The Grundfos concept of electronic speed control
Within the Grundfos concept of speed-controlled pumps, the circulator is integrated with a frequency converter, a sensor and software for speed control. This sensor automatically identifies variations in flow and communicates this information to the frequency converter. This in turn regulates itself to achieve the head needed. This interaction happens constantly thus ensuring the most energy-efficient operation possible.
This new era of pump technology means electronic speed control

Regulating the temperature is not sufficient
By controlling a heating system or an air-conditioning system on the basis of temperature only, a considerable amount of energy is wasted if the flow varies. Without constant regulation the volume of water flowing through the system will be unnecessarily excessive.

Old circulators ...and new
In systems with circulators that have no speed control the head increases as the flow decreases, and visa versa. In practice, this means that a lot of energy is lost in the system. The development of speed-controlled pumps means that this energy, formerly lost in a hydraulic system due to changes in consumption throughout the day and the year, can now be saved or used for other purposes. As the utilisation of energy is subject to the law of affinity, the value of even small differences is significant.

A comparison ...
To make a comparison with the world of motoring, a pump without speed control is like a car being driven at full speed with the driver reducing the speed by applying the brakes. Taking the same analogy using speed control, this is comparable to a driver controlling the speed of the car by using the accelerator.
Electronic speed control means...

The basic principle
The idea behind speed-controlled pumps is to integrate electronic control, thus ensuring each pump automatically adapts its output to the current conditions. This ensures that energy consumption is always maintained at its minimum, for the given conditions. By automatically controlling its own speed, the pump will continuously regulate the pressure (head) so that it is optimally adapted to the speed of water (flow). As the flow decreases, the converter will regulate the speed of the circulator, to achieve the required head. The pump will therefore adjust to the reduced friction in pipes, valves and thermostats at the lower flows.

The components and their interaction
Within the Grundfos range of speed-controlled pumps the circulator is integrated with a frequency converter, a sensor and software for speed control. The sensor automatically identifies the variations in the flow and communicates this information to the frequency converter so it can regulate accordingly, to achieve the required head. This interaction is continuous and ensures the most energy-efficient operation.

Temperature control as well
The pump can also be temperature-regulated. This regulation also happens automatically.
A new era in pump technology
The development of speed-controlled pumps has created nothing short of a revolution in pump technology. By being able to automatically control its own speed, the pump will continually regulate the pressure so that it optimally adapts to the flow. The driving force behind this innovative process has been the desire to achieve energy savings and an increase in comfort levels – without compromising the pumps lifespan or reliability.

The easy to install all-in-one solution
Grundfos speed-controlled pumps have an in-built motor, frequency converter and the necessary application software to make installation much simpler. As well as ensuring the optimum adjustment of flow rates, and thereby achieve energy savings, the installation costs and the risks of errors are reduced as components are pre-configured, and therefore already fully integrated.

Large capacity and parallel coupling
Offering large flow capacity and the parallel coupling of pumps, we design solutions with external frequency converters and control systems. Although these do not comprise a single unit in the physical sense, they are fully integrated as regards functionality and offer a true all-in-one solution.

Two versions: Series 2000 and Series 1000
We offer two versions of speed-controlled pumps – each of which covers a wide range of products. The Series 2000, which is pre-defined to continuously regulate the pressure according to flow, and the Series 1000, which allows for any configuration of control method required: i.e. constant pressure, proportional pressure, temperature control or constant flow.
Grundfos electronic speed-controlled pumps have many possible applications

Full-line in building services
Grundfos speed-controlled pumps are equally suitable for heating, air-conditioning and pressure-boosting systems. All these types of systems can benefit from using a speed-controlled regulator, which adjusts automatically.

Heating which offers significant energy savings
In the area of heating, the ultimate benefit of Grundfos speed-controlled pumps is the ability to achieve huge energy savings without compromising the pumps lifespan or reliability.

Air-conditioning and custom-built pump solutions for optimising the system
Never mind how complex an air-conditioning system is, or how dramatic the variations in flow are during any 24-hour period, we will have the correct pump solution to optimise the entire system.

Pressure boosting and reliability of supply
Through continuously controlling the speed, and thereby adjusting the flow, the use of Grundfos speed-controlled pumps for boosting, reduces energy consumption, while ensuring the supply is regulated throughout the day.
A one-stop pump supplier

Meeting all requirements
Grundfos offers a broad range of speed-controlled pump solutions. Our extensive range of different pumps and components ensure this. When coupled with a wide selection of support tools and the expert advice available, you have a reliable, value-for-money solution, for virtually any pump application.

One-stop pump supplier
Working in partnership with Grundfos means you can reduce the number of pump suppliers required, to just one - Grundfos. A supplier who will assume the responsibility for ensuring the correct components are selected and combined to offer the best possible solution. This is both in terms of reliability and from a value for money perspective.

Easy to select speed-controlled pumps
To provide straightforward and reliable answers to pump selection questions, we have developed a collection of support tools. For example, the electronic tool, WinCAPS. With WinCAPS what may have previously appeared to be a complex decision, has now become a comparatively simple process.

Life Cycle Cost analysis
In addition, Life Cycle Cost (LCC) analysis is an important equation within the selection of speed-controlled pumps. The LCC creates a unique standard of reference and provides the answers to questions about the cost savings that can be made by choosing a given speed-controlled solution. This method calculates the cost of a complete pump system, from a 'cradle to grave' scenario and incorporates all costs including the cost of the initial technology, installation, ongoing maintenance as well as the all important area of energy consumption.

<table>
<thead>
<tr>
<th>Products</th>
<th>System Pressure boosting</th>
<th>Heating systems</th>
<th>Air-conditioning systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPE Series 2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPE Series 2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Series 1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydro systems</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MAGNA
TPE single-phased
TPE three phased

Pumps with integrated sensors
Pre-setting for circulation, constant and proportional pressure
The Grundfos Series 2000 means speed-controlled pumps which are preset and ready to operate

Pre-configured to adapt to the flow
The Series 2000 pumps are pre-configured to regulate the pressure continually in accordance with flow. To achieve this, the pump has an inbuilt sensor that automatically identifies the variations in flow and communicates this information to the frequency converter so that it can adjust, to achieve the required head.

Ready to install
Being pre-configured, Series 2000 pumps eliminate the need for any initial programming, thus making the installation process extremely easy and straightforward.

All Series 2000 pumps benefit from the ability of being speed-controlled which means they:
• utilise the energy by adapting to the heat fluctuations in each specific building
• adjust to match the climatic variations throughout the year
• ensure optimum performance throughout the day
• minimise the noise of the circulators by reducing the load on the valves.

Large capacity
With Grundfos speed-controlled pumps, you also get a reliable connection of pumps in situations where more than one pump is required.
The Series 1000 pumps offers free choice of settings

Free choice of settings
The circulators of the Series 1000 pumps have options for selecting any configuration and control method required: i.e. constant pressure, proportional pressure, temperature control or constant flow. The configuration can be defined to suit any specific operating conditions and can equally be amended to allow for ongoing changes.

Extra potential
The Series 1000 pumps incorporate all the benefits of the Series 2000 as well as offering the potential for even more sensitive regulation. Which solution offers the best value for money can be calculated in each individual situation on the basis of, for example, Life Cycle Cost analysis.

Large capacity
The Grundfos concept of speed-controlled pumps also means reliable connection of pumps in situations where more than one pump is required.
TPE single-phased twin pump  1.1 kW
TPE three phased  7.5 kW
TPE three phased  22 kW
NBE 7.5 kW
The CRE series offers pressure boosting in conjunction with improved supply reliability

The ultimate challenge – a reliable supply
The Grundfos CRE pumps and Hydro pump systems for pressure boosting are based on exactly the same principles as all Grundfos speed-controlled pumps: By continuously adapting to achieve the optimal flow, the energy used is maximised and the reliability of supply remains constant throughout the day. So even allowing for huge variations in consumption, a high level of comfort and maximum energy-efficient operation is guaranteed.

Superior precision and corrosion resistance
Every Grundfos speed-controlled pump is primarily produced from high-grade stainless steel, which allows for extremely high degrees of precision in pump design as well as offering superior corrosion resistance.

Minimising noise
At the same time, the valve load is reduced and therefore noise is minimised.

The Grundfos System Guide has a specific section devoted to Pressure Boosting. If you require more technical information on boosting, you can request a Grundfos System Guide – or the electronic selection tool WinCAPS.
Communications and comfort
Direct communication between building management systems and individual system components is vital in ensuring the reliability of supply as well as other aspects of user comfort.

Network communication
A network communications option is integrated into each Grundfos speed-controlled pump. This option can be used with analogue or digital communications, and it gives access to modules compatible with LONbus and the Grundfos GENIbus.

BUS communication
By using BUS communication, the Grundfos speed-controlled pumps can communicate with all kinds of building management systems. From a central PC you can assess the pump performance and monitor system conditions. This means that the performance of each circulator can be optimised to system requirements and pump activity can be coordinated with other building systems.
With the Grundfos concept of speed-control, you can achieve the reliable integration of pumps.

It is essential for Grundfos to offer reliable, integrated pump solutions to match any flow capacity and system characteristics required. When there is a demand for solutions with more than one pump, this is provided by external control panels – the Delta Control. For large-capacity systems we integrate the frequency converter with the control panel. These solutions do not form a single unit in the physical sense, however, the components are dedicated to each other and fully integrated functionally, providing a true all-in-one solution.

Furthermore, when we design integrated pump solutions, value-for-money is the ultimate goal – encompassing the total installation costs, maintenance costs and energy consumption.
### Two pumps  Single pump operation (1 operation/1 standby)

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Motor size</th>
<th>Controller</th>
<th>Control mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin-head pumps with integrated speed control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPED Series 2000</td>
<td>≤1.5 kW</td>
<td>None</td>
<td>Proportional/constant pressure</td>
</tr>
<tr>
<td>TPE/LMDE/LPDE Series 3000</td>
<td>≤7.5 kW</td>
<td>DC 2000 ME(PO)</td>
<td>All control modes</td>
</tr>
</tbody>
</table>

| Standard twin-head pumps   |            |            |                               |
| All pumps                  | 22-45 kW   | DC 2000 MF | All control modes             |

| Single head pumps with integrated speed control |            |            |                               |
| UPE Series 2000             | ≤1.5 kW    | Twin head module | Proportional/constant pressure |
| TPE Series 2000             | ≤7.5 kW    | PMU        | Proportional/constant pressure |
| TPE/LME/LPE/CLME/NBE/NKE Series 1000 | ≤22 kW    | DC 2000 ME(PO) | All control modes             |

| Standard single head pumps |            |            |                               |
| All pumps                  | 22-315 kW  | DC 2000 MF | All control modes             |

### 2-4 pumps in parallel operation (+1 standby)

| Single head pumps with integrated speed control |            |            |                               |
| UPE Series 2000             | ≤1.5 kW    | PMU        | Proportional/constant pressure |
| TPE Series 2000             | ≤7.5 kW    | PMU        | Proportional/constant pressure |
| TPE/LME/LPE/NBE/NKE Series 1000 | ≤22 kW | DC 2000 ME(PO)/MEH | All control modes             |

<p>| Standard single head pumps |            |            |                               |
| All pumps                  | 22-315 kW  | DC 2000 MF/MFH | All control modes             |</p>
<table>
<thead>
<tr>
<th>Delta Control 2000 Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
<tr>
<td><strong>Controls for pumps with integrated speed control</strong></td>
</tr>
<tr>
<td>PMU</td>
</tr>
<tr>
<td>ME(PO)</td>
</tr>
<tr>
<td>ME</td>
</tr>
<tr>
<td>MEH</td>
</tr>
<tr>
<td><strong>Controls for pumps with external speed control</strong></td>
</tr>
<tr>
<td>MF</td>
</tr>
<tr>
<td>MFH</td>
</tr>
</tbody>
</table>
Grundfos reliability means knowledge, partnership and support

Speed-controlled pumps mean Grundfos reliability
Just as reliability is a hallmark of the Grundfos constant-speed pumps, so it is within our speed-controlled pumps. Millions of our pump solutions around the world tell the same story of pumps operating perfectly 24 hours day in, day out, year after year.

Our pumps, in context
Each single pump is vital to ensuring the entire flow in a system. We do however understand, that the quality of the pump can only be assessed in its proper context. The value of a pump, speed-controlled or not, is derived from its interaction with the rest of the system. This calls for support through, for example, system knowledge.

Flow Thinking is our working philosophy
Flow Thinking is our working philosophy because it means taking a holistic approach and ensuring we create solutions, which take the entire pumping solution into account. It also demonstrates that partnership is the best possible working relationship. For us, support is the essence of partnership.

Dedicated to knowledge and innovation
Ever since its foundation, Grundfos has been dedicated to ensuring reliable products built to a superior quality – through the relentless pursuit of knowledge and innovation. We invest about EUR 50 million in research a year, and we award the Grundfos Prize to encourage and promote research.

Electronic tools to help with selection
Our one-on-one consultancy has been complimented with electronic support tools. For example, dimensioning, pump selection and cost calculations have all been made easier through utilising either WinCAPS or WebCAPS. WinCAPS is our efficient electronic tool that contains all the important calculation programmes that you may find helpful. A short version, WebCAPS, is available on the Internet at www.grundfos.com.

The Grundfos System Guide – versions for heating, cooling or pressure boosting
This hard-copy guide provides an overview of heating systems, cooling systems and pressure-boosting systems. It gives technical information about the different solutions – and the respective circulators required.

A green company
For Grundfos, it is imperative that innovation should also take into account the protection of the world’s resources. Whenever a speed-controlled pump is chosen to replace one with no regulation, it represents a small, but important contribution, in reducing overall energy consumption.