

case study

The perfect pick!

Error-free manual workstations
for the automotive industry at
Martinshof Werkstatt

In spite of advancing digitalisation, the following still applies: Manual workstations are indispensable, because automation is not always profitable with small batch quantities or complex processes. Such workstations are preferred at the Martinshof Werkstatt Bremen, a sheltered workshop for a mixed workforce including people with handicaps, as they are ideally suited for integrating persons with physical or cognitive handicaps into working life. The Japanese Poka Yoke principle, which aims at the systematic elimination of human errors, coupled with Mitsubishi Electric's 'Guided Operator Solutions', ensures high quality for Martinshof's customers, which include well-known automakers in the region.

With some 2,200 employees, Werkstatt Bremen is one of city's largest employers as well as Germany's oldest and largest workshops for people with and without handicaps. Apart from job order and contract production in the fields of metal and woodworking, electrical assembly, filling, and packaging, Werkstatt Bremen employs 500 workers alone in the automotive business sector, and has been supplying local automakers for more than 30 years.

Handke Industrie-Technik, a long-standing supplier to Werkstatt Bremen of manual workstations, and a premium solution partner of Mitsubishi Electric, recognised the unique opportunity. Together with Mitsubishi Electric, Handke developed a Poka Yoke solution for adapted working. The prototype of the error-free workstation convinced the customer, and was installed in the production line. Since May of 2018, a total of four identical zero-error workstations are in use for automotive parts production.

Consistent operator guidance eliminates mistakes

In a three-shift system, large quantities of up to five different torsion bars (vehicle suspension components) are pre-assembled, transferred to a buffer store, and then delivered 'just in time' to the automakers assembly line. During assembly, small stabilisers, which are very similar but must not be mixed up, are bolted to the left and right hand sides of the torsion bar.

Process overview

Each of the new manual workstations consist of an aluminium profile frame fitted with hydraulic height adjustment for adapting to different ergonomic needs, plus illumination and workpiece holder. Delivered in pallet cages, the torsion bars are individually placed in the workpiece holder, where their barcode is scanned by an intelligent, WiFi-linked torque wrench. Subsequently, the holder is locked.

In the next step, a parts bin is opened, which contains the components for the right hand side. A physical access barrier to the parts bin is provided by means of an intelligent door flap mechanism. Simultaneously, an illuminated push button on the bin prompts the operator to remove one of the parts and acknowledge this by pressing the button (pick to light).



*The Poka Yoke success story
on YouTube*

case study



Thanks to the Poka Yoke controller, existing technology, like a digital torque wrench in this case, can easily be integrated into the error-free process with instructions fed to the operator via the GOT HMI.



Subsequently, the removed part is held in front of a camera to verify it again. In this way, possible labelling errors by the supplier are reliably detected, thereby preventing assembly errors. After release by the camera, the part can be installed.

An additional check is then carried out by inserting a sensor. Only if this check is OK, will the torque wrench be enabled, so that the bolted joint can be tightened to exactly 100 Nm. Every individual step must be carried out, and the tightening torque must be correct, before the second parts bin is opened, and the process can be repeated for the left hand side. When the entire procedure has been completed successfully, the holder releases the finished workpiece for transfer to the buffer store.

Integrating on-site technology and visualisation

“The main challenge of this project involved the integration of existing technology into the new error-free workstations. However, thanks to the interfacing features of our Poka Yoke controller, this was not a problem”, says Nils Knepper, Senior Product Manager Modular PLC/ Software at Mitsubishi Electric Germany. The MELSEC iQ-F series PLC, installed on-site in a small control cabinet, is the intelligent, individually configurable and expandable heart of the solution that controls the picking and assembly sequences. Apart from Mitsubishi’s own components, the system can also handle third-party sensors and actuators. In this case this included the digital torque wrench and a system for industrial image processing. The connection of a barcode printer is being implemented, and thanks to existing conventional interfaces, this can be done easily by the PLC.

“During the design of the user interface, Mitsubishi was highly flexible, and took all our requirements into account. Because many of our employees cannot read very well, we make use of smileys and other symbols”, explains Miriam Berger. “In addition to process reliability, the Poka Yoke workstations have the great advantage for us, unlike the past situation, as practically any employee can now do the job.” The supporting visualisation mentioned uses a 10-inch touchscreen terminal connected in the background to the Poka Yoke controller.

The hardware and software solution from Handke and Mitsubishi Electric deliver simple scalability, convenient configuration, programming and commissioning as well as comprehensive connection possibilities (including MES and ERP). And as soon as freedom from errors is achieved, and the technical potential is available, Werkstatt Bremen will investigate whether the buffer store can be dispensed with in the future, so that after assembly is completed the parts can be directly shipped ‘in time’ to the automaker.

Wide range of components for individualisation

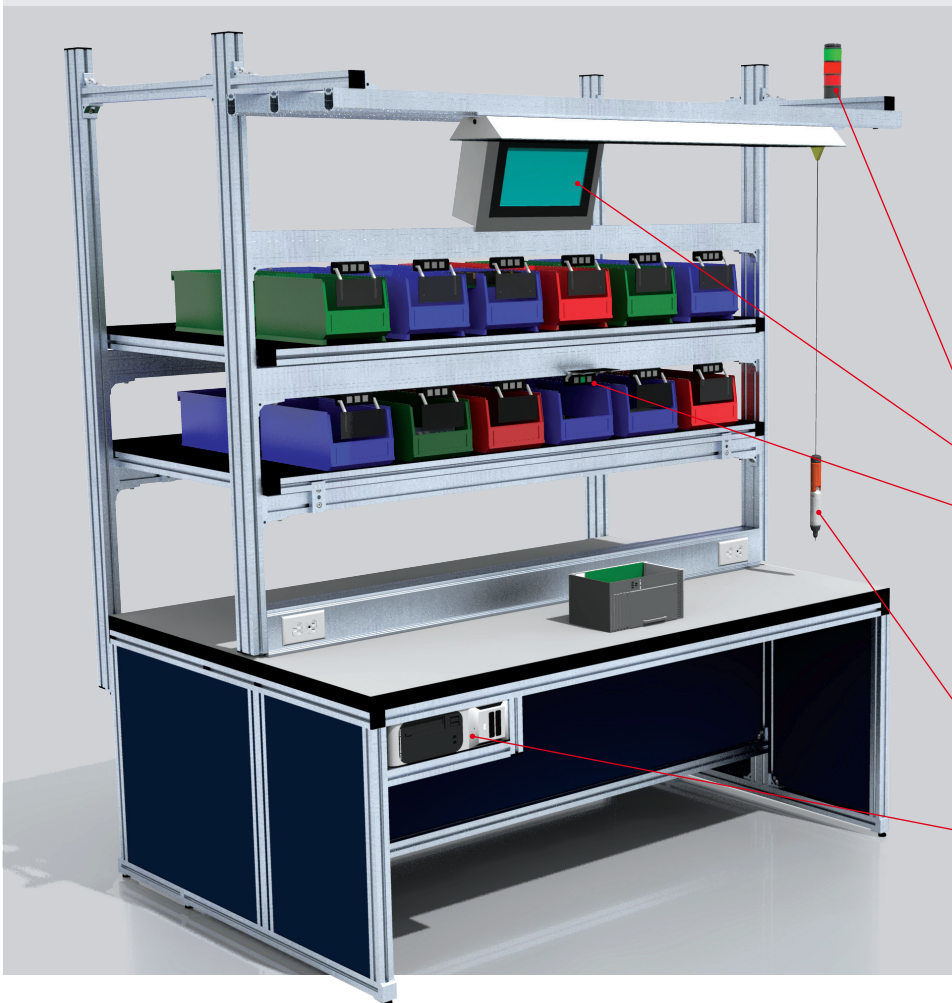
"The need to prevent errors exists everywhere during production and assembly. What is most important is the quick and flexible adaptation to the needs of the persons working there, and to the requirements of the process", remarks Andreas Kebbel, Managing Director of Handke Industrie-Technik.

That is why Mitsubishi Electric and Handke offer their solution in the form of a modular system with a wide range of components and interfaces for operator guidance. Amongst others, these include mechanisms to ensure the correct picking of parts, e.g. light barriers, pick-to-light push buttons (alternatively: pick-to-voice), barcode scanners, and proprietary pick-to-door devices with stroke switches. Moreover, there are monitoring devices such as electric screwdrivers with torque & angle detection, plus vision systems as well as

opportunities for robot integration. HMIs (Human Machine Interfaces) from Mitsubishi Electric's GOT2000 series are used for displaying the individual process steps, offering direct connectivity to the Poka Yoke controller, and meeting every display requirement from text through graphical symbols up to animations and augmented reality. Depending on requirements, the latest generation iQ-R or iQ-F PLCs can be used as controllers for the guided manufacturing solutions. Mitsubishi Electric's Guided Operator Solutions can be integrated in to production systems, so that workstations can be networked and resources controlled and monitored in realtime.

"Werkstatt Bremen is a full-fledged supplier to industry, able to ensure zero errors and meet schedules, and so the new workstations are a tremendous help", confirms Miriam Berger. News about the positive results in Bremen spread quickly. According to Andreas Kebbel, inquiries have come in country-wide from other mixed employee workshops. ■

What is Poka Yoke?



Also known as Guided Operator Solutions, Mitsubishi Electric's integrated manual picking system is based on the principles of Poka Yoke, a Japanese term that means 'mistake prevention'. Poka Yoke is a method of eliminating mistakes in a manufacturing or logistics operation at source before they can occur and can comprise of various component options.

Indicator light.

GOT2000 for easy visualization and diagnostics.

Terminals with opening/closing doors provide a physical barrier to selecting the wrong part, a highly effective method to eliminate mistakes. Additionally some devices are fitted with a display to identify how many pieces should be picked from any bin, again increasing operator effectiveness.

Support for electrical screwdrivers as well as additional tools such as barcode readers or vision systems that enhance quality control.

Programmable sequencer.