SyncroSpeed

energy saving system

ADVANCED ENERGY EFFICIENCY FOR INJECTION MOULDERS

Moulded to suit

ccstechnology

control systems engineering

ABOUT:

What is SyncroSpeed?

...the most effective energy saving retrofit an injection moulder can buy

- *Reduces energy loses in injection moulding*
- *"Bolts on" to most injection moulding machines*
- *35-55% reduction in energy consumption*
- *Market leading results*
- *Reduced cooling load*

SyncroSpeed is a retrofit control system installed on plastic injection moulding machines (IMMs); its purpose is to improve the machine's operating energy efficiency. The system includes a variable speed drive (VSD or inverter) which is used to regulate the speed of the pump motors. Controlled in the correct way, reducing motor speed can result in a considerable reduction in motor power consumption while at the same time maintaining full productivity (cycle time) and process consistency (part quality); this is what SyncroSpeed does.

Induction electric motors are used on all conventional hydraulic machines, selected for their ruggedness, low purchase cost, and low ongoing maintenance. These motors run at a fixed speed and drive the hydraulic pumps, but most of the time the machine operations does not need all the oil from all the pumps. Machine manufacturers use various techniques for the management of the over-production of oil, the excess volumes must be returned back to the oil reservoir, but all with varying degrees of inefficiency. A far more efficient method would be to continuously regulate the speed of the electric motor, so the pumps produce just the right volume of oil that is needed at any instant; this is the purpose of SyncroSpeed.

SyncroSpeed comprises electronics hardware and control software components. All hardware is bought from recognized leading global suppliers and is assembled in an industrial steel enclosure. The software supports unique and highly sophisticated elements of control, developed through the needs and experiences of working with most of the popular makes and models of injection moulding machines around the world.

The savings results depend on several factors ...the plastic injection moulding machine brand & model, the form of the moulded component, and the material being processed. Typical energy savings are between 25%-45%, with some exceptional results exceeding 70%. In practical terms, SyncroSpeed is the best technology, it finds and delivers the energy saving on any hydraulic press. When the bottom line is all about reducing energy and operating costs ... SyncroSpeed is the premium tool to make those reductions and is best deployed on larger motors that are planned to be in production for most hours of the year.

Ruggedness and reliability are underpinned by robust design & build, adherence to prevailing standards & codes, together with a high specification of all key components. The control and physical configuration offers four escalating levels of system by-pass to rapidly manage any minor or major event that may affect production capability.

The remote monitoring system links SyncroSpeed installations with the CCS bureau in England to support real-time monitoring, data-logging, program updates and troubleshooting.

The SyncroSpeed team offer a great deal of know-how and experience. We are ready to assess your stock of injection moulding machines, analyse the savings potential, and offer an effective program of attack on the unseen wasted energy associated with your machines. We have installations from Korea to California on most popular makes of IMM including Krauss Maffei, Engel, Windsor, Stork, Cincinnati, Van Dorn, Sandretto, Negri Bossi, Toshiba, Mitsubishi, Haitian, LG.

CONTENTS

WILL SyncroSpeed WORK FOR YOU?

Good candidate machines are usually:

- Larger than 250 tonnes
- Have fixed displacement pumps
- Have longer cycle times >30s
- Has high utilisation

However not in all cases...

let's find out.

Do you have IMMs bigger than 250 tons press size with motors =>37kW? The cost per kW of motor controlled for VFD's <37kW is relatively high. This, together with the smaller savings on small tonnage IMMs, means the resulting extended ROI can be unacceptable (>5 years). Bigger motors on large tonnage machines offer better opportunities.

What make of IMMs do you have (Van Dorn; Engel; HPM; Windsor; Haitian; etc...)? CCS engineers have worked on most makes of IMMs on the market today. All makes of machines will be different and the answer to this question will help us to qualify the answers you give to us.

How old are the IMMs (year of manufacture) and do you have the model number? Generally new IMMs will be of an improved energy efficient design to those machines 10 to >15 years old. There are exceptions to this for which SyncroSpeed can still achieve a good level of savings.

Do your IMMs have Variable Displacement Pumps? If the answer is NO, then the IMMs must have FIXED displacement pumps and are potentially good candidates for SyncroSpeed. The level of saving on IMMs with FIXED pumps will be 35 to >55%. The saving on IMMs with Variable pumps will be less, 15% to 25%, with a corresponding impact on extended ROI.

PLEASE NOTE: We will look at large tonnage IMMs (2000t to 5000t) with variable displacement pumps on a case-by-case basis. We can save on this type of IMM during static phases of the machine (no movement) but these large tonnage machines can have very long cycle times with over 40% being static. This can still add up to a good financial case.

Do the IMMs have hydraulic accumulators and are they being used? Look for machines that do not have accumulators or where they are inactive. As with the note on question 4, we will assess large tonnage (multi-motor) IMMs with accumulators on a case-by-case basis.

Are the cycle times >25 seconds? SyncroSpeed saves at virtually every phase of the moulding cycle. Longer cycle times = greater saving opportunities. Longer cycle times are associated with bigger mouldings…. running on bigger tonnage IMMs…. and with larger motors. All of which contribute to an improving financial justification.

How many of these injection moulding machines do you have? How many IMMs do you have in total and, with all of these questions in mind, how many IMMs do you have that meet these criteria? CCS Technology has a spreadsheet questionnaire to help collate the required information.

Annual motor running hours (machine utilization)? How many hours in the year are the motors switched on? To keep this simple we just ask how many hours a day, how many days per week and how many weeks a year are you operating the machines?

PLEASE NOTE: SyncroSpeed saves energy even when the IMM is not producing (moulding) but is left switched on with the motors idling. Do not discount (throw away) time here. If the motors are running we can save you money.

Motors switched off time (%)? What % of the hours in the year are the motors switched off ?…. 5% of the time?, 10% of the time?…. or something else? Take an educated guess if you do not know the exact amount of time.

What is your average cost of electricity? We need to know how much you are paying for electricity (cost/kWh)…. also, any price/contract changes ahead? Are you paying maximum availability or demand penalty charge? SyncroSpeed will reduce the kVA at the site transformer and at the same time as saving motor kW consumption. Saving kVA will allow more machines on the same power supply and help with availability and demand issues.

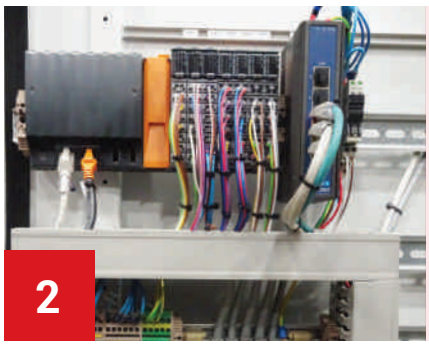
What is the method of hydraulic oil cooling? Are you using cooling towers, chillers... or something else? The energy saved with SyncroSpeed reduces heat in the hydraulic oil. This saves on the cost of cooling that can add a further 10% kW saving... or even more (20%) when chillers are used. This is in addition to that achieved with the motors.

Do you have any rebates or government financial incentives available to you? SyncroSpeed qualifies for government tax breaks and rebates which are intended to provide an incentive to industry to improve energy efficiency of plant and machinery. A positive cash flow is usually the goal of these schemes.

HOW DOES SyncroSpeed WORK?

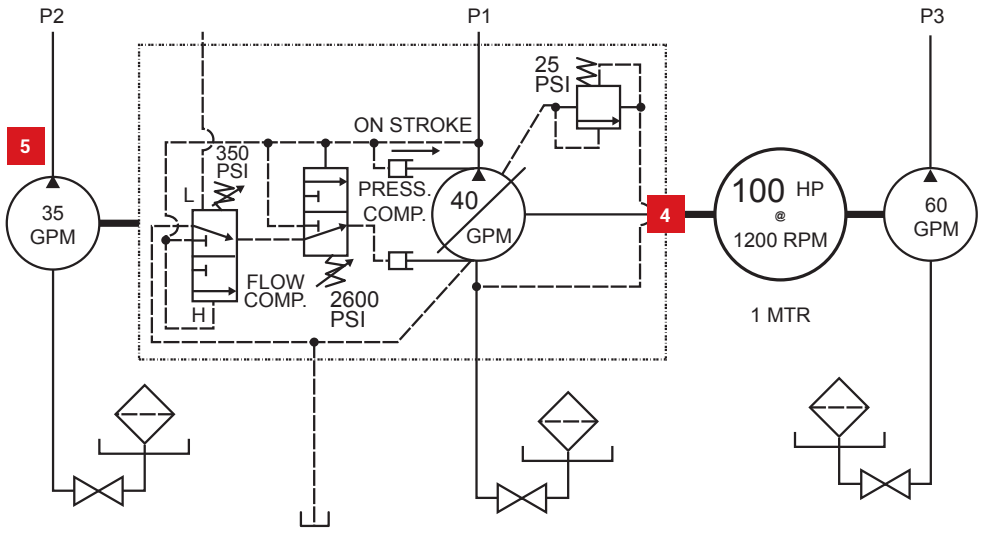
Host moulding machine

1 Deep integration with the control of the host machine enables SyncroSpeed to continuously interpret the machine's movement and speed setpoints.



2 SyncroSpeed's unique control logic assesses and calculates motor speed for optimum energy savings. Speed command is regulated around 50 times each second.

3 The power supply from the inverter to the motor is constantly adjusted in frequency and voltage to drive the motor at variable speeds.



Before SyncroSpeed, the drive shaft to the pumps rotates at a fixed speed. Oil volume produced by the pumps is always more than is needed by the machine.

4

Speed regulation more precisely matches the produced oil volume from the pumps to the true demand for the correct speed of movement. Efficiency gains are also made with variable volume pumps.

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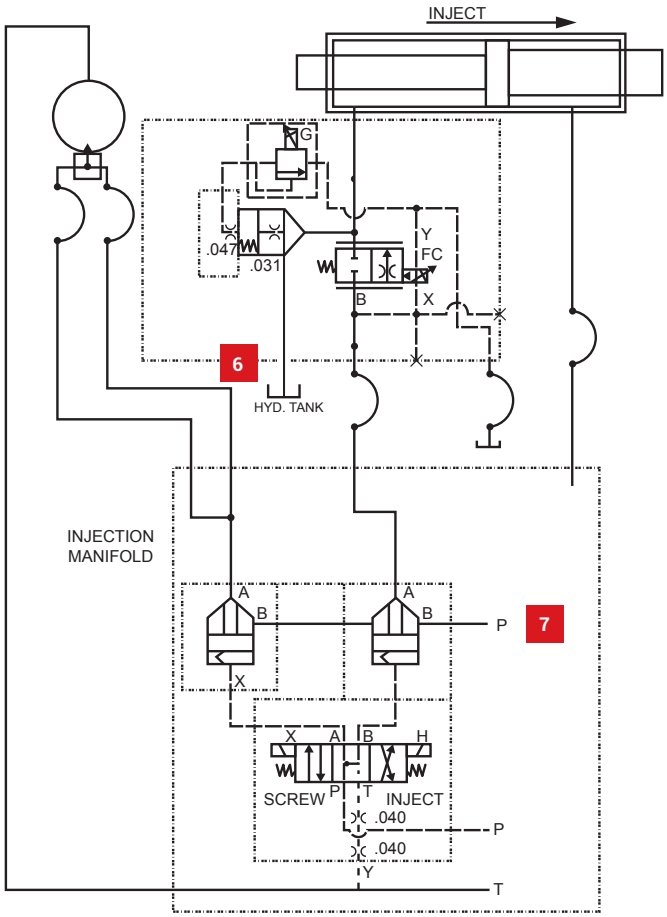

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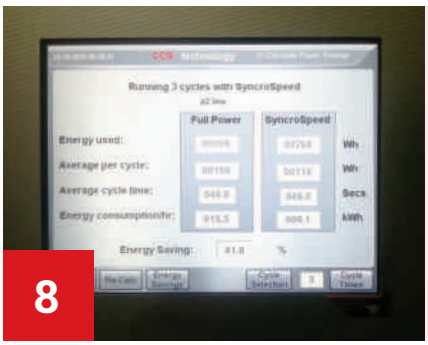
The purpose of the proportional flow control valve is to meter the correct volume of oil to the actuator to produce the correct speed of movement. The excess oil volume produced from the pumps is diverted back to tank.

7

SyncroSpeed ensures adequate oil volume is available for correct speed of movement and eliminates the overproduction of oil from the pumps. Motors and pumps consume less energy, moulding machine efficiency improves.



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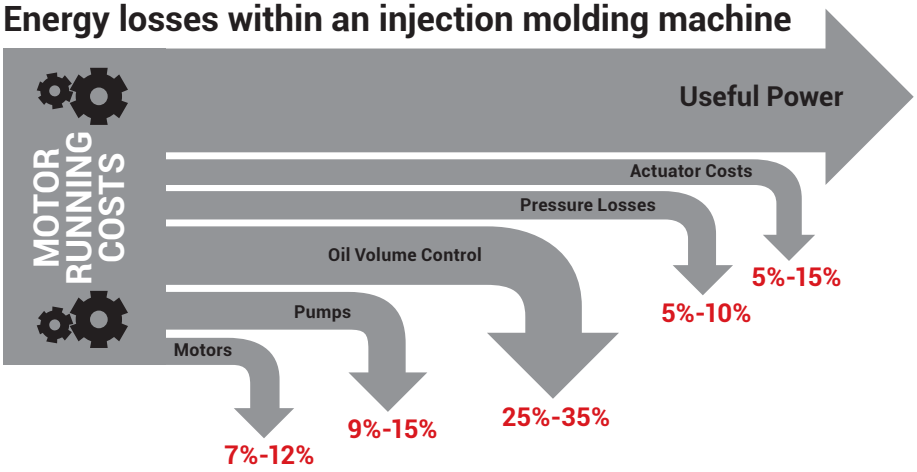
The touchscreen HMI provides a number of screens of information for the user, to monitor energy saving job-by-job, and system status.

Energy losses within an injection molding machine



Useful Power

Less than half of the energy consumed by the electric motors provides useful power to operate the injection moulding machine.

There are energy losses at every stage during the course of generating hydraulic power by the motor and pumps, then transmitting power through hydraulic valves, hoses, and manifolds, and finally consuming power at the actuator.

Understanding where and how the wasted energy occurs is the key to minimising losses and improving the efficiency of the moulding machine.

The SyncroSpeed system attacks the losses associated with oil volume control, pressure losses, and in some cases the operating efficiency of the pumps.

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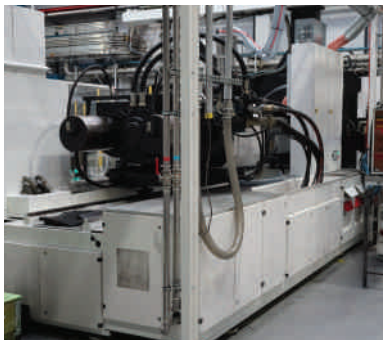
CASE STUDY:

SyncroSpeed excels with Engels

household goods



SyncroSpeed is a dynamic motor speed control system. As a retrofit to any brand of hydraulic injection moulding machine, significant reductions can be made in energy consumption and operating costs of the machine.

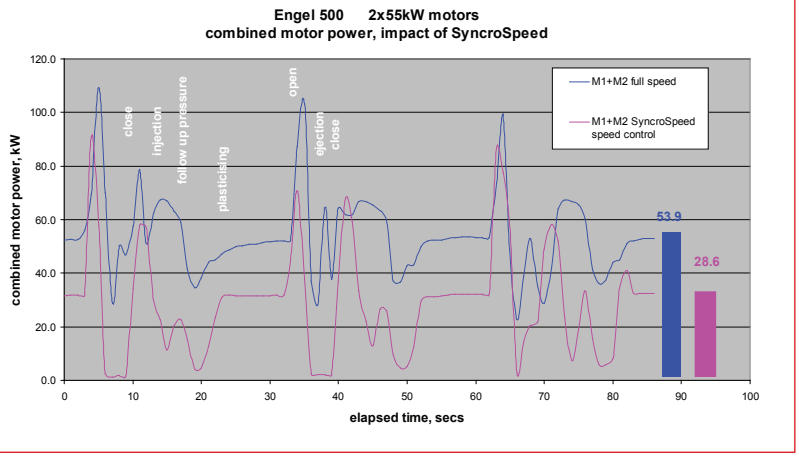
Comprehensive trials on the first Engel 500t were so successful, the customer responded promptly to order eight additional systems for other Engel machines in two European moulding plants. Within a year, the installation programme was rolled out to also include plants in Korea, India, and Mexico. The programme extended to over 100 machines, from six different manufacturers, of which 50 were Engels ranging 500t – 750t.

The majority of Engel machines were two motor with CC90 or CC100 controllers, operating at 50Hz in Europe and 60Hz in Mexico. The SyncroSpeed system was designed for both regions, and took full advantage of the host closed-loop control features to maximise the energy savings while delivering standard cycle times and maintaining all part quality measures. The SyncroSpeed control independently regulates each motor speed, provides full speed and pressure on demand, and manages all combinations of plasticizing/clamp/ejector/core parallel movements.

Particularly with this series of Engel machines, increased plasticizing rates could be achieved, so reducing the frequency of setups requiring an inefficient plasticizing/clamp parallel movement. This also avoided the consequent loss of absolute speed control and also led to some gains in cycle time.

STATS

Machine	Engel 550 t
Motors	55 kW + 55 kW
Power Without	53.9 kW
Power With	28.6 kW
Energy Saving	25.3 kW **46.9%**
Cycle Time	29.5 secs
Component	storage box
Material	polypro
Shot Weight	385g



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CASE STUDY:

HPM

household goods

1000t injection moulding machine
model 1100MkII 260C
3-motor, 55kW+55kW+45kW

Producing storage boxes in polyethylene
42 seconds cycle

POWER STATS

Power Without	84.6 kW
Power With	47.0 kW
Energy Saving	37.6 kW **44%**

ANNUAL REDUCTIONS

Energy Consumption	251,250 kWh
CO_2 Emissions	135 tCO_2e

Return on investment I 20 months

Costs & benefits based on:
Historic sales price including delivery, installation, commissioning
Energy cost GBP0.0399 / kWh
Oil cooling by cooling towers
Emissions conversion 0.537 kg CO_2 / kWh

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energy saving system

CASE STUDY:
Krauss Maffei
automotive

800t injection moulding machine
model KM800-8000
single motor 132kW

producing internal trim in abs
61 seconds cycle

POWER STATS

Power Without	72.0 kW
Power With	36.9 kW
Energy Saving	35.1 kW **48%**

ANNUAL REDUCTIONS

Energy Consumption	286,210 kWh
CO_2 Emissions	154 tCO_2e

Return on investment I 15 months

Costs & benefits based on:
Historic sales price including delivery, installation, commissioning
Energy cost EUR0.040 / kWh
Oil cooling by cooling towers
Emissions conversion 0.537 kg CO_2 / kWh

SyncroSpeed
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CASE STUDY:
Cincinnati
household goods

1000t injection moulding machine
model 1000-165oz
3-motor, 75kW+45kW+18.5kW

Producing toilet seats in polypropylene
105 seconds cycle

POWER STATS

Power Without	77.4 kW
Power With	43.4 kW
Energy Saving	34 kW **44%**

ANNUAL REDUCTIONS

Energy Consumption	200,940 kWh
CO_2 Emissions	108 tCO_2e

Return on investment I 16 months

Costs & benefits based on:
Historic sales price including delivery, installation, commissioning
Energy cost GBP0.0659 / kWh
Oil cooling by cooling towers
Emissions conversion 0.537 kg CO_2 / kWh

SyncroSpeed
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CASE STUDY:

Farrel

automotive

1500t injection moulding machine
model E1500 H260D
3-motor, 75kW+75kW+75kW

Producing internal component in glass-filled polypropylene
87 seconds cycle

POWER STATS

Power Without	75.3 kW	
Power With	40.0 kW	
Energy Saving	35.3 kW	**47%**

ANNUAL REDUCTIONS

Energy Consumption	320,250 kWh
CO_2 Emissions	176 tCO_2e

Return on investment | 17 months

Costs & benefits based on:
Historic sales price including delivery, installation, commissioning
Energy cost USD0.120 / kWh
Oil cooling by cooling towers
Emissions conversion 0.550 kg CO_2 / kWh

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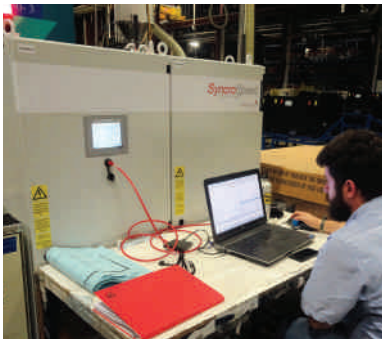
CASE STUDY:

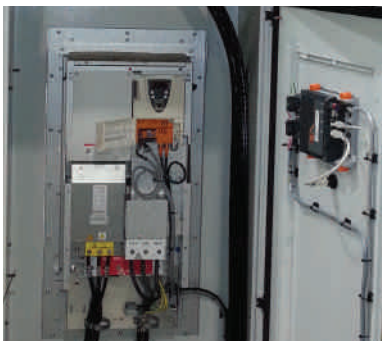
Sandretto

automotive

1000t injection moulding machine
model 1000 MegaT
single motor 110kW

Producing glove box in abs
32 seconds cycle





POWER STATS

Power Without	44.3 kW	
Power With	28.6 kW	
Energy Saving	15.7 kW	**35%**

ANNUAL REDUCTIONS

Energy Consumption	98,390 kWh
CO_2 Emissions	53 tCO_2e

Return on investment | 20 months

Costs & benefits based on:
Historic sales price including delivery, installation, commissioning
Energy cost GBP0.080/ kWh
Oil cooling by chillers
Emissions conversion 0.537 kg CO_2 / kWh

HOW CAN WE HELP YOU?

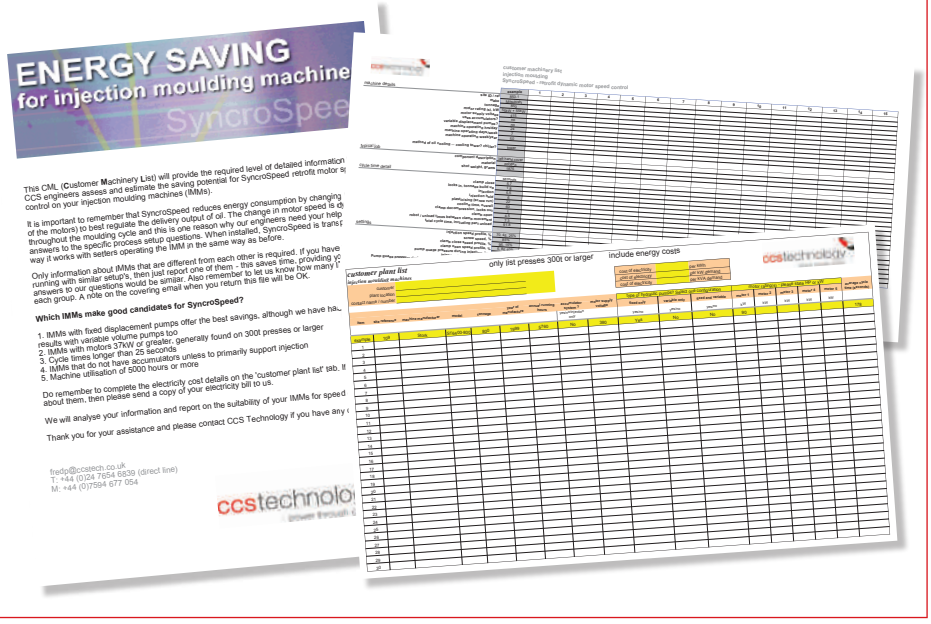
Energy savings assessment.

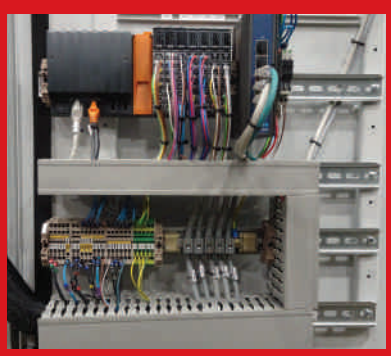
A successful SyncroSpeed installation relies on many factors. To get going you will want to know the benefits and costs relating to your machines in your plant.

You provide the information, we will provide the answers.

Make of machine, material and form of molded parts, annual operating hours, forecast energy costs ... these are all important factors that define the financial benefit that can be achieved with SyncroSpeed.

Call or email to discuss how SyncroSpeed may perform for you. We will forward forms for data capture then get back to you with an assessment of the energy saving potential. We will highlight the more attractive candidates to make energy savings... and also identify machines that are unlikely to make such a good financial return.





SyncroSpeed
Frequently Asked Questions

How much downtime of the machine is needed to complete the SyncroSpeed installation? For a single motor machine, allow about 8 hours. If there are more motors in the system then depending on their size and location allow another 2-4 hours for each additional motor. With some simple planning and communication, we can normally ensure that machines are available for production through the night shift, while we complete the work during the day.

What can go wrong with a SyncroSpeed installation? Our installation and commissioning procedures are developed to ensure that the finished job leaves your machine in a fully-functioning condition. On the way we may encounter some difficulties that are related to the machine and its 'as found' condition.

If the specification of the machine is different from the information supplied, we will discuss with you what that means to the installation programme, review the options, and revise the plan accordingly.

If we find any loose or bad connections, we'll make them good, or tell you about them.

When setting up the control system, we sometimes identify pumps that are not producing 100%, or valves that are not responding correctly. Often these maintenance issues are not exposed or identified when the pumps are constantly operating at full speed and at full delivery. We'll point out these issues and get you to fix them, or just work with them in the best way we can.

What if the SyncroSpeed system fails, what can be done to get our machines back in production? Any form of failure or mal-function of the SyncroSpeed system can be bypassed within an hour or less … that's the entire risk to any lost time of production.

At the touch of a button, our control software can be bypassed at either of two levels. First, force the motor to go at full speed for a specific phase of the moulding cycle. Second, force the motor to run at full speed all the time. Either method is your way of eliminating the motor speed control as being a source of any moulding difficulty.

Level3 bypass is for hardware failure of the SyncroSpeed controller. Your technician will take a few minutes to reconfigure the inverter (VFD) to run the motor at full speed without command from the SyncroSpeed controller.

Level4 bypass takes your electrician about 1 hour, to remake power supply connections from the motor starter (which is always kept in circuit) to the motor. We arrange cable terminations in such a way that this is a straightforward procedure to bypass the inverter, reverting your machine back to a condition before SyncroSpeed hardware was installed.

Isn't it yet another thing that my machine setters will have to worry about? Not an issue - our system is completely transparent in operation. Once configured when we install SyncroSpeed, there is no need to touch it further. The setters set-up the machine exactly as they have always done, doing nothing more, nothing less, and nothing different. SyncroSpeed monitors what the setter has demanded of the machine and reacts to that.

What maintenance is required? Regular clean or replacement of the air intake filter, and periodically you should check that cable connections are secure, look for any damage or loose assembly - just as you would on any item of electrical equipment. That's it.

Won't the motor overheat if it runs at a low speed? Leading motor manufacturers claim that the cooling by the fixed fan on the motor is adequate for motor full load down to about 50% of speed. With SyncroSpeed, lower speeds are associated with reduced power consumption by the motor, meaning lower loads … so the circulating currents and their heating effects are much reduced. The cooling requirement is correspondingly much reduced. Our trials have shown temperature shifts of motor casings up to 5°C, but either way, sometimes warmer, sometimes cooler. It's the difference between reduced cooling effect and reduced heating effect, and in most cases is not significant.

What about interference from the inverter? The adoption of good installation practices, such as the use of quality RFI filters, earthed screening on motor cables, ground plane bonding etc. overcomes such potential problems. We are fully aware of them and alert in looking out for their effects.

Might there be problems operating the pumps at lower speeds? Most pump manufacturers will say that the minimum operating speed is around 600rpm. One reason is because below that speed the pump may not develop pressure at start up. Once oil is flowing the fluid pressure will maintain vane seal, as well as providing the required lubrication. SyncroSpeed manage these issues. Our control system has strategies to avoid high-pressure/very low speed operating points of the pumps. We cannot make worn-out pumps new again, but we do avoid early damage and accelerated wear.

What about mains harmonics? SyncroSpeed specification includes an increased reactance to the mains supply in order to reduce low order harmonics. Harmonics is a site-wide issue, arising from any non-linear load such as a variable speed drive. Other more common sources are Personal Computers and modern electronic fluorescent lighting. We can assist with site evaluation of mains harmonics should the issue be of concern.

Do we need to change the motor to an inverter duty motor? The main concern here is premature failure of the motor winding insulation due to high voltage transients at the motor terminals. Industry recommendations for supply voltages less than 500V are to use standard motors, keep motor cable lengths to less than 10m, and work to best installation design & practice. This applies to virtually all our applications … even older motors from the late 1980's are running well with SyncroSpeed. Only have concern if your motors are in bad shape through poor bearing maintenance, cheap rewinds, or operating environments causing them to run hot. For higher supply voltages, there may be a need for additional hardware, such as inverter output reactors. We will consider each installation's requirements, although it is unlikely there will be a need to change the motor.

ABOUT:

Introducing CCS Technology

CCS Technology design bespoke industrial control systems and provides replacement PLC and drive systems for aging production machinery. The industrial control systems we produce are based around PLC, DCS, PC or CNC controllers including and fail safe systems to SIL2 and SIL3.

Established in Coventry, England in 1988, the company continues to strive to establish a team of professional electrical and software engineers with backgrounds in electrical and electronic engineering with specific emphasis on industrial control systems and motion control. Our offices and workshops are located within an 19th century school house, in the village of Wolston just on the outskirts of Coventry. Centrally located in the Midlands and connected by excellent transport routes, we are within 3 hours for anywhere in England and Wales. Our bespoke control systems are installed around the world.

Over recent years we have expanded into new industries and market sectors which use the same control system principles and technologies found in our traditional automotive and manufacturing machinery backgrounds. We remain focused on delivering purpose built control systems engineering solutions, whilst expanding our range of standard products which include the following:

VistaVison – Wireless condition and plant monitoring systems

SmartStart – Mains power/Generator automatic power changeover and management systems

SyncroSpeed – Energy saving systems for injection moulding machines

CCS Technology supports many markets, these are a few of our current and recent clients and their respective industries.

Automotive

- BMW Manufacturing (UK) Limited
- Ford Motor Co.
- Dana Axel
- Lear

Food & Beverage

- Cadburys Trebor Bassett
- Coca Cola
- Warburtons
- Nestle

Nuclear & Aerospace

- British Energy Group / EDF
- Alstec (Nuclear Division)
- Rolls Royce
- Airbus

Oil, Gas and Mining

- Zeuitina Oil Company
- Qualter Hall & TTK Gelik
- Kuwait Oil Company
- Ashanti Gold, Ghana

Machinery

- Gudel Lineartech
- Schmid Machine GMBH
- Timsons

Chemical & Pharmaceutical

- Dow Chemicals
- The Automation Partnership

CCS Technology design & install energy saving systems for retrofit to injection moulding machines. Our SyncroSpeed is the single biggest energy saver the moulding industry can embrace to achieve its goals in improving energy efficiency, reducing energy costs, reducing emissions, improving its green credentials.

"Centrally based in the UK, installations around the world."

Clients you may know

- Tupperware
- Plastic Omnium
- Aliaxis Group (Ipex, GSP Durapipe)
- International Automotive Components
- Mattel
- Faurecia
- Wavin
- Linpac Group
- Mann & Hummel
- Xten Industries
- Ames True Temper
- Bosch und Siemens Hausgerate
- Yanfeng
- Rubbermaid

Locations of SyncroSpeed systems.

- India
- France
- Belgium
- Netherlands
- Portugal
- Greece
- South Korea
- UK
- USA
- Canada
- Mexico
- Germany
- Spain

Machines SyncroSpeed has made more efficient & cost effective.

- Engel
- Van Dom
- Demag
- Negri Bossi
- HPM
- Windsor
- Krauss Maffei
- Stork
- Mitsubishi
- Meiki
- LG
- Bone Cravens
- Buhler
- Sandretto
- Cincinnati
- Haitian
- Toshiba
- Farrel

Example proven benefit with SyncroSpeed

Client X

- 36 x Injection moulding machines
- 5.8 million kWh per year reduction
- Saving £1.7m over next 5 years
- 5-year carbon footprint reduction 12,500 tonnes CO_2

Client Y

- 6 x Injection moulding machines
- 2 million kWh per year reduction
- Saving £722,00 over next 5 years
- 5-year carbon footprint reduction 4,300 tonnes CO_2

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ccstechnology
control systems engineering