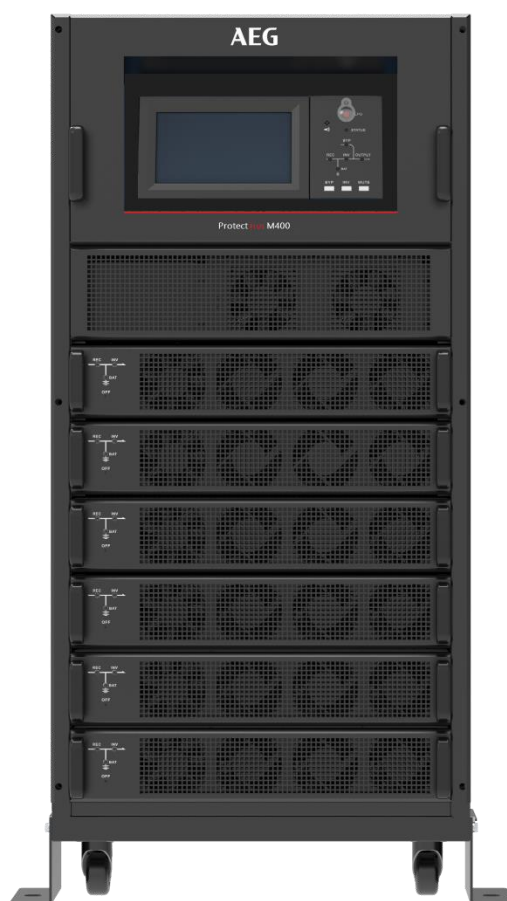


PROTECT^{PLUS} M400

Installation & User Manual

Protect^{PLUS} M400 20 kVA
Protect^{PLUS} M400 30 kVA
Protect^{PLUS} M400 40 kVA
Protect^{PLUS} M400 45 kVA
Protect^{PLUS} M400 60 kVA
Protect^{PLUS} M400 90 kVA



AEG Power Solutions GmbH, Warstein-Belecke
Department: PS R&D
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Author: 01.08.2024 / Moriñigo

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Preface

Usage

The manual contains information on the installation, use, operation, and maintenance of the modular UPS. Please read this manual carefully prior to installation.

Users

Technical Support Engineer
Maintenance Engineer

Note

Our company provides a full range of technical support and services. Customers can contact our local office or customer service center for help.

The manual will be updated for product upgrades or other reasons. Unless otherwise agreed, the manual is to be used only as a guide for users, and any statements or information contained therein do not constitute a warranty, whether explicit or implicit.



AEG Power Solutions GmbH

Emil-Siepmann-Straße 32
59581 Warstein
Germany



+49 2902 763 100
Fax: +49 2902 763 645

E-mail: service.aegpss@aegps.com

Internet: <http://www.aegps.com>

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Safety Precautions

This manual contains information on the installation and operation of the modular UPS AEG Protect Plus M400. Please read this manual carefully prior to installation. Protect Plus M400 cannot be put into operation until it is commissioned by engineers approved by the manufacturer (or its agent). Not doing so could result in a safety risk to personnel, to equipment malfunctioning and to an invalidation of the warranty.

The UPS has been designed for commercial or industrial use only and is not intended for use in any life support application. This is a CLASS C Uninterruptible Power Supply (UPS) product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take additional measures.

Safety Message Definition

Danger: Serious human injury or even death may be caused if this requirement is ignored.

Warning: Human injury or equipment damage may be caused if this requirement is ignored.

Attention: Equipment damage, loss of data or deficient performance may be caused if this requirement is ignored.

Commissioning engineer: The engineer who installs or operates the equipment should be well trained in electrical applications and safety, and be familiar with the operation, debugging, and maintenance of the equipment.

Requirements for Back Feeding Protection Units

The IEC 62040-1 standard, "General and safety requirements for UPS", specifies that a UPS must prevent the transfer of dangerous voltages or energies to the input terminals when the input power supply is switched off.

This UPS has a control signal available for use with an automatic device, externally located, to protect against back feed risks. If this protection unit is not used together with the external disconnection device located in the switchgear that is used for protecting/isolating the bypass input, a label must be added to the switchgear to inform service personnel that the circuit is connected to a UPS system. The text on the label indicates that the UPS should be isolated before work is done on the circuit.

Warning Label

The warning label indicates the possibility of human injury or equipment damage and indicates the appropriate measure to take to avoid the danger. In this manual, there are three types of warning labels as listed below.

	 DANGER Serious human injury or even death may be caused if this requirement is ignored.
	 WARNING Human injury or equipment damage may be caused if this requirement is ignored.

	ATTENTION Equipment damage, loss of data or deficient performance may be caused if this requirement is ignored.
---	--

Safety Instructions

	 DANGER Performed only by commissioning engineers. This UPS is designed for commercial and industrial applications only and is not intended for use in life-support devices or systems.
---	---

	 WARNING Read all the warning labels carefully before operation and follow the instructions.
---	--

	ATTENTION When the system is running, do not touch the surface with this label to avoid burns.
---	---

	ATTENTION There are ESD-sensitive components inside the UPS, thus anti-ESD measures should be taken before handling.
--	---

Moving & Installation

	 DANGER Keep the equipment away from heat sources or air outlets. In the event of fire, use dry powder extinguisher only. Liquid extinguishers could cause electric shock.
---	--

	 WARNING Do not start the system if any damaged or abnormal parts are found. If the UPS meets wet material or wet hands, there may be a risk of electric shock.
---	---

	ATTENTION Use appropriate equipment to handle and install the UPS. Protective footwear, clothing and other protective equipment are necessary to avoid injury. During positioning, keep the UPS away from shocks or vibrations. The UPS cabinet can only be transported without the power modules. Install the UPS in an appropriate environment. More details can be found in this document.
---	--

Debugging & Operating

	 DANGER
	Make sure the grounding cable is well connected before connecting the power cables. The grounding cable and neutral cable must comply with the local and national codes of practice. Before moving or reconnecting the cables, ensure that all input power sources are cut off, and wait at least 10 minutes for internal discharge. Use a multimeter to measure the voltage on the terminals, and ensure the voltage is lower than 36 V before operation.

	ATTENTION
	Before the UPS is powered (for both mains line and battery line connections), earth connection must be made. Earth leakage current that is introduced by the UPS (configurations from 10 kW to 40 kW) is to exceed 3.5 mA and must not exceed 1000 mA and must comply with the requirements of IEC 62040-1. When selecting residual current circuit breakers (RCCB) or RCD devices, transient and steady-state earth leakage currents that may occur during equipment start-up should be considered. RCCBs must be selected that are sensitive to DC unidirectional pulses (class A) and insensitive to transient current pulses. Earth leakage currents of the load will be carried by the RCCB or RCD. This equipment must be grounded in accordance with local electrical authority codes of practice. Initial check and inspection should be performed after long-term storage of the UPS.

Maintenance & Replacement

	 DANGER
	All equipment maintenance and servicing procedures involving internal access require special tools and should be carried out only by trained personnel. The components that can only be accessed after the protective cover has been opened (with tool) cannot be serviced by user. This UPS is compliant with IEC 62040-1 regarding the general and safety requirements for UPS. Dangerous voltages are present in the battery box. However, the risk of contact with these high voltages is minimized for non-service personnel. Since the high-voltage component can only be touched when the protective cover is opened (with tool), the possibility of contact with the high-voltage component is minimized. There are no risks to personnel if the equipment is operated normally as per the operating procedure recommended in this manual.

Battery Safety



DANGER

All the battery maintenance and servicing procedures involving internal access need special tools or keys and should be carried out only by trained personnel.

WHEN CONNECTED, THE BATTERY TERMINAL VOLTAGE WILL EXCEED 400 Vdc AND IS POTENTIALLY FATAL.

Battery manufacturers supply details of the necessary precautions to be observed when working on, or near, a large bank of battery cells. These precautions should be always followed explicitly. Attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting equipment.

Ambient temperature is a major factor in determining battery capacity and battery life. The nominal operating temperature of the battery is between 20°C and 25°C. Operating out of this temperature range will reduce battery life. To ensure UPS back-up time, the battery should be changed periodically, as indicated in the battery user manuals.

Replace the batteries only with the same type and amount of battery. A different type of battery could cause an explosion or deficient performance.

When connecting the battery, follow the precautions for high-voltage operation. Before accepting and using the battery, check the appearance of the battery. If the package is damaged, or the battery terminal is dirty, corroded or rusted, or if the shell is broken, deformed or leaks, replace it with a new product. Otherwise, the damage could reduce battery capacity, or cause electrical leakage or fire.

Remove any rings, watches, necklaces, bracelets or other metal jewellery before operating the battery.

Wear rubber gloves.

Eye protection should be worn to prevent injury from accidental electric arcs.

Only use tools (e.g. wrench) with insulated handles.

The batteries are very heavy. Please handle and lift the battery properly to prevent human injury, or damage to the battery terminal.

Do not disassemble, modify or damage the battery. Otherwise, battery short circuits, leakage or even human injury may be caused.

The battery contains sulfuric acid. During normal operations, the sulfuric acid soaks into the fibre between the plates of the battery. However, when the battery case is broken, the acid will leak from the battery. Therefore, be sure to wear protective glasses, rubber gloves and an apron when operating the battery. If not, acid could get into your eyes, which could lead to blindness or skin damage.

At the end of battery life, the battery may have an internal short circuit, a discharge of electrolytes and a corrosion of positive/negative plates. If this condition continues, the temperature may become uncontrollable, and the battery may swell or leak. Be sure to replace the battery before these phenomena occur.

Disposal

	If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid, and disposed of in accordance with local regulations. If electrolytes meet the skin, the affected area should be washed immediately with water.
--	--

	 WARNING Dispose of used battery according to the local regulations.
---	--

Conformity and standards

This product complies with the following UPS product standards:

- *IEC 62040-1 "General and safety requirements for UPS"
- *IEC 62040-2 EMC requirements CLASS C
- *IEC 62040-3 Performance requirements and test methods

For more details, refer to this document.

Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.

1 Installation

1.1 Introduction

This chapter introduces the relevant requirements for positioning and wiring of the modular UPS AEG Protect Plus M400 and related equipment. Since each site has its own requirements, it is not the aim of this chapter to provide step-by-step installation instructions, but to act as a guide for the general procedures and practices that should be observed by the installing engineer.



WARNING

Installation can only be done by authorized engineers.

Do not apply electrical power to the UPS equipment before the commissioning engineer arrives at the installation site. The UPS should be installed by a qualified engineer in compliance with the information in this chapter. All equipment not referred to in this manual is shipped with its own information on mechanical and electrical installation.



ATTENTION

Note: Three-phase, four-wire input power is required

The standard UPS system can be connected to a TN, TT AC three-phase, four-wire distribution system (IEC60364-3). A three-wire to four-wire conversion transformer is provided as an optional part. A one-phase, three-wire part is also provided as an option.



WARNING

Battery hazards

SPECIAL CARE SHOULD BE TAKEN WHEN WORKING WITH THE BATTERIES ASSOCIATED WITH THIS EQUIPMENT.

When connecting the battery, the battery terminal voltage will exceed 400Vdc and is potentially fatal.

Eye protection should be worn to prevent injury from accidental electric arcs.

Remove rings, watches and all metal objects.

Only use tools with insulated handles.

Wear rubber gloves.

If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.

If electrolyte comes into contact with the skin, the affected area should be washed immediately with water.

1.2 Initial Check

Perform the following checking operations prior to UPS installation.

- Visually examine if any damage has been done to the interior and exterior of the UPS rack or battery equipment because of transport. Report any such damage to the shipper immediately.
- Verify the product label and confirm that the equipment is correct. The equipment label is attached on the top cover. The UPS model, capacity and main parameters are marked on the label.

1.3 Location

1.3.1 UPS Location

The UPS is intended for indoor installation and should be placed in a cool, dry and clean environment with adequate ventilation to keep the environmental parameters within the specified operating range (see *Technical Data sheet*). The modular UPS series uses forced convection cooling by internal fans. Cooling air enters the module through ventilation grills located at the front part of the cabinet and exhausted through grills located in the rear part of the cabinet. Please do not block the ventilation holes.

If necessary, a system of extractor fans should be installed to aid cooling airflow. An air filter should be used when the UPS is to operate in a dirty environment and should be regularly cleaned to maintain airflow. The cooling capacity of the air conditioner should be selected in compliance with the power loss data of the UPS specified in *Technical Data sheet: Normal mode* (VFI SS 111 double-conversion UPS).

Note: The UPS should be installed on a cement surface or other surface that is not flammable.

1.3.2 External Battery Room

The battery will generate some hydrogen and oxygen at the end of charging, so the fresh air volume of the battery installation environment must meet DIN EN IEC 62485-2 requirements.

The ambient temperature of the battery must be stable. Ambient temperature is a major factor in determining the battery capacity and life. The nominal operating temperature of the battery is 20°C. Operating above this temperature will reduce battery life, and operation below this temperature will reduce battery capacity. If the average operating temperature of the battery is increased from 20°C to 30°C, then the service life of the battery will be reduced by 50%. If the operating temperature of the battery is above 40°C, then the battery service life will decrease exponentially. In a normal installation, the battery temperature is maintained between 15°C and 25°C. Keep batteries away from heat sources or air outlets.

If external batteries are to be used, the battery circuit breakers (or fuses) must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible.

1.3.3 Storing

Should the equipment not be installed immediately, it must be stored in an indoor location to protect it from excessive humidity and heat (see *Technical Data sheet*). The battery needs to be stored in a cool and dry place with good ventilation. The most suitable storage temperature is 20°C to 25°C.

	ATTENTION
	Preventing deep discharge of battery Should the UPS remain unpowered for a prolonged period while the batteries are being connected, there is a risk of deep discharge and thus of permanent damage to the batteries. In such a case, it is recommended to leave the battery circuit breaker(s) open. In any case, periodically charge the battery during storage as per the battery user manuals.

1.4 Positioning

When the equipment has been finally positioned, ensure that the UPS will remain stationary and stable. To prolong service life, chose a place that will ensure:

- space for effortless operation on the UPS
- sufficient air to dispel heat produced by UPS
- protection against atmospheric agents
- protection against excessive humidity and heat
- protection against dust
- compliance with the current fire prevention requirements
- maximum efficiency relative to temperature, as the batteries have a maximum efficiency when they are kept at a temperature in the same range as the operating environment of between +20°C to +25°C. For information on battery storage, transportation and environment, refer to *Technical Data sheet*.
- that the equipment has a steel frame structure with removable panels. The top and side panels are fixed by screws.
- that the auxiliary connections for external low voltage interface and maintenance bypass can be accessed. The UPS has an operating and control panel located on its front, which provides basic operating status and alarm signal information. Batteries are external. The UPS provides an air inlet port in the front and an air exhaust port in the rear.

1.4.1 System Cabinet

Depending on the specific system requirements, a UPS system can be comprised of a UPS and an external battery cabinet.

Refer to Chapter 4: Installation drawing for the positioning of the UPS cabinet.

1.4.2 Moving the UPS

	 WARNING Ensure that any lifting equipment used in moving the UPS has enough lifting capacity. The UPS is fitted with castors – take care to prevent movement when unbolting the equipment from its shipping pallet. Ensure that adequate personnel and lifting aids are available when removing the shipping pallet.
---	---

Ensure that the UPS weight is within the weight-loading capacity range of any hoisting equipment. See *Technical Data sheet* for UPS weight.

The UPS and optional cabinets can be handled by means of a forklift or similar equipment. For short distances, the UPS cabinet can also be moved on its castor rollers.

Note: *Units equipped with batteries must be handled with care. Keep such moves to a minimum.*

1.4.3 Clearances Required for Operating

As the UPS housing has no ventilation grills at either side, no clearances are required for the sides.

To enable routine tightening of power terminations in the UPS, it is recommended that clearance at the front and the rear of the equipment should be sufficient to enable free passage of personnel. It is important to leave min 500mm at the rear of the rack to permit adequate circulation of air coming out of the unit.

1.4.4 Front Access

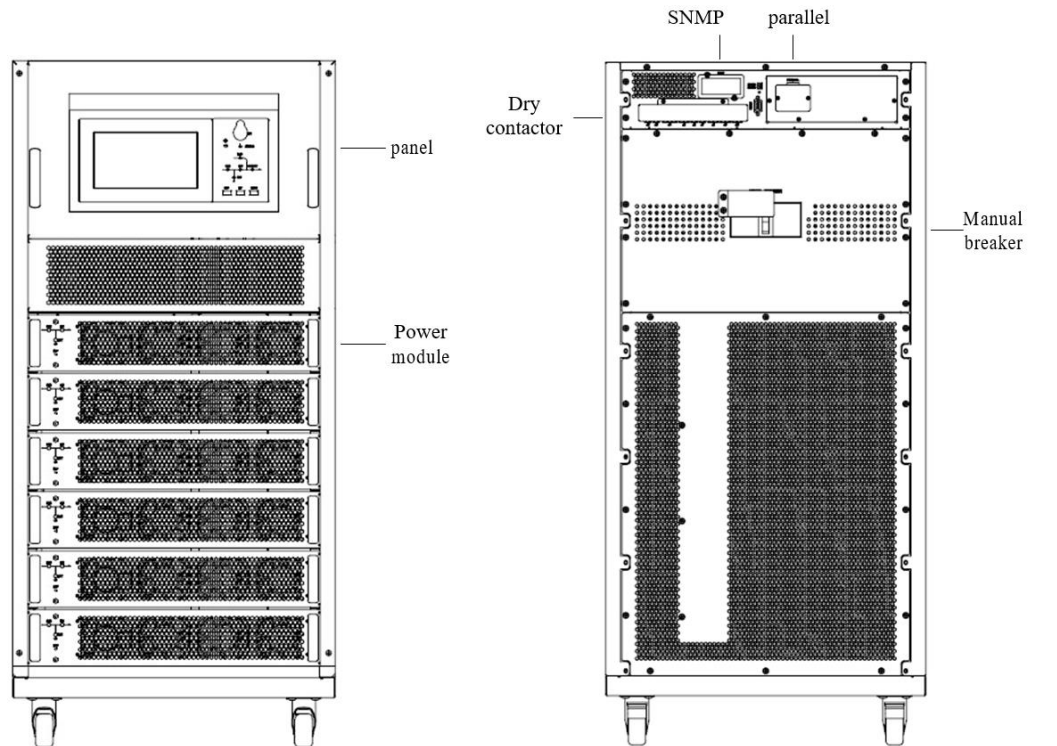
The component layout of the UPS rack system supports front access of the UPS for repairs, which thus reduces the space requirement for side access.

1.4.5 Final Positioning

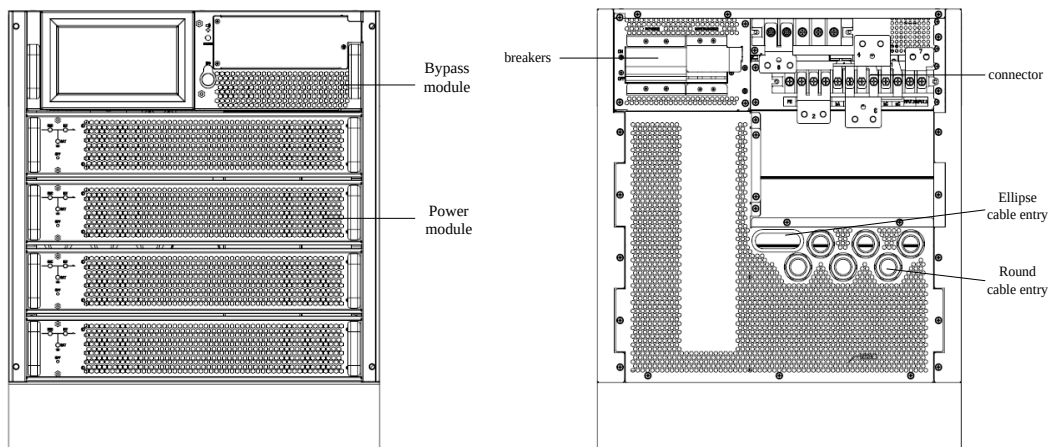
When the equipment has been finally positioned, ensure that the construction is fixed so that the UPS will remain stationary and stable.

1.4.6 UPS Composition

The UPS structure is shown in *Fig. 1-1*. The UPS configuration is provided in *Table 1-1*



6-module cabinet



4-module cabinet

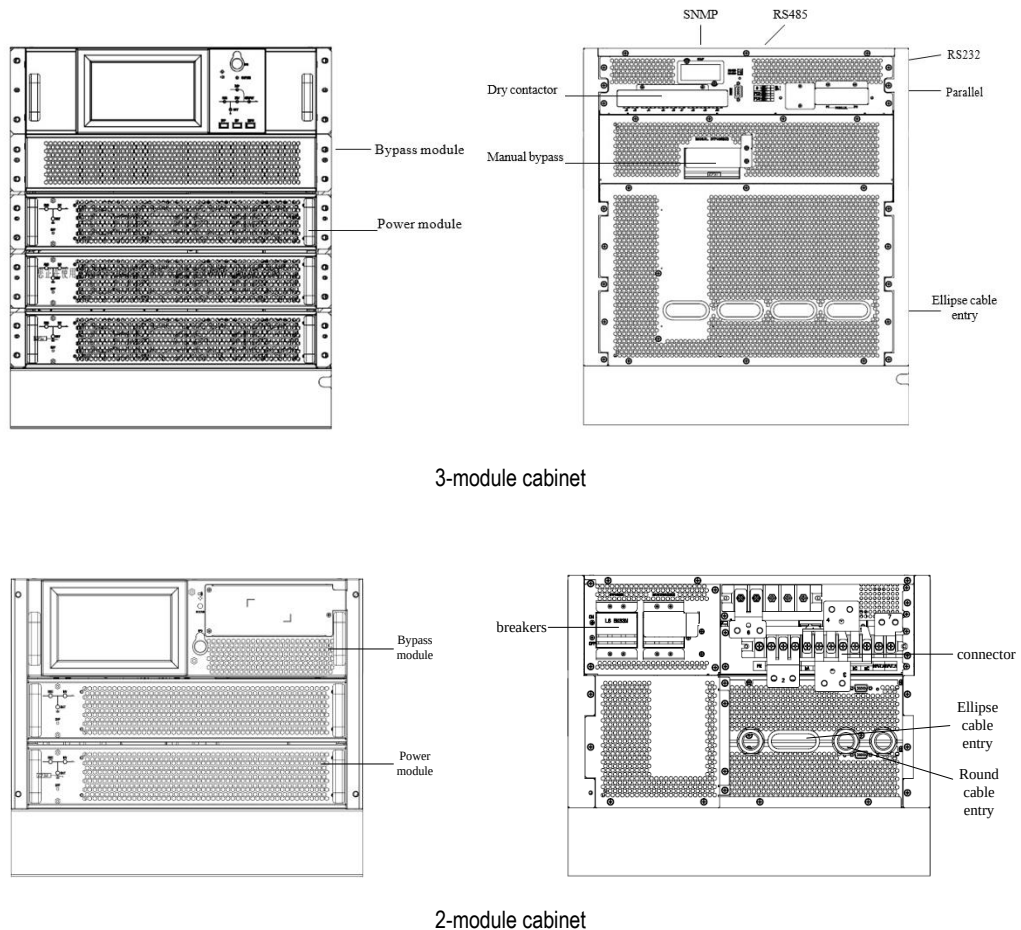


Fig.1- 1: UPS structure

Item	Components	Quantity/ Units	Remark
1	System display	1	Required, factory installed
2	Bypass module	1	Required, factory installed
3	Bypass/maintenance bypass breakers	1	Required, factory installed
4	Power module	1 ≤ n ≤ X	X, maximum slots per rack (2,3,4, or 6)
5	Charger module		
6	Decorative metal strip	2	Factory installed

Table 1- 1: UPS configuration list

1.4.7 Installing Power Modules

The number and installation positions of the power modules may vary depending on the selected factory configuration. Please install the power modules from bottom to top to avoid toppling of the cabinet due to a high center of gravity.

Installation procedures of power modules:

When installing power modules, always work from the lowest section upwards to maintain a lower center of gravity. The default setting from the bottom upwards is NO. 1 to NO. 2 (2-module cabinet), NO. 1 to NO. 4 (4-module cabinet). NO. 1 to NO. 3 (3-module cabinet). NO. 1 to NO. 6 (6-module cabinet).

Note

If installed as a standalone unit, it is recommended that power modules are installed from the upper section downwards to prevent corrosion of the bottom module.

- Take hold of the decorative metal strips from the two sides of the front panel. Loosen the screws in the holes on the metal strips, **pull metal strips upwards**, then remove the strips as in *Fig.1-2(a)*.
- Insert the module in the installation position and push it into the cabinet.
- Secure the module to the cabinet via the fixing holes on both sides of the front panel.
- Loosen the four top and bottom screws and fix the two side metal strips (as in *Fig.1-2*) covering the screws on the front side as in *Fig.1-2(c)(d)*.
-

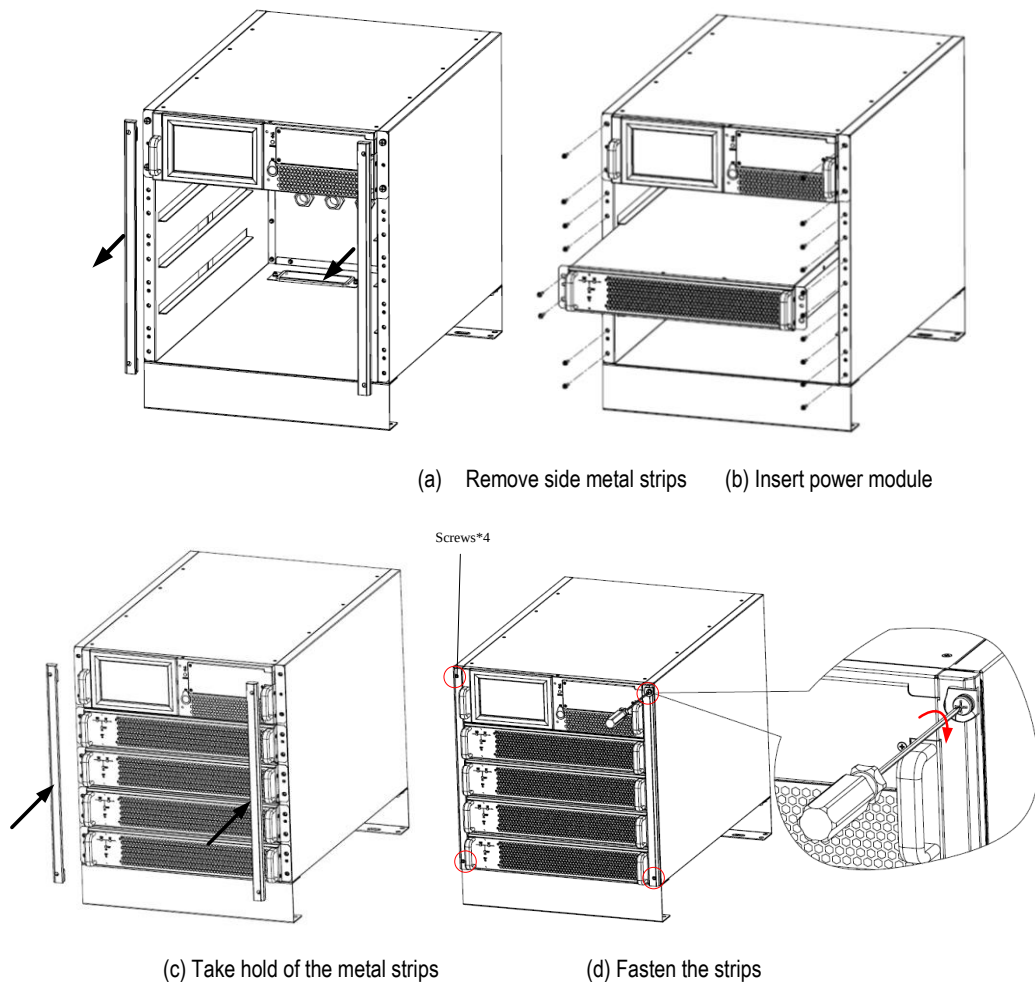
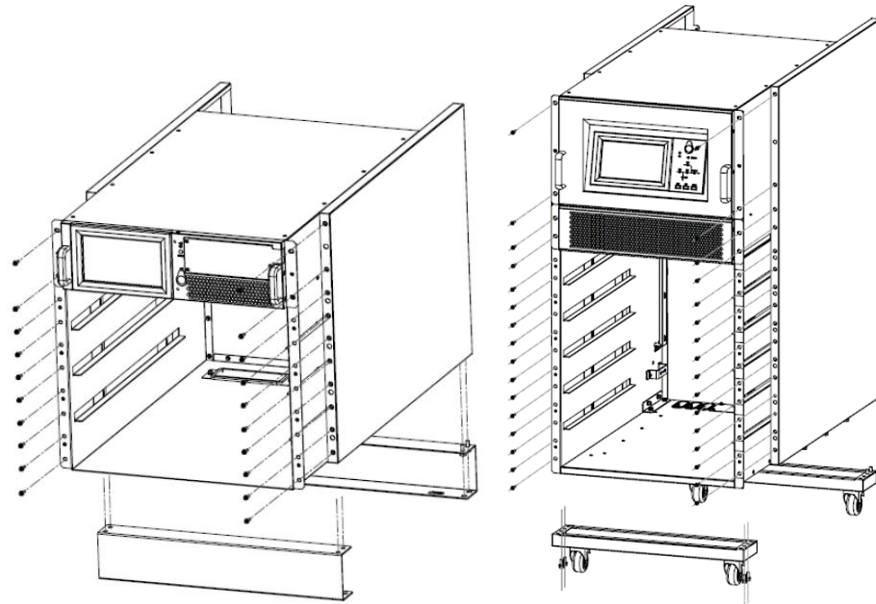
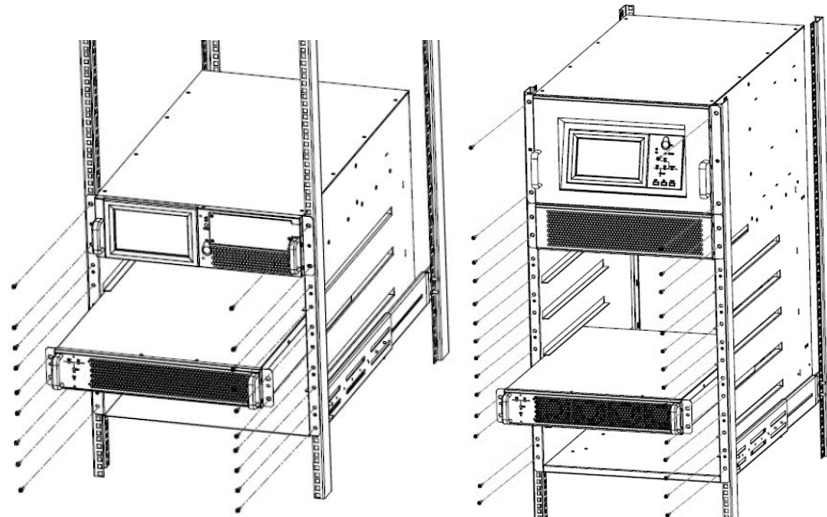


Fig.1- 2: Power Module Installation

When using the UPS in a rack-mount configuration, the UPS must be supported by slide kit, fixed rails or a shelf. Fasten slide kit into the rack enclosure. Remove side panels and holders of UPS as in *Fig.1-3*. Lay the UPS in rack-mounting position. Fasten the UPS into the rack enclosure with (20) M6 screws.



a. Remove side panels and holders



b. Fasten cabinet into rack enclosure

Fig.1- 3: Rack-mounted installation



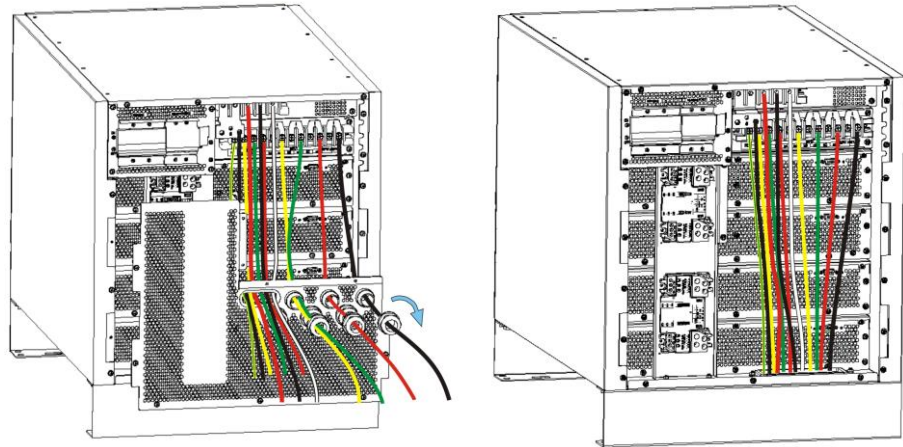
WARNING

Service rack enclosure inside doors should be selected to cover side panel of UPS cabinet, otherwise the power module connector might meet tools, such as a screwdriver.

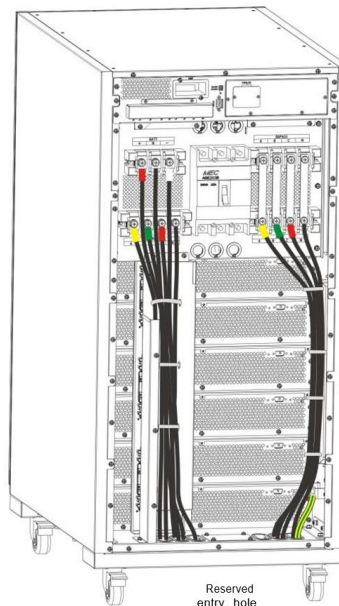
1.4.8 Cable Entry

Cables can enter the module UPS rack system from both bottom and back. The recommended installation practice is to connect cables through the cable feed-through (ellipse hole) to prevent foreign objects from entering the cabinet. Use a circular entry protector if the hole is not big enough. If connecting cables by the bottom entry, remove the cover and first install a rubber cable protector in the bottom entry hole.

Cable entry is as shown in Fig.1-4.



2-module or 4-module cabinet cable entry



6-module cabinet cable entry

Fig.1- 4: Cable entry

Note:

Cables should be connected as shown in the diagram on the rear panel or in *Appendix 1 (2-module and 4-module cabinet)*

Fix cables in 6-module cabinet as Fig.1-4(b) to make sure best ventilation.

If cables do not fit through the holes, they should be fed in through cover. In this case, block the remaining space to protect the UPS from small rodents entering.

1.5 External Protective Devices

For safety purposes, it is necessary to install external circuit breakers or other protective devices for the AC input supply of the UPS system. This section provides general, practical information for qualified installation engineers. The installation engineers should have knowledge of regulatory wiring standards, and of the equipment to be installed.

1.5.1 Rectifier and Bypass Input Supply of the UPS

Overcurrent

Install suitable protective devices in the distribution unit of the incoming mains supply, taking into considering the power-cable current load capacity and overload capacity of the system. An IEC60947-2 magnetic circuit breaker is recommended that has a C (normal) tripping curve at 125% of the current listed in the Technical Data sheet. Split bypass: If a split bypass is used, separate protective devices should be installed for the rectifier input and bypass input in the incoming mains distribution panel.

Note: *The rectifier input and bypass input must use the same neutral line.*

Protection against earth faults (Residual Circuit Breaker, RCB devices):

The RCB device installed upstream of the input supply should:

- be sensitive to DC unidirectional pulses (class A) in the network
- be insensitive to transient current pulses
- have an average sensitivity that is adjustable between 0.3A and 1A.

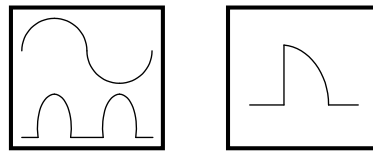


Fig.1- 5: The RCB symbols

When using the RCB in the separated bypass system or the parallel connection, the RCB should be installed upstream to the input distribution to avoid incorrect alarm signals.

The residual current introduced by the RFI filter in the UPS is between 3.5 mA and 1000 mA. It is recommended that the sensitivity of the RCD of the upstream input distribution and downstream distribution (to load) be confirmed.

1.5.2 External Battery

The DC-rated circuit breaker or fuses provide overcurrent protection for the UPS system and the battery, which is usually installed to the external battery.

1.5.3 UPS Output

If an external distribution panel is used for load distribution, the selection of protective devices must be distinct from those that are used at the input to the UPS.

1.6 Power Cables

The cables should be selected as described in this section and comply with local regulatory wiring standards. Environmental conditions (temperature and physical support media) should also be taken into consideration. Refer to IEC62477-1 Table 3B: Cabling.

	 WARNING
	Failure to follow adequate earthing procedures can result in emi, electric shock hazard, or risk of fire should an earth fault occur.

UPS power (KVA)	Rated current (A)						
	Main input current at full load and battery charging (1), (2)	Output current at full load (2)			Battery discharging current at E.O.D = 1.67V/cell, no overload.		
	380V	380V	400V	415V	32 Batt./ string	38 Batt./ string	40 Batt./ string
90	180	136	130	125	263	249	236
60	120	92	87	83	175	166	157
45	90	68	65	62.5	132	125	118
40	80	61	58	56	132	111	105
30	60	46	44	42	88	83	79
20	40	31	29	28	66	56	53

Table 1- 2: Maximum steady state AC and DC current

Note:

- (1) Input current of common input configurations of rectifier and bypass
- (2) Take exceptional care when determining the size of the output and bypass neutral cable, as the current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads, which is usually 1.732 times of rated currents.
- The earth cable connecting the UPS to the main ground system must follow the most direct route possible. The earth conductor should be sized according to the fault rating, cable lengths, type of protection, etc.
- According to AS/IEC62477-1, the cross-section area of the conductor should be 10mm²/6mm² (15/20KVA input/output), 16mm²/10mm² (30KVA), 25mm²/16mm² (40/45kVA input/output), 35mm²/25mm² (60kVA input/output), 70mm²/50mm² (90KVA input/output).
- When sizing battery cables, a maximum volt drop of 4Vdc is permissible at the current ratings given in Table 1-2. The load equipment is connected to a distribution network of individually protected busbars fed by the UPS output rather than connected directly to the UPS.

- In parallel multi-module systems, the output cable of each UPS unit should be kept at equal length between the output terminals and the parallel distribution bus bar, in order to avoid affecting the shared current.
- When laying the power cables, do not form coils, to avoid the formation of electromagnetic interference.
- See Chapter 4 Installation drawing for the positions of wiring terminals.

1.6.1 Cable Connection

	! WARNING The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficulties, do not hesitate to contact our Customer Service & Support department.
---	---

After the equipment has been finally positioned and secured, refer to Chapter 4 Installation drawing to connect the power cables as described in the following procedures:

- Verify that all the external input distribution switches of the UPS are completely opened, and the UPS internal maintenance bypass switch is opened. Attach necessary warning signs to these switches to prevent unauthorized operation.
- Open rear panel of the UPS; the power connection terminals are visible.
- Connect the protective earth and any necessary grounding cables to the PE terminal. The cabinet for the UPS must be connected to the user's ground connection.

Note:

The grounding cable and neutral cable must be connected in compliance with local and national codes of practice.

Identify and make power connections for incoming cables using one of the two procedures below, depending on the type of installation:

Common Input Connections

- For common bypass and rectifier inputs, connect the AC input supply cables to the UPS input terminals (input A-B-C-N). Refer to *Fig. 4-7* and tighten the connections to 5Nm (M6 bolt) or 13Nm (M8 bolt).
ENSURE CORRECT PHASE ROTATION.

Split Bypass Connections (option)

- If a split-bypass configuration is used, connect the AC input supply cables to the rectifier input terminals (input A-B-C-N). Refer to *Fig. 4-7* and the AC bypass supply cables to the bypass input terminals (bypass A-B-C-N) and tighten the connections to 5 Nm (M6 bolt) or 13Nm (M8 bolt) or to 25Nm (M10 Bolt).
ENSURE CORRECT PHASE ROTATION.

Note: For split bypass operation ensure that the busbars between bypass and rectifier inputs are removed. The neutral line of the bypass input must be connected to that of the rectifier input.

Frequency Converter Mode

- If the frequency converter configuration is used, connect the AC input cables to the rectifier input terminals (input A-B-C-N). Refer to *Fig. 4-7* and tighten the connections to 5Nm (M6 bolt), or to 13Nm (M8 bolt) or to 25Nm (M10 Bolt).
ENSURE CORRECT PHASE ROTATION AND TIGHTEN CONNECTION TERMINALS.
Bypass input cables should not be connected to bypass input terminals (bA-bB-bC-bN).

Note: For the frequency converter operation mode, ensure that the busbars between bypass and rectifier inputs are removed.

Output System Connections

- Connect the system output cables to the UPS output busbars (output A-B-C-N). Refer to *Fig. 4-7* and the critical load and tighten the connections to 5 Nm (M6 bolt) or to 13Nm (M8 bolt) or to 25Nm (M10 Bolt).
ENSURE CORRECT PHASE ROTATION.

	WARNING If, upon arrival of the commissioning engineer, the load equipment is not ready to accept power, ensure that the system output cables are safely isolated at their ends.
---	---

- Re-install all the protective covers.

1.7 Control Cabling and Communication

1.7.1 UPS Dry Contact and Monitoring Board Features

Depending on the specific needs of the field, the UPS may require an auxiliary connection to manage the battery system (including the external battery switch and temperature sensor), to communicate with the PC, to provide alarm signals to the external device, or to have a remote EPO (Emergency Power OFF). These functions are carried out by the UPS dry contact board (GJ) and monitoring board (JK) at the front of the bypass module. The boards provide the following interfaces:

- Emergency Power OFF (EPO)
- Environment and battery temperature input interface
- Generator input dry contact interface
- Battery warning output dry contact interface
- Battery circuit breaker interface
- Mains failure warning output dry contact interface
- User communication interface

The UPS dry contact board provides input dry contacts and output dry contacts that can be programmed with further different signals via the computer.

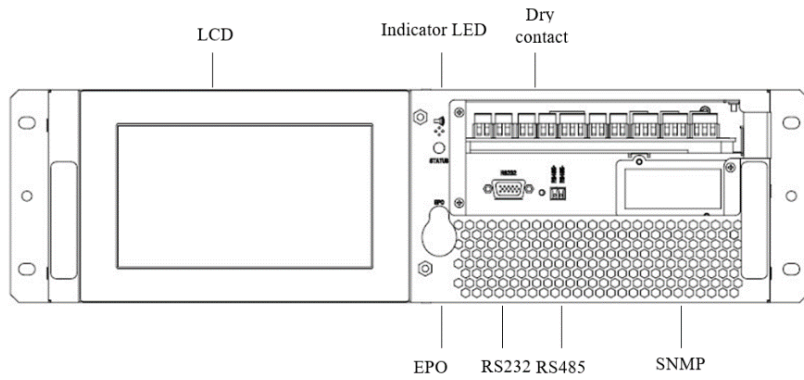


Fig.1- 6: 20 - 40 kVA Bypass module (include bypass and monitoring)

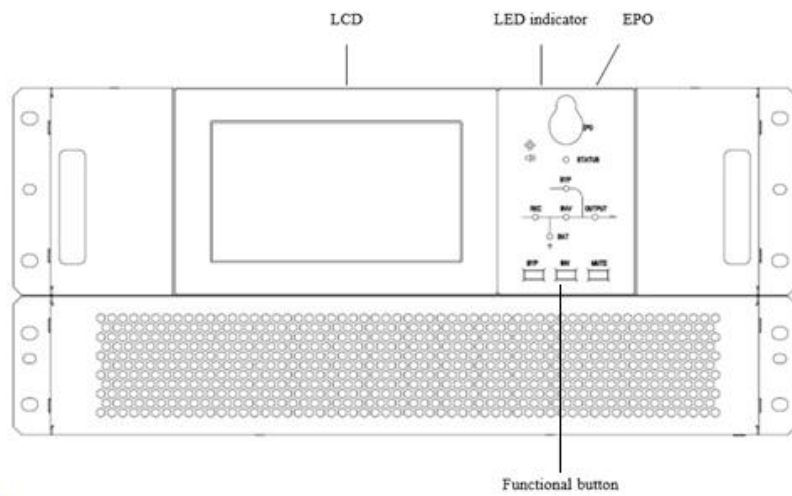


Fig.1- 6: 30-45 kVA Bypass module (include bypass and monitoring)

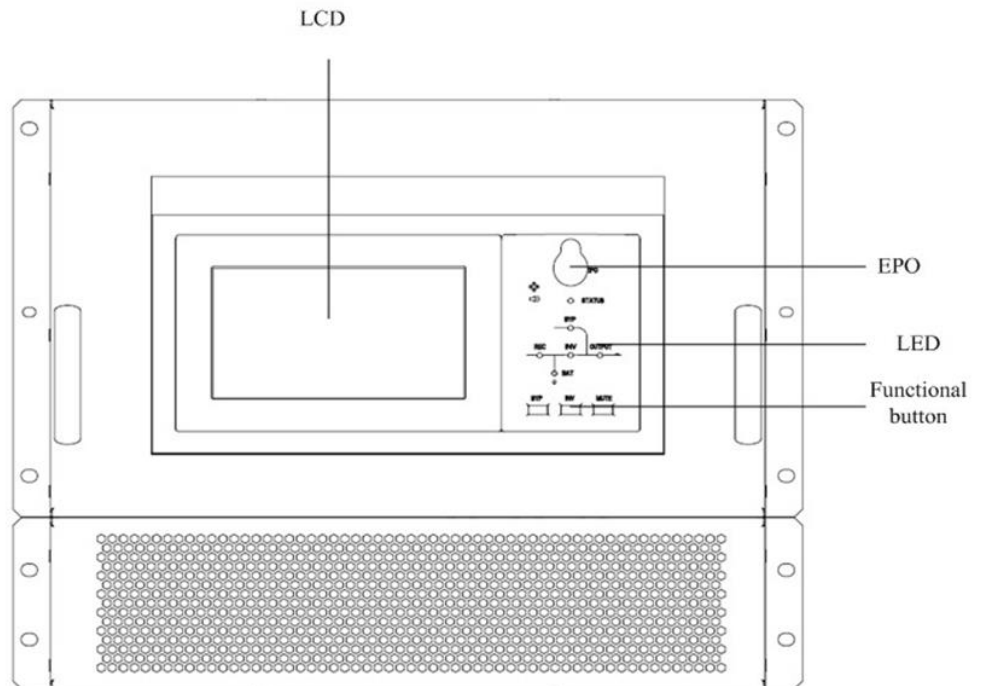


Fig.1- 6: 90 kVA Bypass module (include bypass and monitoring)

1.7.2 Dry Contact Interface of Battery and Environment Temperature Detection

The input dry contacts J2 and J3, which can be used in environment monitoring and battery temperature compensation, detect the temperature of the batteries and the environment.

J2 and J3 interface diagrams are shown in *Fig. 1-7*; the description of the interface is in *Table 1-3*.

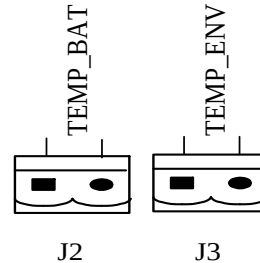


Fig. 1- 7: Diagram of J2 and J3 dry contacts for temperature detection

Port	Name	Function
J2-1	TEMP_BAT	Battery temperature detection
J2.2	TEMP_COM	Common terminal
J3.1	TEMP_ENV	Environment temperature detection
J3.2	TEMP_COM	Common terminal

Table 1- 3: Description of input dry contact J2 and J3 for temperature detection



Specified temperature sensor is required for temperature detection ($R_{25}=50\Omega$, $B_{25/50}=3275$), please confirm with the manufacturer, or contact local maintenance engineers when placing an order.

1.7.3 Remote EPO Input Port

The UPS has an Emergency Power OFF (EPO) function. This function can be activated by pressing a button on the control panel of the UPS or via a remote contact provided by the user. The EPO pushbutton is protected by a hinged plastic cover.

J4 is the input port for remote EPO. It requires shorting NC and +24v during normal operations, and the EPO is triggered when opening NC and +24v, or shorting NO and +24v. The port diagram is shown in *Fig. 1-8*, and port description is shown in *Table 1-4*.

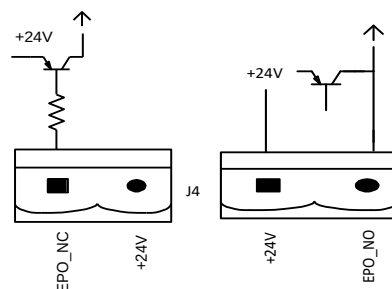


Fig.1- 8: Diagram of input dry contact for remote EPO

Position	Name	Purpose
J4.1	EPO_NC	EPO is activated when disconnecting from J4.2
J4.2	+24V	+24V, connect the common terminal of NC
J4.3	+24V	+24V, connect the common terminal of NO
J4.4	EPO_NO	EPO is activated when shorting with J4.3

Table 1- 4: Description of input dry contact for remote EPO

The EPO is triggered when shorting pin 3 and 4 or opening pin 1 and 2 of J4.

If an external emergency stop facility is required, it is connected via the reserved terminals of J4. The external emergency stop facility needs to use shielded cables to connect to the normally open/closed remote stop switch between these two pins. If this facility is not used, then pin 3 and pin 4 of J4 must be open, or pin 1 and pin 2 of J4 must be shorted.



The emergency stop action within the UPS will shut down the rectifier, inverter and static bypass. However, it does not internally disconnect the mains input power supply. To disconnect ALL power to the UPS, open the upstream input circuit breaker(s) when the EPO is activated.

Pin 1 and 2 of J4 have been short-circuited before the UPS is delivered.

All auxiliary cables must be double-insulated twisted cables with cross-section area of $0.5\text{mm}^2 \sim 1.5\text{mm}^2$ for maximum connection length of between 25m and 50m.

1.7.4 Generator Input Dry Contact

J5 is the status interface for generator connection. Connect J5-2 with J5-1. This indicates that the generator has been connected with the system. The interface diagram is shown in *Fig. 1-9*, and interface description is shown in *Table 1-5*.

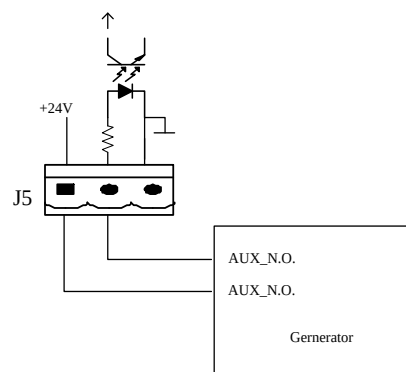


Fig.1- 9: Connection of generator

Factory setting:

Position	Name	Purpose
J5.1	+24V	Internal +24V power supply
J5.2	GEN	Connection status of generator
J5.3	GND	Power ground

Table 1- 5: Description of status interface and connection of generator

i All auxiliary cables must be double-insulated twisted cables with cross-section area of $0.5\text{mm}^2 \sim 1.5\text{mm}^2$ for maximum connection length of between 25m and 50m.

1.7.5 BCB Input Port

J6 and J7 are the BCB ports. The diagram is shown in Fig. 1-10, and the description is shown in Table 1-6.

J6.1 & 7.2 Input

J6.2 Output

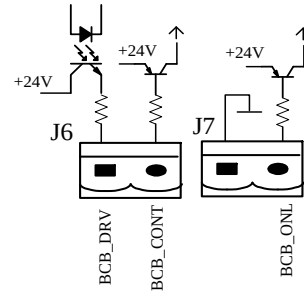


Fig.1- 10: BCB interface

Factory setting:

Position	Name	Description
J6.1	BCB_DRV	BCB actuating signal, provide the actuating signal of +24V, 20mA
J6.2	BCB_CONT	BCB contact status, connect with the normally open signal of BCB
J7.1	GND	Common connection
J7.2	BCB_ONL	BCB on-line-input (normally open), BCB is on-line when the signal is connecting with common connection

Table 1- 6: Description of BCB interface

i All auxiliary cables must be double-insulated twisted cables with cross-section area of $0.5\text{mm}^2 \sim 1.5\text{mm}^2$ for maximum connection length of between 25m and 50m.

i In case of Lithium Battery Installation J6.2 and J7 inputs will be used to communicate with battery BMS (Allow Charge & Allow discharge). See "Appendix 4 Lithium Battery configuration".

1.7.6 Battery Warning Output Dry Contact Interface

J8 is the output dry contact interface, which outputs the battery warnings of low or excessive voltage, when the battery voltage is lower than set value, an auxiliary dry contact signal will be provided via the isolation of a relay. The interface diagram is shown in Fig. 1-11, and description is shown in Table 1-7.

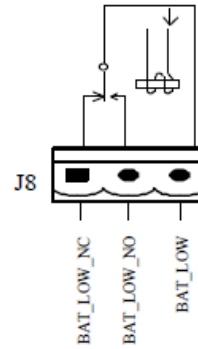


Fig.1- 11: Battery low warning dry contact

Position	Name	Description
J8.1	BAT_LOW_NC	Battery warning relay (normally closed) will be open during warning
J8.2	BAT_LOW_NO	Battery warning relay (normally open) will be closed during warning
J8.3	GND	Common connection

Table 1- 7: Battery warning dry contact interface description

1.7.7 Integrated Warning Output Dry Contact Interface

J9 is the integrated warning output dry contact interface. When one or more present warning is triggered, the system will send an integrated warning, and provide an auxiliary dry contact signal via the isolation of a relay. The interface diagram is shown in *Fig. 1-12*, and the description is shown in *Table 1-8*.

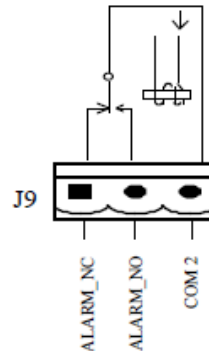


Fig.1- 12: Integrated warning dry contact

Position	Name	Purpose
J9.1	ALARM_NC	Integrated warning relay (normally closed) will be open during warning
J9.2	ALARM_NO	Integrated warning relay (normally open) will be closed during warning
J9.3	GND	Common connection

Table 1- 8: Integrated warning dry contact interface description



All auxiliary cables must be double-insulated twisted cables with cross-section area of 0.5mm² ~ 1.5mm² for maximum connection length of between 25m and 50m.

1.7.8 Mains Failure Warning Output Dry Contact Interface

J10 is the output dry contact interface for utility failure warning. When the utility fails, the system will send a utility failure warning, and provide an auxiliary dry contact signal via the isolation of a relay. The interface diagram is shown in Fig. 1-13, and the description is shown in Table 1-9.

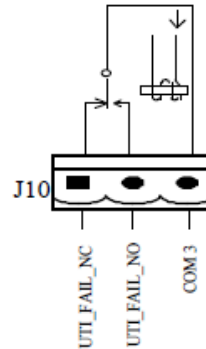


Fig.1- 13: Utility Failure warning dry contact

Position	Name	Purpose
J10.1	UTI_FAIL_NC	Mains failure warning relay (normally closed) will be open during warning
J10.2	UTI_FAIL_NO	Mains failure warning relay (normally open) will be closed during warning
J10.3	GND	Common connection

Table 1- 9: Description of mains Failure warning dry contact



All auxiliary cables must be double-insulated twisted cables with cross-section area of 0.5mm² ~ 1.5mm² for maximum connection length of between 25m and 50m.



Connect dry contact cables as in Fig.4-10

2 Battery Installation and Maintenance

2.1 General Recommendations

Take exceptional care when operating the batteries of the modular UPS system. When all the battery cells are connected, the battery voltage can exceed 400Vdc, which is potentially fatal.



The precautions for battery installation, use and maintenance are to be provided by the battery manufacturers. The precautions in this section include key issues to be considered when designing the installation and may be adjusted according to the specific local situations.



WARNING

Battery Room Design

The battery is to be installed and stored in a clean, cool and dry environment.

Do not install the battery in a sealed battery chamber or sealed room. The battery room ventilation should at least meet the requirements of DIN EN IEC 62485. Otherwise, battery bulging, fire and even human injury may be caused.

The battery is to be installed at a good distance from the heating source (e.g. transformer). Do not use or store the battery in a place near the heating source, do not burn the battery, or put it in a fire. This could cause battery leakage, bulging, fire or explosion.

Batteries should be arranged in such a way that two bare live parts with a potential difference of more than 150 V will not be contacted at the same time. If this is unavoidable, use insulated terminal covers and insulated cables for connection.

If external batteries are to be used, the battery circuit breakers (or fuses) must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible.

**WARNING****Battery Handling**

When connecting the battery, follow the precautions for high-voltage operation:

Before accepting and using the battery, check the appearance of the battery. If the package is damaged; if the battery terminal is dirty, corroded or rusted; or if the case is broken, deformed or has leakages, replace it with a new product. Otherwise, this could result in battery capacity reduction, electric leakage or fire.

Before operating the battery, remove rings, watches, necklaces, bracelets and any other metal jewellery

Wear rubber gloves

Wear eye protection to prevent injury from accidental electric arcs

Only use tools (e.g. wrench) with insulated handles

The batteries are very heavy. Please handle and lift the batteries properly to prevent human injury or damage to the battery terminal.

Do not modify, damage or decompose the battery. Otherwise, battery short-circuits, leakages or even human injury may occur.

The battery contains sulfuric acid. During normal operations, the sulfuric acid soaks into the fiber between the plates of the battery. However, when the battery case is broken, the acid will leak from the battery. Therefore, be sure to wear protective glasses, rubber gloves and an apron when operating the battery. If not, acid could get into your eyes leading to blindness or skin damage.

At the end of battery life, the battery may have an internal short circuit, an electrolyte discharge, or corrosion of positive/negative plates. If the condition continues, the temperature may become uncontrollable, and the battery may swell or leak. Be sure to replace the battery before these phenomena occur.

If a battery leaks an electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in compliance with local regulations.

If electrolytes come into contact with the skin, the affected area should be washed immediately with water.

2.2 Battery Typologies

This UPS can work with Lithium-Ion and VRLA batteries, The factory setting is VRLA, in case you would need to set up Lithium Battery please contact AEG to enable this option.

Depending on the required configuration, the UPS may need batteries consisting of one or more strings of battery blocks installed on shelves in a locked cabinet or in a designated battery room.

i *To Install Lithium Batteries, PLEASE CONTACT AEG.
Between 32 and 44 batteries per string (even numbers) can be installed in a conventional battery cabinet (external).
If the unit is ordered without batteries, the default factory setting is 40.
POWER DERATING will be applied for following battery configurations:
36pcs battery can support max 90% load rate when discharging, online mode 100% load rate.
32~34pcs battery support max 80% load rate when discharging, online mode 100% load rate.
The cabinet can only be used with valve-regulated, maintenance-free, lead-acid batteries.
CAUTION: The lead-acid battery may cause chemical risks.*

2.2.1 VRLA Battery Installation

Only qualified engineers can install, and service batteries mounted in a conventional battery cabinet or shelf. To ensure safety, install the external batteries in a locked cabinet or designated battery room that is accessible to service qualified personnel only.

Please note that the number of cells set via software must be consistent with the actual number of cells.

A minimum space of 10 mm must be reserved on all vertical sides of the battery block to permit free air movement around the cells.

A certain clearance should be reserved between the top of the cells and the underside of the upper shelf, as this is necessary for monitoring and servicing the cells.

When installing the batteries, always work from the bottom shelf upwards to prevent shifting of the center of gravity. Install the batteries reliably avoiding vibrations and bumping. The bending radius of the cable should exceed 10D, with "D" representing the outer diameter of the cable.

When connecting the cables, do not cross the battery cables and do not bind the battery cables together. The battery connection must be firm and stable. After connecting the cables, all connections between the wiring terminals and the batteries must be adjusted to meet the torque requirement provided in the specifications and user manuals of the battery manufacturers.

All battery terminals should be insulated after their connections have been made. Check if the battery is unexpectedly grounded. If this is the case, remove the earth power supply. Contact with any part of the grounded earth may lead to electric shock. Measure the battery voltage and carry out battery voltage calibration after the UPS is started.

Diagram of battery connection is shown as below:

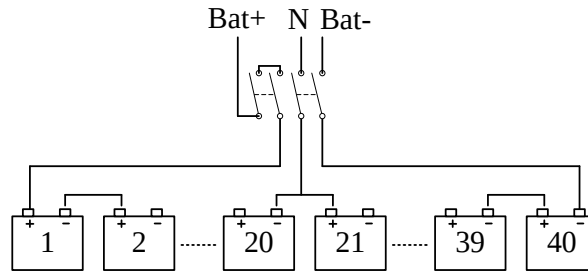


Fig.2- 1: Diagram of battery connections



WARNING

Battery Connection

When using any battery solution, always comply with the following precautions:

- Disconnect the charging power before connecting or disconnecting the cable of the battery terminals.
- Do not connect the cables between the UPS battery terminals and the batteries before getting approval from the commissioning engineer.
- When connecting the cables between the battery terminals and the circuit breaker, always connect the circuit breaker end of the cable first.
- Be sure to connect the positive/negative terminals of the batteries to those of the circuit breakers, and those of the circuit breakers to those of the UPS respectively, in compliance with the positive/negative terminal markings. Reverse connection of battery polarities will result in explosion, fire, damage to the batteries and UPS, and human injury.
- The battery connecting terminal shall not be subject to any external force, such as the pulling force or twisting force of the cable. Otherwise, the internal connection of the battery may be damaged, and in severe cases, the battery may catch fire.
- Do not connect power until the total voltage of the battery string is measured and verified correctly.
- Do not connect any conductor between the positive and negative terminals of the battery.
- Do not close the battery circuit breakers before getting the approval from the commissioning engineer.

2.2.1 Lithium-Ion Battery Installation

See appendix 4

2.3 Battery Maintenance

For battery maintenance and precautionary measures, please refer to IEEE-Std-1188-2005 and the relevant manuals provided by the battery manufacturers.

	 WARNING
	Battery Maintenance Note • Check to ensure that all the safety devices are in place and function normally. Check if the battery management parameter setting is normal. • Measure and record the air temperature in the battery room. • Check if the battery terminals are damaged or heated up, and if the shell or cover is damaged. • Please fasten every bolt on the terminal as per the fastening torque specified in the manual. • After 1 to 2 months of service, recheck to make sure that all screws have been fastened as per the specified torque. Otherwise, there is a risk of fire. CAUTION: Replacement batteries should be of the same capacity and type. If battery is replaced by an incorrect type, it can cause an explosion. CAUTION: Dispose of used battery in compliance with local regulations.

3 Installation of UPS

3.1 Overview

The single system should be installed as in the procedure for the UPS and the requirements in this chapter.

For single UPS installation, the EPO button on the front panel of the bypass module controls the emergency stop of the UPS modules and bypass static switch and supports remote emergency power off function that can be used to shut down the UPS remotely.



The remote EPO switch must provide normally open or normally closed dry contact signals.

The open circuit voltage is 24Vdc, and the current is less than 20mA.

Normally closed EPO-J4 terminals: Pin 1 and pin 2 have been connected in the factory and located on the dry contact board.

Set EPO function as available with monitoring software on PC before using remote EPO function.

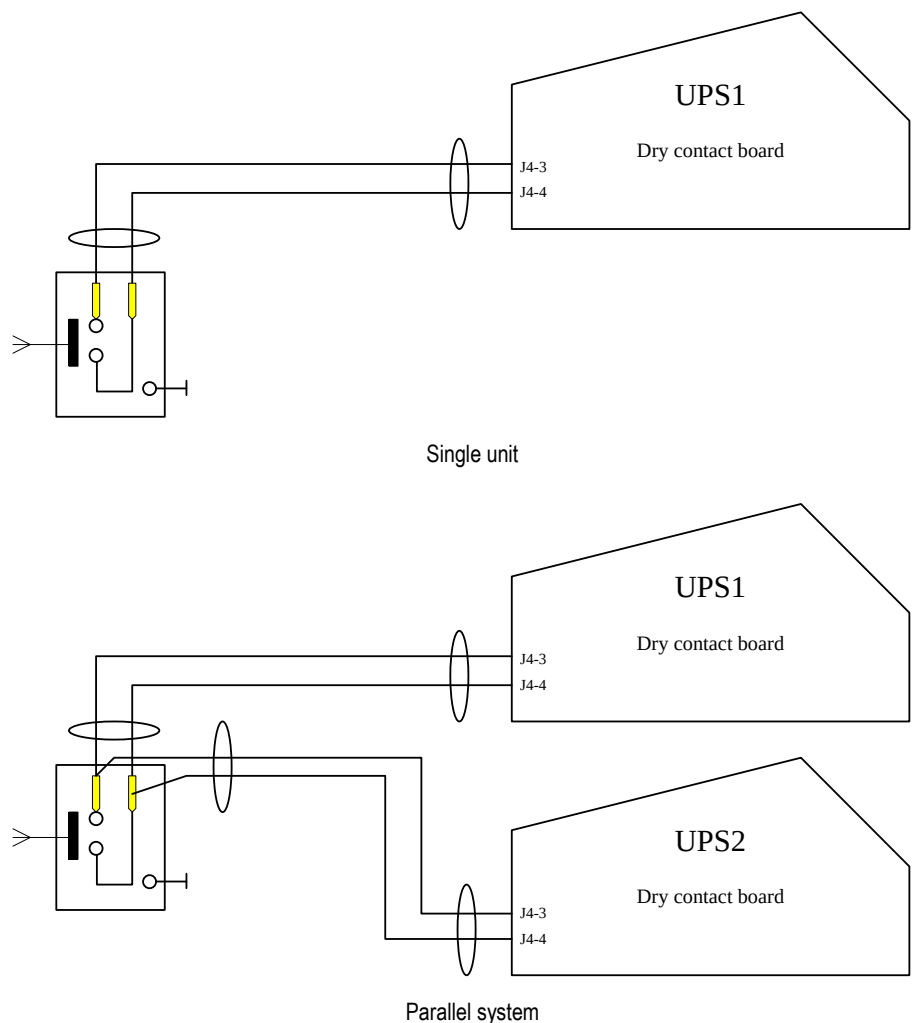


Fig.3- 1: Circuit diagram of EPO

3.2 Parallel System connection

The basic installation procedures of parallel systems are the same of the single UPS system. In this section, only the installation procedure related to the parallel system will be introduced.

3.2.1 Installation of UPS

To make the maintenance and system test easier, an external maintenance bypass is recommended in the installation.

3.2.2 External Protective Devices

Refer to Chapter 1 Installation.

3.2.3 Power Cables

The power cable connection of the parallel system is like the single UPS. If the bypass input and rectifier input share the same neutral terminal and if an RCB protective device is installed at the input, then the RCB device must be installed before the input cables are connected to the neutral terminal. Refer to Chapter 1 Installation

Note: The length and specification of the power cables of each UPS module should be the same, including the bypass input cables and UPS output cables, so that the load sharing effect can be achieved in bypass mode.

3.2.4 Parallel Signal Board

Installation of parallel signal board

The parallel signal board is installed at the rear of the cabinet. Shown as below:

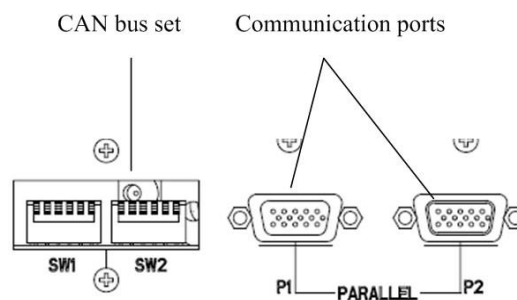


Fig.3- 2: Parallel Board

3-slots cabinet and 6-slots cabinet:

The switches SW1 and SW2 on the UPS should be set as below:

(S) Single- all switches ON

P(2) 2 paralleled- switch SW1 ON, switch SW2 OFF

P(3/4/5) 3 paralleled, 4 paralleled, 5 paralleled- all switches OFF

2-slots cabinet and 4-slots cabinet:

No need to modify CAN bus setting.

3.2.5 Control Cables

Parallel control cable

The parallel control cables are designed to be shielded and double insulated, DB15 terminals, and are connected between the UPS to form a loop as shown below. The parallel signal board is installed at the rear of the cabinet. This close loop connection ensures the reliability of the parallel system control. Refer to *fig. 3-3*

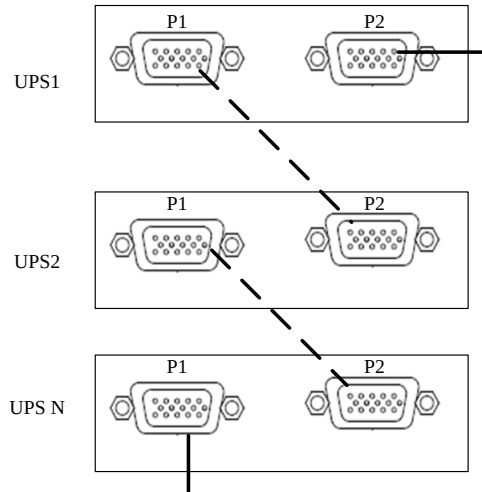


Fig.3- 2: Connection of Parallel Cables of "N" Systems

4 Installation Drawing

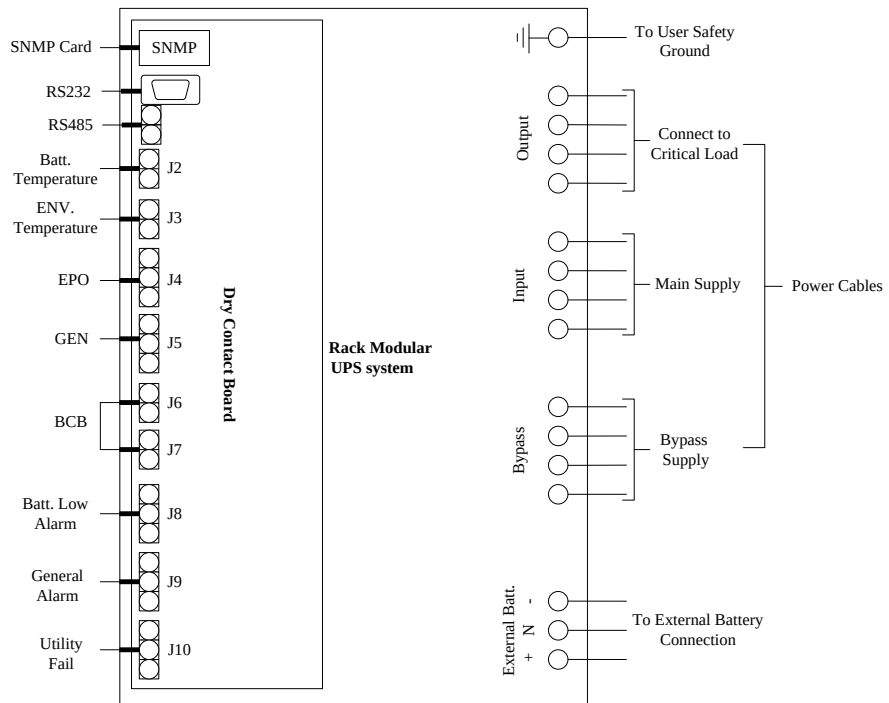
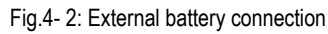
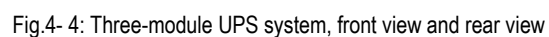
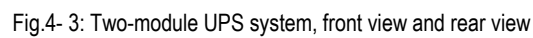


Fig.4- 1: Wiring diagram



GND: J7-1 ground



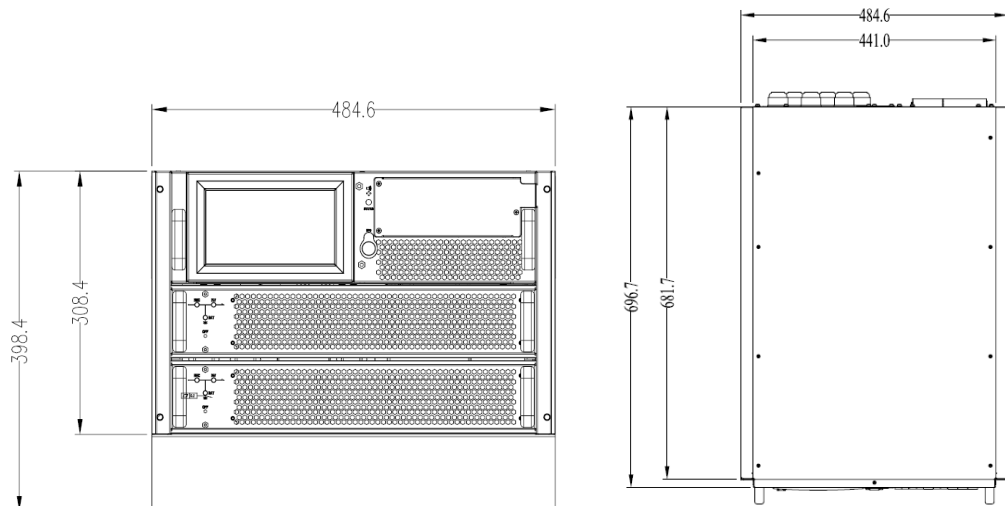
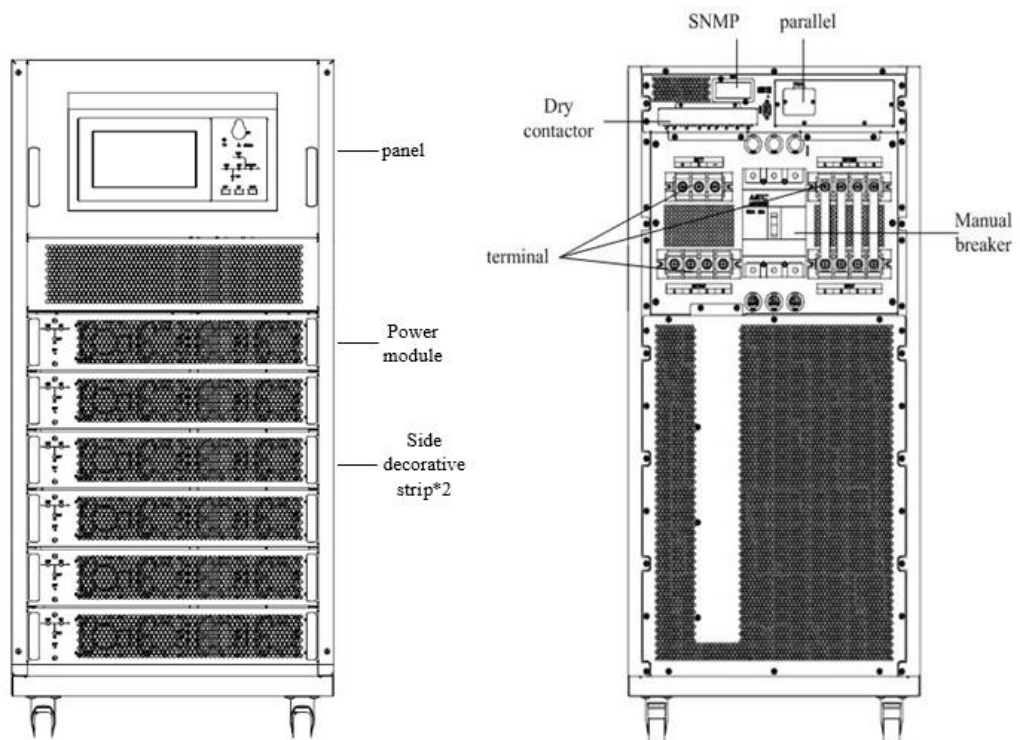
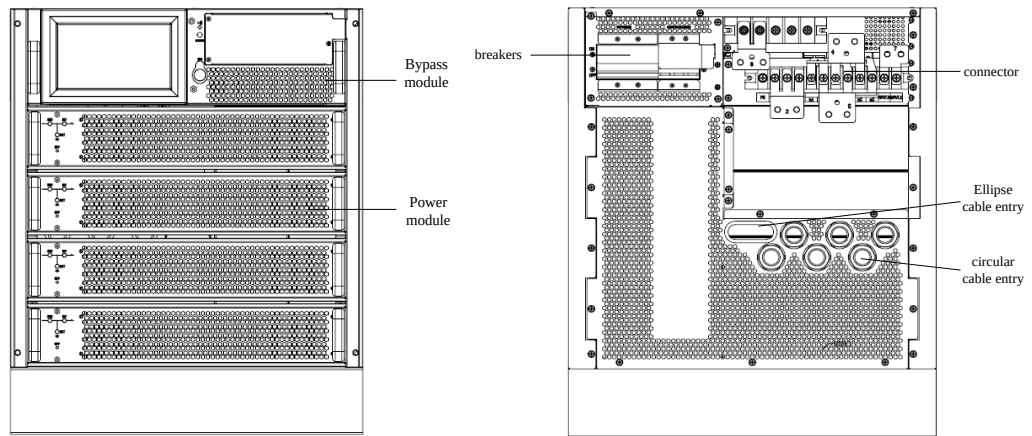


Fig.4- 7: Two-module UPS, external dimensions

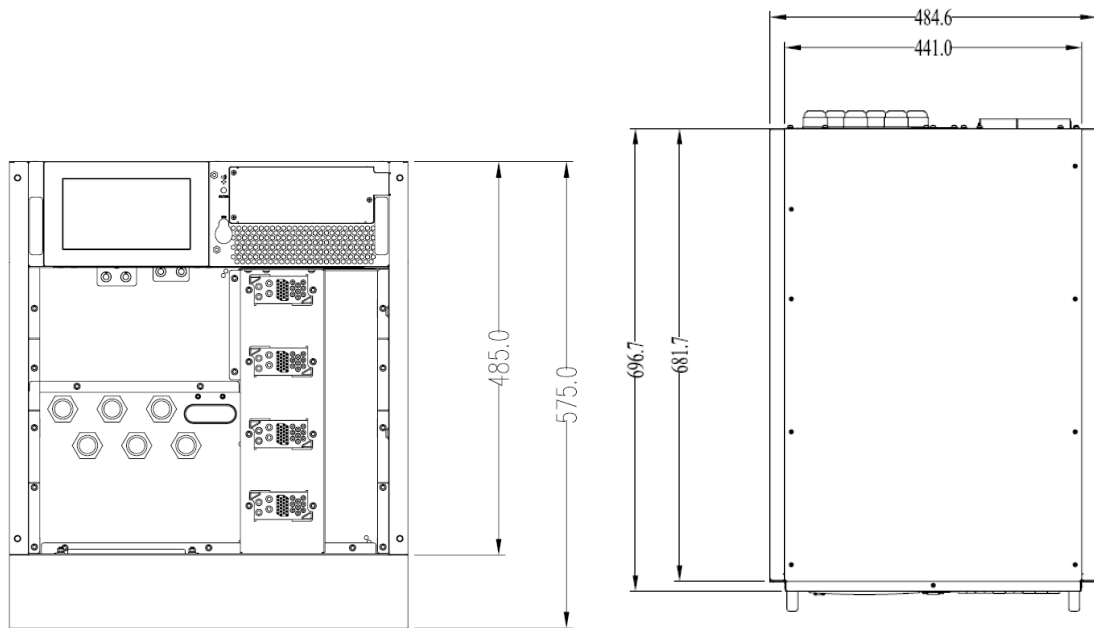


Fig.4- 8: Four-module UPS, external dimensions

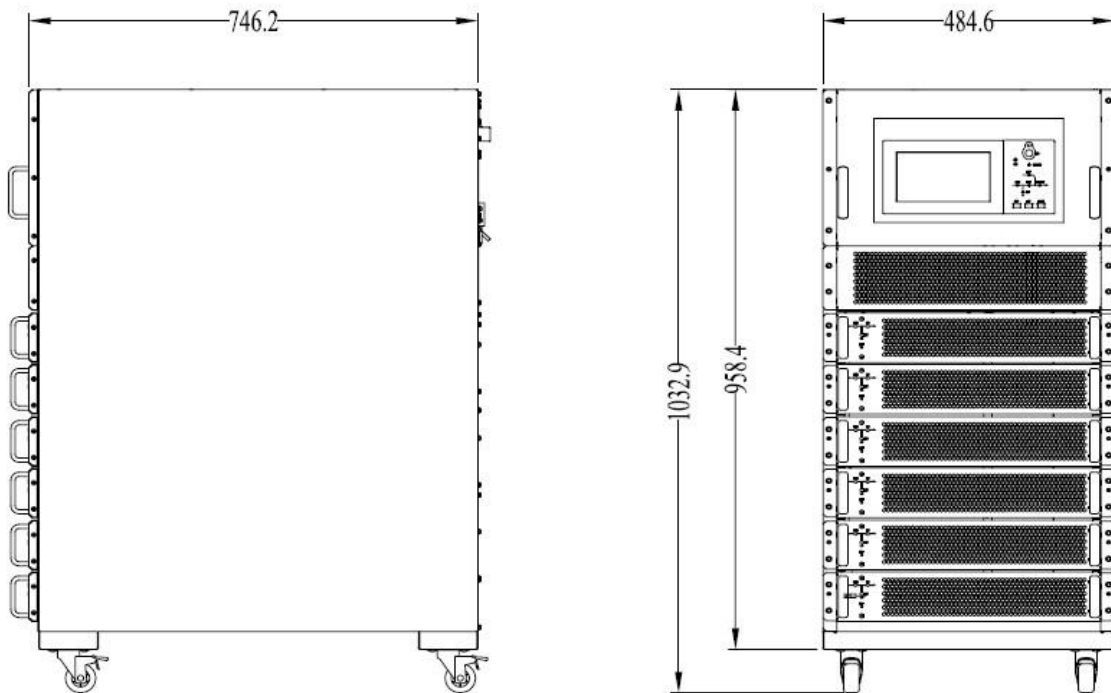


Fig.4- 9: 6 Modules UPS External Dimensions

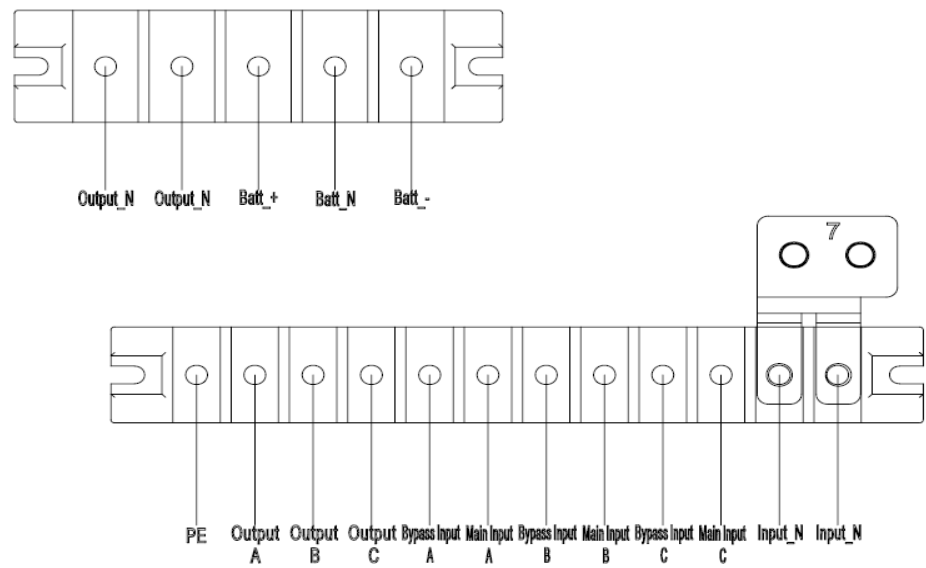


Fig.4- 10: Power connection of Protect Plus M400

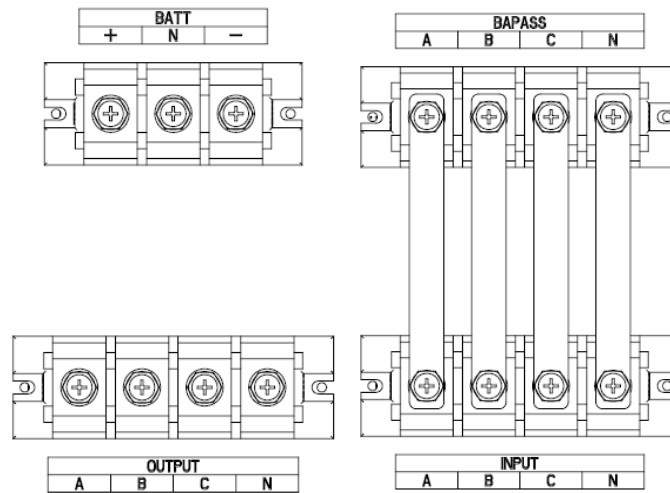


Fig.4- 11: 60KVA/90KVA Power Connection of Module System UPS

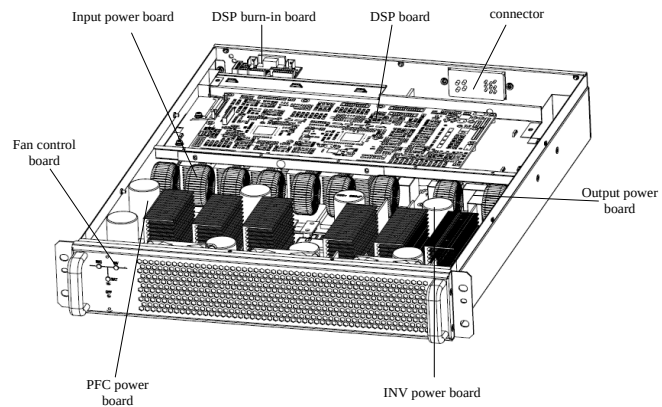


Fig.4- 12: Power module

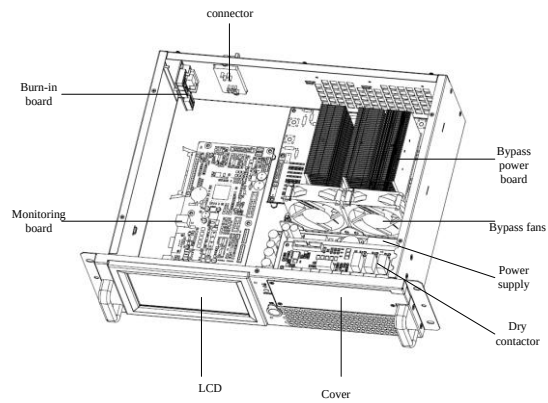


Fig.4- 13: 20-40KVA Monitoring and bypass module

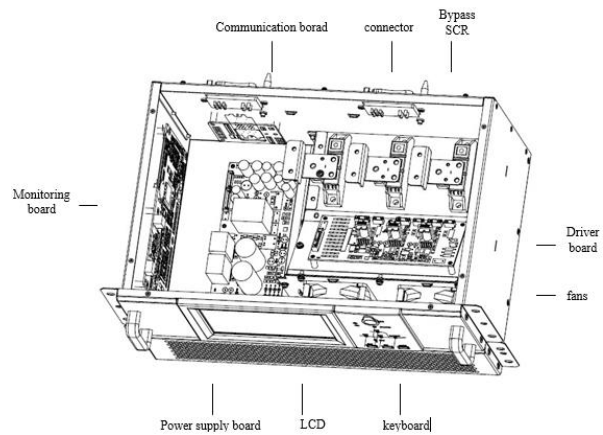


Fig.4- 14:30-45KVA Monitoring and bypass module

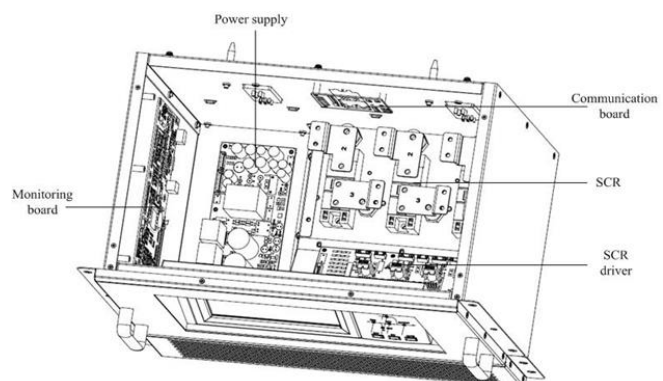


Fig.4- 15:60-90KVA Monitoring and bypass module

Notes for installing modules:

- When installing the modules, install the modules from bottom to top. When removing the modules, remove the modules from top to bottom. The purpose is to maintain a stable center of gravity.
- After inserting the module, tighten all screws.
- When removing the modules, turn off modules first, remove the screws and then remove the modules.
- Wait for 5 minutes before inserting the removed modules.

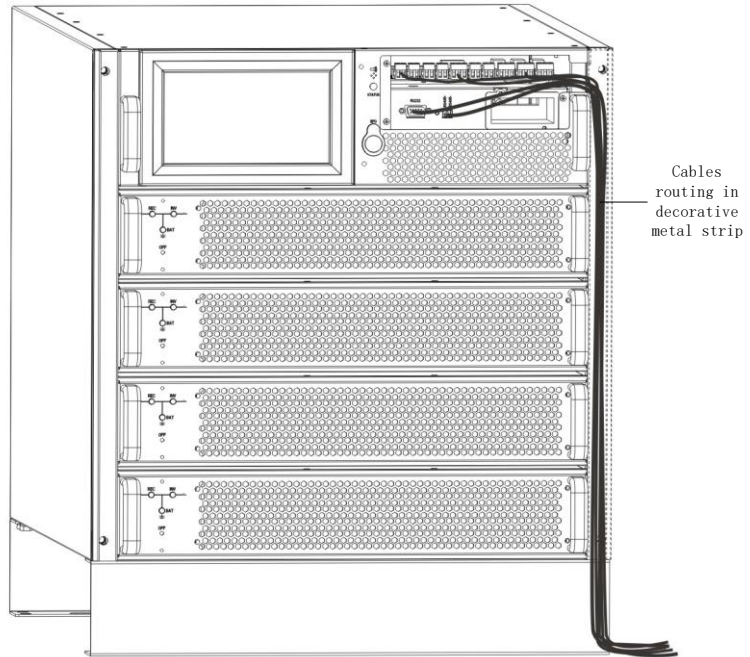


Fig.4- 16: Cables routing (dry contact, RS485, SNMP)

Notes for signal cables routing:

- Remove cover on front panel and remove right metal strip
- Connect cables and route as in Fig. 4-16
- Put right metal strip back to UPS to cover the cables

5 Operations

	WARNING
	Hazardous mains voltage and/or battery voltage behind the protective cover The components that can be accessed only when the protective cover is opened (with tool) cannot be operated by user. Only qualified service personnel are authorized to remove such covers.

5.1 Introduction

The modular UPS system provides the critical load (such as communication and data processing equipment) with high quality uninterruptible AC power. The power from the UPS is free from voltage and frequency variations and disturbances (interruptions and spikes) experienced at the mains AC input supply.

This is achieved through high frequency double conversion power pulse width modulation (PWM) associated with fully digital signal processing control (DSP), which features high reliability and convenience for use.

As shown in *Fig. 5-1*, the AC input mains source is supplied at the UPS input and converted into a DC source. This DC source feeds the inverter that converts the DC source into a clean and input independent AC source. The battery powers the load through the inverter in case of an AC input mains power failure. The utility source can also power the load through the static bypass.

When the UPS needs maintenance or repair, the load can be transferred to maintenance bypass without interruption, and the power module and bypass module can be removed for maintenance.

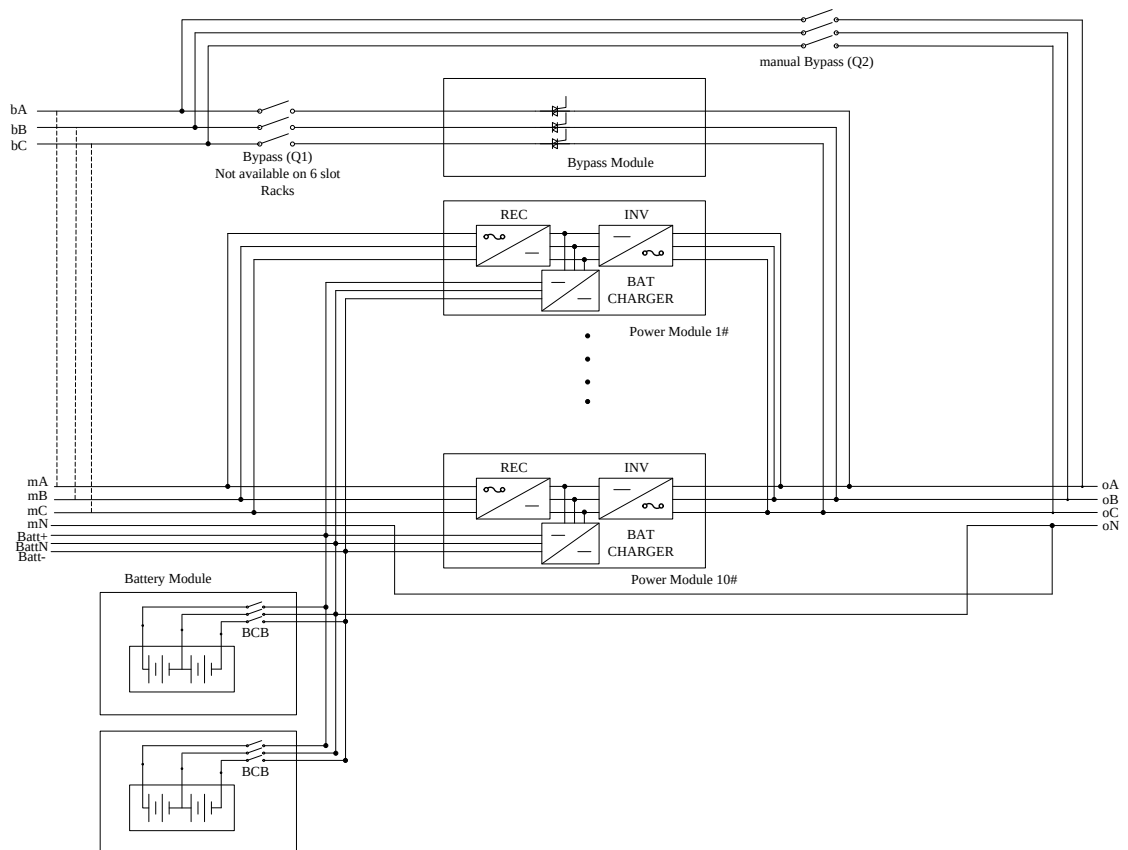


Fig.5- 1: Single unit block diagram

5.1.1 Split-Bypass Input

Fig. 5-1 illustrates the modular UPS in what is known as the split-bypass configuration (i.e., the bypass uses a separated AC power). In this configuration, the static bypass and maintenance bypass share the same independent bypass power supply and connect to the power supply through a separate switch. Where a separated power source is not available, the bypass and rectifier input supply connections are linked.

5.1.2 Static Transfer Switch

The circuit blocks labelled “static switch” contain electronically controlled switching circuits that enable the critical load to be connected to either the inverter output or to a bypass power source via the static bypass line. During normal system operation, the load is connected to the inverter; but in the event of a UPS overload or inverter failure, the load is automatically transferred to the static bypass line. To provide a clean (no-break) load transfer between the inverter output and static bypass line, the inverter output and bypass supply must be fully synchronized during normal operating conditions. This is achieved via the inverter control electronics, which makes the inverter frequency track that of the static bypass supply, provided that the bypass remains within an acceptable frequency window.

A manually controlled maintenance bypass supply is incorporated into the UPS design. It enables the critical load to be powered from the utility (bypass) supply while the UPS is shut down for routine maintenance.



When the UPS is operating in bypass mode or on maintenance bypass, the connected equipment is not protected from power failures or surges and sags.

5.2 1+1 Parallel System

Up to 30 power modules can make a parallel system, with the purpose of providing additional power or reliability (N+1 parallel redundancy). The load will be equally shared between any paralleled UPS.

5.2.1 Features of Parallel System

- The hardware and firmware of single module UPS units are completely compatible with the requirements of a parallel system. Parallel configuration can be achieved merely through settings in configuration software. The parameters settings for the modules in parallel system shall be consistent.
- Parallel control cables are connected in a ring, providing both performance and redundancy. Dual-bus control cables are connected between any two UPS modules of each bus. The intelligent paralleling logic provides the user with maximum flexibility. For example, shutting down or starting up UPS modules in a parallel system can be done in any sequence. Transfers between Normal and Bypass modes of operation are synchronized and self-recovering e.g. following overloads and their clearance.
- The total load of the parallel system can be queried from each unit's LCD.

5.2.2 Parallel Requirements of UPS Modules

A group of paralleled modules behave as if it were one large UPS with the advantage of presenting higher reliability. In order to assure that all modules are equally utilized and to comply with relevant wiring rules, the following requirements apply:

- All UPS modules shall be of the same rating and must be connected to the same bypass source.

- The bypass and the main input sources must be referenced to the same neutral potential.
- Any RCB, if installed, must be of an appropriate setting and located upstream of the common neutral bonding point. Alternatively, the device must monitor the protective earth currents of the system. Refer to the High Leakage Current Warning in the first part of this manual.
- The outputs of all UPS modules must be connected to a common output bus.
- It is strongly recommended that each paralleled UPS install at least a redundant power module.
- It is recommended to install a separate battery supply for each UPS connected in parallel.



Optional isolation transformers must be connected for applications where different input sources do not share the same neutral reference or where the neutral is not available.

5.3 Operating Mode

The modular UPS is an on-line, double-conversion, reverse-transfer UPS that permits operation in these modes:

- Normal mode
- Battery mode
- Auto-restart mode
- Bypass mode
- Maintenance mode (manual bypass)
- Parallel redundancy mode
- ECO mode

5.3.1 Normal Mode

The UPS inverter power modules continuously supply the critical AC load. The rectifier/charger derives power from the AC mains input source and supplies DC power to the inverter while simultaneously FLOAT or BOOST charging its associated backup battery.

5.3.2 Battery Mode

Upon failure of the AC mains input power, the inverter power modules, which obtain power from the battery, supply the critical AC load. There is no interruption in power to the critical load upon failure. After restoration of the AC mains input power, the “Normal Mode” operation will continue automatically without the necessity of user intervention.

5.3.3 Auto-Restart Mode

The battery may become exhausted following an extended AC mains failure. The inverter shuts down when the battery reaches the end of discharge voltage (EOD). The UPS may be programmed to “Auto Recovery after EOD” after a delay time if the AC mains recover. This mode and any delay time are programmed by the commissioning engineer.

5.3.4 Bypass Mode

If the inverter overload capacity is exceeded under normal mode, or if the inverter becomes unavailable for any reason, the static transfer switch will perform a transfer of the load from the inverter to the bypass source, with no interruption in power to the critical AC load. Should the inverter be asynchronous with the bypass, the static switch will perform a transfer of the load from the inverter to the bypass with power interruption to the load. This is to avoid large cross currents due to the paralleling of unsynchronized AC sources. This interruption is programmable but typically set to be less than 3/4 of an electrical cycle, e.g., less than 15ms (50Hz) or less than 12.5ms (60Hz).

5.3.5 Maintenance Mode (Manual Bypass)

A manual bypass switch is available to ensure continuity of supply to the critical load when the UPS becomes unavailable e.g., during a maintenance procedure.

5.3.6 Parallel Redundancy Mode (System Expansion)

For higher capacity or higher reliability, the outputs of several UPS can be programmed for direct parallel while a built-in parallel controller in each UPS ensures automatic load sharing.

5.3.7 Eco Mode

To improve system efficiency, the UPS rack system works in bypass mode at normal time, and the inverter is on standby. When utility fails, UPS transfers to battery mode, and the inverter powers the loads. The efficiency of the ECO system can be up to 98%.

NOTE: There is a short interruption time (lower than 10ms) during the transfer from ECO to battery mode, so ensure that the time has no effect on loads.

5.4 Battery Management—Set During Commissioning



Always follow the battery manufacturer's recommendations, even if this manual provides different instructions

5.4.1 Normal Function

Constant current boost charging

- Current can be set up as 0%~20%, default setting is 10%.

Constant voltage boost charging

- Voltage of boost charging can be set as required by the type of battery.

VRLA batteries: Maximum boost charge voltage should not exceed 2.4V / cell.

LITHIUM-ION batteries: 3.3V to 4.15V.

Float charge

- Voltage of float charging can be set as required by the type of battery.

VRLA batteries: Between 2.2V to 2.3V; default: 2.25V.

Lithium-Ion batteries: Between 3.3V to 4.15V

Float charge temperature compensation (optional)

- A coefficient of temperature compensation can be set as required by the type of battery.

End of discharge (EOD) protection

- If the battery voltage is lower than the EOD, the battery converter will shut down. The battery is isolated to avoid further battery discharge.
- EOD is adjustable from 1.6V to 1.75V per cell (VRLA) and 2.6V-2.85V (Lithium).

5.4.2 Advanced Functions (Software Settings Performed by the Commissioning Engineer)

Battery self-test and self-service

At periodic intervals, 25% of the rated capacity of the battery will be discharged automatically, and the actual load must exceed 25% of the rated UPS (kVA) capacity. If the load is less than 25%, auto-discharge cannot be executed. The periodic interval can be set from 720 to 3000 hours.

Conditions: Battery at float charge for at least 5 hours, load equal to 25~100% of rated UPS capacity, trigger manually by the command of battery maintenance test in the LCD panel, or automatically by battery self-test interval.

Lithium battery compatibility activation

See appendix

Dry INPUT/OUTPUT customization

Battery at float charge for at least 5 hours, load equal to 25~100% of rated UPS capacity, trigger manually by the command of battery maintenance test in the LCD panel, or automatically by battery self-test interval.

5.5 Battery Protection (Settings by Commissioning Engineer)

Battery low pre-warning

The battery under voltage pre-warning occurs before the end of discharge. After this pre-warning, the battery should have the capacity for 3 remaining minutes discharging with full load.

End of discharge (EOD) protection

If the battery voltage is lower than the EOD, the battery converter will be shut down. EOD is adjustable from 1.6V to 1.75V per cell (VRLA) and 2.6V-2.85V (Lithium).

Battery disconnect devices alarm

The alarm occurs when the battery disconnect device disconnects. The external battery connects to the UPS via the external battery circuit breaker. The circuit breaker is manually closed and tripped by the UPS control circuit.

6 Operating Instructions

	 WARNING
	Hazardous mains voltage and/or battery voltage behind the protective cover The components that can be accessed only when the protective cover is opened (with tool) cannot be operated by user. Only qualified service personnel are authorized to remove such covers.

6.1 Introduction

The Protect Plus M400 UPS operates in the following three modes listed in *Table 6-1*. This section describes various kinds of operating procedures under each operating mode, including transfer between operating modes, UPS setting and procedures for turning on/off inverter.

Operating mode	Descriptions
Normal mode	UPS powers the load
Bypass mode	The load power supply is provided by the static bypass. This mode can be regarded as a temporary transition mode between normal mode and maintenance bypass mode, or a temporary abnormal operating status
Maintenance mode	UPS shuts down, the load is connected to the mains via maintenance bypass. NOTE: in this mode, the load is not protected against abnormal mains

Table 6-1: UPS Operating mode

	<i>Refer to Chapter 7: Operator Control and Display Panel, for all the user-operating keys and LED displays.</i>
	<i>The audible alarm may sound at various points during this procedure.</i>
	<i>The UPS function can be set via maintenance software. However, the setting and commissioning must be done by trained maintenance engineers.</i>

6.1.1 Power Switches

The UPS has a manual bypass breaker and a bypass input breaker. All the other transfers are processed automatically by internal control logics. The customer must install an external mains input breaker, an external maintenance bypass breaker and an external output breaker. An external bypass breaker is needed if split-bypass is applied.

	<i>It is recommended that four-pole breakers are used, and that the rated current is higher than the rated current of the bypass breaker in the UPS.</i>
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6.2 UPS Start-Up

Do not start up the UPS until the installation is completed, the system has been commissioned by authorized personnel, and the external power isolators are closed.

6.2.1 Start-Up Procedure

This procedure must be followed when turning on the UPS from a fully powered down condition.

The operating procedures are as follows:

- Open the external power switch. Open the internal power switch. Connect the power supply cables and ensure the correct phase rotation.

	WARNING
During this procedure, the UPS output terminals are live. If any load equipment is connected to the UPS output terminals, please check with the load user that it is safe to apply power. If the load is not ready to receive power, then ensure that it is safely isolated from the UPS output terminals.	

- **Close external output circuit breaker. Close external mains input circuit breaker and connect the mains power.** The LCD starts up currently. The rectifier indicator flashes during the start-up of the rectifier. The rectifier enters normal operation state, and after about 20s, the rectifier indicator turns green. After initialization, the bypass static switch closes. The UPS display will indicate as follows:

LED in display	Status
Rectifier indicator	Green
Battery indicator	Red
Bypass indicator	Green
Inverter indicator	Off
Load indicator	Green
Status indicator	Red

Table 6-2: Status In LED display

- **The inverter starts up automatically.** The inverter indicator flashes during the start-up of the inverter. After about 1 minute, the inverter is ready. The UPS transfers from bypass to inverter and the bypass indicator goes off, and the inverter and load indicators light up. The UPS is in normal mode. The UPS display will indicate as follows:

LED in display	Status
Rectifier indicator	Green
Battery indicator	Red

Bypass indicator	Off
Inverter indicator	Green
Load indicator	Green
Status indicator	Red

Table 6-3: Status In LED display

- Close external battery switch, battery indicator turns off, a few minutes later, the battery will be charged by UPS. The UPS display will indicate as follows:

LED in display	Status
Rectifier indicator	Green
Battery indicator	Green
Bypass indicator	Off
Inverter indicator	Green
Load indicator	Green
Status indicator	Green

Table 6-4: Status In LED display



The panel has Status LED. Power modules have three LED: rectifier, inverter and battery.

6.2.2 Procedures for Switching Between Operation Modes

Switch from normal mode to bypass mode

Press the function button  in menu 'operate' to switch to bypass mode.



In bypass mode, the load is directly fed by the mains power instead of AC power from the inverter.

Switch from bypass mode to normal mode

Press the function button  to end the bypass mode. After the inverter enters normal operation, the UPS transfers to normal mode.

6.3 Procedure for Switching the UPS between Maintenance Bypass and Normal Mode

6.3.1 Procedure for Switching from Normal to Maintenance Bypass Mode

This procedure can transfer the load from the UPS inverter output to the maintenance bypass supply, but the precondition is that the UPS is in normal mode before the transfer.



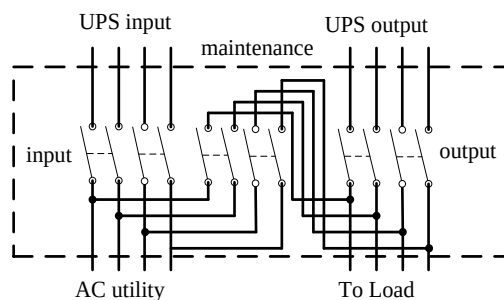
Before carrying out this operation, read messages on display to be sure that bypass supply is regular, and inverter is synchronous with it, so as not to risk a short interruption in powering the load.

- Press the function button  in menu 'operate' on the right side of the LCD.
- The UPS mimic indicator inverter will flash green, and the status indicator will turn red accompanied by an audible alarm. The load transfers to static bypass, and the inverter standby.

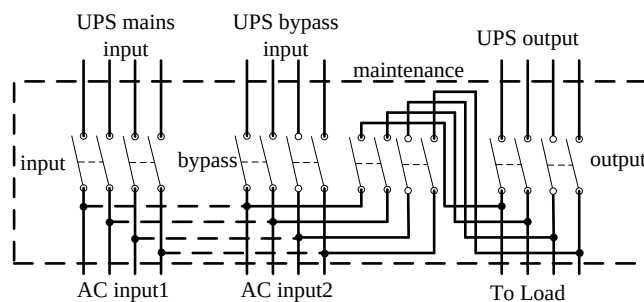


Pressing the mute-off button  in 'operate' menu cancels the audible alarm but the warning message will remain displayed until the alarm condition is rectified.

- Close the manual bypass breaker from OFF to ON position. The load power supply is provided by the manual bypass.
- Press EPO to make sure the charge current is 0. Open the battery breaker. Then power modules can be serviced.
- If cabinet maintenance is needed, the external maintenance bypass breaker is required. If the external maintenance bypass breaker is available, close external maintenance bypass breaker, open the external input breaker and external output breaker, and then the UPS cabinet can be serviced. It is recommended that external maintenance breakers are installed as in Fig. 6-1:



Single input



Split-bypass input

Fig.6- 1: External Maintenance Bypass



! WARNING

If you need to service the module, wait 10 minutes to let the DC bus capacitor fully discharge before removing corresponding module.

When the manual bypass switch is in the ON position, some parts of the UPS circuit still have hazardous voltage. Therefore, only qualified service personnel can service the UPS.



When the UPS is in maintenance bypass or manual bypass mode, the load is not protected against abnormal mains supply.

6.3.2 Procedure for Switching from Maintenance to Normal Mode

- Close bypass breaker, if available. Close manual bypass breaker Q2. Close external output breaker. Close external mains input breaker. The LCD starts up in this moment. The rectifier indicator flashes during the start-up of the rectifier. The rectifier enters normal operation state, and after about 20s, the rectifier indicator turns green. After initialization, the bypass static switch closes, and the bypass indicator turns green.
- Open the external maintenance breaker. Open manual bypass breaker Q2.



! WARNING

Before opening the maintenance breaker, make sure that static bypass switch is working according to power flow displayed on LCD.

- After about 60s, UPS transfers to inverter. Close external battery breaker and internal battery breaker (for battery built-in cabinet).

6.3.3 Procedure for switching from Normal to manual Bypass Mode

- Press the function button  on the LCD. The UPS mimic indicator inverter will flash green, and the status indicator will turn red accompanied by an audible alarm. The load transfers to static bypass, and the inverter standby.
- Close manual bypass breaker Q2 to ON position. Open bypass breaker Q1.
- Press EPO button to ensure the battery current is 0. Open the battery circuit breaker or disconnect battery terminals.



! WARNING

Make sure not to open external input breaker, otherwise, UPS output will be interrupted.

6.3.4 Procedure for switching from Manual Bypass to Normal Mode

- Press the function button  in menu 'operate' to clear EPO alarm.
- Close bypass breaker Q1, and bypass indicator will turn green.
- Open manual bypass breaker Q2.
- Press the function button  to end the bypass mode, UPS transfers to inverter after about 60s.
- Close external battery circuit breaker or internal battery circuit breaker.

	WARNING Before opening the manual breaker Q2, make sure that the static bypass switch is working according to power flow displayed on LCD.
---	---

6.4 Procedure for Completely Powering Down a UPS

If you need to completely power down the UPS, use the following procedure:

- Press EPO button on the front panel
- Open external battery breaker and internal battery breaker
- Open manual bypass breaker Q2, external input breaker, external output breaker

If the rectifier and bypass use different power supplies, you will need to open the two input breakers respectively.

6.5 EPO Procedure

The EPO button is designed to switch off the UPS in emergency conditions (e.g., fire, flood, etc.). To do this, just press the EPO button and the system will turn off the rectifier and inverter and stop powering the load immediately (including the inverter and bypass), and the battery will stop charging or discharging.

If input power supply is available, the UPS control circuit will remain active; however, the output will be turned off. To completely isolate the UPS, you will need to open the mains input breaker and battery breaker.

6.6 Auto Start

Commonly, the UPS is started up on static bypass. When the mains power fails, the UPS draws power from the battery system to supply the load until the battery voltage reaches the end of discharge (EOD) voltage, and the UPS will shut down.

The UPS will automatically restart and enable output power:

- after the mains power is restored
- if auto recovery-enabling feature is enabled after EOD

6.7 UPS Reset Procedure

After using EPO to shut down the UPS, operate as follows to restore UPS:

- Shut down UPS completely

- Start UPS as in *Section 6.2.1*

If the UPS is shut down due to excessive temperature, switching, or overload of the inverter, the UPS will reset the fault automatically when fault is cleared.



The rectifier will be turned on automatically when the overtemperature fault disappears (after overtemperature signals have disappeared).

After pressing the EPO button, the UPS will be completely powered down if the UPS mains input has been disconnected. When the mains input is restored, the EPO status will be cleared, and the UPS system will enable static bypass mode to restore the output.



WARNING

If the maintenance bypass breaker is put to ON and the UPS has mains input, then the UPS output is powered.

6.8 Operation Instruction for Power Module Maintenance

The following procedure is to be carried out by trained operators only.

Maintenance guidance for power modules

If the system is in normal mode and the bypass is in normal mode, and there is at least one redundant power module.

- Enter function menu and press  to release shutdown power module function.
- Press "off" button on the front panel of power module to manually power off power module.
- Remove the metal strip on both sides, loosen the screws of the power module, then after five minutes remove the module.

If there are no redundant power modules:

- Enter function menu and press  to transfer to bypass mode.
- Remove the metal strip on both sides, loosen the screws of the power module, then after five minutes remove the module.



To ensure safety during maintenance of the power module, use a multimeter to measure the DC bus capacitor voltage, and make sure the voltage is below 60V before operation.

- After finishing maintenance on the power module, insert the main power module (inserting interval for each module is longer than 10s), the power module will automatically join the system operation. Tighten the screws at both sides of the power module.
- Fix the metal strip to cover the screws on both sides of the front panel.

Maintenance guidance for bypass power module



The bypass power module cannot be serviced in battery mode.

If the system is in normal mode and the bypass is in normal mode:

- Manually shut down the inverter, and the UPS will transfer to bypass. Close the manual bypass breaker, and the UPS will transfer to manual bypass. Open the bypass breaker to shutdown bypass.
- Press the EPO button to ensure the battery current is zero. Open the battery circuit breaker or disconnect battery terminals.
- Wait for 5 minutes, remove the bypass power module that need maintenance or repair then service the bypass power module. After finishing maintenance on the bypass power module, insert the module.
- Transfer to normal mode as in *Section 6.3.2*.



The connection bolts of the bypass module are larger than those of the power modules and therefore require more force when the bypass module is inserted to contact the bolts safely.

6.9 Language Selection

The LCD menus and data display are available in seven languages: German, English, Russian, Chinese.

Select a language as follows:

- In the main menu, press  to enter the setting menu on the LCD screen.
- Select LANGUAGE menu.
- Select the language. At this time, all the words in the LCD will be displayed in the selected language.

6.10 Changing the Current Date and Time

To change the system date and time:

- In the main menu, press  to enter the setting menu in the LCD screen.
- Select DATE&TIME.

- Enter new date and time, then press enter to confirm.

6.11 Default Control Password

The system is password-protected to limit the operator's control authority. You can only operate and test the UPS and battery after entering the correct password. The first default password is **1203**.

7 Operator Control and Display Panel

This chapter introduces the functions and operation instructions of the UPS operator control and display panel in detail, and provides LCD display information, including LCD display types, detailed menu information, quick window information and UPS alarm list.

7.1 Introduction

The operator control and display panel are located on the front panel of the UPS. Via the LCD panel, the operator can operate and control the UPS, and check all measured parameters, UPS and battery status, event and history logs. The operator control panel is divided into two functional areas as shown in *Fig. 7-1*: LCD display & menu, LED and operation button. The indicator LED show you the status of the cabinet. The EPO (emergency power off) button switch the UPS off.

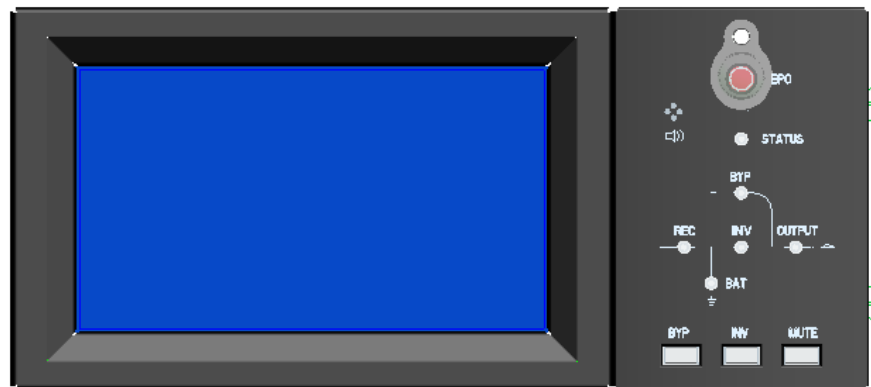


Fig.7- 1: 3-modules and 6-modules cabinet

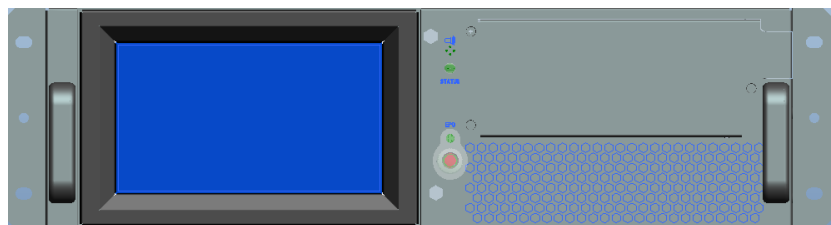


Fig.7-2: UPS operator control and display panel 2-module and 4-module cabinet

Other indicator LEDs are on the power modules. They show a mimic current path of each individual module.

Indicator	Function	Button	Function
REC	Rectifier indicator (90kVA)	EPO	EPO (emergency power off)
BAT	Battery indicator (90kVA)	HOME	Back to main menu (90kVA)
BYP	Bypass indicator (90kVA)	LEFT/RIGHT ARROW	Select main menu items; switch between submenu; increase or reduce for number input (90kVA)
INV	Inverter indicator (90kVA)	ENTER	Confirm (90kVA)
OUTPUT	Load indicator (90kVA)		
STATUS	Status indicator		

Table.7- 1: Description of UPS Operator Control and Display Panel

7.1.1 Mimic Current Path

The LEDs shown on the mimic current path represent the various UPS power paths and show the current UPS operating status. The status description of indicators is shown in table.7-2.

Indicator	State	Description
Rectifier indicator	Steady green	Rectifier of all modules is normal
	Flashing green	At least one of module rectifier is starting
	Steady red	At least one Rectifier of module fault
	Flashing red	Main input of at least one module is abnormal
	Off	Rectifier is not working
Battery indicator	Steady green	Battery is charging
	Flashing green	Battery is discharging
	Steady red	Battery is abnormal (battery failure, no battery or battery reverse) or battery converter is abnormal (failure, over current or over temperature), EOD
	Flashing red	Battery voltage is low
	Off	Battery and battery converter is normal, battery is not charging
Bypass indicator	Steady green	UPS is working in bypass mode
	Steady red	Bypass is failure
	Flashing red	Bypass voltage is abnormal
	Off	Bypass is normal and is not working
Inverter indicator	Steady green	Inverter is feeding the load
	Flashing green	Inverter is starting, or UPS is working in ECO mode
	Steady red	At least one module's inverter is failure, and inverter is not feeding the load

	Flashing red	Inverter is feeding load, and at least one module's inverter is failure
	Off	Inverter is not working in all modules
Load indicator	Steady green	UPS output is on and is normal
	Steady red	UPS output is overload and time is over, or output is shortened, or output has no power supply
	Flashing red	UPS is overload
	Off	No output voltage
Status indicator	Steady green	Normal operation
	Steady red	Fault

Table.7- 2: Status Description of Indicator

7.1.2 Audible Alarm (Buzzer)

There are two diverse types of audible alarms during UPS operation as shown in *Table 7-3*.

Alarm	Purpose
Two short, one long	This alarm can be heard when the system has a general alarm, e.g., main input is abnormal
Continuous alarm	This alarm can be heard when the system has serious faults, e.g., fuse or hardware fault

Table 7- 3: Description of audible alarm

7.1.3 Functional Keys

In the 3 and 6 modules racks, there are 4 functional buttons on operator control and display panel, which are used together with LCD. The functions description is shown in table.7-4, on other versions this would be available through display.

Functional key	Functions
EPO	To cut off the load power to shut down the rectifier, inverter, static bypass, and battery
HOME	To return the main menu
LEFT/RIGHT ARROW	Select options in the main menu, switch over secondary menu pages, upward and downward roll the historical log, add, and subtract the entered number.
Enter	Confirm

Table.7- 4: Functions of Functional Keys

7.1.4 Battery Indicator

The LED on the front panel of battery pack indicates battery pack status. If battery fuse in battery is broken, LED changes to be red. Customer must contact our local distributor to maintain it.

7.2 LCD Display Type

Following the self-check of UPS LCD display, the main LCD display is shown in Fig. 7-3, which can be divided into 4 display windows: system information, power path, current record and main menu.

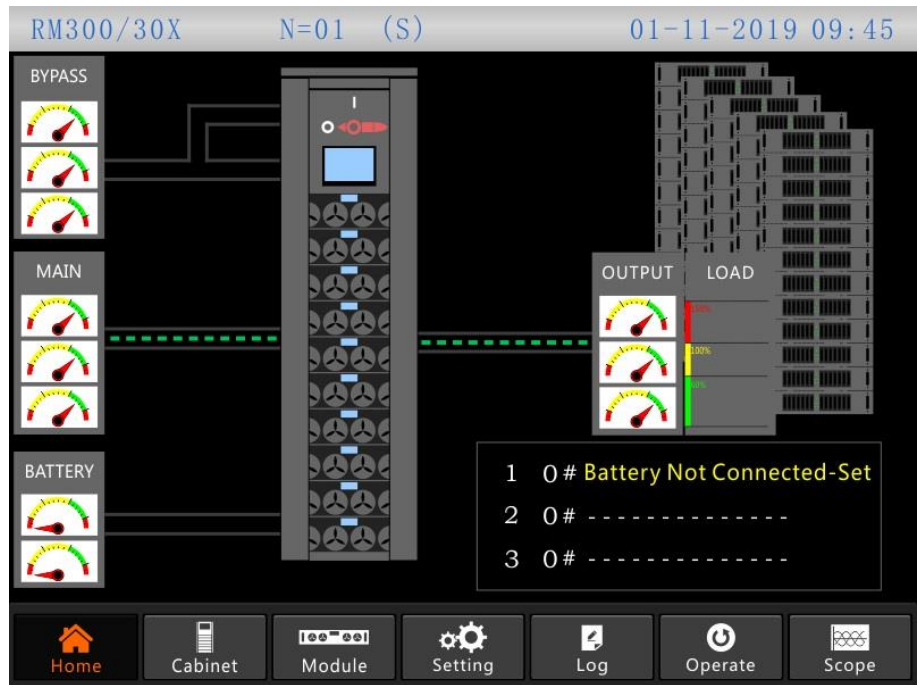


Fig.7-3: Main LCD Display

The description of the LCD icons is shown in Table 7-5:

Icon	Description
	Return to main menu
	Information on bypass, main, output (voltage, current, PF, frequency), battery information (capacity, remaining time, days worked, battery temperature, ambient temperature), load information (percent, active load, reactive load, apparent load)
	Information on power module (main, output, load, S-code, module information)
	Date & time, language, communication, user (use first password), battery set, service set, rate set, configure
	History log
	Mute ON/OFF, fault clear, transfer to bypass, transfer to inverter, enable module "off," reset battery history data, reset dust filter using time, battery test, battery maintenance, battery boost, battery float, stop test
	Scope of output voltage, output current, bypass voltage

Table 7- 5: Description of LCD icons

The LCD menu structure is shown below. Please refer to *Figure 7-4: Item description of UPS menu*

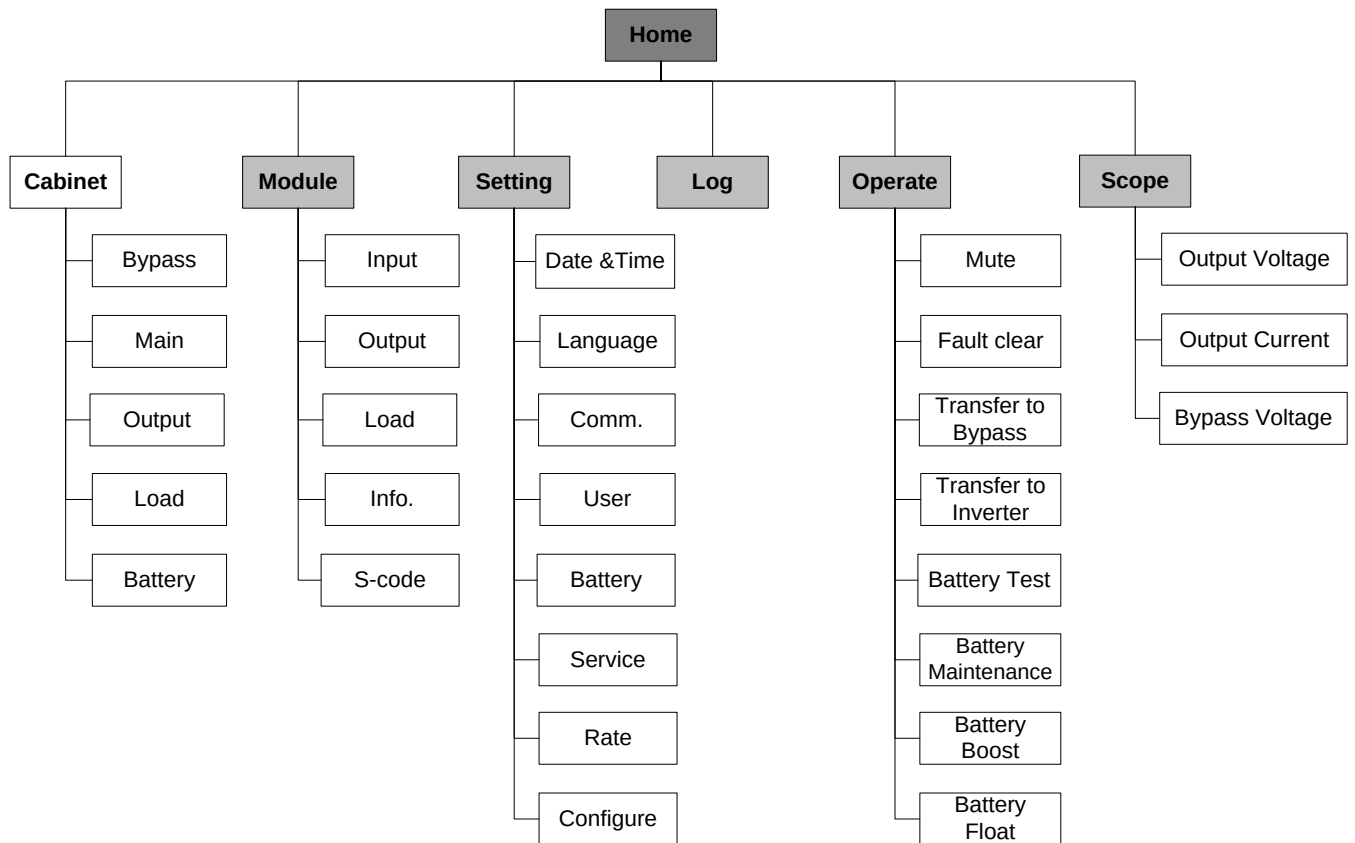


Fig.7-4: Menu structure

7.3 Detailed Description of Menu Items

The LCD main display shown in *Fig. 7-3* is described in detail below.

7.3.1 Home UPS system information window

UPS information window: unit model, module numbers, unit mode, current date and time are displayed. The information from the window is not required for user operation. The information is described in Table 7-6.

Display contents	Meaning
RM040/10X	Unit model: 40-unit capacity, 10 power module capacity
N=04	4 power modules in system
(s)	Unit mode: S -- single unit, P-0/1 -- parallel mode, E -- ECO mode, L -- LBS mode, PE-0/1 -- parallel ECO mode, PL-0/1 -- parallel LBS mode not available
06-30-2018 11:03	Date and time

Table 7-6: Description of items in UPS system information window

Main menu window

Details of UPS menu is shown in Figure 7-4.

7.3.2 Cabinet submenu

Enter  to get cabinet information.

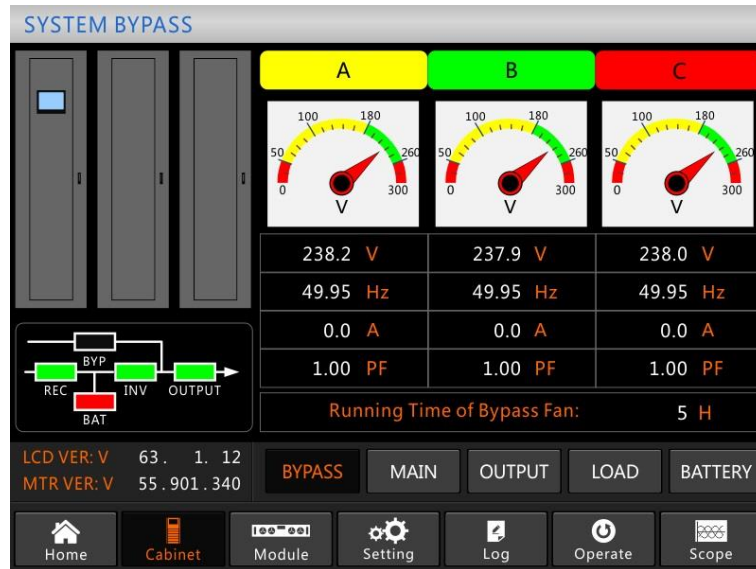
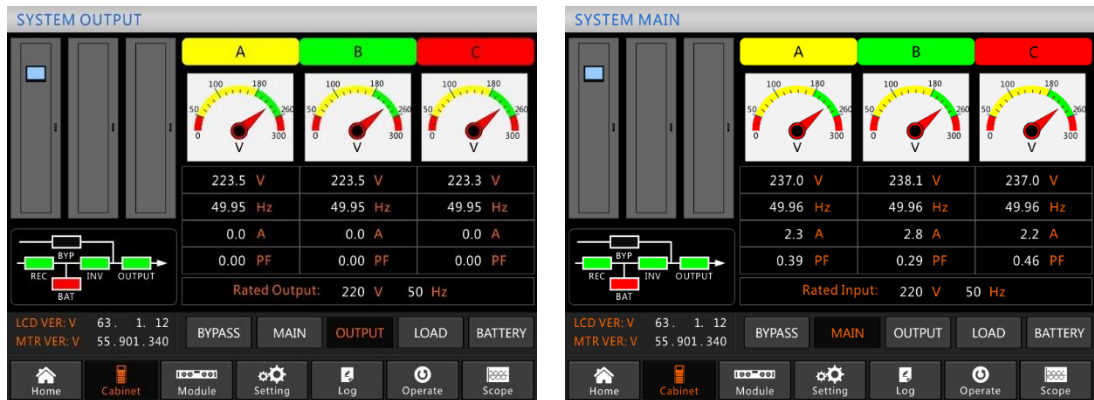


Fig.7-5: Cabinet menu

Submenu BYPASS, MAIN, OUTPUT

Bypass information, main input, and output information (voltage, current, frequency, PF) are displayed in cabinet menu, voltage is also shown in meter type. Current mimic status indicators, LCD and monitoring version are displayed. As shown below:



(a) Main input information

(b) Output information

Fig.7-6: Main input and output information

Submenu LOAD, BATTERY

Load information includes load percent, active load, reactive load, apparent load. Battery information includes battery number, battery voltage, battery current, remaining capacity, remaining discharge time, discharge times, working days, discharge hours, battery temperature (optional), ambient temperature (optional). As shown below:



(a) System load information

(b) System battery information

Fig.7-7: Load and battery information

7.3.3 Module submenu

Enter  to get power module information.

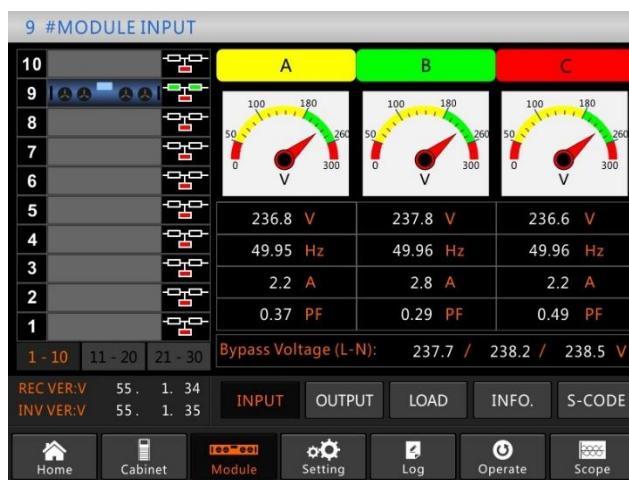


Fig.7- 8: Power module information

Module information menu includes input, output, load, internal information, S-code, software version.

Submenu INPUT, OUTPUT, LOAD

Input and output information include voltage, current, frequency, PF. Load information includes load percent, active load, reactive load, apparent load. See Figure below.



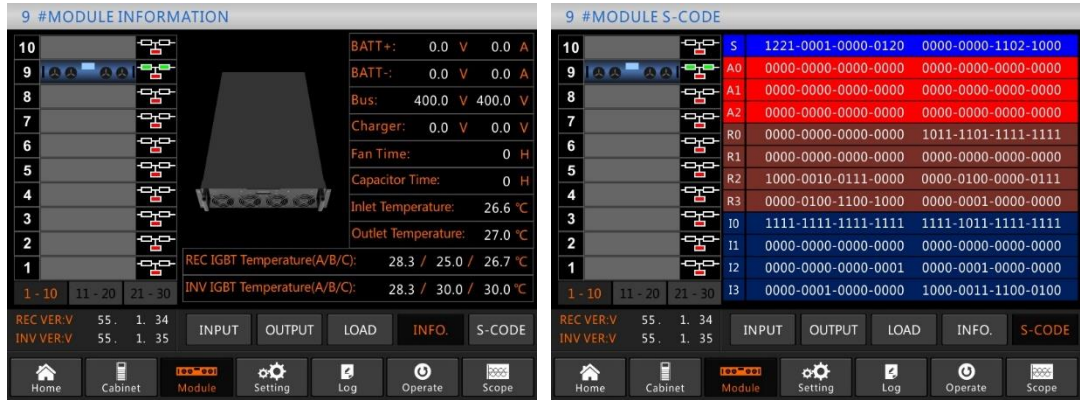
(a) Module output information

(b) Module load information

Fig.7- 9: Module output and load information

Submenu INFO, S-Code

INFO menu includes module battery information, inlet temperature, outlet temperature, and IGBT temperature. The S-code menu displays the S-code of power module to indicate what has happened to power module.



(a) Module information

(b) S-code of the power module

Fig.7- 10: Module information and S-code

7.3.4 Settings submenu

Enter  to set UPS system.

It includes DATE&TIME, LANGUAGE, COMM., USER, BATTERY, SERVICE, RATE, CONFIGURE. And the submenu BATTERY, SERVICE, RATE, CONFIGURE is only available for the service engineer or manufacturer.

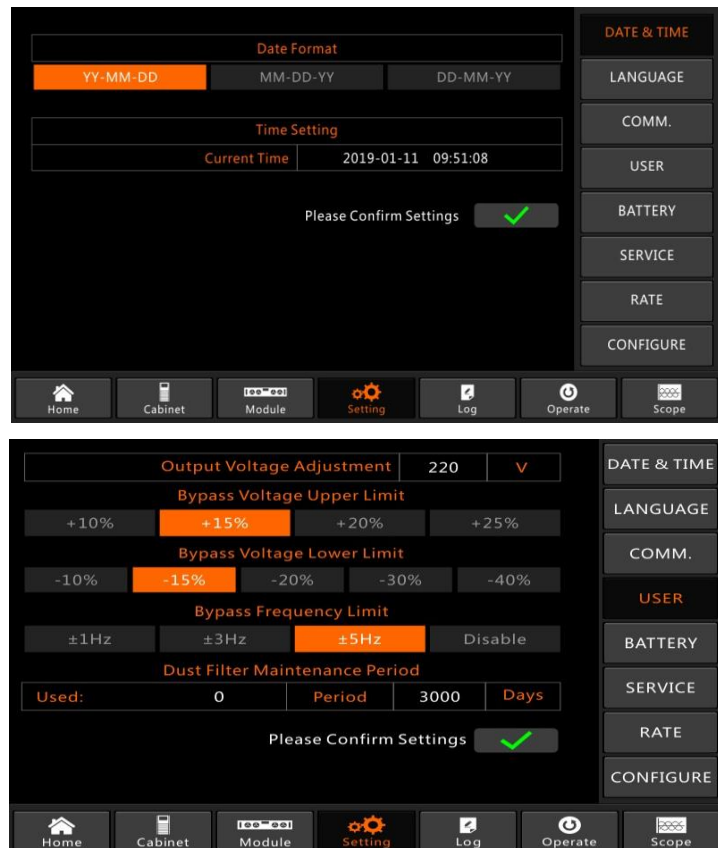


Fig.7-11: Setting menu

Submenu Name	Contents	Meaning
Date Time	Date format setting	Three formats are available: (a) year/month/day, (b) month/day/year and (c) day/month/year
	Time setting	For setting time
Language	Current language	For language in use
	Language selection	Simplified Chinese and English can be selected. Selection takes place immediately after the language icon is touched.
COMM	Device address	For setting the communication address
	RS232 protocol selection	SNT protocol, ModBus protocol, YD/T protocol and Dwin (for factory use)
	Baud rate	For setting the baud rate of SNT, Modbus and YD/T
	Modbus mode	For setting mode for Modbus: ASCII and RTU can be selected
	Modbus parity	Setting the parity for Modbus
USER	Output voltage Adjustment	Setting the output voltage
	Bypass Voltage	Limits of working voltage for bypass settable: $\pm 10\%$, $\pm 15\%$, $\pm 20\%$, $+25\%$, -30% , -40%
	Bypass Frequency Limited	Permitted working frequency for bypass Settable : $\pm 1\text{Hz}$, $\pm 3\text{Hz}$, $\pm 5\text{Hz}$
	Dust Filter Maintenance Period	Setting dust filter maintenance period
BATTERY	See next chapter	
SERVICE	System Mode	Setting the system mode: Single, parallel, Single ECO, paral. ECO, LBS, paral. LBS
RATE	Configure the rated Parameter	For factory use
CONFIGURE	Configure the system	For factory use

Table 7-7: Description of details of submenu in setting

Battery configuration

The M400 UPS can work with VRLA and Lithium Batteries, From the factory, the system is set to work with VRLA batteries. The following parameters can be configured through the HMI:

BATTERY	Battery Number	Setting the number of the battery (12V)
	Battery Capacity	Setting of the AH of the battery
	Float Charge Voltage/Cell	Setting the floating voltage for battery cell
	Boost Charge Voltage/Cell	Setting the boost voltage for battery cell
	EOD (End of charge) Voltage/Cell, @ 0.6C Current	EOD voltage for cell battery, @ 0.6C
	EOD (End of charge) Voltage/Cell, @ 0.15C Current	EOD voltage for cell battery, @ 0.15C
	Charge Current Percent Limit	Charge current (percentage of the rated current)
	Battery Temperature Compensate	Coefficient for battery temperature compensation
	Boost Charge Time Limit	Setting boost charging time
	Auto Boost Period	Setting the auto boost period
	Auto Maintenance Discharge Period	Setting the period for auto maintenance discharge

Table 7- 8: VRLA Battery setting

HMI battery setting menu (configuring ranges):

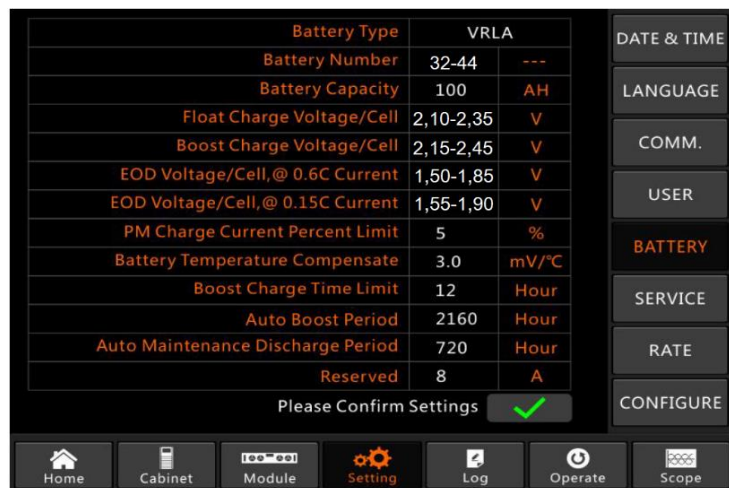


Fig.7- 12: VRLA Battery Setting menu

7.3.5 Log submenu

Enter  to get history log of UPS system. Use   to scroll the list.

7.3.6 Operate submenu

Enter  to control the UPS system. The function and test commands are shown as below:

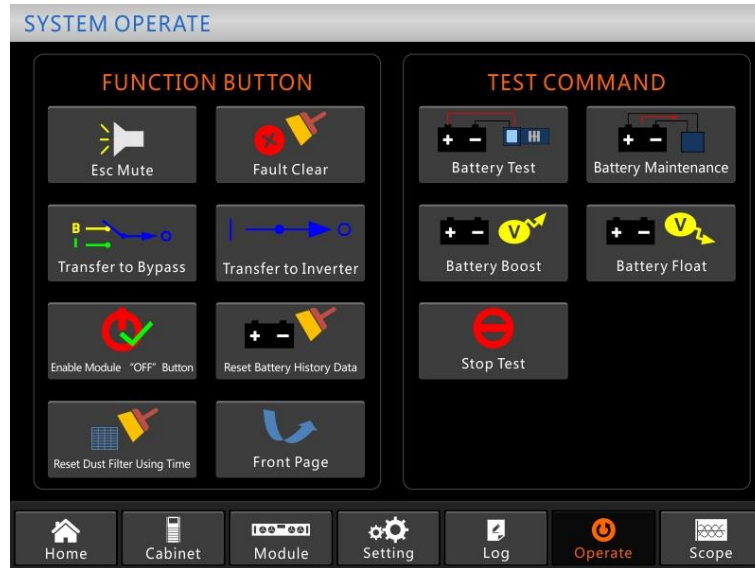


Fig.7- 13: System Operate

Menu for operation includes:

Functional operations

-  Mute off or mute on
-  Fault clear manually
-  Manually transfer to bypass, escape from bypass mode
-  Transfer to inverter mode manually; output could be interrupted.
-  Enable the “OFF” button on the front panel of the power module. When the “OFF” button is available, user can press the button to shut down the power module.
-  Reset battery history data including discharge dates and hours, and discharge times. Normally reset battery history data after replacing new batteries.
-  Reset dust filter data including days and maintenance period. Normally reset filter data after cleaning filter or replacing with new filter.
-  Battery test command. UPS transfers to battery mode, main LED indicator is off and the LED battery indicator flashes green. If battery malfunctions or fails, the UPS will send alarm signal and transfer back to normal mode or to bypass mode. Make sure there are no further warnings or alarm signals, and that the battery voltage is higher than 90% of float voltage. If the battery is in normal mode, the UPS will transfer back to normal mode after 20 seconds. If battery test fails, UPS sends alarm to the history log.



Battery Maintenance Battery maintenance command. UPS transfers to battery mode, main LED indicator is off and LED battery indicator flashes green. Make sure there are no further warnings or alarm signals, and that battery voltage is higher than 90% of float voltage. If the battery is in normal mode, the UPS will transfer back to normal mode until battery voltage comes down to 105% of EOD voltage, and then transfer back to normal mode.



Battery Boost Manually enable charger by entering boost charge mode to charge the batteries more quickly.



Battery Float Manually enable charger by entering float charge mode.



Stop Test Stop battery test or battery maintenance.

7.3.7 Scope submenu

Enter in main menu  to see the waveform of output voltage, current and bypass voltage.

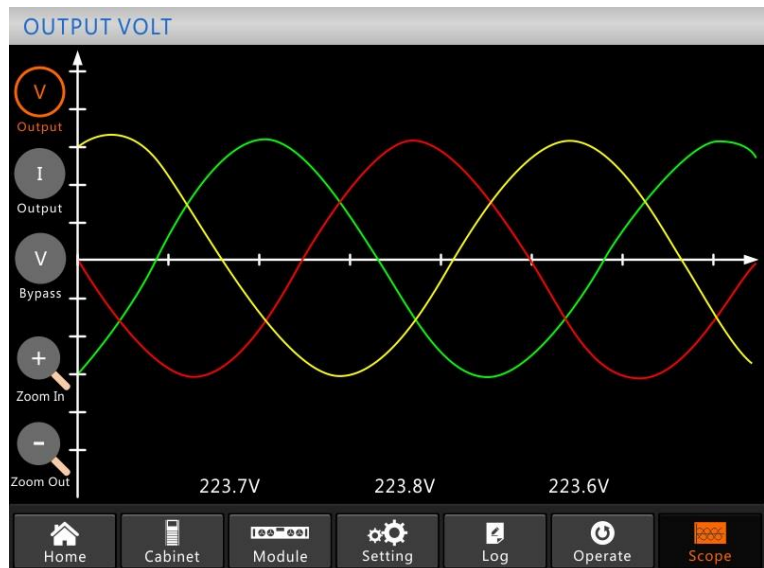


Fig.7- 14: Output and bypass waveform

7.4 UPS Status Log

The follow *Table 7-9* provides the complete list of the UPS status displayed in the history log and current record window.

NO.	UPS status	Description
1	Fault clear	Manually clear fault
2	Log clear	Manually clear history log
3	Load on UPS	Inverter feeds load
4	Load on bypass	Bypass feeds load
5	No load	No load
6	Battery boost	Charger is working in boost charging mode
7	Battery float	Charger is working in float charging mode
8	Battery discharge	Battery is discharging

9	Battery connected	Battery is already connected
10	Battery not connected	Battery is not yet connected
11	Maintenance CB closed	Manual maintenance breaker is closed
12	Maintenance CB open	Manual maintenance breaker is opened
13	EPO	Emergency power off
14	Module on less	Available power module capacity is less than load capacity. Reduce the load capacity or add an extra power module to make sure that the UPS capacity is sufficient.
15	Generator input	Generator is connected and a signal is sent to the UPS
16	Utility abnormal	Utility (grid) is abnormal. Mains voltage or frequency exceeds the upper or lower limit, and results in rectifier shutdown. Check the input phase voltage of rectifier.
17	Bypass sequence error	Bypass voltage sequence is reversed. Check if input power cables are connected correctly.
18	Bypass volt abnormal	This alarm is triggered by an inverter software routine when the amplitude or frequency of bypass voltage exceeds the limit. The alarm will automatically reset when the bypass voltage is normal. Check if an alarm is provided, such as "Bypass Circuit Breaker Open," "Byp Sequence Err" and "Ip Neutral Lost". If there is such an alarm, first clear this alarm. 1. Then check and confirm if the bypass voltage and frequency displayed on the LCD are within the setting range. Note that the rated voltage and frequency are respectively specified by "Output Voltage" and "Output Frequency." 2. If the displayed voltage is abnormal, measure the actual bypass voltage and frequency. If the measurement is abnormal, check the external bypass power supply. If the alarm occurs frequently, use the configuration software to increase the bypass high limit set point as per user's suggestions.
19	Bypass module fail	Bypass module fails. Or bypass fan fails. This fault is locked until power is off.
20	Bypass module overload	Bypass current is over the limit. If the bypass current is under 135% of the rated current, the UPS signal appears, but no action is required.
21	Bypass overload t out	The bypass overload status continues and the overload times out.
22	Byp freq over track	This alarm is triggered by an inverter software routine when the frequency of bypass voltage exceeds the limit. The alarm will automatically reset if the bypass voltage becomes normal. Check if an alarm is provided, such as "Bypass Circuit Breaker Open," "Byp Sequence Err" and

		"Ip Neutral Lost". If there is such an alarm, first clear this alarm. 1. Then check and confirm if the bypass frequency displayed on the LCD are within the setting range. Note that the rated frequency is respectively specified by "Output Frequency". 2. If the displayed voltage is abnormal, measure the actual bypass frequency. If the measurement is abnormal, check the external bypass power supply. If the alarm occurs frequently, use the configuration software to increase the bypass high limit set point as per user's suggestions.
23	Exceed Tx times Lmt	The load is on bypass because the output overload transfer and re-transfer is fixed to the set times during the current hour. The system can recover automatically and will transfer back to the inverter with one hour.
24	Output short circuit	Output is short-circuited. First check if anything is wrong with the loads. Then check if anything is wrong with the terminals, sockets or other power distribution unit. If the fault has been rectified, press "Fault Clear" to restart UPS.
25	Battery EOD	Inverter turned off due to low battery voltage. Check the mains power failure status and recover the mains power in time.
26	Battery test	System transfer to battery mode for 20 seconds to check if batteries are normal.
27	Battery test OK	Battery test is OK.
28	Battery maintenance	System transfer to battery mode until battery is down to 1.1*EOD voltage, to maintenance battery string
29	Battery maintenance OK	Battery maintenance has been successful.
30	Module inserted	Power module is inserted into system.
31	Module exit	Power module is pulled out from system.
32	Rectifier fail	The N# power module rectifier fails; the rectifier is malfunctioning and results in a rectifier shutdown and battery discharge.
33	Inverter fail	The N# power module inverter fails; the inverter output voltage is abnormal and the load transfers to bypass.
34	Rectifier over temp.	The N# power module rectifier is over-heated. The temperature of the rectifier IGBTs is too high to keep the rectifier running. This alarm is triggered by the signal from the temperature-monitoring device mounted in the rectifier IGBTs. The UPS recovers automatically after the over temperature signal disappears. If there is an over temperature, check whether: - the ambient temperature is too high, - the ventilation channel is blocked,

		- a fan fault has occurred, - the input voltage is too low.
35	Fan fail	At least one fan fails in the N# power module.
36	Output overload	The N# power module output is on overload. This signal appears when the load rises above 100% of nominal rating. The alarm automatically resets once the overload condition is removed. 1. Check which phase has overloaded by the load (%) displayed in the LCD to confirm if this signal is correct. 2. If the signal is correct, measure the actual output current to confirm if the displayed value is correct. Disconnect the non-critical load.
37	Inverter overload t out	N# power module inverter in overload has timed out. The UPS overload status continues and the overload times out. Note: The highest loaded phase will indicate overload timing-out first. When the timer is active, then the alarm "unit overload" should also be active as the load is above nominal. When the time has expired, the inverter switch is opened, and the load transferred to bypass. If the load decreases to lower than 95%, after 2 minutes, the system will transfer back to inverter mode. Check the load (%) displayed in LCD to confirm if this alarm is true. If LCD displays that overload has occurred, then check the actual load and confirm if the UPS was in overload before signal appeared.
38	Inverter over temp.	The N# power module inverter over temperature. The temperature of the inverter heat sink is too high to keep inverter running. This alarm is triggered by the signal from the temperature-monitoring device mounted in the inverter IGBTs. The UPS recovers automatically after the over temperature signal disappears. If over temperature exists, check whether: - the ambient temperature is too high, - the ventilation channel is blocked, - there is a fan fault, - the inverter overload time is out.
39	On UPS inhibited	Inhibit system transfer from bypass to UPS (inverter). Check whether: - the power module's capacity is large enough for load, - the rectifier is ready, - the bypass voltage is normal.
40	Manual transfer byp	Transfer to bypass manually
41	Esc manual bypass	Escape from "transfer to bypass manually" command. If UPS has been transferred to

		bypass manually, this command enables UPS to transfer to inverter.
42	Battery volt low	Battery voltage is low. Before the end of discharging, a "battery volt low" warning should appear. After this pre-warning, the battery should have a 3-minute capacity for discharging at full load.
43	Battery reverse	Battery cables are not connected correctly.
44	Inverter protect	The N# power module inverter protection has triggered. Check whether inverter voltage is abnormal, and if the inverter voltage is much different from that of the other modules. If that is the case, adjust inverter voltage of the power module separately.
45	Input neutral lost	The mains neutral wire is lost or cannot be detected. For three-phase UPS, it is recommended that the user use a three-pole breaker or switch between input power and UPS.
46	Bypass fan fail	At least one of the bypass module fans has failed.
47	Manual shutdown	The N# power module has manually shut down. The power module shuts down the rectifier and inverter, and so there is no inverter output.
48	Manual boost charge	Manually force the charger to work in boost-charge mode.
49	Manual float charge	Manually force the charger to work in float-charge mode.
50	UPS locked	It is prohibited to shut down the UPS power module manually.
51	Parallel Cable Error	Parallel cables error. Check: If one or more parallel cables are disconnected or not connected correctly If parallel cable round is disconnected If parallel cable is OK
52	Lost N+X redundant	Lost N+X redundant. There is no X redundant power module in the system.
53	EOD sys inhibited	System is inhibited to supply after the battery is EOD (end of discharging)
54	Battery test fail	Battery test has failed. Check if UPS is normal and the battery voltage is over 90% of float voltage.
55	Battery maintenance fail	Check if UPS is normal without any alarm signals, if the battery voltage is over 90% of float voltage, and if load is over 25%.
56	Ambient over temp	Ambient temperature is over the limit of UPS. Air conditioners are required to regulate ambient temperature.
57	REC CAN fail	Rectifier CAN bus communication is abnormal. Check if communication cables are connected correctly.

58	INV IO CAN fail	IO signal communication of inverter CAN bus is abnormal. Check if communication cables are connected correctly.
59	INV DATA CAN fail	DATA communication of inverter CAN bus is abnormal. Check if communication cables are connected correctly.
60	Power share fail	The difference of two or more power modules' output current in system is over the limit. Adjust output voltage of power modules and restart UPS.
61	Sync pulse fail	Synchronization signal between modules is abnormal. Check if communication cables are connected correctly.
62	Input volt detect fail	Input voltage of N# power module is abnormal. Check whether: the input cables are connected correctly, input fuses are broken, Mains line is normal.
63	Battery volt detect fail	Battery voltage is abnormal. Check: - if batteries are normal, - if battery fuses are broken on input power board.
64	Output volt fail	Output voltage is abnormal.
65	Bypass volt detect fail	Bypass voltage is abnormal. Check whether: bypass breaker is closed and is in order, bypass cables are connected correctly.
66	INV bridge fail	Inverter IGBTs are broken and opened.
67	Outlet temp error	Outlet temperature of power module is over the limitation. Check whether: fans are abnormal, PFC or inverter inductors are abnormal, air passage is blocked, ambient temperature is too high.
68	Input curr unbalance	The difference of input current between every two phases is over 40% of rated current. Check if rectifier's fuses, diodes, IGBT or PFC diodes are broken. Check if input voltage is abnormal.
69	DC bus over volt	Voltage of DC bus capacitors is over limitation. UPS shutdown rectifier and inverter.
70	REC soft start fail	While soft start procedures are finished, DC bus voltage is lower than the limitation of calculation according utility voltage. Check whether: rectifier diodes are broken, PFC IGBTs are broken, PFC diodes are broken, drivers of SCR or IGBT are abnormal, soft start resistors or relays are abnormal.
71	Relay connect fail	Inverter relays are opened and cannot work, or fuses are broken.

72	Relay short circuit	Inverter relays are shorted and cannot be released.
73	PWM sync fail	PWM synchronizing signal is abnormal
74	Intelligent sleep	UPS is working in intelligent sleep mode. In this mode, the power modules are on standby in turn. It is more reliable and efficient. Confirm whether remaining power modules' capacity is large enough to feed load. Confirm whether working modules' capacity is big enough when user adds a higher load to the UPS. It is recommended that "sleeping" power modules be awakened if the capacity of the newly added loads is uncertain.
75	Manual transfer to INV	Manually transfer UPS to inverter. It? is used to transfer the UPS to the inverter when bypass is off tracking the interruption time could exceed 20ms.
76	Input over curr Tout	Input over current timeout and UPS transfer to battery mode. Check if input voltage is too low and output load is high. Increase input voltage if possible or disconnect some loads.
77	No Inlet temp. sensor	Inlet temperature sensor is not connected correctly.
78	No outlet temp. sensor	Outlet temperature sensor is not connected correctly.
79	Inlet over temp.	Inlet air is over-heated. Make sure the operation temperature of UPS is between 0-40°C.
80	Capacitor time reset	Reset timing of DC bus capacitors.
81	Fan time reset	Reset timing of fans.
82	Battery history reset	Reset battery history data.
83	Byp fan time reset	Reset timing of bypass fans.
84	Battery over temp.	Battery is over-heated (option).
85	Bypass fan expired	Working life of bypass fans has expired; it is recommended to replace the fans. This must be activated via software.
86	Capacitor expired	Working life of capacitors is expired; it is recommended to replace the capacitors. This must be activated via software.
87	Fan expired	Working life of power modules' fans is expired; it is recommended to replace the fans. This must be activated via software.
88	INV IGBT driver block	Inverter IGBTs are shut down. Check if power modules are inserted correctly in the cabinet. Check if fuses between rectifier and inverter are broken.

89	Battery expired	Working life of batteries has expired; it is recommended to replace the batteries. This must be activated via software.
90	Bypass CAN fail	The CAN bus between bypass module and cabinet is abnormal.
91	Dust filter expired	Dust filter needs to be cleaned or replaced.
92	Battery Test Fail	Battery test function is forbidden. Please check if battery voltage is higher than please check if load is higher than 25%, Please check if battery connection is OK
93	Stop Test	Manually stop battery test or battery maintenance, UPS will transfer back to normal mode.
94	Wave trigger	Waveform has been saved while UPS fail
95	Bypass CAN fail	Bypass and cabinet communicate with each other via CAN bus. Check: whether the connector or signal cable is abnormal, whether the monitoring board is abnormal.
96	Firmware error	Only for manufacturer's use.
97	System setting error	Only for manufacturer's use.
98	Bypass over temp.	Bypass module is over-heated. Check whether: bypass load is overloaded, ambient temperature is over 40°C, bypass SCRs are assembled correctly, bypass fans are normal.
99	Module ID duplicate	At least two modules are set as same ID on the power connector board, please set the ID as correct sequence.

Table 7- 9: Status Log table

8 Optional Parts

8.1 Option SNMP Adapter Network Card

SNMP card is installed on the front panel of bypass module. To install SNMP card:

Two installation ways are available, 3 and 6 modules racks, they have the slot in the rear side while 2 and 4 slots racks in the front.

For 3 & 6 slot cabinet:

- Turn around the UPS and find the SNMP slot, remove the cover of intelligent slot (see *Fig. 8-2*).
- Install SNMP card in the slot and tighten it with screws.

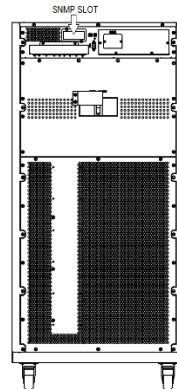


Fig.8- 1: SNMP card 3-slot and 6-slot cabinet

For 2 & 4 slot cabinet:

- Remove the cover of intelligent slot (see *Fig. 8-1*).
- Install SNMP card in the slot and tighten it with screws.

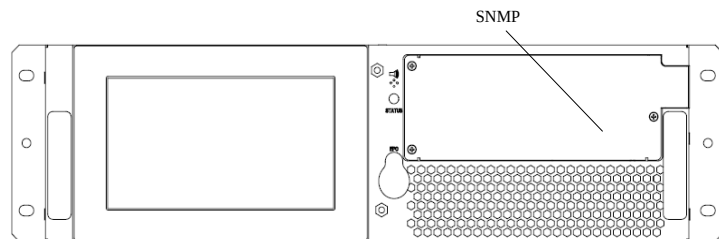


Fig.8- 2: SNMP card 2-slot and 4-slot cabinet

- if the SNMP Adapter is installed, it blocks the RS232 Port, for setting parameters with computer remove the SNMP adapter from slot!
- See relevant manuals.

8.2 Option BACnet Interface via Modbus Gateway

- SNMP Adapter and BACnet Interface runs together at the same time.
- SNMP Adapter and BACnet Interface are connected over a special cable.
- see relevant manual.

9. Product Specification

Please refer to the **technical data sheet** (TD) for information on optimum setting values for the unit.

10 Disposing of the equipment

This section tells you how to dispose of the individual components of the equipment.

- **Packaging:** Dispose of the stretch plastic film and the moulded parts made from polyethylene foam with normal industrial waste. They are chemically inactive and can be disposed of or recycled.
- **Metal parts:** Take metal parts to a scrap metal dealer. The equipment housing, the lines, the inverter, the rectifier and the transformers can be recycled via normal routes.
- **Electronics components:** Take the electronics components to a recycling company which specialises in disposing of electronics components.
- **Batteries:** Follow the specifications set out by the battery manufacturer for toxic and hazardous substances.
- Batteries must be removed from all parts of the equipment and disposed of in accordance with the regulations for toxic and hazardous substances.
- **Other components:** Dispose of rubber seals and plastic parts with industrial waste. They can be disposed of or recycled.



Electrical and electronics waste must only be disposed of in compliance with local legislation and regulations.



Never dispose of used **batteries or battery material** with refuse. Ensure compliance with local legislation and regulations governing the storage, handling and disposal of batteries and battery material.

Appendix 1: Power Connection

Fig.1-1 and Fig.1-2 illustrate the power connection of Protect Plus M400 with 3/3, 3/1 and 1/1 configurations.



If separated bypass input is needed, please disconnect the linked copper bars (phase A, B, C).

With 3/1, 1/1, 3/1 copper kits are already delivered. Set UPS as 3/1, or 1/1 with software. If 3/3 connection is needed, please remove the copper kits.

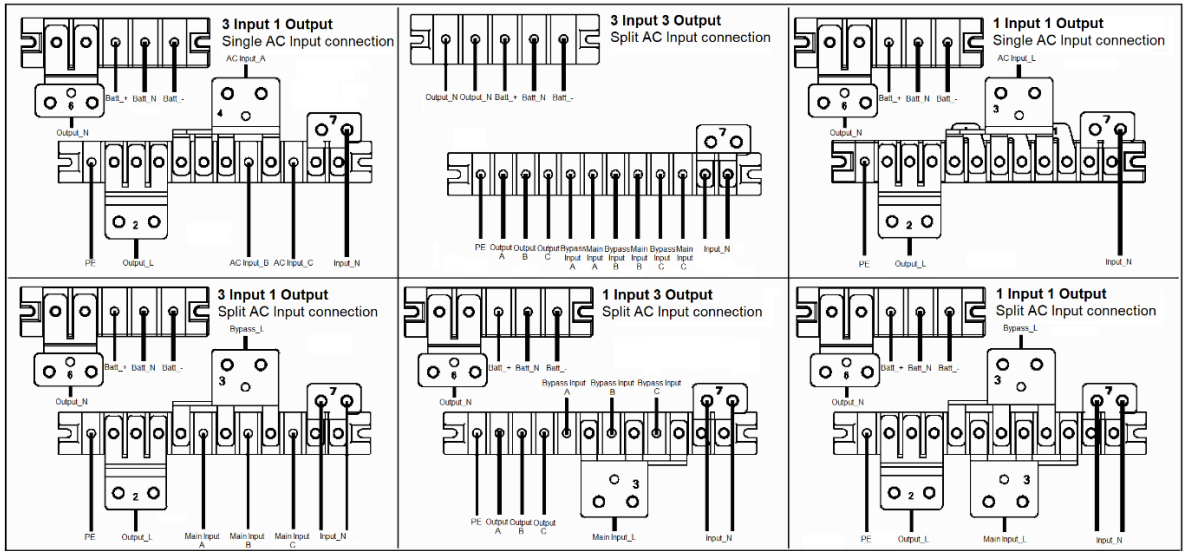


Fig A1-1: Power connection of 2-slot and 4-slot cabinet

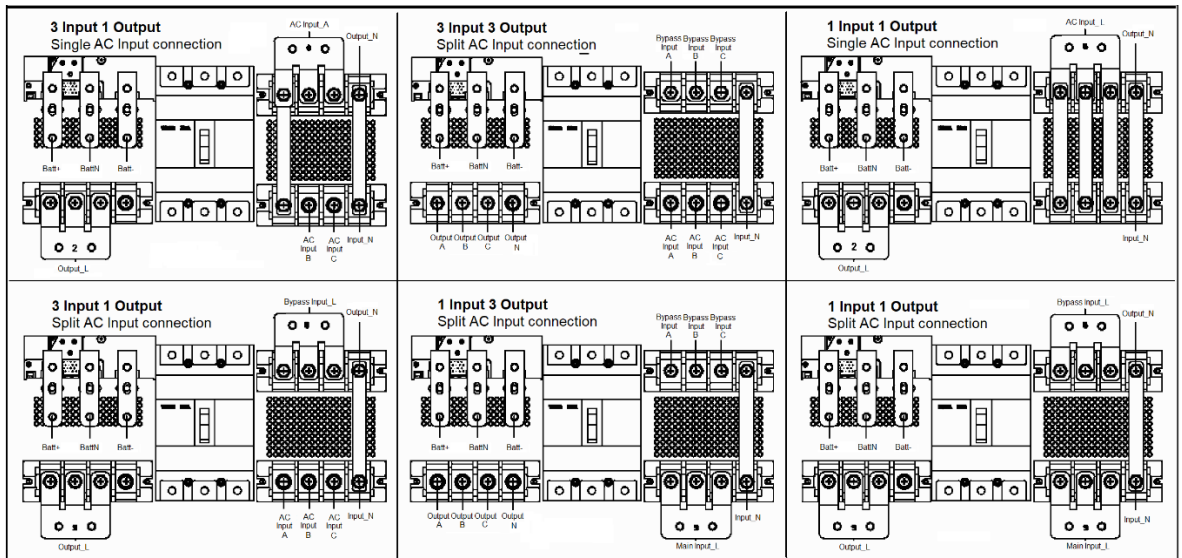


Fig.A1-2 Power Cables Connection of 6 slots cabinet

- **3 phases in, 3 phases out** (common input) are the default setting. If you require **3 phases in, 3 phases out (split bypass input)**, remove connecting copper bars between bypass and main input as in Fig.1-1 & Fig.1-2.



WARNING

Only the system with 10kVA power module can be configured as 3/1, 1/1 and 1/3 mode.

15 KVA power module **MUST** be installed always in 3/3 mode.

- If you need to set UPS as **3 phases in, 1 phase out**, connect cables as in Fig. A-1 as needed. Then set UPS with software as below:
Enter in “**Rate Setting**”, set **output** as ☒ Out 3/1(1) in **Syscode Setting1**, set **input** as ☐ In 3/1(1) in **Syscode Setting 2**, then confirm the set.
- If you need to set UPS as **1 phase in, 1 phase out**, connect cables as in Fig. A-1 as needed. Then set UPS with software as below:
Enter in “**RateSetting**”, set **output** as ☒ Out 3/1(1) in **Syscode Setting1**, set **input** as ☒ In 3/1(1) in **Syscode Setting2**, then confirm the set.
- If you need to set UPS as **1 phase in, 3 phases out (split bypass input)**, connect cables as in Fig. A-1 as needed. Then set UPS with software as below:
Enter in “**RateSetting**”, set **output** as ☐ Out 3/1(1) in **Syscode Setting1**, set **input** as ☒ In 3/1(1) in **Syscode Setting 2**, then confirm the set.



If you want to set UPS as 1 phase in, 3 phases out but single input, you must prohibit bypass function via software.

*If want to set **6 slots cabinet** as 1/1, 3/1, please make sure that connect output neutral cable to the input or bypass neutral connector.*

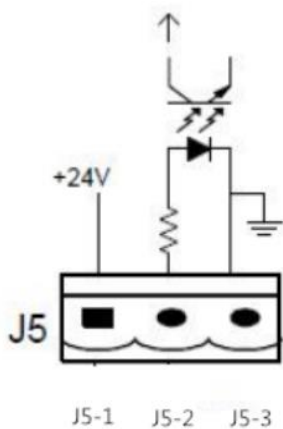
Appendix 2: Dry in and Dry Out configuration possibilities

The inputs and outputs are pre-configured as explained in this manual. However, if any of these signals need to be modified, the available options are detailed below. Important: to make this modification, you will need to contact AEG, as it cannot be done through the equipment's HMI.

	 WARNING
	This customization must be done by AEG power solutions

INPUTS:

J5: Available INPUT signals

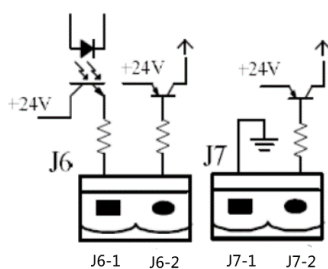


INPUT J5	Description
Generator Input*	It means the input comes from the generator
Mute	The alarm sound is not disabled
Transfer Inverter	UPS transfer to inverter mode
Transfer Bypass	UPS transfer to bypass mode
Fault Clear	"Fault Clear" is operated
BMS Allow Charge	Charging is allowed (Lithium Batteries)
BMS Allow Discharge	Discharging is allowed (Lithium Batteries)

*Factory setting

Table A2-1: Dry contact options

J6.2 & J7: Available INPUT signals



INPUT 6.2 & 7	Description
BCB Online*	"BCB Status" detection is allowed
Generator Input	It means the input comes from the generator
Mute	The alarm sound is not disabled
Transfer Inverter	UPS transfer to inverter mode
Transfer Bypass	UPS transfer to bypass mode
Fault Clear	"Fault Clear" is operated
BMS Allow Charge	Charging is allowed (Lithium Batteries)
BMS Allow Discharge	Discharging is allowed (Lithium Batteries)

*Factory setting

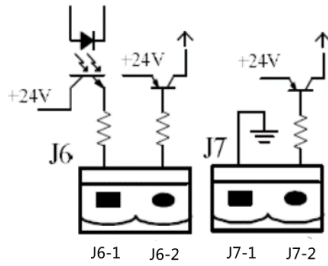
Table A2-2: Dry contact options



In case of Lithium Battery Installation J6.2 and J7 inputs will be used to communicate with battery BMS (Allow Charge & Allow discharge). See "Appendix 4 Lithium Battery configuration".

OUTPUTS:

J6.1: Available OUTPUT signals

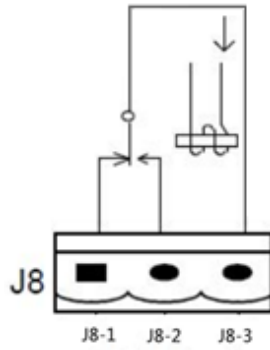


OUTPUT 6.1	Description
BCB Trip*	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when EPO is triggered, or the discharging end point of batteries reaches. The signal can be used to the external battery breaker to trip
Byp Back feed Trip	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when the bypass back feed fault occurs. The signal can be used to the external bypass input breaker to trip
Overload	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when UPS is overloaded
General Alarm	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when any alarm occurs
Output Lost	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when the output is broken (no output voltage)
Batt Mode	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when UPS runs on battery mode
Utility Fail	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when the input power supply fails
On Inverter	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when UPS runs on inverter mode
Batt Charge	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when batteries are charged
Normal Mode	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when UPS runs on normal mode
Batt Volt Low	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when the alarm "Battery voltage low" occurs
On Bypass	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when UPS runs on bypass mode
Batt Discharge	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when batteries are discharging
Battery Boost Charge	One "24VDC/20mA" drive signal will be sent out between J6-1 and J7-1 when batteries are in the period of boost charge

*Factory setting

Table A2-3: Dry contact options

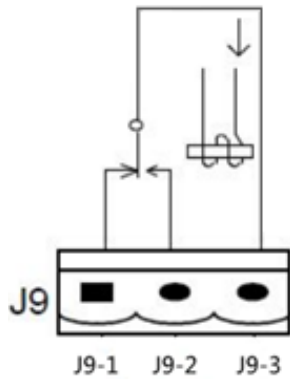
J8: Available OUTPUT signals



OUTPUT J8	Description
Overload	When overload occurs, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
General Alarm	When any alarm occurs, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Output Lost	When the output is broken (no output voltage), J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Batt Mode	When UPS runs on battery mode, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Utility Fail	When the input supply fails, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
On Inverter	When UPS runs on inverter mode, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Batt Charge	When batteries are being charged, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Normal Mode	When UPS runs on normal mode, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Batt Volt Low	When the alarm "Battery voltage low" occurs, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
On Bypass	When UPS runs on bypass mode, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Batt Discharge	When batteries are discharging, J8-1 and J8-3 are open, J8-2 and J8-3 are closed
Battery Boost Charge	When batteries are in the period of boost charge, J8-1 and J8-3 are open, J8-2 and J8-3 are closed

*Factory setting

Table A2-4: Dry contact options



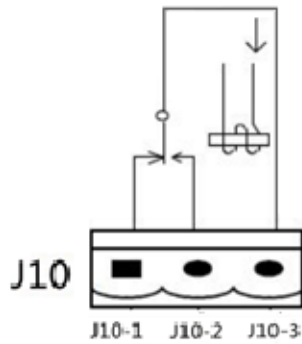
J9: Available OUTPUT signals

OUTPUT J9	Description
Overload	When overload occurs, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
General Alarm	When any alarm occurs, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Output Lost	When the output is broken (no output voltage), J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Batt Mode	When UPS runs on battery mode, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Utility Fail	When the input supply fails, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
On Inverter	When UPS runs on inverter mode, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Batt Charge	When batteries are being charged, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Normal Mode	When UPS runs on normal mode, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Batt Volt Low	When the alarm "Battery voltage low" occurs, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
On Bypass	When UPS runs on bypass mode, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Batt Discharge	When batteries are discharging, J9-1 and J9-3 are open, J9-2 and J9-3 are closed
Battery Boost Charge	When batteries are in the period of boost charge, J9-1 and J9-3 are open, J9-2 and J9-3 are closed

*Factory setting

Table A2-5: Dry contact options

J10: Available OUTPUT signals



OUTPUT J10	Description
Overload	When overload occurs, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
General Alarm	When any alarm occurs, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Output Lost	When the output is broken (no output voltage), J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Batt Mode	When UPS runs on battery mode, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Utility Fail*	When the input supply fails, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
On Inverter	When UPS runs on inverter mode, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Batt Charge	When batteries are being charged, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Normal Mode	When UPS runs on normal mode, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Batt Volt Low	When the alarm "Battery voltage low" occurs, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
On Bypass	When UPS runs on bypass mode, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Batt Discharge	When batteries are discharging, J10-1 and J10-3 are open, J10-2 and J10-3 are closed
Battery Boost Charge	When batteries are in the period of boost charge, J10-1 and J10-3 are open, J10-2 and J10-3 are closed

*Factory setting

Table A2-6: Dry contact options

Appendix 3: Lithium Battery Installation

Only qualified engineers can install, and service batteries mounted in a cabinet. To ensure safety, install the external batteries in a locked cabinet or designated battery room that is accessible to service qualified personnel only.

The installation location of lithium battery plays a key role in its safety, service lifetime and performance. It is recommended to install the lithium battery in an air-conditioned room. The system should be in a place where wiring is convenient and easy to maintain and operation to ensure the effective ventilation and heat dissipation of the lithium battery system, lithium batteries heat dissipation usually adopts forced air cooling, and depending on the heat dissipation channel there could be some installation limitations. Check with battery manufacturer if selected battery can be installed against the wall.

After determining the position of the cabinet, it is necessary to move the modules to the position of the installation point. It is recommended that two people carry the module and wear anti-smash shoes and anti-slip gloves. Manual or machine handling can be decided according to the site situation.



Caution: Pay attention to the weight of the module. It is recommended to carry at least two people to avoid personal safety caused by improper handling. At the same time, wear anti-smashing shoes and anti-slip gloves.

For connection, follow strictly manufacturer's instructions.

Appendix 4: Lithium Battery Configuration

Lithium battery configuration

If the UPS will be used with a Lithium-Ion battery, **please contact AEG to enable this option**. Once enabled, you will find the same configuration page as for VRLA configuration:

	WARNING
	For Lithium battery integration, you must contact AEG to enable this option. The end customer will not be able to modify this on their own.

BATTERY	Battery Number	Setting the number of the battery cells (3,2V nominal)
	Battery Capacity	Setting of the AH of the battery
	Float Charge Voltage/Cell	Setting the floating voltage for battery cell
	Boost Charge Voltage/Cell	Setting the boost voltage for battery cell
	EOD (End of charge) Voltage/Cell, @ 0.6C Current	EOD voltage for cell battery, @ 0.6C
	EOD (End of charge) Voltage/Cell, @ 0.15C Current	EOD voltage for cell battery, @ 0.15C
	Charge Current Percent Limit	Charge current limit (percentage of the rated current)
	Battery Temperature Compensate	Coefficient for battery temperature compensation
	Boost Charge Time Limit	Setting boost charging time
	Auto Boost Period	Setting the auto boost period
	Auto Maintenance Discharge Period	Setting the period for auto maintenance discharge

Table A4-1: Lithium Battery setting

This is the battery settings menu with the available configuration ranges for Lithium Ion Battery:

Battery Type	Lithium		DATE & TIME
Battery Number	70-180	---	LANGUAGE
Battery Capacity	100	AH	COMM.
Float Charge Voltage/Cell	3,3-4,15	V	USER
Boost Charge Voltage/Cell	3,3-4,15	V	BATTERY
EOD Voltage/Cell, @ 0.6C Current	2,6-2,8	V	SERVICE
EOD Voltage/Cell, @ 0.15C Current	2,65-2,85	V	RATE
PM Charge Current Percent Limit	30	%	CONFIGURE
Battery Temperature Compensate	0,0	mV/°C	
Boost Charge Time Limit	1	Hour	
Auto Boost Period	4320	Hour	
Auto Maintenance Discharge Period	720	Hour	
Reserved	0	A	
Please Confirm Settings			

Fig.A4-1: Lithium-Ion Battery Setting menu.

For the battery communication with the UPS, specific dry contacts are used UPS charging and discharging. By connecting these defined dry contacts, the BMS can send signals to control the UPS charging and discharging operations.

Dry Contact Setting Items	Set value	Note
J6-2	BMS allow charge	Connect to BATTERY BMS output dry contact
J7	BMS allow discharge	Connect to BATTERY BMS output dry contact

Table A4-2: Lithium Battery communication

The dry contact configuration, including the assignment of Input dry contacts J6-2 and J7 for communication, will be performed concurrently with the enabling of Lithium battery compatibility by AEG.

The UPS needs three pole battery connection, BAT+ / N / BAT-, for its correct working.

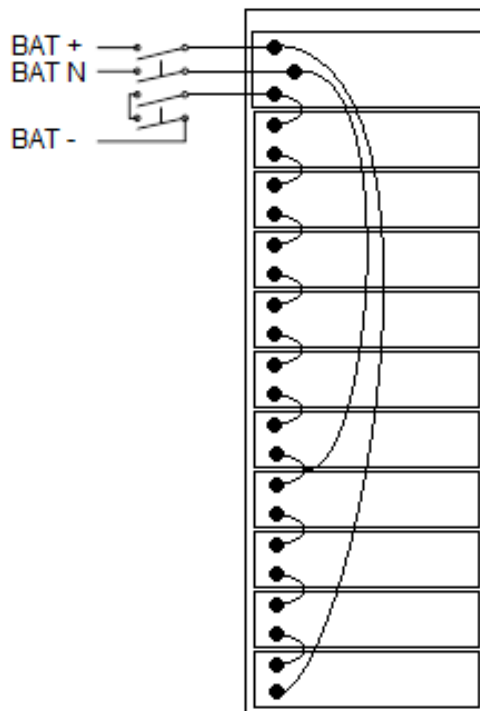


Fig A5-2: Diagram of battery connections

Appendix 5: Guide for Ordering UPS Rack System

Family	Description	AEG code
3/3 Phases configurations	30 kVA (Up to 2 x15KVA modules) Empty Frame	30000233
	45 kVA (Up to 3 x15KVA modules) Empty Frame	30005857
	90 kVA (Up to 6 x15KVA modules) Empty Frame	30005004
	15 kVA/KW hot swappable power module* (3/3 phases only)	30000231
3/3 - 3/1 - 1/1 Phases configurations	20 kVA (Up to 2 x10KVA modules) Empty Frame	30000232
	40 kVA (Up to 4 x10KVA modules) Empty Frame with	30000234
	60 kVA (Up to 6x10KVA modules) Empty Frame	30005005
	10 kVA / kW hot-swappable power module*	30000230
Options	External charger 15A (Additional)	30000236
	M400 Combo Cabinet 20 kVA	30001200
	M400 Combo Cabinet 40 kVA	30000417
	Cabinet Plus (Empty cabinet)	30921832
	Battery temperature sensor	40002211
	Parallel Kit	40010216
	SNMP Card ("Budget")	30919556
	SNMP Card ("Professional")	30919557
	Wheels (1 set per Frame)	30000235
	Power Distribution Unit, external mounted, valid only with Cabinet Plus	30000729
	External maintenance bypass (to be mounted in Cabinet Plus)	30000237
	Dust filter for the 10/15 kVA Power Module	30000238
Battery fuse boxes & External maintenance bypass	Wide Range of external battery fuse boxes and external maintenance bypass.	

*10KVA and 15 KVA modules are **only compatible with their respective racks**, they cannot be mixed.

Table A5-1: Ordering information

[illegible]

Certificate of guarantee

Model:

Serial number:

Date of purchase:

Trading stamp / Signature

Specifications are subject to change without notice.

Operating instructions 8000064255_06_BAL



AEG Power Solutions

Emil-Siepmann-Str. 32 | 59581 Warstein-Belecke | Germany | Tel. +49 180 523 4787 | Fax +49 180 523 4789 | www.aegps.com

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