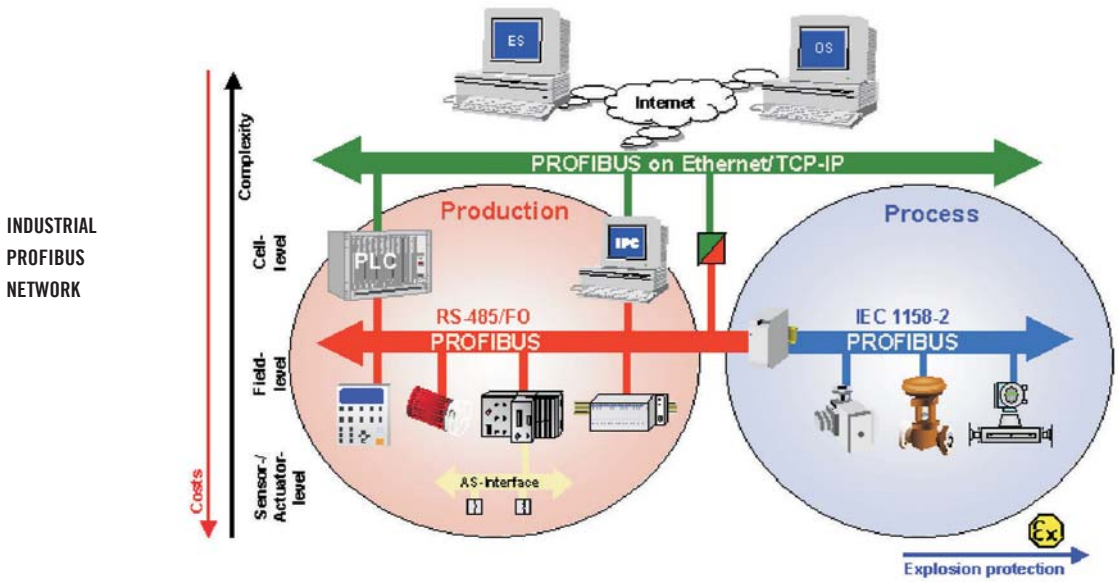
PROFIBUS GENERAL INFORMATION

PROFIBUS (Process Field Bus) is a serial communications standard for devices connected to automation networks (field bus). It is an open protocol defined by the DIN 19245 that became European standard as EN 50170 volume 2. Profibus is promoted by Siemens and is widely diffused all over Europe. Thanks to the definition of three different communication profiles DP, FMS and PA, this field bus is suitable for many requirements in automation system. Starting with applications requiring a high cyclical exchange speed of a reduced number of bit (Profibus DP), up to the management of complex communications between "intelligent" devices (Profibus FMS) or tasks strictly related to automation process (Profibus PA).
Hereinafter the attention will be focused on the DP version (decentralized periphery), which is the standard solution to manage devices by a bus. These devices usually are: I/O modules, sensors/transducers or actuators on a low level in automation systems.



PROFIBUS DP CHARACTERISTICS

NETWORK TOPOLOGY: It is a common bus structure (closed on both sides) where up to 126 devices can be connected at the same time. If the physical support is an RS485 interface, up to 32 nodes can be inserted without using signal repeaters/re-generators.
HARDWARE LEVEL: In addition to the RS485 differential serial technology transmission, an optical fiber connection can be used. In any event, DP and FMS devices can co-exist in the same network. They share the same harware interface communication (they are the same levels 1 and 2 of the ISO/OSI stack). The established standard requires an extremely accurate communication speed between 9.6 kBaud (min) and 12 kBaud (max).
DEVICES PRESENT IN THE NETWORK: It is possible to divide the devices into three classes: class 1 Master DP(DPM1), class 2 Master DP (DPM2) and Slave. The class 1 includes all the devices periodically exchanging information with distributed peripheral (they can directly manage the I/O network data with the other nodes, mainly slaves). The class 2 masters are designated to con-figure and to monitor network status and devices connected to it. Slaves have the task of directly exchanging information with the external word in both directions (in and out). Typical examples of slaves are: digital I/O, encoders, drivers, valves, different types of transducers, etc.
BUS ACCESS METHODS: Two configurations are available in a bus with single or multi master operating ways: the 'Token Passing' one, for exchanging information about network management among possible available masters, and the well known 'polling interrogation' for the master-slave communication.

The main characteristics implemented in the Profibus DP protocol are as follows:

Periodic data exchange: after the slave initialization step, every master is configured in order to exchange a maximum of 244 input bytes and 244 output bytes with every slave. The effective data exchange rate is based on the selected BaudRate, on the nodes present in the network and on the specific bus settings. Considering the maximum data exchange rate of 12 Mbaud, the Profibus DP is one of the fastest field buses.

Synchronization: command controls are available (they are sent by the master in multicast). This gives the possibility to create a synchronous acquisitions through a slave, a group or all the slaves (Freeze Mode). Outputs sent to the slave have similar behavior. (Sync Mode).
Parameterization and configuration security: After a preset period of time - if the communication between the master/s and the slave/s is not repeated - the system goes into a safe status.

Diagnostic functions: each slave can require to the master to be set up for reading its own diagnostic. In such way any possible problem occouring in the slave can be easily localized. The diagnostic can contain up to 244 bytes of information. Among them, the first six are mandatory for each DP slave.

Dynamic slave management: there is the possibility to activate or disactivate slaves present in the network. Moreover, it is possible to change by the bus slaves addresses that make possible this function.

Easy network configuration: main characteristics of each device present in the network are listed in the form of a GSD file complying to Profibus specifications. This simplify the set up and the configuration of the device by a graphic tools suitable for the purpose, such as the Siemens COM PROFIBUS software. As mentioned, the master-slave exchange data takes place periodically depending on the topology of the network and on the number of nodes present. However, before this step the slave has to be successfully parameterized and configured.

Parameter setting: the master sends to the slave a series of parameters necessary to specify its operation. The standard requires 7 bytes containing the mandatory information for the slave. Additional data can start from the eighth byte in the DU field (Data Unit, for more information see the Profibus DP) up to a maximum of 244 bytes for the communication frame.

Configuration: This step starts when the master has successfully set slave's parameters. During this step the master specifies the number and type of data, or better, the number of bytes to be exchanged with the slave both for incoming and outgoing information. This data is also present in the DU field of the communication frame: if the slave accepts the configuration, it can periodically exchange with the master.

Periodic exchange: The master specifies within the DU field frame the necessary information and the slave sends requested data within the reply frame. During periodic exchange, the slave may advise the master that a new diagnostic data is ready and then it asks to the master if it prefers reading this information in the next polling instead of the input data coming from the peripheral.

MASTER - SLAVE COMMUNICATIONS

As already mentioned, the master-slave data exchange is periodic and essentially depends on the network topology and on the present node number. However, before starting the data exchange, it is necessary that slave parameter settings and slave configuration have been successfully completed. More details are as follows:

Parameter setting: during this step the master sends to the slave a series of operating parameters necessary for specifying its operation. The standard requires 7 bytes containing the mandatory information for the slave. Additional data can start from the eighth byte in the DU field (Data Unit, for more information see the Profibus DP) up to a maximum up to a maximum of 244 bytes.

Configuration: when the master successfully set slave parameters, the configuration process starts. Then, the master specifies the number and type of data represented from the incoming and outgoing bytes number which has to be exchanged with the slave. This data is also present in DU field; if the slave accepts the configurations, it will begin to periodically exchange data with the master.

Periodic exchange: the master specifies within the DU field frame the needed information and the slave will send requested data in the reply frame. During periodic data exchange the slave may advise the master that a new diagnostic data is ready and then it asks to the master if it prefers reading this information in the next polling instead of the input data coming from the peripheral.

NETWORK CONFIGURATION BETWEEN THE GDS FILES