

Q-DAS CAMERA® Concept: Performance Measurement System for Knowledge Acquisition

Stephan Sprink, Q-DAS® GmbH & Co. KG

The software tools of the Q-DAS CAMERA® Concept harness data streams in order to gain knowledge. They process characteristics values and process parameters obtained in industrial production based on current standards and guidelines, convert them into reliable statistics and convey them. However, the Q-DAS CAMERA® Concept (see Figure 3) does not only consist of software tools but also includes different services supporting companies in implementing, realizing and maintaining the system. Q-DAS® also advises companies on any statistical questions starting with the definition and calculation of statistics, the joint development of an evaluation configuration and process optimization. All of these tasks are part of the introduction of a performance measurement system ensuring that the entire potential of statistical evaluations can contribute to an increase in efficiency at any time – a valuable acquisition of knowledge leading to our customers' success.

What Are the Requirements of Our Customers?

Since the demands on the products and the corresponding production rise continuously, the processes have to become more and more transparent in order to monitor them in a timely manner and to take respective corrective action. The closer you approach the technological limits of the manufacturing process, the more significant becomes the precise knowledge of the current status of the production. The Q-DAS CAMERA® Concept provides this knowledge in the form of reliable statistics in order to avoid consequential costs caused by rejects, rework, customer complaints or the like. The processed statistics must be displayed user-friendly and clearly (see Figure 2) in order that the respective



Figure 1: Statistics for knowledge acquisition

(process) owner receives a clear image of the relevant processes.

Integration of Information Sources

In order to gain a comprehensive overview of the processes, the integration of the different information sources is required (see Figure 3). It is of particular importance to connect measuring and test instruments from manufacturing, production and the measurement laboratory to the system in order to make quality-related statements. Descriptive parameters of the manufacturing process from controls (PLCs) provide further important information needed for the assessment / evaluation of the processes. They help to determine dependencies between product and process characteristics.

Many measuring and test instruments and SPC systems support the Q-DAS® ASCII transfer format which is widely used in the market. The AQDEF (advanced quality data exchange format) data format is based on this transfer format and defines an industry standard of how to transfer data to the Q-DAS® system (see Figure 4). Several conglomerates and suppliers even took a step further by regulating that not only the measurement results have to be transferred in the AQDEF format but even the minimum amount of descriptive data. A certification offered by Q-DAS® provides the safety that the data transmission works properly. Further information about AQDEF is available on our homepage (<http://www.q-das.de/> ; Service – Data format).

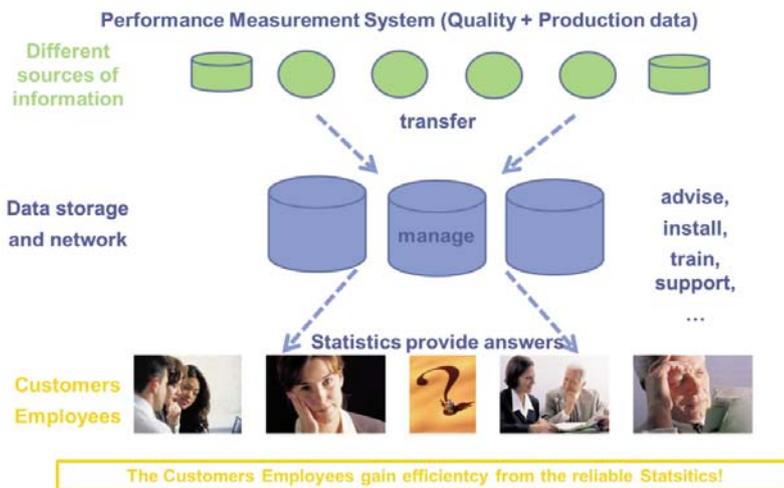


Figure 2: Customer requirements

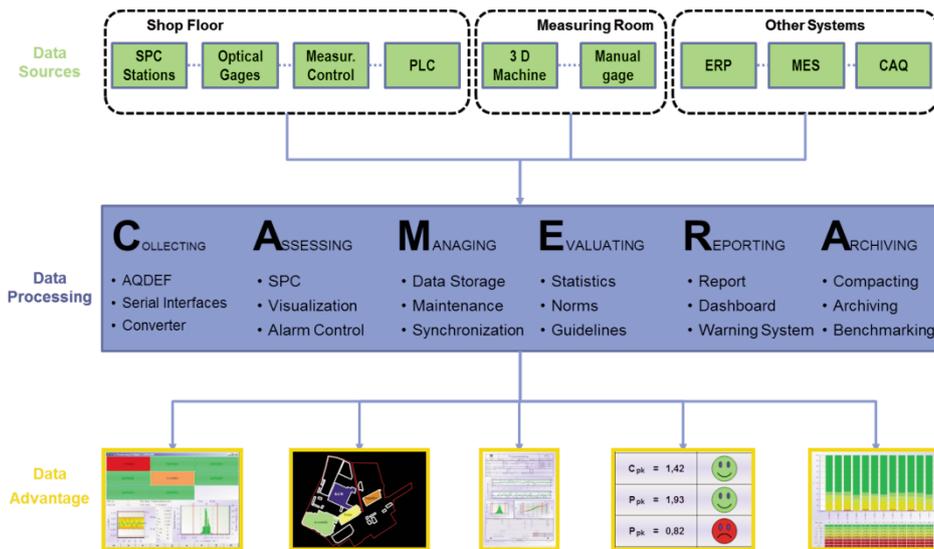


Figure 3: Q-DAS® CAMERA Concept

Standard measuring equipment, such as calipers, height measuring instruments or external micrometers, which are only able to pass the measured values, are directly connected to Q-DAS® products via serial interface (RS232 or USB) or multiplexer boxes. The respective Q-DAS® test plan selected before starting the measurement contains the required header data (work piece information, characteristics description, tolerance limits, ...). The characteristics are allocated to the respective measuring equipment in the test plan. Overall, the Q-DAS® software supports more than 150 measuring instruments or boxes for an easy connection of current measuring equipment. Instruments that have not been connected yet are integrated into the standard range of supported Q-DAS® interfaces after examination. However, this integration might be subject to a charge.

In addition to these sources of information, the system can integrate data from other systems, such as ERP, MES and CAQ, or files (Excel lists, text files, ...), depending on the respective requirements and demands. The standardized SAP interfaces QM-STI and QM-IDI help to exchange measurement and test data between the SAP QM module and the Q-DAS® software products. In this case, SAP is the leading system and, depending on the respective application, the Q-DAS® software products take over the specifications from SAP QM (QM-IDI interface) for the recording of test data or the Q-DAS® products evaluate the measured values available in SAP QM and transfer the evaluation results back to SAP QM (QM-STI interface).

The communication between MES and CAQ is either based on the Q-DAS® ASCII transfer format described before or established via call parameters or services allowing for a seamless integration. A converter supports customers in quickly integrating files that are not available in the Q-DAS® format yet. Even handwritten

control charts or any other manual recordings can be taken over into the Q-DAS® software products, e.g. by using scanning software for sheets of paper.

In addition to the recorded measured values, you may save descriptive additional information for each dataset. Examples are batch information, serial number of the individually produced and / or tested part, machine and spindle information, etc. When analyzing the data later on, a specific selection of data will be feasible and the traceability will be ensured.

Real-time Monitoring

After determining the format the data of different information sources are available in or the interface transferring information to the Q-DAS® system, the software is able to visualize and evaluate the process data immediately. We distinguish between two control loops in order to control processes (see Figure 5). The software immediately visualizes and monitors data in the “small” control loop while they are transferred to the Q-DAS® system. A typical application is the display of results for a quick reaction at the operator level. Signals in case of process interventions or alarm violations accompany the display of results.

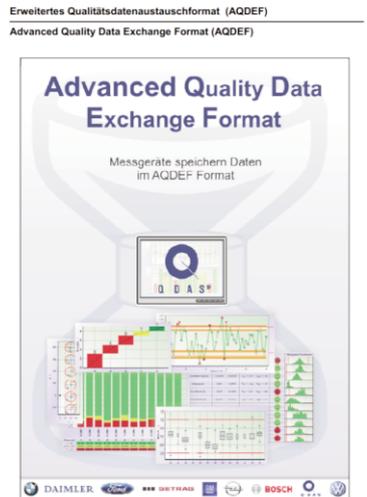


Figure 4: Advanced quality data exchange format



Figure 5: Control Loop

Classical applications are CMMS' real-time displays of measurement results, the permanent visualization of process parameter values and a local or central display of test data recorded manually or via serial interface. In case defined alarm criteria are violated while recording data, users have to add a comment (event, measure, cause) in order to allocate or identify the process intervention later. For the monitoring of processes based on standardized criteria in real-time monitoring, companies should define corporate specifications (calculation of control limits, stability criteria, tolerance analyses, ...). Only these specifications help to guarantee reproducibility. The processes are then monitored based on the same conditions company-wide.

The Q-DAS® software products procella® and O-QIS fulfill these very tasks of data recording, real-time visualization and alarm monitoring.

Evaluation and Reporting System

The option to evaluate and assess data automatically in accordance with certain specifications (standards, corporate and association guidelines) provides the basis for the application of a performance measurement system, the reproducibility of results and for the supply of information required at the planning and management levels ("big" control loop). Despite a huge amount of data, users are able to keep track and clearly detect significant deviations from process specifications. The most important feature for a validated evaluation in the Q-DAS CAMERA® Concept is the evaluation method (see Figure 6). Users may either define statistical calculations and specifications specific to the respective customer or access already integrated standards and corporate guidelines that are mainly applied in the automotive industry. By applying the Q-DAS CAMERA® Concept company-wide / across locations with a uniform evaluation method included, the results become comparable

and reproducible. It is easy to validate the system at the customer since Q-DAS® is responsible for the verification of numerics.

Besides the calculation of statistics, the display of results in graphics also plays a major role. Mere columns of figures, even if they are calculated correctly, incur the risk of overlooking important information about critical processes. By contrast, graphics make it easier and quicker to detect changes over time, especially in case the evaluation results are displayed in task-related graphics. That is the only way to identify the real situation quickly and safely and to take corrective action or evaluate taken measures.

Standardized and clearly structured layouts for reports including evaluation results ensure that users are able to find the information about desired statistics (see Figure 7) quickly. Depending on the recipient of the report of evaluation results, it is important to compress the data to a certain degree in order not to get lost in the details and to obtain the required measures. Respective database queries, displays of evaluation results and options to sort statistics guarantee a target-oriented processing of the desired process information including the respective level of detail.

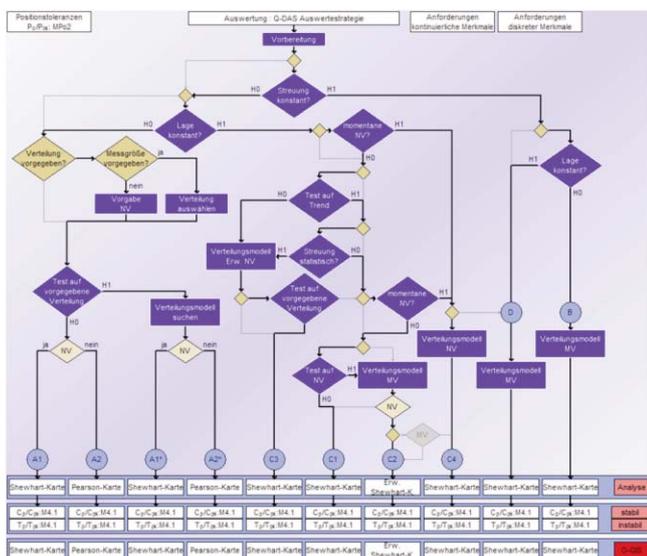


Figure 6: Evaluation Method

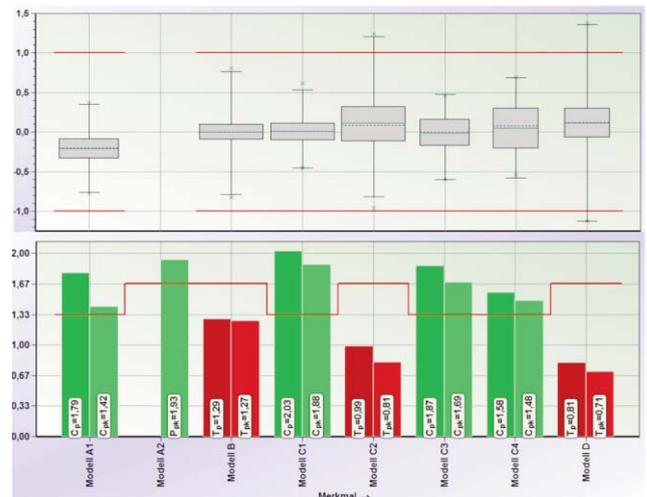


Figure 7: Display of Evaluation Results

The Q-DAS CAMERA® Concept is particularly comfortable in case statistics are not calculated by being triggered manually but the system performs the calculation automatically in the background. Optionally, it reports all selected processes or only those processes not meeting the requirement adjusted in the current evaluation method. For example, users evaluate the data per day, week or shift and the system automatically provides the results (report, result file, e-mail) to the responsible operator. This procedure saves time and raises the

added value of a successfully implemented performance measurement system.

Moreover, there is the option to access statistics over a website that can be designed individually. This allows for a location-independent observation and evaluation of the company's processes. Predefined dashboards or websites adapted to the individual customer requirements help to display statistics, graphics and reports in the web browser. Thus, users do not have to install Q-DAS® software products on local workstations but require nothing but the authorization to access defined websites of the company.

Data Storage / Data Backup

One of the main tasks of the Q-DAS CAMERA® Concept's data flow is to merge locally recorded information on a central server or to make centrally defined specifications available on local workstations. Measurement and test data as well as values of process parameters are saved to a central server database or, if required and depending on the organizational structure, to several databases. Since databases are part of the security and maintenance concept of the companies' IT departments, data security can be established without any additional effort. In terms of the obligation to keep records for critical characteristics / data in accordance with customer agreements or legal regulations, data security is a necessity in companies, anyway.

In the context of the Q-DAS CAMERA® Concept's data flow, the Q-DAS® software products write / read directly in / from the database or automated services for transferring locally generated data save them to the structured central database. This fact ensures that no data will be lost in case client PCs breakdown or are exchanged. Q-DAS® database tools for outsourcing historical data or for maintaining the database help users to work with a high-performance database but having all information still available. Mechanisms of this type have become indispensable over time since there are sometimes more than 1 million datasets saved to the database per day. All these data require a well-structured data management.

Types of Installation

The most common type of installation for Q-DAS® software products is a server client installation. In this case, the central server contains all program files, configurations and system settings. The local

computer accesses all required data at the start of the program, e.g. the license, or the program checks whether there are still licenses available in case of a concurrent licensing. Thus it is even feasible to implement corporate solutions that are quite frequently based on terminal server installations.

Standardization as a Key to Success

Why reinvent the wheel when you can access existing and established standards?

The Q-DAS® software products are standardized products that have continuously grown in the course of time by adapting them to customer requirements. Today, they cover a wide range of applications and still continue to grow. Due to the created flexibility and available configuration options, the software is directly geared to the needs of customers. Even upcoming updates and upgrades of the respective version are easy to implement.

The standardization involves different functionalities of the software. When defining an evaluation method – the basis for statistical calculations of statistics – the customer selects one of the different integrated evaluation standards or creates an individual evaluation method.



Figure 8: VDA 5, MSA 4th Edition and GUM as well as "Bosch Heft 10" and "GMPT Measurement System Specification" as examples of company guidelines"

Depending on the desired evaluation module / program, standards and guidelines provide the necessary support to eventually obtain the suitable evaluation method.

The evaluation of machines, production facilities and the running production process is based on the statistical evaluation of characteristics values. Measurement processes helping to measure predefined characteristics provide these characteristics values. In order to avoid misinterpretations, the recorded measured values have to reflect the real situation with an adequate accuracy. In other words, the measured values have to be suitable for the respective application. Customers may perform these capability analyses in solara.MP.

In solara.MP customers conduct capability analyses according to MSA, measurement process capability analyses in accordance with VDA 5 and measurement uncertainty analyses as per GUM. For concretization and the practical application of these analyses, the automotive industry created guidelines specific to the respective company. These guidelines are also available in solara.MP (see Figure 8).

qs-STAT® is a software package for comprehensive statistical evaluations of quality information relevant in the manufacturing process. Its main purpose is to assess processes and systems based on the evaluation results. In case of machine and process qualification, the evaluations are based on integrated standards and company guidelines (e.g. BMW, GMPT, Robert Bosch, Volkswagen, etc.). There are numerous statistical procedures available in order to find the best suitable distribution time model and to allocate process models according to DIN ISO 21747 (now ISO 22514-2) automatically. Using a standardized evaluation provides safety and guarantees the reproducibility of results. In addition to the integrated evaluation methods (see Figure 9), customers may even define an evaluation method for their own companies based on already available evaluation methods or create methods that are completely new. We will be pleased to support our customers and advise them on finding a suitable evaluation method. If desired, we include the new definition in our default version in order to provide it to suppliers / customers, too. Thus you all “talk the same language” when evaluating and assessing processes which makes the communication between customers and suppliers easier

In order to implement the Q-DAS CAMERA® Concept successfully and quickly, Q-DAS® created a guideline and checklists offering support in planning and realizing it. This guideline is also available on our website under <http://www.q-das.de/en/service/project-guideline/>.

This guideline describes typically required specifications and procedures in order to implement the Q-DAS CAMERA® Concept forming the basis for the creation, operation and maintenance of a performance measurement system. The guideline ensures that all requirements and general conditions for a successful project are fulfilled.

It is not possible to introduce a performance measurement system quickly and efficiently without a specification that is as accurate as possible. Moreover, the specification provides a binding basis for customers and suppliers contributing to the achievement of objectives. Nowadays, the services required for the system integration already play a major role compared to the software the customer needs. In order to reduce the effort to a minimum and to optimize costs, customers require distinctive and clearly defined targets and procedures. Our experienced consultants help to organize an efficient preparation phase and ensure that customers reach their targets. The guideline does not have the purpose to illustrate any possible project constellations but wants to provide support and suggestions for the individual handling of the project. Depending on

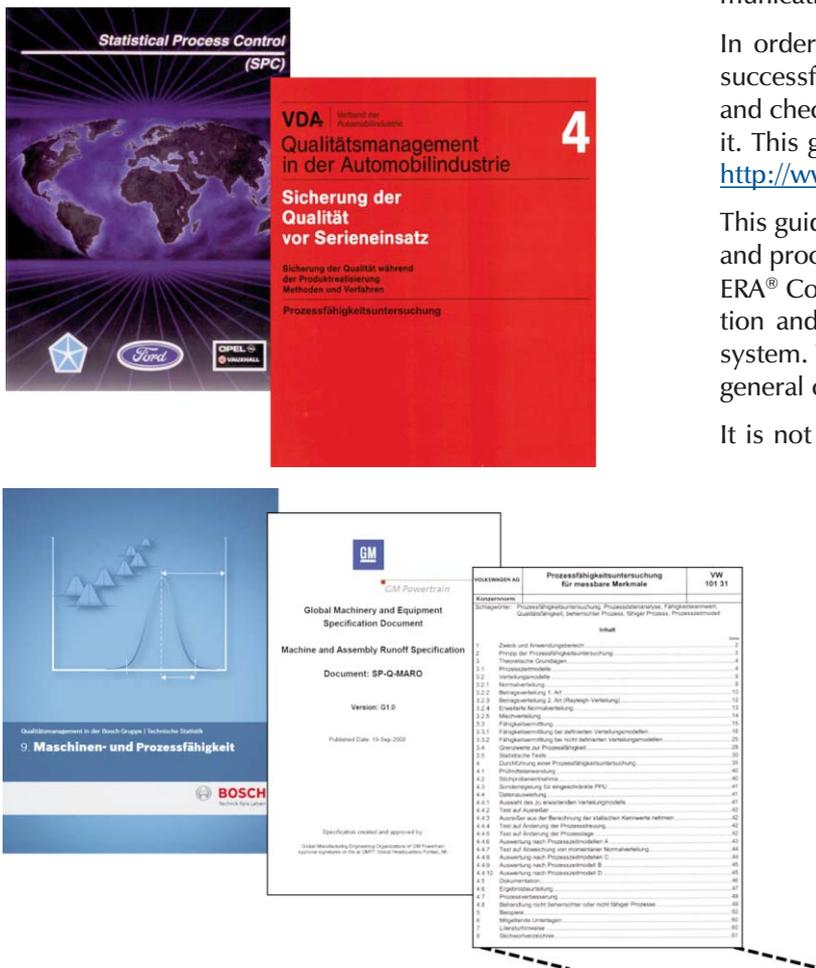


Figure 9: Statistical Process Control (SPC) and VDA 4 as well as “Bosch Heft 9”, GM Powertrain „Machine and Assembly Runoff Specification“ and Volkswagen AG “Prozessfähigkeitsuntersuchung für messbare Merkmale“ as examples of company guidelines



Figure 10: Q-DAS® publication “Kennzahlensystem“ and Project Guideline (available only in German)

the project, only single aspects of the guideline might be relevant. Many companies applying Q-DAS® products globally defined and documented their corporate specifications based on this guideline. Due to this standardization, customers are able to realize the introduction of the Q-DAS CAMERA® Concept in a short time.

A major part of the specification is the definition of the data format. It describes the interface between the information sources to be connected and the applied products in the Q-DAS CAMERA® Concept. In addition to the structure of the format, customers also define the contents to be transferred. The contents help to select specific data and to give an individual overview of the process later. It is advisable to consider the AQDEF format (see Figure 4) for standardization purposes. Even many manufacturers of measuring instruments know this format by now which allows for a quick and safe connection.

An Overview of the Q-DAS CAMERA® Concept's Benefits

After describing the functions of the Q-DAS CAMERA® Concept and the procedure for implementing the system, the question that is still open is the question of the benefits the customers have when introducing such a new system. Of course, cost savings come first in order to have or gain a permanent competitive edge.

Advantages of the Q-DAS CAMERA® Concept:

- Standardized interfaces to measuring instruments, controls or other data sources provide safety and enable a quick connection.
- The integration of quality and process data gives a comprehensive overview of the current situation.
- A validated statistical evaluation of the data supplied by any integrated information source is based on standards and guidelines and thus ensures reproducibility and provides a firm basis of decision-making.
- Automated evaluation systems offer user-friendly displays of results. These displays save time and guarantee transparent processes.
- A Q-DAS CAMERA® Concept consisting of single modules saves money, true to the motto: Everybody gets what he needs!
- Standardized implementation approaches reduce the introduction effort.
- Continuous development of standard software products protects your investment.
- An international network of subsidiaries and partners ensures local support.

Q-DAS® Software Also Available in Thai

Due to the integration of Thai as another language, the Q-DAS® software products are now applicable in 21 languages. Since version 10 (110914) Thai has been available as an additional language. The program texts of all Q-DAS® software products are translated in order to ensure an overall consistency. A Thai translation agency translated the software texts. The agency checked and released the translated texts in collaboration with an international Q-DAS® customer located in Thailand. This collaboration guarantees the correct translation of the program texts.

Find all available languages at

<http://www.q-das.de/de/anwendungen/sprachen/>

Please inform us about any further language you require!

