

POWERBOX

Engineering Reliable Power

Medical

P R
B X

A close-up photograph of a medical device's rear panel. Four BNC-style connectors are visible, each with a grey coaxial cable plugged in. The background is slightly blurred, showing other ports and labels on the device. Overlaid on the image is the text 'PRBX' in large, white, sans-serif capital letters. The 'P' and 'R' are in the upper left and right, while the 'B' and 'X' are in the lower left and right.



Medical solutions

Power solutions for medical applications

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.

Standards for medical applications

Safety and quality, and with this the corresponding standards, are for obvious reasons paramount for medical equipment. The IEC60601-1 (ANSI/AAMI60601-1 in North America) is the main electro-medical safety standard. With the release of AM1:2012 for the 3rd edition of 60601-1 risk management file and process in line with ISO14971 are mandatory. External medical power supplies are considered stand alone equipment and therefore a risk management file is performed as a part of the safety approval process, whereas for internal power supplies that are integrated into the medical device system. The risk management is performed on system level by the medical device manufacturer. For quality ISO13485, generally harmonizing with ISO9001, is the quality management system standard for design and manufacture of medical devices. At Powerbox we not only meet what is required, but also prepare for what is to come. We support our customers in keeping their products in line with standards and related requirements.

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:

- Imaging
- Monitoring and display
- Therapy and home health care
- Bio Life science and diagnostics
- Surgical
- Dental
- Laser
- Ventilators
- Infusion pumps

Medical solutions

Standard products

Our extensive range of standard converters for medical applications comprises of both our own products, designed by our engineers and manufactured at world class manufacturing facilities, as well as products from our leading product partners. After working in the medical market for 30+ years chances are good we have a standard power supply to meet your needs.

Custom products

If a suitable product cannot be found from our standard product range, we can consider providing modified standard, semi or full custom solutions. Our custom design capability and reputation is second to none. We have completed more than 3,500 custom design projects to date, whereof 2,000 at our Gnesta, Sweden, design center.

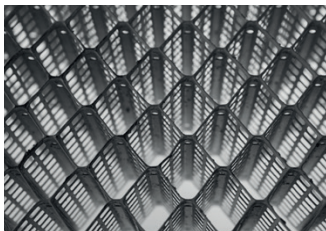
Services

The right product is essential, but it is not everything. In addition to product offerings we include a comprehensive range of services, from analysis and qualification in the development stage, demand planning and special logistics in the production phase, to RMA handling and end user support in the after-market. We aim to serve you with simplicity to ensure your customers return time and again.

Systems

An application might require more than a single converter. We then use our product range and our custom capability to build systems. These can feature multiple standard, semi-custom, and/or full-custom converters, battery backup, communications, remote control, intelligent charging, distribution panels, sub racks, enclosure etc., and maybe also a number of value-added services. We lean confidently on over 40 years of experience and subject matter expertise to identify the best means of solving every particular power conversion challenge. Together with our customers we find the optimized solution.

Some defining qualities of our medical power supplies



Reliability

- Low component count
- Extra long life components
- Superior EMC/EMI
- Convection cooling
- Intelligent over temperature protection
- Fanless cooling



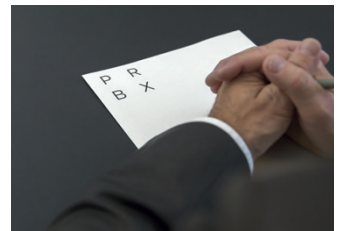
Personal safety

- Isolation barrier
- 2 x MOPP
- Class I and II double isolation
- Integrated IP21
- Low leakage current



Environment

- High efficiency
- Low standby power
- Lean design - reducing material use
- High power density reducing footprint
- Withstand shock and vibrations



Standards and processes

- IEC60601-1 Ed3.1
- IEC61000
- EN55011
- RoHS, RoHS 2, RoHS III, China
- RoHS, REACH
- ISO 9001
- ISO 14971 RMF
- ISO 13485

Standard products – Medline



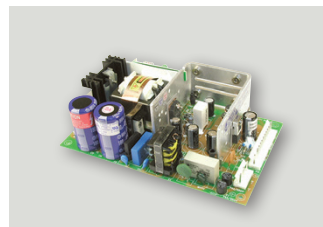
**Medline 40
OBH07 Series**
30-48W Open frame 2" x 4"
Universal input 90-264VAC
Multiple output 5, 12, 15, 24
or 48VDC



**Medline 60
OBJ07 Series**
37.5-64W Open frame 2" x 4"
Universal input 90-264VAC
Multiple output 5, 12, 15, 24
or 48VDC



**Medline 100
OFM100 Series**
100W Open frame 2" x 4"
Universal input 90-264VAC
Low leakage 75uA
EN55011/22 Class B
Single output 12, 15, 18 or 24VDC



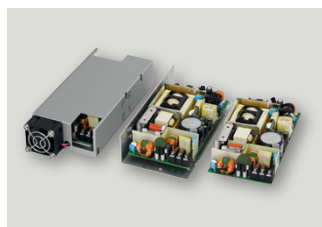
**Medline 110
OBL04 Series**
72-110W Open frame
Universal input 90-264VAC
Multiple output 3.3, 5, 12, 15, 24
or 30VDC



**Medline 200
OBN01, OBM08 Series**
200W Open frame
Universal input 90-264VAC
Single and Multi output



**Medline 225
OFM225 Series**
225W Open frame 3" x 5"
Universal input 90-264VAC
Single output 12.3, 15.3 or
24.4VDC



**Medline 300
OBP03 Series**
300W Open frame/L bracket/
Enclosed 3" x 6"
Universal input 90-264VAC
Single output



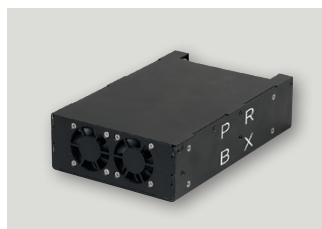
**Medline 400
OBP07 Series**
400W Open frame 7" x 4"
Universal input 90-264VAC
Single output 12, 15, 18, 24, 28, 36
or 48VDC



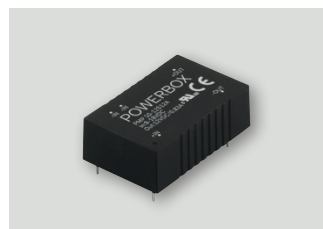
**Medline 450
OBQ05 Series**
350-480W Open frame 10" x 4.5"
Universal input 90-264VAC
Multiple output 12, 15, 24, 27, 30,
40, 48VDC



**Medline 650
OBR03 Series**
650-700W Open frame 10.5" x 5"
Universal input 90-264VAC
Multiple output 12, 15, 24, 27, 30,
36, 48VDC



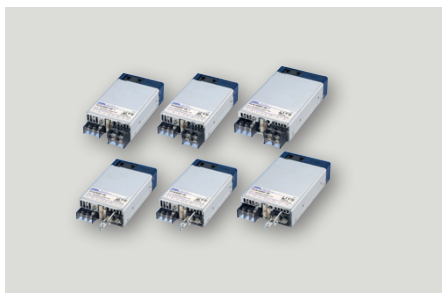
**Medline 1100
OBS01 Series**
1100W Open frame 5.91" x 9.25"
Universal input 90-264VAC
Low leakage 220uA at 264VAC
EN55011/22 Class B
Variable fan speed control
Single output 24, 28, 32, 36 or
48VDC



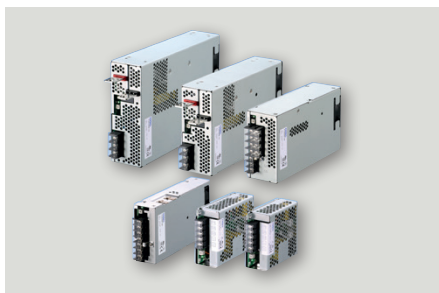
High isolation DC/DC
PMP series. 3 to 10W.
Isolation 3000VAC
PMP series. 3 to 30W.
Isolation 5000VAC.
Single & Dual o/p. 2:1 or
4:1 input voltage range.

Standard Powerbox products

Powerbox offers a broad range of standard power conversion products for industrial and commercial applications. The portfolio includes AC-DC power supplies, DC-DC converters, power modules, EMI filters, DIN-rail solutions, and configurable power systems available across a wide range of power levels and form factors.



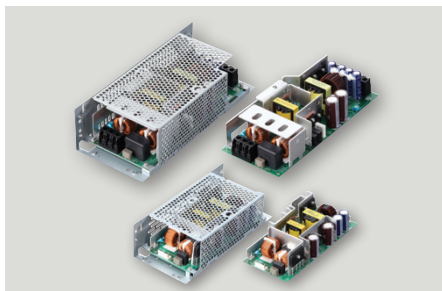
Programmable
300W-1500W



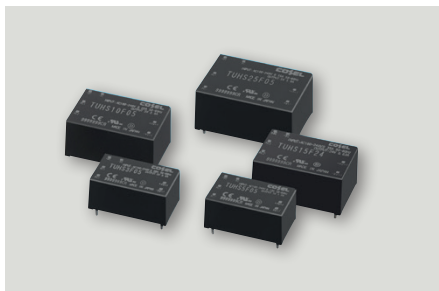
Enclosed
10W – 10KW



Configurable
300W – 1200W



Open Frame
10W – 300W



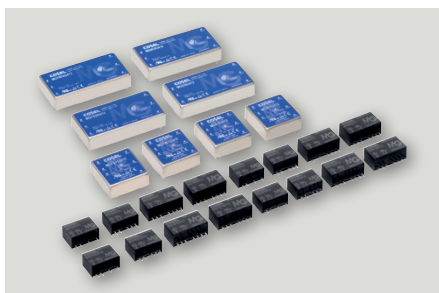
PCB AC/DC
3W – 25W



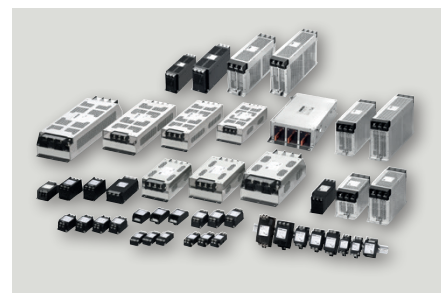
PCB Power Modules
50W-1200W



DIN-Rail
30W – 480W



Low power series
1.5W – 80W

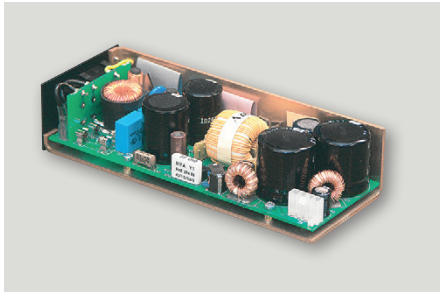


EMI filters

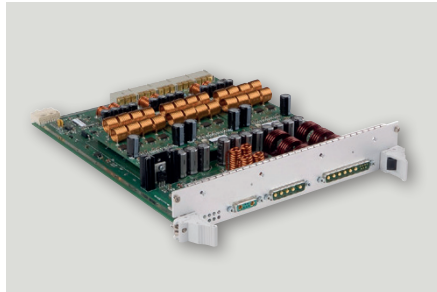
Medical

Custom products

Here are examples of customized products we have provided to medical customers in the past. Powerbox has to date completed more than 2500 custom design projects.



200W AC/DC open frame customized to deliver 385W output power supply for ultra welding of medical consumables.



670W coreless technology DC/DC power supply, fully DSP-regulated converter for use in strong magnetic fields such as in MRI systems. 2.4 MHz switching frequency.



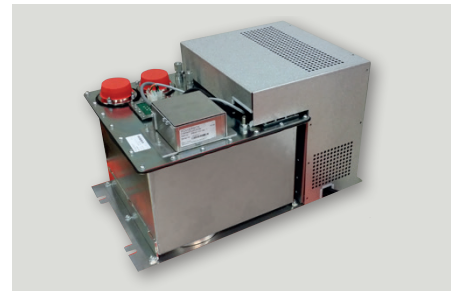
650W AC/DC enclosed single output power supply customized for peak power, low noise and improved heat management powering surgical displays.



400W AC/DC open frame quad output power supply for diagnostic system.



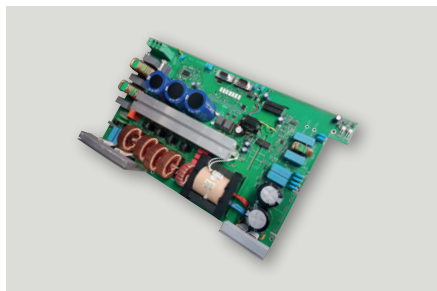
900W AC/DC enclosed multi output power supply for printing of diagnostic images.



Power system designed for Mobile Medical Electrical Equipment (MEE) applications and for use within professional healthcare environments.



1000W DC UPS system built to ensure patient safety during critical applications.



2250W AC/DC capacitor charger for laser applications, certified to comply with the medical safety standards.

Power solutions examples

X-ray

The challenge: An X-ray application required 35 kV for the x-ray, together with several other voltages for feeding other parts of the equipment (as filament current, anode rotation and other auxiliary). Available space for the power equipment was limited.

The solution: Powerbox developed a 35 kV high voltage generator where the input converter also supplied a bus voltage feeding converters for all other loads.

Added value: This architecture reduced the number of converters required, which in turn:

- Reduced space requirement, due to fewer converters
- Reduced heat dissipation due to fewer conversion steps, which in turn further reduced space requirement
- Increased system availability due to fewer units involved
- Optimized system cost by reducing both the number of converters and the space required

Folio printer for images

The Challenge: A folio image printer required 14 different power outputs, and the space available for converters was very limited. As it was for use in sensitive medical environment strict EMC requirements, as well as other typical medical requirements, applied. The application involved several DC motors with frequent starts and stops which made the EMC aspect especially challenging. An additional challenge was that in order to maximize image quality the power to the printing head had to follow a logic signal from the printer, adapting the thermal profile to both what was printed in each instance, and to what had previously been printed.

The solution: Powerbox custom designed two new converters supplying the 14 voltages and meeting all other requirements. We also assisted the customer with EMC verification of the complete end product.

Added value: Meeting all requirements while minimizing the number of converters contributed both to on-time launch and a competitive end product.

Gamma knife surgical system

The challenge: A surgical "gamma-knife" requires exceptionally high power availability. Especially crucial is power for being able to remove the patient out of the unit under all conditions, including total loss of external power (as hospital standby UPS).

The solution: Powerbox designed a custom power system tailored to the application, including battery back-up and redundant power supplies to secure battery charge.

Added value: Fast-tracked design enabled on-time launch of the system and to date, after 8 years in the field, there is not a single fault reported or unit claimed.

Powering high demanding MRI with efficiency

The challenge: Magnetic resonance imaging (MRI) uses a magnetic field and pulses of radio wave energy to make pictures of organs and structures inside the body. The magnetic field generated by the coil is in a range of 2 to 4 Tesla, which is a huge magnetic field with direct effect on some of the electrical equipment such as power supplies getting their transformers saturated and impossible to operate in such environment. For safety and patient comfort during the MRI session, some equipment require the power supply to be as close as possible to the load, meaning the power-unit must operate safely while exposed to the high magnetic field generated by the coil.

The solution: We developed a 670W coreless power solution, using the principle of transferring energy from an inductance to inductance. To guarantee the highest performance, we implemented a DSP control and advanced power topologies switching at 2.5 MHz and higher. To protect the complete power supply from electromagnetic leakage, we shielded the power unit with a 80dB screen.

Added value: Primarily developed for MRI systems, the platform Coreless power supply platform developed by Powerbox (PRBX) is also suitable for other demanding industrial applications and research industry where electronic systems operated under high magnetic field environment.

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.

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