

1/2005

POWERBOX

Journal

world class manufacturer of power supplies

Supply chain
management

Insights to
high voltage

Ready to deal with
the Chinese dragon

Powering
medical
progress

powerbox



Dear Readers,

We have chosen to focus this issue of the Powerbox Journal on Medical applications. Some of you recall that we have already covered medical before in addition to

the telecom-, industry and automotive issues. One obvious reason to cover medical again is that, even though we have a very good balance of our business represented in the mentioned applications, Powerbox medical business has actually moved up from being the smallest to now be the largest area in just three years time.

One driver for the development is that medical treatment including well-being is moving towards the patient in regards to an increasing demand on home and self care equipment. Thanks to the new walk-in labs and medical centres popping up in many cities, you can also check your cholesterol and thyroid levels and rule out Lyme disease, among other things, all without a physician's referral.

All this means an increasing number of devices for self treatment are available and the equipment must be 100% reliable and safe. Our customers appreciate that the quality of the power supply is directly deciding the reliability of their equipment so the selection of the power supply is crucial. Conroy is offering products for hermetic sealing of blood and I am sure that you will enjoy reading about their business and their selection of power supply (page 6). Reliability of the power supply is important but there are also other special demands on medical power supplies. For those of you who would like a deeper view of these demands I recommend the designing aspects article, page 9.

In this issue we also cover a number of other subjects including supply chain management, high voltage power supply and important facts around the WEEE/RoHS directives.

I wish you an enjoyable reading.

Louis Masreliez

President
Business Area Powerbox

YOUR DEPENDABLE POWER PARTNER!
Close to you!



30
years
in

Karl Fredmark,
founder of Powerbox.

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Powerbox was born in the fall of 1974. Few could by then imagine the development Powerbox would have. And how fast! Least of all the founder, Karl Fredmark, who started Powerbox with the vision of creating a multinational company with a turn over of 10 M Euro in time for his retirement, but actually achieved five times that with annual sales of 50 M Euro.



Undeniably, it is multinational. Today, Powerbox has Sales and R&D companies in 15 countries worldwide, and still counting. However, the goal of turnover that Karl Fredmark predicted was too low. Since the start, 30 years ago, the company has had an annual growth of 27 per cent, and is now reaching a turn over of 50 M Euro. A figure that is expected to double within the next coming years.

A flying start

The background to Powerbox is to be found in Germany. That's where Karl Fredmark worked during 1971-1974 as a marketing director, for a Swiss company focusing on power supply. It was brilliant times, the Swiss company increased its sales figures continuously and soon opened new offices in France and Italy.

That development awakened the entrepreneur in Karl Fredmark, and the idea of starting his own power supply business begun to take shape. In 1974 he finished his employment in Germany, and moved back home to Gnesta, Sweden. With him, he also brought an extensive network of customers, business contacts, producers and suppliers.

"Even if an own company wasn't exactly according to the plans at that time, we got a flying start and became international very quickly"

says Karl Fredmark. "Mostly because I knew the business in detail, and also had the contacts needed to succeed".

The Baltics next

The first distributors were signed for in 1975 in Sweden, Norway and Denmark. Two years later, the company had reached a turnover of 200.000 Euro. And in 1979 the Norwegian subsidiary opened up the doors.

1985-86 it was time for expansion in USA and Australia, followed by a number of European countries in the late 80's and early 90's. In 1995, Powerbox inaugurated its offices in New Zealand and Singapore. Norway expanded in 1997 with an R&D facility, and 1999 a similar company was set up in Australia. Year 2000, Craftec was established, which quickly became a very successful distribution company within the Powerbox Group.

The latest contribution to the Powerbox Group, effective since the fall 2004, is the new company in China. The Chinese office will provide power supply equipment to Swedish and foreign customers/companies establishing new business in China.

"We are also very interested in the markets of the new EU members, such as the Baltic countries", says Karl Fredmark. "Many companies

are setting up business there, and it's important for us to follow that development. We strongly believe the Baltics can be a successful market for us", Karl Fredmark continues.

Another future scenario, according to Karl, could be a possible introduction to the stock market within a three to five years time frame. "That is an interesting thought, which most certainly will mean an even faster growth for us" says Karl Fredmark.

Competent personnel

30 years has passed, and during the year Powerbox will celebrate its anniversary. "We haven't decided exactly how yet" says Karl Fredmark. "But it will be something enjoyable for all our 170 employees with families. Because it is our staff that is the engine of Powerbox if you like. We have marvelous employees, with a personal interest in developing our company further, and they all put in that extra energy to make it happen."

"To work for Powerbox and Craftec is for many of us not just an ordinary work, it's a lifestyle", Karl Fredmark ends.

Did you know...

...that China's area is 9 596 960 sq km and consists of 31 provinces (= bigger than USA).

...that the population is almost 1.3 billion people, i.e. 22% of the world's population.

...that China is a member of WTO and that Beijing will host the Olympic Games in the summer of 2008 and Shanghai will host the World Expo in 2010.

...that the principal language is Mandarin (Chinese Pu Tong Hua). There are several other main dialect languages such as Yue (Cantonese) and Hu (Shanghainese) and several other minor languages as well, spoken by and 56 ethnic groups and minorities.

...that the GNP is 4,5 billion dollar (agriculture 19%, industry 49% and service 32%).

...that China is the world's ninth largest IT-economy, the fifth largest in computers, e-commerce, cellular phones, and that the number of Internet users is steadily increasing.

...that In 1949 only 10,6% of the population lived in the cities. Today that number is more than 30%.

...that the chopsticks date from the Shang dynasty in 1766-1122 B.C. when culture became more important than the art of making war. According to Confucius knives were associated with aggressive actions and should therefore not be used to eat with.

...that the Chinese invented the paper around year 200, and that they invented the compass, printing technique and gunpowder around year 950.

...that the Great Wall is more than 5000 km long, 5-6 m wide and 8-9 m high. The oldest parts of the Great Wall date from around 400 years B.C.

...that the climate shifts from almost arctic in the north to tropical in the south.

...that China's natural resources are mainly coal, iron ore, oil, natural gas, mercury, tin, aluminum, lead, zinc, uranium, and water power (the world's largest reserve).

...that China's national holiday is 1st of October.



Ready to deal with the **Chinese** dragon

China today is a rising and exciting market place, where enterprises from all over the world are establishing part of their business. The possibilities seems to be endless in this Empire of the Sun, with more than one billion inhabitants. Since the early fall in 2004, Powerbox are in place with a sales office as well as a production plant in Shanghai – the most dynamic region in the new China. “It is definitely a very interesting step for us, and a commitment we strongly believe in” says Louis Masreliez, President, Business Area Powerbox.



Aerial view of Shanghai

The main purpose for Powerbox to establish operations in China is to support and follow European and US customers, getting into the Chinese market. Also, it is part of Powerbox philosophy to be close to the market and close to customers.

"The local presence and the local production are important for us" says Louis Masreliez. "To be close to our customers in order to support them with products and services."

Partnership, as well as a long and close relationship with its customers are essential ingredients and a prerequisite to reach the optimal customer solutions the Powerbox strive for. Experiences shows, that the earlier Powerbox gets involved in a new project, the better and more cost effective the final solution will be for the customer.

The Shanghai operation includes also a production plant and the quality assurance of locally produced products.

Immediate expansion

The establishment of the new office in Shanghai was planned for almost a year. Powerbox got valuable support by the Swedish Trade Council in China, which guided them through all necessary

steps to get the required approvals and licenses. In September, Powerbox moved in to the new office in Shanghai, perfectly suited to its purpose.

Roy Zhang is the new General Manager in Powerbox Power Supply Kunshan Co Ltd, which is the official name of the Chinese company. So far, the Chinese Powerbox office has four employees besides Roy Zhang, and Louis Masreliez is convinced that within a year, the company will employ 10-15 people.

"We have started a telecom project we believe will expand substantially this year" says Louis Masreliez. "Even if we are a fairly new company in the region today, I'm convinced that Powerbox in Shanghai will play a role as an important power supply manufacturer in China and by that make a considerable contribution to the entire Powerbox Group."

China – land of opportunities

Meeting Roy Zhang, is a meeting with the new China – young, optimistic and positive, and very competent and professional. Young China?

Roy Zhang explains: "There was an experimental period of almost 10 years, between 1984-1992, when socialism vs capitalism was explored and evaluated. Since the early 90's though, a socialist market economic system has been established, which has meant big developments for the Chinese business environment."

Before joining Powerbox, Roy Zhang held a position as Production and Product Manager for a German company based in China. What made him join Powerbox, in September last year?

"I couldn't resist the opportunity to start a new company" he says, and continues, "Purchasing and quality management is my strengths, and that is what I will bring to Powerbox and to our customers".

And of course the language, Mandarin, as well as the Chinese culture – which both are critical success factors to run business in this giant country (big as Western Europe!)

These first 1-2 years, Powerbox and Roy Zhang with team will focus on supporting current customers, including to follow European and US customers relocating or transferring their business to China.

A licence to sell

An ordinary day in the Shanghai office, Roy Zhang starts with reading and answering his emails at 8 am, with focus on customer issues – such as new requests and demands.

"My focus is to maintain and develop current customers and their needs, and of course on staying profitable, so identifying new business opportunities with existing customers as well as in a long term perspective to find new customers" says Roy Zhang.

"And to handle pending questions, finish unfinished business, often production issues", says Roy Zhang. "We are also constantly looking for new sources of power supply components



The Dragon (Ky-Lin) signifies strength, courage, perseverance, determination and wisdom. The dragon also stands for masculinity in Feng shui, i.e. Yang. Yang is the active male energy. Safety and security is his characteristics but also the ability to change. In Chinese mythology the dragon is the predestined partner to Phoenix (Feng-Huang), who symbolises Yin, femininity.

for our products, in order to offer our customers the best price/performance solution."

Today, the China office has a business licence to manufacture and sell products in China or on export. At present the focus is sales, service, sourcing and manufacturing but over time we plan also to establish a local design cell.

Roy Zhang and his team are very keen to support their customers and deliver high quality products and solutions to the market, in their ambition to be a leading power supply manufacturer in this Empire of the Sun.

"China has many, many opportunities, everything is possible" ends Roy Zhang, and smiles.



Mr Roy Zhang, Manager of Operations (in the middle), and his colleagues at the Chinese office.



Blood, sweat and tears

Around the world, all year around, there are people willing to give their blood to help others, suffering from serious diseases. As leukaemia or aplastic anaemia. Or from any other complaints, which need a surgery and a blood transfusion. These people, the blood donors, are saving lives – and so does the products that Conroy provides.

This is a success story, and it will include both blood and sweat. There will also be lots of joy, laughter, hard work, and not to mention award winning design. But what about the tears? Well, they will most likely belong to Conroy's competitors.

Conroy is a world leading company operating in a very special field of the medical market; hermetic sealing for blood handling.

They are providing innovative products and technologies used for hermetic sealing of collection, processing, storage and transfusion of blood and blood components. A handling that has to be done in a safety and efficient way, as well as ergonomic friendly for the user.



BLOODY FACTS & FIGURES

- Blood is transporting oxygen from the lungs to body tissue and carbon dioxide from body tissue to the lungs.
- A full-grown human body contains 5 litres of blood
- 1 cubic mmm blood contains aprox:
 - 5 billion red blood corpuscles (Erythrocyte)
 - 4 000 - 9 000 white blood corpuscles (Leukocyter)
 - 200 000 - 300 000 blood platelets (Thrombocyter)

More details

- Approximately 55 percent of blood is plasma, a straw-colored clear liquid.

- The liquid plasma carries the solid cells and the platelets which help blood clot.
- Without blood platelets, you would bleed to death.

Four types of blood:

- A – Type. Can receive blood from blood type A- and 0-donors.
- AB – Type. Can receive blood from A-, B-, AB – and 0-type donors.
- B – Type. Can receive blood from blood type B- and 0-donors.
- 0 – Type Type. Can only receive blood from blood type 0-donors.

The size, and the technical specification – combined with the strict medical requirements always surrounding medical equipment – was a tough challenge (and a spur!) – for Powerbox in the development of a new power supply unit.

Fortunately, Powerbox has a long history and experience of working with medical related products and are familiar with the different directives in both EU and elsewhere. And custom design is one of their well-known strengths.

The most challenging part, however, has been the low current load. Combined with the fact that the Tube Sealer is hand held by the hospital personnel.

All electric appliances have leakage currents, and to prevent and minimize the risk of electric shocks for the persons handling the Tube Sealer, these leakage currents has to be extremely low.

At the same time, the Tube Sealer has to be able to work with power levels ranging between 200W up to 400W.

And last but not least, the new Tube Sealer needs to be small which calls for new and innovative ideas of the design – for the tube sealer product, as well as the built-in power supply, and cooling.

Award winning design

The idea of having an industry designer involved in the product design from the start is today a matter of course for Conroy and Per Jansson. Even his business card is designed, in a modern, plastic material – and it definitely communicates Conroy's products in an effective way.

“The design shall enhance the product. And we want it to show that we have put in an effort in the product design. A product that feels, and is, reliable is good for the customers, and good for the marketing”, says Per Jansson.

And it has payed off. Conroy and the Tube Sealer has been awarded twice for its design; “Excellent Swedish Design” in 1999 by the

Swedish Form organization, and in 2003 by German “Red Dot”.

Not to mention the satisfaction among the hospital personnel. The tube sealer is operated by a user-friendly, automatic, one-touch design – and at the same time the blood handling is quality secured.

Can you imagine, the Red Cross in New York only, does some 2 billion seals every 24 hrs?!

Once upon a time

I must admit, that maybe it's not the image of a world leading company that cross my mind when driving up in front of a small, yellow wood house in Upplands Väsby, 30 min north of Stockholm. But it has definitely awakened my

Conroy – a lifesaver

It's very important that all blood handling is hygienic and the blood is tested – to prevent fatal diseases to spread – which also is the main reason for a hermetic sealing of the tubes and blood packs. It is also important that the tube sealer is mobile. And small.

Per Jansson, founder and Technical Manager of Conroy, explains:

“In Europe for example, it is common with mobile blood donor centres – close to peoples workplaces or place of residences – where you need to set up all equipment needed.”

There are also very complicated regulations and tough requirements on medical equipment

Technical challenge

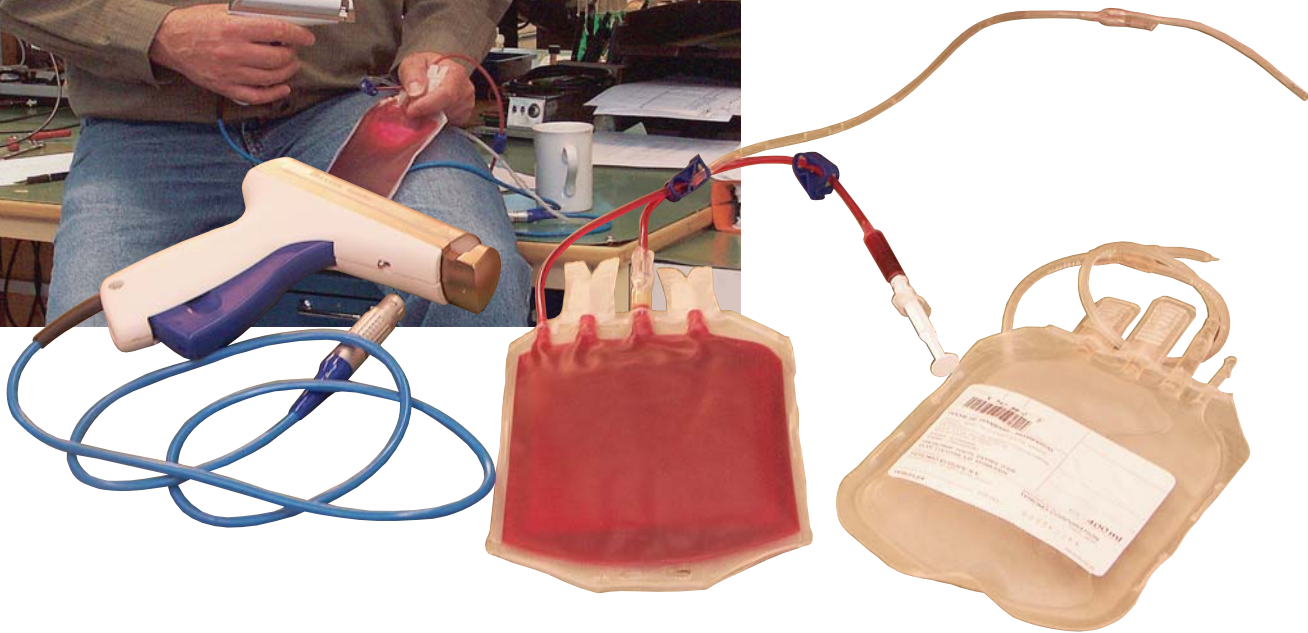
The new Tube Sealer product that Conroy is launching, is as small and mobile as it can be. The base unit size is about 10"x6"x3" and that will also include the power supply and cooling!



Per Jansson, Conroy AB



” The design shall enhance the product. And we want it to show that we have put in an effort in the product design. A product that feels, and is, reliable is good for the customers, and good for the marketing.



curiosity, about the company and the people behind Conroy.

Per Jansson tells us about the story of Conroy.

In the early 90's, Per Jansson and Olle Bergman, co-founder and CEO, decided to start their own business. And they wanted to focus on a special niche of medical technology they used to work with as employees.

Said and done. It only took them 3 months to be a market leader in the US, with 70% market share! Today, they still have some 50% of the US market, and Conroy's customers are present in some 155 countries.

Conroy employs 15 people, working with product development and production, sales and marketing on an international scale. All managed and operated from the little yellow house in Upplands Väsby in Stockholm, Sweden.

No free ride

The co-operation with Powerbox is almost as old as Conroy, since 1995. But a long co-operation is no ticket to a free ride.

Several power supply companies was invited for the tender, when it was time for developing the new Tube Sealer product. What made Conroy to chose Powerbox this time? Per Jansson says:

“Powerbox has an extensive experience of custom design power, and they really understood what kind of technical solution we where looking for. I also think we are just about the right size for each other – which makes us a prioritized customer for Powerbox, not too small, not too big”.

He adds: “And Powerbox also has a well functioned quality system, in reality, not just on paper”.



FEATURES POWERBOX POWER SUPPLY PBSE1072

- Input voltage 100-240VAC ($\pm 10\%$).
- Output 1: 48VDC ($\pm 5\%$) @ 4A, 8A output current during 20ms. Output will decrease to minimum 40VDC. Ripple noise 50mV.
- Output 2: 12VDC ($\pm 5\%$) @ 0,75A. Ripple noise 50mV.
- All output short circuit proof, auto reset.
- Thermal protection built in, shuts down operation reset.
- Certified against EN60601 (certification made on system level).



Designing aspects of **medical** power supplies

The fundamental function in a medical power supply, to convert voltages, does not differ much from industrial or telecom. It is the focus on the safety aspect that distinguishes medical power supply units from other types of power supplies.



The standards normally used during development are based on IEC60601-1 (for Europe EN60601-1, USA UL60601-1 and Canada CSA22.2-601.1). The most important design criteria are leakage current and insulation.

Medical electrical equipments is classified into three groups, type B, BF and CF depending on the applications.

Type B is the less demanding. Applied part of type B is normally grounded. Type BF is a type B with floating applied parts. Type CF is the most stringent class for product in contact with the heart. It's a floating type.

LEVELS IN IEC60601-1

| | Type B | | Type BF | | Type CF | |
|-------------------------|--------|-----|---------|-----|---------|------|
| | NC | SFC | NC | SFC | NC | SFC |
| Earth (general) | 0.5 | 1 | 0.5 | 1 | 0.5 | 1 |
| Earth ¹ | 2.5 | 5 | 2.5 | 5 | 2.5 | 5 |
| Earth ² | 5 | 10 | 5 | 10 | 5 | 10 |
| Enclosure | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 |
| Patient leakage current | 0.1 | 0.5 | 0.1 | 0.5 | 0.01 | 0.05 |

Maximum allowed leakage current in mA

- 1 Equipment with accessible parts non-earthed or with mains parts screened.
- 2 Equipment provided with permanently installed earth protection that can be disconnected only with the aid of a tool.

NC Normal conditions

SFC Single fault conditions

| | Air clearance | Creepage distance |
|------------------------|---------------|-------------------|
| Basic or Supplementary | 2.5 mm | 4 mm |
| Double or Reinforced | 5 mm | 8 mm |

Clearance and distance @ maximum 250Vac

In any design there are lots of design considerations that have to be handled and of course it is the same for medical PSU design. When designing for low leakage current, and at the same time meeting EMC standards, one must use an intelligent strategy for thermal management, mechanical layout, topology and filter design.

Modern power supplies use high frequency technique to convert energy from mains to the

load. The reason for that is to reduce size and increase efficiency. The disadvantage with using such types of converters is the noise generated due to high dV/dT and dI/dT . The source is the square shaped voltage created on primary side, normally working at fundamental switching frequency of 100kHz to 300kHz, with rise and fall time of less than 100ns.

The conducted noise can be either common mode or differential. Low frequency ($< 5\text{MHz}$) common mode current is mainly capacitive-coupled noise in transformer primary to secondary, and also from transistor body to heat sink. Differential noise is coming from the high frequency charge and discharge of primary capacitances.

The big challenge in a medical PSU is to limit the noise below 5MHz without exceeding maximum leakage current. All noise current will return to the source and the important thing is to control that path and stop noise from going out on the mains cable. There are four types of components that can be use to filter noise; common mode inductors, series inductors, Y-capacitors (line/neutral to ground), and X-capacitors (between line and neutral).

With the restriction of leakage current we cannot use Y-capacitors to the extent we would like to. The only way to increase filtering is to add inductors, which will increase cost and size. Other solutions are to reduce the noise at the source or remove possible path for the current. Reduction of noise can be done with

a resonance converter type where the high frequency noise is reduced compared to a "hard switching" type. With that type of converter we can use high leakage inductance in the transformer as a resonance element. That allows us to have a good separation between the primary and secondary side, resulting in low noise.

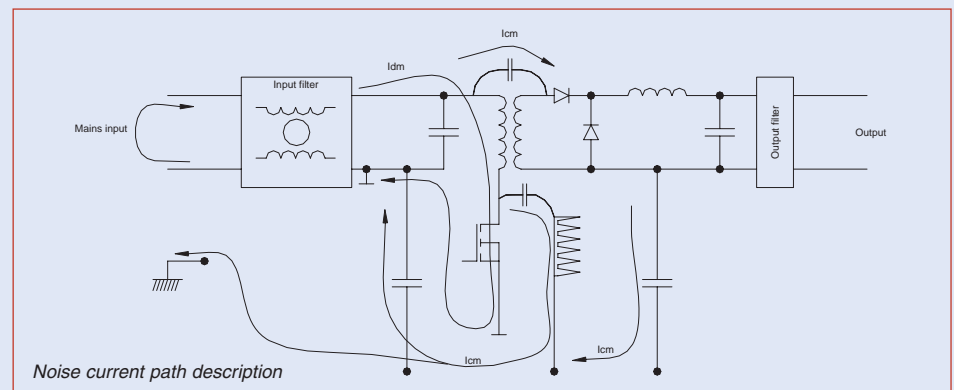
The current path from the switching transistors to chassis ground can be minimised simply by having the heat sink separated from chassis. That makes the thermal management more complicated and sometimes results in the need for forced air-cooling.

If the internal heat sink is not connected to chassis ground the parasitic capacitance driven current will be kept at a minimum level. It is also the safety aspects during single fault condition that makes it an advantage to have the heat sink separated from chassis ground. The physical positions of components are also very important

It is important to have a close contact between the power supply designer and the designer of the overall medical system to get the most optimum solution. Some of the key factors to succeed in designing medical power supplies are mechanical layout, selection of topology and filter design.

Powerbox has extensive experience in these areas and are able to help all customers in the design of their medical equipment.

Written by Ulf Carlsson, Technical Director



● Broadcasting



Solutions for broadcasting

Powerbox offers a wide range of power supplies mainly developed for equipment for the transmission of analog and digital television signals or FM transmission. Following an ever increasing number of new customers and products, Powerbox Italy has developed extensive skills in providing power supply products for the Broadcasting market.

One factor behind the success is the Italian design team's skills in the unique designing aspects for this specific market. Powerbox offer advanced and reliable technical solutions in line with the company's strategy. Example of the broadcasting applications includes:

- High power analog /digital TV transmitters
- MMDS modulator
- TV Exciters
- Audio Mixers
- Compact high power amplifier
- FM Transmitters

For all these applications the reliability of the power supply is mandatory. Down time is very expensive and any failure or service may also be costly due to remote locations and tower mounted equipment.

The design, the prototyping and the pre-compliance tests of the units are made by Powerbox whereas the manufacturing is taken care of by qualified partners. The co-operation is very close, allowing easy and fast feed-back from the factory to the designer to assure that the units are designed for manufacturability.

The manufacturing partners are located both in Italy and in Eastern Europe. The Eastern European partners are mainly used for mature products and higher volumes.

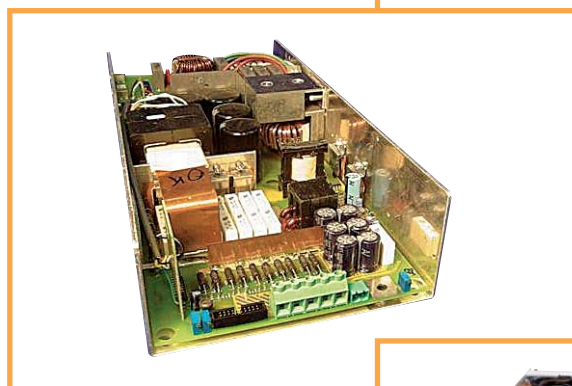
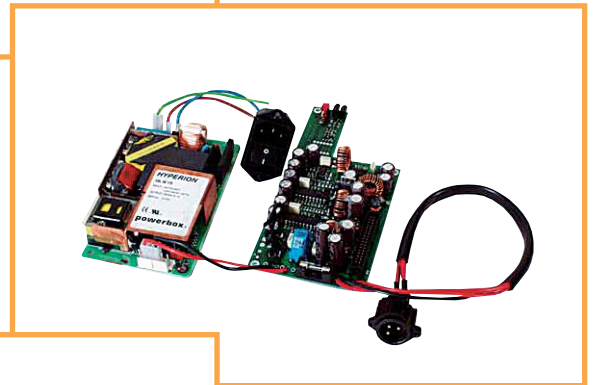
Certification support is given to the customers. This covers everything from providing CB reports to actually managing certification (Powerbox has an agreement with Nemko).

The units includes features such as power factor correction circuit, remote control/inhibit, current and voltage monitoring. The output power ranges from modules of 10W up to 2.500W delivered as single units or arranged in systems.



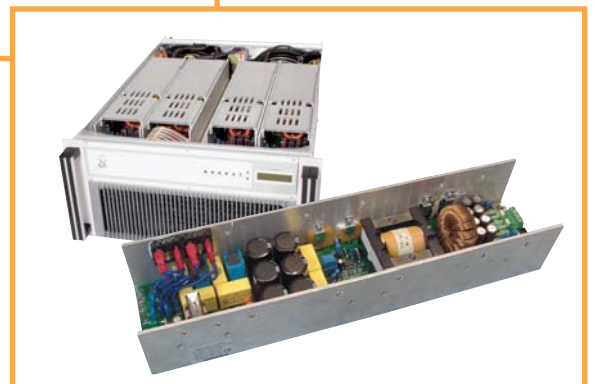
- AC/DC and DC/DC – TV Exciters
- 230W output power
- PFC built in
- 90-264VAC & 42-55VDC input
- Five DC outputs
- Remote inhibit; voltage/current monitors
- 400 x 110 x 55 mm

- AC/DC and DC/DC – MMDS modulator
- 120W output power
- PFC built in
- 90-264VAC & 42-55VDC input
- Five DC outputs
- Remote inhibit; voltage/current monitors
- 300 x 90 x 37 mm



- AC/DC – High power transmitter
- Monophase 230VAC
- 3-phase 208VAC input
- 2500W output power
- Two outputs (five channels)
- Remote inhibit; voltage/current monitors
- EN61000-3-2
- 380 x 190 x 80 mm

- AC/DC
- 3-phase; 1700 W power supply feeding three broadcasting amplifiers
- Four DC outputs
- More than 85% efficiency
- Remote inhibit; voltage/current monitors
- 430 x 100 x 80 mm





A small package of Power

The new Switchbox F10XX Series from Powerbox, consists of a number of external AC/DC power supplies, rated at 45, 50, 60, and 65W. What makes these units "stand out from the crowd", however, is their size. At no more than 109x50x28mm, and a weight of 250g, they are some very compact pieces of electronics.

The various models in the series all come with a universal input, and a choice of outputs of either 12-14V, 15-17V, or 18-24V. The 65W version is an exception to this, as this variant only is available with the 18-24V output. The efficiency for the series is roughly 75%, which isn't too shabby for an external power supply of this size. The units are all convection cooled, and have an operating temperature range of 0°C to 40°C.

Besides the variety of available outputs, the Switchbox F10XX series also comes with an option a variety of output connectors, as well as both a 2-pin and a 3-pin (Mickey Mouse version!) input option.

On the more technical side, it's worth mentioning that the units come equipped with overvoltage and overcurrent protection, as well as short circuit protection with an auto-recover function. Finally, the models in the F10XX series are all CE marked and both fulfil the EN60950 and UL60950 safety standards, as well as the EN55022 Class B requirements for EMC.

Switchbox PM201 & 300 from Powerbox – medical switching power supplies



The new Switchbox PM201 and PM300 series from Powerbox, comprising single and multiple output models for 200 and 300 watts of continuous output power, are specially designed for medical applications. They operate from 90 to 264 VAC input voltage without the need of a selector strap. Both series are mechanically based on a U-bracket to support efficient heat sinking. A cover-and-fan assembly can be added from the factory. All units meet EN55011 and FCC Class B.

New Custom Design Brochure

The strength of Powerbox is the company's ability to offer its customers a complete range of products, from standardised off the shelf items to full custom designs.

As the custom design solution is a rapidly growing area, Powerbox now releases a 40 page brochure devoted to this capability.

The Custom Design brochure should be a tool for any design engineer that needs a power supply for an application. Contact your local Powerbox office to get your personal copy, or download the brochure in pdf-format on www.powerbox.info.



Switchbox CFM series from Powerbox – now up to 100 Watts output power



Switchbox CFM series features reliable, high density open frame AC/DC switch mode power supplies from 5 to 100 Watts output power.

Small industry standard footprint and universal input make these power supplies suitable for various information technology and industrial applications.

All power levels available with single output from 3,3VDC to 48 VDC. 40 Watts series are also available with dual or triple output. All CFM series fulfills international safety standards and the production will be RoHS compliant from January 2006.

● Supply chain management

Some people would regard logistic and sourcing as something required but not desired. Powerbox view is the opposite. The company knows that it is a tool to add considerable customer value.

SUCCESSFUL SUPPLY CHAIN MANAGEMENT IS ADDING

Customer value

Experience and flexibility are the key success factors. "We have 30 years of experience in developing and manufacturing power supplies, and Powerbox sourcing structure provides great flexibility" says Louis Masreliez.

Powerbox "The Best of Two Worlds" approach includes a decentralized design cell organization offering close contact and a fast development time. It includes also an out-sourced manufacturing structure with local partners for low volume and Asian or Eastern European partners for mid to high volume projects meaning cost effective and flexible manufacturing.

Louis Masreliez continues "Our target is to challenge the largest power supply companies on being flexible and cost efficient in manufacturing but also to challenge the local power supply companies on being close and responsive during the design".

Powerbox is adapting the logistic structure to the individual customer's requirements. All types of set-ups are being handled. This from

traditional purchase orders with agreed lead time to actually managing our customer's inventory. Managing the customer's inventory or so called VMI (Vendor Managed Inventory) or SMOI (Supplier Managed and Owned Inventory) can be efficient tools to reduce the inventory capital and improve the supply chain efficiency.

The ways of transportation can also be adapted. Some products manufactured in Asia are normally shipped by boat to reduce cost but a small buffer stock is kept in the factory allowing air-shipments for non forecasted needs.

Out-sourcing – before the concept was even known

Since Powerbox establishment in 1974 the company has been used to rely upon partnership with the best contract manufacturers. Methods for selecting and integrating the external manufacturers were developed early on and they have been improved over the years. Today the manufacturing partners are acting as

integrated parts of a virtual organization.

"There were times when we had to explain why we did out-source our manufacturing. Some people were suspicious in the beginning but after understanding the great advantages with the flexibility and also learning that Powerbox were expert in handling external manufacturing, we got a lot of support for our approach. Since the last 10 years it seems that the entire industry has been following our example" says Karl Fredmark, the founder of the Powerbox Group.

Powerbox is having local manufacturing partners close to the regional design cells and close to the customers and they are used for low to mid volume projects.

There are also three major manufacturing partners in China and two in Eastern Europe for projects running in higher quantities, meaning normally 5000 to 250.000 units per Year.

The flexibility and the experience allows Powerbox to have a project initially produced in lower quantities close to the customer but as the



By gathering product orders from various customers, Central Services makes use of their size. Big volumes give better purchase conditions

volume is increasing the manufacturing location maybe changed to a low cost environment. This is adding value to the customer.

Asian sourcing – one key to success requiring special skills

With the establishment of Powerbox in China in 2004 the group did get a second foot-hold in Asia, this in addition to Powerbox Singapore that was established already in 1996. The two companies are offering procurement services to the Powerbox group as well as to external customers needs. Main focus are power related components and manufacturing services. The procurement capability means that Powerbox benefits from low cost sourcing conditions that normally only very large companies does.

“We do get double benefits when producing products in larger volumes in China. The actual manufacturing and labour cost is of course lower than in Europe or in the US but we do also see considerable savings in localizing the components. The most important cost reductions are made on magnetic components, cable harnesses, printed circuit boards and on heat-sinks. The mentioned cost reduction is an important factor but we cannot afford to make any compromise on the quality or the delivery accuracy. Our presence in Asia is a great help to handle all the required aspects” says Orjan Blomberg, Operations Manager at Powerbox in Stockholm.



” We have 30 years of experience in developing and manufacturing power supplies, and Powerbox sourcing structure provides great flexibility.

“Don’t mess with logistics”

Want to get your products moving, from east to west, south to north or from right to left? Let's go for a ride in Powerbox group's Central Service centre located in Gnesta Sweden to find out what they can do for you.

Back in the mid nineties, Jan Ancker and his colleagues at Central Services in the Powerbox Group was reviewing what the distribution chain look like. In the past the groups order handling and the warehousing was distributed to the different group companies in Europe. They found that the time and effort spent on shipping products from A to B, could be done in a much more efficient way.

“We came to the conclusion that a consolidated European logistic structure would help us and our customers to save time and capital. Today we are proud to have achieved the targets when looking at a well functioned, lubricated machinery consolidating logistics of standard products” says Jan Ancker.

What will customers get from Central Services?

“Safety first, that is what our customers gets, and that's why they choose us” says Jan Ancker, General Manager at Central Services. He continues; “An interruption in our customers production will cost them a fortune – so getting the right product, in right time to the right place is critical – and that is what we offer.”

Every customer is unique, and as every power product are part of the customers total solution, it is extremely important that the power products are delivered on time, as agreed to the customer.

By consolidating product orders for standard products from various customers, Central Services makes use of the total business. Big volumes give better purchase conditions, which of course benefits Powerbox customers too.

Another beneficial example is a more cost effective use of floor space in the customers warehouse. As this way of working means a constant flow/torrent of products, it also means less cost for floor



” An interruption in our customers production will cost them a fortune – so getting the right product, in right time to the right place is critical – and that is what we offer.

space – which can be a significant amount of money, considering the rents in Europe.

Environmental friendly / Better safe than sorry

This way of gathering product orders and transports also means that there will actually be less individual shipments, gaining not only the customers wallets but also the environment.

Most of the shipping are products produced in Asia/China going west, to demanding customers based in Europe. With Powerbox Central Services, these customers will not only get an environmental friendly logistic solution, but also a very knowledgeable partner to help them navigate within the EU/UN directives.

High and Low Insights to high voltage

High voltage power must be the modern civilization in a nutshell. And the most difficult to achieve and control. Think of a thunderstorm. The dark, rainy sky. And the lightning. Then imagine that you can actually control it. If you do, you have high voltage power. Sounds easy? Well, maybe when Kalle Strandberg at Powerbox explains it.

It's very interesting and instructive to talk with Kalle Strandberg. What he doesn't know about a power supply, is simply not worth to know. Yet he has a very humble attitude, to his profession and towards us people who doesn't have the same knowledge, and he never let us feel stupid about it.

Anyway, high voltage power. It is used in a wide range of applications, such as industrial and medical x-rays equipment, or fibre optic cleavers, neon signs, monitors and various laser applications.

Tricky technology

High voltage power is a sensitive technology. It has a tendency to "creep", especially under humid conditions, as rainy weather. And as its weather cousin – the lightning – it has an inclination for electrostatic discharge and short circuits. The point is to use and control the discharges and short circuits in a preferred and desirable way.

As in a neon light sign. Inside a glass tube you use gases like neon, krypton or argon at low pressure. In both ends of the tube there are metal electrodes, and when you apply high voltage to the electrodes the gas ionizes and the electrons are flowing through the gas – and there is light.

Other applications are far more sensitive and tricky to power supply with high voltage – such as the fibre optic cleaver or medical x-rays that operates with very high precision.

Insulating power

With power levels ranging between 0-1000 V, the high voltage can be handled by a transformer as it is. However, for applications up to 10 kV the same transformer is typically using a cast of epoxy or similar material. And above the 10 kV, oil would be the best insulating material.

Core business

Many times, this kind of applications needs custom designed power supply. And a power supply designer who is familiar with the current application. Very often, it requires special knowledge, not only of the power supply, but also of means for cooling the equipment.

For Powerbox, and Kalle Strandberg, high voltage power supply is core business. They do this all the time, and are well aware of the latest technology developments within the power supply area.

Powerbox has – along with a proven record of custom designed power supply – also access to the right lab environment for test of the power supply, to ensure the equipment will meet all test- and requirement- specifications from each unique customer. And in the most cost effective way.

Examples of Powerbox high voltage designs

- Medical X-ray generators with voltages up to 150 kV and power of 5 kW
- High resolution imaging processing generators with voltages up to 5 kV and power of 10 kW
- Optical fiber splicing device with voltages up to 15 kV

Did you know...

Arcs, sparks and Jacobs Ladder – Three ways to light the fire.

Sparks

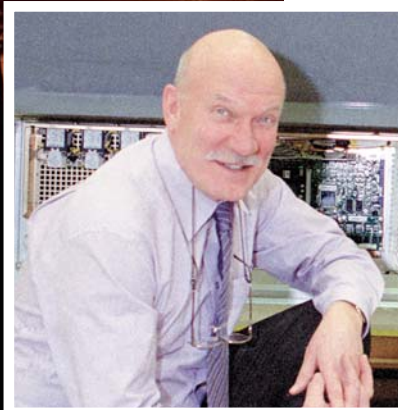
Sparks are a single, very short electric discharges across an air gap that forms a flash of light. Between every new spark, the voltage source must be recharged again.

Arcs

Arcs, on the other hand, are continuous discharges, initiated as a spark but keeps burning. The voltage that keeps the arc burning is lower than the voltage needed to set it on fire – typically a few hundred up to a thousand volts.

Jacob's ladder

This is a special arc device, using a V-shaped electrode equipment, with the smallest gap in the bottom. Adding high voltage, an arc forms at the bottom is carried upwards to the end of the ladder, and then starts all over again. Once you know what a Jacob's ladder is, you can easily spot them in old black and white horror movies, being used as part of the apparatus bringing good old Frankenstein's monster to life (!).



What Kalle Strandberg doesn't know about a power supply is simply not worth to know.



Facts regarding WEEE and RoHS Directives

There are two new European EC Directives that will be implemented and affect the electronic industry the coming years. The two directives are *Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC* and *Restrictions of the Use of Certain Hazardous in Electrical and Electronic Equipment (RoHS) Directive 2002/95/EC*. The objectives with these directives are to limit the environmental stress and to protect human health.

WEEE Directive

This directive will come into force as from August 13th, 2005. The directive covers 10 categories of products:

1. Large household appliances
2. Small household appliances
3. IT & telecommunications equipments
4. Consumer equipments
5. Lightning equipments
6. Electrical and electronic tools
7. Certain toys, leisure and sports equipments
8. Medical devices
9. Monitoring and control instruments
10. Automatic dispensers

Producers shall guarantee financing of the collection, treatment, recovery and recycling of collected WEEE. The definition "Producers" does cover anyone who:

- manufacture and sell electrical and electronic equipment under own brand.
- resells equipment produced by other supplier under own brand.
- is importing or exporting electrical and electronic equipment on a professional basis.

RoHS Directive

From 1st July 2006, new electrical and electronic equipment placed on the market shall not contain: (The proposed limits are 0.01% for cadmium and 0.1% for all other substances by weight in homogenous substances.)

- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent chromium (CR VI)
- Certain brominated flame retardants (BFR)
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ethers (PBDE)

The directive covers the same categories as WEEE except for Medical devices and Monitoring and control instruments.

Powerbox road map

The limitations or restrictions on substances stated in the directive are respected when selecting material, components and production processes. Powerbox has been moving to green components fulfilling the directive since mid 2004 and this work is an ongoing process and will continue until December 31st, 2005. The work to change to lead free soldering process in the production is also in progress. Already today Powerbox have manufacturing plants globally including in China adopted to lead free production. The time schedule for the European production plants is to be ready early Q1-2006. All new developed products will be designed to fulfil the directive.

Existing custom design products will be converted on request.

The majority of standard products will be converted during 2005. In some cases new series will be offered as an alternative.

Please contact Powerbox sales representatives for more information on any specific product.

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