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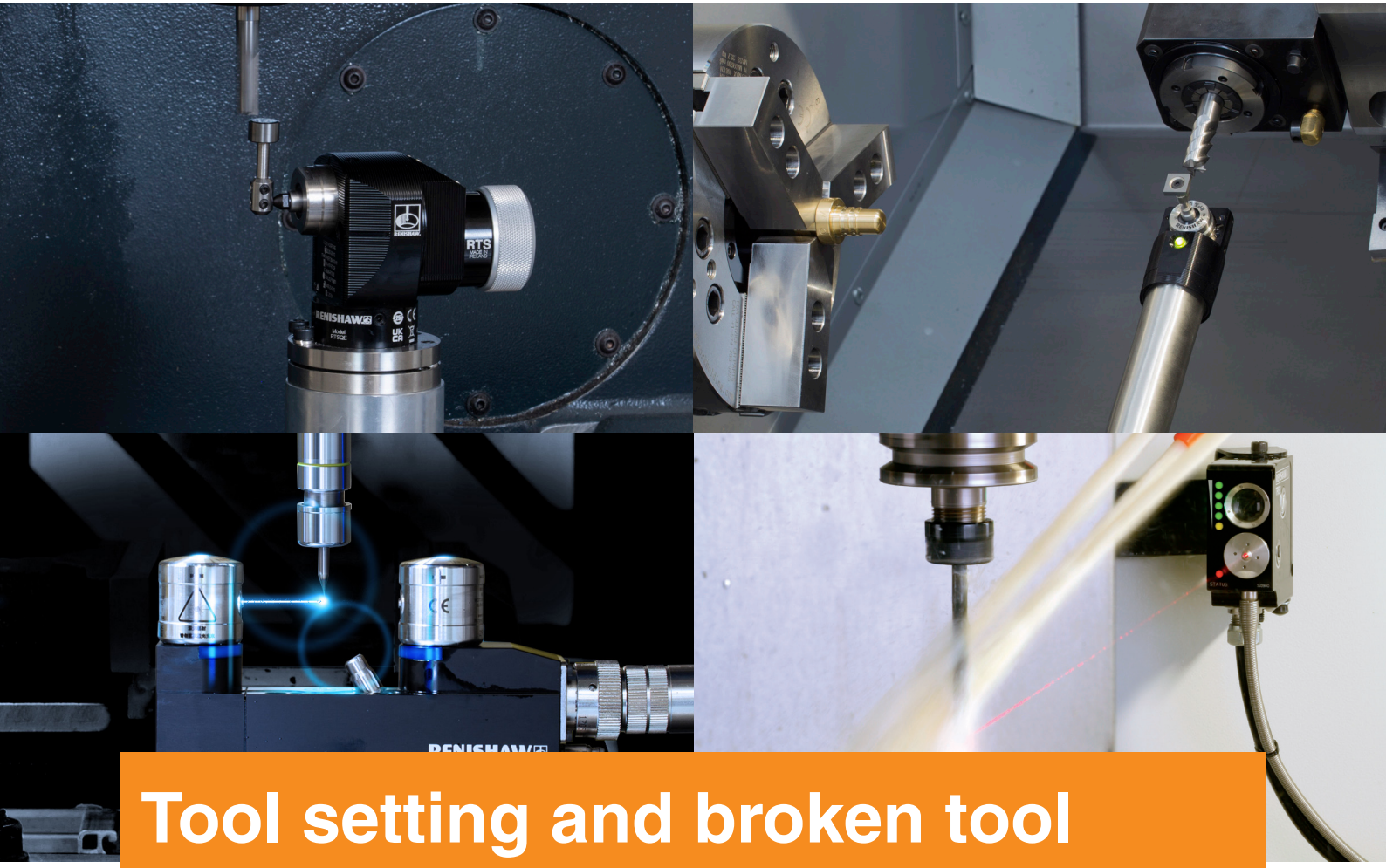

Tool setting and broken tool detection

The objective of the TE500 series of modules is to:

- summarise the benefits of tool setting and broken tool detection operations
- introduce the available tool setting technologies, and their operational advantages and limitations
- outline the considerations when selecting the most suitable tool setting product for an individual application

What is tool setting?

On-machine tool setting and broken tool detection are hugely important because of the effect they can have on cycle times and scrap rates. They form a part of process setting and in-process activities required for the accurate machining of a component.

To ensure a machined component is within specification, it is essential that:

- the machine tool knows the geometric parameters for the cutting tools being used
- the cutting tool is in good condition
- changes in cutting tool condition or dimension can be detected and compensation applied in-process
- the methods used to obtain this information are repeatable and accurate

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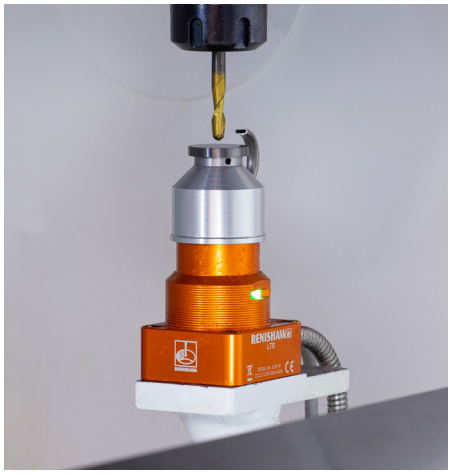
Tool setting is the process of determining geometric information - length, radius and/ or diameter - of a cutting tool using a tool setting device and dedicated software, then communicating this information to the machine tool control.

Tool condition monitoring is an in-process control that does not determine geometric information of the tool, looking simply for tool breakage and giving an output of 'not broken' or 'broken'.

These processes are performed using specialised devices and dedicated software cycles incorporated into the machine tool and machining processes. The most basic tool setters are only capable of measuring tool length. More sophisticated systems can also determine tool radius (and diameter). Broken tool detection is available as a function of most tool setters as well as via dedicated devices.



Renishaw's LTS (Length tool setter)

Why toolset?

To accurately machine a component, the machine tool needs to know the position of the tool tip or cutting edge relative to the spindle nose and the position of the material to be machined within the machine co-ordinate system. Therefore, it is vital that the geometric data and dimensions for the tools are accurately known and input into the machine tool. This can be done offline or within the machining cycle.

Tool setting off-line using a pre-setter can introduce a number of errors, both through the manual input of length and radial offsets, operator error, and through the inability of the method to allow for physical attributes of the machine: tool clamping, 'run out', thermal stability and the spindle 'pull up' effect cannot be taken into account.

Determining geometric information and the actual condition of a cutting tool on the machine can help to improve the manufacturing process in a number of ways. Primarily, the advantages are to help remove operator induced errors, checking the correct tool for the scheduled machining program has been loaded, assisting in the automation of tool offset information input, correcting for tool wear and checking for tool breakage, as well as reducing the time taken to accomplish these tasks.

The make, model and technology used by the tool setter installed on a machine affects the level of information that can be determined for a specific tool, the cycle time and the measurement repeatability. Current technology allows tools to be measured with a repeatability of less than 1 µm.

The benefits of performing tool setting at the process setting stage are:

- Ensures a tool is capable of performing the required task
- Improves process accuracy
- Reduces the level of operator intervention required

Whilst it would usually be too time consuming and unnecessary to carry out tool setting after every machining operation, it is worth performing frequent broken tool detection cycles as tools, especially small diameter ones, can become chipped or broken during a machining cycle. The recommended checking frequency is dependent upon the scenario, and could be determined by experience of which tools break most often.

Detection of a broken tool is a good indicator that previously machined features may have been produced incorrectly. Detection cycles can be programmed to sound an alarm, call an operator or change to a sister tool when a broken tool is detected, saving time, re-work and scrap, and further manufacturing costs.

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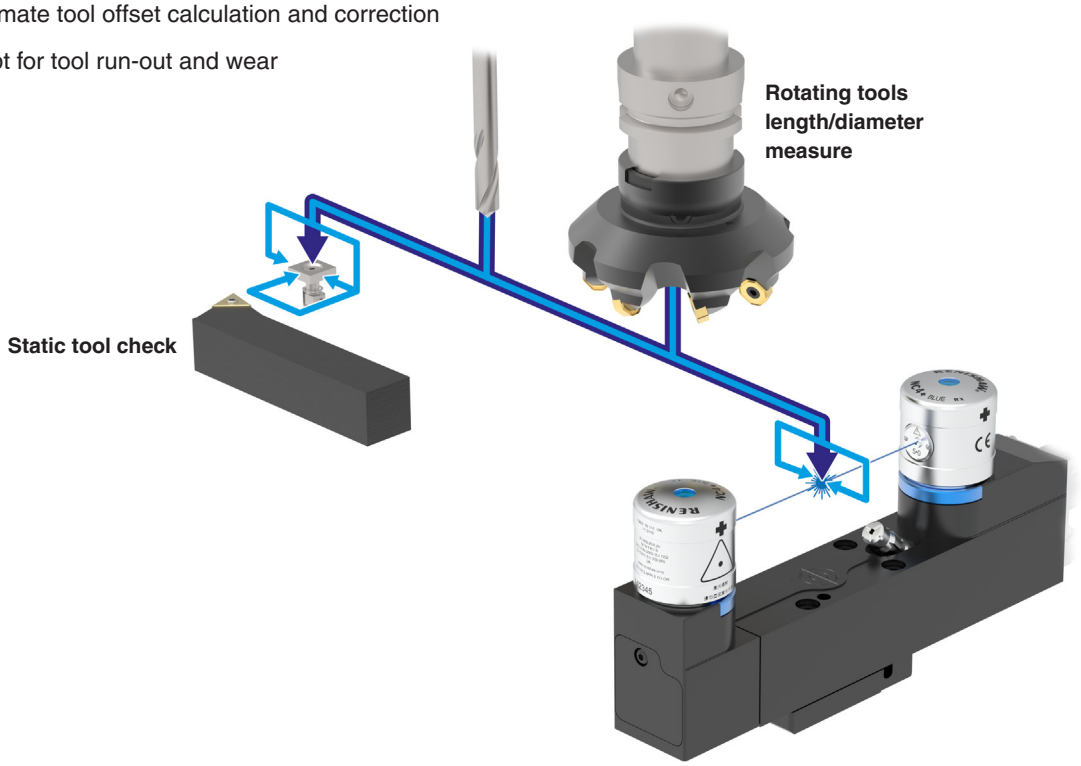
Summary

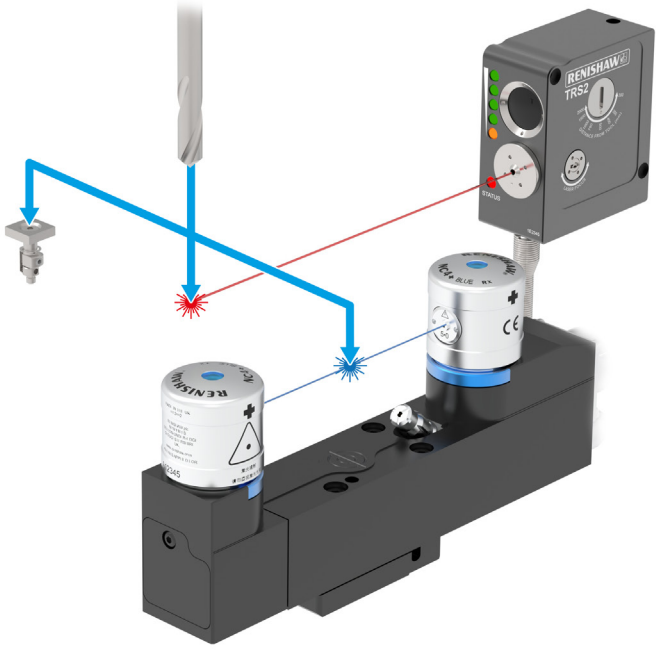
Tool setting helps to:

- ensure accurate dimensional measurement of tooling
- eliminate incorrect tool loading and manual setting errors
- compensate for thermal growth in the machine spindle and tool
- automate tool offset calculation and correction
- adapt for tool run-out and wear



Broken tool detection or **recognition** helps to:

- prevent broken or chipped tools cutting air
- reduce scrap
- reduce labour requirements



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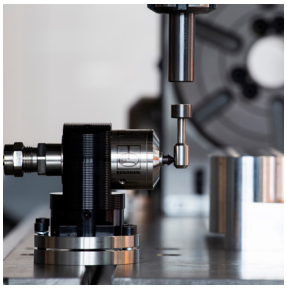
Renishaw's tool setting products

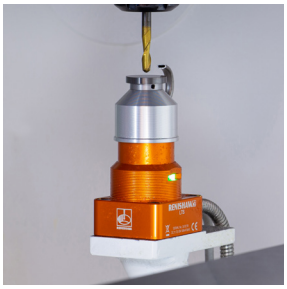
Contact tool setters



TS27R
See TS27R data sheet
H-2000-2171

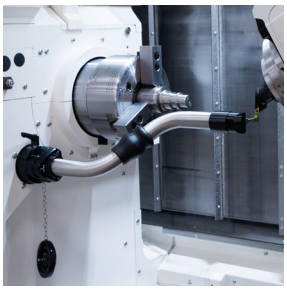
OTS
See OTS data sheet
H-5514-8200

RTS
See RTS data sheet
H-5646-8200



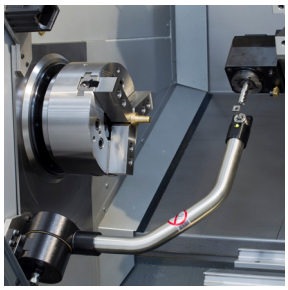
LTS
See LTS data sheet
H-5475-8200

Tool setting arms

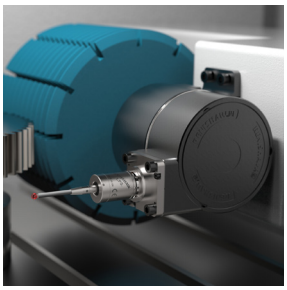


HPRA
See HPRA data sheet
H-2000-2029

HPPA
See HPPA data sheet
H-2000-2032

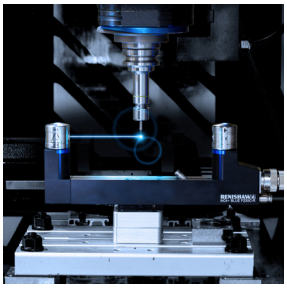


HPMA
See HPMA data sheet
H-2000-2037

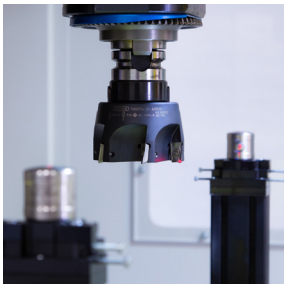


HPGA
See HPGA data sheet
H-5616-8200

Non-contact tool setters

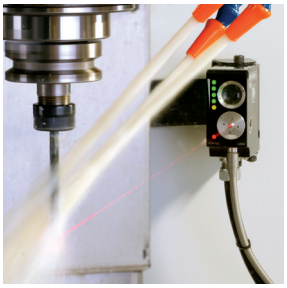


NC4 (Fixed)
See NC4+ Blue data sheet
H-6435-8200



NC4 (Separate)
See NC4 data sheet
H-6270-8200

Broken tool detection



TRS2
See TRS2 data sheet .
H-5450-8200

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