Automation systems – based on selected SIMATIC S7-400 components

Selected SIMATIC S7-400 components can be combined in the automation systems (AS) of the SIMATIC PCS 7 process control system.

The following characteristics make the SIMATIC S7-400 predestined for use as a SIMATIC PCS 7 automation system:

- Modular design without fans
- High expansion capability and ruggedness
- Single or redundant design
- Comprehensive communication facilities
- Integral system functions
- Integrable safety functions (Safety Integrated)
- Simple linking of central or distributed I/O.

Various automation systems are available with a price/performance ratio which can be tailored to your system requirements. All automation systems are equipped with an onboard PROFIBUS DP fieldbus connection. Additional PROFIBUS communication modules can be fitted if required.

Components

The automation systems are delivered as preassembled and tested complete systems without surcharge. In most cases they comprise:

- Racks with 9 or 18 slots, which can be physically separate in the case of redundant systems
- SIMATIC standard CPU 414-3 / 414-3 PN/DP, 416-2, 416-3 / 416-3 PN/DP or 417-4 or redundant CPU 414-4H or 417-4H
- 24 V DC or 120/230 V AC power supply including backup battery/batteries
- Main memory from 1.4 MB to 30 MB
- Memory card with 2 to 16 MB RAM (max. 64 MB)
- Interface to Industrial Ethernet (via CP or integrated in CPU)

Each of these bundles is combined with a SIMATIC PCS 7 AS Runtime license for 100 process objects (PO). The number of POs can be extended with cumulative Runtime licenses for 100, 1,000 or 10,000 POs.
Automation systems

Standard automation systems

The AS 414-3 / 414-3IE automation systems are tailored for small applications with small quantity frameworks. They therefore meet the demand for low-cost initial implementation with a modular and scalable system. Larger quantity frameworks can be implemented with the AS 416-2, AS 416-3 / 416-3IE and AS 417-4 automation systems. These systems are preferred for medium-sized or larger systems.

In the AS 414-3IE and 416-3IE, the Industrial Ethernet interface is integrated in the CPU. They offer the same performance as the comparable AS 414-3 and AS 416-3, but differ in terms of the time synchronization (NTP instead of S7 synchronization).

The firmware of the standard automation systems can be updated either by Flash EPROM memory card (8 MB) or from the central engineering system over the plant bus.

Fault-tolerant automation systems

Fault-tolerant automation systems are used to minimize the risk of production failures. The higher investment in fault-tolerant automation systems is often negligible compared to the costs resulting from production stoppages. The higher the costs resulting from loss of production, the more important a fault-tolerant system becomes.

The AS 414H and AS 417H models are the fault-tolerant automation systems for use with SIMATIC PCS 7. They are based on the 1-out-of-2 principle and switch to the backup system in the event of a fault. These systems use a completely redundant design to maximize availability. This means: all major components such as CPU, power supply and hardware for coupling the two CPUs are present in pairs. Which other components are also made available in pairs in the interest of availability depends on the particular automation task.

The two subsystems of a redundant automation system are electrically isolated from one another. This increases the system stability with respect to electromagnetic interference. A redundant automation system can be installed mechanically in a one-rack or two-rack architecture. Automation systems are installed in two racks, for example, if the two parts of the automation system have to be physically separated from one another by a fire-resistant wall. Appropriate complete units are available for every type of application. Mixed operation of redundant and standard systems is also possible.

The firmware of the fault-tolerant automation systems can be updated by means of a Flash EPROM memory card (4 MB).

Safety-related automation systems

Safety-related automation systems (F/FH systems) are used for critical applications in which an incident can result in danger to persons, plant damage or environmental pollution. The F/FH systems collaborate with the safety-related F-modules of the ET 200 distributed I/O systems or the fail-safe transmitters connected directly via the fieldbus to detect not only faults in the process, but also their own, internal faults. They automatically bring the plant into a safe state in the event of a fault.
The safety-related automation systems are based on the hardware of the AS 414H and AS 417H automation systems that are extended by the S7 F Systems software package to include safety functions.

They are available in two versions:

- Single-channel AS 414F or AS 417F (with only one CPU, safety-related)
- Fault-tolerant AS 414FH or AS 417FH (with two redundant CPUs, safety-related and fault-tolerant)

The redundancy of the FH systems only serves to increase the availability. It is not relevant to processing of the safety functions or the associated fault detection.

The safety-related automation systems are TÜV-certified and conform to the safety requirements up to SIL 3 in accordance with IEC 61508.

In the multitasking systems, several programs can run simultaneously in one CPU, both Basic Process Control (BPCS) and safety-related applications. The programs are reaction-free, i.e. faults in the BPCS applications have no effect on safety-related applications and vice versa. Even special tasks with very short response times can be implemented.

In the parallel processing of BPCS and safety functions in one CPU, mutual interference is prevented by ensuring that the BPCS programs and the safety-related programs are kept strictly separate and that the data exchange is by means of special conversion function blocks. The safety functions are processed twice in different sections of a CPU by means of redundant, diverse instruction processing. Potential errors are detected by the system during the subsequent comparison of results.

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Typical mixed quantity frameworks for SIMATIC PCS 7 automation systems