SIEMENS

Technical article

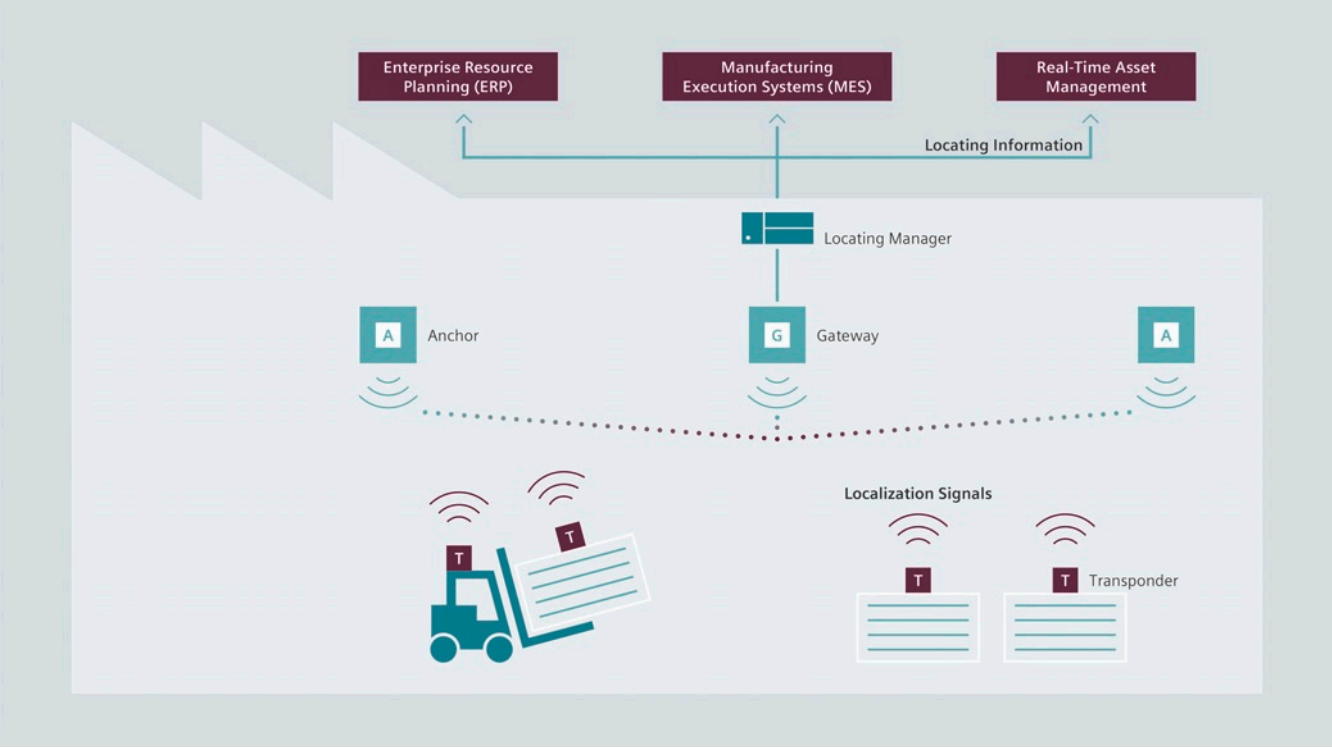
# The answer to the thrilling question of the “where”

## Real-time locating systems for digital logistics and production

**How can material flow and production sequences be organized in the best possible way? A question that organizational experts and manufacturing specialists have to face every day. For the perfect production process, all the goods necessary must be provided as effectively and as efficiently as possible – and in increasingly dynamic structures. New technologies such as real-time locating form the basis for new processes in production and logistics.**

It is Monday morning. The early shift was to begin with the production of an important order – but an assembly part is missing. According to the enterprise resource planning (ERP) system, it was delivered on time, but at the indicated storage location, there is a gaping void. The remedy is provided by a real-time locating system (RTLS). By means of RTLS, the current position – the “where?” – can be synchronized in real time and fully automatically with the IT systems. Instead of having employees search for the part, a mouse click is enough, and production can begin. The locating platform SIMATIC RTLS, the real-time locating system from Siemens, delivers the locating data wirelessly, accurate to within centimeters.

Locating is therefore a key technology to identify optimization needs, to implement solutions and to improve them continuously. Thanks to RTLS, it is always known what is located where. Because only if the “where” is known, processes can be automatically controlled or answers for a possible optimization be found. In addition to avoiding search efforts, it is above all the automatic synchronization between physical location and the virtual data record that constitutes the value of a locating system. Thus, certain parameters of the product quality, for example, which machine was used and when, can be automatically documented. Automated guided vehicles (AGVs) can




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

be automatically scheduled and controlled for the onward transport. And a complete overview of the use of mobile equipment – such as containers or tools – allows for the optimization of the inventory. Ultimately, RTLS creates the basis for a modern, dynamic and self-controlling process organization in the production.

**Components of the locating system**

A network-like infrastructure made up of the hardware components – Anchors, Gateways and transponders – as well as the locating manager software form the foundation for the centimeter-accurate locating in real time. Anchor and Gateway are the permanently installed reference components of the SIMATIC RTLS infrastructure. Depending on the environment and site-specific conditions, these are installed at regular intervals in the area to be localized in. The Anchor captures the signals of the transponders, gives them a position stamp and forwards the bundled data to the Gateway. Wireless communication to the transponders is used for distance measurement and general exchange of information. The Gateway bundles all data collected and transmits it to the locating server – the locating manager. The locating manager calculates the real-time location information from the transmitted distances and passes the information to a higher-level system.

**Hybrid technology for maximum scalability**

The entire SIMATIC RTLS localization infrastructure of anchors and gateways is highly flexible, since both components not only operate in the 2.4 GHz spectrum, but can also be used in the UWB range with the same infrastructure. This hybrid technology enables interference-free locating with maximum scalability in indoor and outdoor areas. With just one infrastructure, it offers locating with accuracy in the meter range as well as in the centimeter range. Examples can be found at forklift locating or in container management. Both objects are used indoors as well as outdoors and require different levels of locating accuracy depending on the requirements. The optimized antenna performance achieves maximum range with high accuracy.

Depending on the application and operational area, the transponders are attached to workpieces, robots, vehicles, etc. They are the counterpart to the Anchor and Gateway. At defined time intervals, they send a wireless signal to the Anchor and Gateway. Here, the two different locating methods TWR (two-way ranging) and TDOA (time difference of arrival) can be used. Use and type of transponder depends on the respective application. The compact, smallest battery-operated transponder is all-purpose and can be used for locating pallets as well as containers or workpiece carriers.


Anchors and Gateways provide the "where" of all mobile objects – from manufacturing equipment to materials and components to the finished product.

Transponders with e-ink display provide position-dependent visualization of information. These transponders are used for locating pallets as well as more compact and larger workpieces or containers. The bidirectional communication enables a data transfer from and to the transponders. Thus, relevant information can not only be directed to the higher-level systems, but information can also be returned from the system and directly displayed on the transponder. All components of the SIMATIC RTLS infrastructure have their own power supply. Anchors and Gateways are powered by an external 24 V power supply or Power-over-Ethernet. Transponders receive power through replaceable or rechargeable batteries.

**Advantages for the logistics of the future**

How can the logistics of the future be realized with RTLS? The bandwidth in these applications ranges from simple search and find to complex, automatically controlled processes. Simply avoiding search tasks can save considerable costs. In a specific application, 40 employees of an electronics company searched about 5 minutes per day for various materials or tools. What at first glance appears to be a small number of results in annual productivity losses of more than €300,000, before even taking into account the costs for late deliveries.

RTLS also ensures a complete documentation, which is essential for an industry-compliant quality assurance. An automatic capture of production sections creates transparency with respect to all material flows. All arrival and departure times of materials, products and tools are automatically recorded. Not only can quality assurance be proven with that, but also maintenance and repair work be better anticipated, and potential quality problems be faster responded to.

If the material flows are continuously captured, their monitoring and control is simplified many times over. Using container management as an example, this can be explained as follows: Through real-time locating, the transport routes and the utilization of all containers used can be retrieved and evaluated with high quality. If the frequency and duration of use of the containers is known, the stock can be optimally adjusted for best the capacity utilization, without affecting day-to-day operations. In addition, further optimization potential arises if location-dependent information combined with data from higher-level ERP systems or production planning is sent back to e-ink transponders.

**Transponder with display for new logistics concepts**

A SIMATIC RTLS ePaper transponder features an e-ink display so that the required data can be read by the employees at exactly the time it is needed in the production section. The use of ePaper represents an important building block for a paperless digital factory. The use of paper for the intermediate documentation within a production section is no longer process-reliable. The complex processes of new modern factories require new standards. Switching to digital is a logical consequence. On the one hand, tons of paper are saved, thus protecting forests and the environment. Furthermore, the work is made significantly easier. The employee receives the relevant data while in the corresponding production section. Exact information can be visualized in countless variations at the right moment. This makes the process stable and better. This bidirectional communication in real time enables data to be collected even more precisely along the entire process chain in order to continuously drive the improvement process. Production throughput can be increased while simultaneously raising quality and decreasing costs.


The ePaper transponders enable new forms of interaction between employees and IT systems at Materials Solutions.

RTLS can also support navigation. If necessary repair work is pending, it is important that external maintenance personnel are guided as targeted as possible in the shortest and safest way to the destination. Accurate location information with site-dependent instructions helps in avoiding hazardous situations and in efficiently directing staff depending on their position and the respective maintenance tasks.

All movement sequences of production means or tools in a smart factory can not only be better understood and controlled due toreal-time locating. The key to the digital enterprise are flexible and self-controlled production and logistics concepts. Automated guided vehicles (AGVs) or mobile robots are a core element for dynamic organizational processes in today's industry. The determination of the optimal movement paths and workloads makes self-control possible. The created transparency over the complete production thanks to locating data is the cornerstone for today's and tomorrow's digital concepts of industrial production and logistics.

**Connection to ERP, MES or cloud**

The x, y, z coordinates are supplied by the locating manager via a standardized ISO interface or via the open Message Queuing Telemetry Transport (MQTT) protocol to the higher-level systems of the existing IT system landscape. This means that the movement data can be flexibly integrated into existing ERP or MES systems and be processed there. The use of cloud-based platforms such as MindSphere is also possible: across plants, data from a wide range of sources and systems come together here. For advanced analytics and application, the data is transformed into usable, valuable knowledge. Existing potential can thus be tapped even better.

**Proven in practice**

SIMATIC RTLS as an answer to the requirements of the factory of tomorrow is not a futuristic vision but has already proven itself in numerous installations. An example is Materials Solutions in Worcester, England. The company is engaged in the industrialization of additive manufacturing using the laser-sintering process. The factory is constructed completely without conventional materials handling technology, because the dynamics in the machine park result in constant reorganization. Instead, the flow production of materials and semi-finished products has been basically virtualized through the use of AGVs. RTLS transponders on the containers for workpieces and products together with the SIMATIC RTLS infrastructure ensure an automatic flow of goods in the factory. A special advantage: The ePaper transponders enables a novel, dynamic communication between employees and IT systems, which represents another building block for increasing flexibility. The factory of Materials Solutions is thus not only a leader in production technology, but also has given itself an equally modern manufacturing concept.

**Conclusion**

Real-time locating data thus serves as the basis for innovative manufacturing concepts and digitalization projects. It is a basic building block for the development and establishment of digital processes, products or services. The annoying search at the beginning of the week is eliminated and the optimization of the processes through the use of new digital production and logistics concepts can start.

**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 **https://www.siemens.com/industrialsecurity**

Published by
Siemens

Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

PDF
Technical article
FAV-DI-PA-18/19-5
BR 0619 4 En


**www.siemens.com/simatic-rtls**