



REHLKO *PW* 8000DPA (RI)

Modular three-phase uninterruptible power supply

(Up to 80 kVA/kW)

Technical Specification

REHLKO PW 8000DPA (RI) SYSTEM

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

The Rehlko PW 8000DPA (RI) 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 IEC 62040-3 (VFI-SS-111) standards.

The Rehlko PW 8000DPA (RI) is a rack-independent, modular design that is available in a range of seven rack/sub-rack assemblies comprising the UPS module(s), switch panel, battery tray(s), power connectors and a number of optional communication facilities. The UPS modules themselves are available as either 10 kW or 20 kW units.

System configuration

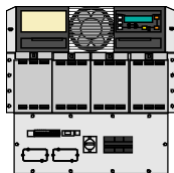
Table 1 : Available sub-rack configurations

FRAME	MAX OUTPUT	BATTERY
PW8000-RI 10	20 kW (1x 20kW)	External
PW8000-RI 11	20 kW (1x 20kW)	Internal (1 string of 40x 12V blocks)
PW8000-RI 12	20 kW (1x 20kW)	Internal (2 strings of 40x 12V blocks)
PW8000-RI 20	40 kW (2x 20kW)	External
PW8000-RI 22	40 kW (2x 20kW)	Internal (2 strings of 40x 12V blocks)
PW8000-RI 24	40 kW (2x 20kW)	Internal (4 strings of 40x 12V blocks)
PW8000-RI 40	80 kW (4x 20kW)	External



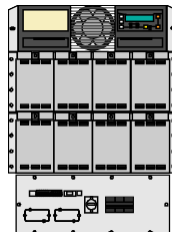
RI-10 Frame

1 x module
External Batt.



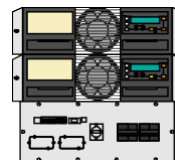
RI-11 Frame

1 x module
40 x 7/9Ah Batt.



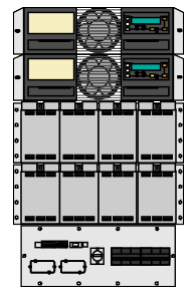
RI-12 Frame

1 x module
80 x 7/9Ah Batt.



RI-20 Frame

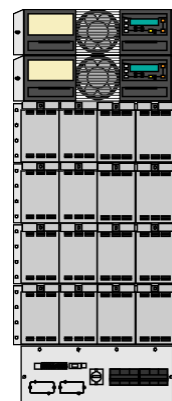
2 x module
External Batt.



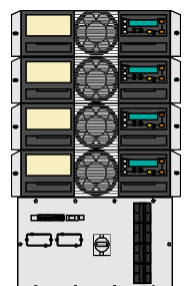
RI-22 Frame

2 x module
80 x 7/9Ah Batt.

RI-24 Frame
2 x module
160 x 7/9Ah Batt.



RI-40 Frame
4 x module
External Batt.



10kVA or 20kVA modules may be used in each configuration but in a parallel-module system all the modules must be of equal rating.

Advanced Design Features

Hot swappable modules

Where the Rehiko PW 8000DPA (RI) frame contains two or more UPS modules – for example RI-20, RI-22, RI-24, RI-40 – the installed modules operate in parallel, with inter-module control signals ensuring that they remain fully synchronised to each other and the incoming mains supply, and equally share the connected load demand.

Thanks to the UPS module's advanced Distributed Parallel Architecture (DPA) design, it is possible to operate a multi-module frame with just a single module fitted and add the second/subsequent module(s) at a later date when it is necessary to increase the system capacity to match any designed increase in load demand.

This 'hot-swappable' design also allows a module in a parallel-module frame to be exchanged during UPS operation without needing to transfer the load to the bypass supply – of course this depends on the system redundancy and prevailing load demand.

Note that the frame Type Number takes the form of 'RI-XY' and identifies the number of UPS module and battery sub-racks (shelves) that are fitted to the frame. RI= Rack Installable, X= Max. No. of modules, Y= Max No. of battery rows.

For example:

RI-20 has provisions for two UPS modules and no batteries.

RI-22 has provisions for two UPS modules a two battery rows.

RI-24 has provisions for two UPS modules and four battery rows.

Advanced input booster/rectifier technology

The Rehiko PW 8000DPA (RI) UPS module's advanced booster technology results in an input power factor of 0.99 with a harmonic content of < 3% THD(i). 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.

Cabling and fusing costs are also reduced as a result of the high input power factor due to the low reactive power consumption.

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

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

Flexible battery management

The Rehiko PW 8000DPA (RI) 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 prolongs battery life.

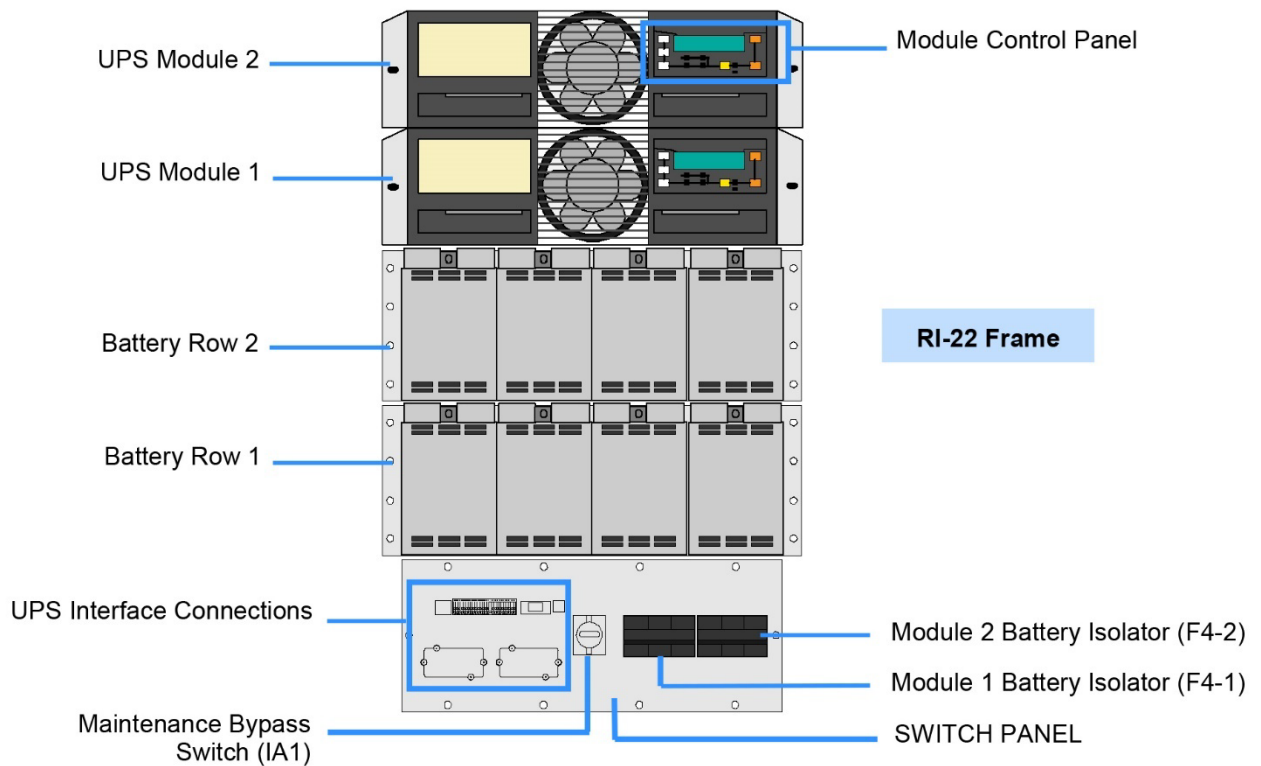
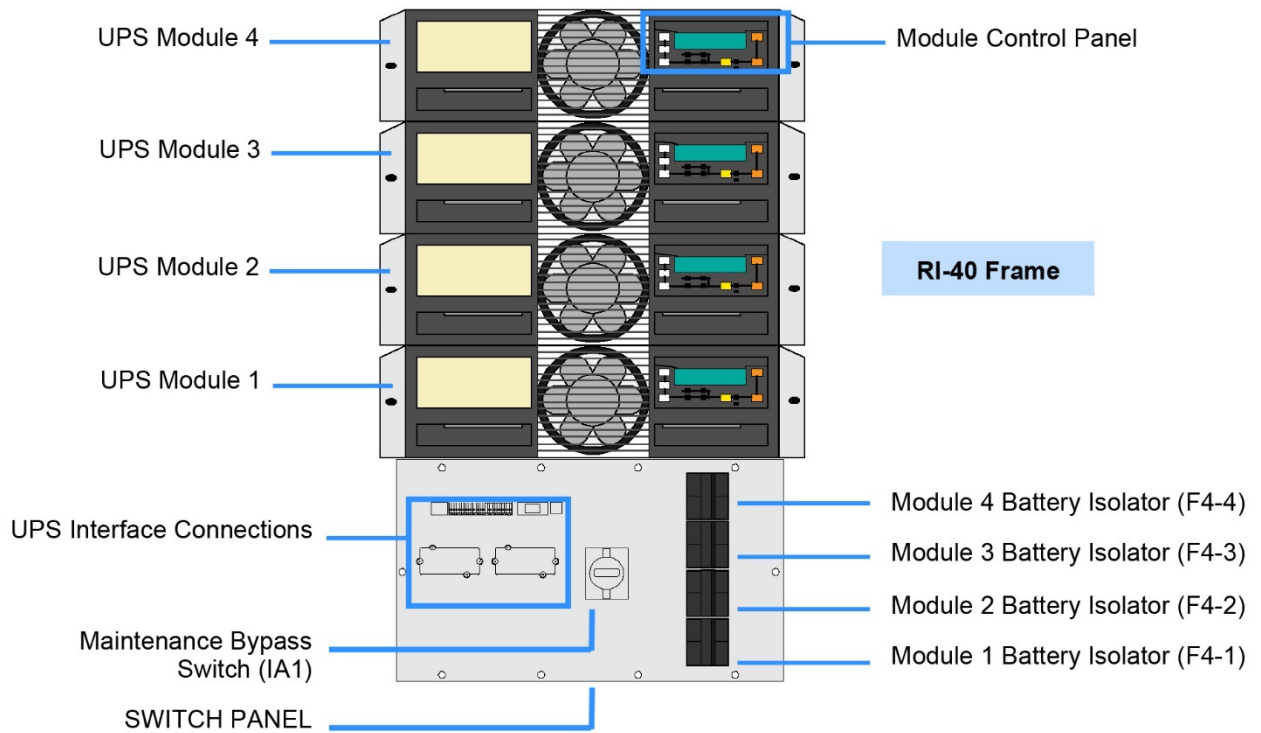
The major benefits are:

- ripple-free battery charging due to an independent dc-dc charger with no connection to the rectifier and inverter
- wide range of number of 12V battery blocks; depending on the required autonomy time
- the UPS's wide input voltage operating window extends the battery life due to fewer discharge cycles
- battery discharge protection caused by load jumps
- proactive battery protection from false manipulations and inadequate charging voltages
- proactive battery failure detection thanks to Advanced Battery Diagnosis (ABD) - algorithm
- user-selectable battery tests
- optional temperature-compensated battery charging to enhance battery life

Decentralized Parallel Architecture (DPA)

The Rehiko PW 8000DPA (RI) 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.

UPS CONSTRUCTION



UPS Modules

The rack-mounted UPS modules have sliding guides on the lower left and right sides to ensure that the module is inserted 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 in a parallel module system the modules are numbered from 1 upwards, with module 1 fitted on the sub-rack lowest shelf. When upgrading 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 and requires two persons to safely lift the unit.

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. RI-22) then the battery string positive and negative cables are connected directly to the isolator. If the battery installation is external to the UPS rack (e.g. RI-40) 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). Note that where an external battery cabinet/frame is used, it must also 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 10.

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.

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.*

GENERAL SPECIFICATION

Mechanical characteristics (Frame)

		RI-10	RI-11	RI-12
Configuration accommodates:	Max.	1 module (10 or 20kVA)	1 module (10 or 20kVA) with 40 x 7/9Ah batteries	1 modules (10 or 20kVA) with 80 x 7/9Ah batteries
Max. sub-rack capacity	kW	20	20	20
Dimensions (WxHxD) (with front mounting wings)	mm	448x310x565 (7 HU) 482x310x565 (7 HU)	448x487x735 (11 HU) 482x487x735 (11 HU)	448x665x735 (15 HU) 482x665x735 (15 HU)
Weight of empty frame	kg	20	40	56
Weight of frame with modules and w/o batteries	kg	39 up to 42 (with 1 modules)	59 up to 62 (with 1 module)	75 up to 78 (with 1 module)

		RI-20	RI-22	RI-24
Configuration accommodates:	Max.	2 modules (10 or 20kVA)	2 modules (10 or 20kVA) with 80 x 7/9Ah batteries	2 modules (10 or 20kVA) with 160 x 7/9Ah batteries
Max. sub-rack capacity	kW	40	40	40
Dimensions (WxHxD) (with front mounting wings)	mm	448x440x565 (10 HU) 482x440x565 (10 HU)	448x798x735 (18 HU) 482x798x735 (18 HU)	448x1153x735 (26 HU) 482x1153x735 (26 HU)
Weight of empty frame	kg	25	66	93
Weight of frame with modules and w/o batteries	kg	62 up to 68 (with 2 modules)	103 up to 104 (with 2 modules)	130 up to 136 (with 2 modules)

		RI-40
Configuration accommodates:	Max.	4 modules (10 or 20 kVA)
Max. sub-rack capacity	kW	80
Dimensions (WxHxD) (with front mounting wings)	mm	448x798x735 (18 HU) 482x798x735 (18 HU)
Weight of empty frame	kg	50
Weight of frame with modules and w/o batteries	kg	124 up to 136 (with 4 modules)

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) 482 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 $\cos\phi$ 0.8	kVA	10	20
Output rated power per module $\cos\phi$ 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%) 3x308/184 V to 3x460/264 V for <100 % load (-26%/+15%) 3x280/170 V to 3x460/264 V for < 80 % load (-35%/+15%) 3x240/150 V to 3x460/264 V for < 60 % load	
Input frequency range	Hz	35 – 70	
Input power factor		PF=0.99 @ 100% load	
Overvoltage Category		II (2500Vpk)	
Rated Conditional short circuit current (Icc)	kA	25	
Backfeed Protection		Optional	
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 $\cos\phi$ = 1.0)	KW	10.5	21
Max. input current with rated output power and charged battery per module (output $\cos\phi$ = 1.0)	A	15.2	30.4
Max. input power with rated output power and discharged battery per module (output $\cos\phi$ = 1.0)	KW	11.5	23
Max. input current with rated output power and discharged battery per module (output $\cos\phi$ = 1.0)	A	16.6	33.3
Output characteristics			
Output rated power per module $\cos\phi$ 0.8	kVA	10	20
Output rated power per module $\cos\phi$ 1.0	KW	10	20
Output current in @ $\cos\phi$ 1.0 (400 V)	A	14.5	29
Output rated voltage	VAC	3x380/220V or 3x400/230V or 3x415/240V	
Output voltage stability	%	Static: < \pm 1% Dynamic (Step load 0%-100% or 100%-0%) < \pm 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 < \pm 2% (selectable for bypass operation) or < \pm 4% Free running +/- 0.1%	
Bypass operation		At Nominal Input voltage of 3x400 V \pm 15% or 196 V to 264 V ph-N	
Permissible unbalanced load	%	100%	
Phase angle tolerance (With 100% unbalanced load)	Deg	2.0 deg.	
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>By/By>Inv/Ecomode	ms	<1 / <5 / <6	

Heat Dissipation With Non-linear Load			
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 400V 50Hz Cosφ 1.0) (depending on % module power) (Tolerance +/- 0.5% applies on all figures)	100%	94.5%	
	75%	95.0%	
	50%	95.0%	
	25%	94.0%	
ECO mode efficiency at 100% load	%	98%	
Environmental Characteristics			
Audible noise with 100% / 50% load	dBA	55 / 49*	55 / 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 (IEC 62040-3) (ALL MODULES)		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 (no need for side, top or rear access)	
Positioning		Min. 20 cm rear space (required for fan)	
Input and output power cabling		From the bottom on the rear	
* 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 or NiCd	
Permitted number of VRLA 12V battery blocks	No	30-50 *	
Permitted number of 1. NiCd cells	No	300-500 *	
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)	
Fault Current Rating	A	Up to 5000	

* 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

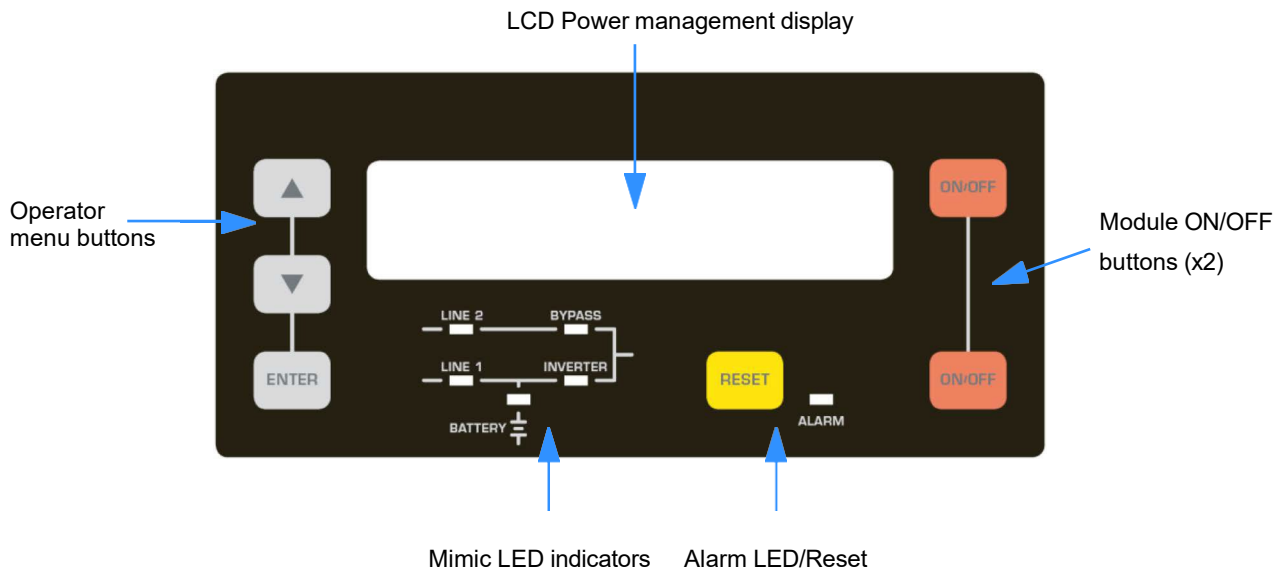
Communication Options

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

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

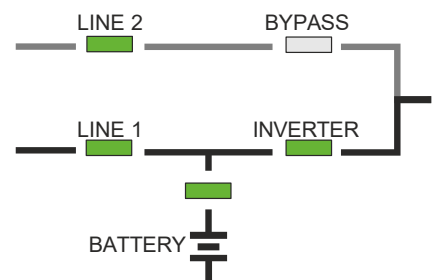
MODULE CONTROL PANEL



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. The indication change to red if the battery is faulty or fully discharged.
- 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:

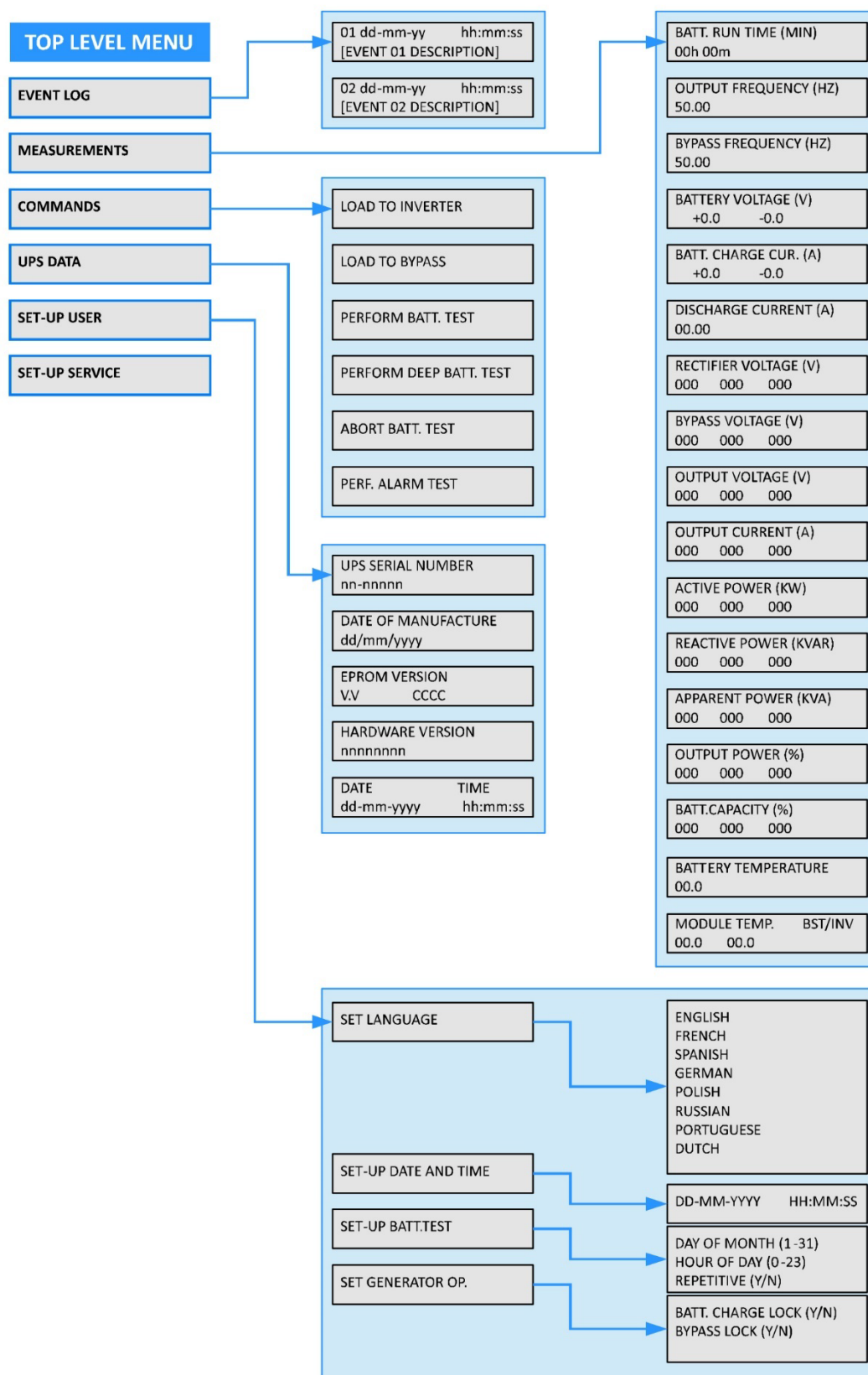
- Set operating parameters and make adjustments via the menu-driven LCD display.
- Start and stop the UPS, and transfer the load between the inverter and bypass.
- Monitor the UPS input/output voltage, current, frequency and other parameters – shown on the LCD display.

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.

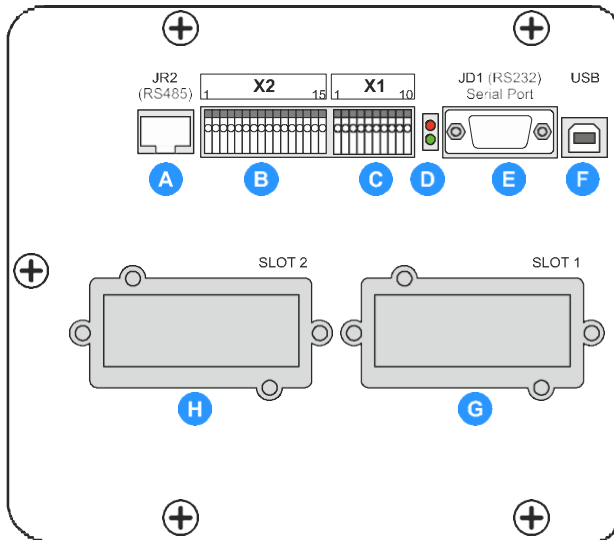
LCD Power management display

During normal operation the LCD displays a UPS status screen that provides a summary of the operating status. From the status screen the user can open a multi-layered interactive menu that provides access to a range of UPS operating and monitoring functions. Navigation through the nested sub-menus is possible using the UP / DOWN buttons to scroll, and the ENTER button to make a menu selection.

The menu tree is shown on the following page.



EXTERNAL COMMUNICATION FACILITIES



PW8000-RI Communications interface		
A	JR2	RJ45 Port: Network interface
B	X2	Customer output dry ports:
C	X1	Customer input dry ports:
D	LEDs	Status LEDs:
E	JD1	RS232 Smart port computer interface:
F	USB	Standard USB interface:
G	SLOT 1	Slot for optional modem/Ethernet card ONLY.
H	SLOT 2	Slot for optional SNMP card ONLY

A communications interface board, located to the lower left front of the frame, 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. All the communications interface board connections are accessible from the front of the UPS cabinet.

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)

	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	

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.

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.

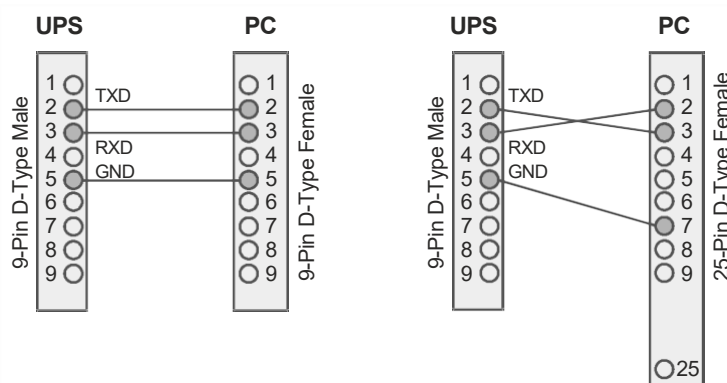
USB Port

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:

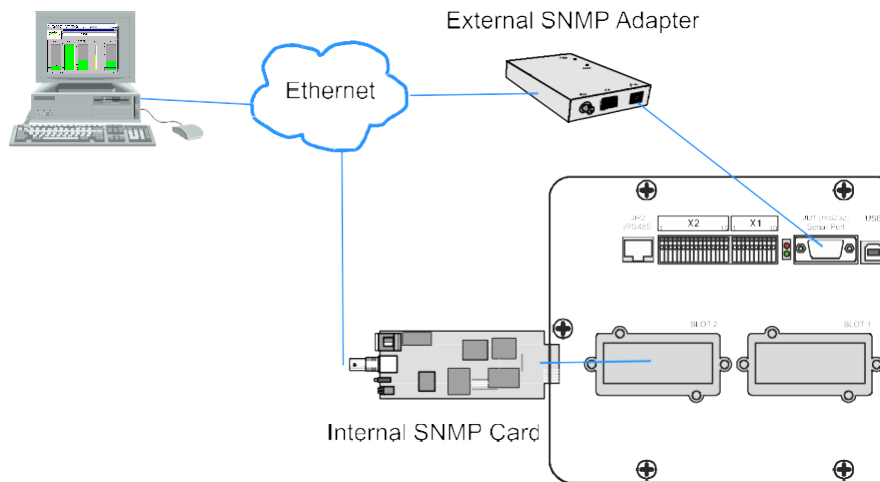
- Simple Network Management Protocol (SNMP)
- MODBUS over TCP/IP
- MODBUS over RS-485

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 PW8000DPA RI 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 PW8000DPA RI 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.

Rehiko 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.

Three (optional) monitoring systems are available for use with the Rehiko PW 8000DPA (RI) UPS system:

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

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 Rehiko, 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 PW8000DPA RI 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/adaptor

An SNMP card/adaptor 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:

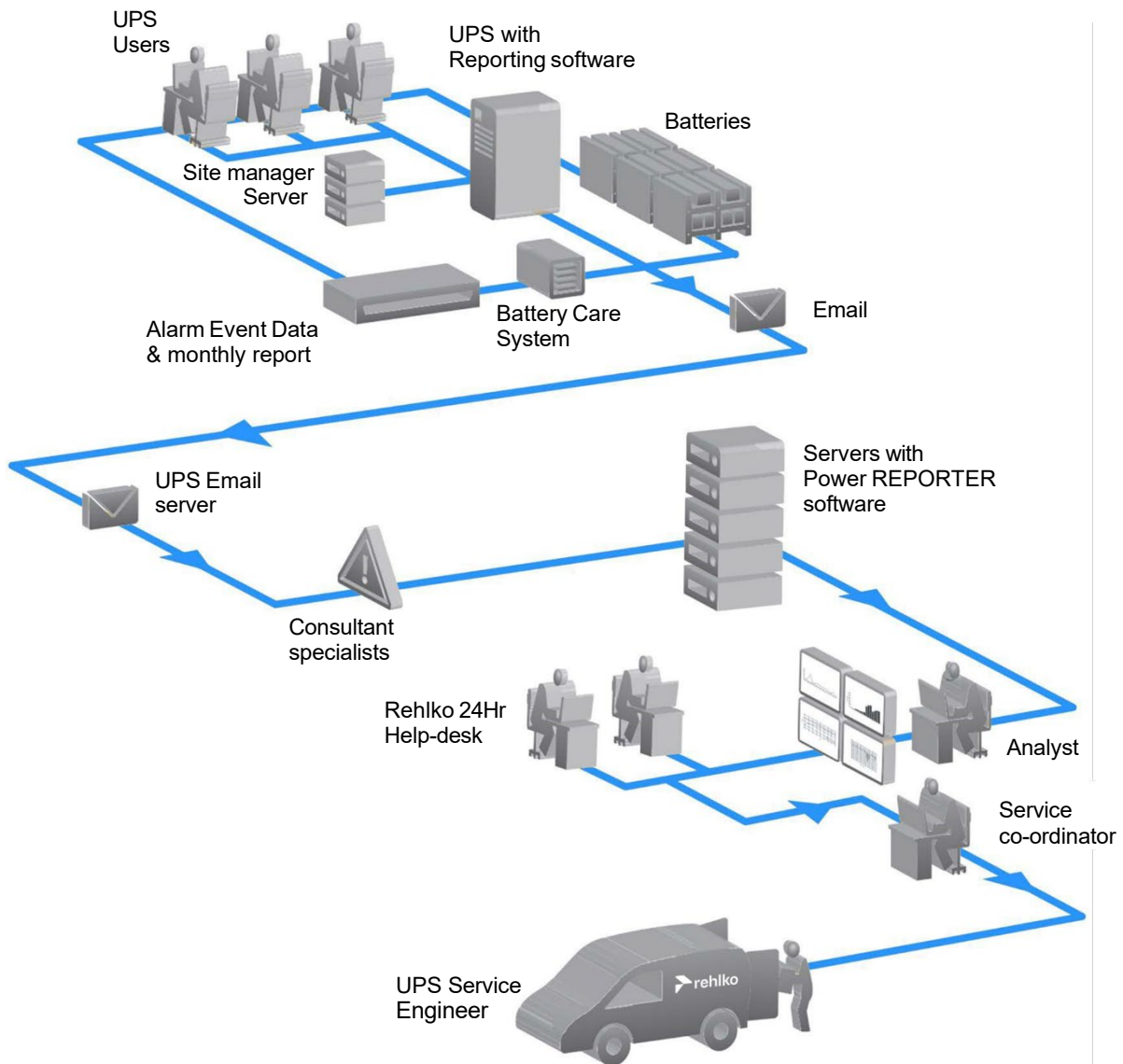
- real time alarm or critical event email notification sent directly to Rehiko service centre
- acquisition of key performance data and productivity information to allow a better understanding of the UPS system performance and quickly troubleshoot downtime events
- improved service level. Combined with a service contract, PowerREPORTER ensures an engineer can determine if 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 Rehiko 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.



Power Reporter remote monitoring chain

INSTALLATION PLANNING

A certain amount of pre-planning will help ensure a smooth and trouble-free UPS installation process. This section contains essential information concerning the environmental, mechanical and electrical requirements that should be considered when planning the installation of the Rehlko PW 8000DPA (RI) 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 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 needed 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 prescribed equipment ambient temperature is 0°C to +40°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.

Mechanical installation

The PW8000DPA RI UPS is of rack/sub-rack construction designed to be installed in a standard 19 inch cabinet. The table below shows the rack height required by each model. We recommend that the UPS is installed at the bottom of the rack cabinet, especial if the UPS assembly includes internal batteries.

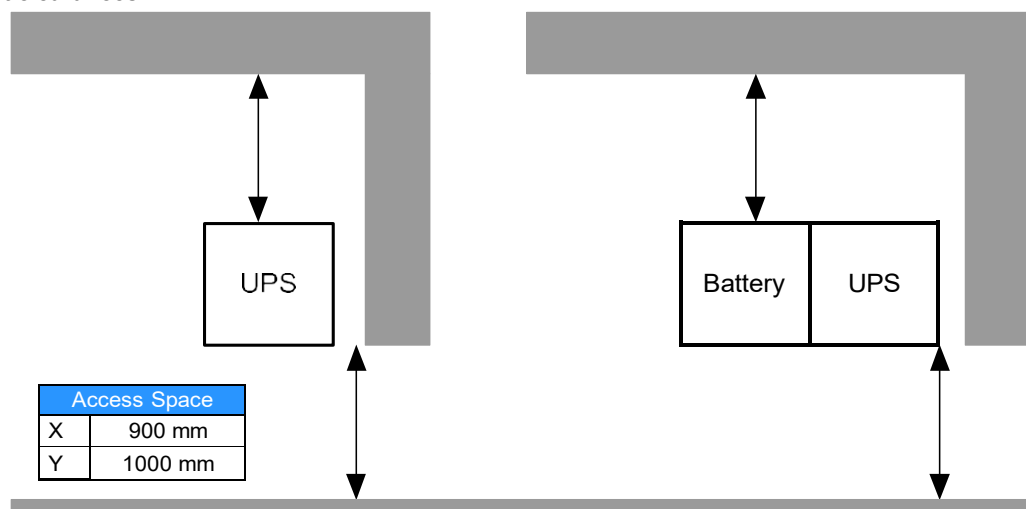
	UPS Rack						
	RI-10	RI-11	R1-12	RI-20	RI-22	RI-24	RI-40
Dimensions (W x H x D) mm	448x310x565 482*x310x565	448x487x735 482*x487x735	448x665x735 482*x665x735	448x440x565 482*x440x565	448x798x735 482*x798x735	448x1153x735 482*x1153x735	448x798x735 482*x798x735
Rack Height	7HU	11HU	15HU	10HU	18HU	26HU	18HU
482* is the width of the UPS rack including the front mounting wings							

Internal cabinet clearances

Cooling air enters inlets at the sides and bottom of the UPS module(s) and is drawn through the back of the unit by extraction fans that are mounted on the rear of the UPS rack. The host cabinet must have sufficient internal clearances in front and behind the UPS modules to provide an adequate cooling air flow through the UPS module(s). The minimum required front and back clearance within the host cabinet depends on the cabinet's design, in particular whether or not the cabinet has a fully ventilated front/back door.

	Cabinet with ventilated door	Cabinet with non-ventilated door
Recommended internal front clearance	50 mm	100 mm
Recommended internal rear clearance	50 mm	200 mm

External cabinet clearances



The PW8000DPA RI UPS sub-rack requires rear access in order to connect the power cables, and we recommend a minimum of 900 mm clearance is provided at the rear of the rack cabinet. A minimum clearance of 1000 mm is required at the front of the rack cabinet to allow the UPS assemblies to be installed and serviced.

If the system includes an external battery it should be installed next to the UPS unit to reduce the voltage drop on the battery cables. The battery cabinet can be located on either side of the UPS but ideally it should be placed to the left of the UPS unit.

Heat dissipation figures are provided in the General Specifications section of this document.

Electrical and cabling planning

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

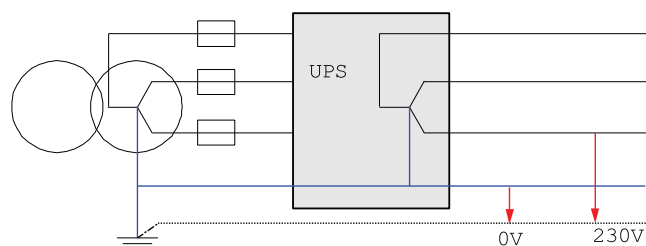
IMPORTANT NOTE: The UPS does not contain internal fuse protection for the bypass mains or input mains supplies. It is the customer's responsibility to ensure that external supply fuses (or other protective devices) are fitted and correctly sized to provide the recommended level of UPS protection. We 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 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.



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 switchboard on a TN-S system.

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.

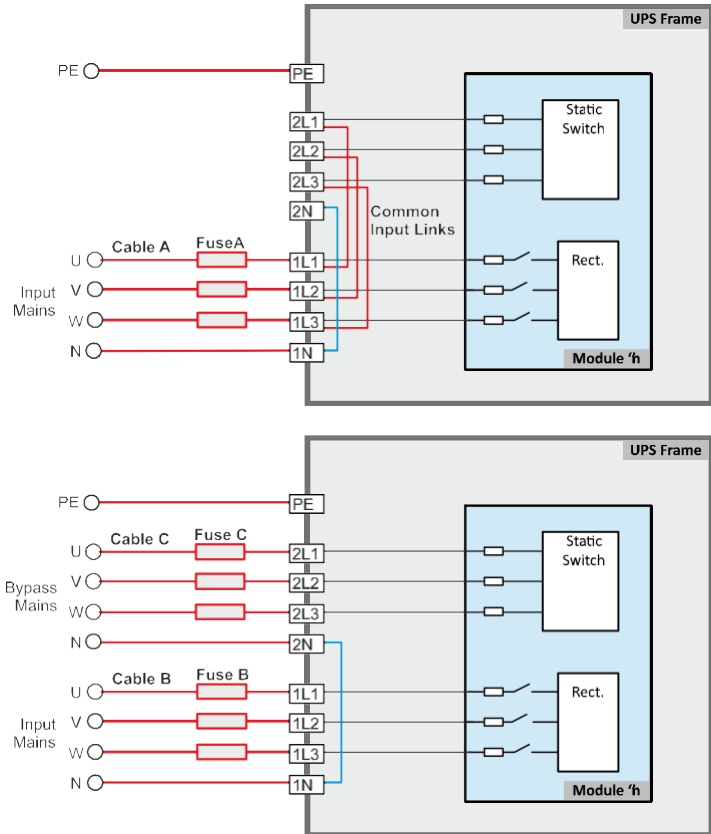
In a 'single feed' system (standard) the UPS input mains and bypass mains terminals are linked within the UPS cabinet, but in a 'dual feed' system the links are removed and the bypass mains terminals are connected to a dedicated bypass mains supply. The two configurations are shown here.

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.

We recommend that the input cables are sized for the full frame rating in a parallel module frame 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 PW8000DPA RI 40 frame should be rated for the full 80 kW load even if fewer than four UPS modules are fitted.

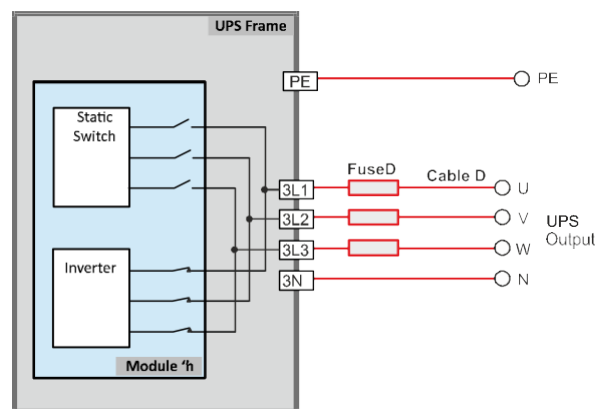


UPS Output cables

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 frame rating in a parallel module frame 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 PW8000DPA RI 40 frame should be rated for the full 80 kW load even if fewer than four UPS modules are fitted.



Internal batteries

The batteries in PW8000DPA RI models RI-11, RI-12, RI-22, RI-24 are installed on shelves that form part of the UPS frame and are therefore described as being 'internal.' Each shelf contains a complete battery string which is connected to a UPS module via a battery breaker (F4-x).

Note that in the RI-12 and RI-24 models there are two rows of battery trays provided for each UPS module. In these models two battery strings can be connected in parallel at the module battery breaker to provide a greater autonomy time (battery run-time) than that which is available from a single battery string



Key Point: PW8000DPA RI frames that contain internal batteries are shipped without the batteries installed.

External batteries

PW8000DPA RI models RI-10, RI-20, RI-40 do not have provision for internal batteries and therefore require the batteries to be installed in an external enclosure. External batteries are installed in a purpose designed enclosure or battery cabinet that should be located as close as possible to the UPS rack. A range of external battery enclosures is available from Rehiko.

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

- The external battery must be installed as close as possible (ideally on the left side) to the UPS equipment rack.
 - We recommend that when dealing with a parallel UPS frame a separate battery is provided for each UPS module. (See 'common' / 'separate' battery configuration details below.)
 - If a bespoke battery installation is planned, it must include a 3-pole battery breaker (for each set of battery cables) installed as close as possible to the battery installation.
 - The battery and DC cables must be connected by the commissioning engineer.
 - The battery cables and fuses are bespoke to the installation and will be provided by Rehiko but it is the customer's responsibility to 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.

Common battery configuration

A 'common battery' installation is shown on pages 23 and 25.

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 its associated module and the remainder of the UPS system can fully support the critical load – assuming n+1 module redundancy.

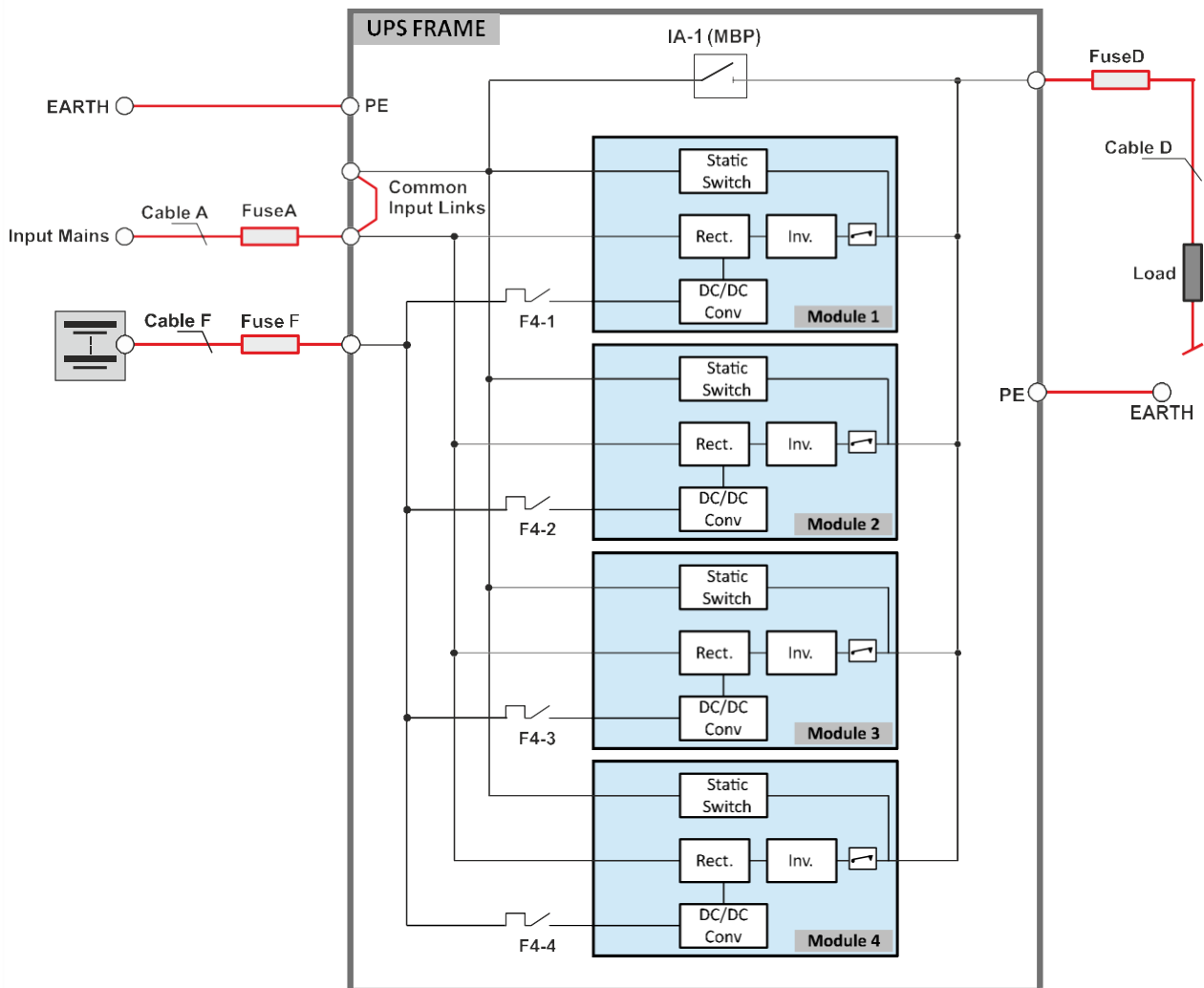
A 'separate battery' installation is shown on pages 24 and 26 for a single-feed input and dual-feed input respectively. In these illustrations each battery is connected directly to the module circuit breakers (F4-x) and not to the main battery busbars (+ve & -ve).

Cabling diagrams

The following diagrams provide recommended cable and fuse rating for the entire PW8000DPA RI range.

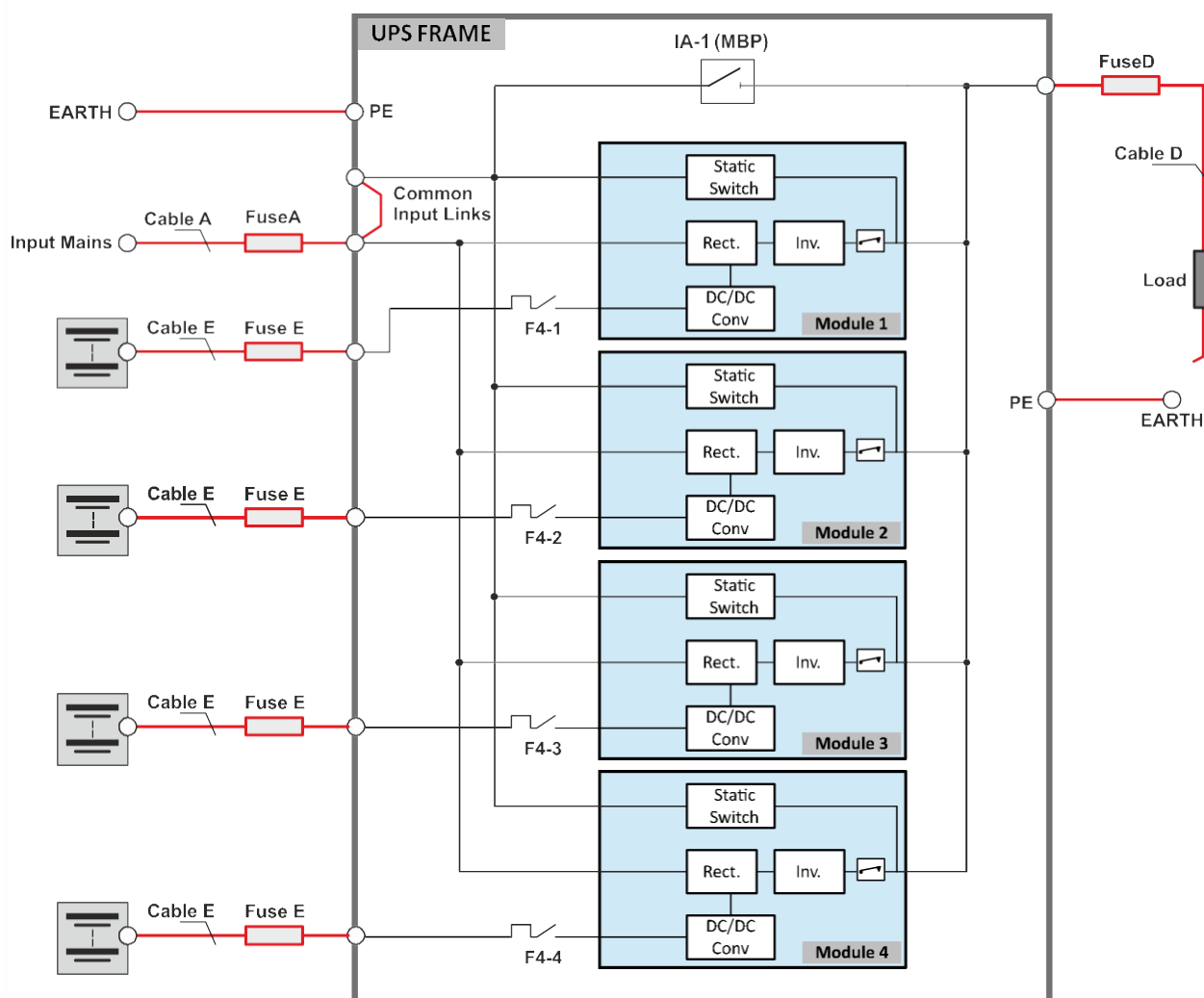
- The protective earth cable must be sized according to local and national regulations
- Rating are shown for 400V operation with unity load factor. See specification chapter for 380/415V operation.

Single input cabling with common battery



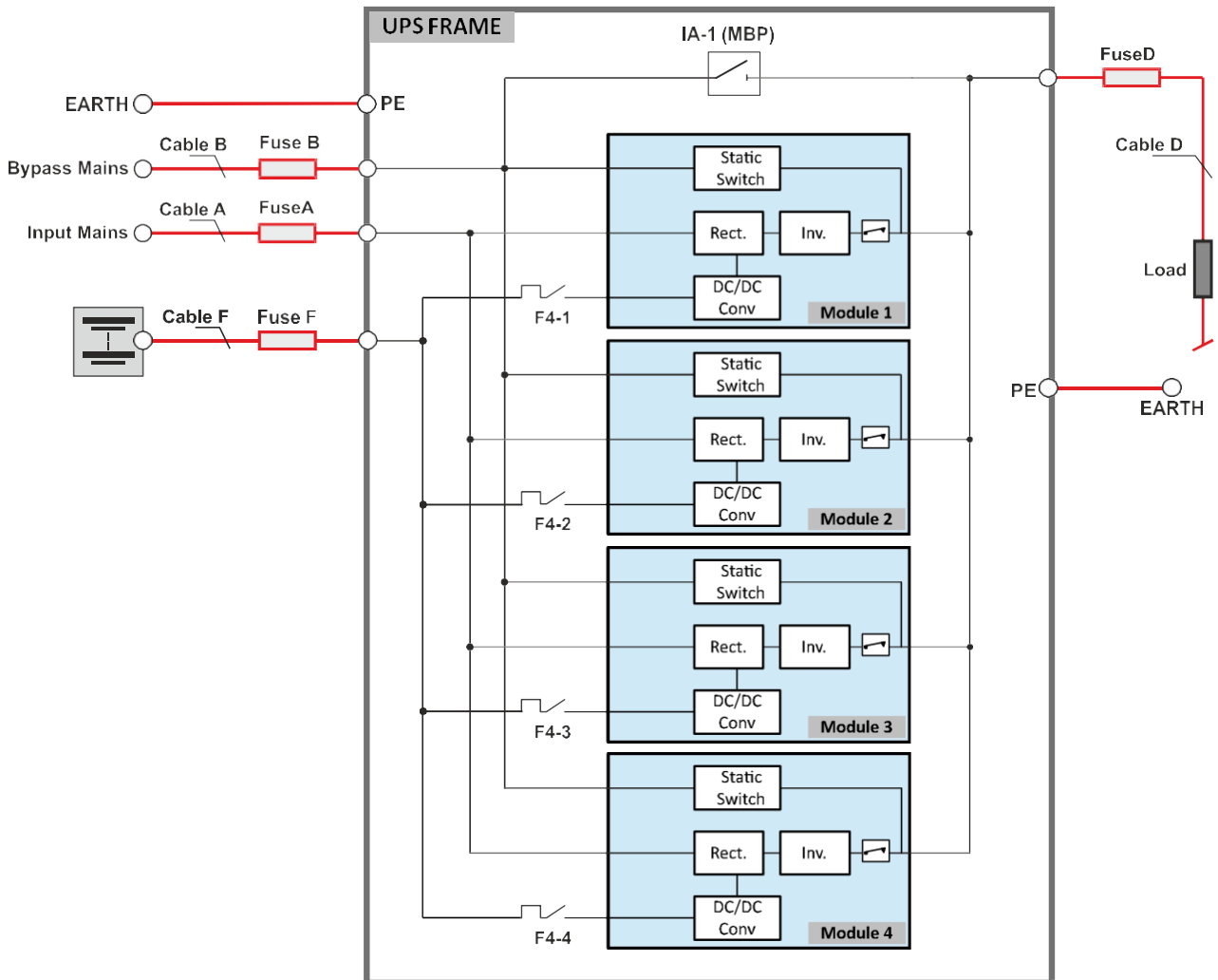
UPS CABINET CONNECTIONS							
UPS Model (fully populated)	RI-10	RI-11	RI-12	RI-20	RI-22	RI-24	RI-40
Load (kW)	20 kW	20 kW	20 kW	40 kW	40 kW	40 kW	80 kW
Fuse A (Agl/CB)	3x 40A	3x 40A	3x 40A	3x 80A	3x 80A	3x 80A	3x 160A
Max input current, battery charging (A)	34A	34A	34A	68A	68A	68A	136A
Nominal output current	29A	29A	29A	58A	58A	58A	116A

Single input cabling with separate batteries



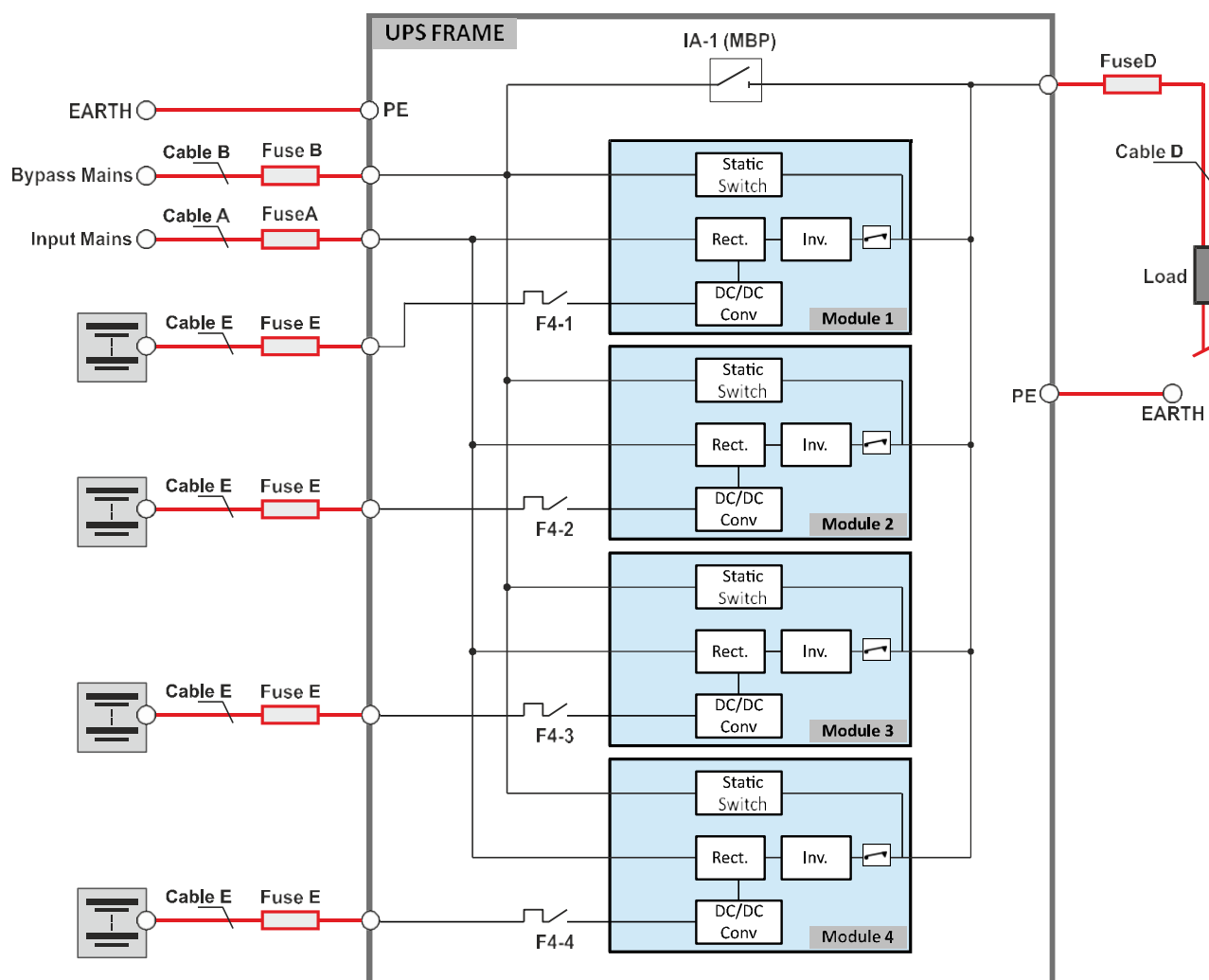
UPS CABINET CONNECTIONS							
UPS Model (fully populated)	RI-10	RI-11	RI-12	RI-20	RI-22	RI-24	RI-40
Load (kW)	20 kW	20 kW	20 kW	40 kW	40 kW	40 kW	80 kW
Fuse A (Agl/CB)	3x 40A	3x 40A	3x 40A	3x 80A	3x 80A	3x 80A	3x 160A
Max input current, battery charging (A)	34A	34A	34A	68A	68A	68A	136A
Nominal output current	29A	29A	29A	58A	58A	58A	116A

Dual input cabling with common battery



UPS CABINET CONNECTIONS							
UPS Model (fully populated)	RI-10	RI-11	RI-12	RI-20	RI-22	RI-24	RI-40
Load (kW)	20 kW	20 kW	20 kW	40 kW	40 kW	40 kW	80 kW
Fuse A (Agl/CB)	3x 40A	3x 40A	3x 40A	3x 80A	3x 80A	3x 80A	3x 160A
Max input current, battery charging (A)	34A	34A	34A	68A	68A	68A	136A
Nominal output current	29A	29A	29A	58A	58A	58A	116A

Dual input cabling with separate batteries

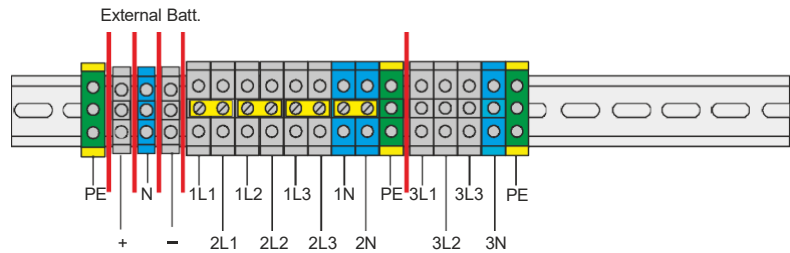


UPS CABINET CONNECTIONS							
UPS Model (fully populated)	RI-10	RI-11	RI-12	RI-20	RI-22	RI-24	RI-40
Load (kW)	20 kW	20 kW	20 kW	40 kW	40 kW	40 kW	80 kW
Fuse A (Agl/CB)	3x 40A	3x 40A	3x 40A	3x 80A	3x 80A	3x 80A	3x 160A
Max input current, battery charging (A)	34A	34A	34A	68A	68A	68A	136A
Nominal output current	29A	29A	29A	58A	58A	58A	116A

Terminal block connections

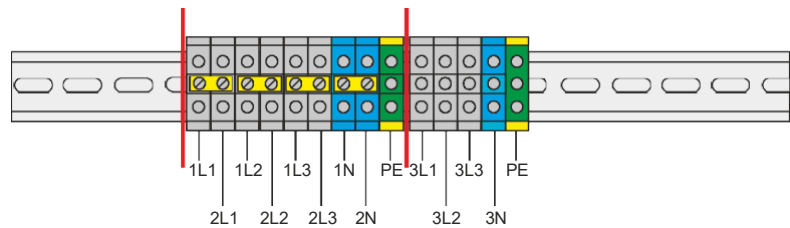
RI-10 connections

The RI-10 model requires an external battery connected to the battery terminals on the left hand side of the terminal block.



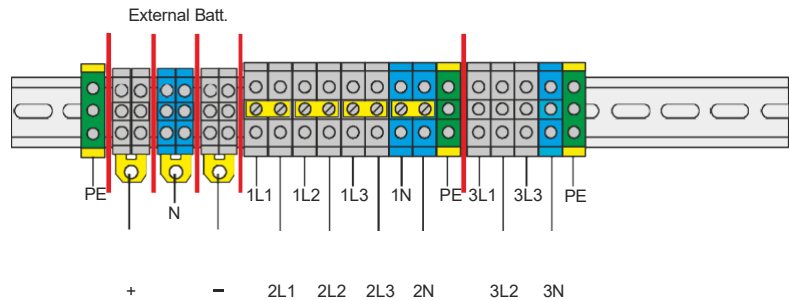
RI-11 & RI-12 connections

The RI-11 and RI-12 models have internal batteries so no battery terminal block is provided.



RI-20 connections

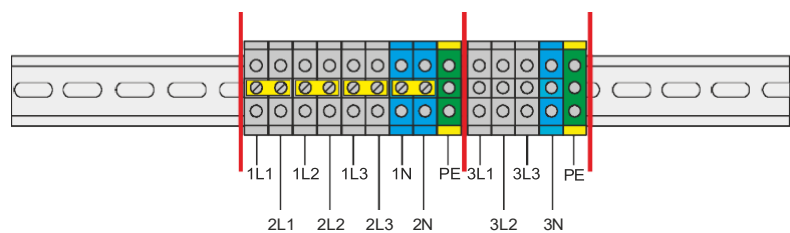
The RI-20 model requires an external battery connected to the battery terminals on the left hand side of the terminal block. As two battery strings can be connected to this model, 'common battery links' are provided



(as shown). These must be removed for separate battery installation.

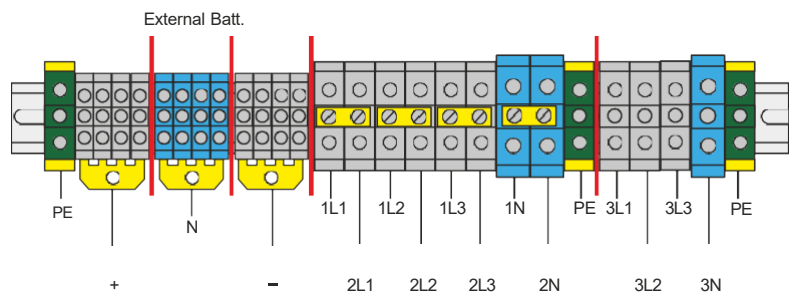
RI-22 & RI-24 connections

The RI-22 and RI-24 models have internal batteries so no battery terminal block is provided.



RI-40 connections

The RI-40 model requires an external battery connected to the battery terminals on the left hand side of the terminal block. As four battery strings can be connected to this



model, 'common battery links' are provided (as shown). These must be removed for separate battery installation.

Figure 1 Terminal block connections

Terminal connection size

UPS Model	Batt. Earth (PE)	Separate Batt. (+/N/-)	Common Batt. (+/N/-)	Input Bypass (3+N)	Input Rectifier (3+N+PE)	Output Load (3+N+PE)
RI-10	16/25 mm ² (T)	3x 10/16 mm ² (T)	–	4x 10/16 mm ² (T)	5x 10/16 mm ² (T)	5x 10/16 mm ² (T)
RI-11 & RI-12	–	–	–			
RI-20	16/25 mm ² (T)	2x (3x 10/16 mm ²) (T)	3x M5 (B)	4x 16/25 mm ² (T)	5x 16/25 mm ² (T)	5x 16/25 mm ² (T)
RI-22 & RI-24	–	–	–			
RI-40	50 mm ² (T)	4x (3x 10/16 mm ²) (T)	3x M6 (B)	3x 50 mm ² (T) +N 70/90 mm ² (T)	3x 50 mm ² (T) +N 70/90 mm ² (T) +PE 50 mm ² (T)	3x 50 mm ² (T) +N 70/90 mm ² (T) +PE 50 mm ² (T)

Note: T = Terminal block, B = Bolted connection

EXTERNAL MAINTENANCE BYPASS

Operationally, an external maintenance bypass facility is not essential. The internal maintenance bypass switch (IA1) is fully rated and can be used to connect the UPS output directly to the bypass mains supply if the UPS modules are unavailable. However, when the load is powered via IA1 the UPS frame bypass mains terminals must be permanently live in order to power the load. This means that it is not possible to fully isolate the mains supplies from the UPS frame while the internal maintenance bypass is in use.

This situation can be overcome by the addition of an 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.

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

A fourth isolator may be 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) switch panel.

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

