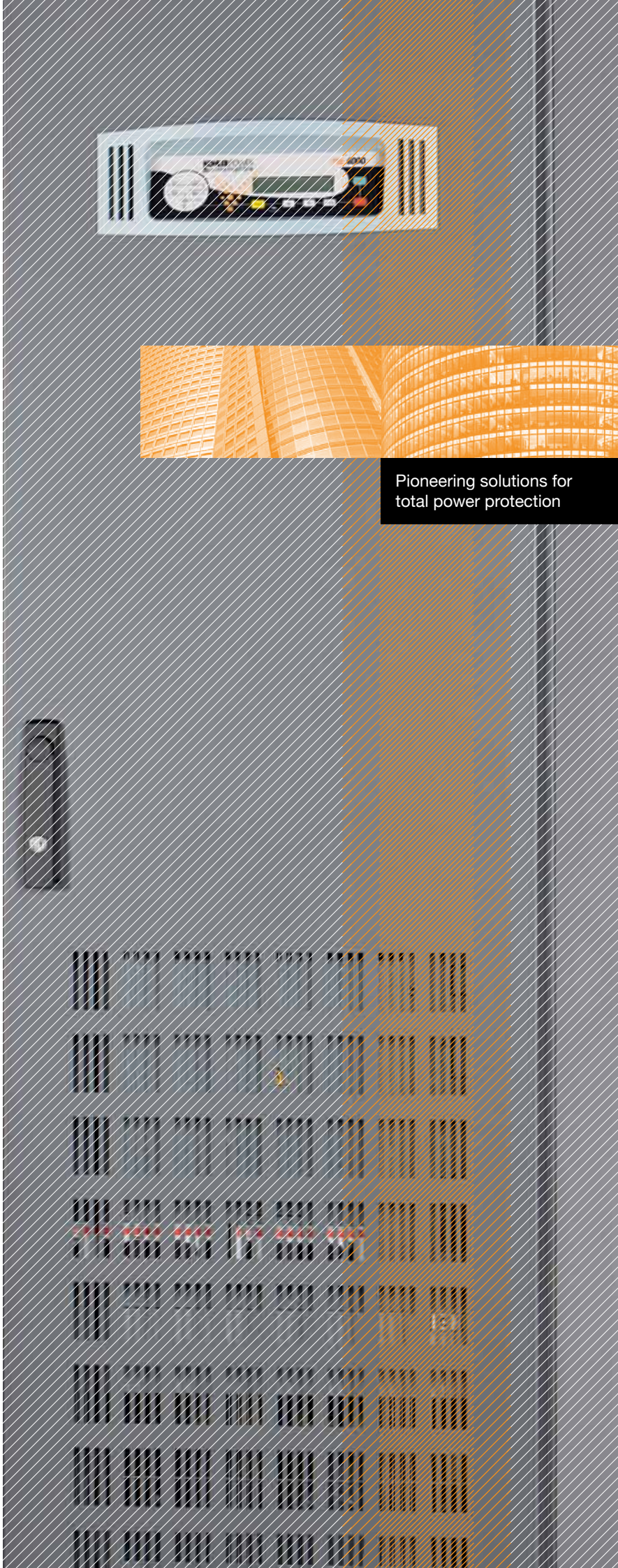
User Manual

Kohler PW 6000



Pioneering solutions for
total power protection

KOHLER POWER
uninterruptible

Document Control

ISSUE	DATE	REVISION SUMMARY
1.0	02-05-12	Initial issue of 60-500kVA Manual
1.1	08-05-12	Minor typographic errors corrected
1.2	25-06-12	Minor typographic errors corrected and new Lexan inserted in Ch-4

Kohler Uninterruptible Power 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.

Table of Contents

4 Operation

5 Maintenance

6 Troubleshooting

7 Options

8 Specifications

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: This UPS must be serviced by qualified personnel.
You run risk of exposure to dangerous voltages by opening or removing the UPS-covers! Uninterruptible Power Supplies Ltd will assume no responsibility nor liability due to incorrect operation or manipulation of the UPS.

WARNING: The Kohler PW 6000 is a Class A UPS product (according to EN 62040-3). 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 Introduction

Congratulations on your purchase of the Kohler PW 6000 UPS.

Continuous power availability is essential in today's dynamic IT and process-related work environments. It is equally important that any installed power protection system is sufficiently resilient and adaptable to handle any changes brought about by the introduction of new server technologies, migration and centralization.

Such demands are well met by the Kohler PW 6000 UPS system, which provides the foundation for continuous power availability of network-critical infrastructures both in enterprise data centres, where business continuity has paramount importance, and in process control environments where manufacturing continuity is essential.

2.1.1 Reliability and quality standards

The Kohler PW 6000 UPS is available over a model range of 60kVA to 500kVA and incorporates the latest technological developments in power engineering. Representing a completely new generation of high power three phase UPS systems, its advanced double conversion VFI (Voltage and Frequency Independent) topology responds fully to both the highest availability and environmentally friendly requirements compliant with IEC 62040-3 (VFI-SS-111) standards.

High reliability, upgrade ability, low operating costs and excellent electrical performance are only some of the highlights of this innovative UPS solution.

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

2.1.2 Key features

The highlights of this innovative UPS solution include its high reliability, upgrade ability, low operating costs and excellent electrical performance.

KEY FEATURES	
Compact size, small foot print	Space saving on expensive floor space
Flexible battery management	Advanced management of battery charging and preventive failure diagnostics avoids premature deterioration of battery life.
Best in class ac-ac efficiency, up to 96%	Energy-Operational cost savings (TCO)
Low input power factor (near unity)	Cost savings during installation and the entire life cycle (TCO)
Blade-server-friendly power; full power from 0.9 lead to 0.9 lag	No de-rating required with leading PF loads
Very low input current distortion THDi THDi = < 3.5% @ 100% load	Gen-set power and installation cost saving

2.2 Kohler PW 6000 Model range

The Kohler PW 6000 UPS range includes 60, 80, 100, 120, 160, 200, 250, 300, 400 and 500kVA models.

Models in the 60-100kVA range are available in three cabinet sizes, two of which incorporate internal battery housings. Modules greater than 100kVA require the UPS batteries to be mounted in a separate battery enclosure or mounted on a purpose-designed battery rack. A range of optional battery closures are available.

For a complete description of the various cabinets' weight and dimensions see Chapter 8 (Specifications).

2.2.1 Single/Parallel system configurations

The Kohler PW 6000 UPS can be configured to operate as a single, stand-alone UPS or several (up to 10) UPS cabinets can be connected in parallel to operate as a multi-module UPS system. A multi-module configuration is generally chosen either to increase a system's total power capacity or to increase the system's overall reliability by providing a degree of

module redundancy.

***Note:** In this manual the terms 'multi-module system' and 'parallel system' are synonymous.*

Parallel system operation

When operating as part of a parallel UPS system it is critical that various control functions such as load sharing, frequency synchronisation and load transfer are observed by all the connected UPS modules. In the Kohler PW 6000 UPS system this is achieved by a parallel control bus which allows all the connected modules to communicate with each other and carry out the necessary synchronous control operations.

Due to its Decentralised Parallel Architecture (DPA) design each Kohler PW 6000 UPS can take the leadership role when operating in a multi-module system. This avoids single points of failure in the parallel chain once again ensure the highest level of power availability.

Parallel system expansion

Most data centres present a low initial power demand which increases as the data centre grows to its full capacity; and it is essential that the installed power protection system can be expanded to meet the growing demand without compromising the existing load. This situation is easily managed in a Kohler PW 6000 multi-module installation which allows an additional module to be connected to an existing parallel system without having to temporarily transfer the load to the raw mains (by-pass) supply. Thus the load still receives UPS protected power at all times during the upgrade process – without interruption.

Key Point: All the UPS modules connected to a parallel system must be of the same power rating.

2.3 Kohler PW 6000 functional description

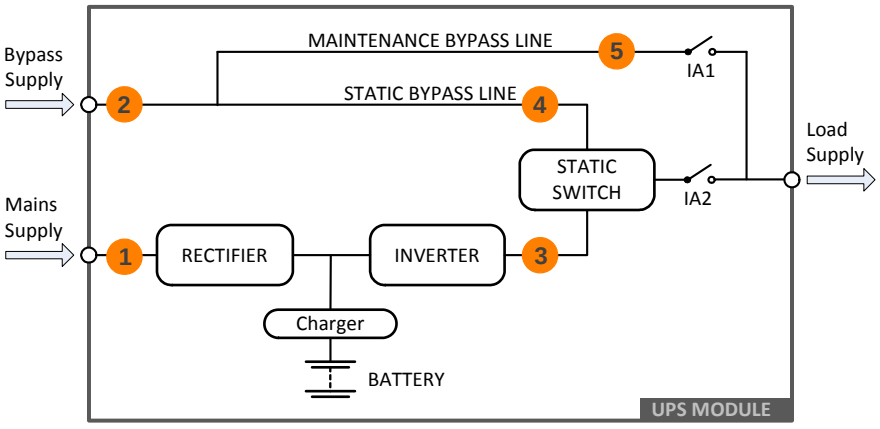


Figure 2.1 Kohler PW 6000 UPS block diagram

2.3.1 Kohler PW 6000 block diagram

Figure 2.1 shows the power blocks contained within the Kohler PW 6000 UPS.

UPS Input supplies

The Mains supply (1) is a three phase supply which is connected to the UPS rectifier. During normal operation this supply is rectified to provide a DC input to the inverter and also charges the battery. A separate mains supply (2) is shown connected to the static bypass in Figure 2.1; however in a standard UPS module the bypass supply terminals (2) are usually linked to the mains supply terminals (1) so the UPS effectively requires only a single mains supply connection. (See paragraph 3.6.2 for details concerning 'Single Feed' & 'Dual Feed' input supply configurations.) The bypass supply is shown connected to the static switch (4) and the maintenance bypass line (5).

UPS Output (load) supply

Figure 2.1 shows that the UPS output (Load supply) can be provided through one of three power paths from within the UPS, depending on the UPS operating mode:

- From the inverter (3), via the static switch and isolator IA2
- From the static bypass line (4) via the static switch and isolator IA2
- From the maintenance bypass line (5) via the maintenance bypass isolator IA1

The criteria for operating under each of these UPS modes is described below.

2.3.2 UPS internal operating modes

Load on Inverter

This is the normal operating mode and the only one that provides the load with continuously processed and backed-up power.

In this mode, the mains supply is converted to DC by the rectifier which then charges the battery and provides operating power for the inverter; which converts the rectifier output back to AC suitable to provide the load power.

If the mains supply fails or strays outside a preset voltage range, the rectifier shuts down and the battery provides an alternative DC power source for the inverter; which continues to operate until the battery is discharged.

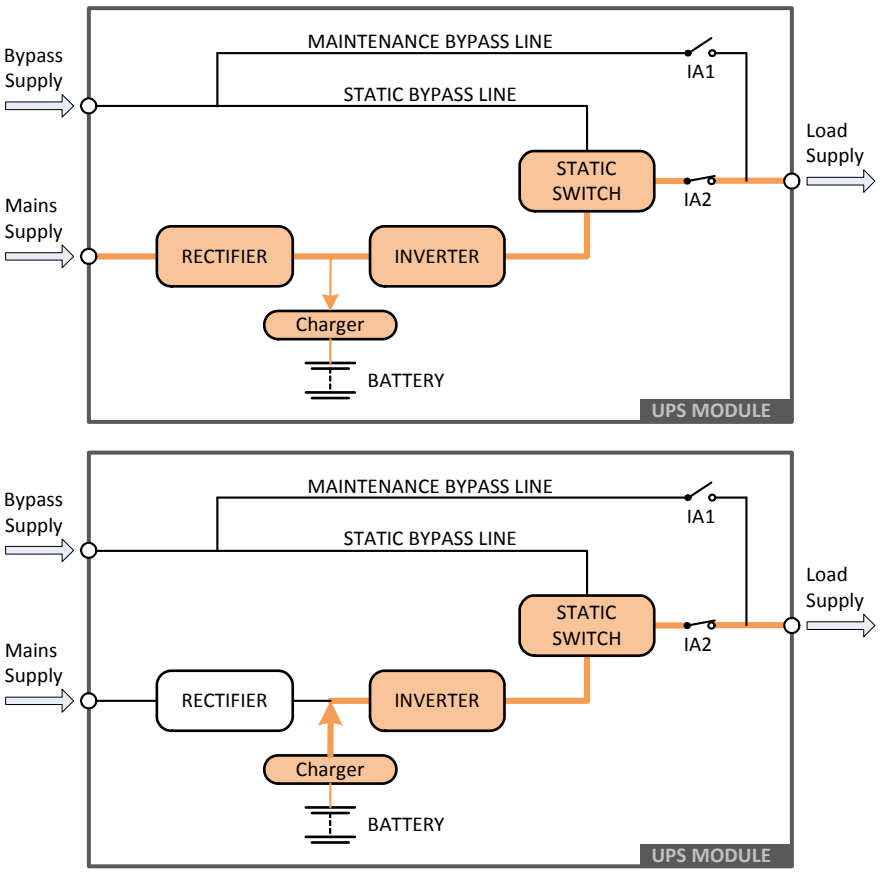


Figure 2.2 Load on inverter

When operating in the 'Load on Inverter' mode the inverter output frequency is synchronised to the bypass supply provided the bypass supply frequency remains within preset limits. If these limits are exceeded, or if the bypass supply fails altogether, the inverter frequency control reverts to a free-running oscillator that will maintain the output frequency at a constant 50/60Hz.

When operating from battery power various alarms are generated at preset voltages as the battery discharges. This enables the operator to shut-down the load in an orderly manner (e.g. save data) before the battery reaches its end-of-discharge voltage. Various options are available to automate the load shut-down process, as described in Chapter 7 of this manual (Options).

Load on Bypass

In the 'Load on Bypass' mode the load supply is connected to the unprocessed static bypass line via the static switch.

When operating in this mode the rectifier, charger and inverter sections can be turned off entirely or remain running, and continue to provide battery charging.

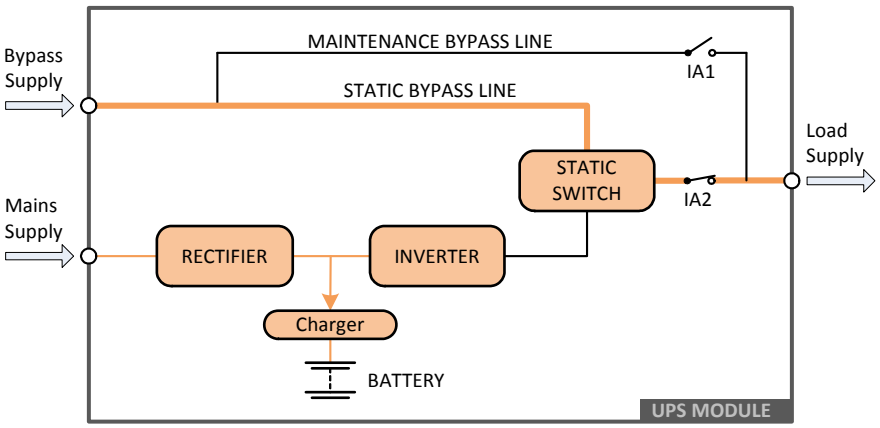


Figure 2.3 Load on bypass

Inverter/Bypass load transfer

As illustrated in the above diagrams, the load is connected to the inverter or static bypass power circuits by means of the static switch. This is a solid state switch which is operated by the UPS microprocessor control system and allows the inverter/bypass operating mode to be selected manually via the UPS operator control panel or automatically depending on various UPS operating conditions *(see paragraph 2.3.3)*.

Load on Maintenance Bypass

In this mode of operation the manually closed maintenance bypass switch connects the load supply directly to the unprocessed bypass supply. This is used to keep the load supplied (albeit without any power protection) whilst allowing the remainder of the UPS to be shut down for service repair.

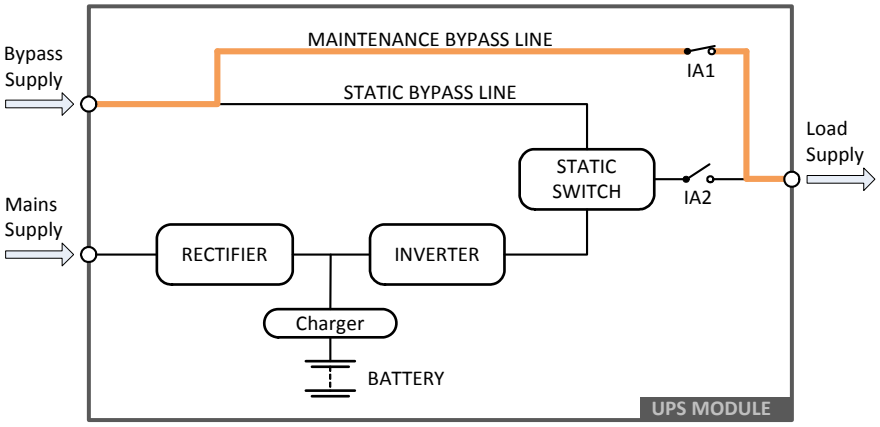


Figure 2.4 Load on maintenance bypass

***Note:** Live voltages are still present on the UPS input and output power terminals when in this mode.*

To prevent possible inverter damage, it is important that the inverter output and maintenance bypass lines are never connected in parallel. Therefore when transferring from the 'load on inverter' mode to the 'load on maintenance bypass' mode it is important that the load is first transferred to the static bypass ('load on bypass') before the maintenance bypass switch is closed – always follow the operating instructions in Chapter 4 of this manual when starting or shutting down the UPS.

2.3.3 System operating modes

The previous section described the various UPS internal operating modes: but UPS systems are also categorised according to the way in which they operate at a 'system' level, and are typically described as being an 'on-line', 'off-line' or 'line interactive' UPS system.

The Kohler PW 6000 can be operated in all three of the above categories.

On-line operation

When used as an 'on-line' UPS the Kohler PW 6000 is configured to normally operate in the Load on Inverter mode.

In the unlikely event of an inverter fault or overload condition the UPS will transfer the load to the static bypass automatically and without interruption (transfer time = 0). If the transfer is due to a UPS overload the system will transfer back to the Load on Inverter mode if the overload clears and the inverter returns to normal operation.

This mode provides the highest degree of load protection, especially in the event of a mains disturbance or failure, and is always recommended if the critical load (e.g. computer system) will not tolerate even very brief supply interruption.

Off-line / line interactive operation

When the Kohler PW 6000 is used in an 'off-line' (or 'line-interactive') configuration the UPS is normally operated in its Load on Bypass mode, with the load being supplied from the static bypass supply. However the rectifier and battery charger are still powered up to maintain battery charging, and the inverter section is turned on and operating on standby.

In the event of a bypass supply error, or total failure, the load is automatically transferred to the inverter (Load on Inverter mode) by the static switch within 3 to 5 milliseconds; and if the rectifier mains supply is missing when the transfer takes place the UPS inverter will support the load operating from its battery power, as described above. If the bypass supply returns to normal the load is retransferred back to the static bypass and the inverter returns to its standby function.

This mode of operation is slightly more energy efficient than the on-line mode due to the reduced rectifier/ inverter losses during normal operation; and it is sometimes referred to as the "ECO" mode. However this mode is recommended only if the connected load equipment can tolerate power interruptions of 3 to 5 ms during the transfer period.

WARNING: The on-line mode must always be used for critical load protection.

2.3.4 Multi-cabinet parallel system concept

Up to ten Kohler PW 6000 UPS cabinets can be connected in parallel for increased power capacity or redundancy operation. A parallel system comprising 3 UPS cabinets is shown in figure 2.5.

***Note:** If a Kohler PW 6000 is purchased as a stand-alone UPS it will require a field upgrade in order to be connected to a parallel system.*

A Kohler PW 6000 UPS parallel system has a decentralised bypass architecture in that each UPS module contains its own static bypass/static switch. This eliminates the need for a separate bypass cabinet (as required by some manufacturers' systems) and avoids a potential single point of failure.

In a multi-module parallel system the topology and internal operation of the UPS is identical to that described previously for a stand-alone unit except that the UPS control logic is subject to additional 'system level' control functions which are applied via a parallel control bus connected between each UPS.

The parallel control bus performs many functions including:

- System-wide load transfer control
- Inter-module (and bypass) frequency synchronisation
- Load sharing

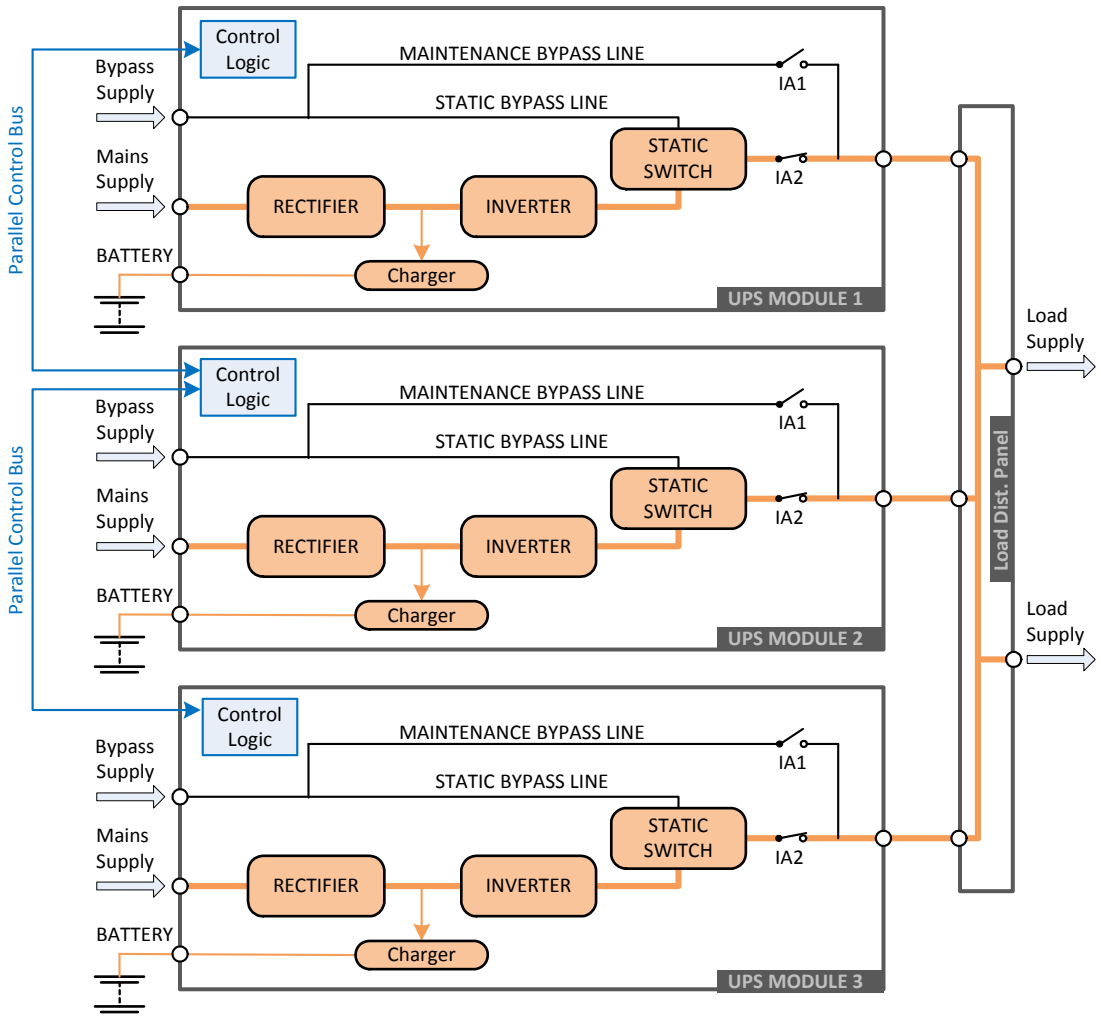


Figure 2.5 Kohler PW 6000 UPS Parallel system

System-wide load transfer operation

All the modules that are connected to the load in a parallel system must be in the same internal mode of operation at all times – i.e. it is not permissible for one module to be operating with Load on Inverter while the remaining modules are in the Load on Bypass mode – such a situation would damage the UPS module(s).

In a parallel system, if you activate the `LOAD TO BYPASS` command *on any one module* then all the modules will simultaneously switch to the Load on Bypass mode. Conversely, when operating on bypass if you select the command `LOAD TO INVERTER` *on any one module* all the UPS modules will simultaneously transfer the load to their inverters (provided a sufficient number of modules are operating to satisfy any system redundancy requirements).

Frequency synchronisation and load sharing

Using sensing signals passed over the parallel control bus, each UPS is able to compare its own frequency and output current with that of its neighbouring module. This allows the UPS control logic to carry out fine adjustments to each module to achieve balanced conditions

The control logic always observes one of the modules as being the 'master' and the others as 'slaves'. However if the 'master' module goes faulty at any time the next module in the chain (a former 'slave') will immediately take over the role of master, and the former master module will turn off. Master/slave configuration is achieved through selector switches located in each cabinet and is set-up during commissioning *(See paragraph 3.9.2)*.

Module redundancy

If a system is designed with module redundancy then it contains at least one UPS module more than the number required to provide the specified system full load power.

For example, if the system shown in figure 2.5 comprises 3x100kVA modules it could be employed as a redundant module system for a load of 200kVA. This means that under normal circumstances each module shares the load equally and supplies up to 66.6kVA at full load; but if one module fails, or is taken off-line, then the remaining two modules are capable of sustaining the full rated load. The ability to lose one module yet still provided the full load with processed, backed-up power significantly increases the overall system reliability.

It is possible to connect two or more Kohler PW 6000 UPS modules to a common battery and allow them to share the battery charging. However by employing a separate battery bank for each module, as illustrated in figure 2.5, it again avoids a potential single point of failure and effectively extends the system redundancy to include the batteries – which is highly recommended.

Isolating a module from the system

As explained immediately above, if a parallel system incorporates module redundancy it is possible to isolate a module from the system for service/repair purposes without affecting the remaining modules or load.

Every UPS module is provided with an output (parallel) isolator (IA2) which can isolate the module from the parallel load bus. Once IA2 is open there is no load power being drawn from the inverter and the module can be shut down in the normal way using the ON/OFF buttons on the UPS control panel. Using these buttons will shut down the associated module only and will not cause the remaining modules to shutdown or transfer the load to bypass.

WARNING: When the UPS module is shut down its output terminals will be live even if the module's input mains and bypass supplies are isolated.

2.4 Warranty

The Kohler PW 6000 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 engineer. 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 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 it's safety or effectiveness
- applications concerned with 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
- the liability of Kohler Uninterruptible Power is adequately protected under the circumstances

CAUTION: *The UPS may contain batteries that must be re-charged for a minimum of 24 hours every six months to prevent deep-discharging. Batteries that have been deep-discharged, for whatever reason, are not covered by the warranty.*

2.5 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 cover (excluding batteries and capacitors)

Contact the Service Support Hotline on +65 6302 0708 for further details.

2.6 Additional service/maintenance support

In addition to providing support for the Kohler PW 6000 UPS, Kohler Uninterruptible Power are able to provide maintenance and support on a wide range of different UPS products.

If you are interested in an extended warranty for your Kohler PW 6000 UPS, or any other UPS you may have, please complete the enquiry form shown opposite and return or FAX to:

Regional Office (South East Asia)
Kohler Uninterruptible Power
7 Jurong Pier Road
Singapore 619159
Tel: +65 6302 0708
Fax: +65 6302 0717
Email: serviceUPS.sg@kohler.com

Fax to: +65 6302 0717 **www.kohlerups.sg**

Regional Office (South East Asia)
Kohler Uninterruptible Power
7 Jurong Pier Road
Singapore 619159
Tel: +65 6302 0708

Name: .....

Job Title: .....

Company: .....

Address: .....

.....

.....

.....

Post Code .....

Tel. .....

Fax. .....

E-mail .....

Please contact me to discuss:

☐ Extended Warranty options for my Kohler PW 6000 UPS

☐ Extended warranty options for my UPS System as below:

Manufacturer:.....

Model Nº:.....

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 call free on +65 6302 0708,

or E-mail us on serviceUPS.sg@kohler.com

3 Installation

3.1 Introduction

This chapter contains essential information concerning the unpacking, positioning, installing and cabling of the Kohler PW 6000 UPS.

WARNING: All cabling operations must be supervised by an authorised electrician or other suitably qualified person. All installation and operating procedures must be carried out in strict accordance with the instructions contained in this manual. Kohler Uninterruptible Power will take no responsibility for any personal injury or material damage caused by the incorrect installation, cabling or operation of this product.

WARNING: Once the UPS equipment is installed it must be commissioned by an engineer approved by Kohler Uninterruptible Power before it is powered-up. Kohler Uninterruptible Power will take no responsibility for any personal injury or material damage caused by the application of electrical power to this equipment before it has been fully commissioned.

3.2 Taking receipt of the UPS

The UPS cabinet and accessories are delivered on purpose designed pallets that are easy to off load and move using a forklift or suitable pallet jack.

CAUTION: *Observe the following precautions when off-loading and moving the UPS:*

- *Always keep the packages in an upright position.*
- *Do not drop the equipment.*
- *Due to the high-energy batteries involved and heavy weight, do not stack the pallets.*

The packing container protects the UPS from mechanical and environmental damage during transit. This protection is further increased by wrapping the Kohler PW 6000 UPS with a plastic sheet.

Upon receiving the UPS you should carefully examine the packing container for any sign of physical damage. The external 'Tip&Tel' (“FRAGILE” and “ARROW”) indicator should be intact if the equipment has been correctly transported in an upright position. If the packaging has been ruptured in transit, or if the 'Tip&Tel' indicator is suspect, inform both the carrier and Kohler Uninterruptible Power immediately.

CAUTION: *Claims for visible shipping damage must be notified to the carrier immediately on receipt. Other shipping damage claims must be filed immediately when found and the carrier must be informed within a maximum of 7 days following receipt of the equipment.*
If shipping damage is discovered, store all packing materials for further investigation.

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

3.2.1 Site transportation

Please observe the following precautions when you transport the UPS equipment from the off loading site and its intended installation (or storage) location.

CAUTION: *Transportation:*

- *When transporting the equipment, use the front and rear shipping brackets to secure the cabinet to help prevent the UPS from toppling over.*
- *Do not at any time tilt the cabinet by more than 10° from vertical.*

CAUTION: *Potential dangers:*

- *If the UPS/battery cabinet is tilted by more than 10° it could cause internal damage. If tilting occurs do not connect the UPS to the mains electrical supply.*
- *The weight of the UPS/battery equipment can cause serious personal injury and/or structural damage to the surrounding area if dropped in transit. Always take extreme care when moving the equipment.*

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

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 pallet.
2. Cut the wrappers and remove the packing container by pulling it upwards.
3. Remove the plastic sheeting covering the UPS.
4. Remove any anchor bolts securing the cabinet to the pallet then remove the UPS from the pallet.
5. Retain the packaging materials for possible future shipment of the UPS.
6. Examine the UPS for signs of damage and notify your supplier immediately if any damage is found.
7. Check that the details on the UPS nameplate corresponds to the purchased material mentioned in the delivery note. The rating specifications can be found on a nameplate located inside the UPS door.

3.4 Storage

UPS Cabinet

If you plan to store the UPS cabinet prior to use it should be held it in a clean, dry environment with a temperature between -5°C to +40°C and RH <90%. The UPS should be stored in the original packing and shipping carton. If the packing container is removed you must take measures to protect the UPS from dust.

Battery

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

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

- *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.*

3.5 Planning the installation (site considerations)

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

1. The route to the installation location must allow the equipment to be transported in an upright position.
2. The floor at the proposed installation site 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. Locations with high ambient temperature, moisture or humidity must be avoided.
   a) The installation site humidity should be <90% non-condensing.
   b) The prescribed ambient temperature is +15°C to +25°C. An ambient temperature of 20°C is recommended to achieve a long battery life.
   c) Any requested cooling air flow must be available. The air entering the UPS must not exceed +40°C.
   d) The air conditioning system must be able to provide a sufficient amount of cooling air to keep the room within the prescribed temperature range.
4. The following environmental conditions should also be considered:
   a) Fire protection standards must be respected.
   b) The location must be free of dust and corrosive/explosive gases.
   c) The location must be vibration free.
   d) If the UPS is located in bayed enclosures, partition walls must be installed.
   e) The available space must permit the minimum cabinet clearances shown below.

3.5.1 Clearances

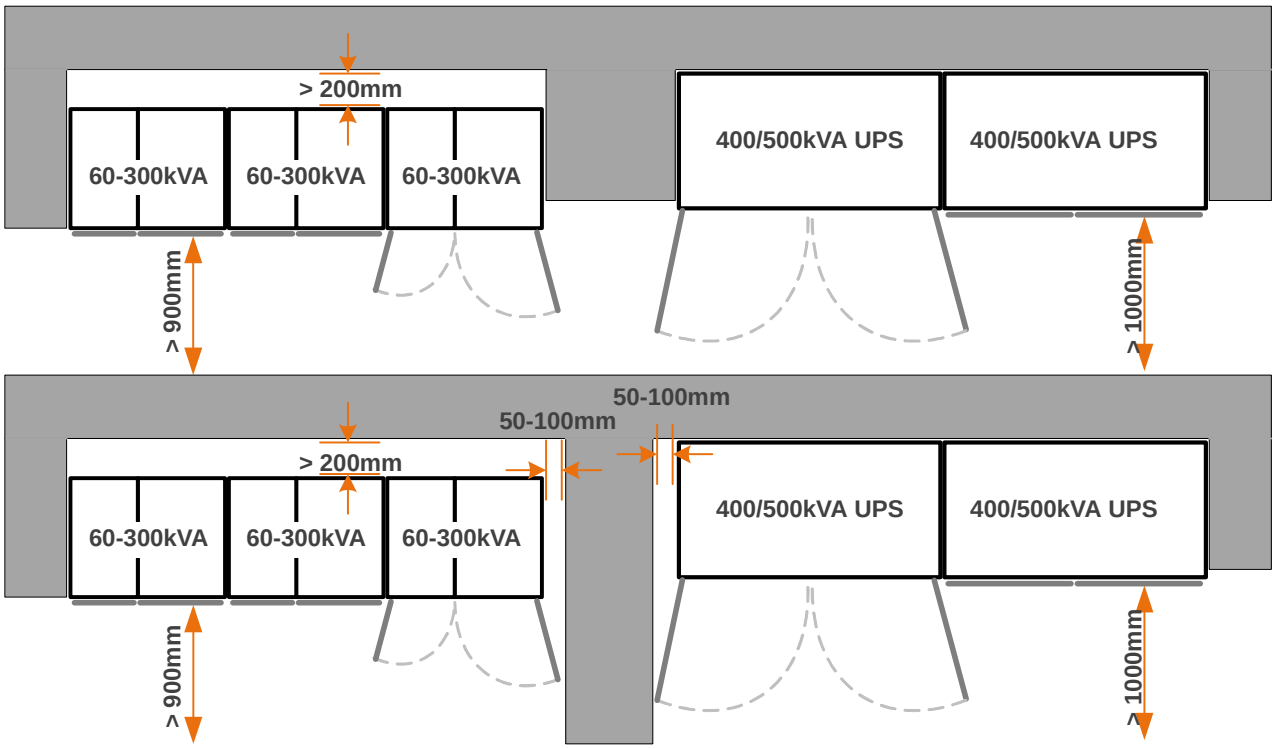


Figure 3.1 UPS Cabinet access space recommendations

All cables enter the UPS via the bottom of the cabinet therefore no service/installation access is required from the rear or sides of the cabinets.

A minimum of 900-1000mm clearance is required at the front of the cabinets for service access, and where possible this should be increased to allow safe passage in front of the UPS with the doors open.

In order to gain full access to some internal components it is necessary to open the doors by slightly more than 90º. If the cabinet is located adjacent to a partition or wall that extends beyond the front of the cabinet a clearance of 50-100mm should be provided between the cabinet and the partition to allow the doors to open adequately, as illustrated in the lower diagram above. Note that there is no space required between cabinets.

The 60-300 kVA cabinets are force-cooled by rear-mounted extraction fans which require a minimum of 200mm space at the rear of the cabinet to allow adequate exhaust air flow.

The 400-500 kVA cabinets are force-cooled by roof-mounted extraction fans and do not require any space at the rear of the cabinet but a minimum free space of 400mm is required above the cabinets to allow adequate exhaust air flow.

	60-100 kVA	120-200 kVA	250-300kVA	400-500kVA
Dimensions (WxHxD)mm	550x1820x750 970x1820x750 (Batt cab A) 1180x1820x750 (Batt cab B)	850x1820x750	1100x1920x750	1650 x 1994 x 850
Accessibility	Totally front accessibility for service and maintenance			
Positioning (for ventilation)	Min. 200 mm rear space			Min. 400mm space above cabinet
Input and Output Power Cabling	From the bottom at the front			

3.6 Planning the installation (cabling considerations)

3.6.1 General requirements

The information in this section should help with the preparation and planning of the UPS power cabling.

It is the customer's responsibility to provide all external fuses, isolators and cables that are used to connect the UPS input and output power supplies. The UPS input and bypass terminals should be connected to the utility mains supply through a suitable LV-Distribution board containing a circuit breaker or fused isolator to provide both overload protection and a means of isolating the UPS from the mains supply when required. Similarly, the UPS output supply terminals should be connected to the load equipment via a suitably fused load distribution board.

Input neutral grounding

A permanently connected input neutral is required to enable the rectifier to operate correctly and allow the UPS to function properly when operating on battery. The input neutral must also be grounded to permit correct operation when the UPS is running on battery.

Key Point: As the input neutral must be unswitched and connected to the UPS at all times, a 4-pole input switch or isolator must not be used at the LV Distribution board on a TN-S system.

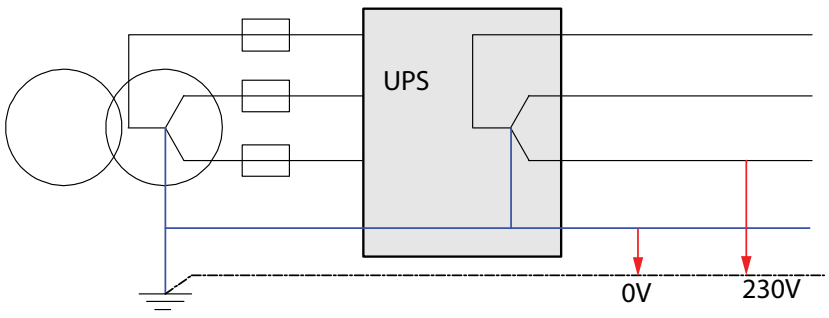


Figure 3.2 Input neutral grounding

3.6.2 Cable and fuse sizing

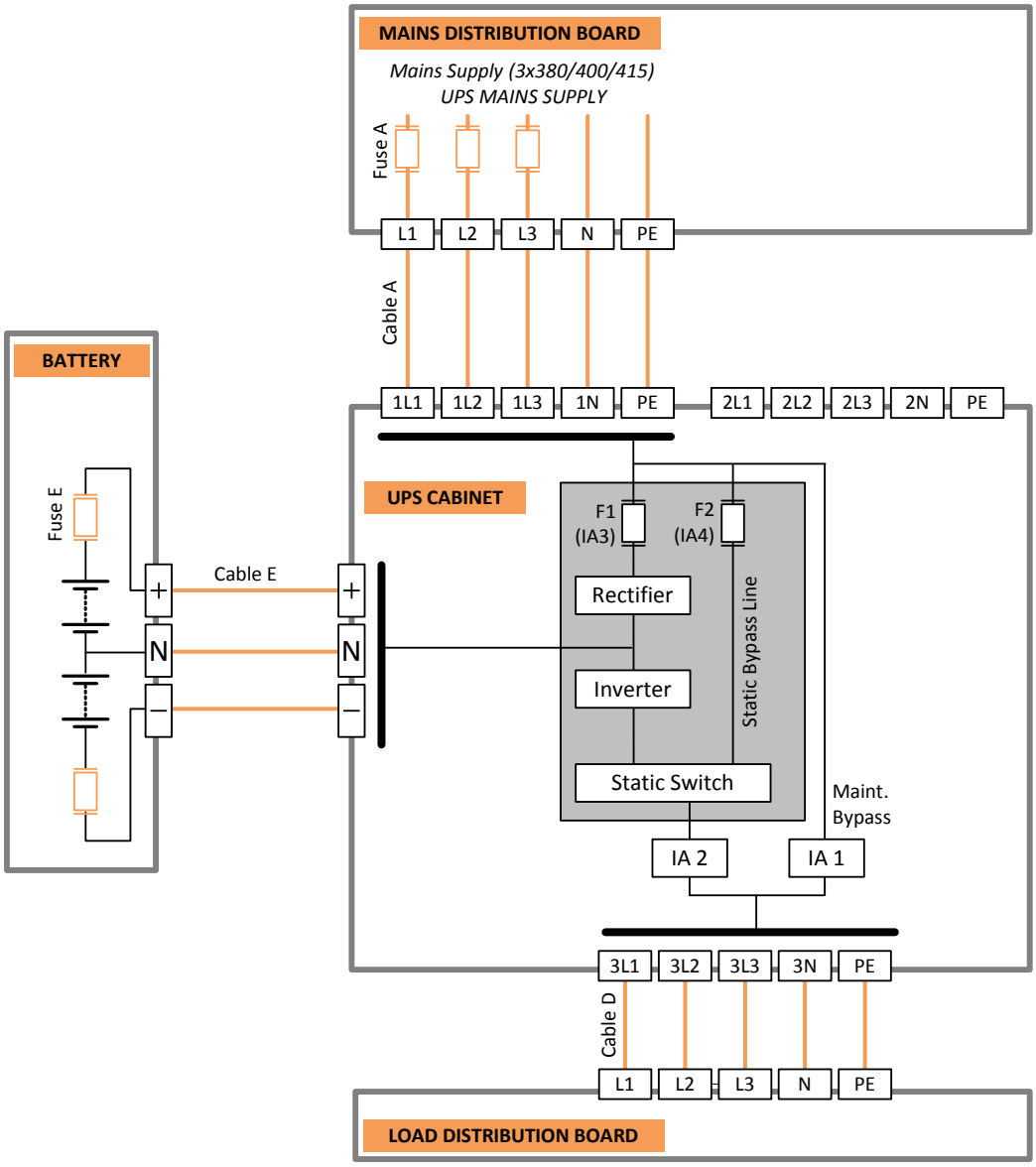
Single feed / Dual feed inputs

The UPS can be wired for a ‘single feed’ input (standard), whereby the UPS input supply terminals and bypass supply terminals are internally linked; or it can be wired for a ‘dual feed’ input, where the bypass links are removed and the UPS bypass terminals are connected to a dedicated ‘bypass’ supply.

Both configurations are shown in Figure 3.3 (single feed) and Figure 3.4 (dual feed) together with details of the recommended fuse and cable ratings.

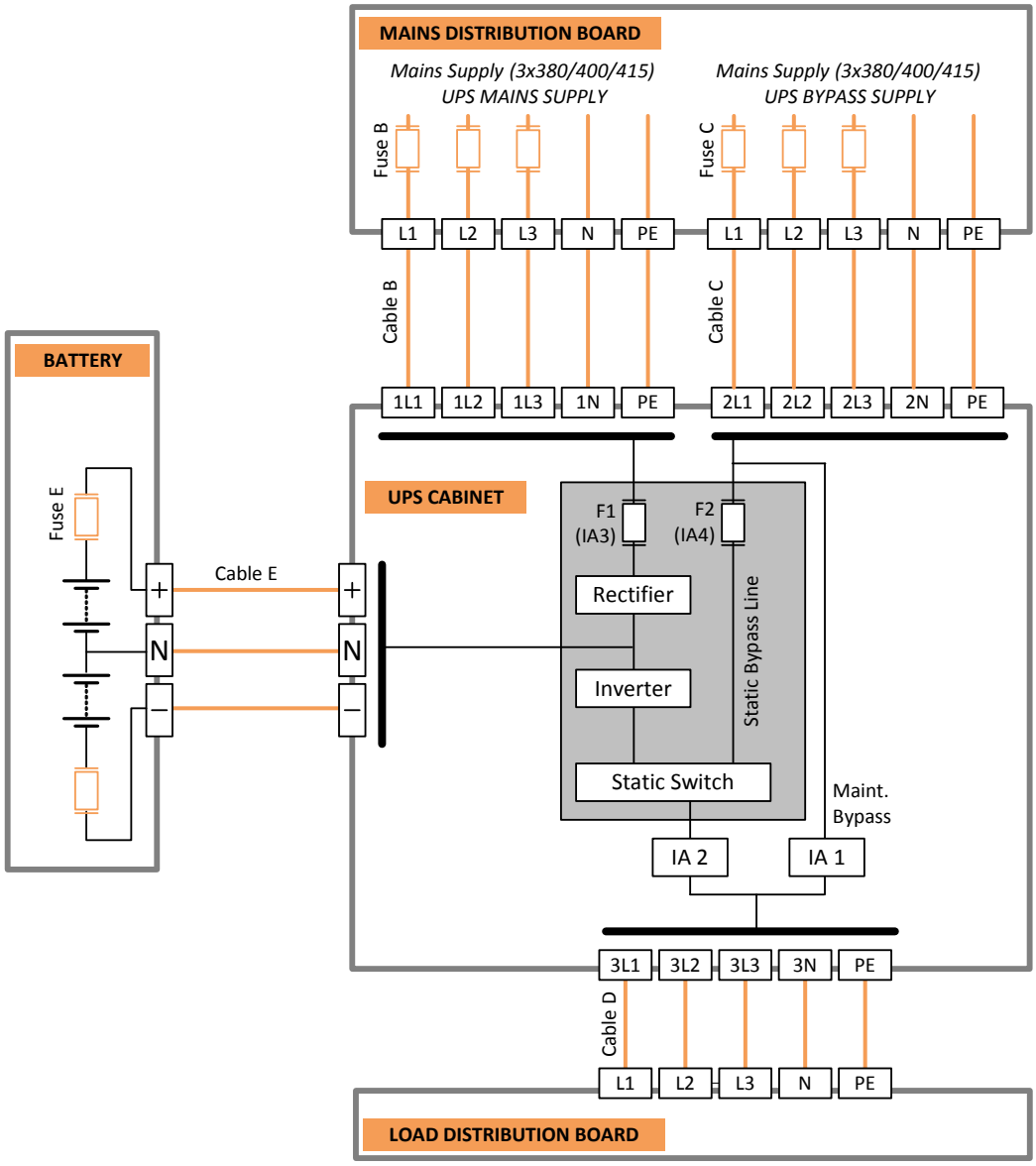
Key Point: This information in figures 3.3 and 3.4 is given for guidance only:

- **Fuse and Cable recommendations are to IEC 60950-1:2001.**
- All external fuses, isolators and power cables must be rated and installed in accordance with the prescribed IEC standards or local regulation – e.g. BS7671:2008.
- External DC Cables and battery fuses are bespoke to the installation.



Power (kVA)	Fuse A (Agl/CB)	Cable A	Cable D
60	3x100	5x35	5x35
80	3x125	5x50	5x50
100	3x160	5x50	5x50
120	3x200	5x70	5x70
160	3x250	5x120 or 5x(2x50)	5x120 or 5x(2x50)
200	3x315	5x185 or 5x(2x70)	5x185 or 5x(2x70)
250	3x400	5x240 or 5x(2x95)	5x240 or 5x(2x95)
300	3x500	5x(2X120)	5x(2X120)
400	3x630	5x (3x95) or 5x (2x185)	5x (3x95) or 5x (2x185)
500	3x800	5x (3x150)	5x (3x150)
Note: Cable E and Fuse E are bespoke to the installation			

Figure 3.3 Single feed input fuse and cable ratings



Power (kVA)	Fuse B (Agl/CB)	Cable B	Fuse C (Agl/CB)	Cable C	Cable D
60	3x100	5x35	3x100	5x35	5x35
80	3x125	5x50	3x125	5x50	5x50
100	3x160	5x50	3x160	5x50	5x50
120	3x200	5x70	3x200	5x70	5x70
160	3x250	5x120 or 5x(2x50)	3x250	5x120 or 5x(2x50)	5x120
200	3x315	5x185 or 5x(2x70)	3x315	5x185 or 5x(2x70)	5x185
250	3x400	5x240 or 5x(2x95)	3x400	5x240 or 5x(2x95)	5x240 or 5x(2x95)
300	3x500	5x(2x120)	3x500	5x(2x120)	5x(2x120)
400	3x630	5x(3x95) or 5x(2x185)	3x630	5x (3x95) or 5x(2x185)	5x(3x95) or 5x(2x185)
500	3x800	5x (3x150)	3x800	5x50	5x(3x150)
Note: Cable E and Fuse E are bespoke to the installation					

Figure 3.4 Dual feed input fuse and cable ratings

3.6.3 Power cable terminations

The table below gives details of the cable termination sizes applicable to the various models across the Kohler PW 6000 range. Figure 3.5 illustrates the terminal block/busbar layouts.

	Mains Supply (3+N+PE)	Bypass Supply (3+N)	Output Load (3+N+PE)	Battery (+ / N / – / PE)	Max admissible cable section (mm^2)	Tightening Torque (Nm)
60kVA	4 x 35 mm^2 + PE M8	4 x 35 mm^2	4 x 35 mm^2 + PE M8	4 x M8	35	3.5
80kVA	4 x 50 mm^2 + PE M8	4 x 50 mm^2	4 x 50 mm^2 + PE M8	4 x M8	50	5
100kVA	4 x 70 mm^2 + PE M8	4 x 70 mm^2	4 x 70 mm^2 + PE M8	4 x M8	95	8
120kVA	5 x M10	4 x M10	5 x M10	4 x M10	185	Max. 50
160kVA	5 x M10	4 x M10	5 x M10	4 x M10	185	Max. 50
200kVA	5 x M10	4 x M10	5 x M10	4 x M10	240	Max. 50
250kVA	5 x M10	4 x M10	5 x M10	4 x M10	240	Max. 50
300kVA	5 x M10	4 x M10	5 x M10	4 x M10	240	Max. 50
400kVA	3x (5 x M12)	3x (4 x M12)	3x (5 x M12)	3x (4 x M12)	240	Max 84
500kVA	3x (5 x M12)	3x (4 x M12)	3x (5 x M12)	3x (4 x M12)	240	Max 84

All the input and output power cables are routed through the bottom of the UPS cabinet below the power connectors/busbars.

See the following assembly diagrams for details:

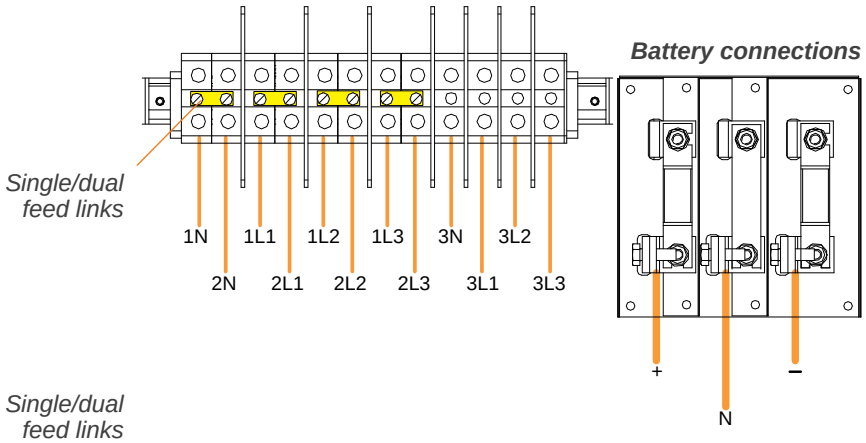
Figure 3.7 - 60kVA-100 kVA Module details

Figure 3.8 - 120kVA-200 kVA Module details

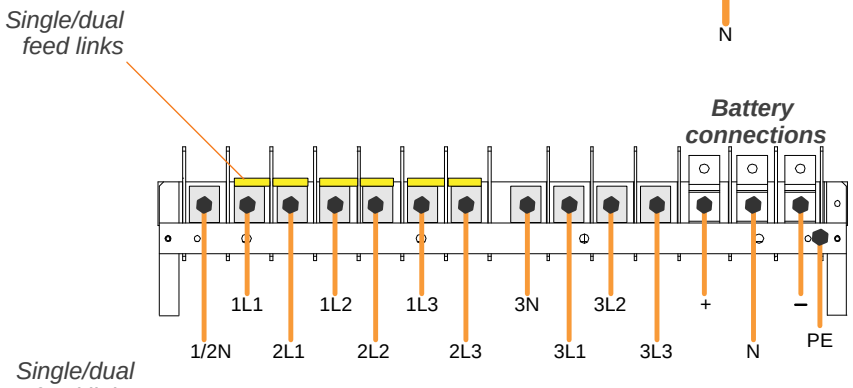
Figure 3.9 - 250kVA-300 kVA Module details

Figure 3.10 - 400kVA-500kVA Module details

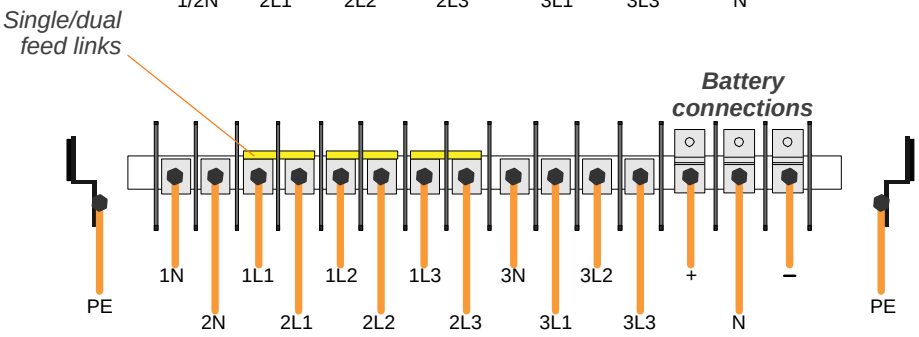
60kVA- 100kVA Power connections



120kVA- 200kVA Power connections



250kVA- 300kVA Power connections



400kVA - 500kVA Power connections

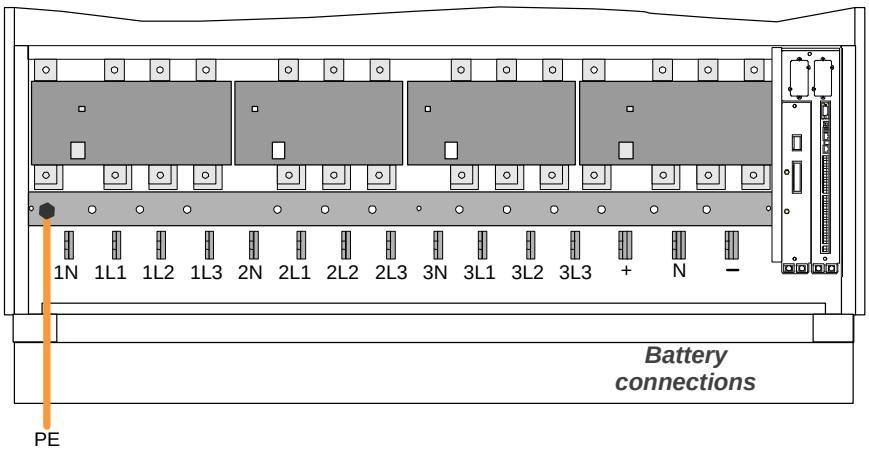


Figure 3.5 Input, output and battery power terminals

3.6.4 Power cabling in a parallel system

In order to achieve equal load sharing between the various UPS cabinets in a multi-cabinet installation, the input cables from the mains distribution board to each UPS cabinet should be of equal length. Similarly the UPS output cables to the load distribution board should be of equal length *(See Figure 3.6)*.

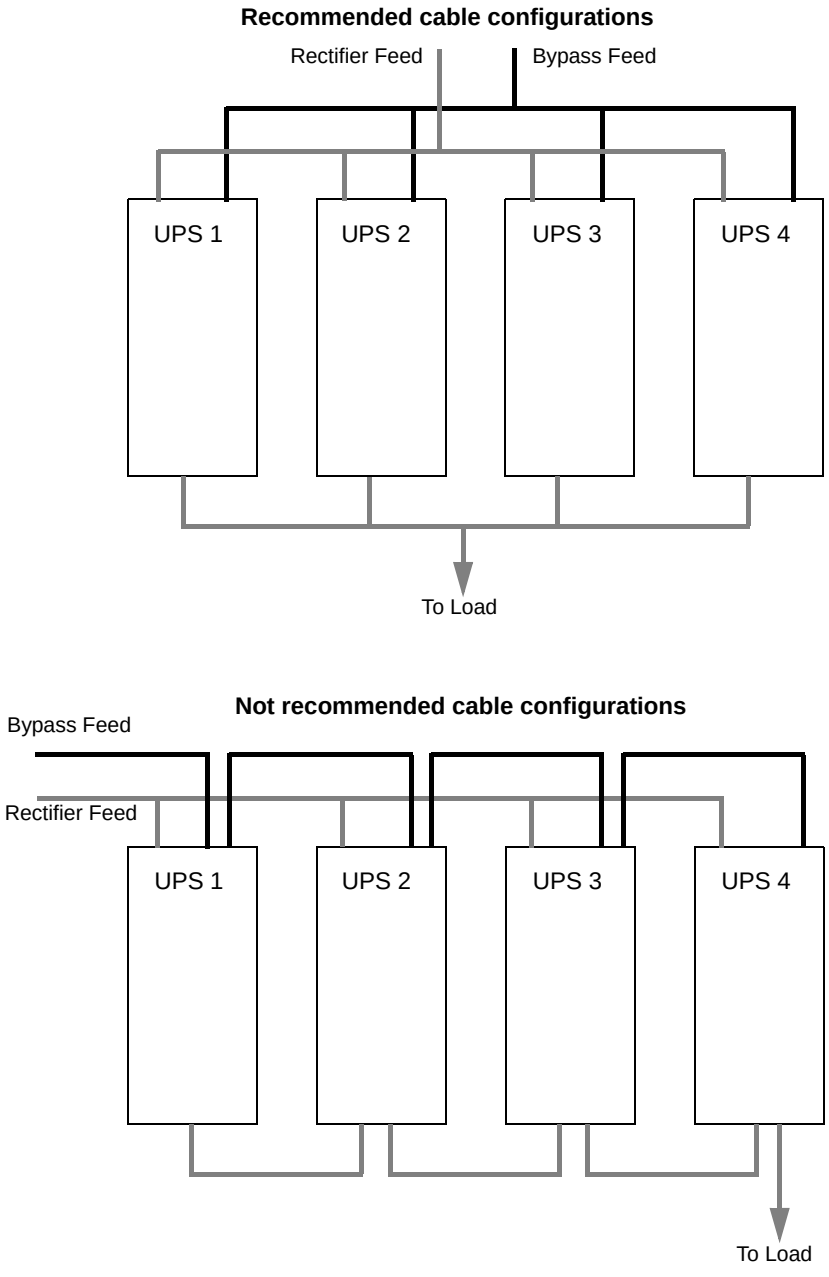


Figure 3.6 Cable lengths for multi cabinet configurations (dual feed input supply shown)

3.7 UPS Cabling procedure

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

Safety notes

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

1. Do not commence this procedure until the UPS mechanical installation is completed.
2. All the cable installation procedures detailed below must be supervised by a qualified electrician.
3. Do not connect or operate the UPS if there is water or moisture present.
4. When carrying out any work on the UPS power cables, or terminals, you must ensure that the UPS input and load supplies are isolated and locked out at their respective distribution boards. Warning notices should be posted to prevent any inadvertent operation of the UPS mains supply isolators.
5. Before you start connecting the UPS input cables ensure that the customer-provided fuses and cables are suitably rated in accordance with the prescribed IEC standards or local regulations (for example BS7671:2008) – also see figures 3.3 and 3.4.
6. Once the electrical installation is completed the UPS must be commissioned by an engineer authorised by the manufacturer before it is brought into use.

WARNING: Do not apply electrical power to the UPS before it has been commissioned.

7. When installing the UPS cables ensure that the connection procedures are performed under the following conditions:
   a) No mains voltage is present at the UPS mains/bypass distribution board terminals.
   b) All loads are shut down and disconnected at the load distribution board.
   c) The UPS is fully shut down and voltage-free.
   d) The UPS Maintenance Bypass Isolator IA1 is open (OFF).
   e) The UPS Parallel Isolator IA2 is open (OFF).

3.7.1 Connecting the input cables

1. Gain internal access to the UPS and remove the UPS terminal cover.
2. Connect the earth cable from the mains distribution board to the protective earth (PE) busbar located just below the UPS input terminals, as shown in Figures 3.7 to 3.10.

Single Input Feed

3. Refer to the schematic drawing and connection table in Figure 3.3.
4. Connect the UPS input supply cables to terminals 1L1, 1L2, 1L3 and 1N on the UPS terminal block. Ensure correct (clockwise) phase rotation.

CAUTION: *The input Neutral cable must be unswitched and ALWAYS connected.*

5. Secure the cables to the fixing rail under the connection terminals.

Dual Input Feed

6. Refer to the schematic drawing and connection table in Figure 3.4.
7. The UPS is supplied for single feed input (as standard). For a dual feed configuration remove the links between 1L1-2L1; 1L2-2L2; 1L3-2L3 and 1N-2N, on the UPS terminal block.
8. Connect the UPS input supply cables to terminals 1L1, 1L2, 1L3 and 1N on the UPS terminal block. Ensure correct (clockwise) phase rotation.

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

9. Connect the earth cable from the bypass mains distribution board to the protective earth (PE) busbar located just below the UPS bypass terminals, as shown in Figures 3.7 to 3.10.
10. Connect the UPS bypass mains supply cables to terminals 2L1, 2L2, 2L3 and 2N on the UPS main terminal block. Ensure correct (clockwise) phase rotation.

    Note: *For 120-200kVA modules connect the bypass neutral to the same neutral terminal (N) as that used for the input supply.*

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

11. Secure the cables to the fixing rail under the connection terminals.

Note: *The UPS commissioning engineer will re-configure the UPS electronics to operated with a dual feed input at the time of commissioning.*

3.7.2 Connecting the UPS output cables

It is recommended that a separate load distribution board is provided for the load.

Before you begin connecting the UPS output cables to the load distribution board:

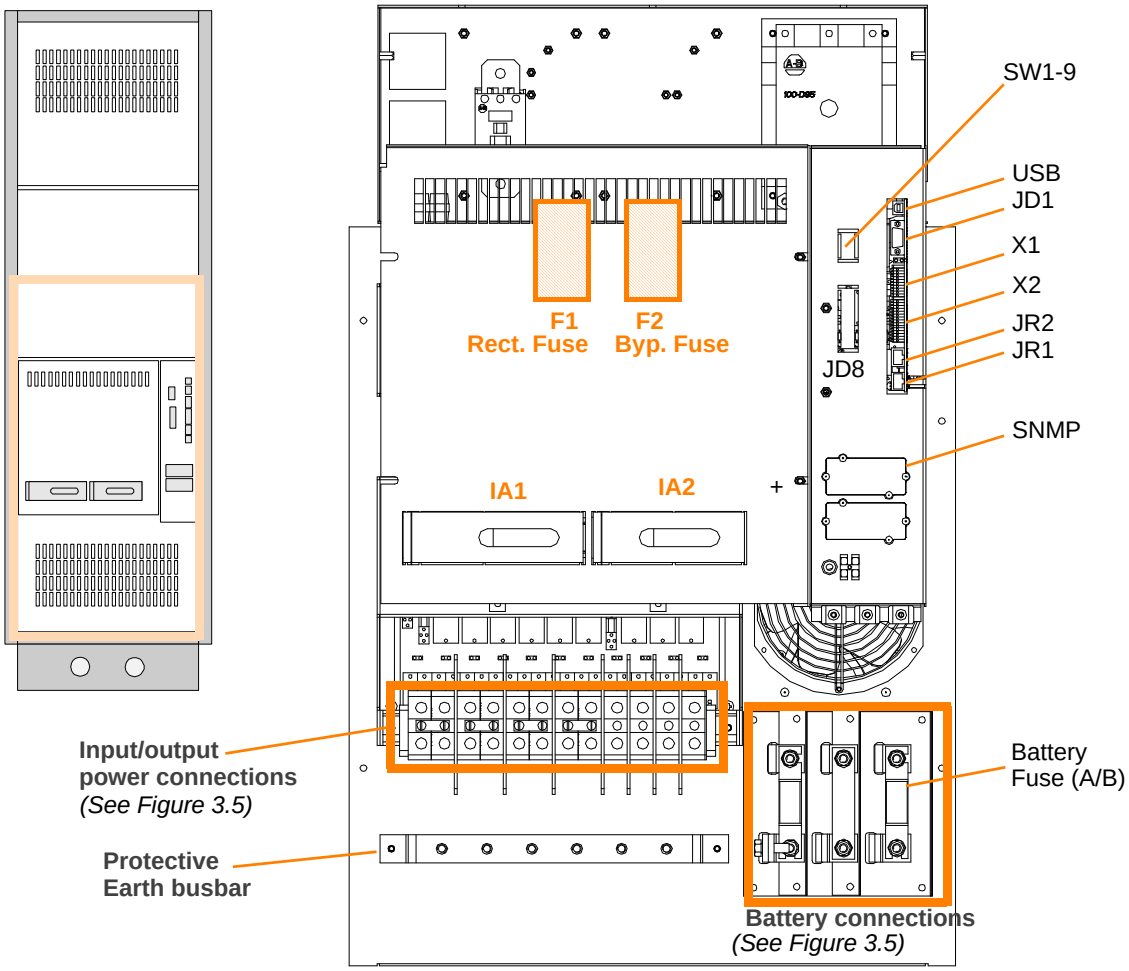
- Check that the potential full load does not exceed the UPS output power rating (`OUTPUT POWER` on the nameplate).
- ensure the load circuit breakers on the load distribution board are correctly sized with respect to the load rating and associated cabling.
- Ensure that the maximum total load rating, and maximum load rating of each individual load socket, is indicated on the load distribution board.

The circuit breakers must comply with the prescribed IEC Standards (e.g. BS7671:2008).

1. Gain internal access to the UPS and remove the UPS terminal cover (if fitted).
2. Connect the protective earth cable from the load distribution board to the protective earth (PE) busbar in the UPS.
3. Connect the UPS output supply cables to terminals 3L1, 3L2, 3L3 and 3N on the UPS main terminal block. Ensure correct (clockwise) phase rotation.

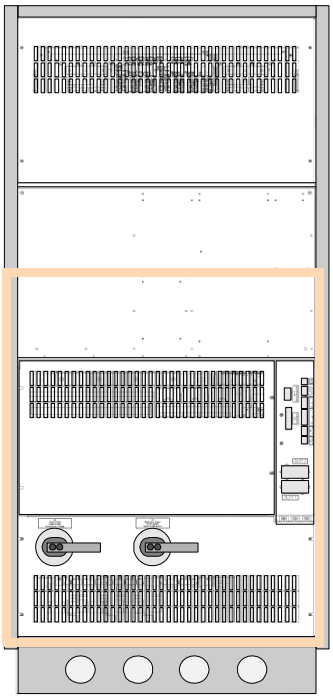
CAUTION: *The output Neutral cable must ALWAYS be connected.*

4. Secure the cables to the fixing rail located under the UPS connection terminals.
5. Ensure the output cables are connected to the correct power terminals on the load distribution board.



USB	PC Interface
JD1	RS232 Sub D9/female Interface (UPS system to computer)
X1	Customer Inputs
X2	Customer interface on Phoenix Terminals: X2= Potential free contacts
JR2	RS485 on RJ 45 port –Remote panel connection (see Section 3)
JR1	RS485 on RJ 45 port – Interface for Multidrop connection between several UPS cabinets
SW1-9	Multi-Cabinet Configuration Switch (see section 4)
JD8	Parallel BUS connector – ONLY For paralleling cabinets use optional adapter:
JD5	Parallel BUS - Input Connector
JD6	Parallel BUS - Output Connector
SNMP	Slot for optional SNMP card ONLY
IA1	Maintenance Bypass
IA2	Parallel Isolator
F2	Bypass Line Fuse
F1	Rectifier Fuse

Figure 3.7 60kVA-100 kVA Module details



USB	PC Interface
JD1	RS232 Sub D9/female Interface (UPS system to computer)
X1	Customer Inputs
X2	Customer interface on Phoenix Terminals: X2= Potential free contacts
JR2	RS485 on RJ 45 port –Remote panel connection
JR1	RS485 on RJ 45 port – Interface for Multidrop connection between several UPS cabinets
SW1-9	Multi-Cabinet Configuration Switch
JD8	Parallel BUS connector – ONLY For paralleling cabinets
SNMP	Slot for optional SNMP card ONLY

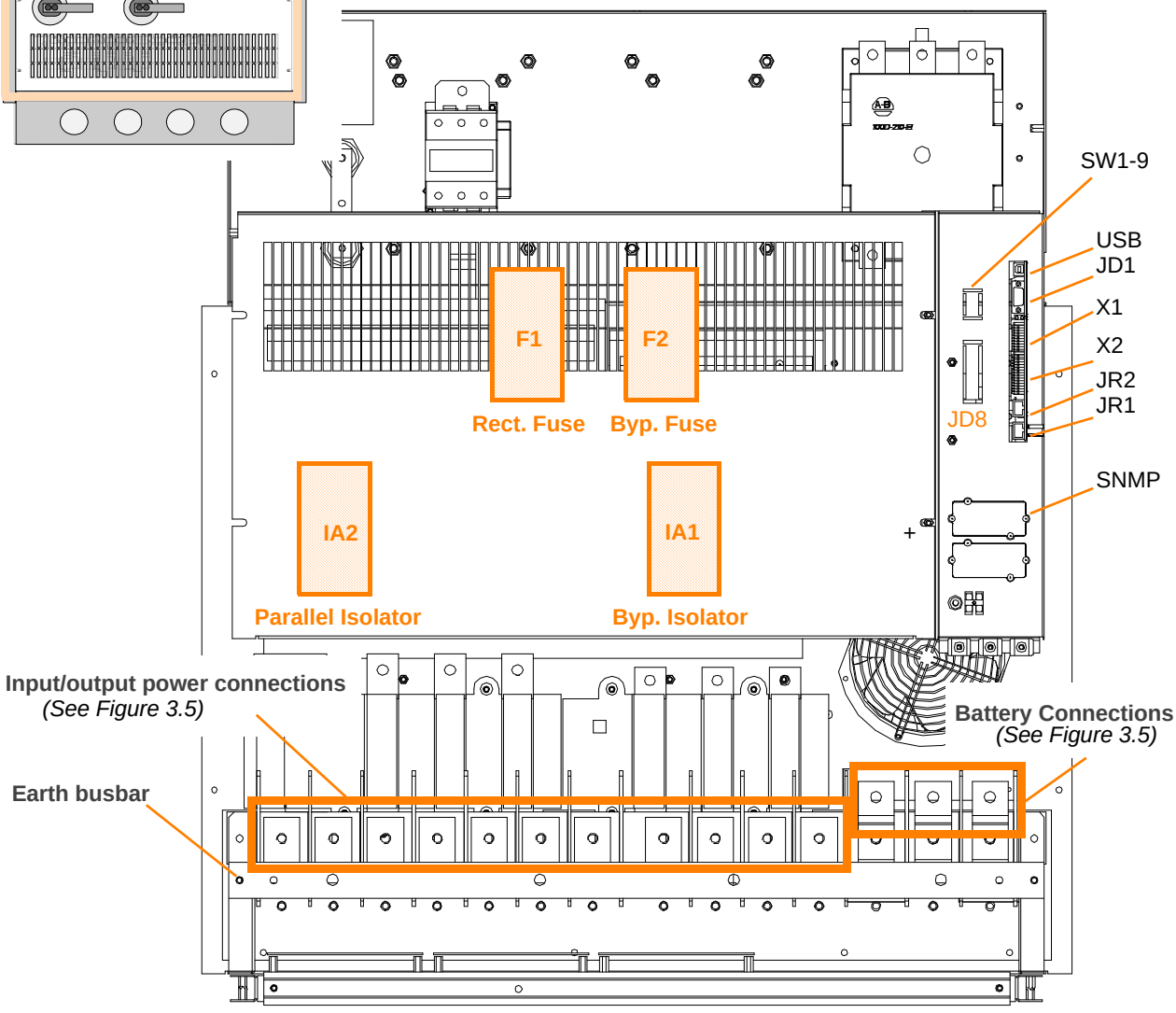
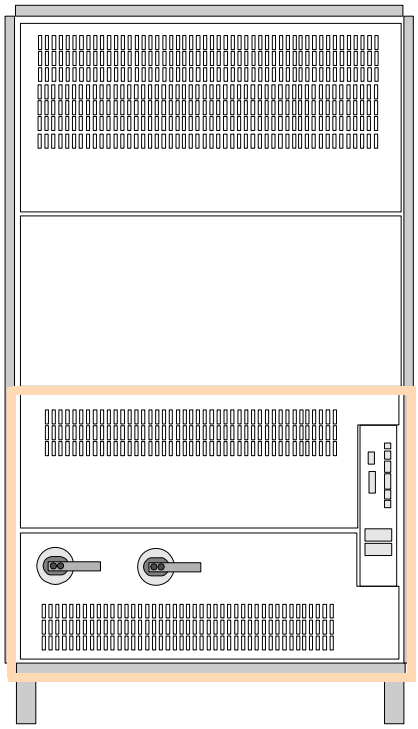


Figure 3.8 120kVA-200 kVA Module details



USB	PC Interface
JD1	RS232 Sub D9/female Interface (UPS system to computer)
X1	Customer Inputs
X2	Customer interface on Phoenix Terminals: X2= Potential free contacts
JR2	RS485 on RJ 45 port –Remote panel connection
JR1	RS485 on RJ 45 port – Interface for Multidrop connection between several UPS cabinets
SW1-9	Multi-Cabinet Configuration Switch
JD8	Parallel BUS connector – ONLY For paralleling cabinets
SNMP	Slot for optional SNMP card ONLY

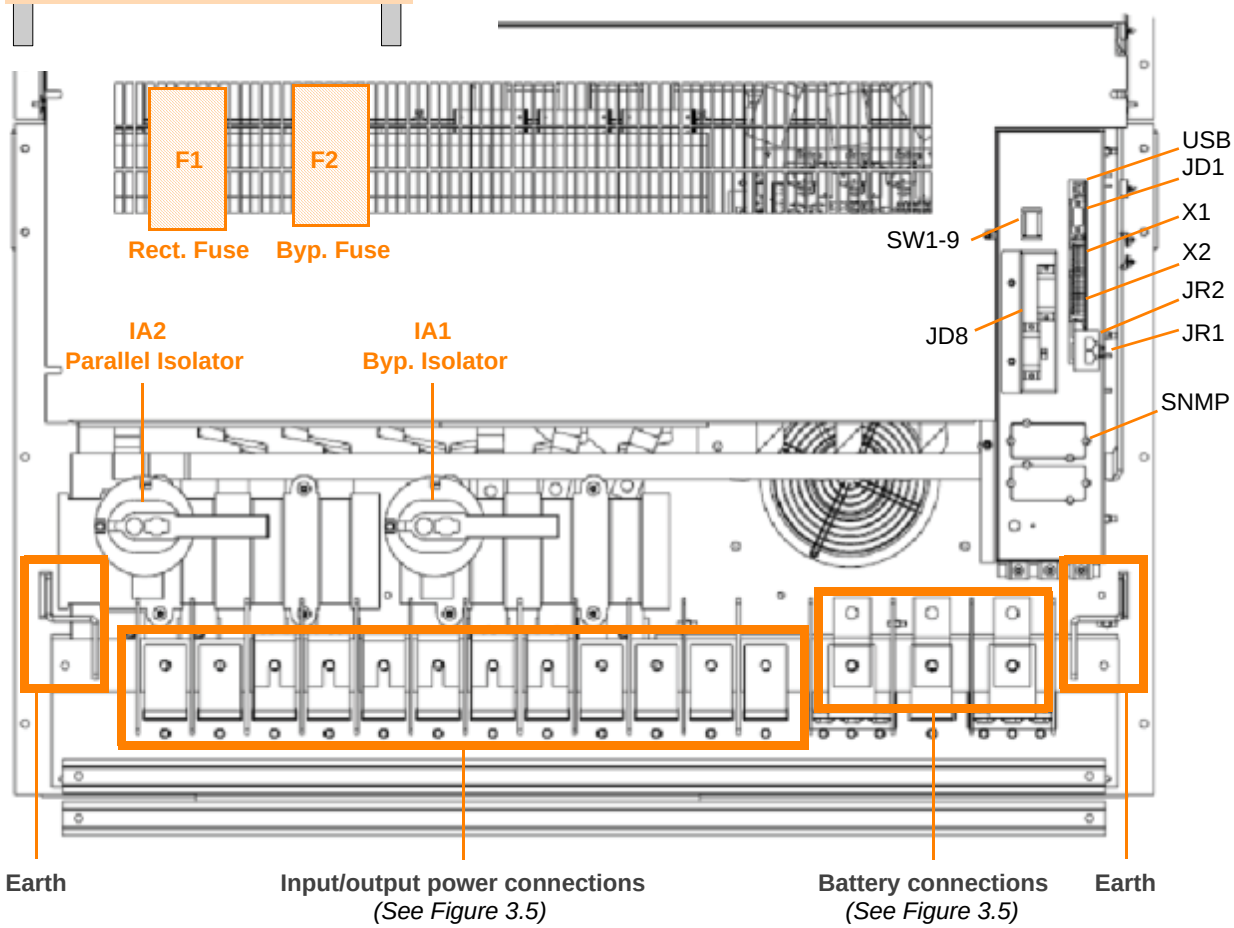
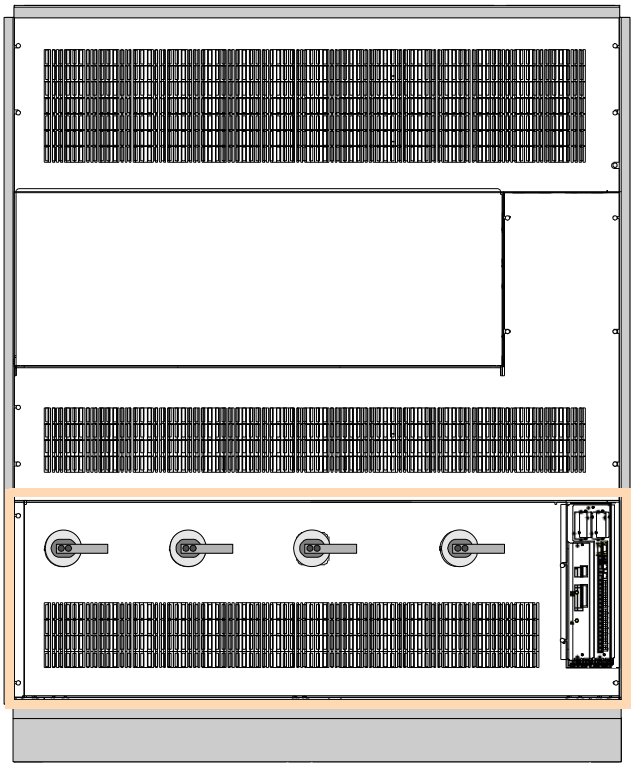


Figure 3.9 250kVA-300 kVA Module details



Power Reporter	Slot for optional Modem/Ethernet card ONLY
SNMP	Slot for optional SNMP card ONLY
USB	PC Interface
JD1	RS232 Sub D9/female Interface (UPS system to computer)
USB	PC Interface
JR3	RS485 on RJ 45 port –Remote panel connection
SW1-9	Multi-Cabinet Configuration Switch
JR2	RS485 on RJ 45 port – Interface for Multidrop connection between several UPS cabinets
JD8	Parallel BUS connector – ONLY For paralleling cabinets
X3	Customer Inputs
X2	Customer interface on Phoenix Terminals: X2= Potential free contacts
X1	Castell Interlock (option)

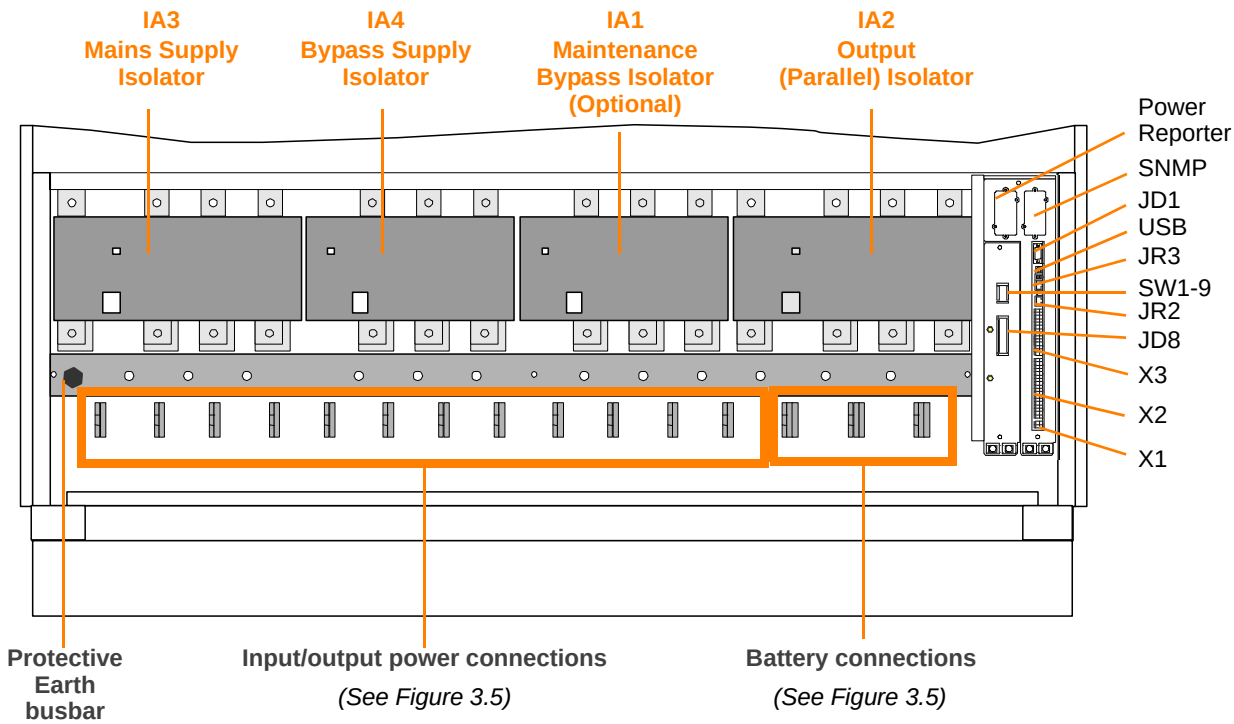


Figure 3.10 400kVA-500kVA Module details

3.8 Battery connections

3.8.1 'Sidecar' battery enclosure (60-100kVA)

Two 'sidecar' battery enclosures are available for attaching to the left-hand side of the UPS cabinet for modules rated up to (and including) 100kVA. Where used, these enclosures are permanently affixed to the UPS cabinet and form an integral part of the UPS. The optional enclosures are nominated as 'Enclosure A' and 'Enclosure B' *(See Figure 3.11)*.

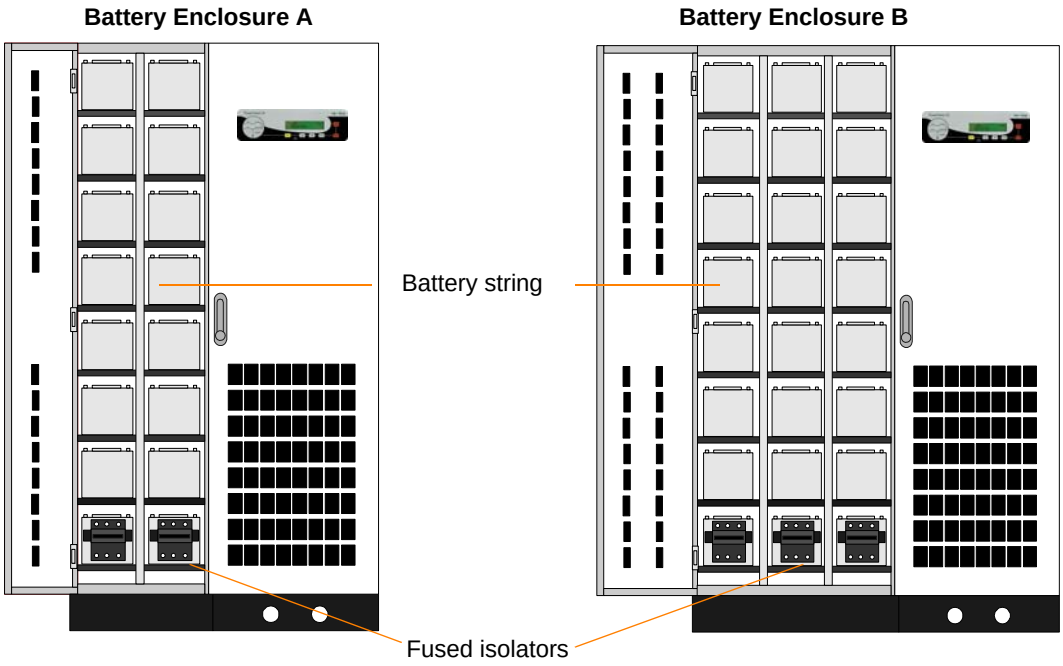


Figure 3.11 'Sidecar' battery enclosures (60kVA-100kVA UPS models only)

The sidecar enclosures are designed to be used with 24Ah or 38Ah battery blocks. The type A enclosure can house up to 80 blocks on 16 shelves whereas the type B enclosure can accept 120 blocks on 24 shelves – which equates to 5 blocks per shelf in each case.

Each column of shelves can be wired as an individual battery string with a fused isolator for each string fitted in front of the lower shelf. As the battery enclosure is shipped already attached to the UPS the internal wiring between the battery isolators and the UPS battery connection terminals is already made. The final assembly and connection of the battery blocks will be carried out by the commissioning engineer.

WARNING: Do not attempt to complete the battery wiring or close the battery isolators before the UPS system has been commissioned.

	BAT- ENC A	BAT- ENC B
Number of battery strings	1 - 2	1 - 3
Terminal size	3 x M8	3 x M8
Fuse type (very fast acting)	2 x 3 x 100A	3 x 3 x 100A
Combined dimensions of UPS and battery sidecar (WxHxD) mm	970x1820x750	1180x1820x750
Weight w/o trays and w/o batteries (kg)	20	30
Battery configuration with BAT-ENC A & B	Bespoke to installation	

***Note:** Only an even number of 12V-battery blocks can be used.*

3.8.2 Remote battery enclosure

In a redundant system it is recommended to provide each UPS module with a dedicated battery so that the system redundancy is expanded to also include the batteries. A range of bespoke battery enclosures can be supplied for the 60kVA-500kVA modules which are designed specifically to suit individual site requirements. In all cases, the battery enclosure will be fitted with suitably rated fused isolators which are connected on site to the battery connection terminals inside the UPS module.

WARNING: The final assembly and connection of the battery installation must be carried out by the commissioning engineer. Do not attempt to fit the batteries, complete the battery wiring or close the battery isolators before the system has been commissioned

3.8.3 Connecting the batteries

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

1. To protect personnel during the battery installation ensure that the connections are performed under the following conditions:
   a) No mains voltage is present at the UPS mains/bypass distribution board terminals.
   b) All loads are shut down and disconnected at the load distribution board.
   c) The UPS is fully shut down and voltage-free.
   d) The UPS and battery connection terminals are voltage-free.
   e) The UPS Maintenance Bypass Isolator IA1 is open (OFF).
   f) The UPS Parallel Isolator IA2 is open (OFF).
   g) Check that the battery fuses and cables are suitably rated.
   Note that Battery fuse and cable ratings are bespoke to the installation.
2. Ensure that the fused isolators and/or circuit breakers in the external battery cabinet (or racks) are open.
3. Connect the protective earth cable (PE) between the UPS and external battery cabinet.
4. Connect the battery power cables between the module battery terminals (+, N, -) and the corresponding terminals on the external battery cabinet.

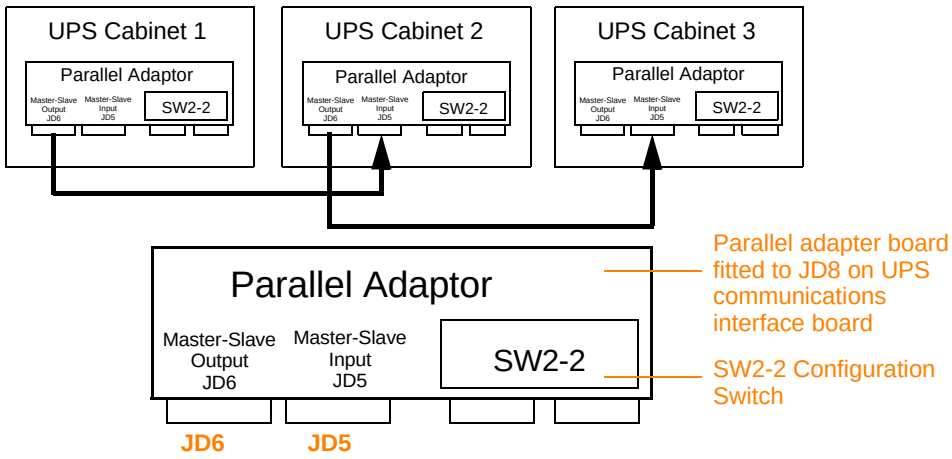
3.9 Multi-module control cabling and configuration

In order to facilitate various control functions such as load sharing, frequency synchronisation, and load transfer, all the UPS modules connected to a parallel system communicate with each other continuously by means of communication bus cables that are daisy-chained between each module, as shown below in figure 3.12. Once the cables are fitted, each module must be configured by means of a DIP switch according to its position in the parallel system.

3.9.1 Connecting the parallel communication bus 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 at the UPS mains/bypass distribution board terminals.
   b) All loads are shut down and disconnected at the load distribution board.
   c) The UPS is fully shut down and voltage-free.
   d) The UPS and battery connection terminals are voltage-free.
   e) The UPS Maintenance Bypass Isolator IA1 is open (OFF).
   f) The UPS Parallel Isolator IA2 is open (OFF).
2. Fit a parallel adaptor board over connector JD8 on the communications interface board in all UPS cabinets (JD8 is identified in Figure 3.13). The parallel adapter board contains a DIP switch (SW2-2) and two ribbon connectors, JD5 & JD6.

3. Set DIP switch SW2-2 on each parallel adaptor board according to the position of the UPS cabinet in the parallel configuration *(See Figure 3.12)*.
4. Connect a bus-cable between PORT JD6 of UPS cabinet 1 parallel adaptor and PORT JD5 of UPS cabinet 2 parallel adaptor.
5. Connect a bus-cable between PORT JD6 of UPS cabinet 2 parallel adaptor and PORT JD5 of UPS cabinet 3 parallel adaptor.
6. Continue with the above steps until a Bus-cable is connected to all modules, as shown below.



	Single Cabinet	First Cabinet	Middle Cabinet	Last Cabinet
SW 2-1	ON	OFF	OFF	ON
SW 2-2	ON	ON	OFF	OFF

Figure 3.12 Bus-lines connections (3 Modules shown)

3.9.2 Configuration DIP switch selection

DIP Switch SW1-9

DIP Switch SW1-9 on the UPS communications interface board *(See Figure 3.13)* must be set to indicate the position of the cabinet in the parallel chain. The three options are:

- First cabinet.
- Middle cabinet (there may be several 'middle' cabinets).
- Last cabinet.

In each cabinet, set Switch SW1-9 according to the table below:

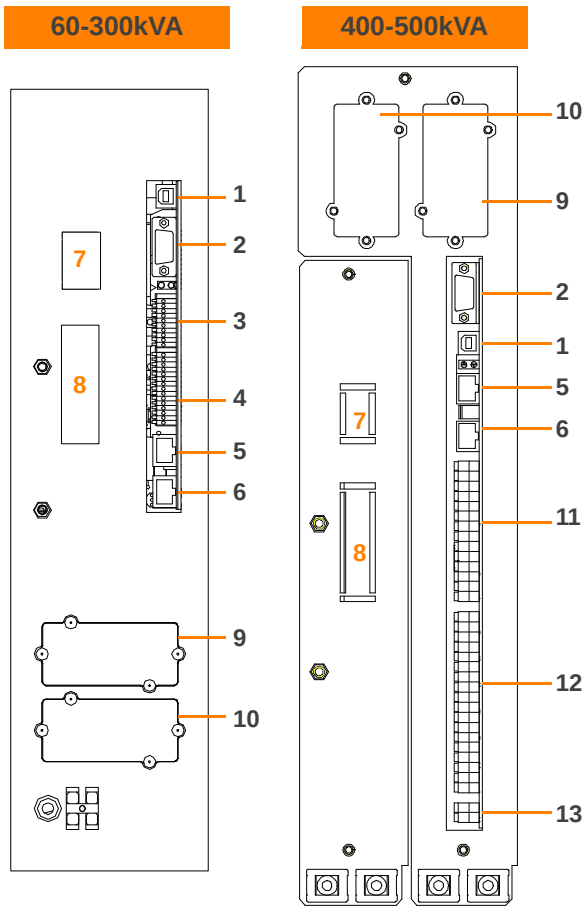
SW1-9	Single Cabinet	First Cabinet	Middle Cabinet	Last Cabinet
1	ON	ON	OFF	ON
2	ON	ON	OFF	ON
3	ON	ON	OFF	ON
4	ON	ON	OFF	ON
5	ON	ON	OFF	ON
6	ON	ON	OFF	ON
7	ON	ON	OFF	OFF
8	ON	OFF	OFF	ON
9	ON	ON	OFF	ON

3.9.3 Module communications interface facilities

Each UPS is fitted with a communications interface board which enables various external monitoring and control applications to be connected to the system to satisfy particular site requirements.

Details of the interface facilities and available options are provided in Chapter 7.

***Note:** All used options should be installed and connected prior to commissioning the UPS so that they be functionally checked as part of the commissioning procedure.*



KEY	IDENT	FUNCTION
1	USB	RS232 PC Interface on standard USB
2	JD1	RS232 PC Interface on Sub D9 Female
3	X1	Customer Inputs
4	X2	Volt-free switched alarm/status outputs
5	JR2	RS485 on RJ45 port. Remote panel interface
6	JR1	RS485 on RJ45 port. Multidrop interface
7	SW1-9	Multi-cabinet configuration DIP switch
8	JD8	For parallel bus adapter (JD5/JD6)
9	SNMP	Slot for optional SNMP card
10	Modem	Slot for optional modem/ethernet card only
11	X3	Customer inputs
12	X2	Volt-free switched alarm/status outputs
13	X1	Castell Interlock function

Figure 3.13 UPS Communications interface board connectors

4 Operation

4.1 Commissioning

The Kohler PW 6000 UPS is a high quality electronic machine that must be commissioned by a fully trained and authorised Uninterruptible Power Supplies Ltd. field service engineer before being put into use.

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

WARNING: Power must not be applied to the Kohler PW 6000 UPS system before it has been commissioned by an Kohler Uninterruptible Power approved service engineer. Kohler Uninterruptible Power will accept no responsibility for the UPS safe operation or the safety of any personnel if power is applied before commissioning. Additionally, the manufacturer's warranty is immediately invalidated if the UPS is put into use before it has been correctly commissioned.

4.2 UPS Control panel

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

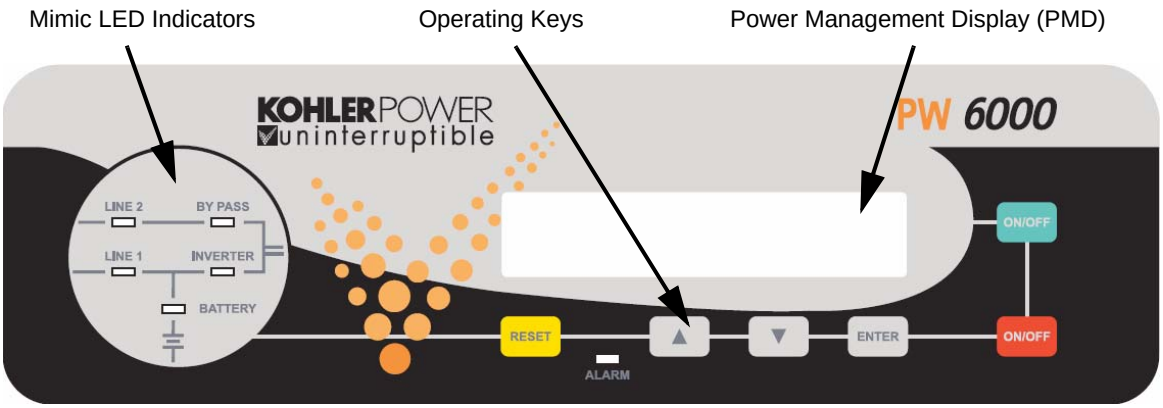


Figure 4.1 UPS Control panel

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 *(See paragraph 4.3)*.

The menu driven LCD enables access to:

- The ‘event register’
- Monitoring the input and output voltage, current, frequency & power
- Monitoring battery run time
- UPS control commands such as UPS start-up and shut-down, load transfer from INVERTER to BYPASS and vice-versa
- Diagnostics (service mode)
- Adjustments and testing (service mode)

4.2.2 Mimic LED indicators

The mimic diagram leds indicate the status of the general UPS power flow and change colour between Green and Red (and OFF) to indicate the current 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 that requires attention. 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. The requirement to press both buttons is to help avoid accidental UPS start-up or shutdown operation.

During normal operation, pressing the two ON/OFF buttons simultaneously will immediately shutdown the UPS.

- In a single module installation this will disconnect the UPS from the load and transfer the load to the UPS internal static bypass.
- In a parallel module system the UPS module will shutdown and will effectively be removed from the parallel load bus. However, the load may or may-not transfer to bypass depending on whether or not the number of remaining live modules satisfies the system's redundancy – i.e. if there are a sufficient number of modules remaining to support the system's load then the load will not be transferred.

To shut down all the modules in a parallel system you must press both ON/OFF buttons on every module.

4.3 Description of the LCD display

4.3.1 Status screens

	DESCRIPTION	LCD-DISPLAY
1.	Load is protected by UPS power supplied by inverter (normal operation).	LOAD P01 PROTECTED
2.	Load is not protected by UPS power –supplied by mains power (load on bypass)	LOAD P01 NOT PROTECTED
3.	Load supply interrupted. UPS has been switched off by "ON/OFF" buttons.	LOAD OFF P01 SUPPLY FAILURE
4.	The UPS/module is not supplying load. The output switch is open.	LOAD DISCONNECTED P01 PARALLEL SWITCH OPEN

On the right hand side of the LCD-Display there is a 3 digit indicator which shows a module's position in a multi-module system. The maximum number of modules that can be used in a parallel system is 10.

S	Stands for **S**ingle module. The system consists only of one UPS cabinet.
P01	Stands for **P**arallel system and 01 identifies the cabinet as the 1st module (**MASTER)** in the system.
P02	Stands for **P**arallel system and 02 identifies the cabinet as the 2nd module (**SLAVE**) in the system. This number can range from 02 to 10 depending on the cabinet's position in the parallel system.

Setting the module position in a single/multi-module chain

The position of a module in a multi-module configuration is set by DIP Switch SW1-9, which is located on the and set by the commissioning engineer. This switch should not be touched by the operator:

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 4.3.6)*.	→ 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) 000 000 000
8. Bypass Input Voltage (all three phases)	BYPASS VOLTAGE (V) 000 000 000

DESCRIPTION	LCD-DISPLAY
9. Output Voltage (all three phases)	OUTPUT VOLTAGE (V) 000 000 000
10. Output Current (all three phases)	OUTPUT CURRENT (A) 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-nnnnn
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 S, P01, P02…
- Single (standard) or Dual input feed
- Frequency-converter, 50/60Hz and 60/50Hz
- Synchronisation window (2-4%)

4.4 Operating instructions

WARNING: The procedures given below must be performed only by a trained operator.

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:

1. How to start up the UPS system and transfer the load from the Maintenance Bypass to the inverters (On Line' mode) *(See paragraph 4.4.1)*.
2. How to stop/start one module in a redundant multi-module system *(See paragraph 4.4.2)*.
3. How to transfer the load to the Maintenance Bypass and shut down the UPS system for maintenance purposes *(See paragraph 4.4.3)*.
4. How to shut down the entire UPS system *(See paragraph 4.4.4)*.

Key Point: The location of the UPS fused isolators and circuit breakers are shown for each UPS model in Figures 3.7 to 3.10.

4.4.1 Starting the UPS system from the maintenance bypass

With the load initially powered from the maintenance bypass, this procedure describes the sequence of operations necessary to power up the UPS module(s) and then transfer the load to the UPS Inverter(s).

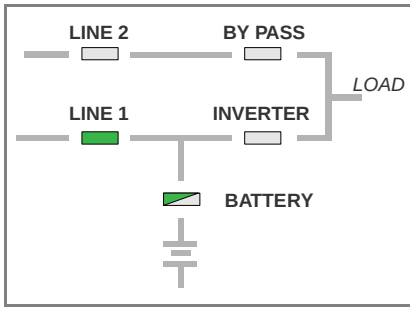
Prior to powering-up the system, check and confirm the UPS system status:

- The load is supplied via the maintenance bypass switch (IA1), which is closed in all modules in a multi-module system
- All UPS modules in a multi-module system are powered down

Powering up the UPS(s):

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

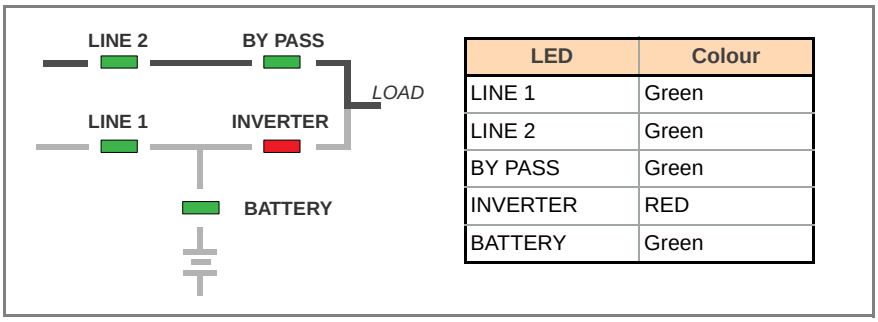
1. On the UPS module close the bypass line fuse holder F2 (IA3) and the rectifier line fuse holder F1 (IA4) if they are open.
2. Close the battery fuses or circuit breaker on the associated battery cabinet/rack.
   a) The UPS mimic panel `LINE 1` LED will be permanent green.
   b) The `BATTERY` LED will be flashing green.
   c) The LCD display will indicate `LOAD OFF, SUPPLY FAILURE`.



LED	Colour
LINE 1	Green
LINE 2	Off
BY PASS	Off
INVERTER	Off
BATTERY	Green Flashing

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.
   b) Initially LINE 2 LED will be red, then change to green.
   c) At this stage the LCD display will indicate LOAD NOT PROTECTED and the module mimic LED indications should be as shown below:

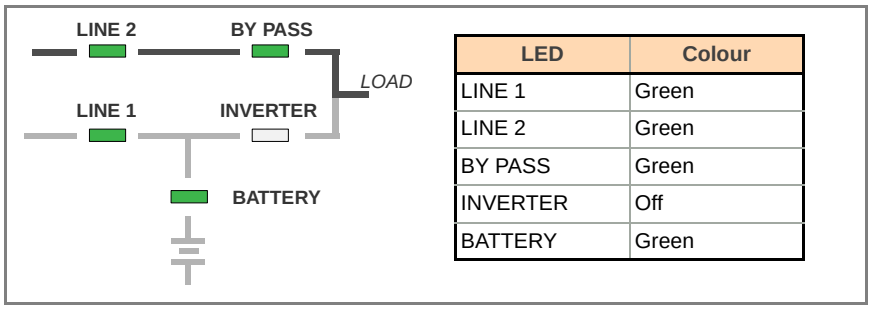


LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	Green
INVERTER	RED
BATTERY	Green

5. When powering up a multi-module system ensure that ALL the modules are in the state shown above before continuing with this procedure.
6. At this stage the load is being powered through both the maintenance bypass switch and the UPS static bypass circuit which are effectively connected in parallel.

Transferring the load away from the maintenance bypass:

7. Ensure that the BYPASS LED is green (on all modules).
8. Open the maintenance bypass switch (IA1) (on all modules).
   a) The LCD panels will display MANUAL BYPASS OPEN.
   b) The INVERTER LED will extinguish.
   c) An audible alarm will sound.



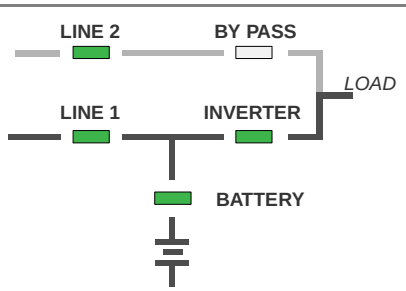
LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	Green
INVERTER	Off
BATTERY	Green

9. Press the RESET button to cancel the audible alarm (on all modules).
   a) The LCD display(s) will now indicate LOAD NOT PROTECTED.
10. At this stage the load is being powered only through the UPS static bypass circuit.

Transferring the load to the inverter:

11. On the control panel (of any one module in a multi-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.

12. The UPS system will transfer the load to inverter (on all modules in a multi-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:



LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	Off
INVERTER	Green
BATTERY	Green

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

4.4.2 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 the protected load supply.

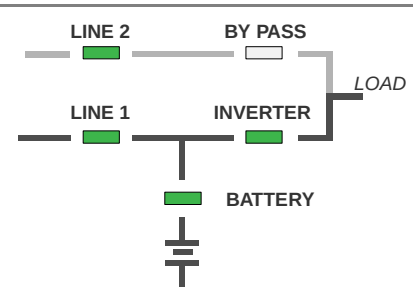
Module start-up:

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

This procedure assumes the following initial conditions:

- The UPS input supply isolator is open on the building's LV distribution panel
- The fused battery isolators are open in the battery cabinet
- In the UPS cabinet, the fused isolators F1 (IA3), F2 (IA4) and the parallel isolator (IA2) are open

1. In the UPS cabinet, close the input supply and bypass supply fused isolators F1 (IA3), F2 (IA4) and the Parallel Isolator IA2.
2. Close the UPS input supply isolator at the LV distribution panel.
    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 battery cabinet/rack associated with 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.



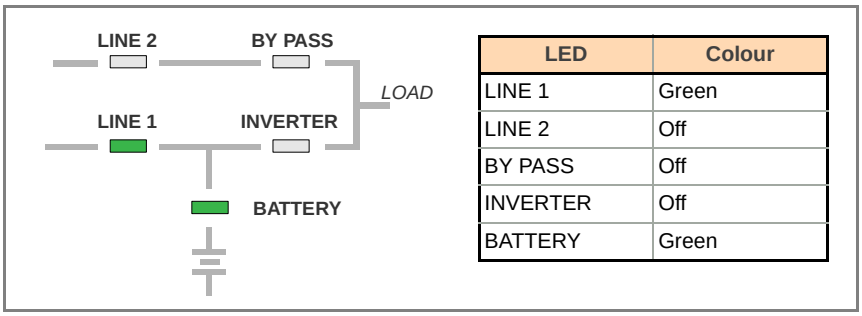
LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	Off
INVERTER	Off
BATTERY	Green

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:



LED	Colour
LINE 1	Green
LINE 2	Off
BY PASS	Off
INVERTER	Off
BATTERY	Green

2. Open the parallel isolator switch IA2.
3. In the UPS cabinet, open the input supply and bypass supply fused isolators F1 (IA3), F2 (IA4).
4. Identify the battery cabinet/rack associated with the UPS module and open the fused battery isolators.
5. Open the UPS input supply isolator and UPS output isolator on the LV distribution panels.
6. The UPS module is now totally shut-down and volt-free.

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

4.4.3 Transfer to maintenance bypass mode

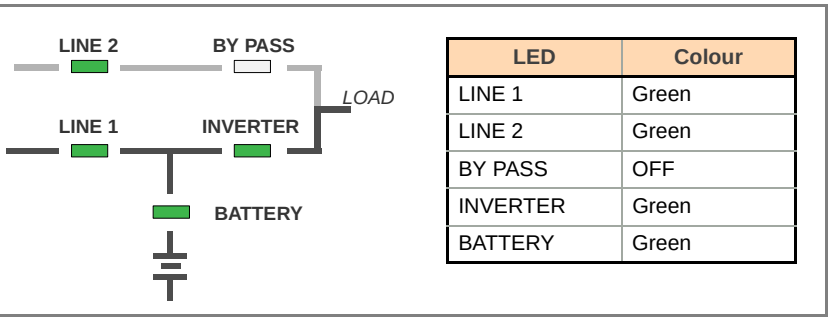
If needed, to perform service or maintenance, it is possible to transfer the load to the maintenance bypass supply and power down the UPS module(s) whilst leaving the load connected to the raw bypass mains supply.

WARNING: Before you close the maintenance bypass isolator the UPS must be operating in its internal (static) bypass mode.

This procedure describes the sequence of operations necessary to transfer the load from the UPS inverter(s) to the maintenance bypass supply and then shut down, and isolate, the UPS module(s).

Prior to commencing this procedure, check and confirm the UPS system status (on all cabinets in a multi-module system):

- Normally, the load should initially be powered from the UPS inverter and the mimic panel LED indications should be as shown below (on all UPS modules in a multi-module system):

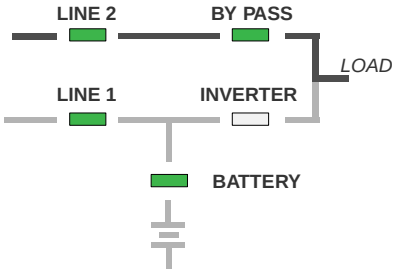


LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	OFF
INVERTER	Green
BATTERY	Green

- 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:

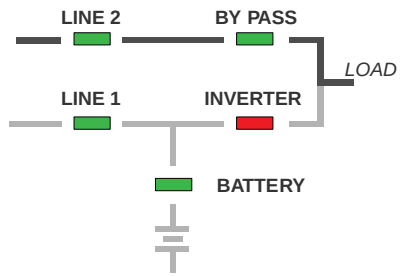
1. On the UPS module's mimic panel (on any module in a multi-module system) press the ENTER key once to access the menu system.
2. Using the UP/DOWN keys, move the cursor so that it is adjacent to COMMANDS and then press the ENTER key.
3. Using the UP/DOWN keys, move the cursor so that it is adjacent to LOAD TO BYPASS and then press the ENTER key.
   a) The UPS system will transfer the load to static bypass (on all UPS modules in a multi-module system).
4. *On all modules* check and confirm that:
   a) The INVERTER LED has extinguished.
   b) The BYPASS LED is green.
   c) The LCD displays LOAD NOT PROTECTED.



LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	Green
INVERTER	Off
BATTERY	Green

Closing the maintenance bypass switch:

5. Close the maintenance bypass switch IA1 (in all modules in a multi-module system).
6. 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.



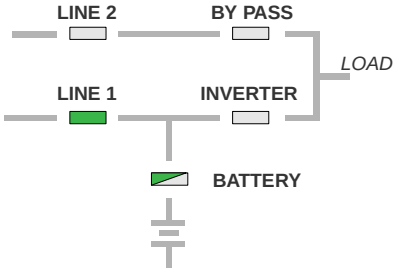
LED	Colour
LINE 1	Green
LINE 2	Green
BY PASS	Green
INVERTER	RED
BATTERY	Green

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.*

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 battery cabinet/rack associated with the UPS module then open the battery fuses or circuit breaker on the battery cabinet/rack.
9. On the UPS module open the module's parallel isolator (IA2).



LED	Colour
LINE 1	Green
LINE 2	Off
BY PASS	Off
INVERTER	Off
BATTERY	Green Flashing

10. Open the bypass line fuse holder F2 (IA4) and the Rectifier Line fuse holder F1 (IA3).

CAUTION: *The load is now powered directly from the bypass mains supply and is not protected against power failure.*

WARNING: The UPS module is still live at its input and output power terminals due to the activation of Maintenance Bypass circuit. Allow 10 minutes for the internal DC capacitors to discharge before touching any UPS internal components.

4.4.4 Complete system shutdown

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

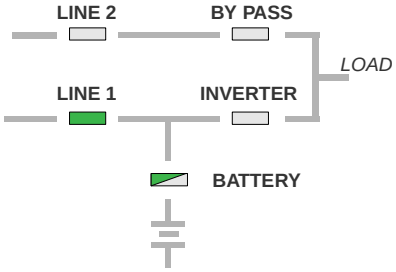
CAUTION: *This procedure will totally disconnect load power. Ensure that it is safe to lose power to all the loads connected to the UPS system before you begin this procedure.*

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 panel.

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 turn 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 battery cabinet/rack associated with the UPS module then open the battery fuses or circuit breaker on the battery cabinet/rack.

5. Open the module's parallel isolator switch (IA2).



LED	Colour
LINE 1	Green
LINE 2	Off
BY PASS	Off
INVERTER	Off
BATTERY	Green Flashing

6. Open the bypass line fuse holder F2 (IA4) and the rectifier line fuse holder F1 (IA3).
7. Open the UPS input and bypass supply isolators (or circuit breakers) on the UPS input supply 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.

5 Maintenance

5.1 Introduction

WARNING: The procedures described in this chapter must be performed by an authorised electrician who has received the appropriate level of training on this UPS system.

As there are no user-serviceable parts contained within the UPS the maintenance requirements are minimal. However, to maximise the useful working life and reliability of the UPS and its batteries we recommend that the UPS system and batteries are routinely inspected and checked for calibration on a 6 monthly basis as part of a preventative maintenance schedule.

5.2 User responsibilities

In order to obtain the best performance and reliability from the UPS system the operator must ensure on a daily basis that the environment in which the UPS operates should be kept cool and dust free at all times.

Any active alarm or status indication that indicates that the UPS is not functioning correctly should be dealt with immediately when found by referring to the troubleshooting chapter of this manual or contacting the manufacture's service desk.

5.3 Routine maintenance

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. To ensure optimum UPS operation and continuous, efficient protection of the connected load, we recommend that the system's operating parameters are checked every six months and recalibrated where necessary.

WARNING: When working inside the UPS cabinet there is a risk of exposure to potentially lethal AC and DC voltages.

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

- 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 Chapter 2.

5.4 Battery testing

The battery test is performed from the UPS control panel and takes approximately 3 minutes to complete.

The test can be carried out independent of the operating mode (Off-line or On-line) and whether or not the load is connected, but it should be undertaken only if there are no alarm conditions and the battery is fully charged.

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 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,

Chapter 4 contains a detailed description of the Menu, Commands, Event Log and Measurements that available on the operator control panel LCD.

6.2.1 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

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.

6.2.2 Fault identification and rectification messages and alarms

The major alarm conditions that will be encountered are:

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

6.3 Contacting service

Kohler Uninterruptible Power has a service department dedicated to providing routine maintenance and emergency service cover for your UPS.

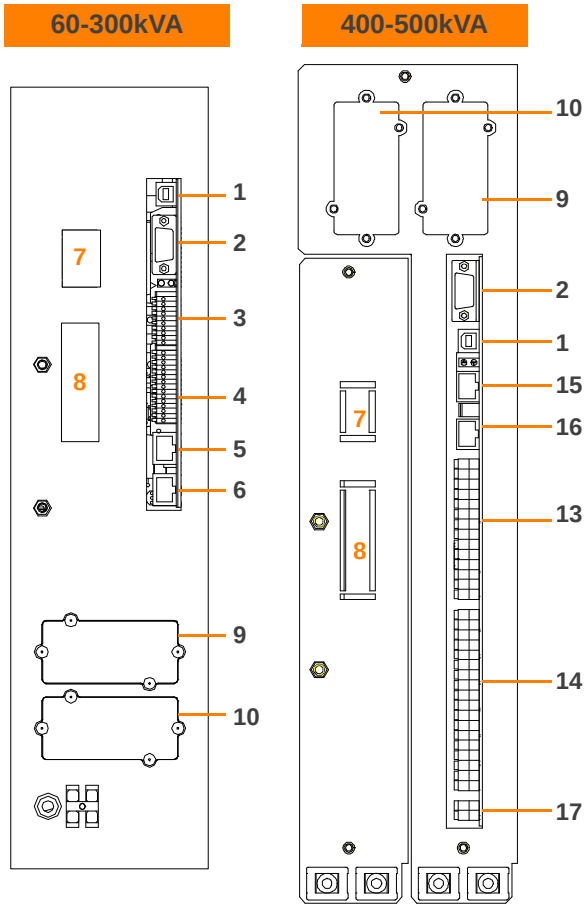
If you have any queries regarding your UPS please contact us.

Regional Office (South East Asia)
Kohler Uninterruptible Power
7 Jurong Pier Road
Singapore 619159

Tel: +65 6302 0708
Fax: +65 6302 0717
Email: 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



KEY	IDENT	FUNCTION
1	USB	RS232 PC Interface on standard USB
2	JD1	RS232 PC Interface on Sub D9 Female
3 13	X1 X3	Customer Inputs
4 14	X2 X2	Volt-free switched alarm/status outputs
5 15	JR2 JR3	RS485 on RJ45 port. Remote panel interface
6 16	JR1 JR2	RS485 on RJ45 port. Multidrop interface
7	SW1-9	Multi-cabinet configuration DIP switch
8	JD8	For parallel bus adapter (JD5/JD6)
9	SNMP	Slot for optional SNMP card
10	Modem	Slot for optional modem/ethernet card only
17	X1	Castell Interlock function

Figure 7.1 UPS interfacing connectors

7.1 Introduction

Each UPS is fitted with a communication interface board, as shown in Figure 7.1, which enables various external monitoring and control applications to be connected to the UPS system to satisfy particular site requirements. These interfaces are described below.

- RS232 Computer serial interface – USB & JD1 *(see paragraph 7.2)*
- RS485 Interface for multidrop – JR1 (JR2 for 400-500kVA) *(see paragraph 7.3)*
- Dry port customer interface – X1, X2 (X1, X2, X3 for 400-500kVA) *(see paragraph 7.4)*
- SNMP/ Modem slots for remote monitoring/control – *(see paragraph 7.5)*

7.2 Serial RS232 Computer interface – USB & JD1 (Smart Port)

A serial RS 232 interface is available through a standard 9-pin D-Type female socket (JD1) or USB port to provide an intelligent RS 232 serial port which allows the UPS to be connected to a computer.

When used in conjunction with the optional WAVEMON software, this port allows the connected computer to continuously monitor the input mains voltage and UPS status, and display a message in the event of any UPS system changes.

Figure 7.2 shows the cable wiring suitable for PC's with a 9 pin or 25 pin serial port respectively. Note that the maximum length for the interconnecting RS232 cable is 15m.

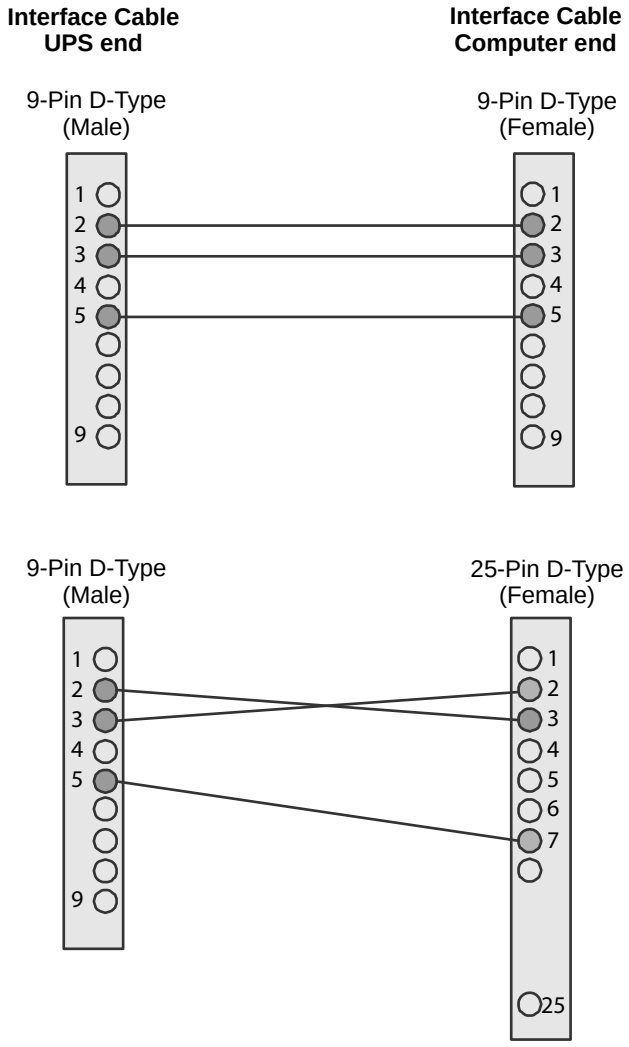


Figure 7.2 Connector Cable - PC Serial Port

7.3 RS485 Interface for multidrop – JR1 (JR2 for 400-500kVA)

Using the Multidrop connection kit, the computer interface (JR1) (JR2 for 400-500kVA) is an intelligent RS485 serial port that allows a computer to access information from all modules connected in a parallel system. The retrieved data can be used to display the system operating parameters and status.

7.4 Dry ports customer interface (X1, X1, X3)

Customer I/O interface facilities are made to Phoenix spring terminal blocks (cable 0.2mm² to 1.5mm²) annotated X1, X2 and X3. All voltage-free contacts are rated at 250Vac/8A, 30Vdc/8A, 110Vdc/0.3A, 220Vdc/0.12A

7.4.1 60-300kVA Model interface connections

	Terminal	Contact	Signal	Display	Function
X1	X1/10	Gnd	Gnd		+12Vdc Power source (max 200mA)
	X1/9	In	+12Vdc		
	X1/8	Gnd	Gnd		REMOTE SHUTDOWN (Do not remove the factory-fitted bridge if this feature is not used)
	X1/7	In	+12Vdc		
	X1/6	Gnd	Gnd		Battery Temperature Sensing (If connected this input is battery temperature dependent)
	X1/5	In	+3.3V		
	X1/4	Gnd	Gnd		Customer Specific Input (1) (Function on request))
	X1/3	In	+12Vdc		
	X1/2	Out	Gnd		Customer Specific Input (2) (Default NC = Generator on line)
	X1/1	Gnd	+12Vdc		
X2	X2/15	Com	Alarm	COMMON ALARM	Common
	X2/14	NC			No Alarm Condition
	X2/13	NO			Common (System) Alarm active
	X2/12	Com	Status	LOAD ON MAINS	Common
	X2/11	NC			No Load On Bypass
	X2/10	NO			Load on Bypass (Mains) active
	X2/9	Com	Alarm	BATT LOW	Common
	X2/8	NC			Battery OK
	X2/7	NO			Battery Low active
	X2/6	Com	Status	LOAD ON INV	Common
	X2/5	NC			Load not On Inverter
	X2/4	NO			Load on Inverter active
	X2/3	Com	Alarm	MAINS OK	Common
	X2/2	NC			Mains Failure
	X2/1	NO			Mains Present

7.4.2 400-500kVA Customer interface connections

	Terminal	Contact	Signal	Display	Function
X3	X3/14	Gnd	Gnd		Battery Temperature Sensing (If connected this input is battery temperature dependent)
	X3/13	In	+3.3V		
	X3/12	Gnd	Gnd		Customer Specific Input (2) (No defined default function)
	X3/11	In	+12V		
	X3/10	Gnd	Gnd	GENERATOR OPER ON	Customer Specific Input (1) (Default NC = Generator on line)
	X3/9	In	+12V		
	X3/8	Gnd	Gnd	EXT MAN BYP	External Manual Bypass (Default NC = External bypass closed)
	X3/7	In	+12V		
	X3/6	Out	+12V		+12Vdc Power source (max 200mA)
	X3/5	Gnd	Gnd		
	X3/4	Gnd	Gnd	REMOTE SHUTDOWN	RSD Remote Shut Down Leave jumper JP5 in place if no Remote Shut Down input is connected
	X3/3	In	+12V		
	X3/2	–		REMOTE SHUTDOWN	RSD Remote Shut Down (For external switch) Max 250Vac/8A, 30Vdc/8A, 110Vdc/0.3A, 220Vdc/0.12A
	X3/1	–			
X2	X2/18	Com			Common
	X2/17	NC			Auxiliary NO
	X2/16	NO			Auxiliary NC
	X2/15	Com	Alarm	COMMON ALARM	Common
	X2/14	NC			No Alarm Condition
	X2/13	NO			Common (System) Alarm active
	X2/12	Com	Status	LOAD ON MAINS	Common
	X2/11	NC			No Load On Bypass
	X2/10	NO			Load on Bypass (Mains) active
	X2/9	Com	Alarm	BATT LOW	Common
	X2/8	NC			Battery OK
	X2/7	NO			Battery Low active
	X2/6	Com	Status	LOAD ON INV	Common
	X2/5	NC			Load not On Inverter
	X2/4	NO			Load on Inverter active
	X2/3	Com	Alarm	MAINS OK	Common
	X2/2	NC			Mains Failure
	X2/1	NO			Mains Present
X1	X1/2	230Vac	–	EXT MAN BYP	Castell Interlock Function External Manual Bypass closed (230Vac 2AT)
	X1/1	N	–		

7.4.3 Remote emergency stop option

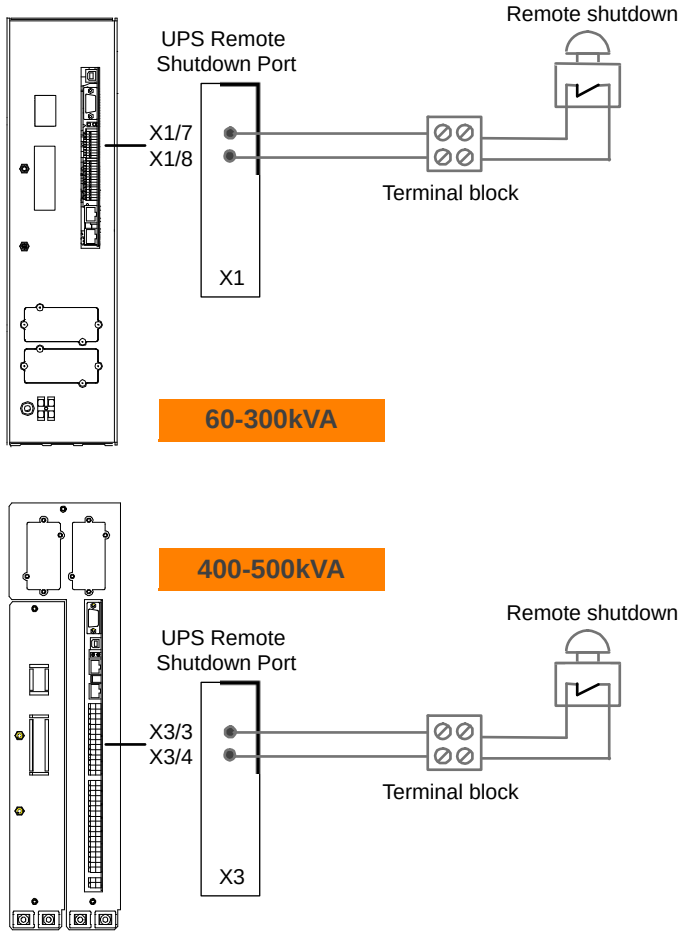


Figure 7.3 Remote emergency stop cabling

On a standard UPS the remote emergency stop function is disabled; and if this option is required it must be activated by a hardware code on the `SETUP SERVICE` menu. Please contact your distributor to enable this operation.

The remote stop facility comprises a normally-closed circuit connected between terminal X1/7 and X1/8 (or X3/3 and X3/4) on the communication card located on the Kohler PW 6000 front frame *(see Figure 7.3)*.

It is recommended that a terminal block, with linking facilities, is installed between the UPS and the remote emergency stop button, as shown, in order to allow the removal, maintenance or testing of the remote emergency stop circuit without disturbing the normal UPS operation.

1. Use a screened cable with 1 pair (section of wires 0.6 mm^2) and maximum length of 100 m.
2. Connect the cable as shown in Figure 7.3.

7.4.4 Generator ON facilities

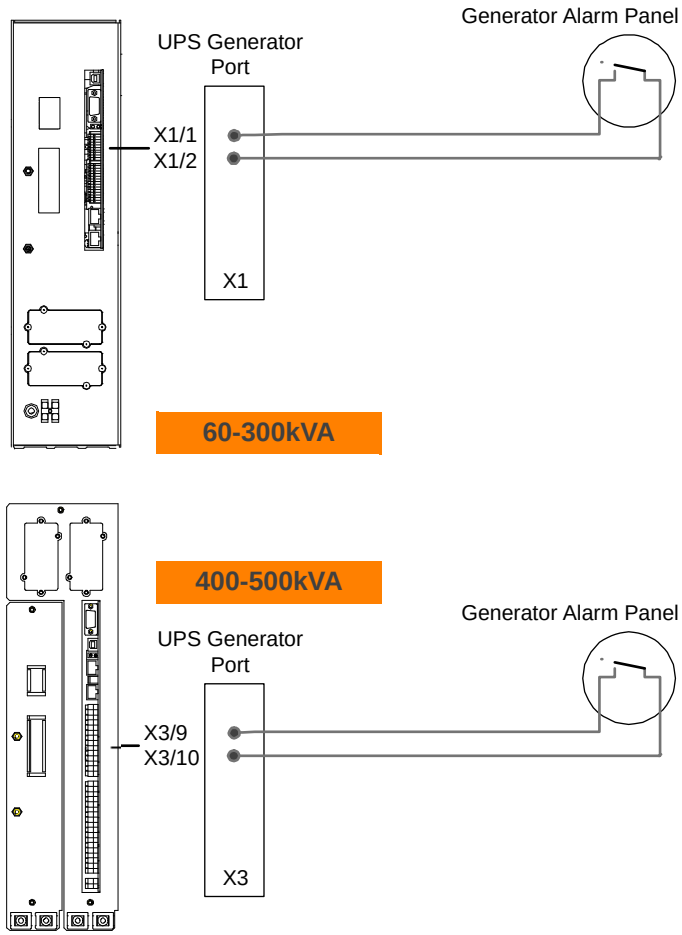


Figure 7.4 Generator ON Connection

The generator ON facility must use a normally-open contact which closes when a standby generator is running and supplying the UPS input power. When used, this facility enables the option to inhibit the operation of the battery charger and/or static bypass. See “Set-up user menu screen” in section 4.3.7.

1. Use a screened cable with 1 pair (section of wires 0.6 mm^2) and maximum length of 100 m.
2. Connect the cable as shown in Figure 7.4.

7.4.5 SNMP Card slots

Simple Network Management Protocol (SNMP) is a world-wide, standardised communication protocol that can be used to monitor any network-connected device via a simple control language and display the results in an application running within a standard web browser.

The Kohler PW 6000 contains two SNMP slots; one is designed to house a Modem/Ethernet SNMP adapter card and the other a Modem/GSM adapter. Alternatively, SNMP connectivity can also be implemented using an external SNMP adapter connected to the UPS RS232 output.

An SNMP/Ethernet adapter contains an RJ-45 connector which allows it to be connected to the network using a standard network cable. Once connected, the UPS-Management software agent, which is already installed in the SNMP adapter, then monitors the UPS operating parameters and outputs its data in SNMP format to the connected network. In a multi-module UPS system the SNMP interface can communicate ‘system-wide’ data or data for an individual UPS module.

The SNMP adaptor requires a PC with terminal connections, and for normal operation at least one network connection (Ethernet) is also required.

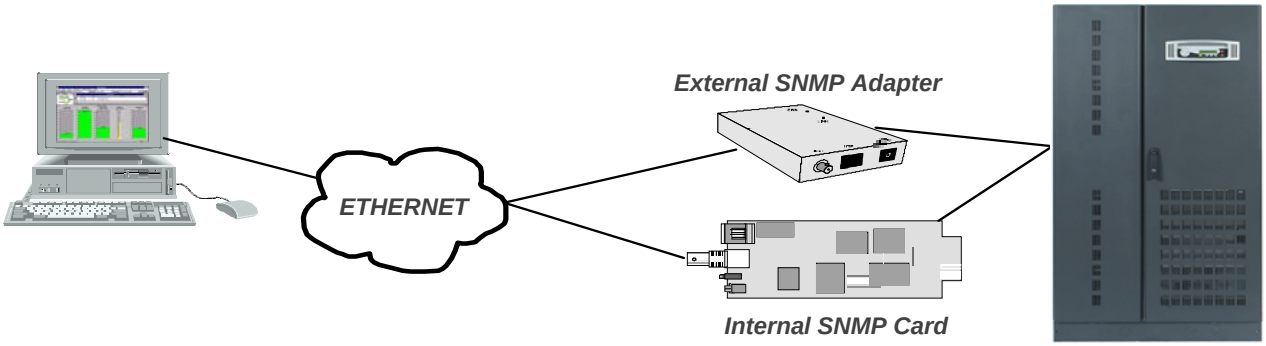


Figure 7.5 SNMP Internal and external adapters

7.5 UPS Monitoring and automated control software

Three (optional) monitoring systems are available for use with the Kohler PW 6000 UPS system:

- SNMP – can be used for monitoring and controlled UPS shutdown
- WAVEMON – can be used for monitoring and controlled UPS shutdown
- PowerREPORTER – can be used to automatically email Kohler Uninterruptible Power details of monitored parameters and alarm events for appropriate service support response

7.5.1 SNMP monitoring software

The SNMP adapter described above requires a PC with terminal connections and, for normal operation, at least one Ethernet network connection. It also requires that the network operating system in use is SNMP-compatible.

7.5.2 WAVEMON UPS monitoring and control software

WAVEMON is designed to operate in conjunction with many of the systems supplied by Kohler Uninterruptible Power and features both UPS monitoring and automatic UPS/server shutdown facilities. The system comprises a bespoke software package which is installed on a local PC and communicates with the UPS over a standard RS232 cable of up to 15m in length.

Kohler Uninterruptible Power offer suitable monitoring software with SNMP functionality for NetWare, OS/2, all Windows NT systems on INTEL and ALPHA network platforms.

The main features of WAVEMON are:

- 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
- Permits alarm warnings to be monitored remotely via email
- Scheduled UPS service mode and other systems status
- Graphical user interface for Windows-compatible platforms
- Automatic unattended local shutdown
- Special modules for MS-Office software to close and save open documents
- Compatible with all optional modules like UPSDIALER, SNMP adaptors, temperature sensors, etc.

7.5.3 PowerREPORTER™ management software

PowerREPORTER™ is a remote monitoring and management service which is a part of the ‘premium power protection concept’.

ThePowerREPORTER™ application:

- Provides affordable, continuous monitoring over mission-critical facilities and offers peace of mind by detecting and warning of any potential system problems before they become a crisis.
- Acquires key performance parameters and productivity information in real-time to enable you to better understand machine performance and faster troubleshoot downtime events
- Gives total transparent information concerning all actions performed on the system, such as all critical status changes, coordination of equipment service, reporting of all alarms with priorities

Key features

- Redundant and secure communication
- Alarm acknowledgment
- Priority driven Management (with escalation)

Comprehensive management system

- Reception and management of alarm calls from Kohler Uninterruptible Power
- Storage of UPS data in a database exportable in a CSV-format for easy handling in Excel
- Unlimited number of UPS that can be managed
- User administration with passwords and permission-level
- Administration of Log file
- Data logging with statistical analysis and diagnostics, report
- Visualization of the UPS data
  – Current status
  – Measured values for single or three phase
  – Recording function including graphs with zooming capabilities for selected measured values
  – Display of event log file
  – Display of UPS parameters
  – Web server functionality, for data access from any web browser

8 Specifications

8.1 General specifications

MECHANICAL CHARACTERISTICS 60-100kVA (No Battery Enc.)				
Rating (kVA)		**60**	**80**	**100**
Dimensions (WxHxD)	mm	550 x 1820 x 750		
Dimensions with elevation kit (WxHxD)	mm	550 x 1975 x 750		
Weight	kg	205	225	230
Colour		Graphite Grey (RAL 7024)		
Batteries		Fitted in external enclosure		
Input and output power cable entry		Bottom		
Exhaust cooling air		Rear		

MECHANICAL CHARACTERISTICS 60-100kVA (Battery Enc. A)				
Rating (kVA)		**60**	**80**	**100**
Dimensions (WxHxD)	mm	970 x 1820 x 750		
Dimensions with elevation kit (WxHxD)	mm	970 x 1975 x 750		
Weight without batteries fitted	kg	250	260	285
Weight with 80 x 28Ah batteries fitted	kg	1140	1150	1175
Colour		Graphite Grey (RAL 7024)		
Batteries (Max configuration)		80 x 28Ah Battery blocks mounted on 16 shelves.		
Input and output power cable entry		Bottom		
Exhaust cooling air		Rear		

MECHANICAL CHARACTERISTICS 60-100kVA (Battery Enc. B)				
Rating (kVA)		**60**	**80**	**100**
Dimensions (WxHxD)	mm	1180 x 1820 x 750		
Dimensions with elevation kit (WxHxD)	mm	1180 x 1975 x 750		
Weight without batteries fitted	kg	260	270	295
Weight with 120 x 28Ah batteries fitted	kg	1590	1600	1625
Colour		Graphite Grey (RAL 7024)		
Batteries (Max configuration)		120 x 28Ah Battery blocks mounted on 24 shelves.		
Input and output power cable entry		Bottom		
Exhaust cooling air		Rear		

MECHANICAL CHARACTERISTICS 120-200kVA				
Rating (kVA)		**120**	**160**	**200**
Dimensions (WxHxD)	mm	850 x 1820 x 750		
Dimensions with elevation kit (WxHxD)	mm	850 x 1975 x 750		
Weight	kg	280	290	310
Colour		Graphite Grey (RAL 7024)		
Batteries		Fitted in external enclosure		
Input and output power cable entry		Bottom		
Exhaust cooling air		Rear		

MECHANICAL CHARACTERISTICS 250-300kVA			
Rating (kVA)		**250**	**300**
Dimensions (WxHxD)	mm	1100 x 1920 x 750	
Dimensions with elevation kit (WxHxD)	mm	1100 x 1975 x 750	
Weight	kg	390	410
Colour		Graphite Grey (RAL 7024)	
Batteries		Fitted in external enclosure	
Input and output power cable entry		Bottom	
Exhaust cooling air		Rear	

MECHANICAL CHARACTERISTICS 400-500kVA			
Rating (kVA)		**400**	**500**
Dimensions (WxHxD)	mm	1650 x 1994 x 850	
Dimensions with elevation kit (WxHxD)	mm	1650 x 2094 x 850	
Weight	kg	950	1000
Colour		Graphite Grey (RAL 7024)	
Batteries		Fitted in external enclosure	
Input and output power cable entry		Bottom	
Exhaust cooling air		Top	

SYSTEM CHARACTERISTICS					
Topology		On-line, double conversion, Voltage and Frequency Independent (VFI)			
Technology		Second generation transformerless design			
Parallel configuration expansion		For added redundancy and/or capacity a parallel system can be extended to up to 10 modules on request			
Double conversion AC/AC efficiency with fully charged battery and linear load (PF = 1)	Load	25%	50%	75%	100%
	% eff.	95.5%	96.0%	95.5%	95.0%

INPUT CHARACTERISTICS

		60	80	100	120	160	200	250	300	400	500
Nominal input voltage	V	3x 380/220V+N, 3x 400/230V+N, 3x 415/240V+N									
Input voltage tolerance (ref to 3x400/230V) for Loads in %:	V	(-23% to +15%) 3x308/177 V to 3x460/264 V for <100 % load (-30% to +15%) 3x280/161 V to 3x460/264 V for < 80 % load (-40% to +15%) 3x240/138 V to 3x460/264 V for < 60 % load									
Input frequency	Hz	35-70									
Inrush current	A	Limited by soft start									
Max. Input Power with rated output power and charged battery (pf=1.0)	kW	64	85	107	128	170	213	266	319	426	532
Max. Input Current with rated output power and charged battery (pf=1.0)	A	93	123	154	185	247	308	386	463	617	771
Max. Input Power with rated output power and discharged battery (pf=1.0)	kW	70	94	117	141	187	234	293	351	468	585
Max. Input Current with rated output power and discharged battery (pf=1.0)	A	102	136	170	204	271	339	424	509	679	848

Load	25%	50%	75%	100%
Input power factor (leading)	0.96	0.985	0.99	0.99
Input current distortion (THDi) (%)	9.0	6.0	4.5	3.5

BATTERY CHARACTERISTICS

		60	80	100	120	160	200	250	300	400	500
Variable number of 12V battery blocks (only even numbers allowed)	No.	44/50					50	44/50			
Max. battery charger current	A	25			50			60		100	
Battery type		Maintenance-free VRLA or NiCd									
Temperature controlled charger		Yes (temperature sensor optional)									
Battery charging curve		Ripple-free: IU (DIN 41773)									
Battery test		Automatic and periodic (adjustable)									

OUTPUT CHARACTERISTICS

		60	80	100	120	160	200	250	300	400	500
Output rated power (@min 44 battery blocks)	kW	60	80	100	120	160	*200	250	300	400	500
Output current In (PF=1.0) (@min 44 battery blocks)	A	87	116	145	174	232	*290	361	433	577	722
Output rated voltage	V	3x 380/220 or 3x 400/230 or 3x 415/250									
Output voltage stability (Static)	%	< ± 1.0									
Output voltage stability (Dynamic)	%	< ±4 (with load step 0-100%, 100-0%)									
Output voltage distortion with linear load	%	< 2 with linear load									

OUTPUT CHARACTERISTICS (Continued)		60	80	100	120	160	200	250	300	400	500
Output voltage distortion with non-linear load	%	< 4 (EN 62040-3:2001)									
Output frequency	Hz	50 or 60									
Output frequency tolerance	%	±0.1 free-running, quartz oscillator ±2 or ±4 with mains synchronised (selectable)									
Frequency slew rate	Hz/s	1.0									
Output waveform		Sinewave with 0deg. phase imbalance @100% unbalanced load									
Permissible unbalanced load	%	100% (all 3 phases independently regulated)									
Overload capability on inverter	%	At PF=1.0 110% load for 10 minutes At PF=1.0 135% load for 1 minute At PF=0.9 125% load for 10 minutes At PF=0.9 150% load for 1 minute									
Inverter short circuit capability (x rated output for 40ms)	A	2.7x	2.0x	2.3x	1.8x	1.9x	2.1x	1.8x	2.0x	2.0x	2.0x
Bypass short circuit capability		10x rated In for 10ms									
Crest factor		3:1									
Bypass operation		At ±15.0% of nominal input voltage									
***** *With 50 battery blocks only*											

OUTPUT POWER VERSUS COS Ø														
		Inductive (lagging COS ø)								Unity	Capacitive (leading COS ø)			
Module		0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1.0	0.95	0.9	0.85	0.8
60	kVA	60	60	60	60	60	60	60	60	60	60	60	59	58
	KW	36	39	42	45	48	51	54	57	60	57	54	50	46
80	kVA	80	80	80	80	80	80	80	80	80	80	80	78	77
	KW	48	52	56	60	64	68	72	76	80	76	72	66	61
100	kVA	100	100	100	100	100	100	100	100	100	100	100	98	97
	KW	60	65	70	75	80	85	90	95	100	95	90	83	77
120	kVA	120	120	120	120	120	120	120	120	120	120	120	117	116
	KW	72	78	84	90	96	102	108	114	120	114	108	100	92
160	kVA	160	160	160	160	160	160	160	160	160	160	160	156	154
	KW	96	104	112	120	128	136	144	152	160	152	144	132	122
200*	kVA	200	200	200	200	200	200	200	200	200	200	200	195	194
	KW	120	130	140	150	160	170	180	190	200	190	180	166	154
250	kVA	250	250	250	250	250	250	250	250	250	250	250	245	241
	KW	150	163	175	188	200	213	225	238	250	238	225	208	192
300	kVA	300	300	300	300	300	300	300	300	300	300	300	294	291
	KW	180	195	210	225	240	255	270	285	300	385	270	249	231
400	kVA	400	400	400	400	400	400	400	400	400	400	400	392	388
	KW	240	260	280	300	320	340	360	380	400	380	360	333	310
500	kVA	500	500	500	500	500	500	500	500	500	500	500	490	485
	KW	300	325	350	375	400	425	450	475	500	475	450	417	338
*Vout=230Vac (L-N), 50 Hz, with minimum of 44 battery blocks (*50 Battery blocks on 200kVA model)*														

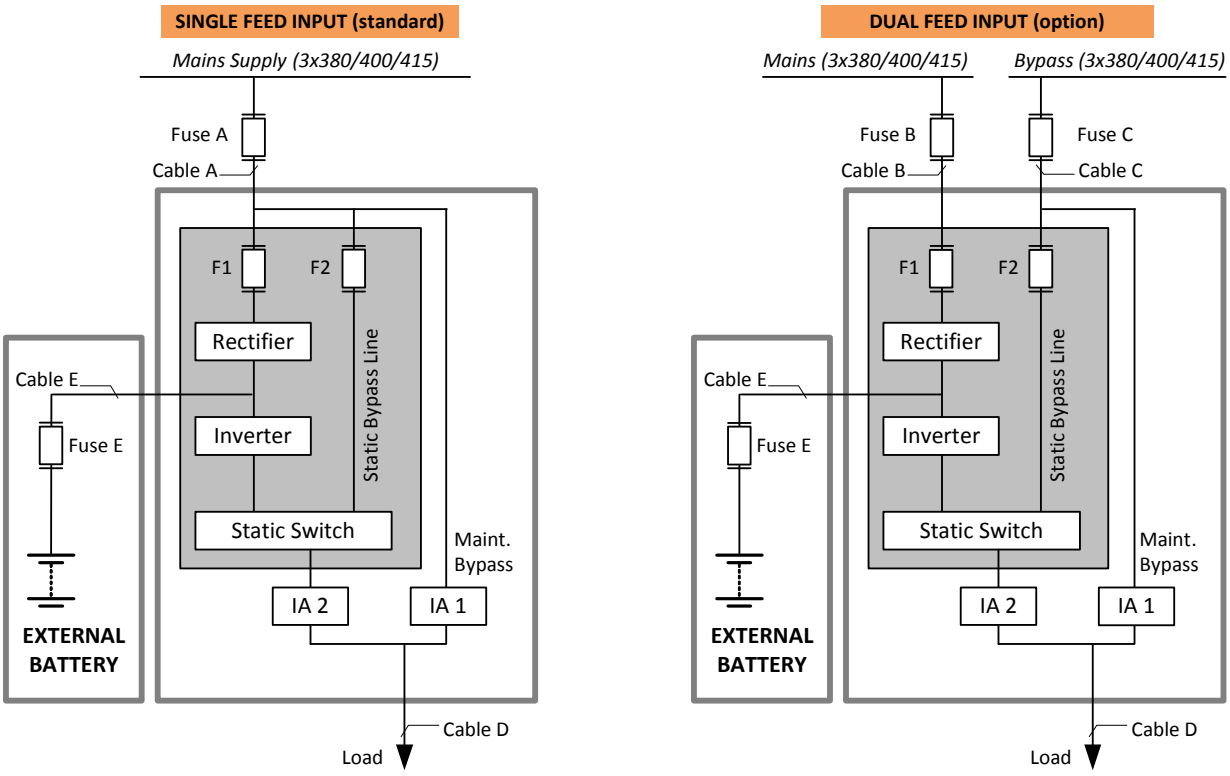
ENVIRONMENTAL CHARACTERISTICS											
		60	80	100	120	160	200	250	300	400	500
Audible noise @ 100/50% load	dBA	< 65			< 69			< 71		N/A	
Ambient temperature for UPS	°C	0-40									
Ambient temperature for batteries (recommended)	°C	20									
Battery storage time at ambient temperature		Maximum 6 months									
Fan assisted cooling air flow		Front entry, rear exit								Front entry top exit	
Airflow (25 - 30°C) with 100% non-linear load	m³/h	1300	1500	1700	2500			3350		6550	
Heat dissipation with 100% non-linear load	W	3830	5106	6368	7660	10213	12766	15957	19149	24000	30000
Heat dissipation with 100% non-linear load	BTU/h	13071	17428	21785	26142	34856	43570	54462	65355	81913	102389
Heat dissipation without load	W	850			1500			2300		4000	
Relative air-humidity		Maximum 95% (non-condensing)									

Max altitude above sea level without derating	1000m (3300ft) without derating	
De-rating factor for use at altitudes above 1000m sea level according (IEC 62040-3)	Height above sea level (m/ft) 1500 / 4850 2000 / 6600 2500 / 8250 3000 / 9900	Derating factor for power 0.95 0.91 0.86 0.82

STANDARDS	
Safety	EN62040-1-1:2003 EN60950-1:2001/A11/;2004
Electromagnetic compatibility	IEC/EN 62040-2:2005, IEC/EN61000-3-2:2000, IEC/EN61000-6-2:2001,
Performance	EN 62040-3:2001
Product certification	CE
Degree of protections	IP20

COMMUNICATION OPTIONS	
Power Management Display (PMD)	LCD display and mimic diagram showing UPS operational status
Customer Interfaces: (Dry Ports)	Volt-free output interface provide status and alarm outputs for remote indication and interfacing with BMS systems. Together with customer inputs interface for connecting an Emergency Stop, On Generator status etc.
RS232 on Sub-D9 port RS232 on USB port	For monitoring and integration in network management
RS485 on RJ45 port	Remote monitoring system with graphical display (option)
RS485 on RJ45 port	For multidrop purposes (option)
Slot for SNMP Card	Ethernet card for monitoring and integration in network management (option)
Slot for SNMP Card	Modem card for GSM remote monitoring (option)

8.2 60-300kVA Fuses & cables quick reference



Single feed input

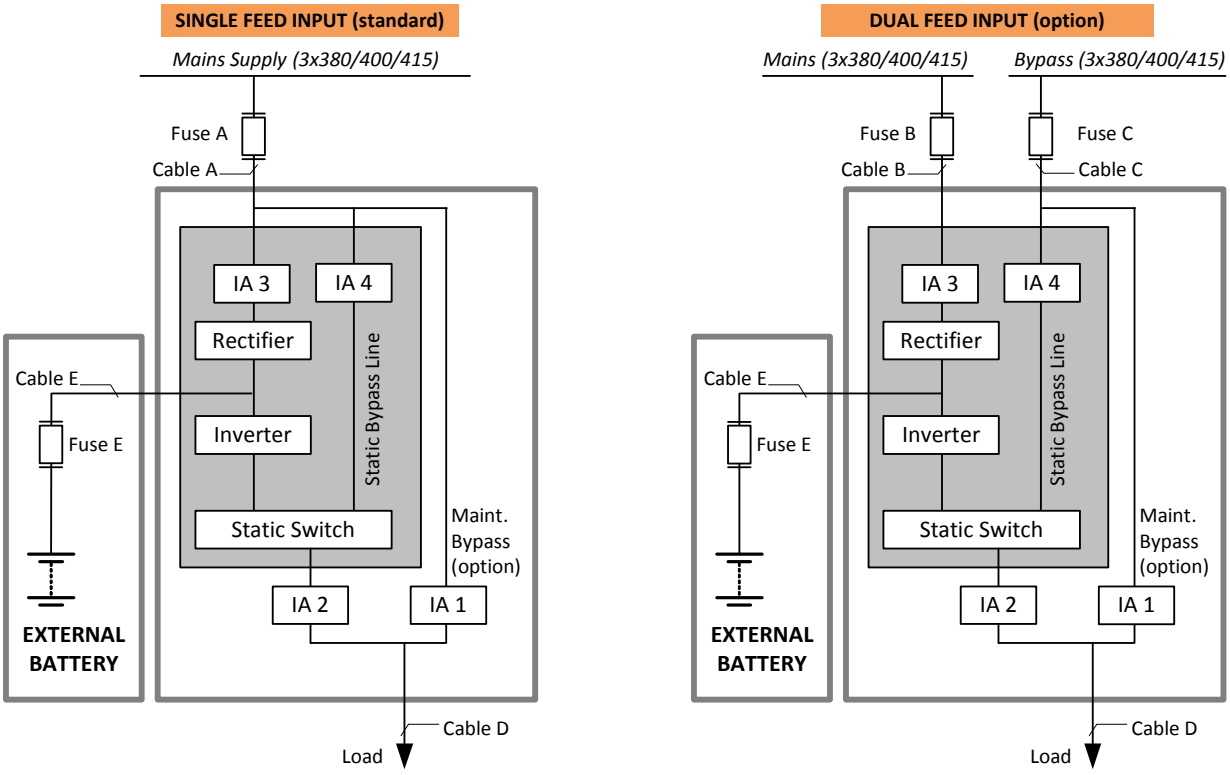
Power (kVA)	Fuse A (Agl/CB)	Cable A	Cable D
60	3x100	5x35	5x35
80	3x125	5x50	5x50
100	3x160	5x50	5x50
120	3x200	5x70	5x70
160	3x250	5x120 or 5x(2x50)	5x120 or 5x(2x50)
200	3x315	5x185 or 5x(2x70)	5x185 or 5x(2x70)
250	3x400	5x240 or 5x(2x95)	5x240 or 5x(2x95)
300	3x500	5x(2X120)	5x(2X120)

Dual feed input

Power (kVA)	Fuse B (Agl/CB)	Cable B	Fuse C (Agl/CB)	Cable C	Cable D
60	3x100	5x35	3x100	5x35	5x35
80	3x125	5x50	3x125	5x50	5x50
100	3x160	5x50	3x160	5x50	5x50
120	3x200	5x70	3x200	5x70	5x70
160	3x250	5x120 or 5x(2x50)	3x250	5x120 or 5x(2x50)	5x120
200	3x315	5x185 or 5x(2x70)	3x315	5x185 or 5x(2x70)	5x185
250	3x400	5x240 or 5x(2x95)	3x400	5x240 or 5x(2x95)	5x240 or 5x(2x95)
300	3x500	5x(2x120)	3x500	5x(2x120)	5x(2x120)

Note: Battery cabling (Cable E) and battery fuses (Fuse E) are bespoke to the installation

8.3 400-500kVA Fuses & cables quick reference



Single feed input

Power (kVA)	Fuse A (Agl/CB)	Cable A	Cable D
400	3x630	5x (3x95) or 5x (2x185)	5x (3x95) or 5x (2x185)
500	3x800	5x (3x150)	5x (3x150)

Dual feed input

Power (kVA)	Fuse B (Agl/CB)	Cable B	Fuse C (Agl/CB)	Cable C	Cable D
400	3x630	5x(3x95) or 5x(2x185)	3x630	5x (3x95) or 5x(2x185)	5x(3x95) or 5x(2x185)
500	3x800	5x (3x150)	3x800	5x50	5x(3x150)

Note: Battery cabling (Cable E) and battery fuses (Fuse E) are bespoke to the installation