TURCK

Industrial Automation

RFID in industrial manufacturing, a special challenge, or sometimes the whole is more than the sum of the parts!

RFID has been the subject of an increasing number of positive as well as negative headlines in many newspapers – not just in the specialized journals – due to the proposed integration in identity cards, or based on the announcements by large supermarket chains intending to introduce RFID based customer cards and to apply RFID labels to all their goods. The cost saving and customer orientation aspects on the one hand are contrasted by the fears associated with the "transparent individual" on the other. The benefits and drawbacks of this application have been discussed in great detail and will continue to be the subject of much discussion, but we do not intend to analyse them further here.

One field of industrial manufacturing has being applying RFID systems practically unnoticed by the public eye for a number of years. No protests against the use of RFID systems have been evident here. What are the characteristic features of the industry where these systems are used and what exactly are they?

First of all we will examine the modern manufacturing process using car production as an example.
The developments in the industry have lead to the "personalised automobile" which inevitably lead to the introduction of RFID systems. In earlier years the cars were usually purchased "off the peg", whereas today the customer expresses his wishes for each car before production. Almost every single car is different and has its own individual features.

It is necessary to somehow mark every car with the desired features in order provide transparency and make them available at all times through out the manufacturing process. This is undertaken using various methods, as a universal solution for the entire manufacturing process does not yet exist or is unfeasible due to costing pressures, as a further special feature of automobile manufacturing is the utilisation of almost all classical manufacturing processes.

It is possible to encounter elements of mechanical engineering in conjunction with elements of transport technology, handling technology and logistics as well as general metal processing techniques, painting, presses etc., as well as a wide variety of different interlinked processes with varying demands, which partly differ significantly from those associated solely with the distribution of goods.
In addition to speed and safety there is also a demand for robust systems which are insensitive to every type of interference and extreme temperature influences.
Structurally, there are hardly and differentiations in the systems (see Fig. 1).

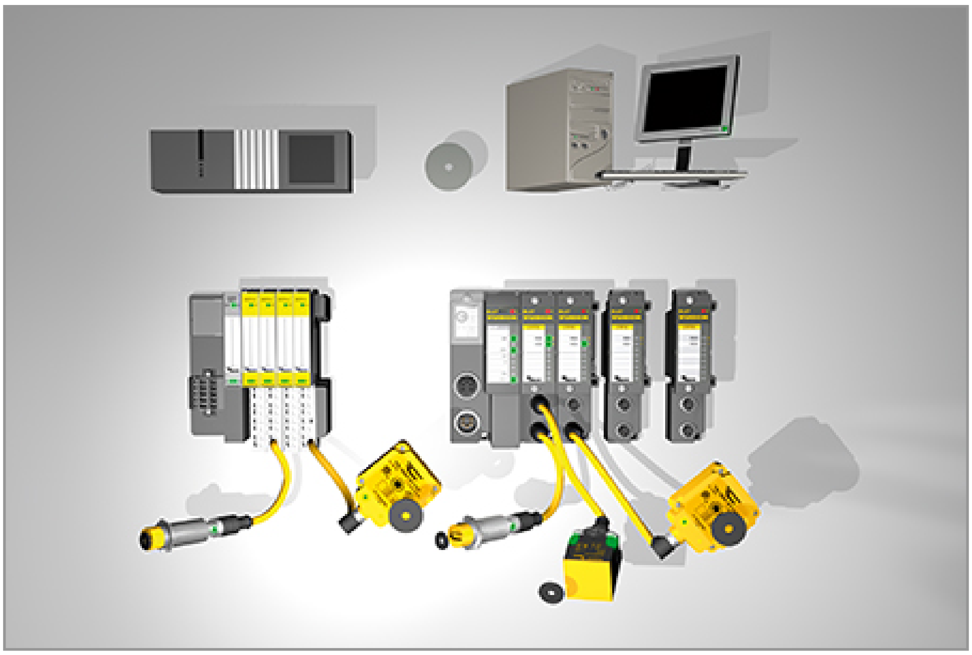

Fig. 1 System overview

Each RFID system always consists of data carriers (TAGs), read-write heads (transceivers), interface modules, the higher-levels of controls, and if required, logistics systems as well as the software required for implementation. The similarity with identification systems based on barcodes is amazing. If TAGs were replaced by barcode labels and transceivers by scanners, the well-known barcode system with all its benefits and drawbacks would be the result. It would appear as if time had stood still. This changes however, if the structure is separated into its component parts and they are examined individually with their features. Nevertheless, this affinity considerably simplifies the integration into the world of automation.

Data carriers, also standardises for extreme temperatures

Fig. 2 HT data carriers

Barcode labels regardless of if they are one or two dimensional can only be read in one direction. This also initially applied with RFID technology, as the first data carriers only originally contained just read only memory, so that the most important features such as insensitivity to dirt and humidity as well as the recognition through non-transparent media could be viewed as benefits in comparison to conventional barcode systems.

This situation has changed drastically up to the present day. Modern data carriers feature a write capable memory based on EEPROMs, and in more recent times, even FRAM technology is available with memory sizes up to 64 kBytes.

FRAMs can be written to at least 1010 times and only EEPROMs up to 5 x 105 times and even feature a significantly higher speed. If considerable demands are placed on speed, or if data must once again be stored on the TAG, the only choice of data carrier can be FRAM memory. If for example data were written onto an EEPROM every second, the memory is no longer safe to use after just 6 days where as this would only be the case after 300 years with the FRAM.

The transmission features have also developed in a similar way. Whereas initially the transfer of data according to the quasi-standard was undertaken at 125 kHz, or alternatively proprietary frequencies such as 1.5 MHz have been used, there are currently different frequencies in use. Only three common frequencies are permitted world-wide and these are 125 kHz, 13.56 MHz and 2.45 GHz, i.e. for companies who operate world-wide only one of these frequencies is worthy of consideration.

In the field of industrial system technology the emphasis is being placed more often on the ISO 15693 standardised 13.56 MHz technology, as it provides for a direct powering of the data carrier via the RF field. In comparison to the 125 kHz technology it provides transmission rates which are several times faster and which are also well outside the range of industrial interference fields.

In addition to the these sources of interference, these data carriers are also subject to extreme temperatures in many manufacturing environments. Temperature ranges from -40…+210°C are supported. Solutions are provided by special data carriers which are protected against these temperature ranges.

The BLident HT solutions feature extremely small dimensions and the use of standard data carriers and thus enable universal use (see Fig.2). Thus the same read-write heads can both read and write the HT data carriers as well as the more attractively priced "normal versions".

Write-read heads

The designation indicates the difference here. Writing and reading of data is possible, in contrast to the pure scanning operation involved with the barcode system or some outdated RFID systems, which still only use read heads from the times when just "read-only data carriers" were used. And the term "Transceiver" states nothing more than it is comprised of "Transmit" and "Receive".

For industrial use, the standardised housing designs which have evolved over the years are ideal. They can be integrated optimally in the corresponding environment and every technician knows how to install them, and an entire range of attachment accessories are available (see Fig. 3).

During the installation you must only consider restrictions similar to those which apply with the use of inductive sensors, such as flush or non-flush or the necessary clearances to each other to avoid mutual interference. Functions which provide for exclusive switch on and off are also helpful. Thus the clearances between the write-read heads can be matched without influencing one another.

Fig. 3 Write-read heads

Interaction between data carriers and write-read heads,

or the question posed regarding: “achievable distances, speeds and data quantities“, the "crucial question" for many users. This is the first question with which you are confronted, as these are the known parameters from the application which the user can define.

Variables such as: "recommended write-read distance = 40mm“ or "data transfer with 2kbps“ etc. are only helpful if complex calculations are to be solved as every combination of data carrier and write-read head delivers different variables.

Simulations are useful here, such as for example the configurator of Blident which automatically completes the corresponding calculations and which allows the user to "play" with the application variables, and provides the user with a possible selection for his or her application. (See Fig. 4)

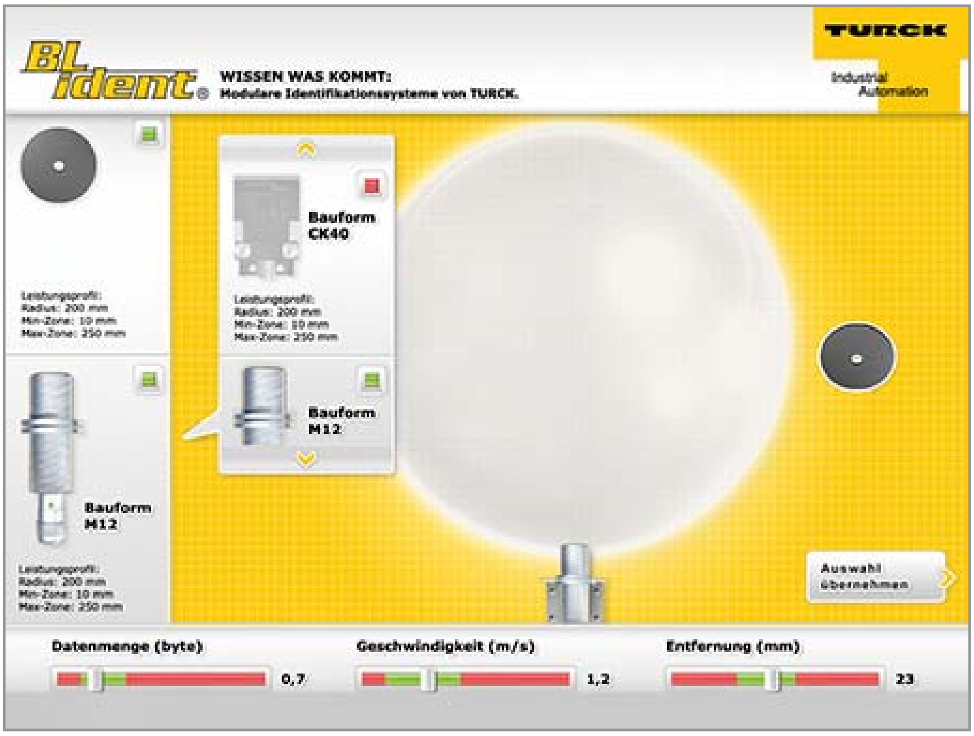

Fig. 4: A recording with the BLident configurator.

The connection from above, the interface module

The interaction between the data carriers and the transceivers is one of the primary factors of all RFID systems, however the connection to the control world is not without its own difficulties. They are sometimes the subject of delays and difficulties in the communication channels.

Accordingly, the reaction times and the application speeds are reduced and the manufacturing costs are increased unnecessarily. BLident relies on the separation in this case, i.e. the asynchronous processing of individual commands. Accordingly, read and write commands can be saved independently of the physical presence of the data carrier in the so-called "air-interface" of the transceiver in the interface modules.

As soon as a data carrier enters the "air-interface" they are processed without delay. Theoretical application speeds of up to 30 m/s are possible. The read data is stored in interface modules and can be requested successively from the higher control levels without a time lag occurring in the application. Reading and writing "on the fly" - in motion - becomes possible and the manufacturing speed can be increased significantly.

With the integration into the control world, the BLident has the option in most applications to fall back on standards used such as Profibus, DeviceNet or Ethernet. The so-called standard function module simplifies the integration into the control world. The system also offers a simple solution with expansions.

The addition of interface modules allows the capacity of a fieldbus node to be increased to up to 8 write-read heads and enhances the planning security by these potential reserves (see Fig. 5).
All transceivers connected in this fashion are processed in parallel.

Fig. 5 2, 4, 6, 8-channel interface module

Recapitulating it is possible to state that BLident incorporates the features of previous RFID systems and the new innovations, to provide a solution in which the demands of a modern production environment are combined with "more" functionality and flexibility and the need for cost optimisation. Sometimes the whole is really more than the sum of the parts.

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