



Robotics – from R2-D2 to artificial intelligence

By M Dilchert, Lapp Group

Thinking back to the late 1970s when George Lucas created R2-D2 in Star Wars... who imagined that one day we would see this as reality?

Did anyone ever think that R2-D2's head would turn in the same direction numerous times and still operate? More recently, Wall-E (Waste Allocation Load Lifter Earth-Class) came along, designed to clean up the abandoned earth's waste allocation lifter – earth class which had operated for many years and needed many parts to continue. What if he had used Lapp Group solutions – what would have been in the container? From the robot that searched the World Trade Centre for survivors – to the flying drones that will be delivering parcels to our homes in the future, robots will soon be as

integral a part of our everyday lives as they are in major industrial sectors. It is no wonder that scientists and journalists alike are dubbing the 21st Century as 'the age of artificial intelligence'.

Robotics rapidly advancing

Forecasts suggest that in 2015, annual sales of industrial robots will exceed 200 000 units. This boom will come about because robotics has developed in giant steps. Today's intelligent helpers are much

“Anyone who joins a tour at the Museum of Communication in Berlin will be amazed, not just by the superb exhibits on display there, but particularly by the museum guide. The job is done by a robot. This is just one of the many examples of how robots are now firmly established as part of our day-to-day lives. Contrary to most science fiction scenarios, humans and machines live a peaceful and productive coexistence”.

Andreas Lapp



easier to programme and teach than just a few years ago. They can be flexibly and individually used for a huge variety of different tasks with extremely short set-up times.

These high-tech descendants have little in common with their great grandfathers, who packed bottles into boxes back in the 1960s. Robots are not only used in production, logistics and storage these days. Wherever there are jobs that are too dirty, too dangerous, too strenuous or simply impossible for humans, smart companies are relying on artificial intelligence. The best example of this is service robots. Service robots include remote-controlled vehicles that inspect or weld underwater oil and gas pipelines; robots that ensure drinking water quality in hot regions; or even tiny robots that are sent into sewage systems to clear and repair them.

Robotics – the supreme discipline for cables

As demanding as the tasks performed by robots are, the requirements for the cabling are equally stringent. This is why robotics is a major focus in the Lapp Group. Building on a wealth of manufacturing expertise within the company, while the French subsidiary (Lapp Muller in Grimaud) has specialists with more than 25 years' experience in robot and drag chain applications.

This know-how creates competence. Ultimately, competence is exactly what it takes to be successful in robotics, with its countless range of applications and individual designs. It is an area where practically no two applications are the same. This means that every cable solution has to be unique, whether it is to provide a specific power supply for robots or high-performance data transmission, for example, when building robots with high resolution camera systems.

However, for many robot applications, the outer material of a cable is just as crucial as what is inside. The cable may need to be able to withstand mechanical abrasion and chemicals, or requirements might include resistance to harsh working environments, or extreme tensile strength. Whatever people demand from a robot as an indefatigable worker, they demand exactly the same from the cables.

Industrial robots

- o Articulated robots with four to six axes are flexible to use and can do everything from handling to assembly tasks to welding, loading and unloading. Painting and coating robots are a special form, providing efficient and precise bonding, dusting and painting. A painting robot can switch from one paint colour to another in

10 seconds with minimal wastage. Dürr has managed to reduce the inevitable paint loss to around 10 ml per colour change (two teaspoons or a half-full shot glass)

- o Swivel arm robots carry out 'pick and place' tasks, moving materials in a limited radius at high speed
- o Parallel kinematic robots with opposing arm systems are primarily used in the food and beverage sector

Artificial intelligence increases efficiency

Dürr is a system provider supplying cleaning systems for the production of engine and gearbox components, as well as balancing systems and products for final assembly. However, Dürr's main role is in planning and building paint shops for the automotive industry. In other words, this means workstations for robots.

Indiana red, Misano red, Tornado red – all automotive manufacturers have their own specific colours. Many of these have something in common, namely that all the vehicles are often painted by robots supplied by Dürr. Visiting the company's headquarters in Bietigheim-Bissingen, we find a football team of 6-axis robots lined up, ready for their functional test and nearly ready for use.

The robots' destinations are already decided – Melfi, Dingolfing, Shanghai. Many of them are going on a world trip, as the company has a significant international focus. One of them is marked RPL (Robot Paint Low). Its taller colleague has the code RPE – E being Elevated as some painting robots are built higher. These robots not only paint cars throughout the world, but also their big brothers – commercial vehicles.

High-tech helpers

When it comes to painting vehicles, both drivers and car manufacturers alike have very specific expectations. Frequent changes of model, innovative vehicle designs and new paint systems demand a high level of flexibility and innovation from Dürr. These days, painting is very much a high-tech sector.

A painting robot has the job of moving the nozzle during painting, at a constant vertical distance from the body surface. This ensures an even application of paint. To achieve this, Dürr constructs and programmes not only moving and stationary painting robots for exterior and interior painting, but also so-called handling robots, which are small, intelligent helpers that can open, hold and close car doors and bonnets.

Art of reduction

Under Dürr's logo is the phrase: 'Leading in production efficiency', while their flag shows a simple formula: Less is more: Less time and distance, less material required and less energy consumption. Whenever Dürr can reduce colour changeover times or minimise paint and solvent losses, the global market leader is increasing its customers' production efficiency. Their robots use cables that are subjected to huge loads. There are torsional movements that the cable simply has to be able to cope with. Not twice – but millions of times. 'Cope' in this case means that the cable needs to have a dynamic bending radius equivalent to 10 times its outer diameter, capable of approximately 180 °m of torsion. Lapp cables are tested for 10 million bending and torsion cycles. The extreme mechanical and chemical loads or even the demanding technical requirements are not the only challenges. Because no two robot applications are ever the same, every cable is a special solution to a certain extent.

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Quantum leap in production

Fully automatic, reliable processes based on robots – with its new metal processing centre, the Lapp Group has one of Europe's most modern plants for manufacturing rectangular industrial connectors. For the Lapp Group, robots are not just on the customer list, they can be found in the building. Since mid-2013, some tasks that were previously carried out by hand on a lathe are now being performed by autonomous machines in the new metal processing centre. As well as ensuring effective process flows and quality at Lapp, this is helping to safeguard Germany's future as an industrial location. Thanks to the new metal processing centre, Lapp has managed to bring production from the Czech Republic back to Germany.

This is a good example of how industrial production of high grade components can help the country remain competitive internationally in this age of globalisation. The new plant not only achieves higher volumes, it can also manufacture all variations in the product range flexibly and with short lead times. Four Fanuc robots, two metal processing machines, a fully automatic riveting station with loading and unloading station and a washing system are in use around the clock. They turn 54 housings blanks into around 580 industrial versions of EPIC rectangular and circular connectors. Production of the inserts for the connectors is also automated.

Fully automatic quality control

While quality control for the EPIC connectors was previously performed manually, the entire process is now fully automatic. Robots

use a scanner to measure each individual part, then calculate any dimensional variation and tolerance and resolve any discrepancies immediately.

They find the new zero point for the hole automatically or separate out a part if its tolerance variation is too high. Everything runs fully automatically in the subsequent riveting station too. The bolts are individually fed to the riveting unit according to their type and position, then positioned and riveted. The riveting point is corrected automatically where necessary.

At the same time, the riveting pressure is monitored, and the values are documented and stored. This guarantees traceability at all times. By combining full automation with digital quality control, optimum repeat accuracy and high quality are achieved. Translated into added value for the customer, this means a high, dependable quality level and, thanks to increased flexibility in production and faster processing times, also shorter delivery times.

Conclusion

For many years the Lapp Group has provided solutions to the End Of Market (EOM) as it is an integral part of their process towards the end solution. As a trusted partner to this sector, Lapp Group manufacturing expertise within the company provides the customer with a complete 'end2end' solution developed in-house.

Lapp Group not only supplies complete solutions for the robotics environment to cover power cables, data cable, servo cables sensor cables, hose systems, energy chains, connectors and more, but focuses on the whole Original Equipment Manufacturer (OEM) and machine-building environment from a box drop solution through to end2end design of complete harnesses on a plug and play option with guarantees to suit.



Mark Dilchert is the managing director of Lapp Group Southern Africa. Enquiries: Tel. 011 201 3200 or email mark.dilchert@lappgroup.co.za