**Autonomous systems and networked controllers**

**Getting to grips with automation is easier with intelligent planning**

**In modern-day production processes, machines and systems are becoming increasingly autonomous, intelligent and effective. This is particularly true for the end devices and tools needed for process tasks – that is to say sensors, buttons or handling systems and their controllers. They can work with greater autonomy and have the potential to become decentralised. While individual components once required a centralised control system, they can now take on a great many functions themselves. The intelligence is consequently shifting from the controller level to the machine level, meaning a traditional system architecture is not always suitable for ensuring process efficiency. Instead, new architectures are required.**

Typical system architectures in automation systems are composed of a lower level – the machine level – featuring end devices such as handling systems that execute specific tasks involved in the material flow or the production process. Overarching controllers at the controller level, such as programmable logic controllers (PLCs) and industrial PCs (IPCs), logically connect the subordinate systems together. PLCs are autonomous control modules that do not require the use of computers but can still be combined with other IT systems. There are also software solutions that perform these tasks. To use this software, IPCs are integrated into the network of the machines and systems. In linear technology applications, the overarching control system controls individual steps involved in completing a transport task, with sensors (such as photoelectric barriers, temperature sensors and limit switches) and actuators (for example lifting and adjustment systems) from different manufacturers often being linked together.

**System architectures are evolving**

Lower-level systems in traditional system architectures were previously not very effective, but times have changed considerably. As the machine level is becoming more intelligent, it is frequently integrated together with the controller level into one device. With more and more of the end devices from the earlier machine level consequently featuring their own controllers, they can take on precision work in production and logistics. Sensors in manufacturing processes, for example, are able to position themselves independently. Furthermore, intelligent end devices can be used in 2D gantries based on linear technology. As a result – and depending on the application scenario and the intelligence of a machine – various system architectures can be created.

**PLCs compared to controllers without a PLC connection**

The use of PLCs is advisable if changes to a workflow have to be made quickly. This is because they feature standardised interfaces and can be combined with other IT systems with ease. In other words, they encompass multiple areas of digitalisation, true to the concept of Industry 4.0. Once created, control programs can be copied and used as often as required. PLCs can be accessed from different locations, meaning remote maintenance is not a problem. Rapid error analysis and reliable operation are additional advantages of PLCs. By contrast, when it comes to performing straightforward tasks or if no higher-level control system is required, autonomous systems featuring their own controller without a PLC connection are the go-to option. As a consequence, the outlay involved in setting up the system is reduced considerably. There is no need for a separate IT infrastructure to connect the different systems, which makes it possible to plan and expand production facilities step-by-step and means companies, particularly SMEs, have less trouble getting to grips with automation. Investments can be made over a long period of time and adapted to the company’s performance. It is also possible to bring both systems together and purposefully use autonomous systems in tandem with networked systems.

**Applications in combination with linear technology**

Particularly in the field of [linear technology](https://www.item24.de/en/productworld/automation.html), there are many examples that show how efficiency levels in production and logistics can be raised with relatively little programming outlay. Among other things, standalone linear technology solutions are ideal for simple tasks such as lifting, lowering or positioning workpieces and tools. A PLC connection is not required for this. Carriages are moved along a linear axis, or cantilever axes are used with a carriage that is fixed firmly into place. When it comes to moving tools from one point to the next and making sure they are perfectly positioned, for example, automated linear units are ideal and ensure even heavy loads, such as robots or production facilities, are moved in an automated process. Cantilever axes use the support profile of the linear unit to exert force on a workpiece or accurately position a tool. Among other things, they can be used for material and load testing. One example application that requires intelligent end devices to be linked with a PLC is the control system of 2D and 3D gantries. Here, the end devices are positioned along a surface or within an area. Such solutions are typically used to carry out pick-and-place tasks in production and logistics and to feed in products, for example when filling liquids. 2D gantries can be used to guide printer heads, nozzles, scanners and sensors to the correct place. 3D gantries are used, for example, to stack or sort materials. For this purpose, cantilever axes are equipped with grippers or suckers that move the material within an area.

**One system for a multitude of applications**

Comprised of a Linear Unit, Motor, Controller, drive and comprehensive software support for planning and commissioning, the [customised end-to-end system](https://www.item24.de/en/productworld/automation/item-linear-motion-unitsr.html) from item provides a versatile basis for automating processes. “Our item linear motion unit® offers an ideal system that supports both traditional and state-of-the-art system architectures and consequently covers a great many linear technology applications,” says Uwe Schmitz, product manager for machine automation at item Industrietechnik GmbH. “Transport tasks can be carried out without an overarching control system, but it’s also possible to establish a connection to a PLC via a fieldbus or I/O ports.” Various preassembled Linear Units are available for classic automation tasks, featuring a range of drive and guidance technologies – all perfectly coordinated. With just a few details, item MotionDesigner® can pull together the perfect combination of components to configure a Linear Unit. The software factors in the static, dynamic and thermal loads of all components, generating the optimum solution from thousands of possible combinations. item MotionSoft® then ensures the configuration and commissioning processes for the automation solution are straightforward. This commissioning software and the intelligent item Controller measure the Linear Unit independently, calculating the optimum settings.

**Straightforward programming and perfect integration**

The core task of the item Controllers is to ensure optimum actuation of the item servomotors at all times. These programmable servo controllers combine several functions in one compact housing. Complete motion profiles can be stored and executed in the Controller. Signals are read and evaluated straight away, for example via I/O ports. “Users can take care of programming using the [item MotionSoft®](https://www.item24.de/en/productworld/automation/item-linear-motion-unitsr.html) software,” Schmitz explains. “This enables them to specify key parameters such as speed and acceleration and define the motion profile.” Once the motion profile is stored in the Controller, the Controller executes it independently. A PLC is therefore not required to move the application into position or to carry out simple processes. The item Controllers support all standard fieldbus systems and feature interfaces to overarching controllers, meaning the Linear Units can also be integrated into complex processes as whole assemblies. It is thus also possible to work with a PLC should there be a need to perform more complicated tasks.

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**Caption 1:** Among other things, standalone linear technology solutions are ideal for simple tasks such as lifting, lowering or positioning workpieces and tools. They ensure even heavy loads, such as robots or production facilities, are moved in an automated process.

**Caption 2:** One example application that requires intelligent end devices to be linked with a PLC is the control system for 2D and 3D gantries. 2D gantries can be used to guide printer heads, nozzles, scanners and sensors to the right place.

**Caption 3:** 3D gantries are used, for example, to stack or sort materials.

**Caption 4:** Complete motion profiles can be stored and executed in the item Controller. Signals are read and evaluated straight away, for example via I/O ports.

**About item**

item Industrietechnik GmbH is a global market leader in building kit systems for industrial applications and employs around 500 members of staff. It has been designing and marketing construction solutions for machinery, fixtures and plants since 1976. Today, the item product portfolio comprises more than 4,000 high-quality components designed for use in machine bases, work benches, automation solutions and lean production applications. Thanks to the inclusion of transport solutions and dynamic elements, the company’s products can cover virtually all working processes, from manual production to automated manufacturing. The highly skilled employees work day in, day out to develop innovative solutions for state-of-the-art mechanical engineering and also offer exceptional consulting services. item is headquartered in Solingen, Germany. Eleven branches and support centres ensure the company is always close to customers in Germany. The group has wholly owned subsidiaries in the USA, China, Mexico, Italy, Poland and Switzerland.

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