

An In-depth Guide: Selecting or Developing the Right Power Supply for Medical Device

Standard or custom? That is the question for many of Delta's medical device customers. Selecting the right power supply is a technical decision as well as a commitment to patient safety and device reliability.

As a leading power supply technology provider, Delta offers comprehensive solutions, ranging from readily available standard power supplies to semi-custom, user-configurable options, and even innovation of the entire power supply.

This article outlines the key considerations when choosing power supplies for various medical devices and introduces Delta's customization capabilities to assist developers in finding the best power solutions for their systems.

Considerations for Choosing a Power Supply for Healthcare Devices

Compliance with Safety Standards

The 3rd edition of IEC 60601 emphasizes the safety of both operating personnel and patients. This edition introduces a classification system called MOP (Means of Protection) to evaluate medical electrical equipment. Devices that do not come into direct contact with patients and are only used by trained operators fall under the Means of Operator Protection or MOOP category. These typically need to comply with IEC 62368-1 standards for Audio/Visual and Information Technology Equipment (ITE).

When devices have direct physical contact with patients, they fall into the Means of Patient Protection or MOPP category and must meet stricter safety standards, particularly concerning insulation. These products must feature two separate insulation barriers to protect against electric shock. The permissible leakage current decreases as the contact with the patient increases, and devices are classified based on their contact type with the patient.

Low Leakage Currents & Electrical Specifications

Electric currents passing through the body can be fatal, with as little as 40mA being potentially deadly for a healthy person. For those who are anesthetized or weakened by illness, the danger threshold is even lower. Therefore, power supplies for medical devices must meet stringent requirements regarding leakage and stray currents. These limits vary depending on the type of applied part (AP) in contact with the patient.

Determine the medical device's voltage and current requirements to select a power supply with the appropriate output specifications. Decide whether you need high-efficiency power supplies to reduce heat generation and energy consumption, which are crucial for devices intended for continuous operation.

Patient Environmental

Even if a power supply meets leakage-current and isolation standards, the entire system must still be evaluated for compliance within the patient environment. Patient environment is classified as Type B (Body) when there is no direct physical contact with the patient (e.g., LED lighting in operating theaters, medical laser units). It is classified as Type BF (Body Float) when there is physical contact with the patient or risk to the patient from device failure (e.g., incubators, ultrasonic devices, diagnostic equipment). Meanwhile, Type CF (Cardiac Float) is when there is direct contact with the patient's heart, with a high risk of injury or death if the device fails (e.g., defibrillators, heart-lung machines).

Thermal management is also a primary concern. Evaluate the power supply's cooling mechanisms, such as fan-cooled, convection, or conduction cooling, to ensure it can operate reliably without overheating and affecting the patient environment.

EMC Standards

Look for power supplies that meet international medical safety standards, with certifications such as IEC 60601-1, to ensure they are designed to protect both patients and operators. These standards cover essential aspects like electrical safety, electromagnetic compatibility (EMC), and mechanical safety for life-supporting or life-saving devices where faults due to electromagnetic or radio interference can be fatal.

The IEC 60601-1-2 standard's criteria for electromagnetic interference and immunity are essential in risk management, requiring equipment to withstand HF fields up to 2.7GHz. It also places limits for electrostatic discharge protection, from 6 to 8kV for contact discharge and from 8 to 15kV for air discharge.

Reliability and Durability

Check the power supply's build quality. A well-constructed power supply significantly impacts the overall reliability and lifespan of the medical device. Therefore, look for power supplies built with high-quality components and durable designs. Standard protection features such as overvoltage protection (OVP), overcurrent protection (OCP), and short-circuit protection (SCP) must also be ensured to safeguard the medical device and patients in case of a malfunction.

Form Factor and Integration

Make sure the power supply's physical size and mounting options are compatible with the medical device's design constraints. Also, consider connectivity and integration with the medical device, including the types of connectors and the possibility of modular connections for future expansions or modifications.

Delta offers two categories of medical power supplies: external and internal. The external solution involves a medical adapter that is either a desktop or wall mount. The internal solution has several options, including the medical enclosed power supply with a metal case, and a medical open frame power supply without any mechanical protection such as a case, frame, or housing. There is also a configurable power supply with a metal case and modular design, which allows for more flexible configurations.







Consider options for adjustability and programmability, as some medical applications may need power supplies with adjustable output parameters or programmable features to adapt to different operating modes or patient needs.

Customization and Support

Depending on the application, custom medical power supplies may be necessary to meet unique requirements not addressed by off-the-shelf solutions. Consider the level of technical support and customization services offered by the power supply manufacturer.

The Trusted & Reliable Power Supply for Medical Devices

Delta's standard medical power supply portfolio primarily targets mid to high-end applications. Customers often opt for Delta due to the higher power density, low leakage current, and Class B conducted and radiated EMI interference.

	IMA Series	MEB Series	MEU Series	MEP Series	MEA Series	MEG-A Series
						
Output power	400 W~2000 W	500 W~2500 W*	600 W, 650 W	120 W, 200 W	65 W~300 W	16.5 W~3000 W
Number of output	Single output with 5 V standby	Single output with 5 V standby	Single output with 5 V standby and 12 V for fan	Single output	Single output	Up to 18 configurable
Safety certificates	IEC 60601, 62368	IEC 60601, 60335, 61558, 62368	IEC 60601, 60335, 61558, 62368	IEC 60601, 60335, 61558, 62368	IEC 60601, 62368	IEC 60601, 62368
Earth and isolation	Type BF, 2 x MOPP					
Format	Enclosed	Enclosed	Open frame	Open frame	Adapter	Enclosed
Cooling	Fan	Fan	Convection	Convection	N/A	Fan
EMI	Class B					
Current sharing	Yes	Yes	Yes	-	-	With single module
Proven medical applications (selected)	Surgery robotics, radiology, lab machines, hematology analyzers, medical operation tables, lab temperature equipment.	Therapy machines, MRI, aesthetic machines, blood analyzers, ultrasound.	Dialysis equipment, dental equipment, IVD equipment, anesthesia machines, ultrasound.	Oxygen concentrators, aesthetic machines.	Handheld ultrasound, medical treatment equipment, CPAPs, endoscopy, medical displays.	Laparoscopy surgical system, microscopy/sequencers, medical laser, imaging systems, spectroscopy.

*2500 W coming soon

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Medical Power Supplies for High-End Applications

For high-end medical equipment, critical requirements include low-noise variable speed fans, adjustable output voltage, active current sharing, low leakage current, and Class B conducted and radiated EMI compliance.

Our [IMA Series](#) and [MEB Series](#) include the most high-end single-output medical power supplies available in the market. With an output power capacity of 1000 W and higher, they incorporate up to two variable-speed fans that effectively manage power supply temperature without producing unbearable noise.




These high-efficiency power supplies for medical devices offer adjustable output voltage and active current sharing, providing greater flexibility for end system design and development. Their low leakage current and adherence to conducted and radiated EMI Class B standards contribute to enhanced safety and EMC at the system level. The IMA-S2000 PLUS and MEB-1K5A48T also excel with high peak power to support the start-up of electromechanical components like fans and motors.

Medical power supplies for high-end applications	IMA-S2000 PLUS	MEB-1K5A	MEB-2K5A
			
Output power	2000 W	1500 W	2500 W (coming soon)
Adjustable output range	±20%	±10%	-11%~+16%
Dimensions	309.6 x 127 x 40.6 mm	127 x 204 x 40.5 mm	127 x 259 x 40.6 mm
Acoustic noise level	< 39 dB(A) @ 50% load, 30°C	30 dB(A) @ 30% load, 25°C 45 dB(A) @ 80% load, 25°C	< 45 dB(A) @ 2000 W, 30°C
Leakage current (264Vac/63Hz, normal condition)	Input-earth < 300 µA Output-earth < 230 µA	Input-earth < 500 µA Output-earth < 100 µA	Input-earth < 306 µA Output-earth < 64 µA
PMbus	Yes	-	Yes
Special highlights	Remote on/off, power good, AC good, peak power 3000 W for 5 sec	Remote on/off, peak power 2200 W @ 48 V, no load power consumption 1 W	Up to 29.5 W/inch ³ power density, remote on/off, power good

Medical Power Supplies for Small to Midsize Applications

When it comes to small to mid-sized medical devices, the most significant considerations often revolve around compact size, noiseless convection cooling, peak power, and derating performance.

The [MEU](#) and [MEP](#) Series are designed and engineered for small to mid-sized, typically portable medical devices, where acoustic noise levels and power density are major concerns. These power supplies offer the most compact options at their respective output levels, preserving internal system space for other functionalities, while their convection cooling design ensures a noiseless operation. Additionally, they outperform competitors with up to a 20% better derating performance, assuring reliable system operation under extreme conditions.

Medical power supplies for small to mid-size applications	MEU-650A	MEP-120A	MEP-200A
			
Output power	650 W	120 W	200 W
Dimensions	152.4 x 101.6 x 40 mm	76.2 x 50.8 x 31 mm	101.6 x 50.8 x 28.5 mm
Power density	17.25 W/inch ³	16.67 W/inch ³	22.3 W/inch ³
Energy efficiency	Up to 96%	Up to 94%	Up to 95.4%
Peak power	N/A	150 W @ 15 V for 10 spec	N/A
Derating	53.3% load @ 70°C	50% load @ 70°C	50% load @ 70°C

Configurable Power Supplies for Advanced Medical Machines

MEG-A Series configurable power supplies are designed for flexibility, offering compact sizes, a wide range of output selections, PMbus capability, lower leakage current, and reversible fans. These qualities make them the ideal power supply for healthcare devices and the most advanced medical systems.

For developers working on the most advanced medical machines, [MEG-A Series configurable standard power supplies](#) offer the flexibility to achieve cutting-edge design. The MEG-A Series is one of the most compact configurable power supplies available in the market, with a power density up to 2.6 times that of its configurable counterparts, allowing system designers the flexibility to optimize limited internal space. The series also offers an adjustable output voltage range from 2V to 60V for varying modules and current configurations.

MEG-A Series supports PMbus and a selection of multiple communication modules, which are ideal for integration with medical IoT in advanced medical systems. It operates efficiently over a broad temperature range with reversible fans providing diverse thermal solutions at the system level. Its user-friendly graphic interface allows users to adjust the output voltage of each module and monitor input voltage, fan speed, and ambient temperature.

4 types of cases and max. output



MEG-700A3
700W
3 slots
88.9 x 215.9 x 41.5 mm



MEG-1K2A4
1200W
4 slots
88.9 x 254 x 40.5 mm



MEG-2K1A6
2100W
6 slots
127 x 254 x 40.5 mm



MEG-3K0A9
3000W
9 slots
181 x 254 x 40.5 mm

3 types of output modules



Single slot module
300W



Single slot dual-output module
240W



Triple slot module
1200W

3 types of communication modules



RS-232 communication module



RS-485 communication module



USB communication module

2V~60V
Adjustable Output Voltage

Up to **2.6X**
Power Density

Up to **93%**
Energy Efficiency

-20~70°C
Operatable

3000 W
Max. Output

- ✓ Adjustable output voltage
- ✓ Monitor input voltage
- ✓ Monitor fan speed
- ✓ Monitor ambient temperature



Custom Medical Power Supplies

Delta has been developing and engineering reliable power supplies for medical devices manufactured by the world's best-known brands for over 50 years. Customers entrust Delta with some of the most challenging power supply design projects to create their next big innovations. Here are two success stories:

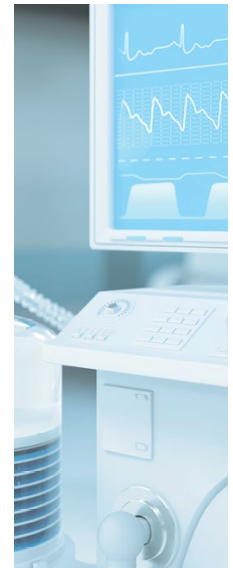


Customer requirement: A 2-in-1 power supply and onboard charger with both AC and DC outputs and extremely low ripple for an ultrasound machine.

A customer wanted to build a high-end portable ultrasound machine that generates crystal-clear, high-resolution ultrasound images. The power supply needed to provide multiple AC and DC outputs and charge batteries simultaneously. Additionally, the ripple from the power supply needed to be further reduced to achieve the desired imaging results. Delta owns several related patents and has extensive experience in reducing ripples. Our first sample met most of the customer's requirements.

Customer requirement: A fanless power supply with 2 x MOPP isolation, microcontroller-controlled battery management, and durability against extreme shocks and vibrations for an artificial respiration machine.

A customer wanted to build a portable artificial respiration machine that could withstand extreme shocks and vibrations in an ambulance. Since the machine is used in near-patient scenarios, it requires a power supply that is compliant with the most stringent standard – 2 x MOPP isolation. Battery backup and microcontroller-controlled management are also critical as it is a life-saving device. Delta offered a design incorporating digital interaction with analog power train control methods and an intelligent charging function to protect LiFePo4 batteries. Project management and documentation processes also adhered to the required IEC 13485 and IEC 62304 certifications for software and hardware.



Innovative & Effective Solutions

"Delta's R&D did a great job by identifying issues in the customer specs and providing innovative solutions to end up with exactly what we need. Great job done!" – Customer feedback

Delta Electronics has been developing and engineering power supplies for the world's best-known brands since 1971, serving the consumer electronics, appliances, industrial, and medical fields. Thanks to the trust of our customers, in 2022, Delta was ranked as the largest manufacturer of merchant power supplies globally for the third consecutive year*.

We offer top-of-the-line standard products and high-quality customization services to assist medical device brands and manufacturers. Please do not hesitate to [contact us](#) for more details to help you choose power supplies for your medical devices.