Introduction

Process management is an important tool that makes it possible to measure the applicable variables within a process in real time, to compare the values, and to actively manage the process.
The advantages of a process management system are:

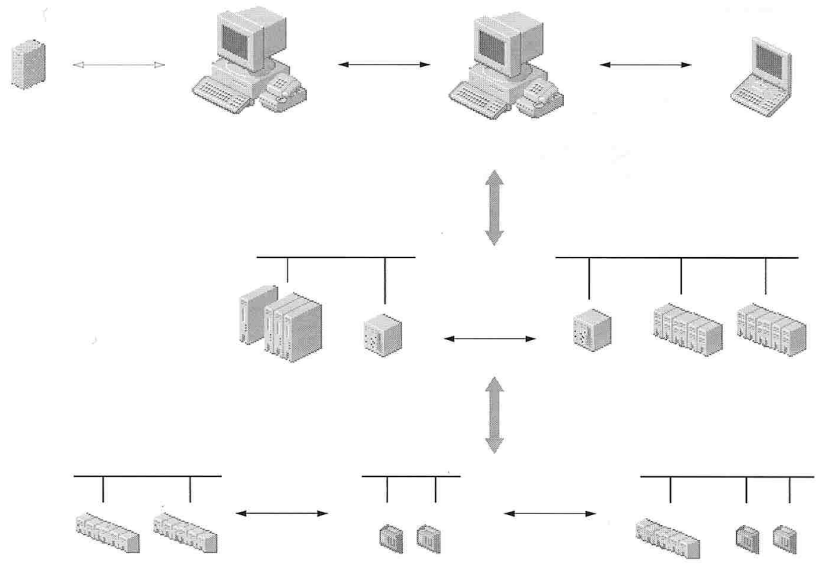
- Measurement of throughput and
- Measurement of effectiveness
- Analysis of the network quality

This section is divided into three parts:

- Field Equipment
- Monitoring
- Management

Levels in a process management system

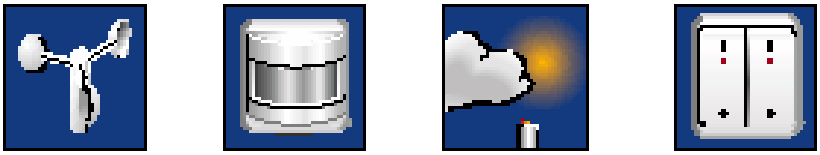
The hierarchical structure of a process management system provides for the specific delegation of tasks and functions relating to the differing automation levels. In a modern company the process management system may consist of numerous levels. A classic breakdown is illustrated below:



1. Field level

The field level is the most basic level at which various use-related equipment operates. The tasks comprise the following:

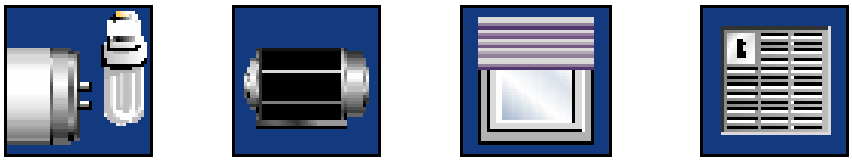
- **For determining the plant status by means of sensors**



Sensors

- **And for influencing the status of plant by the operation of actuators**

Actuators



Field level devices may produce either analogue or digital signals. These need to be differentiated when considering signal output and signal reception.

Analogue signals

Sensors producing analogue signals are normally used for measuring values such as temperature, pressure, moisture, flow rate, as well as for the reporting of the position of positioning motors through signal reception and continuously driven positioning devices through signal output.

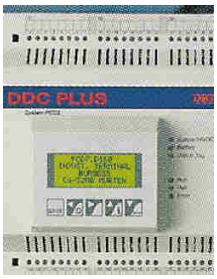
Digital signals

These signals have an on/off characteristic.
On the reporting side they can indicate a disruption has occurred or that the status signal is normal.
On the controlling side they may mean, switch on or switch off a single piece of equipment or the entire production line.

Data points
The generic term for these signals is the “data point“. Both analogue and digital data points physically exist.
There are also further variants and these are virtual data points. These points do not physically exist within the system – they cannot be physically touched or directly measured. They serve the purpose of better capturing and processing the status within an operating sequence. For example, where two digital input signals are combined into one logical result, an additional virtual digital data point is created.

2. Automation level

The processing units at the automation level are DDC automation stations. An automation station consists of:



- a microprocessor and
- input/output units

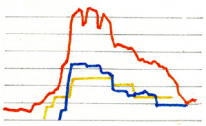
The physical data points are picked up by the input/output units and made available to the microprocessor.
Within the microprocessor, appropriate software runs so, that in conjunction with the input/output units, a completely functional unit exists. The software must be developed by experienced programmers who not only possess skills in software programming but also knowledge of the types of units required.

The tasks of automation stations in detail:

- Cyclical logging of the process signals and the corresponding output. This is a very important assessment criterion. If the programme cycle duration lasts longer than the particular process on site, then the outcome will be that the plant will never function efficiently!

- Controlling, regulating and calculative processing functions are carried out by the DDC system. It must be appreciated that not all systems available on the market are able carry out all the necessary mathematical functions. For this reason problems can arise with some applications if the relevant procedures cannot be represented mathematically within the programme.

- Processing functions are modular programme building blocks available from a manufacturer. This means that not everything has to be programmed for each plant unit and that individual programming components can be accessed directly. In this area differences also exist as to whether a system is freely programmable or can be freely parameterised. A higher degree of latitude is available with systems that are freely programmable.



Optimisation functions

In order to have a cost saving control technology installed, it is important to check the capabilities that the system offers. There are many optimisation functions that can be used in various areas of process automation. It is important to compare the individual systems available for this purpose and weigh up the associated possibilities for their use.
The following functions are examples suited to process automation:

- Free (night) cooling
- Optimum start/stop
- Cooling down protection
- Flexible switching
- Intermittent duty
- Soft start-up

Manual servicing level

Because automation stations must continue functioning when the central control system fails and thus must be able to be operated independently, the potential for manual servicing at the automation station level must be allowed for.
By means of this manual servicing level, output signals can be provided by hand e.g. for switching on a unit.
What happens at the manual servicing level must be reported back to the automation station so that during normal operations it can simply be seen whether a manual intervention has taken place. Manual interventions are displayed visually at the automation level by the use of lights. This ensures that a quick overview of what has been happening is available.

Observation unit/service display

A service display must be connected at the automation station. By this means, fast access to the programme is possible on-site. Any possible adjustments necessary can be dealt with without having any problems. It is therefore important for the operator that the service display enables communication in plain language. There are still systems around where the operator must determine an associated instruction by referring to code lists. These systems are now out of date and make the daily job unnecessarily complicated.

The technical potential to access all the connected microprocessors from the service display by means of a bus connection exists with some systems. This means it is not necessary to physically go to each station. This is made possible by distant intervention connections. It should be noted that bus wide servicing requires an appropriate level of knowledge from operating staff. This is essential because the status of the plant can't be directly observed.

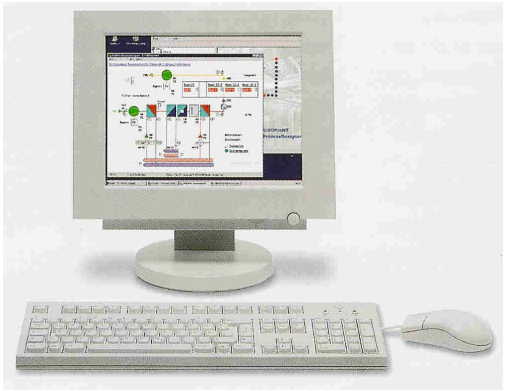
3. Management level

The data accumulating in the automation station is, to a certain extent, transferred over a bus system to the central management centre and used there for central servicing and monitoring of the whole plant.

Operating system

Exotic systems can easily become obsolete and, for this reason, do not have continuous support. Choosing such systems can result in having a system that rapidly becomes out of date because advances in this sector quickly lead to its replacement. Standard operating systems are the preferred option in order to obtain a better service at an acceptable cost and have better interoperability.

Visualisation



The display of plant information – "process visualisation" – takes place by means of a colour monitor or a touch screen. Process visualisation is normally produced by using plant diagrams that have been specially designed for this purpose. This ensures that its operation by the user is as easy and efficient as possible. Current values are displayed on the diagram so that plant status can be quickly ascertained visually. The software should ideally be in a position to display dynamic processes corresponding to the real time situation. Use of the display by operational staff is simplified further if the plant status is clearly displayed by using different colours for different states.

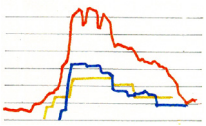
Trends

So-called trends can be designed in order to document the pattern of plant performance. In this way the continuous optimisation of a process becomes possible. As an additional benefit, using trends can lead to the achievement of an improved result at a lower cost input.

Analysis of the trends should also be carried out using standard software in order to facilitate simple processing of the data. This is because the data alone are of little value. For this reason the potential to be able to work in an interdisciplinary fashion must exist between the technical and operational departments.

Alarm memory

In addition, any alarms that are set off can be logged by means of an alarm memory. By using this function the plant can be monitored and possible repair work can be carried out before a major problem actually occurs. This is important because making a replacement or substitution at the right time can save a great deal of money. Operational staff can be given an appropriate early warning by the alarm so that as little time as possible is lost due to disruptions. For this purpose, the possibility of passing on an alarm report rapidly by means of a fax, SMS or voice message exists. Through a combination of trend analysis and an alarm memory, possible causes of faults can thus be quickly localised and corrected.



Interfaces

One important point to consider is the openness of the system. The case might be that within an individual company several different automation systems are being used.

However, for the operator it is important that only one visualisation software system is used for servicing, otherwise complexity in the plant is increased unnecessarily. In addition it is also important that data is also available for use in other systems. By taking such an approach, an homogenous overall system can be used on top of a range of differing systems.

In the area of communications the latest technological advance is over OPC interfaces. This technology is based on the OLE function in the Microsoft world and facilitates the simple management of various systems. The majority of large suppliers already have the appropriate interfaces and can thus communicate with each other.

In this area standardisation is also paramount. This results in money being saved and the realisation of improvements in functionality.