MODULAR ONLINE UPS · INTERNAL BATTERIES · THREE-PHASE 208/120 V

RADIANT-IB

20–100 kVA

Modular three-phase online double-conversion UPS with hot-swappable 20 kVA power modules, 240 internal VRLA blocks in 24 trays and the AEC color touchscreen, in the 100 kVA cabinet (5 slots).



User Manual

Installation · Operation · Maintenance

RADIANT-IB 100 kVA cabinet

20 kVA power modules

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AEC-UM-RADIB-US · Rev. G · November 2026. Rev. G sizes the neutral, the grounding conductors and the external battery breaker to the NEC, adds rear working space, site-planning data, arc-flash and lockout rules, the menu tree and a data table for the engineer, and corrects the battery capacity setting, the battery test conditions, the leveling feet and the module slot order.

BEFORE YOU START

About this manual

Thank you for choosing an AEC RADIANT-IB UPS. This manual describes the RADIANT-IB 20–100 kVA modular UPS with internal batteries: safety, the cabinet and its parts, planning, installation, the internal 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 100 kVA cabinet, 23.6 × 39.4 × 78.7 in (5 slots: 20 to 100 kVA, RADIB100-1X20 to -5X20), with 20 kVA power modules (RADIB-PWR-20) and 240 internal 12 V VRLA blocks in 24 trays, three-phase 208/120 V, 4-wire. Ordering codes: Table 2-6.

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 move the crate** with a forklift rated for the weight. Section 4.1, page 25.
2. **Place the cabinet** with its front and rear working space and lower the four leveling feet. Fit the power modules from the bottom slot up and the 24 battery trays. Section 4.3, page 27, Section 4.5, page 29.
3. **Size the breakers and cables for the full 100 kVA** and wire PE first, then input, bypass and output, at 133 lb-in. Table 4-3, page 30, Section 4.7, page 30.
4. **Connect EPO, sensors, dry contacts and the network card.** Section 4.8, page 34.
5. **Commission with the AEC engineer:** close the breakers in order and let the UPS go to inverter. Section 5.2, page 40.
6. **Check the battery and set the system mode** on the touchscreen. Section 6.7, page 50.

20 kVA	240	208/120 V	Touch
hot-swappable power modules, 5 slots	internal 12 V VRLA blocks in 24 trays	three-phase, 4-wire, 60 Hz	7-inch AEC color touchscreen

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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-IB 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.
- Do not touch surfaces marked with the hot-surface label while the system runs: risk of burns.
- 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 DC (30 V AC) 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 Arc flash and lockout (NFPA 70E)

Work on or near exposed live parts of this UPS is energized electrical work under NFPA 70E. The power terminals, the breakers and the battery bus can all release an arc flash.

⚠ DANGER

Arc flash and shock. Before you open the rear doors, the terminal cover or a slot with the UPS energized, follow the arc-flash risk assessment of the site (NFPA 70E 130.5): wear the PPE it states and keep to its boundaries. AEC does not publish an incident energy for this UPS: it depends on the available fault current and the upstream protection of each site.

- **Arc-flash label.** Field-mark the UPS with an arc-flash warning label (NEC 110.16(A)). The values on it come from the site study.
- **Fault current.** Before connection, the engineer of record checks the available fault current at the main input and the bypass input (from the site's short-circuit study) against the short-circuit current rating of the UPS (NEC 110.10). The short-circuit current rating of the RADIANT-IB: ask AEC.

Electrically safe work condition. Before you touch the terminals, the cables or any part inside the cabinet, lock out and verify (NFPA 70E Article 120; OSHA 29 CFR 1910.147):

1. Open, lock and tag the external main input breaker, the external bypass input breaker (separate bypass feed) and the external maintenance bypass breaker, if there is one. In a parallel system, also open and lock the breaker between this cabinet's output and the common output bus.
2. Open the **Battery**, **Input**, **Output** and **Maintenance** breakers in the cabinet (Figure 2-5).
3. The battery breaker does not isolate the trays or the battery bus between the trays and the breaker. For work on the battery bus, also unplug every tray connector (Figure 2-11, item 4): with the battery breaker open, they carry no load current.
4. Wait at least 10 minutes for the capacitors to discharge.

5. With a meter checked before and after use, verify that every terminal is below 36 V DC and 30 V AC, phase to phase and phase to ground.

1.5 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 cabinet, on the battery trays and on the battery busbars. In normal operation, following this manual, there is no risk to the operator.

1.6 Battery safety

DANGER

- Battery maintenance and service that need internal access require special tools or keys and trained personnel.
- Each internal battery string is 20 blocks of 12 V in series: 240 V DC nominal (±120 V to the center tap), and more while charging. This voltage is lethal. The battery trays stay live when the UPS is off and the battery breaker is open.
- 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.

DANGER

- 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: a full tray weighs 63.5 lb (28.8 kg). Lift and handle trays 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.

1.7 Disposal

> ⚠ ***WARNING***
>
> Dispose of used batteries according to local regulations. Used lead-acid batteries are hazardous waste: recycle them. Do not throw them away with other waste.

1.8 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
IEC 62040-2	UPS — electromagnetic compatibility (EMC), Category C3
IEC 62040-3	UPS — performance and test requirements (VFI SS 111)
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)

1.8.1 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-IB cabinet, its power modules, internal battery and breakers, the front and rear, how the UPS works, its operating modes and its protections.

2.1 Introduction

RADIANT-IB is a modular online double-conversion UPS for 208/120 V three-phase, 4-wire loads, with its batteries inside. It is built in one cabinet, the 100 kVA cabinet, 23.6 × 39.4 × 78.7 in (600 × 1,000 × 2,000 mm), with five slots for 20 kVA / 20 kW power modules: 20, 40, 60, 80 or 100 kVA.

The cabinet holds the bypass & monitoring module, 240 VRLA blocks of 12 V in 24 trays, and four switching devices: the battery breaker, the main input breaker, the maintenance bypass breaker and the output breaker. The 7-inch color touchscreen is on the front door. Up to three cabinets of the same rating run in parallel.

TABLE 2-1 RADIANT-IB at a glance

Feature	What it gives you
20 kVA modules	Up to five, hot-swappable. Each module is a complete rectifier, inverter and charger.
240 internal blocks	24 trays of ten 12 V VRLA blocks: 12 strings of 20 blocks, ±120 V DC.
N+X	A redundant module carries the load if another stops or is replaced.
94 %	Efficiency in double conversion and in battery mode; input power factor above 0.99.
kVA = kW	Output power factor 1; 0 ms transfer between inverter and bypass when synchronized.
×3	Up to three cabinets in parallel, for power or redundancy.

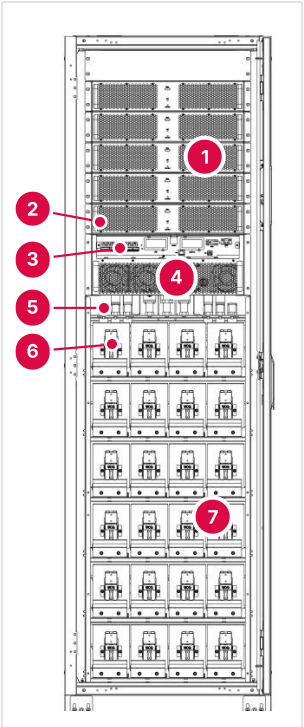
2.2 Front of the cabinet

The front door carries the touchscreen, the status indicators and the EPO button (Figure 2-1). Behind the door are the power modules, the bypass & monitoring module and the battery trays (Figure 2-2).



1. Touchscreen, 7-inch color (Section 6.1)
2. Status indicators, beside the screen
3. EPO button with protective cover (Section 5.8)
4. Door handle and lock
5. Perforated door: air in

FIGURE 2-1 Front of the cabinet, door closed



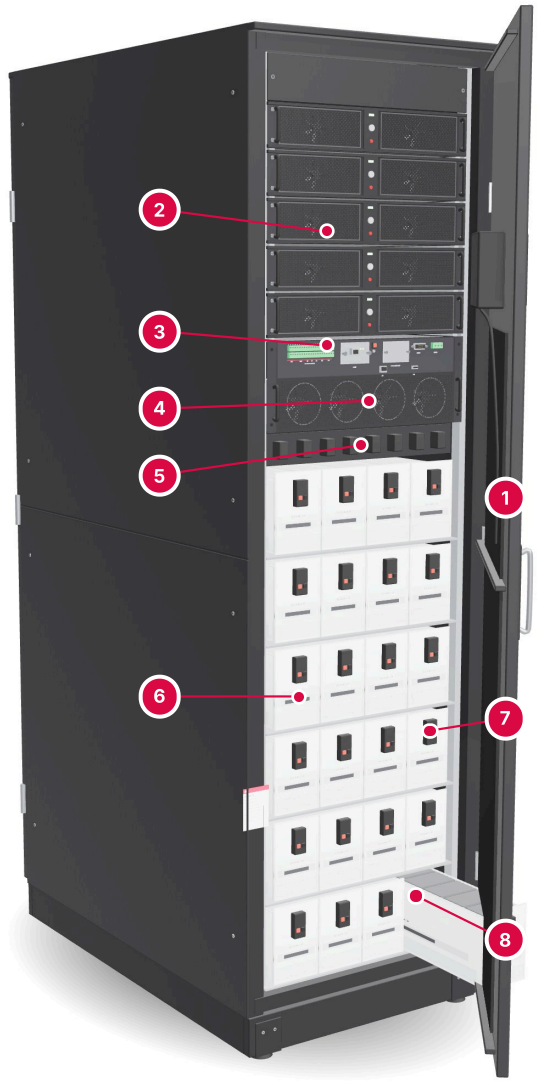
1. Power modules, 20 kVA: up to 5
2. Slot No. 1, at the bottom: fit modules from the bottom up
3. Bypass & monitoring module: communication panel (Section 4.8)
4. Fans of the bypass & monitoring module
5. Battery bus connectors
6. Tray connector (50 A), one per tray
7. Battery trays: 6 rows of 4, 24 trays

FIGURE 2-2 The 100 kVA cabinet, door open

TABLE 2-2 Front of the cabinet

Part	What it is
Touchscreen and indicators	The AEC touchscreen and the status indicators on the front door (Section 6.1).
EPO	Covered emergency power off button beside the touchscreen (Section 5.8).
Power modules	20 kVA, hot-swappable: up to 5. Slot No. 1 is at the bottom.
Bypass & monitoring module	Static bypass, controls, the communication panel and the battery cold-start button. Not hot-swappable.
Battery trays	24 trays of ten 12 V blocks under the modules: 240 blocks. Each tray plugs into the battery bus with its own 50 A connector.

Figure 2-3 shows how the cabinet is built behind the front door: the power modules at the top, the bypass & monitoring module under them, the battery bus and the 24 battery trays, one of them drawn out.

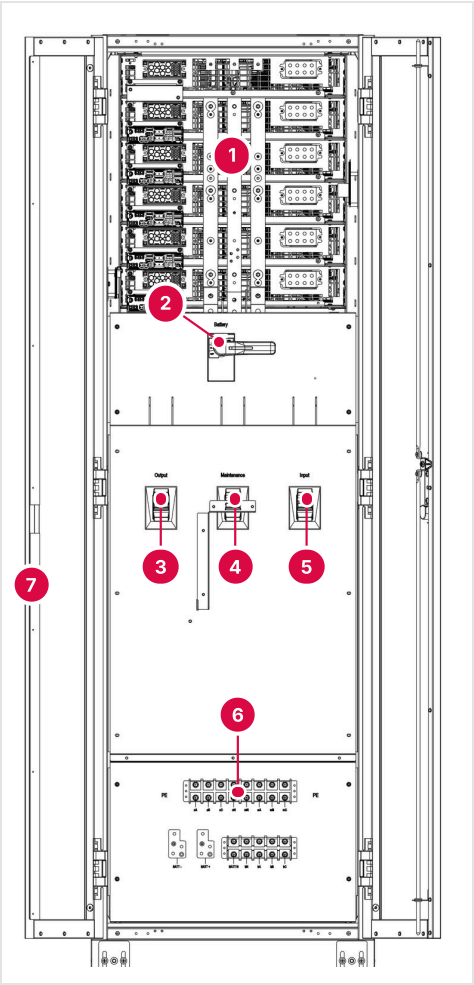


1	Front door, open: touchscreen, indicators and EPO on its front
2	Power modules, 20 kVA (slot No. 1 at the bottom)
3	Bypass & monitoring module: communication panel (Figure 4-8)
4	Fans of the bypass & monitoring module
5	Battery bus connectors
6	Battery trays: 6 rows of 4, 24 trays
7	Tray connector (50 A), one per tray
8	A tray drawn out: ten 12 V blocks

FIGURE 2-3 Illustration — internal layout simplified: the 100 kVA cabinet with five modules, front door open, one battery tray drawn out

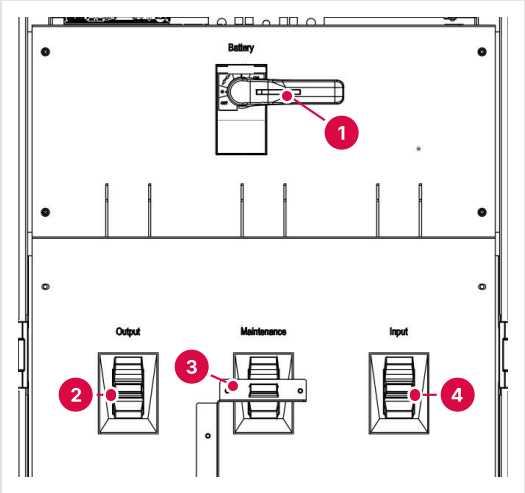
2.3 Rear of the cabinet and the breakers

The breakers and the power terminals are at the rear, behind two rear doors.



1. Module backplane (power modules seen from the rear)
2. Battery breaker
3. Output breaker
4. Maintenance bypass breaker
5. Main input breaker
6. Power terminals (Figure 4-6)
7. Rear doors

FIGURE 2-4 Rear doors open — the 100 kVA cabinet



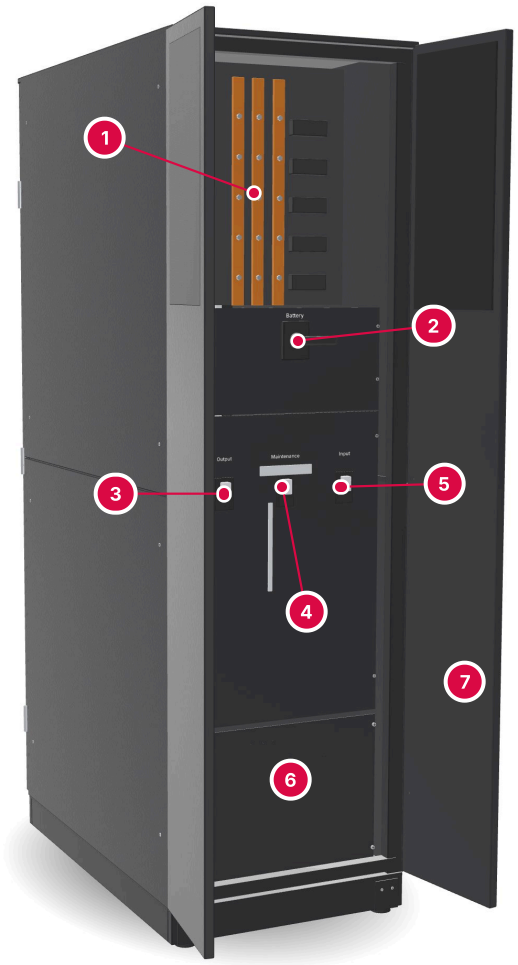
1. **Battery** — battery breaker. Connects the 240 internal blocks to the DC bus of the power modules. The UPS can trip it through OP4 at end of discharge or on EPO (Section 4.8.5).
2. **Output** — output breaker. Connects the inverters and the static bypass to the output terminals and the load.
3. **Maintenance** — maintenance bypass breaker. Connects the bypass input straight to the output, around the whole UPS, for service. Normally OFF.
4. **Input** — main input breaker. Feeds the rectifiers of the power modules from the main input terminals.

FIGURE 2-5 The breaker panel at the rear — each switch is labeled on the panel (100 kVA cabinet shown)

NOTICE

There is no bypass input breaker in the cabinet: the bypass input is protected by the external bypass breaker in the distribution panel (Section 4.6). The cabinet breakers are 3-pole; the neutral is not switched.

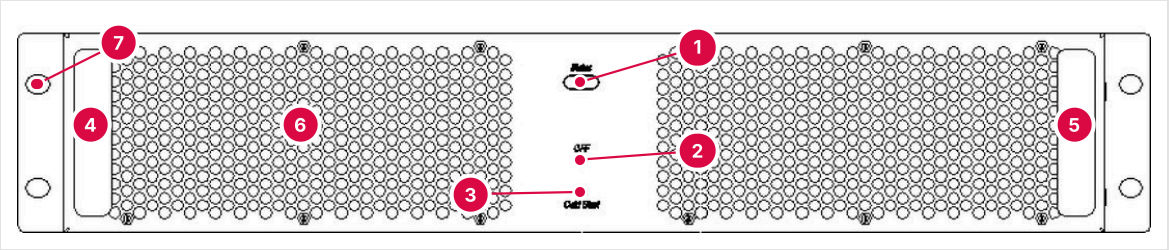
Figure 2-6 shows where the breakers and the power terminals sit at the rear, with both rear doors open.



1. Module backplane with its busbars
2. Battery breaker
3. Output breaker
4. Maintenance bypass breaker
5. Main input breaker
6. Cover over the power terminals (Figure 4-5)
7. Rear doors (two), open

FIGURE 2-6 Illustration — rear of the 100 kVA cabinet, rear doors open: breakers and terminal area

2.4 Power modules and bypass & monitoring module



1. Status LED, green: the module runs
2. OFF pinhole (hold 3 s)
3. Cold Start pinhole (start on battery)
4. Left handle
5. Right handle
6. Fan grille (front-to-back cooling)
7. Fixing holes: screws on both sides hold the module in its slot

FIGURE 2-7 Front of a 20 kVA power module (RADIB-PWR-20)

TABLE 2-3 Power module RADIB-PWR-20

Item	Value
Rating	20 kVA / 20 kW
Inside	Rectifier, inverter, bidirectional DC/DC charger
Size	17.3 × 26.7 × 3.3 in (440 × 678 × 85 mm), 2U
Weight	44 lb (20 kg)
Front	Green Status LED; OFF and Cold Start pinholes; two handles, fixing screws
Slots	Five, numbered from No. 1 at the bottom

The bypass & monitoring module sits under the power modules (Figure 2-2, item 3). It holds the static bypass, the controls, the communication panel (Figure 4-8) and the red battery cold-start button. It is not hot-swappable: only AEC service removes it, with the load on the maintenance bypass or the UPS fully off.

i NOTE The OFF pinhole of a module works only after **Control › Function › Module Button Power Enable** (Section 6.8).

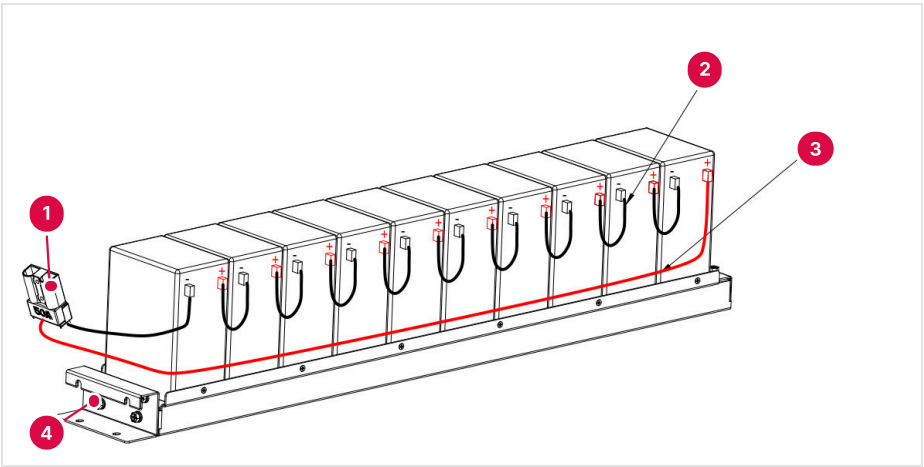
2.5 The internal battery

The cabinet holds 240 VRLA blocks of 12 V in 24 trays of ten blocks. Two trays form one string of 20 blocks, with the neutral at the midpoint: 240 V DC nominal, ±120 V to the neutral. The 12 strings are in parallel on the battery bus.



1. Trays in place: six rows of four
2. A tray drawn out: ten 12 V blocks
3. Tray front with the tray connector (50 A)

FIGURE 2-8 Battery trays behind the front door, some drawn out



1. Tray connector, 50 A: plugs into the battery bus
2. Jumper cables between the blocks (+ of one block to − of the next)
3. Tray cable from the last block back to the connector
4. Tray frame with its fixing bracket

FIGURE 2-9 Inside one tray — ten blocks in series to the tray connector

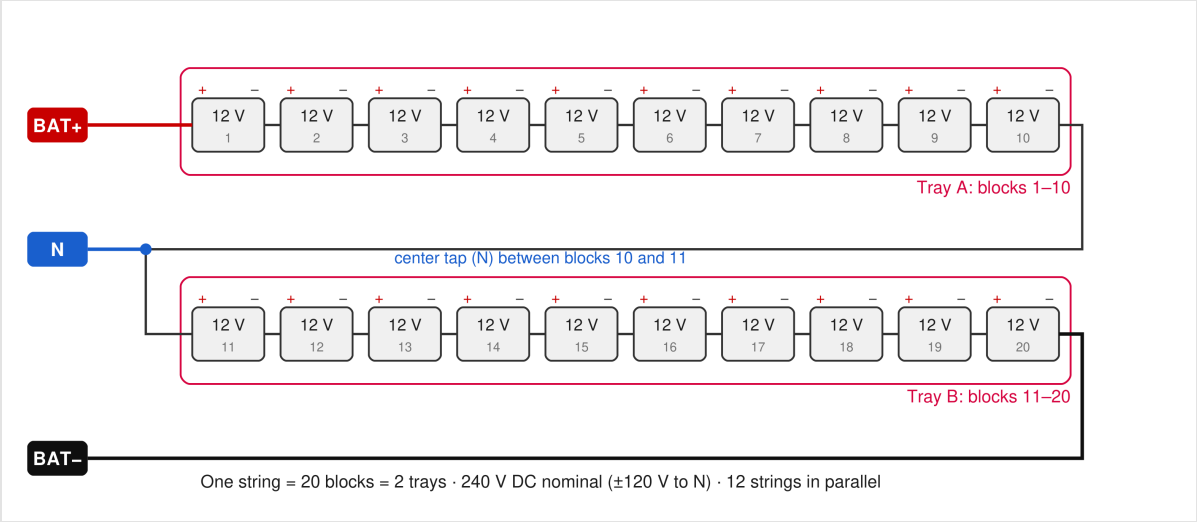
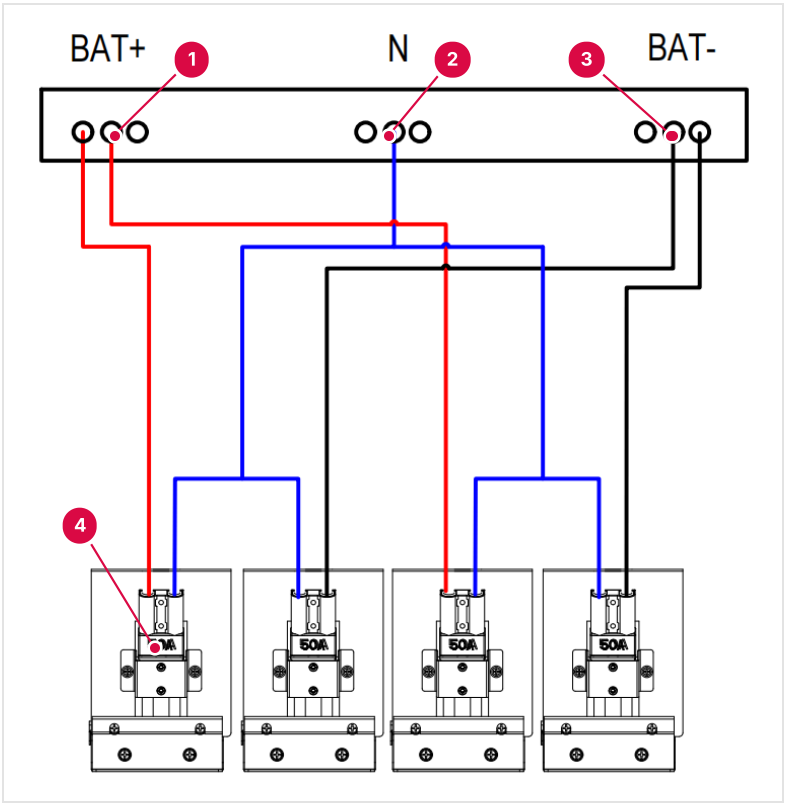


FIGURE 2-10 One string: 20 blocks in two trays, with the neutral (N) between blocks 10 and 11



1. BAT+ busbar
2. N busbar (center tap)
3. BAT– busbar
4. Tray connector, 50 A (four trays shown)

FIGURE 2-11 Battery bus: each group of four trays (two strings) connects to BAT+, N and BAT– — red +, blue N, black –

TABLE 2-4 The internal battery

Item	Value
Blocks	240 × 12 V VRLA, 9 Ah (7 Ah also possible — ask AEC)
Trays	24 × 10 blocks; RADIB-BATTR-10×9A, 63.5 lb (28.8 kg) each
Strings	12 strings of 20 blocks in parallel; neutral between blocks 10 and 11: 240 V DC nominal (±120 V)
Charge	Float 2.25 V/cell, boost 2.30 V/cell; best charging current 0.1 C, maximum 0.2 C (Chapter 9)
End of discharge	1.65 V/cell at 0.6 C · 1.75 V/cell at 0.15 C
Battery Capacity setting	108 Ah: 12 strings × 9 Ah (84 Ah with 7 Ah blocks) (Table 9-1)
Battery breaker	At the rear (Figure 2-5, item 1); the UPS can trip it through OP4 at end of discharge or on EPO (Section 4.8.5)
Cold start	From the batteries, about 60 s to output (Section 5.3)

TABLE 2-5 Backup time with the 240 internal 9 Ah blocks (minutes, new batteries, 77 °F / 25 °C)

Load	At 50 % load	At 100 % load
20 kVA (1 module)	85	32
40 kVA (2 modules)	32	14
60 kVA (3 modules)	22	8
80 kVA (4 modules)	14	6
100 kVA (5 modules)	12	3

The backup time depends on the load: every RADIANT-IB has the same 240 blocks, whatever the number of modules. The charger is in the power modules, so a cabinet with one or two modules recharges the same battery with less charging power: the recharge time for each build is not published (ask AEC).

2.6 Models and ordering codes

TABLE 2-6 RADIANT-IB ordering codes and weights

Code	Configuration	Weight (approx.)
RADIB100-1X20	100 kVA cabinet, 1 × 20 kVA module (20 kVA), 240 blocks	1,998 lb (906 kg)
RADIB100-2X20	100 kVA cabinet, 2 × 20 kVA modules (40 kVA), 240 blocks	2,042 lb (926 kg)
RADIB100-3X20	100 kVA cabinet, 3 × 20 kVA modules (60 kVA), 240 blocks	2,086 lb (946 kg)
RADIB100-4X20	100 kVA cabinet, 4 × 20 kVA modules (80 kVA), 240 blocks	2,130 lb (966 kg)
RADIB100-5X20	100 kVA cabinet, 5 × 20 kVA modules (100 kVA), 240 blocks	2,174 lb (986 kg)
RADIB-FRAME	100 kVA cabinet: 5 slots, bypass & monitoring module and breakers; no module, no tray	430 lb (195 kg)
RADIB-PWR-20	Power module 20 kVA / 20 kW, hot-swappable	44 lb (20 kg)
RADIB-BATTR-10×9A	Battery tray with ten 12 V 9 Ah VRLA blocks	63.5 lb (28.8 kg)
RADIB-BATTR-EMPTY	Battery tray, empty	—
SNMP-M · DRYCNT	SNMP network card · dry-contact expansion card	—

How to read the code. RADIB100-3X20 means the 100 kVA cabinet (RADIB100), then the number of 20 kVA modules (3 × 20 = 60 kVA installed). Order one module for every 20 kW of load and one more for N+1. Every complete UPS comes with its 240 blocks in 24 trays. The weights add the cabinet, the modules and 24 full trays.

2.7 What is in the box

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

- 1 × RADIANT-IB 100 kVA cabinet with the bypass & monitoring module, the touchscreen and the breakers, on four leveling feet (no casters: moved with a pallet truck or forklift)
- The power modules ordered and the 24 battery trays (fitted, or packed separately — see the packing list)
- 1 × user manual

2.8 How the UPS works

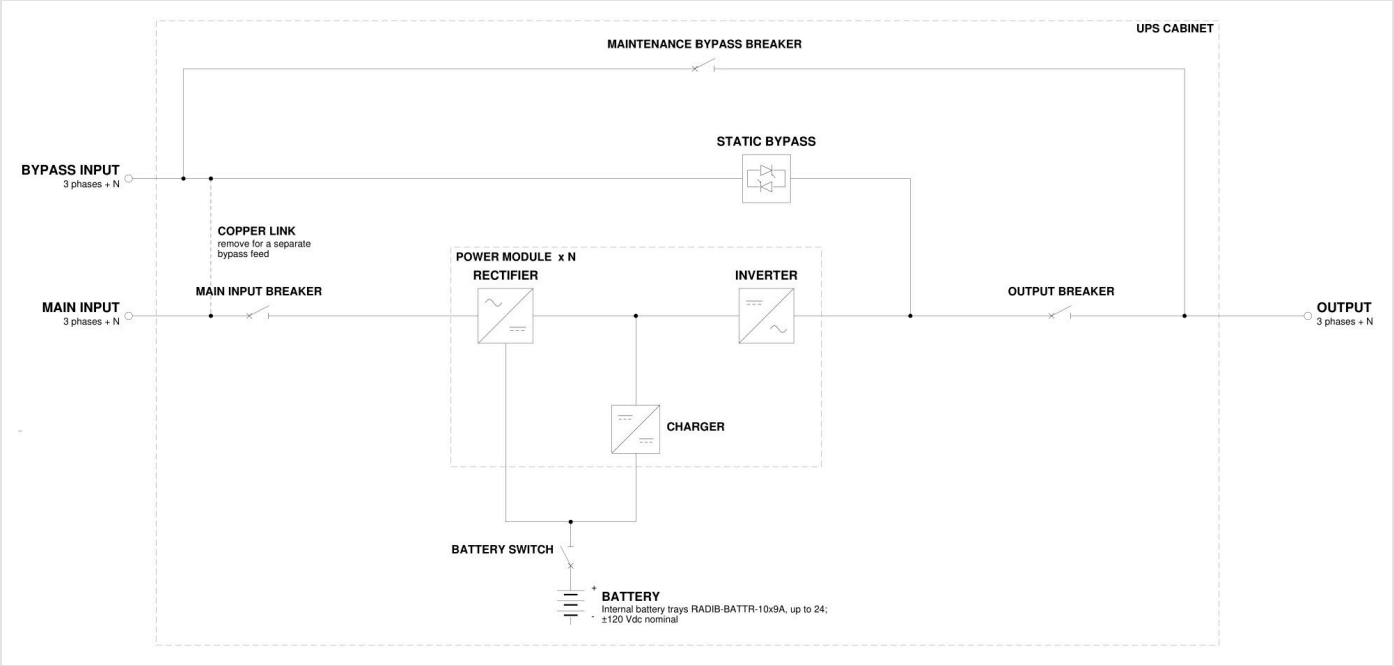


FIGURE 2-12 Single-line diagram — one line stands for the three phases and the neutral; PE not shown

TABLE 2-7 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 above 0.99; current THD 3 % or less, typical).
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 internal 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 & monitoring module: feeds the load from the bypass input when the inverters are off, overloaded or faulty.
Copper link	Joins the main input and the bypass input as delivered. Remove it only for a separate bypass feed (Section 4.7.1).
Breakers	Battery, main input, maintenance bypass and output in the cabinet (Figure 2-5). The bypass input has no breaker in the cabinet.

2.9 Operating modes

TABLE 2-8 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 internal 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).
Maintenance bypass	With the maintenance bypass breaker closed the load is fed from the bypass input, so the UPS can be serviced without stopping the load. Dangerous voltage stays on the input, output and neutral terminals and on the internal busbars, even with all modules and the touchscreen off.
ECO	The load runs on the static bypass while the bypass stays within its 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: make sure the loads accept this short break.
Auto restart	After the battery has reached end of discharge, the UPS restarts by itself when the utility returns (the commissioning engineer sets the mode and the delay).
Module sleep	At part load the modules not needed stand by in turn, so that they age evenly; they wake as the load grows.
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.

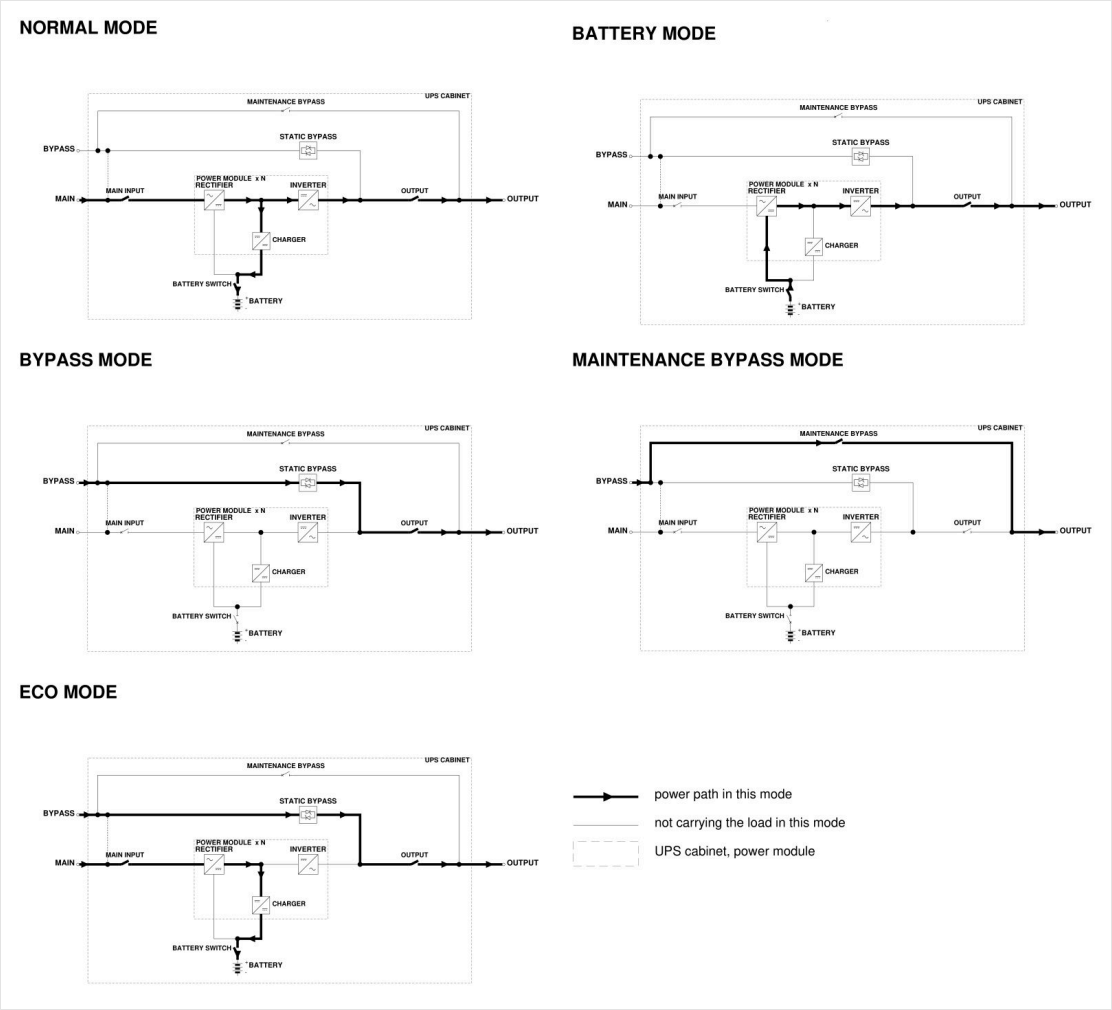


FIGURE 2-13 The power path in each operating mode — thick line: power path; thin line: not carrying the load

NOTICE

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

2.10 Protections

- **Overload, inverter (typical):** 110 % for 1 h · 125 % for 10 min · 150 % for 1 min · above 150 % for 200 ms, then transfer to bypass.
- **Overload, bypass:** up to 110 % continuous · 110–125 % for 5 min · 125–150 % for 1 min · above 150 % for 1 s.
- **Output short circuit** protection.
- **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 through OP4 at end of discharge or on EPO (Section 4.8.5).
- **Input:** input neutral lost, bypass phase sequence, bypass voltage and frequency window.
- **Redundancy:** alarm when N+X redundancy is lost.
- **EPO:** covered 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-IB uses hot-swappable power modules of 20 kVA / 20 kW (output power factor 1: kVA = kW). 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 (20 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 left with one module out, for start-up currents and growth.
5. Up to five modules fit the cabinet; for more power, up to three cabinets run in parallel (Section 4.9). Free slots stay closed with their covers until you add modules.
6. 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 — 55 kW of load

Step	Result
Load	55 kW
Modules for the load (N)	55 ÷ 20 = 2.75 → 3 modules
With 80 % margin	55 ÷ (20 × 0.8) = 3.44 → 4 modules
For N+1 redundancy	5 modules: 100 kVA cabinet (RADIB100-5X20)

3.2 Planning the battery

The battery is inside the cabinet: 240 blocks of 12 V in 24 trays. The runtime at your load is in Table 2-5.

- The battery is set for 20 blocks per string and 108 Ah (12 strings × 9 Ah). The number of blocks and the capacity in **Set › BATT Set** must match the installed battery exactly (Table 9-1).
- Allow floor loading for the batteries: the 24 full trays weigh 1,524 lb (691 kg) of the cabinet weight (Table 2-6, Table 4-2).
- Battery life is best at 68–77 °F (20–25 °C). If you need more runtime than Table 2-5 gives, ask AEC.

3.3 Running on a generator

The PFC rectifier (input power factor above 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 4.8.4), 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.

04

CHAPTER 4

Installation

Unpacking, the site and its working space, positioning the cabinet, the modules and battery trays, protective devices and cables, 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 internal battery strings are 240 V DC nominal and lethal. Wear eye protection, remove rings, watches and metal objects, use tools with insulated handles and rubber gloves.

4.1 Unpacking and moving

1. While the crate is still on the truck, inspect it for damage. If damage is apparent, notify the carrier and AEC at once.
2. Move the crate to the site with a forklift rated for the weight: up to about 2,200 lb (1,000 kg) with modules and batteries (Table 2-6).
3. Open the top plate of the crate, then the side boards (Figure 4-1). Remove the protective foam around the cabinet.
4. Check the cabinet for transport damage. Check the product label (model, cabinet and capacity) and the contents against the packing list (Section 2.7).
5. Remove the bolts that hold the cabinet to the pallet. Move the cabinet to its place with a pallet truck or forklift (it has no casters), with care, so as not to scratch it.

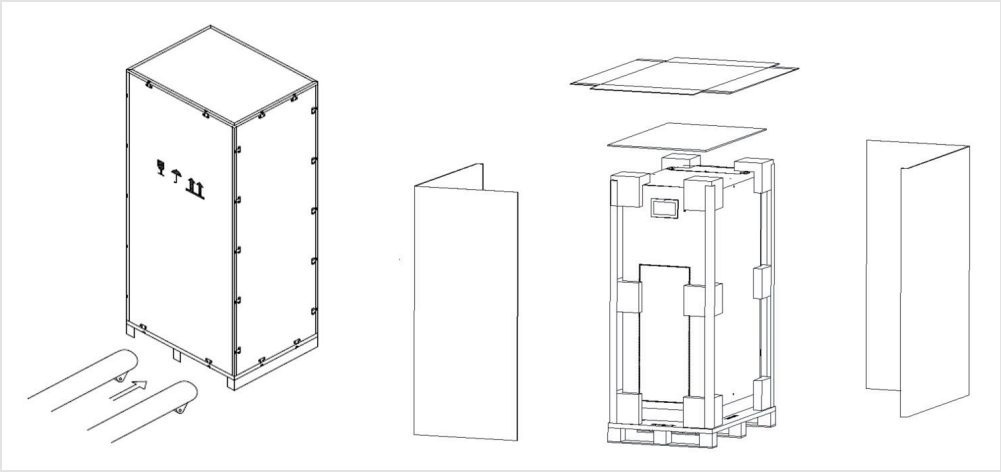


FIGURE 4-1 Move the crate with a forklift (left), then remove the top plate, the side boards and the foam (right)

4.2 Site and environment

TABLE 4-1 Operating and storage environment

Item	Requirement
Location	Indoors; dry, clean and ventilated; away from water, heat sources, flammable or corrosive substances, conductive dust, salt air and direct sunlight
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 3,300 ft (1,000 m); from 3,300 to 6,600 ft (1,000–2,000 m) derate the power by 1 % per 330 ft (100 m)
Protection · noise	IP20 · below 65 dB at 100 % load, 62 dB at 45 % load
Floor	Level (less than 5° slope), no vibration, rated for the load of Table 4-2: up to about 2,200 lb (1,000 kg) on four leveling feet (Figure 4-3)
UPS storage and transport	−40 to 158 °F (−40 to 70 °C), indoors, dry
Battery storage	Dry, cool and ventilated; 68–77 °F (20–25 °C) is best. Recharge stored VRLA batteries as their maker requires (typically every 3–6 months)

TABLE 4-2 Site planning data, calculated

Build	Weight	Heat at full load	Floor load over the footprint	Per leveling foot
RADIB100-1X20 (20 kW)	1,998 lb (906 kg)	4,360 BTU/h (1.28 kW)	309 lb/ft² (1,510 kg/m²)	500 lb (227 kg)
RADIB100-2X20 (40 kW)	2,042 lb (926 kg)	8,710 BTU/h (2.55 kW)	316 lb/ft² (1,543 kg/m²)	511 lb (232 kg)
RADIB100-3X20 (60 kW)	2,086 lb (946 kg)	13,070 BTU/h (3.83 kW)	323 lb/ft² (1,577 kg/m²)	522 lb (237 kg)
RADIB100-4X20 (80 kW)	2,130 lb (966 kg)	17,420 BTU/h (5.11 kW)	330 lb/ft² (1,610 kg/m²)	533 lb (242 kg)
RADIB100-5X20 (100 kW)	2,174 lb (986 kg)	21,780 BTU/h (6.38 kW)	337 lb/ft² (1,643 kg/m²)	544 lb (247 kg)

How these figures are calculated. Heat = output kW × (1 ÷ 0.94 − 1) × 3,412 BTU/h per kW, at the published efficiency of up to 94 %. At part load, at lower efficiency and while the battery recharges the losses are higher: size the cooling with margin, and for the full 100 kVA if modules will be added later. Floor load = weight ÷ footprint (23.6 × 39.4 in = 6.46 ft², 0.60 m²); per foot = weight ÷ 4, an equal share. The cooling airflow (CFM), the center of gravity and the measured load on each foot are not published: ask AEC.

NOTICE

- VRLA batteries give off small amounts of hydrogen and oxygen at the end of charging. The room needs fresh-air ventilation according to NFPA 70 Article 480 and IEEE 1635.
- Battery life halves for each 18 °F (10 °C) above 68 °F (20 °C) — see Section 10.3.

4.3 Working space and clearances

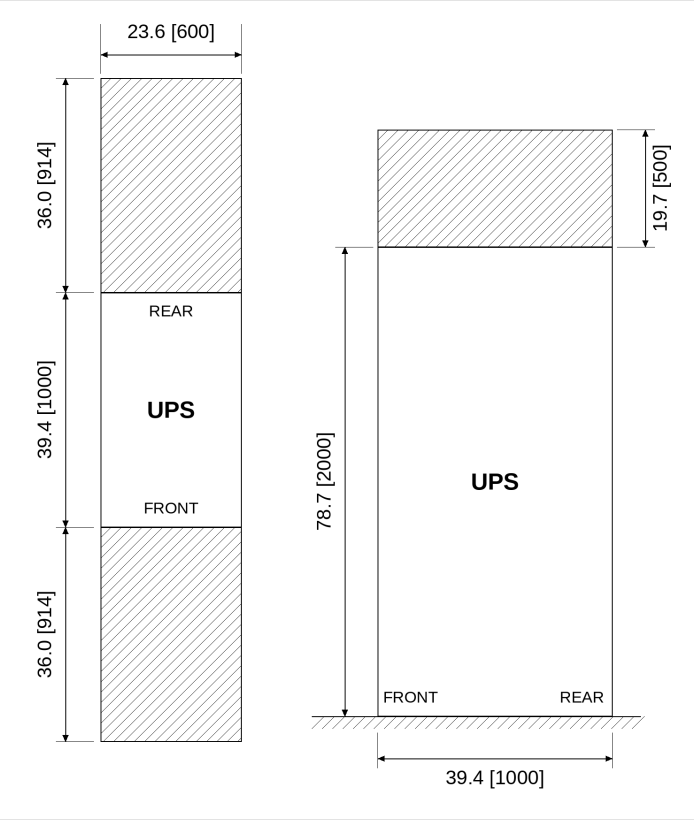


FIGURE 4-2 Space to keep free, plan view (left, front at the bottom) and side view (right, front on the left) — hatched: keep free; inches [mm]

- **Front:** keep a working space of at least 36 in (914 mm) deep in front of the cabinet, 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)). This also covers the AEC minimum of 31.5 in (800 mm) to open the door fully and replace modules.
- **Rear:** a working space of at least 36 in (914 mm) deep, 30 in (762 mm) wide and 6.5 ft (1.98 m) high (NEC 110.26(A)), because the breakers you operate and the power terminals are at the rear, behind the rear doors. This also covers the AEC minimum of 19.7 in (500 mm) for ventilation and cooling. Leave room for both rear doors to open fully.
- **Top:** at least 19.7 in (500 mm).
- **Sides:** no side distance is stated. Ask AEC if the cabinet stands against a wall or another cabinet.

4.4 Positioning the cabinet

The cabinet has no casters: it is moved with a pallet truck or forklift and stands on four leveling feet (Figure 4-3). The leveling feet carry and level the cabinet; they do not fix it to the floor.

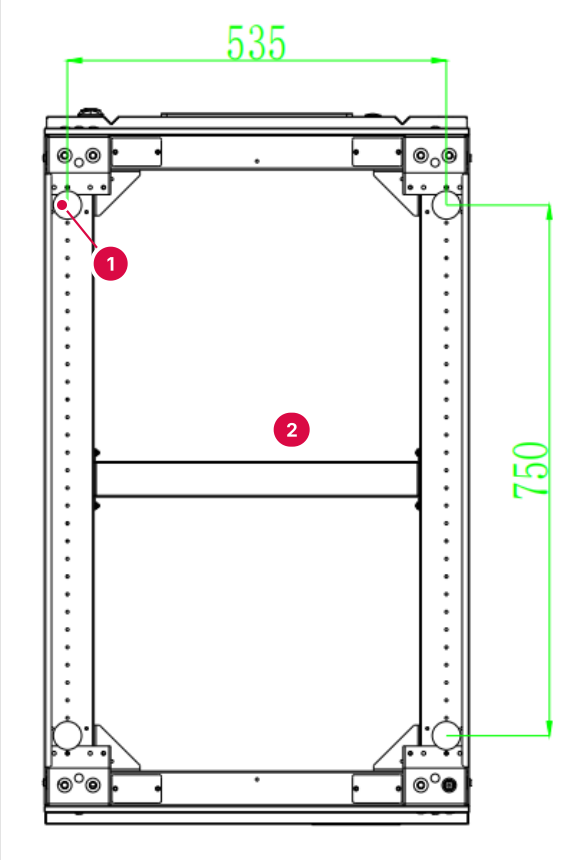
WARNING

The cabinet is heavy and tall: up to 2,174 lb (986 kg) and 78.7 in (2,000 mm). It can tip over while it is moved. Move it with a pallet truck or forklift rated for the weight, slowly, on a flat floor, and keep people away from its sides. Install the power modules and battery trays only after the cabinet is in its final place. On a weak floor, spread the load with steel plates or larger supports under the leveling feet.

1. Check that the leveling feet are in good condition and that the floor is level, flat and strong enough (Table 4-2).
2. Turn the leveling feet counterclockwise with a wrench to raise them, so the pallet truck can set the cabinet down without catching them.
3. Set the cabinet down in its final place, over the floor opening for the cables.
4. Turn the four leveling feet clockwise until the cabinet rests on them.
5. Check that the four feet are at the same height and that the cabinet is level and does not move.

NOTICE

AEC publishes no floor-anchoring kit, no seismic rating and no center of gravity for this cabinet. In a seismic zone, or where the local code requires equipment to be anchored, ask AEC before installation.



1. Leveling foot (4): the cabinet rests on them once in place
2. Bottom cable entry

FIGURE 4-3 Bottom view of the cabinet — leveling-foot spacing 21.1 × 29.5 in (535 × 750 mm)

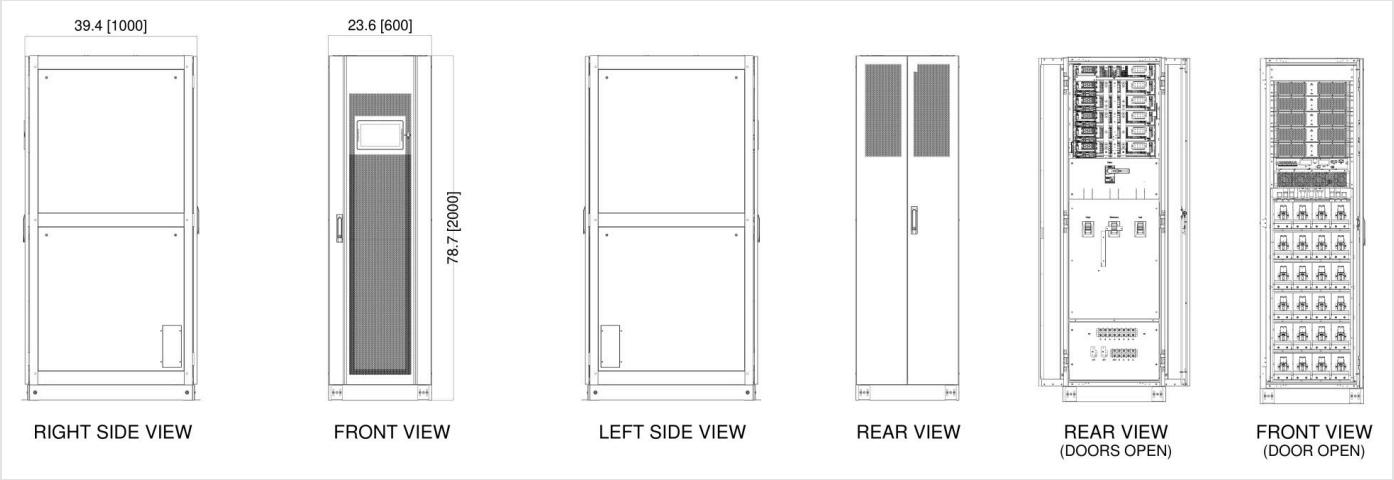


FIGURE 4-4 Appearance and dimensions of the 100 kVA cabinet, inches [mm]: right side, front, left side, rear, rear with the doors open, front with the door open.

4.5 Installing the power modules and battery trays

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 2-2), to keep the center of gravity low. This applies to every cabinet, with any number of modules.
3. Push each module fully in and fasten it with the screws on both sides of its front panel (Figure 2-7, item 7).
4. Leave the empty slots closed with their covers.
5. Slide the 24 battery trays into their places, from the bottom row up (Figure 2-8).
6. Plug each tray into the battery bus with its 50 A Anderson-type connector. The trays are wired in groups of four (two strings) to BAT+, N and BAT− (Figure 2-11).
7. Before you close the battery breaker, check the polarity and measure the voltage of each string: about 240 V DC from BAT+ to BAT−, about 120 V DC from each to N.

⚠ DANGER

The string voltage is 240 V DC nominal and more while charging. Make sure +, N and − are connected correctly from the trays to the battery breaker and from the breaker to the UPS. Reversed polarity can cause explosion, fire and damage to the battery and the UPS.

4.6 External protective devices

Install breakers upstream of the UPS in the distribution panel. Size them with Table 4-3.

- The UPS is a continuous load. Size every overcurrent device at **at least 125 % of the continuous current** (NEC 210.20(A), 215.3) and use the next standard rating (NEC 240.6(A)).
- **Single feed (as delivered).** The copper link joins the main input and the bypass input. One feeder, protected by the external main input breaker, supplies the rectifiers and, through the link, the static bypass and the maintenance bypass. Connect nothing to bA, bB, bC, bN, and never connect a second breaker to the linked terminals.
- **Separate bypass feed.** Remove the copper link. The main input and the bypass input each have their own external breaker, fed from sources with the same neutral.
- Use 3-pole breakers upstream; the neutral is not switched.

- 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.
- The Maintenance breaker in the cabinet keeps the load on while the modules are serviced, but the cabinet stays live. To service the cabinet with no voltage inside, an external maintenance bypass is required (Section 5.6).

TABLE 4-3 Currents and external breakers — 100 kVA cabinet, 208 V

Item	100 kVA cabinet
Main input current (maximum)	348 A
Bypass input and output current (rated)	277 A
Neutral current rating, bypass and output	471 A (1.7 × 277 A)
Battery current at 100 kW	476 A at 1.75 V/cell, losses not included; about 537 A at 1.65 V/cell (calculated)
External main input breaker	450 A, 3-pole (348 A × 1.25 = 435 A)
External bypass input breaker (separate bypass feed only)	350 A, 3-pole (277 A × 1.25 = 346 A)
External output breaker	350 A, 3-pole (277 A × 1.25 = 346 A)
External maintenance bypass breaker (for full isolation)	350 A, 3-pole (277 A × 1.25 = 346 A)
External battery breaker (external battery cabinet only)	700 A DC (537 A × 1.25 = 671 A)

Currents at 208 V rated line voltage. The battery current of 476 A is the factory figure: 100 kW ÷ (120 cells × 1.75 V/cell). At the default end-of-discharge voltage of 1.65 V/cell (120 cells, 198 V) and 94 % efficiency it is about 100,000 ÷ 0.94 ÷ 198 = 537 A: the breaker and the DC conductors of an external battery cabinet are sized on this calculated value. Size the breakers and cables for the full rating of the cabinet, so that modules can be added later without rewiring. The battery breaker of the internal trays is in the cabinet (Figure 2-5, item 1).

External battery breaker (external battery cabinet only). A DC-rated breaker, as close to the battery as possible (NEC Article 480), with:

- a DC voltage rating of at least 294 V DC (120 cells × 2.45 V/cell, the highest boost setting);
- an interrupting rating at least the short-circuit current of the battery, from the battery maker;
- a 24 V DC shunt-trip coil that OP4 can drive (100 mA maximum) and normally-open auxiliary contacts for IP1 and IP2 (Section 4.8.5);
- three poles for BAT+, N and BAT−.

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 4-4 Minimum copper conductors — 100 kVA cabinet, 75 °C, NEC Table 310.16

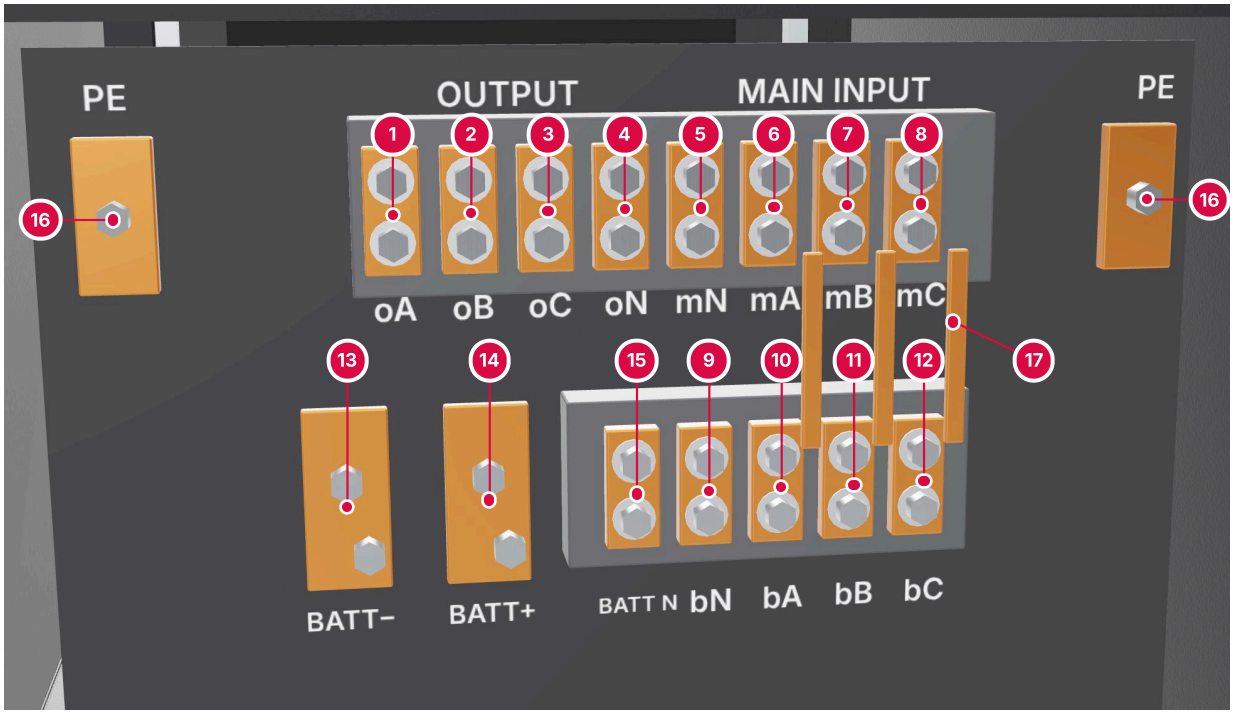
Circuit (breaker)	Phases	Neutral	EGC, in each raceway
Main input (450 A)	2 × 4/0 AWG [2 × 107 mm²]	2 × 250 kcmil [2 × 127 mm²]	2 AWG [33.6 mm²]
Bypass input and output (350 A)	2 × 2/0 AWG [2 × 67.4 mm²]	2 × 250 kcmil [2 × 127 mm²]	3 AWG [26.7 mm²]
Battery, external cabinet only (700 A DC)	+ and −: 2 × 500 kcmil [2 × 253 mm²]	N: 2 × 500 kcmil [2 × 253 mm²]	1/0 AWG [53.5 mm²]

- **Basis.** Copper, 75 °C ampacity (NEC 110.14(C), Table 310.16), 86 °F (30 °C) ambient, two parallel sets in two raceways, three current-carrying conductors in each raceway. Correct for other conditions (NEC 310.15(B) and (C)).
- **Phases.** The ampacity of each pair of conductors is at least the breaker rating, so the next-size-up rule of NEC 240.4(B) is not used: main input 2 × 230 A = 460 A for 450 A; bypass and output 2 × 175 A = 350 A for 350 A; battery 2 × 380 A = 760 A for 700 A. It is also at least 125 % of the continuous current (NEC 210.19(A)(1), 215.2(A)(1)): 435 A and 346 A.
- **Neutral.** Rated 1.7 × 277 A = 471 A for mainly non-linear loads: 2 × 255 A = 510 A. With the copper link fitted, the main input neutral carries this current too, so it is the same size. Keep that size with a separate bypass feed as well, unless the engineer of record sizes it otherwise.
- **Neutral as a current-carrying conductor.** When most of the load is non-linear (IT power supplies, LED drivers, drives), the neutral counts as a current-carrying conductor (NEC 310.15(E)(3)): four in each raceway, adjustment factor 80 % (NEC Table 310.15(C)(1)). Calculated for that case, with 90 °C conductors (THHN or XHHW-2) for the adjustment and the 75 °C limit at the terminals: main input 2 × 250 kcmil, bypass and output 2 × 3/0 AWG, neutral 2 × 300 kcmil.
- **Parallel sets** are 1/0 AWG or larger, of the same length, material, size and insulation, with the same terminations (NEC 310.10(G)). Run each set (A, B, C, N and its EGC) in its own raceway.
- **Equipment grounding conductor** per NEC Table 250.122, on the breaker rating: 2 AWG for 450 A, 3 AWG for 350 A, 1/0 AWG for 700 A. With parallel sets in separate raceways, run a full-size EGC in each raceway (NEC 250.122(F)). If you enlarge the phase conductors for voltage drop, enlarge the EGC in proportion (NEC 250.122(B)).
- **Voltage drop.** Keep it below 3 % on AC runs and 1 % on DC runs: AC runs longer than about 164 ft (50 m) and DC runs longer than about 98 ft (30 m) need larger conductors.
- **Terminals.** M10 bolts, two per pole: torque 133 lb-in (15 N·m). Use crimped ring lugs. The largest conductor and lug the terminals accept are not published: ask AEC before you order the 250 kcmil neutral lugs.
- Final sizing is by the electrical engineer of record (ambient, length, voltage drop, local code).

4.7.1 Terminal block and wire order

Open the rear doors and remove the cover over the terminals to reach them (Figure 2-4, item 6). Each terminal is marked on the block.

The terminal area is at the bottom of the rear, under the breakers (Figure 2-6, item 6). Figure 4-5 numbers every terminal, and Table 4-5 gives the bolts, the torque and the conductor sizes for each group.



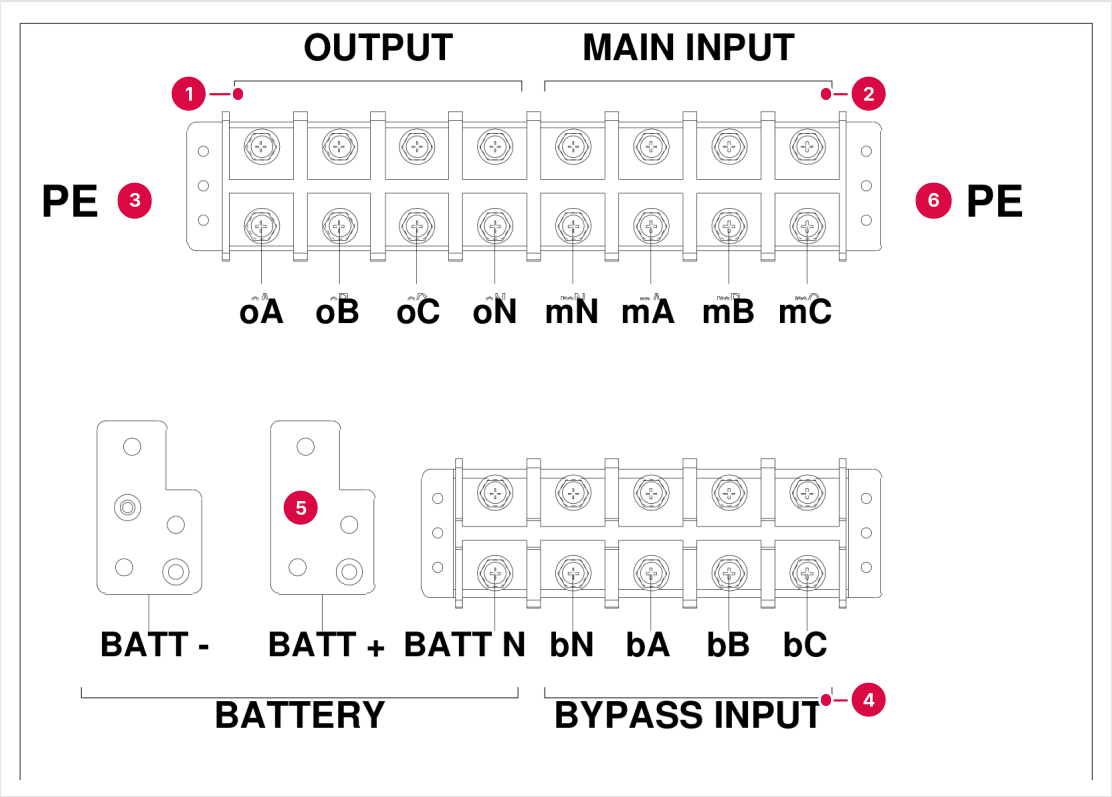
1. oA — Output A (L1)
2. oB — Output B (L2)
3. oC — Output C (L3)
4. oN — Output N
5. mN — Main input N
6. mA — Main input A (L1)
7. mB — Main input B (L2)
8. mC — Main input C (L3)
9. bN — Bypass input N
10. bA — Bypass input A (L1)
11. bB — Bypass input B (L2)
12. bC — Bypass input C (L3)
13. BATT – (factory-wired)
14. BATT + (factory-wired)
15. BATT N (factory-wired)
16. PE — protective earth, two places: connect first
17. Copper links main input – bypass input (as delivered)

FIGURE 4-5 Illustration: the power terminals, rear view with the cover removed — every terminal numbered

TABLE 4-5 Terminal data

Terminal (Figure 4-5)	Bolts	Torque	Wire, min. (NEC size)	Lug
Output oA, oB, oC, oN (1–4)	M10, two per pole	133 lb-in (15 N·m)	Phases 2 × 2/0 AWG; oN 2 × 250 kcmil	Crimped ring lug
Main input mN, mA, mB, mC (5–8)	M10, two per pole	133 lb-in (15 N·m)	Phases 2 × 4/0 AWG; mN 2 × 250 kcmil	Crimped ring lug
Bypass input bN, bA, bB, bC (9–12)	M10, two per pole	133 lb-in (15 N·m)	Separate bypass feed only: phases 2 × 2/0 AWG; bN 2 × 250 kcmil	Crimped ring lug
Battery BATT –, BATT +, BATT N (13–15)	M10, two per pole	133 lb-in (15 N·m)	Factory-wired; external battery cabinet only: 2 × 500 kcmil	Crimped ring lug
PE, two places (16)	M10	133 lb-in (15 N·m)	EGC of each raceway: 2 AWG (main input), 3 AWG (bypass, output)	Crimped ring lug

The wire sizes are the minimum copper conductors of Table 4-4, in mm² there. The smallest and largest conductor and lug the terminals accept: ask AEC.



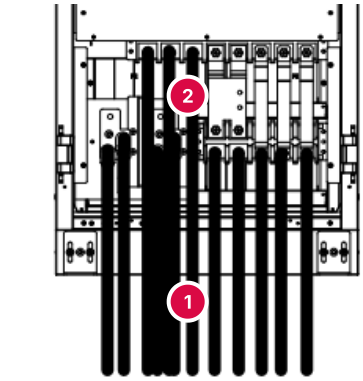
1. **Output** — oA, oB, oC, oN: to the load panel
2. **Main input** — mA, mB, mC, mN: utility L1, L2, L3 and neutral to the rectifiers
3. **PE** — protective earth, two places: connect first
4. **Bypass input** — bA, bB, bC, bN: bypass supply L1, L2, L3 and neutral
5. **Battery** — BATT –, BATT +, BATT N
6. **PE**, second place

FIGURE 4-6 Power terminals, rear view with the terminal cover removed

TABLE 4-6 Wire order

Terminal group	Marking (left to right)	Notes
Output	oA (L1) · oB (L2) · oC (L3) · oN	208 V line to line, 120 V line to neutral.
Main input	mN · mA (L1) · mB (L2) · mC (L3)	Clockwise phase rotation A-B-C.
Bypass input	bN · bA (L1) · bB (L2) · bC (L3)	Same phase rotation as the main input, or the UPS alarms Bypass Sequence Error. Same neutral as the main input. As delivered, a copper link joins the bypass and main inputs: remove it only for a separate bypass feed.
Battery	BATT – · BATT + · BATT N	Factory-wired to the internal battery bus. Connect nothing here unless AEC supplies an external battery cabinet; then + to +, N to the center tap, – to –, and check polarity with a voltmeter.
PE	PE (two places)	Protective earth, first on and last off.

Cable entry. Cables enter from the bottom only: they come up through the plinth to the terminals at the rear (Figure 4-7); the roof has no cable entry. Plan the floor opening or trench under the cabinet before it is set down. Fix the cables so the ventilation stays clear, and close any remaining opening against rodents.



1. Power cables from the bottom to the terminals
2. Terminal area

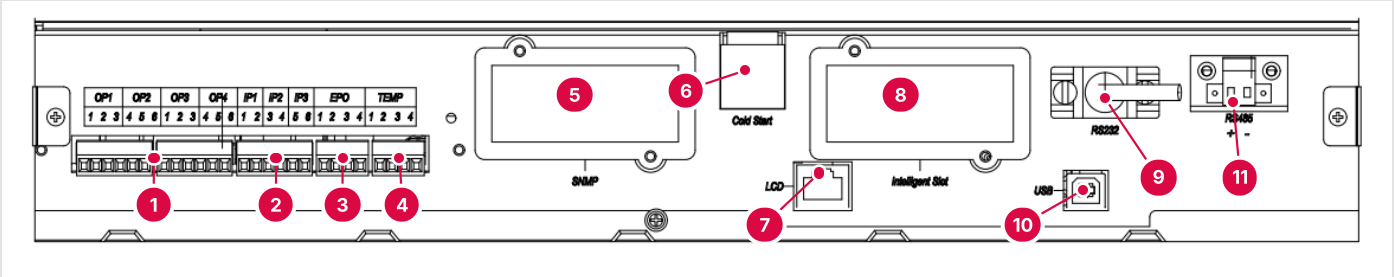
FIGURE 4-7 Bottom cable entry, rear view: the power cables come up to the terminal area

Connection sequence

1. Check that every external breaker is open, and that all four breakers in the cabinet — **Battery**, **Output**, **Maintenance** and **Input** — are open (Figure 5-1, state A). Lock them out and hang warning signs on them.
2. Open the rear doors and remove the cover over the terminals.
3. Connect the protective earth (PE) conductors to the PE terminals first (Figure 4-6, item 3).
4. Connect the main input cables to mA, mB, mC, mN and the load cables to oA, oB, oC, oN.
5. For a separate bypass feed, remove the copper link between the main input and the bypass input, then connect the bypass cables to bA, bB, bC, bN.
6. Tighten every lug to 133 lb-in (15 N·m). Check the phase rotation and the wiring, then refit all covers.

4.8 Control and communication cables

The communication panel is on the front of the bypass & monitoring module (Figure 2-2, item 3). It holds the dry contacts, the cold-start button, the touchscreen port, RS-232, RS-485, USB, the SNMP slot and the intelligent slot.



1. OP1 · OP2 · OP3 · OP4: alarm relays and battery breaker trip
2. IP1 · IP2 · IP3: BCB status, BCB online, generator input
3. EPO: remote emergency power off input
4. TEMP: ambient and battery temperature sensors
5. SNMP slot: SNMP-M network card (Section 8.1)
6. Cold-start button (start on battery)
7. LCD: cable to the touchscreen (RJ45) — not a network port
8. Intelligent slot: dry-contact expansion card
9. RS-232 port (DB9)
10. USB port
11. RS-485 port (terminal, + −)

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

The dry-contact terminals are pluggable. Signal cables must be shielded and double insulated, 20 to 16 AWG (0.5–1.5 mm²), no longer than 80 to 160 ft (25–50 m), and run apart from the power cables.

4.8.1 Dry contacts

The dry contacts have five groups of terminals. The functions in Table 4-7 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 4-7 Dry contacts

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
TEMP-4	BAT TEMP	Battery temperature sensor
IP1-1 · IP1-2	BCB STATUS · GND	Battery breaker status (normally-open auxiliary contact). 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)
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 end of discharge or EPO)

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

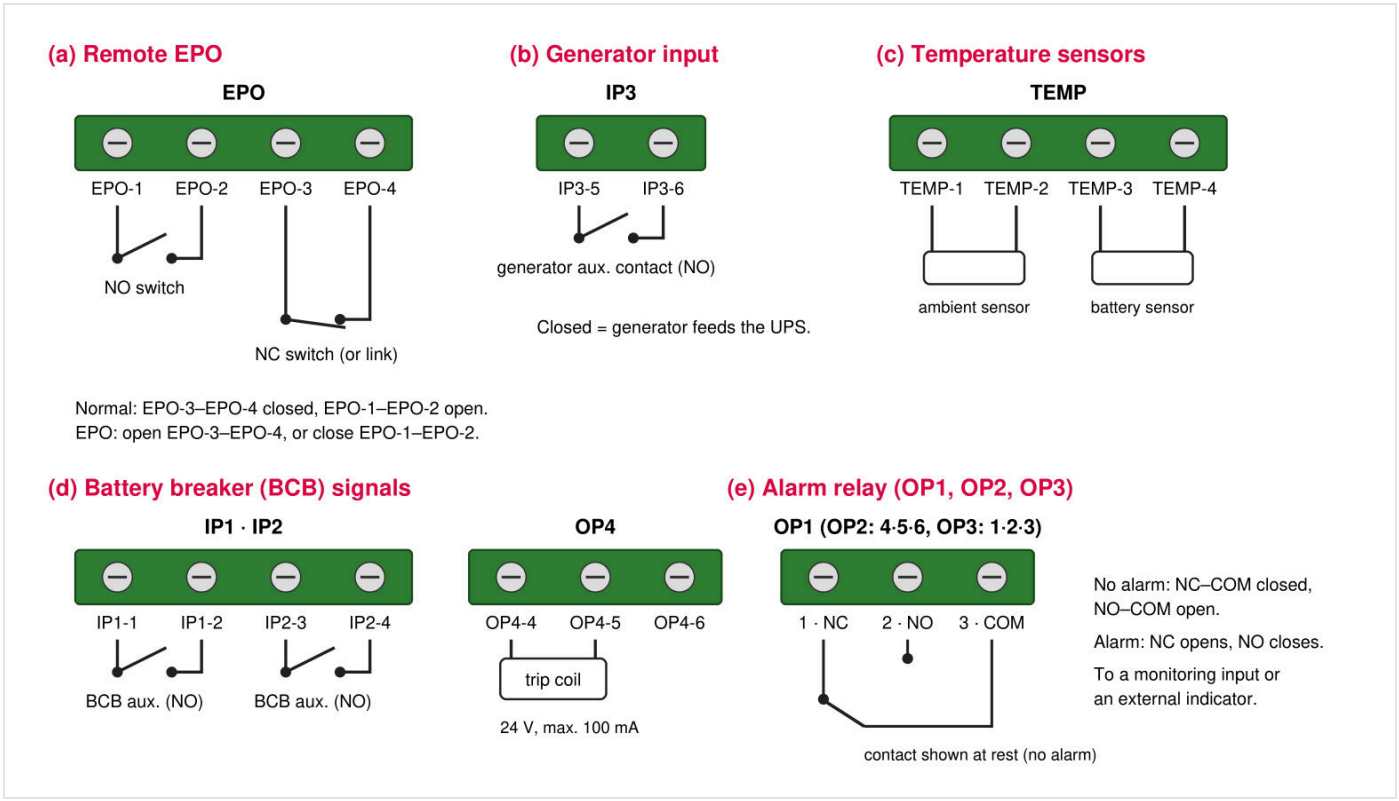


FIGURE 4-9 How to wire the dry contacts: (a) remote EPO, (b) generator, (c) temperature sensors, (d) battery breaker, (e) alarm relays

4.8.2 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 (Figure 4-9, a). A remote EPO switch must be a voltage-free normally-open or normally-closed contact: the +24 V on EPO-2 and EPO-3 comes from the UPS. No software setting is needed to enable the remote EPO.

i NOTE Keep EPO-1 and EPO-2 open in normal operation.

4.8.3 Temperature sensors

TEMP-1 and TEMP-4 take the ambient and the battery temperature sensor; TEMP-2 and TEMP-3 are their common (Figure 4-9, c). The battery sensor drives the charge temperature compensation. The sensors are optional and specific to the UPS: order them from AEC.

4.8.4 Generator input

Wire a normally-open auxiliary contact of the generator between IP3-5 (GEN CONNECTED) and IP3-6 (+24 V) (Figure 4-9, b). The contact closes when the generator feeds the UPS.

4.8.5 Battery breaker interface (BCB)

IP1 and IP2 read normally-open auxiliary contacts of a battery breaker; OP4-4 (BCB DRV, +24 V, max. 100 mA) drives its trip coil at end of discharge or on EPO (Figure 4-9, d). When the breaker is closed the UPS sees the battery as connected; when it is open, it alarms Battery Not Connected.

NOTICE

Whether the battery breaker of the internal trays is wired to IP1, IP2 and OP4 at the factory is not published: ask AEC before you connect anything to these terminals. If its trip coil is not wired to OP4, the UPS cannot open it: after an EPO or an end of discharge, open the **Battery** breaker by hand.

4.8.6 Alarm relays

OP1 signals battery low, OP2 a general alarm and OP3 a utility failure (Figure 4-9, e). Before the alarm, NC and common are closed and NO and common are open; at the alarm the relay changes over.

4.8.7 Serial ports and slots

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

4.9 Parallel system

Up to three RADIANT-IB cabinets run in parallel, for more power or for redundancy. The parallel function is an option: confirm it with AEC when you order. The installation of each cabinet is that of a single unit, plus:

- All cabinets must have the same rating and be fed from the same bypass source. The bypass and main inputs must share the same neutral.
- Connect the outputs of all cabinets to a common output bus. Keep the input and output cables of all cabinets of the same length and size, so that the load shares equally in bypass mode.
- Install an external maintenance bypass for the whole system, so that each cabinet can be isolated.
- Any ground-fault device must be upstream of the common neutral bonding point.
- Connect the parallel ports with the parallel cables in a closed ring (Figure 4-13).
- Wire the EPO of all cabinets to the same remote switch.
- Set the system mode and the IDs on each cabinet as described in Appendix A.

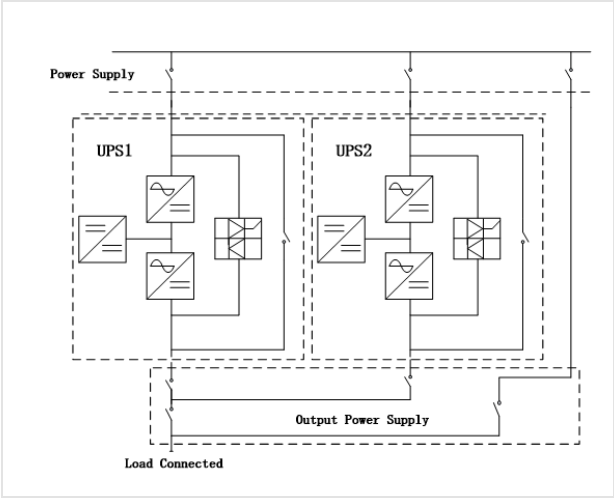


FIGURE 4-10 Parallel system of two cabinets on a common supply and a common output bus

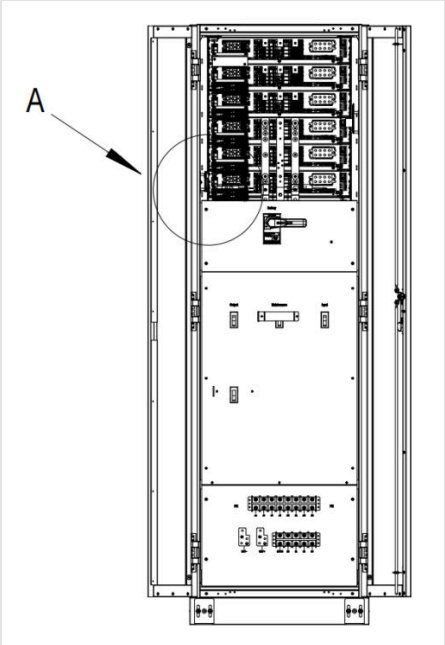
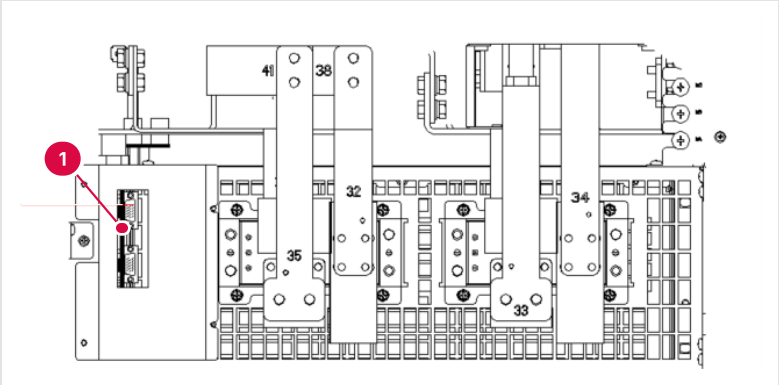


FIGURE 4-11 Rear view: position A of the parallel port



1 Parallel port (DB15)

FIGURE 4-12 Detail A — the parallel port

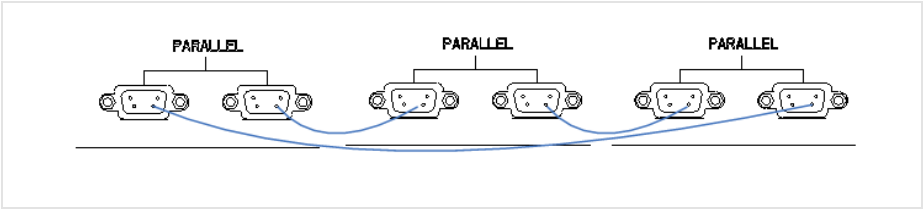


FIGURE 4-13 Parallel cables in a closed ring, three cabinets

4.10 Installation checklist

- ☐ The cabinet stands level on its four leveling feet, with the front and rear working space of Section 4.3.
- ☐ The power modules are fitted from the bottom slot up; empty slots are closed.
- ☐ All 24 battery trays are in place and plugged in; string polarity and voltage checked; the battery breaker is open.
- ☐ Upstream breakers and conductors match Table 4-3 and Table 4-4; PE connected first; torque 133 lb-in.
- ☐ Phase rotation of main and bypass input checked; copper link removed only for a separate bypass feed.
- ☐ EPO, sensors, dry contacts, network card and (parallel systems) parallel cables connected.
- ☐ The commissioning engineer is booked: power is applied only in his presence.

05

CHAPTER 5

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	External breakers on; Output and Input breakers on; the UPS goes to inverter by itself; Battery breaker on (Section 5.2)
Start without utility (cold start)	Battery and Output breakers on; red cold-start button 3 s; then the Cold Start pinhole of a power module (Section 5.3)
Load to bypass and back	**Control › Function › Manual Bypass**, then **Ecs Manual Bypass** (Section 5.4)
Service with the load on	Maintenance bypass (Section 5.5)
Isolate the UPS with the load on	Maintenance bypass, then Input and Output breakers off (Section 5.6)
Switch everything off	Loads off, then the battery breaker and the input breakers (Section 5.7)
Emergency	Covered EPO button (Section 5.8)

5.1.1 Breaker positions

The breakers are at the rear of the cabinet, behind the rear doors (Figure 2-5). The procedures refer to these breaker states. The external breakers in the distribution panel are given in the text.

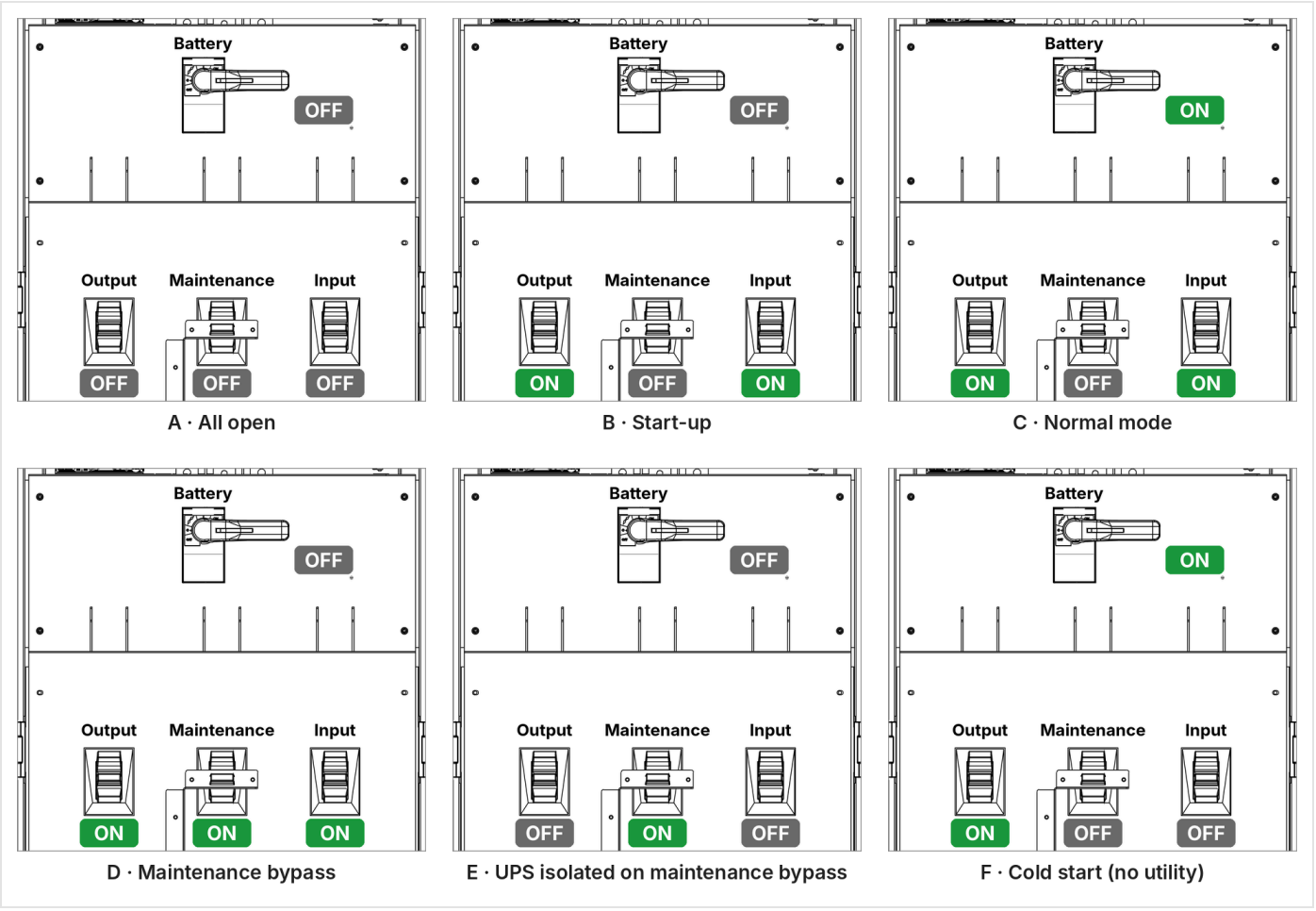


FIGURE 5-1 Breaker states A to F used in the procedures — green ON, gray OFF

5.2 Starting the UPS from fully off

The commissioning engineer starts the UPS after the installation is complete.

> ⚠ ***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).
2. Close the external main input breaker, and the external bypass input breaker if the bypass has a separate feed.
3. Open the rear doors. Close the **Output** breaker, then the **Input** breaker, one by one (Figure 5-1, state B). You see: the touchscreen lights and shows the home page (Figure 6-2); the power modules' indicators turn green.
4. Wait about 30 s: the rectifiers have started, the static bypass feeds the load and the inverters start.
5. Wait: after about 90 s the UPS transfers from bypass to inverter. You see: on the home page the energy flow runs from the utility through rectifier and inverter to the output (Figure 6-2, item 5, and Figure 2-13).
6. Close the **Battery** breaker (Figure 5-1, state C). The UPS starts charging the batteries. You see: **Cabinet › Battery** shows the battery connected and charging (Figure 6-6).
7. Close the external output breaker, then the branch breakers of the loads one by one.

The stored settings are loaded at start-up. Every event of the start-up is in **Log**.

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. Check that the battery trays are plugged in and that at least one power module is installed.
2. Close the **Battery** breaker and the **Output** breaker (Figure 5-1, state F).
3. Press the red cold-start button on the bypass & monitoring module (Figure 4-8, item 6) for 3 s. You see: the monitoring module starts and the touchscreen turns on.
4. Press the recessed Cold Start pinhole of a power module (Figure 2-7, item 3). You see: the module starts, then the rectifier and the inverter; after about 60 s the UPS runs in battery mode (Figure 2-13).
5. Close the external output breaker to supply the loads.

5.4 Transferring to bypass and back

1. To bypass: check on the touchscreen that the bypass is normal. Then select **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; the button reads "Ecs", the event log "Esc Manual Bypass"). 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.

To battery: the UPS transfers by itself as soon as the utility fails or leaves its limits.

> ⚠ ***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 UPS 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). You see: the inverters stop, the buzzer sounds and the static bypass feeds the load. Silence the alarm with the speaker icon (Figure 6-2, item 7).
2. Open the **Battery** breaker.
3. Close the **Maintenance** breaker (Figure 5-1, state D). The maintenance bypass and the static bypass now feed the load together.
4. To isolate the UPS as well, continue with Section 5.6.

5.5.2 From maintenance bypass to normal mode

1. Check that the **Input** and **Output** breakers are closed (Figure 5-1, state D). You see: after about 30 s the static bypass closes; the static bypass and the maintenance bypass feed the load together.
2. Check on the touchscreen that the static bypass feeds the load. Then open the **Maintenance** breaker.
3. Wait: after about 30 s the rectifiers start, then the inverters. After about one minute more the UPS transfers to inverter (normal mode). If the load stays on bypass, select **Control › Function › Ecs Manual Bypass**.
4. Close the **Battery** breaker (Figure 5-1, state C).

> ⚠ ***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***
>
> In maintenance bypass, dangerous voltage is present on the terminals and the internal busbars. Before you open a power module, wait 10 minutes for its DC bus capacitors to discharge.

5.6 Isolating the UPS on the maintenance bypass

Use this procedure when the power modules and the battery must be without power while the load runs on the maintenance bypass.

5.6.1 From normal mode to the isolated UPS

1. Go to maintenance bypass as in Section 5.5.1 (Figure 5-1, state D).
2. Enable the module pinholes (**Control › Function › Module Button Power Enable**, Figure 6-20, item 6), then press and hold the OFF pinhole of each power module for 3 s.
3. Open the **Input** and **Output** breakers (Figure 5-1, state E). The load is on the maintenance bypass (Figure 2-13).

> ⚠ ***WARNING***
>
> The bypass input has no breaker in the cabinet. With the external bypass breaker closed, the bypass input, the static bypass and the maintenance bypass stay live. Do not open the external breaker that feeds the bypass input: the maintenance bypass is fed from it, and the output would be interrupted.

To service the bypass & monitoring module (AEC service only), the whole cabinet must be dead. This needs an external maintenance bypass:

1. With the UPS on its maintenance bypass, close the external maintenance bypass breaker.
2. Open the battery breaker, the external main input breaker, the external bypass input breaker (separate bypass feed) and the external output breaker, one by one. The load runs on the external maintenance bypass and the touchscreen goes dark.
3. To return: close the external output breaker, the external bypass input breaker (separate bypass feed) and the external main input breaker, then the battery breaker. After about 2 minutes the bypass is normal on the touchscreen. Open the external maintenance bypass breaker, then the Maintenance breaker in the cabinet. The inverters start by themselves; after about 60 s the UPS transfers to normal mode.

5.6.2 From the isolated UPS back to normal mode

1. Close the **Output** and **Input** breakers (Figure 5-1, state D). The touchscreen starts; after about 30 s the static bypass closes.
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. The rectifiers and inverters start; if the load stays on bypass, select **Ecs Manual Bypass**. The UPS transfers to inverter after about 60 s.
5. Close the **Battery** breaker (Figure 5-1, state C).

5.7 Shutting the UPS down completely

1. Shut down the loads correctly.
2. Open the **Battery** breaker.
3. Open the **Input** breaker (or the external main input breaker) and, with a separate bypass feed, the external bypass input breaker, one by one. The touchscreen goes dark.
4. Open the **Output** breaker (Figure 5-1, state A). If the UPS was in maintenance bypass, also open the **Maintenance** breaker.

5.8 Emergency power off (EPO)

The EPO button is on the front door beside the touchscreen, under a cover against accidental use (Figure 6-1, item 4). Press it in an emergency (fire, flood). The UPS switches off the rectifiers, the inverters and the static bypass and stops feeding the load at once; the batteries stop charging and discharging. If the battery breaker is wired to OP4, the UPS also trips it; otherwise open it by hand (Section 4.8.5).

With utility present the controls stay powered but the output is off. To isolate the UPS completely, open the external main input and bypass input breakers.

Restart after EPO. Shut the UPS down completely (Section 5.7), then start it as in Section 5.2.

> ⚠ ***WARNING***
>
> When the EPO is triggered the load is no longer powered by the UPS. Use the EPO with care. 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 restart is enabled, it restarts by itself when the utility returns, after the delay set by the commissioning engineer. After an over-temperature or overload the UPS clears the fault by itself when the cause is gone.

5.10 Replacing a power module

Only trained operators may replace a power module. First check that the UPS is in normal mode and the bypass is normal. With the front door open, live parts are near: wear the PPE of the site's arc-flash assessment (Section 1.4).

1. Check that the remaining modules can carry the load. If not, transfer the UPS to bypass first: **Control › Function › Manual Bypass**.
2. Select **Control › Function › Module Button Power Enable** (Figure 6-20, item 6): the modules' OFF pinhole works.

3. Press and hold the OFF pinhole of the module for 3 s (Figure 2-7, item 2). It leaves the system.
4. After 10 minutes remove the fixing screws on both sides and pull the module out. Two people lift it.
5. Push the new module in and tighten the screws on both sides. It starts and joins the system by itself. Insert modules one at a time, at least 10 s apart.
6. If you transferred to bypass in step 1, return to normal mode with **Ecs Manual Bypass** 2 minutes after the module has started.

> ⚠ ***WARNING***
>
> - Remove power modules from the top down, so that the cabinet does not tip.
> - Measure the voltage between the parts and ground with a multimeter before you handle a removed module: below 36 V DC and 30 V AC.
> - The bypass & monitoring module is not hot-swappable: only AEC service removes it (Section 5.6).

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 the bypass is normal, that there is no alarm and that the battery voltage is above 90 % of the float voltage (**Cabinet › Battery** shows float charge).
2. **Battery Maintain** (item 2): a maintenance discharge. The UPS runs on battery until 20 % capacity is left or the voltage is low (1.1 × the end-of-discharge voltage), then returns to normal mode. It needs a normal bypass, no alarm, a battery voltage above 90 % of the float voltage and a load above 25 %.
3. **Stop Test** (item 3) ends a test or a maintenance discharge.
4. An automatic maintenance discharge can repeat on a set period (**Battery Auto Discharge** and **Auto Maintenance Discharge Period**, set by AEC service). It starts only with a load of 20–100 %.
5. Test the batteries if they have not been used for a long time.

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

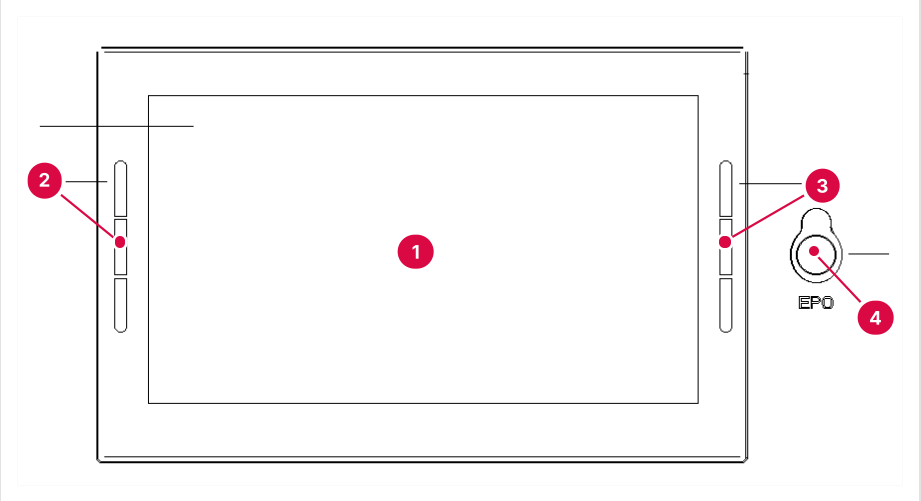
CHAPTER 6

Touchscreen

The AEC color touchscreen: operator panel, 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 indicators, left of the screen
3. Status indicators, right of the screen
4. EPO button, under its cover

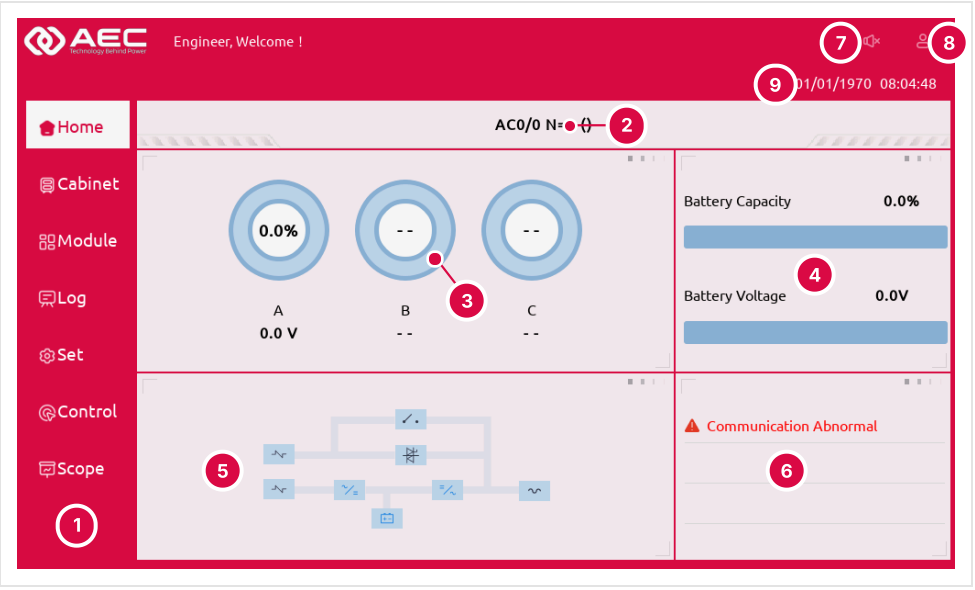
FIGURE 6-1 Operator panel on the front door

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 (Section 5.8).

TABLE 6-1 Indicators and buzzer

Signal	Meaning
Steady green	System working normally
Steady yellow	System warning (for example utility failure or overload)
Steady 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 and the self-test. 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. Service-level access is reserved to AEC service — call +1 786 553 2100.

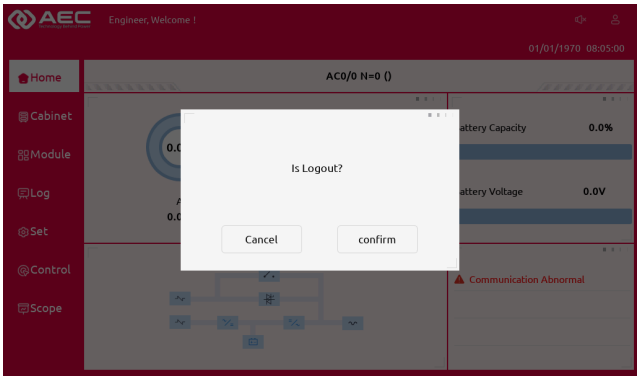


FIGURE 6-3 The user icon asks before it logs out

6.3 Menu tree

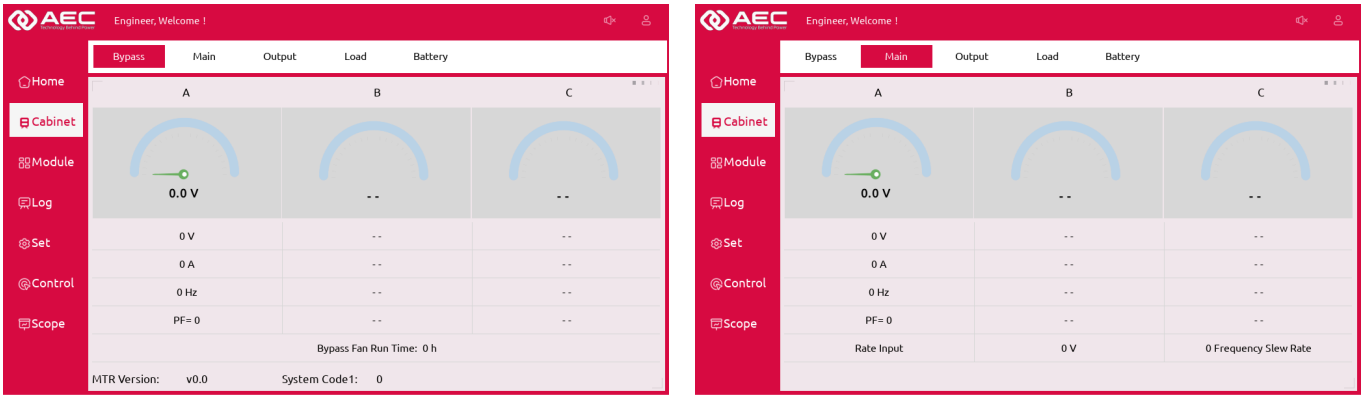
TABLE 6-2 Menu tree of the touchscreen

Menu	Pages
Home	The home page: status bar, output gauges, energy flow, warnings (Section 6.2)
Cabinet	Bypass · Main · Output · Load · Battery (Section 6.4)
Module	Input · Output · Load · Information · S-Code, for the module selected in the list (Section 6.5)
Log	Current Alarm · History Alarm · Operation Log · Maintenance Record (Section 6.6)
Set	Language · Sys Func · NetWork · Uart · Display Set · Alarm Set · BMS · Comm Set · BATT Set · Sys Set · System Code1 · Calibration · Dry Contact · Rate Set (Section 6.7)
Control	Function · Test (Section 6.8)
Scope	Output Voltage · Output Current · Bypass Voltage (Section 6.9)

6.4 Cabinet (system readings)

TABLE 6-3 Cabinet pages

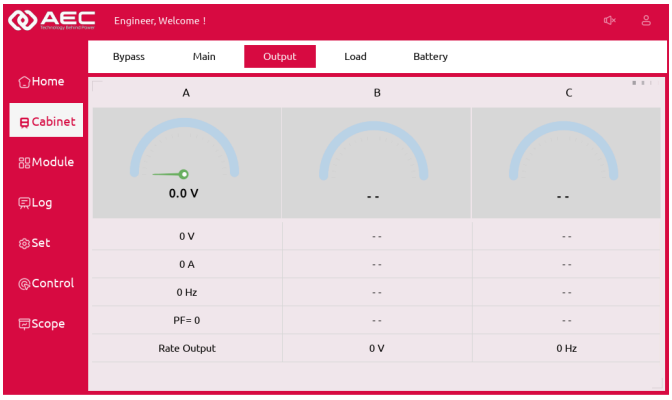
Page	Shows
Bypass	Phase voltage (V), current (A), frequency (Hz) and power factor of the bypass; bypass fan running time.
Main	Phase voltage, current, frequency and power factor of the main input; rated input.
Output	Phase voltage, current, frequency and power factor of the output; rated output.
Load	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.



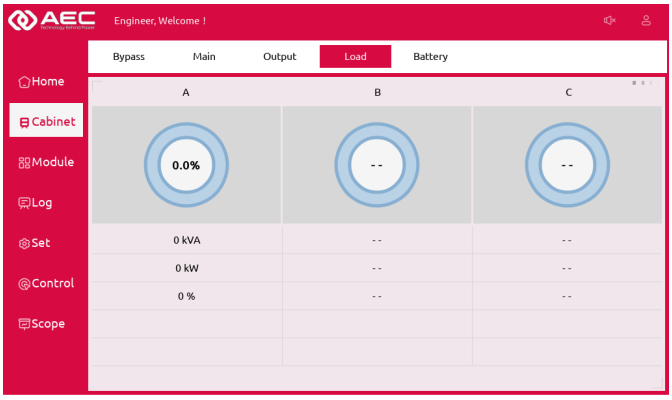
Cabinet — Bypass

Cabinet — Main

FIGURE 6-4 Cabinet — Bypass and Main

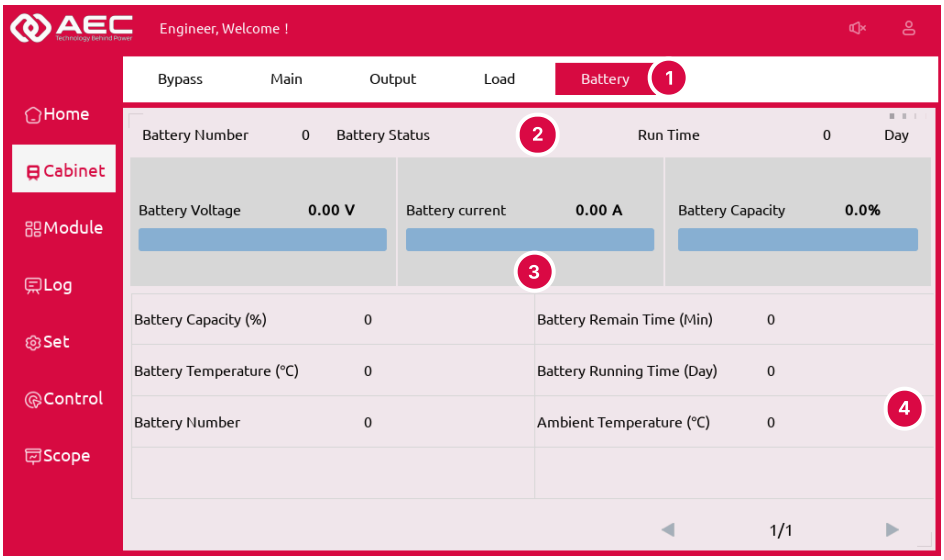


Cabinet — Output



Cabinet — Load

FIGURE 6-5 Cabinet — Output and Load



1. Cabinet tabs: Bypass, Main, Output, Load, Battery
2. Battery number per string (20), 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 6-6 Cabinet — Battery, the page to check after start-up and during an outage

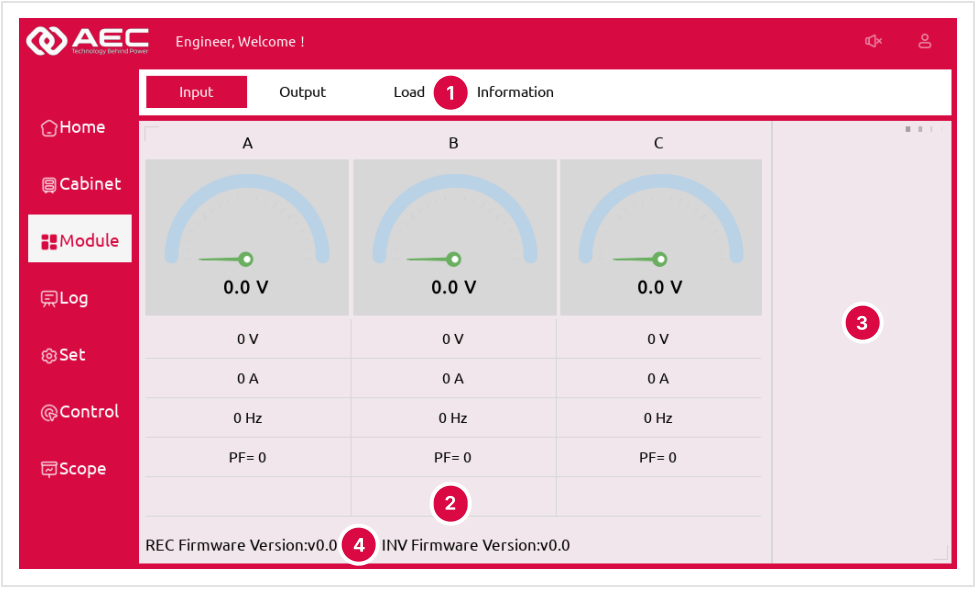
6.5 Module (power module readings)

Select a power module in the list on the right to see its values. The list shows the five slots of the cabinet.

TABLE 6-4 Module pages

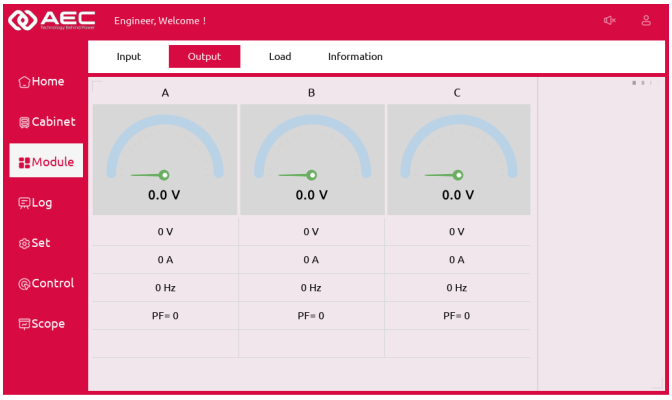
Page	Shows
Input	Input phase voltage, current, frequency and power factor of the selected module.
Output	Output phase voltage, current, frequency and power factor of the selected module.
Load	Apparent, active and reactive power and load (%) of the selected module.

Page	Shows
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.
S-Code	Fault code, for AEC service.



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

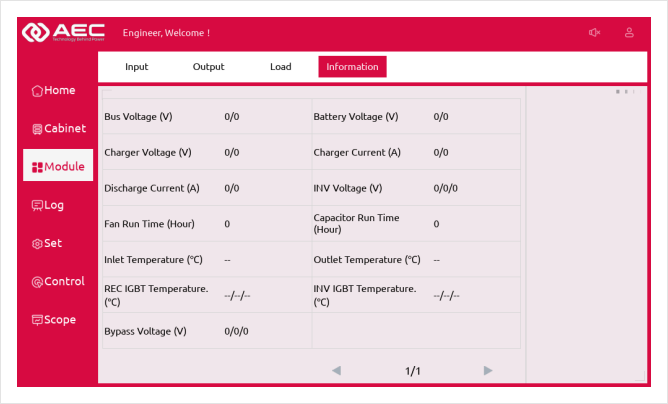


FIGURE 6-9 Module — Information

6.6 Log

Log has four pages: **Current Alarm**, **History Alarm**, **Operation Log** and **Maintenance Record**. The alarms and events are listed by date and time, with the time each was set and cleared. The color of the text gives the level: green, an event occurs or ends; yellow, a warning; red, a fault. The meaning of every event is in Section 11.3.

6.7 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 (20 blocks per string), or the batteries and the UPS can be seriously damaged.

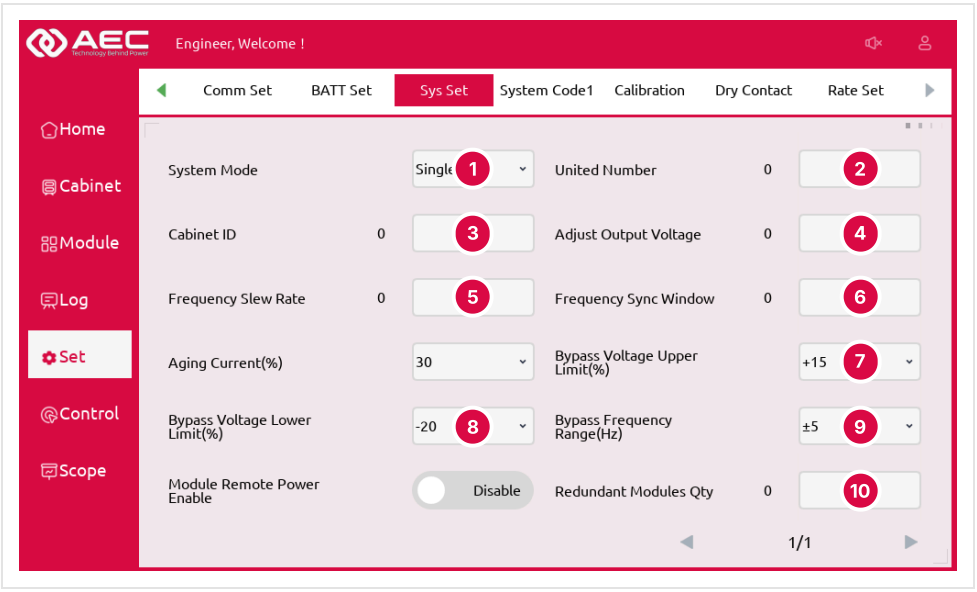
The Set menu has two rows of tabs; the green arrows at the ends switch between them.

TABLE 6-5 Set pages

Page	Settings	Default
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; not used with the internal VRLA battery).	Not used
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.	See Table 9-1

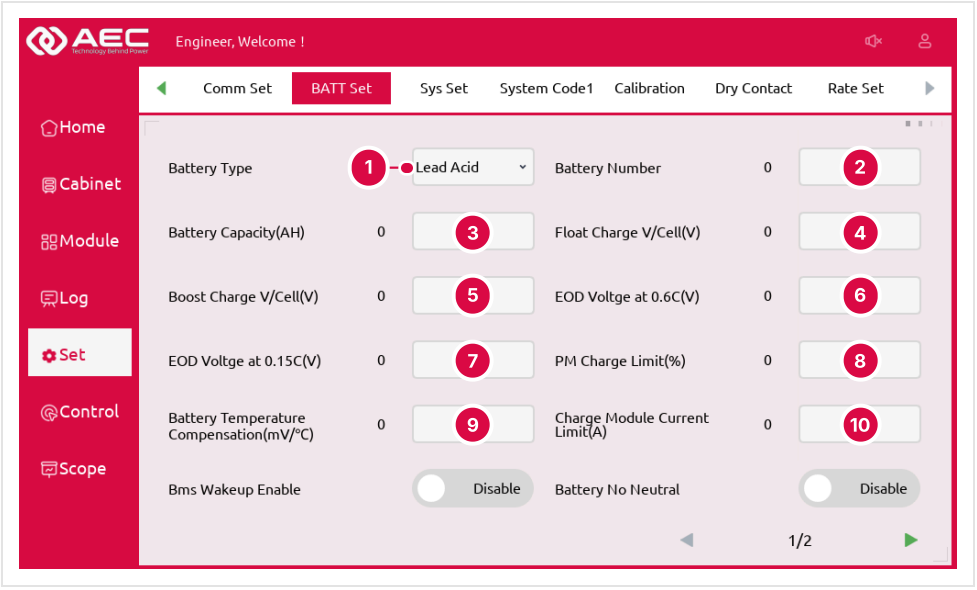
Page	Settings	Default
Sys Set	System mode (single, parallel, ECO, LBS), number of units and cabinet ID, output voltage adjustment, bypass voltage and frequency window, redundant modules.	Bypass window +15 % / −20 %
System Code1	Parallel delayed start; line-voltage display.	—
Calibration	Output, bypass, inverter DC, input AC and battery voltages against a meter (maintenance only).	—
Dry Contact	Function of the three inputs (e.g. generator input) and four outputs (e.g. battery breaker trip).	See Table 4-7
Rate Set	Rated input and output voltage and frequency.	208 V, 60 Hz (US units)

A dash means that no default is published: read the value on the unit and record it in the installation record (Appendix E).



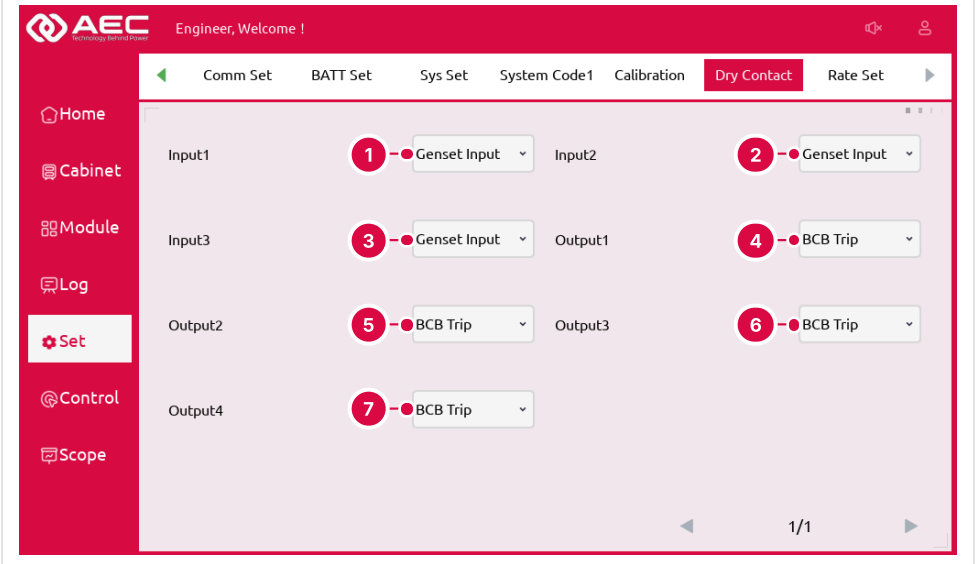
1. System Mode: Single, Parallel, Single ECO, Parallel ECO, LBS, Parallel LBS
2. United Number: number of cabinets in parallel (1 to 3)
3. Cabinet ID: 0, 1, 2 — one per cabinet
4. Adjust Output Voltage
5. Frequency Slew Rate
6. Frequency Sync Window
7. Bypass Voltage Upper Limit: +10 / +15 / +20 %
8.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

FIGURE 6-10 Set — Sys Set



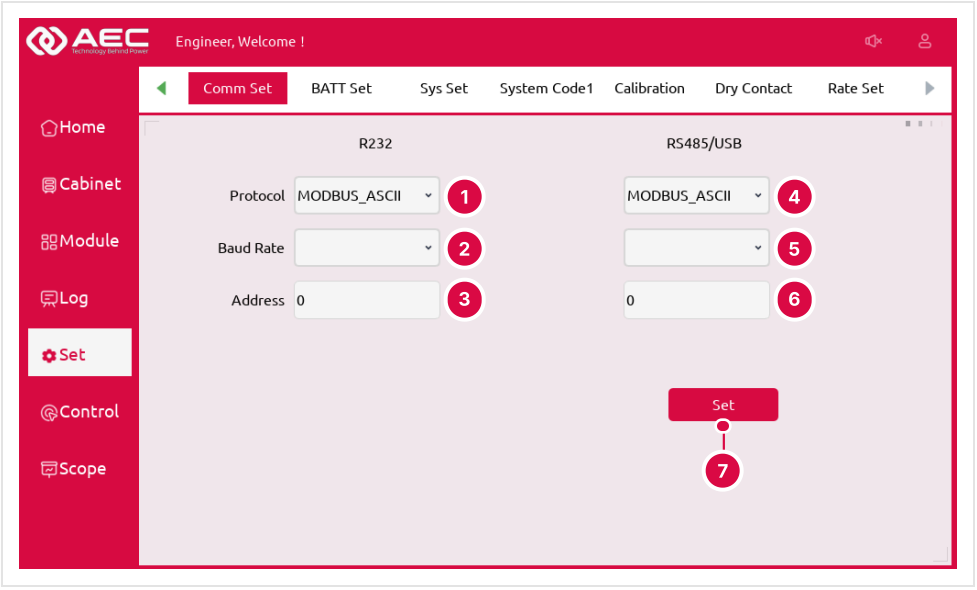
1. Battery Type: VRLA
2. Battery Number: 20 blocks per string
3. Battery Capacity (Ah) of the installed battery
4. Float Charge V/Cell
5. Boost Charge V/Cell
6. EOD Voltage at 0.6 C
7. EOD Voltage at 0.15 C
8. PM Charge Limit (%)
9. Battery Temperature Compensation (mV/°C)
10. Charge Module Current Limit (A)

FIGURE 6-11 Set — BATT Set, page 1



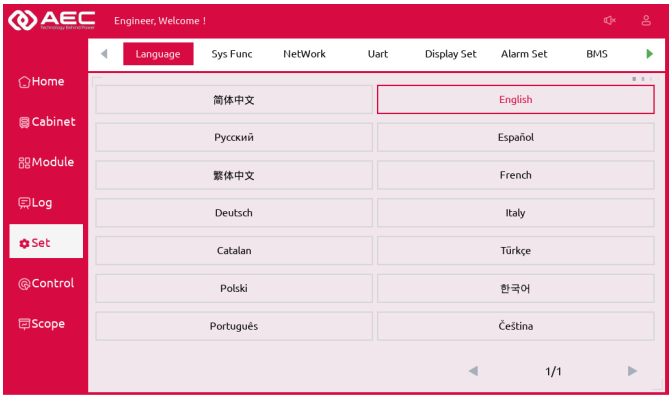
1. Input1 (IP1)
2. Input2 (IP2)
3. Input3 (IP3), e.g. Genset Input
4. Output1 (OP1)
5. Output2 (OP2)
6. Output3 (OP3)
7. Output4 (OP4), e.g. BCB Trip

FIGURE 6-12 Set — Dry Contact

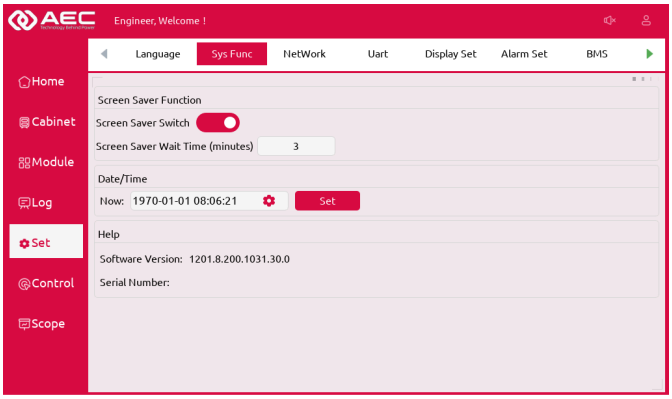


1. RS-232 protocol
2. RS-232 baud rate
3. RS-232 address
4. RS-485 / USB protocol
5. RS-485 / USB baud rate
6. RS-485 / USB address
7. Set: apply

FIGURE 6-13 Set — Comm Set

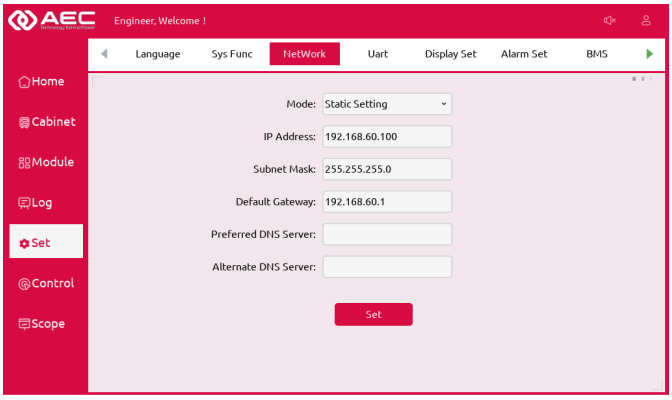


Language

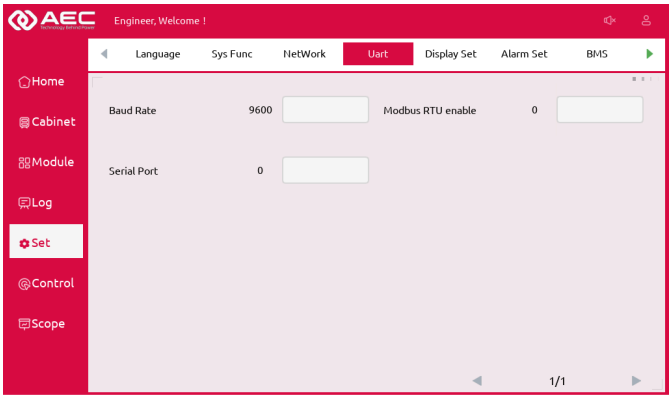


Sys Func

FIGURE 6-14 Set — Language and Sys Func

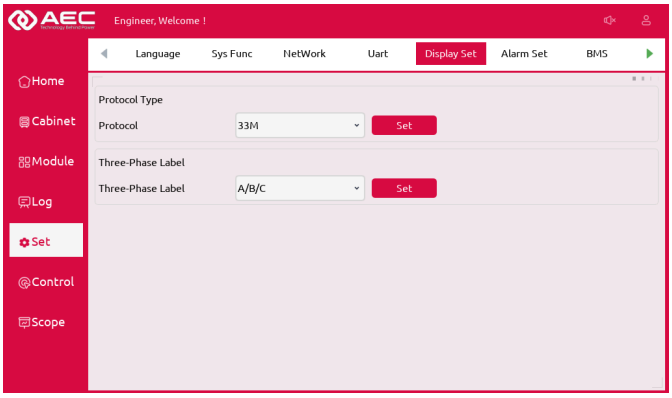


NetWork

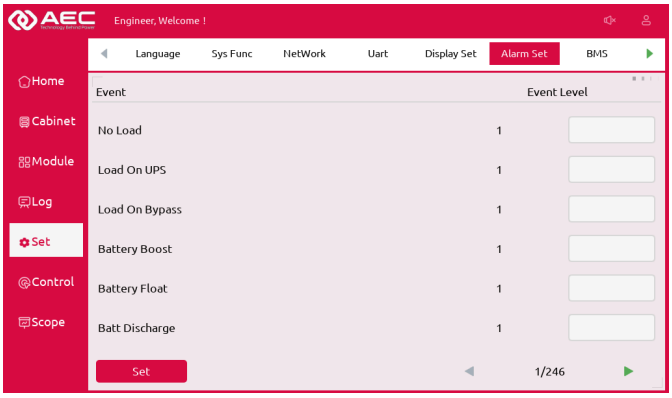


Uart

FIGURE 6-15 Set — NetWork and Uart

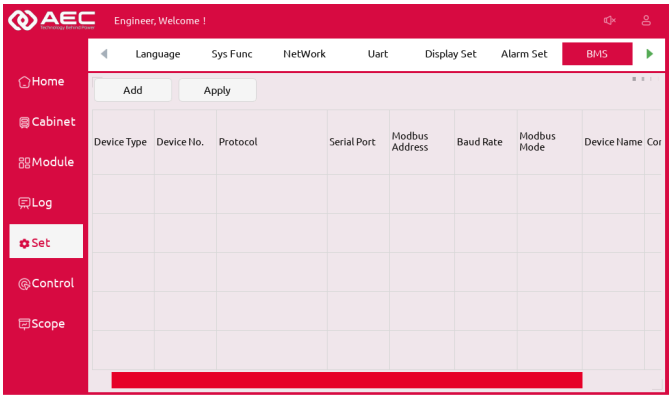


Display Set

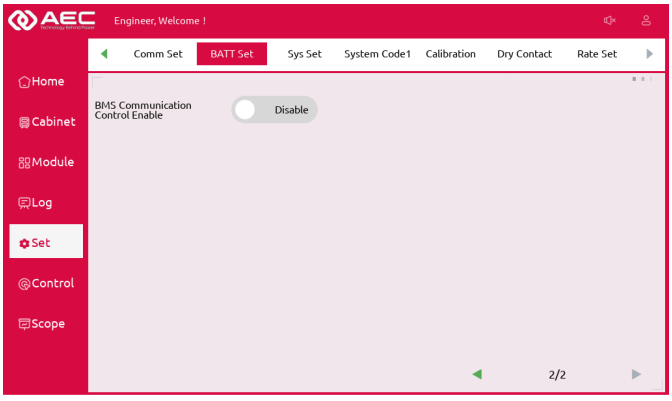


Alarm Set

FIGURE 6-16 Set — Display Set and Alarm Set

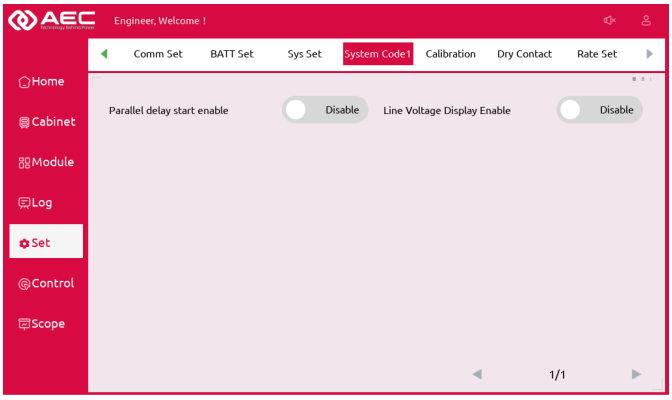


BMS

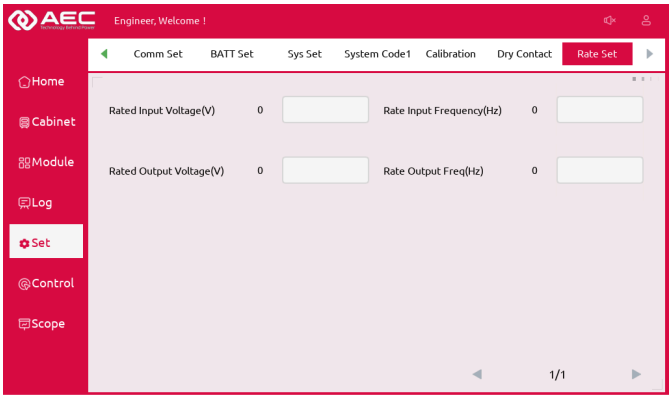


BATT Set, page 2

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

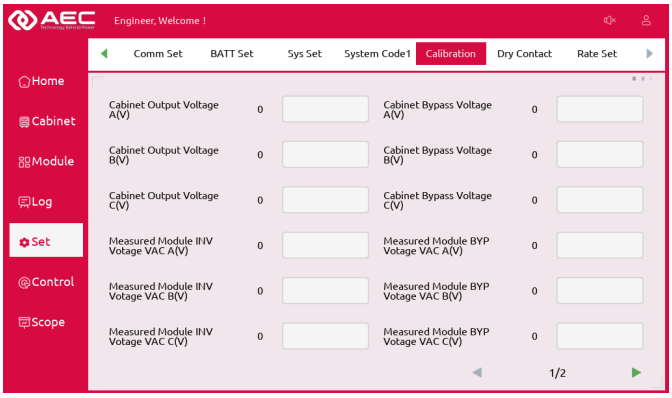


System Code1

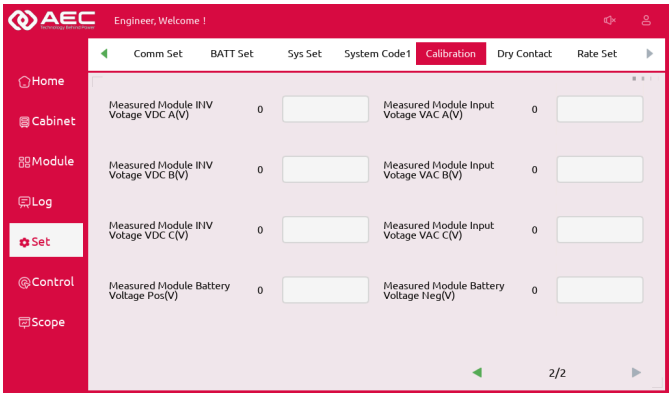


Rate Set

FIGURE 6-18 Set — System Code1 and Rate Set



Calibration, page 1



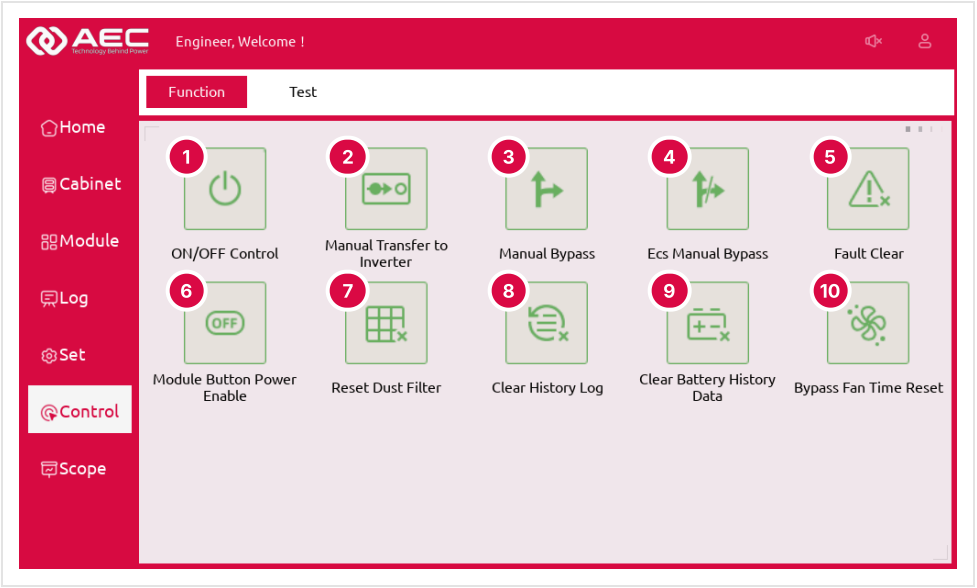
Calibration, page 2

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

6.8 Control

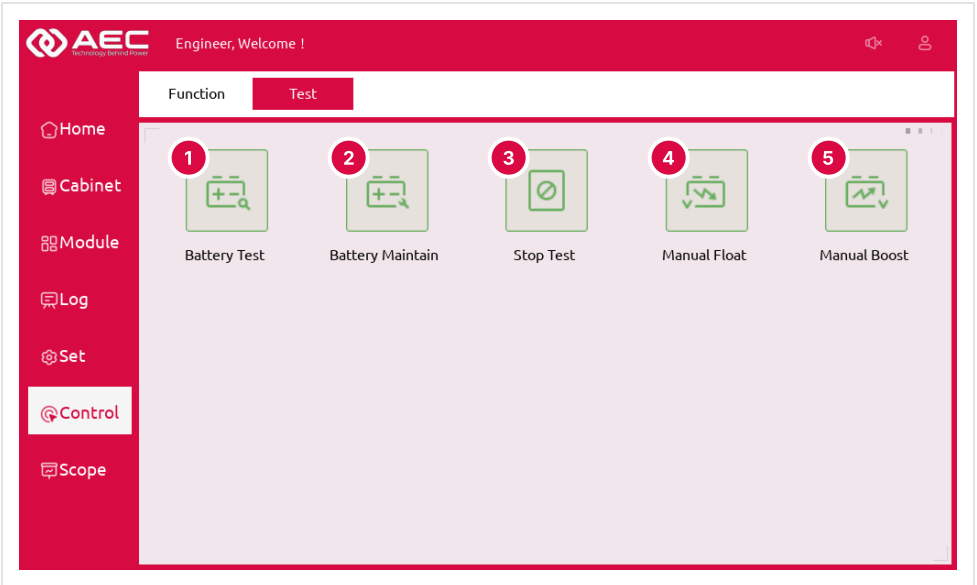
TABLE 6-6 Control pages

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 pinhole on the power modules) · Reset Dust Filter (days in use and service period) · Clear History Log · Clear Battery History Data (discharge count, days running and hours of discharge — 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 pinhole
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 (maintenance discharge)
3. Stop Test
4. Manual Float charge
5. Manual Boost charge

FIGURE 6-21 Control — Test

6.9 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 6-6). The typical runtime is in Table 2-5.
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; orange warning text on the home page	Warning or general alarm (for example utility failure or overload)	Read **Log**; look the event up in Section 11.3.
Red indicator; continuous tone; red warning text	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**.
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 cabinet 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 SNMP slot, the intelligent slot and EPO — are described in Section 4.8. 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 slot marked SNMP on the bypass & monitoring module (Figure 4-8, item 5) — not in the intelligent slot, which takes the dry-contact card. 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. On the card's web page, **Sys Set › Device**, choose protocol **ACM(10-600KVA)** (the label of the RADIANT-IB 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.
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.

i NOTE The RS-232 port does not answer while its protocol is set to MEGA in **Set › Comm Set**: set Modbus RTU or Modbus ASCII for UPS View.

1. Choose the PC's COM port (Windows Device Manager › Ports).
2. UPS View shows the live data, the status, the alarms and the settings of the UPS.

NOTICE

Use UPS View on the RS-232 port or monitor through the SNMP-M card — not both at the same time, unless AEC confirms that the two ports work together on your unit.

✓ 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, battery care 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. The number of blocks set must equal the number installed. Wrong values damage the batteries and the UPS.

TABLE 9-1 Battery settings

Setting	Default	Range
Number of blocks	20 × 12 V per string	Must equal the blocks installed (20 per string in the internal trays)
Capacity	108 Ah	Block capacity × number of strings in parallel: 12 × 9 Ah = 108 Ah (84 Ah with 7 Ah blocks)
Float charge voltage (VRLA)	2.25 V/cell	2.20–2.35 V/cell
Boost charge voltage (VRLA)	2.30 V/cell (factory default)	2.30–2.45 V/cell; set the battery maker's boost value for the installed blocks
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)
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
Charge current	0.1 C best	Up to 0.2 C; set as a percentage of the rated current

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: the UPS boost-charges the battery to full, then changes to float charge. C is the capacity set in **Battery Capacity**: for a setting of 100 Ah, 0.1 C = 10 A.

Battery care

- **Temperature:** best at 68–77 °F (20–25 °C). Battery life halves for every 18 °F (10 °C) above 68 °F (20 °C).
- **Current:** the best charging current is 0.1 C, the maximum 0.2 C; the discharging current should be 0.05–3 C.
- **Deep discharge:** avoid it. A long run on battery at light or no load discharges the battery deeply and shortens its life.
- **Checks:** look for abnormalities, measure that the block voltages are balanced and discharge the battery periodically (Section 5.11).
- **Installation:** keep the cabinet in a dry, cool, ventilated place away from sunlight and heat. Use blocks of the same type and age throughout.

> ⚠ ***WARNING***
>
> Check every day that no battery heats abnormally, and check regularly that the battery connections are tight. A leaking or damaged battery must be replaced, stored in a container resistant to sulfuric acid and recycled according to local regulations: used lead-acid batteries are hazardous waste.

Battery protections

- **Battery Volt Low:** the 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:** tripped through OP4 at end of discharge or on EPO, when its trip coil is wired to OP4 (Section 4.8.5).

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 cabinet are clear and the fans run; check the room temperature.
Every 3–6 months	Clean or replace the dust filters, if fitted (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 the VRLA batteries as a full set (all 24 trays).

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 filters (if fitted)	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: their service life roughly halves for every 18 °F (10 °C) above 68 °F (20 °C), the nominal battery temperature. The table applies that rule.

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

Average temperature	Relative life	Typical life
68 °F (20 °C)	100 %	3–5 years
77 °F (25 °C)	about 70 %	2–3.5 years
86 °F (30 °C)	50 %	1.5–2.5 years
95 °F (35 °C)	about 35 %	1–1.8 years
104 °F (40 °C)	25 %	9–15 months

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 cabinet, 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 indicators and the buzzer are described in Table 6-1 (Figure 6-1): steady green is normal, steady yellow a warning, steady red a failure; two short beeps and one long mean a general alarm, a continuous tone a serious fault. On the home page, orange text is a general alarm and red text a serious alarm.

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 persists, 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 the tray connectors.
Maintenance CB Closed	The maintenance bypass breaker is closed.
Maintenance CB Open	The maintenance bypass breaker is open.
EPO	Emergency power off.

Event	Meaning and action
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 Sequence Error, Input Neutral Lost). Check that the bypass voltage and frequency on the touchscreen are within the set range, then measure them; check the external 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 timer has expired: the overload lasted longer than the bypass allows. Reduce the load at once.
Byp Freq Over Track	Bypass frequency outside the tracking limit; the inverter does not synchronize. First clear related alarms, then check the bypass supply.
Exceed Tx Times Lmt	Too many overload transfers in one hour: the load stays on bypass. It returns to the inverter by itself within one hour. Check the load.
Output Short Circuit	Output short circuit: check the loads, the output cables and the output terminals; then clear the fault with **Fault Clear**.
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 shuts down and the module runs from the battery. 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.
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.

Event	Meaning and action
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 and that the battery is above 90 % of float voltage.
Battery Maintenance Fail	Battery maintenance failed: check that the UPS has no alarm, that the battery is above 90 % of float voltage and that the load is above 25 %.
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.
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 external 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.

Event	Meaning and action
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).
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 cabinet 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-IB 20–100 kVA, 100 kVA cabinet. Subject to change without notice.

TABLE 12-1 RADIANT-IB 20–100 kVA specifications

Item	Value
Ratings	100 kVA cabinet: 20, 40, 60, 80, 100 kVA (1 to 5 modules) · 20 kVA modules · output power factor 1 (kVA = kW)
Input	
Connection · voltage	3 phases + N + PE · 208 V L-L (120 V L-N); 200 or 220 V L-L as a setting (Set › Rate Set); same neutral as the bypass input
Voltage range	166–261 V L-L at full load; 125–166 V L-L with the power derated to 75 % (typical)
Frequency	60 Hz (50 Hz as a setting); range 40–70 Hz
Power factor · current THD	> 0.99 · ≤ 3 % (typical)
Maximum input current	348 A (Table 4-3)
Bypass	
Voltage · current	208 V L-L, 120 V L-N, 4-wire · rated 277 A
Voltage window	Upper limit +10, +15 or +20 %; lower limit −10, −15, −20, −30 or −40 %; default +15 / −20 %
Frequency window	±1, ±3 or ±5 Hz, settable
Overload	≤ 110 % continuous · 110–125 % 5 min · 125–150 % 1 min · > 150 % 1 s
Neutral current rating	1.7 × rated current: 471 A
Output	
Voltage	208 V L-L, 120 V L-N, 3 phases + N (200 or 220 V as a setting)
Frequency	60 Hz (50 Hz as a setting) ± 0.1 %
THD	≤ 1 % linear load, ≤ 5 % non-linear load (typical)
Inverter overload	110 % 1 h · 125 % 10 min · 150 % 1 min · > 150 % 200 ms (typical)
Rated output current	277 A
Transfer time	0 ms synchronized; < 3/4 cycle (12.5 ms) not synchronized (typical); < 10 ms from ECO
Efficiency	Up to 94 % in double conversion and in battery mode
Battery	
Type · blocks	Internal VRLA · 240 × 12 V 9 Ah (7 Ah possible) in 24 trays · 12 strings of 20 blocks, center tap
Bus voltage	±120 V DC nominal (240 V DC per string)
Charge	Float 2.25 V/cell (2.20–2.35); boost 2.30 V/cell factory default (2.30–2.45; set the battery maker's value); constant current / constant voltage; best 0.1 C, max. 0.2 C

Item	Value
Battery Capacity setting	108 Ah (12 strings × 9 Ah)
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), with the optional sensor
Battery current at 100 kW	476 A at 1.75 V/cell (factory); about 537 A at 1.65 V/cell and 94 % (calculated)
Backup at 50 / 100 % load	20 kVA 85 / 32 min · 40 kVA 32 / 14 min · 60 kVA 22 / 8 min · 80 kVA 14 / 6 min · 100 kVA 12 / 3 min (Table 2-5)
System	
Breakers in the cabinet	Battery, main input, output and maintenance bypass, 3-pole; no bypass input breaker
Module	RADIB-PWR-20, 20 kVA, 2U, 17.3 × 26.7 × 3.3 in (440 × 678 × 85 mm), 44 lb (20 kg)
Display · communication	7-inch color touchscreen, status indicators, covered EPO · RS-232, RS-485, USB, dry contacts (3 inputs, 4 outputs, EPO, temperature); SNMP slot and intelligent slot
Parallel	Up to 3 cabinets of the same rating (option); Cabinet ID 0, 1, 2
Environment	32–104 °F (0–40 °C) · 0–95 % RH, non-condensing · IP20 · full power to 3,300 ft (1,000 m), −1 % per 330 ft (100 m) up to 6,600 ft (2,000 m) · < 65 dB at 100 % load, 62 dB at 45 % load
Storage	UPS −40 to 158 °F (−40 to 70 °C)
W × D × H	23.6 × 39.4 × 78.7 in (600 × 1,000 × 2,000 mm) · bottom cable entry · four leveling feet, no casters
Heat at full load	Up to 21,780 BTU/h (6.38 kW) at 100 kW, calculated at 94 % (Table 4-2)
Weight	Cabinet without modules and trays (RADIB-FRAME): 430 lb (195 kg) · module 44 lb (20 kg) · full tray 63.5 lb (28.8 kg) · complete UPS 1,998 to 2,174 lb (906 to 986 kg) (Table 2-6)
Color	Black
Standards	UL 1778 standard; FCC Part 15, Class A
Warranty	3 years on the UPS · 2 years on the VRLA batteries

12.1 Data for the electrical engineer

What the engineer of record needs for the drawings, the permit and the coordination study, in one table. Values marked "calculated" are AEC's arithmetic on published data; "ask AEC" means the value is not published yet.

TABLE 12-2 Data for the electrical engineer — 100 kVA cabinet, 208 V

Item	Value	Basis
System	208Y/120 V, 3-phase, 4-wire + PE, 60 Hz; single feed through the copper link, or separate bypass feed	Section 4.6
Main input current	348 A maximum	Factory
Bypass input and output current	277 A rated	Factory
Neutral current, bypass and output	471 A	1.7 × 277 A, factory
Battery current at 100 kW	476 A at 1.75 V/cell; about 537 A at 1.65 V/cell and 94 %	Factory; calculated

Item	Value	Basis
External breakers	Main input 450 A · bypass input 350 A · output 350 A · external maintenance bypass 350 A · DC (external battery cabinet) 700 A	125 %, NEC 210.20(A), 215.3, 240.6(A)
Conductors, copper 75 °C	Table 4-4, with the 80 % case for non-linear loads	NEC 310.16, 310.10(G), 310.15(E)(3)
Equipment grounding conductor	2 AWG main input · 3 AWG bypass and output · 1/0 AWG DC, in each raceway	NEC 250.122, 250.122(F)
Working space	36 in deep front and rear, 30 in wide, 6.5 ft high; top 19.7 in (500 mm)	NEC 110.26(A); AEC
Terminals	M10, two per pole, 133 lb-in (15 N·m), crimped ring lugs; bottom entry only	Factory
Heat at full load	Up to 21,780 BTU/h (6.38 kW) at 100 kW	Calculated at 94 %
Weight, floor load	Up to 2,174 lb (986 kg); 337 lb/ft² (1,643 kg/m²)	Calculated
Short-circuit current rating (SCCR), main and bypass input	Ask AEC	NEC 110.10
Inverter fault current and duration (for downstream coordination)	Ask AEC	—
Earth leakage current	Ask AEC	—
Largest conductor and lug per terminal · floor opening size	Ask AEC	—
Internal battery breaker rating and DC interrupting rating	Ask AEC	—
Cooling airflow · center of gravity	Ask AEC	—
Standards	UL 1778 standard; FCC Part 15, Class A	Section 1.8

A

APPENDIX A

Parallel setting

Setting the cabinets of a parallel system on the touchscreen.

1. When all parallel cables and power cables are connected, set each cabinet 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 cabinets in the system (2 or 3).
3. Give each cabinet its own **Cabinet ID**, starting from 0: 0 and 1 for two cabinets; 0, 1 and 2 for three. Two cabinets must never have the same ID.
4. Every other setting must be the same on all cabinets. Then start the system.

APPENDIX B

B Drawings

AEC drawings of the RADIANT-IB 20–100 kVA, revision 001. Dimensions in inches [mm].

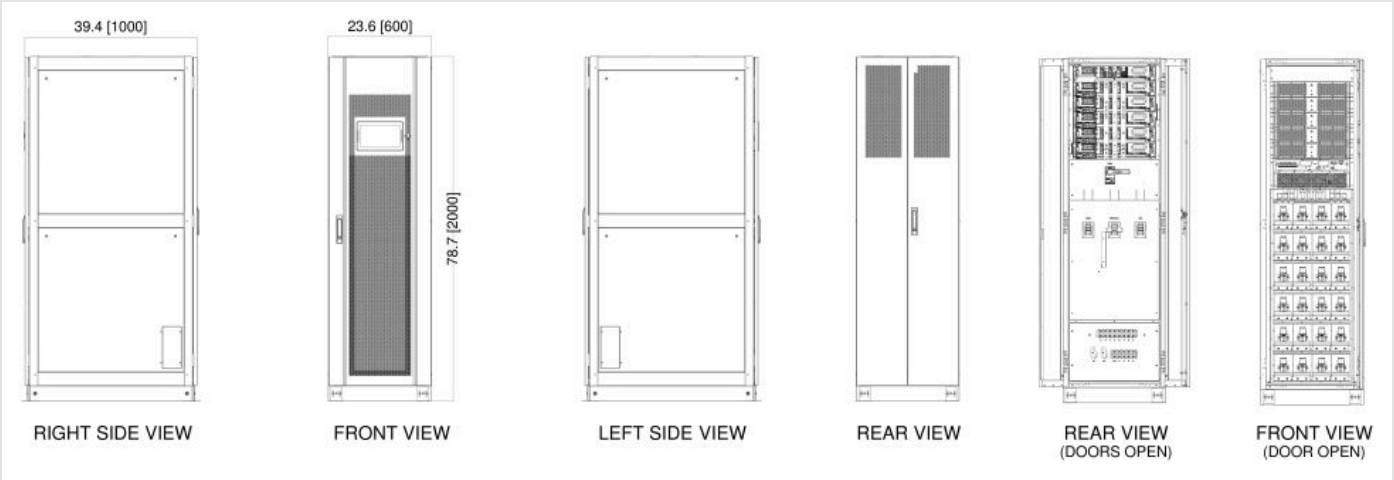


FIGURE B-1 Appearance of the 100 kVA cabinet: right side, front, left side, rear, rear with the doors open and front with the door open.

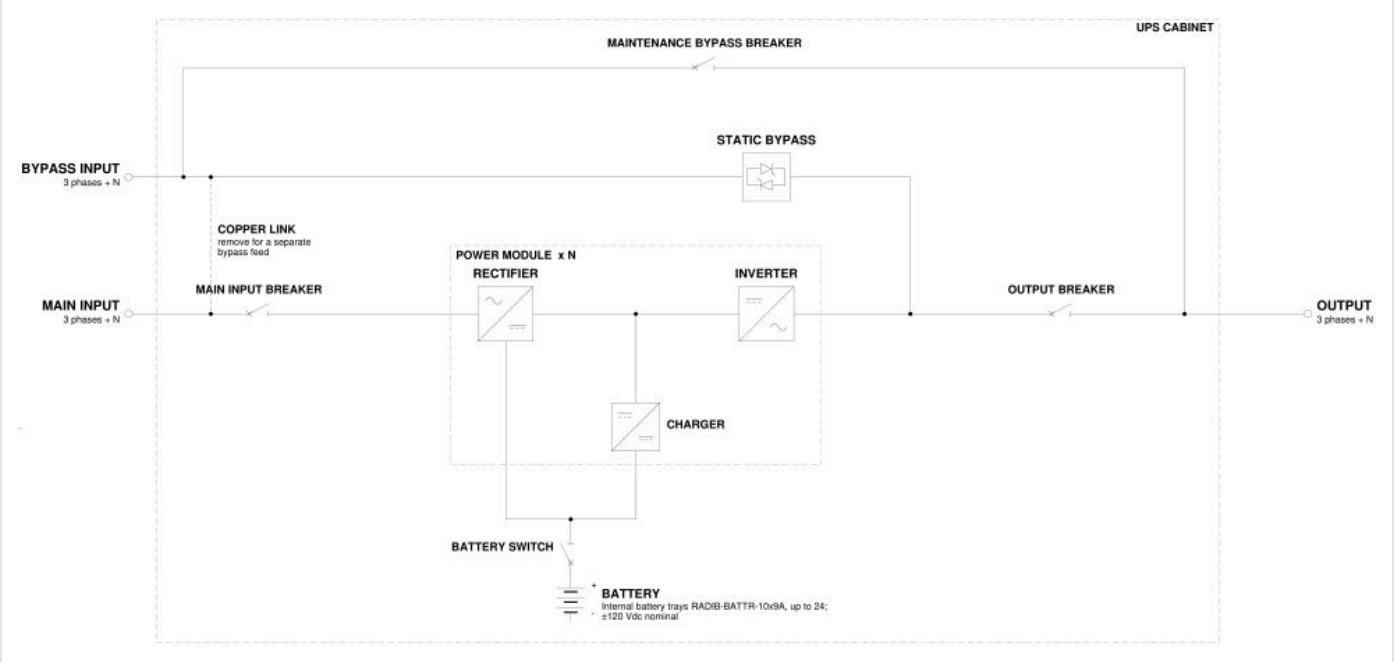


FIGURE B-2 Single-line diagram: 208 V 3-phase 4-wire; 20 kVA power modules in parallel on the same input, output and battery; battery, main input, output and maintenance bypass breakers in the cabinet; internal battery ±120 V DC nominal

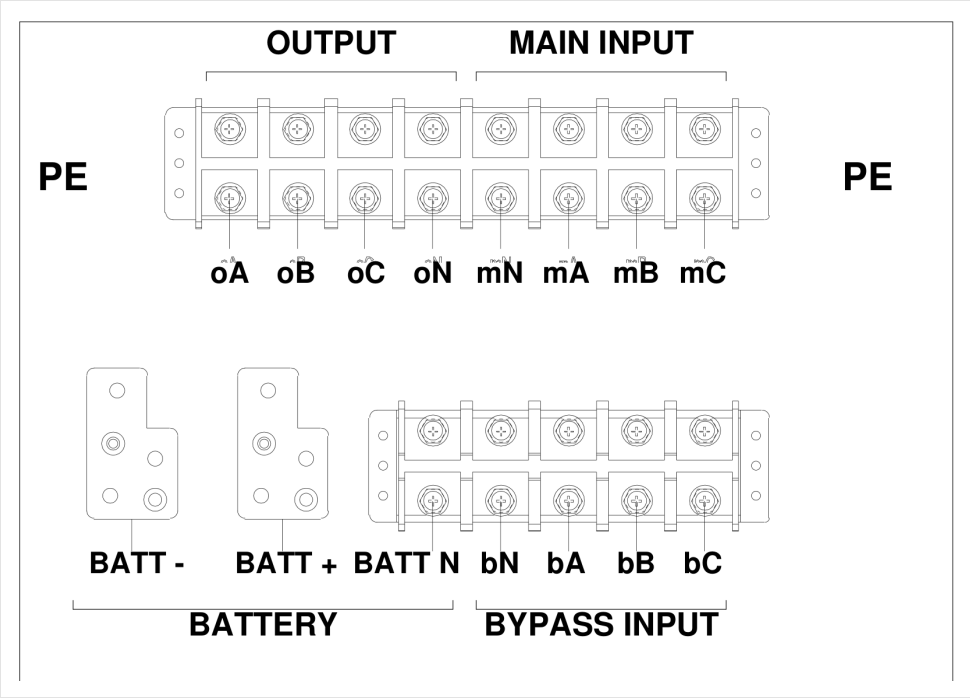


FIGURE B-3 Terminal positions, rear view with the cover removed: M10 bolts, two per pole; terminals 11 to 17 in (270 to 420 mm) above the floor

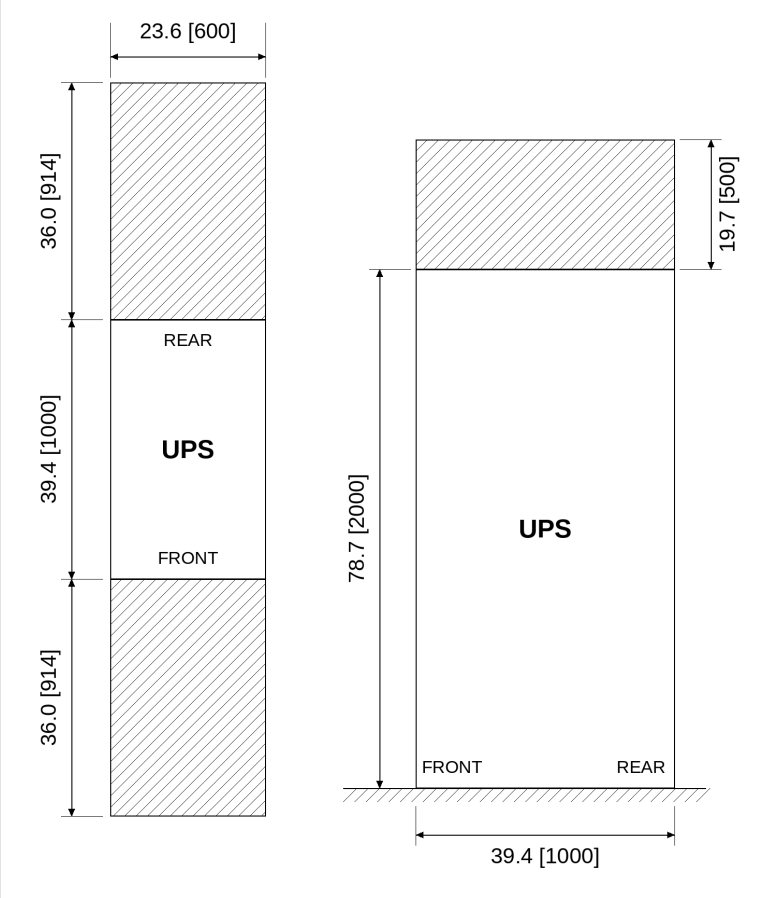


FIGURE B-4 Space and clearances, plan and side view

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 pinholes	**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 door

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, up to five. The 20 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 full cabinet from the start (Table 4-3).
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.
How long does the battery last?	See Table 2-5: for example 22 minutes at 30 kW (60 kVA at 50 % load).
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.

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	
Available fault current at the main and bypass input (site study)	
Battery: blocks per string, strings, capacity (Ah); string voltages measured	
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	

F

APPENDIX F

Warranty

What the RADIANT-IB warranty covers.

TABLE F-1 Warranty

Item	Coverage
RADIANT-IB UPS	3 years
VRLA batteries	2 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
C	Battery capacity in Ah (0.1 C = one tenth of the capacity, as a current)
DC/DC	DC-to-DC converter (the module's bidirectional charger)
ECO	Economy mode: the load on the static bypass
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, the ordering code, the serial number (on the rating label and in Set › Sys Func), the alarm or event shown, the load and the number of modules — a photo of the display and of the label speeds things up on WhatsApp.