BATTERY POWERED

Anthony Vangasse, Rotork, UK, explores how modern battery technology improvements within electric valve actuation can help a site to maintain an optimum level of operations.

In order for a site to be productive, profitable and efficient, the assets that operate within it must be continually available, even if power is lost.

Flow control assets are often key pieces of equipment at a plant, providing essential duties for safe operation. Unplanned downtime can be costly and disruptive, affecting output yield, quality, and a company's reputation.

Battery technology can provide solutions to a key problem that all operators and manufacturers face: how to ensure that production at a plant can continue even if a central power supply fails. The technology can help manufacturers to operate at peak efficiency and productivity.

The importance of actuator shutdown battery technology

The value of battery technology within valve actuation is substantial. In the event of mains power loss, a shutdown battery can continue to function automatically to a site-configurable end of travel safe position, providing fail-to-position functionality on critical valves within oil and gas applications.

Specific examples include valves that require emergency shutdown (ESD) and partial stroke testing (PST); plants dependent on unreliable power supplies; remote solar-powered sites; wellheads; diverter valves; or sites that require replacement for remote, process gas-powered pneumatic actuators.

Any downtime that has not been planned in advance, that is brought on by power supply issues, can have severe implications. If there is a loss of power, the process will typically fail-to-position right away (to guarantee safety and prevent product loss), but often operators want their applications to run as long as they can without power.

Safety is a key element to consider; if power is lost in the middle of an actuator's action, the continued flow of a product may be dangerous. Flow control technology must provide a solution to ensure that, if desired, the process fails in a safe and controlled state.

Site uptime is essential, and battery technology can address power supply issues at critical locations, enabling flow control to continue to operate with the aid of a battery. A lithium-ion battery supplies back-up power from within the actuator enclosure, therefore maintaining benefits such as non-intrusive capability, hazardous area classification, and IP68 protection.

Lithium-ion batteries are small, light, efficient and dependable, and offer an operating life of up to 20 years. The battery charges automatically from the actuator mains (when mains power is on), saving time and improving efficiency. As the battery is charged, it has no impact on normal operations and its health can be monitored both locally and remotely, by way of intelligent actuators.

Actuators controlling the valve can either continue to run in the absence of electricity or safely cease the operation. Rotork's intelligent electric IQT part-turn Shutdown Battery provides fail-to-position functionality in explosion-proof applications. The failure mode can be easily configured through the advanced set-up menu, depending on customer requirements. This fail-to-position can be fail-closed, open, stay put or go-to-a-percent position, depending on what fail-to-position action is needed to ensure that the process fails to a safe operating state. This means that the process concludes in a known and dependable state, preventing potential safety issues and avoiding monetary consequences due to loss of process control. With the shutdown battery, there is no need for additional back-up systems, such as compressors, to provide this functionality.

Another important function of a shutdown battery is its uninterruptible power supply (UPS) mode, providing power when the primary power supply is lost. The shutdown battery's UPS allows for continued use of the actuator until battery charge is depleted, extending operation and control when power is lost or temporarily cuts out. Normal actuator service can be automatically restored on return of power, but it can also continue operating until the charge runs out. This mitigates the clear risks of lost revenue and interrupted action of flow control assets.

Site operators require a shutdown battery that is suitable for use in hazardous and EX areas. While other solutions, such as spring-return and hydraulic actuators, can provide some functionality, such as opening or closing the valve and therefore providing a fast-acting fail-safe action, they can be large and heavy.

Advantages of battery technology

The traditional method of storing energy for an actuator is through a spring. The mechanical nature of springs means that it has to be 2.5 – 3 times the size needed for the valve, in order to generate sufficient torque.

The advantage of battery technology within an electric actuator is that the energy required to compress the spring is not needed. As such, it requires the size, torque and, ultimately, weight of the complete system.

Springs can also waste up to 5 – 10 W of electrical power. In order to be effective, the spring needs to be compressed and, in certain circumstances, held by a strong electromagnet, which constantly uses energy to remain on standby waiting for a potential power failure. This can also cause significant wear, as the actuator drives compression into the spring, through day-to-day operation.

Control is another significant advantage that battery-powered shutdown has over springs. Speed and torque cannot be controlled by a spring, but a shutdown battery can be programmed to fulfil the specific requirements of the operator.

The adjustable battery technology is significantly more flexible than spring-based alternatives. A shutdown battery can be programmed and given controlled logic to meet the needs of the user, while a spring is a single function, either open or closed.

Springs are adequate if the application requires a simple one-time closing, fast action fail-safe. However, batteries provide an extra level of control that enables the end user to be more flexible in their operation and make adjustments that are relevant to their specific needs.

Figure 1. An actuator onsite at a fuelling depot.

The value of battery shutdown technology on a tank farm

On tank farms, uptime is of critical importance. Any unplanned downtime through interruption of the power supply can significantly detract from operational goals and cause major financial and reputational damage. Intelligent actuation, combined with modern shutdown battery technology, presents a solution to the biggest obstacles to efficient tank farm site management.

An example of where a shutdown battery can mitigate the issue of downtime would be when an operator is trying to reach optimal mass balance and accuracy in the blending of the product constituents. In normal operation, valves open/close or move to a position on the loss of power, regardless of the site's current blending status.

In the case of a power failure here, the previously mentioned UPS mode of the shutdown battery would take communicated instructions and allow the actuator to complete the correct process, even though the mains power was down.

Another area where a shutdown battery can make a difference is on truck-to-tank fuel loading bays. When transferring products such as gasoline or diesel to a tanker, there is a requirement to have one or two valves that are fail-close to avoid overfill. Flow begins with a connection to the tank and stops on disconnection. Usually, spring fail-safe close (FSC) actuators are used to ensure closure of the ball valve on disconnection of the fuel supply. However, the user will only know if a spring is broken through PST or after the failure.

A battery-powered intelligent actuator such as Rotork's IQT3 can provide continuous diagnostics of its health and ability to close, reducing the risk of overspill situations and associated fines.

Figure 2. IQT3 Shutdown Battery actuators at a tank farm.

Intelligent actuators and battery shutdown in oil and gas

Oil and gas applications often feature lease automatic custody transfer (LACT) skids on the wellhead or terminals, which manage the transfer of products between companies. The role of the skid is to sample and measure oil quality. If there is too much sediment and water in the oil, then a diverter will route the oil to a separate oil tank. If the sediment levels are acceptable, then a valve will open and send the oil to the receiving company via a measuring demonstration such as a Coriolis meter.

A shutdown battery actuator has stored energy, which gives assurance that it will revert to a fail-to-position if the diverter valve loses power. This means that there is no risk to oil quality, and reduced costs of reworking any contaminated oil. Additionally, as the majority of these skids are in remote locations, an intelligent actuator with a performance data logger allows for monitoring.

In the case of upstream production, ball valves are needed to prevent flow and isolate pressure if there is a loss of power and communications, which is usually managed through FSC actuation. This can lead to a wellhead shut-in, regardless of the duration of the power loss, and even in the case of a false alarm.

An intelligent actuator with programmable logic and shutdown battery integration, such as Rotork's IQT, can allow for a delay before the fail-close operation occurs. In the event that power or communication systems temporarily drop out through an unreliable supply, the operation can still continue.

Conclusion

Flow control powered by battery technology is increasingly seen on various sites, across different markets. All sites that require flow control need these assets to provide reliable, safe and efficient operation. Actuators that can be powered by battery technology play a key role in ensuring the critical process uptime and production availability that is at the heart of a site's success. Downtime can be costly and disruptive, especially for oil and gas production and tank farms/terminals. Battery-powered flow control technology can both extend operation where appropriate, and assist in bringing production to a safe halt if power supply is interrupted. T&T