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Three times as flexibility and highly dynamic

Real-time Locating System controls the factory of the future

Modern production processes are indispensable for Industrie 4.0 in order to meet the requirements for higher flexibility and reduced development times (time-to-market). However, developing new processes in the lab, such as additive manufacturing (AM) is one thing – the widespread industrial usage is a completely different matter. Innovative production concepts and the use of modern communication technology help the British company Materials Solutions to make AM suitable for industrial purposes.

Gordon Green is an engineer with heart and soul. His eyes light up as he reports how completely new products are being created using additive manufacturing. “There are product structures, such as turbine parts, which can only be realized with AM,” says Green. Air ducts can be included in the product here, which help to greatly reduce waste heat, for example. Reductions in weight can also be achieved in some components which, in aviation for instance, results in important cost advantages: Each kilogram of weight saved helps to lower kerosene consumption on every flight. It goes without saying that both industry sectors demand parts with maximum performance.

At the British company Materials Solutions, based in Worcester, Green supports in the development of the production design. With the move to a new, empty building, Gordon Green and the team had the unique opportunity to completely redesign the production layout. The result is nothing less than an archetype for the factory of the future: dynamically configurable production structures, flexible batch sizes down to single pieces, and complete documentation of each manufacturing step including the materials.

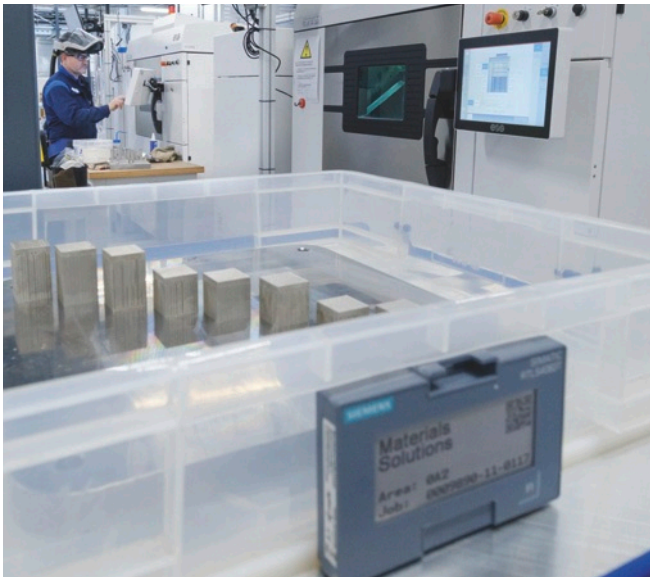
However, such a factory cannot be built according to a simple sure formula but must be tailored to the characteristics of the company. The specific production

processes are particularly relevant. Materials Solutions has dedicated itself exclusively to additive manufacturing using the laser-sintering process. The company works with nickel, aluminum or titanium; the products are built up layer by layer in a print farm. Here, metal powder is applied to a carrier plate and welded using up to four laser beams to form the desired product structures. The printer then applies the next layer of powder, which again is fused by the lasers with pinpoint accuracy – until finally the product can be removed from the printer. The product, though, is not yet ready. Depending on the specification, a temperature hardening is required; the printed products must be separated from the base plate; further (machining) processing steps need to be carried out, etc.

The main cost driver is the print farm. Each of the high-precision machines used costs several hundred thousand euros to purchase – correspondingly high is the cost per printing process, which can even take several days depending on the product. The production process is only scalable to a limited extent: If four times the throughput is desired by using four laser units in one machine, the costs also rise by nearly a factor of four. Special attention must therefore be paid to the flexibility of the machinery and the maximum accuracy of the processes, explains Green. This starts with the suppliers of the metal powders, who at first had to get accustomed to the quality requirements of Materials Solutions. Whereas a few wasted start-up parts and some rejects are to be expected in traditional applications, this is not acceptable with AM due to the long throughput times and high costs.

But one's own processes, too, need to be adapted to the special requirements. Materials Solutions is challenged with three dynamics and flexibility. First, because of the low economies of scale, AM is particularly suitable for small

The use of materials is presently still documented manually.



The SIMATIC RTLS ePaper transponders make innovate interactions between employees and IT systems possible.

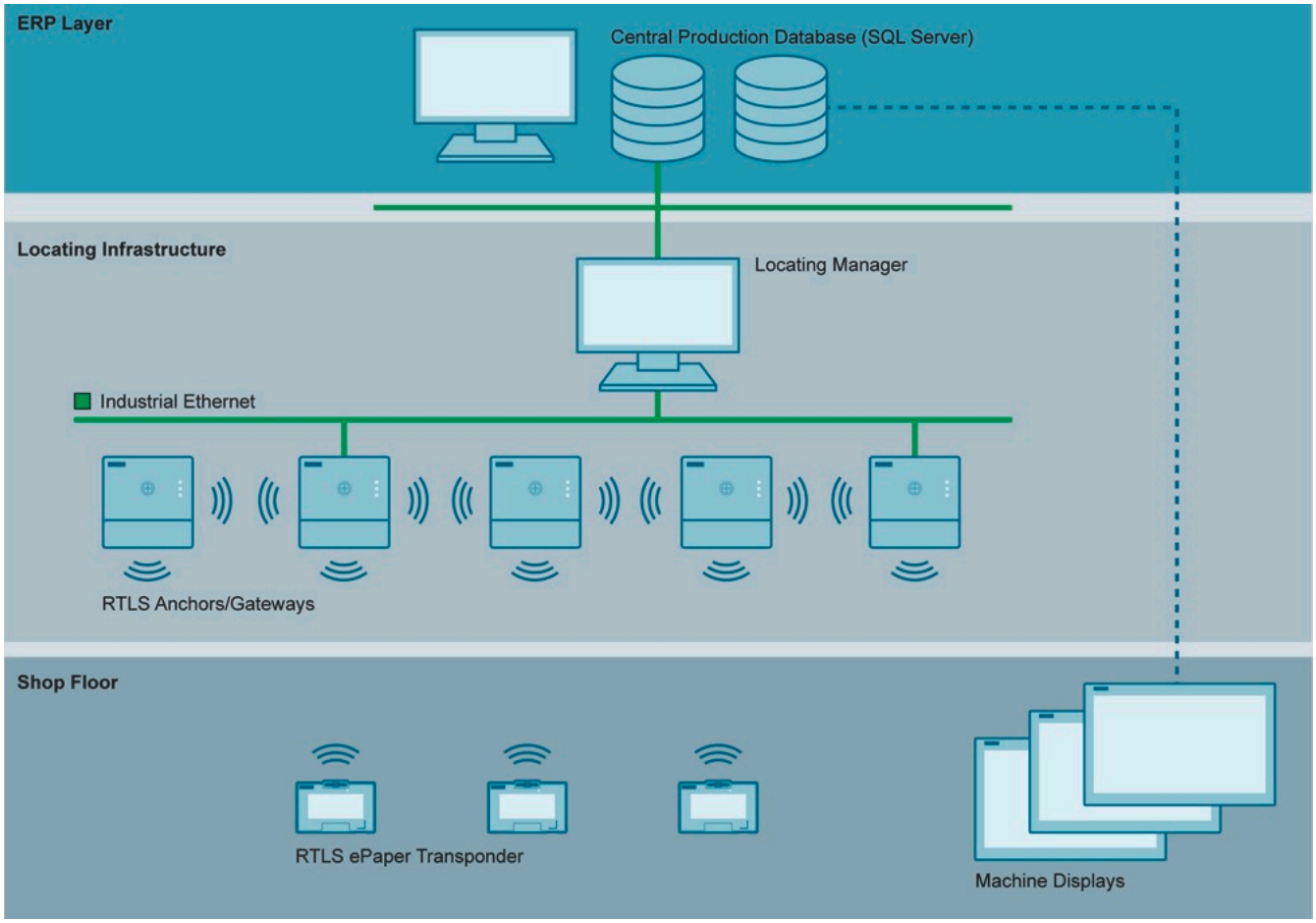
series such as prototypes or spare parts, or special niche products that cannot be manufactured conventionally. So there are hardly any orders consisting of several hundred pieces, but a lot of single-unit and very small-scale production runs. This poses no problem in terms of production, since AM does not require any set-up procedures. Rather, the material transport is a critical core process: The alloys used are just as diverse as the products themselves. Not only the correct use of the material but also the complete monitoring and documentation of the material is extremely important for the process quality: How much material was withdrawn when, how long was it in contact with the ambient air, etc.? The third perspective is then the machinery itself. This is where constant additions are made to be able to take advantage of technological advances of the printers, for example, for larger product structures. Accordingly, the production must be constructed in such a way that it can be relatively easily reconfigured. "Fixed linking with conveyor technology therefore makes no sense at all for us," says Gordon Green. Instead, automated guided vehicles (AGVs) are used to transport products and materials.

But that still is not enough to ensure the production quality. Monitoring is required when filling the machines as well as tracking the products and documenting material usage. The ideal solution here has turned out to be the use of a radio-based real-time locating system (RTLS) from Siemens. Nicholas Turner, project manager for the RTLS rollout, first cites the high flexibility of the system as a decisive advantage. "Especially because we have to reconfigure the machines again and again and also support different applications – products, materials, AGVs – RTLS is the right choice," says Turner. Rather than offering a single-point identification as

The RTLS infrastructure can be used for a variety of applications.

with RFID or barcodes, RTLS acts as an infrastructure for a variety of applications. In the production halls of Materials Solutions, approximately 50 so-called Anchors were installed, which ensure the localization of the (mobile) transponders and, at the same time, provide location information as a Gateway to the target applications via the Locating Manager. The cabling is extremely cost-effective – thanks to Power-over-Ethernet (PoE), a single cable is sufficient. And commissioning is also extremely simple thanks to the auto-configuration.

Turner and Materials Solutions decided to use SIMATIC RTLS from Siemens for two reasons. For one: The localization software fits seamlessly into the IT architecture at Materials Solutions. The SIMATIC RTLS Locating Manager transmits the location information to an SQL server, which also manages the data from the ERP system. It is thus possible to combine the "digital twin" and RTLS information in a simple link table. For the employees at the machines, both sets of information can be seen at a glance and can also be used for the process control. "An AGV can now be ordered to go to specific goods at the push of a button – thanks to RTLS, the location information is already in the system," states Turner. The manual documentation of material withdrawals can also be digitized this way.



The SQL interface of the SIMATIC RTLS Locating Manager allows for easy, high-performance integration with the ERP system at Materials Solutions.

A second important advantage is the ePaper transponder from SIMATIC RTLS. These small radio devices are equipped with an energy-efficient display that shows dynamically changing information to the workers. The material or corresponding order of a stationary or transport container is thus clear at first glance. “This allows for completely new forms of process integration between employees and IT – a new level of digitalization,” says project manager Turner. The depiction of 2D codes on the display also helps to create an interaction with other systems.

For Turner, the journey is not yet over – further applications are gradually being developed, tested and rolled out. The RTLS project is planned for two years following the start of the infrastructure. RTLS will also be utilized as an analysis tool, for example, to detect possible bottlenecks in the flow of goods. One thing is clear for Materials Solutions: To play with the best in terms of digital competition, one not only needs innovative products and production processes – sometimes the production organization also has to break completely new ground.

Security information

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens’ products and solutions only form one element of such a concept. For more information about industrial security, please visit

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