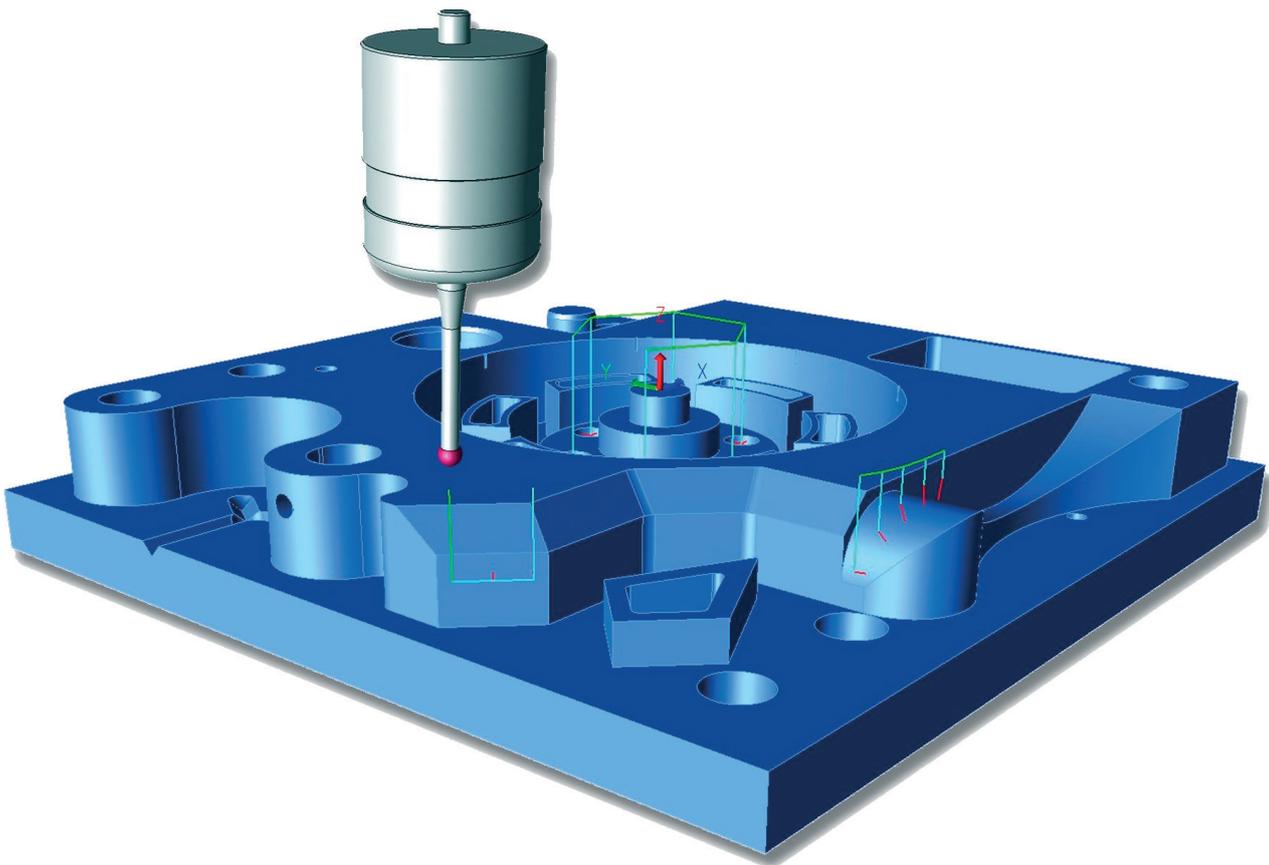**RENISHAW** ®
apply innovation™

Productive Process Patterns™
solutions for intelligent process control

What are Productive Process Patterns™?

'Design Patterns' were first established in the architectural design industry as a method of guiding people to proven solutions for common design problems.

Principles of these Design Patterns have been adapted by Renishaw to form a set of Productive Process Patterns which propose solutions to common manufacturing problems.

Patterns are grouped by layers of Renishaw's Productive Process Pyramid, a model for the implementation of process control (as shown in figure 1). The Patterns make use of workpiece inspection probes, tool setters, tool recognition systems and machine diagnostic equipment.

- *Preventative process foundation patterns* such as Machine condition monitoring (AP100 and AP101) can be implemented in advance of component manufacture to ensure compliance with machine specifications
- *Predictive process setting patterns* such as Part identification (AP200), Job set-up (AP203) and Tool identification (AP205) can be implemented just before machining to ensure that processes run smoothly
- *Active in-process control patterns* such as Cutter parameter update (AP301), and Dynamic re-machining (AP302) can be implemented during a machining process to allow processes to adapt to inherent variations
- *Informative post-process monitoring patterns* such as Process reporting (AP400) provide users with traceable information about a process after it is complete, allowing them to make decisions about changes they may wish to implement

Each Pattern:
- identifies a common manufacturing **problem**
- establishes a potential **solution**
- outlines the **benefits** of addressing the problem
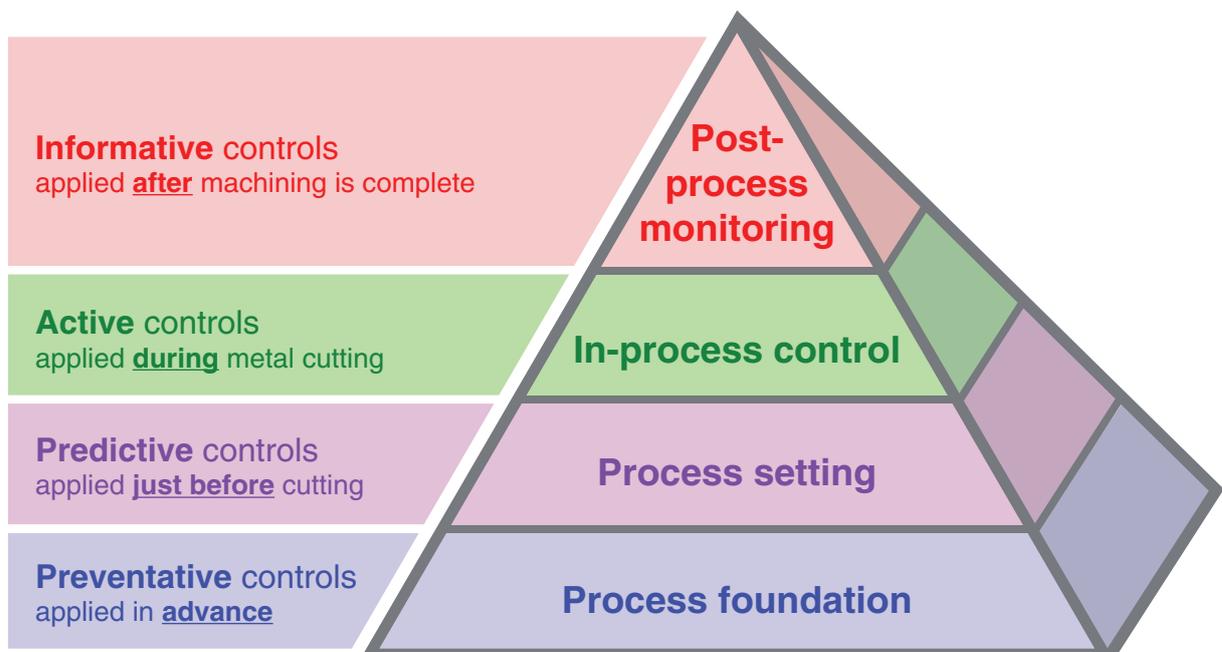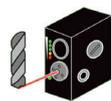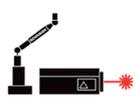- provides a real-life **example**

Figure 1: Renishaw's Productive Process Pyramid™

Productive Process Pattern™	Technology type			
	Workpiece inspection probe	Tool setting	Tool recognition	Machine diagnostics
Preventative, process foundation				
AP100 - Machine condition monitoring - linear axes				x
AP101 - Machine condition monitoring - multi-axis	x			x
Predictive, process setting				
AP200 - Part identification	x			
AP201 - Intelligent program selection	x			
AP202 - Part presence check	x			
AP203 - Job set-up	x			
AP204 - Tool setting		x		
AP205 - Tool identification		x		
AP206 - Machine capability check	x			
AP207 - Clearance check	x			
AP208 - Parametric programming	x			
AP209 - Path optimisation	x			
AP210 - Adaptive machining	x			
Active, in-process control				
AP301 - Cutter parameter update	x			
AP302 - Dynamic re-machining Addendum - Three pillar test piece	x			
AP303 - Thermal correction - machine drift	x	x		
AP304 - Tool condition monitoring		x	x	
AP305 - In-process datum setting	x			
AP306 - Thermal correction - workpiece expansion	x			
Informative, post-process monitoring				
AP400 - Process reporting	x	x	x	
AP403 - Critical feature reporting	x	x		

Click on the name of any Process Pattern to download the document, or visit
www.renishaw.com/processcontrol for further information.

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About Renishaw

Renishaw is an established world leader in engineering technologies, with a strong history of innovation in product development and manufacturing. Since its formation in 1973, the company has supplied leading-edge products that increase process productivity, improve product quality and deliver cost-effective automation solutions.

A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Products include:

- Additive manufacturing, vacuum casting, and injection moulding technologies for design, prototyping, and production applications

- Advanced material technologies with a variety of applications in multiple fields

- Dental CAD/CAM scanning and milling systems and supply of dental structures

- Encoder systems for high accuracy linear, angle and rotary position feedback

- Fixturing for CMMs (co-ordinate measuring machines) and gauging systems

- Gauging systems for comparative measurement of machined parts

- High speed laser measurement and surveying systems for use in extreme environments

- Laser and ballbar systems for performance measurement and calibration of machines

- Medical devices for neurosurgical applications

- Probe systems and software for job set-up, tool setting and inspection on CNC machine tools

- Raman spectroscopy systems for non-destructive material analysis

- Sensor systems and software for measurement on CMMs

- Styli for CMM and machine tool probe applications

For worldwide contact details, please visit our main website at www.renishaw.com/contact

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