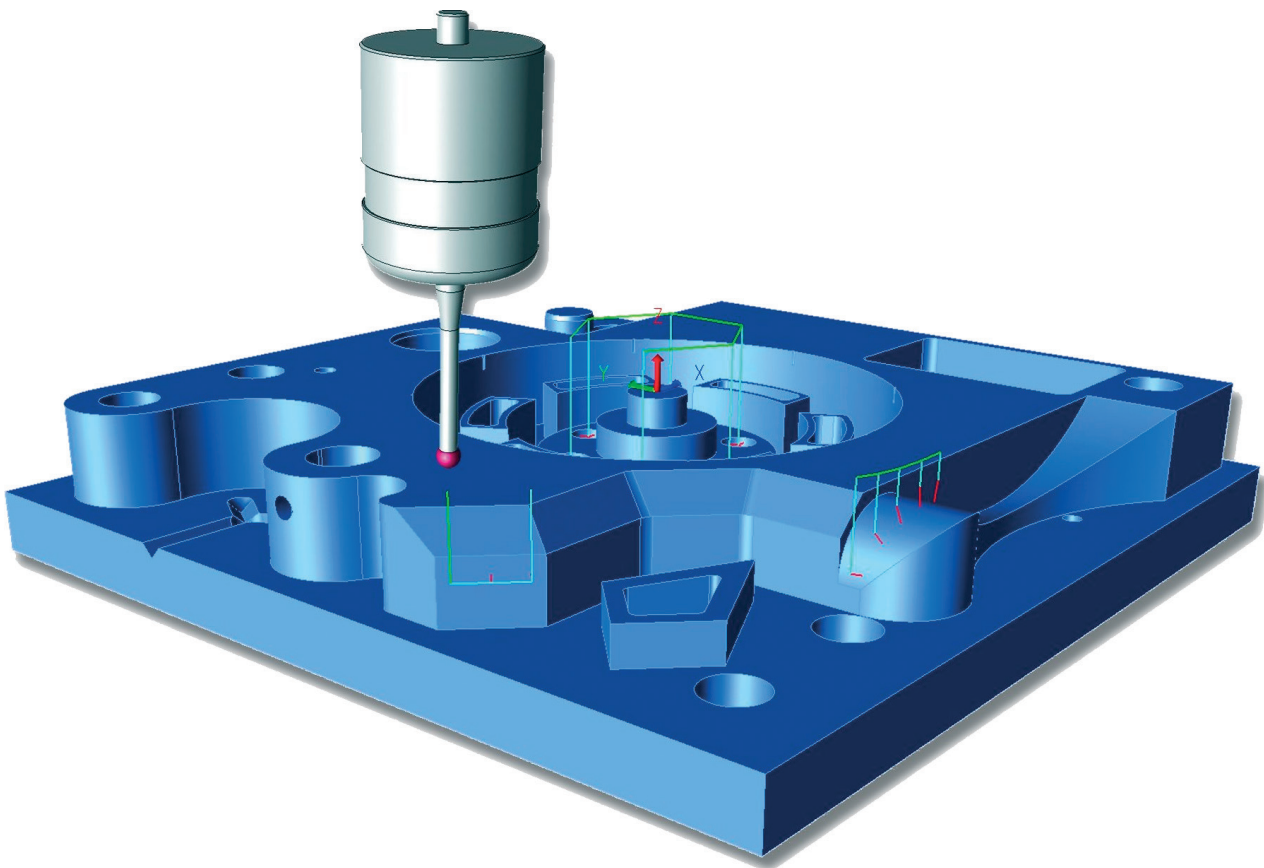


# Productive Process Patterns™

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**

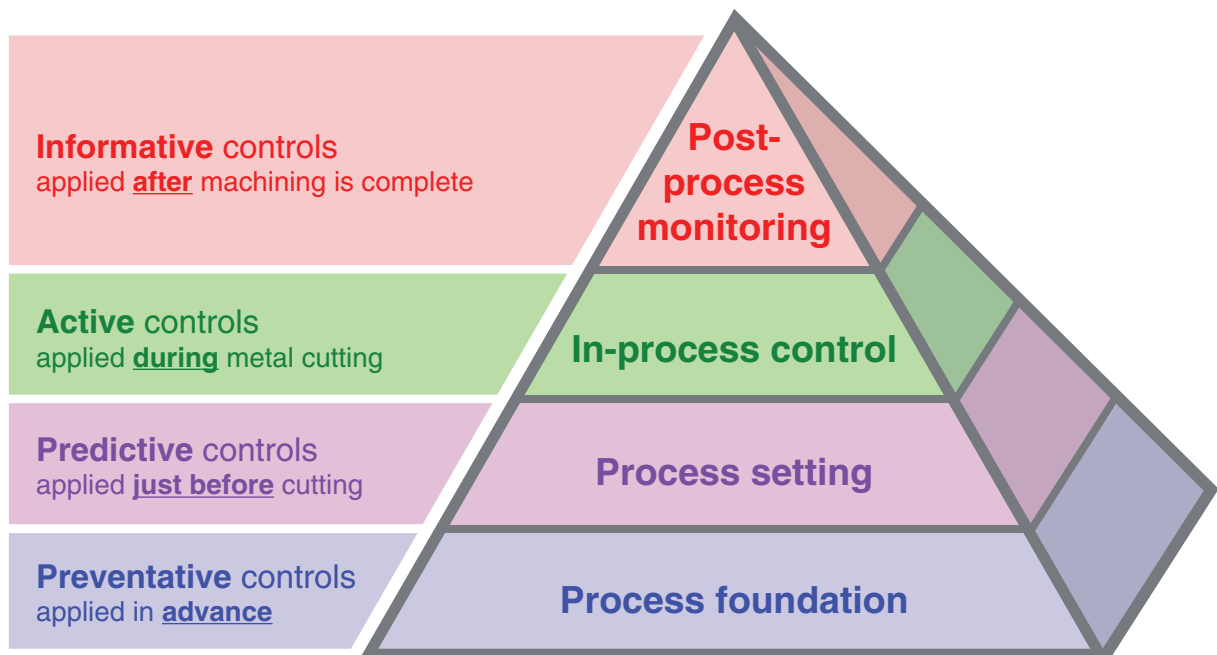

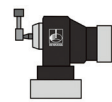
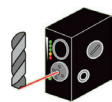
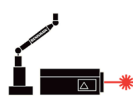


Figure 1: Renishaw's Productive Process Pyramid™

Productive Process Pattern™	Technology type			
	Workpiece inspection probe 	Tool setting 	Tool recognition 	Machine diagnostics 
<b>Preventative, process foundation</b>				
AP100 - Machine condition monitoring - linear axes				x
AP101 - Machine condition monitoring - multi-axis	x			x
<b>Predictive, process setting</b>				
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			
<b>Active, in-process control</b>				
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			
<b>Informative, post-process monitoring</b>				
AP400 - Process reporting	x	x	x	
AP403 - Critical feature reporting	x	x		

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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](http://www.renishaw.com/contact)



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