

# Transform your manufacturing performance with help from the process control experts



**More throughput from your existing assets**



**Increase automation and reduce human intervention**



**Reduce rework, concessions and scrap**



**Increase your capabilities and traceability**



# Tackle process variation at source ...

Process variation is the enemy of competitiveness and profitability. It causes waste and inefficiency, leads to high quality costs and manning levels, and results in late deliveries and poor traceability.

The secret to consistent, automated, and productive machining is to understand where variation comes from and to deal with it at source.

Renishaw's *Productive Process Pyramid*<sup>™</sup> provides a framework within which to identify and control variation in your factory, backed by innovative technology, proven methods and expert support. Renishaw can help bring your goal of 'green button' or 'lights out' machining into reach.

## Informative controls

applied after machining is complete

## Active controls

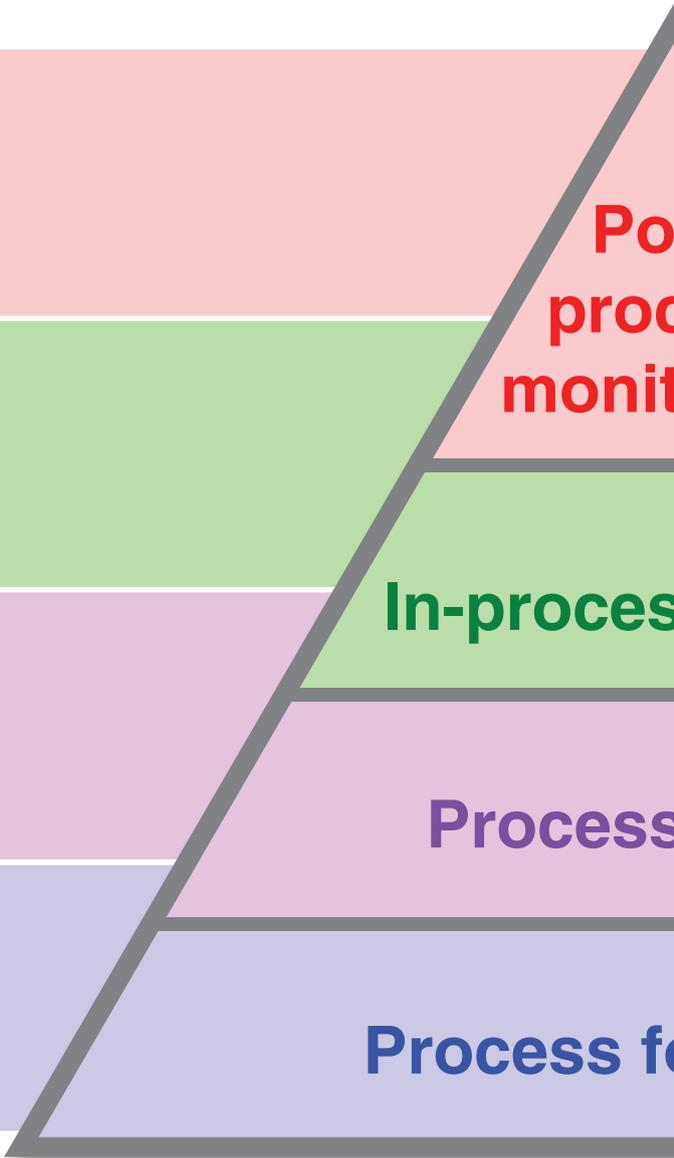
applied during metal cutting

## Predictive controls

applied just before cutting starts

## Preventative controls

applied in advance



## ... and reap the rewards

- ✓ achieve more throughput from your existing assets
- ✓ increase automation and reduce human intervention
- ✓ reduce rework, re-makes, concessions and scrap
- ✓ shorten manufacturing lead times
- ✓ increase your capabilities and traceability
- ✓ control your costs and boost your bottom line

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toring**

Fast, traceable reporting of part conformance to specification  
and logging of the route and outcome of cutting operations

**ss control**

Adapt metal cutting operations to the actual material  
and environmental conditions with automated feedback

**s setting**

Fast, automatic and repeatable set-up  
of metal cutting operations

**oundation**

Optimise and monitor the  
performance of your machines

## Increase throughput from your existing assets

If your machines are overloaded then you may be facing a sizeable capital investment to make up the shortfall. Either that, or a large sub-contract bill. Or worse still, you might find yourself turning away profitable work.

*But what if you could extract more throughput from the machinery you already have?*

- ✓ defer capital expenditure
- ✓ reduce your sub-contract and overtime bills
- ✓ pursue additional business

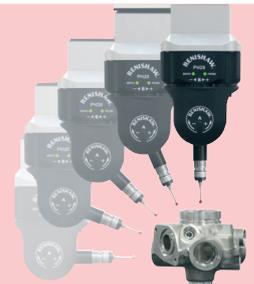
“Lamborghini saved €150K a year with Renishaw tool breakage detection systems, increasing throughput by 6%.”

### Informative controls



You can inspect parts 3 times faster on your CMMs using the latest 5-axis techniques.

Versatile gauging systems provide rapid verification of medium and high volume parts.



### Active controls



Adaptive process control enables parts to be made ‘right first time’, so capacity needn’t be set aside for rework and re-makes.

Automated in-process measurement means your machines will no longer be waiting for operators to re-start them.

### Predictive controls



Automated setting using probing can be up to 10 times quicker than manual methods, freeing up more time for cutting metal.

Probing is also predictable - you’ll know how long setting will take and can plan accordingly.

### Preventative controls



A machine that is ‘fit for purpose’ will deliver consistently good parts and will suffer fewer unplanned stoppages.

This means more time available for metal cutting and also allows your maintenance staff to stop fire-fighting and become more proactive.

## Increase automation and reduce human intervention

Are you reliant on skilled operators to keep your machines running, leading to high labour costs and a substantial overtime bill? Or perhaps your engineers are tied up with shop support rather than working on new processes?

*What impact would lower direct labour and shop support costs have on your competitiveness?*

- ✓ automate manual setting and measurement processes
- ✓ reduce direct labour costs
- ✓ redeploy staff into proactive engineering roles

“The biggest benefit of probing is the reduction... no, it would be more appropriate to say total elimination, of all offset problems. The second biggest is the de-skilling of the operations.”



Modern inspection technologies enable fully automated inspection of even the most complex parts, often in a single set-up.

This reduces the need for skilled inspectors to oversee quality assurance checks.



In-cycle gauging gives your machine tools the intelligence they need to make decisions for themselves, enabling extended periods of 'lights out' machining, boosting your productivity.



Setting processes that use on-machine probing can be fully program controlled, so that skilled operators are no longer needed to take measurements, make calculations and input offset changes.



Regular checks of the condition of your machines with powerful diagnosis of the source of any errors, means that you can minimise reactive maintenance effort and focus on valuable preventative work.



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## Reduce rework, concessions and scrap

Scrapping parts is always painful - it's a waste of time, effort and materials. Similarly, rework and concessions lead to late deliveries, fire-fighting and overtime.

*If you could largely eliminate such quality costs, how would this help your responsiveness and profitability?*

- ✓ improved conformance and consistency
- ✓ lower unit costs
- ✓ shorter lead times

“The probes have shortened make-ready time dramatically and brought guaranteed precision and quality control to the production process, whilst all but eliminating the possibility of costly errors.”

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On-machine verification can detect component non-conformance before the set-up is broken down, so any remedial work can be performed there and then.

Versatile gauges situated next to the machine provide rapid feedback, reducing process variation.



Probing the size of the component at key stages of the machining process allows process parameters to be adjusted.

This centres the process and reduces part-to-part variation, thus increasing process capability and reducing non-conformance.



Removing the influence of the operator on the setting process eliminates a major source of non-conformance and means you can be confident that parts will be 'right first time'.



The condition of your machines may account for up to 25% of your non-conformance. If you optimise and maintain the precision of your machines, then you can be sure that they are not hurting your quality.

## Enhance your capability and take on more work

Customers are demanding ever more complex work, whilst regulations are driving greater traceability throughout the manufacturing process. Are your capabilities keeping pace with the needs of your market?

*Do you need a cost-effective way to boost the capability of your machining and inspection processes?*

- ✓ offer your customers state-of-the-art capabilities
- ✓ take on more complex work
- ✓ meet customer demands for traceability

“We’ve transformed our inspection capacity and capability. We’re ahead of the game and have a clear advantage.”



Renishaw’s 5-axis technologies transform the capability of CMMs, supporting fast, flexible measurement with the option of multi-sensor functionality (such as surface finish measurement).

High volume parts can be inspected on the shop floor with full traceability using Renishaw’s innovative versatile gauging systems.

**Informative  
controls**



With less part-to-part variation as a result of more effective process control, you will have the capability to take on more demanding work.

Automated process feedback can also provide traceability, giving you the option to log process updates so that you have a full record of how each component was manufactured.

**Active  
controls**



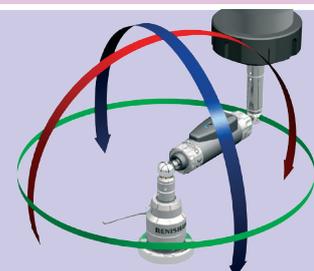
Automated setting using probes will allow you to set up complex components, with no need for costly precision fixtures.

This means you can respond quickly to new customer requirements by rapidly introducing new processes.

**Predictive  
controls**



Machine performance optimisation is a major contributor to improved process capability, and provides certified historical data so that you can demonstrate your capability to your customers.



**Preventative  
controls**

# Innovative process control solutions

## Post-process monitoring



**REVO®** 5-axis high-speed scanning and multi-sensor inspection system.

Available as a retrofit



**PH20** 5-axis touch-trigger inspection system, suitable for all sizes of CMM.

Available as a retrofit



**Equator™** versatile gauge enables fast inspection of high volume parts.

## In-process control



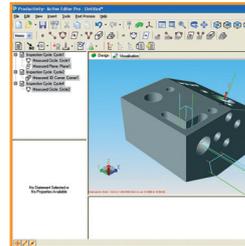
**Workpiece inspection probes** for in-process measurement of roughed and finished features.

Available as a retrofit



**TRS2** tool recognition system for rapid in-cycle checks for broken tools.

Available as a retrofit



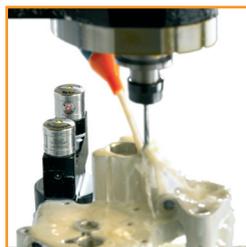
**Productivity+™** with multi-axis machine support enables creative process control on 5-axis machines.

## Process setting



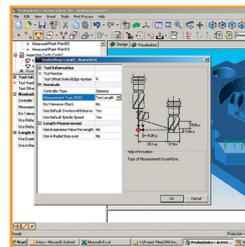
**Workpiece inspection probes** for automated measurement of component position and alignment.

Available as a retrofit



**Tool setters** enable dynamic setting of cutting tools on the machine tool.

Available as a retrofit



**Productivity+™** enables tool and part setting to be seamlessly integrated with metal cutting.

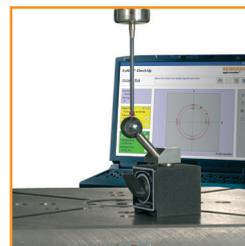
## Process foundation



**XL-80** calibration laser error maps machine tools and CMMs to improve their precision.



**QC20-W** wireless ballbar allows rapid condition monitoring of a machine tool's linear axes.



**AxiSet™** Check-Up provides a fast, automated health check for rotary axes on 5-axis machine tools.