



iONE CONTINENTAL

AI-Powered Autonomous Solar Power Platform
Product Catalog & Technical Manual

2.88 – 4.32 kWp
Solar Array

16 – 48 kWh
LiFePO₄ Storage

Up to 12 Days
Autonomy

INDUSTRY APPLICATIONS

OIL & GAS • DEFENCE & SECURITY • TELECOM
FIRE GUARD • AGRICULTURE • INFRASTRUCTURE

Modular Platform • Add-on Equipment Ready • 25-Year Design Life



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TABLE OF CONTENTS

TABLE OF CONTENTS.....	2
1. EXECUTIVE SUMMARY.....	3
2. INDUSTRY APPLICATIONS.....	3
3. POWER GENERATION.....	10
3.1 Solar Array Configurations.....	10
3.2 Dual-Axis Solar Tracker.....	10
3.3 Storm Protection Modes.....	11
3.4 Hybrid Wind Option.....	11
4.1 System Architecture.....	12
4.2 Module Options.....	12
4.3 Power Output Configurations.....	12
4.4 Connectors & Cabling.....	12
5.1 Battery Configuration Matrix.....	13
5.2 Autonomy Calculator.....	13
5.3 Battery Specifications.....	13
6. MISSION CONTROL & SERVICE.....	14
6.1 System Management Unit (SMU).....	14
6.2 Connectivity Options.....	14
6.3 Sensor Array.....	14
6.4 Automated Service Dispatch.....	15
7.1 Foundation System.....	16
7.2 Structural Materials.....	16
7.3 Deployment Timeline.....	16
8. LOGISTICS & SHIPPING.....	17
8.1 Shipping Configuration.....	17
8.2 System Dimensions (Packed).....	17
8.3 Battery Shipping (UN38.3).....	17
9. CERTIFICATIONS & STANDARDS.....	18
10. MAINTENANCE & SPARE PARTS.....	19
10.1 Recommended Spare Parts (per 10 units).....	19
10.2 Scheduled Maintenance.....	19

1. EXECUTIVE SUMMARY

iONE CONTINENTAL: The Universal Standard for Autonomous Energy Infrastructure

iONE CONTINENTAL is a strategic, universal autonomous power platform engineered for critical mission environments where grid infrastructure is non-existent, economically unfeasible to deploy, or represents an unacceptable security vulnerability. By combining aerospace-grade precision with industrial resilience, CONTINENTAL provides a permanent energy foundation for global industries.

The platform integrates three core technological pillars into a single, rapidly-deployable system: **precision dual-axis solar tracking**, **high-density industrial LiFePO₄ storage**, and **AI-driven predictive management**. This allows the system to operate independently for years without human intervention, automatically adapting to shifting weather patterns and complex load demands.

Platform Capabilities & Technical Range:

- **Solar Generation:** 2.88 kWp (Tactical) or 4.32 kWp (Industrial)
- **Energy Storage:** 16 kWh to 48 kWh LiFePO₄ (N+1 redundant battery strings)
- **Operational Autonomy:** 2 to 36+ days (depending on load; up to 870h for 50W IoT payloads)
- **Deployment Speed:** 1 day, 2 persons, no heavy machinery or concrete
- **Structural Design Life:** 25 years (Structure), 15+ years (Battery @ >80% capacity)
- **Power Reliability:** N+1 redundancy for both MPPT solar chargers and AC inverter modules.

2. INDUSTRY APPLICATIONS

The Industrial Standard of Energy Independence

The iONE CONTINENTAL autonomous power platform is engineered for mission-critical applications where failure is not an option. Unlike iONE SOLAR consumer-grade solar solutions, the EUROPE series is built to a rigorous **Industrial & Defence Standard**, specifically designed to operate as a primary power source in the harshest environments.

The transition from "consumer" to "industrial" standard in the EUROPE series is defined by several key technological pillars:

- **Hardened Power Electronics:** Equipped with high-torque low-frequency (LF) inverters and supercapacitor buffers capable of handling massive **400A inrush currents** that would destroy standard consumer inverters.
- **Industrial Energy Density:** Utilizing large-scale LiFePO₄ storage with capacities up to 48 kWh, providing a deep energy buffer that ensures 24/7 operation for heavy industrial loads.
- **Structural Resilience:** Constructed from marine-grade **Stainless Steel 316L** and high-strength **6061-T6 Aluminum** to ensure survivability in aggressive, corrosive, or high-wind environments.
- **Redundant Reliability:** Features N+1 operational redundancy and predictive AI diagnostics that identify potential issues before they lead to system downtime.

This industrial architecture transforms the iONE CONTINENTAL from a simple solar generator into a **strategic energy asset** capable of supporting the most demanding global industries.

OIL & GAS Uninterrupted Energy Independence

Autonomous Continuous Power for Telemetry, Actuation & Connectivity

The Energy Foundation for the Industry

The **IONE CONTINENTAL** platform serves as the primary power source for assets isolated from the central grid. The system provides constant, 24/7/365 power supply to onsite equipment, leveraging high-efficiency solar generation and AI-driven energy management.

Resilience and System Survivability

Unlike standard solutions, **IONE CONTINENTAL** possesses an immense safety margin for extreme operational conditions:

- **Autonomy Without Sunlight:** The integrated LiFePO₄ storage guarantees from 48 to 144 hours of uninterrupted operation for critical telemetry and communication channels, even in total darkness.
- **High-Torque Actuation:** The CORE-48 battery capacity is sufficient to perform 40 complete open-close cycles of main pipeline valves using battery power alone.
- **High-Load Capability:** The AC Modular 8kW (4+1) inverter easily handles starting surges up to 400A, enabling the operation of heavy chemical pumps and valve actuators without the need for expensive soft-start devices.
- **Corrosion Resistance:** Constructed from SS 316L stainless steel and 6061-T6 aluminum, the platform is rated for 15+ years of service in aggressive environments including salt mist and H₂S exposure.

Targeted Power Payloads

IONE CONTINENTAL is engineered to maintain the continuous operation of complex industrial equipment:

- **Environmental Monitoring:** Power for laser CH₄ detectors and H₂S perimeter sensors to ensure ESG compliance and leak detection.
- **Connectivity & SCADA:** Continuous supply for satellite terminals (Starlink, Iridium), SCADA RTUs, and LoRaWAN gateways for facility-wide data transmission.
- **AI Security:** Thermal cameras and AI-driven surveillance for detecting equipment overheating and unauthorized intrusion.

Recommended Configuration

Parameter	Specification
Solar Array	INDUSTRIAL 4.32 kWp (Max harvest, dual-axis tracking ±0.1°)
Energy Core	CORE-32 or CORE-48 (48–144h autonomy for critical telemetry)
Power Output	DC NATIVE 48V + AC Modular 8kW (4+1) + Supercaps (Optional)
Installation	6 Screw Piles (Zero concrete, rapid relocation capability)

Payload Equipment

Equipment	Function
Laser CH ₄ detector	Continuous methane scanning, ESG compliance reporting
Open-path H ₂ S sensor	Perimeter security monitoring
SCADA RTU	Protocol conversion, data storage and transfer
Satellite terminal	Satellite communication channel for facilities without infrastructure
LoRaWAN gateway	Data collection from 1000+ field sensors within a 15 km radius
Valve actuator controller	Remote emergency shutdown (ESD)

DEFENCE & SECURITY

Silent Power for Tactical Operations

Constant Energy Generation for Covert Surveillance and Electronic Warfare

The **iONE CONTINENTAL** provides a continuous, high-reliability power supply for military and border security applications where silence and low signatures are mission-critical. It eliminates the dependency on noisy, heat-emitting fuel generators, providing a persistent energy foundation for electronic assets.

Strategic Power Supremacy & Stealth

- **Dual Configuration Support:** The platform is available in two main versions to meet specific mission requirements: the TACTICAL (2.88 kWp) for maximum concealment and the INDUSTRIAL (4.32 kWp) for high-energy payloads like heavy radar or active jamming.
- **180° Stealth Fold (Tactical Exclusive):** A unique capability that allows complete concealment of the reflective solar surfaces behind the mast structure, reducing visual and IR signatures by 90% during high-threat operations.
- **Signature Neutrality:** The DC-native 48V architecture eliminates inverter-induced acoustic noise and thermal output, which is vital for maintaining the integrity of covert surveillance positions.
- **Massive Operational Buffer:** With the CORE-48 energy core, the system maintains a guaranteed power reserve for up to 145 hours for radar systems (300W load) even when generation is intentionally paused for stealth.
- **Rapid Frontline Deployment:** The foundation-free screw pile system enables the establishment of a permanent power grid for forward operating bases in 8–12 hours without heavy machinery or concrete.

Recommended Tactical & Industrial Configurations

Parameter	TACTICAL (Stealth Focused)	INDUSTRIAL (Power Focused)
Solar Array	2.88 kWp (Enables 180° Fold)	4.32 kWp (Max harvest/90° Fold)
Energy Core	CORE-48 (Max autonomy)	CORE-48 (High-load reserve)
Power Output	DC NATIVE 48V (Silent)	DC 48V + AC Modular 8kW (4+1) (Optional)
Protection	180° Stealth Fold	90° Vertical Protection)
Wind Rating	Survival >200 km/h	Up to 180 km/h
Installation	6 Screw Piles (Zero concrete)	6 Screw Piles (Zero concrete)

Persistent Power for Defense Payloads

iONE CONTINENTAL is engineered to provide uninterrupted energy for a wide array of mission-critical equipment:

- **Electronic Warfare:** Continuous supply for C-UAS radar systems (60–150W), RF direction finders, and signal jammers.
- **Intelligence & Surveillance (ISR):** Constant power for PTZ thermal cameras, night vision systems, and seismic/acoustic perimeter sensors.
- **Secure Comms:** Uninterrupted operation of encrypted radio networks, satellite terminals (Starlink/Iridium), and tactical mesh nodes.

TELECOM & CONNECTIVITY

Off-Grid Base Stations and Repeaters

Carrier-Grade Power Infrastructure for Rural and Remote Networks

The **iONE CONTINENTAL** platform addresses the primary barrier to telecommunications expansion: the prohibitive cost of extending grid power to remote locations. By providing native, high-efficiency energy generation, **iONE CONTINENTAL** serves as a permanent power foundation for off-grid base stations and repeaters.

High-Efficiency Network Power

- **Native 48V DC Architecture:** The system provides carrier-grade 48V DC power used natively by telecom equipment, achieving 98%+ efficiency by eliminating unnecessary conversion losses.
- **Scalable Load Support:** Engineered to power everything from small cells (100–300W) to full macro sites (500–1000W) through appropriate battery sizing.
- **N+1 Operational Redundancy:** Integrated MPPT modules feature N+1 redundancy, ensuring the network remains online even during individual component failures.
- **Climate-Adaptive Protection:** Standardized with 90° Fold protection, with an optional 180° Fold configuration specifically for high-wind coastal installations.
- **Guaranteed Uptime:** The system is designed to meet requirements for 96+ hour autonomy during grid outages, ensuring emergency services remain active.

Recommended Configuration

Parameter	Specification
Solar Array	INDUSTRIAL 4.32 kWp (supports 24/7 high-load operation)
Energy Core	CORE-32 minimum (58h @ 500W), CORE-48 for critical sites
Power Output	DC NATIVE 48V (telecom standard, 96%+ efficiency)
Protection	90° Fold standard, 180° for coastal high-wind sites
Installation	6 Screw Piles (Zero concrete, rapid relocation capability)

Continuous Power for Network Payloads

iONE CONTINENTAL is built to maintain the constant operation of a diverse telecom ecosystem:

- **Mobile Networks:** 4G/5G small cells, micro base stations, and sector antennas (700MHz to 3.5GHz).
- **Backhaul & Relay:** Microwave backhaul equipment and satellite terminals (Starlink, OneWeb compatible).
- **Local Connectivity:** Wi-Fi 6 access points for rural coverage and LoRaWAN gateways for industrial IoT networks.

FIRE GUARD

Forest Fire Detection & Drone Operations

Distributed Power Hub for Automated Aerial Surveillance and Fire Mitigation

The **iONE CONTINENTAL** serves as a complete autonomous detection hub in regions lacking any infrastructure. It provides continuous energy for complex sensor networks and serves as a critical charging station for reconnaissance drones, enabling 24/7 aerial surveillance during high-risk seasons.

Autonomous Fire Mitigation Infrastructure

- **Automated Drone Base:** The platform enables drones to return for autonomous charging and high-speed data upload, while EUROPA transmits alerts via cellular or satellite links.
- **High-Power Charging:** Supports AC Modular 8kW (4+1) output to handle drone chargers (such as DJI Matrice) requiring 1.5–2kW peak power.
- **Environmental Resilience:** Features a unique 180° Fold mode for "fire ember protection," shielding the solar array from falling debris and heat.
- **Compact Footprint:** The TACTICAL 2.88 kWp array is optimized for rapid deployment in forest clearings and remote agricultural lands.
- **Energy Buffer for Operations:** Integrated storage (CORE-16/32) ensures enough power for multiple drone charging cycles and continuous sensor operation regardless of cloud cover.

Recommended Configuration

Parameter	Specification
Solar Array	TACTICAL 2.88 kWp (compact footprint for forest clearings)
Energy Core	CORE-16 or CORE-32 (drone charging cycles + sensors)
Power Output	DC 48V + AC Modular 8kW (4+1) (Optional)
Protection	180° Fold (fire ember protection)
Installation	6 Screw Piles (Zero concrete, rapid relocation capability)

Constant Power for Detection Payloads

The platform is designed to maintain the constant operation of:

- **Detection Gear:** Thermal cameras (150W with integrated heaters for de-icing) and smoke/particulate sensors.
- **Environmental Intelligence:** Full weather stations monitoring wind, humidity, and temperature for fire spread prediction.
- **UAV Integration:** Drone-in-a-Box systems for fully automated, pilotless reconnaissance missions.
- **Critical Uplink:** Satellite communication for transmitting emergency alerts from areas without cellular coverage.

AGRICULTURE

Irrigation Pumps & Field Monitoring

High-Torque Power Solutions for Precision Farming and Remote Water Management

Modern precision agriculture relies on distributed sensors and automated irrigation systems operating in vast fields far from reliable grid connections. **IONE CONTINENTAL** addresses the specific engineering challenge of agricultural machinery: high inrush currents at startup that can damage standard electronic inverters.

Heavy-Duty Agricultural Power

- **Motor Startup Mastery:** The AC Modular configuration utilizes a dedicated supercapacitor buffer and 4+1 redundant architecture to handle motor starting surges of up to 400A. This allows for the direct-drive operation of irrigation pumps without the need for additional, expensive soft-start devices.
- **Daytime Pumping Efficiency:** The INDUSTRIAL 4.32 kWp array is designed to provide simultaneous energy for active daytime pumping while charging the battery core for overnight operations.
- **Intermittent Load Management:** The CORE-32 energy core serves as a robust buffer, ensuring stable power for intermittent pump operation even during fluctuating solar conditions.
- **Resilient Protection:** The system is equipped with 90° Fold protection to safeguard the solar array against hail, which is a common threat in many agricultural regions.
- **Soil and Livestock Oversight:** Beyond irrigation, the platform maintains continuous power for soil nutrient sensors, weather stations for frost warning, and livestock GPS tracking.

Recommended Configuration

Parameter	Specification
Solar Array	INDUSTRIAL 4.32 kWp (daytime pumping + battery charge)
Energy Core	CORE-32 (buffer for intermittent pump operation)
Power Output	DC 48V + AC Modular 8kW (4+1) (Optional)+Supercaps (handles pump inrush)
Protection	90° Fold (hail protection for agricultural regions)
Installation	6 Screw Piles (Zero concrete, rapid relocation capability)

Persistent Power for Farming Payloads

IONE EUROPA ensures the constant operation of the following critical agricultural systems:

- **Water Management:** Irrigation pump controllers capable of driving motors up to 7.5kW.
- **Precision Sensors:** Soil moisture, nutrient sensors, and multispectral crop health cameras.
- **Environmental Safety:** Specialized weather stations for early frost warnings to protect sensitive crops.
- **Asset Security:** Livestock water level monitors, GPS trackers, and electric fence energizers.

INFRASTRUCTURE

Smart City, Highways, and Public Safety

Foundation-Free Power Hub for Critical Urban and Transport Networks

The **iONE EUROPE** platform provides a strategic solution for infrastructure projects where the cost of trenching and cabling often exceeds the budget for the equipment itself. It offers a rapidly deployable, permanent power foundation for public safety, traffic management, and smart city sensors without permanent site modification.

Strategic Infrastructure Advantages

- **Elimination of Civil Works:** The foundation-free design allows for installation, relocation, or removal of the power hub in a single day, avoiding the massive costs of grid connection permits and road excavations.
- **Guaranteed Emergency Uptime:** Engineered for maximum reliability, the system provides 96+ hours of autonomy during total grid outages, ensuring that emergency SOS stations, traffic monitors, and public safety systems remain active during extreme weather events.
- **Industrial Resilience:** The INDUSTRIAL 4.32 kWp array combined with the CORE-48 energy core creates a multi-day emergency reserve for critical highway and urban nodes.
- **Vandal and Weather Protection:** In 90° Fold mode, the solar array is protected from hail and serves as a robust deterrent against vandalism in public spaces.
- **Universal Equipment Support:** The AC Modular 4-8 kW (2(4)+1) configuration ensures seamless compatibility with all standard public infrastructure hardware.

Recommended Configuration

Parameter	Specification
Solar Array	INDUSTRIAL 4.32 kWp (reliable harvest for public systems)
Energy Core	CORE-32 or CORE-48 (multi-day emergency reserve)
Power Output	DC 48V + AC Modular 4–8 kW (2(4)+1 Optional)
Protection	90° Fold (vandal resistance, hail protection)
Installation	6 Screw Piles (Zero concrete, rapid relocation capability)

Constant Power for Infrastructure Payloads

iONE CONTINENTAL is designed to maintain the continuous operation of:

- **Lighting & Safety:** High-output LED area lighting and smart street lamps.
- **Traffic Monitoring:** PTZ cameras, ANPR systems, traffic counters, and speed sensors.
- **Public Communication:** High-capacity Public Wi-Fi access points and highway SOS intercoms.
- **Environmental Intelligence:** Air quality monitoring stations and weather sensors.
- **Emergency Hubs:** Power for public safety mesh networks and disaster response nodes.

3. POWER GENERATION

CONTINENTAL's generation system combines high-efficiency bifacial solar panels with precision dual-axis tracking to maximize energy harvest throughout the day and across seasons. Optional wind hybridization extends capability to low-sun and high-wind environments.

3.1 Solar Array Configurations

PARAMETER	TACTICAL ARRAY	INDUSTRIAL ARRAY
Panel Count	4 panels (2x2)	6 panels (3x2)
Peak Power	2.88 kWp	4.32 kWp
Panel Specification	720W Bifacial TOPCon	720W Bifacial TOPCon
Array Dimensions	~2.35 x 2.7 m	~4.5 x 2.5 m
Daily Harvest (avg)	10-13 kWh/day	15-19 kWh/day
Storm Protection	Level 1, 2 & 3 (Extreme)	Level 1 & 2 (Critical)
Folding Mechanics	180° Book Fold + 90° Drop	90° Vertical Drop
System Weight	750-950 kg (Parity)	750-950 kg (Parity)

Panel Technology: Bifacial TOPCon with ALD Coating

- Glass-glass construction (no backsheet degradation, 30-year life)
- TOPCon cell technology (>22% efficiency)
- Bifacial gain: +10-30% from ground reflection (albedo dependent)
- ALD Al₂O₃ aerospace coating (sand/salt/UV resistance)
- Manufacturer: Heckert Solar or Sonnenstromfabrik (German quality)

3.2 Dual-Axis Solar Tracker

The tracking system positions panels perpendicular to sunlight throughout the day, increasing energy harvest by 25-35% compared to fixed-mount installations. Aerospace-grade slewing drives provide precise motion control even under ice loading.

COMPONENT	SPECIFICATION
Drive Type	Worm-gear slewing drive (self-locking)
Azimuth Range	±180° (full rotation)
Elevation Range	0° to 90° (horizontal to vertical)
Tracking Precision	±0.1° (4-quadrant photodiode array + GPS ephemeris)
Sun Finding	Optical sensors + astronomical algorithm fallback
Ice/Snow Load	Automatic shake-off cycle at dawn

3.3 Storm Protection Modes

IONE CONTINENTAL automatically protects the solar array based on real-time wind measurements and weather service forecasts. The system can preemptively enter protection mode before severe weather arrives.

IONE CONTINENTAL features a 3-tier "Protection Constructor" based on real-time ultrasonic wind data and predictive weather APIs. The sensors remain active and unblocked in all positions to ensure safe automatic recovery.

- Level 1: DYNAMIC ADAPTATION (Standard) – Panels do not fold. The system dynamically adjusts the angle of attack to minimize wind resistance. Ideal for moderate European climates.
- Level 2: CRITICAL GUST (90° Drop) – Optimized for INDUSTRIAL arrays. Two sections of 3 panels drop vertically. High-speed protection for extreme gusts.
- Level 3: EXTREME PROTECTION (180° + 90°) – Exclusive to TACTICAL arrays. Panels perform a 180° book fold (protecting surfaces from sand/snow) then the entire mass drops 90°. Designed for Desert Shield and Arctic conditions.

MODE	POSITION	WIND RATING	USE CASE
TRACKING	Dynamic	< 60 km/h	Normal operation
FEATHER	0° Horizontal	< 120 km/h	Standard storm
VERTICAL	90° Upright	< 180 km/h	Hail, coastal
STEALTH	180° Book Fold	> 200 km/h	Extreme, tactical

The 180° Stealth Fold is unique in the industry—no commercial competitor offers full panel concealment for large-format arrays. This capability is critical for defence applications requiring minimal visual and IR signature.

3.4 Hybrid Wind Option

For installations in high-latitude or high-wind locations, a 500W Vertical Axis Wind Turbine (VAWT) supplements solar generation. The turbine operates in winds from 3 m/s to 25 m/s, providing power during polar night or extended overcast periods.

- Rated Power: 500W @ 12 m/s
- Cut-in Speed: 3 m/s
- Survival Speed: 50 m/s
- Integration: Dedicated MPPT channel, additive to solar

4. POWER ELECTRONICS

IONE CONTINENTAL 's electrical architecture is based on a 48V DC bus—the telecom industry standard. All components are hot-swappable with N+1 redundancy, ensuring continuous operation even during maintenance or component failure.

4.1 System Architecture

- 48V DC Bus: Central power rail connecting all modules
- MPPT Solar Chargers: Convert variable PV voltage to regulated 48V
- Battery Management: Monitors cell health, balances, protects
- DC Distribution: Direct 48V output for telecom/industrial loads
- Inverter (optional): Converts 48V DC to 230V AC for standard loads
- System Controller (SMU): AI-driven management and monitoring

4.2 Module Options

MODULE	CAPACITY	EFFICIENCY	APPLICATION
MPPT 4kW	4 kW per unit	96%	Solar charging (Standard)
AC Inverter Module	2 kW per unit	96%	Modular AC power block
AC Power Rack (4+1)	8 kW usable / 10 kW total	95%	Standard N+1 redundant config
Supercap Buffer	400A surge	98%	Motor starting

4.3 Power Output Configurations

DC NATIVE (Maximum Efficiency)

Direct 48V DC output for equipment designed for telecom power standards. No conversion losses. Ideal for cellular base stations, industrial controllers, LED lighting with DC drivers.

AC MODULAR POWER (Heavy Industrial / Mission Critical) Scalable 2kW-step architecture with 4+1 redundancy. Features a supercapacitor buffer to handle motor starting surges up to 400A. Supports critical equipment even during single module maintenance or failure.

4.4 Connectors & Cabling

All external connections use aviation-grade or military-specification connectors for reliability in harsh environments:

- Power Output: Anderson SB175 (DC) / CEE 32A (AC)
- Solar Input: MC4-compatible with locking ring
- Data: M12 circular connectors (IP67)
- Antenna: N-type or TNC (weatherproof)
- Internal: Mil-spec D-sub with strain relief

5. ENERGY STORAGE

IONE CONTINENTAL uses Lithium Iron Phosphate (LiFePO₄) battery technology—the safest and most durable lithium chemistry available. Unlike NMC or LCO cells, LiFePO₄ does not experience thermal runaway and can operate for 15+ years in demanding conditions.

5.1 Battery Configuration Matrix

CORE	CAPACITY	CONFIGURATION	USABLE (90%)	WEIGHT
CORE-16	16.1 kWh	16S1P × 280Ah	14.5 kWh	~90 kg
CORE-32	32.2 kWh	16S2P × 280Ah	29.0 kWh	~180 kg
CORE-48	48.4 kWh	16S3P × 280Ah	43.5 kWh	~360 kg

5.2 Autonomy Calculator

Battery-only autonomy (no solar input). Formula: Usable Capacity ÷ Load = Hours

LOAD SCENARIO	CORE-16	CORE-32	CORE-48
50W (IoT, gas monitor)	290h (12 days)	580h (24 days)	870h (36 days)
150W (cameras, sensors)	96h (4 days)	193h (8 days)	290h (12 days)
300W (radar, small cell)	48h (2 days)	96h (4 days)	145h (6 days)
500W (telecom hub)	29h	58h (2.4 days)	87h (3.6 days)
1000W (high load)	14.5h	29h	43.5h

Note: AC loads reduce autonomy by ~5% (inverter efficiency). Cold weather (<0°C) reduces capacity by 10-20%.

5.3 Battery Specifications

PARAMETER	SPECIFICATION
Cell Chemistry	LiFePO ₄ (Lithium Iron Phosphate)
Cell Format	Prismatic 280Ah (CATL/EVE grade)
Nominal Voltage	51.2V (16S × 3.2V)
Cycle Life	>10,000 cycles @ 80% DoD (to 80% remaining capacity)
Calendar Life	15+ years @ 25°C average
Operating Temp	Charge: 0°C to +45°C / Discharge: -20°C to +55°C
BMS Features	Cell balancing, over/under voltage, over current, temperature
Cold Weather	PTC heating for charging below 0°C (automatic)

6. MISSION CONTROL & SERVICE

Every **IONE CONTINENTAL** station is a connected asset reporting its status in real-time. The System Management Unit (SMU) provides local autonomy while transmitting telemetry to the cloud for fleet-wide analytics and predictive maintenance.

6.1 System Architecture

Component	Location	Function
SMU	On-station	Local controller — executes algorithms, collects sensor data, transmits telemetry
Intelligence Cloud	Remote server	Data storage, AI analytics, operator interface

6.2 System Management Unit (SMU)

- Real-time monitoring: Voltage, current, temperature, state-of-charge
- Predictive analytics: AI identifies degradation trends 30-90 days before failure
- Weather integration: API fusion with forecast services for proactive storm protection
- Load management: Priority-based shedding during low battery conditions
- Cold protection: Automatic battery pre-heating before charging in sub-zero conditions

6.3 Connectivity Options

INTERFACE	SPECIFICATION	USE CASE
Cellular	4G LTE Cat-M1 / NB-IoT	Primary telemetry
Satellite	Iridium SBD (optional)	Remote/Arctic sites
Ethernet	1 Gbps RJ45	Local network
Protocols	SNMP v3, Modbus TCP/RTU, MQTT	SCADA integration

6.4 Sensor Array

12+ sensors provide complete environmental awareness for autonomous operation:

SENSOR	TYPE	FUNCTION
Wind	Ultrasonic anemometer	Storm protection trigger
Irradiance	Pyranometer	Harvest prediction
Sun Position	4x photodiodes	Tracking optimization
Temperature	PT1000 x 5	Thermal management
Inclination	Dual-axis MEMS	Ground subsidence, tamper
Vibration	Accelerometer	Structural integrity
Position	GPS/GLONASS	Geolocation, anti-theft
Current	Hall effect x 3	Solar/battery/load monitor

6.5 Intelligence Cloud

Black Box — complete operational history of each station:

- All sensor readings, state changes, anomalies
- Deviation causes and resolution logs
- Power cycles, communication drops, recovery events
- Retained for entire service life (15+ years)

AI Analytics — fleet-wide pattern recognition:

- Learns degradation signatures across all deployed units
- Predicts component failures 30-90 days ahead
- Generates service tickets with parts, GPS, route

Mission Control — operator interface (web/app):

- Real-time monitoring of station or fleet
- Access to Black Box history and reports
- Remote commands (reboot, mode change, firmware update)
- Service dispatch management

6.6 Automated Service Dispatch

When the SMU detects a fault or predicts an upcoming failure, it automatically generates a Service Ticket containing:

- Exact GPS coordinates of the station
- Diagnostic fault code and severity level
- Recommended spare parts (with part numbers)
- Estimated time to failure (if predictive)
- Optimized route for service technician (integrated mapping)

7. INSTALLATION & FOUNDATION

IONE CONTINENTAL is designed for rapid deployment without concrete foundations or heavy equipment. The screw pile system allows installation in one day and complete removal without permanent site modification.

7.1 Foundation System

COMPONENT	SPECIFICATION
Pile Configuration	6 screw piles (optimized load distribution)
Perimeter Piles	4 × 1.0 m depth (frame anchoring)
Center Piles	2 × 2.0 m depth (mast load, lever arm forces)
Pile Diameter	76 mm shaft, 200 mm helix
Installation Tool	Hydraulic drive head (handheld or mini-excavator)
Soil Types	Sand, clay, gravel, frozen ground (with pre-drilling)

7.2 Structural Materials

COMPONENT	MATERIAL	PROPERTIES
Main Frame	Aluminum 6061-T6	High strength, lightweight
Tracker Structure	Aluminum 6061-T6	Corrosion resistant
Fasteners & Joints	Stainless Steel 316L	Marine grade, chloride resist
Screw Piles	Hot-dip Galvanized Steel	50+ year ground life
Enclosure	Aluminum + Powder Coat	RAL 7035, UV stable

7.3 Deployment Timeline

PHASE	DURATION	ACTIVITIES
Site Prep	1-2 hours	Clear vegetation, mark pile locations
Foundation	2-3 hours	Drive 6 screw piles, attach mounting plates
Frame Assembly	2-3 hours	Assemble base frame, mount electronics enclosure
Solar & Tracker	2-3 hours	Mount panels, connect tracker, align system
Commissioning	1-2 hours	Power on, system test, cloud registration

Total deployment: 8-12 hours with 2-person crew, no crane or concrete mixer required.

8. LOGISTICS & SHIPPING

IONE CONTINENTAL is designed for efficient transport in standard shipping containers. All components are packaged for protection during sea freight and road transport to remote sites.

8.1 Shipping Configuration

PARAMETER	SPECIFICATION
20' Container Capacity	4-5 complete EUROPA systems
40' Container Capacity	10-12 complete EUROPA systems
Pallet Configuration	EUR pallets (1200×800mm)
Heaviest Single Package	Battery module ~200 kg (forklift required)
Panel Packaging	Wooden crate with foam inserts (6 panels/crate)

8.2 System Dimensions (Packed)

COMPONENT	DIMENSIONS	WEIGHT	QTY
Solar Panel Crate	2500×1400×400 mm	~240 kg	1
Body	3200×800×400 mm	~100 kg	1
Electronics Enclosure	1000×800×600 mm	~80 kg	1
Battery Module	1100×200×200 mm	~180-200 kg	1-3
Frame Package	3200×600×400 mm	~120 kg	1
Tracker & Mast	2200×400×400 mm	~150 kg	1
Screw Piles	2100×500×500 mm	~100 kg	1

Total system weight: 750-950 kg.

Weight Parity: The Tactical version (4 panels) maintains weight parity with the Industrial version (6 panels). The reduction in panel weight is utilized for the reinforced 180° folding hinges and heavy-duty actuators required for Extreme Protection modes..

8.3 Battery Shipping (UN38.3)

LiFePO₄ batteries are classified as Class 9 Dangerous Goods for transport. All EUROPA battery modules are:

- UN38.3 tested and certified
- Shipped at <30% state of charge (safety requirement)
- Packaged in UN-approved containers
- Accompanied by MSDS and shipping declarations

9. CERTIFICATIONS & STANDARDS

STANDARD	DESCRIPTION
CE	European Conformity (EMC, LVD, RED)
IEC 62619	Lithium batteries for industrial applications
IEC 61215	Crystalline silicon PV modules—design qualification
IEC 61730	PV module safety qualification
IEC 62109	Power converter safety
IP65/IP67	Ingress protection (dust-tight, water resistant)
UN38.3	Battery transport safety testing
EN 60068-2-11	Salt spray corrosion (500+ hours)

Defence-Specific Certifications (Optional)

- MIL-STD-810H: Environmental engineering considerations
- MIL-STD-461G: EMI/EMC for military equipment
- STANAG 4280: Electrical power characteristics

10. MAINTENANCE & SPARE PARTS

10.1 Recommended Spare Parts (per 10 units)

COMPONENT	QTY	REPLACEMENT INTERVAL
MPPT Module 4kW	1	As needed (MTBF >100,000h)
Inverter Module 2kW	1	As needed
SMU Controller	1	As needed
Slewing Drive Motor	1	10-15 years
Cooling Fan Assembly	2	5-7 years
Air Filters	10	Annual replacement
Fuse Set	2	As needed

10.2 Scheduled Maintenance

INTERVAL	ACTIVITIES
Annual	Visual inspection, filter replacement, connector check, firmware update
5 Years	Full electrical test, battery capacity verification, bearing lubrication
10 Years	Slewing drive assessment, cable replacement if degraded
15 Years	Battery capacity assessment (replace if <80% original)

CONTACT & SUPPORT

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