

Handling and assembly

Simplified linear technology:

Smart 24V modules as the key to mechatronization

Linear direct axes with integrated intelligence reduce the commissioning and maintenance costs in handling applications, minimize the system wear and reduce the energy costs. They have what it takes to replace pneumatic axes.

In line production of the automotive, electronic and consumer goods industries, pneumatically controlled handling modules have been considered standard for years. This might be coming to an end soon: mechatronic handling devices have recently been turning into a successful newcomer, which are impressive compared to conventional pneumatically driven components with all their finesse, starting from a higher diversity and communication skills, to advantages when it comes to wear, right up to a significantly improved energy efficiency. Only the complexity of the control and the high price have previously prevented the all-rounder from rapidly expanding. This is precisely where SCHUNK, the competence leader for gripping systems and clamping technology is now launching a mechatronic 24 V standard program for high-performance assembly. A central element alongside mechatronic grippers and rotary modules is a linear axis with wear-free direct drive and auto-learn technology, which can be operated intuitively, independently set and requires no mechatronic expertise from the operator. Pilot users like automotive specialist Neumayer Tekfor in Hausach see a great deal of potential in the soft high-speed components. The company was one of the first to seize the opportunity, and put the SCHUNK ELP linear axis to the test in a testing system for forgings. With an unequivocal result: after a test period of eight weeks, four additional systems were promptly retrofitted to the high-performance module.

High dynamics with soft drive into the end position

Neumayer Tekfor GmbH in Hausach is a leading provider of components and assemblies in the powertrain sector. The company has around 700 employees and generates annual sales of around 140 million euros. The ambitious automotive supplier processes around 100 t steel per day. In order to ensure maximized quality, all functional-critical parts run through a meticulous 100% screening. Around 1.3 million forgings for engine components and drivetrains are produced and inspected by Neumayer Tekfor every day. The requirements of the inspection machines used and built by Neumayer Tekfor are correspondingly high. "It is incredible how rapidly wear on the systems increases if we try to extract the last 7-10% cycle time", says Jürgen Müller, head of special purpose machines at Neumayer Tekfor, describing the status quo before the SCHUNK ELP. The cycle time for the crack detection using eddy-current technology 15 years ago was still seven to eight seconds. Now, due to constant investment into new technologies, it has been reduced to under two seconds. Large orders made it possible to expand the performance of pneumatic axes by opening the throttle right up to the limits of what is feasible. As a consequence, the wear on the

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shock absorbers rapidly increased. Other components were also affected by the harsh drive into the end position and the accompanying vibrations. This reduced the life span of a camera system for detecting the forgings from ten years – a condition which would be unsustainable in the long term – to just nine to twelve months.

And Jürgen Müller was delighted when SCHUNK demonstrated a prototype of the smart SCHUNK ELP linear axis. "The extremely fast movements in connection with the harmonious drive into the end position were really impressive. It enabled us to look after our machines and even had the added benefit of the axis being faster", the head of special purpose machines recalls. He doesn't hide the fact that Neumayer Tekfor carried his role as pilot user to the extreme. "SCHUNK believed it would be child's play to install the axis. Without an electrician or engineer. And this is precisely what we did, leaving the commissioning up to a third-year apprentice." After asking an electrician just one question, the young professional was able to connect the axis and parameterize it. "You simply specify the traverse path from A to B, and the module immediately and fully automatically determines the optimum motion profile using the mass moved. This cannot be compared to programming conventional axes with regulators." After eight weeks of test operation, it was clear: the vibrations in the machine have significantly reduced whilst the cycle time could be increased even more.

Auto-learn technology automates commissioning

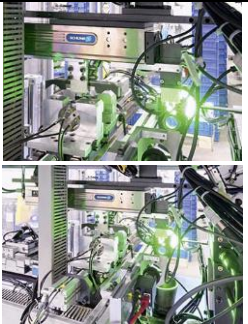
The self-learning axes from SCHUNK have a great deal of intelligent features which make it child's play to set up mechatronic assembly systems and bring significant cost advantages for the user. Maintenance-free linear direct drives and low-wear guidances reduce the maintenance costs to practically zero and increase the process reliability. Failure due to overloaded shock absorbers or incorrectly set throttles are a thing of the past. At the same time, by eliminating the pneumatics, significant energy savings can be made, which also reduces the noise level. Compared to pneumatic modules, the SCHUNK ELP is around 20 dB quieter in ongoing operations. And last but not least, the mechatronic systems are extremely easy to commission. Meaning it is sufficient to connect the standard plug (M8/M12), set the end position mechanically using an Allen key, and the speed of extension and retraction is defined directly on the module using two rotary encoding switches. After just two to five strokes, programming using the integrated auto-learn technology is completed fully automatically, without the operator having or even being able to influence the encapsulated learning process. During the learning process, the maximum possible speed for the current payload is calculated. The motion profile itself is designed as a ramp, i.e. the unit automatically accelerates and brakes depending on the overall stroke. Impacts and oscillations and uncontrolled driving at maximum speed of the module are therefore excluded. If the component weight changes in the ongoing process, the axis automatically adjusts its movement profile in a few strokes, without throttles having to be adjusted as with pneumatic modules or new sequences having to be installed as with electrically controlled modules. The SCHUNK ELP axes are compatible with all common controllers since everything is controlled via digital I/O. Pneumatic components can be replaced with mechatronic ones 1:1. For operation, neither valve terminals in the system nor drive controllers in the control cabinet are required. This saves space and a great deal of time when plan-

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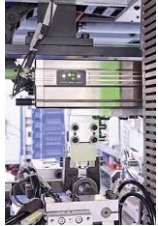
ning, procuring and commissioning. Jürgen Müller also accommodates low voltages: "We already have 24 volts in every machine anyway."

Martin Prinzbach, special purpose machine designer at Neumayer Tekfor, sees significant benefits in the axis: "the learning function is a big step forward; it makes it easier for mechanics and electrical designers are no longer needed for the module." In ongoing operations, SCHUNK ELP has proven with Neumayer Tekfor: "while pneumatic axes due to the shock absorption can only be partially accelerated, otherwise they lose the component, the SCHUNK axis travels with maximum speed and no vibrations right up to the end position", Jürgen Müller highlights. The premature failure of the camera system was able to be completely eliminated using the soft axis. "If we were to take this saving and the shorter cycle time into account, the axis is paid off after half a year", Müller determines, adding: "the price-performance ratio is very competitive compared to other systems, if not even better." For applications where the cycle time is critical, Neumayer Tekfor will use the module again any time in the future.

Captions:

Title picture/lead picture	As a pilot user, Neumayer Tekfor in Hausach tested the SCHUNK ELP linear axis and replaced pneumatic axes with the linear-direct drive module. The result is significantly reduced vibrations, a minimized wear of the used components and a shortened cycle time.	
Test stations 1 + 2	The SCHUNK ELP combines highly dynamic movements with a smooth travel into the end position. This protects the axis and the surrounding components, such as the camera system for identifying the forgings.	

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ELP application	The SCHUNK ELP assumes the rapid handling between the camera-supported parts identification and a geometric check of the part height. This is followed by the crack detection of the surfaces.	
Camera inspection	Due to the strong vibrations, the camera system had to be regularly replaced up to now. With its soft traveling into the end positions, the SCHUNK ELP has eliminated the problem.	
Transfer station	The ELP is very easy to commission: connect the axis, mechanically set the end positions using a screw and regulate the extension and retraction speed using a rotary switch.	
Rotary encoding switch	Due to the auto-learn function of the compact SCHUNK ELP, no knowledge of mechatronics is required to commission them. The drive and controller are completely integrated into the axes.	
Group photo	Jürgen Müller (2nd from the left), head of special purpose machines, and Martin Prinzbach (right), special purpose machine designer, see significant advantages in the mechatronic module. They were advised by SCHUNK expert consultant, Norbert Fehrenbacher (left) on this project.	

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