

ESU SERIES

ENERGY STORAGE UTILITY SCALE

250kVA -500kVA



Magellan Power ESU Series of Utility Scale Energy Storage combines smart functionality and connectivity with high reliability afforded by proven rugged power electronics to offer flexible, programmable, durable and easy to install range of energy storage for generation and distribution applications.



ESU FEATURES

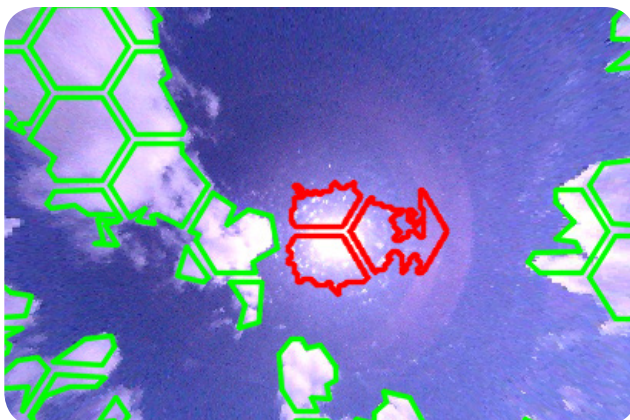
- Rugged industrial design ensures operation in harsh environmental conditions
- ESU inverter can integrate with many battery chemistries: Lead Acid, Lithium Ion & Flow batteries
- Four quadrant inverter technology enables many generation and distribution applications
- Magellan proprietary dynamic controller uses global numerical weather forecast data together with machine learning/neural network for maximum solar yield
- Dynamic real and reactive power control (P&Q)
- Black start capability
- Modular inverter design
- Touch screen mimic display
- Programmable grid management functions
- External control
- Smart communication protocols
- Easy to install and operate
- Modular design maximising reliability
- 5 year warranty



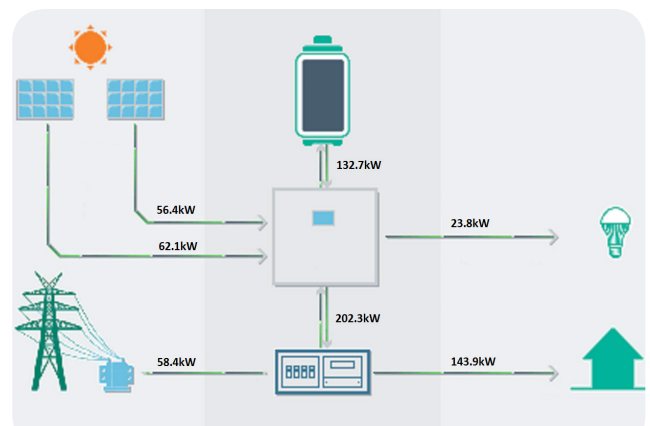
Lithium Batteries



ESU: Internal View



Numerical Weather Forecast Software



Magellan Dynamic Controller

SPECIFICATIONS

INVERTER SPECIFICATION: ESU 250 -500

RATED POWER		
Configuration		Bidirectional Conversion
Housing		Customized container
AC Output	Voltage Nominal	415V
	AC Grid Voltage Range	358V – 456V
	AC Grid Frequency Range	45Hz – 55Hz
	Voltage Regulation	±1%
	Frequency	50 Hz ± 0.1Hz
	Waveform	Sinusoidal
	THD	Less than 5%
	Power Factor	0.9 lag to 0.9 lead
	Phase	Three-phase, Four Wire
Grid Support		Supports grid by providing reactive and active power compensation
Inverter Efficiency		>95% At rated power, nominal input voltage
Protections		As per AS 62040.1.1-2003 (R 2013)
EMI		As per AS 62040.2-2008/CISPR II/A
Switchboards		As per AS 3000
AC Current THD		Less than 5% as per AS 4777-3
Communication Interface		Modbus RTU (RS232/RS485/USB), Modbus TCP, SUNSPEC, ODBCw Distributed Network Protocol 3 (Ethernet) Inbuilt Website, VPN & SSH
Ambient Temperature		0°C to +50°C
Monitored System Parameters		Battery State-of-Charge, State of Health, Current, Cell Voltage & Temperature Inverter Voltage, Current, Watts, VARs & Temperatures Mains Voltage, Current, Watts, VAR, Power Factor & Frequency
In-built Diagnostic System		Periodic Data Logging into SQL database on Solid State Storage. (10 years of logged data at 1 minute interval) Battery SoC, SoH, Voltage, Current, Power & Temperature, Cell Temperatures and Voltages, Mains Voltage, Power & VARs, Power Factor Inverter Voltage, Temperature, Power & VARs Fault Event Recorder
Cooling		Forced air with temperature controlled cooling fans
Real Power Control Method		Programmable charge or export level depending on control mode
Reactive Control Method		Programmable voltage proportional controller or fixed reactive power injection, with priority given to real power.
Maximum Humidity		95% R.H., Non condensing

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INVERTER SPECIFICATION: ESU 250-500

Protections	Transient	Surge Diverters fitted to Grid input and DC Output
	Circuit Breakers	Battery Input Grid Input DC Load Output Surge Diverter Circuit Breakers
	Grid Protections	Over Voltage Under Voltage, Over Frequency, Under Frequency, Islanding Detection
	Inverter Protections	Inverter Over Voltage Monitoring Inverter Over Load Monitoring, Inverter Current Limit, Over Temperature Monitoring, AC Contactor Fault, Sensing Feedback Faults, Cooling Failure
	Battery Protections	Battery Cell Under / Over Temperature Monitoring Battery Cell Under / Over Voltage Monitoring Battery Cell Failure, Battery Health Warning, Battery Imbalance Warnings, Battery Over Current Battery Magnetic Isolator, DC Earth Leakage
	User Terminals	Battery Positive & Negative Grid Actives & Neutral Protective Earth (Optional MEN Link) Volt Free Relays: Grid Failure, Common Alarm, Battery Low Alarm
Indications	User Interface	Colour touch screen 4.5"
	Monitored System Parameters	Battery State-of-Charge, State of Health, Current, Cell Voltages & Temperatures, Inverter Voltages, Currents, Watts, VARs & Temperatures, Mains Voltages, Currents, Watts, VAR, Power Factor & Frequency Enclosure Temperature
	Mimic Indications	Graphical overview of system and status, showing power flow directions and contactor positions
	Monitoring & Diagnostic Download Software	"Access Facility" PC Software

SPECIFICATIONS

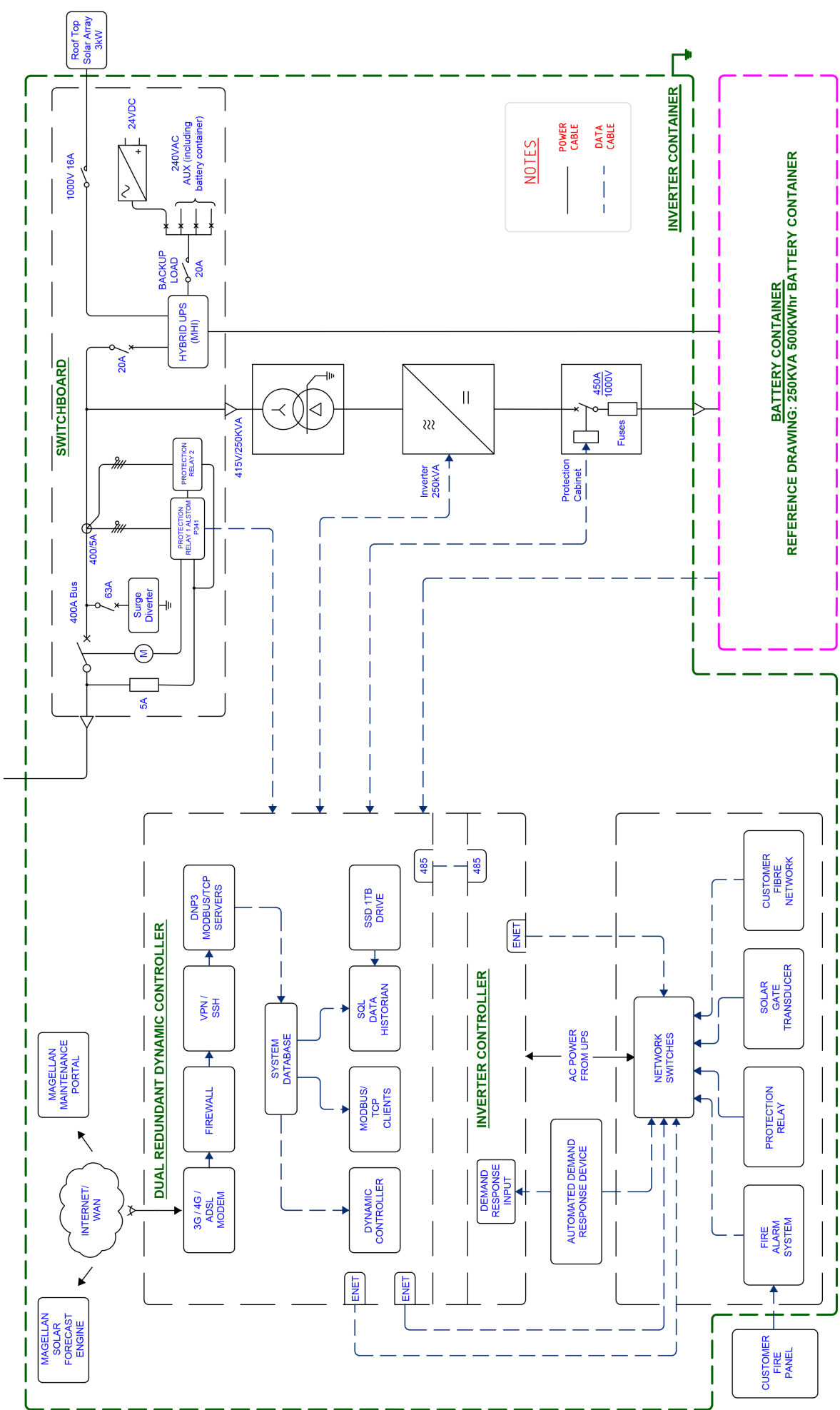
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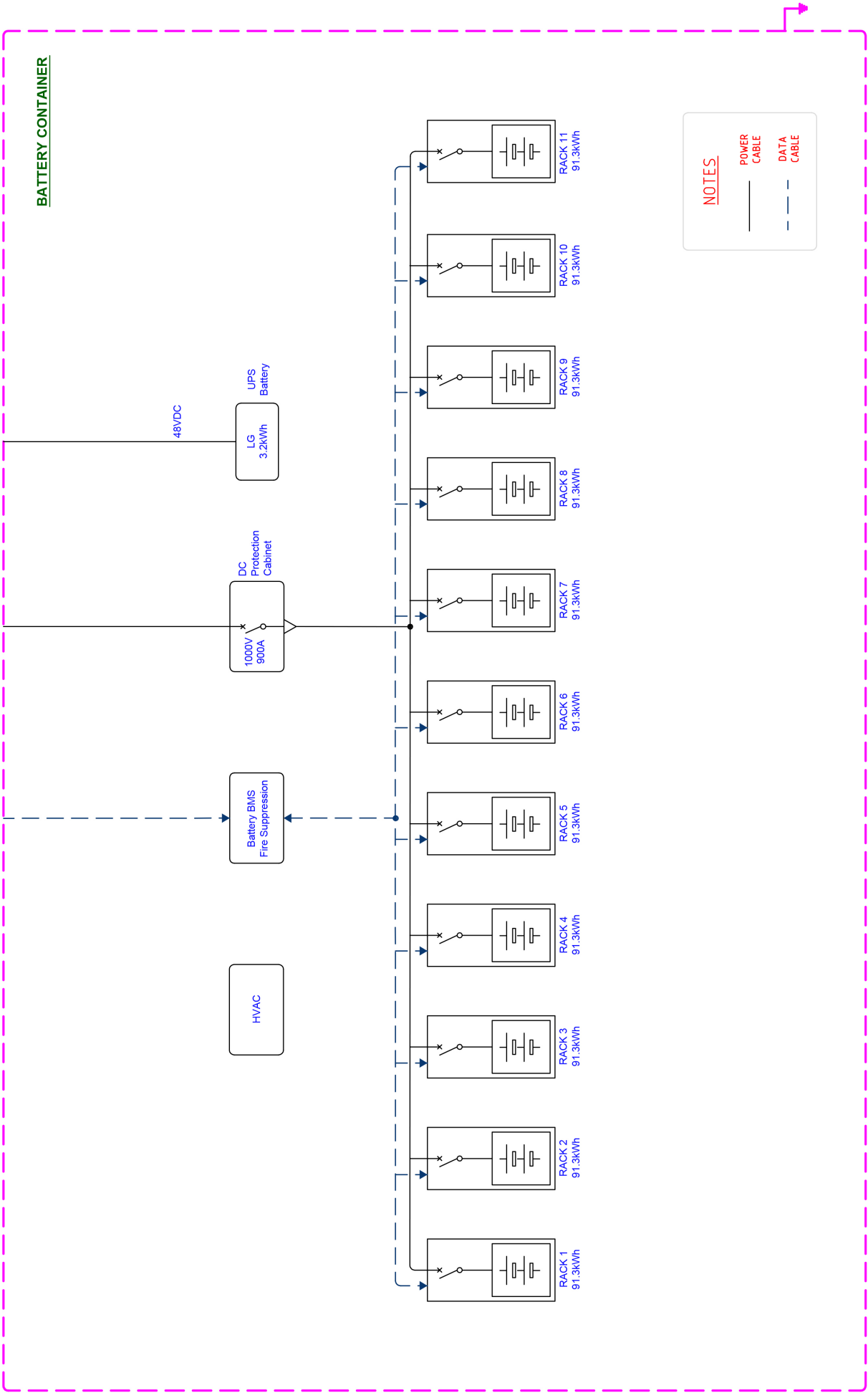
Supervisory Control Scheduling	Scheduling Algorithm	Triggered from Inbuilt Time-of-Day Clock and pre-programmed times or Digital Inputs or via Communications Interfaces
	Dynamic Control	Global numerical weather forecast data together with machine learning/ neural network for load profile prediction and solar forecasting for optimal dispatch.
	AC Charge Control	Conventional charger with programmable parameters Programmed Charging Current Levels Automatically started or paused via Scheduled Events Terminated by battery full condition.
	AC Export Control	Automatically started via Scheduled Event Programmable at two possible Export Power Levels Terminated by low battery state of charge
	Standby Mode	Low-power consumption mode This is automatically triggered after batteries are fully charged.
	Profile Mode	Pre-configured P,Q profiles with external manual override.

BATTERY SPECIFICATION: ESU-BAT

Description	Value	Remark
Nominal Energy	91.3kWh	Per Rack
Rated Capacity	To suit application	@0.3C discharge $23 \pm 5^{\circ}\text{C}$
Cell Capacity	63Ah	N/A
Minimum Voltage	$3\text{V} * 14 * 14 = 588\text{V}$	N/A
Nominal Voltage	$3.7\text{V} * 14 * 14 = 725.2\text{V}$	N/A
Maximum Voltage	$4.2\text{V} * 14 * 14 = 823.2\text{V}$	N/A
Max Continuous Charge Current	1C	
Peak Charge Current	1C	
Max Continuous Discharge Current	1C	
Peak Discharge Current	1C	
Duty Cycle	1 Cycle per day (For Rated Specified Cycle Life)	
Rest Time	N/A	
Round Trip Efficiency	95%	@ $23 \pm 5^{\circ}\text{C}$ as a new product
Cell Cycle Life	7,000	@ $23 \pm 5^{\circ}\text{C}$, 1C / 1C, 80% DoD
Operational Temperature (Optimal)	$0 \sim 40^{\circ}\text{C}$ $23 \pm 5^{\circ}\text{C}$	Derating of batteries SoH will accelerate it if used out of $23 \pm 5^{\circ}\text{C}$
Storage Temperature	$-30 \sim 60^{\circ}\text{C}$	As the degradation of battery product is accelerated in high temperature, it is not recommended to store battery modules over 40°C for more than 10 hours. Degradation will be 0.1% per day and 0.15% per day when the temperature is 35°C and 45°C respectively under the condition of SoC 80%. Recommendation temperature range is $23 \pm 5^{\circ}\text{C}$

Example System





APPLICATIONS

Renewable Power Smoothing

Energy stored in batteries provide smooth power from erratic renewable generation.

Reactive power control

Reactive power supply can be controlled via different methods to meet any grid requirement.

Power ramp up/ down control

Smooth the rate of change of power due to cloud cover or other sources.

Peak Shaving and Shifting

Reduce the maximum power demand during peak hours, stored in batteries and delivered where needed.

Frequency Regulation System

The ESU discharges and charges the battery during overfrequency and underfrequency to support the stabilisation of grid frequency.

Voltage Regulation

Injection of reactive power to stabilise the grid voltage. Regulation from pure lagging to pure leading.

UPS

Back-up power for critical loads.

Spinning Reserve