

Different levels to connect machines - 4.0 made real by Sirris

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Peter ten Haaf

4.0 MADE REAL by Sirris

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Machines and equipment can be connected in several ways, each offering a dataset that differs in level of detail and information. Depending on your needs, time and budget you can select the most suited connection method. Within our 4.0 manufacturing system different methods will be demonstrated.

When talking and thinking about connecting machines one of the first questions to answer is: what do we want to achieve with the data we will collect? Depending on the answer, you will end up with a different solution. Within our 4.0 manufacturing system we have defined four levels of connectivity with increasing level of detail and information and, therefore, also offering an increasing range of potential actions. Of course, a higher level requires also a more complex connectivity solution.

- **Level 1: Shop floor**
  In the first level we want to obtain the information we can observe with our own eyes when crossing the shop floor. In general, it concerns information such as: is the machine running, idle, in error, etc. Most information we collect ourselves from observing the coloured lights of signal posts most machines have installed. Collecting these data can be done by reading the electric signals going to the coloured lights.
- **Level 2: Machine**
  In the second level more information on the machine activity is desired. Not only the status, but also some more detail on program running, tools used, start and stop timestamps, etc. is being sought. In this level it will be necessary to connect to the machine controller or even the PLC, to read out the necessary data. Modern NC controllers offer special connectivity packages allowing just that.
- **Level 3: Process**
  In the third level we are looking for actual process data that allows us to monitor and evaluate (in real time) the manufacturing process. Some data can already be obtained from the internal machine sensors by reading PLC data (power consumed, torque needed, etc.), but in most cases you will want to add your own sensors to obtain more detailed information. The challenge here is to combine multiple data streams each having an own structure, frequency, ...
- **Level 4: Quality**
  The highest level focuses no longer on ways to collect data, but on the ability to undertake the appropriate actions to ensure manufacturing quality. Here data from level 1 to 3 combined with quality inspection data will be analysed by machine learning algorithms to identify these actions.

When you start building or start transforming your existing system into a 4.0 manufacturing system connecting machines is a key component. However, it is not necessary to immediately go for the ultimate connection method if you don't have the time or budget to realise this from the start. 'Level 1' can be realised by cost-efficient solutions and gives you already useful insights on machine utilisation. In our opinion it is also more important to have access to even a limited dataset from all machines than full remote control of only one machine.

Within our 4.0 manufacturing system we will demonstrate the different levels and also different solutions within each level.

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Authors



Peter ten Haaf