

Data Safety for Automation Technology - Protection against Production Downtimes -

Thomas Hoerauf
GEPA mbH

Abstract

Over the last years ethernet networks and computing power has increased rapidly bringing with it an increase in the amount of data which has to be administered and backed up. Also more and more scada systems or CNC stations are placed and used in the production. Each station is running with a different application and the administration of these applications becomes more and more difficult.

Modern data management tools simplifies the administration and management of big amounts of data and makes the handling more save and easy. Production downtimes occur more rarely and even if it happens the downtime is reduced to a minimum of time which saves the most money!

During the planning and development stage a PLC project for example may involve several different software versions per week. Once the plant is running new versions are created each time when the plant is optimized or modified after a disturbance. Keeping track of these changes and different versions requires huge administrative effort.

Practical examples:

1. What happens if the PLC crashes? Which action will minimize the downtime and save a lot of money? Where is the most recent valid version of the PLC program? Which server PG tape or other data medium is it stored on? Anyone who is familiar with PLC programming, service and maintenance will know how important it is to manage the PLC project files in an orderly way. Even the S5 PLC involves not only the S5D file, but a large number of parameter files too (CP, ET 200, OP, and so on...). When the S5 PLC was developed to the S7 PLC, the volume of data multiplied. Even an empty project in the S7 requires up to 1 MB and also generates a complex directory structure with lots of files. In addition, a number of "hand-made" versions also arise with typical names like "OLD", "NEW", "BRANDNEW", "TEST", "TEST1", which confuse even the maintenance person who created them after a couple of weeks. Furthermore, the volume of data is permanently on the increase. Work should be made easier by so-called packers, which create compressed file packages with a click of the right mouse button. But problems already arise when it comes to the naming of archives. The options here are to use the variant "V0.1.1 to infinity" or meaningful file names such as "Change_for_restart_optimization_dated_7.3.2001_re-quested_by_Production.zip".
2. As soon as the PLC is commissioned there are already 2 versions of the software – one running on the PLC and the second on the programmer notebook. It is now essential that the S7 file from the notebook should be stored at a central location. This is the only way other people, such as night shift colleagues, can be sure where to find the latest version of the program. This means there is now a third version of

the S7 file. Because of a mistake the next step might be to change once more the system in which instance a new engineer fetches the latest version of the S7 file from the server and creates additional versions on his notebook and the PLC. In a very short time it is possible to have 5 or 6 versions of the same program.

3. It is after midnight and a control component breaks down. The night shift is sparsely staffed and no technical specialist is available. The normal maintenance staff can replace the mechanical component but the restoration of the software part turns out to be a problem! Where is the current version and how fast can this be found? The longer the downtime takes the more money will be lost – every minute of a downtime in production is very costly!
4. It is widespread in the industry to make process optimizations only in the memory of the individual PLC controllers instead of in the source data on central data servers. But devices fail, are replaced, extended, converted or changed. Only additionally secured data is not lost. In opposite to that the expenditure for a renewed optimization is enormous.

A central software solution can provide uniformity and help – modern data management tools address these issues.

Data Management Solution with Version Management

Once the system is optimized - the newly created version is up to this time the “valid one”. Version management must take place on a central basis to ensure that everyone working on the system has access to the current program variant. This is the only way to prevent the usage of out-dated program code. All employees and service providers who are involved with the program code must fetch the code from the central location before they start work and return it there afterwards, irrespective of whether they have made any changes. In order to minimise the risk of accessing an out-dated variant, it is useful to check at regular intervals to see whether the program code declared to be the valid version is really loaded in the PLC.

In a networked system, it can take place automatically from a central location.

The key requirements of a data management solutions:

- Central project data files with user administration and copying management
- Automatic examination of the archives quality by detailed difference analysis
- Timely automatic program and data protection for PLC, CNC, PC Scada systems, robots ...
- Integration into the different PLC and Scada Systems
- Accurate and fast "Disaster Recovery" and thus decrease of possible downtimes or disturbances
- Minimization of planning costs
- Life cycle management: support for all project phases - from the development over start-up, optimization and extension up to the maintenance.
- Documented change process after ISO 900x and FDA 21 CFR11

The mainly wishes from the Enduser - Result of an inquiry:

- It should be possible to administer projects centrally on a server and to facilitate access management and evaluations across all projects
- Complete downloads (for example from the PLC to the Server) should take place automatically and should be stored as back-ups
- A change history for files should be kept in a database
- It should be possible to reload the current program version quickly after an automation device crashes
- The right version must be available when production changes over to another product
- Parameters, formulas and set values should be archived automatically or on the request of the user
- If changes to the code are made by different people as part of maintenance and servicing, then it is essential that these changes be documented
- If changes are made directly on the system itself, then a supervisor must be informed automatically
- The data relevant to the maintenance and servicing or PLC should be available as status information (project status for software, archive PLC co-ordination, output status of the CPU, cycle time of the CPU, etc.)

The advantages of a Data Management Systems (DMS):

Reduction of errors and downtimes

Manage programmable device program and documentation changes made by multiple users from multiple locations. Central data management increases productivity and reduces errors by providing a common central clearinghouse of all changes.

Managing changes dramatically increases efficiencies and ensures peak software and process performance. Analyzing historical changes allows to identify bottlenecks and observe trends in programming practices.

Increase of the productivity

Data Management Systems provides a comprehensive suite of tools to protect, save, restore, discover, and track changes for industrial programmable devices and documents. DMS unifies plant automation software under one common user interface. Use of a DMS results in a secure, well documented, controlled environment which dramatically reduces coordination constraints, wasted effort, and safety concerns.

Protect Users and assets

Manage versions and ancestors of all automation project files, programs, documentation, and associated historical tracking and configuration information stored in a central secured location.

Discover unknown modifications

Monitor changes to programmable devices and track history of updates. The DMS server periodically uploads programs from networked programmable devices, discovers differences, sends an email alert of those changes, then creates a new program ancestor. The email message could also contain a hyper-link to the differences report.

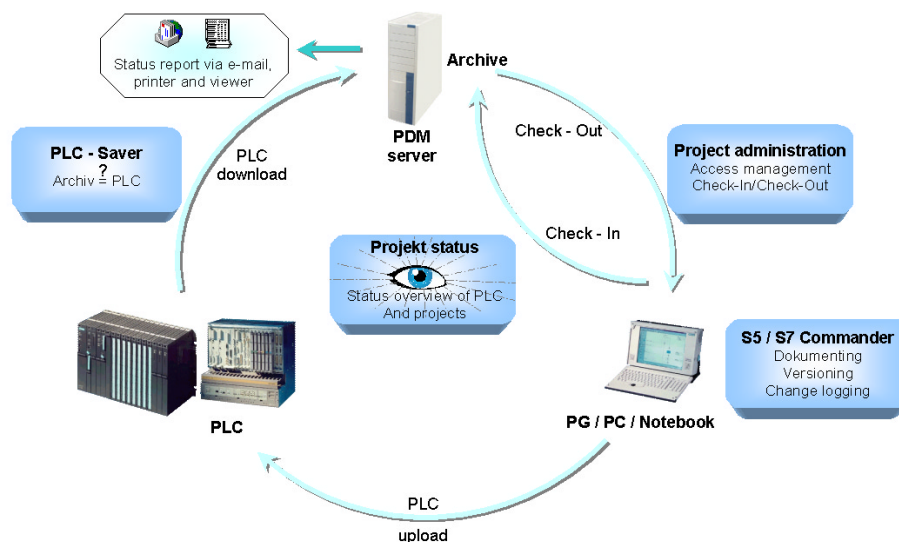
Seamless Operation

The DMS Server periodically uploads programs from networked devices automatically, detects and reports changes. The DMS server captures and saves program updates as they are edited. New program versions can be created for synchronization with client workstations. A Data Management System is for sites with large numbers of devices to be uploaded in a limited amount of time. If 100 PLC are saved only once in a week from one maintenance worker and he probably needs at least 5 minutes per PLC – it would take 500 Minutes or more than one day which is worth to save!

Demand Download Recovery

A DMS provides on-demand rapid recovery of failed devices with access to the latest program version of all programs. If a device fails, the correct program can be restored quickly. Whether a plant has 5 devices or 5,000, a DMS reduces unscheduled downtime and protects against accidentally loaded devices regardless of the number and types of personnel involved.

A Data Management System typically consists of a number of modules (as example VersionWorks from the company GEPA):



- **Commander** - The commander supports service and programming staff during program changes, troubleshooting and documentation. A change history is created in the database and changes are detected and version numbers are automatically created. Versioning and commenting take place locally on the working system, no server is required and all the information can be transferred back to the server once

the changes are complete. In addition, the commander offers functions for viewing, comparing and manipulating S5/S7 files and elements.

- **Project Administrator** - Project administration manages for example S5 and S7 projects centrally on a server. It handles access management, deadline monitoring and cross-project evaluation tasks. The commander acts as a client. It can be used to check out projects for processing or viewing (copying from the server to the local PC with exclusive use tag) and to check them in again after the changes have been made (copying from the local PC to the server).
- **PLC-Saver** - PLC-Saver is used to save PLC data directly from the PLC's, and to coordinate between documented, archived programs and the programs currently running in the PLC. PLC downloads performed are executed cyclically or at the user's request via Ethernet and are stored on the server. Downloads are either complete (for PLC back-up or archive PLC co-ordination) or only involve previously parameterised parts of the program (set value archiving). Set element areas are automatically compared with the archived version. The status reports created by PLC-Saver can be viewed almost anywhere, thanks to the e-mail possibility. Differences can be displayed down to program code level in the convenient viewer.
- **Project Status** - Project status gathers the maintenance and service-related PLC data and makes it available as status information. The information includes the project status of the software, archive PLC co-ordination, the version of the CPU, the cycle time of the CPU, etc. If the specific configuration of the monitored PLC does not permit data to be determined automatically, then the information should also be entered manually by means of dialogs.

Conclusion

Management of data is critical for companies to meet their ISO and quality objectives and to ensure that the plant operation is restored quickly and efficiently after a failure.

Companies who need to fulfill the FDA 21 CFR 11 regulatories or ISO 900x can use a Data Management System for their audit to make auditing fast and easy. Product changes on the same productionline are easy to handle.

A Data Management System provides full program management and history. It simplifies the administration and management of big amounts of data and makes the handling more save and easy – especially if lots of people are working on the software versions. Production downtimes occur more rarely and even if it happens the downtime is reduced to a minimum of time which saves the most money.

It typically needs less than one year to reach the return of investment!