

Plug & produce in factory

automation: pressing and joining



Setting up production modules quickly, automatically putting them into operation and collecting production data at the same time – with the Smart Function Kit for pressing and joining applications, you can put a subsystem into operation in five easy steps. Here is a brief introduction and three practical examples.

5 EASY STEPS TO A FINISHED APPLICATION

Pressing, joining, assembling and forming – these typical processes in production lines take up a great deal of time and resources: from engineering and purchasing, to assembly, commissioning and programming, and even service. Process evaluation systems do not usually program themselves. The numerous recurrent, inefficient individual steps clearly go against the idea of the Factory of the Future. The Factory of the Future demands streamlined, standardized engineering processes, connectivity during operation and flexible production which can react dynamically to changing requirements. How can these properties be achieved in a cost-effective manner? The answer is very simple: a mechatronic toolbox made up of preselected kits comprising mechanics, electrics and

software can be designed, configured and ordered with a material number quickly using modern e-tools. Everything is delivered in a package. On location, the system can be put into operation within minutes with the help of a wizard. The process is set up via the intuitive Web HMI with the help of ready-made building blocks. These can easily be arranged in the correct order via drag and drop, and then they only need to be parametrized.



▲ Five easy steps towards the Factory of the Future: selection, ordering, set-up, operation and maintenance.

Thanks to functional modules from the software library, connection to a higher-level control system can be achieved quickly. The same applies to process evaluation and the exchanging of data via OPC UA or REST-API. Such an innovative “plug & produce” approach for typical pressing and joining applications is already available as a subsystem and in use. As a well-integrated part of production lines, it reduces the previous engineering outlay by up to 80 percent. Because new functions are added with each software update, the range of applications is growing all the time. Unlike with conventional solutions, the hardware components no longer need to be calculated, selected and ordered separately. This further reduces the engineering time and the costs. The following three examples give an impression of the savings that machine manufacturers and end users have achieved in practice with the Smart Function Kit from Bosch Rexroth for forces of up to 30 kN:

USE CASE 1: COMPLEX PRODUCTION LINE FOR ELECTRIC MOTORS

Situation: A manufacturer of special machines was to build a production line for electric motors on behalf of a customer.

Requirement: In order to avoid “over engineering”, a modular bundle solution for an attractive price was needed, one which could be integrated easily and flexibly into the line control system.

Solution: With a total of 11 Smart Function Kits for pressing and joining applications, the machine manufacturer achieved various applications with forces ranging from 0.4 to 19 kN and moving tool masses of between 0.5 and 15 kg. The processes are performed either through force joining with position monitoring or position joining with force monitoring. In terms of performance, the Smart Function Kits in the line work with very low cycle times of up to 1.5 s. Three example applications:

- Inserting ball bearings into housings
- Joining magnets
- Pressing bearing seats onto hollow shafts

The Smart Function Kit software visualizes the result of the individual pressing procedures as OK or NOK. This assessment is made on the basis of elements such as envelopes or windows which were defined using a number of reference curves.

Result: Thanks to the 11 preconfigured Smart Function Kits, the machine manufacturer could reduce the engineering time by 40 percent. The straightforward parametrization of sequential modules, which required no programming knowledge whatsoever, was a particularly positive factor. The open interfaces for the straightforward exchanging of data further simplified the system, as did the convenient connection to the higher-level control system, which thanks



▲ The Smart Function Kit can transfer process data and results to higher-level control systems via a fieldbus.

to the fieldbus module provided, was achieved quickly. The verdict regarding the first application – “Your product is pretty cool!” – suggests that further projects could follow.

USE CASE 2: FLEXIBLE SENSOR PRODUCTION IN SMALL BATCHES

Situation: An international sensor manufacturer was looking for a modular pressing solution for a flexible multi-product line producing small batch sizes of up to 10,000 product versions.

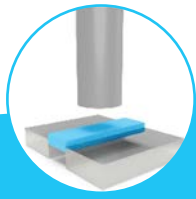
Requirement: The sensor lid should be pressed onto the housing with great precision with the help of distancing pins. In addition, it should be as easy as possible to put the solution together on location, it should allow automatic commissioning and it should be possible to set it up without classic programming work.

Solution: The sensor manufacturer identified the Smart Function Kit as a flexible, precise and cost-effective solution. The most important decision-making criteria were the economical production of small batches, code-free commissioning and straightforward recording of process data and results. Because the electromechanical linear axis must move relative to the workpiece, the Smart Function Kit first scans the housing surface and sets the zero point when the force increases.

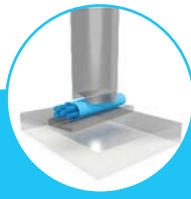


Result: With the Smart Function Kit, the sensor manufacturer got a high-precision, ready-to-use and preconfigured solution for a relatively low price. It meets the company’s requirements, namely 0.05 mm precision at forces of up to 8 kN. In spite of the great product variance on the line, the solution is 100 percent reliable. The straight-

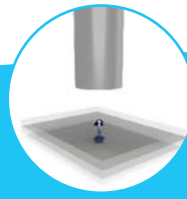
ASSEMBLY AND JOINING



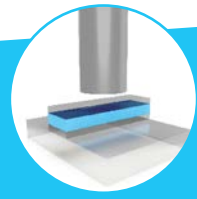
PRESS-FITTING
Example: Stator packages for electric motors



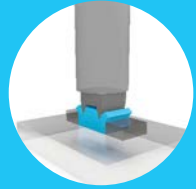
CRIMPING
Examples: Hoses, cables and plastic parts in the automotive industry



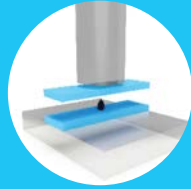
RIVETING
Example: Economical joining of sheet metal parts



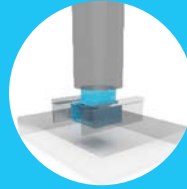
ASSEMBLING
Example: Bearings in a housing



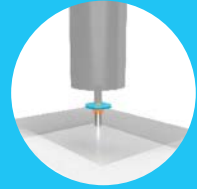
INSERTING
Example: Integration of magnets in lamination stacks in electric motor production



BONDING
Example: Bonding of plastic and composite materials

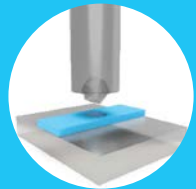


CLIPPING
Example: Connector contacts in connector housing

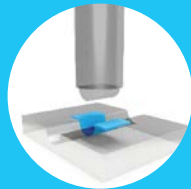


WELDING
Example: Hot plate welding

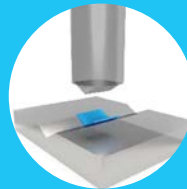
FORMING



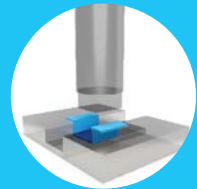
EMBOSSING
Example: Logos in plastic film in the plastics or packaging industries



SHAPING
Example: Boxes in the packaging industry

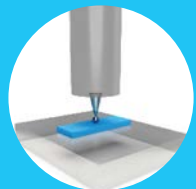


BENDING
Example: Metal sheets in the metal industry

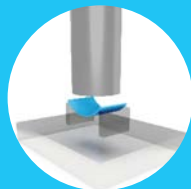


DEEP DRAWING
Example: Forming of thin sheet material

TESTING



TESTING / MEASURING
Example: Material test stands



TESTING
Examples: Test setups, e.g. for dampers, springs, brake pedals

Numerous applications, one tool:
With the Smart Function Kit, numerous typical sub-processes within a production line can be achieved and digitalized efficiently.

forward analysis of the pressing process with the help of assessment elements allows maximum transparency during the operating phase. All process data collected are fed directly to the electronic data processing system where they are stored and analyzed.

In the final stage of the production line, the kit obtains the individual production parameters from a chip on the workpiece pallet via an RFID solution. There are also plans to duplicate the line at other international sites and to scale the solution on an international level. From the user perspective, “[The] Smart Function Kit greatly improves transparency in production and is a proven solution for the Factory of the Future”.

rexroth SMART FUNCTION KIT



▲ Informative and quickly set up: reference curve with envelope and target force window.



▲ Modular drag and drop process configuration: via the intuitive Web HMI, the motion sequence and assessment elements can be set up with no programming work.

USE CASE 3: ATTRACTIVE RIVETING SOLUTION FOR AN AUTOMOTIVE SUPPLIER

Situation: An automotive supplier wanted to rivet electronics to a metal board inside a machine and was looking for a cost-effective solution.

Requirement: The riveting takes place in a machine with four tools which is connected to a higher-level control system. The solution should require little engineering time and allow quick commissioning on location with minimal programming.

Solution: A Smart Function Kit is used for each of the four riveting tools. Once the electronics have been prepositioned on the board, the components are fixed together

with great precision using aluminum pins. The “force joining” procedure allows the necessary +/- 15 N precision and monitors the position while the riveting force of approx. 900 N builds up over a distance of 2 to 3 mm.

Result: Originally, the manufacturer only wanted to order an electromechanical cylinder for the solution. Although programming knowledge was available, the manufacturer ultimately opted for the Smart Function Kit given its greater efficiency. The key reasons: its attractive price, quick delivery time and the demo toolbox for testing the subsystem.

DID YOU KNOW?

New functions are being added to the software for the Smart Function Kit all the time. A new update is available to users roughly every three months. Because the practical findings from customer projects are taken into account, the solution becomes even more practical and the range of applications for users becomes even wider.

CONCLUSION

The three reference projects show how quickly and easily functions for pressing and joining can be achieved today – and the extent to which they can be digitalized.

With the Smart Function Kit as a flexible, cost-effective and intelligent mechatronic toolbox, engineering can be streamlined by up to 80 percent. Together with automatic commissioning and straightforward programming including process evaluation and data transfer to the quality monitoring and documenting system, the time to market is reduced too. And the Factory of the Future moves one step closer.

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MORE INFORMATION ABOUT THE SMART FUNCTION KIT FOR PRESSING AND JOINING APPLICATIONS IS AVAILABLE ONLINE:



Learn more on our Webpage:
www.boschrexroth-us.com/smartmechatronix



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