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Sumitomo (SHI) Demag

Analysis of energy consumption with "activeEcon" integrated energy measurement

Energy consumption of the injection moulding process is an on-going matter of key interest, together with quality and cycle times, for the operators of injection moulding machines. In order to provide our customers with the possibility of also monitoring, analysing and, if required, controlling the energy consumption of their machine, Sumitomo (SHI) Demag is now offering a tool for measuring and analysing data which is integrated into the machine's controls with "activeEcon".

We have been offering our customers such a tool for measuring energy consumption for over 30 years now, the first time being in 1981, in the shape of the ECON 80 and, since 1991, the ECON 2000 systems, based on NC4 controls and now "activeEcon". This helps make Sumitomo (SHI) Demag a pioneer in this field as well and shows that the subject of energy consumption has long been a fixed component within the strategic considerations of the company.

The subject of energy consumption has been increasingly focused on in the past few years due to rising energy prices and CO2 pollution. The new NC5 machine controls now provide considerably more possibilities for analysing and visually evaluating energy consumption data. With "activeEcon", the user can now refer to three dedicated screens representing the energy consumption of the injection moulding machine and the costs associated with this.

These screens allow, for example, for very precise tracking of how changes of the process parameters are affecting energy consumption. For this purpose, the energy consumption of a cycle is recorded and stored. After the setting of the machine has been changed, the effect of the change on energy consumption can then be analysed precisely through a comparison curve. The knowledge gained regarding the impact of the process parameters on energy consumption can then usually be transferred to other machines. This enables the machine operators to become sensitive towards this important subject and allows them to develop their own strategies for setting the machines efficiently.

Additional functionality: Monitoring of production costs

A further function of "activeEcon" is to provide comparisons between current production costs and a previous order used for reference purposes. To this end, material costs, energy costs and the machine hourly rate are stored in the tool catalogue after the order has been executed and are then available as reference values for the current production the next time the same dataset is entered. This allows for very rapid tracking of whether and, if required, how production costs have changed when compared with the previous production run.

Integrated "activeEcon" energy measurement provides our customers with a strong instrument for optimising and monitoring energy consumption and production costs.



Optimisation of production costs with "activeEcon"

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Function principle

The energy consumption of the drives is measured via an energy measurement module. It inputs the voltages and electrical currents of the 3 phases cyclically and then calculates the power being recorded at that moment by multiplying the values. In addition, the energy intake during a machine cycle and the entire energy intake since the previous initialisation (order commencement) are determined. Cycle measurements depend on the digital outputs (see control wiring diagram) for "Cycle commencement" and "Cycle running". The following power or energy data is determined from the cycle signals:

- Energy intake of the previous cycle
- Energy intake per kg of the previous cycle (energy intake depending on the shot weight entered)
- Peak power of the last cycle (currently not used)

The energy consumption used for cylinder heating is calculated from the performances of the heating tapes and the duration of the switch-on time.

"activeEcon" - Integrated energy measurement and more!



- Display of consumption of drives, heating and overall consumption
- Comparison of various machine settings → Display of the effect of settings on energy consumption
- Display of consumption
 - Per cycle (Wh)
 - Per kg of plastic processed (kWh/kg)
 - Average power consumption (kW)
 - Current power consumption (kW)

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- Power consumption and energy consumption are displayed over a cycle
- Power consumption of individual loads can be measured
- Precise analysis of the different loads

The screenshot displays the 'ENERGIE AUFTRAG' (Energy Order) interface, which provides a comparison of energy and cost data for a current order and a reference order. The table is titled 'Referenz speichern' and includes columns for 'letztes Teil', 'akt. Auftrag', and 'Referenz'. The data is as follows:

	letztes Teil	akt. Auftrag	Referenz
Durchschnittliche Leistungsaufnahme [kW]	142.2	72.8	
Energiebedarf laufender Auftrag [kWh]	437	630	
Produktionszeit [h]	3.07	8.65	
Materialpreis [EUR /kg]	1.6000	1.5678	0.0081
Preis für kWh [EUR /kWh]	0.1200	0.1175	0.0006
Maschinenlundsatz [EUR /h]	18.7000	18.3239	0.2549
Energiekosten/kg [EUR]	0.0684	0.0722	0.0002
Energiekosten/Teil [EUR]	0.0001	0.0000	0.0000
Produktionskosten/Teil [EUR]	0.0026	0.0025	0.0000
Gesamtkosten [EUR]		9.60	0.11

The interface also includes navigation buttons for PDE, Statistik, Energie Zyklus, Energie Auftrag, and Energie-analyse.

- Material costs (per kg) and electricity costs (per kWh) as well as machine hour rate can be entered
- "activeEcon" displays the energy consumption and the costs of current production (linked with product counter)
- Values are stored with the mould dataset. This allows consumption and costs to be compared with previous production data.

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Benefits:

- ✓ Reduction in energy costs
- ✓ Simple operation of the screens through familiar screen lay-out
- ✓ Visual representation of the effect of the process parameters on energy consumption
- ✓ Monitoring of production costs through storing of previous reference orders

Tips and tricks for achieving optimum energy setting

- Adjustment of the dosing speed to the cooling period A reduced injection moulding speed not only protects the melt, but also reduces electricity consumption.
- Determination of the precise clamping force
- Optimum hold pressure height and hold pressure time
- Optimum temperature control of plastification cylinders, hot runners, mould and, if applicable, temperature control of the oil
- Use of brake energy recycling (implemented as standard by Sumitomo (SHI) Demag wherever possible)

The Golden Rule applies:

The quality of the part must be right to begin with, then the cycle time is optimised and then the setting for energy technology is fine-tuned.