

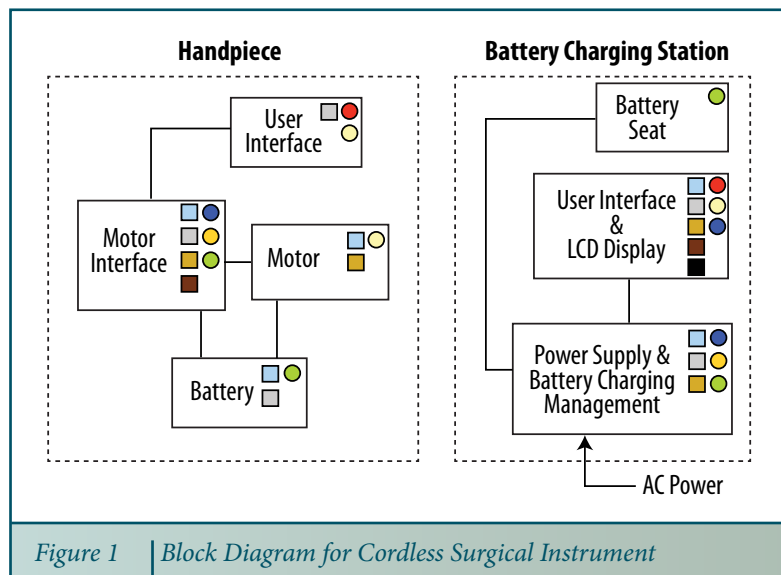
Application Note

Bourns® Components in Handheld Surgical Devices

The medical device industry has been competitive since its inception with regulatory requirements, manufacturing methods, and clinical needs looming in the background over every step of product development. One unwavering requirement for a medical device is that it must conform to high reliability standards. This requires robust designs and extensive testing resulting in a product that will deliver accurate, reliable results, while maintaining the safety of the patient in the process. Given the number of interfaces and controls in modern medical devices, and the multiple points of failure, it is essential that only the highest quality components with proven reliability from an established supplier are included in the design. Bourns has a vast technology portfolio and proven track record of providing reliable solutions to selected applications in the medical industry.

Cordless Handheld Surgical Instruments

A cordless surgical instrument provides improved comfort, maneuverability and control during cutting and drilling procedures in surgery. Electronics must be sealed since instruments are sterilized by autoclaving. Rechargeable or disposable batteries are used in cordless surgical instruments. A typical charging station for surgical instruments can recharge multiple batteries. Figure 1 illustrates a block diagram where the various functions of a cordless handheld surgical instrument are represented. Applicable Bourns® components are indicated in each of the various functions.



Bourns Product Key*

- SinglFuse™ Thin Film Chip Fuse / Multifuse® PTC Resettable Fuse
- Diode
- Magnetic
- ChipGuard® MLV
- TBU® High Speed Protector
- Potentiometer / Switch / LMP
- Encoder
- Trimmer
- Fixed Resistor
- Modular Contact

*Bourns® Specialty Engineering and Manufacturing Services (SEMS) provide module packaging / assembly solutions maximizing efficiencies in size, performance and cost.

Figure 1 | Block Diagram for Cordless Surgical Instrument



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TBU® High Speed Protectors

Cordless Handheld Surgical Instruments (*Continued*)

Two discrete sections are included in the design of a cordless handheld surgical instrument. Within each section there are several functional blocks.

The first section (hand piece) contains the user interface, motor control, motor, and battery. The user interface may contain:

- Switches, panel controls, or encoders needed to operate and control the instrument
- TVS diodes to provide ESD protection
- Linear motion or rotary potentiometers and controllers to provide speed control

The motor control requires:

- Trimmers for adjustment
- Fixed resistors and modular contacts for the interface with the battery
- A TBU® high speed protector to protect it from surges
- Inductors for noise filtering
- A ChipGuard® device for ESD protection
- A Multifuse® PTC resettable fuse to prevent the battery from overheating

The motor may have inductors for noise filtering, Multifuse® and SinglFuse™ devices for the interface to the battery, and encoders for motor position feedback to the controller. In addition to its modular contacts to connect to the motor control block, the battery uses TVS or Zener diodes to protect from transient and reverse voltage.

The second section (battery charging station) contains the battery seat or cradle, power supply and battery charge management, and user interface with LCD display. Modular contacts allow the battery to connect to the battery seat and power supply. The power supply and battery charge management uses:

- Fixed resistors to handle power management
- SinglFuse™ and Multifuse® devices to prevent the battery from overheating during charge and discharge, and SinglFuse™ devices to isolate the charging station from detrimental faults
- TVS or Zener diodes, or a combination of the two, for transient and reverse voltage protection in the charging station
- Transformers for power storage and isolation in the power management circuit
- TBU® devices for protecting the user interface and display from surges

Finally, the user interface and LCD display employ the following types of components:

- Potentiometers, switches, encoders, and trimmers which allow the operator to control the system and make adjustments as necessary
- Transformers to provide isolation from the power supply block
- SinglFuse™ and Multifuse® devices to provide overcurrent protection against events from rapid charging and discharging in the neighboring power supply and battery charging block
- ChipGuard® devices to provide ESD protection from the user
- TBU® devices to protect from surges



Multifuse® PTC Resettable Fuses



SinglFuse™ Thin Film Chip Fuses



ChipGuard® MLVs



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Conclusion

Having explored the basic electronic component requirements of a handheld surgical device, the design of a similar handheld surgical device can be derived using a similar block diagram. The block diagram approach is a great asset in selecting components for medical instrument design. Let Bourns provide the reliable electronic solutions for your next generation designs.



Fixed Resistors



Inductors



Transformers

For further technical support and for complete component solutions, please visit

www.bourns.com

Bourns® products have not been specifically designed and tested for FDA Class III applications and their use in such applications is neither recommended nor supported.

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