

Application Note

Bourns® Hybritron® Precision Potentiometers in Medical Non-Implantable Infusion Equipment



3549



3549 Servo



3549 Dual Gang

Medical non-implantable infusion devices, such as pumps and controllers, are commonly used in healthcare practice for the administration of intravenous (IV) drugs. Since the administration of IV medication occurs over an extended period of time (from 30 minutes to > 24 hours), electronic infusion pumps are often used to precisely and continuously administer medication. In most cases, these devices are used in hospital environments. However, special battery-equipped units are available for ambulatory requirements. Pumps are different from controllers in that they harness positive pressure for the infusion of liquids. Controllers operate on gravitation and regulate fluid flow on the basis of a feedback system.

Background

Particular requirements for the safety of infusion pumps were first published in 1998 under IEC 60601-2-24, Medical Electrical Equipment Guidelines part 2-24. The classification procedures are described in the Code of Federal Regulations, Title 21, Part 860 (also known as 21 CFR 860). Infusion pumps are typically Class II devices (Class IIb in Europe) and are subject to special controls which may include special labelling requirements, mandatory performance standards, and post-market surveillance.

The important characteristics of an infusion pump are:

- The ability to set a controlled flow rate
- The time to start the infusion
- Recording the size of the bag or syringe to be infused
- The length of time for the infusion
- The time between infusions

Solution

The sensors can either be directly coupled with the motor (using a servo mount option) or directly linked to the plunger using an armature. The sensor may also have a gear fitted to the shaft that rotates in sync with a gear attached to the plunger. In applications where the potentiometer is intended for direct coupling to a motor it is recommended that a ball bearing equipped design be chosen. In general, ball bearing equipped potentiometers are recommended for use with infusion pumps as the shaft is robustly supported in these designs. A well-supported shaft minimizes the introduction of reading errors as a result of axial induced shaft side-load, or radial play.



3549



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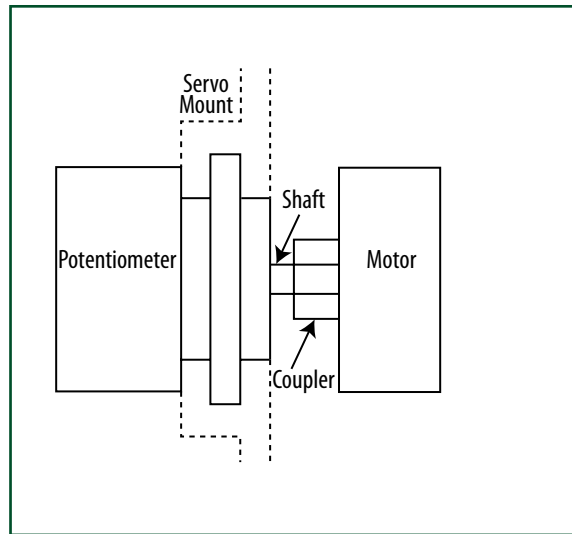


Figure 1 | Actuation via direct motor drive

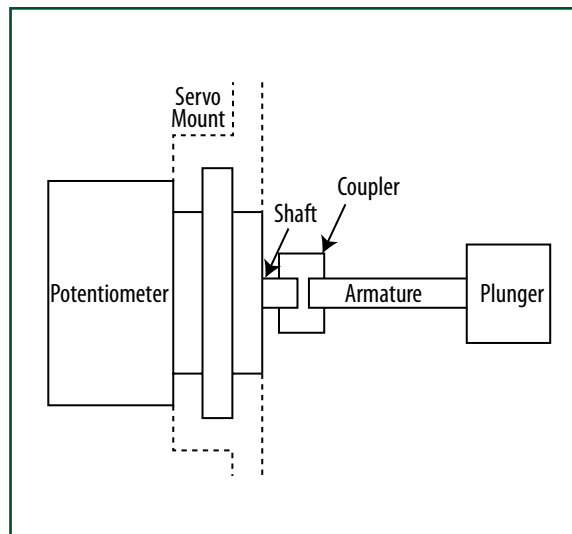


Figure 2 | Actuation via coupler to armature

Solution (Continued)

Bourns® sensors can be employed to provide a signal for the following programmed responses:

- Setting a single pump rate or volume
- Inserting a pause, or control and respond to external inputs
- Sounding an alarm in cases where the syringe stalls
- Changing pumping direction (infuse or withdraw fluids)
- Changing volumetric flow rates
- Pumping a precision volume and stopping
- Ramping up or ramping down flow rates

The resolution of the position sensor determines the measurement capability of the infusion pump, an important aspect in terms of volumetric measurement of the infusion. The Model 3549H has an essentially infinite resolution that can produce incremental measurements with extreme accuracy.

In cases where the infusion pump design requires a fail-safe mode of operation, a dual-gang potentiometer can be used to provide the added reliability. This design features an additional independent potentiometer providing redundancy and added reliability through closed-loop position feedback.



3549



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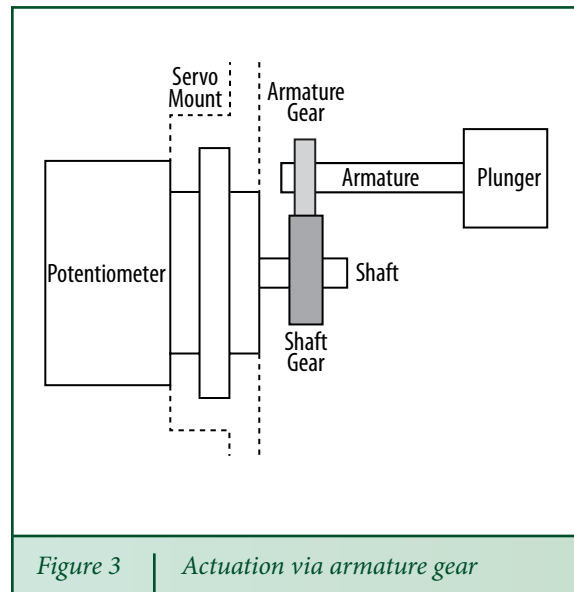


Figure 3 | Actuation via armature gear

Bourns® Hybritron® Precision Potentiometers

Bourns offers several high reliable solutions for infusion pump designs. Models with Hybritron® element options include:

- 10-turn Models: 3549, 3540/41, 3500/3501, 3700/01, and 3750/51
- 5-turn Models: 3548 and 3545
- 3-turn Models: 3547 and 3543



3549



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Other Bourns® Products Available

Other Bourns® products available for use in infusion pump designs include Chip Resistors & Arrays, Inductors, Modular Contacts, Multifuse® PPTC Resettable Fuses, Panel Controls, Power Chokes, Resistor Networks, Surge Line Protectors, Thyristor Circuit Protection, and Trimming Potentiometers.

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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