

# 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 the direct interface to the CNC control, TMAC makes automatic, instantaneous, corrective adjustments without the need for human intervention.

## TOOL MONITORING

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



## ADAPTIVE CONTROL

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 difficult to machine materials.



- 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

# HIGH SPEED DATA PROCESSING



TMAC utilizes a powerful, high-speed processor that handles all communication between TMAC, the sensors, and the CNC control. With this robust processor, TMAC can monitor multiple sensors simultaneously to handle different types of machining challenges and react instantaneously to changing conditions.

The TMAC processor has a built-in web server to allow remote configuration and monitoring from any network connected device (including smart phones).

## SENSOR TECHNOLOGY

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

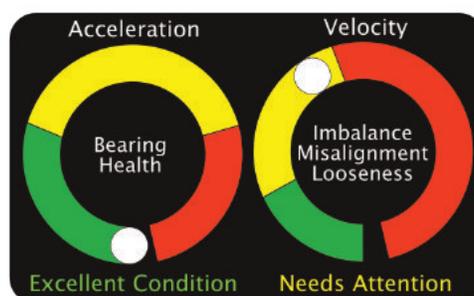
■ GE P11TF12 Compliant

## 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



The vibration signal is analyzed for acceleration to detect the health of the bearings, and velocity to detect misalignment, imbalance, and looseness.

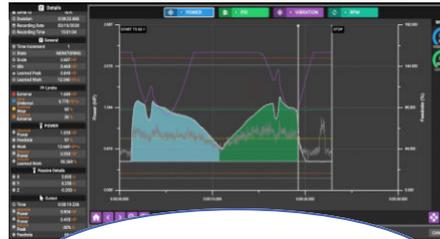
# DATA AT YOUR FINGERTIPS

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



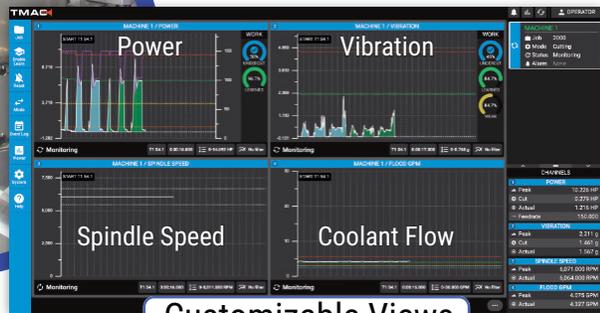
View the details of any cut, with pan and zoom options for a closer look!

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

Time	Machine ID	Event Type
10:00:00	MACHINE001	Tool Change
10:00:05	MACHINE002	Tool Change
10:00:10	MACHINE003	Tool Change
10:00:15	MACHINE004	Tool Change
10:00:20	MACHINE005	Tool Change

## FEATURES AND BENEFITS

TMAC MONITORS MULTIPLE PROCESSES AND SENSOR CHANNELS SIMULTANEOUSLY



- 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

## WHAT CAN TMAC DO FOR ME?

### VISUALIZE



TMAC allows the user to visualize the part program to make the necessary adjustments to run at optimum efficiency.

### PROTECT

TMAC monitors tool wear and automatically stops the machine and retracts the tool when breakage is detected; extending tool life and preventing damage to the machine and part.



### BOOST

TMAC optimizes the cutting program, reduces cycle time, and allows unattended operation.





Monitor multiple different TMAC systems on multiple different machines...  
...all from ONE browser!

## OTHER PRODUCTS FROM CARON ENGINEERING



Monitor *any* area of concern on your CNC machine tool or fixture



Eliminate operator data-entry errors with automatic tool wear compensation software



Automatically transfer tool presetter data from RFID tags in tool holders to and from the machine control



Replace your existing status light; 1000 available modes and programmable audible alarm



All CEI products are **MTConnect** compliant

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