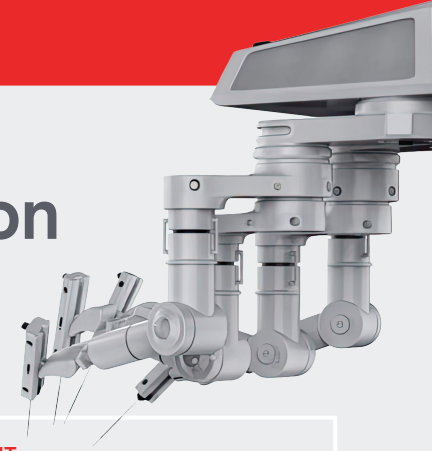


Multiple Output AC-DC's for Surgeon Console and Robotic Arms



INDUSTRY

Surgical Robotics

SOLUTION

BF Rated Low Leakage Current System

EQUIPMENT

Surgeon Console & Robotic Arm's

CHALLENGE

The challenge for the team at AE was providing power solutions for the both the surgeon console and the robotic arms. The surgeon console required a multiple output power AC/DC to drive discrete power systems including monitors, motors, surgeons joystick and controls, optical control and computing. The power supply for the robotic arms, had to deliver power to multiple isolated motors for the robotic arm movements. Both solutions had to ensure low leakage current for safety and meet EMI requirements

ensuring no system interference. Another consideration was to ensure that the solution was compact in size to aid the mobility of the console. Additional essential features for this solution included:

- Discrete power to multiple isolated motors for robotic arm movements
- Rapid control of outputs to ensure movement accuracy
- High output to ground isolation
- Each part of system must have <math><300\mu\text{A}</math> leakage current

SOLUTION

There were multiple solutions suggested by the team at AE from the Excelsys and Artesyn product lines, starting with Excelsys CoolX1800 of medically certified configurable power supplies. The CX18M-CCCCGC0-P4B would work for the console to deliver 4 x 24V outputs for motors, control and system housekeeping power. The power for the robot tower used the CX18M-DDCCCB-P4B to deliver 2 x 48V, 3 x 24V to drive multiple discrete motors for each robotic arm, handing simultaneously peak loads as motors start, and back EMF as motors brake/stop, with an additional 12V for system power and to drive multiple DC/DCs.

The CoolX1800 also provides <math><150\mu\text{A}</math> leakage current to keep system under the safety limitations and low power auxiliary of 5V (always on) to keep system on standby and ready for next procedure or action.

Artesyn Series AVQ100-24S05 of isolated DC/DC converters were used for stepping down 24V to 5V, for on board DC/DC conversion for low voltage system electronics. Other Artesyn DC-DC converters, such as modules LGA50D and LGA80D, dual output POL converters were used to step down from 12V to 3.3V and 5V with low ripple and noise for low voltage noise sensitive microprocessors.

RESULT

The outcome of this multi-faceted approach for a solution by the AE team provided the end customer with the following results:

- High System efficiency - Over >90% on AC/DC conversion with 95%+ on DC/DC conversion minimised power losses, ensuring the system can run off standard wall sockets.
- Variable speed fans, reducing system acoustic noise improving the operating environment for surgeon.
- Higher efficiency conversion generates less heat, thereby improving system reliability.
- Responsive Individual output control enabled improved surgeon control of instruments.
- Reverse Energy protection on outputs reduced the need for external protective components.
- BF rating on the outputs with high output to ground isolation simplified system compliance.
- High power density 1U AC/DC power supplies ultra-compact DC/DC converters improved system mobility though reduced weight and space used for power conversion.
- Fully certified for 60601 4th edition EMC-check box item.

CONCLUSION

By choosing the AE team the end customer received expert local applications engineering support with in depth knowledge of all AE power products which accelerated the selection of the appropriate power solutions. Having one power supply partner minimized system integration of the power solutions utilizing AE's lab-based system characterization. The BF rating on the CoolX greatly simplified the safety isolation design of the system and reduced the compliance time and cost for the full system. The digital communications (PMBus) on power supplies is used for system monitoring, however as system evolves, it can be used for increased data analytics (future need) in the system.



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