rehlko

REHLKO *PW* 8000DPA (ST)

Modular three-phase uninterruptible power supply

(10–200 kVA/kW)
Parallelable up to 400 kVA/kW

Technical Specification

Document Control

ISSUE	DATE	REVISION SUMMARY
TS_741_01	02/08/23	Rebranding to KUP International Version
TS_741_02	02/04/2024	Corrections to battery data and efficiency
TS_741_03	03/12/2025	Storage temperature and note, Li-Ion added, Static transfer time added, Icc added
TS_741_04	22/04/2026	Rebranding to Rehlko & revised VRLA battery End of Discharge Voltage from 1.265 to 1.65V/cell
TS_741_05	26/05/2026	Correction to Max input current description

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REHLKO PW 8000DPA (ST) SYSTEM

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

The Rehlko PW 8000DPA (ST) is a truly modular UPS system using a third generation high-power-density (HPD), leading-edge, double-conversion design. Its advanced double-conversion Voltage and Frequency Independent (VFI) topology responds fully to the highest availability and environmentally friendly requirements compliant with EN62040-1 (VFI-SS-111) standards.

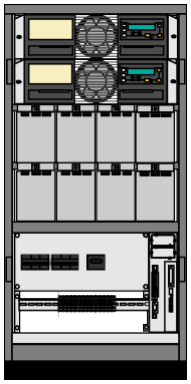
The Rehlko PW 8000DPA (ST) system is designed around 10 kW or 20 kW UPS power modules, up to ten of which can be installed in a range of purpose-designed, free-standing cabinets.

As shown below, each UPS cabinet is rated according to the maximum number of 20 kW modules that it can house. The 40 kW and 60 kW cabinets contain the UPS batteries; however, the 80 kW, 120 kW and 200 kW models require external batteries which are usually contained in a purpose-designed battery cabinet that is installed as close as possible to the UPS cabinet. A range of matching battery cabinets is available.

System cabinet configurations

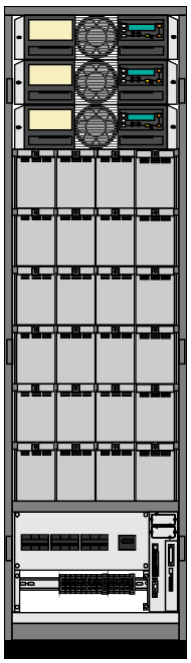
Table 1 : Standard cabinet configurations

CABINET	MAX OUTPUT	BATTERY
PW8000DPA ST-40	40 kW (2x 20 kW UPS modules)	Internal (2x strings of 40x 12V blocks)
PW8000DPA ST-60	60 kW (3x 20 kW UPS modules)	Internal (6x strings of 40x 12V blocks)
PW8000DPA ST-80	80 kW (4x 20 kW UPS modules)	External
PW8000DPA ST-120	120 kW (6x 20 kW UPS modules)	External
PW8000DPA ST-200	200 kW (10x 20 kW UPS modules)	External



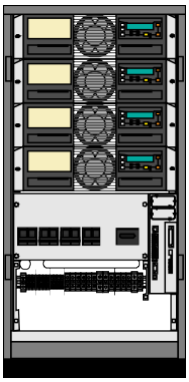
ST-40 Cabinet

2x UPS modules
80 Batteries



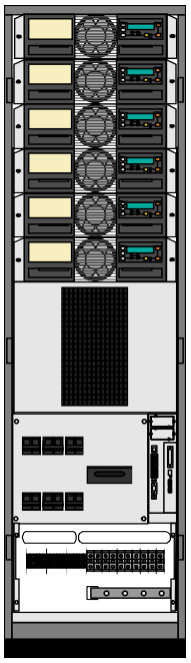
ST-60 Cabinet

3x UPS modules
240 Batteries



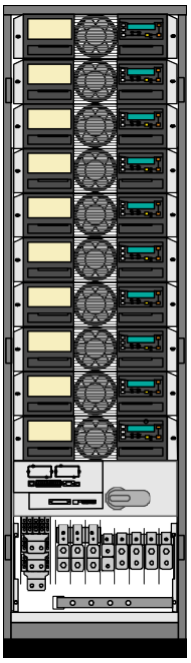
ST-80 Cabinet

4x UPS modules
No Batteries



ST-120 Cabinet

6x UPS modules
No Batteries



ST-200 Cabinet

10x UPS modules
No Batteries

System expansion using parallel cabinets

Some UPS applications present a low initial power requirement which increases over time as the application grows, and it is therefore essential that the installed UPS system can be expanded to meet a growing load demand without compromising the existing load. This is well met with the 'hot swappable' nature of the Rehlko PW 8000DPA (ST) UPS power modules in which additional module(s) can be inserted into a vacant slot in an existing cabinet when needed. The system capacity can also be increase by connecting several UPS cabinets in parallel.

When two or more UPS cabinets are connected together, the UPS modules within the cabinets are effectively paralleled – for example a UPS system comprising three fully populated ST-120 cabinets will contain 18 fully paralleled UPS modules offering a system capacity of 360 kW.

If, for reasons of load expansion, an existing installation requires a further cabinet to be added to the UPS system, the existing system will have to be shut down while the additional cabinet is being electrically connected. This situation can be avoided by installing the correct number of UPS cabinets at the outset to power the designed eventual load demand.

For example, if it is known at the outset that an application's eventual load is likely to reach 300 KW it makes good design sense to install and cable-up four ST-80 cabinets and equally distribute the number of initially required modules between them. This will provide an expandable system of up to 320 kW which will satisfy the eventual 300 kW load and included module redundancy.

Key Point: In a parallel-cabinet system the UPS modules should be equally distributed between the cabinets.

The maximum number of PW 8000DPA (ST) cabinets that can be paralleled is shown in the table below.

Table 2 : Parallel cabinet

	ST-40	ST-60	ST-80	ST-120	ST-200
Number of UPS power modules per cabinet	2	3	4	6	10
Parallel cabinets per system	4	4	4	3	2
Max number of UPS power modules per system	8	12	16	18	20
Max system capacity (without redundancy)	160 kW	240 kW	320 kW	360 kW	400 kW

'Capacity' parallel system

When a system is described as being a 'capacity system' it implies that the potential full load requires ALL the paralleled UPS modules to be operational – i.e. if one module trips off line due to a fault, the remaining modules will be unable to supply the load demand and will automatically transfer the load to the bypass supply, where it will no longer be protected against supply aberrations.

'Redundant' parallel system

If a system is designed with module redundancy it must contain at least one UPS module over and above that necessary to power the applied load.

Using the example given above, four fully populated ST-80 cabinets (16 modules = 320 kW) would present one redundant module for a 300 kW load. Under normal circumstances with all 16 power modules on-inverter they would each provide 18.75kW when full load is applied, but if one module fails or is taken off-line, the remaining 15 modules can sustain the load by each providing their rated 20 kW output.

Clearly, the ability to lose one UPS module yet still supply the rated load with processed, backed-up power significantly increases the overall system reliability.

A parallel system operating with one redundant module is known as an 'N+1' system.

Advanced design features

Using a unique modular construction, the Rehlko PW 8000DPA represents a completely new generation of medium power, 3 phase UPS-Systems, incorporating the latest technological developments in power engineering. High reliability, upgrade ability, low operating costs and excellent electrical performance are just some of the highlights of this innovative UPS solution.

Decentralized Parallel Architecture (DPA)

The Rehlko system features Decentralized Parallel Architecture (DPA) paralleling technology that provides N+x parallel redundancy without introducing a single-point-of-failure. Utilizing the DPA technology, each parallel UPS module is completely autonomous, containing bypasses, CPUs, control panels and independent battery configuration.

Hot swappable modules

Although the previous illustrations show fully populated UPS cabinets, thanks to the UPS module's advanced Distributed Parallel Architecture (DPA) design it is possible to operate an PW 8000DPA (ST) cabinet with just a single module fitted – additional module(s) can then be installed in a vacant slot to expand the system capacity as needed, without having to shut down the system or transfer the load to the bypass supply.

This 'hot-swappable' design similarly allows a UPS module to be exchanged during UPS operation without disrupting the load supply – but of course this depends on the system redundancy and the load demand at the time the exchange takes place.

Input booster technology

The Rehlko PW 8000DPA UPS module's advanced booster technology results in an input power factor of 0.99 with a harmonic content of <4.5% THD (10 kW module) and <3% THD (20 kW module). This enhances the system reliability and minimises the winding losses of any generator or transformer connected to the UPS input, which in turn reduces the generator/transformer costs. It also overcomes the need for an input harmonic filter, resulting in further savings.

In summary, the benefits of the UPS module's high input power factor are:

- reduced cable losses
- no over-sizing of generators required
- no erratic operation of sensitive connected loads
- low input harmonic currents
- reduced heating of transformers and generators
- no false circuit breaker tripping and malfunction
- no resonance with power factor correction capacitors

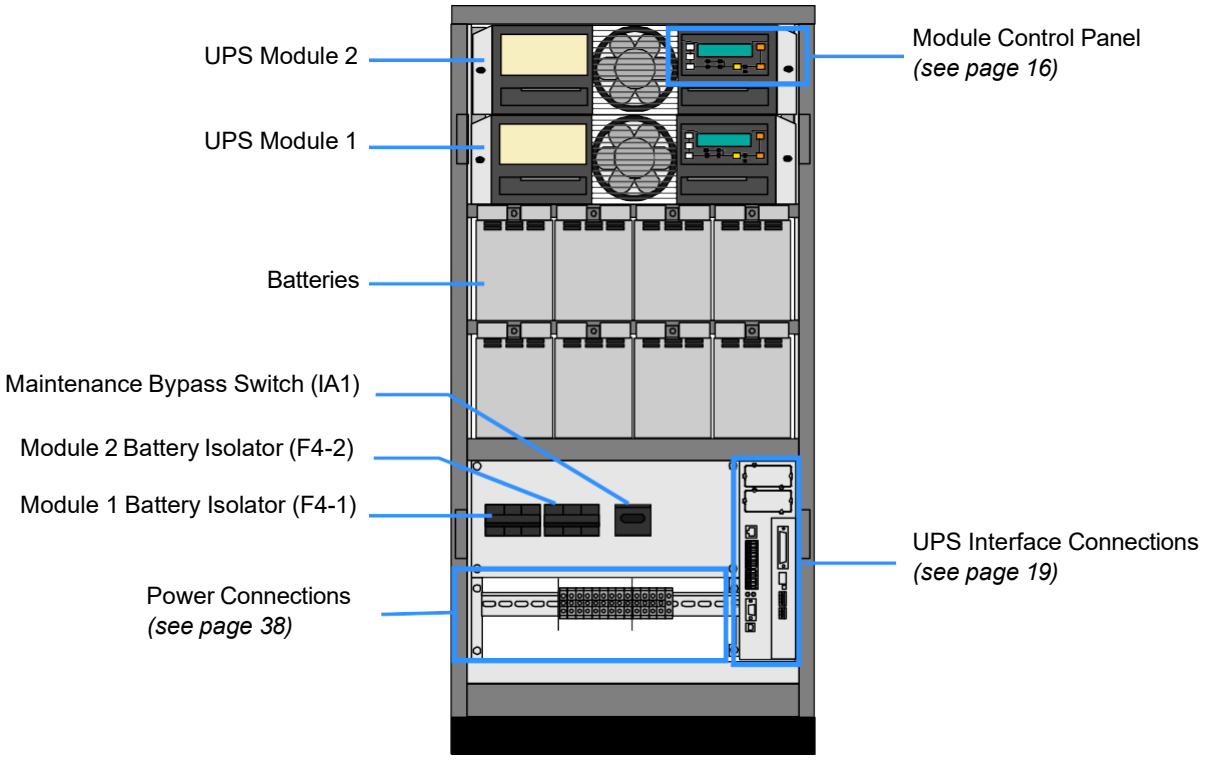
Flexible battery management

The Rehlko PW 8000DPA UPS includes, as standard, a flexible battery management system that provides intelligent battery charging and continuous battery condition monitoring. Together, these functions greatly reduce premature battery deterioration and prolong battery life.

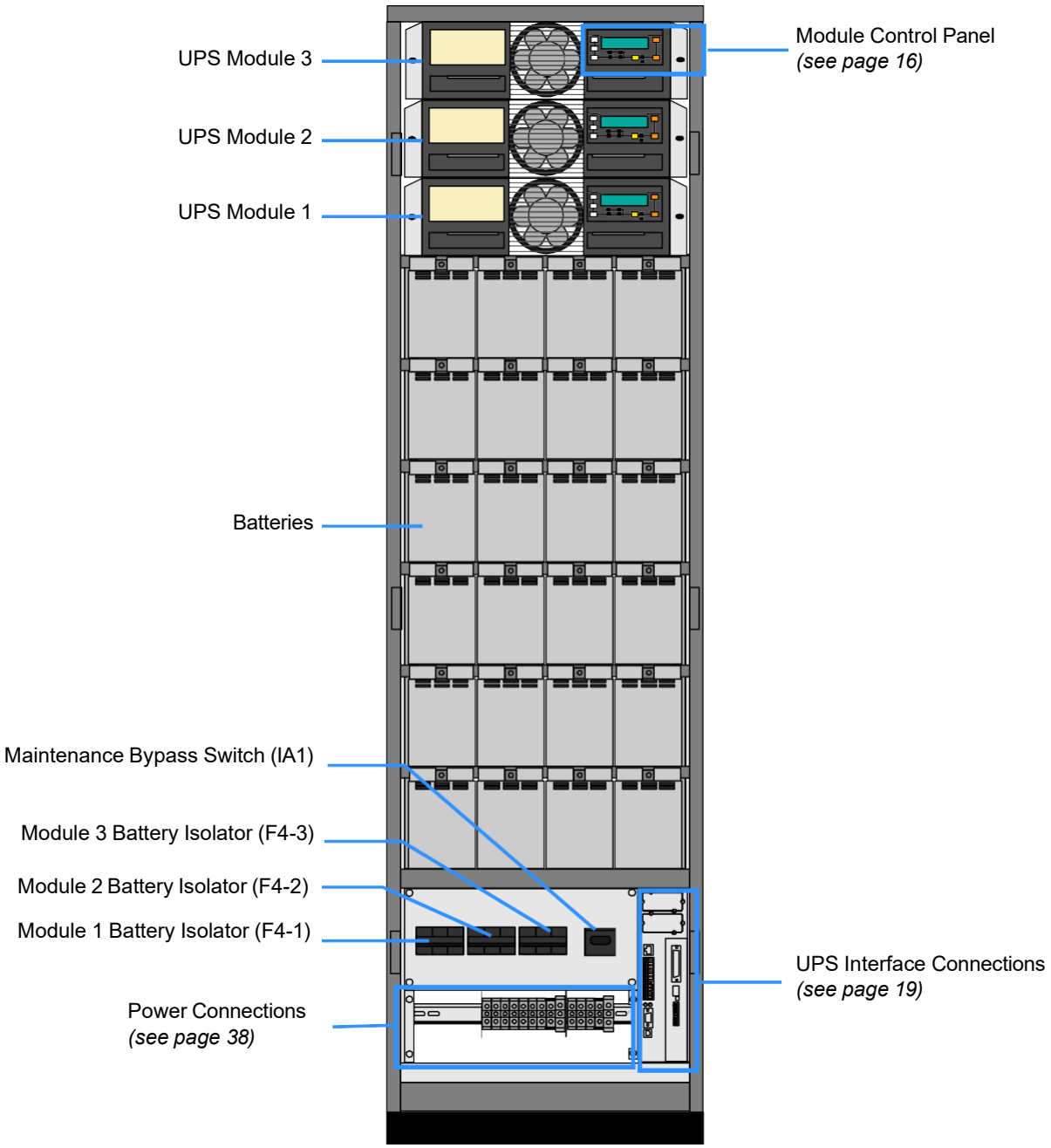
The major benefits are:

- ac-ripple free battery charging due to a dc-dc charger separated from the rectifier and inverter
- wide range of number of battery blocks (30-50 blocks of 12V, depending autonomy times)
- wide UPS input voltage operating window extends the battery life due to fewer discharge cycles
- battery discharge protection caused by load steps
- proactive battery protection from false manipulations and inadequate charging voltages
- proactive battery failure detection thanks to Advanced Battery Diagnosis (ABD) algorithm
- user selectable battery tests
- optional temperature compensated charging to enhance battery life

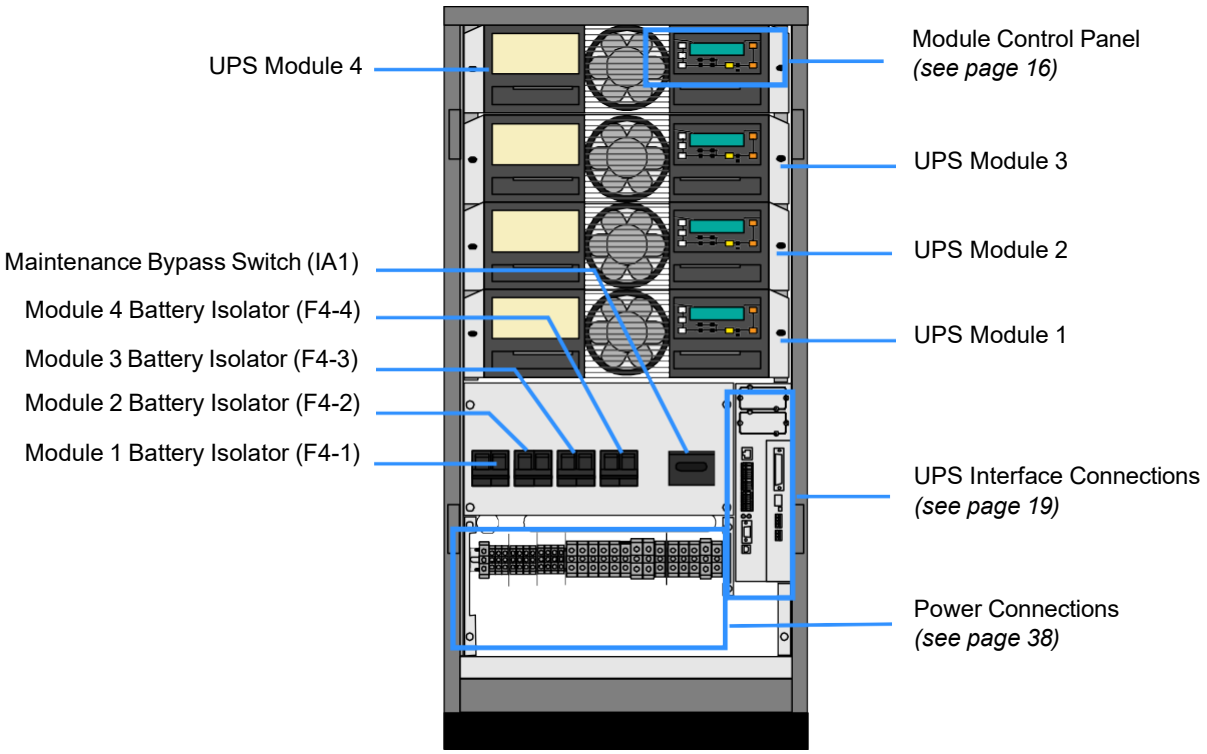
MODULE CONSTRUCTION



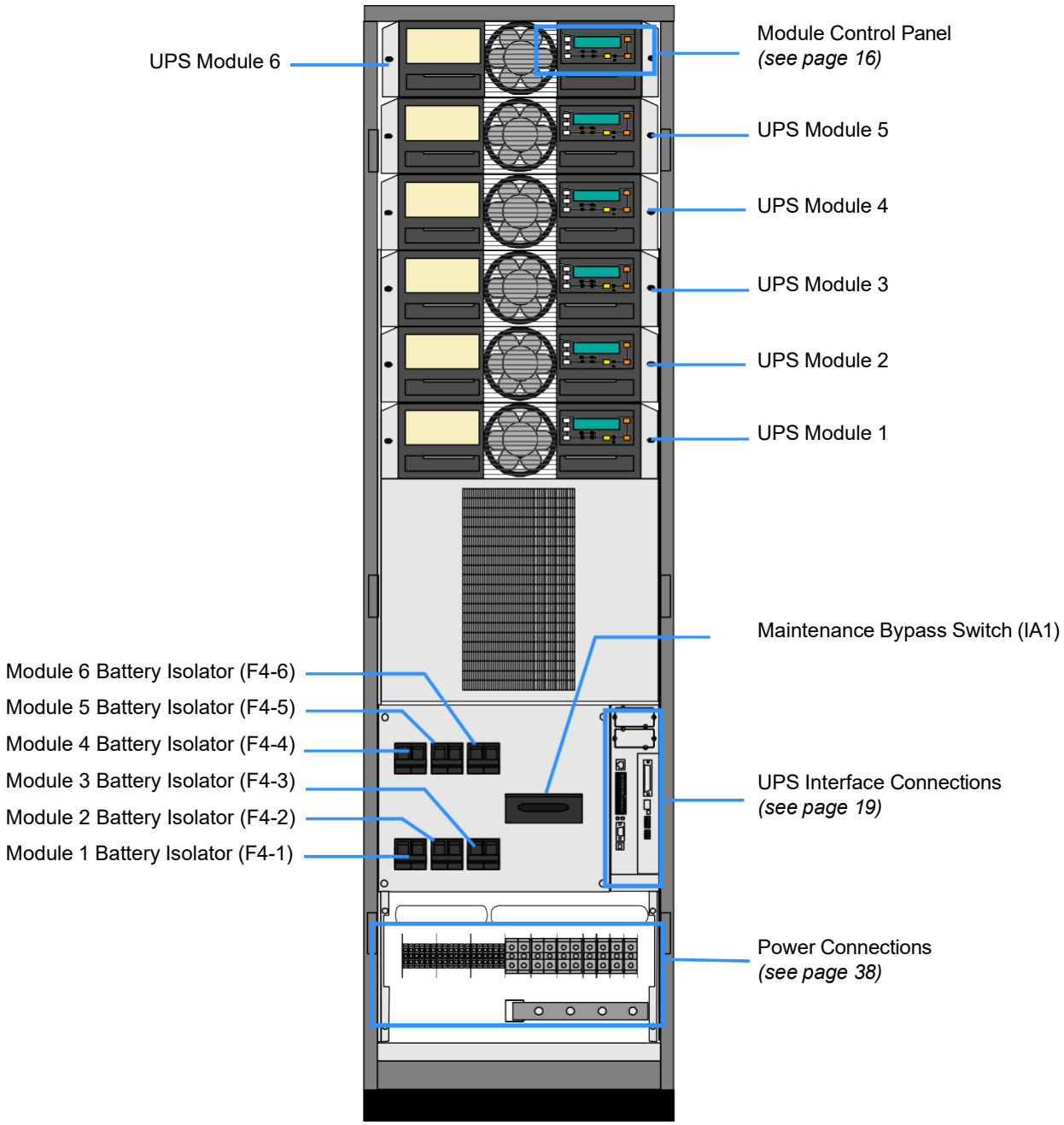
ST-40 Cabinet front view



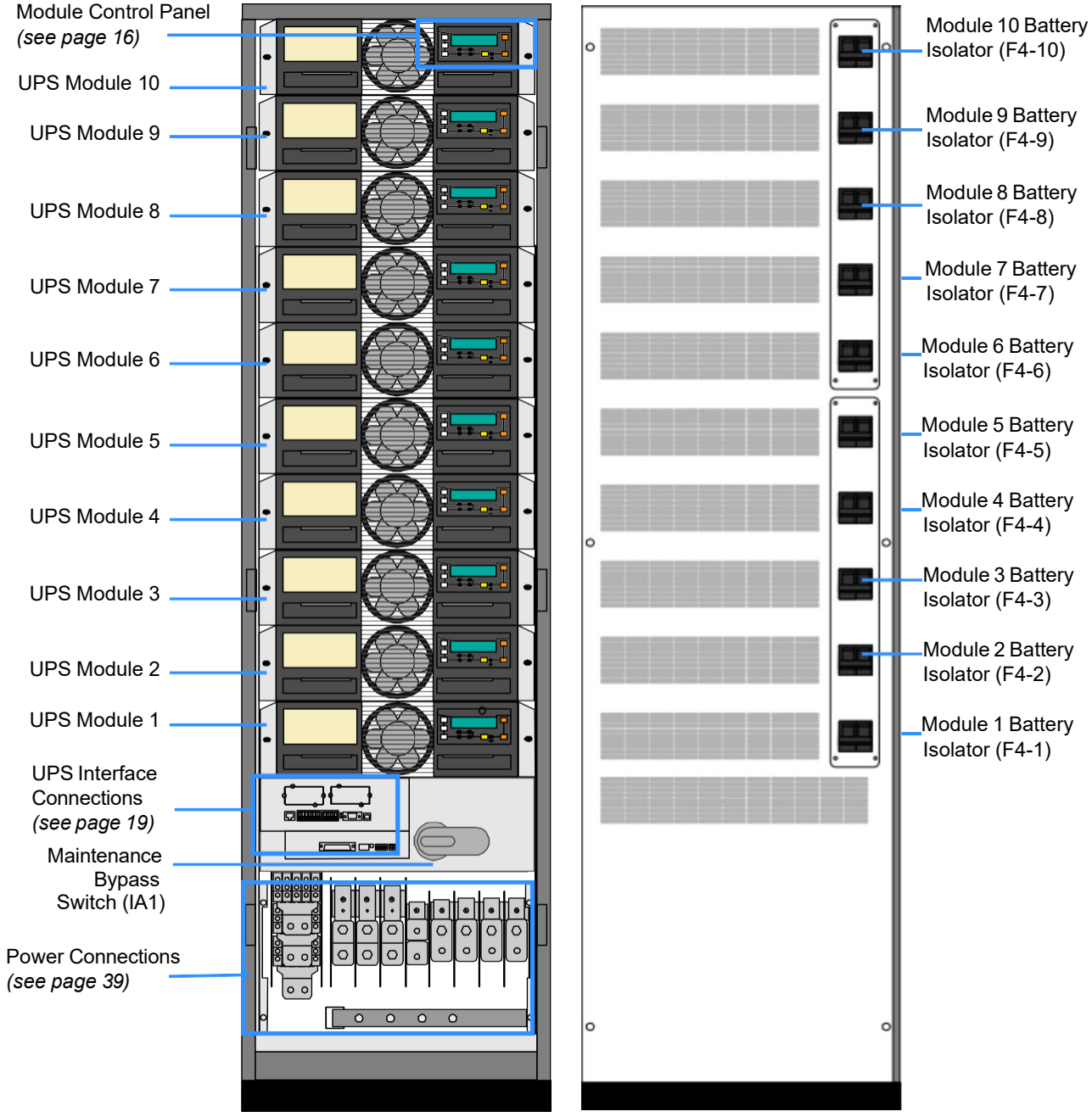
ST-60 Cabinet front view



ST-80 Cabinet front view



ST-120 Cabinet front view



ST-200 Cabinet front and rear view

UPS Modules

Sliding guides on the lower left and right sides of the UPS module to ensure that it is inserted into the cabinet rack correctly. The module plugs in to fixed electrical connectors fitted to the back of the rack. A heavy-duty power connector carries the UPS input, bypass, battery and AC output connections, and an additional connector carries the UPS parallel control connections together with the external interface cables.

All the UPS control panels and power switches are accessible from the front of the frame.

Note that within the cabinet the modules are numbered from 1 upwards, with module 1 fitted on the lowest shelf. When uprating a parallel module system that has spare capacity, additional modules must be inserted in the order shown.

WARNING: The UPS module weighs 21.5 kg. Ensure all manual handling guidelines are adhered to when transporting the module.

Maintenance bypass switch

The maintenance bypass switch (IA1) provides a complete wrap-around, connecting the UPS AC output to the raw bypass mains supply, and should only be operated when the UPS system is operating on static bypass. Always follow the operating instructions closely when using this switch.

Battery isolator(s)

A 2-pole battery isolator (F4-*x*) is provided for each UPS module in a parallel module system. If the batteries are mounted within the UPS rack (e.g. ST-40, ST-60) then the battery string positive and negative cables are connected directly to the isolator. If the battery installation is external to the UPS cabinet then the external battery strings are connected to the battery terminals of the UPS power terminal block, which are in turn connected to the frame's F4-*x* battery isolator(s). The battery isolators are fitted on the rear panel of the ST-200 cabinet and sufficient space must be provided to allow safe operator access around the rear of the cabinet.

Where an external battery cabinet is used it must contain a fused, three pole battery isolator for each battery string.

Note that all battery cabling must be carried out by a Rehlko approved engineer as part of the system commissioning procedure.

UPS Interface connections

A range of interface facilities are provided to permit the UPS to remotely monitored and controlled. These are described on page 19.

Module control panel

An LCD control panel located on the front of each UPS module is used for day-to-day UPS operation and performance monitoring *(see page 16)*.

From the UPS control panel the operator can:

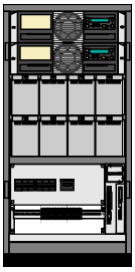
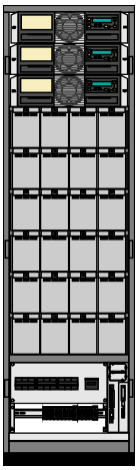
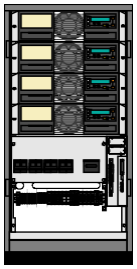
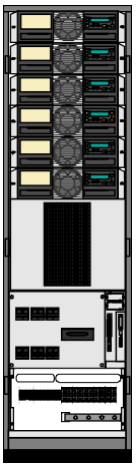
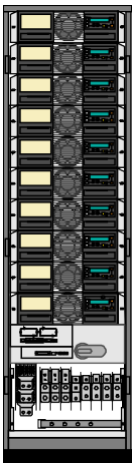
- stop and start the UPS module
- transfer the UPS AC output (load) between the inverter and bypass
- monitor the UPS input/output voltage, current and frequency
- monitor the battery charge / discharge current, and battery status
- interact with monitored alarm and warning messages
- configure the UPS operating parameters (*service mode)
- interrogate the UPS operating events and alarm history (*service mode)
- carry out diagnostic procedures (*service mode)

**Note that the service mode is password protected to restrict its use to trained service personnel.*

System control panel

An optional TFT system control panel can be fitted to the cabinet door. In a parallel-cabinet UPS system the system control panel is fitted to one cabinet only, and provides monitoring and control functionality for the entire system *(see page 18)*.

MECHANICAL CHARACTERISTICS – UPS CABINET

		ST-40	ST-60	ST-80	ST-120	ST-200
						
Maximum configuration		2 module (10 or 20KW) + 80 x 7Ah batteries	3 modules (10 or 20KW) + 240 x 7Ah batteries	4 modules (10 or 20KW) NO batteries	6 modules (10 or 20KW) NO batteries	10 modules (10 or 20KW) NO batteries
Max. Power	kW	40	60	80	120	200
Dimensions (WxHxD)	mm	550x1135x775	550x1975x775	550x1135x775	550x1975x775	
Weight of empty cabinet	kg	92	173	82	133	174
Weight with modules and no batteries	kg	130 up to 136 (with 2 Modules)	229 up to 238 (with 3 Modules)	157 up to 169 (with 4 Modules)	245 up to 263 (with 6 Modules)	360 up to 389 (with 10 Modules)
Max number parallel cabinets		4	4	4	3	2
Max number of modules per system		8	12	16	18	20
Max system capacity (no redundancy)		160kW	240kW	320kW	360kW	400kW
Backfeed Protection		Optional				
Colour		Black (RAL 9005)				
Operator access		Front				
Cable entry		From the bottom				
Protection class		IP20				

UPS MODULE CHARACTERISTICS

Mechanical		10 kVA UPS module	20 kVA UPS module
Dimensions (WxHxD) (with front mounting wings)	mm	448 x 132 x 540 (3 HU) 488 x 132 x 540 (3 HU)	
Weight UPS module	kg	18.6	21.5
Colours		Front: RAL 9005	
Input characteristics			
Output rated power per module cosφ 0.8	kVA	10	20
Output rated power per module cosφ 1.0	KW	10	20
Nominal input voltage	VAC	3x380/220V+N, 3x400V/230V+N, 3x415/240V+N	
Input voltage tolerance (ref to 3x400/230V) for loads in %	VAC	(-20%/+15%) 3x320/184 V to 3x460/264 V for <100 % load (-26%/+15%) 3x296/170 V to 3x460/264 V for < 80 % load (-35%/+15%) 3x260/150 V to 3x460/264 V for < 60 % load	
Input frequency	Hz	35 – 70	
Input power factor		PF=0.99 @ 100% load	
Overvoltage Category		II (2500Vpk)	
Rated Conditional short circuit current (Icc)	kA	25	
Inrush current	A	max. In	
Input distortion THDI @ 100% load		< 4.5%	< 3.0
Max. input power with rated output power and charged battery per module (output cosφ = 1.0)	kW	10.5	21
Max. input current with rated output power and charged battery per module (output cosφ = 1.0)	A	15.2	30.4
Max. input power with rated output power and charged battery per module (output cosφ = 1.0)	kW	11.5	23
Max. input current with rated output power and discharged battery per module (output cosφ = 1.0)	A	16.6	33.3
Output characteristics			
Output rated power per module cosφ 0.8	kVA	10	20
Output rated power per module cosφ 1.0	KW	10	20
Output current in @ cosφ 1.0 (400 V)	A	14.5	29
Output rated voltage	VAC	3x380/220V or 3x400/230V or 3x415/240V	
Output voltage stability	%	Static: < ±1% Dynamic (Step load 0%-100% or 100%-0%) < ±4%	
Output voltage distortion	%	With Linear Load< 1.5% With Non-linear Load (EN62040-3:2001)< 3%	
Output frequency	Hz	50 Hz or 60 Hz	
Output frequency tolerance	%	Synchronized with mains < ±2% (selectable for bypass operation) or < ±4% Free running+/- 0.1%	
Bypass operation		At Nominal Input voltage of 3x400 V ±15% or 196 V to 264 V ph-N	
Permissible unbalanced load	%	100% (All 3 phases regulated independently)	
Phase angle tolerance	Deg.	2.0 deg. (With 100% unbalanced load)	
Overload capability on inverter	%	125% load 10 min. 150% load 60 sec.	
Output short capability (RMS)	A	Inverter: 3.0 x In during 40 ms Bypass: 10 x In during 20 ms	Inverter: 2.25 x In during 40 ms Bypass: 10 x In during 20 ms
Crest factor		3:1	
Static Bypass transfer time Inv>Byp/Byp>Inv/Ecomode	ms	<1 / <5 / <8	

Heat Dissipation With Non-linear Load		10 kVA UPS module	20 kVA UPS module
Heat dissipation with 100% non-linear load. Per module (EIN 62040-1-1:2003	W	550	1100
Heat dissipation with 100% non-linear load. Per module (EIN 62040-1-1:2003)	BTU/h	1887	3754
Airflow (25° - 30°C) with non-linear load. Per module (EIN 62040-1-1:2003)	m³/h	150	150
Dissipation at no load	W	120	150
Module efficiency			
Efficiency ac-ac up to (at Cosφ 1.0) (depending on % module power) (Tolerance +/- 0.5% applies on all figures)	100% 75% 50% 25%	94.5% 95.0% 95.0% 94.0%	
Efficiency with linear load at cosφ = 0.8ind Efficiency non-linear load (EN 62040-1-1:2003)		Typically up to 1% higher of above values Typically up to 1% lower of above values	
ECO mode efficiency at 100% load	%	98%	
Environmental Characteristics			
Audible noise with 100% / 50% load	dBA	55 / 49*	57 / 49*
Operation temperature	°C	0 – 40	
Ambient temperature for batteries (recommended)	°C	20	
Storage temperature	°C	-25 - +55**	
Battery storage time at ambient temperature		Max. 6 months	
Max. altitude (above sea level)	m	1000m (3300ft) without de-rating	
De-rating factor for use at altitudes above 1000m sea level according to (IEC 62040-3) (ALL MODULES) to maximum of 3000m		**Height above sea level (m / ft)**	**De-Rating Factor for Power**
		1500 / 4850	0.95
		2000 / 6600	0.91
		2500 / 8250	0.86
		3000 / 9900	0.82
Relative air-humidity		Max. 95% (non-condensing)	
Accessibility		Totally front accessibility for service and maintenance	
** These are approximate figures for one module only. The audible noise also depends on the characteristics of the host cabinet in which the UPS sub-rack is fitted.*			

***Elevated storage temperatures may impact useful life, specifically for the UPS capacitors. Ideal storage temperature is between +5 and +35C and at relative humidity of up to 75%. Long term storage in an environment with high humidity should be avoided. Likewise, one should avoid storage environments that contain halogenated gases (and other hazardous gases), sprinkling water or oil as well as exposure to any radiation.*

BATTERY CHARACTERISTICS

Battery characteristics		10 kVA UPS module	20 kVA UPS module
Battery type		Maintenance free VRLA, NiCd or Li-Ion	
Permitted number of VRLA 12V battery	No.	30-50 *	
Permitted number of 1.2V NiCd cells	No.	300-500 *	
Permitted number of 3.2V Li-Ion Cells	No.	160-192	
Maximum battery charger current	A	4 A (6A on request)	
Floating voltage	VDC	VRLA: 2.26V/cell at 20C - NiCad: 1.4 V/cell	
End of Discharge Voltage	VDC	VRLA: 1.65V/cell at 20C - NiCad: 105 V/cell	
Battery charging curve		Ripple free: IU (DIN 41773)	
Temperature compensation		Standard (temp. sensor optional)	
Battery test		Automatic and periodically (adjustable)	

* Battery capacity usage	10KW UPS Module			20KW UPS Module									
Number of battery blocks	30	32	34-50	30	32	34	36	38	40	42	44	46	48-50
Max. Power in KW	8.6	9	10	12	13	14	14.8	15.6	16	17	18	19	20

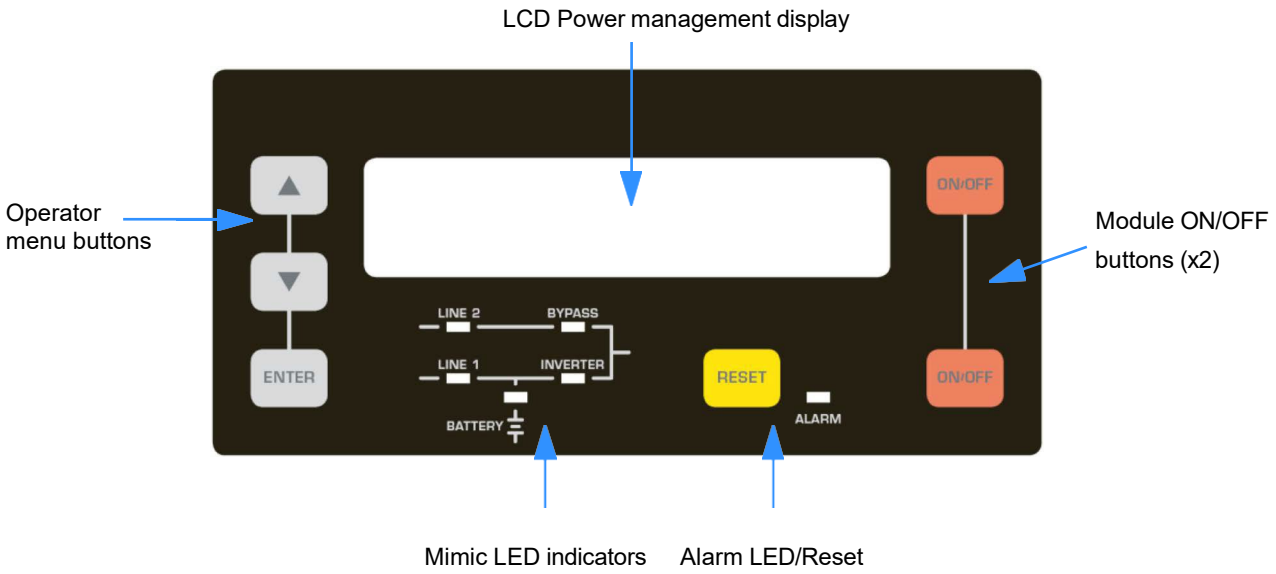
STANDARDS

Standards		
Safety	EN 62040-1-1, EN 60950-1	
Electromagnetic Compatibility	EN 61000-6-4 Prod. Standard: EN 62040-2, EN 61000-6-2 Prod. Standard: EN 62040-2, EN 61000-4-2, EN 61000-4-3 – EN 61000-4-4 – EN 61000-4-5 – EN 61000-4-6	
Emission class	C3	
Immunity class	C3	
Performance	IEC/EN62040-3	
Product certification	CE UKCA	
Degree of protection	IP 20	

COMMUNICATION OPTIONS

Communication options (All systems)	
Module control panel LCD display	1 x LCD display fitted to module control panel of each module
RJ45 Plug (Not used)	RJ45 Plug (for future options)
Customer interfaces: outputs DRY PORT X2	5 Voltage free contacts For remote signalling and automatic computer shutdown
Customer interfaces: inputs DRY PORT X1	1 x Remote Shut down [EMERGENCY OFF (Normally closed)] 2 x Programmable Customer's Inputs (1st default as GEN-ON (Normally open) (2nd free Programmable Customer's Inputs (Normally open)) 1 x Temp. Sensor for Battery Control 1 x 12 Vdc output (max. 200mA)
Serial ports RS232 on Sub-D9	1 x system frame For monitoring integration in network management and service
USB	1x For monitoring and software management
Slot for SNMP	SNMP card (optional) For monitoring and integration in network management

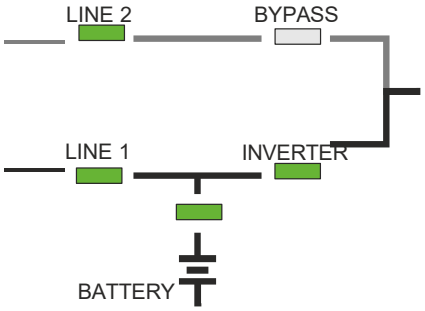
MODULE CONTROL PANEL



Module mimic LED indicators

The module mimic LED colours change between GREEN, RED and OFF to indicate the operational status of key UPS stages, and thereby serve to show the active power path through the UPS.

- LINE 1 (rectifier) and LINE 2 (bypass) LEDs indicate the availability of the input mains and bypass mains supplies respectively.
- INVERTER and BYPASS LEDs illuminate green to indicate which of the two sources is providing the UPS output supply.



- BATTERY illuminates green when the battery is being charged and flashes when the battery is discharging – e.g. when the inverter is operating from battery power.
- Although it is not part of the module mimic, the ALARM LED, located towards the lower-right of the control panel, provides a visual indication that an alarm condition has been detected. When an alarm condition is present the LED is accompanied by an audible alarm.

Operator buttons

The operator buttons allow the user to:

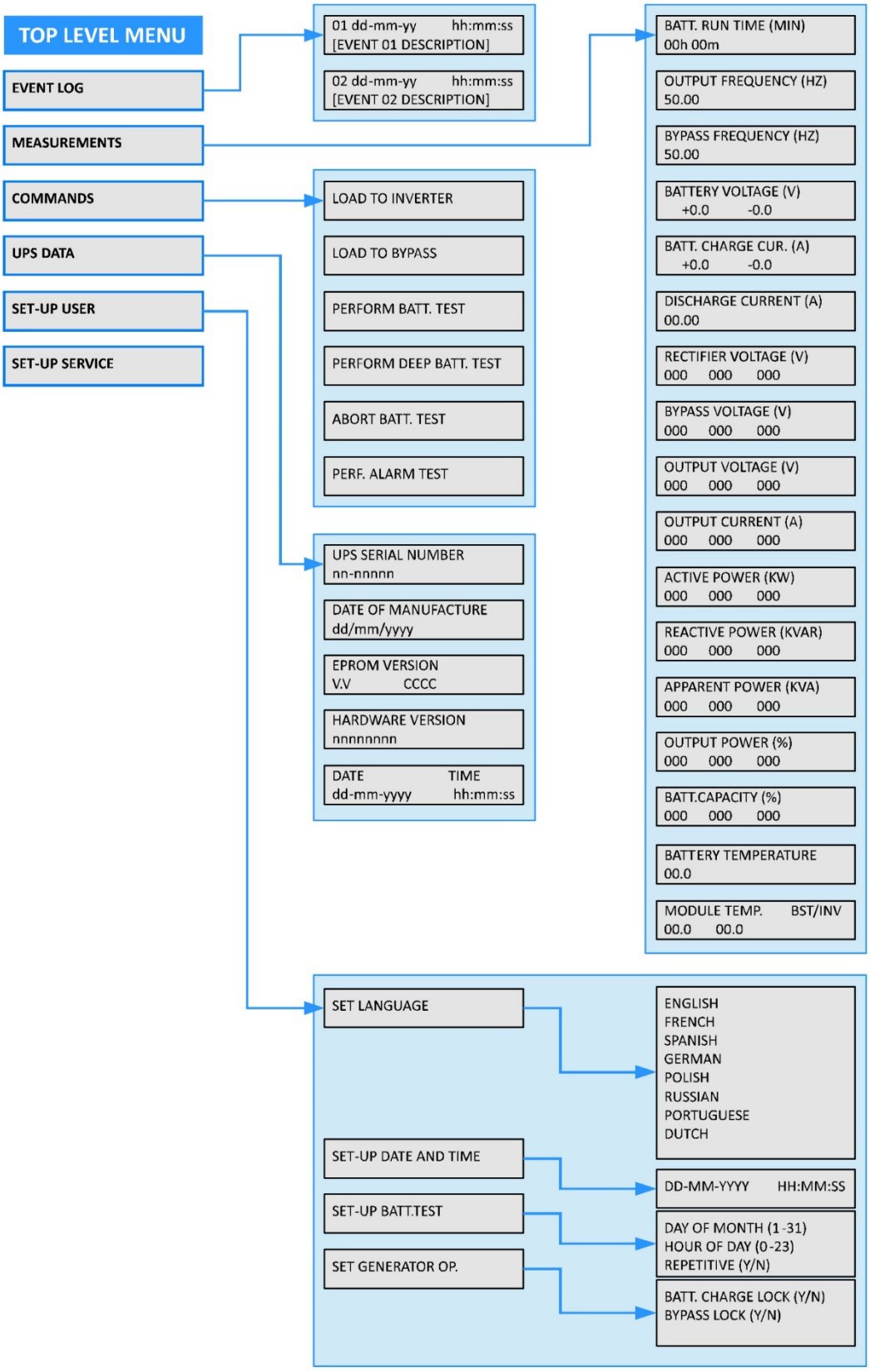
- Set operating parameters and make adjustments via the menu-driven LCD display.
- Start and stop the UPS, and transfer the load between inverter and bypass.
- Monitor the UPS input/output voltage, current, frequency and other parameters – shown on the LCD display.

The UPS can be switched ON or OFF by simultaneously pressing both ON/OFF buttons. The requirement to press *both* buttons is to help avoid accidental operation.

LCD Power management display

During normal operation the LCD displays a UPS status screen similar to those shown below. From the status screen the user can access the 'top level' menu by pressing either the UP or DOWN button; and then further navigate through the nested sub-menus using the UP / DOWN buttons to scroll, and the ENTER button to make a selection. On the right hand side of the LCD status screen display is a three digit module ID indicator which shows a module's position in a multi-module system.

The menu tree is shown on the following page.


TOP LEVEL MENU
EVENT LOG
MEASUREMENTS
COMMANDS
UPS DATA
SET-UP USER
SET-UP SERVICE
01 dd-mm-yy hh:mm:ss
[EVENT 01 DESCRIPTION]
02 dd-mm-yy hh:mm:ss
[EVENT 02 DESCRIPTION]
LOAD TO INVERTER
LOAD TO BYPASS
PERFORM BATT. TEST
PERFORM DEEP BATT. TEST
ABORT BATT. TEST
PERF. ALARM TEST
UPS SERIAL NUMBER
nn-nnnnn
DATE OF MANUFACTURE
dd/mm/yyyy
EPROM VERSION
V.V CCCC
HARDWARE VERSION
nnnnnnnn
DATE TIME
dd-mm-yyyy hh:mm:ss
BATT. RUN TIME (MIN)
00h 00m
OUTPUT FREQUENCY (HZ)
50.00
BYPASS FREQUENCY (HZ)
50.00
BATTERY VOLTAGE (V)
+0.0 -0.0
BATT. CHARGE CUR. (A)
+0.0 -0.0
DISCHARGE CURRENT (A)
00.00
RECTIFIER VOLTAGE (V)
000 000 000
BYPASS VOLTAGE (V)
000 000 000
OUTPUT VOLTAGE (V)
000 000 000
OUTPUT CURRENT (A)
000 000 000
ACTIVE POWER (KW)
000 000 000
REACTIVE POWER (KVAR)
000 000 000
APPARENT POWER (KVA)
000 000 000
OUTPUT POWER (%)
000 000 000
BATT.CAPACITY (%)
000 000 000
BATTERY TEMPERATURE
00.0
MODULE TEMP. BST/INV
00.0 00.0
SET LANGUAGE
ENGLISH
FRENCH
SPANISH
GERMAN
POLISH
RUSSIAN
PORTUGUESE
DUTCH
SET-UP DATE AND TIME
DD-MM-YYYY HH:MM:SS
SET-UP BATT.TEST
DAY OF MONTH (1-31)
HOUR OF DAY (0-23)
REPETITIVE (Y/N)
SET GENERATOR OP.
BATT. CHARGE LOCK (Y/N)
BYPASS LOCK (Y/N)

OPTIONAL SYSTEM CONTROL PANEL

The system control panel is an optional component which is fitted to one UPS cabinet in a parallel cabinet system.

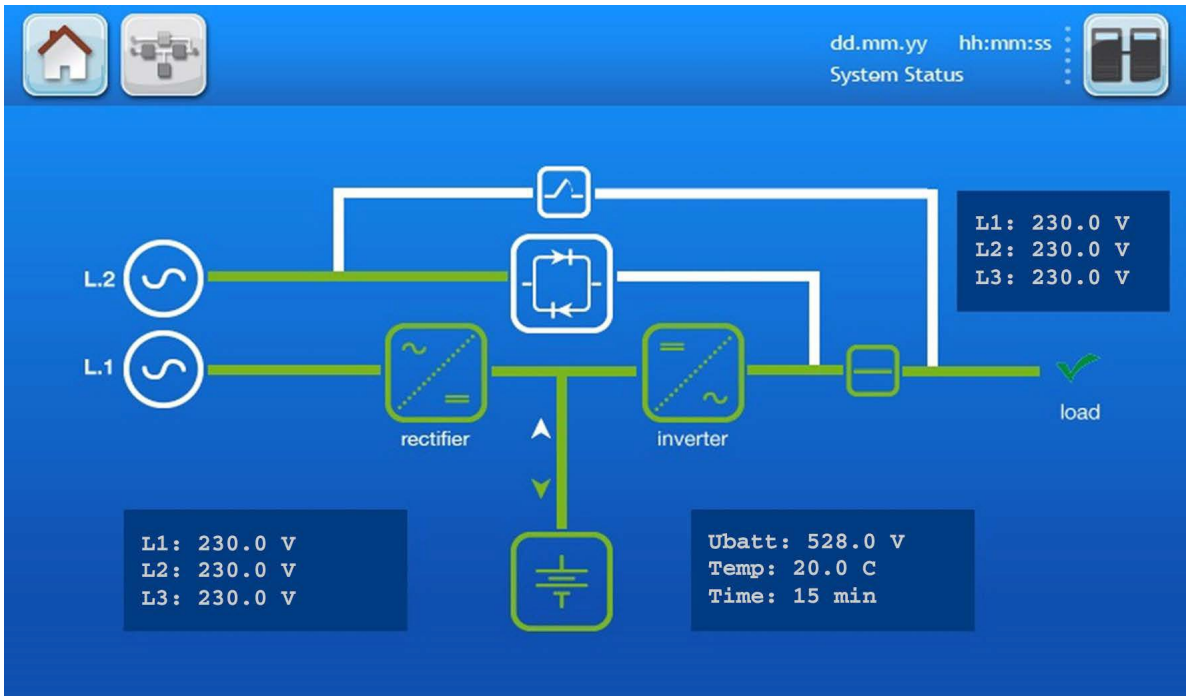
It contains a microprocessor-based TFT touch-screen display which enables the operator to monitor the status of the overall UPS system as well as each individual UPS module. It also allows the operator to transfer the load between the inverter and bypass.

All other module-level commands must be performed from the UPS module control panels. By working at 'module' and 'system' level, having both control panels in place results in providing enhanced user friendliness without compromising on robustness.

Using the touch-screen, the operator can:

- check system's operational status and measurements
- execute system-level commands
- monitor the power flow through the UPS system
- check alarm and events history
- silence alarms
- adjust programmable parameters
- view the battery status

The display turns on automatically when the first UPS power module is energised; and after a few seconds of initialisation it displays the default module mimic screen shown in Figure .



System control panel – default display

EXTERNAL COMMUNICATION FACILITIES

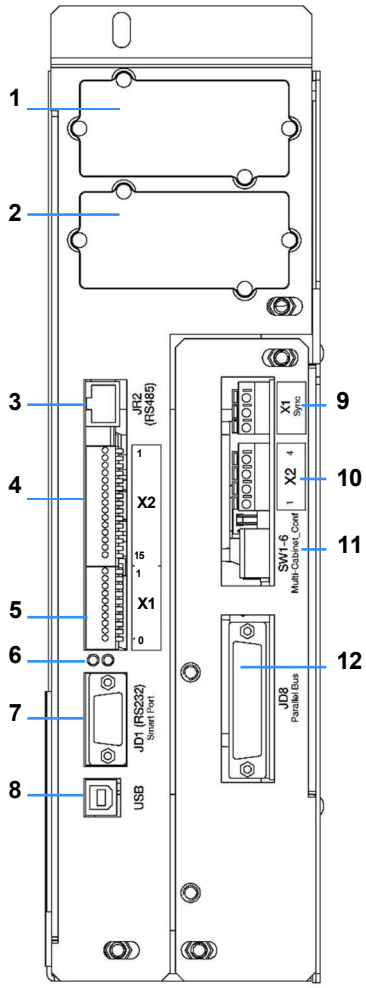
UPS Interface boards

Two interface boards are fitted in the lower part of the UPS cabinet. One is the customer interface board, which offers a range of connections that enable the user to interface the UPS with a local network, building management system or a simple remote alarms facility. The other is the parallel interface board which contains the connections used to control and monitor the cabinets when connected as part of a parallel cabinet system.

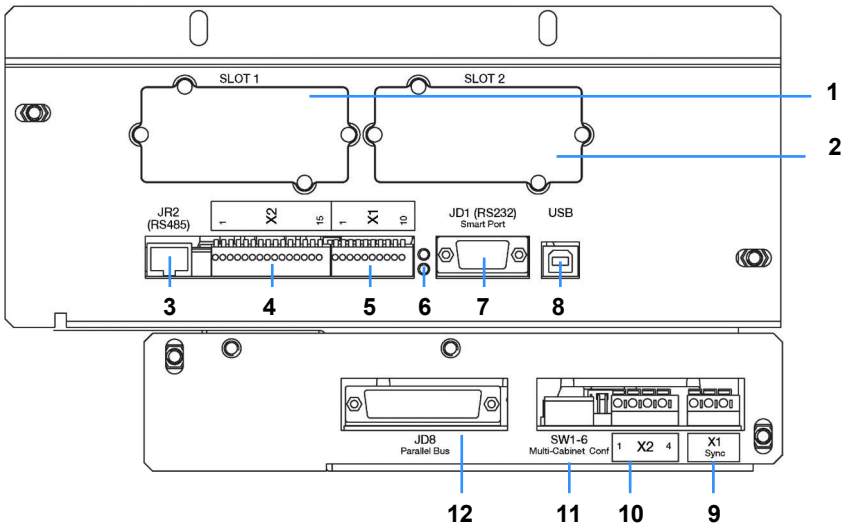
All the communications interface board connections are accessible from the front of the UPS cabinet.

Key Point: The parallel interface board is part of the factory-fitted 'paralleling kit' and is installed only in UPS cabinets that are used in a parallel system.

ST40-120 Cabinets



ST200 Cabinet



		Customer Interface Board
1	SLOT 1	Slot for optional Modem/Ethernet card ONLY.
2	SLOT 2	Slot for optional SNMP card ONLY.
3	JR2	RJ45 Port: (Not used)
4	X2	Customer output dry ports (Phoenix terminal block):
5	X1	Customer input dry ports (Phoenix terminal block):
6	LEDs	Interface board tatus LEDs (red/green)
7	JD1	RS232 Smart port computer interface
8	USB	Standard USB interface
		Parallel Interface Board (fitted in a parallel UPS cabinet only)
9	X1	Sync Input: Optional sync to an external source
10	X2	External manual bypass/ External output isolator (options): Electrical interlock input
11	S1-6	Configuration DIP switch:
12	JD8	Parallel bus: Inter-cabinet parallel bus connector

UPS Interface Boards

Customer control inputs (X1)

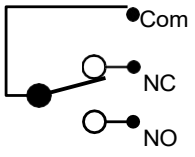
Terminal block X1 provides a range of standard input interfaces that can be used by the customer as required. All connections are made to Phoenix spring terminals. These terminals will accept wires up to 1.5 mm² but we recommend 0.5 mm² gauge wires are used for ease of connection.

Four switched inputs are used to signal an external Remote Shut Down, On Generator and a customer-specific function (special application) operation, together with a battery temp sensor input. These are applied to the UPS internal control system via isolation relays fitted on the communications interface board that are controlled directly by the external inputs.

	Terminal	Contact	Signal	Function
X1	X1/10	Gnd	Gnd	UPS-protected+12 Vdc output supply (max 200mA).
	X1/9	In	+12 Vdc*	
	X1/8	Gnd	Gnd	REMOTE SHUTDOWN (Do not remove the factory-fitted bridge if this feature is not used)
	X1/7	In	+12 Vdc*	
	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 (Function on request to be defined)
	X1/3	In	+12 Vdc*	
	X1/2	Gnd	Gnd	GENERATOR OPERATION (NC = Generator on line)
	X1/1	In	+12 Vdc*	
	*+12 Vdc is the terminal open-circuit voltage. This are pulled down to 0V (Gnd) when the external circuit is closed.			

Dry port outputs (X2)

All the dry port output terminals (X2) can accept cables from 0.5 mm² to 1.5 mm².
X2 outputs are switched by volt-free contacts and are suitable for driving an external alarm panel or providing automatic and orderly shutdown of servers, AS400 or automated building systems. The contacts are rated at a maximum of 30 VAC/ 6A or 60 VDC/0.7A.

	Terminal	Contact	Signal	Display	Function	Contacts
X2	X2/15	Com	ALARM	COMMON_ALARM	Common	
	X2/14	N/C			No Alarm Condition	
	X2/13	N/O			Common Alarm (system)	
	X2/12	Com	MESSAGE	LOAD_ON_MAINS	Common	
	X2/11	N/C			Load On Inverter	
	X2/10	N/O			Load On Bypass (mains)	
	X2/9	Com	ALARM	BATTERY_LOW	Common	
	X2/8	N/C			Battery OK	
	X2/7	N/O			Battery Low	
	X2/6	Com	MESSAGE	LOAD_ON_INV	Common	
	X2/5	N/C			Load On Bypass (mains)	
	X2/4	N/O			Load On Inverter	
	X2/3	Com	ALARM	MAINS_OK	Common	
	X2/2	N/C			Mains Not Present	
	X2/1	N/O			Mains Present	

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 via the USB port.

The RS232/USB interface allows the UPS to be connected to a computer which, when used with appropriate power management software, allows the computer to continuously monitor the input mains voltage and UPS status, and display messages in response to any UPS system changes.

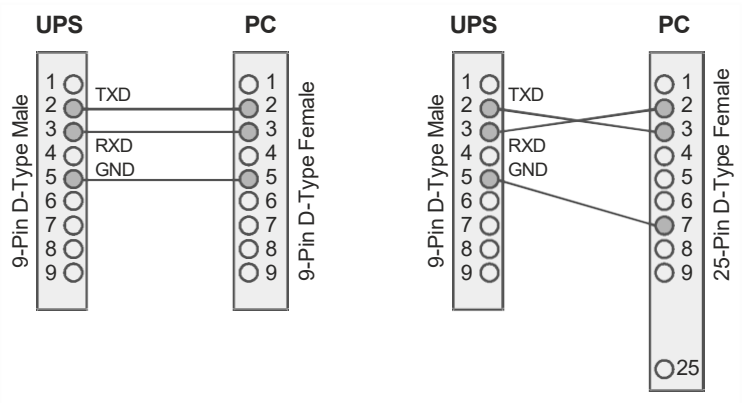
USB Port

To establish communication between the UPS and a computer, connect the USB cable that is supplied with the UPS between the UPS USB port and the USB port on the computer. The USB port is compliant with USB 1.1 protocol.

JD1 RS232 Port

J1 is a standard 9-pin D-Type female socket which provides an intelligent RS-232 serial port.

Note that the maximum length for the interconnecting RS232 cable is 15m.



Network interface card slots

The communications interface board contains two card slots that can be used with a range of network interface cards to interface the UPS system with a building management system or computer network. A suitable network interface card can be chosen to enable the UPS to be monitored and interrogated by one of following protocols:

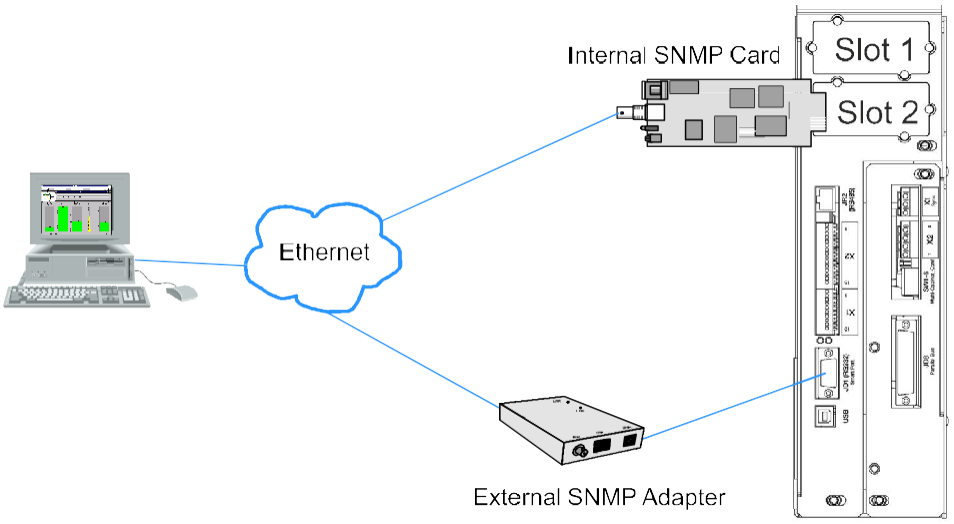
- Simple Network Management Protocol (SNMP)
- MODBUS over TCP/IP
- MODBUS over RS-485

SNMP is a world-wide, standardised communication protocol and the one that is used most often to integrate the UPS with a wider building/network management system. It 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.

An SNMP/Ethernet adapter card contains an RJ-45 connector which can be connected to the network using a standard CAT-5 cable. Once connected, the UPS-Management software agent which is already installed in the SNMP adapter can monitor the UPS operation and output its data to the connected network in SNMP format. In a parallel module UPS system such as the PW 8000DPA (ST) the SNMP interface can communicate 'system-wide' data or data for an individual UPS module.

The SNMP adaptor card requires a PC with terminal connections and, for normal operation, at least one Ethernet connection. The SNMP card enables event/alarm email traps, server shut down (with optional licenses) and other tasks; and can also be integrated with BMS software over a local area network (LAN) for SNMP or Modbus information over IP.

Alternatively, SNMP connectivity can be implemented using an external SNMP adapter connected to the communications interface board RS232 output (JD1), as shown below.



SNMP adaptor card options

UPS MONITORING AND AUTOMATED CONTROL SOFTWARE

The importance of UPS management

The utility supply is inevitably unreliable every now and then; and assuring continuous power to all the facilities connected to it can be a difficult task. The situation is further complicated if worldwide systems are managed via a Local or Wide Area Network (LAN/WAN).

However, by interfacing the PW 8000DPA (ST) UPS system with purpose-designed network management tools, a System Administrator can take measures to back-up data and prevent system errors in the event of a long utility supply outage.

Suitable UPS management software can enable a System Administrator to monitor all attached networks from a central point and identify bottlenecks at an early stage but, in spite of extensive system monitoring, serious damage can still occur if an administrator fails to intervene in a timely manner. It is therefore important that, when appropriate, the installed UPS software can react automatically to shut down the supplied system in a safe and controlled manner.

Rehlko considers it important to have a complete solution for its UPS systems and offers its customers a number of remote control and monitoring tools to provide optimum protection.

Optional monitoring systems are available for use with the Rehlko PW 8000DPA UPS system:

- SNMP – can be used for monitoring and controlled UPS shutdown
- WAVEMON – can be used for monitoring and controlled UPS shutdown

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.

WAVEMON UPS monitoring and control software

WAVEMON is a bespoke software package, designed to operate in conjunction with many of the systems supplied by Rehlko, which features both UPS monitoring and automatic UPS/server shutdown facilities.

The package is installed on a local PC and communicates with the UPS via USB or an RS-232 serial cable so does not require the purchase of an SNMP card or adapter.

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.

Functional description

WAVEMON is a client/server software application designed for networks and local workstations. In general, it consists of two parts: the server module of the UPS management software is *UPSMAN,* which communicates with the UPS via an RS232/USB interface. Running as a background application, *UPSMAN* collects and interprets the messages received from the UPS and places them at the disposal of the client module *UPSMON,* as well as any connected SNMP-based instrumentation and control system.

If *UPSMAN* detects voltage variations or a power failure, it can execute various 'system event' routines, by means of which, for example, the server is switched off or a warning/alarm is sent to the connected users. These 'system event' routines are a part of the management software and can be configured in to suit local application requirements.

The PW 8000DPA (ST) UPS software unit can be integrated into a network in two ways:

1. By the server which is supplied by the UPS itself and has been integrated into the network.

   In most cases this server is used as a sub-agent and you only need the WAVEMON software (without an SNMP adapter). You will also need to establish an RS232/USB connection between the UPS and computer/server.

2. By the use of an SNMP card/adapter

   An SNMP card/adapter is to be preferred in order to integrate the UPS into the network. In this case up to 50 computers can be shut down in one RCCMD environment. RCCMD (remote console command) is an additional software module that is used in order to execute a command (typically a shutdown command) in a remote system.

Licensing

A licence is issued with every software serial number for use of what is known as the 'UPS service' on a single server in connection with one UPS and an unlimited number of connected WINDOWS workstations. For operation with two or more servers, a further licence is required for each additional server. In this case it is of no importance whether the UPS service on these servers is active or whether the server was stopped by a remote UPS service. The same applies to the use of RCCMD with the 'remote send/receive' modules for 'multi-server shutdown' under NT, UNIX and other operating systems.

The service programs are generally supplied as single licences. In order to use a single CD-ROM for several 'multi-server shut-down' units you must acquire additional licence codes.

RCCMD Server shutdown

In order that remote shutdown of servers can take place, initiated by the SNMP card or WAVEMON software, further licenses must be purchased. The license is for the RCCMD client (or listening) software that resides in each target server.

PowerREPORTER™ management software

PowerREPORTER is a remote monitoring and management service which provides peace-of-mind protection by offering a continuous (24/7/365) watch over mission-critical facilities. Continuous monitoring is an affordable insurance policy to detect issues and provide an early warning before they develop into a crisis.

The main features and benefits offered by PowerREPORTER are:

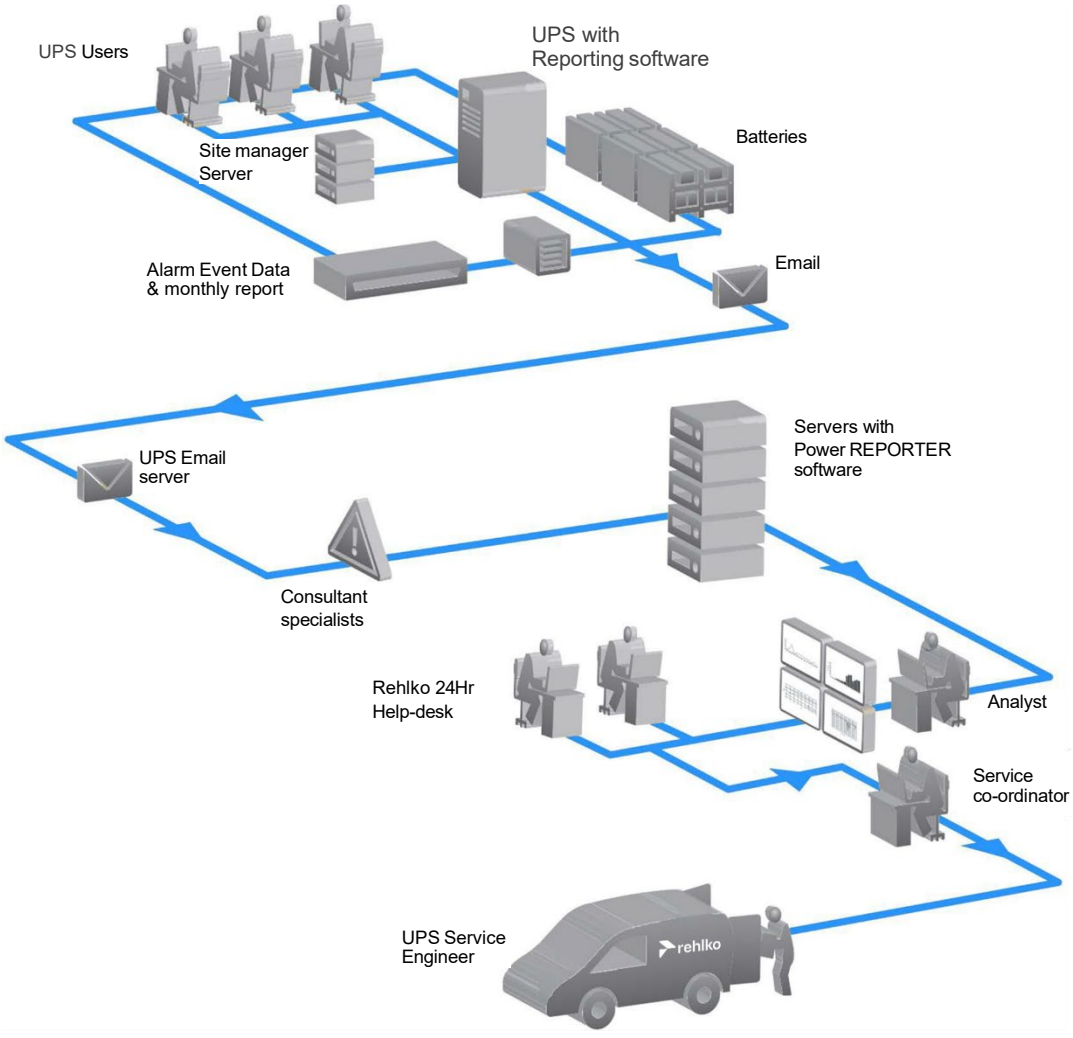
- Real time email notification sent directly to KUP Service Centre in response to alarm/critical events
- Acquisition of key performance data and productivity information. Empowers you with the details needed to better understand machine performance and quickly troubleshoot downtime events
- Improved service level. Combined with a service contract, PowerREPORTER ensures an engineer can determineif site attendance is necessary and bring relevant spare parts
- Monthly Status Report detailing trends and alarms

An optional battery analysis and care service; PowerNSURE - measures battery voltage, temperature, impedance and prolongs battery service life through the application of battery charge equalization

Functional description

PowerREPORTER communicates constantly with your UPS system to automatically detect any error or alarm messages. If it encounters an incident, PowerREPORTER will automatically transmit a status message, via email, to the Rehlko Ltd service centre providing details relating to the identified fault, a snapshot of the UPS performance parameters and a device identification string.

The email automatically alerts the service centre personnel who then remotely diagnose the UPS incident and liaise with the company's field service team so that they can reach the facility with appropriate spare parts within the contracted service agreement time-frame.



Remote monitoring communications chain

INSTALLATION PLANNING

A certain amount of pre-planning will help ensure a smooth and trouble-free UPS installation process.This chapter contains essential information concerning the environmental, mechanical and electrical requirements that should be considered when planning the installation of the Rehlko PW 8000DPA UPS system.

Environmental and mechanical planning

Environmental considerations

It is essential that the following environmental guidelines are observed when planning a suitable UPS location and operating environment.

1. The route between the equipment off-loading point and 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 any transport aids used during transit.
3. Locations with high ambient temperature, moisture or humidity must be avoided.
   a) The installation site humidity should be <95% non-condensing.
   b) The specified equipment ambient temperature is 0°C to +40°C but ideally this should be around 20°C to 25°C.
   c) A battery temperature of 20°C to 25°C is recommended to achieve a long battery life.
   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.
   e) The air entering the UPS must not exceed +40°C.
4. To obtain the best system performance 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, or 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 minimum cabinet clearances described below must be provided.

Installation

The Rehlko PW 8000DPA is designed as a modular system contained in a range of UPS cabinets as illustrated in the table below.

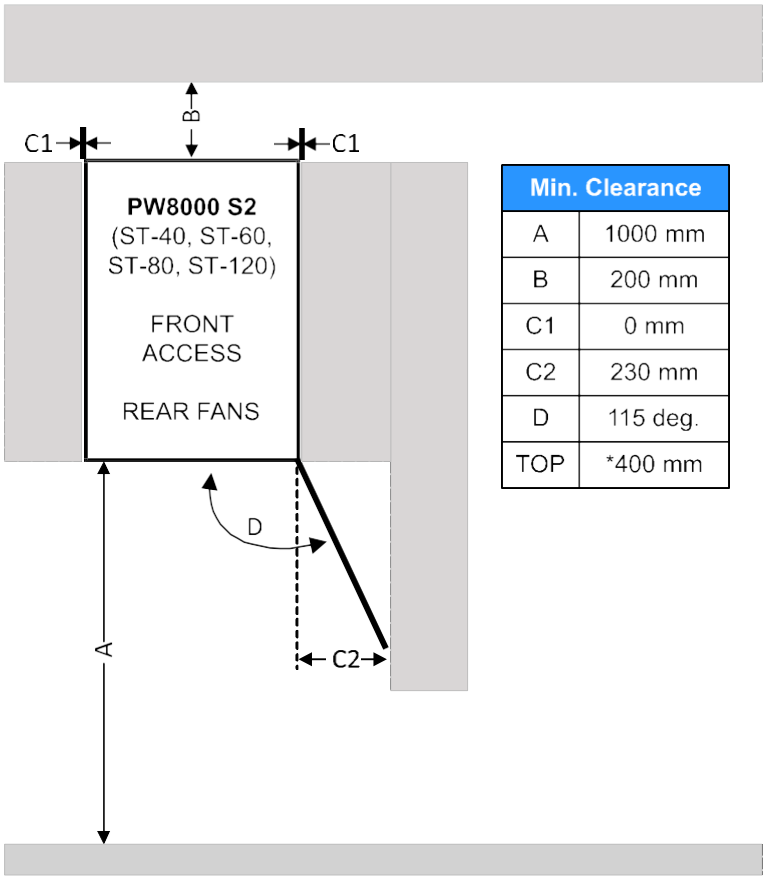
	ST-40	ST-60	ST-80	ST-120	ST-200
Dimensions (WxHxD) mm	550 x 1135 x 775	550 x 1975 x 775	550 x 1135 x 775	550 x 1975 x 775	550 x 1975 x 775
Maintenance Accessibility	*Totally front accessibility for service and maintenance (no side or top access required)				
Input/Output Power Cabling	From the bottom front				
***Note:** The battery fuses are located on the back of the ST-200 cabinet and rear access is required to operate the equipment. See Figure for optional installation positioning of the ST200 cabinet.*					

When several cabinets are connected together to form a parallel-cabinet UPS system they should be positioned as close together as possible – ideally standing immediately adjacent to each other to form a cabinet suite. The ST-40 and ST-60 cabinets contain internal batteries but the other models require external batteries contained in a purpose designed enclosure, or rack mounted. Rehlko can provide a range of suitable battery cabinets if required

An external battery enclosure should be located as close as possible to the UPS cabinet(s) to reduce the volts drop on the DC cables when the batteries are in use – again, in an ideal installation the battery enclosure should be installed adjacent to the UPS cabinet(s) if possible.

Clearances

Key Point: When planning a UPS installation that incorporates external batteries it is important that the battery enclosure installation requirements (access clearance, ventilation requirements, weight etc.) are accounted for in the planning process – if a non-Rehlko battery cabinet is to be used, these details must be obtained from the battery cabinet supplier.

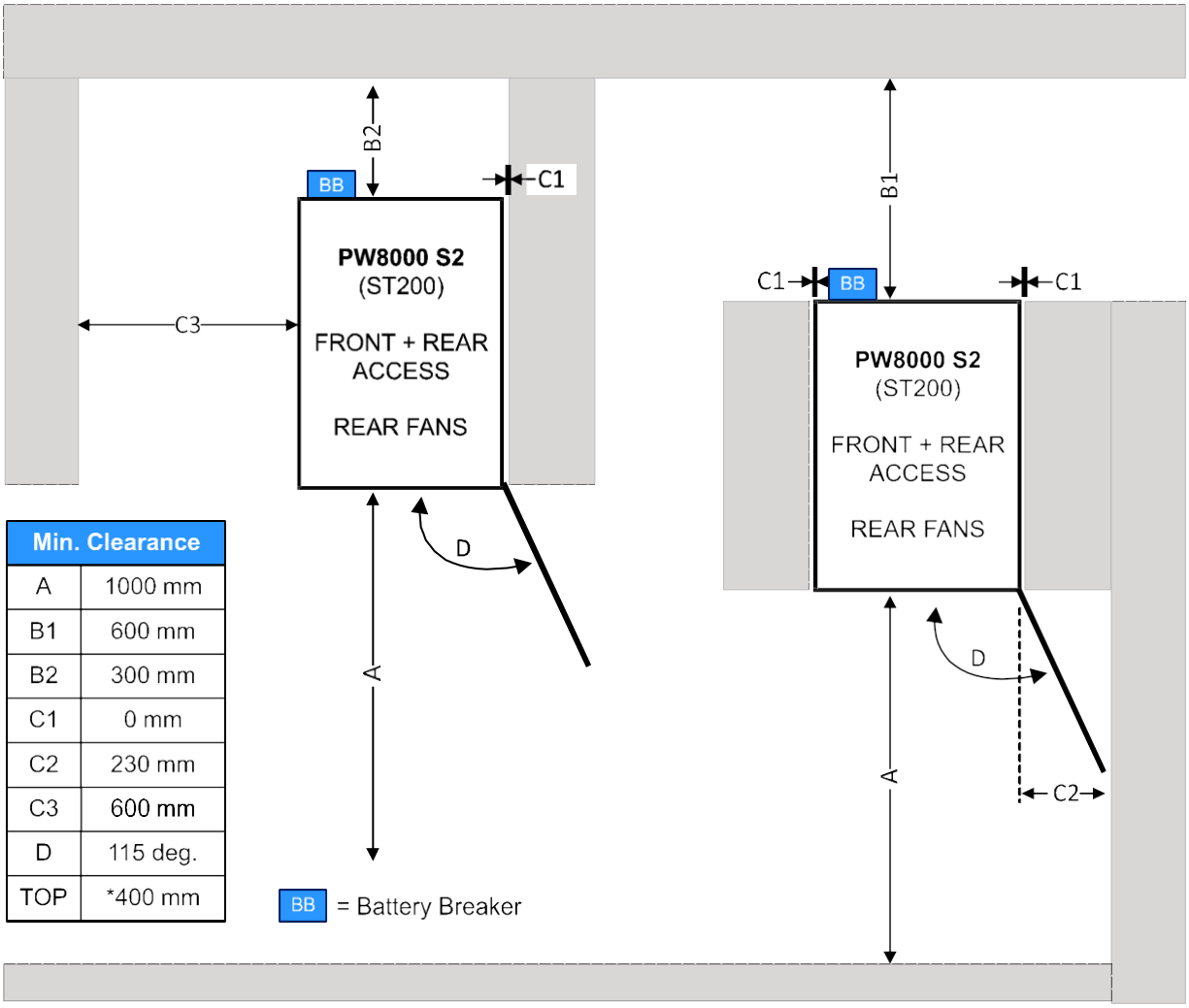


Min. Clearance	
A	1000 mm
B	200 mm
C1	0 mm
C2	230 mm
D	115 deg.
TOP	*400 mm

ST40 - ST120 Clearance recommendations

ST40 - ST120 clearances notes

1. No rear or side access is required for maintenance, servicing or user operation.
2. A clearance of 1000mm is required at the front of the UPS cabinet to allow the UPS modules to be withdrawn (A).
3. A clearance of 200mm must be provided at the back of the cabinet to provide adequate ventilation airflow (B).
4. No side clearance is necessary (C1).
5. The cabinet right-hand door must be opened by 115° in order to remove/fit the UPS power modules so the right-hand side of the cabinet cannot be positioned directly against a projecting wall – in this case an additional side clearance must be provided immediately in front of the cabinet right side (C2).
6. A clearance of 400mm should be provided at the top of the cabinet to assist ventilation if the route at the back of the cabinet is insufficient to dissipate the cooling airflow.



Min. Clearance	
A	1000 mm
B1	600 mm
B2	300 mm
C1	0 mm
C2	230 mm
C3	600 mm
D	115 deg.
TOP	*400 mm

ST200 Clearance recommendations

ST-200 clearances notes

1. A clearance of 1000mm is required at the front of the UPS cabinet to allow the UPS modules to be withdrawn (A).
2. The ST200 battery circuit breaker [BB] is located on the back of the cabinet and suitable access must be provided to operate the breaker. Two alternative installation layouts are shown in Figure .
   a) In the left hand diagram there is no through passageway behind the cabinet so a rear clearance of 300 mm (B2) and left side clearance of 600 mm (C3) is provided to enable battery breaker access.
   b) In the right hand diagram there is a passageway behind the cabinet and a passage width of 600 mm (B1) should be adequate to enable battery breaker access. In this situation there is no need to allow any clearance on the left side of the cabinet (C1)
3. No right side clearance is necessary (C1).
4. The cabinet right-hand door must be opened by 115° in order to remove/fit the UPS power modules so the right-hand side of the cabinet cannot be positioned directly against a projecting wall – in this case an additional side clearance must be provided immediately in front of the cabinet right side (C2).
5. A clearance of 400mm should be provided at the top of the cabinet to assist ventilation if the route at the back of the cabinet is insufficient to dissipate the cooling airflow.

ELECTRICAL AND CABLING PLANNING

Key Point: When planning a UPS installation that incorporates external batteries it is important that the battery enclosure installation requirements (access clearance, ventilation requirements, weight etc.) are accounted for in the planning process – if a non-Rehlko battery cabinet is to be used, these details must be obtained from the battery cabinet supplier.

General requirements

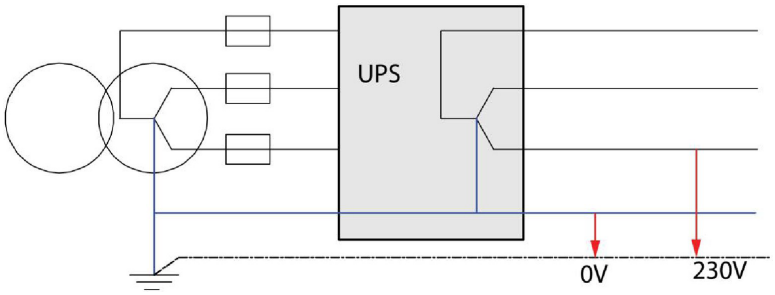
It is the customer's responsibility to design the UPS input and load distribution circuits, and provide all the external fuses, isolators and cables that are required to connect the UPS input and output power supplies. The following information should help with the preparation and planning of the UPS power cabling.

IMPORTANT NOTE: The UPS does not contain internal fuse protection for the bypass mains or input mains supplies. It is the customer's responsibility to ensure that external supply fuses (or other protective devices) are fitted and correctly sized to provide the recommended level of UPS protection. We also recommend that a spare set of fuses are held locally to ensure they are readily available if required.

The UPS bypass mains and input mains terminals should be connected to the utility mains supply through a LV mains switchboard that contains suitable circuit breakers or fused isolators. These are necessary to provide a means of isolating the UPS from the mains supplies when required and also provide suitable overload protection. Similarly, the UPS output supply terminals should be connected to the load equipment via a fused output distribution panel.

Input neutral grounding

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



Input neutral grounding

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 mains switchboard on a TN-S system.

External Backfeed protection

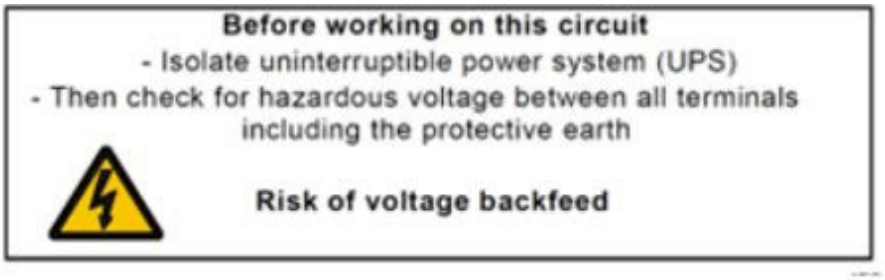
A UPS shall prevent hazardous voltage or hazardous energy from being present on the UPS input AC distribution after interruption of the input AC power. This is achieved by mandatory backfeed protection. Unless optional internal protection is included in UPS frame, such protection shall be provided by others and be installed as part of building installation. The backfeed protection shall be implemented in the form of an air gap, separating the upstream circuit from UPS when AC input fails. This is typically achieved through a contactor installed over the common AC input line or over each separate AC input line. Preferred location is just after the overcurrent protective devices serving each UPS input line. Such contactors shall have the coil supplied by the AC upstream circuit, to be engaged when AC upstream voltage is ON or dis-engaged when AC upstream voltage is OFF.

Specifications:

The device shall be three-poles, creating an air gap of at least 3 mm.

The thermal current shall meet the external overcurrent protection's rating described in the coming sections.

Electrical contractor is required to attach following "Voltage backfeed warning label" as close as possible to the external isolator:



Cable and fuse sizing

Key Point: 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.

Input/bypass mains supply cables

The UPS cabinet can be wired for a 'single feed' or 'dual feed' (split bypass) mains supply.

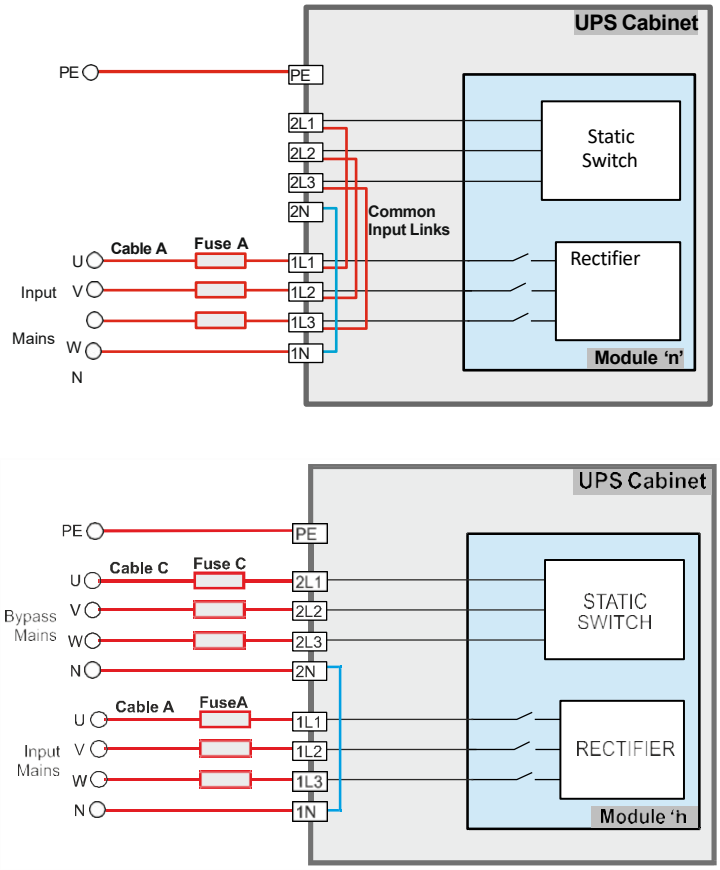
In a 'single feed' system (standard) the UPS input mains and bypass mains terminals are linked within the UPS cabinet, but in a 'dual feed' system the links are removed and the bypass mains terminals are connected to a dedicated bypass mains supply. The two configurations are shown in Figure .

The input supply and bypass supply neutrals are connected to a common neutral busbar. If the input

mains and bypass mains are obtained from the same AC power source in a 'dual feed' system it is permissible to connect just one neutral cable.

All input mains and bypass mains cables should be connected through a LV mains switchboard and protected by circuit breakers or fuses to provide overload protection and a means of isolating the UPS from the mains supply when required.

Note: We recommend that the input cables are sized for the full cabinet rating even if some UPS modules are not initially installed. This will allow the system to be expanded to its full rating without having to shut it down to up-rate the input cables. For example: the cables connected to the PW 8000DPA (ST)-200 cabinet should be rated for the full 200 kW load even if fewer than ten UPS modules are fitted.

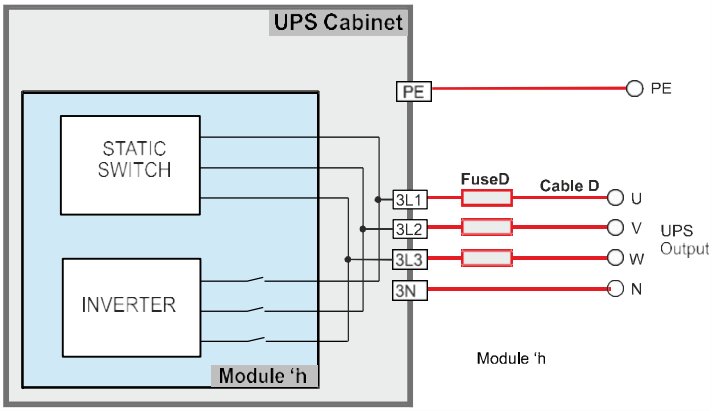


Single and dual feed input configuration

UPS Output cables

The UPS output cables should be connected to the load equipment via a suitably fused output distribution panel.

Note: We recommend that the output cables are sized for the full cabinet rating even if some UPS modules are not initially installed. This will allow the system to be expanded to its full rating without having to shut it down to up-rate the output cables. For example: the output cables connected to the PW 8000DPA (ST)-200 frame should be rated for the full 200 kW load even if fewer than ten UPS modules are fitted.



UPS Output cables

Battery cables

Internal batteries

The internal batteries in PW 8000DPA (ST) models ST-40 and ST-60 are installed on shelves that form part of the UPS cabinet. Each shelf contains a complete battery string which is connected to a UPS module via a battery breaker (F4-*x*).

Key Point: The PW8000 ST-40 and ST-60 cabinets are shipped without the batteries installed.

External batteries

PW 8000DPA (ST) models ST-80, ST-120 and ST-200 do not have provision for internal batteries and therefore require the batteries to be installed in an external enclosure. A range of external battery enclosures is available from Rehlko

When planning for an external battery installation please consider the following:

- the external battery must be installed as close as possible to the UPS cabinet
- we recommend that a separate battery is provided for each UPS module. (See 'common' / 'separate' battery configuration details below.)
- each set of battery cables must be protected by a 3-pole battery breaker which is installed as close as possible to the battery installation
- external battery cables and fuses are bespoke to the installation and will be provided by Rehlko, but it is the customer's responsibility to design and install any cable containment where necessary. *Note that the external battery string connection requires three cables, one each connected to the battery positive (+) and negative (–) extremities and a third (N) cable that is connected to the mid-point of the battery string.*
- the battery and DC cables must be connected by the commissioning engineer

Common battery configuration

A 'common battery' installation is shown on pages 33 and 35.

In this configuration a single external battery, which can itself comprise several parallel battery strings, is connected to the battery terminals (+, N, –) within the UPS cabinet from where it is connected to the UPS modules via dedicated circuit breakers (F4-*x*).

Following a mains outage, if there is a total battery failure in a 'common battery' system the entire UPS is unable to operate from battery power, resulting in the loss of the critical load supply. However, the battery normally consists of several parallel battery strings, and a battery failure in one string only means that the UPS will operate on battery power as normal but with a much reduced autonomy.

Separate battery configuration

A 'separate battery' configuration enhances the overall reliability/availability of the UPS system by providing a degree of battery redundancy – i.e. following a mains outage, the total failure of a battery only affects it's associated module and the remainder of the UPS system can fully support the critical load – assuming n+1 module redundancy.

A 'separate battery' installation is shown on pages 34 and 36 for a single-feed input and dual-feed input respectively. In these illustrations each battery is connected directly to the module circuit breakers (F4-*x*) and not to the main battery busbars (+ve & -ve).

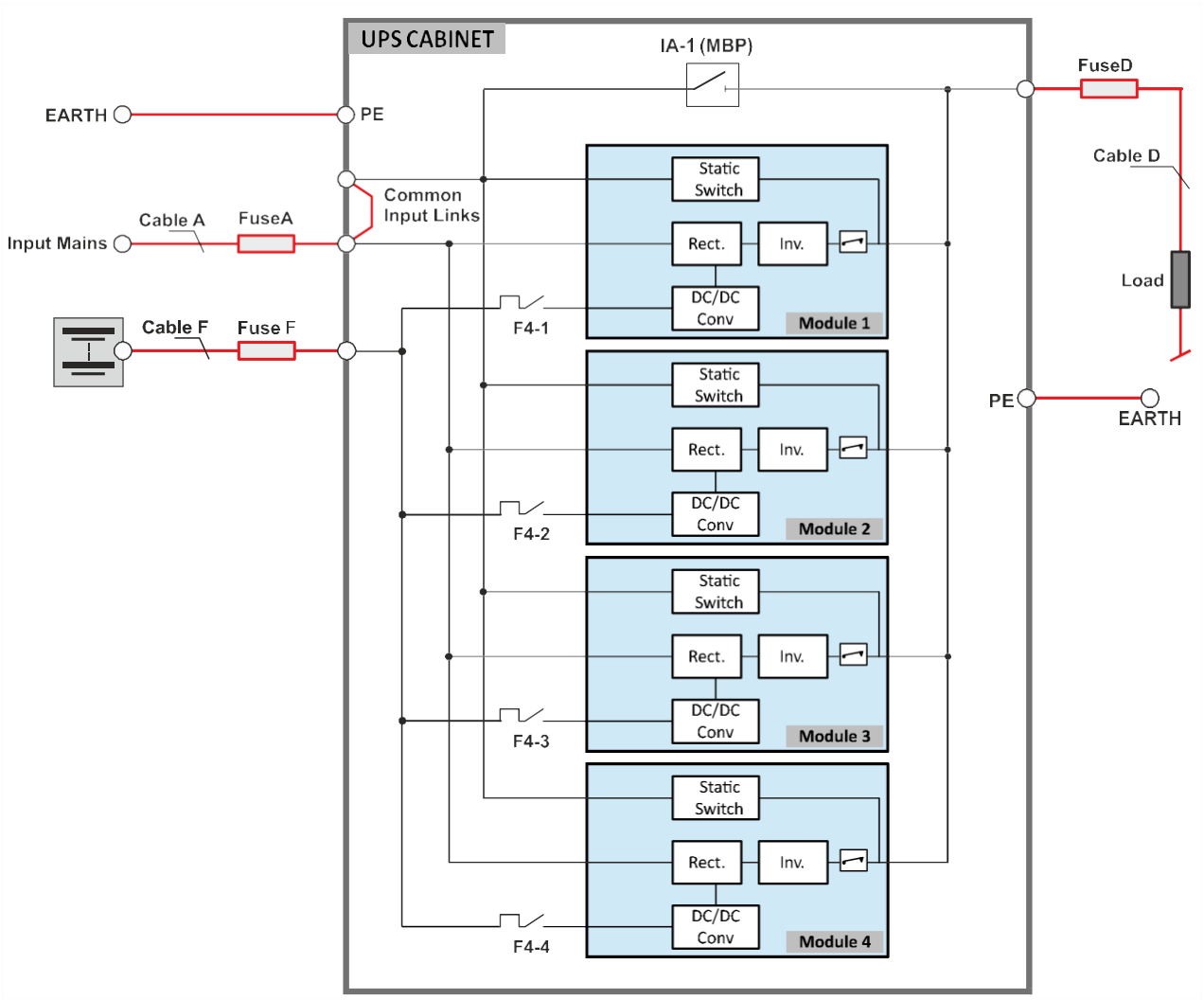
Note that the PW 8000DPA (ST)-200 cabinet only has five sets of battery connections. Therefore for this model each battery is connected to two UPS modules if a separate battery installation is used.

Cabling diagrams

The following diagrams provide recommended cable and fuse rating for the entire PW 8000DPA (ST) range.

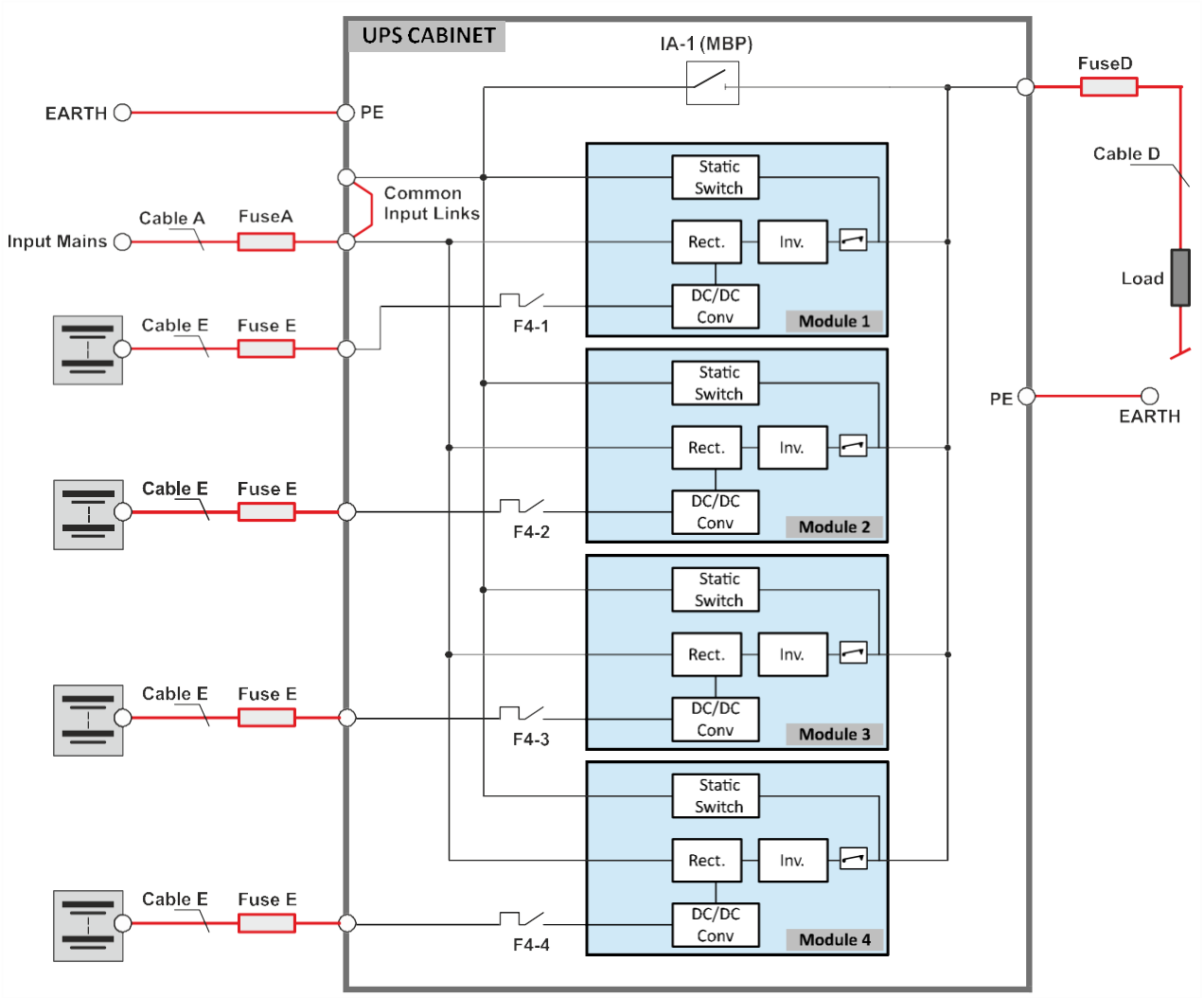
Note: The diagrams illustrate the ST-80 cabinet (4 modules), but the attached rating tables cover the complete range.

- the protective earth cable must be sized according to local and national regulations
- rating are shown for 400V operation with unity load factor. See specification chapter for 380/415V operation



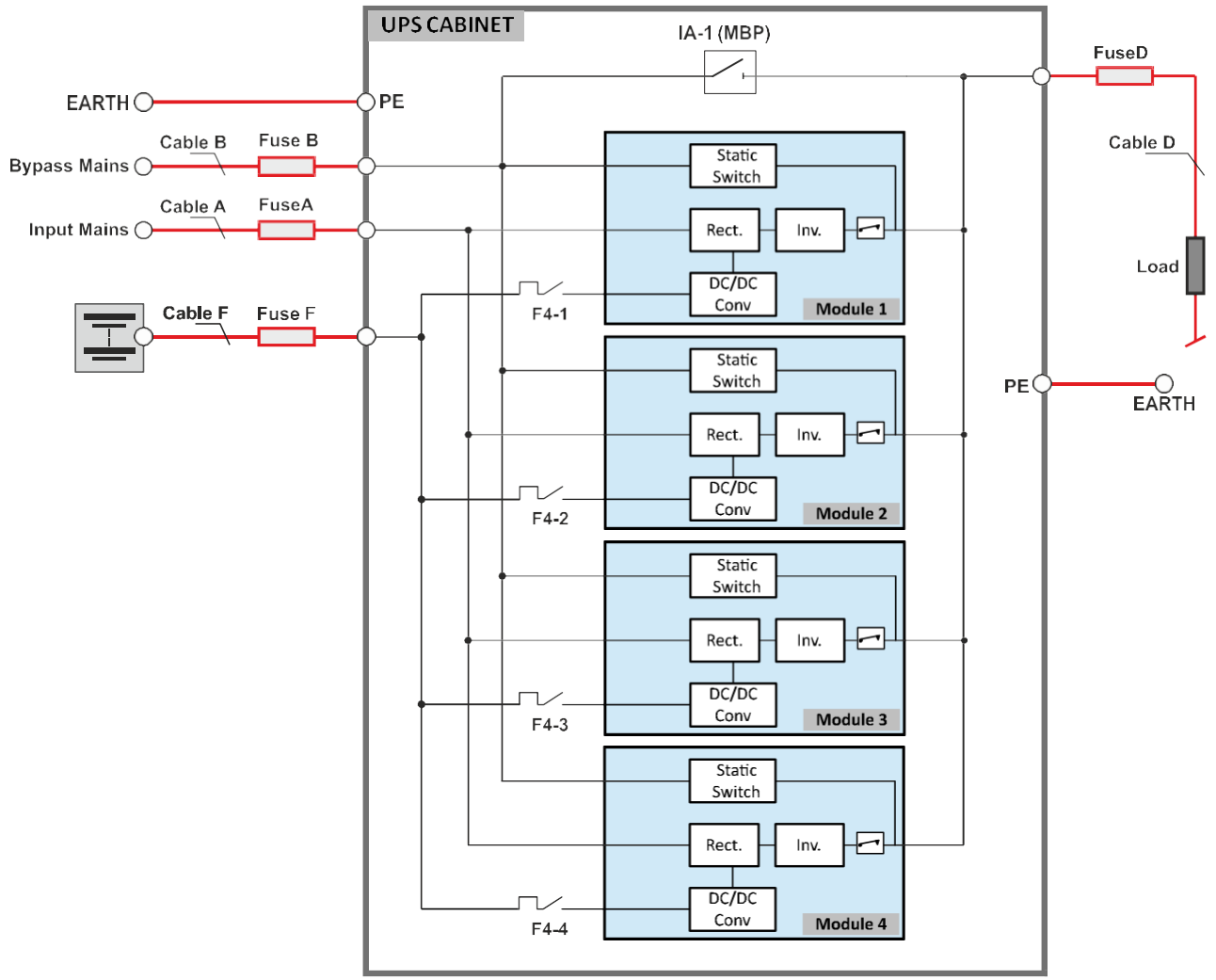
UPS CABINET CONNECTIONS					
UPS Module	**ST-40**	**ST-60**	**ST-80**	**ST-120**	**ST-200**
Load (kW)	40 kW	60 kW	80 kW	120 kW	200 kW
Input mains Fuse A (Agl/CB)	3x 80A	3x 125A	3x 160A	3x 224A	3x 350A
Input mains Cable (A) Max input current, including max battery charging	68A	102A	136A	208A	333A
UPS output Cable D nominal current	58A	87A	116A	174A	290A
Battery Fuse F (Agl/CB) (with common battery only)	Bespoke to installation				

Single input cabling with common battery



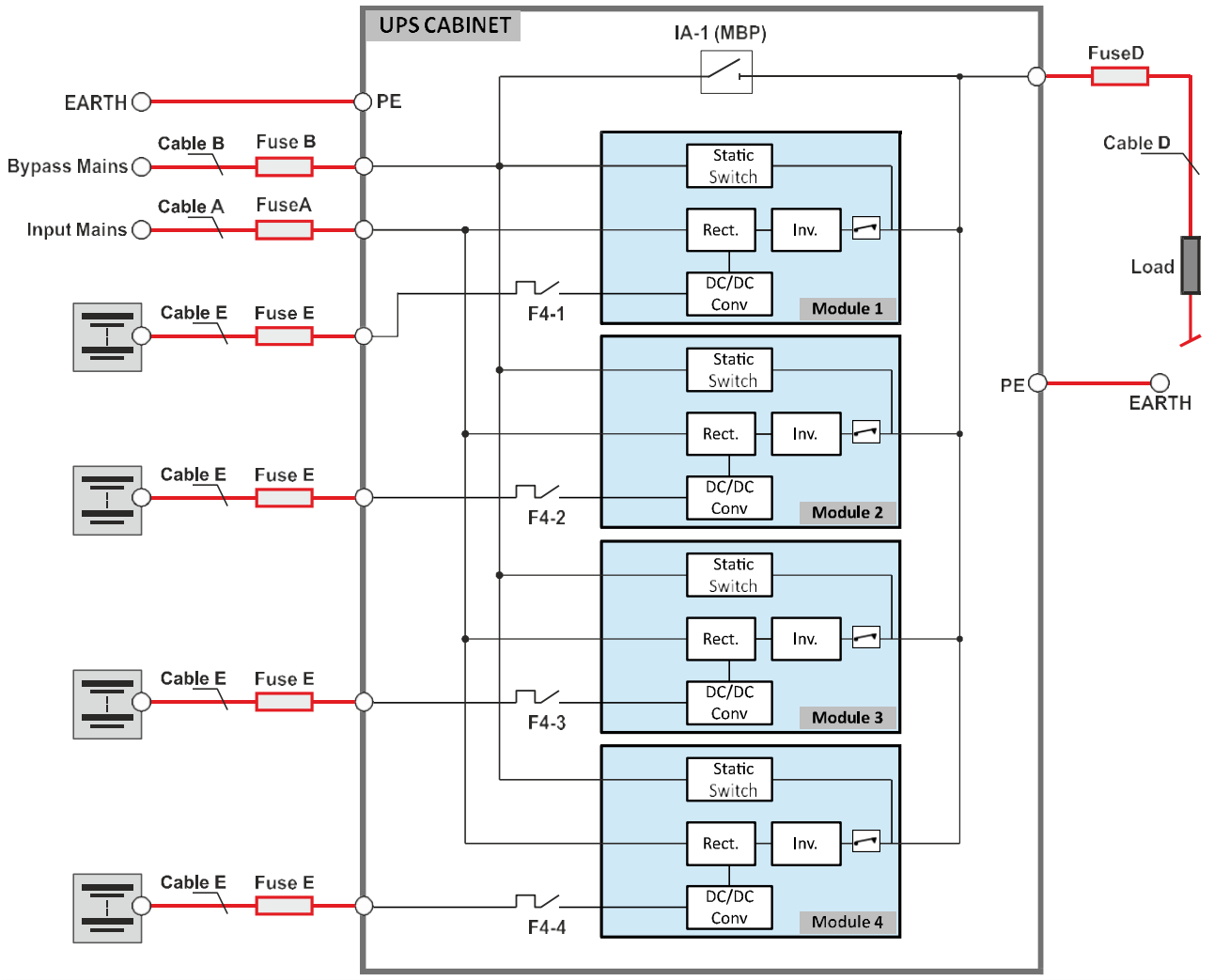
UPS CABINET CONNECTIONS					
UPS Module	**ST-40**	**ST-60**	**ST-80**	**ST-120**	**ST-200**
Load (kW)	40 kW	60 kW	80 kW	120 kW	200 kW
Input mains Fuse A (Agl/CB)	3x 80A	3x 125A	3x 160A	3x 224A	3x 350A
Input mains Cable (A) Max input current, including max battery charging	68A	102A	136A	208A	333A
UPS output Cable D nominal current	58A	87A	116A	174A	290A
Battery Fuse E (Agl/CB) (per battery)	Bespoke to installation				

Single input cabling with separate batteries



UPS CABINET CONNECTIONS					
UPS Module	**ST-40**	**ST-60**	**ST-80**	**ST-120**	**ST-200**
Load (kW)	40 kW	60 kW	80 kW	120 kW	200 kW
Input mains Fuse A (Agl/CB)	3x 80A	3x 125A	3x 160A	3x 224A	3x 350A
Input mains Cable (A) Max input current, including max battery charging	68A	102A	136A	208A	333A
Bypass mains Fuse B (Agl/CB)	3x 80A	3x 125A	3x 160A	3x 224A	3x 350A
Bypass mains Cable B, max bypass current	58A	87A	116A	174A	290A
UPS output Cable D nominal current	58A	87A	116A	174A	290A
Battery Fuse E (Agl/CB) (per battery)	Bespoke to installation				

Dual input cabling with common battery



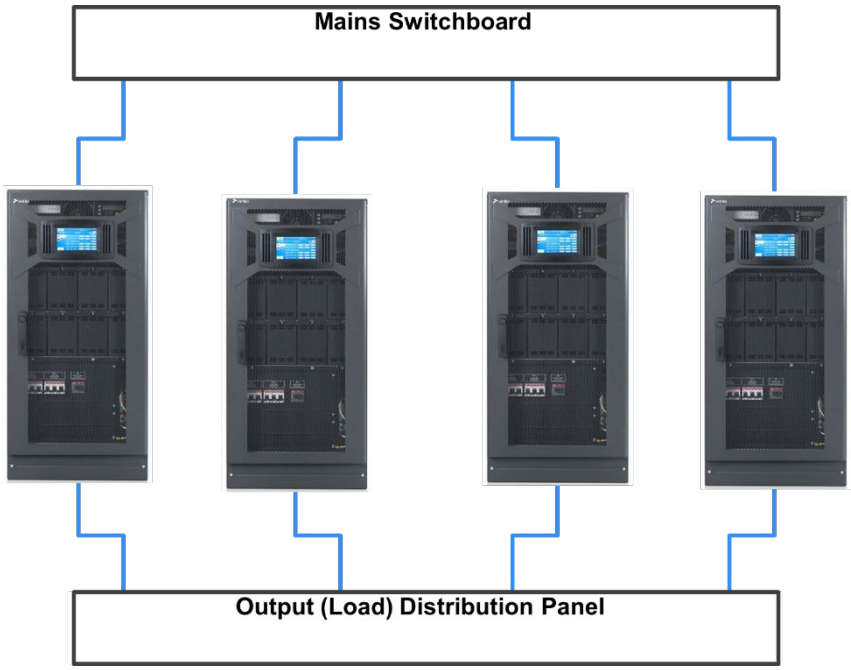
UPS CABINET CONNECTIONS					
UPS Module	**ST-40**	**ST-60**	**ST-80**	**ST-120**	**ST-200**
Load (kW)	40 kW	60 kW	80 kW	120 kW	200 kW
Input mains Fuse A (Agl/CB)	3x 80A	3x 125A	3x 160A	3x 224A	3x 350A
Input mains Cable (A) Max input current, including max battery charging	68A	102A	136A	208A	333A
Bypass mains Fuse B (Agl/CB)	3x 80A	3x 125A	3x 160A	3x 224A	3x 350A
Bypass mains Cable B, max bypass current	58A	87A	116A	174A	290A
UPS output Cable D nominal current	58A	87A	116A	174A	290A
Battery Fuse E (Agl/CB) (per battery)	Bespoke to installation				

Dual input cabling with separate batteries

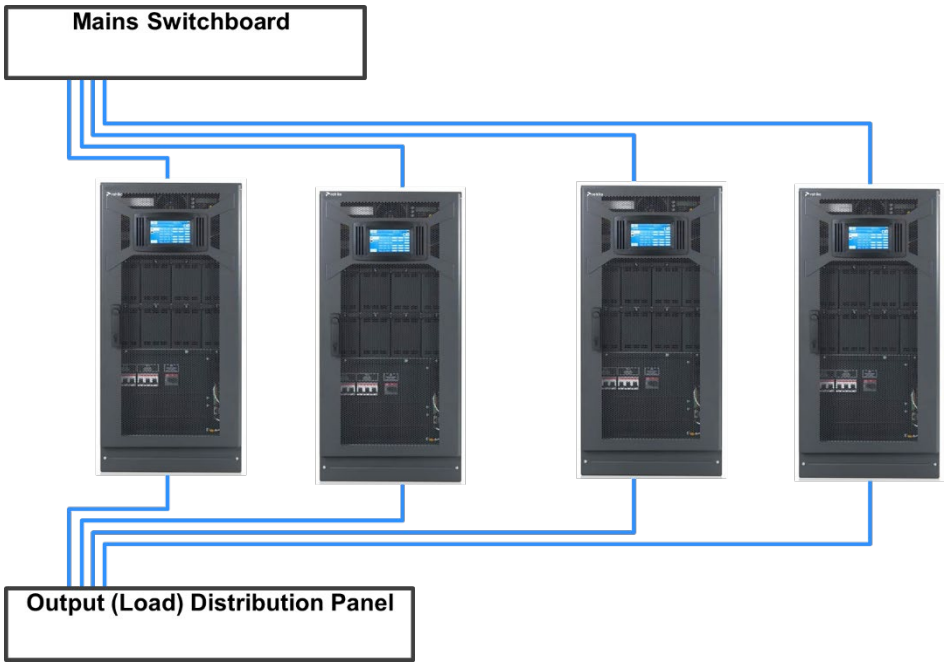
Parallel cabinet cabling recommendations

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

CORRECT

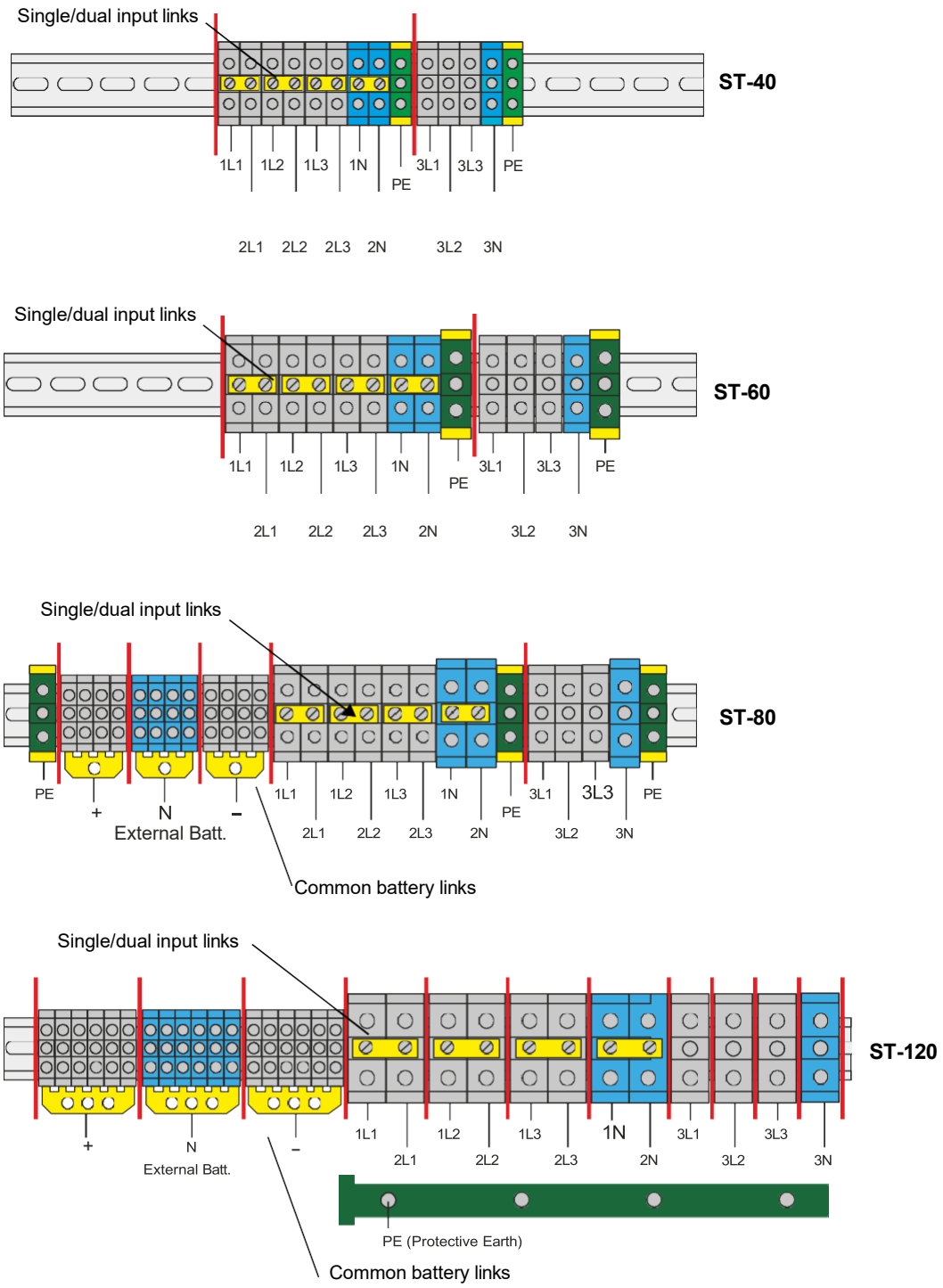


INCORRECT

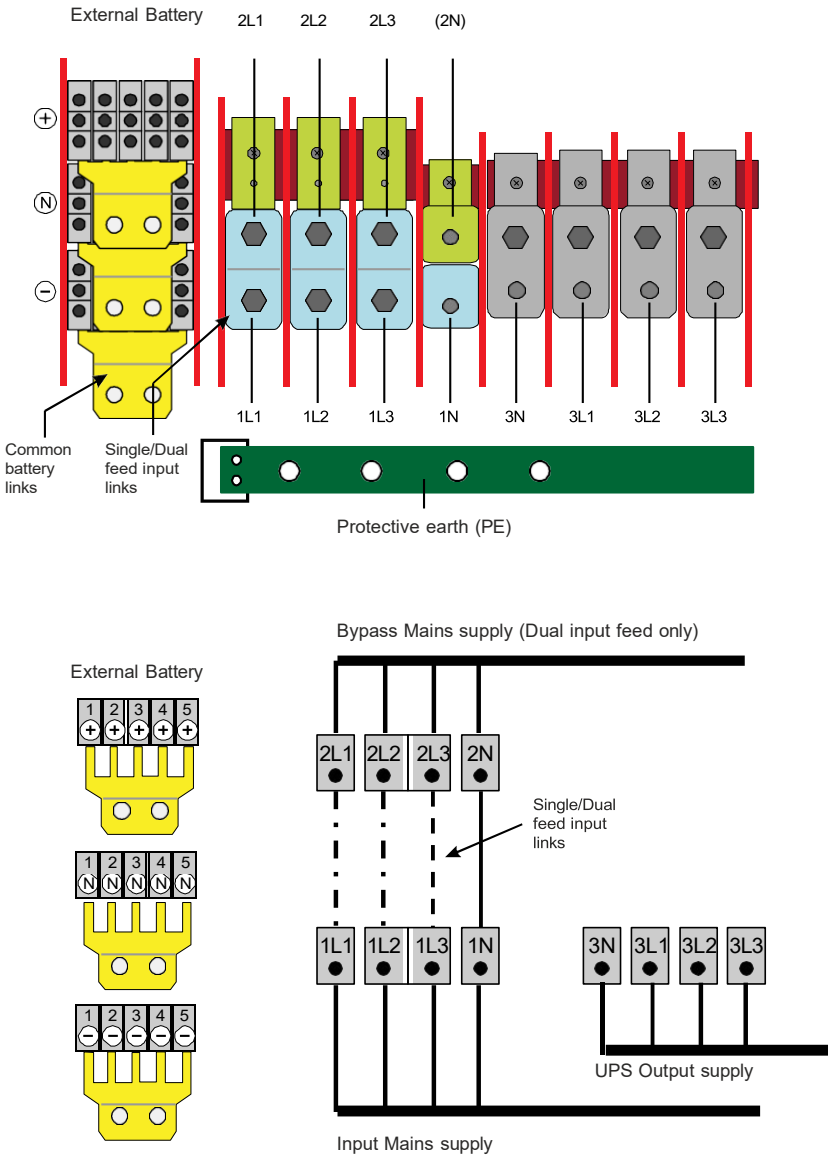


Terminal block connections

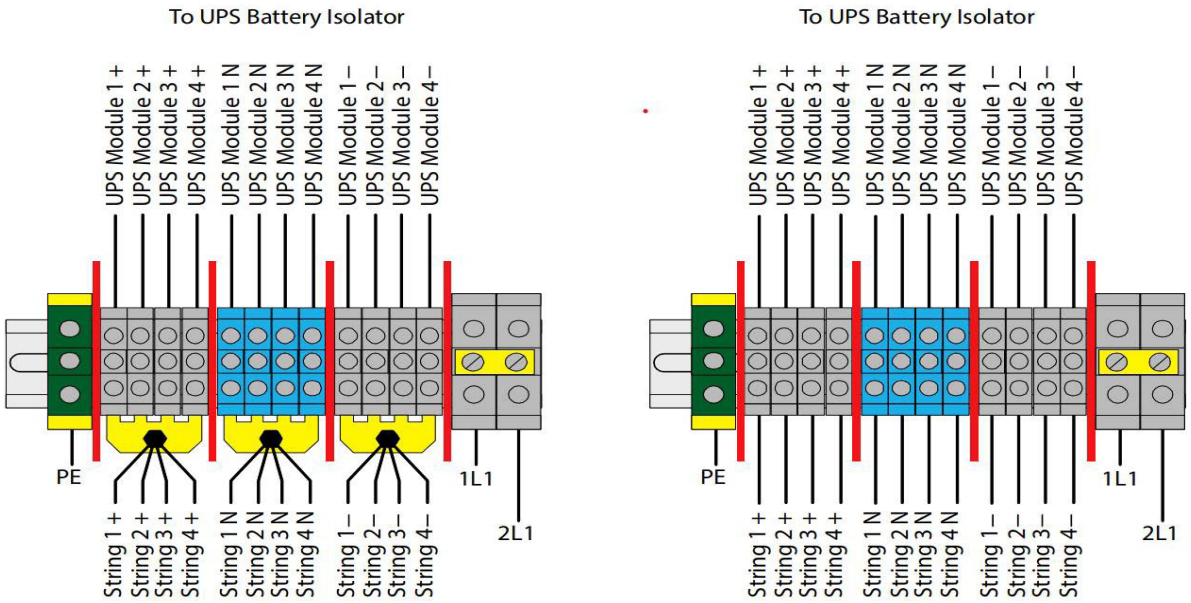
The ST-40 and ST-60 models have internal batteries so no battery terminal block is provided.



ST-40, ST-60, ST-80, ST-120 Power terminal connections



ST-200 Power terminal connections



Battery connections (ST-80 cabinet shown)

Table 3 : Terminal connection size

	400V / 230V			BATTERY		
	UPS INPUT MAINS (Rectifier)	UPS BYPASS MAINS (Bypass)	UPS OUTPUT	PE	Separate	Common
	Terminal (mm²)	Terminal (mm²)	Terminal (mm²)	Terminal (mm²)	Terminal (mm²)	Terminal (mm²)
ST-40	3x 25 (T) 1x 25 (N)(T) 1x 25 (PE)(T)	3x 16/25 (T) 1x 16/25 (N)(T)	3x 25 (T) 1x 25 (N)(T) 1x 25 (PE)(T)			
ST-60	3x 35 (T) 1x 35 (N)(T) 1x 50 (PE)(T)	3x 35 (T) 1x 35 (N)(T)	3x 35 (T) 1x 35 (N)(T) 1x 50 (PE)(T)			
ST-80	3x 50 (T) 1x 50 (N)(T) 1x 50 (PE)(T)	3x 50 (T) 1x 50 (N)(T)	3x 50 (T) 1x 50 (N)(T) 1x 50 (PE)(T)	1x 50 (T)	3x (4x 16) (T)	3x M6 (B)
ST-120	3x 95 (T) 1x 95 (N)(T) 1x M10 (PE)(B)	3x 95 (T) 1x 95 (N)(T)	3x 95 (T) 1x 95 (N)(T) 1x M10 (PE)(B)	1x M10 (B)	3x (6x 16) (T)	3x (2x M5) (B) or 3x M10 (B)
ST-200	3x M12 (B) 1x M12 (N)(B) 1x M12 (PE)(B)	3x M12 (B) 1x M12 (N)(B)	3x M12 (B) 1x M12 (N)(B) 1x M12 (PE)(B)	1x M10 (B)	3x (5x 35) (T)*	3x (2x M10) (B)

(PE) = Protective Earth
(N) = Neutral
(B) = Busbar connections with indicated bolt size. Cable must be terminated with a suitable lug.
(T) = Screwed terminal block with indicated maximum cable c.s.a. Cables must be suitably prepared.
***** In the ST-200 model with individual battery configuration, each battery feeds two UPS modules.

EXTERNAL MAINTENANCE BYPASS

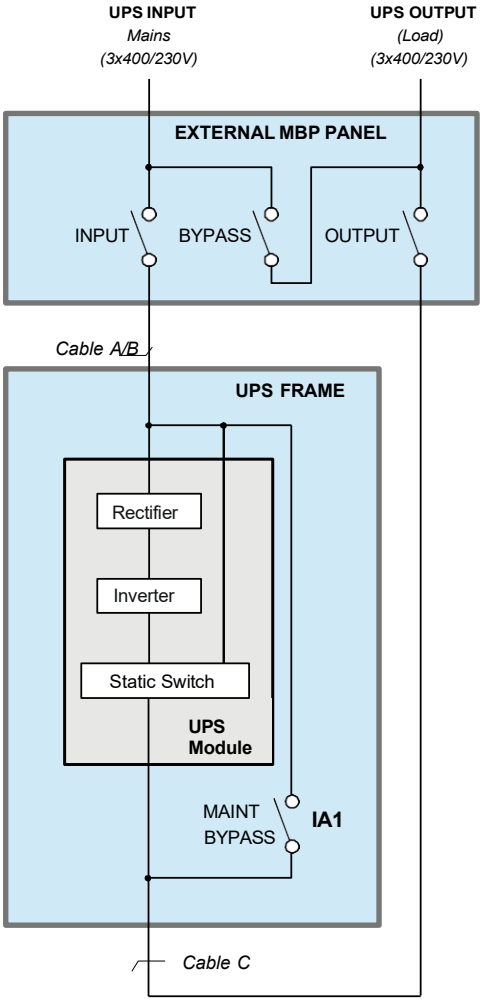
An external maintenance bypass is a required part of a multi-cabinet PW 8000DPA (ST) system but is optional in the case of a single cabinet installation.

The external bypass is bespoke to the installation but generally comprises three isolators rated to carry the full system load and connected in a similar fashion to that shown.

A fourth isolator is included if the UPS is configured for a dual input supply.

Depending on size and location, the isolators may be installed in a dedicated Maintenance Bypass cabinet or included in an existing (or dedicated) switchboard.

Rehlko can provide a range of external maintenance bypass solutions to suit all of its UPS systems.



External Maintenance Bypass

Single UPS cabinet installation

An external maintenance bypass facility is not essential for a single cabinet installation because the internal maintenance bypass switch (IA1) is fully load rated and can be used to connect the load directly to the raw UPS bypass mains supply.

However, when the load is powered via IA1 the UPS cabinet's bypass mains terminals must be permanently live in order to supply the load. This means that it is not possible to fully isolate the mains supplies from the UPS cabinet while the internal maintenance bypass is in use.

This situation can be overcome by the addition of the optional external maintenance bypass facility which can supply the load through an external BYPASS switch while allowing the UPS input and output supplies to be totally isolated by opening the external INPUT and OUTPUT switches.

Parallel UPS cabinet installation

If two (or more) UPS cabinets are connected as a parallel system each one still contains the internal maintenance bypass switch (IA1).

However, the switch is only rated for the specified cabinet output and is not designed to switch the potential full system load.

An external maintenance bypass facility containing a 'system rated' bypass switch is therefore an essential part of a parallel cabinet system as it allows the full load to be switched between the system and maintenance bypass. It also allows the modules' mains supplies to be isolated as described above for the single UPS cabinet system.