

ActiveEdge

Auto Compensating Boring System

Rigibore® The Most Accurately Adjustable Boring Tools in the World



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ActiveEdge Overview

The main piece of hardware in the ActiveEdge system is the custom tool. This tool can be designed with up to eight individually adjustable micron-accurate cartridges, bespoke to the customer's application.

There are 3 main ways to integrate the ActiveEdge tool, these are :-

•Level 1- Remote Adjuster- A remote control is used to make adjustments to the boring bar. By entering the unique tool ID and required adjustment amount into the 3T Adjuster, an automatic request is sent the tool's cutting edge by radio signal. The tool's cutting edge will subsequently adjust to the required diameter.

•Level 2- Machine Integrated Interface- This method requires a level of on-site integration in conjunction with the machine tool supplier. ActiveEdge tooling can be integrated with an external gauging or probing device allowing CNC programs to adjust and monitor ActiveEdge boring bar on the machine. Rigibore provide customisable sub-routines for all boring tool functionality.

•Level 3- Machine Integrated with ActiveNet network- This format is regularly adopted by aerospace and automotive customers that require process monitoring capabilities. A Rigibore industrial computer is supplied with 'ActiveNet' software. This software keeps a data log of each command and current status of an individual ActiveEdge tool.



Benefits	Level 1	Level 2	Level 3
Micron-Accuracy In Adjustment	✓	✓	✓
Reduction In Skill	✓	✓	✓
Health and Safety Improvements	✓	✓	✓
Closed-Loop Manufacturing	✗	✓	✓
Adjustment Based On Probe Measuremnt	✗	✓	✓
Improved Cpk Performance	✗	✓	✓
Total Monitoring of Bore Sizes	✗	✓	✓
Maxmise Production Efficiency	✗	✗	✓

Rigibore design and build these custom tools in as little as 4-6 weeks.

ActiveEdge is largely about process integration. In order to maximise effectiveness the tool needs to be integrated in the most efficient way to suit the process.

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Entry Level 1

Entry Level 1

ActiveEdge provides unrivalled simplicity in adjustment, allowing micron-precise changes to be made to the cutting edge at the push of a button.

By simply entering the unique tool ID and the required adjustment, a request is sent directly to the ActiveEdge Boring Bar. The cutting edges subsequently adjust to the required size.

This innovative design eliminates the need for manual adjustments, making the process faster and more accurate.



3T Adjustment Process

- 1) Enter adjustment amount in microns into the remote adjuster
- 2) Adjustment data transfer occurs through wireless radio transmission
- 3) ActiveEdge cartridges automatically adjust to the required diameter

Key Benefits of 3T Adjustment

Health and Safety Benefits	Adjustments are made outside the machine
Reduction in skill Requirement	Enter the amount of adjustment on the remote controlled adjuster
Individual Adjustment	5 cartridges on one tool can be individually adjusted
No Clamping Mechanism	No Clamping- No deflections

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Entry Level 2

Closed Loop - Level 2

ActiveEdge's auto-compensation technology allows bore sizes to be continuously monitored, ensuring a close tolerance bore diameter is maintained throughout the operation.

The ActiveEdge Tool can be integrated with a third party probing or gauging device and CNC machine to automatically measure and adjust the tool for wear compensation.

ActiveEdge Interface



Adjustments can be made to the tool anywhere in the machine after probe data is reviewed, allowing the process to continue.

Closed-Loop Manufacturing

Organisations use Rigibore program cycles to produce operator-free adjustment to boring bars. This is also known as Closed-Loop Manufacturing.

Statistical Process Control macros analyse machined diameters, ensuring bore sizes are between a user defined tolerance parameter of an upper and lower control limit.

If bore sizes are not within the upper and lower control limits, a compensation request is sent to the ActiveEdge tool which adjusts its cutting edge to ensure the next machined bore is set to nominal size.

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Entry Level 3

Monitoring Data With ActiveEdge - Level 3

This advanced design has all the benefits of both Level 1 and Level 2, providing micron-accuracy in adjustment and improving productivity whilst reducing risks to health and safety.

However, this method of ActiveEdge integration also has the additional capability of gathering and storing real time data from the customer's boring operation.



ActiveNet

A Rigibore industrial computer running our sophisticated software 'ActiveNet', will allow multi-machine cell operations to be controlled from one central location.

'ActiveNet' stores the complete compensation history of any individual tool, providing a comprehensive overview of the entire production process.

This function enables an organisation to successfully analyse its manufacturing operation, allowing continuous improvements to be made through process monitoring.

'ActiveNet' can be used successfully by organisations to highlight inconsistencies in the manufacturing process, such as wear compensation



PC Running
ActiveEdge Software

Benefits

- Highlight Inconsistencies In Performance**- ActiveNet can be used successfully by organisations to highlight inconsistencies in the manufacturing process, such as identifying wear compensation patterns.
- Improved Efficiency In Production**- Organisations can benefit from continuous process improvement, making operations more streamlined and efficient.
- Simplicity In Operation** - This software helps simplify complex boring operations with multi-machine cells, allowing careful and systematic monitoring from just one central location.

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The Boring Cycle

What Is ActiveEdge?

Rigibore's ActiveEdge is much more than a tool. This auto-compensating system uses wireless technology to perform micron-accuracy in adjustment without the need for an operator's intervention.

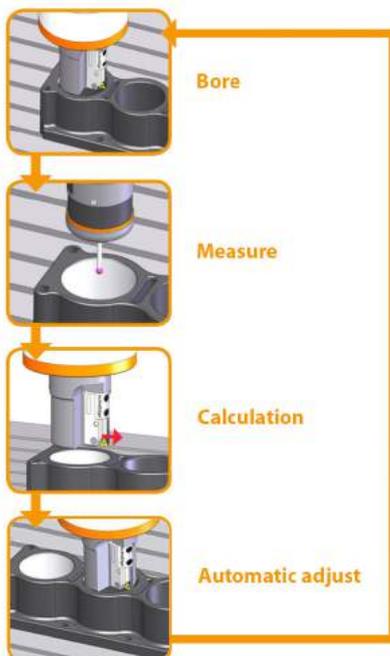
Adjustments are made via radio signal with the tool still in the machine spindle, ensuring that non-productive time in the operation is eliminated.

ActiveEdge tooling is a manufacturer's dream, making operations simpler, quicker and more accurate.



The Boring Cycle - How ActiveEdge Works

ActiveEdge tooling follows a succinct and simple process, ensuring that micron-accuracy is achieved and maintained automatically in boring operations.



1. Firstly a hole is accurately bored with the ActiveEdge tool, just as you would with any other conventional boring tool.
2. This bore is then measured using a probing or gauging device, either internal or external to the CNC machine. This measured diameter is then translated and saved in a variable in the CNC machine.
3. The bore measurement is assessed against a set of Statistical Process Control (SPC) macros. The macros calculate where the bore data is within the required tolerance band between the upper and lower warning limits.
4. If bore sizes are not within this user defined parameter, an automatic adjustment request is sent directly to the ActiveEdge tool, which adjusts to ensure that the next machined bore is returned to nominal size.

- Rigibore design and develop statistical process macros in-house
- These macros are customisable by users to create the required tolerance parameters
- Operators can significantly increase productivity through implementation of Closed-Loop Manufacturing

ActiveEdge 3T Adjustment and ActiveEdge Cartridges

3T Adjustment

ActiveEdge's remotely controlled 3T adjuster allows micron-precise adjustments to be made to tool cutting edges, at the touch of a button.

Instantaneous adjustment can be achieved simply by entering the tools unique ID code and the required diameter change into the 3T adjuster.

An automatic adjustment request is then sent directly to the tool through radio connectivity.

The sophisticated internal software contains all the cartridge collaboration files in the SD card. This ensures when cartridges are swapped, the 3T adjuster maintains the correct collaboration file.



ActiveEdge Cartridges

ActiveEdge has the capability to integrate with upto 5 independently adjustable cartridges on one boring bar.

This allows for multiple diameters to be cut in one operation, reducing cycle time and spindle downtime.

This capability enables micron-accurate bores to be produced in one operation.

ActiveEdge allows for continuous machining at tight tolerances without the need for an operator's intervention.



Benefits

Micron-Accuracy In Adjustment - ActiveEdge's 3T adjuster will adjust to just one micron on diameter.

Reduction In Skill - 3T adjustment allows changes to the cutting edges to be made automatically, with no requirement for manual adjustment with a wrench. This reduces the need for skilled operators and reduces the risk of errors.

Health and Safety Improvements - Implementation of 3T adjustment means changes do not have to be made in the machine envelope thereby creating a safer working environment.



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Reduced Operator Intervention

Is your operation reliant on skilled staffing to make manual adjustments?

Large outgoings on personnel costs for overtime and skilled operators?

Struggling to meet productivity and output objectives?

Reduced Operator Intervention

The ActiveEdge boring system allows organisations to exploit benefits associated with removing operator involvement in the process.

Sophisticated Statistical Process Control (SPC) macros are used to assess whether diameters are meeting the required criteria throughout the boring operation.

If bore sizes are out of tolerance, an automatic adjustment request is sent to the ActiveEdge tool, which ensures the next machined bore is returned to nominal size.

This sophisticated solution makes manual methods of adjustment redundant and reduces the need for an operator's intervention.



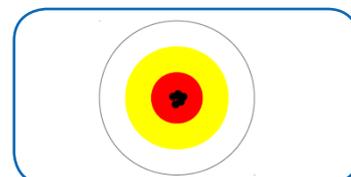
Reduce Costs: ActiveEdge tooling allows a close tolerance bored diameter to be maintained throughout the boring operation, without the involvement of an operator's intervention.

This can lead to long term cost savings, reducing the cost of labour, removing the reliance on skilled operators to make manual adjustments and decreasing scrap and re-work rates.



Increase Productivity: By removing the need for manual adjustments to be made, operators are subsequently released to complete other shopfloor duties thereby increasing productivity and output.

Organisations can also benefit from increased production through lights-out machining, allowing micron-precise adjustments to be made to the cutting edge without a human presence on site.



Improve Accuracy: Automation of bore sizes throughout the process leads to increased accuracy and repeatability.

This is unlike manual methods, where reliance on operators to make adjustments risks errors, creating higher scrap and re-work rates through undersized or oversized bores.

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Adjustment In The Carousel

Adjustment In The Carousel

Rigibore's ActiveEdge creates huge reductions in operation time by applying auto-compensation technology, allowing cutting edges to be automatically adjusted whilst remaining in the machine carousel.

This unique capability minimises the time which the tool spends idle, ensuring that non-productive time is greatly reduced.



Maximising Efficiency In Operation

Firstly, the ActiveEdge tool bores a hole, this diameter is then measured by a gauging or probing device and data is sent directly to the CNC machine.

A set of macros designed in house by Rigibore determine whether the bore size is within the Upper Warning Limit and the Lower Warning Limit. If an adjustment is required, a direct request is transmitted to the ActiveEdge tool.

The ActiveEdge tool receives this request whilst idle in the machine carousel and adjusts automatically, stopping the process for just a matter of seconds.

Manual Methods of Adjustment	Adjustment Using ActiveEdge Tooling
<p>✗ Stopped for several minutes while operators make adjustments.</p>	<p>✓ Adjustments are made in a matter of seconds- meaning no spindle downtime</p>
<p>✗ If operators are busy with other tasks, the operation stops completely.</p>	<p>✓ No operator intervention required- freeing staff up for other shopfloor activities</p>
<p>✗ Relies on skilled operators to make adjustments accurately</p>	<p>✓ Guaranteed micron-accuracy in adjustment</p>
<p>✗ Difficulty adjusting in the machine spindle, risk of errors for oversized and undersized bores</p>	<p>✓ A more streamlined and efficient process, leading to reduced cycle time</p>

Do you spend valuable time each day setting boring bars or padded reamer tools?

Does this wasted time setting tools impact on other shopfloor activities?

Rigibore's ActiveEdge provides the solution to streamlining your boring operation!

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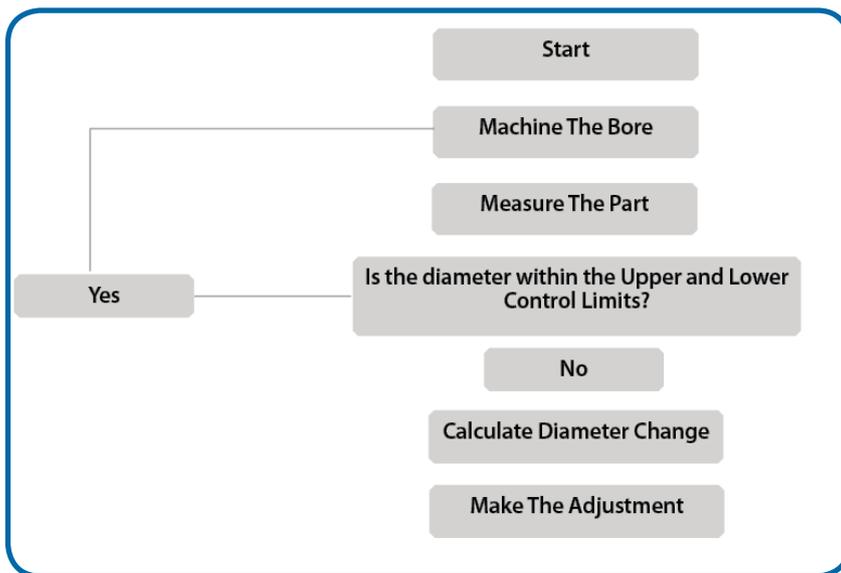
Closed Loop Manufacturing

Closed Loop Manufacturing

ActiveEdge Tooling can be successfully integrated with partner products, creating a process where bore sizes can be automatically adjusted if they fail to meet the required tolerance.

This continuous process needs no intervention from an operator, guaranteeing micron-accuracy in adjustment and the ability to exploit productivity and performance benefits.

The Closed-Loop



A probing or gauging device is used to measure the diameter of the bored hole.

The probe then sends data directly to the CNC machine, allowing the Rigibore macro to analyse data and decide if an adjustment is required.

Intelligent hardware in the ActiveEdge yoke allows the cutting edges to be adjusted automatically, with no operator intervention necessary.

This process offers exceptional repeatability, ensuring accuracy is achieved with every bored hole.

Benefits of Closed Loop

Increase Productivity

Organisations can benefit from implementation of lights-out manufacturing

Reduce Operator Involvement

Automating bore sizes removes the need for an operator, helping organisations reduce labour costs

No Spindle Downtime

Production throughput is increased and cycle time is reduced

Maintain Quality Assurance

Automation offers bore sizes with greater accuracy and repeatability

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Integrate With Probes

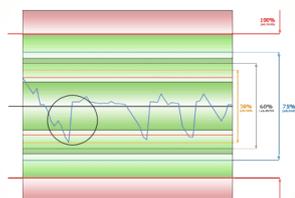
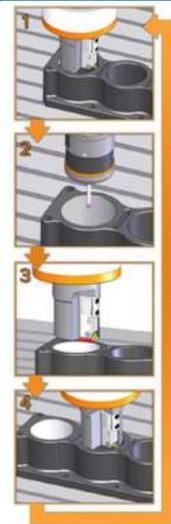
ActiveEdge Integration With Probes

Problem: When using a rotating boring bar a machine tool offset cannot be used to adjust the diameter of the hole produced, meaning that for the diameter to be changed, the geometry must be physically moved.

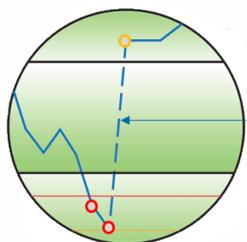
Solution: Rigibore's ActiveEdge boring bar has insert holders that can be automatically adjusted based on a probe measurement value.

The Boring Cycle

- 1) Firstly a hole is bored using the Rigibore ActiveEdge tool.
- 2) This bore is then measured with the probe to establish the bored diameter, this measured value is then translated and saved into a variable in the CNC machine
- 3) This bore measurement is assessed against a set of Statistical Process Control (SPC) macros supplied by Rigibore, calculating whether bore data is within the required tolerance band between upper and lower warning limits.
- 4) If bore sizes are not within the user defined parameter, an automatic compensation request is sent directly to the ActiveEdge tool which adjusts to ensure the next bore is machined to nominal size.



This diagram outlines bore sizes throughout the operation. The red lines represent the upper and lower warning limits.



The close up shows bore sizes falling below the lower control limit, the dotted line indicates ActiveEdge automatically adjusting to nominal size.

Key Benefits

- **Improved Operator Safety**- Operators do not have to enter the machine carousel to make adjustments.
- **Improved Results**- By staying within the upper and lower warning limit, greater consistency and repeatability in bore sizes are achieved.
- **No Spindle Downtime**- Adjustments made automatically in the carousel means that the process is stopped for just a matter of seconds.
- **Reduced Operator Intervention**- Automatic adjustments remove the reliance on skilled operators to make adjustments manually.

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Improving Cpk Performance

Improving Cpk Performance

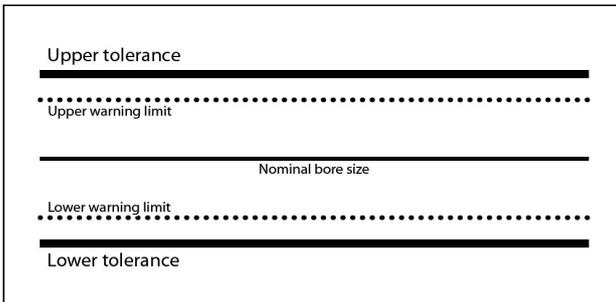
ActiveEdge tooling contributes significantly towards helping achieve good process control, producing the desired bores sizes in an accurate and repeatable manner.

Our unique capabilities establish micron-accuracy in adjustments, applying careful analysis throughout the process to ensure no over-sized or under-sized bores are produced.



ActiveEdge Tooling contributes to a more efficient boring operation.

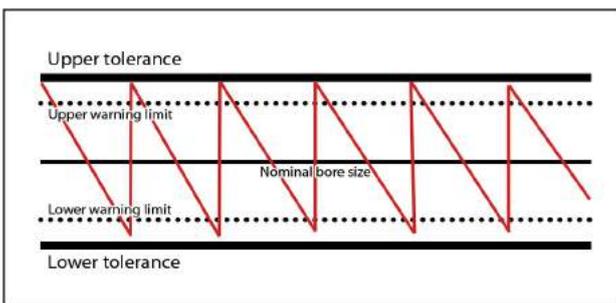
ActiveEdge and Cpk- Unlock Process Control Improvements



The Adjustment Process

The first diagram outlines the structure of the adjustment process. An organisation's main objective is to maintain bore sizes between the upper and lower control limits.

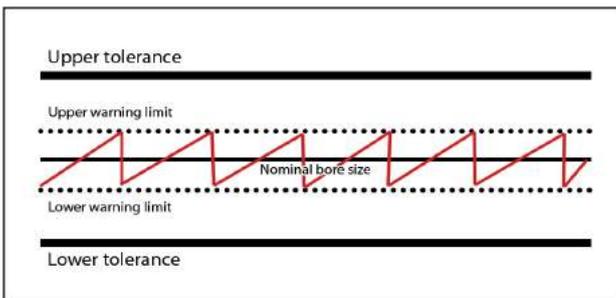
The closer to nominal bore sizes are throughout the operation means greater accuracy and reliability of the process.



Manual Adjustment

This diagram simulates the process of manual adjustment in boring operations.

There is a high deviation on bore sizes towards and sometimes outside the upper and lower control limits, creating high probabilities for oversized or undersized bores.



Adjustment With ActiveEdge

ActiveEdge tooling maintains a much closer tolerance on bore sizes, setting a smaller tolerance band on the upper and lower control limits.

This demonstrates a much lower deviation, with bore sizes always close to nominal diameter and achieving a high Cpk value.

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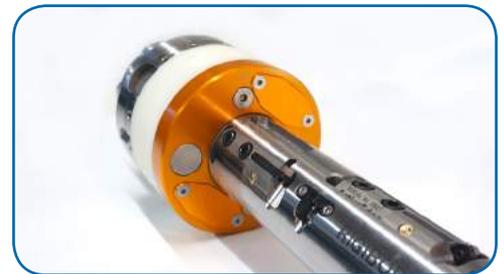
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Line Bar Application

Superior Solutions- Line Bar Application

The ability to deliver an accurate and repeatable process, achieving precision bores in the most streamlined and efficient way allows organisations to gain a distinct advantage over the competition.

Rigibore's Line Boring Application has shown to create and sustain improved process speeds and bore quality, efficiency and accuracy in operation whilst reducing tool maintenance and stoppages in production.



Design and Performance

Rigibore, a specialist in custom tool design and manufacture can design and develop tools with multiple cutting edges on one bar, bespoke to the customer's application.

Implementing up to 5 ActiveEdge cartridges on one bar allows a close tolerance bored diameter to be maintained throughout the process.

These cartridges are independently adjustable. By simply entering the unique cartridge ID and the required diameter change on the remote 3T adjuster, an instantaneous adjustment is made.

PCBN inserts are integrated to reduce resistance to wear and improve surface finish of bores.



The 3T Adjuster provides simplicity through wireless compensation adjustments

Performance Benefits



- **Improved Quality**- Superior quality is achieved in precision boring operations, allowing the tool to maintain a close tolerance bored diameter with micron-accurate adjustments being made.
- **Time Saving**- This process removes significant time in set up and operation, contributing to a significantly more streamlined operation with a reduced cycle time.
- **Adjustment In the Carousel**- ActiveEdge's enables for adjustments to be made whilst idle in the carousel, leading to significantly reduced spindle downtime.
- **Fewer Moving Parts**- The Line Bar's robust design has fewer moving parts, reducing tool wear.



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Presetting With ActiveEdge

Presetting With ActiveEdge

ActiveEdge tooling allows organisations to benefit from automatic presetting of rotating boring bars.

Rigibore have developed relationships with many of the top Presetter Manufacturers in order to make presetting operations quicker, simpler and more accurate, these include:- **Zoller, Nikken, Kelch** and **Parlec**.

Automatic Presetting

Presetters allow accurate measurements of the ActiveEdge tool's cutting edges before directly transmitting this information to the ActiveEdge interface.

The ActiveEdge interface is linked with the Presetter, giving the Presetter direct access to adjustment requirements for the ActiveEdge tool.

Using radio frequency, the cutting edges of the ActiveEdge tool can be automatically set to the established preset size after an insert is changed.

A constant communication stream is maintained between the Presetter and the ActiveEdge tool to ensure the cutting edges are set accurately.



Benefits of Automtatic Presetting

- **Reducing Operator Intervention** - This automation releases operators to conduct other important shop floor duties, as opposed to making manual adjustments to the cutting edge.
- **Process Efficiency** - Automatic presetting allows for a more streamlined and efficient operation, reducing the amount of non-productive time spent in operation and contributing to productivity improvement.
- **Guaranteed Quality in Operation** - The process of automation not only creates a quicker operation, but also a more accurate one, ensuring cutting edges are set to nominal size.
- **Standardised Process Implementation** - Automatic presetting allows the process to be accurately repeated. This is especially important in high-volume production operations.





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Frequently Asked Questions

Set-Up

Q: What is required to fit ActiveEdge to a machine tool in a closed loop process?

A: The tool communicates by RADIO to the AEI (ActiveEdge Interface). The AEI is hard-wired to the machine tool control and converts signals from the tool into voltage-free outputs that are linked to the control I/O module.

Instructions to move the tool are converted by the NC control into signals that are sent through the machines I/O to the AEI and then transmitted to the tool.

Installation of ActiveEdge hardware requires available I/O (1 input and 1 output) to be identified by the machine tool builder. In some instances a very small PLC modification is required so that this I/O can be enabled. The AEI also requires 24v and a 0v supply, this AEI is CE marked and tested for use in the machine tool.

The AEI is opto-isolated, therefore hardware has no effect on the safety performance of the machine control system.

Functionality

Q: Are any modifications required to be made to the machine tool spindle for ActiveEdge?

A: No physical changes are required to the machine spindle.

Q: What guarantees do Rigibore give on tool functionality?

A: Rigibore want the entire process to provide our customers with cost saving benefits. We will support customer applications fully and provide detailed quotes for installation, intergration and maintenance.

Rigibore guarantees the performance of the tool, ensuring adjustment is accurate to the commanded amount. Process capability includes every element of the closed-loop process from component material, fixturing, machine tool accuracy, thermal change in the machine and all assoicated factors within metal working principles.

Rigibore will assist where possible with every aspect but cannot be held responsible for problems in the process caused by third party hardware or process.

Frequently Asked Questions

Tool Hardware

Q: How long do the batteries last ?

A: Typically, the specially supplied batteries last around 2-3 months with normal use. The biggest influence on battery life is the polling duration set on the tool, every tool has a factory set polling time dependant on the process the tool is used in.

The polling time can be either 5, 10 or 20 seconds. Shorter polling times result in reduced battery life. Another influencing factor is the frequency and amount of movement requested and completed by the tool.

Q: What inserts can be used in the tooling?

A: ActiveEdge cartridges are built to take ISO Standard CC..0602.. inserts and TC ..1102 inserts.

Q: What is the size range offered by Rigibore?

A: The maximum size is only dictated by the tool itself, there is theoretically no maximum bore size. As a standard principle the minimum bore size is Ø38mm.

Communications

Q: How does the communication work? Is there any radio interference?

A: The tool has a reliable communication protocol that is resistant to other radio devices, operating in open frequencies that do not require licensing. For a tool frequency chart please see our website.

Q: What is the range of tool's communication?

A: An antenna is mounted on the machine, in the tools' magazine area, machine envelope or in some cases, externally on the top of the machine.

The tool has a working range of around 10 meters from the antenna. In an open field it can be almost three times this amount.

ActiveEdge

Frequently Asked Questions

Probing

Q: Is probing accurate enough to measure this level of compensation?

A: Modern probes have highly efficient repeatability of 1µm when they are kinematic in design and strain gauge probes can have repeatability of 0.25 µm.

In process, the accuracy of a probe is reliant on a number of other factors and processes must be effectively written to resolve these factors. The accuracy of the machine tool is the most essential factor. Regular calibration of the probe hardware allows thermal deviation in the machine environment to be accounted for.

In process checks on the values supplied by the probe can easily be built into the NC program, identifying swarf contamination. Rigibore also provides SPC (Statistical Process Control) based macros. These macros adjust based on trend figures not on a single measurement basis.

Feeds and Speeds

Q: How long does the tool take to adjust?

A: On average it takes 2 seconds per micron of adjustment on diameter. The adjustment is usually done while the tool is in the machine magazine so there is no spindle downtime.

Q: What is the maximum RPM of an ActiveEdge tool?

A: All finishing tools supplied by Rigibore are balanced to the speed required for the cutting parameters at G6.3 or G2.5 where possible.

The maximum spindle speed for ActiveEdge is 3,500RPM. This is dictated by the extensive testing carried out on the batteries.