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# PRODUCTION MONITORING 1

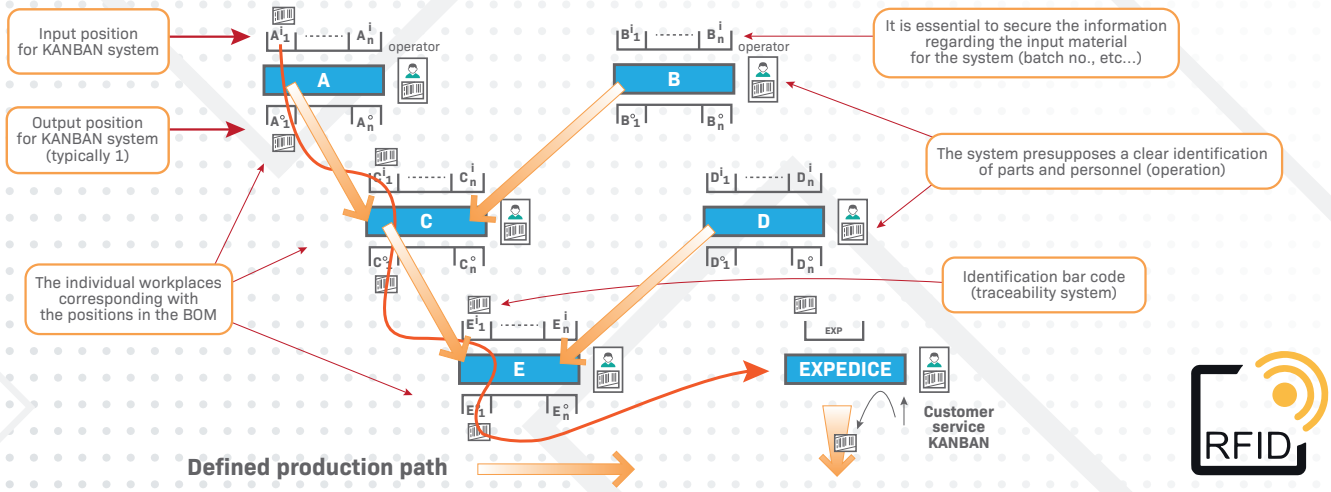

## Production traceability

Traceability (hereafter referred to as TC) is a way of tracking the movement of work-in-progress and recording packaging. It ensures the registration of monitored locations (storage areas, co-operative locations) of individual products (or packaging), on-line tracking of their movement through the production process, tracking the work in progress of a production order based on the identification of the current stage of production. If it is not permissible to directly mark each product with an identifier that would be placed directly on its body, temporary marking of the transport unit, then packaging or transport box is used for the purpose of TC. A prerequisite for correct operation is the observance of the correct FIFO order when placing parts in the box and the treatment of limit states, e.g. when removing a reject. When monitoring the packaging, the system also includes regular maintenance of the packaging. It is possible to fine-tune the maintenance cycles of the packaging by setting the expiry date. A prerequisite for the correct functioning of TC is the necessary quality technology for clear identification. For this purpose, in addition to the latest RTLS technology, other industrial marking and reading technologies such as barcodes, 2D codes, NFC or RFID are used for product location. If the nature of the product does not allow it to be uniquely marked in a cost-effective manner, we can provide clear identification by tracking the work package (blister) and the position of the product within it.

The TC ensures forward and backward traceability of the current location of a product or its component at a workplace. This information is available in traceability to each production step.

Forward traceability ensures that all products or parts that contain the specified component or material are located, both in ongoing production and among already produced pieces (search for affected products, based upon a quality control initiative). Traceability will allow to locate all components (and batches of material) used in a product that has already been diverted (useful in case of complaints).

The TC system can also be used for production quality control, e.g. when a wrong batch of material is input, it can immediately identify and trace all parts in-progress and finished products affected by this batch. Action will be taken before the affected products are shipped to the customer.



# Production process data collection

Data collection from machines and production lines is used to obtain up-to-date information on production status, number of products, and number of defective pieces or downtime, which can also be interactively supplemented by the operator with data of their causes. Modern technology for collecting data from machines or displaying it via terminals in the production line area ensures an error-free evaluation of reali current status (which is often difficult to achieve when manually entering the data into predefined forms). Information about production operations is accurate and details of the work performed can be transferred directly to the ERP system.

The production data acquisition module performs tracking of incoming parts into production, records values of critical process parameters during production, automatic control of the sequence of production operations, control of production run-off, analysis and evaluation of process errors and validation of the production process(es). Due to the variety of machines used for data acquisition, it is not possible to universally determine a single suitable solution but individual adaptation is envisaged.

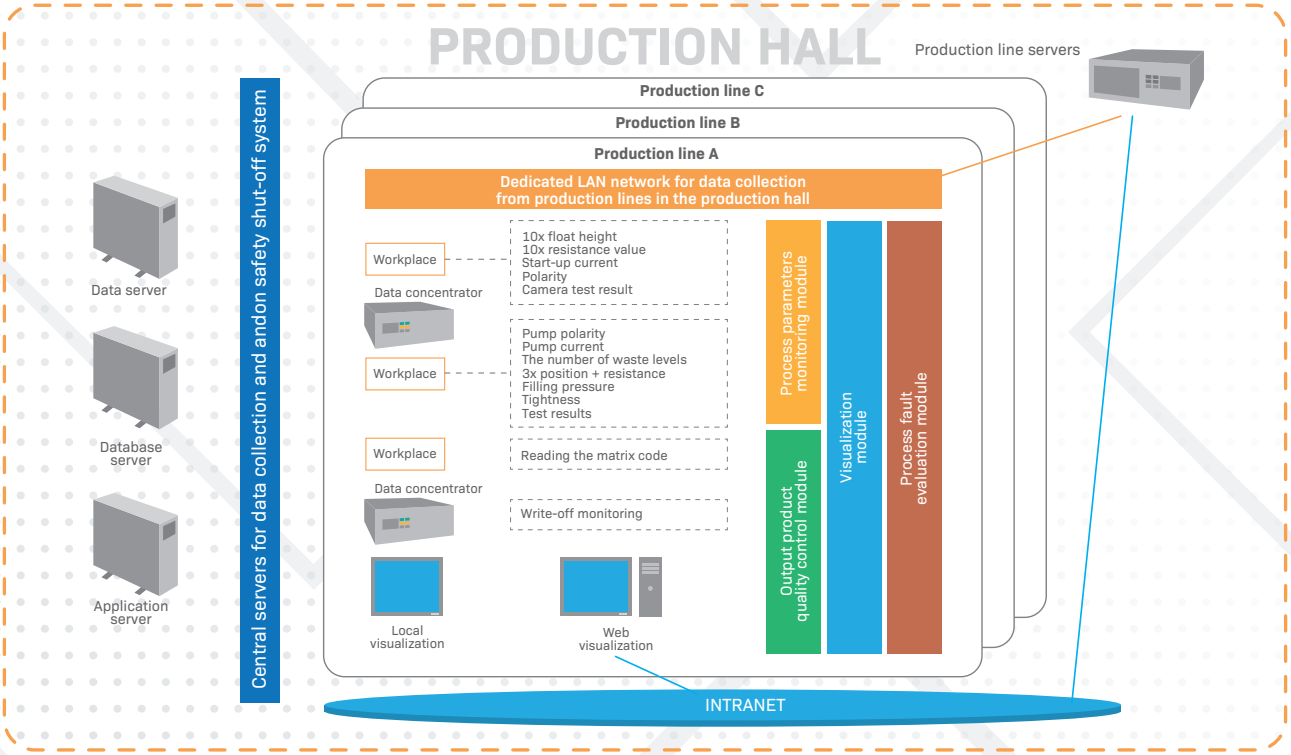
Automatic data collection from production is achievable in two ways:

- **Data collection from the control system:** Connection to an existing and documented data output of the monitored machine, for example via an OPC UA server.

- **External sensors (inductive; optical; etc...):** Solution using additional external sensors that detect production or non-production status, matching or non-matching product, selected product parameter, without direct connection to the machine control unit. In this way any machine can be equipped with sensors based on optical sensors, electromagnetic sensors, counting scales, etc., after adding sensors to the production site.

The automatic data collection is often supplemented by data entered manually into terminals; for example at the production transfer station. The terminal can also be used for possible manual correction of OK/NOK number of pieces produced and other communication with the production system. In the case of manual removal of produced pieces (or even for monitoring of performed production operations), the terminal can be supplemented with various technologies for retrieving information from the production order or other sources, or an attendance card/chip reader for quick operator login (authorization). The data acquisition module can also collect information on the status of production machines, production lines or technological units. It can also include complete records of production, orders, materials used, product parts, including historical data.

## SYSTEM FOR COLLECTING AND EVALUATING DATA FROM PRODUCTION LINES





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