



WhitePaper: Integrated Electronics within LEMO Connectors Offer New Features for Medical Device Designers

Medical device design engineers and military equipment designers face similar challenges: a need to save valuable PC board space. One popular solution is to integrate electronics into a connector. An example of connector manufacturers doing this for many years is a connector integrating noise filtering and EMP (Electromagnetic Pulse) suppression components into the rear shell of circular or d-sub connectors.

LEMO USA, Inc., a subsidiary of LEMO SA, a leading push-pull connector manufacturer, has an integrated solution available to the medical device designer. Integrated solutions can be achieved by designing a small PCB that fits a small surface mount circuit with IC packages such as the TSOC (Thin Small-Outline C-lead), SOT (Small Outline Transistor), SO (Small Outline) and passive SMD components such as resistors, caps and fuses. Figure 1 (below) shows some example configurations of LEMO connectors with integrated electronics.



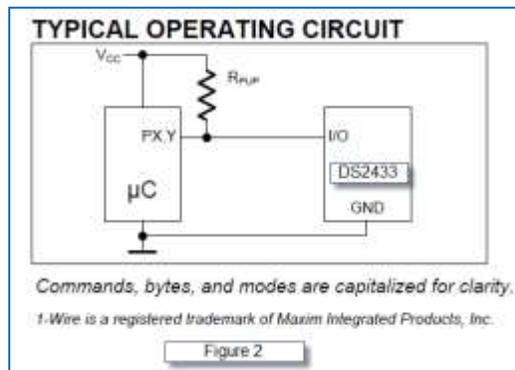
A: Single Patient Use receptacle for cable mounting

B: Shielded metal plug for cable mounting

C: Plastic plug for cable mounting

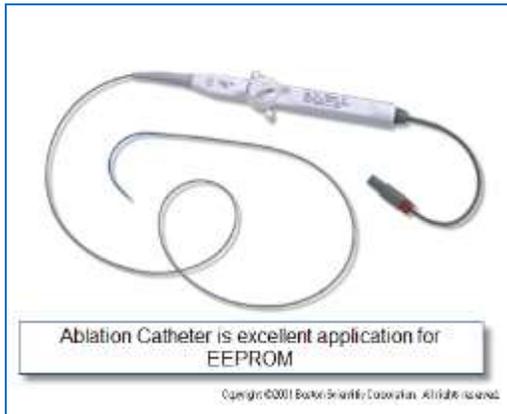
“One of the trends we see today is a smart medical device using a microcontroller and EEPROM, integrated with the connector plug or receptacle,” said Steven Lassen, Product & Applications Manager. Using an EEPROM (Electrically Erasable Programmable Read-Only Memory) opens up many new possible features for medical devices. For example using this solution with disposable probes, which are designed to have limited usage, can enable the main device to keep count and give an error message or disable the disposable unit if it’s used too many times. This would prevent operator error and, allow logging of usage, and even alleviate potential liability issues related to equipment connections. This EEPROM solution can also serve as a method of electronic serialization. Electronic serialization or tracking can reduce expenses associated with physical marking of devices such as insufficient space, permanency, poor cosmetics, and legibility. Memory in the probe allows for calibration and unique adjustments of each probe. Another benefit of integrated electronics is the ability to prevent pirating and counterfeits by having built-in code and authentication features. See Figure 2 (below) for typical circuit using a microcontroller. Other features made possible with an EEPROM:

- Anti-counterfeiting - Only products with valid codes will function.
- Encoding and device type ID - Allows different device and probe types to automatically be recognized when attached to the same port.
- Enables on-board calibration and storage of unique calibration and offsets.



Using an EEPROM can enhance any of these applications:

- Exploratory catheter diagnostics
- Medical therapeutic ablation
- Test and Measurement with Probe calibration
- Sensors and devices with TEDS (Transducer Electronic Data Sheet) requirements



Quick solution available: LEMO USA stocks the Maxim 1-Wire 4Kb EEPROM, PN DS2433+, in the 3 lead PR-35 package. This device is simple to terminate. The PR-35 package only needs two leads to be terminated and these can be soldered directly to a LEMO connector solder contacts as part of the cable assembly with no need for a PCB; See Figure 3 (below). This EEPROM is also available in an 8 pin SO package for surface mount onto a PCB. For the data sheet on this EEPROM please visit:

http://www.maxim-ic.com/quick_view2.cfm/qv_pk/2915



Integrated Electronics: The medical device designer may also consider custom circuits for noise filtering or EMI (Electromagnetic Interference) suppression, signal conditioning, temperature sensing, or circuit protection integrated on a PCB within the connector. In this way the electronics will be in close proximity to the probe or sensor, or noise source improving system performance.

There are a variety of ways to mount and orient the PCB depending on the application needs. The PCB can be mounted perpendicularly through the PCB contacts of the connector (Figure 1A,

1B), or axially and surface mounted to the connector contacts (Figure 1C). The LEMO connector shell serves as a protective enclosure for the electronics, reducing warranty expense for repairs. If LEMO metal connector models are chosen, such as the B or K Series, the shell provides and maintains shielding for EMI protection (Figure 1B). If shielding is not a concern, the plastic REDEL P series or the new XP series connectors can be used, providing a lightweight aesthetic and ergonomically pleasing package (Figures 1A, 1C).

LEMO USA also has extensive engineering prototyping capabilities to help bring a connector with integrated electronics from a design concept to a working prototype. With LEMO USA's design partners, rigid PCBs or flex circuits can also be added as needed for the application. See Figure 4. LEMO USA's model shop has dedicated lathes, mills, and a screw machine available for prototyping. With these capabilities, rapid prototyping is available.



For an evaluation of whether integrating electronics into a LEMO connector is a viable and a cost effective option, per your application, contact LEMO USA Applications Engineering at 1-800-444-5366 or email: info-us@lemo.com