# Capacitance modules offer an energy saving solution for machine builders

**Machine builders are increasingly under pressure to build energy saving features into their industrial machines. Chris Nevin, an expert in machine building at Bosch Rexroth, argues that capacitance modules could offer a simple solution.**

The issue of energy saving has in the past never been a high priority for machine builders. However, with escalating energy prices there is increasing pressure for energy saving options to be fitted to industrial machinery in order to help mitigate the impact of rising prices for end users.

One way of achieving this is to use simple capacitance modules which improve the energy balance in applications where machining cycles take place in rapid succession, such as roll feeds or cross cutting lines.

Effectively, the capacitance module acts like a kinetic energy recovery system (KERS) on a Formula 1 car, which has become very popular in F1 in recent seasons. The KERS system recovers a moving vehicles kinetic energy under braking, which is then stored in a reservoir, such as a flywheel or a battery for later use under acceleration.

With a capacitance module, which is connected to the DC bus, the machine effectively has a temporary energy storage unit which can reduce the heat loss in the control cabinet by relieving the braking resistor.

The primary role of the capacitance module is, in the event of a power failure, the reserve energy enables a controlled retraction motion. This protects the workpiece and the tool, for example in gear cutting machines. Rather than use the energy generated by braking to produce heat in a braking resistor, the energy is stored in a capacitance module and re-used on the next cycle of the machine.

However, an additional benefit of the capacitance module is that in storing energy the panel does not become overheated and there is no need for a cooling system to keep the panel cool.

**Power saving calculation for Henrob system using a Capacitance module.**

| | | |
|---|---|---|
| Phase current during average cycle | A | 1.3 |
| Line Voltage | V | 400 |
| Cycle time of rivet | S | 1.6 |
| Rivets / Car | | 3000 |
| Cars / Day | | 500 |
| Cost of a unit of electricity | £ | 0.12 |
| Days worked per year | | 240 |
| Saving using module | % | 13.36 |
| Per Rivet | | |
| Supply power | W | 899.6 |
| Energy | WS | 562.25 |
| Rivets / Day (500 cars each with 3000 rivets) | | 1500000 |
| Energy / Day | WS | 843375000 |
| Energy / Day | KWH | 14056.25 |
| Cost of Energy / Day for all rivets | £ | 1686.75 |
| Saving using all Modules | £/day | 225.3498 |
| Saving using all Modules | £/year | 54083.952 |
| Cost of Module | £ | 286 |
| Number of Modules | | 500 |
| Total spend on modules | | 143000 |
| **Pay back time** | **Years** | **2.644038** |

Bosch Rexroth has worked extensively with Atlas CopCo, the global manufacturers of self-piercing riveting equipment, to introduce capacitance modules into a number of the company's machines.

This has enabled both parties to analyse the impact of capacitance modules in actual production environments.

Figure 1 (based on figures in 2012) is a breakdown of costs using 500 capacitance modules on a vehicle production line, which requires the driven load to stop very quickly. As illustrated 1.3 amps

of energy is used during an average cycle with 400 volts input into the machine and each rivet taking 1.6 seconds. With a capacitance module in use this results in a 13.36 per cent saving in current.

During the course of a typical production day, 500 cars will be manufactured, each with 3000 rivets, which equates to 1,500,000 rivets per day with a total KWH of energy per day of 14056.25 costing £1686.75.

The saving from the capacitance module equates to £225 per day which over a 12 month period resulted in a saving of more than £54,000. Ultimately, the use of a capacitance module in this automotive application had a payback period of 2.64 years.

It is clear therefore that capacitance modules can play a significant role in helping to save energy and cut costs in machinery applications. Crucially, capacitance modules have a relatively low unit price and can therefore offer a short payback period on any investment.