



THE LEADER IN
SOLAR+STORAGE
ADVANCED CONTROLS

TURNKEY STORAGE, SOLAR AND HYBRID CONTROLS PLATFORM



SOLUTION OVERVIEW

TURNKEY ENERGY STORAGE AND SOLAR CONTROL SYSTEM

Fractal EMS provides a comprehensive energy management suite of software, controllers, integration, and analytics (with options for 24/7 monitoring and market dispatch optimization). Fractal EMS was designed for mission-critical assets with stringent performance, uptime, and cybersecurity requirements. Fractal EMS is the industry's only fully vertical EMS with hardware-agnostic, turnkey solutions for BMS, EMS, and MPC, enabling buyers to choose different equipment for different projects using a unified software and controls platform.

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KEY FEATURES

Fractal EMS combines advanced features with competitive pricing to create the industry's best value in energy storage and hybrid controls.



✓ TECHNOLOGY AGNOSTIC

Flexible architecture that allows you to use different types of batteries, generation, and balance of plant equipment, enabling a universal fleet management system.

✓ MADE IN THE U.S.A.

Fractal EMS is U.S.-made with an in-house controller, FNE manufacturing, and in-house, domestic software development.

✓ TURNKEY CONTROLS

Full-stack controls and software for EMS/SCADA/MPC. Fractal designs, installs, and commissions the controls, networking, SCADA, historian, and HMI.

✓ LOCAL CONTROLS

Fractal can host the historian, reports, and HMI on-site or off-site (the equipment controls are on-site and do not need the cloud).

✓ BESS AND HYBRID SOLUTIONS

Standalone BESS or PV, AC or DC-coupled PVS, Gas and Data Center solutions.

✓ ROBUST HISTORIAN

Fractal stores data for the contract's life to support warranty claims and asset sales.

✓ ISO 9001 AND ISO 27001 CERTIFIED

Fractal EMS is ISO9001 certified for Quality Management Systems (QMS) and ISO 27001 for Information Security Management Systems (ISMS)

✓ SCALABLE

Open, modular platform that can control multiple sites with 100+ inverters. Fractal provides a fleet-level view of your portfolio.

✓ CYBER SECURITY

Built on ISO 27001, NERC CIP, and NIST 800-53 framework. Highly experienced in-house cyber/IT team with third-party auditing.

✓ EXPERIENCED TEAM

Our team has over a decade of experience in energy storage control development, integration, commissioning, and operations.

✓ BUILT FOR RELIABILITY

Hardened equipment backed by a high availability guarantee.

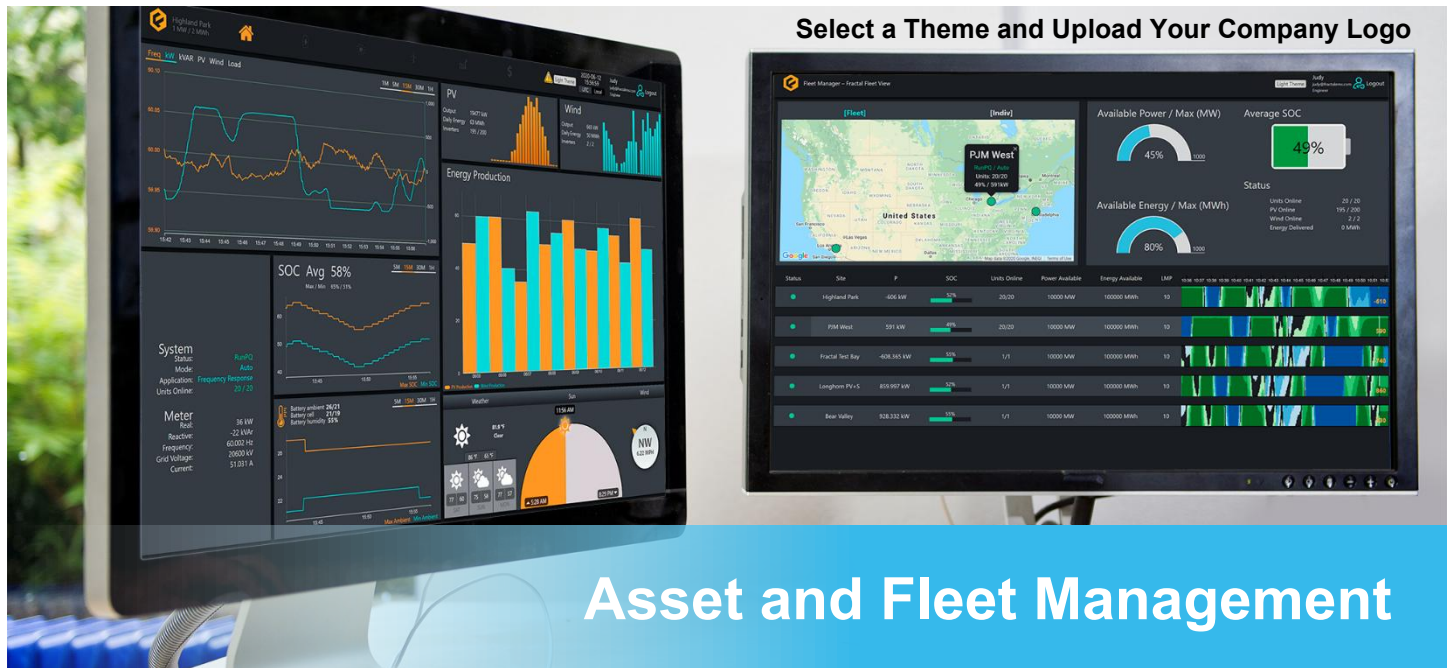
✓ DIAGNOSTICS AND ANALYTICS

Root cause identification and performance analytics to maximize performance and uptime.

FRACTAL EMS OPERATING SYSTEM (OS)

ASSET AND FLEET MANAGEMENT

Fractal EMS has a flexible and scalable architecture that allows assets to be easily added, removed or changed. Dispatch one asset or your entire portfolio. The UI enables control, active management and monitoring, P/Q response capability and dashboards to monitor system conditions, safety controls and faults/alarms.



ROBUST CONTROL MODES

Fractal EMS can configure communications and network security to meet your project needs.

CLOUD DISPATCH



Schedule dispatches through the Fractal Calendar. Also receive API commands, ADS (CAISO), or Dispatch Calendar invites from Fractal Optimizer

UTILITY SCADA DISPATCH



Securely receive power (P/Q) commands from SCADA (historical data securely sent to the cloud for monitoring, reporting, and predictive failures).

LOCAL DISPATCH



The Fractal Site Controller can be programmed to respond autonomously by responding to local measurements (voltage, frequency, load, etc.)

Fractal EMS provides the following control modes:

MANUAL SCHEDULE



Schedule applications (stack up to ten) using the Fractal Calendar.

MONITOR / RESPOND



Monitor load, pricing, or SCADA (AGC) and respond using predefined applications.

MEASURE / RESPOND



Measure frequency, solar/wind power, and/or voltage, and respond using predefined applications.

RECEIVE / RESPOND



Receive commands via SCADA (AGC) or from a third party (using Fractal's API).



APPLICATION STACKING

Fractal EMS provides applications that are customizable and stackable. Applications can respond to market or sensor inputs. Through the UI, applications can operate concurrently (stacks) and be prioritized (e.g., perform application 2 only if application 1 is not active). Applications can also be configured to use a certain percentage of the asset (application 1 has access to 60% of the BESS rated power, and Application 2 has access to 40% of BESS rated power). Applications can be scheduled to operate during certain hours of the day.

MERCHANT SERVICES



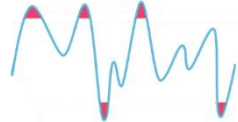
- Energy Arbitrage
- Frequency Regulation
- Spinning Reserves
- Non-Spin
- Fast Frequency
- Ramp Support
- EIM

PEAK SHAVING



- Coincident Peak Shaving
- Demand Charge Mitigation
- TOU Energy Shifting
- Congestion Relief
- Load Leveling

RELIABILITY



- Resource Adequacy
- Capacity
- Volt / Var Support
- Blackstart
- T&D Deferral
- SOC Balancing

RENEWABLES



- Shifting
- Smoothing
- Firming
- Clip Charging
- PV Self Consumption

USER PERMISSIONS

The Fractal EMS HMI has multiple user access levels:

- Viewer: Read-only, can access data and create reports
- Operator: Viewer + ability to start/stop and schedule events
- Engineer: Operator + ability to change parameters (SOC bands, droop curves, etc.)
- Admin: Can assign users and access levels within your organization

REMOTE SYSTEM OPERATIONS

- Open and close site-level switchgear/breakers
 - Open and close inverter breakers (AC and DC)
 - Open and close battery rack contactors
 - Switch operating modes and reset PCS
 - Seamlessly update parameters and setpoints in real-time (locally and remotely)
 - Receive and acknowledge faults, warnings, and alarms
- Address faults, alarms, and warnings by performing diagnostics and reviewing bit status codes
 - Issue an emergency stop (E-Stop)
 - Automatically and remotely deploy fire suppression
 - Custom BOP control algorithms and optimization are available



Enhanced Situational Awareness

REAL-TIME MONITORING AND DIAGNOSTICS

- Real-time monitoring of performance
 - Monitor that the system is within safe limits as defined by the manufacturer
 - Display faults, warnings, and alarms, and use diagnostic tools to maintain availability
- Respond to temperatures or abnormalities by reducing output or stopping the system
 - Ensure that the system is operating at an optimal level (proper SOC bands, ideal temperatures, designed power levels)

ALARMS AND WARNINGS

- Over/under-temperature and voltage thresholds
 - Malfunctions of PCS and BMS
 - Ground faults
 - Loss of communications
 - Open doors
- Activation of any of the interlocking mechanisms (racks, DC isolation switch)
 - HVAC, fire suppression system, and other BOP alarms

ROBUST HISTORIAN AND REPORTING

Fractal EMS includes a data historian and custom report builder. Fractal EMS hosts data in our secure cloud, which manages data storage, network security, node clustering and data replication to ensure high reliability, performance and availability.



DATA ENCRYPTION

All data is encrypted (including customer provided data) and is hosted with separate permissions for privacy and security.



ACCESS DATA ANYTIME / ANYWHERE

Access your data securely from anywhere in the world for fast decision-making and troubleshooting with no limit on storage.



OPTIMIZE PERFORMANCE AND SAFETY

View and analyze historical data to identify trends and opportunities for increased component and system performance, battery life and fire safety.



CUSTOM REPORTS AND GRAPHS

Create custom reports by selecting different measurements and devices. Display data tables or visualizations using a date range

Time series data (typically 300 to 1,000 points per inverter) are available for all system equipment, including PCS, battery racks and management systems, unit controllers, meters, sensors, fire panels, thermal management, switchgear, transformers, and generators.

TIME SERIES DATA STREAMS

State of Charge
State of Health
Real Power (Actual)
Real Power (Commanded)
Reactive Power (Actual)
Reactive Power (Commanded)
POI Metered Data
(Frequency, Current, Voltage)
Market Telemetry
Available Power and Capacity

PCS Status
(RunPQ, Standby, Off)
AC Voltage and Current
DC Voltage and Current
Max/Min Rack SOC
Max/Min Rack SOH
Max/Min Cell Temperatures
Max/Min Cell Voltages
Fault and Warning Statuses
(PCS and BMS)

Fire Suppression Status
Fire Panel Outputs
HVAC Statuses
Ambient Temperature Sensors
Humidity
GPS / Time / Date
Weather
Load / Generation Data
Sensors and Meters
More...

PERFORMANCE ANALYTICS

Fractal EMS provides fleet and asset analytics, which allow users to monitor asset performance and health and simplify management.



Battery Analytics and Anomaly Detection

PERFORMANCE REPORTING

- Track and report performance KPIs and trends at the fleet, site, and equipment level.
- Automates and customizes reports and notifications to manage expectations.

ANOMALY DETECTION

- Machine learning is used to identify fire risks or weak batteries.
- Decommission safety concerns and/or swap battery modules.

PREDICTIVE ANALYTICS

- Uses statistical and machine learning methods to transform data into actionable insights.
- Facilitating the identification of root causes and maximizing system uptime through proactive O&M.

STATE OF HEALTH

- Tracks SOH along with key factors that affect battery degradation.
- Digital twin models of capacity and degradation to allow adjustment of use and/or augmentation plans.

PREDICTIVE FAILURES

- Identify equipment that is exhibiting reduced efficiency or higher runtimes.
- Schedule additional preventative maintenance to avoid downtime.

WARRANTY TRACKING

- Monitor equipment compliance with warranty terms (degradation vs throughput and temperature)
- Performance Guarantee (power, energy, and RTE) trending and tracking

INTUITIVE CALENDAR

Fractal Calendar allows you to schedule applications and to schedule when your system will start/stop. Calendar events are customizable, and you can prioritize applications and configure individual parameters. Calendar events can be repeated, color-coded, and copied. Timeframes can be as short as one minute and as long as a year.



Intuitive and Responsive User Interface

PERFORMANCE TEST VALIDATION

Fractal EMS manages the performance tests (capacity, roundtrip efficiency, etc.), ISO testing, and off-taker PPA/capacity tests. Fractal also provides troubleshooting to identify equipment issues.



Performance Test Validation

CONTROL HARDWARE – UNIT/SITE/MPC

FRACTAL EMS CONTROLLERS

The Fractal EMS Unit Controller, Site Controller, and Master Plant Controller devices are built using ruggedized embedded controllers with an MTBF of > 40 years. All hardware device assembly and factory acceptance testing are done in the U.S.A. and built tough for harsh environments and stringent uptime guarantees.



PRODUCT	FRACTAL EMS UNIT CONTROLLER – 1 PER PCS
Function	The Unit Controller is the primary programmable hardware device deployed on-site to conduct concurrent monitoring, control, and operation coordination of each Unit. It aggregates data and provides controls to the PCS, Battery Management System (BMS), thermal management system, and fire system.

PRODUCT	FRACTAL EMS SITE CONTROLLER – 1 PER SITE
Function	The Site Controller coordinates the equipment operations to create a single point of control and monitoring for a BESS subproject. The Site Controller manages all control modes and algorithms the project requires for operation. The Site Controller is the primary programmable hardware device deployed on-site to conduct concurrent BESS monitoring, control, and operation. One Site Controller is required per BESS Point of Interconnection (POI). The Site Controller interacts with each inverter and battery block, collects data or feedback, and runs control mode algorithms that optimize system operations. The Site Controller also serves as the single point of interaction with external parties. Each Unit Controller communicates with the Site Controller.

PRODUCT	FRACTAL EMS MASTER PLANT CONTROLLER – 1 PER PROJECT
Function	At the plant (project) level, the Fractal EMS MPC is deployed on-site to conduct concurrent monitoring, control, and dispatch coordination of all subprojects. These could be a combination of storage, PV, or PV + storage assets. It monitors the POI readings and each subproject's output to calculate the necessary output required from each subproject to meet the POI requirements. The MPC is ultimately responsible for ensuring all POI limitations are not violated by managing all sub-project dispatch instructions.

Note: The Fractal EMS redundancy option deploys two site controllers and MPCs.

BUILT TOUGH FOR RUGGED ENVIRONMENTS

- Hardened, industrial-grade controllers for utility and commercial applications
- Enables energy storage plants to meet all competitive requirements
- Efficient communication system with millisecond response time
- Precise regulation of real and reactive power using closed-loop response
- Individual control of PCS and subcomponents
- Compact design enables easy and fast installation
- Digital and analog I/O modules for communication with third-party devices
- Ingestion, diagnostics, and reporting of BOP components, thermal management, fire panel, and metering
- Configuration, parameterization, and diagnostics via Fractal's web dashboard

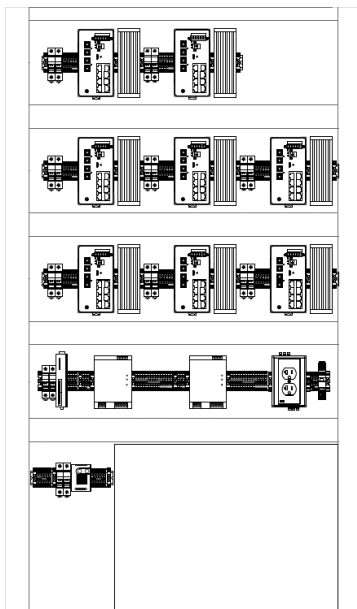
FREESTANDING AND PANEL FIELD NETWORK ENCLOSURES

Fractal EMS Unit-Level FNE

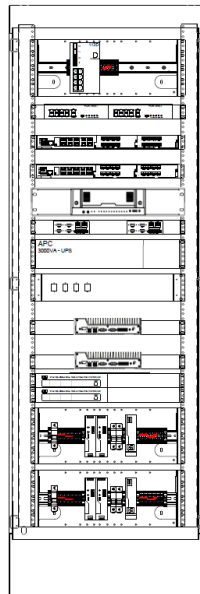
- Small, Medium, or Large FNE Options
- Unit Controllers, one per PCS
- Unit-Level Network Switch
- Network Transceiver
- Misc. (Terminal Blocks, Cables, Fuses, Circuit Breaker, Wiring, Mounting Hardware, etc.)
- Power Supply / AC Power Distribution / Surge Protection
- Factory Acceptance Test
- FNE Thermal Management (Optional)
- Sensory / Field IO Relays (Optional)
- Uninterrupted Power Supply (Optional)

Fractal EMS Site-Level FNE

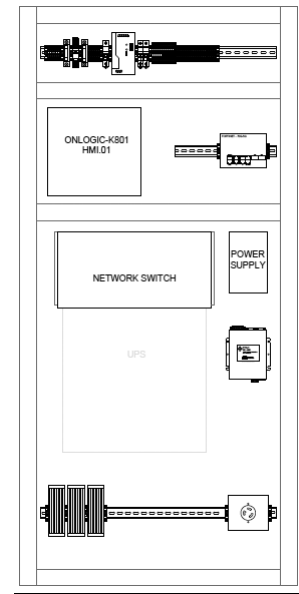
- Freestanding or Panel Mount Enclosure
- Site Controller, One per Site
- MPC (if Applicable), One per POI
- Site-Level Network Switch
- Network Transceiver / Firewall
- On-site Server
- Power Supply / AC Power Distribution / Surge Protection
- SEL RTAC(s)
- Cell Modem and Antenna
- Misc. (Terminal Blocks, Cables, Fuses, etc.)
- Factory Acceptance Test
- Touchscreen HMI and UPS (Optional)
- FNE Thermal Management (Optional)
- Sensory / Field IO Relays (Optional)
- CCTV Head Unit / Starlink Kit (Optional)



Unit-Level FNE (Sm, Med and Large)



Site-Level Freestanding Unit



Site-Level Panel Mount Enclosure

PROJECT-SPECIFIC SOLUTIONS

Fractal EMS is the industry's only fully vertical controls provider with hardware-agnostic, turnkey solutions for BMS, EMS, and MPC. This allows buyers to choose different equipment for different projects using Fractal's unified software and controls platform.

STANDALONE BESS – VARIOUS DC BLOCKS AND INVERTERS

Suitability

Designed for projects using any battery system that does not provide a local or site controller combined with any PCS.

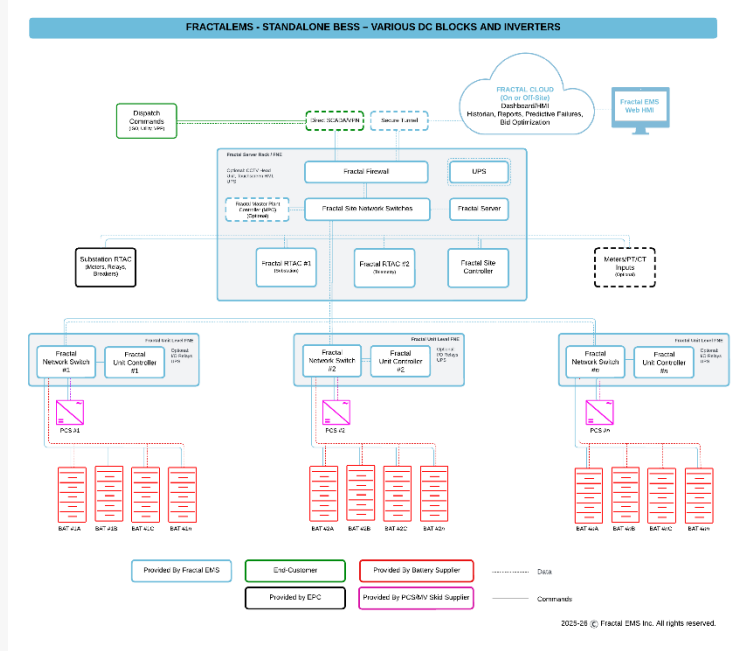
Description

Fractal EMS's scope:

- **EMS Hardware:** Fractal provides the hardware for FNEs, controllers (unit, site, optional MPC), local server, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMIs with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points directly from the equipment.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

Division of Responsibility

Example Suppliers



Batteries: A123, ATESS, ATL, BatteroTech, BYD, CALB, CATL, COSPOWERS, CRRC, Cube Energy, Dongguan, ECO Power, Eneon, Envision, E-Storage, EVE Energy, EVLO, Goldwind, Gotion, Great Power, Hithium, Hyperstong, IPotisEdge, JinkoSolar, Kore Power, Narada, RelyEZ, REPT Battero, Samsung, Shoto, Sinexcel, Sunwoda, SVOLT, SYL, Trina, Topband, Woolong, Zentech

Inverters: PE, SMA, EPC Power, Dynapower, Ingeteam, Kehua, Huawei, CRRC, Sinexcel

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STANDALONE BESS – BATTERY+PCS SUPPLIER WITH LOCAL CONTROLLER

Suitability

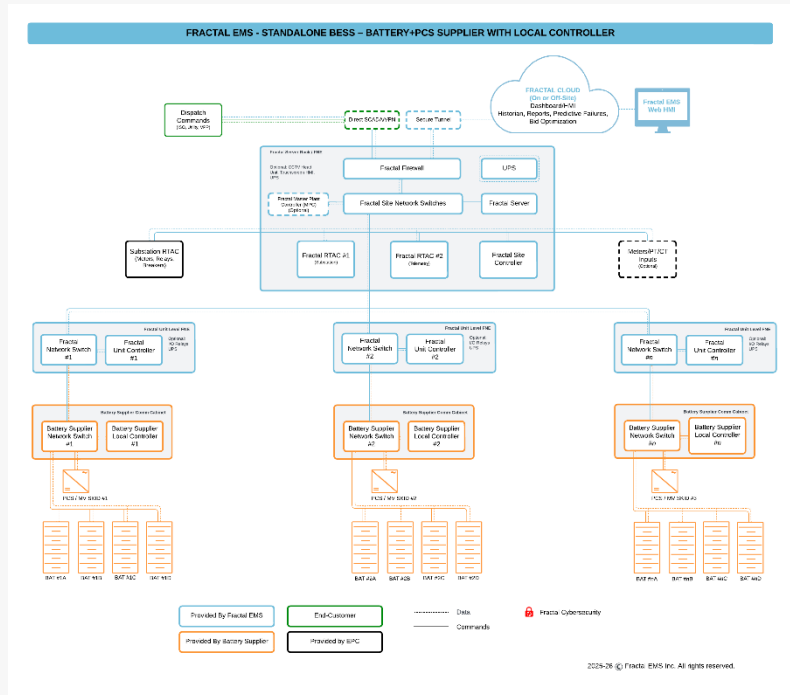
Designed for projects using a battery container and PCS that is pre-integrated with a local controller.

Description

Although the OEM provides a local controller, Fractal still provides a unit controller and maintains the majority of the EMS scope. Fractal EMS provides:

- **EMS Hardware:** Fractal provides the hardware for FNEs, controllers (unit, site, optional MPC), local server, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) most of the communication (OEM provides unit-level communications).
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMIs with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points through the OEM local controller.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

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Example Suppliers

Sungrow, LSES, Clou Electronics

STANDALONE BESS – BATTERY SUPPLIER WITH SITE CONTROLLER

Suitability

Designed for projects using a battery system that is pre-integrated with a site controller.

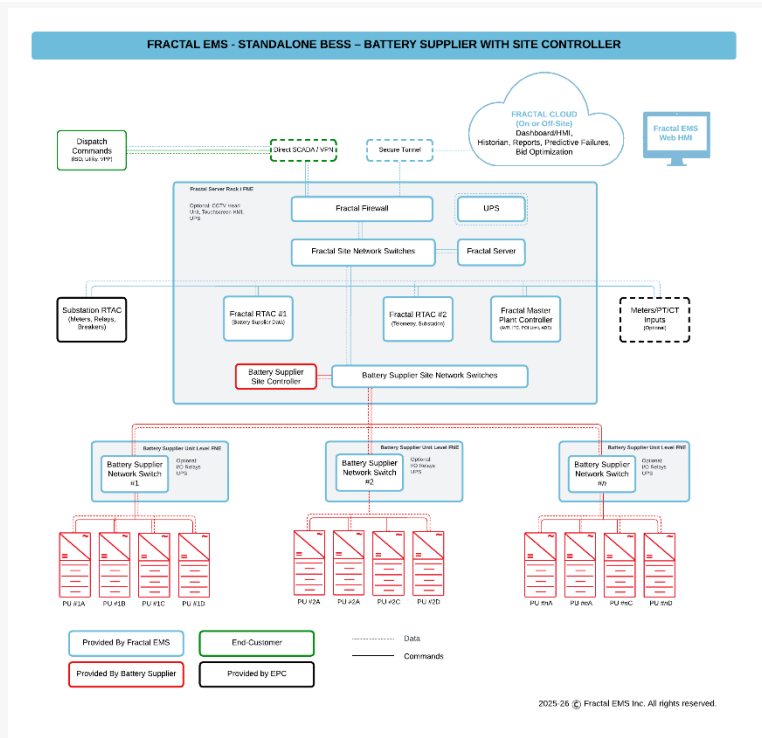
Description

Due to the OEM-provided site controller, Fractal does not provide unit-level (inverter, batteries, thermal management, and fire system) or site-level communication and coordination. Fractal issues a site-level power command using an MPC. The OEM's site controller decides how to distribute power between the units. Fractal EMS provides:

- **EMS Hardware:** Fractal provides the equipment for FNEs, MPC controllers, local server, communication devices, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMIs with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points through the OEM site controller.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

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Example Suppliers



Tesla, Powin, etc.

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AC COUPLED SOLAR + BESS

Suitability

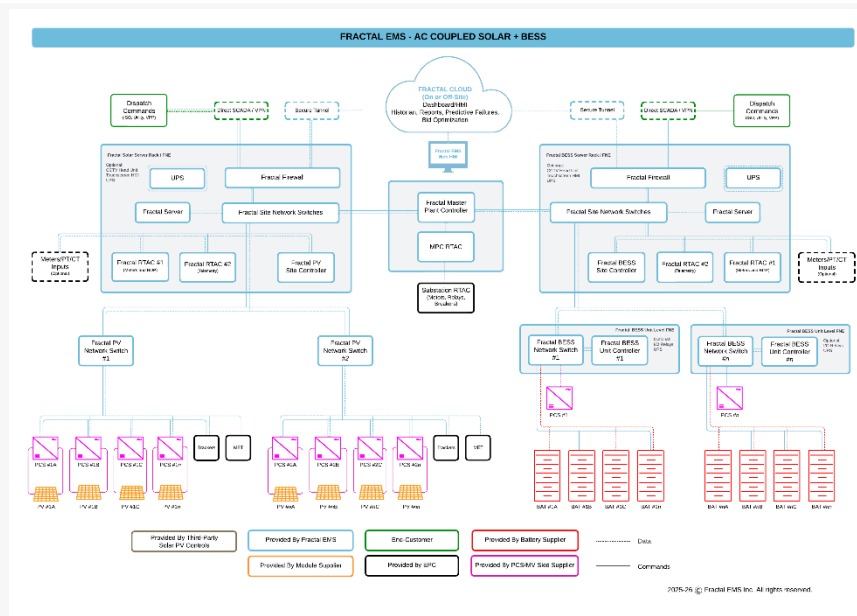
Designed for AC coupled solar + storage projects where Fractal EMS provides both the Solar PV, BESS, and Master Plant controls. Fractal can provide the applicable BESS controls solution (DC Block Only, Supplier with Local Controller, Supplier with Site Controller) based on the equipment selection.

Description

Fractal EMS provides:

- **EMS Hardware:** Fractal provides the hardware for FNEs, Solar PV and BESS controllers (unit, site, and MPC), local server, communication devices, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMI with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points directly from the equipment.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

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AC COUPLED SOLAR + BESS – THIRD-PARTY SOLAR CONTROLS

Suitability

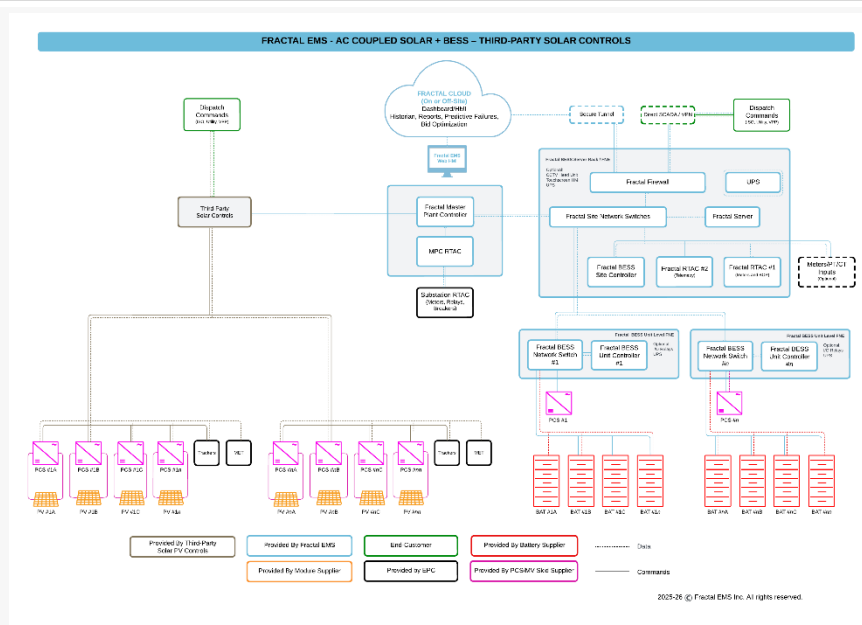
Designed for AC coupled solar + storage projects where Fractal EMS provides the BESS controls and Master Plant controls, but a third party provides the Solar PV controls. Based on equipment selection, Fractal can provide the applicable BESS controls solution (DC Block Only, Supplier with Local Controller, Supplier with Site Controller).

Description

Fractal EMS provides:

- **EMS Hardware:** Fractal provides the hardware for FNEs, BESS controllers (unit, site, and MPC), local server, communication devices, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more. A different vendor provides the Solar PV plant controls.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMI with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points directly from the equipment.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

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DC COUPLED SOLAR + BESS

Suitability

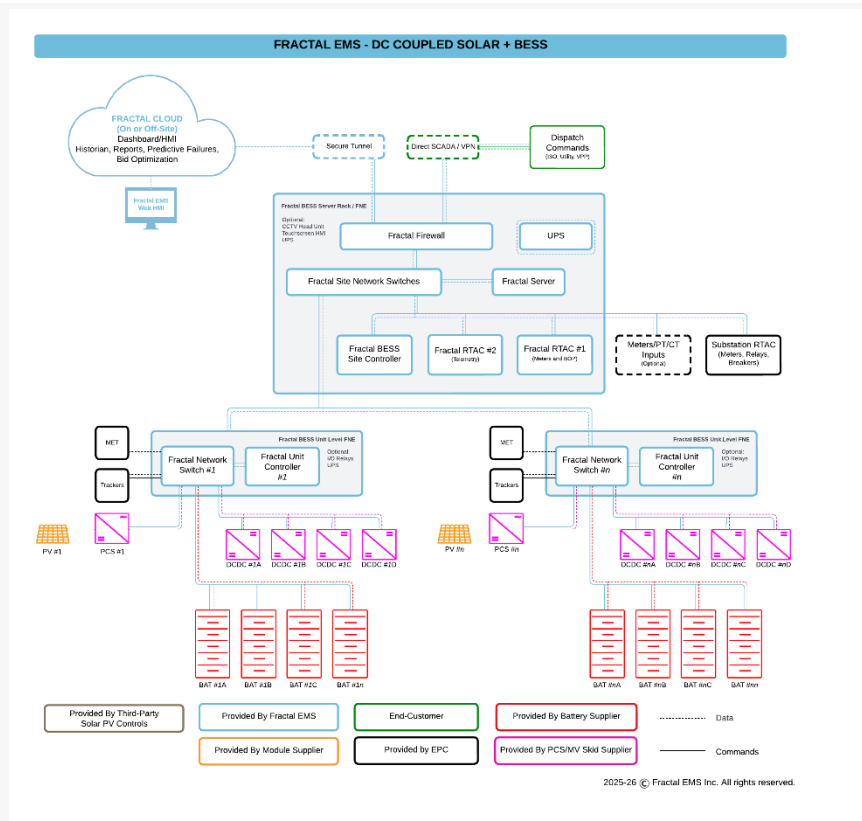
Designed for DC coupled solar + storage projects (it is highly recommended that one EMS provides both the Solar SCADA and BESS EMS). Fractal provides a unified EMS with joint controls, HMI, and server.

Description

Fractal EMS provides:

- **EMS Hardware:** Fractal provides the hardware for FNEs, Solar PV and BESS controllers (unit, site, and MPC), local server, communication devices, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMI with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points directly from the equipment.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

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WIND + BESS – THIRD-PARTY WIND CONTROLLER

Suitability

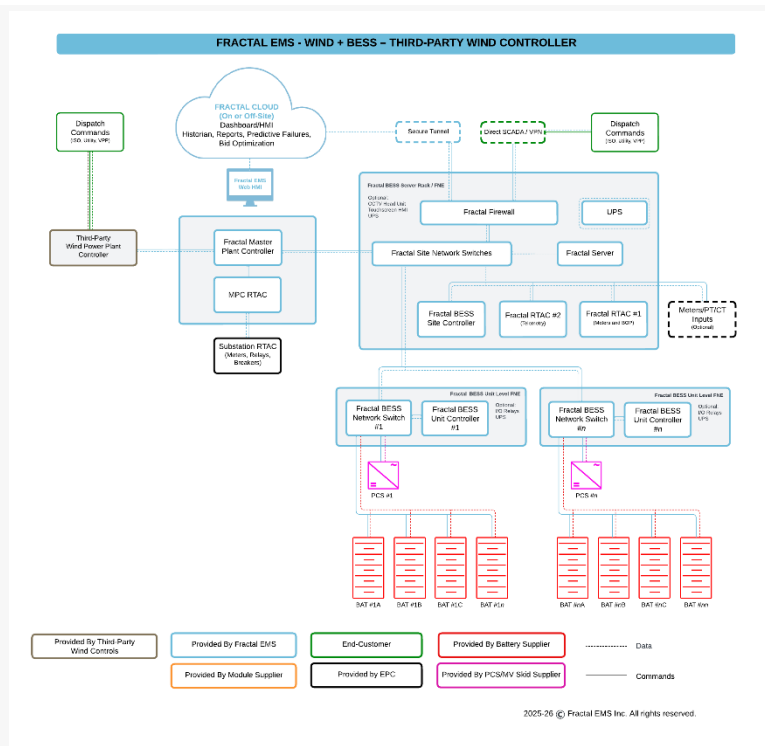
Designed for wind + storage projects where Fractal EMS provides the BESS controls and Master Plant controls, but a third party provides the Wind power plant controller. Based on the equipment selection, Fractal can provide the applicable BESS controls solution (DC Block Only, Supplier with Local Controller, Supplier with Site Controller).

Description

Fractal EMS provides:

- **EMS Hardware:** Fractal provides the hardware for FNEs, BESS controllers (unit, site, and MPC), local server, communication devices, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more. A different vendor provides the wind plant controls.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
- **Commissioning:** Fractal performs unit-level commissioning, site acceptance testing, and ISO/utility performance testing.
- **HMI:** Fractal provides local and remote HMI with dashboards, historians, performance reports, analytics, and scheduling. The Fractal historian captures the OEM data points directly from the equipment.
- **O&M:** Fractal provides options for 24/7 monitoring and bid optimization services.

Division of Responsibility



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ITC HYBRID SOLUTIONS

Suitability

Designed for projects that intend to blend FEOC and Non-FEOC equipment to meet the Material Cost Ratio (MACR) requirements to qualify for the Investment Tax Credit (ITC), or projects that intend to blend Domestic and Non-Domestic equipment to achieve the Domestic Content ITC bonus adder.

Start of Construction Date	Credit Percentage Available for Energy Storage	Domestic Content (+10%) Requirements	Tariffs	Material Assistance from FEOC Limits for Energy Storage
Before 2025	100% (full credit)	40% Manufactured Products	Country-Specific Tariffs	Not Applicable
2025	100% (full credit)	45% Manufactured Products	Country-Specific Tariffs	Not Applicable
2026	100% (full credit)	50% Manufactured Products	Country-Specific Tariffs	55% Non-FEOC / 45% or less from FEOC
2027	100% (full credit)	55% Manufactured Products	Country-Specific Tariffs	60% Non-FEOC / 40% or less from FEOC
2028	100% (full credit)	55% Manufactured Products	Country-Specific Tariffs	60% Non-FEOC / 40% or less from FEOC
2029	100% (full credit)	55% Manufactured Products	Country-Specific Tariffs	65% Non-FEOC / 35% or less from FEOC
2030	100% (full credit)	55% Manufactured Products	Country-Specific Tariffs	70% Non-FEOC / 30% or less from FEOC
2034	75%	55% Manufactured Products	Country-Specific Tariffs	75% Non-FEOC / 25% or less from FEOC
2035	50%	55% Manufactured Products	Country-Specific Tariffs	75% Non-FEOC / 25% or less from FEOC
After 2035	0% (expired)	55% Manufactured Products	Country-Specific Tariffs	75% Non-FEOC / 25% or less from FEOC

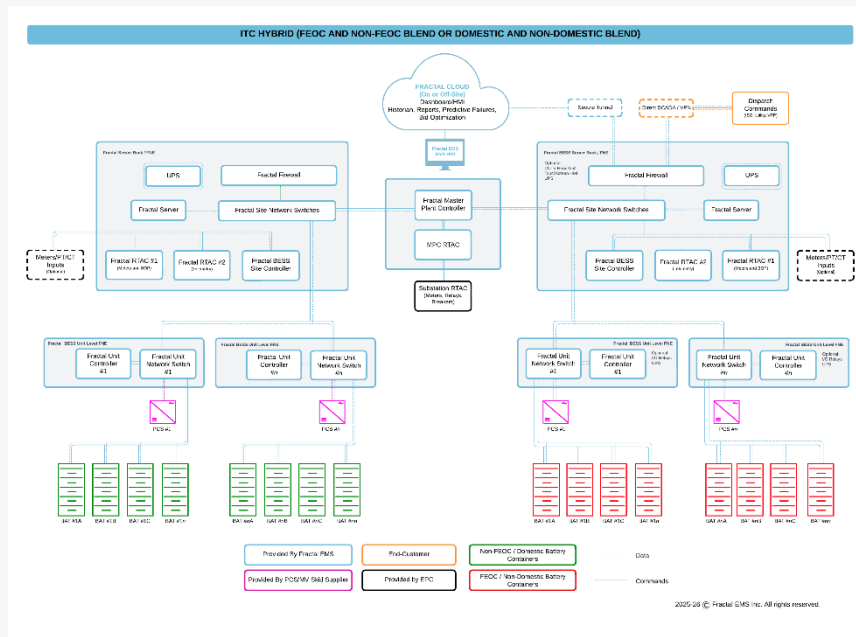
Based on equipment selection, Fractal can provide the applicable BESS controls solution (DC Block Only, Supplier with Local Controller, Supplier with Site Controller) for each equipment option.

Description

Fractal EMS provides:

- **EMS Hardware:** Fractal provides the hardware for FNEs, BESS controllers (unit and site), local server, communication devices, networking equipment, RTACs, UPS, I/O relays, fiber patch panels, and more.
- **Networking:** Fractal designs, procures, installs, configures, and tests all the networking equipment necessary to meet project and cybersecurity requirements.
- **Communications:** Fractal designs (IP schema), procures, installs, and configures (VLAN) all communication.
- **SCADA:** Fractal designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment.
- **Integration:** Fractal provides equipment driver development, control narrative, design packages, integration, and troubleshooting.
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MADE IN THE U.S.A.

Fractal EMS equipment is built in the U.S.A. and satisfies the domestic content and non-FEOC requirements in the Inflation Reduction Act for the Investment Tax Credit. Our solutions are designed for critical infrastructure with stringent cybersecurity requirements and challenging environments.



INTEGRATION

Fractal provides on-site installation, integration, testing, and commissioning. Our field engineers are OSHA 30 certified.

- On-Site Installation and Integration
- IP Schema
- Points List (Individual and Consolidated)
- Control Narrative
- Communication Flow / Network Comms Diagram
- EMS/PPC PSSE and PSCAD Models
- Battery and PCS Driver Development and Integration
- Fractal Cloud Configuration and Setup
- Network Security Configuration and Setup
- RTAC Development and Integration
- BESS Integration (BOP and Auxiliary Equipment)
- Utility/ISO Telemetry



Pre-Built / Pre-Tested Control Solutions

COMMISSIONING SUPPORT

Fractal's 24/7 Remote Operations Center (ROC) is staffed with experienced operators and engineers who can support Owners, Developers, and EPCs with hot commissioning and COD testing. Fractal EMS can troubleshoot commissioning issues, propose solutions, and help keep the project on schedule.

- Comm checks of all project equipment
- 3rd party equipment liaison (let our team troubleshoot with the OEMs)
- Point-to-point checkouts
- Proper alarm/warning handling and notification
- Fault code diagnosis and troubleshooting support
- Network configuration
- Operational checks (Start/Stop, AC breakers, DC contactors, etc.)
- Utility/ISO testing
- Control mode tuning
- Power operations (capacity tests, PPA tests, performance tests)
- Ad hoc data analysis and performance reports

NETWORKING

Fractal EMS has an in-house team of IT and cybersecurity professionals who will design network architecture to meet project requirements and optimize operational efficiency, security, and scalability. Fractal's objective is to design a secure network by prioritizing network segmentation, access controls, data encryption, continuous monitoring, physical security, and layered security. Fractal uses hardened devices, strong authentication mechanisms, and advanced threat detection to protect critical infrastructure from cyberattacks.

COMPONENTS

COMPONENT	DESCRIPTION
Firewall	• Fractal provides the firewall(s) to serve as overall network security by: ○ Providing a barrier between the trusted internal project network and the external network (internet) ○ Examining incoming and outgoing data packets and filtering them based on predefined rules/permissions ○ Preventing unauthorized access ○ Serving as the primary router for the project network by managing traffic between switches and devices within the network ○ Assigned VLANs to partition physical networks into suitable grouping to optimize performance, security, and traffic management • Fractal can configure the firewall in a High-Availability (HA) pairing that provides physical and ISP redundancy for critical assets.
Managed Switches	• Fractal provides site-level network switches to aggregate devices securely. • Multiple site network switches can be utilized as a redundant or clustering configuration, depending on project requirements
Connectivity	• Fractal can supply fiber patch panels to aggregate the fiber runs from the project. • Depending on the equipment, each unit controller will communicate with each PCS unit via Modbus TCP/IP or CAN 2.0. The Unit Controller will also communicate with the BMS via Modbus TCP/IP. Depending on the project's topology, multiple BMS can be integrated at the unit level. • The Site Controller is connected via ethernet to the main network switch, which is then connected to the FNE-level switches through a fiber ring (most common). The Site Controller communicates with all Unit Controllers for the project via TCP-based protocol and communicates with the Fractal-supplied RTAC via Modbus or DNP3 using TCP/IP or serial for site-related telemetry.

TOPOLOGY

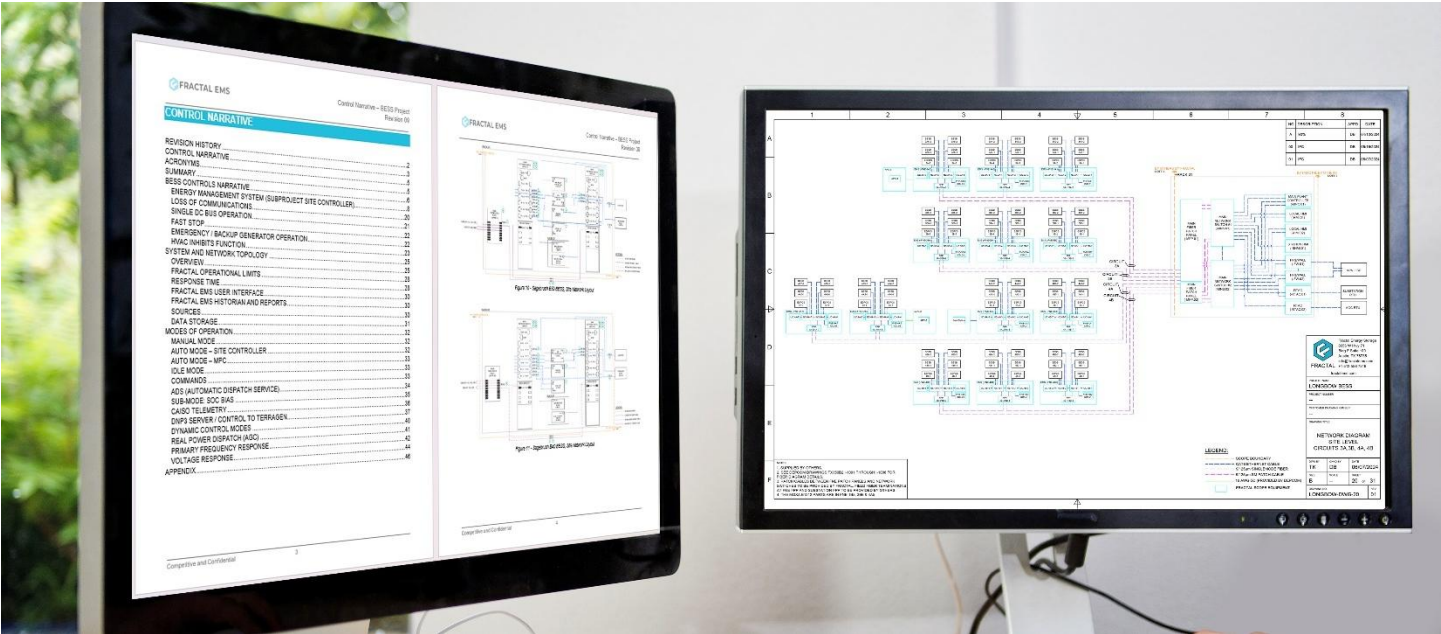
Fractal's network topology is very flexible and can consist of a single, redundant ring or star topology. Ring topologies typically align with the number of feeders to minimize extraneous trenching. Fractal works with the EPC to determine the suitable fiber type and configuration based on the project design and requirements. Fractal provides a fiber patch panel at the unit level to support the fiber ring tie-in to the unit-level network switches.

Note: Fractal EMS prefers two hardline internet connections for maximum stability, speed, and security. Additionally, the Fractal network has a cellular backup connection with a dual SIM card to serve as a failover in case the hardwired internet connection(s) fails or becomes unavailable. A Starlink router and service can also be incorporated in areas with limited options.

PROTOCOLS

Various communication protocols can be used to communicate between devices, and an RTAC is implemented as a protocol gateway.

- Secure (e.g., 2-factor security authentication) access and communications using industry-standard protocols, including MQTT over TLS 1.3
 - Supports multiple communication protocols: RESTful Web API, Modbus, DNP3, IEC61850, IEC60870-5-104, CAN
- Ability to interoperate with leading equipment providers
 - Authentication via certificates. Multiple levels of access and control for different user profiles
 - VPN tunnels and certificates between on-site and off-site communications



SCADA / RTAC

Fractal EMS designs, procures, installs, and configures the RTACs necessary to communicate off-site (to Utility, TSP, QSE, and ISO) and on-site (to meters, transformers, and breakers), including coordinating the points list for the SCADA equipment. Fractal can provide one or more RTAC(s) to support the following functionalities:

FUNCTION	DESCRIPTION
ISO/QSE/RIG Telemetry	• All ISO and market-related data (Analog and Digital IO) can be read from the Fractal RTAC, e.g., meter data, BESS status (SOC, energy available, power available, units online, HSL/LSL, etc.) • The ISO/QSE can write to select registers on the Fractal RTAC for dispatching and controlling the BESS, e.g. AGC, ancillary service responsibility (awarded MW capacity), breaker trips, etc.
Utility/Off-taker Data Server	• Fractal can provide a separate RTAC for the utility/off-taker to serve as a data server for a separate, network-segmented data stream (non-market-related). • Fractal programs the RTAC with the customer's pre-selected points from the BESS network (e.g., meters, site controller, OEM equipment, etc.). The RTAC translates those into the desired protocol.
Substation RTAC	• Fractal can provide a separate RTAC for substation integrations to interact with the Substation RTAC (project meters, breakers, relays, LTCs, capacitor bank controllers, etc.). This enables Fractal to write to control select devices and serve as a data aggregator. The Substation RTAC can be provided by Fractal or the EPC, depending on the project's division or responsibility.

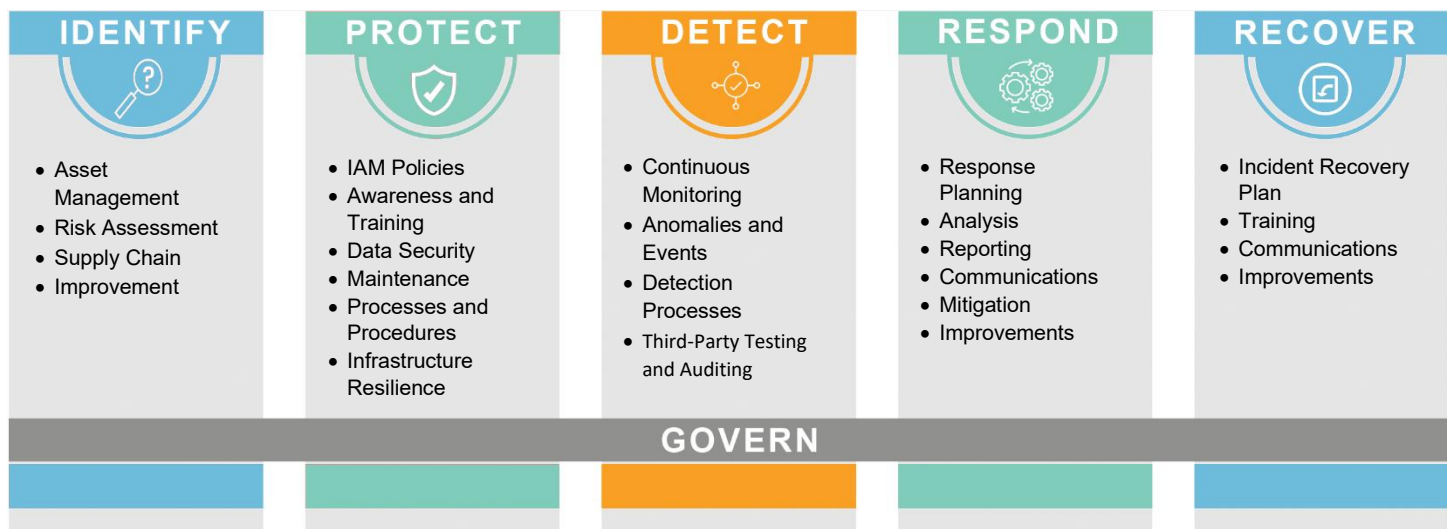
CYBERSECURITY

Fractal EMS was designed for Critical Infrastructure Protection. Fractal EMS is built on the NIST 800-53 framework and applies best practices of policies, architecture, and operational processes to satisfy the requirements of our most security-sensitive customers. Fractal EMS utilizes a comprehensive, integrated approach to ZTA (Zero Trust Architecture) within our cybersecurity IT/OT networks. We adhere to proven methodologies and apply best practices. Our position is to provide a "Zero Trust" framework and architecture to meet or exceed Industrial Control Systems cybersecurity requirements, including personnel, hardware, and software. Fractal EMS has an in-house team of cybersecurity and IT specialists to provide an architecture that meets project requirements.

CYBER SECURITY PROCESSES

- MFA authentication for access, communications, and account management using industry-standard protocols
 - Layering and segmentation of devices and encryption, including endpoints, firewalls, and intrusion detection systems
 - Server-to-cloud connectivity using MQTT and TLS 1.3 with digital certificate authentication
 - Real-time monitoring of appliances, operating system (OS), configuration, firmware, common vulnerabilities, and exposures (CVE)
 - Operation, engineering, commissioning malware, anti-virus, ransomware, spyware, and malicious code protection and mitigation
 - Data retention and recovery training and testing
 - Inventory control of network hardware and software assets
 - Internal policies, procedures, and accountability
- Penetration and vulnerability testing
 - Change management that defines what controls, standards, and requirements are needed within documents, data, configuration, and escalation
 - Account management to identify and authenticate users, devices, and software within the architecture
 - Public Key Infrastructure (PKI) authentication and management
 - Network and application distributed denial of service (DDoS) protection
 - System use notification
 - Auditable log, resource, and management to include historical data retention
 - Data retention and recovery training and testing.
 - Corporate Security Awareness: phishing testing, cybersecurity training, email and web browser protection, internal and external communications protections
 - Incident response management

NIST CYBERSECURITY FRAMEWORK 2.0



QUALITY ASSURANCE

ISO/IEC 9001:2015 AND 27001:2022 CERTIFICATIONS

Fractal EMS Inc., headquartered at 8656 W Highway 71, Building F, Suite 100, Austin, TX 78735, United States, has been certified to ISO/IEC 9001:2015 for its Quality Management System (QMS) and ISO/IEC 27001:2022 for its Information Security Management System (ISMS). These certifications were issued by ABS Quality Evaluations, Inc., an ANAB-accredited management systems certification body.

The certified ISMS scope covers the provision of software, engineering, and controls services, including design, development, assembly, sales, project management, analytics, commissioning, and asset management (Statement of Applicability rev 1). This confirms that Fractal EMS's information security controls, processes, and quality management systems are systematically designed and independently assessed against internationally recognized best practices.



Customers and partners can request additional information about our ISMS and certified scope through their Fractal EMS representative.

INTEGRATION

Fractal EMS integrates the following components to create an energy storage system:

- System BMS, including all the data and controls that flow to/from the Rack BMSs
- Power Conversion System (PCS)
- Optional equipment such as meters, breakers, transformer warnings, and alarms
- Balance of Plant Equipment to include:
 - Thermal management
 - Fire detection and fire suppression
 - Door alarms and lights
 - POI disconnect/breaker/switch
 - Aux meters and aux breaker status

DATA STORAGE

Fractal EMS captures, publishes, and stores data in the cloud in real time. This provides data for warranty claims and uncovers anomalies for predictive failures.

- 1-sec data capture rate
- Data retention for the life of the contract
- Interactive and intuitive visualizations
- High-speed data capture available (50 samples/sec, up to 8 data points) e.g., frequency and power

ALERTS AND ALARMS

Fractal EMS has extensive alarms and warning capabilities directly embedded in the User Interface. A real-time alarms table provides status notifications of abnormalities or pre-configured alerts to include:

- Over/under-temperature
- Status of BMSs, such as malfunction of the battery modules or racks
- Electrical faults in the system
- Loss of auxiliary supply
- Opening of the user entry container doors (if available through Modbus TCP)
- Activation of any of the interlocking mechanisms (racks, DC isolation switch)
- Fire Suppression System alarms



ABNORMALITY RESPONSE

Fractal EMS provides autonomous system protection and redundancy to vendor setpoints:

- Monitors and responds to electrical faults
- Maintains functionality of the system within owner-defined operating limits
- Reduces power when operating outside normal conditions of voltage, current, or temperature
- Ceases operation under severe conditions e.g., ground fault, to prevent hazardous conditions
- Powers down the PCS before the BMS opens the DC contactors of the DC block to protect the PCS
- Integrates with BOP equipment and BMS with PCS for tripping and derating

REAL-TIME MONITORING

Fractal EMS provides in-house remote operation and monitoring that:

- Prioritizes, escalates, and communicates events or abnormalities with owners
- Performs trend analysis, reporting, and troubleshooting on KPIs. This maintains system health and performance
- Initiates emergency response protocols and contacts first responders
- Ensures automated safety interlocks associated with equipment are appropriately executed

INCIDENT RESPONSE AND ALARMS



Virtual Fire Alarm Control Panel

Fractal EMS's Incident Dashboard has the functionality of an FACP, except that it is not hardwired to the battery containers. Instead, Fractal EMS collects data digitally through the network. This feature provides situational awareness without the cost of a hard-wired FACP. Fractal EMS can optionally install a first responder panel (an on-site enclosure with a screen that shows the Incident Dashboard for first responders).

- Fractal EMS receives and repeats major alarms related to the container Fire Alarm Control Panel (FACP) and distinguishes between gas sensors, smoke sensors, heat sensors, trigger of NFPA 69 venting systems, trigger of fire suppression systems, and other events related to emergencies.
- Fractal EMS details and displays active alarms for any out-of-specification condition and malfunction.
- Fractal EMS can trip the BESS container when alarm conditions affect the warranty.
- Fractal EMS can trip the PCS and open battery racks if the fire system detects a fire.
- Fractal EMS reports equipment warnings, alarms, and faults and will provide alarm points via Modbus so that a site RTAC can open breakers.
- Warnings, alarms, and faults that cause trip signals are configurable to include fire, gas, water-based fire suppression, etc.
- Fractal EMS will display system-level and vendor-specific alarm notifications (priority, description, and location) visually in the HMI.
- Alarms can be configured to take automatic action in the BESS based on safety conditions or be informational only.

FRACTAL EMS PACKAGES

BASE PACKAGE (EMS/PPC)

[REQUIRED] The Fractal EMS Base Package delivers a hardware-agnostic EMS, PPC, and unit-level controllers for a single resource asset like a standalone BESS or solar plant. It features an integrated HMI and a data Historian, backed by comprehensive cybersecurity. The package also includes on-site installation and commissioning support, backed by a 98%-99.5% availability guarantee.

Included Controls (PPC and Unit/Local Controllers)		
<u>Equipment:</u> ✓ Power Plant Controller (PPC) ✓ Unit-Level Controllers ✓ Site-Level Indoor Server Rack ✓ Uninterrupted Power Supply (UPS) <u>Testing and Commissioning:</u> ✓ Factory Acceptance Testing (FAT) ✓ Cold/Hot Commissioning ✓ Hot Commissioning Verification ✓ Substantial Completion (SC) Testing Support	<u>Installation and Training:</u> ✓ On-Site Installation ✓ Remote Training <u>Project Management:</u> ✓ Remote Calls ✓ WIPS <u>Software Development Included:</u> ✓ Driver Development ✓ NTP / Satellite Clock ✓ Closed Loop Control	<u>Deliverables:</u> ✓ Technical Packages ✓ Manuals <u>Warranty and Performance Included:</u> ✓ 5-Year Standard Warranty ✓ 98%-99.5% Availability Guarantee. ✓ Recommended Spare Parts

Add-On Controls		
<u>Add-On Equipment:</u> ☐ Extended UPS ☐ Satellite Clock ☐ Sensors/IO Relays ☐ Fractal's First Responder Panel <u>Add-On Testing/Commissioning:</u> ☐ OEM Hot Commissioning (via Fractal ROC) ☐ Control Hardware-in-Loop Testing (CHIL)	<u>Add-On Testing/Commissioning cont.:</u> ☐ Fire Alarm and Control Unit (FACU) Integration ☐ Bench Test (Mini FIT) <u>Add-On Enclosures:</u> ☐ Site-Level Enclosure ☐ Field Network Enclosures (FNEs) ☐ FNE Thermal Management	<u>Add-On Integration:</u> ☐ Sensors/IO Relays ☐ Substation Data ☐ Substation Controls ☐ Met Station Integration <u>Add-On Warranty:</u> ☐ Extended Warranty

Included HMI and Historian		
<u>HMI Features:</u> ✓ Dual On-Site Server ✓ Local HMI ✓ Remote HMI ✓ Custom Dashboard Builder ✓ Standard Control Points ✓ Real-Time Data ✓ Calendar/Scheduler ✓ Project-Level Dashboards ✓ Fleet-Level Dashboards ✓ Data Visualizations ✓ Alerts and Notifications ✓ Application/Stack Design ✓ Self-Diagnostic Points Checkout ✓ Data Encryption	<u>Historian Features:</u> ✓ Local Historian (3-6 months of storage) ✓ Remote Historian (Cloud) ✓ MQTT Data Server <u>Access Included:</u> ✓ Unlimited Users ✓ Permission-Based User Levels ✓ Organization API Access <u>Analytics and Reporting Included:</u> ✓ Monthly KPI Performance Report ✓ Custom Report Builder <u>Software Development:</u> ✓ Local Server and Cloud Setup	<u>Applications Included cont.:</u> ✓ Manual Active/Reactive Power ✓ POI/POM Limits ✓ External Active Power Control ✓ Site-level SOC Balancing / Biasing ✓ TOU Energy Shifting ✓ Energy Arbitrage / Peak Shaving ✓ Primary Frequency Response (PFR) ✓ Fast Frequency Response (FFR/FFRS) ✓ Automatic Governor Control (AGC) Response ✓ Volt / VAR Support ✓ Automatic Voltage Regulator (AVR) ✓ Maintenance Mode ✓ Automated Battery Balancing

Add-On HMI and Historian		
<u>Add-On HMI Features:</u> ☐ Single Line Diagram (SLD) ☐ Site-Level Laptop ☐ Site-Level Touchscreen HMI <u>Add-On Historian Features:</u> ☐ Local Historian 1-year Storage	<u>Add-On Applications cont.:</u> ☐ Target SOC / SOC Management ☐ ADS API Integration ☐ Power / Rate Limiting ☐ Demand Charge Mitigation ☐ T&D Deferral ☐ Third-Party Data Integration ☐ Power Smoothing/Ramp Rate Control	<u>Add-On Applications cont.:</u> ☐ MET Station Integration ☐ Tracker Integration ☐ Substation Breaker Control ☐ Substation Capacitor Bank Control ☐ Backup Generator Failover ☐ Load Tap Changer (LTC) Controls ☐ Black-Start

Add-On Data Access:		
☐ Telemetry / QSE / Utility Integration (more than 100 points)	☐ PV Only Control	☐ Grid Forming Support
☐ DNP3 Data Server	☐ DC Coupled PV+S Controls	☐ Power Oscillation Dampening (POD)
☐ Modbus Data Server	☐ Selective Solar Charging	☐ Multiple Metering Integration
☐ OPC-UA Data Server	☐ Solar Firming	☐ Camera System Integration
☐ Third-Party API Access	☐ Solar Shedding	☐ HVAC Inhibit Logic
	☐ Co-located Solar Controls	☐ First Responders Panel (FRP)
	☐ Solar Curtailment	
	☐ Clipping Recapture	

BASE + NETWORKING PACKAGE

[OPTIONAL] The Network + Base Package upgrades our Base Package (Controls, HMI, and Historian) with a fully engineered network and cybersecurity infrastructure. Designed to deliver custom network design, rugged networking equipment, and proactive cybersecurity directly, it completely streamlines the deployment of a secure, unified asset communication ecosystem. This robust, hardware-agnostic solution is backed by a 98% - 99.5% availability guarantee.

Included Networking and Cybersecurity		
Network Equipment Included:	Network/Cybersecurity Included cont.:	Network/Cybersecurity Included cont.:
✓ Site-Level Network Switch	✓ Network Design	✓ OT Security
✓ Unit-Level Network Switches	✓ Firewall Threat Management	✓ Auditable Event Logging
✓ Patch Panel	✓ Internal Traffic Monitoring	✓ DDoS Protection
✓ Firewall	✓ External Attack Monitoring	✓ Multi-Factor Authentication
	✓ Network Antivirus	✓ Data Retention & Recovery Tools
	✓ Intrusion Protection (IPS)	✓ Application & Web Filtering
	✓ Intrusion Detection (IDS)	✓ Data Loss Prevention (DLP)

Add-On Networking and Cybersecurity		
Add-On Network Equipment:	Add-On Network/Cybersecurity:	Add-On Network/Cybersecurity cont.:
☐ Backup Cellular Connection	☐ Firewall License	☐ GOP (NERC CIP Medium)
☐ Starlink	☐ Site Network Switch License	☐ Penetration Testing
☐ CCTV Head Unit	☐ Field Network Switch License	☐ Fortinet Fabric Add-On Service
	☐ VPN Tunnel Setups	

FULL SCOPE PACKAGE

[OPTIONAL] The Fractal EMS Full Scope Package delivers our ultimate utility-scale solution, extending the Network + Base platform to encompass the entire substation and balance of plant ecosystem. In addition to the Base + Networking offering, this package includes the end-to-end engineering, procurement, and custom programming of Real-Time Automation Controllers (RTACs). It seamlessly aggregates data streams from all balance of system (BOS) and substation equipment while orchestrating high-fidelity off-site telemetry for unified, top-to-bottom facility control—all backed by a 98%-99.5% availability guarantee.

Included SCADA/RTAC/RTU		
Equipment Included:	Implementation Services Included:	Implementation Services Included cont.
✓ RTAC (Telemetry and Dispatch)	✓ Point-to-Point Testing	✓ System Functionality
✓ RTAC (Equipment Integration & Control)	✓ Security	✓ Real-Time Monitoring
	✓ Integration	✓ Telecontrol Management
	✓ Operational Telemetry	✓ Asset Supervision & Protection

Add-On SCADA/RTAC/RTU	
☐ GPS Time Synchronization	☐ Add-On Integrations

REDUNDANCY

[OPTIONAL] The Fractal EMS Redundancy Package is engineered for high-stakes utility-scale assets—such as merchant BESS and contracted power plants—where uptime directly dictates revenue and regulatory compliance. By eliminating single points of failure, this multi-layered architecture ensures your facility remains fully dispatchable, secure, and operational during component faults or emergency maintenance, backed by a 99%-99.5% availability guarantee.

Package	Optional Redundancy	
Base Package	☐ Second Site-Controller	☐ Third Server
Base + Network	☐ Second Firewall	☐ Second Site-Level Switch
Base + Network + Telemetry/RTAC	☐ Second RTAC (Telemetry and Dispatch)	☐ Second RTAC (Equipment Integration & Control)

MASTER PLANT CONTROLLER

[OPTIONAL] The Fractal EMS MPC is deployed on-site to concurrently monitor, control, and coordinate multi-asset installations, multi-phase project expansions, and hybrid configurations blending diverse power technologies (such as varying battery chemistries and distinct PCS systems). It dynamically calculates and issues optimized dispatch instructions to each sub-component, ensuring seamless technology integration and real-time compliance with all POI limitations.

Included Controls	Optional Redundancy
✓ Master Plant Controller (MPC)	☐ Add-On Redundancy

24/7 REMOTE MONITORING

[OPTIONAL] Fractal EMS provides (optional) continuous 24/7 real-time monitoring by NERC CIP-compliant operations center in Austin, Texas, proactive system health tracking, remote troubleshooting and restoration, comprehensive vendor advocacy, and on-demand engineering support to maximize asset uptime and profitability.



Included Remote Monitoring Service Package

Monitoring and Management:

- ✓ Conduct 24/7 real-time human monitoring and proactive asset management.
- ✓ Monitor BESS control system hardware health and status.
- ✓ Provide remote troubleshooting and system restoration services.
- ✓ Perform remote inverter resets to minimize downtime.
- ✓ Oversee SoC, C-rate, and DoD parameters to optimize battery performance.
- ✓ Track fire alarm activity via the fire suppression panel and report all events.
- ✓ Escalate and respond to operational events.
- ✓ Notify the owner of all Level 2, 3, and 4 events.
- ✓ Assess necessary remedial actions if remote troubleshooting fails to resolve an issue.
- ✓ Respond to all owner and equipment provider inquiries promptly.
- ✓ Alert the owner within five minutes of any technical event that reduces BESS availability.

Vendor Liaison:

- ✓ Assess and respond to all reported site events.
- ✓ Administer warranty claims and serve as the owner's primary advocate with equipment vendors.
- ✓ Facilitate resolution of BESS technical issues by serving as the direct liaison between the owner and equipment providers, while accurately estimating impacts on site performance.
- ✓ Collaborate with manufacturers to diagnose complex issues—such as cooling loop pressure drops, sensor lockups, or recurring nuisance alarms—and implement effective solutions.
- ✓ Coordinate with customer-specified service providers to execute all necessary corrective and preventative maintenance.

Engineering and Consulting Support:

- ✓ Provide monthly support for engineering, consulting, or software development to ensure ongoing system reliability and operational optimization.

Troubleshooting & Root-Cause Analysis:

- ✓ Provide high-tier technical diagnostics to swiftly resolve complex control anomalies, communication faults, and balance-of-plant (BOP) engineering failures.

Enhanced Analytics and Reporting:

- ✓ Conduct monthly techno-economic assessments, performed by experienced analysts, to evaluate system profitability, asset health, and overall financial performance.
- ✓ Execute monthly performance assessments to optimize system settings and operational parameters, while identifying actionable performance improvements.
- ✓ Perform continuous anomaly detection and rigorous trend analysis to identify subtle degradation or operational deviations.
- ✓ Deliver comprehensive outage root cause analysis to document system failures and implement long-term mitigation strategies.

SCHEDULE A TOUR OR DEMO

Schedule a demo to learn more about the Fractal EMS platform, or plan a visit to tour our facility in Austin, TX.



UNMATCHED EXPERIENCE

EXPERIENCE HIGHLIGHTS

Fractal EMS is the market leader in front-of-the-meter third-party energy storage controls. Request our Statement of Qualifications to view our projects list and flagship projects.

- Hands-on operation and current management of 17+ GWh battery storage (multiple chemistries and regions) with Fractal EMS
- ISO27001 and ISO9001 certified
- Largest operational project to date of 2.6 GWh
- NERC CIP Medium Remote Operations Center
- EMS provider for the #1 and #3 largest BESS projects in the world
- The first and only fully vertical third-party controls provider in the world: BMS/EMS/PPC/MPC
- 100% on-time commissioning track record

17+ GWh
BESS IN OPERATIONS

37 GWh
AWARDED PROJECTS

10
COUNTRIES

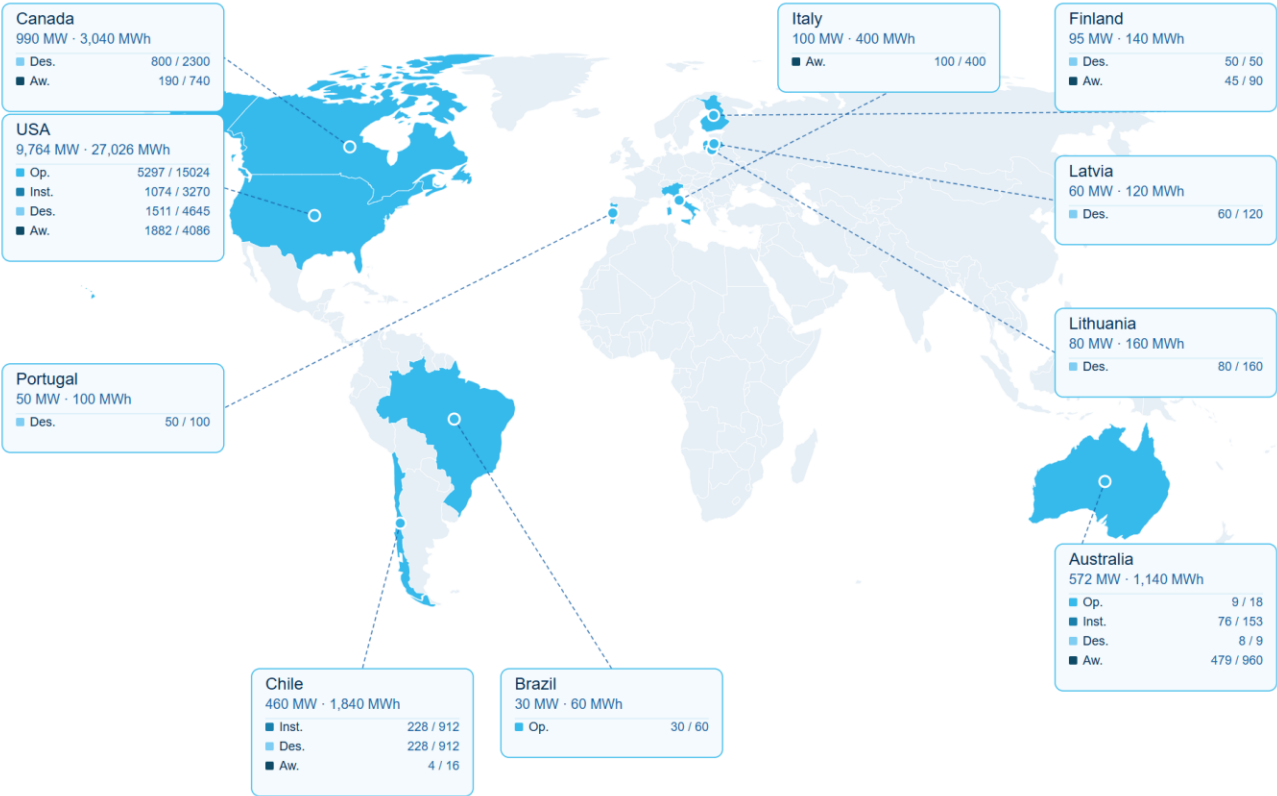
2.6 GWh
LARGEST SITE

GLOBAL PROJECT EXPERIENCE

Global project experience

236 projects - 10 countries - 11,200 MW / 34,026 MWh deployed

Operational Install & commissioning Design & execution Awarded & contracting



UNITED STATES PROJECT EXPERIENCE

US project experience

174 projects - 20 states - 9,764 MW / 27,026 MWh deployed

Operational Install & commissioning Design & execution Awarded & contracting

