

Kohler PW 9000DPA

User Manual



Pioneering solutions for
total power protection

Document Control

ISSUE	DATE	REVISION SUMMARY
1.0	01-06-10	Initial issue.

Kohler Uninterruptible Power Ltd has taken every precaution to produce an accurate, complete and easy to understand manual and will therefore assume no responsibility nor liability for direct, indirect or accidental personal or material damage due to any misinterpretation of or accidental mistakes in this manual.

© 2010 Kohler Uninterruptible Power

This manual may not be copied nor reproduced without written permission of Kohler Uninterruptible Power.

Table of Contents

1	Safety	
1.1	Description of symbols used in this manual	1-1
1.2	User precautions	1-1
2	Description	
2.1	Reliability and Quality Standards	2-1
2.2	PowerWAVE 9000 DPA System	2-1
2.3	System Configuration	2-1
2.3.1	Single/Parallel module configurations	2-1
2.3.2	Single/Multi cabinet configurations	2-2
2.3.3	'Redundant-module' versus 'Capacity' system	2-2
2.3.4	PowerWAVE 9000DPA MD Frames	2-3
2.3.5	PowerWAVE 9000DPA MX Frames	2-4
2.4	Advanced Design Features	2-4
2.4.1	Hot-swappable modules	2-4
2.4.2	Advanced booster technology	2-4
2.4.3	Flexible battery management (FBM)	2-5
2.4.4	Decentralized Parallel Architecture (DPA)	2-5
2.5	Warranty	2-6
2.6	Extended Warranty	2-6
2.7	Additional Service/Maintenance Support	2-6
3	Installation	
3.1	Introduction	3-1
3.2	Receipt of the UPS	3-1
3.2.1	Site transportation	3-1
3.3	Unpacking	3-2
3.3.1	Nameplate	3-2
3.4	Batteries	3-2
3.5	Storage	3-3
3.5.1	UPS	3-3
3.5.2	Battery	3-3
3.6	Positioning	3-3
3.6.1	Planning the installation	3-3
3.7	UPS Power Cabling (preparation and planning)	3-4
3.7.1	General requirements	3-4
3.7.2	Multi-cabinet installation cabling considerations	3-6
3.8	Connecting the UPS input supply	3-7
3.8.1	Safety notes	3-7
3.8.2	Preparing the input cabling	3-7
3.8.3	Connecting the UPS input power cables	3-7
3.9	Connecting the UPS output	3-8
3.9.1	Safety notes	3-8
3.9.2	Preparation for the output cabling	3-8
3.9.3	Connecting the UPS output cables	3-9

3.9.4	Connection Terminal Details	3-10
3.10	Connecting the batteries	3-19
3.10.1	Safety Notes	3-19
3.10.2	Battery cabling	3-19
3.10.3	Connecting the battery cables	3-21
3.11	Internal Battery Systems	3-21
3.11.1	DPA-25	3-21
3.11.2	DPA-75	3-22
3.11.3	DPA-50	3-22
3.11.4	DPA-150	3-23
3.12	External Battery Cabinets and Battery Connections	3-23
3.13	Multi-cabinet Parallel Communication Cables (Bus-lines)	3-24
3.14	Interfacing Facilities	3-26
3.14.1	Interface Board	3-26
3.14.2	Smart Port (Serial RS 232)	3-27
3.14.3	Dry Port (volt-free contacts)	3-27
3.14.4	JD11/RS232 Computer Interface	3-28
3.14.5	JD12/RS232 Interface for Multidrop	3-28
3.14.6	USB/2 Computer Interface	3-28

4 Operation

4.1	Commissioning	4-1
4.2	Control Panel	4-1
4.2.1	Power Management Display (PMD)	4-1
4.2.2	Mimic LED indicators	4-2
4.2.3	Operator keys	4-2
4.3	Description of the LCD	4-3
4.3.1	Status screens	4-3
4.3.2	Main menu screen	4-4
4.3.3	Event log menu screen	4-4
4.3.4	Measurements menu screen	4-4
4.3.5	Commands menu screen	4-5
4.3.6	UPS Data menu screen	4-5
4.3.7	Set-up User menu screen	4-6
4.3.8	Set-Up Service menu screen	4-6
4.4	Operating Modes	4-7
4.4.1	On-Line (Inverter) mode	4-7
4.4.2	OFF-Line (also known as ECO or Bypass) mode	4-7
4.4.3	Maintenance Bypass mode	4-8
4.4.4	Parallel Isolator switch(IA2)	4-8
4.5	Operating Instructions	4-9
4.5.1	Transfer to Maintenance Bypass Mode	4-9
4.5.2	Starting the UPS system from the Maintenance Bypass	4-11
4.5.3	Complete system shutdown	4-13
4.5.4	Individual module start/stop procedure	4-14
4.6	Replacement of the UPS Module in a Single Module System	4-15
4.6.1	Removing a UPS Module	4-15
4.6.2	Refitting the UPS Module	4-16
4.7	Replacing a UPS Module in a REDUNDANT Multi-Module System	4-17
4.7.1	Removing the UPS Module	4-17
4.7.2	Inserting a UPS Module	4-18
4.8	Replacing a Module In a CAPACITY Multi-Module System	4-18
4.8.1	Removing a Module	4-18
4.8.2	Refitting a Module in a Capacity Multi-Module System	4-19

5	Maintenance	
5.1	Introduction	5-1
5.2	System calibration	5-1
5.3	User responsibilities	5-1
5.4	Routine maintenance	5-1
5.5	Battery Testing	5-2
5.6	Battery Maintenance	5-2
5.7	Battery Disposal and Recycling	5-2
6	Troubleshooting	
6.1	Alarms	6-1
6.2	Menu, Commands, Event Log, Measurements,	6-1
6.3	Fault Identification and Rectification Messages and Alarms	6-2
6.4	Contacting Service	6-2
7	Options	
7.1	Introduction.	7-1
7.2	Remote Emergency Stop Facilities	7-1
7.3	Generator ON Facilities	7-2
7.4	WAVEMON Shutdown and Management Software	7-2
	7.4.1 Why is UPS Management important?	7-2
	7.4.2 Wavemon Shutdown and Monitoring Software	7-3
7.5	SNMP CARD/ADAPTER For Network Management /Remote Monitoring	7-4
8	Specifications	
8.1	Mechanical Characteristics	8-1
8.2	Input Characteristics	8-3
8.3	Battery	8-3
8.4	Output	8-4
8.5	Environmental	8-5
8.6	Packed weights	8-6
8.7	Cable and fuse sizing (Single feed input)	8-7
8.8	Cable and fuse sizing (Dual feed input)	8-8

1

Safety

1.1 Description of symbols used in this manual



WARNING: The warning symbol is used where there is danger of an electrical shock, equipment damage or personal-injury.



CAUTION: The caution symbol is used to highlight important information to avoid possible equipment malfunction or damage.

1.2 User precautions



WARNING: Keep this manual with the UPS for future reference.



WARNING: The UPS and peripheral equipment must be installed and commissioned by suitably qualified and trained personnel who are aware of the potential shock hazards.



WARNING: Do not attempt to install this UPS system until you are satisfied that ALL the safety instructions and hazard warnings contained in this manual are read and fully understood.



WARNING: High leakage current!
Ensure that the UPS has been correctly earthed before you connect the mains power supply!



WARNING: This UPS must not be started-up or put into use without having first been commissioned by a fully trained engineer authorised by the manufacturer.



WARNING: All servicing must be performed by qualified personnel. Do not attempt to service the UPS yourself.
You run risk of exposure to dangerous voltages by opening or removing the UPS-covers! Kohler Uninterruptible Power will assume no responsibility nor liability due to incorrect operation or manipulation of the UPS.



WARNING: The PowerWAVE 9000 DPA is a Class A UPS product (according to EN 50091-2). In a domestic environment the UPS may cause radio interference. In such an environment the user may be required to undertake additional measures.

2

Description

2.1 Reliability and Quality Standards

Congratulations on your purchase of the PowerWAVE 9000 DPA UPS.

By using a unique modular construction and incorporating the latest technological developments in power engineering, the PowerWAVE 9000 DPA represents a completely new generation of transformer-less 3 phase UPS-System. High reliability, upgrade ability, low operating cost and excellent electrical performance are just some of the highlights of this innovative UPS solution.

Kohler Uninterruptible Power specialises in the design, building, installation and maintenance of Uninterruptible Power Systems. This compact and powerful UPS is just one example of our wide range of state of the art power protection devices and will provide your critical equipment with a steady and reliable power supply for many years.

The criteria and methods which are used in the design, manufacture, and maintenance of Uninterruptible Power Supply systems are certified to International Standard ISO 9001/EN 29001. A full UPS Specification is given in Chapter 8 of this manual.

2.2 PowerWAVE 9000 DPA System

PowerWAVE 9000 DPA is a truly modular system based on a range of 10kVA to 45kVA UPS power modules that can be connected in parallel to form a redundant-module system. The UPS modules are housed in free-standing cabinets which are purpose designed to contain up to one, three or five modules. Two cabinet ranges are available as standard – the 'MD' cabinet range is designed for use with 10kVA-25kVA modules (see Figure 2.2), whereas 'MX' cabinets are used with modules from 30kVA to 45kVA (see Figure 2.3).



Key Point: All the modules fitted within a cabinet must be of the same rating – i.e. it is not possible to mix 10kVA and 20kVA modules in the same parallel system.

Cabinets designed for three (or fewer) modules also contain the UPS batteries; however an additional, external battery cabinet can be used to extend the battery autonomy time if required. An external battery cabinet is always required for cabinets designed for 5 UPS modules. A range of battery cabinets of matching style and colour is available to sit alongside the UPS cabinets to provide a matching suite.

2.3 System Configuration

The PowerWAVE 9000 DPA system configurations are described below.

2.3.1 Single/Parallel module configurations

Within the UPS cabinet, the power modules can be configured in one of two ways:

Single-module system

As its name suggests, a 'single-module' system comprises a cabinet fitted with just one UPS module, even if the cabinet is designed to house several modules – for example a TRIPLE DPA-75 or -150, UPGRADE DPA-125 or -250 fitted with a single module is still considered as a 'single' module system.

Parallel-module system

A 'parallel-module' system employs several modules (of the same rating) operating in parallel within the same cabinet (e.g. TRIPLE DPA-75) using the DPA technology (see paragraph 2.4.4).

2.3.2 Single/Multi cabinet configurations

Single cabinet system

A single-cabinet system comprises a stand-alone cabinet containing one or more UPS power module(s) operating as a single-module or module-module system (as defined in paragraph 2.3.1).

Multi-cabinet system

To further increase the overall system capacity it is possible to connect up to 10 standard cabinets in parallel. Depending on the model type, each cabinet can contain up to 5 UPS power modules, thereby potentially resulting in a system comprising up to 50 parallel modules if 10x UPGRADE DPA-125 or 10x UPGRADE DPA-250 cabinets are employed. Although, in practice, a typical multi-cabinet system will be made up of fewer than 10 cabinets.

Every standard PowerWAVE 9000 DPA cabinet is provided with the parallel option, eliminating any need for time-consuming or expensive upgrading on site.

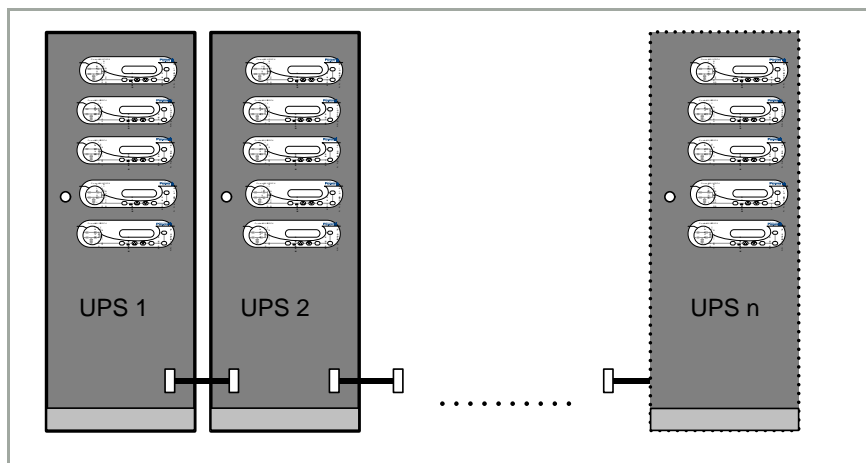


Figure 2.1 PowerWAVE 9000 DPA UPS Multi-Cabinet Chain.



The multi-cabinet configuration is based on a Decentralised Bypass Architecture (DPA) – i.e. every UPS is provided with its own static bypass. In a parallel system there is always one *master* module and the other modules are *slaves*. If at any time the master goes faulty the next UPS (former slave) will immediately take over the master function and the former master will switch off.

2.3.3 'Redundant-module' versus 'Capacity' system

The difference between a '*redundant-module*' system and a '*capacity*' system is that a '*capacity*' system is rated such that ALL the UPS power modules are required to provide the necessary output load power. This is not the case for a '*redundant-module*' system, whereby the overall system is designed with one (or more) modules over and above that required to supply the full load. In a redundant-module system it is therefore possible to lose one (or more) UPS module without affecting the load supply.

Every UPS power module in a parallel configuration is provided with an output parallel Isolator (IA2) which, when opened, isolates the corresponding module from the parallel system and the module no longer contributes to the system's power output. In a '*capacity*' system opening this isolator this will cause the load to transfer to the (unprotected) bypass supply. but in a '*redundant-module*' system the load will continue to receive protected power until the number of off-line modules exceeds the inbuilt system redundancy.

2.3.4 PowerWAVE 9000DPA MD Frames

PowerWAVE DPA MD Frames		CLASSIC DPA-25	TRIPLE DPA-75	UPGRADE DPA-125	
					
Capacity	Max.	1 module (10-25kVA) 200 x 7/9Ah batteries	3 modules (10-25kVA) 180 x 7/9Ah batteries	5 modules (10-25kVA) External batteries	
Max. Power connection	kVA	25	75	125	
Dimensions (WxHxD)	mm	550x1650x780	550x1975x780	550x1975x780	
Weight of Empty Frame	kg	200	220	160	
Weight of Frame with modules and no batteries	kg	224 - 233 (with 1 Module)	292 - 319 (with 3 Modules)	280 - 325 (with 5 Modules)	
Colours		Front: RAL 9007 + black (inlets). Side walls: Graffito grey			




PowerWAVE DPA Modules		DPA 10	DPA 15	DPA 20	DPA 25
					
Output Apparent Power	KVA	10	15	20	25
Output Active Power	KW	8	12	16	20
Output Power (PF=1)	KVA/KW	8 / 8	12 / 12	16 / 16	20 / 20
Variable Number of 12V Battery Blocks	No.	30 – 50	30 – 50	30 – 50	40-50
Dimensions (WxHxD)	mm	483 x 225 x 700			
Weight UPS Module	kg	24		33	
Colours		Front: RAL 9007			

Figure 2.2 PowerWAVE 9000DPA MD Frames

2.3.5 PowerWAVE 9000DPA MX Frames

PowerWAVE DPA MX Frames		CLASSIC DPA-50	TRIPLE DPA-150	UPGRADE DPA-250
				
Capacity	Max.	1 module (30-45kVA) 280 x 7/9Ah batteries	3 modules (30-45kVA) 240x 7/9Ah batteries	5 modules (30-45kVA) External batteries
Max. Power connection	kVA	50	150	250
Dimensions (WxHxD)	mm	730x1650x800	730x1975x800	730x1975x800
Weight of Empty Frame	kg	250	270	190
Weight of Frame with modules and no batteries	kg	300 - 310 (with 1 Module)	420 - 450 (with 3 Modules)	440 - 490 (with 5 Modules)
Colours	Front: RAL 9007 + black (inlets). Sidewalls: Graffito grey			


PowerWAVE DPA MODULES		DPA 30	DPA 40	DPA 50
				
Output Apparent Power	KVA	30	40	45*
Output Active Power	KW	24	32	40
Output Power (PF=1)	KVA / KW	24 / 24	32 / 32	40 /40
Number of 12V Battery Blocks	No.	40-50	40-50	40-50
Dimensions (WxHxD)	mm	663 x 225 x 720		
Weight UPS Module	kg	50	57	60
Colours	Front: RAL 9007			
		* On Inverter mode 50 KVA/40kW on Bypass mode 45 KVA/40kW		

Figure 2.3 PowerWAVE 9000DPA MX Frames

2.4 Advanced Design Features

2.4.1 Hot-swappable modules

In a redundant module system (see paragraph 2.4.4) the unique *Hot-Swappable* feature enables a UPS module to be inserted or removed from the larger cabinet assembly whilst it is still powered (*hot*) without affecting the supply to the load, and without having to transfer to bypass.

Note: In a non-redundant configuration the load will unavoidable have to be transferred to bypass while a module is removed from the system.

2.4.2 Advanced booster technology

The UPS module's inbuilt advanced booster technology results in a perfect sinusoidal input power quality at 0.99 input power factor with a harmonic content of less than 3% THD(i). This leads to a more reliable total system operation and savings in generator and transformer sizing as winding losses are minimised. It also means that traditional harmonic filters are no longer required.

The high power factor presented by the UPS on the incoming mains supply minimises cabling and fusing costs due to the resulting lack of reactive power consumption. This, together with the accompanying low harmonic currents, provide the following benefits:

- No additional losses in wires and cables.
- No extra heating of transformers and generators.
- No over sizing of generators.
- No false circuit breaker tripping and malfunction.
- No erratic operation of computers, telecommunication, monitors, electronic test equipment etc.
- No resonance with power factor correction capacitors.

2.4.3 Flexible battery management (FBM)

This equipment employs a flexible battery management which avoids premature deterioration of battery life by advanced management of battery charging and preventive failure diagnostics.

The major benefits are:

- AC-ripple free battery charging due to a dc-dc charger separated from the rectifier and inverter.
- Wide range of number of battery blocks (30-50 blocks of 12V; depending autonomy times).
- UPS's wide input voltage operating window extends the battery life due to fewer discharge cycles.
- Battery discharge protection caused by load jumps.
- Proactive battery protection from false manipulations and inadequate charging voltages.
- Proactive battery failure detection thanks to Advanced Battery Diagnosis (ABD) - Algorithm.
- User selectable battery tests.
- Optional temperature compensated charging to enhance battery life.

2.4.4 Decentralized Parallel Architecture (DPA)

In a 'redundant' parallel UPS system the UPS modules are linked together in parallel so that in the event that one module fails the others can automatically sustain the load supply.

A 'parallel redundancy' configuration is achieved by having a random or fixed *master-slave* relationship among the UPS modules whereby the *master* logic gives out individual commands to all the *slave* units. Unfortunately, in some designs this can lead to a single-point-of-failure for the entire system if the master logic or communication to the slaves fails.

The PowerWAVE 9000 DPA system features DPA paralleling technology that provides $n+x$ redundancy without introducing a single-point-of-failure. The modules utilizing the DPA technology are completely autonomous by means of individual power units, bypasses, CPUs, control panels and separate battery configuration.

DPA technology uses *multi-master* logic with separated independent regulation and logic buses to maintain the highest system availability.

This unique decentralized design:

- enables a parallel redundant system providing 100% conditioned power at all times.
- eliminates the system-level single point of failure inherent in traditional parallel UPS
- exponentially increases the reliability of the overall system.
- allows up to ten UPS cabinets to supply the same load in *parallel* and *redundant* configuration.

2.5 Warranty

The PowerWAVE 9000 DPA UPS is supplied with a limited warranty that the UPS and its component parts are free from defects in materials and workmanship for a period of one year from the date of original commissioning or fifteen months from the date of original delivery, whichever is the sooner. This warranty is the only warranty given and no other warranty, express or implied, is provided.

This warranty is invalidated if the UPS is put into use without having been commissioned by a fully trained and authorised person. This warranty does not apply to any losses or damages caused by misuse, abuse, negligence, neglect, unauthorised repair or modification, incorrect installation, inappropriate environment, accident, act of God or inappropriate application.

If the UPS fails to conform to the above within the warranty period then Kohler Uninterruptible Power will, at its sole option, repair or replace the UPS. All repaired or replaced parts will remain the property of Kohler Uninterruptible Power.

As a general policy, Kohler Uninterruptible Power does not recommend the use of any of its products in life support applications where failure or malfunction of the product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Kohler Uninterruptible Power does not recommend the use of any of its products in direct patient care. Kohler Uninterruptible Power will not knowingly sell its products for use in such applications unless it receives in writing assurances satisfactory to Kohler Uninterruptible Power that the risks of injury or damage have been minimized, the customer assumes all such risks and the liability of Kohler Uninterruptible Power is adequately protected under the circumstances.

THE UPS SYSTEM MAY CONTAIN BATTERIES WHICH MUST BE RE-CHARGED FOR A MINIMUM OF 24 HOURS EVERY SIX MONTHS TO PREVENT DEEP-DISCHARGING. BATTERIES THAT HAVE BEEN, FOR WHATEVER REASON, DEEP-DISCHARGED ARE NOT COVERED BY THE WARRANTY.

2.6 Extended Warranty

The Standard Warranty may be enhanced by protecting the UPS with an Extended Warranty Agreement (maintenance contract). An Extended Warranty Agreement enhances the standard warranty by providing the following:-

- Regular preventative maintenance inspections.
- Guaranteed speed of response to operational problems.
- 24 hour telephone support.
- Fully comprehensive (excluding batteries) cover.
- Contact the Service Support Hotline on +65 6302 0708 for further details.

2.7 Additional Service/Maintenance Support

In addition to providing support for the PowerWAVE 9000 DPA, Kohler Uninterruptible Power can provide maintenance and support of a wide range of different UPS products.

If you are interested in an extended warranty for your PowerWAVE 9000 DPA, or any other UPS you may have, please complete the enquiry form shown opposite and return or FAX to:

Kohler Uninterruptible Power.
7 Jurong Pier
Singapore 619159
Tel: +65 6302 0708
Fax: +65 6302 0717
Email: serviceUPS.sg@kohler.com

Fax to: +65 6302 0717

www.kohlerupu.sg

Kohler Uninterruptible Power
7 Jurong Pier
Singapore 619159
Tel: +65 6264 6422

Name:

Job Title:

Company:

Address:

.....

.....

.....

Post Code:

Tel.

Fax.

E-mail

Please contact me to discuss:

Extended Warranty options for my PowerWAVE 9000 DPA UPS

Extended warranty options for my UPS System as below:

Manufacturer:.....

Model N°:.....

Rating kVA:.....

Replacement Batteries.....

Other(please specify)

Thank you for your enquiry, which will receive our prompt attention.
If you need to contact us immediately on +65 6264 6422 ,
or E-mail us on serviceUPS.sg@kohler.com
www.kohlerups.sg

3

Installation

3.1 Introduction

This chapter contains all the information necessary for the correct unpacking, positioning, cabling and installation of the PowerWAVE 9000 DPA.



WARNING: All the operations described in this section must be performed by authorised electricians or suitably qualified personnel.

Kohler Uninterruptible Power will take no responsibility for any personal or material damage caused by incorrect cabling or operations, or activities which are not carried out in strict accordance with the instructions contained in this manual.

3.2 Receipt of the UPS

The UPS and accessories are delivered on a specifically designed pallet that is easy to move with a forklift or a pallet jack.



CAUTION: When off loading the UPS always keep it in an upright position.

Do not drop the equipment.

Do not stack the pallets due to the high-energy batteries involved and the heavy weight.

The packing container protects the UPS from mechanical and environmental damage. This protection is further increased by wrapping the PowerWAVE 9000 DPA UPS with a plastic sheet.

Upon receiving the UPS, carefully examine the packing container and the UPS for any sign of physical damage. The outside 'Tip&Tel' ("FRAGILE" and "ARROW") indicator should be intact if the equipment has been transported in an upright position. In case of rupture (or if they are suspect) inform the carrier and Kohler Uninterruptible Power immediately.



CAUTION: Visible transport damages must be claimed to the carrier immediately after receipt!

Other claims for shipping damage must also be filed immediately and the carrier must be informed within 7 days of receipt of the equipment.

Packing materials should be stored for further investigation.

Ensure that the received UPS corresponds to the description indicated in the delivery note.

3.2.1 Site transportation

If you transport the UPS equipment after it has been off-loaded (for example, for storage or moving to a different installation location) please observe the following precautions.



CAUTION: Transportation:

To avoid the UPS cabinets and/or battery cabinet falling over, use the shipping brackets on the rear and front to secure the cabinets.

– Do not tilt the cabinets more than 10° from vertical.



CAUTION: Potential dangers:

– If the cabinet has been tilted it might damage the equipment and it should not therefore be connected to the mains electricity supply.

– The weight of the UPS system could cause serious injuries to persons or anything in the surrounding area.


CAUTION: Storage:

- The UPS should be stored in the original packing and shipping carton.
- The recommended storing temperature for the UPS system and batteries is between +5 °C and +40°C.
- The UPS system and the battery sets must be protected from humidity < 90% RH (non-condensing).

3.3 Unpacking



WARNING: The UPS system, the battery cabinet (option) and the batteries are heavy and may tip during transportation causing serious injury if the unpacking instructions are not followed closely.

If the packages are received in good order (i.e. the 'tip & tell' "FRAGILE" and "ARROW" indications on the packing container are intact) then perform the following steps to unpack the UPS:

1. If the cabinet is shipped inside a wooden case, remove the screws at the base and sides of the case then carefully remove the case from the equipment.
2. Cut the wrappers and remove the packing container by pulling it upwards.
3. Remove the plastic sheeting covering the UPS.
4. Remove the UPS from the pallet.
5. Retain the packaging materials for future shipment of the UPS.
6. Examine the UPS for any sign of damage.
Notify your supplier immediately if damage is apparent.
7. Open the cabinet door and ensure that all the UPS modules are correctly and securely fitted in their compartments. Ensure that a protection cover is fitted to the front of any empty UPS compartments.

3.3.1 Nameplate

The technical specifications of the PowerWAVE 9000 DPA are provided on the nameplate which is situated at the front (internal door) of the UPS.

Check that the details on the nameplate corresponds to the purchased material detailed on the delivery note.

3.4 Batteries

The standard batteries connected to the UPS are sealed, maintenance-free batteries which will be mounted either within the UPS cabinet or an external battery cabinet. The battery will usually be connected when the UPS is commissioned.

Battery life depends very much on the ambient temperature, and optimum battery life will be obtained if the batteries are operated at a temperature of 20°C.

If the UPS is delivered without batteries, Kohler Uninterruptible Power is not responsible for any damage or malfunctioning caused to the UPS by the incorrect storage, installation or connection of batteries by third parties.

3.5 Storage

3.5.1 UPS

If you plan to store the UPS prior to use, store it in a clean dry environment with a temperature between 5°C to +40°C and RH of less than 90%. If the packing container is removed, you must protect the UPS from dust.

3.5.2 Battery

The UPS utilizes sealed, maintenance-free batteries, whose storage capability depends on ambient temperature. It is therefore important not to store the UPS for longer than 6 months at 20°C, 3 months at 30°C or 2 months at 35°C storage temperature without recharging the batteries. For longer term storage the battery should be fully recharged every 6 months @20°C.



CAUTION: Sealed batteries must never be stored in a discharged or partially discharged state. Extreme temperature, under-charge, overcharge or over-discharge will destroy batteries!



Key Point: Note the following:

- Charge the battery both before and after storing.
- Always store the batteries in a dry, clean, cool environment in their original packaging.
- If the packaging is removed protect the batteries from dust and humidity.

3.6 Positioning

3.6.1 Planning the installation

A certain amount of pre-planning will help ensure smooth, trouble-free equipment installation. The following guidelines should be taken into account when planning a suitable UPS location and environment.

1. The equipment must be installed and transported in a upright position.
2. The floor at the installed location and en-route from the off-loading point must be able to safely take the weight of the UPS and battery equipment plus fork lift during transit.
3. The UPS cabinet requires space to bottom/front and back to enable cooling airflow. Suitable ventilation airflow must also be provided (See Figure 3.1). Allow a 200mm minimum clearance at the back of the cabinet.
4. All parts of the UPS required for maintenance, servicing and user operation are accessible from the front. Reserve a minimum of 1000mm space at the front of the UPS cabinet.
5. An ambient temperature of 20°C is recommended to achieve a long battery life. The cooling air entering the UPS must not exceed +40°C.
6. Avoid high ambient temperature, moisture and humidity. The floor material should be non-flammable and strong enough to support the heavy load.
7. In summary, the UPS should be located where:
 - a) Humidity (< 90% non-condensing) and temperature (+15°C to 25°C) are within prescribed limits.
 - b) Fire protection standards are respected.
 - c) Cabling can be performed easily.
 - d) A minimum 900mm front accessibility is available for service or periodic maintenance.
 - e) Requested air cooling flow is available.
 - f) The air conditioning system can provide a sufficient amount of air cooling to keep the room at, or below, the maximum desired temperature.
 - g) No dust or corrosive/explosive gases are present.
 - h) The location is vibration free.
 - i) If the UPS will be installed in bayed enclosures, partition walls have to be installed.

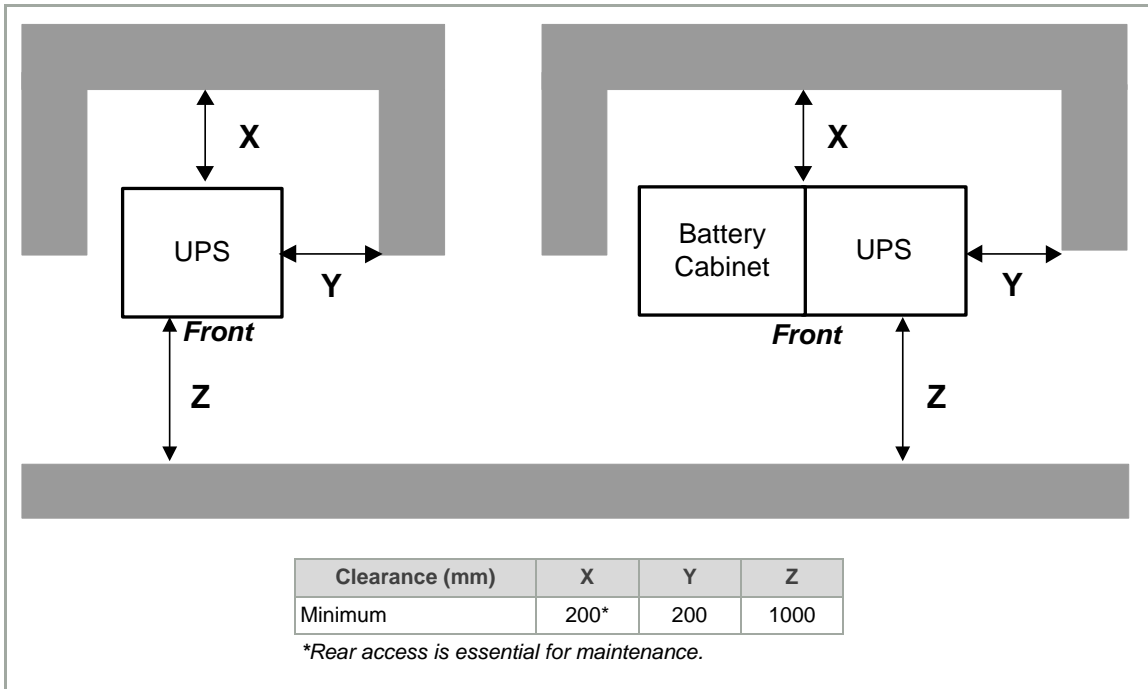


Figure 3.1 UPS & Battery Cabinet Space Requirements

3.7 UPS Power Cabling (preparation and planning)

3.7.1 General requirements

It is the customer's responsibility to provide all external fuses, isolators and cables used to connect the UPS input and output power supplies. The information in this section should assist in the planning and preparation of the UPS power cabling.

The UPS input supply and bypass supply should be connected to the utility mains through a LV-Distribution board and protected by a circuit breaker or fuse. This provides overload protection and also a means of isolating the UPS from the mains supply when required. Similarly, the UPS output supply should be connected to the load equipment via a suitably fused output distribution panel.

The UPS can be wired with a 'single feed' input (standard), whereby the UPS input supply is connected internally to the UPS bypass circuit (see Figure 3.5); or it can be wired with a 'dual feed' input, whereby the UPS bypass circuit is connected to a dedicated 'bypass' supply (see Figure 3.6). These diagrams identify the UPS input/output cabling requirements and provides information regarding fuse ratings, cable ratings and cable sizing.



Key Point: This information is given for guidance only. All fuses, isolators and power cables must be rated and installed in accordance with the prescribed IEC standards or local regulation.

Figure 3.4 outlines of the power terminal connections with the various UPS cabinets including connection sizes. Detailed connection diagrams can be found in:

- Figure 3.7 (DPA-25 Input/Output Terminal Block, Front View)
- Figure 3.8 (DPA-75 Input/Output Terminal Block, Front View)
- Figure 3.9 (DPA-125 Input/Output Terminal Block, Front View)
- Figure 3.10 (DPA-50 Input/Output Terminal Block, Front View)
- Figure 3.11 (DPA-150 Input/Output Terminal Block, Front View)
- Figure 3.12 (DPA-250 Input/Output Terminal Block, Front View)

These illustrations show that the UPS cabinet requires the following power cables:

Rectifier (In):

- three-phase (1L1, 1L2, 1L3)
- neutral (1N)
- protective earth (PE) connection for the rectifier input

Bypass (In):

- three-phase (2L1, 2L2, 2L3)
- neutral (2N)
- protective earth (PE) connection for the bypass if used as 'Dual Feed' input

Load (Out):

- three-phase (3L1, 3L2, 3L3)
- neutral (3N)
- protective earth (PE) connection for the load output

(External) Battery:

- Plus (+)
- Common (N)
- Minus (-)
- protective earth (PE) connection for the external batteries

Input neutral grounding



Key Point: Input neutral is required to operate the rectifier.

In TN-S systems, no 4-pole input switches or circuit breakers should be used. During battery operation the neutral must always be grounded.

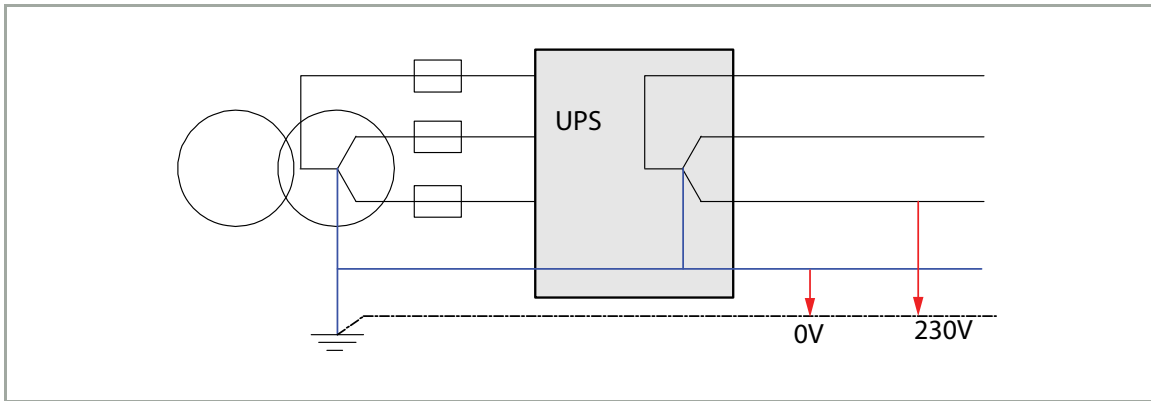


Figure 3.2 Input neutral grounding

3.7.2 Multi-cabinet installation cabling considerations

In order to achieve equal load sharing between the UPS cabinets in a multi-cabinet installation, the input cables from the input distribution board to each UPS cabinet should be of equal length. Similarly the UPS output cables to the output distribution board should be of equal length (See Figure 3.3).

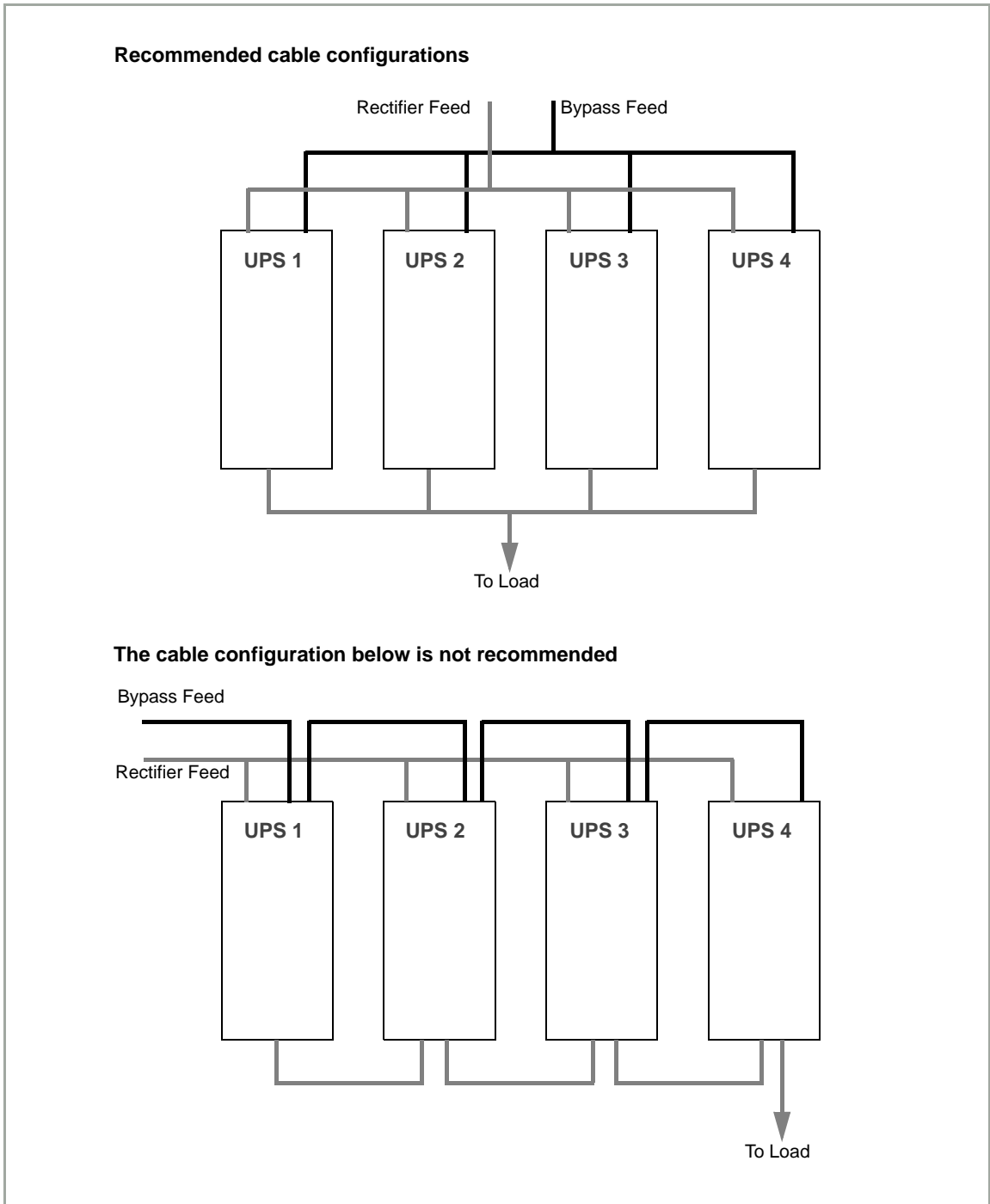


Figure 3.3 Cable Lengths for Multi Cabinet Configurations (assuming a 2 cable input)

3.8 Connecting the UPS input supply



WARNING: Opening or removing the UPS enclosure covers will create the risk of exposure to dangerous voltages if power is connected to the UPS.

3.8.1 Safety notes

Please ensure you read and understand the following safety notes before you begin the UPS electrical installation.

1. All operations detailed in this section must be performed by an authorised electrician or qualified/ approved personnel.
2. Once the electrical installation is completed the initial UPS start-up and commissioning must be performed by qualified personnel authorised by the manufacturer.
3. Do not operate the UPS if there is water or moisture present.
4. When carrying out any work on the UPS input power cables you must ensure that the UPS supplies are isolated at the supply distribution panel and, where possible, locked out. Warning notices should be posted where applicable to prevent inadvertent operation of the input supply isolators.

3.8.2 Preparing the input cabling

Before you start connecting the UPS input cables:

- Ensure that the provided fuses and cables satisfy the ratings shown in Figures 3.5 and 3.6, and are in accordance with the prescribed IEC Standards or local regulations.
- Do not commence this procedure until the UPS is properly installed at its intended final location.

3.8.3 Connecting the UPS input power cables

1. To protect personnel during the UPS installation ensure that the connections are performed under the following conditions:
 - a) No mains voltage is present.
 - b) Loads are shut down and disconnected.
 - c) The UPS is shut down and voltage-free.
 - d) The UPS Maintenance Bypass Isolator IA1 is OFF.
2. Gain internal access to the UPS cabinet and remove the UPS power terminal cover.
3. Connect the earth cable from the LV-Distribution Board to the protective earth (PE) terminal in the UPS.
4. The PowerWAVE 9000 DPA input supply can be wired for 'single feed' (standard) or 'dual feed' operation. Connect the input power cable coming from the LV-Distribution Board to the UPS input terminals following the appropriate instructions (single feed) or (dual feed) below.

Single Input Feed

Refer to the schematic drawing and connection table shown in Figure 3.5.

1. Connect the UPS input supply cables to terminals 1L1, 1L2, 1L3 and 1N on the UPS main terminal block (See Figure 3.4). Ensure correct (clockwise) phase rotation.



CAUTION: The input Neutral cable must ALWAYS be connected.

2. Secure the cables to the fixing rail located under the UPS connection terminals.

Dual Input Feed

Refer to the schematic drawing and connection table in Figure 3.6.

1. The UPS is supplied (as standard) with facilities for a single cable feed for the rectifier and bypass supplies. For a dual feed configuration remove the links between 1L1 - 2L1; 1L2 - 2L2; 1L3 - 2L3 and 1N - 2N, on the input terminal block.
2. Connect the UPS input supply cables to terminals 1L1, 1L2, 1L3 and 1N on the UPS main terminal block. Ensure correct (clockwise) phase rotation.



CAUTION: The input Neutral cable must ALWAYS be connected.

3. Connect the UPS bypass supply cables to terminals 2L1, 2L2, 2L3 and 2N on the UPS main terminal block. Ensure correct (clockwise) phase rotation.



CAUTION: The bypass Neutral cable must ALWAYS be connected.

4. Secure the cables to the fixing rail located under the UPS connection terminals.

Note: The UPS commissioning engineer will configure the UPS system for a dual input operation at the time of commissioning.

3.9 Connecting the UPS output



WARNING: Opening or removing the UPS enclosure covers will create the risk of exposure to dangerous voltages if power is connected to the UPS.

3.9.1 Safety notes

Ensure you read and understand the following safety notes before you begin the UPS electrical installation.

1. All operations detailed in this section must be performed by an authorised electrician or qualified/approved personnel.
2. Once the electrical installation is completed the initial UPS start-up and commissioning must be performed by qualified personnel authorised by the manufacturer.
3. Do not operate the UPS if there is water or moisture present.
4. When carrying out any work on the UPS output power cables you must ensure that the UPS supplies are isolated at the supply distribution panel and, where possible, locked out. Warning notices should be posted where applicable to prevent inadvertent operation of the input supply isolators.

3.9.2 Preparation for the output cabling

Circuit breakers (or equivalent protection) must be fitted between the UPS output and load equipment to provide additional protection to the UPS in the event of an overload or short circuit, and also provide a means of isolating individual loads if required.

Before you start connecting the UPS output cables to the load distribution panel:

- Ensure that the potential load does not exceed the UPS model output power rating (OUTPUT POWER) on the nameplate.
- Ensure the output circuit breakers are correctly sized with respect to the load rating and associated cabling.
- The maximum total load rating and maximum load rating of the individual load sockets should be indicated on the output distribution board.
- The circuit breakers must comply with the prescribed IEC Standards. It is recommended that a separate output distribution board is provided for the load.

3.9.3 Connecting the UPS output cables

1. To protect personnel during the UPS installation ensure that the connections are performed under the following conditions:
 - a) No mains voltage is present.
 - b) Loads are shut down and disconnected.
 - c) The UPS is shut down and voltage-free.
 - d) The UPS Maintenance Bypass Isolator IA1 is OFF.
2. Gain internal access to the UPS and remove the UPS terminal cover (if fitted).
3. Connect the protective earth cable from the Load Distribution Board to the output protective earth (PE) terminals, as shown in Figure 3.4.
4. Connect the UPS output supply cables to terminals 3L1, 3L2, 3L3 and 3N on the UPS main terminal block. Ensure correct (clockwise) phase rotation.



CAUTION: *The output Neutral cable must ALWAYS be connected.*

5. Secure the cables to the fixing rail located under the UPS connection terminals.
6. Ensure the output cables are connected to the correct power terminals on the output (load) distribution panel.

3.9.4 Connection Terminal Details

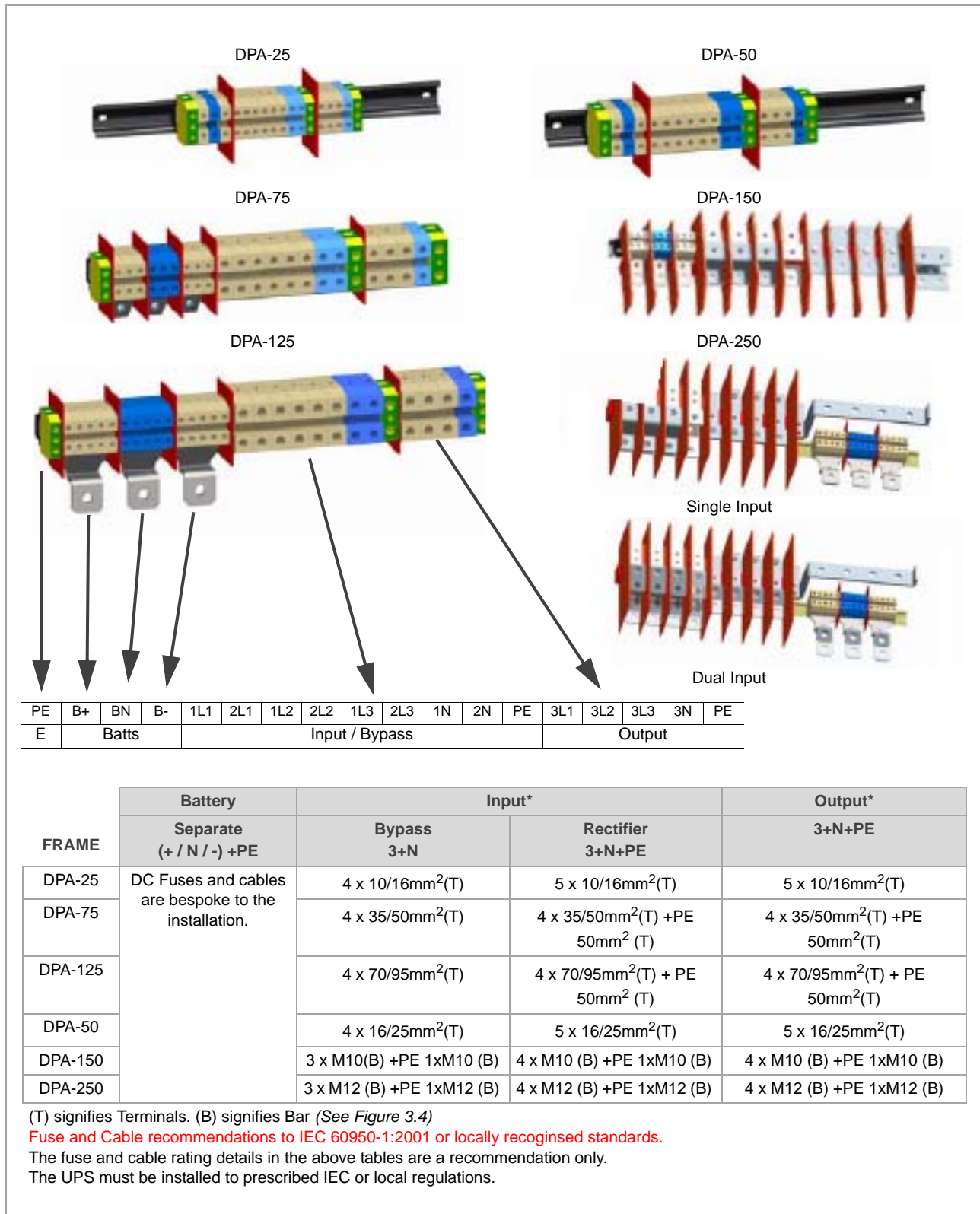


Figure 3.4 Terminal Layouts

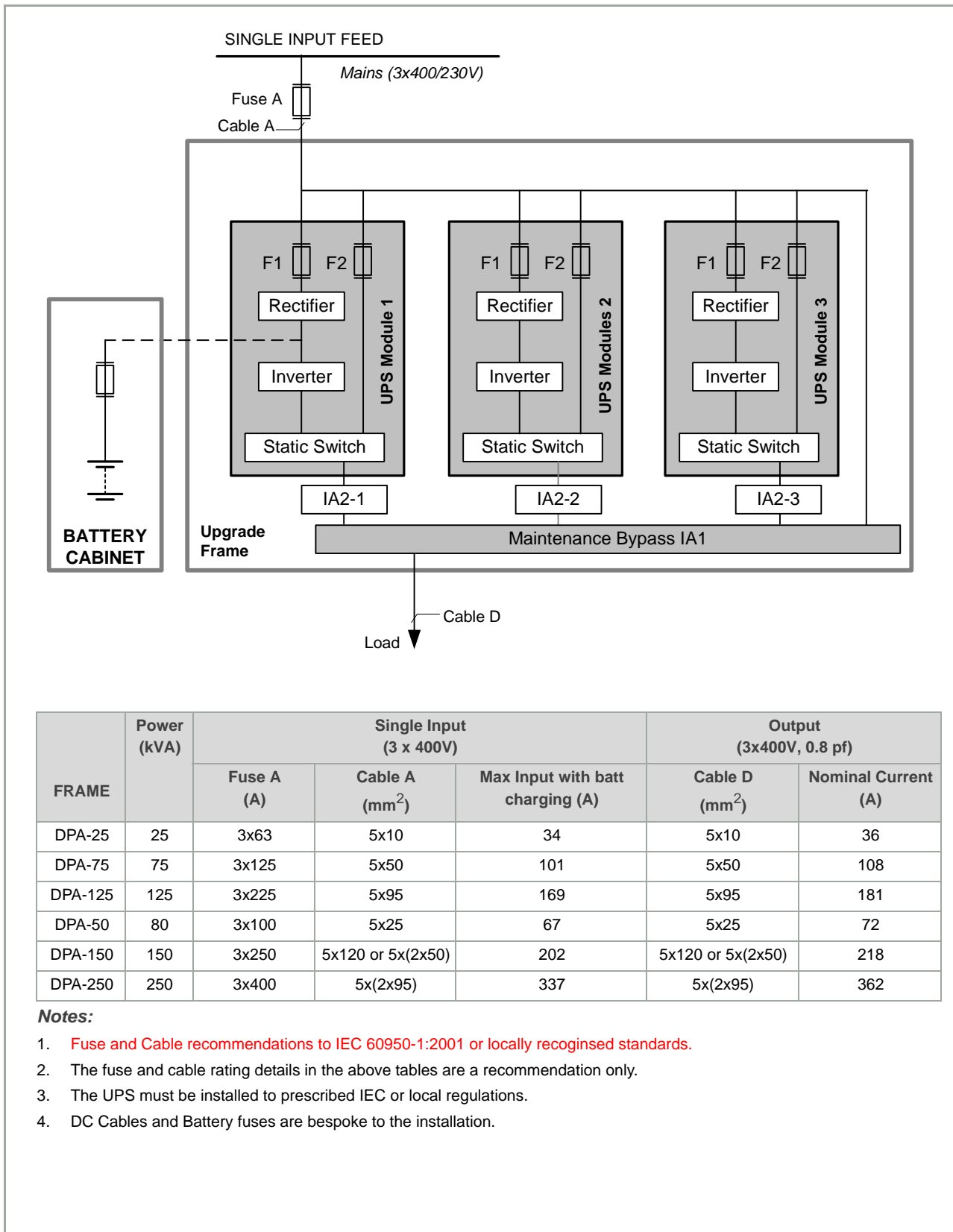


Figure 3.5 Single input block diagram with cable and fuse sizing

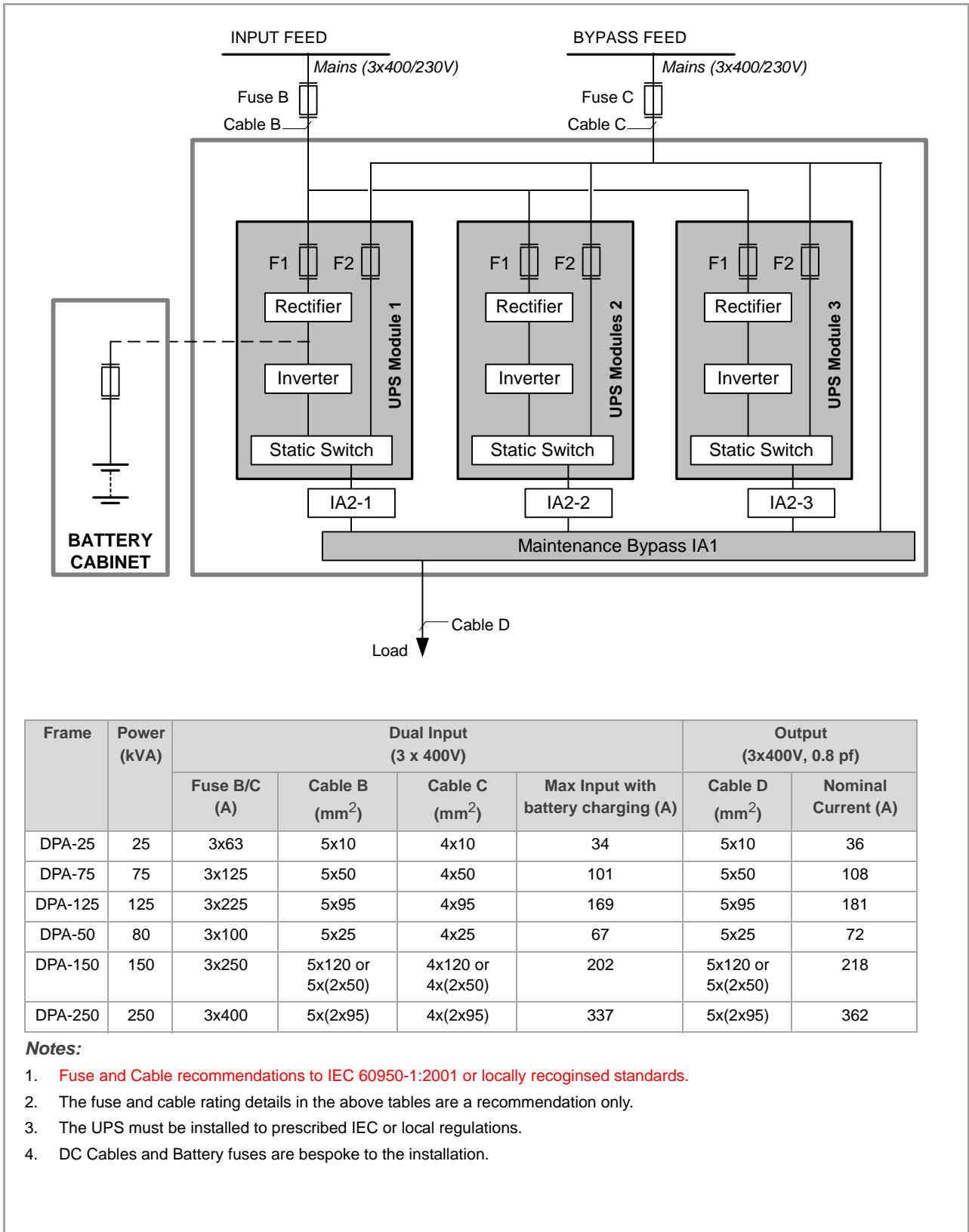


Figure 3.6 Dual input block diagram with cable and fuse sizing

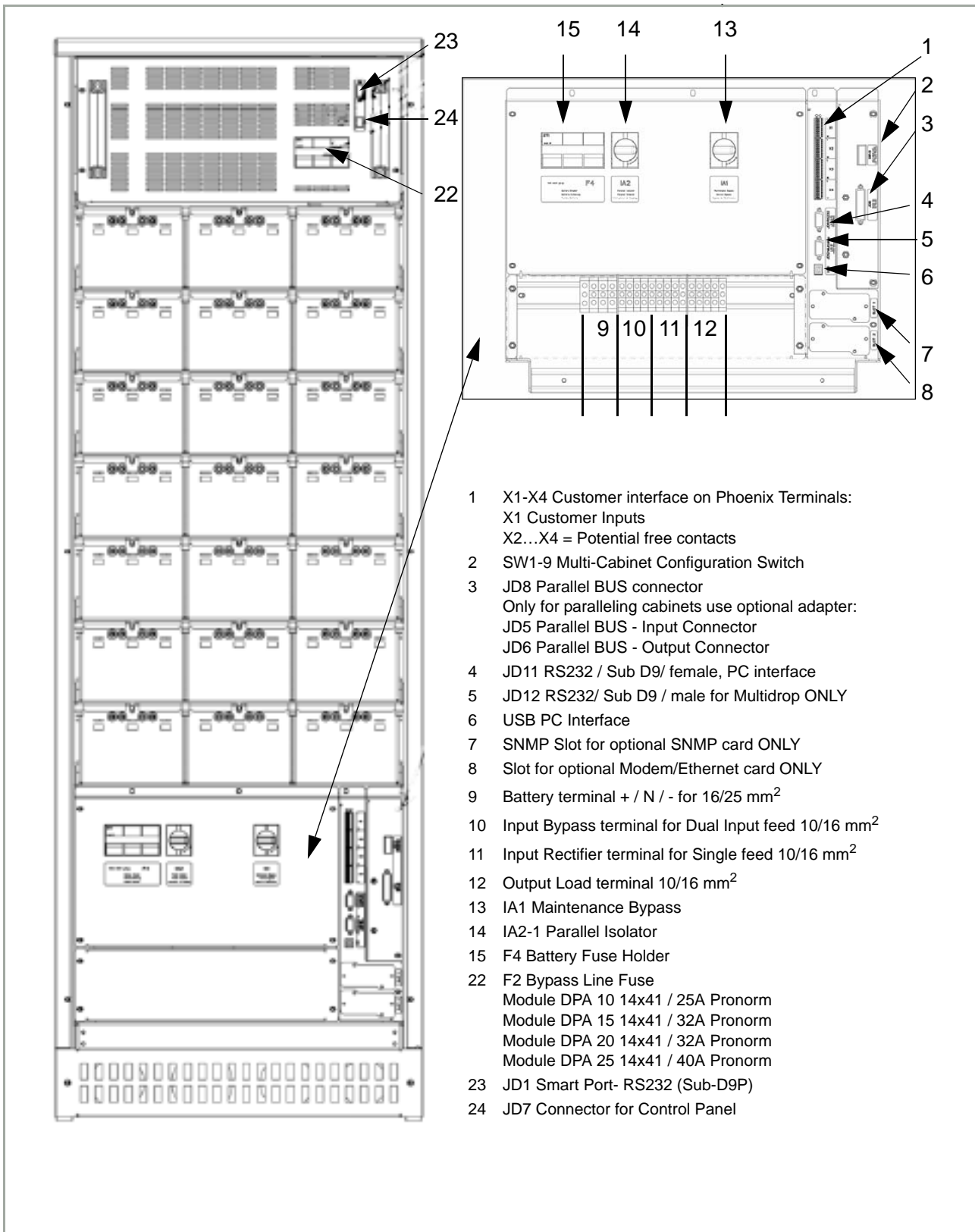


Figure 3.7 DPA-25 Input/Output Terminal Block, Front View

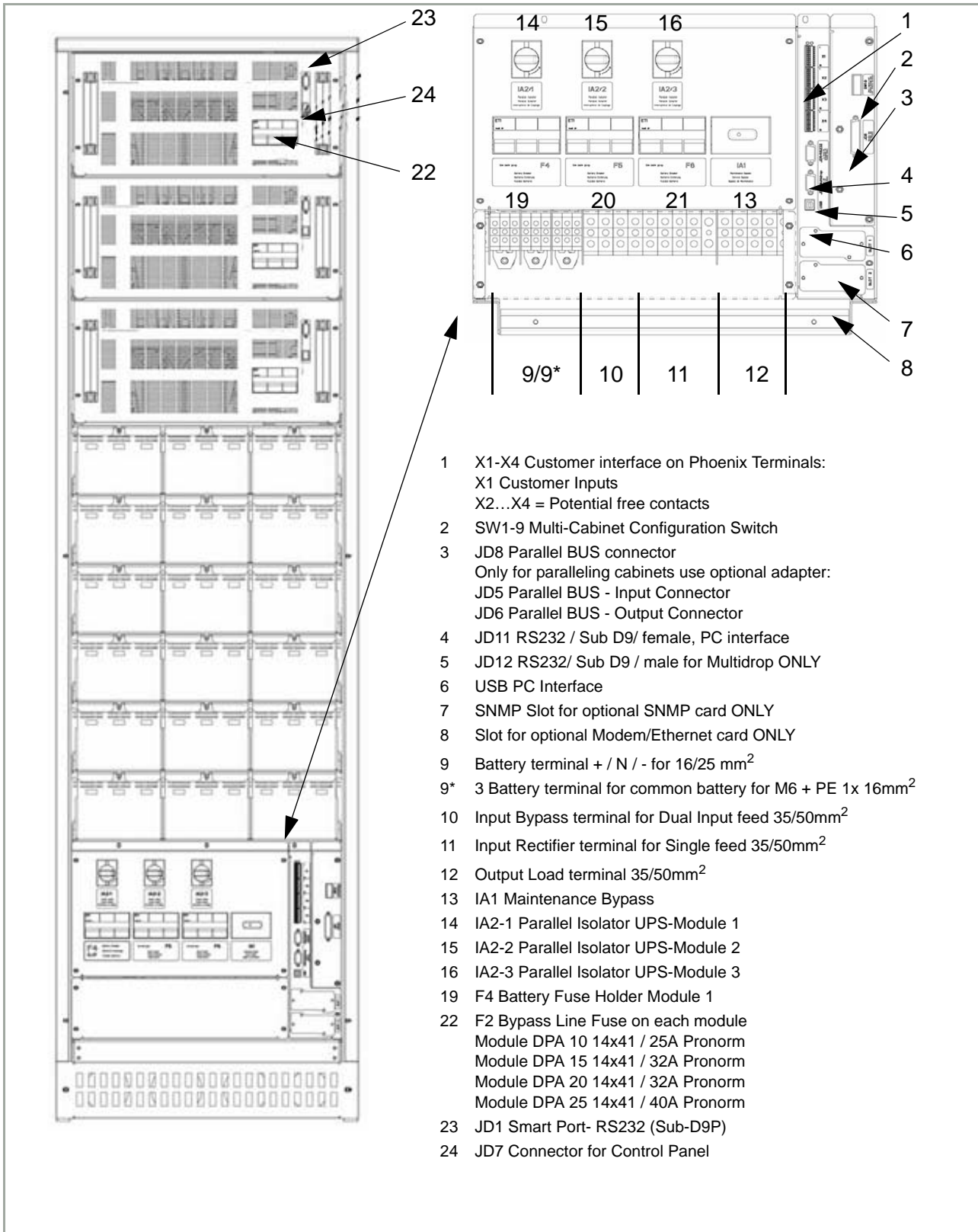


Figure 3.8 DPA-75 Input/Output Terminal Block, Front View

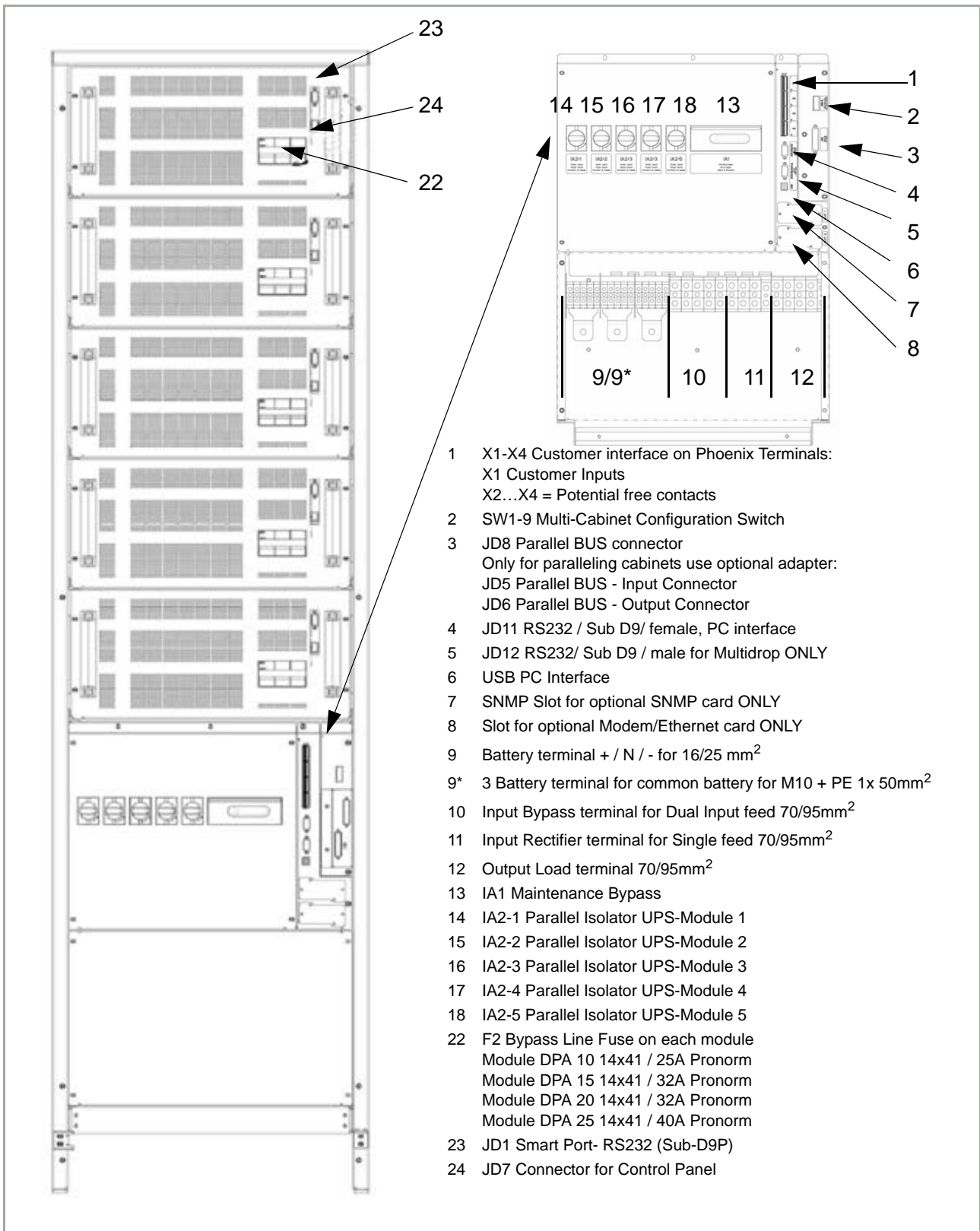


Figure 3.9 DPA-125 Input/Output Terminal Block, Front View

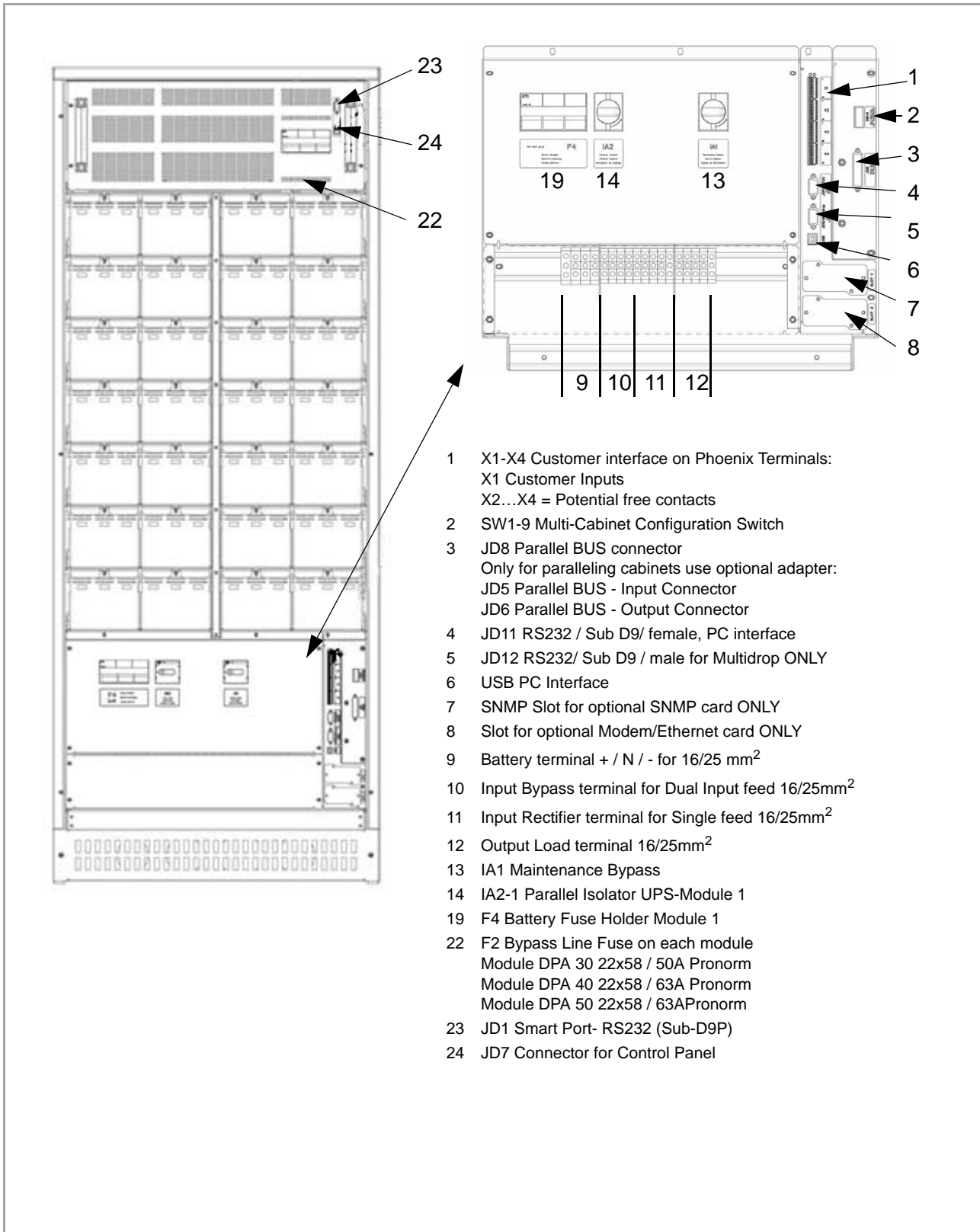


Figure 3.10 DPA-50 Input/Output Terminal Block, Front View

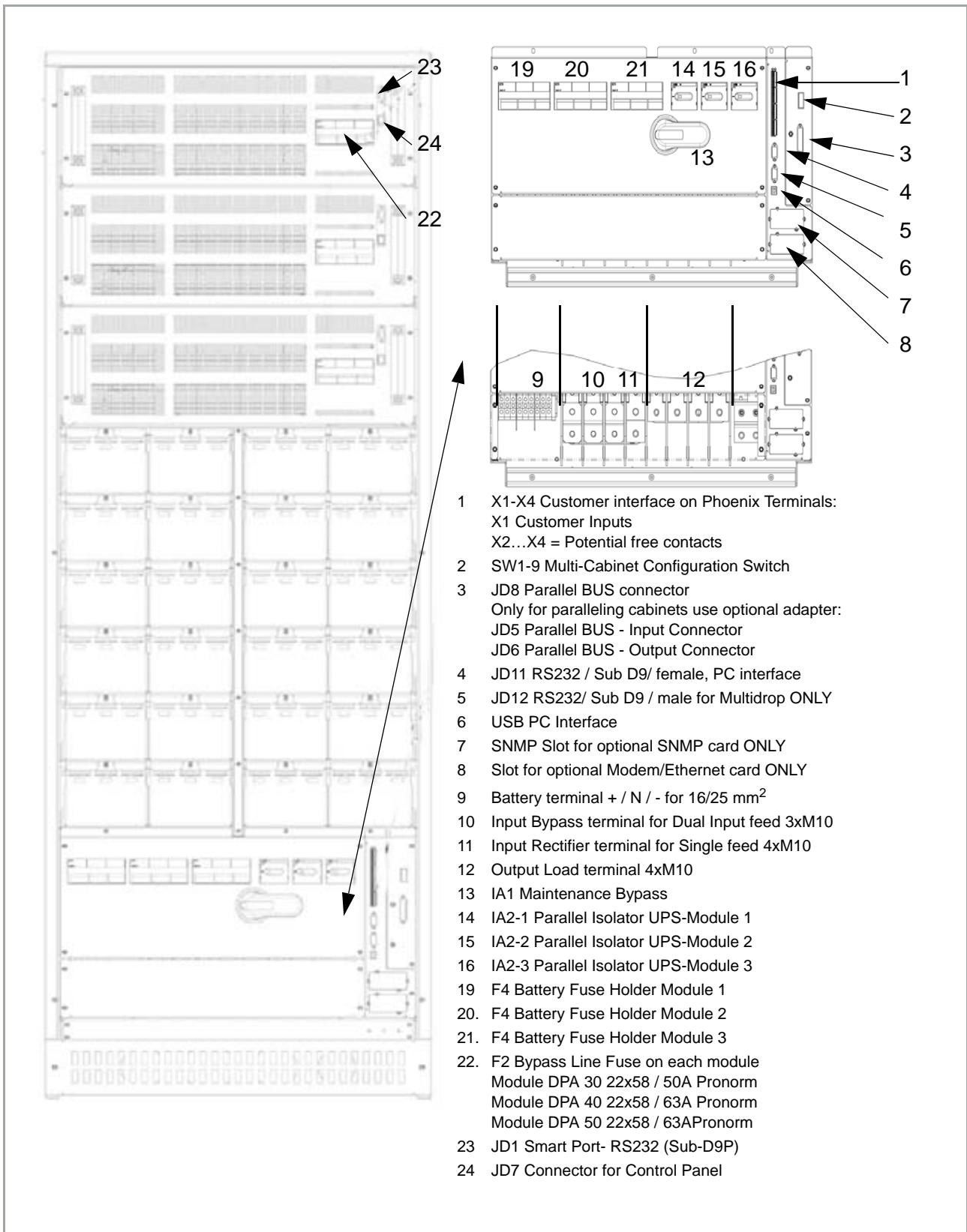


Figure 3.11 DPA-150 Input/Output Terminal Block, Front View

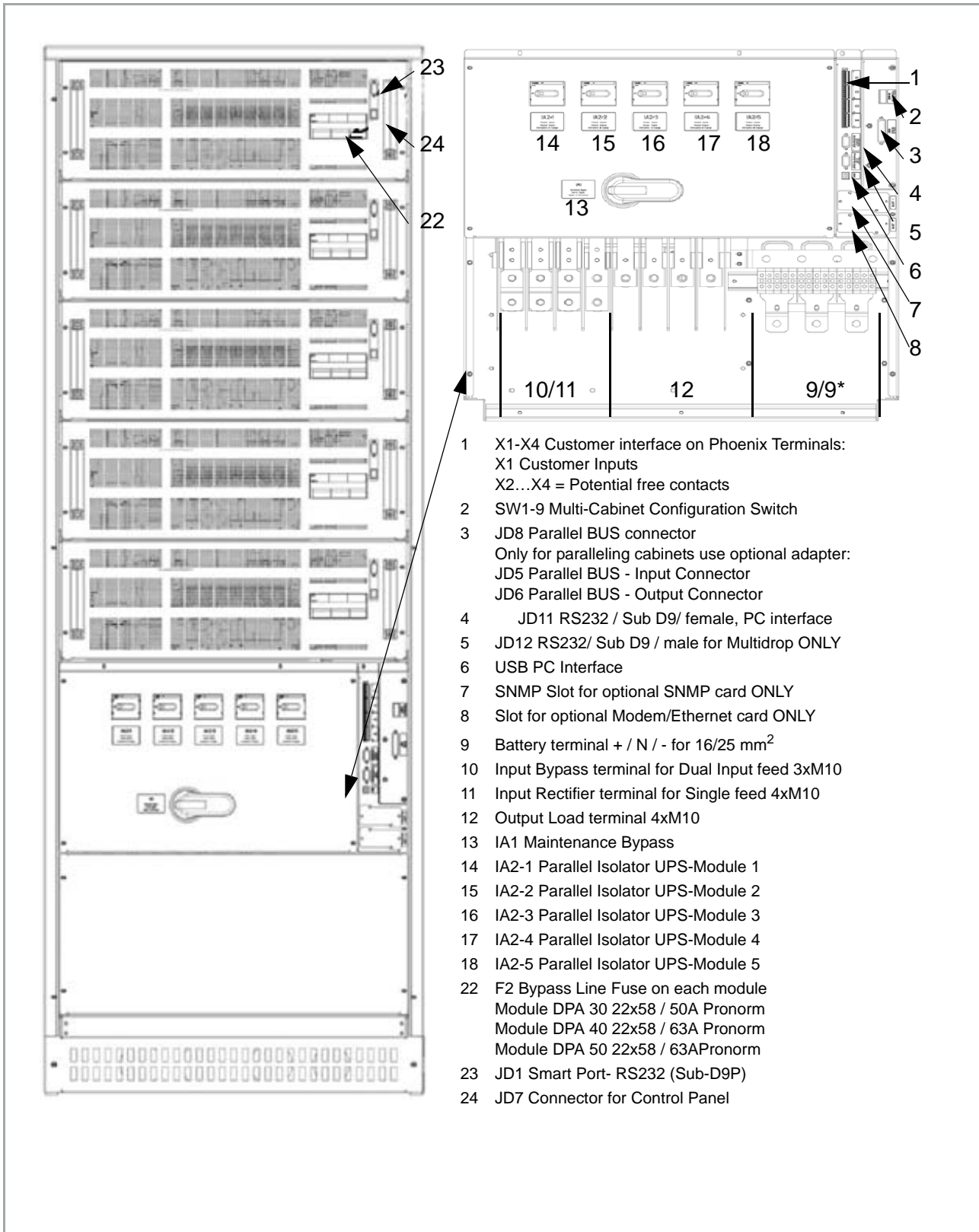


Figure 3.12 DPA-250 Input/Output Terminal Block, Front View

3.10 Connecting the batteries

3.10.1 Safety Notes



WARNING: Opening or removing the UPS enclosure covers will create the risk of exposure to dangerous voltages if power is connected to the UPS.

The final assembly and connection of the battery units must be carried out by (or under the supervision of) the commissioning engineer. Do not attempt to complete the battery wiring or close the battery isolators before system commissioning.

1. For personal protection, ensure that the battery cables are connected under the following conditions:
 - a) No mains voltage is present in the UPS.
 - b) All the loads are disconnected.
 - c) The UPS battery isolators are open and the external battery isolators are open in the external battery cabinet (where used) – i.e. the terminals to which the battery cables are to be fitted are electrically isolated.

3.10.2 Battery cabling

The UPS battery comprises a number of battery blocks (30-50) connected in series to form a battery string of the required voltage and capacity; and connected to the UPS module by three connections annotated '+', '-', and 'N'. The plus and minus connections are taken from the battery string positive and negative extremities and the 'N' terminal is connected to a point mid-way in the battery string (hence the reason why the string must comprise an even number of battery blocks).

There are two basic battery supply configurations:

- *Common battery* – where several battery strings are connected in parallel to each UPS module.
- *Individual battery* – where each module is connected to individual battery string.

These configurations are depicted in Figure 3.13, which shows the alternative connections for internal batteries in a 3-module cabinet. Figure 3.14 shows an example of the alternative connections when using an external battery cabinet (shown connected to a 5-module UPS cabinet).

The available battery configurations within the standard internal and external battery cabinets are described in paragraph 3.11 (*Internal Battery Systems*) and paragraph 3.12 (*External Battery Cabinets and Battery Connections*).

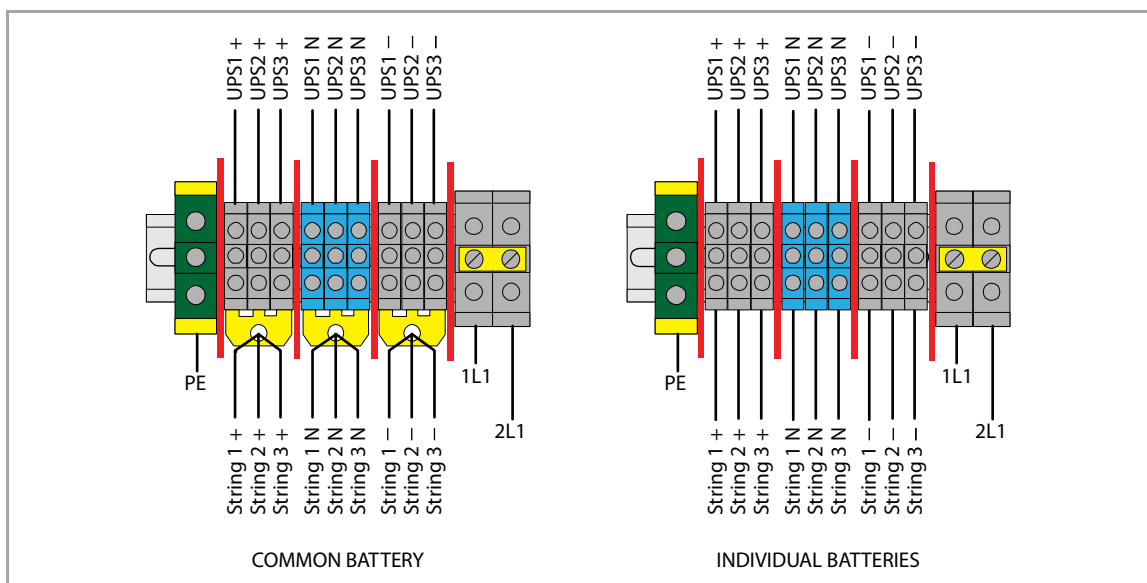
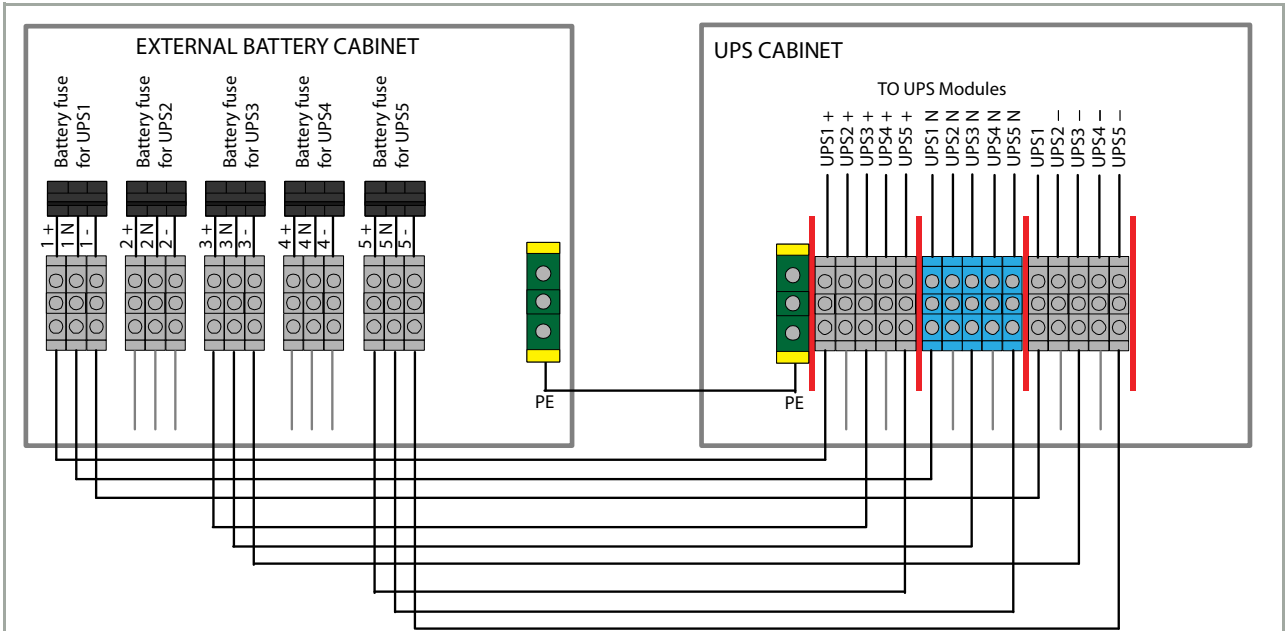


Figure 3.13 Internal battery connections (3-module UPS cabinet shown)



For reasons of clarity, the wiring for modules 1,3,5 only is shown in detail

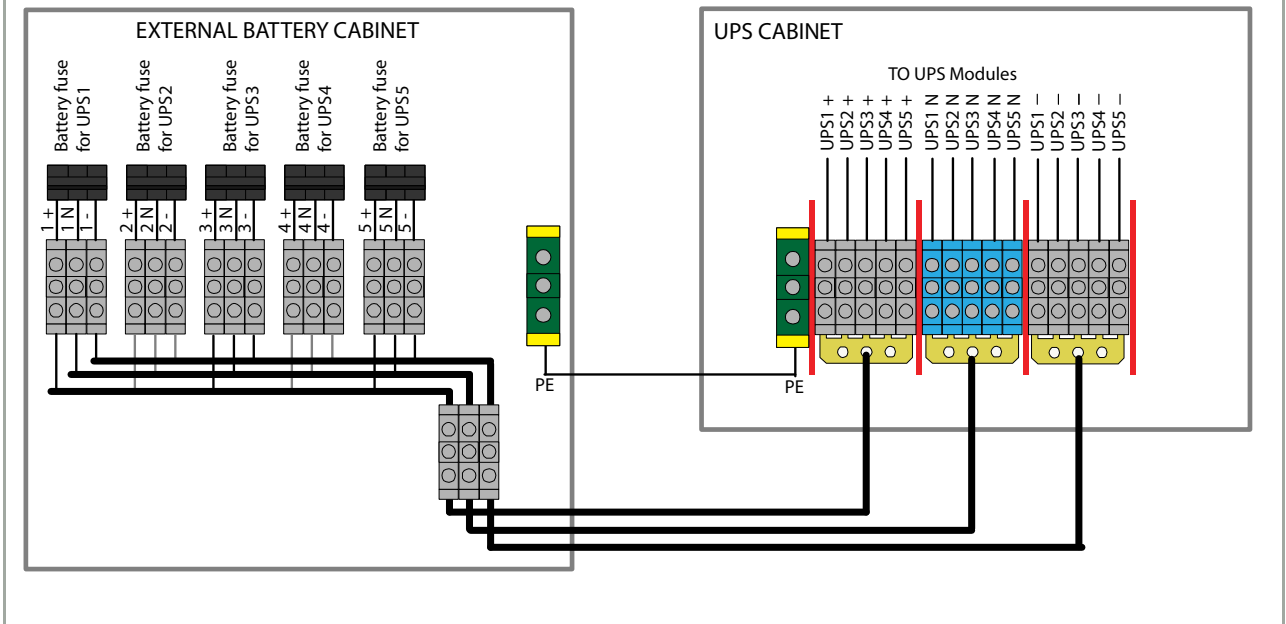


Figure 3.14 External battery cabinet wiring (5-module UPS cabinet shown)

3.10.3 Connecting the battery cables



WARNING: This procedure must be carried out by (or under the supervision of) the system commissioning engineer.

1. Ensure that the UPS input/bypass supply isolators/fuses are open on the input distribution board and verify that no power is being fed to the UPS.
2. Ensure that the MAINTENANCE BYPASS isolator (IA1) is open (OFF).
3. Ensure that the battery isolators within the UPS cabinet are open.
4. If connecting wiring to an external battery cabinet (or racks):
 - a) Ensure that the fused battery isolators in the external battery cabinet (or racks) are open.
 - b) Connect the protective earth cable (PE) between the UPS and external battery cabinet.
 - c) Connect the battery cables, ensuring the cables are connected to the corresponding + / N /- terminals.
5. If connecting the internal batteries:
 - a) Connect the batteries to the battery connection terminal blocks ensuring the cables are connected to the corresponding + / N /- terminals.

Note: DC and battery fuses are bespoke to the installation.

3.11 Internal Battery Systems



CAUTION: In DPA 10kVA, DPA 15kVA, DPA 20kVA, 30-50 12V-battery blocks are permitted (even numbers only). In DPA 25kVA, DPA 30kVA and DPA 50kVA, 40-50 12V-battery blocks are permitted (even numbers only). The correct number of battery blocks is set up on the Control Panel Menu: Service-Set-Up).

3.11.1 DPA-25

In a DPA-25 FRAME there is space for up to 200 x 9Ah internal batteries. Figure 3.15 shows the different battery and system configurations.

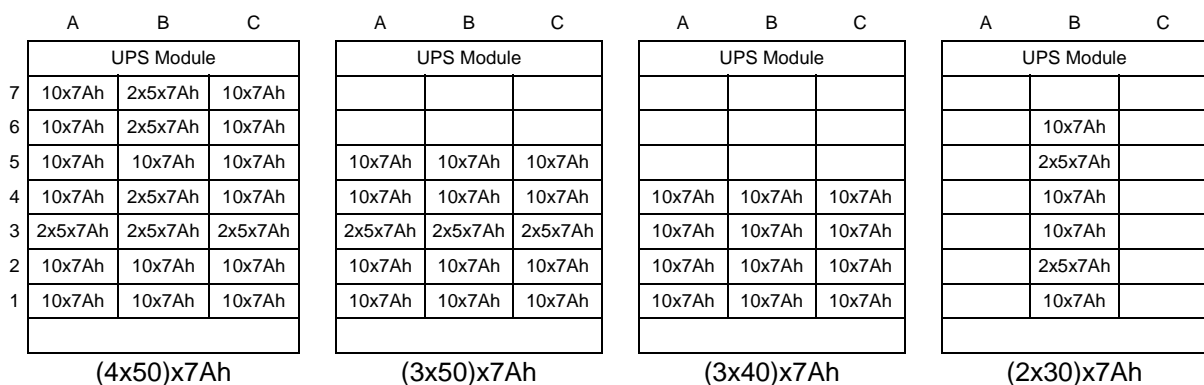


Figure 3.15 DPA-25 Battery Configurations

3.11.2 DPA-75

In a DPA-75 FRAME there is space for up to 180 x 9Ah internal batteries. Figure 3.16 shows the different battery and system configurations. The batteries may be wired as separate strings for each UPS-module or as a common battery for all three UPS-Modules.

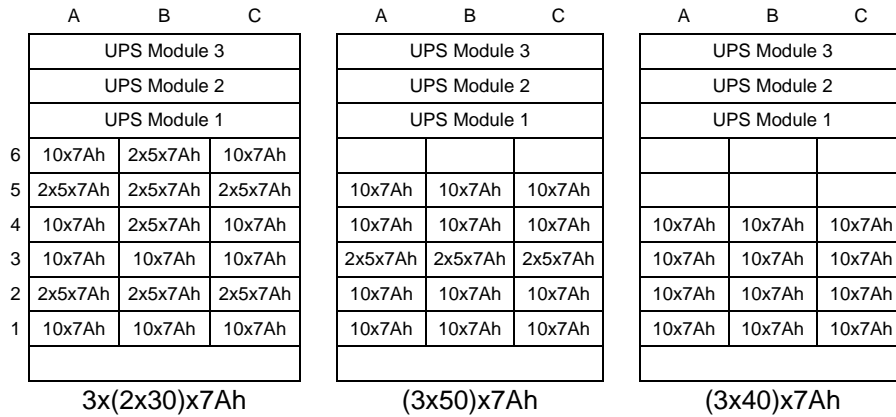


Figure 3.16 DPA-75 Battery Configurations

3.11.3 DPA-50

In a DPA-50 FRAME there is space for up to 280 x 9Ah internal batteries. Figure 3.17 shows the different battery and system configurations.

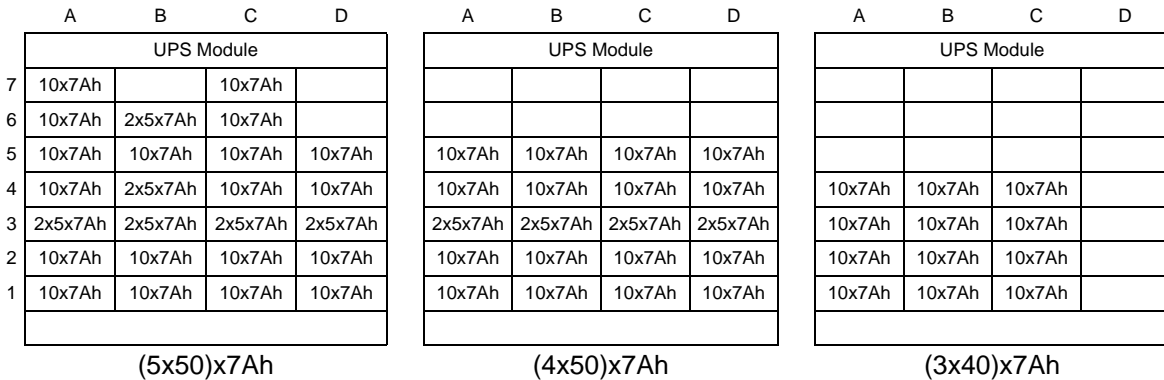


Figure 3.17 DPA-50 Battery Configurations

3.11.4 DPA-150

In a DPA-150 FRAME there is space for up to 240 x 9Ah internal batteries. Figure 3.17 shows the different battery and system configurations. The batteries may be wired as separate strings for each UPS-module or as a common battery for all three UPS-Modules.

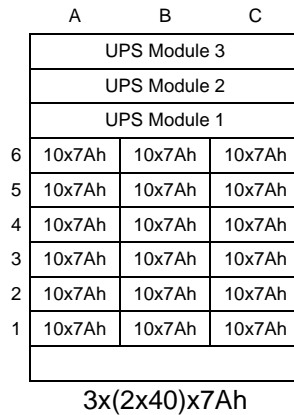


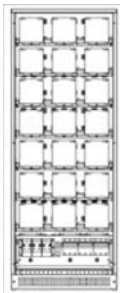
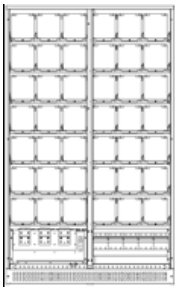
Figure 3.18 DPA-150 Battery Configurations

3.12 External Battery Cabinets and Battery Connections

In the UPS-cabinet DPA 125 or DPA 250 there is no space provided for batteries, instead there are 2 external matching battery cabinets available:

- CBAT DPA-120 for battery configurations of 24Ah or 28Ah blocks (max. 120 Blocks)
- CBAT DPA-200 for battery configurations for 24Ah or 28Ah blocks (max. 200 Blocks)

S-type = For Separate Battery
C-type = For Common Battery

		CBAT-DPA-120 S-type = item no. 00-7912 C-type = item no. 00-7964	CBAT-DPA-200 S-type = item no. 00-7913 C-type = item no. 00-7965
BATTERY FRAMES			
Configuration accommodates:	Max.	120 Batt. block x 24Ah/28Ah on 8 shelf 3x5=15 blocks/shelf	200 Batt. blocks x 24Ah/28Ah on 7 shelf 6x5=30 blocks/shelf
Battery fuses / Max. Batt. Strings Terminals:	S-type	3 / 3 (Terminal 9 x 16/25mm ²)	5 / 5 (Terminal 15 x 16/25mm ²)
Battery fuses / Max. Batt. Strings Terminals:	C-type	3 / 3 + Com. Connection Bar 3 x (2xM8) +PE 2xM8	5 / 5 + Com. Connection Bar 3 x (2xM10) +PE 2xM10
Fuse Type (Very Fast acting)	A	3x100 A *	5x100A *
Dimensions (WxHxD)	mm	730x1975x800	1200x1975x800
Weight w/o trays and w/o batteries	kg	150	250
Note: Battery fuses and cables are bespoke to the installation. The above are recommendations only, all fuses and cables must comply with prescribed IEC standards or local regulations.			



CAUTION: In DPA 10kVA, DPA 15kVA, DPA 20kVA, 30-50 12V-battery blocks are permitted (even numbers only). In DPA 25kVA, DPA 30kVA and DPA 50kVA, 40-50 12V-battery blocks are permitted (even numbers only). The correct number of battery blocks is set up on Control Panel Menu: Service-Set-Up).

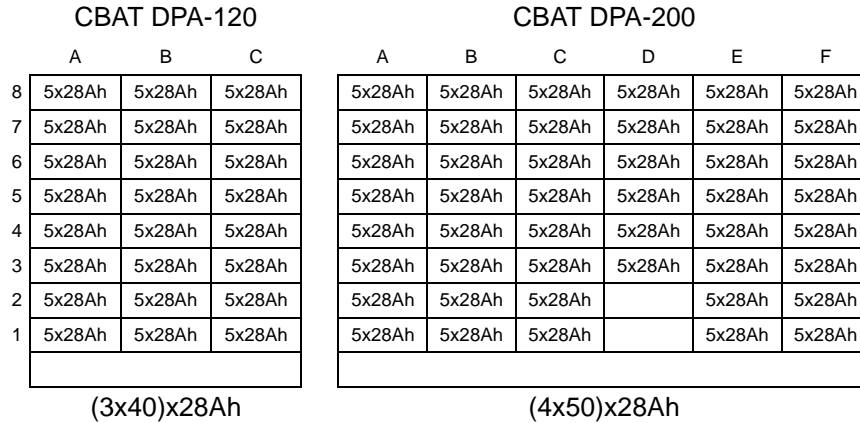


Figure 3.19 External cabinet battery configurations

3.13 Multi-cabinet Parallel Communication Cables (Bus-lines)



Key Point: This section is required only if two (or more) cabinets are to be connected in a multi-cabinet parallel configuration, as described paragraph 2.3.2.

In a multi-cabinet system a series of communication bus lines must be connected between each cabinet to enable various parallel control functions to be carried out.

Communication BUS lines are connected as shown below (See Figure 3.20).



WARNING: Before making the following connections ensure that all the UPS cabinets are powered down and each parallel isolator IA2 is open.

Connect the parallel cabinet control cables

Note: Refer to Figures 3.7 to 3.12 to identify the location of the components mentioned below.

1. Fit a Parallel Adapter over the Connector JD8 on all UPS-cabinets.
Note: The Parallel Adapter contains two connectors, JD5 and JD6 and a DIP switch (SW2) (see Figure 3.20).
2. Set DIP Switch SW2-2 on each Parallel Adapter depending on the UPS Cabinet in the parallel cabinet configuration
3. Connect PORT JD6 of the Parallel Adapter in Cabinet 1 to PORT JD5 of the Parallel Adapter in Cabinet 2 using the corresponding BUS-Cable (supplied).
4. Connect PORT JD6 of the Parallel Adapter in Cabinet 2 to PORT JD5 of the Parallel Adapter in Cabinet 3 using the corresponding BUS-Cable (supplied).
5. Continue in the same manner for the remaining UPS-Cabinets, as illustrated in Figure 3.20.
6. In each cabinet, set DIP Switch SW2-2 on the Parallel Adapter according to the cabinet configuration, as shown in Figure 3.20.

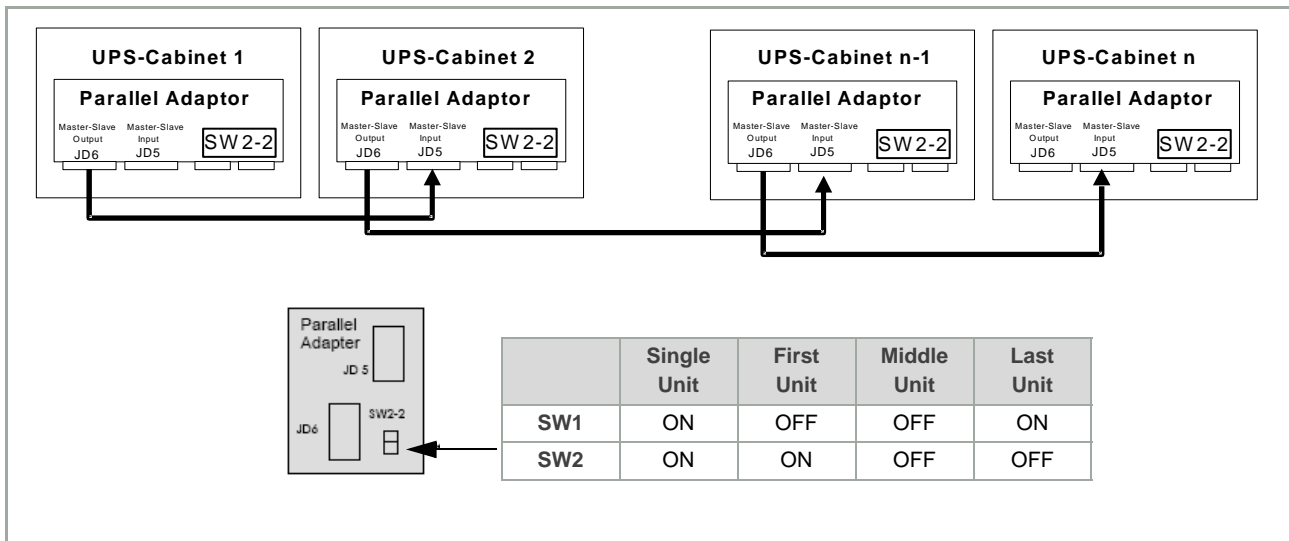


Figure 3.20 Connection of the Bus-lines when paralleling UPS-Cabinet Parallel Adaptors

Configuration DIP Switch SW1-9

DIP Switch SW1-9, located in every cabinet, is used to configure the position of the cabinet in a multi-cabinet parallel chain. Using this switch you can define the cabinet's position as:

- the *first* cabinet in the chain (e.g. *cabinet 1* in Figure 3.20).
 - The *middle* cabinet in the chain (there may be more than one).
 - the *last* cabinet in the chain (e.g. *cabinet n* in Figure 3.20).
7. Set DIP Switch SW1-9 on the Parallel Adaptor Board (PCB NW8141) of each cabinet according to the table below:

	First UPS	Middle UPS	Last UPS	Single UPS
SW 1a 1	ON	OFF	ON	ON
SW 1b 2	OFF	OFF	ON	ON
SW 1c 3	ON	OFF	OFF	ON
SW 1d 4	ON	OFF	ON	ON
SW 1e 5	ON	OFF	ON	ON
SW 1f 6	ON	OFF	ON	ON
SW 1g 7	ON	OFF	ON	ON
SW 1h 8	ON	OFF	ON	ON
SW 1i 9	ON	OFF	ON	ON

3.14 Interfacing Facilities

Each UPS cabinet contains an Interface Board which has a number of communications interface connectors that can be used with a range of I/O options.

3.14.1 Interface Board

The Interface board has two LEDs:

- Green LED showing the status of the Interface:
 - Blinking: 2/sec = Interface is Master (1st Cab. of a System)
 - Blinking: 1/sec = Interface is Slave (2nd.. nth cab. of a System)
- Red LED Board Alarm (indicates a possible faulty board)

Master Interface Board

The following ports are active on the Interface Board when fitted to the Master cabinet:

- The Input ports (X1)
- The Output port (X2, X3, X4)

Slave Interface Boards

The following ports are active on the Interface Board when fitted to a Slave cabinet:

- The Output ports X3/6 ... X3/10
- The Output ports X4/1 ...X4/10 (Means Alarm. Module 1, 2, 3,4, 5)
- All other input or output ports on the Slave boards are not activated

Note: Figure 3.21 shows the interface Board fitted to the DPA-75 cabinet. For details of the other cabinets refer to Figures 3.7 to 3.12 to identify the location of the components mentioned below.

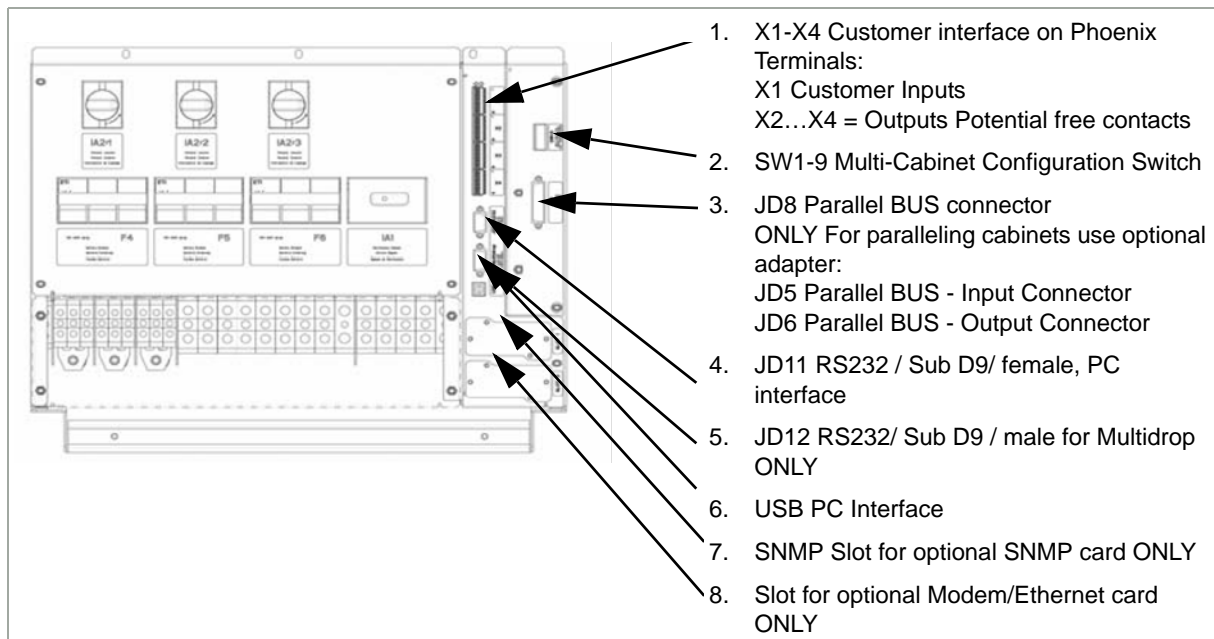


Figure 3.21 DPA-75 Cabinet interface connections

3.14.2 Smart Port (Serial RS 232)

The SMART PORT is an intelligent RS 232 serial port that allows the UPS to be connected to a computer. The connector is a standard D-Type, 9-pin, male.

When installed the optional SMART PORT software, WAVEMON allows the computer to monitor the mains voltage and the UPS-status continuously.

Figure 3.22 shows the connection to a PC from the UPS.

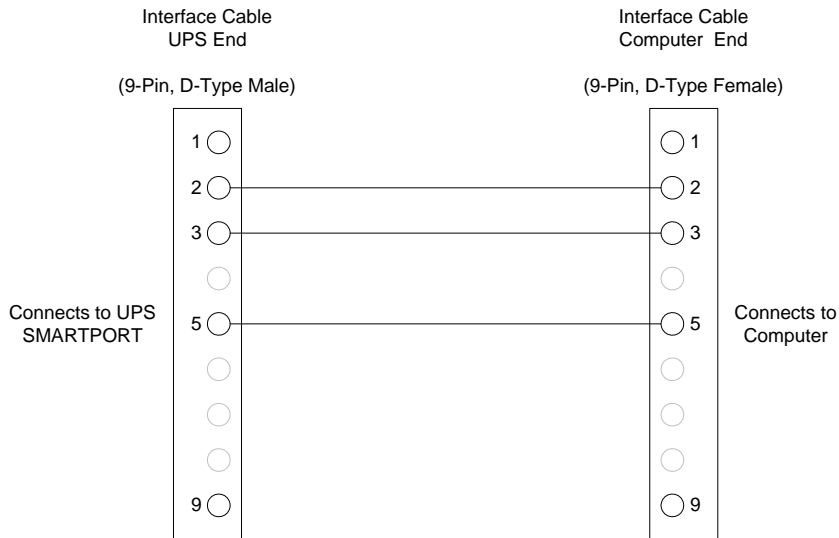


Figure 3.22 Connector Cable - PC Serial Port with 9-pin Connection

3.14.3 Dry Port (volt-free contacts)

All the Input and Output interfaces are connected to Phoenix terminals (cable 0.5 mm²)

Input Interfaces Terminal block X1

Connection of Remote Shut down facilities, Generator Operation, Customers specials (see Section 9, chapter 1.2 OPTIONS).

Term	Contact	Signal	Display	Function
X1/1 X1/2		+3.3Vdc GND		Remote Shut down - (Do not remove the factory mounted bridge until external Remote Shut down is connected)
X1/3 X1/4		+3.3Vdc GND		Generator Operation
X1/5 X1/6		+3.3Vdc GND		Customer IN 1
X1/7 X1/8		+3.3Vdc GND		Customer IN 2
X1/9 X1/10		+3.3Vdc GND		Temperature Battery

Figure 3.23 Dry Port (X1) Connections

Output Interfaces Terminal blocks X2, X3, X4 (DRY PORTS)

Provides signals for the automatic and orderly shutdown of servers, AS400 or Automation building systems.

Term	Contact	Signal	Display	Function
X2/1		ALARM	MAINS_OK	Mains Present
X2/2				Mains Failure
X2/3				Common
X2/4		Message	LOAD_ON_INV	Load on Inverter
X2/5				Load on Bypass
X2/6				Common
X2/7		ALARM	BATT_LOW	Battery Low
X2/8				Battery OK
X2/9				Common
X2/10		Message	LOAD_ON_MAINS	Load on Bypass
X3/1				Load on Inverter
X3/2				Common
X3/3		ALARM	COMMON_ALARM	Common Alarm
X3/4				No Alarm
X3/5				Common
X3/6		ALARM	MODUL_ALARM1	Module 1 Alarm
X3/7				No Alarm
X3/8				Common
X3/9		ALARM	MODUL_ALARM2	Module 2 Alarm
X3/10				No Alarm
X4/1				Common
X4/2		ALARM	MODUL_ALARM3	Module 3 Alarm
X4/3				No Alarm
X4/4				Common
X4/5		ALARM	MODUL_ALARM4	Module 4 Alarm
X4/6				No Alarm
X4/7				Common
X4/8		ALARM	MODUL_ALARM5	Module 5 Alarm
X4/9				No Alarm
X4/10				Common

Figure 3.24 Dry Port (X2..X4) Connections

3.14.4 JD11/RS232 Computer Interface

The Computer Interface JD11 is a standard D-Type, 9-pin, female. It is an intelligent RS 232 serial port allowing the UPS system to be connected to a computer. When used with the optional PowerREPORTER software it allows the computer to monitor the mains voltage and the UPS system status continuously and display a message in the event of any changes.

3.14.5 JD12/RS232 Interface for Multidrop

The Computer Interface JD12 (5) I is an intelligent RS232 serial port that monitors signals from several UPS cabinets connected in parallel. The connector JD12 is a standard D-Type, 9-pin, male.

3.14.6 USB/2 Computer Interface

The Computer Interface USB (6) is in parallel with the intelligent RS 232 serial port JD11.

When installed, the USB Computer Interface and the optional WAVEMON software allows the computer to monitor the mains voltage and the UPS system status continuously.

4

Operation

4.1 Commissioning

The PowerWAVE 9000 DPA UPS is a high quality electronic machine that must be commissioned by a fully trained and authorised Kohler Uninterruptible Power field service engineer before being put into use.

Commissioning the UPS involves connecting the UPS battery, checking the electrical installation and operating environment of the UPS, performing a controlled start-up and testing of the UPS system, and customer training.



WARNING: Any PowerWAVE 9000 DPA UPS system not commissioned by an Kohler Uninterruptible Power field service engineer must be considered an electrical hazard and Kohler Uninterruptible Power accepts no responsibility for its safe operation or the safety of any personnel. Additionally, the manufacturer's warranty is immediately invalidated if the UPS is put into use before it has been correctly commissioned.

4.2 Control Panel

The user-friendly control panel is composed of three parts:

- Power Management Display (PMD).
- Mimic LED Indicators
- Operating keys.

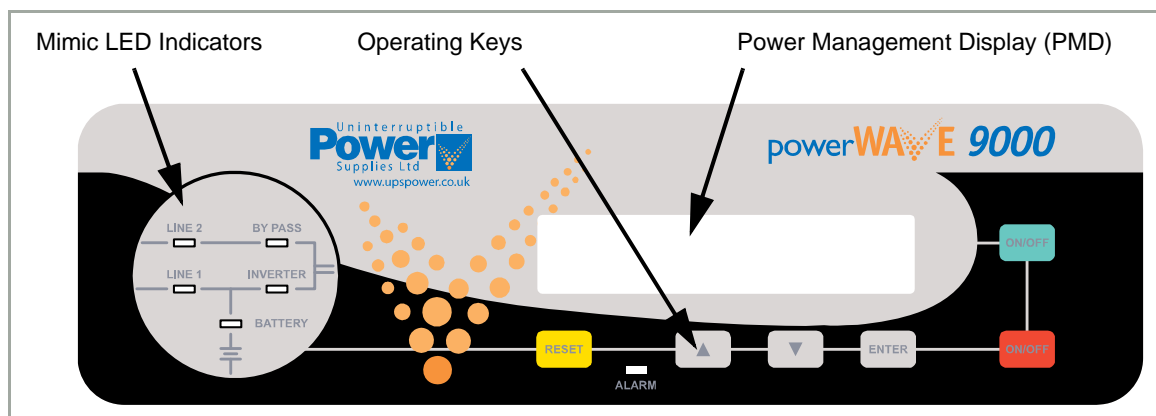


Figure 4.1 Control Panel

4.2.1 Power Management Display (PMD)

The 2 x 20 character LCD Power Management Display simplifies communication with the UPS and also provides UPS monitoring information.

The menu driven LCD enables the access to:

- The 'Event register'
- Monitoring the input and output voltage, current, frequency & power
- Monitoring battery run time
- Perform commands such as UPS start-up and shut-down, Load transfer from INVERTER to BYPASS and vice-versa

- Diagnostic (service mode)
- Adjustments and testing (service mode)

4.2.2 Mimic LED indicators

The mimic diagram indicates the status of the general UPS power flow and change colour between Green and Red (and OFF) to indicate the UPS operating conditions.

LINE 1 (rectifier) and LINE 2 (bypass) indicate the availability status of the mains power supply.

INVERTER and BYPASS, if green, indicate which of the two sources is supplying the critical load power.

The BATTERY LED indicator flashes when the battery is supplying the load – e.g. following a mains failure.

The ALARM LED is a visual indication of any internal or external alarm condition. When activated, it is accompanied by an audible alarm.

LED Indication summary

Indicator	Indicator Status	Interpretation
LINE 1	GREEN RED	Mains available Mains not available
LINE 2	GREEN RED	Mains bypass OK Mains bypass not OK or not present
ALARM	OFF Flashing RED + buzzer RED	No alarm condition Alarm condition Alarm condition (has been reset)
INVERTER	GREEN RED OFF	Load on inverter Inverter fault Inverter not operating
BY-PASS	GREEN OFF	Load on bypass Bypass not operating
BATTERY	GREEN RED Flashing RED Flashing GREEN	Battery OK Battery fault or discharged Battery fuses blown On Battery

4.2.3 Operator keys

The operator keys allow the user to:

- Make settings and adjustments via the menu driven LCD display
- Start-up and shut down the UPS and transfer the load between inverter and bypass
- Monitor and display the UPS operating voltages, currents, frequencies and other values on the LCD display

Key function summary

KEYS	FUNCTION
ON/OFF ON/OFF	Used to switch-on or switch-off the UPS
UP (▲)	Scroll upwards through a displayed menu
DOWN (▼)	Scroll downwards through a displayed menu.
RESET	Cancels the audible alarm. If the alarm condition was transient the ALARM LED will also extinguish, otherwise it will remain ON (red).
ENTER	Confirms (selects) a chosen menu item.

ON/OFF Start-up and shutdown buttons

The UPS may be switched ON or OFF by simultaneously pressing both ON/OFF keys on the control panel. This is to prevent accidental UPS start-up or shutdown.

Note: When the UPS is under normal operation, pressing the two ON/OFF simultaneously will immediately shutdown the UPS. In a single module installation this will disconnect the UPS from the load. In a parallel module system the UPS module will shutdown and the module will effectively be removed from the parallel load bus; however, the load may or may-not transfer to the bypass supply in the remaining modules depending on the available module redundancy. To shut down all the modules in a parallel system you must press both ON/OFF buttons on every UPS cabinet!



CAUTION: If the ON/OFF buttons are operated while the UPS is not in Maintenance Bypass it will interrupt the load power supply.

LOAD OFF in a PowerWAVE 9000 DPA Single module system

If, for security or emergency reasons, it is necessary to immediately disconnect the load from the UPS, press the two red ON/OFF Buttons simultaneously. The simultaneous action of both buttons is necessary to avoid any accidental manipulation.

LOAD OFF in a PowerWAVE 9000 DPA Parallel module system

If, for security or emergency reasons, it is necessary to immediately disconnect the load from the UPS in a multi-module system, the two ON/OFF buttons must be pressed simultaneously on one module and then action repeated on all remaining modules sequentially.

4.3 Description of the LCD

4.3.1 Status screens

DESCRIPTION	LCD-DISPLAY	
1. Load is protected by UPS power Load is supplied by inverter (Normal Operation).	LOAD PROTECTED	Unit:01/1
2. Load is not protected by UPS Load is supplied by mains power (load on bypass).	LOAD NOT PROTECTED	Unit:01/1
3. Load supply completely interrupted. UPS has been switched off by "ON/OFF" buttons.	LOAD OFF SUPPLY FAILURE	Unit:01/1
4. UPS/module is not supplying load. The output switch is open	LOAD DISCONNECTEDPARALLEL SWITCH OPEN	Unit:01/1

Note: The 'Unit' number on the right hand side of the LCD indicates the cabinet number (in a multi-cabinet system) together with the UPS module (slot) number within the cabinet. The maximum number of Module units is 10 and the module slot number can vary from 1 to 5. The definition of a Module's position is achieved in the menu Service Set-Up.

For example: Unit:05/3 indicates UPS module number 3 in system Cabinet number 5.

DESCRIPTION	LCD-DISPLAY	
1. Single Systems.	SYSTEM CONFIGURATION SINGLE	Unit:01/1
2. Parallel System eg. First Cabinet/Master Modules no 2 in slot 2.	SYSTEM CONFIGURATION PARALLEL	Unit:02/2
3. Parallel System eg. Second Cabinet/Slave Modules no 5 in slot 3.	LOAD OFF SUPPLY FAILURE	Unit:05/3
4. Parallel System eg. Second Cabinet/Slave Modules no 6 in slot 2.	LOAD DISCONNECTEDPARALLEL SWITCH OPEN	Unit:06/4

4.3.2 Main menu screen

DESCRIPTION	LCD-DISPLAY
1. A log of the last 64 events is stored in the Power Management Display (See paragraph 4.3.3).	→ EVENT LOG MEASUREMENTS
2. Allows monitoring of voltages, power, frequencies, currents, autonomy etc (See paragraph 4.3.4)	→ MEASUREMENTS COMMANDS
3. Enables the commands "Load to inverter", "Load to bypass" and battery test to be executed (See paragraph 4.3.5).	→ COMMANDS SET-UP DATA
4. Allows the UPS personalized information (such as serial number) to be entered (See paragraph).	→ SET-UP DATA SET-UP USER
5. Allows user to set up Date/Time, automatic battery test, etc. (See paragraph 4.3.7)	→ SET-UP USER SET-UP SERVICE
6. Password-protected area for service engineer use only (See paragraph 4.3.8).	→ SET-UP SERVICE

4.3.3 Event log menu screen

DESCRIPTION	LCD-DISPLAY
1. Logging Control; a log of the last 64 events is stored in the Power Management Display.	01 05-10-08 14-38-56 LOAD TO INV.
2. Every stored event is identified with a sequential number and time stamp.	02 05-10-08 14-38-59 LOAD TO BYP.
3. By pressing ENTER the code of the event will be displayed.	03 05-10-08 14-39-14 LOAD OFF

4.3.4 Measurements menu screen

DESCRIPTION	LCD-DISPLAY
1. Battery Runtime	BATT. RUN TIME (MIN) 00h 00mm
2. UPS-Output Frequency	OUTPUT FREQUENCY (HZ) 50.00
3. Bypass Frequency.	BYPASS FREQUENCY (HZ) 50.00
4. Battery Voltage	BATTERY VOLTAGE (V) +0.0 - 0.0
5. Battery Charger Current	BATT. CHARGE CUR. (A) + 0.0 - 0.0
6. Battery Discharge Current.	DISCHARGE CURRENT (A) 00.00
7. Rectifier Input Voltage (all three phases)	RECTIFIER VOLTAGE (V) 00.00 00.00 00.00
8. Bypass Input Voltage (all three phases)	BYPASS VOLTAGE (V) 00.00 00.00 00.00

DESCRIPTION	LCD-DISPLAY
9. Output Voltage (all three phases)	OUTPUT VOLTAGE (V)0 0.00 00.00 00.00
10. Output Current (all three phases)	OUTPUT CURRENT (A)0 0.00 00.00 00.00
11. Active Output Power (all three phases)	ACTIVE POWER (KW) 00.00 00.00 00.00
12. Reactive Output Power (all three phases)	REACTIVE POWER (kVAR) 00.00 00.00 00.00
13. Apparent Output Power (all three phases)	APPARENT POWER (KVA) 00.00 00.00 00.00
14. Output Power (all three phases)	OUTPUT POWER (%) 00.00 00.00 00.00
15. Battery capacity	BATT. CAPACITY (%) 00.00

4.3.5 Commands menu screen

DESCRIPTION	LCD-DISPLAY
1. Transfer Load to inverter	→ LOAD TO INVERTER LOAD TO BYPASS
2. Transfer Load to bypass.	→ LOAD TO BYPASS PERFORM BATT. TEST
3. Battery Test	→ PERFORM BATT. TEST

4.3.6 UPS Data menu screen

DESCRIPTION	LCD-DISPLAY
1. These general UPS Data are installed at the manufacturing plant.	UPS SERIAL NUMBER nn-nnnnnn
2. Manufacturing date	DATE OF MANUFACTURE 15-03-09
3. EPROM Version	EPROM VERSION V-000
4. Actual Date and Time	DATE TIME dd-mm-yyyy hh:mm:ss

4.3.7 Set-up User menu screen

DESCRIPTION	LCD-DISPLAY
1. Set-up language	→ SET LANGUAGE SET DATE AND TIME ENGLISH FRANCAIS DEUTCH DUTCH SPANISH POLISH PORTOGUESE
2. Set-up Date and Time	→ SET-UP DATE/TIME SET-UP BATT. TEST DD-MM-YY HH-MM-SS
3. Set-up battery test	→ SET-UP BATT. TEST SET-UP GEN-SET OPER. DAY OF MONTH (1-31) HOUR OF DAY (0-23) REPETITIVE (Y/N) 000
4. Set-up operation with Gen-Set	→ SET-UP GEN-SET OPER. BATT. CHARGE LOCK (Y/N) BYPASS LOCK (Y/N)

4.3.8 Set-Up Service menu screen

DESCRIPTION	LCD-DISPLAY
1. This Menu is reserved for authorized service engineers. It is not to be used by End-Users.	→ SET-UP SERVICE PASSWORD
2. Type in password.	→ PASSWORD*



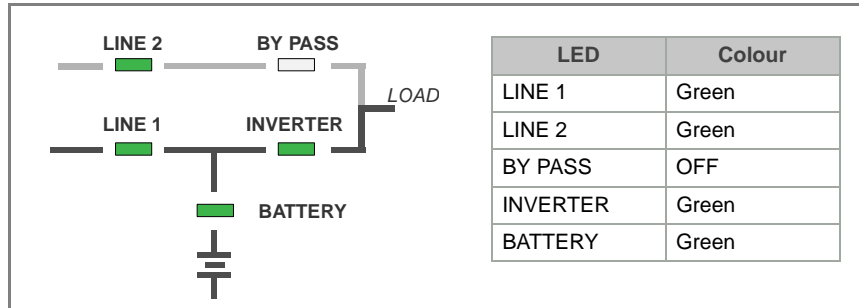
Key Point: It is essential to enter the password.

From within the Set-up Service menu a service engineer can adjust the UPS voltages, frequencies, currents, power and autonomies, together with setting up:

- UPS Rated Power
- Module configuration and position in the system
- Single (standard) or Dual input feed
- Frequency-converter, 50/60Hz and 60/50Hz
- Synchronisation window (2-4%)

4.4 Operating Modes

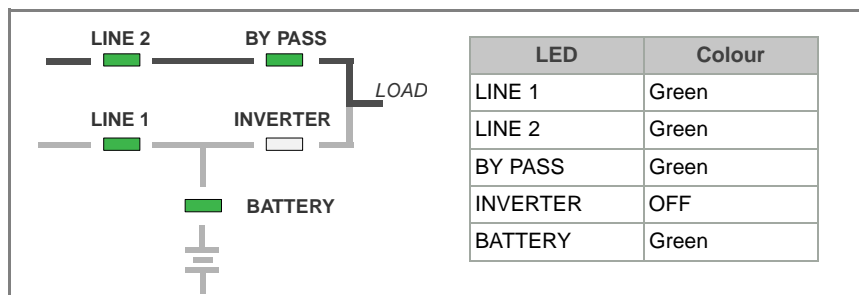
4.4.1 On-Line (Inverter) mode



When the UPS is operating in the On-Line mode the load is supplied through the LINE 1 (RECTIFIER) and INVERTER. This mode provides the highest degree of protection, especially in the event of a mains disturbance or failure, and is always recommended if the critical loads (computer systems) will not tolerate any (even very brief) interruption of the supply.

In the unlikely event of an inverter fault or overload condition the UPS will transfer the load automatically, and without interruption, to the static bypass supply (transfer time = 0).

4.4.2 OFF-Line (also known as ECO or Bypass) mode



In the Off-Line (ECO/Bypass) mode the load is supplied from the bypass mains (LINE 2) and the static BYPASS. In the event of a mains failure the load is automatically transferred to the inverter within 3 to 5 msec – this is valid for single and parallel module systems. The battery charger remains active in this mode.

Although this mode of operation offers greater efficiency than the On-Line mode, it is recommended only if the load can tolerate interruptions of 3 to 5 ms – which is the transfer time taken to change from Bypass mode to On-Line mode.



WARNING: The On-Line mode must always be used to provide maximum load protection.

4.4.3 Maintenance Bypass mode

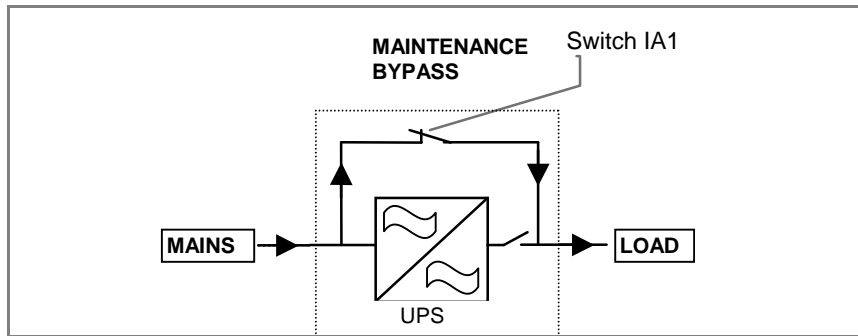


Figure 4.2 Maintenance Bypass Mode

Each module is fitted with a Maintenance Bypass switch (IA1) which, when closed, connects the UPS module output terminals directly to the UPS Bypass Mains supply. This facility enables a UPS module to be shut down for maintenance or repair whilst maintaining the load on the raw (unprotected) bypass supply.



WARNING: In a multi-module system ensure that ALL the UPS modules are operating in the Bypass mode before transferring the load to Maintenance Bypass (IA1)

Maintenance Bypass switch (IA1)

Switch IA1	Effect
ON	Maintenance Bypass-Switch Closed (Load on bypass mains) LCD-indication: MAINTENANCE BYP CLOSED LED Indicators will indicate as shown in table below
OFF	Bypass-Switch Open – Normal operating condition (Load on inverter) LCD-indication MAINTENANCE BYP OPEN LED Indicators will indicate as shown in table below.

When the UPS is operating on Maintenance bypass the module mimic indications will be as follows

LED Indicator	ON	OFF
LINE 1	Green	Green
LINE 2	Green	Green
BYPASS	Green	OFF
INVERTER	RED	ON
BATTERY	Green	Green



CAUTION: If the UPS is operating in the Maintenance Bypass mode the load will not be protected in the event of a mains failure. It is therefore strongly recommended to switch over to the On-line mode or Bypass mode as soon as possible.

4.4.4 Parallel Isolator switch(IA2)

Each UPS module is provided with an output isolator (IA2). When this isolator is opened it totally disconnects the UPS module from the output load bus. In a parallel module system this isolates the UPS modules and allows it to be replaced without having to disturb the remainder of the system (provided the loss of modules does not exceed the system redundancy).



CAUTION: In a single module configuration the load must be transferred to the maintenance bypass before the isolator is opened otherwise it will cause a loss of supply.

4.5 Operating Instructions

Under normal operating conditions all the UPS modules in a multi-module system are running, and operating in the 'On Line' (On Inverter) mode.

The following procedures are provided in this section:

How to transfer the load to the Maintenance Bypass and shut down the UPS system for maintenance purposes – (See paragraph 4.5.1).

How to start up the UPS system and transfer the load from the Maintenance Bypass to the inverters ('On Line' mode) (See paragraph 4.5.2).

How to shut down the entire UPS system (See paragraph 4.5.3).

How to stop/start one module in a redundant multi-module system (See paragraph 4.5.4).

4.5.1 Transfer to Maintenance Bypass Mode

If needed, to perform service or maintenance, it is possible to transfer the load to Maintenance Bypass Mode and power down the UPS module(s) whilst leaving the load connected to the raw bypass mains supply.

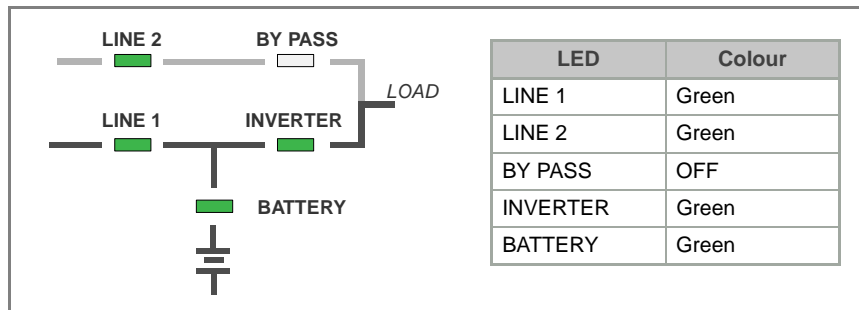


WARNING: Before you close the Maintenance Bypass isolator ensure that the UPS is operating in the Bypass Mode.
All the operations in this section must be performed by authorised and trained personnel.

This procedure describes the sequence of operations to transfer the load to the Maintenance Bypass supply and then shut down, and isolate, the UPS Module(s).

Prior to commencing this procedure, check and confirm the following UPS system status (on all modules in a parallel system):

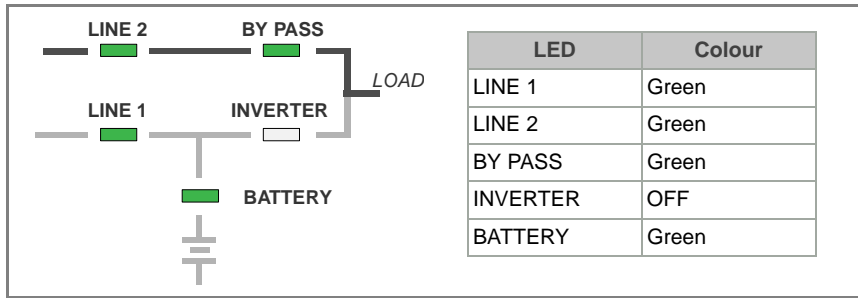
- The mimic panel LED indications should be as per the following table (on all cabinets in a multi-module system):



- The LCD panel should display LOAD PROTECTED. If anything other than LOAD PROTECTED is displayed then press the RESET button, and if LOAD PROTECTED is still not displayed there is a problem with the UPS – seek assistance!

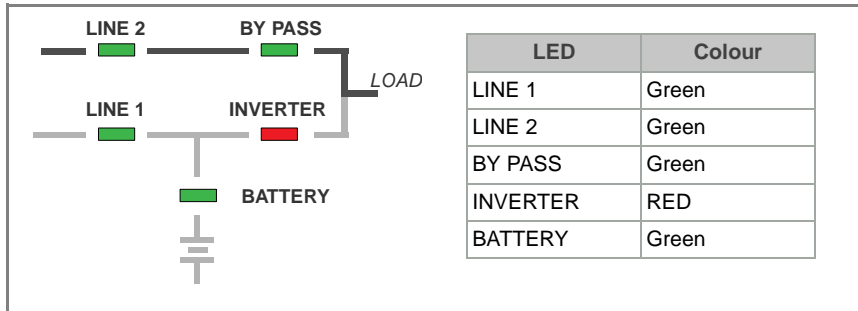
Transferring the UPS to 'Bypass' mode:

- On any one of the UPS module's mimic panel press the ENTER key once to access the menu system.
- Using the UP/DOWN keys, move the cursor so that it is adjacent to COMMANDS and then press the ENTER key.
- Using the UP/DOWN keys, move the cursor so that it is adjacent to LOAD TO BYPASS and then press the ENTER key.
 - The UPS system will transfer the load to static bypass.
- On all modules check and confirm that:
 - The INVERTER LED has extinguished.
 - The BYPASS LED is green.
 - The LCD displays LOAD NOT PROTECTED.



Closing the Maintenance Bypass switch:

5. Close the Maintenance Bypass switch IA1 (in all cabinets in a multi-cabinet system).
6. On all UPS modules check and confirm that:
 - a) The INVERTER LED has turned to red.
 - b) The BYPASS LED is green.
 - c) The LCD displays MANUAL BYP IS CLOSED.

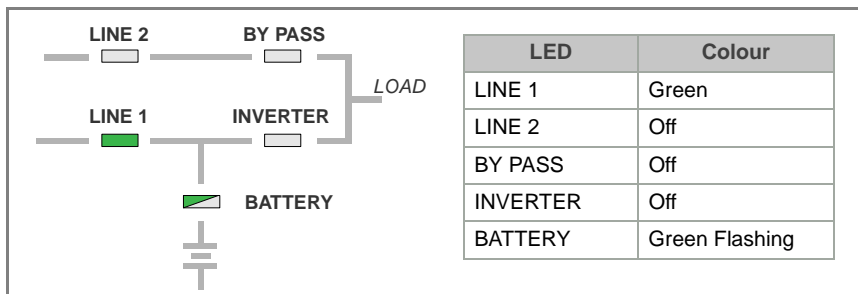


Powering down a UPS module:

When the load is connected to the Maintenance Bypass supply, as described above, the UPS module(s) can be powered down (for example, if required for maintenance/testing) using the following procedure:

Note: Carry out the following procedure on each module in a parallel system to totally shut down the system.

7. On the UPS control panel simultaneously press both ON/OFF buttons.
 - a) The LCD panel will indicate: LOAD OFF , SUPPLY FAILURE.
8. Identify the associated battery fuse for the UPS module (in external battery cabinet if fitted).
 - a) Open the battery fuses/breaker .
9. On the UPS module open the module's Parallel Isolator (IA2).



10. Open the Bypass Line fuse holder F2 and the Rectifier Line fuse holder F1.



WARNING: The UPS cabinet is still live at its input and output power terminals due to the activation of Maintenance Bypass circuit.

WARNING: Allow 10 minutes for the internal DC capacitors to discharge before touching any UPS internal components.

WARNING: The load is now supplied from the bypass mains and is not protected against power failure.

4.5.2 Starting the UPS system from the Maintenance Bypass

This procedure describes the sequence of operations necessary to power up the UPS module(s) whilst the load is connected to the Maintenance Bypass supply, and then transfer the load to the UPS Inverter(s) ('On-Line' mode).



WARNING: All the operations in this section must be performed by authorised and trained personnel.

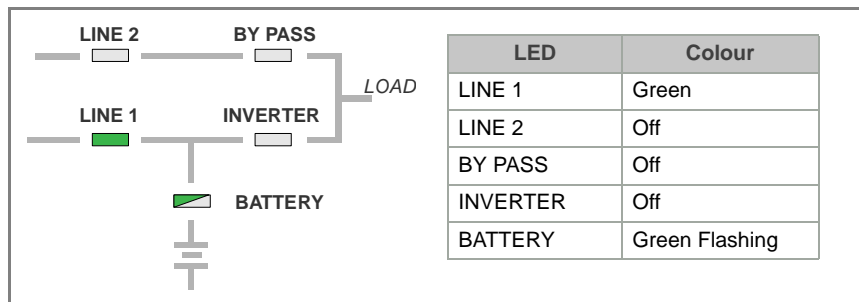
Prior to powering-up the system, check and confirm the UPS system status:

- The load is supplied via the Maintenance Bypass switch (in all modules)
- The UPS module(s) are powered down

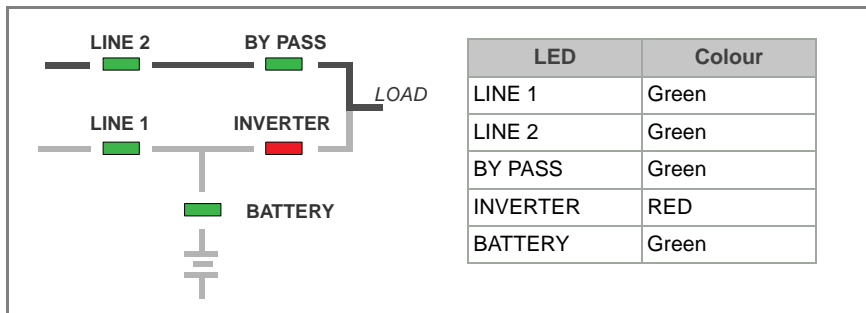
Powering up the UPS Module(s):

In a multi-module system perform each of the steps in turn on every module.

1. On the UPS module close the Bypass Line fuse holder F2 and the Rectifier Line fuse holder F1 if they are open.
2. Close the battery fuses/breaker (in external battery cabinet if fitted).
 - a) The UPS mimic panel LINE 1 LED will be permanent green.
 - b) The BATTERY LED will be flashing green.
 - c) The LCD display will indicate LOAD OFF, SUPPLY FAILURE.



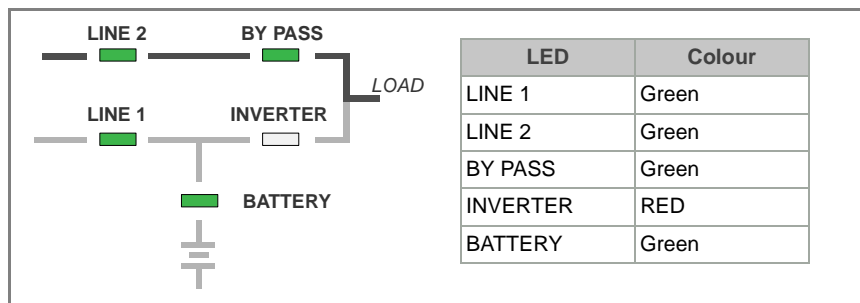
3. Close the Parallel Isolator switch (IA2) and check that the PARALLEL SW CLOSED message is shown on the LCD display.
4. On the UPS mimic panel press and release both ON/OFF buttons simultaneously and wait approximately 60 seconds.
 - a) The UPS module will begin to power up.
 - a) Initially LINE 2 LED will be red, then change to green.
 - a) At this stage the LCD display will indicate LOAD NOT PROTECTED and the module mimic LED indications should be as follows:



5. When powering up a multi-module system ensure that ALL the modules are in the state shown above before continuing with this procedure.

Transferring to the UPS from the Maintenance Bypass:

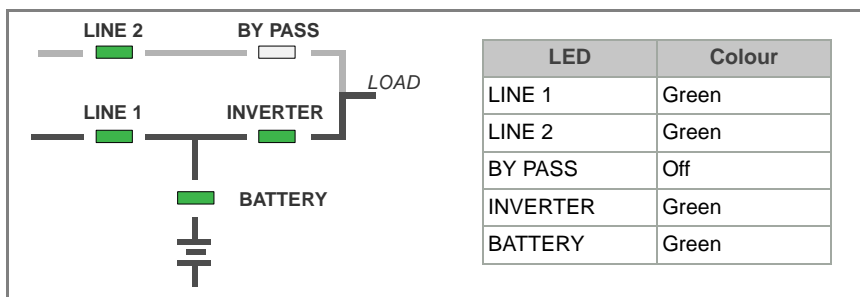
6. Ensure that the BYPASS LED is green (on all modules).
7. Open the Maintenance Bypass switch (IA1) (on all cabinets in a multi-cabinet system).
 - a) The LCD panels will display MANUAL BYPASS OPEN.
 - b) The INVERTER LED will be extinguished.
 - c) An audible alarm will sound.



8. Press the RESET button to cancel the audible alarm (on all modules).
 - a) The LCD display(s) will now indicate LOAD NOT PROTECTED.

Transferring the load to the inverter:

9. On the Control Panel (of any one module in a parallel module system):
 - a) Press the UP key once to access the menu system.
 - b) Use the UP/DOWN keys to move the cursor so that it is adjacent to COMMANDS and then press the ENTER key.
 - c) Use the UP/DOWN keys move the cursor so that it is adjacent to LOAD TO INVERTER and then press the ENTER key.
10. The UPS system will transfer the load to Inverter (on all modules in a paralleli-module system).
 - a) The LCD display(s) will now indicate LOAD PROTECTED.
 - b) Check and confirm that the LED display(s) are as shown below:



11. The UPS is now operating in 'On-Line' mode. The load is protected and supplied by inverter power.

4.5.3 Complete system shutdown

The UPS system may be shutdown completely if the load does not need input power for an extended period of time. Use this procedure to totally turn of the load power and shutdown the entire UPS system.



WARNING: All the operations in this section must be performed by authorised and trained personnel.



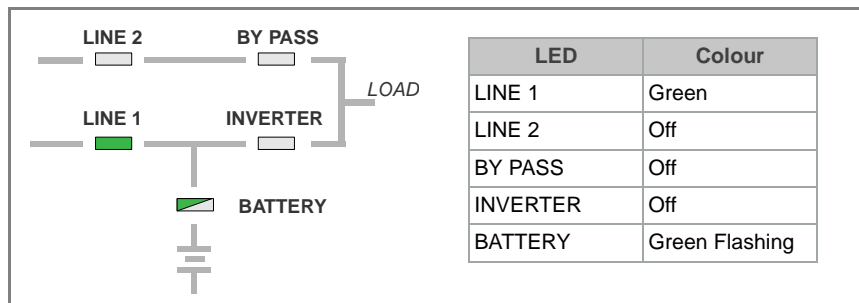
CAUTION: This procedure will totally disconnect load power. Ensure that it is safe to lose power to all the loads connected to the UPS system before you begin this process.

1. Isolate all load equipment connected to the output of the UPS system by opening the fused isolators or circuit breakers in the UPS output load distribution board.



WARNING: Perform the following steps only after the load has been fully isolated.

2. Verify that the loads are powered down. Then carry out the following actions on every module in a multi-module system.
3. On the UPS control panel simultaneously press both ON/OFF buttons.
 - a) The LCD panel will indicate: LOAD OFF , SUPPLY FAILURE.
4. Identify the associated battery cabinet/rack for the UPS module.
 - a) Open the battery fuses/breaker on the battery cabinet/rack.
5. Open the module's Parallel Isolator switch (IA2).



6. Open the Bypass Line fuse holder F2 and the Rectifier Line fuse holder F1.
7. Open the UPS Input and Bypass supply fused isolators (or breakers) in the building power distribution panel.
8. The UPS is now voltage free.



WARNING: Allow 10 minutes for the internal DC capacitors to discharge before touching the UPS internal components.

4.5.4 Individual module start/stop procedure

If a multi-module system is designed with built-in redundancy, it is possible to stop and start one module without affecting the operational status of the overall system – e.g. one module can be taken off-line for servicing whilst the remaining modules maintain a protected load supply.



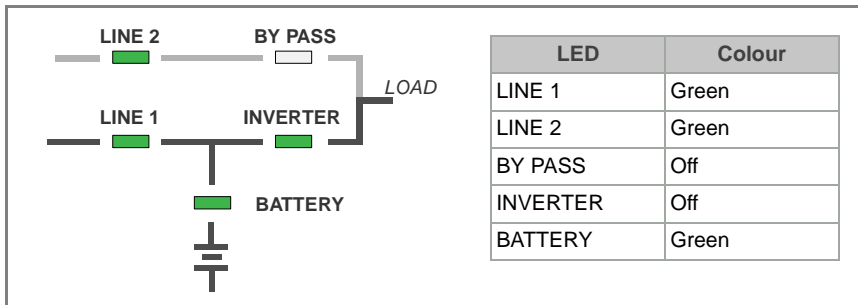
WARNING: All the operations in this section must be performed by authorised and trained personnel.

Module start-up:

Use this procedure to start a module and connect it to a multi-module system.

This procedure assumes the following initial conditions:

- UPS input isolators are open on the building's LV supply switchboard
 - The fused battery isolators are open in the battery cabinet
 - In the UPS cabinet, the fused isolators F1, F2 and the parallel isolator (IA2) are open
1. In the UPS cabinet, close the Input supply and Bypass supply fused isolators F1, F2 and the Parallel Isolator IA2.
 2. Close the UPS input supply isolator at the LV switchboard.
 - a) The LINE 1 indicator will illuminate green.
 - b) The LCD display will indicate LOAD OFF SUPPLY FAILURE. If necessary press the RESET button to obtain this display.
 3. Identify the associated battery cabinet/rack for the UPS module and close the fused battery isolators.
 4. Simultaneously press the two ON/OFF push buttons on the UPS control panel.
 - a) The UPS will run through an automated start-up sequence accompanied by the following indications:
 LINE 2 LED lights red then changes to green.
 INVERTER LED lights green.
 BATTERY LED lights green (constant).
 - b) LCD displays the LOAD PROTECTED message.

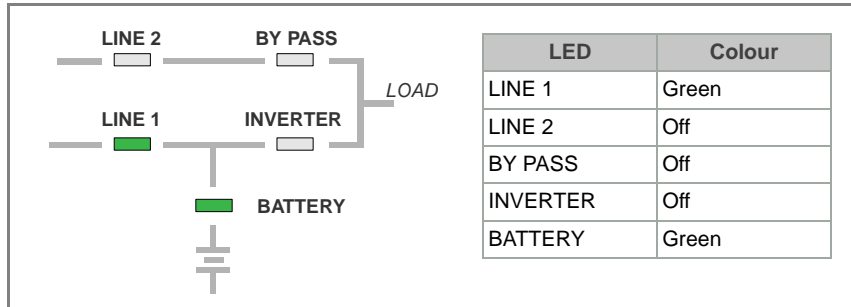


5. The UPS module is now On Line and connected to the parallel system.

Module shut-down:

Use this procedure to power down a single module in a redundant module system.

1. Simultaneously press the two ON/OFF buttons on the UPS control panel.
 - a) The LED display will give the following indications:



2. Open the Parallel Isolator switch IA2.
3. In the UPS Cabinet, open the Input supply and Bypass supply fused isolators F1 and F2.
4. Identify the associated battery cabinet/rack for the UPS module and open the fused battery isolators.
5. Open the UPS input supply isolator and UPS output isolator on the LV Switchboard.
6. The UPS module is now totally shut-down.

4.6 Replacement of the UPS Module in a Single Module System



WARNING: All the operations in this section must be performed by authorised and trained personnel. By opening or removing the UPS modules and module covers you run risk of exposure to dangerous voltages!



WARNING: When removing a UPS module wait for at least 2 minutes after it has been disconnected in order to allow the DC Capacitors to fully discharge.



WARNING: When the UPS module is removed from the cabinet always fit an appropriate blanking cover.



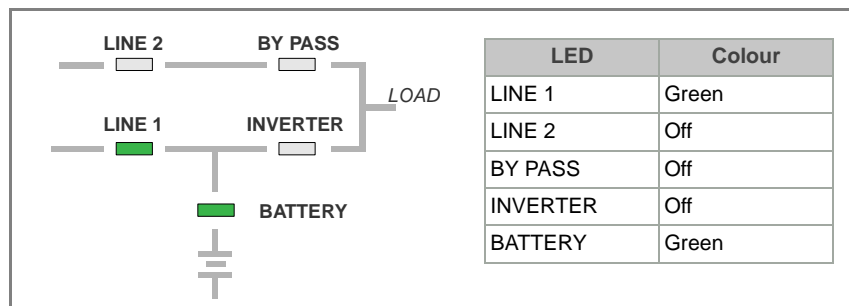
WARNING: Two persons are needed to pull out the module from the UPS Frame. The weight of a DPA 50, 40kW module is 60kg (the weight of DPA 10, 8kW/60 kVA module is 24kg). Employ suitable lifting aids and safety platforms where possible.

If a UPS-module goes faulty in a Single Module system, the load will automatically transfer to the UPS bypass supply (BYPASS mode) and the load is unprotected against a mains supply failure.

4.6.1 Removing a UPS Module

If your PowerWAVE 9000 DPA consists of only one single UPS Module then perform the following steps to extract the module:

1. Transfer the load to the Maintenance Bypass (see paragraph 4.5.1).
 - a) The load is now directly supplied by mains and is not protected
2. Simultaneously press the two ON/OFF buttons on the UPS control panel.
 - a) The LED display will give the following indications:



3. Open the fused battery isolator for the UPS module in the UPS cabinet or in the external battery cabinet/rack, as applicable.
 - a) The UPS module is now totally shut-down.
4. Disconnect cables from connectors JD7 and remove the four screws on the front of the UPS module that are fixing it to the cabinet / UPS-frame.
5. Pull the UPS module forwards until the rear connectors are disconnected. **DO NOT FULLY EXTRACT THE UNIT**



WARNING: Wait at least 2 minutes to allow the module's electrolytic capacitors time to discharge.

6. Wait two minutes then fully withdraw the UPS module from the cabinet by pulling it horizontally.
7. If you are not intending to replace the UPS module immediately, cover the UPS compartment opening with an appropriate protection cover and secure with four screws.

4.6.2 Refitting the UPS Module

1. Remove the UPS module compartment protection cover (if fitted) by unscrewing four screws on the front.
2. Using two persons to lift the UPS module, slide two thirds of the module into the UPS-compartment (make sure not to plug the UPS-Module into the rear connector).
3. Push UPS-module firmly into its final position, to assure good contact on the rear plugs.
4. Tighten the four screws on the front of module to secure it to the UPS cabinet / frame.
5. Connect the control panel cable to connector JD7.
6. Start the UPS module and bring it on line (See paragraph 4.5.2).

4.7 Replacing a UPS Module in a REDUNDANT Multi-Module System



WARNING: All the operations in this section must be performed by authorised and trained personnel. By opening or removing the UPS modules and module covers you run risk of exposure to dangerous voltages!



WARNING: When removing a UPS module wait for at least 2 minutes after it has been disconnected in order to allow the DC Capacitors to fully discharge.



WARNING: When the UPS module is removed from the cabinet always fit an appropriate blanking cover.

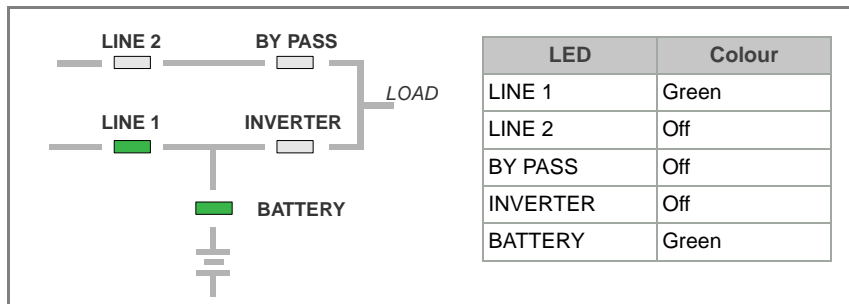


WARNING: Two persons are needed to pull out the module from the UPS Frame. The weight of a DPA 50, 40kW module is 60kg (the weight of DPA 10, 8kW/60 kVA module is 24kg). Employ suitable lifting aids and safety platforms where possible.

If a UPS-module goes faulty in a REDUNDANT parallel system, the load will continue to be protected by the remaining modules which will continue to operate in the ON-LINE mode (INVERTER mode). Under these circumstances the faulty UPS module may be replaced without having to transfer the load to bypass.

4.7.1 Removing the UPS Module

1. On the UPS module to be replaced, simultaneously press the two ON/OFF buttons on the UPS control panel.
 - a) The LED display will give the following indications:



2. Open the UPS module's Parallel Isolator (IA2).
3. Open the fused battery isolator for the UPS module in the UPS cabinet or in the external battery cabinet/rack, as applicable.
4. The UPS module is now totally shut-down.
5. Disconnect the control panel cable to connector JD7.
6. Remove the four screws on the front of the UPS module that are fixing it to the cabinet.
7. Pull the UPS module forwards until the rear connectors are disconnected. **DO NOT FULLY EXTRACT THE UNIT.**



WARNING: Wait at least 2 minutes to allow the module's electrolytic capacitors time to discharge.

8. After waiting two minutes, fully withdraw the UPS-Module from the cabinet by pulling it horizontally.
9. If you are not intending to replace the UPS module immediately, cover the UPS compartment opening with an appropriate protection cover and secure with four screws.

4.7.2 Inserting a UPS Module

1. Remove the UPS module compartment protection cover (if fitted) by unscrewing four screws on the front.
2. Using two persons to lift the UPS module, slide two thirds of the module into the UPS-compartment (make sure not to plug the UPS-Module into the rear connector).
3. Push UPS-module firmly into its final position, to assure good contact on the rear plugs.
4. Tighten the four screws on the front of module to secure it to the UPS cabinet / frame.
5. Connect the control panel cable to connector JD7.
6. Start the UPS module and bring it on line (See paragraph 4.5.4).

Note: The module must be previously set according to system personalization. Please make sure with your nearest service centre for correct settings.

4.8 Replacing a Module In a CAPACITY Multi-Module System



WARNING: All the operations in this section must be performed by authorised and trained personnel. By opening or removing the UPS modules and module covers you run risk of exposure to dangerous voltages!



WARNING: When removing a UPS module wait for at least 2 minutes after it has been disconnected in order to allow the DC Capacitors to fully discharge.



WARNING: When the UPS module is removed from the cabinet always fit an appropriate blanking cover.

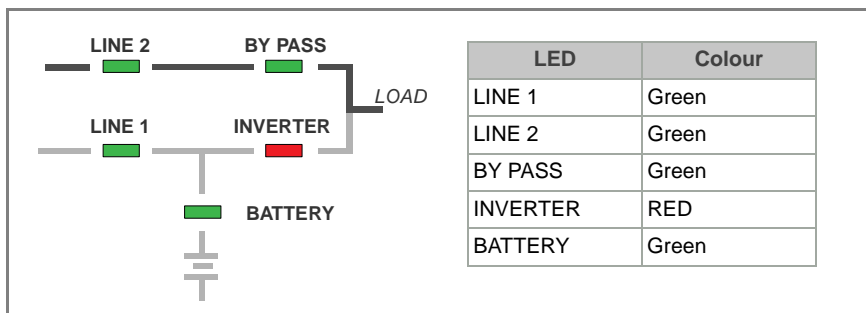


WARNING: Two persons are needed to pull out the module from the UPS Frame. The weight of a DPA 50, 40kW module is 60kg (the weight of DPA 10, 8kW/60 kVA module is 24kg). Employ suitable lifting aids and safety platforms where possible.

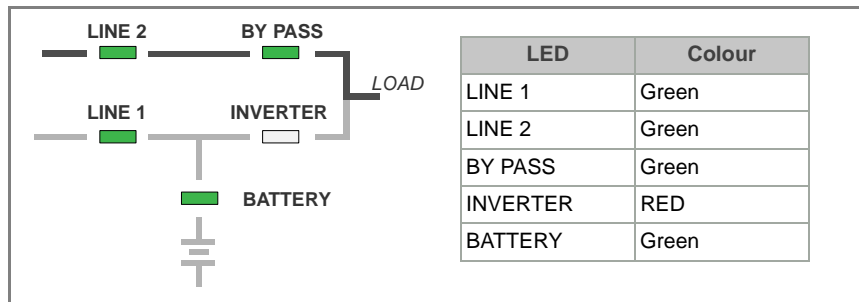
If, in a capacity parallel system, a UPS Module fails and there is not enough capacity left to protect the load by the remaining operating UPS modules, the load will automatically be transferred to bypass (Bypass Mode or ECO-Mode) and will continue to be supplied by the mains supply.

4.8.1 Removing a Module

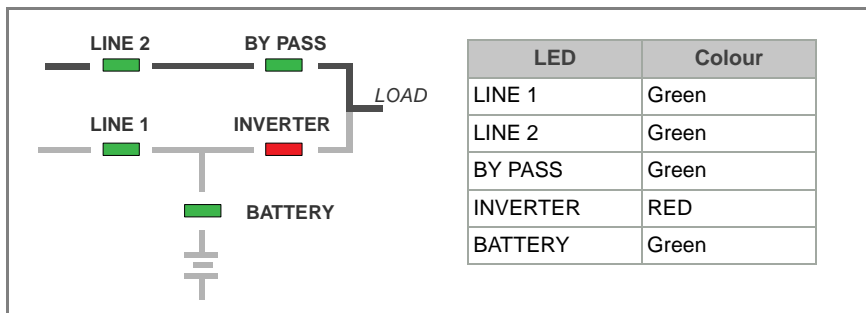
1. Verify that the load is on BYPASS and is supplied by the mains power (Bypass Mode or Eco-Mode) on ALL UPS modules.
 - a) In the majority of the events the LED indicators on Control Panel of the faulty module will show:



- b) Whereas the LED indicators on the Control Panels of the other two Operating Modules will show:



2. Close Maintenance Bypass Switch IA1 (ON)
3. On **all** modules check and confirm that:
 - a) The INVERTER LED has turned to red.
 - b) The BYPASS LED is green.
 - c) The LCD displays MANUAL BYP IS CLOSED.



4. Open the Parallel Isolator Switch IA2 (switch to position "OFF") of UPS module to be replaced.
5. Open the fused battery isolator for the affected UPS module in the UPS cabinet or in the external battery cabinet/rack, as applicable.
6. The UPS module is now totally shut-down.
7. Disconnect the control panel cable to connector JD7.
8. Remove the four screws on the front of the UPS module that are fixing it to the cabinet.
9. Pull the UPS module forwards until the rear connectors are disconnected. **DO NOT FULLY EXTRACT THE UNIT.**



WARNING: Wait at least 2 minutes to allow the module's electrolytic capacitors time to discharge.

10. After waiting two minutes, fully withdraw the UPS-Module from the cabinet by pulling it horizontally.
11. If you are not intending to replace the UPS module immediately, cover the UPS compartment opening with an appropriate protection cover and secure with four screws.



CAUTION: While the UPS is operating in the maintenance bypass mode the load is not protected and in the event of a mains failure the load supply will be interrupted.

4.8.2 Refitting a Module in a Capacity Multi-Module System

1. Remove the UPS-Module compartment protection cover (if fitted) by unscrewing four screws on the front.
2. Using two persons to lift the UPS module, slide two thirds of the module into the UPS-compartment (make sure not to plug the UPS-Module into the rear connector).
3. Push UPS-module firmly into its final position, to assure good contact on the rear plugs.

4. Tighten the four screws on the front of module to secure it to the UPS cabinet / frame.
5. Connect the control panel cable to connector JD7.
6. Start the UPS module and transfer the load from 'Maintenance Bypass' to 'On Line' mode (See *paragraph 4.5.2*).

5

Maintenance

5.1 Introduction



WARNING: All the operations described in this chapter must be performed by authorised electricians or otherwise qualified personnel.

5.2 System calibration

To ensure optimum UPS operation and continuous, efficient protection of the connected load, it is recommended that the system's operating parameters are checked every six months and recalibrated where necessary. The batteries should also be checked every six months, depending on the ambient temperature.

5.3 User responsibilities

There are no user-serviceable parts contained within the UPS so the maintenance requirements of the user are minimal. To maximise the useful working life and reliability of the UPS and its batteries, the environment in which the UPS operates should be kept cool and dust free.

5.4 Routine maintenance

It is essential that the UPS system and batteries receive regular preventative maintenance inspection to maximise both the useful working life and the reliability of the UPS system. When the UPS is commissioned, the commissioning field service engineer will attach a service record book to the front of the UPS which will be used to log the full service history of the UPS.

Preventative maintenance inspections involve working inside the UPS which contains hazardous AC and DC voltages.



WARNING: Only Kohler Uninterruptible Power trained and authorised field service engineers are fully aware of all of the hazardous areas within the UPS.

During a preventative maintenance inspection the field service engineer will check:

- Site/environment conditions
- Integrity of electrical installation
- Cooling airflow
- Rectifier operation and calibration
- Inverter operation and calibration
- Static switch operation
- Battery status
- Load characteristics
- Integrity of alarm and monitoring systems
- Operation of all installed options

Preventative maintenance inspections form an integral part of all Extended Warranty Agreements (maintenance contracts) offered by Kohler Uninterruptible Power.

For further details on Extended Warranty Agreements see Paragraph 2.6.

5.5 Battery Testing

The battery test takes approximately 3 minutes and should be performed only if:

- There are no alarm conditions
- The battery is fully charged
- The input mains supply is present

Battery testing can be carried out independently of the operating mode (Off-line or On-line) and whether or not the load is connected.

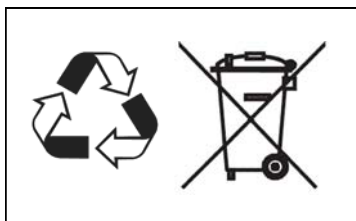
The battery test procedure can be performed from the UPS front panel (See paragraph 4.3.5).

5.6 Battery Maintenance

The battery maintenance shall be done by an authorized Kohler Uninterruptible Power Service Partner.

5.7 Battery Disposal and Recycling

Batteries contain dangerous substances that will harm the environment if thrown away. If you change the batteries yourself, call qualified organizations for battery disposal and recycling.



6

Troubleshooting

6.1 Alarms

In the event of an alarm condition the red ALARM LED-indicator will illuminate on the operator control panel and the audible alarm will sound.

In this case proceed as follows:

1. Silence the audible alarm by pressing the RESET button.
2. Identify the cause of the alarm condition by means of the events register in the main menu (See paragraph 4.3.3).
3. In case of doubt please contact your nearest service agent or call Kohler Uninterruptible Power on +65 6302 0708.

Fault identification and rectification information is given on the following pages.

6.2 Menu, Commands, Event Log, Measurements,

A detailed description of the Menu, Commands, Event Log and Measurements that can be operated and displayed on the LCD can be found in Section 4.

Event Log Screen

DESCRIPTION	LCD-DISPLAY
1. Logging Control	05-10-00 14-38-56 LOAD TO INV.
2. A log of the last 64 events is stored in the Power Management Display.	05-10-00 14-38-59 LOAD TO BYP.
3. All events and alarms are indicated with their date and time of occurrence.	05-10-00 14-39-14 LOAD OFF

The full list of Alarms and Messages are shown in section 6.3.

As you step through the event memory, make a separate note of each alarm condition as this will assist in the identification of any problems.

6.3 Fault Identification and Rectification Messages and Alarms

Messages will not appear automatically on the LCD as they occur, but will be recorded in the Event Log, with the time and date of their occurrence.

Alarm Condition	Meaning	Suggested Solution
UPS FAULT	There is a fault in the UPS and therefore normal operation cannot be guaranteed	Call the authorised service centre for assistance
MAINS BYP/RECT FAULT	Mains power supply is outside prescribed tolerance	The input power to UPS is too low or missing. If site power appears to be OK, check the input circuit breakers etc. supplying the UPS
OUTPUT SHORT	There is a short circuit at the output of UPS (on load side)	Check all output connections and repair as required.
OVERLOAD	Load exceeds the UPS rated power	Identify which piece of equipment is causing the overload and remove it from the UPS. Do not connect laser printers, photocopiers, electric heaters, kettles etc. to the UPS
OVERTEMPERATURE	UPS temperature has exceeded the allowed value	Check the ambient temperature of the UPS is less than 30° C. If the ambient temperature is normal call the authorised service centre for assistance.
BATTERY CHARGER OFF	The attached battery and the battery charger set-up do not correspond or battery charger fault	Call the authorised service centre for assistance.
INVERTER FAULT	Inverter is faulty.	Call the authorised service centre for assistance.
SYNCHRON FAULT	The inverter and mains are not synchronised.	The frequency of the input voltage to the UPS is outside operational limits and the UPS static bypass has been temporarily disabled.
BATTERY IN DISCHARGE	Battery is near end of autonomy	Shutdown load connected to UPS before the UPS switches itself off to protect its batteries
MANUAL BYP IS CLOSED	Maintenance Bypass closed. Load supplied by mains	This alarm is only displayed if the UPS is on Maintenance Bypass

6.4 Contacting Service

Kohler Uninterruptible Power has a service department dedicated to providing routine maintenance and emergency service cover for your UPS. If you have any queries regarding your UPS please contact us.

Kohler Uninterruptible Power.
 7 Jurong Pier Road
 Singapore 619159
 Tel: +65 6302 0708
 Fax: +65 6302 0717
 Email: E: serviceUPS.sg@kohler.com

We recommend that your UPS is protected by an Extended Warranty Agreement (see Section 2 for details). These agreements assist us in caring for your UPS correctly, ensuring that it is well maintained and attended to promptly should any problems occur.

7

Options

7.1 Introduction.

The PowerWAVE 9000 DPA UPS has the following options available:

- Remote Emergency Stop facilities
- Generator ON facilities
- 2 Customer-input functions (customer defined)
- Temperature sensor for temperature-dependent battery charging
- WaveMON shutdown and management software
- SNMP Card for network management and remote monitoring
- Modem/Ethernet interface for PowerReporter™ management software

7.2 Remote Emergency Stop Facilities

The remote emergency stop facility **must** use a normally-closed contact which opens to operate the emergency stop sequence.

The emergency stop port X1/1 and X1/2 is located at the bottom of the DPA Cabinet on the communication card with terminal blocks X1..X4. See Figure 3.7 for a location drawing.

In order to permit removal, maintenance or testing of any remote emergency stop facility without disturbing the normal UPS operation, it is recommended that a terminal block with linking facilities be installed between the communications card and the remote emergency stop button.

Use a screened cable with 1 pair (section of wires 0.6 mm²) and maximum length of 100 m and connect the cable as shown in Figure 7.1.

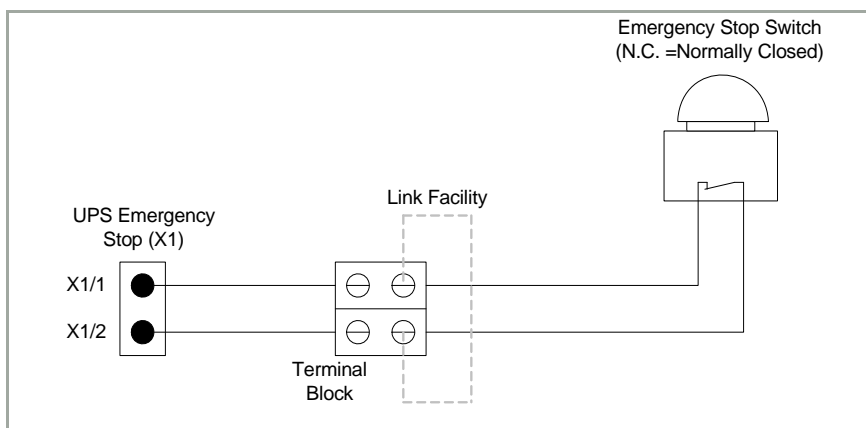


Figure 7.1 Remote Emergency OFF Switch Cabling

7.3 Generator ON Facilities

The Generator ON facility must use a normally-open contact which closes to indicate that a generator is running and supplying input power to the UPS.

The UPS Generator port X1/3 and X1/4 is located at the bottom of the DPA Cabinet on the communication card with terminal blocks X1..X4. See Figure 3.7 for a location drawing.

When used, this facility enables an option to inhibit the operation of the battery charger and/or static bypass (See paragraph 4.3.7).

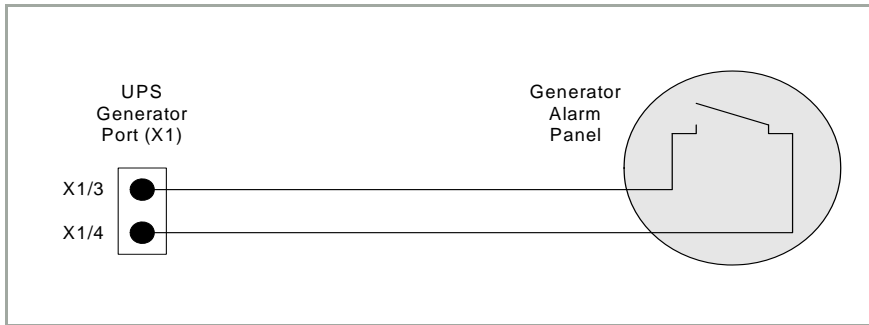


Figure 7.2 Generator ON Connection

7.4 WAVEMON Shutdown and Management Software

7.4.1 Why is UPS Management important?

By combining a UPS with a variety of network management products, such as orderly shutdown software and SNMP adaptors, system-administrators can be assured that their electricity supplies are monitored for power disruptions and depleted battery conditions. Such conditions pose the greatest threat through power disturbance, to valuable computer data by causing possible corruption or loss. By installing UPS/Mains monitoring software, administrators are able to monitor the utility power from a central location, allowing early warning of problems even across more complex systems like Wide Area Networks (WAN) and Enterprise Wide Networks of multinational companies.

A prolonged mains failure may outlast the battery autonomy of the UPS system. If this situation occurs UPS management software will initiate an automatic, graceful shutdown of the operating system, protecting valuable data.

Kohler Uninterruptible Power offer a wide range of local and remote monitoring and control systems, offering maximum protection for computer systems.

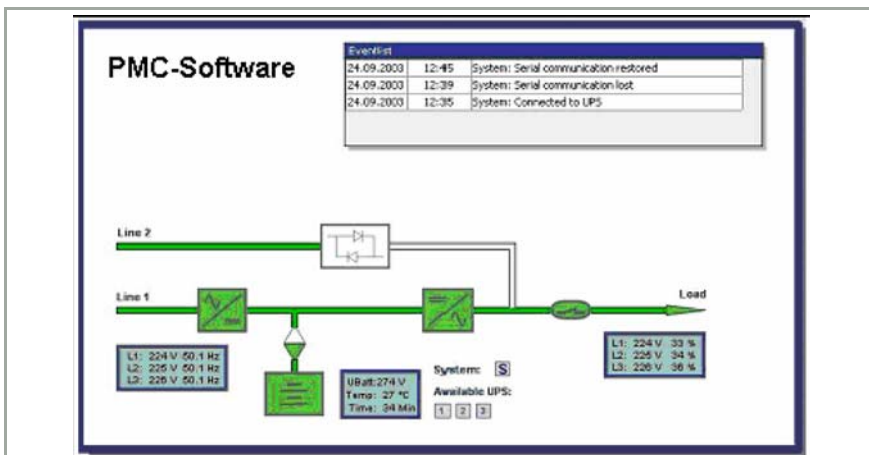


Figure 7.3 Monitoring screen image.

7.4.2 Wavemon Shutdown and Monitoring Software

Wavemon is an external monitoring and shutdown software which is designed to operate with many of Kohler Uninterruptible Power UPS products, both with the DRY PORT (Relays) on terminal block X2..X4 and RS232 port JD11 on the communication card.

The software packet consists of a CD ROM for most commonly used operating systems, a standard cable set and a user manual.

The dry port X2...X4 with voltage-free contacts may also be used for automatic shutdown in connection with WAVEMON Software. It is necessary to provide a cable of 0.5 mm² to connect Terminals X2..X4 of the UPS and the serial port of the server.

The main characteristics of Wavemon software are (assuming RS232 port used):

- Automatic unattended master/slave shutdown in heterogeneous networks.
- On-screen autonomy time/battery time countdown.
- On-screen server log off and shutdown procedure.
- Time and date stamp event log, extensive logging of all UPS activity and power quality data.
- Scheduled UPS economy mode, service mode, other systems status.
- Graphical user interface for Windows compatible platforms.
- Automatic unattended local shutdown.
- Special modules for the MS-Office software to close and save open documents.
- Compatible with all optional modules like UPSDIALER, SNMP adapters, Temperature sensors, etc.

The UPS-Management software is a client-/server-application for networks and local workstations. Basically WAVEMON-software consists of two parts: the server-module of the UPS-Management Software is UPSServ, which communicates via RS-232 cable with the UPS.

Working as a background process the UPSServ collects messages, received from the UPS, interprets the messages and then makes them available to the client-module UPSCli and to any SNMP-based management station.

When UPSServ detects voltage variations or a power failure it can execute various so called system 'event routines', which for example may shutdown the server or send a warning to connected users. These system event routines are a part of the UPS-Management Software can be adjusted to suit the customer's demands.

The UPS management software includes the licence for using the UPS service on one server with one UPS and an unlimited numbers of connected Windows workstations. When operating with two or more servers, a licence is required for every additional server, irrespective of whether the UPS service runs at that location, or if the server is halted by a UPS service via remote command.

The same regulations apply to the remote send/receive modules (RCCMD) and multiserver shutdown under NT, UNIX and other operating systems. The service programs are generally delivered as a single-licence. To use a single CD ROM to shutdown multiple servers you have to purchase additional CD license keys.

Parallel/redundant UPS systems are also manageable by the software. The main principle is to introduce a shutdown of a server only when strictly necessary. Correct parallel handling has therefore to manage a parallel system as a whole and always consider the system redundancy.

The following statements apply:

- Every alarm on any unit is immediately notified, but a reaction to a serious fault is introduced only when the minimum number of UPS Modules necessary to supply the load exhibits an alarm situation.
- Battery autonomy time of the parallel system is computed continuously.
- Maintenance on a redundant unit may be executed without affecting the management system (supervisor).

The PowerWAVE 9000 DPA can be integrated in a network in two ways:

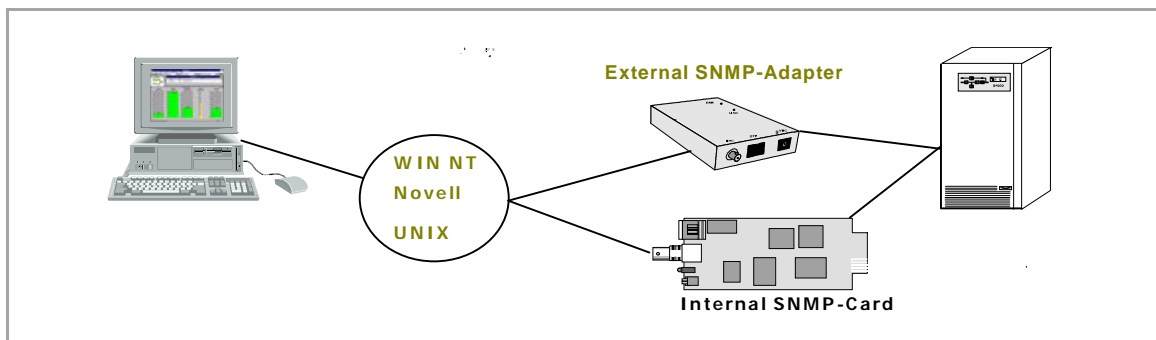
- By means of the server which is being powered by the UPS and is integrated in the network. In most cases the server is used as a sub-agent and only the Wavemon software is needed, without any SNMP Adapter. The standard connection is between the RS232 SMART port of UPS and RS232 port of computer/server.

- If the UPS is powering network hardware such as routers, then an SNMP adapter is necessary. Up to 50 computers can be shut down in a RCCMD (Remote Console Command) environment. RCCMD is an additional module, which executes a command in a distant system.

7.5 SNMP CARD/ADAPTER For Network Management /Remote Monitoring

The Simple Network Management Protocol (SNMP) is a worldwide-standardized communication-protocol. It is used to monitor any device in the network via simple control language. The UPS-Management Software also provides its data in this SNMP format with its internal software agent. The operating system you are using must be SNMP compatible. We offer our software with SNMP functionality together with NetWare, OS/2, all Windows NT systems on INTEL and ALPHA.

There are two types of SNMP-Adapters available: External SNMP-Adapter and Internal SNMP-Card (both have the same functions).



SNMP Adapter

The SNMP adapter requires a PC with terminal connections. For normal operation at least one network connection (Ethernet) is also required.

The SNMP adapter is used to monitor any device in the network and can be used, utilising the RCCMD send function, for an automatic network wide shut down or informing connected users. The shut down procedure can be initiate from the remaining time (downtime) or as countdown timer from the beginning of the alarm. A shut down is therefore possible without extra input from the operator, but fully software controlled.

For detailed information please refer to the Software Manual provided with the WAVEMON CD ROM. This adaptor communicates via the serial port of the UPS and makes a direct multiple server shut down possible without additional SNMP management software.

RCCMD - Remote Console Command module for a multi-server shutdown. The RCCMD modules are independent programs that may be activated on the computer that is running UPSMAN. This makes a shutdown call possible in any LAN and WAN, regardless of the network type or operating system.

External SNMP Adapter

The External SNMP adapter is small, 12 x 7 cm. and is supplied with the following accessories:

- RJ-45 connector for 10/100 Base-T (autoswitchable)
- Serial Port (COM2) or optional ModBus interface.
- Error/Link LED for UPS status
- Aux Port
- DIP Switch
- Serial Port to the UPS (COM1)
- DC Supply (9 VDC or 9-36 VDC supply, depending on model);



Internal SNMP Adapter

.The Internal SNMP-Card can also be inserted into an appropriate expansion slot in the PowerWAVE 9000 Modules or Cabinet.








This adapter communicates via the serial port of the UPS and makes a direct multiple server shut down possible without additional SNMP management software.






8

Specifications

8.1 Mechanical Characteristics

		CLASSIC DPA-25	TRIPLE DPA-75	UPGRADE DPA-125	
'MD' Cabinets (Frames)					
Capacity	Max.	1 module (10-25kVA) 200 x 7/9Ah batteries	3 modules (10-25kVA) 180 x 7/9Ah batteries	5 modules (10-25kVA) No batteries	
Max. Power connection	kVA	25	75	125	
Dimensions (WxHxD)	mm	550x1650x780	550x1975x780	550x1975x780	
Weight of Empty Cabinet	kg	200	220	160	
Weight of Cabinet with modules and no batteries	kg	224 - 233 (with 1 Module)	292 - 319 (with 3 Modules)	280 - 325 (with 5 Modules)	
Colours	Front: RAL 9007 + black (inlets). Side walls: Graffito grey				
PowerWAVE DPA UPSModules					
Output Apparent Power	KVA	10	15	20	25
Output Active Power	KW	8	12	16	20
Output Power (PF=1)	KVA/ KW	8 / 8	12 / 12	16 /16	20 /20
Variable Number of 12V Battery Blocks	No.	30 – 50	30 – 50	30 – 50	40-50
Dimensions (WxHxD)	mm	483 x 225 x 700			
Weight UPS Module	kg	24		33	
Colours	Front: RAL 9007				

		‘MX’ Cabinets (Frames)		
		CLASSIC DPA-50	TRIPLE DPA-150	UPGRADE DPA-250
				
Capacity	Max.	1 module (30-45kVA) 280 x 7/9Ah batteries	3 modules (30-45kVA) 240x 7/9Ah batteries	5 modules (30-45kVA) no batteries
Max. Power connection	kVA	50	150	250
Dimensions (WxHxD)	mm	730x1650x800	730x1975x800	730x1975x800
Weight of Empty Cabinet	kg	250	270	190
Weight of Cabinet with modules and no batteries	kg	300 - 310 (with 1 Module)	420 - 450 (with 3 Modules)	440 - 490 (with 5 Modules)
Colours		Front: RAL 9007 + black (inlets). Sidewalls: Graffito grey		

		PowerWAVE DPA MODULES		
		DPA 30	DPA 40	DPA 50
				
Output Apparent Power	KVA	30	40	45*
Output Active Power	KW	24	32	40
Output Power (PF=1)	KVA / KW	24 / 24	32 / 32	40 / 40
Number of 12V Battery Blocks	No.	40-50	40-50	40-50
Dimensions (WxHxD)	mm	663 x 225 x 720		
Weight UPS Module	kg	50	57	60
Colours		Front: RAL 9007		
		* On Inverter mode 50 KVA/40kW on Bypass mode 45 KVA/40kW		

8.2 Input Characteristics

Module Range		MD				MX		
Module Type		DPA 10	DPA 15	DPA 20	DPA 25	DPA 30	DPA 40	DPA 50
Output Rated Power per Module $\cos\Phi$ 0.8	kVA	10	15	20	25	30	40	45 ¹
Output Rated Power per Module $\cos\Phi$ 1.0	KW	8	12	16	20	24	32	40
Nominal Input Voltage	V	3x380/220V+N, 3x400V/230V+N, 3x415/240V+N						
Input Voltage Tolerance (ref to 3x400/230V) for Loads in %:	V	(-23%/+15%) 3x308/177 V to 3x460/264 V for <100 % load (-30%/+15%) 3x280/161 V to 3x460/264 V for < 80 % load (-40%/+15%) 3x240/138 V to 3x460/264 V for < 60 % load						
Input Frequency	Hz	35 - 70						
Input Power Factor		PF=0.99 @ 100 % load						
Inrush Current	A	limited by soft start / max. In						
Input Distortion THDI		Sine-wave THDi = < 2 % @ 100% load						
Max. Input Power with rated output power and charged battery per Module (output $\cos\Phi$ = 1.0)	kW	8.5	12.8	17.0	21.3	25.4	33.9	42.9
Max. Input Current with rated output power and charged battery per Module (output $\cos\Phi$ = 1.0)	A	12.3	18.5	24.7	30.8	36.8	49.1	62.1
Max. Input Power with rated output power and discharged battery per Module (output $\cos\Phi$ = 1.0)	kW	9.3	14.0	18.6	23.3	27.8	37.1	46.9
Max. Input Current with rated output power and discharged battery per Module (output $\cos\Phi$ = 1.0)	A	13.5	20.2	27.0	33.7	40.3	53.7	68.0

1) On Inverter mode 50 KVA/40kW on Bypass mode 45 KVA/40kW

8.3 Battery

Module Range		MD				MX		
Module Type		DPA 10	DPA 15	DPA 20	DPA 25	DPA 30	DPA 40	DPA 50
Variable Number of 12V Battery Blocks	No.	30-50	30-50	30-50	40-50	40-50	40-50	40-50
Maximum Battery Charger Current	A	6A Standard (10 A optional)				10A Standard (15 A optional)		
Battery Charging Curve		Ripple free ; IU (DIN 41773)						
Temperature compensation		Standard (temp. sensor optional)						
Battery Test		Automatic and periodically (adjustable)						
Battery Type		Maintenance free VRLA or NiCd						

8.4 Output

Module Range		MD				MX		
Module Type		DPA 10	DPA 15	DPA 20	DPA 25	DPA 30	DPA 40	DPA 50
Output Rated Power per Module	kVA	10	15	20	25	30	40	45 1)
Output Rated Power per Module	KW	8	12	16	20	24	32	40
Output Current In @ cosΦ 1.0 (400 V)	A	11.6	17.4	23.2	29	35	46.5	58
Output Rated Voltage	V	3x380/220V or 3x400/230V or 3x415/240V						
Output Voltage Stability	%	Static: < +/- 1% Dynamic (Step load 0%-100% or 100%-0%) < +/- 4%						
Output Voltage Distortion	%	With Linear Load < +/- 2% With Non-linear Load (EN62040-3:2001) < +/- 4%						
Output Frequency	Hz	50 Hz or 60 Hz						
Output Frequency Tolerance	%	Synchronized with mains < +/- 2 % (selectable) or < +/- 4 % Free running +/- 0.1 %						
Bypass operation		At Nominal Input voltage of 3x400 V +/- 15 % or 190 V to 264 V ph-N						
Permissible Unbalanced Load (All 3 phases regulated independently)	%	100%						
Phase Angle Tolerance (With 100 % Unbalanced load)	Deg.	+/- 0 deg.						
Overload Capability on Inverter	%	125 % load 10 min. 150 % load 60 sec.						
Output short capability (RMS)	A	Inverter: 2 x In during 250 ms Bypass: 10 x In during 10 ms						
Crest - Factor		3 : 1						

1) On Inverter mode 50 KVA/40kW on Bypass mode 45 KVA/40kW

Cap.	cosφ	MD Module Range								MX Module Range					
		DPA10		DPA15		DPA20		DPA25		DPA30		DPA40		DPA50 ¹⁾	
		kW	kVA	kW	kVA	kW	kVA	kW	kVA	kW	kVA	kW	kVA	kW	kVA
Ind.	0.85	6.2	7.3	9.3	11	12.3	14.5	15.4	18.1	18.5	21.8	24.6	29	31	36.5
	0.90	8	8.9	12	13.3	16	17.8	20	22.2	24	26.7	32	35.6	40	44.4
	0.95	8	8.4	12	12.6	16	16.8	20	21.1	24	25.3	32	33.7	40	42.1
	1.00	8	8	12	12	16	16	20	20.0	24	24	32	32.0	40	40
	0.95	8	8.4	12	12.6	16	16.8	20	21.1	24	25.3	32	33.7	40	42.1
	0.90	8	8.9	12	13.3	16	17.8	20	22.2	24	26.7	32	35.6	40	44.4
	0.85	8	9.4	12	14.1	16	18.8	20	23.5	24	28.2	32	37.6	40	47.1
	0.80	8	10	12	15	16	20	20	25	24	30	32	40	40	50 ¹⁾
	0.75	7.6	10	11.4	15	15.3	20	19.1	25	22.9	30	30.5	40	38	50 ¹⁾
	0.70	7.2	10	10.8	15	14.5	20	18.1	25	21.7	30	28.9	40	36	50 ¹⁾
0.60	6.3	10	9.5	15	12.7	20	15.9	25	19	30	25.4	40	32	50 ¹⁾	

1) DPA 50 : On Inverter Mode 50 KVA/40kW on Bypass Mode 45 KVA/40kW

8.5 Environmental

Module Range		MD				MX		
Module Type		DPA 10	DPA 15	DPA 20	DPA 25	DPA 30	DPA 40	DPA 50
Audible Noise with 100% / 50% Load	dB(A)	55/49	57/49	57/49	57/49	59/51	65/55	65/55
Operation temperature	°C	0 - 40						
Ambient Temperature for Batteries	°C	20 - 25 (recommended)						
Storage Temperature	°C	-25 - +70						
Battery Storage Time at Ambient Temperature		Max. 6 months						
Max. altitude (above sea level)	m	1000m (3300ft) without de-rating						
		Above sea level (m / ft)				Power De-Rating Factor		
De-rating factor for use at altitudes above 1000m sea level according (IEC 62040-3)		1500 / 4850				0.95		
		2000 / 6600				0.91		
		2500 / 8250				0.86		
		3000 / 9900				0.82		
Relative Air-humidity		Max. 95% (non-condensing)						
Accessibility		Totally front accessibility for service and maintenance (no need for side, top or rear access)						
Positioning		Min. 20 cm rear space (required for fan)						
Input and Output Power Cabling		From the bottom on the front						
Efficiency AC-AC up to (cosΦ _i 1.0) (depending on Module power)	%	Load : 100 % 75 % 50% 25% DPA 30-50 : 94.5% 94.5% 94% 93 DPA 10-25 : 94% 94% 93.5% 91%						
Efficiency Linear Load at cosΦ=0.8ind Efficiency Non-linear Load (EN 62040-1-1:2003)		Typically up to 1 % higher of above values Typically up to 1 % lower of above values						
Eco-Mode efficiency at 100% load	%	98 %						
Heat Dissipation with 100% Non-linear Load per Module (EN 62040-1-1:2003)	W	600	900	1200	1500	1670	2225	2780
Heat Dissipation with 100% Non-linear Load per Module (EN 62040-1-1:2003)	BTU	2047	3070	4094	5118	5698	7592	9485
Airflow (25° - 30°C) with Non-linear Load per Module (EN 62040-1-1:2003)	m ³ /h	150	150	150	150	380	380	380

8.6 Packed weights



Figure 8.1



Figure 8.2



Figure 8.3



Figure 8.4



Figure 8.5

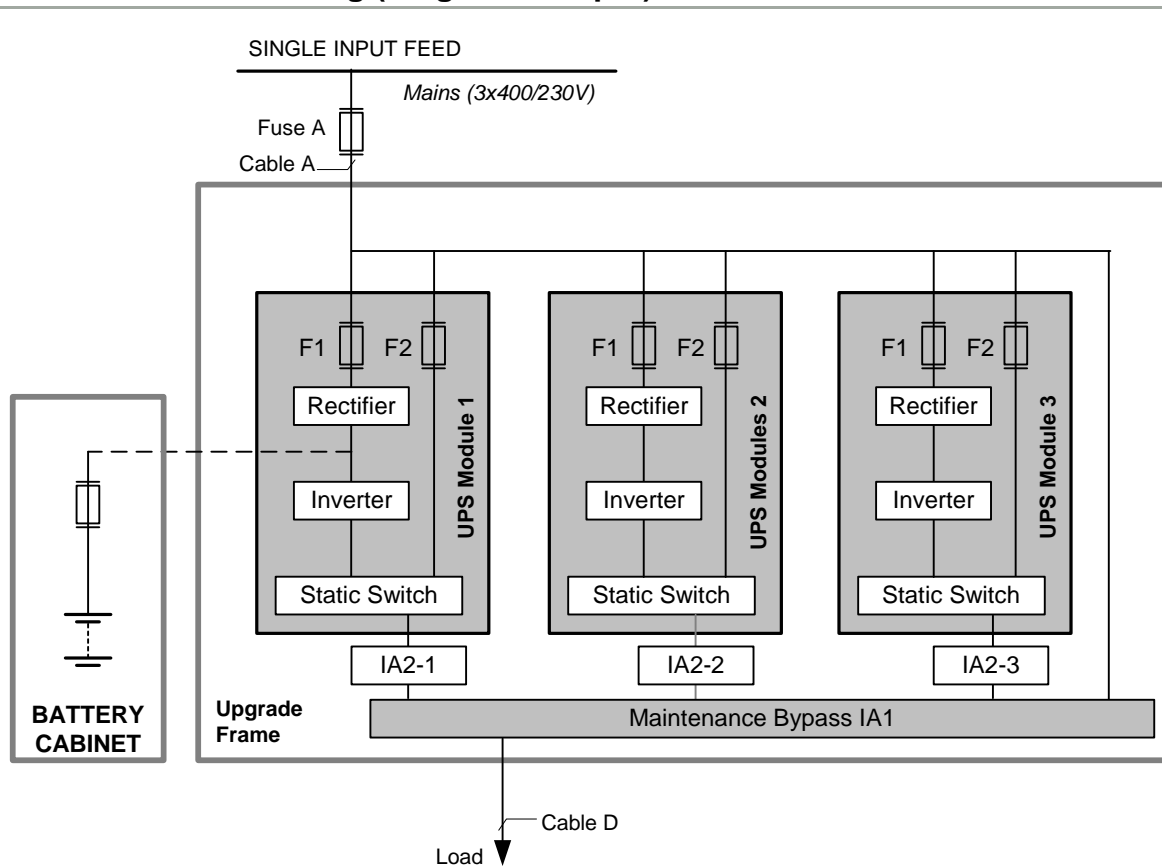


Figure 8.6

Fig	UPS	Modules	Packed Weight (Kg)			Packed Dimension mm	Unpacked Weight			Unpacked Dimension mm
			DPA 10 or 15 no Batt.	DPA 20 or 25 no Batt.			DPA 10 or 15 no Batt.	DPA 20 or 25 no Batt.		
8.1	DPA-25	1	284	293		700x1825x895	224	233		550x1650x780
8.2	DPA-75	1	304	313		700x2150x895	244	253	TBA	550x1975x780
		2	328	346		700x2150x895	268	286	TBA	550x1975x780
		3	352	379		700x2150x895	292	319	TBA	550x1975x780
8.3	DPA-125	1	244	253		700x2150x895	184	193		550x1975x780
		2	268	286		700x2150x895	208	226		550x1975x780
		3	292	319		700x2150x895	232	259		550x1975x780
		4	316	352		700x2150x895	256	292		550x1975x780
		5	340	385		700x2150x895	280	325		550x1975x780

Fig	UPS	Modules	Packed Weight (Kg)			Packed Dimension mm	Unpacked Weight			Unpacked Dimension mm
			DPA 10 or 15 no Batt.	DPA 20 or 25 no Batt.			DPA 10 or 15 no Batt.	DPA 20 or 25 no Batt.		
8.4	DPA-50	1	360	367	370	880x1825x915	300	307	310	730x1650x800
8.5	DPA-150	1	TBA	TBA	TBA	880x2150x915	TBA	TBA	TBA	730x1975x800
		2	TBA	TBA	TBA	880x2150x915	TBA	TBA	TBA	730x1975x800
		3	TBA	TBA	TBA	880x2150x915	TBA	TBA	TBA	730x1975x800
8.6	DPA-250	1	300	307	310	880x2150x915	240	247	250	730x1975x800
		2	350	364	370	880x2150x915	290	304	310	730x1975x800
		3	400	421	430	880x2150x915	340	361	370	730x1975x800
		4	450	478	490	880x2150x915	390	418	430	730x1975x800
		5	500	535	550	880x2150x915	440	475	490	730x1975x800

8.7 Cable and fuse sizing (Single feed input)

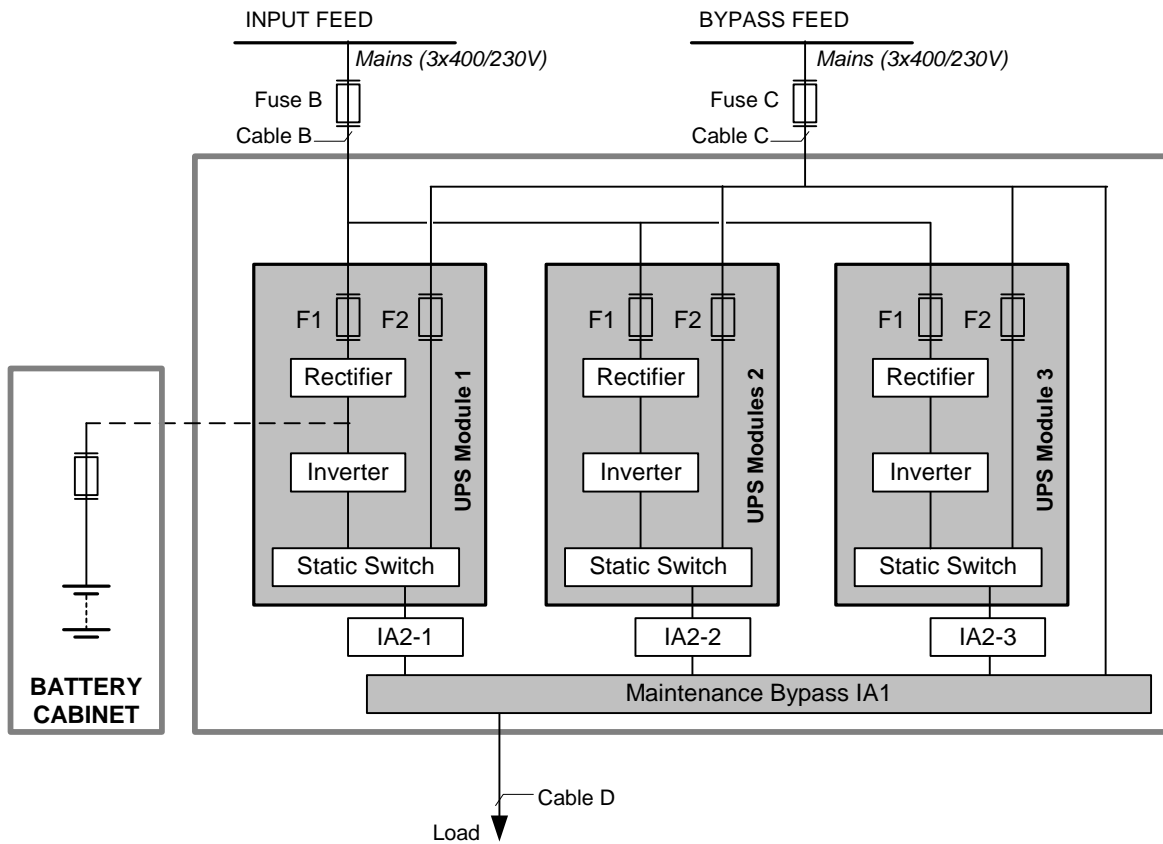


FRAME	Power (kVA)	Single Input (3 x 400V)			Output (3x400V, 0.8 pf)	
		Fuse A (A)	Cable A (mm ²)	Max Input with batt charging (A)	Cable D (mm ²)	Nominal Current (A)
DPA-25	25	3x63	5x10	34	5x10	36
DPA-75	75	3x125	5x50	101	5x50	108
DPA-125	125	3x225	5x95	169	5x95	181
DPA-50	80	3x100	5x25	67	5x25	72
DPA-150	150	3x250	5x120 or 5x(2x50)	202	5x120 or 5x(2x50)	218
DPA-250	250	3x400	5x(2x95)	337	5x(2x95)	362

Notes:

1. Fuse and Cable recommendations to IEC 60950-1:2001 or locally recognised standards.
2. The fuse and cable rating details in the above tables are a recommendation only.
3. The UPS must be installed to prescribed IEC or local regulations.
4. DC Cables and Battery fuses are bespoke to the installation.

8.8 Cable and fuse sizing (Dual feed input)



Frame	Power (kVA)	Dual Input (3 x 400V)				Output (3x400V, 0.8 pf)	
		Fuse B/C (A)	Cable B (mm ²)	Cable C (mm ²)	Max Input with battery charging (A)	Cable D (mm ²)	Nominal Current (A)
DPA-25	25	3x63	5x10	4x10	34	5x10	36
DPA-75	75	3x125	5x50	4x50	101	5x50	108
DPA-125	125	3x225	5x95	4x95	169	5x95	181
DPA-50	80	3x100	5x25	4x25	67	5x25	72
DPA-150	150	3x250	5x120 or 5x(2x50)	4x120 or 4x(2x50)	202	5x120 or 5x(2x50)	218
DPA-250	250	3x400	5x(2x95)	4x(2x95)	337	5x(2x95)	362

Notes:

1. Fuse and Cable recommendations to IEC 60950-1:2001 or locally recognised standards.
2. The fuse and cable rating details in the above tables are a recommendation only.
3. The UPS must be installed to prescribed IEC or local regulations.
4. DC Cables and Battery fuses are bespoke to the installation.

