LanSharc™ Application: Transfer Line

Single Spindle cutting, milling, drilling and boring
cutting energy Process Indicator Gauge (ePIG)

SDC003
ePIG

Gauging is a critical step in ensuring manufacturing quality and consistency. While gauging is at best done by automatic systems, it is still often done by manual collection of data. In-process gauging is expensive and done only at critical steps of the manufacturing process. As a result, most common machining operations are not measured and controlled. Dozens, hundreds or even thousands of unacceptable parts can be produced before the next "spot check" along a line catches a problem condition. Flaws are often a result of simple operator error (tool mount, etc), part problem (hardened material) or a process problem (broken/dull tool, speeds/feeds, loss of lube or coolant, etc). In most cases this change of condition from "good" manufacturing to "bad" can be captured and validated with a simple dynamic process indicator based on a "cutting energy" signature. The ePIG system, based on the SDC003 LanSharc™ hardware platform, uses statistical analysis to alert the machine operator that an alarm condition exists where the cutting energy has substantially changed from the expected. By using variances from the expected results, ePIG can also accommodate processes with evolving cutting energy levels (such as those with tool wear and tool change) without false alarming. By providing a trustworthy process alert, ePIG has earned the respect of both machine operators and process engineers alike.

Using a simple non-intrusive vibration sensor, ePIG measures and analyzes both the cutting energy during a machining cycle and also the ambient rotating energy while the machine idles. During machining, the trend of the cutting energy indicator provides a clear signal for monitoring a "substantial change in the manufacturing process". To determine what caused the change in the process, the cutting energy indicator trend can then be analyzed either at the machine by downloading data to a PDA or PC, or by remotely addressing ePIG over Ethernet. A single installation of 16 ePIG's at an auto manufacturer's single spindle transfer lines has provided an estimated $10 million of savings in part quality, avoided down time, minimized scrap and reduced maintenance costs over just the first year of operation.

Opening broad access to process monitoring, ePIG utilizes highly innovative algorithmic processing with low cost hardware. The algorithms are based on adaptive processing techniques, wherein the box automatically learns the base signature during the machining process. The ePIG approach monitors only the statistical data on a normalized basis. This eliminates the need for any specialized setup based on machine type or speed, making ePIG a universal tool. Faults are detected on the basis of variances of the expected results, rather than via commonly utilized amplitude templates, which are highly subject to false alarm and require expert intervention to setup and evaluate. Again, this results in an extremely effective and easy-to-use process monitor, which continuously obtains all data without shutting down the line.

Since the process throughput is so high due to the dedicated DSP, every machining hit can be monitored along with idle time, part transfer, and clamping integrity. When alarms signal, the user simply connects the palm size harvester to receive an automatic and reliable indicator of machining anomalies, part quality problems, or spindle degradation during production. Using a portable PC, process engineers can connect to the ePIG or the harvested process indicator database to examine more detail in tooling or part quality trends and performance. Achieving this data provides information on trends, performance and downtime for manufacturing metrics of single lines or line-to-line comparisons.

The ePIG can be selected to either provide an alert LED or communicate directly with a PLC allowing operators and engineers to further automate their systems as experience builds. The resulting output is simple to understand and directly relates to process integrity and spindle health. Compared to conventional process monitoring systems, ePIG is simple and robust.

"YOUR ONE STOP SOUND AND VIBRATION SHOP"

THE MODAL SHOP INC.
A PCB GROUP CO.

Helping you test, model, and modify the behavior of structures.

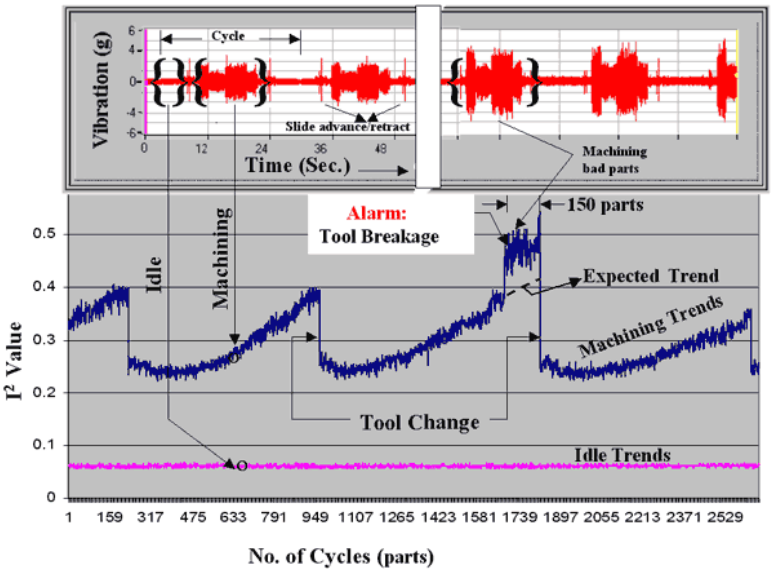
1775 Mentor Avenue
Cincinnati, Ohio
45212-3520
U.S.A.

Ph. **513-351-9919**
FAX **513-458-2172**
1-800-860-4867
www.modalshop.com

SDC003
ePIG

T H E
MODAL
SHOP
I N C .
A PCB GROUP CO.

Illustrating ePIG's simplicity, the only connections required are the sensor (attached to the spindle housing) and a 24VDC power supply. The ePIG is then mounted external to the machine. Once installed, ePIG functions like a simple monitoring device. Green lights indicate that ePIG is powered, running, and functioning properly. A red light alerts the operator when a fault has been detected. If applicable, the ePIG can be connected directly to the machine PLC via one of four available digital lines or via standard RS232 connection.



As an extra benefit, the vibration sensor used for the dynamic process gauging can also supply indications of the machinery health. Machinery health monitoring is a common practice providing useful machine condition information (often spindle or bearing related); however its usefulness is often overshadowed by requiring production to be stopped in order to take proper vibration measurement. Due to the costs and inconvenience associated with "route-based" or "walk-around" vibration measurement, it may take place on a given machine only a few times a year. It also is often performed on machines that are in perfect health, which is certainly not cost effective. Online systems have emerged to provide continuous health monitoring but generally have failed to reach broad acceptance, due to the machine complexity, high measurement system costs and distrust in repeated false alarms.

When using ePIG, if a traditional machinery health-monitoring program supports the machine, the vibration analyst may acquire idle data for regular spindle health trending purposes without having to stop the production line. The ePIG supplements traditional vibration health-monitoring by providing consistent, online, safe access to vibration readings (no reaching behind guards for access to the measurement). In this manner, the ePIG functions just like existing installations of permanently installed vibration sensors connecting to a junction box for "walk up" readings.

Benefits of ePIG

- **ePIG results can be used as a guide line for part quality improvement, which is directly related to customer satisfaction and machine reliability.**
- **Process variances and resulting tolerance concerns can be monitored and controlled.**
- **Machining quality can be maintained, thereby reducing the amount of scrapped or reworked parts.**
- **Machine operation process can be optimized based on this information - permits optimization of machining processes.**
- **ePIG long and immediate term trend and variance data allows individual machine processes to be directly compared to similar processes from other plants - allows for process data comparison between plants on individual machines.**
- **Allows for better specification and design of machines for new line installations.**
- **ePIG extends tool life and reduces tooling cost. It is deployable to most all single-spindle machining processes.**
- **Maintenance can be scheduled only on machines that are indicating a decrease in performance, avoiding catastrophic failures in the middle of the production shift.**
- **ePIG does not require a specialized setup, since the performance matrix is not machine dependent.**

Call for more information and delivery of the Cutting energy Process Indicator Gauge for cost effective and innovative machine process monitoring in quality manufacturing, or visit us at www.processvibration.com.

Helping you test, model, and modify the behavior of structures.

1775 Mentor Avenue
Cincinnati, Ohio
45212-3520
U . S . A .

Ph. **513-351-9919**
FAX **513-458-2172**
1-800-860-4867
www.modalshop.com

Revision 9.07.2001