

# **Leap in intelligence and performance through decentralized macro programming**

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Decentralizing drive intelligence brings considerable benefits to the machine designer. Both PLC functionalities, such as the analysis of sensor signals, and motion control functions such as camming or synchronization are available in the Kollmorgen S300 and S700 drives using the integrated macro language and the MacroStar programming tool. Using a macro language solution enables the axis to be positioned up to 12 times more quickly than is possible with fieldbus solutions. The easy to learn macro language and the intuitive development interface allow quick, optimum program creation and implementation of extended drive tasks. The macro functionality can take the place of an external PLC for simple applications. For more complex applications, time-critical tasks or tasks that need to be adjusted frequently can be off-loaded to the drive. In addition to the high-performance and flexibility, the macro solution increases system safety, as components, connections, and cabling are eliminated. The drive task is solved where the motion takes place.

The macro language is a firmware component of S300 and S700 servo drives that permits independent, programmable single axis positioning. Special functions for customer-specific applications can be programmed using structured text similar to IEC 61131-3. The MacroStar development tool, with its integrated variables and command catalogs, helps the machine designer to quickly program PLC and motion functions. Macros can be very simply and quickly created on site, and are easy to modify without the need to adjust the PLC program.

Program execution can run on 16 kHz cycles (62.5  $\mu$ s) for time-critical processes. Fieldbus systems require three system cycles to be able to react to a modified specification. For example, a very fast fieldbus with an access time of 256  $\mu$ s (x3) is slower by a factor of 12. The superior performance of the macro solution allows camming, synchronization, protective, and other functions contribute to the highest level of productivity and manufacturing quality.

Decentralized intelligence also means enhanced safety. If the controlling fieldbus should fail, a macro program in the servo drive can still safely control the processes by, for example, moving axes to safe positions. Drive tasks for individual axes can be programmed just as well as synchronized functions for multiple axes that are connected via a CAN.

The installed S300 or S700 servo drives execute the application programs created using MacroStar. These servo drives are capable of controlling rotary synchronous, asynchronous, HF, and DC motors, as well as rotary and linear direct drive motors. They use standardized high performance control electronics, and the resulting fast and precise regulation of power, speed, and position guarantees that all axes are optimally synchronized to one another at all times. Shorter work cycles and hence considerable increases in productivity are possible. As a one-stop provider, Kollmorgen also offers a standardized servo concept, which saves time and money in project development, installation, and commissioning. The closely stepped scaling of the drive outputs permit optimum coordination for each individual axis in a system, which in turn leads to outstanding overall machine performance.

## A little programming effort leads to effective process optimization

The importance of using a PLC programming tool of this nature can best be recognized by way of example, in this case making necessary adjustments to an insertion line after installation. In this application the finished printed



copies of a newspaper appearing continuously on a transport chain system are automatically fed with an inserter. The practical application revealed that gaps can appear in the sequence of newspapers, but that an empty transport chain must not be fed to an inserter. Quickly creating a small anti-collision PLC program directly using MacroStar became the answer. This relatively simple measure easily solved the problem, and underlines the opportunities for achieving greatest flexibility and reliability in production.

Numerous similar and other real-life challenges have been resolved using MacroStar. For instance, control loops can be defined to keep forces or torques in the process constant, to build up pressure control or to create a standing pendulum. Furthermore, users can program technology functions such as a flying saw or special winding counters

Cams must be used if complex motion sequences in cyclically running machines have to be harmonized with one another. Electrical cams are preferred over mechanical solutions because mechanical solutions offer too little freedom and are not up to the requirements of modern, high performance machinery. Electrical cams define the independence of movement between the leading and the following axes, and can be used to map speed profiles or other key characteristics that need to be taken into consideration.

The complete motion sequence is controlled in the S300 or S700. The MacroStar software can be used to create these electronic cams using a set point table. The master and slave positions are entered into a two-column table. In addition, parameters such as the nature of the interpolation between the curve set points or the scaling of the cam can be defined. The cams can also be quickly modified at the press of a button. When changed to a different product, the machine changes format in just milliseconds. This gives the machine manufacturer great flexibility in finding a solution for each specific application; with significant increases in machine availability.

## Conclusion

With some thought and armed with the knowledge of coupling mechanisms, users can be equipped to effectively minimize EMI issues when best practices are not available.

## About Kollmorgen

Kollmorgen is a leading provider of motion systems and components for machine builders around the globe, with over 70 years of motion control design and application expertise. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

**For more informations contact us.**

## Simple implementation and programming

Programming is based on the Structured Text programming language as defined in IEC 61131-3. The MacroStar development tool supports the programmer in program control, handling constants, variables, and operators, as well as subroutines and the definition of the runtime environment. In addition, special commands are provided for defining motion such as the description of cams, transport tasks, homing runs, starting inching mode, ending movement and more. The finished program is stored in the flash memory (60 KB) in the servo drive and compiled automatically during the start-up phase to ensure the quickest possible program execution.

The MacroStar programming interface is a modern and clear design. It also provides flags with descriptions of the commands and libraries with drag and drop functions. Drag and drop can be used to implement macro variables such as inputs/outputs, CAN communication for multi-axis systems, ASCII commands and macro functions such as filters or debuggers with go-to function and example programs (cam, flying saw etc.).

Kollmorgen offers wide-ranging support with a variety of example programs, and will create customized macro programs to suit unique needs. Kollmorgen also has a corresponding training program. With the flexible MacroStar PLC on board, Kollmorgen's servo drives provide a very efficient programming tool that offers a fast, flexible, and tailor-made solution for many applications without requiring additional hardware, and that helps the machine manufacturer to considerably reduce his system costs.

