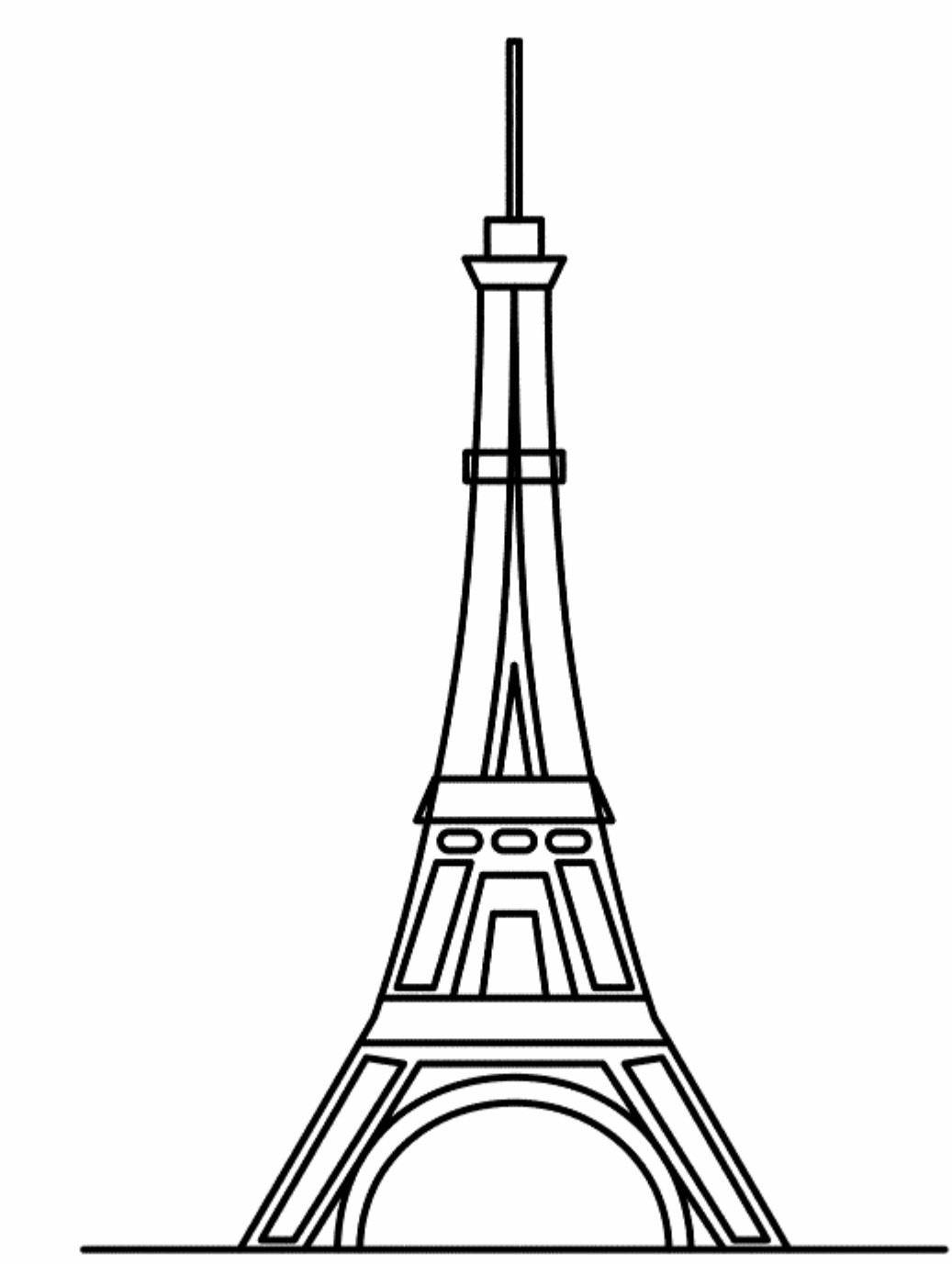
Tower Electronic Systems



3300 UPS Instruction Manual

AUGUST 2005

CONTENTS

1.0 INTRODUCTION

1.1 General description

The Tower 3300 series of three phase double conversion Uninterruptible Power Supplies (UPS) provide quiet, reliable and continuous power to an external load.

The load is protected against input transients and the output frequency is controlled to within specified parameters. In the event of a power failure the UPS will continue to maintain the load demands for a period dependant on the size of the installed battery and the degree of loading.

In the unlikely event of UPS failure, the load will be automatically transferred without any interruption directly onto the reserve mains supply. The unit can then be connected into Manual Bypass mode for repairs to the unit (if required) without disturbance to the load.

1.2 UPS building blocks

The Tower 3300 series has the following major building blocks:

1.2.1 Boost converter

The boost converter is able to utilize any of two sources to create a regulated, filtered DC link which supplies the inverter.
State of the art power electronics is used to provide a near unity input power factor while boosting its primary rectifier mains source.
If the incoming supply is lost, the boost converter boosts the battery.
When the primary source becomes available again, a linear *soft start* circuit ensures that there is no *inrush* current drawn by the UPS.

1.2.2 Inverter

The inverter's input is connected directly to the DC link with which it generates three phase power to support the load.
The inverter uses Digital Signal Processors (DSP) to closely control and monitor its output precisely – ensuring that the waveform remains perfectly sinusoidal under all load conditions.
The frequency of the inverter is maintained in a phase locked condition with the reserve supply frequency as long as it remains within the selectable tolerance band. The inverter will run at its own oscillator derived frequency if the reserve supply should fail.

1.2.3 Static transfer switch

The static switch is totally independent along with its own two independent power supplies. The static switch will normally connect the load to the inverter output. If the inverter becomes unavailable or goes out of tolerance, the static switch (analog detection) will transfer the load to the reserve source without interruption. The static switch also enables no break transfer/retransfers during the maintenance bypass procedure.

1.2.4 Battery charger

The battery charger uses DSP control to regulate the temperature compensated charging of the battery. The charger is equipped with both a battery impedance test circuit and boost function. All the charger functions can be controlled via the display.

2.0 INSTALLATION

2.1 Installation precautions

The following factors should be considered to determine a suitable location for your unit:

- Protection against excessive temperature and humidity
- Protection against moisture
- Ease of access and adequate lighting for service personnel
- It's position relative to the critical load for ease of reticulation
- Adequate ventilation clearance (rear end)
- A close proximity of the UPS to the battery cabinet where applicable
- Potential expansion, e.g. additional battery cabinet/unit

2.2 General

The supply neutral must not be cut. *All switchgear, including generator change-over panels, must be three-pole only and the neutrals must remain bridged.*
The unit requires access from the front, top and from one side so care should be taken in positioning the unit accordingly.

2.3 Cable and circuit breaker ratings

The recommended input, output cable and circuit breaker sizes are listed in the table below. The input circuit breaker must have a **D curve** response and should be mounted in the existing DB board. The UPS supply **must not** be connected via an earth leakage breaker.

kVA Rating	Input Current	Circuit Breaker	Input Cable	Output Current	Output Cable
10	32A	40A	$10mm^2$	15A	$2.5mm^2$
15	32A	40A	$10mm^2$	23A	$4mm^2$
20	32A	40A	$10mm^2$	30A	$6mm^2$
30	63A	80A	$16mm^2$	45A	$10mm^2$
40	63A	80A	$16mm^2$	60A	$16mm^2$

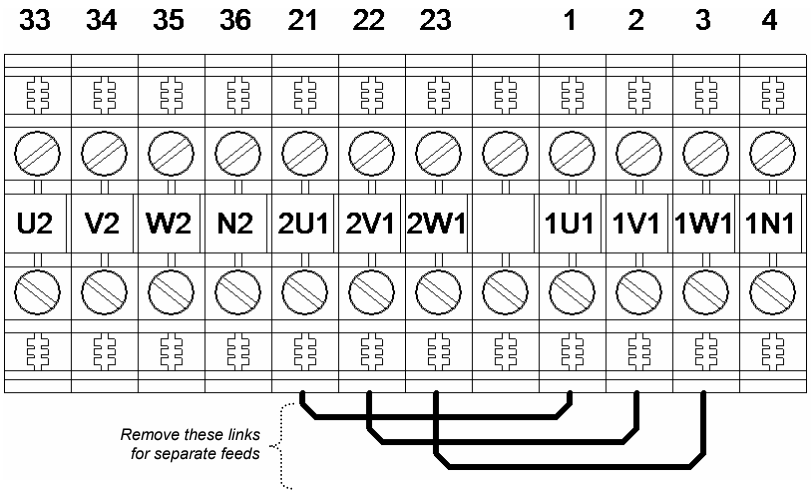
All input and output cables should have four cores plus an earth respectively

2.4 Wiring layout and connections

The cable entry for the unit is at the rear behind a removable cover-plate.
Always ensure that all the cables are secure and the length adequate.
The terminal block layout and wiring numbering is shown on the next page.
It can bee seen that the reserve and rectifier terminals are bridged.
If it is required to supply the unit from two different sources, simply remove the bridging cables. **The phase rotation must always be clockwise**.
The labeling notation is as follows:

Rectifier input terminals: 1U1, 1V1, 1W1 & 1N1
Reserve input terminals: 2U1, 2V1 & 2W1
Output terminals: U2, V2, W2 & N2

The earth connection is made to the earth stud under the wiring compartment.



The wiring terminals as seen from rear of the unit

2.5 The internal battery

The Tower 3300 series can house a maximum of **four** parallel banks of 32x12V7A/h or 32x12V9A/h internal batteries. The nominal battery voltage is 384VDC, which is dangerous and can be potentially lethal.

2.5.1 Battery safety

Extreme care should be exercised when working with batteries.

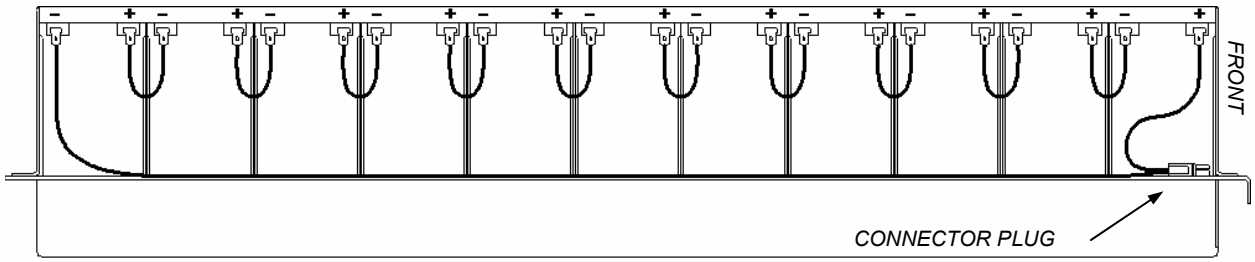
- Do not short out the battery terminals
- Do not drop the batteries
- Ensure the polarity connections are correct
- Ensure that the battery interconnections are connected securely
- Ensure that the interconnections are not pinched between trays
- Batteries should only be installed by qualified personnel

2.5.2 Battery tray connection

The batteries in the battery tray are wired to a tray connector plug at the front of each tray. The tray connectors respectively plug into the interconnections that are fixed to the UPS chassis.

Note: The top four trays house ten batteries each, while the middle and bottom trays all house eleven batteries each.

The interconnecting cables are supplied with the unit

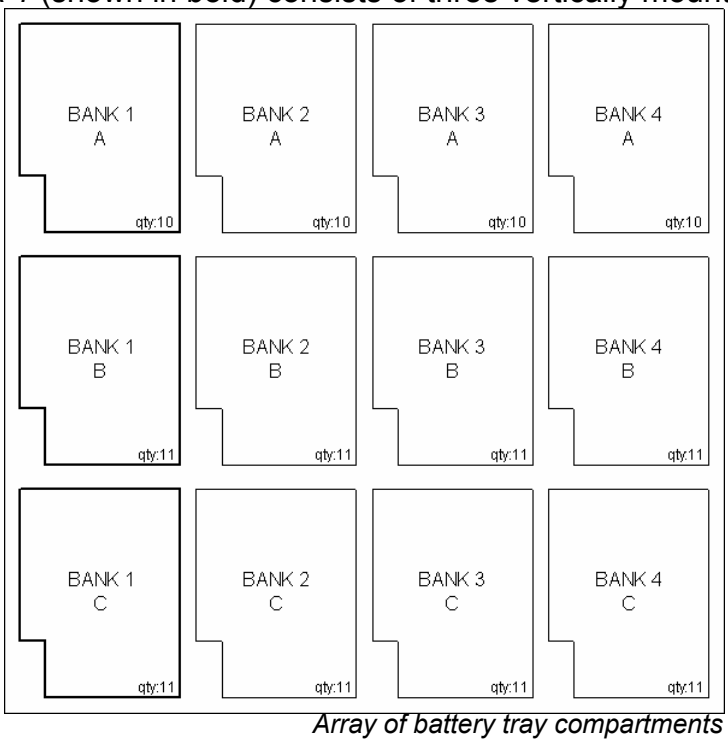


Detail of battery tray connection to the tray connector plug

2.5.3 Installing the battery trays

Each of the four internal battery banks consist of three vertically mounted trays. These *four by three* form an array of tray compartments, as shown below. Ensure that the battery fuses are all open before any of the battery trays are plugged in.

e.g.: *Bank 1* (shown in bold) consists of three vertically mounted trays: (ABC)

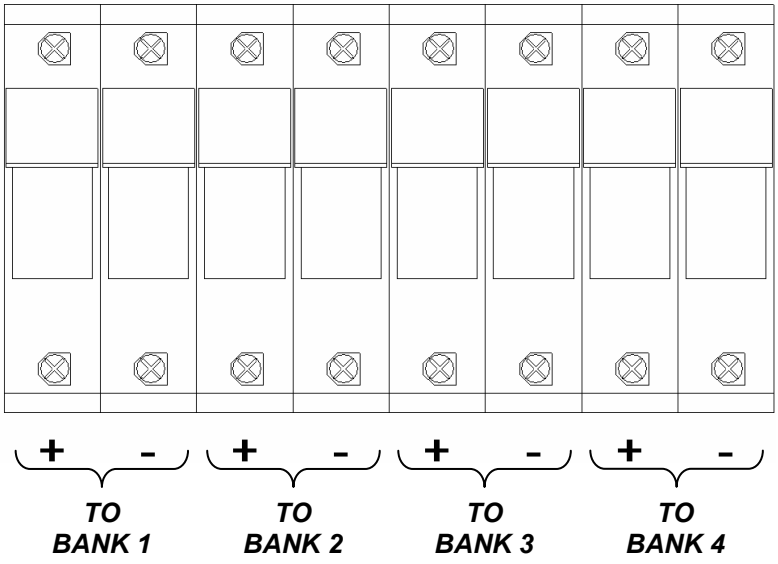


Array of battery tray compartments

2.5.4 The battery fuse arrangement

Each of the four internal battery banks are individually fused, thereby allowing the batteries to be changed safely while the unit is running.

The diagram below details the battery fuse arrangement.



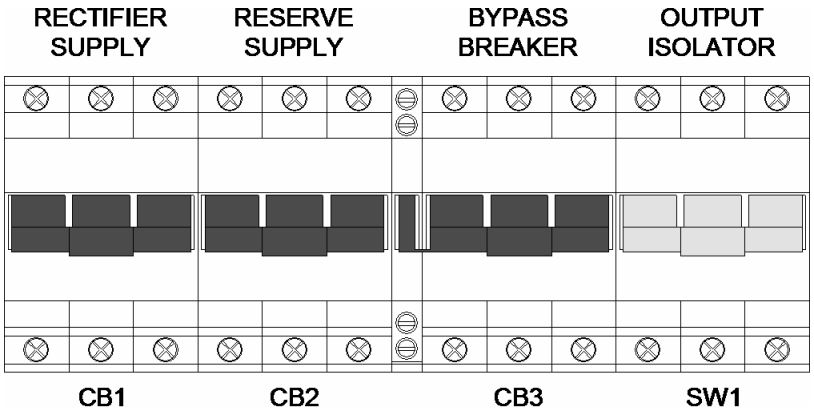
Battery fuse arrangements

3.0 OPERATING PROCEDURES

It is recommended that one carefully considers all actions that involve switching the circuit breakers as indiscriminate switching can result in loss of load.

3.1 Circuit breaker layout

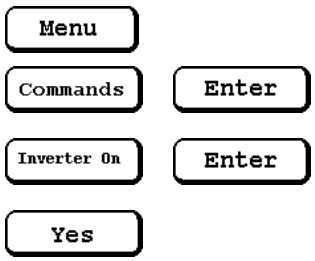
The circuit breaker layout is shown below.



Circuit breaker layout

3.2 Initial startup

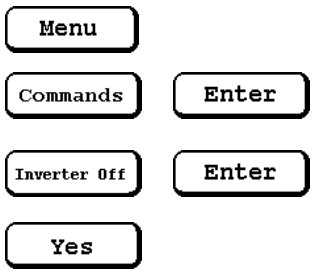
Close Rectifier Input (CB1).
Close Reserve Input (CB2).
After a short time period the display will power up.
Confirm: "**`Load on Static Bypass`**" is displayed
Close Load Output Isolator (SW1).
Open Manual Bypass (CB3).
Close Battery Fuses.
On Display Select:



Confirm: "**`No Active Alarms`**" is displayed within approx. 20 sec.

3.3 Transferring load to static bypass

Confirm: "**No Active Alarms**" is displayed.
On Display Select:



3.4 Manual bypass (detour)

Perform **Load on Static Bypass** procedure.
Close Manual Bypass (CB3).
Open Load Output Isolator (SW1).
Open Rectifier Input (CB1).
Open Reserve Input (CB2).
Open Battery Fuses.
The unit will be safe to work on once the display has switched off.

4.0 TOUCH PANEL

The Tower 3300 UPS series is equipped with a graphic display and touch panel as a user interface. The touch panel can be pressed using your finger.
(Sharp objects may cause damage to the touch panel.)

Various *buttons*, which can be *pressed,* are drawn on the display.
Once pressed, the button's image is inverted accompanied by a brief *click* sound.
Certain buttons (such as arrows) can be kept in to perform a repeated scrolling action.

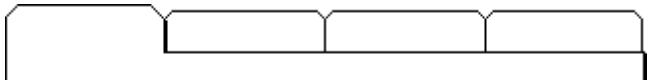
Button not pressed

Button pressed

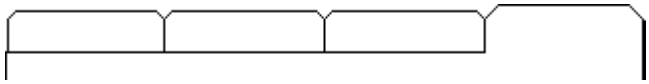
All buttons (except the tabs) have a distinct button border around them so they can be easily identified as buttons. It is shown here what happens when the down arrow is pressed and held down to activate the scrolling function. Not all buttons will allow scrolling.

4.1 Display Views

Tabs are used to change the display views. To switch views, simply press the centre of the corresponding tab.
Although only four tabs are shown, there is in fact more than four and they will automatically scroll left and right until either the first or the last tab is reached.



The first tab is the left-most tab

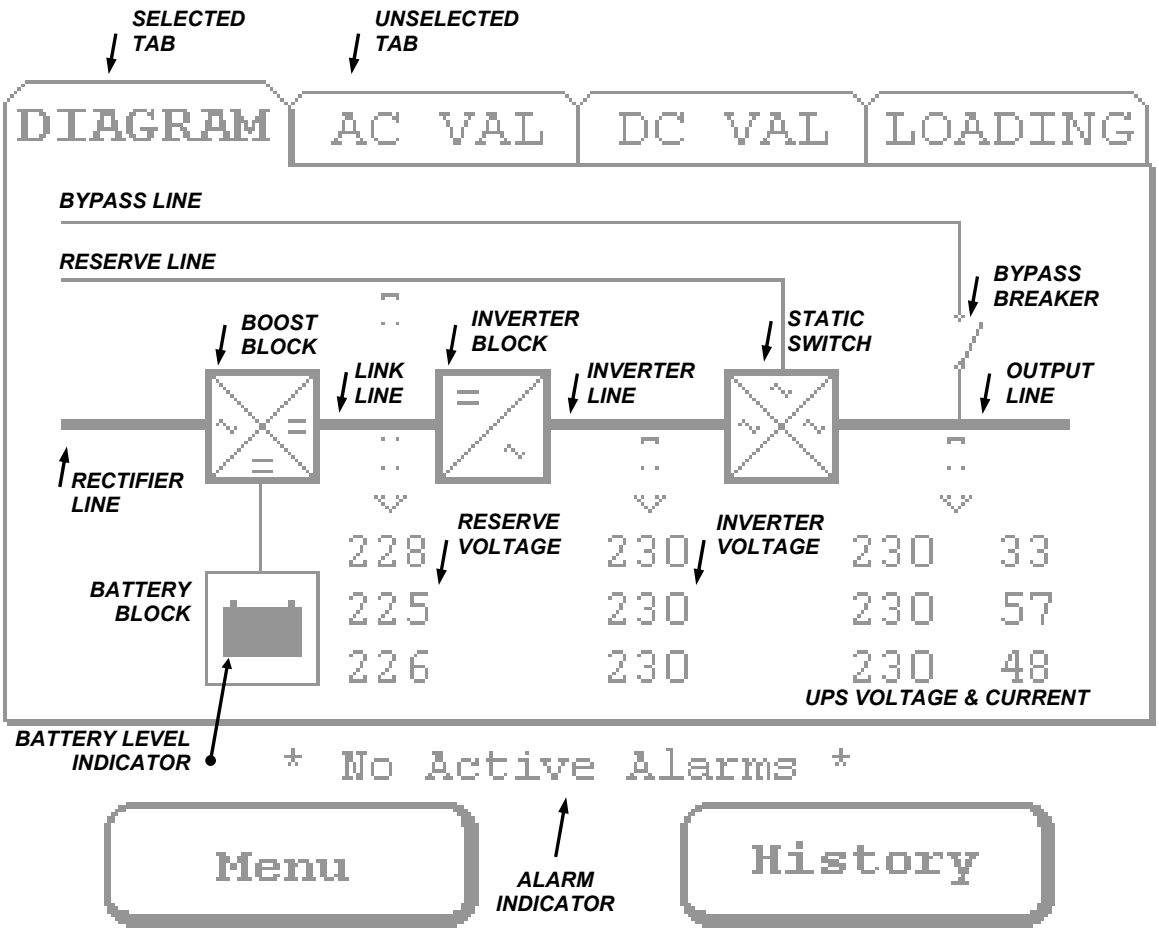


The last tab is the right-most tab

4.1.1 Line diagram

The line diagram provides a status of all the UPS's functional blocks at a glance. The screenshot on the next page has been labeled for easy identification of the various components, each of which will be described in detail.

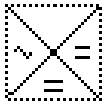
4.1.1 Line diagram */…cont*



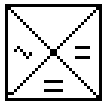
A full list of alarm meanings is given in Appendix C

4.1.1.1 Boost block

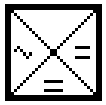
The boost block can be seen in three forms as follows:



DISABLED: The boost converter is off.



ENABLED: The boost converter is on but is not supporting the load.

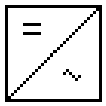


ACTIVE: The boost converter is on and is supporting the load.

4.1.1.2 Inverter block

The inverter block can be seen in three forms as follows:

DISABLED: The inverter is off.



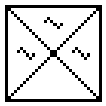
ENABLED: The inverter is on but is not supporting the load.

ACTIVE: The inverter is on and is supporting the load.

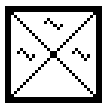
4.1.1.3 Static switch block

The static switch can be seen in three forms as follows:

DISABLED: The static switch output is off.



ENABLED: The static switch is providing output but it is not supporting the load.



ACTIVE: The static switch is supporting the load.

4.1.1.4 Bypass breaker

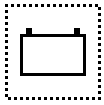
The bypass breaker can be seen in two forms as follows:

OPEN The UPS is not in maintenance bypass.

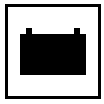
CLOSED: The UPS is in maintenance bypass.

4.1.1.5 Battery block

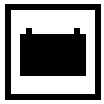
The battery block can be seen in three forms as follows:



DISABLED: The battery is depleted or not in circuit.



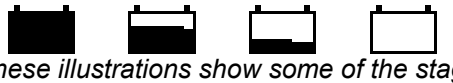
ENABLED: The battery voltage is within limits but is not supporting the load..



ACTIVE: The battery is supporting the load.

4.1.1.6 Battery level indicator

The battery level can be seen in the form of a *fill* on the battery picture:



These illustrations show some of the stages the battery goes through as it discharges

4.1.1.7 Lines

The various lines can be seen in three forms as follows:

DISABLED: The voltage on the line is out of limits or there is no voltage on the line.

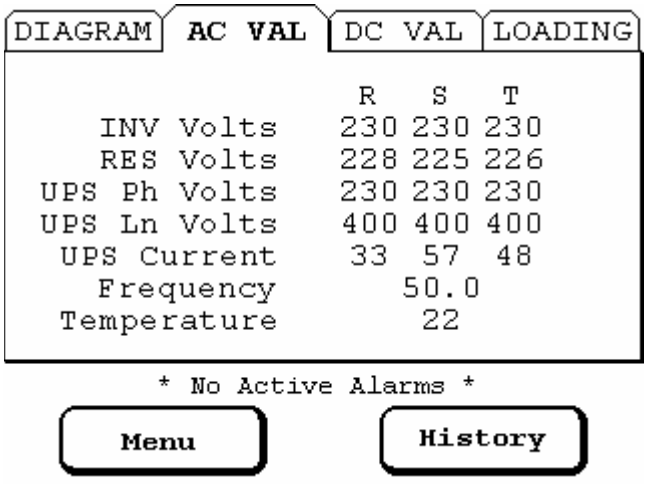
ENABLED: The voltage on the line is within limits but the load is not powered via the line

ACTIVE: The line is being used to support the load

The tab scrolling concept can also be seen in the next few illustrations.

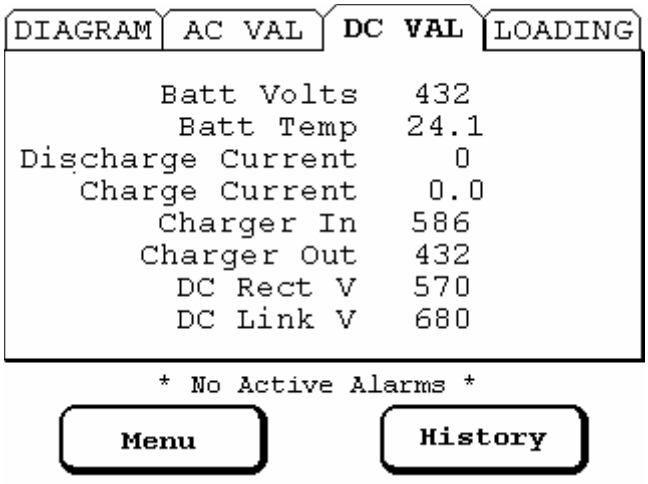
4.1.2 AC values

The AC values view will display all the RMS AC voltages/currents in a tabular form. Included on this view is the UPS temperature and output frequency.



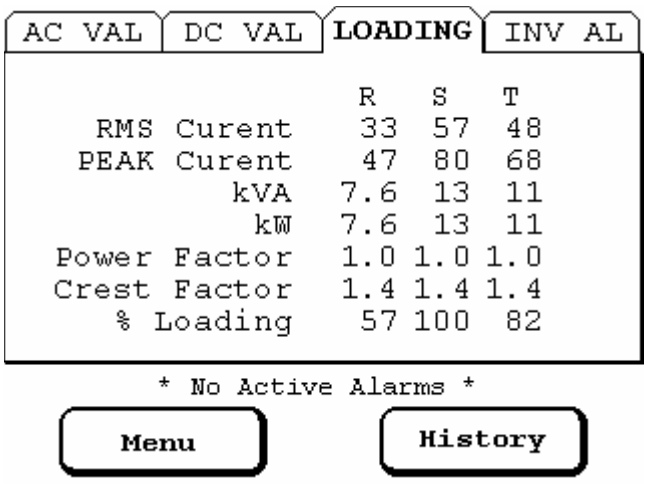
4.1.3 DC values

The DC values view will display all the DC voltages/currents in a tabular form. Included on this view is the battery temperature and link voltage.



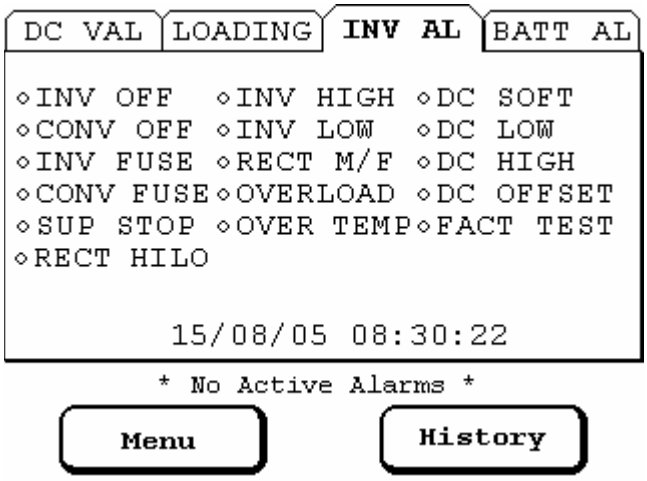
4.1.4 Loading

The loading view will display all the load related measurements in a tabular form.



4.1.5 Inverter alarms

The inverter alarm view will display all the inverter/converter related alarm statuses in an alarm indicator panel type view. System date and time is also shown The virtual LED's are seen in two forms as shown below:



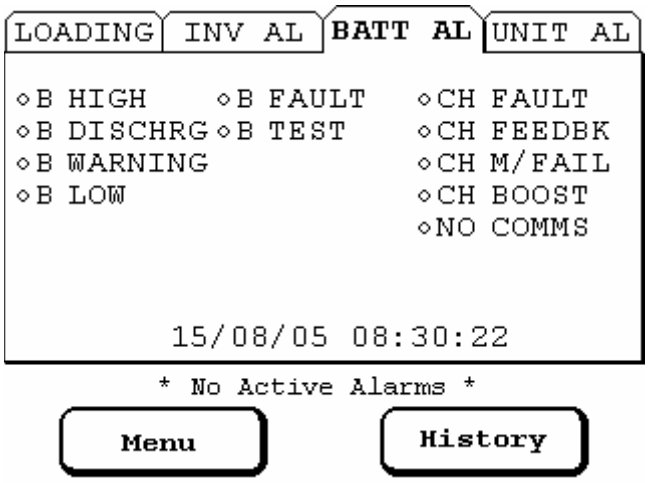
LED OFF (enlarged)

LED ON (enlarged)

A full list of alarm meanings is given in Appendix C

4.1.6 Battery alarms

The battery alarm view will display all the battery/charger related alarm statuses in an alarm indicator panel type view. System date and time is also shown The virtual LED's are seen in two forms as shown below:



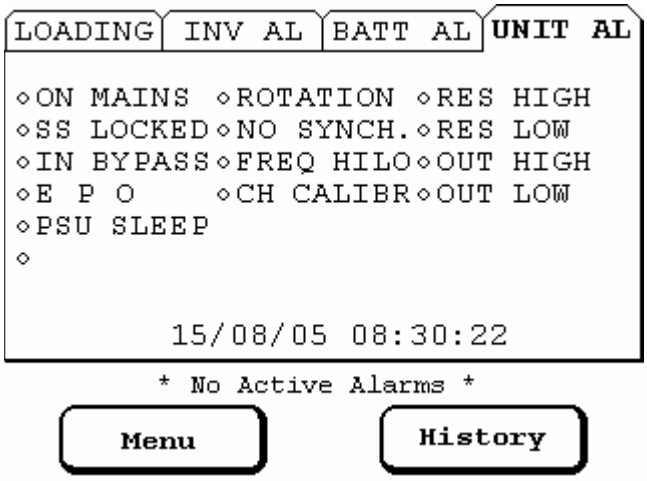
LED OFF (enlarged)

LED ON (enlarged)

A full list of alarm meanings is given in Appendix C

4.1.7 Unit alarms

The unit alarm view will display all the static switch/UPS related alarm statuses in an alarm indicator panel type view. System date and time is also shown
The virtual LED's are seen in two forms as shown below:



LED OFF (enlarged)

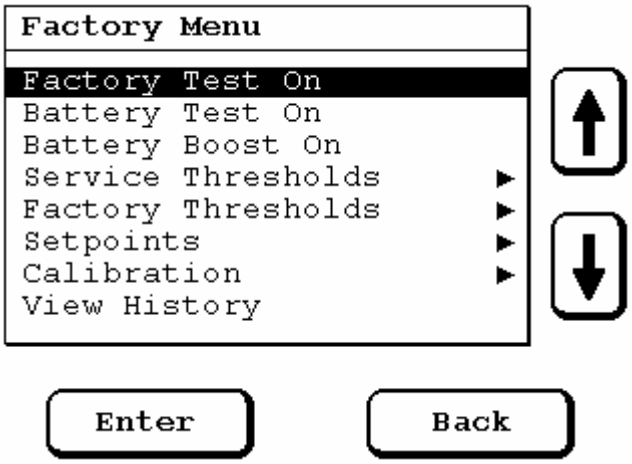
LED ON (enlarged)

A full list of alarm meanings is given in Appendix C

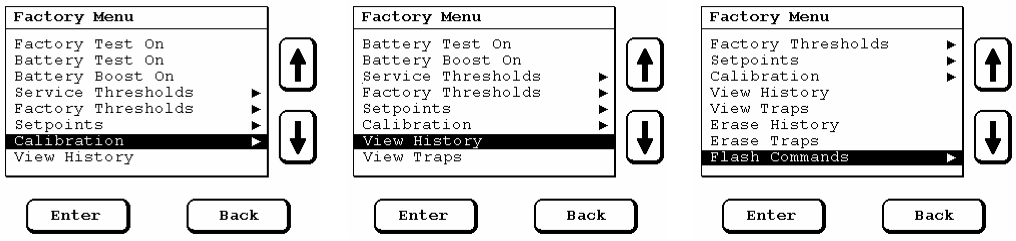
Note that this is the last tab, as the tab has positioned itself on the right-most edge of the screen.

4.2 Menu navigation

The UPS has several menus as part of the interface to simplify tasks/instructions.
The factory menu is shown below as an example:



The arrow buttons are used to scroll the focus line up or down. The menu list may be longer than what can be displayed on the menu screen.
In this case, the focus will only move until it is one position away from the, after which, the list will move instead of the focus.
At the end of the list, the focus will move the focus will move into the last position



If the list is too long to be displayed, it will scroll until the focus reaches the bottom position.

A full list of menus and sub menus is given in Appendix D

4.3 Confirmation

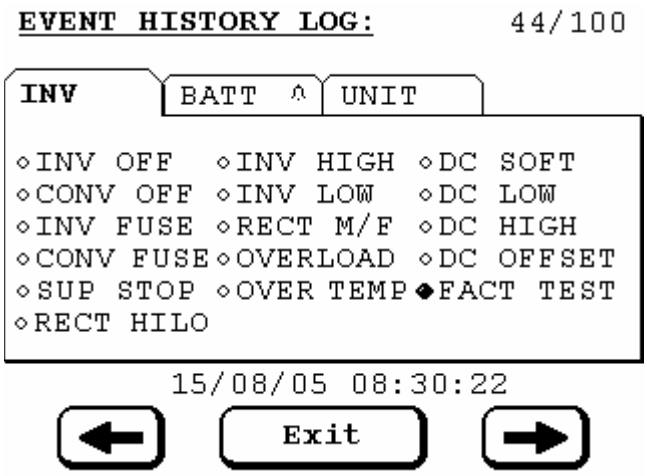
If any command given to the UPS is likely to effect the load, the user will be prompted for confirmation.
Please ensure that the confirmation is not taken lightly as it's purpose is to prevent accidental loss of load.
Each command given to the unit will be logged in the events history log – along with the date, time and source of the command.

4.4 Alarm acceptance

The UPS has a thirty second delay before any audible alarm is issued.
Once an audible alarm sounds it may be silenced by simply pressing a button on the display.
Any alarm condition should immediately be investigated or reported as it may effect the system's operation if it is ignored.
Even if the audible alarm has been silenced, it will re-initiate if new alarm events occur.
Each time the alarm is silenced, the date, time and accepted alarm conditions will be logged in the events history log.

4.5 Event history

The Tower 3300 UPS will log a hundred of the latest events in an event history log.
The event history log closely resembles the alarm tabs:



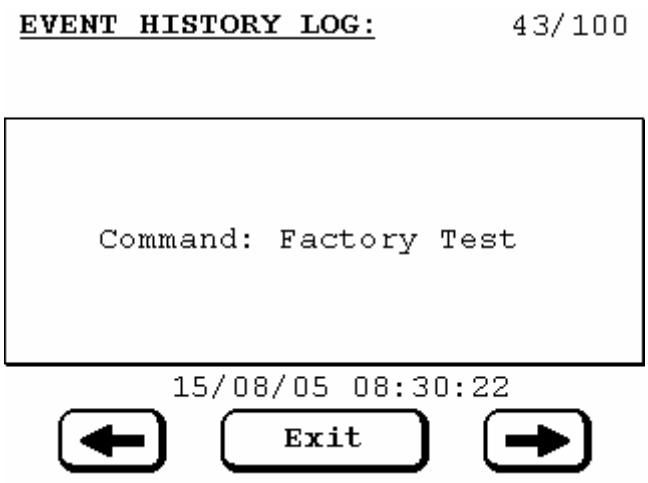
Although there was only one active alarm on the inverter tab at the time of this log being recorded, the little bell on the battery tab indicates that there were active alarm(s) on that tab too.

✓ *indicates alarm acceptance*
R *indicates display reset*

A full list of alarm meanings is given in Appendix C

4.5 Event history */…cont*

Instructions or user actions are also logged as follows:



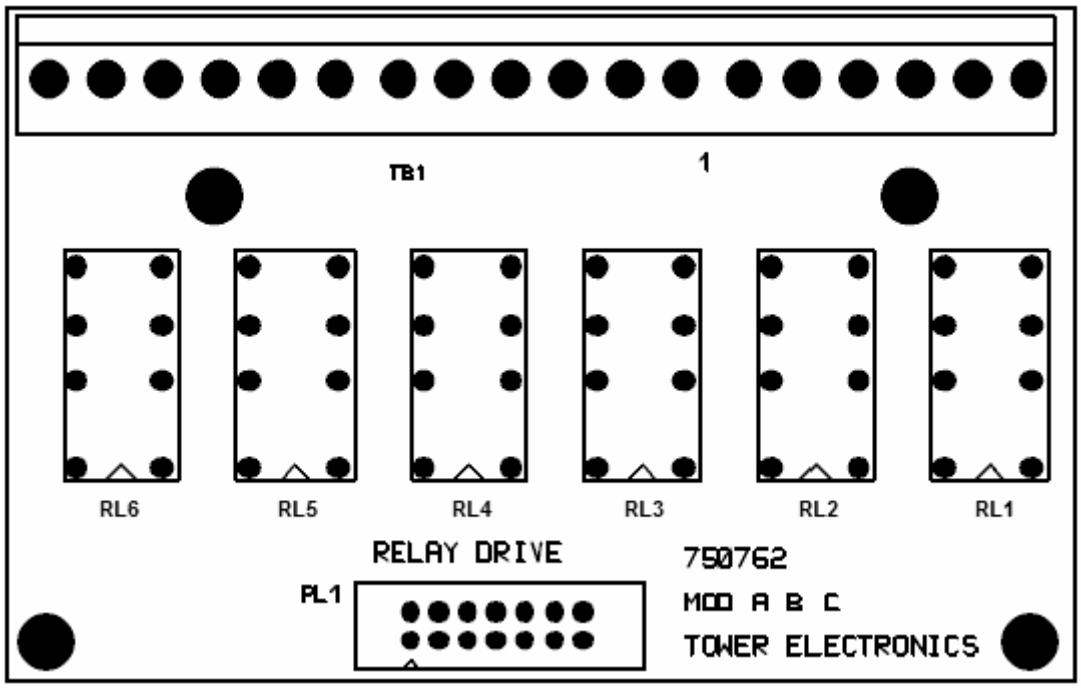
A full list of possible instruction entries is given in Appendix D

5.0 REMOTE SIGNALING

The Tower 3300 UPS is equipped with the following remote connectivity:

5.1 Voltage free relay board

The voltage free relay board, situated at the rear of the UPS, has six relays, each with a normally open and a normally closed set of contacts.
Five of the relays can be selected via the relay menu (alarms from Appendix C) while the sixth relay is a dedicated common alarm relay.



Layout of the voltage free relay board

5.2 RS232 serial connection

The RS232 Serial connection, situated at the rear of the UPS is intended for the use of shutdown software and is designed around the Mega Tec protocol for UPSilon 2000.
Alternatively this port is used by the service technician to download settings and events from the UPS's logs.

5.3 Ethernet connection

The Ethernet connection is intended for remote network connection to the UPS. A TCPIP link can be established for network control and a SNMP connection can be established for network monitoring.

6.0 APPENDIX A SPECIFICATIONS

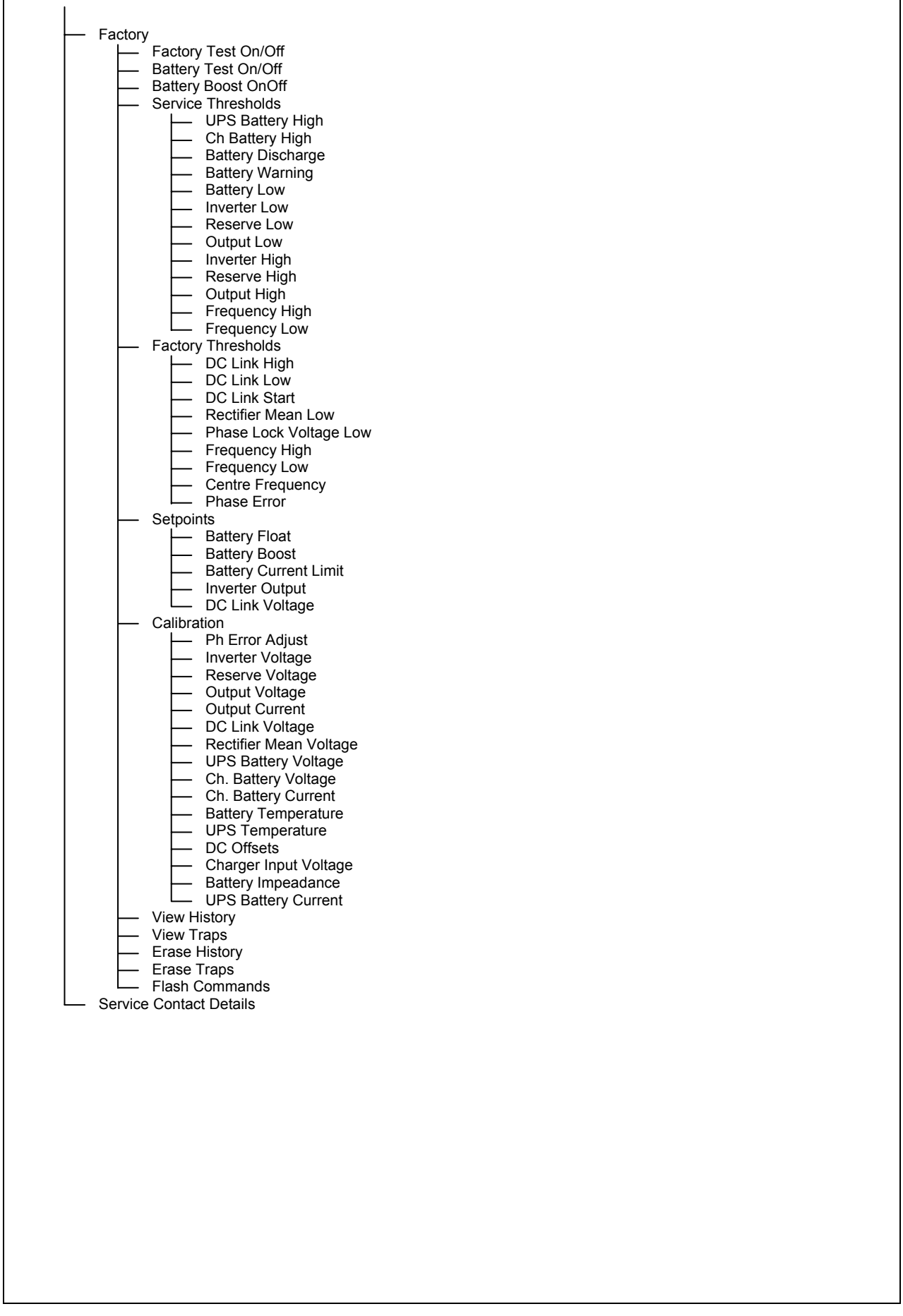
INPUT	10kVA	15kVA	20kVA	30kVA	40kVA
Voltage	380 -400 -415V ±20%	380 -400 -415V ±20%	380 -400 -415V ±20%	380 -400 -415V ±20%	380 -400 -415V ±20%
Frequency	45 – 65 Hz	50Hz ±4%	50Hz ±4%	50Hz ±4%	50Hz ±4%
Power Factor	0.98	0.98	0.98	0.98	0.98
OUTPUT					
Voltage – (Line – Line) (Line – Neutral)	380-415V 220-240V	380-415V 220-240V	380-415V 220-240V	380-415V 220-240V	380-415V 220-240V
Voltage stability – static Voltage stability – dynamic 0 -100%	1% <5%	1% <5%	1% <5%	1% <5%	1% <5%
Power Factor	0.8	0.8	0.8	0.8	0.8
Frequency	50Hz +-0.1%	50Hz +-0.1%	50Hz +-0.1%	50Hz +-0.1%	50Hz +-0.1%
Waveform	Sine	Sine	Sine	Sine	Sine
Harmonic distortion (linear loads) Harmonic distortion (non linear loads)	< 2% < 5%	< 2% < 5%	< 2% < 5%	< 2% < 5%	< 2% < 5%
Inverter overload 150% Inverter overload 150% Inverter overload 125%	0.1 seconds 30 seconds 5 minutes	0.1 seconds 30 seconds 5 minutes	0.1 seconds 30 seconds 5 minutes	0.1 seconds 30 seconds 5 minutes	0.1 seconds 30 seconds 5 minutes
Crest Factor	3 : 1	3 : 1	3 : 1	3 : 1	3 : 1
BYPASS - Static switch Voltage +-15%	380-415V 220-240V	380-415V 220-240V	380-415V 220-240V	380-415V 220-240V	380-415V 220-240V
BYPASS – Static switch overload	10 times for 1000 m Sec	10 times for 1000 m Sec	10 times for 1000 m Sec	10 times for 1000 m Sec	10 times for 1000 m Sec
Efficiency (input-output)	>90%	>90%	>90%	>90%	>90%
BATTERY					
N° of 12V blocks	32 x 8A/H	32 x 8A/H	32 x 8A/H	32 x 8A/H	32 x 8A/H
Max N° of banks in cabinet	4	4	4	4	4
Float voltage	432V	432V	432V	432V	432V
Battery discharging	384V	384V	384V	384V	384V
Low DC off	335V	335V	335V	335V	335V
Recharge current	10A	10A	10A	10A	10A
Autonomy 100% @ 0.8 pf (4 banks)	~ 50 min	~ 30 min	~ 20 min	~ 15 min	~ 10 min
GENERAL					
Weight of UPS with 4 set of batteries	420kg	420kg	420kg	420kg	420kg
Dimensions of UPS units and extended battery cabinets	D - 890mm H - 1270mm W - 610mm				
Interfacing	Dry Contacts – RS232 for MEGATEC S/W – Ethernet network connection				
Ambient temperature	0 - 40°C –90% maximum humidity				
Noise level	50 - 55dBA @ 1 meter				
PROTECTION (ALL RANGES)					
CIRCUIT BREAKERS AC - rectifier - reserve – bypass – output DC FUSES – Internal batteries					
STATIC SWITCH – analog detection – independent power supply					
ELECTRONIC - peak current limit pulse by pulse – IGBT supervision – overcurrent peak – RMS overload					

7.0 APPENDIX B ALARM EXPLANATION

ALARM NAME	ALARM MEANING
Inverter Off	The inverter is off
Inverter Voltage High	The RMS inverter voltage is over the allowable limit
Link Soft Starting	The DC link voltage is being pre charged
Rectifier Off	The boost converter is off
Inverter Output Low	The RMS inverter voltage is under the allowable limit
DC Link Voltage Low	The DC link voltage is under the allowable limit
Inverter Fuse Blown	The inverter fuse has blown
Rectifier Mains Fail	The rectifier supply is under the allowable limit
DC Link Voltage High	The DC link voltage is over the allowable limit
Rectifier Fuse Blown	The boost converter's fuse has blown
Overload	The UPS is being overloaded
Inverter DC Offset High	The DC component of inverter output is over allowable limit
Supervision Stop	The inverter bridge has been stopped by supervisory circuits
Over Temperature / Fan Failure	The UPS temperature is over allowable limit
* FACTORY SETUP MODE *	The UPS is in a drive signal checking mode (used at factory)
Rectifier High / Low	The rectifier output voltage is over/under allowable limit
Battery Volts High	The battery voltage is over allowable limit
Battery Fault Detected	The charger has detected a battery impedance fault
Charger Fail	The charger is not working
Battery Discharging	The battery voltage has dropped below 2V per cell
* Battery TEST MODE *	Battery test is in progress
Charger Feedback Fault	The charger is reporting a feedback fault
Battery Warning	The battery is nearly depleted
Charger Supply Out Limits	The charger's supply is over/under allowable limit
Low Battery Shutdown	The battery voltage is under allowable limit
Battery Boost Charge Active	The charger is in boost mode (vented cells only)
Charger Comms Error	Communications with the charger has been lost
Load on Static Bypass	The load is being supplied by the reserve source
Phase Rotation Fault	The reserve source's phase rotation is incorrect
Reserve Voltage High	The reserve source's voltage is over allowable limit
Retransfer Lockout	Attempts to retransfer the load failed - resulting in lockout
Loss of Phase Lock	The inverter is unable to synchronize to it's reserve source
Reserve Voltage Low	The reserve source's voltage is under the allowable limit
Maintenance Bypass Closed	The maintenance detour switch has been closed
Supply Freq Out Limits	The reserve source's frequency is over/under allowable limit
Output Voltage High	The static switch output voltage is over allowable limit
E.P.O. Activated	The external EPO has been triggered
Charger Needs Calibrating	The charger failed to receive valid calibration constants
Output Voltage Low	The static switch output voltage is under allowable limit
PSU Sleep Mode Warning	The PSU is about to go into sleep mode

8.0 APPENDIX C MENU TREE

- Menu
  - Commands
    - Erase History
    - Inverter On/Off
    - S/S Mode to Auto/Manual
    - S/S Lock Reset
  - Setup
    - Setup Relays
      - Assign Relays
      - Enable Relays
      - Test Relays
      - Save Relay Settings
    - Set Date & Time
    - View Specifications
    - Battery Discharge Curve
    - Password
  - History
  - Service
    - Download
    - Re-Kit
      - Control Card
      - Display
    - Setpoints
      - Battery Float
      - Battery Boost
      - Battery I Limit
      - Inverter Output
    - Thresholds
      - UPS Battery High
      - Ch Battery High
      - Battery Discharging
      - Battery Warning
      - Battery Low
      - Inverter Low
      - Reserve Low
      - Output Low
      - Inverter High
      - Reserve High
      - Output High
      - Frequency High
      - Frequency Low
    - Calibration
      - Ph Error Adjust
      - Inverter Voltage
      - Reserve Voltage
      - Output Voltage
      - Output Current
      - DC Link Voltage
      - Rectifier Mean Voltage
      - UPS Battery Voltage
      - Ch. Battery Voltage
      - Ch. Battery Current
      - Battery Temperature
      - UPS Temperature
    - Log This Service
    - Save ALL settings to flash
    - Reset the display


Factory
Factory Test On/Off
Battery Test On/Off
Battery Boost OnOff
Service Thresholds
UPS Battery High
Ch Battery High
Battery Discharge
Battery Warning
Battery Low
Inverter Low
Reserve Low
Output Low
Inverter High
Reserve High
Output High
Frequency High
Frequency Low
Factory Thresholds
DC Link High
DC Link Low
DC Link Start
Rectifier Mean Low
Phase Lock Voltage Low
Frequency High
Frequency Low
Centre Frequency
Phase Error
Setpoints
Battery Float
Battery Boost
Battery Current Limit
Inverter Output
DC Link Voltage
Calibration
Ph Error Adjust
Inverter Voltage
Reserve Voltage
Output Voltage
Output Current
DC Link Voltage
Rectifier Mean Voltage
UPS Battery Voltage
Ch. Battery Voltage
Ch. Battery Current
Battery Temperature
UPS Temperature
DC Offsets
Charger Input Voltage
Battery Impeadance
UPS Battery Current
View History
View Traps
Erase History
Erase Traps
Flash Commands
Service Contact Details