	GROUND CONNECTION
8	ETERNAL BYPASS TERMINALS
9	OUTPUT CONNECTORS TERMINALS
10	BATTERY FAST FUSES AND CONNCECTION TERMINALS

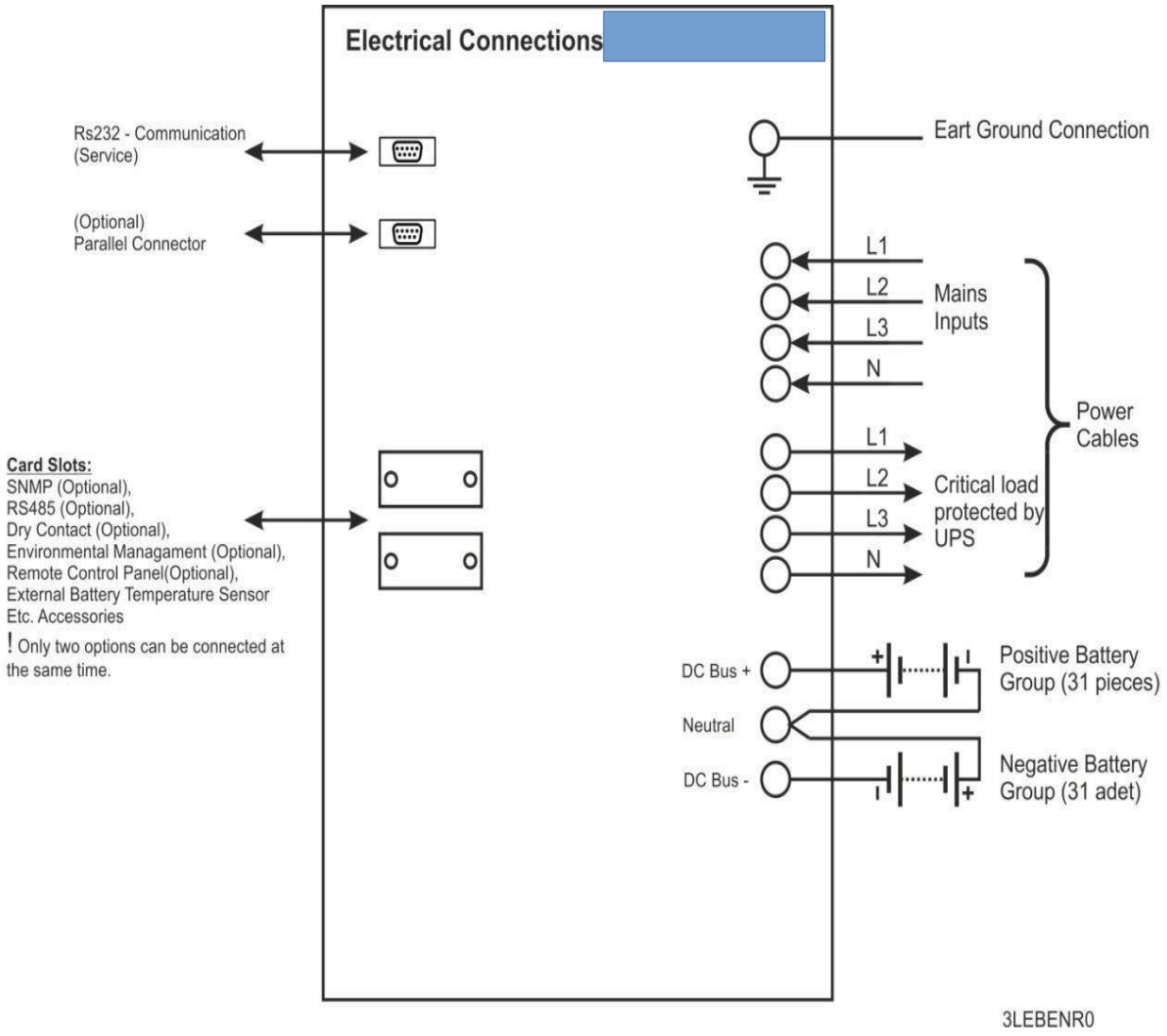
11	BATTERY START-UP SWITCHES
12	OUTPUT BREAKER
13	THYRISTOR HOT AIR DISCHARGE CHANNEL
14	RS232 TERMINAL FOR COMMUNICATION SOFTWARE
15	OPTIONAL CARD SLOTS
16	OPTIONAL PARALLEL PORT TERMINAL

- **80-100-120-160-200-300 KVA**



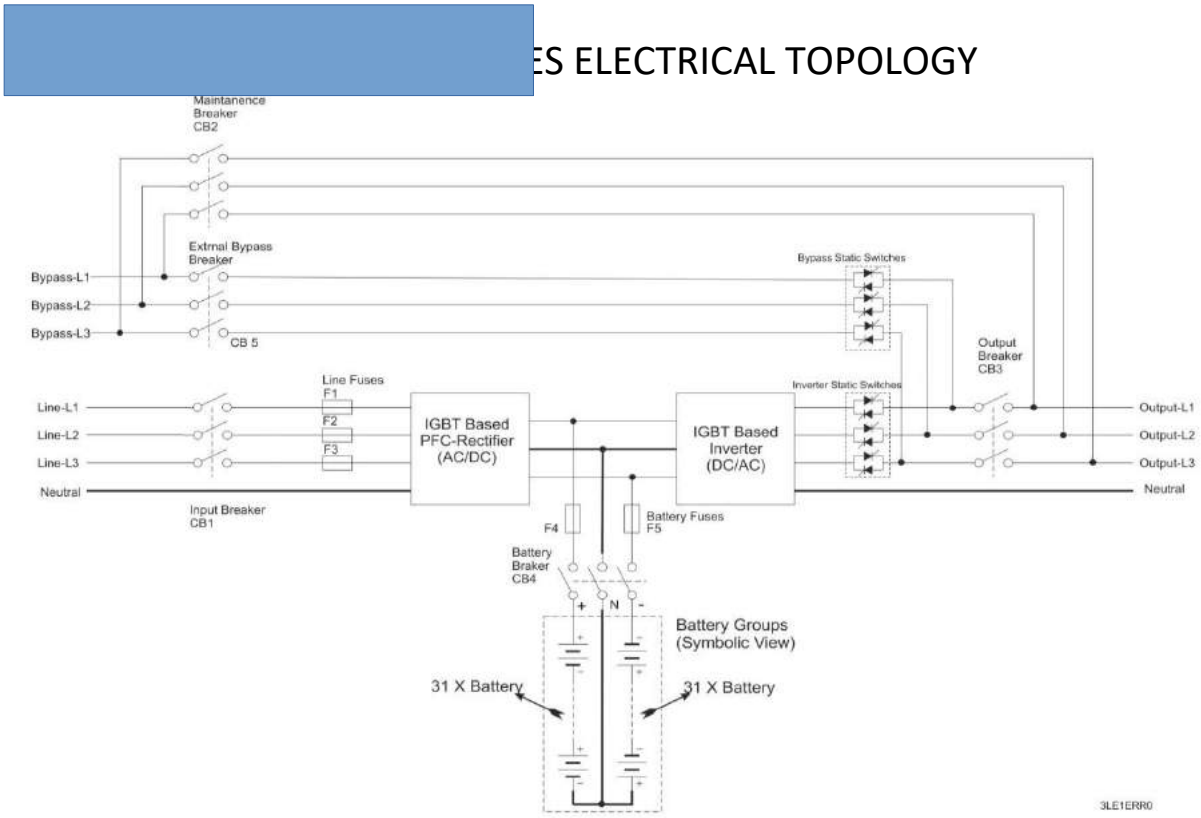
3L100120R007R0

1	PARALLEL PORT TERMINAL
2	RECTIFIER, CHARGER, INVERTER HOT AIR EVACUATION CHANNEL
3	WIRING HOT AIR EVACUATION CHANNEL


Electrical Connections
Rs232 - Communication
(Service)
(Optional)
Parallel Connector
Eart Ground Connection
L1
L2
L3
N
Mains
Inputs
Power
Cables
L1
L2
L3
N
Critical load
protected by
UPS
Card Slots:
SNMP (Optional),
RS485 (Optional),
Dry Contact (Optional),
Environmental Managament (Optional),
Remote Control Panel(Optional),
External Battery Temperature Sensor
Etc. Accessories
! Only two options can be connected at
the same time.
DC Bus +
Neutral
DC Bus -
Positive Battery
Group (31 pieces)
Negative Battery
Group (31 adet)
3LEBENR0

2.8 General Information

General operation topology of AEC IST5 Series UPS can be recognizing 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. Rectifier converts the AC mains to DC voltage and charges the batteries. When the mains voltage is not available, the necessary the DC bus voltage is generated with use of the battery voltage. 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 to loads through the static semi-conductor switches and output (load) breakers.

When maintenance or repair is needed, before the Input (CB1) and Output switches (CB3) are put to the open circuit (OFF) position, the device must be switched to static bypass mode (please see 4.1.3.2). Consequently the maintenance switch (CB2) is put to the position closed circuit (ON). After that first Output breaker (CB3), then Input switches (CB1) are turned OFF respectively.

2.8.1 Static Transfer Switch

Some blocks are named as “static switches” as can be seen above. These blocks consist of inverse parallel connected thyristors. Controlled by the main board control unit (DSP) these switches provide feeding of 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 are no problems with the system.

System provides the loads to be fed smooth and seamless by mains or inverter. In order to manage this process at minimum risk, UPS synchronizes the inverter output and static (mains) bypass as phase and frequency. Therefore, Inverter frequency can be considered same with mains as long as it is within frequency limit.

User can switch between mains and inverter by using front panel. When the inverter is ready, while the loads are fed through the bypass line, in case of either power failure or if mains values are out of tolerances, the loads automatically will be fed through the inverter.

2.8.2 Battery Temperature Regulation

In the external battery cabinets the battery temperature is measured and detected by ‘’temperature sensor’’. UPS adjusts battery charge parameters according to the detected temperature.

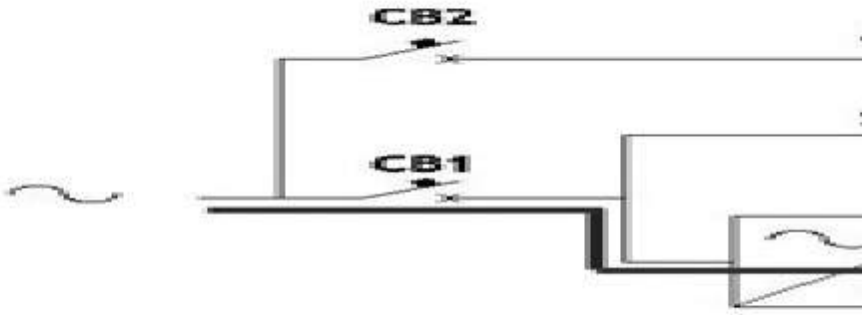
2.9 UPS’s Operation Modes

IST5 series is on-line double conversion device. Our products operate in the following modes:

- Online Mode
- Battery Mode
- Bypass Mode
- Auto Restart
- Maintenance Mode

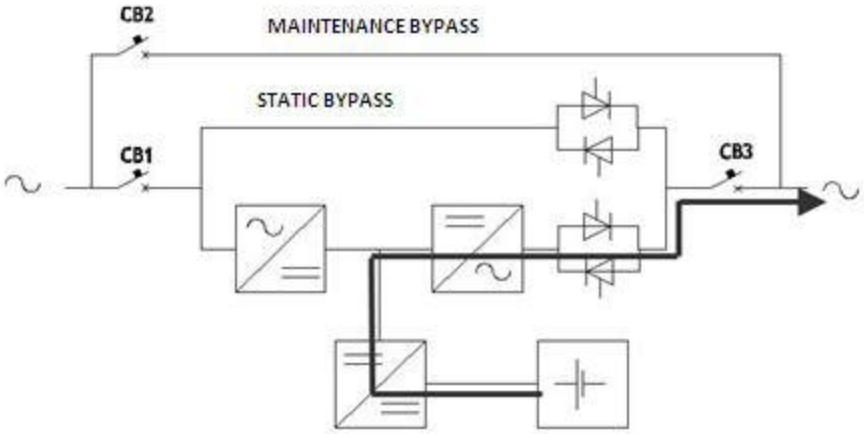
2.9.1 Normal (Online) Mode

In this mode, UPS feeds the load through the inverters. Rectifier unit is fed by the AC mains power. Inverter and battery charge units are fed by DC supply generated by rectifier unit.



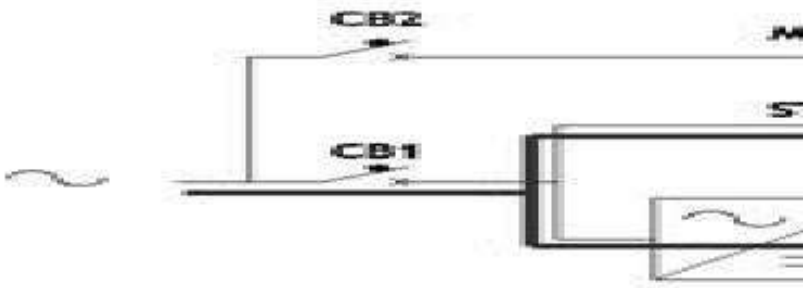
2.9.2 Battery (Stored) Mode

When the mains voltage is bad the UPS runs on battery mode. UPS feeds the critical load through the inverter; the energy is obtained from batteries.



2.9.3 Bypass Mode

In case when UPS is overloaded or if inverter cannot generate a quality AC output due to any problem and if bypass voltage and frequency values are within the limits, the load will be fed from the static bypass source (mains). UPS without interruption switches from inverter to AC source (mains) via static transfer switching. If inverter output and mains are not synchronized, switching may take up to 15ms varying according to load type.

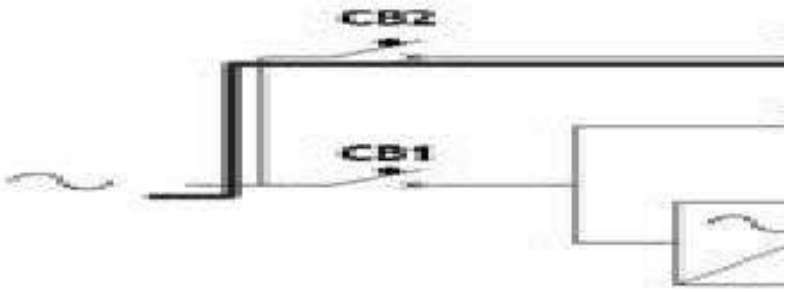


2.9.4 Automatic Restart Mode

In case of any failure of the mains, UPS will continue feeding the critical loads until the batteries reaches the end of discharge voltage level. UPS, will go on working until the batteries are drained and then will shutdown. After the mains conditions gets back to normal, UPS automatically stats to operate, in the period determined by the user. In this case, UPS continues to operates in normal (online) mode as long as the mains values are in desired criterions. For IST5 Series UPS, this feature is not activated in the initial factory set-up.

2.9.5 Maintenance Mode

On the maintenance mode loads are switched to the maintenance bypass line with a breaker, so that the UPS can be serviced without cutting off the power to loads. The breaker is in full conformity with capacity of loads.



2.10 Battery Management

Lead- acid batteries are used with UPSs.

2.10.1 Normal Operation Mode

Constant Charge Current

Constant current at 1/10 rate of the battery capacity is applied to battery, until reaches the float voltage.

Float Charge

Depending on the battery discharge current the 1/3 of the battery energy is charged at this level. With this level of charging batteries are kept ready for use at maximum 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, we recommend using the temperature sensor.

Deep Discharge Protection

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

Low Battery Warning

While the system operates on battery (stored) mode, according to actual loads, if the battery capacity drops below 40% of its value, device will give audible and visible alarms. This value is adjustable and can be set by user between 20%-70%.

2.10.2 Advanced Functions (Battery test) Auto Battery Test

The auto battery test discharges 10% of the battery energy in a user defined period. Default is 90 days. Test reports the battery condition as good, weak or replace. Results of the latest test can be seen on the battery screen from the status menu.

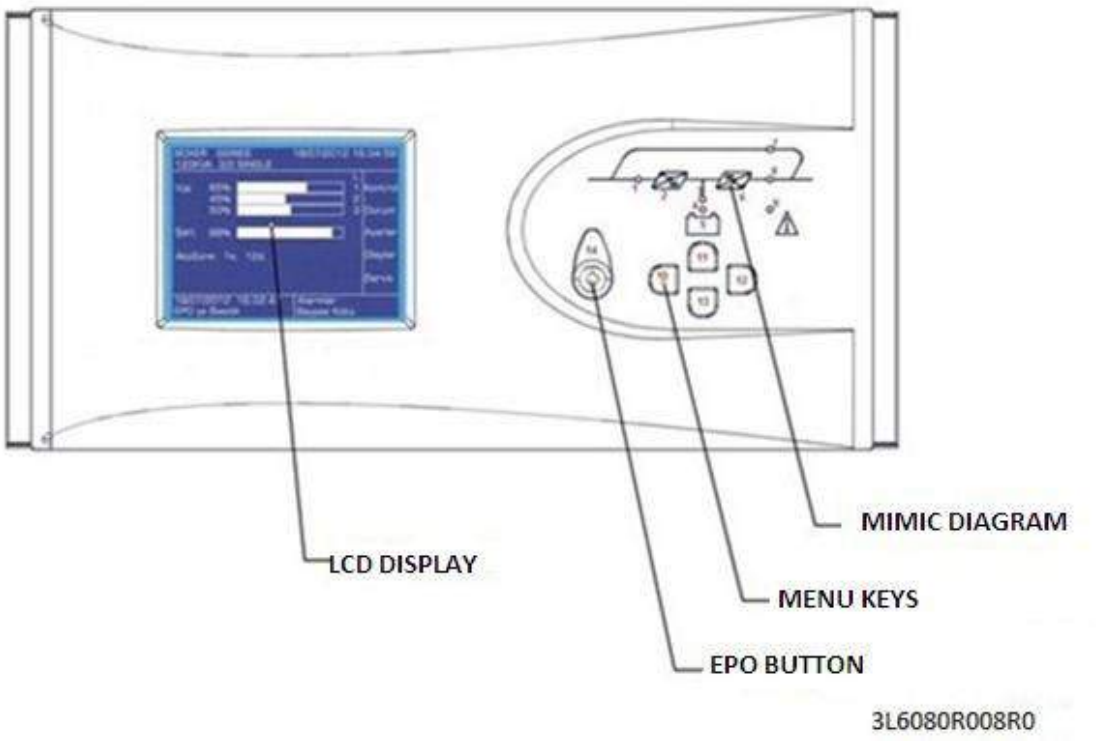
WARNING: If the test result is "replace", then batteries are completely drained during the test. This may cause the interruption in the power supply to the critical loads in case of the mains failure.

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

The purpose of the battery test is to check if the batteries can supply the minimum back-up time needed in case of mains failure. We recommend checking the test results on the regular basis.

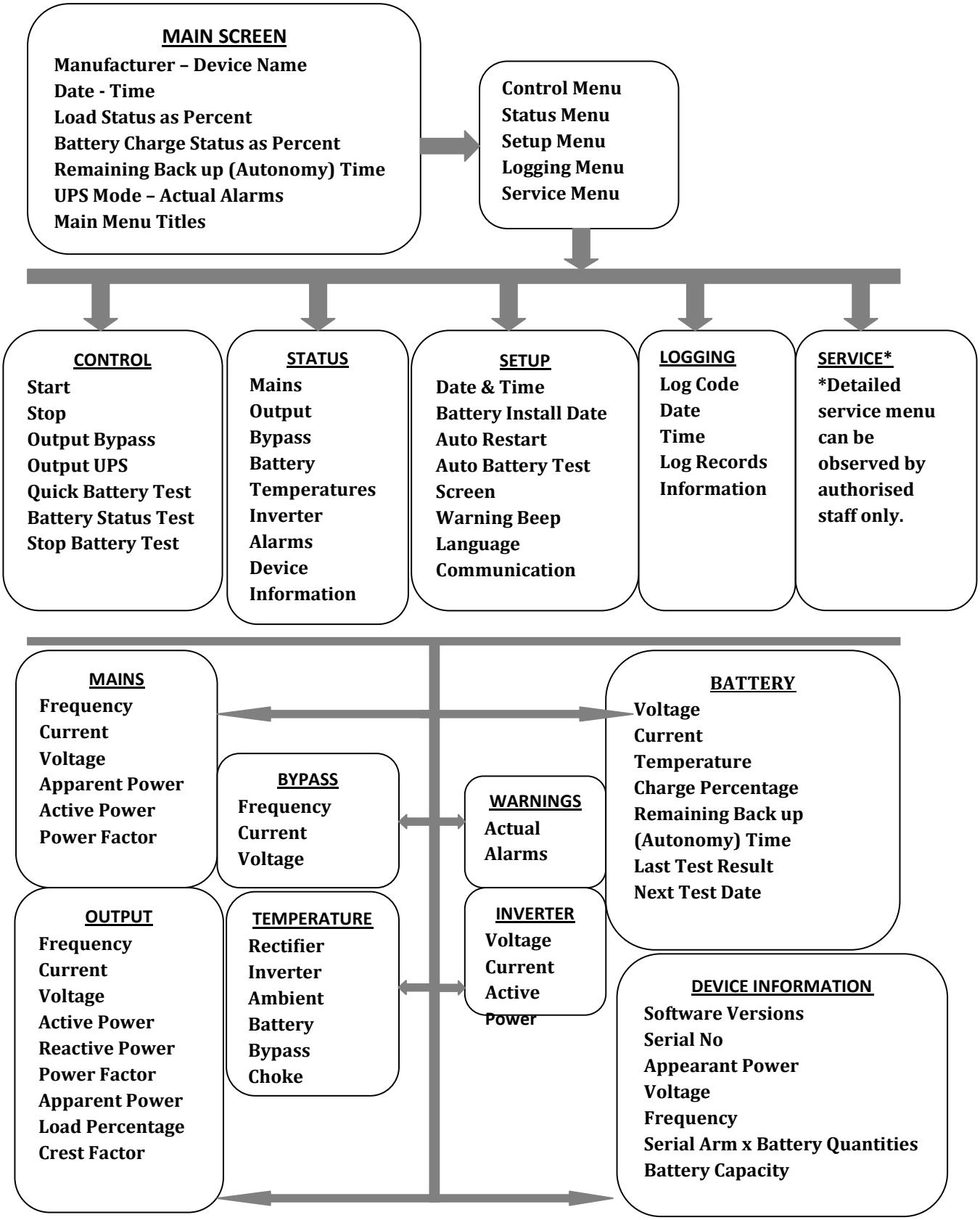
2.11 User Panel

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



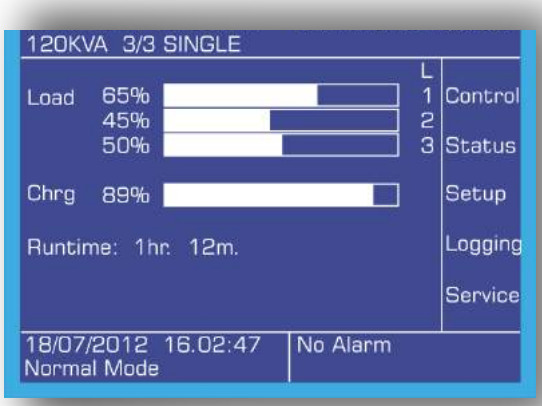
1	Rectifier indicator LED Flashes while the DC bus is ramping up. Illuminates when Rectifier works
2	AC/DC module (Rectifier)
3	Battery discharge LED Illuminates on battery mode. Flashes when UPS is started up through batteries.
4	Battery charge indicator LED Illuminates while the batteries are charging.
5	Battery module
6	DC/AC module (Inverter)
7	Static Bypass Switch 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



2.11.1 Opening 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. In case of an alarming condition, alarms are shown on the left-down row. If no button is pressed for 5 minutes, system returns to the opening screen.

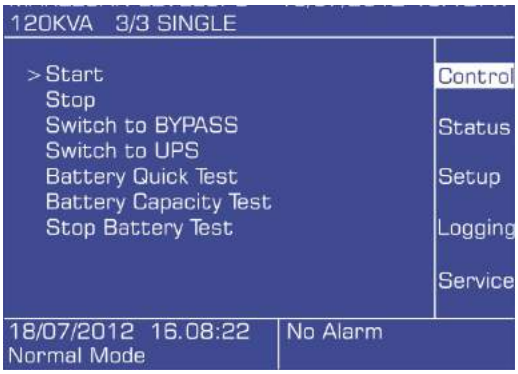


2.11.2 Main Menu Screen

To switch from opening screen to the Main menu, press Enter.

2.11.3Navigation through the menu

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 below.
Some sub-menus may have more than one page. Keep pressing up or down key to get to the next screen.



Some menus have changeable options like ON/OFF, duration or quantity. To make changes in the menu press ENTER to choose the variable, up and down keys to change the value, and press ENTER to set the new value. Press ESC to cancel.

2.11.4 Password-protected menus

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

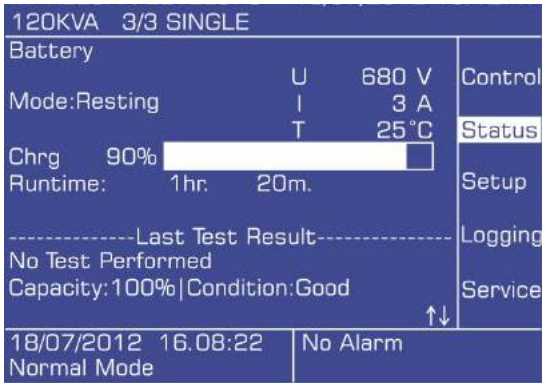
2.11.5 Control Menu

Within 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 10% of battery energy and reports batteries which has more capacity than 10% as **"Good"**, less capacity than 10% as **"Replace"** according to the test results.

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



Note: Batteries must be fully charged and kept floating for at least 1 hour before applying the quick battery tests.

Batteries must be fully charged and kept in floating mode for at least 5 hours before performing the battery tests.

Battery tests are performed by directing the power to the mains, independently from the loads. If the mains values change during the test and are out of limits, the test will be canceled.

Status > Battery >menu timers shows the remaining time to the next test.

If "**Stop Battery Test**" command is chosen, UPS cancels the battery test and returns the previous operating mode.

2.11.6 Status Menu

On this menu you can see information about the mains, output, bypass line, battery, temperature, inverter and alarms.

Mains

UP, I, F, UL	Voltage, current and frequency of each phase (phase-neutral)
S, P, PF	Active power, apparent power and power factor of each phase

Output

UP, I , F ,UL	Voltage, current and frequency of each phase (phase-neutral)
S, P, PF	Active power, apparent power and power factor of each phase
L, CF	Load percent of each phase and crest factor

Bypass

UP, I, F	Voltage, current and frequency of each phase (phase-neutral)

Battery

Mode	UPS operation mode
U, I, °C	Charging voltage, current and temperature.
Charge	Charge percentage.
Autonomy Time	Remaining back-up (autonomy) time
Last Test Result	Capacity and status according to the last test results
Next Test Date	Next test date, time and remaining time for test

Temperature

°C,°C,°C,°C,°C	Rectifier, inverter, charger, ambient, battery and thyristors temperatures

Inverter

U, I, P	Voltage (phase-neutral), current and apparent power of each phase

Alarms

Alarms	Actual UPS alarms

Device Information

____ -____-___-___	Inverter, rectifier, CPLD, front panel software version
----------	UPS serial no
KVA, V/Hz	Apparent power, instantaneous output voltage (phase-neutral), instantaneous output frequency
_x__ , Ah	Parallel battery arm number x Serial battery arm number Battery capacity adjusted in UPS

2.11.7 Setup Menu

Setup menu consists of the following:

Date & Time

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

Battery install date

Use this menu to set the battery install date,
only when new batteries are installed.

Auto restart

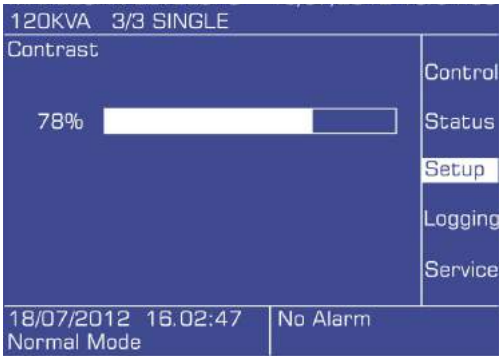
In battery mode, the device turns off at the end of battery discharge. Auto-restart can be used to restart the UPS automatically when the mains are restored.
Turn on auto-restart and set the time to define when the device will be started after the normal values of the mains are restored.

Battery self test

This function can be turned on to start the user independent battery tests.
Set the time interval for the next test.
Note: Battery self test is the equivalent of battery quick test.

Screen

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



Beeper

Turn the beeper sound on/off.

Language
Set the menu language.

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

2.11.8 Logging Menu

Last 500 events of the device can be seen in the logging menu. When viewing a log, press enter to see detailed info about the UPS. All recorded data for that particular event (status, setup etc.) can be seen on the menu. Use up and down keys to see older/newer event logs.

2.11.8 Service Menu

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

3 INSTALLATION

3.1 Single Module Installation

This section contains the warnings and control actions that must be performed before the UPS start-up. Additionally, you will find here important information about the UPS cabins transportation, positioning and connections.

3.1.1 Warnings

The UPS must be installed by a certified electrician of AEC.
The warranty is valid only for the UPS installed by a certified electrician of AEC.

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.

Batteries with leakage must never be used and must be replaced. Defected batteries must be uninstalled and transported to the destruction points with safety precautions taken.

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 three phase and four cable (+ground) supply system for input. This supply system type is confirmed as IEC60364-3 standards. Optionally UPS have transformers which have ability to convert from 3 cables to 4 cable system. If IT AC power distribution system will be installed, 4 pole-circuit breaker systems must be used. More detailed explanations can be found in the IEC60364-3 standards titles.

3.1.2 Pre-installation check up

Before installation of the device the following control actions must be taken, these first and most important steps will secure the accurate operation of the product.

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

3.1.3 Positioning

The device and the batteries are designed for the indoor use. Keep the device in a cool and dry place, with the air flow, humidity and temperature values must be within the specified range.

3.1.3.1 Positioning the UPS

In the IST5 Series, fresh air enters the device from the front and goes out from the fans on the rear side of the device. Care must be taken in order not to cover the air entrance and exit spots. UPS must be positioned on a place where it is protected from water etc. contact risks.

If the area is dusty, optional filters must be used for such environment. These filters usage must be done as per instructions document.

Below given cooling values must be provided to reach the maximum level of performance of UPS and batteries

UPS	AMOUNT OF BTU/h FOR COOLİNG	BRİDGE LOAD %100 (NON-LİNEER) ESTİMATED BTU/h VALUE FOR LOAD WORKİNG
10KVA	1800	2100
15KVA	2600	3100
20KVA	3500	4100
30KVA	5200	6200
40KVA	6900	8200
60KVA	10300	12300
80KVA	13700	16400
100KVA	17100	20500
120KVA	20500	24600

3.1.3.2 External Battery Configuration

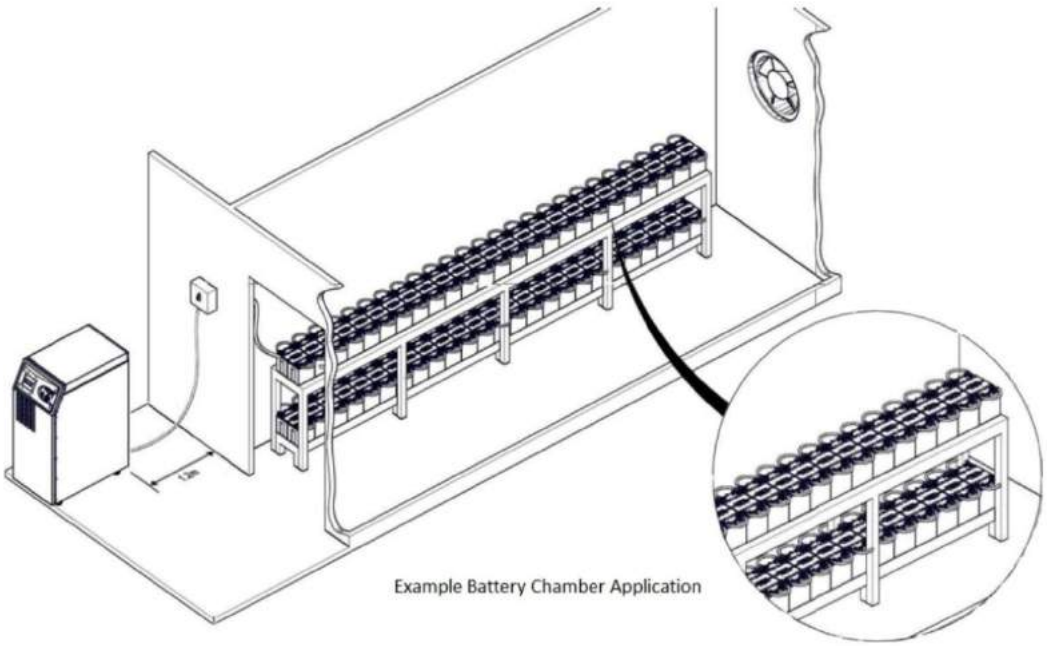
Batteries should be used in the environment with uniform temperature conditions. Temperature is a major factor in determining the battery life and capacity. The operating temperature for batteries recommended by battery manufacturers is 20-25 °C. Operating above this range will reduce the battery life while operation below this range will reduce the battery capacity, as a result the expected backup time might not be obtained while autonomy. Please keep batteries away from heat sources and main air inlets. Pay attention and observe the following points.

- 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 battery 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

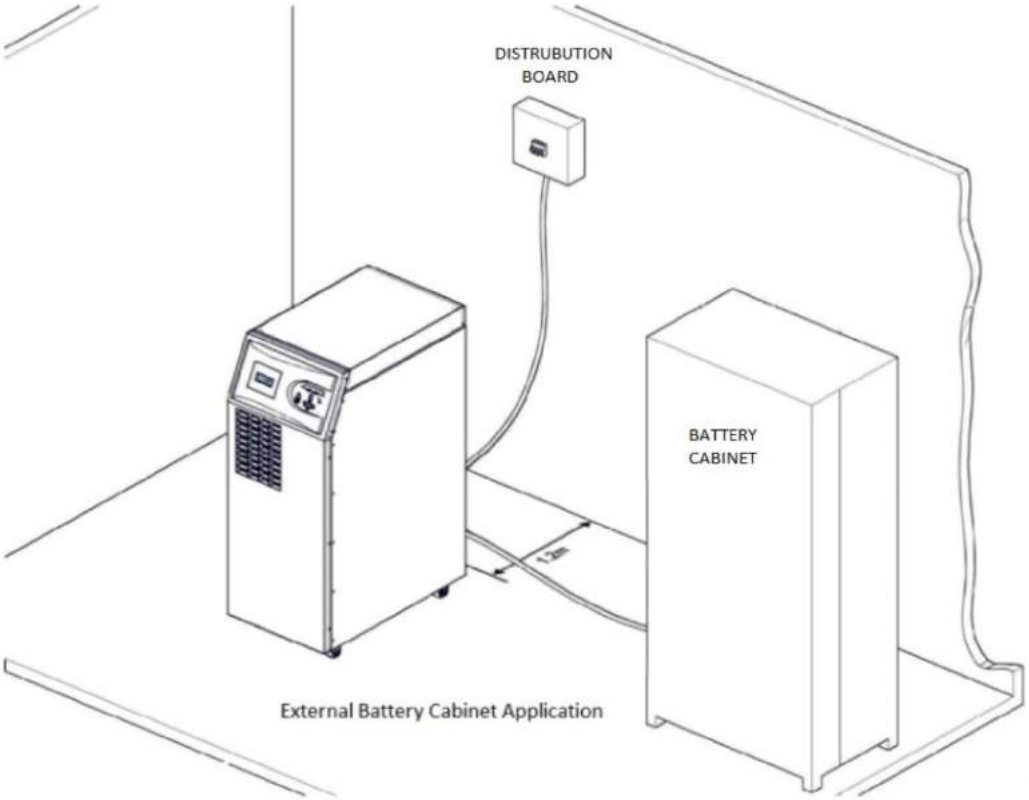
Especially, for the external cabinet batteries system of UPS, fuses must definitely be used. These fuses must be mounted as close as possible to the batteries. This closeness will increase the electrical operation safety.

THE TABLE OF IST5 SERIES EXTERNAL BATERY USAGE									
DEVİCE RATING(KVA)	10KVA	15KVA	20KVA	30KVA	40KVA	60KVA	80KVA	100KVA	120KVA
BATTERİES IS SERIES	31	31	31	31	31	31	31	31	31
NUMBER OF PARALLEL ARMS	2	2	2	2	2	2	2	2	2
TOTAL NUMBER OF BATTERİES	62	62	62	62	62	62	62	62	62
$I_{bat.max}$ @ $V_{bat.max}$ (A)	1,8	2,7	3,6	5,3	7,1	10,6	14,2	17,7	21,2
$I_{bat.max}$ @ V_{cutoff} (A)	16,3	24,6	32,7	49,2	65,4	98,1	130,8	163,5	196,1
RECOMMENDED INTERNAL FUSE(A)	20	32	40	80	100	100	160	250	300

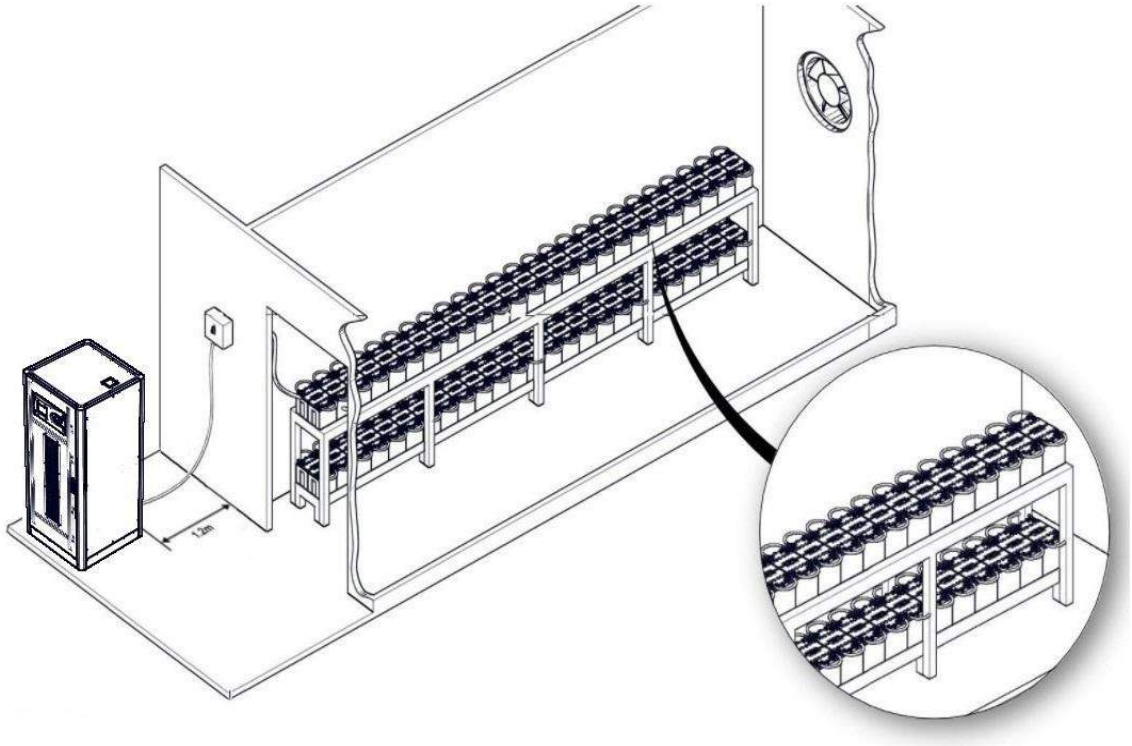
External battery cabinet and battery room applications are given below as an example. The application form may vary according to the customer.



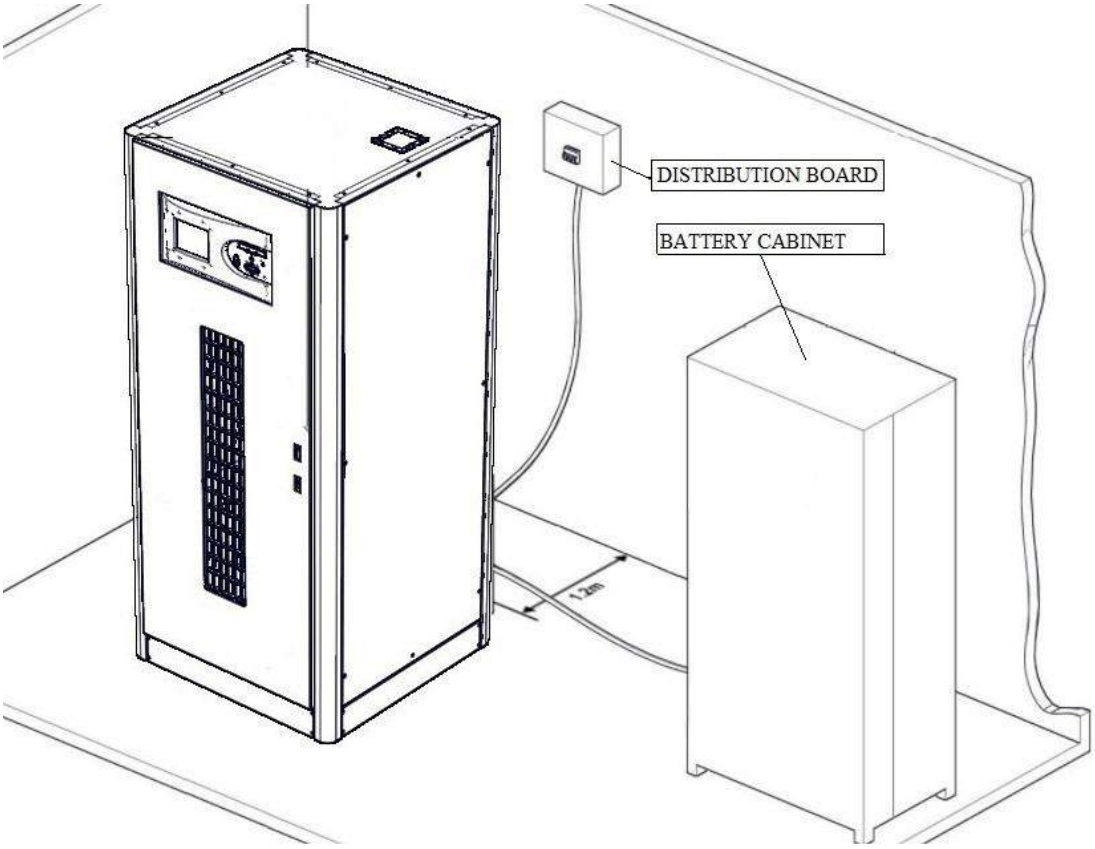
Example Battery Chamber Application



External Battery Cabinet Application



3L100120R009R0



3L6080EN010R0

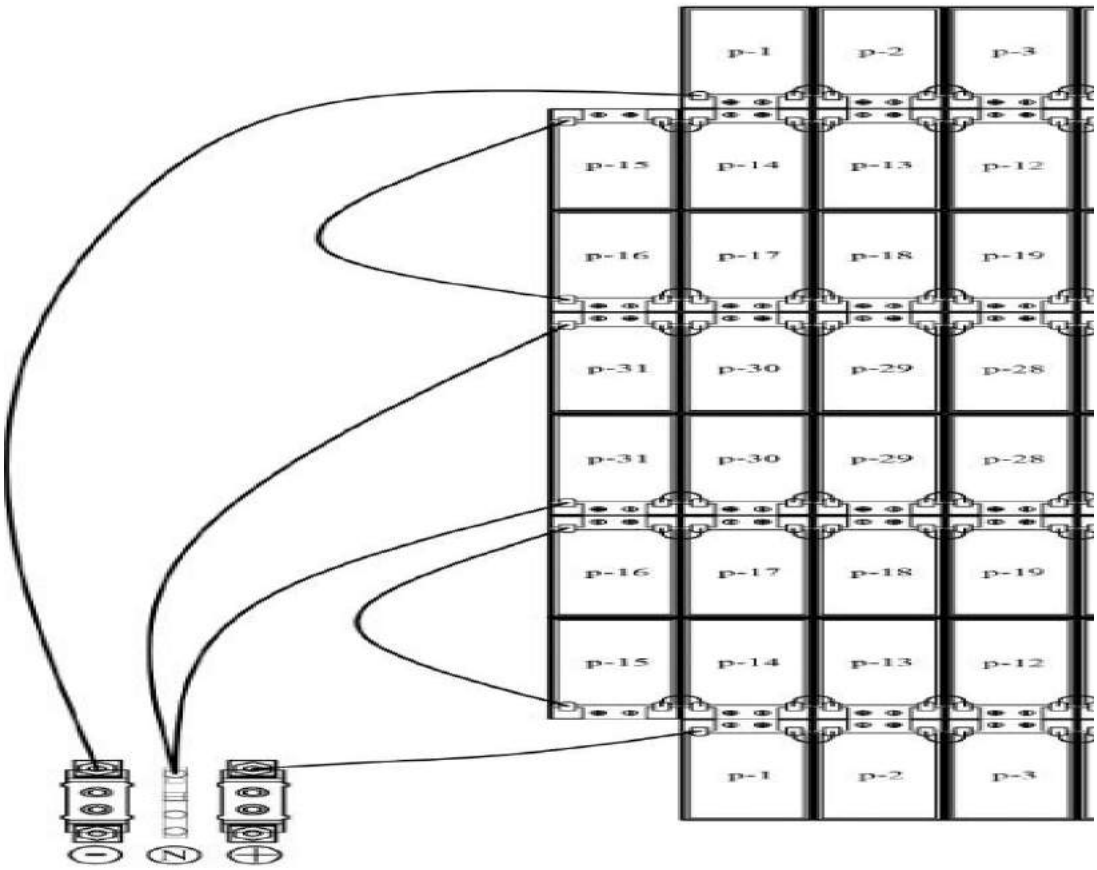
3.1.3.3 Internal Battery Configuration

The internal battery configuration is valid for the 10-15-20-30-40 kVA UPS only, it can be configured by 62 paces 4,5 Ah, 7 Ah or 9Ah standard as following.

IST5 SERIS INTERNAL BATTERY USAGE TABLE					
UPS POWER (KVA)	10KVA	15KVA	20KVA	30KVA	40KVA
BATTERIES IN SERIES	31	31	31	31	31
NUMBER OF PARALLEL ARMS	2	2	2	2	2
TOTAL NUMBER OF BATTERIES	62	62	62	62	62
I_bat_max @ V_bat_cut off. (A)	16,3	24,6	32,7	49,1	49,1
RECOMMENDED INTERNAL FUSE (A)	20	32	40	80	80
RECOMMENDED REAR PANEL FUSE (A)	20	32	40	80	80

*** Table shows recommended battery configurations.**
***** Fast and semi-conductor protection type fuses are used for batteries.

The 7/9 Ah and 4.5 Ah batteries positioning can be seen at the following table;



3.1.4 Transportation Type of Cabinets

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

UPS and optional battery cabinets are designed to be carried by a forklift or such vehicles.

Be more careful or sudden movements, especially when batteries are inside of cabinet. Move the UPS as rarely as possible.

3.1.5 Mains, Load and Battery Connections

AEC strictly recommends a distribution board for the UPS output. Proper fuses and breakers must be used in such distribution board. Additionally variable speedy fuses may be needed according to load. A-B type fuses or magnetic breakers are recommended if the load is suitable.

3.1.6 External Protections

To protect the AC inputs, thermal magnetic breakers or V type breakers must be installed on the distribution board. Herein, the cable intersections and fuse values must be determined and connected by an expert authorized person.

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. AEC recommends the use of 700mA rated relays for handling leakage currents.

Those relays must also be:

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

3.1.7 Cable and Fuse Configuration

Cable designs must be compatible to current and voltage values stated herein, additionally local instructions must be obeyed about these topics

UPS RATİNG (KVA)	RATED CURRENTS (A)					
	INPUT CURRENTS@MAX CHARGE CURRENT (3P+N)			OUTPUT CURRENTS @100% LOAD (3P+N)		
	380V	400V	415V	380V	400V	415V
10	22	20,9	20,2	19,7	18,8	18
15	33	31,4	30,2	29,6	28,2	27,1
20	44	41,8	40,2	30,3	28,2	27,8
30	66	62,7	60,5	45,6	43,4	41,9
40	89	84,6	81,6	78,9	75	72,4
60	133	126,4	121,7	118,4	112,5	108,5
80	177	168,2	162,1	157,8	149,9	144,5
100	222	210,9	203,3	197,3	187,4	180,7
120	266	252,7	243,6	236,7	224,9	216,7

It should be noted that with non-linear loads, neutral current may rise up to 1.5 times the phase current.
Ground cable must be connected directly to ground line and must be kept as short as possible.
Typical ground cable cross sections are (for IST5 PF: 1):

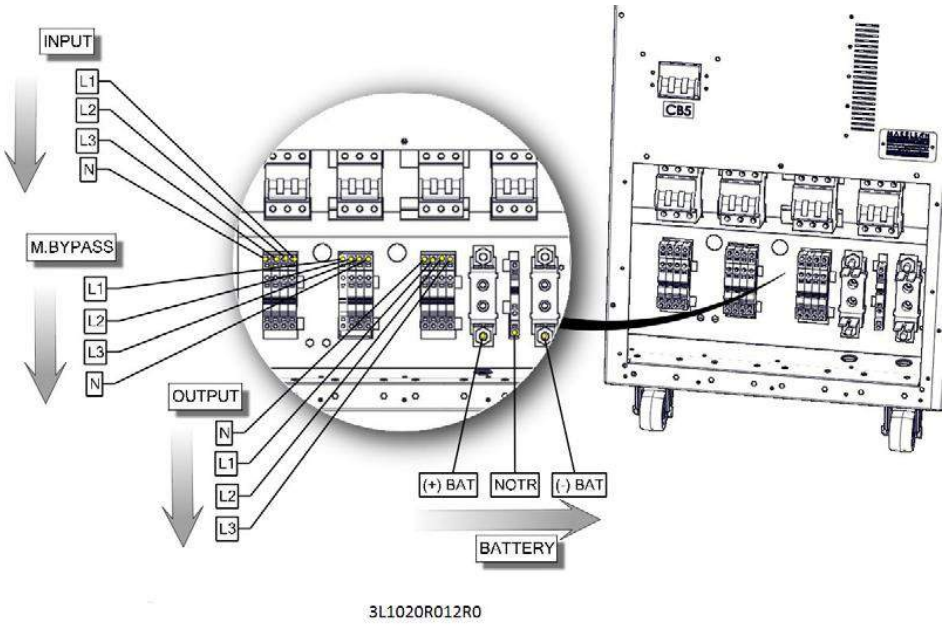
- 4 mm2 for 10KVA
- 6 mm2 for 15KVA
- 10 mm2 for 20KVA
- 16 mm2 for 30KVA
- 25mm2 for 40KVA
- 35 mm2 for 60KVA
- 50 mm2 for 80KVA
- 70 mm2 for 100KVA
- 95 mm2 for 120KVA ratings.

The length of the cable must not be over 5 meters.

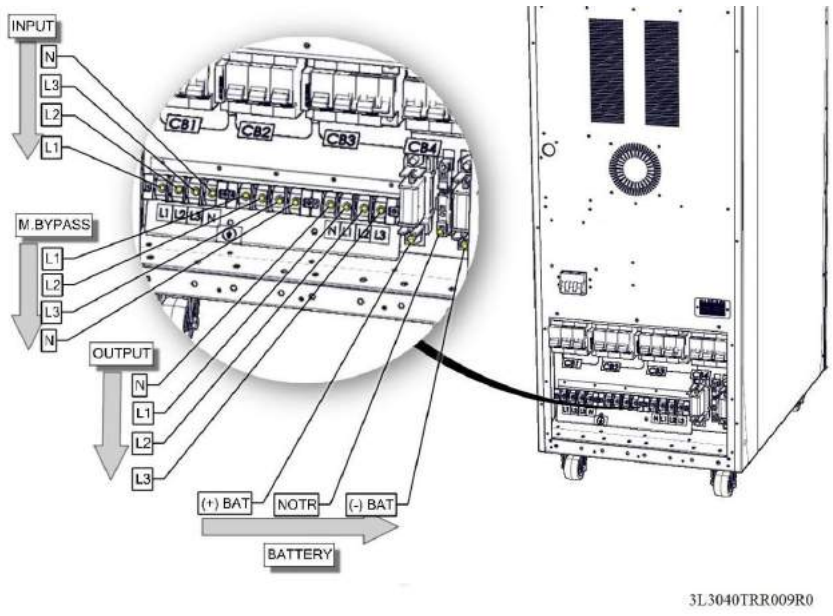
3.1.5.3 Cable connections

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

3.1.5.3.1 for IST5 10-15-20-30-40 KVA



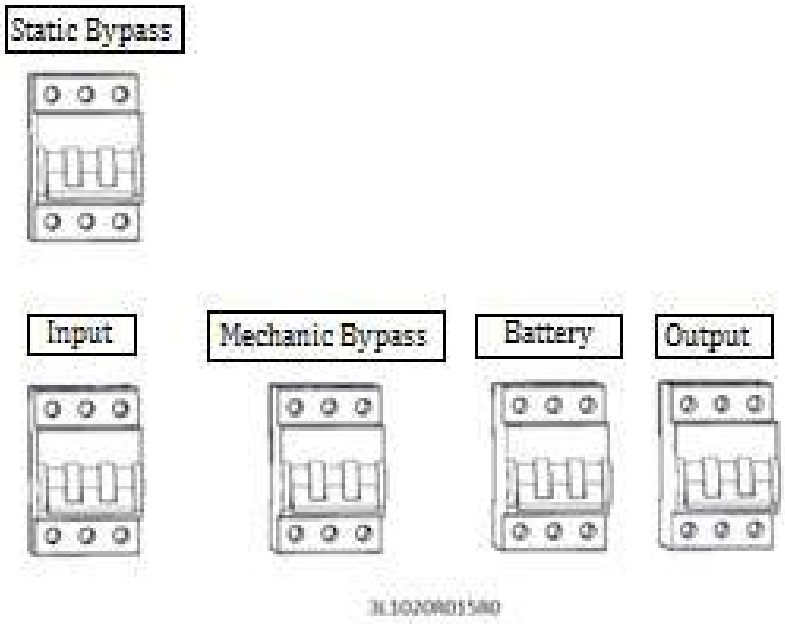
10-15-20KVA



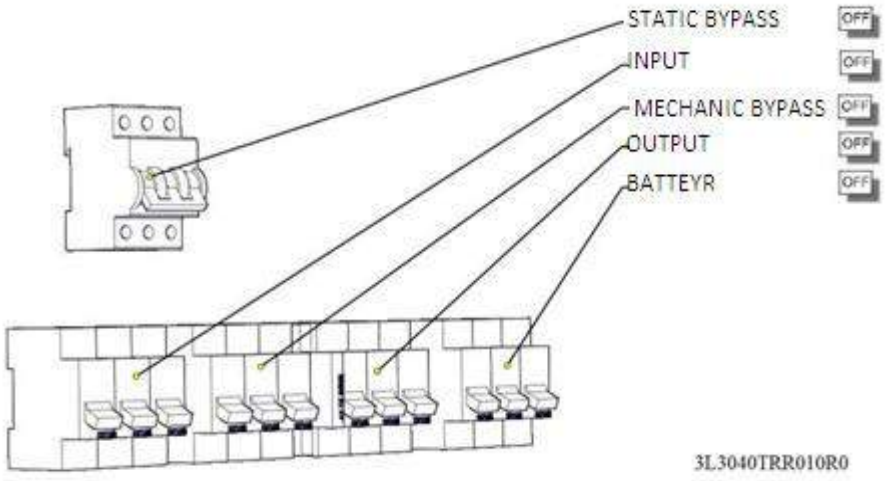
30-40KVA

Read the following steps to connect the cables properly.

1. Turn **OFF** all the distribution board breakers (both input and output distribution boards) to make sure that the load and mains are completely disconnected from any cable.

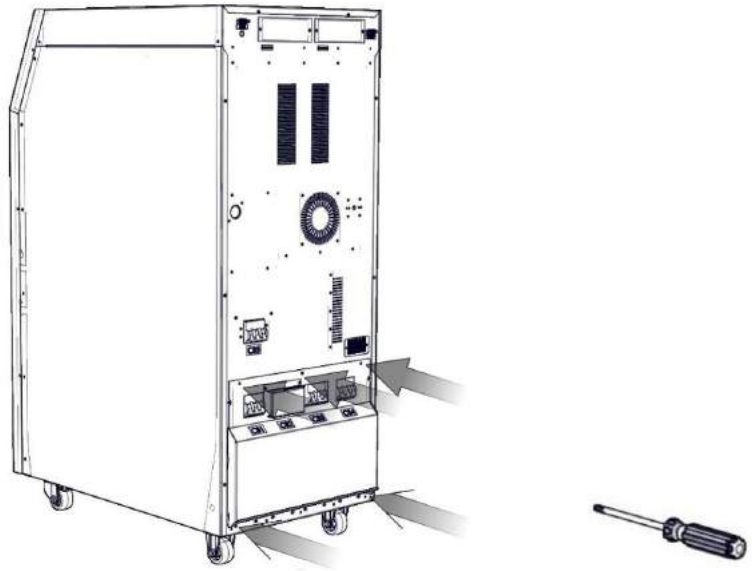


10-15-20KVA



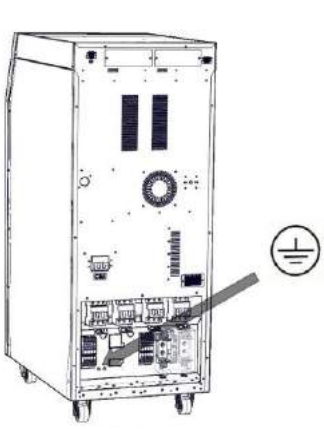
30-40KVA

2. Unscrew and remove the metal board on the rear side of the device.



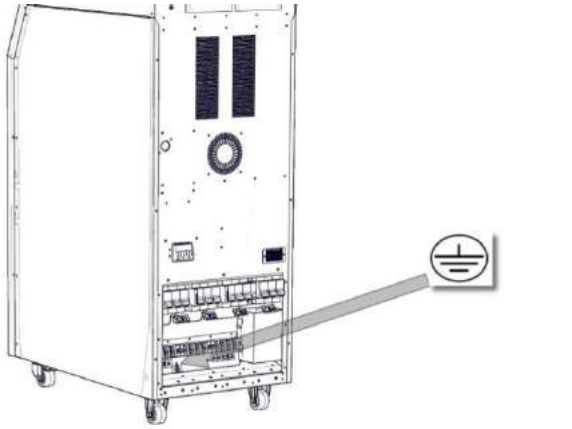
3L1020R013R0

3. Connect the ground cable.



3L1020R014R0

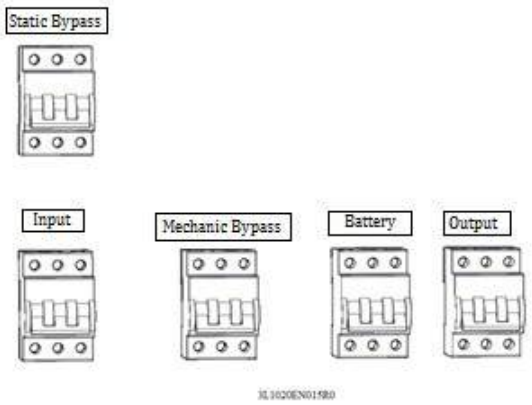
10-15-20KVA



3L3040TRR011R0

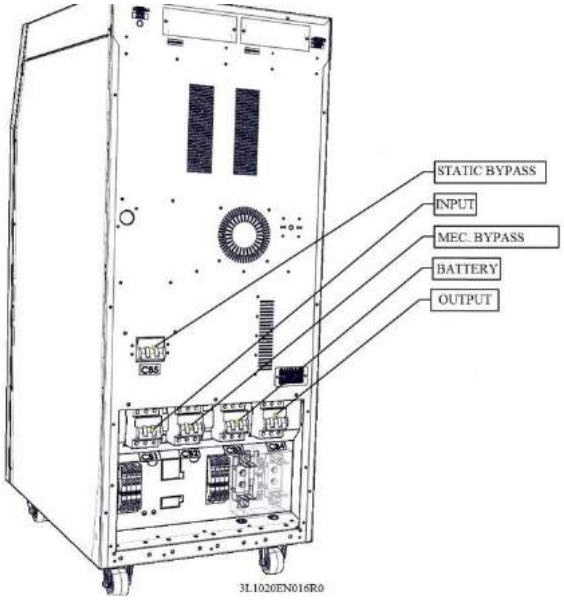
30-40KVA

4. Make sure that the circuit breakers are off. The use of these circuit breakers is explained on the operation section.



5. Connect the input cables.

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



6. Check the phase sequence.

7. Repeat steps 4-5 for output cables.

8. Replace the rear board and tighten the screws

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.

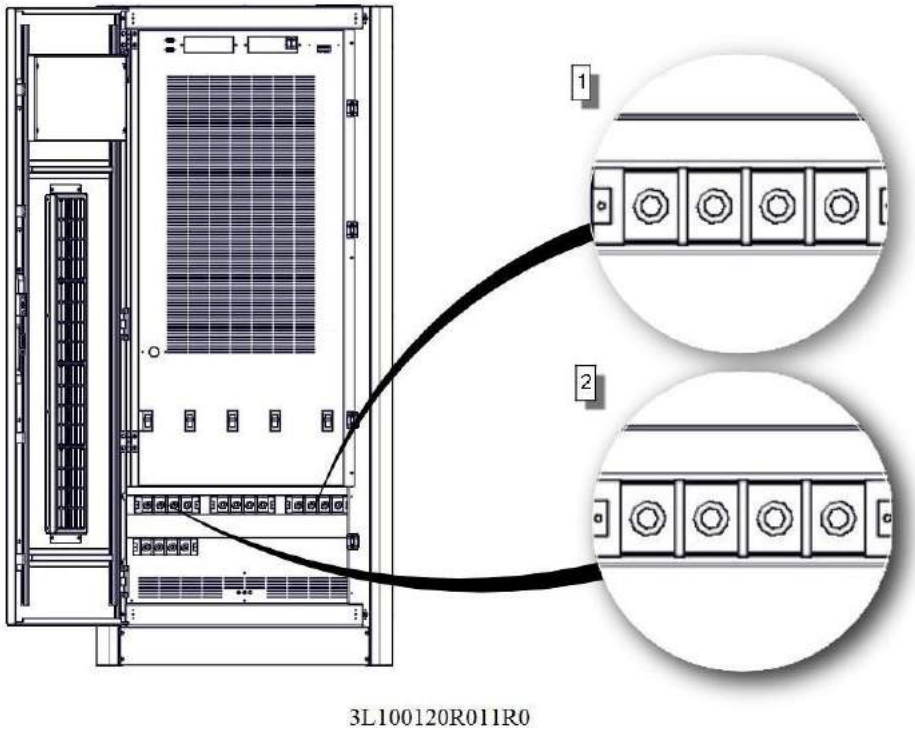
WARNING: Make sure that the cables are connected properly before UPS is started. Additionally, check if there are galvanic isolation transformers at input of UPS and consider the local directions.

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

3.1.5.3.2 for IST5 60-80-100-120-160-200 KVA

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

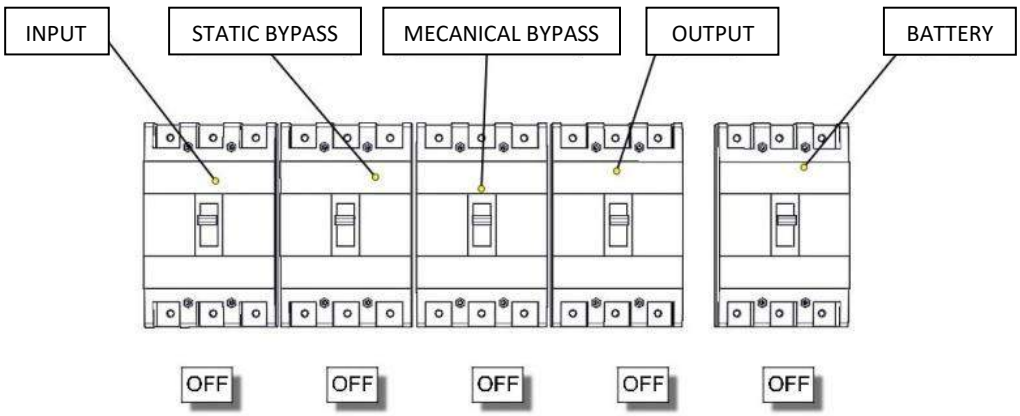
ATTENTION! 3 pole-circuit breakers (switch) are used for the input and output of UPS, Neutral line must not be interrupted.



3L100120R011R0

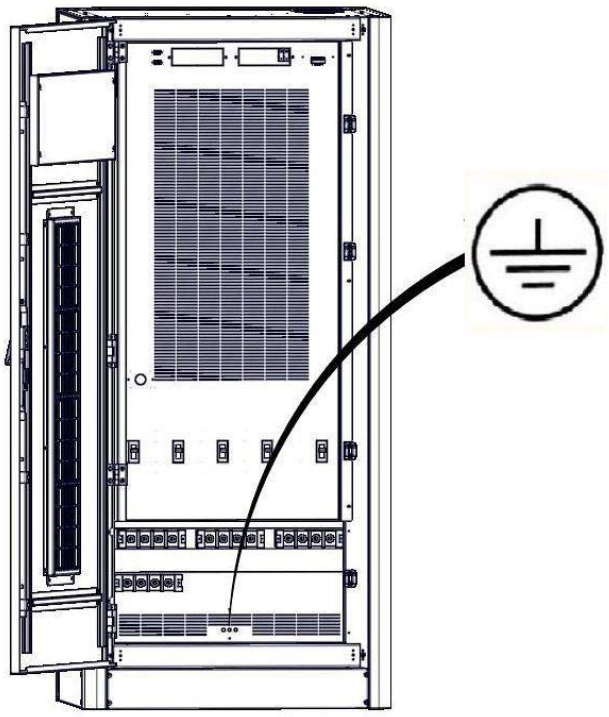
1	Output Terminal
2	Input Terminal

1. Turn **OFF** all the distribution board breakers (both input and output distribution boards) to make sure that the load and mains are completely disconnected from any cable.



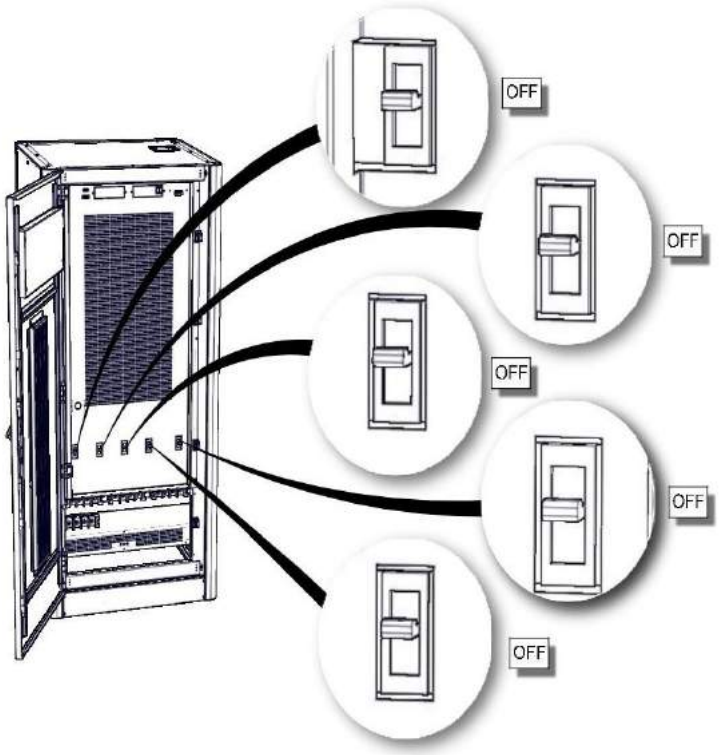
3L100120R012R0

2. Connect the ground cable. Unscrew and remove the metal board on the rear side of the device.



3L100120R013R0

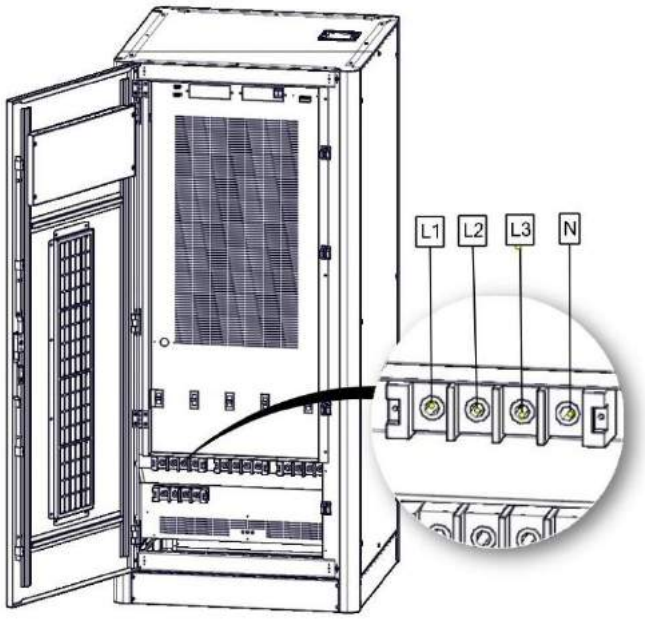
3. Make sure that the circuit breakers are off. The uses of these circuit breakers are explained on the operation section.



3L100120R014R0

4. Connect the input cables.

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



3L100120R015R0

5. Check the phase sequence.

6. Repeat steps 4-5 for output cables.

7. Replace the rear board and tighten the screws

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. Additionally, check if there are 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 installation 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.

3.1.5.4.1 Internal Battery connection (10-15-20-30KVA)

Battery installation procedure

Read the following steps to connect the internal batteries properly.

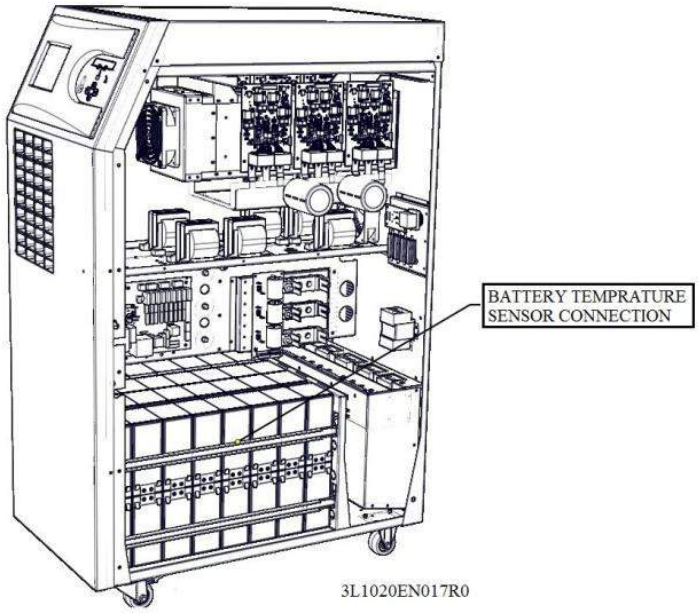
1. Remove the battery fuse.
2. Make sure that the batteries are connected properly in series and parallel.
3. Reach the –BAT labeled cable inside the UPS and connect it to the negative battery terminal.
4. Reach the +BAT labeled cable inside the UPS and connect it to the positive battery terminal.
5. Check the polarity of the battery connection once again.
6. Replace the metal rear cover.

Avoid short circuit in the batteries. Short circuited batteries are hazardous to human health and environment!

Battery terminal may rise up to 450 Vdc.

Battery temperature monitoring

Internal battery temperature is monitored by the NTC connected to the J26 socket of the main board. Refer to the options section for external battery monitoring.



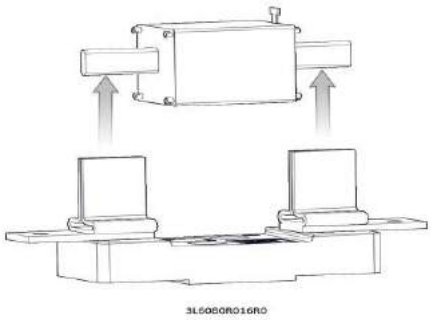
3.1.5.4.2 External Battery Installation Procedure and Connection (30-40-60-80-120-160-200KVA)

You can find details about how to configure external batteries above under “External Batteries Configuration” title.
The information about connection of external batteries and UPS is given in this section.

Avoid short circuiting batteries. Short circuit the batteries can damage you and your environment!

Battery terminal may rise up to 450 Vdc!

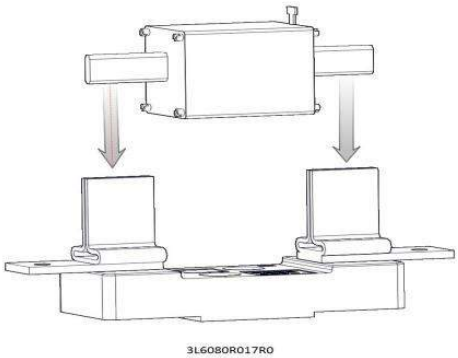
1. Switch “CB4”breaker OFF on UPS.
2. If there is breaker on battery cabinet, Switch it “OFF” .
3. Remove the fuse on battery cabinet.
4. Remove battery fuse on UPS.



5. Make sure of serial and parallel connections of external battery packs are correct.
6. Connect the cable to terminals of two neutral "N (battery neutral)" , one "+Battery" and one "-Battery" respectively.
7. Connect four cables that come from UPS to terminals on battery cabinet or in battery room according to external battery connection diagram below. As follows:

- N(UPS) ←-----→ Positive Battery Group "-" terminal
- N(UPS) ←-----→ Negative Battery Group "+" terminal
- “+ BATTERY” ←-----→ Positive Battery Group “+“ Terminal
- “ -BATTERY” ←-----→ Negative Battery Group "-" Terminal

8. Make sure that the polarities are connected correctly by checking battery connections for the last time.
9. Replace battery fuse on UPS.
10. Replace battery fuse on battery cabinet.

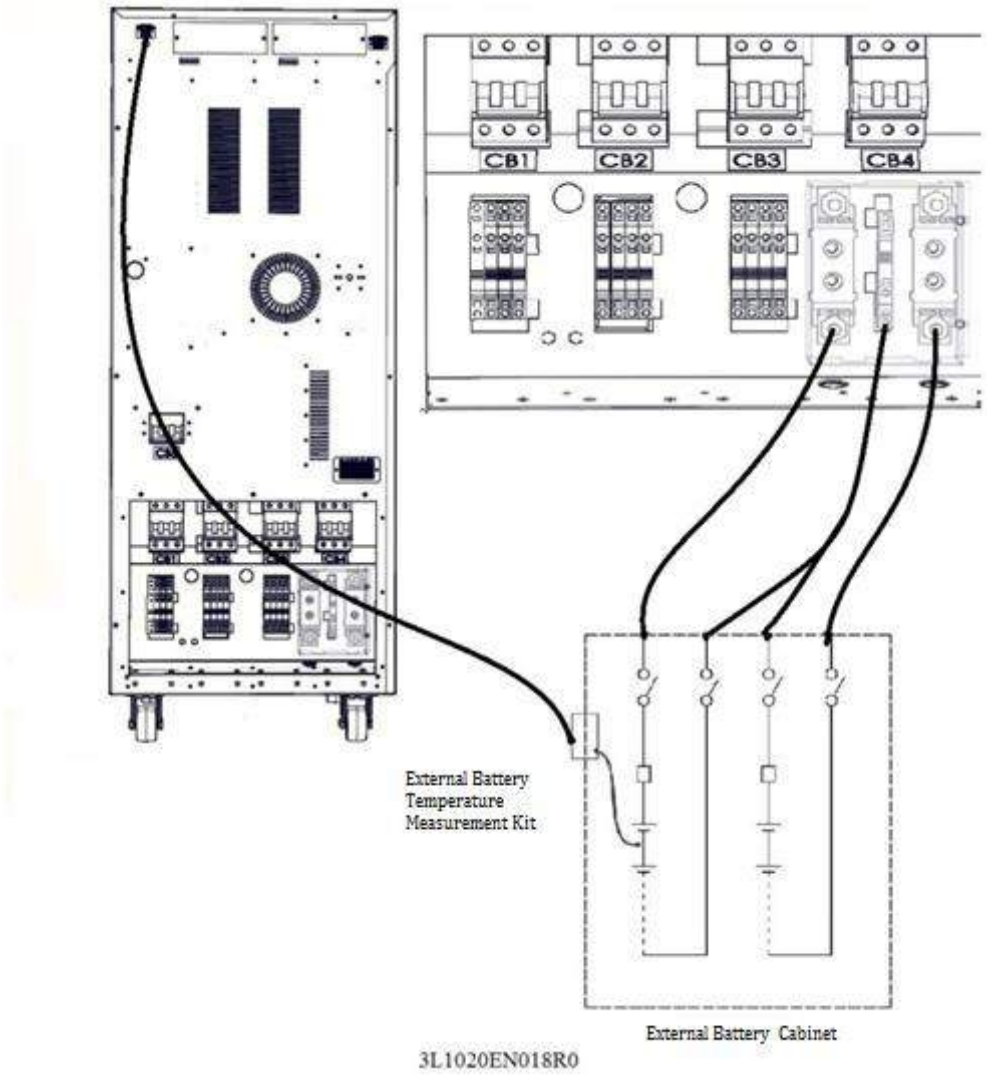


11. If there is breaker on battery cabinet, switch it “ON”.
12. Check if there is appropriate battery voltages to the battery input terminals by proper measuring device.

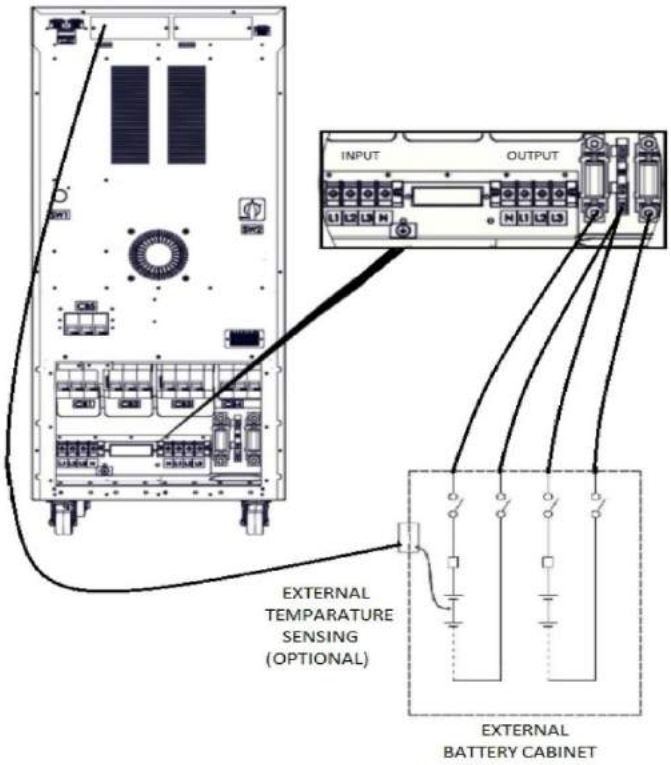
External battery cable selection is determined by application. Fuses which are recommended for UPS and battery cabinet are given. To connect to these type fuses, the lowest diameter cables are suggested. Please, refer to standard called EN 50525-2-31(VDE 0100-430) in this subject. The selection should be such that the cable will allow at most 0.5 Vdc decreasing.

"External Battery Temperature Measurement Kit" is used for optimization according to battery temperatures, batteries use is optimized according to temperature.

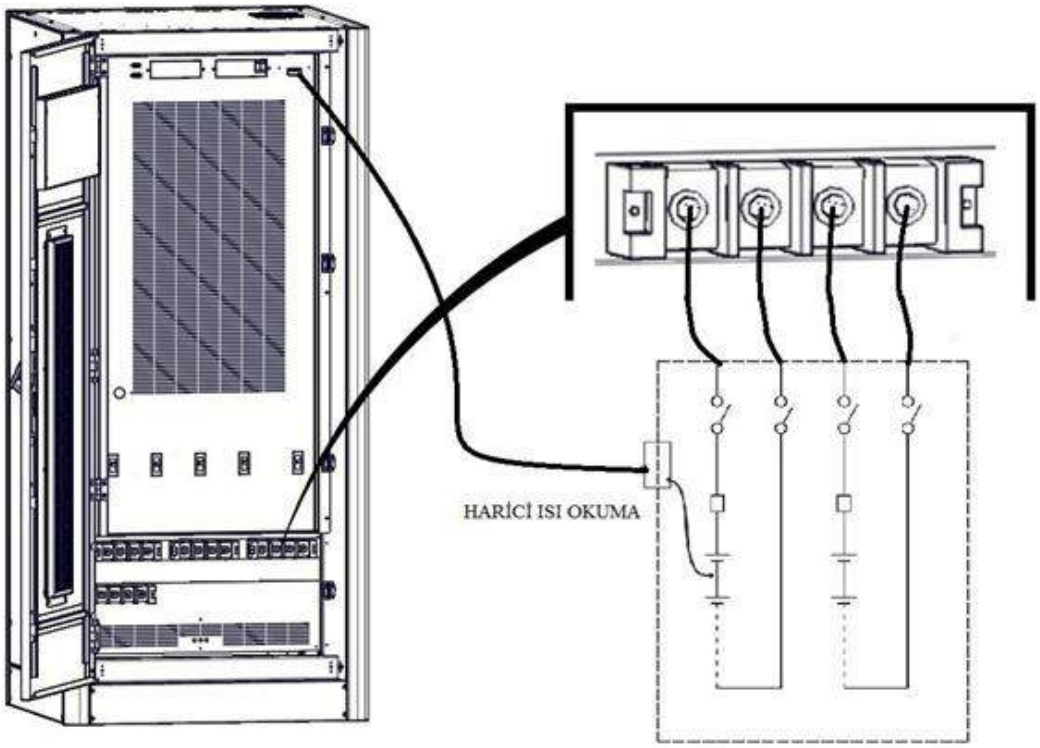
The external battery connection diagram is given below.



10-15-20KVA



30-40KVA



3L100120R018R0

60-80-100-120-160-200-300 KVA

3.1.5.5 Control and Communication Cable Connections

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

3.1.5.5.1 for AEC IST5 10-15-20 KVA;

Connections on the rear side of UPS:

- One RS232 serial communication connection (Standard),
- Two expansion slots (Optional)
- One parallel port (Standard)

3.1.5.5.2 for AEC IST5 30-40 KVA;

Connections on the front side of UPS:

- One RS232 serial communication connection (Standard),
- Two expansion slots (Optional)

Connections on the top side of UPS:

- One parallel port (Standard)

3.1.5.5.3 for AEC IST5 60-80 KVA;

Connections on the front side of UPS:

- One RS232 serial communication connection (Standard),
- Two expansion slots (Optional)

Connections on the top side of UPS:

- One parallel port (Standard)

3.1.5.5.1 for AEC IST5 100-120-160-200-300 KVA;

Connections on the front side of UPS:

- One RS232 serial communication connection (Standard),
- Two expansion slots (Optional)
-

Connections on the top side of UPS:

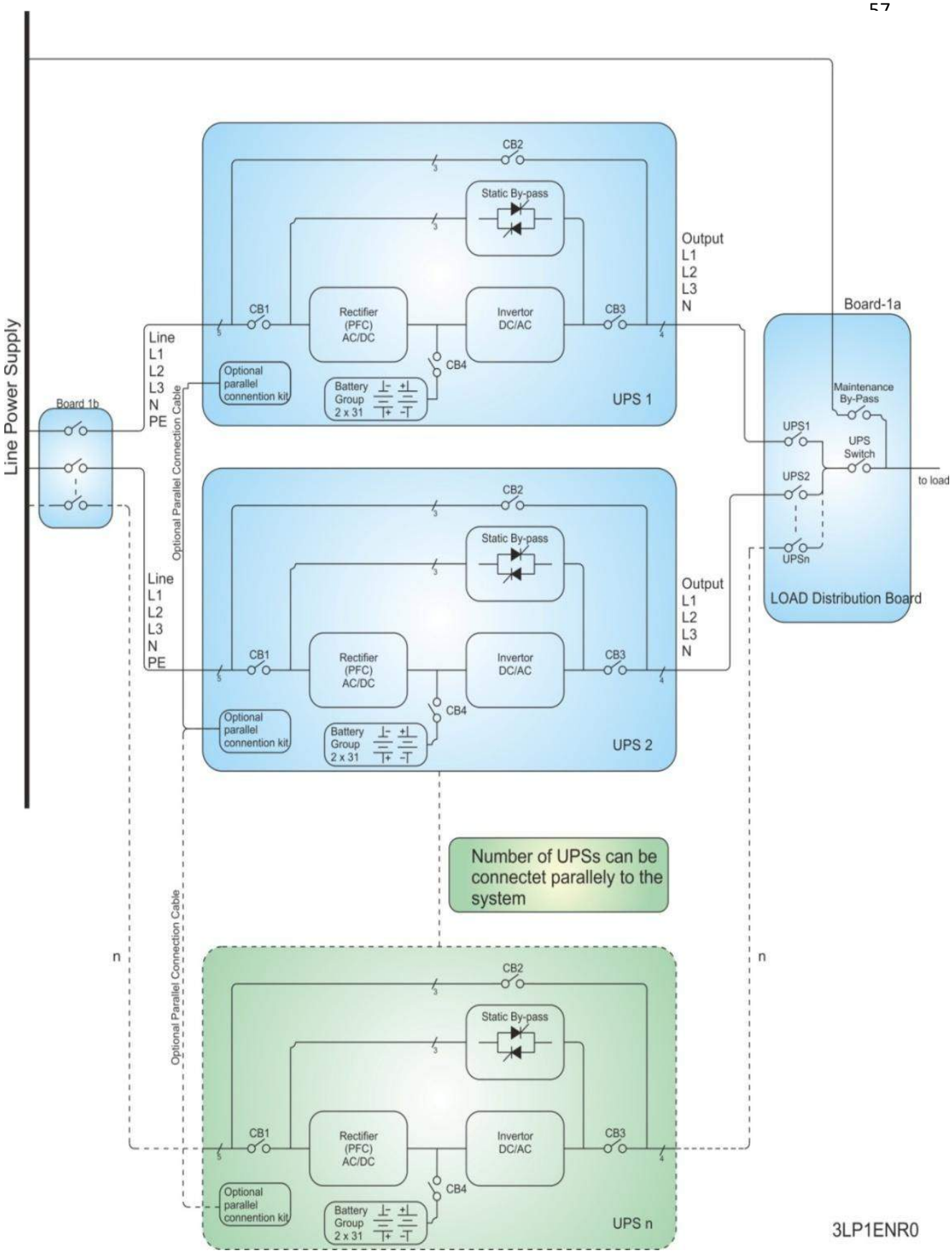
- One parallel port (Standard)

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 AEC!

In case of need for redundancy or more power, IST5 series can be operated in parallel up to quantity 8 (eight). A schematic diagram which shows two UPS connected in parallel can be seen below.


Line Power Supply
Board 1b
Line
L1
L2
L3
N
PE
Optional Parallel Connection Cable
CB2
Static By-pass
CB1
Rectifier
(PFC)
AC/DC
Invertor
DC/AC
CB3
CB4
Optional
parallel
connention kit
Battery
Group
2 x 31
UPS 1
Output
L1
L2
L3
N
Board-1a
Maintenance
By-Pass
UPS1
UPS
Switch
UPS2
to load
UPSn
LOAD Distribution Board
UPS 2
Number of UPSs can be
connectet parallely to the
system
n
UPS n
3LP1ENR0

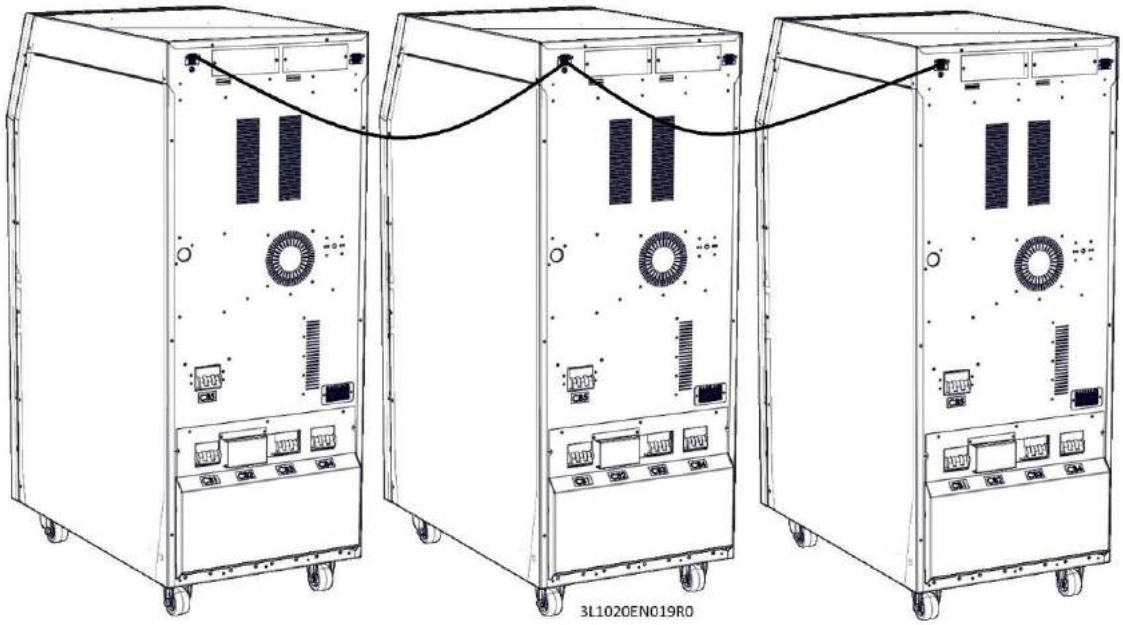
Input and output of more than one UPS are connected to each other; but definitely each battery group is different from another, batteries cannot be used in common. The following points should be considered while placement of UPS in parallel system and their electrical connections are made:

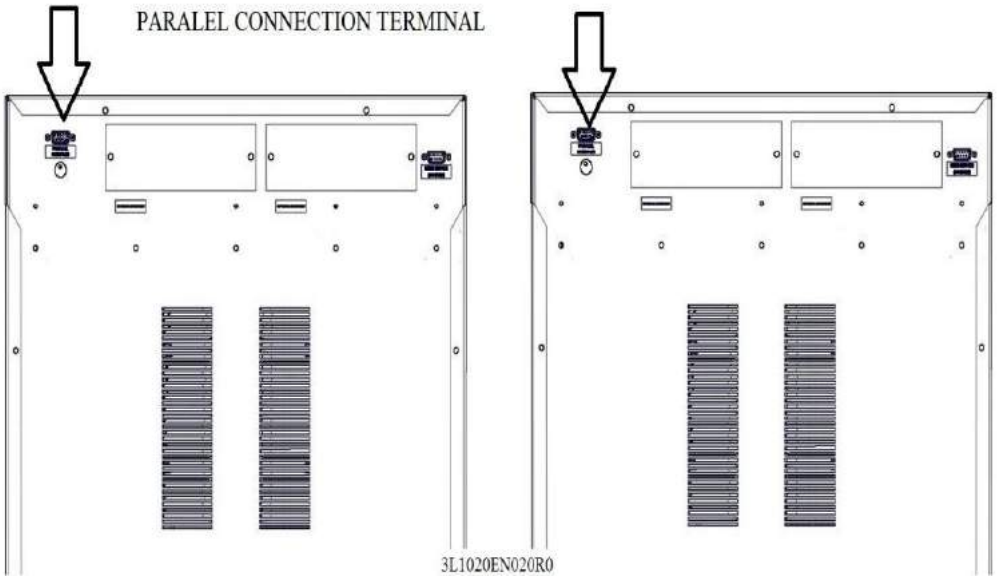
- The UPSs which are connected in parallel must be from the same series and must have the same rated power.
- Devices must be running on the same firmware, if not, old firmware must be updated.
- Devices must be located as close possible as to each other (max. 6 x 110 cm paralleling cables.)
- Each device must have its own ground cable.
- UPS must be connected in parallel on the distribution panel an 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.
- Power input and output cables from the device to the distribution board must be equal in length and cross section in order to proceed equal current sharing.

3.2.1 Parallel Settings

3.2.1.1 10-15-20 KVA;

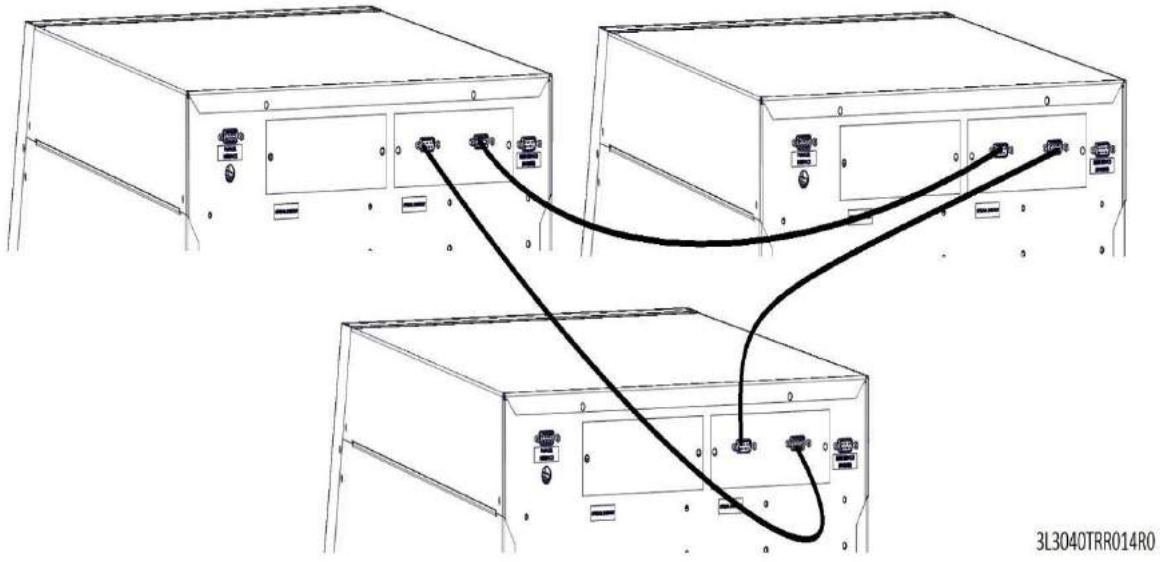
Connect the parallel cable as shown in figure below. Only use the cables provided by AEC. Software settings on the user panel should be made by authorized personnel.





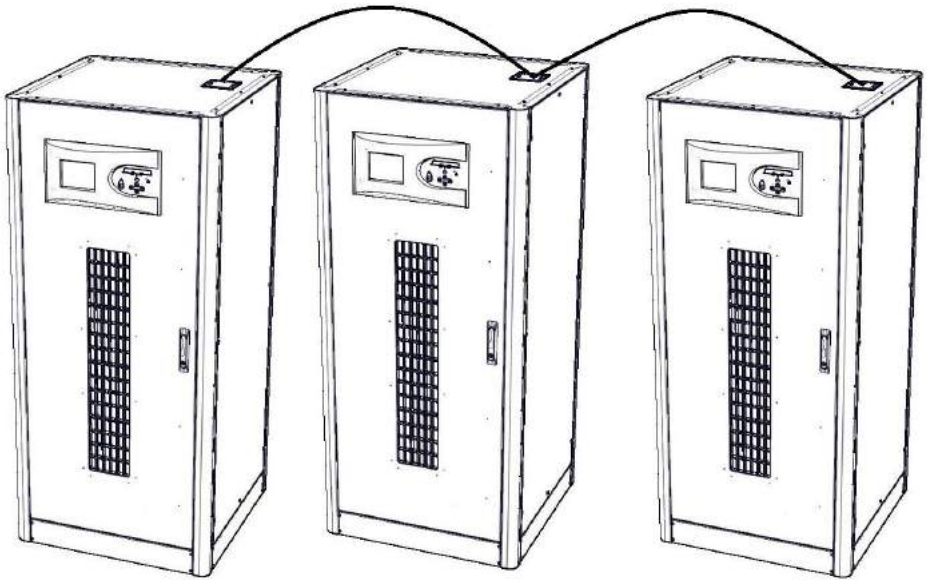
3.2.1.2 30-40 KVA;

Connect the parallel cable as shown in figure below. Only use the cables provided by AEC. Software settings on the user panel should be made by authorized personnel.

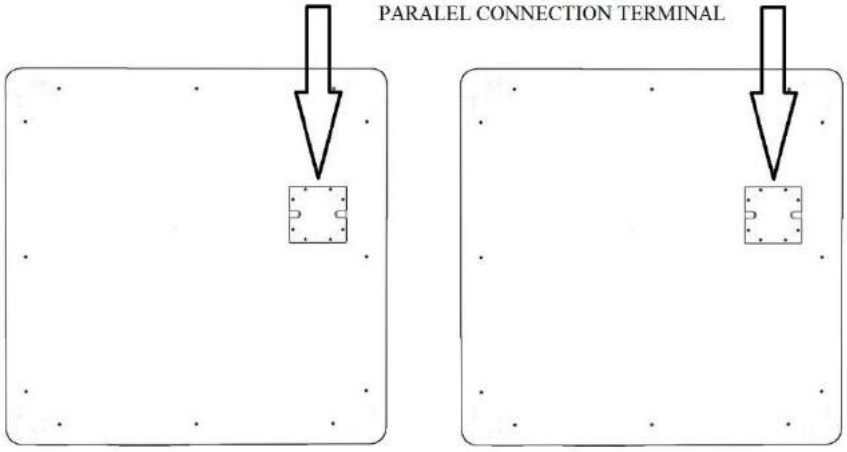


3.2.1.3 60-80 KVA;

Connect the parallel cable as shown in figure below. Only use the cables provided by AEC. Software settings on the user panel should be made by authorized personnel.



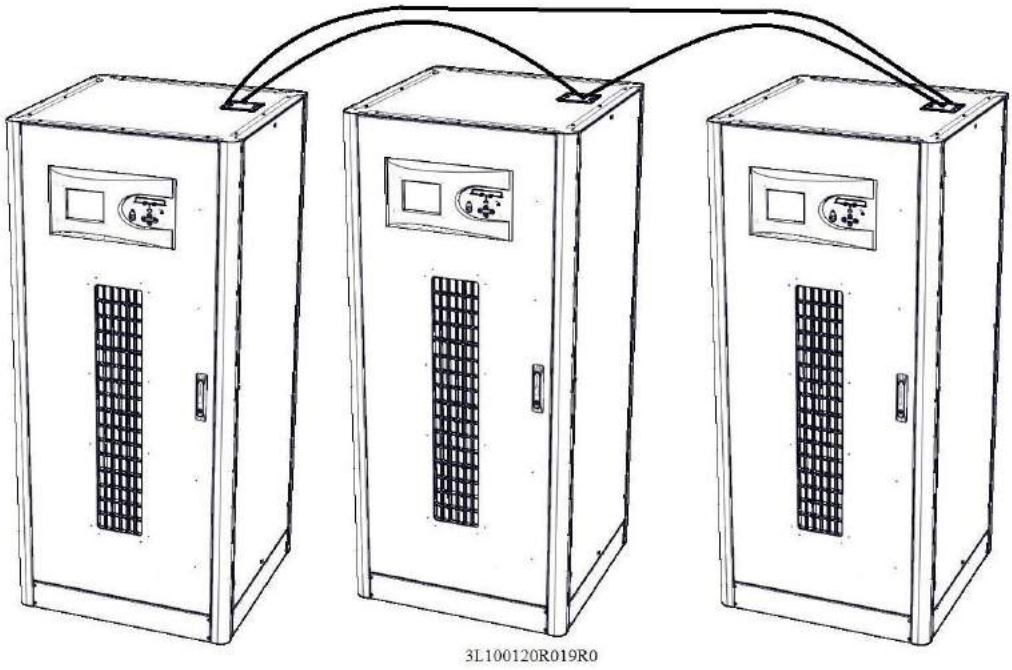
3L6080R019R0



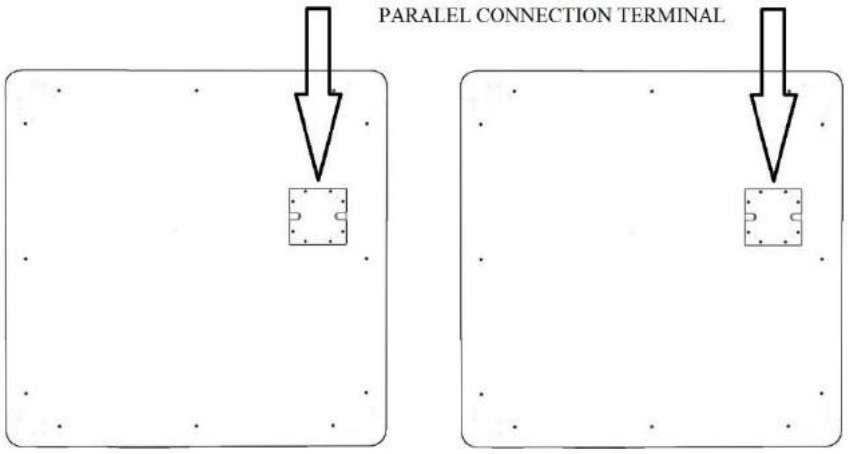
3L6080EN020R0

3.2.1.4 100-120 KVA;

Connect the parallel cable as shown in figure below. Only use the cables provided by AEC. Software settings on the user panel should be made by authorized personnel.



3L100120R019R0



3L6080EN020R0

3.2.2 Parallel Connection Procedure

Please read the following instructions before you use the devices in parallel mode.

3.2.2.1 Check if the devices can be used in parallel mode.

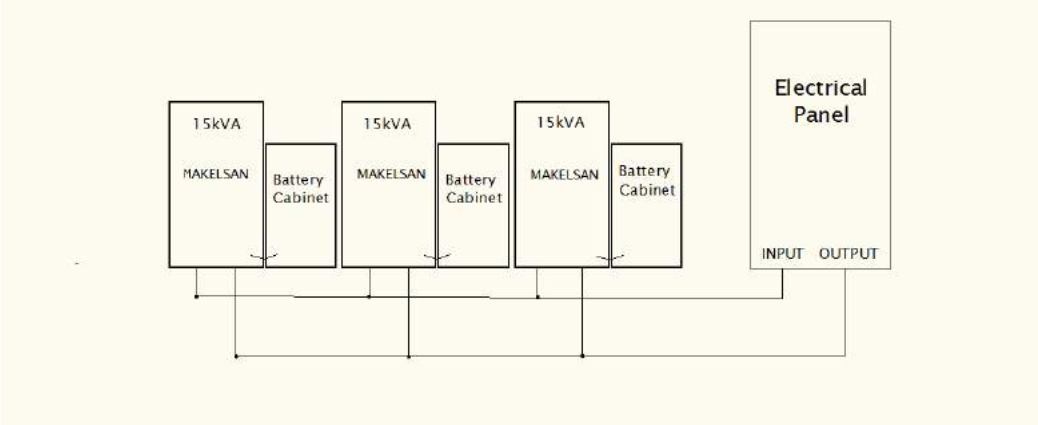
1. Be sure that all devices are from the same series and rated the same power.
2. Go to the ***version*** screen using menu keys, and check if all devices have the same firmware.

Main screen > Setup > Version

3.2.2.2 Check the positioning of the devices.

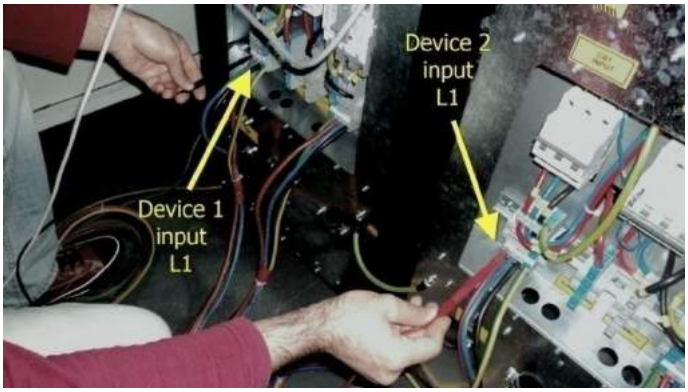
Keep the devices as close to each other as possible. The distance between must not exceed 1 meters.

3.2.2.3 Making the electrical connections

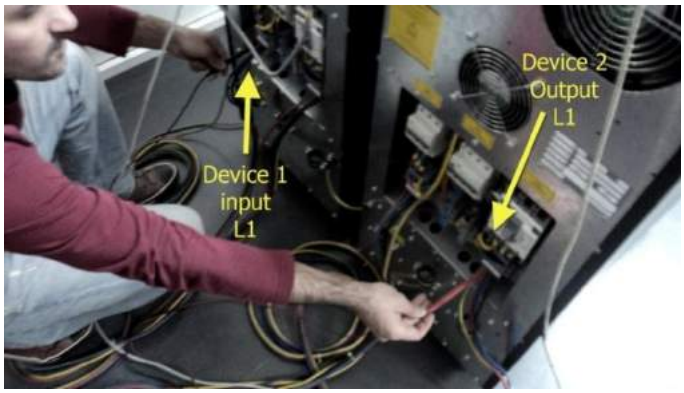


1. Make sure that the devices are turned OFF and have been kept off for at least 5 minutes before you make any electrical connections.
2. Connect the devices in parallel through the electrical panel. Refer to parallel connection example (UDD-SD-40E) for detailed connection drawing. Connect each device to ground using separate cables.
3. Connect each device to ground using separate cables.
4. Make sure that the phases are in the right order. ***(U_1-U_2-...-U_N), (V_1-V_2-...-V_N), (W_1-W_2-...-W_N).***
5. Check the connections using a multimeter in diode mode;

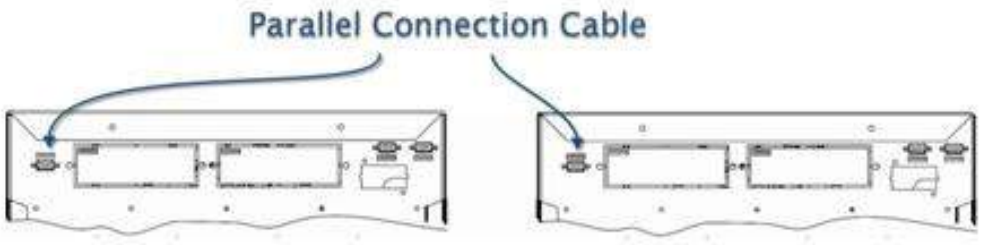
6. First turn the maintenance switches OFF and sees if the inputs of the devices are connected to each other.



7. Then turn the maintenance switch ON and check the connection between the input of the first device and the output of the second device.



8. Use separate sets of batteries for each device. Do NOT use the same set of batteries on more than one device at the same time.
9. Connect the communication cable and secure the connections.



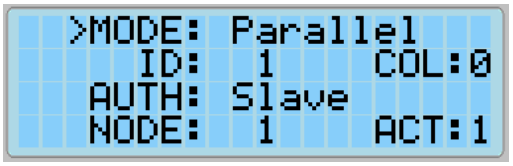
10. Check the termination resistors on the connection cable.
11. Remove the UPS top panel and reach the main board.
12. Find the J9 socket on the main board, and check the resistance between pin 2 and pin 3 using a multimeter. (60Ω)
13. Check the resistance between pin 4 and pin 5. (60Ω)
14. Close the replace the UPS top panel. Turn on the device.

3.2.2.4 Set the software for parallel operation.

In parallel operation, IST5 series UPS use the Master/Slave configuration. Master authorization is temporary for a UPS; one of the slaves may become the master depending on the conditions.

1. Go to the ***Service*** menu and enter the ***Parallel Operation*** screen.
   Main screen > Setup > Service Menu > Parallel Operation

2. Change MODE to parallel using the menu keys.



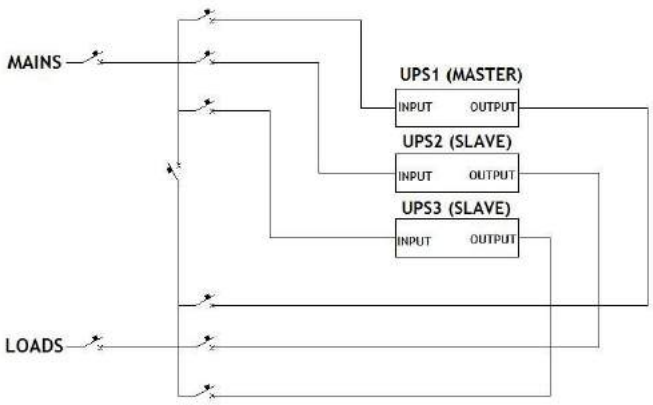
3. Set a different ID number for each device and then authorize one of the devices as MASTER.

4. Check the number of running devices (ACT) on the right lower side of the screen. If the number is not correct, make sure that each device has its own ID number.

3.2.3 Parallel Operation

Master/Slave configuration

Open the status menu to see if any device is a master or a slave.

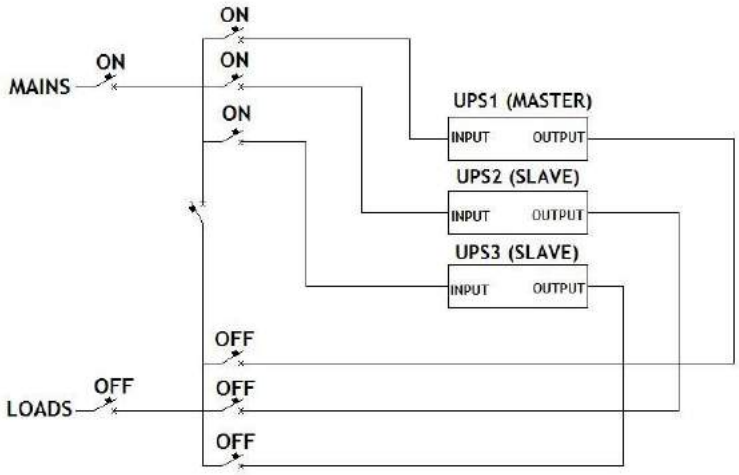


Open the status menu to see if any device is a master or a slave. The letter on the lower left corner of the LCD screen is “M” or “S” in parallel mode.

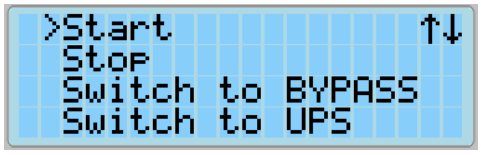
3.2.3.1 Parallel start-up

Read the following to start the parallel system.

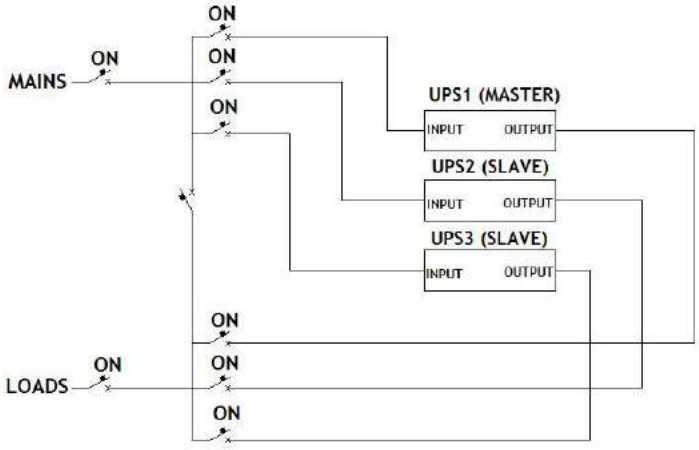
- Turn on the UPS breakers on the distribution board, and then turn on the main input breaker.



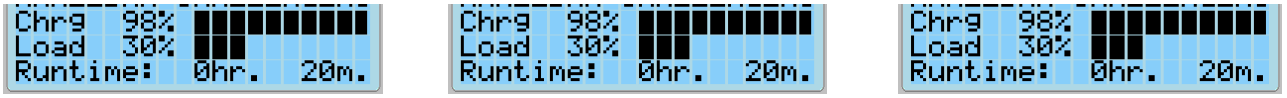
- Start one of the UPS using the front panel, and all the other UPS will start automatically.



- Turn on the output breakers on the distribution board, and then turn on the main output breaker.

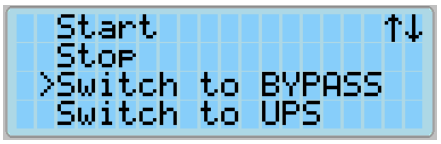


- The loads will be equally distributed on all devices.



3.2.3.2 Switching to static bypass

- If any one of the devices is manually switched to static bypass mode, the others will automatically switch to static bypass mode.

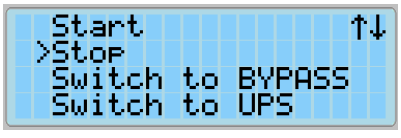


- To switch all the devices to online mode, select switch to UPS on any device.

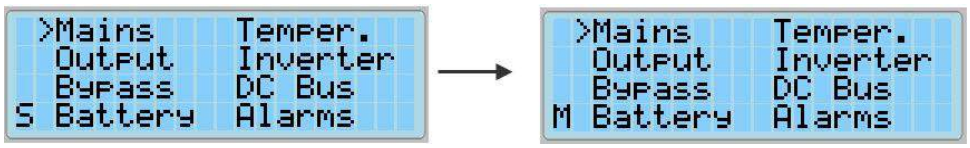
3.2.3.3 Stopping/Removing a single UPS

In a parallel Challenger system, any one of the devices can be removed off the system without affecting the others. To remove a UPS off the parallel system for maintenance, follow the steps below:

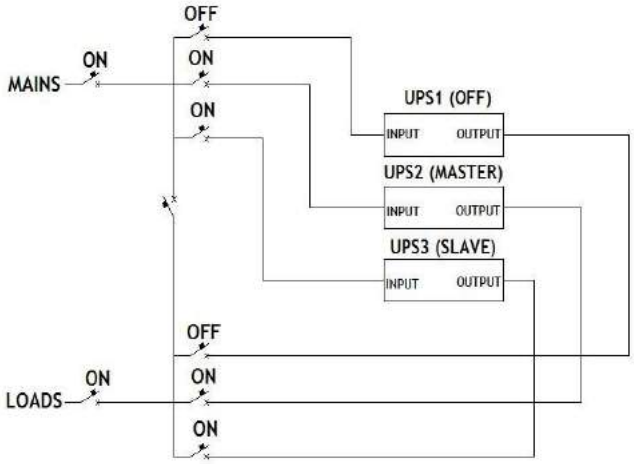
- Stop the desired UPS using the control menu.



- If the Master device is stopped, the UPS with the smallest ID no will become the new Master device.



- Turn off the UPS input breaker (CB1)
- Turn off the UPS output breaker (CB3) and the maintenance breaker (CB2)
- Turn off the UPS breakers on the distribution board.



3.2.3.4 Stopping all UPS

To stop all the UPS in a parallel system, go to ***Setup >Service Menu >Control >Stop All UPS.***

Note: Pressing the EPO button on any UPS will stop all UPS

4 OPERATION

4.1 Operation Procedure

You can find information's 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

There are four circuit breakers on the rear side of the device.
These are used for the AC input, maintenance bypass, output and the battery connections respectively.

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

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

CB3 is used to connect or separate AC voltage that come from static switches to the loads on UPS.

External batteries are connected to UPS through **CB4.**

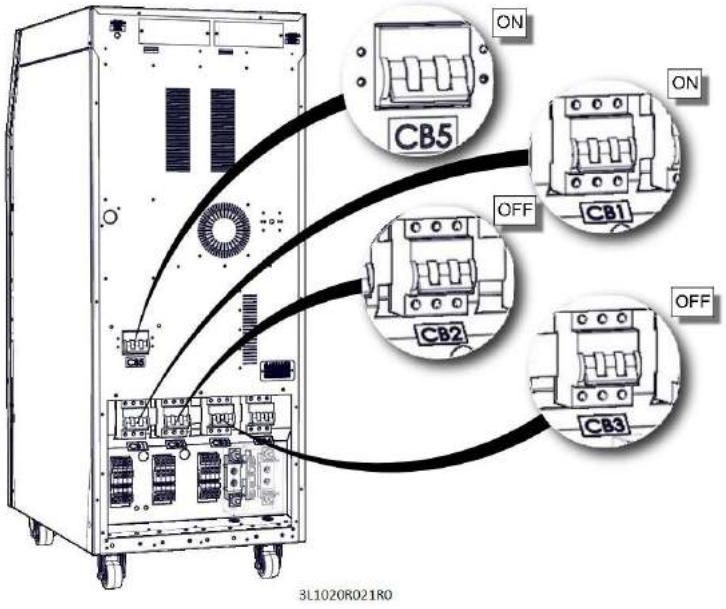
CB5 is used as an external bypass switch.

Active Breakers	Operation Mode	Explanation
CB1, CB3, CB4, CB5	Normal Mode	UPS operates in normal mode.
CB1, CB3, CB4, CB5	Static Bypass Mode	UPS is overloaded, loads will be transferred to static bypass line temporarily
CB2	Static Bypass Mode	UPS is shut down for maintenance, loads will be fed through mechanical bypass line.

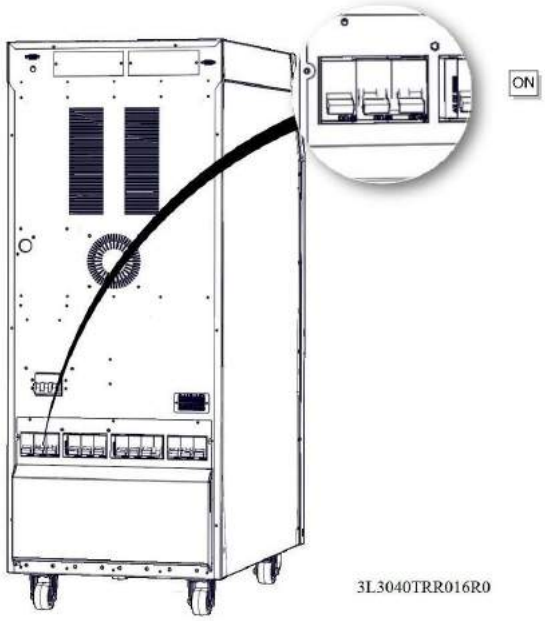
4.1.2 First start-up

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

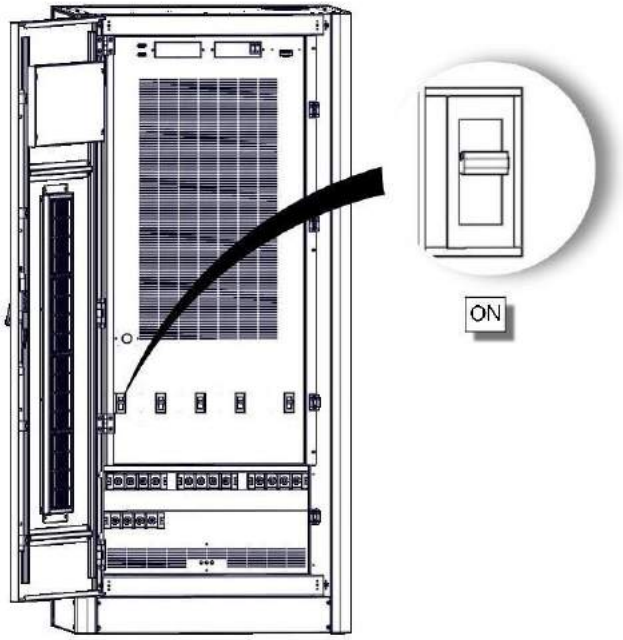
1. Turn all circuit breakers OFF.
2. Push the soft start button (SW1) at least for 10 sec.
3. Turn input circuit breaker (CB1) ON. If there is an external bypass input, put the external bypass switch (CB5) to position closed circuit (ON)



10-15-20 KVA



30-40KVA

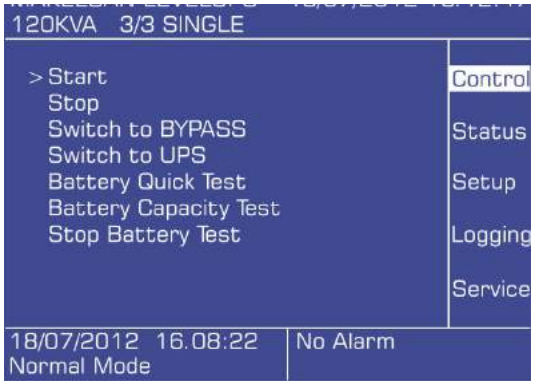


3L100120R021R0

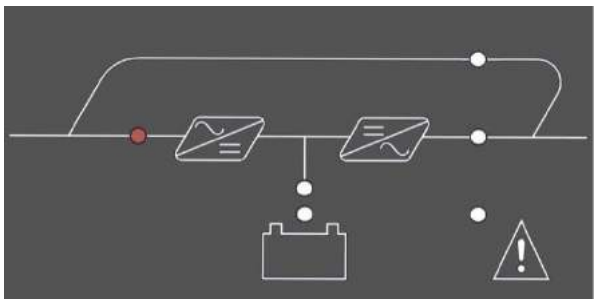
60-80-100-120KVA

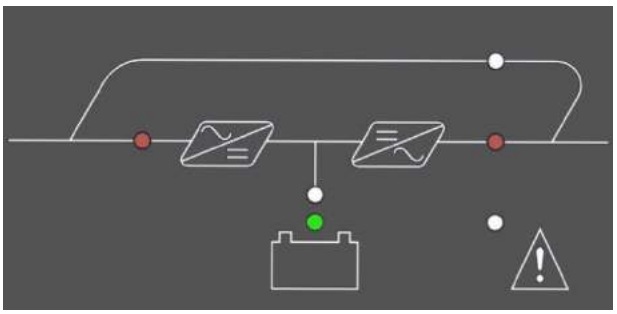
4. Start the UPS using the front panel.

Main menu> Control > Password > Start

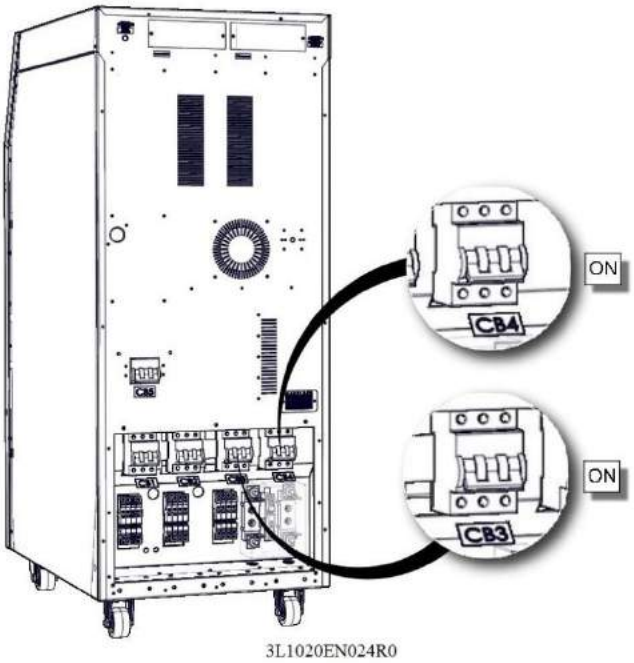


5. Check the UPS has switched to normal operation mode, via mimic diagram LEDs and LCD panel.

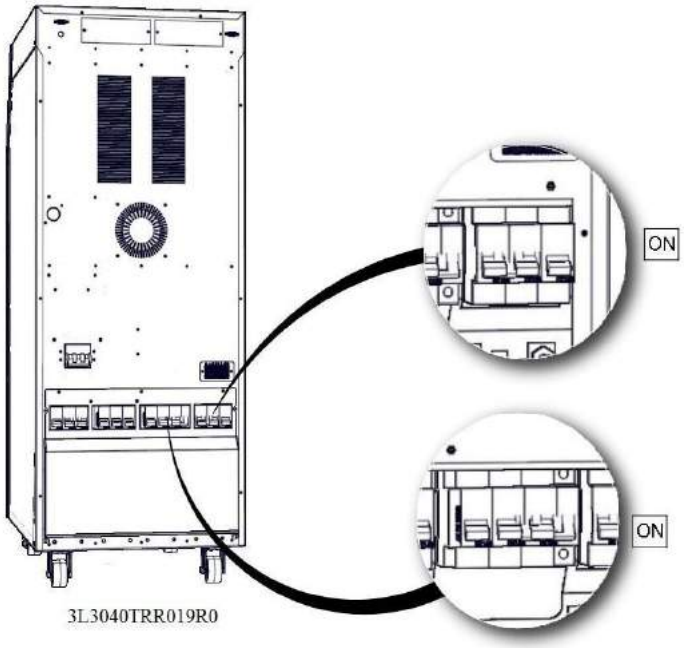




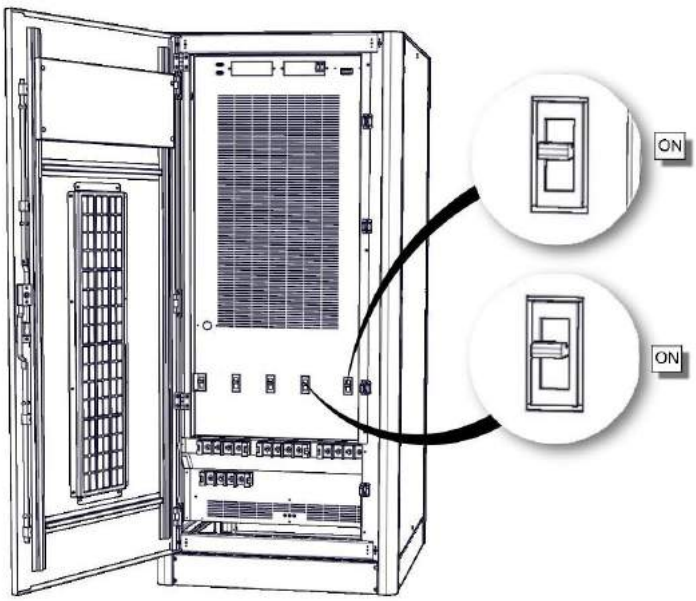
6. Turn battery circuit braker (CB4) ON.
7. Turn output circuit braker (CB3) ON.



10-15-20 KVA



30-40 KVA



3L6080R024R0

60-80-100-120KVA

8. 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 UPS Operation Modes Testing

After first start-up check device operation by switching between the operations. Modes change manually.

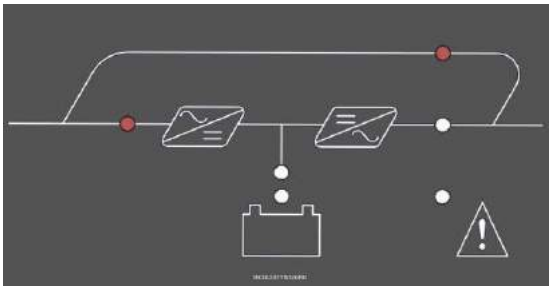
4.1.3.1 Switching from Online Mode to Battery Mode

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.

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

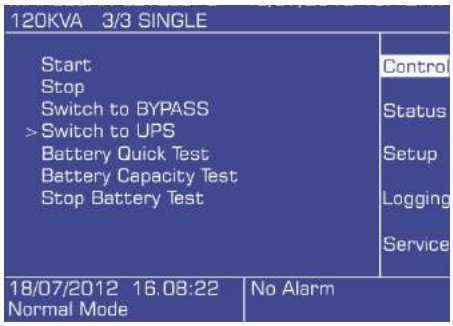


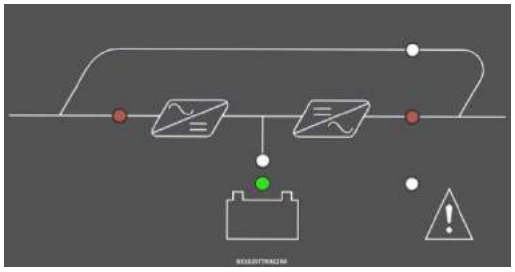
NOTE: UPS will not switch to bypass mode if the inverter voltage is out of limits or there is an overload or over temperature situation.

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





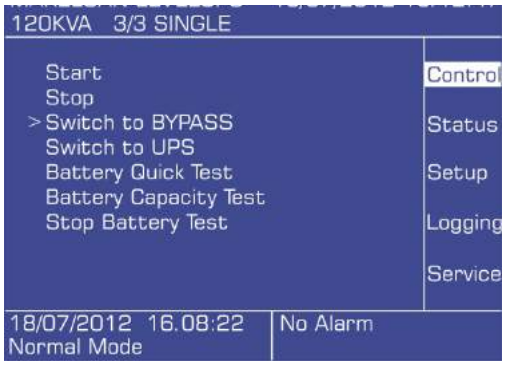
NOTE: the UPS will not switch to normal mode if the inverter voltage is out of limits, or there is an over load or over temperature situation.

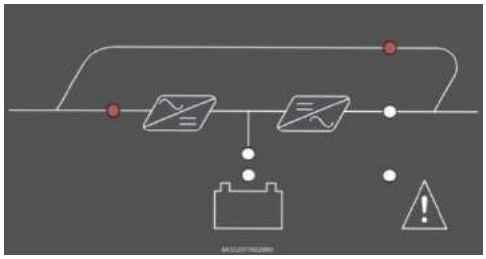
4.1.3.4 Switching from Online Mode to Maintenance Bypass Mode

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.

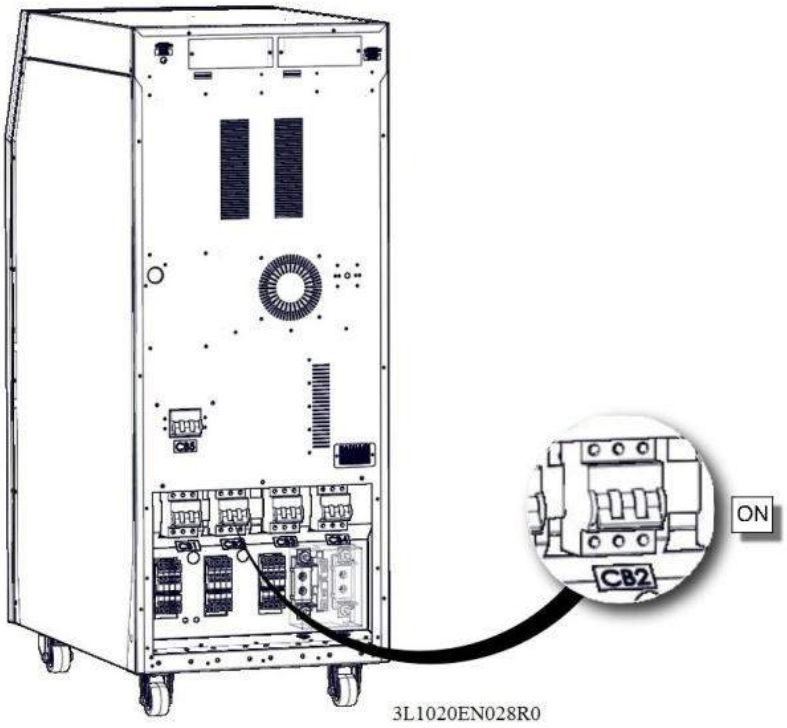
Use the front panel to switch the device to static bypass mode. Check the mimic panel to make sure that the device has switched to bypass mode.

Main menu > Control > Switch to Bypass

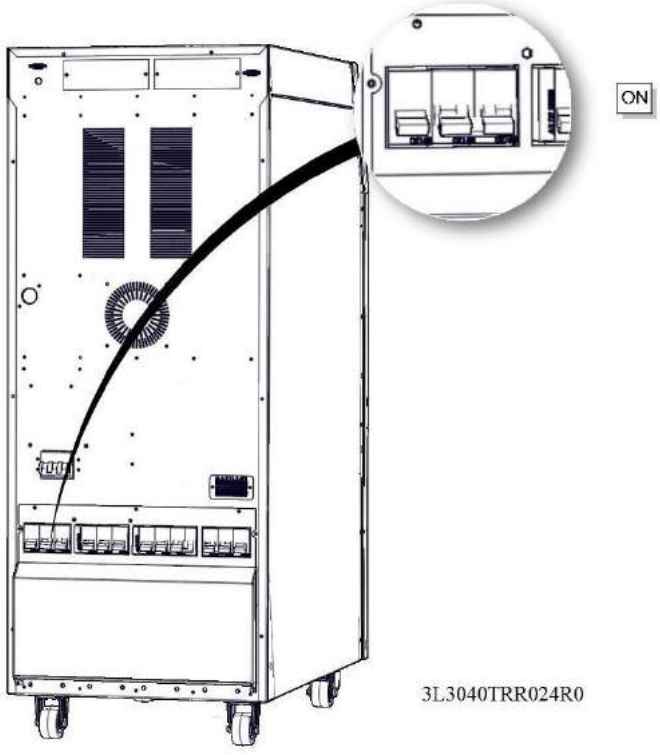




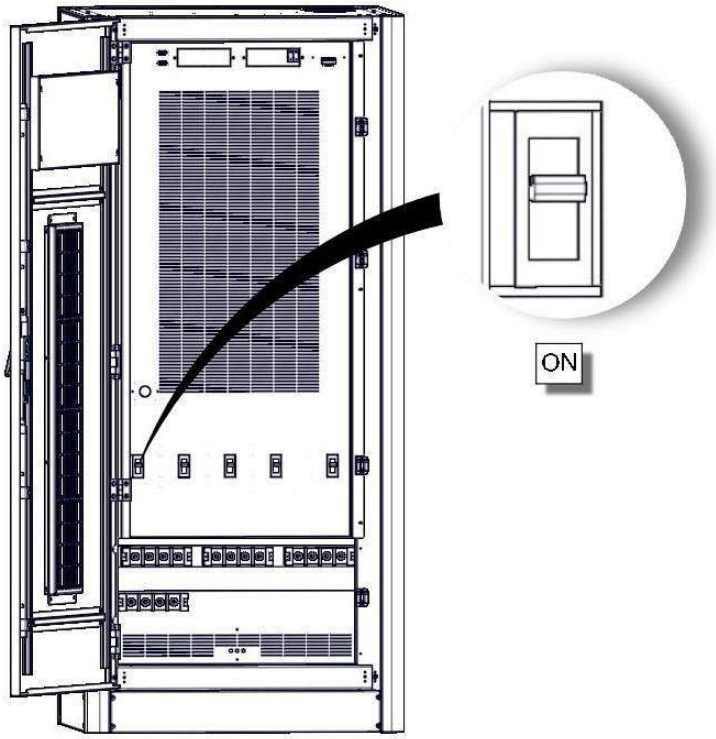
1. Turn CB2 **ON.**



10-15-20KVA



30-40KVA

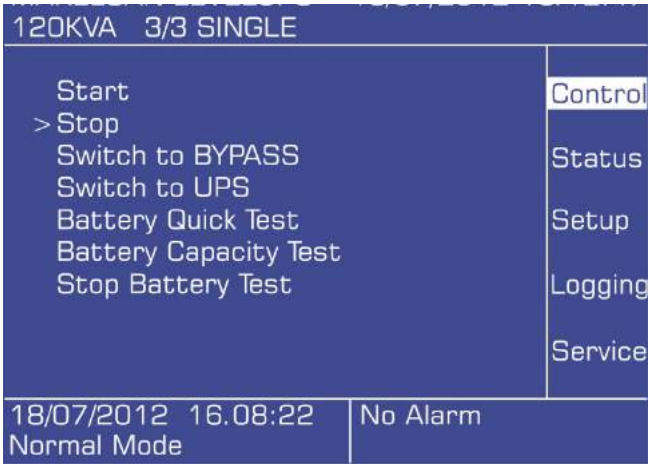


3L100120R025R0

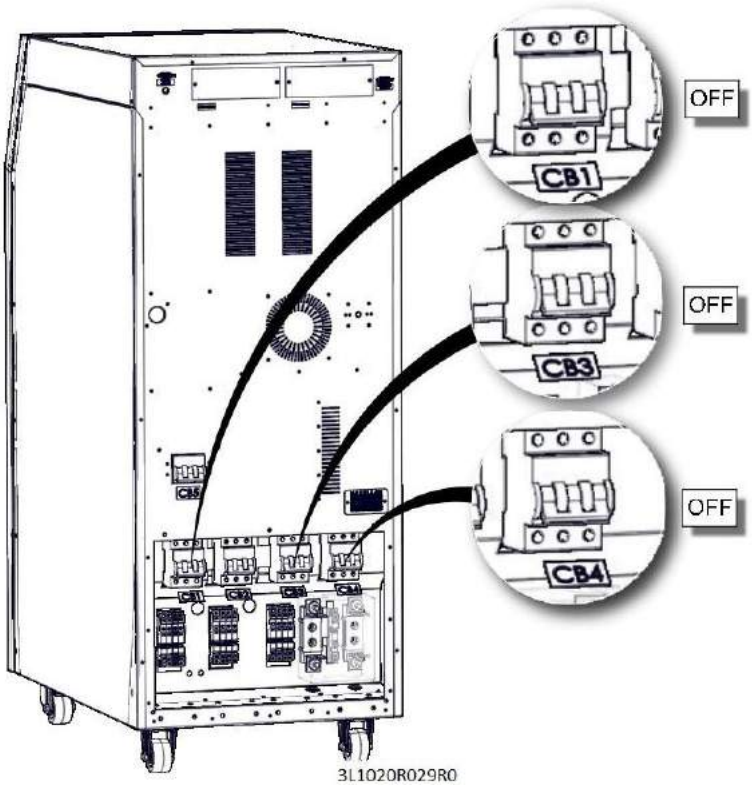
60-80-100-120KVA

2. Stop the UPS using the user front panel.

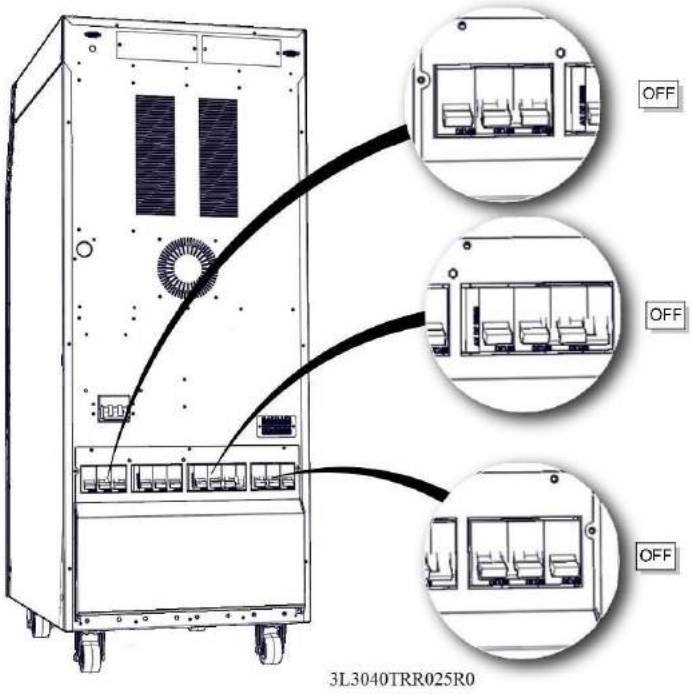
Main menu > Control > Stop



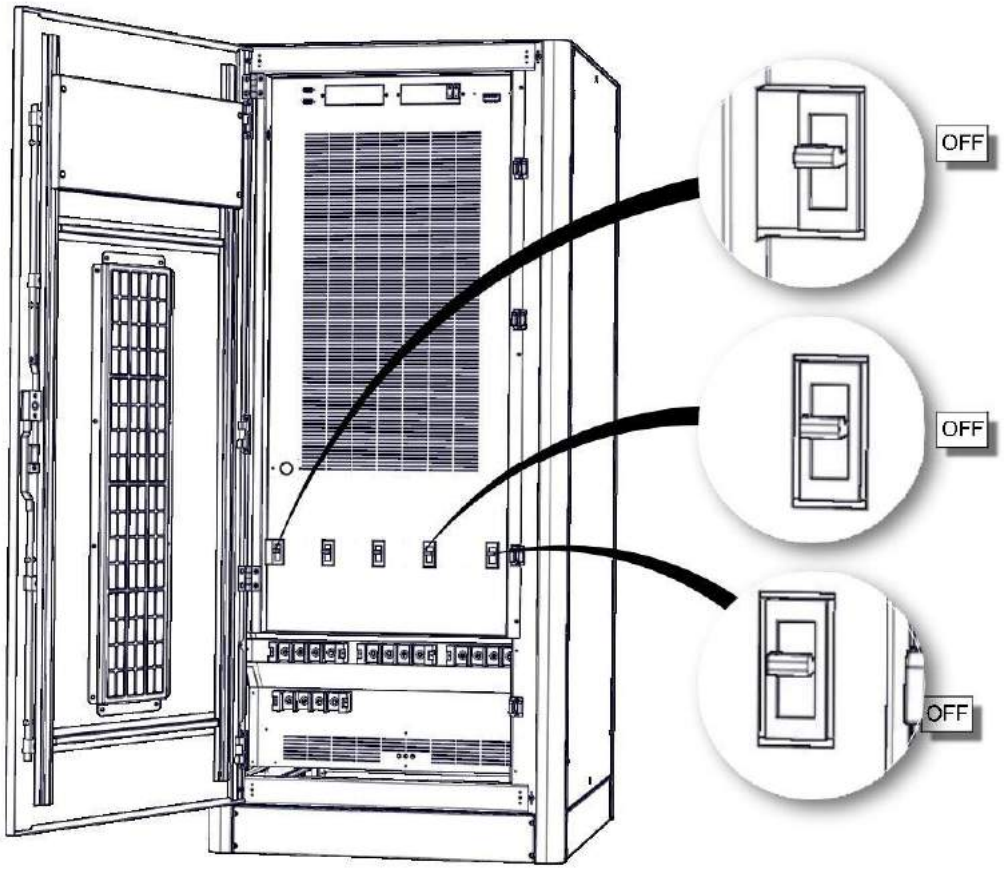
3. Turn CB1, CB3 and CB4 **OFF.**



10-15-20KVA



30-40KVA



3L6080R030R0

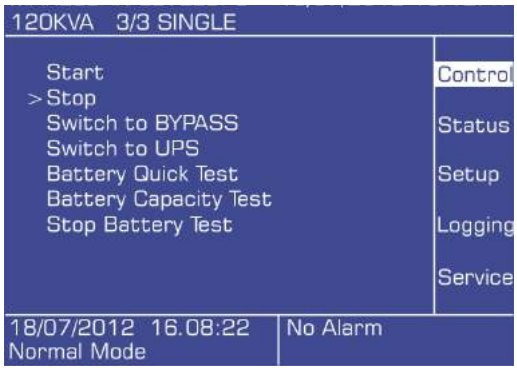
60-80-100-120KVA

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

1. Turn off the loads connected to the device.
2. Use the front panel to turn the device OFF

Main Menu> Control> Password> Stop

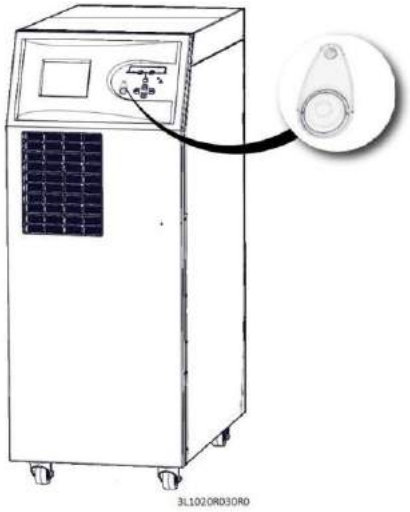


3. Check if the UPS has switched to bypass mode, via mimic diagram LEDs and LCD panel.
4. Turn OFF respectively the output (CB3), battery (CB4), outer battery (CB5) and input (CB1).

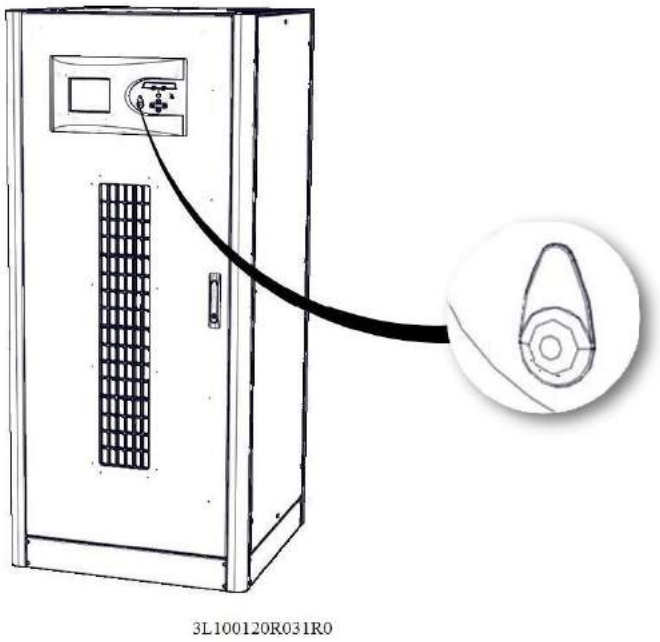
WARNING: Make sure that there are no critical loads on the UPS output before performing a complete shutdown.

4.1.5 EPO (Emergency Power OFF)

By pressing the EPO button, the device respectively turns the rectifier, the booster and the inverter OFF. If the output breaker turn off option is set, the UPS completely disconnects from the system.



10-15-20-30-40KVA



60-80-100-120KVA

4.1.6 RS232 Serial Communication Installation and Investigation

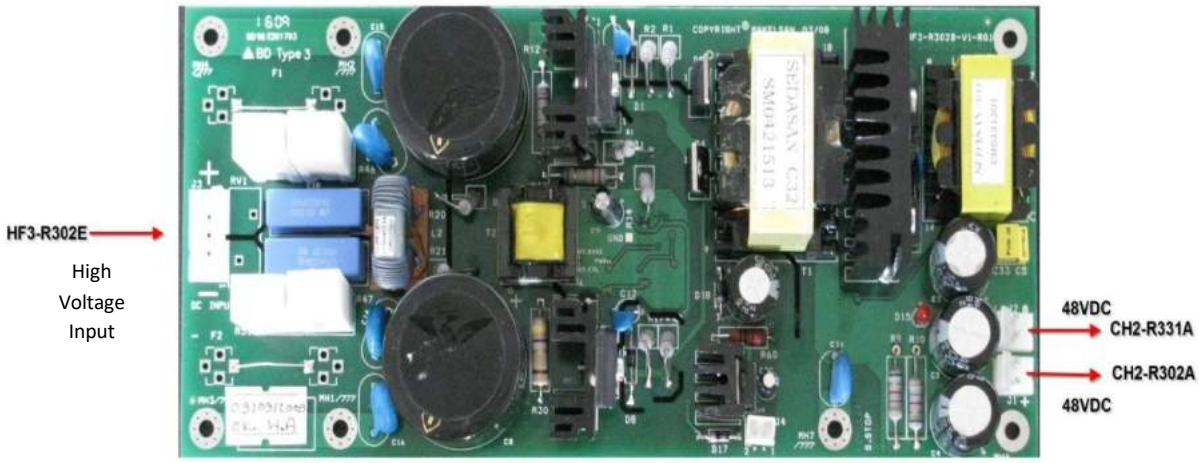
IST5 series has an RS-232 interface which supports SEC and TELNET protocol as standard. This interface is fully isolated and safe. UPS can be monitored remotely via a computer (PC) or SNMP by using this protocol. This connection works with all kinds of options.

5 ELECTRONIC BOARDS

5.1 High Voltage DC to DC SMPS

High voltage coming from HF3-R302E card goes to J3 socket and leaves as 48VDC from J1 and J2.

High Voltage DC to DC SMPS



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

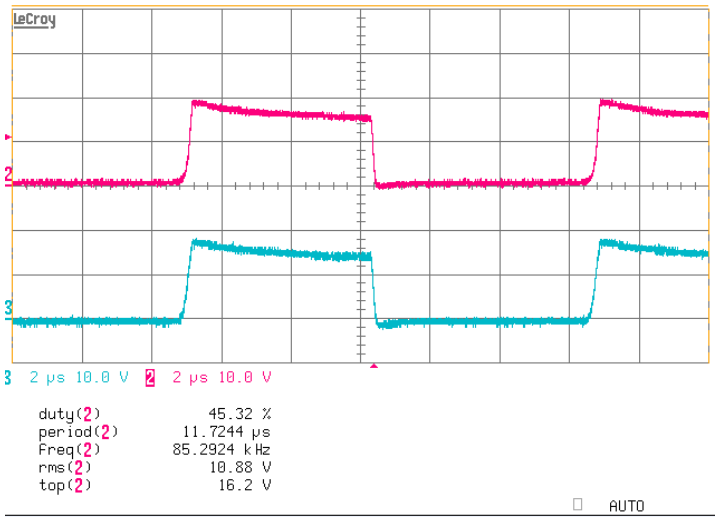
- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

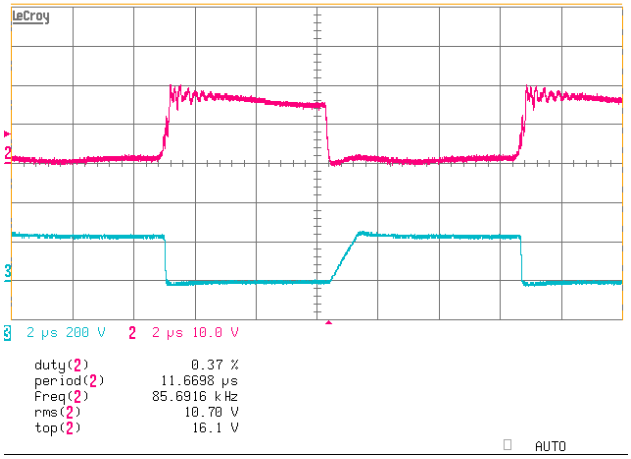
➢ Electrical Tests:

1. DC 0-900V supply is connected to J3
2. R60 resistance is connected to DC voltmeter.
3. In second channel of oscilloscope, negative side of probe is connected to number 3 of Q3 and positive side is connected to number 1 by isolated probe.
4. In third channel of oscilloscope with isolated probe, negative side of probe is connected to number 3 of Q1; positive side is connected to number 1. Volt/Div=10V Offset=-20 are all set. Trigger is set to channel 2 and the slope step should be pos/time.
5. Number 1 of J4 socket is applied to zero; number 2 is applied to 15VDC.
6. Under these conditions, the oscilloscope can be seen as follows.

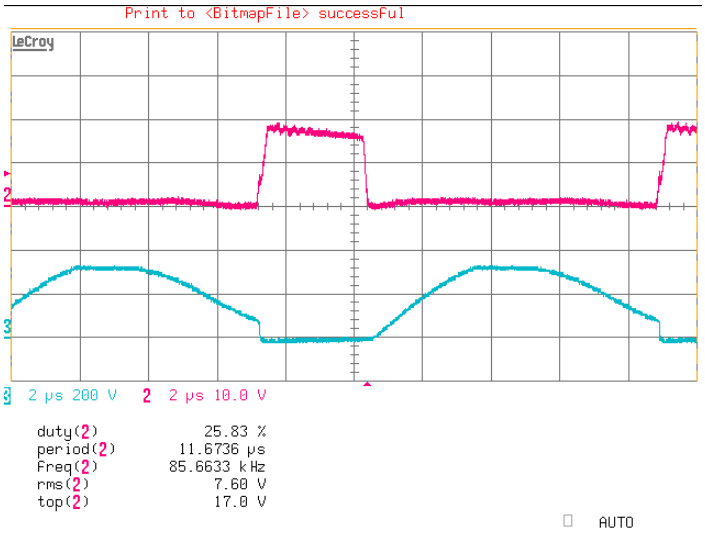


7. Two signals should be seen as 85±%5 KHz frequency. Voltage should not be spiked in both signal fluctuating edges. Signal peaks should not be passed 18V.
8. In third channel of oscilloscope with isolated probe, negative side of probe is connected to number 3 of Q1; positive side is connected to number 2. Volt/Div=200V Offset=-600 are all set. Trigger is set to channel 2 and the slope step should be pos/time.
9. Number 1 of J1 socket is connected to negative side of measuring device, number 2 is connected to positive side of measuring device.
10. Positive side of the other measuring device is connected to jumper on F1; negative side is connected to jumper on F2.

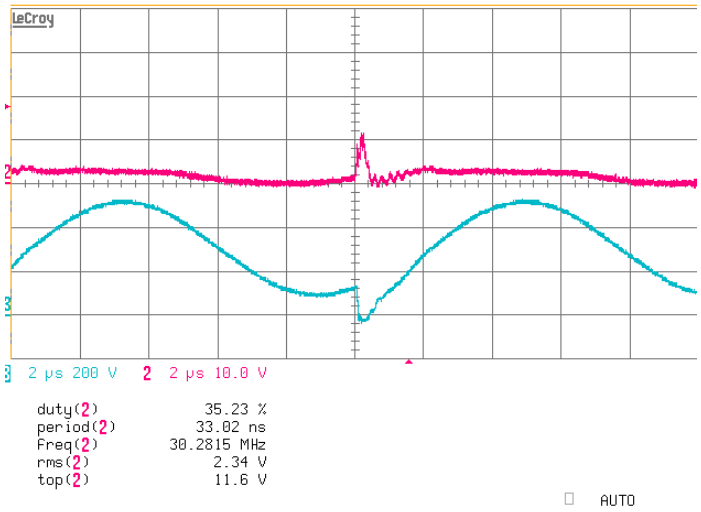
11. DC supply is increased by 20 in V steps. Current is not withdrawn from DC supply, output voltage is increasing gradually.
12. Signals can be observed in the oscilloscope. The signals in the channel 2 are stable, signals in the channel 1 can be seen as increased gradually in the following picture.



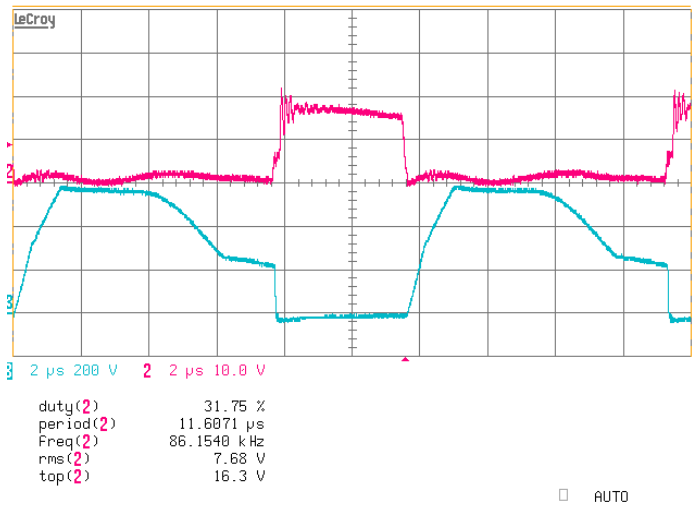
13. If incoming voltage is 250V, output voltage, 48V is regulated and signal changes can be observed during the regulation in the following picture.



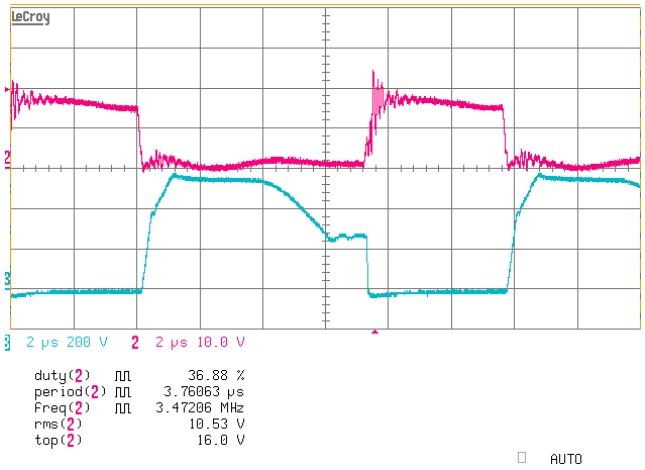
14. Input voltage is continued to be increased in this point. When it reaches to 550V, output voltage becomes 48V±%2. Signals in the oscilloscope can be seen in the following picture.



15. J1 socket can be loaded with 100Ω 23W (0,5A) resistance. Signals in the oscilloscope can be seen in the following picture.



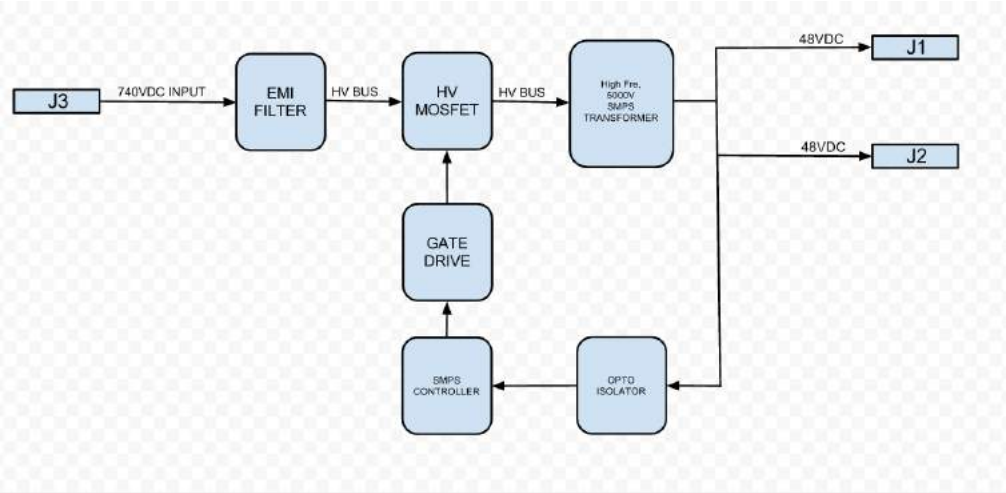
16. Please pay attention that voltage spikes should not be happened on the signals. The peak signal in the channel 1 should not pass 20V, the peak signal in the channel 2 should not pass 600V.
17. 15V supply should be from J4 socket.
18. 0-900VDC supply is increased by 50V. Once it reaches 250VDC, output voltage should be 27VDC±%2, input should not be passes 200Ua from DC supply and D15 LED becomes ON. The measuring device on R60 is seen as 12V±%2 or above.
19. Incoming voltage set to 550V. It is loaded by resistance 24Ω 100W (2A) from J1 socket. The signals can be seen in the following picture. Voltage spikes should be occurred and output voltage should be observed as 48V±%2 and above.



20. Input voltage is set to 700V. It is loaded by resistance 24Ω 100W (2A) from J1 socket. Output voltage should be observed as 48V±%2 and above.
21. Wait for a moment as DC supply is turned off. After unloading the capacitors in the circuits, DC supply and remove the components in the board.

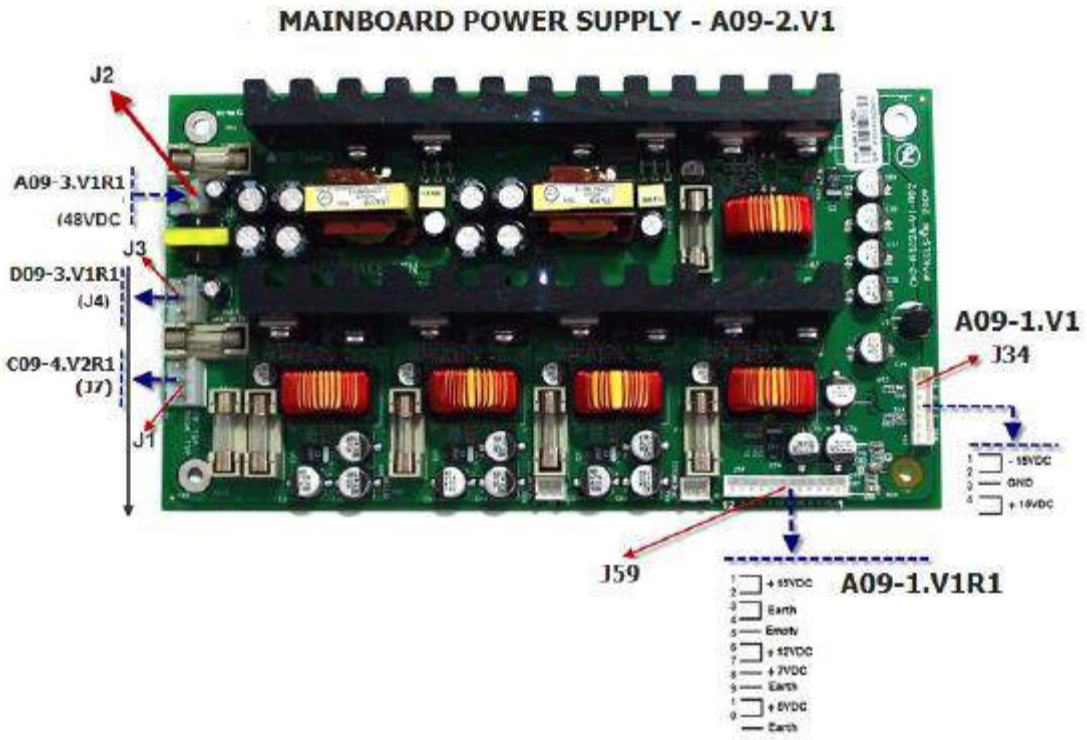
After completing the test by running all the functions, the board should be labelled and stored in available conditions.

Signal Flow Diagram



5.2 Main Board Power Supply

This board provides 48VDC which supplies the main board and current transformers.



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

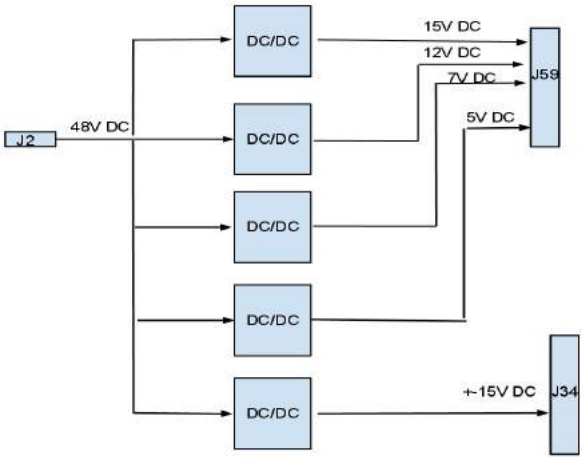
➢ Electrical Tests:

1. Power supply is set to series mode. Each channel is set to +24V and as a total of 48V.
2. 48V is applied from J2 socket.
3. Available fuse is chosen for F1 fuse holder which is defined in GENERAL MATERIAL LIST.
4. 48V is applied by turning on the power supply. By observing, the current is not withdrawn from power supply.
5. Number 1 of J3 socket is the ground of measuring device, number 2 is the active point of measuring device. DC24V±%2 is measured.
6. Number 1 of J3 socket is the ground of measuring device, number 3 is the active point of measuring device. DC24V±%2 is measured.
7. Number 1 of J1 socket is the ground of measuring device, number 2 is the active point of measuring device. DC24V±%2 is measured.
8. Number 1 of J1 socket is the ground of measuring device, number 3 is the active point of measuring device. DC24V±%2 is measured.
9. 3A is withdrawn from number 1 and 2 of J3 socket by 8Ω 71W load. Number 1 and 2 points are measured as DC24V±%3.
10. 3A is withdrawn from number 1 and 2 of J1 socket by 8Ω 71W load. Number 1 and 2 points are measured as DC24V±%3.
11. Number 4 of J3 socket is the ground of measuring device, number 1 is the active point of the measuring device. Number 2 of F8 fuse is applied to +24VDC from the 0-24V point of power supply. Approximately 20mA is withdrawn and D19 LED is ON. Number 1 and 4 from J34 socket has 15VDC±%2.
12. If number 1 and 4 of J34 socket are loaded as 15Ω 15W, DC 15V ±%3 can be measured.
13. Number 4 of J3 socket is the ground of measuring device, number 7 is the active point of the measuring device. Number 2 of F8 fuse is applied to +24VDC from the 0-24V point of power supply. Approximately 20mA is withdrawn and D19 LED is ON. Number 4 and 7 from J34 socket has 15VDC±%2.
14. If number 4 and 7 of J34 socket are loaded as 15Ω 15W, DC 15V ±%3 can be measured.
15. Available fuse is chosen for F8 fuse holder which is defined in GENARAL METARIAL LIST.
16. If number 1-4 and number 3-4 of J59 socket are loaded as 1,67Ω 15W, DC 15V±%2 can be measured.
17. Number 2 of F6 fuse is applied to DC +24V from 0-24V point of power supply. After the procedure, D21 LED is ON. Number 3-4 of J59 is measured as ground of measuring device; number 10-11 is measured as active point of the device.
18. If number 1-4 and number 3-4 of J59 socket are loaded as 1,67Ω 15W, DC 15V±%2 can be measured.
19. The fuse is inserted in F6 fuse holder as definer in GENERAL MATERIAL LIST.
20. Number 2 of F5 fuse is applied to DC +24V from 0-24V point of power supply. After the procedure, D20 LED is ON. Number 3-4 of J59 is measured as ground of measuring device, number 8 is measured as active point of the device. DC 7V±%2 is measured.

21. If number 3-4 and number 8 of J59 socket are loaded as 3,5Ω 14W, DC 7V±%3 can be measured.
22. The fuse is inserted in F5 fuse holder as definer in GENERAL MATERIAL LIST.
23. Number 2 of F7 fuse is applied to DC +24V from 0-24V point of power supply. After the procedure, D22 LED is ON. Number 3-4 of J59 is measured as ground of measuring device; number 6-7 is measured as active point of the device. DC 12V±%2 is measured.
24. If number 3-4 and number 6-7 of J59 socket are loaded as 6Ω 24W, DC 12V±%3 can be measured.
25. The fuse is inserted in F3, F4, F7 fuse holder as definer in GENERAL MATERIAL LIST.

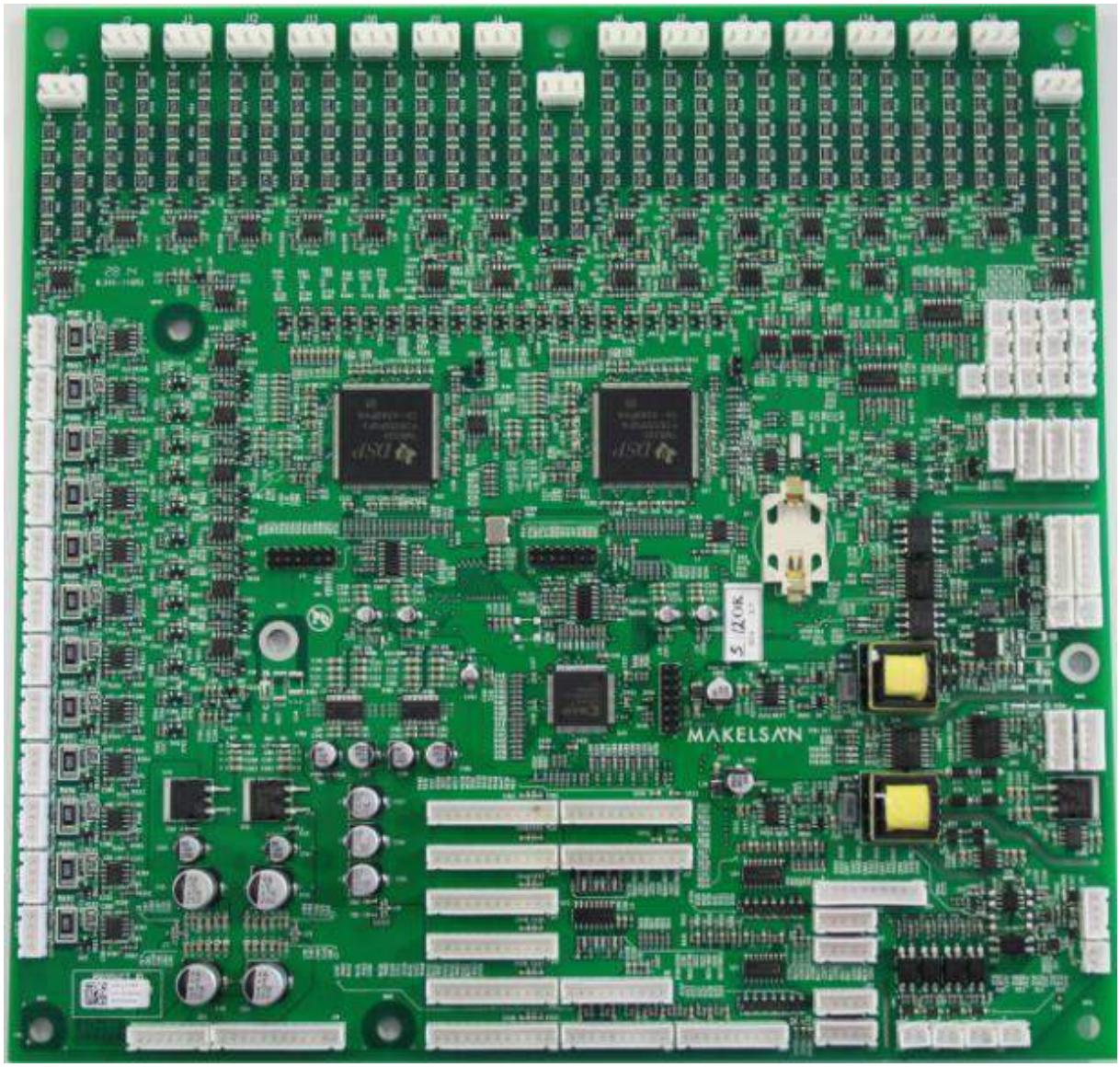
After completing the test by running all the functions, the board should be labelled and stored in available conditions.

Signal Flow Diagram



5.2 Main Board

This board controls all the operations of the UPS. Not only the basic function like start/stop, it also monitors the changes that occur in UPS operational modes, evaluation of the sampled parameters of the UPS and according to that produces various control signals changing the UPS parameters.



***Type of IST5 main boards

A13-1.V1 MAIN BOARD 3L	Control board
A13-1.V2 MAIN BOARD 3L	10KVA
A13-1.V3 MAIN BOARD 3L	15KVA
A13-1.V4 MAIN BOARD 3L	20KVA
A13-1.V5 MAIN BOARD 3L	30KVA
A13-1.V6 MAIN BOARD 3L	40KVA
A13-1.V7 MAIN BOARD 3L	60KVA
A13-1.V8 MAIN BOARD 3L	80KVA
A13-1.V9 MAIN BOARD 3L	100KVA
A13-1.V10 MAIN BOARD 3L	120KVA
A13-1.V12 MAIN BOARD 3L	160KVA

Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

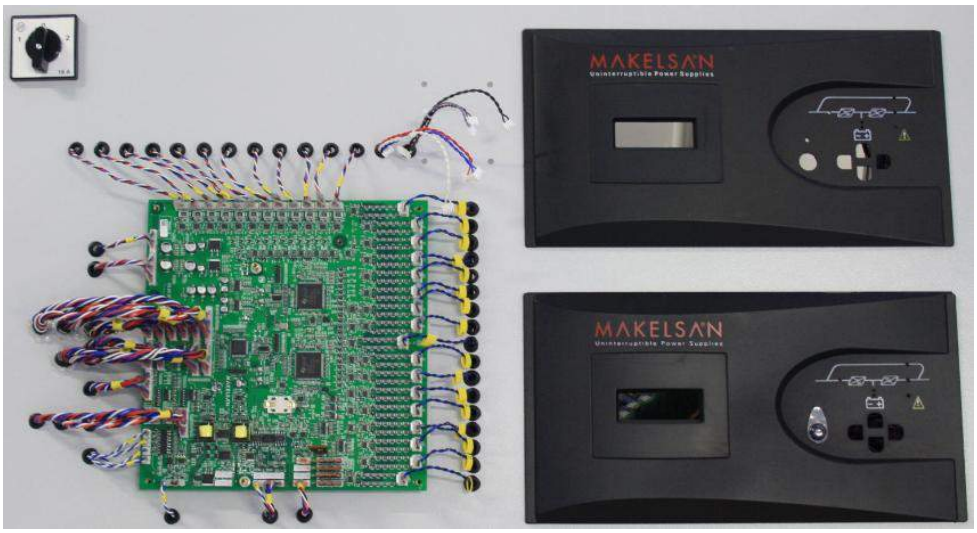
- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

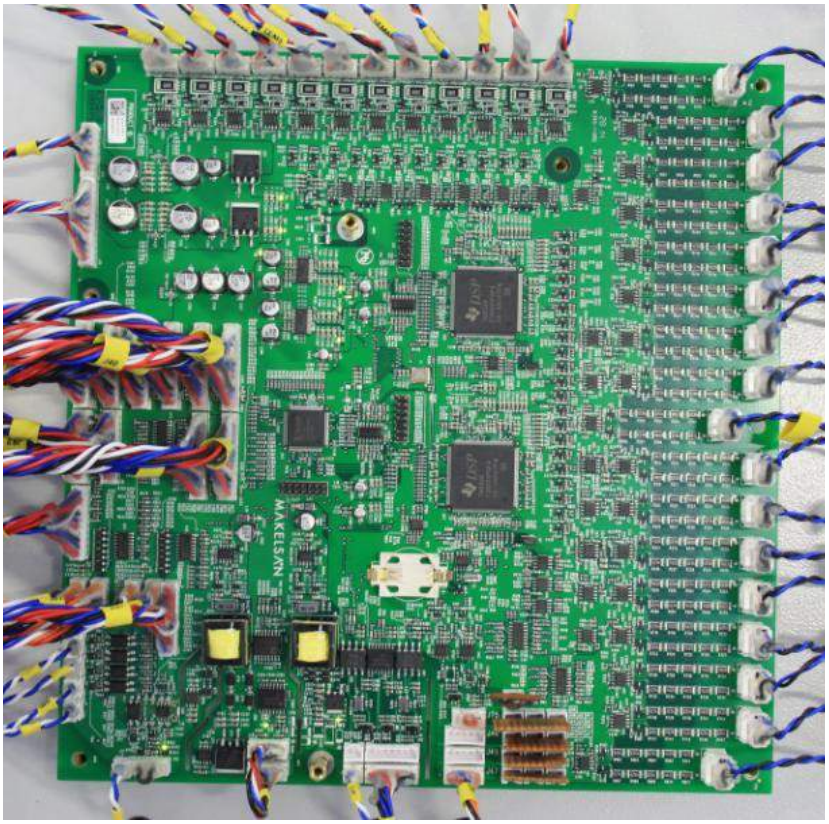
Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

➢ Electrical Tests:

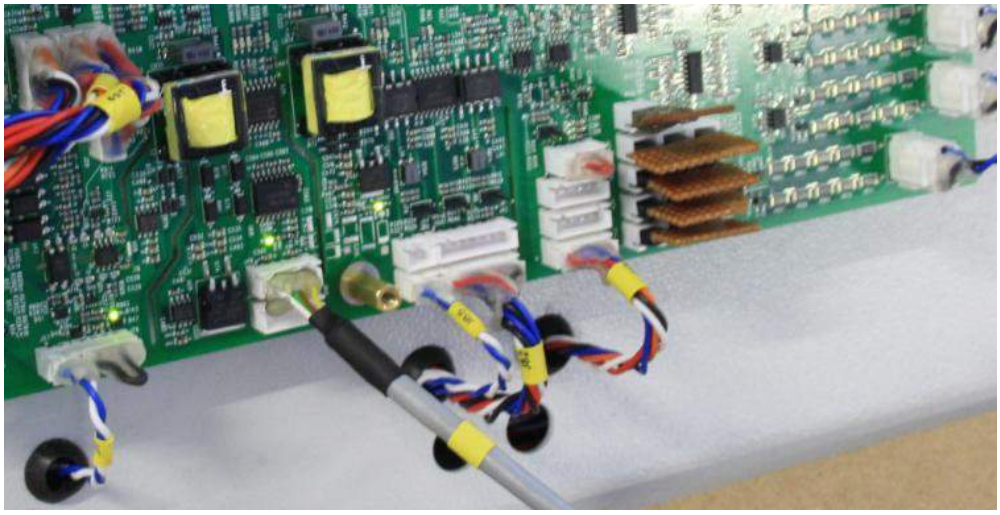
1. Main board which is connected to testing board can be seen in the following picture.



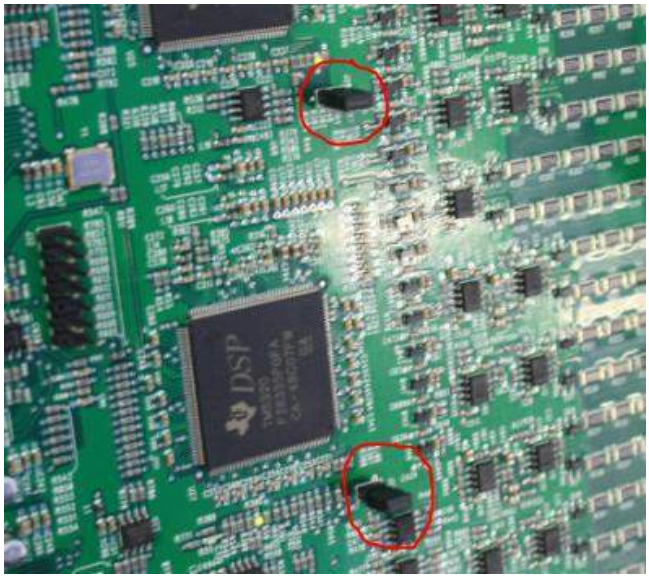
2. Main board and testing board connections can be seen in the following picture.



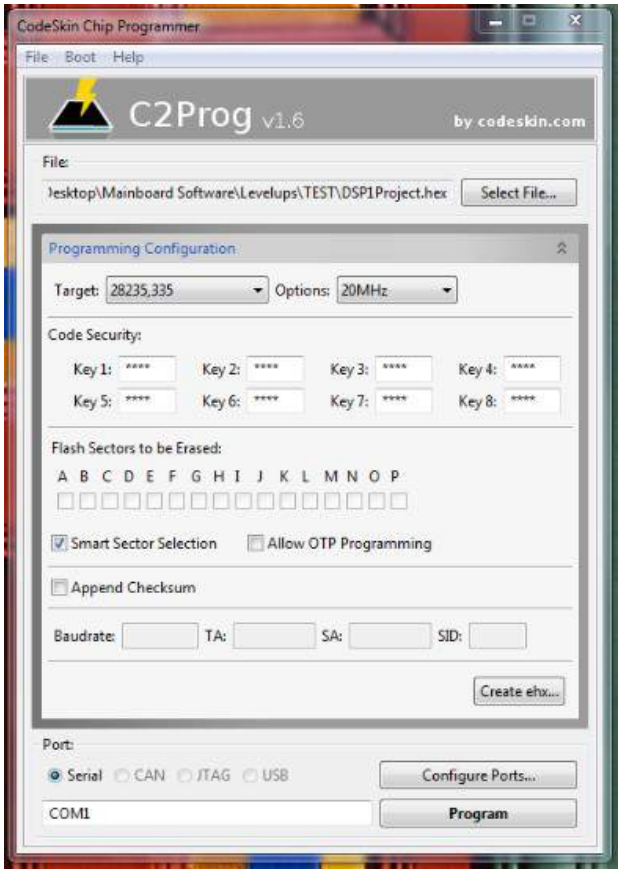
3. Should install the testing software for testing the main board.
    - Program is downloaded via J48, j49 and DSP1, DSP2 connections.



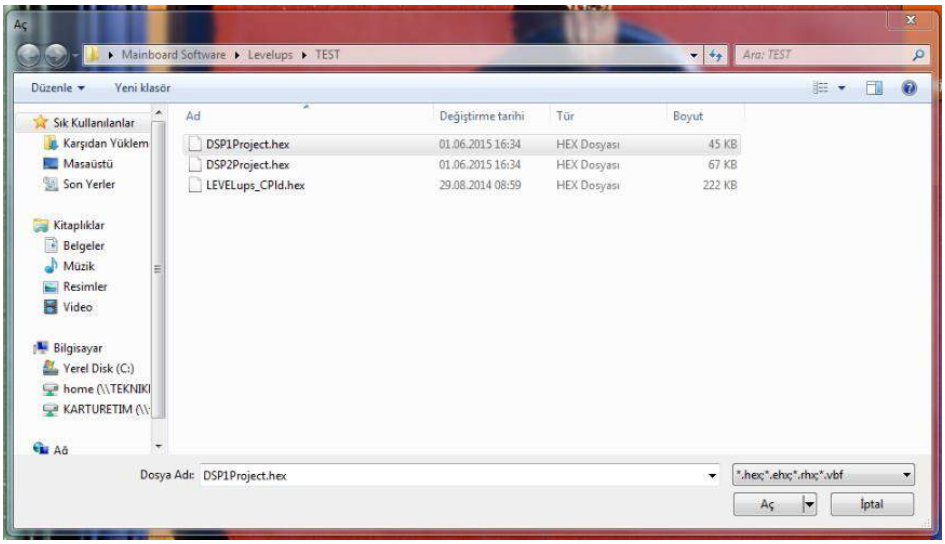
- J20 and J21 jumpers should connect for install the software.



4. Computer interface for installing the software from J48 and J49 connections as below.

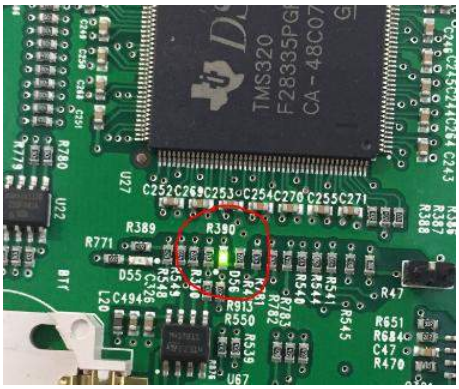


5. Selected the DSP1Project.hex and install the software from J49 to DSP1.



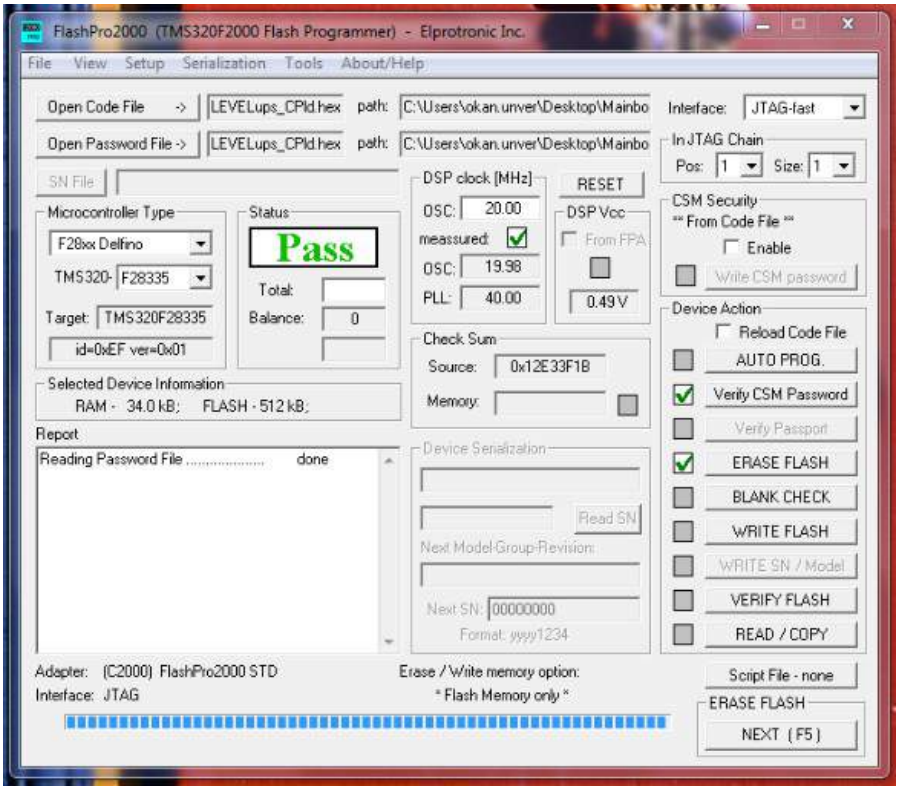
6. IST5_CPId.hex software installed to J48

7. Cut off the energy and take out J20-J21 jumpers and then energised again. Should seen the flashing of D56 LED.

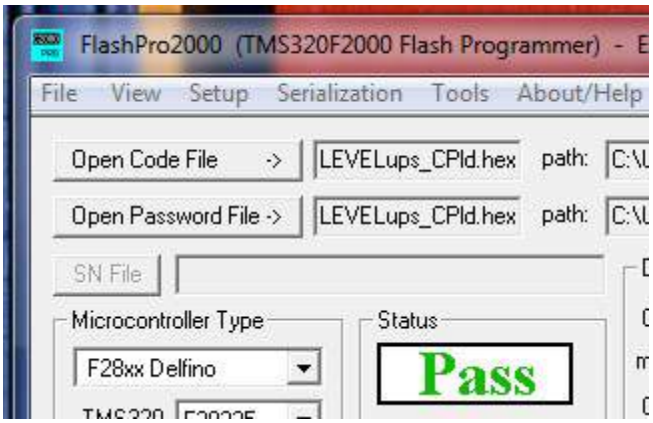


8. Cut off the energy again then connect J20-J21 jumper.
9. Emulator is connected to J32 as following picture.

10. Energised again and delete the DSP2 software from the following computer interface picture.

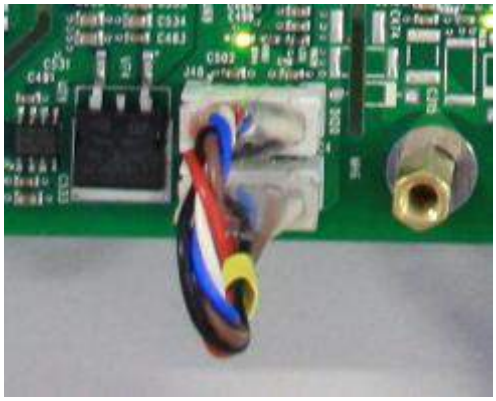


11. Select IST5_CPId.hex via Open Code File and Open Password File

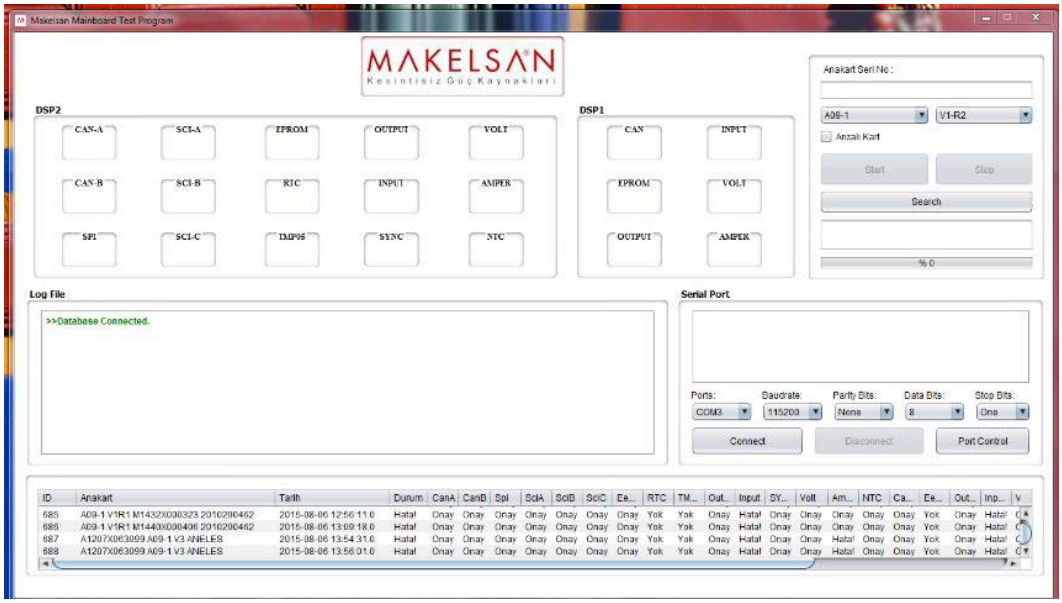


12. Click the ERASE FLASH
13. After that cut off the energy and then install DSP2Project.hex software from J48

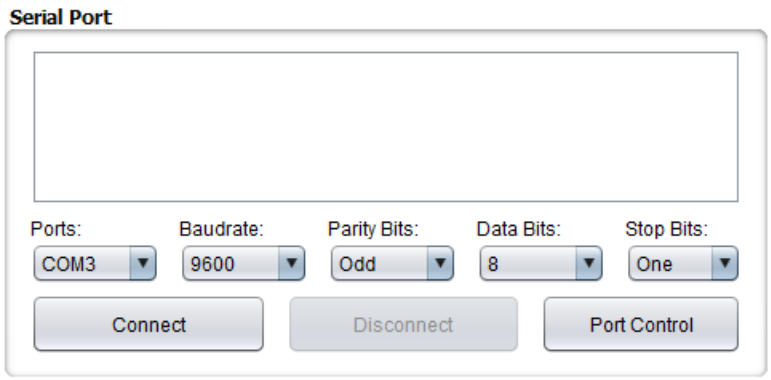
14. J48 and J49 connected each other and take out the J21 jumper.



15. Energised the circuit and open the following computer interface.

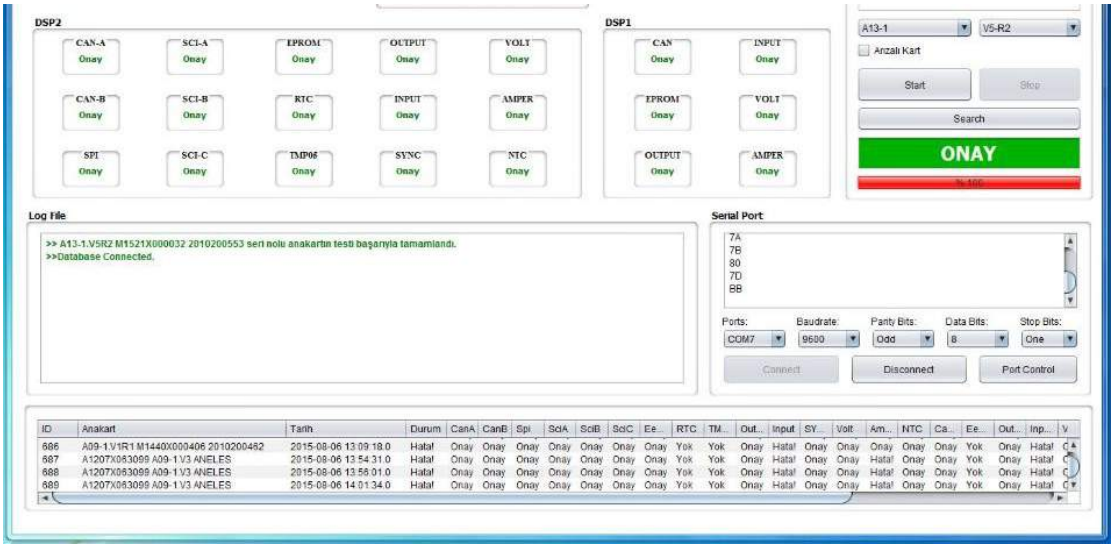


16. Chose serial connection values as following picture.



17. Read the main boards barcode and chose boards type. In that way completed main board pre test procedure.
18. Start the board test

19. If board is reliable than software will accepted the board as following picture.

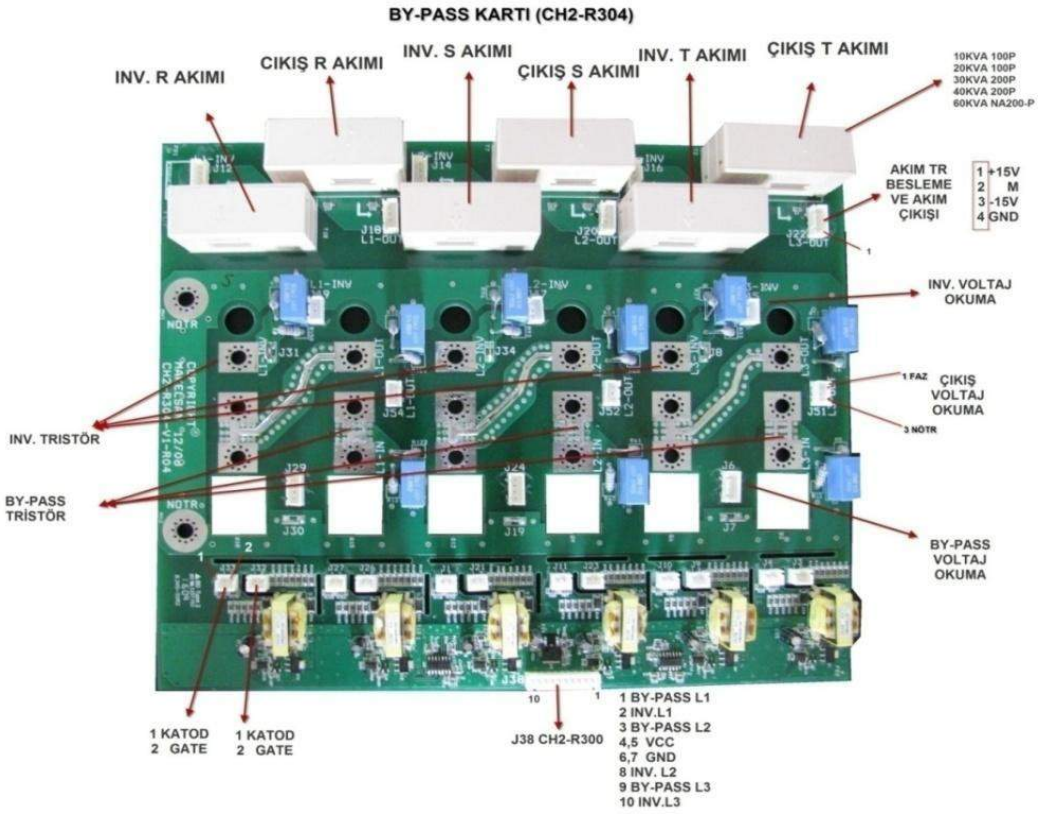


20. After completing the test by running all the functions, the board should be labelled and stored in available conditions.

5.4 By-pass Board

By-pass board is controlled by the main board. This is the board that drives by-pass thyristor and by-pass inverter thyristor. By-pass voltage and current and also inverter voltage and current readings can be done by the by-pass board.

10-60KVA



80-300KVA

Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope
- Adjusted DUTY ratio function generator
- Thermal camera(preferably able to transfer image to the computers

➢ Preparation before the Test:

Required thyristor and connection cables should be there for gate outputs

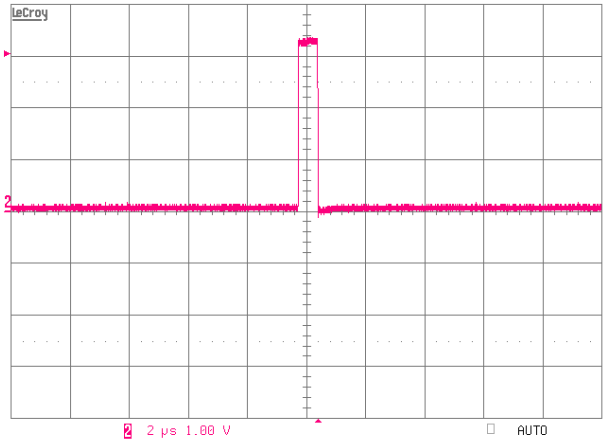
➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

➢ Electrical Tests:

1) Power Supply sets to **INDEP** (Two channels should be adjusted separately.) First channel is set to 12Vdc

2) Output of function generator should be set by 16 kHz %50 Duty and able to produce square wave signal. Adjusted signal should start from 0V and peak value should be 3,3V. (See Picture1)



Picture 1

3) In the beginning, function generator and power supply should be OFF. Power supply always turned on first and then function generator is turned on. For switching off, vice versa should be applied, function generator is first and then power supply.

Note: Function generator should not be switched on/off from power switch. Switch should be connected to output J2 socket at the positive side.

4) The feeding voltage is applies as follows: pin 4-5 of J38 socket is connected to +12V, pin 6-7 is connected to GND.

5) Number 3 of U2 regulator integration should be measured as +12V.(against GND)

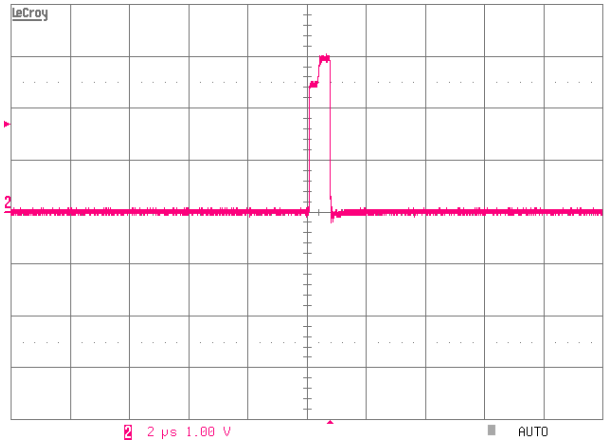
6) Number 2 of U2 regulator integration should be measured as +5V.(against GND)

7) Thyristor J3 and J4 connection points should be connected the board before the test.

8) Adjusted PWM as in the second article is applied to number 1 of J38 socket by function generator.

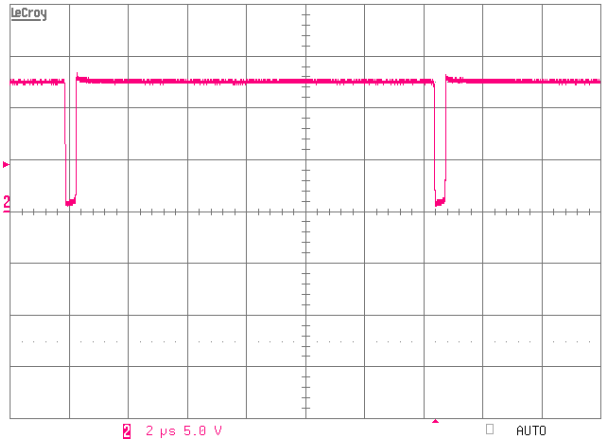
9) D2 LED is **ON** after these steps.

10) The signal should be seen in the number 4 of U1 integration as shown below (against GND)(See Picture 2)



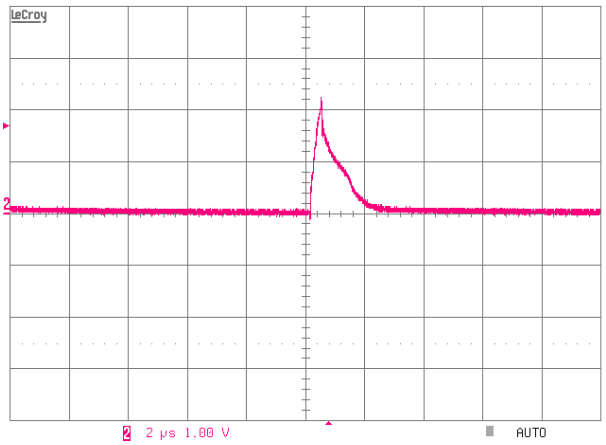
Picture 2

11) The signal should be seen as below in the number 2 of Q2 transistor. (See Picture 3)



Picture 3

12) The signals should be measured in the order of J3 and J4. Pin 1 of sockets are negative(-) and pin 2 of sockets are positive. Probes of the oscilloscope should be polarized according to this statement. (See Picture 4)



Picture 4

13) Thyristor J9 and J10 connection points should be connected the board before the test.

14) Adjusted PWM as in the second article is applied to number 2 of J38 socket by function generator.

15) D7 LED is ON after these steps.

16) The signal should be seen in the number 8 of U1 integration as above. (against GND) (See Picture 2)

17) The signal should be seen in the number 2 of Q4 transistor as above. (See Picture 3)

18) The signals should be measured in the order of J9 and J10. Pin 1 of sockets are negative(-) and pin 2 of sockets are positive. Probes of the oscilloscope should be polarized according to this statement. (See Picture 4)

19) Thyristor J11 and J23 connection points should be connected the board before the test.

20) Adjusted PWM as in the second article is applied to number 3 of J38 socket by function generator.

21) D13 LED is ON after these steps.

22) The signal should be seen in the number 8 of the U1 integration. (against GND) (See Picture 2)

23) The signal should be seen in the number 2 of Q7 transistor as above.(against GND) (See Picture 3)

24) The signals should be measured in the order of J11 and J23. Pin 1 of sockets are negative(-) and pin 2 of sockets are positive. Probes of the oscilloscope should be polarized according to this statement. (See Picture 4)

25) Thyristor J1 and J25 connection points should be connected the board before the test.

26) Adjusted PWM as in the second article is applied to number 8 of J38 socket by function generator.

27) D18 LED is ON after these steps.

28) The signal should be seen in the number 4 of the U3 integration. (against GND) (See Picture 2)

29) The signal should be seen in the number 2 of Q10 transistor as above.(against GND) (See Picture 3)

30) The signals should be measured in the order of J1 and J21. Pin 1 of sockets are negative(-) and pin 2 of sockets are positive. Probes of the oscilloscope should be polarized according to this statement. (See Picture 4)

31) Thyristor J27 and J26 connection points should be connected the board before the test.

32) Adjusted PWM as in the second article is applied to number 9 of J38 socket by function generator.

33) D22 LED is ON after these steps.

34) The signal should be seen in the number 8 of the U3 integration. (against GND) (See Picture 2)

35) The signal should be seen in the number 2 of Q13 transistor as above.(against GND) (See Picture 3)

36) The signals should be measured in the order of J27 and J26. Pin 1 of sockets are negative(-) and pin 2 of sockets are positive. Probes of the oscilloscope should be polarized according to this statement. (See Picture 4)

37) Thyristor J33 and J32 connection points should be connected the board before the test.

38) Adjusted PWM as in the second article is applied to number 10 of J38 socket by function generator.

39) D28 LED is ON after these steps.

40) The signal should be seen in the number 10 of the U3 integration. (against GND) (See Picture 2)

41) The signal should be seen in the number 2 of Q16 transistor as above.(against GND) (See Picture 3)

42) The signals should be measured in the order of J33 and J32. Pin 1 of sockets are negative(-) and pin 2 of sockets are positive. Probes of the oscilloscope should be polarized according to this statement. (See Picture 4)

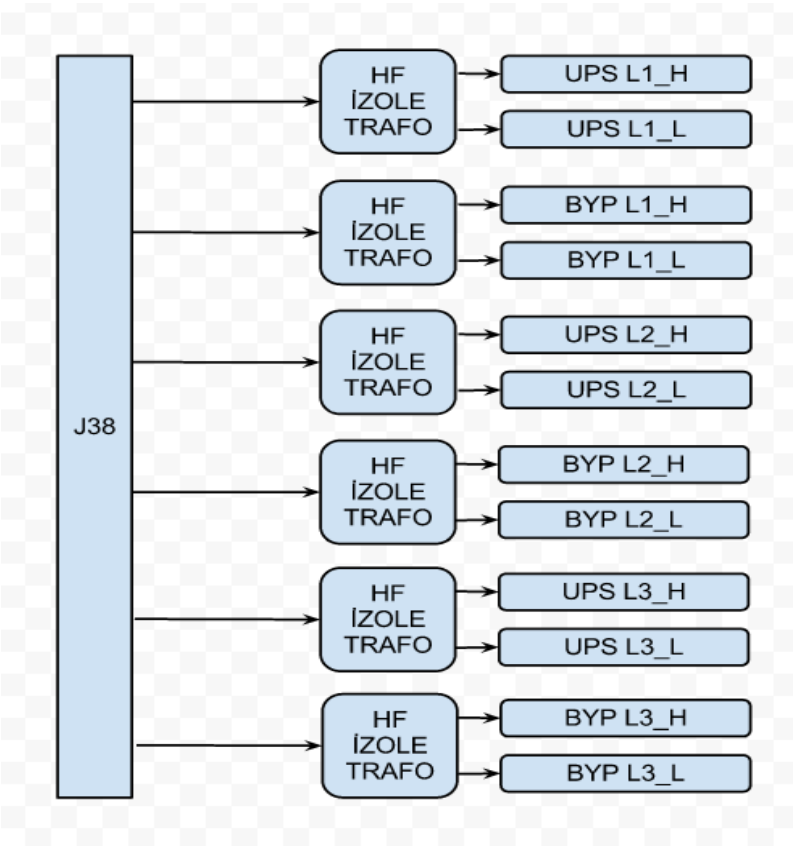
43) Once all the procedures are completed, the board should be inspected by thermal camera and check if there is any anormal

44) Two way current flow should be performed by current sensors. Before starting the test, the pin 1 of input socket should be connected by +15V and pin 3 is connected to -15V and pin 4 is connected to GND.

After completing the test by running all the functions, the board should be labeled and stored in available conditions.

Signal Flow Diagram

İzole trafo means isolated transformer



5.5 IGBT Driver Board

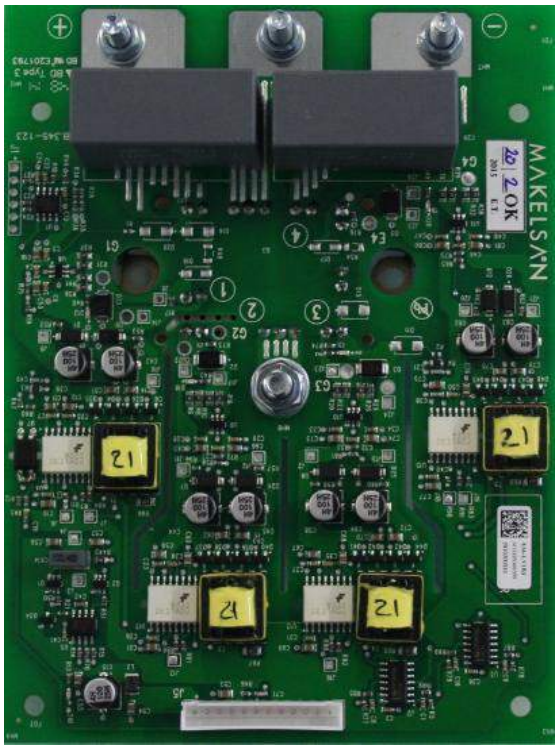
The Pulse Width Modulation signals obtained from the main controller board unit are transmitted to this board. These transmitted signals are transformed to suitable pulse width modulation signals for IGBTs.

In order to protect the IGBTs against over current fast monitoring and control is provided. This is accomplished by IGBT control logic available inside the hybrids over this board. In this part the transistor's collector-emitter voltage is continuously monitored and controlled.

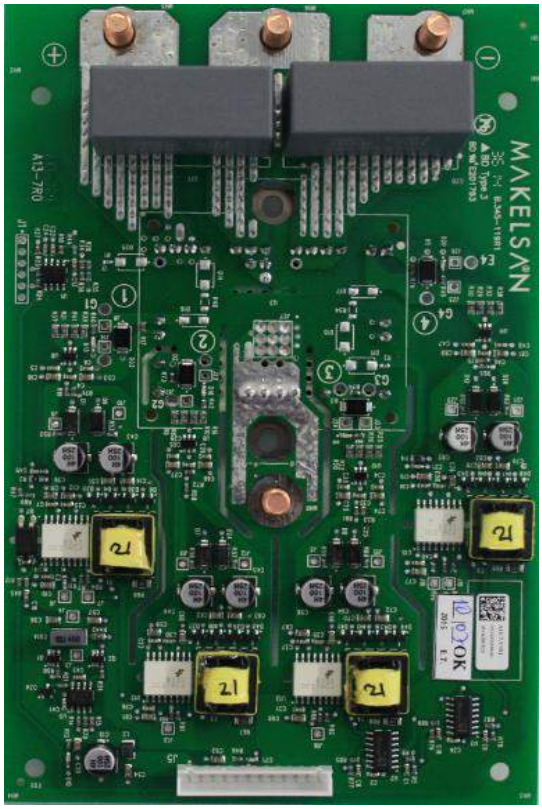
There are two drivers in the system. One of them is for the rectifier unit and the other one is for the inverter unit.

WARNING: Driver board differs depending on the IGBT used on the device. Check the version number before installing the board.

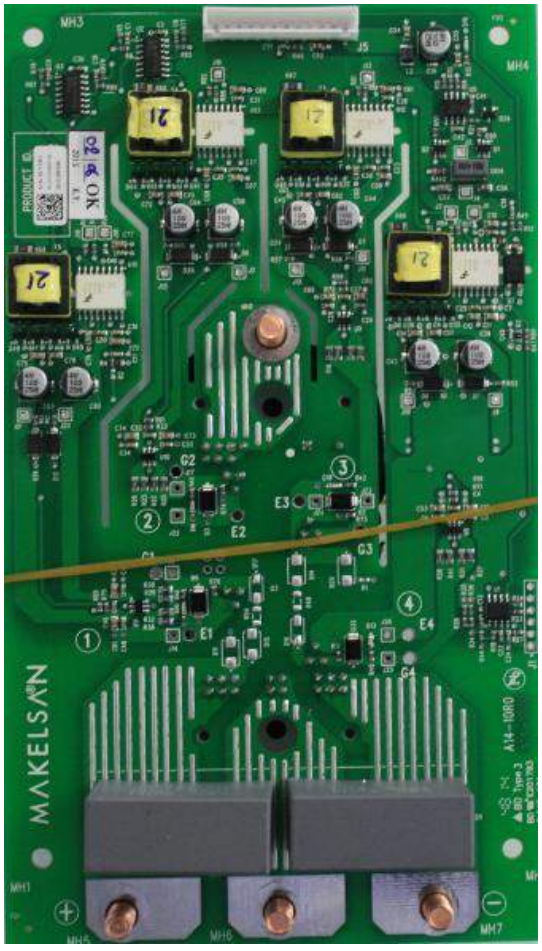
10-15KVA IGBT Driver



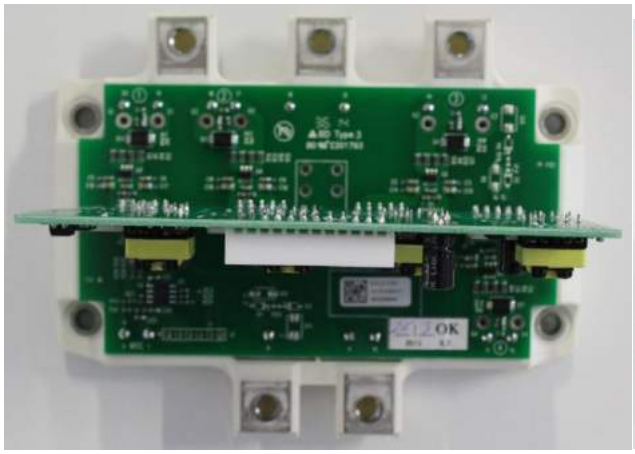
20-30KVA IGBT Driver



40KVA IGBT Driver



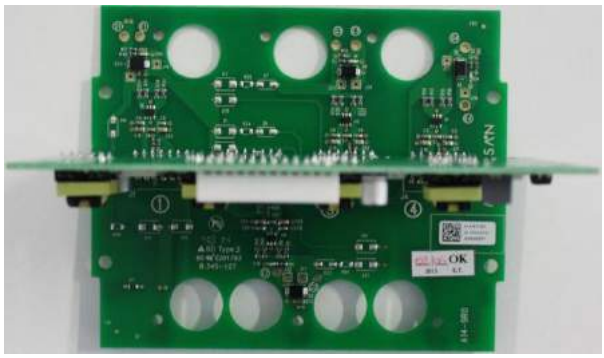
60-80KVA IGBT Driver



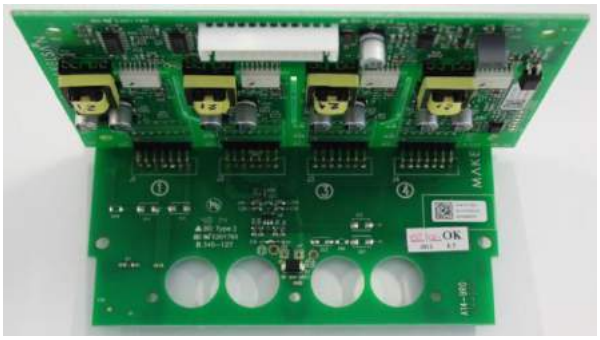
Up side view

Side view

100-120KVA IGBT Driver



Up side view



Side view

Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

- Adjusted DUTY ratio function generator
- Thermal camera(preferably able to transfer image to the computers

➢ Preparation before the Test:

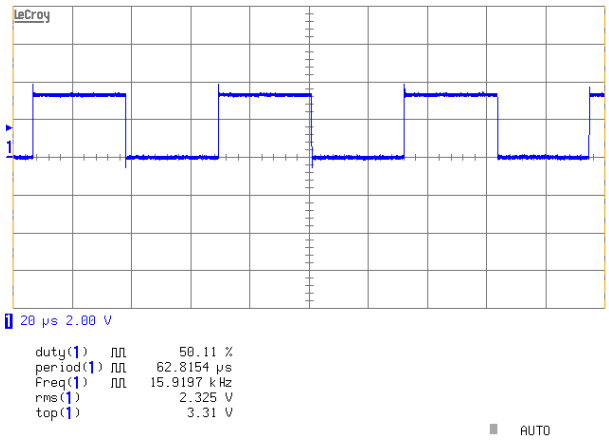
Required thyristor and connection cables should be there for gate outputs

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

➢ Electrical Tests:

1. Power Supply sets to **INDEP** (Two channels should be adjusted separately.) First channel is set to 15Vdc and 500mA.
2. Output of function generator should be set by 16 kHz %50 Duty and able to produce square wave signal. Adjusted signal should start from 0V and peak value should be 3,3V. The adjusted signal is called as PWM-1, The complement of this signal is called as PWM-2.



3. In the beginning, function generator and power supply should be OFF. Power supply always turned on first and then function generator is turned on. For switching off, vice versa should be applied, function generator is first and then power supply.

   Note: Function generator should not be switched on/off from power switch. Switch should be connected to output J2 socket at the positive side.

4. C09-1.V4 board J2 socket connection should be performed as in the following table.

1	N/C
2	GND-Pwm
3	PWM-1
4	N/C
5	N/C
6	N/C
7	N/C
8	PWM-2
9	GND-Pwm
10	N/C
11	+15Vdc
12	GND-Power

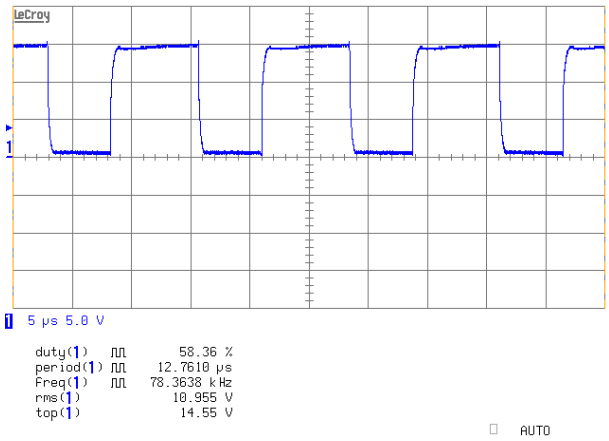
Table 1

5. **C09-2.V1** board should be assembled into **C09-1.V4** and not be affected from vibration by strengthening the connection.

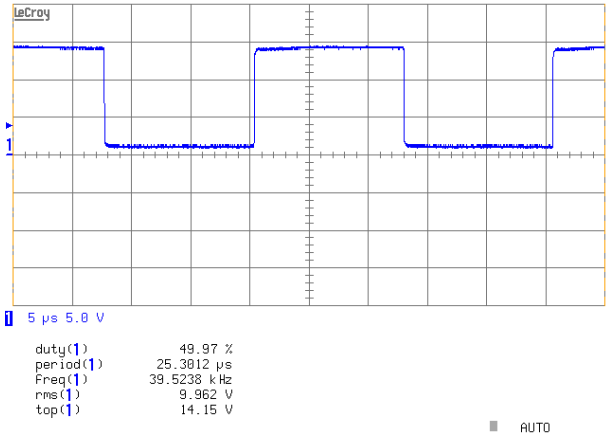
6. PWM signals and feeding voltage in the **Table 1** should be applied to the C09-1.V4 board. (First feeding voltage and PWM signals should be applied.)

7. D9,D14,D15 LED on the C09-1.V4 board and D2 LED on the C09-2.V1are all **ON**.

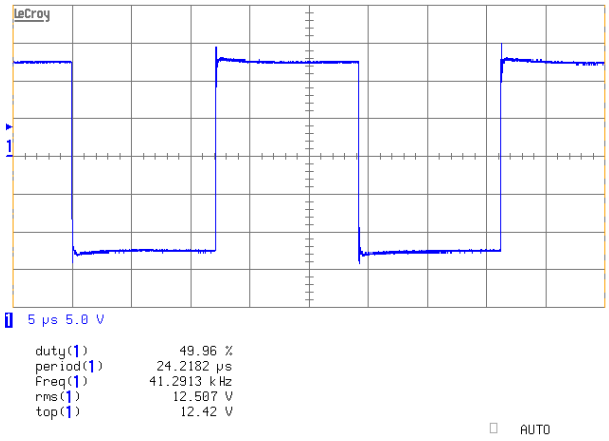
8. The signal should be as follows at the pin 4 of the U3 integration



9. The signal should be seen as follows at the pin4 of the U4 and U6 integration.(against GND-Power)

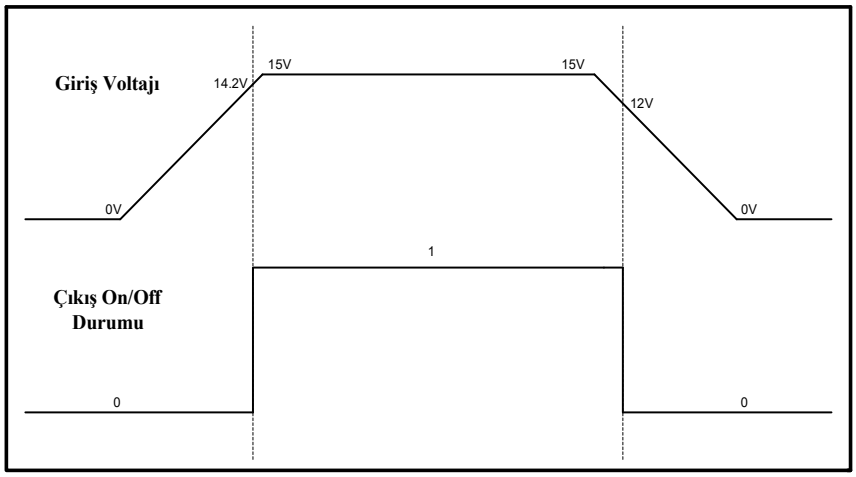


10. The signals at the pin 5 and pin 6 in the transformer T1.



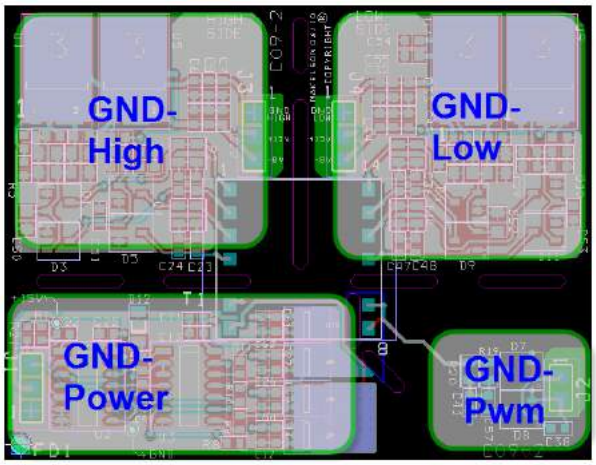
11. Pin 3 of the U1 integration should be +15.5Vdc, pin 2 should be observed as 19.5Vdc. (against GND-High)
12. Pin 3 of the U5 integration should be +11.5Vdc, pin 2 should be observed as 8Vdc. (against GND-High)
13. Pin 3 of the U7 integration should be +15.5Vdc, pin 2 should be observed as 19Vdc. (against GND-Low)
14. Pin 3 of the U9 integration should be +11.5Vdc, pin 2 should be observed as 8Vdc. (against GND-Low)
15. Pin 2 of the J2 header should be seen as +8.5Vdc.(against GND-Pwm)
16. The board should be tested for low voltage.

a) The feeding voltage of the board should be initiated from 0V and the board should be run in the 14.2V level.
b) The feeding voltage of the board should be decreased from 15V and board should be stop running at the level of 12V.

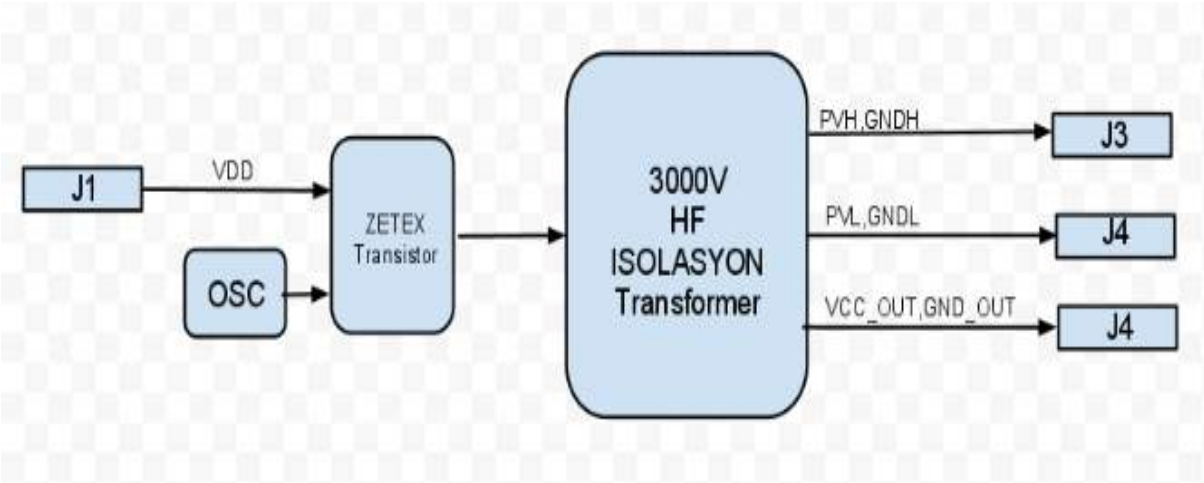


After completing the test by running all the functions, the board should be labeled and stored in available conditions.

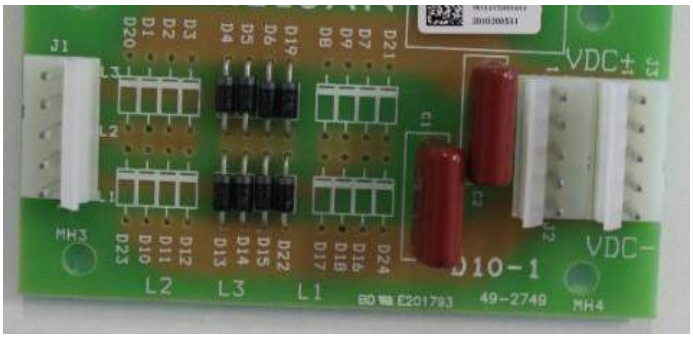
GND AREAS



Signal Flow Diagram



5.6 Relay Board



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

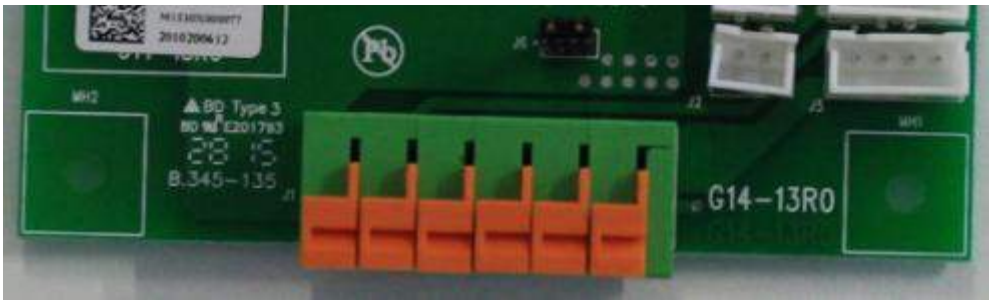
➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.7 EPO Board



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.8 Bridge Rectifier Board

Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

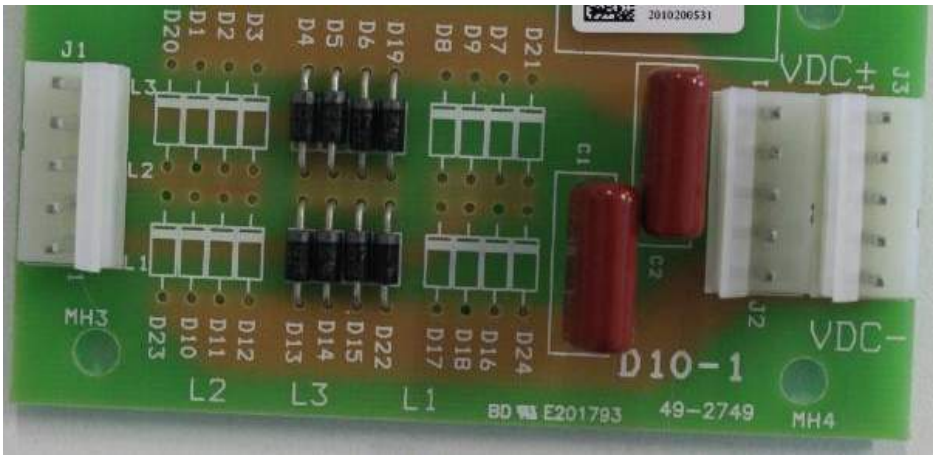
➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.9 DC Bus Feeding Board



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

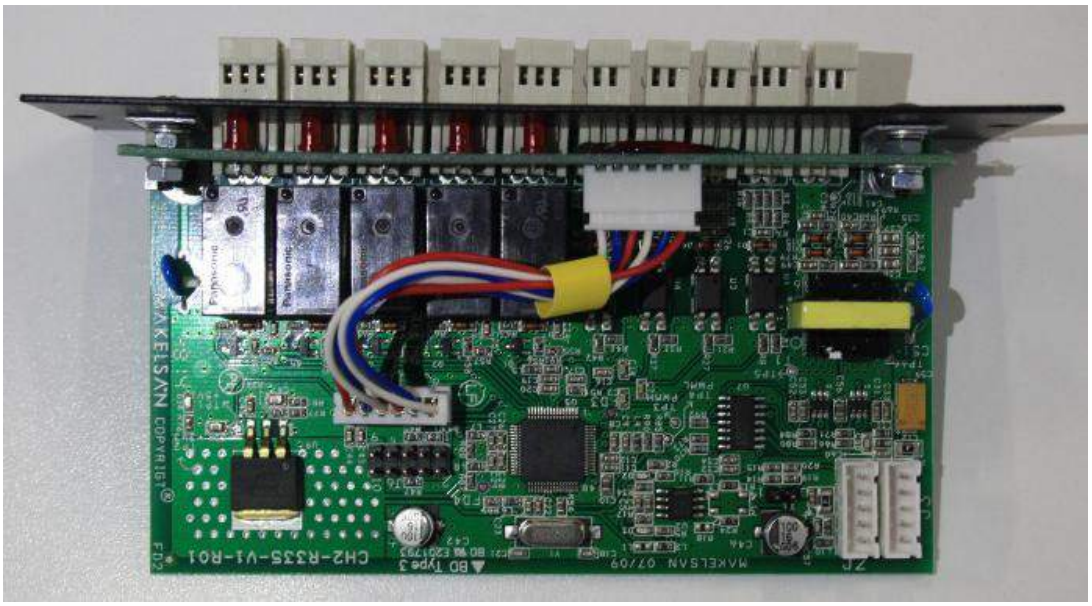
➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.10 Dry Contact Board



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

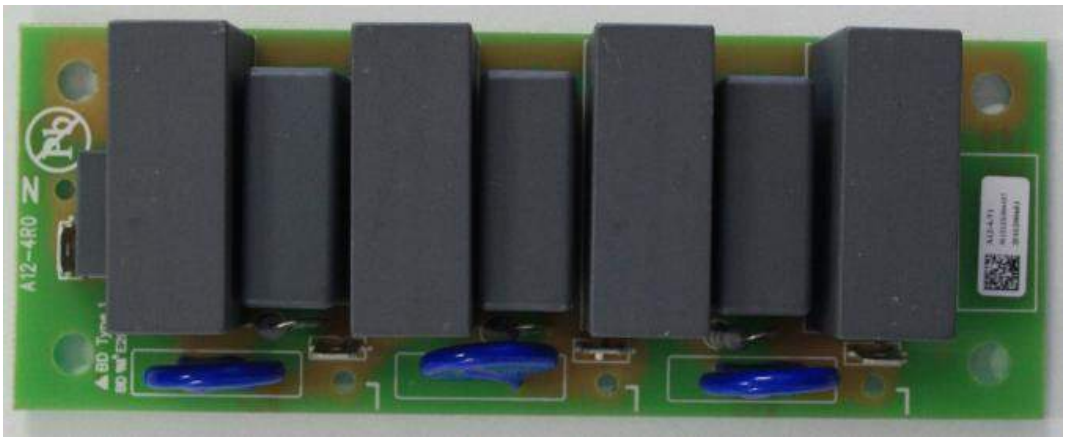
➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.11 EMI Filter Board



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.12 PFC Board

Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

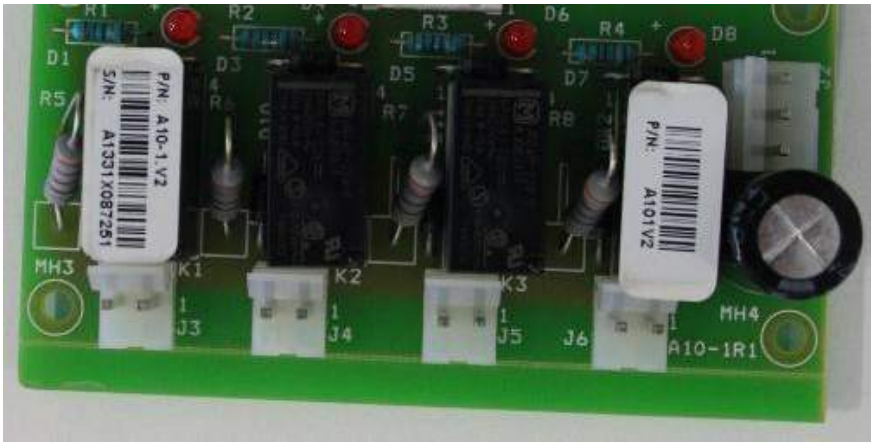
➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

5.13 Relay Board



Test Instruction:

- **PURPOSE**

Board should be tested by functionality.

- **EXECUTION**

Before the test, precaution should be performed for electrostatic protection. Without defined direction IPC-A-610D article 3(Protecting the Assembly-EOS/ESD and Other Handling Considerations) taken as a reference, ESD safety requirements should be provided.

➢ Required Test Equipments:

- Short circuit protected, constant current and voltage adjusted, series, parallel or individually runs and constant 5V double channel Linear DC Power Supply
- Measuring device for started conditions
- 200*1,3Mp digital microscope
- 3 channel isolated 1Ghz or any capable oscilloscope

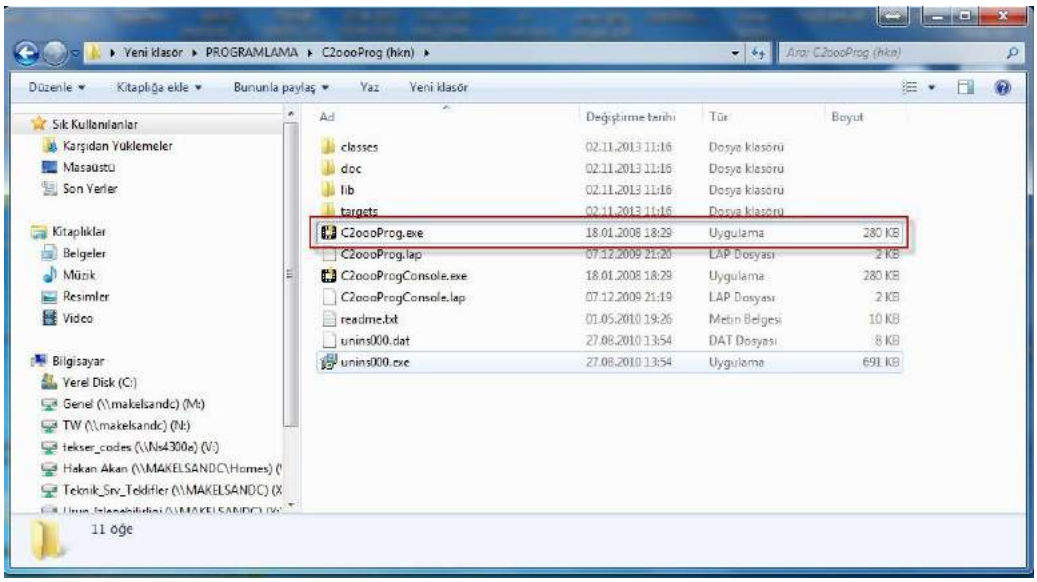
➢ Testing Board Physically:

Circuit components and PCB should be tested by physically and microscope and IPC-A-610D CLASS II criteria and assembly directions should be validated.
Bar-coding order should be controlled and validated.

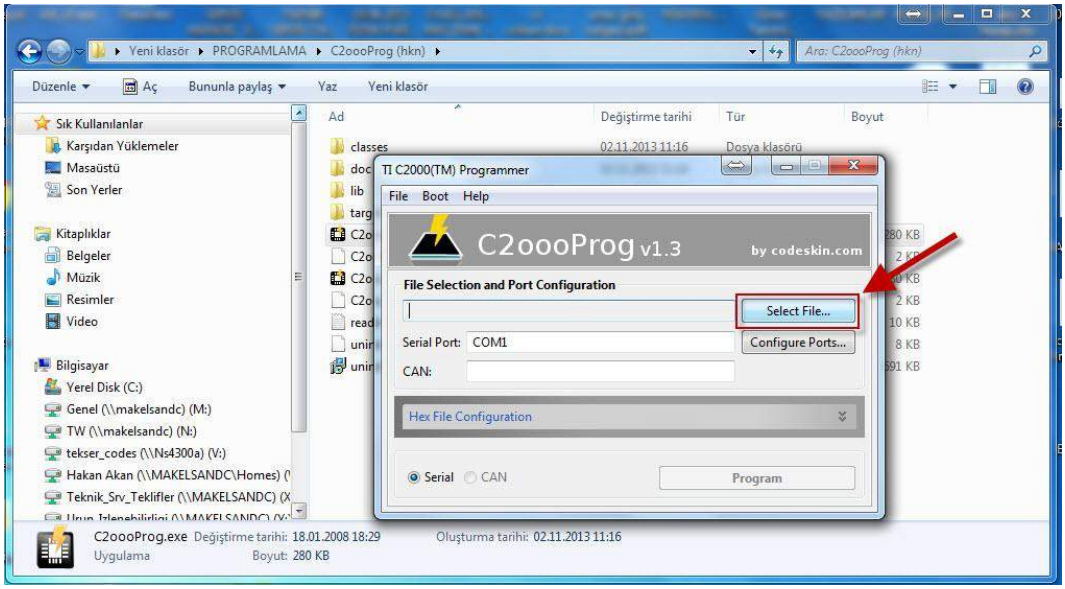
Batt. Capacity (Ah)	9	*Akü kapasitesi*
Batt. Paral. Arms	2	*Akü paralel kol sayısı*
Current Offset Lmt.	ENTER 'OK'	

6.3

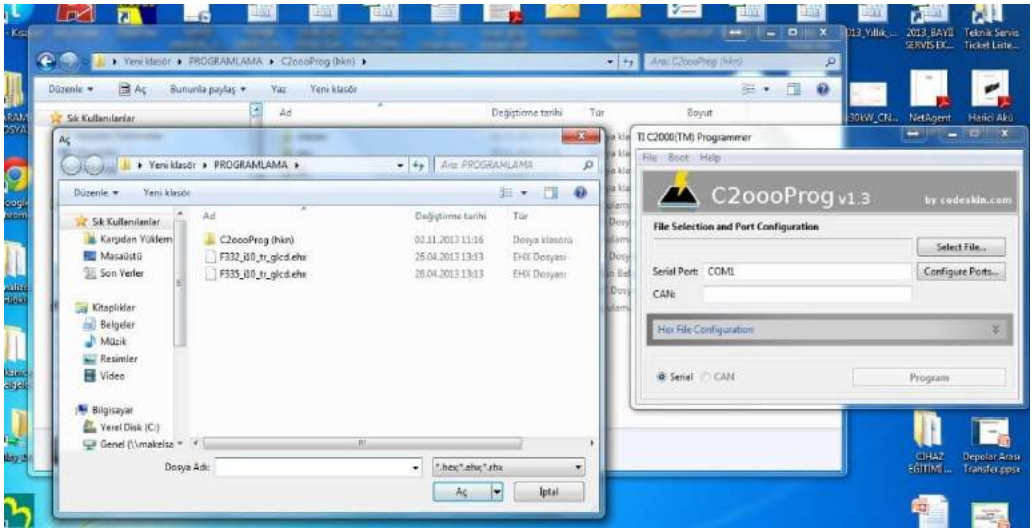
1) Make all the circuit breakers of UPS off. Drain DC bus energy.
2) There are four notches on SW2 switch. The switch 1 must be on, in the shown group in Picture 2.The PWM sockets of J36-J37 will be unplugged on the main board as shown in Picture 2.
3) Plug the serial cable into the "RS232" slot on the rear side of the UPS. The J1 inverter cable socket which comes from DB9 socket and existing in the UPS will be plugged on the main board of the UPS**.**
4) Connection between UPS and computer is made by chipset FTDI/FT232RL converter.
5) Run the "C2000 programmer" on computer and select related to COM port and rectifier file as shown Picture 03-06



Picture 03.

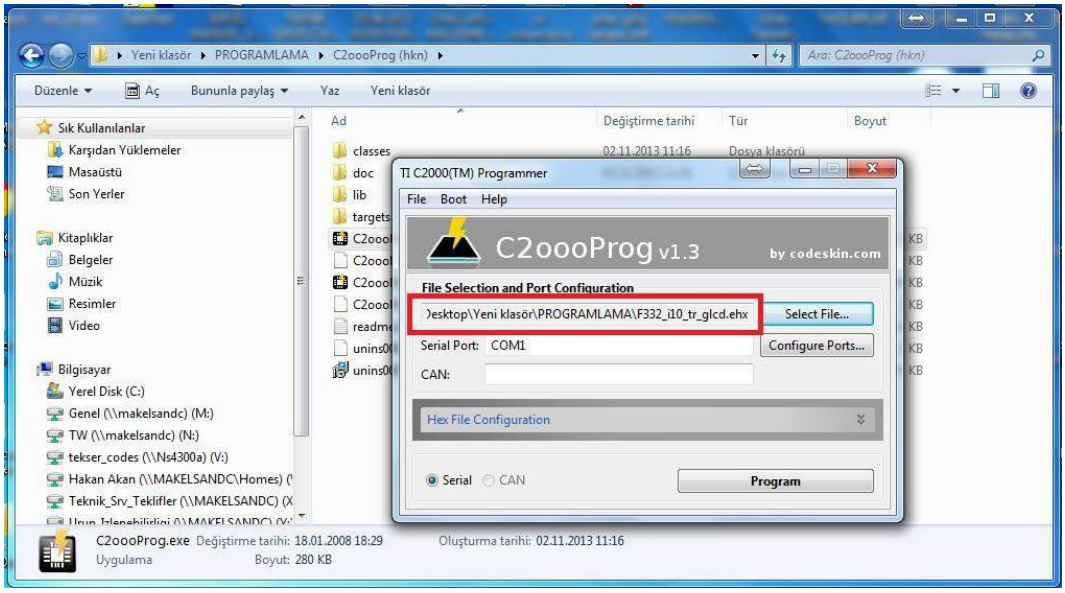


Picture 04.



Picture 05.

6) Check the DSP version no,it can be either 332 or 335.For example:F28335PGFA.

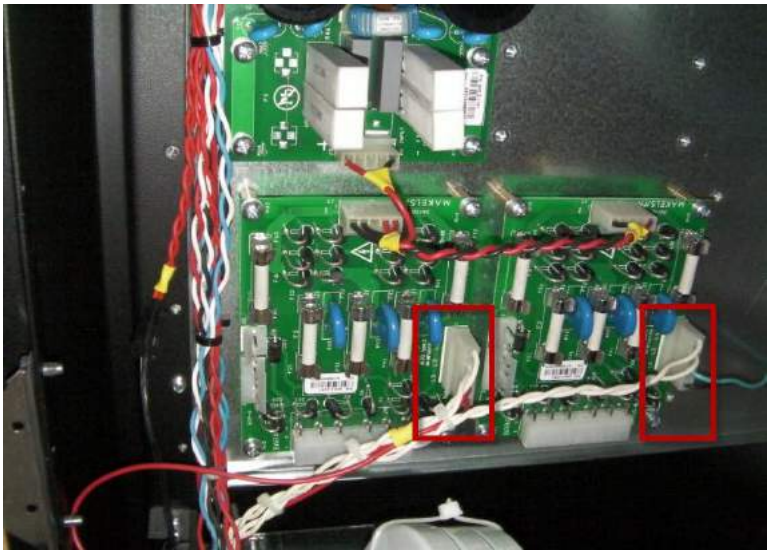


Picture 06.

7) C2000 prog asks for password on first programming; **PASS: IST52014**

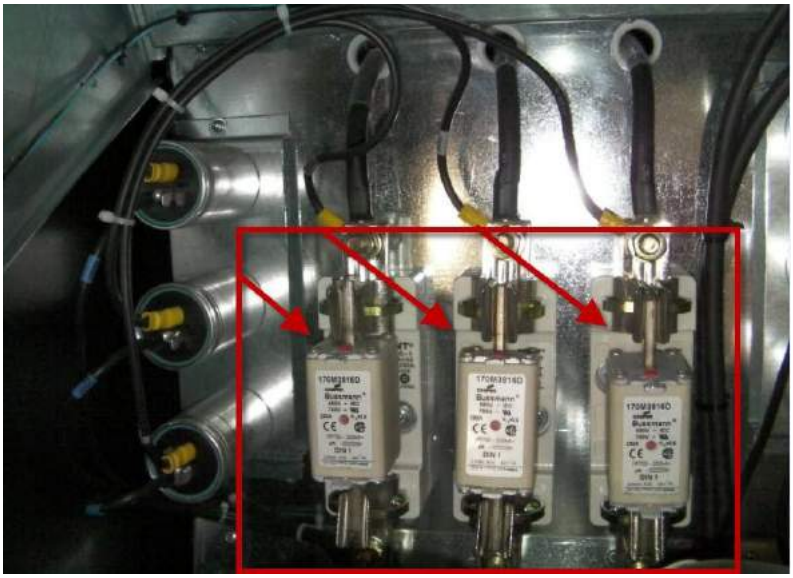
Picture 07

8) Main board requires energy for the software update. There are two methods for energising main board at Boxer model. External power supply is the first method for energising. The second method is to unplug all NH fuses. The best fit method can be chosen for your current situation.
9) Unplug J2 (L1-L2-L3-N) socket for the external power supply as shown in Picture8.



Picture .08

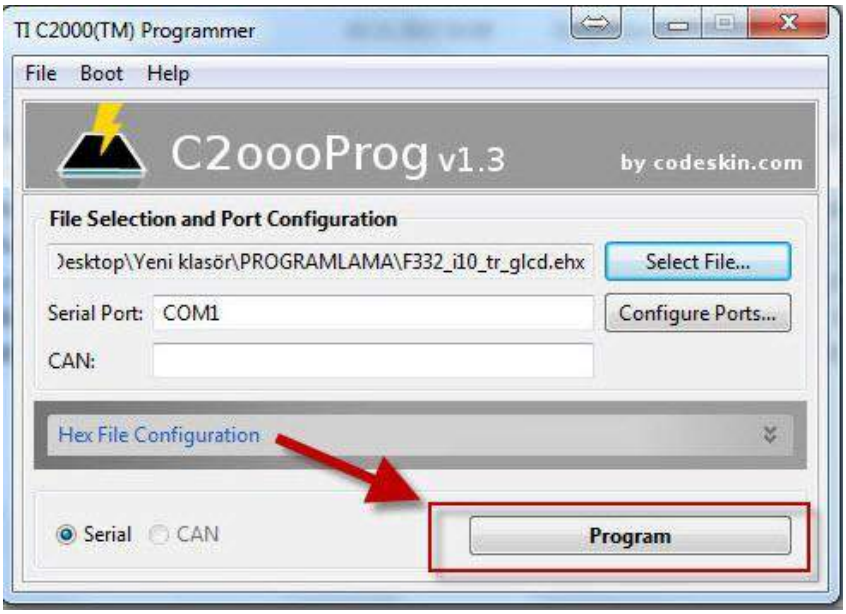
10) Plug in external power supply socket instead of J2 socket.External power supply consists of L1 and L3 phases.
11) Input and battery fuses are unplugged as shown in Picture 9-10 if there isn't enough equipment for the external power supply



Picture .09

12) To ensure safe operation, do pay attention to DC bus voltage after NH fuses were unplugged. When the input breaker(CB1)was turned on, the mainboard energising must be observed.
13) Click activated program button and wait until the programming has finished as shown in Picture11.

NOTE: On the main board D4-D3 are inverter programming LEDs. Those will blink during programming.



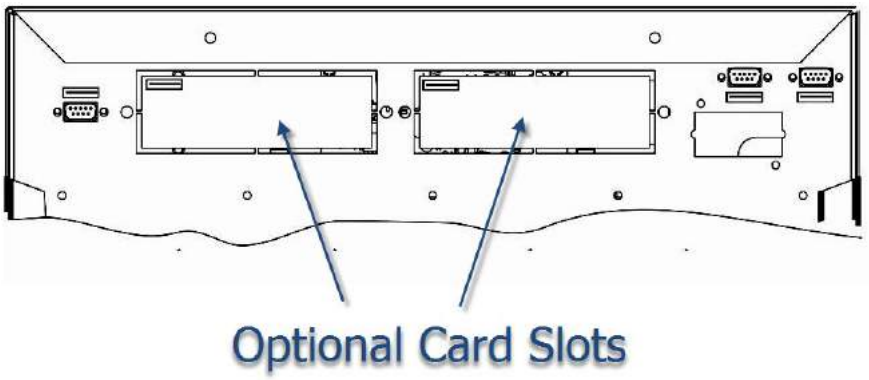
Picture .11

14) C2000 prog software indicates that the programming is successful, click OK.
15) After the installation is completed, turn UPS's input breaker (CB1) off position and see UPS de-energised. Turn SW2 notch 1 off again.
16) Turn UPS's input breaker (CB1)on again and see the main board is energised again. Check that the correct version is to set in the control panel. This shows that the programming is successfully done.
17) Turn UPS's input breaker (CB1) off .Plug in J2 sockets instead of external power supply. Plug in input and battery fuses if they are unplugged.
18) After the installation is completed, the PWM sockets of J36-J37 are plugged on the main board. Remove the serial cable off the UPS. **The J1 inverter cable socket which comes from DB9 socket and existing in the UPS will be unplugged on the main board of the UPS**
19) The start up operations must be carried out according to the instruction.

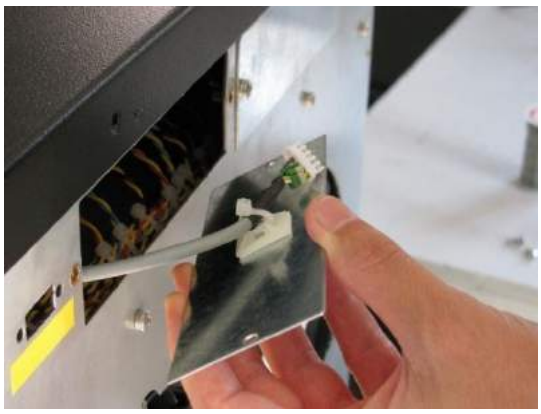
6.4 RS335 Dry Contact Installation

Installation

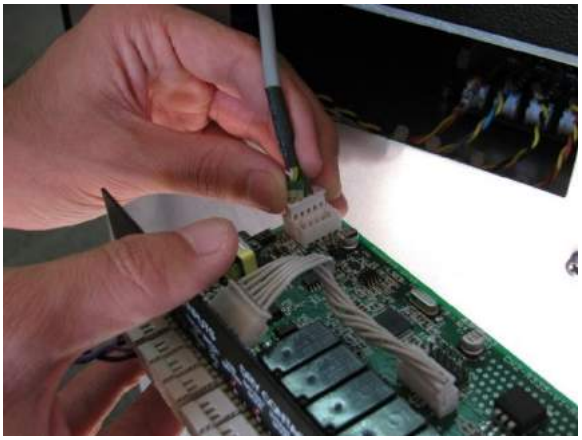
The module is installed on the left side slot on the rear side of the machine.



1. Unscrew and remove the left hand side slot cover, reach the female CAN socket. (attached to the slot cover)

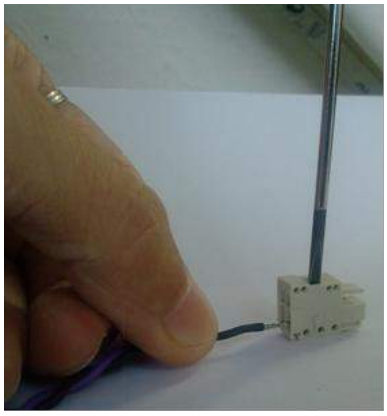


2. Detach the cable from the socket cover using a cutter, and insert the female socket into the *male J3* socket on the dry contact module.



3. Carefully insert the module into the slot, and screw to make sure that it is stable.

4. Insert the signal cables into the sockets while pressing on the connector with a screwdriver.



Operation

- Relay outputs are isolated from the UPS and ground.
- If the contacts are going to be used for load switching, it should be made sure that the relays are capable of handling the load.

- Operating voltage for the isolated inputs is between 3.3 – 24 Volts and the input impedance is 3 kohms.
- Polarity must be checked before applying any voltage to the inputs.
- The 12V/150mA power supply on the module is also isolated from the UPS.

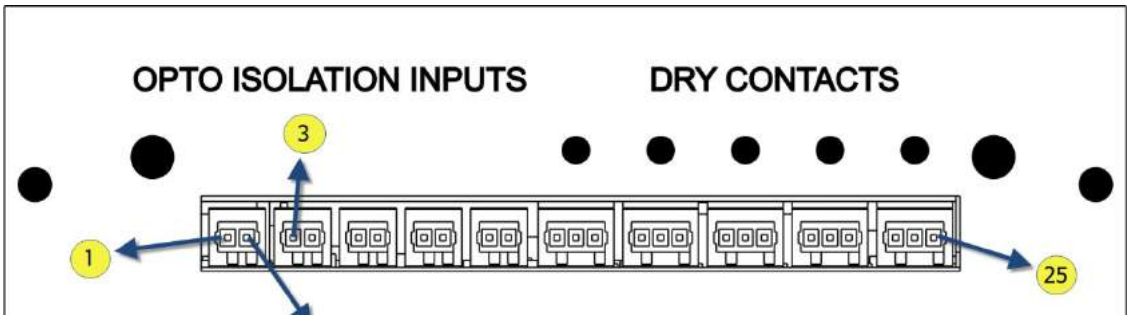
Relay info

Rated Switching NO	5A 250VAC
Rated Switching NC	2A 250VAC
Max. Switching Current NO	10A
Max. Switching Current NC	3A
Max. Switching Voltage NO	250VAC - 110VDC
Max. Switching Voltage NC	250VAC - 110VDC
Cable Cross-section	min. 0,25mm², max. 0,5mm²

Isolated input info

Min. Input Voltage	3.3 Vdc
Max. Input Voltage	24 Vdc
Min. Drawn current	1 mA
Max. Drawn current	8 mA
Input Impedance	3 KΩ
Cable Cross-section	min. 0,25mm², max.0,5mm²

Pin functionality



The module has 25 I/O pins as seen on figure above. Refer to the following table for pin functionality info.

Pin	Function	Pin	Function
1	12 Vdc Out (+)	**14**	Output-2(battery mode) NO

2	12 Vdc Out (-)	**15**	Output-2(battery mode) COM
3	Input-1(start) (+)	**16**	Output-2(battery mode) NC
4	Input-1(start) (-)	**17**	Output-3(bypass mode) NO
5	Input-2(stop) (+)	**18**	Output-3(bypass mode) COM
6	Input-2(stop) (-)	**19**	Output-3(bypass mode) NC
7	Input-3(bypass mod) (+)	**20**	Output-4(common fault) NO
8	Input-3(bypass mod) (-)	**21**	Output-4(common fault) COM
9	Input-4(ups mode) (+)	**22**	Output-4(common fault) NC
10	Input-4(ups mode) (-)	**23**	Output-5(battery fault) NO
11	Output-1(low battery) NO	**24**	Output-5(battery fault) COM
12	Output-1(low battery) COM	**25**	Output-5(battery fault) NC
13	Output-1(low battery) NC		

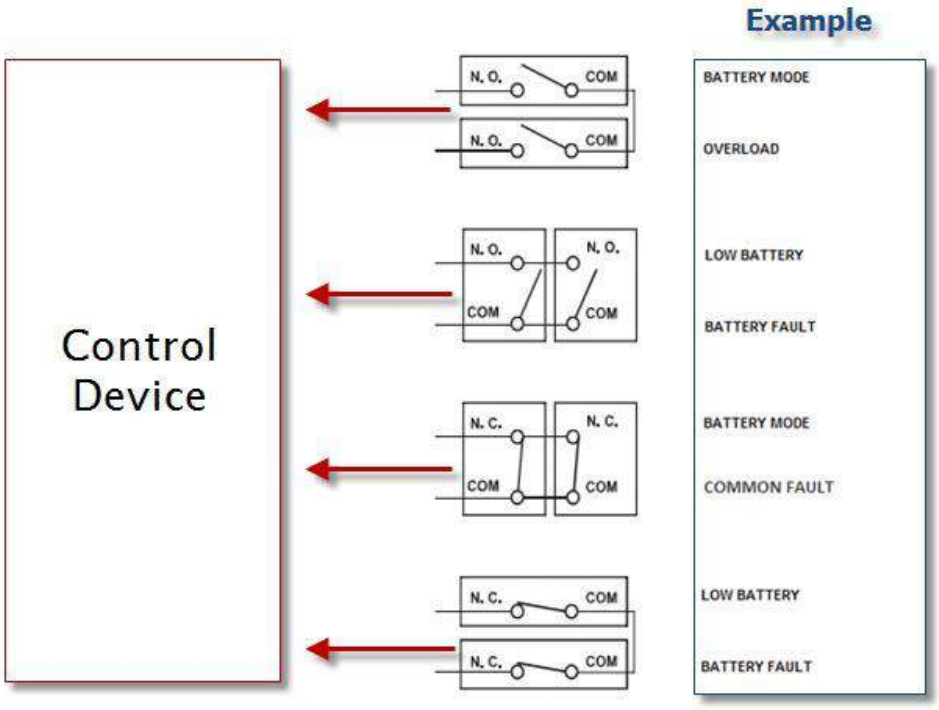
Pins 11-25 belong to output relays and their default function is shown on the table. Different functions can be assigned to these relays; please refer to Challenger installation manual (*UDD-SD-01 – UDD-SD-03*) for setup.

Dry contact functions

Over Temp.	Test in Progress
Over Load	Replace Batterys
Bypass Bad	Inverter Bad
UPS Shutdown	Battery Mode
Charger Fail	Parl. ID Collision
Fan Fail	No Parallel Comm.
Fuse Fail	Low Battery
Shutdown Pending	ECO Mode
No Battery	Tyristor Fault
M.Byp.Breaker On	Byp.Phs.Rot.Err.
S. Byp.Mode	Parl.Missing Dev.

Connection examples

Output relays can be connected in various ways to meet with control necessities.



“AND” and “OR” configurations can be set with the relays by connecting them in series or parallel as seen in the figure above.

7. 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.

	Event	Explanations
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 to normal values.
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	**Inverter Overtemp.**	Inverter's temperature is out of limit, in case of 5 degrees more increment ,Load will be transferred to Bypass line.
18	**PFC Overtemp.**	Rectifier 's temperature is out of limit, in case of 5 degrees more increment ,Load will be transferred to Bypass line.
19	**STS Overtemp.**	Static Transfer Switches' temperatures are out of limits.UPS will be stopped.
20	**Outp.PL1 Cur. Limit.**	Short circuit protection is activated for output L1 phase.
21	**Outp.PL2 Cur. Limit.**	Short circuit protection is activated for output L2 phase.
22	**Outp.PL3 Cur. Limit.**	Short circuit protection is activated for output L3 phase.

23	**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.
24	**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.
25	**Coil Overtemp**	Over temperature is observed for UPS' inverter and rectifier coils.
26	**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.
27	**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.
28	**Maint. BYP. Sw. Off**	Maintenance bypass switch is deactivated.
29	**Ambient Nor. Temp.**	UPS ambient temperature has got back to allowed limit values.
30	**Mains Voltage Nor.**	Mains voltage is in the limited values , UPS will switch to normal mode.
31	**Inverter Nor. Temp.**	Inverter temperature is in the limited values .If load and temperature values are normal, UPS will switch to normal mode.
32	**PFC Nor. Temp.**	Rectifier temperature is in the limited values .If load and temperature values are normal, UPS will switch to normal mode.
33	**Charger Nor. Temp.**	Charger/booster module temperature is in the allowed limits , charging will be activated again.
34	**STS Nor. Temp.**	Temperature of Static transfer switches is in the allowed limit.
35	**Bypass Voltage Nor.**	Bypass voltage is within defined limits.
36	**Bypass Freq. Nor.**	Bypass frequency is within defined limits.
37	**Coil Normal temp.**	UPS inverter or rectifier coil temperature has got back to normal values.
38	**Inverter Volt. Norm.**	Inverter voltage is in the limited values , UPS will switch to normal mode.
39	**Normal Load**	Output load is under %100 , If charging was OFF , It will be ON .
40	**BYP Thyr.L1 Short C.**	UPS has detected short circuit at bypass L1 thyristor.UPS will shut down.
41	**BYP Thyr.L2 Short C.**	UPS has detected short circuit at bypass L2 thyristor.UPS will shut down.
42	**BYP Thyr.L3 Short C**	UPS has detected short circuit at bypass L3 thyristor.UPS will shut down.
43	**UPS Thyr.L1 Short C.**	UPS has detected short circuit at inverter L1 thyristor.UPS will shut down.
44	**UPS Thyr.L2 Short C.**	UPS has detected short circuit at inverter L2 thyristor.UPS will shut down.
45	**UPS Thyr.L3 Short C.**	UPS has detected short circuit at inverter L3 thyristor.UPS will shut down.
46	**UPS Thyr.L1 Open C.**	UPS has detected that inverter L1 thyristor can not be activated.Load will be transferred to bypass line.
47	**UPS Thyr.L2 Open C.**	UPS has detected that inverter L2 thyristor can not be activated.Load will be transferred to bypass line.

48	**UPS Thyr.L3 Open C.**	UPS has detected that inverter L3 thyristor can not be activated.Load will be transferred to bypass line.
49	**BYP Thyr.L1 Open C.**	UPS has detected that bypass L1 thyristor can not be activated.Load will be transferred to inverter line.
50	**BYP Thyr.L2 Open C.**	UPS has detected that bypass L2 thyristor can not be activated.Load will be transferred to inverter line.
51	**BYP Thyr.L3 Open C.**	UPS has detected that bypass L3 thyristor can not be activated.Load will be transferred to inverter line.
52	**Parl. Phs. Rot. Err.**	One or more of UPSs which operate in paralel mode do not match in phase sequence.
53	**Battery Start**	Starting through battery command has been given to UPS .
54	**Parl. Start Error**	One or more of UPSs which operate in paralel mode could not start to operate.
55	**Inverter Fault**	UPS couldn't prepare the inverter voltage.
56	**Output Off**	Static transfer switches all disabled. The loads can not be energized.
57	**Normal Mode**	UPS is operating in the normal mode,load are energized through rectifier – inverter line.
58	**Battery Mode**	UPS is operating in the battery mode,load are energized through battery – inverter line.
59	**Bypass Mode**	UPS is operating in the bypass mode,load are energized through bypass line.
60	**Maint. Bypass Mode**	UPS is operating in the maintenance bypass mode,load are energized through maintenance bypass line.
61	**Parallel Mode**	2 or more UPS are operating in power sharing mode. Load is fed through UPSs' inverter lines.
62	**Test Mode**	UPS has switched to battery test mode,loads are energized through rectifier-battery- inverter line as source sharing.
63	**Manual Switch to UPS**	Switching to inverter(normal) mode command has been given via front panel.
64	**Output Voltage Error**	Output voltage is detected during the period of starting UPS .UPS has been stopped.
65	**PFC Stop Cmd.**	Abnormal stuation is detected during the moment of rectifier operating.UPS has stopped itself.
66	**Manuel Start Command**	Start command is given via UPS command menu.
67	**Manuel Stop Command**	Stop command is given via UPS command menu.
68	**UPS Stopped**	UPS has been stopped.
69	**Bypass Problem**	UPS has switched to bypass mode so many times i a short period,UPS will be shut down.
70	**Parameters Changed**	Device-related parameters were changed on the service menu
71	**Batterys Changed**	Battery replacement date has been changed.battery statistics will be reset.
72	**Load impact Transfer**	The load which can not be handled by inverter is activated. Loads will be transferred to bypass line.
73	**Parallel Command**	UPS which is operating in paralel mode has been given a command to change the status of static switches.

74	**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.
75	**Ext. Start Command**	UPS which is operating in paralel mode has been given a command to start up by another (master) UPS.
76	**Ext. Stop Command**	UPS which is operating in paralel mode has been given a command to stop by another (master) UPS.
77	**Ext. Switch To BYP.**	UPS which is operating in paralel mode has been given a command to transfer the load to bypass line.
78	**Ext. Switch To UPS**	UPS which is operating in paralel mode has been given a command to transfer the load to inverter line.
79	**Parallel Comm. FE.**	Slave UPS which is operating in paralel mode has detected a failure of input current sharing.
80	**Inverter OKEY**	Inverter voltage reached needed value after UPS is started up. UPS can feed the loads through inverter.
81	**Batt. Temp. Err.**	Battery temperature is out of defined limits, batteries can be damaged.
82	**EPO key pressed**	EPO key button is pressed.
83	**Battery Low**	Battery capacity has decreased below defined " battery low limit" while UPS was operating in battery mode.
84	**No P.485 Bus Comm.**	Parallel RS485 communication between the systems is not available.
85	**STS OverCurrent**	OverCurrent in Bypass line.
86	**BYP. Phase Rot. Err.**	Reverse phase sequence was detected in mains at the UPS run time.
87	**Output DC Volt.Fault**	Over Inverter DC voltage. Loads will be transferred to the bypass line.
88	**Output Offset Err.**	One or more phase of slave UPS' output is not connected to master UPS in Parallel systems.
89	**Battery Temp. Nor.**	Battery temperature is normal.
90	**PFC Pbus OverVoltage**	Positive DC Bus overvoltage.
91	**PFC Nbus OverVoltage**	Negatif DC Bus overvoltage
92	**PFC PhL1 OverCurrent**	Short circuit protection is activated for rectifier L1 phase.
93	**PFC PhL2 OverCurrent**	Short circuit protection is activated for rectifier L2 phase.
94	**PFC PhL3 OverCurrent**	Short circuit protection is activated for rectifier L3 phase.
95	**Single Stop**	Command to stop itself has been given to UPS which is operating in paralel mode separately from paralel system.
96	**Master Changed**	UPS became master device in paralel system.
97	**Par.Bus ID Collision**	ID value of one or more UPS is the same as each other in parallel system.
98	**Stop All Units**	Stop all units command was given via front panel.
99	**Pwr. Supply Fault**	The error signal is detected on UPS through power source circuit debugger.
100	**Generator Mode**	Signal is detected from "generator mode input" of dry contact board. UPS will switch to "generator mode".