Furnace Control and Data Archiving with an Automation System

Over the course of more than 90 years, Vacuumschmelze GmbH & Co. KG, with its headquarters in Hanau, Germany has evolved into one of the world's leading companies for magnetic and metallic special materials and products refined from these materials. Today, the company employs over 4,000 individuals and owns more than 800 patents. Excellent products for almost all industries and markets are produced every year in the business units semi-finished products, parts, cores, components, and permanent magnets.

Extremely precise, reliable, and reproducible temperature control is needed to manufacture and refine these materials. The various furnaces work at temperatures above 1,000 °C for their application. The scalable JUMO mTRON T measurement, control, and automation system is used at VAC in Hanau. The JUMO mTRON T with its modular design uses an Ethernet-based system bus and an integrated PLC – even for decentralized automation tasks. The universally deployable system stands out mainly with its simple, application-oriented, and user-friendly configuration concept. At its heart is a central processing unit with a process map for up to 30 input/output modules. The CPU has superordinate communication interfaces including a web server. For individual control applications, the system has a PLC (CODESYS V3), program generator and limit value monitoring functions, as well as math and logic modules.

In addition to enabling visualization of all processes, the convenient multifunction panel enables easy to operate controllers and program generators. User-dependent access to parameter and configuration data for the overall system is also supported. The recording functions of a full-fledged paperless recorder, including a web server, are implemented as a special feature. The use of predefined screen masks that come as a standard feature considerably reduces startup times. All acquired data is then analyzed and archived using the PCA3000 software.

Vacuumschmelze GmbH & Co. KG also used the engineering services from JUMO to commission the JUMO mTRON T. JUMO's many years of experience with highly precise control technology was a major advantage here. JUMO Engineering can implement even the most complex package solutions – from authoring the product requirements specifications through to startup and training. Vacuumschmelze GmbH & Co. KG particularly relied on JUMO Engineering to optimize the furnace systems, leading to noticeable improvements in the results and energy efficiency.

Thus, manual or automatic optimization of controllers often reveals significant savings potentials. Controller optimization means adapting the controller to the given process or the control process. To do this, the control parameters must be selected so as to achieve the most favorable control loop behavior for the given operating conditions. However, this favorable behavior can be defined differently. For example: as achieving the guide value quickly with a minor overshoot or achieving an overshoot-free start-up given a slightly longer setting time. If the behavior expected of the controller is only equivalent to a limit contact (without cyclic behavior) then there is no need to look for the optimal setting for the proportional range, derivative time, and reset time. Instead, only the switching differential must be defined.

The control parameters can typically be defined by the controller itself thanks to the existing self-optimization feature if the process allows for self-optimization. Alternatively, the most favorable parameter setting can be determined "manually" by trial and error and rules of thumb. When replacing controllers or in the case of plants with identical control technology, the control parameters can be directly adopted and entered.

JUMO PID control algorithms have an excellent track record in industrial furnaces, regardless of whether they are used in continuous-process or batch furnaces. The firing system type is not an important factor. Scheduling programs allow accurate mapping of the firing curves or process screen. Connections can be established with the JUMO SVS3000 visualization software via fieldbus interfaces so that the measurement data can be recorded and analyzed for each batch. Manufacturers who produce plants for the aerospace and automobile industry can also get JUMO devices with the required certificates according to AMS 2750E or CQI-9.

At Vacuumschmelze GmbH & Co. KG temperature control in several furnaces was significantly optimized by adapting the control algorithms. The extensive JUMO product portfolio which in addition to automation solutions also includes thermocouples, controllers, thyristor power controllers, recording devices, and safety temperature limiters was once again used to construct the furnaces.

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Fig. 1: Harald Schöppner

Fig. 2: Installation situation

Fig 3: Closed furnaces

Fig 4: Open furnace

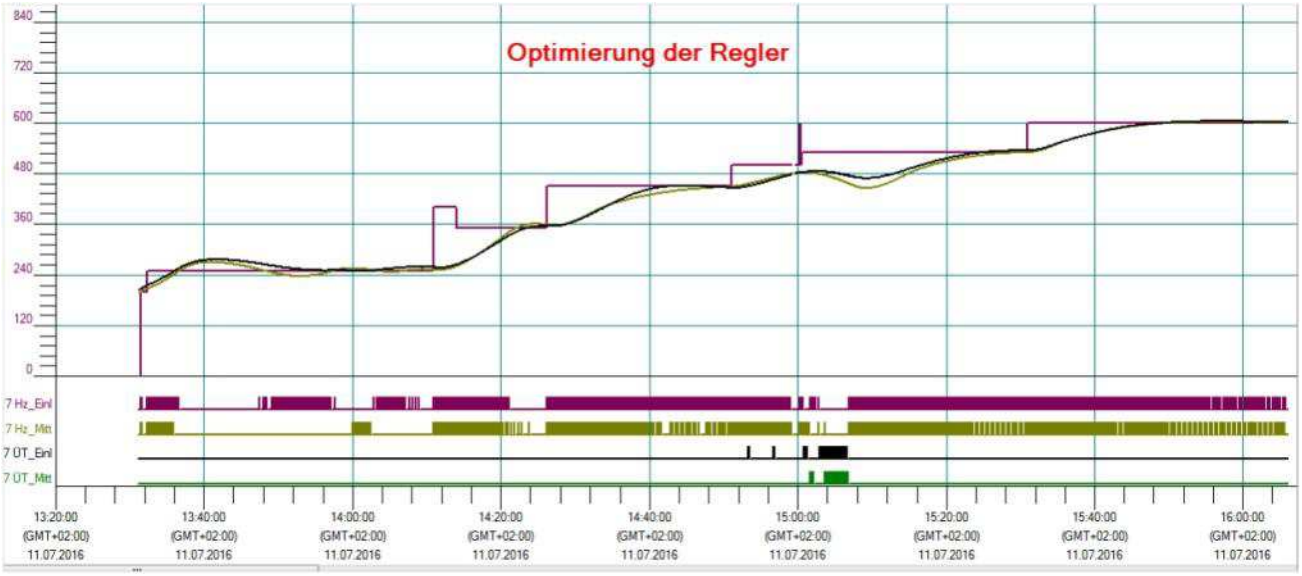

Fig. 5: "Controller optimization" process screen