

# DATA CENTER POWER SOLUTIONS

AC-DC SOLUTIONS | DC-DC SOLUTIONS



PRECISION | POWER | PERFORMANCE | TRUST





# Data Center Power Solutions

Accelerate, Improve, and Enhance the  
Capabilities of Your Next System Design

## Your Global Partner for Data Center Power Supplies

As one of the largest power supply companies in the world, Advanced Energy has many years of experience in designing and manufacturing advanced power solutions for data center, enterprise, telecom, industrial, and medical applications. We have an unmatched ability to design power conversion solutions for your specific needs.

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Advanced Energy's innovations for hyperscale and cloud computing data centers focus on optimizing efficiency and power density to reduce the total cost of ownership.

Contact your Advanced Energy sales representative to learn how you can reduce operating costs for your data center. Our dedicated research and development and operations teams ensure swift deployment and stable operations for your program needs.

### Benefits

- High Reliability
- High Quality
- High Efficiency
- High Density
- Broadest Portfolio
- Versatile Designs
- In-house Manufacturing
- Custom Designs

### Applications

- Power Shelves
- Battery Backup Modules
- Cooling Modules
- PDU Solutions



## Power Supply Design Controls

Advanced Energy uses the latest design methodologies and techniques to ensure that our power supplies meet the rigorous quality and reliability requirements of hyperscale data centers.

### Reliability Models and Predictions

- Our sophisticated modeling capability enables us to predict design reliability in terms of mean-time-between-failures (MTBF) using Telcordia, Bellcore, or MIL-HDBK-217F.
- We provide design trade-off analysis and a review of part stress derating performance.

### Failure Modes and Effect Analysis

- Our analytical techniques enable us to identify, review, and mitigate failure modes, their causes, mechanisms, and effects.
- We provide a formal risk assessment to reduce field failures at the customer site.

### Derating Analysis

We implement custom or industry standard derating guidelines to predict and reduce the failure rate of the power supply.

### Component Selection

- We maintain a database warehouse of all component information.
- Our design engineers can only select components rigorously approved from suppliers that have undergone strict qualification and auditing process.

### Design for Manufacturability

Our internal design rules regarding manufacturability ensure consistency and highest quality in the production process.

### Common Firmware Platform

- Our rapid prototyping capability and faster firmware development helps to improve time to market.
- Modules are produced, tested, reviewed, and revised, resulting in higher quality levels.

## Advanced Energy Computer-Aided Engineering Tools Simulation Analysis

- Thermal Simulation
- Circuit Simulation
- EMI Field Simulation
- Detailed Mechanical Design
- PCB Layout and Tracking
- Structural Simulation

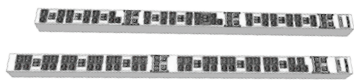


## Power Solutions for Data Center Racks

Advanced Energy's Artesyn power supplies offer simplicity of architecture for rapid deployment, making it the ideal solution for hyperscale and cloud computing data centers.

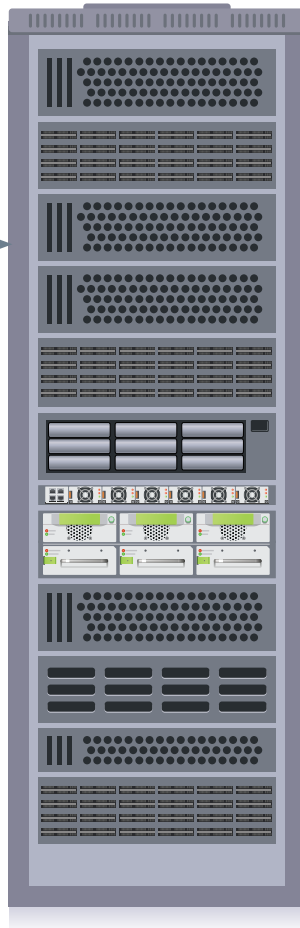
### Multi-faceted expertise in the design of power shelves:

- Integration of PDUs, shelves, and modules
- Power management and user interface
- Considerations for installation and maintenance
- Ingress protection
- Various input voltage options
- Future-proofing designs



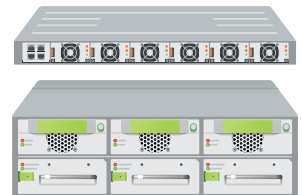
#### PDU SOLUTIONS

Our designs provide a wide range of PDU solutions from the simple to the intelligently-managed distributed network power. Whatever your needs, we can provide filtering, load balancing, metering, and monitoring, and control.



#### FAN TRAYS/COOLING MODULES

Our capabilities include the design of cooling modules to effectively manage thermal challenges.



#### POWER SHELVES

Our breadth of experience in managing thermal complexity to handle cooling enables our solutions to provide every watt of usable power from the power cord to the chip.



#### AC-DC SOLUTIONS

Our portfolio covers a wide output power range with options for 12 V or 48 V output voltage solutions. Our technology enables high density and high efficiency designs.



#### DC-DC SOLUTIONS

We offer alternative input options to our modules to enable flexibility in the ever-changing hyperscale market.



#### BATTERY BACKUP MODULES

Our designs for backup power help fulfill power requirements for mission critical environments when you need it, where you need it.

## Power Shelf Solutions

Advanced Energy's Artesyn power shelves can be populated with power supplies from our standard product range, allowing you to configure a rack scale power system to suit your data center applications. With the development of a rack management

controller (RMC) which sometimes known as a shelf management controller to provide monitoring and control functions via the data center management network.

### 12 V Shelf Power

#### 9.9 kW 12 V ORV2 Power Shelf

- High efficiency
- 9.9 kW output (6.6 kW N+1)
- Three 3.3 kW PSU modules
- OCP Compliant
- Hot swappable PSUs
- Accommodate three BBU Modules

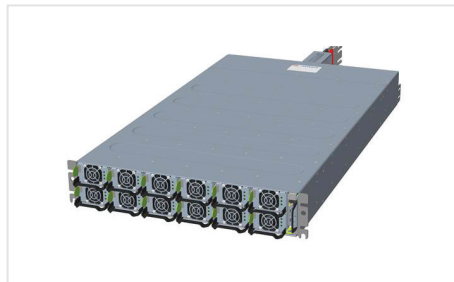


### 48 V Shelf Power and Rectifier



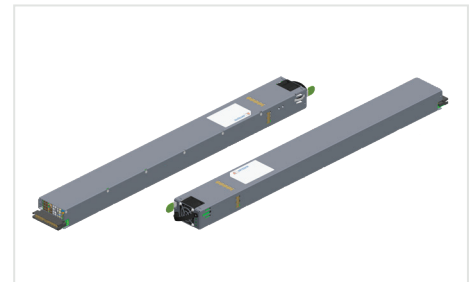
#### 18 kW 48 V ORV3 Power Shelf

- >97.5% Efficiency PSUs
- 18 kW output (15 kW N+1)
- Six 3 kW PSU modules
- 21 inch rack, 10U height
- Supports AC and DC input
- Hot swappable PSUs
- RMC for management
- OCP Compliant



#### 36 kW 2U Open Rack Power Shelf

- >97.5% Efficiency PSUs
- 36 kW output (33 kW N+1)
- Twelve 3 kW PSU modules
- 21 inch rack, 20U height
- Supports AC and DC
- Hot swappable PSUs
- RMC for management

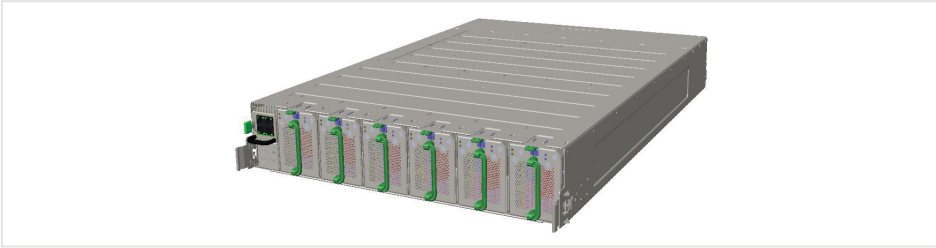


#### 3 kW, Open Rack Rectifier with ATS

- >96% efficiency from 240 to 277 V AC input with 30 to 100% load (peak efficiency of 97%)
- 68 mm wide
- I<sup>2</sup>C
- >24 ms hold up
- 200 to 277 VAC input
- OCP compliant
- 36 kW total, 33 kW N +1, or 18 kW N + N



## Backup Power



### 18 kW 48 V ORV3 BBU Shelf

- 18 kW power for five min at end of life
- Five 3 kW BBU modules
- 21 inch 2U High Power Shelf
- RMC for remote management
- Hot swappable BBU modules

## 50 V Shelf Power and Rectifier



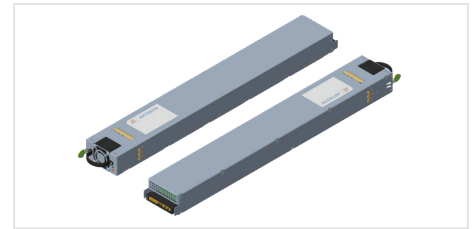
### 18 kW, 1U Open Rack Power Shelf

- 15000 W at 50 V with active current share
- Six 3 kW power modules and a removable shelf controller
- Accepts three types of input configurations (3P Delta 4 W, 3P Wye 5 W, 3x of 1P)



### 36 kW, 2U Open Rack Power Shelf

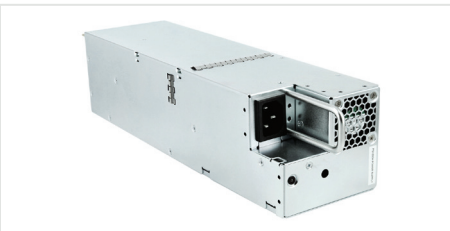
- 36 kW at 50 V with active current share
- Twelve 3 kW power modules and a removable shelf controller
- Very high efficiency
- Accepts three types of input configurations (3P Delta 4 W, 3P Wye 5 W, 3x of 1P)



### 3 kW, Open Rack Rectifier

- >96.5% efficiency from 240 to 277 V AC input with 30-100% load (peak efficiency of 97.5%)
- 200 to 277 VAC input
- OCP compliant
- Hot pluggable PSUs
- Status LEDs for fault monitoring
- 48 V fixed on battery test operation

## Stand-alone Power Modules



### OCS Architecture

- Platinum-level efficiency
- 1600 W PSU with optional battery backup (BBU) power; up to six PSU in parallel
- Battery provides >35 sec run time (plus 10 second 'walk-in' period)
- Flexible, optimized, customizable chassis/rack-level deployments



### PS1000 and PL1000 12 V PSUs Project Olympus Architecture

- 92% peak efficiency
- 1000 W PSU
- Internal 680 W N+1 redundant
- Dual three-phase AC input with input voltage selector
- Fault mode resiliency
- PMBus® compliant
- PL1000 includes embedded BBU



### PS1650 12V PSU Project Olympus Architecture

- 91% peak efficiency
- 1650 W PSU
- Fault mode resiliency
- Up to four hot pluggable PSUs per system
- PMBus compliant

## Isolated and Non-Isolated Products

Advanced Energy's Artesyn portfolio of DC-DC converters includes both isolated and non-isolated converters. These products support a two-stage power conversion design or a single, direct conversion design to realize power architectures within a server.

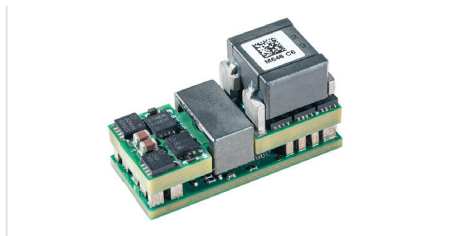
The Artesyn ADC100 converters follow the industry's first standardized footprint for this class of product. Artesyn was one of the founding members of the Power Stamp Alliance which defined the standard footprints.



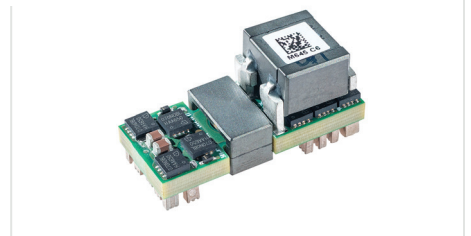
### ADC100M and ADC100S Direct Conversion

- 100 A PSA Main and Satellite footprints supported
- 1100 A to 600 A combination of one Main plus five Satellites possible
- SVID and AVSBus control interface available
- 1.8 V and 1 V nominal output voltage versions
- >93% efficiency targeted

ADC100M



ADC100S



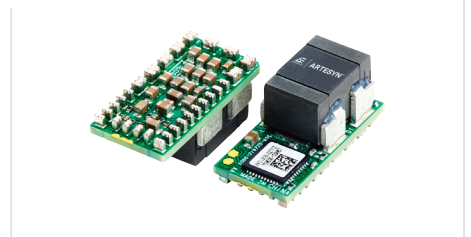
### LGA110D, LGA80D, and LGA50D Non-Isolated

- 220 A per in<sup>2</sup> current density
- Flexibility of use with digital/analog control
- Wide-range output (0.6 to 5.2), dual independent channel
- Stackable up to four (4) units:
  - 440 A for LGA110D
  - 320 A for LGA80D
  - 200 A for LGA50D

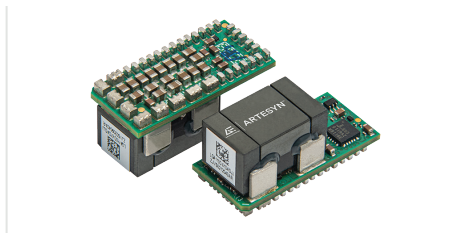
LGA50D



LGA80D



LGA110D





## Isolated 12 Vout 1/8 and 1/4 Bricks

- 1/8 brick: 300 W and 550 W
- 1/4 brick: 500 W, 600 W, 700 W, 800 W, and 1300 W
- Digital control and interface
- Up to 97.5% efficiency

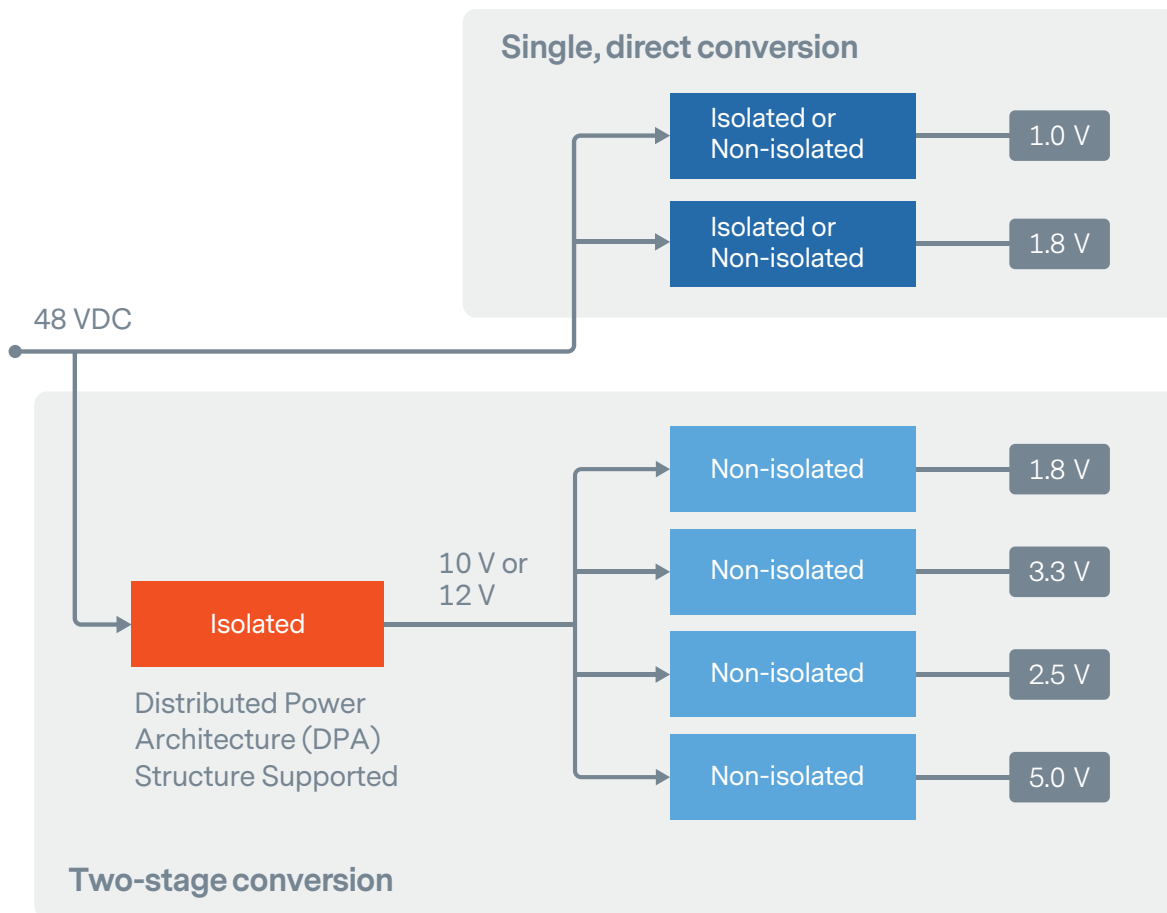
ADO550



BDQ1300



## 48 Volt Input Hybrid Power Conversion Architecture



## Industry Standard Power Supply Options

Industry standard form factors for computing, storage, and networking needs

### Industry Standard Features

- Platinum-level efficiency
- Standard and reverse airflow options
- 450 to 3000 W
- N+1 or N+N redundancy
- Hot pluggable PSUs
- PMBus® compliant



1U x 80 mm x 280 mm

- DS1200-3 (1200 W)

1U x 54.5 mm x 322 mm

- DS760SL-3 (760 W)
- DS1100SLPE (1100 W)



1U x 86 mm x 195 mm

- DS495SPE-3 (500 W)
- DS750PED-3 (750 W)
- DS1100PED-3 (1100 W)
- DS1600SPE-3 (1600 W)
- DS2000SPE-3 (2000 W)
- DS2400SPE-3 (2400 W)



1U x 80 mm x 195 mm

- CSV550BP-3 (550 W)
- CSV750BP-3 (750 W)
- CSV900BP-3 (900 W)
- CSV1100BP-3 (1100W)
- CSV1300BP-3 (1300 W)
- CSV1600BP-3 (1600 W)
- CSV2000BP-3 (2000 W)



1U x 73.5 mm x 185 mm

- CSU550AP-3 (550 W)
- CSU800AP-3 (800 W)
- CSU1300AP-3 (1300 W)
- CSU1800AP-3 (1800 W)
- CSU2000AP-3 (2000 W)
- CSU2400AP-3 (2400 W)
- CSU2000ADC-3 (2000 W)

## Custom PDU Solutions

### Basic Features

- Input options: Three-phase Wye or Delta up to 528 VAC, Single-phase up to 277 VAC
- Multiple output receptacle configurations including 277 VAC options
- Class A EMI
- Breaker protection for outputs
- Factory installed input cables
- Various mounting location options

### Advanced Features

- Intelligent power management for remote monitoring and control
- Environmental monitoring
- Input overcurrent protection
- Surge suppression and filtering
- Status LED indicators for alarms





## Why Work with Advanced Energy?

### 01 Shorter Time-to-market

We use modular hardware and software approaches to help drive mature solutions during development. Your custom power solution will benefit from our design experience and years of applied deployments. Our in-house EMI/EMC compliance and safety certification laboratory help speed the product design process.

### 02 Higher Reliability

A wide range of on-site environmental testing capabilities ensures Advanced Energy products are designed for quality and reliability.

### 03 Greater Scalability

Our design philosophy helps drive common platforms that are scalable, programmable, and plug-compatible with our earlier-generation products, enabling quick system changes or enhancements. You can now satisfy most changes in power requirements simply by reprogramming the power supplies — and if your needs change radically, our scalable platforms allow fast transitions to optimized designs.

### 04 Higher Efficiency

We not only design some of the highest efficiency power supplies on the market, Advanced Energy power solutions incorporate best-in-class technology, powerful programming, monitoring, and self-testing software that provides the critical data you need to manage power consumption.

### 05 Dedicated Project Team

Your power conversion project will be handled by a seasoned and committed team of expert engineers, project managers, and operations professionals to ensure it is delivered on time and on budget.

### 06 Outstanding Technical Support

Our experienced field application engineers will ensure the solution meets your needs and are backed by a dedicated customer application support lab that is staffed by power engineering experts and fully equipped to test almost any power supply for almost any application. With this capability, we're able to test how power supplies will perform in certain situations and provide written application test notes.

### 07 In-house Manufacturing

Advanced Energy products are backed by state-of-the-art equipment, innovative automation processes and industry-leading quality.

### 08 Operational Excellence

We use innovative demand and supply replenishment systems with an uncompromising focus on helping you succeed.



For international contact information,  
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## ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. We design and manufacture highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

Our products enable customer innovation in complex applications for a wide range of industries including semiconductor equipment, industrial, manufacturing, telecommunications, data center computing, and medical. With deep applications know-how and responsive service and support across the globe, we build collaborative partnerships to meet rapid technological developments, propel growth for our customers, and innovate the future of power.

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