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dots PCS

with Modularity

dots energy is a first company that supplies modularized PCS utilizing modular inverter and it comes with EMS platform optimized for the sustainable revenue stream.

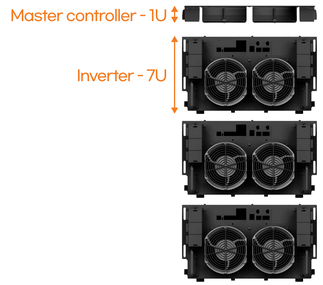
dots energy

dots PCS series utilize the LS Electric's smart modular inverter by the cutting-edge technology with industry-leading power density, the Modular Inverter (MSSP) offers the patented ability to parallel the inverter on both AC and DC sides, making it easily configured into any size inverter. The MSSP can operate from 650 VDC up to 1500 VDC at various AC Line connect (380~690), making it compatible with most current and future bidirectional PCS technologies. Air-cooled, the MSSP can operate in environments up to 50°C (w derating), making it suitable for most applications.

The unique MSSP inverter has been cost-efficiently designed with a compact architecture. With the standard 19" rack mounting configuration, integration into a complete solution is simple. The inverter can either easily fit into the same rack structure as most batteries or be placed in a separate rack. The MSSP is designed as a string inverter. But, its patented ability to be hard paralleled on both AC and DC sides allows it to be configured into a central inverter or a central string inverter, giving it the advantages of both central and string inverter concepts. Because MSSP can be configured into the appropriate size based on the same 120/150/180/200 kVA building block when it comes to use 380~690 Vac, it is suitable for both front-of-the-meter and behind-the-meter applications.

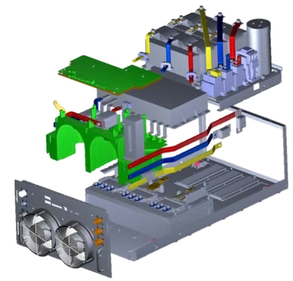
MSSP

Modular
Scalable
String
Platform



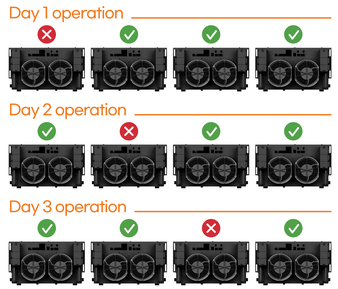
Scalable Inverter Approach

- Parallel up to 16 units : based on power need Select preferred number of DC uses to properly match your energy configuration and short circuit currents
- Separate powerful master Controller (Only 1 Controller needed per max 16 units)
- Advanced functionality for UL1741 SA and IEEE1547 compliance
- Integrate into preferred enclosure design for indoor or outdoor application (Inverter rated up to 50℃ without need for A/C)



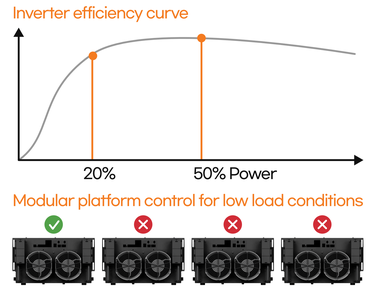
MSSP provide the following advantages based on the features above

- Designed 3-level NPC topology
- > 98% Efficiency
- Forced-Air Cooling System
- Black Start Function Integrated
- 7U tall and fits in standard 19” rack : easy to Configure into final size



Increased longevity via intelligent cycling of inverters

- Operating Plan up to running fatigue
- Measure running fatigue from running time
- Increase total system life with rotated running of string inverter within fans and capacitor’s limited life-time.



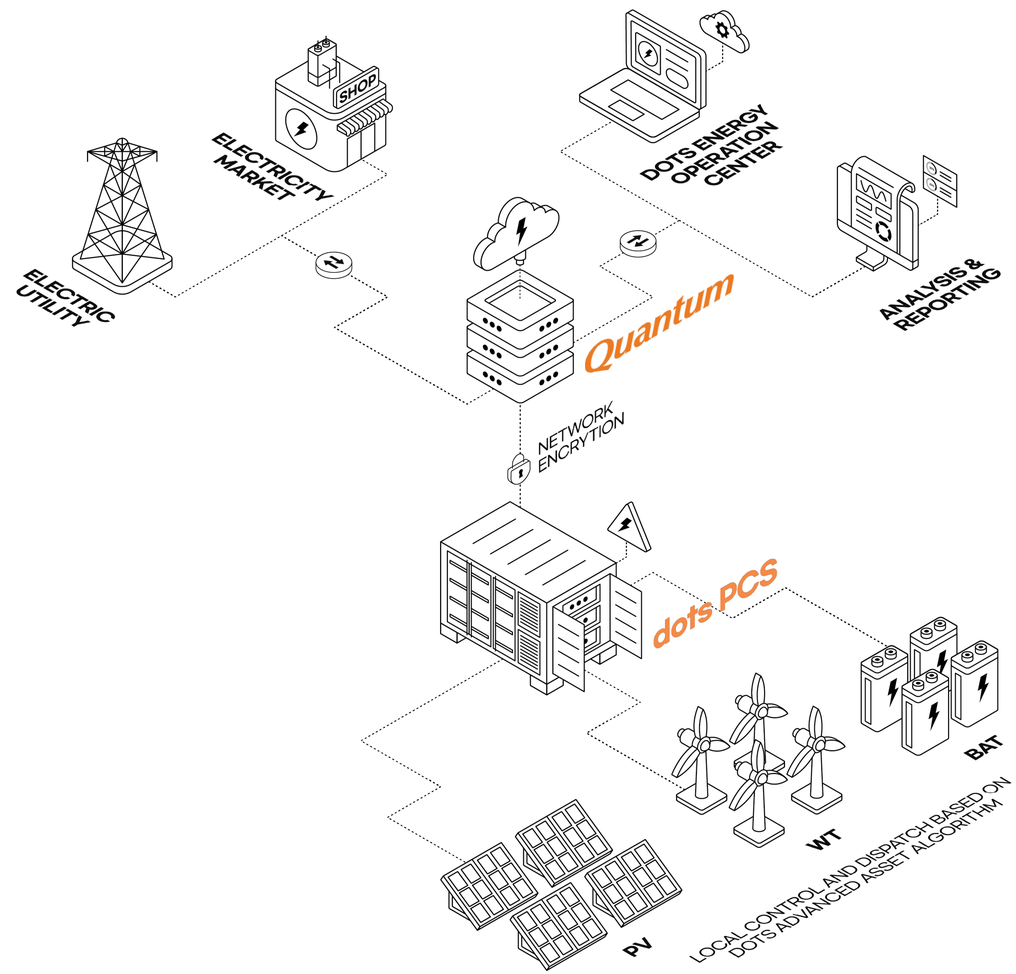
Optimized efficiency for low power mode

- Running separately to enhance efficiency
- If running a system consisting of a single inverter when the load factor is low, the efficiency of the inverter is dramatically low.
- LS ELECTRIC Modular Scalable String Platform enhance the efficiency by operating each inverter separately as per the load factor.

Modular PCS

Modular PCS

dots PCS built-in PMS can configure the ESS solution at any type of typical ESS site and typically use for not only energy resiliency but load management, recently ESS is emerging to enter the trade market as a power generator for grid stability.	dots PCS equip the overall solutions to meet the green energy industry. To operate PCS, ‘Revenue meter’ for either the Behind the meter or Front of the meter, ‘Transformer SG(switch gear), and ‘Power Distribution Panel’ for distribution with management of various loads within the site can be connected to PCS and EMS for control and multiple operation depending on the site use cases of PCS doing for.	dots EMS optimized for the modular inverter provide the control and operation at the side of ESS/ASSET and/or SITE level.



Modular PCS

dots energy offer the Modular PCS as the First Company by the differentiated technology.

Given the characteristics of modular inverters, dots energy applies modularization technology by structurally distinguishing the features of PCS, and supplies a product line that can satisfy various customer demands, such as installation location(indoor or outdoor) and required output(kW), etc.

dots energy offer the Modular PCS as the First Company by the differentiated technology.

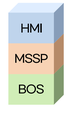
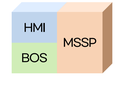
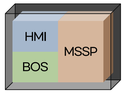
(Unit : kVA)

PCS MODEL		PITTA-1	PITTA-2	UNCIA-3	RHINO-6	RHINO-12	RHINO-16
Number of paraller MSSP		1	2	3	6	12	16
380Vac	Output	120	240	360	720	1440	1920
	Location	A / B	A / B	-	-	-	-
480Vac	Output	150	300	450	900	1800	2400
	Location	A / B	A / B	-	-	-	-
600Vac	Output	180	360	540	1080	2160	2880
	Location	-	-	A / B / C	A / B / C	A / B / C	-
690Vac	Output	200	400	600	1200	2400	3200
	Location	-	-	-	-	-	-

PCS Criteria by the installation location

Type	Installation Location	System Structure	Environmental Grade
B	Outdoor	Enclosure w/Air Forced Cooling	IP44
C	Outdoor	Container w/Full HVAC System	IP55

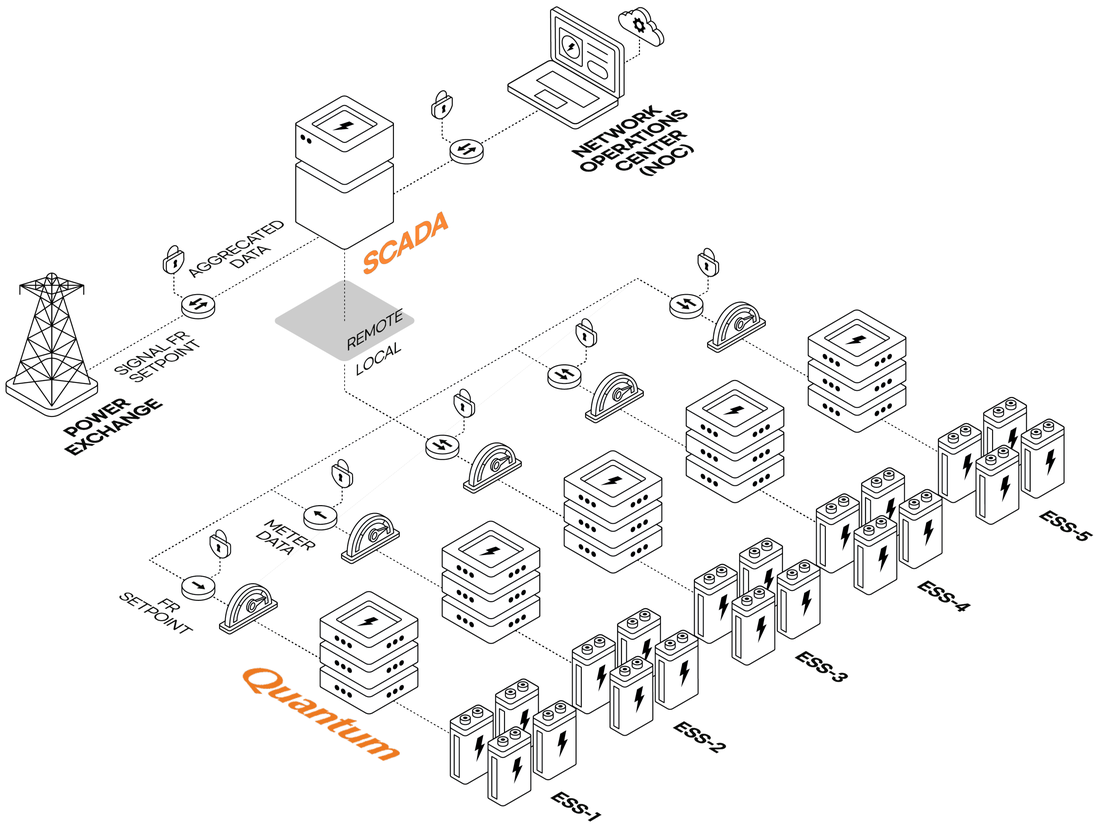
Summery of dots energy Modular PCS in the Structural Diversity

PCS MODEL	PITTA	RHINO	
PCS Structure			
Installation Location	B	B	C
Enclosure Type	Outdoor Enclosure	ISO Container	
Temp. Control	Air Forced Cooling	Air Forced Cooling	Full HVAC
IP Grade	IP44	IP44	IP55

Quantum

Multi-stage safe
driving function applied to
dots energy’s Quantum(PMS)
and it supports optimized
operation of the battery and
maximum capacity use.

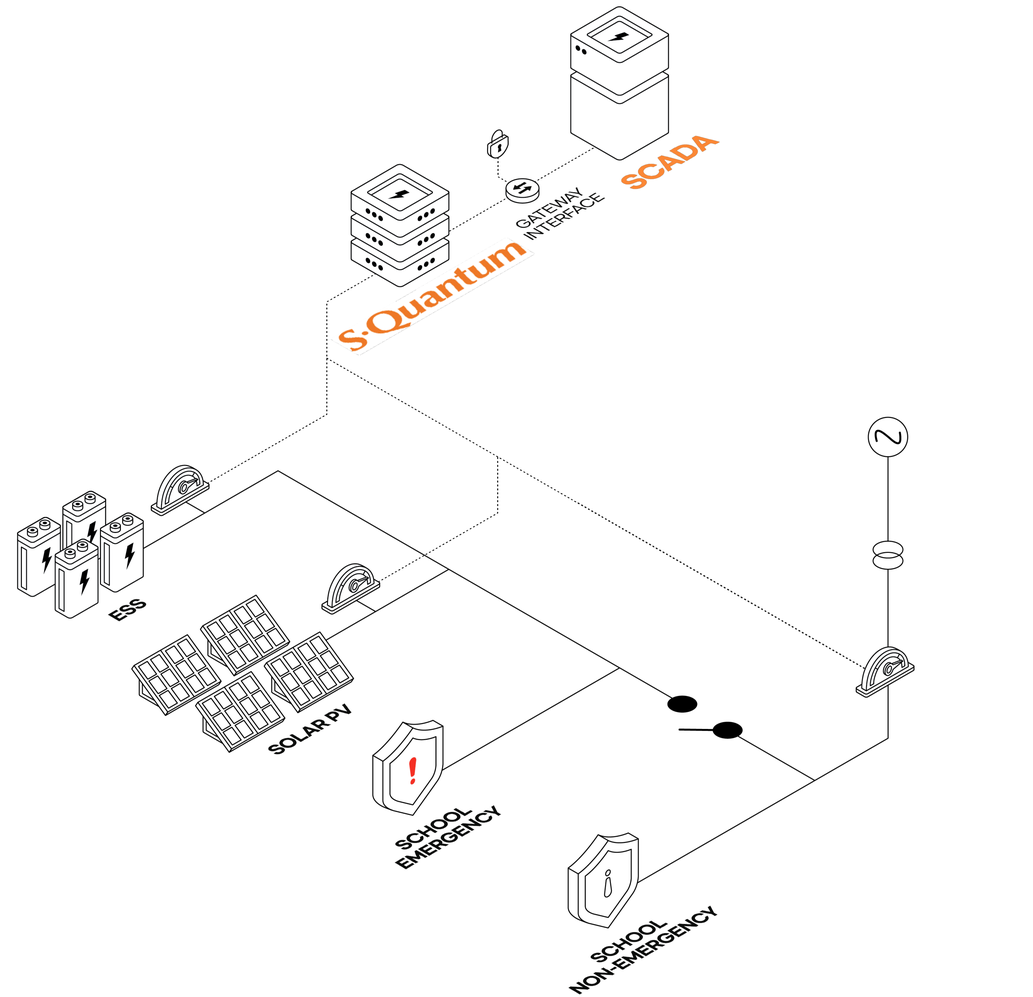
Quantum



Customer do not need to pay for EMS to control and operate SITE for the revenue.

Power Management System (QUANTUM), as a default parts of PCS, presents ESS and Site level controls topology, where the installed systems can be monitored, controlled and configured at various levels depending on the preferences of the operator and/or based on the application and use case being implemented.

Conceptual communication diagram with single site.



S-Quantum controls at multiple levels of distributed resources. Customers can manage at the Asset level, which is the ESS itself, or they may want to manage the entire site including the ESS, so there is no need for a separate ESS or Site controller as they can intervene at the required level with a single solution.

Access to the installed capacity is available at the individual ESS level as well as at the site level. Optionally, if the systems are distributed to multiple sites, the systems can be controlled and monitored at pre-defined aggregation levels through Dots Asset Management Platform (AMP). Aggregation levels can be based on specific grid architecture (transformer, feeder, substation, etc)

Artificial Intelligence (AI) based optimization ‘containers’ are hosted within each layer (i.e. ESS Controller, Site Controller, SCADA) providing a seamless integration for optimal management, characterization and operation of the deployed products. The integrated controls platform ensures cell life longevity, safe operating parameters, and continual refinement of capacity availability for various use cases - all within a performance guarantee wrapper and cyber-secure network model.

Quantum

A. Dashboard

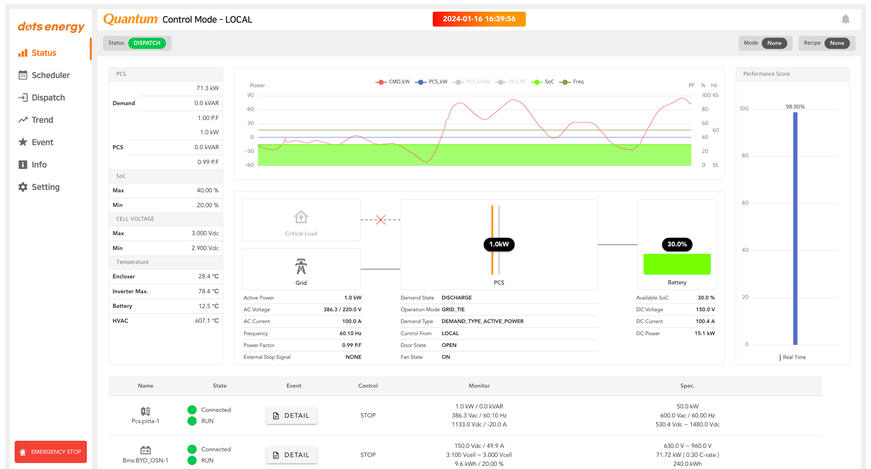
- Provide the Real time operation status of ESS levels
- End user can forecast the effect with live data according to the running application
- Display the visual status, graphical live data and running recipes
- Perform dispatcher to run ESS with programmed file in the Dashboard screen

B. Trend

- Save all log and history to the user computer
- Download, if required, the saved logs for dedicated BMS and meter data
- Log storage interval/retention period : 0.5 seconds / year

C. Scheduler

- Scheduler provide the operating sequences by Recipe, Deck and Player scheme with various operation modes and conditions. (CP/CC/CV/CP-CV/CC-CV).
- Display the DECK operation status

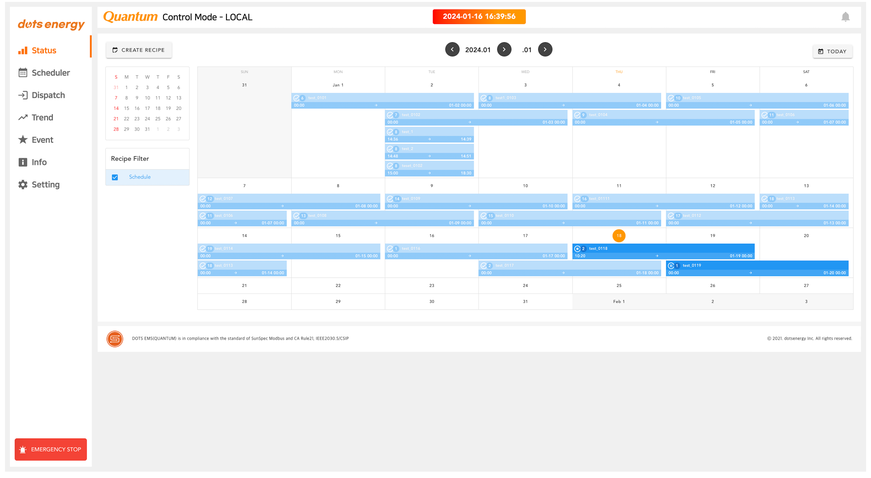


Compatibility

- ESS agnostic, can be easily integrated with any PCS & Battery system
- Standard part of PCS as an optimal product with industry leading brands
- Supports battery with parallel connections

Resilience

- Autonomous running and stop when there is no network connection
- Sustained operations during power interruptions
- When a fault is occurred, it automatically restarts when it's back to normal.

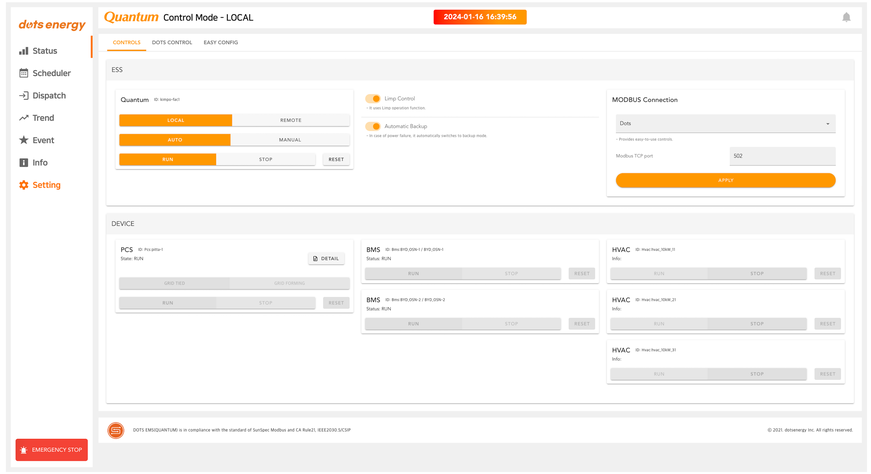


Operating Mode

- Scheduler (Schedule mode by recipe & sequence)
- Dispatch (Manual command or File simulation)
- Remote Demand (by Modbus)

Functionality

- dots Control mode : System safety & protection function from unexpected run
- Limp Control : Smart function for continue running even a BMS breaks down
- Back up mode : Switch to Grid forming automatically during power outage
- Easy Config mode : Easy setup and mapping the BMS protocol with PMS
- Predefined Output mode : Set Power and PF separately during RUN
- Other modes : Local ↔ Remote, Manual ↔ Automatic



Communication

- Ethernet/TCP
- Support MODBUS TCP, Sun-spec & Mesa

Connectivity

- Wired Ethernet
- LTE or Wi-Fi (Optional)

PCS Criteria by the installation location

The following modes of operations, and associated settings and ramp rates, are configurable at both the individual BESS and Site Level (and Fleet Level if deployed across mutiple sites)

No.	Item	ESS Level	Site Level
1	Real Power - Setpoint	Yes	Yes
2	Reactive Power - Setpoint	Yes	Yes
3	Power Factor Mode	Yes	Yes
4	Volt / Var	Yes	Yes
5	Volt / Watt	Yes	Yes
6	Frequency / Watt	Yes	Yes
7	Solar Smoothing	-	Yes
8	Time Shifting	-	Yes
9	Peak Management & Backfeed Control	-	Yes
10	Market Servces	-	Yes
11	Grid Forming and Black Start	Yes	Yes
12	Storm {reparation - SOC Setpoint	Yes	Yes
13	Idle Mode	Yes	Yes

Spec Board

20ft. Utility Scale.

- Scalable Output up to 3200kVA
- DC Voltage w. Max 1500Vdc
- Up to 70kW HVAC
- 8 Independent BESS

10ft. Utility Scale.

- Scalable Output up to 1200kVA
- DC Voltage w. Max 1500Vdc
- 10kW HVAC × 3ea
- 8 Independent BESS

C&I Scale.

Modular Inveters		**1**	**2**	**3**	
AC side	AC Output Power (kVA)	120-200	240-400	360-600	
	Max AC Output Current (Arms)	205	410	615	
	Operating Grid Voltage (V)	380-690 (3ø 3W)			
DC side	DC Voltage Range (Full Power)	650-1500 V			
Environment	Operating Temperature Range	-20 ~ 50℃ / Active Power Derating (> 50℃)			
Cabinet	Environment Protection	IP44, Outdoor (AFC)	IP44, Outdoor (AFC)	IP44, Outdoor (AFC)	IP55, Outdoor (Antisalinity)
	Dimensions [WxHxD] (m)	0.8x1.5x1.25	0.8x1.75x1.25	1.6x2.1x1.4	ISO 10ft CTNR (2.4x2.9x3.0)
	Weight (kg)	~450	~850	~2500	~5000 (TBD)
PCS control interface	Communication Structure	HMI (PCS Level, Default) - Quantum (ESS Level, Default) - S-Quantum (Site Level, Option)			
Certifications & Standards		UL 1741SA, IEEE1547 (Inverter)			

Spec Board

Modular Inveters		**1**	**2**	**3**		**6**	**12**	**16**
AC side	AC Output Power (kVA)	120-200	240-400	360-600		720-1200	1440-2400	1920-3200
	Max AC Output Current (Arms)	205	410	615		1230	2460	3280
	Operating Grid Voltage (V)	380-690 (3ø 3W)						
	Operating Grid Frequency (Hz)	50/60						
	Current Harmonic Distortion (THD)	< 5 %						
	Power Factor	1.0 Leading to 1.0 Lagging						
	Reactive Power Compensation	4 Quadrant Operations						
DC side	DC Voltage Range (Full Power)	650-1500 V						
	Max. DC Continuous Current (A)	205	410	615		1230	2460	3280
	Max. DC Short Circuit Current (A)	Approx. 3 kA / 85 kA						
Efficiency & AUX. Supply	Efficiency (Max)	> 98 %						
	Max Ramp Rate	< 16.67 ms						
	Auxiliary Power Usage (W)	495	765	1035		1845	3465	4435
Environment	Operating Temperature Range	-20 ~ 50℃ / Active Power derating (> 50℃)						
	Operating Relative Humidity Range	RH < 85 % (No Condensation)						
	Max. Altitude (above sea level)	1000 M						
Protections	General AC Protection & Disconn.	AC SPD, AC FUSE, EMI		AC SPD, AC EMI, AC FUSE		AC SPD, AC EMI, AC Fuse (Inverter)		
	General DC Protection & Disconn.	DC SPD, DC FUSE, EMI		DC SPD, DC EMI, DC FUSE		DC SPD, DC EMI, DC Fuse (PCS/Inverter)		
Cabinet	Environment Protection	IP44, Outdoor (AFC)	IP44, Outdoor (AFC)	IP44, Outdoor (AFC)	IP55, Outdoor (Antisalinity)	IP55, Outdoor (Antisalinity)	IP55, Outdoor (Antisalinity)	IP55, Outdoor (Antisalinity)
	Dimensions [WxHxD] (m)	0.8x1.5x1.25	0.8x1.75x1.25	1.6x2.1x1.4	ISO 10ft CTNR (2.4x2.9x3.0)	ISO 10ft CTNR (2.4x2.9x3.0)	ISO 20ft CTNR (2.4x2.9x6.0)	ISO 20ft CTNR (2.4x2.9x6.0)
	Weight (kg)	~450	~850	~2500	~5000 (TBD)	~6500 (TBD)	~10000 (TBD)	~12000 (TBD)
PCS control interface	Communication Structure	HMI (PCS Level, Default) - Quantum (ESS Level, Default) - S-Quantum (Site Level, Option)						
	Front Indication	AC Line On, ACCB, Run/Fault, E-Stop Button						
	Interface & Protocol	HMI Touch Screen Type, Modbus TCP						
Operation	Selectable Mode	CC & CP W/Grid Tied & Forming W/UPS (Option)						
	Control Mode	Active Power, Freq-Watt Droop (IEEE1547), Freq-Watt Curve (Freq. LUT), Const-Current, Reactive Power, Volt-Var, Power-Factor, Watt-PF Curve, Watt-Var Curve, Volt-Watt Droop(UL1741-SA), Volt-Watt Curve						
Certifications & Standards		UL 1741SA, IEEE1547 (Inverter)						