

A concept for the future: modular and flexible

Requirements for the latest servo drive series: dynamism and synchronism

When developing new machine tools and production machinery, cost and time saving starts well before the production process itself, right from the development phase of the machine. Increased complexity of processes is competing with constant or even shortening lifecycles and the associated demand for ever shorter development lead times (time to market). Consequently, the modularity and flexibility of a state-of-the-art, future-proof servo drive series is key to its simple yet optimum integration into the machine process.

The areas of application of servo drive systems and the requirements made of them vary widely, and the expectations of machine tool and production machinery manufacturers are high.

Alongside the highest demands in terms of dynamism and synchronism, the cycle times of the production machinery must also be reduced at the same time. This means that individual steps in the machine process at different machining locations are often grouped together into a single step on one machining station. For production machinery or machine tools this brings an increase in speed accompanied

by improved precision as well as increased complexity of the complete automation solution.

Criterion: short setup times

The importance of universal machine tools and production machinery adaptable to the production process has also increased significantly. Whereas in the past mainly inflexible special machinery with often specific mechanisms had to be used, today the programming options and recipe management systems offered by state-of-the-art drive concepts mean that much more flexible universal machines can be deployed which adapt almost entirely dynamically to a changing production process in order to minimize setup times, and thus of course also costs. As well as greater expectations in terms of speed, precision and flexibility, technical issues a round personal safety and safety of machines

will become more important in future. Maximum process safety is demanded, in order to attain the highest possible availability while retaining the existing levels of required cost-effectiveness. A line is, though, only as safe as its individual components. In order to attain the required safety level, the interaction of the safety-related components in the safety chain is key. Based on the safety functionality built into the drive controller, such as Safe Standstill, Safely Limited Speed and Safe Shutdown, the drive controller itself becomes an integral part of the safety concept, and so is embedded even more deeply in the overall drive system of the production machine or machine tool.

To meet all these demands, the components of the overall drive solution must form an optimally harmonized complete system solution together with the mechanical construction and the safety components.

EXCLUSIVELY IN KEM



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The modular servo drive series Servoone offers output currents from 4 to 170 A and an overload capability up to 400 %
 Picture: Lust



Commissioning must remain simple

From the requirements set out with regard to control technology, programmability and safety engineering, it quickly becomes clear that the complexity of modern-day drive controllers has increased enormously. This means it is all the more important to provide modular, consistent drive series and simple commissioning tools in order to deliver fast, simple, reliable – and so ultimately also cost-effective – solutions for the widely varied and complex automation and drive tasks. Only harmonious integration of the drive concept into the overall machine solution will deliver success. Consequently, a drive series must feature standardized communications interfaces, defined motion control profiles and standardized programming languages. At the same time, though, there must be a degree of freedom for customization, so as to ensure optimum system performance. The drive may, for example, interact via state-of-the-art real-time communications interfaces with a centralized multi-axis machine controller, while at the same time featuring distributed motion control intelligence in order to attain maximum performance. Innovative service and diagnostic tools for demanding controller commissioning operations and process optimization must also form part of a unified drive concept.



The Servoone is the solution for demanding applications with linear and rotational direct drives

The latest high-performance drive series from Lust, the 'Servoone', aims to meet just those high demands of machine tool and production machinery manufacturers with maximum dynamism and synchronism based on the integration of innovative control algorithms and the interfacing of various state-of-the-art real-time communications interfaces, as well as by integrating extensive safety functionality.

Single/multi-axis system

Two feed concepts provide for targeted application as a single or multi-axis system, with output currents from 4 to 170 A respectively. An overload capability of up to 400 % enables highly dynamic acceleration. A conventional mains power connection or a DC feed with a centralized power supply unit are the available options. It would also be conceivable in future to fit out the supply unit in future with a multi-axis machine controller. These concepts mean the housings can be designed extremely slim, so providing for optimum utilization of the available cabinet space. Particular attention was paid in developing the Servoone series to achieving maximum control quality. Advanced control algorithms permit operation of a broad range of motor types, from synchronous servomotors through asynchronous motors



Manufacture of carbide-tipped cutters: the high dynamism of the Servoone help increase the machine's speed and cycle rate
Picture: Andron

to linear and torque motors. So as to avoid cost-intensive absolute linear scales, various commutation finding methods are available in conjunction with linear motors. The basis for the system's optimum synchronism and low noise is its interference-proof encoder evaluation with the patented correction method. For precision positioning with mechanisms subject to play, from resolvers to precise Sin/Cos single or multi-turn encoders, three encoders can be evaluated simultaneously by way of an encoder management system.

High-grade synchronism

The compensation of motor detent torques and non-sinusoidal EM curves reduces the static and dynamic torque ripple and so ensures the particularly high levels of synchronism as are required, for example, for precision-synchronized motion in the preparation of printing plates. The precision of the motion profile can be further enhanced by a directional correction of production tolerances, as are encountered on spindles, among other components. Integrated monitors improve the dynamism by filtering the speed signal with no phase delay while at the same time providing good noise suppression. The monitors also enable non-measurable state variables

to be defined which can be used for active vibration damping or load torque feed. The controller structure additionally offers extensive options for pre-control, interpolation and vibration prevention based on freely configurable digital filters as well as active vibration damping by means of state control. The pre-control is designed so that, when the parameters are set appropriately, the control response for the position setpoint corresponds to the dynamic of the current controller. Automatic commissioning and controller optimization – including during the machining process – permits a consistently high manufacturing quality to be maintained.

Various communications interfaces

In order to be able to integrate the high-level control performance of the Servoone in different automation solutions, a variety of communications interfaces are available as factory pre-installed and tested option cards. Alongside CANopen and Profibus, fast, synchronous multi-axis motion is executed via the Sercos II or Ethercat motion control buses. In future Sercos III and Profinet will also be available for the Servoone. Distributed motion control tasks can be implemented by way of standardized CANopen or

Sercos profiles. For custom applications covering a range of motion tasks, the Lust Motion Profile or the IEC61131 Motion Control modules are additionally available. For advanced control functionality there is a Lust Firmware Library, permitting flexible application of the IEC61131 programming system through to the control modules.

Also, every motion profile features interfaces to utilize internal functions such as cam groups, cam plates or probes. The set-point profiles for the slave axis can also be generated via the IEC61131 programming system as Ethercat or CANopen masters.

So that users need just one software program for a wide variety of motion tasks, Lust has developed a so-called Profile Manager



Machined free-form surface contour: the precision cutting with the Servoone means no polishing stage is required.

Picture: Andron

for the Servoone. It allows the most suitable motion profile for the application to be selected independently of the option card used. The selection is made over the connected field bus. Alternatively, the newly developed 'Drive Manager 5' service tool

also provides helpful wizards for initial commissioning. The intelligence and information on the selected profile is located in the drive itself, thereby eliminating any incompatibilities between software versions, the service tool and the various option cards. This is an advantage which pays dividends with regard to ordering, stock-holding and service.

This management concept similarly offers a high degree of flexibility as a power management system for connection of the power sections.

Each power stage provides the power management system with a description of itself. The practical advantage of this is that even older or custom software versions can easily interwork with more recent or custom power stage variants.

This means costly multiple software releases are a thing of the past for example, despite the high degree of modularity and flexibility in terms of power stage or option card hardware, because customers are able to utilize already running software components.

As a result, despite its maximum modularity and flexibility the Servoone presents itself to users and commissioning technicians as fully unified, independent of software version, unit size or option card used. Whether for current or future applications, the key is perfect integration of the drive controller into the automation solution. Flexible and modular concepts of state-of-the-art servo drive series offer clear advantages in this.