



DC POWER SOLUTIONS for Core Applications

Delivering High Availability,
Energy Efficiency and Scalability
for Converging Networks



Vertiv™

Vertiv designs, builds and services mission critical technologies that enable the vital applications for data centers, communication networks, and commercial and industrial environments. We support today's growing mobile and cloud computing markets with our portfolio of power, thermal, infrastructure management products, software and solutions, all complemented by our global service network. Bringing together global reach and local knowledge, and our decades-long heritage including brands like Chloride®, Liebert®, and NetSure™, our team of experts is ready to take on your most complex challenges, creating solutions that keep your systems running—and your business moving. Together, we're building the future of a world where critical technologies always work.

YOUR VISION, OUR PASSION.

VertivCo.com



The Challenge

We are witnessing exciting times for the telecommunication industry. As the digital transformation, with the emergence of IoT enabled devices and increases in data transfer speed demands, telecom and datacom sites are required to adapt their critical infrastructures. Keeping operating costs in check while delivering high availability and superior quality of service is a constant concern. Regardless of size, you can't afford for your critical network infrastructure to go down.

The Path to a Highly Available Core Site

Meeting the expectations for constant availability while minimizing operational cost is key, whether you need DC back up for 12V, 48V or 400V power. Building your core site with reliable components designed to achieve high efficiency is a great way to control cost – from the rectifiers within the DC power systems to cabinets that minimize energy losses in power conversion from grid to load. Choosing the right DC power solution for your application needs helps keep CapEx and energy losses to a minimum. Performing regular maintenance, executed by an experienced service team, ensures the equipment is working reliably at all times and at optimal efficiency.

Dependable battery backup is also essential. Batteries need to be monitored to ensure they are healthy enough to support the load when needed. Additionally, the ability to measure and log power consumption and trends for each individual load on site is important. This type of intelligence enables you to anticipate when batteries need to be replaced or predict overload before it occurs.

When high availability is crucial, invest in a DC power solution that protects your bottom line.

CHALLENGES	CONSEQUENCES	OPPORTUNITIES
<p>Network availability impacted by:</p> <ul style="list-style-type: none"> • Matching capacity and protection needs with demand • Live site maintenance and repair. 	<ul style="list-style-type: none"> • Costly deployment of excess capacity up front • Disruption of service. 	<ul style="list-style-type: none"> • Scalable power systems that can be safely adjusted during live operation to meet power demand today and tomorrow • Power supply and load distribution optimization • Ensure the health of your power infrastructure with regular preventive maintenance.
<p>Operating cost impacted by:</p> <ul style="list-style-type: none"> • Improper solution dimensioning causes power and cooling inefficiencies • Lack of visibility to site metrics including current load, rack load, and energy use. 	<ul style="list-style-type: none"> • Site inefficiencies reduce overall profitability • Load buildup and potential overload. 	<ul style="list-style-type: none"> • Reduce system heat dissipation to improve energy efficiency • Energy consumption mapping to identify site load distribution inefficiencies and possible hotspots in advance • Reduce unnecessary travel to site with remote services that enable you to identify issues and take corrective actions
<p>Network convergence is causing:</p> <ul style="list-style-type: none"> • Difficulty predicting future load requirements • Increased network complexity due to explosion of data traffic • Large fluctuations in the mix of AC and DC power. 	<ul style="list-style-type: none"> • Live site work to meet new demands may disrupt service • Increased CapEx to compensate for power fluctuations. 	<ul style="list-style-type: none"> • Safe system expansion with live distribution and circuit breaker changes to easily adapt to new load requirements • Ability to power AC and/or DC loads within the same power system to accommodate network convergence • Implement 400V DC power to reduce AC to DC conversions, minimize use of copper and save floor space.

A Brilliant Combination of Technology and Real-World Capability

The Vertiv line of DC power systems demonstrates unparalleled reliability and industry-leading efficiency ratings at 12, 48 and 400 VDC. These power solutions can be further enhanced with the addition of intelligent controllers, remote system monitors, battery management units and a full range of distribution modules.

48V DC Power

Incremental Growth for Site Expansion

NetSure™ 7100 & 8100 Multi Cabinets

NetSure DC power multi cabinet systems deliver outstanding reliability within a modular, scalable cabinet platform. Expansion is easy, as power can be scaled incrementally on live sites. Distribution units and rectifiers can be added, swapped or removed from existing cabinets. Each cabinet can



be equipped with up to 12 single-phase 3.5 kW rectifiers or 8 three phase 5.8 kW rectifiers.

High Capacity in a Small Footprint

NetSure 7100 Semi-Bulk and Bulk

NetSure DC power bulk systems are designed to satisfy the need for reliable high capacity back up in smallest possible footprint. Options include pure bulk systems paired with designated distribution cabinets for DC power output. Bulk systems come with 3.5 kW rectifiers and are rated up to 210 kW



per system. Space saving semi-bulk models are available with integrated distribution and equipped with 30 rectifiers or Semi-Bulk XL option with 60 rectifiers per cabinet.

DC Power Back Up in a Single Footprint

NetSure 7100 Stand-Alone Cabinet

With a scalable configuration in a single, stand-alone cabinet that occupies minimal space, the NetSure 7100 delivers affordable high power density with outstanding efficiency and system reliability. Power can be scaled with 3.5 kW rectifiers up to 63 kW per single cabinet. Complete



systems with up to 21 kW power including distribution and batteries in a single footprint.

Quick and Easy Work on Live Sites

Remote Distribution Cabinets

The 48V NetSure Advanced Remote Distribution and high capacity cabinets are designed for use in close proximity to -48V data or telecom loads. They offer quick, safe and reliable ways to



feed the loads on sites with changing power needs. In combination with the Intelligent Load Management option, this system delivers a detailed understanding of all site loads and gives early warning of possible overload.

Batteries Nicely Contained

NetSure Battery Cabinets

Battery cabinets are available in the NetSure look and feel to match existing equipment onsite. These cabinets offer an aesthetic housing for your batteries and can be equipped with internal



battery protection. Open racks are also available for simplified and efficient storage of batteries.

AC & DC Back Up in a Single Footprint

NetSure 7100 Converged Cabinet

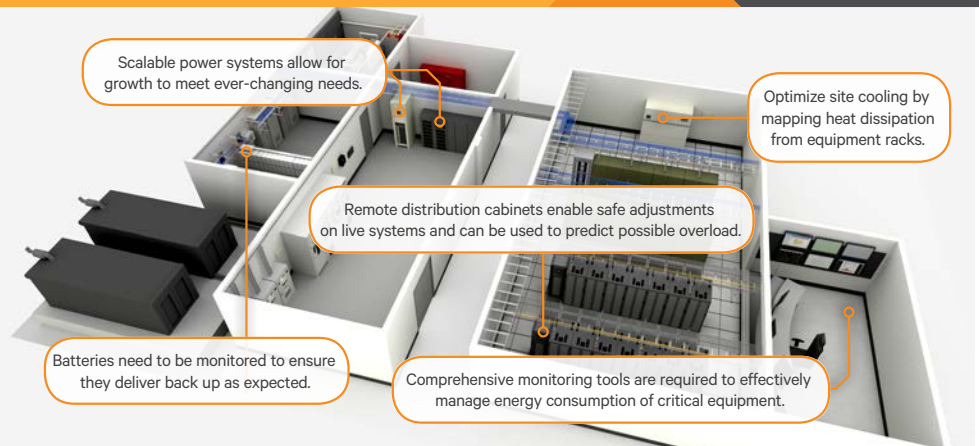
NetSure 7100 converged AC and DC power cabinets deliver power flexibility for various load types, minimizing energy loss and reducing heat dissipation. This easy to use system occupies a minimal footprint



and eliminates the need for separate AC and DC backup since rectifiers and inverters are fed from the same battery bank. Compact and scalable TSI™ inverters deliver a pure sine wave AC supply and provide up to 20 kVA capacity to the AC load. Total system capacity is 63 kW.

We understand your operating challenges

Vertiv has the technology and expertise to meet and overcome your operating challenges.



Upgrading Technology for Less

Retrofit Applications

NetSure systems for retrofit applications offer a cost efficient way to upgrade an existing power system while keeping present infrastructure



intact. Old rectifiers are replaced with high efficiency eSure™ rectifiers, substantially improving system power efficiency and reliability. Retrofit solutions can be installed on live systems with no interruption of service, enabling you to upgrade technology at a fraction of the cost.

World Class Reliability World Class Power Density

NetSure Systems with eSure™ Rectifiers

eSure high-efficiency rectifiers deliver superior operating performance and uncompromised reliability.



The 3,5kW G3 eSure rectifier offer superior power density, yet with the well known reliability, durability and efficiency of all eSure rectifiers. The eSure rectifier is also available as Ultra High Efficiency version. Three phase and single phase rectifiers alike offer wide temperature operating ranges and supply DC power even under the harshest conditions.

Global Resources with Local Knowledge

Vertiv's service expertise and project management capabilities make core site planning and deployment easy. We have the resources to service your facility anywhere, anytime.

Simplifying Installation

Vertiv's Deployment Services use a holistic approach to your network to make sure that every facet of your infrastructure is rapidly deployed and operating at maximum efficiency from day one. We offer a full portfolio of essential services, from site survey to hand over of the site, all managed through a single interface thanks to regional project management teams.

Improving Availability, Energy Use, Maintenance Costs and CapEx

By leveraging our in-house knowledge of DC power, inverters, batteries, generators, thermal management, UPS, alternative and other energy sources, we pay attention to the entire system and help keep your network reliable in even the most remote or challenging environments. With remote monitoring – managed by your Network Operating Center or our Energy Operation Centers, staffed 24/7/365 with experts in all disciplines – you receive a continuous stream of vital health parameters and alarms from the site. This knowledge provides early warnings to protect you against failures or enable you to act quickly if an issue should arise.

Preventive Maintenance

Keeping your equipment at best possible status requires regular maintenance. Vertiv can serve as the single point of contact for all your maintenance needs. We understand your specific challenges and will tailor a service agreement that meets or exceeds your requirements.

Optimizing Backup Time

Vertiv Branded Batteries

We offer a wide range of VRLA batteries perfectly suited for -48VDC telecom applications.

Vertiv's Duration 40-100-165-190-200Ah

12V battery block range provides affordable-, reliable-and long lasting top terminal front access float application batteries in energy dense format.

Vertiv's Excellence 100Ah 12V and 200Ah 6V battery block range provides most long lasting-, reliable-and energy dense top/front terminal float application batteries that can be fitted in 400mm depth battery compartments.



Monitoring & Control

Comprehensive real-time monitoring of your DC power network infrastructure is enabled by a full range of products from Vertiv. With Intelligent Load Management, an optional patented utility, Vertiv's NetSure™ Control Unit (NCU) offers three advanced functions that optimize network efficiency and deliver maximum availability.

Intelligent Load Management

Individual Current Measurement

Configure & Monitor Each Load

Individual current measurement makes it possible to configure and monitor each load, and display performance data down to the distribution/fuse/breaker level. With the help of Hall effect elements or shunts, each circuit breaker or fuse feeding the load will be constantly measured and monitored. An early warning based on threshold levels means that measures can be taken before a possible overload occurs.

Customer Power Consumption Mapping

Ensure billing according to energy usage

Power consumption mapping can be used to show aggregated power for each tenant on shared/hosted co-location sites. Maintenance staff can easily view and obtain rack current, power, energy and cyclical power consumption data for each tenant. Network elements such as servers/switches/routers can be logged and billed based on their individual energy utilization. With full overview of each tenants aggregated power consumption, network providers can operate shared/hosted co-location sites with full energy cost control.

Site Power Consumption Mapping

Identify Load Distribution Inefficiencies

Power consumption mapping can also be used to display each site rack's power performance characteristics. Discovering when and where power is consumed helps operators identify site load distribution inefficiencies. Since power to servers typically relate to heat dissipation, power consumption data is a good indicator of site hotspots. This can be used to adjust cabinet loads or placements to obtain optimal site cooling efficiency. Understanding power distribution on site is the first step to a cost effective energy savings plan.



Individual circuit breaker readings show current for each circuit breaker in relation to predefined threshold levels.



Power consumption map showing aggregated power for each customer on shared/hosted co-location sites.



Power consumption map showing load (amps), status and position on the floor plan of all connected DC equipment.

Vertiv has the technology, expertise and global reach to build and support your telecom and data network infrastructure.

- Maximize network availability with highly reliable systems that can log individual loads and give early overload warnings
- Lower operating costs by optimizing energy efficiency with high efficiency rectifiers, systems and supporting tools
- Minimize CapEx and risk with scalable infrastructure that can easily adapt to changing site requirements.

We consistently anticipate your rapidly changing business environment, so your technology investments – and your business – run without interruption.

Monitoring Hardware & Software

Vertiv has a complete portfolio of hardware and software designed to collect the most important information for your site infrastructure to easily monitor your site and speed up the resolution of any incidents that may arise.

Increasing Availability

NetSure Control Unit

The state of the art NetSure Control Unit (NCU) is designed for easy use with a start-up wizard and intuitive user interface. Connect to Ethernet via IPv4 and/or IPv6 with dual Ethernet ports and local DHCP laptop connection. The NCU offers advanced battery monitoring and optional Intelligent Load Management, and is backward compatible with NetSure SCU+, ACU and ACU+ controllers.



Enabling Centralized Control

EnergyMaster Site Controllers

Controllers can be connected to Vertiv as well as third-party equipment, enabling full remote monitoring and control of your DC system and other site equipment.



Advanced Monitoring Capabilities

EnergyMaster Supervision Modules

Supervision modules provide information, alarms, control of batteries and voltages, current and AC grid site data, and connection to auxiliary equipment such as climate units, inverters & building alarms.



Managing Energy Consumption

EnergyMaster™ ENEC Monitoring System

ENEC is a supervision and control system, managed either by your own



experts or monitored 24x7 by Vertiv's team of remote services infrastructure experts. By gathering and analyzing customer site performance and alarm data, this system helps customers increase network reliability and benefit from a continuous cycle of operational improvements across the network.

Data Traffic & Computing Demands Drive Adoption of New Technologies

Advances in power conversion technologies and increasing use of DC-based equipment at core sites has driven 12V and 400V DC power distribution to become a safe and viable alternative to traditional power architectures.

12V DC Power

Eliminating Conversion Stages

In-Rack NetSure Solutions

The compact and modular NetSure 12V DC power system is designed to provide a total DC power solution, complete with battery backup, for a wide range of data rack applications. The system supplies up to 6000 amps at 12 volts DC via high efficiency 3 kW switch mode rectifiers. A system control card controls and monitors the rectifiers and battery backup units while communicating with the rack management system.



400V DC Power

Significantly Reduce Cost and Improve Site Design

NetSure 400V DC Power Systems

Our NetSure 400V DC power systems are built with proven topologies including modular, hot-swappable 15 kW rectifiers that achieve greater than 97% peak efficiency, providing a low cost of operation on top of exceptional NetSure reliability.

400V DC power systems, expandable to up to 900 kW total capacity, can increase overall power efficiency, reduce infrastructure footprint and improve availability compared to modern alternatives.

NetSure 400V DC to -48V DC converter systems can also be used to maximize copper reduction benefits of 400V DC and still enable the use of existing -48V DC networking loads in core telecom applications.





Vertiv.com | Vertiv Infrastructure Limited, George Curl Way, Southampton, SO18 2RY, VAT Number: GB188146827

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