RENISHAW
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Smart manufacturing data platform

Unlock the power of data-driven manufacturing

Renishaw Central is a smart manufacturing data platform that collects and presents accurate, actionable process and metrology data.

Renishaw Central

www.renishaw.com/central

#renishaw

Our experience in smart manufacturing

Smart thinking enabled Renishaw's co-founder to invent the touch-trigger probe over 50 years ago. This innovation solved a specific manufacturing problem at the time and went on to revolutionise three-dimensional co-ordinate measurement for global manufacturing.

Our digital transformation began in the early 90's, when demand for our probing instruments increased. Our innovative approach to solving manufacturing challenges led to the development of our in-house Renishaw Automated Milling, Turning and Inspection Centre (RAMTIC).

RAMTIC enabled us to use process control to increase production with then unprecedented levels of machining accuracy and process automation. This automated solution was conceived to fulfil a specific requirement and, like the touch-trigger probe before it, RAMTIC revolutionised our manufacturing operations.

Today, smart thinking remains at the heart of our approach to smart manufacturing. We're not just a well-established manufacturer; we've been practising smart manufacturing principles across four decades. So, who better to partner with for expert guidance and support on the journey to a smarter factory?

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Making data actionable

The digital transformation of industry is accelerating due to rapid progress in technologies such as artificial intelligence and the Industrial Internet of Things (IIoT). While developments in IT and plug-and-play options promise to make it easier to integrate, adoption hasn't met expectation. Today, factories are collecting and processing more data than ever before, but only those manufacturers with access to the right data at the right time can actually take advantage of connectivity technologies and the potential they hold.

Integrating physical manufacturing processes, data and communication technologies enables manufacturers to develop automated solutions and processes for long-term productivity, capability and efficiency gains.

The use of data to increase intelligence about manufacturing processes also enhances decision making for process improvements.

Unlock the power of your manufacturing data with Renishaw Central

Benefit from smart factory technologies

Renishaw Central is a powerful manufacturing connectivity and data platform born out of our need to digitalise end-to-end manufacturing operations within our own production facilities.

Connectivity, **consistency** and **control** drive **confidence**; Renishaw Central enables users to exploit digital twin and future factory concepts.

Identify, predict and correct

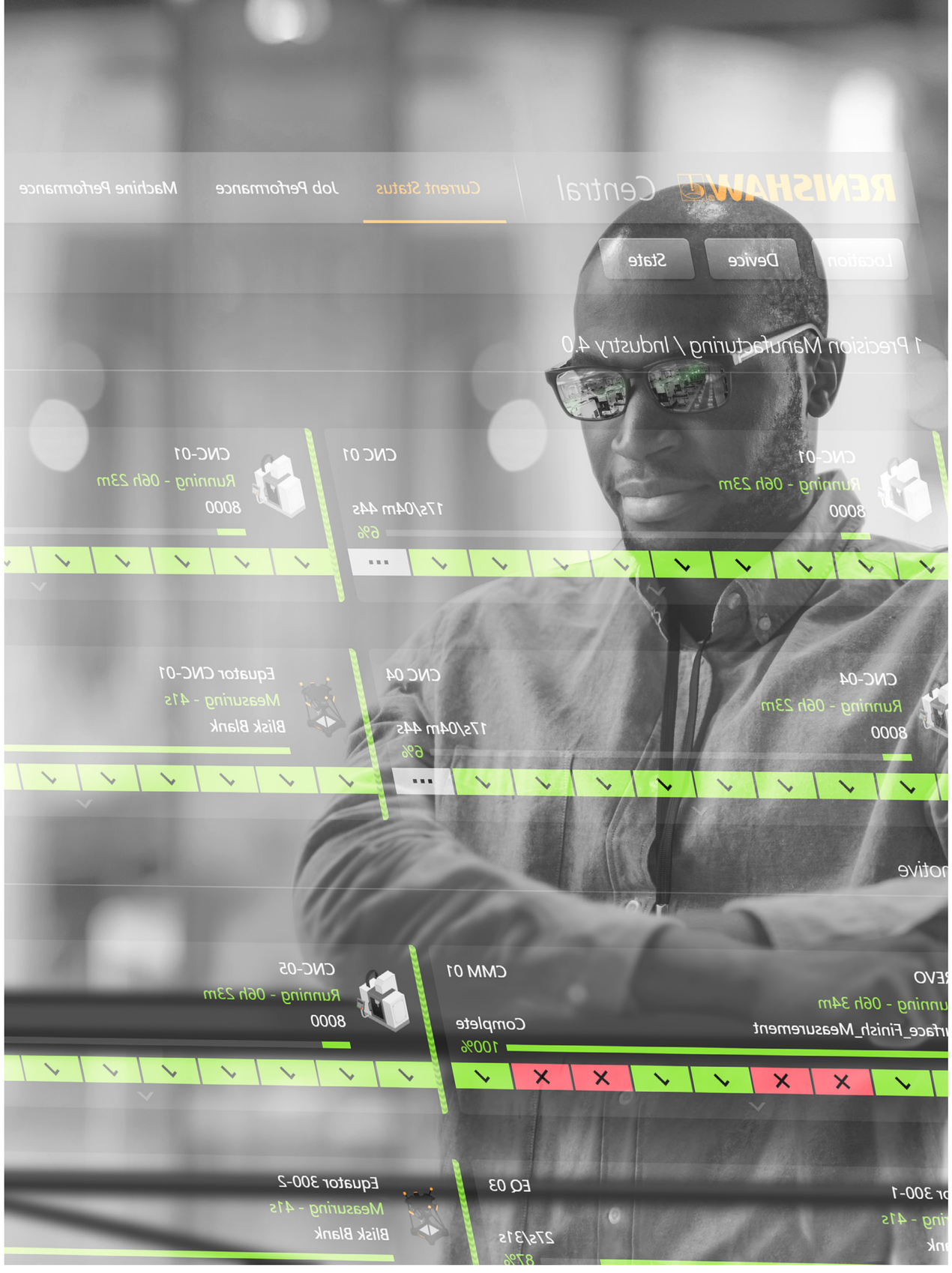
End-to-end process data capture provides insights for analysis and the improvement of manufacturing processes, enabling manufacturers to predict, identify and correct process errors before they happen.

Renishaw Central collects and provides visibility of machining process data across the factory for insights at the point of manufacture. This can be used to analyse and health-check the performance of devices on the shop floor, examine device utilisation and part quality, and to sign off and validate the part.

Easy-to-use dashboards enable users to visualise live device data, supporting in-process control applications and continuous improvement.

By standardising the flow of data to and from the modern, data-intensive shop floor, Renishaw Central makes it easy for a variety of systems and processes to access Renishaw device data and deliver new levels of operational efficiency. Up-to-date machine and job information, including metrology, machine status and alert data is made available to customers in several ways, including:

- Standards-based output (such as MTConnect®).
- Visualised using intuitive dashboards, and exported using the Renishaw Central API into your own third-party applications.



Make the ‘factory of the future’ a reality today

Renishaw Central provides a clear view of a manufacturing facility’s process and metrology data. It can do this by collecting process, machine and part data from across the machine shop, including additive manufacturing (AM) systems, on-machine measurements, shop floor gauging and co-ordinate measuring machines (CMMs).

We support our global customers with their smart manufacturing ambitions by helping them to operate their ‘factories of the future’ today.

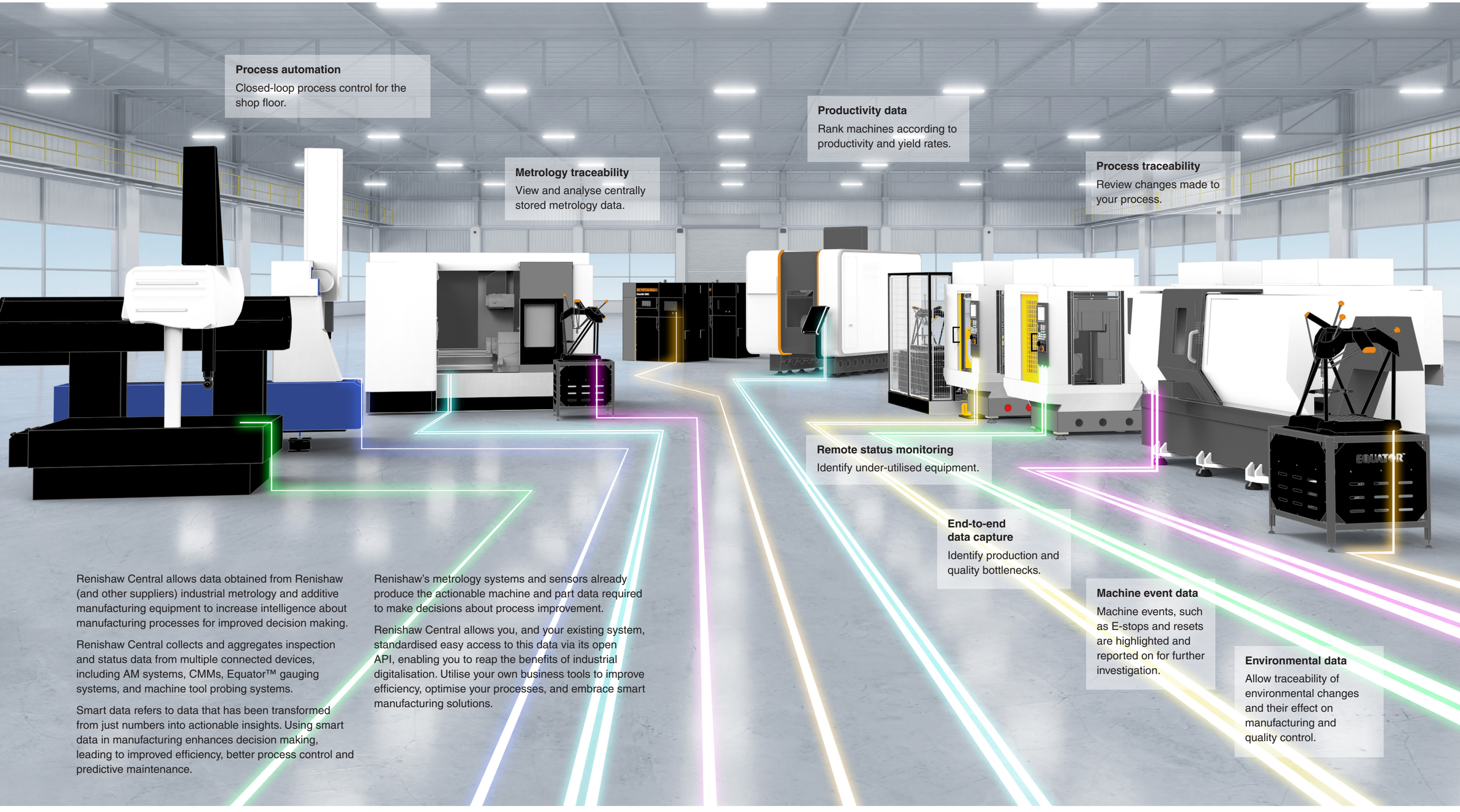
Data-driven manufacturing

On a connected shop floor, machines and systems communicate with each other by sharing data and trends. Real-time monitoring enables manufacturers to make informed decisions and have complete control of their end-to-end manufacturing.

Renishaw Central allows you to:

- Connect to a single machine or to multiple, connected machines.
- Capture end-to-end process data for the insight, analysis, and update of manufacturing processes.
- Collect metrology data from connected devices in a central location and increase quality throughout the entire manufacturing process.
- Enhance decision making for process improvements.
- Increase operational efficiency and reduce human intervention.

The connected machine shop



Renishaw Central allows data obtained from Renishaw (and other suppliers) industrial metrology and additive manufacturing equipment to increase intelligence about manufacturing processes for improved decision making.

Renishaw Central collects and aggregates inspection and status data from multiple connected devices, including AM systems, CMMs, Equator™ gauging systems, and machine tool probing systems.

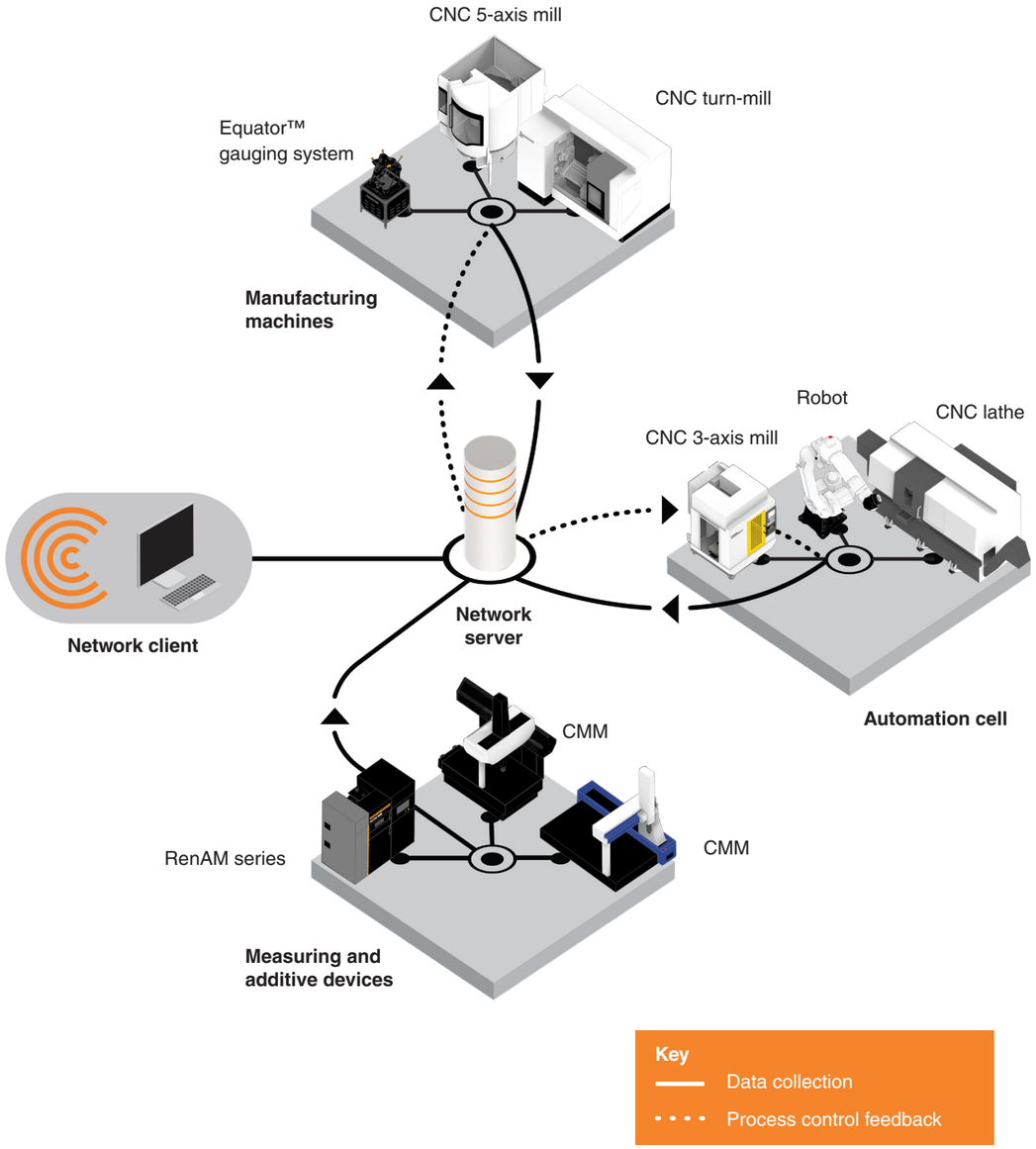
Smart data refers to data that has been transformed from just numbers into actionable insights. Using smart data in manufacturing enhances decision making, leading to improved efficiency, better process control and predictive maintenance.

Renishaw's metrology systems and sensors already produce the actionable machine and part data required to make decisions about process improvement.

Renishaw Central allows you, and your existing system, standardised easy access to this data via its open API, enabling you to reap the benefits of industrial digitalisation. Utilise your own business tools to improve efficiency, optimise your processes, and embrace smart manufacturing solutions.

How does Renishaw Central work?

Connected hardware provides metrology, status and alarm data for improved consistency and active control of manufacturing operations.



What data does Renishaw Central display?

The following manufacturing process data is available to users connecting their existing Renishaw products to Renishaw Central:

Compatible products with Renishaw Central

Data categories	Supported platform	Machine status	Machine alerts	Job process	Job yield	Metrology data	Time series data	Process updates
Renishaw products								
CMM	MODUS™ UCC Suite	●	●	●	●	●	●	●
CNC machine tool	Renishaw Reporter	●	●	●	●	●	●	●
Equator gauging system	Equator Software Suite (ESS)	●	●	●	●	●	●	●
Additive manufacturing	MSS	●	●	●			●	
Renishaw Central API		●	●	●	●	●	●	●
Other supported data								
MTConnect®		●	●	●	●	Future release	●	
CMM	Multiple vendors	API integration is available for leading brands of CMM software						

The availability of data may vary based on the source of third party data.
For information on compatibility with third party devices, contact your local Renishaw office.

Tiered licensing models

Renishaw Central is a flexible and scalable data platform which uses a tiered modular licence structure enabling it to grow with your requirements without the need to change products or lose data as it expands.

Single licence: Connect to a single machine

Standalone installation on a single inspection machine. Provides open-standards connectivity, with single-device data analysis.

- Automated efficient data collection.
- Solutions for easy implementation and maintenance.
- Standards-based outputs allow connectivity to third-party platforms.

Server licence: Monitor data from connected machines in a central location

Server licence supports fully connected machine shops and provides insights and analytics capability for all devices connected.

- Ideal for manufacturers wishing to see data from across their facilities.
- Continuous improvement through analysis of end-to-end process data across operations, cells and time periods.
- Predict, identify and correct process errors before they happen by characterising acceptable process trends and performance.

Intelligent Process Control (IPC) module: Use collected data to update the CNC controller

The IPC module for Renishaw Central is available as an add-on for both single or server licences. It provides the ability to update one or multiple machine tools using the actionable data collected and can control the manufacturing process.

- Closed-loop process automation enables unattended productive manufacturing.
- Intelligent and automated decision making.
- Increase machine utilisation and reduce waste.

Comparison

Features and benefits	Single licence	Single licence with IPC	Server licence[1]	Server licence[1] with IPC
Update a machine tool from an Equator gauging system or CMM		●		●
Closed-loop process control in small production cells		●		
Local installation on or next to the inspection machine, ideal for monitoring individual production cells	●	●		
Factory network required			●	●
Provides closed-loop process control across the factory floor				●
Update one or many machine tools from an Equator gauging system or CMM				●
Monitoring multiple devices across the factory shop floor via a dedicated local server[2]			●	●
Update machine variables as well as tool offsets		●		●
Intuitive dashboards	●	●	●	●
Scalable system architecture	●[3]	●[3]	●	●
Built-in API with the ability to output data to third party software or standards (MTConnect[4] and REST API)	●	●	●	●
Secure data transmission and data storage with permission control for users, locations, and groups	●	●	●	●
Receive data from Renishaw and third party devices[5]	●	●	●	●

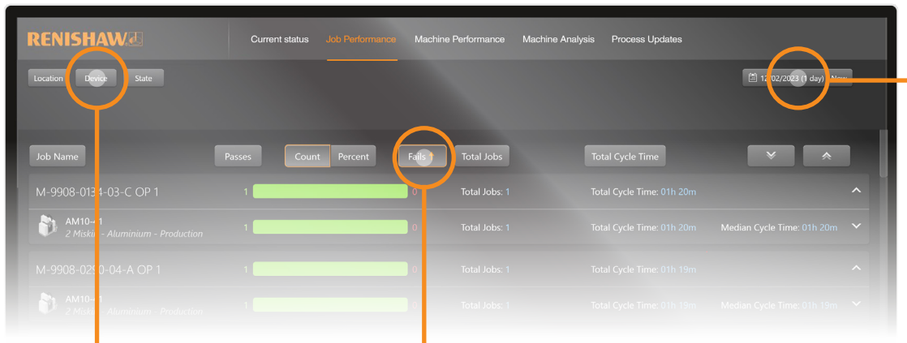
1. Renishaw Central server allows up to 10, 25 or 150 machines to be connected depending on the licence purchased.
2. Server upgrade licences are available for customers wishing to move to the next licence tier.
3. Upgrade routes available for single licence customers wishing to upgrade to a server multi-licence (additional computer hardware may be required).
4. MTConnect 1.4 supported.
5. Contact your local office for device compatibility.

Renishaw Central dashboards

The right information, in the right place, at the right time

Dashboards allow live data to be displayed, sorted, filtered and plotted. Data analytics can benefit from integration into industry-leading tools which support APIs, such as Microsoft® Power BI.

Below are common dashboard filters which can be found across many dashboard views.



Filters

The location, device and state tabs are a filter to enable the user to select certain types of machines or locations.

Filter sort

- **Job name** lists programs alphabetically.
- **Passes** lists programs based on the number of runs passed.
- **Count | percent** converts the number of failures/passes into percentages.
- **Fails** lists programs based on the number of runs failed.
- **Total jobs** lists programs based on the number of runs completed.
- **Total cycle time** lists programs based on the total cycle times of the machine.

Time filters

Last hour, day, three-day and seven-day view buttons are provided along with a calendar to view a specific period.

All views of information and metrics depend on the availability of these data types from the corresponding devices connected to Renishaw Central.

Data available therefore varies according to brand, model, age and protocol of connected equipment.

Current status

A top level overview covering the status, alerts and outcomes of recently run jobs.

Alerts

Notifications direct the user's attention to any important machine alerts that are currently active.

Connected device and machine status

Displays the current machine state as a traffic light. Text provides additional detail, such as running, forced idle, awaiting user input or offline.

Each machine's unique ID number is displayed along with an icon depicting the type of machine that is connected. Machines can be grouped together if required.

Job/Progress bar

Shows the current program being run. The progress bar provides a summary of a machines progress through its current job. Time to complete is predicted, based on previous runs of the same job.

Recent job verdict history

View the verdicts for the ten most recent jobs run. Click a job to reveal job information in greater detail.

Job performance

Quickly analyse outcomes of all jobs and apply filters like pass/fail, count/percentage, total jobs, and cycle time to focus on areas of interest or concern.

Filter and sort the following data:

- Job name
- Passes
- Count | percent
- Fails
- Total jobs
- Total cycle

Drop-down analysis

Program can be selected and expanded to reveal the machine(s) that have run a program. Each machine can be expanded to display all the runs completed on that machine. The view shows:

- Program name.
- All machines on the network that have run the specific program.
- Pass/fail ratio (displayed as a count, percentage or in a bar format).
- Total number of jobs run over the selected period.
- Total cycle times for the program per machine, with each machine showing the mean cycle time of the program.
- Each line in the table corresponds with a completed run of the program.

Machine performance

An overview of completed jobs highlighting machine performance metrics, such as utilisation and any errors occuring during that period.

Machine expanded view – Machine state and errors

Top two machine states as relative percentage values. Top two errors by count number. The error reason is listed and shown as a proportional bar chart.

Job completion

Bar showing the ratio of completed, aborted or incomplete jobs.

Utilisation and top-level statistics

Total jobs completed, hours spent running and total warnings or errors during the period.

Job yield

Bar showing the proportion of jobs that have passed, failed or have no verdict.

Machine expanded view – Job summary

Each machine can be expanded for greater detail. On the left are the top five jobs run on that machine, with their respective bars for completion and yield.

Machine analysis – job

Access and compare feature measurement data from individual jobs, including previous and subsequent data series.

Page mode switch

- **Job -** Tabular view of a job with either a single or a run of seven inspection(s) displayed.
- **Process** - Graphically overlay and compare metrology data with environmental or process time series data (e.g. temperature and a key control diameter).
- **Machine** - Pareto and table of errors with the mean time to the first failure.

Job list

Lists all jobs the machine has run in the current time frame. A graphic showing the pass rate is included with absolute values for:

- Number of runs.
- Number of passes.
- Number of fails.

Selecting one or more of the job tiles will filter the job bar making it easy to see when it was run, the distribution of passes/fails (or association with errors, process events).

Alerts, status and results bar

Shows the jobs run over time. Clicking on an individual job highlights it and updates the results table below.

Single/multi-job toggle

Switches what is displayed in the table.

Results table

Lists key properties of inspected features and characteristics. Ordered by the largest error for the selected job.

Machine analysis – process

Powerful visual display allows for in-depth understanding and analysis of process data.

Measurement series

Inspection data can be displayed with multiple series at a time, revealing trends over time relative to each other, including environment data or process changes.

Time series

Generally covers environmental data such as temperature and pressure, but can display any time data required (for example, speed override or tool length).

Graphic display

Overlay metrology and times series data (e.g. temperature). The graph zooms and pans in sync with the bars above to clearly see which jobs were run and relevant notifications.

Machine analysis – machine

Errors can occur and when they do, regularly monitoring machine stoppages and errors helps streamline the production process and progress towards ‘lights-out machining’.

Errors – pareto chart

Errors in the timeframe displayed with the most frequent on the left and cumulative percentage as a line.

Errors – tabular view

Adds to the pareto with a display of the error name as well as the mean time before failure (MTBF). Highlighting rows links the table highlights with the relevant bars on the pareto and filters the error bar at the top to show only the errors highlighted. This makes it easier to identify when a particular error type occurred.

Intelligent Process Control (IPC) – overview

IPC enables machine shops to utilise the data collected in Renishaw Central for process control purposes, clearly linking measurement processes to corresponding manufacturing processes.

Programme name

Lists the CNC programmes which have been configured to be updated via IPC.

Manufacturing machines

Shows the CNCs which have been configured to receive the IPC updates for each of the specific programmes.

Number of offsets applied

Informs the user how many programme characteristics have been configured to be updated via IPC.

Measuring machines

Shows the measuring machines which are used to provide the measurement data for IPC.

IPC status

Informs the user if IPC is set to automatic mode (automatically updates the CNC without user intervention) or manual mode (IPC displays the update it would make but relies on the user themselves to manually make the correction).

IPC – combining measurement and tools

Set up and control your process by linking measured features to tool offsets. Then specify adjustment triggers, values and limits.

Measurement machines

Select one or many measuring machines to provide the measurement data.

Manufacturing machines

Select one or many machines on which process are to be updated.

Characteristics

Select measured features from which compensations will be calculated.

Settings

Specify:

- Tool control limits.
- Machine settings.
- Correction settings.
- Feature control limits.

IPC – process updates

Provides an overview of active process updates managed by IPC. Easily identify updated machines, the extent of applied changes and the timing.

Controlled offset

Unique parameter for the individual controlled offset.

Offset usage

The percentage of the offset parameter in use based on the IPC settings.

Measurement details

The measurement profiles identifying and controlling the process update.

Offset adjustment

Value of the last adjustment sent to the manufacturing machine and if the value was applied, capped or exceeded as defined in the IPC settings screen.

Time of last update

Shows when the last update was sent to the manufacturing machine.

Sustainability – Your journey to Net Zero

Renishaw technologies for productive and sustainable manufacturing

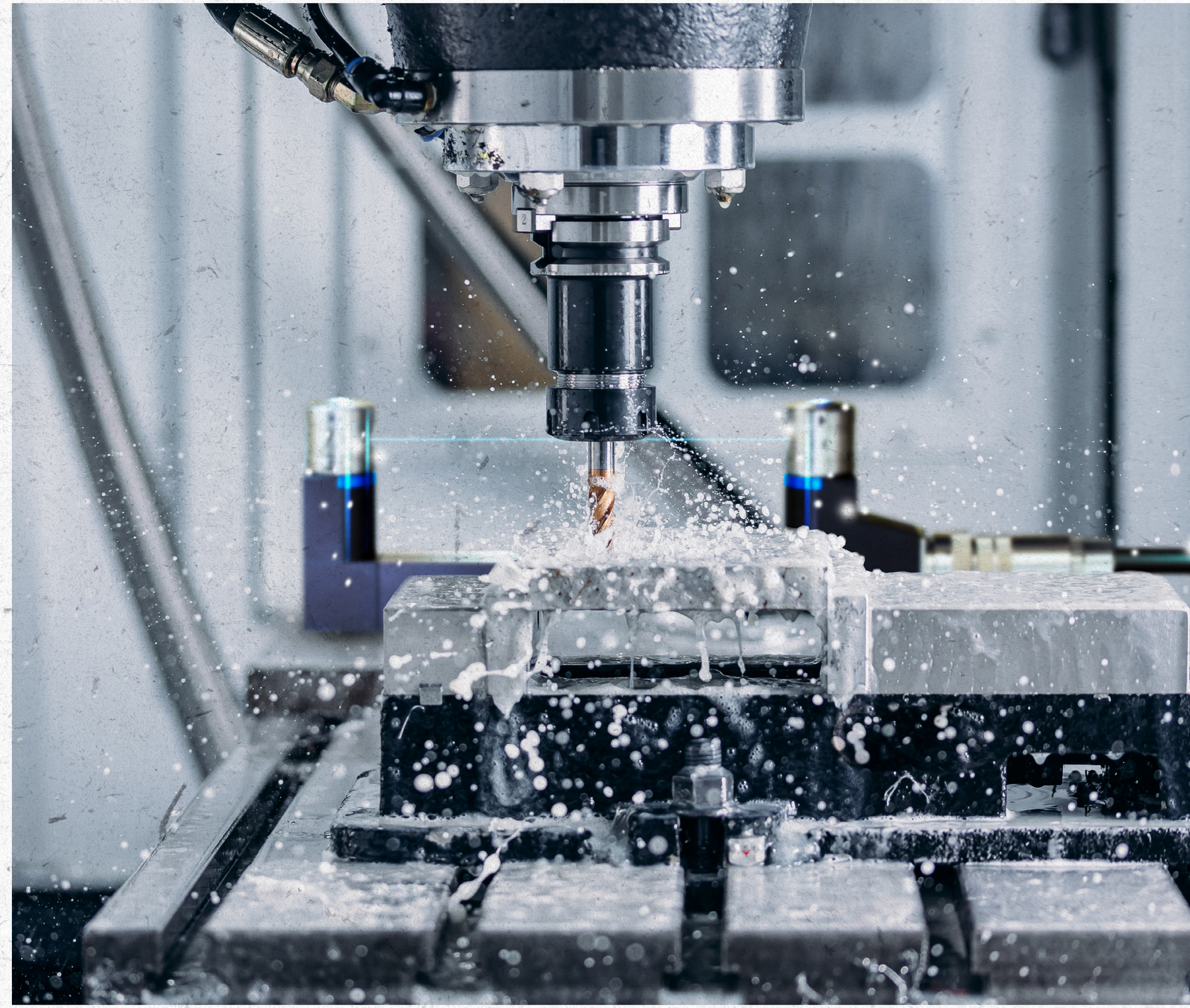
Our portfolio of manufacturing solutions helps our customers around the world to minimise unproductive machining time, eliminate scrap components and reduce total energy consumption. Renishaw Central builds on these solutions to help you achieve more productive and sustainable manufacturing.

Our precision measurement and process control technologies enable you to predict, identify and correct process errors before they happen. This helps to eliminate scrap and, in turn, reduces the wasted energy, time and materials involved in producing scrap components.

Factory automation drives operational efficiency by increasing machine uptime and overall output, without adding extra machines. Our probing solutions for the automation of CNC machining processes allow you to increase machine utilisation and operate 24/7. With process automation technologies in place, you can successfully implement physical automation. This enables you to take complete control of your machining operations, become more productive, and reduce energy and waste consumption.

Other products that can help to reduce energy consumption include our REVO® multi-sensor measurement system. This allows a wide range of inspection tasks (contact, non-contact, surface and ultrasonic) to be carried out on a single co-ordinate measuring machine (CMM) eliminating the need for multiple dedicated machines.

Fast yet accurate, multi-purpose CMM equipment releases valuable time and space in your factory for additional technologies or allows you to operate out of smaller sites, which can often require less energy to run.



Maximising machine uptime: Renishaw Central boosts machine availability by 79 hours weekly

Renishaw Central was born out of our own need to digitalise, visualise and control the manufacturing and measurement processes within our production facilities. We wanted to reduce assumptions when problem solving and facilitate the adoption of automated process control. Because we live and breathe many of the same challenges faced by our customers, we're confident that we've created a digital solution capable of driving actionable data across machining shop floors everywhere.

Challenge

As manufacturers ourselves, we face the same production challenges as our customers. Process improvement, minimising downtime and scrap are top priorities. Ultimately, any process improvement can significantly affect the productivity and profitability of a manufacturing shop floor.

Solution

With confidence in its capabilities, we made the decision to implement Renishaw Central across our manufacturing sites in the UK. This powerful platform facilitates data collection from multiple machines across various sites, empowering us to delve deeper into the collected data and identify trends and patterns that might have otherwise gone unnoticed. Renishaw Central provides us with the ability to monitor machine status, identify errors, assess machine health, and gain valuable insights into quality from a metrology perspective.

Renishaw Central has fostered increased collaboration among Operations, Maintenance, and Engineering teams to drive actionable outcomes.

> **"The Renishaw Central concept was born out of our own need to digitalise, visualise and control the manufacturing and measurement processes within our own production facilities. We wanted to reduce assumptions when problem solving and facilitate the adoption of automated process control. Because we live and breathe many of the same challenges faced by our customers, we're confident that we've created a digital solution capable of driving actionable data across machining shop floors everywhere."**
>
> Guy Brown (Renishaw Central Development Manager)

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Results

Across the 23 automation cells involved in the initial study, a weekly increase of 27.5 hours of machining availability was achieved. Renishaw Central and the productivity improvements were subsequently introduced across a total of 66 automation cells, correspondingly increasing the gains.

Renishaw Central's connectivity with Microsoft PowerBI enabled analysis of the detailed process data, demonstrating clearly that 82% of automation stoppages were associated with the top two error types. Targeted remedial actions, focussed on these errors alone reduced the number of unplanned stoppages by 69%. Less stoppages leading to increased availability of both machining time and operator's availability for other tasks.

The set-up process for manufacture of new parts on sliding-head (Swiss type) CNC lathes has traditionally been an area in which automation has been difficult to apply. In early trials of applying Renishaw Central's IPC functionality to such machines indicate a possible reduction in set-up time in the order of 85% on the most complex parts.

To read the full case study, visit **www.renishaw.com/central**

The Productive Process Pyramid™

Our data-driven approach to process control

At Renishaw, we've applied our own innovative approach to eliminating or controlling sources of variation in our manufacturing and we use our own products to address these common challenges. We've shared our learning with our customers who are now consistently producing performance parts, manufactured to tighter tolerances and with minimal human intervention.

For further details regarding the benefits of all levels of process control within the Productive Process Pyramid™, visit **www.renishaw.com/processcontrol.**

Post-process monitoring

The post-process monitoring layer focuses on the monitoring and reporting activities that provide information on the outcome and route of completed processes. These informative controls can be used to influence subsequent activities.

In-process control

The in-process layer features controls that are embedded within the metal cutting process. These active controls automatically respond to material conditions, inherent process variations and unplanned events to minimise process non-conformance.

Process setting

The process setting layer establishes the relationships between the machine, the part and the tools before cutting starts. These automated, predictive controls ensure that the first cuts are correct.

Process foundation

The foundation layer maximises the stability of the environment and the performance of the machine on which the process will run. These preventative controls reduce the chances of special causes of variation having an impact on the machining process.

Process control can make operations more profitable and boost competitiveness. Our structured approach to identifying and controlling variation in manufacturing operations is backed by innovative technology, proven methods and expert support.

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