APsystems
ALTENERGY POWER

Leading MLPE Technology

for Smart Residential Solar Energy Storage System Handbook

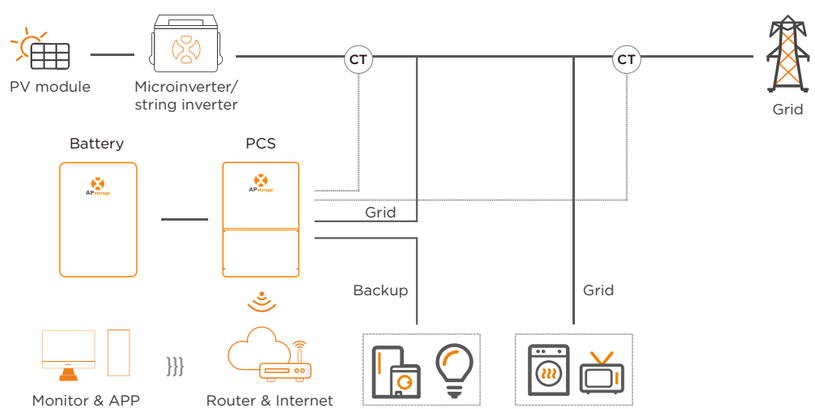
Altenergy Power System Inc.

System Introduction

APsystems Energy Storage system consists of a solution combining APsystems microinverters with an APstorage system.The APstorage systems includes PCS (Power Conversion Systems) with compatible battery units.

During the day, the microinverter photovoltaic system generates electricity to power the household load and can direct the excess of solar energy generated to charge the battery. At night, the storage system can discharge the battery to be used in the home depending on the consumption needs of the household.

At the same time, the energy storage system provides backup & off-grid functions, and can also supply power to the household in case of power grid cuts.



System Advantage

Safe

With APsystems microinverters, every PV module is connected in parallel. DC Voltage of each PV module never exceeds the PV module Voc, which is lower than 60Vdc for most of PV modules used with APsystems microinverters. The energy storage system uses a 48V low-voltage battery input to avoid potential safety hazards caused by high DC voltage.

Efficient

Each input channel has individual Maximum Peak Power Tracking (MPPT) control, which ensures that the maximum power is produced to the utility grid regardless of the performance of the other PV modules of other channels in the array. With this inventive design, the charge and discharge efficiency of the energy storage inverter is up to 96.5%.

Smart

Equipped with an Energy Management System, users are able to monitor the microinverter system at the module level and manage household energy storage systems through the APsystems EMA platform and mobile phone APP, effectively improving energy use and savings.

Both DC and AC Solution:

APsystems Microinverter + APstorage PCS / Other brands' PV inverter + APstorage PCS

Support Parallel connection:

Supports single phase and three phase in parallel, users can expand the system according to the demand of power consumption & storage during different periods.

Better backup overload capacity:

In case of power grid outage, PCS can activate the off-grid mode and support 150% overload capacity within 30 seconds

Local power network formation function:

In the event of a power failure, the PV inverter or micro inverter can continue to work for load consumption and battery charging.

Zero export:

Anti-back flow function to limit sending energy back to the grid.

Customize the use of energy according to your needs :

The APstorage APP offers the user various modes including: PV self-consumption, back-up and off-grid & load shifting/peak shaving VPP

APsystems DS3 Microinverter

Dual-module // Single phase // 3rd generation

- One microinverter connects to two modules
- Max output power reaching 625VA, 750VA or 880VA
- Two input channels with independent MPPT
- Reactive Power Control
- Maximum reliability, IP67
- Safety protection relay integrated
- Perfectly match 5kW requirement with 8 units

Model	DS3-NA	DS3-EU
Input Data (DC)		
Recommended PV Module Power (STC) Range	400Wp-660Wp+	
Peak Power Tracking Voltage	28V-45V	
Operating Voltage Range	26V-60V	
Maximum Input Voltage	60V	
Maximum Input Current	20A x 2	
Output Data (AC)		
Maximum Continuous Output Power	880VA	
Nominal Output Voltage/Range(1)	240V/211V-264V	230V/184V-253V
Nominal Output Current	3.7A	3.8A
Nominal Output Frequency/Range(1)	60Hz/59.3-60.5Hz	50Hz/48-51Hz or 60Hz/59.3-60.5Hz
Power Factor(Default/Adjustable)	0.99/0.8 leading...0.8 lagging	
Maximum Units per 2.5mm² Branch(2)	7	6
Efficiency		
Peak Efficiency	97%	
CEC Efficiency	96.5%	
Nominal MPPT Efficiency	99.5%	
Night Power Consumption	20mW	
Mechanical Data		
Operating Ambient Temperature Range(3)	- 40 °C to + 65 °C	
Storage Temperature Range	- 40 °C to + 85 °C	
Dimensions (W x H x D)	262mm x 218mm x 41.2mm	
Weight	2.7kg	
AC Bus Cable	12AWG (28A)	2.5mm² (23A)
DC Connector Type	Stäubli MC4 PV-ADBP4-S2&ADSP4-S2	
Cooling	Natural Convection - No Fans	
Enclosure Environmental Rating	IP67	
Features		
Communication (Inverter To ECU)(4)	Encrypted ZigBee	
Isolation Design	High Frequency Transformers, Galvanically Isolated	
Energy Management	Energy Management Analysis (EMA) system	

(1) Nominal voltage/frequency range can be extended beyond nominal if required by the utility.
(2) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.
(3) The inverter may enter to power de-grade mode under poor ventilation and heat dissipation installation environment.
(4) Recommend no more than 80 inverters register to one ECU for stable communication.

APsystems QT2 3-Phase Microinverter

The most powerful 3-phase Quad microinverter

- Designed for 3-phase grid connection (208V or 480V)
- Single unit connects to 4 modules, 2 MPPTs, module-level DC voltage
- Maximum continuous AC output power 1728VA @ 208V, 1800VA @ 480V
- Engineered to harness today's high-capacity PV modules (Maximum input current 20A)
- Integrated safety protection relay
- Adjustable power factor

Model	QT2-NA-208	QT2-NA-480
Input Data (DC)		
Recommended PV Module Power (STC) Range	315Wp-670Wp+	
Peak Power Tracking Voltage	30V-45V	
Operating Voltage Range	26V-60V	
Maximum Input Voltage	60V	
Maximum Input Current	20A x 4	
Output Data (AC)		
Maximum Continuous Output Power	1728VA	1800VA
Nominal Output Voltage/Range(1)	208V/183V-229V	480V/422V-528V
Adjustable Output Voltage Range	166V-240V	385V-552V
Nominal Output Current	4.8Ax3	2.17Ax3
Nominal Output Frequency/Range(1)	60Hz/59.3-60.5Hz	
Adjustable Output Frequency Range	55Hz-65Hz	
Power Factor (Default/Adjustable)	0.99/0.8 leading...0.8 lagging	
Maximum Units per 10AWG branch(2)	7	16
AC Bus Cable	10AWG (35A)	
Efficiency		
Peak Efficiency	96.5%	
Nominal MPPT Efficiency	99.5%	
Night Power Consumption	40mW	
Mechanical Data		
Operating Ambient Temperature Range(3)	-40 °F to +149 °F (-40 °C to +65 °C)	
Storage Temperature Range	-40 °F to +185 °F (-40 °C to +85 °C)	
Dimensions (W x H x D)	14" × 9.5" × 1.8" (359mm X 242mm X 46mm)	
Weight	13 lbs (6kg)	
DC Connector Type	Stäubli MC4 PV-ADBP4-S2&ADSP4-S2	
Cooling	Natural Convection - No Fans	
Enclosure Environmental Rating	Type 6	
Features		
Communication (Inverter To ECU)(4)	Encrypted ZigBee	
Isolation Design	High Frequency Transformers, Galvanically Isolated	
Energy Management	Energy Management Analysis (EMA) system	

Model	QT2-EU
Input Data (DC)	
Recommended PV Module Power (STC) Range	315Wp-670Wp+
Peak Power Tracking Voltage	30V-45V
Operating Voltage Range	26V-60V
Maximum Input Voltage	60V
Maximum Input Current	20A x 4
Output Data (AC)	
Maximum Continuous Output Power	2000VA
Nominal Output Voltage/Range(1)	380V/324V-468V
Adjustable Output Voltage Range	305V-478V
Nominal Output Current	3.03Ax3
Nominal Output Frequency/Range(1)	50Hz/48-51Hz or 60Hz/59.3-60.5Hz
Adjustable Output Frequency Range	45Hz-65Hz
Power Factor(Default/Adjustable)	0.99/0.8 leading...0.8 lagging
Maximum Units per 2.5mm² Branch(2)	9
AC Bus Cable	4mm² (28A)
Efficiency	
Peak Efficiency	96.5%
Nominal MPPT Efficiency	99.5%
Night Power Consumption	40mW
Mechanical Data	
Operating Ambient Temperature Range(3)	-40 °C to +65 °C
Storage Temperature Range	-40 °C to +85 °C
Dimensions (W x H x D)	359mm X 242mm X 46mm
Weight	6kg
DC Connector Type	Stäubli MC4 PV-ADBP4-S2&ADSP4-S2
Cooling	Natural Convection - No Fans
Enclosure Environmental Rating	IP67
Features	
Communication (Inverter To ECU)(4)	Encrypted ZigBee
Isolation Design	High Frequency Transformers, Galvanically Isolated
Energy Management	Energy Management Analysis (EMA) system

(1) Nominal voltage/frequency range can be extended beyond nominal if required by the utility.

(2) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

(3) The inverter may enter to power de-grade mode under poor ventilation and heat dissipation installation environment.

(4) Recommend no more than 80 inverters register to one ECU for stable communication.

APsystems DS3D Microinverter

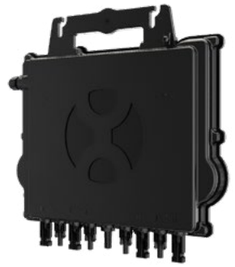
- One microinverter connects to four modules
- Max output power reaching 1800W
- Two input channels with independent MPPT
- Engineered to match the highest power modules available (Max input current 20A)
- Maximum reliability, IP67
- Encrypted Zigbee Communication
- Safety protection relay integrated

Model	DS3D
Input Data (DC)	
Recommended PV Module Power (STC) Range	315Wp-670Wp+
Peak Power Tracking Voltage	56V-90V
Operating Voltage Range	52V-118V
Maximum Input Voltage	118V
Maximum Input Current	20A x 2
Output Data (AC)	
Maximum Continuous Output Power	2000W
Nominal Output Voltage/Range(1)	230V/184-253V
Adjustable Output Voltage Range	180V-270V
Nominal Output Current	8.7A
Nominal Output Frequency/Range(1)	50Hz/48-51Hz or 60Hz/59.3-60.5Hz
Adjustable Output Frequency Range	45Hz-65Hz
Maximum Units per 4mm² Branch(2)	3
Efficiency	
Peak Efficiency	97%
CEC Efficiency	96.7%
Nominal MPPT Efficiency	99.5%
Night Power Consumption	20mW
Mechanical Data	
Operating Ambient Temperature Range(3)	-40 °C to +65 °C
Storage Temperature Range	-40 °C to + 85 °C
Dimensions (W x H x D)	283mm X 233mm X 48.4mm
Weight	3.8kg
AC Bus Cable	4mm² (28A)
DC Connector Type	Stäubli MC4 PV-ADBP4-S2&ADSP4-S2
Cooling	Natural Convection - No Fans
Enclosure Environmental Rating	IP67
Features	
Communication (Inverter To ECU)(4)	Encrypted ZigBee
Isolation Design	High Frequency Transformers, Galvanically Isolated
Energy Management	Energy Management Analysis (EMA) system
Compliance	
Compliance	IEC 62109-1; IEC 62109-2; IEC 61000-6-1,-2,-3,-4; IEC 61727; IEC 62116; AS 4777.3; MEA; PEA; EN 62109-1; EN 62109-2; EN 61000-6-1; EN 61000-6-3; EN 50549-1;

(1) Nominal voltage/frequency range can be extended beyond nominal if required by the utility.
(2) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.
(3) The inverter may enter to power de-grade mode under poor ventilation and heat dissipation installation environment.
(4) Recommend no more than 80 inverters register to one ECU for stable communication.

APsystems QT2D 3-Phase Microinverter

- Designed for 3-phase grid connection
- 4 input channels
- Single unit connects to 8 modules
- Maximum continuous AC output power 3600VA
- Engineered to match the highest power modules available (Maximum input current 20A)
- Safety protection relay integrated
- Adjustable output power factor Balancing 3-phase output



Model	QT2D
Input Data (DC)	
Recommended PV Module Power (STC) Range	315Wp-670Wp+
Peak Power Tracking Voltage	58V-85V
Operating Voltage Range	52V-118V
Maximum Input Voltage	118V
Maximum Input Current	20A x 2
Output Data (AC)	
Maximum Continuous Output Power	3200VA
Nominal Output Voltage/Range(1)	380V/324V-468V
Adjustable Output Voltage Range	305V-478V
Nominal Output Current	4.85Ax3
Nominal Output Frequency/Range(1)	50Hz/48-51Hz
Adjustable Output Frequency Range	45Hz-55Hz
Power Factor (Default/Adjustable)	0.99/0.8 leading...0.8 lagging
Maximum Units per 4mm² Branch(2)	6
Efficiency	
Peak Efficiency	97%
Nominal MPPT Efficiency	99.9%
Night Power Consumption	40mW
Mechanical Data	
Operating Ambient Temperature Range(3)	-40 °C to +65 °C
Storage Temperature Range	-40 °C to +85 °C
Dimensions (W x H x D)	359mm X 273mm X 56mm
Weight	7kg
AC Bus Cable	4mm² (28A)
DC Connector Type	Stäubli MC4 PV-ADBP4-S2&ADSP4-S2
Cooling	Natural Convection - No Fans
Enclosure Environmental Rating	IP67
Features	
Communication (Inverter To ECU)(4)	Encrypted ZigBee
Isolation Design	High Frequency Transformers, Galvanically Isolated
Energy Management	Energy Management Analysis (EMA) system
Compliance	
Compliance	IEC 62109-1; IEC 62109-2; IEC 61000-6-1,-2,-3,-4; IEC 61727; IEC 62116; AS 4777.3; MEA; PEA; EN 62109-1; EN 62109-2; EN 61000-6-1; EN 61000-6-3; EN 50549-1

(1) Nominal voltage/frequency range can be extended beyond nominal if required by the utility.
(2) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.
(3) The inverter may enter to power de-grade mode under poor ventilation and heat dissipation installation environment.
(4) Recommend no more than 80 inverters register to one ECU for stable communication.

APstorage ELS-5K

- Nominal Power Rating up to 5000VA
- Peak Backup Power up to 7500VA
- Max Efficiency up to 96.5%
- 48V Low Battery Voltage Input

Model	ELS-5K
General Specification	
Dimensions W/H/D	847×502×197mm
Weight	37kg
Maximum Efficiency	96.5%
Temperature Range	-25°C-65°C (-13°F-149°F)
Ingress Protection	IP65
Relative Humidity	10%-90%
Ventilation	Natural convection
Communication Ports	Ethernet/ Wireless/RS485/CAN
Parallel Function	Yes
Grid Regulation	VDE4105, AS/NZS4777.2
Safety	IEC62477, IEC62040, AS62040
EMC/EMI Protection	EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4
Battery Input /Output Data	
DC Battery Input Voltage	40.0-60.0VDC
Battery Capacity	50-800Ah
Charging Strategy for Li-Ion Battery	Self-adaption to BMS
Max Continuous Charge Current	100A/96A(DE)
Max Continuous Discharge Current	100A/96A(DE)
AC Output Data (On-grid)	
Max. Continuous Output Power	5000VA/4600VA(DE)
Max. Continuous Output Current	21.7A/20.0A(DE)
Max. AC Current From Utility Grid	43.4A/40.0A(DE)
Nominal Output Voltage	230V (±2%)
Nominal Output Voltage Range	184-264V
Nominal Output Frequency/Range	50Hz/48-51Hz
Output Power Factor	>0.99(Adjustable from 0.8 leading to 0.8 lagging)
THD	<3%
Grid Connection	Single-phase
AC Output Data (Backup)	
Max. Output Apparent Power	5000VA/4600VA(DE)
Peak Output Apparent Power	7500VA/6900(DE) (10s)
Max. Output Current	21.7A/20.0A (DE)
Nominal Output Voltage	230V (±2%)
Nominal Output Frequency	50Hz

APstorage PPS

- Output Power Rating up to 1000W
- 1036Wh Battery
- Support AC or DC charging mode
- Support 99% electrical equipment
- Advanced Battery Management System
- Multi-level intelligent protection
- Digital display screen
- Portable folding handle
- Foldable module matching

MODEL	PPS
Output Ports	
AC Output x1	Total power 1000W, peak power 1500W / 230Vac(50/60Hz)
USB-A Output x2	5V-20V/3A, 60W max
USB-C Output x2	5V-20V/3A, 60W max
DC1 Output x1	12V/12A，144W max
DC2 Output x1	12V/12A，144W max
Input Ports	
DC1 x1	12V-22.5V, 150W max
DC2 x1	12V-22.5V, 150W max
Battery Info	
Cell Chemistry	Lithium-ion(vehicle regulation level)
Battery model	18650
Discharge temperature	-4-140° F (-20-60 °C)
Charge temperature	32-113° F (0-45 °C)
Shelf Life	1 year (after a full charge)
Cycle Life	More than 80% of the initial capacity can be maintained after 800 times
General Info	
Net Weight	8.5Kg
Dimensions	328x169x124mm
Capacity	34.8Ah/29.4V (1023Wh)

ECU-R

- Collects individual module and microinverter statistics
- Communicates in real time
- Requires no additional wiring
- Warranty 3 years, IP30
- ZigBee communication

Communication to Microinverter	
Communication	ZigBee 2.4 GHz
Maximum Communicating Inverter*	100
Communication to EMA	
Ethernet	10/100M Auto-sensing, Auto-negotiation
Wireless	Wi-Fi 802.11g/n /GSM Cellular
Wireless Security	WEP, WPA2-PSK
USB Port	For Reserved
Power Date	
Power Supply	5V, 2A
Power Consumption	1.7 W
Mechanical Data	
Dimensions (W×H×D)	4.8" x 3.4" x 0.98" (122 mm x 87 mm x 25 mm)
Weight	0.33lbs (150g)
Ambient Temperature Range	-4°F to +149°F (-20°C to +65°C)
Cooling	Nature Convection; No Fans
Enclosure Environmental Rating	Indoor - NEMA 1 (IP20)
Features	
Compliance	IEC 60950-1, EN60950-1, IEC 60529, EN 60529, ANSI/UL 60950-1, CAN/CSA C22.2 No.60950-1, UL50E, FCC part 15, EN61000-6-1, EN61000-6-3, ICES-003, AS NZS 60950-1, GB/T17799

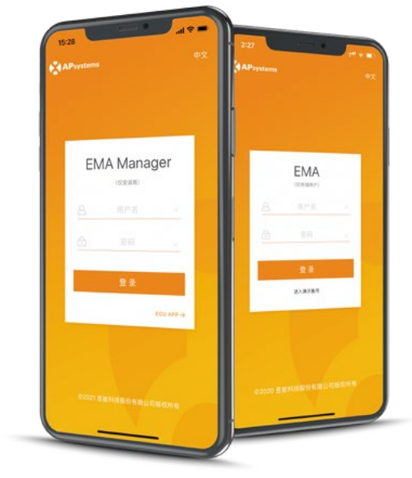
ECU-C

- Electricity data monitoring
- Power grid environment monitoring
- Anti-backflow control
- Relay control
- Built-in WiFi
- Internal meter
- Apply to single phase or three phase system

Communication to Microinverter	
Communication	ZigBee 2.4 GHz
Maximum Communicating Inverter*	120
Communication to EMA	
Ethernet	10/100M Auto-sensing, Auto-negotiation
Wireless	Wi-Fi 802.11g/n /GSM Cellular
USB interface	5Vdc - 0.5A Output x 2
RS232	Standard
RS485	Standard
RJ45	Standard
Power Supply	
AC Power Supply	110-277VAC, 50-60Hz Single Phase – (3-Phase Optional)
DC Power Supply	12V-16V
Power Consumption	3W
Mechanical Data	
Dimensions (W x H x D)	8.3" x 4.7" x 1.6" (210mm x 120mm x 41mm)
Ambient Temperature Range	-40°F to +149°F (-40°C to +65°C)
Weight	1.1lbs (500g)
Cooling	Nature Convection; No Fans
Enclosure Environmental Rating	Indoor - IP20 (NEMA 1)
Other Features	
Grid Type	Single Phase/ Three Phase
Relay Driver	Control external AC contact or relay
Advanced Functions	Get relay signal, could do anti-backflow control(For single and 3-phase grid), and energy management
Digital Input	For external control device connection
CT Sensor	Production and consumption metering
Meter Accuracy	Integrated PV production metering (+/- 0.5% via CT) and optional consumption monitoring (+/- 2.5% via CT)
Compliance	
Compliance	IEC/EN61010-1, EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4, 2014/30/EU, EN301489-1/-17, EN62479, EN 300328

EMA

- Monitors and allows analysis of each solar module, microinverter and Displays the operating status, working mode and battery level of the energy storage device.
- Allows remote access to the solar array
- Shows performance issues and alerts the user to inverter events
- Communicates in real time
- Graphs system solar output over time to boost troubleshooting



About APsystems

APsystems is pushing the market forward with constant, intensive research and development to make tomorrow's MLPE technology available today. APsystems is a worldwide leader in advanced solar MLPE technology. In fact, with over 170,000 installations in more than 100 countries, in 2019 APsystems became #1 multi-module microinverter manufacturer worldwide, offering the widest range of microinverters available on the market. Also, in 2020, APsmart's DC Rapid shutdown devices shipments exceeded 100MW.

Founded in Silicon Valley in 2010

More than 2GW MLPE products shipments

More than 1.8 Million RSD products shipments

Company Profitable since 2012, strong bankability

ISO 9001, ISO 14001QA Certified

Technology protected by over 116 patents

Procurement and Manufactruing

- ISO 9001:2008, 14001:2004
- certifiedPartnership with DBG
- World-class Contract Manufacturer

Designed for life

- Largest MLPE offering
- 40,000 hours accelerated life testing for RSD products
- 0.3% global failure rate
- IP68 enclosure rating

Global footprint

- 116 Patents
- Serving customers in more than 100 countries
- Sustainability

Financials and Bankability

- Profitable since 2012
- Supported by first class industrial investors Haining Oriental Tianli innovation Innovation Industry Fund Haining Huili Trade LLC.

Company History

2009
- APsystems founded in Silicon Valley, USA

2010
- Established Jiaxing Headquarters Focus on R&D and operation

2011
- Sydey office opens / Shanghai office opens

2012
- Office in Seattle, USA opens
- APsystems completes largest microinverter installation (6MW)

2013

The first Multi-module Design:
- Launched the world's first dual-module and single-phase microinverter YC500
- Launched the world's first four-module and three-phase microinverter YC1000-3

2014
- Rotterdam, Netherlands office opens

2015
- APsystems surpasses 250MWp installed WW

2016
- Lyon, France office opens

2017
- Office in Mexico opens
- The first micro-inverter YC600 & QS1 compliant with smart grid scheduling

2018
- APsystems surpasses 550MWp installed WW

2019
- Create APsmart brand: Launched the single-component-level shutdown RSD-S using self-developed ASIC-specific chips

2020
- APsystems Microinverter cumulative shipments exceeds 1GW

2021
- The world's first 20A high-current micro-inverter DS3 & QT2 series products
- Launched the world's first two-module component-level shutdown RSD-D with an input current of 20A

2022
- The cumulative global sales volume of MLPE component-level power electronic products exceeds 2GW
- Successfully landed on the A-share Science and Technology Innovation Edition, entering a new development platform

Leading MLPE Technology APstorage