# User's and Installation Manual
# 20 - 80 kVA parallel UPS systems

# User's and Installation Manual
# 20 - 80 kVA Parallel Systems

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Revision C

## Table of content:


**1. Safety Instructions** ..... **5**
1.1 General ..... 5
1.2 Installation and service ..... 5
1.3 User operations ..... 6
**2. Introduction** ..... **7**
2.1 Overview ..... 7
2.2. Easy power protection ..... 7
**3. System Description** ..... **8**
3.1 Overview ..... 8
3.2 Theory of operation ..... 9
3.3 Sizing ..... 10
3.4 Accessories ..... 10
**4. Instructions and preventive maintenance** ..... **11**
4.1 General ..... 11
4.2 Unpacking and incoming inspection ..... 11
4.3 Storage ..... 12
4.4 Handling and lifting ..... 12
4.5 Moving ..... 12
4.6. Initial start-up and upgrades ..... 12
4.7 Maintenance ..... 13
**5. Mechanical installation** ..... **14**
5.1 Overview ..... 14
5.2 Placing UPS modules ..... 15
5.3 Placing battery cabinets ..... 17
**6. Electrical installation** ..... **18**
6.1 Overview ..... 18
6.2 Location of terminals ..... 18
6.3 Input and output power cables ..... 19
6.4 Parallel operation ..... 20
6.5 Battery cables ..... 20
6.6 SPM tie cabinet options ..... 23
6.7 Input filter option ..... 33
6.8 Installation check list ..... 34
**7. Communication interfaces** ..... **34**
7.1 Overview ..... 34
7.2 Software ..... 35
7.3 RS-232 serial communication ..... 35
7.4 Potential free relay outputs ..... 36
7.5 Signal inputs ..... 37
**8. Start-up and operation** ..... **38**
8.1 Overview ..... 38
8.2 Start-up procedure ..... 38
8.3 Operating system bypass switch ..... 39
8.4 Shut-down procedure ..... 40
8.5 Control panel operation ..... 41
8.6 Control panel displays ..... 42
**9. Troubleshooting** ..... **45**
9.1 Overview ..... 45
9.2 Alarms and reasons ..... 45
**10. Warranty** ..... **46**
**11. Technical specifications** ..... **47**

# 1. Safety Instructions

## 1.1 General

**Warning!**

**The complete safety instructions (p/n: 1009917) must be followed when installing, operating and servicing the parallel UPS system. Study the complete safety instructions carefully.**

Because of the high energy stored within the batteries, the UPS equipment must be handled with care. The UPS must always be kept in the position marked on the package and must not be dropped during storage or transportation. Moreover, do not place the parallel UPS system in an airtight room.

The instructions are important for electrical safety with all personnel involved in UPS handling. Any failure to recognise the electrical hazards could prove fatal or cause injury.

## 1.2 Installation and service

Switch off the supply to the distribution point to which the UPS unit is to be connected. Remove the fuses from the selected line for extra safety precaution. Make absolutely sure that there is no power connected to UPS modules.

**Warning!**

**The parallel UPS system must be installed according to the instructions given on this manual. Qualified electricians should carry out all electrical installation and maintenance work on the parallel UPS system. Local safety legislation and regulations for electrical UPS installations must be followed.**

Any installation work must be done with the power off, and power is not to be reconnected unless the installation work is complete. Ensure by measuring that the part of the cabinet you are working on is not live.

**Warning!**

**UPS modules are not provided with automatic power feedback relay. A readily accessible disconnect device must be installed in the fixed input wiring. Note that dangerous voltages remain in battery terminals when disconnect device is opened.**

Ensure that the output of an UPS module is disconnected from the other parallel modules. Thus, open the output service switch before any installation work or maintenance in a parallel connected UPS module.

## 1.3 User operations

**Warning!**

**Do not open the UPS cabinet! Some components inside the UPS cabinet carry high voltages. To touch them may prove fatal or cause injury. All operations inside the unit must be carried out only by service personnel from the manufacturer or from an agent authorised by the manufacturer.**

Do not operate the equipment in the presence of flammable gases or fumes. Operation of the electrical equipment in such an environment constitutes a safety hazard.

The only user operations permitted are:

- Starting up and shutting down the UPS unit (not the initial start up).
- Using the maintenance bypass switch of the system bypass module
- Operating the user interface.
- Connecting data interface cables.
- Monitoring the UPS modules with LanSafe III and PowerVision software.

User operations must be performed according to the instructions given on this manual. During any of these operations, the user must take greatest care and perform only the prescribed operations. Any deviation from the instructions could be dangerous to the operator.

# 2. Introduction

## 2.1 Overview

This manual gives you the necessary information about parallel UPS systems in redundancy or capacity configuration. The largest systems include maximum of four UPS modules in parallel configuration.

Instructions and procedures are covered in this manual: shipping; storing; handling; installation; user start-up and operation; troubleshooting; and preventive maintenance. The manual is intended for the chief operator/system supervisor, electrical consultants and installation electricians. It describes the specific functions and features of the parallel UPS system.

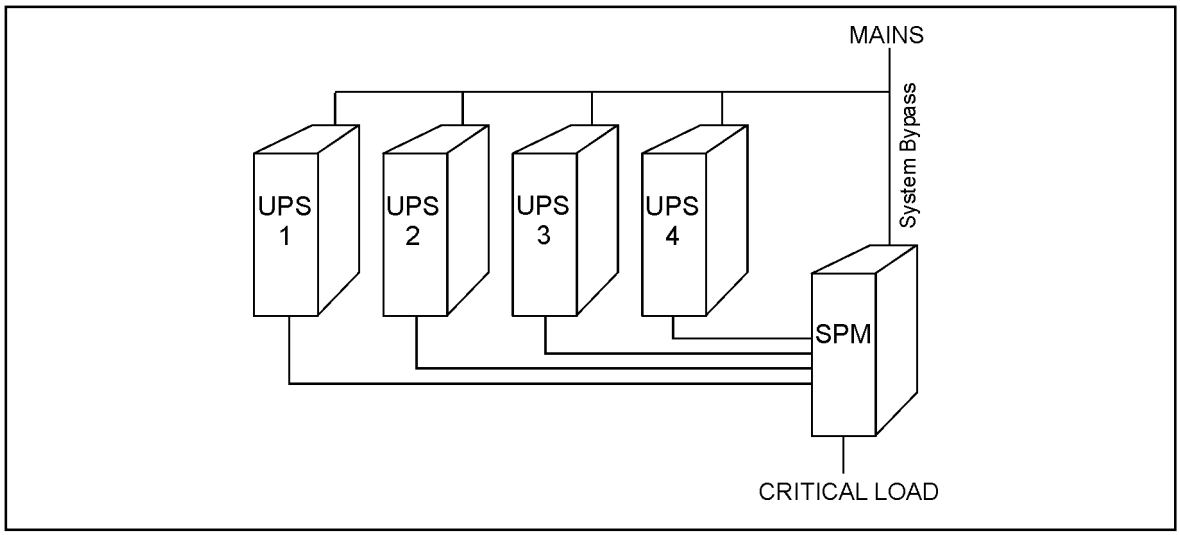



**Figure 1**. A parallel configuration constructed with four UPS modules.

Always remember that the parallel UPS system is connected to the AC mains power and contains internal high-current batteries for back up. Hence, prudence principle must be followed to prevent electrical hazards when operating the parallel UPS system.

## 2.2. Easy power protection

One can choose from a variety of power protection devices to shield critical data and equipment from power problems. However, by far the most sophisticated devices are Uninterruptible Power Systems (UPS).

An on-line, double conversion UPS is ideally suited for the most critical equipment. It provides clean AC power and protects the critical load against nine types of power problems:

1. Power outages
2. Power sags
3. Power surges
4. Undervoltages
5. Overvoltages
6. Switching transients
7. Line noise
8. Frequency variations
9. Harmonic distortion

# 3. System Description

## 3.1 Overview

Parallel UPS configurations are recognised as either redundancy or capacity systems. The redundancy system is used to improve the system reliability with N+1 redundant UPS module. The capacity system for its part provides the maximum output power without focusing to the highest system reliability.

A parameter selection is used to switch between the redundancy and capacity modes. It is important to remember that the mode is affecting to the output power rating and overall system reliability.

UPS modules of the parallel system share equally the load with Hot Sync™ technology. The parallel outputs are combined in a System Parallel Module or cabinet. It is the system component containing the obligatory service switches. Customer's low-voltage distribution panel can also be used instead of the System Parallel Module. In the redundancy system, service switches enable the maintenance or service on an UPS module. In the capacity system, one needs to have a common system bypass switch to do the maintenance or service without safety hazards.

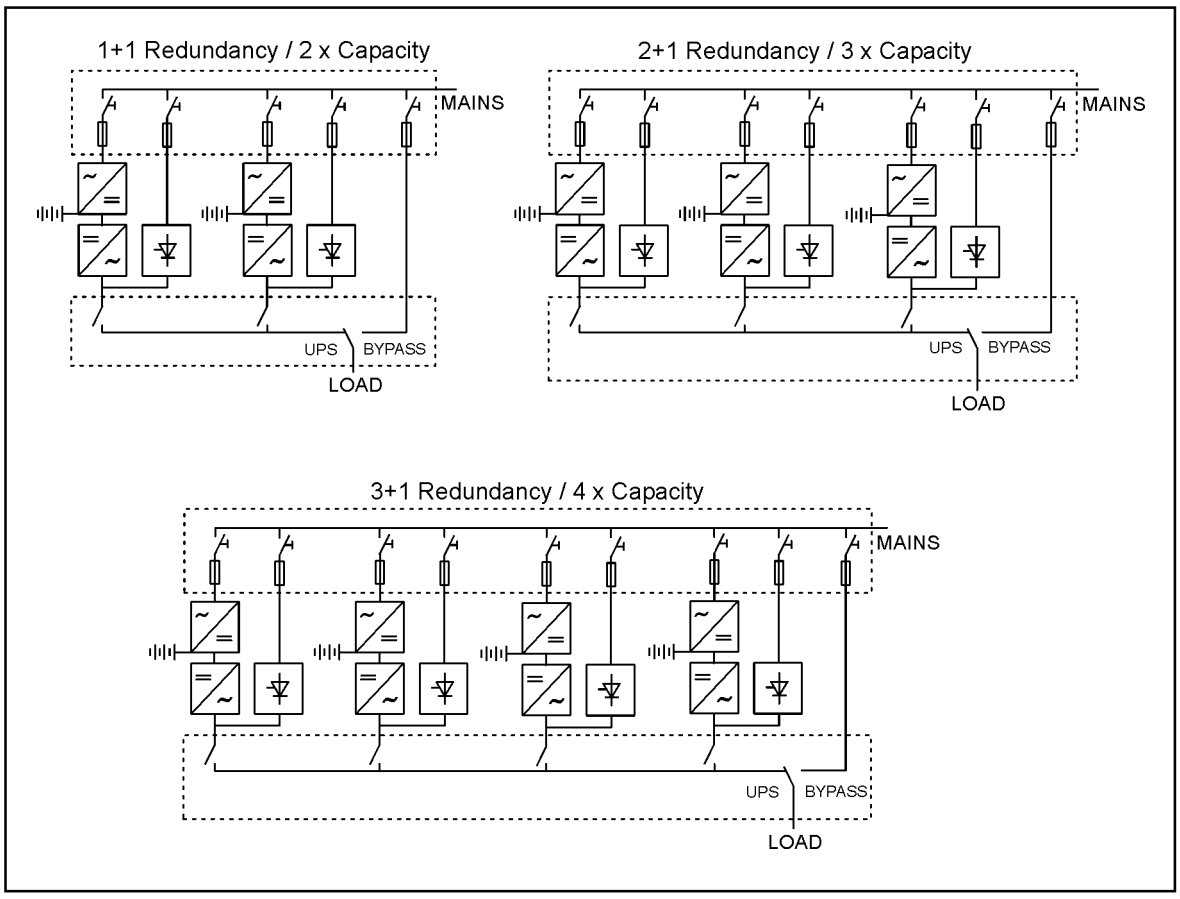



**Figure 2.** Parallel configurations with UPS modules.

Field upgrading can be used to extend existing capacity/redundancy systems with UPS modules. The upgrading must be carried out by service personnel from the manufacturer or from an agent authorised by the manufacturer.

## 3.2 Theory of operation

A double conversion on-line UPS conditions the raw mains and supplies continuous, clean three-phase power to the critical systems. It keeps the battery constantly charged while feeding the critical load. The UPS will continue to supply clean power without any interruption at the output even at mains failure. It will shut down in order to prevent a total discharge of the battery if the power failure outlasts the backup time of battery bank. The UPS will start up again automatically, providing power to the critical load and charging the battery bank, when the mains voltage is restored.

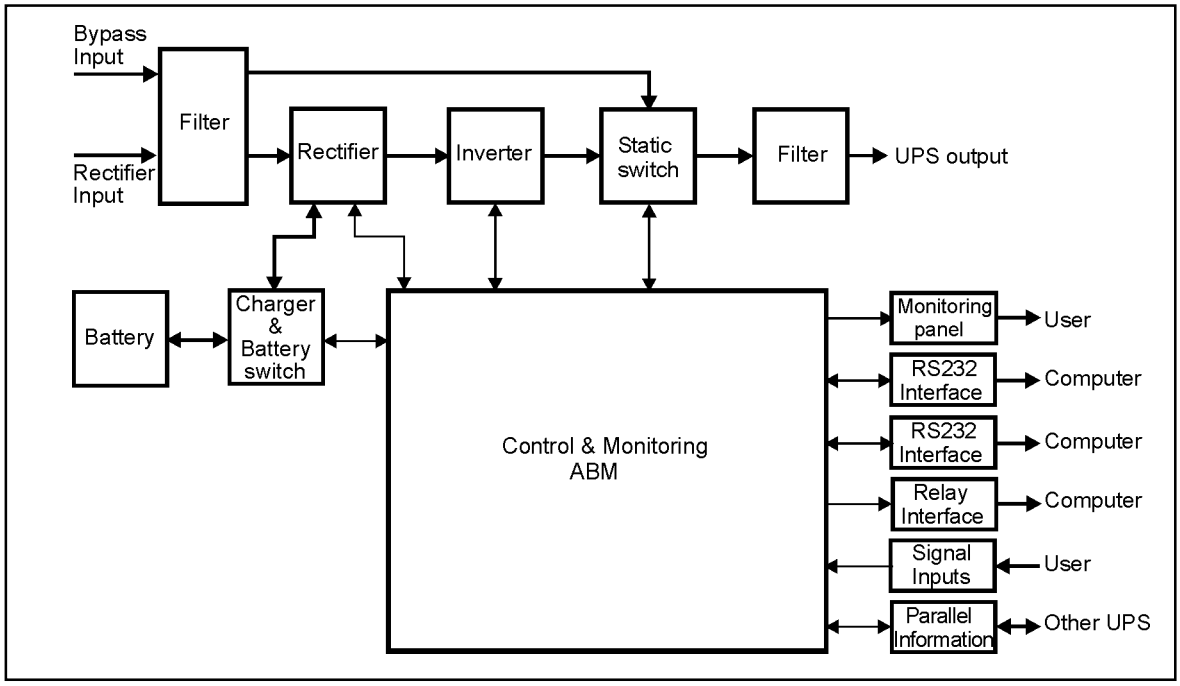



**Figure 3a.** Block diagram of UPS module

A double conversion UPS provides the best protection for computer systems and other intelligent devices such as measurement instruments and industrial automation applications. UPS modules incorporate digital signal processing technology to monitor and control its own operation. They protect different types of sensitive electrical devices such as computers, workstations, banking systems, sales terminals, critical instrumentation, telecommunications systems, process control systems, hospital equipment, etc.

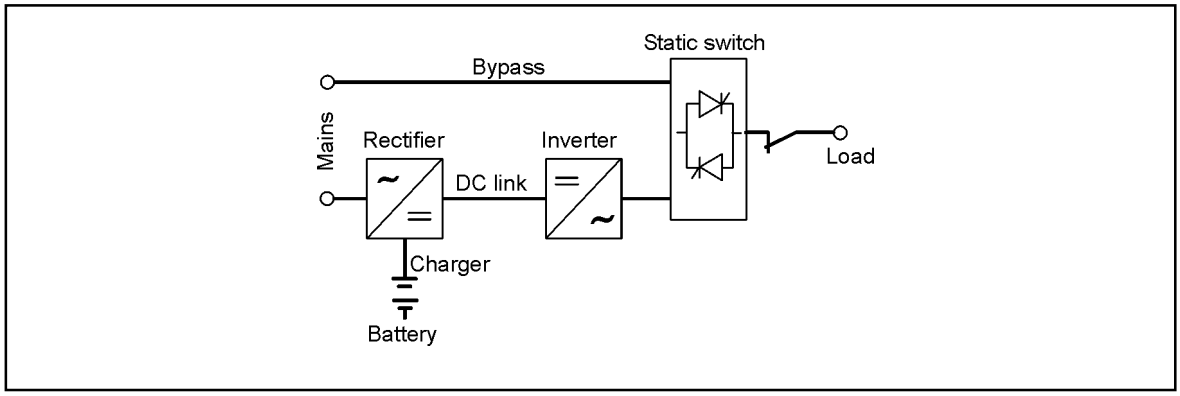



**Figure 3b.** Functional components of UPS module

The mains is rectified and boosted to DC power in the rectifier part. The rectifier provides power to the battery charger and the inverter load. The battery charger keeps the battery in recharged condition with ABM™ technology. The DC Link connects the rectifier output with the inverter input. It is the means for transferring power between these system components.

The output of the inverter is constantly maintained in phase synchronism with the bypass supply voltage provided that it is within the voltage and frequency tolerances specified for the load transfer condition. The inverter is changing the output operation to internal set frequency if the bypass supply exceeds these tolerances.

In the event of a mains power interruption, the battery is supplying the inverter load. The rectifier starts again to supply the inverter load when the AC mains power returns. The battery charger is recharging the battery after the mains return, too.

The static switch is initiating uninterrupted transfer of the load to the bypass line when the inverter is overloaded or the inverter is not able to feed the load. The output is protected with a tripping circuit breaker to separate the faulty UPS module from the parallel load bus.

The parallel load sharing is implemented individually in UPS modules with Hot Sync™ technology. The critical load is supported even in the unlikely situation of the redundant bus communication failure.

## 3.3 Sizing

The output power rating of the parallel UPS configuration should be specified according to the total power demand of the protected load. Some margin should be allowed for potential expansion, and for possible inaccuracy in calculating or measuring the actual power requirement.

The battery should be sized according to the desired backup time. Note that the backup time is longer if the load is less than the nominal power rating of the parallel UPS system.

## 3.4 Accessories

The following external options are available:

- System Parallel Module (SPM):
  – SPM9305 cabinet : 2-4 x 80 kVA
  – SPM9305 cabinet : 2-4 x 20-60 kVA
  – SPM9305/9340 cabinet : 2 x 80-130 kVA
  – SPM9305 module : 2 x 40-60 kVA
  – SPM9305 module : 2 x 20-30 kVA
- Battery cabinets:
  – BAT D, BAT E, and BAT F
- Input filter:
  – THDi 10%
- ViewUPS:
  – Remote status/control panel
- LanQuattro:
  – 4 x RS-232 data manager
- ConnectUPS:
  – SNMP adapter
- Others:
  – Engineered solutions upon request

# 4. Instructions and preventive maintenance

## 4.1 General

Proper provision must be made for transportation and handling because of heavy weight and high energy stored within batteries. See technical specifications for dimensions and weights of the UPS modules.

## 4.2 Unpacking and incoming inspection

Unpack the equipment and remove the shipping and packing materials. The shipping and packing materials should be stored for further investigation if damage has occurred during the transportation.

The equipment must be inspected for shipping damage. A claim must be filed immediately if visible damages can be noticed. Proceed as follows to file the claim for a shipment damage:

- Inform the carrier about the damage within 7 days of receipt of the equipment.
- Check and verify that the shipment is complete against the packing list.

The installation may proceed if there are no damages or discrepancies. UPS system is also thoroughly inspected and tested at the factory.

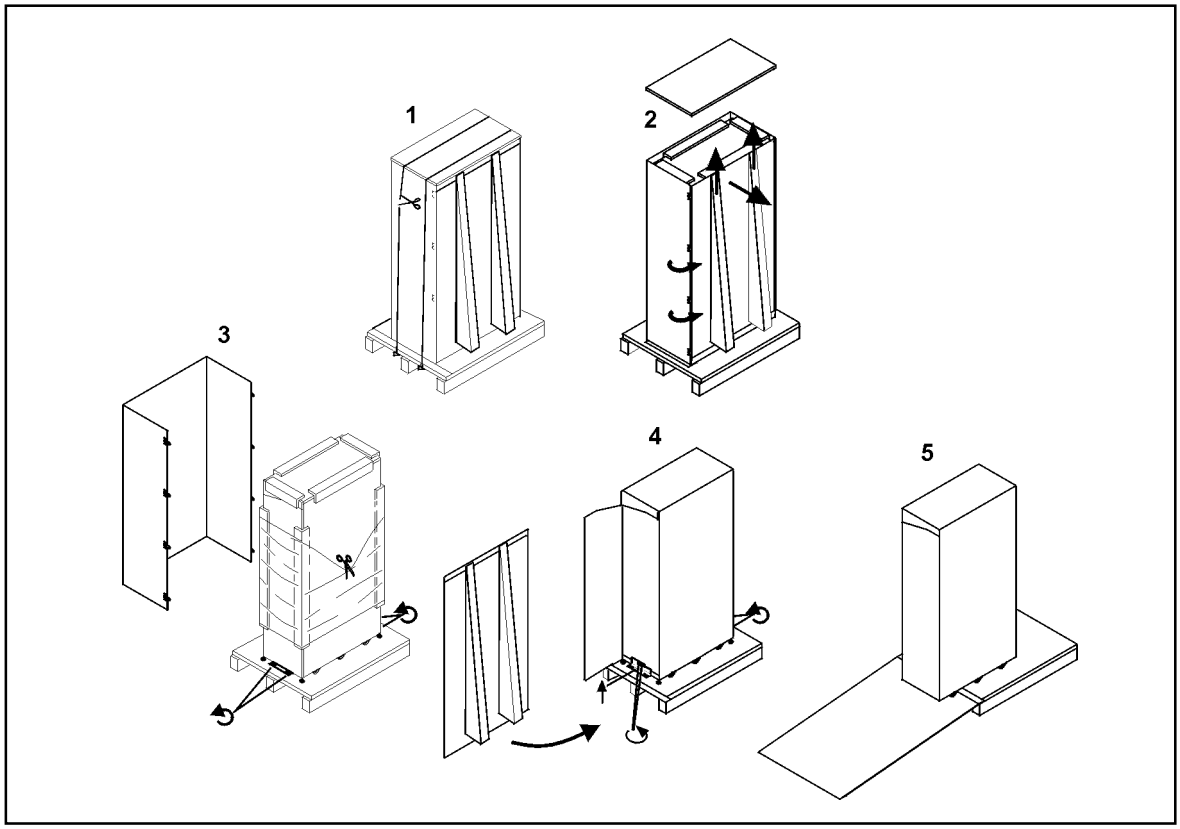



**Figure 4.** Removing the UPS module from the shipping pallet.

## 4.3 Storage

UPS modules must be stored in the original packing and shipping pallet. They should be handled with care. Make sure that you do not stack the pallets when the equipment is placed to local warehouse for storage.

If the UPS is not immediately installed the following must be remembered:

- Electrical equipment must always be protected from moisture and weather.
- The recommended storage temperature is between +15°C and +25°C
- UPS batteries should be charged regularly for at least 8 hours every 6 months to maintain the battery condition.

## 4.4 Handling and lifting

UPS modules are shipped on specifically designed packing and pallets. It is easy to move and lift them with a forklift. Hence, equipment should be lifted in the original and packed condition.

Crane lifting can be used if a suitable lifting net is used. There exist no lifting eyeholes for crane lifting. Note that equipment must be kept in an upright position and must not be dropped.

## 4.5 Moving

UPS can be simply pushed into place after unpacking. They are equipped with castors for easy movement but be careful not to tilt it. Please verify that the surface material, on which the UPS modules are moved, is strong enough for the heavy weight.

## 4.6. Initial start-up and upgrades

The authorised field service person shall perform the following procedure and tests during the start- up the new parallel UPS system:

**1. Visual inspection**

- Make a visual inspection of the equipment for signs of damage or foreign material. Observe the type of ventilation system, the cleanliness of the room, the use of safety signs, and other environmental factors affecting the functionality or personnel safety.

**2. Mechanical and electrical inspection**

- Check the power connections, control wiring terminations, and plugs for tightness or proper seating. Verify that the alarms log is clear and in the 'green' condition.
- Check the parallel UPS system for possible ground leakage, proper input and bypass voltages, and correct phase rotation. Check the proper battery float voltage.

**3. Operating inspection**

- Energise the parallel UPS system and verify the proper DC and AC output voltages. Check the final DC link voltage and output wave form of the inverter output.

**4. Operational training**

- Before leaving the site, the field service engineer shall familiarise responsible personnel with the operation of the UPS system. The UPS equipment shall be available for demonstration of the modes of operation.

Normally, the complete parallel UPS system is calibrated at the factory and no output calibration is needed in the field. However, UPS module upgrades to the existing parallel UPS system require always the service visit due to the field adjustment of calibration settings. Special calibration software and tools are required to make the parallel system function properly with the new, purchased UPS module.

## 4.7 Maintenance

**Warning!**

**Maintenance work must be performed only by a service person with the service training completed.**

One should sign a service and maintenance contract with an authorised local service centre. The maintenance work for parallel UPS system can be done with the system bypass switch.

The good condition of the batteries is crucial to correct operation of the parallel UPS system. Therefore, a battery discharge test is recommended once or twice per year in the preventive maintenance procedure.

The UPS units are provided with the automatic battery test ABM™, which continuously controls the condition of the battery bank. “Battery failure” alarm is activated when the capacity of the battery bank has decreased remarkable from the default value.

### Scrapping

Before scrapping UPS or its battery cabinet, battery bank and the lithium battery on the logic board must be removed. Due to high energy and high voltage, removal of batteries is allowed only for authorised service personnel. Local requirements must be followed in battery recycling or discard.

**WARNING!**


**HAZARDOUS MATERIALS. Batteries may contain HIGH VOLTAGES, and CAUSTIC, TOXIC and FLAMMABLE substances. Batteries can injure or kill people and damage equipment if used improperly. DO NOT DISCARD unwanted batteries or battery material in the public waste disposal system. Follow ALL applicable, local regulations for storage, handling and disposal of batteries and battery materials.**

# 5. Mechanical installation

## 5.1 Overview

Environmental requirements and restrictions described in the technical specification shall be met to guarantee the proper function and safety of the equipment.

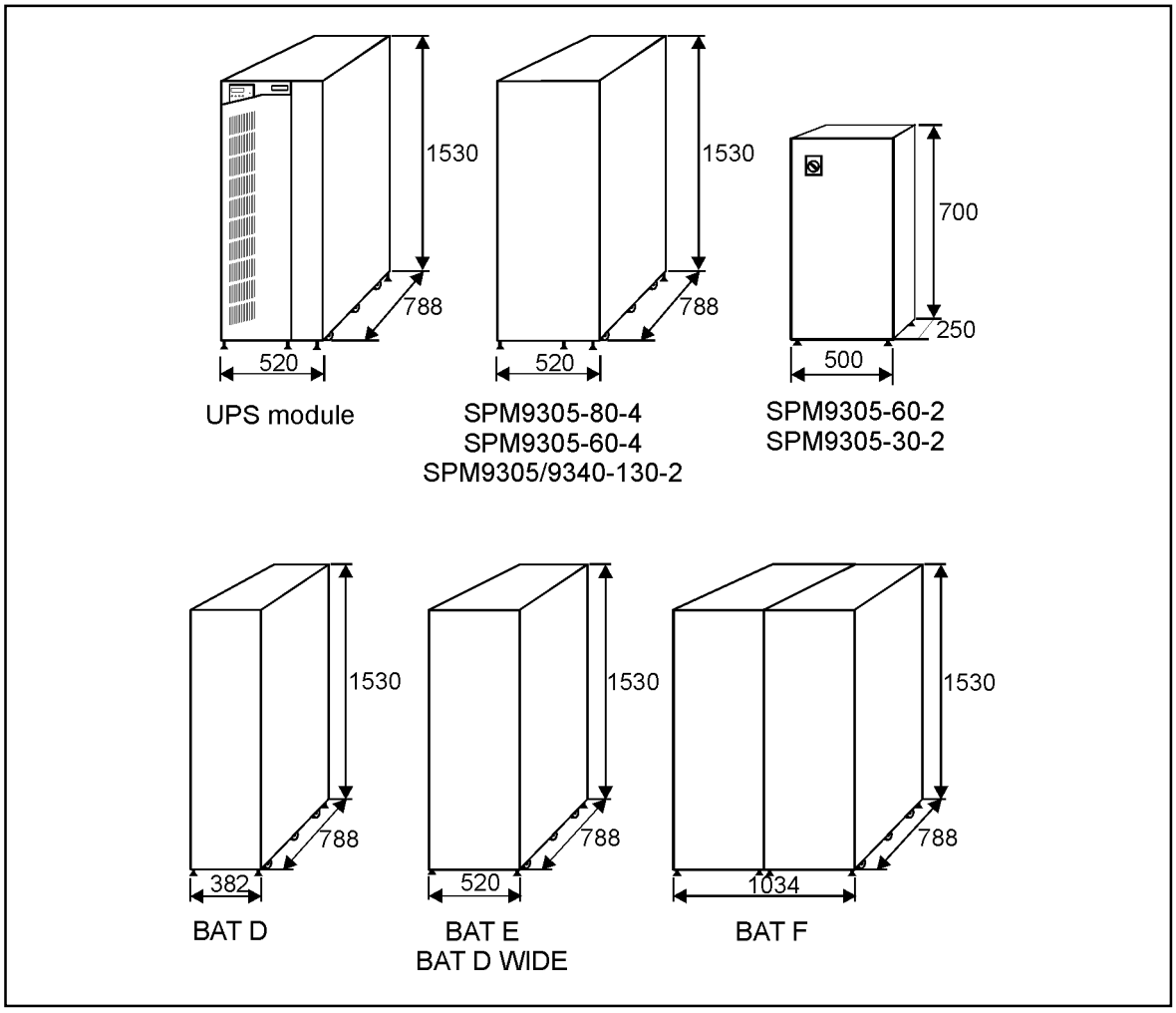



**Figure 5.** Dimensions of the parallel UPS system components.

The installation surface must be smooth and steady to carry the point and distributed loading of the whole parallel UPS system.

| Description | Weight (kg) | Point loading ($kg/cm^2$) | Distributed loading ($kg/m^2$) |
|---|---|---|---|
| 20-30 kVA UPS w/o batteries | 210 | 3,1 | 520 |
| 20-30 kVA UPS with (2x32 pcs.) batteries | 400 | 5,9 | 1265 |
| 20-30 kVA UPS with (2x48 pcs.) batteries | 490 | 7,2 | 1550 |
| 40-60 kVA UPS w/o batteries | 260 | 4,0 | 635 |
| 80 kVA UPS w/o batteries | 280 | 4,3 | 680 |
| SPM9305-60-4 | 210 | 3,1 | 520 |
| SPM9305-80-4 | 280 | 4,1 | 695 |
| SPM9305/9340-130-2 | 280 | 4,1 | 695 |
| SPM9305-60-2 | 50 | 0,7 | 125 |
| SPM9305-30-2 | 50 | 0,7 | 125 |
| External BAT D cabinet | 550 | 8,1 | 1830 |
| External BAT D WIDE cabinet | 580 | 8,5 | 1930 |
| External BAT E cabinet | 815 | 12 | 1990 |
| External BAT F cabinet | 1390 | 10,4 | 1705 |

**Table 1.** The floor loading of the parallel UPS system components.

## 5.2 Placing UPS modules

Maintain 1000-mm clearance at front of the UPS modules for service, user operations, and fire escape safety. Make also sure that free space requirements around UPS modules are met for the cooling air.

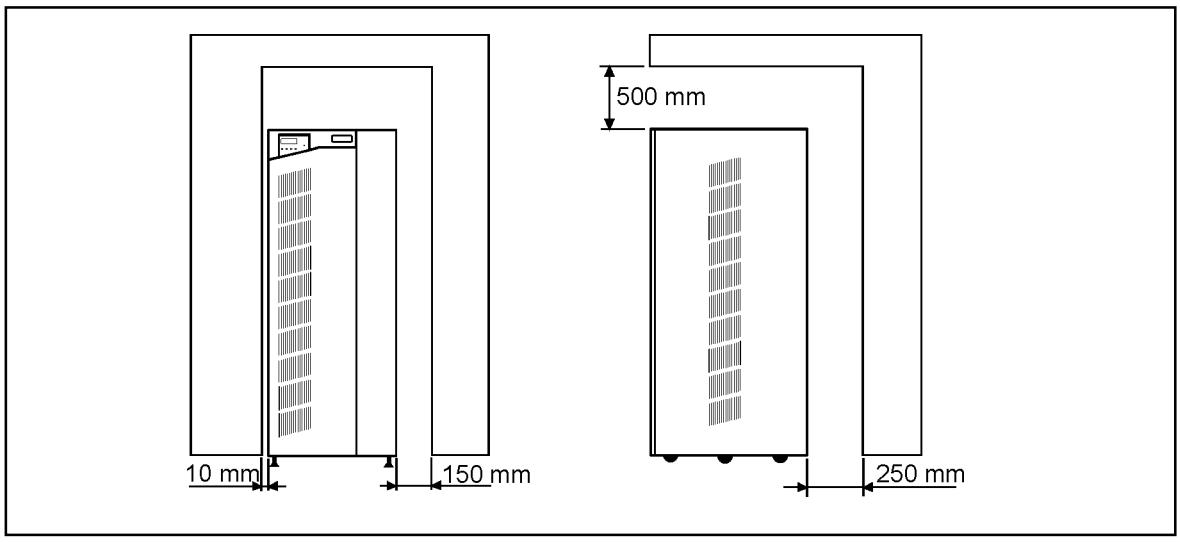



**Figure 6a.** Ventilation and space requirements for 20 - 30 kVA UPS.

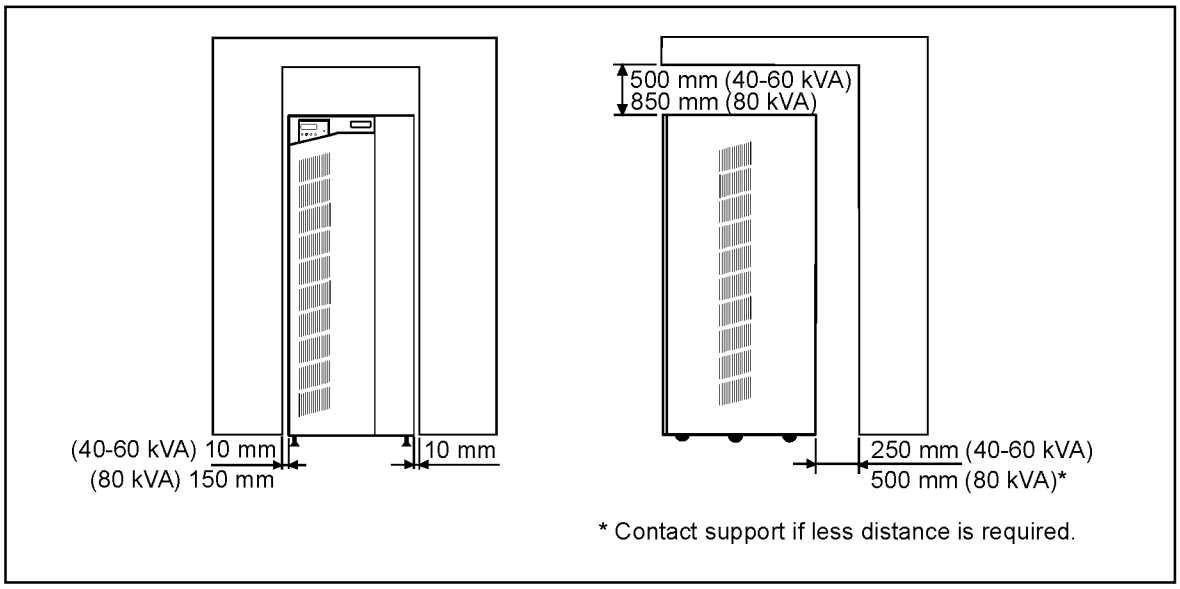



**Figure 6b.** Ventilation and space requirements for 40 - 80 kVA UPS.

Power cables shall be routed from the bottom or rear side of the UPS modules. The cables shall be protected with a casing tube. The size and location of the cable entries is shown in the drawing.

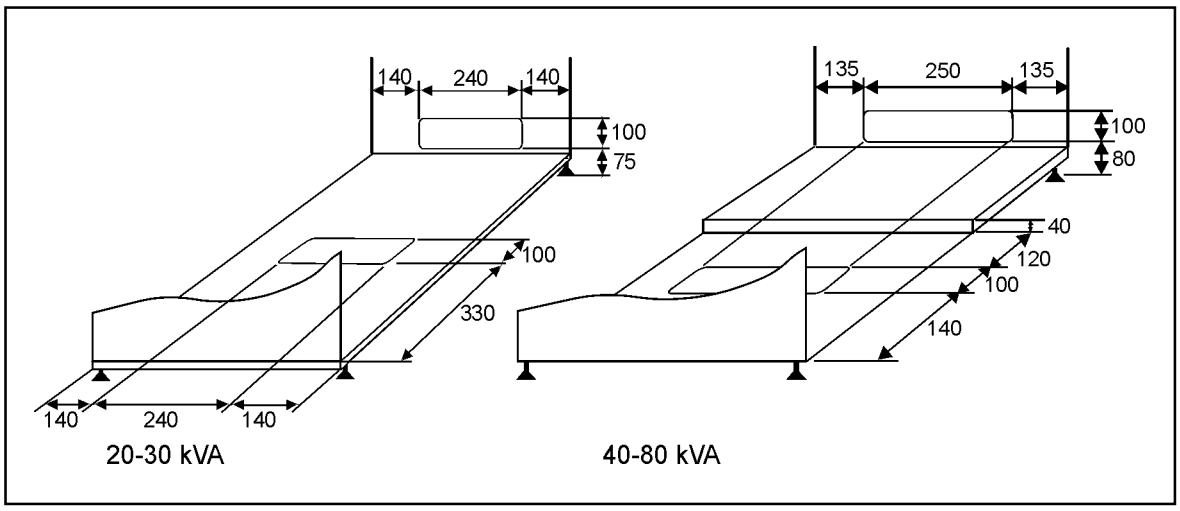



**Figure 7.** Cable entries of UPS modules.

## 5.3 Placing battery cabinets

The detailed installation instructions for the external battery cabinets are included in the shipment. External battery cabinets shall be installed next to the UPS modules and the location of the cable routing is under the external battery cabinets:

- 20-30, 80 kVA UPS modules shall have the external battery cabinets on the left side.
- 40-60 kVA UPS modules shall have the external battery cabinets on the left or right side.

External battery cabinets shall be connected together by using narrow metal plates provided with external battery cabinets. The external battery cabinet shall be connected together without the side plate(s). Hence, remove both side plates if you are connecting an external battery cabinet in the middle of line-up. Do not remove the side plates from the UPS modules.

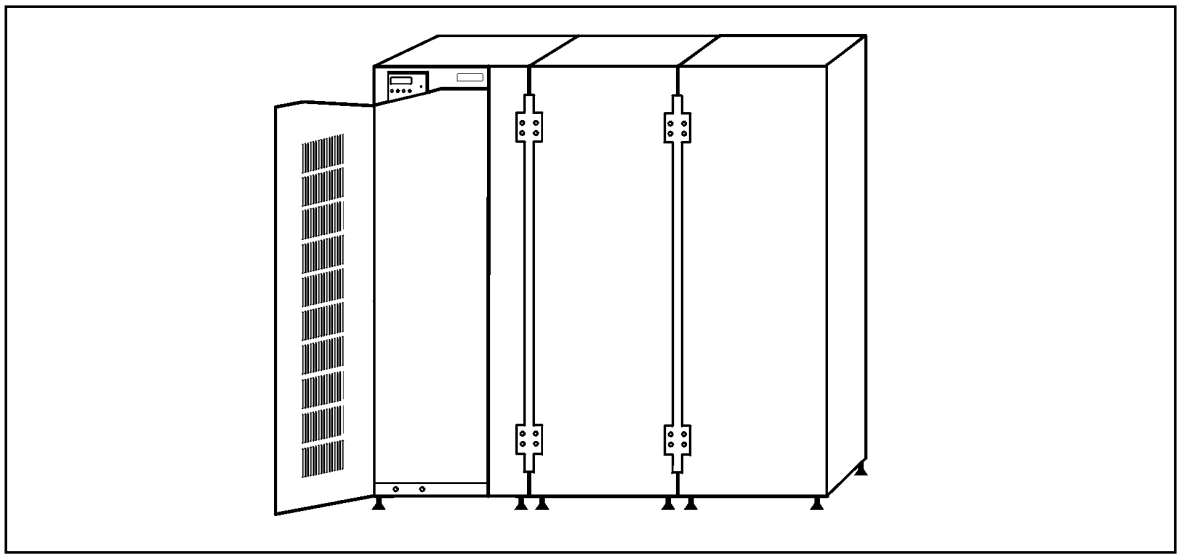


**Figure 8.** An UPS module connected to external battery cabinets with narrow metal plates.

Leave a 10-mm free space between the UPS module and the external battery cabinet by using the narrow metal plates provided with external battery cabinets.

# 6. Electrical installation

## 6.1 Overview

Qualified personnel should do the electrical installation planning of the parallel UPS system in compliance with the warnings laid down in this manual. The inspection and initial start up of the UPS modules and external battery cabinets must be carried out by service engineer from the manufacturer or from an agent authorised by the manufacturer.

**Warning!**

**The UPS system contains high voltage and current that can injure or kill personnel and damage equipment.**

Input and output power cables must be selected according to local regulations and installation environment. The recommendations of this manual can be used as a guideline for the installation and selection of power cables.

## 6.2 Location of terminals

Input and output terminals are located behind the door. A cover plate and a narrow front panel are protecting some of the terminals.

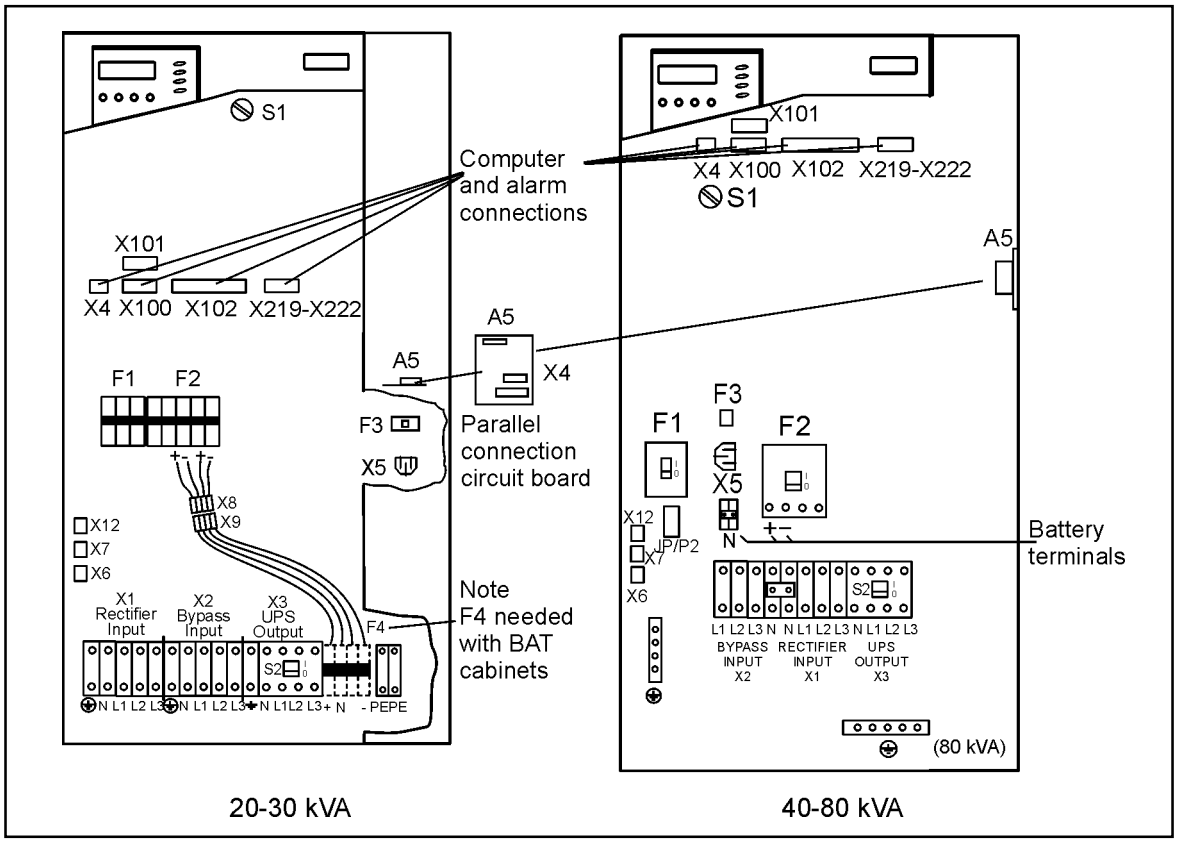



**Figure 9.** Location of terminals in UPS modules.

Cable routing is through the cable entry at the bottom or back of the UPS cabinet. Take care to maintain a safety distance between control and power cables to avoid disturbances caused by high frequency currents.

## 6.3 Input and output power cables

Input terminals X1 and X2 have a five-wire connection (L1, L2, L3, N, and PE) for the rectifier and bypass line. The output terminal X3 is located directly in the circuit breaker. Cables with copper conductors should be used to fit the terminals.

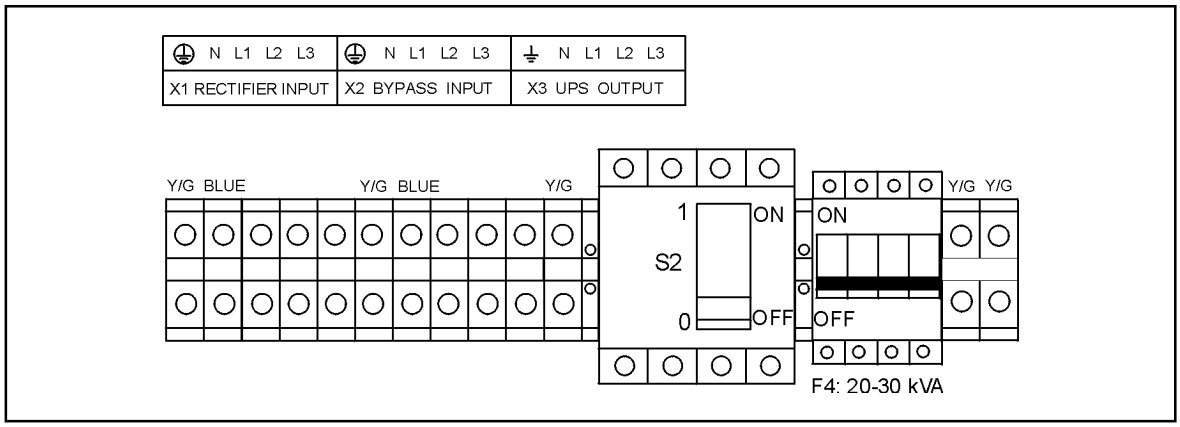



**Figure 10.** Bottom cabinet layout of power terminals.

Slow fuses (gG type) should be used to protect the input cables in case of a short circuit. The fuses should be dimensioned according to local safety regulations, appropriate mains voltage and the rated current of the UPS module. An internal circuit breaker is used to protect the input bridge and power semiconductors.

| UPS rating | Input cable for rectifier/bypass | Input fuse | Output cable |
|---|---|---|---|
| 20 kVA | 16 mm² | 50 A | 16 mm² |
| 30 kVA | 16 mm² | 50 A | 16 mm² |
| 40 kVA | 16 mm² | 63 A | 16 mm² |
| 50 kVA | 25 mm² | 80 A | 25 mm² |
| 60 kVA | 35 mm² | 100 A | 35 mm² |
| 80 kVA | 50 mm² | 125 A | 50 mm² |

**Table 2**. Recommended input/output cables and fuses of parallel UPS modules.

**Note!**
Input and output cables must be of equal length (and type) to quarantine a balanced load distribution in parallel UPS configuration. A great variance in input/output cable lengths (or types) will cause the UPS modules to drop the critical load due to imbalance currents.

## 6.4 Parallel operation

UPS modules have a cable connection between them to inform about the phase synchronism of the bypass voltages. It is needed in order to transfer the critical load back from the bypass line to inverters at the same time. The transfer from inverters to bypass functions without the data bus connection in case of overload situation.

A cable entry is located on rear panel beside the power cable entry. Route the cables behind the narrow front panel to the circuit board A5: X3/X4. The cable is leaving from the terminal X4 on the circuit board A5 and connected to the terminal X3 in the next UPS module. See the figure for correct wiring of the communication bus.

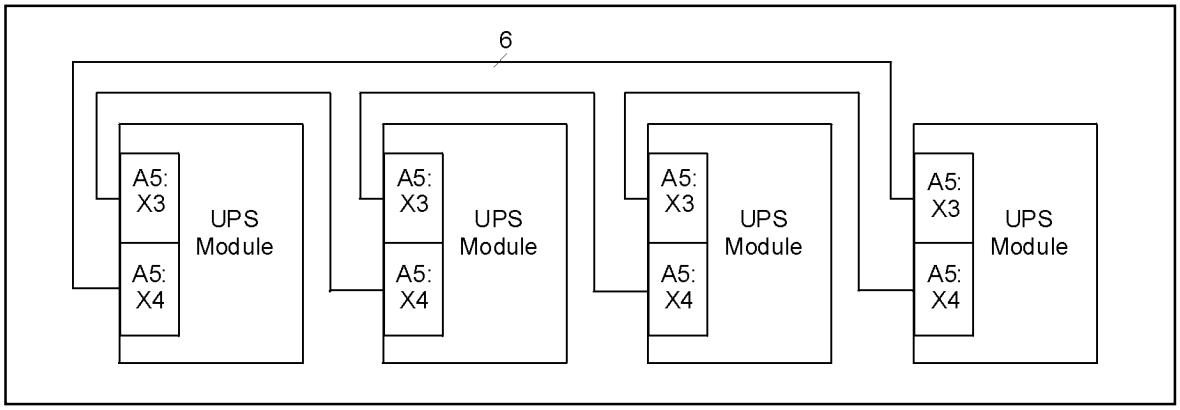



**Figure 11.** Ring topology of the cable connection between UPS modules.

The shield of the parallel information cable has to be grounded to the UPS ground from the one end of the cable only. Connect the cable shield to the grounding screw of the RFI board (20-30 kVA) or the PCB A12 assembly plate (40-80 kVA).

## 6.5 Battery cables

Located behind the door, the external battery connection (+, -, N and PE) is used with BAT D, BAT E and BAT F cabinets.

Each shipment of external battery cabinets includes 16 $mm^2$ power cables for the electrical installation. The electrical installation of external cabinets should be done according to appropriate wiring diagrams.

External battery cabinets also have a temperature measurement sensor that is located under the roof. The temperature information must be linked together when installing several external cabinets. The control cable of temperature measurement sensor should be connected to the male terminal X6 in the UPS module

### Battery configurations with 20-30 kVA UPS modules

An optional battery breaker F4 (p/n: 1014196) is needed with each 20-30 kVA UPS modules if external battery cabinets are used. The breaker includes a four-part X9 plug terminal that is connected to the X8 plug terminal of the UPS module. Be careful with the X8-X9 terminal because it's connected to the internal battery bank and contains high DC voltage.

Power cables should be connected directly to the terminals of battery breaker F4. See the battery wiring diagrams and chapter 'Location of terminals' for the correct power cable connections.

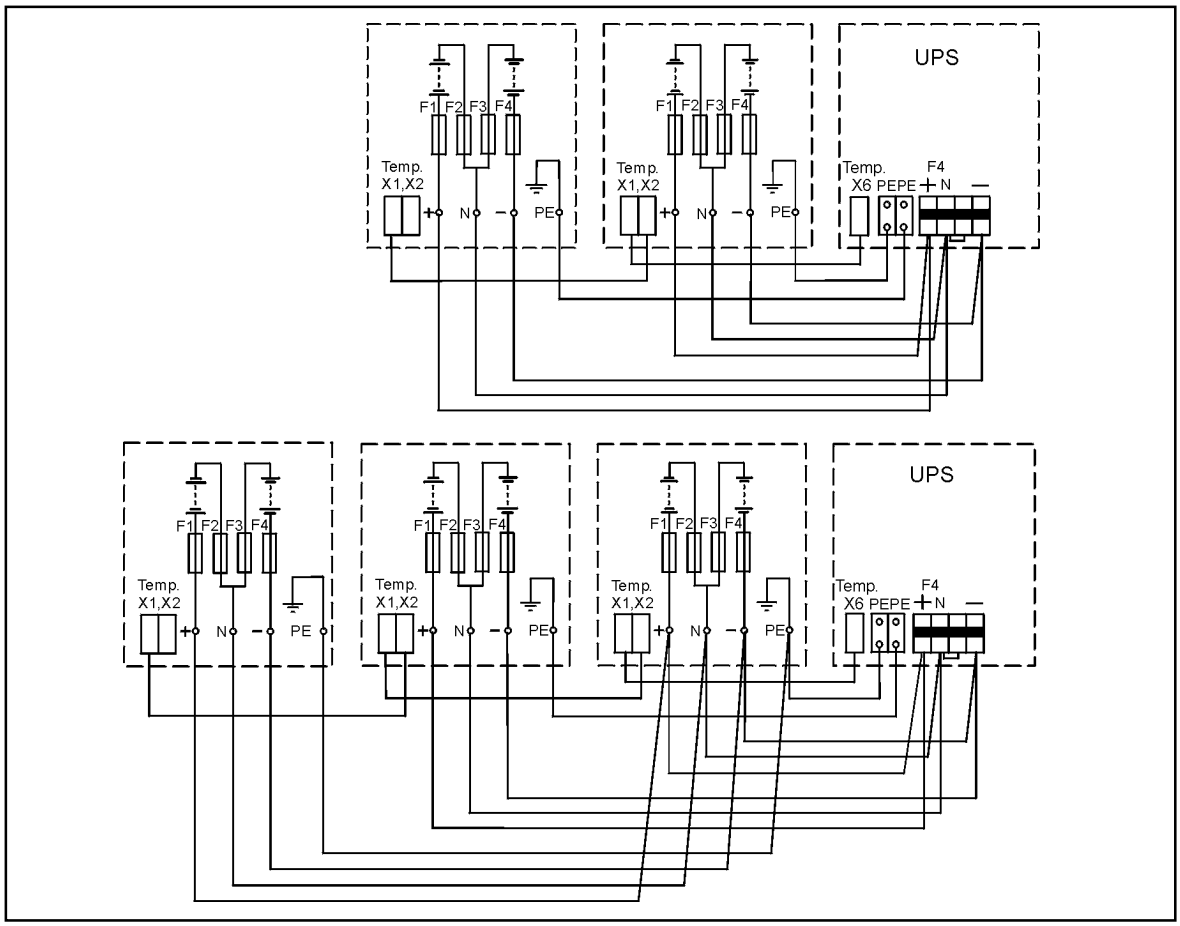



**Figure 12**. Wiring diagram of the external battery cabinets D and E.

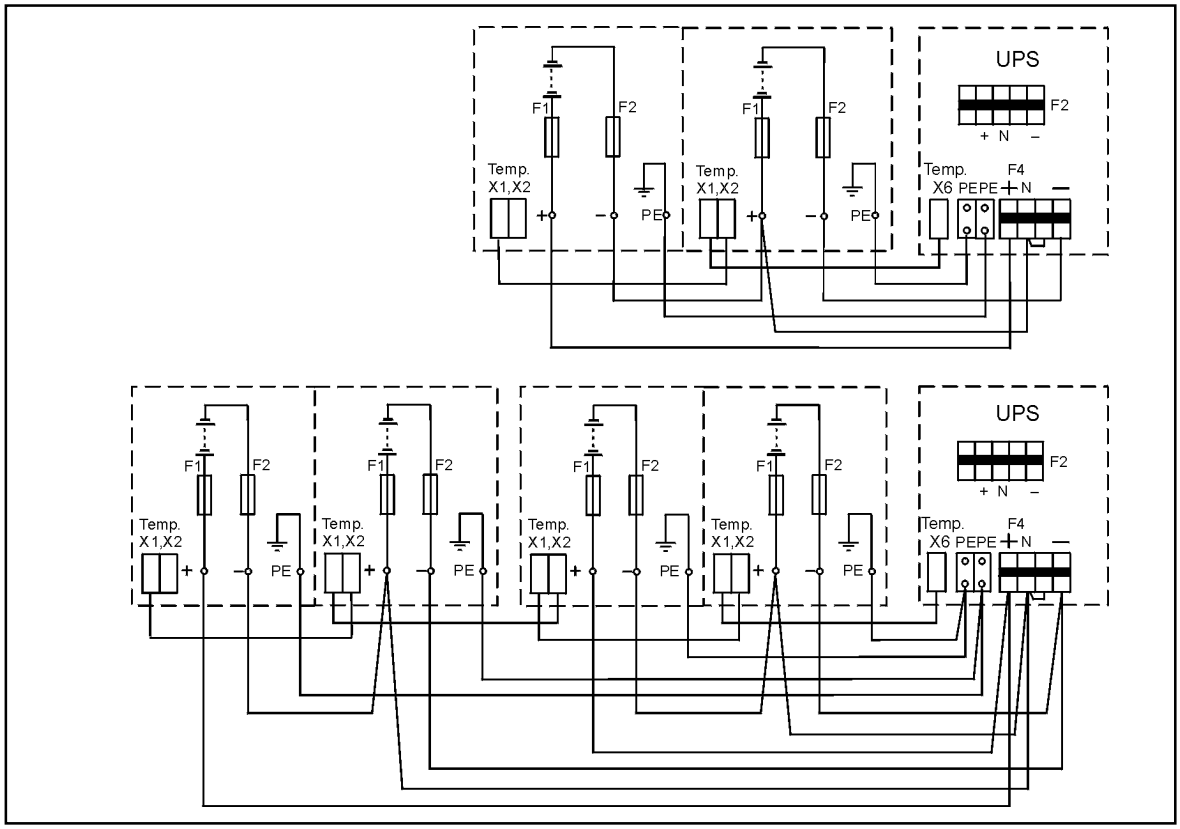



**Figure 13.** Wiring diagram of the external battery cabinet F.

### Battery configurations with 40-80 kVA UPS modules

Power cables should be connected to the battery terminals of the UPS modules. See the battery wiring diagrams and chapter 'Location of terminals' for the correct power cable connections.

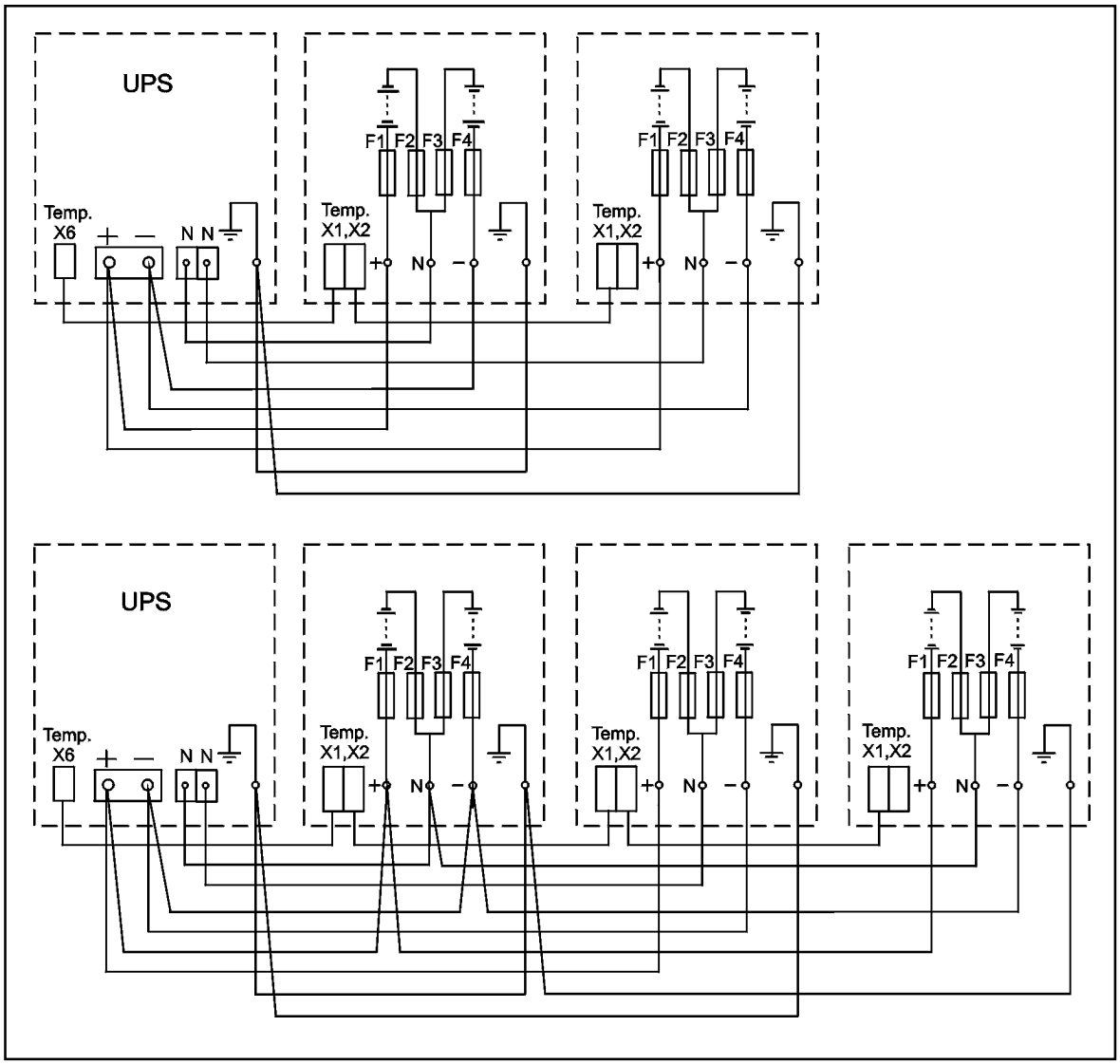



**Figure 14.** Wiring diagram of the external battery cabinets D and E.

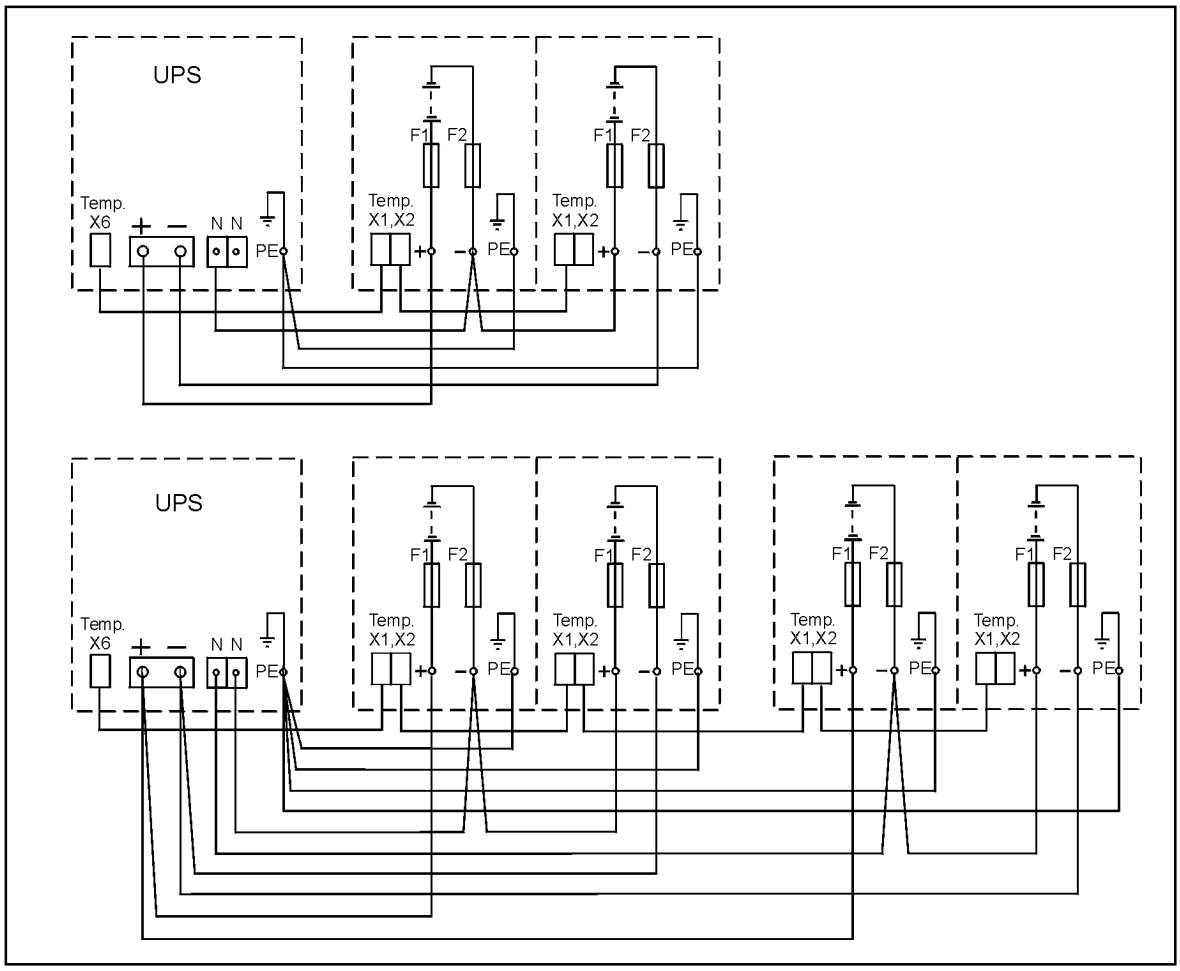



**Figure 15.** Wiring diagram of the external battery cabinets F.

## 6.6 SPM tie cabinet options

The system parallel module (SPM) has input connections up to four or two parallel UPS modules and make-before-brake type of system bypass switch. The UPS manufacturer provides five (5) different types of System Parallel Modules:

| Part nro. | Type | Description |
|---|---|---|
| 1019852 | SPM9305/9340-130-2 | Floor-standing SPM cabinet for 1-2 x UPS 80-130 kVA modules |
| 1019850 | SPM9305-80-4 | Floor-standing SPM cabinet for 1-4 x UPS 60-80 kVA modules |
| 1017978 | SPM9305-60-4 | Floor-standing SPM cabinet for 1-4 x UPS 20-60 kVA modules |
| 1015475 | SPM9305-60-2 | Wall-mounted SPM cabinet for 1-2 x UPS 40-60 kVA modules |
| 1015294 | SPM9305-30-2 | Wall-mounted SPM cabinet for 1-2 x UPS 20-30 kVA modules |

**Table 3.** System Parallel Modules (SPM)

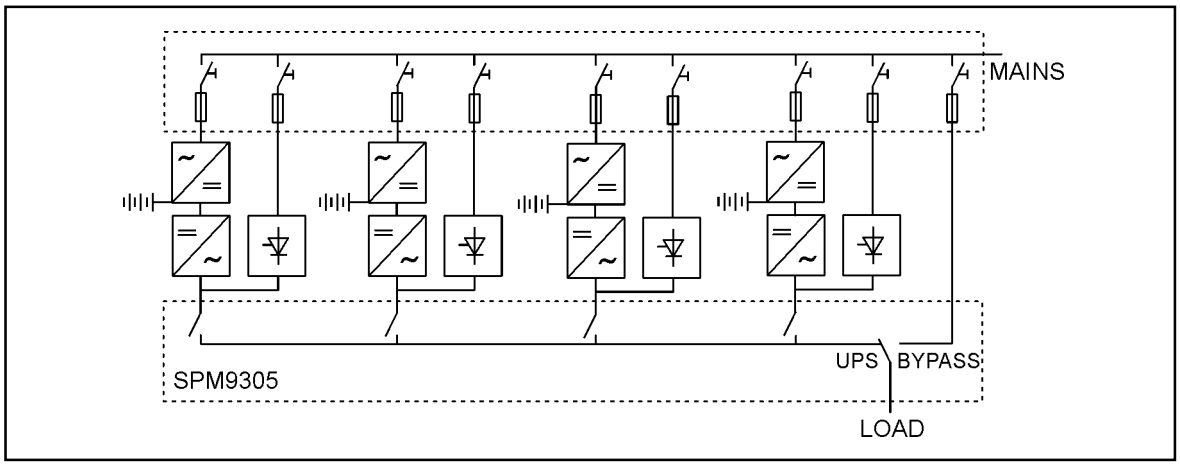



**Figure 16.** A parallel 4 x UPS configuration with the SPM tie cabinet

Local regulations and installation environment shall be considered when selecting power cables and fuses/breakers. The recommendations of this manual can be used as a guideline for the electrical wiring and installation.

Slow gG fuses or C-type breakers should be used for short-circuit protection of the power cables. The electrical installation shall be dimensioned according to local safety regulations, appropriate mains voltage and the rated current of the load.

**Notice!**

Pay attention to the correct phase order when connecting the UPS output and system bypass cables to the SPM tie cabinet. Phases L1, L2 and L3 must be in the same order when transferring the load to the system bypass. The correct phase rotation is not enough to prevent UPS hardware damages. Make also sure that the neutral cable is properly connected in all terminals.

### SPM9305/9340-130-2, SPM9305-80-4 and SPM9305-60-4 tie cabinets

The SPM tie cabinet provides the UPS connection terminals for the shared load bus. It also enables the make-before-break transfer of the load to the system bypass. This can be used for service or test purposes.

The available SPM tie cabinets have the following maximum power ratings:

| Type | UPS rating | Bypass rating | System voltage |
|---|---|---|---|
| SPM9305/9340-130-2 | 1-2 pcs. x 130 kVA | 260 kVA | 400/230 V, 50 or 60 Hz |
| SPM9305-80-4 | 1-4 pcs. x 80 kVA | 320 kVA | 400/230 V, 50 or 60 Hz |
| SPM9305-60-4 | 1-4 pcs. x 60 kVA | 240 kVA | 400/230 V, 50 or 60 Hz |

X2 and X4 input terminals have a five-wire connection (L1, L2, L3, N, and PE). Power cables with copper conductors should be used to fit the terminals. The wiring shall be done according to the wiring diagram. The terminals and cable routing is shown it the figure below.

Auxiliary contact information of the system bypass switch enables a safe transfer of the load. Pay attention that the signal cable of the bypass switch aux. contact is wired correctly to the UPS modules: the polarity of the signal must be the same for all parallel connected UPS modules because the signal sensing is done against the ground.

**Notice!**

UPS modules should get a minimum of 10 ms leading closed-contact signal when the system bypass switch is turned from UPS to BYPASS position.

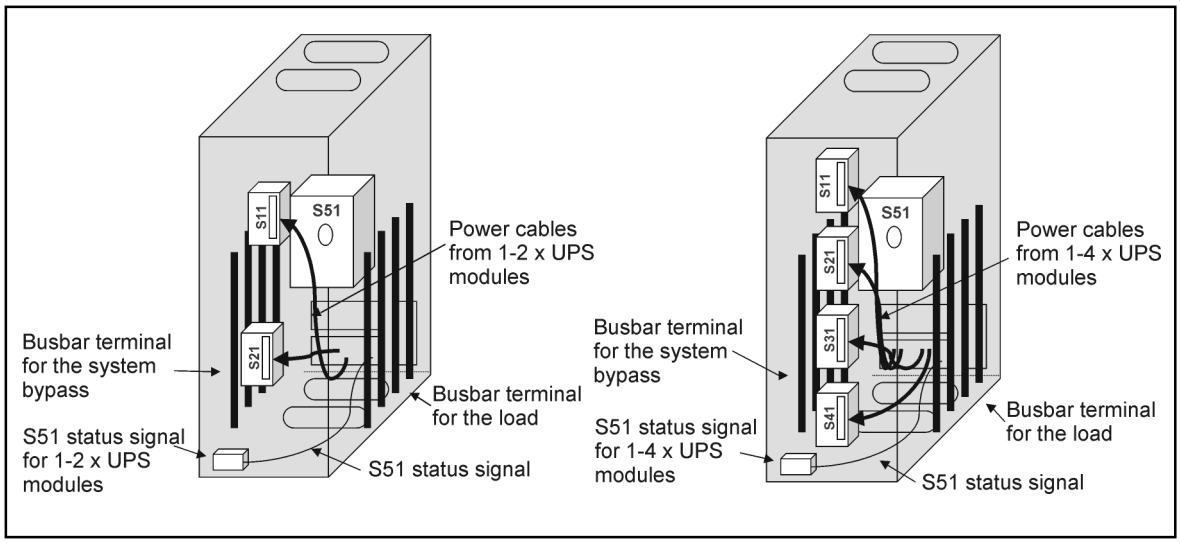



**Figure 17.** Cable routing of SPM9305/9340-130-2 and SPM9305-80-4 tie cabinets.

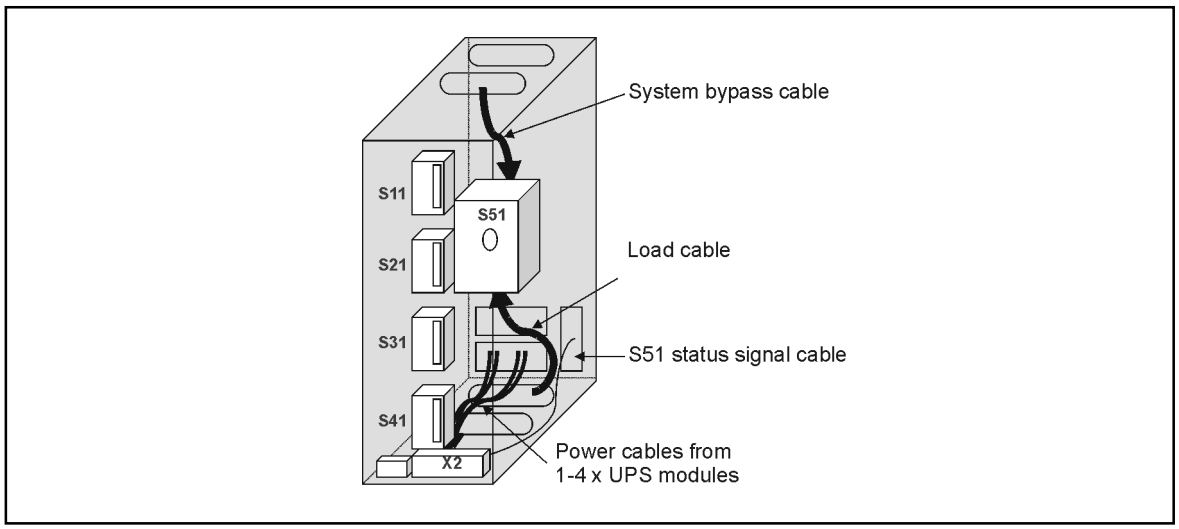



**Figure 18.** Cable routing of SPM9305-60-4 tie cabinets.

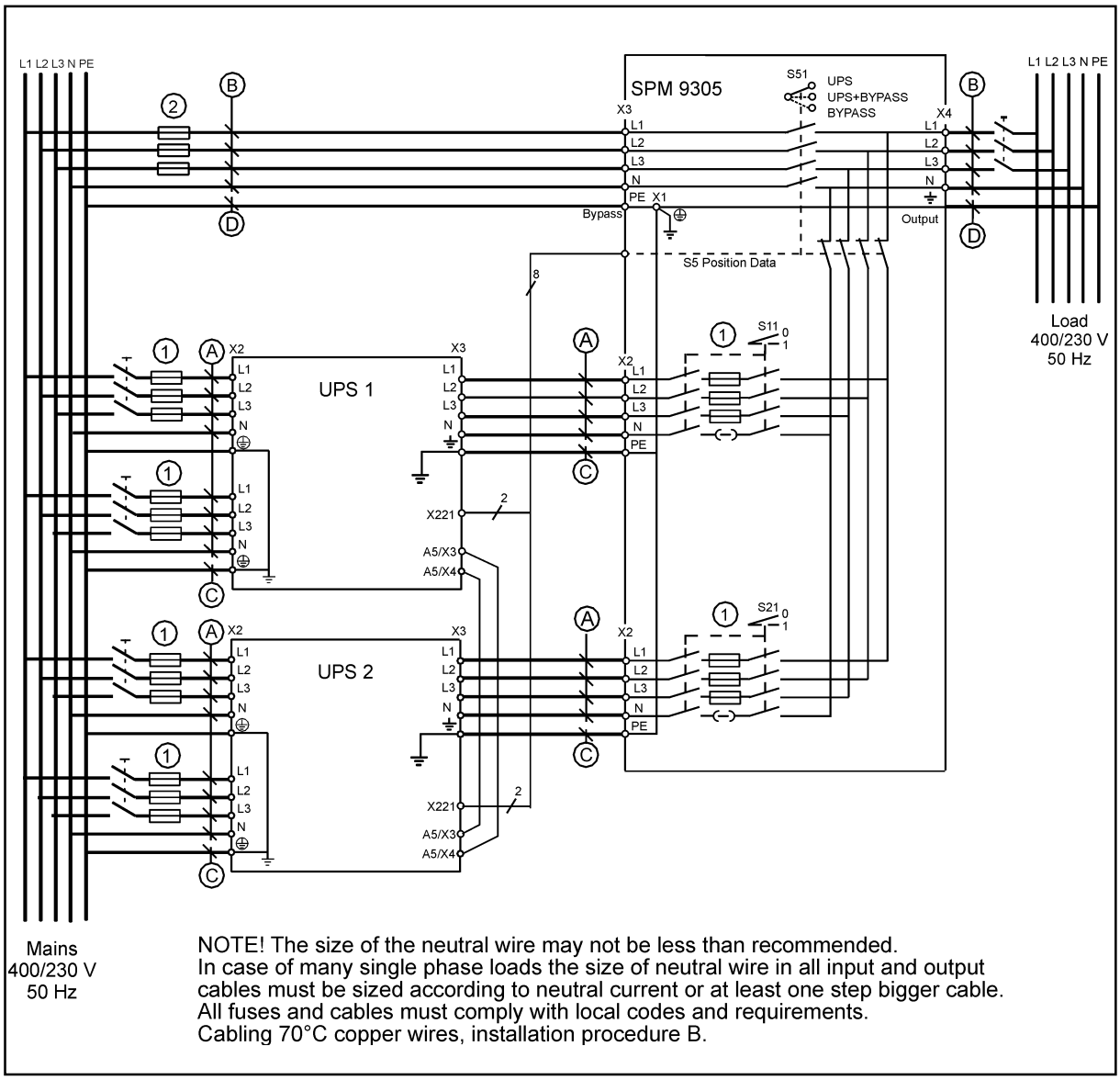



**Figure 19.** Wiring diagram with SPM9305/9340-130-2 tie cabinet.

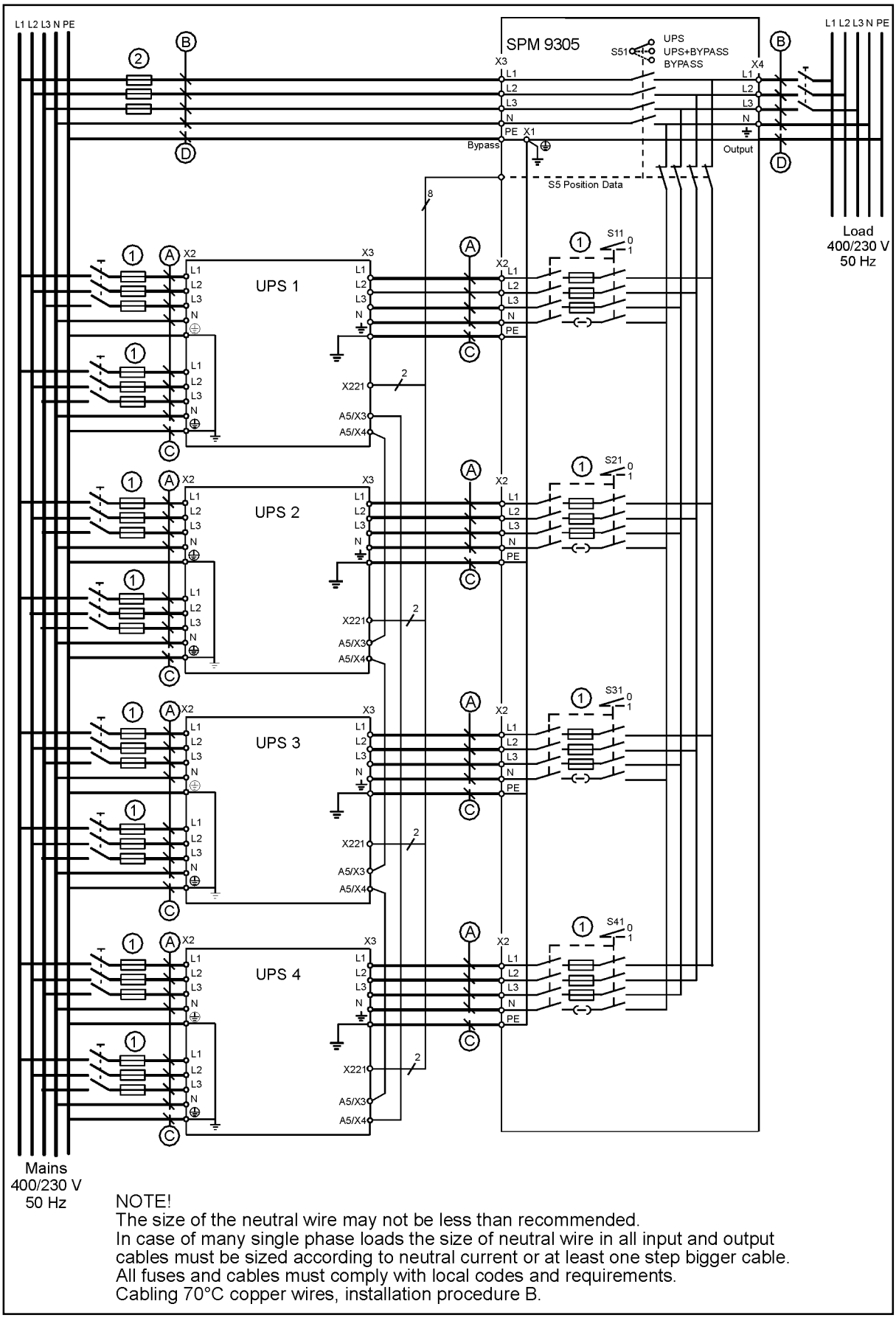



**Figure 20.** Wiring diagram with SPM9305-60-4 and SPM9305-80-4 tie cabinets.

| UPS module | Cable A | Cable C | Fuse 1 |
|---|---|---|---|
| 20 kVA | 16 mm² | 16 mm² | 50 A |
| 30 kVA | 16 mm² | 16 mm² | 50 A |
| 40 kVA | 16 mm² | 16 mm² | 63 A |
| 50 kVA | 25 mm² | 16 mm² | 80 A |
| 60 kVA | 35 mm² | 16 mm² | 100 A |
| 80 kVA | 50 mm² | 25 mm² | 125 A |
| **SPM 9305 module** | **Cable B** | **Cable D** | **Fuse 2** |
| 20 kVA | 16 mm² | 16 mm² | 50 A |
| 30 kVA | 16 mm² | 16 mm² | 50 A |
| 40 kVA | 16 mm² | 16 mm² | 63 A |
| 50 kVA | 25 mm² | 16 mm² | 80 A |
| 60 kVA | 35 mm² | 16 mm² | 100 A |
| 80 kVA | 50 mm² | 25 mm² | 125 A |
| 90 kVA | 70 mm² | 35 mm² | 160 A |
| 100 kVA | 95 mm² | 50 mm² | 200 A |
| 120 kVA | 95 mm² | 50 mm² | 200 A |
| 150 kVA | 120 mm² | 70 mm² | 250 A |
| 160 kVA | 150 mm² | 95 mm² | 250 A |
| 180 kVA | 185 mm² | 95 mm² | 315 A |
| 200 kVA | 185 mm² | 95 mm² | 315 A |
| 240 kVA | 240 mm² | 150 mm² | 400 A |
| 320 kVA | 2 x 150 mm² | 150 mm² | 2 x 250 A or 500 A |

**Table 4.** Recommended cables and fuses for the wiring diagrams.

### SPM9305-60-2 and SPM9305-30-2 tie cabinets

The SPM tie cabinet provides the UPS connection terminals for the shared load bus. It also enables the make-before-break transfer of the load to the system bypass. This can be used for service or test purposes.

The available SPM tie cabinets have the following maximum power ratings:

| Type | UPS rating | Bypass rating | System voltage |
|---|---|---|---|
| SPM9305-60-2 | 1-2 pcs. x 60 kVA | 120 kVA | 400/230 V, 50 or 60 Hz |
| SPM9305-30-2 | 1-2 pcs. x 30 kVA | 60 kVA | 400/230 V, 50 or 60 Hz |

X2 and X4 input terminals have a five-wire connection (L1, L2, L3, N, and PE). Power cables with copper conductors should be used to fit the terminals. The wiring shall be done according to the wiring diagram. The terminals and cable routing is shown it the figure below.

Auxiliary contact information of the system bypass switch enables a safe transfer of the load. Pay attention that the signal cable of the bypass switch aux. contact is wired correctly to the UPS modules: the polarity of the signal must be the same for all parallel connected UPS modules because the signal sensing is done against the ground.

**Notice!**

UPS modules should get a minimum of 10 ms leading closed-contact signal when the system bypass switch is turned from UPS to BYPASS position.

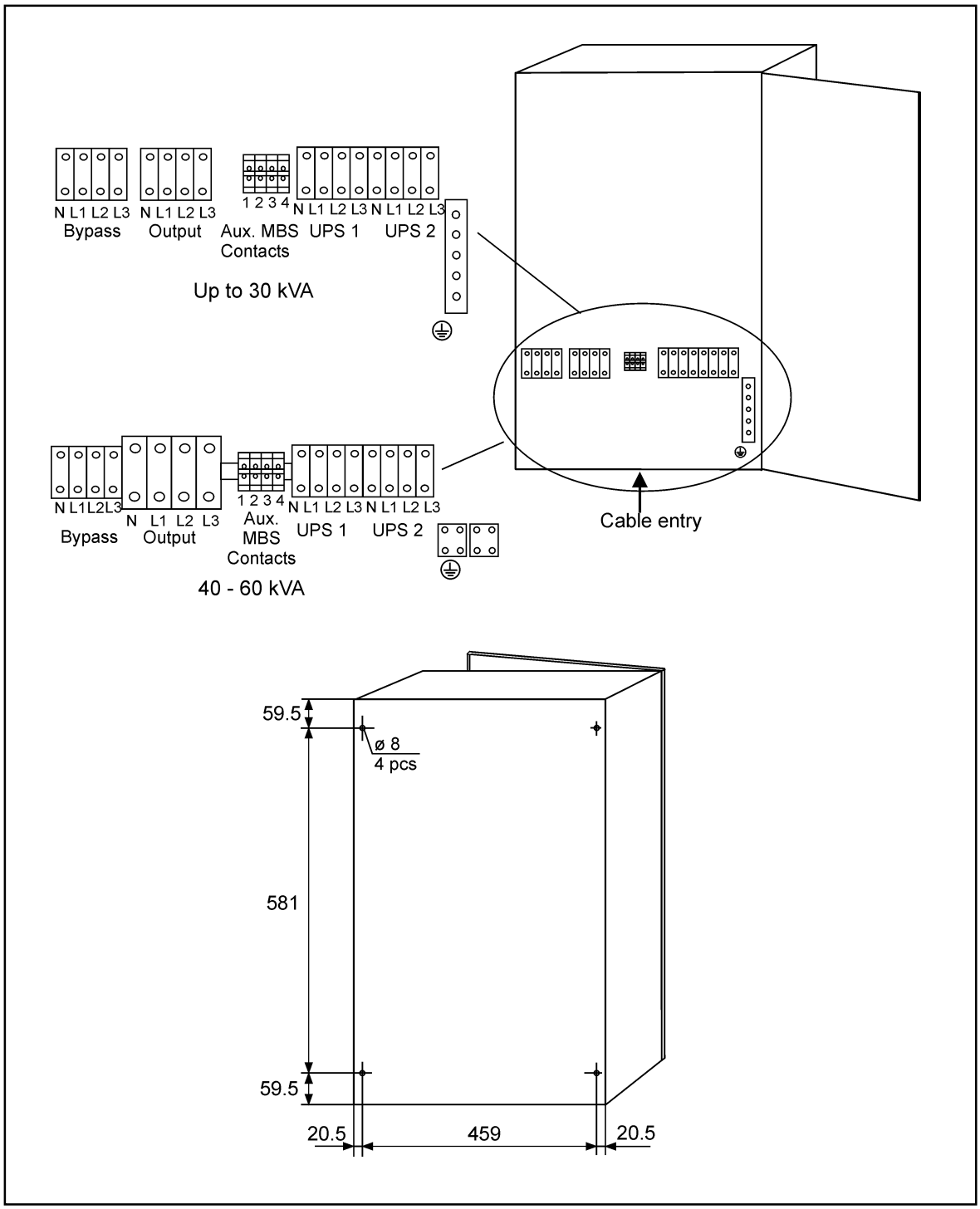



**Figure 21 .** Cable routing and mounting holes for SPM9305-60-2 and SPM9305-30-2 tie cabinets.

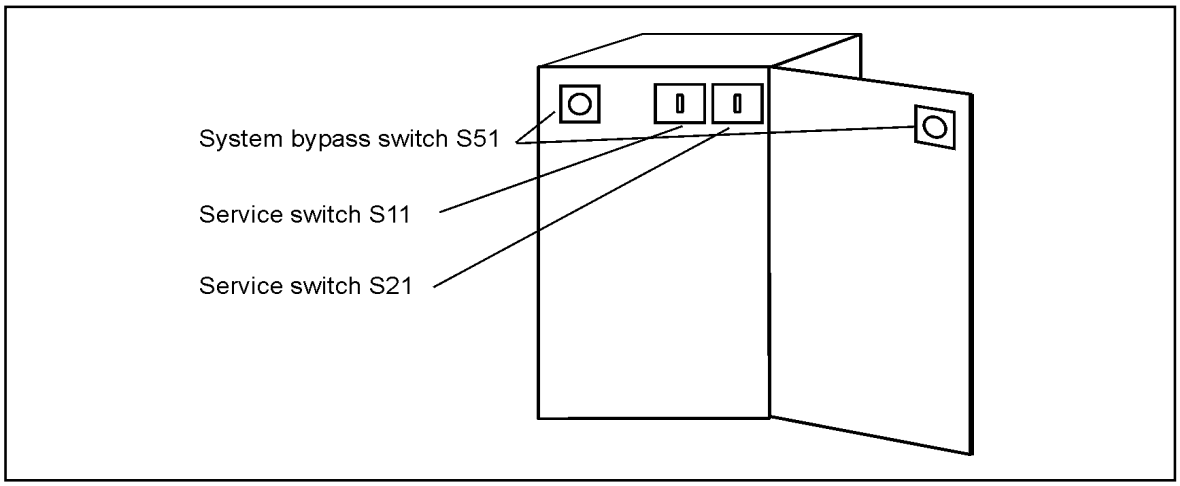



**Figure 22.** Location of SPM9305-60-2 and SPM9305-30-2 control switches.

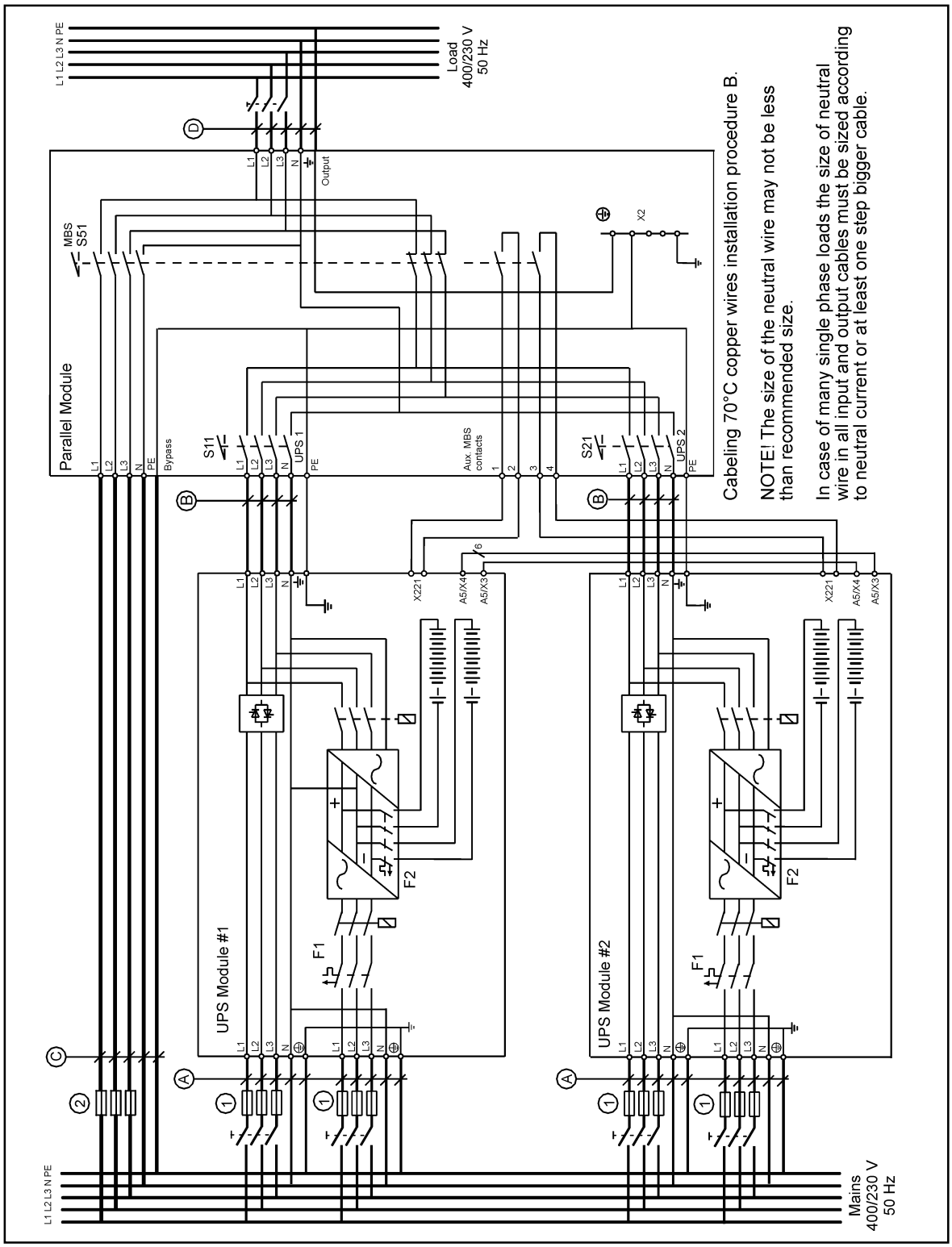



**Figure 23.** Wiring diagram with SPM9305-30-2 tie cabinet.

| Power | Fuse 1 | Fuse 2 | Cable A/B | Cable C/D |
|---|---|---|---|---|
| 20 kVA | 50 A | 63 A | 16 mm² | 16 mm² |
| 30 kVA | 50 A | 100 A | 16 mm² | 35 mm² |

**Table 5.** Recommended cables and fuses for the wiring diagram.

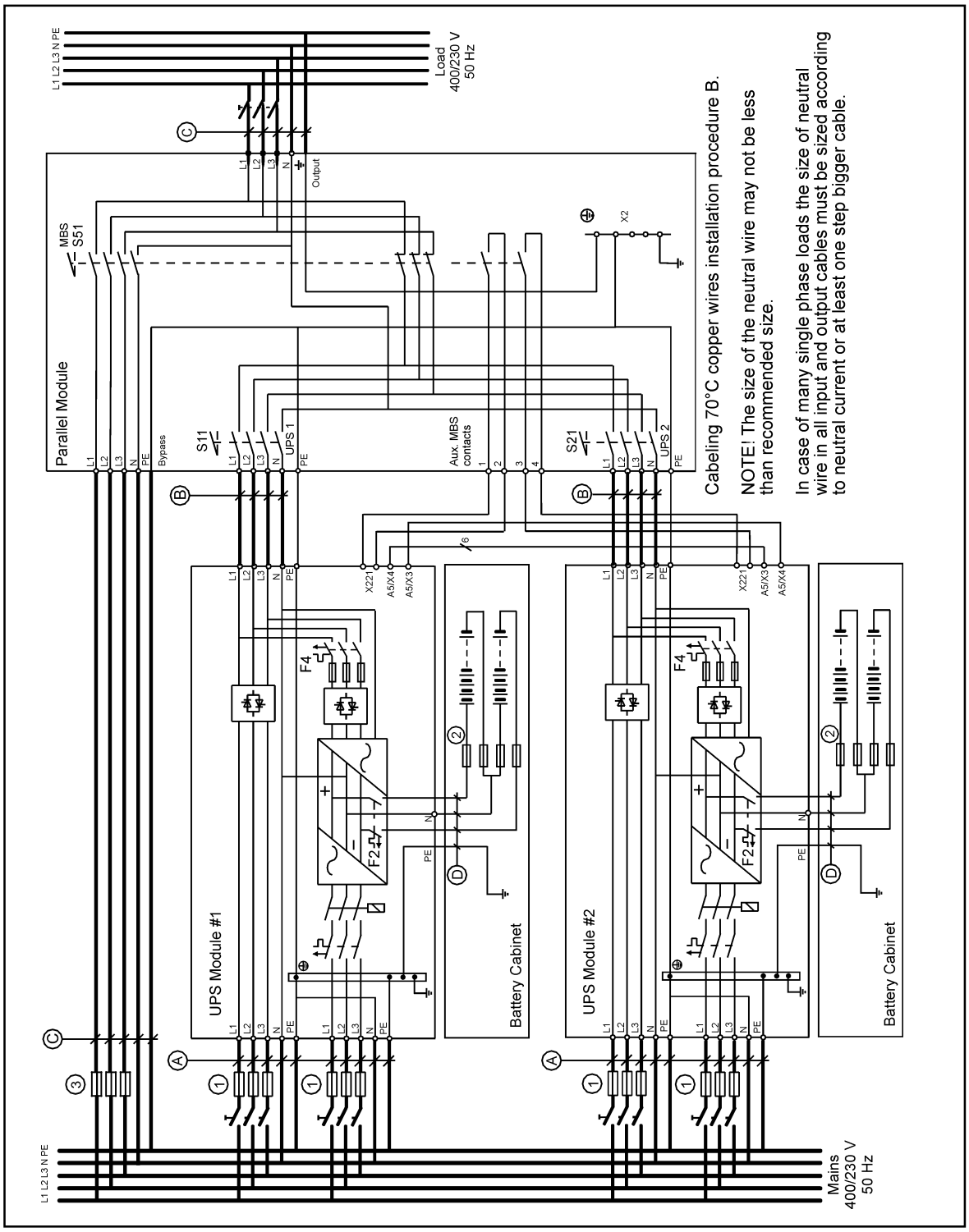



**Figure 24.** Wiring diagram with SPM9305-60-2 tie cabinet.

| Power | Fuse 1 | Fuse 2 | Fuse 3 | Cable A/B | Cable C | Cable D |
|---|---|---|---|---|---|---|
| 40 kVA | 63 A | 100 A | 125 A | 16 mm² | 50 mm² | 16 mm² |
| 50 kVA | 80 A | 100 A | 200 A | 25 mm² | 70 mm² | 16 mm² |
| 60 kVA | 100 A | 100 A | 200 A | 35 mm² | 95 mm² | 16 mm² |

**Table 6.** Recommended cables and fuses for the wiring diagram.

### Local tie panel solutions

The internal wiring diagrams of SPM9305 tie cabinets can be used as a reference when designing local tie panels.

Parallel UPS configurations require a tie panel at the system output. It must facilitate service switches for each UPS module output. The system bypass switch is optional but helps when doing the maintenance for the whole parallel UPS system.

It's recommend to source cabinet, cables, busbars, terminals, fuses, switches and breaker components from the local market. If needed, standard SPM9340 components can be ordered as spare parts from the UPS manufacturer.

**Notice!**
The operational function of the S51 system bypass switch or equivalent breaker system must be following:

1. The system bypass switch S51 is turned from "UPS" to "UPS+BYPASS" position.
2. Auxiliary contacts provide 10 ms leading signal with a closed contact
3. One should check from the LCD panels that UPS modules are not unsyncronised and the signal wiring polarity is correct.
4. All parallel UPS modules receive the auxiliary contact signal simultaneously and firmware transfers the UPS modules to internal bypass.
5. Now, the S51 system bypass switch is in "UPS+BYPASS" position. The UPS and BYPASS power lines are in parallel and supply the load. The parallel UPS modules still receive the auxiliary contact signal, thus, forcing the UPS modules to internal bypass lines.
6. Turn S51 bypass switch to "BYPASS" position. As a result, the system bypass line is alone supplying the load.
7. Load switches S11/S21/S31/S41 can be opened to do the maintenance in the parallel UPS system.

## 6.7 Input filter option

The terminal X7 provides a temperature sensor connection for the 10% THDi input filter. This terminal is located beside the input/output power terminals.

For more information see the installation instructions manual for the input filter option.

## 6.8 Installation check list

1. Check that electrical connections to the installation site have been properly executed.

2. Check that input cables from a low-voltage switchgear are connected to the UPS modules and the system parallel panel. Make sure that the neutral of UPS input is properly connected.

   A readily accessible disconnect device with a contact separation of at least 3 mm is mandatory in the fixed input wiring of UPS modules. Use fuses or miniature circuit breakers to protect cables from a short circuit.

3. Check that the output cables of UPS modules are connected to the system tie panel. Pay a special attention to the correct phase order because the system bypass and UPS modules must have the same order of L1, L2 and L3 phases.

4. Check that the contact information of the system bypass switch is properly connected to all UPS modules. Make sure the polarity of the information is correct. Cables are delivered with the UPS modules.

5. Check that the parallel information cable between UPS modules has been properly connected in a ring configuration. Cables are delivered with the UPS modules.

6. Since the UPS does not have automatic backfeed isolation a warning label must be added on all primary power isolators installed remote from the UPS area to warn electrical maintenance personnel that the circuit feeds a UPS. The warning label shall carry the following wording or equivalent: ”ISOLATE UNINTERRUPTIBLE POWER SYSTEM (UPS) BEFORE WORKING ON THIS CIRCUIT.”

The UPS system should be now connected to the mains and to the load but there is no power.

# 7. Communication interfaces

## 7.1 Overview

A single UPS module sends information about mains, load, and internal operation and status. The information can be used in a computer to ensure a total protection of the critical software and data. It is available in two RS232 serial communication ports, four potential free relay outputs and four signal inputs. These communication interfaces are located behind the door.

UPS modules are provided with a 230 VAC power supply (terminal X5) for use with internal modem or portable computer. This power supply is protected with an automatic 10 A fuse F3.

UPS modules are delivered with the relay adapter circuit board that converts the 16-pin relay interface X102 to a 15-pin male D-sub terminal. It is used together with options such as ‘Remote Status Panel’ and ‘Alarm Extension Unit’.

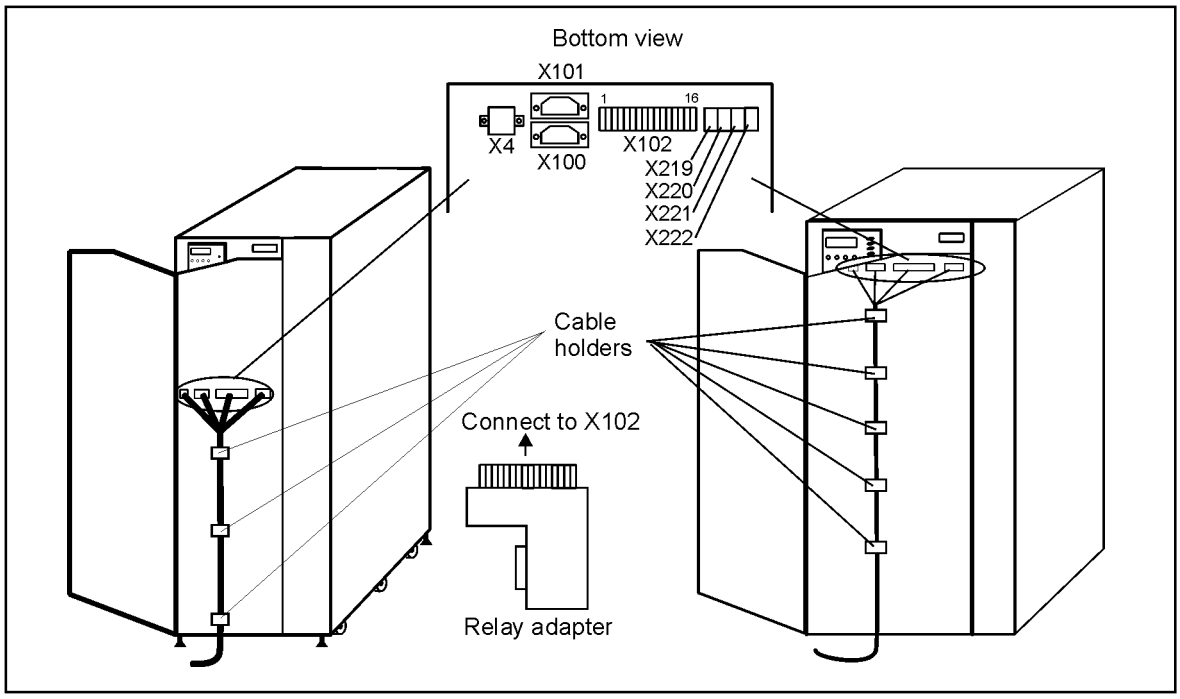



**Figure 25.** Location of terminals in 20/30 kVA (left) and 40/50/60 kVA (right) UPS modules. Cable holders should be used for routing to the terminals.

Note!
**All communication connections must not have a galvanic connection to any mains connected circuits. Reinforced insulation to the mains is required for equipment and cables connected to these connections.**

## 7.2 Software

UPS modules are designed to comply with LanSafe III and PowerVision software. Optional software solution packages are delivered with communication devices for complete power management. The pin configuration of the serial port should be verified if an unknown software is connected to the UPS modules.

Software can control or monitor UPS modules individually, not as a parallel system. Check from the software documentation that the platform running on your computer is supported. Use no other than the communication cable provided with the package to connect the UPS modules to a computer.

Please contact your local dealer if you are interested in special operating systems, SNMP and more advanced power protection solution combinations.

## 7.3 RS-232 serial communication

The RS232 interface on terminal X100 uses a 9-pin female D-sub connector. It is used for connecting a computer to the UPS module. The data includes information about the utility, load and the status of the UPS module.

| | |
|---|---|
| Pin 1 | Received data |
| Pin 2 | Transmitted data |
| Pin 4 | Signal ground |
| Pin 8 | + 12 V unregulated |
| Pin 9 | UPS ground |

**Table 7.** RS-232 connection (X100) for the computer, 9-pin female D-sub.

The RS-232 interface on terminal X101 uses a 9-pin male D-sub connector. It is used for connecting a modem (or a computer) to the UPS module. The data includes information about the utility, load and the status of the UPS module.

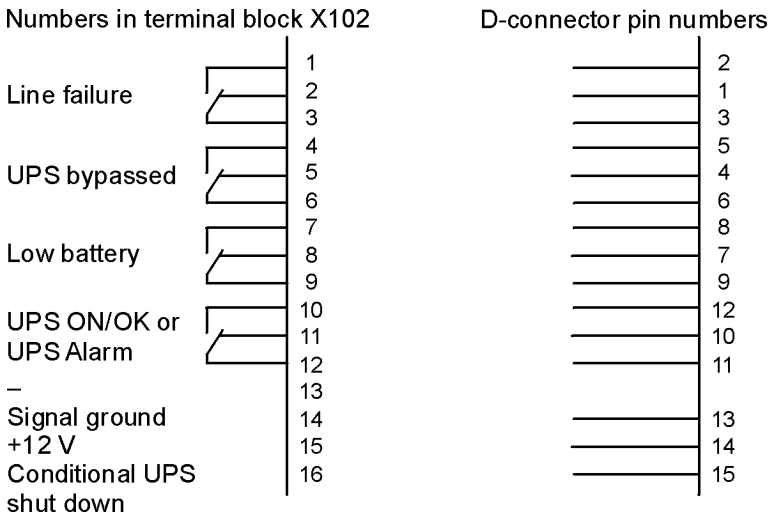
| | |
|---|---|
| Pin 1 | Data carrier detected |
| Pin 2 | Received data |
| Pin 3 | Transmitted data |
| Pin 4 | Data terminal ready |
| Pin 5 | Signal ground |
| Pin 7 | Ready to send |

**Table 8.** RS-232 connection (X101) for the modem, 9-pin male D-sub.

## 7.4 Potential free relay outputs

UPS modules have four potential free relays on terminal X102 with a maximum rating of 1A / 30VAC or 0.2A / 60VDC. They have a complete galvanic isolation from the other UPS circuits according to IEC60950 and EN50091-1. It is recommended that the relay output signals run as twisted pairs.

The relay interface includes the Pin 16, which is the UPS module shutdown input. It is active only when the UPS is in battery operation. A high level signal for 5 seconds is needed to turn off the UPS until proper voltage returns.




| | Pin numbers connected | System state |
|---|---|---|
| Line failure | 2 - 3<br>1 - 3 | Line ok<br>Line failure |
| UPS bypassed | 4 - 6<br>5 - 6 | Inverter supply<br>Bypass supply |
| Low battery | 8 - 9<br>7 - 9 | Battery normal<br>Battery low |
| UPS on/ok or<br>UPS Alarm | 10 - 12<br>11 - 12 | UPS on/ok<br>UPS alarm |

**Figure 26.** Potential free relay output connection (X102) for UPS module information.

## 7.5 Signal inputs

The programmable auxiliary inputs are used to control the operation of UPS modules. A double shielded cable is the best alternative but single shielded twisted multipair cable is also usable. Remember that signals should not have a galvanic connection to any mains connected circuits.

### Emergency Power Off (EPO)

The emergency shut down wiring is connected to the terminal X4 with maximum resistance of 10 ohm. It can also be used for a remote shut down in the event of a room overtemperature by thermal relay. EPO terminals must not be connected in series with the parallel system configuration. Internal EPO circuits require a galvanic isolation of the signals.

The terminal X4 is a 'normally closed' type of connection. Hence, the logic circuitry will immediately shut down the UPS module when the connection is open. The terminal X4 has to be shorted to keep the UPS module running. A manual start is needed to make the UPS module run again after the emergence power off mode.

### Generator On

Auxiliary contact wires of a generator control device are connected to the terminal X219. It is used for inhibiting the transfer to static bypass line when the UPS module is supplied from an unstable AC source. The information has to be connected to all parallel UPS modules.

The terminal X219 is a 'normally open' type of connection. Hence the logic circuitry will prevent the transfer to unstable power source when the connection is closed. UPS modules are delivered the connection open on the terminal X219.

### Remote Output On/Off

The remote output on/off wiring is connected to the terminal X220. It can be used to turn off the UPS module output from a distance.

The terminal X220 is a 'normally open' type of connection. Hence the logic circuitry will turn off the inverter when the connection is closed. In order to turn on the inverter the connection between these pins has to be open.

### System Bypass Switch

The auxiliary contact wiring of the system bypass switch is connected to the terminal X221. The information has to be connected to all parallel UPS modules. Make sure that the polarity of the auxiliary contact wiring is the same for all UPS modules.

In parallel UPS systems this signal must be connected to the auxiliary contact information of the system bypass switch in the tie panel.

The terminal X221 is a 'normally open' type of connection. Hence the logic circuitry will transfer the UPS modules to internal bypass line when the connection is closed.

### Environment Alarm

The building alarm wiring is connected to the terminal X222. For example, it can be used for overtemperature or smoke detector alarms.

The terminal X222 is a 'normally open' type of connection. Hence the logic circuitry will indicate to the user through the RS-232 when the connection is closed.

# 8. Start-up and operation

## 8.1 Overview

This chapter contains the necessary information on how to use the UPS system. The starting up and shutting down procedures described here are only used on a few occasions for example when preparing for a long term mains failure or changing the batteries. In normal operation the UPS system runs automatically.

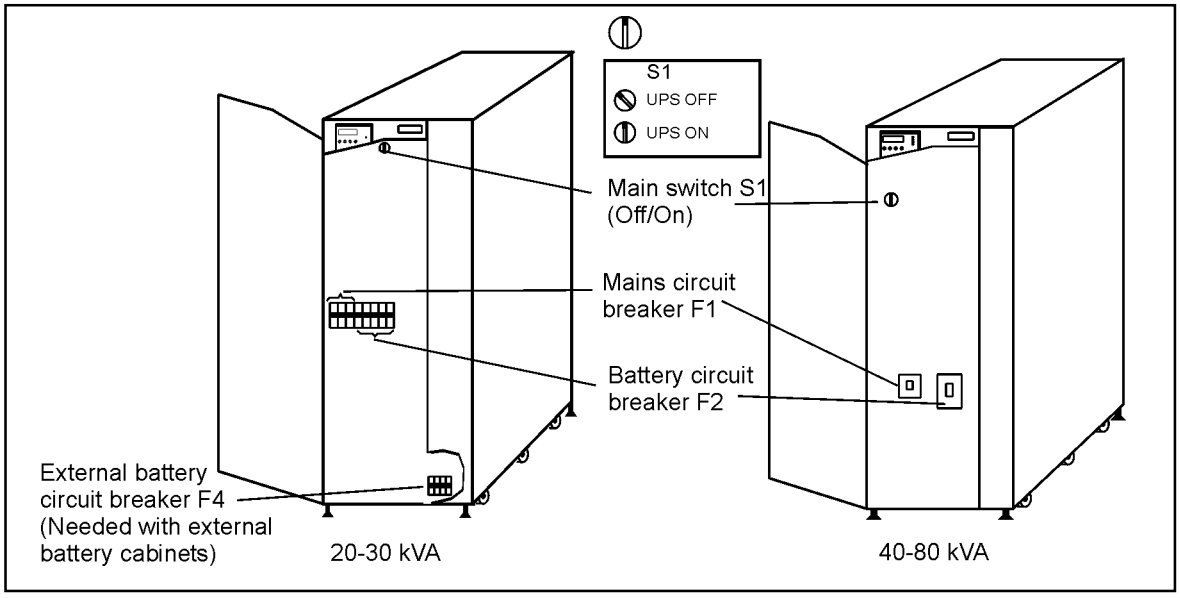



**Figure 27.** Location of switches and breakers

Initial start up is always performed by a service engineer of the manufacturer or by a representative of an agent authorised by the manufacturer. Otherwise the safety of personnel during installation or use, or that the unit will function properly, can not be guaranteed.

During commissioning the manufacturer representative will train the users to operate the parallel UPS system.

## 8.2 Start-up procedure

Check that the parallel UPS system has been installed and control wiring is done correctly before starting up any UPS modules. Make sure that ground connections have been done in the tie panel for UPS module outputs.

Depending on the situation, the parallel UPS system will start with normal start-up procedure (mains power is available), or with cold start-up procedure (battery power is available). The UPS modules will start-up to the load bus with 10-60 seconds delay of synchronisation.

The parallel UPS system should started in the orderly (UPS1-2-3-4) manner:

1. Check that the UPS modules are in the start-up condition (open front door):
   – Main switch, main circuit breaker, and battery breakers are in the OFF position

2. Check that the optional system bypass switch is in the 'BYPASS' position, and the individual service switches are in the ON position.
   If the system configuration does not include the external system bypass switch, the critical load must be disconnected, (when cold battery start) or UPS modules must be started immediately after each one (during 30 seconds) to prevent overload situation at the system start-up.

3. Start UPS modules one by one:
   - Check that the output breaker S2 has not been tripped by resetting it to the ON position.
   - Turn on the main breaker F1 and battery circuit breaker F2 to the 'ON' position.
   - Turn on the circuit breaker F4 (20/30 kVA UPS modules with ext. BAT cabinets) to the 'ON' position.

4. Start the UPS module by turning the main switch S1 to the 'ON' position.

5. Check that the UPS module has started:
   - Green UPS ON led is lit if mains power is available (normal start)
   - Yellow BATTERY led is lit if the battery power is available (cold-start).

6. Check that yellow BYPASS led (contact signal of the system bypass switch is ok) is lit in the front panel.

7. Repeated sections 3 through 6 until all UPS modules have started.

8. Check that service switches of the SPM9305 (or local tie panel) are in the 'ON' position.

9. Transfer the critical load to UPS modules by turning the system bypass switch to 'UPS' position.

## 8.3 Operating system bypass switch

The system bypass switch is used to bypass the parallel system during maintenance or servicing. Maintenance bypass switch is located on the front panel of the optional SPM9305 cabinet. Using the switch does not cause any break in the output voltage, if the input voltage and frequency are accepted and the system is synchronised to the input mains.

The parallel module includes a mechanical bypass switch S51 (Make-Before-Break type) and four maintenance switches S11, S21, S31, and S41 for disconnecting the outputs of UPS modules during maintenance or service.

The maintenance bypass switch has the following positions:

- 'I' or 'UPS' normal position, the load is supplied from the UPS modules.
- 'I+II' or 'UPS + BYPASS' position, the load is supplied from UPS modules (internal bypass mode) and the system bypass in parallel.
- 'II' or 'BYPASS' position, the UPS modules are bypassed and the critical load is supplied from the system bypass power line.

If the system bypass switch needs to be used it is recommended to check that the bypass input power is connected and present in the SPM9305 cabinet. The switch is used only on rare occasions and the procedure is following:

1. Check that the unsynchronised alarm is not active in the UPS modules. (Press Menu button, choose UPS status display)

2. Turn the maintenance bypass switch to BYPASS position.

**Warning!**

**The use of the maintenance bypass switch will cause a break in the output voltage if the input voltage or frequency is not correct and the UPS system is not synchronised to mains.**

Following procedure does returning to normal online mode:

1. Make sure UPS modules have been started according to chapter 'Start-up procedure'.

2. Check that UPS ON and BYPASS LED's are lit in the front panel.

3. Make sure service switches S11…S41 in the SPM9305 are in 'ON' position

4. Turn the system bypass switch S51 to 'UPS' position.

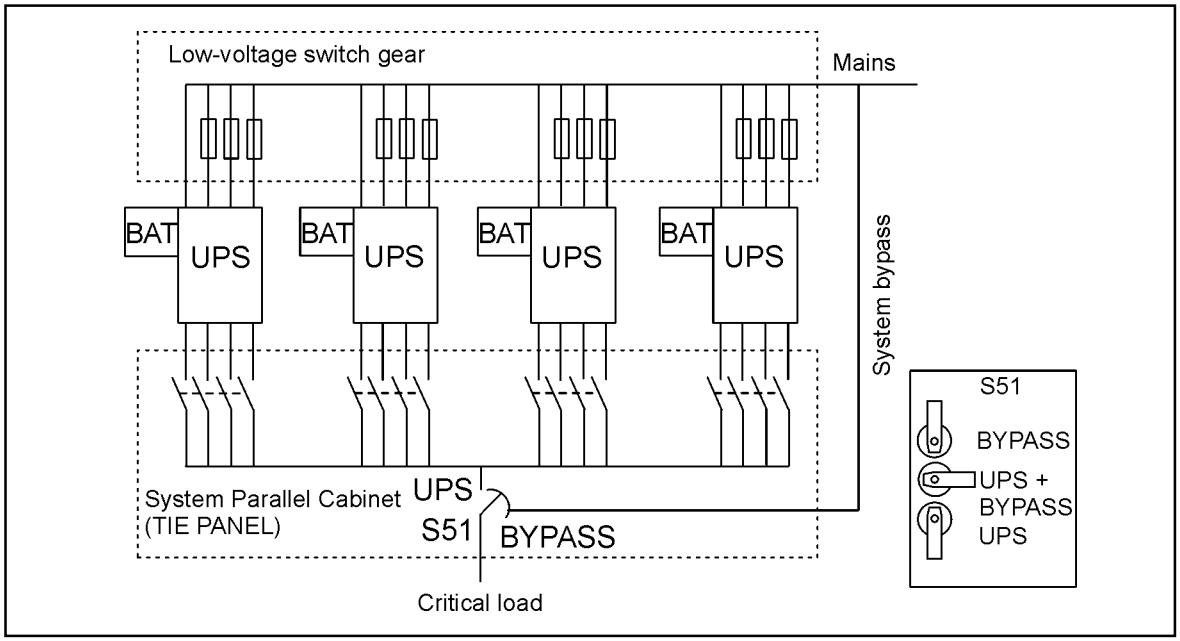



**Figure 28.** System bypass switch of the optional SPM9305.

## 8.4 Shut-down procedure

The UPS system does not have to be shut down at the end of each day. The system is designed to cope with a continuous load from the day it is installed until a change is needed in the backup battery bank.

It is possible to shut down a single UPS module and still get maximum protection for the critical load. This operation requires that the parallel system to be in the N+1 redundancy mode. In capacity mode, the system bypass switch should be used to transfer the system to bypass power.

Use the following procedure when you want to do service for a redundant UPS module:

1. Check that the UPS module is in the operational condition (open front door):
   – Main switch, main circuit breaker, and battery breakers are in the 'ON' position
   – Output breaker in the 'ON' position and has not been tripped.
   – No critical alarms or "Loss of redundancy" message in the control panel display.

2. Check that the parallel UPS system is in the N+1 redundancy mode.
   (Press Menu button, choose UPS parameters display P31.)

   The system bypass switch must be used first to transfer to 'BYPASS' if the system is in the N capacity mode. The critical load must be disconnected if system does not contain the system bypass switch.

3. Turn the main switch S1 to the 'OFF' position

4. Turn off the battery circuit breakers F2 and F4 (20/30 kVA UPS modules with ext. BAT cabinets).

5. Turn off the main circuit breaker F1 to the 'OFF' position.

6. Check that UPS ON or BATTERY LED's are not lit.
   – It has now stopped the supply of output power and is disconnected from the batteries.

7. Disconnect the appropriate service switch (S1…S4) to 'OFF' position at the optional SPM9305 or local tie panel. This prevents high voltage to be present in the output terminals of the UPS module because of the parallel configuration.

**Warning!**

**Be careful because there are still be high voltages and live parts inside of the UPS module.**

## 8.5 Control panel operation

Operation of the panel are controlled with the push buttons under the LCD display. The screen informs the user about the UPS type, measurements, and status alarms. The control panel shows the status of UPS operation with four LED indicators. It also generates an audible alarm if the user should be alerted.

The 'MENU' button allows the user to move through the options in the parameter menu. Push buttons ↑ ↓are used to moving in the submenus. Display functions are selected with the push button ↵.

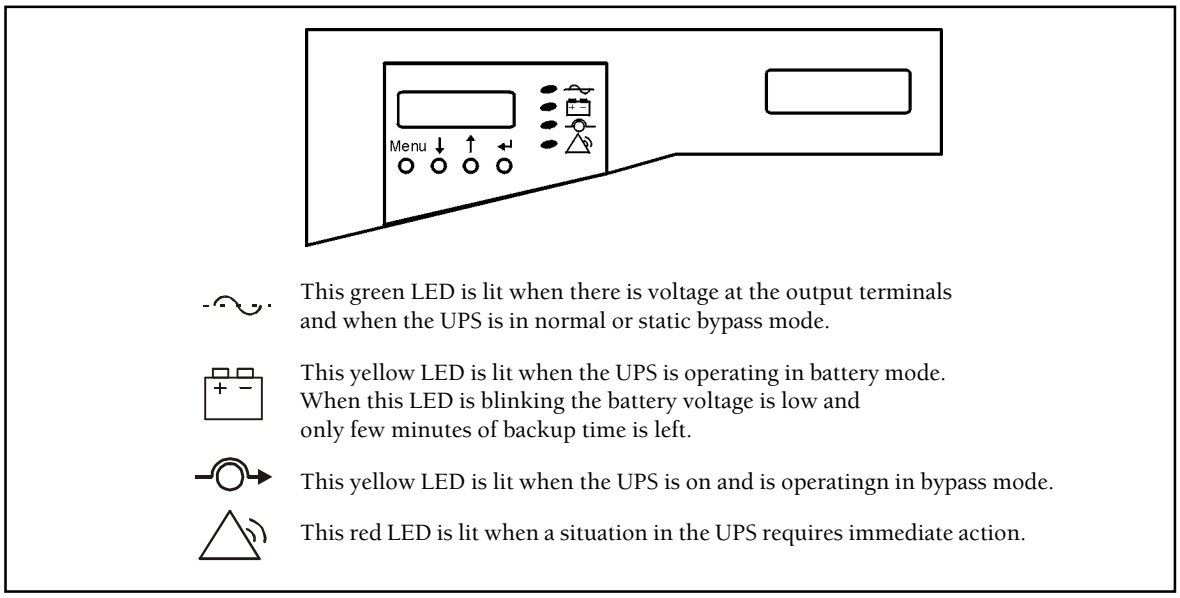



**Figure 29.** Control panel and LED status indications.

## 8.6 Control panel displays

### Normal display

The Normal display shows the UPS type. The panel automatically returns to this display state from any other display state after a delay time of 1 to 2 minutes from last display state change.

### Menu display

The following display choices can be selected in the Menu display by scrolling through menu with ↑ and ↓buttons and pressing ↵ button:

- UPS Status
- Meters
- Battery Status
- Alarm log
- UPS parameters
- UPS Identification
- Reset Button
- Display Data

The control panel will return to Normal display if 'MENU' button is pressed.

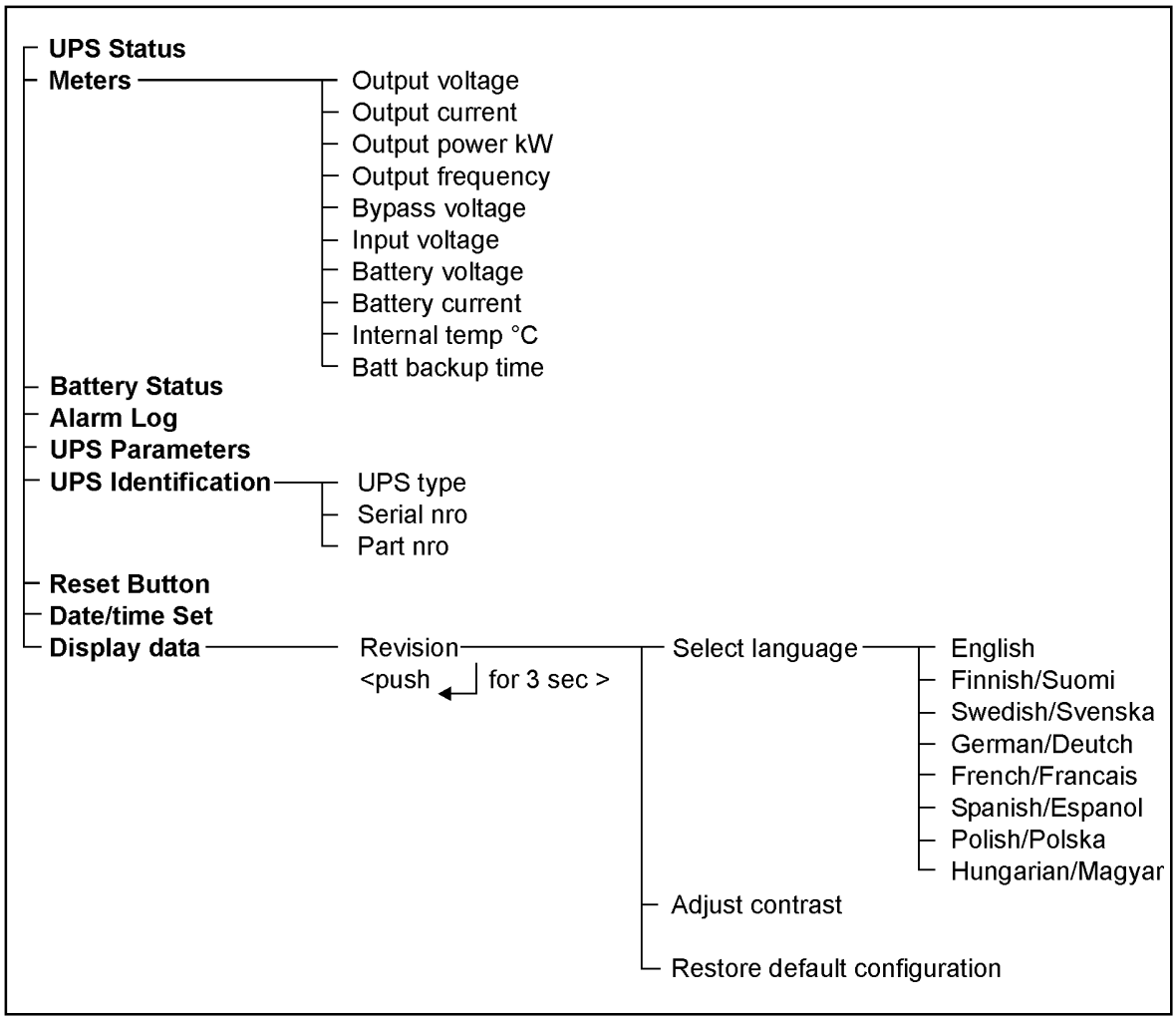



**Figure 30.** Menu map

## UPS Status display

UPS Status display will indicate the current operation mode of the UPS on the top row of the display. The display will automatically come to this display state if there is some abnormal operation in the unit. If there is active alarm in the unit it will be indicated on the bottom row. Pressing ↓button will transfer the display to Active Alarms display. Here all the active alarms can be scrolled through with the ↓button and return to UPS Status display can be made with ↑ button.

The display generates an audible alarm when an active alarm appears. Pressing any button shall silence it.

Pressing Menu button will return the display to Menu display.

### Meters display

The Meters display will inform various measurements of the UPS. Different measurements can be selected with ↓and ↑ buttons. Following measurement information is available:

- Output voltage, shows AC voltage of each output phase
- Output current, shows current of each output phase
- Output power, shows power in kW of each output phase
- Output frequency, unit is Hz
- Bypass voltage, shows bypass line voltages of each phase
- Input voltage, shows rectifier input line voltages of each phase
- Battery voltage, shows DC voltage of both positive and negative battery string
- Battery current, shows battery current of both positive and negative battery string
- Internal temp, shows temperature inside the UPS, unit is °C.
- Batt backup time, shows the battery backup time in minutes. If backup time is more than 90 minutes the display shows 9999.

Pressing Menu button will return the display to Menu display.

### Battery Status display

The Battery Status display informs what is the mode of operation of the ABM (Advanced Battery Management).

Pressing Menu button will return the display to Menu display.

### Alarm Log display

The Alarm Log display will indicate the 8 latest alarms of the UPS and also the time when each alarm has happened. The time showed (days hrs:min:sec) is the time between consecutive alarms. The alarms can be viewed by pressing the ↓button. Pressing Menu button will return the display to Menu display.

### UPS parameters display

The UPS Parameters display will inform the values of the operational parameters of the UPS. These parameters are to be changed only by service personnel of the manufacturer or by a representative of an agent authorised by the manufacturer. The parameter value changes are password protected.

The values of different parameters can be viewed with ↓and ↑ buttons. The display will indicate first the parameter number (Pxx) and after that the value of the parameter (Vyy).

Pressing Menu button will return the display to Menu display.

### UPS Identification display

The display informs the UPS type, unit serial number and unit part number. These options can be scrolled with ↓and ↓buttons.

Pressing Menu button will return the display to Menu display.

### Reset button display

Selecting this function will reset alarms that are not auto resetting. It will also return the unit to normal mode if the unit has locked to bypass due to too many transfers to bypass assuming transfer back to normal operation is enabled. The reset button does not correct the condition that caused the alarm.

Pressing Menu button will return the display to Menu display.

**Display Data display**

The display shows information about the display software: revision, compilation date and check sum. To adjust the contrast or select a different language push ↵ button down during three seconds. These options can be scrolled with ↓and ↓buttons.

Pressing Menu button will return the display to Menu display.

# 9. Troubleshooting

## 9.1 Overview

The firmware contains intelligence to cope with any failure that could occur in the parallel UPS system. Note that the capacity mode provides more output power but is more vulnerable to system failures compared to the N+1 redundant mode.

## 9.2 Alarms and reasons

The normal procedure from the parallel UPS system is to go to the battery operation or bypass operation in case of power problems. The alarm messages are used together with the events logger as part of a diagnostic system for the UPS service specialist.

Battery power is used when the rectifier cannot feed the DC link well enough from the mains. Hence, the transfer to battery operation is made based on the DC link voltage. It is possible that a single UPS module of the system is in the battery operation while other modules still have mains power available. The back-up time is dependent on how much battery capacity is selected for the UPS modules.

Before calling for assistance you may take one or more of the following actions.

1. Check the local mains power supply. One or more fuses may be blown or someone could have switched off the supply by a mistake.

2. Check that the cooling air intake has not been blocked or the ventilation of the electrical room is not sufficient.

3. Check that output load capacity has not been exceeded. Someone might have placed too many loads on the UPS system output.

| Alarm Display | Reason | UPS action | What to do? |
|---|---|---|---|
| LOW BATTERY VOLTAGE | The battery voltage has dropped below the alarm limit. | UPS has reduced backup time on battery mode. | Check the alarm dissapears as the battery charger starts to operate. |
| BATTERY LOW LIMIT | The battery voltage is below the low limit. | Output of the inverter is turned off in 60 seconds. | Check that bypass operation is ok. |
| BATTERIES DISCONNECTED | The battery voltage has dropped below the low limit. | Battery operation and charging are disabled. | Check that external battery breakers are closed. Call for assistance. |
| BATTERY FAILURE | ABM has detected faulty battery. | ABM charging cycle is initiated. | Batteries have exceeded their normal life time. Call for assistance. |
| BATTERY OVERVOLTAGE | The battery voltage has been too high. | Chargers are turned off. | Check the battery configuration. Call for assistance. |
| BYPASS UNAVAILABLE | At least one of the bypass voltages is out of the limits. | Transfers to bypass are disabled. | Check the local mains power supply. One or more fuses may be blown or some-body could by accident have switched off the supply. |
| CABINET OVERTEMPERATURE | Temperature inside the UPS cabinet is too high. | None. | Check if the cooling air intake on your UPS has been blocked. |
| EMERGENCY POWER OFF | EPO input X4 is active. | Shutdown of the unit. All controls are turned off, and battery circuit breaker is tripped. | Check the jumper on terminal X4 of the UPS module. |
| LOSS OF REDUNDANCY | The number of the units running has been reduced. (redundancy mode) | None. | Check the reason for the loss of an UPS module. Call for assistance |
| UPS DISSABLED | The number of units running has been reduced (capacity mode). | None. | Check the reason for the loss of an UPS module. Call for assistance. |
| OVERLOAD | The load is too high. | UPS transfers to bypass. | Check if somebody has placed too much. Call for assistance. |
| REDUNDANCY OVERLOAD | Load is exceeding the redundant N+I system capacity. | None. | Check the total load. |
| PARALLEL BUS FAILURE | Communication between units is not available. | None. | Check the parallel communication cable. |

**Table 9.** Typical alarms with their indications.

# 10. Warranty

The product is warranted against defects in material and workmanship for a period of 12 months from its original date of purchase.

# 11. Technical specifications

### 1. General

| | |
|---|---|
| 1.1 Rated power | 20 kVA, 30 kVA, 40 kVA, 50 kVA, 60 kVA, 80 kVA; at p.f. 0,7, inductive or non linear load |
| 1.2 Technology | Double conversion online topology with automatic bypass switch and maintenance bypass switch.<br>Voltage and Frequency Independent operation: Class VFI-SS-111 by IEC 62040-3 |

### 2. Input

| | |
|---|---|
| 2.1 Rated voltage | 220/380, 230/400, 240/415 Vac; three phase input (3xL+N+PE) |
| 2.2 Voltage range | 170/294-279/484 VAC without depleting battery 20-50 kVA and 80 kVA<br>180/312-279/484 VAC without depleting battery 60 kVA<br>196/336-279/484 VAC full charge capability |
| 2.3 Rated frequency | 50/60 Hz |
| 2.4 Frequency range for rectifier | 45 - 65 Hz |
| 2.5 Nominal/max input current | 20 kVA 3 x 21 A / 3 x 30 A<br>30 kVA 3 x 36 A / 3 x 45 A<br>40 kVA 3 x 47 A / 3 x 65 A<br>50 kVA 3 x 60 A / 3 x 80 A<br>60 kVA 3 x 70 A / 3 x 93 A<br>80 kVA 3 x 97 A / 3 x 125 A |
| 2.6 Input power factor | > 0.96 (Cosphi 1) |

### 3. Output

| | |
|---|---|
| 3.1 Nominal voltage | 220/380, 230/400, 240/415 VAC, selectable |
| 3.2 Voltage regulation | < ± 1% static<br>< ± 1% with 100% unbalanced load<br>< ± 5% dynamic at 100% load change<br>Recovery time < 1 ms |
| 3.3 Voltage distortion | < 1 % THD linear load<br>< 5 % THD non linear load |
| 3.4 Frequency | 50/60 Hz, selectable |
| 3.5 Frequency regulation | Synchronisation to line, ± 0.5, ± 1.0 or ± 2.0 Hz selectable.<br>Free-running ± 0.05 Hz<br>Slew rate 0.5, 2.5, 6 Hz/sec, selectable |
| 3.6 Over load | 101% to 110% for 10 minutes (online)<br>111 - 125% for 60 sec (online)<br>126 - 150% for 30 sec (online)<br>151 - 170% for 5 sec (online)<br>125% continuous (bypass)<br>1000% for one cycle (bypass) |
| 3.7 Parallel load sharing | ±5% of the rated load |

Single UPS modules

| **Output power** | **20 kVA 14 kW** | **30 kVA 21 kW** | **40 kVA 28 kW** | **50 kVA 35 kW** | **60 kVA 42 kW** | **80 kVA 56 kW** |
|---|---|---|---|---|---|---|
| Output rated current | 3x29 A | 3x43 A | 3x58 A | 3x72 A | 3x87 A | 3x116 A |
| Output peak current (300 ms) | 3x115 A | 3x115 A | 3x128 A | 3x190 A | 3x190 A | 3x250 A |
| Efficiency (p.f.07) | 93% | 93% | 93% | 93% | 93% | 93% |
| Power dissipation | 1400 W | 1650 W | 2100 W | 2600 W | 3100 W | 3900 W |
| DC-voltage | 2x288 (2x192) V | 2x288 V | 2x288 V | 2x288 V | 2x288 V | 2x288 V |
| Internal batteries | 2x48x7 Ah (2x32x7 Ah) | 2x48x7 Ah | - | - | - | - |
| Weight | 490 (400) kg | 490 kg | 230 kg | 260 kg | 260 kg | 280 kg |
| Width | 520 mm | 520 mm | 520 mm | 520 mm | 520 mm | 520 mm |
| Depth | 788 mm | 788 mm | 788 mm | 788 mm | 788 mm | 788 mm |
| Height | 1530 mm | 1530 mm | 1530 mm | 1530 mm | 1530 mm | 1530 mm |

The number indicated in parentheses are for units with battery banks of 32 pcs battery system.

### Parallel Hot Sync™ systems

| **Redundancy mode** | **Power rating** | | | | | |
|---|---|---|---|---|---|---|
| **Nr of UPS modules** | **20 kVA modules** | **30 kVA modules** | **40 kVA modules** | **50 kVA modules** | **60 kVA modules** | **80 kVA modules** |
| 1+1 UPS | 20 kVA | 30 kVA | 40 kVA | 50 kVA | 60 kVA | 80 kVA |
| 2+1 UPS | 40 kVA | 60 kVA | 80 kVA | 100 kVA | 120 kVA | 160 kVA |
| 3+1 UPS | 60 kVA | 90 kVA | 120 kVA | 150 kVA | 180 kVA | 240 kVA |
| **Capacity mode** | **Power rating** | | | | | |
| **Nr of UPS modules** | **20 kVA modules** | **30 kVA modules** | **40 kVA modules** | **50 kVA modules** | **60 kVA modules** | **80 kVA modules** |
| 2xUPS | 40 kVA | 60 kVA | 80 kVA | 100 kVA | 120 kVA | 160 kVA |
| 3xUPS | 60 kVA | 90 kVA | 120 kVA | 150 kVA | 180 kVA | 240 kVA |
| 4xUPS | 80 kVA | 120 kVA | 160 kVA | 200 kVA | 240 kVA | 320 kVA |

## 4. Environmental

| | |
|---|---|
| 4.1 Ambient temperature | 0° ... + 40°C operating<br>+15°C ... +25°C recommended<br>-25°C ... +55°C storage (without battery) |
| 4.2 Ventilation | Fan cooling, temperature µP monitored |
| 4.3 Altitude | 1000 m operating w/o derating<br>15 000 m during transportation |
| 4.4 Humidity | 15 ... 90% RH, non-condensing |
| 4.5 Audible noise | < 55 dB(A) at 1 meter distance 20-30 kVA<br>< 60 dB(A) at 1 meter distance 40-60 kVA<br>< 65 dB(A) at 1 meter distance 80 kVA |
| 4.6 Protection class | IP 21 S |

| | |
|---|---|
| 4.7 Cooling air requirements | Q=300 x P/t, where: Q=air flow in m3/h, P=power losses in kW, t=temp. rise in celcius, which means that each kW of losses needs an airflow of 300 m3/hour trough a room to keep temp raise at 10 celcius max. |

## 5. Standards

| | |
|---|---|
| 5.1 Safety | IEC 60950, EN 50091-1-1 (1996) |
| 5.2 Emissions | EN 50091-2 (1995) |
| 5.3 Immunity | EN 50091-2 (1995) |

## 6. DC circuit

| | |
|---|---|
| 6.1 Battery type | Valve regulated Lead Acid; 48 pcs. 12 V blocks with 5 or 10 years design. |
| 6.2 Battery charging | Advanced Battery Management™ or traditional float charging |
| 6.3 Nominal battery voltage | 2x288 V (2x144 cells) |
| 6.4 DC voltage range | 252 - 329 V (1.75 VDC - 2.28 VDC) |
| 6.5 Battery charging current | max. 8 A (40-80 kVA)<br>max. 6 A (20-30 kVA) |

External battery cabinets with sealed lead-acid batteries.

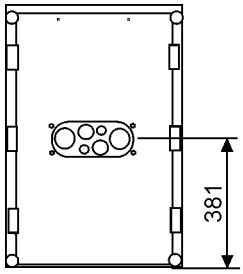
| | BAT D | BAT E | BAT F |
|---|---|---|---|
| DC-voltage | 2x288 V | 2x288 V | 2x288V |
| Batteries | 2x24x24 Ah | 2x24x38 Ah | 2x24x65 Ah |
| Weight | 550 kg | 815 kg | 1390 kg |
| Width | 382 mm | 520 mm | 1034 mm |
| Depth (mm) | 788 mm | 788 mm | 788 mm |
| Height (mm) | 1530 mm | 1530 mm | 1530 mm |

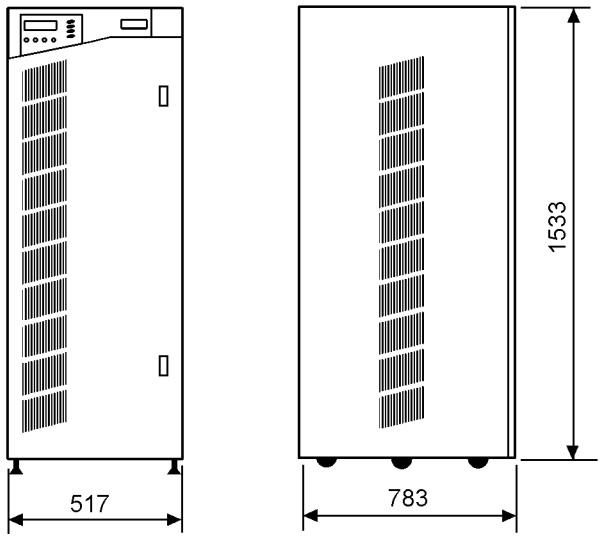
Note!
A Battery cabinet F consists of two cabinets, total width is 1034 mm.

| | SPM9305-60-4 | SPM9305-60-2 | SPM9305-80-4 | SPM9305-30-2 | SPM9305/9340-130-2 |
|---|---|---|---|---|---|
| Output power | 240 kVA<br>168 kW | 120 kVA<br>84 kW | 320 kVA<br>224kW | 60 kVA<br>42 kW | 260 kVA<br>182 kW |
| Weight | 210 kg | 50 kg | 230 kg | 50 kg | 230 kg |
| Width | 520 mm | 500 mm | 520 mm | 500 mm | 520 mm |
| Depth | 788 mm | 250 mm | 788 mm | 250 mm | 788 mm |
| Height | 1530 mm | 700 mm | 1530 mm | 700 mm | 1530 mm |

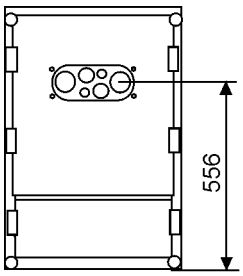
| | 1+1 Parallel UPS system (example) | | | | | |
|---|---|---|---|---|---|---|
| Output power | 20 kVA<br>14 kW | 30 kVA<br>21 kW | 40 kVA<br>28 kW | 50 kVA<br>35 kW | 60 kVA<br>42 kW | 80 kVA<br>56 kW |
| Output peak current | 3x200 A | 3x200 A | 3x380A | 3x380 A | 3x380 A | 3x500 A |
| Efficiency | 89% | 91% | 90% | 90% | 91% | 91% |
| Power dissipation | 1500 W | 1850 W | 2800 W | 3500 W | 3750 W | 5000 W |

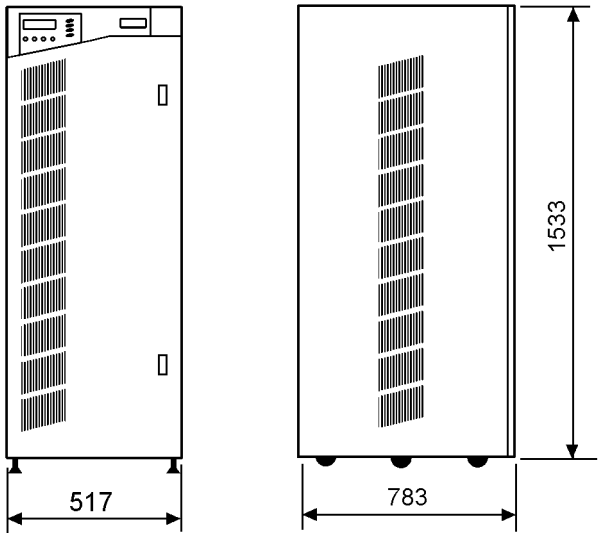
## Appendix A – Dimension drawings 20-30 kVA UPS



## Appendix B – Dimension drawings 40 - 80 kVA UPS



**Appendix C – Dimension drawings SPM9305**

**Ref. SPM9305-80-4 / SPM9305-60-4 / SPM9305/9340-130-2**