

POWERBOX  
Mastering Power

A Cosel Group  
Company

Custom capabilities

P R

B X





# Index

The combination of our extensive standard product range, our custom design capability, and our service offering, is truly unique. 40+ years of designing power supplies for demanding applications has built a rock solid experience. Our "Making the complex simple" business idea runs throughout our operation, from our customer interface and cooperation to how we design our products.

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# Powerbox custom capabilities

## **Environment: Implementing environmentally friendly technologies and processes**

Powerbox places the environment and sustainable development at the forefront of everything that we do. In fact in product development, manufacturing, supply, sourcing and operations we are constantly implementing technologies and processes that reduce energy consumption and other environmental impacts.

- Reduction of traveling by the implementation of video-conferencing systems
- Deployment of collaborative tools that contribute to high efficiency levels in our work
- Employees are engaged in our sustainability program
- Working in close cooperation with our partners to reduce waste
- Developing technology platforms with lower components count
- Optimizing sourcing and supply to reduce environmental impact

## **Development: Thanks to our rich and unique design pool our development times are short**

With more than 3,500 implemented power supply solutions we own one of the most comprehensive libraries of circuit layouts, specifications, mechanics and specialized expertise. This allows us to develop customized and efficient power solutions in a shorter time, reducing Time-To-Market. This also guarantees that our customers receive a product that is both highly competitive and energy efficient.

- Experienced, highly qualified development teams
- Extensive library of proven technical solutions
- Flexible design teams that can be matched to each individual requirement
- Teams composed of EMC experts, CAD specialists, top programmers, etc
- Experienced project managers act as your Single Point of Contact (SPOC)
- More than 60 % of our R&D staff are electronic engineers or technicians

## **Manufacturing: Strong focus on environmental and supply chain efficiency**

With a strong focus on environmental issues and reducing our carbon footprint, our policy is to use a reduced impact manufacturing location while fully supporting our customers. Powerbox has a long partnership with world-class electronics manufacturers, including ISO13485 certified facilities, constantly monitoring their quality and their respect for an ethical code of conduct.

- Manufacturing in Europe for pilot production and supply chain delivery to European markets
- Partnerships in Asia for large-volume production and a supply chain into Asia
- Grouped shipments and sea transportation for Asian production
- UL and CSA certified production facilities
- Consistently traceable production processes
- Quality audit and respect of Code of Conduct on regular basis



# Powerbox custom capabilities

## **Economic viability: Efficiency rules**

Simplicity is one of our core values and we always apply this principle when developing a new product (standard, modified-standard or custom). Combining the extended technology platform with local manufacturing, testing facilities and configuration center, we optimize the solution to match your budget envelope.

- Short development cycle based on extensive technology platforms and expertise
- Modified standard power supplies for very short times to market
- Modular solutions combining standard modules with additional intelligence
- Preferred manufacturing location for supply chain optimization
- Supply chain permanently working on cost efficiency and critical components
- Securing long lead-time components avoiding supply chain disruption
- Optimized project management to reduce cost and time
- Flat hierarchy and agile process with efficiency in mind

## **Ruggedness: Power supplies for the toughest environments**

Delivering reliable, robust power supply solutions for the most extreme conditions are all part of Powerbox's ruggedized platforms. With experience and expertise in transportation, railways, aeronautics, oil and gas, and defense, we have designed and delivered products and solutions capable of handling the toughest conditions such as:

- Harsh vibration, e.g. in rail vehicles or wind power plants
- Wide operating temperature ranges, e.g. -40°C to +85°C in railway applications
- Extreme humidity and condensation, e.g. deep-sea environments
- Extreme magnetic fields, e.g. in magnetic resonance imaging equipment with a field strength of 2 tesla

## **Precision: High-quality engineering without compromise**

Most of our power supplies are used for applications in which absolute precision is essential (e.g. in studio equipment, flight control systems, or power plant control technology). All technical specifications and certifications are meticulously met and controlled in accordance with industry standards while meeting the customer's specific requirement and exceeding normal standards.

- Quality management, ISO 9001 certified and monitored by independent auditors
- Production control and device inspections according to UL and CSA; fulfillment of ATEX and IECEx requirements for explosive environments as well as numerous other standards for EMC, rail traffic, high performance electronics, etc.
- Products with stable output voltages with low output noise and fluctuation
- Highest levels of efficiency based on most recent technologies
- State-of-the-art switching technologies
- Digital control and monitoring platforms (e.g. DSP, Microcontroller, State Machine...)



# Powerbox custom capabilities

## Testing: Detailed tests for each power supply unit

We test each and every device thoroughly and place the same level of requirement on our partners. We use advanced automated test equipment ensuring that functional and safety tests are carried out to meet the most demanding quality standards. Burn-in testbeds are computerized and permanently monitored to guarantee the highest quality.

- 100% device-specific routine tests
- Intensive check of the power supplies' mechanical attributes, coating and encapsulation
- Microcontroller programming and calibrating
- In-house engineered measurement system for samples and design verification
- Automated test system with extended parameters and matrix data analysis
- Testing of line regulation, load regulation (dynamically and statically), efficiency measuring, ripple and spike measuring, etc.
- Traceability by archiving of all measurement results for each power supply unit supplied

## Adaptation: Reducing costs with standard power supplies while meeting individual specifications

Simplicity and efficiency are part of our DNA, and despite our extensive range of standard products, your application may require something more involved than that, but not a full custom solution. This is where our development teams in Gnesta (SE), Bremen (DE) and Etten-Leur (NL) can combine standard products with extra circuitry (e.g.

filters, sequencing, monitoring) or specific mechanical arrangements that will fully meet your application requirements. In addition, we are working with qualified partners complementing our modular platform, extending our solution offering.

- Expertize from the 3,500 custom and modified standard projects delivered to market
- Low to high power extensive applications database
- Combined expertise from the three design centers
- Qualified partners in specific areas

## Integration: Seamless system integration up to level 3

Working closely with our customers, we have gathered extensive knowledge and experience regarding the integration of power supplies in virtually any system, and we know there are many challenges far beyond the power supply that might happen during system development. We are able to provide support up to and including the last mile, seamlessly integrating products into unexpected system variations or older equipment upgrades.

- Virtual prototyping by CAD simulation prior to prototyping
- Assembly of cabinet systems, racks, subracks, casings, plugs, cooling and ventilation technology, etc.
- Proprietary mechanical construction with decades of experience in customized casing
- Control of thermal profiles, EMC guidelines
- Smart interface integration (e.g. I2C, USB, RS232, RS422, RS485, SPI, CAN)



# Powerbox custom capabilities



## **Experience: Half a century of innovation**

With half a century of innovation, over 3,500 customized power supplies solutions, millions of standard power supplies shipped to demanding applications and close cooperation with leading partners, we can assist our customers from the early stages of design through to very late integration. However, our experience is much more than just products, we 'Master Power' from single components to complex applications.

- 50 years of experience in developing, manufacturing and integrating power supply solutions, paired with extensive practical expertise in demanding industries
- Millions of standard power supplies sold
- Sourcing, manufacturing, and specialized contacts established, intensified, and optimized over the course of decades
- Highly qualified, experienced, top engineers
- Three design centers with unique expertise in industrial, medical transportation and defense

## **Network: Global network – local presence**

With offices in Eusope, USA and Asia, we are able to provide localized support to all of our customers – wherever they are located. We have high levels of expertise to manage transferred business, for example when the design-in took place in a certain part of the world (e.g. Europe) and manufacturing in another part (e.g. Asia Pacific) with a strong focus on business continuation. Our logistics department is also used to managing complex projects being relocated during their lifetime to accommodate customers' supply chain, reducing the environmental impact. In addition to our own network, we rely on local partners adding competence and value to our products and solutions.

- Localized offices with native speaking employees
- Expertize in local laws and regulations
- Use of collaborative tools to interconnect all offices and shorten decision times
- Dynamic business flow expertize
- Regional warehousing, optimizing supply chain



Temp Air	25.56 C	Date	1/26/2014	Customer	World
Temp Wk	33.94 C	Time	00:00	Status	Work
Temp Wk	32.15 C	Job	WMS076	Scale	MAX



# Industrial solutions

## **From watts to kilowatts**

We have been powering demanding industrial applications for more than 40 years. The more demanding the application, the better the odds we can offer you a differentiating advantage in the form of an optimized solution. "Demanding" might for instance refer to electrical specification, environmental conditions, EMC requirements, or number of outputs. Our solutions span from single output converters to systems with multiple outputs, redundancy, back-up, etc.

Our range of power converters covers AC/DC, DC/AC, DC/DC with a wide span of voltages and power, from a few watts to many kilowatts. The extensive standard range, comprising a combination of our own designs and products from our leading partners, is complemented by our custom design capabilities, ensuring we can always provide optimized solutions. We accommodate any mechanical format and several different cooling principles. Communications interfaces and control software can also be incorporated.

We have a long term approach to customer relations. Working together we create competitive advantages by means of optimized power solutions.

## **Typical demanding industrial applications**

Our extensive experience in powering industrial applications covers many different application areas, as automation, building control, signaling, test & measurement and many more. Some examples are:

- Automation
- Building
- Information and communications technology
- Test and measurement
- LED
- Environmental technology

## **Standards**

The standard which to us in itself is a definition of the Industrial segment is EN/UL60950 and the coming UL/EN 62638 standard.

With 40 years of designing Industrial power supplies and systems we are not only experienced in meeting various standards for different types of applications or different parts of the world. We have also followed the development of new standards and are well prepared for the requirements to come.

# Capacitor bank replaces batteries

## 29F 54V 60A S-CAP

Critical applications operating in hostile or confined environments are strictly regulated in terms of chemical and other hazardous risks, reducing or forbidding certain type of batteries such as Lithium Ion.

For safety reasons, those applications must have a power backup long enough to run alarms and safety shutdown processes. In such arduous conditions conventional batteries are replaced by supercapacitor banks whose values could be from few Farads to 200 Farads for general applications, but up to container size in the case of large systems.

### Features

- Energy storage system with ultra capacitors; no build-up of explosive gases
- Current output 5s at 60 A, 30s at 25 A
- Charging current of up to 150W
- Automatic cell monitoring and control
- Capacity of 29 F
- Overvoltage protection
- Shock and vibration protection



S-CAP BOOST technology tightly controls vital parameters, from a single 2.8V cell supercapacitor to a wide range of assemblies delivering a specific voltage and energy required for a given application.

### Input

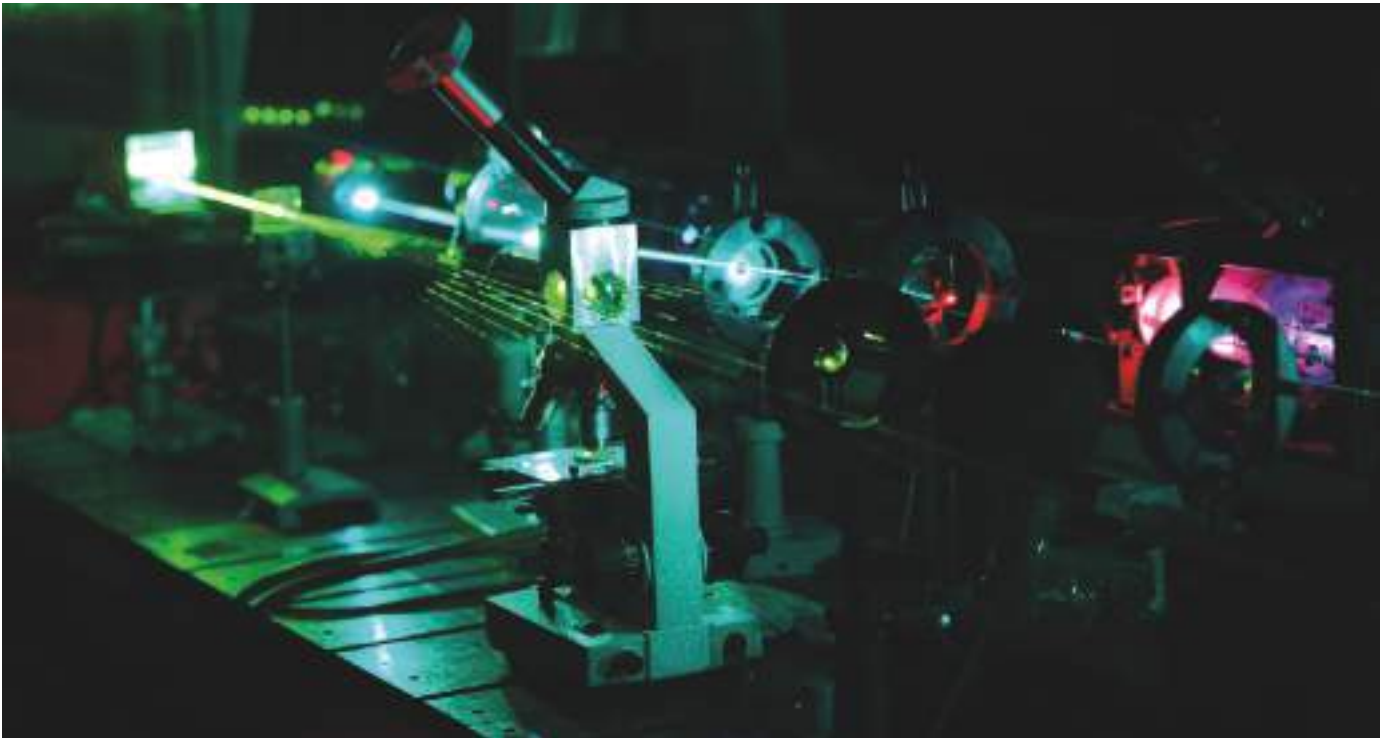
- 40-57 VDC

### Output

- 55VDC
- 5s at 60 A, 30s at 25 A

### Dimensions

- 320 x 280 x 125



# Power for factory automation

## ENI250A24

Factory automation is already well established in many industries, but with the progress in Artificial Intelligence (AI), remote communication and the growing demand for shorter customers lead times, it is predicted to explode in coming years. Similarly, the growth of automated parcels-hubs is expected to rise spectacularly. The rapid development of e-commerce has contributed to the creation of highly automated hubs with conveyers, sorting switches and many other equipment requiring efficient and intelligent power solutions able to work in demanding environment.

Parcels hub designers and operators are facing multiple challenges in having to deal with a large variety and types of equipment. One problem is being able to guarantee hub operation 24/7 with no downtime. This requires very high reliability levels in all parcel handling equipment from 'In to Out'. This not only requires high quality, high performances power supplies, but the ability to operate in harsh environments with a complex mix of mechanical, thermal and electrical constraints. Hub operators also require simple, painless solutions when it comes to maintenance and upgrades, which translated into power supplies requirements means the communications interface, IP54, the ability to deliver peak power and even to manage energy recycling.

Designed to meet such demanding requirements with built in high Ingress Protection (IP) for harsh environments, Powerbox's three-phase ENI250A24 is not only a robust and efficient power solution but a mechanically reconfigurable platform able to fit different form factors or even direct integration into DC motors.

### Features

- High capacitive load
- DC-OK
- Remote reset
- Peak power
- Efficiency up to 94%
- Soft start <6A
- Paralleling for increased power or redundancy
- IP54
- LED status indicator
- Custom features by microcontroller
- Warranty, customer choice 1-5 year



The ENI250A24 is equipped with a micro controller to manage functions and protective circuits. Functions like peak power, current trip and others can easily be set to suit customers' specific needs. It offers a peak power level up to 480W for startup of electrical motors or relays. Mounting brackets available for easy installation, with no need for additional casing.

The ENI250A24 is designed using Powerbox's reliable power platform concept and uses a high efficiency power factor correction (PFC) in combination with a compact resonant topology. Customer benefits include low power losses and a compact, flexible solution.

### Input

- 323-560VAC 3phase

### Output

- 24VDC, other voltages on request
- Power 250W
- Peak power 480W, 1s

# Power supply unit for chemical process control systems

## VP1200

The VP 1200 is used in a chemical process control system, which is why we equipped it with a double overvoltage protection (OVP). Thanks to its two converters, the power supply unit is highly efficient. Whenever the power output sinks below a defined value, one of the converters goes on standby until the power demand increases.

## Features

- Wide input range (93 – 253 VAC)
- Active Power Factor Correction (PFC)
- High efficiency (> 87 %), from 15 to 100 % load
- Build in blocking diodes
- Cooling by temperature controlled internal fan
- IEC input socket
- Safety acc. EN 60950 standard, UL 508 approved
- ATEX, IEC-EX approved
- Microprocessor based passive load sharing
- Microprocessor based thermal management
- Wall mounting cassette
- Temperature range from –40 °C to +70 °C
- Double Over Voltage Protection (OVP)

## Input

- 93 – 253 VAC



## Output 1200 W

- 25 VDC / 48 A, switchable to
- 28 VDC / 43 A

## Dimensions

- 90 x 140 x 408 mm (DxWxH)

## Option for output voltage

- 48 VDC, 60 VDC, 110 VDC, 120 VDC



# Multiple output AC/DC converter for high end microscopes

## VP168

The key challenge in developing this power supply unit consisted in its extremely compact design. Our developers succeeded in exhausting the full potential of the output/volume ratio for this device. Similarly difficult was the integration of this complex unit into the microscope system. The main criteria to be considered here were the electro-magnetic compatibility and the thermal and mechanical design of the unit.

## Features

- 115 / 230 VAC input
- High efficiency (> 80 %)
- Two fixed outputs (24 VDC and 5 VDC)
- Adjustable output (0 –12 VDC)
- 12 VDC output monitoring
- Convection cooling
- Thermal protection
- Safety acc. EN 60950 standard, UL/CSA approved
- IEC input socket incl. switch

## Input

- 115 / 230 VAC



## Output 168 W

- 24 VDC / 2 A, fixed
- 0–12 VDC / 9.2 A, adjustable
- 5 VDC / 2 A, fixed

## Dimensions

- 70 x 130 x 100 mm (DxWxH)





# Medical solutions

Higher-than-normal requirements for personal safety and reliability are the main defining factors for our Medical Power Solutions.

Patient safety is critical when it comes to medical equipment. So powering that equipment involves precision manufactured power converters, working within controlled design criteria, with high reliability as a given. Such designs require higher levels of insulation and superior EMC performance. Lean design with low component count, together with high quality components, enhances reliability. System solutions with redundancy and back-up can increase availability. Convection cooling increases reliability and eliminates fan noise.

Our product range for medical applications covers AC/DC and DC/DC converters, from single units to complex systems, from watts to kilowatts. We have been solving complex challenges in power for the medical market for more than 30 years. In addition to meeting regulatory and specification requirements, every Powerbox medical power solution has this experience built-in.

## Core strengths

Powerbox excels in designing power converters with low leakage currents, whilst providing superior EMC performance in lean design concepts. One of our recognized core strengths involves designing medical power products featuring low component count designs, ensuring long life products, with low stand-by power and high efficiency. Another core strength is designing advanced systems such as high voltage generator systems.

## Powerbox experience in medical power supply

In our 30+ years of designing and selling medical power supplies we have gathered experience from a large variety of medical applications. As in all other fields where we are active we are primarily focusing on applications with some more demanding aspects. This could be in electrical specification, reliability requirements, space restrictions, environmental aspects, to mention a few. Some medical applications where we have carried out several projects and thereby accumulated specific experience are:

- Diagnostic equipment and systems
- Therapy equipment and systems
- Monitoring and display
- Home patient care
- Surgical devices
- Medical printers
- Biolife science
- X-ray

# Power supply unit for MRT systems

## GB350

The biggest challenge in developing the GB350 did not emerge until we started realizing the project. Since the power supply unit is used in a MRT system, it is exposed to a very strong magnetic field. This meant that we could not use an inductive unit with a magnetic core for this product.

The solution for this problem consists of a new technology. Newly developed coreless induction units allowed the power supply to operate flawlessly even in a strong magnetic field. In addition, we integrated an 80-dB shielding that shields the MRT system from interferences from the measuring system.



## Features

- Fully DSP-regulated converter
- For use in strong magnetic fields
- Ventilation with integrated speed control
- 80dB screen for the front connectors
- Special casing for optimized ventilation
- New technology with magnetic coreless inductivity
- 2.4 MHz switching frequency

## Input

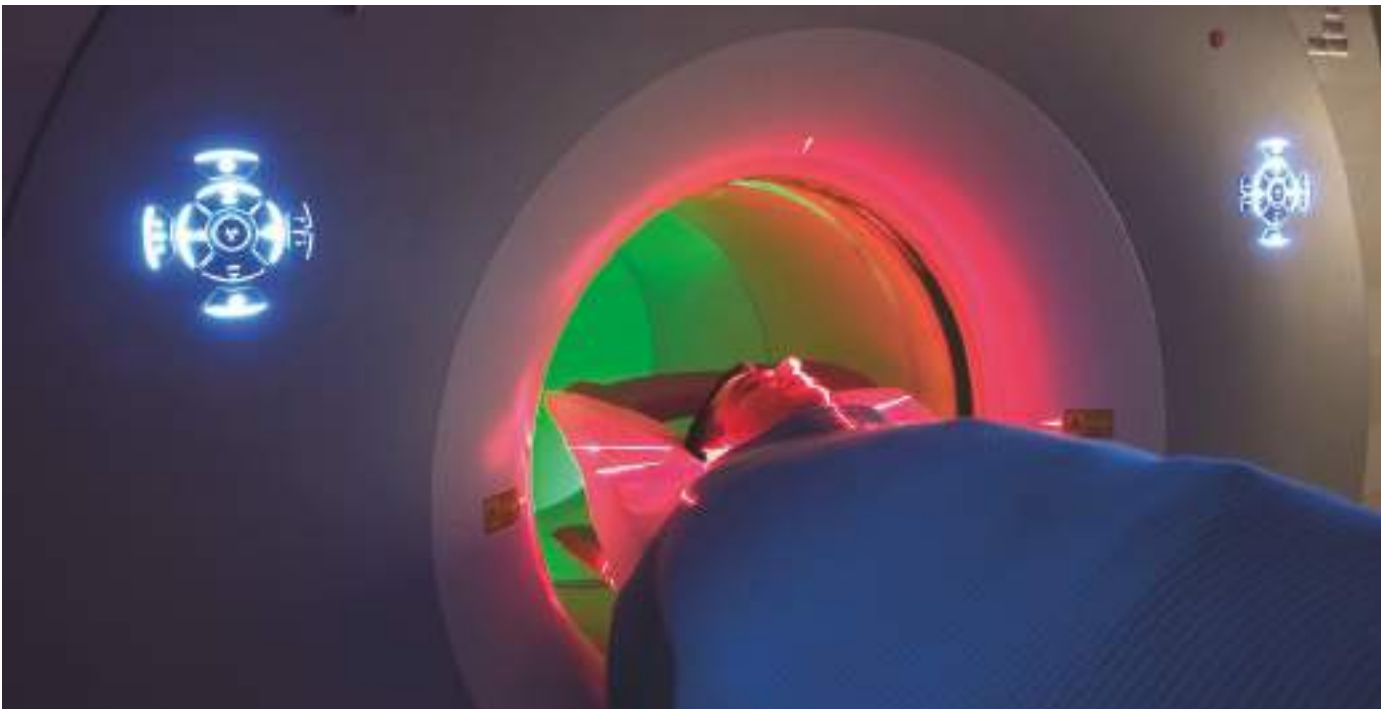
- +13 VDC

## Output

- +6.90 VDC / 60 A
- +3.45 VDC / 50 A
- +1.65 VDC / 50 A

## Dimensions

- 280 mm x 9 HP x 6 U (DxWxH)





# Ensuring safe battery backup for medical devices

## SMM900A2C6-C

Medical devices used within the professional healthcare environment may often have the need of a battery backup to ensure a safe operation of the Medical Device its powering.

Powerbox flexible design offering can utilize standard off the shelf medically approved AC/DC converters for a certified MAINS isolation providing 2MOPP and easily tailor a DC/DC solution to fit the system requirements of the Medical Device. Based upon the already certified mains converter the approval for the complete system is made easy for class II Medical Devices.

The SMM900A2C6-C is a dual output unit providing a battery voltage output as well as a second regulated output. SMM900A2C6-C can be equipped with either one battery pack (48V/7Ah) or two depending of the backup time required. Available time during battery operation is >20 minutes ensuring that the patient treatment may continue or safely be discontinued. Recharging time approx.4 hours. Status signals are available both as visual indication and monitoring signals via a d-sub connector. The battery fuse unit is both equipped with a circuit breaker of 20A as well as a relay that disconnects the load at low battery voltage.

### Features

- Medical DC UPS system
- Containing charger, battery, distribution
- Application is positioning system for treatment bed
- Regulatory compliance by ETL listing
- Monitoring
  - Mains voltage level is OK signal
  - Charger output voltage is OK signal
  - Converter voltage is OK signal (both 24 V, redundant, converters)
  - Battery voltage and battery fuse is OK signal
  - Temperatures is OK signals, three internal sensors combined

### Input

- Nominal input 100-240 VAC
- Input range 90-264VAC
- Frequency 45-65 Hz
- Input source current max 9A rms



During maintenance the engineer can disconnect the mains voltage and safely monitor the battery discharge cycle to estimate the remaining lifetime of the batteries.

Powerbox extensive knowledge within battery charging allows for either advanced control and monitoring functionalities or, equally safe, more simplified float charge types. By the use of a microcontroller the charging characteristics may as well be tailored to the specified requirements of the battery manufacturer.

### Output

- Output 1: 48 VDC: 44-56 VDC max 700W
- Output 2: 24 VDC (redundant): 22.8-25.2 VDC max 300W

### Environmental

- Operating temperature +10°C to +40°C
- Storage temperature 0°C to +70°C

### General

- Over current protection
- Over temperature protection
- Over voltage protection
- Dimension 483x266x400 mm (width 19", height 6U)
- Weight 25 kg with one battery unit 36 kg with two battery units
- MTBF >10 years (batteries excluded)
- Isolation 4,000 VAC primary - secondary
- Connections via screw terminals and/or lockable connector
- Battery deep discharge protection
- Temperature indication via LED and d-sub connector

# High peak load applications

## SMM3000A80024-C

Laser equipment is widely used in medical applications and from cosmetic through to general surgery they all require power supplies to be able to deliver very high peak energy levels to the laser or discharge tubes. However, high peak energy and the repetition thereof generates electromagnetic radiation and line disturbance. This is a challenge for power designers who need power solutions that are able to deliver the required amount of power without generating line disturbances, whilst also guaranteeing patient and operator safety when high voltages and energy levels are involved during the process.

CO<sub>2</sub> (carbon dioxide) laser or Erbium YAG are commonly used in medical applications, though the energy released during the pulse related to the specific task varies by a large amount. There are different types of pulsing for CO<sub>2</sub> lasers. In the cosmetic world, there is a newer technology called UltraPulse (which consists of a very short pulse duration with high pulse power and very high influence), that is even faster than SuperPulse (medium pulse duration with medium pulse power). A good device has less than a millisecond pulse width, meaning that it is incredibly fast-firing, requiring the power supply to be able to deliver high energy levels during the pulse, but also able to restore energy for the next pulse. A tough ask.

Designed to meet such requirements, the Powerbox SMM3000A80024-C is a 2.25kW AC/DC capacitor charger certified to comply with the medical safety standard IEC60601-1 3rd. The power supply provides a level of protection, primary to secondary main output of 2xMOOP, and 2xMOPP to auxiliary output. To accommodate different capacitor banks and applications, the output voltage can be adjusted from zero to 800VDC (600VDC nominal) with an output current of 5.5A at nominal.

### Features

- Microprocessor controlled charging
- Soft start function
- Signalling and control via D-sub (set, monitor and fault reporting)
- Temperature controlled fans
- 5V stand-by

### Input

- Wide input range, 193-264 VAC, 50/60Hz 1ph
- PFC stage and soft start circuitry



An automatic current controller guarantees that the power envelope is always within safe limits, reducing capacitor aging and overstressing of components, thus contributing to a longer lifetime. The SMM3000A80024-C has a built-in microprocessor constantly monitoring the charging status, reporting end of charge and discharge level, as well as all protection warnings due to abnormal operation such as over-temperature, over-voltage and current.

To reduce line disturbances the SMM3000A80024-C includes a very high efficiency power factor corrector (PFC), soft-start circuitry, filtering and is housed in a six-sided shielded case. To limit audible noise to a minimum, the SMM3000A80024-C's fans are thermo-controlled, regulating their speed to the minimum required for normal, safe operation.

The SMM3000A80024-C also delivers an auxiliary output voltage of 24VDC, reducing the need for an additional power supply to power laser controller and interfaces.

### Output

- 0-800 VDC, 5.5 A, 2.25 kW max

### Environmental

- Operating temperature +10°C to +50°C, altitude 2000 m

### General

- Dimension 383 x 88.5 x 218.5 mm
- Primary to secondary O/P1: 2 MOOP, O/P2: 2 MOPP
- Primary to ground 1 MOOP
- Secondary to ground O/P1: 1 MOOP, O/P2: 1 MOPP

# Power system for mobile medical electrical equipment

## SMM650A-C

Power systems for mobile medical electrical equipment (MEE) can be very complex and depending on the final application, composed of multiple power level sub-systems such as a battery charger, a boost charger to supply energy to the high voltage element (e.g. laser, X-Ray), peak energy storage, and regenerative energy using supercapacitors. Power systems for MEE often include digital control and a communication capability with other medical equipment.

Powerbox's SMM650A is a power system purpose designed for Mobile Medical Electrical Equipment (MEE) applications and for use within professional healthcare environments, bringing advanced healthcare closer to the patient's location. This power system is developed for use specifically with imaging equipment, supporting both low and high voltage areas as well as charging battery banks and handling regenerative power from motors with an environmental aspect in mind. The system's high voltage parts support approximately 35kW peak power with high repeatability. SMM650A complies with the medical safety standard IEC 60601-1 3rd edition and provides an isolation of 2xMOPP.

In order to deliver the different voltages and peak power required by medical imaging equipment, the SMM650A includes a high efficiency master power unit supplying voltage to a DC/DC battery charger especially designed for safe charging the system's high voltage Li-ion battery bank. The charger delivers 3.25A and a nominal output voltage of 200VDC. To deliver peak power to the high-



voltage element, a booster charger pumps up the 200VDC to the desired voltage, charging a supercapacitor bank and making it possible to deliver a very high peak current without disturbing the main power supply.

The SMM650A power unit also supplies power to the DC propulsion motors, assuring the mobility of the MEE. For safety reasons the propulsion motors use 24VDC. A power converter steps down the 200VDC from the battery to 24VDC and when the MEE is stopped, the reverse energy is stored in the supercapacitor bank, saving energy and power dissipation. Being able to deliver peak-current, the supercapacitor bank can deliver the energy required by the DC motors without disturbing the main system voltage and also reducing stress on the battery.

## Features

- Battery charger: PWM controlled charging cycle.  
Fan output
- Boost charger: Constant current
- Load dump: Protecting the system against voltage raise during motor breaking. Storing regenerative energy in super capacitors

## Control

- Battery charger: PWM pulse xxxxx

## Input

- Battery charger: 50 VDC,  $\pm 5$  VDC (Start up at 40 VDC).  
Power loss <38W efficiency
- Boost charger: 200 VDC
- Load dump: 24 VDC

## Output

- Battery charger: 200 VDC, 3,25 A
- Boost charger: 100 VDC
- Load dump: 24 VDC, 42 A

## Dimensions

- Battery charger: 130 x 95 x 50 mm
- Boost charger: 285 x 95 x 70 mm
- Load dump:

## Environmental

- Operating temperature +10°C to +40°C



# Transportation solutions

A moving non-controlled environment is a challenge for any electronics. Our power solutions for transportation are well prepared for this.

The transportation industry is enormous, encompassing everything from municipal bus, subway, and commuter-train systems that get people to and from work and school, container ships that transport goods from port to port all around the globe; from the rail and trucking networks that move those containers across states, countries, and continents and many more requiring efficient and reliable power solutions. Powerbox has more than 40 years' experience in designing and delivering transportation power supplies for applications in railway, marine and automotive. From watt to multi kilowatts we are able to design and supply the most efficient power solution to your application.

## **Railway**

There are many challenges in ensuring a stable and reliable power supply system in the railway industry, requiring to conform to several international standards and regulations. Our power solution for railway are designed to comply and to guarantee sustainable power to any of your applications.

Railway applications can be divided into rolling stock and track side, with the former dividing again into propulsion and car body. Most of them share the combination of higher than normal reliability requirements and a challenging environment. Propulsion system applications are among the most challenging anywhere with regard to the reliability/ environment combination. Powerbox has more than 40 years' experience in designing and delivering railway power supplies for all types of railway applications. Our customer base is considerable, which has led to an enviable reputation and track record of reliability and our LCC (Life Cycle Cost) is second to none. We work with some of the largest players in the international rail industry – a position of trust we value highly.

## **Marine**

Powerbox has focused on developing switching power supplies for the marine market for more than 40 years. The requirements imposed on products responsible for shipping and offshore installations are heavier than the

average for industrial and office environment. In addition, that standardization in the requirements is complex, requiring in depth knowledge of the application and where it will be operated. Our power solutions for marine are designed to comply and to guarantee sustainable power to any of your applications.

Powerbox delivers a complete range of marine power supplies which are type approved for use in all spaces in ships and offshore installations. This means that the user no longer needs different types for different applications, but can cover all needs with those standard power supplies. Also in the marine industry, there is a need for more and more functionality in a smaller space. Ship owners nowadays want to equip their vessels with broadband internet connections for both passengers and crew with as much as possible the same features than when ashore.

## **Automotive**

The industrial automotive industry comprises a large segment of diverse applications such as buses, trucks, industrial vehicles, mobile machinery e.g. mining equipment, forklifts, cleaning, automated machines, emergency, and service vehicles, all requiring flexible power solutions. Such operating conditions necessitate power supplies to include state of the art power switching technology to reduce power dissipation, coupled with thorough mechanical and thermal designs to ensure reliability and a long life. Our power solutions for automotive are designed to guarantee sustainable power to any of your applications.

Our range of automotive power supplies covers AC/DC, DC/AC, and DC/DC with a wide span of voltages and power, from a few watts to many kilowatts. The extensive standard range, comprising a combination of our own designs and products from our leading partners, is complemented by our custom design capabilities, ensuring we can always deliver optimized solutions. We can accommodate virtually any mechanical format and several different cooling principles. Communications interfaces and control software can also be incorporated. Most of all we have a long term approach to customer relations, and working together we create a competitive advantage by means of our optimized power solutions.

# Battery backup system for railway signalling

## BBU1200

Railway modernization, now integrating digital control and additional safety functionalities, requires new generation of equipment for signalling - with monitoring and independent battery backup. Part of the modernization will require to maintain and upgrade existing systems without any traffic disruption, demanding high flexibility in the power solution deployed on track side.

To achieve this goal, Powerbox developed a modular concept, making it easy to adjust to different configurations. On installed based, power modules and monitoring units can be substituted by the new generation fitting into the existing chassis. In case expansion or high level of upgrade, requiring very short time to operation, the new modular racks can be customized to specific configuration to power new signaling equipment such as optical fiber transmission.

Combining high efficiency switching with an optimized topology integrating control and monitoring, the new generation of Powerbox Track Side Power System for signalling offers a significant cost saving compared to conventional technology. The platform includes a range of products which can be quickly modified to meet specific demand such as adaptive voltage and power to the length of the track and to the number of systems powered on the signaling network.

## Features

- Active Power Factor Correction (PFC)
- Two independant battery strings
- Automatic battery capacity tests
- Build-in output distribution
- Integrated controller for power and charging management
- Various alarm signals
- All modules pluggable
- Complete subrack pluggable



The power supplies units are enclosed in metal cases with a 230Vac input, delivering regulated voltage to the signaling equipment (ac and dc). The system also incorporates a power supply backup system based around SLA batteries.

The entire system is intended to be installed, maintained, repaired and eventually decommissioned with the minimum possible time spent track side. Any part/company likely to fail during the life of the system must have provision to be quickly and easily repaired or replaced. Our units are plug and play components so they can be changed very easily and quick.

## Input

- 185-253 VAC or 93-253 VAC

## Output

- 24 VDC / 1200W (battery voltage)
- Option 110 VDC / 1200W

## Dimensions

- 19" x 6U x 235mm (DxWxH)
- Option 19" x 3U x 235mm rated 400W

# Precharger unit

## ENR1000-PC

Two separate units. One for output 400VDC (model no ENR1000D110/400-PC), another for 600VDC (model no ENR1000D110/600-PC).

The precharger unit converts the input battery voltage to a regulated output voltage to charge capacitor bank. The unit will be used to charge the DC-link to a reduced voltage level of 400VDC/600VDC. An enable input signal is used to set the precharger unit in active mode or standby mode. A power OK output signal indicates normal/abnormal status.

The precharger unit will start to charge the DC-link when the enable input signal is set to high level. Enable signal is normally set to low level when the DC-link is charged to 400VDC/600VDC. The primary side, secondary side and the I/O interface are galvanic isolated from each other.



### Input

- Nominal input voltage 72-110VDC
- Min voltage 50VDC
- Max voltage 137.5VDC
- Max peak voltage 154VDC, max 100ms
- Input current max 20Arms
- The converter is protected against reversed polarity
- Input current level <5A after 1ms
- Max peak inrush current <350A

### Output

- Output voltage nominal 400VDC/600VDC
- Min voltage 380VDC/540VDC
- Max voltage 420VDC/625VDC
- Output ripple voltage <2%
- Continuous output power 70W during 5 minutes at ambient temperature +70°C
- Capacitance load 5 to 35mF at 400VDC, 10-12mF at 600VDC
- External output reverse voltage max 5800VDC
- Overvoltage, overload and short circuit protection
- Thermal protection

### Environmental

- Operating temperature range -40°C to +70°C, EN50155 temperature class TX
- The internal temperature protection circuit can be activated if the number of repetitive charging cycles will be more than 5

- Storage temperature -40°C to +85°C
- Shock and vibrations IEC61373, Cat 1 Class B

### EMC

- Design acc to EN50155, EN50121-3-2 and EN50121-5
- ESD acc to IEC61000-4-2 and IEC62236-3-2
- Fast transient immunity acc to IEC61000-4-4 and IEC62236-3-2
- Surge acc to EN61000-4-5 and IEC62236-3-2

### Electrical Design

- Precharger unit is designed acc to EN50155, EN50124-1 and IEC61287-1
- Insulation secondary side to ground 8.5kVDC, 1 min
- Insulation primary to secondary side 8.5kVDC, 1 min
- Primary input side to ground 1.5kVDC, 1 min
- I/O interface 1.5kVDC, 1 min
- Clearance and creepage distances acc to IEC664
- Overvoltage category II, pollution degree II
- Material group IIIa, CTI 175-400
- Max working voltage between 0V output (X2) and ground (PE) 3000VDC

### Mechanical

- 229 x 184 x 86mm (output cables and connectors excl)
- Weight max 2.5kg

# Flexible power solutions for marine commander bridge

## OFMA60AD12

The requirements imposed on products responsible for shipping and offshore installations are greater than the average ones for industrial and office environments. They require power designers to follow strict design rules, employ technologies and the selection of components that comply with international standards.

Generally two zones are recognized on a ship, namely the "bridge and the open deck zone", and the "general power zone" which basically covers all other areas of the ship. The open deck areas and bridge place extra demands on electromagnetic emission and immunity (EMC) since sensitive equipment is positioned here such as communication, radar and navigational devices. The EMC requirements regarding emissions are required to be below the known EN55022 Level B and measurement begins at 10 kHz instead of the usual 150 kHz.

The limits regarding mechanical and climatic requirements are also more demanding than for the average industrial application. Vibration levels up to 4g are common, as well as large temperature fluctuations ranging from -25 to + 70 degrees C, and high relative humidity where condensation cannot be excluded.

In the case of powering critical equipments such as those used for navigation and safety, power supplies are connected to two power networks, a 90 to 264VAC one which is the common voltage distributed from the power generators to the overall vessel, and to a 24VDC supply used for the battery backup system in case of failure of the main voltage.

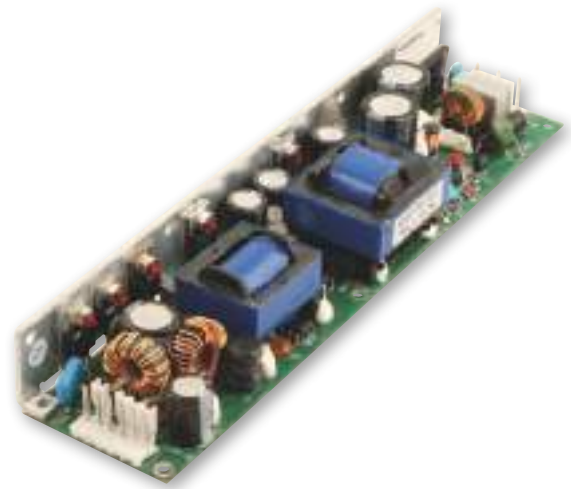
In normal circumstances power supplies are fed from the AC supply, but in the event of this being lost for

### Features

- Design optimized for convection cooling
- Dual input voltage AC and DC
- Automatic switching of input supply in the case of main power failure
- Meets marine safety and environmental standards

### Input

- 90 to 264VAC
- 17.5 to 36VDC



whatever reason, they need to be powered by the DC bus and changeover is to be effected without interruption. This is a particular feature designed by Powerbox in the OFMA60AD12, thus guaranteeing full performance in both conditions.

Designed for commander bridge applications where noise levels must be kept to a minimum, the OFMA60AD12 mechanical design has been optimized for natural conduction cooling. All dissipative components are fixed to a single metal plate that can be attached to a heat sink or a cold wall.

The OFMA60AD12 complies with maritime navigation and radio equipment systems (General requirement / Method of testing and required test results) IEC 60945, as well as other related standards for ICT and radio equipment such as EN55024, EN55022, EN61000-6-3 and EN61000-6-1.

### Output

- 12VDC, 5A, 60W

### Environmental

- -20°C to +70°C



# Highly integrated 300W DC/DC converter for eMotiv

## ENA300-48S13.7

The automotive industry comprises a large number of segments operating in a wide range of varying applications. These applications require flexible power solutions able to deliver stable voltages with immunity from line disturbances, feed a growing number of connected devices and Internet of Things and eMotive applications. From geo localization systems installed in fleets of vehicles to the latest generation of buses equipped with video-on-demand per seat and high speed internet connections, the automotive industry requires a new generation of power supply technology that is simple to install, simple to operate and comes in a standardized packaging.

Part of Powerbox's Automotive Line, the ENA platform has been developed in response to the automotive electronics equipment manufacturer's demand for a 'standardized' mechanical format in a low profile packaging that is lower than 20mm (0.8") to accommodate isolated, non-isolated, charging and other power functions as required by the technology thirsty automotive industry.

Based on a low-component count approach for optimum reliability, Powerbox's ENA platform features a high-efficiency power switching topology to reduce power losses, planar technology with thermal-drains and low ESR MOSFETs, and is manufactured using a so called back-flip assembly process to increase cooling capacity. The platform offers a quick solution to automotive system designers when wanting specific requirements in the form of a 100W to 400W power module that is not available 'off the shelf', and simultaneously requiring a very short time to prototype.

### Features

- Reliable front edge design
- Very low component count
- High efficiency
- Wall mount mechanics
- Low profile design
- Conduction cooling

### Input

- 38-65VDC

### Output

- 13.7V / 22A



The ENA300-48S13.7 is a good example of the adaptability of the ENA platform. Within a few weeks it was able to provide a specific power solution for an eMotive equipment application powered by a 42V Lithium ion battery. The final equipment required a very stable voltage to power embedded computer and communication systems when the battery could be in discharge mode or on peak charge when the system was recycling energy e.g. when driving downhill or stopping.

With an IP-class of 21, galvanic isolation, low conducted and radiated EMI, the ability to sustain 2kV surges along with a requirement for simple installation, the ENA300-48S13.7 also benefits from the high volume manufacturing levels of the standard ENA series, reducing time to production and time to customer.

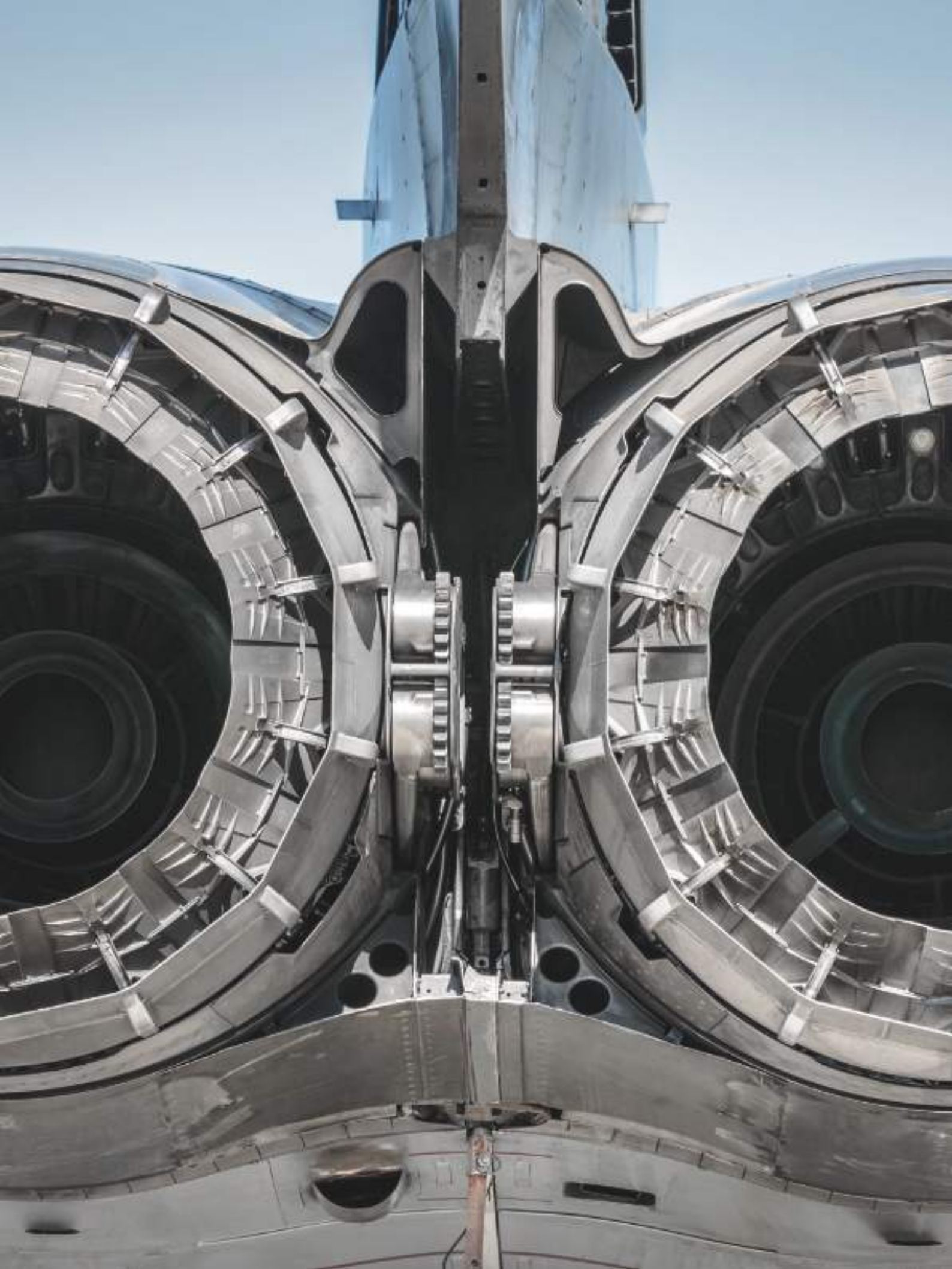
The ENA300-48S13.7 is but one amongst many modified versions of the ENA standard offered by PRBX, and is a Swiss army knife for automotive designers who require evaluation samples to quickly test their application and drive them rapidly forwards into production.

### Environmental

- Humidity 100% non-condensing
- Ambient temperature -20°C to +50°C (70°C baseplate)
- RoHS and REACH compliant

### General

- Power efficiency 95%
- IP-Class IP21
- Isolation input/output and input/output to case 500VDC
- Weight 500 grams
- Housing: Plastic enclosure, polycarbonate



# Defense solutions

## **From watts to kilowatts**

We have been powering demanding industrial applications for more than 40 years. The more demanding the application, the better the odds we can offer you a differentiating advantage in the form of an optimized solution. "Demanding" might for instance refer to electrical specification, environmental conditions, EMC requirements, or number of outputs. Our solutions span from single output converters to systems with multiple outputs, redundancy, back-up, etc.

Our range of power converters covers AC/DC, DC/AC, DC/DC with a wide span of voltages and power, from a few watts to many kilowatts. The extensive standard range, comprising a combination of our own designs and products from our leading partners, is complemented by our custom design capabilities, ensuring we can always provide optimized solutions. We accommodate any mechanical format and several different cooling principles. Communications interfaces and control software can also be incorporated.

We have a long term approach to customer relations. Working together we create competitive advantages by means of optimized power solutions.

## **Typical demanding industrial applications**

Our extensive experience in powering industrial applications covers many different application areas, as automation, building control, signaling, test & measurement and many more. Some examples are:

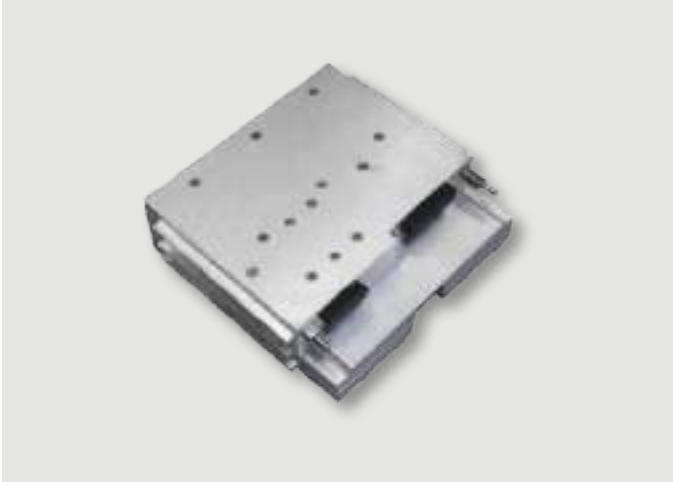
- Automation
- Building
- Information and communications technology
- Test and measurement
- LED
- Environmental technology

## **Standards**

The standard which to us in itself is a definition of the Industrial segment is EN/UL60950.

With 40 years of designing Industrial power supplies and systems we are not only experienced in meeting various standards for different types of applications or different parts of the world. We have also followed the development of new standards and are well prepared for the requirements to come.

# Defense solutions

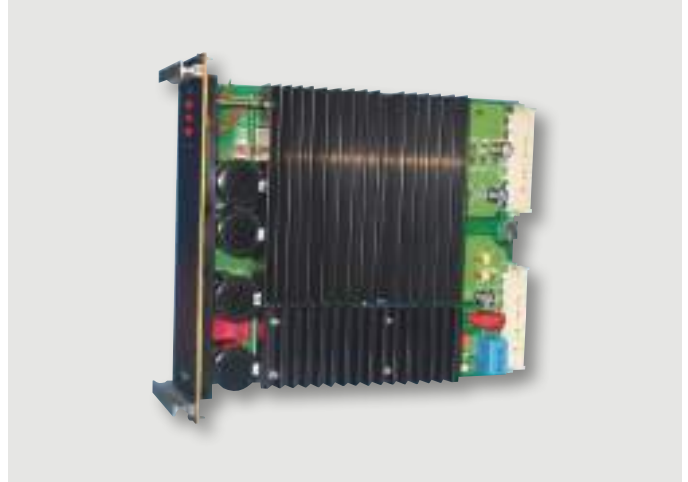


**Application** Military airborne application

**Outline Specification** 60W convection cooled DC/DC converter, 28VDC i/p, 3 o/p voltages. Solid extruded aluminum case.

**Design** Customized using standard brick converters

**Reason for Success** Powerbox success was due to a willingness to produce prototype units very quickly along with low NRE charges.



**Application** Naval sonar application

**Outline Specification** 800W AC/DC converter with outputs i.e 3.3VDC, 6VDC and 12VDC. Approved to MIL-STD-461E, MIL-STD-1676-1, MIL-STD-901C and EN61000-3-2

**Design** Customized using 3 standard brick converters with a discrete PFC stage

**Reason for Success** Powerbox success was due to providing a highly efficient power supply incorporating extremely low noise output voltages.



**Application** Anti-ship missile test system

**Outline Specification** 1kW convection cooled AC/DC converter. 115Vac three phase input with 5 output voltages.

**Design** Customized using 5 standard brick converters and 5 discrete outputs

**Reason for Success** The reason for Powerbox's success was simple – the customer could find no one else who would design & manufacture a unit to their specification!



**Application** Power supply for antenna aerial

**Outline Specification** 60W DC/DC converter with 28VDC input and 3 DC output voltages.

**Design** Discrete component design.

**Reason for Success** Powerbox success was due to being able to produce a mechanically complex designed unit with a difficult high voltage rail delivered with low NRE charges.

# Defense solutions



**Application** Vehicle mounted missile guidance system

**Outline Specification** 85W DC/DC converter, 22-33VDC input. Outputs: 24VDC, 5VDC, 3.3VDC with current limited filter output. Approved to MIL-STD1275B (Military vehicle voltage standard) MIL-STD461E (Military EMC standard) MIL-STD810F (Military environmental)

**Design** Customized design using board mount converters.

**Reason for Success** Powerbox success was due to quick time to market and compact size.



**Application** Mobile military VHF radio

**Outline Specification** AC/DC converter 28VDC@400W output, with customized mechanics. Approved to MIL-STD-461E, MIL-STD-810E/F

**Design** Customized modular design.

**Reason for Success** Powerbox success was due to quick time to approve and get to market.

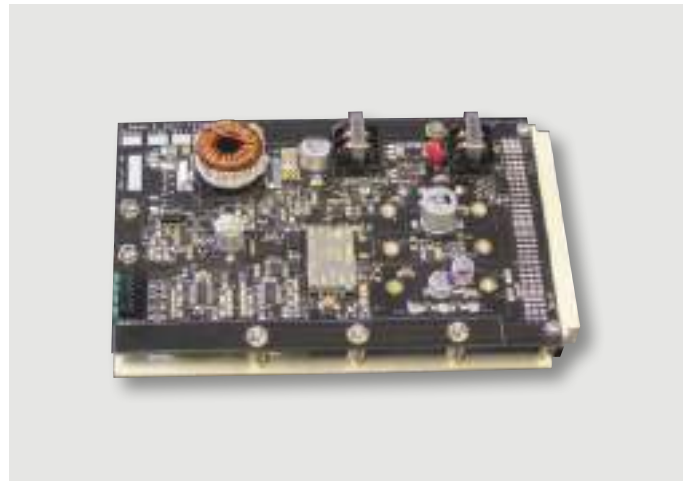


**Application** Missile launcher control module

**Outline Specification** 1.5KW DC/DC converter, several DC output voltages. Conformally coated designed unit with ruggedized chassis.

**Design** Customized using board mount converters with some discrete design circuitry.

**Reason for Success** Powerbox success was due to fulfilling extreme specification requirements, with very high temperature/environmental conditions.



**Application** Powering a controller for embedded computing and sensor electronics on helicopters

**Outline Specification** 60W mini-CPCI DC/DC converter with 28VDC i/p and 3 DC voltage o/p's . The unit was a ruggedized, conformally coated, baseplate design incorporating a Calmark locking system.

**Design** Discrete component design, incorporating board mount converters.

**Reason for Success** Powerbox success was due to being able to replace expensive custom power products by offering flexible customized units utilizing board mount converters

# About Powerbox

## **Who we are**

The combination of our extensive standard product range, our custom design capability, and our service offering, is truly unique. 40+ years of designing power supplies for demanding applications has built a rock solid experience. Our "Making the complex simple" business idea runs throughout our operation, from our customer interface and cooperation to how we design our products.

## **Improving your competitiveness**

The power solution chosen for any electronics has an impact on competitiveness. Function and reliability are given basics. Size, weight and audible noise might be important. Cost is always a consideration. Standards fulfillment can open up new markets. Time to market might be critical. Well executed supply chain management can generate savings. Aftermarket support has a lasting long term impact. The list goes on.

Our extensive experience and market awareness makes it simple to explain to us what you need. Together we define which power solution will serve your application the best.

## **Making the complex simple**

With our global presence we are close to you, and our knowledge and experience of working with so many different applications helps to make life easier for you. We can assist at all stages of product development, including evaluations, validations, and the writing of specifications. We aim for simplicity in design, referring both to lean design with fewer components and to a modular approach reusing proven circuits and building blocks, maybe with some modifications.

## **Quality assurance and follow-up**

Quality is an integrated part of everything we do. Our design process includes extensive testing, internal as well as external. Tests are also frequently run by our customers in their respective applications. In addition to the information we gain by tracking repairs and service requests, we also do regular quality follow up together with our customers, all to ensure a long and trouble-free life for our products. Powerbox is also certified by DNV according to ISO 9001:2008.

## **Manufacturing**

We manufacture at selected CEMs (Contract Equipment Manufacturer), where we apply rigorous process and quality requirements. We aim for long-term relationship with our manufacturing partners. A dedicated team for CEM Management and Quality Assurance work closely with them.

## **Caring for the environment**

At Powerbox we take an active role in protecting our environment. Our contribution includes:

Streamlined solutions and lean design using fewer components reduces material used. RoHS, WEEE and REACH are among the standards governing choice of materials.

High efficiency reduces energy consumption both directly by reducing losses and indirectly by reducing the need for cooling.

Energy efficient transportation and well developed use of online meetings are important elements in our determination to meet or exceed international standards by sustaining ISO-14001 compliance or the equivalent.

## **Providing peace of mind**

Even the best designed power solutions might require midlife support. Components involved in the design might be discontinued, or the application might be modified or changed, requiring changes in the power solution. In situations like this Powerbox' stability and endurance, and long term approach to customer relations, are true comforts.

## **About Cosel**

Established in Japan 1969, COSEL is one of the world's leading designers and manufacturers of high performance AC-DC Power Supplies, DC-DC Converters and EMI Filters. With quality, reliability & flexibility as our main focus, we pride ourselves on developing some of the highest quality and most reliable products seen anywhere in the world today. Our product range is aimed mostly at demanding applications within the Industrial, Factory Automation, Medical, Telecoms, Lighting, Audio/ Broadcast & Renewable Energy sectors. A flexible approach with full in-house design means we deliver products using the very latest technology meeting the growing demands of our customers.

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