



Control paper grammage weights precisely



Ball sector valve with precise positioning drive – 8192 steps over 90°

An application report by Dr. Rainer Lange and Ronny Grubitz

The Grünewald company with headquarters in Kirchhundem-Hofolpe in the southern part of the Sauerland region has modernized its process control. Thanks to a new process control system and a new grammage weight control valve the company's throughput and paper quality are being further improved. Through the introduction of a highly accurate Sector Ball Valve with an internally mounted angle transducer and Stepper motor, a significant stabilisation of the process could be achieved together with improved quality at markedly higher throughputs.

The production of papers with grammage weights in the range of only 18 up to max 60 g/m² demands a very accurate process control. Grünewald, with an annual capacity of ca. 50,000 tonnes, supplies largely food contact paper in rolls for the production of foodbags, waxed paper or flower tissue paper as well as paper table cloths.

The existing out-dated system was replaced by a modern process control system in order to stabilise the paper weights and allow increased production. This necessitated the increase of control valve size from 100 mm to 150 mm incorporating a Schubert & Salzer DN 150 Ball Sector Valve (Fig.1). The main problem was that the old stepper motor with a resolution of 10.000 steps which was used for the DN 100 valve was no longer available for DN150. The former valve fitted with a stepper motor operating at 5800 steps proved to be unable to maintain accurate tolerance of the paper weight.

“With a larger valve every incorrect positioning step caused more trouble than would be the case with a smaller valve”, said Reinhard Christes, Head of Electrical, Measurement and Control Engineering at Grünewald Paper. “The change of valve size led to a completely inadequate level of accuracy and the consequences were unacceptable fluctuations in the paper grammage weight. “For that reason the stepper motor was replaced with a newly developed precision servo motor drive from Schubert & Salzer.



Fig. 1: an illustration of a very accurate precision control valve – the ball sector valve (4) is combined with a servo motor (1) and a planetary drive (2). By means of the Absolute-rotational angle transducer (5) the exact position of the ball sector is calculated with out any force applied and the signal then relayed to the controls. The valve can be positioned with the emergency manual actuator (3) even in case of power failure.

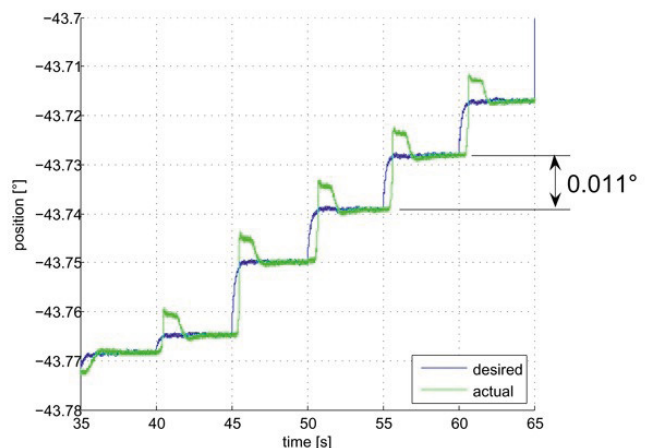


Fig. 2: This chart shows the step function response of the new precision valve drive to very small changes in the positioning signal. The resolution here equates to 0,011°, which with a 90° swivel movement corresponds to a resolution of 8.192 steps. This measured directly at the ball sector.

Precise volumetric flows require targeted measures

The servo motor can be configured in the factory to customers requirement for a command signal either via an analogue positioning signal (4 to 20 mA) or through a stepper/directional control with a signal level of 24 V and 400 Hz maximum input frequency. The activation of the positioning drive is either performed by CAN-Bus or with Profibus (Fig. 2).

The drive control via stepper/directional control is performed, depending on process and/or accuracy requirements, in such a way that the 90° rotational movement can be achieved within a range of 1,000 up to 8,192 steps.

Elimination of backlash is done by the use of compact planetary drive. In this way the set number of steps corresponds exactly to the actual number of positioning steps transmitted to the ball sector and not to the number of steps of the motor.

The vital feedback for an uncompromised control accuracy is supplied through a highly accurate 15 bit Absolute-rotational angle transducer which is attached load-free to the bottom trunion, and records the current position of the ball sending this as a digital signal to the control system. This control circuit, monitoring valve movement internally, ensures that the very highest level of accuracy is achieved between positioning signal and the actual valve position.

Activated through an analogue positioning signal the positioning time for this valve drive over a 90° rotation can be set in a range of 1 up to 300 seconds. The control system is enclosed in a compact cabinet. In addition this delivers an analogue return signal which can be evaluated by the equipment controls.

“With this new precision drive system all our problems were solved at once. This 8,000 step resolution certainly supplied the basis for the solution but the valve’s internal positioning signal direct to the drive is the outstanding feature of this valve drive” said Christes.

To the highest control accuracy without hysteresis

Hysteresis is often an underestimated problem with control valves. High levels of control accuracy require a backlash free transmission of the drive to the valve functioning unit. Only then does a positioning signal correlate with the parametrized opening angle of the valve and the corresponding volumetric flow. With the combination of a very accurate valve drive and ball sector valve Schubert & Salzer Control Systems has succeeded in producing a precision valve unit for even the highest volumetric flows. The decisive step towards high precision is made by an internally mounted absolute-rotational angle sensor evaluating the actual valve position in real time and transmits a return signal with a positioning value to the control regulator. In addition the resolution of more than 8,000 steps to drive the valve through 90° reduces the hysteresis below 0.02%.

In this way volumetric flows such as in the case of paper manufacturing can be controlled and regulated to extremely precise levels. “We can now correlate exactly the valve position of the paper



Fig. 3: Dosage metering of additives old valve (top) with strong fluctuations and new valve with precision servo motor drive (below).

grammage regulating valve to a specific material volumetric flow and the valve adopts precisely this position setting” said Christes. “Thanks to the new servo drive of the grammage control valve from Schubert & Salzer. Fitted with the internal return signal electronics we can run our grammage weights much more accurately than ever before (Fig. 3). We are producing today with significantly smaller longitudinal weight fluctuations. The more accurately we run the better this is for the whole line. This precision valve drive also has an impact on the dosage metering of additives. Since there are no more fluctuations in the system, the dosage metering also works considerably more stable. As much grammage weight changes are being carried out much more efficiently today. We give the valve a new position setting and it runs exactly to this and remains stable. That is simply superb! Position repeatability is accurate and fast once control parameters have been set.

Contact:

Schubert & Salzer Control Systems GmbH

Bunsenstr. 38, 85053 Ingolstadt, Germany

Tel: +49 (0) 841 96 54-0 · Fax: +49 (0) 841 96 54-590

info.cs@schubert-salzer.com | www.schubert-salzer.com