TMAC
Adaptive Tool Monitoring System

Caron Engineering's TMAC (Tool Monitoring Adaptive Control) system interfaces directly with almost any CNC control, optimizing the machining process, to improve *performance*, *productivity*, and *profitability*. TMAC uses high resolution sensor data to measure tool wear in real-time. With its direct interface to the CNC control, TMAC makes automatic and instantaneous, corrective adjustments without the need for human intervention.

TOOL MONITORING FOR WEAR AND BREAKAGE

TMAC reduces the high costs associated with broken tools, lost production, and rejected parts by measuring tool wear in real-time.

- Maximizes tool life
- Prevents tool breakage and lowers scrap rate
- Reduces the cost of consumable tooling
- Provides valuable information about the cutting process
- Immediately stops the machine in the event of tool breakage
- Graphically displays all cutting data for analysis
- Sends remote notifications of machine alarms

Alarms for **extreme**, **wear**, and **undercut** limits per tool

ADAPTIVE CONTROL FEED RATE OPTIMIZATION

TMAC learns the optimum power for each tool and continuously maintains a constant tool load by automatically adjusting the feed rate in real-time. ***The result?*** Decreased cycle time, longer cutter life, and more machine uptime, especially with <u>difficult to machine materials</u>.

Feed Rate Adjustment

Actual Cut

- Typical cycle time savings of 20 - 60%
- Allows tools to run at optimum feed rates
- Adjusts to variations in material and tooling
- Excellent for unattended/lights-out operation
- Adjusts feed rates smoothly versus CAD/CAM programs that can only adjust per line in the program
- Calculates tooth pass frequency to adapt to slow RPM cutters

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Power, Vibration, and Strain sensors can all be used by TMAC to measure tool wear. Other sensors can be installed and monitored by TMAC including spindle speed, coolant flow, and coolant pressure
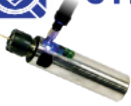
POWER TRANSDUCER

■ 3-phase, multi-range power transducer measures the power load on the tool to determine wear

■ High speed power analytical measurements with extremely high resolution and data rate

STRAIN SENSOR

■ A strain gauge sensor is embedded in a tool holder to measure force

■ Includes built in *temperature sensor*

VIBRATION SENSOR

■ Capable of measuring vibration to 22 KHZ, with adjustable sensitivity

■ Includes built in *temperature sensor*

Multiple sensor options for
TOTAL MACHINE CONDITION MONITORING

COOLANT FLOW

COOLANT PRESSURE
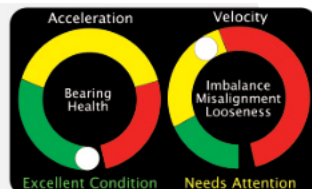
SPINDLE SPEED

■ GE P11TF12 Compliant

WHAT ELSE CAN TMAC DO?

Spindle Bearing Analysis

A vibration sensor can be attached to the spindle, hardwired to TMAC, with the bearing analysis initiated in the CNC part program.

■ Results displayed within 5 seconds

■ Reports are saved for analysis

■ Trend data can be used to establish maintenance requirements

Acceleration | Velocity
Bearing Health | Imbalance Misalignment Looseness
Excellent Condition | Needs Attention

Signature Analysis

Using the signature analysis mode, TMAC learns the entire path (signature) of a cut using any sensor type.
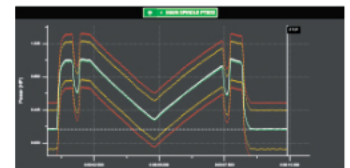
■ The user can define boundaries around the learned signature, both above and below it

■ These boundaries define a window that the signature must stay within to satisfy a good cut

■ If any portion of the monitored signature exceeds the warning (yellow) or extreme (red) boundaries, an alarm is generated
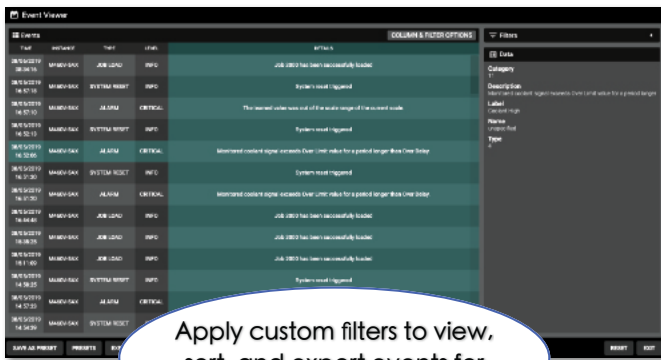
DATA AT YOUR FINGERTIPS

The browser-based user interface allows users to access the TMAC system anytime, anywhere, and from any network connected device!

- Data all in one place
- Intuitive streamlined interface with multiple viewing options
- Remotely view live data from any TMAC system on your network
- Seamless communication with third party OEE software via the industry standard **MTConnect** protocol

EVENT & DATA VIEWERS

- All monitored data and events are stored and can be exported in various formats for analysis
- CNC position data allows the user to inspect the CNC axis positions and program line number; to interrogate alarms and anomalies during cutting
- Cutting data can be overlaid to compare cuts

Apply custom filters to view, sort, and export events for analysis.

View the details of any cut, with pan and zoom options for a closer look!

FEATURES AND BENEFITS

TMAC MONITORS MULTIPLE PROCESSES AND SENSOR CHANNELS SIMULTANEOUSLY

Power

Vibration

Spindle Speed

Coolant Flow

Customizable Views

- Automatic real-time data graphing
- Auto-scaling display sensitivity for optimum resolution
- Universal interface easily adapts to CNC controls
- Real-time automatic corrective adjustments
- Process automation and lights-out machining
- Increased machine tool utilization with less downtime
- Programmable to call a redundant tool when a wear limit is reached (control dependent)
- Easily monitors tapping cycles
- Eliminates air cutting using the *APPROACH FEED RATE* feature
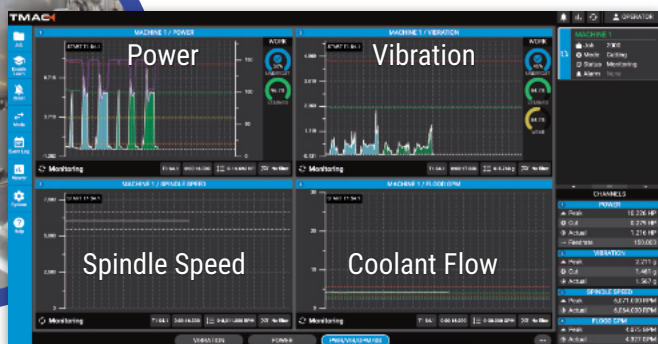
Monitor multiple different TMAC systems on multiple different machines…

…all from ONE browser!

OTHER PRODUCTS FROM CARON ENGINEERING

TOOL CONNECT powered by **MiCONNECT**

AutoComp

D-TectIT

CEI SMART LIGHT

All CEI products are MTConnect compliant