

Condition monitoring for all!



Preventative maintenance based on data from permanent condition monitoring is frequently discussed, but rarely practiced, in the field of mechanical engineering due to the high cost of conventional systems. A newly developed, intrinsically intelligent B&R X20 module for evaluating oscillations eliminates the need for additional hardware and software and could possibly lead to condition monitoring becoming a standard feature on every machine.

ISO 10816-3 limits for vibration velocity

				mm/s rms	Vibration velocity ($2 \cdot 1000 \text{ Hz } r > 600 \text{ min}^{-1}$ ($2 \cdot 1000 \text{ Hz } r > 1200 \text{ min}^{-1}$)	
				11.00		
				7.10		
				4.50		
				3.50		
				2.80		
				2.30		
				1.40		
				0.70		
Solid	Soft	Solid	Soft	Machine base		
Mid-sized machines 15 kW < P < 300 kW		Large machines 300 kW < P < 50 MW		Machine type		
Motors 160 mm < H < 315 mm		Motors 315 mm < H				
Group 2		Group 1		Group		

- Risk of machine damage
- Operated only for a limited time
- Continuous operation without limitations
- Neu in Betrieb gesetzte Maschinen

Machine manufacturers can use the limit values defined in ISO 10816 as guidelines to develop appropriate responses.

When managers are considering whether or not to invest in new machinery, they evaluate not only the purchasing price, but the cumulative cost over its entire useful service life. In order to reduce these overall costs, often referred to as TCO (total cost of ownership), the goal is to maximize machine availability while minimizing the time and money spent on maintenance. One of the ways mechanical engineers are attempting to optimize maintenance costs is to replace fixed maintenance intervals with condition-based preventative

maintenance. An advantage of this is that maintenance work can be delayed until it is actually needed, which can be quite a bit longer than conservatively estimated maintenance intervals. In addition, scheduling freedom is retained and maintenance work can be performed during regularly scheduled downtime, such as on weekends. At the same time, this solution avoids risking system failure due to neglected maintenance.



With dimensions of 25x99 mm, the X20CM4810 is one of the smallest 4-channel condition monitoring modules in the world.

What makes this balancing act possible is condition monitoring, i.e. the permanent monitoring of conditions throughout the entire system. Data gathered through condition monitoring can be used to identify the maintenance requirements of the respective equipment. "B&R has long offered a number of options for condition monitoring," says engineer Andreas Waldl. "Input modules for temperature or current measurement are used for this purpose, as are the motor monitoring functions on ACOPOS drive controllers."

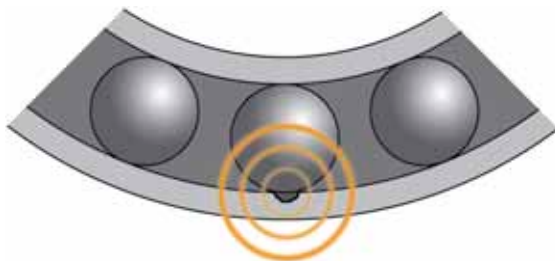
Vibration as a factor

While working in B&R's business unit for custom solutions, Waldl faced the challenging demands of a well-known manufacturer of rotary machines. "For this particular Scandinavian company, we developed a module that evaluates acceleration sensors, converts the collected vibration data into a specific format and passes it on for further processing," reports Waldl. The tricky part was that condition monitoring was nothing new for this customer – they had been offering it as an option for 15 years. As a result, in order for the signals to be compatible with the processing equipment, »

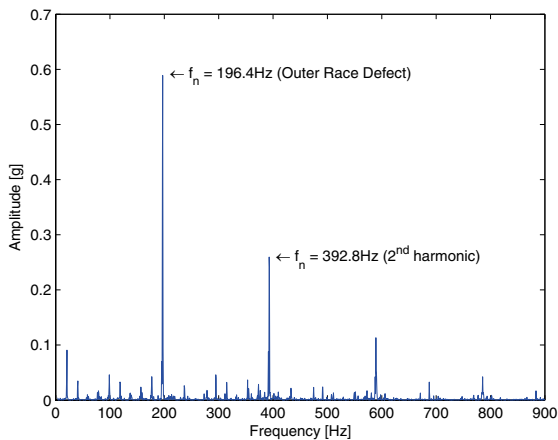


The X20 condition monitoring module presented at the SPS/IPC/Drives exhibition has revolutionized the evaluation of vibration data. It's compact, can be seamlessly integrated in B&R automation systems without an external computer and optimizes condition monitoring for the field of machine manufacturing.

Andreas Waldl, Technical Manager BU Customized Solutions B&R



Outer ring damage is clearly visible in the spectrum. This is even easier with the innovative X20CM4820 module – by using integrated signal analysis and querying individual process variables.



Frequency spectrum of a strong imbalance.

they first had to be converted to a specific format. With the B&R module they were able to save on expensive external circuitry and can now offer condition monitoring as a basic feature of their equipment rather than as a premium option. Knowing that this type of condition monitoring was previously only available using expensive and bulky external systems provided the impetus to develop a standard condition monitoring module based on vibration measurement. "Extremely helpful in this process was the fact that one of our customer's previous suppliers was in the process of withdrawing from this market and was willing to share its expertise in the field of oscillatory physics," says Waldl. "This knowledge had not yet been established at B&R, yet it was essential to understanding the relationship between vibration signals and the condition of machine components."

Developed with and for the customer

"During the predevelopment phase there were numerous discussions, and measurements were made on a range of machines in various industries," says Waldl. "These findings and customer feedback were funneled directly into development of the new B&R condition monitoring modules for the machine manufacturing industry." The first device in the new series was revealed at the SPS/IPC/Drives exhibition. The X20 CM4810 is two slots wide and is equipped with four input chan-



The new generation of ALDEC G2 decanters from ALFA LAVAL employs B&R condition monitoring and reduces total power consumption for dewatering or thickening tasks by up to 40%.

nels for reading acceleration sensors via the standardized ICP sensor interface (integrated circuit piezoelectric), which also serves as the power supply. These signals are sampled at 51.6 kHz and converted into more than 70 parameters directly in the module during runtime.

Thirty-two of these parameters are adjustable damage frequencies. These are factors that can be multiplied by the speed of the measured axis to form the actual disturbance frequency. An imbalance, for example, would have a damage frequency of 1, and a misalignment would have a damage frequency of 2. Higher damage frequencies depend on the geometry of the system and are published, for example, by the manufacturers of gearboxes and roller bearings. The other 40 or so parameters are fixed values, such as the kurtosis and the crest factor, or are used to monitor the ISO 10816 standard limits for the oscillation velocity.

Compact solution with no service required

The multitude of criteria that can be set and monitored allows even the most complex vibration patterns to be monitored on a single channel, such as in the case of gearboxes. The main difference between this solution and established conventional solutions is the fact that this evaluation takes place inside the module itself. This integration eliminates the need for an external computer programmed specifically for the task and also lightens the load on the fieldbus and system CPU. "The required processing power depends on the application and should not be underestimated," says Waldl. "In the pulp processing industry, it is not uncommon for a condition monitoring system to handle 2000 or more channels." From a development standpoint, Automation Studio's

integration of parameter configuration and response programming reduces the cost and time necessary for software development while minimizing problems with interface compatibility.

Alpha prototype testing at selected pilot customer locations has been ongoing since September 2011. General availability of prototypes is planned for the second quarter of 2012, with series availability to follow in the third quarter. "When we developed these modules, the most important requirement was that they be easy to use as part of an overall automation solution without expert knowledge in oscillation mechanics," explains Waldl. "It needs to be enough to configure the module so that the controller performs the appropriate responses to the values supplied by the X20 slice." ■



Smart Engineering: Accelerated development times thanks to simple configuration and fully integrated analysis in a single tool – B&R Automation Studio.