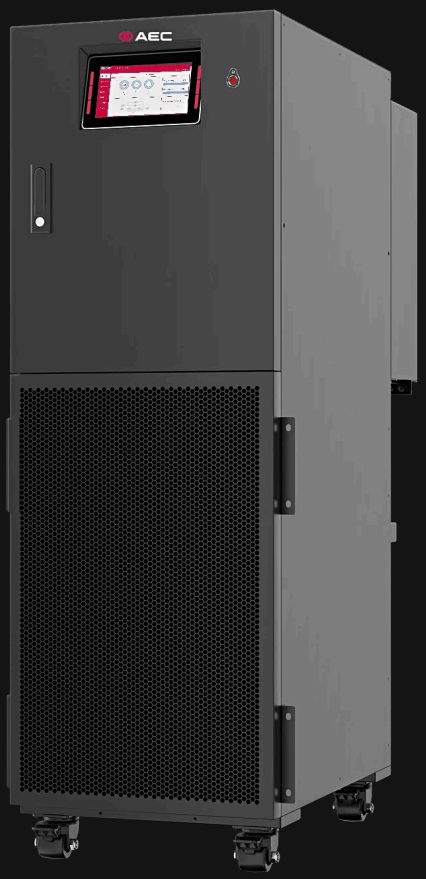
MODULAR ONLINE UPS · THREE-PHASE 208/120 V

RADIANT

15–90 kVA

Modular three-phase online double-conversion UPS: one 6-slot frame with one to six hot-swappable 15 kVA power modules, N+X redundancy and the AEC color touchscreen.



User Manual

Installation · Operation · Maintenance

RADIANT 15 kVA | 30 kVA | 45 kVA | 60 kVA | 75 kVA | 90 kVA | 15 kVA modules

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AEC-UM-RAD-US · Rev. E · November 2026. Rev. E restores the breaker and cable sizing for every build from 15 to 90 kVA (sized to NEC 125 %), the battery, environment and synchronization ranges and the full maintenance bypass procedures, adds call-out pictures for every panel, breaker and port, and removes factory references.

BEFORE YOU START

About this manual

Thank you for choosing an AEC RADIANT UPS. This manual describes the RADIANT 15–90 kVA modular UPS: safety, planning, installation, the battery, parallel systems, operating modes and procedures, the AEC touchscreen, communication, maintenance, the event log and the specifications. Read it before you start, and keep it near the UPS.

MODELS COVERED

The RADIANT 90 kVA frame (RAD90-FRAME, 6 slots, 4 breakers) with one to six 15 kVA power modules (RAD-PWR-15): 15, 30, 45, 60, 75 and 90 kVA, three-phase 208/120 V, 4-wire, external battery. Ordering codes: Table 2-2.

WHO THIS MANUAL IS FOR

Qualified electricians install and wire the UPS. An engineer approved by AEC commissions it. Trained operators use it every day: they read the touchscreen and follow the procedures of the operation chapter.

Safety messages

Safety messages in this manual follow ANSI Z535.6. The signal word tells how serious the hazard is:

DANGER	A hazardous situation which, if not avoided, **will** result in death or serious injury.
WARNING	A hazardous situation which, if not avoided, **could** result in death or serious injury.
CAUTION	A hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Information about practices that could damage the equipment, lose data, reduce performance or give unexpected results — not related to injury.

Other conventions

i NOTE Additional information that stresses or completes the text.

✓ TIP A hint that helps you solve a problem or save time.

Keys are shown like [ON]; menus like **Settings › Battery**. Numbers in red circles on a picture are explained in the list under it. Cross-references in red are links in the PDF.

QUICK START

From delivery to normal mode in six steps

The short version — each step points to the full instructions. Read the safety chapter first.

1. **Inspect the delivery and the frame.** Report damage to the carrier and to AEC. Section 4.1, page 23.
2. **Place the frame** with its working space, lock the casters and fit the power modules from the bottom slot up. Section 4.3, page 24, Section 4.5, page 25.
3. **Size the breakers and cables for your build** (15 to 90 kVA) and wire PE first, then input, bypass, output and battery, at 248 lb-in. Table 4-2, page 26, Section 4.7, page 26.
4. **Connect EPO, sensors, dry contacts and the network card.** Section 4.9, page 32.
5. **Commission with the AEC engineer:** close the breakers in order and let the UPS go to inverter. Section 5.2, page 41.
6. **Set the battery and the system mode** on the touchscreen. Section 6.6, page 52.

15 kVA	N+X	208/120 V	Touch
hot-swappable power modules, 1 to 6 per frame	redundancy, up to 90 kVA per frame	three-phase, 4-wire, 60 Hz	7-inch AEC color touchscreen

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01

CHAPTER 1

Safety

Read this chapter before you install, operate or service the UPS. Safety messages also appear in the chapters where each task is described.

⚠ WARNING · IMPORTANT SAFETY INSTRUCTIONS — SAVE THESE INSTRUCTIONS

This manual contains important instructions for the installation and operation of the RADIANT modular UPS. Read it before installation. Do not put the UPS into operation until an engineer approved by AEC has commissioned it: otherwise there is a risk to people, the equipment may malfunction and the warranty is void.

Commissioning engineer: the engineer who installs or operates the equipment must be trained in electricity and safety, and familiar with the operation, commissioning and maintenance of the equipment.

1.1 General

⚠ DANGER

- Only commissioning engineers may install, commission and service the UPS.
- This UPS is designed for commercial and industrial applications only. It is not intended for life-support devices or systems.

⚠ WARNING

- Read all warning labels before operation and follow their instructions.
- The UPS contains electrostatic-sensitive components. Take ESD precautions before you handle them.

1.2 Moving and installation

⚠ DANGER

- Keep the equipment away from heat sources and air outlets.
- In case of fire, use a dry-chemical (powder) extinguisher only. A liquid extinguisher can cause electric shock.

⚠ WARNING

- Do not start the system if you find any damage or abnormal part.
- Touching the UPS with wet materials or wet hands can cause electric shock.

⚠ CAUTION

- Use suitable equipment to handle and install the UPS. Wear safety shoes, protective clothing and other protective equipment.
- Protect the UPS from shock and vibration while you position it.
- Install the UPS in a suitable environment, as described in Section 4.2.

1.3 Commissioning and operation

⚠ DANGER

- Connect the grounding conductor before the power cables. Grounding and neutral conductors must comply with the National Electrical Code (NFPA 70) and local codes.
- Before you move or reconnect cables, switch off all input power sources and the battery breaker, and wait at least 10 minutes for the internal capacitors to discharge. Check with a multimeter that the voltage on the terminals is below 36 V before you work.

⚠ WARNING

- Any upstream ground-fault (residual-current) device carries the earth leakage current of the load.
- After long storage, inspect and check the UPS before you start it.

1.4 Maintenance and replacement

⚠ DANGER

Maintenance and service that need internal access require special tools and trained personnel. Parts reached by opening a protective cover with a tool are not user-serviceable. Hazardous voltage is present inside the frame and the battery cabinet. In normal operation, following this manual, there is no risk to the operator.

1.5 Battery safety

⚠ DANGER

- Battery maintenance and service that need internal access require special tools or keys and trained personnel.
- Connected in series, the battery string is 240 V DC nominal (±120 V to the center tap) with 20 blocks, and more while charging. This voltage is lethal.
- Follow the battery maker's precautions for work on or near a large battery bank at all times, in particular for the environment, protective clothing, first aid and fire fighting.
- Replace batteries only with the same type and number. Otherwise there is a risk of explosion or poor performance.
- Inspect the batteries before you connect them. If the package is damaged, the terminals are dirty, corroded or rusty, or the case is broken, deformed or leaking, replace the battery. Otherwise capacity can drop, current can leak or fire can result.
- Remove rings, watches, necklaces, bracelets and other metal jewelry. Wear rubber gloves and eye protection against arc flash. Use only tools with insulated handles.
- Batteries are heavy. Lift and handle them correctly to prevent injury and damage to the terminals.
- Do not disassemble, modify or damage a battery: risk of short circuit, leakage or injury.

⚠ WARNING · Sulfuric acid

- The VRLA batteries contain sulfuric acid. If a case breaks, acid can leak. Wear safety glasses, rubber gloves and an apron. Acid in the eyes can cause blindness; it burns the skin.
- At the end of its life a battery can short internally, lose electrolyte and corrode its plates, then overheat, swell or leak. Replace batteries before this happens.
- Replace a leaking or damaged battery, store it in an acid-resistant container and dispose of it according to local regulations.
- If electrolyte touches the skin, wash the area immediately with water.

Ambient temperature is a major factor in battery capacity and life. The nominal battery temperature is 68 °F (20 °C); higher temperatures shorten battery life, lower temperatures reduce capacity. Replace the batteries as their maker requires, to keep the rated runtime.

1.6 Disposal

⚠ WARNING

Dispose of used batteries according to local regulations. Lead-acid batteries must be recycled.

1.7 Standards

The UPS meets the UL 1778 standard. It is designed according to the following standards.

TABLE 1-1 Design standards

Standard	Subject
UL 1778	Uninterruptible power systems — safety (North America)
IEC 62040-1	UPS — general and safety requirements

Standard	Subject
IEC 62040-2	UPS — electromagnetic compatibility (EMC)
IEC 62040-3	UPS — performance and test requirements
IEC 61000-3-12	Harmonic currents, equipment of 16 A to 75 A per phase
IEC 61000-3-11	Voltage fluctuations and flicker
IEC 61000-4-2	Immunity to electrostatic discharge
IEC 61000-4-3	Immunity to radiated electromagnetic fields
IEC 61000-4-4	Immunity to electrical fast transients / bursts
IEC 61000-4-5	Immunity to surges
IEC 61000-4-6	Immunity to conducted disturbances
IEC 61000-4-8	Immunity to power-frequency magnetic fields
IEC 63000	Restriction of hazardous substances (RoHS) — technical documentation
NFPA 70 (NEC)	Installation: branch circuits, conductors, working space, battery systems (Article 480)

1.7.1 FCC statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio-frequency energy and, if not installed and used in accordance with this manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

02

CHAPTER 2

Product description

The RADIANT frame, its breakers and power modules, the front, sides and rear, how the UPS works, its operating modes and its protections.

2.1 Introduction

RADIANT is a modular online double-conversion UPS for 208/120 V three-phase, 4-wire loads. One 17.4-inch-wide frame takes one to six hot-swappable power modules of 15 kVA / 15 kW, for 15 to 90 kVA with N+X redundancy. The frame holds four breakers — main input, bypass input, output and maintenance bypass — the bypass module and a 7-inch color touchscreen. The battery bank is external.

TABLE 2-1 RADIANT at a glance

Feature	What it gives you
15 kVA modules	One to six per frame, hot-swappable. Each module is a complete rectifier, inverter and charger.
N+X	A redundant module carries the load if another stops or is replaced.
94 %	Efficiency online; 99 % in ECO mode. Input power factor 0.99.
kVA = kW	Output power factor 1; 300 % fault current for 200 ms; 170 % neutral current.
4 breakers	Main input, bypass input, output and maintenance bypass, in the frame.
Touchscreen	7-inch AEC color touchscreen, green, yellow and red status colors, EPO button.

2.2 Models and ordering codes

TABLE 2-2 RADIANT ordering codes

Code	Configuration	Weight
RAD90-1X15	RADIANT 15 kVA: frame with 1 × 15 kVA module	238 lb (108 kg)
RAD90-2X15	RADIANT 30 kVA: frame with 2 × 15 kVA modules	268.5 lb (121.8 kg)
RAD90-3X15	RADIANT 45 kVA: frame with 3 × 15 kVA modules	299 lb (135.7 kg)
RAD90-4X15	RADIANT 60 kVA: frame with 4 × 15 kVA modules	329.5 lb (149.5 kg)
RAD90-5X15	RADIANT 75 kVA: frame with 5 × 15 kVA modules	360 lb (163.4 kg)
RAD90-6X15	RADIANT 90 kVA: frame with 6 × 15 kVA modules	390.5 lb (177.2 kg)
RAD90-FRAME	Frame: six slots, bypass module and four breakers, no power module	207.5 lb (94.1 kg)
RAD-PWR-15	Power module 15 kVA / 15 kW, hot-swappable	30.5 lb (13.85 kg)
SNMP-M · DRYCNT	SNMP network card · dry-contact card	—

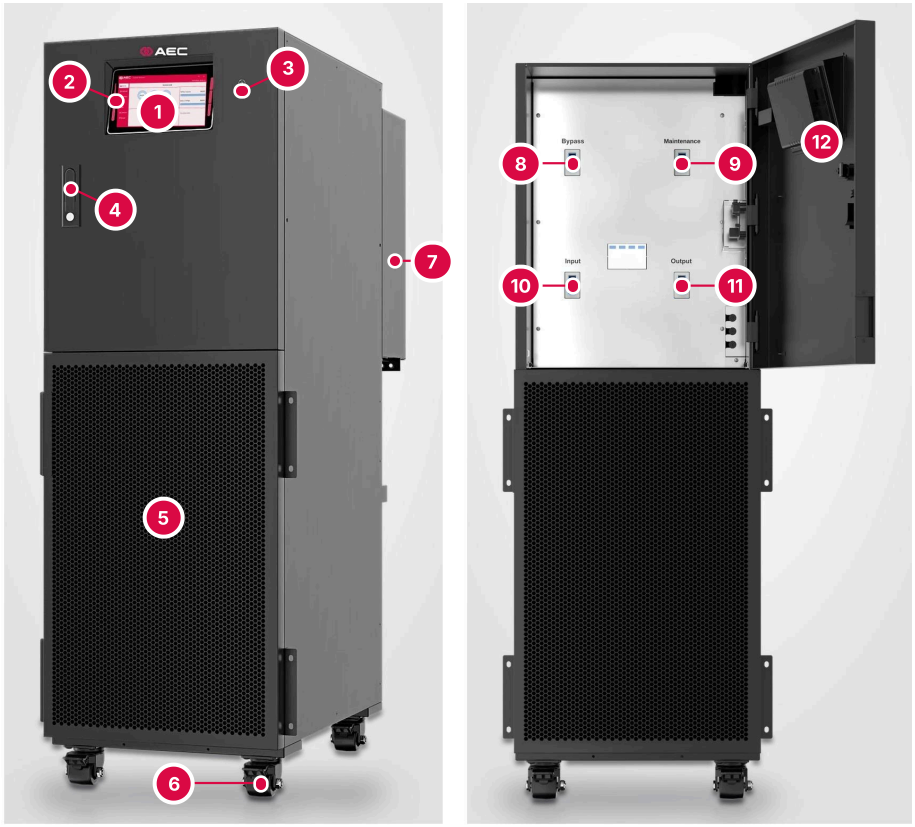
How to read the code. RAD90-4X15 means the 90 kVA frame (RAD90), then the number of 15 kVA modules (4 × 15 = 60 kVA installed). Order one module for every 15 kW of load and one more for N+1. AEC sizes the external battery bank.

2.3 What is in the box

Inspect the contents on delivery. Report damage to the carrier and missing parts to AEC.

- 1 × RADIANT frame with the bypass module, the touchscreen and the four breakers, on four casters
- The power modules ordered (fitted, or packed separately — see the packing list)
- 1 × user manual

2.4 Front of the frame



Doors closed | Upper door open

1 Touchscreen, 7-inch color (Section 6.1)	6 Casters (4): lock them once in place
2 Status indicator bars, green / yellow / red, both sides of the screen	7 Terminal box at the rear: power terminals
3 EPO button (emergency power off, Section 5.8)	8 Bypass input breaker
4 Upper door handle and lock	9 Maintenance bypass breaker
5 Lower door, perforated: air in; behind it the bypass module and the six module slots	10 Main input breaker
	11 Output breaker
	12 Inside of the upper door: back of the touchscreen and its cable

FIGURE 2-1 Front of the frame, doors closed (left) and upper door open (right)

The four breakers sit behind the upper door, on the breaker panel. Figure 2-2 names each one and says what it switches. The procedures of Chapter 5 use one picture per breaker state.



1. **Bypass** — bypass input breaker. Feeds the static bypass in the bypass module from the bypass input terminals.
2. **Maintenance** — maintenance bypass breaker. Connects the bypass input straight to the output, around the whole UPS, for service. Normally OFF.
3. **Input** — main input breaker. Feeds the rectifiers of the power modules from the main input terminals.
4. **Output** — output breaker. Connects the inverters and the static bypass to the output terminals and the load.
5. Back of the touchscreen, on the inside of the upper door

FIGURE 2-2 The breaker panel behind the upper door — each breaker is labeled on the panel

NOTICE

The battery breaker is not in the frame: it is in the external battery cabinet (Section 4.8). The frame breakers are 3-pole; the neutral is not switched.

Figure 2-3 shows how the frame is built, with the upper door open and the lower door taken off: the four breakers on the breaker panel, the bypass module and the power modules in their slots, and the terminal box at the rear.



1. Upper door, open: touchscreen, status bars and EPO on its front
2. Bypass input breaker
3. Maintenance bypass breaker
4. Main input breaker
5. Output breaker
6. Communication ports and dry contacts (position simplified; the real panel: Figure 4-8)
7. Bypass module, with its fans
8. Power module, top slot (No. 6)
9. Power module, bottom slot (No. 1)
10. Lower door, perforated: air in (removed)
11. Terminal box at the rear: power terminals
12. Casters (4)

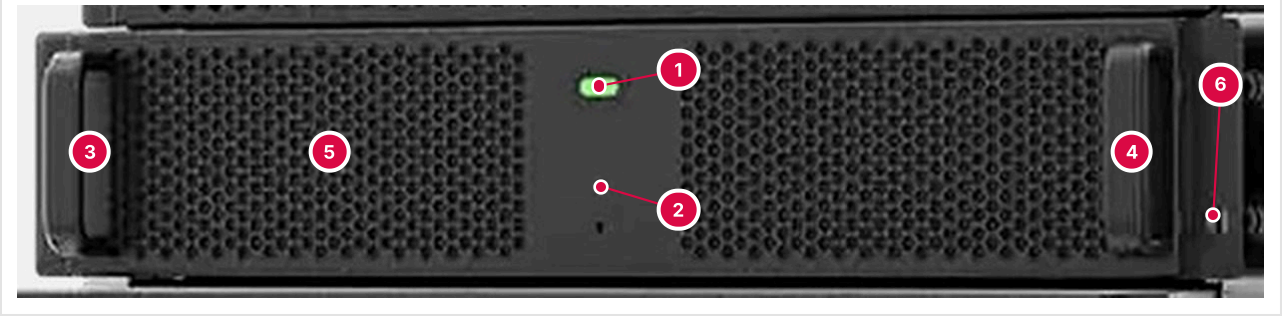
FIGURE 2-3 Illustration — internal layout simplified: the frame with six modules, upper door open, lower door removed

2.5 Power modules and bypass module



1	Bypass module: static switch, fans, communication panel (Section 4.9) and cold-start button. One per frame.
2	Power module, top slot (No. 6)
3	Power module, bottom slot (No. 1). Fit modules from the bottom up.
4	Status lamp of the module
5	Mounting ears with the fixing screws
6	Casters

FIGURE 2-4 Bypass module and power modules (modules shown drawn out)



1. Status lamp: green = the module runs
2. OFF key and cold-start button (the two small push-buttons under the lamp)
3. Left handle
4. Right handle
5. Air inlet grille (front-to-back cooling)
6. Mounting ear: fixing screws hold the module in its slot

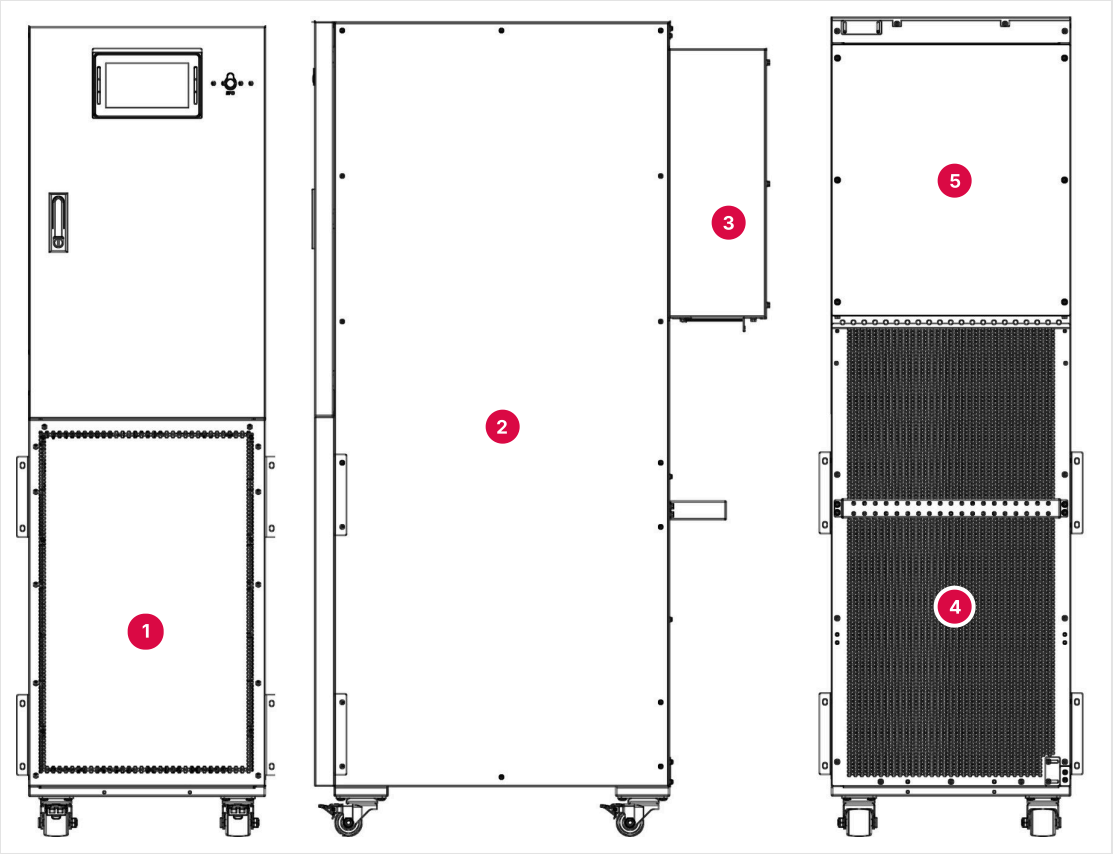
FIGURE 2-5 Front of a 15 kVA power module (RAD-PWR-15)

TABLE 2-3 Power module RAD-PWR-15

Item	Value
Rating	15 kVA / 15 kW
Inside	Rectifier, inverter, bidirectional DC/DC charger
Size	15.7 × 19.5 × 3.4 in (400 × 495 × 86 mm), 2U
Weight	30.5 lb (13.85 kg)
Front	Status lamp, OFF key, cold-start button, two handles, fixing screws
Slots	Six per frame, numbered 1 (bottom) to 6 (top)

i NOTE The OFF key works only after **Control › Function › Module Button Power Enable** (Section 6.7). The modules have no locking switch: the fixing screws hold them in the slot.

2.6 Sides, rear and airflow



1. Front: lower door, air in
2. Right side: 26.0 in (661 mm) cabinet
3. Terminal box at the rear: 33.1 in (840 mm) overall depth
4. Rear grille: air out
5. Rear cover over the power terminals

FIGURE 2-6 Front, right side and rear at one scale — air in at the front, out at the rear

TABLE 2-4 What each side carries

Side	Carries
Front	Touchscreen and EPO on the upper door; the perforated lower door, air in.
Right side	26.0 in (661 mm) of cabinet; with the terminal box at the rear, 33.1 in (840 mm).
Rear	The cover over the power terminals at the top; the rear grille, air out.
Base	Four casters; lock them once in place.

Internal fans cool the UPS from front to back. Keep the front door and the rear grille clear. The dust filter sits in the removable magnetic lower door; its service period and reset are on the touchscreen.

2.7 How the UPS works

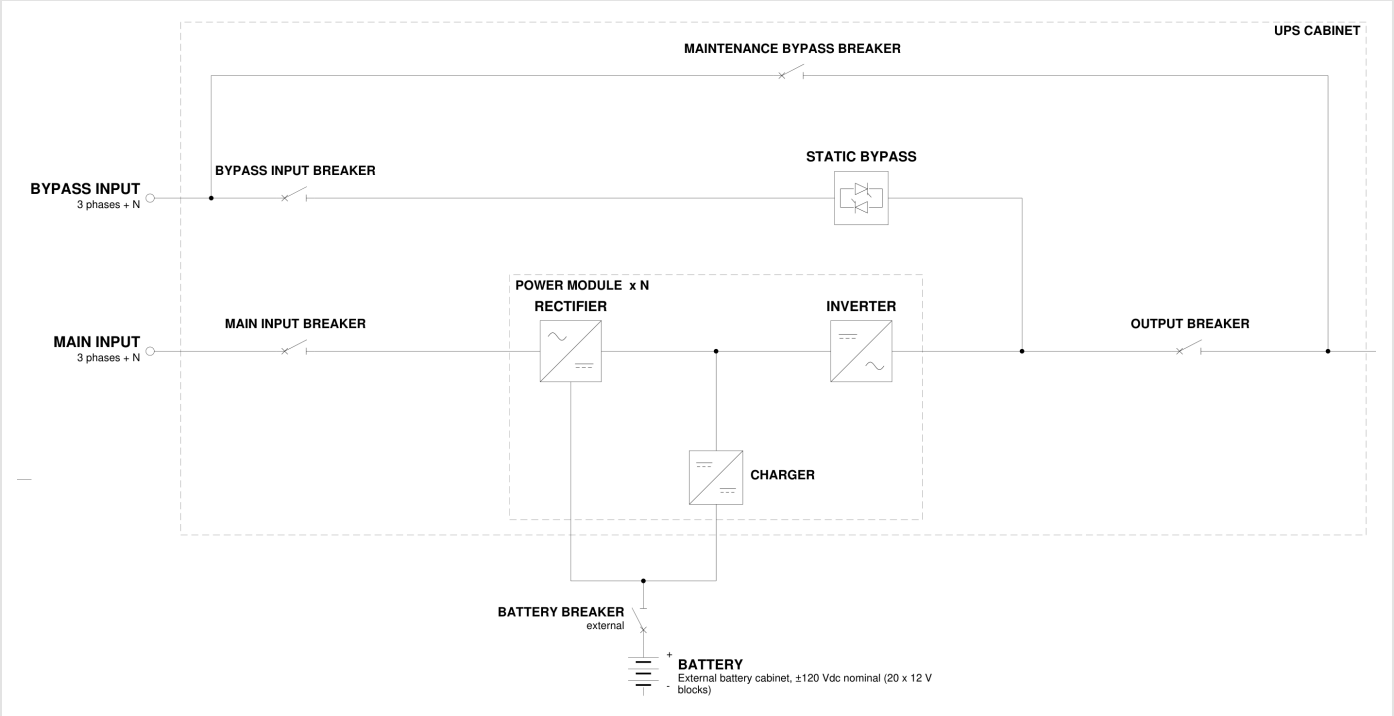


FIGURE 2-7 Single-line diagram — one line stands for the three phases and the neutral; PE not shown

TABLE 2-5 The parts of the power path

Part	What it does
Rectifier	In each power module: turns the utility into a regulated DC bus, drawing a near-sinusoidal current (power factor 0.99, current THD below 2.2 %).
Inverter	In each power module: rebuilds the three-phase sine wave from the DC bus. The modules share the load.
Charger (bidirectional DC/DC)	Charges the external battery from the DC bus and, on a utility failure, feeds the DC bus from the battery with no break.
Static bypass	In the bypass module: feeds the load from the bypass input when the inverters are off, overloaded or faulty.
Breakers	Main input, bypass input, output and maintenance bypass in the frame (Figure 2-2); battery breaker in the external battery cabinet. Main and bypass inputs have separate terminals: a split bypass (separate bypass supply) is possible.

2.8 Operating modes

TABLE 2-6 Operating modes

Mode	What happens
Normal	The rectifiers turn the utility into DC and the inverters turn it back into regulated AC for the load. The chargers keep the battery charged.
Battery	On a utility failure the inverters run from the battery with no break. When the utility returns the UPS goes back to normal mode by itself. The UPS can also start from the battery alone (cold start, Section 5.3).
Bypass	With the inverters off, overloaded, too hot or faulty, the static bypass feeds the load from the bypass input: the load is not protected. A transfer out of synchronism interrupts the load for less than 3/4 of a cycle (12.5 ms at 60 Hz).

Mode	What happens
Maintenance bypass	With the maintenance bypass breaker closed the load is fed from the bypass input, so the UPS and the battery can be serviced without stopping the load. Dangerous voltage stays on the input, output and neutral terminals.
ECO	The load runs on the static bypass while the bypass stays within the ECO window; the inverters stand by and the chargers keep the battery charged. If the bypass fails the inverters take the load in less than 10 ms. Efficiency 99 %.
Source sharing	When the utility cannot give the rectifiers all the power, each module draws from the utility and the battery together: the load stays on the inverter without a transfer.
Module sleep	At part load the modules not needed stand by in turn, so that they age evenly; they wake as the load grows.
Auto restart	After the battery has reached end of discharge, the UPS restarts by itself when the utility returns (if enabled; the commissioning engineer sets the mode and the delay).
Frequency converter	40–70 Hz in, 50 or 60 Hz out; the static bypass is disabled; the battery is optional.

The thick line in each diagram shows the power path in that mode.

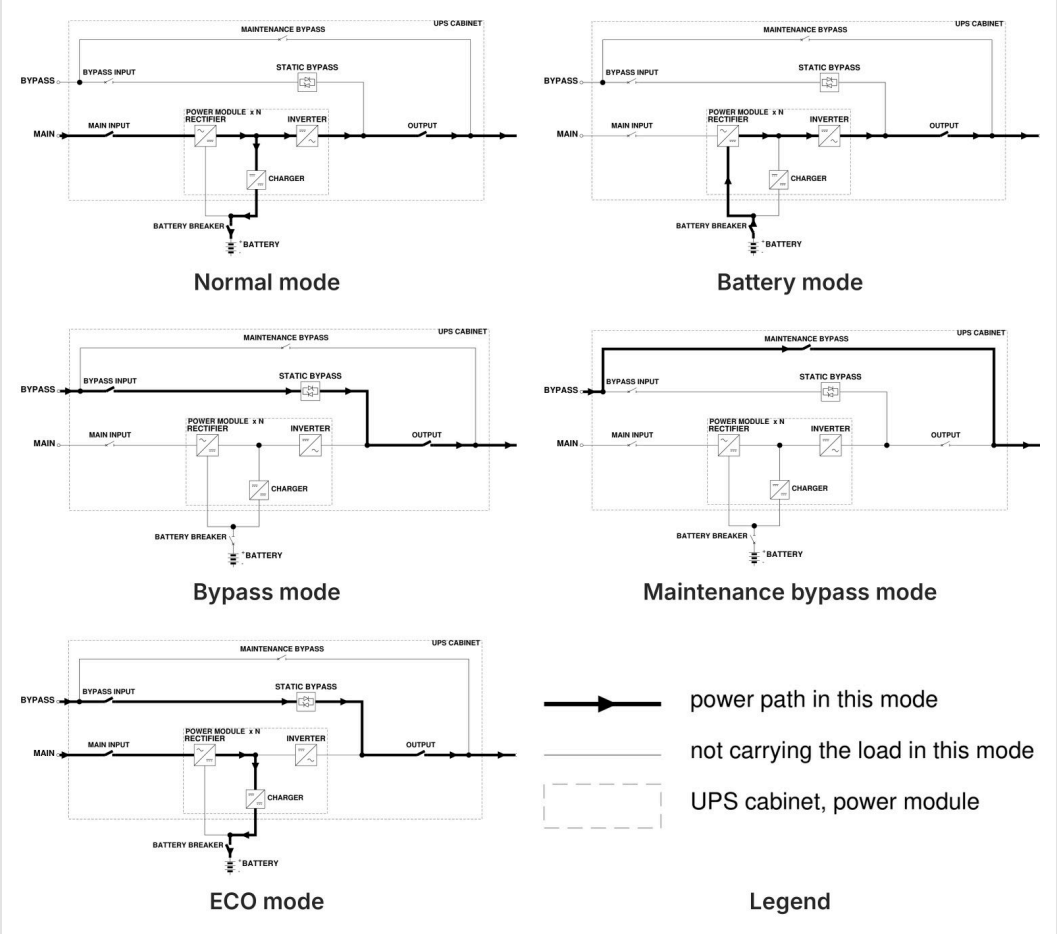


FIGURE 2-8 The power path in each operating mode — thick line: power path; thin line: not carrying the load

NOTICE

On bypass, on maintenance bypass and in ECO mode the load is not protected from utility disturbances.

2.9 Protections

- **Overload, inverter:** 110 % for 1 h · 125 % for 10 min · 150 % for 1 min · above 150 % for 200 ms, then transfer to bypass.
- **Overload, bypass:** below 110 % continuous · 125 % for 10 min · 150 % for 1 min · above 150 % for 1 s.
- **Output short circuit:** fault current limited to 300 % for 200 ms.
- **Temperature and wear:** module over-temperature, fan failure, inlet and outlet temperature; capacitor, fan and dust-filter service timers.
- **Battery:** battery low warning (about 3 minutes left at full load), end-of-discharge shutdown, reverse battery connection, battery breaker trip at EOD or EPO.
- **Input:** input neutral lost, bypass phase sequence, bypass voltage and frequency window.
- **EPO:** button on the front and remote EPO input.

CHAPTER 3

03 Planning the installation

Sizing the power modules for capacity and redundancy, the battery, and running on a generator.

3.1 Sizing the power modules

RADIANT uses hot-swappable power modules of 15 kVA / 15 kW (output power factor 1: kVA = kW). The frame holds up to six modules (90 kVA). Size the system on the kW the loads draw.

1. Add up the active power (kW) of all the loads, from their data sheets or from measurements on the existing installation.
2. Divide by the module rating (15 kW) and round up: that is N, the number of modules that carry the load.
3. For redundancy add one module (N+1) or more (N+X). If a module fails or is removed for service, the others carry the load with no interruption.
4. Keep the load at or below about 80 % of the capacity that remains with one module out, for start-up currents and growth.
5. Set the number of redundant modules in **Set › Sys Set** (Figure 6-10), so that the UPS alarms when redundancy is lost.

TABLE 3-1 Worked example — 52 kW of load

Step	Result
Load	52 kW
Modules for the load (N)	52 ÷ 15 = 3.47 → 4 modules
With 80 % margin	52 ÷ (15 × 0.8) = 4.33 → 5 modules
For N+1 redundancy	6 modules (90 kVA installed, RAD90-6X15)

✓ TIP Leave the free slots closed with their covers: you can add modules later, hot-swapped, as the load grows.

3.2 Planning the battery

RADIANT uses an external VRLA battery bank. The runtime depends on the load, the battery and the number of blocks. AEC sizes the battery for the runtime you need, from the makers' discharge data.

- Each string has an **even number of 12 V blocks, from 20 to 24** (20, 22 or 24), connected with a center tap: ±120 V to ±144 V DC. The factory setting is 20.
- The number of blocks per string and the capacity entered in **Set › BATT Set** must match the installed battery exactly.
- Battery life is best at 68–77 °F (20–25 °C). Plan the battery location for it.
- Allow space and floor loading for the battery: lead-acid batteries are heavy.
- Mount the battery breaker as close to the battery as possible, and keep the battery cables short.

3.3 Running on a generator

The PFC rectifier (input power factor 0.99) and the wide input window let the UPS run from a standby generator.

- As a general rule, choose a generator rated at least 1.5 times the UPS input power, to cover the battery recharge as well.

- A dry-contact input can tell the UPS that the generator runs (**Set › Dry Contact**, input IP3, Section 4.9.4), for example to limit the battery charge on the generator.
- Let the generator reach stable voltage and frequency before it feeds the UPS. The UPS stays on battery until the input is within range.

CHAPTER 4

04 Installation

Unpacking, the site and its working space, moving the frame, the modules, protective devices and cables for every build, the battery, control cables and parallel systems.

DANGER

Only authorized engineers may install and commission the UPS. Do not apply power to the UPS before the commissioning engineer arrives at the site.

WARNING · Battery hazards

The battery string is 240 V DC nominal and lethal. Wear eye protection, remove rings, watches and metal objects, use tools with insulated handles and rubber gloves. Replace a leaking battery and dispose of it according to local regulations.

4.1 Unpacking and inspection

1. While the frame is still on the truck, inspect it and the shipping container for damage or mishandling. If damage is apparent, do not install the system: file a claim with the carrier and notify AEC at once.
2. Check the product label: the UPS model, capacity and main parameters must match the order.
3. Check the contents against the bill of lading (Section 2.3) and report any missing item.

4.2 Site and environment

TABLE 4-1 Operating and storage environment

Item	Requirement
Location	Indoors; cool, dry, clean and ventilated; on a concrete or other non-combustible floor
Operating temperature	32–104 °F (0–40 °C); 68–77 °F (20–25 °C) for maximum battery life
Humidity	0–95 % RH, non-condensing
Altitude	Full power up to 9,800 ft (3,000 m); from 9,800 to 13,100 ft (3,000–4,000 m) derate the power by 2 % per 330 ft (100 m)
Protection · noise	IP20 · 64 dB at 100 % load, 62 dB at 55 % load, at 3.3 ft (1 m)
Floor	Rated for the weight: up to 390.5 lb (177.2 kg) for the frame with six modules, plus the battery
UPS storage and transport	−13 to 158 °F (−25 to 70 °C), indoors, dry
Battery storage	−4 to 86 °F (−20 to 30 °C); 68 °F (20 °C) is best. Recharge stored VRLA batteries as their maker requires (typically every 3–6 months)

NOTICE

- VRLA batteries give off small amounts of hydrogen and oxygen while charging. The battery room needs ventilation according to NFPA 70 Article 480 and IEEE 1635. Do not install batteries in a sealed room or cabinet.
- Battery life halves for each 18 °F (10 °C) above 77 °F (25 °C).
- Keep the battery away from heat sources such as transformers.

4.3 Working space and clearances

- **Front:** keep a working space of at least 36 in (914 mm) deep in front of the frame, at least 30 in (762 mm) wide or the width of the equipment, and 6.5 ft (1.98 m) high (NEC 110.26(A)). The doors must open fully.
- **Rear:** the power terminals are reached from the rear and the air leaves at the rear. Keep the rear accessible for wiring and service and clear for the air.
- **Top:** keep the top free for the air and for top cable entry.
- AEC has not published fixed minimum rear and top distances for this frame. Ask AEC for them when you plan the room, and use the larger of the AEC value and the NEC working space.

4.4 Moving and placing the frame

⚠ WARNING

Lifting equipment must be rated for the weight (Table 2-2). The frame stands on four casters: move it with care on a flat floor and lock the casters once it is in place. Install the power modules only after the frame is in its final place: they raise the weight and the center of gravity. On a raised floor, mount the frame on a pedestal designed for its point loading.

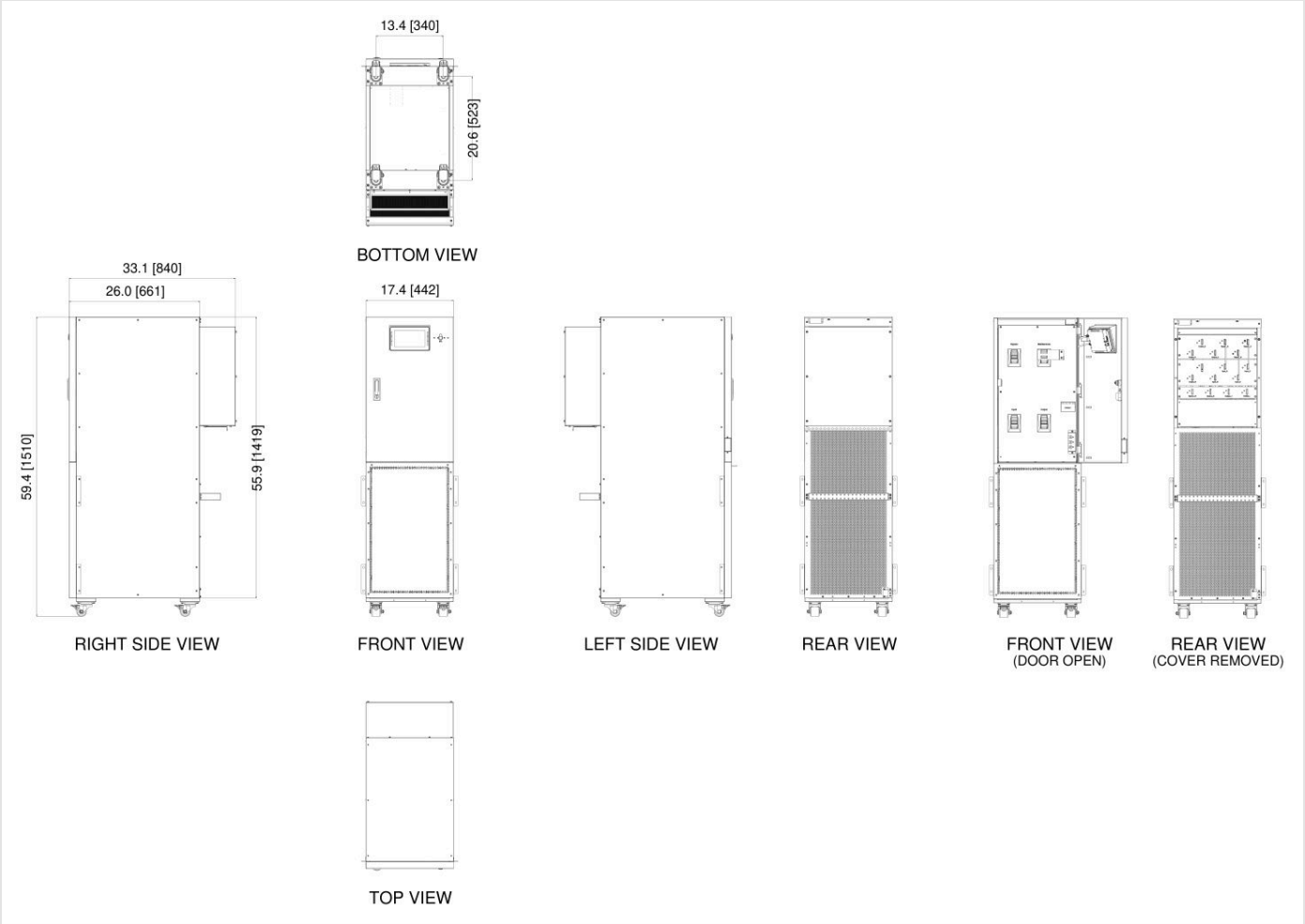


FIGURE 4-1 Appearance and dimensions, in inches [mm]: right side, front, left side, rear, front with the door open, rear with the cover removed, bottom and top

4.5 Installing the power modules

1. Remove the slot covers for the number of modules ordered.
2. Insert the modules from the bottom slot upward (No. 1 at the bottom, Figure 2-4), to keep the center of gravity low.
3. Push each module fully in and tighten its fixing screws (Figure 2-5, item 6).
4. Leave the empty slots closed with their covers.

4.6 External protective devices

Install breakers upstream of the UPS in the distribution panel, and a DC breaker in the battery circuit. Size them for your build with Table 4-2.

- The UPS is a continuous load. Size every overcurrent device at **125 % of the continuous current** (NEC 215.2, 215.3) and use the next standard rating (NEC 240.6).
- With a split bypass, the main input and the bypass input each need their own breaker, fed from sources with the same neutral.
- Use 3-pole breakers upstream; the neutral is not switched. Main input and bypass input must share the same neutral.

- Breakers with ground-fault (RCD) protection are not recommended on the UPS feeds. Where ground-fault monitoring is required, place it upstream of the common neutral bonding point, or monitor the combined four-wire input currents.
- The battery breaker is in the external battery cabinet. The UPS can trip it (BCB interface, Section 4.9.5).

TABLE 4-2 Currents and external breakers for each build — 208 V

Build	Modules	Max. input current	Rated bypass / output current	Max. battery current	Main input breaker	Bypass input breaker	Output breaker	Battery breaker (DC)
15 kVA	1	53 A	42 A	67 A	70 A, 3-pole	60 A, 3-pole	60 A, 3-pole	90 A
30 kVA	2	106 A	84 A	134 A	150 A, 3-pole	110 A, 3-pole	110 A, 3-pole	175 A
45 kVA	3	159 A	126 A	202 A	200 A, 3-pole	175 A, 3-pole	175 A, 3-pole	300 A
60 kVA	4	213 A	168 A	269 A	300 A, 3-pole	225 A, 3-pole	225 A, 3-pole	350 A
75 kVA	5	265 A	210 A	336 A	350 A, 3-pole	300 A, 3-pole	300 A, 3-pole	450 A
90 kVA	6	318 A	252 A	403 A	400 A, 3-pole	350 A, 3-pole	350 A, 3-pole	600 A

Currents at 208 V rated line voltage; at 220 V multiply by 0.95. The battery current is the maximum, at end of discharge. Each breaker is at least 125 % of the current, rounded up to a standard rating. If you plan to add modules later, size the breakers and cables for the final build. The maintenance bypass breaker in the frame is 315 A, 3-pole, for every build.

4.7 Power cables

DANGER

Failure to follow adequate grounding procedures can result in electric shock or fire. Connect the protective earth (PE) first.

TABLE 4-3 Minimum copper conductors for each build — 75 °C, NEC Table 310.16

Build	Main input A, B, C, N	Bypass input and output A, B, C, N	Battery +, N, –	Equipment grounding (PE)
15 kVA	4 AWG [21.2 mm²]	6 AWG [13.3 mm²]	3 AWG [26.7 mm²]	8 AWG [8.4 mm²]
30 kVA	1/0 AWG [53.5 mm²]	2 AWG [33.6 mm²]	2/0 AWG [67.4 mm²]	6 AWG [13.3 mm²]
45 kVA	3/0 AWG [85 mm²]	2/0 AWG [67.4 mm²]	350 kcmil [177 mm²]	4 AWG [21.2 mm²]
60 kVA	350 kcmil [177 mm²]	4/0 AWG [107 mm²]	500 kcmil [253 mm²]	3 AWG [26.7 mm²]
75 kVA	500 kcmil [253 mm²]	350 kcmil [177 mm²]	2 × 4/0 AWG [2 × 107 mm²]	2 AWG [33.6 mm²]
90 kVA	600 kcmil or 2 × 3/0 AWG [304 or 2 × 85 mm²]	500 kcmil [253 mm²]	2 × 350 kcmil [2 × 177 mm²]	1/0 AWG [53.5 mm²]

- Each conductor has an ampacity at 75 °C (NEC 110.14(C)) at least equal to the rating of its breaker in Table 4-2. The grounding conductor follows NEC 250.122 for the largest upstream device.
- The sizes are for copper, up to three current-carrying conductors in a raceway and 86 °F (30 °C) ambient. Correct them for other conditions (NEC 310.15).
- Keep the voltage drop below 3 % on AC runs and 1 % on the battery run: AC runs longer than about 164 ft (50 m) and battery runs longer than about 98 ft (30 m) need larger conductors.
- Size the neutral 1.5 to 1.7 times the phase conductor for mainly non-linear loads (the output neutral carries up to 170 %).
- All terminals are M12 studs: torque 248 lb-in (28 N·m). Use crimped ring lugs (one per stud, or a two-hole lug pair where two conductors per pole are needed).

4.7.1 Terminal block and wire order

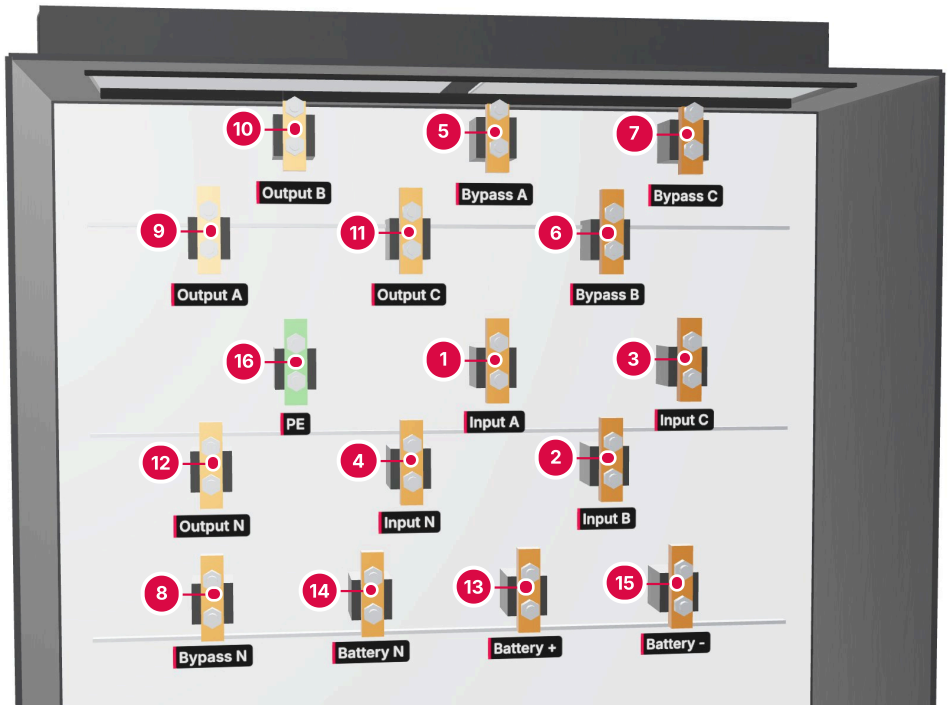
Remove the rear protective cover to reach the terminals (Figure 4-5). Each terminal is a busbar stud with its name printed beside it.

The terminal box is at the top of the rear of the frame (Figure 4-2). Figure 4-3 numbers every terminal, and Table 4-4 gives the stud, the torque and the conductor sizes for each group.



1	Terminal box with the rear protective cover: power terminals behind it
2	Cable entry plates (top entry)
3	Rear grille: air out
4	Casters

FIGURE 4-2 Where the power terminals are — rear of the frame



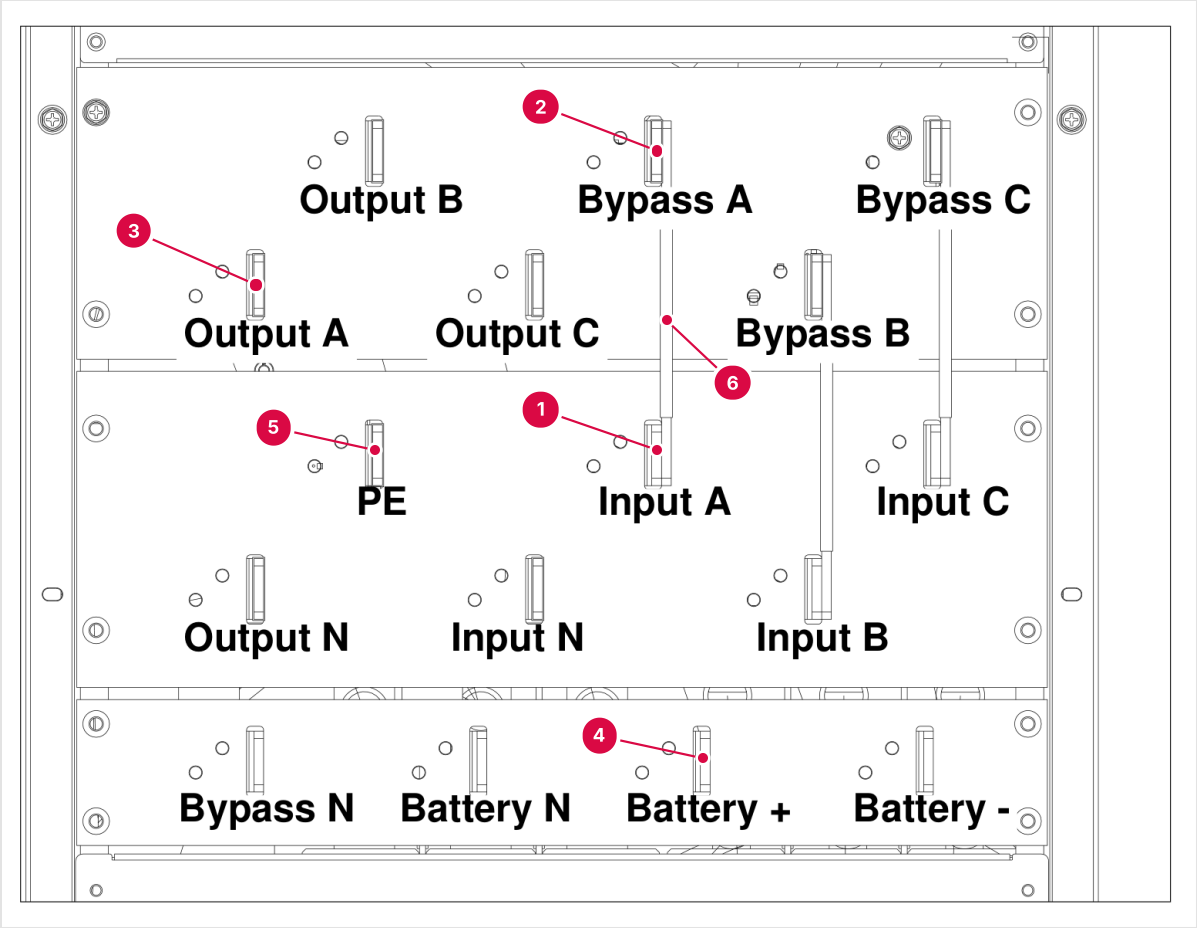
1	Input A (L1)	9	Output A (L1)
2	Input B (L2)	10	Output B (L2)
3	Input C (L3)	11	Output C (L3)
4	Input N	12	Output N
5	Bypass A (L1)	13	Battery +
6	Bypass B (L2)	14	Battery N
7	Bypass C (L3)	15	Battery –
8	Bypass N	16	PE (protective earth): connect first

FIGURE 4-3 Illustration: the power terminals, rear view with the cover removed — every terminal numbered

TABLE 4-4 Terminal data

Terminal (Figure 4-3)	Stud	Torque	Wire, min. (15 kVA build)	Wire, max. (90 kVA build, NEC size)	Lug
Input A, B, C, N (1–4)	M12	248 lb-in (28 N·m)	4 AWG [21.2 mm²]	600 kcmil or 2 × 3/0 AWG [304 or 2 × 85 mm²]	Crimped ring lug
Bypass A, B, C, N (5–8)	M12	248 lb-in (28 N·m)	6 AWG [13.3 mm²]	500 kcmil [253 mm²]	Crimped ring lug
Output A, B, C, N (9–12)	M12	248 lb-in (28 N·m)	6 AWG [13.3 mm²]	500 kcmil [253 mm²]	Crimped ring lug
Battery +, N, – (13–15)	M12	248 lb-in (28 N·m)	3 AWG [26.7 mm²]	2 × 350 kcmil [2 × 177 mm²]	Crimped ring lug
PE (16)	M12	248 lb-in (28 N·m)	8 AWG [8.4 mm²]	1/0 AWG [53.5 mm²]	Crimped ring lug

The wire sizes are the minimum copper conductors of Table 4-3 for the smallest and the largest build. Use one lug per stud, or a two-hole lug pair where two conductors per pole are needed. The smallest and largest conductor and lug the studs accept: ask AEC.

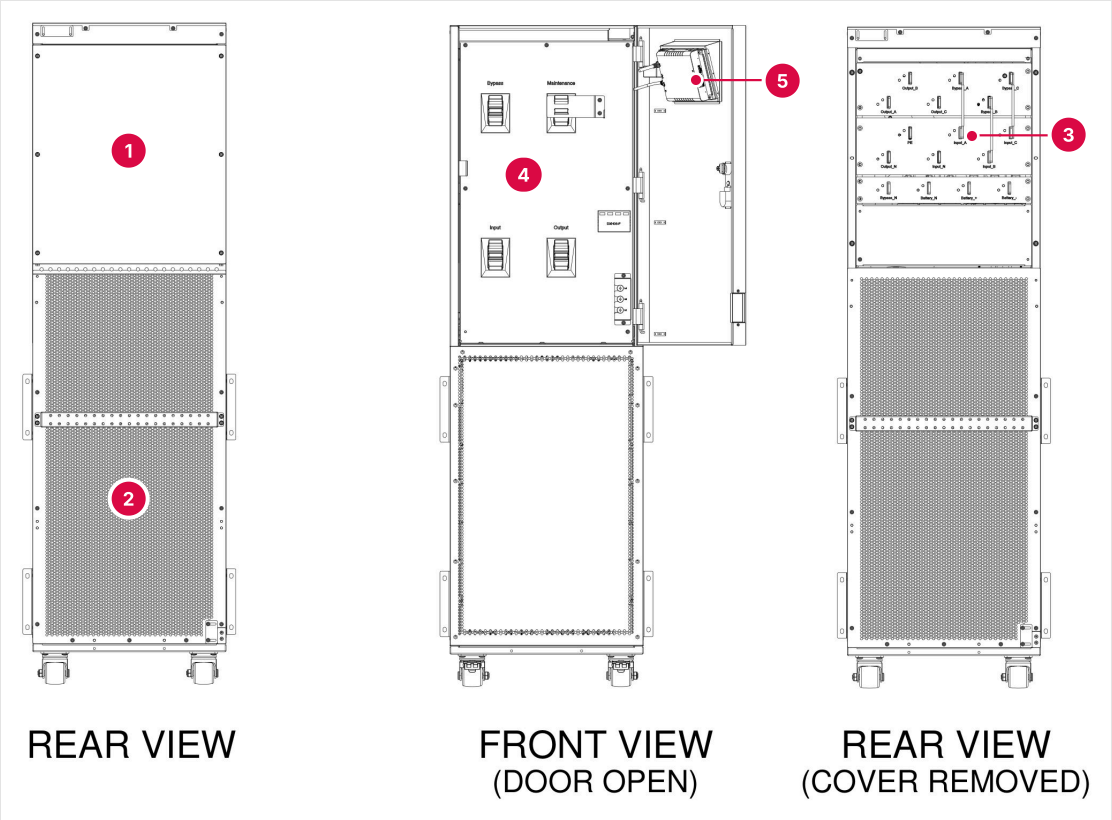


1. **Main input** — Input A, Input B, Input C, Input N: utility L1, L2, L3 and neutral to the rectifiers
2. **Bypass input** — Bypass A, Bypass B, Bypass C, Bypass N: bypass supply L1, L2, L3 and neutral
3. **Output** — Output A, Output B, Output C, Output N: to the load panel
4. **Battery** — Battery +, Battery N, Battery –: to the external battery breaker
5. **PE** — protective earth: connect first
6. Copper links Bypass A–Input A, B–B, C–C: they join the two inputs for a single (common) supply. Remove them only for a split bypass.

FIGURE 4-4 Power terminals, rear view with the terminal cover removed

TABLE 4-5 Wire order

Terminal group	Order (left to right on the cable)	Notes
Main input	A (L1) · B (L2) · C (L3) · N	Clockwise phase rotation A-B-C.
Bypass input	A (L1) · B (L2) · C (L3) · N	Same phase rotation as the main input, or the UPS alarms Bypass Sequence Error. Same neutral as the main input.
Output	A (L1) · B (L2) · C (L3) · N	208 V line to line, 120 V line to neutral.
Battery	+ · N · –	+ to the positive end of the string, N to the center tap, – to the negative end (Figure 4-6). Check polarity with a voltmeter.
PE	PE	Protective earth, first on and last off.



1. Rear cover over the power terminals (top of the rear)
2. Rear grille: air out
3. Power terminals, cover removed (Figure 4-4)
4. Breaker panel behind the upper door (Figure 2-2)
5. Back of the touchscreen, inside the upper door

FIGURE 4-5 Rear view, front with the upper door open, and rear with the terminal cover removed

Cable entry. Cables enter at the rear terminal area, from the top or the bottom, through the removable cover plates. For bottom entry fit the rubber cable protector in the entry hole first. Fix the cables as shown on the rear panel so the ventilation stays clear. Close any remaining opening against rodents.

Connection sequence

1. Confirm that every upstream breaker and every breaker in the frame is open (Figure 5-1, state A). Lock them out and hang warning signs on them.
2. Remove the rear protective cover to reach the input, output, battery and earth terminals.
3. Connect the protective earth (PE) conductor first (Figure 4-4, item 5).
4. Connect the main input cables to Input A, B, C, N and the load cables to Output A, B, C, N. With a split bypass, remove the links (item 6) and connect the bypass cables to Bypass A, B, C, N.
5. Connect the battery cables to Battery +, N and −. The external battery must have its own breaker; leave it open.
6. Tighten every lug to 248 lb-in (28 N·m), check the wiring, then refit the protective cover.

4.8 Battery

The battery bank is external: VRLA, 20 to 24 blocks of 12 V per string (an even number; 20 is the factory setting), connected as a split string with a center tap: ±120 to ±144 V DC (+, N, –). The battery cabinet has its own breaker.

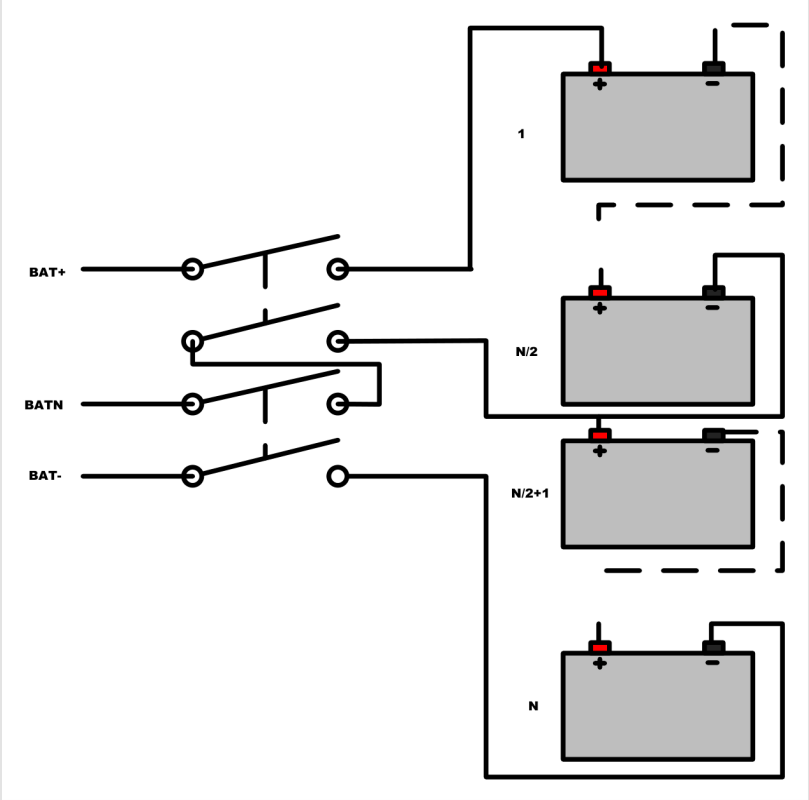


FIGURE 4-6 Battery string connection: blocks 1 to N/2 between BAT+ and BATN, blocks N/2+1 to N between BATN and BAT–, through the battery breaker

⚠ WARNING

- Do not connect the battery cables to the UPS and do not close the battery breaker before the commissioning engineer allows it.
- Disconnect the charging power before you connect or disconnect the battery terminals. Connect the breaker end of each cable first.
- Check the polarity of every connection and the total string voltage with a voltmeter before you close the breaker. Reversed polarity can cause explosion, fire, and damage to the battery and the UPS.
- Use the same type, capacity and age of block throughout. The number of blocks set in **Set › BATT Set** must equal the number installed.
- Do not connect any conductor across the positive and negative terminals of a battery. Keep the battery terminals free from cable tension or twist.

- Install the battery in a locked cabinet or a battery room open only to qualified service personnel.
- Keep at least 0.4 in (10 mm) free on all vertical sides of each block, and space above for measuring.
- Install the blocks from the bottom shelf upward. Fix them against vibration.
- Bend battery cables no tighter than 10 times their outer diameter. Do not cross or bundle the battery cables.
- Where two bare live parts would be more than 150 V apart, use insulated terminal covers and insulated cables.

- Tighten the block terminals to the battery maker's torque and insulate each terminal once connected.
- Check that the battery is not accidentally grounded. After start-up, measure the battery voltage and calibrate it on the touchscreen (Section 6.6).

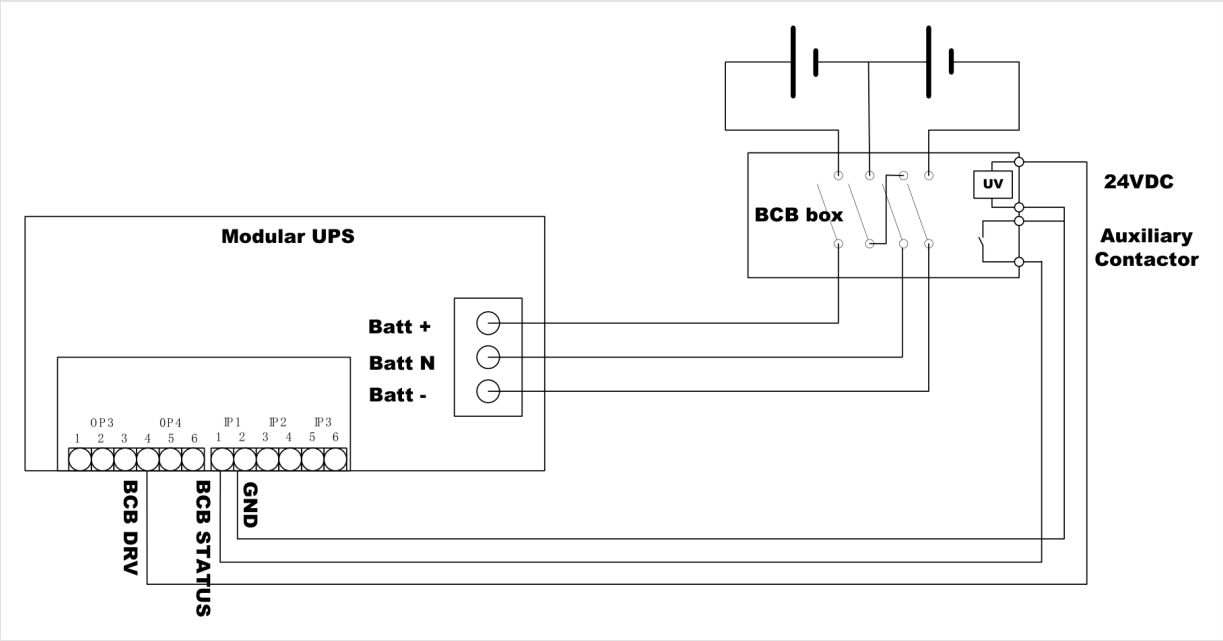
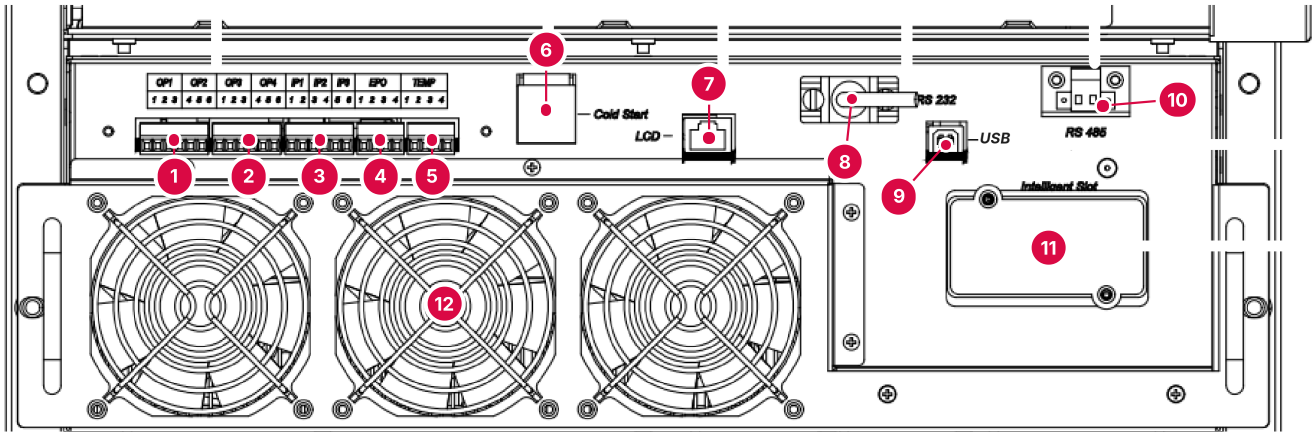


FIGURE 4-7 External battery breaker (BCB) wiring: power cables to Batt +, N, –; trip coil (UV) on OP4-4 BCB DRV; auxiliary contact on IP1 BCB STATUS and GND

4.9 Control and communication cables

The communication panel is on the front of the bypass module (Figure 2-4, item 1). It holds the dry-contact board, the cold-start button, the touchscreen port, RS-232, RS-485, USB and the intelligent slot for the network card. The parallel ports are on the parallel board.



1. OP1 · OP2: battery-low and general alarm relays
2. OP3 · OP4: utility-fail relay and battery breaker trip (BCB DRV)
3. IP1 · IP2 · IP3: BCB status, BCB online, generator input
4. EPO: remote emergency power off input
5. TEMP: ambient and battery temperature sensors
6. Cold-start button (start on battery)
7. LCD: cable to the touchscreen (RJ45) — not a network port
8. RS-232 port (DB9)
9. USB port
10. RS-485 port (terminal)
11. Intelligent slot: SNMP-M network card
12. Fans of the bypass module

FIGURE 4-8 Communication panel on the front of the bypass module

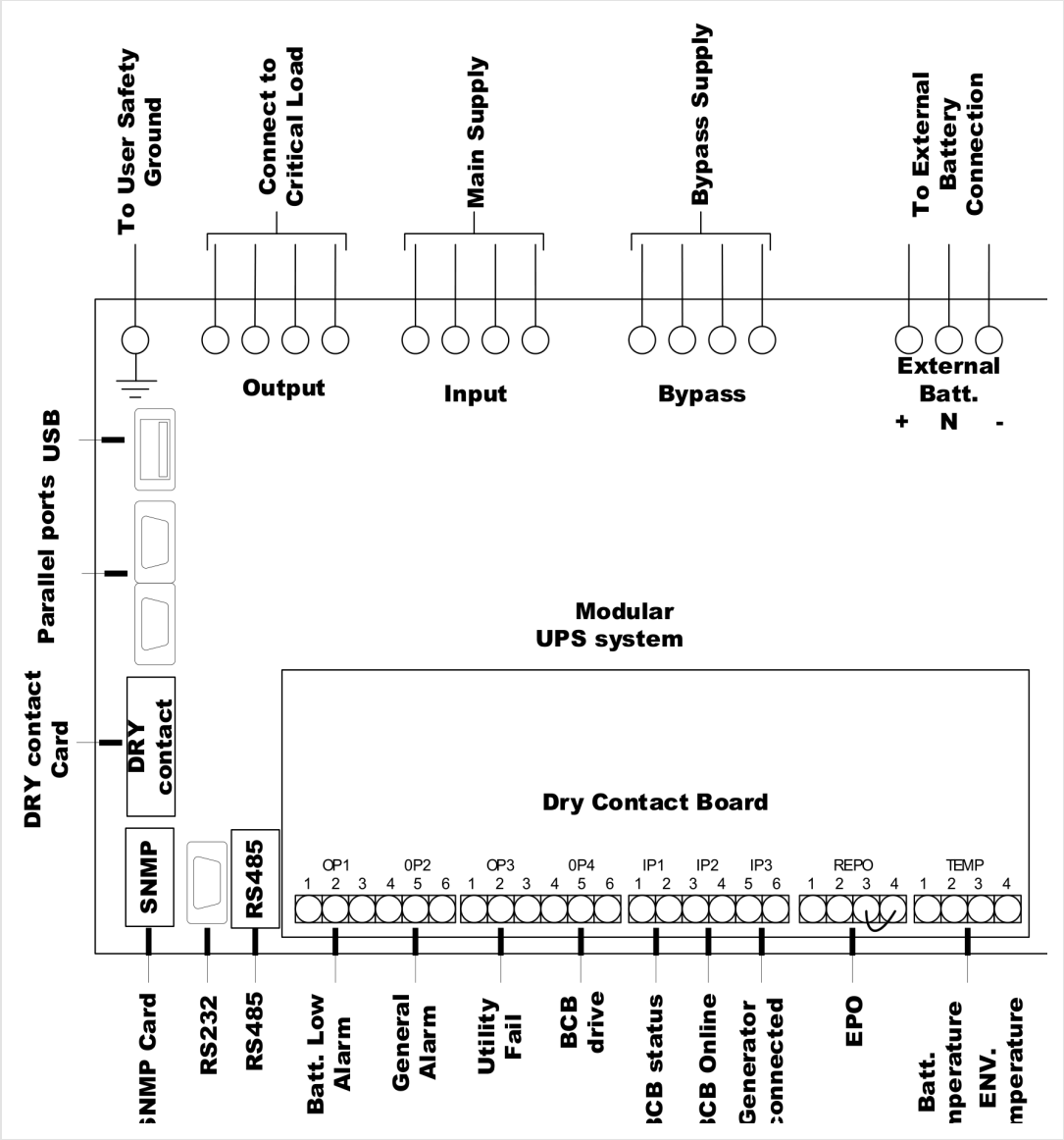


FIGURE 4-9 Wiring diagram: power terminals, ports and the dry-contact board with the function of each terminal

4.9.1 Dry-contact board

The dry-contact board has five groups of terminals. The functions in Table 4-6 are the factory defaults; the inputs and outputs can be set to other functions in **Set › Dry Contact** (Figure 6-12) or with the monitoring software.

TABLE 4-6 Dry-contact board

Terminal	Signal	Function (default)
EPO-1	REMOTE EPO NO	EPO when shorted to EPO-2
EPO-2 · EPO-3	+24V DRY	+24 V
EPO-4	REMOTE EPO NC	EPO when disconnected from EPO-3
TEMP-1	ENV TEMP	Ambient temperature sensor
TEMP-2 · TEMP-3	TEMP COM	Temperature sensor common

Terminal	Signal	Function (default)
TEMP-4	BAT TEMP	Battery temperature sensor
IP1-1 · IP1-2	BCB STATUS · GND	Battery breaker status (normally-open auxiliary contact of the BCB). If BCB status is not valid, the UPS reports the battery as not connected.
IP2-3 · IP2-4	BCB ONLINE · GND	Battery breaker online (normally-open auxiliary contact of the BCB)
IP3-5 · IP3-6	GEN CONNECTED · +24V	Generator connected (input)
OP1-1 · OP1-2 · OP1-3	BAT LOW NC · NO · common	Battery low alarm relay
OP2-4 · OP2-5 · OP2-6	GENERAL ALARM NC · NO · common	General alarm relay
OP3-1 · OP3-2 · OP3-3	UTILITY FAIL NC · NO · common	Utility failure alarm relay
OP4-4 · OP4-5 · OP4-6	BCB DRV · GND · +24V	Battery breaker trip output, 24 V, max. 100 mA (at EOD or EPO)

A relay NC contact opens when the alarm occurs; the NO contact closes.

4.9.2 Remote EPO

In normal operation EPO-3 and EPO-4 are linked and EPO-1 and EPO-2 are open. Opening EPO-3/EPO-4, or closing EPO-1/EPO-2, triggers the emergency power off. A remote EPO switch must be a voltage-free normally-open or normally-closed contact; the open-circuit voltage is 24 V DC and the current below 20 mA. Enable the remote EPO function with the monitoring software before you use it.

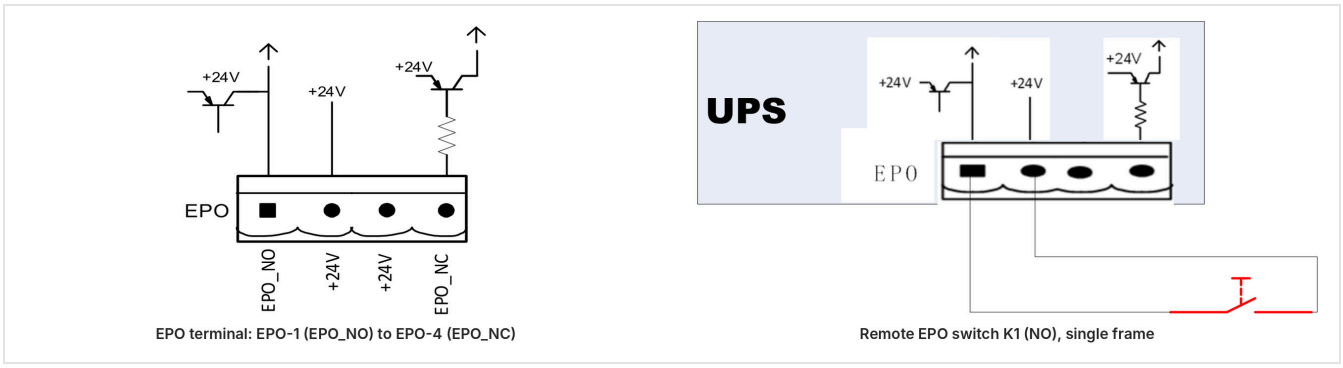


FIGURE 4-10 EPO terminal (left) and remote EPO with a normally-open switch K1 on a single frame (right)

4.9.3 Temperature sensors

TEMP-1 and TEMP-4 take the ambient and the battery temperature sensor; TEMP-2 and TEMP-3 are their common. The battery sensor drives the charge temperature compensation. The sensors are specific to the UPS (R25 = 5 kΩ, B25/50 = 3275): order them from AEC.

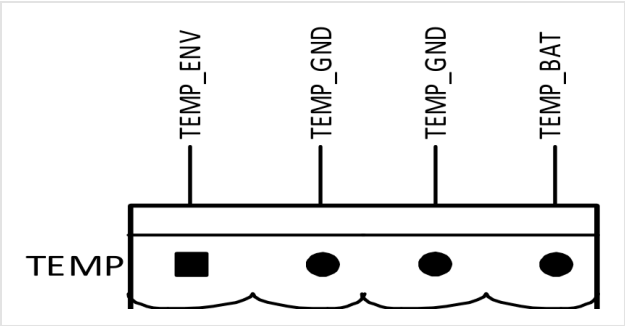


FIGURE 4-11 Temperature sensor terminal TEMP-1 to TEMP-4

4.9.4 Generator input

Wire a normally-open auxiliary contact of the generator between IP3-5 (GEN) and IP3-6 (+24 V). The contact closes when the generator feeds the UPS.

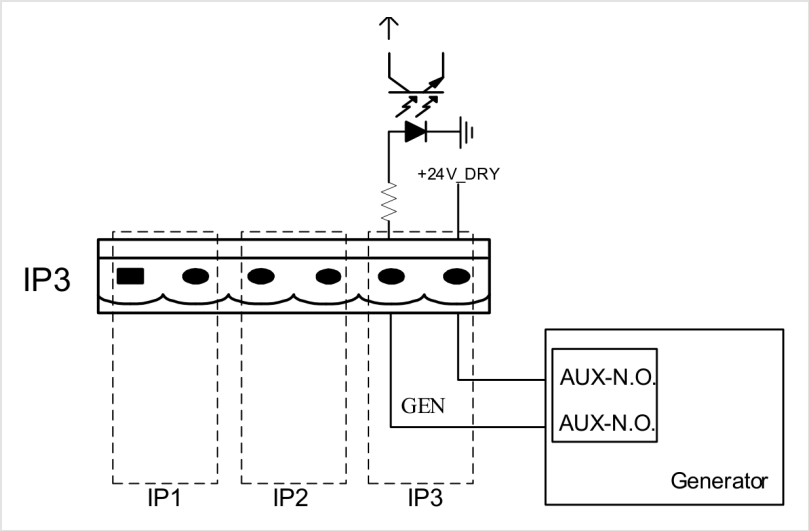


FIGURE 4-12 Generator input on IP3

4.9.5 Battery breaker interface (BCB)

IP1 and IP2 read the auxiliary contacts of the battery breaker; OP4-4 (BCB DRV, 24 V, max. 100 mA) trips it at end of discharge or on EPO. Figure 4-7 shows the complete wiring.

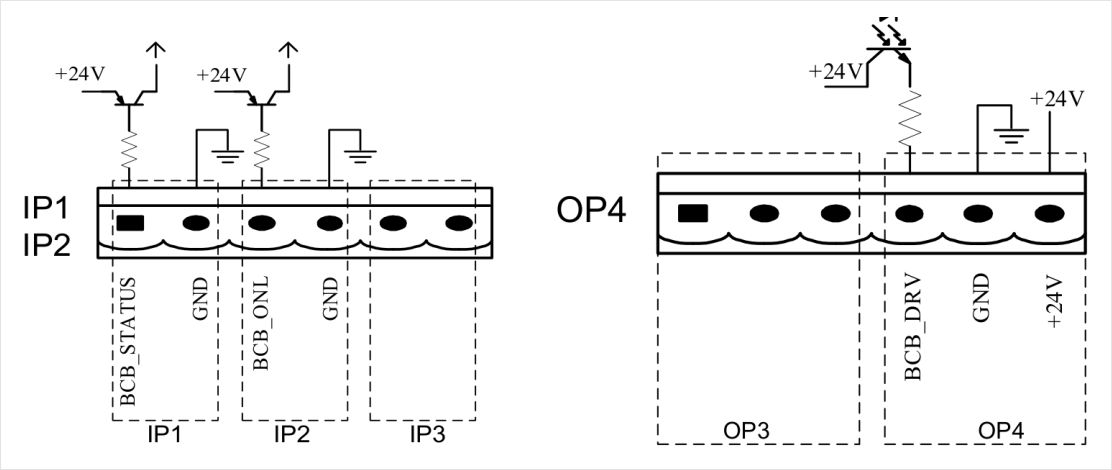


FIGURE 4-13 BCB interface: IP1 BCB_STATUS · GND, IP2 BCB_ONL · GND, OP4 BCB_DRV · GND · +24V

4.9.6 Alarm relays

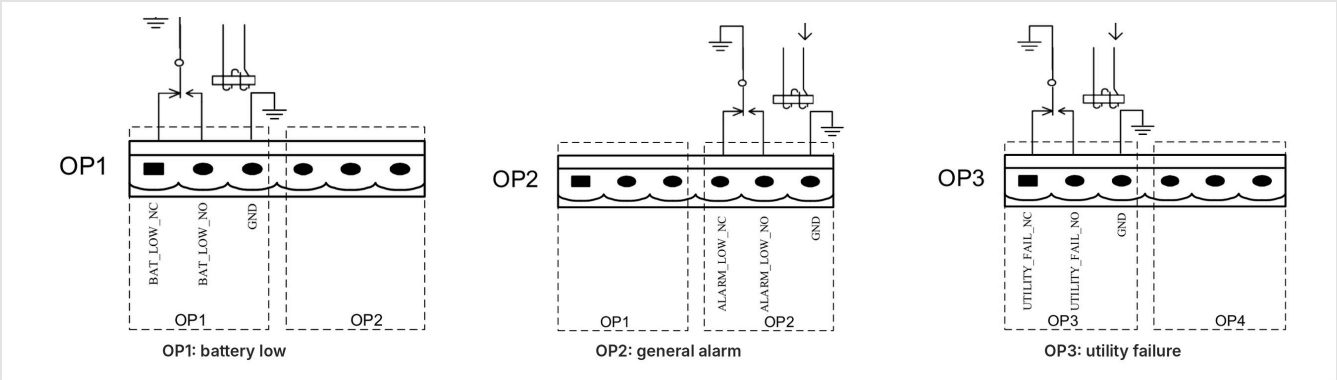


FIGURE 4-14 Alarm relays OP1 (battery low, OP1-1 to OP1-3), OP2 (general alarm, OP2-4 to OP2-6) and OP3 (utility failure, OP3-1 to OP3-3)

4.9.7 Serial ports and network card

- **RS-232** (Figure 4-8, item 8): to a PC with UPS View, or to a building system (Modbus). Pin 2 TXD, pin 3 RXD, pin 5 GND.
- **RS-485** (item 10) and **USB** (item 9): Modbus or UPS View; they share one setting in **Set › Comm Set**.
- **Intelligent slot** (item 11): the SNMP-M network card (Section 8.1).
- Run the communication cables from the front of the frame, away from the power cables.

4.10 Parallel system

Up to four RADIANT frames of the same rating can run in parallel, as 1+1 (two frames) or N+1, for redundancy or capacity. The total load is shared equally and can be read on each frame. The installation of each frame is that of a single unit, plus:

- All frames must have the same rating and be connected to the same bypass source. The bypass and main inputs must share the same neutral.
- Connect the outputs of all frames to a common output bus. Keep the input and output cables of all frames of the same length and size, so that the load shares equally in bypass mode.
- Install an external maintenance bypass for the whole system (Figure 4-18), so that each frame can be isolated.
- Any ground-fault device must be upstream of the common neutral bonding point.
- Fit at least one redundant power module in each frame.

- Connect the parallel boards with the shielded, double-insulated DB15 parallel cables in a closed ring.
- Wire the EPO of all frames to the same remote switch (Figure 4-17).
- Set the system mode and the IDs on each frame as described in Appendix A.

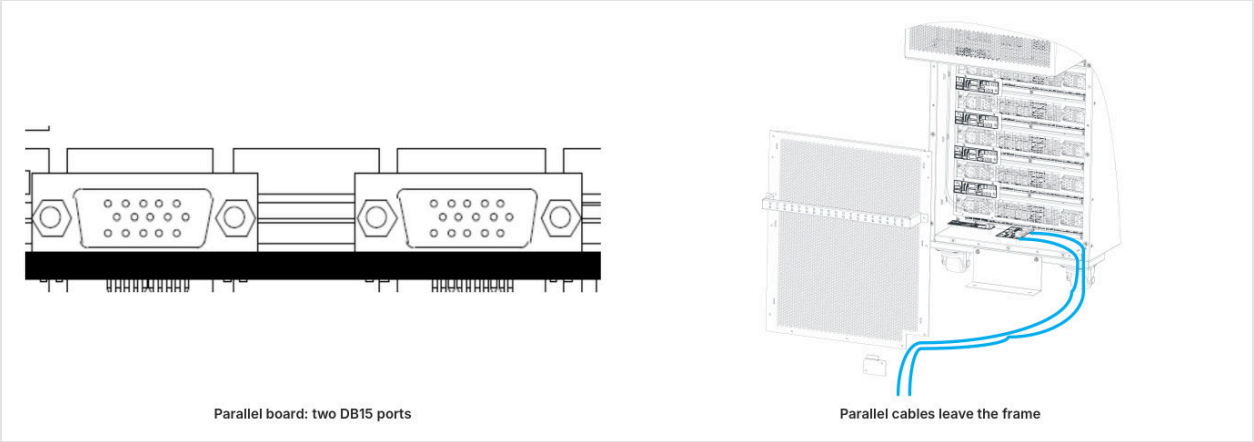


FIGURE 4-15 The parallel board and the parallel cables leaving the frame

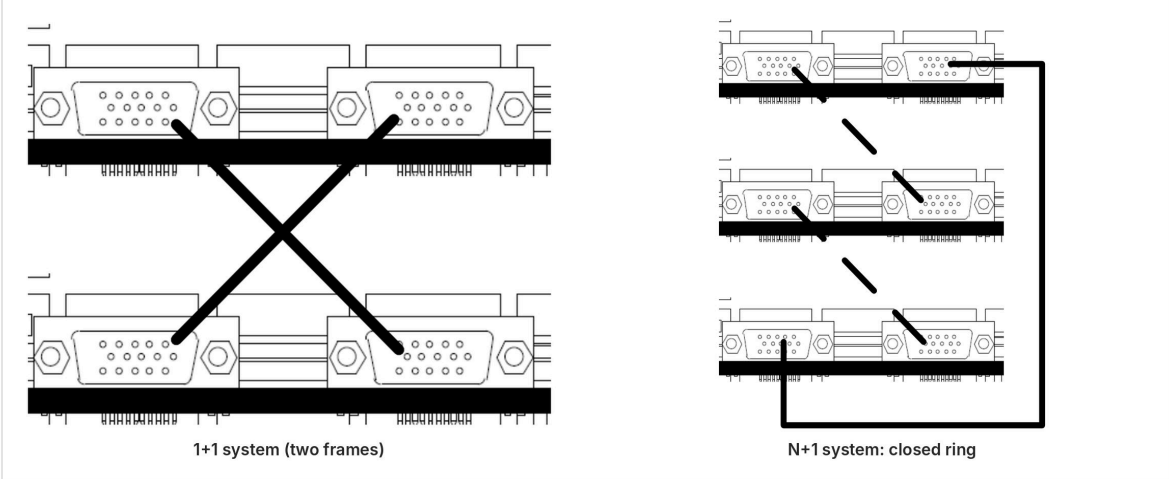


FIGURE 4-16 Parallel cables, 1+1 system (left) and N+1 system, a closed ring through every frame (right)

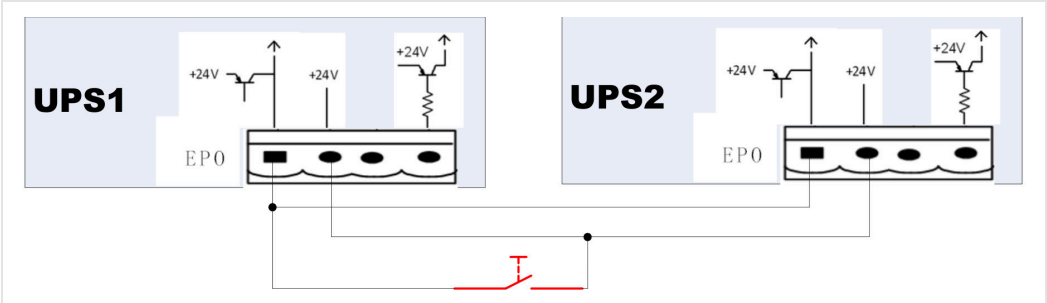


FIGURE 4-17 One remote EPO switch for two frames in parallel

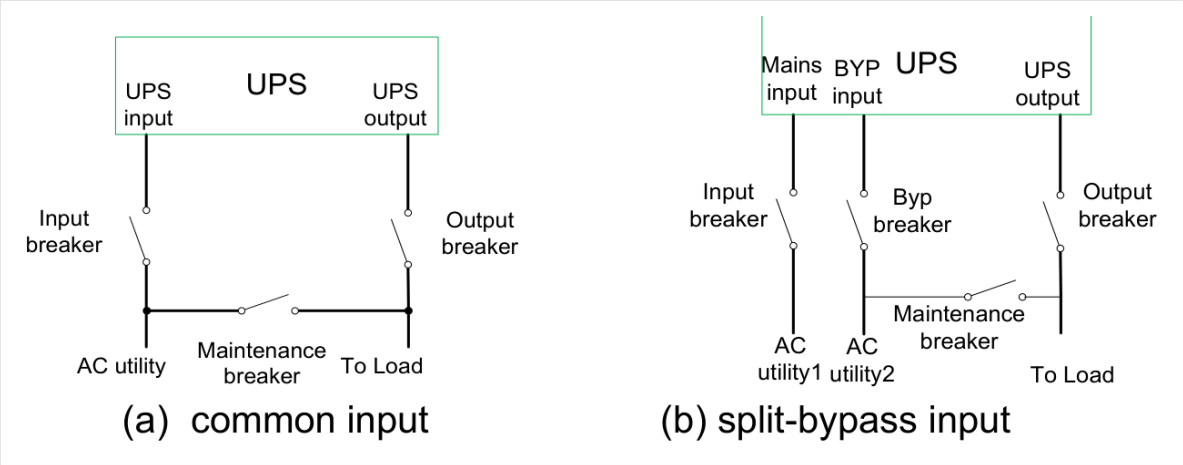


FIGURE 4-18 External maintenance bypass: (a) common input, (b) split-bypass input

i NOTE The parallel board has jumpers that depend on the number of frames. AEC service sets them at commissioning.

4.11 Installation checklist

- ☐ The frame stands on its locked casters with the working space of Section 4.3.
- ☐ The power modules are fitted from the bottom slot up; empty slots are closed.
- ☐ Upstream breakers and conductors match Table 4-2 and Table 4-3 for the final build; PE connected first; torque 248 lb-in.
- ☐ Phase rotation of main and bypass input checked; links removed only for a split bypass.
- ☐ Battery polarity and string voltage checked; the battery breaker stays open until commissioning.
- ☐ EPO, sensors, dry contacts, network card and (parallel systems) parallel cables connected.
- ☐ The commissioning engineer is booked: power is applied only in his presence.

CHAPTER 5

05 Operation

Starting, stopping and transferring the UPS, the maintenance bypass, EPO, replacing a power module, and the battery test — with the breaker positions for each step.

DANGER

Hazardous utility and battery voltage is present behind the protective covers. Only qualified service personnel may remove them.

5.1 Operation at a glance

TABLE 5-1 Operation at a glance

To	Do this
Start from fully off	Close bypass, output and main input breakers; the inverters start by themselves; close the battery breaker (Section 5.2)
Start without utility (cold start)	Cold-start button on the bypass module, then the cold-start button of each power module (Section 5.3)
Load to bypass and back	**Control › Function › Manual Bypass**, then **Ecs Manual Bypass** (Section 5.4)
Service the modules with the load on	Maintenance bypass (Section 5.5)
Service the whole frame with the load on	Isolate the frame on the maintenance bypass (Section 5.6)
Switch everything off	EPO, then open the battery and all breakers (Section 5.7)
Emergency	EPO button (Section 5.8)

5.1.1 Breaker positions

The procedures refer to these breaker states. The battery breaker is in the battery cabinet and is given in the text.

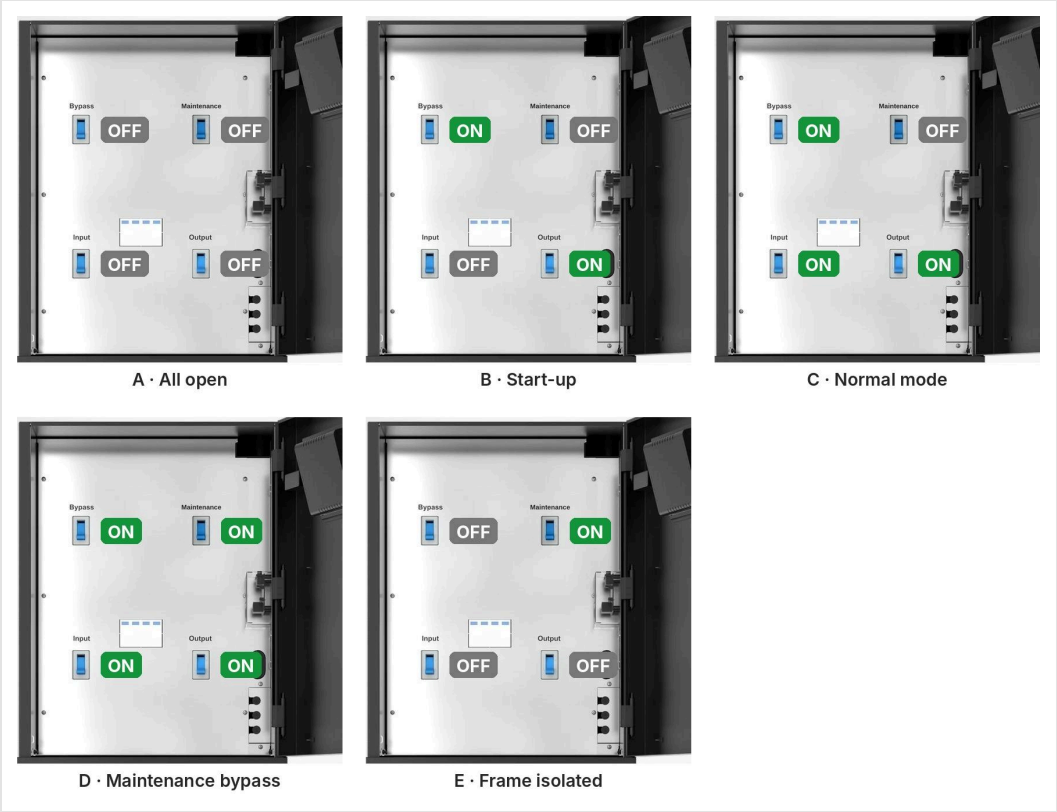


FIGURE 5-1 Breaker states A to E used in the procedures — green ON, gray OFF

5.2 Starting the UPS from fully off

> ⚠ ***WARNING***
>
> During this procedure the output terminals become live. If loads are connected, check with their users that it is safe to apply power; otherwise isolate them from the UPS output.

1. Check that all breakers are open (Figure 5-1, state A) and that the cables are connected with the correct phase rotation.
2. Close the **Bypass** breaker and the **Output** breaker in the frame (Figure 5-1, state B), and the external output breaker.
3. Close the external main input breaker, then the **Input** breaker in the frame (Figure 5-1, state C). You see: the touchscreen starts; the rectifiers start and, after initialization, the static bypass feeds the load.
4. Wait: the inverters start by themselves. After about one minute the UPS transfers from bypass to inverter. You see: green indicator; on the home page the energy flow runs from the main input through rectifier and inverter to the output (Figure 6-2, item 5, and Figure 2-8).
5. Close the external battery breaker. A few minutes later the battery starts charging. You see: **Cabinet › Battery** shows the battery connected and charging (Figure 6-4).

5.3 Starting on battery (cold start)

Use the cold start when there is no utility and the load must run from the battery.

1. Make sure the battery string is connected and its breaker is closed, and that the **Output** breaker is closed.

2. Press the cold-start button on the communication panel of the bypass module (Figure 4-8, item 6) for about 1 s. You see: the touchscreen turns on.
3. Press the cold-start button on the front of a power module (Figure 2-5, item 2). You see: after about 2 minutes the module runs in battery mode (Figure 2-8).
4. Start the other power modules one by one in the same way.

5.4 Transferring to bypass and back

1. To bypass: **Control › Function › Manual Bypass** (Figure 6-20, item 3). The load is fed directly from the bypass input, not from the inverters.
2. Back to normal: **Control › Function › Ecs Manual Bypass** (item 4). When the inverters are ready the UPS transfers to normal mode.
3. If the bypass frequency is out of tracking range, use **Manual Transfer to Inverter** (item 2) instead. The output can be interrupted for more than 20 ms.

> ⚠ ***WARNING***
>
> In bypass mode the load is fed directly by the utility, not by the inverter, and is not protected.

5.5 Maintenance bypass

Use this procedure to service the power modules or the battery while the load stays on.

5.5.1 From normal mode to maintenance bypass

> ⚠ ***WARNING***
>
> Before you start, check on the touchscreen that the bypass is normal and the inverters are synchronized with it, so as not to interrupt the load.

1. Transfer the UPS to bypass: **Control › Function › Manual Bypass** (Figure 6-20, item 3). Silence the alarm with the speaker icon (Figure 6-2, item 7); the message stays until the condition ends.
2. Close the **Maintenance** breaker (Figure 5-1, state D). The maintenance bypass and the static bypass now feed the load together.
3. Enable the module keys (**Control › Function › Module Button Power Enable**, item 6), then press OFF on each power module.
4. Open the external battery breaker. The power modules can now be serviced.
5. To service the whole frame, continue with Section 5.6.

5.5.2 From maintenance bypass to normal mode

1. Check that the **Bypass**, **Input** and **Output** breakers are closed (Figure 5-1, state D). You see: the touchscreen starts; after about 20 s the rectifiers run and the static bypass feeds the load.
2. Check on the touchscreen that the static bypass feeds the load (energy flow on the home page), then open the **Maintenance** breaker (Figure 5-1, state C).
3. If the load stays on bypass, select **Control › Function › Ecs Manual Bypass**. After about 60 s the UPS transfers to inverter.
4. Close the external battery breaker.

WARNING

Before you open the Maintenance breaker, make sure on the touchscreen that the static bypass is feeding the load. Otherwise the load drops.

DANGER

With the Maintenance breaker closed, parts of the UPS are still live. Before you remove a power module wait 10 minutes for its DC bus capacitors to discharge.

5.6 Isolating the frame on the maintenance bypass

Use this procedure to service the whole frame — bypass module and power modules — while the load runs on the maintenance bypass.

5.6.1 From normal mode to the isolated frame

1. Select **Control › Function › Manual Bypass**. The load transfers to the static bypass with an audible alarm, and the inverters stand by.
2. Close the **Maintenance** breaker (Figure 5-1, state D).
3. Enable the module keys, then press OFF on each power module.
4. Open the external battery breaker, or disconnect the battery.
5. Open the **Bypass**, **Input** and **Output** breakers in the frame (Figure 5-1, state E). The load is on the maintenance bypass (Figure 2-8); the touchscreen goes dark.

WARNING

Do not open the external input breaker that feeds the bypass input: the maintenance bypass is fed from it, and the output would be interrupted. With an external maintenance bypass (Figure 4-18), you can isolate the frame completely: close the external maintenance breaker, then open the external input and output breakers.

5.6.2 From the isolated frame back to normal mode

1. Close the **Output** and **Bypass** breakers. The static bypass turns on.
2. On the touchscreen, clear the alarms: **Control › Function › Fault Clear** (Figure 6-20, item 5).
3. Check that the static bypass feeds the load, then open the **Maintenance** breaker.
4. Close the **Input** breaker (Figure 5-1, state C). Select **Ecs Manual Bypass**: the UPS transfers to inverter after about 60 s.
5. Close the external battery breaker.

5.7 Shutting the UPS down completely

1. Shut down or transfer the loads.
2. Stop the output: press EPO on the front of the UPS (Figure 2-1, item 3). The rectifiers, inverters and bypass stop; nothing is fed to the load. To stop only the inverters and keep the load on the bypass, use **Control › Function › ON/OFF Control** instead.
3. Open the external battery breaker.

4. Open the **Bypass**, **Input** and **Output** breakers (Figure 5-1, state A), and the external breakers (with a split bypass, both input breakers).

5.8 Emergency power off (EPO)

Pressing EPO switches off the rectifiers, inverters and the bypass and stops the output at once; the battery stops charging and discharging. With utility present the controls stay powered but the output is off. To isolate the UPS completely, open the main input and battery breakers.

Restart after EPO. Shut the UPS down completely (Section 5.7), then start it as in Section 5.2. If the utility input was disconnected after the EPO, the EPO condition clears when the utility returns and the UPS restores the output on the static bypass.

> ⚠ ***WARNING***
>
> If the Maintenance breaker is closed and the utility is present, the output stays energized after EPO.

5.9 Automatic restart

On a utility failure the UPS runs from the battery until end of discharge (EOD), then shuts down. If auto recovery after EOD is enabled, it restarts by itself when the utility returns. After an over-temperature, overload or too many transfers, the UPS clears the fault by itself when the cause is gone; the rectifier restarts by itself when the over-temperature signal disappears.

5.10 Replacing a power module

Only trained operators may replace a power module.

With a redundant module (N+X) and the bypass normal

1. Select **Control › Function › Module Button Power Enable** (Figure 6-20, item 6): the modules' OFF key works.
2. Press OFF on the module (Figure 2-5, item 2). It leaves the system and the others carry the load.
3. Loosen the fixing screws and pull the module out by its handles after 5 minutes.
4. Insert the new module. Insert modules one at a time, at least 10 s apart. They join the system by themselves. Tighten the screws.

Without a redundant module

1. Transfer to bypass: **Control › Function › Manual Bypass**.
2. Loosen the screws and pull the module out after 5 minutes.
3. Insert the new module, tighten the screws, and return to normal mode with **Ecs Manual Bypass**.

> ⚠ ***WARNING***
>
> Measure the DC bus capacitor voltage of a removed module with a multimeter: it must be below 36 V before you handle it. The bypass module cannot be serviced in battery mode; its service is reserved to AEC service.

5.11 Battery test and maintenance

1. **Control › Test › Battery Test** (Figure 6-21, item 1): the UPS runs on battery for 20 seconds. A weak battery raises an alarm and the UPS returns to normal or bypass mode. Before the test, check that there is no alarm and that the battery voltage is above 90 % of the float voltage.

2. **Battery Maintain** (item 2): the battery is discharged down to 1.1 × the end-of-discharge voltage, then the UPS returns to normal mode. Conditions: battery in float for at least 5 hours, load 25–100 % of the rating.
3. **Stop Test** (item 3) ends a test or a maintenance discharge.
4. The commissioning engineer can set an automatic self-test every 720 to 3,000 hours.

5.12 Language, date and time

- **Language: Set › Language** (Figure 6-14). Choose English, Spanish, French, German, Italian, Portuguese, Russian, Polish, Czech, Catalan, Turkish, Korean or Chinese (simplified or traditional).
- **Date and time: Set › Sys Func** (Figure 6-14). Tap the date and time, enter the new values and press Set. Every log entry carries them.

06

CHAPTER 6

Touchscreen

The AEC color touchscreen: home page, cabinet and module readings, logs, settings, controls and waveforms.

i NOTE The screen pictures in this chapter were taken from a display not connected to a UPS: the readings are zero and "Communication Abnormal" is shown. Your screens show the live values.

6.1 Operator panel



1. Touchscreen, 7-inch color, 1024 × 600
2. Status indicator bars, left of the screen
3. Status indicator bars, right of the screen
4. EPO button

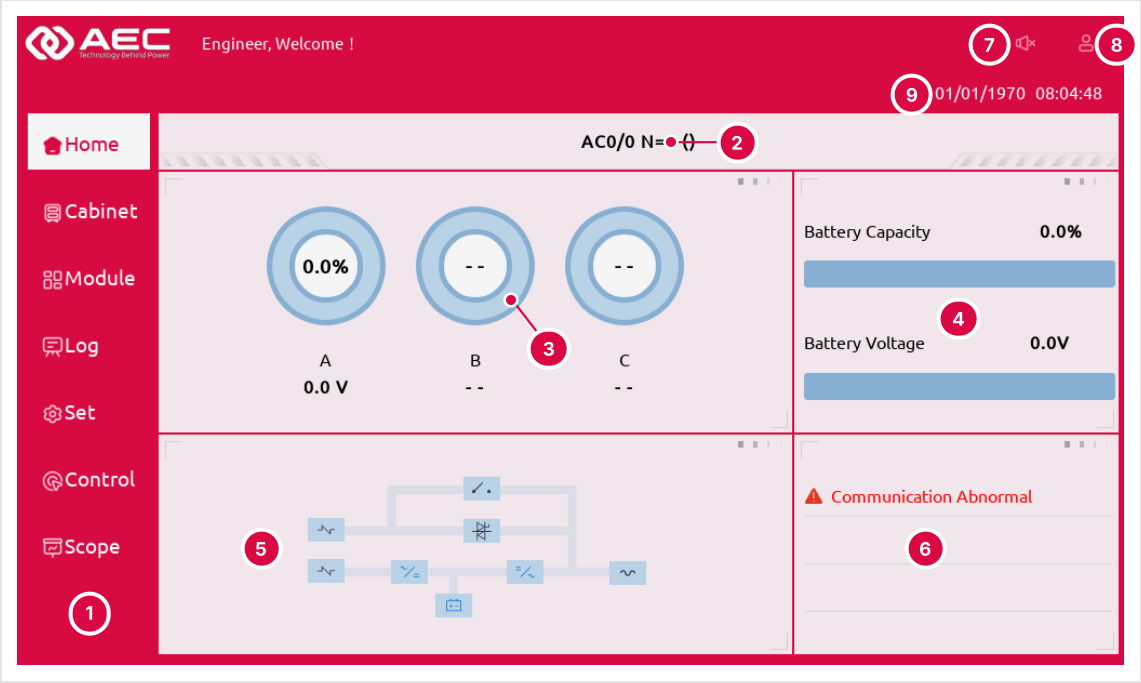
FIGURE 6-1 Operator panel on the upper door

The status indicators show the system status. The buzzer tells the kind of alarm. Press EPO to shut down the rectifier, inverter, charger and bypass in an emergency.

TABLE 6-1 Indicators and buzzer

Signal	Meaning
Green	System working normally
Yellow	System warning (utility failure, overload, etc.)
Red	System failure or fault
Two short beeps and one long beep	General alarm (for example utility input abnormal)
Continuous tone	Serious fault (for example a fuse or hardware fault)

6.2 Home page and main menu



1. Main menu: Home, Cabinet, Module, Log, Set, Control, Scope
2. Status bar: cabinet capacity / module capacity, number of modules (N = ...), single (S) or parallel (P) mode
3. Output voltage gauges, phases A, B, C
4. Battery capacity and battery voltage bars
5. Energy flow: bypass, maintenance bypass, main input, rectifier, inverter, battery, output
6. Warning information: red = serious alarm, orange = general alarm
7. Speaker icon: mute or unmute the alarm
8. User icon: log in or out
9. Date and time

FIGURE 6-2 Home page

The home page comes up after the welcome window. A dash instead of a value means that phase is not wired or not read.

⚠ CAUTION

Settings and controls are protected by login. AEC gives the login accounts to the owner and the commissioning engineer. Only authorized, trained personnel may change settings or use the Control menu.

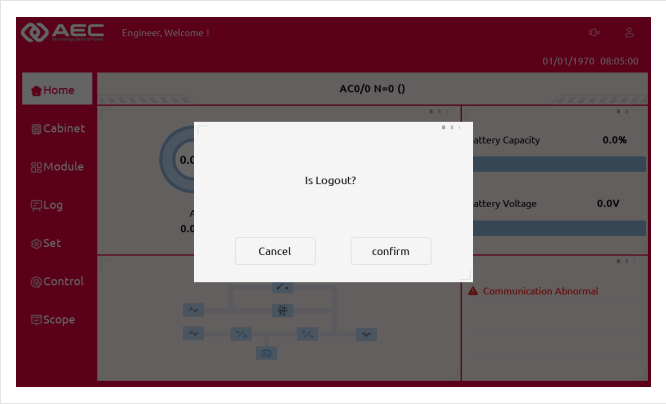
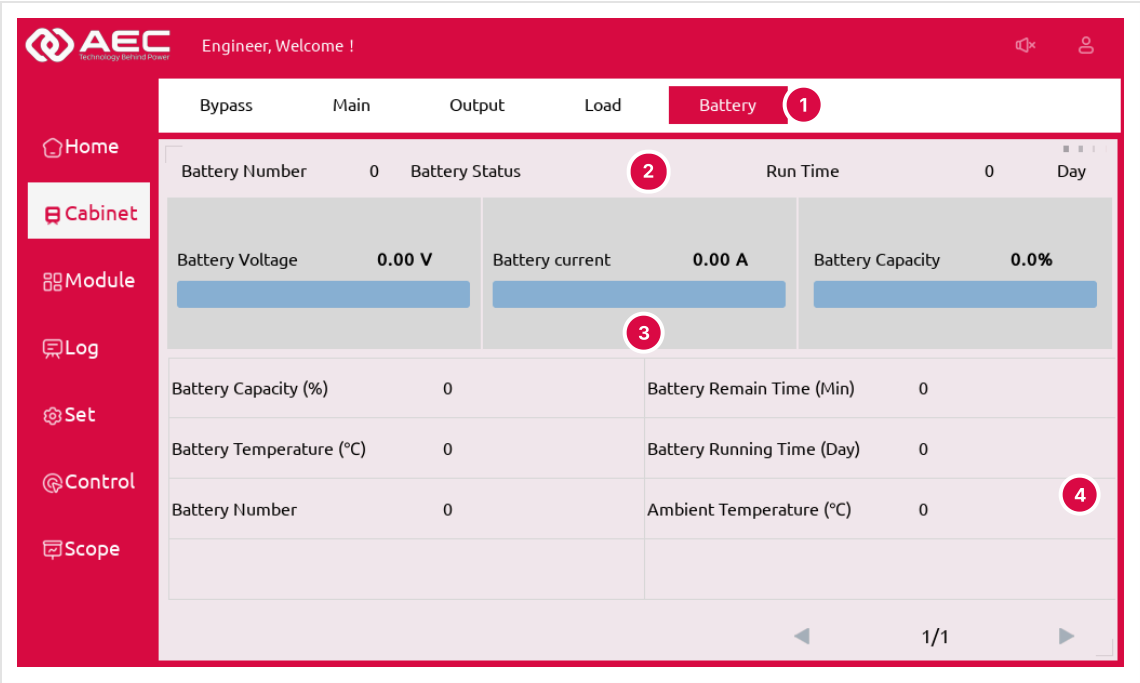


FIGURE 6-3 The user icon asks before it logs out

6.3 Cabinet (system readings)

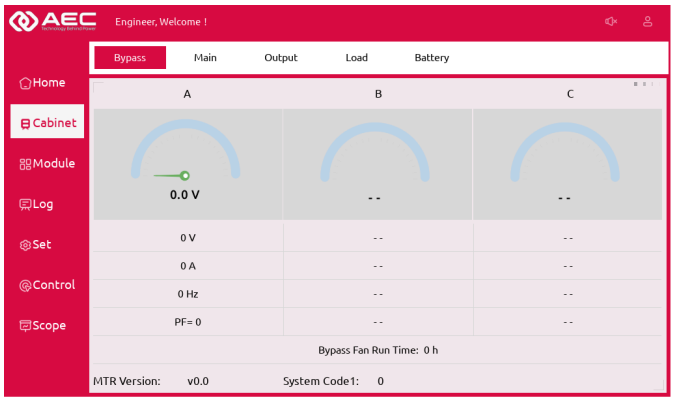
TABLE 6-2 Cabinet pages

Page	Shows
Bypass	Phase voltage (V), current (A), frequency (Hz) and power factor of the bypass; bypass fan running time.
Main	Phase voltage, current, frequency and power factor of the main input; rated input.
Output	Phase voltage, current, frequency and power factor of the output; rated output.
Load	Apparent power (kVA), active power (kW), reactive power (kVAr) and load (%) per phase.
Battery	Number of batteries per string, status (boost / float charge), run time, total voltage and current, capacity compared with a new battery (%), remaining time (min), battery and ambient temperature.

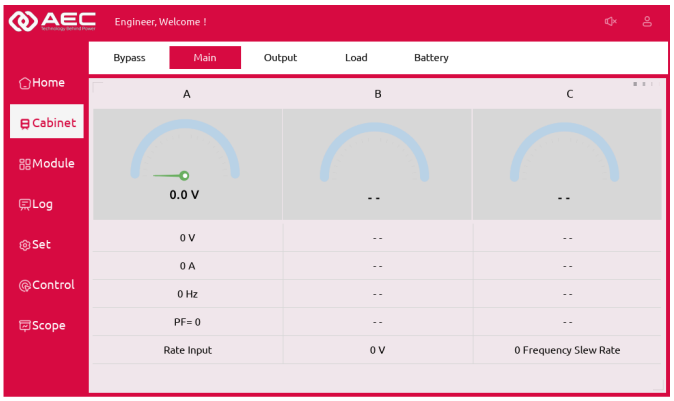


1. Cabinet tabs: Bypass, Main, Output, Load, Battery
2. Battery number per string, status (boost / float), run time
3. Battery voltage, current and capacity, positive and negative half
4. Capacity compared with a new battery, remaining time, battery and ambient temperature

FIGURE 6-4 Cabinet — Battery, the page to check after start-up and during an outage

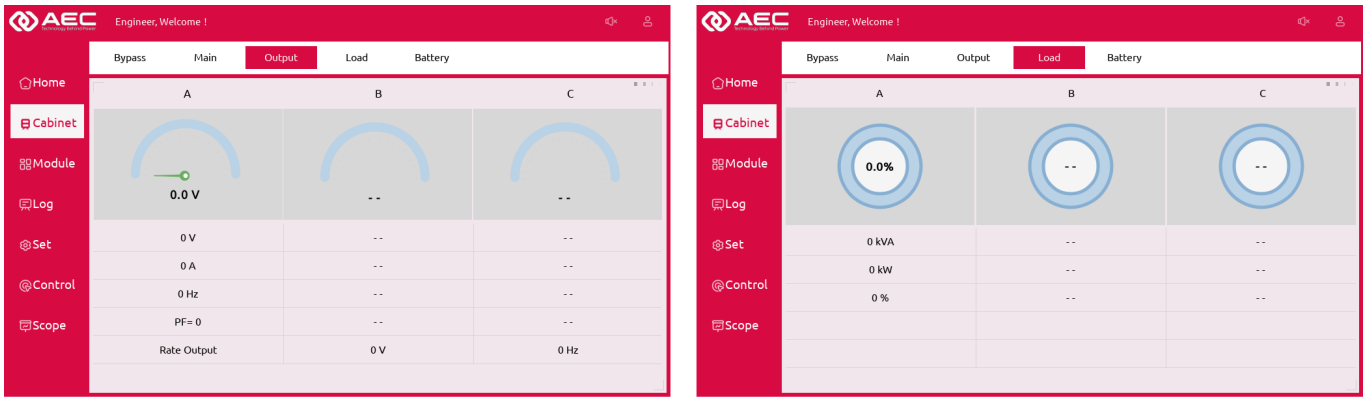


Cabinet — Bypass



Cabinet — Main

FIGURE 6-5 Cabinet — Bypass and Main



Cabinet — Output

Cabinet — Load

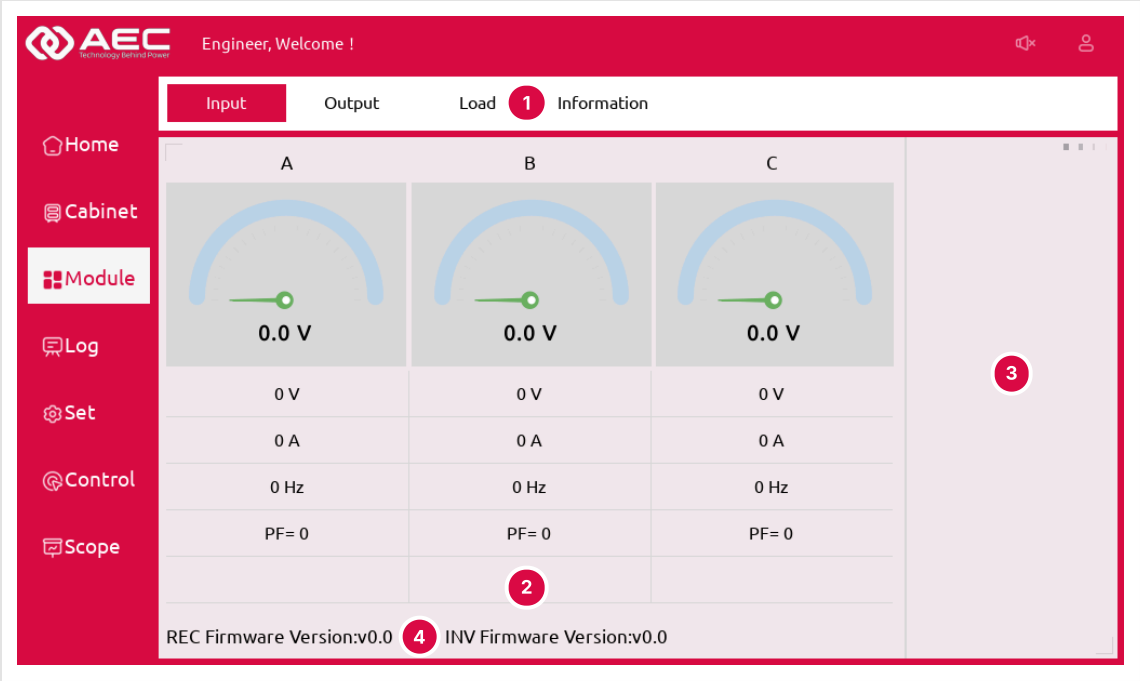
FIGURE 6-6 Cabinet — Output and Load

6.4 Module (power module readings)

Select a power module in the list on the right to see its values.

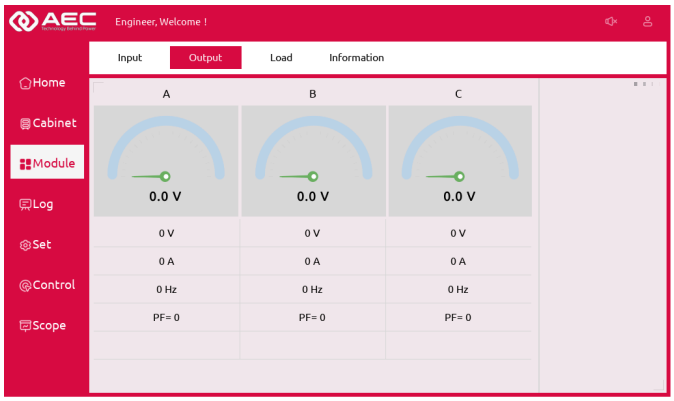
TABLE 6-3 Module pages

Page	Shows
Input	Input phase voltage, current, frequency and power factor of the selected module.
Output	Output phase voltage, current, frequency and power factor of the selected module.
Load	Apparent, active and reactive power and load (%) of the selected module.
Information	DC bus voltage (+/–), battery voltage, charger voltage and current, discharge current, inverter voltage per phase, fan and capacitor running hours, inlet, outlet and IGBT temperatures.



1. Module tabs: Input, Output, Load, Information
2. Readings of the selected module, phases A, B, C
3. Module list: green = module shown, black = module connected, empty = no module in that slot
4. Rectifier and inverter firmware versions of the module

FIGURE 6-7 Module — Input



Module — Output



Module — Load

FIGURE 6-8 Module — Output and Load

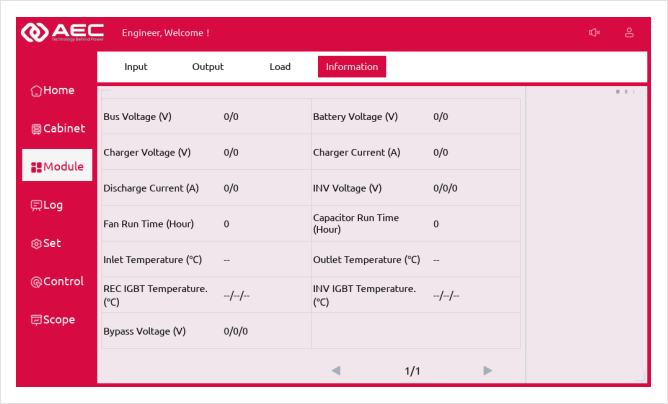


FIGURE 6-9 Module — Information

6.5 Log

Log lists the current alarms and the history of alarms and events by date and time. The meaning of every event is in Section 11.3.

6.6 Set (settings)

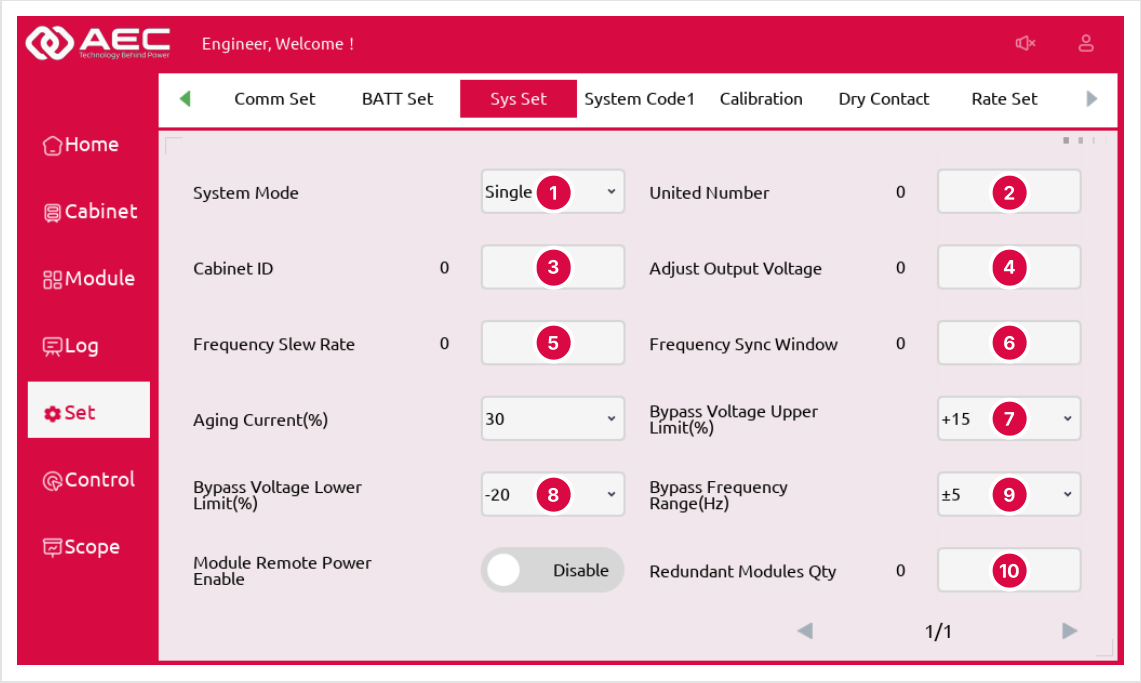
> **CAUTION**
>
> Settings change how the UPS works. Battery, calibration, communication and dry-contact settings are for service engineers. The number of batteries set must equal the number installed, or the batteries and the UPS can be seriously damaged.

The Set menu has two rows of tabs; the green arrows at the ends switch between them.

TABLE 6-4 Set pages

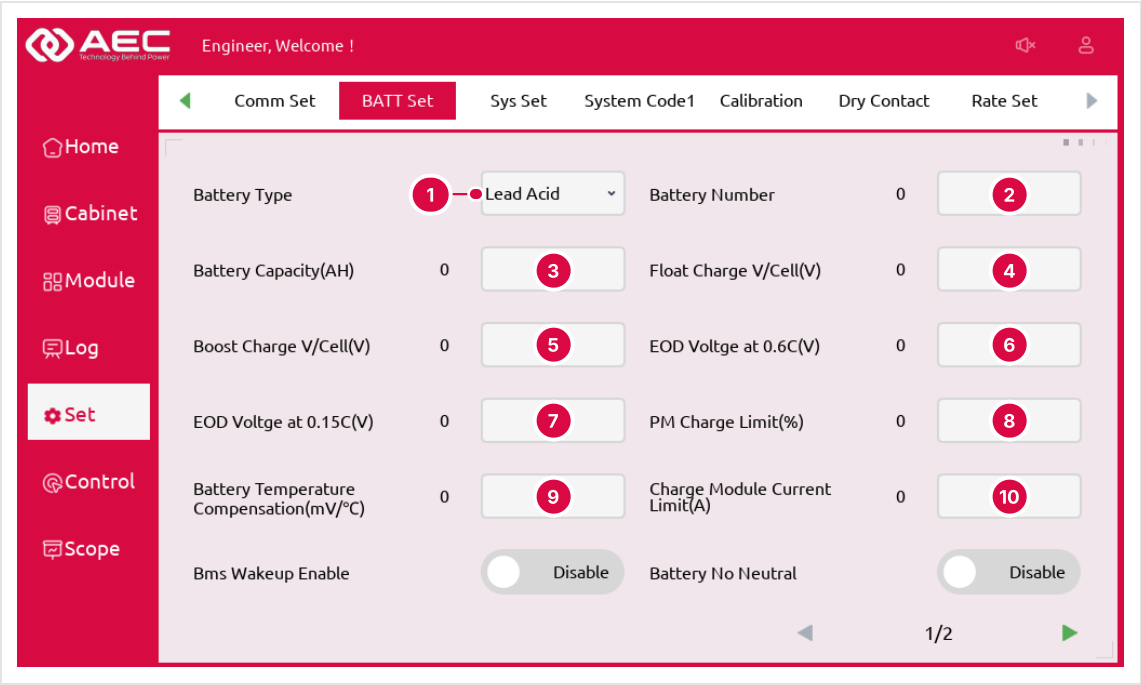
Page	Settings
Language	Display language (Section 5.12).
Sys Func	Screen saver and wait time, system date and time; software version and serial number.
NetWork	Static or DHCP, IP address, subnet mask, gateway and DNS servers of the display and its web monitor.
Uart	Serial port, baud rate, Modbus RTU enable.
Display Set	Display protocol and phase labels.
Alarm Set	Level of each UPS event — green: event, yellow: warning, red: fault.
BMS	Add and apply a battery management system device (lithium battery cabinet).
Comm Set	Protocol (MEGA, Modbus ASCII, Modbus RTU), baud rate and address of the RS-232 and RS-485 / USB ports.
BATT Set	Battery type, number, capacity (Ah), float and boost voltage per cell, end-of-discharge voltage at 0.6 C and 0.15 C, charge current limit, temperature compensation; BMS communication control.
Sys Set	System mode (single, parallel, ECO, LBS), number of units and cabinet ID, output voltage adjustment, frequency slew rate and sync window, bypass voltage and frequency window, redundant modules.
System Code1	Parallel delayed start; line-voltage display.
Calibration	Output, bypass, inverter DC, input AC and battery voltages against a meter (maintenance only).

Page	Settings
Dry Contact	Function of the three inputs (e.g. generator input) and four outputs (e.g. battery breaker trip).
Rate Set	Rated input and output voltage and frequency.



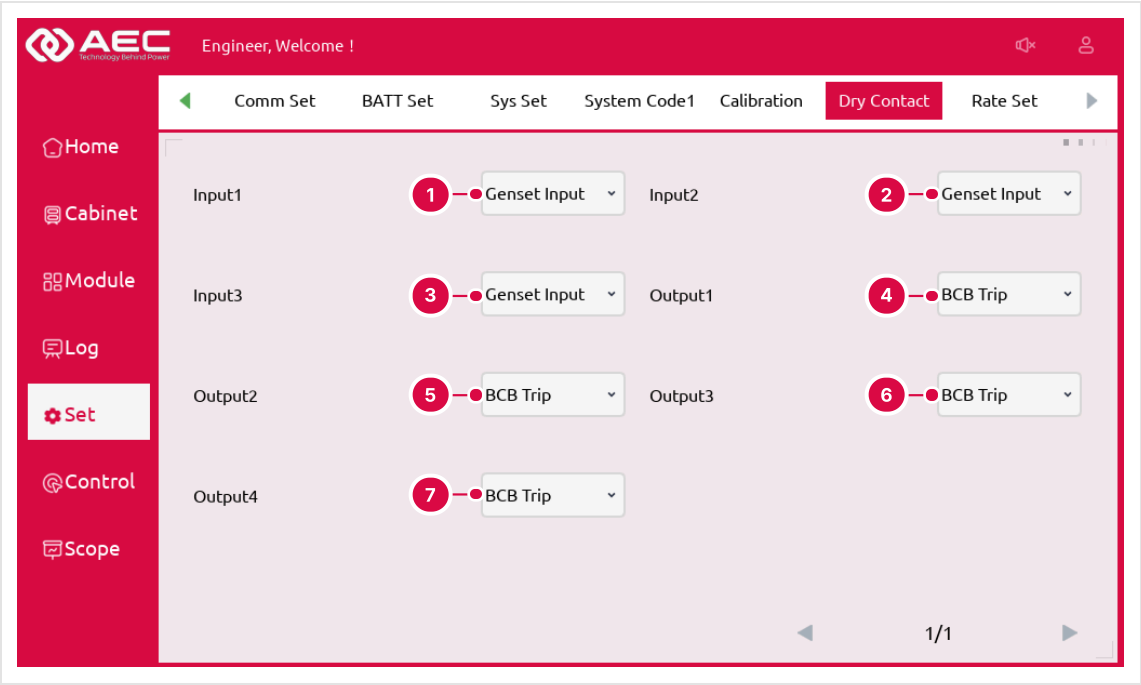
1. System Mode: Single, Parallel, Single ECO, Parallel ECO, LBS, Parallel LBS
2. United Number: number of frames in parallel
3. Cabinet ID: 0, 1, 2 … one per frame
4. Adjust Output Voltage
5. Frequency Slew Rate: 0.1–5 Hz/s
6. Frequency Sync Window: ±1 to ±5 Hz
7. Bypass Voltage Upper Limit: +10 / +15 / +20 / +25 %
8. Bypass Voltage Lower Limit: −10 / −20 / −30 / −40 %
9. Bypass Frequency Range: ±1, ±3, ±5 Hz
10. Redundant Modules Qty (N+X)

FIGURE 6-10 Set — Sys Set



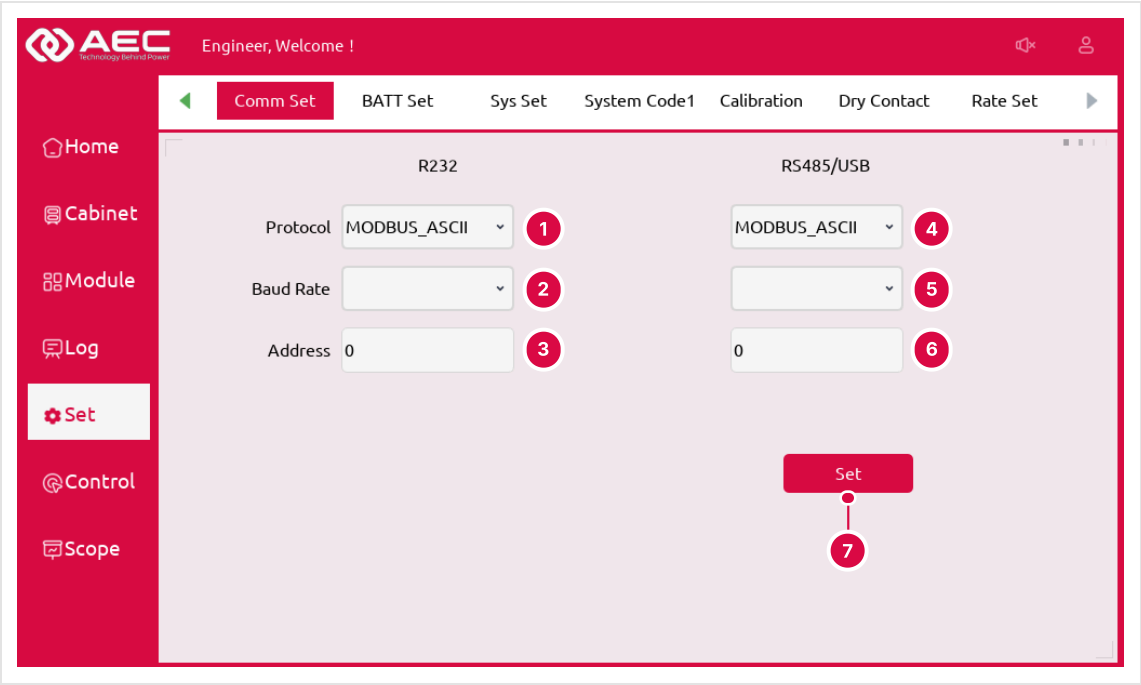
1. Battery Type
2. Battery Number: 20, 22 or 24 blocks
3. Battery Capacity (Ah)
4. Float Charge V/Cell
5. Boost Charge V/Cell
6. EOD Voltage at 0.6 C
7. EOD Voltage at 0.15 C
8. PM Charge Limit (%)
9. Battery Temperature Compensation (mV/°C)
10. Charge Module Current Limit (A)

FIGURE 6-11 Set — BATT Set, page 1



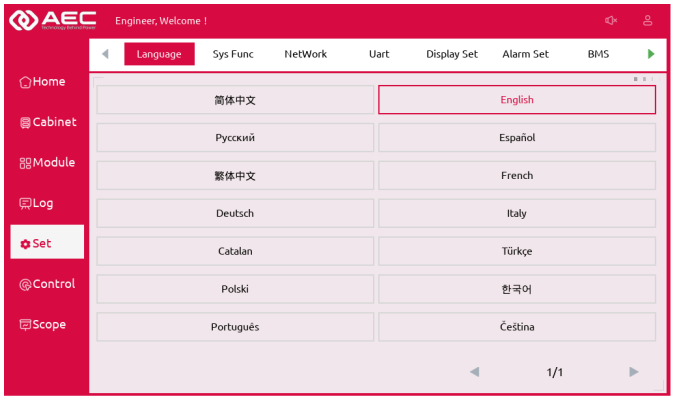
1. Input1 (IP1)
2. Input2 (IP2)
3. Input3 (IP3), e.g. Genset Input
4. Output1 (OP1)
5. Output2 (OP2)
6. Output3 (OP3)
7. Output4 (OP4), e.g. BCB Trip

FIGURE 6-12 Set — Dry Contact

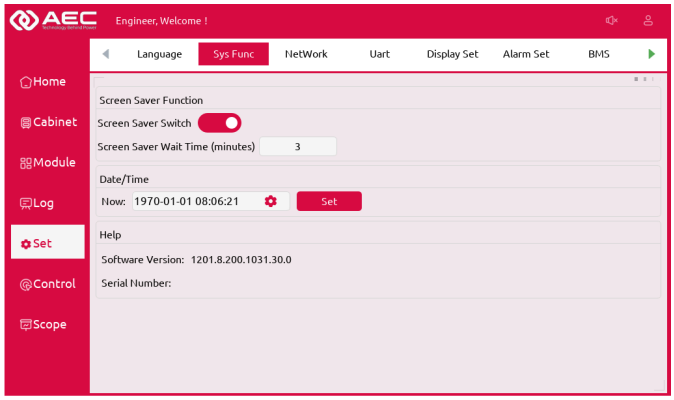


1. RS-232 protocol
2. RS-232 baud rate
3. RS-232 address
4. RS-485 / USB protocol
5. RS-485 / USB baud rate
6. RS-485 / USB address
7. Set: apply

FIGURE 6-13 Set — Comm Set

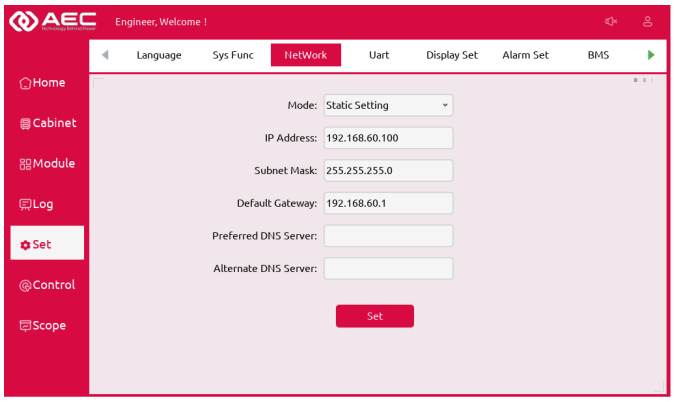


Language

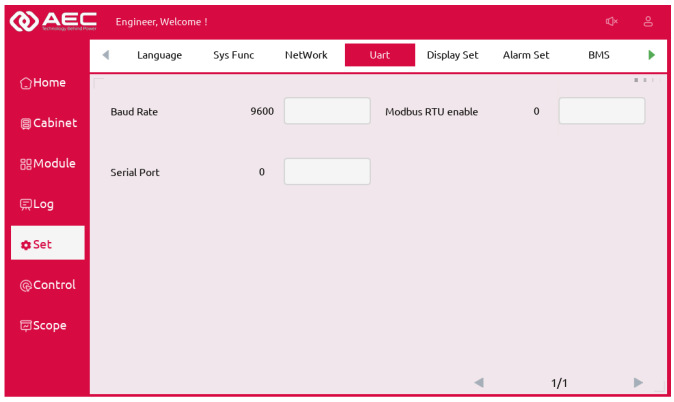


Sys Func

FIGURE 6-14 Set — Language and Sys Func

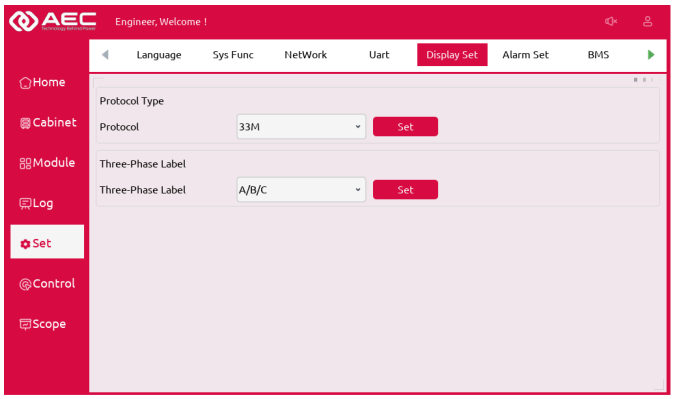


NetWork

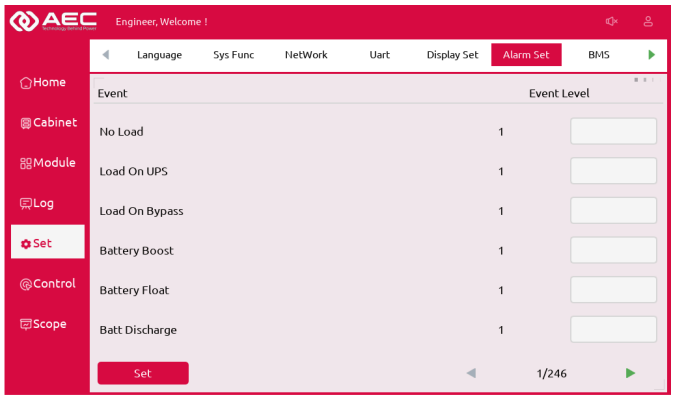


Uart

FIGURE 6-15 Set — NetWork and Uart

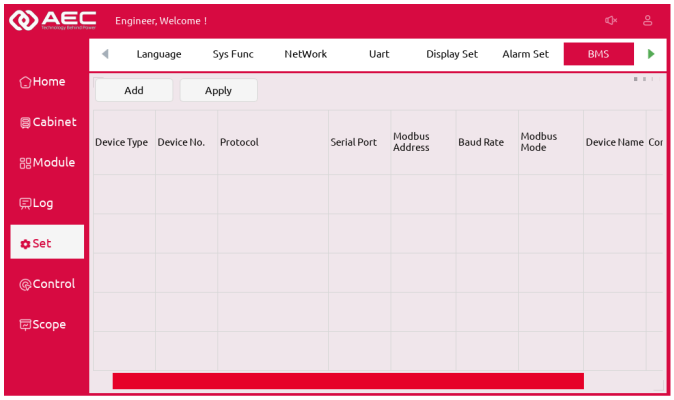


Display Set

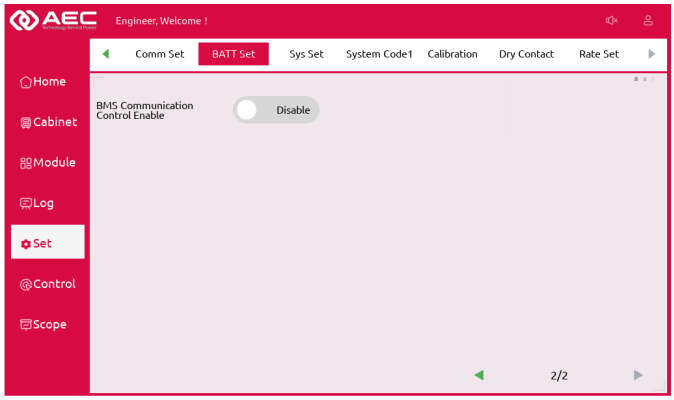


Alarm Set

FIGURE 6-16 Set — Display Set and Alarm Set



BMS



BATT Set, page 2

FIGURE 6-17 Set — BMS and BATT Set page 2

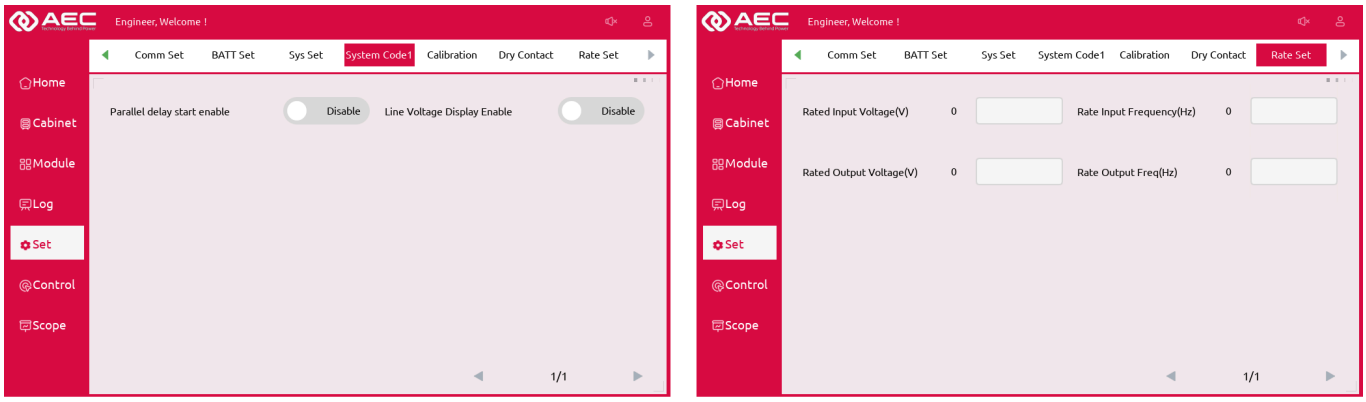


FIGURE 6-18 Set — System Code1 and Rate Set

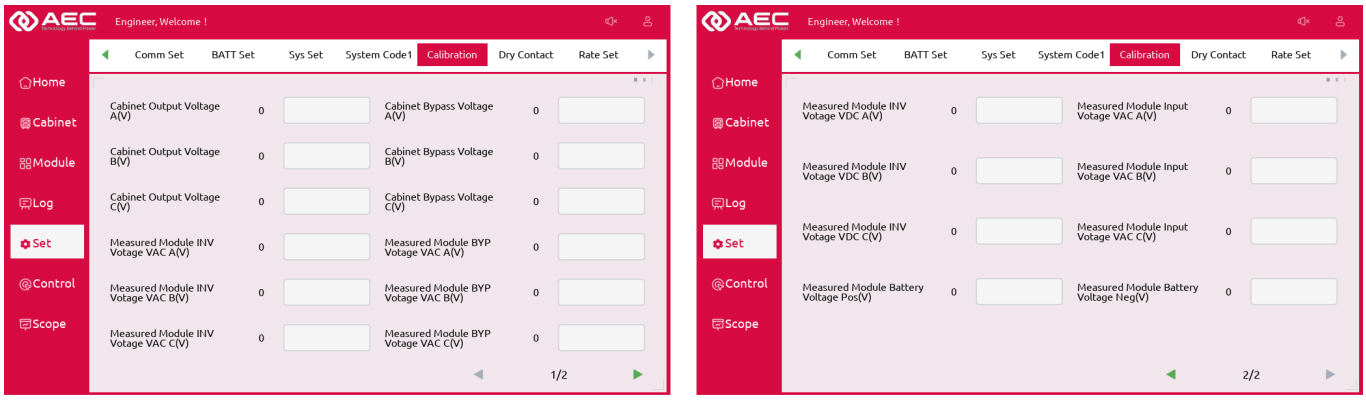
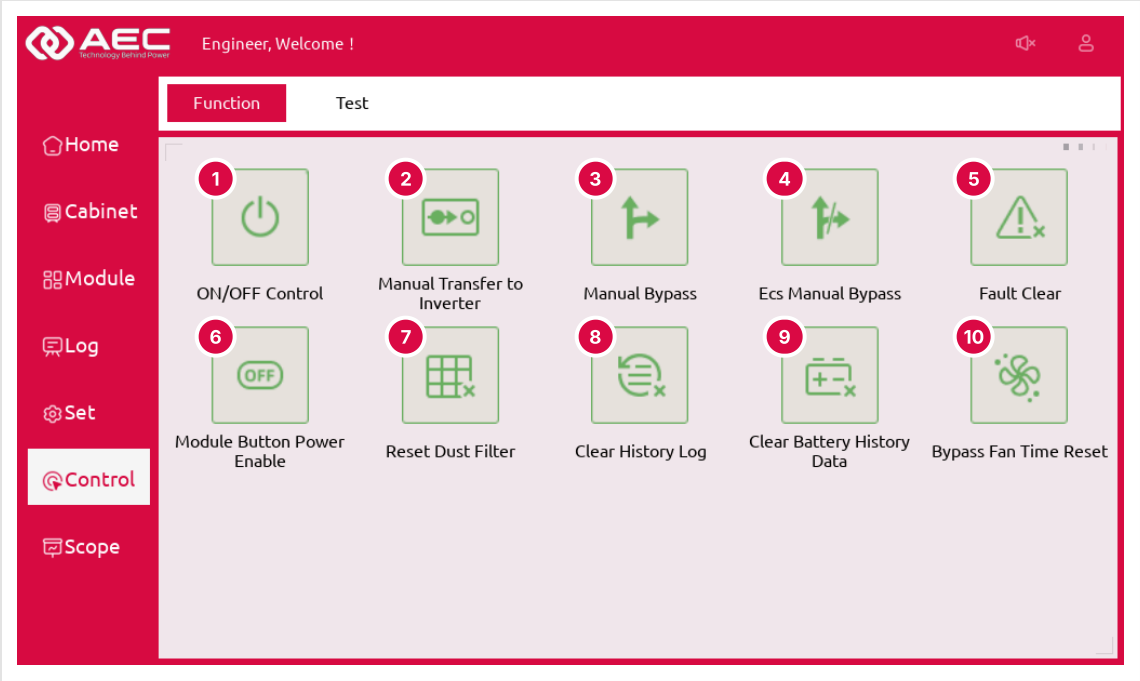


FIGURE 6-19 Set — Calibration, pages 1 and 2

6.7 Control

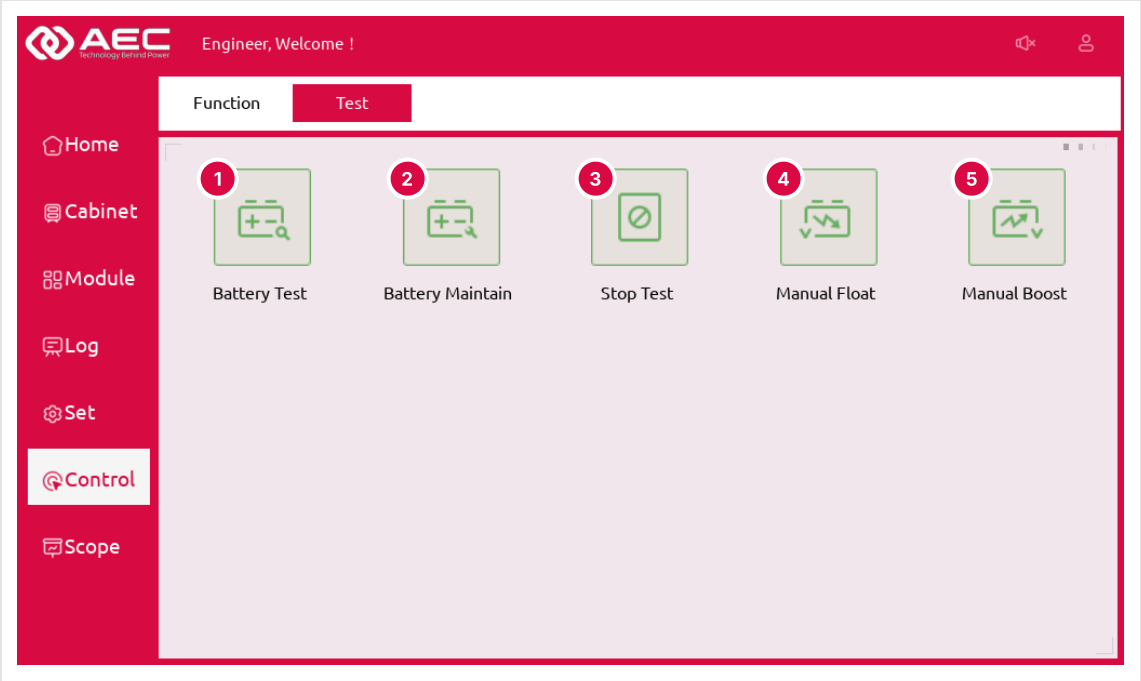
TABLE 6-5 Control pages

Page	Commands
Function	ON/OFF Control (inverter on/off, with confirmation) · Manual Transfer to Inverter (the output can be interrupted) · Manual Bypass and Ecs Manual Bypass (its cancel) · Fault Clear · Module Button Power Enable (enables the OFF key on the power modules) · Reset Dust Filter · Clear History Log · Clear Battery History Data (after new batteries) · Bypass Fan Time Reset.
Test	Battery Test · Battery Maintain · Stop Test · Manual Float · Manual Boost charge.



1. ON/OFF Control: inverter on or off
2. Manual Transfer to Inverter
3. Manual Bypass: load to the static bypass
4. Ecs Manual Bypass: cancel the manual bypass
5. Fault Clear
6. Module Button Power Enable: enables the modules' OFF key
7. Reset Dust Filter
8. Clear History Log
9. Clear Battery History Data
10. Bypass Fan Time Reset

FIGURE 6-20 Control — Function: the commands used in the operating procedures



1. Battery Test (20 s on battery)
2. Battery Maintain (discharge to 1.1 × EOD)
3. Stop Test
4. Manual Float charge
5. Manual Boost charge

FIGURE 6-21 Control — Test

6.8 Scope (waveforms)

Scope shows the waveforms of the output voltage, the output current and the bypass voltage of the three phases: yellow = phase A, green = phase B, red = phase C.

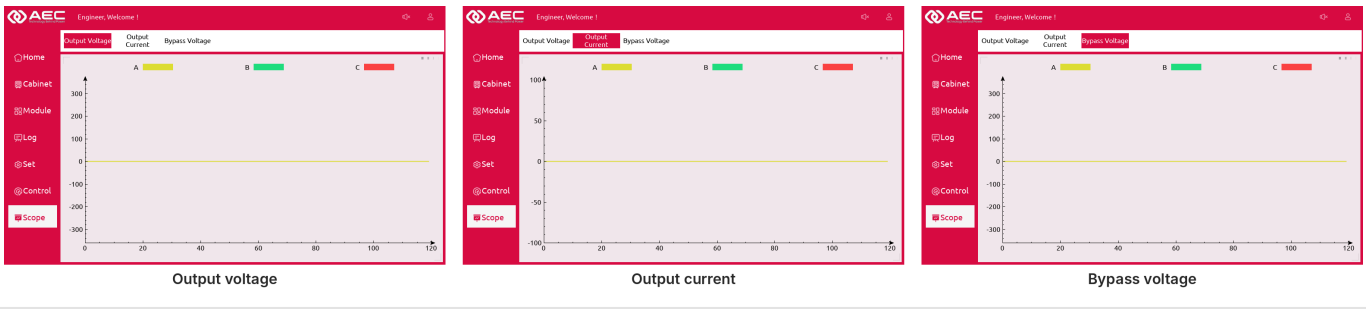


FIGURE 6-22 Scope — output voltage, output current and bypass voltage

CHAPTER 7

07 Everyday use

Power outages, what the panel tells you, and good habits.

7.1 During a power outage

1. The UPS switches to battery with no break. The load keeps running, the energy flow on the home page shows the battery feeding the inverter, and the buzzer sounds.
2. Silence the buzzer with the speaker icon at the top right of the screen (Figure 6-2, item 7).
3. Watch **Cabinet › Battery**: capacity and remaining time (Figure 6-4).
4. If the outage lasts, shut the loads down in order before the battery is exhausted — automatically through the SNMP-M card if installed.
5. At the end of discharge the UPS switches its output off to protect the battery. When the utility returns it restarts and recharges the battery (auto restart).

7.2 What the panel tells you

TABLE 7-1 What you see, what it means, what to do

What you see	Meaning	What to do
Green indicator; energy flow from the main input through rectifier and inverter	Normal mode	Nothing.
Battery feeding the inverter; buzzer	Utility failure: on battery	See Section 7.1.
Yellow indicator; two short beeps and one long beep	General alarm (for example utility input abnormal)	Read **Log**; look the event up in Section 11.3.
Red indicator; continuous tone	Serious fault (for example a fuse or hardware fault)	Read **Log**, note the event, call AEC service. Do not restart repeatedly.
Load on bypass in the energy flow	Manual bypass, overload or a fault	Read **Log**; remove the cause; return with **Ecs Manual Bypass** or **Manual Transfer to Inverter**.
Orange warning text on the home page	General alarm	Read the text and **Log**.
Red warning text on the home page	Serious alarm	Call AEC service.
Redundancy alarm (Lost N+X Redundant)	Fewer modules than the redundancy set	Check the modules in **Module**; replace or reinsert the failed one.

7.3 Good habits

- Leave the UPS running all the time. Check the home page and **Log** once a week.
- Keep the room clean, cool and within 32–104 °F (0–40 °C). Keep the front and rear of the frame clear.
- Before adding load, check **Cabinet › Load**: stay within the capacity with one module out.
- Run a battery test every six months (**Control › Test › Battery Test**).
- Only trained personnel use the Set and Control menus.

CHAPTER 8

08 Communication and monitoring

The communication ports, the SNMP-M network card and the UPS View software.

The communication ports — RS-232, RS-485, USB, dry contacts, the intelligent slot and EPO — are described in Section 4.9. Set the protocol, baud rate and address of the serial ports in **Set › Comm Set** (Figure 6-13).

8.1 Setting up the SNMP-M card

1. Fit the card in the intelligent slot of the bypass module (Figure 4-8, item 11) and connect it to the network with an RJ45 cable. The green PWR LED lights.
2. On a PC in the same network, run IPSearch (AEC app › Support › Downloads › SNMP › SNMP-M). It lists the card with its IP and MAC address.
3. Select the card › NetWork set › Static IP: enter a free IP address, the subnet mask and the gateway (ask your IT department), or choose Obtain IP for DHCP. Press Set.
4. Press Web page (or type the card's IP in a browser) and log in as admin.
5. In the card's UPS settings choose protocol **ACM(10-600KVA)** (the label of the RADIANT protocol in the card menu), port Uart · Port A, the same baud rate as the UPS (for example 9600) and address 1 — the same values as set on the UPS. The yellow DATA LED stops flashing when the card reads the UPS.
6. Set up e-mail alarms and, if used, SNMP traps (port 162) or Modbus TCP.

TABLE 8-1 SNMP-M card indicators

LED	State	Meaning
PWR (green)	On · Off	Card powered · not powered
SYS (red)	Off · Flashing · On	System normal · general alarm · serious alarm
DATA (yellow)	Off · Flashing	Communication with the UPS normal · abnormal

CAUTION

The card's default web accounts (admin, full rights; user, view only) and their passwords are given by AEC technical service. Change both passwords at the first login.

8.2 UPS View software

UPS View (version 2.0.7) monitors and sets up one UPS from a Windows PC through a direct cable, without the network card. Download UPSView_V2.0.7.rar from the AEC app (Support › Downloads › SNMP › SNMP-M), unpack it and run the program inside: no installation is needed.

TABLE 8-2 Connecting UPS View

Connection	How
RS-232	A serial cable from the UPS's RS-232 port to the PC's COM port (pin 2 TXD, pin 3 RXD, pin 5 GND); a USB-to-serial adapter on PCs without a COM port.

Connection	How
RS-485	Through a 485-232 adapter, with the special serial cable supplied with the UPS.
USB	A standard USB cable; some PCs need a driver.

1. Connect the cable to the RS-232, RS-485 or USB port of the UPS (Figure 4-8).
2. Start UPS View. Leave the equipment type, baud rate and Modbus mode on Auto. If the connection does not start, set them by hand: Equip Type **M(10-600kVA)**, Modbus mode RTU or ASCII and the baud rate as set on the UPS (**Set › Comm Set**), address 1. UPS View talks Modbus: the ACM(10-600KVA) protocol is the SNMP-M card's setting, not UPS View's.
3. Choose the PC's COM port (Windows Device Manager › Ports).
4. UPS View shows the live data, the status, the alarms and the settings of the UPS.

NOTICE

The RS-232 port and the intelligent slot share the same communication line. Use UPS View with the SNMP-M card removed, or monitor through the card — not both at the same time.

✓ **TIP** The AEC UPS View Monitor User Manual (AEC-UM-UPSV-US) describes every UPS View page; the SNMP-M User Manual describes the card's web interface. Both are in the AEC app, Support › Downloads › SNMP › SNMP-M.

09

CHAPTER 9

Battery management

The battery settings made at commissioning, their ranges, and the battery protections.

CAUTION

The commissioning engineer makes the battery settings in **Set › BATT Set** (Figure 6-11), following the battery maker's values. Wrong values damage the batteries.

TABLE 9-1 Battery settings

Setting	Default	Range
Number of blocks	20 × 12 V per string	20, 22 or 24 (even number); must equal the blocks installed
Boost charge current	10 %	0–20 %
Float charge voltage (VRLA)	2.25 V/cell	2.20–2.35 V/cell
Boost charge voltage (VRLA)	2.40 V/cell	2.30–2.45 V/cell
Temperature compensation	−1.7 mV/°F/cell (−3.0 mV/°C/cell), with the battery sensor	0 to −2.8 mV/°F/cell (0 to −5.0 mV/°C/cell), reference 77 °F (25 °C) or 86 °F (30 °C), or off
End of discharge at 0.6 C	1.65 V/cell	1.60–1.75 V/cell
End of discharge at 0.15 C	1.75 V/cell	1.65–1.80 V/cell
Charging power	50 % of the UPS rating	1–50 %
Self-test interval	—	720–3,000 h; discharges 25 % of the capacity; needs 25–100 % load

The end-of-discharge voltage changes linearly between the 0.6 C and the 0.15 C value with the discharge current. Charging is constant current, then constant voltage.

Battery protections

- **Battery low pre-warning:** before end of discharge, with about 3 minutes left at full load.
- **End-of-discharge protection:** below the EOD voltage the battery converter shuts down and the battery is isolated.
- **Battery breaker alarm:** when the battery breaker opens. The UPS can trip the external battery breaker (BCB) at EOD or EPO (Section 4.9.5).

Battery maintenance. Follow IEEE 1188 and the battery maker's manual. Check that all safety devices are in place, the battery settings are right and the battery room temperature is recorded. Check the terminals for damage or heating and the cases for damage. One to two months after installation, check the torque of every battery terminal bolt again.

CHAPTER 10

10 Preventive maintenance

The maintenance schedule, component life and battery life.

10.1 Maintenance schedule

TABLE 10-1 Maintenance schedule

Interval	Task
Weekly	Check the home page and **Log**: normal mode, no alarm; load within the capacity with one module out.
Monthly	Check that the front and rear of the frame are clear and the fans run; check the room temperature.
Every 3–6 months	Clean or replace the dust filter in the lower door (more often in dusty rooms); reset the filter timer: **Control › Function › Reset Dust Filter**.
Every 6 months	Battery test: **Control › Test › Battery Test**. Read the battery data in **Cabinet › Battery**.
Yearly	AEC service: inspection of the power connections (tightness, signs of heating), the modules, fans and capacitors; battery measurement; firmware check.
3–5 years	Replace VRLA batteries as a full set.

10.2 Component life

Some components wear with time and heat. Planned replacement, before they fail, keeps the UPS available.

TABLE 10-2 Typical service life at 77 °F (25 °C)

Component	Typical life	Action
Cooling fans	5–7 years	Replace when worn or at the end of the period; a failed fan raises an alarm.
DC bus electrolytic capacitors	7–10 years	Replaced by AEC service.
AC filter capacitors	5–7 years	Replaced by AEC service.
VRLA batteries (5-year design life)	3–5 years	Replace as a full set (Chapter 9).
Dust filter	3–6 months	Check and clean or replace; more often in dusty rooms.

Life is shorter at higher temperature, in dusty rooms and under continuous heavy load. The figures are typical for online UPS; AEC service plans the replacement during preventive maintenance.

10.3 Battery life and temperature

VRLA batteries age faster in heat. As a rule of thumb, their service life roughly halves for every 18 °F (10 °C) above 77 °F (25 °C).

TABLE 10-3 Typical effect of temperature on VRLA battery life

Average temperature	Relative life	Typical life
68–77 °F (20–25 °C)	100 %	3–5 years
86 °F (30 °C)	about 70 %	2–3.5 years

Average temperature	Relative life	Typical life
95 °F (35 °C)	about 50 %	1.5–2.5 years
104 °F (40 °C)	about 35 %	1–1.7 years

CHAPTER 11

11 Troubleshooting

The indicators and buzzer, what to do first, and the list of UPS events.

✓ TIP WhatsApp and phone +1 786 553 2100, always available · e-mail service.us@aecups.com. Send the model, the serial number and a photo of the display and of the alarm: it is the fastest way to a solution.

11.1 Indicators and buzzer

The indicator bars and the buzzer are described in Table 6-1 (Figure 6-1): green is normal, yellow a warning with two short beeps and one long, red a fault with a continuous tone.

11.2 What to do first

1. Silence the buzzer with the speaker icon.
2. Open **Log**: note the events with their date and time.
3. Look each event up in Section 11.3 and do what it says.
4. After the cause is removed, clear a fault with **Control › Function › Fault Clear**.
5. If the fault remains, call AEC service with the model, serial number, the events and the load.

11.3 UPS event log

TABLE 11-1 UPS events

Event	Meaning and action
Fault Clear	A fault was cleared by hand.
Log Clear	The history log was cleared by hand.
Load On UPS	The inverter feeds the load.
Load On Bypass	The bypass feeds the load.
No Load	No load on the output.
Battery Boost	The charger is in boost charge.
Battery Float	The charger is in float charge.
Battery Discharge	The battery is discharging.
Battery Connected	The battery is connected.
Battery Not Connected	The battery is not connected: check the battery breaker and cables.
Maintenance CB Closed	The maintenance bypass breaker is closed.

Event	Meaning and action
Maintenance CB Open	The maintenance bypass breaker is open.
EPO	Emergency power off.
Module On Less	The capacity of the running power modules is less than the load: reduce the load or add modules so that the UPS has enough capacity.
Generator Input	A generator is connected: the signal reaches the UPS on the dry-contact input.
Utility Abnormal	Utility voltage or frequency outside the limits, so the rectifier shuts down: check the input voltage.
Bypass Sequence Error	Bypass phase sequence reversed: check that the input power cables are connected correctly.
Bypass Volt Abnormal	Bypass voltage or frequency outside the limits; it resets when the bypass returns to normal. First clear related alarms (bypass breaker open, Bypass Sequence Error, Input Neutral Lost). Check the bypass breaker and supply; if it recurs, AEC service can widen the bypass window.
Bypass Module Fail	Bypass module fault, or bypass fans failed; latched until power-off. Call AEC service.
Bypass Module Over Load	Bypass current above the limit (below 125 % of rating the UPS alarms only).
Bypass Over Load Tout	The bypass overload lasted too long: the output is switched off.
Byp Freq Over Track	Bypass frequency outside the tracking limit; the inverter does not synchronize. Check the bypass supply.
Exceed Tx Times Lmt	Too many transfers in one hour: the load stays on bypass. It returns to the inverter within one hour, or clear the fault by hand. Check the load.
Output Short Circuit	Output short circuit: check the loads, the output cables and the output terminals; then clear the fault.
Battery EOD	Inverter off at end of discharge: restore the utility.
Battery Test	The UPS runs on battery for 20 s to check the battery.
Battery Test OK	Battery test passed.
Battery Maintenance	The UPS runs on battery down to 1.1 × end-of-discharge voltage to maintain the battery.
Battery Maintenance OK	Battery maintenance completed.
Module Inserted	A power module was inserted.
Module Exit	A power module was pulled out.
Rectifier Fail	Rectifier of module N# failed: the rectifier and the battery charger of that module shut down. Call AEC service.
Inverter Fail	Inverter of module N# failed: the load moves to bypass or to the other modules. Call AEC service.
Rectifier Over Temp.	Rectifier of module N# too hot: the rectifier shuts down and restarts when it cools. Check the room temperature, the ventilation, the fans and the input voltage.
Fan Fail	At least one fan of module N# failed.

Event	Meaning and action
Output Over Load	Module N# above 100 % of its rating; resets when the load is reduced. Check the load per phase; in a parallel system, check the load balance.
Inverter Overload Tout	The overload of module N# lasted too long: the load moves to bypass, and back to the inverter 2 minutes after the load falls below 95 %.
Inverter Over Temp.	Inverter of module N# too hot: the load moves to bypass. Check the room temperature, the ventilation and the fans.
On UPS Inhibited	Transfer from bypass to inverter blocked: module capacity too small for the load, the rectifier not ready, or the bypass voltage abnormal.
Manual Transfer Byp	Transferred to bypass by hand.
Esc Manual Bypass	The manual transfer to bypass was cancelled.
Battery Volt Low	Battery voltage low: about 3 minutes of full-load runtime remain.
Battery Reverse	Battery cables connected the wrong way.
Inverter Protect	Inverter of module N# protected: inverter voltage abnormal or out of step with the other modules.
Input Neutral Lost	Input neutral lost or not detected. A 3-pole breaker is recommended between the supply and the UPS.
Bypass Fan Fail	At least one fan of the bypass module failed.
Manual Shutdown	Module N# switched off by hand: rectifier and inverter off, no output from it.
Manual Boost Charge	The charger was forced into boost charge.
Manual Float Charge	The charger was forced into float charge.
UPS Locked	Manual shutdown of power modules is not allowed.
Parallel Cable Error	Parallel cable missing, loose or not in a ring: check the parallel cables.
Lost N+X Redundant	No redundant module left: the load needs every running module.
EOD Sys Inhibited	Output inhibited after end of discharge, until the utility returns.
Battery Test Fail	Battery test failed: check that the UPS has no alarm, that the battery is above 90 % of float voltage and that the load is above 25 %.
Battery Maintenance Fail	Battery maintenance failed: same checks as the battery test.
Ambient Over Temp	Room temperature above the UPS limit: air conditioning is needed.
REC CAN Fail	Rectifier communication bus abnormal: check the communication cables.
INV IO CAN Fail	Inverter signal bus abnormal: check the communication cables.
INV DATA CAN Fail	Inverter data bus abnormal: check the communication cables.
Power Share Fail	Output current of the modules out of balance: AEC service adjusts the module output voltage.

Event	Meaning and action
Sync Pulse Fail	Synchronization signal between modules abnormal: check the communication cables.
Input Volt Detect Fail	Input voltage of module N# abnormal: check the input cables, fuses and utility.
Battery Volt Detect Fail	Battery voltage abnormal: check the batteries and battery fuses.
Output Volt Fail	Output voltage abnormal.
Bypass Volt Detect Fail	Bypass voltage abnormal: check that the bypass breaker is closed and good, and the bypass cables.
INV Bridge Fail	Inverter IGBTs broken or open. Call AEC service.
Outlet Temp Error	Outlet temperature of a module above the limit: check the fans, the air path and the room temperature. Call AEC service.
Input Curr Unbalance	Input currents differ by more than 40 % of rating between phases: check the input voltage. Call AEC service.
DC Bus Over Volt	DC bus capacitor voltage too high: rectifier and inverter shut down.
REC Soft Start Fail	DC bus voltage too low after soft start. Call AEC service.
Relay Connect Fail	Inverter relays open or fuses broken.
Relay Short Circuit	Inverter relays shorted.
PWM Sync Fail	PWM synchronizing signal abnormal.
Intelligent Sleep	Module sleep active: modules stand by in turn at part load and wake when the load grows. Make sure the running modules can carry any load you add; wake the sleeping modules if unsure.
Manual Transfer to INV	Transferred to the inverter by hand (used when the bypass frequency is out of tracking range; the transfer can interrupt the output for more than 20 ms).
Input Over Curr Tout	Input over current for too long: the UPS moves to battery. Check whether the input voltage is low and the load high.
No Inlet Temp. Sensor	Inlet temperature sensor not connected correctly.
No Outlet Temp. Sensor	Outlet temperature sensor not connected correctly.
Inlet Over Temp.	Inlet air too hot: keep the room within 32–104 °F (0–40 °C).
Capacitor Time Reset	The DC bus capacitor timer was reset.
Fan Time Reset	The fan timer was reset.
Battery History Reset	The battery history was reset.
Byp Fan Time Reset	The bypass fan timer was reset.
Battery Over Temp.	Battery too hot (with the optional battery sensor).

Event	Meaning and action
Bypass Fan Expired	Service life of the bypass fans reached: replace them, then reset the timer.
Capacitor Expired	Service life of the capacitors reached: replace them, then reset the timer.
Fan Expired	Service life of the module fans reached: replace them, then reset the timer.
INV IGBT Driver Block	Inverter IGBTs stopped: check that the power modules are fully inserted. Call AEC service.
Battery Expired	Service life of the batteries reached: replace them, then reset the timer.
Bypass CAN Fail	Communication bus between the bypass module and the frame abnormal: check the connector and signal cable.
Dust Filter Expired	The dust filter must be cleaned or replaced; then reset the timer.
Stop Test	Battery test or maintenance stopped by hand: the UPS returns to normal mode.
Wave Trigger	A waveform was saved when the UPS failed.
Firmware Error	Reserved to AEC service. Call AEC service.
System Setting Error	Reserved to AEC service. Call AEC service.
Bypass Over Temp.	Bypass module too hot: check the bypass load, the room temperature (below 104 °F / 40 °C) and the bypass fans.
Module ID Duplicate	Two modules have the same ID: call AEC service to set the IDs in sequence.

CHAPTER 12

12 Specifications

Electrical, mechanical and environmental data of the RADIANT 15–90 kVA. Subject to change without notice.

TABLE 12-1 RADIANT 15–90 kVA specifications

Item	Value
Ratings	15, 30, 45, 60, 75 and 90 kVA: 1 to 6 × 15 kVA modules · output power factor 1 (kVA = kW)
Input	
Connection · voltage	3 phases + N + PE · 208 V L-L (120 V L-N); 220 V L-L as a setting (Set › Rate Set)
Voltage range	167–260 V L-L at full load; 125–167 V L-L with the power derated from 100 % to 50 %
Frequency	60 Hz (50 Hz as a setting); range 40–70 Hz
Power factor · current THD	0.99 · < 2.2 % (100 % linear load)
Maximum input current	53 A per module: 53 / 106 / 159 / 213 / 265 / 318 A for 15 / 30 / 45 / 60 / 75 / 90 kVA (Table 4-2)
Bypass	
Voltage · current	208 V L-L, 120 V L-N, 4-wire, same neutral as the main input · 42 to 252 A rated
Voltage window	Upper limit +10, +15, +20 or +25 % (default +15 %); lower limit −10, −20, −30 or −40 % (default −20 %)
Frequency window	±1, ±3 or ±5 Hz, settable
Overload	< 110 % continuous · 125 % 10 min · 150 % 1 min · > 150 % 1 s
Neutral current rating	1.7 × rated current
Output	
Voltage	208 V L-L, 120 V L-N, 3 phases + N (220 V as a setting); ±1 % balanced load, ±1.5 % 100 % unbalanced load; transient ±5 %
Frequency · synchronization	60 Hz (50 Hz as a setting) · sync window ±2 Hz (settable ±1 to ±5 Hz) · slew rate 1 Hz/s (settable 0.1–5 Hz/s)
Inverter voltage range	±5 %
THD	< 1 % linear load, < 5 % non-linear load
Inverter overload	110 % 1 h · 125 % 10 min · 150 % 1 min · > 150 % 200 ms
Fault current · neutral · non-linear load	300 % for 200 ms · 170 % · 100 %
Rated output current	42 A per module: 42 / 84 / 126 / 168 / 210 / 252 A
Transfer time	0 ms synchronized; < 3/4 cycle (12.5 ms) not synchronized; < 10 ms from ECO
Efficiency	94 % online · 99 % in ECO mode
Battery	
Type · blocks	External VRLA · 20, 22 or 24 × 12 V blocks per string (even number; default 20), center tap

Item	Value
Bus voltage	±120 to ±144 V DC nominal (240 V DC with 20 blocks)
Charge	Float 2.25 V/cell (2.20–2.35); boost 2.40 V/cell (2.30–2.45); constant current / constant voltage
End of discharge	1.65 V/cell at 0.6 C (1.60–1.75); 1.75 V/cell at 0.15 C (1.65–1.80)
Temperature compensation	−3.0 mV/°C/cell (0 to −5.0), or off
Ripple	Voltage ≤ 1 % of float; current ≤ 5 % C10
Charging power · current	Up to 50 % of the rating (1–50 %) · max. battery current 67 A per module, up to 403 A at 90 kVA
System	
Frame · module	RAD90-FRAME, 6 slots, 4 breakers (maintenance bypass 315 A) · RAD-PWR-15, 15 kVA, 2U, 15.7 × 19.5 × 3.4 in (400 × 495 × 86 mm), 30.5 lb (13.85 kg)
Display · communication	7-inch touchscreen, indicators, EPO · RS-232, RS-485, USB, dry contacts (3 inputs, 4 outputs), intelligent slot for the SNMP-M card, remote EPO
Parallel	1+1 or N+1 with frames of the same rating, up to 4 frames; Cabinet ID 0 to 3
Environment	32–104 °F (0–40 °C) · 0–95 % RH · IP20 · full power to 9,800 ft (3,000 m), −2 %/330 ft above · 64 dB
Storage	UPS −13 to 158 °F (−25 to 70 °C) · battery −4 to 86 °F (−20 to 30 °C)
W × D × H	17.4 × 33.1 × 59.4 in (442 × 840 × 1,510 mm)
Weight	15 kVA 238 lb · 30 kVA 268.5 lb · 45 kVA 299 lb · 60 kVA 329.5 lb · 75 kVA 360 lb · 90 kVA 390.5 lb (Table 2-2)
Color	Black
Standards	UL 1778 standard; FCC Part 15, Class A
Warranty	3 years on the UPS

APPENDIX A

A Parallel setting

Setting the frames of a parallel system on the touchscreen.

1. When all parallel cables and power cables are connected, set each frame on the touchscreen: **Set › Sys Set** (Figure 6-10) — **System Mode** Parallel (or Parallel ECO / Parallel LBS).
2. Set **United Number** to the number of frames in the system.
3. Give each frame its own **Cabinet ID**, starting from 0: 0 and 1 for two frames; 0, 1, 2 and 3 for four frames. Two frames must never have the same ID.
4. Every other setting must be the same on all frames. Then start the system.

APPENDIX B

B Drawings

AEC drawings of the RADIANT 15–90 kVA, revision 001. Dimensions in inches [mm].

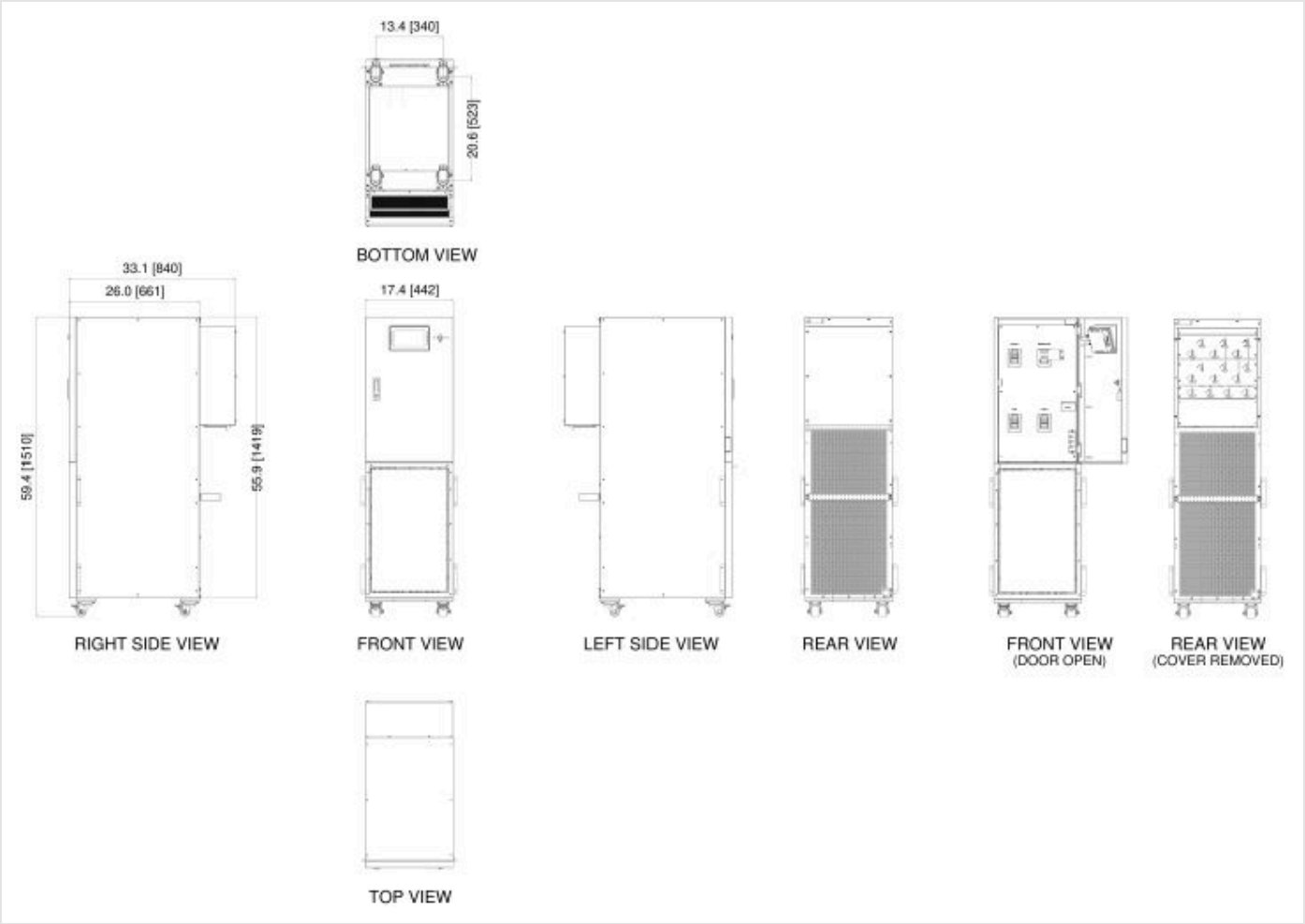


FIGURE B-1 Appearance: right side, front, left side, rear, front with the door open, rear with the cover removed, bottom and top views

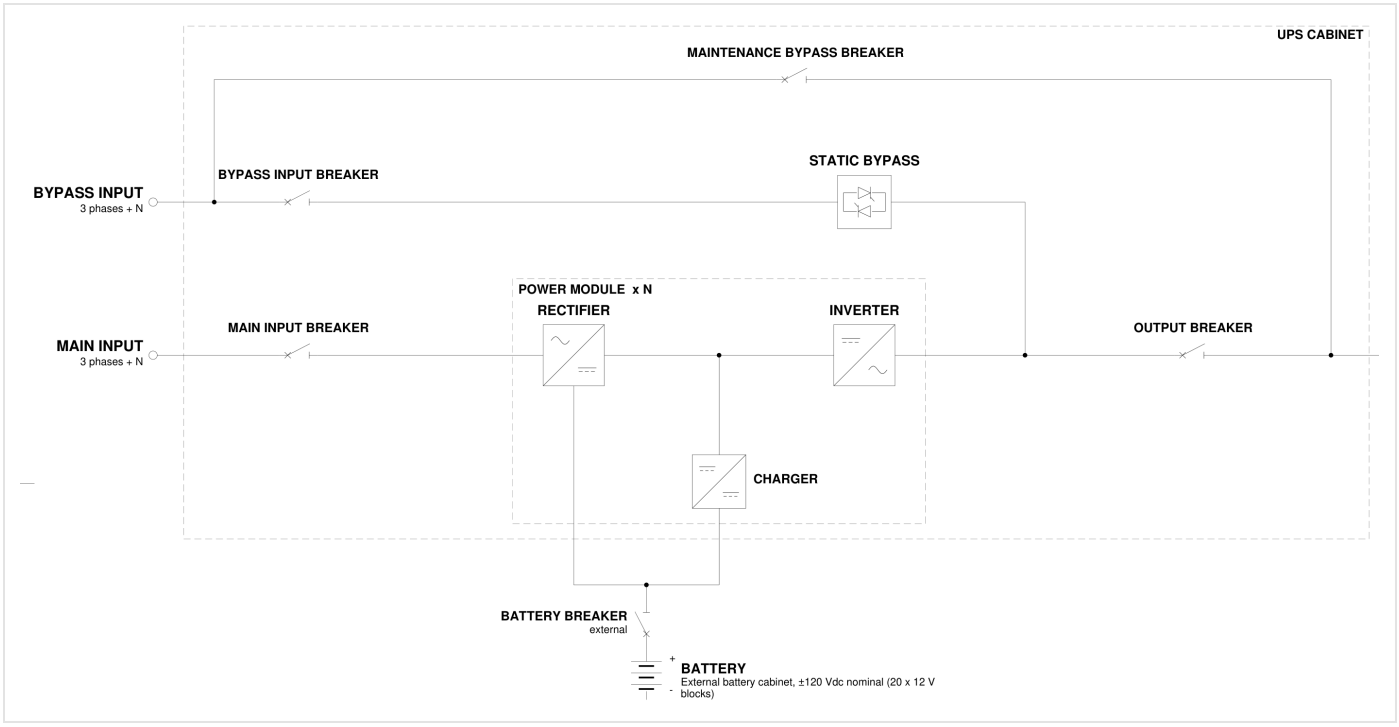


FIGURE B-2 Single-line diagram: 208 V 3-phase 4-wire, 1 to 6 power modules of 15 kVA in parallel on the same input, output and battery; four breakers in the frame; external battery ±120 V DC nominal (20 × 12 V blocks)

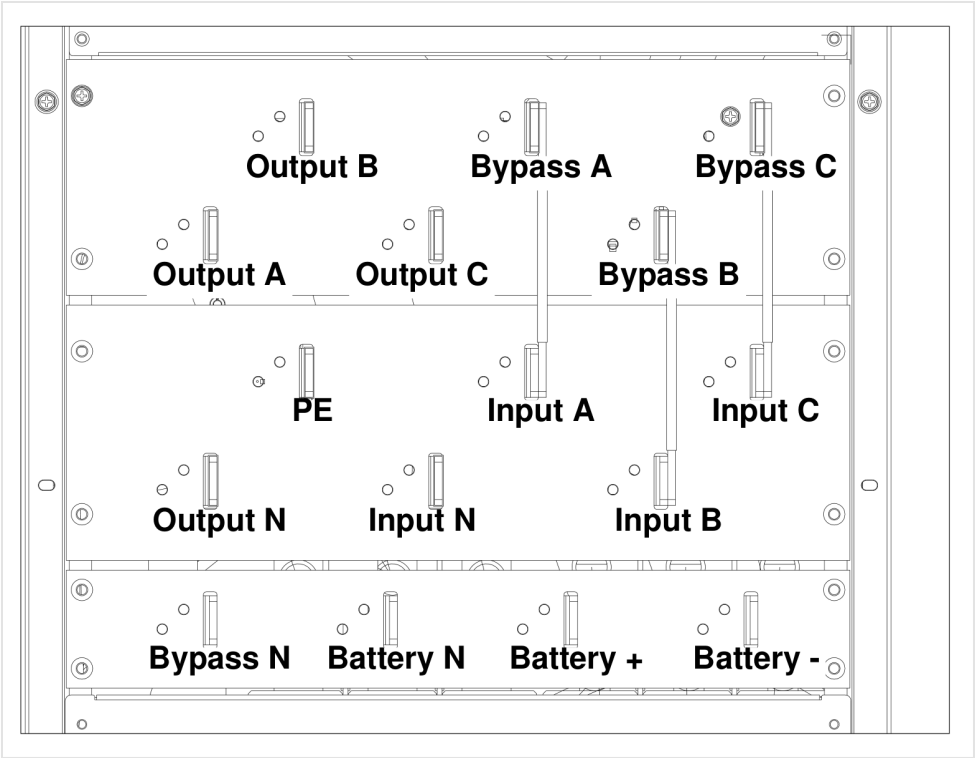


FIGURE B-3 Terminal positions, rear view with the terminal cover removed; one M12 busbar stud per terminal, terminals 47 to 57 in (1,190 to 1,440 mm) above the floor

C

APPENDIX C

Quick reference

The touchscreen paths for everyday tasks.

TABLE C-1 Quick reference — touchscreen

Task	How
Start or stop the inverter	**Control › Function › ON/OFF Control**
Transfer to bypass	**Control › Function › Manual Bypass**
Return to the inverter	**Control › Function › Ecs Manual Bypass** (or **Manual Transfer to Inverter**)
Enable the module OFF keys	**Control › Function › Module Button Power Enable**
Silence the buzzer	Speaker icon, top right
Alarms and events	**Log**
Clear a fault	**Control › Function › Fault Clear**
Battery test	**Control › Test › Battery Test** · **Stop Test**
Battery status and remaining time	**Cabinet › Battery**
Load per phase	**Cabinet › Load**
One power module	**Module** — select it in the list
Battery set-up	**Set › BATT Set**
Single / parallel / ECO / redundancy	**Set › Sys Set**
Network address of the display	**Set › NetWork**
Serial ports	**Set › Comm Set**
Date, time, serial number	**Set › Sys Func**
Waveforms	**Scope**
Emergency stop	EPO button on the front

D

APPENDIX D

Frequently asked questions

Short answers to the questions AEC support hears most.

TABLE D-1 Frequently asked questions

Question	Answer
Can I add power modules later?	Yes. The 15 kVA modules are hot-swappable: insert them in free slots with the UPS running, then set the system in **Set › Sys Set** (AEC service recommended). Size the breakers and cables for the final build from the start (Table 4-2).
What does N+1 mean?	One module more than the load needs: if any module fails, the others carry the load with no interruption.
Can I remove a module while the UPS runs?	Yes, if the remaining modules can carry the load. Follow Section 5.10.
Is the output a pure sine wave?	Yes. The UPS is online double conversion: the inverter builds a regulated sine wave at all times.
What happens when the battery runs out?	The UPS switches its output off at the end of discharge, and restarts and recharges when the utility returns (auto restart).
What is ECO mode?	The load runs on the bypass while the utility is good: efficiency is higher, but the load is not protected from disturbances. Use normal online mode for critical loads.
Can the UPS run from a generator?	Yes — see Section 3.3.
Who may change the settings?	Only trained personnel: settings and controls are protected by login.
How do I monitor the UPS on the network?	With the SNMP-M card — see Section 8.1.
How many blocks can the battery string have?	An even number from 20 to 24 blocks of 12 V (Section 3.2).

E

APPENDIX E

Installation record

Fill this record in at commissioning and keep it with the UPS.

TABLE E-1 Installation record

Item	Value
Model and ordering code	
Serial number	
Installation and commissioning date	
Commissioned by (company, engineer)	
Site and room	
Number of power modules · redundancy (N+X)	
Main input, bypass and output breakers, conductor sizes	
Battery: type, blocks per string, strings, capacity (Ah), battery breaker	
Battery settings (BATT Set) checked	
System mode (single, parallel, ECO) · Cabinet ID	
Display network address · SNMP-M address	
Load at commissioning (kW, %)	
Battery test result and date	

APPENDIX F

Warranty

What the RADIANT warranty covers.

TABLE F-1 Warranty

Item	Coverage
RADIANT UPS	3 years

During the warranty AEC repairs or replaces a faulty product. Keep the purchase invoice. Not covered: transport damage, incorrect installation or use, use outside the conditions of this manual, repairs by anyone not authorized by AEC, and natural events. The sales contract prevails.

APPENDIX G

Acronyms and abbreviations

The abbreviations used in this manual and on the touchscreen.

TABLE G-1 Acronyms and abbreviations

Term	Meaning
BCB	Battery circuit breaker
DC/DC	DC-to-DC converter (the module's bidirectional charger)
ECO	Economy mode: the load on the static bypass
EGC	Equipment grounding conductor
EOD	End of discharge
EPO	Emergency power off
IGBT	Insulated-gate bipolar transistor
LBS	Load bus synchronization (two systems kept in step)
N+X	X redundant modules beyond the N that carry the load
NEC	National Electrical Code (NFPA 70)
PE	Protective earth
RCD	Residual-current (ground-fault) device
THD	Total harmonic distortion
VRLA	Valve-regulated lead-acid (battery)

Service and support

AEC technical support is available 24 hours a day, 7 days a week. For help with installation, start-up, alarms, settings, spare parts, warranty claims and service visits, contact us by WhatsApp, phone or e-mail.

TECHNICAL SUPPORT · 24/7	**+1 786 553 2100**	WhatsApp and phone — always available
SERVICE E-MAIL	**service.us@aecups.com**	Technical questions, service requests, warranty claims
SALES	**sales@aecups.com**	
ADDRESS	**AEC UPS USA LLC**	4872 SW 72nd Ave, Miami, FL 33155
WEB	**aecups.com**	

When you contact us, have ready: the model and ordering code, the serial number (on the rating label and in Set › Sys Func), the alarm or event shown, the load and the battery set-up — a photo of the display and of the label speeds things up on WhatsApp.