

Multiturn vs. Single-turn

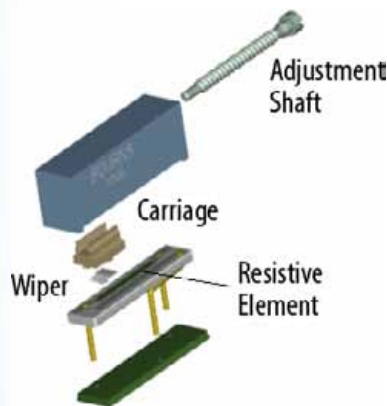
Introduction:

This application note serves as a general selection guideline to determine the most cost-effective trimmer for a particular application – Multiturn or single-turn.

Types of Actuation:

Multiturn

Bourns® Multiturn trimmers consist of three actuation types - lead screw, worm gear, and planetary gear. Lead screw actuated trimmers have a linear wiper path; worm gear and planetary gear actuated trimmers have a circular path. Multiturn trimmers are suitable for applications that require fine resistance adjustment.



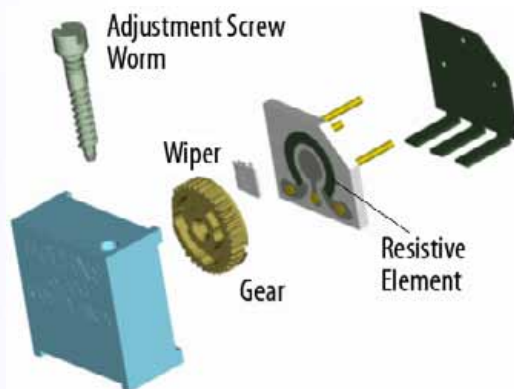
Lead Screw Actuators

A simple thread along the body of the adjustment shaft engages grooves in the carriage that holds the wiper. This mechanism provides the translation from turns of input rotation to the required linear wiper travel along the resistive element. Bourns® lead screw trimmers incorporate an automatic clutching action at the end of travel, preventing damage to the wiper assembly due to overtravel.

Figure 1: Typical Lead Screw Actuated
(Bourns® Models: 3005, 3006, 3009, 3057 and 3059)

Worm Gear Actuators

Unlike lead screw actuated trimmers, the adjustment screw engages the teeth of the small plastic worm gear, which is approximately the same diameter as the resistance element. The wiper is placed between the plastic gear and the element. By turning the adjustment screw, the gear rotates, moving the wiper along the resistance element. Bourns® worm gear actuated trimmers also incorporate an automatic clutching action at the end of travel, preventing damage to the wiper assembly due to overtravel. Typical designs include a mechanical stop to prevent further movement beyond the end of the resistance element.



Trimmers can be categorized based on the type of actuation. Lead screw and worm gear actuated Multiturn trimmers provide a reliable means of adjusting and setting the position of the wiper at the desired resistance value. The combination of threaded shafts and gears provides a means for fine adjustment of the output voltage or resistance, typically 11-25 turns. These package types are sealed to withstand standard cleaning processes.

Figure 2: Typical Worm Gear Actuated
(Bourns® Models: 3214, 3223, 3224, 3250, 3252, 3260, 3262, 3266, 3269, 3290, 3292, 3296 and 3299)

Planetary Gear Actuators

The third type of actuation for a Multiturn trimmer is the planetary drive system. As the user adjusts the shaft, the spur gear at the center of the shaft actuates two drive wheels, which are compressed, between the teeth of the spur gear of the shaft and the gear teeth of the outer ring insert. The axes of the two drive wheels are attached to the rotor / wiper assembly. The drive wheels are rotated along the teeth of the outer ring insert, which causes the rotor assembly to rotate in the same direction that the shaft is rotated such that the wiper traverses along the resistive element in a circular path.

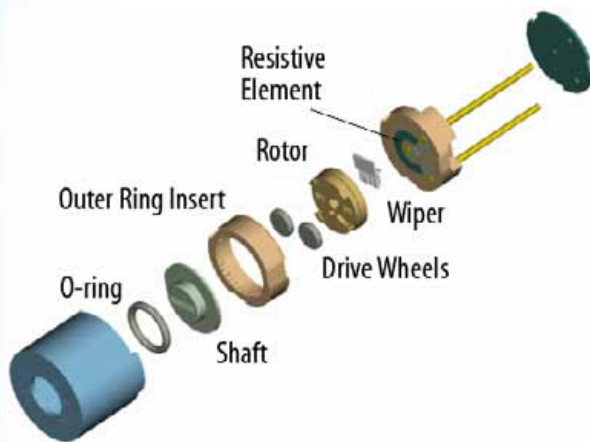
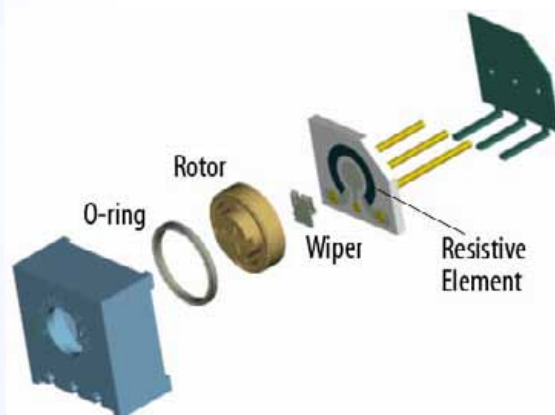


Figure 3: Typical Planetary Gear Actuated
(Bourns® Model: 3339)

The drive wheels rotate in the same manner as planets revolving around the Sun, just as the name implies. In this instance, the Sun is the center of the shaft spur gear. This mechanism allows for fine-tuning and ease of setting the resistance to a desired value. The unique design is built to offset an overcompensated adjustment, providing flexibility to technicians.

Single-turn

Bourns® single-turn trimmers are actuated by a direct-drive mechanism. It consists of a simple rotor with a slot, whose wiper movement is traversed in a circular path.



Package types available are sealed or open-frame designs. Sealed trimmers are built with an o-ring seal to prevent entrance of moisture and serve as a mechanical restraint to prevent unwanted wiper movement. Open-frame trimmers are not sealed to withstand a cleaning process and are usually lower in cost.

Figure 4: Typical Single-turn
(Bourns® Models: 3345, 3329, 3352, 3386, 3362, 3313, 3314, and 3361)

Single-turn vs. Multi-turn

In terms of functionality and performance capability, there are key differences between a single-turn and a multi-turn trimmer based on setting accuracy and speed of adjustment. Table 1 illustrates the difference.

Table 1: Capability Comparison

	Single-turn	Multi-turn
Setting Accuracy		X
Speed Adjusting To Accurate Setting		X
Speed Adjusting To Approximate Setting	X	

Setability – Single-turn vs. Multi-turn

Technicians or production workers typically adjust a multi-turn to a desired setting faster than a single-turn.

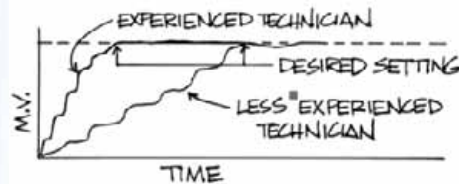


Figure 5: Multi-turn Setability

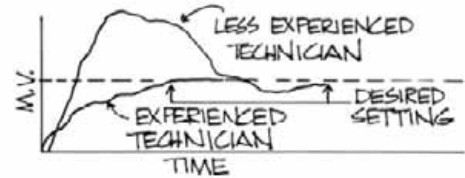


Figure 6: Single-turn Setability

Select the trimmer best suited to the operator's skill and adjustment time requirements. Remember, not everyone can make fine adjustments quickly.

Typical Trimmer Applications

Applications that usually favor the cost-effective use of multi-turn trimmers:

1. *Op Amp Zero Adjust* – The multi-turn advantage over single-turns in the application is a shorter adjustment time to an accurate setting.
2. *Voltage Regulator Adjust* – Single-turn trimmers used in this application require two fixed Vdrop-in resistors. The extended range feature of a multi-turn provides voltage dropping and f

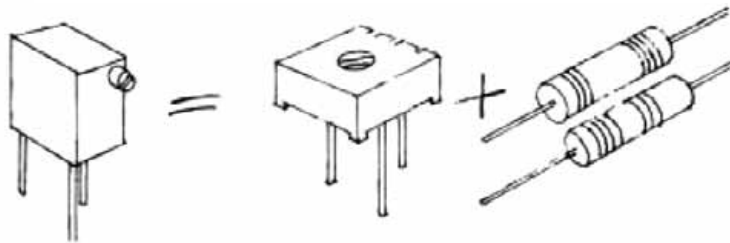


Figure 7: Equivalent performance range of Multi-turn

3. *Oscillator Frequency Adjustment* – Multi-turns give quick and accurate adjustment, even when done by an inexperienced operator.

Summary

- *Multi-turn trimmers are available in three types of actuation – lead screw, worm gear, and planetary drive system. Package types are sealed to withstand standard cleaning processes.*
- *Single-turn trimmers are designed with a direct-drive actuation for resistance adjustment. Package types are available as either open-frame or sealed.*
- *Multi-turn trimmers allow for fine-tuning and provide a faster setting-to-time ratio than single-turn trimmers.*
- *Single-turn trimmers are suitable for applications such as data input for digital equipment, where the level of accuracy is not critical.*

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