



An attracting state of affairs

Quality assurance in magnet production through measurement data acquisition and evaluation

Permanent magnets are used today in many branches, for example in the auto industry, in sensor technology and in medical technology. Magnet production demands a well designed manufacturing process which includes modern measurement data acquisition and evaluation systems. Only then can levels of quality be assured. This article reports on how these demands were met in this uncommon manufacturing process.

The magnet producer Schramberg GmbH & Co. KG, located in Germany's Black Forest, had clearly defined requirements: to increase manufacturing quality and thereby decrease the need for reworking. The company went in search of a universal system for data acquisition, monitoring and evaluation. The system also had to be PLC compatible and linkable to an existing weighing system. They found their system at Delphin who could supply the required hardware, PC software and know-how.

True to size production

Magnet manufacture requires several processes such as powder processing, pressing, sintering and then the actual manufacture. The latter is performed with diamond-tip tools and is therefore extremely costly. It is therefore really important to manufacture the magnets to the correct precision to reduce as far as possible the need for any reworking. Sintering is a major factor here because the sintering process can create a loss of up to 25%. This loss is dependent on the magnets' density prior to sintering. This means that during the pressing procedure care should be taken to achieve a uniform green density rather than just a true to size product. This was the starting point for Schramberg to initialize a project at the beginning of 2003 with the aim of increasing manufacturing precision and decreasing the levels of reworking. To achieve this it was necessary to record and monitor the most important processing parameters such as weights and pressing force.

Quick configuration

Establishing the weight of magnet components was difficult. The weighing machine's RS232 port was already being used to serially transmit weights to regulate the press. Analog interfaces were out of the question due to their lack of precision. The task was then how to access the weighing machine's data without interfering with existing data streams.

At first it was necessary to find the right sensors and then a measurement system which could process different types of signal – analog as well as serial. After initial problems finding such a system, Schramberg then discovered Delphin's TopMessage measurement data acquisition system which immediately impressed them. Personnel from the pressing workshop explained, "After a long search we eventually discovered Delphin's TopMessage devices and ProfiSignal software for the acquisition, monitoring and recording of process data. After a short period of familiarization we were able to configure and set up the system ourselves".

The first TopMessage device was installed in November 2004 along with the MHouse software (for trends and analysis). In just one day of on-site training and installation in Schramberg, the users could perform a basic configuration so that an initial analysis of the pressing process could be undertaken. The MHouse software was adequate in producing initial trend output but, just as the appetite grows when the food arrives, the users were soon demanding more.



Practice convinced

For the day to day data acquisition and monitoring it was decided that default values such as weights, press capacities etc., along with their tolerance values, should be input by the user via an input mask. Direct configuration into the TopMessage device was also possible but proved not to be practical. Therefore, in September 2005 the MHouse software was upgraded with Delphin's ProfiSignal software. The Schramberg personnel could now create on the screen what they required. The input of default values, online and offline computations proved to be no problem when using ProfiSignal. All required functions could be put into practice despite the users having no specialist IT knowledge and the system was quickly accepted by the users. In September 2005 two further presses were equipped with the measurement system. Each press now even has its own PC.

A complete overview

The system has now been developed to the extent that Schramberg can record all the required data as well as simultaneously computing and displaying densities. The production management are able to access the data from their office at any time because the TopMessage devices are connected to the company's network. Evaluation can then take place at a glance and at any point within the process. In May 2006 three presses were operating with Delphin systems. There has been a marked improvement in quality due to the monitoring system and the more informed actions by the press operators. The system reveals any changes taking place within the process and an overview of the data is provided in A4 format. ProfiSignal automatically produces reports which can be used in the event of returns to determine whether the problem actually occurred within the pressing process.

Plans already made

The press workshop has plans to use the acquired measurement data for press process control, i.e. the press will automatically stop or adjust itself when a tolerance has been exceeded. The machines will be PLC controlled with a Profibus DP connection to the TopMessage system. Future monitoring systems are also planned, e.g. thermal monitoring of the press moulds. Plans have also been made in respect of quality assurance with statistical analysis of the data being seen as the next step. Machine and process efficiency of the presses is to be evaluated using averaging and distribution analysis. This means the ever increasing demands from the customer can then be met, e.g. ppm values and Six Sigma from the auto industry. The production management team would also like to have operational data incorporated into the system, such as press operating times and malfunction causes. Delphin will be available to provide help and advice, just as they have in all phases of the project. The team at Schramberg concluded, "What was crucial to us in choosing Delphin was not only their high quality products but also the intensive customer service and support they provided".

Why use TopMessage and ProfiSignal?

With TopMessage hardware and ProfiSignal software, Delphin have developed a complete system which could simply and effectively meet the requirements of the Schramberg magnet manufacturers. The Profibus DP and RS232 interfaces, as well as the universal analog and digital input/outputs, enabled all the necessary information to be acquired and processed within the same database. Virtual channels enabled the TopMessage to perform process monitoring, calculations and control operations – independently and without the need for PC support. Real time data acquisition, monitoring and (when necessary) response is especially important in fast processes such as magnet production. The TopMessage's internal datalogger guarantees data security even in the event of a network or PC failure. The ProfiSignal software performs several tasks. One task is to serve as the interface between user and equipment. Input masks provide the TopMessage device with the required process parameters and header data. External data can also be imported/exported using the ODBC/SQL interfaces. Another task is the long-term archiving and analysis of measurement data. An integrated Dataservice enables the unrestricted recording of data. This data can then be used for the evaluation and reporting for any required time period.