item

State-of-the-art working processes in the automotive industry

Seamlessly integrating staff and partners into efficient production.

Content

1. The aim of this white paper

In light of relentlessly tough competition, the increasing variety of models and equipment, and ever-growing customer expectations, companies in the automotive industry are under a great deal of pressure to achieve maximum efficiency. Although options such as FIFO, Karakuri, Poka-Yoke and related lean production approaches are now well known throughout the entire industry, companies often find it difficult to work out exactly what it is they need to do in practical terms. The same applies to partly autonomous taxi trolleys for material transport that follow the Kanban system for increasingly customised vehicles. In this white paper, we will clearly outline why actively involving staff at every stage is more important than ever when it comes to adapting state-of-the-art automotive production processes. This is the only way to establish a self-sustaining culture of improvement within a company. In order to actually harness the potential of the resulting CIP approaches, selecting suitable system suppliers that offer an extensive range of components, expert advice and support, and excellent supply availability is hugely important.

2. Challenges facing today's automotive industry

The automotive industry is characterised by tightly synchronised production that factors in the maximum possible process reliability. Traditionally, safeguarding and effectively controlling material supply are critical to an overall lean production process. The increasing variety of models and equipment available requires an assembly sequence that sees custom-configured vehicles move through production lines like a string of pearls. Likewise, the share of electric and hybrid vehicles on the assembly line is on the rise, and comprehensive infotainment and driving safety systems are now being installed in the compact vehicle segment. All these factors place particular demands on ESD-safe goods transport in intralogistics. Moreover, flexible transport systems must be loaded error-free with the pre-planned components and arrive at the conveyor belt in time to produce the custom-configured vehicle. This kind of transport can, in the medium term, no longer be carried out efficiently using tugger trains and a bus system, meaning that the requirements for designing transport systems are changing, too. The components must be flexible enough that they can be used to easily pick and transport as many parts as possible for assembly. Flexible, modular components are also important when it comes to changing from one model to another, as they make it possible to easily reconfigure an existing fleet of transport vehicles – which is preferable to finding a supplier to create completely new transport systems or having to create them in-house. At the same time, however, modularity should not come at the expense of the robustness required for manual component transport. Failures during production must be prevented as far as possible, and maintenance outlay kept to a minimum. This changes the requirements profile when purchasing the components on which the perfect transport solutions are based. The initial purchase price of the system components on its own becomes less significant when they are being integrated into an increasingly complex overall concept. By contrast, component selection, the ability to deliver even large quantities and delivery reliability become all the more important. In this context, suppliers become strategic collaboration partners actively embedded in the challenges of their customers, in keeping with lean philosophies.

3. Lean Production

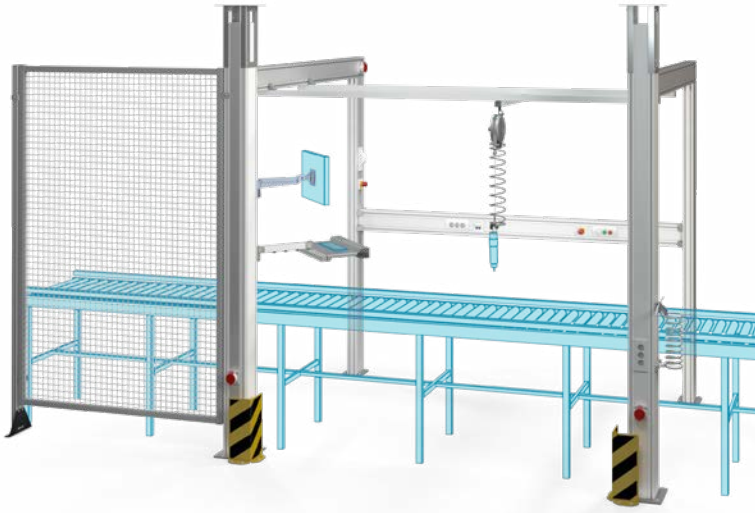
Ever since the advent of the Toyota Production System (TPS), the automotive sector has traditionally been the role model and pacesetter for industry when it comes to lean production. Avoiding errors, overproduction, waiting times and buffer stock, and integrating the core skills of strong external partners have long been cornerstones of CIP in automotive production. The need to avoid waste and create synchronous processes in lean production is steadily returning to the fore due to the wide variety of available models and increasingly customised configuration of individual vehicles in contemporary automotive production. This places special demands on the flexibility and modularity of the components that make up the factory equipment used in intralogistics and production. Both factors are critical to ensuring rapid restructuring (Kaikaku) can be carried out where necessary for smooth just-in-sequence production.

Flexibility

When selecting components for factory equipment, using a flexible overall system yields greater benefits as automotive production processes become more complex. Building kit systems for factory equipment engineering can be used to build workstations, transport trolleys and clearing stations, and quickly create a separate storage area or office directly in the production area. Universal components simplify warehousing and enable production teams to rapidly implement CIP ideas and new custom equipment.

Modularity

In practical terms, when it comes to building kit systems, flexibility and modularity go hand in hand. What use is a universal component – particularly in the automotive industry – if the design cannot be easily expanded or reconfigured? Modularity means being able to attach an additional transport safety device to a material supply trolley without having to carry out complex machining. As a result, engineers don't have to account for all possible eventualities as early as the preliminary planning stage, which can often lead to over-engineering. What's more, all components within the overall modular system are compatible with each other, meaning an installation column used to supply an information terminal with power and data can be extended at any time to include holders for hand-held scanners, monitors or a storage area.



Avoiding errors

Flexibility and modularity ultimately provide the ideal conditions for product assurance along the entire production chain. Poka-Yoke (ポカヨケ, translated into English as "avoiding unfortunate mistakes") offers many options for avoiding errors – particularly in the early stages of production – with the help of mechanical and technological aids. Pick-by-light, pick-by-voice, the pairing of loading lists and transport systems using barcodes, and mechanical locks all have one thing in common – they should be quick and easy to implement. To ensure this is the case, state-of-the-art modular systems offer either specific components or system grooves and adapters that can be used to easily integrate third-party solutions directly into factory equipment. These systems also provide users with everything they need to design simple Karakuri solutions for automating processes in a simple but intelligent way using physical principles – with no drives, sensors, electricity or compressed air. Simple automation makes many operations more straightforward and, ideally, cannot be misused.

The intention is to use resources that are already in place – existing plants, parts and components on the one hand and the creativity of the on-site workforce on the other (low-cost automation).

4. Intralogistics

Ensuring a continuous and error-free flow of components from warehouses and supermarkets to the production line is vital to assembling vehicles efficiently – a process that is more complex than ever before due to the wide variety of vehicle models and configurations being manufactured. In view of the sheer number of components and variety of batch sizes, flexibility and modularity are also essential when it comes to designing the best possible intralogistics processes. What's more, there are a few more key points that need to be taken into account in order to ensure a smooth material flow – particularly when it comes to engineering transport trolleys.

Ergonomics

The automotive industry recognised the benefits of designing ergonomic workflows much earlier than many other sectors. At the same time, efficient transport trolleys need to carry as many components as possible on as compact a frame as possible. Modular building kit systems offer a number of potential approaches to introducing ergonomic working practices that also meet this basic requirement – such as drawer systems for transport crates and small load carriers. They can also be used to create ergonomic, two-sided component supply systems. This is another area where Karakuri mechanisms take the strain off staff by automating tasks that don't add value – particularly when it comes to optimised material supply and removing empty containers. A lack of ergonomics in these scenarios could also be viewed as a form of wastefulness, which, if remedied, would immediately result in increased added value and healthier staff.

Robustness

In automotive production, order picking and component transport are largely manual activities carried out under time constraints. As a result, factory equipment is almost certain to undergo some rough handling from time to time, and it is important this can be easily accounted for when planning and designing equipment. Building kit systems used to engineer factory equipment provide all the components needed for just that. A basic frame made of robust profile technology can therefore simultaneously serve as both a collision guard and a modular basis for the actual transport trolley. Slide protection plates for the start of a roller conveyor protect the first few rollers from the impact of a transport box introduced too quickly. A modular design also makes it possible to ensure sustainable functional reliability by adapting the system to a wide range of logistical size parameters – which can even be done gradually if necessary.

Factory equipment – procuring components and the subsequent costs.

Initially, the retail price for products such as Profile Tubes from a building kit system is usually higher than that of plain bars or tubes. When it comes to welded steel frames in particular, the finishing work they require clearly constitutes an additional time and cost factor. Not only that, but welded connections are not easy to undo. By contrast, a transport trolley made from aluminium profile tubes with screw connections can be easily converted to accommodate a different component size. The only major machining step required is sawing, which results in significantly lower overall costs over the components' service life.

Ease of maintenance

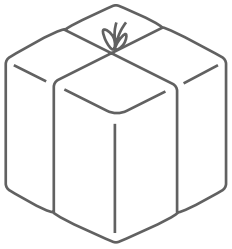
Even if your factory equipment has a highly robust basic design, there's no avoiding maintenance outlay. In the best-case scenario, maintenance can be scheduled reliably with longer intervals and carried out with ease. State-of-the-art building kit systems for factory equipment engineering truly excel in this regard thanks to their durable fasteners. The bolted connections fit flush with the individual components and thus do not exhibit any creep behaviour. If an individual component such as a roller or a single profile tube is damaged, the affected component can be quickly replaced using minimal tools and without causing any additional damage.

5. Automated guided vehicles

The aim of transitioning from just-in-sequence processes to in-line vehicle sequencing in vehicle assembly is to minimise the risk of interruptions by transporting the necessary components using more flexible taxi systems rather than comparatively rigid tugger trains. Firmly integrated into the IT infrastructure for production planning and control, the individual transport processes themselves are increasingly carried out using automated guided vehicle (AGV) systems. This places special demands on both the basic construction of the transport trolleys deployed for this purpose as well as the materials used to build them.

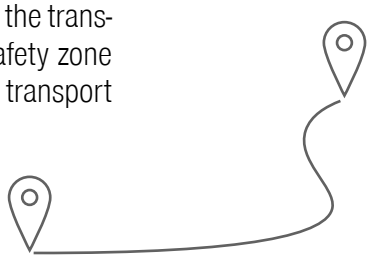
Order picking

Since an AGV itself cannot compare the transport order against a loading list, each order must be correctly allocated to one transport trolley. This could be done, for example, by scanning a unique barcode on the trolley. This barcode is then linked to the coding of the loading list via the AGV control system. As such, the order picking station must be supplied with adequate power, be connected to the IT infrastructure and feature holders for scanners, a monitor or alternatively a tablet. In order to fully harness the load-carrying capacity of the AGV system, the trolley should not only be highly stable, but also carry as little dead weight as possible. Aluminium performs better than steel in this regard.



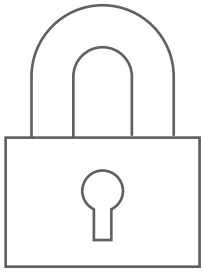
Routing

State-of-the-art automated guided vehicle systems feature an on-board map of the route between the warehouse and the assembly line, meaning they no longer move along fixed tracks of magnetic tape. Instead of being allocated to fixed routes, AGVs are assigned to jobs flexibly so as to minimise the distance they need to travel. Time-sensitive orders are automatically given priority. It is important that the basic dimensions of the transport trolleys can be kept as small as possible in relation to the transported component and the batch size. The basic dimensions determine the size of the safety zone that the AGV maintains around itself during transport, meaning an inadequately designed transport trolley will stop more often than actually necessary.



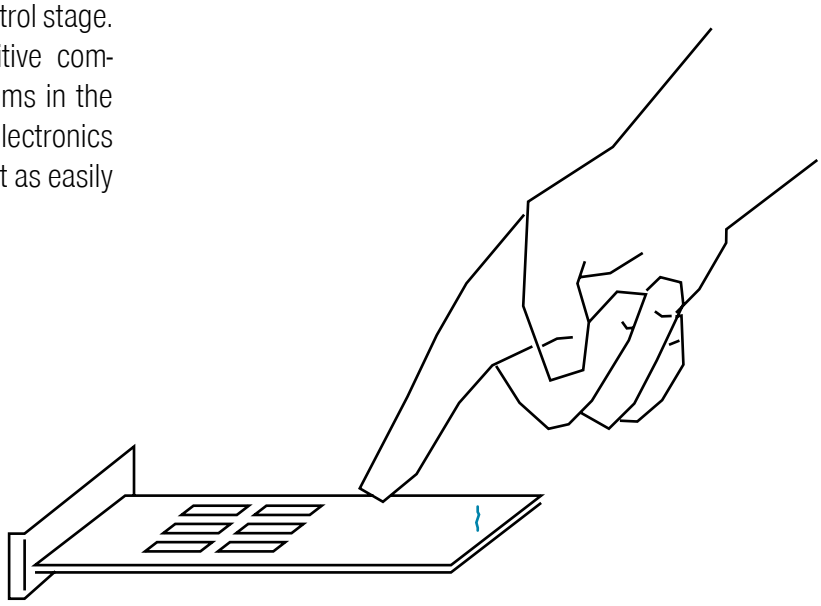
Process reliability

Establishing an adequate data exchange system helps ensure the AGV knows how large a safety zone to maintain around the trolley being transported. Ideally, the transport trolley and transport system should be able to communicate directly when the transport operation starts so as to rule out possible input errors at the order picking stage or in the AGV control room from the very outset. Technically speaking, there is a wide range of available options for facilitating communication between AGVs and transport trolleys. No matter which solution is selected, it is crucial that the corresponding information carriers can be easily and securely attached to the transport trolley using holders or grooves.

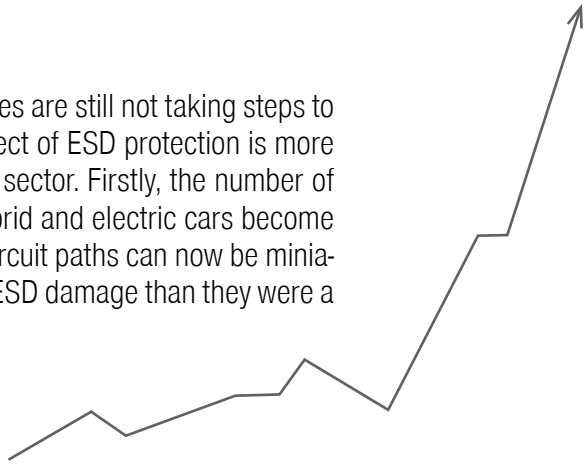


6. ESD protection

Taking appropriate protective measures against electrostatic discharges (ESD) is becoming an increasingly important part of the most effective error avoidance methods used at every stage of production in the automotive industry. These measures are crucial to ensuring process reliability in this sector, particularly given how difficult it is to check for ESD-related errors at the quality control stage. This applies all the more because ESD-sensitive components are often used in safety-relevant systems in the vehicle. Not only that, but, given that the vehicle electronics are highly interconnected, the damage could just as easily be caused by a secondary component.

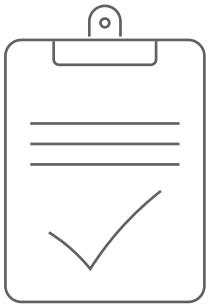


Growing importance



Although ESD protection is taken seriously as an issue, many businesses are still not taking steps to raise awareness of the topic throughout the entire company. The subject of ESD protection is more relevant than ever before, mainly due to two factors in the automotive sector. Firstly, the number of electronic components installed in vehicles is continuing to rise as hybrid and electric cars become easier to mass-produce. Secondly, as a result of the degree to which circuit paths can now be miniaturised, the individual components are now much more susceptible to ESD damage than they were a just few years ago.

Difficult quality control



An additional challenge that arises when dealing with ESD-sensitive components is the inability to detect an ESD. Intralogistics and assembly staff do not usually notice the ESD damage they cause in an unprotected work environment. As a general rule, an ESD can be triggered any time a component is handled without adequate protection – from delivery or order picking right up to the moment it is plugged in during final assembly.

While only a very small amount of ESD-induced damage exhibits symptoms that can be detected during a functional check, most of the effects are more subtle in nature – taking the form of microscopic defects in the nanometre (billionth of a metre) range, which go completely unnoticed throughout the test cycle. The manufactured part functions perfectly at first, despite this hidden flaw, which gradually worsens over the course of the part's life cycle – without anyone having any idea.

Potential risk for end customers

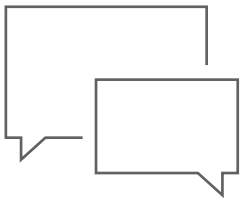
The error only comes to light after the part has been in use for some indeterminate length of time – often with fatal consequences that can result in a total failure. If safety-relevant components (control units, ESP, ABS, driver assistance systems, etc.) fail, the consequences can be devastating. From the point of view of quality assurance, it is therefore vital to ensure sensitive components are protected against ESD for the entire product cycle. Aiming to achieve 100% protection is the only option, ideally starting as early as product design. This also involves mitigating risks that occur after the actual production process – during maintenance, for example. Components used to construct transport trolleys and other factory equipment must therefore be ESD-safe and contain as few individual insulating parts made of plastic as possible. Besides ensuring individual components are designed to be safe, structures built with these parts also need to be configured with these goals in mind and tested by experts to ensure their suitability. This applies in particular to work benches, ready-made transport trolleys, interlinking elements and FIFO racks intended for use in an EPA (electrostatic protected area). One of the greatest hazards besides all the factory and intralogistics equipment is posed by people who don't know how to properly handle ESD-sensitive parts. An ESD-safe production line therefore requires both equipment that is perfectly adapted to the specific circumstances, and a team of well-trained employees.

7. Lean deployment

All the challenges and specific optimization measures mentioned so far have an impact on the usual day-to-day work of staff in intralogistics and assembly. Although these changes improve workflows and allow for more ergonomic working postures, they must also be viewed as beneficial by staff and accepted. To ensure that is the case, decision-makers in production planning need to take account of three main principles that all fall under the umbrella term of “lean deployment” and ultimately help create a work-place culture characterised by a mutual appreciation that spans all hierarchy levels.

Active communication

All the challenges and specific optimization measures mentioned so far have an impact on the usual day-to-day work of staff in intralogistics and assembly. Although these changes improve workflows and allow for more ergonomic working postures, they must also be viewed as beneficial by staff and accepted. To ensure that is the case, decision-makers in production planning need to take account of three main principles that all fall under the umbrella term of “lean deployment” and ultimately help create a workplace culture characterised by a mutual appreciation that spans all hierarchy levels.

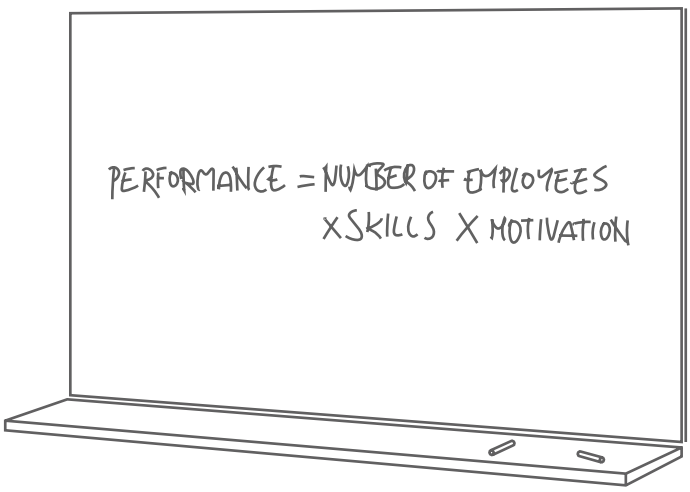


Allowing for feedback

Shaving three seconds off a single production step does not automatically make an entire work process more efficient and boost value creation. However, these small factors are indeed standing in the way of potential efficiency gains, and measures to remedy them only start to make a noticeable difference when employees make the effort to implement them. Getting active feedback from the place where value is actually created does more than just expose another level of the company to CIP – solving problems as a team helps create a sense of community, which is important to ensuring the sustainable success of the lean deployment strategy.

Encouraging a proactive approach

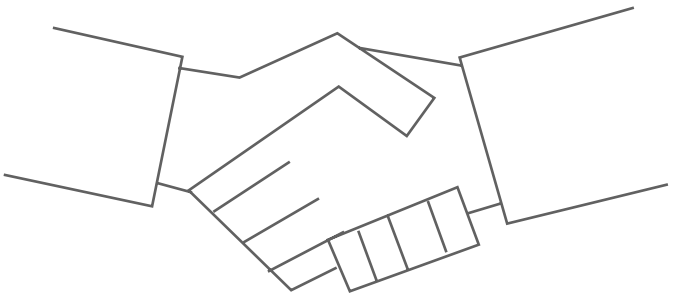
It is safe to say that lean deployment has gained a foothold within a company when employees start contributing their own suggestions to the continuous improvement process. One approach successful companies are taking to actively support this kind of participation is to provide material boxes filled with discarded factory equipment, which staff can use to actually test out their idea for improvement for a set time each week. In practice, this not only generates insights that could be extremely beneficial for value creation, it also puts responsibility in the hands of individual employees. Under the TPS, individual employees are given so much responsibility that they can bring the entire production chain to a halt by pulling the proverbial Andon cord.



8. Choosing the right cooperation partners

The general state of production as it exists today – with a demanding market environment, increasingly customised vehicles and technical innovations – is affecting manufacturers beyond just the automotive sector. Companies that, in the past, would have typically just supplied factory equipment are increasingly taking on the role of cooperation partners whose expert advice and support enable them to play an active role in finding the perfect solutions to a wide range of challenges. This trend of companies getting involved in the overall process of optimising value creation is also changing what it means to be a good system supplier. Buying solutions for factory equipment engineering solely based on the price of individual components is a short-sighted approach in modern automotive production. Besides the individual cost centre, another key factor to be considered is whether the components used can be reliably delivered in large volumes over an extended period of time with a high degree of reliability. What's more, as flexibility and modularity become ever more important when designing workstations and transport solutions, the big question is what kind of overall system is needed to achieve them.

When it comes to engineering factory equipment for the automotive industry, aluminium building kit systems tick all the right boxes. They combine thousands of mutually compatible components, giving engineers maximum creative freedom. The use of screw connections rather than welds makes it easy to expand and maintain existing systems or retrofit a transport trolley so that it can be used in tandem with an automated guided vehicle system. At the same time, they make it easy for employees working directly at the place of value creation to carry out minor modifications



themselves with little effort and very few tools. If companies are to meet the growing challenges associated with ESD-safe production conditions, they require partners that can provide comprehensive consulting services as well as a high degree of safety when it comes to handling and designing factory equipment. By combining a strong cooperation partner with a system designed to meet the demands of the modern automotive industry, companies can minimize subsequent costs, meaning that individual components remain extremely cost-effective from the moment they are purchased all the way to the end of their service life.

Summary

As time goes on, motivated employees who are actively involved in value creation and process orders using factory equipment perfectly configured for their tightly synchronised production processes will remain a cornerstone of efficient automotive production. Using flexible, modular components to design factory equipment helps create solutions that are perfect for the task at hand and can be easily expanded or reconfigured as required. Market-ready solutions for automated guided vehicle systems and retrofitting tablet holders to transport trolleys for the use of paperless loading lists are some of the latest examples of this fundamental development currently sweeping the industry as a whole. This is a trend that not only the individual companies but also their chosen suppliers need to keep up with. The ideal scenario is for both parties to become close partners, working together to create the best possible intralogistics control system and seamlessly integrate it into the production line.

item Industrietechnik GmbH
Friedenstraße 107-109
42699 Solingen

Tel.: +49 212 65 80 0
Fax: +49 212 65 80 310

info@item24.com
item24.com

About the publisher

item Industrietechnik GmbH is a midsize company dedicated to the development and worldwide sale of high-quality components used to build fixtures, machinery and plants as well as system solutions for lean production operations and work bench design. item building kit systems are based on aluminium construction profiles and fastening techniques that are tailored to a whole range of application scenarios in terms of their function and design. Its wide portfolio of accessories enables users to create an almost unlimited range of applications – from simple frames and machine enclosures right through to complex handling systems and custom machines.

Learn more about intralogistics and lean production at item24.de/en/productworld/lean-production

item. Your ideas are worth it.®