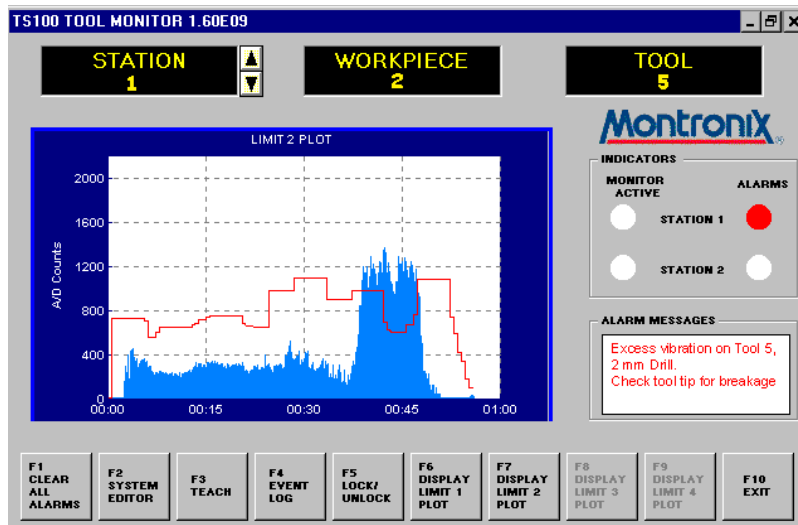


Montronix, Inc. & Lean Manufacturing

- Reducing manufacturing costs while detecting and diagnosing machining problems.





Why Montronix?



- Montronix started in 1990
 - A spin-off from Kennametal -- advanced manufacturing systems division
 - Global market leader since 1995 with 9 offices - 3 continents
- Largest tool and process monitoring company in North America
 - Largest annual sales
 - Most customer-support specialists
- Restructured in 2001
 - Increased customer focus
 - Improved products and services



Montronix Strength

Knowledge

- Applications
- Process variability relationships
- Process economics
- ...

- Diagnostic tools
- Hardware
- Software

- Project Mgmt
- Customer Support
- **Certified Training**

Satisfied Customers Worldwide

> 250 End users

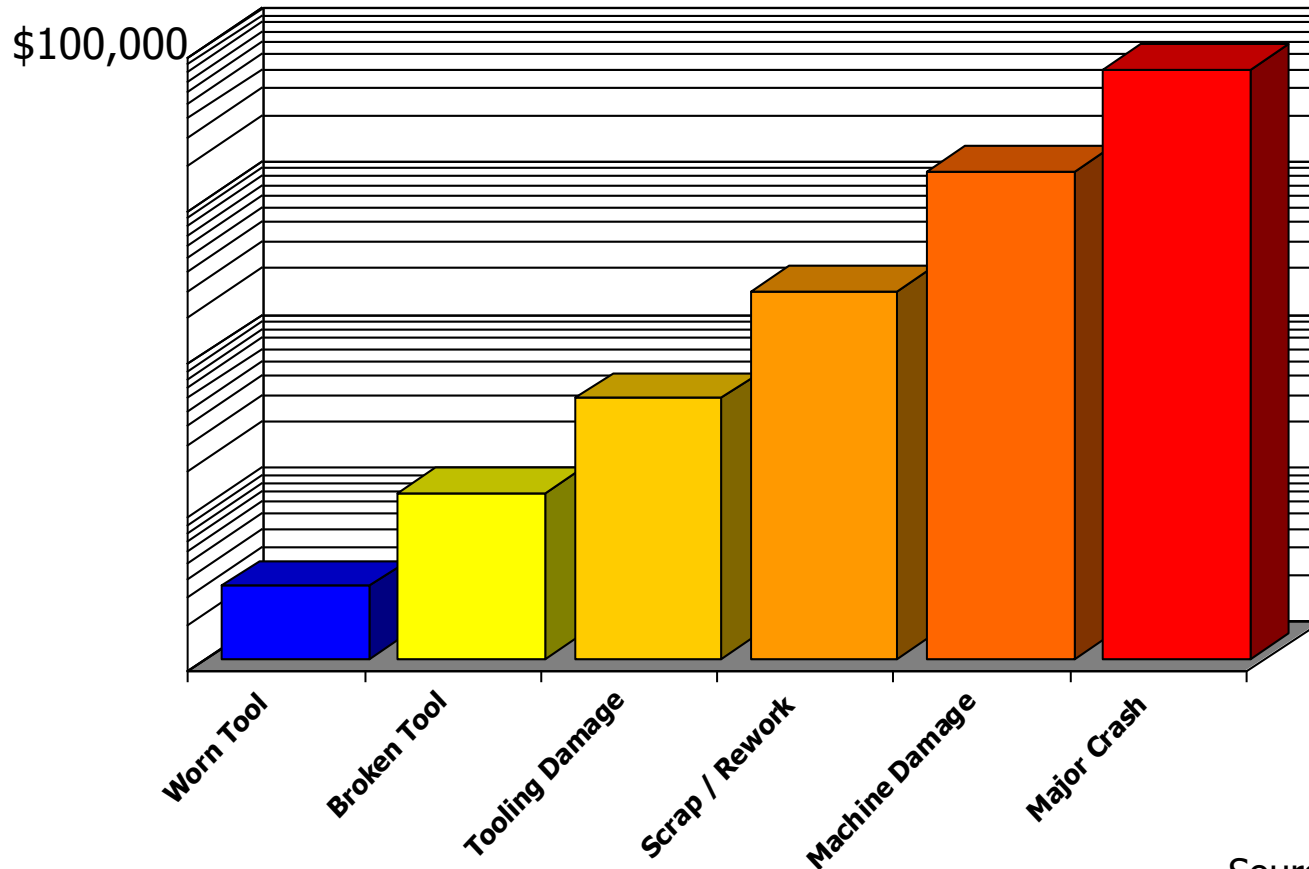
- DaimlerChrysler
- General Motors
- SKF Bearings
- PBR Automotive
- Delphi
- Bosch
- Ford
- Cummins
- Navistar
- Allison Transmission
- ...

> 100 OEMs

- Chiron
- OKK
- Enshu
- Lamb
- Hueller Hille
- Emag
- Fuji
- ...



Unmonitored Process is Expensive!



Source: Montronix study



Montronix Tool & Process Monitoring System Justified on...

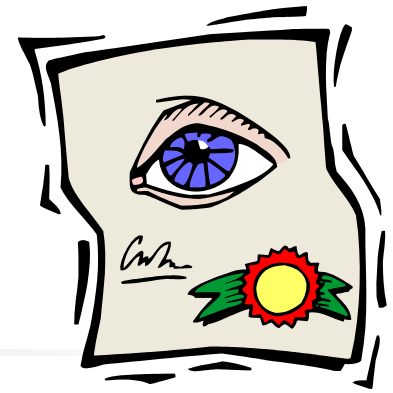
- Expensive / Critical Machines.
- Expensive Components. } (Even on low cost Machines)
- Expensive Tools. }
- Expensive/Critical Process (High value addition to the component)
- Shorter cycle time processes (Mass production: Auto Industry)
- Longer cycle time processes (Job Production: Aero & Heavy Engg.)

□ **Montronix Tool and Process Monitoring System in a Manufacturing system is a wise investment that**

- Pays back faster than any capital investments.
- One major event pays back the Montronix investment.
- Return on investment, Event based not the Time.
- Enjoy extended quality life of machine as bonus on Montronix investment.



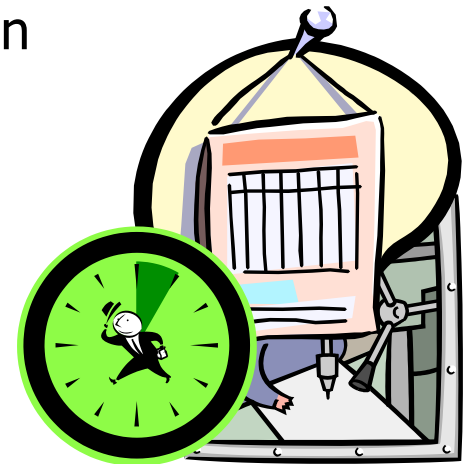
Montronix Solutions

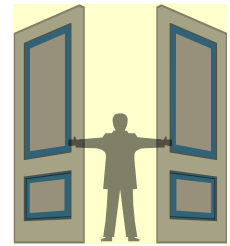


- Helpful
 - Identify machine has a problem
 - Identify machining process has a problem
 - Help diagnose and solve the problem
- Invisible
 - Monitor the situation without human involvement
 - Visible only when a problem occurs
- Easy to use
 - Menu driven navigation
 - Montronix certified training

Montronix & Lean Manufacturing

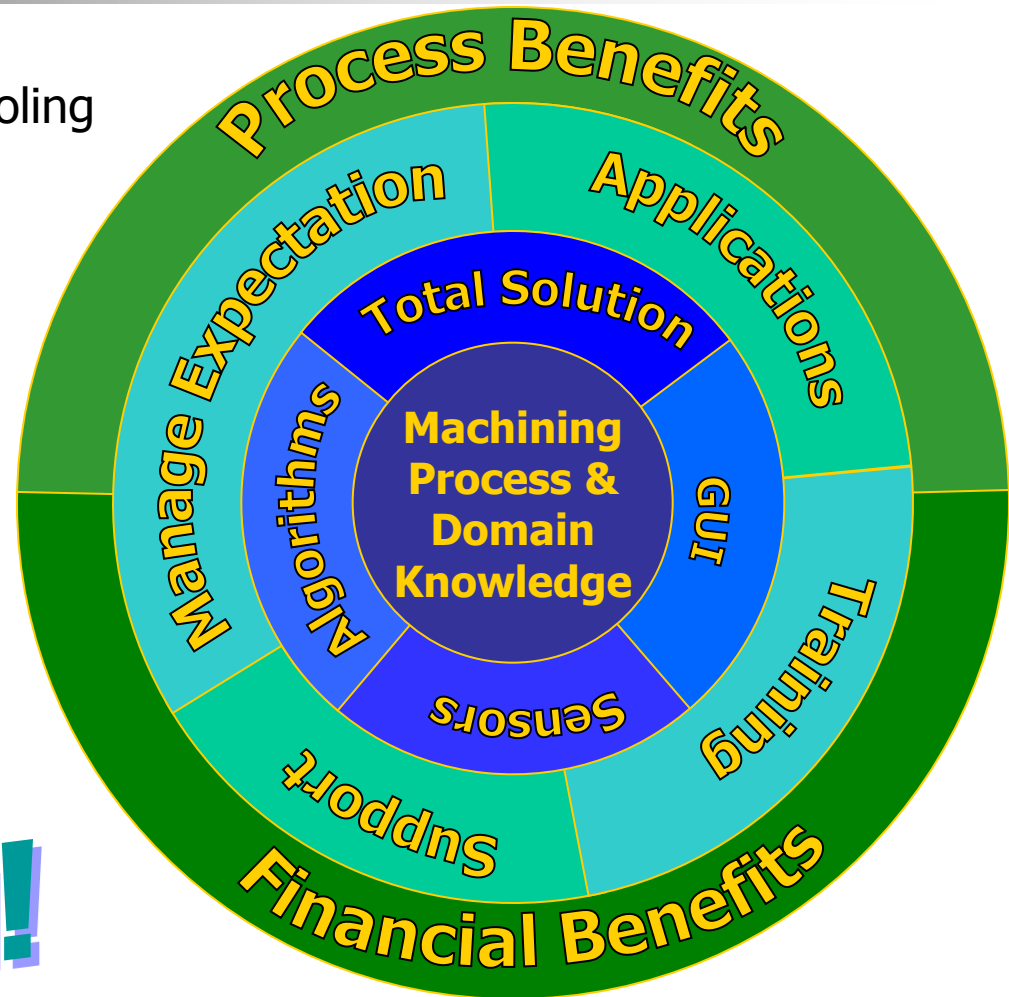
- Improves machining efficiency
 - Increase uptime – reduce downtime
 - Reduce cycle-time
- Keeps cost low
 - Reduce scrap & rework
 - Reduce investment – e.g. gaging and probing equipment
 - Reduce manpower for machine supervision
- Optimizes use of consumable assets
 - E.g. cutting tools
- Protects expensive equipment
 - Catastrophic events





Montronix Advantage

- Protect machine & expensive tooling
- Monitor & optimize process
- Reduce warranty costs
- Reduce scrap & rework
- Reduce start-up time
- Reduce cycle time
- Reduce post-process inspection
- Increase productivity & throughput
- Improve quality
- Improve customer satisfaction
- Be more competitive



For You!



Management Benefits

- Quality by Strict Process Control, not by Inspection.
- Enhanced Productivity.
- Quality Consistency /Assurance .
- Reduced cost per piece.
- Optimum Utilisation of Man, Machine and Tooling.
- Enhanced Quality life of the machine.
- Safe Working Environment for both Operators and Machines
- Minimum Tool Inventory, Reduced Overheads.
- Ensured Process.
- No Surprise rejections.
- Document of process for evaluation (M-view, Event Log).
- Aid for “Continuous Improvement”



Benefited Areas

Process Engineering

- Helps in Optimising the Process
- Visualise process on real time
- Measure of incoming material quality
- Enhanced machine capacity

Tool Management

- Optimum Utilisation of tool
- More Components per Tool
- Reduced Tool Inventory
- Evaluation of Tool Quality
- Log of Tool Life

Production

- Quality by Consistent process
- Optimum Manpower Utilisation
- Ensured Machine Uptime
- Ensured Machine accuracy over machine life
- Log of process events in Ghost shift
- Reduced Scrap
- Reduced WIP

Maintenance

- Reduced machine down time Costs
- Reduced Spares cost
- Enhanced Machine life
- Machine condition monitoring on real time



Significance of Montronix Presence

Component Produced on the machine Equipped with Montronix Tool and Process Monitoring system is ensured of,

- All operations performed
- All performed operations are with good tools
- All operations are performed with frozen cutting parameters.
- Acceptable metallurgical structure.



Process Establishing for “Cpk” And “Cycle Time” Involves.

- Machine Mechanical Stability.
- Machine Electrical Capability.
- Fixture/Component holding rigidity.
- Tool capacity. to cut higher depths, feed rate, tool wear etc)
- Coolant parameters (Flow, Pressure, Temperature.)
- Component solidity.
- Achieving expected Component quality

All the above constituents of Manufacturing System are frozen and expected to adhere with time, **except Tool Wear.**

i.e. **Tool Wear is a major parameter to achieve Cpk.**

Tool wear is managed by establishing **Fixed Replacement Policy (FRP)** for consistent / improve **Cpk.**

Unfortunately, In shop floor ?????



Fixed Replacement Policy (FRP) for Tools Does Not Work Always

WHY??

- Improper Resharpener / Tool Geometry.
- Alternative Tools used .
- Hard Spots in the Component.
- Metallurgical variations in Input Material.
- Improper Coolant supply-Pressure/Flow/Temperature
- Contaminated Coolant.
- Machine Deterioration/Slides/Vibrations/Guide Bush/Belt Slippage
- Manipulated Feed rates.
- Improper Clamping of Tool/Work/Fixture

LEADS TO

EITHER

- Over Utilisation of Tool Resulting in Quality Deviation.

OR

- Under Utilisation of the Tool Resulting in Increased Cost Per Piece .

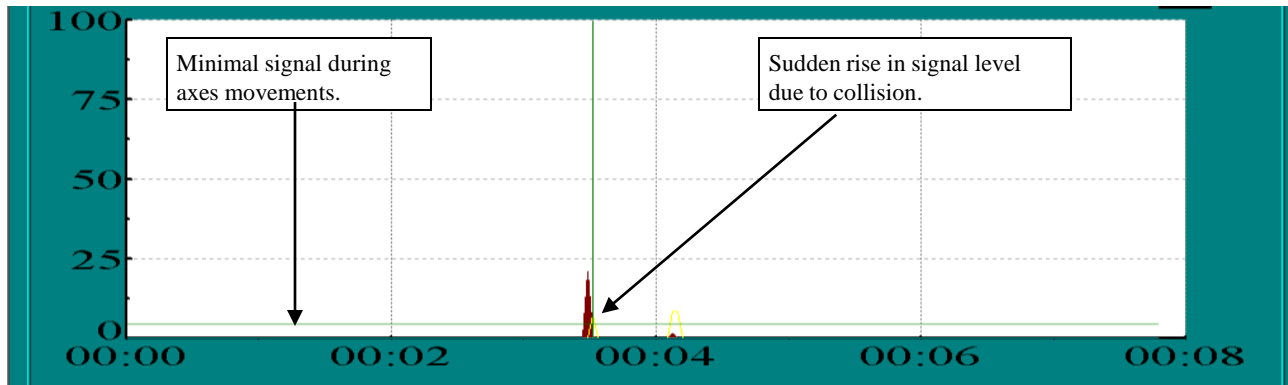
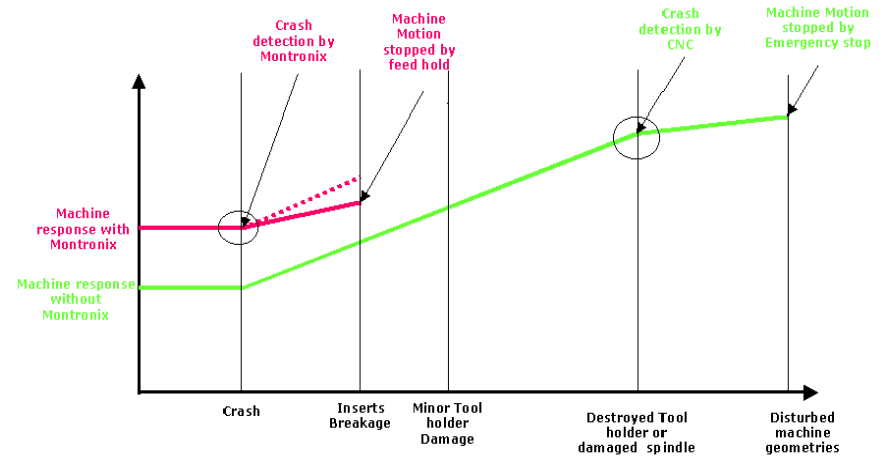


How Tool Monitoring Works?

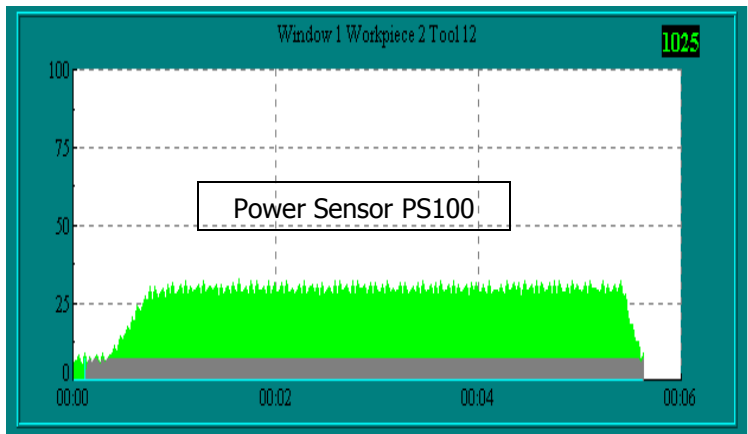
Montronix 'Tool & Process Monitoring System' works on the principle of signature comparison on "Real Time" basis.

- Ideal signatures for an acceptable process are acquired with new tools & frozen parameters.
- Signatures are acquired with worn-out tool for the process.
- limits are defined by comparing both signature strengths to allow the process for producing quality components.
- In the event, the signal strength exceeds the Limits ,the Tool Monitoring processor influences the machine & inhibits further operation.
- The above Procedure of setting the limits is done for all the tools in the process.

Collision

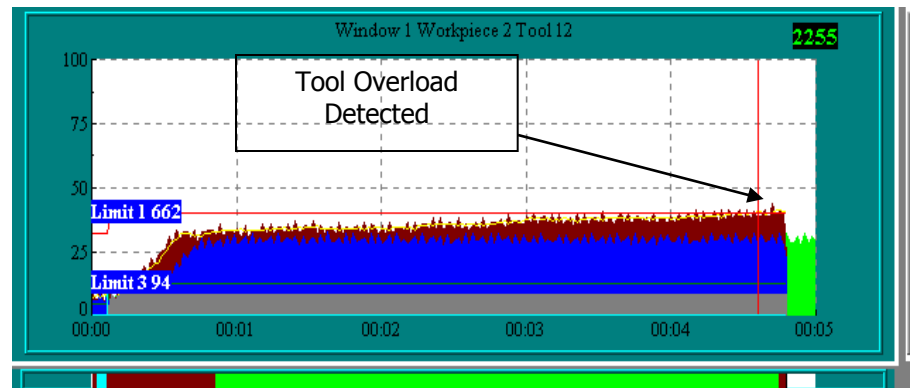
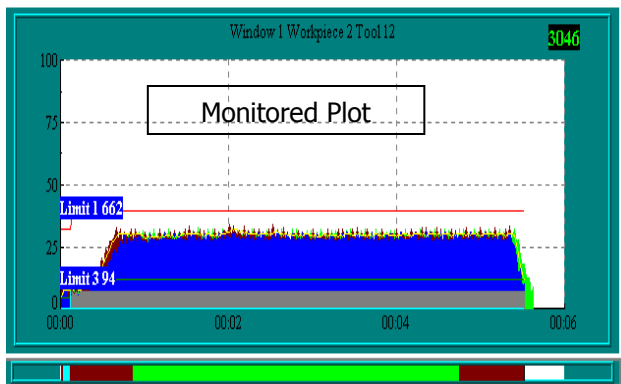
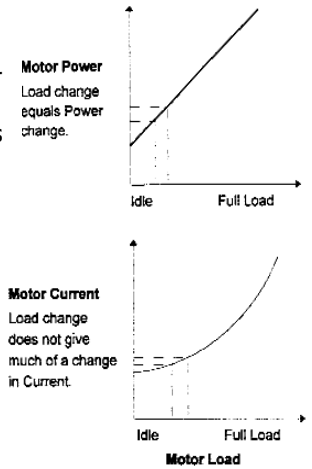


Gross Tool Overload

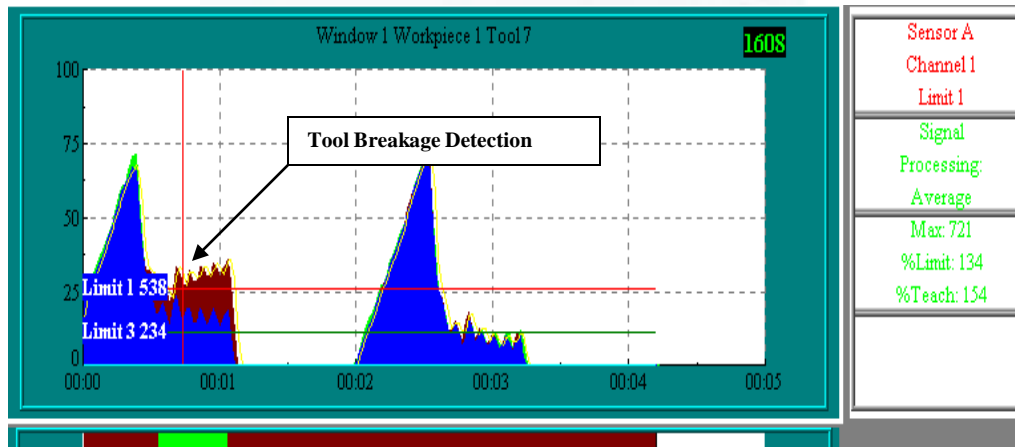
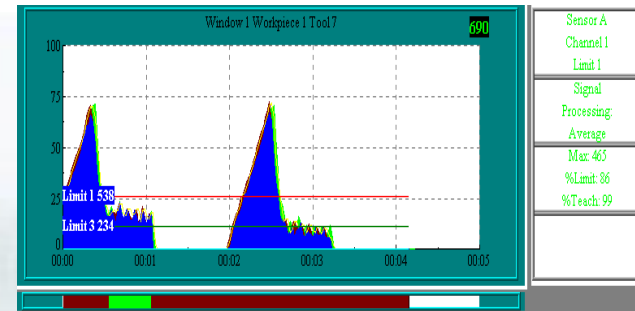
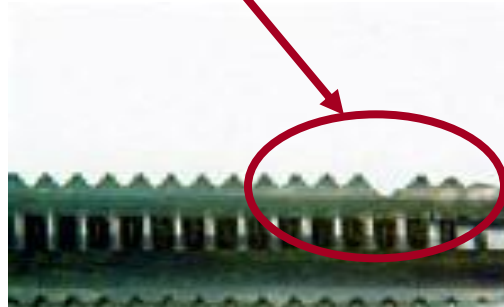
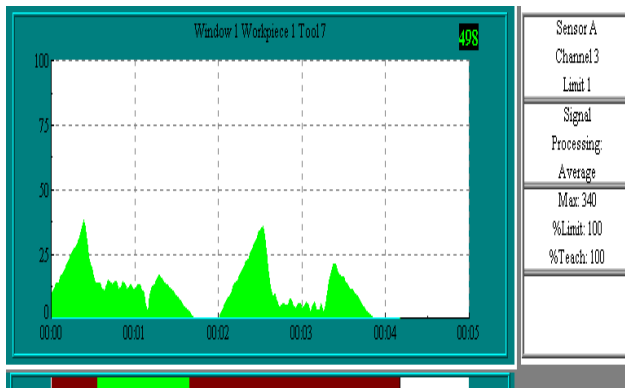


Why monitor power? Power is linear so change in motor load is a change in power. Current is not a sensitive indicator of power at low loads in three phase motors. At low loads current hardly varies

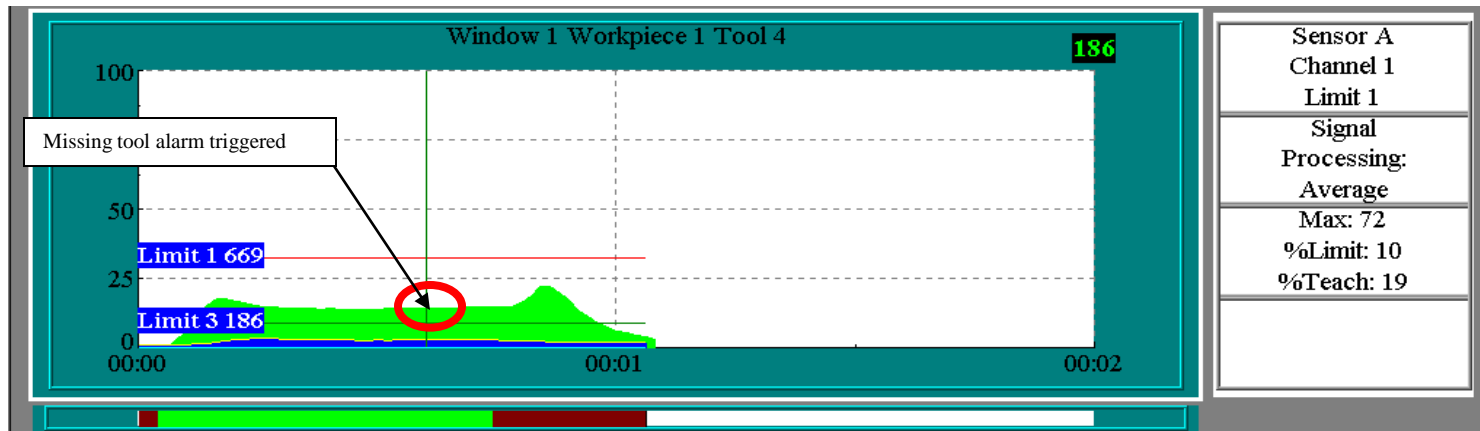
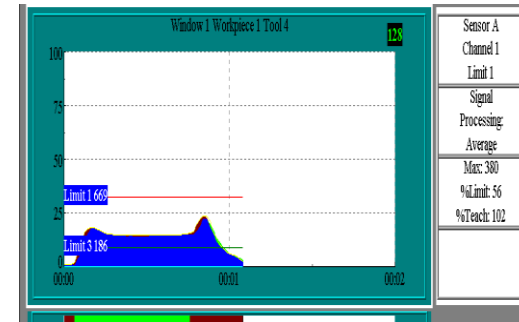
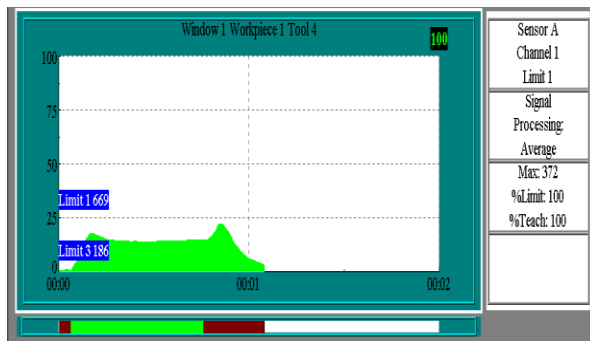
The Montronix Power Sensor monitors power directly, giving ten times greater sensitivity than current sensors at light loads for three-phase motors.



Tool Breakage



Missing Tool/Component/Process





Montronix Tool Monitoring System Components

PROCESSORS

Machine Health Monitoring & Collision Monitoring –

- **Spectra Pulse**

Single Station Monitoring

- **Spectra SL3, Spectra PC1.**

Multi Station Monitoring

- **Spectra GL1, Spectra GL2, Spectra PC2,**

SENSORS

- Power Sensor with digital Gain Module
- Broad Band Vibration Sensor
- Single Axis & 3 Axes ICA Force Sensor
- Retro Bolt Force Sensor
- Torque Sensor

HMI

- **GLCD:** Graphic Liquid Crystal Display
- **M-View:** Visualisation and Diagnostic Software
- **IPM:** Integrated Process Monitoring Software

Established Application with Right Sensor

APPLICATION TYPE	Machine Power	SENSOR TYPE				Broadband Vibration
		Torque	Retro Bolt	Force 1-axis	Force 3-Axes	
Lathe						
Lathe with driven Tool						
Machining Center						
Grinding						
Punch/Press						
Drilling, Reaming, Milling						
Tapping						
Drilling, Reaming (Multi Spindle)						
Tapping (Multi Spindle)						
Gear Hobbing / Gear Shaving						
Assembly Process (stud Fitting)						
Gear Box Noise Testing						



Common Application



Application Dependent Solution



Application Examples

- Machining centers (All types).
- Turning centres, Turn-mill centres, VTL.
- Gun drilling Applications.
- Gear Cutting (Hobbing, Shaping, Shaving).
- Broaching.
- Grinding.
- Honing.
- Multi-spindle drill and tap transfer machine stations.
- SPMs(Skiving& Burnishing,Round table SPMs).
- Customised Applications.



What's Next?

- Let's move forward

