



The Importance of Knobs & Switches to Proper System Operation:

An examination across industries

Millions of rotary switches and knobs are sold globally every year for heavy-duty commercial and industrial applications where reliable operation, precise positional setting and the ability to withstand harsh environments are absolutely critical parameters. These small, seemingly insignificant, parts can provide big control functions and incorporate more capabilities than their compact, unassuming appearance may let on.

Not only is there an emphasis on the feel

(haptics) and robustness of its switches, but knobs also need to incorporate aesthetics, such as the finish or style, these components are clearly visible on the system control panel.

Reliable operation and dependability are the two most important core requirements needed for rotary switches and knobs used in-the-field and in rugged environments. What good is the knob or switch on a "control panel" if it fails to "control"?

Construction is Important to Reliability

Another important consideration is panel and shaft sealing up to IP68 to prevent dust and water ingress into the equipment's chassis. The option for panel sealing is a standard offering for all of Elma's rotary switches and encoders. Shaft material should also be of primary concern because the shaft itself is overwhelmingly the point of damaging contact in equipment drops or radial or axial impacts of any kind. Brass as standard material, or stainless steel for added durability in harsh conditions, should always be considered.

In addition to the added robustness provided by brass and stainless, these two premium materials add to the reliability of panel sealing, due to the resultant machine finish on the exterior surface of the shaft, providing a much smoother surface for O-rings to seat against versus tooled aluminum. Lastly, to ensure years of trouble-free electrical performance, all internal contacts should be plated with hard gold over a nickel sealing layer.



Functionality Plays a Role

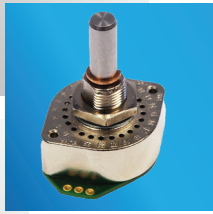
Rugged design elements for switches and knobs are only half the story; switches are available in many competing technologies and knobs are available in many different materials and fixing schemes...all with their advantages and disadvantages.

Selecting the correct switch functionality or technology can be confusing, due to some of the common yet confusing industry vernacular, and knob materials can range from basic plastic to high temperature plastic to different kinds of metals. These elements need to be considered, depending on the application.

Many factors influence the right switch technology, so be sure to ask questions like the following, before selecting a knob or switch:

- What rotational or switching cycle life is needed for the application?
- What is the turning force (turning torque) required for the application?
- Is the actuator stepped (click/click) or continuous (smooth turning)?
- What is the expected indexing angle (space between position) desired for the application?
- What are the cost considerations in comparison to your budget?

The following examples highlight some of the historically non-traditional uses where of knobs and switches to provide greater control and functionality in a growing number of rugged applications:



Agriculture: Multi-Selector (MR50)

An increasingly diverse group of industries are turning to a more sophisticated user interface as digital technologies force the transition from inexpensive components to more advanced switches and knobs, and these components are

finding their way into replacing traditionally manual, heavy-duty applications.

In the agricultural world, switches and knobs play a critical role in all equipment from planting, harvesting and storage of crops. Because much of the machinery used in commercial agriculture spends its life outdoors, components need to stand up to challenging environmental conditions. Protection against moisture, dust and fine particles is critical to maintaining reliable operation.

In one case, Elma Electronic's MR50 multi-selector switch is used as the mode selector switch on a grain spreader that needed a switch capable of up to 16 positions with only 1/2" of round space horizontally and 10mm depth behind the panel.

The switch's front panel meets IP68 panel sealing for ingress protection and operates in temperatures from -45°C to +85°C, ensuring reliable operation across the seasons, wet or dry, hot or cold.

The positive tactile feedback from the MR50 is excellent, even while using heavy-duty gloves; and the standard, low-profile, stainless-steel shaft provides resistance to lateral impacts of all kinds that can occur on a routine basis.

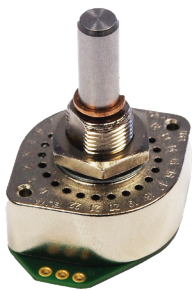
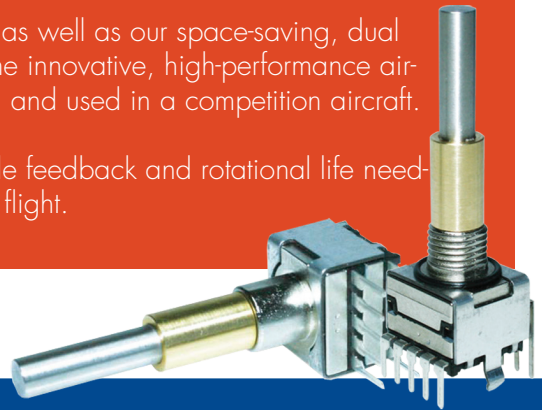
Aviation: High Precision

Air races...fast paced, high flying fun...and at the annual Red Bull Air Race, an official World Championship accredited by the FAI – The World Air Sports Federation, Elma was there, helping pilots cruise through the course!

At the event, pilots navigated their extremely light and maneuverable racing aircraft at a speed of up to 370 km/h (300 mph). This demanding, and extremely safety-critical, environment requires all on-board equipment to include the most reliable and haptic-rich switches available, as pilots do not always look at their controls, but rather turn and count the clicks to know where they are setting the switch, a practice commonly used in public safety radios, as well.

Elma's robust, mechanical encoder type E33, as well as our space-saving, dual concentric encoder type E37, are staples in the innovative, high-performance aircraft navigation systems developed by LXNAV, and used in a competition aircraft.

Both encoders offer the switching torque, tactile feedback and rotational life needed to ensure safe control of the aircraft during flight.



Retail Food Service: Repeatable Efficiency (Type X4)

As the fast-paced food service industry buckles under the pressures of staff shortages and increasing customer demands, making each employee most efficient by streamlining processes and improving automation are on every business owner's mind. Such is the task of one national coffee retailer that serves a variety of hot and cold beverages as well as light pastry items, snacks and sweet treats.

To expedite ordering, the company has invested in different ways to enable employees to facilitate multiple tasks in a shorter period of time, like using a modified type X4 coded switch with a push button



from Elma on one of its hot beverage product dispensers. The switch features a very specific indexing profile, where each position dictates a preset fill level for the liquid in the cup. This allows the barista to do move about and complete other aspects of a customer's order, rather than sitting idle to watch the machine and ensure it doesn't overflow.



Defense: Compact, Yet Provides Excellent Tactile Feedback (E37)

Helicopters aren't exactly known for the smooth ride, but they do need solid communications controls. Pilots operate their choppers in high vibration conditions, while wearing gloves and working in extremely tight spaces. Feeling that tell-tale 'click' means knowing a switch is in the correct position is critical to a safe and successful flight. And knowing the switch won't vibrate out of position, brings added piece of mind.

In rugged, mobile environments, the effects of moisture and dust are often mitigated with reinforced coatings or coverings to protect the components, which adds bulk and can minimize precision in certain applications. Safeguarding helicopter electronics from these common

environmental exposures requires specialized protections, since the methods used can't detract from the needed tactile feedback or stability of the switch's positioning.

Elma's IP68-sealed E37 switch features water and air-tight sealing between the shafts that still enables the high-quality, tangible click and doesn't dampen the tactile feel of the switch. As an added benefit for the cramped spaces of a helicopter's console, the switch is only 7.5 mm deep, and even has an option for a smaller center shaft that enables smaller diameter knobs to make room for more switches side-by-side on a panel.





Robotics: Master Control (E33)

The growth of robotics in manufacturing, control and testing equipment has been exponential. Reliable interfaces with these systems come in the form of display panels that present the user with information, but also in the physical controls associated with setting parameters on a main control panel or hardware-based interface. (not sure how to integrate the following two examples-if pick one, will need more info...)

This can be either machinery that builds the robotics as well as the master control room for robotics running an operation.

Elma's E33s are commonly specified for this application arena where design for dependability and excellent sealing from dust and liquid are mandatory.

There's a good chance you'll see our switches used on equipment such as testing & controls equipment on a factory floor, where the user interface is subject to dirt and grime. Our E33 encoders are used for stage lighting robotics – computers that control the light shows are typically located in a console, where they are controlled by the main light manager.

Reliable panel controls are highly desirable in these applications. Feel is less important than ruggedness, and sealing is important in the event of spills, for example.



Audio Recording: Making Music History (MR50)

Known by respected and astute audio engineers, studio owners and sound technicians, Elma has a long history with audio manufacturers and audiophiles who have used our switches and knobs for decades, creating some of the most iconic recordings of our lifetime.

One such company, Sound Techniques Ltd., started as a recording studio in 1964 in Chelsea, London, and grew to be one of the premier recording spaces at the dawn of rock and roll. Scores of artists, including Pink Floyd, The Who, David Bowie, Elton John, Jimi Hendrix, Queen, The Doors, The Rolling Stones, Led Zeppelin and of course, The Beatles, all recorded on Sound Techniques consoles.

The original Sound Techniques A-Range consoles employed Elma's knobs and switches even back then.

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